

## Features

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

# **Applications**

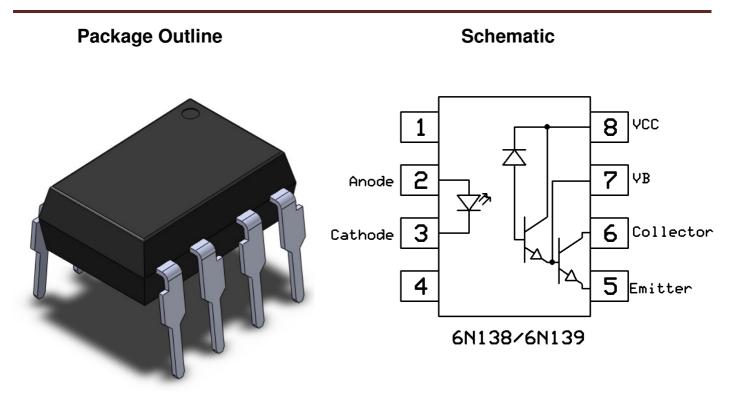
- Digital logic ground isolation
- Telephone ring detector
- EIA-RS-232C line receiver
- High common mode noise line receiver
- $\mu$  P bus isolation
- Current loop receiver

### 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.



Note: Different lead forming options available. See package

dimension.



# Low Input Current Photodarlington Coupler

# Absolute Maximum Rating at 25°C

Symbol	Parameters	Ratings	Units	Notes	
Viso	Isolation voltage	5000	VRMS		
Topr	Operating temperature		-55 ~ +100	°C	
Тѕтс	Storage temperature		-55 ~ +125	°C	
TSOL	Soldering temperature		260	°C	
Emitter					
lF	Forward current		25	mA	
I <sub>FP</sub>	Peak forward current (50% duty, 1ms P.W)		50	mA	
IF(TRANS)	Peak transient current (≤1µs P.W,300pps)	1			
$V_{R}$	Reverse voltage	5	V		
PD	Power dissipation	40	mW		
Detector	-		•		
PD	Power dissipation		100	mW	
VEBR	Emitter-Base reverse voltage		0.5	V	
lo	Output Current	60	mA		
		6N138	-0.5 to 7	V	
Vo	Output voltage	6N139	-0.5 to 18	V	
N/	Quarkushara	6N138	-0.5 to 7	V	
Vcc	Supply voltage	6N139	-0.5 to 18	V	



### Electrical Characteristics T<sub>A</sub> = 0 - 70 °C, V<sub>cc</sub>=4.5V (unless otherwise specified).

#### **Emitter Characteristics**

Symbol	Parameters	Test Conditions	Min	Тур	Max	Units	Notes
VF	Forward voltage	I <sub>F</sub> = 16mA	-	1.45	1.6	V	
IR	Reverse Current	$V_{R} = 5V$	-	-	5	μA	
$\Delta V_F / \Delta T_A$	Temperature coefficient of forward voltage	I <sub>F</sub> =16mA	-	-1.8	-	mV/℃	

### **Detector Characteristics**

Symbol	Parameter	rs	Test Conditions	Min	Тур	Max	Units	Notes
la	Logic High Output	6N139		-	0.008	80	μA	
Іон	Current	6N138	- I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =18V,	-	-	200		
ICCL	Logic Low Supply Current		I⊧=1.6mA, V₀=Open, V <sub>CC</sub> =18V	-	0.5	1.4	mA	
I <sub>ССН</sub>	Logic High Supply Current		I⊧=0mA, V₀=Open, V <sub>CC</sub> =18V	-	0.04	8	μΑ	

