# QT-Brightek Optocoupler Series

## 10Mbit/s High Speed Logic Gate Optocoupler

## Part No.: 6N137, QT2601

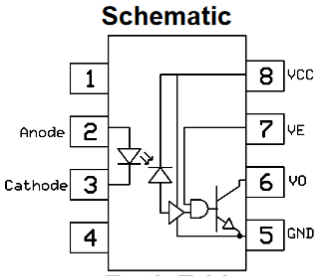
**Table of Contents:**

# Introduction

**Feature:**

- High Speed 10Mbit/s
- High Isolation voltage between input and output (Viso = 5000V rms)
- Creepage distance > 7.4mm
- Available in Tube or Tape and reel
- Available with standard DIP-8, Gullwing lead bend, SMD lead bend, and SMD low profile options.

**Schematic:**



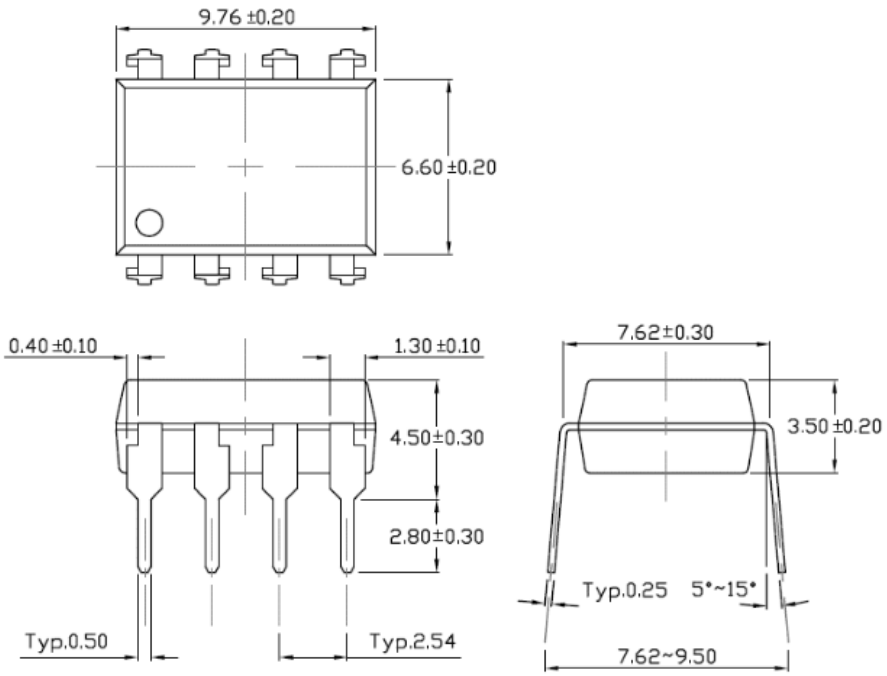

**Truth Table**

| Input | Enable | Output |
|---|---|---|
| H | H | L |
| L | H | H |
| H | L | H |
| L | L | H |
| H | NC | L |
| L | NC | H |

## Certification & Compliance:

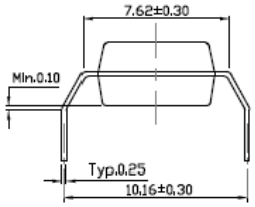
- Pb free and RoHS Compliant
- UL recognized (File #E338132)
- VDE (File #40030457)

Package Dimension

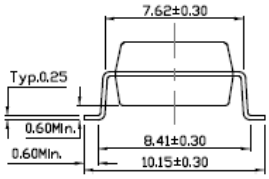


Forming Option

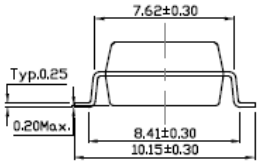
M Type



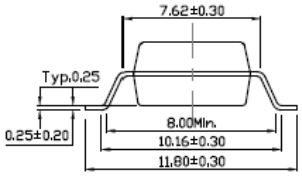

S Type




SL Type




SLM Type




Unit: mm

## Absolute Maximum Rating

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{ISO}$ | Isolation Voltage* | 5000 | $V_{RMS}$ |
| $T_{STG}$ | Storage Temperature | -55 ~ +125 | ºC |
| $T_{OPR}$ | Operating Temperature | -55 ~ +100 | ºC |
| $T_{SOL}$ | Lead Solder Temperature | 260 for 10 sec | ºC |
| **EMITTER** | | | |
| $I_F$ | Forward Current | 50 | mA |
| $V_R$ | Reverse Voltage | 5 | V |
| $P_I$ | Power Dissipation | 100 | mW |
| **DETECTOR** | | | |
| $P_O$ | Power Dissipation | 85 | mW |
| $I_O$ | Average Output current | 50 | mA |
| $V_O$ | Output voltage** | 3.0 ~ 7.0 | V |
| $V_{CC}$ | Supply voltage | 3.0 ~ 7.0 | V |
| VE | Enable Input Voltage Not to Exceed VCC by more than 500mW | 5.5 | V |

# Electrical Characteristic

Typical values are measured at $T_A$=25°C and Vcc=5V

**Emitter**

| Symbol | Characteristics | Test Condition | Range | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $V_F$ | Forward Voltage | $I_F$ =10mA | - | 1.4 | 1.6 | V |
| $V_R$ | Reverse Voltage | $I_R$= 10μA | 5.0 | - | - | V |
| $\Delta V_F/\Delta T_A$ | Temperature coefficient of forward voltage | $I_F$ =10mA | - | -1.8 | - | mV/°C |

**Detector**

| Symbol | Characteristic | Test Condition | Range | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $I_{CCH}$ | Logic High Supply Current | $I_F$=0mA, $V_E$=0.5V, $V_{CC}$=3.3V | - | 4.0 | 10 | mA |
| | | $I_F$=0mA, $V_E$=0.5V, $V_{CC}$=5.5V | - | 6.5 | 10 | |
| $I_{CCL}$ | Logic Low Supply Current | $I_F$=10mA, $V_E$=0.5V, $V_{CC}$ =3.3V | - | 5.5 | 13 | mA |
| | | $I_F$=10mA, $V_E$=0.5V, $V_{CC}$ =5.5V | | 8.8 | 13 | |
| $V_{EH}$ | High Level Enable Voltage | $I_F$=10mA, $V_{CC}$ =3.3V | 2.0 | - | - | V |
| | | IF=10mA, $V_{CC}$=5.5V | 2.0 | - | - | |
| $V_{EL}$ | Low Level Enable Voltage | $I_F$=10mA, $V_{CC}$ =3.3V | - | - | 0.8 | V |
| | | IF=10mA, $V_{CC}$=5.5V | - | - | 0.8 | |
| $I_{EH}$ | High Level Enable Current | $V_E$=2.0V, $V_{CC}$=3.3V | - | -0.2 | -1.6 | mA |
| | | $V_E$=2.0V, $V_{CC}$=5.5V | | -0.53 | -1.6 | |
| $I_{EL}$ | Low Level Enable Current | $V_E$=0.5V, $V_{CC}$=3.3V | - | -0.42 | -1.6 | mA |
| | | $V_E$=0.5V, $V_{CC}$=5.5V | - | -0.75 | -1.6 | |

## Transfer Characteristics

| Symbol | Characteristic | Test Condition | Range | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $I_{FT}$ | Input Threshold Current | $V_{CC}$=3.3V, $V_O$=0.6V, $V_E$=2.0V, $I_O$=13mA | - | 1.6 | 5 | mA |
| | | $V_{CC}$=5.5V, $V_O$=0.6V, $V_E$=2.0V, $I_O$=13mA | | 2.5 | 5 | |
| $I_{OH}$ | Logic High Output Current | $I_F$=250μA, $V_O$=$V_{CC}$=3.3V, $V_E$=2.0V | - | 7.0 | 100 | μA |
| | | $I_F$=250μA, $V_O$=$V_{CC}$=5.5V, $V_E$=2.0V | | 2.0 | 100 | |
| $V_{OL}$ | Logic Low Output Voltage | $I_F$=5mA, $I_O$=13mA, $V_{CC}$=3.3V, $V_E$=2.0V | - | 0.45 | 0.6 | V |
| | | $I_F$=5mA, $I_O$=13mA, $V_{CC}$=5.5V, $V_E$=2.0V | | 0.35 | 0.6 | |

