

# **QT-Brightek Optocoupler Series**

**Low Input Current Photodarlington coupler**

**Part No.: 6N138, 6N139**

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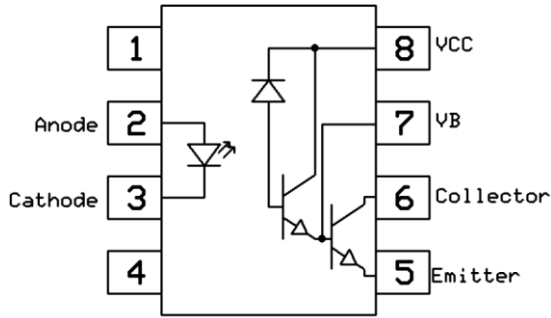
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## Introduction

### Feature:

- High CTR – 300%
- Low input current – 0.5mA
- High Isolation voltage between input and output (Viso = 5000V rms)
- Available in Tube or Tape and reel
- Available with standard DIP-8, Gullwing lead bend, SMD lead bend, and SMD low profile options.

### Schematic:



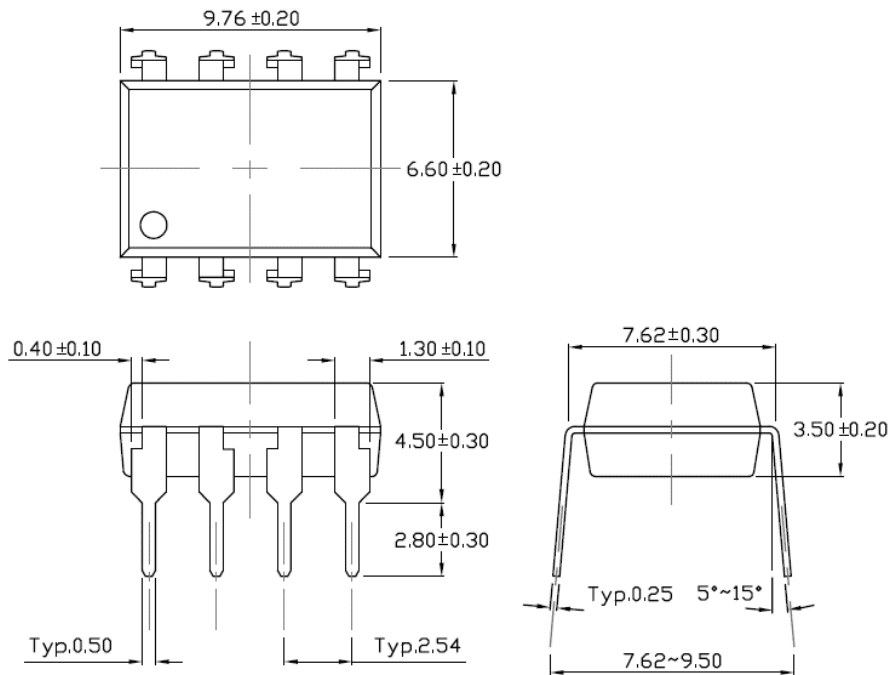
### Certification & Compliance:

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

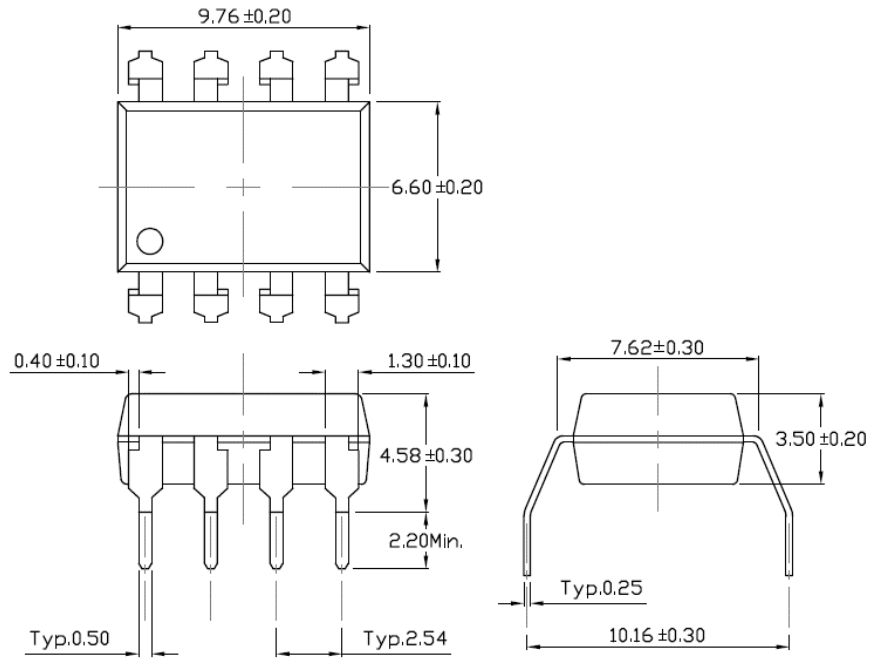


### Dimension: (Dot location indicates pin 1)

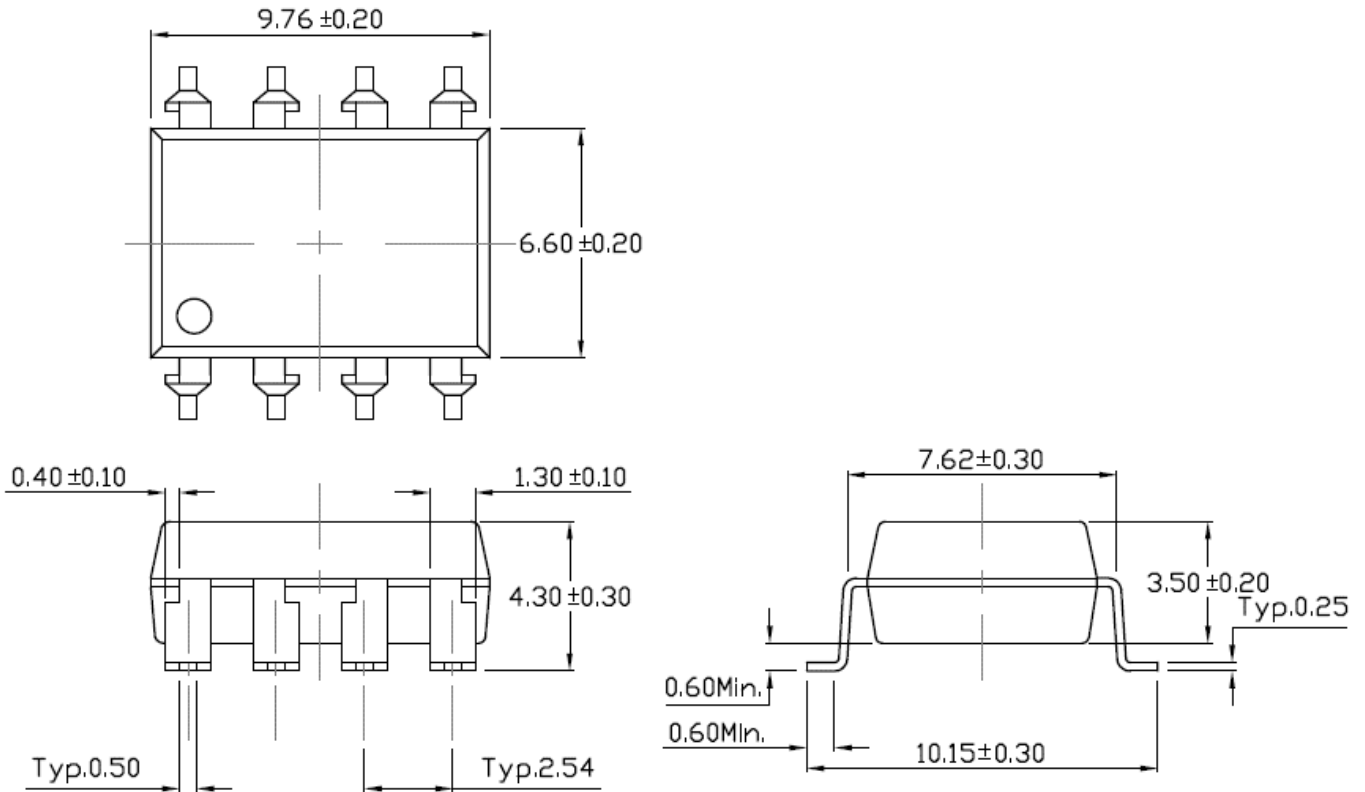
#### 8-Pin Dip (standard):



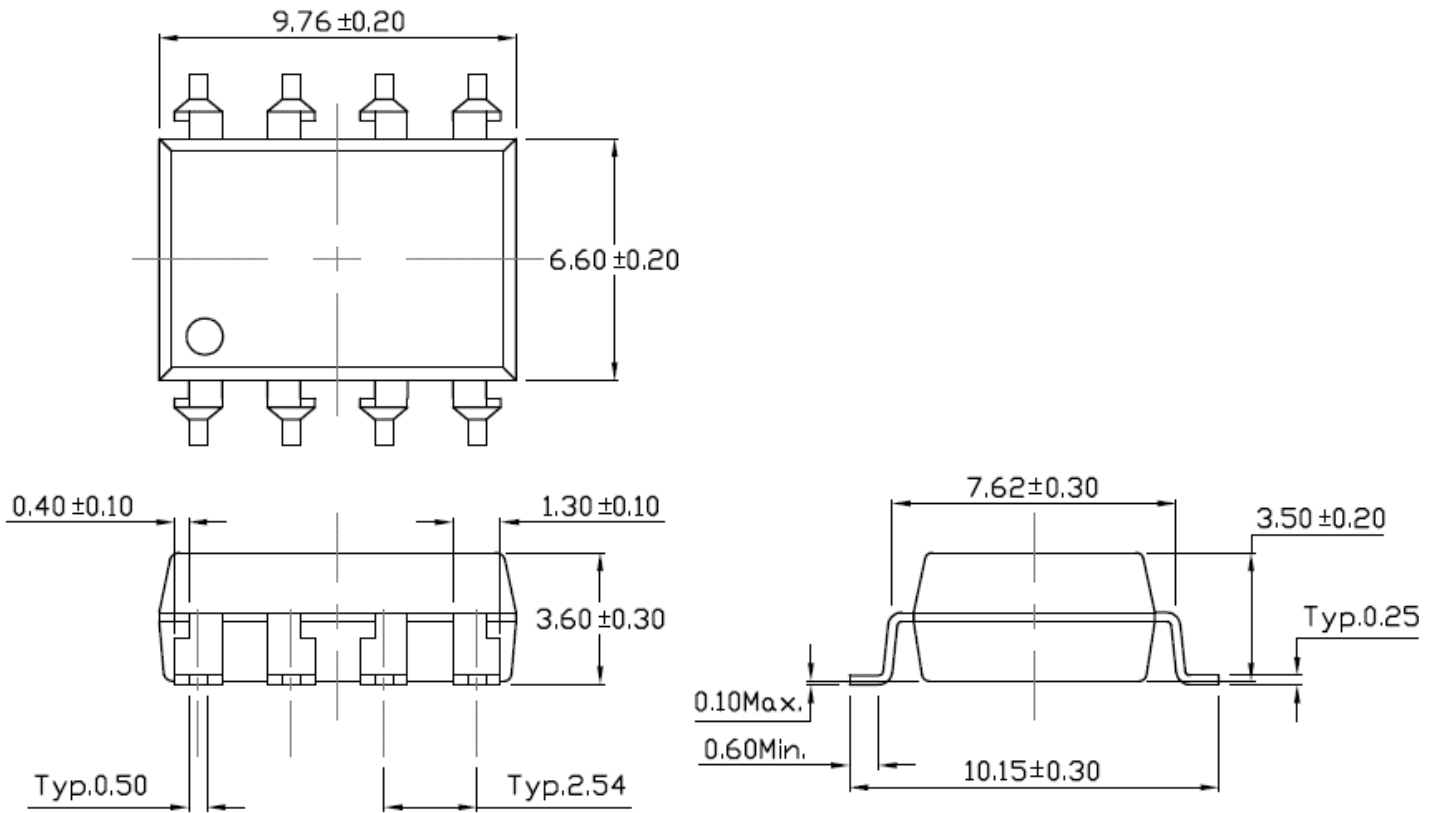
**Gullwing (400mil) lead bend (Option M):**



