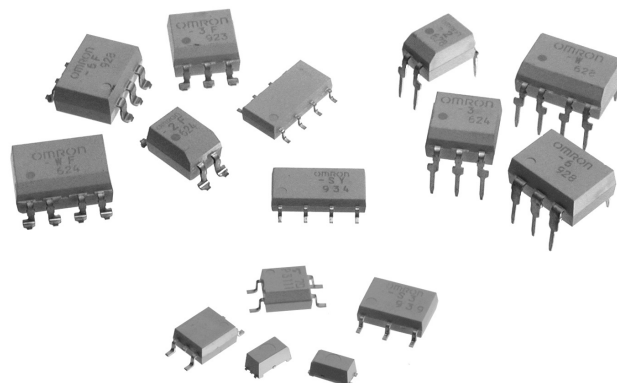


# MOS FET Relays G3VM Series

## Wide Range of Contact Forms, Sizes and Package Types

- Controls load voltages up to 600 V.
- Terminal packages include PCB through-hole, SMT gullwing, SOP, and SSOP.
- Low ON-resistance, low output capacitance, current limiting, and high dielectric (5000 VAC) models available.
- Packaged for efficient automatic insertion: PCB through-hole and SMT are in tubes; tape-and-reel packaging is standard for SOP and SSOP models, and optional for SMT models ("TR" suffix).
- Complete specifications follow, divided by Package Type, Terminals and Contact Form.



## Typical Applications

### ■ Communications

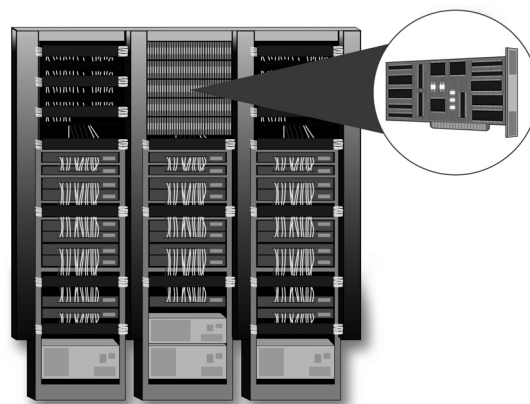
- Local area network equipment
- Central office circuit boards for subscriber line interfaces, multiplexers and other routing equipment
- Wireless communications for cell phones and pagers
- Set-top TV boxes with internal modems
- Fax machines
- PCMCIA card
- Internal modems for PDA equipment and laptop computers

### ■ Test & Measurement

- Board testers
- IC testers
- Portable voltage testers

### ■ Security

- Alarm control boards
- Home security systems
- Garage door openers



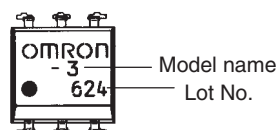
# Selection Guide

| Load voltage | Contact form | Package/<br>Terminal shape | No. of terminals | Model      | Load current (mA) | Voltage withstand (VAC) | ON resistance (max.) | Output capacitance | Additional features | Page no. |
|--------------|--------------|----------------------------|------------------|------------|-------------------|-------------------------|----------------------|--------------------|---------------------|----------|
| 20V          | 1 Form A     | SMT                        | 8                | G3VM-22FO  | 150               | 2,500                   | 4 Ω                  | 8 pF (typ.)        | Low ON resistance   | 62       |
|              |              |                            | 4                | G3VM-21GR  | 160               | 1,500                   | 8 Ω                  | 2.5 pF (max.)      | Low pF•Ω            | 70       |
|              |              | SSOP                       | 4                | G3VM-21GR1 | 300               | 1,500                   | 1.5 Ω                | 12 pF (max.)       | Low pF•Ω            | 70       |
|              |              |                            |                  | G3VM-21LR  | 150               | 1,500                   | 8 Ω                  | 12 pF (max.)       | —                   | 88       |
|              |              |                            |                  | G3VM-21LR1 | 300               | 1,500                   | 1.5 Ω                | 12 pF (max.)       | Low pF•Ω            | 88       |
|              |              |                            |                  |            |                   |                         |                      |                    |                     |          |
| 40V          | 1 Form A     | SOP                        | 4                | G3VM-41GR3 | 80                | 1,500                   | 37 Ω                 | 1.4 pF (max.)      | —                   | 72       |
|              |              |                            |                  | G3VM-41GR4 | 250               | 1,500                   | 3 Ω                  | 7 pF (max.)        | Low pF•Ω            | 74       |
|              |              |                            |                  | G3VM-41GR5 | 300               | 1,500                   | 1.5 Ω                | 14 pF (max.)       | Low pF•Ω            | 74       |
|              |              |                            |                  | G3VM-41GR6 | 120               | 1,500                   | 15 Ω                 | 2 pF (max.)        | Low pF•Ω            | 74       |
|              |              | SSOP                       | 4                | G3VM-41LR3 | 80                | 1,500                   | 35 Ω                 | 1.4 pF (max.)      | —                   | 88       |
|              |              |                            |                  | G3VM-41LR4 | 250               | 1,500                   | 3 Ω                  | 7 pF (max.)        | Low pF•Ω            | 90       |
|              |              |                            |                  | G3VM-41LR5 | 300               | 1,500                   | 1.5 Ω                | 14 pF (max.)       | Low pF•Ω            | 90       |
|              |              |                            |                  | G3VM-41LR6 | 120               | 1,500                   | 15 Ω                 | 2 pF (max.)        | Low pF•Ω            | 90       |
|              |              |                            |                  |            |                   |                         |                      |                    |                     |          |
|              |              |                            |                  |            |                   |                         |                      |                    |                     |          |
| 60V          | 1 Form A     | Thru-hole                  | 4                | G3VM-61A   | 500               | 2,500                   | 2 Ω                  | 140 pF (max.)      | Low ON resistance   | 32       |
|              |              |                            |                  | G3VM-61A1  | 500               | 2,500                   | 2 Ω                  | 130 pF (typ.)      | Low ON resistance   | 34       |
|              |              |                            | 6                | G3VM-61B   | 500               | 2,500                   | 2 Ω                  | 140 pF (max.)      | Low ON resistance   | 38       |
|              |              |                            |                  | G3VM-61B1  | 500               | 2,500                   | 2 Ω                  | 130 pF (typ.)      | Low ON resistance   | 40       |
|              |              |                            |                  | G3VM-V     | 300               | 2,500                   | 2 Ω                  | 170 pF (typ.)      | Low ON resistance   | 40       |
|              |              |                            | 8                | G3VM-61CP  | 500               | 2,500                   | 0.6 Ω                | 500 pF (max.)      | Low ON resistance   | 42       |
|              |              |                            |                  | G3VM-61CR  | 2000              | 1,500                   | 0.12 Ω               | 1400 pF (max.)     | Low ON resistance   | 44       |
|              |              | SMT                        | 4                | G3VM-61D   | 500               | 2,500                   | 2 Ω                  | 140 pF (max.)      | Low ON resistance   | 52       |
|              |              |                            |                  | G3VM-61D1  | 500               | 2,500                   | 2 Ω                  | 130 pF (typ.)      | Low ON resistance   | 54       |
|              |              |                            | 6                | G3VM-61E   | 500               | 2,500                   | 2 Ω                  | 140 pF (max.)      | Low ON resistance   | 58       |
|              |              |                            |                  | G3VM-61E1  | 500               | 2,500                   | 2 Ω                  | 130 pF (typ.)      | Low ON resistance   | 60       |
| 60 V         | 1 Form A     | SMT                        | 6                | G3VM-VF    | 300               | 2,500                   | 2 Ω                  | 170 pF (typ.)      | Low ON resistance   | 60       |
|              |              |                            |                  | G3VM-61FP  | 500               | 2,500                   | 0.6 Ω                | 500 pF (max.)      | Low ON resistance   | 64       |
|              |              |                            |                  | G3VM-61FR  | 2000              | 1,500                   | 0.12 Ω               | 1400 pF (max.)     | Low ON resistance   | 64       |
|              |              | SOP                        | 4                | G3VM-61G1  | 400               | 1,500                   | 2 Ω                  | 130 pF (typ.)      | Low ON resistance   | 76       |
|              |              |                            |                  | G3VM-S1    | 400               | 1,500                   | 2 Ω                  | 140 pF (max.)      | Low ON resistance   | 76       |
|              |              |                            |                  | G3VM-61H1  | 400               | 1,500                   | 2 Ω                  | 130 pF (typ.)      | Low ON resistance   | 80       |
|              | 2 Form A     | Thru-hole                  | 8                | G3VM-62C1  | 500               | 2,500                   | 2 Ω                  | 130 pF (typ.)      | Low ON resistance   | 46       |
|              |              | SMT                        | 8                | G3VM-62F1  | 500               | 2,500                   | 2 Ω                  | 130 pF (typ.)      | Low ON resistance   | 66       |
|              |              | SOP                        | 8                | G3VM-62J1  | 400               | 1,500                   | 2 Ω                  | 130 pF (typ.)      | Low ON resistance   | 84       |
|              |              |                            |                  | G3VM-SY    | 300               | 1,500                   | 2 Ω                  | 140 pF (max.)      | Low ON resistance   | 86       |
| 80 V         | 1 Form A     | SOP                        | 4                | G3VM-81G1  | 350               | 1,500                   | 1.2 Ω                | 40 pF (max.)       | Low ON resistance   | 76       |
|              |              |                            | 6                | G3VM-81HR  | 1250              | 1,500                   | 0.15 Ω               | 1000 pF (max.)     | Low ON resistance   | 80       |
| 200 V        | 1 Form A     | SOP                        | 4                | G3VM-S5    | 150               | 1,500                   | 8 Ω                  | 100 pF (typ.)      | —                   | 78       |

| Load voltage | Contact form           | Package/<br>Terminal shape | No. of terminals | Model      | Load current (mA) | Voltage withstand (VAC) | ON resistance (max.) | Output capacitance | Additional features | Page no. |
|--------------|------------------------|----------------------------|------------------|------------|-------------------|-------------------------|----------------------|--------------------|---------------------|----------|
| 350 V        | 1 Form A               | Thru-hole                  | 4                | G3VM-2     | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 30       |
|              |                        |                            |                  | G3VM-2L    | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | Current limiting    | 30       |
|              |                        |                            |                  | G3VM-351A  | 120               | 2,500                   | 35 Ω                 | 30 pF (typ.)       | —                   | 30       |
|              |                        |                            | 6                | G3VM-351B  | 120               | 2,500                   | 35 Ω                 | 30 pF (typ.)       | —                   | 34       |
|              |                        |                            |                  | G3VM-3     | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 36       |
|              |                        |                            |                  | G3VM-3L    | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | Current limiting    | 36       |
| 350 V        | 1 Form A               | SMT                        | 4                | G3VM-2F    | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 50       |
|              |                        |                            |                  | G3VM-2FL   | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | Current limiting    | 50       |
|              |                        |                            |                  | G3VM-351D  | 120               | 2,500                   | 35 Ω                 | 30 pF (typ.)       | —                   | 50       |
|              |                        |                            | 6                | G3VM-351E  | 120               | 2,500                   | 35 Ω                 | 30 pF (typ.)       | —                   | 54       |
|              |                        |                            |                  | G3VM-3F    | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 56       |
|              |                        |                            |                  | G3VM-3FL   | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | Current limiting    | 56       |
|              |                        | SOP                        | 4                | G3VM-351G  | 110               | 1,500                   | 35 Ω                 | 30 pF (typ.)       | —                   | 70       |
|              |                        |                            |                  | G3VM-S2    | 120               | 1,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 78       |
|              |                        |                            |                  | G3VM-351H  | 110               | 1,500                   | 35 Ω                 | 30 pF (typ.)       | —                   | 78       |
|              |                        |                            | 6                | G3VM-S3    | 120               | 1,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 82       |
|              |                        |                            |                  | G3VM-355CR | 120               | 2,500                   | 25 Ω                 | 65 pF (typ.)       | —                   | 44       |
|              |                        |                            |                  | G3VM-355FR | 120               | 2,500                   | 25 Ω                 | 65 pF (typ.)       | —                   | 64       |
|              | 1 Form A +<br>1 Form B | Thru-hole                  | 8                | G3VM-355JR | 120               | 2,500                   | 25 Ω                 | 65 pF (typ.)       | —                   | 82       |
|              |                        | SMT                        | 8                | G3VM-352C  | 120               | 2,500                   | 35 Ω                 | 30 pF (typ.)       | —                   | 44       |
|              |                        |                            | 8                | G3VM-W     | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 46       |
|              |                        | SOP                        | 8                | G3VM-WL    | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | Current limiting    | 48       |
|              |                        |                            | 8                | G3VM-352F  | 120               | 2,500                   | 35 Ω                 | 30 pF (typ.)       | —                   | 66       |
|              |                        |                            | 8                | G3VM-WF    | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 68       |
|              |                        | SMT                        | 8                | G3VM-WFL   | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | Current limiting    | 68       |
|              |                        |                            | 8                | G3VM-352J  | 110               | 1,500                   | 35 Ω                 | 30 pF (typ.)       | —                   | 82       |
|              |                        |                            | 8                | G3VM-SW    | 120               | 1,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 84       |
|              |                        | Thru-hole                  | 4                | G3VM-353A  | 150               | 2,500                   | 25 Ω                 | 100 pF (typ.)      | —                   | 32       |
|              |                        |                            | 6                | G3VM-353B  | 150               | 2,500                   | 25 Ω                 | 100 pF (typ.)      | —                   | 34       |
|              |                        |                            | 4                | G3VM-353D  | 150               | 2,500                   | 25 Ω                 | 100 pF (typ.)      | —                   | 52       |
|              |                        |                            | 6                | G3VM-353E  | 150               | 2,500                   | 25 Ω                 | 100 pF (typ.)      | —                   | 54       |
| 350 V        | 1 Form B               | SOP                        | 4                | G3VM-353G  | 120               | 1,500                   | 25 Ω                 | 130 pF (typ.)      | —                   | 72       |
|              |                        |                            | 6                | G3VM-353H  | 120               | 1,500                   | 25 Ω                 | 65 pF (typ.)       | —                   | 80       |
|              | 2 Form B               | Thru-hole                  | 8                | G3VM-354C  | 120               | 2,500                   | 35 Ω                 | 100 pF (typ.)      | —                   | 48       |
|              |                        |                            | 8                | G3VM-354F  | 120               | 2,500                   | 35 Ω                 | 100 pF (typ.)      | —                   | 68       |
|              |                        | SOP                        | 8                | G3VM-354J  | 120               | 1,500                   | 25 Ω                 | 65 pF (typ.)       | —                   | 86       |
|              |                        |                            | 8                | G3VM-401A  | 120               | 2,500                   | 35 Ω                 | 70 pF (typ.)       | —                   | 32       |
| 400 V        | 1 Form A               | Thru-hole                  | 6                | G3VM-401B  | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 36       |
|              |                        |                            | 6                | G3VM-401BY | 120               | 5,000                   | 35 Ω                 | 75 pF (typ.)       | High I/O isolation  | 38       |
|              |                        |                            | 4                | G3VM-401D  | 120               | 2,500                   | 35 Ω                 | 70 pF (typ.)       | —                   | 52       |
|              |                        | SMT                        | 6                | G3VM-401E  | 120               | 2,500                   | 35 Ω                 | 75 pF (typ.)       | —                   | 56       |
|              |                        |                            | 6                | G3VM-401EY | 120               | 5,000                   | 35 Ω                 | 75 pF (typ.)       | High I/O isolation  | 58       |
|              |                        | SOP                        | 4                | G3VM-401G  | 120               | 1,500                   | 35 Ω                 | 70 pF (typ.)       | —                   | 72       |
|              | 2 Form A               | Thru-hole                  | 8                | G3VM-402C  | 120               | 2,500                   | 35 Ω                 | 70 pF (typ.)       | —                   | 46       |
|              |                        |                            | 8                | G3VM-402F  | 120               | 2,500                   | 35 Ω                 | 70 pF (typ.)       | —                   | 66       |
|              |                        | SOP                        | 8                | G3VM-402J  | 120               | 2,500                   | 35 Ω                 | 70 pF (typ.)       | —                   | 84       |
|              |                        |                            | 8                | G3VM-601BY | 100               | 5,000                   | 45 Ω                 | 100 pF (typ.)      | High I/O isolation  | 38       |
| 600 V        | 1 Form A               | SMT                        | 6                | G3VM-601EY | 100               | 5,000                   | 35 Ω                 | 100 pF (typ.)      | High I/O isolation  | 58       |

# Part Number Index and Ordering Information

**Note:** "G3VM" is not printed on the actual product.



The following tables show standard quantities of G3VM relays as shipped in tubes or tape-and-reel packaging. Dimensions for tape-and-reel parts are shown in individual data sheets that follow.

| Description            | Packaging     | Standard pack quantity | Model          | Page no. |
|------------------------|---------------|------------------------|----------------|----------|
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-2         | 30       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-2F        | 50       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-2F(TR)    | 50       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-2FL       | 50       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-2FL(TR)   | 50       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-2L        | 30       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-21GR      | 70       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-21GR(TR)  | 70       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-21GR1     | 70       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-21GR1(TR) | 70       |
| MOSFET SSOP RELAY      | Tape-and-reel | 1500                   | G3VM-21LR      | 88       |
| MOSFET SSOP RELAY      | Tape-and-reel | 1500                   | G3VM-21LR1     | 88       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-22FO      | 62       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-22FO(TR)  | 62       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-3         | 36       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-3F        | 56       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-3F(TR)    | 56       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-3FL       | 56       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-3FL(TR)   | 56       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-3L        | 36       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-351A      | 30       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-351B      | 34       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-351D      | 50       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-351D(TR)  | 50       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-351E      | 54       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-351E(TR)  | 54       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-351G      | 70       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-351G(TR)  | 70       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-351H      | 78       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-351H(TR)  | 78       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-352C      | 44       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-352F      | 66       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-352F(TR)  | 66       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-352J      | 82       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-352J(TR)  | 82       |

| Description            | Packaging     | Standard pack quantity | Model          | Page no. |
|------------------------|---------------|------------------------|----------------|----------|
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-353A      | 32       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-353B      | 34       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-353D      | 52       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-353D(TR)  | 52       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-353E      | 54       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-353E(TR)  | 54       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-353G      | 72       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-353G(TR)  | 72       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-353H      | 80       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-353H(TR)  | 80       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-354C      | 48       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-354F      | 68       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-354F(TR)  | 68       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-354J      | 86       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-354J(TR)  | 86       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-355CR     | 44       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-355FR     | 64       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-355FR(TR) | 64       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-355JR     | 82       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-355JR(TR) | 82       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-41GR3     | 72       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-41GR3(TR) | 72       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-41GR4     | 74       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-41GR4(TR) | 74       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-41GR5     | 74       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-41GR5(TR) | 74       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-41GR6     | 74       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-41GR6(TR) | 74       |
| MOSFET SSOP RELAY      | Tape-and-reel | 1500                   | G3VM-41LR3     | 88       |
| MOSFET SSOP RELAY      | Tape-and-reel | 1500                   | G3VM-41LR4     | 90       |
| MOSFET SSOP RELAY      | Tape-and-reel | 1500                   | G3VM-41LR5     | 90       |
| MOSFET SSOP RELAY      | Tape-and-reel | 1500                   | G3VM-41LR6     | 90       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-401A      | 32       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-401B      | 36       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-401BY     | 38       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-401D      | 52       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-401D(TR)  | 52       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-401E      | 56       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-401E(TR)  | 56       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-401EY     | 58       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-401EY(TR) | 58       |

This table continues on the next page.

| Description            | Packaging     | Standard pack quantity | Model          | Page no. |
|------------------------|---------------|------------------------|----------------|----------|
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-401G      | 72       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-401G(TR)  | 72       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-402C      | 46       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-402F      | 66       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-402F(TR)  | 66       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-402J      | 84       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-402J(TR)  | 84       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-61A       | 32       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-61A1      | 34       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-61B       | 38       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-61B1      | 40       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-61CP      | 42       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-61CR      | 44       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-61D       | 52       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-61D(TR)   | 52       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-61D1      | 54       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-61D1(TR)  | 54       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-61E       | 58       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-61E(TR)   | 58       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-61E1      | 60       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-61E1(TR)  | 60       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-61FP      | 64       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-61FP(TR)  | 64       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-61FR      | 64       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-61FR(TR)  | 64       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-61G1      | 76       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-61G1(TR)  | 76       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-61H1      | 80       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-61H1(TR)  | 80       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-62C1      | 46       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-62F1      | 66       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-62F1(TR)  | 66       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-62J1      | 84       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-62J1(TR)  | 84       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-601BY     | 38       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-601EY     | 58       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-601EY(TR) | 58       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-81G1      | 76       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-81G1(TR)  | 76       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-81HR      | 80       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-81HR(TR)  | 80       |

| Description            | Packaging     | Standard pack quantity | Model        | Page no. |
|------------------------|---------------|------------------------|--------------|----------|
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-S1      | 76       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-S1(TR)  | 76       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-S2      | 78       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-S2(TR)  | 78       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-S3      | 82       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-S3(TR)  | 82       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-S5      | 78       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-S5(TR)  | 78       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-SW      | 84       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-SW(TR)  | 84       |
| MOSFET SOP RELAY       | Tube          | 50                     | G3VM-SY      | 86       |
| MOSFET SOP RELAY       | Tape-and-reel | 2500                   | G3VM-SY(TR)  | 86       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-V       | 40       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-VF      | 60       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-VF(TR)  | 60       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-W       | 46       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-WF      | 68       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-WF(TR)  | 68       |
| MOSFET SMT RELAY       | Tube          | 50                     | G3VM-WFL     | 68       |
| MOSFET SMT RELAY       | Tape-and-reel | 1500                   | G3VM-WFL(TR) | 68       |
| MOSFET THRU-HOLE RELAY | Tube          | 50                     | G3VM-WL      | 48       |

Specifications tables begin on the following page.

# Specifications

## G3VM-2, -2L, -351A

### Maximum Rating

| Parameter                     |                                | Comments and conditions               |         | G3VM-2                                | G3VM-2L                               | G3VM-351A                             |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 6 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                 | 350 V (AC or DC peak)                 | 350 V                                 |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA                                | 120 mA                                | 120 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{I/O}$ for 1 minute min.           |         | 2500 VAC                              | 2500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -20 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +100 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

### Electrical Characteristics

| Parameter                |                                                | Comments and conditions                                   |         | G3VM-2  | G3VM-2L | G3VM-351A          |
|--------------------------|------------------------------------------------|-----------------------------------------------------------|---------|---------|---------|--------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA                                     | Min.    | 1.0 V   | 1.0 V   | 1.0 V              |
|                          |                                                |                                                           | Typical | 1.15 V  | 1.15 V  | 1.15 V             |
|                          |                                                |                                                           | Max.    | 1.3 V   | 1.3 V   | 1.3 V              |
|                          | Reverse current                                | I <sub>R</sub>                                            | Max.    | 10 μA   | 10 μA   | 10 μA              |
|                          | Reverse voltage                                | V <sub>R</sub>                                            | Max.    | 5 V     | 6 V     | 5 V                |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz                                   | Typical | 30 pF   | 30 pF   | 30 pF              |
|                          | Keep ON LED current (I <sub>FT</sub> )         | I <sub>O</sub> = 120 mA                                   | Typical | 2 mA    | 1 mA    | 1 mA               |
|                          |                                                |                                                           | Max.    | 3 mA    | 3 mA    | 3 mA               |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>ON</sub> =120 mA<br>I <sub>F</sub> =5 mA           | Typical | 22 Ω    | 22 Ω    | 35 Ω (25 Ω, t< 1s) |
|                          |                                                |                                                           | Max.    | 35 Ω    | 35 Ω    | 50 Ω (35 Ω, t< 1s) |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | V <sub>OFF</sub> = 350 V                                  | Max.    | 1.0 μA  | 1.0 μA  | 1.0 μA             |
|                          | Limit current (I <sub>LIM</sub> )              | I <sub>F</sub> = 5 mA, V <sub>DD</sub> = 5 V,<br>t = 5 ms | Min.    | —       | 150 mA  | —                  |
|                          |                                                |                                                           | Max.    | —       | 300 mA  | —                  |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )                                       | Typical | 0.8 pF  | 0.8 pF  | 0.8 pF             |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )                                       | Min.    | 1000 MΩ | 1000 MΩ | 1000 MΩ            |
|                          | Operate time                                   | (t <sub>ON</sub> )                                        | Max.    | 1.0 ms  | 1.0 ms  | 1.0 ms             |
|                          | Release time                                   | (t <sub>OFF</sub> )                                       | Max.    | 1.0 ms  | 1.0 ms  | 1.0 ms             |



## Optimum Operating Conditions

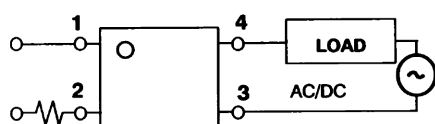
| Parameter                   | Comments and conditions |         | G3VM-2       | G3VM-2L      | G3VM-351A    |
|-----------------------------|-------------------------|---------|--------------|--------------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V        | 280 V        | 280 V        |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA         | 5 mA         | 5 mA         |
|                             |                         | Typical | 7.5 mA       | 7.5 mA       | 7.5 mA       |
|                             |                         | Max.    | 25 mA        | 25 mA        | 25 mA        |
| Continuous load current     | $I_O$                   | Max.    | 100 mA       | 100 mA       | 100 mA       |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C | -20° to 65°C | -20° to 65°C |

## Dimensions

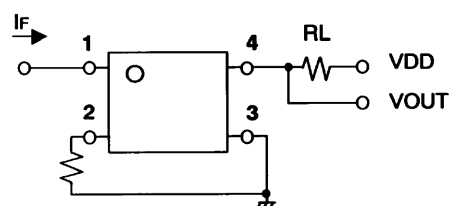
| Item       | G3VM-2      | G3VM-2L     | G3VM-351A   |
|------------|-------------|-------------|-------------|
| Dimensions | See page 92 | See page 92 | See page 92 |

## Connections

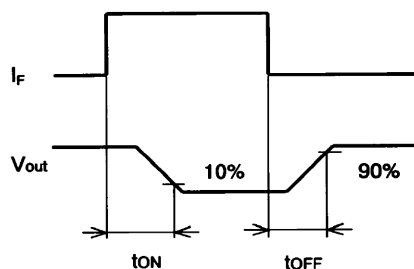
### G3VM-2, 2L



### G3VM-2, 2L, 351A



## Timing Chart



**G3VM-353A, -401A, -61A****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-353A                             | G3VM-401A                             | G3VM-61A                              |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form B/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                 | 400 V                                 | 60 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 150 mA                                | 120 mA                                | 500 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.5 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             | -5.0 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{I/O}$ for 1 minute min.           |         | 2500 VAC                              | 2500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                          | Comments and conditions                     |         | G3VM-353A       | G3VM-401A       | G3VM-61A                      |
|--------------------------|------------------------------------------|---------------------------------------------|---------|-----------------|-----------------|-------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                                 | Min.    | 1.0 V           | 1.0 V           | 1.0 V                         |
|                          |                                          |                                             | Typical | 1.15 V          | 1.15 V          | 1.15 V                        |
|                          |                                          |                                             | Max.    | 1.3 V           | 1.3 V           | 1.3 V                         |
|                          | Reverse current                          | $I_R$                                       | Max.    | 10 $\mu$ A      | 10 $\mu$ A      | 10 $\mu$ A                    |
|                          | Reverse voltage                          | $V_R$                                       | Max.    | 5 V             | 5 V             | 5 V                           |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz                  | Typical | 30 pF           | 30 pF           | 30 pF                         |
|                          | Keep ON LED current ( $I_{FT}$ )         | $I_O = 120$ mA                              | Typical | 1 mA            | 1 mA            | 1 mA                          |
|                          |                                          |                                             | Max.    | 3 mA            | 3 mA            | 3 mA                          |
| Output                   | ON-resistance ( $R_{ON}$ )               | $I_{ON}=150$ mA<br>$I_F=5$ mA               | Typical | 15 $\Omega$     | 18 $\Omega$     | 1 $\Omega$ ( $I_{ON}=500$ mA) |
|                          |                                          |                                             | Max.    | 25 $\Omega$     | 35 $\Omega$     | 2 $\Omega$ ( $I_{ON}=500$ mA) |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | At $V_{OFF}$                                | Max.    | 1.0 $\mu$ A     | 1.0 $\mu$ A     | 1.0 $\mu$ A                   |
|                          | Limit current ( $I_{LIM}$ )              | $I_F = 5$ mA, $V_{DD} = 5$ V,<br>$t = 5$ ms | Min.    | —               | —               | —                             |
|                          |                                          |                                             | Max.    | —               | —               | —                             |
| Transfer characteristics | I/O capacitance                          | ( $C_{I/O}$ )                               | Typical | 0.8 pF          | 0.8 pF          | 0.8 pF                        |
|                          | I/O resistance                           | ( $R_{I/O}$ )                               | Min.    | 1000 M $\Omega$ | 1000 M $\Omega$ | 1000 M $\Omega$               |
|                          | Operate time                             | ( $t_{ON}$ )                                | Max.    | 1.0 ms          | 1.0 ms          | 1.0 ms<br>( $I_F = 10$ mA)    |
|                          | Release time                             | ( $t_{OFF}$ )                               | Max.    | 3.0 ms          | 1.0 ms          | 1.0 ms<br>( $I_F = 10$ mA)    |

**Optimum Operating Conditions**

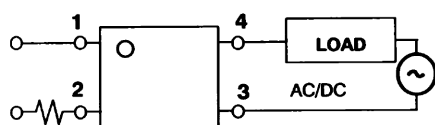
| Parameter                   | Comments and conditions |         | G3VM-353A    | G3VM-401A    | G3VM-61A     |
|-----------------------------|-------------------------|---------|--------------|--------------|--------------|
| Output voltage strength     | V <sub>DD</sub>         | Max.    | 280 V        | 320 V        | 48 V         |
| Operate LED forward current | I <sub>F</sub>          | Min.    | 5 mA         | 5 mA         | 5 mA         |
|                             |                         | Typical | —            | 7.5 mA       | 7.5 mA       |
|                             |                         | Max.    | 25 mA        | 25 mA        | 25 mA        |
| Continuous load current     | I <sub>O</sub>          | Max.    | 150 mA       | 100 mA       | 400 mA       |
| Ambient temperature         | T <sub>A</sub>          |         | -20° to 65°C | -20° to 65°C | -20° to 65°C |