### **Transfer Characteristics**

Symbol	Paramete	ers	Test Conditions	Min	Тур	Max	Units	Notes
	Current Transfer Ratio	6N139	I <sub>F</sub> =0.5mA, V <sub>O</sub> =0.4V,	400	2500	-	%	
CTR		6N138	- I⊧=1.6mA, V₀=0.5V,	300	2000	-		
		6N139		500	2000	-		
	Logic Low Output Voltage	6N139	I⊧= 0.5mA, I₀= 2mA	-	0.04	0.4	-	
			I <sub>F</sub> = 1.6mA, I <sub>O</sub> = 8mA	-	0.08	0.4		
V <sub>OL</sub>			I⊧= 5mA, I₀= 15mA	-	0.11	0.4	V	
			I <sub>F</sub> = 12mA, I <sub>O</sub> = 24mA	-	0.16	0.4		
		6N138	IF= 1.6mA, Io= 4.8mA	-	0.05	0.4		



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

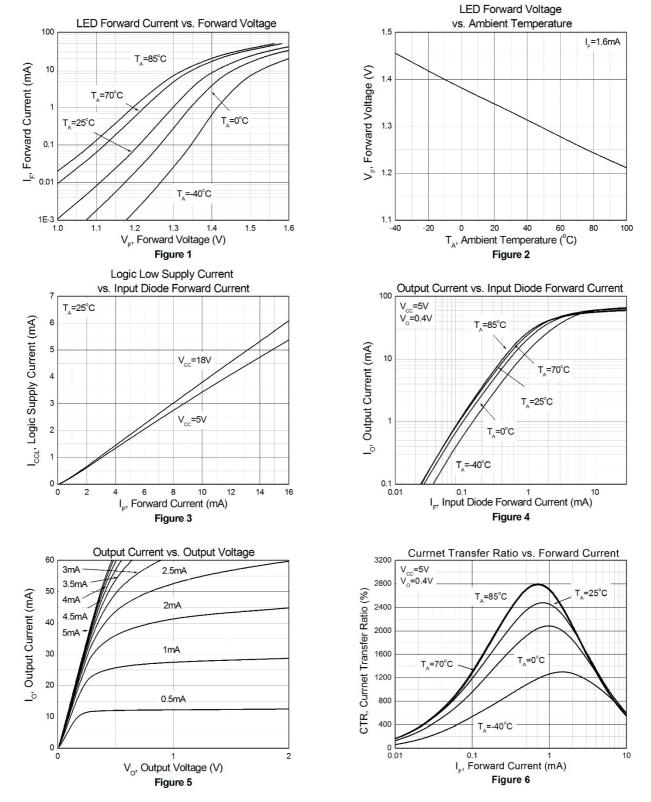
#### Switching Characteristics

Symbol	Paramete	ers	Test Cond	itions	Min	Тур	Max	Units	Notes
		6N139	I <sub>F</sub> = 0.5mA,		-	-	30	μs	
			R∟= 4.7k	T <sub>A</sub> = 25 <sup>0</sup> C	-	4.8	25		-
-	High to Low		I <sub>F</sub> = 12mA,		-	-	2		
T <sub>PHL</sub>	Propagation Delay		R∟= 250	T <sub>A</sub> = 25 <sup>0</sup> C	-	0.2	1		
		01400	I <sub>F</sub> = 1.6mA,		-	-	15		
		6N138	R <sub>L</sub> = 2.2k	T <sub>A</sub> = 25 <sup>0</sup> C	-	1.35	10		
			I <sub>F</sub> = 0.5mA,		-	-	90	- - μs	
		6N139	R∟= 4.7k	T <sub>A</sub> = 25 <sup>0</sup> C	-	15	60		
<b>-</b>	Low to High		I <sub>F</sub> = 12mA,		-	-	10		
T <sub>PLH</sub>	Propagation Delay		R∟= 250	T <sub>A</sub> = 25 <sup>0</sup> C	-	1.6	7		
		01400	I <sub>F</sub> = 1.6mA,		-	-	50		
		6N138	R <sub>L</sub> = 2.2k	T <sub>A</sub> = 25 <sup>0</sup> C	-	7.6	35		
<u>CM</u> .	Common Mode Transient		$I_F = 0mA$ , $ VCM  = 10V_{P-P}$ ,		1 000				
СМн	Immunity at Logic High		$T_A = 25 ^{\circ}\text{C}, R_L = 2.2$	2kΩ	1,000	-	-	V/µs	
CM∟	Common Mode Transient		$I_F = 1.6mA$ ,  VCM	M = 10V <sub>P-P</sub> ,		1,000 -		v/μs	
	Immunity at Logic Low		$T_A = 25 ^{\circ}C, R_L = 2.2$	2kΩ	1,000	-	-		



