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CTW138, CTW139

Low Input Current Photodarlington Coupler

Features

- Low current – 0.5mA
- Superior CTR-2000%
- CTR guaranteed 0–70°C
- MSL class 1
- Regulatory Approvals
  - ✓ UL - UL1577 (E364000)
  - ✓ VDE - EN60747-5-5(VDE0884-5)
  - ✓ CQC – GB4943.1, GB8898(19001231774)
  - ✓ IEC62368 (FI/41119)

Applications

- Digital logic ground isolation
- Telephone ring detector
- EIA-RS-232C line receiver
- High common mode noise line receiver
- Current loop receiver

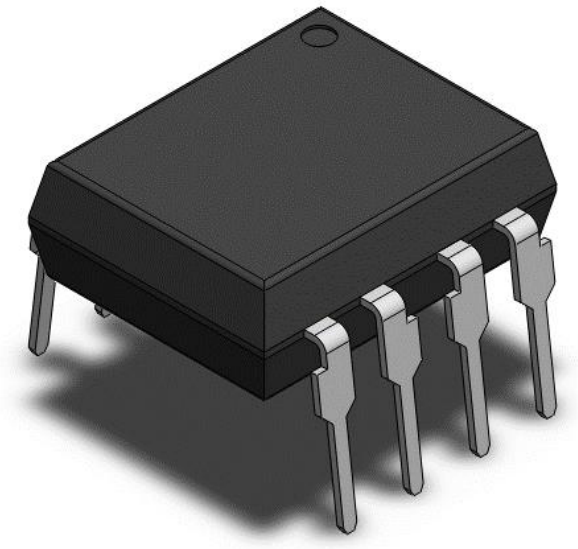
Description

The CTW138 & CTW139 optocouplers consist of an AlGaAs LED optically coupled to a high gain split darlington photodetector.

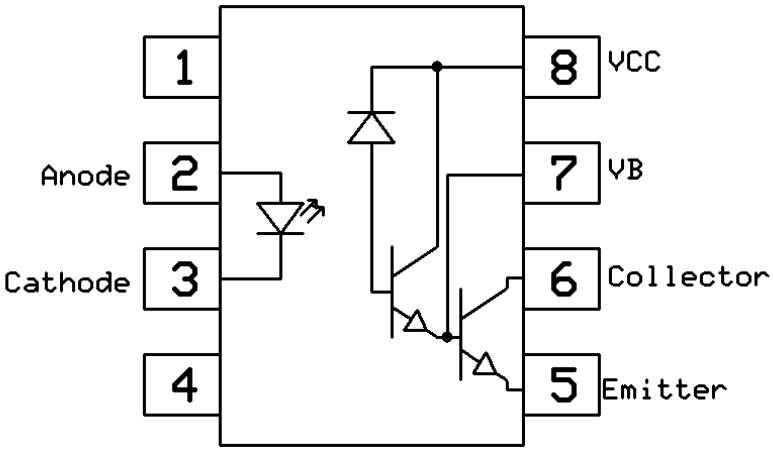
The combination of a very low input current of 0.5mA and a high current transfer ratio of 2000% makes this family particularly useful for input interface to MOS, CMOS, LSTTL and EIA RS232C, while output compatibility is ensured to CMOS as well as high fan-out TTL requirements.

The devices are packaged in an 8-pin widebody package and also available in surface mount lead forming option.

Package Outline



Schematic



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

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	°C	
T_{STG}	Storage temperature		-55 ~ +125	°C	
T_{SOL}	Soldering temperature (For 10 seconds)		260	°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 (≤1μs P.W,300pps)		1	A	
V_R	Reverse voltage		5	V	
P_C	Power dissipation		40	mW	
Detector					
P_D	Power dissipation		100	mW	
V_{EBR}	Emitter-Base reverse voltage		0.5	V	
I_O	Output Current		60	mA	
V_O	Output voltage	CTW138	-0.5 to 7	V	
		CTW139	-0.5 to 18	V	
V_{CC}	Supply voltage	CTW138	-0.5 to 7	V	
		CTW139	-0.5 to 18	V	

Electrical Characteristics *T_A = 0 - 70°C, V_{CC}=4.5V (unless otherwise specified).*

Emitter Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
V_F	Forward voltage	I_F = 16mA	-	1.45	1.6	V	
I_R	Reverse Current	V_R = 5V	-	-	5	μA	
$\Delta V_F/\Delta T_A$	Temperature coefficient of forward voltage	I_F =16mA	-	-1.8	-	mV/°C	

Detector Characteristics

Symbol	*Parameters*		*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
I_{OH}	Logic High Output Current	CTW139	I_F=0mA, V_O=V_{CC}=18V,	-	0.008	80	μA	
		CTW138		-	-	200		
I_{CCL}	Logic Low Supply Current		I_F=1.6mA, V_O=Open, V_{CC}=18V	-	0.5	1.4	mA	
I_{CCH}	Logic High Supply Current		I_F=0mA, V_O=Open, V_{CC}=18V	-	0.04	8	μA	

Transfer Characteristics

Symbol	*Parameters*		*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
CTR	Current Transfer Ratio	CTW139	I_F=0.5mA, V_O=0.4V,	400	2500	-	%	
		CTW138	I_F=1.6mA, V_O=0.5V,	300	2000	-		
		CTW139		500	2000	-		
V_{OL}	Logic Low Output Voltage	CTW139	I_F= 0.5mA, I_O= 2mA	-	0.04	0.4	V	
			I_F= 1.6mA, I_O= 8mA	-	0.08	0.4		
			I_F= 5mA, I_O= 15mA	-	0.11	0.4		
			I_F= 12mA, I_O= 24mA	-	0.16	0.4		
		CTW138	I_F= 1.6mA, I_O= 4.8mA	-	0.05	0.4		

Electrical Characteristics *T_A = 0 - 70°C, V_{CC}= 5V (unless otherwise specified).*