# Dimensions

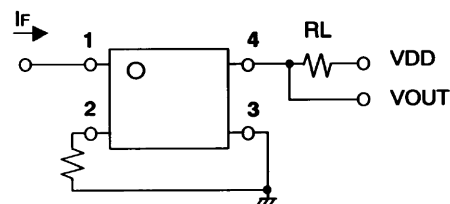
| Item       | G3VM-353A   | G3VM-401A   | G3VM-61A    |
|------------|-------------|-------------|-------------|
| Dimensions | See page 92 | See page 92 | See page 92 |

# Connections

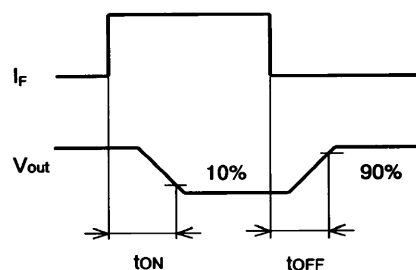
## G3VM-353A



## G3VM-353A, 401A, 61A



# Timing Chart



**G3VM-61A1, -351B, -353B****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-61A1                             | G3VM-351B                                          | G3VM-353B                                          |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|----------------------------------------------------|----------------------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/4 pins                       | 1 Form A/6 pins                                    | 1 Form B/6 pins                                    |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                              | 50 mA                                              |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                                | 1 A                                                |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$                          |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                                | 5 V                                                |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 60 V                                  | 350 V                                              | 350 V                                              |
|                               | Continuous load current        | $I_O$                                 |         | 500 mA                                | 120 mA (for A)<br>120 mA (for B)<br>240 mA (for C) | 150 mA (for A)<br>150 mA (for B)<br>300 mA (for C) |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -5.0 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$ (for A)                  | -1.5 mA/ $^\circ\text{C}$ (for A)                  |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                              | 2500 VAC                                           | 2500 VAC                                           |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$               |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$              |

**Electrical Characteristics**

| Parameter                |                                          | Comments and conditions                     |         | G3VM-61A1                     | G3VM-351B                                       | G3VM-353B                                       |
|--------------------------|------------------------------------------|---------------------------------------------|---------|-------------------------------|-------------------------------------------------|-------------------------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                                 | Min.    | 1.0 V                         | 1.0 V                                           | 1.0 V                                           |
|                          |                                          |                                             | Typical | 1.15 V                        | 1.15 V                                          | 1.15 V                                          |
|                          |                                          |                                             | Max.    | 1.3 V                         | 1.3 V                                           | 1.3 V                                           |
|                          | Reverse current                          | $I_R$                                       | Max.    | 10 $\mu$ A                    | 10 $\mu$ A                                      | 10 $\mu$ A                                      |
|                          | Reverse voltage                          | $V_R$                                       | Max.    | 5 V                           | 5 V                                             | 5 V                                             |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz                  | Typical | 30 pF                         | 30 pF                                           | 30 pF                                           |
|                          | Keep ON LED current ( $I_{FT}$ )         | $I_O = 120$ mA                              | Typical | 1.6 mA                        | 1 mA                                            | 1 mA                                            |
|                          |                                          |                                             | Max.    | 3 mA                          | 3 mA                                            | 3 mA                                            |
| Output                   | ON-resistance ( $R_{ON}$ )               | $I_F=5$ mA                                  | Typical | 1 $\Omega$ ( $I_{ON}=500$ mA) | 35 $\Omega$ ( $I_{ON}=120$ mA) for connection A | 15 $\Omega$ ( $I_{ON}=150$ mA) for connection A |
|                          |                                          |                                             | Max.    | 2 $\Omega$ ( $I_{ON}=500$ mA) | 50 $\Omega$ ( $I_{ON}=120$ mA) for connection A | 25 $\Omega$ ( $I_{ON}=150$ mA) for connection A |
|                          |                                          |                                             | Typical | —                             | 28 $\Omega$ ( $I_{ON}=120$ mA) for connection B | 8 $\Omega$ ( $I_{ON}=150$ mA) for connection B  |
|                          |                                          |                                             | Max.    | —                             | 40 $\Omega$ ( $I_{ON}=120$ mA) for connection B | 14 $\Omega$ ( $I_{ON}=150$ mA) for connection B |
|                          |                                          |                                             | Typical | —                             | 14 $\Omega$ ( $I_{ON}=240$ mA) for connection C | 4 $\Omega$ ( $I_{ON}=300$ mA) for connection C  |
|                          |                                          |                                             | Max.    | —                             | 20 $\Omega$ ( $I_{ON}=240$ mA) for connection C | 7 $\Omega$ ( $I_{ON}=300$ mA) for connection C  |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | At $V_{OFF}$                                | Max.    | 1.0 $\mu$ A                   | 1.0 $\mu$ A                                     | 1.0 $\mu$ A                                     |
|                          | Limit current ( $I_{LIM}$ )              | $I_F = 5$ mA, $V_{DD} = 5$ V,<br>$t = 5$ ms | Min.    | —                             | —                                               | —                                               |
|                          |                                          |                                             | Max.    | —                             | —                                               | —                                               |
| Transfer characteristics | I/O capacitance                          | $(C_{I/O})$                                 | Typical | 0.8 pF                        | 0.8 pF                                          | 0.8 pF                                          |
|                          | I/O resistance                           | $(R_{IO})$                                  | Min.    | 1000 M $\Omega$               | 1000 M $\Omega$                                 | 1000 M $\Omega$                                 |
|                          | Operate time                             | $(t_{ON})$                                  | Max.    | 2.0 ms                        | 1.0 ms                                          | 1.0 ms                                          |
|                          | Release time                             | $(t_{OFF})$                                 | Max.    | 0.5 ms                        | 1.0 ms                                          | 3.0 ms                                          |

## Optimum Operating Conditions

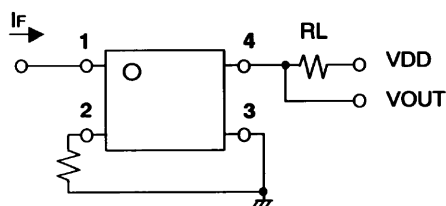
| Parameter                   | Comments and conditions |         | G3VM-61A1    | G3VM-351B    | G3VM-353B    |
|-----------------------------|-------------------------|---------|--------------|--------------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 48 V         | 280 V        | 280 V        |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA         | 5 mA         | 5 mA         |
|                             |                         | Typical | 7.5 mA       | 10 mA        | —            |
|                             |                         | Max.    | 25 mA        | 25 mA        | 25 mA        |
| Continuous load current     | $I_O$                   | Max.    | 500 mA       | 100 mA       | 150 mA       |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C | -20° to 65°C | -20° to 65°C |

## Dimensions

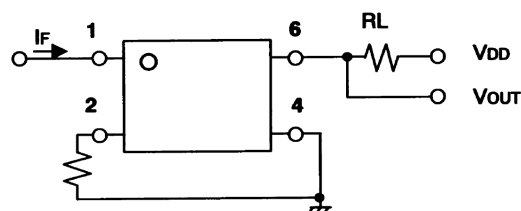
| Item       | G3VM-61A1   | G3VM-351B   | G3VM-353B   |
|------------|-------------|-------------|-------------|
| Dimensions | See page 92 | See page 92 | See page 92 |

## Connections

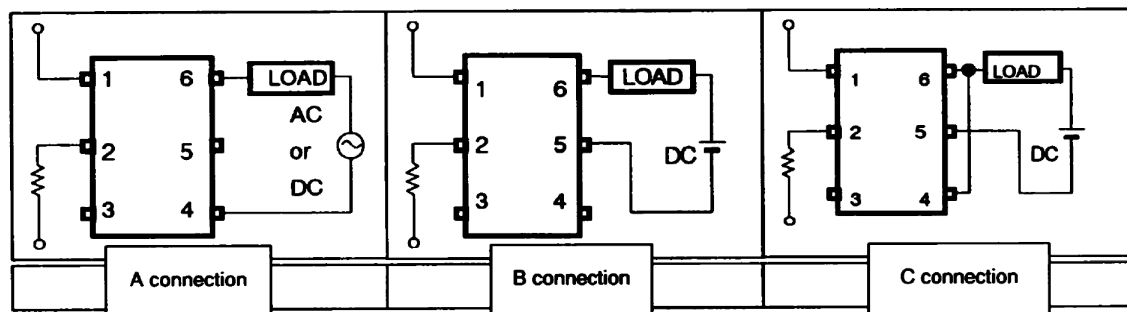
### G3VM-61A1



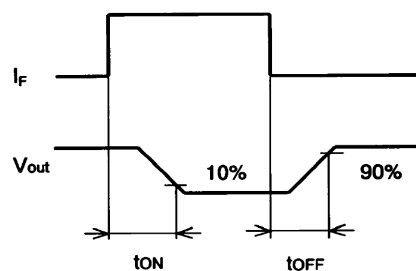
### G3VM-351B, -353B



### G3VM-351B, -353B



## Timing Chart



**G3VM-3, -3L, -401B****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-3                                             | G3VM-3L                               | G3VM-401B                                          |
|-------------------------------|--------------------------------|---------------------------------------|---------|----------------------------------------------------|---------------------------------------|----------------------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/6 pins                                    | 1 Form A/6 pins                       | 1 Form A/6 pins                                    |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                              | 50 mA                                 | 50 mA                                              |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                                | 1 A                                   | 1 A                                                |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$                          |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                                | 5 V                                   | 5 V                                                |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 60 V                                               | 350 V                                 | 400 V                                              |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA (for A)<br>120 mA (for B)<br>160 mA (for C) | 120 mA                                | 120 mA (for A)<br>120 mA (for B)<br>240 mA (for C) |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$ (for A)                  | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$ (for A)                  |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                                           | 2500 VAC                              | 2500 VAC                                           |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -20 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$               |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +100 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$              |

**Electrical Characteristics**

| Parameter                |                                          | Comments and conditions                     |         | G3VM-3                                             | G3VM-3L                        | G3VM-401B                                          |
|--------------------------|------------------------------------------|---------------------------------------------|---------|----------------------------------------------------|--------------------------------|----------------------------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                                 | Min.    | 1.0 V                                              | 1.0 V                          | 1.0 V                                              |
|                          |                                          |                                             | Typical | 1.15 V                                             | 1.15 V                         | 1.15 V                                             |
|                          |                                          |                                             | Max.    | 1.3 V                                              | 1.3 V                          | 1.3 V                                              |
|                          | Reverse current                          | $I_R$                                       | Max.    | 10 $\mu$ A                                         | 10 $\mu$ A                     | 10 $\mu$ A                                         |
|                          | Reverse voltage                          | $V_R$                                       | Max.    | 5 V                                                | 5 V                            | 5 V                                                |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz                  | Typical | 30 pF                                              | 30 pF                          | 30 pF                                              |
|                          | Keep ON LED current ( $I_{FT}$ )         | At $I_O$                                    | Typical | —                                                  | —                              | 1 mA                                               |
|                          |                                          |                                             | Max.    | 3 mA                                               | 3 mA                           | 3 mA                                               |
| Output                   | ON-resistance ( $R_{ON}$ )               | $I_F=5$ mA                                  | Typical | 22 $\Omega$ ( $I_{ON}=120$ mA)<br>for connection A | 22 $\Omega$ ( $I_{ON}=120$ mA) | 17 $\Omega$ ( $I_{ON}=120$ mA) for<br>connection A |
|                          |                                          |                                             | Max.    | 35 $\Omega$ ( $I_{ON}=120$ mA)<br>for connection A | 35 $\Omega$ ( $I_{ON}=120$ mA) | 35 $\Omega$ ( $I_{ON}=120$ mA) for<br>connection A |
|                          |                                          |                                             | Typical | 16 $\Omega$ ( $I_{ON}=120$ mA)<br>for connection B | —                              | 11 $\Omega$ ( $I_{ON}=120$ mA) for<br>connection B |
|                          |                                          |                                             | Max.    | 23 $\Omega$ ( $I_{ON}=120$ mA)<br>for connection B | —                              | 20 $\Omega$ ( $I_{ON}=120$ mA) for<br>connection B |
|                          |                                          |                                             | Typical | 8 $\Omega$ ( $I_{ON}=160$ mA)<br>for connection C  | —                              | 6 $\Omega$ ( $I_{ON}=240$ mA) for<br>connection C  |
|                          |                                          |                                             | Max.    | 12 $\Omega$ ( $I_{ON}=160$ mA)<br>for connection C | —                              | 10 $\Omega$ ( $I_{ON}=240$ mA) for<br>connection C |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | At $V_{OFF}$                                | Max.    | 1.0 $\mu$ A                                        | 1.0 $\mu$ A                    | 1.0 $\mu$ A                                        |
|                          | Limit current ( $I_{LIM}$ )              | $I_F = 5$ mA, $V_{DD} = 5$ V,<br>$t = 5$ ms | Min.    | —                                                  | 150 mA                         | —                                                  |
| Transfer characteristics | I/O capacitance                          | ( $C_{IO}$ )                                | Typical | 0.8 pF                                             | 0.8 pF                         | 0.8 pF                                             |
|                          | I/O resistance                           | ( $R_{IO}$ )                                | Min.    | 1000 M $\Omega$                                    | 1000 M $\Omega$                | 1000 M $\Omega$                                    |
|                          | Operate time                             | ( $t_{ON}$ )                                | Max.    | 1.0 ms                                             | 1.0 ms                         | 1.0 ms                                             |
|                          | Release time                             | ( $t_{OFF}$ )                               | Max.    | 1.0 ms                                             | 1.0 ms                         | 1.0 ms                                             |

## Optimum Operating Conditions

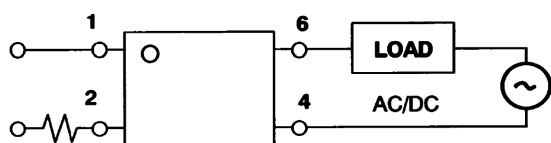
| Parameter                   | Comments and conditions |         | G3VM-3       | G3VM-3L      | G3VM-401B    |
|-----------------------------|-------------------------|---------|--------------|--------------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V        | 280 V        | 320 V        |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA         | 5 mA         | 5 mA         |
|                             |                         | Typical | 7.5 mA       | 10 mA        | 7.5 mA       |
|                             |                         | Max.    | 25 mA        | 25 mA        | 25 mA        |
| Continuous load current     | $I_O$                   | Max.    | 120 mA       | 120 mA       | 120 mA       |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C | -20° to 65°C | -20° to 65°C |

## Dimensions

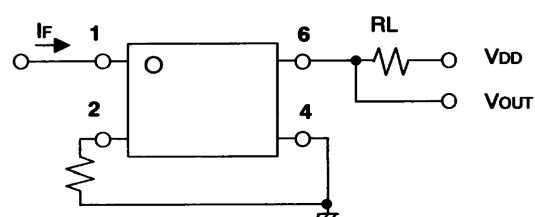
| Item       | G3VM-3      | G3VM-3L     | G3VM-401B   |
|------------|-------------|-------------|-------------|
| Dimensions | See page 92 | See page 92 | See page 92 |

## Connections

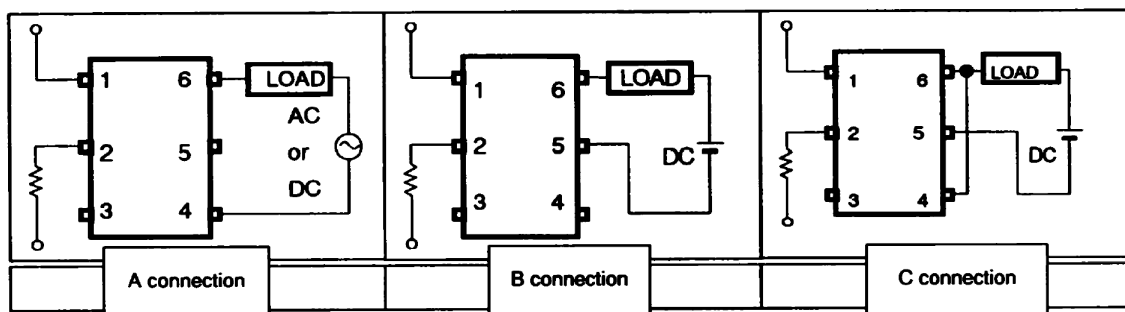
### G3VM-3L



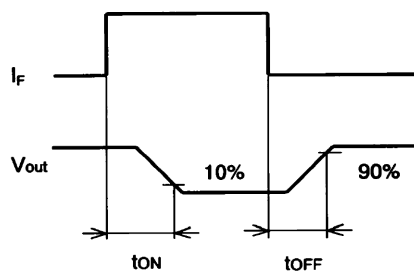
### G3VM-3, -3L, -401B



### G3VM-3, -401B



## Timing Chart



# G3VM-401BY, -601BY, -61B

## Maximum Rating

| Parameter                     |                                | Comments and conditions               |         | G3VM-401BY                                         | G3VM-601BY                                         | G3VM-61B                                            |
|-------------------------------|--------------------------------|---------------------------------------|---------|----------------------------------------------------|----------------------------------------------------|-----------------------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/6 pins                                    | 1 Form A/6 pins                                    | 1 Form A/6 pins                                     |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                              | 50 mA                                              | 50 mA                                               |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                                | 1 A                                                | 1 A                                                 |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$                           |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                                | 5 V                                                | 5 V                                                 |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                                |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 400 V                                              | 600 V                                              | 60 V                                                |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA (for A)<br>120 mA (for B)<br>240 mA (for C) | 100 mA (for A)<br>100 mA (for B)<br>200 mA (for C) | 500 mA (for A)<br>500 mA (for B)<br>1000 mA (for C) |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$ (for A)                  | -1.0 mA/ $^\circ\text{C}$ (for A)                  | -5.0 mA/ $^\circ\text{C}$ (for A)                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                                |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 5000 VAC                                           | 5000 VAC                                           | 2500 VAC                                            |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$                |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$               |

## Electrical Characteristics

| Parameter                |                                          | Comments and conditions                     |         | G3VM-401BY                                      | G3VM-601BY                                      | G3VM-61B                                          |
|--------------------------|------------------------------------------|---------------------------------------------|---------|-------------------------------------------------|-------------------------------------------------|---------------------------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                                 | Min.    | 1.0 V                                           | 1.0 V                                           | 1.0 V                                             |
|                          |                                          |                                             | Typical | 1.15 V                                          | 1.15 V                                          | 1.15 V                                            |
|                          |                                          |                                             | Max.    | 1.3 V                                           | 1.3 V                                           | 1.3 V                                             |
|                          | Reverse current                          | $I_R$                                       | Max.    | 10 $\mu$ A                                      | 10 $\mu$ A                                      | 10 $\mu$ A                                        |
|                          | Reverse voltage                          | $V_R$                                       | Max.    | 5 V                                             | 5 V                                             | 5 V                                               |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz                  | Typical | 30 pF                                           | 30 pF                                           | 30 pF                                             |
| Output                   | Keep ON LED current ( $I_{FT}$ )         | At $I_O$                                    | Typical | —                                               | —                                               | —                                                 |
|                          |                                          |                                             | Max.    | 3 mA                                            | 5 mA                                            | 3 mA                                              |
|                          | ON-resistance ( $R_{ON}$ )               | $I_F=5$ mA                                  | Typical | 17 $\Omega$ ( $I_{ON}=120$ mA) for connection A | 30 $\Omega$ ( $I_{ON}=100$ mA) for connection A | 1 $\Omega$ ( $I_{ON}=500$ mA) for connection A    |
|                          |                                          |                                             | Max.    | 35 $\Omega$ ( $I_{ON}=120$ mA) for connection A | 45 $\Omega$ ( $I_{ON}=100$ mA) for connection A | 2 $\Omega$ ( $I_{ON}=500$ mA) for connection A    |
|                          |                                          |                                             | Typical | 11 $\Omega$ ( $I_{ON}=120$ mA) for connection B | 23 $\Omega$ ( $I_{ON}=100$ mA) for connection B | 0.5 $\Omega$ ( $I_{ON}=500$ mA) for connection B  |
|                          |                                          |                                             | Max.    | 20 $\Omega$ ( $I_{ON}=120$ mA) for connection B | 35 $\Omega$ ( $I_{ON}=100$ mA) for connection B | 1 $\Omega$ ( $I_{ON}=500$ mA) for connection B    |
|                          |                                          |                                             | Typical | 6 $\Omega$ ( $I_{ON}=240$ mA) for connection C  | 12 $\Omega$ ( $I_{ON}=200$ mA) for connection C | 0.3 $\Omega$ ( $I_{ON}=1000$ mA) for connection C |
|                          |                                          |                                             | Max.    | 10 $\Omega$ ( $I_{ON}=240$ mA) for connection C | 18 $\Omega$ ( $I_{ON}=200$ mA) for connection C | —                                                 |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | At $V_{OFF}$                                | Max.    | 1.0 $\mu$ A                                     | 1.0 $\mu$ A                                     | 1.0 $\mu$ A                                       |
|                          | Limit current ( $I_{LIM}$ )              | $I_F = 5$ mA, $V_{DD} = 5$ V,<br>$t = 5$ ms | Min.    | —                                               | —                                               | —                                                 |
|                          |                                          |                                             | Max.    | —                                               | —                                               | —                                                 |
| Transfer characteristics | I/O capacitance                          | $(C_{I/O})$                                 | Typical | 0.8 pF                                          | 0.8 pF                                          | 0.8 pF                                            |
|                          | I/O resistance                           | $(R_{IO})$                                  | Min.    | 1000 M $\Omega$                                 | 1000 M $\Omega$                                 | 1000 M $\Omega$                                   |
|                          | Operate time                             | $(t_{ON})$                                  | Max.    | 1.0 ms                                          | 1.5 ms                                          | 1.0 ms                                            |
|                          | Release time                             | $(t_{OFF})$                                 | Max.    | 1.0 ms                                          | 1.0 ms                                          | 1.0 ms                                            |



## Optimum Operating Conditions

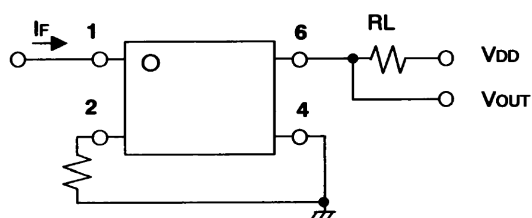
| Parameter                   | Comments and conditions |         | G3VM-401BY   | G3VM-601BY   | G3VM-61B     |
|-----------------------------|-------------------------|---------|--------------|--------------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 320 V        | 480 V        | 48 V         |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA         | 7.5 mA       | 5 mA         |
|                             |                         | Typical | 7.5 mA       | 15 mA        | 7.5 mA       |
|                             |                         | Max.    | 25 mA        | 25 mA        | 25 mA        |
| Continuous load current     | $I_O$                   | Max.    | 120 mA       | 100 mA       | 400 mA       |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C | -20° to 65°C | -20° to 65°C |

## Dimensions

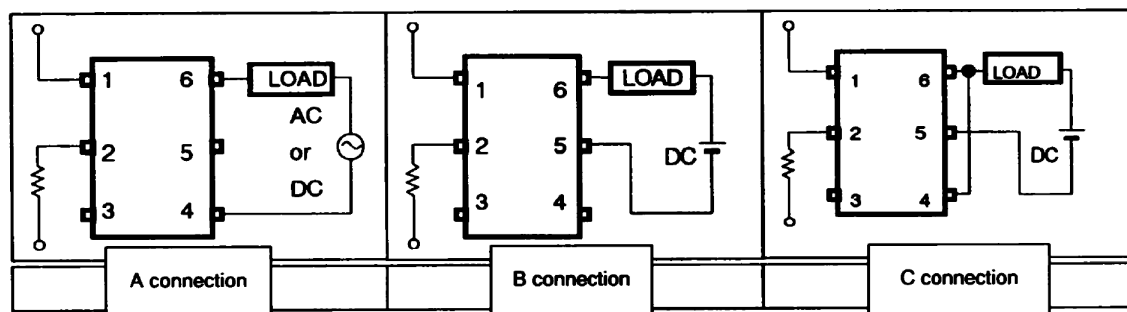
| Item       | G3VM-401BY  | G3VM-601BY  | G3VM-61B    |
|------------|-------------|-------------|-------------|
| Dimensions | See page 92 | See page 92 | See page 92 |

## Connections

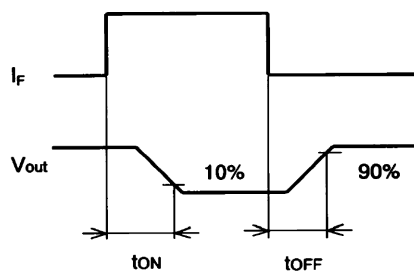
### G3VM-401BY, -601BY, -61B



### G3VM-401BY, -601BY, -61B



## Timing Chart



**G3VM-61B1, -V****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-61B1                                           | G3VM-V                                             |
|-------------------------------|--------------------------------|---------------------------------------|---------|-----------------------------------------------------|----------------------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/6 pins                                     | 1 Form A/6 pins                                    |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                               | 50 mA                                              |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                                 | 1 A                                                |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$                           | -0.5 mA/ $^\circ\text{C}$                          |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                                 | 5 V                                                |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                                | 125 $^\circ\text{C}$                               |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 60 V                                                | 60 V                                               |
|                               | Continuous load current        | $I_O$                                 |         | 500 mA (for A)<br>500 mA (for B)<br>1000 mA (for C) | 300 mA (for A)<br>450 mA (for B)<br>600 mA (for C) |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -5.0 mA/ $^\circ\text{C}$ (for A)                   | -3.0 mA/ $^\circ\text{C}$ (for A)                  |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                                | 125 $^\circ\text{C}$                               |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                                            | 2500 VAC                                           |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$                | -20 $^\circ$ to +85 $^\circ\text{C}$               |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$               | -55 $^\circ$ to +100 $^\circ\text{C}$              |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions                                |         | G3VM-61B1                                          | G3VM-V                                            |
|--------------------------|------------------------------------------------|--------------------------------------------------------|---------|----------------------------------------------------|---------------------------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA                                  | Min.    | 1.0 V                                              | 1.0 V                                             |
|                          |                                                |                                                        | Typical | 1.15 V                                             | 1.15 V                                            |
|                          |                                                |                                                        | Max.    | 1.3 V                                              | 1.3 V                                             |
|                          | Reverse current                                | I <sub>R</sub>                                         | Max.    | 10 μA                                              | 10 μA                                             |
|                          | Reverse voltage                                | V <sub>R</sub>                                         | Max.    | 5 V                                                | 5 V                                               |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz                                | Typical | 30 pF                                              | 30 pF                                             |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>                                      | Typical | 1.6 mA                                             | 1 mA                                              |
| Max.                     |                                                |                                                        | 3 mA    | 5 mA                                               |                                                   |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA                                   | Typical | 1 Ω (I <sub>ON</sub> =500 mA) for connection A     | 1.4 Ω (I <sub>ON</sub> =300 mA) for connection A  |
|                          |                                                |                                                        | Max.    | 2 Ω (I <sub>ON</sub> =500 mA) for connection A     | 2 Ω (I <sub>ON</sub> =300 mA) for connection A    |
|                          |                                                |                                                        | Typical | 0.5 Ω (I <sub>ON</sub> =500 mA) for connection B   | 0.7 Ω (I <sub>ON</sub> =450 mA) for connection B  |
|                          |                                                |                                                        | Max.    | 1 Ω (I <sub>ON</sub> =500 mA) for connection B     | 1 Ω (I <sub>ON</sub> =450 mA) for connection B    |
|                          |                                                |                                                        | Typical | 0.25 Ω (I <sub>ON</sub> =1000 mA) for connection C | 0.35 Ω (I <sub>ON</sub> =600 mA) for connection C |
|                          |                                                |                                                        | Max.    | —                                                  | 0.5 Ω (I <sub>ON</sub> =600 mA) for connection C  |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>                                    | Max.    | 1.0 μA                                             | 1.0 μA                                            |
|                          | Limit current (I <sub>LIM</sub> )              | I <sub>F</sub> = 5 mA, V <sub>DD</sub> = 5 V, t = 5 ms | Min.    | —                                                  | —                                                 |
| Max.                     |                                                |                                                        | —       | —                                                  |                                                   |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )                                    | Typical | 0.8 pF                                             | 0.8 pF                                            |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )                                    | Min.    | 1000 MΩ                                            | 1000 MΩ                                           |
|                          | Operate time                                   | (t <sub>ON</sub> )                                     | Max.    | 2.0 ms                                             | 1.0 ms                                            |
|                          | Release time                                   | (t <sub>OFF</sub> )                                    | Max.    | 0.5 ms                                             | 1.0 ms                                            |

## Optimum Operating Conditions

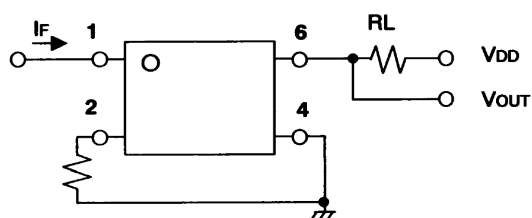
| Parameter                   | Comments and conditions |         | G3VM-61B1    | G3VM-V       |
|-----------------------------|-------------------------|---------|--------------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 48 V         | 48V          |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA         | 7.5 mA       |
|                             |                         | Typical | 7.5 mA       | 15 mA        |
|                             |                         | Max.    | 25 mA        | 25 mA        |
| Continuous load current     | $I_O$                   | Max.    | 500 mA       | 300 mA       |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C | -20° to 80°C |

