

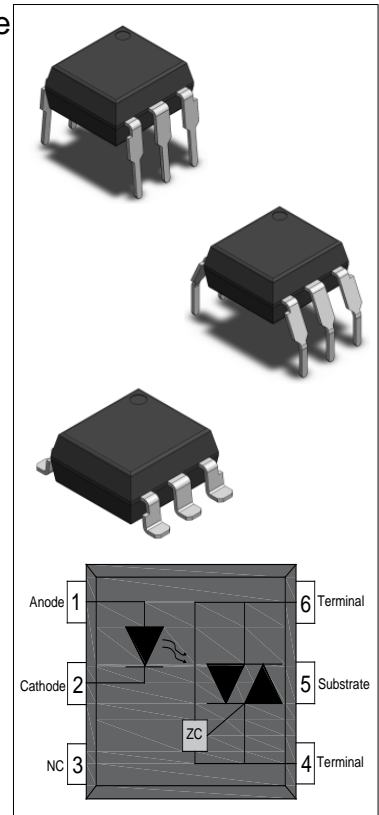


## JOC304X Series

Rev.A.1.0

### DESCRIPTION:

The JOC304X series combine an AlGaAs infrared emitting diode the emitter which is optically coupled to a monolithic silicon zero-cross photo triac in a plastic DIP and SMD package with different lead forming options. The products are widely used in solenoid/valve controls, lighting controls, motor controls, temperature controls, static AC power switches, solid state relays, interfacing microprocessors up to 120 V<sub>AC</sub> peripherals.



### MAIN FEATURES

- High isolation 5000 VRMS
- DC input with zero-cross photo triac output
- Operating temperature range -55 °C to 100 °C
- REACH & RoHS compliance
- HBM: H3A ; MM: M4
- CQC approved
- VDE approved
- UL approved

### ABSOLUTE MAXIMUM RATINGS (Temperature=25°C)

| Parameter |   | Symbol               | Value | Unit  |
|-----------|---|----------------------|-------|-------|
| Input     | Forward Current                                       | I <sub>F</sub>       | 60    | mA    |
|           | Reverse Voltage                                       | V <sub>R</sub>       | 6     | V     |
|           | Junction Temperature                                  | T <sub>j</sub>       | 125   | °C    |
|           | Input Power Dissipation                               | P <sub>I</sub>       | 100   | mW    |
|           | Power Dissipation Derating (T <sub>a</sub> ≥ 25°C)    | Δ P <sub>D</sub> /°C | -1.33 | mW/°C |
| Output    | Off-state Output Terminal Voltage                     | V <sub>OFF</sub>     | 400   | V     |
|           | Peak On-state Current (100μs pulse, 120 pps)          | I <sub>TP</sub>      | 2     | A     |
|           | On-state RMS Current                                  | I <sub>T(RMS)</sub>  | 100   | mA    |
|           | Peak Repetitive Surge Current (P <sub>W</sub> =10 ms) | I <sub>TSM</sub>     | 1     | A     |
|           | Junction Temperature                                  | T <sub>j</sub>       | 125   | °C    |
|           | Output Power Dissipation                              | P <sub>O</sub>       | 250   | mW    |

|                         |   |                               |                   |                      |
|-------------------------|---|-------------------------------|-------------------|----------------------|
|                         | Power Dissipation Derating<br>( $T_a \geq 25^\circ\text{C}$ ) | $\Delta P_D / ^\circ\text{C}$ | -3.33             | mW/ $^\circ\text{C}$ |
| Total Power Dissipation |   | $P_{\text{tot}}$              | 350               | mW                   |
| Isolation Voltage       |   | $V_{\text{iso}}$              | 5000 <sup>①</sup> | V <sub>rms</sub>     |
| Operating Temperature   |   | $T_{\text{opr}}$              | -55~100           | $^\circ\text{C}$     |
| Storage Temperature     |   | $T_{\text{stg}}$              | -55~125           | $^\circ\text{C}$     |
| Soldering Temperature   |   | $T_{\text{sol}}$              | 260 <sup>②</sup>  | $^\circ\text{C}$     |

**NOTE1:** AC for 1minute, R.H.=40~60%

**NOTE2:** For 10 seconds

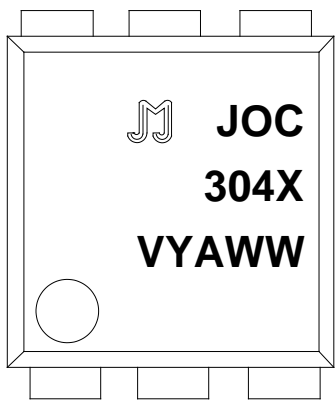
**ELECTRICAL CHARACTERISTICS** (Temperature=25 $^\circ\text{C}$ )