# Low Input Current Photodarlington Coupler

## **Typical Characteristic Curves**





# 6N138, 6N139

10

10

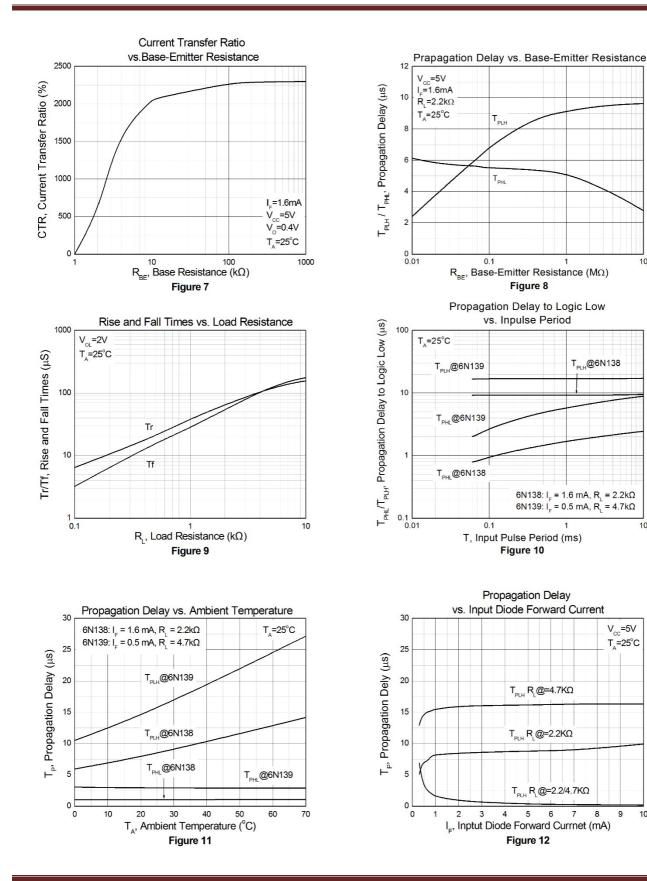
V<sub>cc</sub>=5V

T\_=25°C

7 8 9 10

T<sub>PLH</sub>@6N138

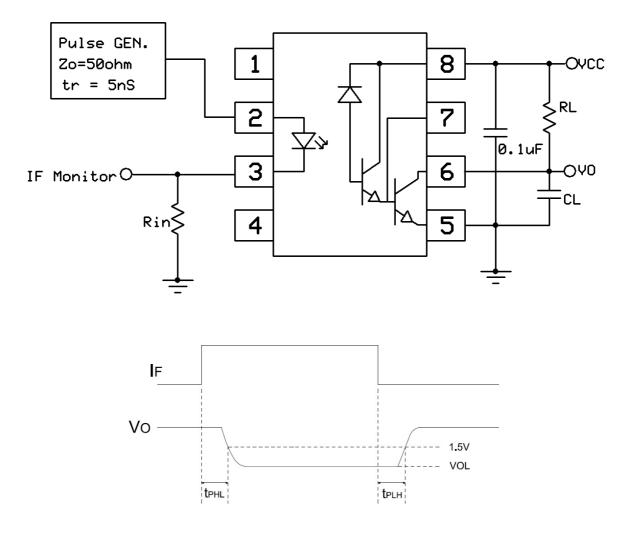
# Low Input Current Photodarlington Coupler





