



### Features

- High isolation 5000 VRMS
- CTR flexibility available see order information
- DC input with transistor output
- External Creepage  $\geq 7.4\text{mm}$
- Distance Through Isolation  $\geq 0.4\text{mm}$
- Spatial Distance  $\geq 7.5\text{mm}$  (S/SL Type)
- Spatial Distance  $\geq 8.0\text{mm}$  (M/SLM Type)
- Operating Temperature range - 55 °C to 110 °C
- Regulatory Approvals
  - UL - UL1577 (E364000)
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC – GB4943.1, GB8898
  - IEC60065, IEC60950

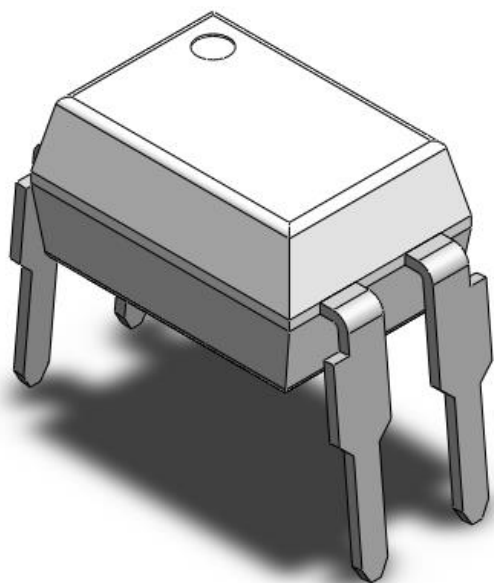
### Description

The CT816 series consists of a photo transistor optically coupled to a gallium arsenide Infrared-emitting diode in a 4-lead DIP package with bending options.

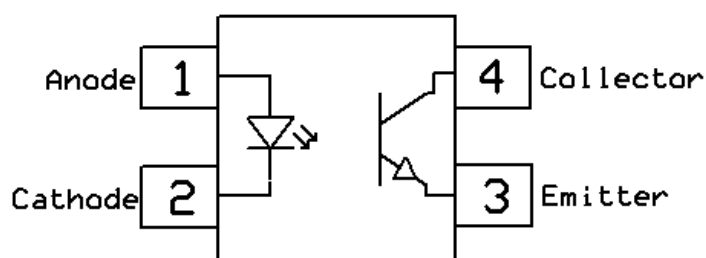
### Applications

- Switch mode power supplies
- Computer peripheral interface
- Microprocessor system interface

### Package Outline



### Schematic



**Absolute Maximum Rating at 25°C**

| <b>Symbol</b>         | <b>Parameters</b>                        | <b>Ratings</b> | <b>Units</b>     | <b>Notes</b> |
|-----------------------|--|----------------|------------------|--------------|
| V <sub>ISO</sub>      | Isolation voltage (AC, 1 minute)         | 5000           | V <sub>RMS</sub> |              |
| P <sub>TOT</sub>      | Total power dissipation                  | 200            | mW               |              |
| T <sub>OPR</sub>      | Operating temperature                    | -55 ~ +110     | °C               |              |
| T <sub>STG</sub>      | Storage temperature                      | -55 ~ +150     | °C               |              |
| T <sub>SOL</sub>      | Soldering temperature                    | 260            | °C               |              |
| <b>Emitter</b>        |  |                |                  |              |
| I <sub>F</sub>        | Forward current                          | 60             | mA               |              |
| I <sub>F(TRANS)</sub> | Peak transient current (≤1μs P.W,300pps) | 1              | A                |              |
| V <sub>R</sub>        | Reverse voltage                          | 6              | V                |              |
| P <sub>D</sub>        | Emitter power dissipation                | 100            | mW               |              |
| <b>Detector</b>       |  |                |                  |              |
| P <sub>D</sub>        | Detector power dissipation               | 150            | mW               |              |
| B <sub>VCEO</sub>     | Collector-Emitter Breakdown Voltage      | 80             | V                |              |
| B <sub>VECO</sub>     | Emitter-Collector Breakdown Voltage      | 6              | V                |              |
| I <sub>C</sub>        | Collector Current                        | 50             | mA               |              |



**Electrical Characteristics**  $T_A = 25^\circ\text{C}$  (unless otherwise specified)

**Emitter Characteristics**

| Symbol   | Parameters        | Test Conditions     | Min | Typ  | Max | Units         | Notes |
|----------|-------------------|---------------------|-----|------|-----|---------------|-------|
| $V_F$    | Forward voltage   | $I_F = 10\text{mA}$ | -   | 1.24 | 1.4 | V             |       |
| $I_R$    | Reverse Current   | $V_R = 6\text{V}$   | -   | -    | 5   | $\mu\text{A}$ |       |
| $C_{IN}$ | Input Capacitance | $f = 1\text{MHz}$   | -   | 30   | -   | pF            |       |

**Detector Characteristics**

| Symbol        | Parameters                     | Test Conditions                         | Min | Typ | Max | Units | Notes |
|---------------|--------------------------------|---|-----|-----|-----|-------|-------|
| $B_{V_{CEO}}$ | Collector-Emitter Breakdown    | $I_C = 100\mu\text{A}$                  | 80  | -   | -   | V     |       |
| $B_{V_{ECO}}$ | Emitter-Collector Breakdown    | $I_E = 100\mu\text{A}$                  | 6   | -   | -   | V     |       |
| $I_{CEO}$     | Collector-Emitter Dark Current | $V_{CE} = 20\text{V}, I_F = 0\text{mA}$ | -   | -   | 100 | nA    |       |

