



Low Input Current Photodarlington Coupler

Features

- Low current – 0.5mA
- Superior CTR-2000%
- CTR guaranteed 0–70°C

Applications

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

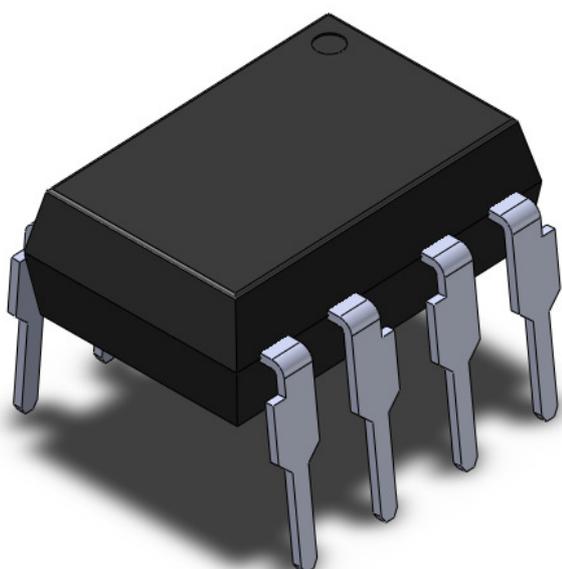
Description

The 6N138 & 6N139 optocouplers consist of an AlGaAs LED optically coupled to a high gain split darlington photodetector.

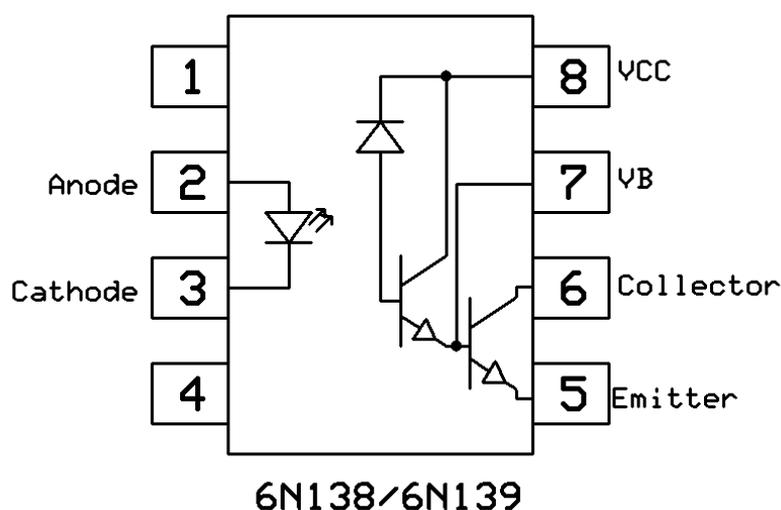
The combination of a very low input current of 0.5mA and a high current transfer ratio of 2000% makes this family particularly useful for input interface to MOS, CMOS, LSTTL and EIA RS232C, while output compatibility is ensured to CMOS as well as high fan-out TTL requirements.

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

Package Outline



Schematic



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



6N138, 6N139

Low Input Current Photodarlington Coupler

Absolute Maximum Rating at 25°C

Symbol	Parameters	Ratings	Units	Notes	
V _{ISO}	Isolation voltage	5000	V _{RMS}		
T _{OPR}	Operating temperature	-55 ~ +100	°C		
T _{STG}	Storage temperature	-55 ~ +125	°C		
T _{SOL}	Soldering temperature	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	0.5	V		
I _O	Output Current	60	mA		
V _O	Output voltage	6N138	-0.5 to 7	V	
		6N139	-0.5 to 18	V	
V _{CC}	Supply voltage	6N138	-0.5 to 7	V	
		6N139	-0.5 to 18	V	



Low Input Current Photodarlington Coupler

Electrical Characteristics $T_A = 0 - 70^\circ\text{C}$, $V_{CC}=4.5\text{V}$ (unless otherwise specified).

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	
I_R	Reverse Current	$V_R = 5\text{V}$	-	-	5	μA	
$\Delta V_F/\Delta T_A$	Temperature coefficient of forward voltage	$I_F = 16\text{mA}$	-	-1.8	-	$\text{mV}/^\circ\text{C}$	

Detector Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
I_{OH}	Logic High Output Current	6N139	$I_F=0\text{mA}$, $V_O=V_{CC}=18\text{V}$,	-	0.008	80	μA
		6N138		-	-	200	
I_{CCL}	Logic Low Supply Current	$I_F=1.6\text{mA}$, $V_O=\text{Open}$, $V_{CC}=18\text{V}$	-	0.5	1.4	mA	
I_{CCH}	Logic High Supply Current	$I_F=0\text{mA}$, $V_O=\text{Open}$, $V_{CC}=18\text{V}$	-	0.04	8	μA	

Transfer Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
CTR	Current Transfer Ratio	6N139	$I_F=0.5\text{mA}$, $V_O=0.4\text{V}$,	400	2500	-	%
		6N138		300	2000	-	
		6N139	$I_F=1.6\text{mA}$, $V_O=0.5\text{V}$,	500	2000	-	
V_{OL}	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	



Low Input Current Photodarlington Coupler

Electrical Characteristics $T_A = 0 - 70^\circ\text{C}$, $V_{CC} = 5\text{V}$ (unless otherwise specified).