| Parameter                     |  | Symbol  | Condition  | Min.              | Typ.      | Max.             | Unit             |
|-------------------------------|--|---|--|-------------------|-----------|------------------|------------------|
| Input                         | Forward Voltage                            | $V_F$   | $I_F=10\text{mA}$  | -                 | 1.27      | 2.2              | V                |
|                               | Reverse Current                            | $I_R$   | $V_R=6\text{V}$  | -                 | -         | 1                | $\mu\text{A}$    |
|                               | Input Capacitance                          | $C_{\text{in}}$                                 | $V=0, f=1\text{kHz}$   | -                 | 10        | -                | pF               |
| Output                        | Peak Off-state Current, Either Direction   | $I_{\text{OFF}}$                                | $V_{\text{OFF}}=400\text{V}, I_F=0$  | -                 | -         | 100 <sup>③</sup> | nA               |
|                               | Peak On-state Voltage, Either Direction    | $V_{\text{TM}}$                                 | $I_{\text{TM}}=100\text{mA}$   | -                 | 1.7       | 2.5              | V                |
|                               | Critical Rate of Rise of Off-state voltage | dV/dt   | $V_{\text{PEAK}}=400\text{V}, I_F=0$   | 1000 <sup>④</sup> | -         | -                | V/ $\mu\text{s}$ |
| Transfer Characteristics      | LED Trigger Current                        | JOC3041   | Terminal Voltage=3V<br>$I_{\text{TM}}=100\text{mA}$                            | -                 | -         | 15               | mA               |
|                               |  | JOC3042   |  | -                 | -         | 10               |                  |
|                               |  | JOC3043   |  | -                 | -         | 5                |                  |
|                               | Holding Current                            | $I_H$   | $I_{\text{TM}}=2\text{mA}, I_F=\text{Rated } I_{\text{FT}}$                    | -                 | 350       | -                | $\mu\text{A}$    |
|                               | Isolation Resistance                       | $R_{\text{ISO}}$                                | DC500V<br>40~60%R.H.   | $10^{12}$         | $10^{14}$ | -                | $\Omega$         |
|                               | Floating Capacitance                       | $C_{\text{IO}}$                                 | $V=0, f=1\text{MHz}$   | -                 | 10        | -                | pF               |
| Response Time                 | $t_{\text{on}}$                            | $V_D=6\text{V}, R_L=100\Omega, I_F=20\text{mA}$ | -  | 15                | 50        | $\mu\text{s}$    |                  |
| Zero-crossing Characteristics | Inhibit Voltage                            | $V_{\text{IH}}$                                 | $I_F=\text{Rated } I_{\text{FT}}$  | -                 | -         | 20               | V                |
|                               | Leakage in Inhibited State                 | $I_{\text{OFF}2}$                               | $I_F=\text{Rated } I_{\text{FT}}, V_{\text{OFF}}=\text{Rated } V_{\text{OFF}}$ | -                 | -         | 1                | mA               |

**NOTE3:** Test voltage must be applied within dV/dt ratings.

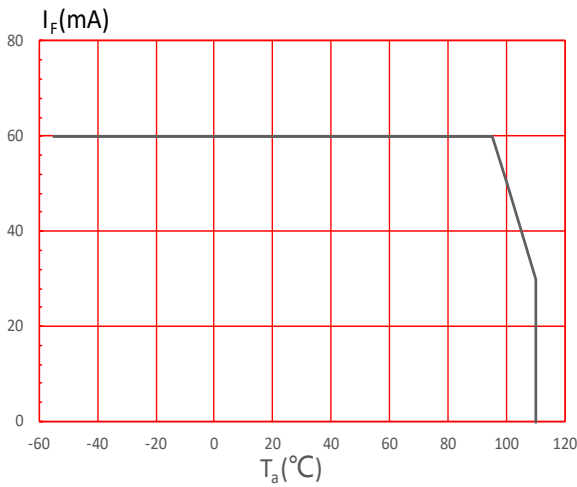
**NOTE4:** Refer to Fig.14 & Fig.15

**ORDERING AND MARKING INFORMATION**

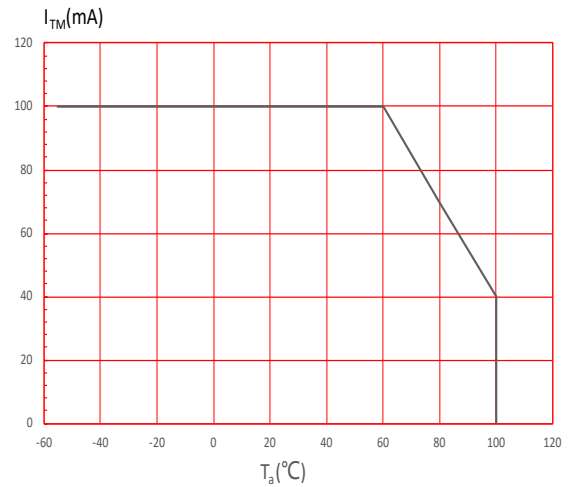
| <b>MARKING INFORMATION</b>   |                 |  |                                     |
|--|-----------------|--|-------------------------------------|
|   |                 | <p>JOC : Company Abbr.<br/>                     304X : Part Number &amp; Rank<br/>                     V : VDE Option<br/>                     Y : Fiscal Year<br/>                     A : Manufacturing Code<br/>                     WW : Work Week</p> |                                     |
| <b>ORDERING INFORMATION</b>  |                 |  |                                     |
| <b>JOC304X(Y)(Z)-GV</b>  |                 |  |                                     |
| <p>JOC – Company Abbr.<br/>                     304X – Part Number<br/>                     (1/2/3)<br/>                     Y – Lead Form Option (M/SL/None)<br/>                     Z – Tape and Reel Option (T1)<br/>                     G – Green Option (G or None)<br/>                     V – VDE Option (V or None)</p> |                 |  |                                     |
| <b>Packing Quantity</b>  |                 |  |                                     |
| Option   | Quantity        | Quantity – Inner box   | Quantity –Outer box                 |
| None   | 65 Units/Tube   | 32 Tubes/Inner box   | 10 Inner box/Outer box =20.8k Units |
| M  | 65 Units/Tube   | 32 Tubes/Inner box   | 10 Inner box/Outer box =20.8k Units |
| SL(T1)   | 1000 Units/Reel | 3 Reels/Inner box  | 5 Inner box/Outer box =15k Units    |

**Characteristics Curves**

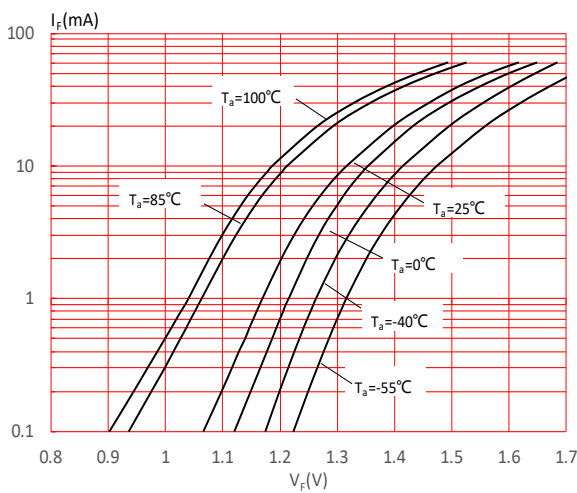
**FIG.1:** Forward Current vs. Ambient Temperature