**Transfer Characteristics**

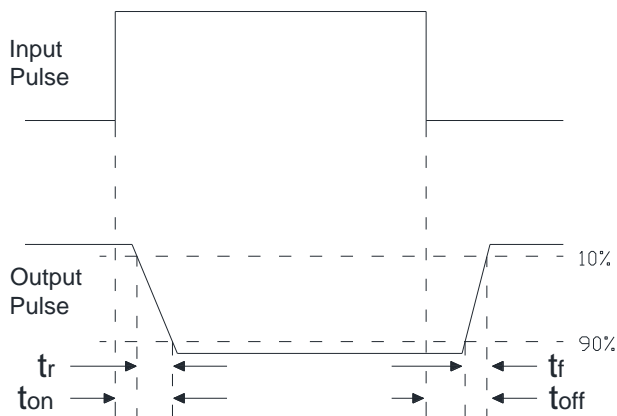
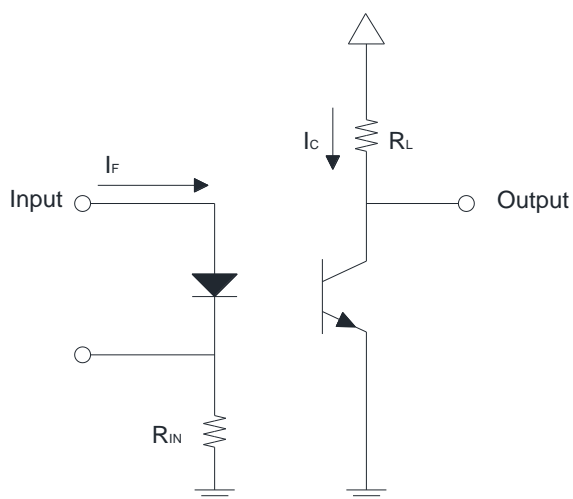
| Symbol        | Parameters                           | Test Conditions                         | Min                | Typ  | Max | Units    | Notes |  |
|---------------|--------------------------------------|---|--------------------|------|-----|----------|-------|--|
| CTR           | Current Transfer Ratio               | $I_F = 5\text{mA}, V_{CE} = 5\text{V}$  | CT816              | 50   | -   | 600      | %     |  |
|               |                                      |   | CT816A             | 80   | -   | 160      |       |  |
|               |                                      |   | CT816B             | 130  | -   | 260      |       |  |
|               |                                      |   | CT816C             | 200  | -   | 400      |       |  |
|               |                                      |   | CT816D             | 300  | -   | 600      |       |  |
|               |                                      |   | CT816F             | 100  | -   | 200      |       |  |
| CTR           | Current Transfer Ratio               | $I_F = 10\text{mA}, V_{CE} = 5\text{V}$ | CT816I             | 63   | -   | 125      | %     |  |
|               |                                      |   | CT816J             | 100  | -   | 200      |       |  |
|               |                                      |   | CT816K             | 160  | -   | 320      |       |  |
|               |                                      | $I_F = 1\text{mA}, V_{CE} = 5\text{V}$  | CT816I             | 22   | -   | -        |       |  |
|               |                                      |   | CT816J             | 34   | -   | -        |       |  |
|               |                                      |   | CT816K             | 56   | -   | -        |       |  |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | $I_F = 20\text{mA}, I_C = 1\text{mA}$   | -                  | 0.1  | 0.2 | V        |       |  |
| $R_{IO}$      | Isolation Resistance                 | $V_{IO} = 500V_{DC}$                    | $5 \times 10^{10}$ | -    | -   | $\Omega$ |       |  |
| $C_{IO}$      | Isolation Capacitance                | $f = 1\text{MHz}$                       | -                  | 0.25 | 1   | pF       |       |  |



Switching Characteristics

| Symbol | Parameters | Test Conditions   | Min | Typ | Max | Units         | Notes |
|--------|------------|---|-----|-----|-----|---------------|-------|
| $t_r$  | Rise Time  | $I_C = 2\text{mA}, V_{CE} = 2\text{V}, R_L = 100\Omega$ | -   | 6   | -   | $\mu\text{s}$ |       |
| $t_f$  | Fall Time  |   | -   | 8   | -   |               |       |