Switching Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
T_{PHL}	High to Low Propagation Delay	6N139	$I_F = 0.5\text{mA}$, $R_L = 4.7\text{k}$	-	-	30	μs
			$T_A = 25^\circ\text{C}$	-	4.8	25	
		6N138	$I_F = 12\text{mA}$, $R_L = 250$	-	-	2	
			$T_A = 25^\circ\text{C}$	-	0.2	1	
		6N138	$I_F = 1.6\text{mA}$, $R_L = 2.2\text{k}$	-	-	15	
			$T_A = 25^\circ\text{C}$	-	1.35	10	
T_{PLH}	Low to High Propagation Delay	6N139	$I_F = 0.5\text{mA}$, $R_L = 4.7\text{k}$	-	-	90	μs
			$T_A = 25^\circ\text{C}$	-	15	60	
		6N138	$I_F = 12\text{mA}$, $R_L = 250$	-	-	10	
			$T_A = 25^\circ\text{C}$	-	1.6	7	
		6N138	$I_F = 1.6\text{mA}$, $R_L = 2.2\text{k}$	-	-	50	
			$T_A = 25^\circ\text{C}$	-	7.6	35	
CM_H	Common Mode Transient Immunity at Logic High	$I_F = 0\text{mA}$, $ V_{CM} = 10V_{P-P}$, $T_A = 25^\circ\text{C}$, $R_L = 2.2\text{k}\Omega$	1,000	-	-	$V/\mu\text{s}$	
CM_L	Common Mode Transient Immunity at Logic Low	$I_F = 1.6\text{mA}$, $ V_{CM} = 10V_{P-P}$, $T_A = 25^\circ\text{C}$, $R_L = 2.2\text{k}\Omega$	1,000	-	-		



