



# **QT-Brightek Optocoupler Series**

## **1 Mbit/s High Speed Phototransistor Optocoupler**

**Part No.: 6N135, 6N136, QT4502, QT4503**

Product: 6N135_6N136_QT4502_QT4503	Date: February 12, 2018	Page 1 of 20
	Version# 1.0	



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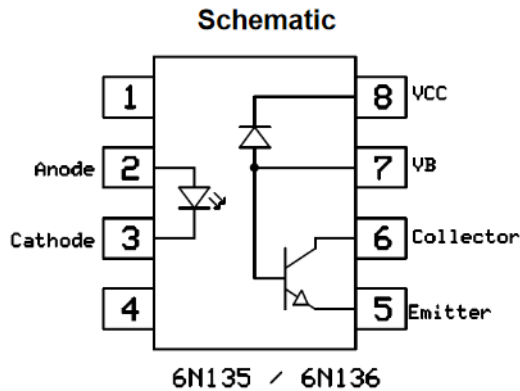
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## Introduction

### Feature:

- High Speed phototransistor 1Mbit/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:



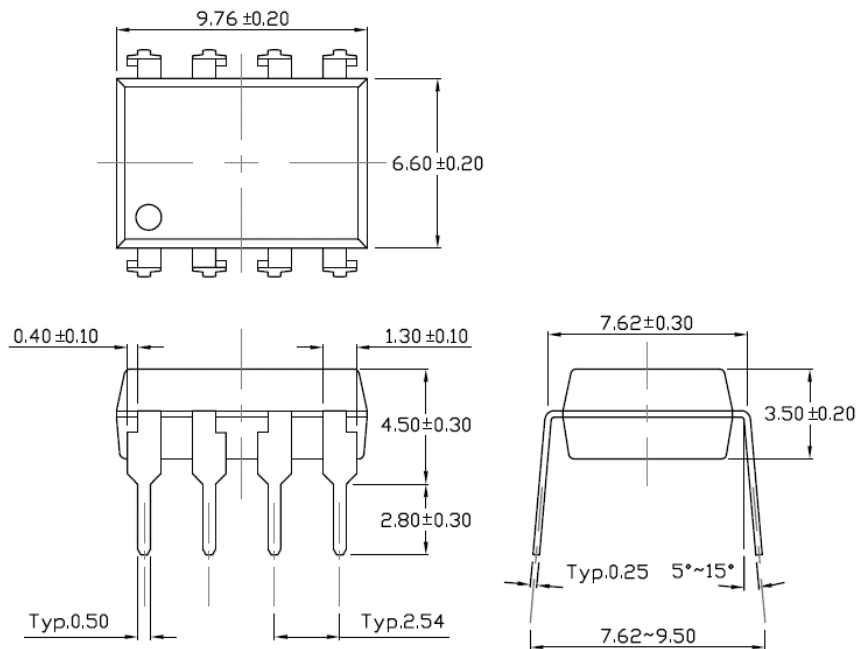
Pin 7 not connected for QT4502 and QT4503

### Certification & Compliance:

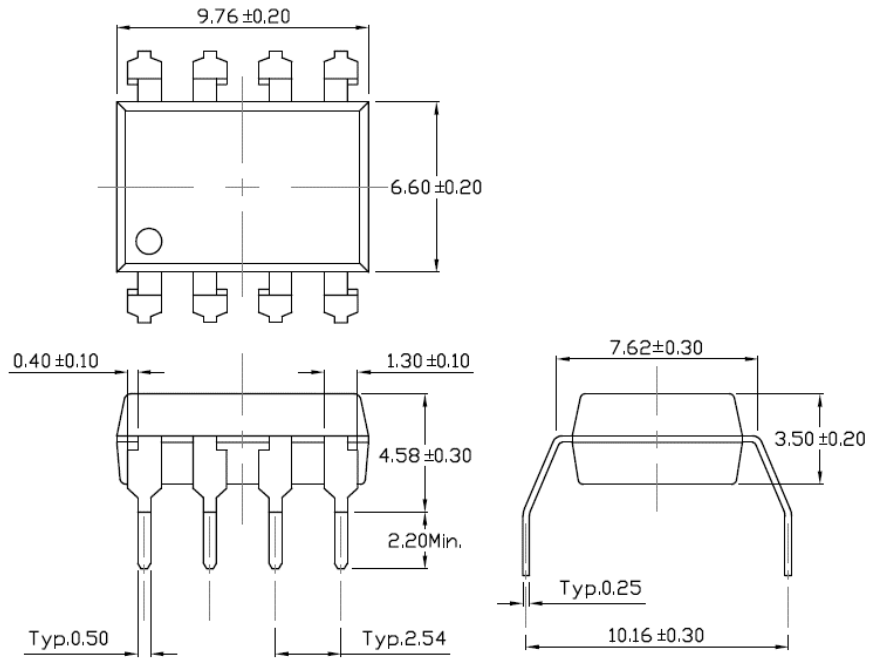
- Pb free and RoHS Compliant
- UL recognized (File #E338132)
- cUL recognized (File #E338132)
- VDE (File #40030457)



