



# Photocouplers

## LTV-0601(Preliminary Version)

### Data Sheet

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Lite-on Technology Corp.

Optoelectronics SBG

<http://www.liteon.com/opto>



## Photocouplers LTV-0601(Preliminary version)

### DESCRIPTION

The LTV-0601 consists of a high efficient AlGaAs Light Emitting Diode and a high speed optical detector. This design provides excellent AC and DC isolation between the input and output sides of the Optocoupler. The output of the optical detector features an open collector Schottky clamped transistor. The enable function allows the optical detector to be strobed. A guaranteed common mode transient immunity is up to 15,000V/ $\mu$ s.

The Optocoupler operational parameters are guaranteed over the temperature range from  $-40^{\circ}\text{C}$  ~  $+85^{\circ}\text{C}$ .

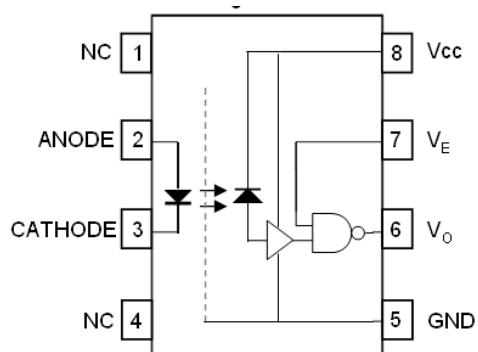
#### 1.1 Features

- SO8 package
- High speed – 10MBd typical
- Guaranteed AC and DC performance over temperature  $-40^{\circ}\text{C}$  ~  $+85^{\circ}\text{C}$ .
- LSTTL/TTL Compatible.
- Strobable output.

#### 1.2 Applications

- Isolation in line receivers
- Ground loop elimination
- Feedback Element in Switching Mode Power Supplier
- High Speed Logic Ground Isolation – TTL/TTL, TTL/CMOS, TTL/LSTTL
- Pulse transformer replacement
- Power transistor isolation in motor drives
- Interface between Microprocessor system, computer and their peripheral

#### 1.3 Functional Diagram



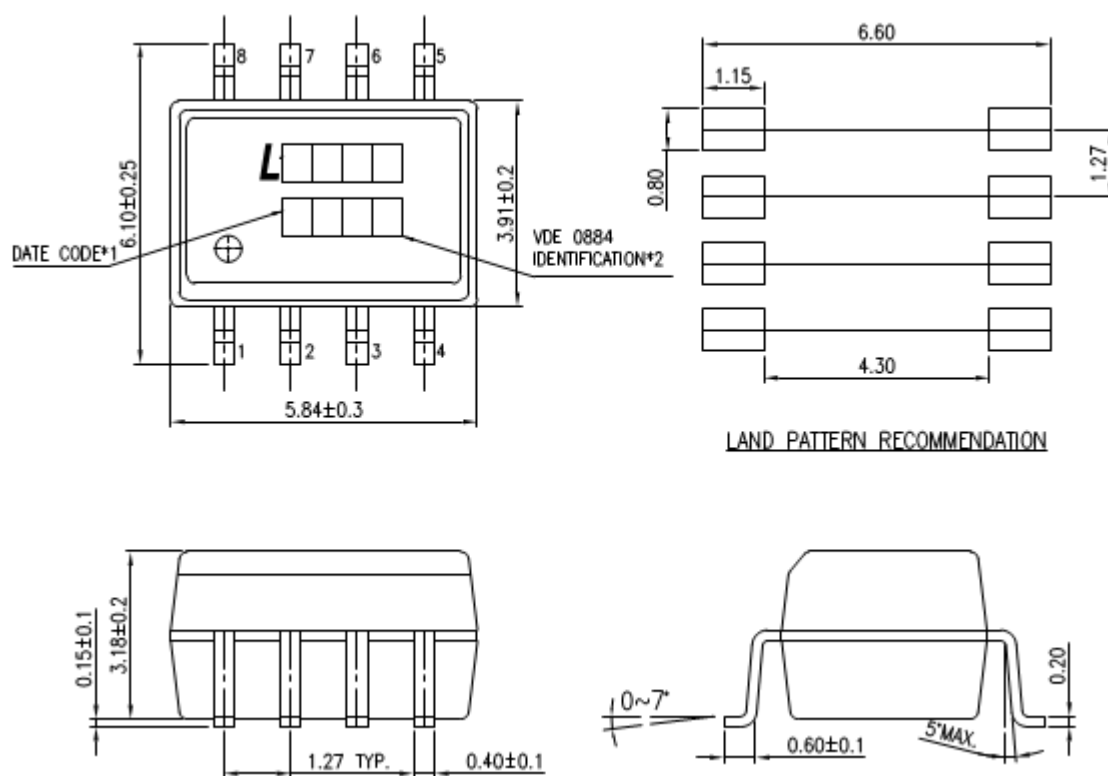
Truth Table (Positive Logic)