## Dimensions

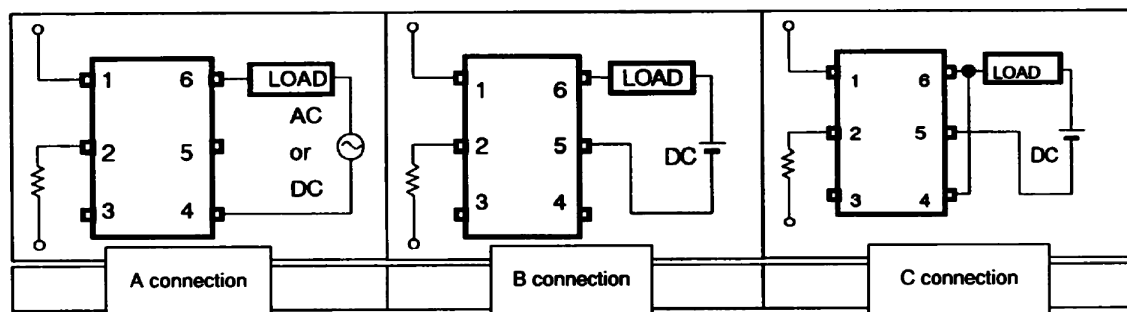
| Item       | G3VM-61B1   | G3VM-V      |
|------------|-------------|-------------|
| Dimensions | See page 92 | See page 92 |

## Connections

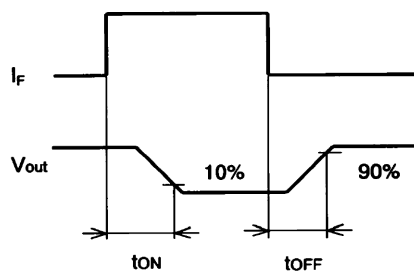
### G3VM-61B1, -V



### G3VM-61B1, -V



## Timing Chart



**G3VM-61CP****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-61CP                             |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/8 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 6 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 60 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 500 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -5.0 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-61CP                       |
|--------------------------|------------------------------------------------|-------------------------|---------|---------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                           |
|                          |                                                |                         | Typical | 1.2 V                           |
|                          |                                                |                         | Max.    | 1.4 V                           |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 15 μA                           |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 6 V                             |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 15 pF                           |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | —                               |
|                          |                                                |                         | Max.    | 5 mA                            |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 0.3 Ω (I <sub>ON</sub> =500 mA) |
|                          |                                                |                         | Max.    | 0.6 Ω (I <sub>ON</sub> =500 mA) |
|                          |                                                |                         | Typical | —                               |
|                          |                                                |                         | Max.    | —                               |
|                          |                                                |                         | Typical | —                               |
|                          |                                                |                         | Max.    | —                               |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                          |
|                          | Capacitance                                    | COFF                    | Typical | 200 pF                          |
| Max.                     |                                                |                         | 500 pF  |                                 |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                          |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                         |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 2.0 ms                          |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 0.5 ms                          |

Optimum Operating Conditions

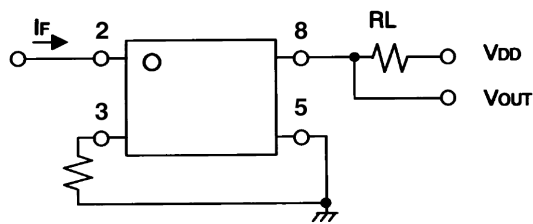
| Parameter                   | Comments and conditions |         | G3VM-61CP    |
|-----------------------------|-------------------------|---------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 48 V         |
| Operate LED forward current | $I_F$                   | Min.    | 10 mA        |
|                             |                         | Typical | — mA         |
|                             |                         | Max.    | 30 mA        |
| Continuous load current     | $I_O$                   | Max.    | 500 mA       |
| Ambient temperature         | $T_A$                   |         | -25° to 50°C |

Dimensions

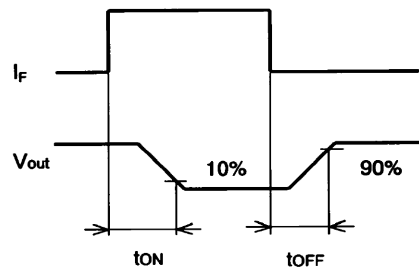
| Item       | G3VM-61CP   |
|------------|-------------|
| Dimensions | See page 93 |

Connections

G3VM-61CP



Timing Chart



**G3VM-61CR, 355CR, 352C****Maximum Rating**

| Parameter                     |                                | Comments and conditions                  |         | G3VM-61CR                             | G3VM-355CR                            | G3VM-352C                             |
|-------------------------------|--------------------------------|------------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                        |         | 1 Form A/8 pins                       | 1FormA+1FormB/<br>8 pins              | 2 Form A/8 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                    | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse,<br>100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$              |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                    | Max.    | 6 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                          |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                                |         | 60 V                                  | 350 V                                 | 350 V                                 |
|                               | Continuous load current        | $I_O$                                    |         | 2000 mA                               | 120 mA                                | 120 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$              |         | -20 mA/ $^\circ\text{C}$              | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                          |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.               |         | 1500 VAC                              | 2500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                      |         | -20 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing                  |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +100 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter      |                                                | Comments and conditions   |                     | G3VM-61CR | G3VM-355CR                     | G3VM-352C           |
|----------------|------------------------------------------------|---------------------------|---------------------|-----------|--------------------------------|---------------------|
| Input          | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA     | Min.                | 1.0 V     | 1.0 V                          | 1.0 V               |
|                |                                                |                           | Typical             | 1.2 V     | 1.15 V                         | 1.15 V              |
|                |                                                |                           | Max.                | 1.4 V     | 1.3 V                          | 1.3 V               |
|                | Reverse current                                | I <sub>R</sub>            | Max.                | 10 μA     | 10 μA                          | 10 μA               |
|                | Reverse voltage                                | V <sub>R</sub>            | Max.                | 6 V       | 5 V                            | 5 V                 |
|                | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz   | Typical             | 15 pF     | 30 pF                          | 30 pF               |
|                | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>         | Typical             | —         | 1 mA                           | 1 mA                |
|                |                                                |                           | Max.                | 5 mA      | 3 mA                           | 3 mA                |
| Output         | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA (1a) | Typical             | —         | 15 Ω (I <sub>ON</sub> =120 mA) | 35 Ω (25 Ω, t ≤ 1s) |
|                |                                                |                           | Max.                | 0.12 Ω    | 25 Ω (I <sub>ON</sub> =120 mA) | 50 Ω (35 Ω, t ≤ 1s) |
|                |                                                | I <sub>F</sub> =0 mA (1b) | Typical             | —         | 15 Ω (I <sub>ON</sub> =120 mA) | —                   |
|                |                                                |                           | Max.                | —         | 25 Ω (I <sub>ON</sub> =120 mA) | —                   |
|                |                                                |                           | Typical             | —         | —                              | —                   |
|                |                                                |                           | Max.                | —         | —                              | —                   |
|                | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>       | Max.                | 4.0 μA    | 1.0 μA                         | 1.0 μA              |
|                | Capacitance                                    | COFF                      | Typical             | —         | —                              | — pF                |
|                |                                                |                           | Max.                | —         | —                              | — pF                |
|                | Transfer characteristics                       | I/O capacitance           | (C <sub>I/O</sub> ) | Typical   | 0.8 pF                         | 0.8 pF              |
| I/O resistance |                                                | (R <sub>IO</sub> )        | Min.                | 1000 MΩ   | 1000 MΩ                        | 1000 MΩ             |
| Operate time   |                                                | (t <sub>ON</sub> )        | Max.                | 5.0 ms    | 1.0 ms                         | 1.0 ms              |
| Release time   |                                                | (t <sub>OFF</sub> )       | Max.                | 3.5 ms    | 3.0 ms                         | 1.0 ms              |

## Optimum Operating Conditions

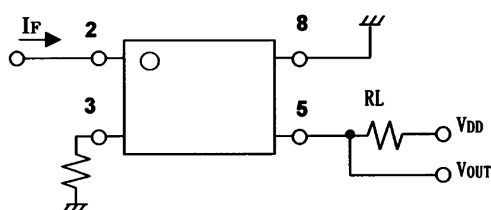
| Parameter                   | Comments and conditions |         | G3VM-61CR    | G3VM-355CR   | G3VM-352C    |
|-----------------------------|-------------------------|---------|--------------|--------------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 48 V         | 280V         | 280 V        |
| Operate LED forward current | $I_F$                   | Min.    | 10 mA        | 5 mA         | 5 mA         |
|                             |                         | Typical | — mA         | —            | 7.5 mA       |
|                             |                         | Max.    | 30 mA        | 25 mA        | 25 mA        |
| Continuous load current     | $I_O$                   | Max.    | 2000 mA      | 120 mA       | 100 mA       |
| Ambient temperature         | $T_A$                   |         | -25° to 50°C | -20° to 65°C | -20° to 65°C |

## Dimensions

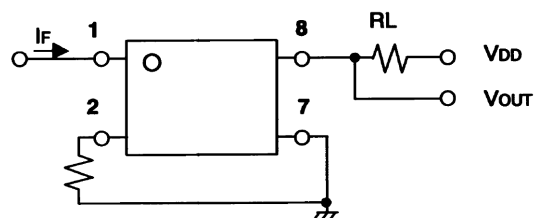
| Item       | G3VM-61CR   | G3VM-355CR  | G3VM-352C   |
|------------|-------------|-------------|-------------|
| Dimensions | See page 93 | See page 93 | See page 93 |

## Connections

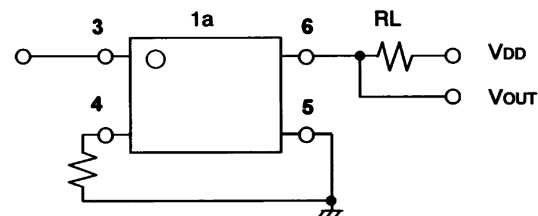
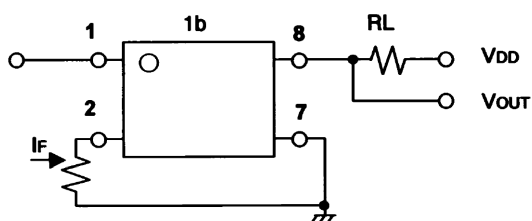
### G3VM-61CR



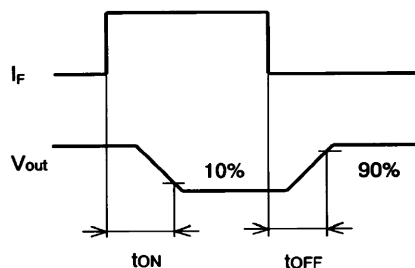
### G3VM-352C



### G3VM-355CR



## Timing Chart



**G3VM-402C, -62C1, -W****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-402C                             | G3VM-62C1                             | G3VM-W                                |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 2 Form A/8 pins                       | 2 Form A/8 pins                       | 2 Form A/8 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 400 V                                 | 60 V                                  | 350 V                                 |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA                                | 500 mA                                | 120 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$             | -5.0 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{I/O}$ for 1 minute min.           |         | 2500 VAC                              | 2500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -20 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +100 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                          | Comments and conditions    |         | G3VM-402C                      | G3VM-62C1                       | G3VM-W                         |
|--------------------------|------------------------------------------|----------------------------|---------|--------------------------------|---------------------------------|--------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                | Min.    | 1.0 V                          | 1.0 V                           | 1.0 V                          |
|                          |                                          |                            | Typical | 1.15 V                         | 1.15 V                          | 1.15 V                         |
|                          |                                          |                            | Max.    | 1.3 V                          | 1.3 V                           | 1.3 V                          |
|                          | Reverse current                          | $I_R$                      | Max.    | 10 $\mu$ A                     | 10 $\mu$ A                      | 10 $\mu$ A                     |
|                          | Reverse voltage                          | $V_R$                      | Max.    | 5 V                            | 5 V                             | 5 V                            |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz | Typical | 30 pF                          | 30 pF                           | 30 pF                          |
|                          | Keep ON LED current ( $I_{FT}$ )         | At $I_O$                   | Typical | 1                              | 1.6 mA                          | 2 mA                           |
|                          |                                          |                            | Max.    | 3 mA                           | 3 mA                            | 3 mA                           |
| Output                   | ON-resistance ( $R_{ON}$ )               | $I_F=5$ mA (1a)            | Typical | 18 $\Omega$ ( $I_{ON}=120$ mA) | 1.0 $\Omega$ ( $I_{ON}=500$ mA) | 22 $\Omega$ ( $I_{ON}=120$ mA) |
|                          |                                          |                            | Max.    | 35 $\Omega$ ( $I_{ON}=120$ mA) | 2.0 $\Omega$ ( $I_{ON}=500$ mA) | 35 $\Omega$ ( $I_{ON}=120$ mA) |
|                          |                                          | $I_F=0$ mA (1b)            | Typical | —                              | —                               | —                              |
|                          |                                          |                            | Max.    | —                              | —                               | —                              |
|                          |                                          |                            | Typical | —                              | —                               | —                              |
|                          |                                          |                            | Max.    | —                              | —                               | —                              |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | At $V_{OFF}$               | Max.    | 1.0 $\mu$ A                    | 1.0 $\mu$ A                     | 1.0 $\mu$ A                    |
|                          | Capacitance                              | COFF                       | Typical | —                              | —                               | —                              |
|                          |                                          |                            | Max.    | —                              | —                               | —                              |
| Transfer characteristics | I/O capacitance                          | ( $C_{I/O}$ )              | Typical | 0.8 pF                         | 0.8 pF                          | 0.8 pF                         |
|                          | I/O resistance                           | ( $R_{I/O}$ )              | Min.    | 1000 M $\Omega$                | 1000 M $\Omega$                 | 1000 M $\Omega$                |
|                          | Operate time                             | ( $t_{ON}$ )               | Max.    | 1.0 ms                         | 2.0 ms                          | 1.0 ms                         |
|                          | Release time                             | ( $t_{OFF}$ )              | Max.    | 1.0 ms                         | 0.5 ms                          | 1.0 ms                         |



## Optimum Operating Conditions

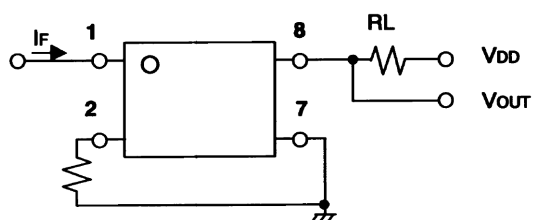
| Parameter                   | Comments and conditions |         | G3VM-402C    | G3VM-62C1    | G3VM-W       |
|-----------------------------|-------------------------|---------|--------------|--------------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 320 V        | 48 V         | 280 V        |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA         | 5 mA         | 5 mA         |
|                             |                         | Typical | 7.5 mA       | 7.5          | 7.5 mA       |
|                             |                         | Max.    | 25 mA        | 25 mA        | 25 mA        |
| Continuous load current     | $I_O$                   | Max.    | 100 mA       | 500 mA       | 100 mA       |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C | -20° to 65°C | -20° to 65°C |

## Dimensions

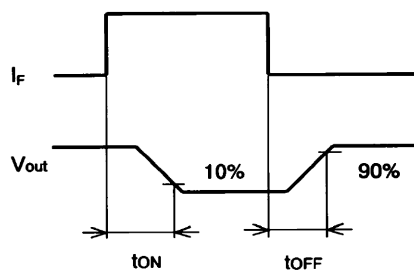
| Item       | G3VM-402C   | G3VM-62C1   | G3VM-W      |
|------------|-------------|-------------|-------------|
| Dimensions | See page 93 | See page 93 | See page 93 |

## Connections

G3VM-402C, -62C1, -W



## Timing Chart



**G3VM-WL, -354C****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-WL                               | G3VM-354C                             |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 2 Form A/8 pins                       | 2 Form B/8 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 6 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                 | 350 V                                 |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA                                | 150 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$             | -1.5 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{I/O}$ for 1 minute min.           |         | 2500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                          | Comments and conditions    |         | G3VM-WL                        | G3VM-354C                      |
|--------------------------|------------------------------------------|----------------------------|---------|--------------------------------|--------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                | Min.    | 1.0 V                          | 1.0 V                          |
|                          |                                          |                            | Typical | 1.15 V                         | 1.15 V                         |
|                          |                                          |                            | Max.    | 1.3 V                          | 1.3 V                          |
|                          | Reverse current                          | $I_R$                      | Max.    | 10 $\mu$ A                     | 10 $\mu$ A                     |
|                          | Reverse voltage                          | $V_R$                      | Max.    | 6 V                            | 5 V                            |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz | Typical | 30 pF                          | 30 pF                          |
|                          | Keep ON LED current ( $I_{FT}$ )         | At $I_O$                   | Typical | 1                              | 1 mA                           |
|                          |                                          |                            | Max.    | 3 mA                           | 3 mA                           |
| Output                   | ON-resistance ( $R_{ON}$ )               | $I_F=5$ mA                 | Typical | 22 $\Omega$ ( $I_{ON}=120$ mA) | 15 $\Omega$ ( $I_{ON}=150$ mA) |
|                          |                                          |                            | Max.    | 35 $\Omega$ ( $I_{ON}=120$ mA) | 25 $\Omega$ ( $I_{ON}=150$ mA) |
|                          |                                          |                            | Typical | —                              | —                              |
|                          |                                          |                            | Max.    | —                              | —                              |
|                          |                                          |                            | Typical | —                              | —                              |
|                          |                                          |                            | Max.    | —                              | —                              |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | At $V_{OFF}$               | Max.    | 1.0 $\mu$ A                    | 1.0 $\mu$ A                    |
|                          | Limit current                            | $I_{LIM}$                  | Min.    | 150 mA                         | —                              |
|                          |                                          |                            | Max.    | 300 mA                         | —                              |
| Transfer characteristics | I/O capacitance                          | ( $C_{I/O}$ )              | Typical | 0.8 pF                         | 0.8 pF                         |
|                          | I/O resistance                           | ( $R_{I/O}$ )              | Min.    | 1000 M $\Omega$                | 1000 M $\Omega$                |
|                          | Operate time                             | ( $t_{ON}$ )               | Max.    | 1.0 ms                         | 1.0 ms                         |
|                          | Release time                             | ( $t_{OFF}$ )              | Max.    | 1.0 ms                         | 3.0 ms                         |

# Optimum Operating Conditions

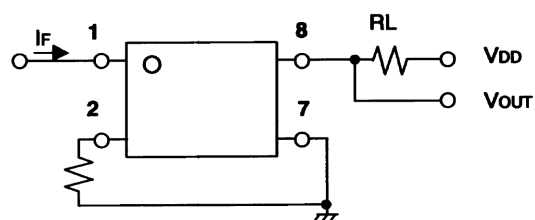
| Parameter                   | Comments and conditions |         | G3VM-WL      | G3VM-354C    |
|-----------------------------|-------------------------|---------|--------------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V        | 280 V        |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA         | 5 mA         |
|                             |                         | Typical | 7.5 mA       | —            |
|                             |                         | Max.    | 25 mA        | 25 mA        |
| Continuous load current     | $I_O$                   | Max.    | 100 mA       | 150 mA       |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C | -20° to 65°C |

## Dimensions

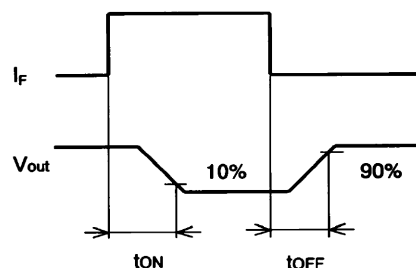
| Item       | G3VM-WL     | G3VM-354C   |
|------------|-------------|-------------|
| Dimensions | See page 93 | See page 93 |

## Connections

G3VM-WL, -354C



## Timing Chart



# G3VM-2F(TR), -2FL(TR), -351D(TR)

## Maximum Rating

| Parameter                     |                                | Comments and conditions               |         | G3VM-2F,<br>G3VM-2F(TR)               | G3VM-2FL,<br>G3VM-2FL(TR)             | G3VM-351D,<br>G3VM-351D(TR)           |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 6 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                 | 350 V                                 | 350 V                                 |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA                                | 120 mA                                | 120 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{I/O}$ for 1 minute min.           |         | 2500 VAC                              | 2500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -20 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +100 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +100 $^\circ\text{C}$ |

## Electrical Characteristics

| Parameter                |                                          | Comments and conditions                     |         | G3VM-2F,<br>G3VM-2F(TR) | G3VM-2FL,<br>G3VM-2FL(TR) | G3VM-351D,<br>G3VM-351D(TR)           |
|--------------------------|------------------------------------------|---------------------------------------------|---------|-------------------------|---------------------------|---------------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                                 | Min.    | 1.0 V                   | 1.0 V                     | 1.0 V                                 |
|                          |                                          |                                             | Typical | 1.15 V                  | 1.15 V                    | 1.15 V                                |
|                          |                                          |                                             | Max.    | 1.3 V                   | 1.3 V                     | 1.3 V                                 |
|                          | Reverse current                          | $I_R$                                       | Max.    | 10 $\mu$ A              | 10 $\mu$ A                | 10 $\mu$ A                            |
|                          | Reverse voltage                          | $V_R$                                       | Max.    | 5 V                     | 6 V                       | 5 V                                   |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz                  | Typical | 30 pF                   | 30 pF                     | 30 pF                                 |
|                          | Keep ON LED current ( $I_{FT}$ )         | $I_O$                                       | Typical | 2 mA ( $I_O = 100$ mA)  | 1 mA ( $I_O = 120$ mA)    | 1 mA ( $I_O = 120$ mA)                |
|                          |                                          |                                             | Max.    | 3 mA ( $I_O = 100$ mA)  | 3 mA ( $I_O = 120$ mA)    | 3 mA ( $I_O = 120$ mA)                |
| Output                   | ON-resistance ( $R_{ON}$ )               | $I_{ON}=120$ mA<br>$I_F=5$ mA               | Typical | 22 $\Omega$             | 22 $\Omega$               | 35 $\Omega$ (25 $\Omega$ , $t < 1$ s) |
|                          |                                          |                                             | Max.    | 35 $\Omega$             | 35 $\Omega$               | 50 $\Omega$ (35 $\Omega$ , $t < 1$ s) |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | $V_{OFF} = 350$ V                           | Max.    | 1.0 $\mu$ A             | 1.0 $\mu$ A               | 1.0 $\mu$ A                           |
|                          | Limit current ( $I_{LIM}$ )              | $I_F = 5$ mA, $V_{DD} = 5$ V,<br>$t = 5$ ms | Min.    | —                       | 150 mA                    | —                                     |
|                          |                                          |                                             | Max.    | —                       | 300 mA                    | —                                     |
| Transfer characteristics | I/O capacitance                          | $(C_{I/O})$                                 | Typical | 0.8 pF                  | 0.8 pF                    | 0.8 pF                                |
|                          | I/O resistance                           | $(R_{I/O})$                                 | Min.    | 1000 M $\Omega$         | 1000 M $\Omega$           | 1000 M $\Omega$                       |
|                          | Operate time                             | $(t_{ON})$                                  | Max.    | 1.0 ms                  | 1.0 ms                    | 1.0 ms                                |
|                          | Release time                             | $(t_{OFF})$                                 | Max.    | 1.0 ms                  | 1.0 ms                    | 1.0 ms                                |

Optimum Operating Conditions

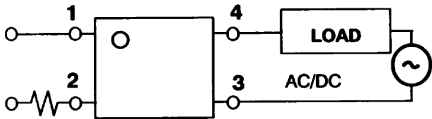
| Parameter                   | Comments and conditions |         | G3VM-2F,<br>G3VM-2F(TR) | G3VM-2FL,<br>G3VM-2FL(TR) | G3VM-351D,<br>G3VM-351D(TR) |
|-----------------------------|-------------------------|---------|-------------------------|---------------------------|-----------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V                   | 280 V                     | 280 V                       |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                    | 5 mA                      | 5 mA                        |
|                             |                         | Typical | 7.5 mA                  | 7.5 mA                    | 7.5 mA                      |
|                             |                         | Max.    | 25 mA                   | 25 mA                     | 25 mA                       |
| Continuous load current     | $I_O$                   | Max.    | 100 mA                  | 100 mA                    | 100 mA                      |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C            | -20° to 65°C              | -20° to 65°C                |

Dimensions

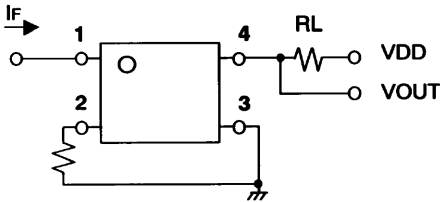
| Item       | G3VM-2F,<br>G3VM-2F(TR) | G3VM-2FL,<br>G3VM-2FL(TR) | G3VM-351D,<br>G3VM-351D(TR) |
|------------|-------------------------|---------------------------|-----------------------------|
| Dimensions | See pages 94, 98        | See pages 94, 98          | See pages 94, 98            |

Connections

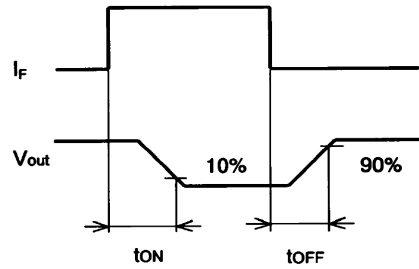
G3VM-2F, -2F(TR), -2FL, -2FL(TR)



G3VM-2F, -2F(TR), -2FL, -2FL(TR), -351D, -351D(TR)



Timing Chart



**G3VM-353D(TR), -401D(TR), -61D(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-353D,<br>G3VM-353D(TR)           | G3VM-401D,<br>G3VM-401D(TR)           | G3VM-61D,<br>G3VM-61D(TR)             |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form B/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                 | 400 V                                 | 60 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 150 mA                                | 120 mA                                | 500 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.5 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             | -5.0 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                              | 2500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +100 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions                                |         | G3VM-353D,<br>G3VM-353D(TR)    | G3VM-401D,<br>G3VM-401D(TR)    | G3VM-61D,<br>G3VM-61D(TR)          |
|--------------------------|------------------------------------------------|--------------------------------------------------------|---------|--------------------------------|--------------------------------|------------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA                                  | Min.    | 1.0 V                          | 1.0 V                          | 1.0 V                              |
|                          |                                                |                                                        | Typical | 1.15 V                         | 1.15 V                         | 1.15 V                             |
|                          |                                                |                                                        | Max.    | 1.3 V                          | 1.3 V                          | 1.3 V                              |
|                          | Reverse current                                | I <sub>R</sub>                                         | Max.    | 10 μA                          | 10 μA                          | 10 μA                              |
|                          | Reverse voltage                                | V <sub>R</sub>                                         | Max.    | 5 V                            | 5 V                            | 5 V                                |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz                                | Typical | 30 pF                          | 30 pF                          | 30 pF                              |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>ON</sub>                                     | Typical | 1 mA                           | 1 mA                           | 1 mA                               |
| Max.                     |                                                |                                                        | 3 mA    | 3 mA                           | 3 mA                           |                                    |
| Output                   | ON-resistance (R <sub>ON</sub> )               | At I <sub>O</sub>                                      | Typical | 15 Ω (I <sub>ON</sub> =150 mA) | 18 Ω (I <sub>ON</sub> =120 mA) | 1 Ω (I <sub>ON</sub> =500 mA)      |
|                          |                                                |                                                        | Max.    | 25 Ω (I <sub>ON</sub> =150 mA) | 35 Ω (I <sub>ON</sub> =120 mA) | 2 Ω (I <sub>ON</sub> =500 mA)      |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>                                    | Max.    | 1.0 μA                         | 1.0 μA                         | 1.0 μA                             |
|                          | Limit current (I <sub>LIM</sub> )              | I <sub>F</sub> = 5 mA, V <sub>DD</sub> = 5 V, t = 5 ms | Min.    | —                              | —                              | —                                  |
|                          |                                                |                                                        | Max.    | —                              | —                              | —                                  |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )                                    | Typical | 0.8 pF                         | 0.8 pF                         | 0.8 pF                             |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )                                    | Min.    | 1000 MΩ                        | 1000 MΩ                        | 1000 MΩ                            |
|                          | Operate time                                   | (t <sub>ON</sub> )                                     | Max.    | 1.0 ms                         | 1.0 ms                         | 1.0 ms<br>(I <sub>F</sub> = 10 mA) |
|                          | Release time                                   | (t <sub>OFF</sub> )                                    | Max.    | 3.0 ms                         | 1.0 ms                         | 1.0 ms<br>(I <sub>F</sub> = 10 mA) |

## Optimum Operating Conditions

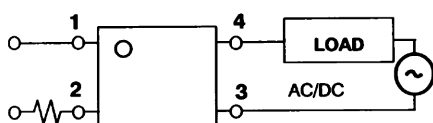
| Parameter                   | Comments and conditions |         | G3VM-353D,<br>G3VM-353D(TR) | G3VM-401D,<br>G3VM-401D(TR) | G3VM-61D,<br>G3VM-61D(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-----------------------------|---------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V                       | 320 V                       | 48 V                      |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                        | 5 mA                        | 5 mA                      |
|                             |                         | Typical | —                           | 7.5 mA                      | 7.5 mA                    |
|                             |                         | Max.    | 25 mA                       | 25 mA                       | 25 mA                     |
| Continuous load current     | $I_O$                   | Max.    | 150 mA                      | 100 mA                      | 400 mA                    |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C                | -20° to 65°C                | -20° to 65°C              |

## Dimensions

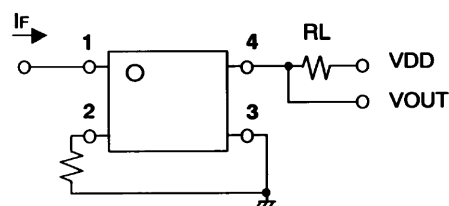
| Item       | G3VM-353D,<br>G3VM-353D(TR) | G3VM-401D,<br>G3VM-401D(TR) | G3VM-61D,<br>G3VM-61D(TR) |
|------------|-----------------------------|-----------------------------|---------------------------|
| Dimensions | See pages 94, 98            | See pages 94, 98            | See pages 94, 98          |

## Connections

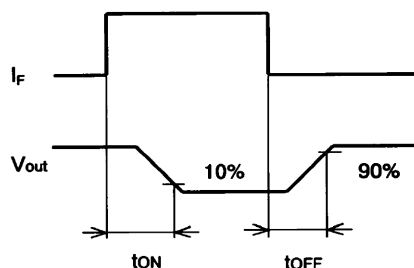
### G3VM-353D, -353D(TR)