## Switching Characteristics (TA=25°C, Vcc=5V)

| Symbol | Characteristic | Test Condition | Range | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $T_{PHL}$ | Propagation Delay Time Logic High to Logic Low | $C_L$= 15pF, RL= 350Ω $V_{CC}$=3.3V | - | 34 | 75 | ns |
| | | $C_L$= 15pF, RL= 350Ω $V_{CC}$=5.5V | | | | |
| $T_{PLH}$ | Propagation Delay Time Logic Low to Logic High | $C_L$= 15pF, RL= 350Ω $V_{CC}$=3.3V | - | 50 | 75 | |
| | | $C_L$= 15pF, RL= 350Ω $V_{CC}$=5.5V | | 39 | 75 | |
| $P_{WD}$ | Pulse Width Distortion | $C_L$= 15pF, RL= 350Ω $V_{CC}$=3.3V | - | 16 | 34 | |
| | | $C_L$= 15pF, RL= 350Ω $V_{CC}$=5.5V | | 5 | 34 | |
| $T_r$ | Output Rise Time | $C_L$= 15pF, RL= 350Ω $V_{CC}$=3.3V | - | 37 | - | |
| | | $C_L$= 15pF, RL= 350Ω $V_{CC}$=5.5V | | | | |
| $T_f$ | Output Fall Time | $C_L$= 15pF, RL= 350Ω $V_{CC}$=3.3V | - | 10 | - | |
| | | $C_L$= 15pF, RL= 350Ω $V_{CC}$=5.5V | | | | |
| $T_{ELH}$ | Enable Propagation Delay Low To High | $V_{EH}$=3.5V, $C_L$=15pF, $R_L$=350Ω | - | 15 | - | ns |
| $T_{EHL}$ | Enable Propagation Delay High To Low | | - | 15 | - | ns |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $CM_H$ | Common Mode Transient Immunity at Logic High | 6N137 | $I_F$=0mA, $V_{CM}$=50Vp-p, $V_{OH}$=2.0V, $R_L$=350Ω | - | 10000 | - | V/μs |
| | | QT2601 | | 5000 | 10000 | - | |
| $CM_L$ | Common Mode Transient Immunity at Logic Low | 6N137 | $I_F$=7.5mA, $V_{CM}$=50Vp-p, $V_{OH}$=0.8V, $R_L$=350Ω | - | 10000 | - | |
| | | QT2601 | | 5000 | 10000 | - | |