| LED | ENABLE | OUT |
|-----|--------|-----|
| ON  | H      | L   |
| OFF | H      | H   |
| ON  | L      | H   |
| OFF | L      | H   |
| ON  | NC     | L   |
| OFF | NC     | H   |

A 0.1 $\mu$ F bypass Capacitor must be connected between Pin8 and Pin5

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### 2. PACKAGE DIMENSIONS



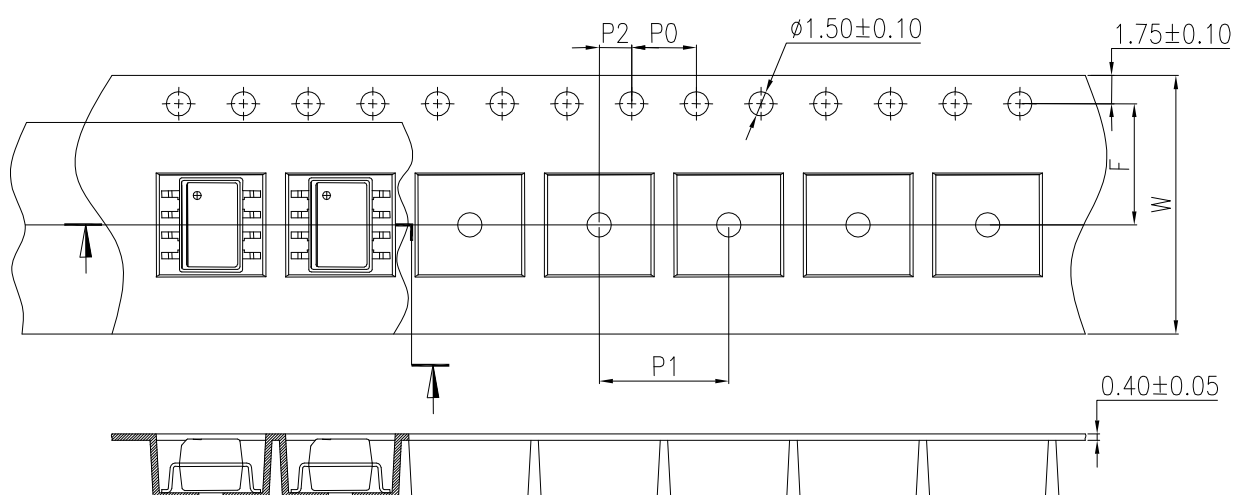
Part No : LTV-0601

#### Notes :

1. Date code
2. "V" to represent VDE0884
3. Date code
4. Dimensions are all in Millimeters.

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### 3. TAPING DIMENSIONS



| Description                            | Symbol         | Dimension in mm (inch) |
|----------------------------------------|----------------|------------------------|
| Tape wide                              | W              | 16±0.3 (0.63)          |
| Pitch of sprocket holes                | P <sub>0</sub> | 4±0.1 (0.15)           |
| Distance of compartment                | F              | 7.5±0.1 (0.295)        |
|                                        | P <sub>2</sub> | 2±0.1 (0.079)          |
| Distance of compartment to compartment | P <sub>1</sub> | 8±0.1 (0.47)           |