6N138, 6N139 Low Input Current Photodarlington Coupler

# **Test Circuits**

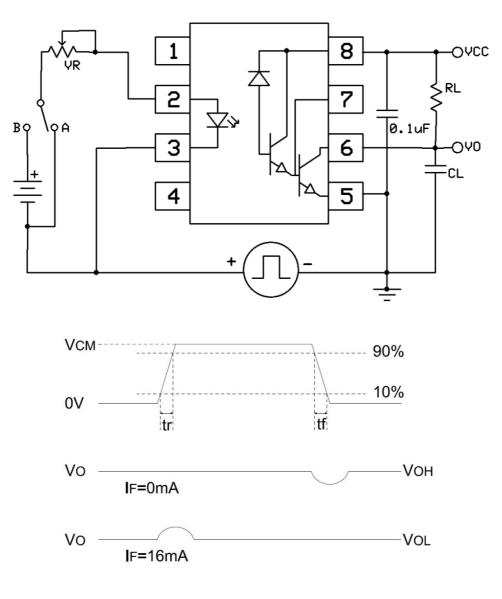


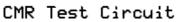
Switching Time Test Circuit



6N138, 6N139 Low Input Current Photodarlington Coupler

# **Test Circuits**

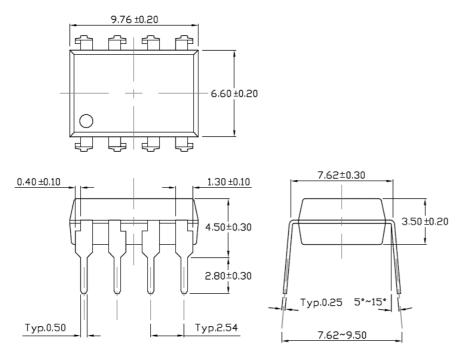




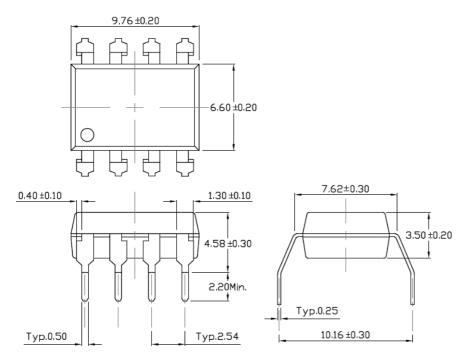


### Package Dimension Dimensions in mm unless otherwise stated

#### Standard DIP – Through Hole

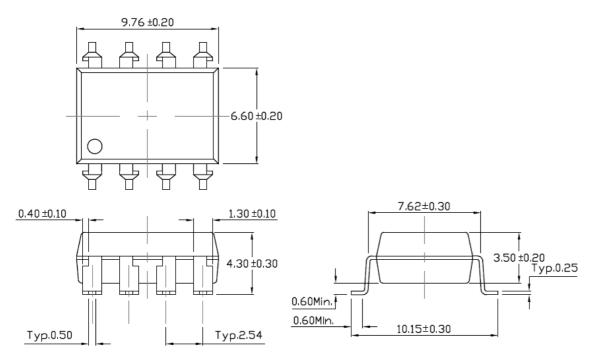


Gullwing (400mil) Lead Forming – Through Hole (M Type)

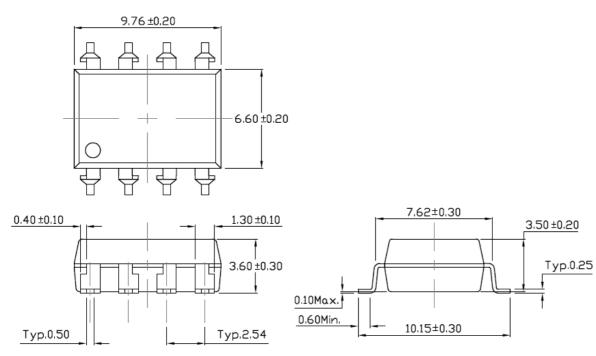




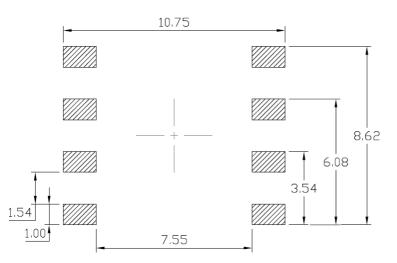
## Surface Mount Lead Forming (S Type)