Low Input Current Photodarlington Coupler

Typical Characteristic Curves

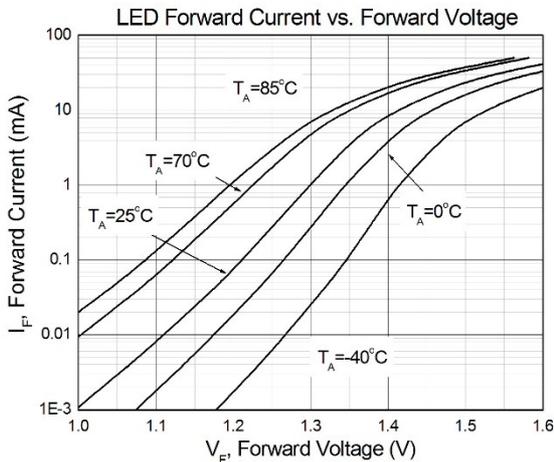


Figure 1

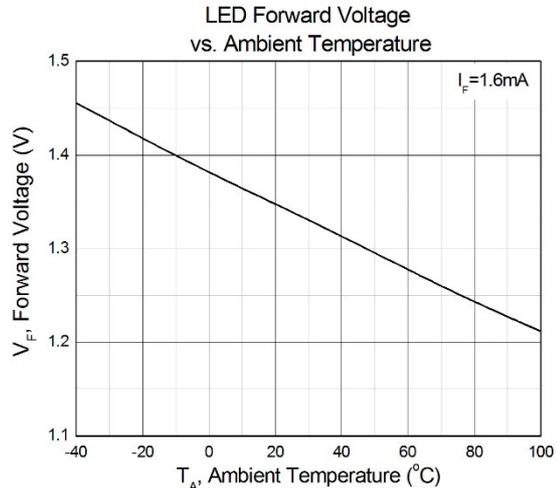


Figure 2

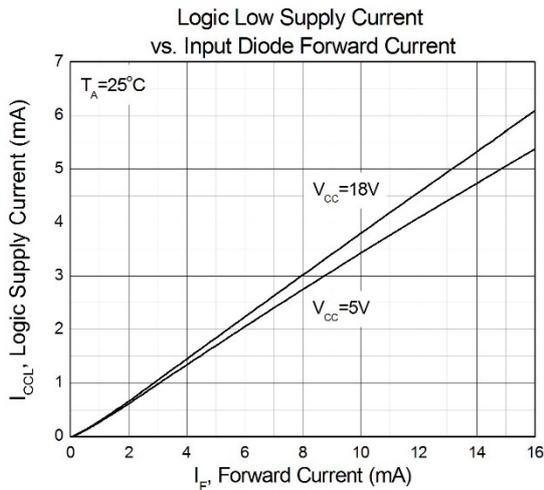


Figure 3

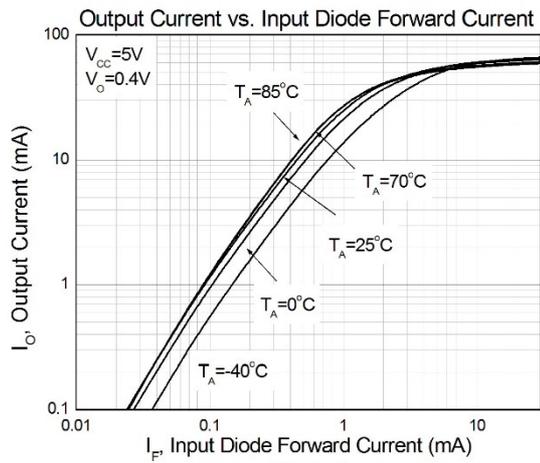


Figure 4

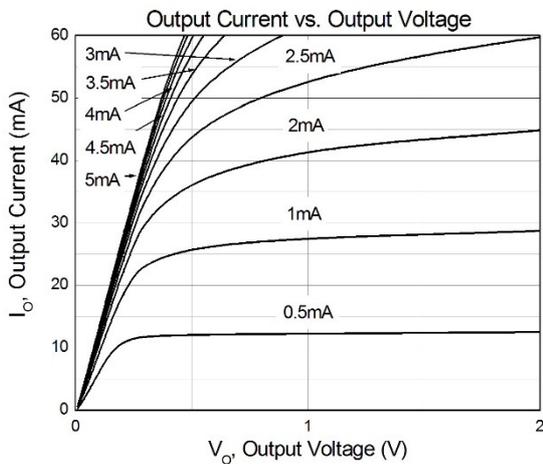


Figure 5

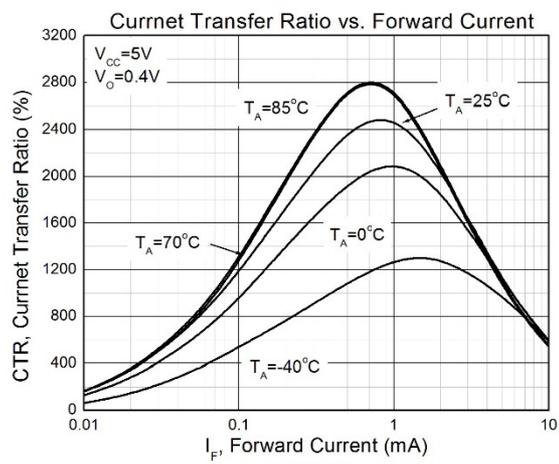
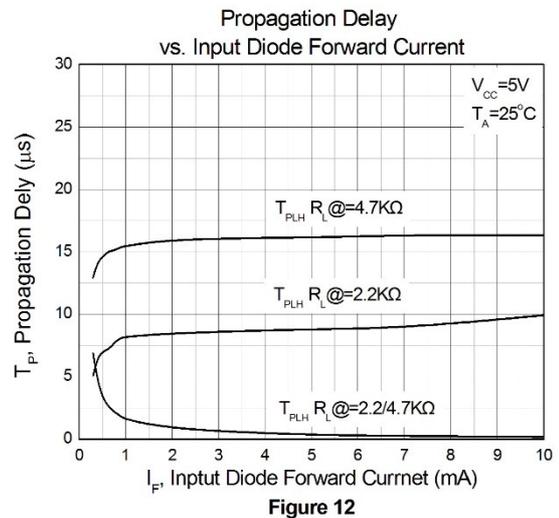
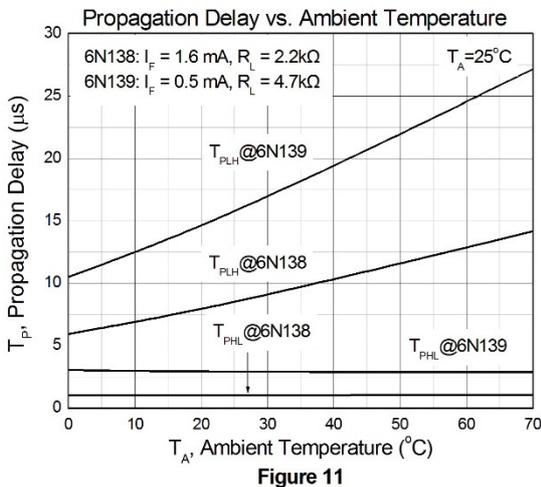
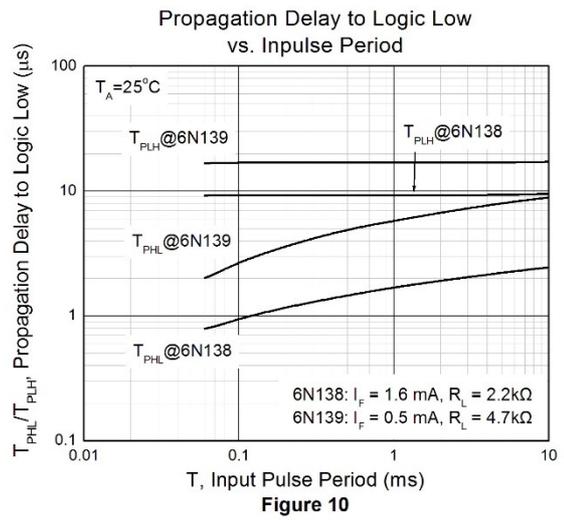
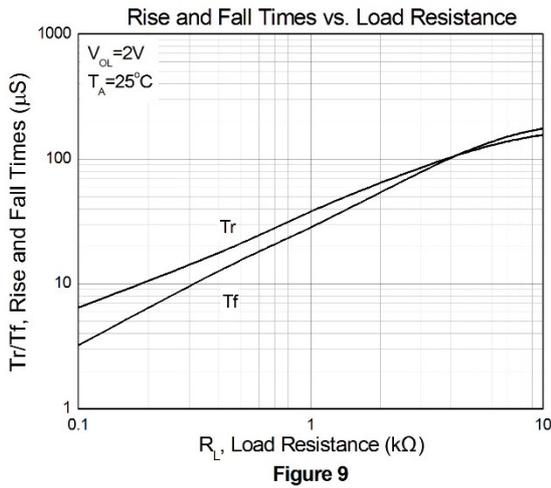
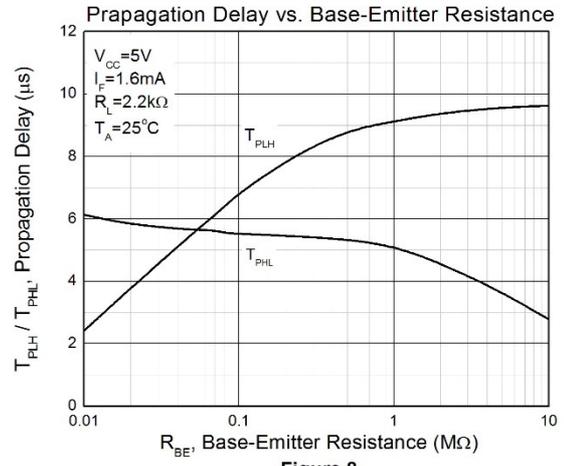
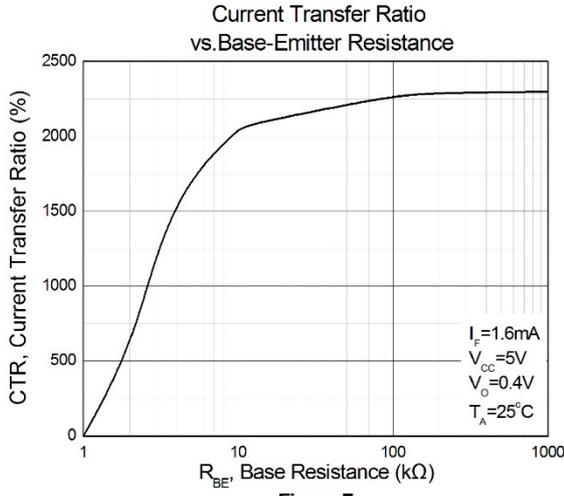


