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6N135, 6N136, CT4502, CT4503

1Mbit/s High Speed Phototransistor Optocoupler

Features

- High speed 1MBit/s
- High isolation voltage between input and output (Viso=5000 Vrms)
- Guaranteed CTR performance from 0°C to 70°C
- Operating emperature range -55°C to 100°C
- MSL class 1
- Regulatory Approvals
  - ✓ UL - UL1577 (E364000)
  - ✓ VDE - EN60747-5-5(VDE0884-5)
  - ✓ CQC – GB4943.1, GB8898(14001104779)
  - ✓ IEC62368 (FI/41119)

Description

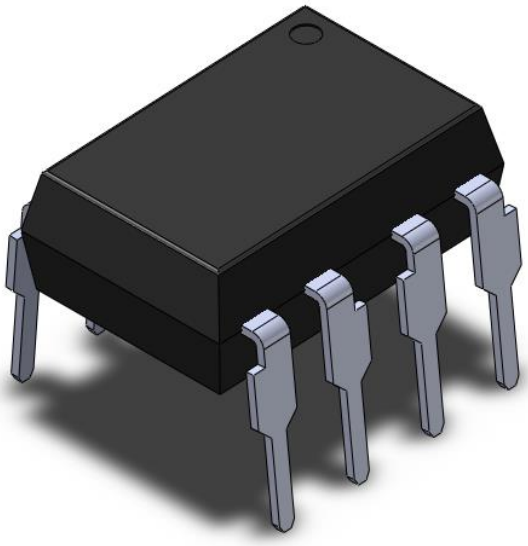
The 6N135, 6N136, CT4502 and CT4503 devices each consist of an infrared emitting diode, optically coupled to a high speed photo detector transistor. A separate connection for the photodiode bias and output-transistor collector increase the speed by several orders of magnitude over conventional phototransistor couplers by reducing the base-collector capacitance of the input transistor.

The devices are packaged in an 8-pin DIP package and also available in gullwing (400mil) and surface mount lead forming.

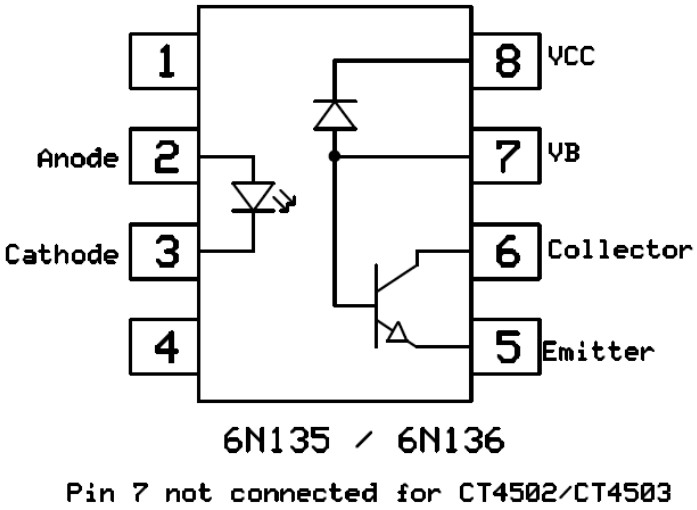
Applications

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

Package Outline



Schematic



6N135 / 6N136

Pin 7 not connected for CT4502/CT4503

Note: Different bending 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_D	Power dissipation	40	mW	
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	

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

Emitter Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
V_F	Forward voltage	IF = 16mA	-	1.45	1.6	V	
V_R	Reverse Voltage	IR = 10μA	5.0	-	-	V	
$\Delta V_F/\Delta T_A$	Temperature coefficient of forward voltage	IF =16mA	-	-1.8	-	mV/°C	

Detector Characteristics

Symbol	*Parameters*	*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
I_{OH}	Logic High Output Current	I_F=0mA, V_O=V_{CC}=5.5V, T_A=25°C	-	0.001	0.5	μA	
		I_F=0mA, V_O=V_{CC}=15V, T_A=25°C	-	0.01	1		
		I_F=0mA, V_O=V_{CC}=15V	-	-	50		
I_{CCL}	Logic Low Supply Current	I_F=16mA, V_O=Open, V_{CC}=15V	-	140	200	μA	
I_{CCH}	Logic High Supply Current	I_F=0mA, V_O=Open, V_{CC}=15V, T_A=25°C	-	0.01	1	μA	
		IF=0mA, VO=Open, VCC=15V	-	-	2		

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*
CTR	Current Transfer Ratio	6N135	I_F=16mA, V_O=0.4V,V_{CC}=4.5V, T_A=25°C	7	-	50	%	
		6N136 CT4502 CT4503		19	-	50		
		6N135	I_F=16mA, V_O=0.5V, V_{CC}=4.5V	5	-	-		
		6N136 CT4502 CT4503		15	-	-		
V_{OL}	Logic Low Output Voltage	6N135	I_F=16mA,I_O=1.1mA,V_{CC}=4.5V, T_A=25°C	-	0.18	0.4	V	
		6N136 CT4502 CT4503	I_F=16mA, I_O=3mA, V_{CC}=4.5V, T_A=25°C	-	0.18	0.4		
		6N135	I_F=16mA, I_O=0.8mA, V_{CC}=4.5V	-	-	0.5		
		6N136 CT4502 CT4503	I_F=16mA, I_O=2.4mA, V_{CC}=4.5V	-	-	0.5		