Test Circuit





### Typical Characteristic Curves

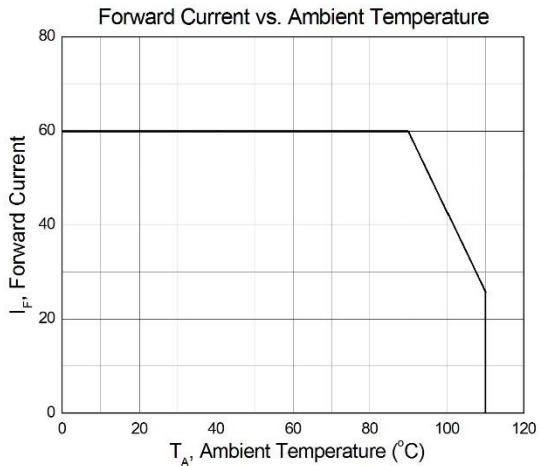


Figure 1

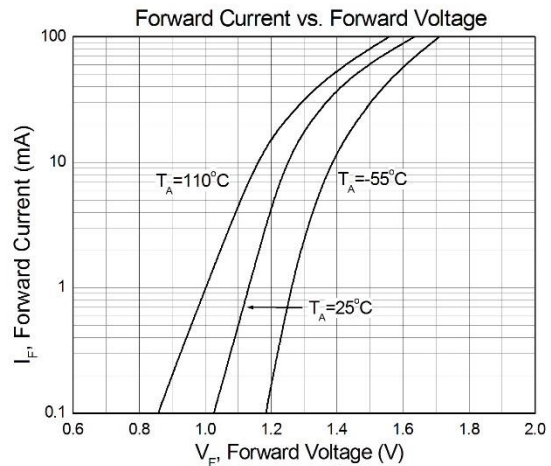


Figure 2

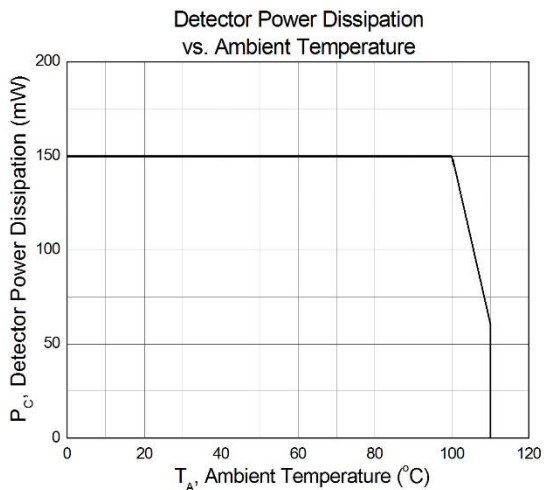


Figure 3

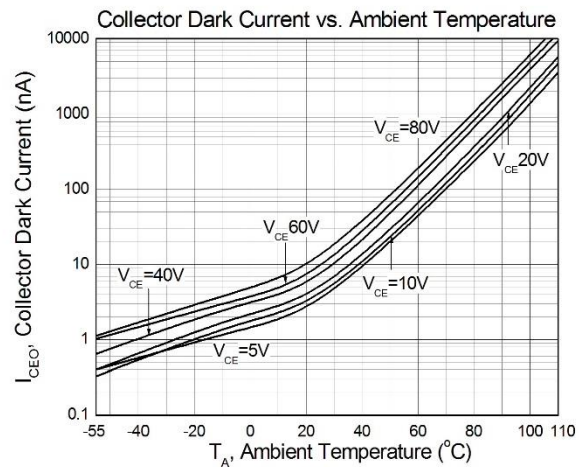


Figure 4

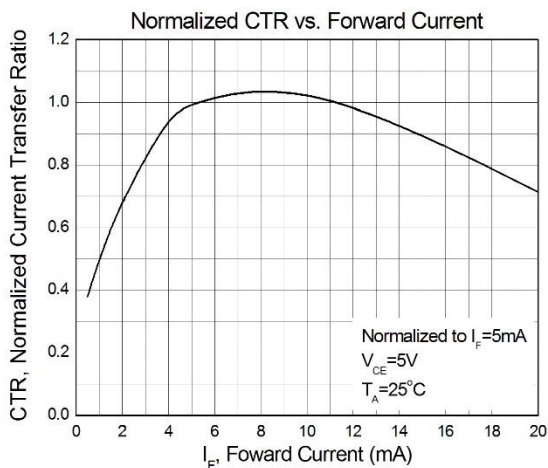


Figure 5

