



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
- Wide operating temperature range of -55°C to 100°C
- Regulatory Approvals
 - UL - UL1577 (E364000)
 - VDE - EN60747-5-5(VDE0884-5)
 - CQC – GB4943.1, GB8898
 - IEC60065, IEC60950

Applications

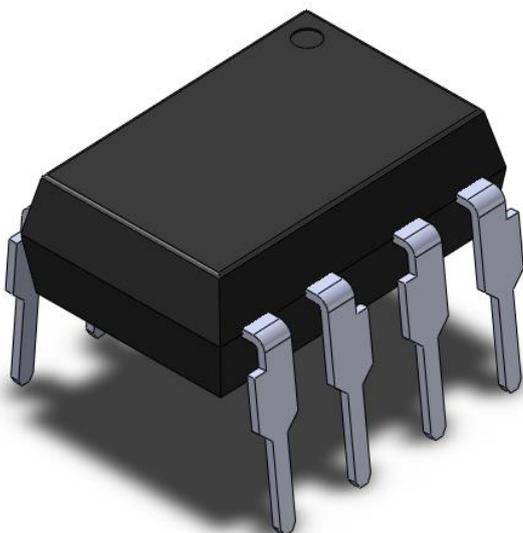
- Line receivers
- Telecommunication equipment
- High speed logic ground isolation
- Feedback loop in switch-mode power supplies
- Home appliances

Description

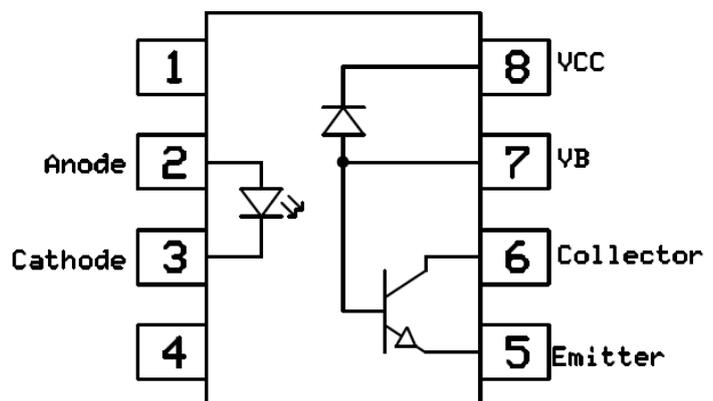
The 6N135, 6N136, CT4502 and CT4503 devices each consist of an infrared emitting diode, optically coupled to a high speed photo detector transistor. A separate connection for the photodiode bias and output-transistor collector increase the speed by several orders of magnitude over conventional phototransistor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

Package Outline



Schematic



6N135 / 6N136

Pin 7 not connected for CT4502/CT4503

Note: Different bending options available. See package dimension.



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Absolute Maximum Rating at 25°C

Symbol	Parameters	Ratings	Units	Notes
V _{ISO}	Isolation voltage	5000	V _{RMS}	1
T _{OPR}	Operating temperature	-55 ~ +100	°C	
T _{STG}	Storage temperature	-55 ~ +125	°C	
T _{SOL}	Soldering temperature	260	°C	2
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	

Notes

1. AC for 1 minute, RH = 40 ~ 60%.
2. For 10 second peak



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Electrical Characteristics

$T_A = 0 - 70^\circ\text{C}$ (unless otherwise specified). Typical values are measured at $T_A = 25^\circ\text{C}$ and $V_{CC}=5\text{V}$

Emitter Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
V_F	Forward voltage	$I_F = 16\text{mA}$	-	1.45	1.6	V	
V_R	Reverse Voltage	$I_R = 10\mu\text{A}$	5.0	-	-	V	
$\Delta V_F/\Delta T_A$	Temperature coefficient of forward voltage	$I_F = 16\text{mA}$	-	-1.8	-	mV/ $^\circ\text{C}$	

Detector Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
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	μA	
		$I_F=0\text{mA}$, $V_O=V_{CC}=15\text{V}$, $T_A=25^\circ\text{C}$	-	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	μA	
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	μA	
		$I_F=0\text{mA}$, $V_O=\text{Open}$, $V_{CC}=15\text{V}$	-	-	2		



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Transfer Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes	
CTR	Current Transfer Ratio	6N135	7	-	50	%		
		6N136 CT4502 CT4503						$I_F=16\text{mA}, V_O=0.4\text{V}, V_{CC}=4.5\text{V},$ $T_A=25^\circ\text{C}$
		6N135	5	-	-			
		6N136 CT4502 CT4503						
V_{OL}	Logic Low Output Voltage	6N135	-	0.18	0.4	V		
		6N136 CT4502 CT4503						
		6N135	-	-	0.5			
		6N136 CT4502 CT4503						
		$I_F=16\text{mA}, I_O=2.4\text{mA},$ $V_{CC}=4.5\text{V}$	-	-	0.5			



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Electrical Characteristics

$T_A = 0 - 70^\circ\text{C}$ (unless otherwise specified). Typical values are measured at $T_A = 25^\circ\text{C}$ and $V_{CC}=5\text{V}$

Switching Characteristics

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



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Typical Characteristic Curves