Figure 6



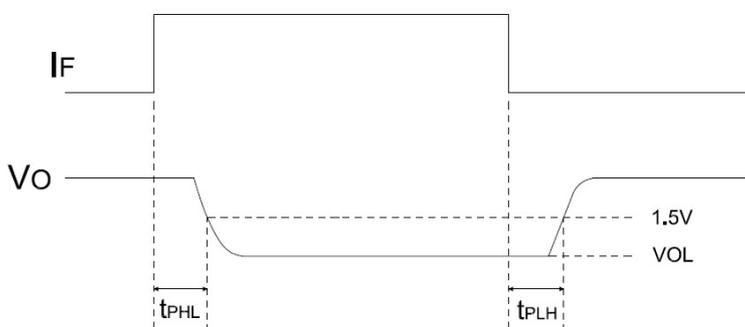
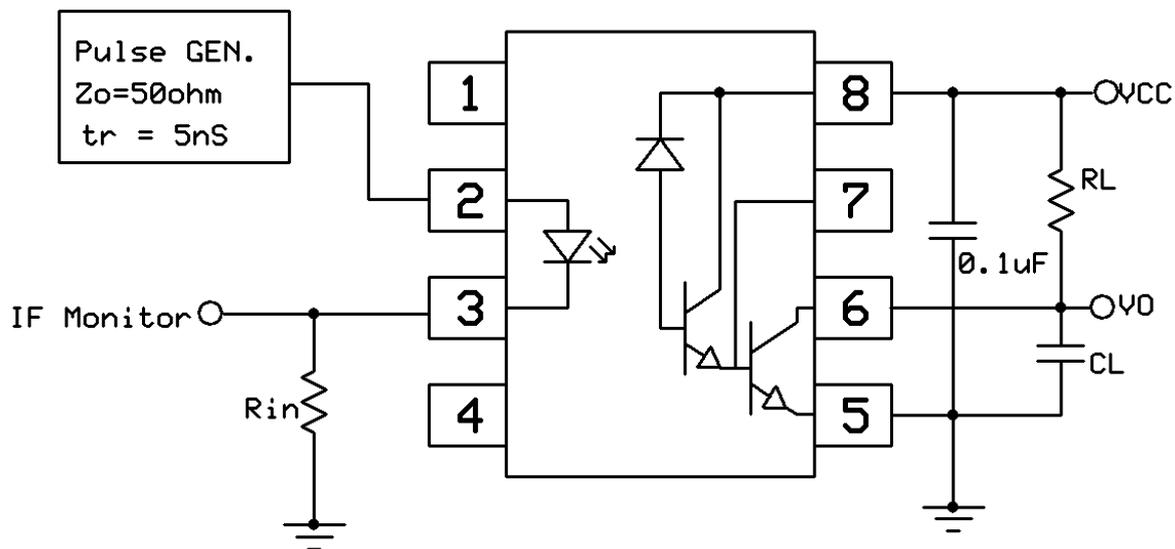
Low Input Current Photodarlington Coupler





Low Input Current Photodarlington Coupler

Test Circuits

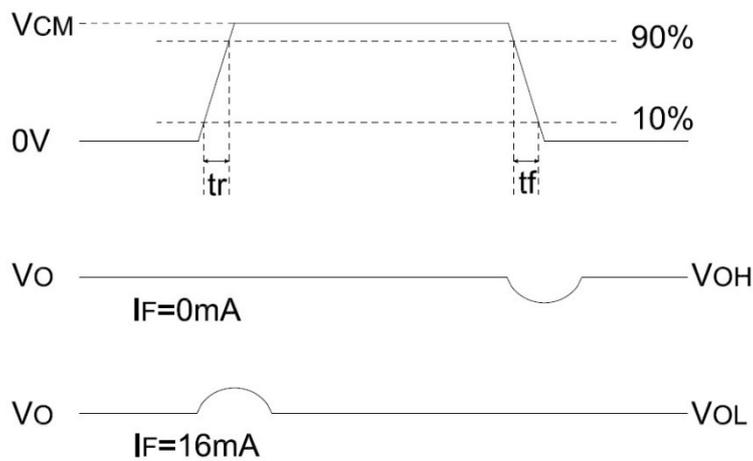
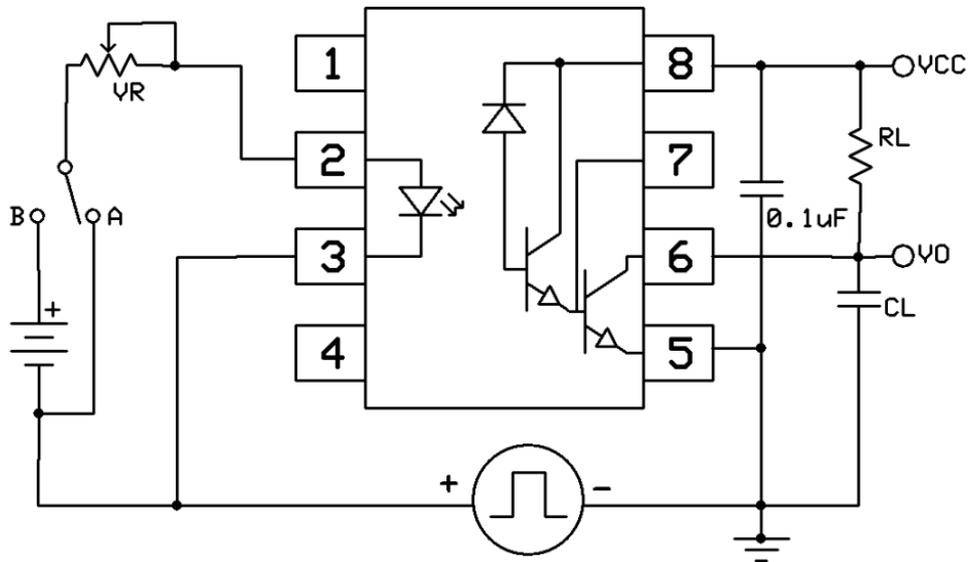


