

**QT-Brightek Optocoupler Series**

**RANDOM-PHASE TRIAC OPTOCOUPLER**

**Part No.: Q301X / Q302X Series**

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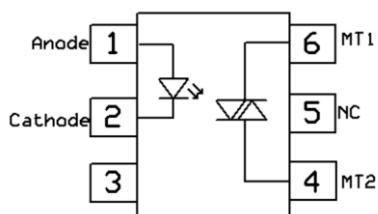
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## Introduction

### Feature:

- High isolation voltage between input and output (Viso=5000Vrms)
- Peak breakdown voltage  
250V: Q3010, Q3011, Q3012  
400V: Q3020, Q3021, Q3022, Q3023
- Operating Temperature up to 100 °C
- Available in Tube or Tape and reel
- Available with standard DIP-6, Gullwing lead bend, SMD lead bend and SMD low profile

### Schematic:



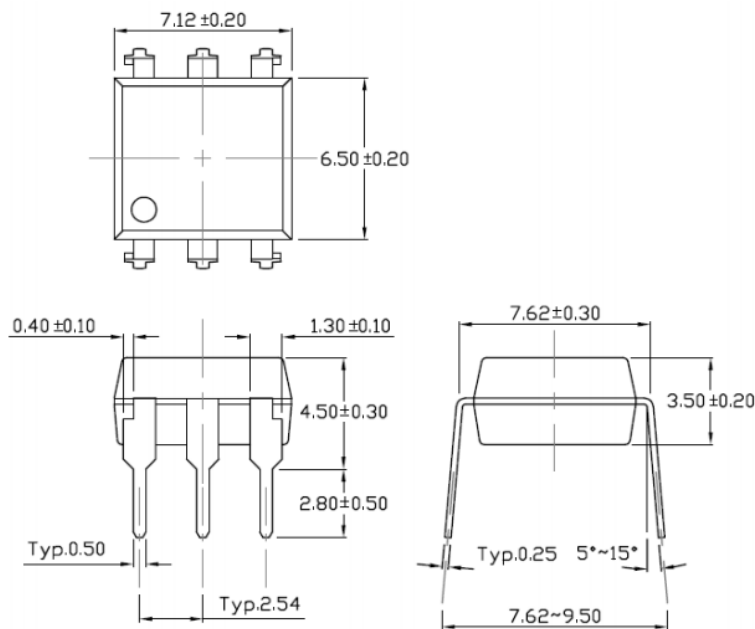
### Certification & Compliance:

- Pb free and RoHS Compliant
- UL recognized (File # E338132)
- VDE recognized (Pending Approval)

