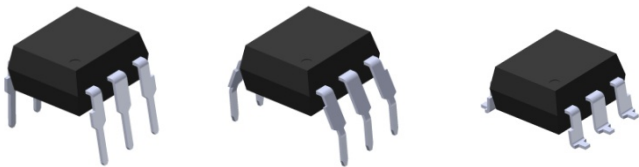


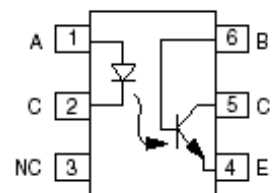
### 6 PIN DIP PHOTOTRANSISTOR PHOTOCOUPLER TIL11X Series MCT2X Series



#### Features:

- TIL11X series: TIL111, TIL117
- MCT2X series: MCT2, MCT2E
- High isolation voltage between input and output  
Viso = 5000 Vrms
- Creepage distance >7.6mm
- Compact dual-in-line package
- Operating temperature up to +110°C
- Pb free and RoHS compliant.
- UL approved (No. E214129)
- VDE approved (No. 132249)
- SEMKO approval
- NEMKO approved
- DEMKO approved
- FIMKO approved
- CSA approved
- CQC approved

#### Schematic



#### Pin Configuration

1. Anode
2. Cathode
3. No Connection
4. Emitter
5. Collector
6. Base

#### Description

The TIL11X series and MCT2X series of devices each consist of an infrared emitting diode optically coupled to a phototransistor detector. They are packaged in a 6-pin DIP package and available in wide-lead spacing and SMD option.

#### Applications

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs
- Appliance system
- Industrial controls

### Absolute Maximum Ratings (Ta=25°C)

|        | Parameter                       | Symbol    | Rating     | Unit  |
|--------|---------------------------------|-----------|------------|-------|
| Input  | Forward current                 | $I_F$     | 60         | mA    |
|        | Peak forward current (t = 10μs) | $I_{FM}$  | 1          | A     |
|        | Reverse voltage                 | $V_R$     | 6          | V     |
|        | Power dissipation               | $P_D$     | 100        | mW    |
|        | Derating factor (above 100°C)   |           | 3.8        | mW/°C |
| Output | Collector-Emitter voltage       | $V_{CEO}$ | 80         | V     |
|        | Collector-Base voltage          | $V_{CBO}$ | 80         | V     |
|        | Emitter-Collector voltage       | $V_{ECO}$ | 7          | V     |
|        | Power dissipation               | $P_C$     | 150        | mW    |
|        | Derating factor (above 100°C)   |           | 9.0        | mW/°C |
|        | Total Power Dissipation         | $P_{TOT}$ | 200        | mW    |
|        | Isolation Voltage*1             | $V_{ISO}$ | 5000       | V rms |
|        | Operating Temperature           | $T_{OPR}$ | -55 to 110 | °C    |
|        | Storage Temperature             | $T_{STG}$ | -55 to 125 | °C    |
|        | Soldering Temperature*2         | $T_{SOL}$ | 260        | °C    |

**Notes:**

\*1 AC for 1 minute, R.H.= 40 ~ 60% R.H. In this test, pins 1, 2 & 3 are shorted together, and pins 4, 5 & 6 are shorted together.

\*2 For 10 seconds

## Electro-Optical Characteristics (Ta=25°C unless specified otherwise)

### Input

| Parameter       | Symbol         | Min. | Typ. | Max. | Unit | Condition                                     |
|-----------------|----------------|------|------|------|------|-----------------------------------------------|
| Forward voltage | TIL111         | -    | 1.22 | 1.4  | V    | I <sub>F</sub> = 16mA                         |
|                 |                | -    | -    | 1.4  |      | T <sub>A</sub> =0-70°C, I <sub>F</sub> = 16mA |
|                 | TIL117         | -    | 1.32 | -    |      | T <sub>A</sub> = -55°C, I <sub>F</sub> = 16mA |
|                 |                | -    | 1.1  | -    |      | T <sub>A</sub> =110°C, I <sub>F</sub> = 16mA  |
|                 | MCT2<br>MCT2E  | -    | 1.23 | 1.5  |      | I <sub>F</sub> = 20mA                         |
| Reverse current | I <sub>R</sub> | -    | -    | 10   | μA   | V <sub>R</sub> = 6V                           |