## Characteristic Curves

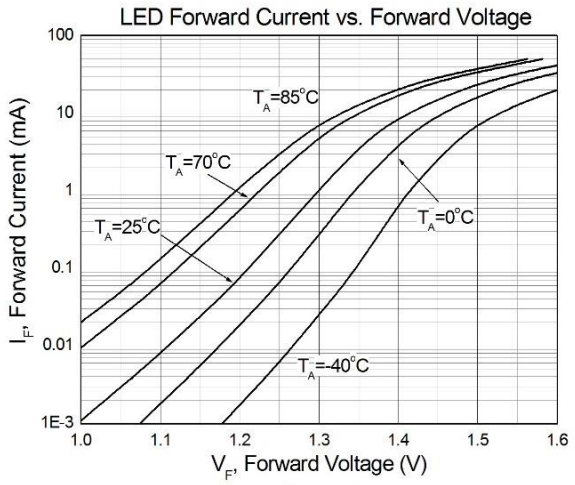


Figure 1

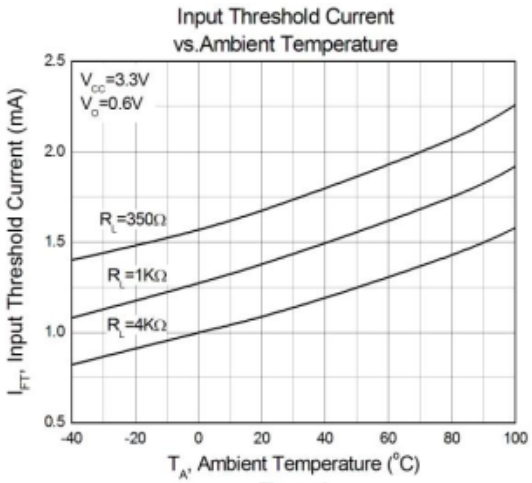


Figure 2

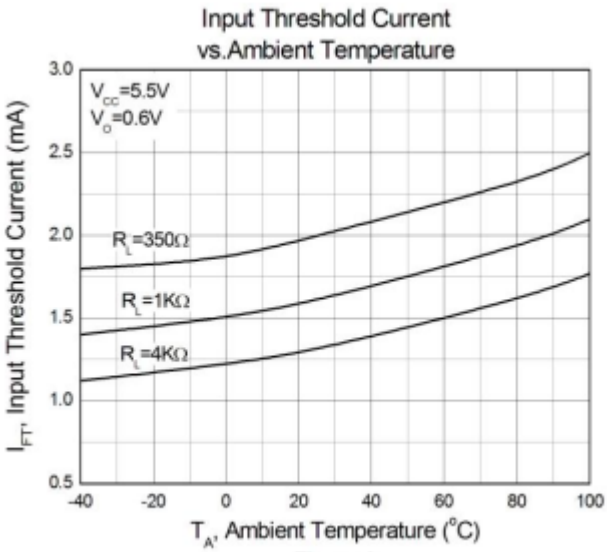


Figure 3

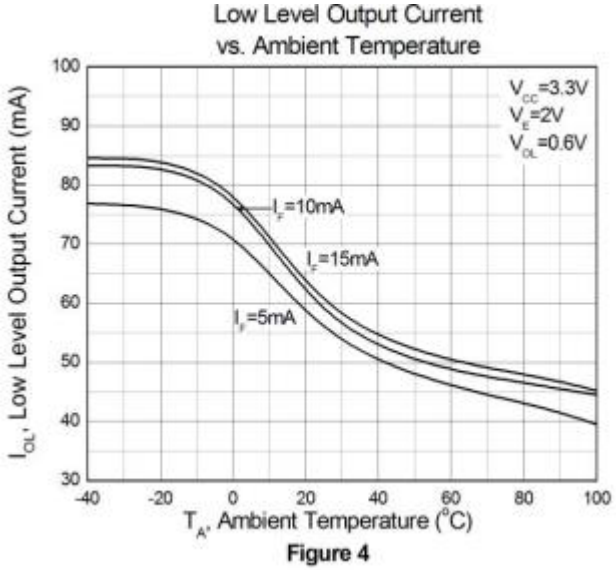


Figure 4

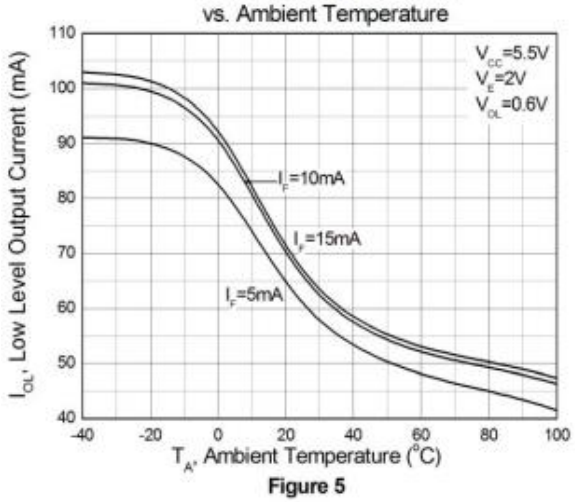



**Figure 5**

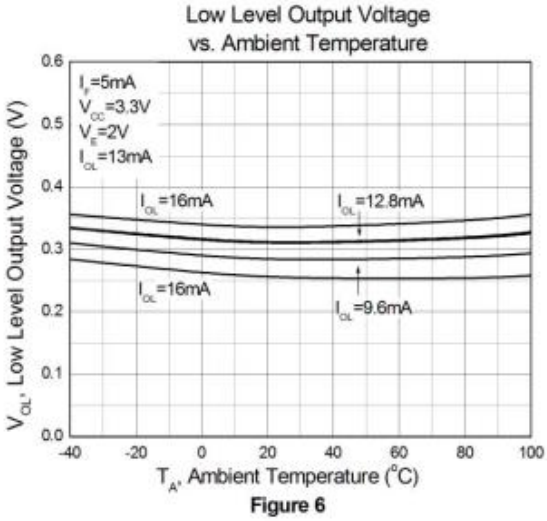



**Figure 6**

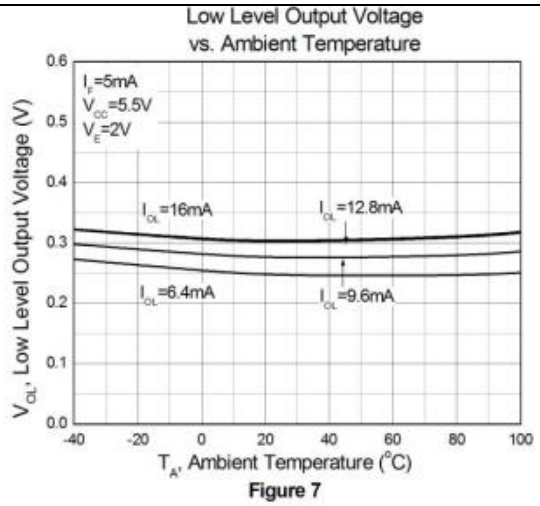



**Figure 7**

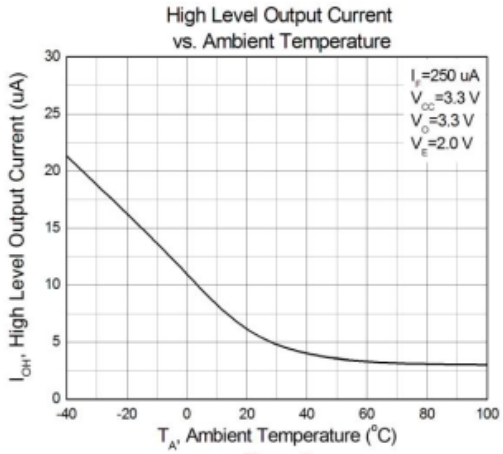



**Figure 8**

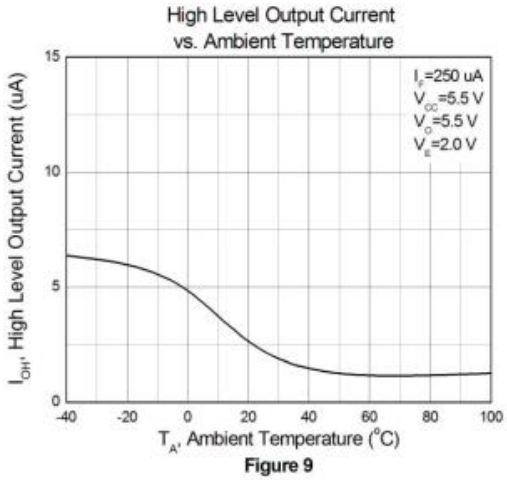
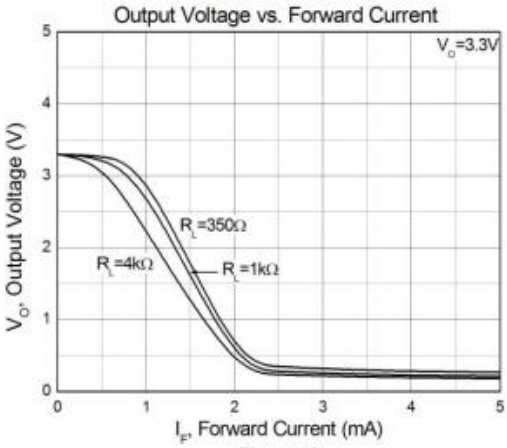



**Figure 9**

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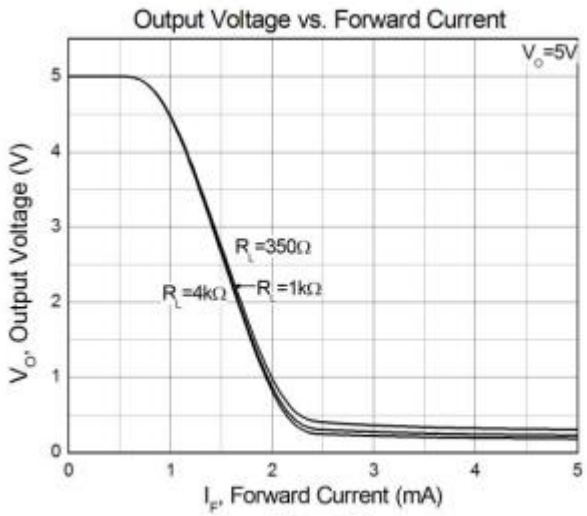
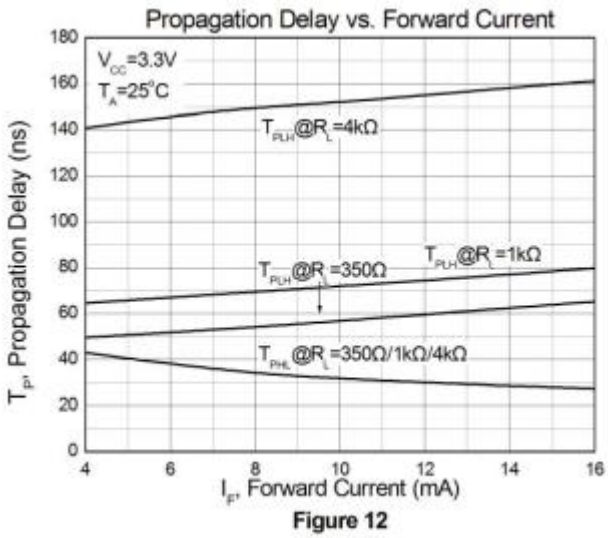


**Figure 11**



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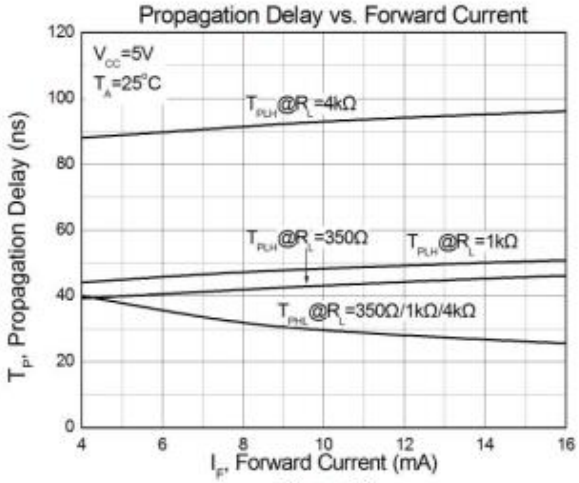
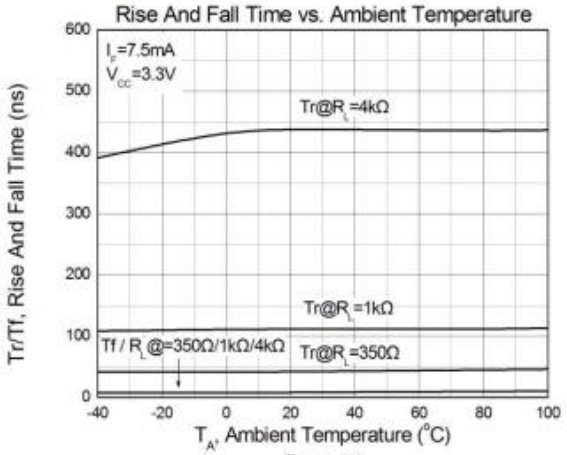
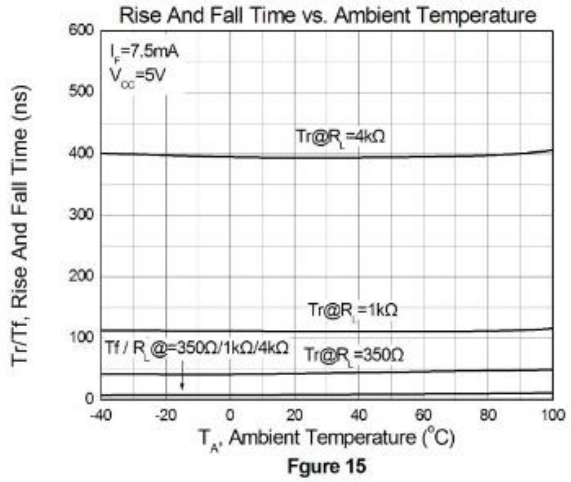