### G3VM-353D, -353D(TR), -401D, -401D(TR), -61D, -61D(TR)



## Timing Chart



# G3VM-61D1(TR), -351E(TR), -353E(TR)

## Maximum Rating

| Parameter                     |                                | Comments and conditions               |         | G3VM-61D1,<br>G3VM-61D1(TR)           | G3VM-351E,<br>G3VM-351E(TR)                        | G3VM-353E,<br>G3VM-353E(TR)                        |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|----------------------------------------------------|----------------------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/4 pins                       | 1 Form A/6 pins                                    | 1 Form B/6 pins                                    |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                              | 50 mA                                              |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                                | 1 A                                                |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$                          |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                                | 5 V                                                |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 60 V                                  | 350 V                                              | 350 V                                              |
|                               | Continuous load current        | $I_O$                                 |         | 500 mA                                | 120 mA (for A)<br>120 mA (for B)<br>240 mA (for C) | 150 mA (for A)<br>150 mA (for B)<br>300 mA (for C) |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -5.0 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$ (for A)                  | -1.5 mA/ $^\circ\text{C}$ (for A)                  |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                              | 2500 VAC                                           | 2500 VAC                                           |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$               |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$              |

## Electrical Characteristics

| Parameter                |                                          | Comments and conditions    |         | G3VM-61D1,<br>G3VM-61D1(TR)   | G3VM-351E,<br>G3VM-351E(TR)                     | G3VM-353E,<br>G3VM-353E(TR)                     |
|--------------------------|------------------------------------------|----------------------------|---------|-------------------------------|-------------------------------------------------|-------------------------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                | Min.    | 1.0 V                         | 1.0 V                                           | 1.0 V                                           |
|                          |                                          |                            | Typical | 1.15 V                        | 1.15 V                                          | 1.15 V                                          |
|                          |                                          |                            | Max.    | 1.3 V                         | 1.3 V                                           | 1.3 V                                           |
|                          | Reverse current                          | $I_R$                      | Max.    | 10 $\mu$ A                    | 10 $\mu$ A                                      | 10 $\mu$ A                                      |
|                          | Reverse voltage                          | $V_R$                      | Max.    | 5 V                           | 5 V                                             | 5 V                                             |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz | Typical | 30 pF                         | 30 pF                                           | 30 pF                                           |
| Output                   | Keep ON LED current ( $I_{FT}$ )         | At $I_{ON}$                | Typical | 1.6 mA                        | 1 mA                                            | 1 mA                                            |
|                          |                                          |                            | Max.    | 3 mA                          | 3 mA                                            | 3 mA                                            |
|                          | ON-resistance ( $R_{ON}$ )               | $I_F=5$ mA                 | Typical | 1 $\Omega$ ( $I_{ON}=500$ mA) | 35 $\Omega$ ( $I_{ON}=120$ mA) for connection A | 15 $\Omega$ ( $I_{ON}=150$ mA) for connection A |
|                          |                                          |                            | Max.    | 2 $\Omega$ ( $I_{ON}=500$ mA) | 50 $\Omega$ ( $I_{ON}=120$ mA) for connection A | 25 $\Omega$ ( $I_{ON}=150$ mA) for connection A |
|                          |                                          |                            | Typical | —                             | 28 $\Omega$ ( $I_{ON}=120$ mA) for connection B | 8 $\Omega$ ( $I_{ON}=150$ mA) for connection B  |
|                          |                                          |                            | Max.    | —                             | 40 $\Omega$ ( $I_{ON}=120$ mA) for connection B | 14 $\Omega$ ( $I_{ON}=150$ mA) for connection B |
|                          |                                          |                            | Typical | —                             | 14 $\Omega$ ( $I_{ON}=240$ mA) for connection C | 4 $\Omega$ ( $I_{ON}=300$ mA) for connection C  |
|                          |                                          |                            | Max.    | —                             | 20 $\Omega$ ( $I_{ON}=240$ mA) for connection C | 7 $\Omega$ ( $I_{ON}=300$ mA) for connection C  |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | At $V_{OFF}$               | Max.    | 1.0 $\mu$ A                   | 1.0 $\mu$ A                                     | 1.0 $\mu$ A                                     |
| Transfer characteristics | I/O capacitance                          | ( $C_{IO}$ )               | Typical | 0.8 pF                        | 0.8 pF                                          | 0.8 pF                                          |
|                          | I/O resistance                           | ( $R_{IO}$ )               | Min.    | 1000 M $\Omega$               | 1000 M $\Omega$                                 | 1000 M $\Omega$                                 |
|                          | Operate time                             | ( $t_{ON}$ )               | Max.    | 2.0 ms                        | 1.0 ms                                          | 1.0 ms                                          |
|                          | Release time                             | ( $t_{OFF}$ )              | Max.    | 0.5 ms                        | 1.0 ms                                          | 3.0 ms                                          |



## Optimum Operating Conditions

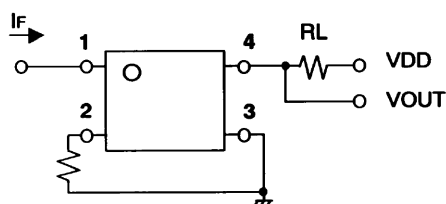
| Parameter                   | Comments and conditions |         | G3VM-61D1,<br>G3VM-61D1(TR) | G3VM-351E,<br>G3VM-351E(TR) | G3VM-353E,<br>G3VM-353E(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-----------------------------|-----------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 48 V                        | 280 V                       | 280 V                       |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                        | 5 mA                        | 5 mA                        |
|                             |                         | Typical | 7.5 mA                      | 10 mA                       | —                           |
|                             |                         | Max.    | 25 mA                       | 25 mA                       | 25 mA                       |
| Continuous load current     | $I_O$                   | Max.    | 500 mA                      | 100 mA                      | 150 mA                      |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C                | -20° to 65°C                | -20° to 65°C                |

## Dimensions

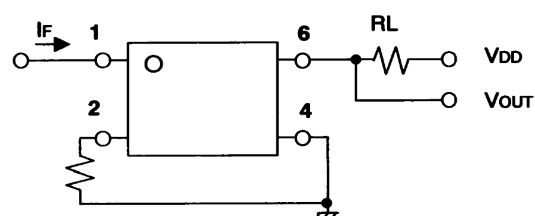
| Item       | G3VM-61D1,<br>G3VM-61D1(TR) | G3VM-351E,<br>G3VM-351E(TR) | G3VM-353E,<br>G3VM-353E(TR) |
|------------|-----------------------------|-----------------------------|-----------------------------|
| Dimensions | See pages 94, 98            | See pages 94, 99            | See pages 94, 99            |

## Connections

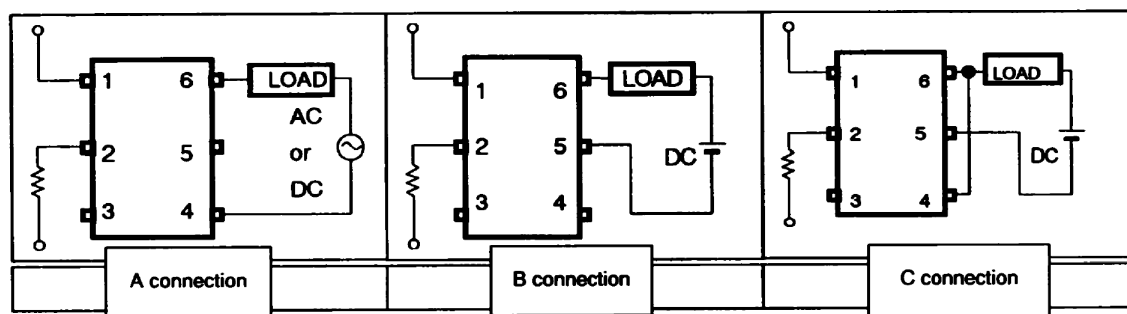
### G3VM-61D1, -61D(TR)



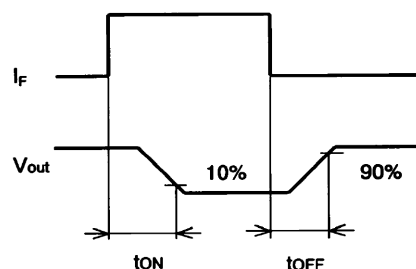
### G3VM-351E, -351E(TR), -353E, -353E(TR)



### G3VM-351E, -351E(TR), -353E, -353E(TR)



## Timing Chart



**G3VM-3F(TR), -3FL(TR), -401E(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-3F,<br>G3VM-3F(TR)                            | G3VM-3FL,<br>G3VM-3FL(TR)             | G3VM-401E,<br>G3VM-401E(TR)                        |
|-------------------------------|--------------------------------|---------------------------------------|---------|----------------------------------------------------|---------------------------------------|----------------------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/6 pins                                    | 1 Form A/6 pins                       | 1 Form A/6 pins                                    |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                              | 50 mA                                 | 50 mA                                              |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                                | 1 A                                   | 1 A                                                |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$                          |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                                | 5 V                                   | 5 V                                                |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                              | 350 V                                 | 400 V                                              |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA (for A)<br>120 mA (for B)<br>160 mA (for C) | 120 mA                                | 120 mA (for A)<br>120 mA (for B)<br>240 mA (for C) |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$ (for A)                  | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$ (for A)                  |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               |
| Dielectric strength           |                                | $V_{I/O}$ for 1 minute min.           |         | 2500 VAC                                           | 2500 VAC                              | 2500 VAC                                           |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -20 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$               |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +100 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$              |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-3F,<br>G3VM-3F(TR)                         | G3VM-3FL,<br>G3VM-3FL(TR)                       | G3VM-401E,<br>G3VM-401E(TR)                     |
|--------------------------|------------------------------------------------|-------------------------|---------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                                           | 1.0 V                                           | 1.0 V                                           |
|                          |                                                |                         | Typical | 1.15 V                                          | 1.15 V                                          | 1.15 V                                          |
|                          |                                                |                         | Max.    | 1.3 V                                           | 1.3 V                                           | 1.3 V                                           |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                                           | 10 μA                                           | 10 μA                                           |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                                             | 5 V                                             | 5 V                                             |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 30 pF                                           | 30 pF                                           | 30 pF                                           |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | —                                               | —                                               | 1 mA                                            |
|                          |                                                |                         | Max.    | 3 mA                                            | 3 mA                                            | 3 mA                                            |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 22 Ω (I <sub>ON</sub> =120 mA) for connection A | 22 Ω (I <sub>ON</sub> =120 mA) for connection A | 17 Ω (I <sub>ON</sub> =120 mA) for connection A |
|                          |                                                |                         | Max.    | 35 Ω (I <sub>ON</sub> =120 mA) for connection A | 35 Ω (I <sub>ON</sub> =120 mA) for connection A | 35 Ω (I <sub>ON</sub> =120 mA) for connection A |
|                          |                                                |                         | Typical | 16 Ω (I <sub>ON</sub> =120 mA) for connection B | —                                               | 11 Ω (I <sub>ON</sub> =120 mA) for connection B |
|                          |                                                |                         | Max.    | 23 Ω (I <sub>ON</sub> =120 mA) for connection B | —                                               | 20 Ω (I <sub>ON</sub> =120 mA) for connection B |
|                          |                                                |                         | Typical | 8 Ω (I <sub>ON</sub> =160 mA) for connection C  | —                                               | 6 Ω (I <sub>ON</sub> =240 mA) for connection C  |
|                          |                                                |                         | Max.    | 12 Ω (I <sub>ON</sub> =160 mA) for connection C | —                                               | 10 Ω (I <sub>ON</sub> =240 mA) for connection C |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                                          | 1.0 μA                                          | 1.0 μA                                          |
|                          | Limit current                                  | (I <sub>LIM</sub> )     | Min.    | —                                               | 150 mA                                          | —                                               |
|                          |                                                |                         | Max.    | —                                               | 300 mA                                          | —                                               |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                                          | 0.8 pF                                          | 0.8 pF                                          |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                                         | 1000 MΩ                                         | 1000 MΩ                                         |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 1.0 ms                                          | 1.0 ms                                          | 1.0 ms                                          |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 1.0 ms                                          | 1.0 ms                                          | 1.0 ms                                          |

## Optimum Operating Conditions

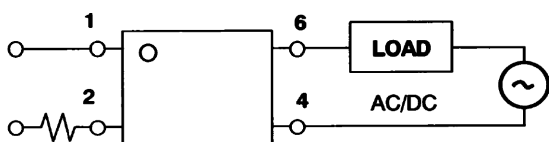
| Parameter                   | Comments and conditions |         | G3VM-3F,<br>G3VM-3F(TR) | G3VM-3FL,<br>G3VM-3FL(TR) | G3VM-401E,<br>G3VM-401E(TR) |
|-----------------------------|-------------------------|---------|-------------------------|---------------------------|-----------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V                   | 280 V                     | 320 V                       |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                    | 5 mA                      | 5 mA                        |
|                             |                         | Typical | 7.5 mA                  | 7.5 mA                    | 7.5 mA                      |
|                             |                         | Max.    | 25 mA                   | 25 mA                     | 25 mA                       |
| Continuous load current     | $I_O$                   | Max.    | 120 mA                  | 120 mA                    | 120 mA                      |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C            | -20° to 65°C              | -20° to 65°C                |

## Dimensions

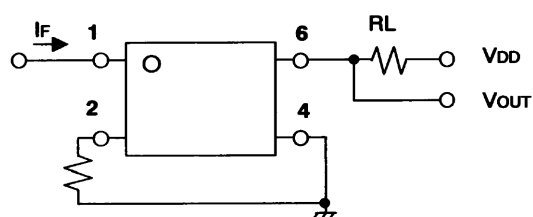
| Item       | G3VM-3F,<br>G3VM-3F(TR) | G3VM-3FL,<br>G3VM-3FL(TR) | G3VM-401E,<br>G3VM-401E(TR) |
|------------|-------------------------|---------------------------|-----------------------------|
| Dimensions | See pages 94, 99        | See pages 94, 99          | See pages 94, 99            |

## Connections

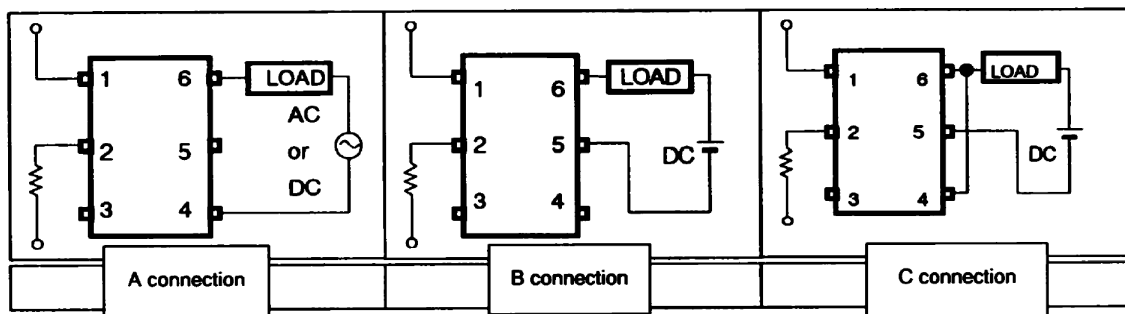
### G3VM-3FL, -3FL(TR)



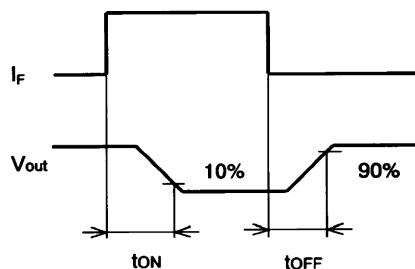
### G3VM-3F, -3F(TR), -3FL, -3FL(TR), -401E, -401E(TR)



### G3VM-3F, -3F(TR), -401E, -401E(TR)



## Timing Chart



**G3VM-401EY(TR), -601EY(TR), G3VM-61E(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-401EY,<br>G3VM-401EY(TR)                      | G3VM-601EY,<br>G3VM-601EY(TR)                      | G3VM-61E,<br>G3VM-61E(TR)                           |
|-------------------------------|--------------------------------|---------------------------------------|---------|----------------------------------------------------|----------------------------------------------------|-----------------------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/6 pins                                    | 1 Form A/6 pins                                    | 1 Form A/6 pins                                     |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                              | 50 mA                                              | 50 mA                                               |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                                | 1 A                                                | 1 A                                                 |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$                           |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                                | 5 V                                                | 5 V                                                 |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                                |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 400 V                                              | 600 V                                              | 60 V                                                |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA (for A)<br>120 mA (for B)<br>240 mA (for C) | 100 mA (for A)<br>100 mA (for B)<br>200 mA (for C) | 500 mA (for A)<br>500 mA (for B)<br>1000 mA (for C) |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$ (for A)                  | -1.0 mA/ $^\circ\text{C}$ (for A)                  | -5.0 mA/ $^\circ\text{C}$ (for A)                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                                |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 5000 VAC                                           | 5000 VAC                                           | 2500 VAC                                            |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$                |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$               |

**Electrical Characteristics**

| Parameter                |                                          | Comments and conditions    |         | G3VM-401EY,<br>G3VM-401EY(TR)                   | G3VM-601EY,<br>G3VM-601EY(TR)                     | G3VM-61E,<br>G3VM-61E(TR)                         |
|--------------------------|------------------------------------------|----------------------------|---------|-------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                | Min.    | 1.0 V                                           | 1.0 V                                             | 1.0 V                                             |
|                          |                                          |                            | Typical | 1.15 V                                          | 1.15 V                                            | 1.15 V                                            |
|                          |                                          |                            | Max.    | 1.3 V                                           | 1.3 V                                             | 1.3 V                                             |
|                          | Reverse current                          | $I_R$                      | Max.    | 10 $\mu$ A                                      | 10 $\mu$ A                                        | 10 $\mu$ A                                        |
|                          | Reverse voltage                          | $V_R$                      | Max.    | 5 V                                             | 5 V                                               | 5 V                                               |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz | Typical | 30 pF                                           | 30 pF                                             | 30 pF                                             |
|                          | Keep ON LED current ( $I_{FT}$ )         | At $I_O$                   | Typical | —                                               | 1.6 mA                                            | —                                                 |
|                          |                                          |                            | Max.    | 3 mA                                            | 5 mA                                              | 3 mA                                              |
| Output                   | ON-resistance ( $R_{ON}$ )               | $I_F=5$ mA                 | Typical | 17 $\Omega$ ( $I_{ON}=120$ mA) for connection A | 22 $\Omega$ ( $I_{ON}=100$ mA) for connection A   | 1 $\Omega$ ( $I_{ON}=500$ mA) for connection A    |
|                          |                                          |                            | Max.    | 35 $\Omega$ ( $I_{ON}=120$ mA) for connection A | 35 $\Omega$ ( $I_{ON}=100$ mA) for connection A   | 2 $\Omega$ ( $I_{ON}=500$ mA) for connection A    |
|                          |                                          |                            | Typical | 11 $\Omega$ ( $I_{ON}=120$ mA) for connection B | 17 $\Omega$ ( $I_{ON}=100$ mA) for connection B   | 0.5 $\Omega$ ( $I_{ON}=500$ mA) for connection B  |
|                          |                                          |                            | Max.    | 20 $\Omega$ ( $I_{ON}=120$ mA) for connection B | 27 $\Omega$ ( $I_{ON}=100$ mA) for connection B   | 1 $\Omega$ ( $I_{ON}=500$ mA) for connection B    |
|                          |                                          |                            | Typical | 6 $\Omega$ ( $I_{ON}=240$ mA) for connection C  | 8.5 $\Omega$ ( $I_{ON}=200$ mA) for connection C  | 0.3 $\Omega$ ( $I_{ON}=1000$ mA) for connection C |
|                          |                                          |                            | Max.    | 10 $\Omega$ ( $I_{ON}=240$ mA) for connection C | 13.5 $\Omega$ ( $I_{ON}=200$ mA) for connection C | —                                                 |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | At $V_{OFF}$               | Max.    | 1.0 $\mu$ A                                     | 1.0 $\mu$ A                                       | 1.0 $\mu$ A                                       |
| Transfer characteristics | I/O capacitance                          | ( $C_{IO}$ )               | Typical | 0.8 pF                                          | 0.8 pF                                            | 0.8 pF                                            |
|                          | I/O resistance                           | ( $R_{IO}$ )               | Min.    | 1000 M $\Omega$                                 | 1000 M $\Omega$                                   | 1000 M $\Omega$                                   |
|                          | Operate time                             | ( $t_{ON}$ )               | Max.    | 1.0 ms                                          | 1.5 ms                                            | 1.0 ms                                            |
|                          | Release time                             | ( $t_{OFF}$ )              | Max.    | 1.0 ms                                          | 1.0 ms                                            | 1.0 ms                                            |

## Optimum Operating Conditions

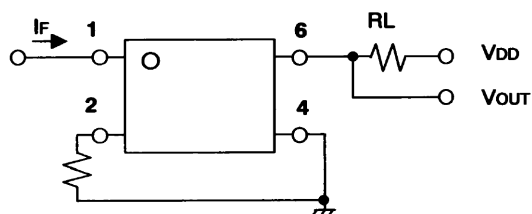
| Parameter                   | Comments and conditions |         | G3VM-401EY,<br>G3VM-401EY(TR) | G3VM-601EY,<br>G3VM-601EY(TR) | G3VM-61E,<br>G3VM-61E(TR) |
|-----------------------------|-------------------------|---------|-------------------------------|-------------------------------|---------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 320 V                         | 480 V                         | 48 V                      |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                          | 5 mA                          | 5 mA                      |
|                             |                         | Typical | 7.5 mA                        | —                             | 7.5 mA                    |
|                             |                         | Max.    | 25 mA                         | 25 mA                         | 25 mA                     |
| Continuous load current     | $I_O$                   | Max.    | 120 mA                        | 100 mA                        | 400 mA                    |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C                  | -20° to 65°C                  | -20° to 65°C              |

## Dimensions

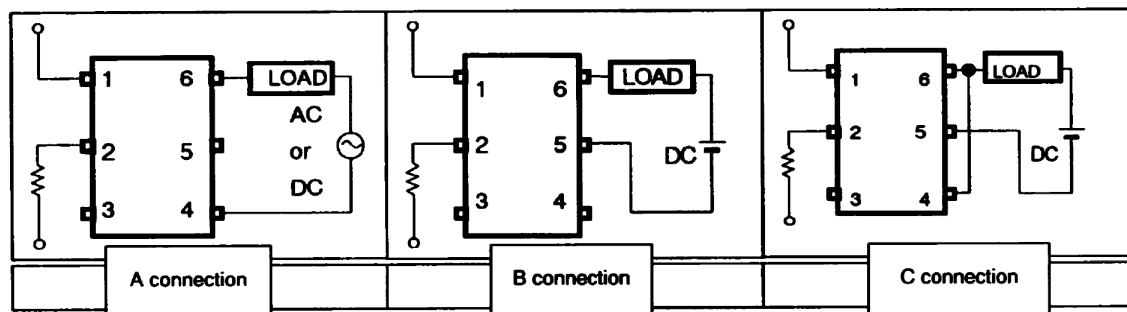
| Item       | G3VM-401EY,<br>G3VM-401EY(TR) | G3VM-601EY,<br>G3VM-601EY(TR) | G3VM-61E,<br>G3VM-61E(TR) |
|------------|-------------------------------|-------------------------------|---------------------------|
| Dimensions | See pages 94, 99              | See pages 94, 99              | See pages 94, 99          |

## Connections

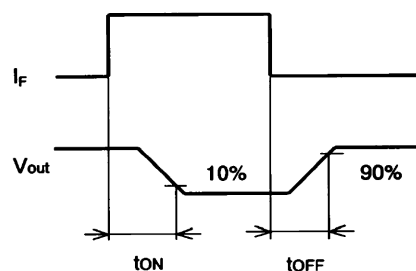
G3VM-401EY, -401EY(TR), -601EY, -601EY(TR), -61E, -61E(TR)



G3VM-401EY, -401EY(TR), -601EY, -601EY(TR), -61E, -61E(TR)



## Timing Chart



**G3VM-61E1(TR), -VF(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-61E1,<br>G3VM-61E1(TR)                         | G3VM-VF,<br>G3VM-VF(TR)                            |
|-------------------------------|--------------------------------|---------------------------------------|---------|-----------------------------------------------------|----------------------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/6 pins                                     | 1 Form A/6 pins                                    |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                               | 50 mA                                              |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                                 | 1 A                                                |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$                           | -0.5 mA/ $^\circ\text{C}$                          |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                                 | 5 V                                                |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                                | 125 $^\circ\text{C}$                               |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 60 V                                                | 60 V                                               |
|                               | Continuous load current        | $I_O$                                 |         | 500 mA (for A)<br>500 mA (for B)<br>1000 mA (for C) | 300 mA (for A)<br>450 mA (for B)<br>600 mA (for C) |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -5.0 mA/ $^\circ\text{C}$ (for A)                   | -3.0 mA/ $^\circ\text{C}$ (for A)                  |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                                | 125 $^\circ\text{C}$                               |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                                            | 2500 VAC                                           |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$                | -20 $^\circ$ to +85 $^\circ\text{C}$               |
|                               | Storage                        | Tstg with no icing                    |         | -55 $^\circ$ to +125 $^\circ\text{C}$               | -55 $^\circ$ to +100 $^\circ\text{C}$              |

**Electrical Characteristics**

| Parameter                |                                          | Comments and conditions    |         | G3VM-61E1,<br>G3VM-61E1(TR)                        | G3VM-VF,<br>G3VM-VF(TR)                           |
|--------------------------|------------------------------------------|----------------------------|---------|----------------------------------------------------|---------------------------------------------------|
| Input                    | LED forward voltage ( $V_F$ )            | $I_F=10$ mA                | Min.    | 1.0 V                                              | 1.0 V                                             |
|                          |                                          |                            | Typical | 1.15 V                                             | 1.15 V                                            |
|                          |                                          |                            | Max.    | 1.3 V                                              | 1.3 V                                             |
|                          | Reverse current                          | $I_R$                      | Max.    | 10 $\mu$ A                                         | 10 $\mu$ A                                        |
|                          | Reverse voltage                          | $V_R$                      | Max.    | 5 V                                                | 5 V                                               |
|                          | Capacitance ( $C_T$ )                    | $V = 0$ ;<br>freq. = 1 MHz | Typical | 30 pF                                              | 30 pF                                             |
|                          | Keep ON LED current ( $I_{FT}$ )         | At $I_O$                   | Typical | 1.6 mA                                             | 1 mA                                              |
| Output                   | ON-resistance ( $R_{ON}$ )               | $I_F=5$ mA                 | Typical | 1 $\Omega$ ( $I_{ON}=500$ mA) for connection A     | 1.4 $\Omega$ ( $I_{ON}=300$ mA) for connection A  |
|                          |                                          |                            | Max.    | 2 $\Omega$ ( $I_{ON}=500$ mA) for connection A     | 2 $\Omega$ ( $I_{ON}=300$ mA) for connection A    |
|                          |                                          |                            | Typical | 0.5 $\Omega$ ( $I_{ON}=500$ mA) for connection B   | 0.7 $\Omega$ ( $I_{ON}=450$ mA) for connection B  |
|                          |                                          |                            | Max.    | 1 $\Omega$ ( $I_{ON}=500$ mA) for connection B     | 1 $\Omega$ ( $I_{ON}=450$ mA) for connection B    |
|                          |                                          |                            | Typical | 0.25 $\Omega$ ( $I_{ON}=1000$ mA) for connection C | 0.35 $\Omega$ ( $I_{ON}=600$ mA) for connection C |
|                          |                                          |                            | Max.    | —                                                  | 0.5 $\Omega$ ( $I_{ON}=600$ mA) for connection C  |
|                          | OFF-state leakage current ( $I_{LEAK}$ ) | At $V_{OFF}$               | Max.    | 1.0 $\mu$ A                                        | 1.0 $\mu$ A                                       |
| Transfer characteristics | I/O capacitance                          | ( $C_{IO}$ )               | Typical | 0.8 pF                                             | 0.8 pF                                            |
|                          | I/O resistance                           | ( $R_{IO}$ )               | Min.    | 1000 M $\Omega$                                    | 1000 M $\Omega$                                   |
|                          | Operate time                             | ( $t_{ON}$ )               | Max.    | 2.0 ms                                             | 1.0 ms                                            |
|                          | Release time                             | ( $t_{OFF}$ )              | Max.    | 0.5 ms                                             | 1.0 ms                                            |

# Optimum Operating Conditions

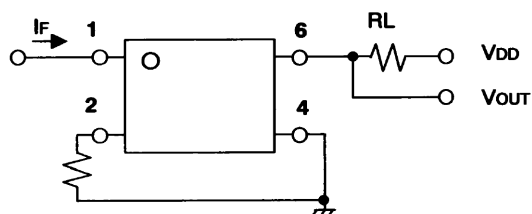
| Parameter                   | Comments and conditions |         | G3VM-61E1,<br>G3VM-61E1(TR) | G3VM-VF,<br>G3VM-VF(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 48 V                        | 48 V                    |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                        | 7.5 mA                  |
|                             |                         | Typical | 7.5 mA                      | 15 mA                   |
|                             |                         | Max.    | 25 mA                       | 25 mA                   |
| Continuous load current     | $I_O$                   | Max.    | 500 mA                      | 300 mA                  |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C                | -20° to 80°C            |