Switching Characteristics

Symbol	*Parameters*		*Test Conditions*		*Min*	*Typ*	*Max*	*Units*	*Notes*
T_{PHL}	High to Low Propagation Delay	CTW139	I_F= 0.5mA,		-	-	30	µs	
			R_L= 4.7kΩ	T_A= 25°C	-	4.8	25		
			I_F= 12mA,		-	-	2		
			R_L= 250Ω	T_A= 25°C	-	0.2	1		
		CTW138	I_F= 1.6mA,		-	-	15		
			R_L= 2.2kΩ	T_A= 25°C	-	1.35	10		
T_{PLH}	Low to High Propagation Delay	CTW139	I_F= 0.5mA,		-	-	90	µs	
			R_L= 4.7kΩ	T_A= 25°C	-	15	60		
			I_F= 12mA,		-	-	10		
			R_L= 250Ω	T_A= 25°C	-	1.6	7		
		CTW138	I_F= 1.6mA,		-	-	50		
			R_L= 2.2kΩ	T_A= 25°C	-	7.6	35		
CM_H	Common Mode Transient Immunity at Logic High		I_F = 0mA, |VCM| = 10V_{P-P}, T_A = 25°C,R_L = 2.2kΩ		1,000	-	-	V/µs	
CM_L	Common Mode Transient Immunity at Logic Low		I_F = 1.6mA, |VCM| = 10V_{P-P}, T_A = 25°C,R_L = 2.2kΩ		1,000	-	-		