### Output

| Parameter                           | Symbol            | Min | Typ. | Max. | Unit | Condition                                                         |
|-------------------------------------|-------------------|-----|------|------|------|-------------------------------------------------------------------|
| Collector-Base dark current         | I <sub>CBO</sub>  | -   | -    | 20   | nA   | V <sub>CB</sub> = 10V                                             |
| Collector-Emitter dark current      | All               | -   | 1    | 50   | nA   | V <sub>CE</sub> = 10V, I <sub>F</sub> =0mA                        |
|                                     | TIL117            | -   | 0.2  | 50   |      | V <sub>CE</sub> = 30V, I <sub>F</sub> = 0mA, T <sub>A</sub> =70°C |
| Collector-Emitter breakdown voltage | BV <sub>CEO</sub> | 80  | -    | -    | V    | I <sub>C</sub> =1mA                                               |
| Collector-Base breakdown voltage    | BV <sub>CBO</sub> | 80  | -    | -    | V    | I <sub>C</sub> =0.01mA                                            |
| Emitter-Collector breakdown voltage | BV <sub>ECO</sub> | 7   | -    | -    | V    | I <sub>E</sub> =0.1mA                                             |
| Emitter-Base breakdown voltage      | BV <sub>EBO</sub> | 7   | -    | -    | V    | I <sub>E</sub> =0.1mA                                             |

\* Typical values at T<sub>a</sub> = 25°C

### Transfer Characteristics

| Parameter                                     | Symbol        | Min                | Typ. | Max. | Unit | Condition                                     |
|-----------------------------------------------|---------------|--------------------|------|------|------|-----------------------------------------------|
| Collector current (Phototransistor operation) | TIL111        | I <sub>C(ON)</sub> | 2    | -    | mA   | I <sub>F</sub> = 16mA, V <sub>CE</sub> = 0.4V |
| Collector current (Photodiode operation)      |               |                    |      |      | μA   | I <sub>F</sub> = 16mA, V <sub>CB</sub> = 0.4V |
| Current Transfer Ratio                        | TIL117        | 50                 | -    | -    | %    | I <sub>F</sub> = 10mA, V <sub>CE</sub> = 10V  |
|                                               | MCT2<br>MCT2E | 20                 | -    | -    |      | I <sub>F</sub> = 10mA, V <sub>CE</sub> = 10V  |

## Transfer Characteristics

| Parameter                            |                  | Symbol        | Min       | Typ. | Max. | Unit     | Condition                                        |
|--------------------------------------|------------------|---------------|-----------|------|------|----------|--------------------------------------------------|
| Collector-Emitter saturation voltage | All              | $V_{CE(sat)}$ | -         | -    | 0.4  | V        | $I_F = 16mA, I_C = 2mA$                          |
|                                      | TIL117           |               | -         | -    | 0.4  |          | $I_F = 10mA, I_C = 0.5mA$                        |
| Isolation resistance                 |                  | $R_{IO}$      | $10^{11}$ | -    | -    | $\Omega$ | $V_{IO} = 500Vdc$                                |
| Input-output capacitance             |                  | $C_{IO}$      | -         | -    | 2    | pF       | $V_{IO} = 0, f = 1MHz$                           |
| Turn-on time                         | TIL117           | $T_{on}$      | -         | 10   | 12   | $\mu s$  | $V_{CC} = 10V,$<br>$I_C = 2mA, R_L = 100\Omega$  |
| Turn-off time                        | TIL117           | $T_{off}$     | -         | 9    | 12   |          |                                                  |
| Rise time                            | TIL117<br>TIL111 | $t_r$         | -         | 6    | 10   |          |                                                  |
| Fall time                            | TIL117<br>TIL111 | $t_f$         | -         | 8    | 10   |          |                                                  |
| Turn-on time                         | MCT2<br>MCT2E    | $T_{on}$      | -         | 3    | 10   | $\mu s$  | $V_{CC} = 10V,$<br>$I_F = 10mA, R_L = 100\Omega$ |
| Turn-off time                        | MCT2<br>MCT2E    | $T_{off}$     | -         | 3    | 10   |          |                                                  |
| Rise time                            | MCT2<br>MCT2E    | $t_r$         | -         | 3    | 10   |          |                                                  |
| Fall time                            | MCT2<br>MCT2E    | $t_f$         | -         | 3    | 10   |          |                                                  |