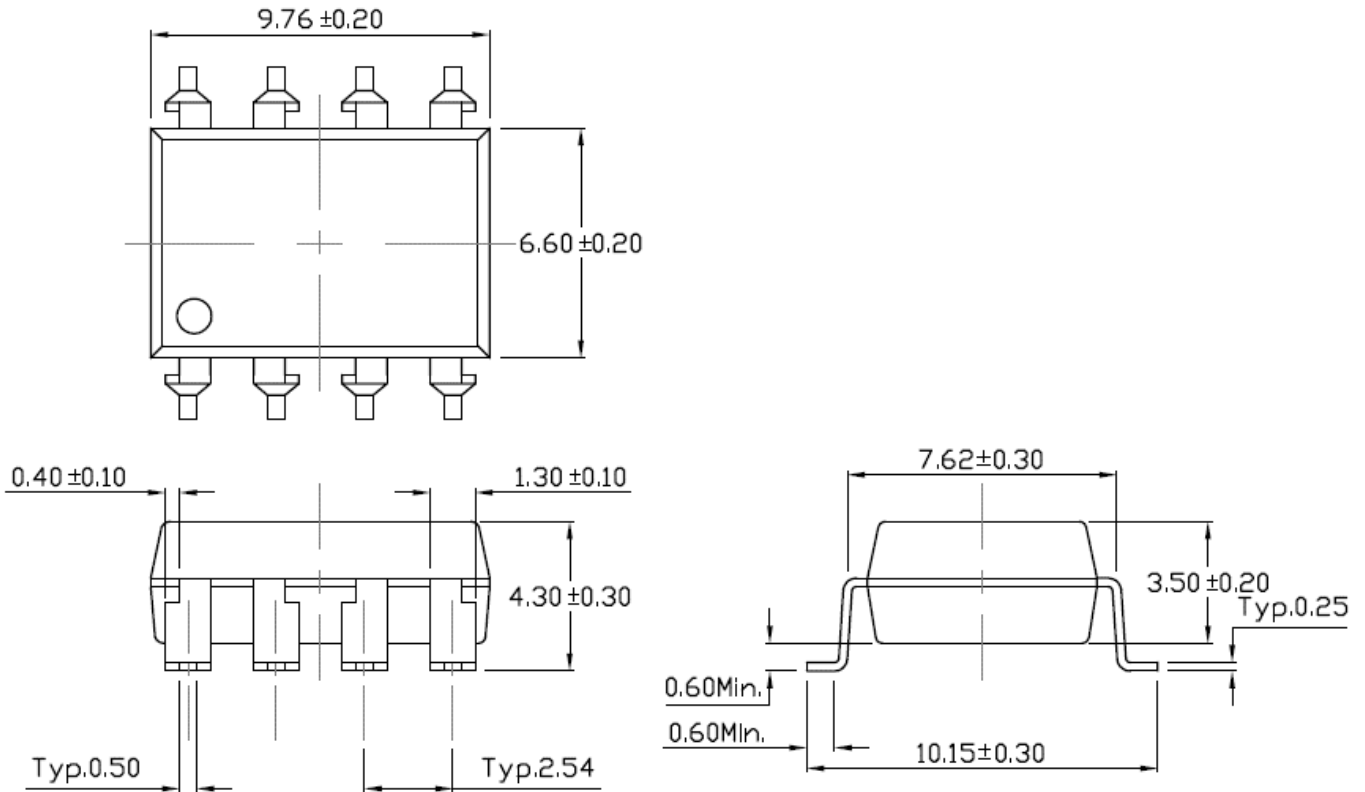
### Dimension: (Dot location indicates pin 1) 8-Pin Dip (standard):



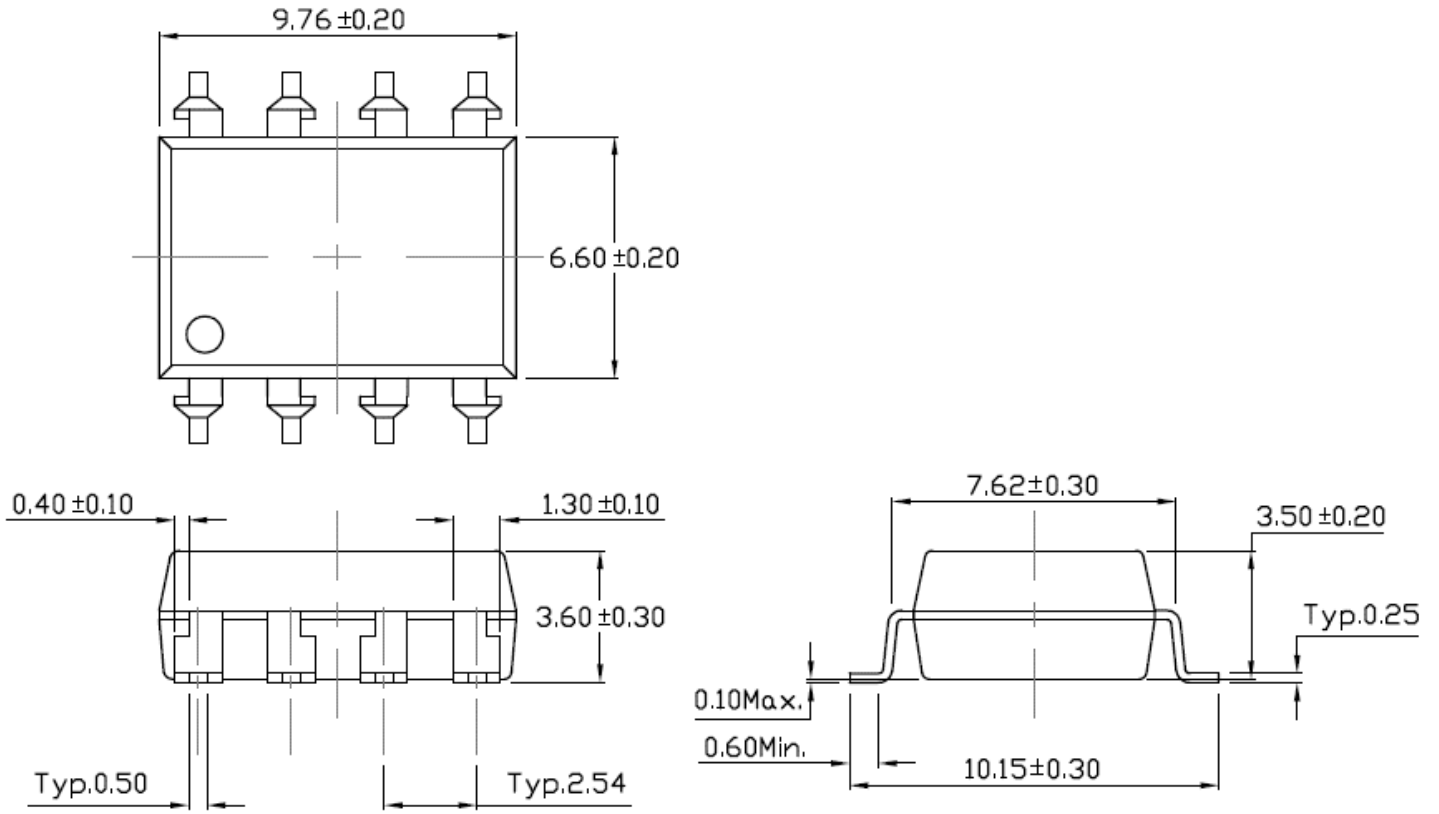
**Gullwing (400mil) lead bend (Option M):**



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



**SMD (Low Profile) bend (Option SL):**



All Dimensions are in mm

## Absolute Maximum Rating

Symbol	Parameter	Rating	Units
$V_{ISO}$	Isolation Voltage*	5000	$V_{RMS}$
$T_{STG}$	Storage Temperature	-55 ~ +125	°C
$T_{OPR}$	Operating Temperature	-55 ~ +100	°C
$T_{SOL}$	Lead Solder Temperature	260 for 10 sec	°C

### EMITTER

$I_F$	Forward Current	25	mA
$I_{FP}$	Peak Forward Current (50% duty, 1ms P.W)	50	mA
$I_{F(TRANS)}$	Peak transient Current ( $\leq 1\mu s$ , 300pps)	1	A
$V_R$	Reverse Voltage	5	V
$P_D$	Power Dissipation	40	mW
	Power Dissipation Derated above 100°C	-	mW/°C

