6N137, CT2601

10MBit/s High Speed Logic Gate Optocoupler

Features

- High speed 10MBit/s
- High isolation voltage between input and output (Viso=5000 Vrms)
- Guaranteed performance from -40°C to 85°C
- Operating Temperature range of -55°C to 100°C
- MSL class 1
- Regulatory Approvals
  - ✓ UL - UL1577 (E364000)
  - ✓ VDE - EN60747-5-5 (40039590)
  - ✓ CQC – GB4943.1, GB8898 (14001104779)
  - ✓ IEC62368 (FI/41119)

Description

The 6N137, CT2601 optocoupler consist of a 850 nm LED, optically coupled to a very high speed integrated photo-detector logic gate with a strobable output. This output features an open collector, there by permitting wired OR outputs.

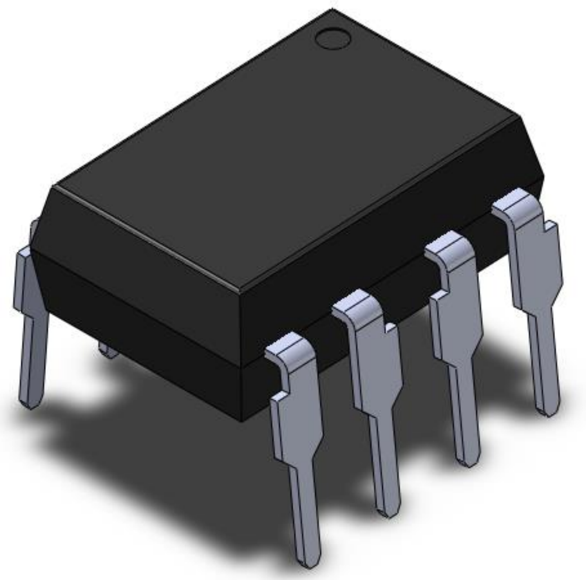
The switching parameters are guaranteed over the temperature range of -40°C to +85°C.

A maximum input signal of 5mA will provide a minimum output sink current of 13mA (fan out of 8).

Applications

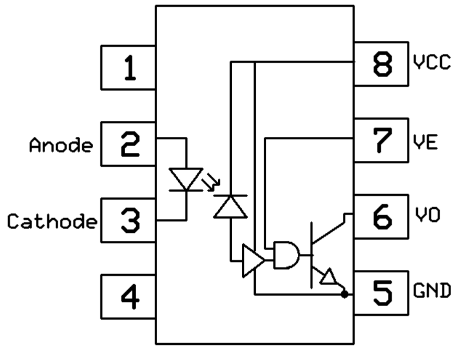
- Line receivers
- Telecommunication equipment
- Feedback loop in switch-mode power supplies
- Home appliances
- High speed logic ground isolation

Package Outline



Note: Different lead forming options available. See package dimension.

Schematic



Truth Table

Input	Enable	Output
H	H	L
L	H	H
H	L	H
L	L	H
H	NC	L
L	NC	H

Absolute Maximum Ratings *T_A = 25°C, unless otherwise specified*

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	*Parameters*	*Ratings*	*Units*	*Notes*
V_{ISO}	Isolation voltage (AC, 1 minute, 40 ~ 60% R.H.)	5000	V_{RMS}	
T_{OPR}	Operating temperature	-55 ~ +100	ºC	
T_{STG}	Storage temperature	-55 ~ +125	ºC	
T_{SOL}	Soldering temperature (For 10 seconds)	260	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	1min(Max.)
V_{CC}	Supply voltage	3.0 ~ 7.0	V	
VE	Enable Input Voltage Not to Exceed VCC by more than 500mV	5.5	V	

Electrical Characteristics *TA = -40 - 85°C (unless otherwise specified). Typical values are measured at TA = 250C and VCC=5V*

Emitter Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
V_F	Forward voltage	IF = 10mA	-	1.4	1.6	V	
V_R	Reverse Voltage	IR = 10μA	5.0	-	-	V	
$\Delta V_F/\Delta T_A$	Temperature coefficient of forward voltage	IF =10mA	-	-1.8	-	mV/°C	

Detector Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
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	
		I_F=10mA, V_{CC}=5.5V	2.0	-	-		
V_{EL}	Low Level Enable Voltage	I_F=10mA, V_{CC}=3.3V	-	-	0.8	V	
		I_F=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		

Electrical Characteristics *T_A = 0 - 70°C (unless otherwise specified). Typical values are measured at T_A = 25°C and V_{CC}=5V*

Transfer Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
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}	Low Level Output Voltage	I_F=5mA, V_{CC}=3.3V, V_E=2.0V, I_O=13mA	-	0.45	0.6	V	
		I_F=5mA, V_{CC}=5.5V, V_E=2.0V, I_O=13mA	-	0.35	0.6		

Electrical Characteristics

TA = -40 - 85°C (unless otherwise specified). Typical values are measured at TA = 250C, VCC=5V and IF= 7.5mA

Switching Characteristics

Symbol	Parameters	Test Conditions		Min	Typ	Max	Units	Notes
T_{PHL}	Output Propagation Delay High to Low	C_L= 15pF, R_L= 350Ω V_{CC}=3.3V		-	34	75	ns	
		C_L= 15pF, R_L= 350Ω V_{CC}=5.5V		-	34	75		
T_{PLH}	Output Propagation Delay Low to High	C_L= 15pF, R_L= 350Ω V_{CC}=3.3V		-	50	75	ns	
		C_L= 15pF, R_L= 350Ω V_{CC}=5.5V		-	39	75		
P_{WD}	Pulse Width Distortion	C_L= 15pF, R_L= 350Ω V_{CC}=3.3V		-	16	34	ns	
		C_L= 15pF, R_L= 350Ω V_{CC}=5.5V		-	5	34		
T_r	Output Rise Time	C_L= 15pF, R_L= 350Ω V_{CC}=3.3V		-	37	-	ns	
		C_L= 15pF, R_L= 350Ω V_{CC}=5.5V		-	37	-		
T_f	Output Fall Time	C_L= 15pF, R_L= 350Ω V_{CC}=3.3V		-	10	-	ns	
		C_L= 15pF, R_L= 350Ω V_{CC}=5.5V		-	10	-		
T_{ELH}	Enable Propagation Delay Low To High	VEH= 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	I_F= 0mA, V_{CM}= 50Vp-p, V_{OH}= 2.0V, R_L= 350Ω	6N137	-	10000	-	V/µs	
			CT2601	5000	10000	-		
CM_L	Common Mode Transient Immunity at Logic Low	I_F=7.5mA, V_{CM}= 50Vp-p, V_{OL}= 0.8V, R_L= 350Ω	6N137	-	10000	-	V/µs	
			CT2601	5000	10000	-		