Switching Time Test Circuit



Low Input Current Photodarlington Coupler

Test Circuits



CMR Test Circuit

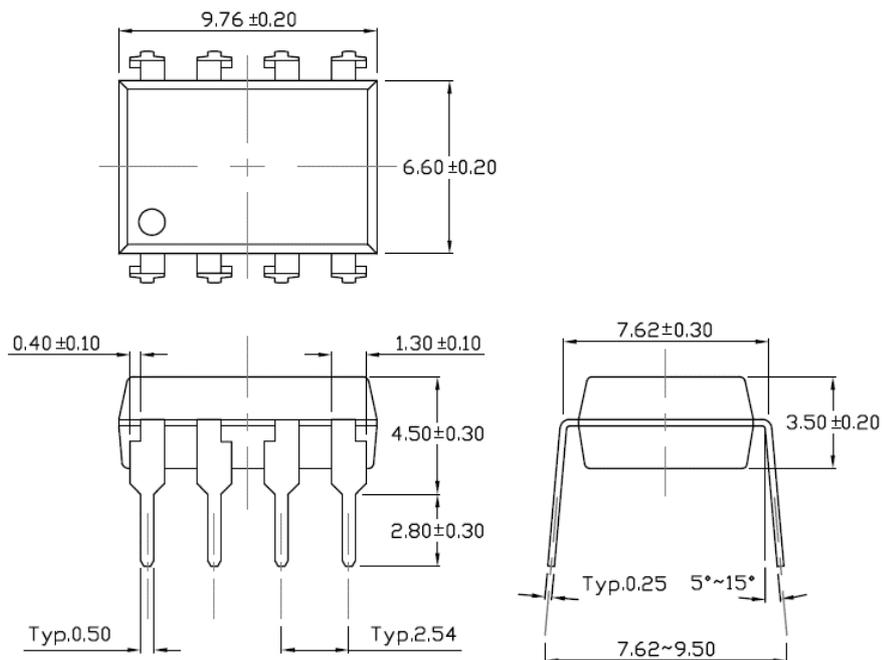


6N138, 6N139

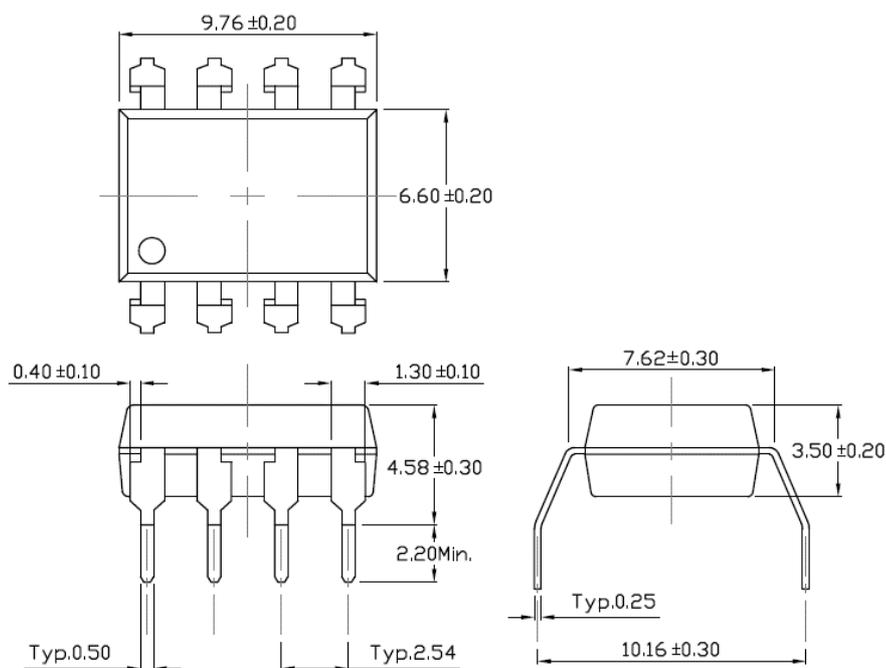
Low Input Current Photodarlington Coupler