### DETECTOR

$P_D$	Power Dissipation	100	mW
$V_{EBR}$	Emitter-Base reverse voltage	5	V
$I_B$	Base current	5	mA
$I_{O(AVG)}$	Average Output current	8	mA
$I_{O(PEAK)}$	Peak Output current	16	mA
$V_O$	Output voltage	-0.5 to 20	V
$V_{CC}$	Supply voltage	-0.5 to 30	V

\*AC for 1 minute, RH =40~60%

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

( $T_A=0$  to  $70^\circ\text{C}$  unless specified otherwise)

### Emitter

Symbol	Characteristics	Device	Test Condition	Range			Unit
				Min	Typ	Max	
$V_F$	Forward Voltage	-	$I_F = 16\text{mA}$	-	1.45	1.6	V
$V_R$	Reverse Voltage		$I_R = 10\mu\text{A}$	5	-	-	V
$\Delta V_F / \Delta T_A$	Temperature coefficient of forward voltage		$I_F = 16\text{mA}$	-	-1.8	-	mV/ $^\circ\text{C}$

### Detector

Symbol	Characteristic	Device	Test Condition	Range			Unit
				Min	Typ	Max	
$I_{OH}$	Logic High Output Current		$I_F=0\text{mA}$ , $V_O=V_{CC}=5.5\text{V}$ , $T_A=25^\circ\text{C}$	-	0.001	0.5	$\mu\text{A}$
			$I_F=0\text{mA}$ , $V_O=V_{CC}=15\text{V}$ , $T_A=25^\circ\text{C}$	-	0.01	1	
			$I_F=0\text{mA}$ , $V_O=V_{CC}=15\text{V}$	-	-	50	
$I_{CCL}$	Logic Low Supply Current	-	$I_F=16\text{mA}$ , $V_O=\text{Open}$ , $V_{CC} = 15\text{V}$	-	140	200	$\mu\text{A}$
$I_{CCH}$	Logic High Supply Current	-	$I_F=0\text{mA}$ , $V_O=\text{Open}$ , $V_{CC}=15\text{V}$ , $T_A=25^\circ\text{C}$	-	0.01	1	$\mu\text{A}$
			$I_F=0\text{mA}$ , $V_O=\text{Open}$ , $V_{CC} = 15\text{V}$	-	-	2	

### Transfer Characteristics

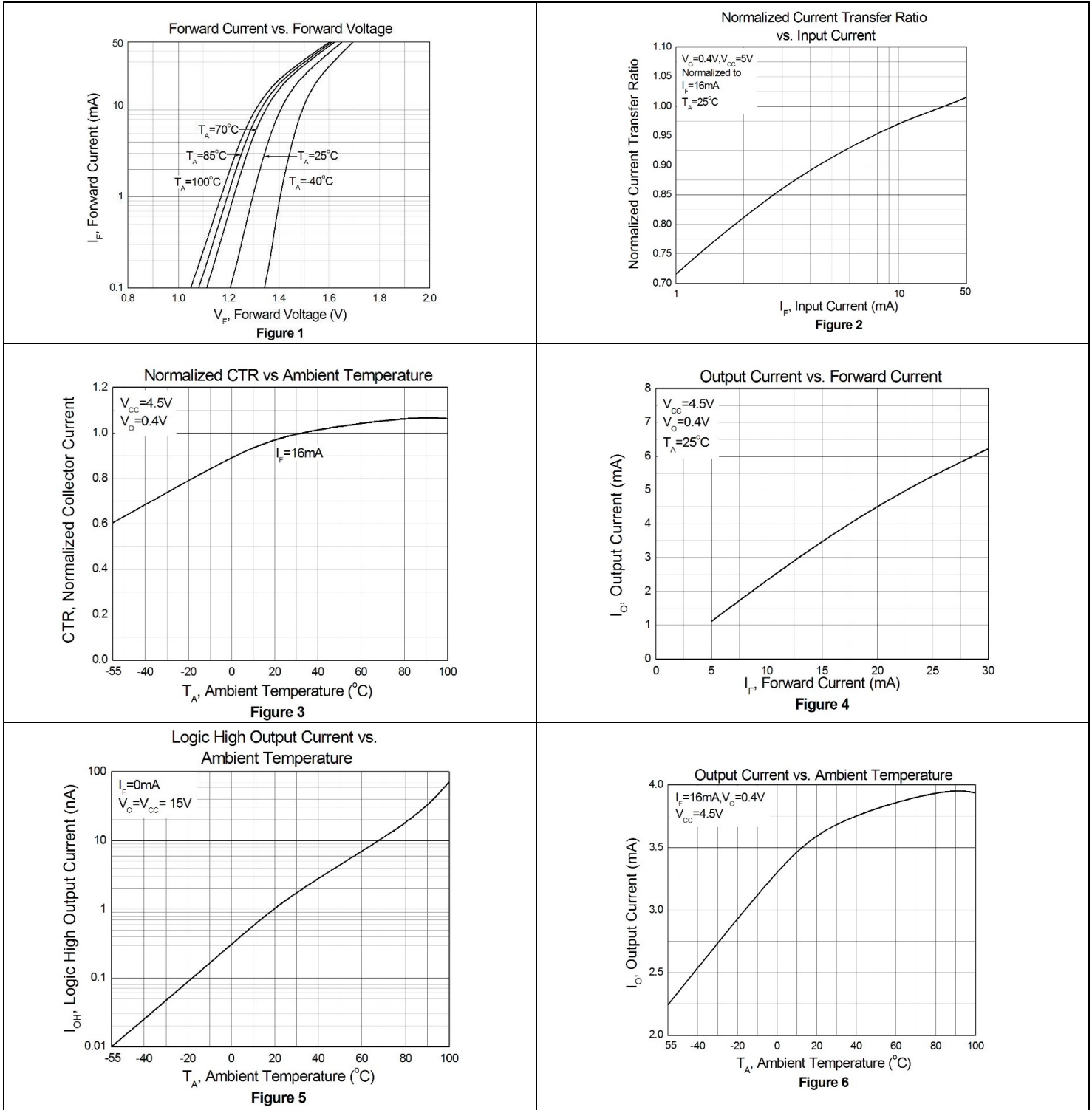
Symbol	Characteristic	Device	Test Condition	Range			Unit
				Min	Typ	Max	
CTR	Current Transfer Ratio	6N135	$I_F=16\text{mA}, V_O=0.4\text{V}, V_{CC}=4.5\text{V}, T_A=25^\circ\text{C}$	7	-	50	%
		6N136 QT4502 QT4503		19	-	50	
		6N135	$I_F=16\text{mA}, V_O=0.5\text{V}, V_{CC}=4.5\text{V}$	5	-	-	
		6N136 QT4502 QT4503		15	-	-	
$V_{OL}$	Logic Low Output Voltage	6N135	$I_F=16\text{mA}, I_O=1.1\text{mA}, V_{CC}=4.5\text{V}, T_A=25^\circ\text{C}$	-	0.18	0.4	V
		6N136 QT4502 QT4503	$I_F=16\text{mA}, I_O=3\text{mA}, V_{CC}=4.5\text{V}, T_A=25^\circ\text{C}$	-	0.18	0.4	
		6N135	$I_F=16\text{mA}, I_O=0.8\text{mA}, V_{CC}=4.5\text{V}$	-	-	0.5	
		6N136 QT4502 QT4503	$I_F=16\text{mA}, I_O=2.4\text{mA}, V_{CC}=4.5\text{V}$	-	-	0.5	



