

**6N138/6N139 – High Speed Darlington Optocouplers**

Aug 2008

**FEATURES**

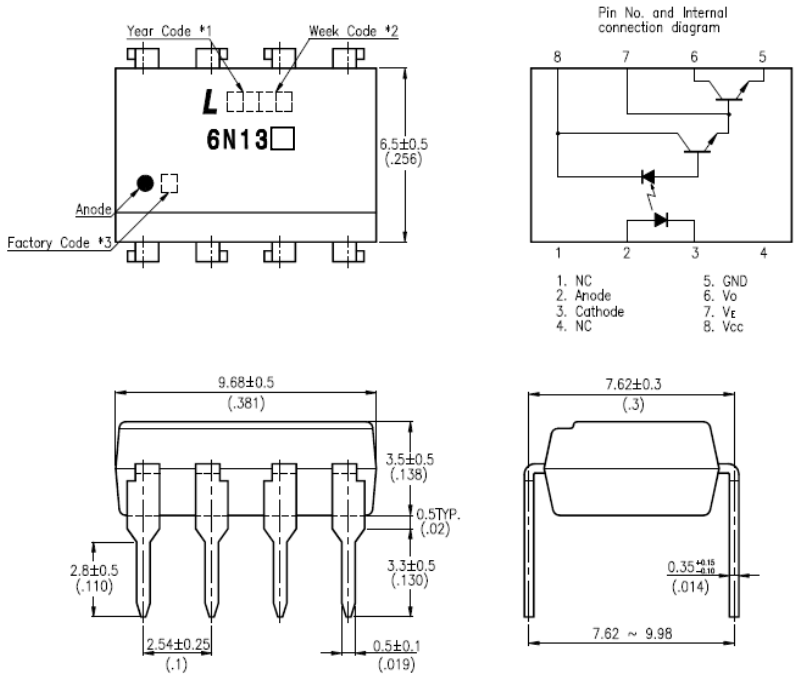
- \* High current transfer ratio – 2000% typical
- \* Low input current requirements – 0.5mA
- \* High output current – 60mA
- \* CTR guarantee - 0 ~ 70°C
- \* Instantaneous common mode rejection– 10KV/μs
- \* TTL compatible output – 0.1V V<sub>OL</sub> typical
- \* UL, CSA, IEC/EN/DIN EN60747-5-2 – Pending
- \* Dual-in-line package - 6N138 / 6N139
- \* Wide lead spacing package - 6N138M / 6N139M
- \* Surface mounting package - 6N138S / 6N139S
- \* Tape and reel packaging - 6N138S-TA / 6N139S-TA, 6N138S-TA1 / 6N139S-TA1

**APPLICATIONS**

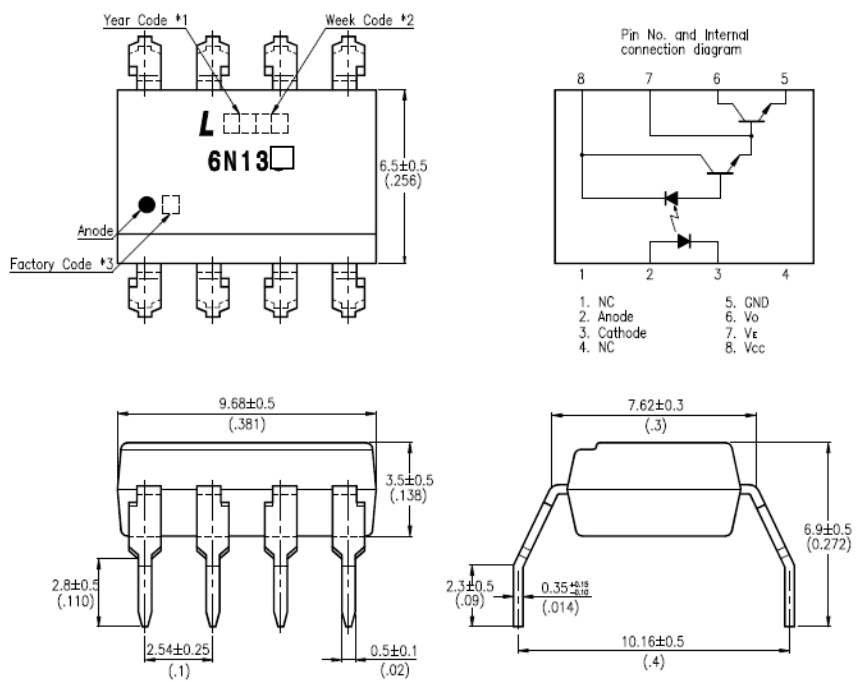
- \* Digital logic ground isolation
- \* Low input current line receiver
- \* Telephone ring detector
- \* EIA-RS-232C line receiver
- \* Current loop receiver
- \* High common mode noise line receiver

