

6N138/6N139 – High Speed Darlington Optocouplers

Aug 2008

FEATURES

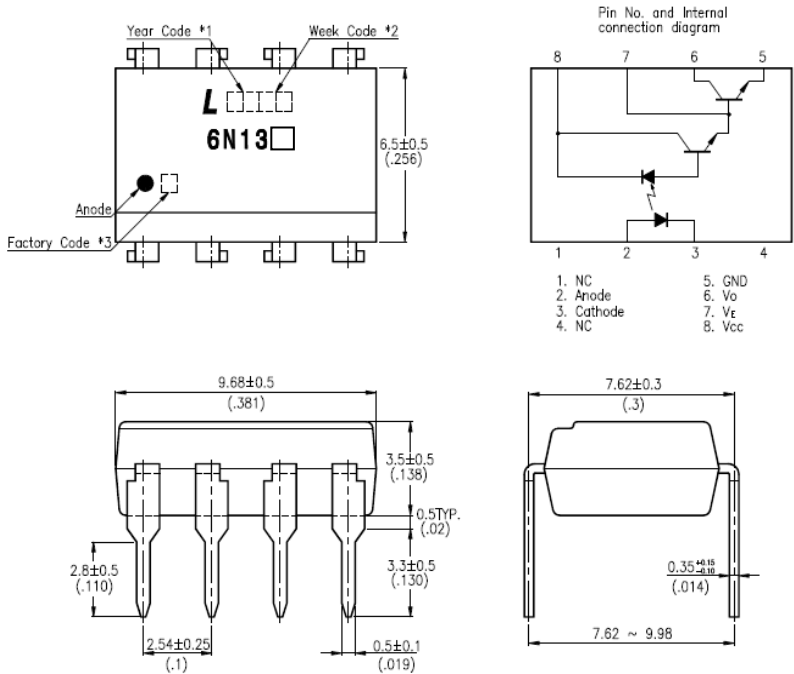
- * High current transfer ratio – 2000% typical
- * Low input current requirements – 0.5mA
- * High output current – 60mA
- * CTR guarantee - 0 ~ 70°C
- * Instantaneous common mode rejection– 10KV/ μ s
- * TTL compatible output – 0.1V V_{OL} typical
- * UL, CSA, IEC/EN/DIN EN60747-5-2 – Pending
- * Dual-in-line 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

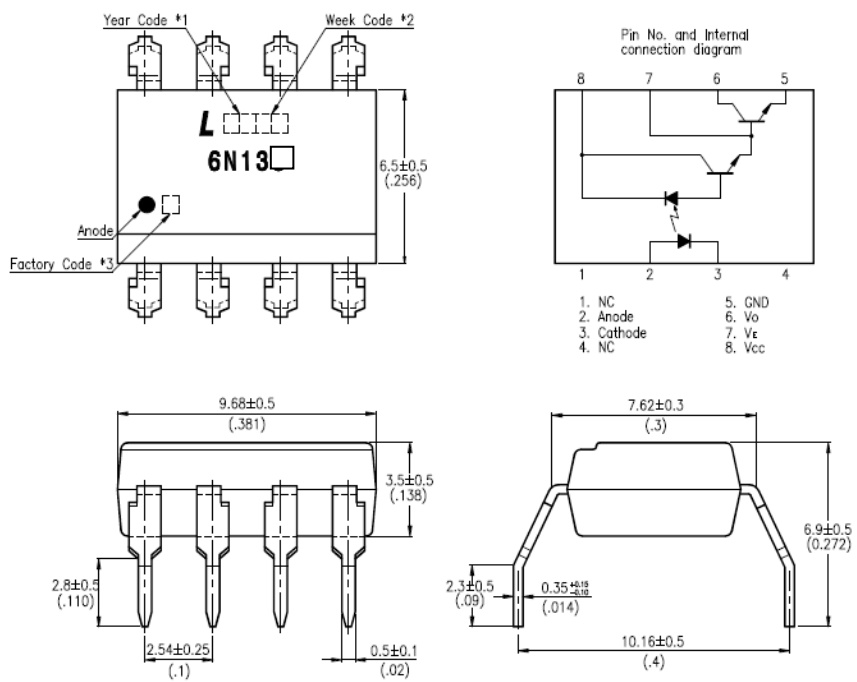
- * Digital logic ground isolation
- * Low input current line receiver
- * Telephone ring detector
- * EIA-RS-232C line receiver
- * Current loop receiver
- * High common mode noise line receiver

