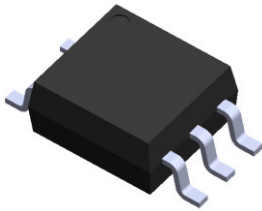


## 5 PIN SOP 3.3V 1Mbit/s HIGH SPEED TRANSISTOR PHOTOCOUPLER ELM453L

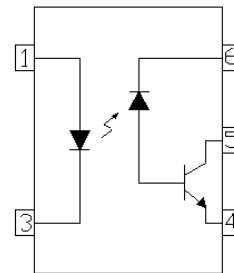


### Features

- Compliance Halogen Free .  
(Br <900 ppm ,Cl <900 ppm , Br+Cl < 1500 ppm)
- Low supply voltage
- High speed 1Mbit/s
- High isolation voltage between input and output (Viso=3750 Vrms )
- High CMR 15KV/us at V<sub>CM</sub>=1500V
- Guaranteed performance from 0°C to 70 °C
- Wide operating temperature range of -40°C to 85 °C
- Compliance with EU REACH
- Pb free and RoHS compliant
- UL and cUL approved(No. E214129)
- VDE approved (No. 40028116)
- SEMKO approved
- NEMKO approved
- DEMKO approved
- FIMKO approved

### Schematic

#### ELM453L



### Pin Configuration

1. Anode
3. Cathode
4. Gnd
5. Vout
6. VCC

### Description

The ELM453L consists of an infrared emitting diode, optically coupled to a high speed photo detector transistor. A separate connection for the photodiode bias and output-transistor collector increase the speed by several orders of magnitude over conventional phototransistor couplers by reducing the base-collector capacitance of the input transistor. The device is packaged in industry standard 5pin SOP package and is suitable for surface mounting technology.

### Applications

- Line receivers
- Field bus communication and control.
- Power transistor isolation in motor drives
- Replacement for low speed phototransistor photo couplers
- High speed logic ground isolation
- Analog signal ground isolation

**Absolute Maximum Ratings ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

|        | Parameter  | Symbol       | Rating     | Unit               |
|--------|--|--------------|------------|--------------------|
| Input  | Forward Current  | $I_F$        | 25         | mA                 |
|        | Peak Forward Current<br>(50% duty, 1ms P.W)                  | $I_{FP}$     | 50         | mA                 |
|        | Peak Transient Current<br>( $\leq 1\mu\text{s}$ P.W, 300pps) | $I_{Ftrans}$ | 1          | A                  |
|        | Reverse Voltage  | $V_R$        | 5          | V                  |
|        | Power Dissipation  | $P_{IN}$     | 45         | mW                 |
| Output | Power Dissipation  | $P_O$        | 100        | mW                 |
|        | Average Output Current                                       | $I_{O(AVG)}$ | 8          | mA                 |
|        | Peak Output Current  | $I_{O(PK)}$  | 16         | mA                 |
|        | Output Voltage   | $V_O$        | -0.5 to 20 | V                  |
|        | Supply Voltage   | $V_{CC}$     | -0.5 to 30 | V                  |
|        | Isolation Voltage <sup>*1</sup>                              | $V_{ISO}$    | 3750       | V rms              |
|        | Operating Temperature  | $T_{OPR}$    | -40 ~ +85  | $^{\circ}\text{C}$ |
|        | Storage Temperature  | $T_{STG}$    | -55 ~ +125 | $^{\circ}\text{C}$ |
|        | Soldering Temperature <sup>*2</sup>                          | $T_{SOL}$    | 260        | $^{\circ}\text{C}$ |

Notes:

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

\*2 For 10 seconds.