## OUTLINE DIMENSIONS

### 6N138 / 6N139



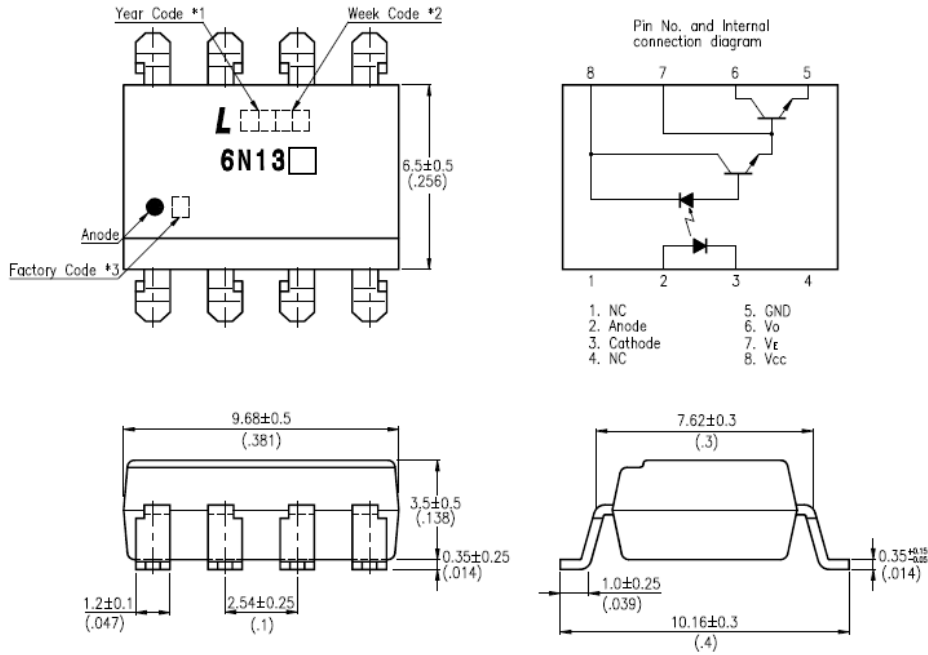
### 6N138M / 6N139M



- \*1. Year date code.
- \*2. 2-digit work week.
- \*3. Factory identification mark shall be marked (Z : Taiwan, Y : Thailand).