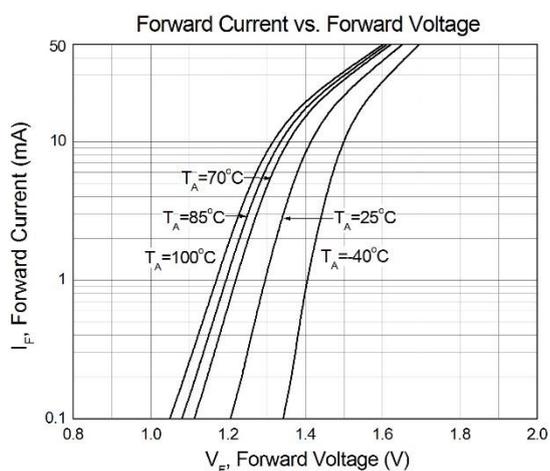


Figure 1

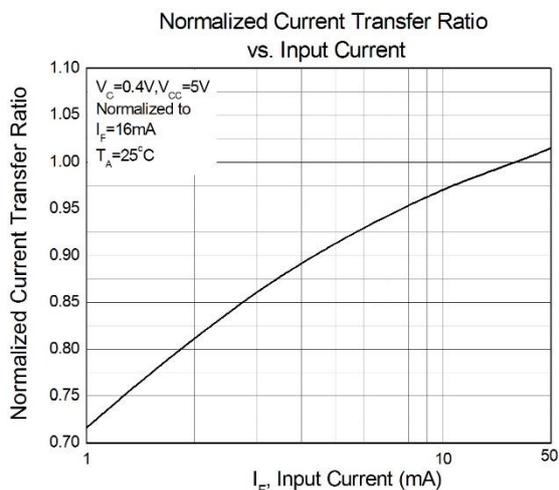


Figure 2

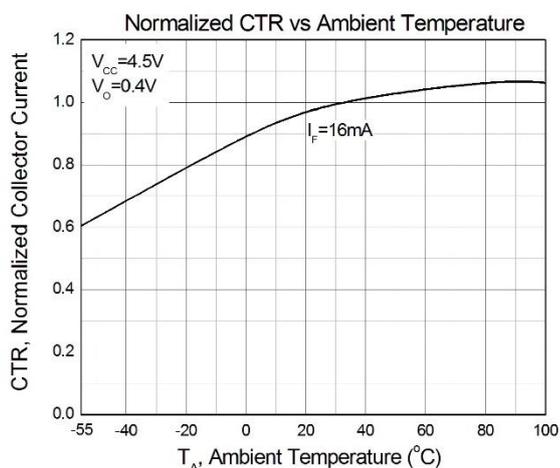


Figure 3

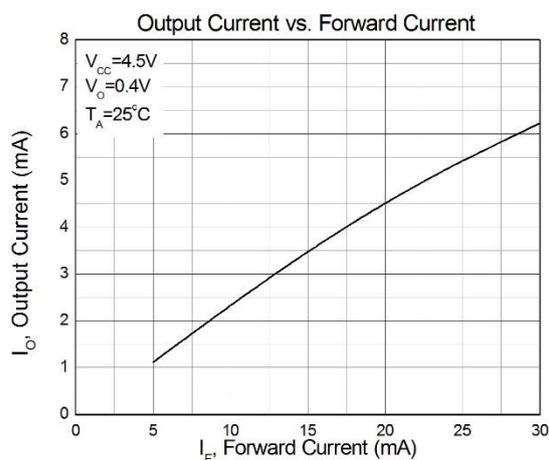


Figure 4

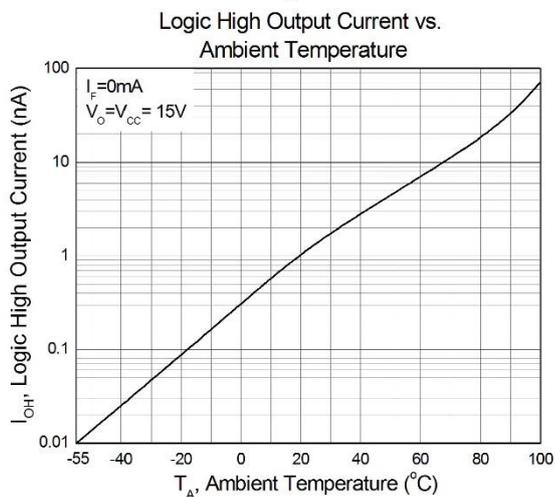


Figure 5

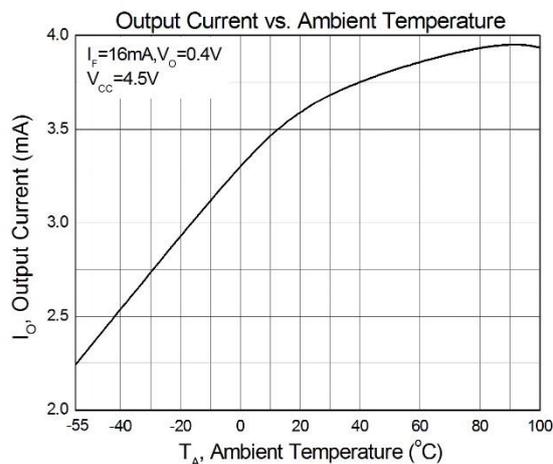


Figure 6