Typical Characteristic Curves *T_A = 25°C, unless otherwise specified*

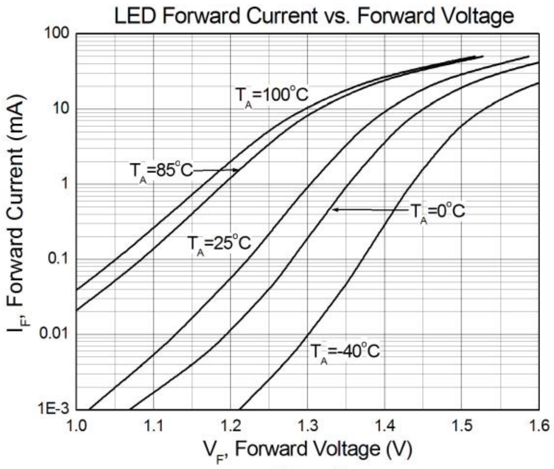


Figure 1

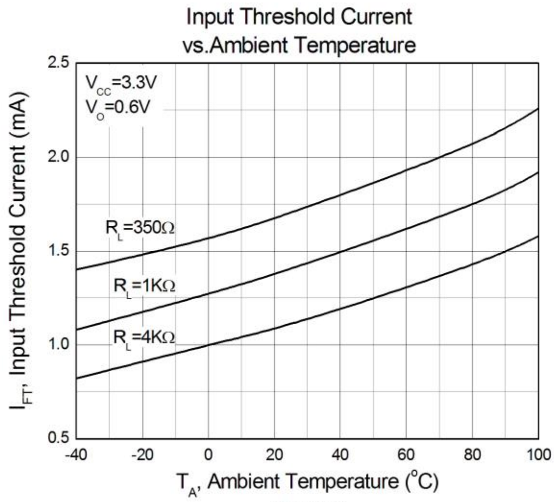


Figure 2

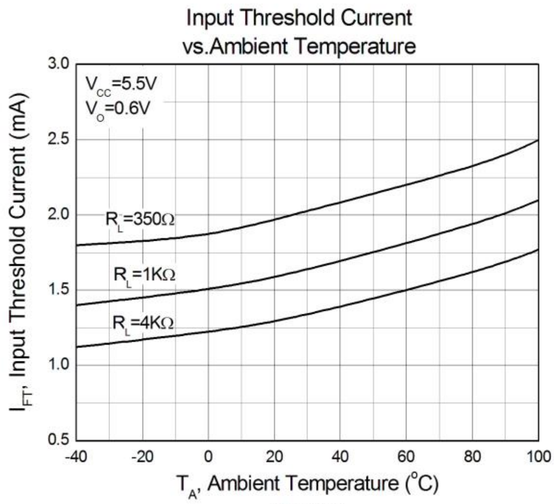
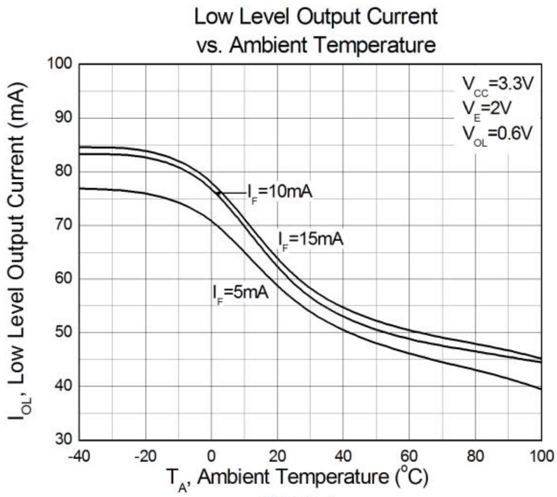


Figure 3



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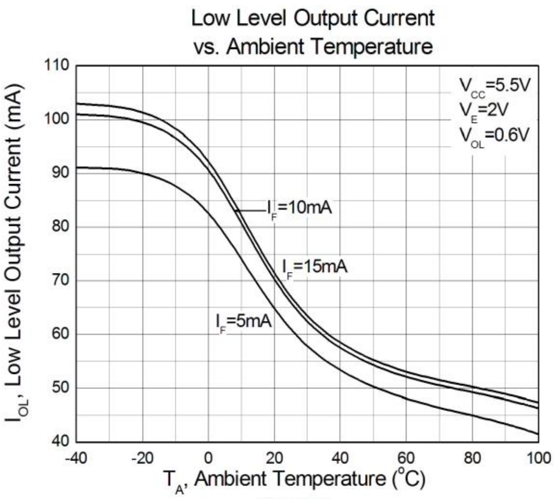