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



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



All Dimensions are in mm

### Absolute Maximum Rating

Symbol	Parameter	Rating	Units
V <sub>ISO</sub>	Isolation Voltage	5000	V <sub>RMS</sub>
T <sub>STG</sub>	Storage Temperature	-55 ~ +125	°C
T <sub>OPR</sub>	Operating Temperature	-55 ~ +100	°C
T <sub>SOL</sub>	Lead Solder Temperature	260 for 10 sec	°C
<b>EMITTER</b>			
I <sub>F</sub>	Forward Current	25	mA
I <sub>FP</sub>	Peak Forward Current (50% duty, 1ms P.W)	50	mA
I <sub>F(TRANS)</sub>	Peak Transient Current (≤1μs P.W, 300pps)	1	A
V <sub>R</sub>	Reverse Voltage	5	V
P <sub>D</sub>	Power Dissipation	40	mW
<b>DETECTOR</b>			
P <sub>O</sub>	Power Dissipation	100	mW
I <sub>O</sub>	Output current	60	mA
V <sub>O</sub>	Output voltage	6N138	-0.5 to 7.0
		6N139	-0.5 to 18
V <sub>CC</sub>	Supply voltage	6N138	-0.5 to 7.0
		6N139	-0.5 to 18

### Electrical Characteristic (T<sub>A</sub>=25 °C)

(T<sub>A</sub>=0 to 70C unless specified otherwise)

#### Emitter

Symbol	Characteristics	Device	Test Condition	Range			Unit
				Min	Typ	Max	
V <sub>F</sub>	Forward Voltage	-	I <sub>F</sub> = 16mA	-	1.4	1.6	V
I <sub>R</sub>	Reverse Current		V <sub>R</sub> = 5V	-	-	5	μA
ΔV <sub>F</sub> /ΔT <sub>A</sub>	Temperature coefficient of forward voltage		I <sub>F</sub> = 16mA	-	-1.8	-	mV/°C

#### Detector

Symbol	Characteristic	Device	Test Condition	Range			Unit
				Min	Typ	Max	
I <sub>OH</sub>	Logic High Output Current	6N139	I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =18V	-	0.008	80	μA
		6N138		-	-	200	
I <sub>CCL</sub>	Logic Low Supply Current	-	I <sub>F</sub> =1.6mA, V <sub>O</sub> =Open, V <sub>CC</sub> =18V	-	0.5	1.4	mA
I <sub>CCL</sub>	Logic Low Supply Current	-	I <sub>F</sub> =0mA, V <sub>O</sub> =Open, V <sub>CC</sub> =18V	-	0.04	8	μA

### Transfer Characteristics

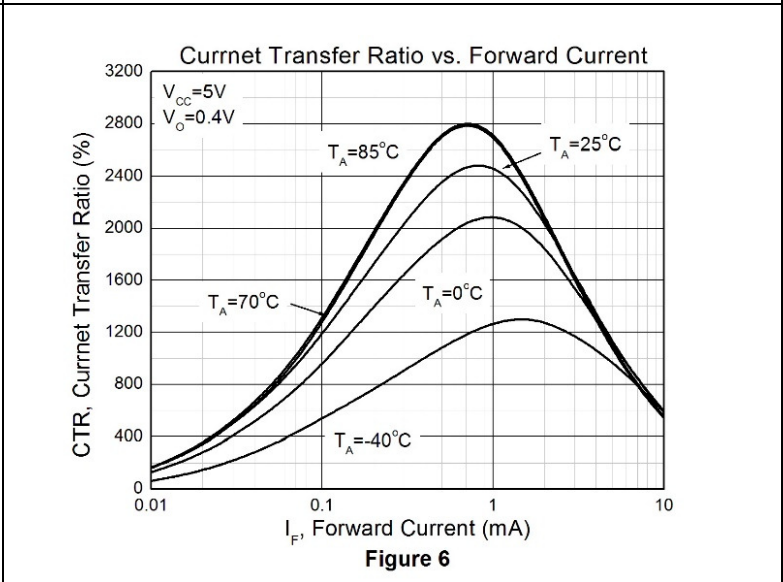
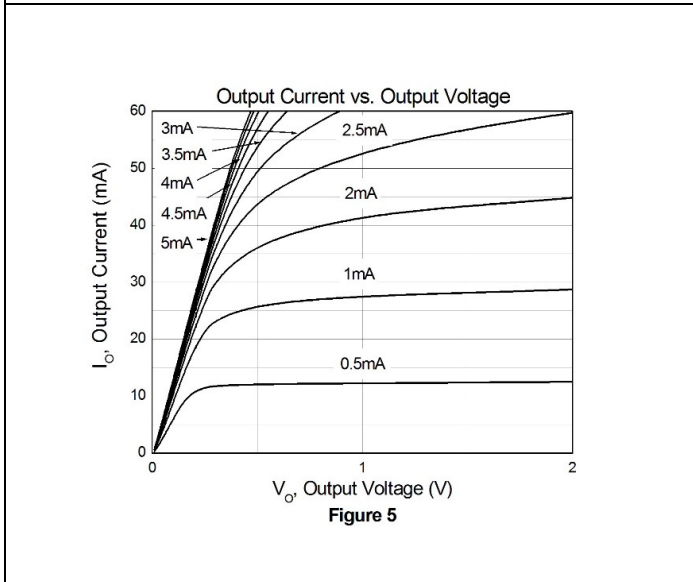
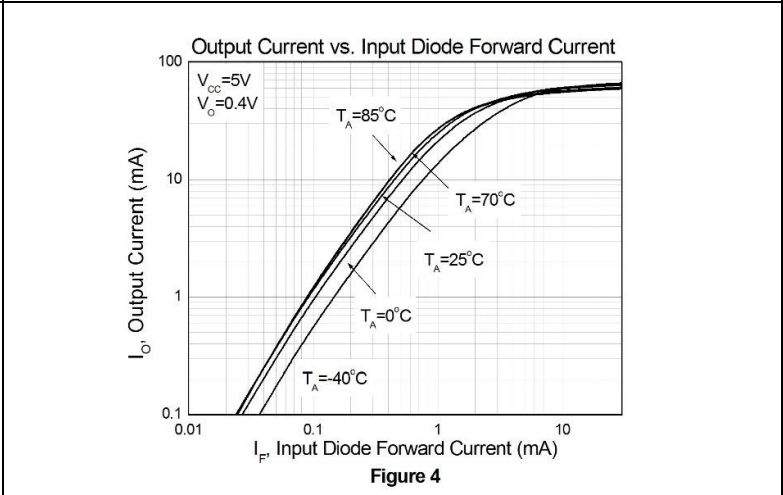
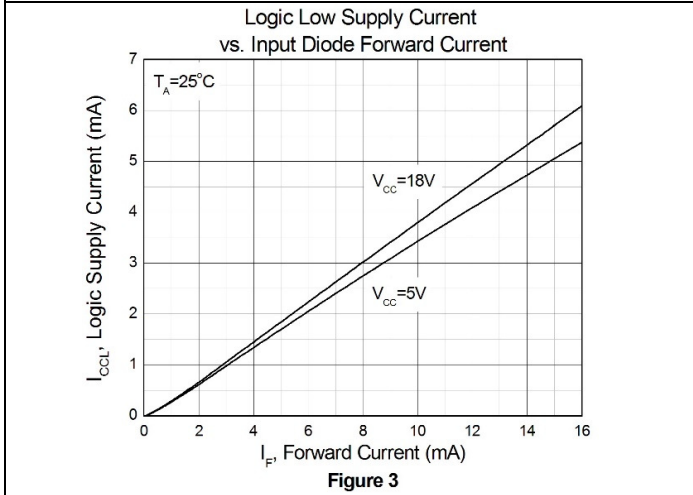
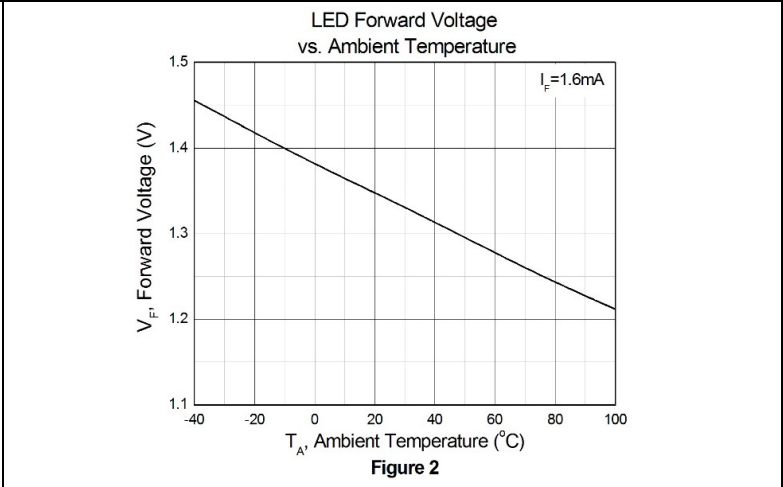
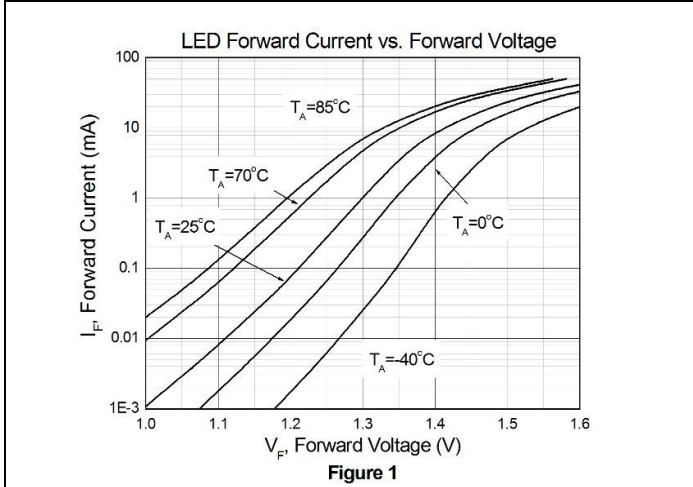
Symbol	Characteristic	Device	Test Condition	Range			Unit
				Min	Typ	Max	
CTR	Current Transfer Ratio	6N139	$I_F=0.5\text{mA}$ , $V_O=0.4\text{V}$ ,	400	2500	-	%
		6N138	$I_F=1.6\text{mA}$ , $V_O=0.5\text{V}$	300	2000	-	
		6N139		500	2000	-	
V <sub>OL</sub>	Logic Low Output Voltage	6N139	$I_F=0.5\text{mA}$ , $I_O=2\text{mA}$	-	0.04	0.4	V
			$I_F=1.6\text{mA}$ , $I_O=8\text{mA}$	-	0.08	0.4	
			$I_F=5\text{mA}$ , $I_O=15\text{mA}$	-	0.11	0.4	
			$I_F=12\text{mA}$ , $I_O=24\text{mA}$	-	0.16	0.4	
		6N138	$I_F=1.6\text{mA}$ , $I_O=4.8\text{mA}$	-	0.05	0.4	