**Switching Characteristics** ( $T_A=25^\circ\text{C}$ ,  $V_{CC}=5\text{V}$ )

Symbol	Characteristic	Device	Test Condition	Range			Unit
				Min	Typ	Max	
$T_{PHL}$	Propagation Delay Time Logic High to Logic Low	6N135	$R_L=4.1\text{K}\Omega$ , $T_A=25^\circ\text{C}$	-	0.35	1.5	$\mu\text{s}$
			$R_L=4.1\text{K}\Omega$	-	-	2.0	
		6N136 QT4502 QT4503	$R_L=1.9\text{K}\Omega$ , $T_A=25^\circ\text{C}$	-	0.35	0.8	
			$R_L=1.9\text{K}\Omega$	-	-	1.0	
$T_{PLH}$	Propagation Delay Time Logic Low to Logic High	6N135	$R_L=4.1\text{K}\Omega$ , $T_A=25^\circ\text{C}$	-	0.35	1.5	$\mu\text{s}$
			$R_L=4.1\text{K}\Omega$	-	-	2.0	
		6N136 QT4502 QT4503	$R_L=1.9\text{K}\Omega$ , $T_A=25^\circ\text{C}$	-	0.35	0.8	
			$R_L=1.9\text{K}\Omega$	-	-	1.0	
$CM_H$	Common Mode Transient Immunity at Logic High	6N135	$I_F = 0\text{mA}$ , $V_{CM}=10\text{Vp-p}$ , $R_L=4.1\text{k}\Omega$ , $T_A=25^\circ\text{C}$	1000	-	-	$\text{V}/\mu\text{s}$
		6N136 QT4502	$I_F = 0\text{mA}$ , $V_{CM}=10\text{Vp-p}$ , $R_L=1.9\text{k}\Omega$ , $T_A=25^\circ\text{C}$	1000	-	-	
		QT4503	$I_F = 0\text{mA}$ , $V_{CM}=1500\text{Vp-p}$ , $R_L=1.9\text{k}\Omega$ , $T_A=25^\circ\text{C}$	15000	20000	-	
$CM_L$	Common Mode Transient Immunity at Logic Low	6N135	$I_F = 16\text{mA}$ , $V_{CM}=10\text{Vp-p}$ , $R_L=4.1\text{k}\Omega$ , $T_A=25^\circ\text{C}$	1000	-	-	$\text{V}/\mu\text{s}$
		6N136 QT4502	$I_F = 16\text{mA}$ , $V_{CM}=10\text{Vp-p}$ , $R_L=1.9\text{k}\Omega$ , $T_A=25^\circ\text{C}$	1000	-	-	
		QT4503	$I_F = 16\text{mA}$ , $V_{CM}=1500\text{Vp-p}$ , $R_L=1.9\text{k}\Omega$ , $T_A=25^\circ\text{C}$	15000	20000	-	