Figure 5

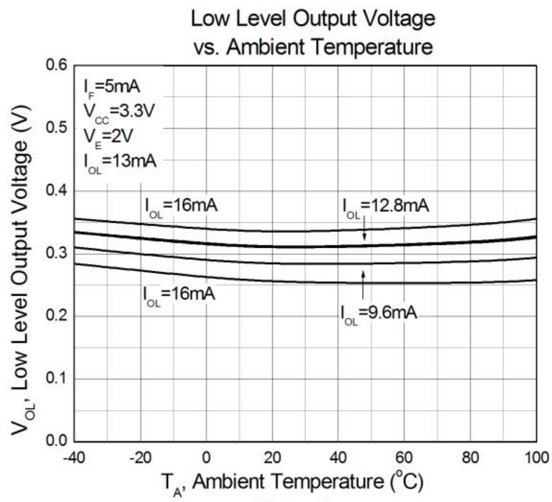


Figure 6

Typical Characteristic Curves *T_A = 25°C, unless otherwise specified*

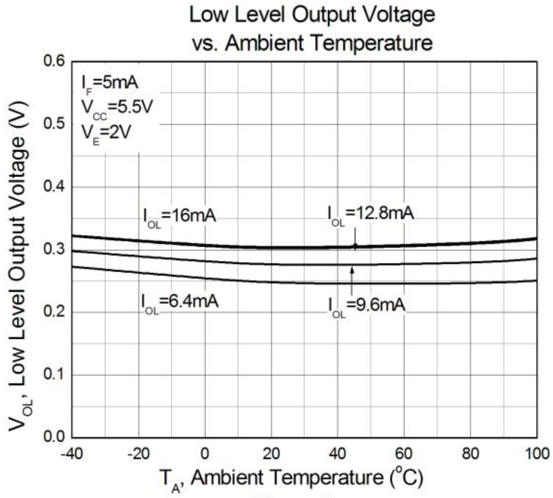


Figure 7

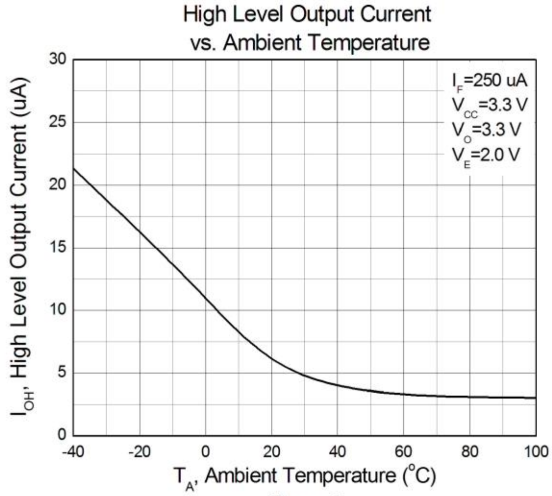


Figure 8

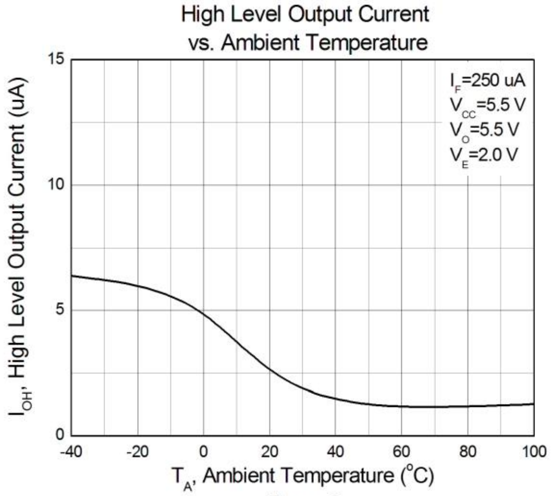


Figure 9

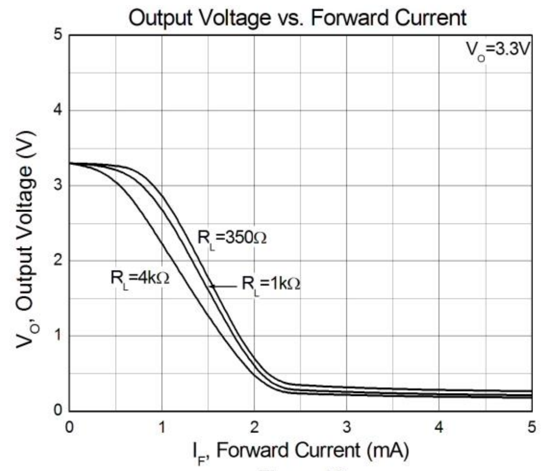


Figure 10

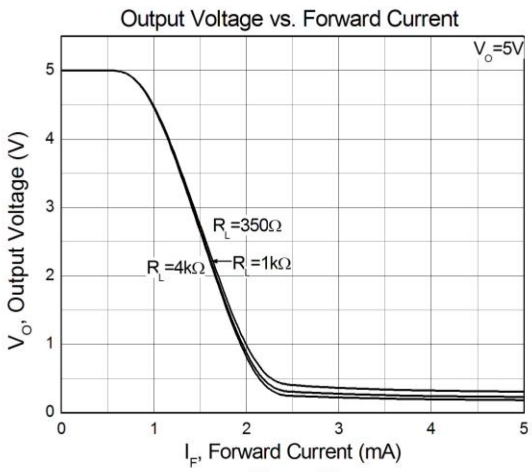


Figure 11

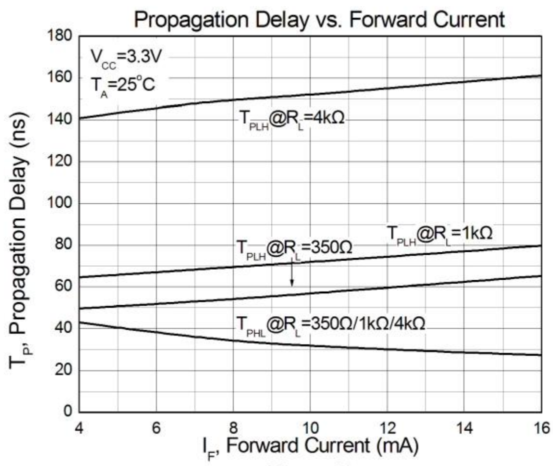


Figure 12

Typical Characteristic Curves *T_A = 25°C, unless otherwise specified*

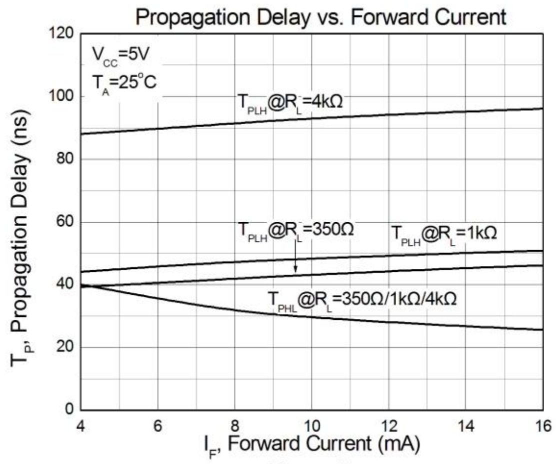
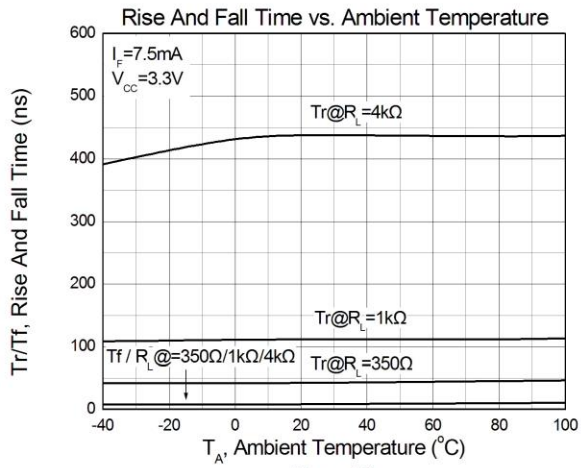
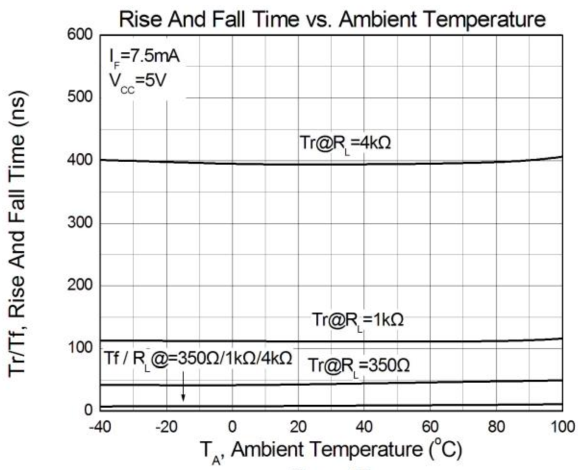