### Switching Characteristics (T<sub>A</sub>=25°C, V<sub>CC</sub>=5V)

Symbol	Characteristic	Device	Test Condition	Range			Unit
				Min	Typ	Max	
T <sub>PHL</sub>	Propagation Delay Time Logic High to Logic Low	6N139	$I_F=0.5\text{mA}$ , $R_L=4.7\text{K}\Omega$	-	-	30	μs
			T <sub>A</sub> =25°C	-	4.8	25	
		6N138	$I_F=12\text{mA}$ , $R_L=250\Omega$	-	-	2	
			T <sub>A</sub> =25°C	-	0.2	1	
T <sub>PLH</sub>	Propagation Delay Time Logic Low to Logic High	6N139	$I_F=0.5\text{mA}$ , $R_L=4.7\text{K}\Omega$	-	-	90	μs
			T <sub>A</sub> =25°C	-	15	60	
		6N138	$I_F=12\text{mA}$ , $R_L=250\Omega$	-	-	10	
			T <sub>A</sub> =25°C	-	1.6	7	
CM <sub>H</sub>	Common Mode Transient Immunity at Logic High	-	$I_F = 0\text{mA}$ , $ V_{CM} =10\text{Vp-p}$ , T <sub>A</sub> =25°C, R <sub>L</sub> =2.2KΩ	1000	-	-	V/μs
CM <sub>L</sub>	Common Mode Transient Immunity at Logic Low	-	$I_F = 1.6\text{mA}$ , $ V_{CM} =50\text{Vp-p}$ , T <sub>A</sub> =25°C, R <sub>L</sub> =2.2KΩ	1000	-	-	