### Quantities Per Reel

| Package Type     | LTV-0601 |
|------------------|----------|
| Quantities (pcs) | 2000     |

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### 4. RATING AND CHARACTERISTICS

#### 4.1 Absolute Maximum Ratings at Ta=25°C \*1

|        | Parameter                          | Symbol    | Rating             | Unit             |
|--------|------------------------------------|-----------|--------------------|------------------|
| Input  | Average Forward Input Current      | $I_F$     | 20                 | mA               |
|        | Reverse Input Voltage              | $V_R$     | 5                  | V                |
|        | Power Dissipation                  | $P_I$     | 35                 | mW               |
|        | Enable Input Voltage               | $V_E$     | V <sub>CC</sub> +5 | V                |
|        | Enable Input current               | $I_E$     | 5                  | mA               |
| Output | Output Collector Current           | $I_O$     | 50                 | mA               |
|        | Output Collector Voltage           | $V_O$     | 7                  | V                |
|        | Output Collector Power Dissipation | $P_O$     | 85                 | mW               |
|        | Isolation Voltage                  | $V_{iso}$ | 3750               | V <sub>rms</sub> |
|        | Supply Voltage                     | $V_{CC}$  | 7                  | V                |
|        | Operating Temperature              | $T_{opr}$ | -55 ~ +85          | °C               |
|        | Storage Temperature                | $T_{stg}$ | -55 ~ +125         | °C               |
|        | Lead Solder Temperature *2         | $T_{sol}$ | 260                | °C               |

1. Ambient temperature = 25°C, unless otherwise specified. Stresses exceeding the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.
2. 260°C for 10 seconds. Refer to Lead Free Reflow Profile.

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### 4.2 Recommended Operating Conditions

| Parameter                               | Symbol   | Min | Max      | Unit      |
|-----------------------------------------|----------|-----|----------|-----------|
| Operating Temperature                   | $T_A$    | -40 | 85       | °C        |
| Supply Voltage                          | $V_{CC}$ | 4.5 | 5.5      | V         |
| Low Level Input Current                 | $I_{FL}$ | 0   | 250      | μA        |
| High Level Input Current                | $I_{FH}$ | 5   | 15       | mA        |
| Low Level Enable Voltage                | $V_{EL}$ | 0   | 0.8      | V         |
| High Level Enable Voltage               | $V_{EH}$ | 2   | $V_{CC}$ | V         |
| Output Pull-up Resistor                 | $R_L$    | 330 | 4k       | Ω         |
| Fan Out (at $R_L=1k\Omega$ per channel) | N        | —   | 5        | TTL Loads |

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### 4.3 ELECTRICAL OPTICAL CHARACTERISTICS at Ta=25°C