**Electrical Characteristics (T<sub>A</sub>=0 to 70°C unless specified otherwise)**

**Input**

| Parameter                                  | Symbol                         | Min. | Typ. | Max. | Unit  | Condition             |
|--|--------------------------------|------|------|------|-------|-----------------------|
| Forward Voltage                            | V <sub>F</sub>                 | -    | 1.45 | 1.8  | V     | I <sub>F</sub> = 16mA |
| Reverse Voltage                            | V <sub>R</sub>                 | 5.0  | -    | -    | V     | I <sub>R</sub> = 10μA |
| Temperature Coefficient of Forward Voltage | V <sub>F</sub> /T <sub>A</sub> | -    | -1.6 | -    | mV/°C | I <sub>F</sub> = 16mA |

**Output**

| Parameter                 | Symbol           | Min | Typ.  | Max. | Unit | Condition  |
|---------------------------|------------------|-----|-------|------|------|--|
| Logic High Output Current | I <sub>OH</sub>  | -   | 0.001 | 0.5  | μA   | I <sub>F</sub> =0mA,<br>V <sub>O</sub> =V <sub>CC</sub> =3.3V,<br>T <sub>A</sub> =25°C   |
|                           |                  | -   | 0.01  | 1    |      | I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =15V,<br>T <sub>A</sub> =25°C       |
|                           |                  | -   | -     | 50   |      | I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =15V                                |
| Logic Low Supply Current  | I <sub>CCL</sub> | -   | 100   | 200  | μA   | I <sub>F</sub> =16mA, V <sub>O</sub> =Open,<br>V <sub>CC</sub> =15V                      |
| Logic High Supply Current | I <sub>CCH</sub> | -   | 0.05  | 1    | μA   | I <sub>F</sub> =0mA, V <sub>O</sub> =Open,<br>V <sub>CC</sub> =15V, T <sub>A</sub> =25°C |
|                           |                  | -   | -     | 2    |      | I <sub>F</sub> =0mA, V <sub>O</sub> =Open,<br>V <sub>CC</sub> =15V                       |

**Transfer Characteristics**

| Parameter                | Symbol          | Min | Typ. | Max. | Unit | Condition  |
|--------------------------|-----------------|-----|------|------|------|--|
| Current Transfer Ratio   | CTR             | 20  | -    | 50   | %    | I <sub>F</sub> = 16mA, V <sub>O</sub> = 0.4V,<br>V <sub>CC</sub> =3.3V, T <sub>A</sub> =25°C |
|                          |                 | 15  | -    | -    |      | I <sub>F</sub> = 16mA, V <sub>O</sub> = 0.5V,<br>V <sub>CC</sub> =3.3V                       |
| Logic Low Output Voltage | V <sub>OL</sub> | -   | -    | 0.4  | V    | I <sub>F</sub> = 16mA, I <sub>O</sub> = 3mA,<br>V <sub>CC</sub> =3.3V, T <sub>A</sub> =25°C  |
|                          |                 | -   | -    | 0.5  |      | I <sub>F</sub> = 16mA, I <sub>O</sub> = 1.1mA,<br>V <sub>CC</sub> =3.3V                      |

**Switching Characteristics ( $T_A=0$  to  $70^\circ\text{C}$  unless specified otherwise,  $V_{CC}=3.3\text{V}$ )**

| Parameter  | Symbol    | Min    | Typ. | Max. | Unit                   | Condition  |
|--|-----------|--------|------|------|------------------------|--|
| Propagation Delay Time to Logic Low <sup>(*)3</sup> (Fig.8)          | $T_{PHL}$ | -      | 0.3  | 0.8  | $\mu\text{s}$          | $I_F=16\text{mA}$ , $R_L=1.9\text{K}\Omega$ ,<br>$T_A=25^\circ\text{C}$                                  |
|  |           | -      | -    | 1.0  |                        | $I_F=16\text{mA}$ , $R_L=1.9\text{K}\Omega$  |
| Propagation Delay Time to Logic High <sup>(*)3</sup> (Fig.8)         | $T_{PLH}$ | -      | 0.65 | 0.8  | $\mu\text{s}$          | $I_F=16\text{mA}$ , $R_L=1.9\text{K}\Omega$ ,<br>$T_A=25^\circ\text{C}$                                  |
|  |           | -      | -    | 1.0  |                        | $I_F=16\text{mA}$ , $R_L=1.9\text{K}\Omega$  |
| Common Mode Transient Immunity at Logic High <sup>(*)4</sup> (Fig.9) | $CM_H$    | 15,000 | -    | -    | $\text{V}/\mu\text{s}$ | $I_F = 0\text{mA}$ ,<br>$V_{CM}=1500\text{Vp-p}$ ,<br>$R_L=1.9\text{K}\Omega$ , $T_A = 25^\circ\text{C}$ |
| Common Mode Transient Immunity at Logic Low (Fig.9) <sup>*3</sup>    | $CM_L$    | 15,000 | -    | -    | $\text{V}/\mu\text{s}$ | $I_F = 16\text{mA}$ ,<br>$V_{CM}=1500\text{Vp-p}$ ,<br>$R_L=1.9\text{K}\Omega$ , $T_A=25^\circ\text{C}$  |