## OUTLINE DIMENSIONS

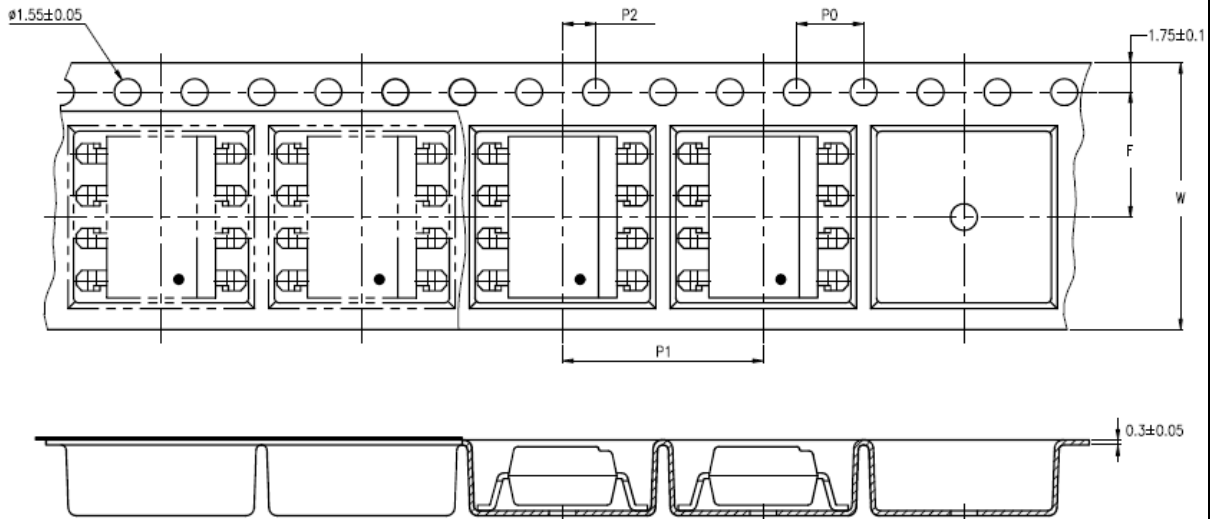
### 6N138S / 6N139S



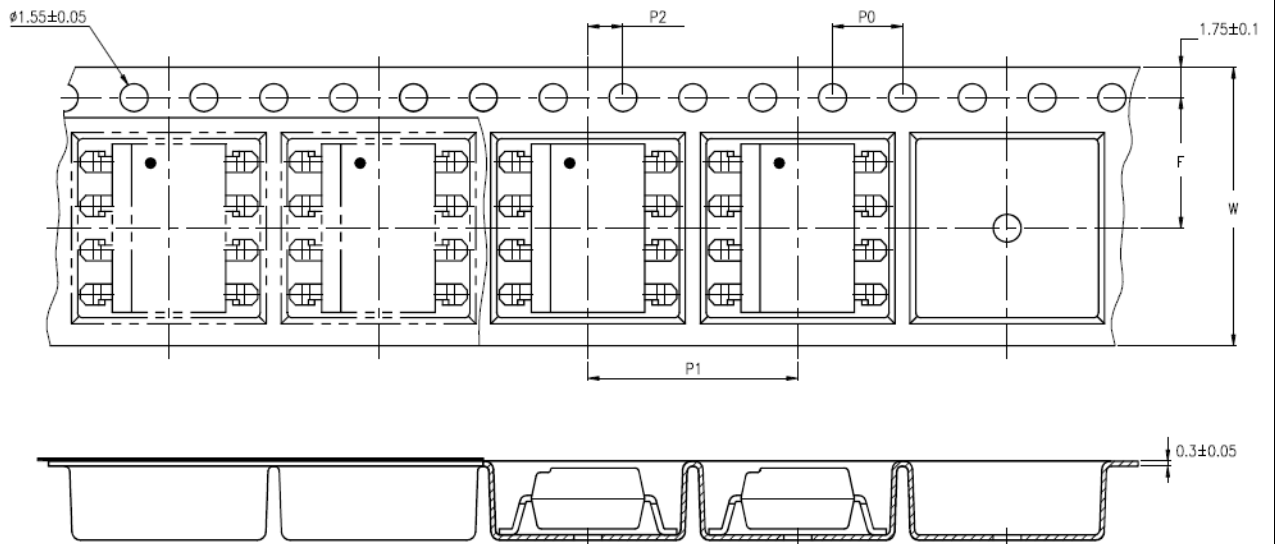
- \*1. Year date code.
- \*2. 2-digit work week.
- \*3. Factory identification mark shall be marked (Z : Taiwan, Y : Thailand).

## TAPING DIMENSIONS

### 6N138S-TA / 6N139S-TA



### 6N138S-TA1 / 6N139S-TA1



Description	Symbol	Dimensions in mm ( inches )
Tape wide	W	$16 \pm 0.3$ ( .63 )
Pitch of sprocket holes	$P_0$	$4 \pm 0.1$ ( .15 )
Distance of compartment	F	$7.5 \pm 0.1$ ( .295 )
Distance of compartment to compartment	$P_2$	$2 \pm 0.1$ ( .079 )
Distance of compartment to compartment	$P_1$	$12 \pm 0.1$ ( .472 )

## ABSOLUTE MAXIMUM RATING

( Ta = 25°C )

PARAMETER		SYMBOL	RATING	UNIT	
INPUT	Forward Current	I <sub>F</sub>	20	mA	
	Reverse Voltage	V <sub>R</sub>	5	V	
	Power Dissipation	P	35	mW	
OUTPUT	Supply Voltage, Output Voltage	6N138	V <sub>CC</sub> , V <sub>O</sub>	-0.5 ~ +7	V
		6N139	V <sub>CC</sub> , V <sub>O</sub>	-0.5 ~ +18	V
	Emitter-base Reverse Withstand Voltage (pin 5 to 7)	V <sub>EBO</sub>	0.5	V	
	Average Output Current	I <sub>O</sub>	60	mA	
	Power Dissipation	P <sub>O</sub>	100	mW	
1	Isolation Voltage	V <sub>iso</sub>	5000	V <sub>rms</sub>	
	Operating Temperature	T <sub>opr</sub>	-40 ~ +85	°C	
	Storage Temperature	T <sub>stg</sub>	-55 ~ +125	°C	
2	Soldering Temperature	T <sub>sol</sub>	260	°C	

**Notes:**

1. AC For 1 Minute, R.H. = 40 ~ 60%

Isolation voltage shall be measured using the following method.