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

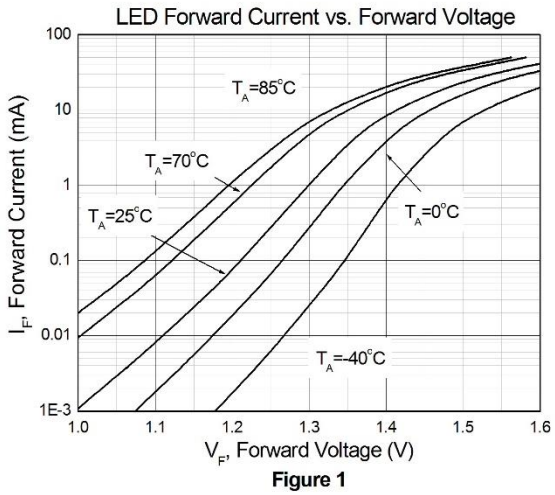


Figure 1

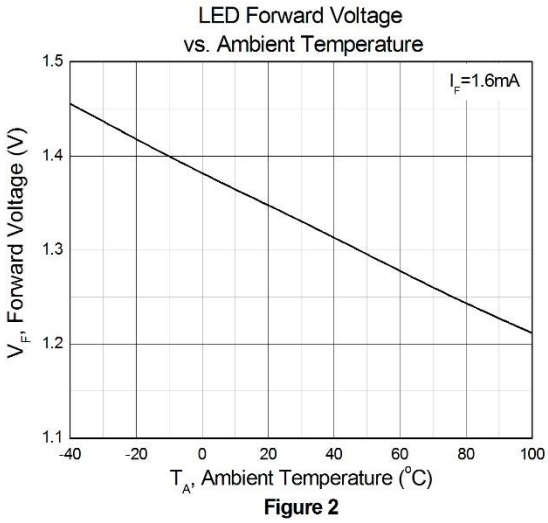


Figure 2

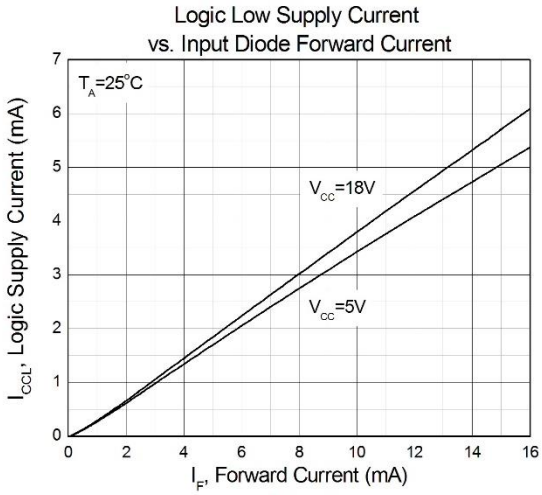


Figure 3

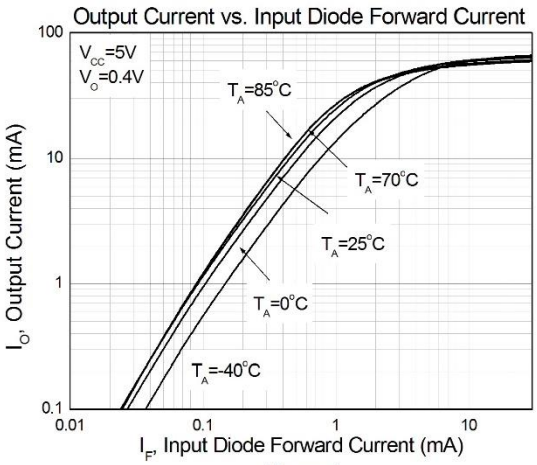


Figure 4

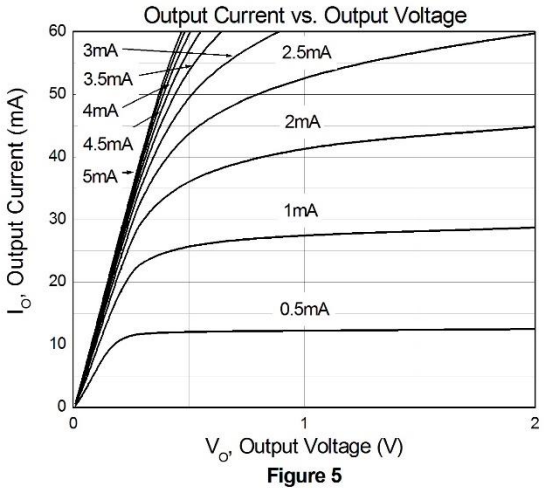


Figure 5