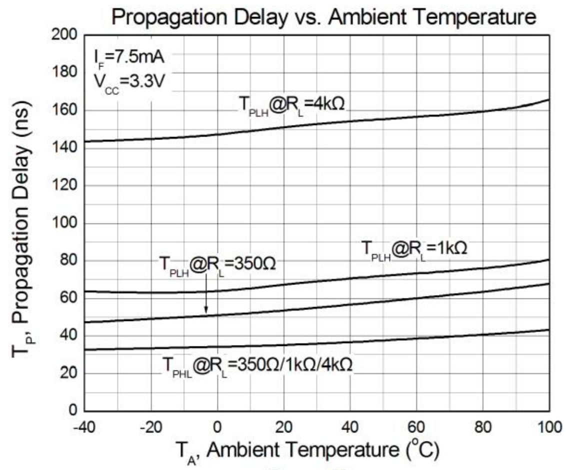
Figure 13



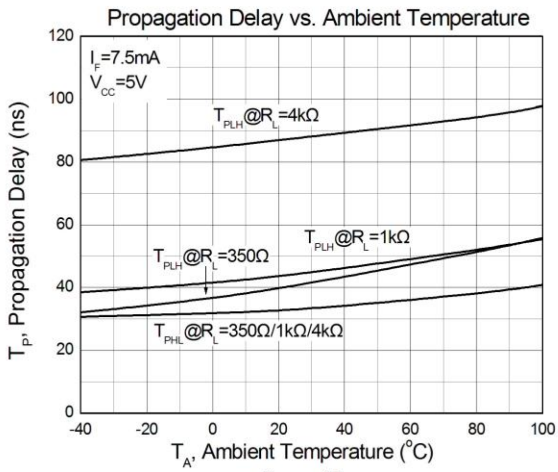
Fgure 14



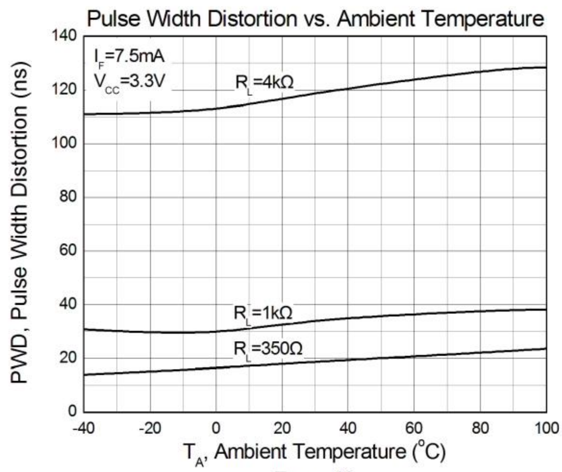
Fgure 15



Fgure 16

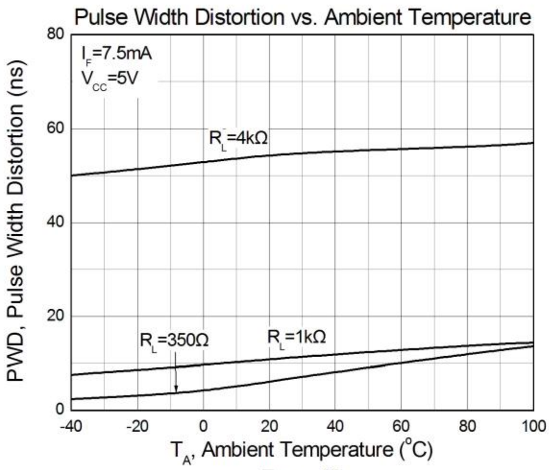


Fgure 17



Fgure 18

Typical Characteristic Curves *T_A = 25°C, unless otherwise specified*



Fgure 19

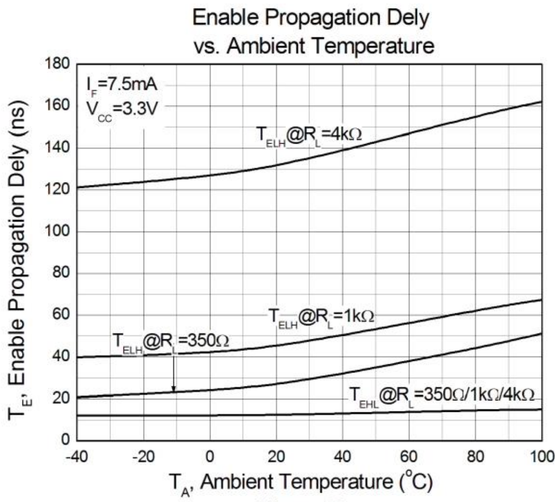


Figure 20

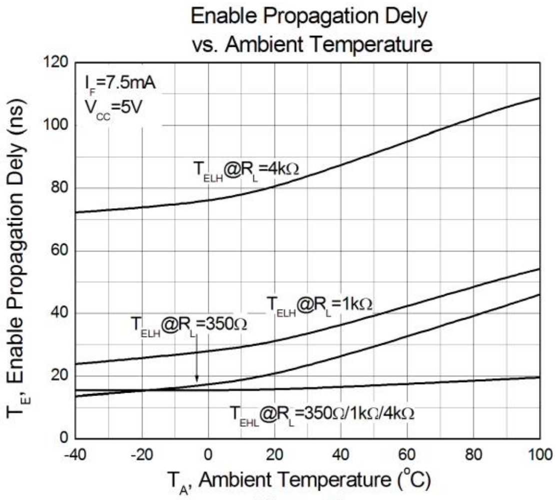


Figure 21

Test Circuits

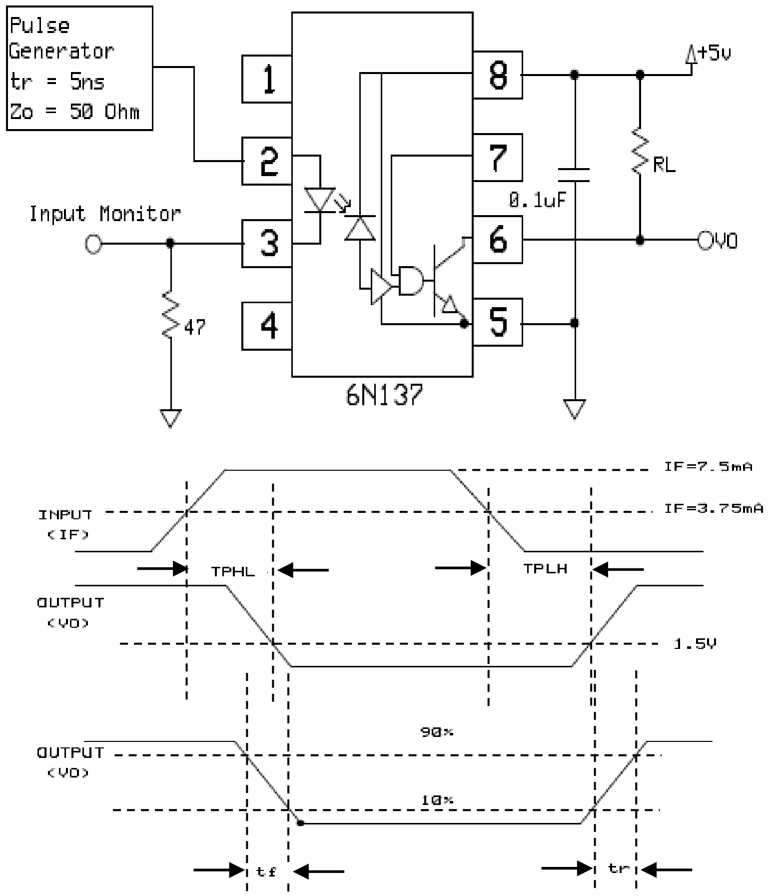


Figure 22: Switching Time Test Circuit