6N135, 6N136, CT4502, CT4503

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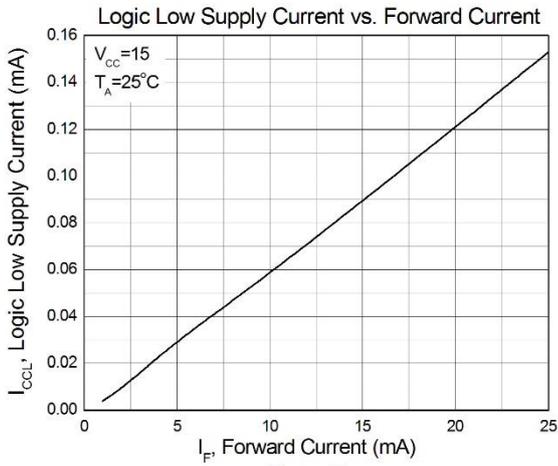


Figure 7

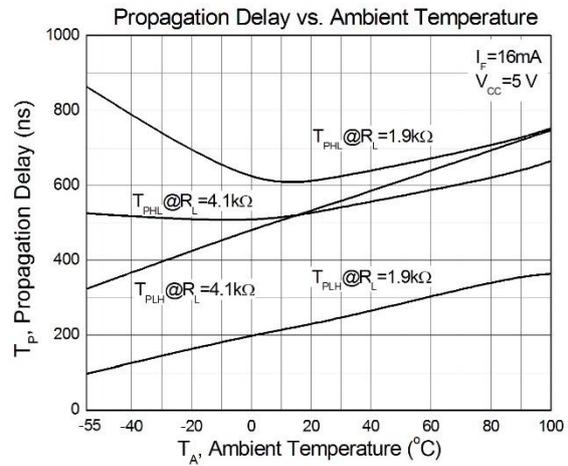


Figure 8

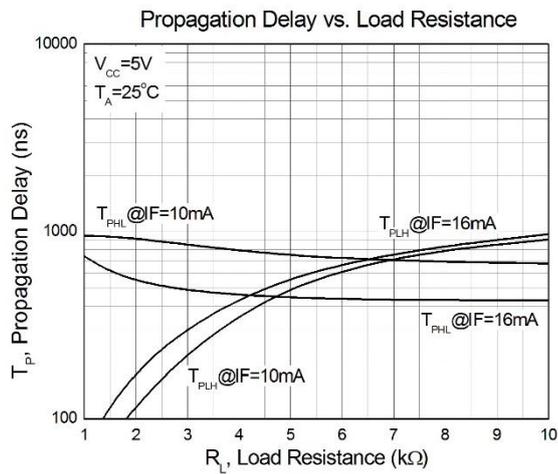
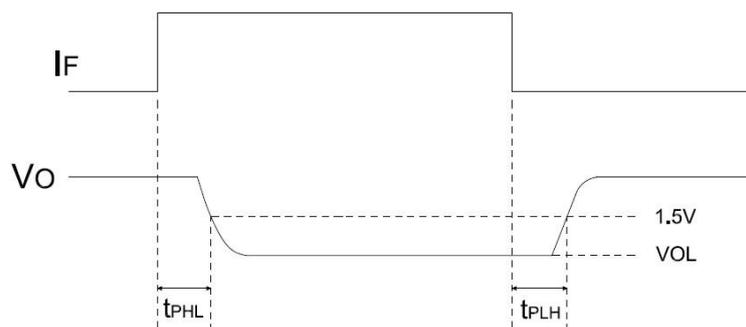
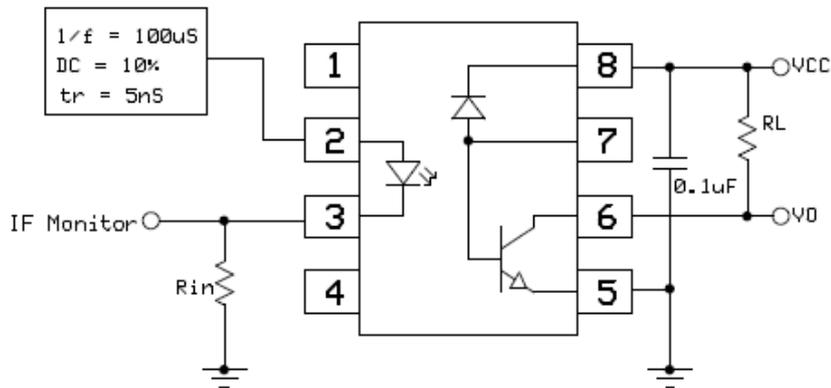