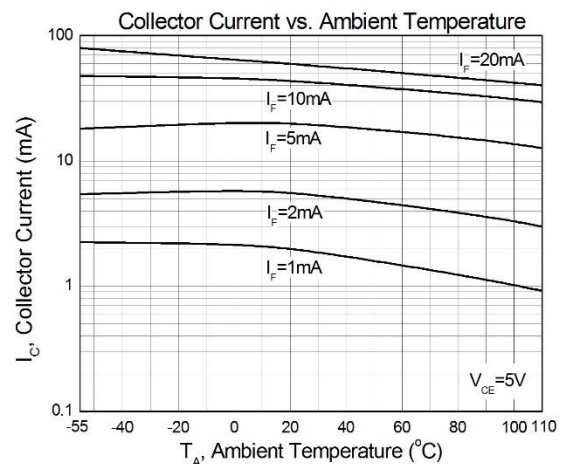


Figure 6

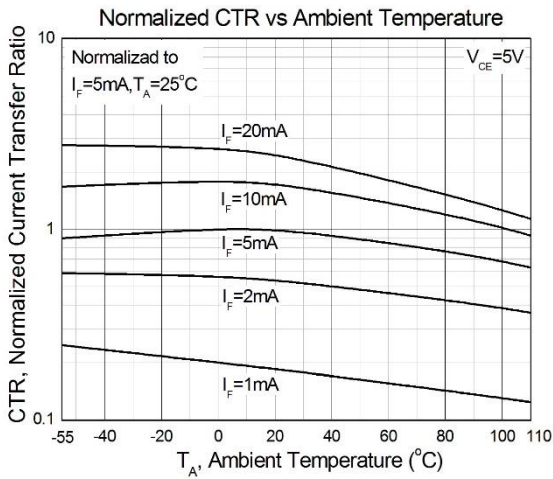


Figure 7

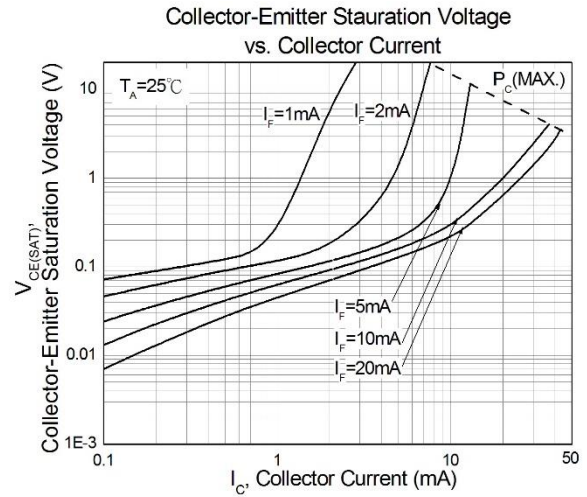


Figure 8

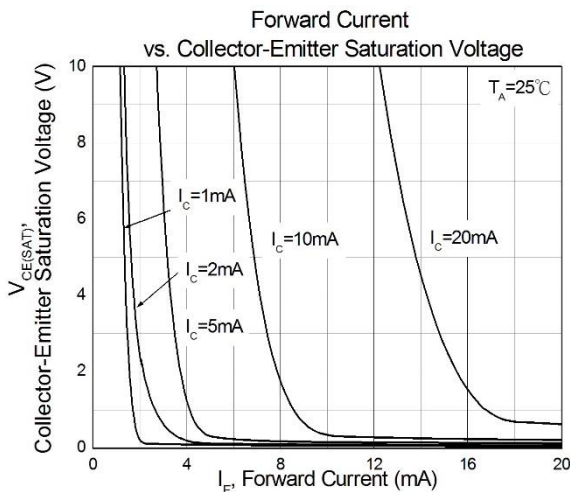


Figure 9

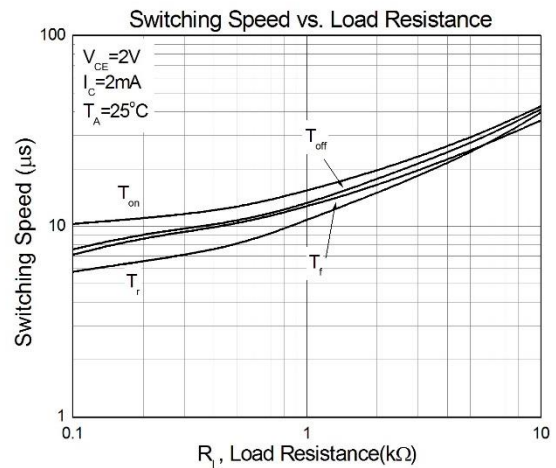


Figure 10

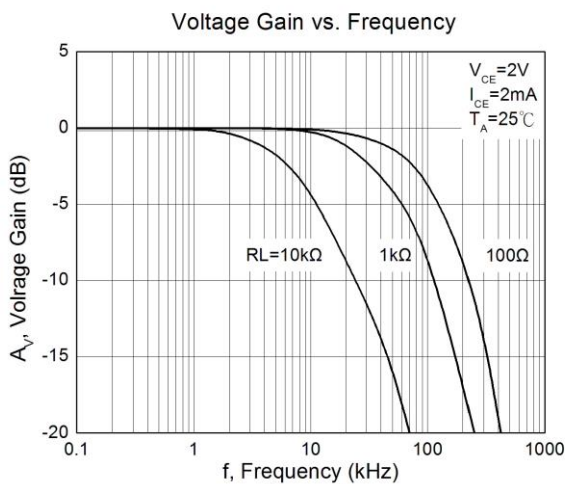
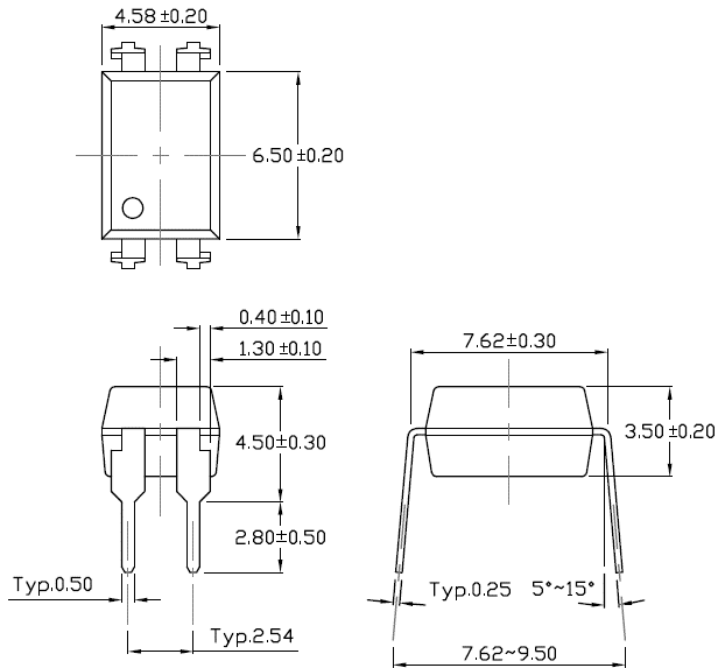