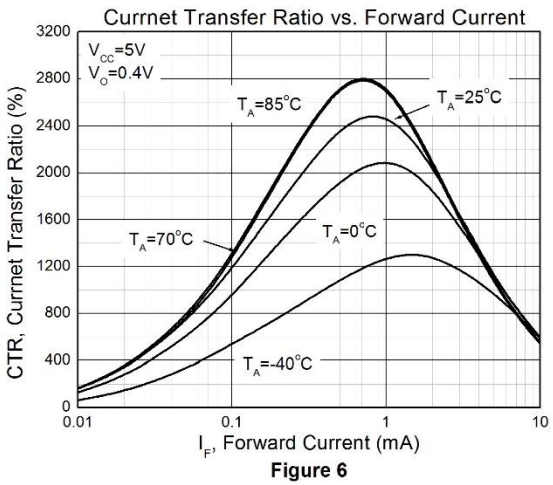


Figure 6

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

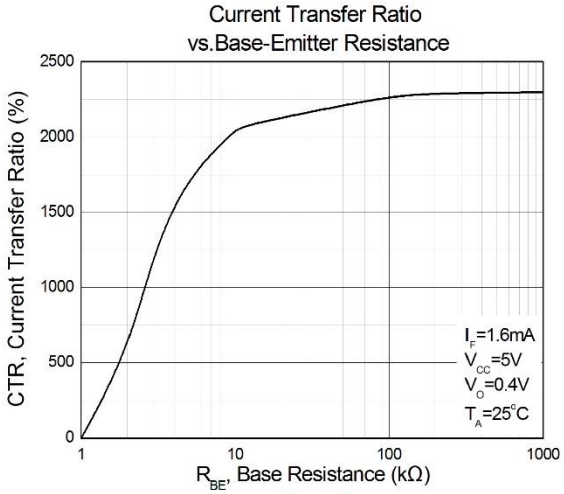


Figure 7

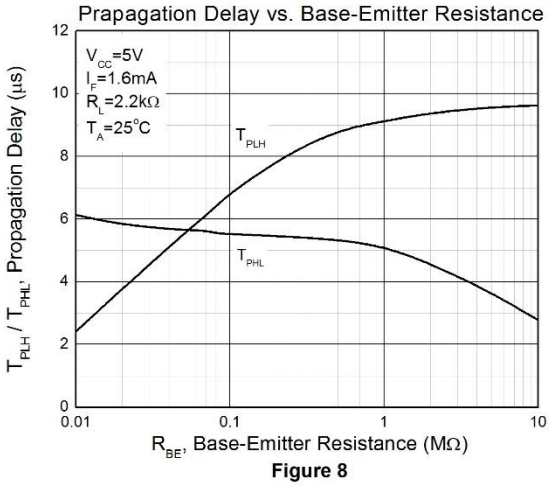


Figure 8

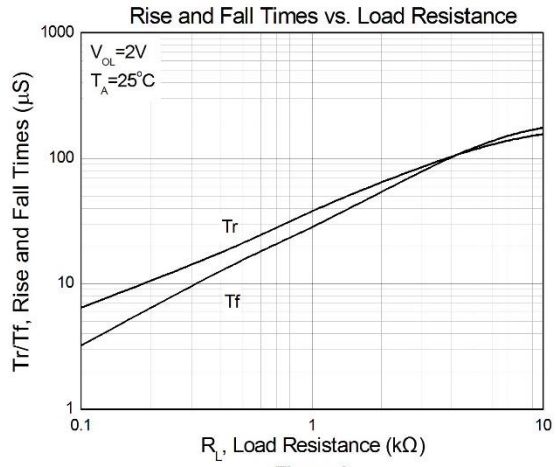


Figure 9

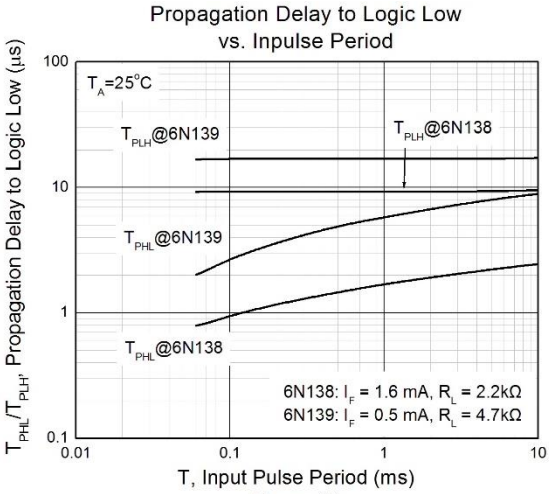