- (1) Short between anode and cathode on the primary side and between collector and emitter on the secondary side.
- (2) The isolation voltage tester with zero-cross circuit shall be used.
- (3) The waveform of applied voltage shall be a sine wave.

2. For 10 Seconds

## ELECTRICAL - OPTICAL CHARACTERISTICS

( T<sub>A</sub> = 25°C, unless otherwise specified )

PARAMETER		SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS	
	Input Forward Voltage	V <sub>F</sub>	—	1.1	1.7	V	Ta=25°C, IF=1.6mA	
	Input Forward Voltage Temperature Coefficient	ΔV <sub>F</sub> / ΔTa	—	-1.9	—	mV/°C	IF=1.6mA	
	Input Reverse Voltage	BV <sub>R</sub>	5.0	—	—	V	Ta=25°C, IR=10 μA	
	Input Capacitance	C <sub>IN</sub>	—	60	—	pF	V <sub>F</sub> =0, f=1MHz	
3 4	Current Transfer Ratio	6N139	CTR	400	2000	—	%	I <sub>F</sub> =0.5mA, V <sub>O</sub> =0.4V, V <sub>CC</sub> =4.5V
		—		500	1600	—		I <sub>F</sub> =1.6mA, V <sub>O</sub> =0.4V, V <sub>CC</sub> =4.5V
		6N138		300	1600	—		
4	Logic Low (0) Output Voltage	6N139	V <sub>OL</sub>	—	0.1	0.4	V	I <sub>F</sub> =0.5mA, I <sub>O</sub> =2mA, V <sub>CC</sub> =4.5V
								I <sub>F</sub> =1.6mA, I <sub>O</sub> =8mA, V <sub>CC</sub> =4.5V
								I <sub>F</sub> =5mA, I <sub>O</sub> =15mA, V <sub>CC</sub> =4.5V
								I <sub>F</sub> =12mA, I <sub>O</sub> =24mA, V <sub>CC</sub> =4.5V
6N138	0.1	I <sub>F</sub> =1.6mA, I <sub>O</sub> =4.8mA, V <sub>CC</sub> =4.5V						
4	Logic High (1) Output Current	6N139	I <sub>OH</sub>	—	0.05	250	μA	I <sub>F</sub> =0, V <sub>CC</sub> =V <sub>O</sub> =18V
		6N138			0.1	100		I <sub>F</sub> =0, V <sub>CC</sub> =V <sub>O</sub> =7V
4	Logic Low (0) Supply Current	I <sub>CCL</sub>	—	0.4	1.5	mA	IF=1.6mA, V <sub>CC</sub> =18V Vo=open	
4	Logic High (1) Supply Current	I <sub>CCH</sub>	—	0.01	10	μA	I <sub>F</sub> =0, V <sub>CC</sub> =18V, Vo= open	

\*\* All typical at T<sub>A</sub> = 25°C

## SWITCHING SPECIFICATIONS (AC)

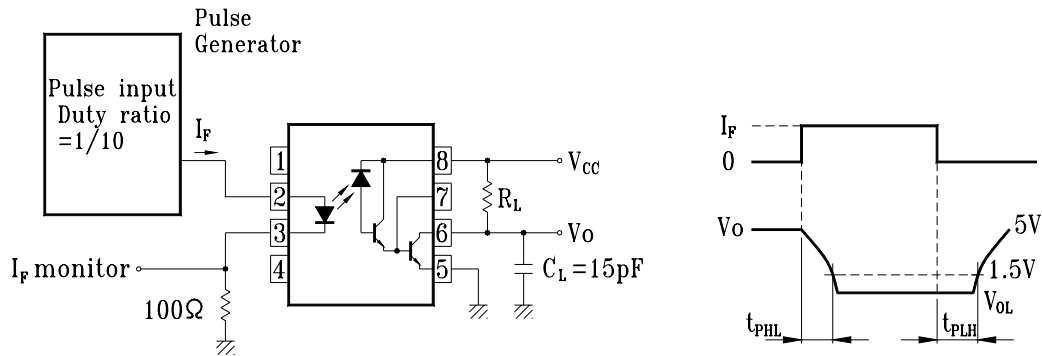
(  $T_A = 0\sim 70^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$ , unless otherwise specified )