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

Switching Characteristics

Symbol	*Parameters*		*Test Conditions*	*Min*	*Typ*	*Max*	*Units*	*Notes*
T_{PHL}	Propagation Delay Time Logic High to Logic Low	6N135	R_L=4.1KΩ, T_A=25°C	-	0.35	1.5	μs	
			R_L=4.1KΩ	-	-	2.0		
		6N136 CT4502 CT4503	R_L=1.9KΩ, T_A=25°C	-	0.35	0.8		
			R_L=1.9KΩ	-	-	1.0		
T_{PLH}	Propagation Delay Time Logic Low to Logic High	6N135	R_L=4.1KΩ, T_A=25°C	-	0.5	1.5	μs	
			R_L=4.1KΩ	-	-	2.0		
		6N136 CT4502 CT4503	R_L=1.9KΩ, T_A=25°C	-	0.3	0.8		
			R_L=1.9KΩ	-	-	1.0		
CM_H	Common Mode Transient Immunity at Logic High	6N135	I_F = 0mA , V_{CM}=10Vp-p, R_L=4.1KΩ, T_A =25°C	1,000	-	-	V/μs	
		6N136 CT4502	I_F = 0mA , V_{CM}=10Vp-p, R_L=1.9KΩ, T_A =25°C	1,000	-	-		
		CT4503	I_F = 0mA , V_{CM}=1500Vp-p, R_L=1.9KΩ, T_A =25°C	15,000	20,000			
CM_L	Common Mode Transient Immunity at Logic Low	6N135	I_F = 16mA , V_{CM}=10Vp-p, R_L=4.1KΩ, T_A =25°C	1,000	-	-	V/μs	
		6N136 CT4502	I_F = 16mA , V_{CM}=10Vp-p, R_L=1.9KΩ, T_A=25°C	1,000	-	-		
		CT4503	I_F = 16mA , V_{CM}=1500Vp-p, R_L=1.9KΩ, T_A=25°C	15,000	20,000			