OUTLINE DIMENSIONS

6N138 / 6N139



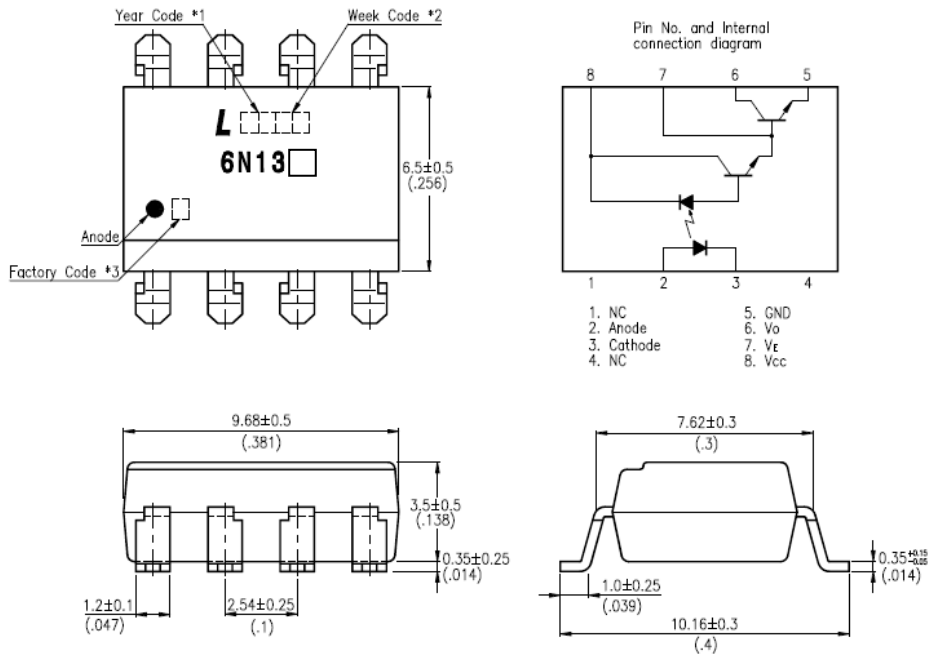
6N138M / 6N139M



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

OUTLINE DIMENSIONS

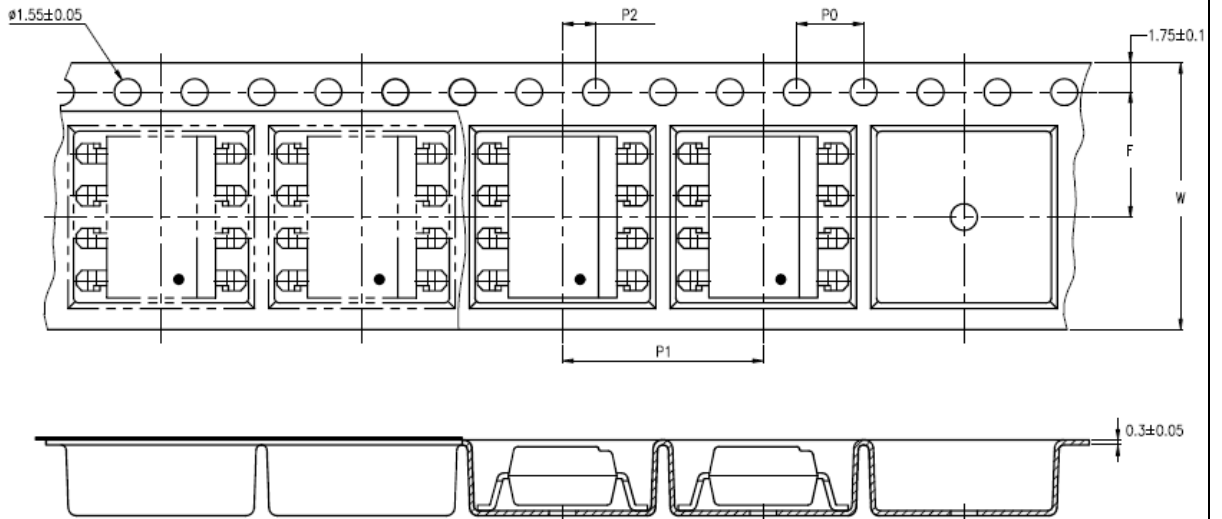
6N138S / 6N139S



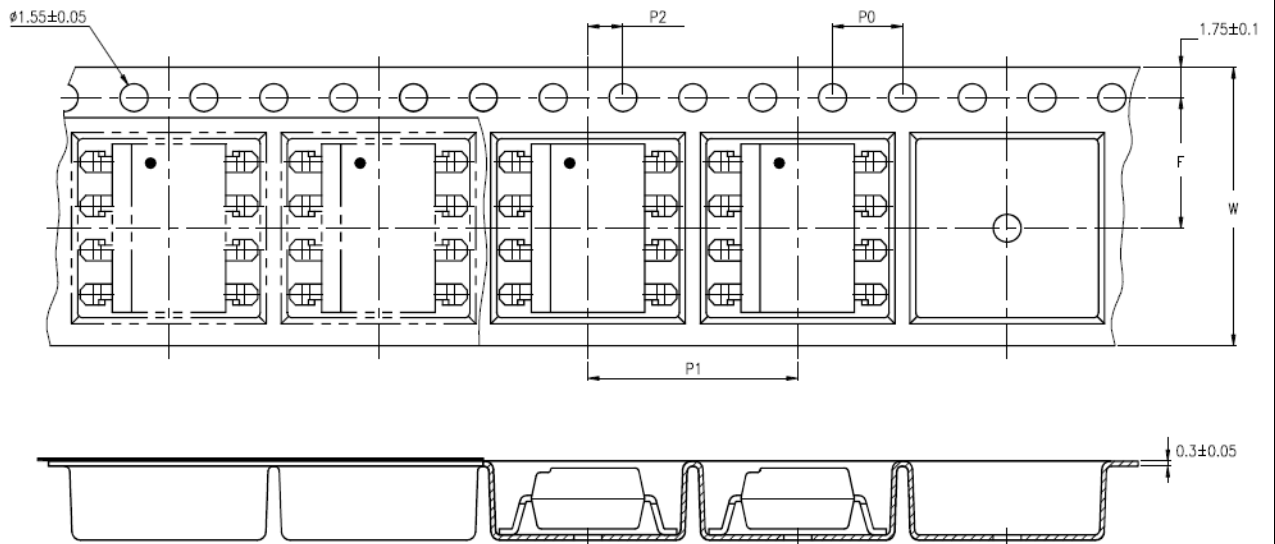
- *1. Year date code.
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TAPING DIMENSIONS

6N138S-TA / 6N139S-TA



6N138S-TA1 / 6N139S-TA1



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

ABSOLUTE MAXIMUM RATING

(Ta = 25°C)

PARAMETER		SYMBOL	RATING	UNIT
INPUT	Forward Current	I _F	20	mA
	Reverse Voltage	V _R	5	V
	Power Dissipation	P	35	mW
OUTPUT	Supply Voltage, Output Voltage	6N138 V _{CC} , V _O	-0.5 ~ +7	V
		6N139 V _{CC} , V _O	-0.5 ~ +18	V
	Emitter-base Reverse Withstand Voltage (pin 5 to 7)	V _{EBO}	0.5	V
	Average Output Current	I _O	60	mA
	Power Dissipation	P _O	100	mW
1	Isolation Voltage	V _{iso}	5000	V _{rms}
	Operating Temperature	T _{opr}	-40 ~ +85	°C
	Storage Temperature	T _{stg}	-55 ~ +125	°C
2	Soldering Temperature	T _{sol}	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_A = 25°C, unless otherwise specified)