\* Typical values at  $T_a = 25^\circ C$

## Typical Electro-Optical Characteristics Curves

Figure 1. Forward Current vs Forward Voltage

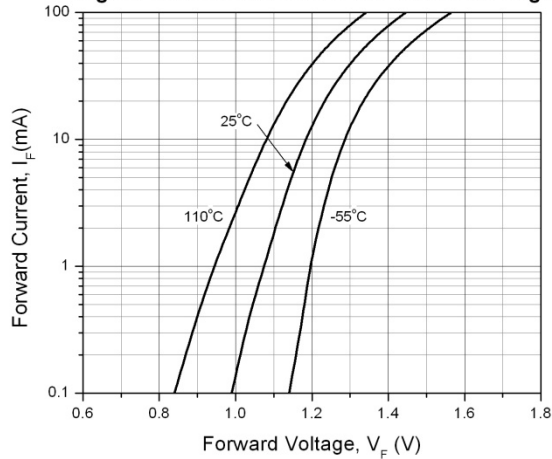


Figure 2. Current Transfer Ratio vs Forward Current

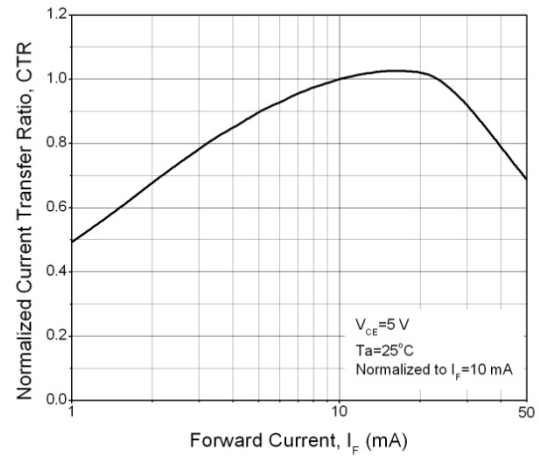


Figure 3. Current Transfer Ratio vs Ambient Temperature

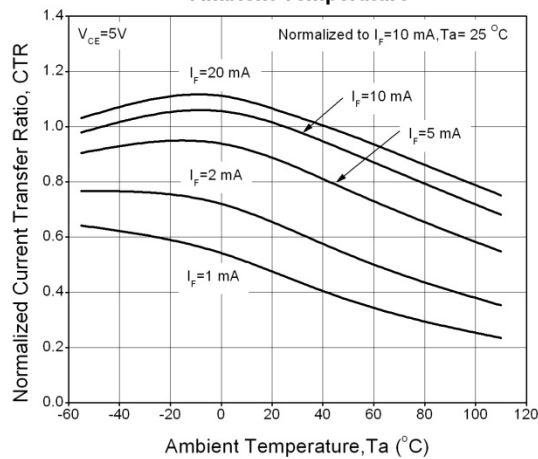


Figure 4. Current Transfer Ratio (Saturated) vs Base-Emitter Resistance

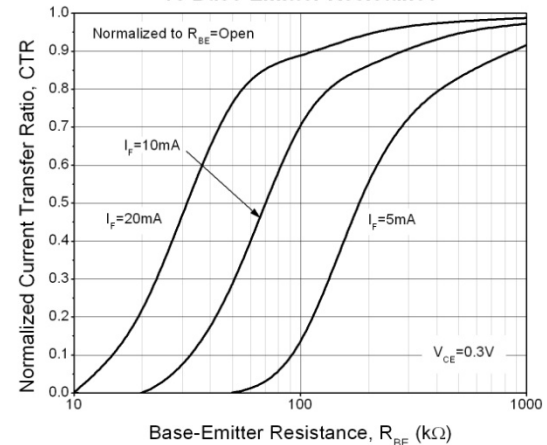