Figure 10

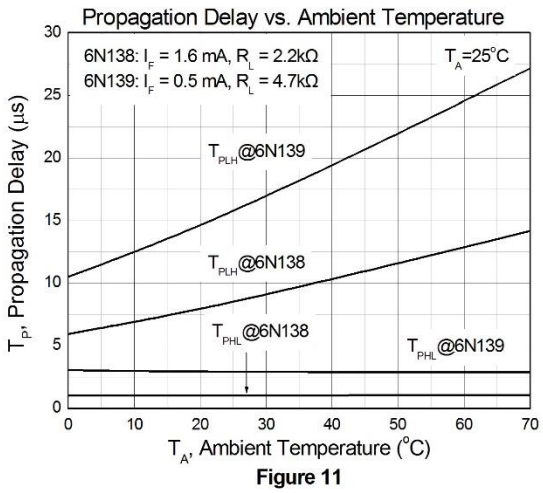


Figure 11

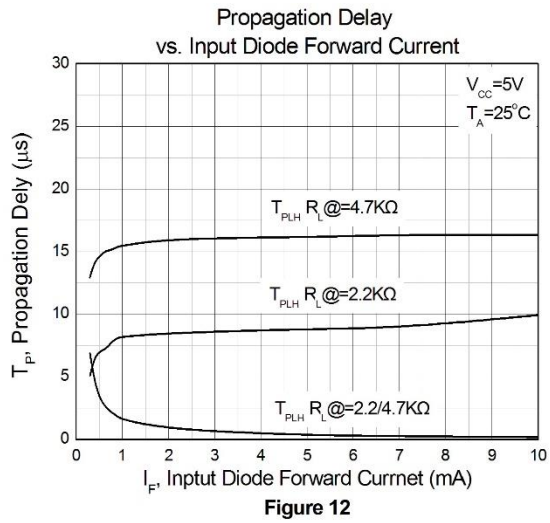


Figure 12

Test Circuits

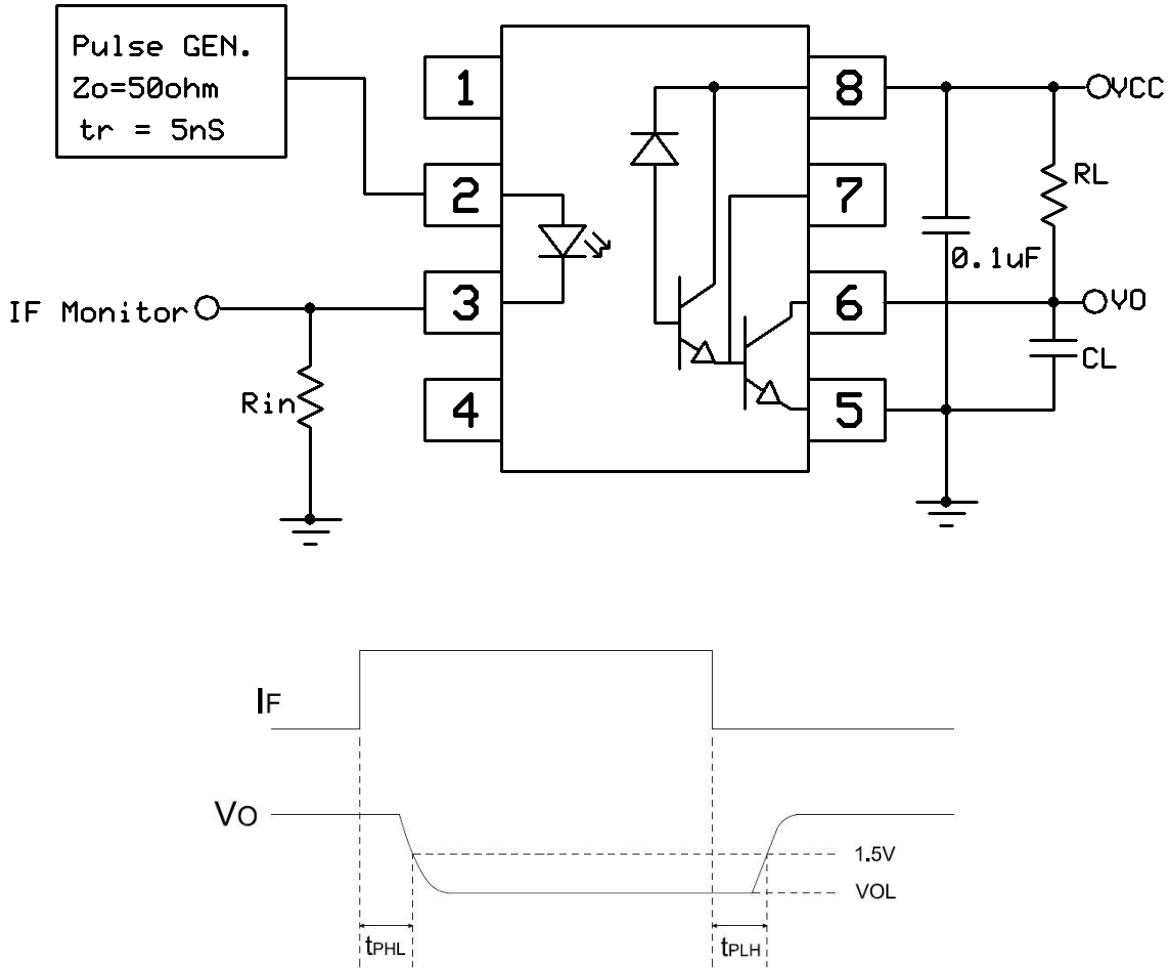


Figure 13: Switching Time Test Circuits

Test Circuits

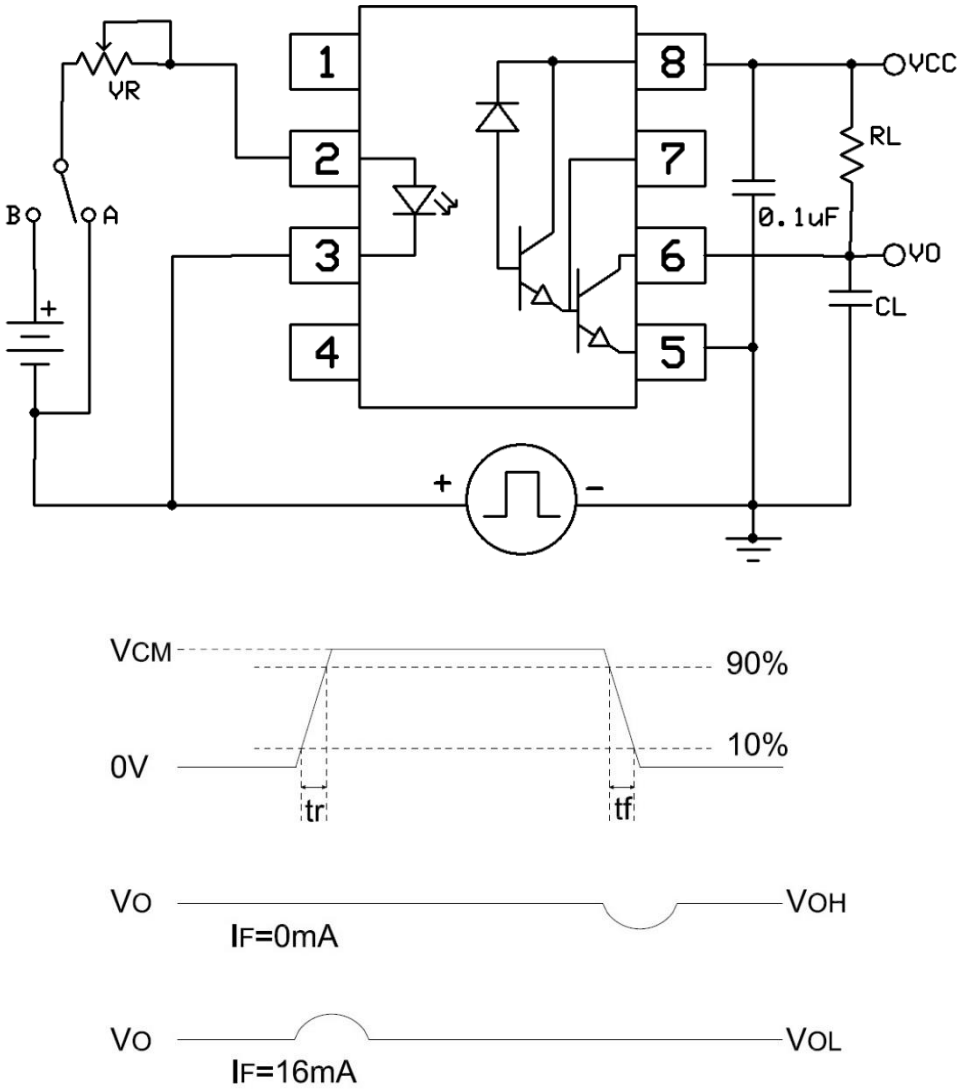
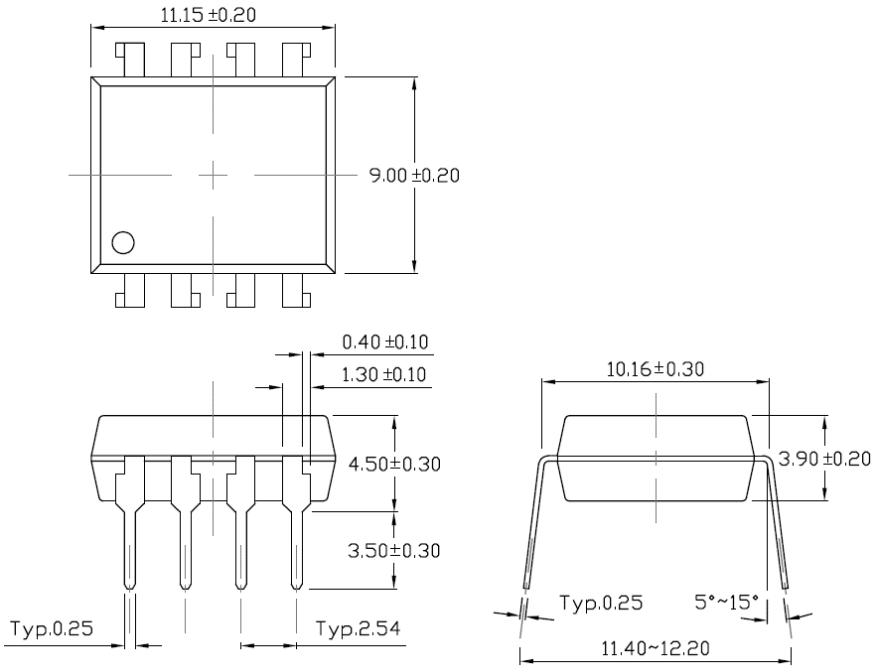