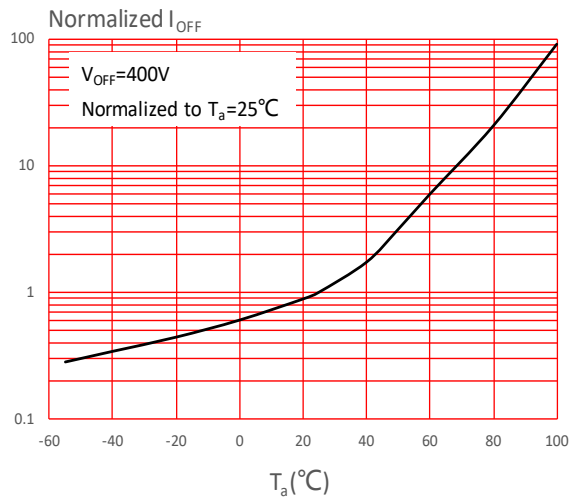
**FIG.2:** On-state Terminal Current vs. Ambient Temperature



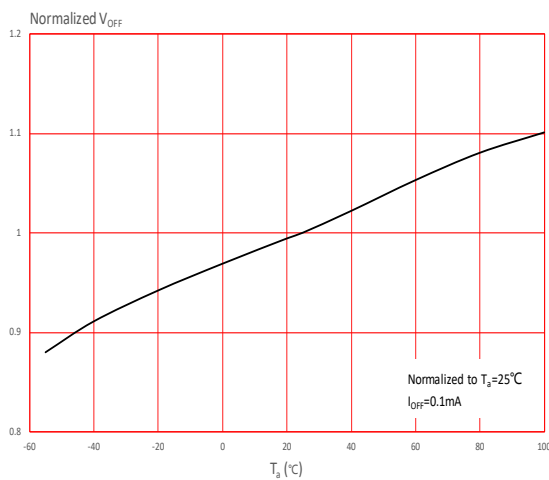
**FIG.3:** Forward Current vs. Forward Voltage



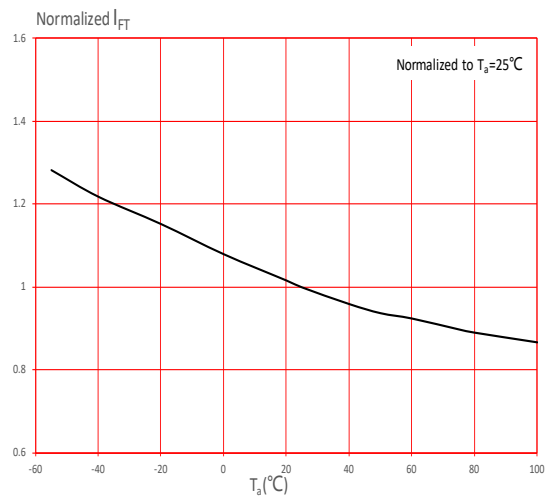
**FIG.4:** Normalized Off-state Terminal Current vs. Ambient Temperature



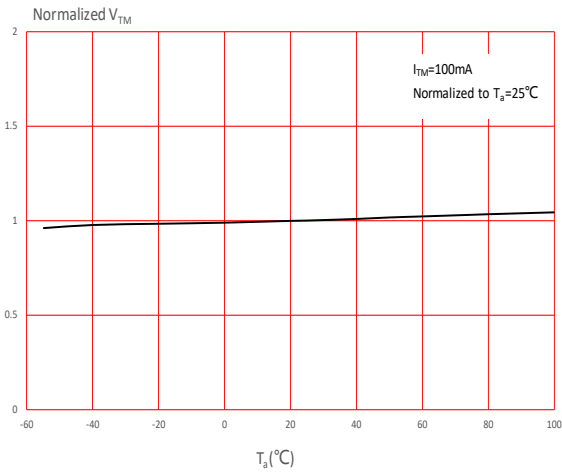
**FIG.5:** Normalized Off-state Terminal Voltage vs. Ambient Temperature



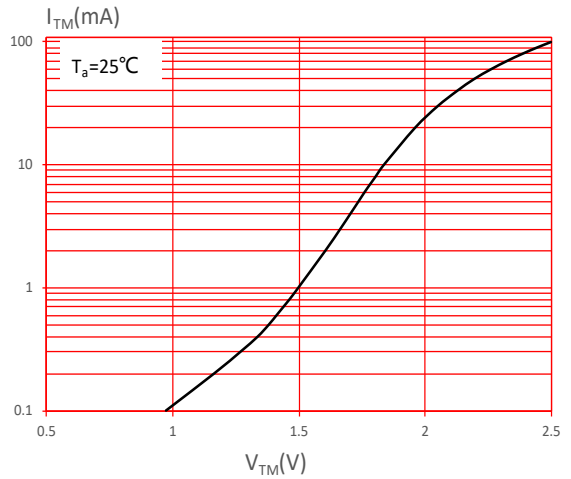
**FIG.6:** Normalized Trigger Current vs. Ambient Temperature