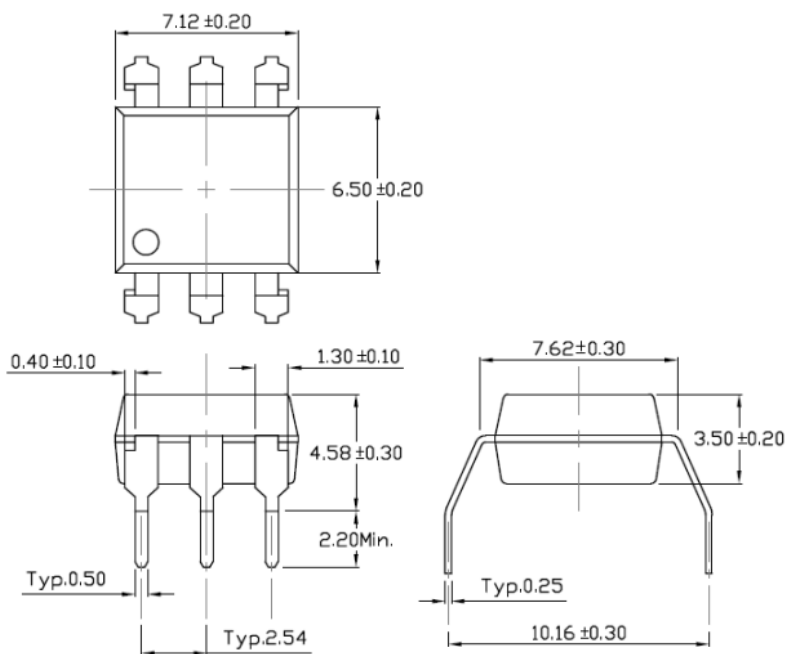


### Dimension: (Dot location indicates pin 1)

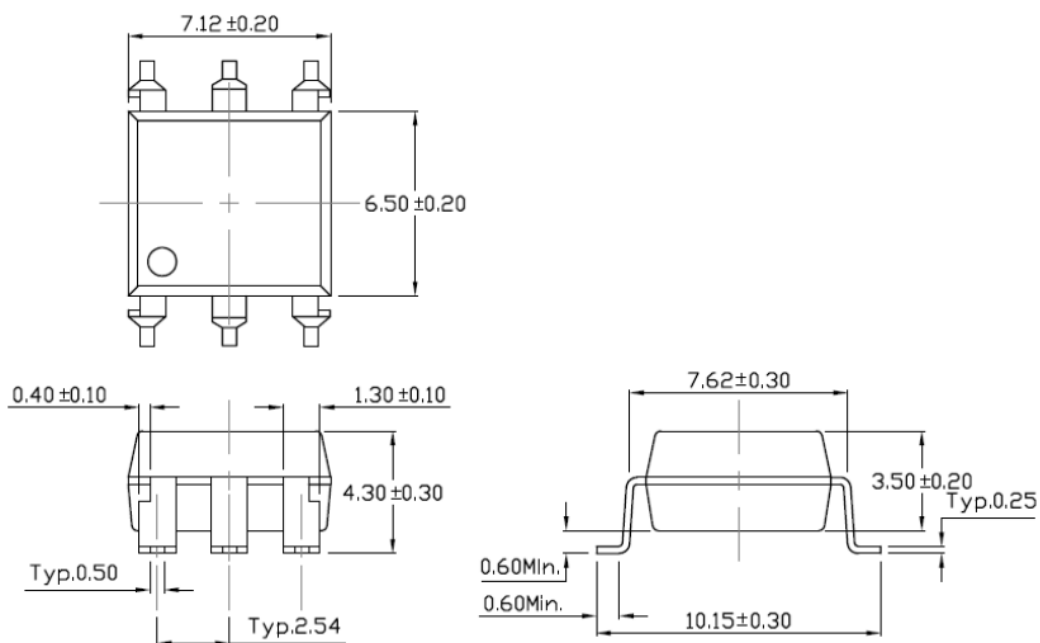
#### 6-Pin Dip (standard):



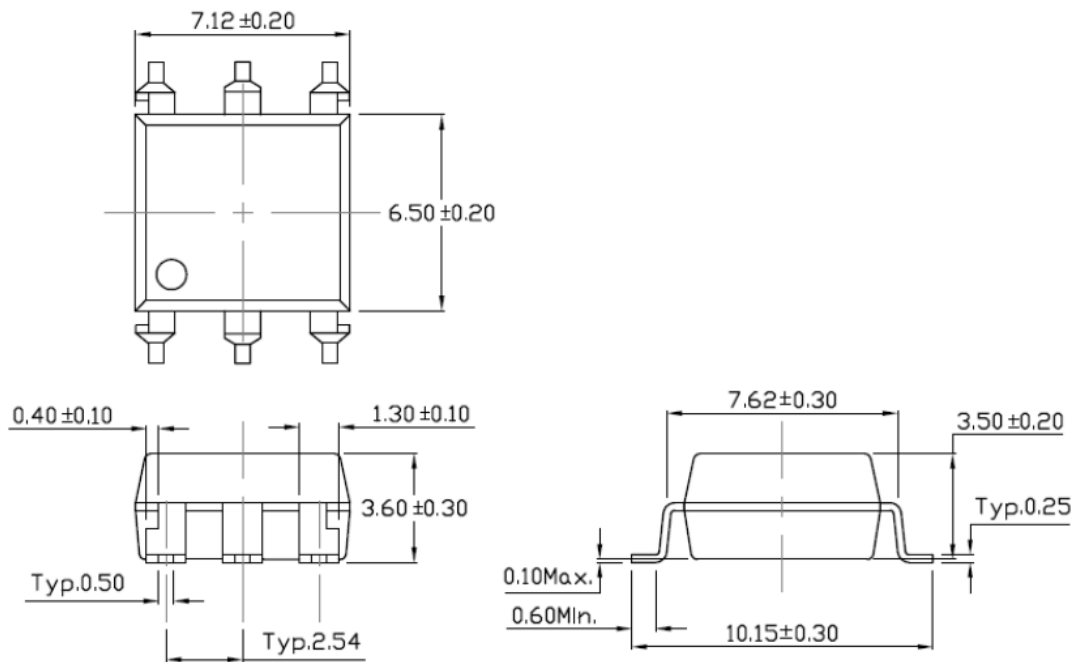
**Wide lead bend (Option M):**



**SMD lead bend (Option S):**



SMD (Low Profile) Bend (Option SL):