## Dimensions

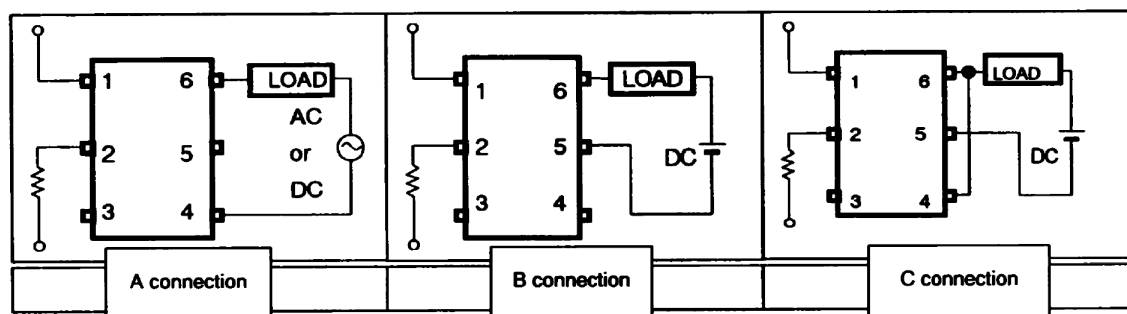
| Item       | G3VM-61E1,<br>G3VM-61E1(TR) | G3VM-VF,<br>G3VM-VF(TR) |
|------------|-----------------------------|-------------------------|
| Dimensions | See pages 94, 99            | See pages 94, 99        |

## Connections

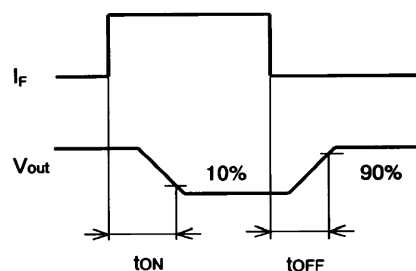
G3VM-61E1, -61E1(TR), -VF, -VF(TR)



G3VM-61E1, -61E1(TR), -VF, -VF(TR)



## Timing Chart



**G3VM-22FO(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-22FO,<br>G3VM-22FO(TR)           |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/8 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 6 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 20 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 150 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.5 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-22FO,<br>G3VM-22FO(TR)   |
|--------------------------|------------------------------------------------|-------------------------|---------|-------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                         |
|                          |                                                |                         | Typical | 1.15 V                        |
|                          |                                                |                         | Max.    | 1.3 V                         |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                         |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 6 V                           |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0; freq. = 1 MHz    | Typical | 15 pF                         |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | 1.5 mA                        |
|                          |                                                |                         | Max.    | 5 mA                          |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 2 Ω (I <sub>ON</sub> =150 mA) |
|                          |                                                |                         | Max.    | 4 Ω (I <sub>ON</sub> =150 mA) |
|                          |                                                |                         | Typical | —                             |
|                          |                                                |                         | Max.    | —                             |
|                          |                                                |                         | Typical | —                             |
|                          |                                                |                         | Max.    | —                             |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                        |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                        |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                       |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 1.0 ms                        |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 1.0 ms                        |



## Optimum Operating Conditions

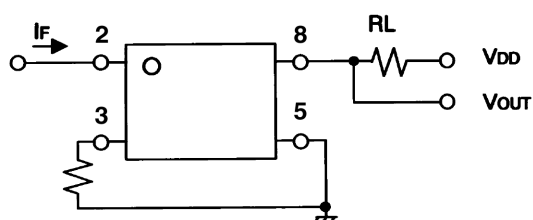
| Parameter                   | Comments and conditions |         | G3VM-22FO,<br>G3VM-22FO(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 20 V                        |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                        |
|                             |                         | Typical | — mA                        |
|                             |                         | Max.    | 30 mA                       |
| Continuous load current     | $I_O$                   | Max.    | 150 mA                      |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C                |

## Dimensions

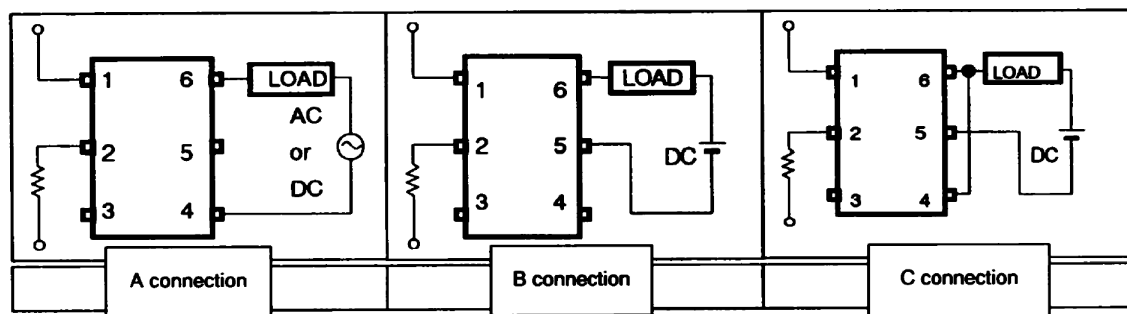
| Item       | G3VM-22FO,<br>G3VM-22FO(TR) |
|------------|-----------------------------|
| Dimensions | See pages 95, 99            |

## Connections

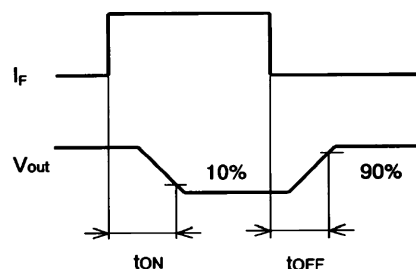
### G3VM-22FO, -22FO(TR)



### G3VM-22FO, -22FO(TR)



## Timing Chart



**G3VM-61FP(TR), -61FR(TR), -355FR(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-61FP,<br>G3VM-61FP(TR)           | G3VM-61FR,<br>G3VM-61FR(TR)           | G3VM-355FR,<br>G3VM-355FR(TR)         |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/8 pins                       | 1 Form A/8 pins                       | 1FormA+1FormB/ 8 pins                 |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 6 V                                   | 6 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 60 V                                  | 60 V                                  | 350 V                                 |
|                               | Continuous load current        | $I_O$                                 |         | 500 mA                                | 2000 mA                               | 120 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -5.0 mA/ $^\circ\text{C}$             | -20 mA/ $^\circ\text{C}$              | -1.2 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                              | 1500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -20 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter      |                                                | Comments and conditions   |                     | G3VM-61FP,<br>G3VM-61FP(TR)     | G3VM-61FR,<br>G3VM-61FR(TR)       | G3VM-355FR,<br>G3VM-355FR(TR)  |
|----------------|------------------------------------------------|---------------------------|---------------------|---------------------------------|-----------------------------------|--------------------------------|
| Input          | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA     | Min.                | 1.0 V                           | 1.0 V                             | 1.0 V                          |
|                |                                                |                           | Typical             | 1.2 V                           | 1.2 V                             | 1.15 V                         |
|                |                                                |                           | Max.                | 1.4 V                           | 1.4 V                             | 1.3 V                          |
|                | Reverse current                                | I <sub>R</sub>            | Max.                | 10 μA                           | 10 μA                             | 10 μA                          |
|                | Reverse voltage                                | V <sub>R</sub>            | Max.                | 6 V                             | 6 V                               | 5 V                            |
|                | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz   | Typical             | 15 pF                           | 15 pF                             | 30 pF                          |
|                | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>         | Typical             | —                               | —                                 | 1 mA                           |
|                |                                                |                           | Max.                | 5 mA                            | 5 mA                              | 3 mA                           |
| Output         | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA (1a) | Typical             | 0.3 Ω (I <sub>ON</sub> =500 mA) | —                                 | 15 Ω (I <sub>ON</sub> =120 mA) |
|                |                                                |                           | Max.                | 0.6 Ω (I <sub>ON</sub> =500 mA) | 0.12 Ω (I <sub>ON</sub> =1000 mA) | 25 Ω (I <sub>ON</sub> =120 mA) |
|                |                                                | I <sub>F</sub> =0 mA (1b) | Typical             | —                               | —                                 | 15 Ω (I <sub>ON</sub> =120 mA) |
|                |                                                |                           | Max.                | —                               | —                                 | 25 Ω (I <sub>ON</sub> =120 mA) |
|                | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>       | Max.                | 1.0 μA                          | 4.0 μA                            | 1.0 μA                         |
|                | Capacitance                                    | C <sub>OFF</sub>          | Typical             | 200 pF                          | —                                 | —                              |
|                |                                                |                           | Max.                | 500 pF                          | —                                 | —                              |
|                | Transfer characteristics                       | I/O capacitance           | (C <sub>I/O</sub> ) | Typical                         | 0.8 pF                            | 0.8 pF                         |
| I/O resistance |                                                | (R <sub>I/O</sub> )       | Min.                | 1000 MΩ                         | 1000 MΩ                           | 1000 MΩ                        |
| Operate time   |                                                | (t <sub>ON</sub> )        | Max.                | 2.0 ms                          | 5.0 ms                            | 1.0 ms                         |
| Release time   |                                                | (t <sub>OFF</sub> )       | Max.                | 0.5 ms                          | 3.5 ms                            | 3.0 ms                         |

## Optimum Operating Conditions

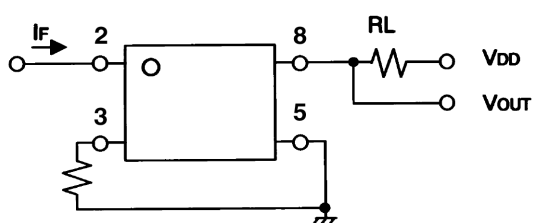
| Parameter                   | Comments and conditions |         | G3VM-61FP,<br>G3VM-61FP(TR) | G3VM-61FR,<br>G3VM-61FR(TR) | G3VM-355FR,<br>G3VM-355FR(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-----------------------------|-------------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 48 V                        | 48 V                        | 280 V                         |
| Operate LED forward current | $I_F$                   | Min.    | 10 mA                       | 10 mA                       | 5 mA                          |
|                             |                         | Typical | — mA                        | —                           | —                             |
|                             |                         | Max.    | 30 mA                       | 30 mA                       | 25 mA                         |
| Continuous load current     | $I_O$                   | Max.    | 500 mA                      | 2000 mA                     | 120 mA                        |
| Ambient temperature         | $T_A$                   |         | -25° to 50°C                | -20° to 50°C                | -20° to 65°C                  |

## Dimensions

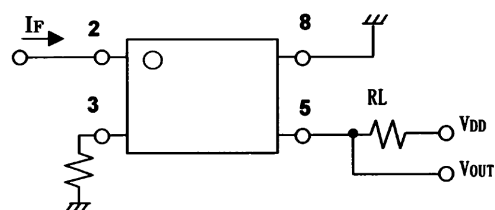
| Item       | G3VM-61FP,<br>G3VM-61FP(TR) | G3VM-61FR,<br>G3VM-61FR(TR) | G3VM-355FR,<br>G3VM-355FR(TR) |
|------------|-----------------------------|-----------------------------|-------------------------------|
| Dimensions | See pages 95, 99            | See pages 95, 99            | See pages 95, 99              |

## Connections

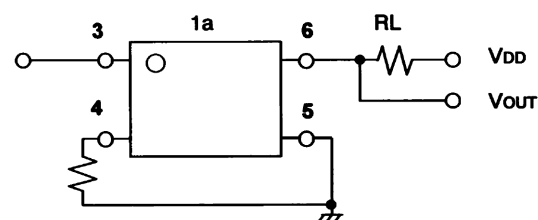
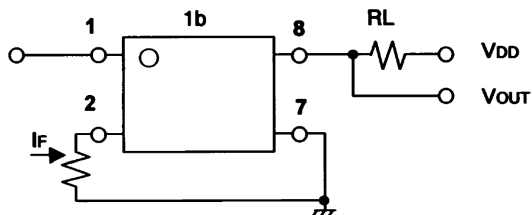
### G3VM-61FP, -61FP(TR)



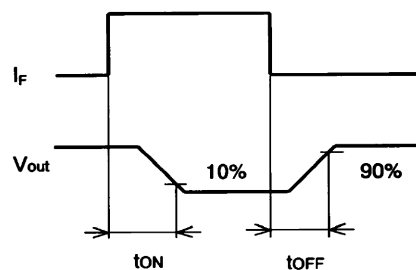
### G3VM-61FR, -61FR(TR)



### G3VM-355FR, -355FR(TR)



## Timing Chart



**G3VM-352F(TR), -402F(TR), -62F1(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-352F,<br>G3VM-352F(TR)           | G3VM-402F,<br>G3VM-402F(TR)           | G3VM-62F1,<br>G3VM-62F1(TR)           |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 2 Form A/8 pins                       | 2 Form A/8 pins                       | 2 Form A/8 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                 | 400 V                                 | 60 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA                                | 120 mA                                | 500 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             | -5.0 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 2500 VAC                              | 2500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-352F,<br>G3VM-352F(TR) | G3VM-402F,<br>G3VM-402F(TR)    | G3VM-62F1,<br>G3VM-62F1(TR)     |
|--------------------------|------------------------------------------------|-------------------------|---------|-----------------------------|--------------------------------|---------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                       | 1.0 V                          | 1.0 V                           |
|                          |                                                |                         | Typical | 1.15 V                      | 1.15 V                         | 1.15 V                          |
|                          |                                                |                         | Max.    | 1.3 V                       | 1.3 V                          | 1.3 V                           |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                       | 10 μA                          | 10 μA                           |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                         | 5 V                            | 5 V                             |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 30 pF                       | 30 pF                          | 30 pF                           |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | 1                           | 1 mA                           | 1.6 mA                          |
|                          |                                                |                         | Max.    | 3 mA                        | 3 mA                           | 3 mA                            |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 35 Ω (25 Ω, t < 1 s)        | 18 Ω (I <sub>ON</sub> =120 mA) | 1.0 Ω (I <sub>ON</sub> =500 mA) |
|                          |                                                |                         | Max.    | 50 Ω (35 Ω, t < 1 s)        | 35 Ω (I <sub>ON</sub> =120 mA) | 2.0 Ω (I <sub>ON</sub> =500 mA) |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                      | 1.0 μA                         | 1.0 μA                          |
|                          | Capacitance                                    | C <sub>OFF</sub>        | Typical | —                           | —                              | —                               |
|                          |                                                |                         | Max.    | —                           | —                              | —                               |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                      | 0.8 pF                         | 0.8 pF                          |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                     | 1000 MΩ                        | 1000 MΩ                         |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 1.0 ms                      | 1.0 ms                         | 2.0 ms                          |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 1.0 ms                      | 1.0 ms                         | 0.5 ms                          |

**Optimum Operating Conditions**

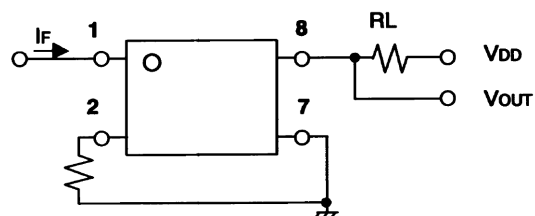
| Parameter                   | Comments and conditions |         | G3VM-352F,<br>G3VM-352F(TR) | G3VM-402F,<br>G3VM-402F(TR) | G3VM-62F1,<br>G3VM-62F1(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-----------------------------|-----------------------------|
| Output voltage strength     | V <sub>DD</sub>         | Max.    | 280 V                       | 320 V                       | 48 V                        |
| Operate LED forward current | I <sub>F</sub>          | Min.    | 5 mA                        | 5 mA                        | 5 mA                        |
|                             |                         | Typical | 7.5 mA                      | 7.5                         | 7.5 mA                      |
|                             |                         | Max.    | 25 mA                       | 25 mA                       | 25 mA                       |
| Continuous load current     | I <sub>O</sub>          | Max.    | 100 mA                      | 100 mA                      | 500 mA                      |
| Ambient temperature         | T <sub>A</sub>          |         | -20° to 65°C                | -20° to 65°C                | -20° to 65°C                |

# Dimensions

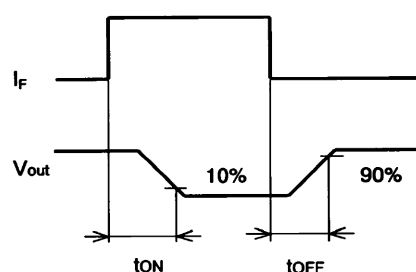
| Item       | G3VM-352F,<br>G3VM-352F(TR) | G3VM-402F,<br>G3VM-402F(TR) | G3VM-62F1,<br>G3VM-62F1(TR) |
|------------|-----------------------------|-----------------------------|-----------------------------|
| Dimensions | See pages 95, 99            | See pages 95, 99            | See pages 95,99             |

# Connections

G3VM-352FR, -352FR(TR), -402F, -402F(TR), -62F1, -62F1(TR)



# Timing Chart



**G3VM-WF(TR), -WFL(TR), -354F(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-WF,<br>G3VM-WF(TR)               | G3VM-WFL,<br>G3VM-WFL(TR)             | G3VM-354F,<br>G3VM-354F(TR)           |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 2 Form A/8 pins                       | 2 Form A/8 pins                       | 2 Form B/8 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 6 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                 | 350 V                                 | 350 V                                 |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA                                | 120 mA                                | 150 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             | -1.5 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{I/O}$ for 1 minute min.           |         | 2500 VAC                              | 2500 VAC                              | 2500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -20 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +100 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-WF,<br>G3VM-WF(TR)        | G3VM-WFL,<br>G3VM-WFL(TR)      | G3VM-354F,<br>G3VM-354F(TR)    |
|--------------------------|------------------------------------------------|-------------------------|---------|--------------------------------|--------------------------------|--------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                          | 1.0 V                          | 1.0 V                          |
|                          |                                                |                         | Typical | 1.15 V                         | 1.15 V                         | 1.15 V                         |
|                          |                                                |                         | Max.    | 1.3 V                          | 1.3 V                          | 1.3 V                          |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                          | 10 μA                          | 10 μA                          |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                            | 6 V                            | 5 V                            |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 30 pF                          | 30 pF                          | 30 pF                          |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | 2 mA                           | 1 mA                           | 1 mA                           |
|                          |                                                |                         | Max.    | 3 mA                           | 3 mA                           | 3 mA                           |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 22 Ω (I <sub>ON</sub> =120 mA) | 22 Ω (I <sub>ON</sub> =120 mA) | 15 Ω (I <sub>ON</sub> =300 mA) |
|                          |                                                |                         | Max.    | 35 Ω (I <sub>ON</sub> =120 mA) | 35 Ω (I <sub>ON</sub> =120 mA) | 25 Ω (I <sub>ON</sub> =300 mA) |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                         | 1.0 μA                         | 1.0 μA                         |
|                          | Limit current                                  | I <sub>LIM</sub>        | Min.    | —                              | 150 mA                         | —                              |
|                          |                                                |                         | Max.    | —                              | 300 mA                         | —                              |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                         | 0.8 pF                         | 0.8 pF                         |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                        | 1000 MΩ                        | 1000 MΩ                        |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 1.0 ms                         | 1.0 ms                         | 1.0 ms                         |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 1.0 ms                         | 1.0 ms                         | 3.0 ms                         |

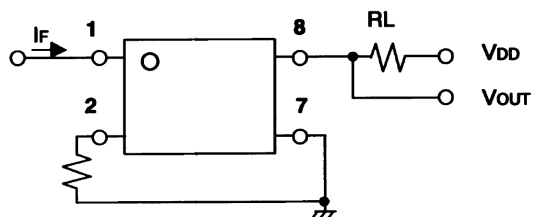
**Optimum Operating Conditions**

| Parameter                   | Comments and conditions |         | G3VM-WF,<br>G3VM-WF(TR)             | G3VM-WFL,<br>G3VM-WFL(TR)           | G3VM-354F,<br>G3VM-354F(TR)         |
|-----------------------------|-------------------------|---------|-------------------------------------|-------------------------------------|-------------------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V                               | 280 V                               | 280 V                               |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                                | 5 mA                                | 5 mA                                |
|                             |                         | Typical | 7.5 mA                              | 7.5 mA                              | —                                   |
|                             |                         | Max.    | 25 mA                               | 25 mA                               | 25 mA                               |
| Continuous load current     | $I_O$                   | Max.    | 100 mA                              | 100 mA                              | 150 mA                              |
| Ambient temperature         | $T_A$                   |         | -20 $^\circ$ to 65 $^\circ\text{C}$ | -20 $^\circ$ to 65 $^\circ\text{C}$ | -20 $^\circ$ to 65 $^\circ\text{C}$ |

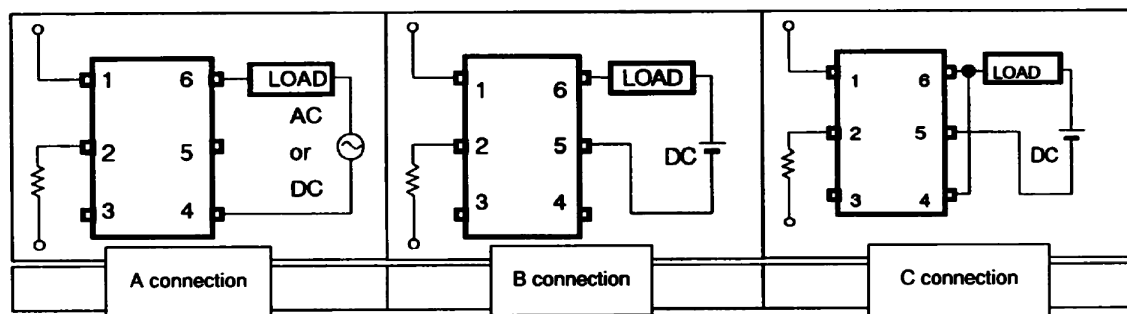
## Dimensions

| Item       | G3VM-WF,<br>G3VM-WF(TR) | G3VM-WFL,<br>G3VM-WFL(TR) | G3VM-354F,<br>G3VM-354F(TR) |
|------------|-------------------------|---------------------------|-----------------------------|
| Dimensions | See pages 95, 99        | See pages 95, 99          | See pages 95, 99            |

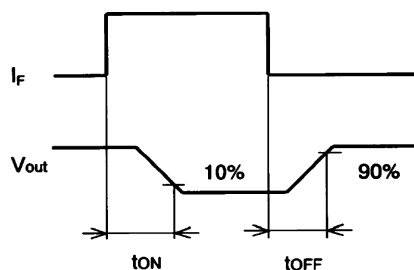
## Connections



G3VM-WF, -WF(TR), -WFL, -WFL(TR), -354F, -354F(TR)



## Timing Chart



**G3VM-21GR(TR), -21GR1(TR), -351G(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-21GR,<br>G3VM-21GR1(TR)          | G3VM-21GR1,<br>G3VM-21GR1(TR)         | G3VM-351G,<br>G3VM-351G(TR)           |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 20 V                                  | 20 V                                  | 350 V                                 |
|                               | Continuous load current        | $I_O$                                 |         | 160 mA                                | 300 mA                                | 110 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.6 mA/ $^\circ\text{C}$             | -3.0 mA/ $^\circ\text{C}$             | -1.1 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 1500 VAC                              | 1500 VAC                              | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -20 $^\circ$ to +85 $^\circ\text{C}$  | -20 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +100 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions                    |                                | G3VM-21GR,<br>G3VM-21GR(TR)    | G3VM-21GR1,<br>G3VM-21GR1(TR)    | G3VM-351G,<br>G3VM-351G(TR)    |
|--------------------------|------------------------------------------------|--------------------------------------------|--------------------------------|--------------------------------|----------------------------------|--------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA                      | Min.                           | 1.0 V                          | 1.0 V                            | 1.0 V                          |
|                          |                                                |                                            | Typical                        | 1.15 V                         | 1.15 V                           | 1.15 V                         |
|                          |                                                |                                            | Max.                           | 1.3 V                          | 1.3 V                            | 1.3 V                          |
|                          | Reverse current                                | I <sub>R</sub>                             | Max.                           | 10 μA                          | 10 μA                            | 10 μA                          |
|                          | Reverse voltage                                | V <sub>R</sub>                             | Max.                           | 5 V                            | 5 V                              | 5 V                            |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz                    | Typical                        | 15 pF                          | 15 pF                            | 30 pF                          |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>                          | Typical                        | —                              | —                                | 1 mA (I <sub>O</sub> = 100 mA) |
| Max.                     |                                                |                                            | 4 mA (I <sub>O</sub> = 100 mA) | 4 mA (I <sub>O</sub> = 100 mA) | 3 mA (I <sub>O</sub> = 100 mA)   |                                |
| Output                   | ON-resistance (R <sub>ON</sub> )               | At I <sub>ON</sub><br>I <sub>F</sub> =5 mA | Typical                        | 5 Ω                            | 1 Ω (I <sub>ON</sub> = 300 mA)   | 35 Ω (25 Ω, t< 1s)             |
|                          |                                                |                                            | Max.                           | 8 Ω                            | 1.5 Ω (I <sub>ON</sub> = 300 mA) | 50 Ω (35 Ω, t< 1s)             |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | V <sub>OFF</sub> = 350 V                   | Max.                           | 1.0 μA                         | 1.0 μA                           | 1.0 μA                         |
|                          | OFF capacitance                                | C <sub>OFF</sub>                           | Min.                           | 1.0 pF                         | 5.0 pF                           | —                              |
|                          |                                                |                                            | Max.                           | 2.0 pF                         | 12.0 pF                          | —                              |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )                        | Typical                        | 0.8 pF                         | 0.8 pF                           | 0.8 pF                         |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )                        | Min.                           | 1000 MΩ                        | 1000 MΩ                          | 1000 MΩ                        |
|                          | Operate time                                   | (t <sub>ON</sub> )                         | Max.                           | 0.5 ms                         | 0.5 ms                           | 1.0 ms                         |
|                          | Release time                                   | (t <sub>OFF</sub> )                        | Max.                           | 0.5 ms                         | 0.5 ms                           | 1.0 ms                         |



## Optimum Operating Conditions

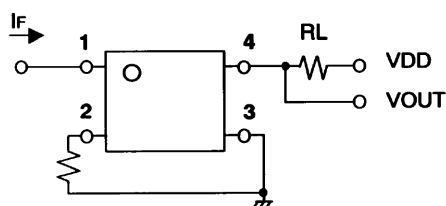
| Parameter                   | Comments and conditions |         | G3VM-21GR,<br>G3VM-21GR(TR) | G3VM-21GR1,<br>G3VM-21GR1(TR) | G3VM-351G,<br>G3VM-351G(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-------------------------------|-----------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 20 V                        | 20 V                          | 280 V                       |
| Operate LED forward current | $I_F$                   | Min.    | 7 mA                        | 7 mA                          | 5 mA                        |
|                             |                         | Typical | —                           | —                             | 7.5 mA                      |
|                             |                         | Max.    | 30 mA                       | 30 mA                         | 25 mA                       |
| Continuous load current     | $I_O$                   | Max.    | 160 mA                      | 300 mA                        | 100 mA                      |
| Ambient temperature         | $T_A$                   |         | -25° to 60°C                | -25° to 60°C                  | -20° to 65°C                |

## Dimensions

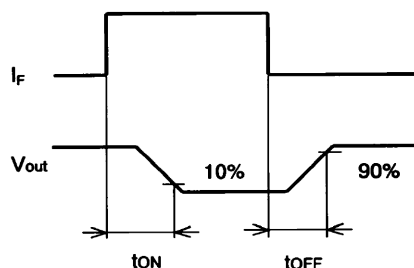
| Item       | G3VM-21GR,<br>G3VM-21GR(TR) | G3VM-21GR1,<br>G3VM-21GR1(TR) | G3VM-351G,<br>G3VM-351G(TR) |
|------------|-----------------------------|-------------------------------|-----------------------------|
| Dimensions | See pages 96, 100           | See pages 96, 100             | See pages 96, 100           |

## Connections

G3VM-21GR, -21GR(TR), -21GR1, -21GR1(TR), -351G, -351G(TR)



## Timing Chart



**G3VM-353G(TR), -401G(TR), -41GR3(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-353G,<br>G3VM-353G(TR)           | G3VM-401G,<br>G3VM-401G(TR)           | G3VM-41GR3,<br>G3VM-41GR3(TR)         |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form B/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                 | 400 V                                 | 40 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA                                | 120 mA                                | 80 mA                                 |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             | -0.8 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 1500 VAC                              | 1500 VAC                              | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-353G,<br>G3VM-353G(TR)    | G3VM-401G,<br>G3VM-401G(TR)    | G3VM-41GR3,<br>G3VM-41GR3(TR) |
|--------------------------|------------------------------------------------|-------------------------|---------|--------------------------------|--------------------------------|-------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                          | 1.0 V                          | 1.0 V                         |
|                          |                                                |                         | Typical | 1.15 V                         | 1.15 V                         | 1.15 V                        |
|                          |                                                |                         | Max.    | 1.3 V                          | 1.3 V                          | 1.3 V                         |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                          | 10 μA                          | 10 μA                         |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                            | 5 V                            | 5 V                           |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 30 pF                          | 30 pF                          | 15 pF                         |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>ON</sub>      | Typical | 1 mA                           | 1 mA                           | —                             |
| Max.                     |                                                |                         | 3 mA    | 3 mA                           | 4 mA                           |                               |
| Output                   | ON-resistance (R <sub>ON</sub> )               | At I <sub>O</sub>       | Typical | 15 Ω (I <sub>ON</sub> =120 mA) | 17 Ω (I <sub>ON</sub> =120 mA) | 25 Ω (I <sub>ON</sub> =80 mA) |
|                          |                                                |                         | Max.    | 25 Ω (I <sub>ON</sub> =120 mA) | 35 Ω (I <sub>ON</sub> =120 mA) | 35 Ω (I <sub>ON</sub> =80 mA) |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                         | 1.0 μA                         | 1.0 μA                        |
|                          | Capacitance                                    | C <sub>OFF</sub>        | Typical | —                              | —                              | —                             |
|                          |                                                |                         | Max.    | —                              | —                              | —                             |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                         | 0.8 pF                         | 0.8 pF                        |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                        | 1000 MΩ                        | 1000 MΩ                       |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 1.0 ms                         | 1.0 ms                         | 0.5 ms                        |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 3.0 ms                         | 1.0 ms                         | 0.5 ms                        |