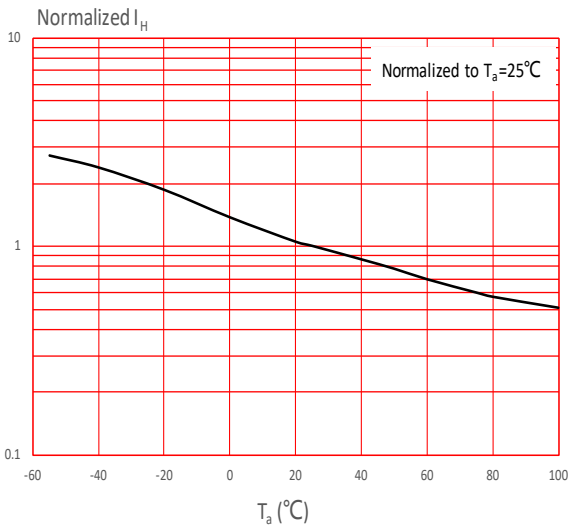
**FIG.7:** Normalized On-state Terminal Voltage vs. Ambient Temperature



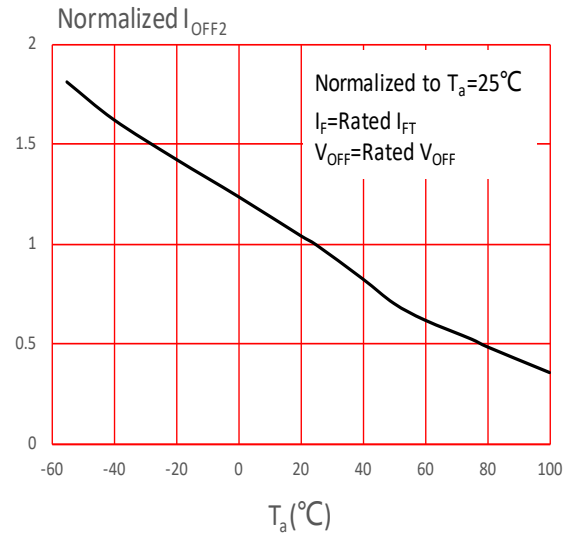
**FIG.8:** On-state Terminal Voltage vs. On-state Terminal Current



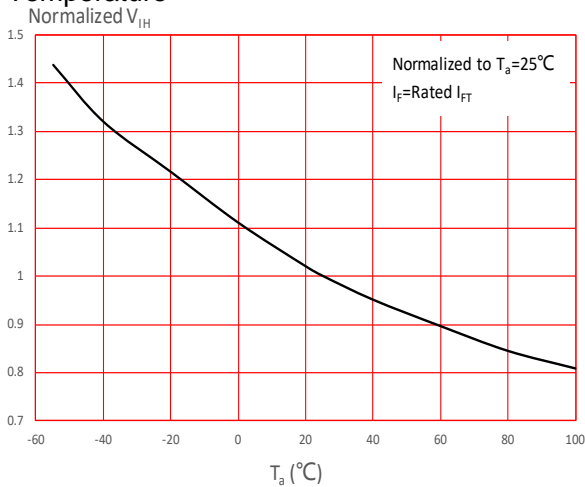
**FIG.9:** Normalized Holding Current vs. Ambient Temperature



**FIG.10:** Normalized Leakage in Inhibit State vs. Ambient Temperature



**FIG.11:** Normalized Inhibit Voltage vs. Ambient Temperature



TEST CIRCUITS

FIG.12: Test Circuits of Turn On Time

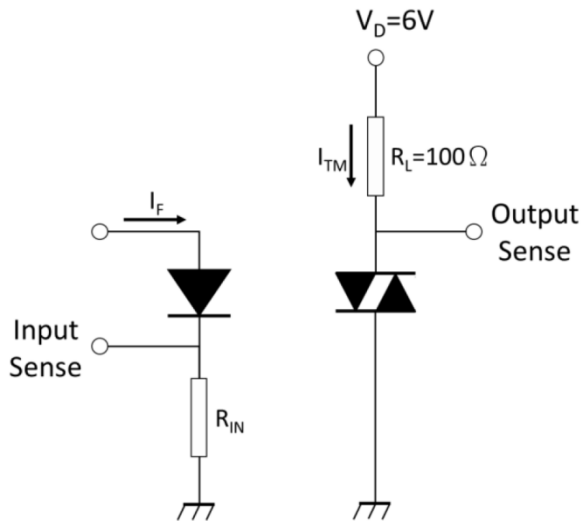


FIG.13: Waveforms of Turn On Time



Fig.14: Test Circuits of dV/dt

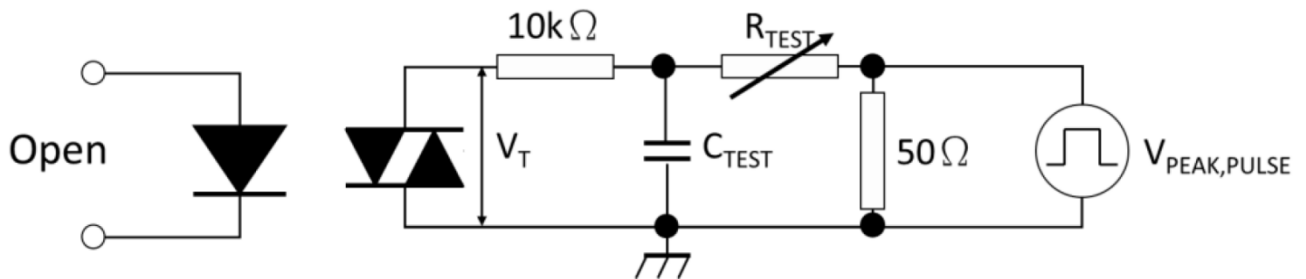
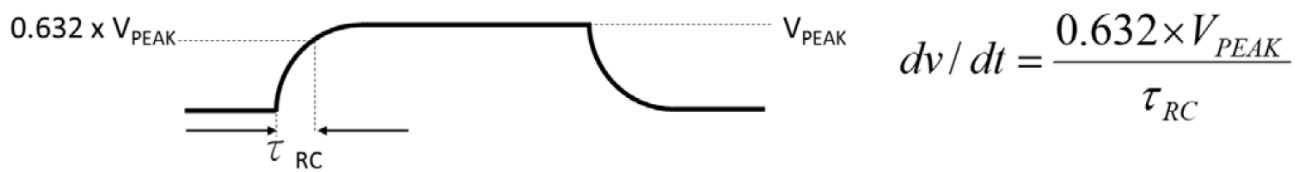
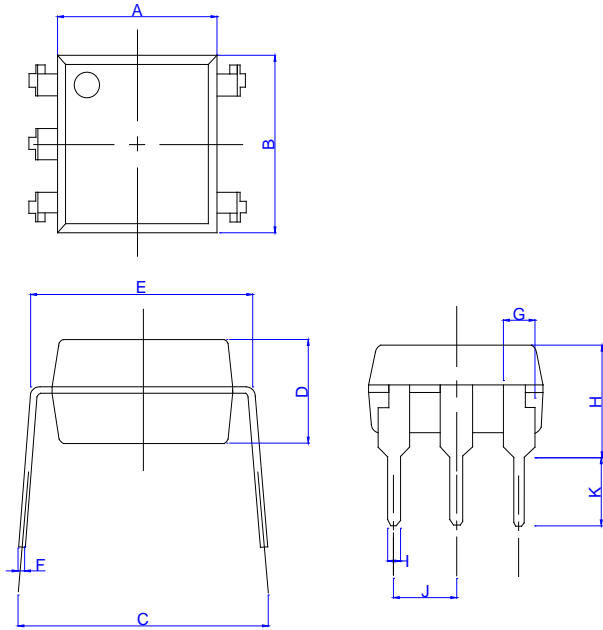