## Characteristic Curves



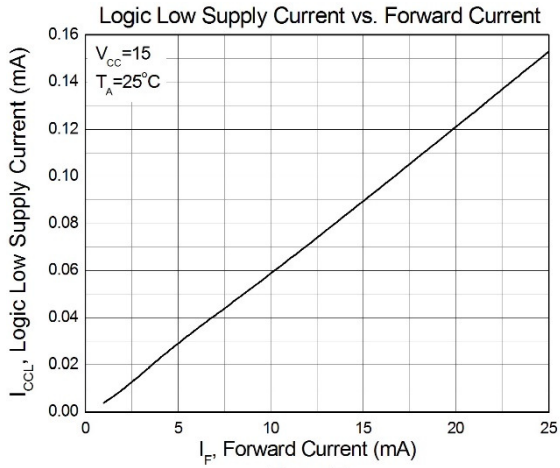


Figure 7

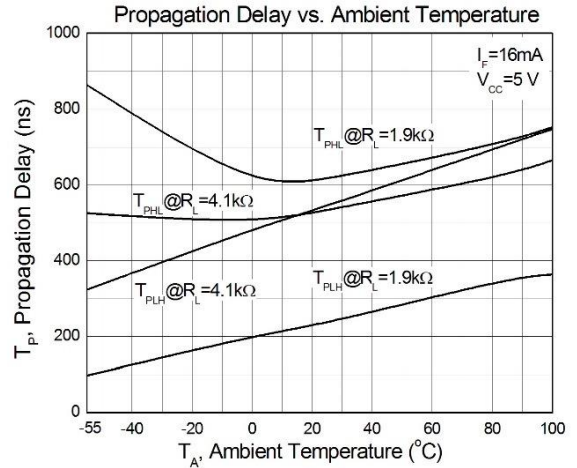


Figure 8

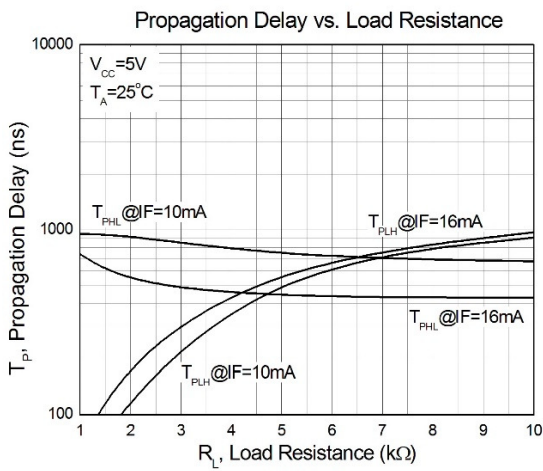
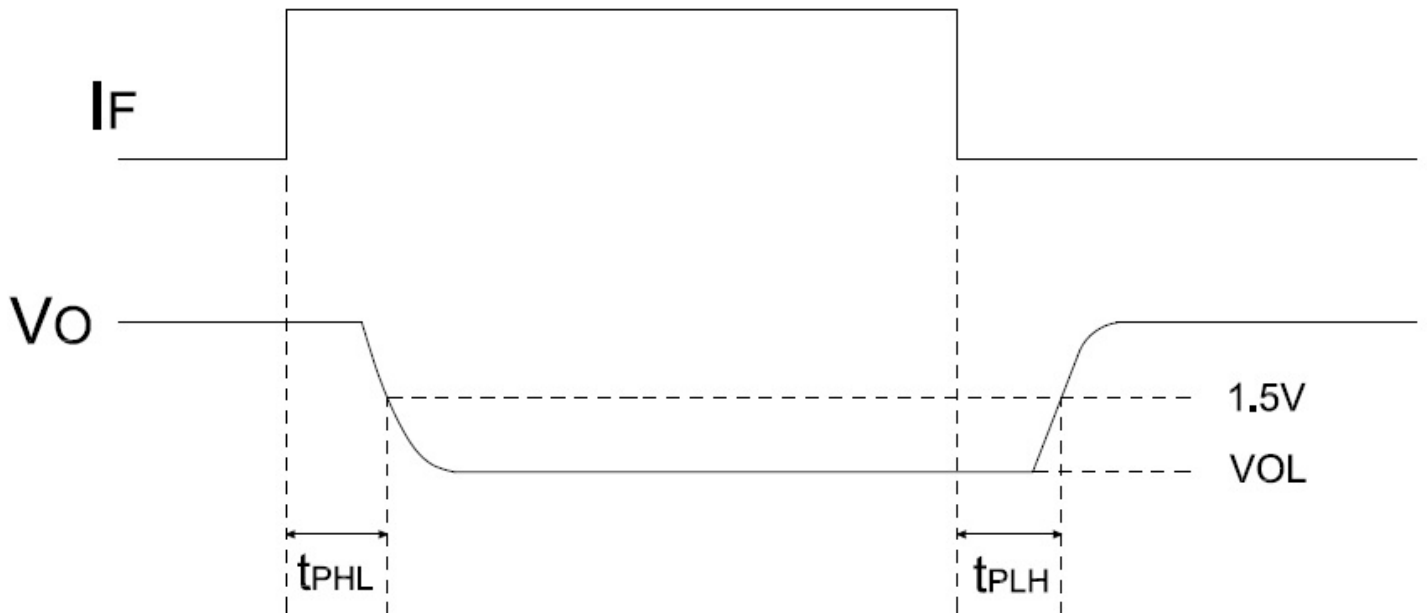
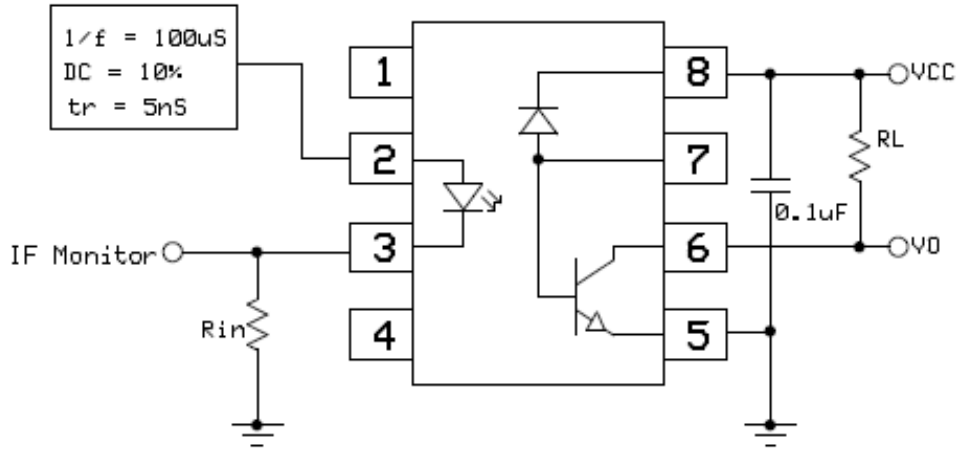
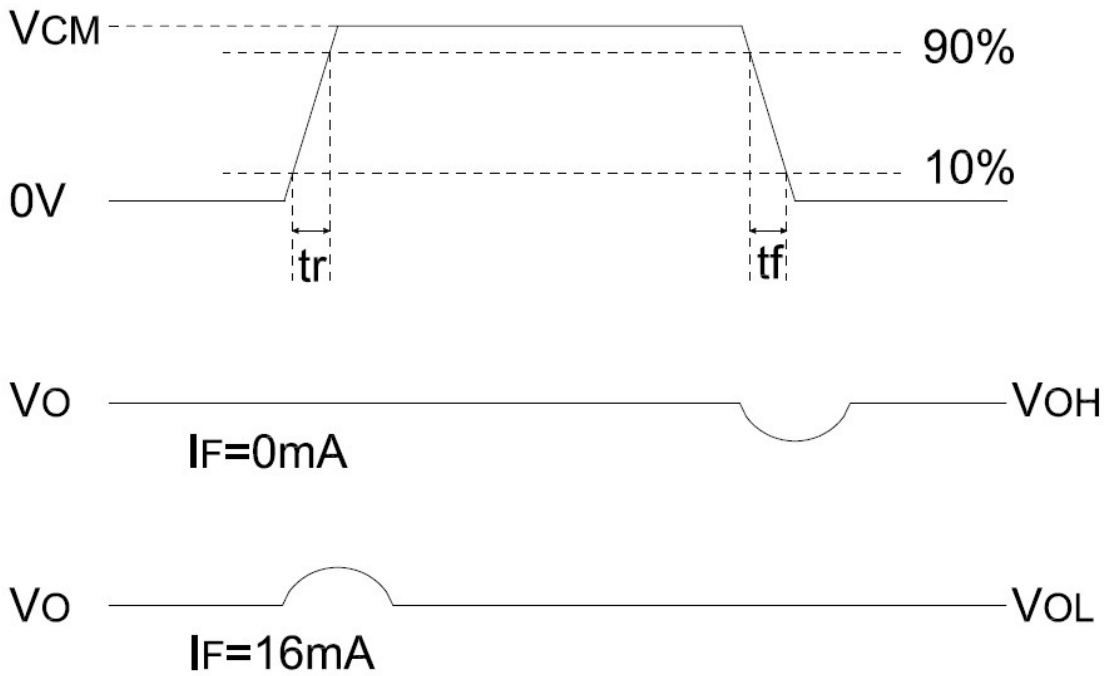
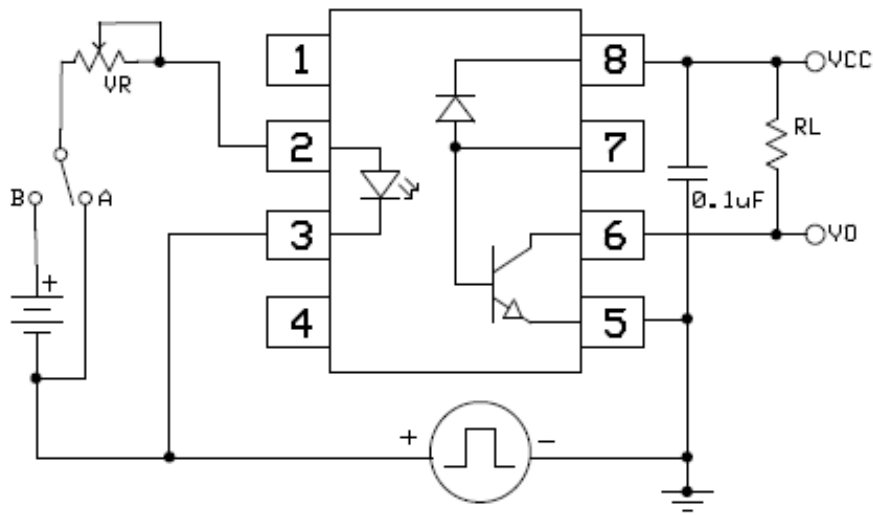