Figure 9



6N135, 6N136, CT4502, CT4503 1Mbit/s High Speed Phototransistor Optocoupler

Test Circuits

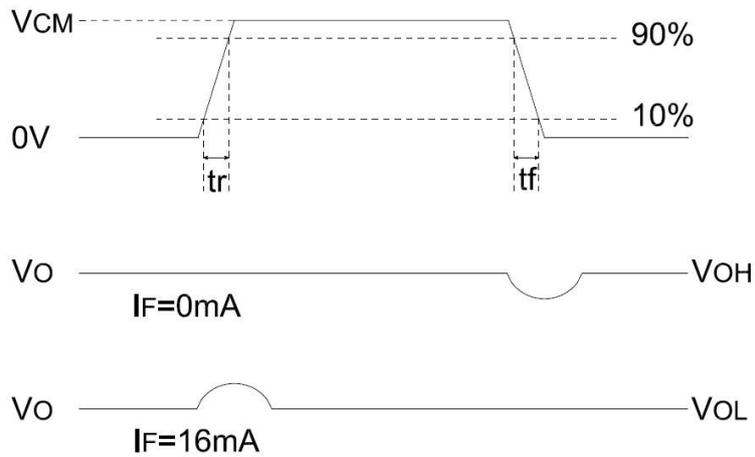
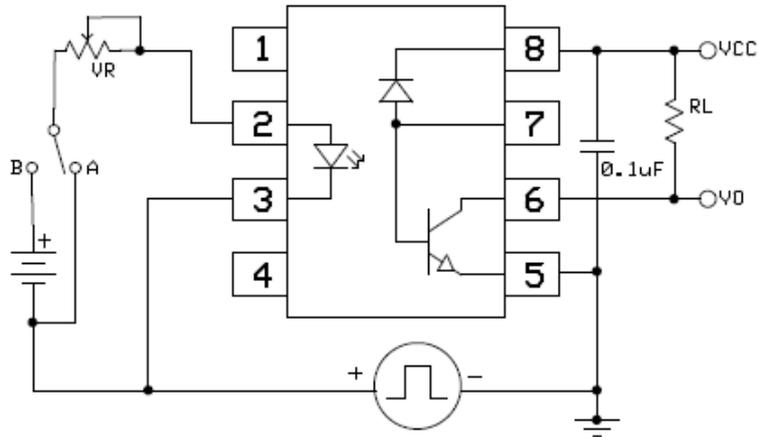


Switching Time Test Circuit



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Test Circuits



CMR Test Circuit

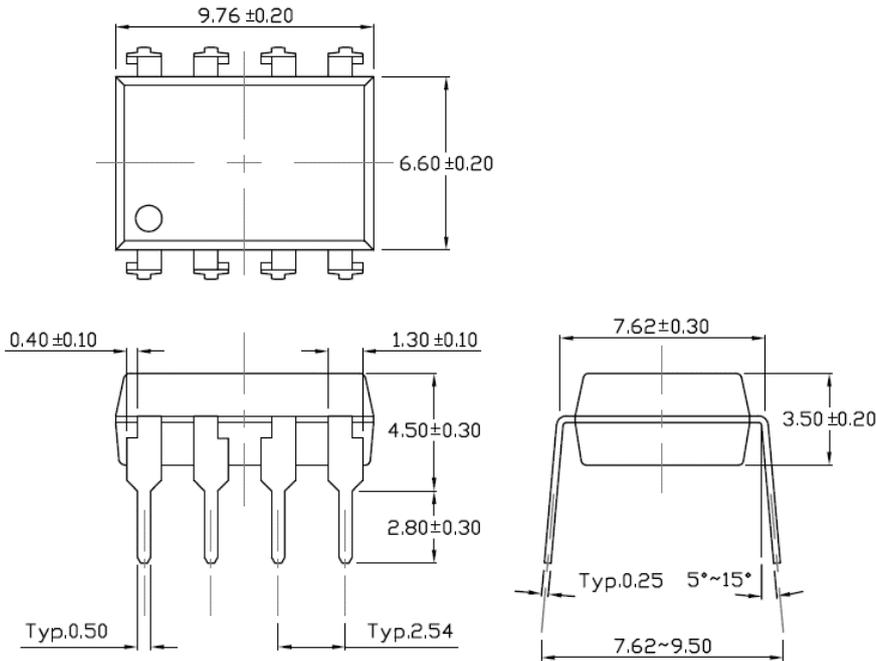


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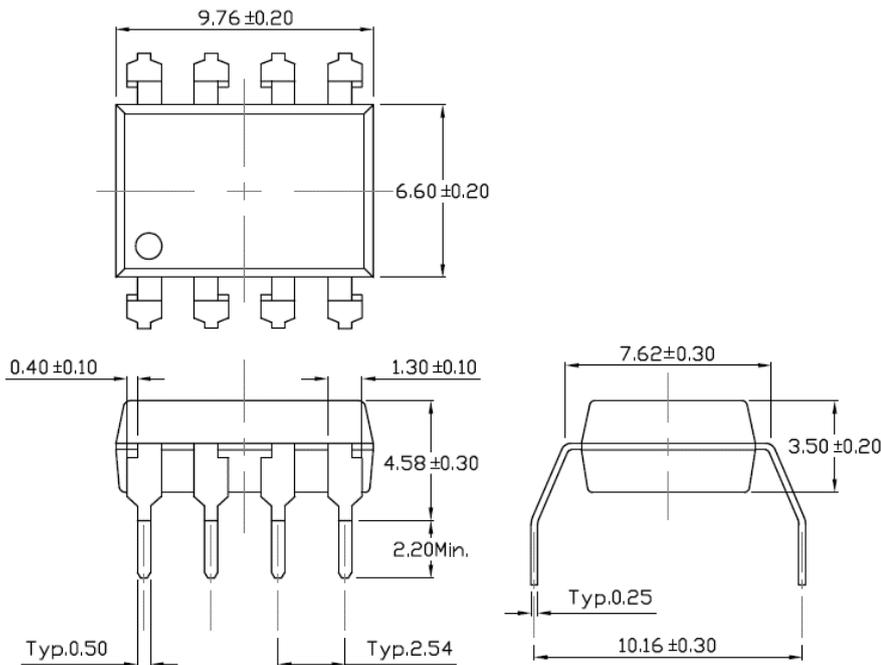
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Package Dimension *Dimensions in mm unless otherwise stated*