Package Dimension *Dimensions in mm unless otherwise stated*

Standard DIP – Through Hole



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

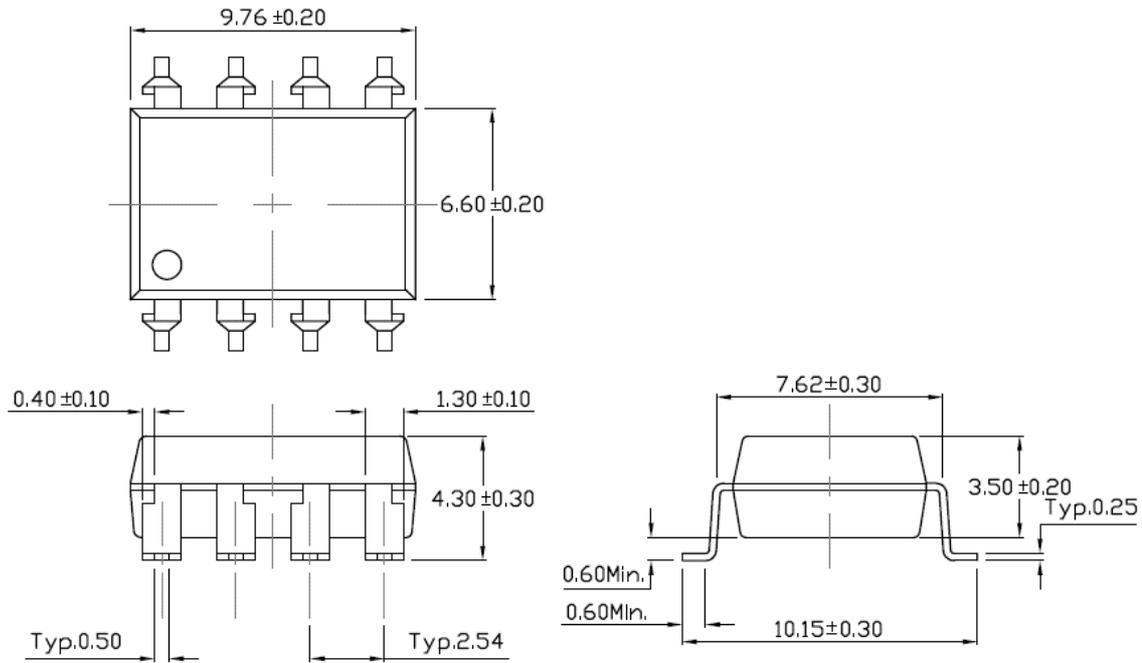




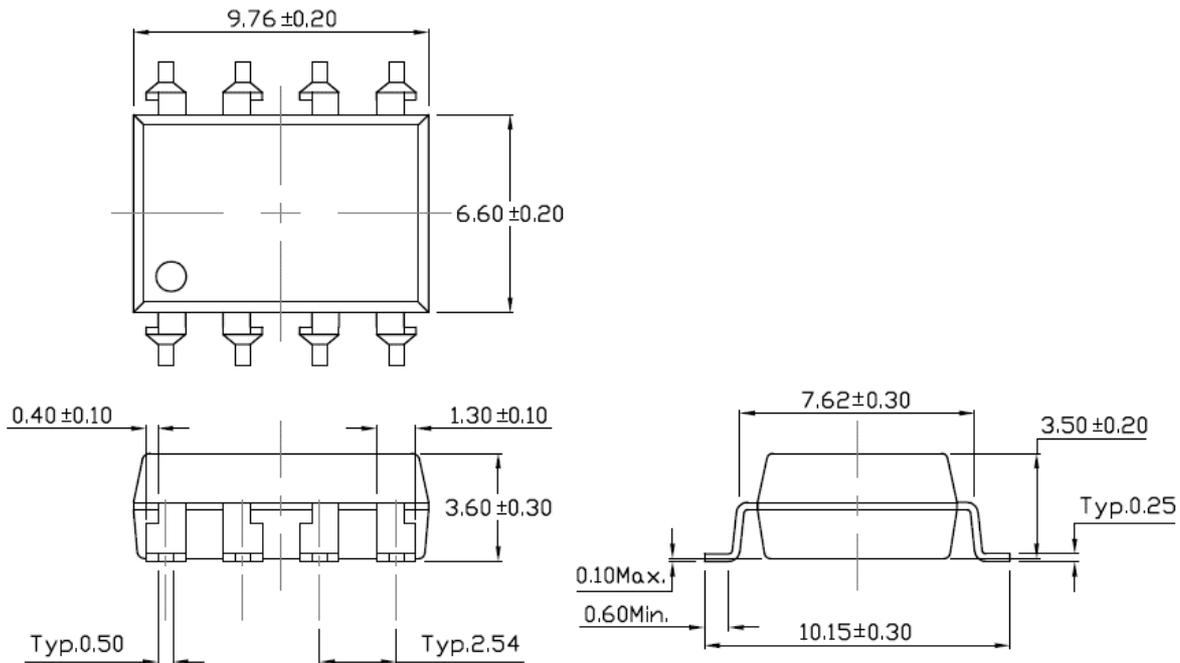
6N138, 6N139

Low Input Current Photodarlington Coupler

Surface Mount Lead Forming (S Type)