Fig.15: Waveforms of dV/dt



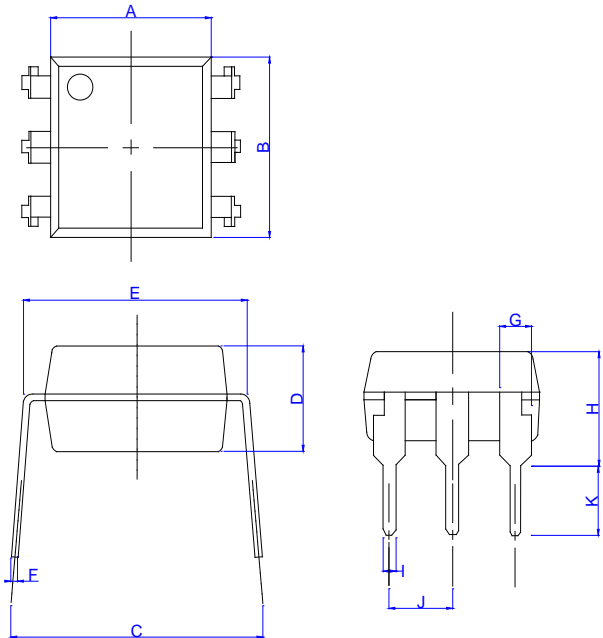
Package Dimension (Unit: mm)

Standard DIP5 Type:



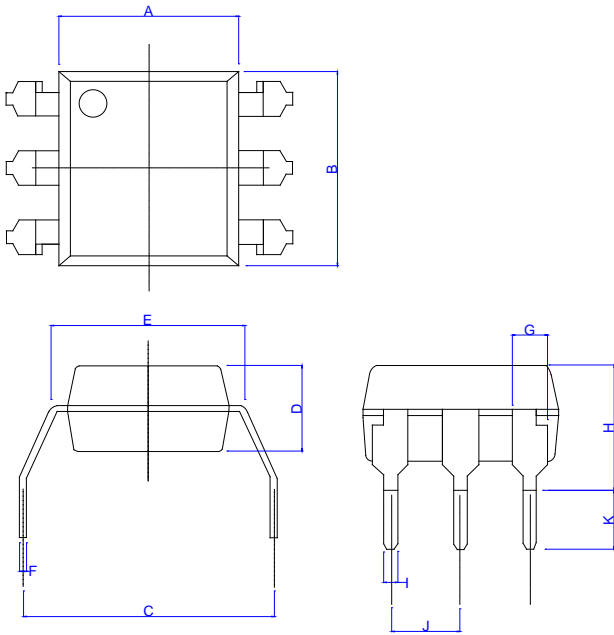
| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    | 6.30        |      | 6.70 | 0.249  |       | 0.265 |
| B    | 6.92        |      | 7.32 | 0.274  |       | 0.289 |
| C    | 7.62        |      | 9.50 | 0.301  |       | 0.375 |
| D    | 3.30        |      | 3.70 | 0.130  |       | 0.146 |
| E    | 7.32        |      | 7.92 | 0.289  |       | 0.313 |
| F    |             | 0.25 |      |        | 0.010 |       |
| G    | 1.20        |      | 1.40 | 0.047  |       | 0.055 |
| H    | 4.20        |      | 4.80 | 0.166  |       | 0.190 |
| I    |             | 0.50 |      |        | 0.020 |       |
| J    |             | 2.54 |      |        | 0.100 |       |
| K    |             | 2.80 |      |        | 0.111 |       |

Standard DIP6 Type:



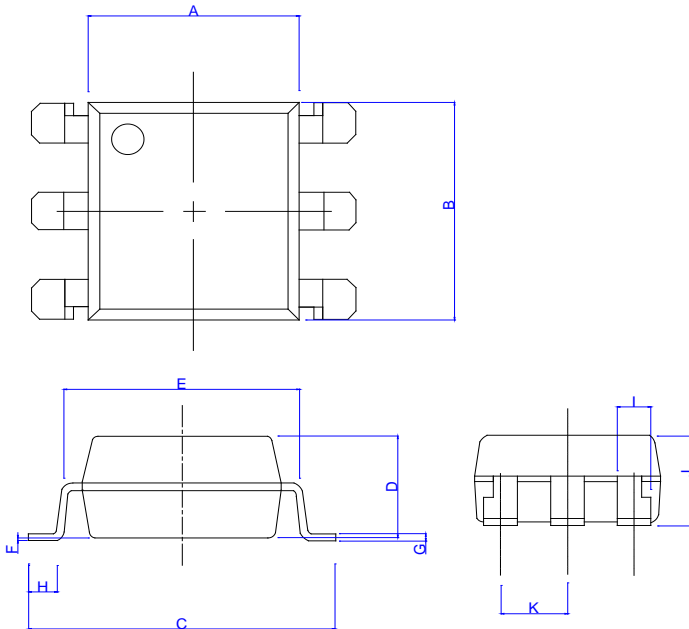
| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    | 6.30        |      | 6.70 | 0.249  |       | 0.265 |
| B    | 6.92        |      | 7.32 | 0.274  |       | 0.289 |
| C    | 7.62        |      | 9.50 | 0.301  |       | 0.375 |
| D    | 3.30        |      | 3.70 | 0.130  |       | 0.146 |
| E    | 7.32        |      | 7.92 | 0.289  |       | 0.313 |
| F    |             | 0.25 |      |        | 0.010 |       |
| G    | 1.20        |      | 1.40 | 0.047  |       | 0.055 |
| H    | 4.20        |      | 4.80 | 0.166  |       | 0.190 |
| I    |             | 0.50 |      |        | 0.020 |       |
| J    |             | 2.54 |      |        | 0.100 |       |
| K    | 2.50        |      | 3.10 | 0.099  |       | 0.123 |

Option M Type:



| Ref. | Dimensions  |      |       |        |       |       |
|------|-------------|------|-------|--------|-------|-------|
|      | Millimeters |      |       | Inches |       |       |
|      | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A    | 6.30        |      | 6.70  | 0.249  |       | 0.265 |
| B    | 6.92        |      | 7.32  | 0.274  |       | 0.289 |
| C    | 9.86        |      | 10.46 | 0.390  |       | 0.413 |
| D    | 3.30        |      | 3.70  | 0.130  |       | 0.146 |
| E    | 7.32        |      | 7.92  | 0.289  |       | 0.313 |
| F    |             | 0.25 |       |        | 0.010 |       |
| G    | 1.20        |      | 1.40  | 0.047  |       | 0.055 |
| H    | 4.28        |      | 4.88  | 0.169  |       | 0.193 |
| I    |             | 0.50 |       |        | 0.020 |       |
| J    |             | 2.54 |       |        | 0.100 |       |
| K    | 2.20        |      |       | 0.087  |       |       |

Option SL Type:

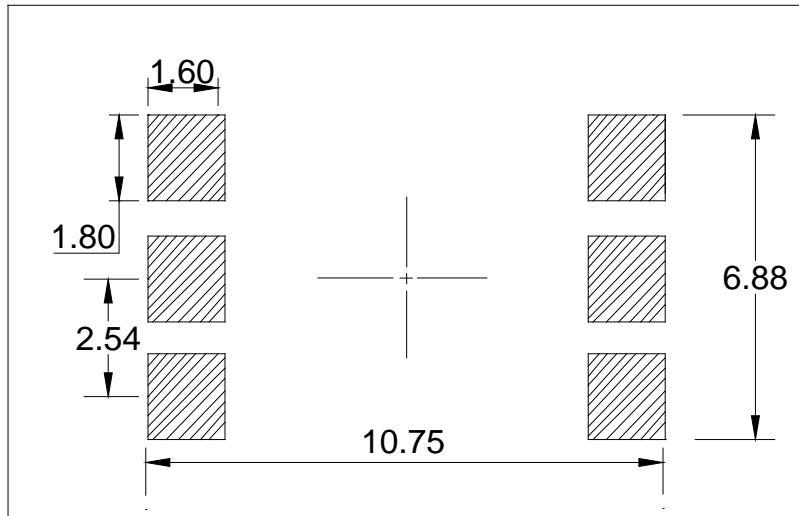


| Ref. | Dimensions  |      |       |        |       |       |
|------|-------------|------|-------|--------|-------|-------|
|      | Millimeters |      |       | Inches |       |       |
|      | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A    | 6.30        |      | 6.70  | 0.249  |       | 0.265 |
| B    | 6.92        |      | 7.32  | 0.274  |       | 0.289 |
| C    | 9.85        |      | 10.45 | 0.389  |       | 0.413 |
| D    | 3.30        |      | 3.70  | 0.130  |       | 0.146 |
| E    | 7.32        |      | 7.92  | 0.289  |       | 0.313 |
| F    |             | 0.10 |       |        | 0.004 |       |
| G    |             | 0.25 |       |        | 0.010 |       |
| H    |             | 0.80 |       |        | 0.032 |       |
| I    | 1.20        |      | 1.40  | 0.047  |       | 0.055 |
| J    | 3.30        |      | 3.90  | 0.130  |       | 0.154 |
| K    |             | 2.54 |       |        | 0.100 |       |