**Characteristic Curves**



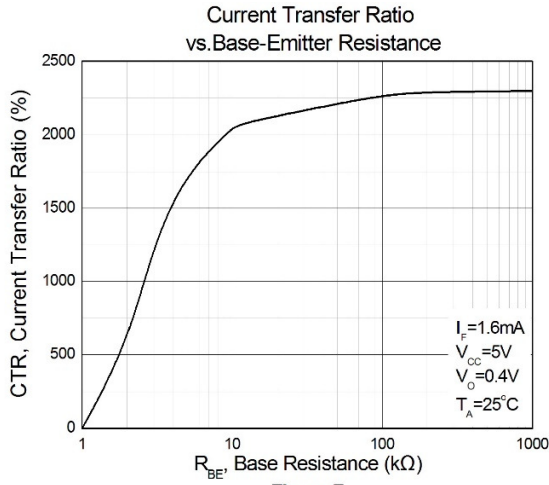


Figure 7

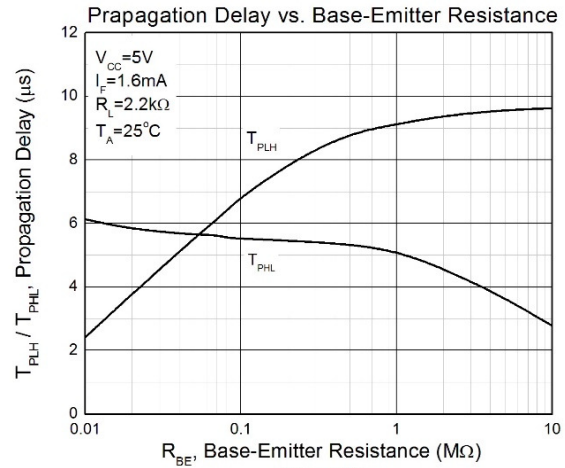


Figure 8

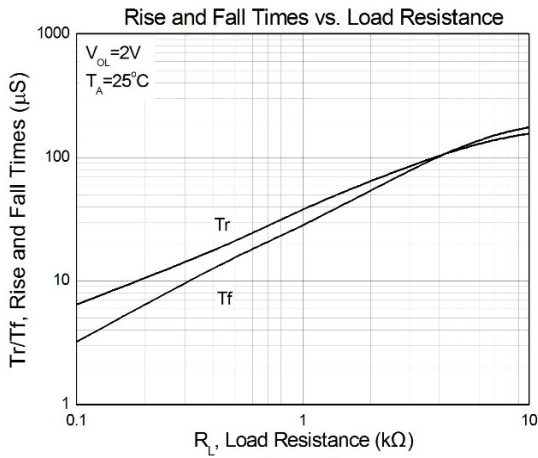


Figure 9

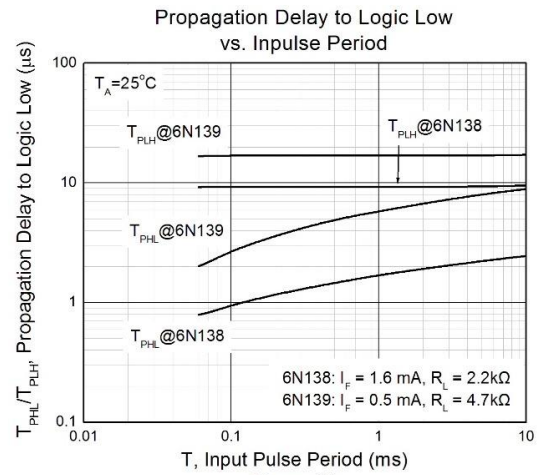


Figure 10