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

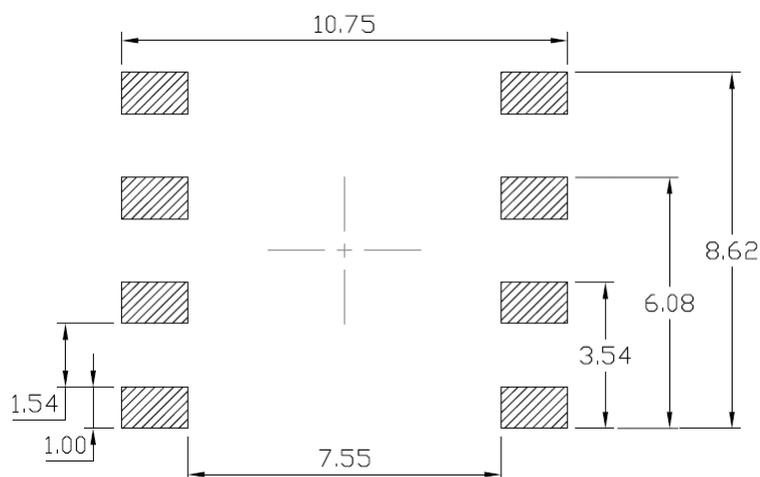




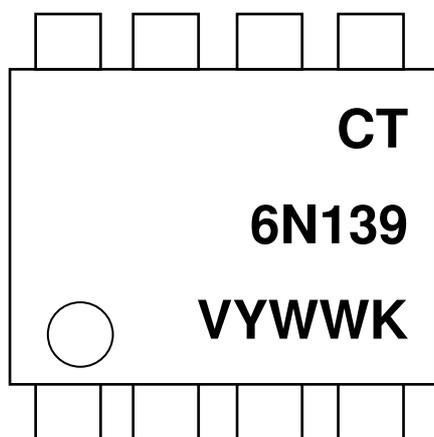
6N138, 6N139

Low Input Current Photodarlington Coupler

Recommended Solder Mask *Dimensions in mm unless otherwise stated*



Device Marking



- CT : Denotes "CT Micro"
- 6N139 : Product Number
- V : VDE Option
- Y : Fiscal Year
- WW : Work Week
- K : Production Code



6N138, 6N139

Low Input Current Photodarlington Coupler

Ordering Information

6N13X(V)(Y)(Z)

X = Part No. (8 or 9)