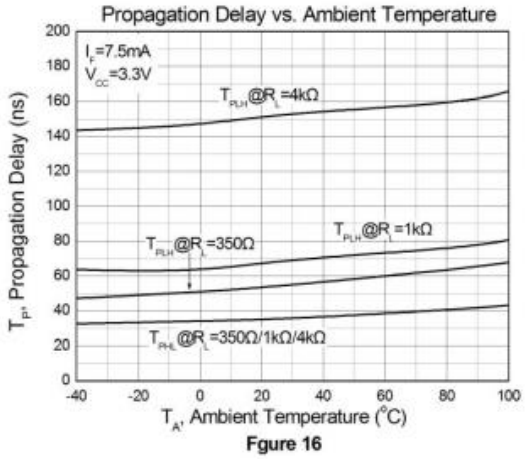
**Figure 13**



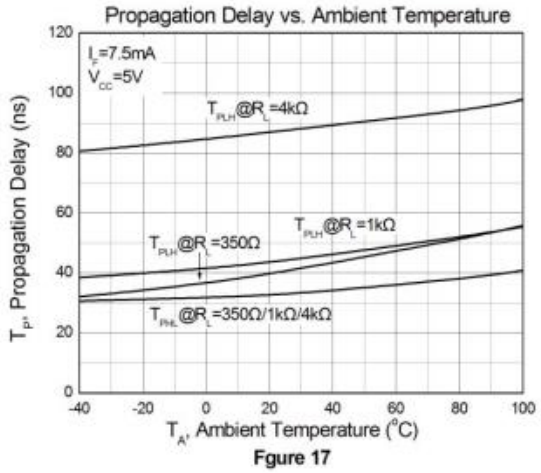
**Fgure 14**



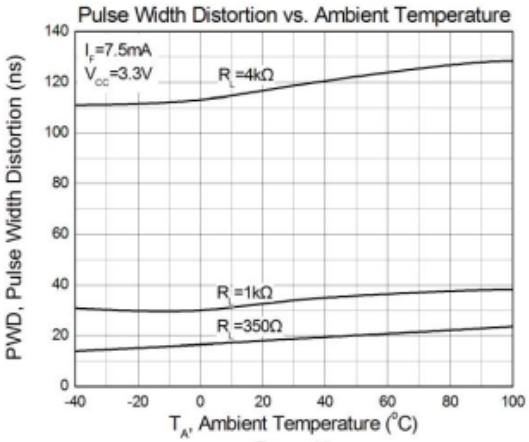
**Fgure 15**



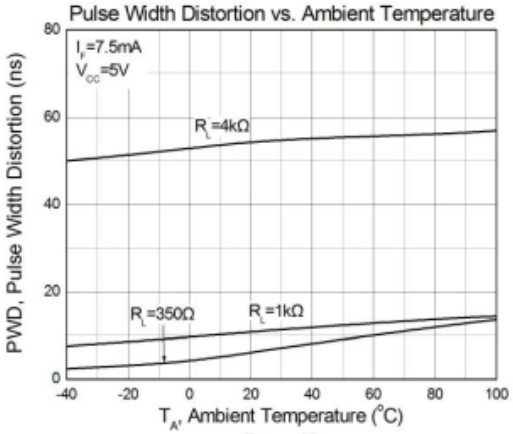
**Fgure 16**




Fgure 17




Fgure 18




Fgure 19

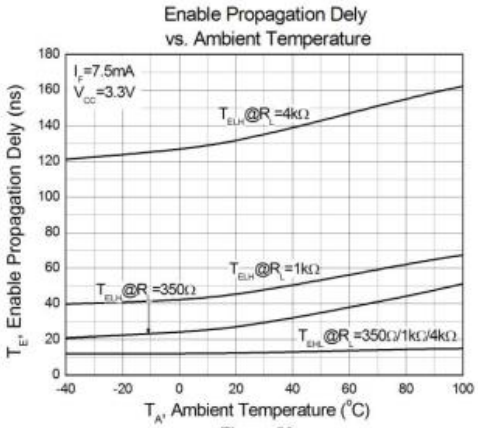



Figure 20

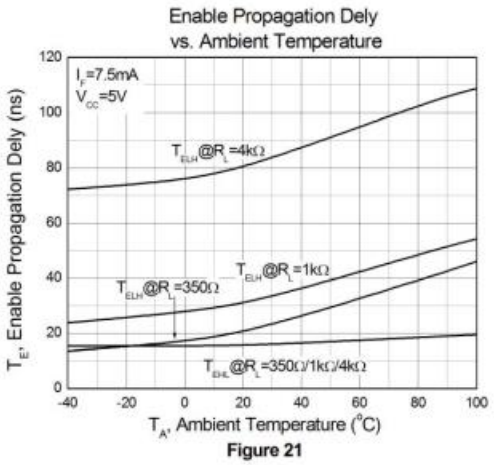
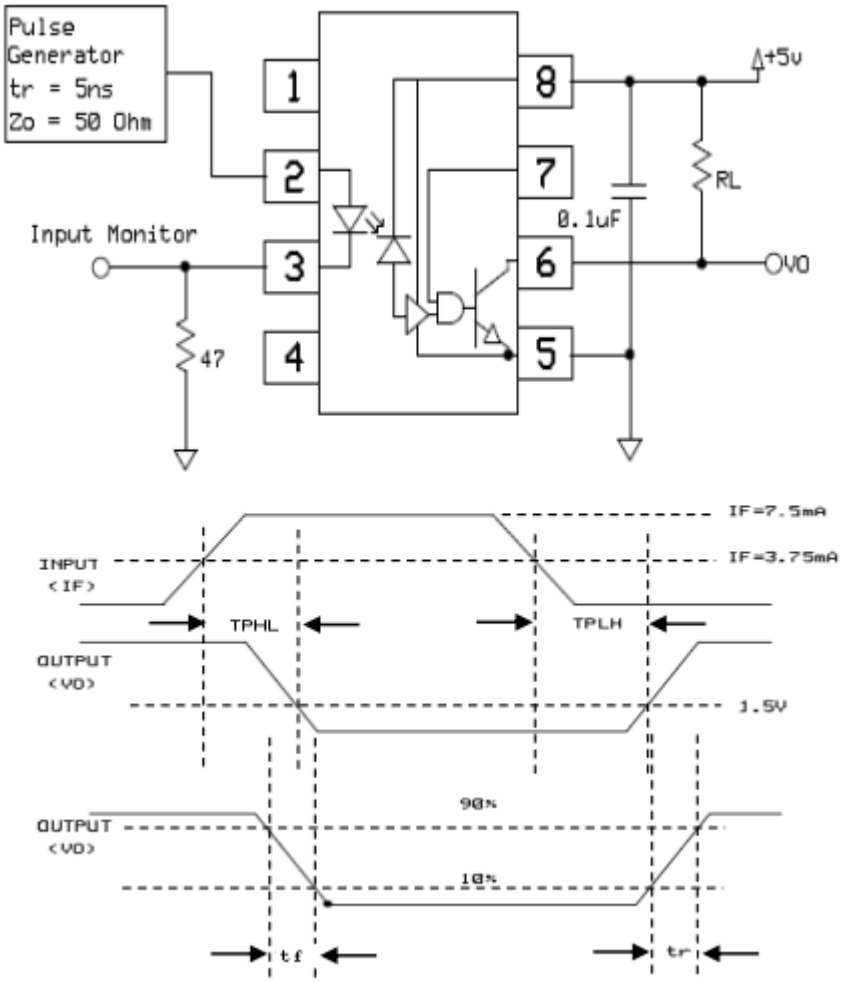