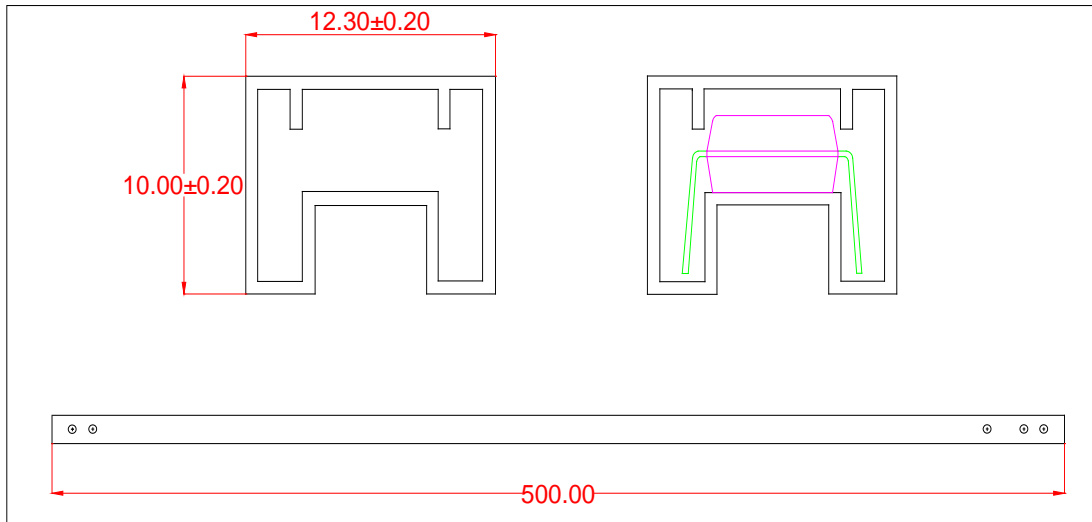
**RECOMMENDED SOLDER MASK (Dimensions in mm unless otherwise stated)**

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

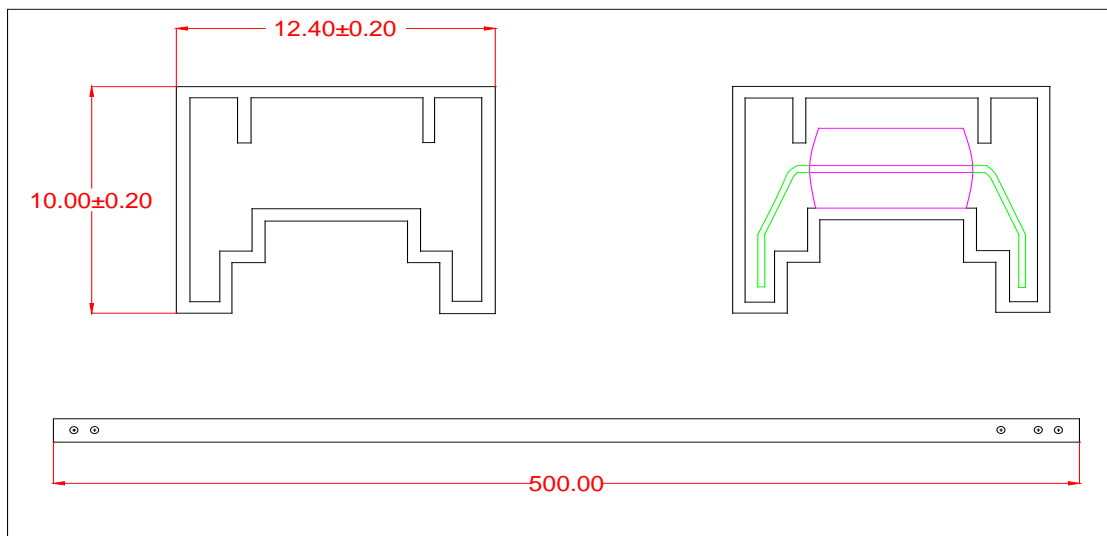


**TUBE SPECIFICATIONS (Dimensions in mm unless otherwise stated)**

**Standard DIP**

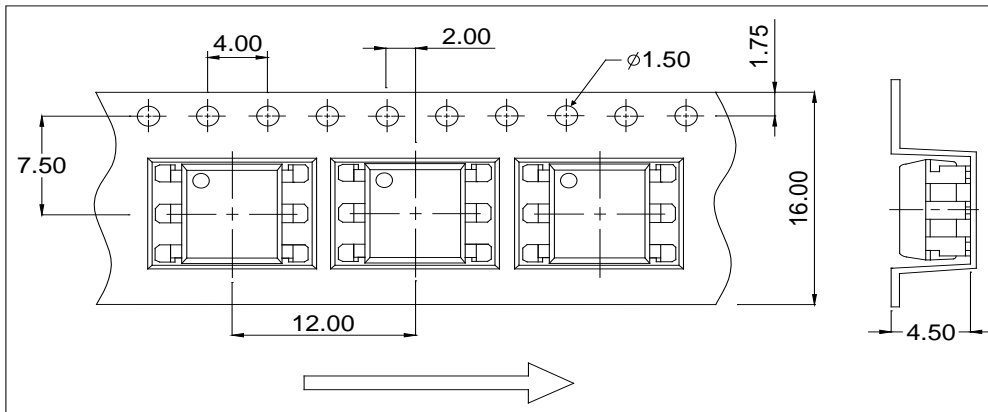


**Option M**



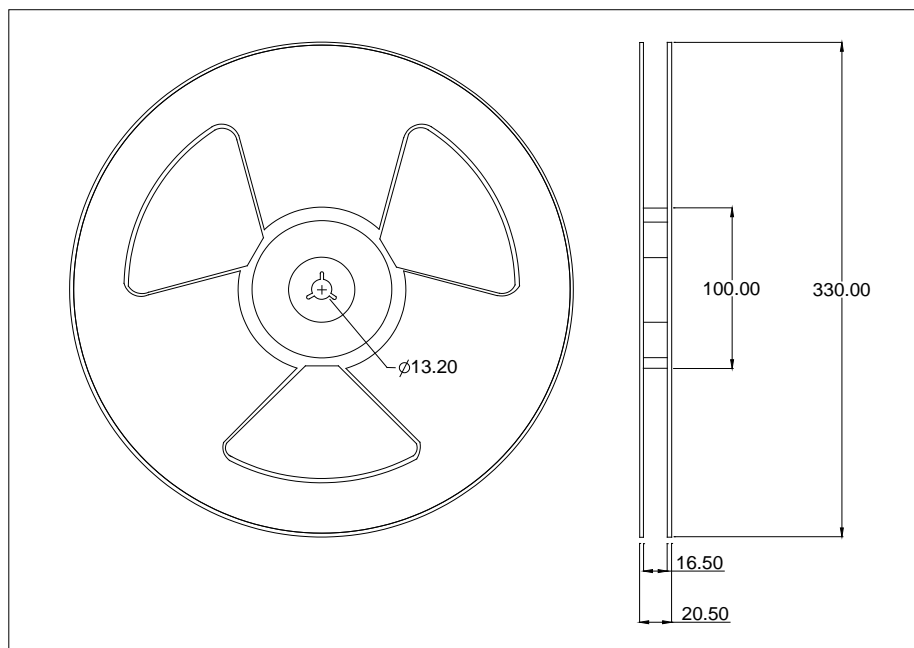
**CARRIER TAPE SPECIFICATIONS (Dimensions in mm unless otherwise stated)**