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

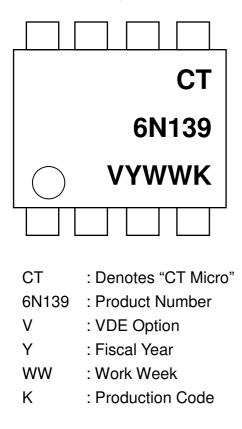






### Recommended Solder Mask Dimensions in mm unless otherwise stated

## **Device Marking**





# **Ordering Information**

# 6N13X(V)(Y)(Z)

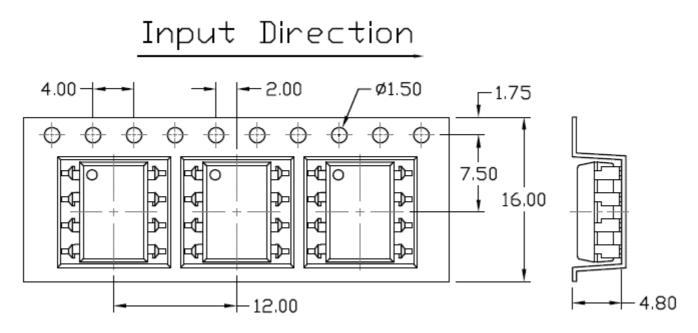
- X = Part No. (8 or 9)
- V = VDE Option (V or None)
- Y = Lead form option (S, SL, M or none)
- Z = Tape and reel option (T1, T2 or none)

Option	ption Description	
None	None Standard 8 Pin Dip	
М	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

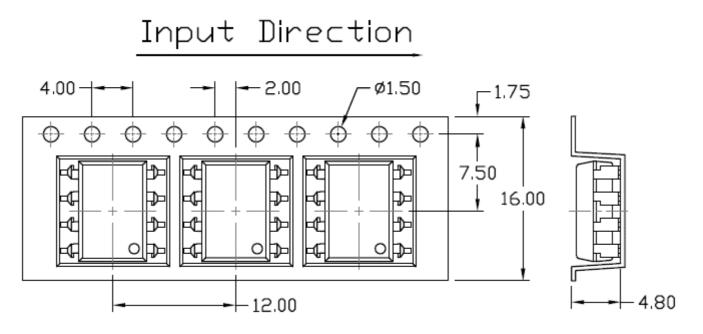


Carrier Tape Specifications Dimensions in mm unless otherwise stated

## Option S(T1) & SL(T1)

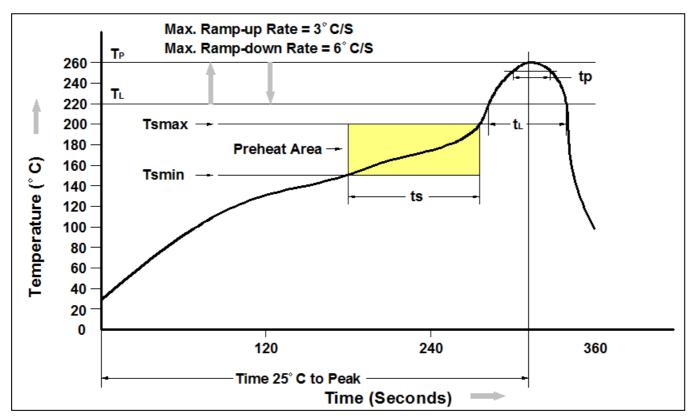


Option S(T2) & SL(T2)





## **Reflow Profile**



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	150°C
Temperature Max. (Tsmax)	200 <i>°</i> C
Time (ts) from (Tsmin to Tsmax)	60-120 seconds
Ramp-up Rate ( $t_L$ to $t_P$ )	3°C/second max.
Liquidous Temperature (TL)	217℃
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60 – 150 seconds
Peak Body Package Temperature	260 ℃ +0 ℃ / -5 ℃
Time (t₂) within 5℃ of 260℃	30 seconds
Ramp-down Rate $(T_P \text{ to } T_L)$	6°C/second max
Time 25℃ to Peak Temperature	8 minutes max.



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