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

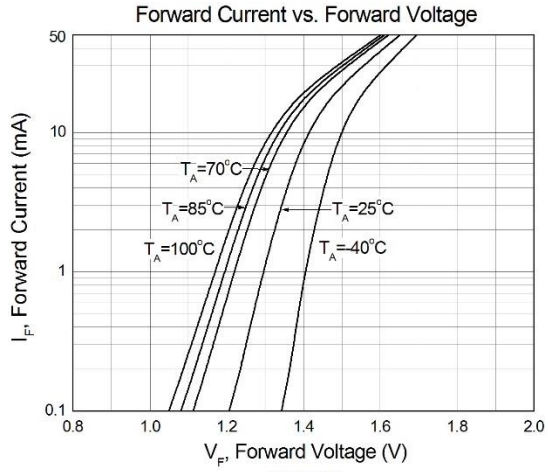


Figure 1

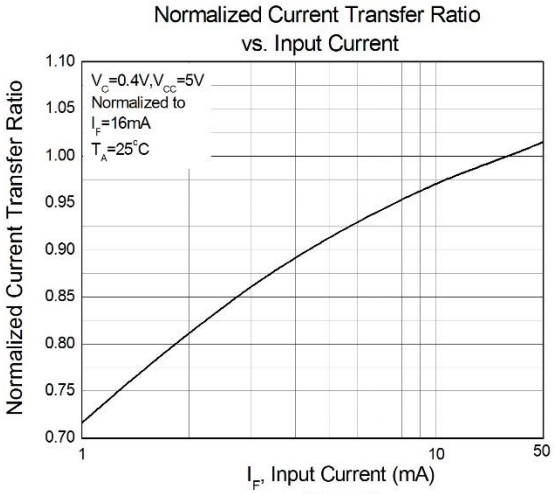


Figure 2

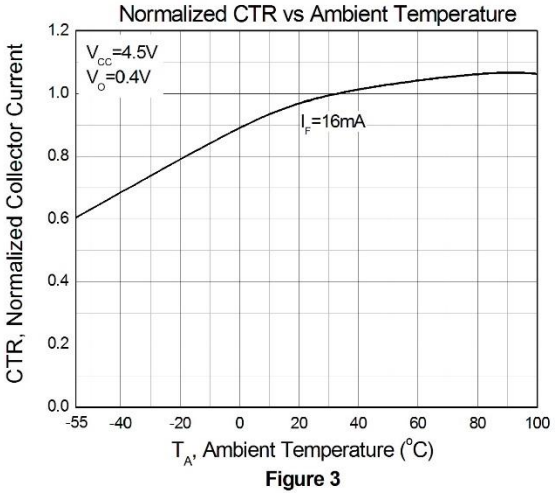


Figure 3

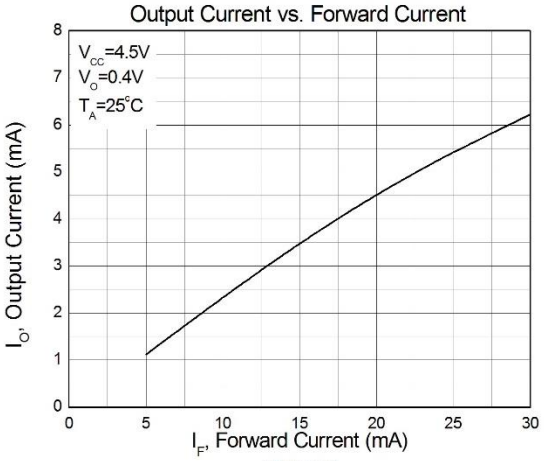


Figure 4

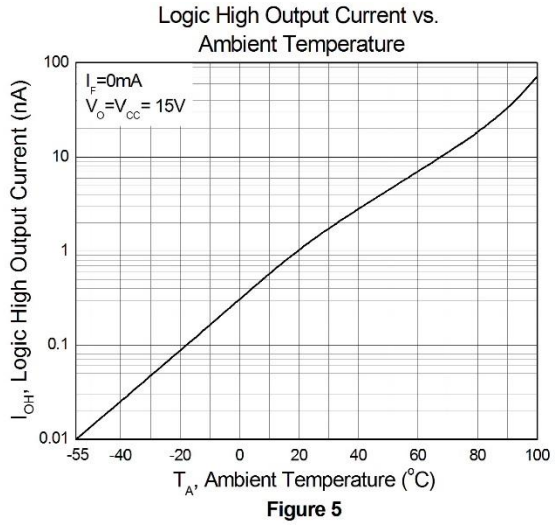


Figure 5

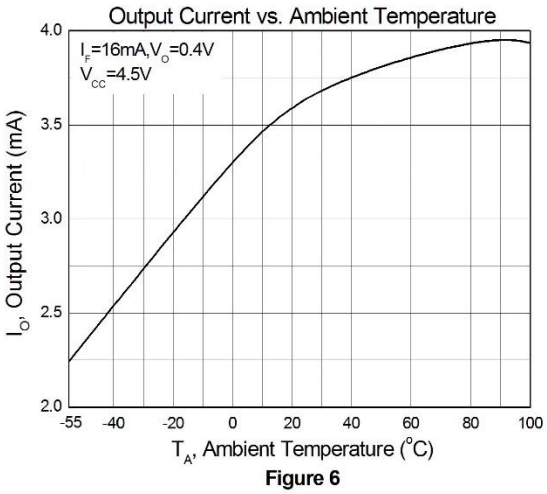


Figure 6

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

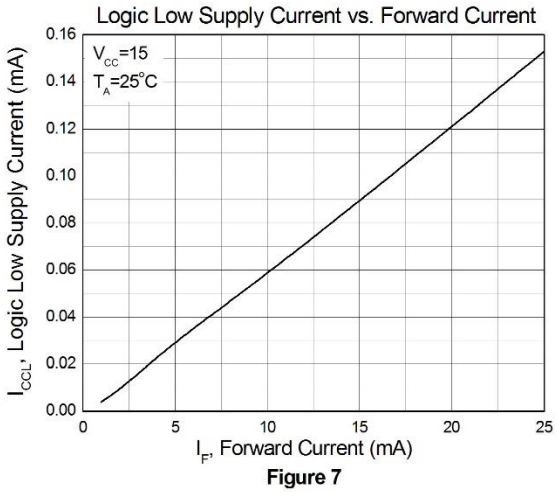
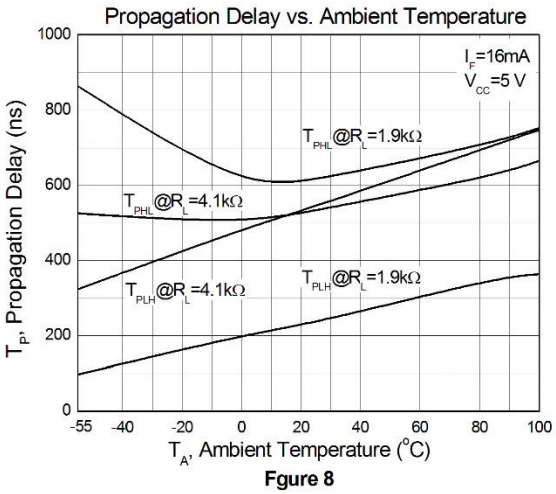