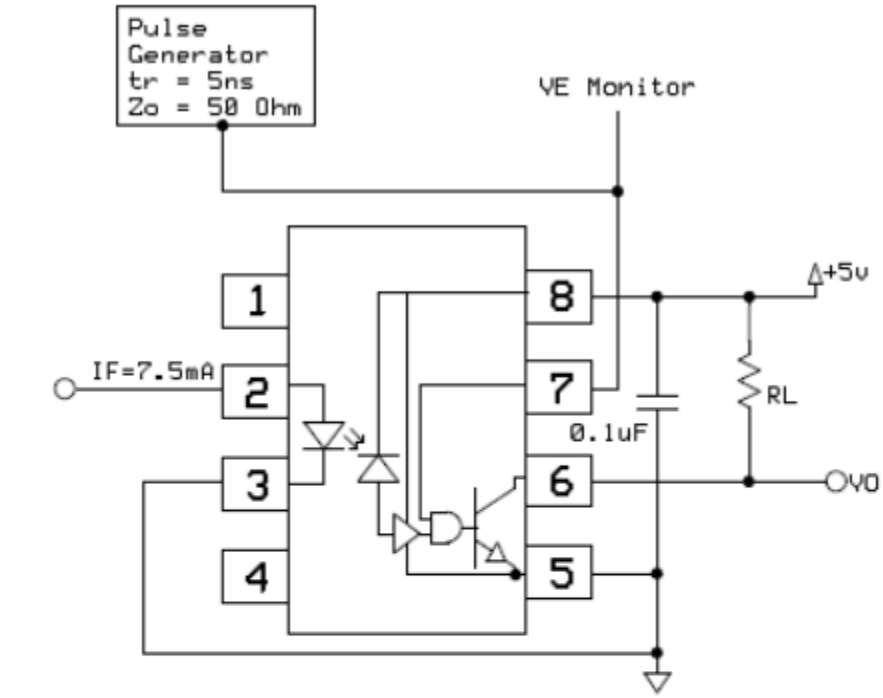

Figure 21

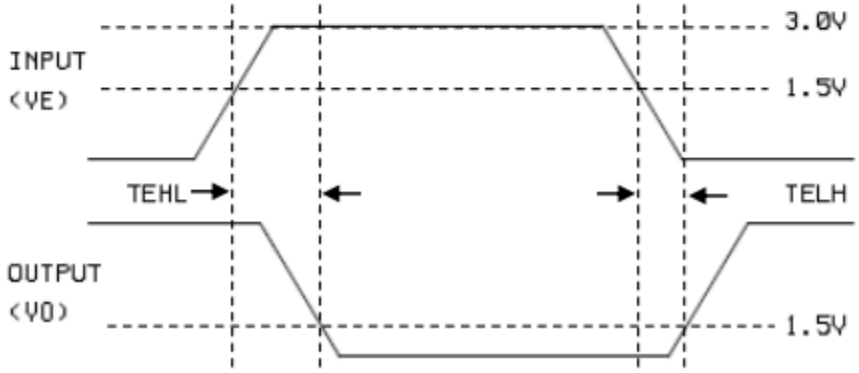
## Test Circuits

## Switching Time Test Circuit

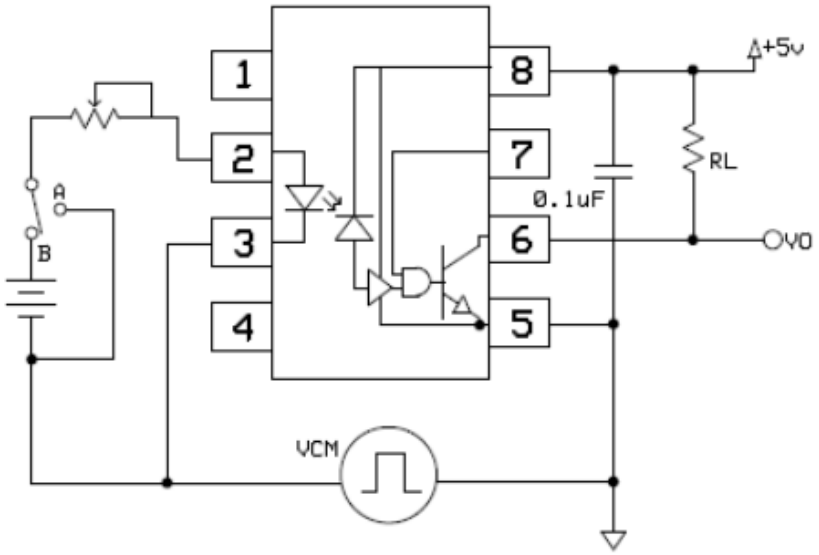


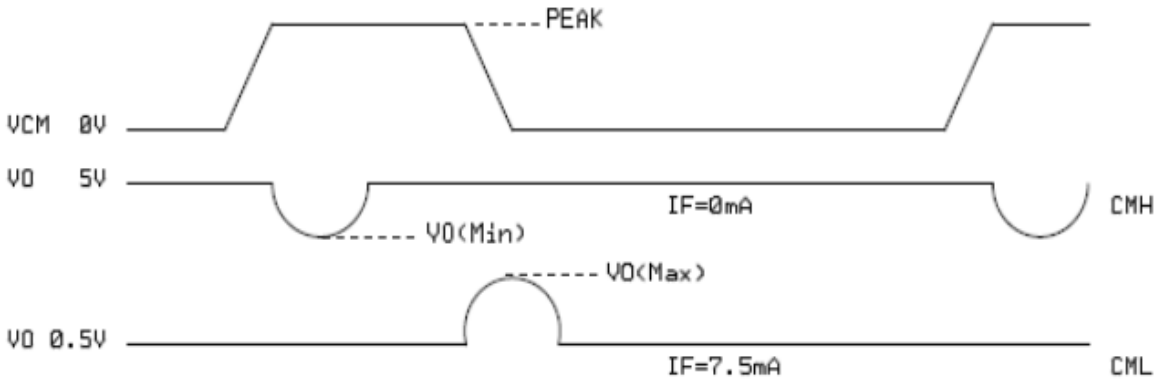
Enable Switching Time Test Circuit



CMR Test Circuit

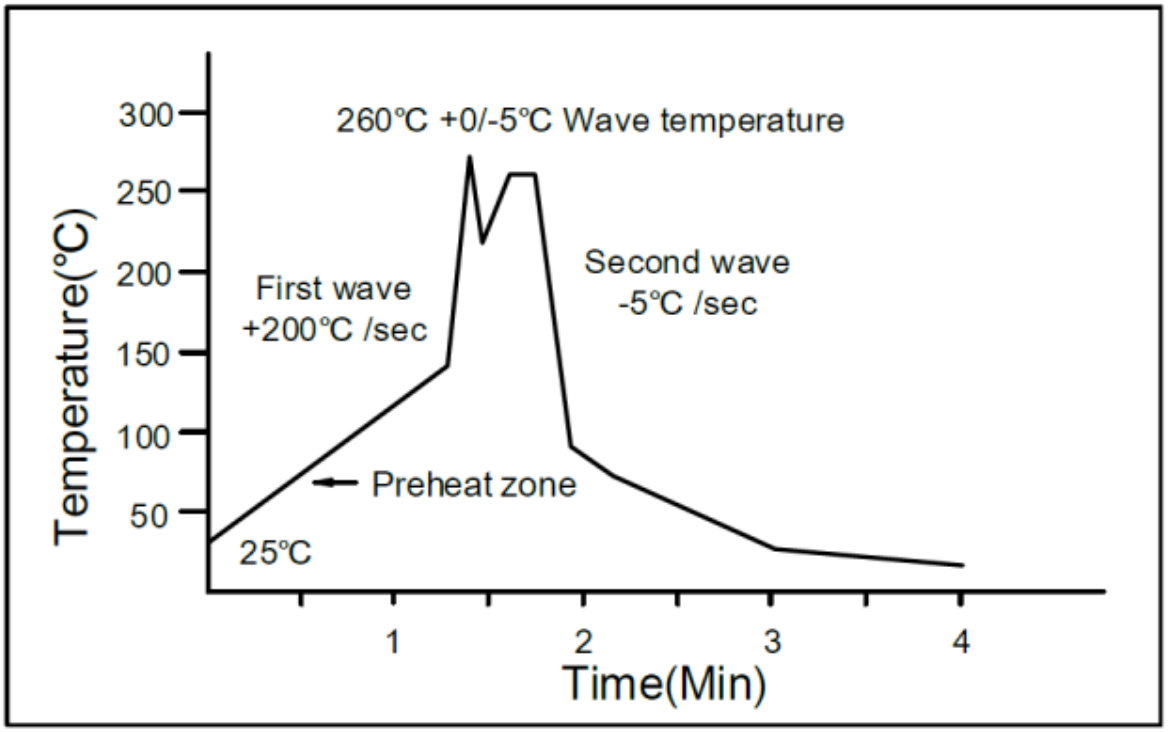