All Dimensions are in mm

## Absolute Maximum Rating

| Symbol           | Parameter                                |              | Rating         | Units            |
|------------------|------------------------------------------|--------------|----------------|------------------|
| V <sub>ISO</sub> | Isolation Voltage                        |              | 5000           | V <sub>RMS</sub> |
| T <sub>OPR</sub> | Operating Temperature                    |              | -55 ~ +100     | °C               |
| T <sub>STG</sub> | Storage Temperature                      |              | -55 ~ +150     | °C               |
| T <sub>SOL</sub> | Lead Solder Temperature                  |              | 260 for 10 sec | °C               |
| EMITTER          |                                          |              |                |                  |
| I <sub>F</sub>   | Continuous Forward Current               |              | 60             | mA               |
| I <sub>FP</sub>  | Peak Forward Current (≤1us, P.W, 300pps) |              | 1              | A                |
| V <sub>R</sub>   | Reverse Voltage                          |              | 6              | V                |
| P <sub>D</sub>   | Power Dissipation                        |              | 100            | mW               |
| DETECTOR         |                                          |              |                |                  |
| P <sub>D</sub>   | Power Dissipation                        |              | 300            | mW               |
| V <sub>DRM</sub> | Off-state Output Terminal Voltage        | Q301X series | 250            | V                |
|                  |                                          | Q302X series | 400            |                  |
| I <sub>TSM</sub> | Peak Repetitive Surge Current            |              | 1              | A                |

## Electrical Characteristic ( $T_A=25^\circ C$ )

### Emitter

| Symbol   | Characteristic    | Test Condition | Range |      |      | Unit    |
|----------|-------------------|----------------|-------|------|------|---------|
|          |                   |                | Min.  | Typ. | Max. |         |
| $V_F$    | Forward Voltage   | $I_F=10mA$     | -     | -    | 1.5  | V       |
| $I_R$    | Reverse Current   | $V_R=6V$       | -     | -    | 5    | $\mu A$ |
| $C_{IN}$ | Input Capacitance | $f=1MHz$       | -     | 45   | -    | pF      |

### Detector

| Symbol    | Characteristic                          | Test Condition                           | Range |     |     | Unit       |
|-----------|-----------------------------------------|------------------------------------------|-------|-----|-----|------------|
|           |                                         |                                          | Min   | Typ | Max |            |
| $I_{DRM}$ | Peak Blocking Current                   | $V_{DRM}=\text{Rated } V_{DRM}, I_F=0mA$ | -     | -   | 100 | nA         |
| $V_{TM}$  | Peak On-state Voltage                   | $I_{TM}=100mA, I_F=\text{Rated } I_{FT}$ | -     | -   | 2.5 | V          |
| $dv/dt$   | Critical Rate of Rise Off-State Voltage | $V_{PEAK}=\text{Rated } V_{DRM}$         | -     | 100 | -   | V/ $\mu s$ |

### Transfer Characteristic

| Symbol          | Characteristic        | Device          | Test Condition                                        | Range              |      |     | Unit |
|-----------------|-----------------------|-----------------|-------------------------------------------------------|--------------------|------|-----|------|
|                 |                       |                 |                                                       | Min                | Typ  | Max |      |
| I <sub>FT</sub> | LED Trigger Current   | Q3020           | Main terminal voltage = 3V,<br>I <sub>TM</sub> =100mA | -                  | -    | 30  | mA   |
|                 |                       | Q3010,<br>Q3021 |                                                       | -                  | -    | 15  |      |
|                 |                       | Q3011,<br>Q3022 |                                                       | -                  | -    | 10  |      |
|                 |                       | Q3012,<br>Q3023 |                                                       | -                  | -    | 5   |      |
| I <sub>H</sub>  | Holding Current       |                 |                                                       | -                  | 250  | -   | μA   |
| R <sub>IO</sub> | Isolation Resistance  |                 | V <sub>IO</sub> =500V <sub>DC</sub>                   | 1x10 <sup>11</sup> | -    | -   | Ω    |
| C <sub>IO</sub> | Isolation Capacitance |                 | f=1MHz                                                | -                  | 0.25 | -   | pF   |