Test Circuits

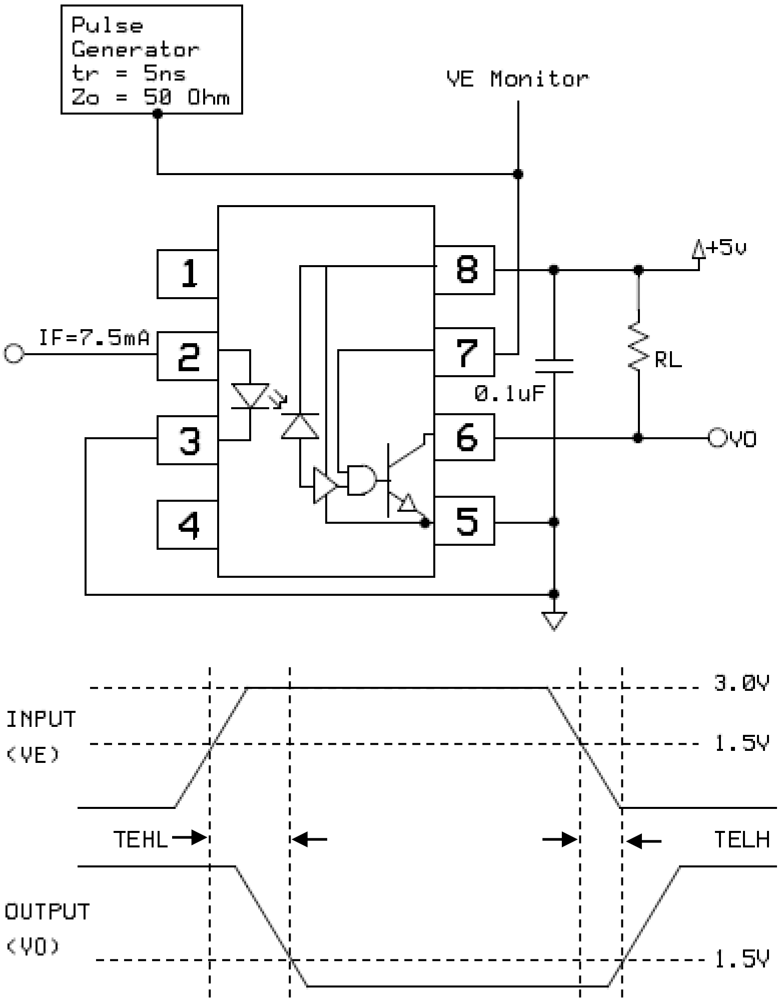


Figure 23: Enable Switching Time Test Circuit

Test Circuits

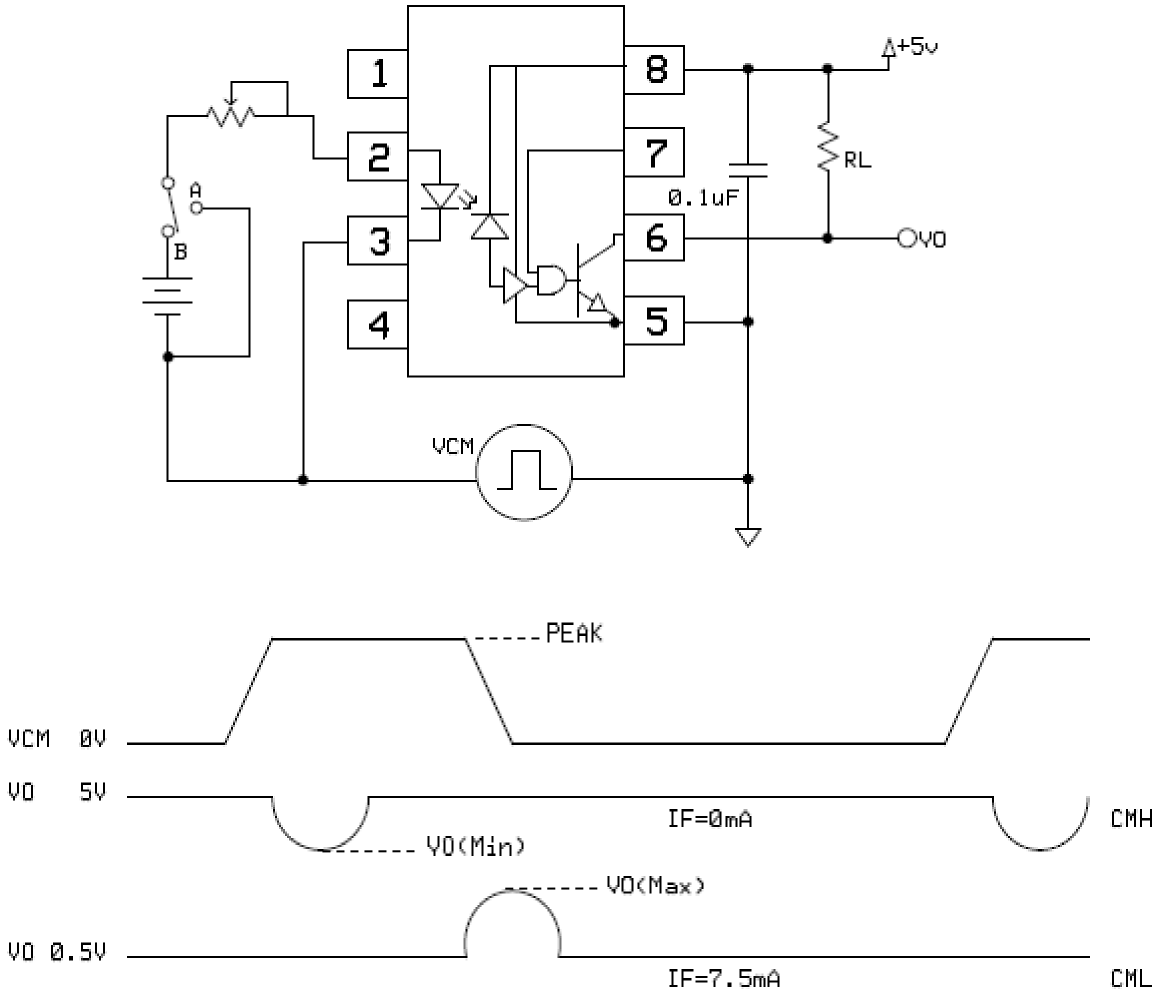
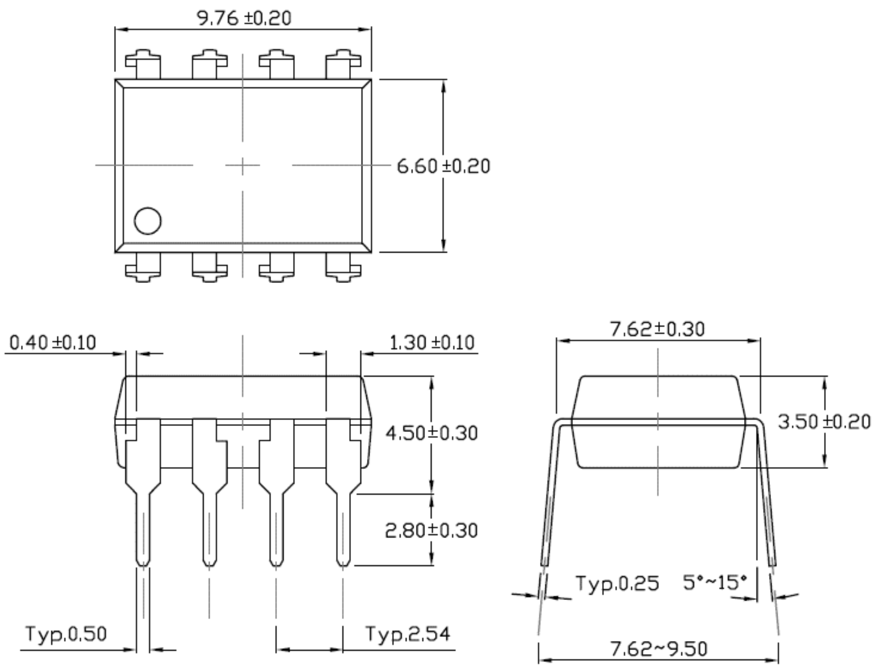
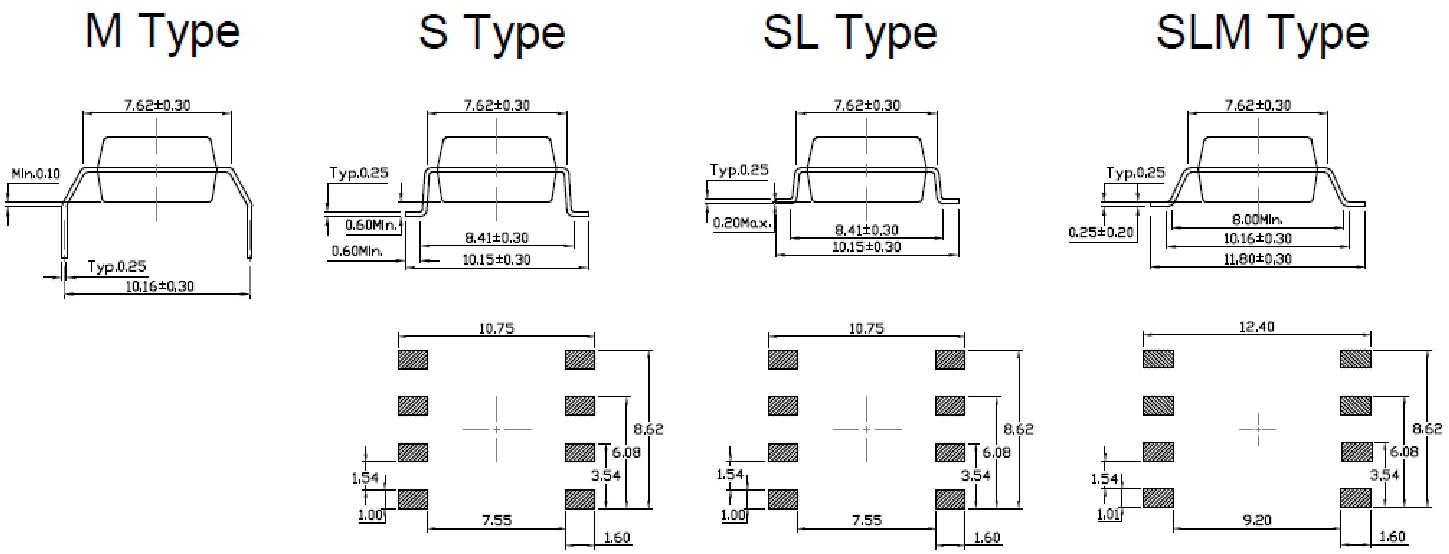


Figure 24: CMR Test Circuit

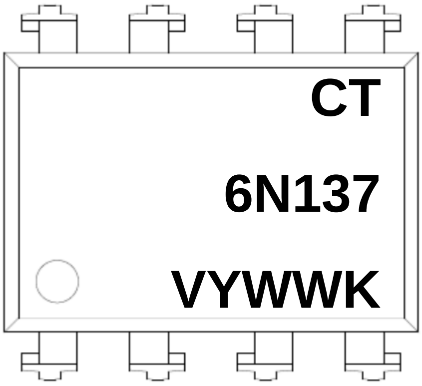
Package Dimension *Dimensions in mm unless otherwise stated*



Forming Option *Dimensions in mm unless otherwise stated*

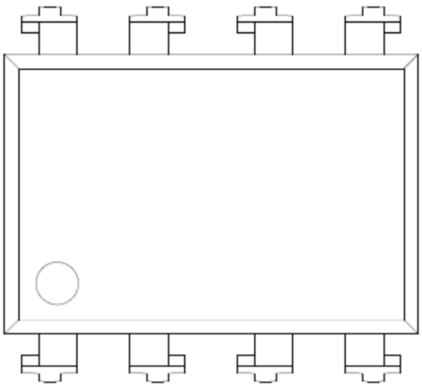


Marking Information



Note:

CT : Denotes “CT Micro”
6N137: Part Number
V : VDE Safety Mark Option (Blank or V)
Y : One Digit Year Code
WW : Two Digit Work Week
K : Manufacturing Code



Note:

CT : Denotes “CT Micro”
2601 : Part Number
V : VDE Safety Mark Option (Blank or V)
Y : One Digit Year Code
WW : Two Digit Work Week
K : Manufacturing Code

Ordering Information

6N137(V)(Y)(Z)-G

6N137	= Part Number
V	= VDE Safety Mark Option (Blank or V)
Y	= Lead Form Option (S, SL, M , SLM or none)
Z	= Tape and Reel Option (Blank, T1 or T2)
G	= Material Option (G: Halogen Free, Blank: Non-Halogen Free)

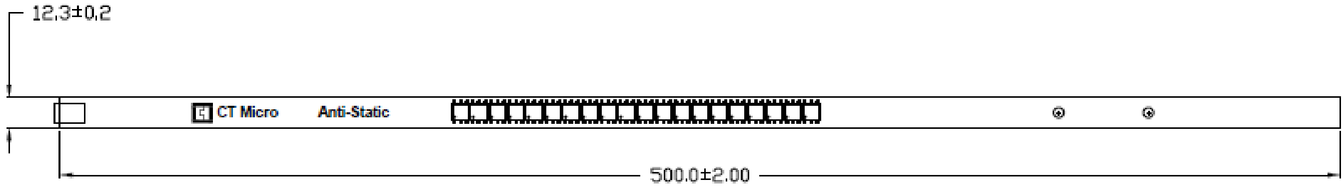
CT2601(V)(Y)(Z)-G

CT2601	= Part Number
V	= VDE Safety Mark Option (Blank or V)
Y	= Lead Form Option (S, SL, M , SLM or none)
Z	= Tape and Reel Option (Blank, T1 or T2)
G	= Material Option (G: Halogen Free, Blank: Non-Halogen Free)

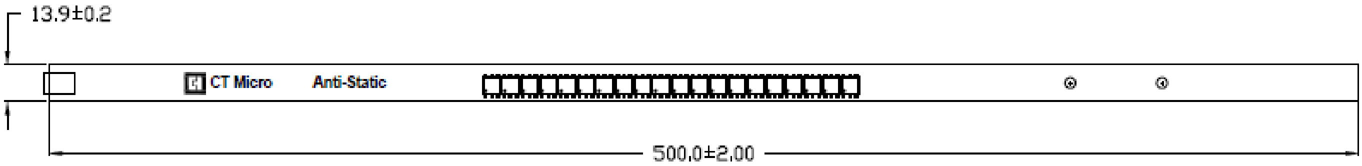
Option	*Description*	*Quantity*
None	Standard 8 Pin Dip	40 Units/Tube
M	Gullwing (400mil) Lead Forming	40 Units/Tube
S(T1)	Surface Mount Lead Forming – With Option 1 Taping	1000 Units/Reel
S(T2)	Surface Mount Lead Forming – With Option 2 Taping	1000 Units/Reel
SL(T1)	Surface Mount (Low Profile) Lead Forming– With Option 1 Taping	1000 Units/Reel
SL(T2)	Surface Mount (Low Profile) Lead Forming– With Option 2 Taping	1000 Units/Reel
SLM(T1)	Surface Mount (Gullwing) Lead Forming– With Option 1 Taping	1000 Units/Reel
SLM(T2)	Surface Mount (Gullwing) Lead Forming – With Option 2 Taping	1000 Units/Reel

Carrier Specifications *Dimensions in mm unless otherwise stated*

Tube Option Standard DIP

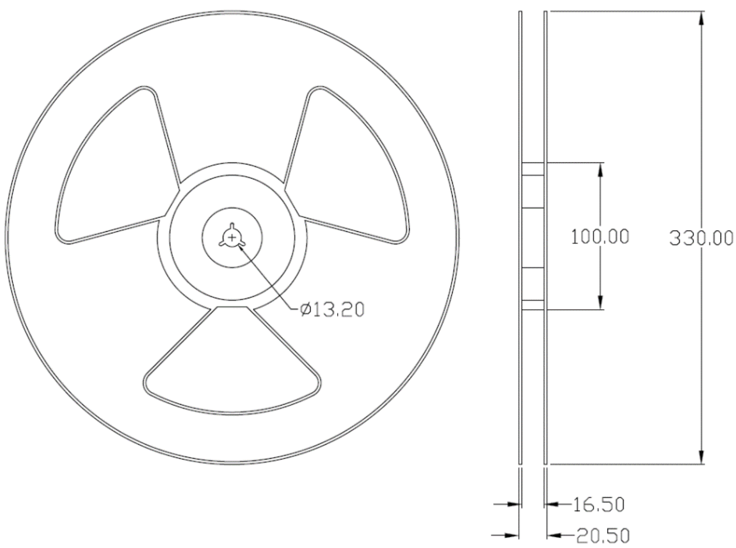


Tube Option M Type

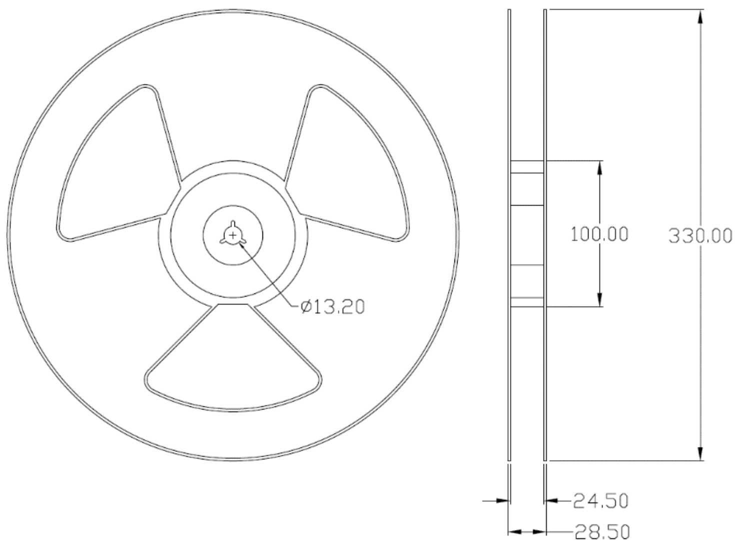


Reel Dimension *All dimensions are in mm, unless otherwise stated*

Option S(T1/T2) & SL(T1/T2)