Standard DIP – Through Hole



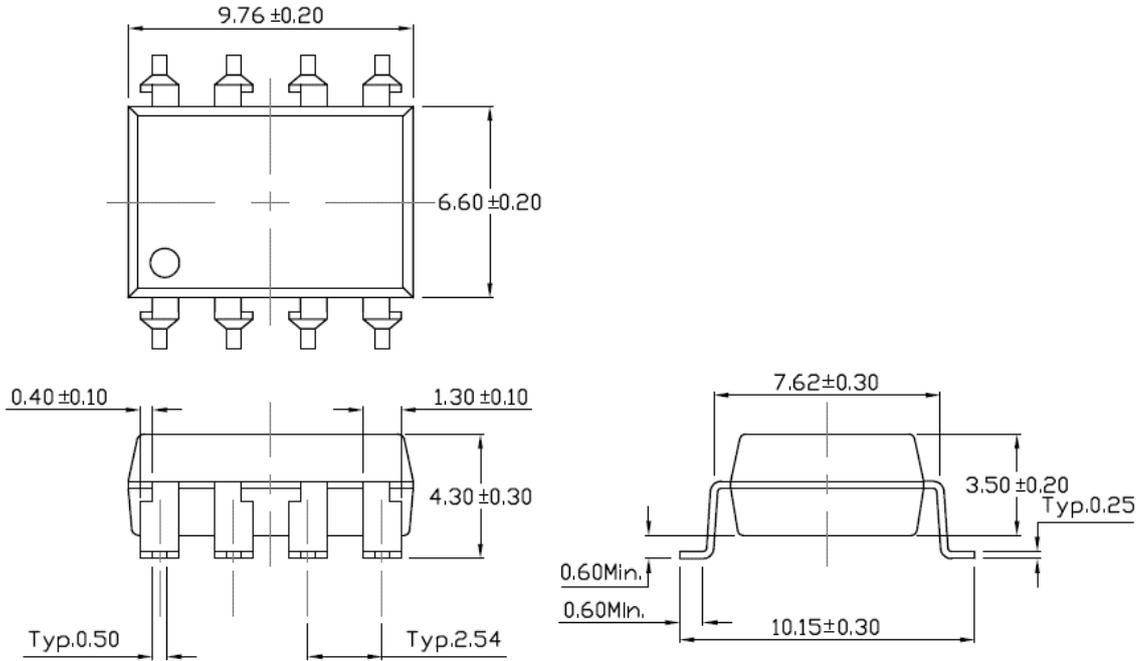
Gullwing (400mil) Lead Forming – Through Hole (M Type)



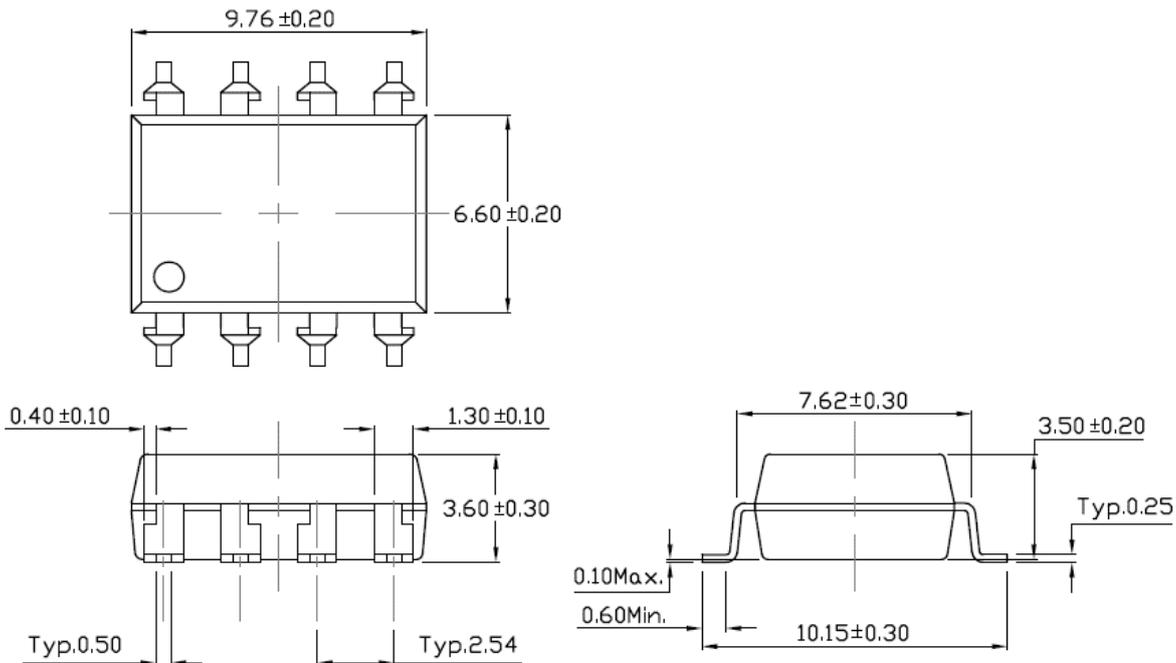


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Surface Mount Lead Forming (S Type)