Figure 7



Fgure 8

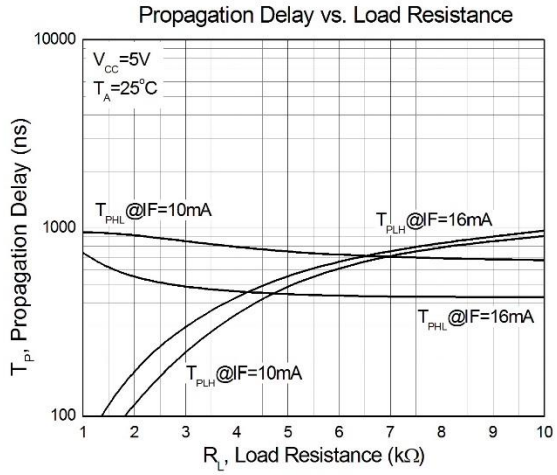


Figure 9

Test Circuits

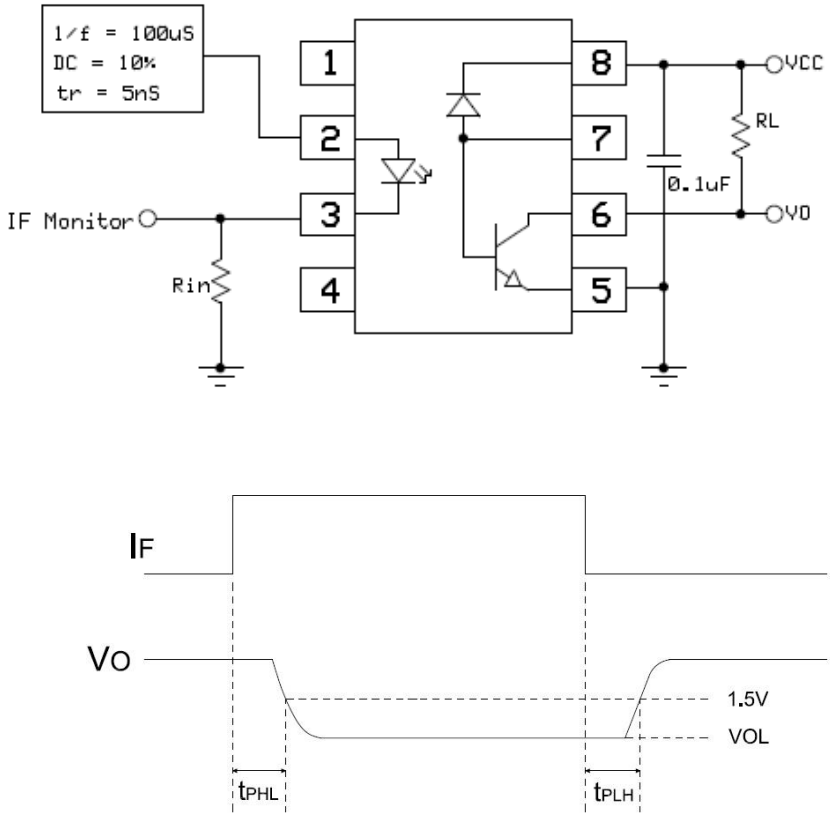


Figure 10: Switching Time Test Circuits

Test Circuits

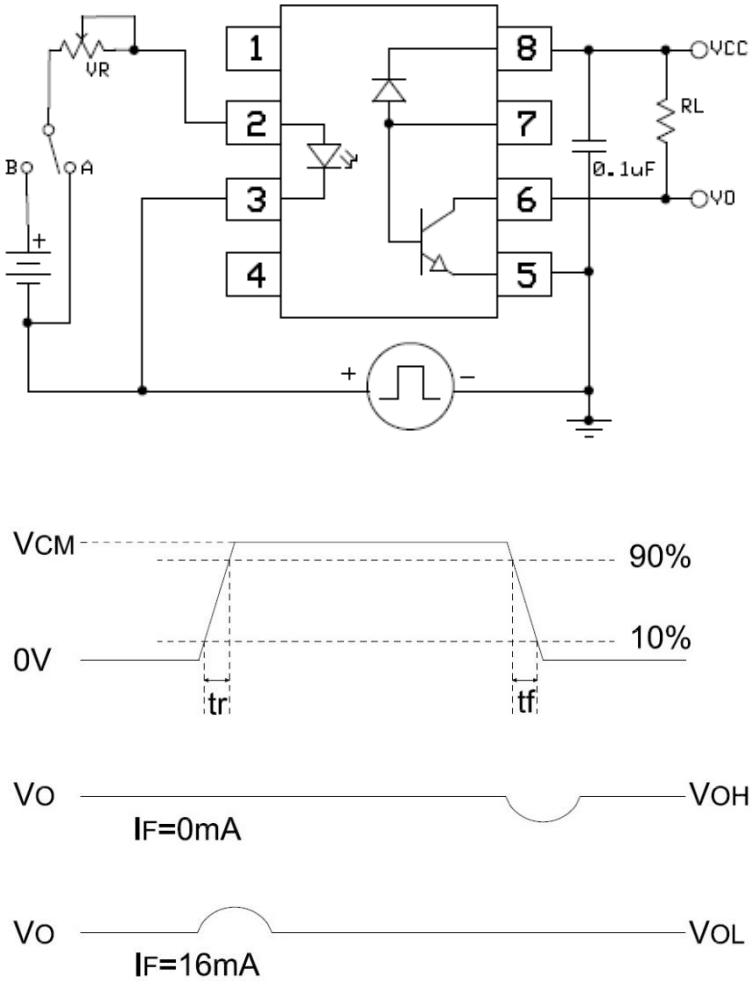
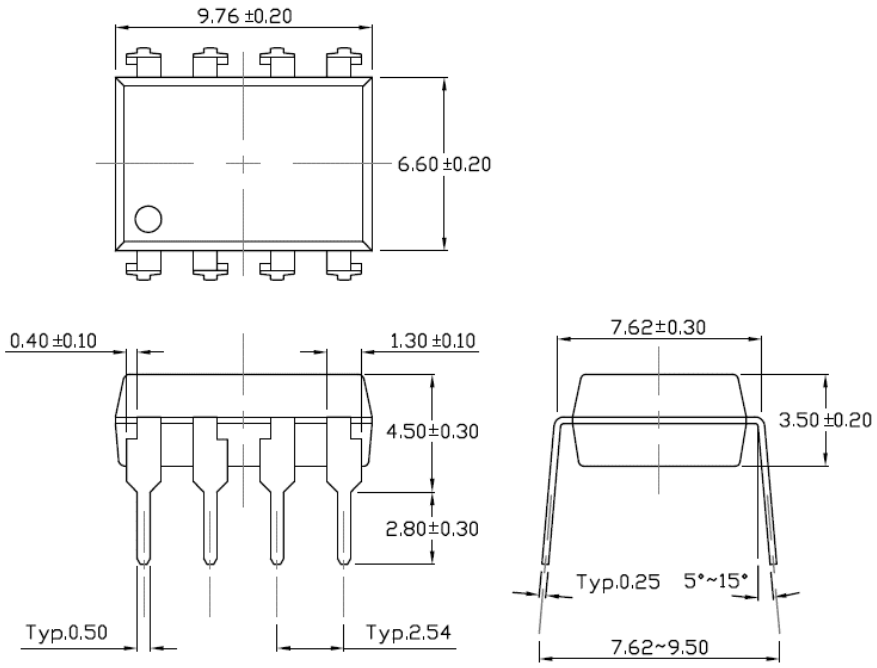
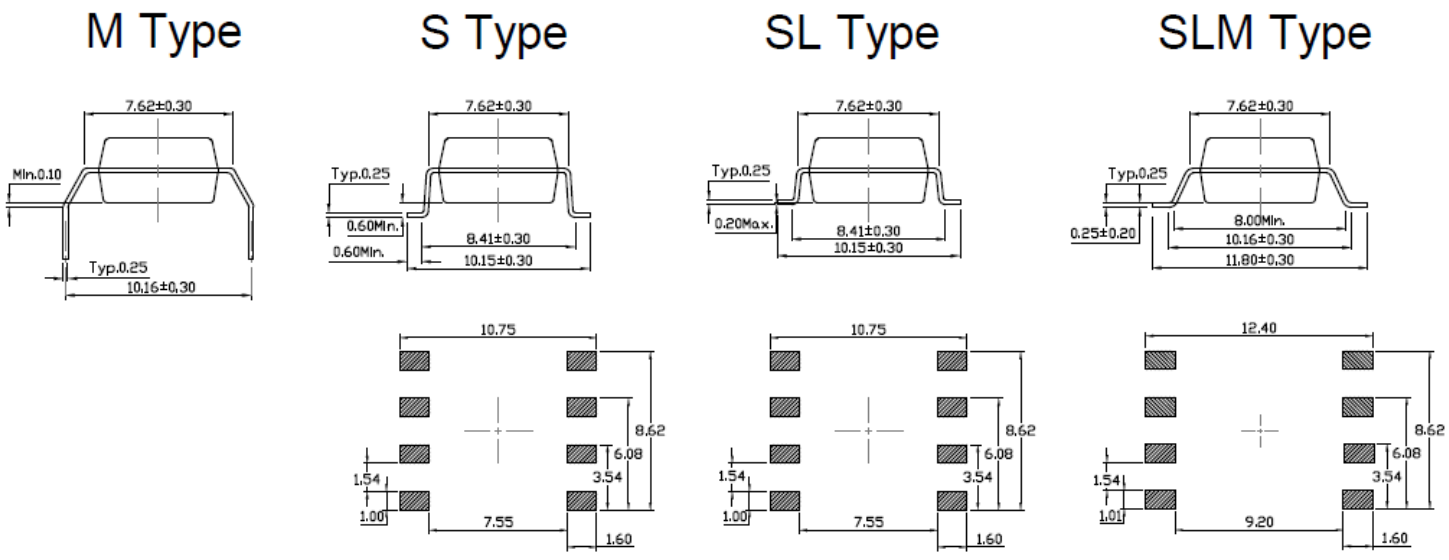