Figure 11

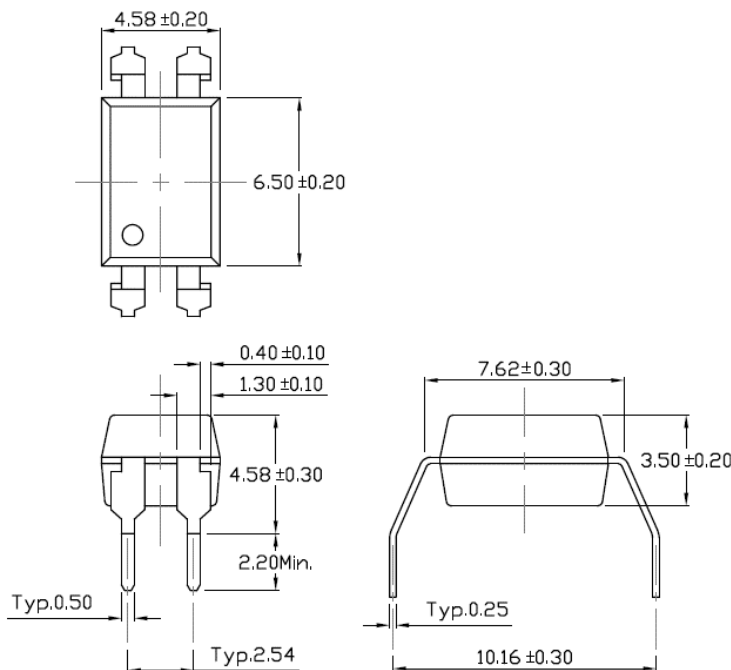


**Package Dimension** *Dimensions in mm unless otherwise stated*

**Standard DIP – Through Hole**

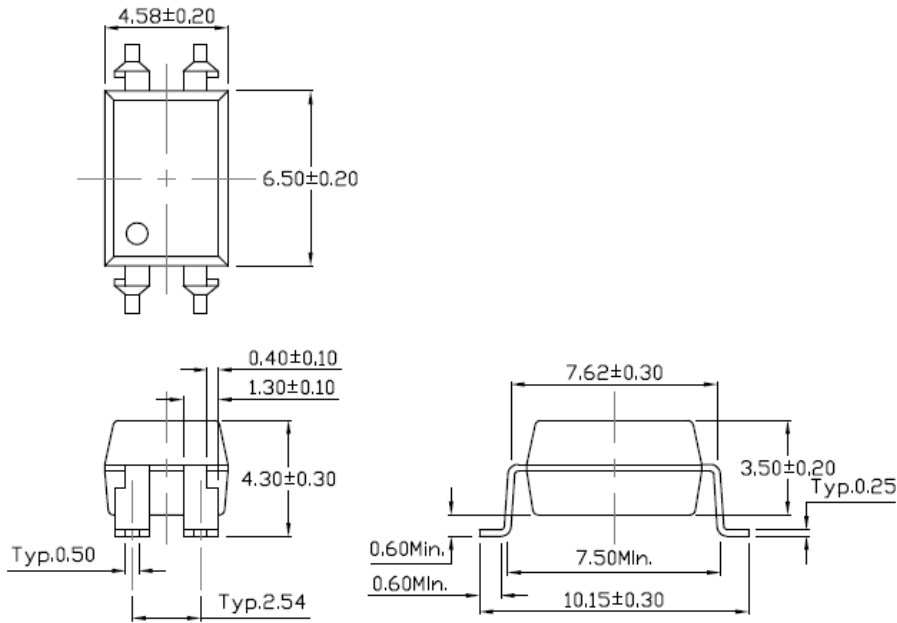


**Gullwing (400mil) Lead Forming – Through Hole (M Type)**

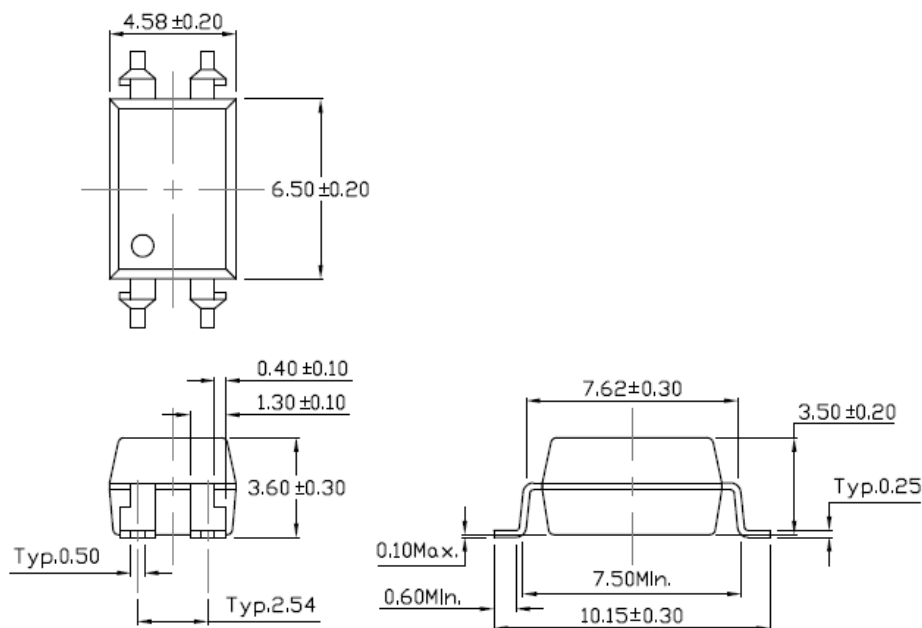




Surface Mount Lead Forming (S Type)