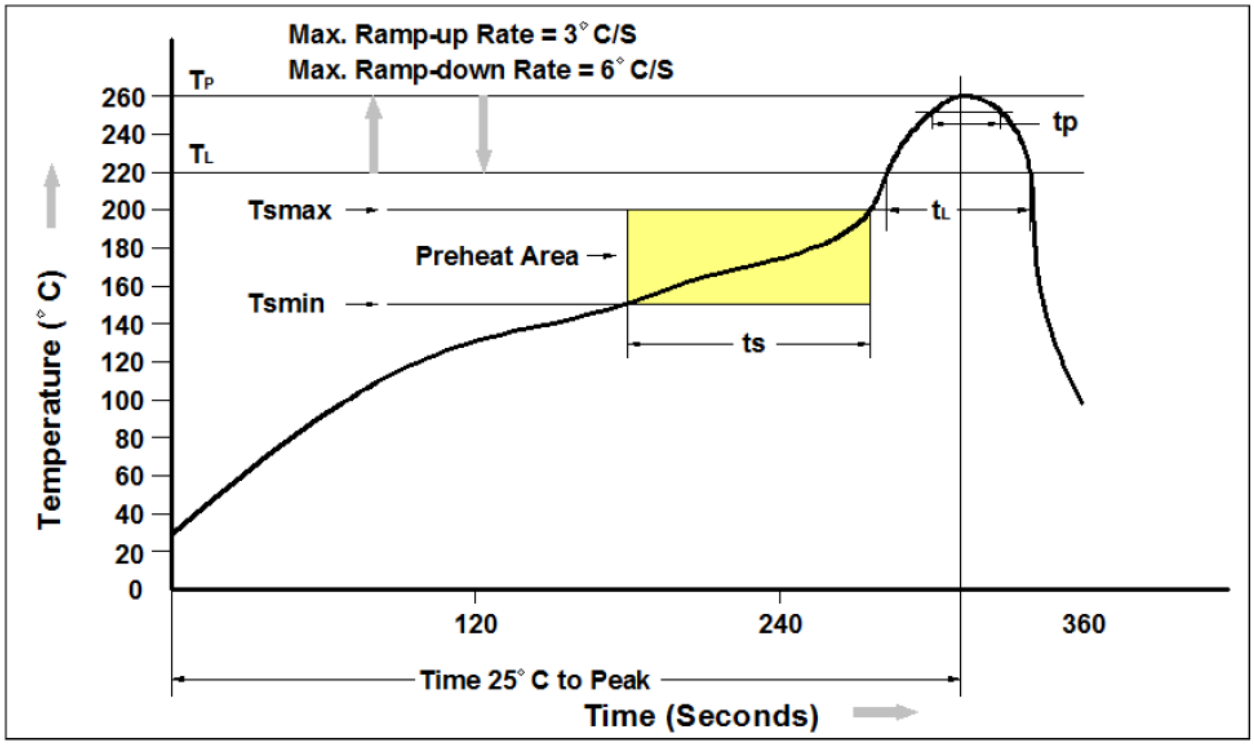
## Solder Profile & Footprint

Wave soldering Profile

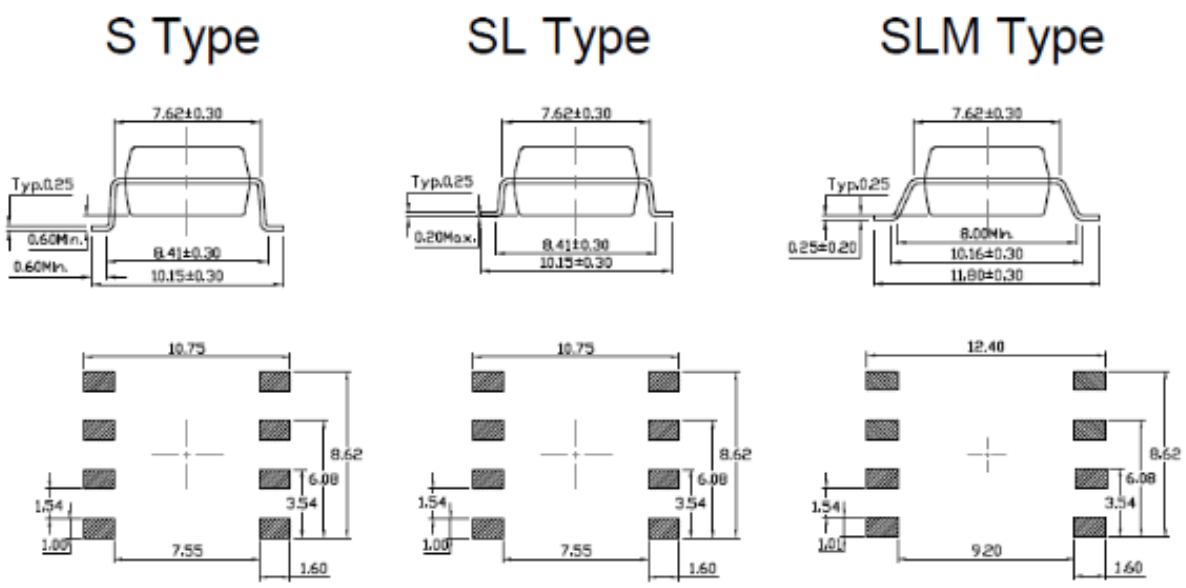
One time soldering is recommended within the condition of temperature.
Temperature: 260+0/-5˚C.
Time: 10 sec.
Preheat temperature:25 to 140˚C.
Preheat time: 30 to 80 sec.