| Parameter                                     | Symbol                  | Min. | Typ.             | Max. | Unit               | Test Condition                                                                                              |
|-----------------------------------------------|-------------------------|------|------------------|------|--------------------|-------------------------------------------------------------------------------------------------------------|
| <b>Input</b>                                  |                         |      |                  |      |                    |                                                                                                             |
| Input Forward Voltage                         | $V_F$                   | —    | 1.38             | 1.8  | V                  | $I_F = 10\text{mA}$                                                                                         |
| Input Forward Voltage Temperature Coefficient | $\Delta V_F / \Delta T$ | —    | -1.6             | —    | mV/ <sup>o</sup> C | $I_F = 10\text{mA}$                                                                                         |
| Input Reverse Voltage                         | $BV_R$                  | 5.0  | —                | —    | V                  | $I_R = 10\mu\text{A}$                                                                                       |
| Input Threshold Current                       | $I_{TH}$                | —    | 1.35             | 5    | mA                 | $V_E = 2\text{V}, V_{CC} = 5.5\text{V},$                                                                    |
|                                               |                         | —    | 2 <sup>(1)</sup> | 3    | mA                 | $I_{OL} \text{ (sinking)} = 13\text{mA}$                                                                    |
| Input Capacitance                             | $C_{IN}$                | —    | 34               | —    | pF                 | $f = 1\text{MHz}, V_F = 0\text{V}$                                                                          |
| <b>Detector</b>                               |                         |      |                  |      |                    |                                                                                                             |
| High Level Supply Current                     | $I_{CCH}$               | —    | 7.4              | 10   | uA                 | $V_E = 0.5\text{V}, V_{CC} = 5.5\text{V},$<br>$I_F = 0\text{mA}$                                            |
| Low Level Supply Current                      | $I_{CCL}$               | —    | 10               | 13   | mA                 | $V_E = 0.5\text{V}, V_{CC} = 5.5\text{V},$<br>$I_F = 10\text{mA}$                                           |
| High Level Enable Current                     | $I_{EH}$                | —    | -0.6             | -1.6 | mA                 | $V_E = 2\text{V}$                                                                                           |
| Low Level Enable Current                      | $I_{EL}$                | —    | -0.9             | -1.6 | mA                 | $V_E = 0.5\text{V}$                                                                                         |
| High Level Enable Voltage                     | $V_{EH}$                | 2    | —                | —    | V                  |                                                                                                             |
| Low Level Enable Voltage                      | $V_{EL}$                | —    | —                | 0.8  | V                  |                                                                                                             |
| High Level Output Current                     | $I_{OH}$                | —    | —                | 100  | $\mu\text{A}$      | $V_E = 2\text{V}, V_{CC} = 5.5\text{V},$<br>$V_O = 5.5\text{V}, I_F = 250\mu\text{A}$                       |
| Low Level Output Voltage                      | $V_{OL}$                | —    | 0.25             | 0.60 | V                  | $V_E = 2\text{V}, V_{CC} = 5.5\text{V},$<br>$I_F = 5\text{mA},$<br>$I_{OL} \text{ (sinking)} = 13\text{mA}$ |

Specified over recommended temperature ( $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ) unless otherwise specified. Typical values applies to  $V_{CC} = 5\text{V}$ ,  $T_A = 25^\circ\text{C}$ . See note 1.

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### 5. SWITCHING SPECIFICATION

$T_A=0\sim70^{\circ}\text{C}$ ,  $V_{CC}=5\text{V}$ , unless otherwise specified.