PARAMETER	SYM.	MIN.	TYP.	MAX.		UNIT	CONDITIONS
				$T_A=25^\circ\text{C}$			
4 Propagation Delay time to Logic Low Output (1)→(0)	6N139	—	5	25	30	$\mu\text{s}$	$I_F = 0.5\text{mA}$ , $R_L = 4.7\text{k}\Omega$
	6N138	—	0.1	1	2		$I_F = 12\text{mA}$ , $R_L = 270\Omega$
		—	1.6	10	15		$I_F = 1.6\text{mA}$ , $R_L = 2.2\text{k}\Omega$
4 Propagation Delay time to Logic High Output (0)→(1)	6N139	—	18	60	90	$\mu\text{s}$	$I_F = 0.5\text{mA}$ , $R_L = 4.7\text{k}\Omega$
	6N138	—	2	7	10		$I_F = 12\text{mA}$ , $R_L = 270\Omega$
		—	10	35	50		$I_F = 1.6\text{mA}$ , $R_L = 2.2\text{k}\Omega$
5 Instantaneous common mode rejection at high logic output (1)	$ CM_H $	1000	10000	—		$\text{V} / \mu\text{s}$	$I_F=0$ , $ V_{CM}  = 10V_{P-P}$ , $RL=2.2\text{k}\Omega$
5 Instantaneous common mode rejection at low logic output (0)	$ CM_L $	1000	10000	—		$\text{V} / \mu\text{s}$	$I_F=1.6\text{mA}$ $ V_{CM}  = 10V_{P-P}$ , $RL=2.2\text{k}\Omega$

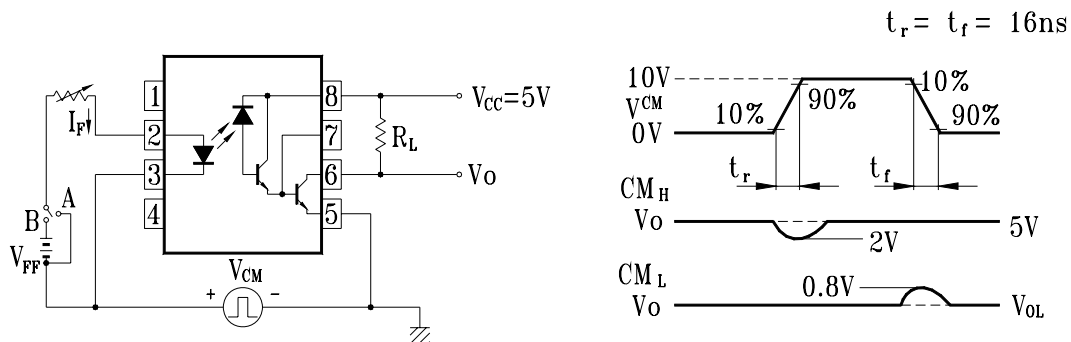
\*\* All typical at  $T_A = 25^\circ\text{C}$

## SWITCHING TEST CIRCUITS (AC)

### Switching Time Test Circuit



### Common Mode Immunity Test Circuit





**ISOLATION CHARACTERISTICS**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
6 Isolation Resistance ( Input-output )	R <sub>I-O</sub>	—	10 <sup>12</sup>	—		T <sub>a</sub> =25°C , RH<45%, V <sub>I-O</sub> =500V DC
6 Capacitance ( Input-output )	C <sub>I-O</sub>	—	0.6	—	pF	f=1MHz

\*\* All typical at T<sub>A</sub> = 25°C

**Notes,**

1. AC For 1 Minute, R.H. = 40 ~ 60%

Isolation voltage shall be measured using the following method.

(1) Short between anode and cathode on the primary side and between collector and emitter on the secondary side.

(2) The isolation voltage tester with zero-cross circuit shall be used.

(3) The waveform of applied voltage shall be a sine wave.

2. For 10 Seconds

3. Current Transfer Ratio (CTR) is defined as the ration of output collector current, I<sub>o</sub>, to the forward LED input current, I<sub>F</sub>, times 100%.

4. Pin 7 open.

5. Instantaneous common mode rejection voltage "output (1)" represents a common mode voltage variation that can hold the output above (1) level (V<sub>o</sub>>2.0V).

Instantaneous common mode rejection voltage "output (0)" represents a common mode voltage variation that can hold the output above (0) level (V<sub>o</sub><0.8V).

6. Device considered a two terminal device. Pins 1, 2, 3 and 4 shorted together and Pins 5, 6, 7 and 8 shorted together.

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