**Optimum Operating Conditions**

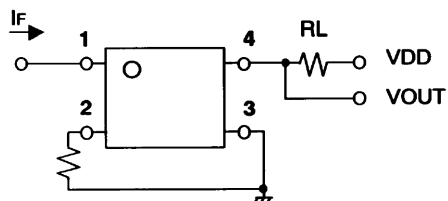
| Parameter                   | Comments and conditions |         | G3VM-353G,<br>G3VM-353G(TR) | G3VM-401G,<br>G3VM-401G(TR) | G3VM-41GR3,<br>G3VM-41GR3(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-----------------------------|-------------------------------|
| Output voltage strength     | V <sub>DD</sub>         | Max.    | 280 V                       | 320 V                       | 32 V                          |
| Operate LED forward current | I <sub>F</sub>          | Min.    | 5 mA                        | 5 mA                        | 10 mA                         |
|                             |                         | Typical | —                           | 7.5 mA                      | —                             |
|                             |                         | Max.    | 25 mA                       | 25 mA                       | 30 mA                         |
| Continuous load current     | I <sub>O</sub>          | Max.    | 120 mA                      | 120 mA                      | 80 mA                         |
| Ambient temperature         | T <sub>A</sub>          |         | -20° to 65°C                | -20° to 65°C                | -25° to 60°C                  |

## Dimensions

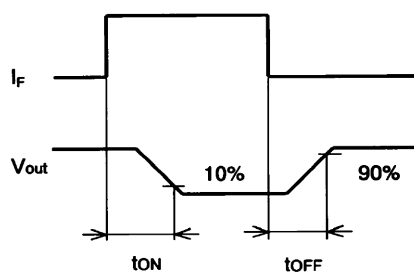
| Item       | G3VM-353G,<br>G3VM-353G(TR) | G3VM-401G,<br>G3VM-401G(TR) | G3VM-41GR3,<br>G3VM-41GR3(TR) |
|------------|-----------------------------|-----------------------------|-------------------------------|
| Dimensions | See pages 96, 100           | See pages 96, 100           | See pages 96, 100             |

## Connections

G3VM-353G, -353G(TR), -401D, -401D(TR), -41GR3, -41GR3(TR)



## Timing Chart



**G3VM-41GR4(TR), -41GR5(TR), -41GR6(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-41GR4,<br>G3VM-41GR4(TR)         | G3VM-41GR5,<br>G3VM-41GR5(TR)         | G3VM-41GR6,<br>G3VM-41GR6(TR)         |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 40 V                                  | 40 V                                  | 40 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 250 mA                                | 300 mA                                | 120 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -2.5 mA/ $^\circ\text{C}$             | -3.0 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 1500 VAC                              | 1500 VAC                              | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -20 $^\circ$ to +85 $^\circ\text{C}$  | -20 $^\circ$ to +85 $^\circ\text{C}$  | -20 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -40 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-41GR4,<br>G3VM-41GR4(TR)  | G3VM-41GR5,<br>G3VM-41GR5(TR)   | G3VM-41GR6,<br>G3VM-41GR6(TR)  |
|--------------------------|------------------------------------------------|-------------------------|---------|--------------------------------|---------------------------------|--------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                          | 1.0 V                           | 1.0 V                          |
|                          |                                                |                         | Typical | 1.15 V                         | 1.15 V                          | 1.15 V                         |
|                          |                                                |                         | Max.    | 1.3 V                          | 1.3 V                           | 1.3 V                          |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                          | 10 μA                           | 10 μA                          |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                            | 5 V                             | 5 V                            |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 15 pF                          | 15 pF                           | 15 pF                          |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>ON</sub>      | Typical | —                              | —                               | —                              |
|                          |                                                |                         | Max.    | 4 mA (I <sub>ON</sub> =100 mA) | 4 mA (I <sub>ON</sub> =100 mA)  | 4 mA (I <sub>ON</sub> =100 mA) |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 2 Ω (I <sub>ON</sub> =250 mA)  | 1.0 Ω (I <sub>ON</sub> =120 mA) | 10 Ω (I <sub>ON</sub> =120 mA) |
|                          |                                                |                         | Max.    | 3 Ω (I <sub>ON</sub> =250 mA)  | 1.5 Ω (I <sub>ON</sub> =120 mA) | 15 Ω (I <sub>ON</sub> =120 mA) |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                         | 1.0 μA                          | 1.0 μA                         |
|                          | Capacitance                                    | C <sub>OFF</sub>        | Typical | 5.0 pF                         | 10 pF                           | 1.0 pF                         |
|                          |                                                |                         | Max.    | 7.0 pF                         | 14 pF                           | 2.0 pF                         |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                         | 0.8 pF                          | 0.8 pF                         |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                        | 1000 MΩ                         | 1000 MΩ                        |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 0.5 ms                         | 0.5 ms                          | 0.5 ms                         |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 0.5 ms                         | 0.5 ms                          | 0.5 ms                         |

**Optimum Operating Conditions**

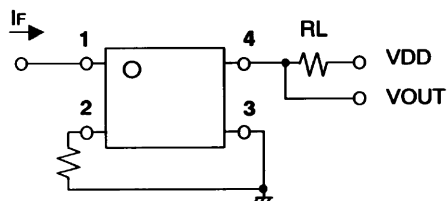
| Parameter                   | Comments and conditions |         | G3VM-41GR4,<br>G3VM-41GR4(TR)       | G3VM-41GR5,<br>G3VM-41GR5(TR)       | G3VM-41GR6,<br>G3VM-41GR6(TR)       |
|-----------------------------|-------------------------|---------|-------------------------------------|-------------------------------------|-------------------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 32 V                                | 32 V                                | 32 V                                |
| Operate LED forward current | $I_F$                   | Min.    | 10 mA                               | 10 mA                               | 10 mA                               |
|                             |                         | Typical | —                                   | —                                   | —                                   |
|                             |                         | Max.    | 30 mA                               | 30 mA                               | 30 mA                               |
| Continuous load current     | $I_O$                   | Max.    | 250 mA                              | 300 mA                              | 120 mA                              |
| Ambient temperature         | $T_A$                   |         | -25 $^\circ$ to 60 $^\circ\text{C}$ | -25 $^\circ$ to 60 $^\circ\text{C}$ | -25 $^\circ$ to 60 $^\circ\text{C}$ |

## Dimensions

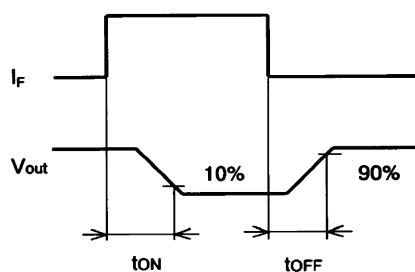
| Item       | G3VM-41GR4,<br>G3VM-41GR4(TR) | G3VM-41GR5,<br>G3VM-41GR5(TR) | G3VM-41GR6,<br>G3VM-41GR6(TR) |
|------------|-------------------------------|-------------------------------|-------------------------------|
| Dimensions | See pages 96, 100             | See pages 96, 100             | See pages 96, 100             |

## Connections

G3VM-41GR4, -41GR4(TR), -41GR5, -41GR5(TR), - 41GR6, -41GR6(TR)



## Timing Chart



**G3VM-61G1(TR), -81G1(TR), -S1(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-61G1,<br>G3VM-61G1(TR)           | G3VM-81G1,<br>G3VM-81G1(TR)           | G3VM-S1,<br>G3VM-S1(TR)               |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 60 V                                  | 80 V                                  | 60 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 400 mA                                | 350 mA                                | 400 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -4.0 mA/ $^\circ\text{C}$             | -3.5 mA/ $^\circ\text{C}$             | -4.0 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 1500 VAC                              | 1500 VAC                              | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-61G1,<br>G3VM-61G1(TR)   | G3VM-81G1,<br>G3VM-81G1(TR)     | G3VM-S1,<br>G3VM-S1(TR)       |
|--------------------------|------------------------------------------------|-------------------------|---------|-------------------------------|---------------------------------|-------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                         | 1.0 V                           | 1.0 V                         |
|                          |                                                |                         | Typical | 1.15 V                        | 1.15 V                          | 1.15 V                        |
|                          |                                                |                         | Max.    | 1.3 V                         | 1.3 V                           | 1.3 V                         |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                         | 10 μA                           | 10 μA                         |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                           | 5 V                             | 5 V                           |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 30 pF                         | 15 pF                           | 30 pF                         |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | 1.6 mA                        | 1.0 mA                          | 1 mA                          |
|                          |                                                |                         | Max.    | 3 mA                          | 4.0 mA                          | 3 mA                          |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 1 Ω (I <sub>ON</sub> =400 mA) | 1.0 Ω (I <sub>ON</sub> =350 mA) | 1 Ω (I <sub>ON</sub> =400 mA) |
|                          |                                                |                         | Max.    | 2 Ω (I <sub>ON</sub> =400 mA) | 1.2 Ω (I <sub>ON</sub> =350 mA) | 2 Ω (I <sub>ON</sub> =400 mA) |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                        | 1.0 μA                          | 1.0 μA                        |
|                          | Limit current                                  | (I <sub>LIM</sub> )     | Min.    | —                             | —                               | —                             |
|                          |                                                |                         | Max.    | —                             | —                               | —                             |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                        | 0.8 pF                          | 0.8 pF                        |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                       | 1000 MΩ                         | 1000 MΩ                       |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 2.0 ms                        | 0.5 ms                          | 2.0 ms                        |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 0.5 ms                        | 0.5 ms                          | 1.0 ms                        |

**Optimum Operating Conditions**

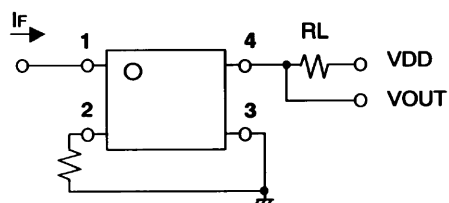
| Parameter                   | Comments and conditions |         | G3VM-61G1,<br>G3VM-61G1(TR) | G3VM-81G1,<br>G3VM-81G1(TR) | G3VM-S1,<br>G3VM-S1(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-----------------------------|-------------------------|
| Output voltage strength     | V <sub>DD</sub>         | Max.    | 48 V                        | 64 V                        | 48 V                    |
| Operate LED forward current | I <sub>F</sub>          | Min.    | 5 mA                        | 5 mA                        | 5 mA                    |
|                             |                         | Typical | 7.5 mA                      | —                           | 7.5 mA                  |
|                             |                         | Max.    | 25 mA                       | 30 mA                       | 25 mA                   |
| Continuous load current     | I <sub>O</sub>          | Max.    | 400 mA                      | 350 mA                      | 300 mA                  |
| Ambient temperature         | T <sub>A</sub>          |         | -20° to 65°C                | -25° to 60°C                | -20° to 65°C            |

# Dimensions

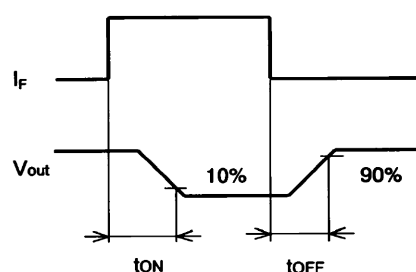
| Item       | G3VM-61G1,<br>G3VM-61G1(TR) | G3VM-81G1,<br>G3VM-81G1(TR) | G3VM-S1,<br>G3VM-S1(TR) |
|------------|-----------------------------|-----------------------------|-------------------------|
| Dimensions | See pages 96, 100           | See pages 96, 100           | See pages 96, 100       |

# Connections

G3VM-61G1, -61G1(TR), -81G1, -81G1(TR), -S1, -S1(TR)



# Timing Chart



**G3VM-S2(TR), -S5(TR), -351H(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-S2,<br>G3VM-S2(TR)               | G3VM-S5,<br>G3VM-S5(TR)               | G3VM-351H,<br>G3VM-351H(TR)                        |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|----------------------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/4 pins                       | 1 Form A/4 pins                       | 1 Form A/6 pins                                    |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                              |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                                |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$                          |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                                |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                 | 200 V                                 | 350 V                                              |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA                                | 150 mA                                | 110 mA (for A)<br>110 mA (for B)<br>220 mA (for C) |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$             | -1.5 mA/ $^\circ\text{C}$             | -1.1 mA/ $^\circ\text{C}$ (for A)                  |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                               |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 1500 VAC                              | 1500 VAC                              | 1500 VAC                                           |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$               |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +100 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$              |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-S2,<br>G3VM-S2(TR)        | G3VM-S5,<br>G3VM-S5(TR)       | G3VM-351H,<br>G3VM-351H(TR)                     |
|--------------------------|------------------------------------------------|-------------------------|---------|--------------------------------|-------------------------------|-------------------------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                          | 1.0 V                         | 1.0 V                                           |
|                          |                                                |                         | Typical | 1.15 V                         | 1.15 V                        | 1.15 V                                          |
|                          |                                                |                         | Max.    | 1.3 V                          | 1.3 V                         | 1.3 V                                           |
|                          | Reverse current                                | I <sub>R</sub>          |         | 10 μA                          | 10 μA                         | 10 μA                                           |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                            | 5 V                           | 5 V                                             |
|                          | Capacitance (CT)                               | V = 0; freq. = 1 MHz    |         | 30 pF                          | 30 pF                         | 30 pF                                           |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | 1 mA                           | 1 mA                          | 1 mA                                            |
| Max.                     |                                                |                         | 3 mA    | 3 mA                           | 3 mA                          |                                                 |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 22 Ω (I <sub>ON</sub> =120 mA) | 5 Ω (I <sub>ON</sub> =150 mA) | 35 Ω (I <sub>ON</sub> =110 mA) for connection A |
|                          |                                                |                         | Max.    | 35 Ω (I <sub>ON</sub> =120 mA) | 8 Ω (I <sub>ON</sub> =150 mA) | 50 Ω (I <sub>ON</sub> =110 mA) for connection A |
|                          |                                                |                         | Typical | —                              | —                             | 28 Ω (I <sub>ON</sub> =110 mA) for connection B |
|                          |                                                |                         | Max.    | —                              | —                             | 40 Ω (I <sub>ON</sub> =110 mA) for connection B |
|                          |                                                |                         | Typical | —                              | —                             | 14 Ω (I <sub>ON</sub> =220 mA) for connection C |
|                          |                                                |                         | Max.    | —                              | —                             | 20 Ω (I <sub>ON</sub> =220 mA) for connection C |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                         | 1.0 μA                        | 1.0 μA                                          |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                         | 0.8 pF                        | 0.8 pF                                          |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                        | 1000 MΩ                       | 1000 MΩ                                         |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 1.0 ms                         | 1.5 ms                        | 1.0 ms                                          |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 1.0 ms                         | 1.0 ms                        | 1.0 ms                                          |



## Optimum Operating Conditions

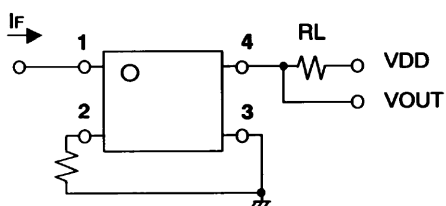
| Parameter                   | Comments and conditions |         | G3VM-S2,<br>G3VM-S2(TR) | G3VM-S5,<br>G3VM-S5(TR) | G3VM-351H,<br>G3VM-351H(TR) |
|-----------------------------|-------------------------|---------|-------------------------|-------------------------|-----------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V                   | 200 V                   | 280 V                       |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                    | 5 mA                    | 5 mA                        |
|                             |                         | Typical | 7.5 mA                  | 7.5 mA                  | 10 mA                       |
|                             |                         | Max.    | 25 mA                   | 25 mA                   | 25 mA                       |
| Continuous load current     | $I_O$                   | Max.    | 100 mA                  | 120 mA                  | 100 mA                      |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C            | -20° to 65°C            | -20° to 65°C                |

## Dimensions

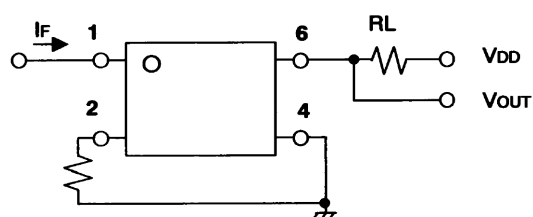
| Item       | G3VM-S2,<br>G3VM-S2(TR) | G3VM-S5,<br>G3VM-S5(TR) | G3VM-351H,<br>G3VM-351H(TR) |
|------------|-------------------------|-------------------------|-----------------------------|
| Dimensions | See pages 96, 100       | See pages 96, 100       | See pages 96, 101           |

## Connections

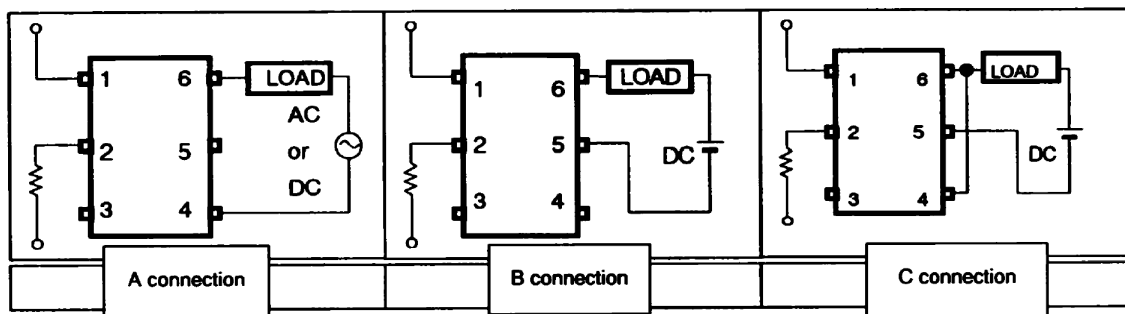
### G3VM-S2, -S2(TR), -S5, -S5(TR)



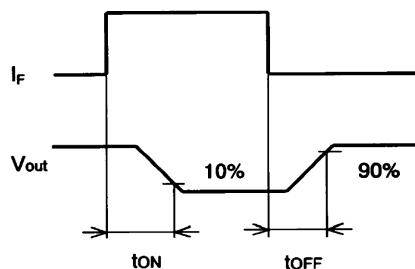
### G3VM-351H, -351H(TR)



### G3VM-351H, -351H(TR)



## Timing Chart



**G3VM-353H(TR), -61H1(TR), -81HR(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-353H,<br>G3VM-353H(TR)                        | G3VM-61H1,<br>G3VM-61H1(TR)                        | G3VM-81HR,<br>G3VM-81HR(TR)           |
|-------------------------------|--------------------------------|---------------------------------------|---------|----------------------------------------------------|----------------------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form B/6 pins                                    | 1 Form A/6 pins                                    | 1 Form A/6 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                              | 50 mA                                              | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                                | 1 A                                                | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                                | 5 V                                                | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 350 V                                              | 60 V                                               | 80 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA (for A)<br>120 mA (for B)<br>240 mA (for C) | 400 mA (for A)<br>400 mA (for B)<br>800 mA (for C) | 1250 mA                               |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$                          | -4.0 mA/ $^\circ\text{C}$                          | -12.5 mA/ $^\circ\text{C}$            |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 1500 VAC                                           | 1500 VAC                                           | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$               | -20 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$              | -40 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-353H,<br>G3VM-353H(TR)                     | G3VM-61H1,<br>G3VM-61H1(TR)                       | G3VM-81HR,<br>G3VM-81HR(TR)       |
|--------------------------|------------------------------------------------|-------------------------|---------|-------------------------------------------------|---------------------------------------------------|-----------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                                           | 1.0 V                                             | 1.0 V                             |
|                          |                                                |                         | Typical | 1.15 V                                          | 1.15 V                                            | 1.15 V                            |
|                          |                                                |                         | Max.    | 1.3 V                                           | 1.3 V                                             | 1.3 V                             |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                                           | 10 μA                                             | 10 μA                             |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                                             | 5 V                                               | 5 V                               |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 30 pF                                           | 30 pF                                             | 15 pF                             |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | 1 mA                                            | 1.6 mA                                            | 2 mA                              |
| Max.                     |                                                |                         | 3 mA    | 3 mA                                            | 5 mA                                              |                                   |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 15 Ω (I <sub>ON</sub> =120 mA) for connection A | 1 Ω (I <sub>ON</sub> =400 mA) for connection A    | 0.11 Ω (I <sub>ON</sub> =1250 mA) |
|                          |                                                |                         | Max.    | 25 Ω (I <sub>ON</sub> =120 mA) for connection A | 2 Ω (I <sub>ON</sub> =400 mA) for connection A    | 0.15 Ω (I <sub>ON</sub> =1250 mA) |
|                          |                                                |                         | Typical | 8 Ω (I <sub>ON</sub> =120 mA) for connection B  | 0.5 Ω (I <sub>ON</sub> =400 mA) for connection B  | —                                 |
|                          |                                                |                         | Max.    | 14 Ω (I <sub>ON</sub> =120 mA) for connection B | 1 Ω (I <sub>ON</sub> =400 mA) for connection B    | —                                 |
|                          |                                                |                         | Typical | 4 Ω (I <sub>ON</sub> =240 mA) for connection C  | 0.25 Ω (I <sub>ON</sub> =800 mA) for connection C | —                                 |
|                          |                                                |                         | Max.    | —                                               | —                                                 | —                                 |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                                          | 1.0 μA                                            | 1.5 μA                            |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                                          | 0.8 pF                                            | 0.8 pF                            |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                                         | 1000 MΩ                                           | 1000 MΩ                           |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 1.0 ms                                          | 2.0 ms                                            | 3.0 ms                            |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 3.0 ms                                          | 0.5 ms                                            | 1.0 ms                            |

## Optimum Operating Conditions

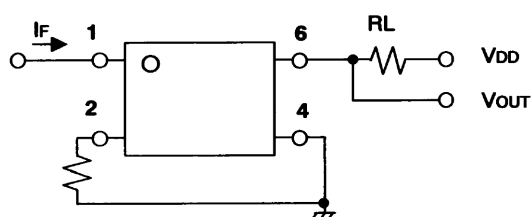
| Parameter                   | Comments and conditions |         | G3VM-353H,<br>G3VM-353H(TR) | G3VM-61H1,<br>G3VM-61H1(TR) | G3VM-81HR,<br>G3VM-81HR(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-----------------------------|-----------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V                       | 48V                         | 64 V                        |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                        | 5 mA                        | 5 mA                        |
|                             |                         | Typical | —                           | 7.5 mA                      | —                           |
|                             |                         | Max.    | 25 mA                       | 25 mA                       | 30 mA                       |
| Continuous load current     | $I_O$                   | Max.    | 120 mA                      | 400 mA                      | 1250 mA                     |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C                | -20° to 65°C                | -25° to 60°C                |

## Dimensions

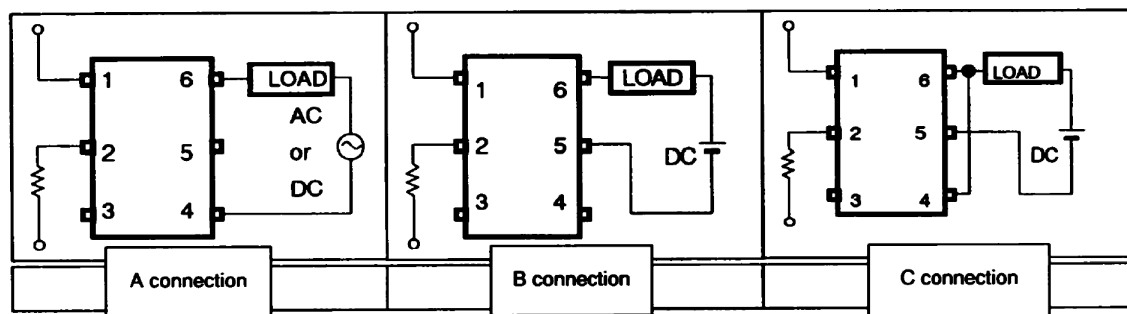
| Item       | G3VM-353H,<br>G3VM-353H(TR) | G3VM-61H1,<br>G3VM-61H1(TR) | G3VM-81HR,<br>G3VM-81HR(TR) |
|------------|-----------------------------|-----------------------------|-----------------------------|
| Dimensions | See pages 96, 101           | See pages 96, 101           | See pages 96, 101           |

## Connections

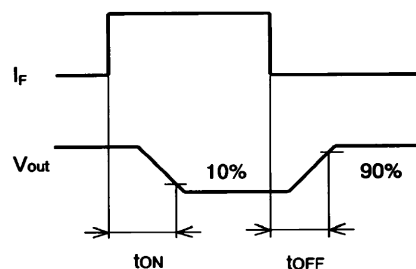
G3VM-353H, -353H(TR), -61H1, -61H1(TR), -81HR, -81HR(TR)



G3VM-353H, -353H(TR), -61H1, -61H1(TR), -81HR, -81HR(TR)



## Timing Chart



**G3VM-S3(TR), -355JR(TR), -352J(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions                  |         | G3VM-S3,<br>G3VM-S3(TR)                            | G3VM-355JR,<br>G3VM-355JR(TR)         | G3VM-352J,<br>G3VM-352J(TR)           |
|-------------------------------|--------------------------------|------------------------------------------|---------|----------------------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                        |         | 1 Form A/6 pins                                    | 1FormA+1FormB/<br>8 pins              | 2 Form A/8 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                    | Typical | 50 mA                                              | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse,<br>100 pps) | Max.    | 1 A                                                | 1 A                                   | 1 A                                   |
|                               | Forward current<br>derating    | $T_a \geq 25^\circ\text{C}$              |         | -0.5 mA/ $^\circ\text{C}$                          | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                    | Max.    | 5 V                                                | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                          |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage<br>strength     | $V_{OFF}$                                |         | 350 V                                              | 350 V                                 | 350 V                                 |
|                               | Continuous load<br>current     | $I_O$                                    |         | 120 mA (for A)<br>120 mA (for B)<br>160 mA (for C) | 120 mA                                | 110 mA                                |
|                               | ON-state current<br>derating   | $T_a \geq 25^\circ\text{C}$              |         | -1.2 mA/ $^\circ\text{C}$                          | -1.2 mA/ $^\circ\text{C}$             | -1.1 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                          |         | 125 $^\circ\text{C}$                               | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.               |         | 1500 VAC                                           | 2500 VAC                              | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                      |         | -20 $^\circ$ to +85 $^\circ\text{C}$               | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing                  |         | -55 $^\circ$ to +125 $^\circ\text{C}$              | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-S3,<br>G3VM-S3(TR)                            | G3VM-355JR,<br>G3VM-355JR(TR)  | G3VM-352J,<br>G3VM-352J(TR) |
|--------------------------|------------------------------------------------|-------------------------|---------|----------------------------------------------------|--------------------------------|-----------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                                              | 1.0 V                          | 1.0 V                       |
|                          |                                                |                         | Typical | 1.15 V                                             | 1.15 V                         | 1.15 V                      |
|                          |                                                |                         | Max.    | 1.3 V                                              | 1.3 V                          | 1.3 V                       |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                                              | 10 μA                          | 10 μA                       |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                                                | 5 V                            | 5 V                         |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 30 pF                                              | 30 pF                          | 30 pF                       |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | —                                                  | 1 mA                           | 1 mA                        |
|                          |                                                |                         | Max.    | 3 mA                                               | 3 mA                           | 3 mA                        |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 22 Ω (I <sub>ON</sub> =120 mA)<br>for connection A | 15 Ω (I <sub>ON</sub> =120 mA) | 35 Ω (25 Ω, t < 1s)         |
|                          |                                                |                         | Max.    | 35 Ω (I <sub>ON</sub> =120 mA)<br>for connection A | 25 Ω (I <sub>ON</sub> =120 mA) | 50 Ω (35 Ω, t < 1s)         |
|                          |                                                |                         | Typical | —                                                  | —                              | —                           |
|                          |                                                |                         | Max.    | 25 Ω (I <sub>ON</sub> =120 mA)<br>for connection B | —                              | —                           |
|                          |                                                |                         | Typical | —                                                  | —                              | —                           |
|                          |                                                |                         | Max.    | 15 Ω (I <sub>ON</sub> =160 mA)<br>for connection C | —                              | —                           |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                                             | 1.0 μA                         | 1.0 μA                      |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                                             | 0.8 pF                         | 0.8 pF                      |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                                            | 1000 MΩ                        | 1000 MΩ                     |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 1.0 ms                                             | 1.0 ms                         | 1.0 ms                      |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 1.0 ms                                             | 1.0 ms                         | 1.0 ms                      |

## Optimum Operating Conditions

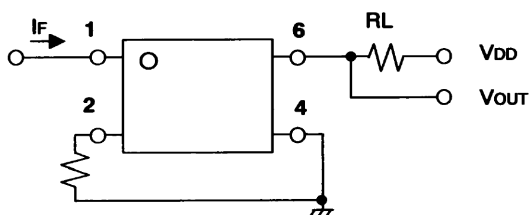
| Parameter                   | Comments and conditions |         | G3VM-S3,<br>G3VM-S3(TR) | G3VM-355JR,<br>G3VM-355JR(TR) | G3VM-352J,<br>G3VM-352J(TR) |
|-----------------------------|-------------------------|---------|-------------------------|-------------------------------|-----------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 280 V                   | 280V                          | 280 V                       |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                    | 5 mA                          | 5 mA                        |
|                             |                         | Typical | 7.5 mA                  | —                             | 10 mA                       |
|                             |                         | Max.    | 25 mA                   | 25 mA                         | 25 mA                       |
| Continuous load current     | $I_O$                   | Max.    | 100 mA                  | 120 mA                        | 100 mA                      |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C            | -20° to 65°C                  | -20° to 65°C                |

## Dimensions

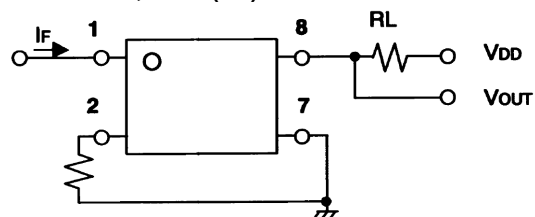
| Item       | G3VM-S3,<br>G3VM-S3(TR) | G3VM-355JR,<br>G3VM-355JR(TR) | G3VM-352J,<br>G3VM-352J(TR) |
|------------|-------------------------|-------------------------------|-----------------------------|
| Dimensions | See pages 96, 101       | See pages 97, 102             | See pages 97, 102           |