| Parameter                                                                | Symbol                              | Min.  | Typ. | Max. | Unit             | Test Condition                                                                                                                                                         | Note |
|--------------------------------------------------------------------------|-------------------------------------|-------|------|------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Propagation Delay Time to Low Output Level                               | $t_{\text{PHL}}$                    | 25    | 40   | 100  | ns               | $R_L = 350\Omega$ , $C_L = 15\text{pF}$                                                                                                                                | 3    |
| Propagation Delay Time to High Output Level                              | $t_{\text{PLH}}$                    | 25    | 27   | 100  | ns               | $R_L = 350\Omega$ , $C_L = 15\text{pF}$                                                                                                                                | 4    |
| Pulse Width Distortion                                                   | $ t_{\text{PLH}} - t_{\text{PHL}} $ | —     | 12   | —    | ns               | $R_L = 350\Omega$ , $C_L = 15\text{pF}$                                                                                                                                | —    |
| Propagation Delay Skew                                                   | $t_{\text{PSK}}$                    | —     | —    | —    | —                | $R_L = 350\Omega$ , $C_L = 15\text{pF}$                                                                                                                                | —    |
| Output Rise Time (10 to 90%)                                             | $t_r$                               | —     | 20   | —    | ns               | $R_L = 350\Omega$ , $C_L = 15\text{pF}$                                                                                                                                | —    |
| Output Fall Time (90 to 10%)                                             | $t_f$                               | —     | 6.6  | —    | ns               | $R_L = 350\Omega$ , $C_L = 15\text{pF}$                                                                                                                                | —    |
| Propagation Delay Time of Enable from $V_{\text{EH}}$ to $V_{\text{EL}}$ | $t_{\text{ELH}}$                    | —     | 28   | —    | ns               | $R_L = 350\Omega$ , $C_L = 15\text{pF}$ ,<br>$V_{\text{EL}} = 0\text{V}$ , $V_{\text{EH}} = 3\text{V}$                                                                 | 5    |
| Propagation Delay Time of Enable from $V_{\text{EL}}$ to $V_{\text{EH}}$ | $t_{\text{EHL}}$                    | —     | 12   | —    | V/ $\mu\text{s}$ | $R_L = 350\Omega$ , $C_L = 15\text{pF}$ ,<br>$V_{\text{EL}} = 0\text{V}$ , $V_{\text{EH}} = 3\text{V}$                                                                 | 6    |
| Logic High Common Mode Transient Immunity                                | $ CM_H $                            | 1,000 | —    | —    | V/ $\mu\text{s}$ | $ V_{\text{CM}}  = 20\text{V}$ , $V_{\text{CC}}=5\text{V}$ ,<br>$I_F = 0\text{mA}$ , $V_{\text{O(MIN)}}=2\text{V}$ ,<br>$R_L = 350\Omega$ , $T_A = 25^{\circ}\text{C}$ | 7,9  |
| Logic Low Common Mode Transient Immunity                                 | $ CM_L $                            | 1,000 | —    | —    | ns               | $ V_{\text{CM}}  = 20\text{V}$ , $V_{\text{CC}}=5\text{V}$ ,<br>$I_F=7.5\text{mA}$ , $V_{\text{O(MIN)}}=0\text{V}$ ,<br>$R_L = 350\Omega$ , $T_A = 25^{\circ}\text{C}$ | 8,9  |

\*All Typical at  $T_A=25^{\circ}\text{C}$

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### 6. ISOLATION CHARACTERISTIC

| Parameter                               | Symbol    | Min. | Typ.      | Max. | Unit      | Test Condition                                               | Note     |
|-----------------------------------------|-----------|------|-----------|------|-----------|--------------------------------------------------------------|----------|
| Input-Output Insulation Leakage Current | $I_{I-O}$ | —    | —         | 1.0  | $\mu A$   | 45% RH, $t = 5s$ ,<br>$V_{I-O} = 3kV$ DC, $T_A = 25^\circ C$ | 10,11    |
| Withstand Insulation Test Voltage       | $V_{ISO}$ | 3750 | —         | —    | $V_{RMS}$ | RH $\leq 50\%$ , $t = 1min$ ,<br>$T_A = 25^\circ C$          | 10,11,12 |
| Input-Output Resistance                 | $R_{I-O}$ | —    | $10^{12}$ | —    | $\Omega$  | $V_{I-O} = 500V$ DC                                          | 10       |
| Input-Output Capacitance                | $C_{I-O}$ | —    | 1.0       | —    | p         | $f = 1MHz$ , $T_A = 25^\circ C$                              | 10       |

Specified over recommended temperature ( $T_A = -40^\circ C$  to  $+85^\circ C$ ) unless otherwise specified. Typical values applies to  $T_A = 25^\circ C$