Figure 9

## Test Circuits



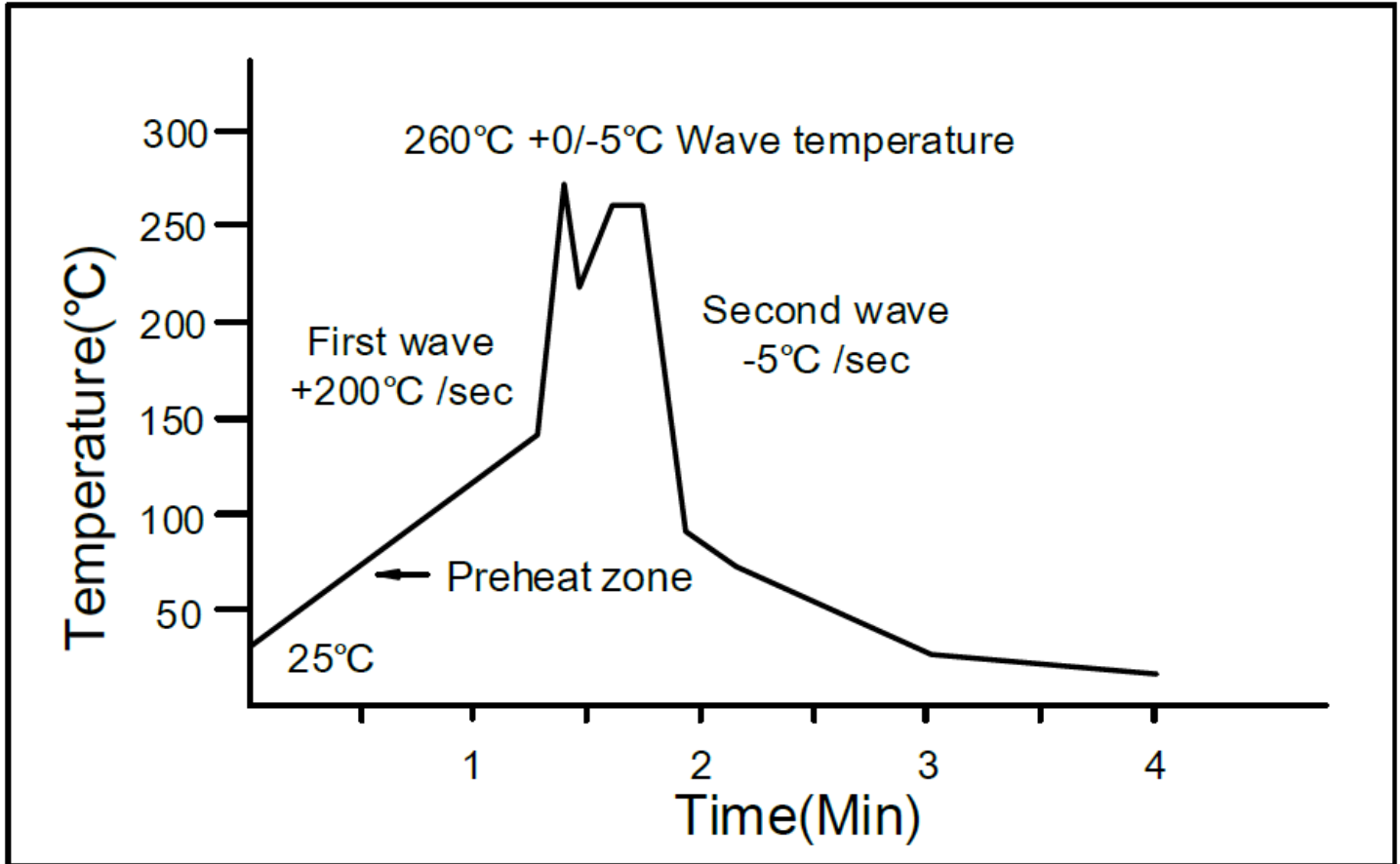
Switching Time Test Circuit



CMR Test Circuit

**Solder Profile & Footprint**

Wave soldering