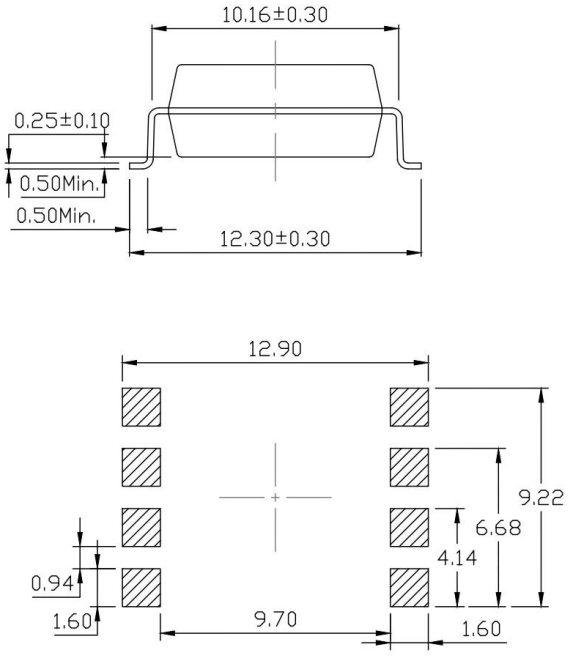
Figure 14: CMR Test Circuit

Package Dimension *Dimensions in mm unless otherwise stated*

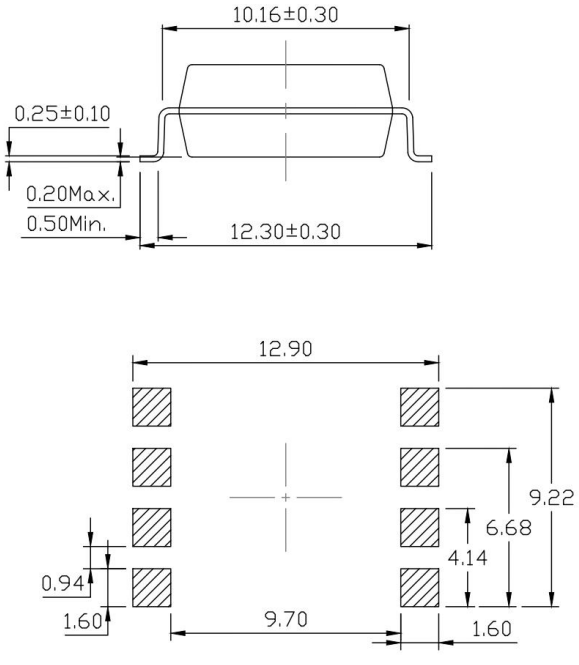


Package Dimension *Dimensions in mm unless otherwise stated*

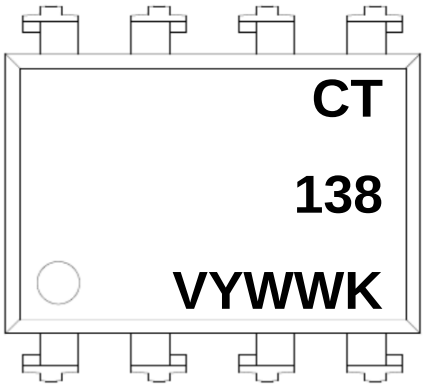
S Type



SL Type

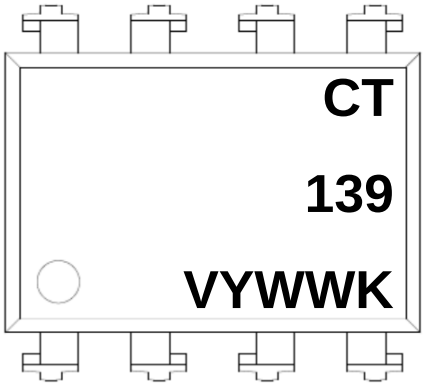


Marking Information



Note:

CT	: Denotes “CT Micro”
138	: 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”
139	: Part Number
V	: VDE Safety Mark Option (Blank or V)
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K	: Manufacturing Code

Ordering Information

6N138(V)(Y)(Z)

6N138 = Part Number

V = VDE Safety Mark Option (Blank or V)

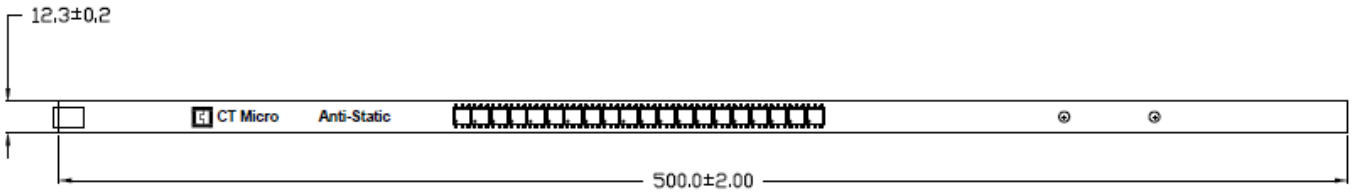
Y = Lead Form Option (S, SL, M or none)

Z = Tape and Reel Option (Blank, T1 or T2)

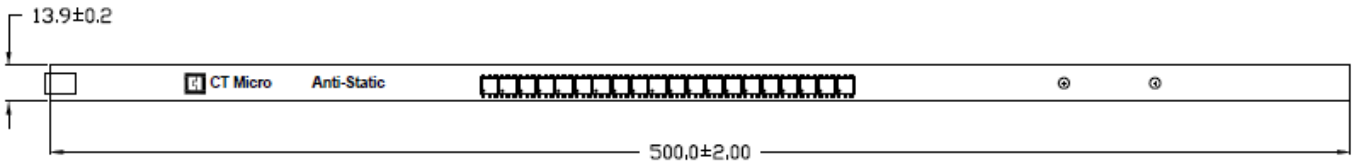
Option	***Description***	***Quantity***
None	Standard 8 Pin Dip	40 Units/Tube
M	Gullwing (400mil) Lead Forming	40 Units/Tube
S(T1)	Surface Mount (Low Profile) Lead Forming– With Option 2 Taping	750 Units/Reel
S(T2)	Surface Mount (Low Profile) Lead Forming– With Option 2 Taping	750 Units/Reel
SL(T1)	Surface Mount (Low Profile) Lead Forming– With Option 1 Taping	750 Units/Reel
SL(T2)	Surface Mount (Low Profile) Lead Forming– With Option 2 Taping	750 Units/Reel