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

Typical Electro-Optical Characteristics Curves

Figure 1. Forward Current vs Forward Voltage

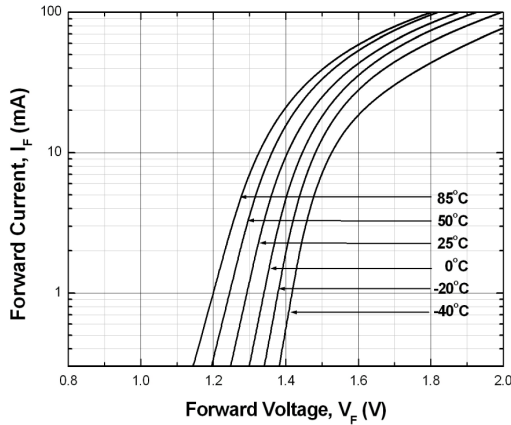


Figure 2. Current Transfer Ratio vs Forward Current

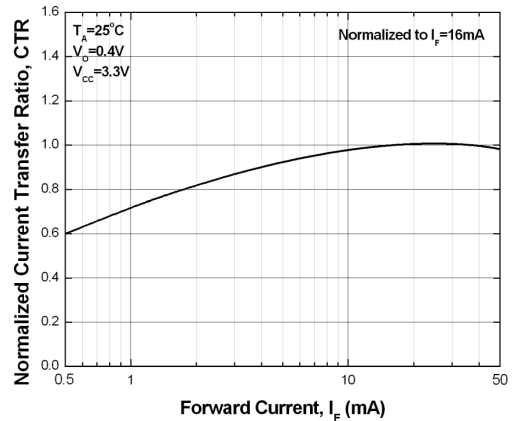


Figure 3. Current Transfer Ratio vs Ambient Temperature

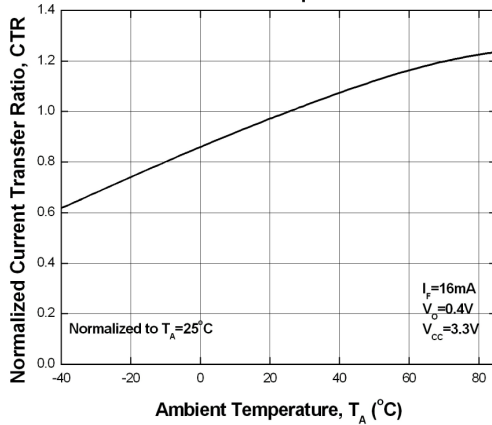


Figure 4. Output Current vs Output Voltage

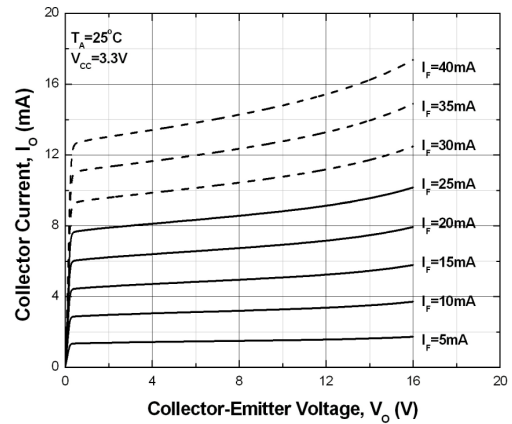