PARAMETER		SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS	
	Input Forward Voltage	V _F	—	1.1	1.7	V	Ta=25°C, IF=1.6mA	
	Input Forward Voltage Temperature Coefficient	ΔV _F / ΔTa	—	-1.9	—	mV/°C	IF=1.6mA	
	Input Reverse Voltage	BV _R	5.0	—	—	V	Ta=25°C, IR=10 μA	
	Input Capacitance	C _{IN}	—	60	—	pF	V _F =0, f=1MHz	
3 4	Current Transfer Ratio	6N139 ————— 6N138	CTR	400	2000	—	%	I _F =0.5mA, V _O =0.4V, V _{CC} =4.5V
				500	1600	—		I _F =1.6mA, V _O =0.4V, V _{CC} =4.5V
				300	1600	—		
4	Logic Low (0) Output Voltage	6N139 ————— 6N138	V _{OL}	—	0.1 0.4 0.2 0.1	V	I _F =0.5mA, I _O =2mA , V _{CC} =4.5V	
							I _F =1.6mA, I _O =8mA , V _{CC} =4.5V	
							I _F =5mA, I _O =15mA , V _{CC} =4.5V	
							I _F =12mA, I _O =24mA , V _{CC} =4.5V	
							I _F =1.6mA, I _O =4.8mA , V _{CC} =4.5V	
4	Logic High (1) Output Current	6N139 ————— 6N138	I _{OH}	—	0.05	250	μA	I _F =0, V _{CC} =V _O =18V
					0.1	100		I _F =0, V _{CC} =V _O =7V
4	Logic Low (0) Supply Current	I _{CCL}	—	0.4	1.5	mA	IF=1.6mA, V _{CC} =18V Vo=open	
4	Logic High (1) Supply Current	I _{CCH}	—	0.01	10	μA	I _F =0, V _{CC} =18V, Vo= open	