Carrier Specifications *Dimensions in mm unless otherwise stated*

Tube Option Standard DIP

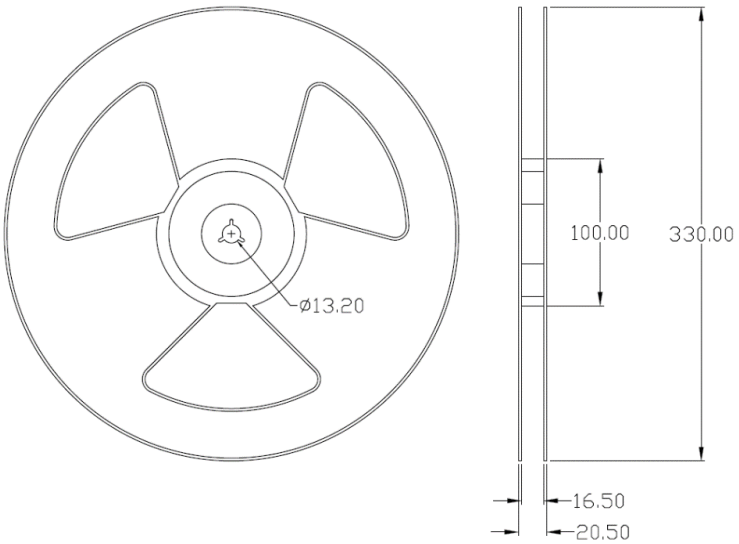


Tube Option M Type



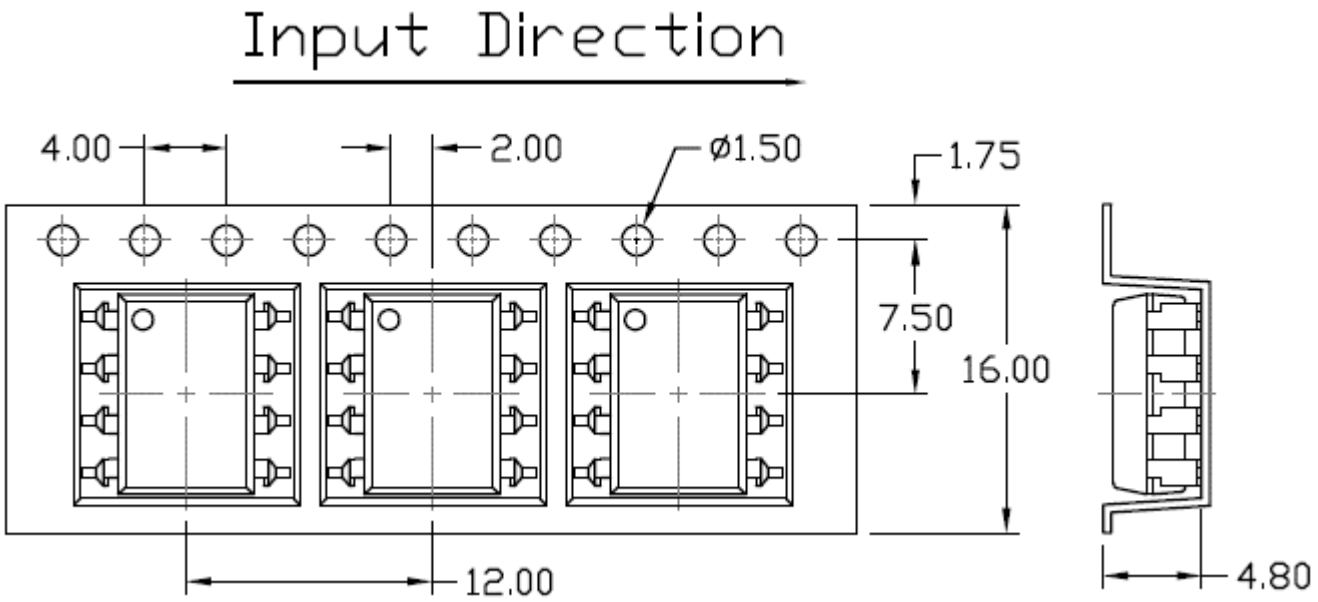
Reel Dimension *All dimensions are in mm, unless otherwise stated*

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

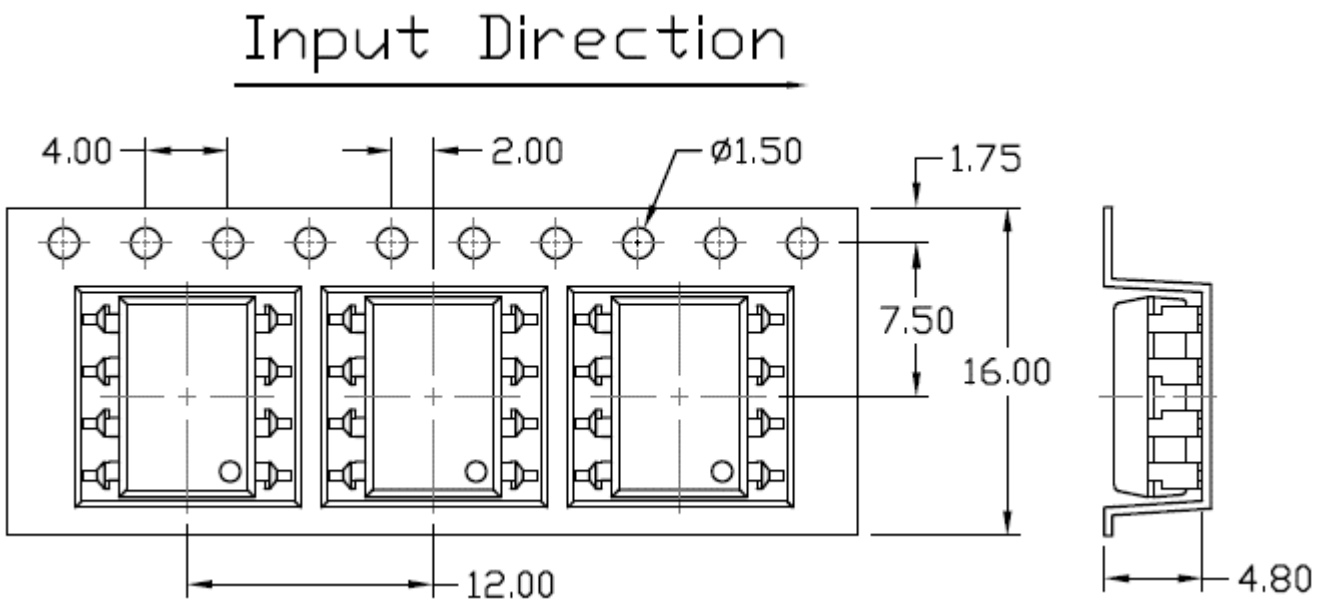


Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

Option S(T1) & SL(T1)



Option S(T2) & SL(T2)