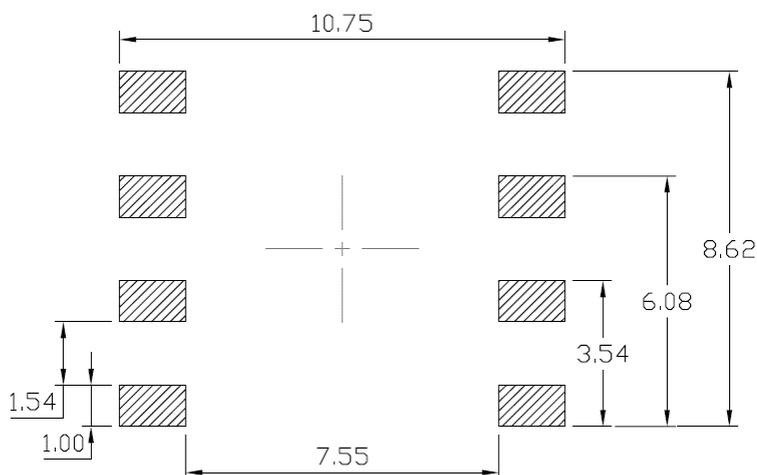
Surface Mount (Low Profile) Lead Forming (SL Type)



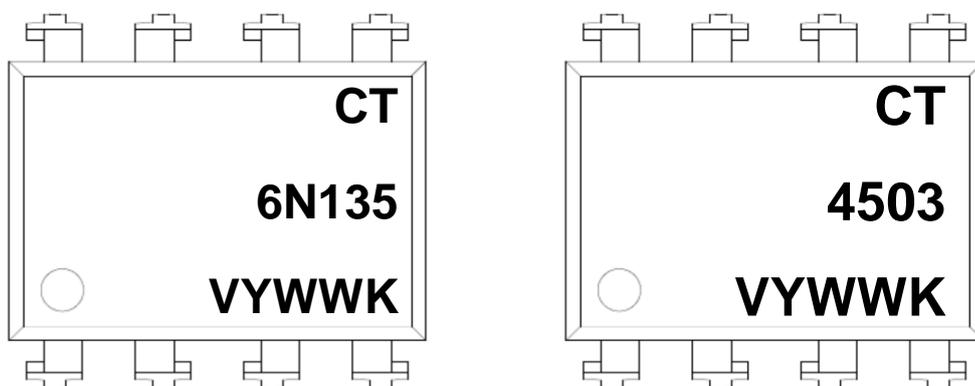


6N135, 6N136, CT4502, CT4503 1Mbit/s High Speed Phototransistor Optocoupler

Recommended Solder Mask *Dimensions in mm unless otherwise stated*



Device Marking



- CT : Denotes "CT Micro"
- 6N135 : Product Number
- 4503 : Product Number
- V : VDE Option
- Y : Fiscal Year
- WW : Work Week
- K : Production Code



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Ordering Information

6N13X(V)(Y)(Z) or CT450X(V)(Y)(Z)

X = Part No. (5,6 for 6N13X series), (2,3 for CT450X series)

V = VDE Option (V or None)

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

Z = Tape and reel option (T1, T2 or none)

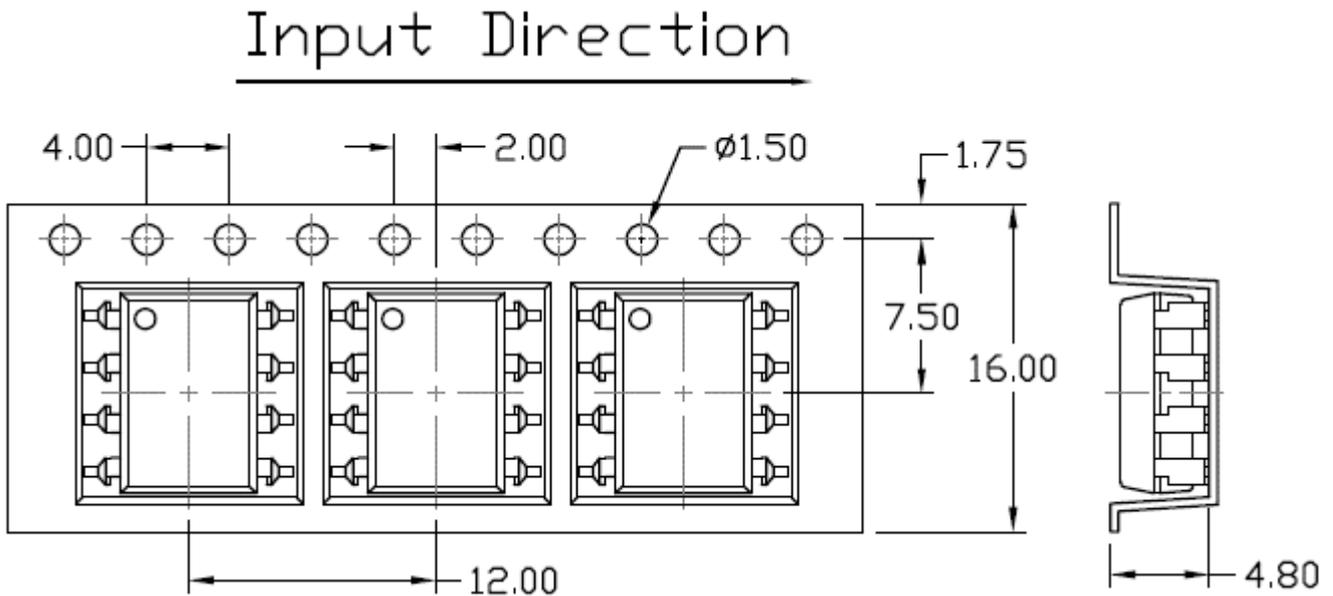
Option	Description	Quantity
None	Standard 8 Pin Dip	40 Units/Tube
M	Gullwing (400mil) Lead Forming	40 Units/Tube
S(T1)	Surface Mount Lead Forming – With Option 1 Taping	1000 Units/Reel
S(T2)	Surface Mount Lead Forming – With Option 2 Taping	1000 Units/Reel
SL(T1)	Surface Mount (Low Profile) Lead Forming–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