Figure 5. Logic High Output Current vs Ambient Temperature

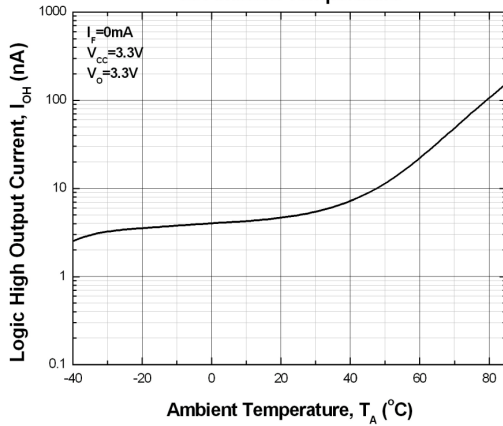


Figure 6. Propagation Delay vs. Load Resistance

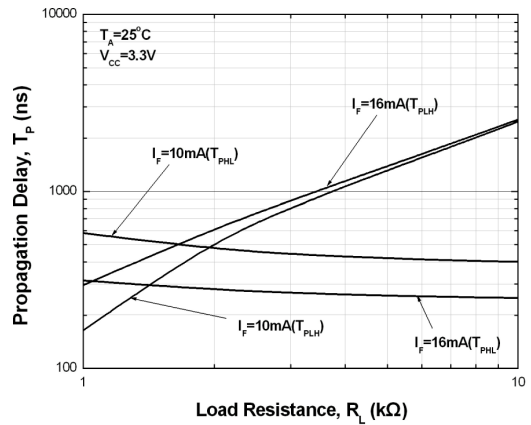


Figure 7. Propagation Delay vs. Temperature

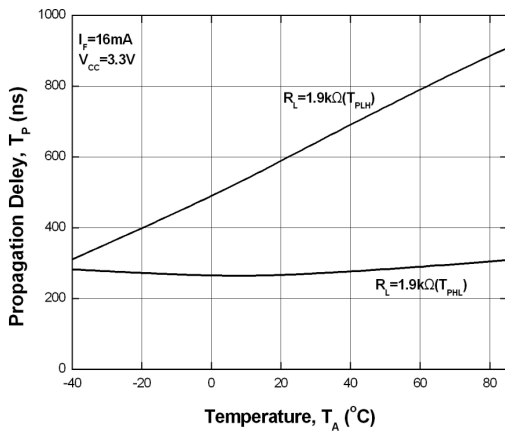


Figure 8. Frequency Response

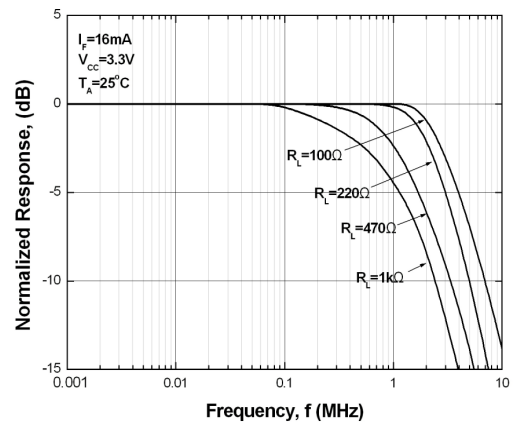


Figure 9. Switching Time Test Circuit & Waveform

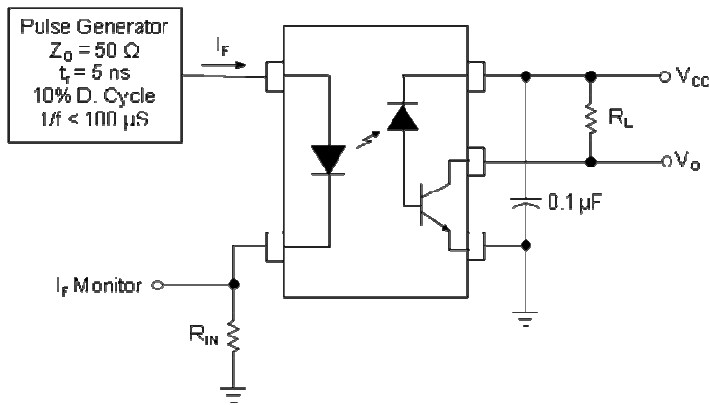
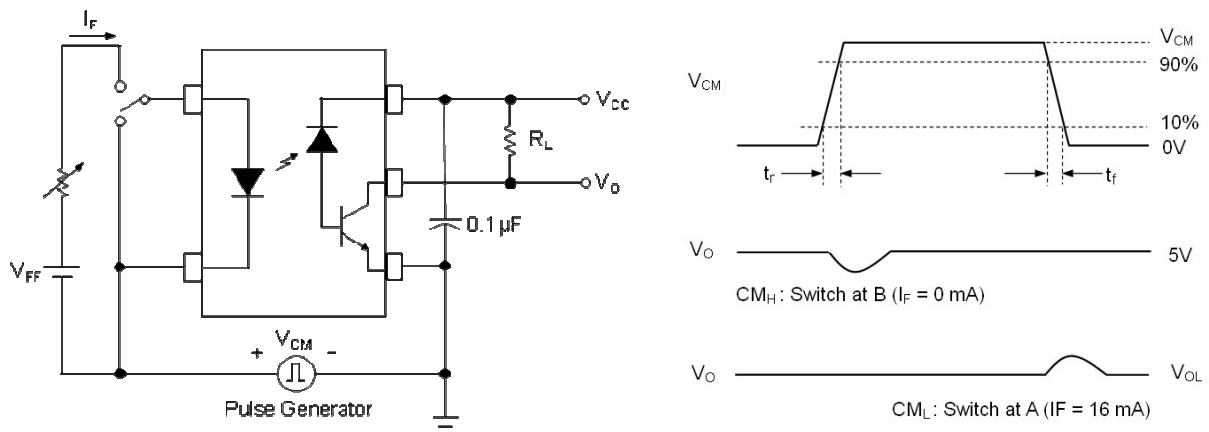