Figure 5. Current Transfer Ratio (Unsaturated) vs Base-Emitter Resistance

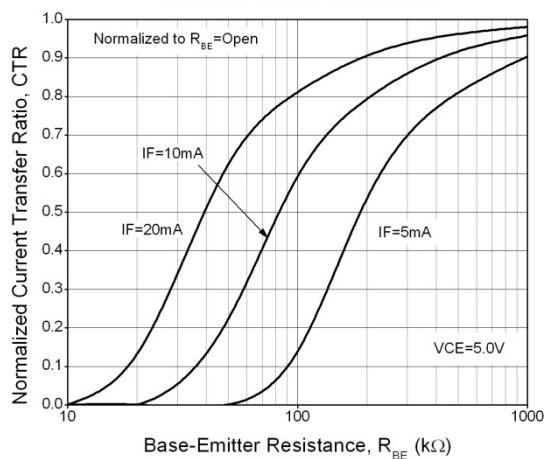


Figure 6. Dark Current vs Ambient Temperature

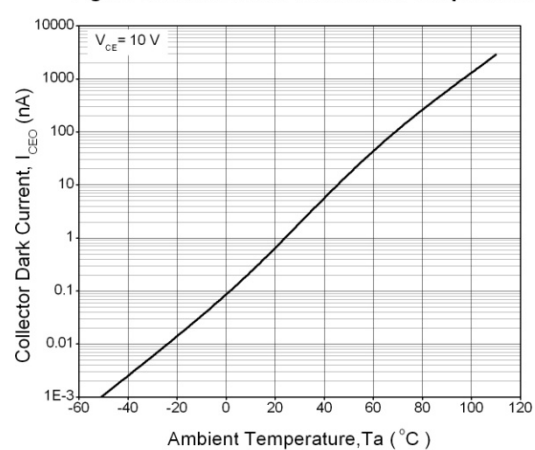


Figure 7. Collector-Emitter Saturation Voltage vs Collector Current

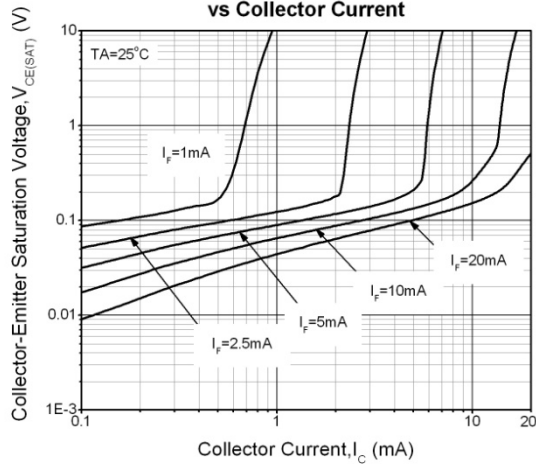


Figure 8. Switching Time vs Load Resistance

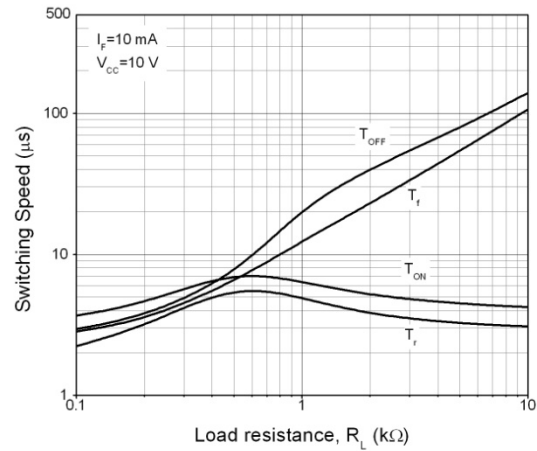


Figure 9. Turn-on Time vs Base-Emitter Resistance

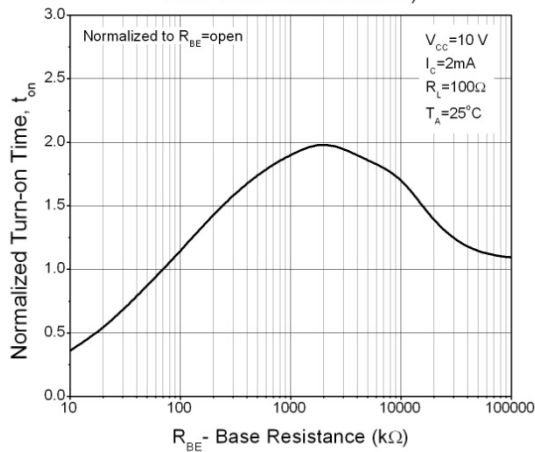


Figure 10. Turn-off Time vs Base-Emitter Resistance