Option SL(T1)

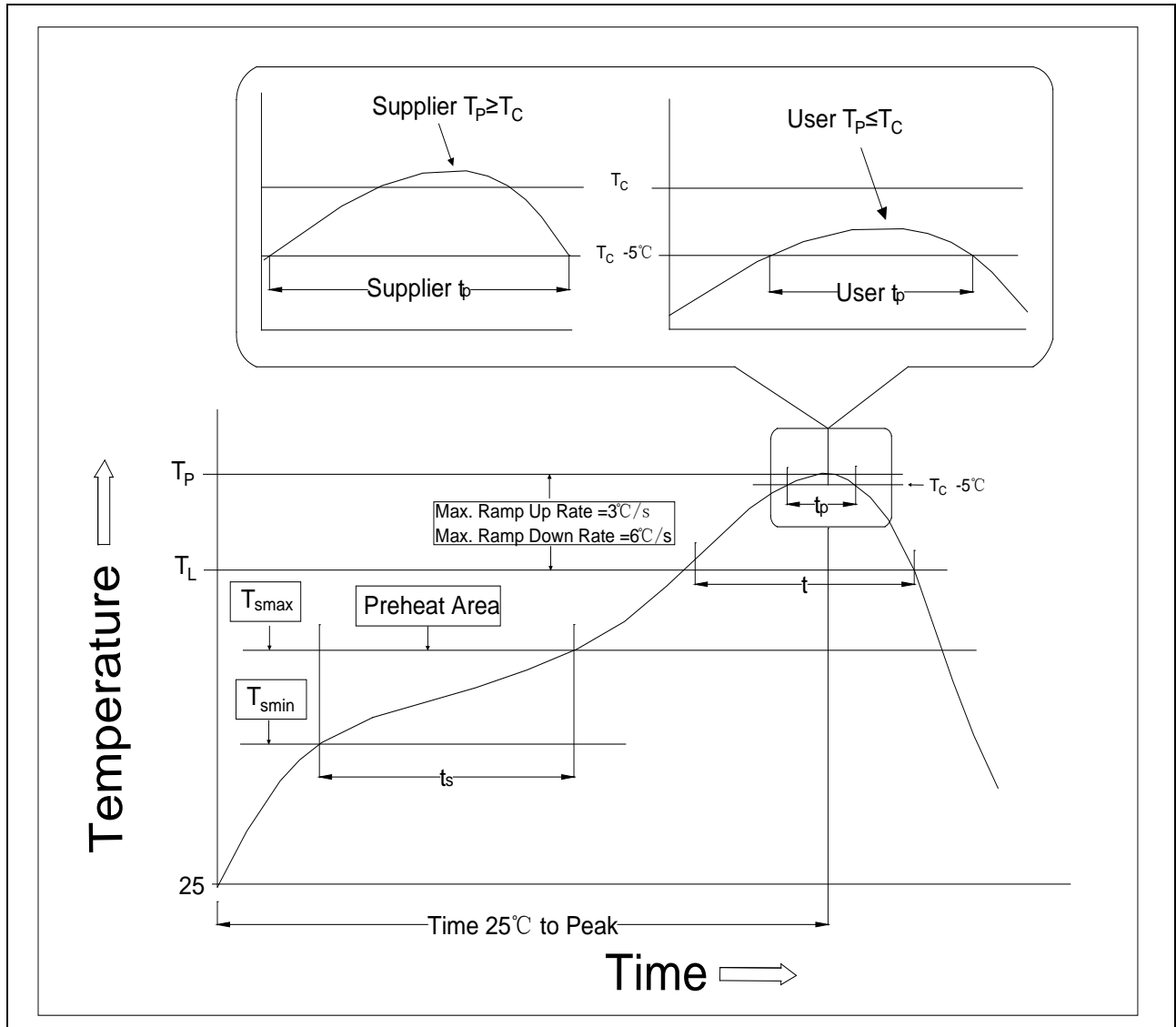


**REEL SPECIFICATIONS (Dimensions in mm unless otherwise stated)**

Option SL




REFLOW INFORMATION



| Profile Feature   | Sn-Pb Assembly Profile | Pb-Free Assembly Profile |
|---|------------------------|--------------------------|
| Temperature Min. (T <sub>smin</sub> )                                 | 100                    | 150°C                    |
| Temperature Max. (T <sub>smax</sub> )                                 | 150                    | 200°C                    |
| Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> ) | 60-120 seconds         | 60-120 seconds           |
| Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )                      | 3°C/second max.        | 3°C/second max.          |
| Liquidous Temperature (T <sub>L</sub> )                               | 183°C                  | 217°C                    |
| Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )             | 60-150 seconds         | 60-150 seconds           |
| Peak Body Package Temperature   | 235°C+0°C/-5°C         | 260°C+0°C/-5°C           |
| Time (t <sub>P</sub> ) within 5°C of 260°C                            | 20 seconds             | 30 seconds               |
| Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )                    | 6°C/second max.        | 6°C/second max.          |
| Time 25°C to Peak Temperature   | 6 minutes max.         | 8 minutes max.           |

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