Figure 11: CMR Test Circuit

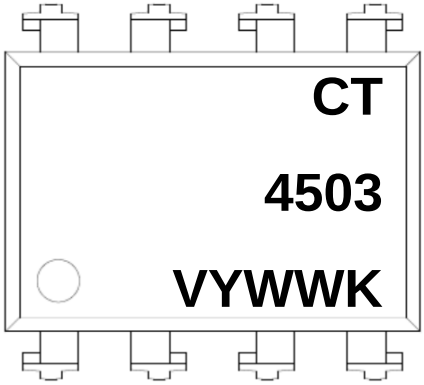
Package Dimension *Dimensions in mm unless otherwise stated*



Package Dimension *Dimensions in mm unless otherwise stated*

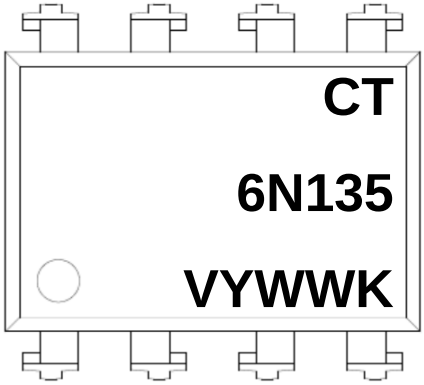


Marking Information



Note:

CT : Denotes “CT Micro”
4503 : 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”
6N135 : 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

6N13X(V)(Y)(Z)

X = Part Number (5,6 for 6N13X series)

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)

CT450X(V)(Y)(Z)

X = Part Number (2,3 for CT450X series)

V = VDE Safety Mark Option (Blank or V)

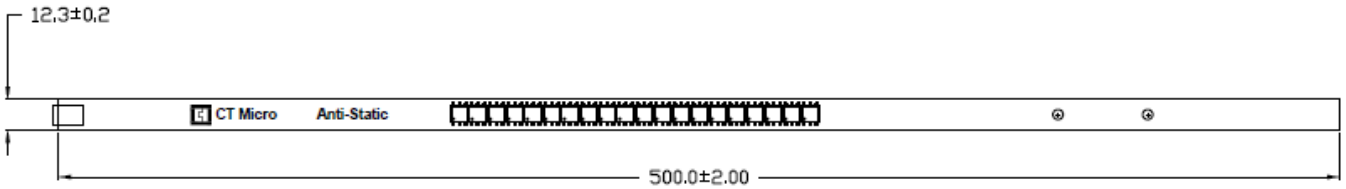
Y = Lead Form Option (S, SL, M, SLM or none)

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

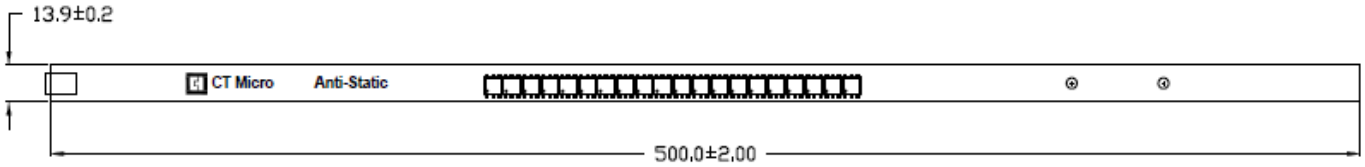
Option	***Description***	***Quantity***
None	Standard 8 Pin Dip	40 Units/Tube
M	Gullwing (400mil) Lead Forming	40 Units/Tube
S(T1)	Surface Mount Lead Forming – With Option 1 Taping	1000 Units/Reel
S(T2)	Surface Mount Lead Forming – With Option 2 Taping	1000 Units/Reel
SL(T1)	Surface Mount (Low Profile)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