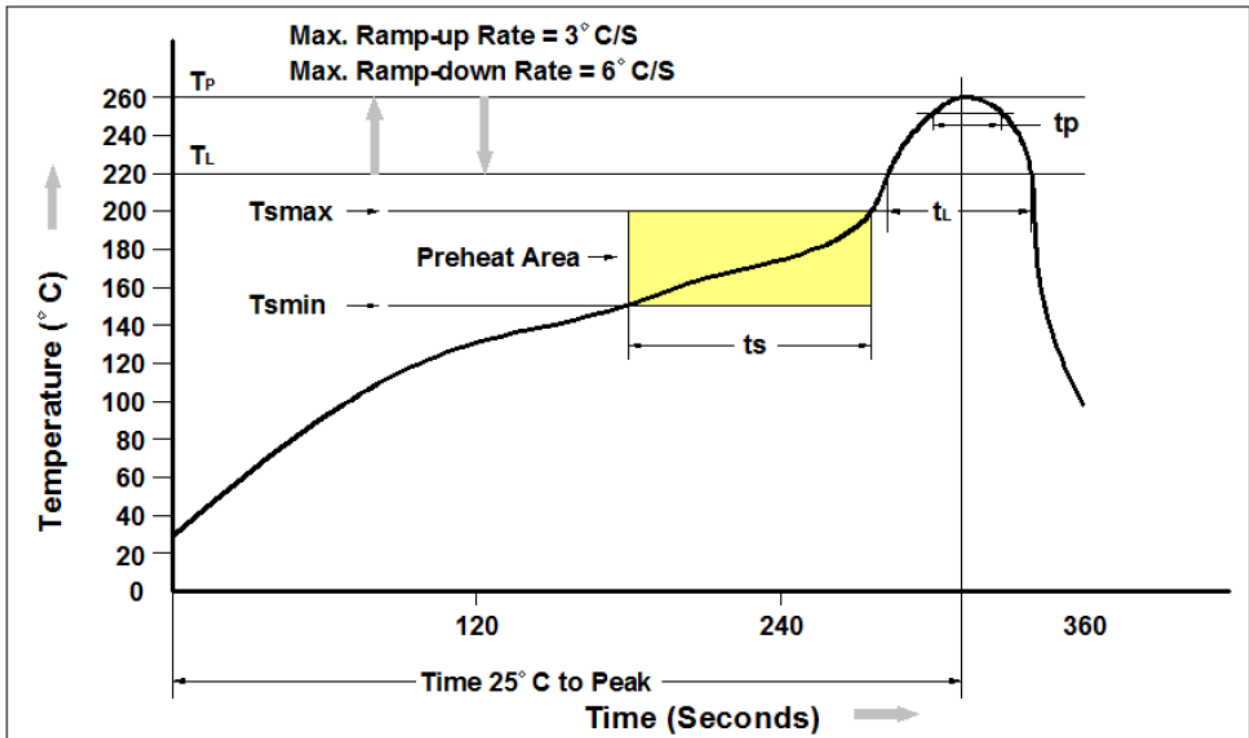
Temperature: 260 +0/-5 °C

Time: 10 Sec

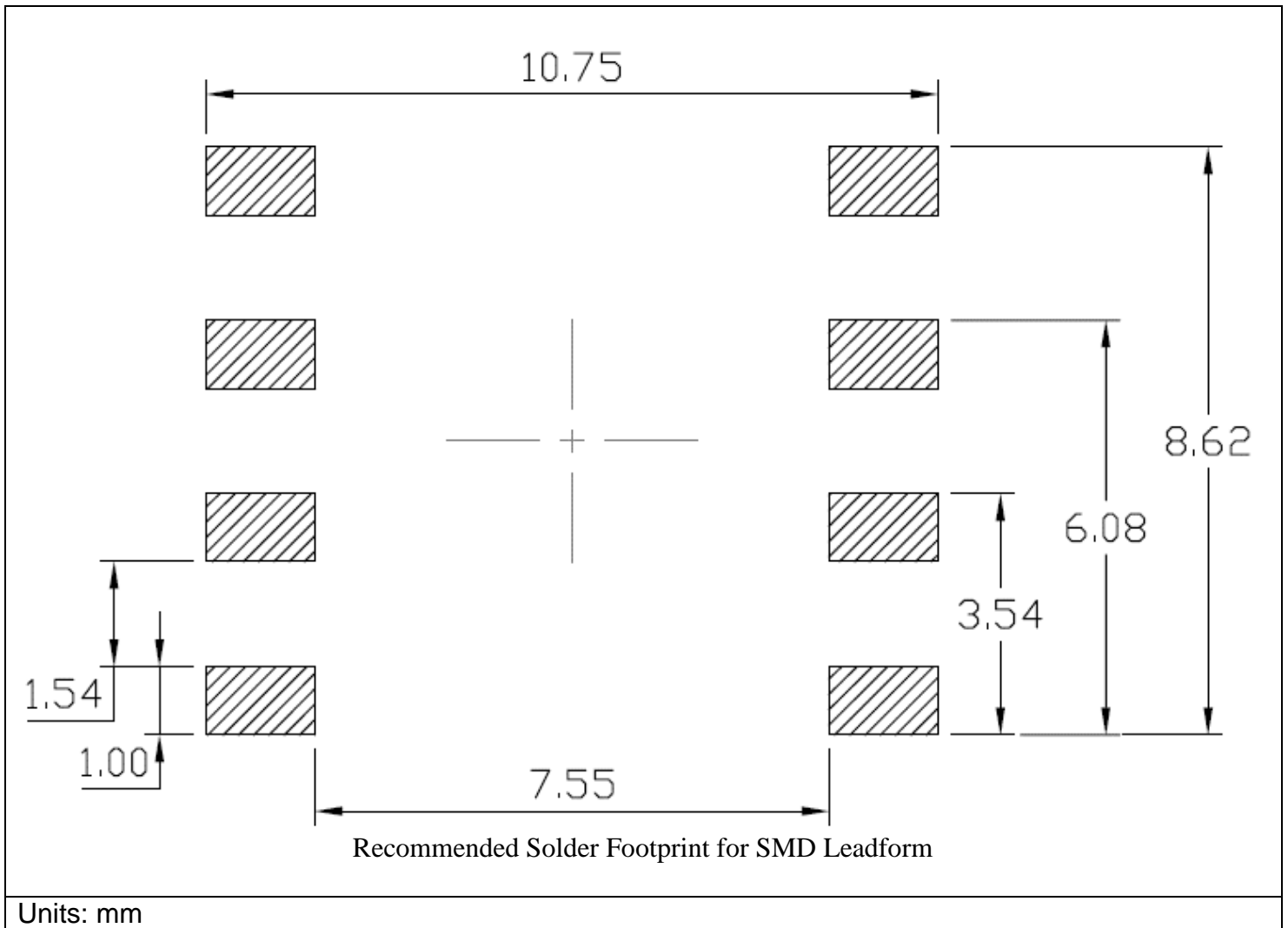
Preheat temperature: 25 to 140 °C

Preheat time: 30 to 80 sec.