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

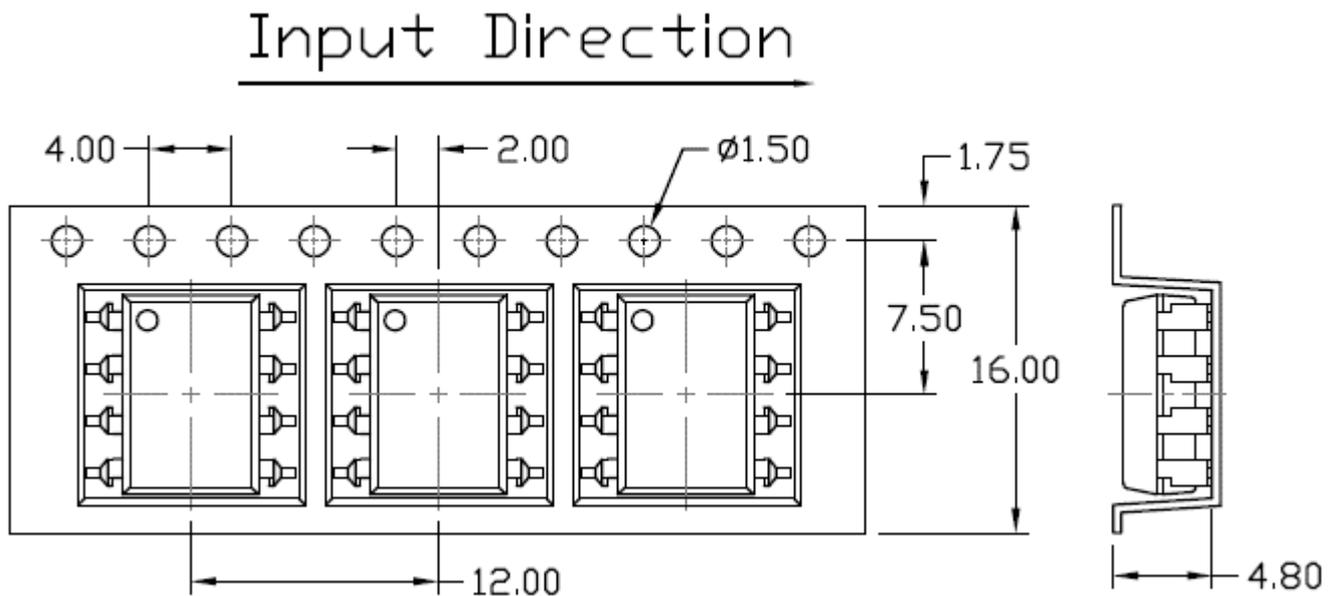


6N138, 6N139

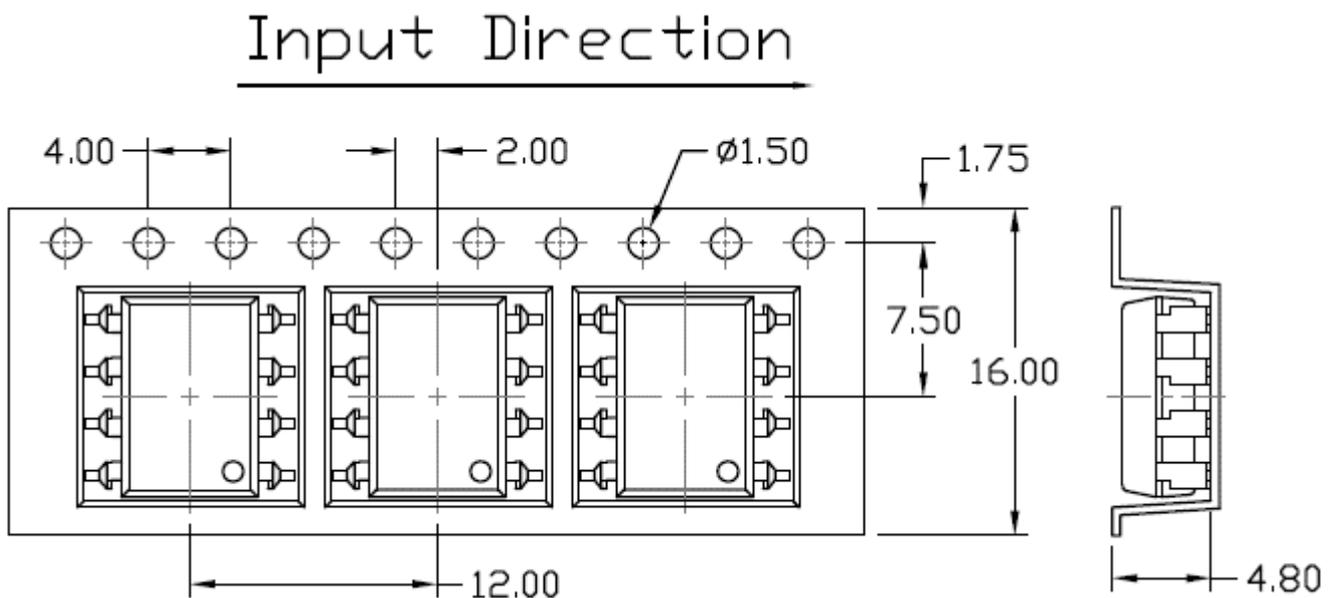
Low Input Current Photodarlington Coupler

Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

Option S(T1) & SL(T1)



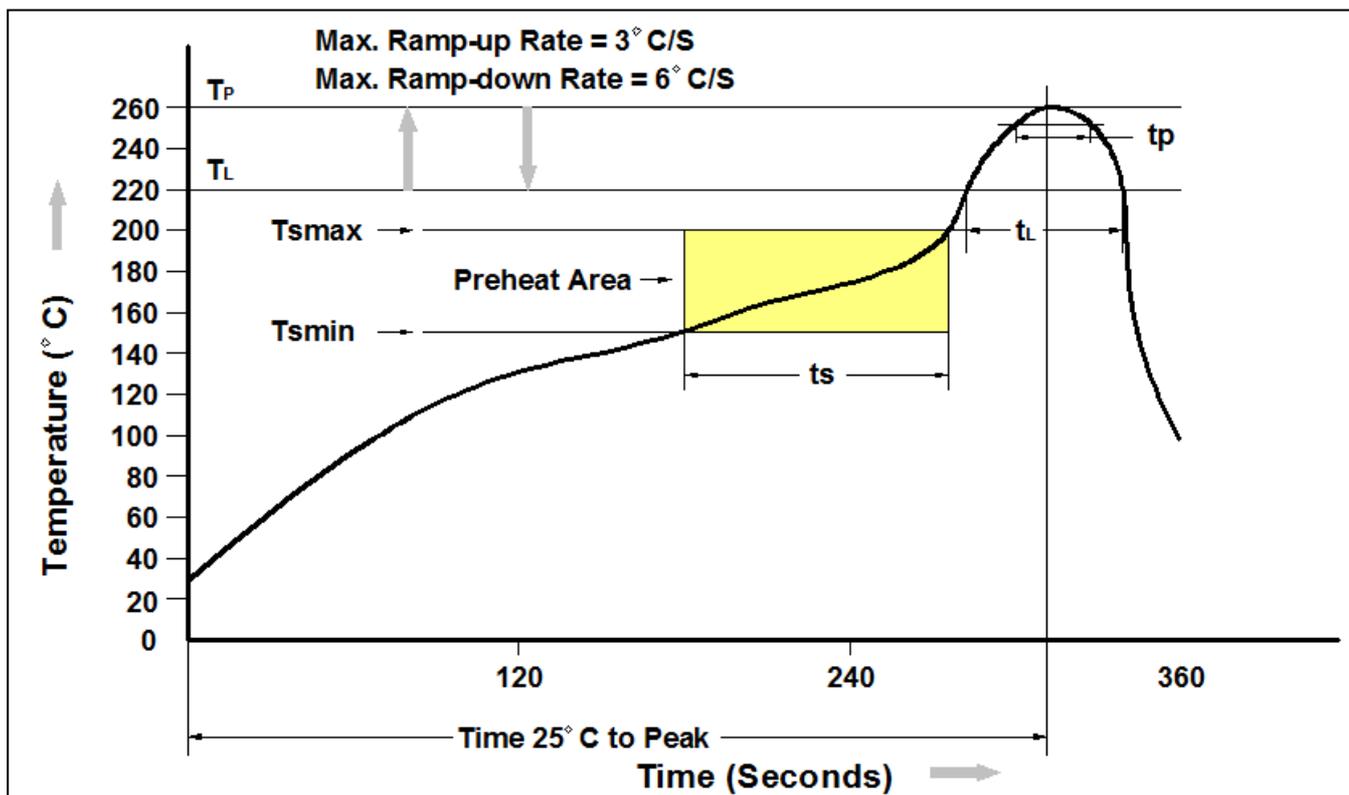
Option S(T2) & SL(T2)





Low Input Current Photodarlington Coupler

Reflow Profile



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T _{min})	150 °C
Temperature Max. (T _{max})	200 °C
Time (t _s) from (T _{min} to T _{max})	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.



6N138, 6N139

Low Input Current Photodarlington Coupler

DISCLAIMER

CT MICRO RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. CT MICRO DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

CT MICRO ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT EXPRESS WRITTEN APPROVAL OF CT MICRO INTERNATIONAL CORPORATION.

- 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, or (c) whose failure to perform when properly used in accordance with instruction for use provided in the labelling, can be reasonably expected to result in significant injury to the user.*
- 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.*