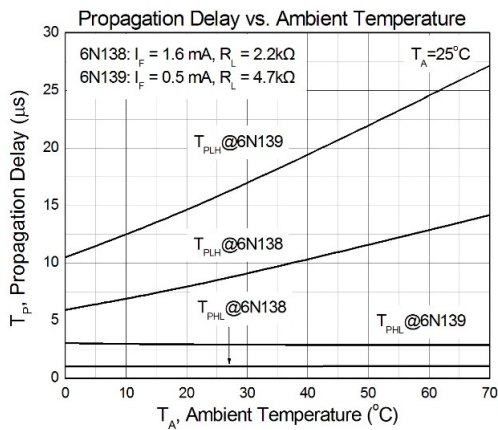


Figure 11

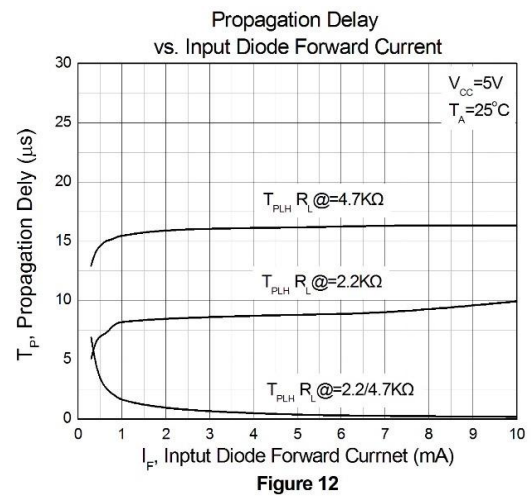
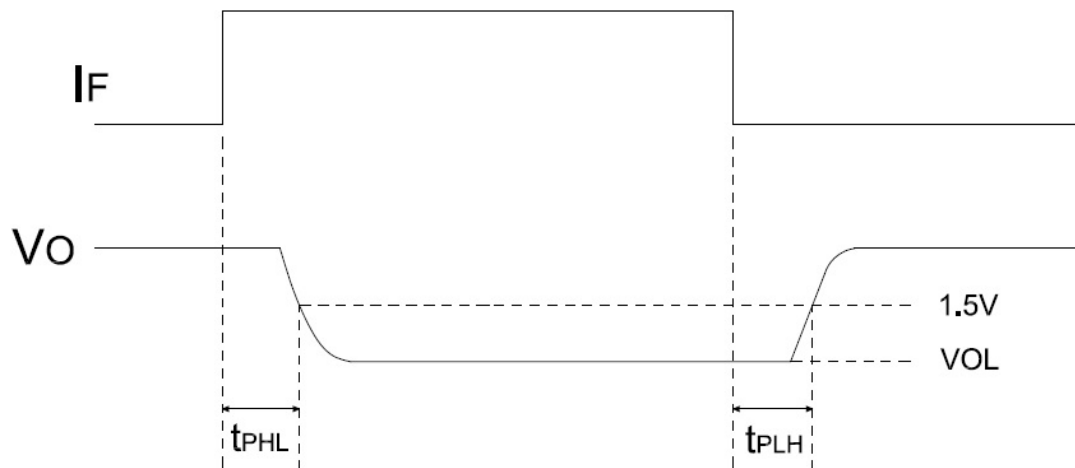
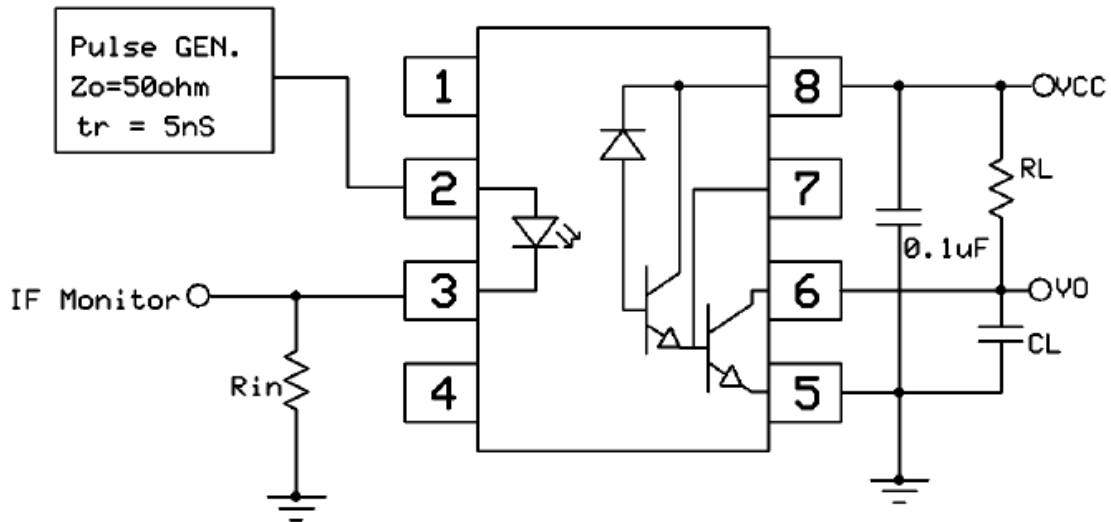
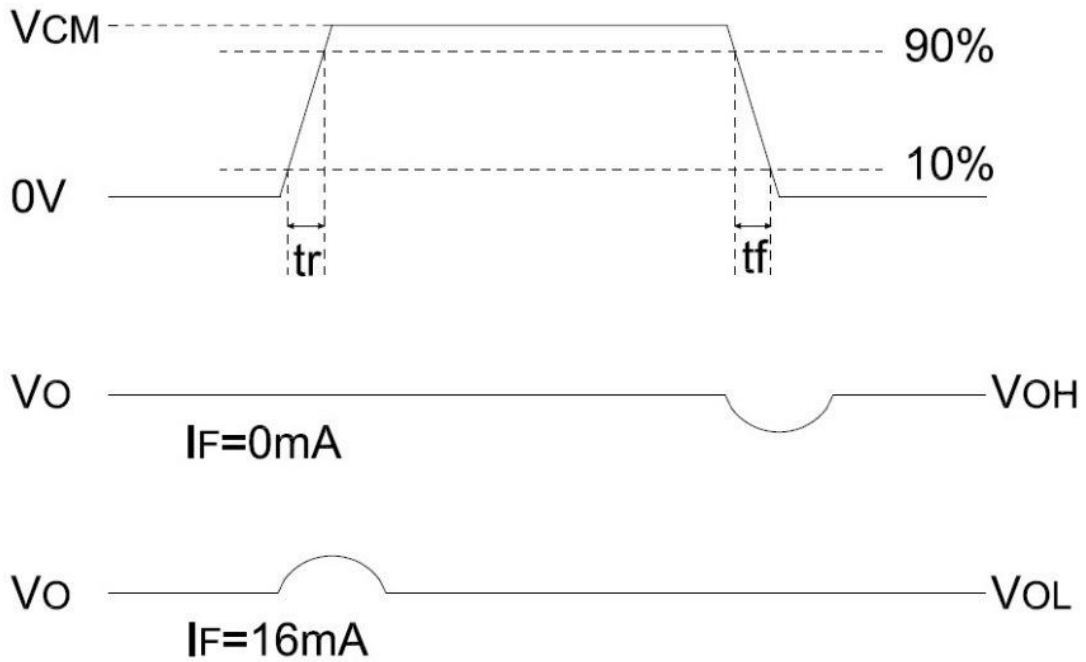
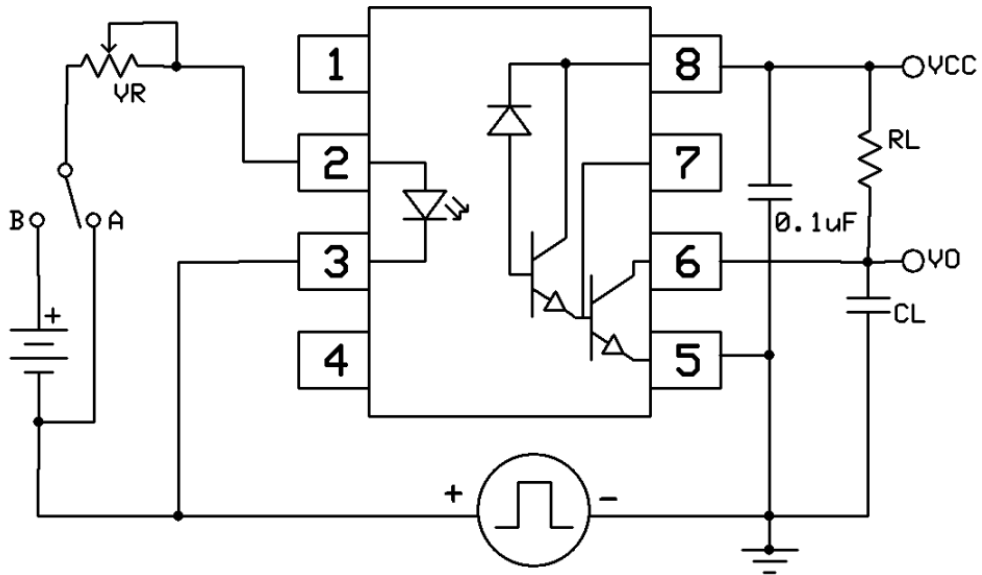