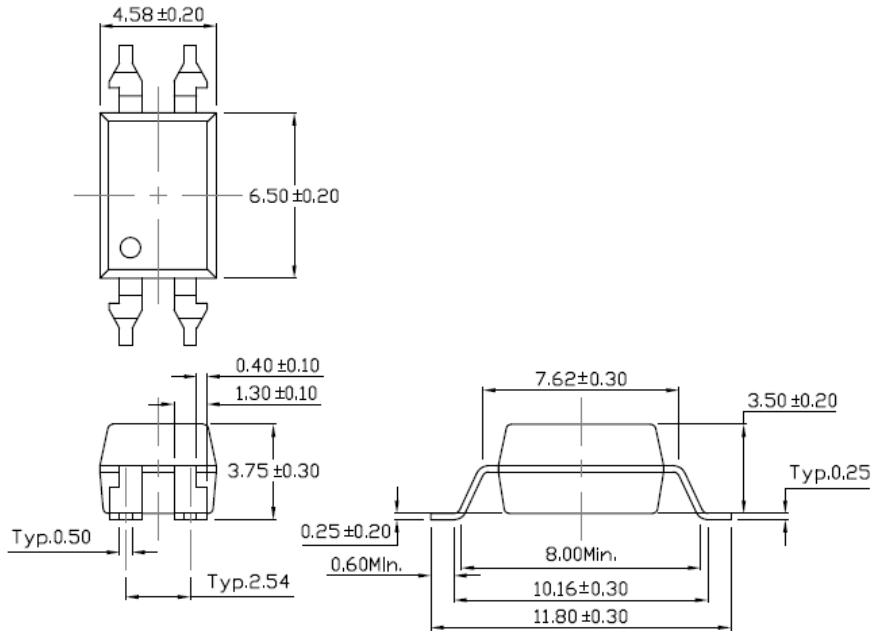
Surface Mount (Low Profile) Lead Forming (SL Type)







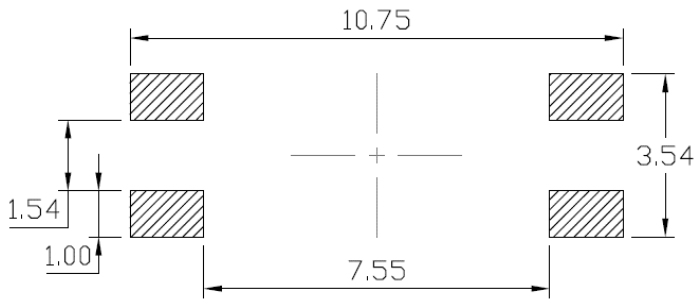
Surface Mount (Gullwing) Lead Forming (SLM Type)



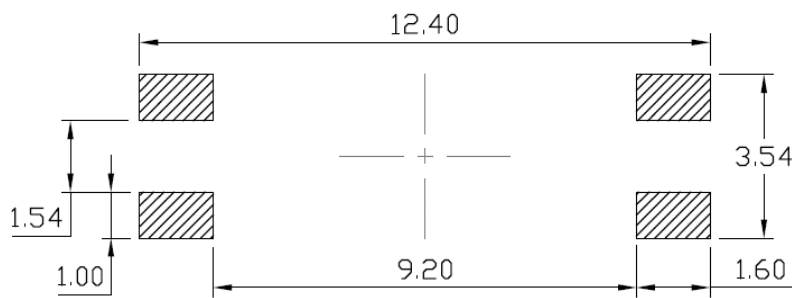


**Recommended Solder Mask** *Dimensions in mm unless otherwise stated*

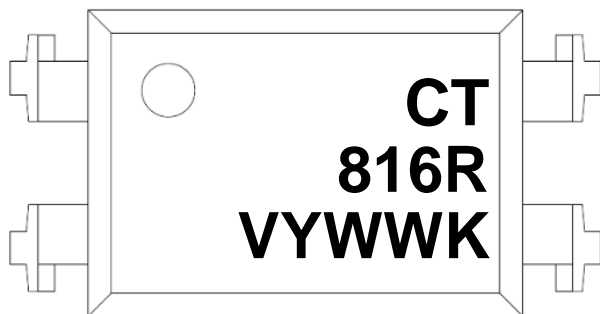
**Surface Mount Lead Forming & Surface Mount (Low Profile) Lead Forming**



**Surface Mount (Gullwing) Lead Forming**



**Marking Information**



**Note:**

- CT : Denotes "CT Micro"
- 816 : Part Number
- V : VDE Option
- R : CTR Rank
- Y : Fiscal Year
- WW : Work Week
- K : Manufacturing Code

**Ordering Information****CT816X(V)(Y)(Z)-HG**

X = Part No. (X=A, B, C, D, I, J, K, None)

V = VDE Option ( V or None)

Y = Lead form option (S, SL, M, SLM or none)

Z = Tape and reel option (T1, T2, T3, T4 or none)

H = Lead frame option (H: Iron, None: Copper)

G= Material option (G: Green, None: Non-green)

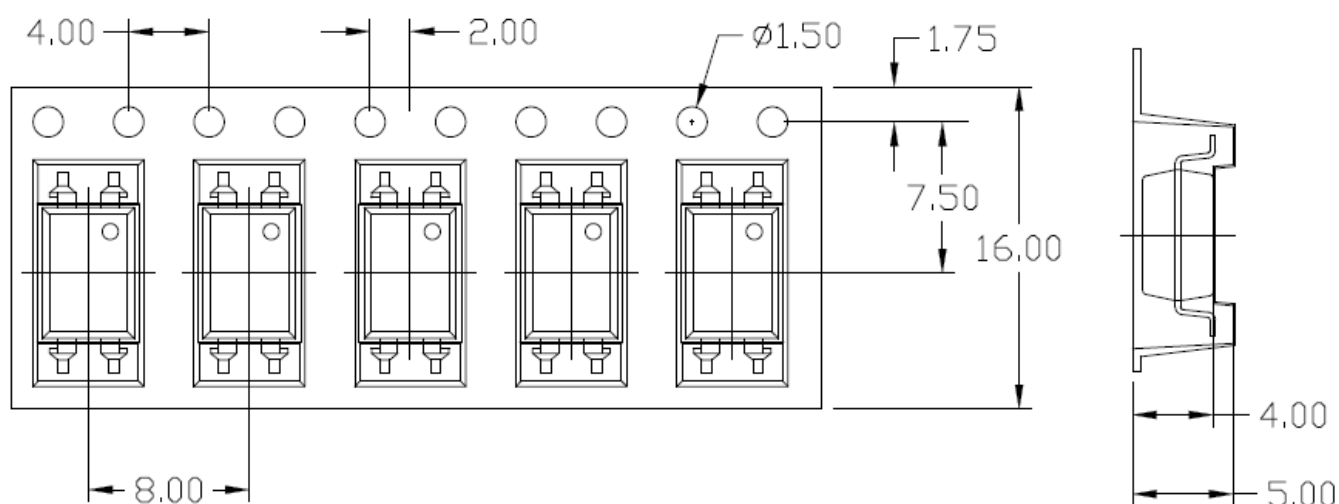
| <b>Option</b> | <b>Description</b>  | <b>Quantity</b> |
|---------------|---|-----------------|
| None          | Standard 4 Pin DIP  | 100 Units/Tube  |
| M             | Gullwing (400mil) Lead Forming                                  | 100 Units/Tube  |
| S(T1)         | Surface Mount Lead Forming – With Option 1 Taping               | 1500 Units/Reel |
| S(T2)         | Surface Mount Lead Forming – With Option 2 Taping               | 1500 Units/Reel |
| S(T3)         | Surface Mount Lead Forming – With Option 3 Taping               | 1000 Units/Reel |
| S(T4)         | Surface Mount Lead Forming – With Option 4 Taping               | 1000 Units/Reel |
| SL(T1)        | Surface Mount (Low Profile) Lead Forming– With Option 1 Taping  | 1500 Units/Reel |
| SL(T2)        | Surface Mount (Low Profile) Lead Forming – With Option 2 Taping | 1500 Units/Reel |
| SL(T3)        | Surface Mount (Low Profile) Lead Forming– With Option 3 Taping  | 1000 Units/Reel |
| SL(T4)        | Surface Mount (Low Profile) Lead Forming – With Option 4 Taping | 1000 Units/Reel |
| SLM(T1)       | Surface Mount (Gullwing) Lead Forming– With Option 1 Taping     | 1500 Units/Reel |
| SLM(T2)       | Surface Mount (Gullwing) Lead Forming – With Option 2 Taping    | 1500 Units/Reel |