#### Notes

1. A 0.1 $\mu F$  or bigger bypass capacitor for  $V_{CC}$  is needed as shown in Fig.1
2. Peaking driving circuit may be used to speed up the LED. The peak drive current of LED may go up to 50mA and maximum pulse width 50ns, as long as average current doesn't exceed 20mA.
3.  $t_{PLH}$  (propagation delay) is measured from the 3.75 mA point on the falling edge of the input pulse to the 1.5 V point on the rising edge of the output pulse.
4.  $t_{PHL}$  (propagation delay) is measured from the 3.75 mA point on the rising edge of the input pulse to the 1.5 V point on the falling edge of the output pulse.
5. The  $t_{ELH}$  enable propagation delay is measured from the 1.5 V point on the falling edge of the enable input pulse to the 1.5 V point on the rising edge of the output pulse.
6. The  $t_{EHL}$  enable propagation delay is measured from the 1.5 V point on the rising edge of the enable input pulse to the 1.5 V point on the falling edge of the output pulse.
7.  $CM_H$  is the maximum tolerable rate of rise of the common mode voltage to assure that the output will remain in a high logic state (i.e.,  $V_O > 2.0 V$ ).
8.  $CM_L$  is the maximum tolerable rate of fall of the common mode voltage to assure that the output will remain in a low logic state (i.e.,  $V_O < 0.8 V$ ).
9. No external pull up is required for a high logic state on the enable input. If the enable pin is not used, tying it to  $V_{CC}$ .
10. Device is considered a two-terminal device: pins 1, 2, 3, and 4 shorted together, and pins 5, 6, 7, and 8 shorted together.
11. In accordance with UL1577, each optocoupler is proof tested by applying an insulation test voltage 3000 V rms for one second (leakage current less than 5  $\mu A$ ). This test is performed before the 100% production test for partial discharge

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## 7. SWITCHING TIME TEST CIRCUIT