## Connections

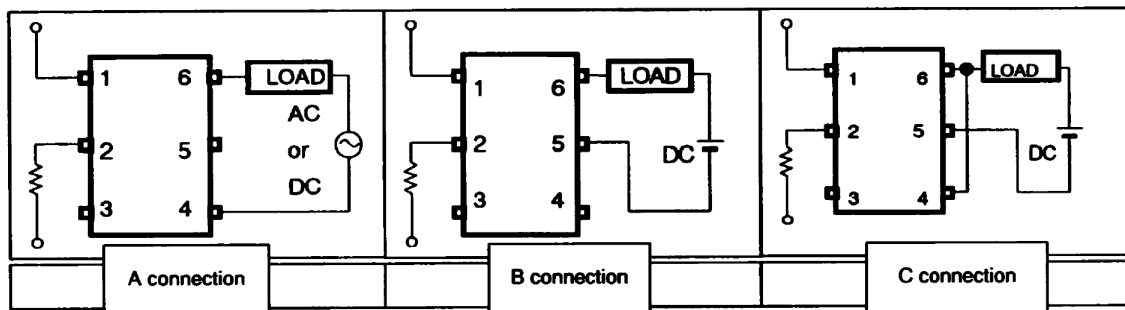
### G3VM-S3, -S3(TR)



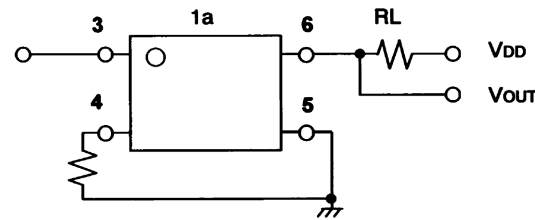
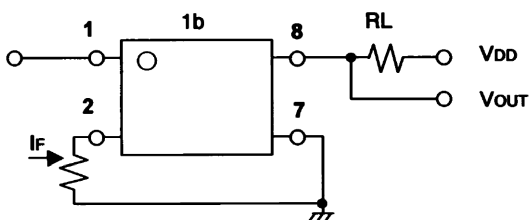
### G3VM-352J, -352J(TR)



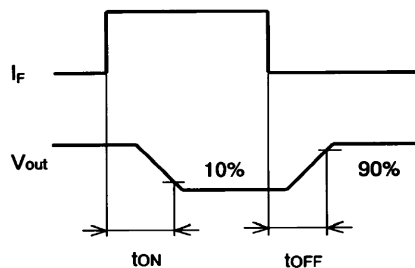
### G3VM-S3, -S3(TR)



### G3VM-355JR, -355JR(TR)



## Timing Chart



**G3VM-402J(TR), -62J1(TR), -SW(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-402J,<br>G3VM-402J(TR)           | G3VM-62J1,<br>G3VM-62J1(TR)           | G3VM-SW,<br>G3VM-SW(TR)               |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 2 Form A/8 pins                       | 2 Form A/8 pins                       | 2 Form A/ 8 pins                      |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 400 V                                 | 60 V                                  | 350 V, DC or AC peak                  |
|                               | Continuous load current        | $I_O$                                 |         | 120 mA                                | 400 mA                                | 100 mA (1+2 ch)<br>120 mA (1 ch)      |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.2 mA/ $^\circ\text{C}$             | -4.0 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$ (1 ch)      |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 1500 VAC                              | 1500 VAC                              | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter      |                                                | Comments and conditions   |                     | G3VM-402J,<br>G3VM-402J(TR)    | G3VM-62J1,<br>G3VM-62J1(TR)     | G3VM-SW,<br>G3VM-SW(TR)        |
|----------------|------------------------------------------------|---------------------------|---------------------|--------------------------------|---------------------------------|--------------------------------|
| Input          | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA     | Min.                | 1.0 V                          | 1.0 V                           | 1.0 V                          |
|                |                                                |                           | Typical             | 1.15 V                         | 1.15 V                          | 1.15 V                         |
|                |                                                |                           | Max.                | 1.3 V                          | 1.3 V                           | 1.3 V                          |
|                | Reverse current                                | I <sub>R</sub>            | Max.                | 10 μA                          | 10 μA                           | 10 μA                          |
|                | Reverse voltage                                | V <sub>R</sub>            | Max.                | 5 V                            | 5 V                             | 5 V                            |
|                | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz   | Typical             | 30 pF                          | 30 pF                           | 30 pF                          |
|                | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>         | Typical             | 1 mA                           | 1.6 mA                          | —                              |
|                |                                                |                           | Max.                | 3 mA                           | 3 mA                            | 3 mA                           |
| Output         | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA (1a) | Typical             | 17 Ω (I <sub>ON</sub> =120 mA) | 1.0 Ω (I <sub>ON</sub> =400 mA) | 22 Ω (I <sub>ON</sub> =120 mA) |
|                |                                                |                           | Max.                | 35 Ω (I <sub>ON</sub> =120 mA) | 2.0 Ω (I <sub>ON</sub> =400 mA) | 35 Ω (I <sub>ON</sub> =120 mA) |
|                |                                                | I <sub>F</sub> =0 mA (1b) | Typical             | —                              | —                               | —                              |
|                |                                                |                           | Max.                | —                              | —                               | —                              |
|                | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>       | Max.                | 1.0 μA                         | 1.0 μA                          | 1.0 μA                         |
|                | Capacitance                                    | C <sub>OFF</sub>          | Typical             | —                              | —                               | —                              |
|                |                                                |                           | Max.                | —                              | —                               | —                              |
|                | Transfer characteristics                       | I/O capacitance           | (C <sub>I/O</sub> ) | Typical                        | 0.8 pF                          | 0.8 pF                         |
| I/O resistance |                                                | (R <sub>I/O</sub> )       | Min.                | 1000 MΩ                        | 1000 MΩ                         | 1000 MΩ                        |
| Operate time   |                                                | (t <sub>ON</sub> )        | Max.                | 1.0 ms                         | 2.0 ms                          | 1.0 ms                         |
| Release time   |                                                | (t <sub>OFF</sub> )       | Max.                | 1.0 ms                         | 0.5 ms                          | 1.0 ms                         |

## Optimum Operating Conditions

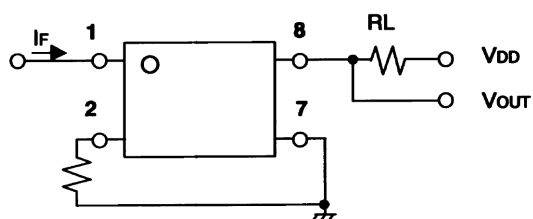
| Parameter                   | Comments and conditions |         | G3VM-402J,<br>G3VM-402J(TR) | G3VM-62J1,<br>G3VM-62J1(TR) | G3VM-SW,<br>G3VM-SW(TR) |
|-----------------------------|-------------------------|---------|-----------------------------|-----------------------------|-------------------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 320 V                       | 48 V                        | 280 V                   |
| Operate LED forward current | $I_F$                   | Min.    | 5 mA                        | 5 mA                        | 5 mA                    |
|                             |                         | Typical | 7.5 mA                      | 7.5 mA                      | 7.5 mA                  |
|                             |                         | Max.    | 25 mA                       | 25 mA                       | 25 mA                   |
| Continuous load current     | $I_O$                   | Max.    | 120 mA                      | 400 mA                      | 100 mA                  |
| Ambient temperature         | $T_A$                   |         | -20° to 65°C                | -20° to 65°C                | -20° to 65°C            |

## Dimensions

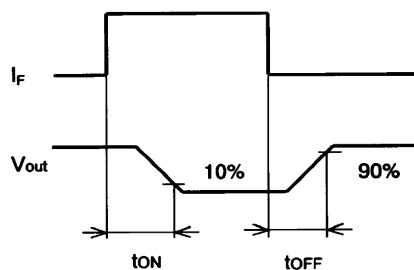
| Item       | G3VM-402J,<br>G3VM-402J(TR) | G3VM-62J1,<br>G3VM-62J1(TR) | G3VM-SW,<br>G3VM-SW(TR) |
|------------|-----------------------------|-----------------------------|-------------------------|
| Dimensions | See pages 97, 102           | See pages 97, 102           | See pages 97, 102       |

## Connections

G3VM-402J, -402J(TR), -62J1, -62J1(TR), -SW, -SW(TR)



## Timing Chart



**G3VM-SY(TR), -354J(TR)****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-SY,<br>G3VM-SY(TR)               | G3VM-354J,<br>G3VM-354J(TR)           |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 2 Form A/8 pins                       | 2 Form B/8 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 60 V                                  | 350 V                                 |
|                               | Continuous load current        | $I_O$                                 |         | 200 mA (1+2 ch)<br>300 mA (1 ch)      | 120 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -3.0 mA/ $^\circ\text{C}$ (1 ch)      | -1.2 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 1500 VAC                              | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -20 $^\circ$ to +85 $^\circ\text{C}$  | -40 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -55 $^\circ$ to +125 $^\circ\text{C}$ | -55 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions |         | G3VM-SY,<br>G3VM-SY(TR)         | G3VM-354J,<br>G3VM-354J(TR)    |
|--------------------------|------------------------------------------------|-------------------------|---------|---------------------------------|--------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA   | Min.    | 1.0 V                           | 1.0 V                          |
|                          |                                                |                         | Typical | 1.15 V                          | 1.15 V                         |
|                          |                                                |                         | Max.    | 1.3 V                           | 1.3 V                          |
|                          | Reverse current                                | I <sub>R</sub>          | Max.    | 10 μA                           | 10 μA                          |
|                          | Reverse voltage                                | V <sub>R</sub>          | Max.    | 5 V                             | 5 V                            |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz | Typical | 30 pF                           | 30 pF                          |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>       | Typical | —                               | 1 mA                           |
|                          |                                                |                         | Max.    | 3 mA                            | 3 mA                           |
| Output                   | ON-resistance (R <sub>ON</sub> )               | I <sub>F</sub> =5 mA    | Typical | 1.4 Ω (I <sub>ON</sub> =300 mA) | 15 Ω (I <sub>ON</sub> =120 mA) |
|                          |                                                |                         | Max.    | 2.0 Ω (I <sub>ON</sub> =300 mA) | 25 Ω (I <sub>ON</sub> =120 mA) |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>     | Max.    | 1.0 μA                          | 1.0 μA                         |
|                          | Capacitance                                    | C <sub>OFF</sub>        | Typical | —                               | —                              |
|                          |                                                |                         | Max.    | —                               | —                              |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )     | Typical | 0.8 pF                          | 0.8 pF                         |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )     | Min.    | 1000 MΩ                         | 1000 MΩ                        |
|                          | Operate time                                   | (t <sub>ON</sub> )      | Max.    | 2.0 ms                          | 1.0 ms                         |
|                          | Release time                                   | (t <sub>OFF</sub> )     | Max.    | 1.0 ms                          | 3.0 ms                         |

**Optimum Operating Conditions**

| Parameter                   | Comments and conditions |         | G3VM-SY,<br>G3VM-SY(TR) | G3VM-354J,<br>G3VM-354J(TR) |
|-----------------------------|-------------------------|---------|-------------------------|-----------------------------|
| Output voltage strength     | V <sub>DD</sub>         | Max.    | 48 V                    | 280 V                       |
| Operate LED forward current | I <sub>F</sub>          | Min.    | 5 mA                    | 5 mA                        |
|                             |                         | Typical | 10 mA                   | —                           |
|                             |                         | Max.    | 25 mA                   | 25 mA                       |
| Continuous load current     | I <sub>O</sub>          | Max.    | 200 mA                  | 120 mA                      |
| Ambient temperature         | T <sub>A</sub>          |         | -20° to 65°C            | -20° to 65°C                |

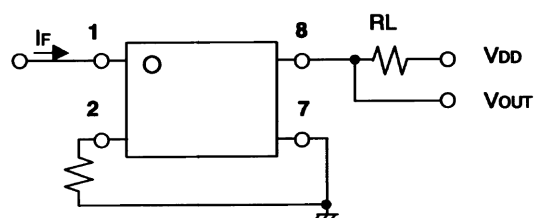


# Dimensions

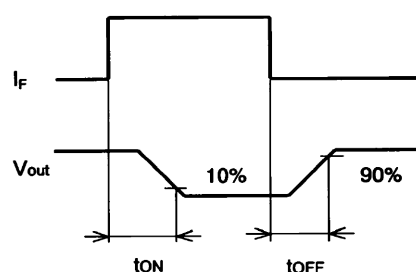
| Item       | G3VM-SY,<br>G3VM-SY(TR) | G3VM-354J,<br>G3VM-354J(TR) |
|------------|-------------------------|-----------------------------|
| Dimensions | See pages 97, 102       | See pages 97, 102           |

# Connections

G3VM-SY, -SY(TR), -354J, -354J(TR)



# Timing Chart



**G3VM-21LR, -21LR1, -41LR3****Maximum Rating**

| Parameter                     |                                | Comments and conditions               |         | G3VM-21LR                             | G3VM-21LR1                            | G3VM-41LR3                            |
|-------------------------------|--------------------------------|---------------------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                     |         | 1 Form A/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$                                 | Typical | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) | Max.    | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$           |         | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$                                 | Max.    | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                             |         | 20 V                                  | 20 V                                  | 40 V                                  |
|                               | Continuous load current        | $I_O$                                 |         | 160 mA                                | 450 mA                                | 80 mA                                 |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$           |         | -1.6 mA/ $^\circ\text{C}$             | -4.5 mA/ $^\circ\text{C}$             | -0.8 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                       |         | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.            |         | 1500 VAC                              | 1500 VAC                              | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                   |         | -20 $^\circ$ to +85 $^\circ\text{C}$  | -20 $^\circ$ to +85 $^\circ\text{C}$  | -20 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing               |         | -40 $^\circ$ to +125 $^\circ\text{C}$ | -40 $^\circ$ to +125 $^\circ\text{C}$ | -40 $^\circ$ to +100 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions                    |                                | G3VM-21LR                      | G3VM-21LR1                       | G3VM-41LR3 |
|--------------------------|------------------------------------------------|--------------------------------------------|--------------------------------|--------------------------------|----------------------------------|------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA                      | Min.                           | 1.0 V                          | 1.0 V                            | 1.0 V      |
|                          |                                                |                                            | Typical                        | 1.15 V                         | 1.15 V                           | 1.15 V     |
|                          |                                                |                                            | Max.                           | 1.3 V                          | 1.3 V                            | 1.3 V      |
|                          | Reverse current                                | I <sub>R</sub>                             | Max.                           | 10 μA                          | 10 μA                            | 10 μA      |
|                          | Reverse voltage                                | V <sub>R</sub>                             | Max.                           | 5 V                            | 5 V                              | 5 V        |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz                    | Typical                        | 15 pF                          | 15 pF                            | 15 pF      |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>O</sub>                          | Typical                        | —                              | —                                | —          |
| Max.                     |                                                |                                            | 4 mA (I <sub>O</sub> = 100 mA) | 4 mA (I <sub>O</sub> = 100 mA) | 4 mA (I <sub>O</sub> = 80 mA)    |            |
| Output                   | ON-resistance (R <sub>ON</sub> )               | At I <sub>ON</sub><br>I <sub>F</sub> =5 mA | Typical                        | 5 Ω (I <sub>O</sub> = 160 mA)  | 0.8 Ω (I <sub>ON</sub> = 450 mA) | 25 Ω       |
|                          |                                                |                                            | Max.                           | 8 Ω (I <sub>O</sub> = 160 mA)  | 1.2 Ω (I <sub>ON</sub> = 450 mA) | 35 Ω       |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | V <sub>OFF</sub> = 350 V                   | Max.                           | 1.0 nA                         | 1.0 nA                           | 1.0 nA     |
|                          | OFF capacitance                                | C <sub>OFF</sub>                           | Min.                           | 1.0 pF                         | 5.0 pF                           | 0.6 pF     |
|                          |                                                |                                            | Max.                           | 2.5 pF                         | 12.0 pF                          | 1.4 pF     |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )                        | Typical                        | 0.8 pF                         | 0.8 pF                           | 0.8 pF     |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )                        | Min.                           | 1000 MΩ                        | 1000 MΩ                          | 1000 MΩ    |
|                          | Operate time                                   | (t <sub>ON</sub> )                         | Max.                           | 0.5 ms                         | 0.5 ms                           | 1.0 ms     |
|                          | Release time                                   | (t <sub>OFF</sub> )                        | Max.                           | 0.5 ms                         | 0.5 ms                           | 1.0 ms     |

## Optimum Operating Conditions

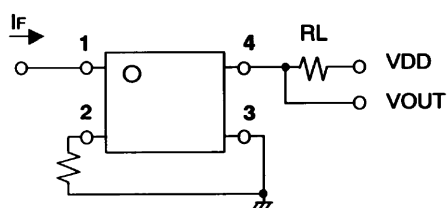
| Parameter                   | Comments and conditions |         | G3VM-21LR    | G3VM-21LR1   | G3VM-41LR3   |
|-----------------------------|-------------------------|---------|--------------|--------------|--------------|
| Output voltage strength     | $V_{DD}$                | Max.    | 32 V         | 20 V         | 32 V         |
| Operate LED forward current | $I_F$                   | Min.    | 7 mA         | 10 mA        | 10 mA        |
|                             |                         | Typical | —            | —            | —            |
|                             |                         | Max.    | 30 mA        | 30 mA        | 30 mA        |
| Continuous load current     | $I_O$                   | Max.    | 160 mA       | 450 mA       | 80 mA        |
| Ambient temperature         | $T_A$                   |         | -25° to 60°C | -25° to 60°C | -25° to 60°C |

## Dimensions

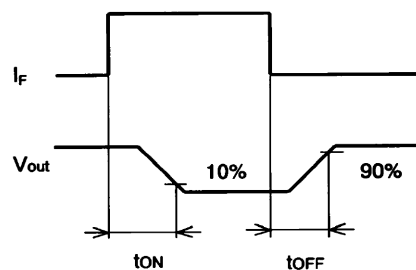
| Item       | G3VM-21LR   | G3VM-21LR1  | G3VM-41LR3  |
|------------|-------------|-------------|-------------|
| Dimensions | See page 97 | See page 97 | See page 97 |

## Connections

### G3VM-21LR, -21LR1, -41LR3



## Timing Chart



**G3VM-41LR4, -41LR5, -41LR6****Maximum Rating**

| Parameter                     |                                | Comments and conditions                    | G3VM-41LR4                            | G3VM-41LR5                            | G3VM-41LR6                            |
|-------------------------------|--------------------------------|--------------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Contact form/no. of terminals |                                | —                                          | 1 Form A/4 pins                       | 1 Form A/4 pins                       | 1 Form A/4 pins                       |
| Input (LED)                   | LED forward current            | $I_F$ Typical                              | 50 mA                                 | 50 mA                                 | 50 mA                                 |
|                               |                                | $I_{FP}$ (100 $\mu$ s pulse, 100 pps) Max. | 1 A                                   | 1 A                                   | 1 A                                   |
|                               | Forward current derating       | $T_a \geq 25^\circ\text{C}$                | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             | -0.5 mA/ $^\circ\text{C}$             |
|                               | Reverse voltage                | $V_R$ Max.                                 | 5 V                                   | 5 V                                   | 5 V                                   |
|                               | Junction temperature ( $T_J$ ) |                                            | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Output (Detector)             | Output voltage strength        | $V_{OFF}$                                  | 40 V                                  | 40 V                                  | 40 V                                  |
|                               | Continuous load current        | $I_O$                                      | 250 mA                                | 300 mA                                | 120 mA                                |
|                               | ON-state current derating      | $T_a \geq 25^\circ\text{C}$                | -2.5 mA/ $^\circ\text{C}$             | -3.0 mA/ $^\circ\text{C}$             | -1.2 mA/ $^\circ\text{C}$             |
|                               | Junction temperature ( $T_J$ ) |                                            | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  | 125 $^\circ\text{C}$                  |
| Dielectric strength           |                                | $V_{IO}$ for 1 minute min.                 | 1500 VAC                              | 1500 VAC                              | 1500 VAC                              |
| Temperature                   | Ambient                        | $T_a$ with no icing                        | -20 $^\circ$ to +85 $^\circ\text{C}$  | -20 $^\circ$ to +85 $^\circ\text{C}$  | -20 $^\circ$ to +85 $^\circ\text{C}$  |
|                               | Storage                        | $T_{stg}$ with no icing                    | -40 $^\circ$ to +125 $^\circ\text{C}$ | -40 $^\circ$ to +125 $^\circ\text{C}$ | -40 $^\circ$ to +125 $^\circ\text{C}$ |

**Electrical Characteristics**

| Parameter                |                                                | Comments and conditions                                |                                | G3VM-41LR4                     | G3VM-41LR5                      | G3VM-41LR6                     |
|--------------------------|------------------------------------------------|--------------------------------------------------------|--------------------------------|--------------------------------|---------------------------------|--------------------------------|
| Input                    | LED forward voltage (V <sub>F</sub> )          | I <sub>F</sub> =10 mA                                  | Min.                           | 1.0 V                          | 1.0 V                           | 1.0 V                          |
|                          |                                                |                                                        | Typical                        | 1.15 V                         | 1.15 V                          | 1.15 V                         |
|                          |                                                |                                                        | Max.                           | 1.3 V                          | 1.3 V                           | 1.3 V                          |
|                          | Reverse current                                | I <sub>R</sub>                                         | Max.                           | 10 μA                          | 10 μA                           | 10 μA                          |
|                          | Reverse voltage                                | V <sub>R</sub>                                         | Max.                           | 5 V                            | 5 V                             | 5 V                            |
|                          | Capacitance (C <sub>T</sub> )                  | V = 0;<br>freq. = 1 MHz                                | Typical                        | 15 pF                          | 15 pF                           | 15 pF                          |
|                          | Keep ON LED current (I <sub>FT</sub> )         | At I <sub>ON</sub>                                     | Typical                        | —                              | —                               | —                              |
| Max.                     |                                                |                                                        | 4 mA (I <sub>ON</sub> =100 mA) | 4 mA (I <sub>ON</sub> =100 mA) | 4 mA (I <sub>ON</sub> =100 mA)  |                                |
| Output                   | ON-resistance (R <sub>ON</sub> )               | At I <sub>O</sub>                                      | Typical                        | 2 Ω (I <sub>ON</sub> =250 mA)  | 1.0 Ω (I <sub>ON</sub> =300 mA) | 10 Ω (I <sub>ON</sub> =120 mA) |
|                          |                                                |                                                        | Max.                           | 3 Ω (I <sub>ON</sub> =250 mA)  | 1.5 Ω (I <sub>ON</sub> =300 mA) | 15 Ω (I <sub>ON</sub> =120 mA) |
|                          | OFF-state leakage current (I <sub>LEAK</sub> ) | At V <sub>OFF</sub>                                    | Max.                           | 1.0 nA                         | 1.0 nA                          | 1.0 nA                         |
|                          | Limit current (I <sub>LIM</sub> )              | I <sub>F</sub> = 5 mA, V <sub>DD</sub> = 5 V, t = 5 ms | Min.                           | 5 pF                           | 10 pF                           | 1.0 pF                         |
|                          |                                                |                                                        | Max.                           | 7 pF                           | 14 pF                           | 2.0 pF                         |
| Transfer characteristics | I/O capacitance                                | (C <sub>I/O</sub> )                                    | Typical                        | 0.8 pF                         | 0.8 pF                          | 0.8 pF                         |
|                          | I/O resistance                                 | (R <sub>I/O</sub> )                                    | Min.                           | 1000 MΩ                        | 1000 MΩ                         | 1000 MΩ                        |
|                          | Operate time                                   | (t <sub>ON</sub> )                                     | Max.                           | 0.5 ms                         | 0.5 ms                          | 0.5 ms                         |
|                          | Release time                                   | (t <sub>OFF</sub> )                                    | Max.                           | 0.5 ms                         | 0.5 ms                          | 0.5 ms                         |

**Optimum Operating Conditions**

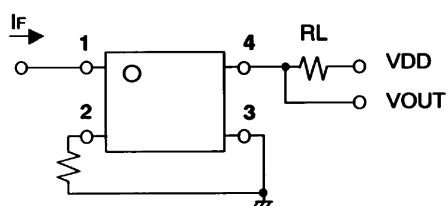
| Parameter                   | Comments and conditions | G3VM-41LR4                          | G3VM-41LR5                          | G3VM-41LR6                          |
|-----------------------------|-------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Output voltage strength     | $V_{DD}$ Max.           | 32 V                                | 32 V                                | 32 V                                |
| Operate LED forward current | $I_F$ Min.              | 10 mA                               | 10 mA                               | 10 mA                               |
|                             | Typical                 | —                                   | —                                   | —                                   |
|                             | Max.                    | 30 mA                               | 30 mA                               | 30 mA                               |
| Continuous load current     | $I_O$ Max.              | 250 mA                              | 300 mA                              | 120 mA                              |
| Ambient temperature         | $T_A$                   | -25 $^\circ$ to 60 $^\circ\text{C}$ | -25 $^\circ$ to 60 $^\circ\text{C}$ | -25 $^\circ$ to 60 $^\circ\text{C}$ |

## Dimensions

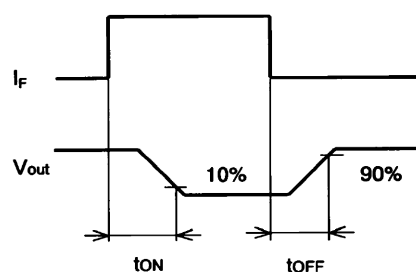
| Item       | G3VM-41LR4  | G3VM-41LR5  | G3VM-41LR6  |
|------------|-------------|-------------|-------------|
| Dimensions | See page 97 | See page 97 | See page 97 |

## Connections

G3VM-41LR, -41L5, -41LR6



## Timing Chart

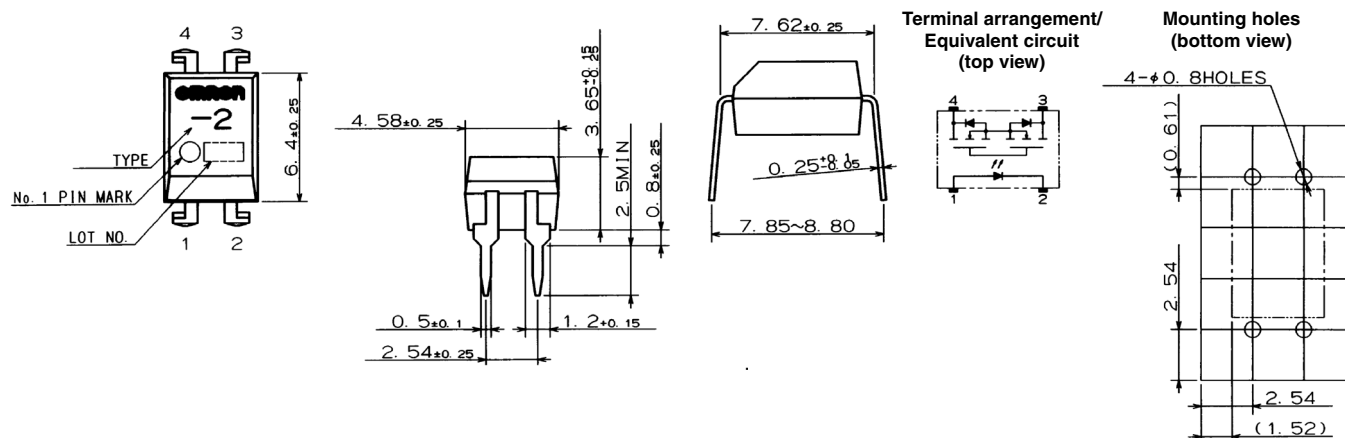


# Dimensions

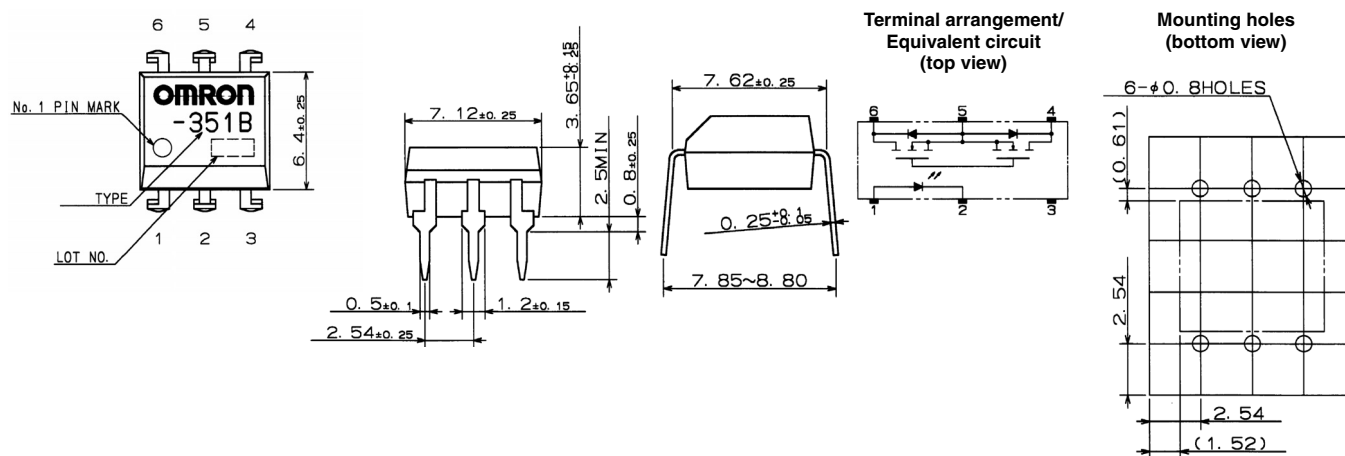
Unit: mm

## ■ PCB Through-Hole Models

G3VM-2, G3VM-2L, G3VM-351A, G3VM-353A, G3VM-401A, G3VM-61A, G3VM-61A1



G3VM-351B, G3VM-353B, G3VM-3, G3VM-3L, G3VM-401B, G3VM-401BY, G3VM-601BY, G3VM-61B, G3VM-61B1, G3VM-V

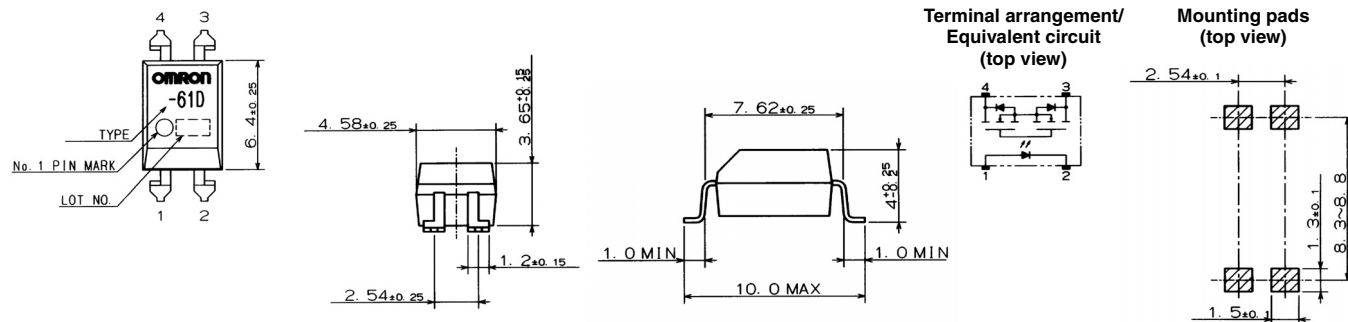




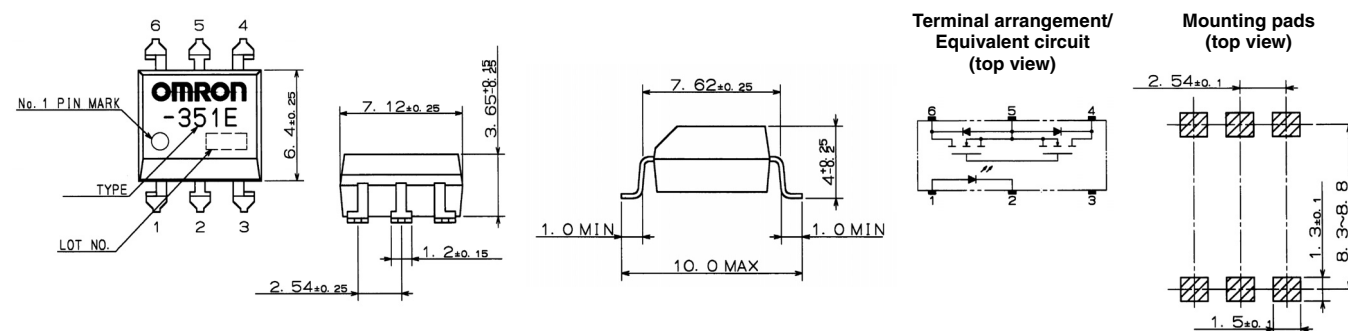
# ■ Surface Mount (SMT) Models

Dimensions also apply to SMT models with (TR) suffix indicating tape-and-reel packaging.