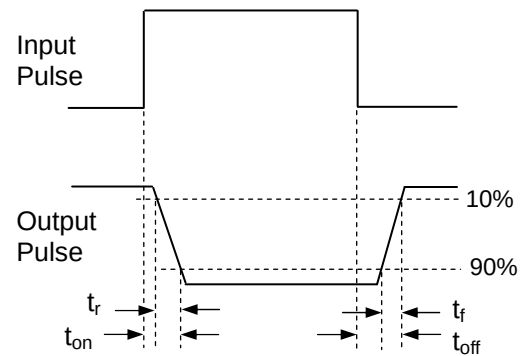
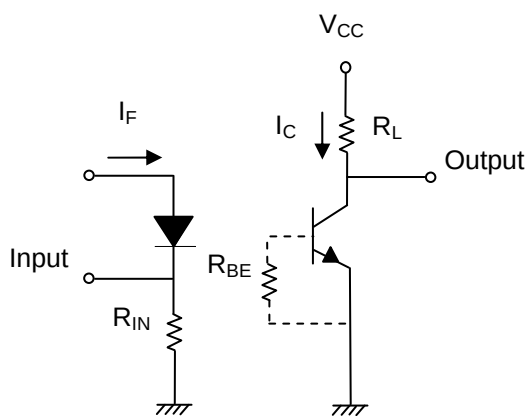
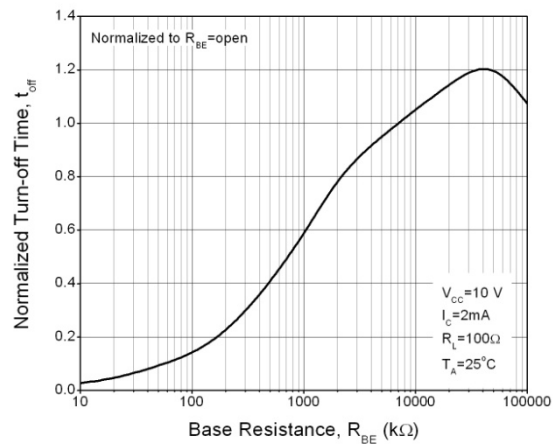


Figure 11. Switching Time Test Circuit & Waveforms

## Order Information

### Part Number

**TIL11XY(Z)-V**

or

**MCT2XY(Z)-V**

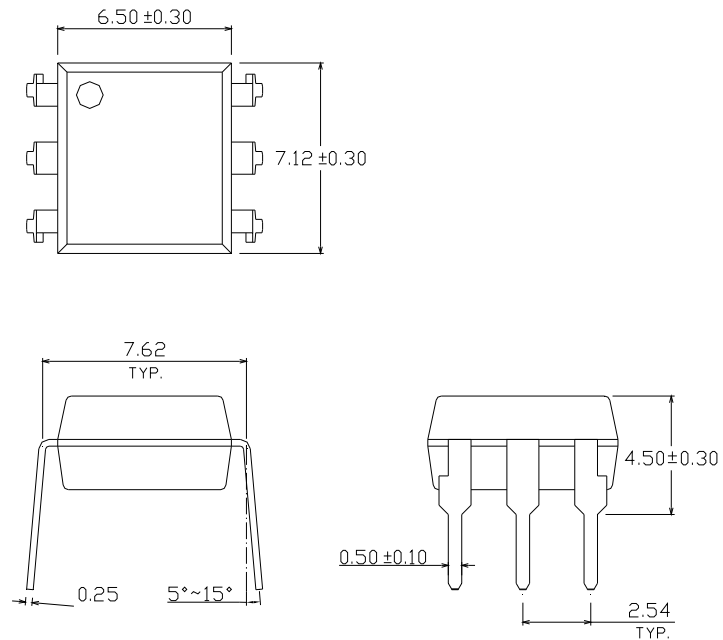
### Note

- X = Part no. for MCT2X series (E or none)  
= Part no. for TIL11X series (1 or 7)  
Y = Lead form option (S, S1, M or none)  
Z = Tape and reel option (TA, TB or none).  
V = VDE safety (optional)