## Characteristic Curves

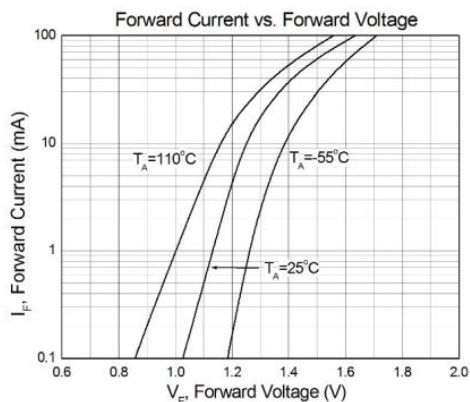


Figure 1

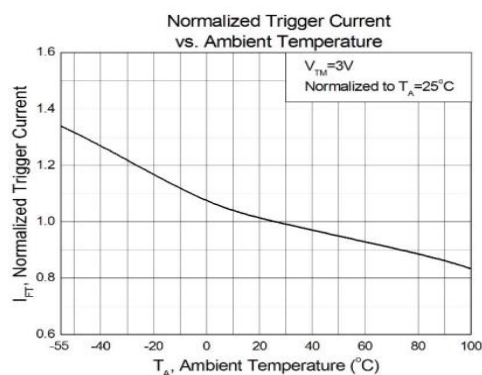


Figure 2

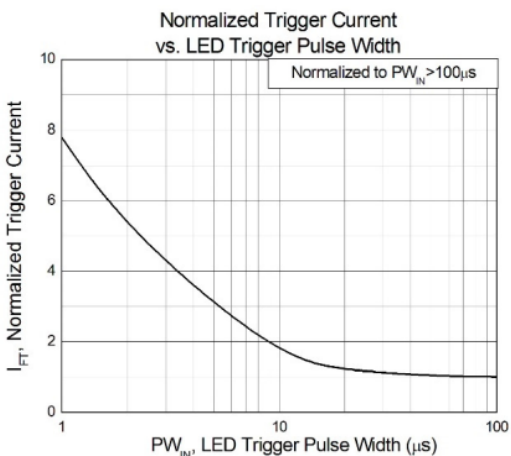


Figure 3

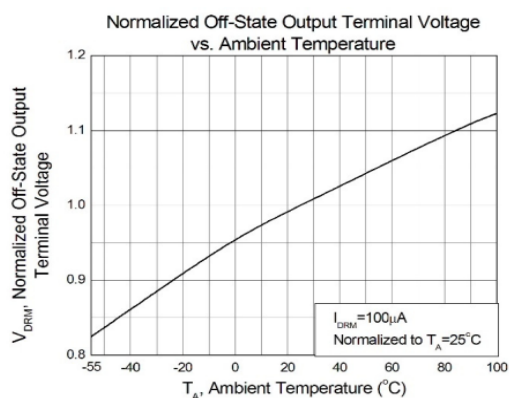