**G3VM-2F, G3VM-2FL, G3VM-351D, G3VM-353D, G3VM-401D, G3VM-61D, G3VM-61D1**

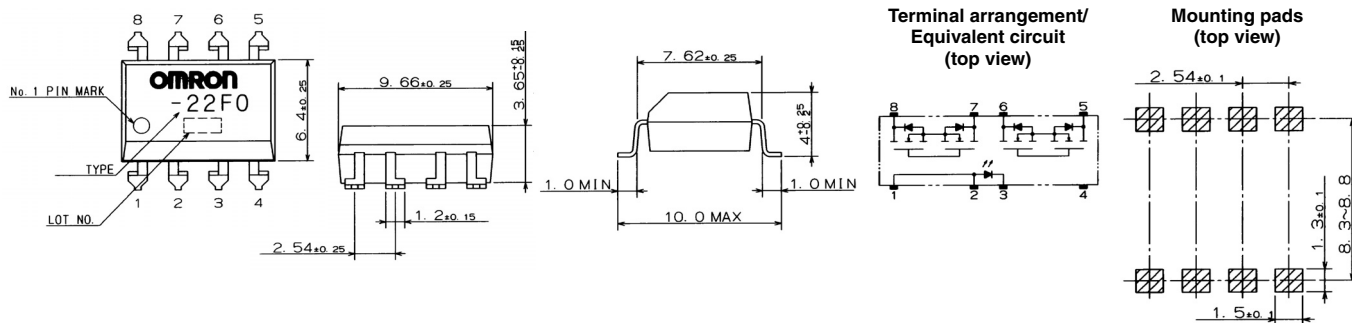


**G3VM-351E, G3VM-353E, G3VM-3F, G3VM-3FL, G3VM-401E, G3VM-401EY, G3VM-601EY, G3VM-61E, G3VM-61E1, G3VM-VF**

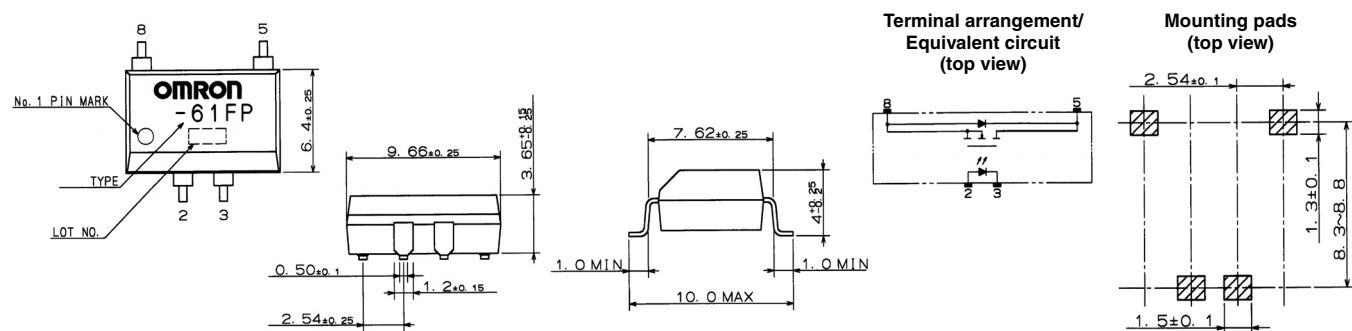




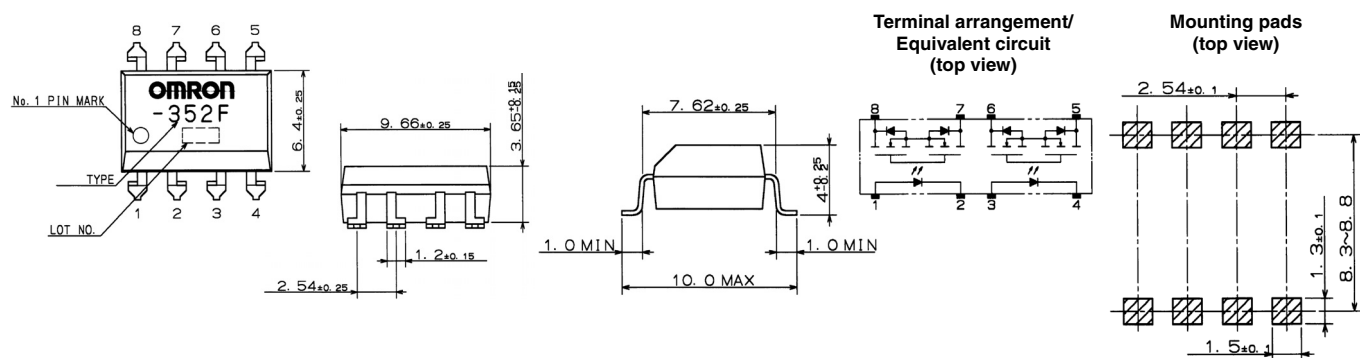
G3VM-22FO, G3VM-61FR



G3VM-61FP



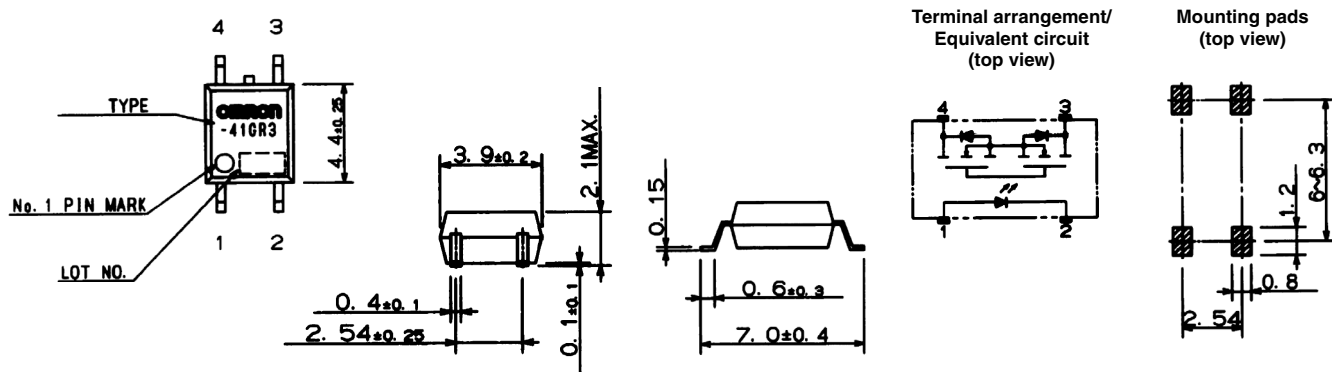
G3VM-355FR, G3VM-352F, G3VM-402F, G3VM-62F1, G3VM-WF, G3VM-WFL, G3VM-354F



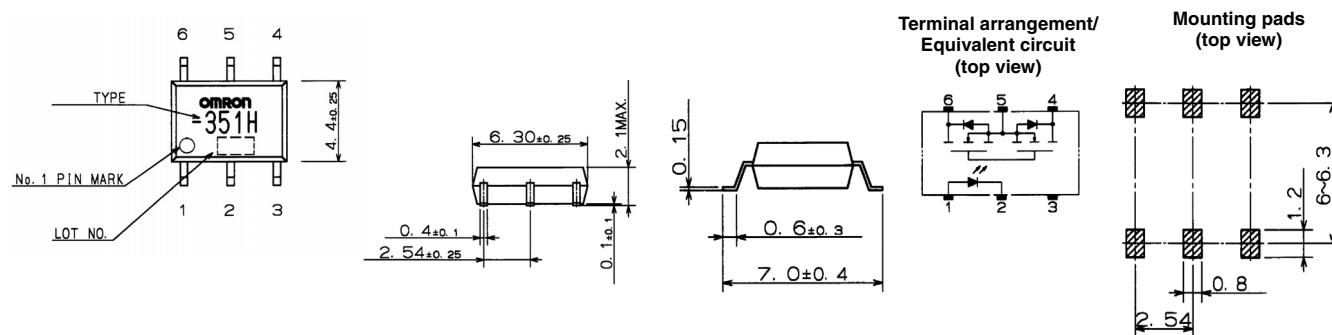
## ■ SOP Models

Dimensions also apply to SOP models with (TR) suffix indicating tape-and-reel packaging.

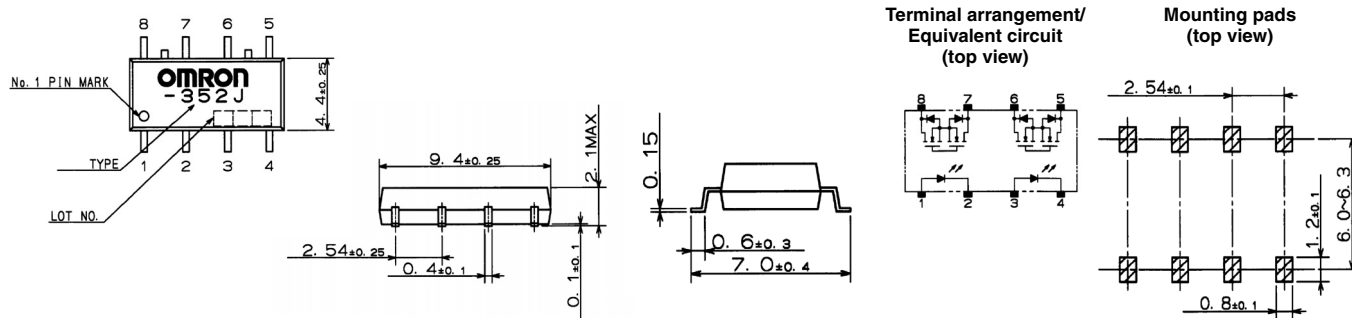
**G3VM-21GR, G3VM-21GR1, G3VM-351G, G3VM-353G, G3VM-401G, G3VM-41GR3, G3VM-41GR4, G3VM-41GR5, G3VM-41GR6, G3VM-61G1, G3VM-81G1, G3VM-S1, G3VM-S2, G3VM-S5**



**G3VM-351H, G3VM-353H, G3VM-61H1, G3VM-81HR, G3VM-S3**

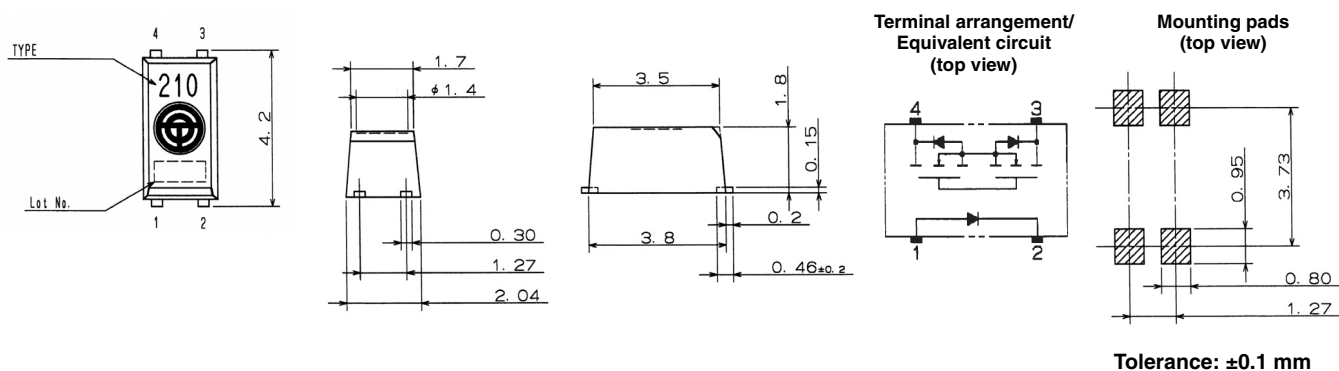


G3VM-352J, G3VM-354J, G3VM-355JR, G3VM-402J, G3VM-62J1, G3VM-SW, G3VM-SY



## ■ SSOP Models

G3VM-21LR, G3VM-21LR1, G3VM-41LR3, G3VM-41LR4, G3VM-41LR5, G3VM-41R6



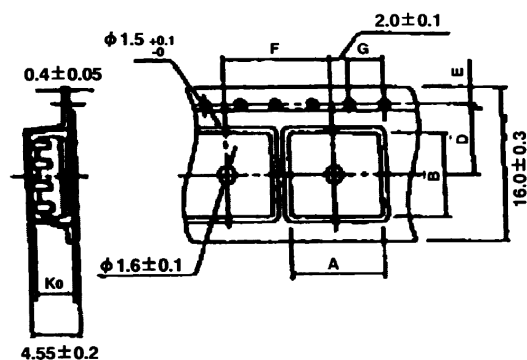
# Tape-and-Reel Dimensions

Unit: mm

## ■ Surface Mount (SMT) Models

G3VM-2F(TR), G3VM-2FL(TR), G3VM-351D(TR), G3VM-353D(TR), G3VM-401D(TR), G3VM-61D(TR), G3VM-61D1(TR)

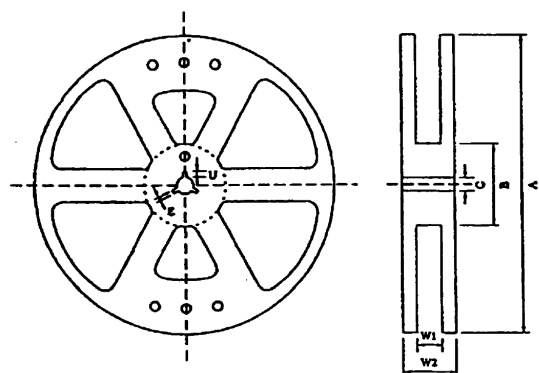
Type Figuration

(Unit: mm)  
Tolerance:  $\pm 0.1$ 

| Symbol | Dimension | Remarks                                                                        |
|--------|-----------|--------------------------------------------------------------------------------|
| A      | 10.4      | —                                                                              |
| B      | 7.6       | —                                                                              |
| K0     | 4.1       | Internal                                                                       |
| F      | 12.0      | Total Height $\begin{smallmatrix} +0.1 \\ -0.3 \end{smallmatrix}$ / 10 pitches |
| G      | 4.0       | Total Height $\begin{smallmatrix} +0.1 \\ -0.3 \end{smallmatrix}$ / 10 pitches |
| E      | 1.75      | From the edge to reel hole                                                     |
| D      | 12.0      | From reel hole to center                                                       |

Reel Figuration

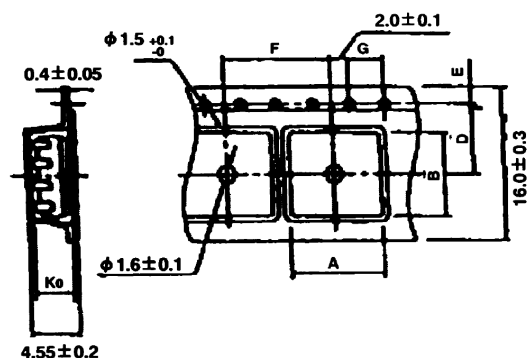
(Unit: mm)



| Symbol | Dimension          |
|--------|--------------------|
| A      | $\phi 380 \pm 2.0$ |
| W1     | $17.5 \pm 0.5$     |
| W2     | $21.5 \pm 1.0$     |
| B      | $\phi 80 \pm 1.0$  |
| C      | $\phi 13 \pm 0.5$  |
| E      | $2.0 \pm 0.5$      |
| U      | $4.0 \pm 0.5$      |

G3VM-351E(TR), G3VM-353E(TR), G3VM-3F(TR), G3VM-3FL(TR), G3VM-401E(TR), G3VM-401EY(TR), G3VM-601EY(TR), G3VM-61E(TR), G3VM-61E1(TR), G3VM-VF(TR), G3VM-22FO(TR), G3VM-61FP(TR), G3VM-61FR(TR), G3VM-355FR(TR), G3VM-352F(TR), G3VM-402F(TR), G3VM-62F1(TR), G3VM-WF(TR), G3VM-WFL(TR), G3VM-354F(TR)

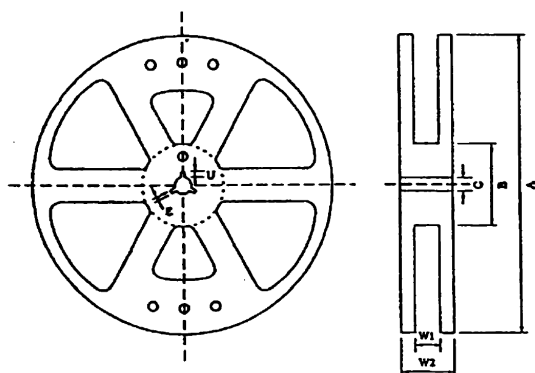
Type Figuration



(Unit: mm)  
Tolerance: ±0.1

| Symbol | Dimension  | Remarks                                    |
|--------|------------|--------------------------------------------|
| A      | 10.4 ± 0.1 | —                                          |
| B      | 10.1 ± 0.1 | —                                          |
| K0     | 4.1 ± 0.1  | Internal                                   |
| F      | 12.0 ± 0.1 | Total Height $^{+0.1}_{-0.3}$ / 10 pitches |
| G      | 4.0 ± 0.1  | Total Height $^{+0.1}_{-0.3}$ / 10 pitches |
| E      | 1.75 ± 0.1 | From the edge to reel hole                 |
| D      | 7.5 ± 0.1  | From reel hole to center                   |

Reel Figuration



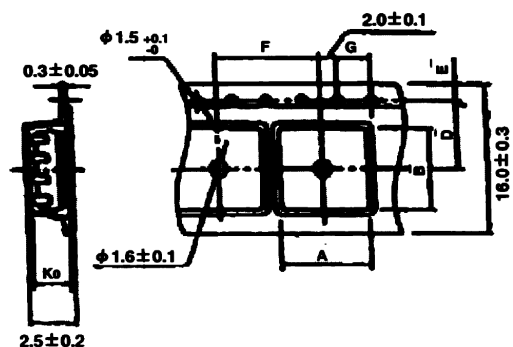
(Unit: mm)

| Symbol | Dimension          |
|--------|--------------------|
| A      | $\phi 380 \pm 2.0$ |
| W1     | 17.5 ± 0.5         |
| W2     | 21.5 ± 1.0         |
| B      | $\phi 80 \pm 1.0$  |
| C      | $\phi 13 \pm 0.5$  |
| E      | 2.0 ± 0.5          |
| U      | 4.0 ± 0.5          |



G3VM-351H(TR), G3VM-353H(TR), G3VM-61H1(TR), G3VM-81HR(TR), G3VM-S3(TR)

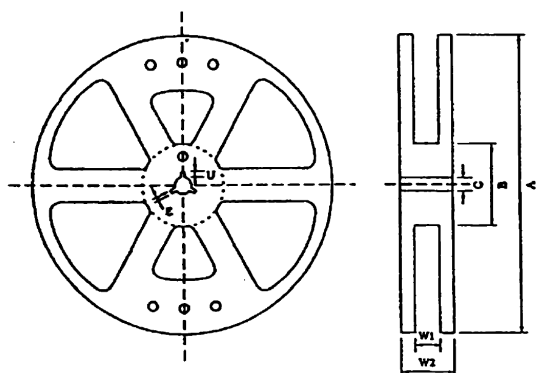
Type Figuration



(Unit: mm)  
Tolerance: ±0.1

| Symbol | Dimension  | Remarks                                                                        |
|--------|------------|--------------------------------------------------------------------------------|
| A      | 7.5 ± 0.1  | —                                                                              |
| B      | 6.7 ± 0.1  | —                                                                              |
| K0     | 2.3 ± 0.1  | Internal                                                                       |
| F      | 12.0 ± 0.1 | Total Height $\begin{smallmatrix} +0.1 \\ -0.3 \end{smallmatrix}$ / 10 pitches |
| G      | 4.0 ± 0.1  | Total Height $\begin{smallmatrix} +0.1 \\ -0.3 \end{smallmatrix}$ / 10 pitches |
| E      | 1.75 ± 0.1 | From the edge to reel hole                                                     |
| D      | 7.5 ± 0.1  | From reel hole to center                                                       |

Reel Figuration



(Unit: mm)

| Symbol | Dimension   |
|--------|-------------|
| A      | φ 380 ± 2.0 |
| W1     | 17.5 ± 0.5  |
| W2     | 21.5 ± 1.0  |
| B      | φ 80 ± 1.0  |
| C      | φ 13 ± 0.5  |
| E      | 2.0 ± 0.5   |
| U      | 4.0 ± 0.5   |

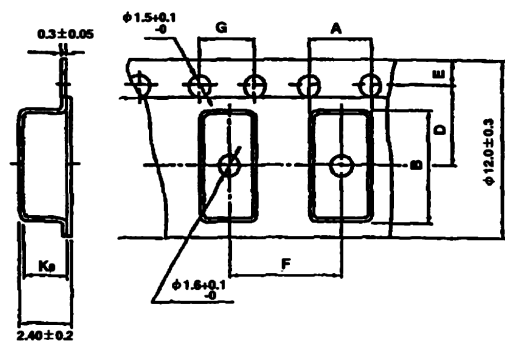




# SSOP Models

G3VM-21LR, G3VM-21LR1, G3VM-41LR3, G3VM-41LR4, G3VM-41LR5, G3VM-41R6

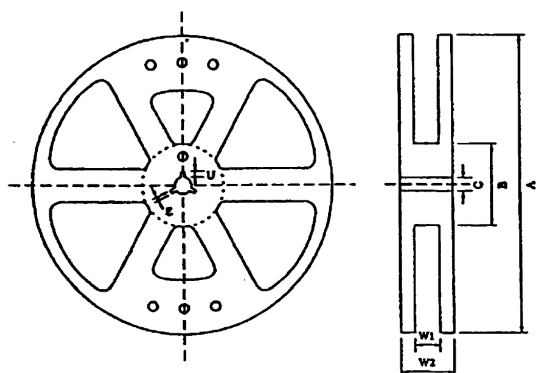
Type Figuration



(Unit: mm)  
Tolerance: ±0.1

| Symbol | Dimension  | Remarks                                                                        |
|--------|------------|--------------------------------------------------------------------------------|
| A      | 2.35 ± 0.1 | —                                                                              |
| B      | 4.5 ± 0.1  | —                                                                              |
| K0     | 2.1 ± 0.1  | Internal                                                                       |
| F      | 4.0 ± 0.1  | Total Height $\begin{smallmatrix} +0.1 \\ -0.3 \end{smallmatrix}$ / 10 pitches |
| G      | 4.0 ± 0.1  | Total Height $\begin{smallmatrix} +0.1 \\ -0.3 \end{smallmatrix}$ / 10 pitches |
| E      | 1.75 ± 0.1 | From the edge to reel hole                                                     |
| D      | 5.5 ± 0.1  | From reel hole to center                                                       |

Reel Figuration



(Unit: mm)

| Symbol | Dimension   |
|--------|-------------|
| A      | φ 380 ± 2.0 |
| W1     | 17.5 ± 0.5  |
| W2     | 21.5 ± 1.0  |
| B      | φ 80 ± 1.0  |
| C      | φ 13 ± 0.5  |
| E      | 2.0 ± 0.5   |
| U      | 4.0 ± 0.5   |

# Precautions

## ⚠ WARNING

Always turn the power off before wiring, or an electric shock may occur.

Do not touch the SSR terminal section (the recharge section) while the power supply is connected. Contact with the recharge section will result in an electric shock.

## ⚠ Caution

Do not use excess voltage or current in the SSR input or output circuits. Otherwise, damage to the SSR or a fire will result.

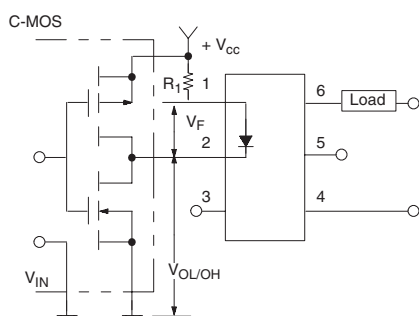
Conduct wiring and soldering correctly according to soldering conditions. If the product is used with incomplete wiring, overheating will occur and may result in a fire.

## ■ Reflow Solder Conditions

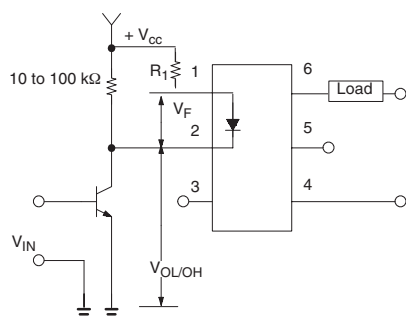
G3VM relays are designed to withstand a maximum soldering temperature of 260°C for 10 seconds.

## ■ Typical Relay Driving Circuit Examples

### C-MOS



### Transistor



Use the following formula to obtain the LED current limiting resistance value to assure that the Relay operates accurately.

$$R_1 = \frac{V_{CC} - V_{OL} - V_F(ON)}{5 \text{ to } 20 \text{ mA}}$$

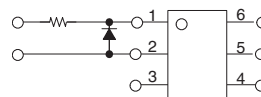
Use the following formula to obtain the LED forward voltage value to assure that the Relay releases accurately.

$$V_F(OFF) = V_{CC} - V_{OH} < 0.8 \text{ V}$$

## ■ Protection from Surge Voltage on the Input Terminals

If any reversed surge voltage is imposed on the input terminals, insert a diode in parallel to the input terminals as shown in the following circuit diagram and do not impose a reversed voltage value of 3 V or more.

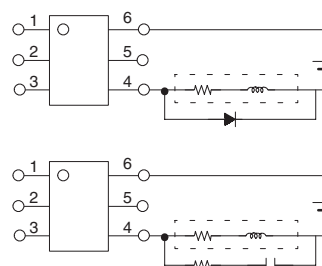
### Spike Voltage Protection Circuit Example



## ■ Protection from Spike Voltage on the Output Terminals

If a spike voltage exceeding the absolute maximum rated value is generated between the output terminals, insert a C-R snubber or clamping diode in parallel to the load as shown in the following circuit diagram to limit the spike voltage.

### Spike Voltage Protection Circuit Example

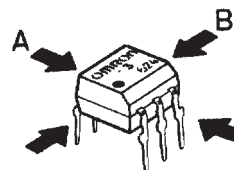


## ■ Unused Terminals

Terminal 3 is connected to the internal circuit. Do not connect anything to terminal 3 externally.

## ■ Relay Holding Force for Automatic Mounting

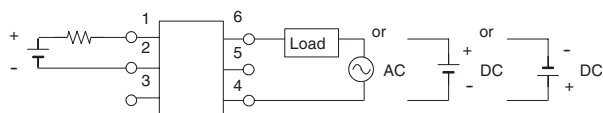
A Relay must not be imposed with a force exceeding 200 gf (1.96 N) in the A or B direction shown in the following illustration when the Relay is mounted automatically, or the characteristics of the Relay may change.



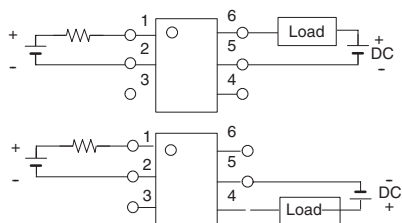
## ■ Load Connection

Do not short-circuit the input and output terminals while the Relay is operating or the Relay may malfunction.

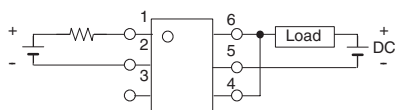
### AC Connection



### DC Single Connection



### DC Parallel Connection





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