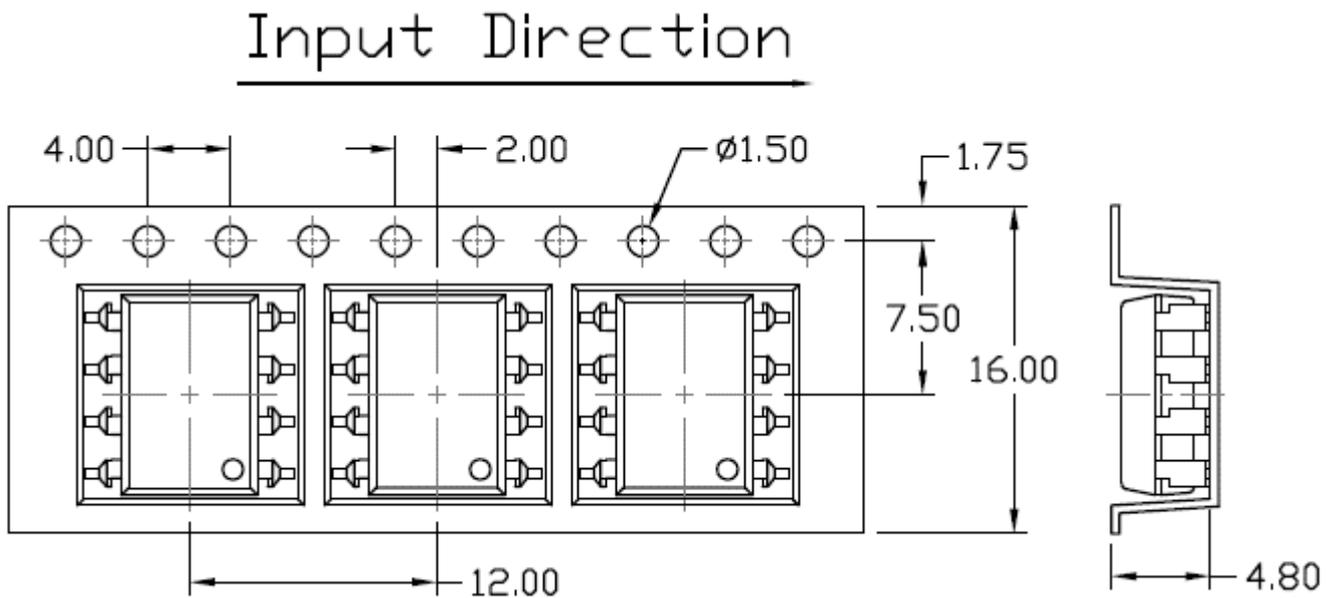
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Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

Option S(T1) & SL(T1)



Option S(T2) & SL(T2)





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Wave soldering (follow the JEDEC standard JESD22-A111)