Figure 4

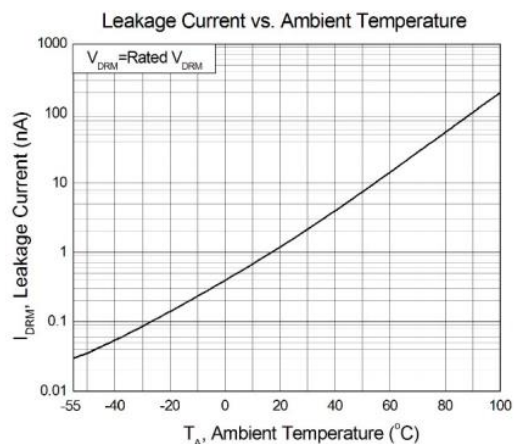


Figure 5

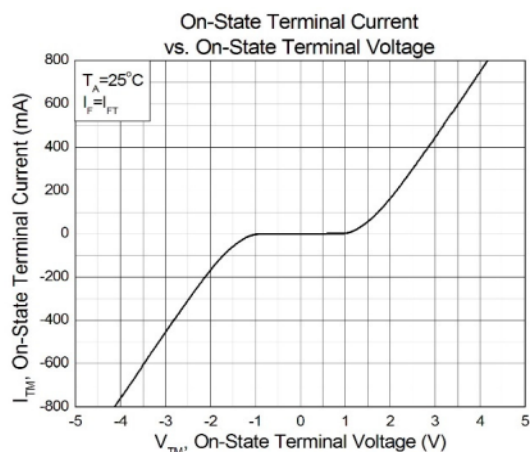
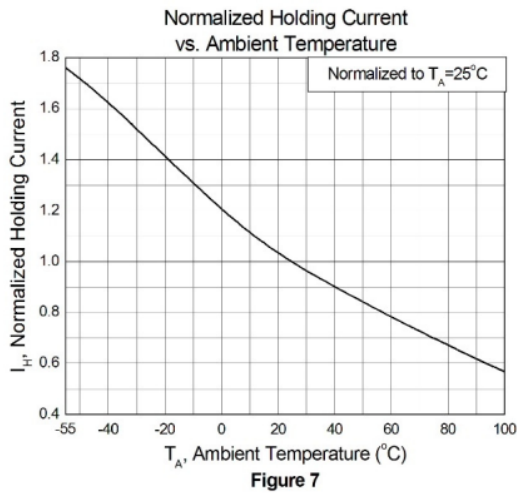
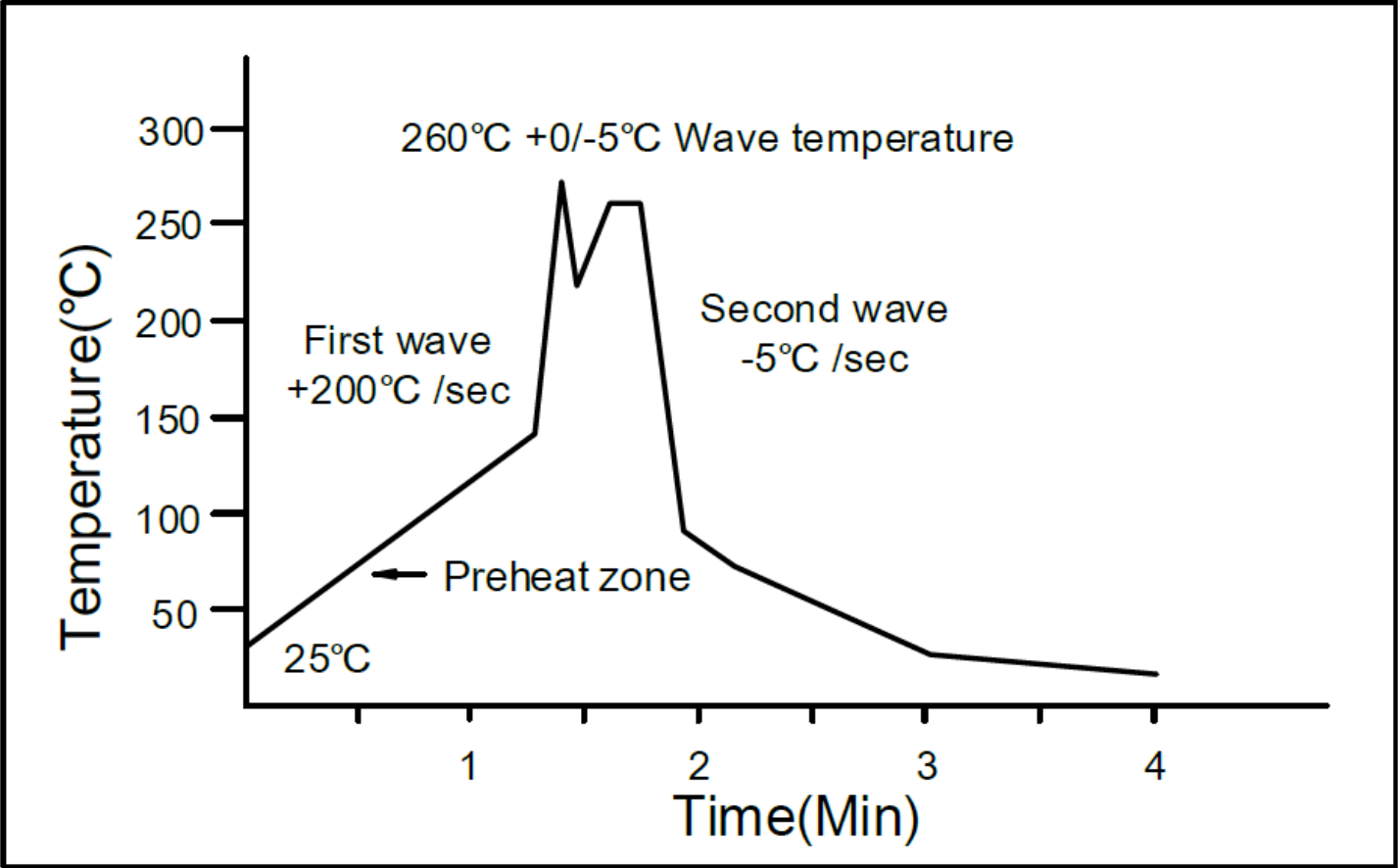