Reflow Profile




| Profile Feature | Pb-Free Assembly Profile |
|---|---|
| Temperature Min. (Tsmin) | 150℃ |
| Temperature Max. (Tsmax) | 200℃ |
| Time (ts) from (Tsmin to Tsmax) | 60-120 seconds |
| Ramp-up Rate ($t_L$ to $t_P$) | 3℃/second max. |
| Liquidous Temperature ($T_L$) | 217℃ |
| Time ($t_L$) Maintained Above ($T_L$) | 60 – 150 seconds |
| Peak Body Package Temperature | 260℃ +0℃ / -5℃ |
| Time ($t_P$) within 5℃ of 260℃ | 30 seconds |
| Ramp-down Rate ($T_P$ to $T_L$) | 6℃/second max |
| Time 25℃ to Peak Temperature | 8 minutes max. |

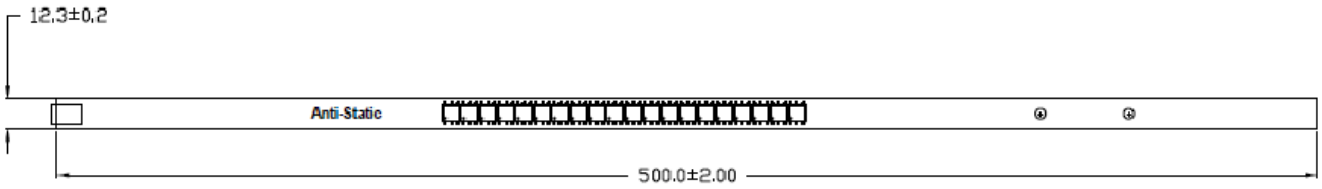



Recommended Solder Footprint for SMD Leadform

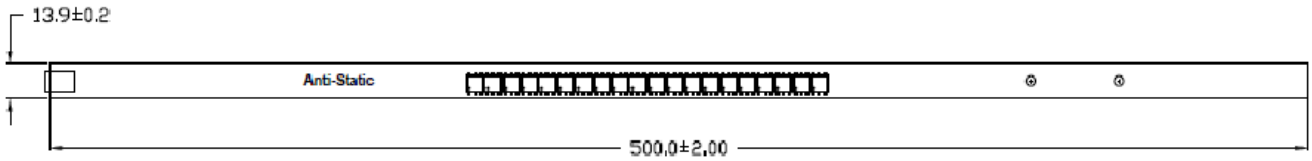
Units: mm

# Packing & Labeling
# Tube Option

Standard DIP

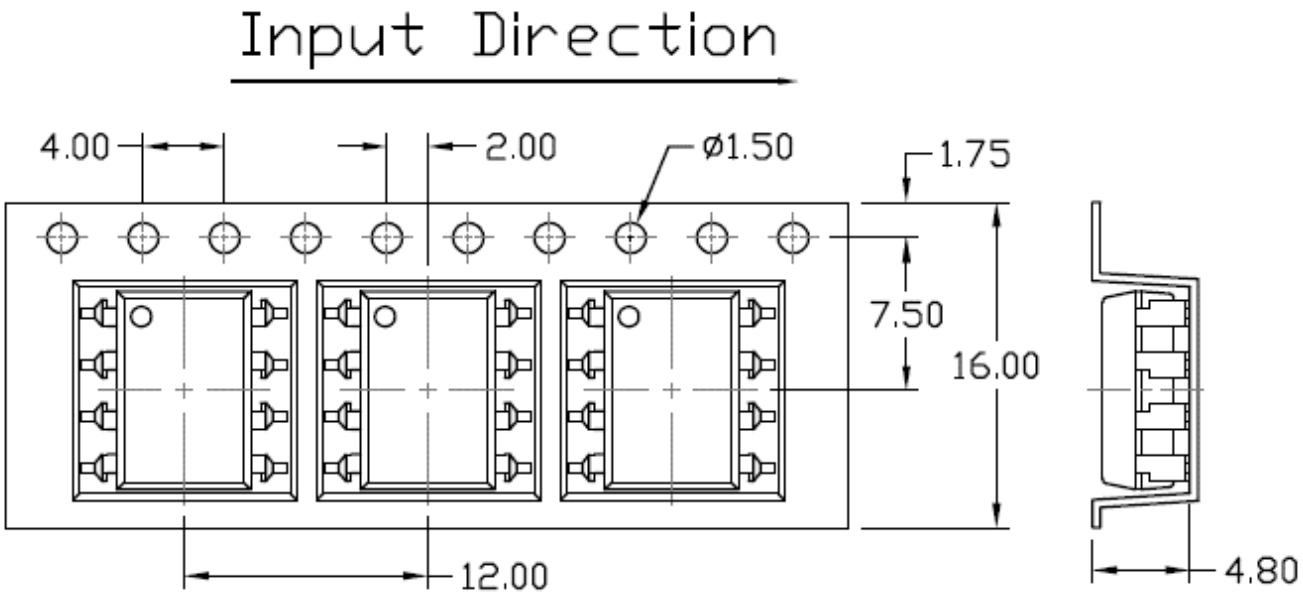



Tube Option M Type

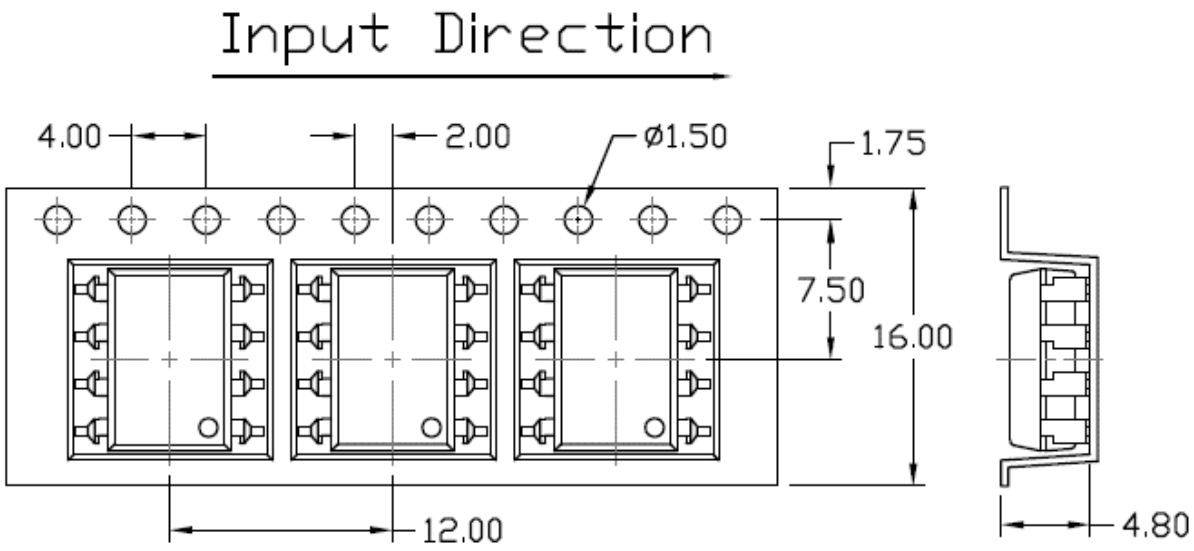


## Tape Dimension for SMD:

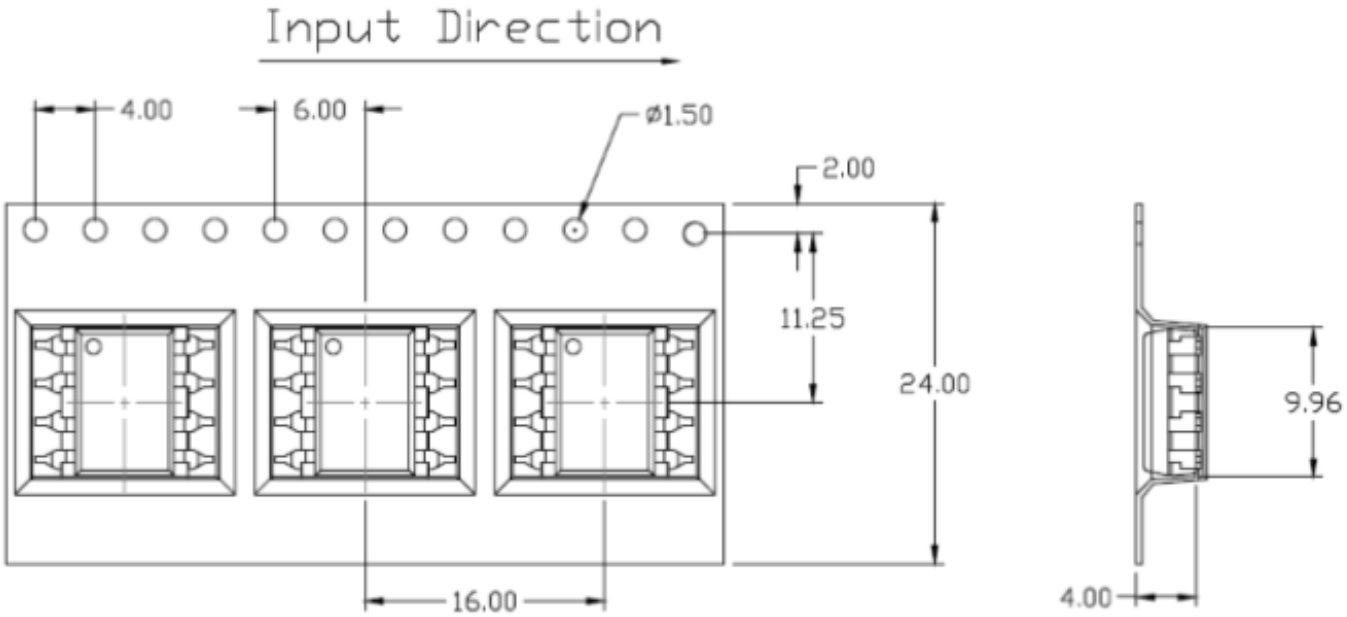
**Option ST1 & SLT1**



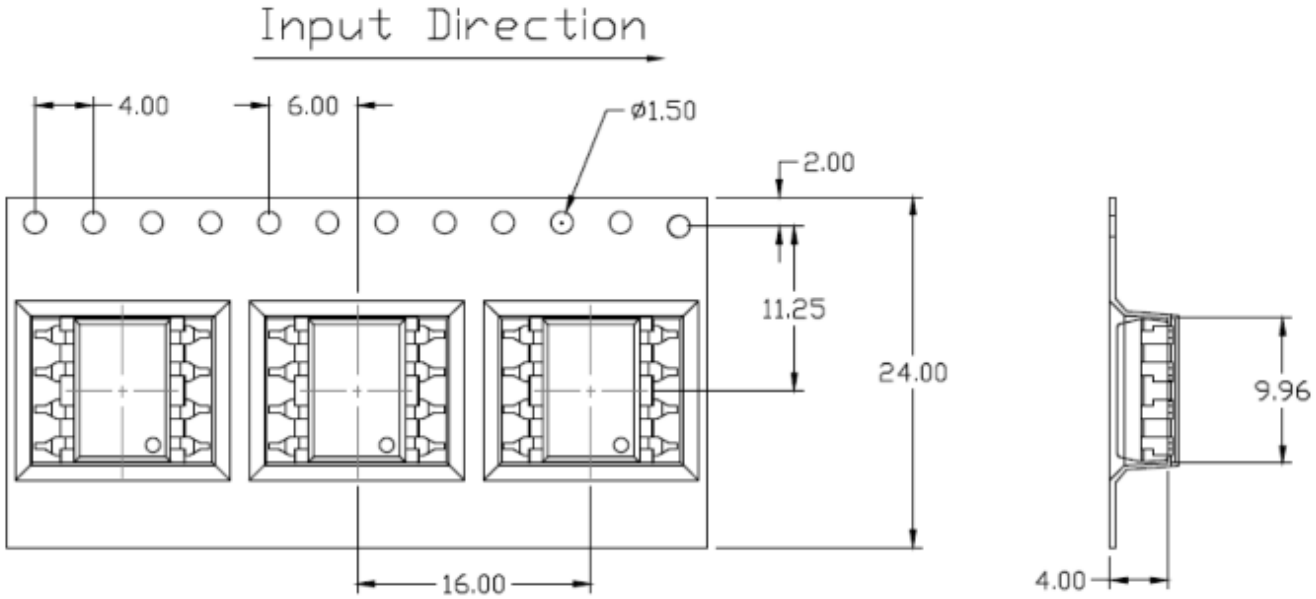

**Option ST2 & SLT2**



## Option SLMT1

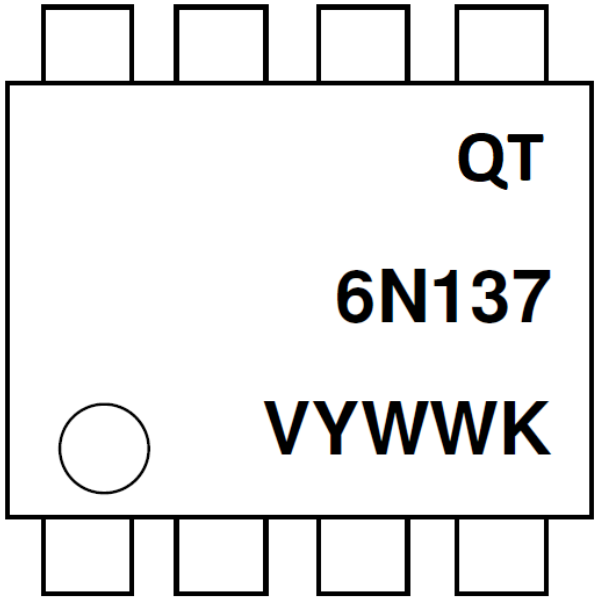


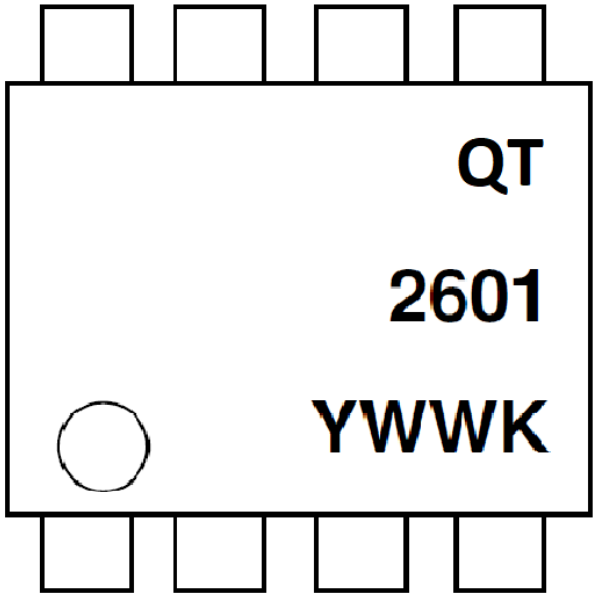

### Option SLMT2




Dimension in mm

## Device Marking




QT = QT-Brightek Corporation
6N137 or 2601 = part number
Y = Year
WW = Week
V = VDE Option
K= Manufacturing code

## Ordering Information

6N137VYZ or QT2601VYZ
V = VDE option (V or None)
Y = Lead form option (S, SL, M, SLM or none)
Z=Tape and reel option (T1 or T2)

| Option | Description | Quantity |
|---|---|---|
| None | Standard 8-Pin DIP | 40 Units/Tube |
| M | Gullwing | 40 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 |
| 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 |

## Revision History

| Description: | Revision # | Revision Date |
|---|---|---|
| Initial release of 6N137_QT2601 | 1.0 | 02/12/2018 |
| Update drawing and spec | 1.1 | 03/26/2024 |
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## Disclaimer

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QT-BRIGHTEK's products are not authorized for use as critical components in life support devices or systems without the express written approval of QT-BRIGHTEK. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.

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.