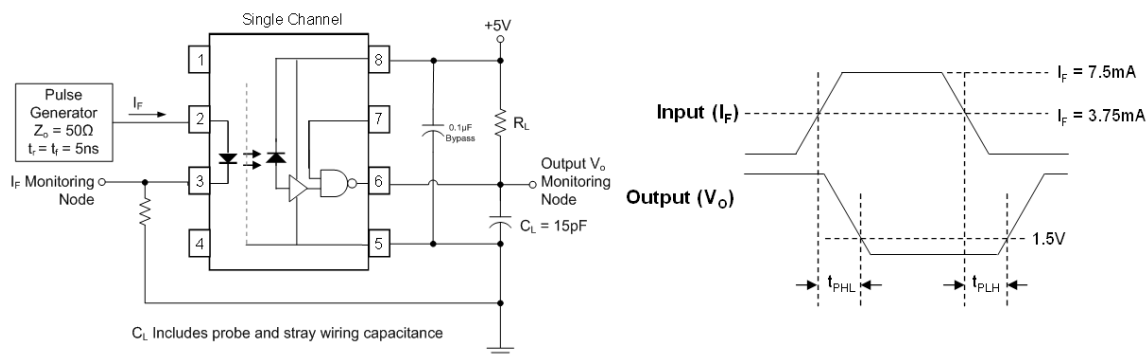


Figure 1: Single Channel Test Circuit for  $t_{PHL}$  and  $t_{PLH}$

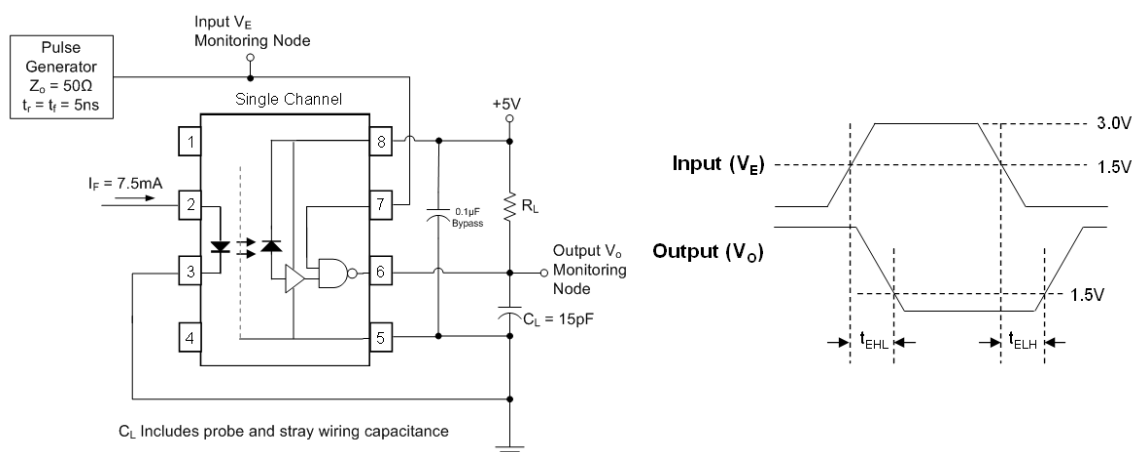


Figure 2: Single Channel Test Circuit for Common Mode Transient Immunity

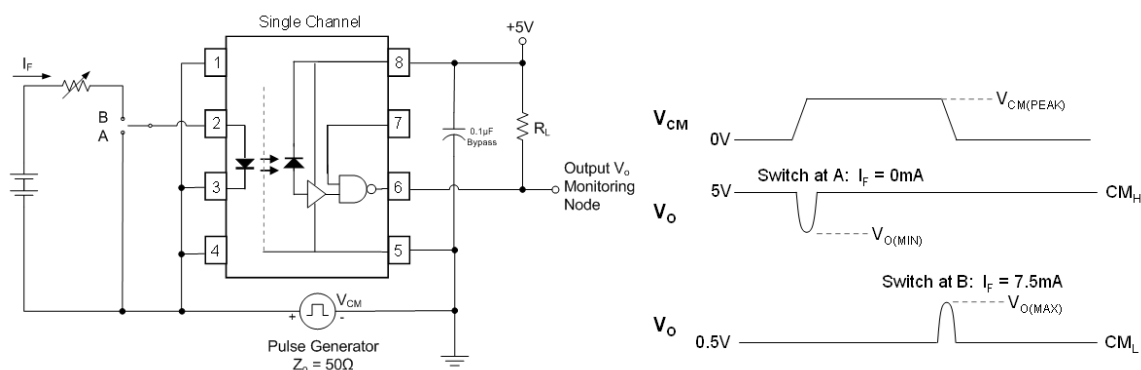


Figure 3: Single Channel Test Circuit for Common Mode Transient Immunity

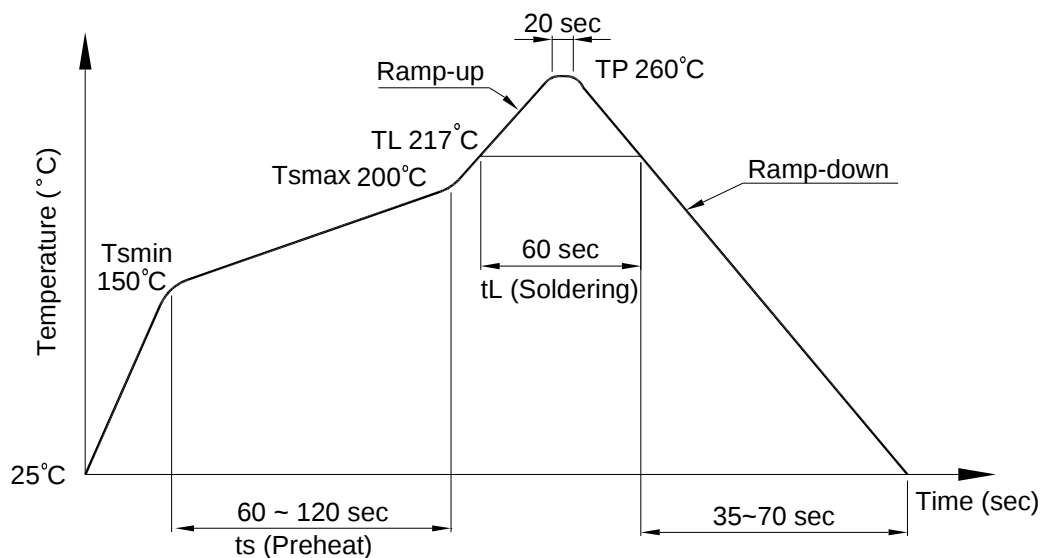
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### 8. TEMPERATURE PROFILE OF SOLDERING