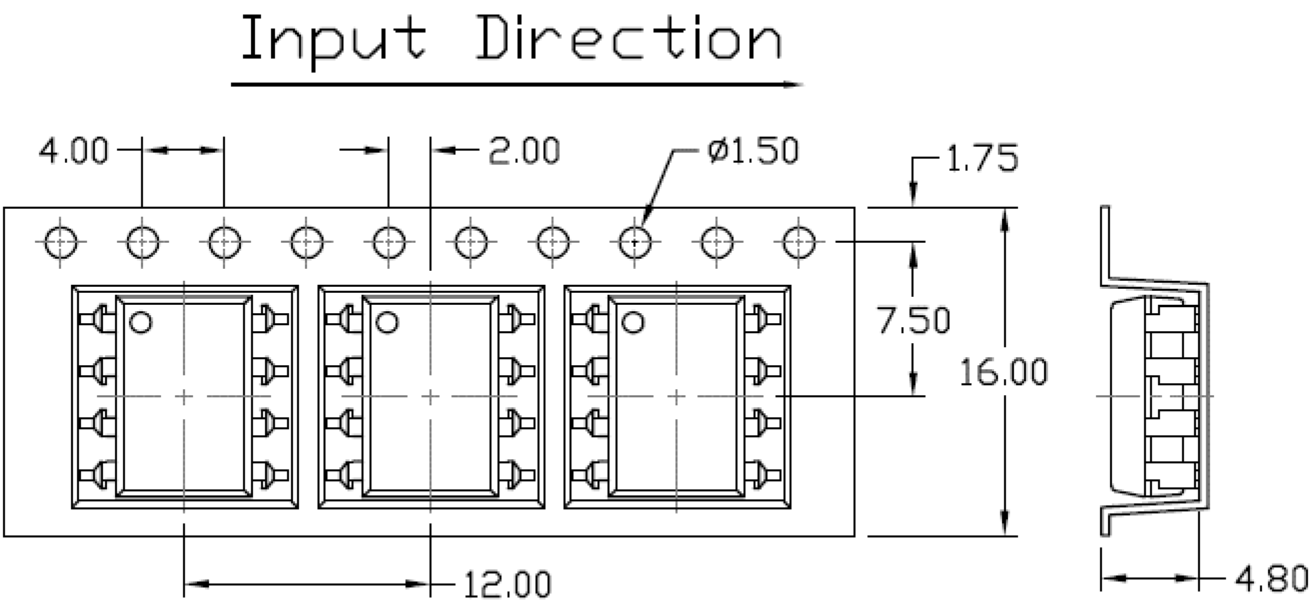


Option SLM(T1/T2)

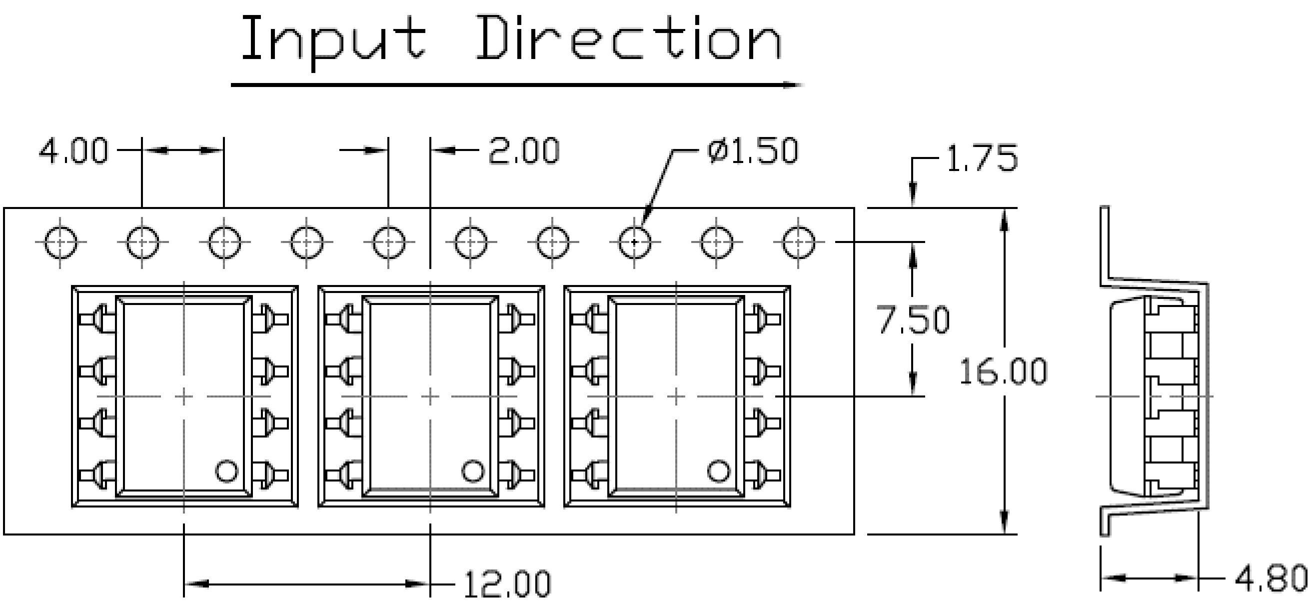


Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

Option S(T1) & SL(T1)

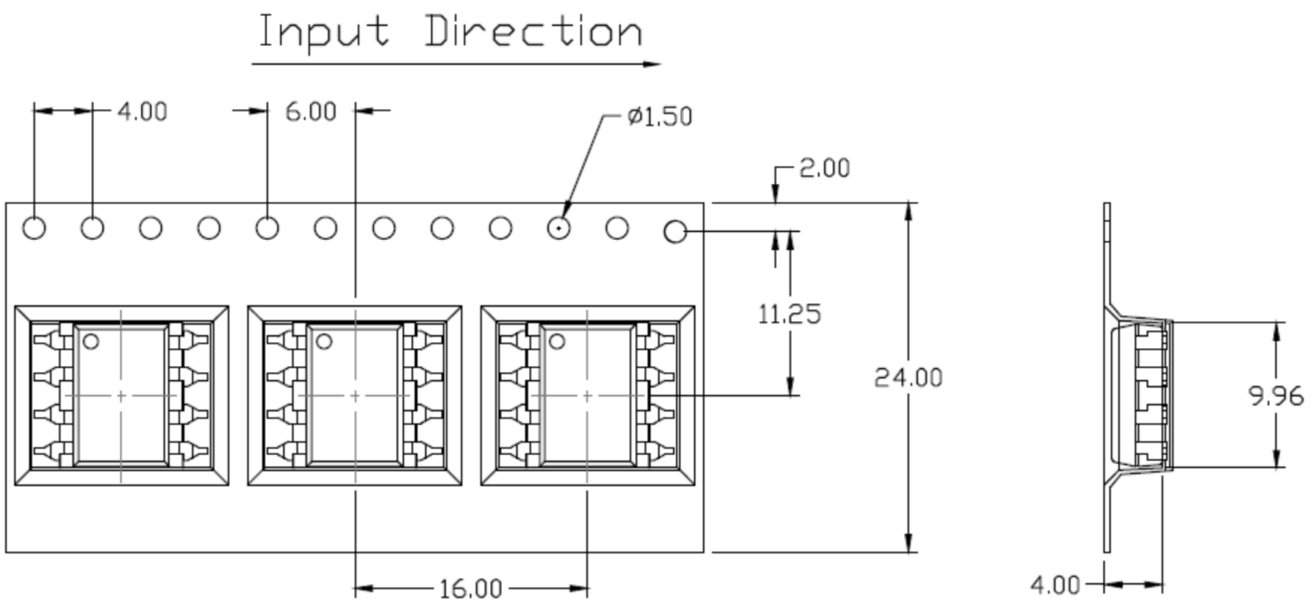


Option S(T2) & SL(T2)