Figure 10. Transient Immunity Test Circuit & Waveform



**Note:**

\*3 Common mode transient immunity in logic high level is the maximum tolerable (positive)  $dV_{CM}/dt$  on the leading edge of the common mode pulse signal  $V_{CM}$ , to assure that the output will remain in a logic high state (i.e.,  $V_O > 2.0V$ ).

Common mode transient immunity in logic low level is the maximum tolerable (negative)  $dV_{CM}/dt$  on the trailing edge of the common mode pulse signal,  $V_{CM}$ , to assure that the output will remain in a logic low state (i.e.,  $V_O < 0.8V$ ).

## Order Information

### Part Number

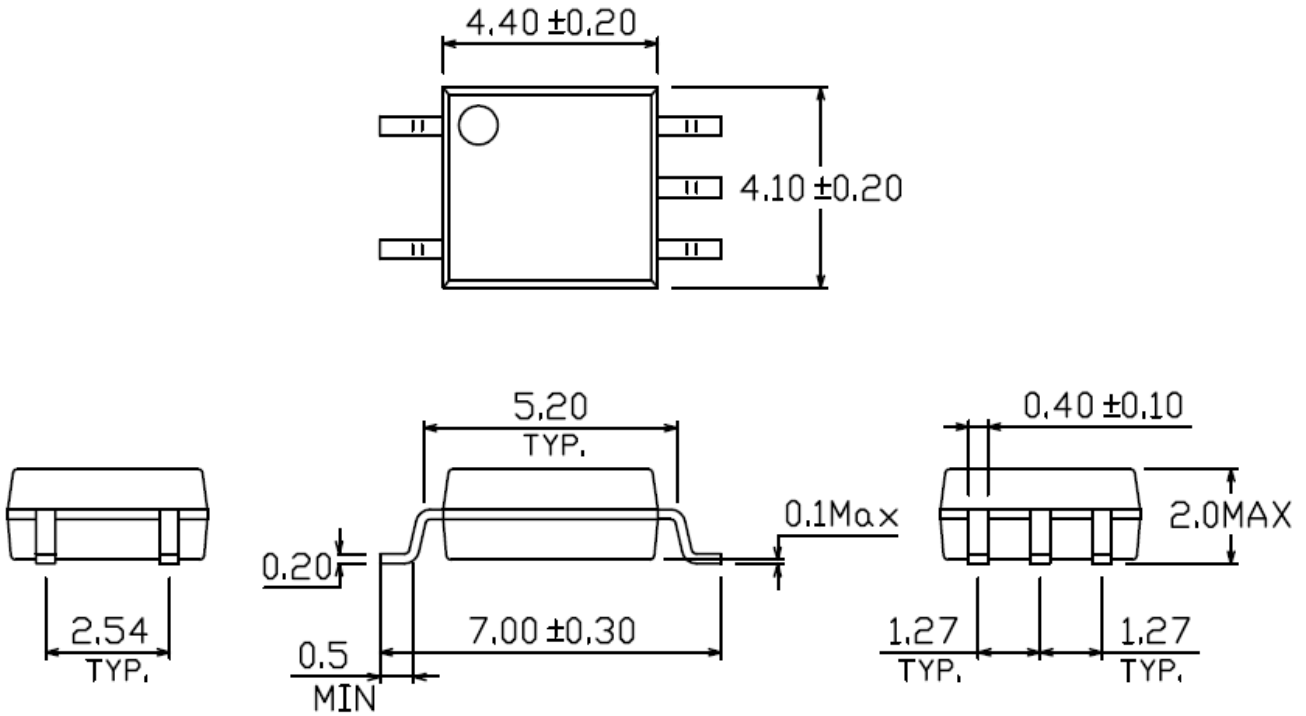
**ELM453L(Z)-V**

### Note

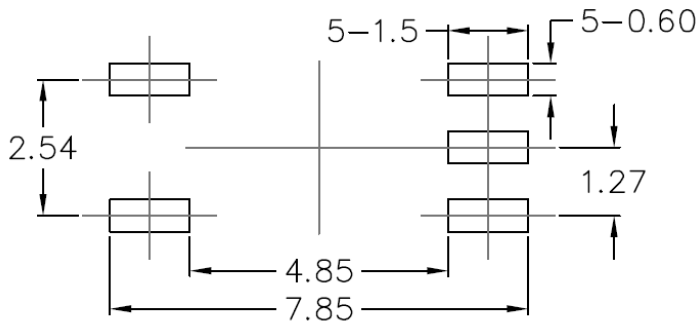
- Z = Tape and reel option (TA, TB or none)  
V = VDE (optional)

| Option | Description                 | Packing quantity    |
|--------|-----------------------------|---------------------|
| None   | Standard                    | 100 units per tube  |
| -V     | Standard + VDE              | 100 units per tube  |
| (TA)   | TA tape & reel option       | 3000 units per reel |
| (TB)   | TB tape & reel option       | 3000 units per reel |
| (TA)-V | TA tape & reel option + VDE | 3000 units per reel |
| (TB)-V | TB tape & reel option + VDE | 3000 units per reel |