#### 8.1 IR Reflow soldering (JEDEC-STD-020C compliant)

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

| Profile item                     | Conditions     |
|----------------------------------|----------------|
| Preheat                          |                |
| - Temperature Min ( $T_{Smin}$ ) | 150°C          |
| - Temperature Max ( $T_{Smax}$ ) | 200°C          |
| - Time (min to max) ( $t_s$ )    | 90±30 sec      |
| Soldering zone                   |                |
| - Temperature ( $T_L$ )          | 217°C          |
| - Time ( $t_L$ )                 | 60 sec         |
| Peak Temperature ( $T_P$ )       | 260°C          |
| Ramp-up rate                     | 3°C / sec max. |
| Ramp-down rate                   | 3~6°C / sec    |



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### 8.2 Wave soldering (JEDEC22A111 compliant)

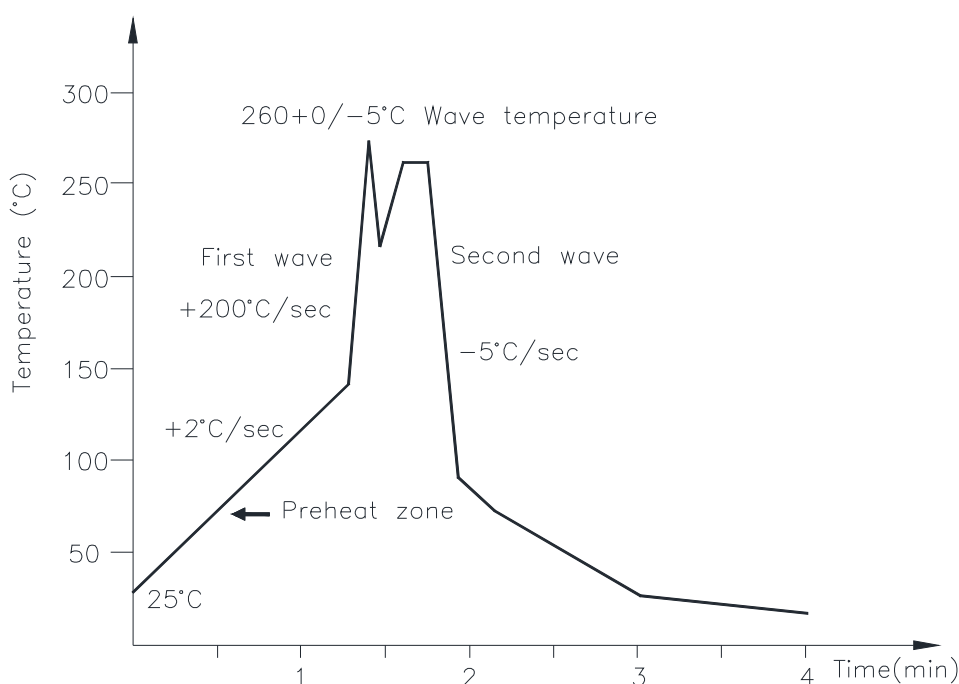
One time soldering is recommended within the condition of temperature.

Temperature:  $260 \pm 0/-5^{\circ}\text{C}$

Time: 10 sec.

Preheat temperature: 25 to  $140^{\circ}\text{C}$

Preheat time: 30 to 80 sec.



### 8.3 Hand soldering by soldering iron

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature:  $380 \pm 0/-5^{\circ}\text{C}$

Time: 3 sec max.

## 9. Notes:

Specifications of the products displayed herein are subject to change without notice.

The products shown in this publication are designed for the general use in electronic applications such as office automation equipment, communications devices, audio/visual equipment, electrical instrumentation and application. For equipment/devices where high reliability or safety is required, such as space applications, nuclear power control equipment, medical equipment, etc, please contact our sales representatives.