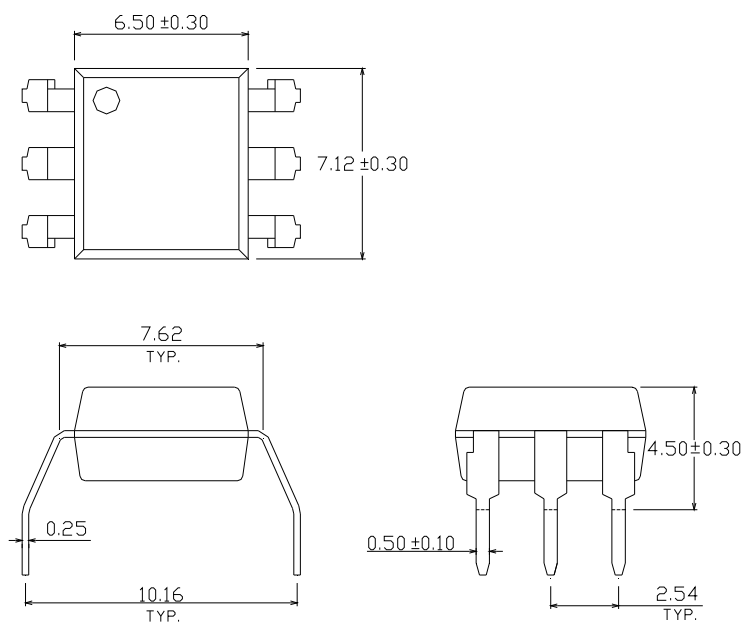
| Option  | Description                                                   | Packing quantity    |
|---------|---------------------------------------------------------------|---------------------|
| None    | Standard DIP-6                                                | 65 units per tube   |
| M       | Wide lead bend (0.4 inch spacing)                             | 65 units per tube   |
| S (TA)  | Surface mount lead form + TA tape & reel option               | 1000 units per reel |
| S (TB)  | Surface mount lead form + TB tape & reel option               | 1000 units per reel |
| S1 (TA) | Surface mount lead form (low profile) + TA tape & reel option | 1000 units per reel |
| S1 (TB) | Surface mount lead form (low profile) + TB tape & reel option | 1000 units per reel |