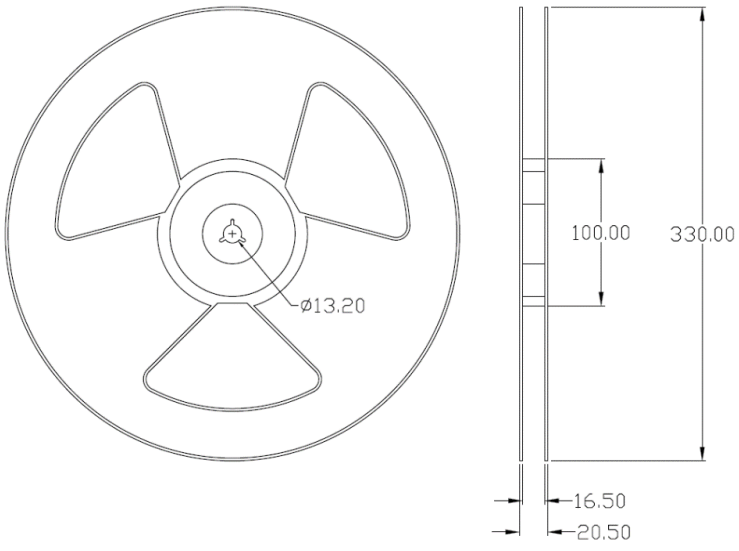


Tube Option M Type

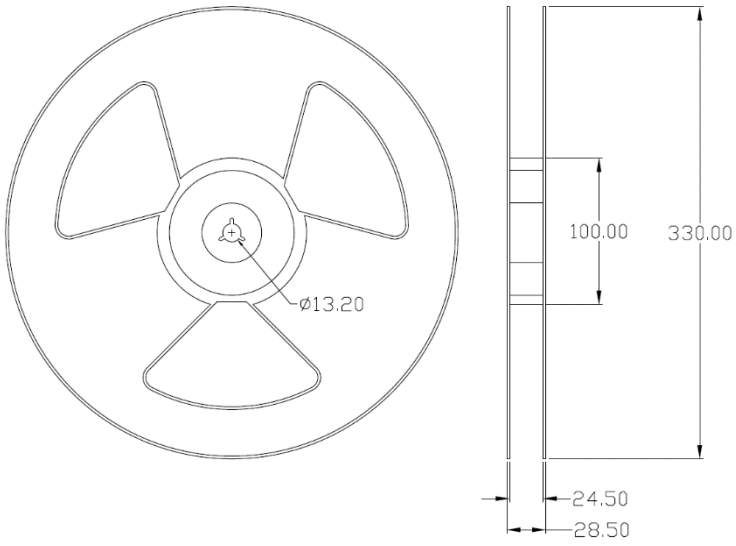


Reel Dimension *All dimensions are in mm, unless otherwise stated*

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

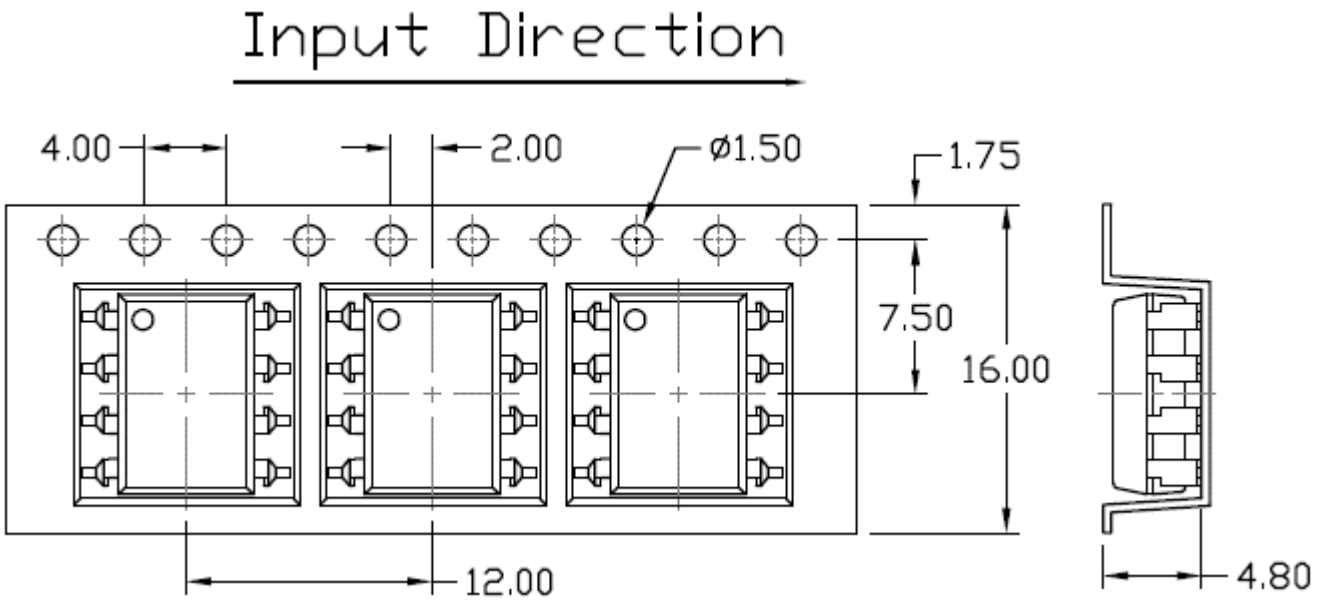


Option SLM(T1/T2)

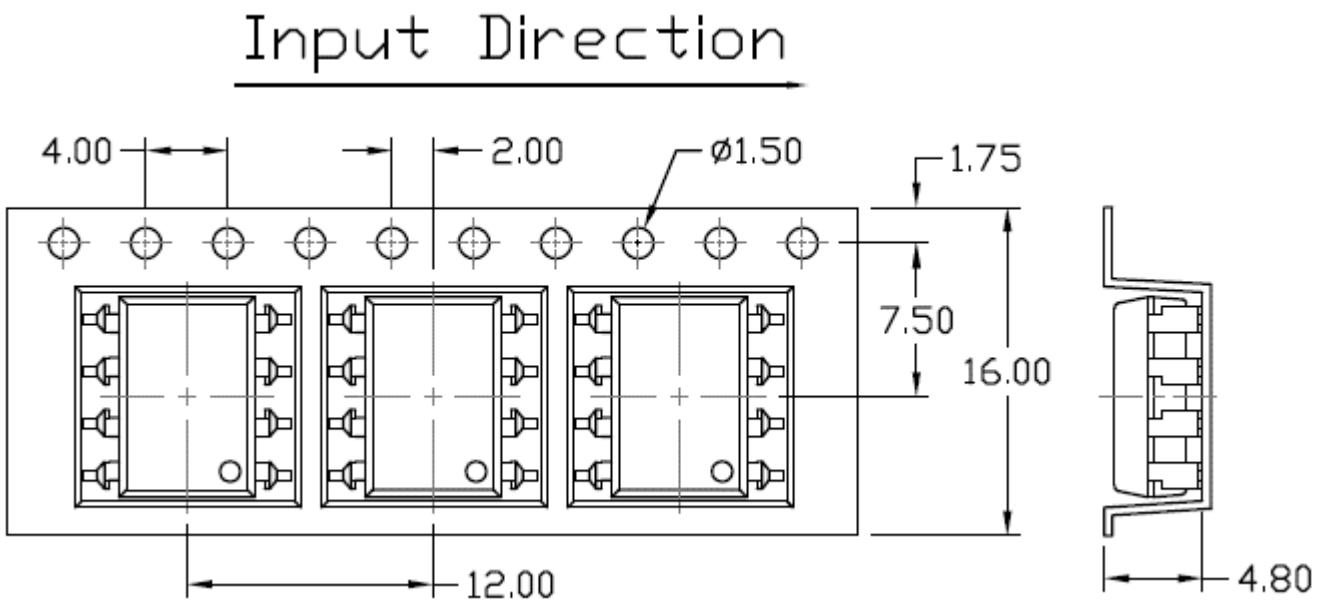


Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

Option S(T1) & SL(T1)