**Carrier Tape Specifications** *Dimensions in mm unless otherwise stated*

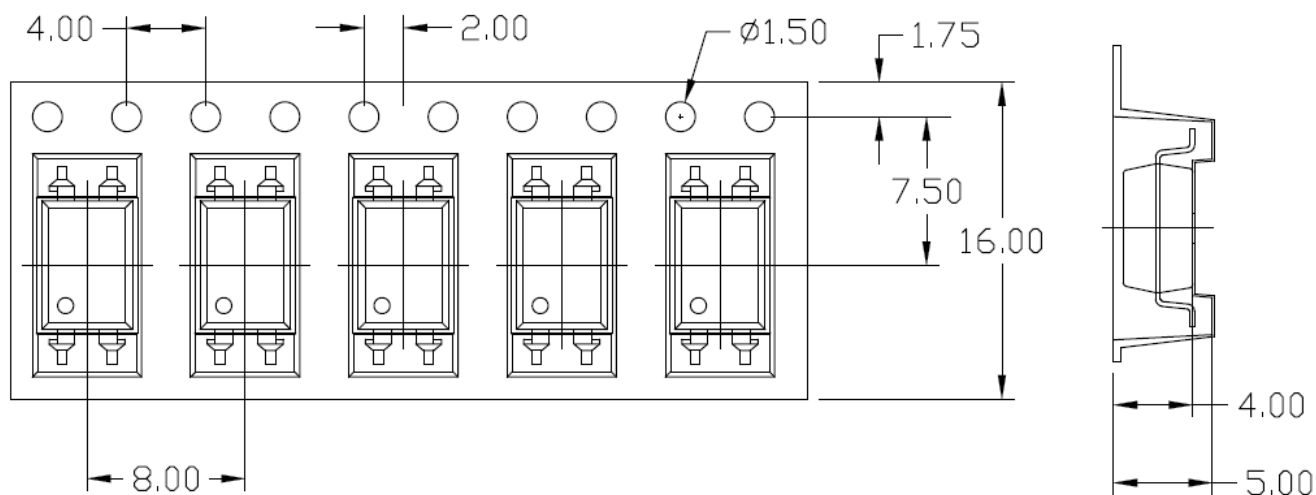
**Option S(T1) & SL(T1)**

Input Direction  
→



**Option S(T2) & SL(T2)**

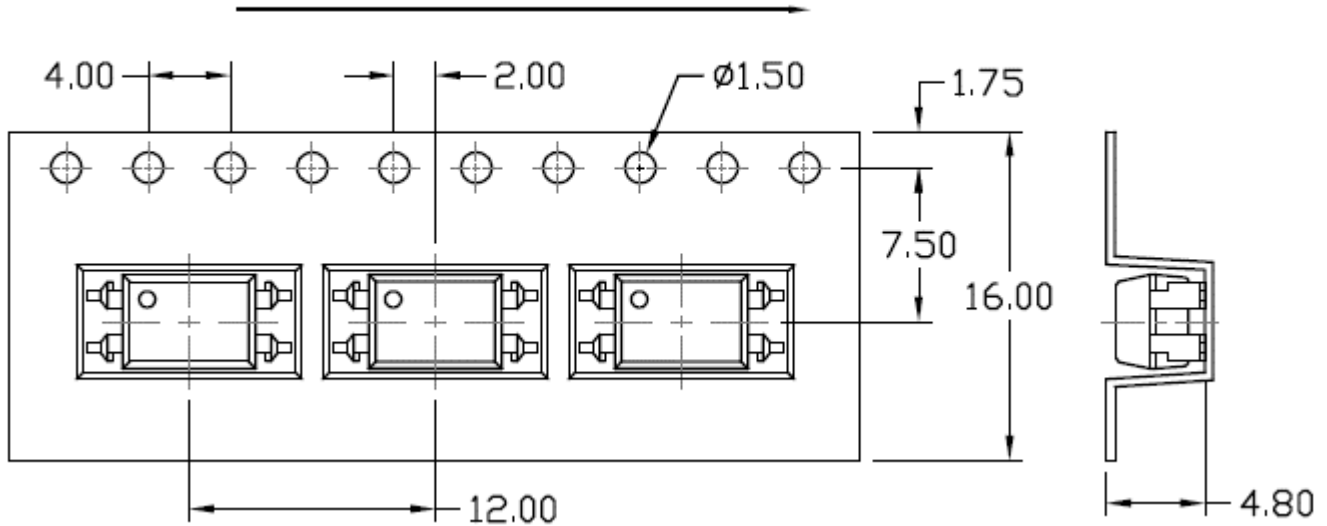
Input Direction  
→





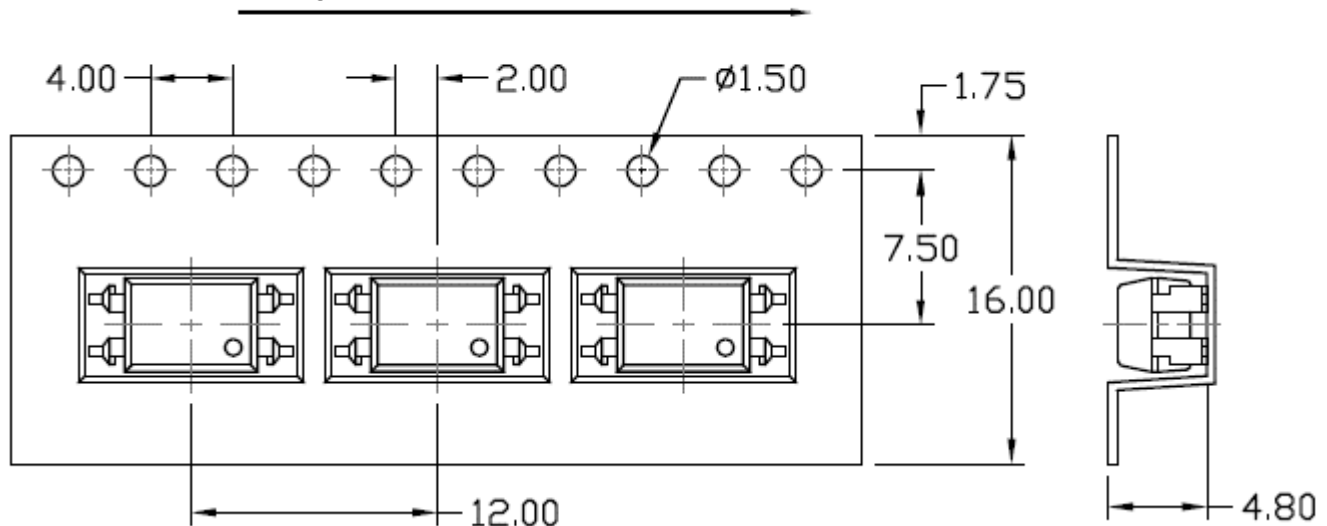
Option S(T3) & SL(T3)

Input Direction



Option S(T4) & SL(T4)

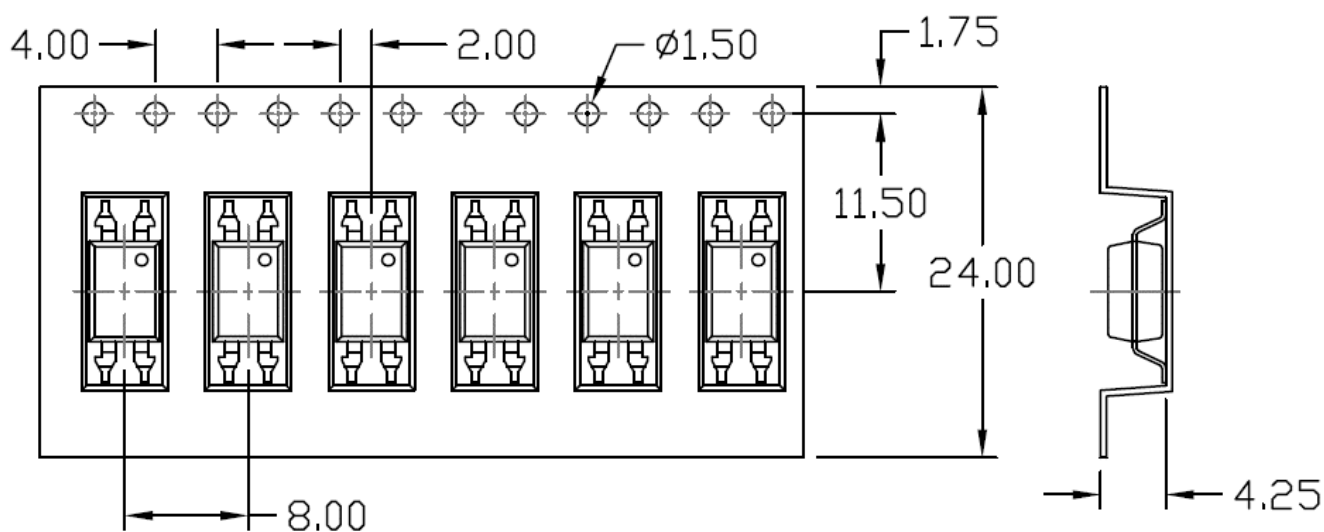
Input Direction





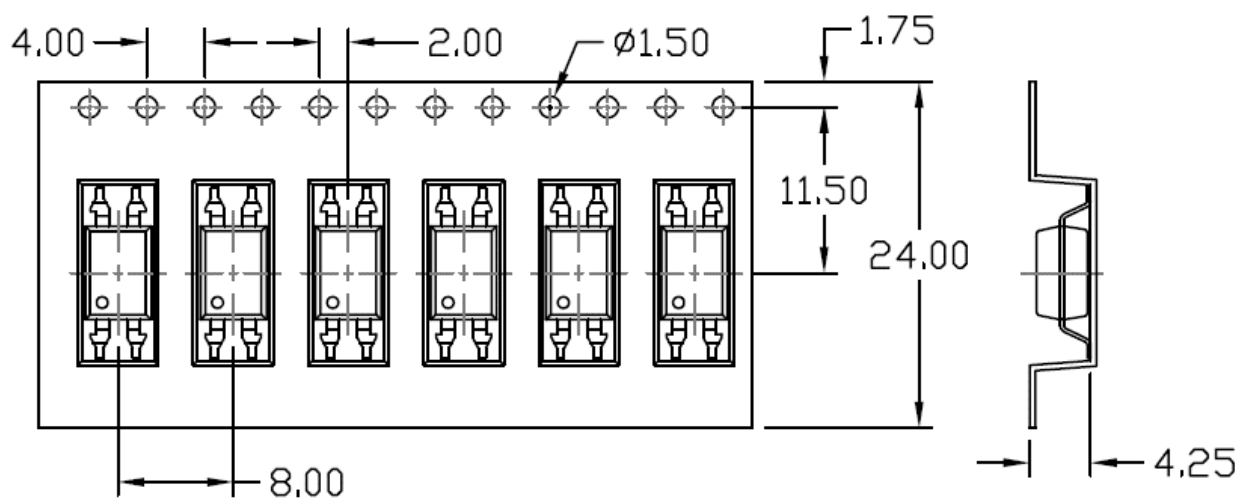
Option SLM(T1)

Input Direction



Option SLM(T2)