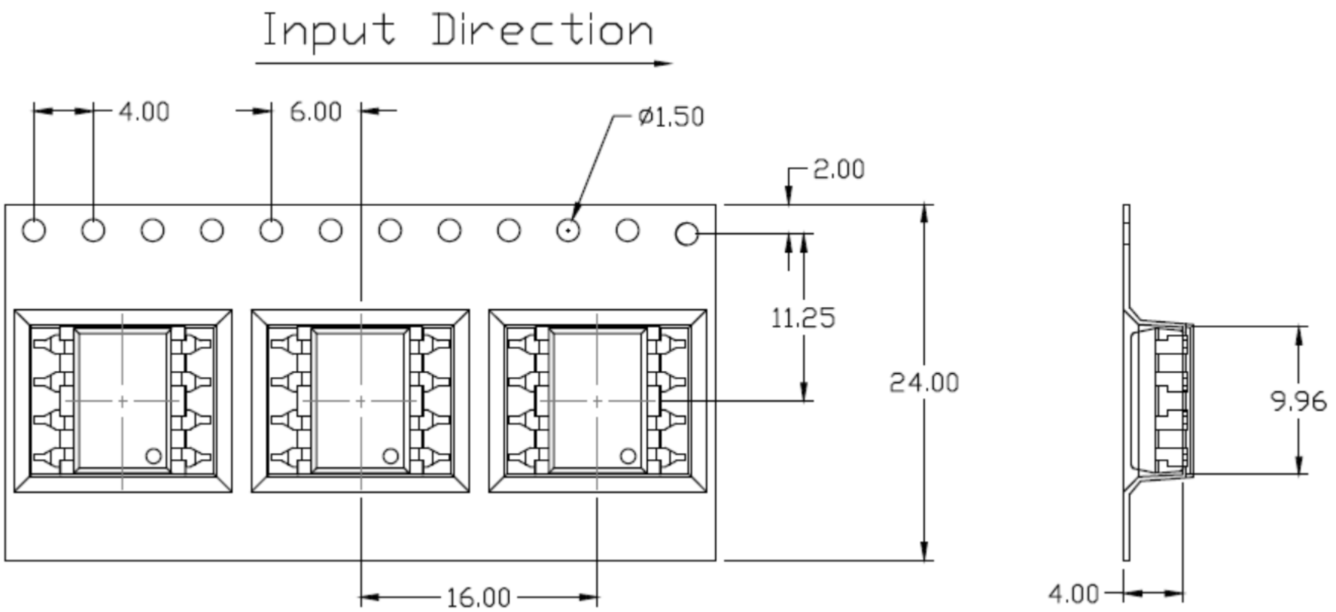


Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

Option SLM(T1)



Option SLM(T2)



Solderability spec (Follow the JEDEC standard JESD22-B102)

Reflow Soldering: Immersed surface, other than the end of pin as cut-surface, must be covered by solder.

Solder-Bath: More than 95% of the electrode must be covered with solder.

Wave soldering (Follow the JEDEC standard JESD22-A111)

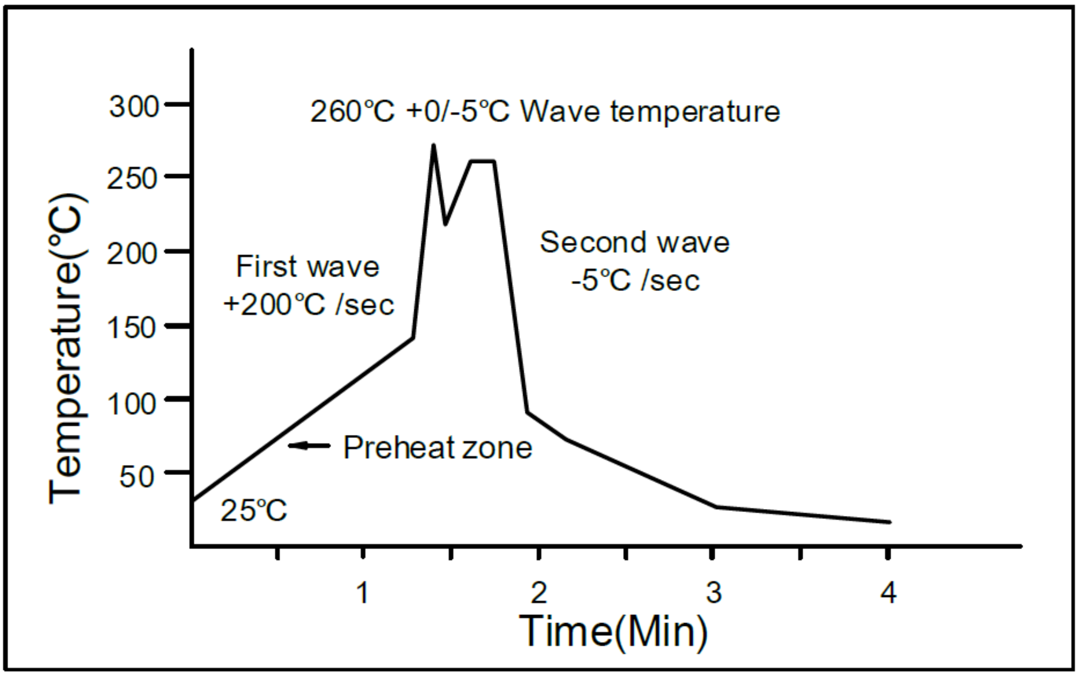
One time soldering is recommended within the condition of temperature.

Temperature: 260+0/-5˚C.

Time: 10 sec.

Preheat temperature: 25 to 140˚C.

Preheat time: 30 to 80 sec.



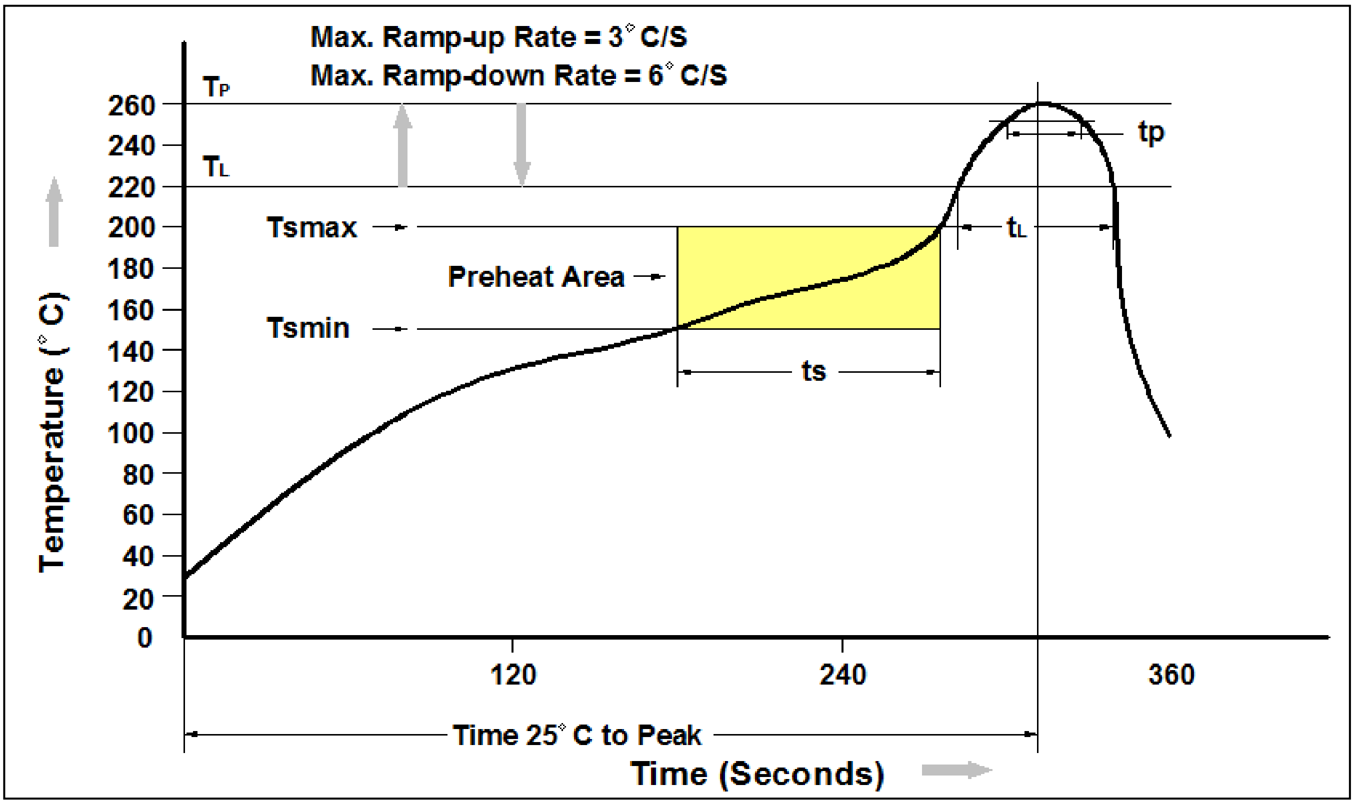
Iron soldering (Follow the standard MIL-STD 202G, Method 210F)

Allow single lead soldering in every single process.

One time soldering is recommended. Temperature: 350±10˚C

Time: 5 sec max.

Reflow Profile (Follow the JEDEC standard J-STD-020)



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

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