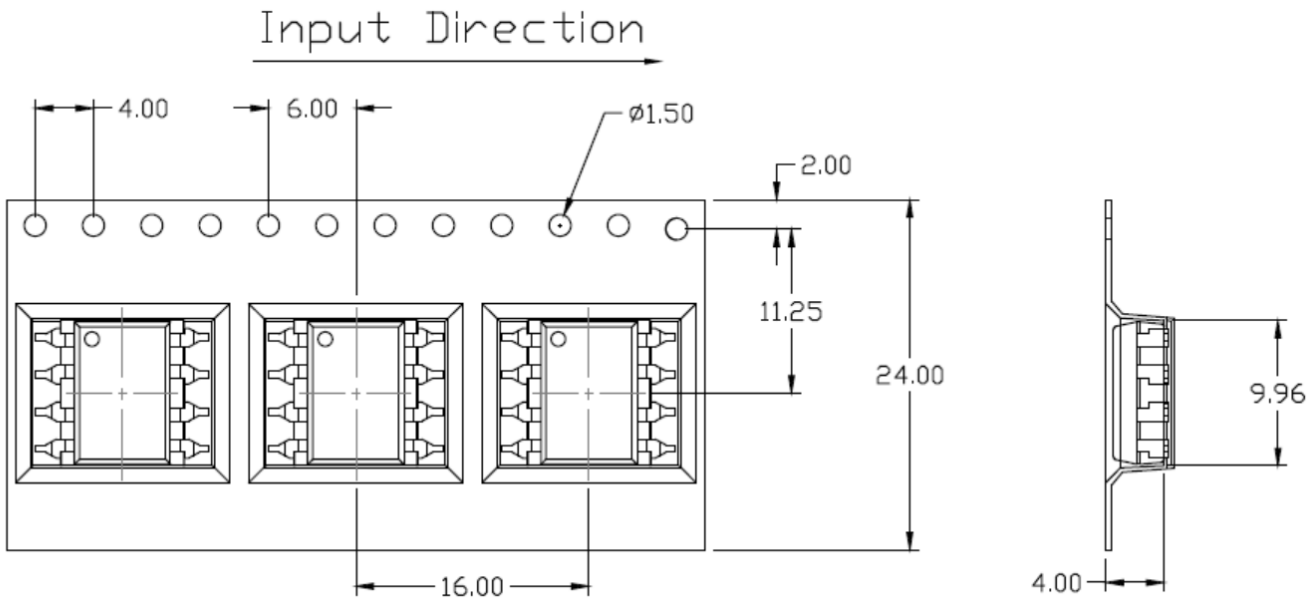


Option S(T2) & SL(T2)

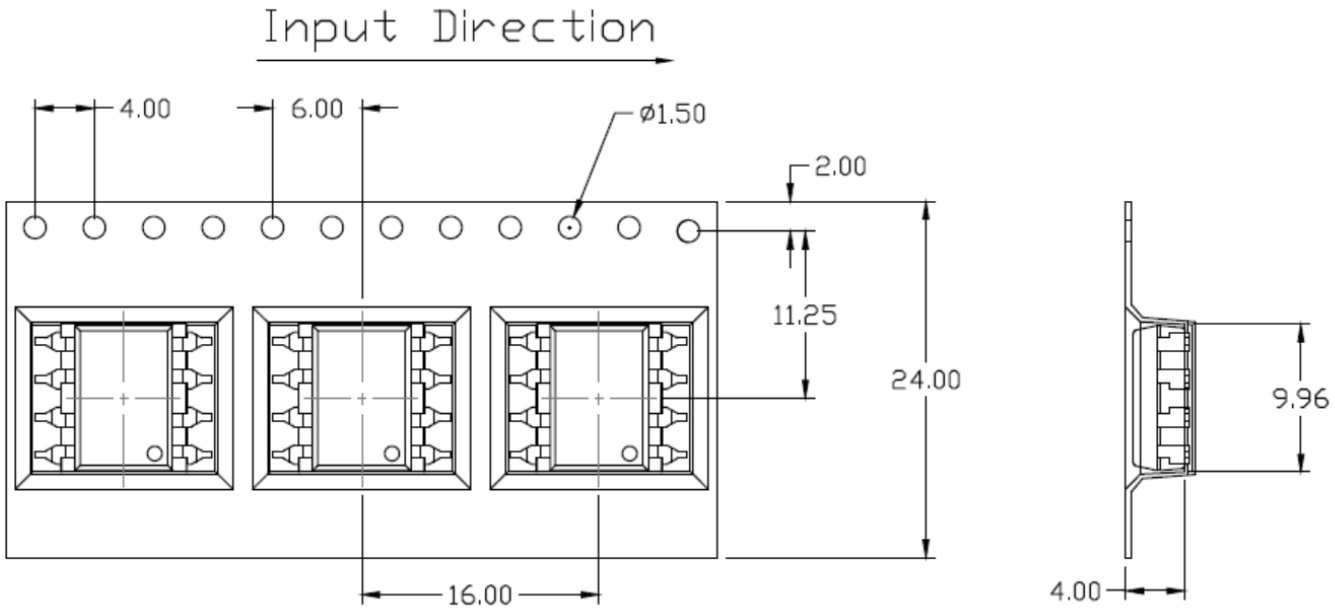


Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

Option SLM(T1)



Option SLM(T2)