** All typical at T_A = 25°C

SWITCHING SPECIFICATIONS (AC)

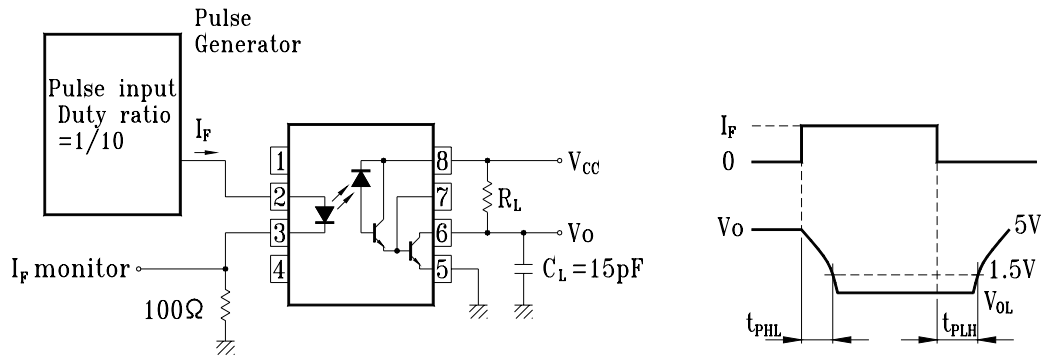
($T_A = 0\sim 70^\circ\text{C}$, $V_{CC} = 5\text{V}$, unless otherwise specified)

PARAMETER	SYM.	MIN.	TYP.	MAX.		UNIT	CONDITIONS					
				$T_A=25^\circ\text{C}$								
4 Propagation Delay time to Logic Low Output (1) \rightarrow (0)	6N139	—	5	25	30	μs	$I_F = 0.5\text{mA}$, $R_L = 4.7\text{k}\Omega$					
							6N138	—	0.1	1	2	$I_F = 12\text{mA}$, $R_L = 270\Omega$
												—
4 Propagation Delay time to Logic High Output (0) \rightarrow (1)	6N139	—	18	60	90	μs	$I_F = 0.5\text{mA}$, $R_L = 4.7\text{k}\Omega$					
							6N138	—	2	7	10	$I_F = 12\text{mA}$, $R_L = 270\Omega$
												—
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}$, $R_L=2.2\text{k}\Omega$					
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}$, $R_L=2.2\text{k}\Omega$					

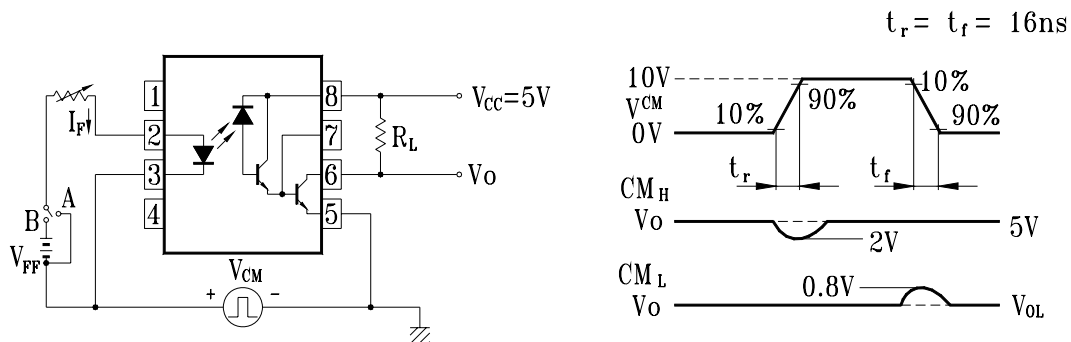
** All typical at $T_A = 25^\circ\text{C}$

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 _{I-O}	—	10 ¹²	—		T _a =25°C , RH<45%, V _{I-O} =500V DC
6 Capacitance (Input-output)	C _{I-O}	—	0.6	—	pF	f=1MHz

** All typical at T_A = 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_o, to the forward LED input current, I_F, 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_o>2.0V).
Instantaneous common mode rejection voltage "output (0)" represents a common mode voltage variation that can hold the output above (0) level (V_o<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.

Notes:

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- Do not immerse unit's body in solder paste.