Figure 6



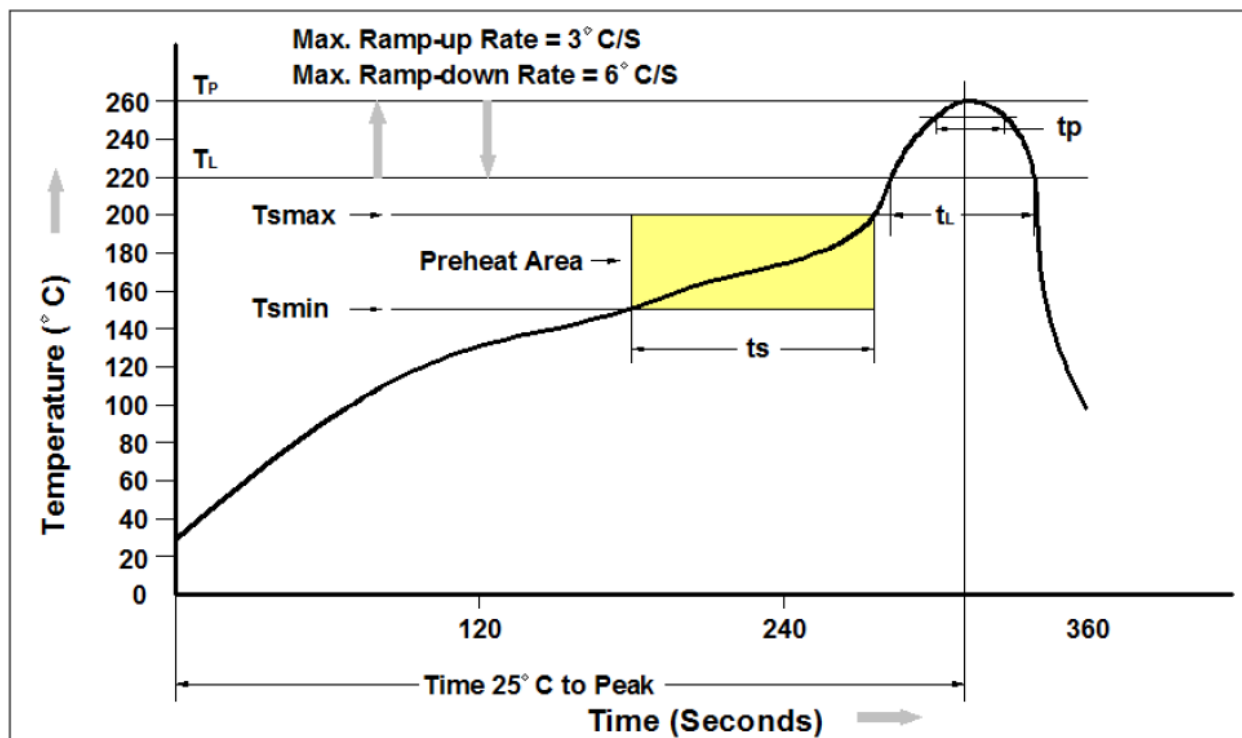
Solder Profile & Footprint

Recommended Wave Soldering Profile



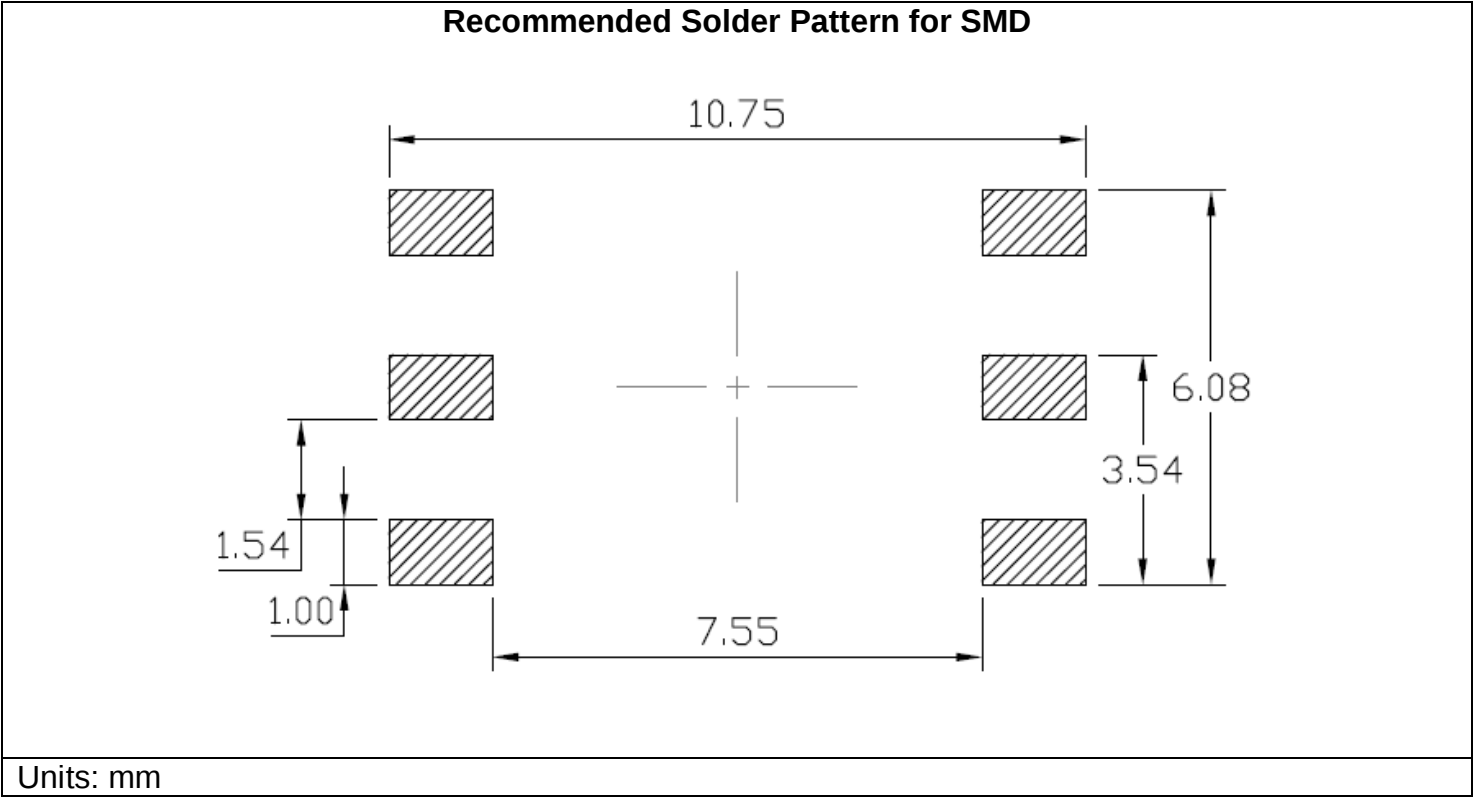
Temperature: 260 +0/-5 °C  
 Time: 10 Sec  
 Preheat temperature: 25 to 140 °C  
 Preheat time: 30 to 80 sec.

**Recommended Reflow Soldering Profile**



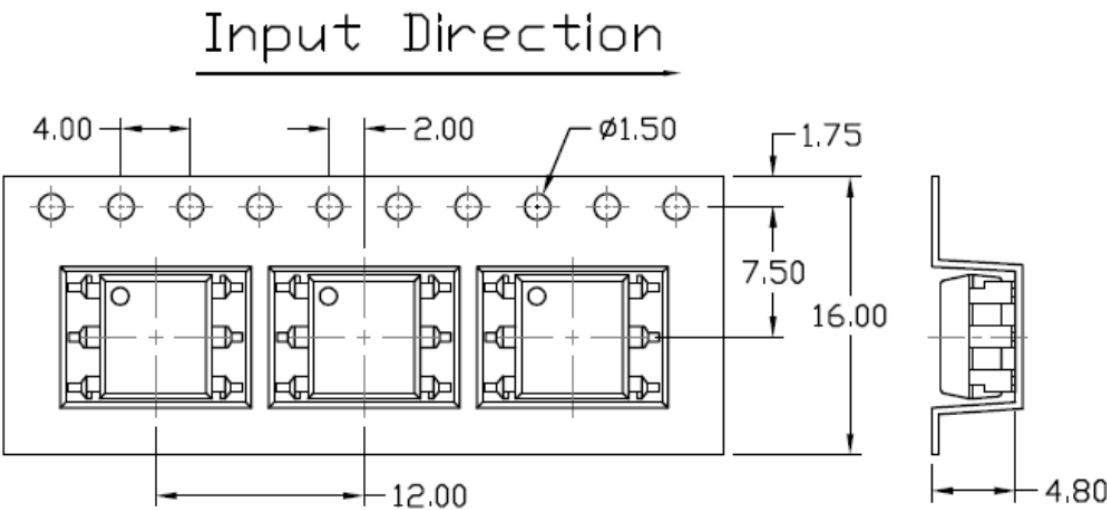
| Profile Feature                                           | Pb-Free Assembly Profile |
|-----------------------------------------------------------|--------------------------|
| Temperature Min. (T <sub>sm</sub> )                       | 150°C                    |
| Temperature Max. (T <sub>sl</sub> )                       | 200°C                    |
| Time (ts) from (T <sub>sm</sub> to T <sub>sl</sub> )      | 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.           |