## Package Dimension (Dimensions in mm)

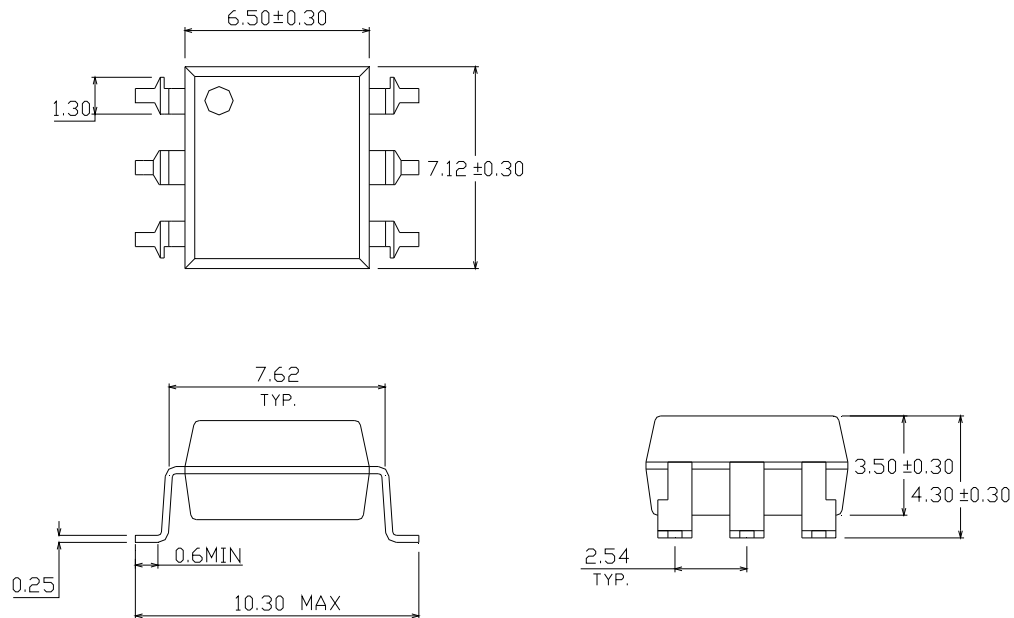
### Standard DIP Type



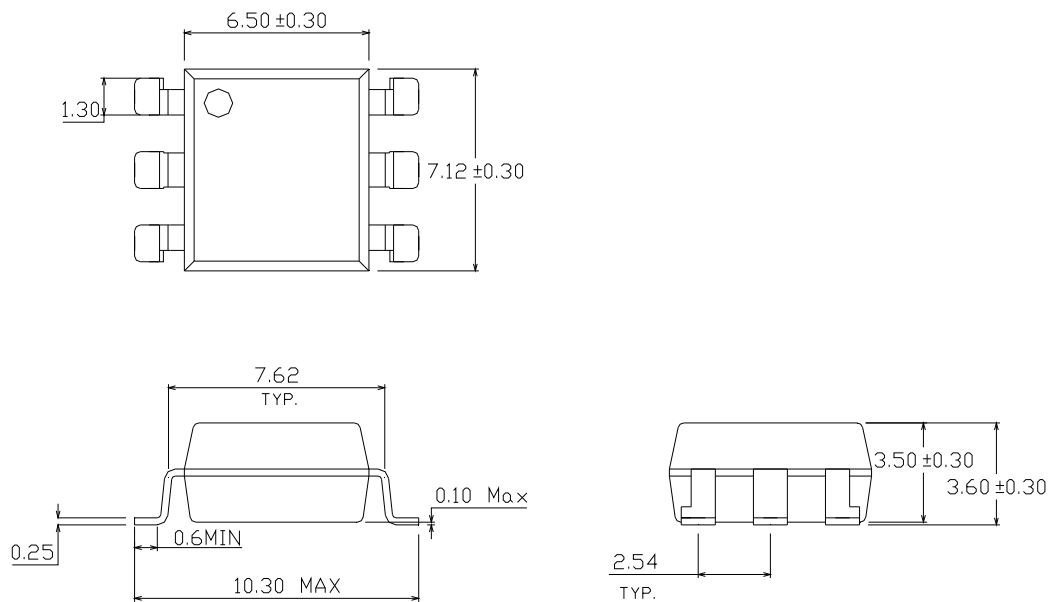
### Option M Type



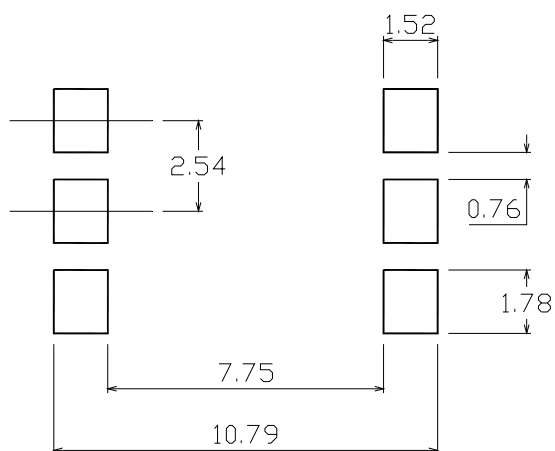
### Option S Type



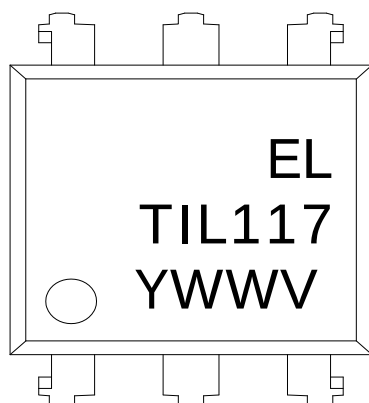
### Option S1 Type



## Recommended pad layout for surface mount leadform



## Device Marking

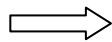
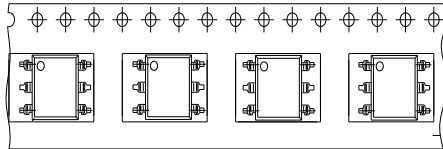


## Notes

|        |                           |
|--------|---------------------------|
| EL     | denotes Everlight         |
| TIL117 | denotes Device Number     |
| Y      | denotes 1 digit Year code |
| WW     | denotes 2 digit Week code |
| V      | denotes VDE optional      |

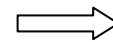
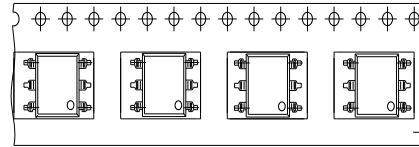
## Tape & Reel Packing Specifications