Figure 12

## Test Circuits

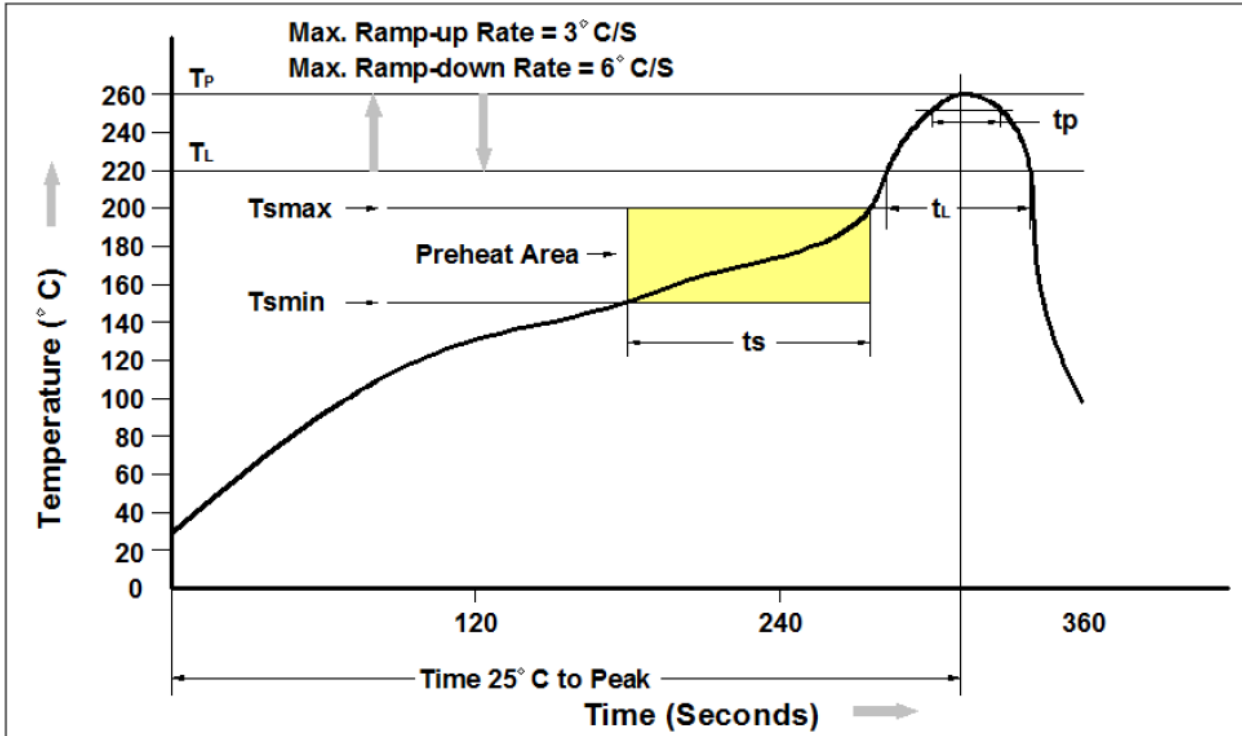


Switching Time Test Circuit

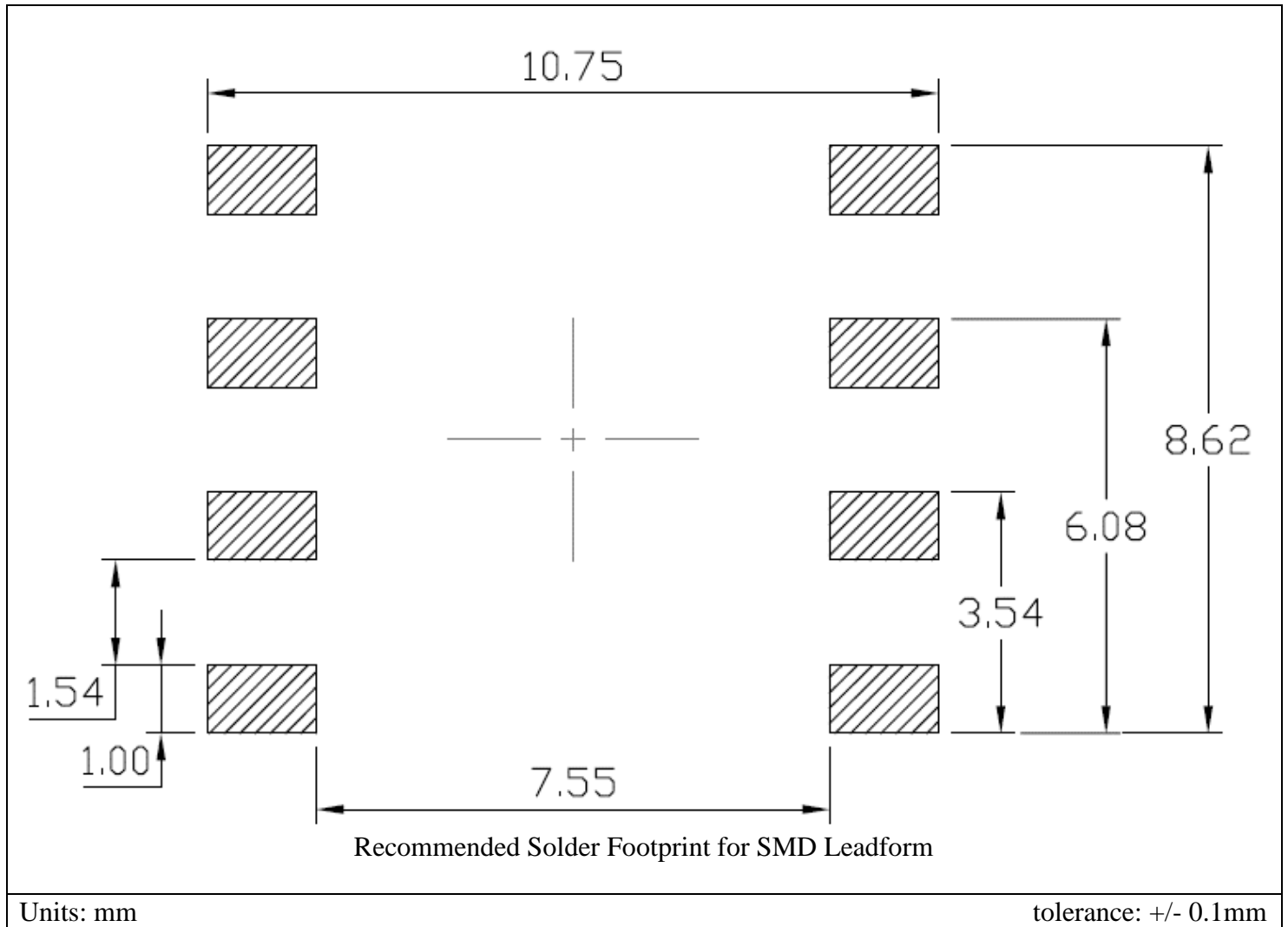


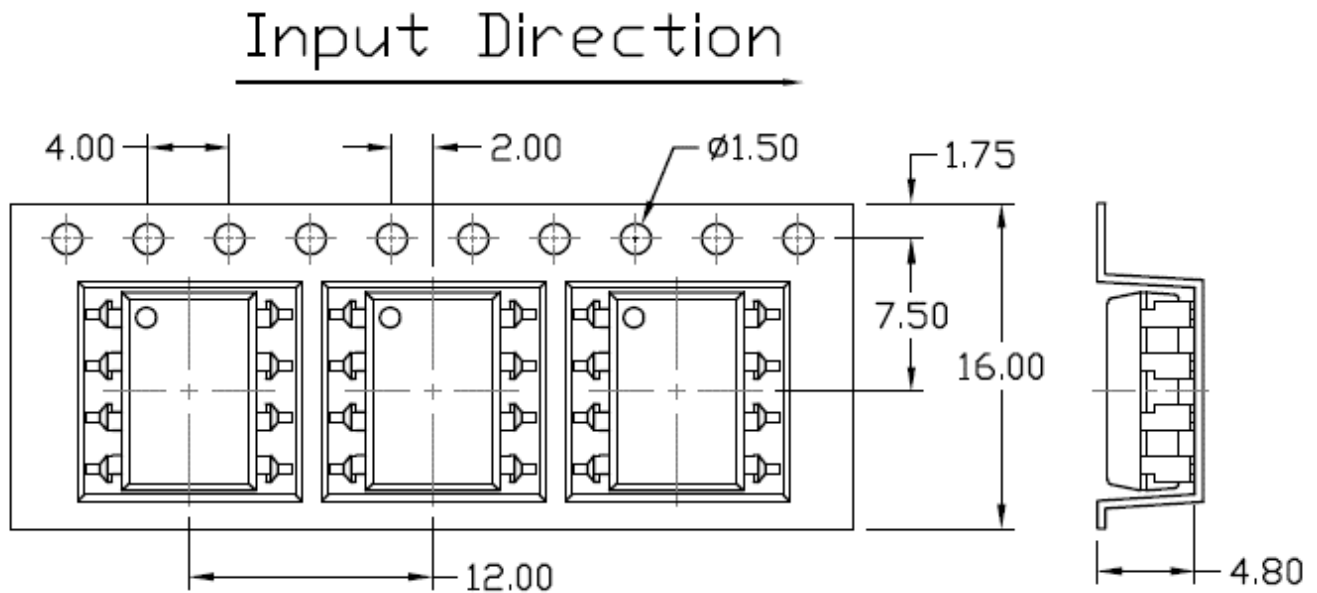
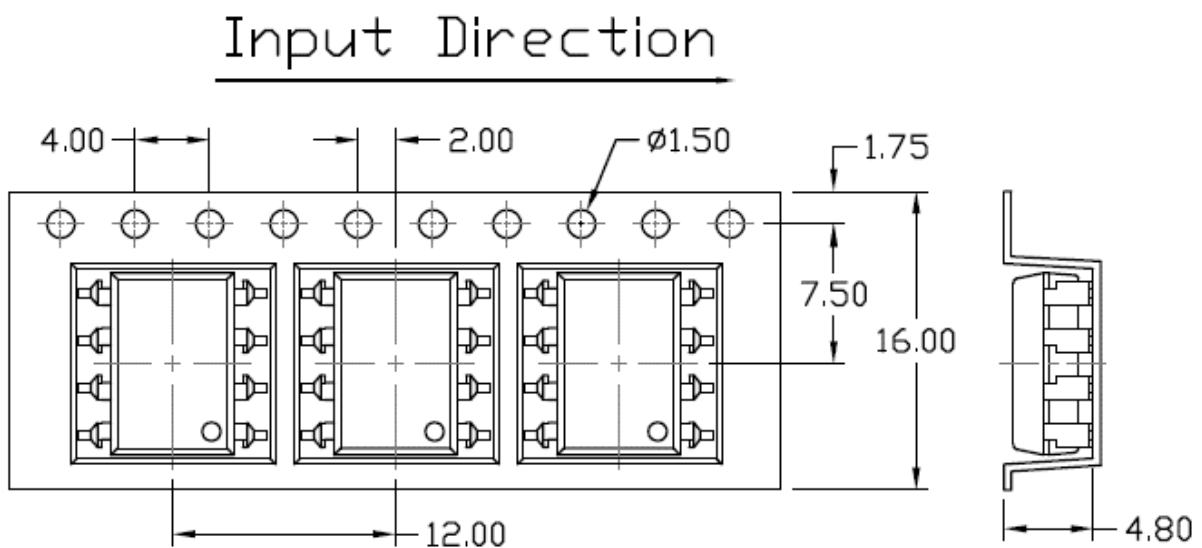
CMR Test Circuit

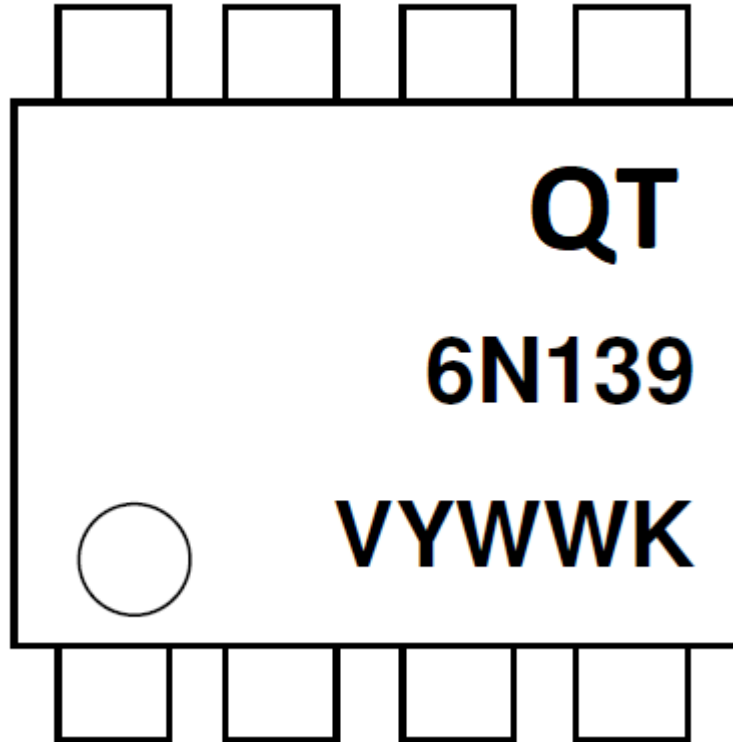
## Solder Profile & Footprint



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)**

**Device Marking**

QT = QT-Brightek Corporation  
6N139 = part number  
Y = Year  
WW = Week  
V = VDE Option  
K = Manufacturing code



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**Ordering Information**

6N13X(V)(Y)(Z)

X= Part number (8 or 9)

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 8-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 6N138_6N139	1.0	02/12/2018

## Disclaimer

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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.

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