Solder Profile & Footprint



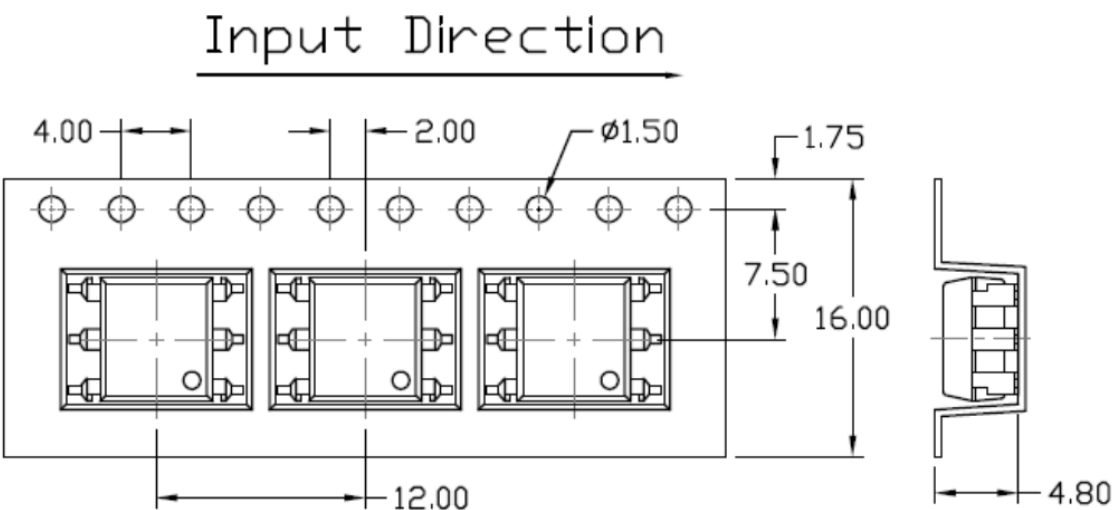
Packing & Labeling

Option 1: ST1 & SLT1



Unit: mm

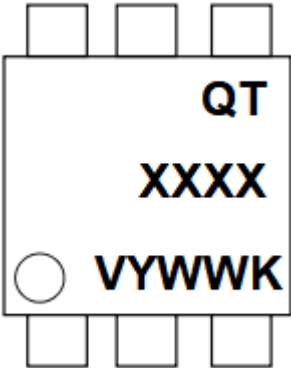
Option 2: ST2 & SLT2



Unit: mm

**Device Marking**

Example



QT = QT-Brightek Corporation  
XXXX = Part Number (3010, 3011, 3012, 3020, 3021, 3022, 3023)  
V = VDE Option  
Y = Year  
WW = Week  
K = Manufacturing code

## Ordering Information

Q301XVYZ, Q302XVYZ

X = Part number (QT301X, X=0, 1, 2) (QT302X, X=0, 1, 2, 3)

V = VDE option (V or None)

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

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

| Option | Description                                           | Quantity       |
|--------|-------------------------------------------------------|----------------|
| None   | Standard 6-Pin DIP                                    | 50 units/tube  |
| M      | Gullwing Lead Bend                                    | 50 units/tube  |
| ST1    | Surface Mount Lead Forming – with Option 1 Taping     | 1000 pcs/ reel |
| ST2    | Surface Mount Lead Forming – with Option 2 Taping     | 1000 pcs/ reel |
| SLT1   | SMD (Low Profile) Lead Forming – with Option 1 Taping | 1000 pcs/ reel |
| SLT2   | SMD (Low Profile) Lead Forming – with Option 2 Taping | 1000 pcs/ reel |

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## Revision History

| Description:                                                          | Revision # | Revision Date |
|-----------------------------------------------------------------------|------------|---------------|
| Initial of Q301X /Q302X/Q305X series                                  | 1.0        | 4/22/2010     |
| Feature, Certification & Compliance, and ordering information updates | 1.1        | 02/01/2011    |
| Update format and packing spec                                        | 1.2        | 02/19/2014    |
| Update specs, format, and packing method, and part number             | 2.0        | 03/16/2018    |
|                                                                       |            |               |

## Disclaimer

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.