**Option TA**



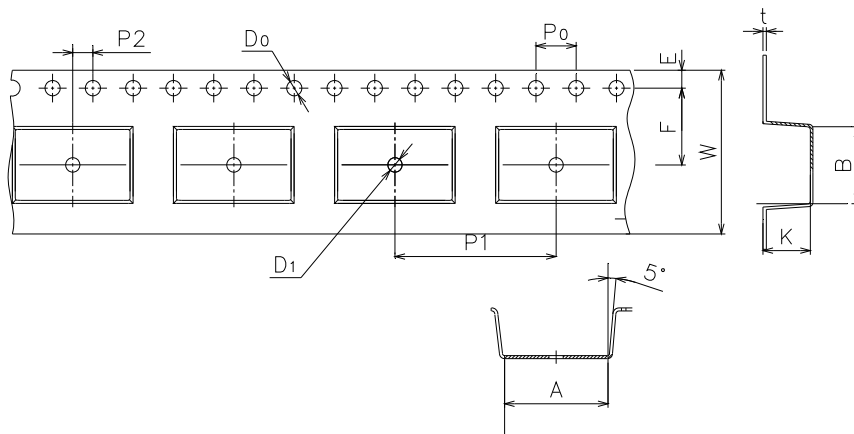
Direction of feed from reel

**Option TB**



Direction of feed from reel

## Tape dimensions

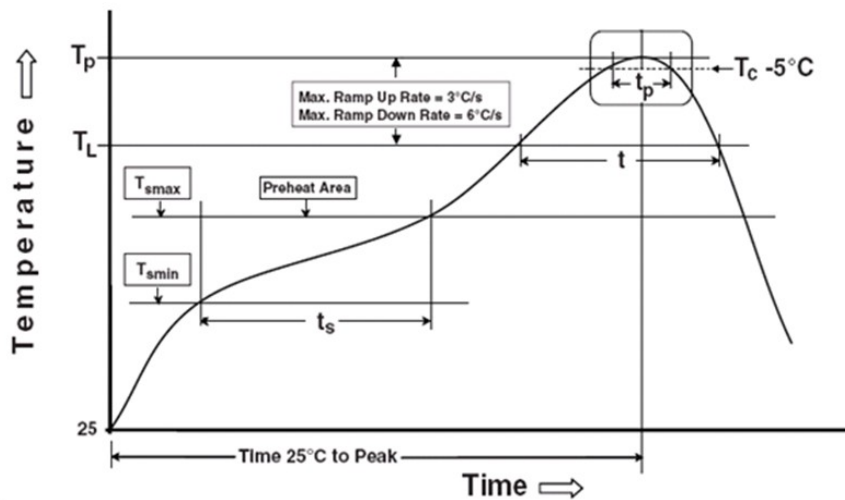


| Dimension No.  | A        | B       | Do      | D1         | E        | F       |
|----------------|----------|---------|---------|------------|----------|---------|
| Dimension (mm) | 10.4±0.1 | 7.5±0.1 | 1.5±0.1 | 1.5+0.1/-0 | 1.75±0.1 | 7.5±0.1 |
| Dimension No.  | Po       | P1      | P2      | t          | W        | K       |
| Dimension (mm) | 4.0±0.15 | 12±0.1  | 2.0±0.1 | 0.35±0.03  | 16.0±0.2 | 4.5±0.1 |

## Precautions for Use

### 1. Soldering Condition

#### 1.1 (A) Maximum Body Case Temperature Profile for evaluation of Reflow Profile



Note:

Reference: IPC/JEDEC J-STD-020D

#### Preheat

|                                              |                 |
|----------------------------------------------|-----------------|
| Temperature min ( $T_{smin}$ )               | 150 °C          |
| Temperature max ( $T_{smax}$ )               | 200°C           |
| Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )  | 60-120 seconds  |
| Average ramp-up rate ( $T_{smax}$ to $T_P$ ) | 3 °C/second max |

#### Other

|                                                                      |                  |
|----------------------------------------------------------------------|------------------|
| Liquidus Temperature ( $T_L$ )                                       | 217 °C           |
| Time above Liquidus Temperature ( $t_L$ )                            | 60-100 sec       |
| Peak Temperature ( $T_P$ )                                           | 260°C            |
| Time within 5 °C of Actual Peak Temperature: $T_P - 5^\circ\text{C}$ | 30 s             |
| Ramp- Down Rate from Peak Temperature                                | 6°C /second max. |
| Time 25°C to peak temperature                                        | 8 minutes max.   |
| Reflow times                                                         | 3 times          |

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