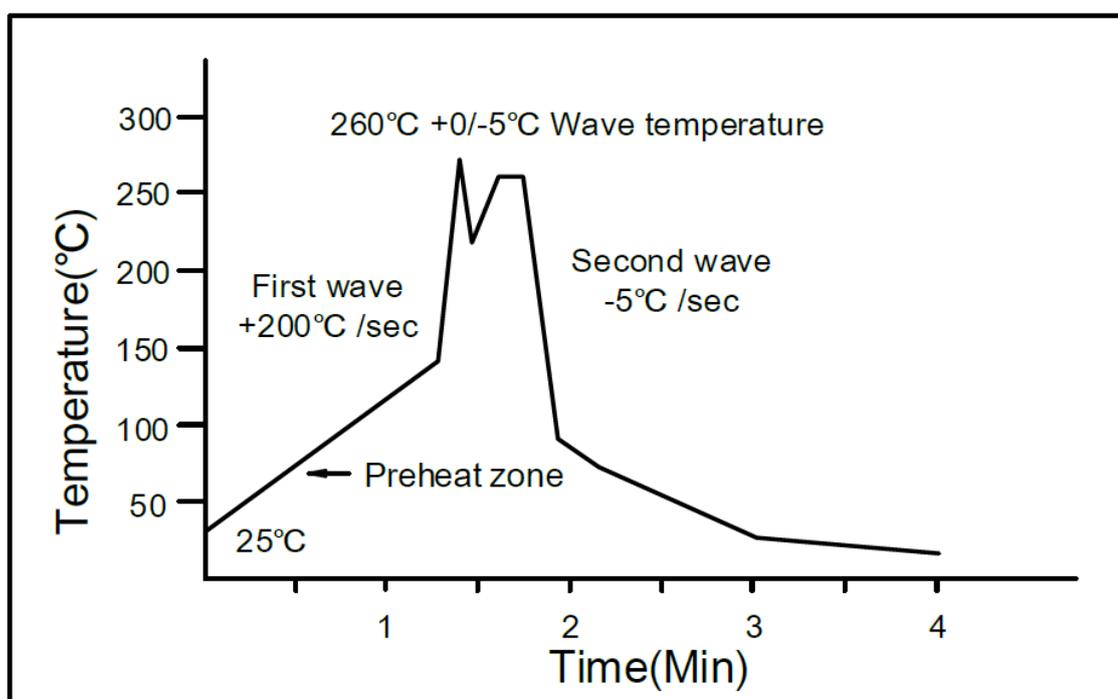
One time soldering is recommended within the condition of temperature.

Temperature: $260 \pm 5^\circ\text{C}$.

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: $350 \pm 10^\circ\text{C}$

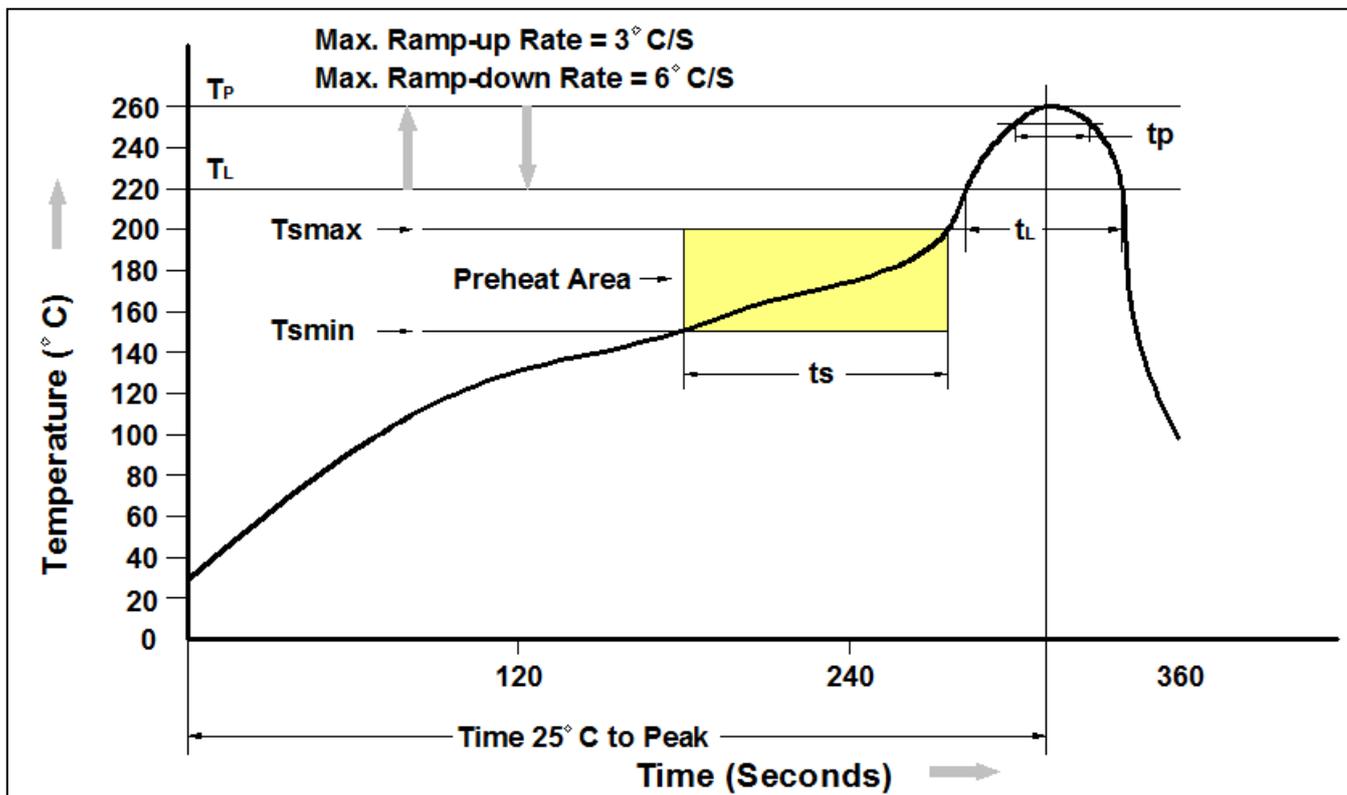
Time: 5 sec max.



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Reflow Profile



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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