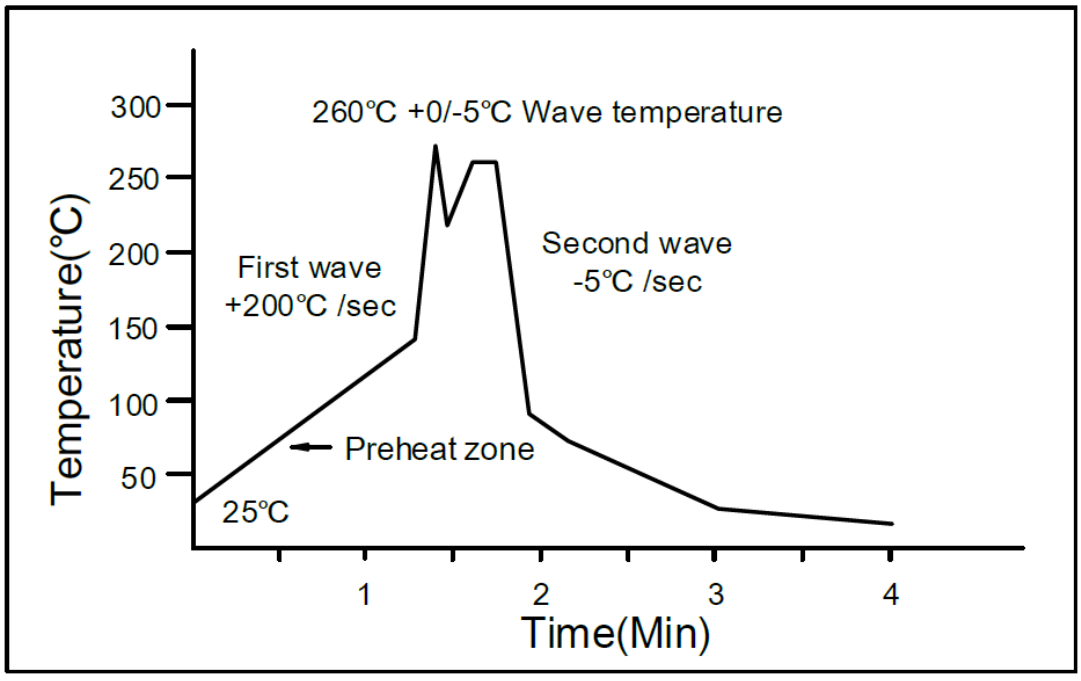


Solderability spec (Follow the JEDEC standard JESD22-B102)

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)

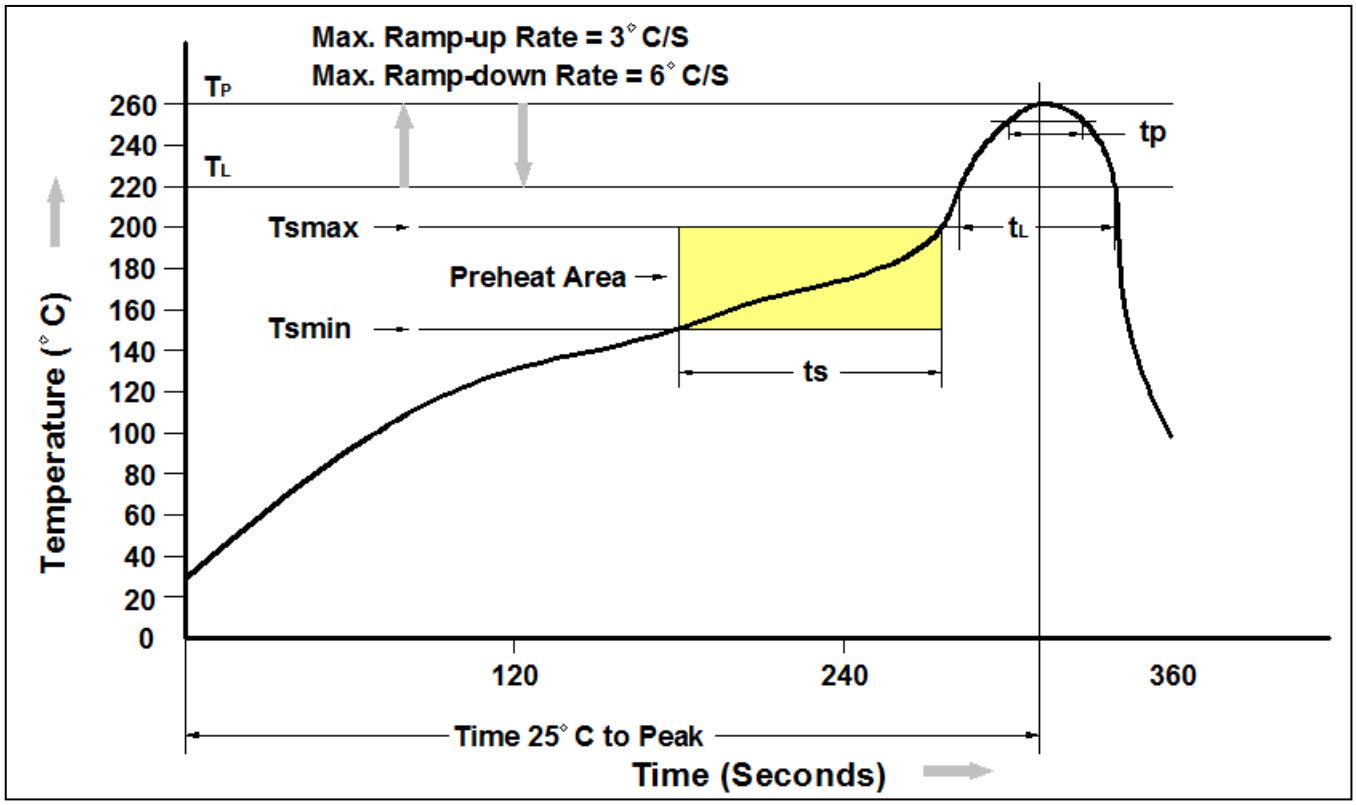
One time soldering is recommended within the condition of temperature.
Temperature: 260+0/-5˚C.
Time: 10 sec.
Preheat temperature: 25 to 140˚C.
Preheat time: 30 to 80 sec.



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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2. *A critical component is 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.*