Input Direction





**Wave soldering (follow the JEDEC standard JESD22-A111)**

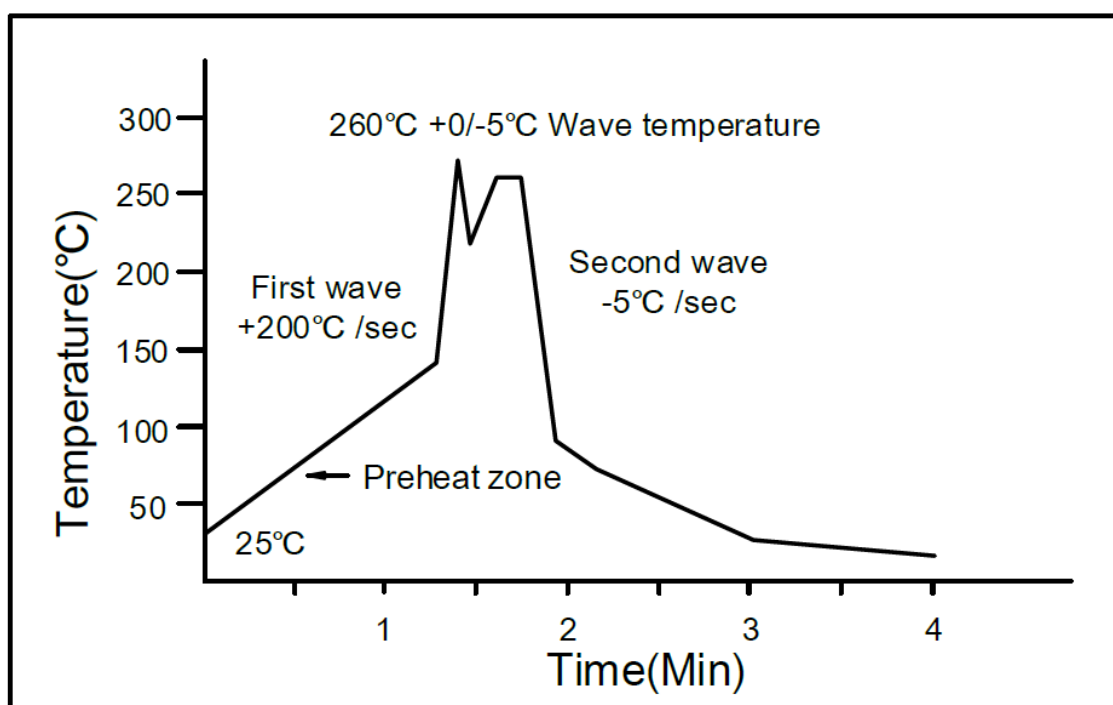
One time soldering is recommended within the condition of temperature.

Temperature:  $260 \pm 5^\circ\text{C}$ .

Time: 10 sec.

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

Preheat time: 30 to 80 sec.



**Iron soldering (follow the standard MIL-STD 202G, Method 210F)**

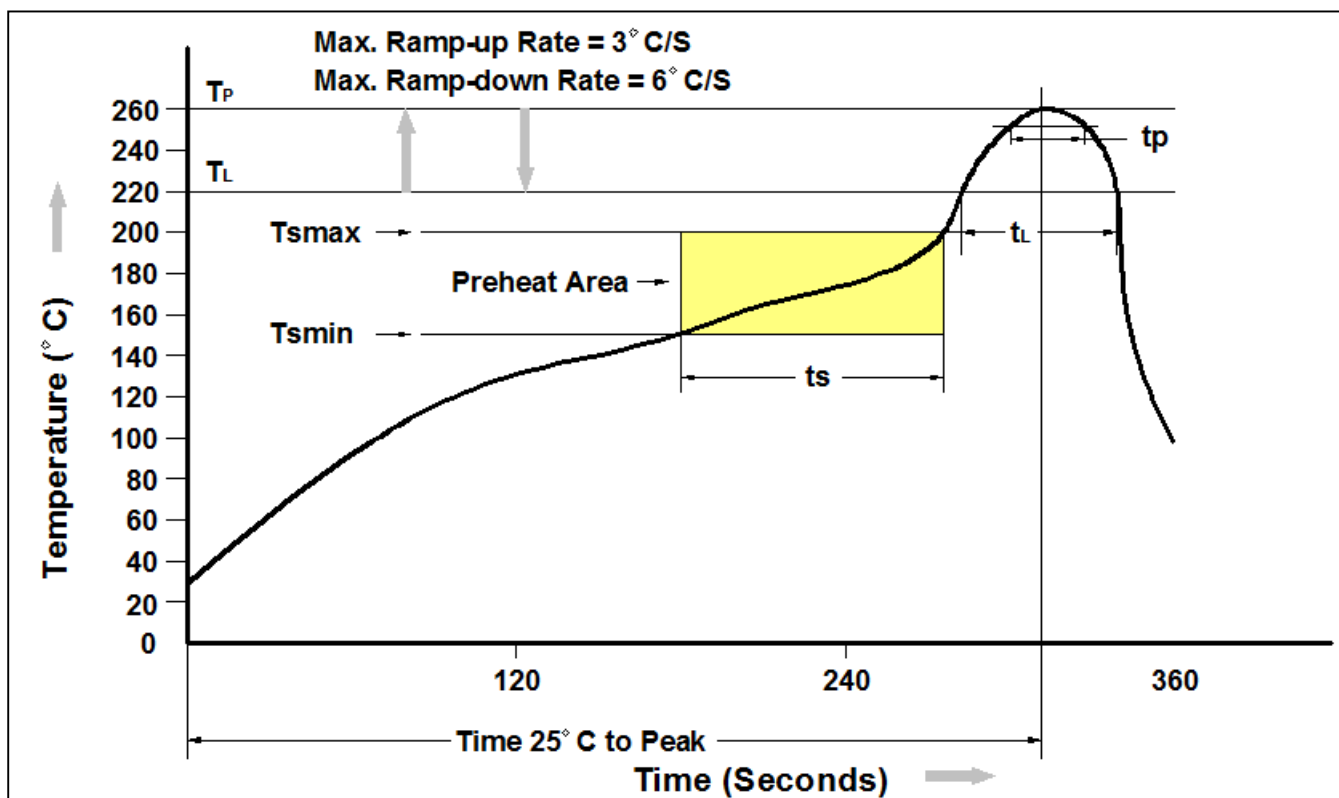
Allow single lead soldering in every single process.

One time soldering is recommended. Temperature:  $350 \pm 10^\circ\text{C}$

Time: 5 sec max.



Reflow Profile



| Profile Feature   | Pb-Free Assembly Profile |
|---|--------------------------|
| Temperature Min. (Tsmin)                                  | 150°C                    |
| Temperature Max. (Tsmax)                                  | 200°C                    |
| Time (ts) from (Tsmin to Tsmax)                           | 60-120 seconds           |
| Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )          | 3°C/second max.          |
| Liquidous Temperature (T <sub>L</sub> )                   | 217°C                    |
| Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> ) | 60 – 150 seconds         |
| Peak Body Package Temperature                             | 260°C +0°C / -5°C        |
| Time (t <sub>P</sub> ) within 5°C of 260°C                | 30 seconds               |
| Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )        | 6°C/second max           |
| Time 25°C to Peak Temperature                             | 8 minutes max.           |





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