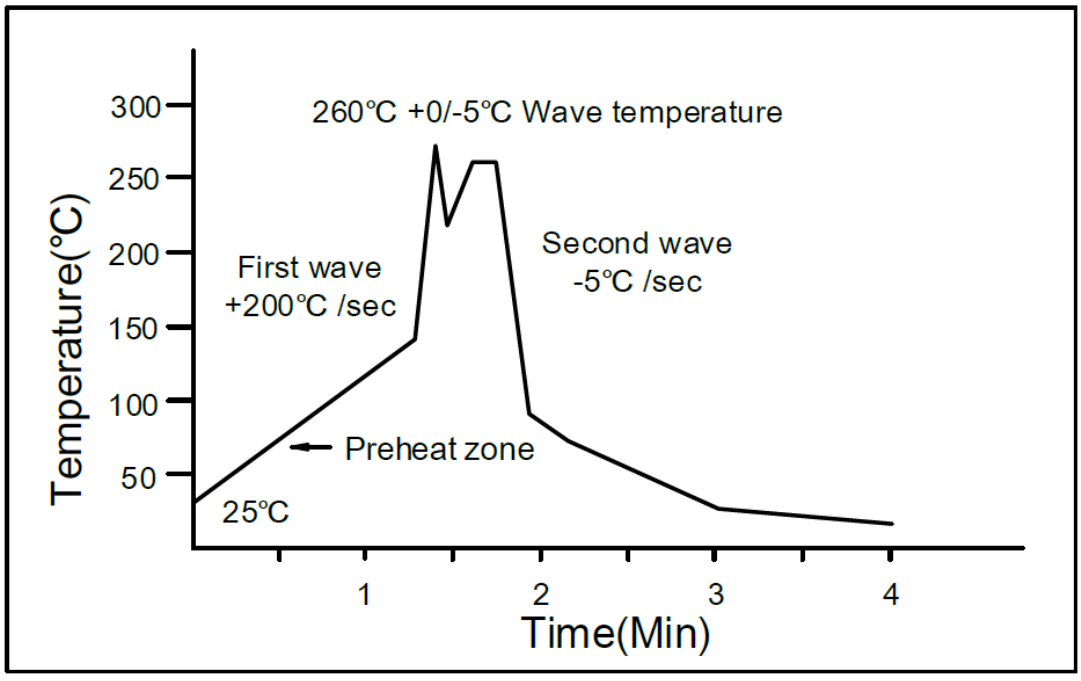


Solderability spec (Follow the JEDEC standard JESD22-B102)

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)

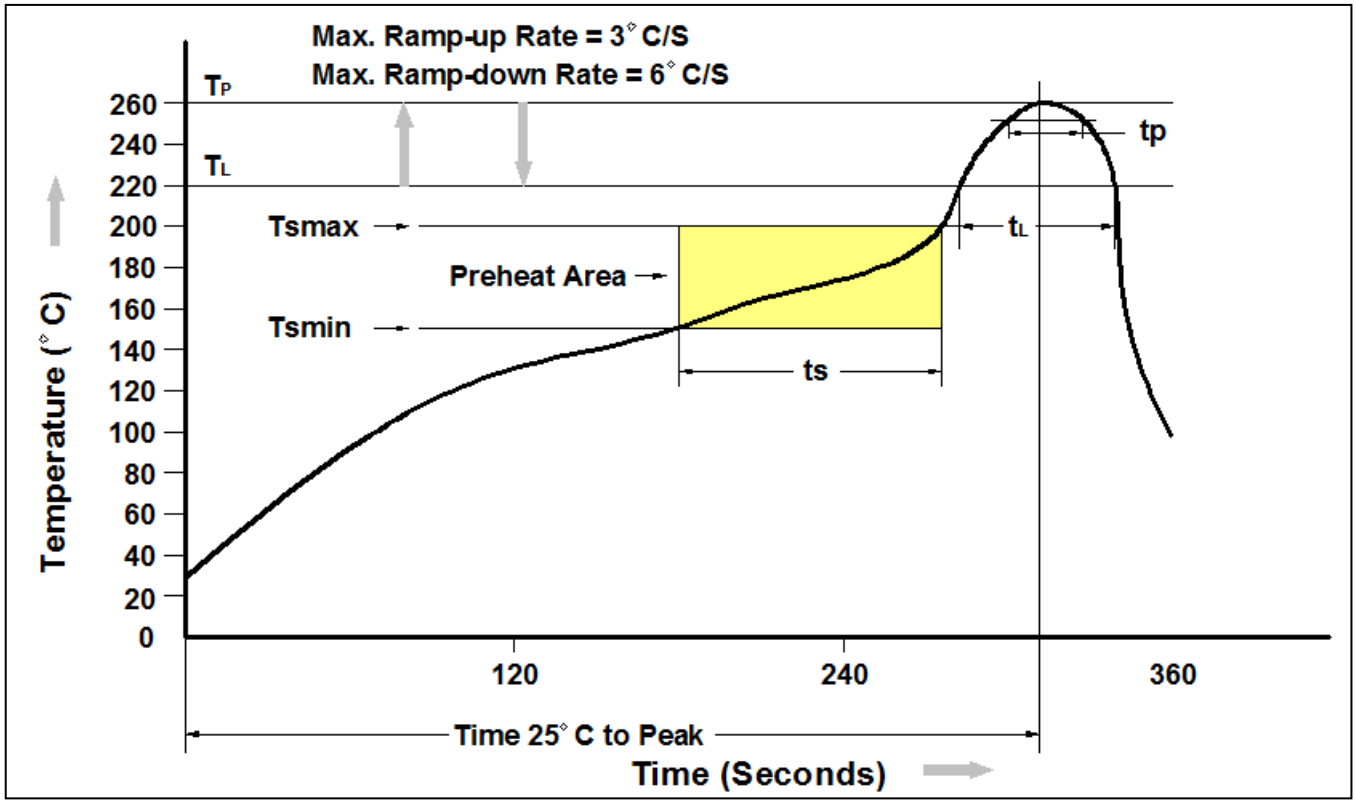
One time soldering is recommended within the condition of temperature.
Temperature: 260+0/-5˚C.
Time: 10 sec.
Preheat temperature: 25 to 140˚C.
Preheat time: 30 to 80 sec.



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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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.*