**Package Dimension**  
(Dimensions in mm)



**Recommended pad layout for surface mount leadform**





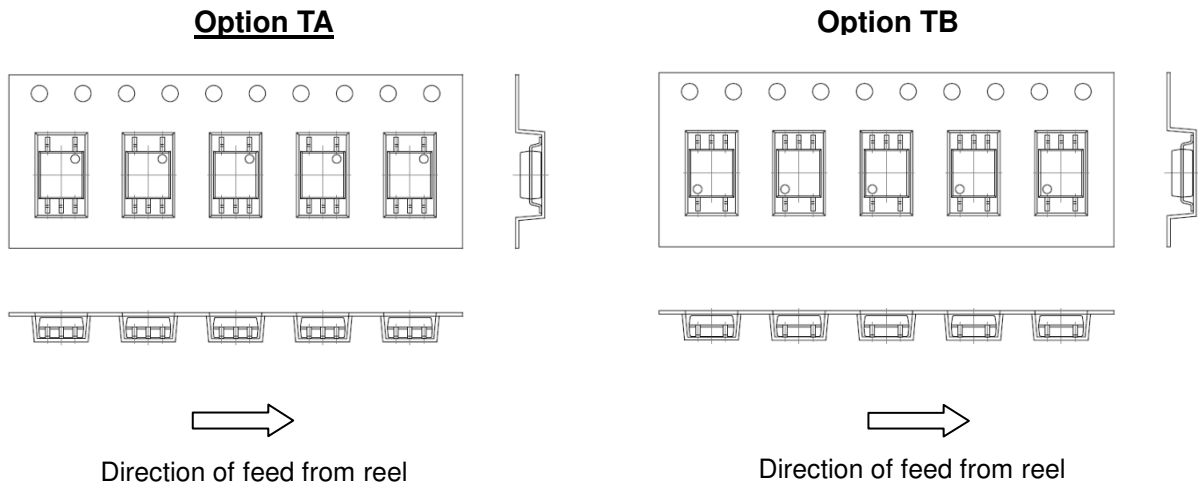
## Device Marking



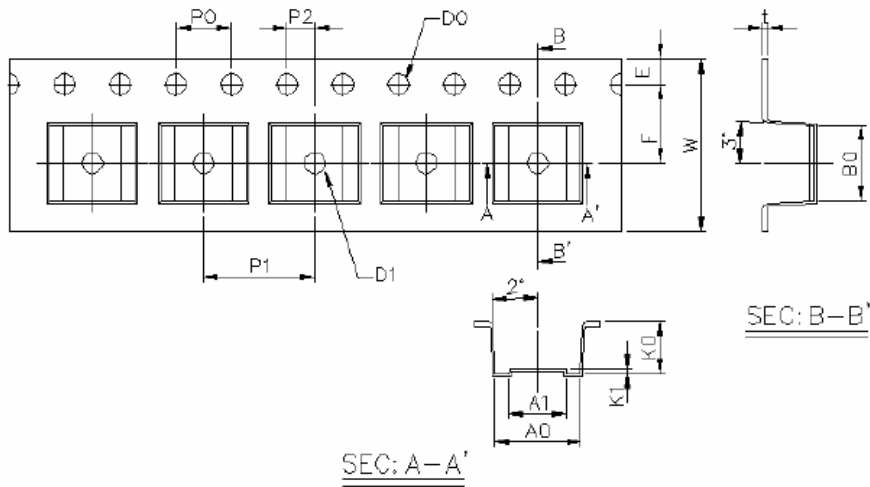
## Notes

|       |                           |
|-------|---------------------------|
| EL    | denotes EVERLIGHT         |
| M453L | denotes Device Number     |
| Y     | denotes 1 digit Year code |
| WW    | denotes 2 digit Week code |
| V     | denotes VDE (optional)    |

**Tape & Reel Packing Specifications**



**Tape dimensions**

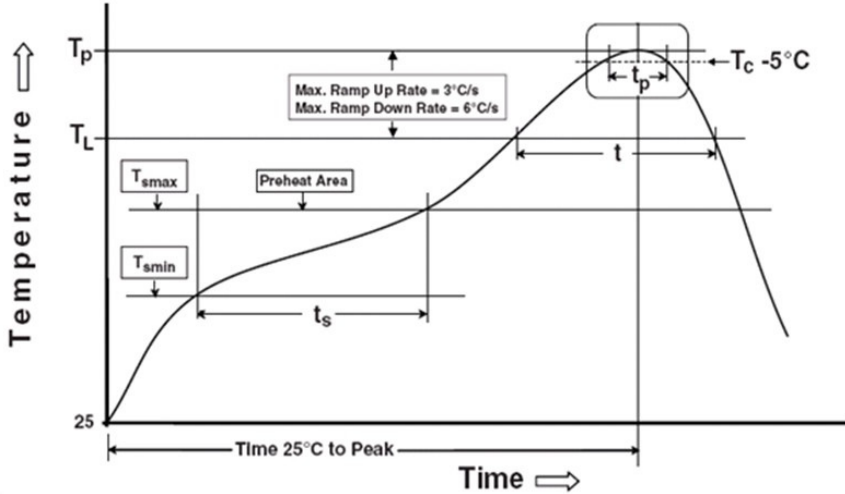


|               |           |           |           |           |                   |           |           |
|---------------|-----------|-----------|-----------|-----------|-------------------|-----------|-----------|
| Dimension No. | <b>A0</b> | <b>A1</b> | <b>B0</b> | <b>D0</b> | <b>D1</b>         | <b>E</b>  | <b>F</b>  |
| Dimension(mm) | 6.2±0.1   | 4.1±0.1   | 5.28±0.1  | 1.5±0.1   | 1.5±0.3           | 1.75±0.1  | 5.5±0.1   |
| Dimension No. | <b>Po</b> | <b>P1</b> | <b>P2</b> | <b>t</b>  | <b>W</b>          | <b>K0</b> | <b>K1</b> |
| Dimension(mm) | 4.0±0.1   | 8.0±0.1   | 2.0±0.1   | 0.4±0.1   | 12.0+0.3/<br>-0.1 | 3.7±0.1   | 0.3±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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