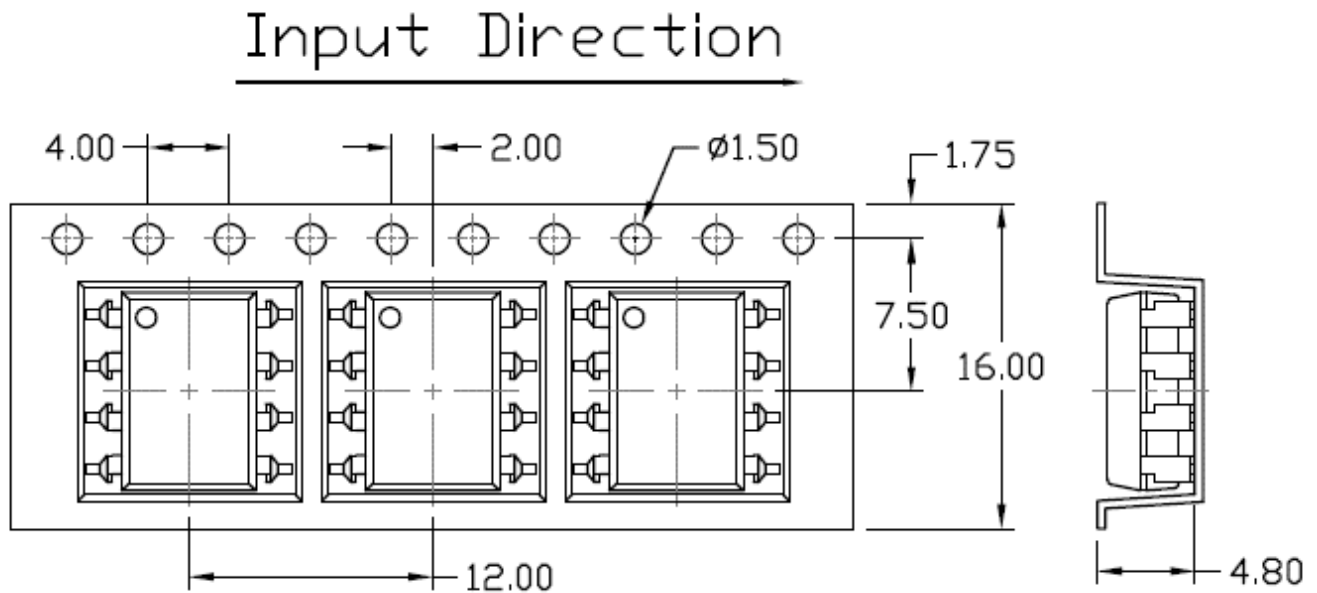
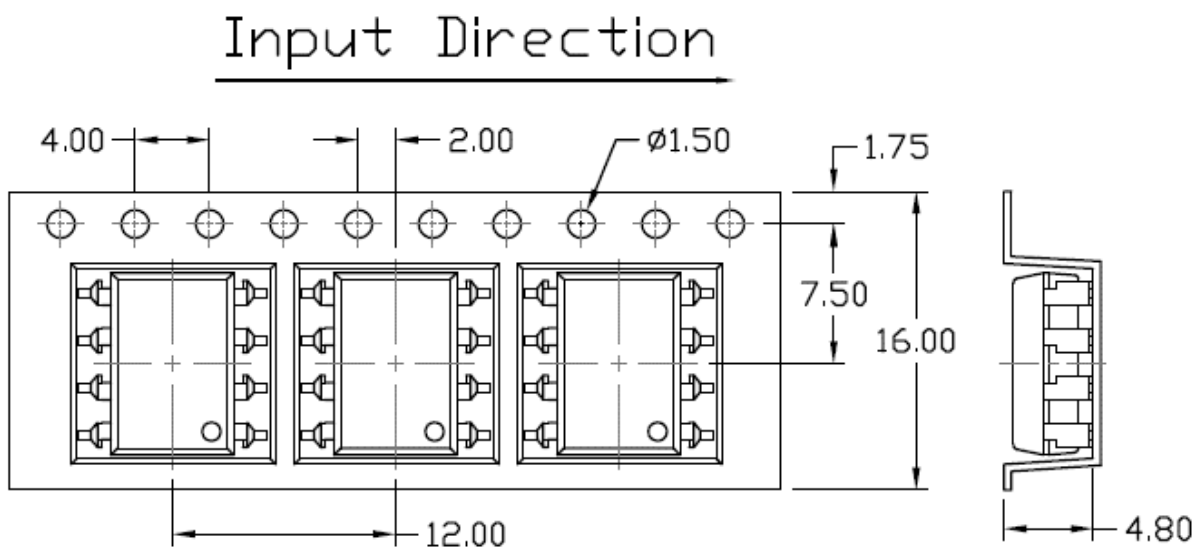
## Reflow Soldering



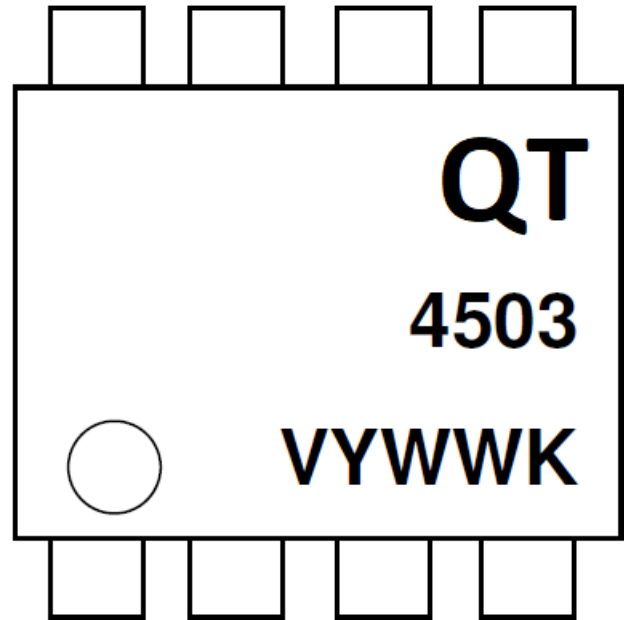
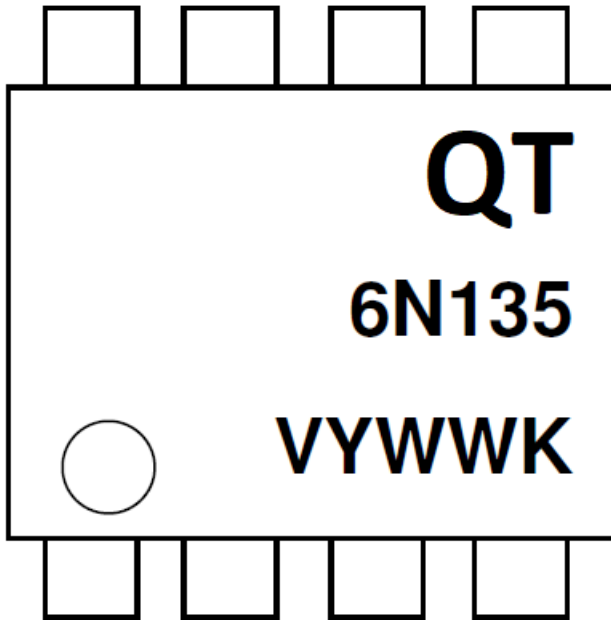
Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	150 °C
Temperature Max. (T <sub>smax</sub> )	200 °C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60-120 seconds
Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second max.
Liquidous Temperature (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.





**Packing & Labeling****Tape Dimension:****Option S(T1) & SL(T1)****Option S(T2) & SL(T2)**

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**Device Marking**

QT = QT-Brightek Corporation  
6N135 = part number  
Y = Year  
WW = Week  
V = VDE Option  
K = Manufacturing code

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**Ordering Information**

6N13X(V)(Y)(Z) or QT450X(V)(Y)(Z)

XX = Part number (5,6 for 6N13X series), (2,3 for QT450X series)

V = VDE option (V or None)

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

Z=Tape and reel option (T1 or T2)

Option	Description	Quantity
None	Standard 4-Pin DIP	40 Units/Tube
M	Gullwing	40 Units/Tube
S(T1)	Surface Mount Lead Forming – with Option 1 Taping	1000 pcs/ reel
S(T2)	Surface Mount Lead Forming – with Option 2 Taping	1000 pcs/ reel
SL(T1)	SMD (Low Profile) Lead Forming – with Option 1 Taping	1000 pcs/ reel
SL(T2)	SMD (Low Profile) Lead Forming – with Option 2 Taping	1000 pcs/ reel



**Revision History**

Description:	Revision #	Revision Date
Initial release of 6N135_6N136_QT4502_QT4503	1.0	02/12/2018

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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.