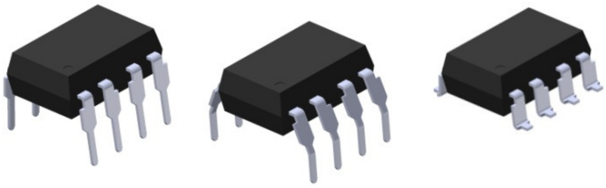
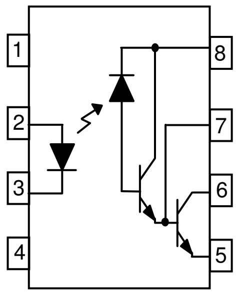
DATASHEET

8 PIN DIP LOW INPUT CURRENT HIGH GAIN SPLIT DARLINGTON PHOTOCOUPLER
6N138 6N139



Schematic



Features

- High current transfer ratio–2000% typical
- High isolation voltage between input and output (Viso=5000 Vrms)
- Guaranteed performance from 0℃ to 70℃
- Pb free and RoHS compliant.
- UL approved (No. 214129)
- VDE approved (No. 132249)
- SEMKO approved
- NEMKO approved
- DEMKO approved
- FIMKO approved
- CSA approved (No. 2037145)

Pin Configuration

1. No Connection
2. Anode
3. Cathode
4. No Connection
5. Gnd
6. Vout
7. V_B
8. Vcc

Description

The 6N138 and 6N139 devices each consists of an infrared emitting diode, optically coupled to a high gain split Darlington photo detector. They provide extremely high current transfer ratio between input and output, with access to a base terminal to adjust the gain bandwidth.These devices are packaged in an 8-pin DIP package and available in wide-lead spacing and SMD options.

Applications

- Digital logic ground isolation
- RS-232C line receiver
- Low input current line receiver
- Microprocessor bus isolation
- Current loop receiver

Absolute Maximum Ratings (Ta=25℃)

	Parameter		Symbol	Rating	Unit
Input	Forward current		I_F	20	mA
	Peak forward current (50% duty, 1ms P.W)		I_{FP}	40	mA
	Peak transient current (≤1μs P.W,300pps)		I_{Ftrans}	1	A
	Reverse voltage		V_R	5	V
	Power dissipation		P_{IN}	45	mW
Output	Power dissipation		P_O	100	mW
	Output current		IO	60	mA
	Emitter-Base Reverse Voltage		VER	0.5	V
	Output voltage	6N138 6N139	V_O	-0.5 to 7 -0.5 to 18	V
	Supply voltage	6N138 6N139	V_{CC}	-0.5 to 7 -0.5 to 18	V
Isolation voltage *1			V_{ISO}	5000	V rms
Operating temperature			T_{OPR}	-40 ~ +85	℃
Storage Temperature			T_{STG}	-55 ~ +125	℃
Soldering temperature *2			T_{SOL}	260	℃

Notes:
*1 AC for 1 minute, R.H.= 40 ~ 60% R.H. In this test, pins 1, 2, 3, 4 are shorted together, and pins 5, 6, 7, 8 are shorted together.

*2 For 10 seconds

Electrical Characteristics (T_A=0 to 70℃ unless specified otherwise)

Input

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	V_F	-	1.3	1.7	V	I_F = 1.6mA
Reverse Voltage	V_R	5.0	-	-	V	I_R = 10μA, T_A=25℃
Temperature coefficient of forward voltage	$\Delta V_F/\Delta T_A$	-	-1.8	-	mV/℃	I_F =1.6mA

Output

Parameter		Symbol	Min	Typ.	Max.	Unit	Condition
Logic High Output Current	6N138	I_{OH}	-	0.01	100	μA	I_F=0mA, V_O=V_{CC}=18V
	6N139		-	-	250		
Logic Low Supply Current	6N138 6N139	I_{CCL}	-	0.6	1.5	mA	I_F=1.6mA, V_O=Open, V_{CC}=18V
Logic High Supply Current	6N138 6N139	I_{CCH}	-	0.05	10	μA	I_F=0mA, V_O=Open, V_{CC}=18V

Transfer Characteristics (T_a=0 to 70℃ unless specified otherwise, Vcc=4.5V)

Parameter		Symbol	Min	Typ.	Max.	Unit	Condition
Current Transfer Ratio	6N139	CTR	400	2500	-	%	I_F = 0.5mA, V_O = 0.4V, V_{CC}=4.5V
			500	2000	-		I_F = 1.6mA, V_O = 0.4V, V_{CC}=4.5V
	6N138		300	2000	-		
Logic Low Output Voltage	6N139	V_{OL}	-	0.05	0.4	V	I_F = 0.5mA, I_O = 2mA, V_{CC}=4.5V
			-	0.09	0.4		I_F = 1.6mA, I_O = 8mA, V_{CC}=4.5V
			-	0.12	0.4		I_F = 5mA, I_O = 15mA, V_{CC}=4.5V
			-	0.17	0.4		I_F = 12mA, I_O = 24mA, V_{CC}=4.5V
	6N138		-	0.06	0.4		I_F = 1.6mA, I_O = 4.8mA, V_{CC}=4.5V

Switching Characteristics (T$_a$=0 to 70℃ unless specified otherwise, Vcc=5V)

Parameter		Symbol	Min	Typ.	Max.	Unit	Condition
Propagation Delay Time to Logic Low (Fig. 13)	6N139	TPHL	-	5	25	µs	I_F = 0.5mA , R_L=4.7kΩ, T_A=25℃
			-	-	30		I_F = 0.5mA , R_L=4.7kΩ
			-	0.2	1		I_F = 12mA , R_L=270Ω, T_A=25℃
			-	-	2		I_F = 12mA , R_L=270Ω
	6N138		-	1.4	10		I_F = 1.6mA , R_L=2.2kΩ, T_A=25℃
			-	-	15		I_F = 1.6mA , R_L=2.2kΩ
Propagation Delay Time to Logic High (Fig. 13)	6N139	TPLH	-	16	60	µs	I_F = 0.5mA , R_L=4.7kΩ, T_A=25℃
			-	-	90		I_F = 0.5mA , R_L=4.7kΩ
			-	1.7	7		I_F = 12mA , R_L=270Ω, T_A=25℃
			-	-	10		I_F = 12mA , R_L=270Ω
	6N138		-	8	35		I_F = 1.6mA , R_L=2.2kΩ, T_A=25℃
			-	-	50		I_F = 1.6mA , R_L=2.2kΩ
Common Mode Transient Immunity at Logic High (Fig. 14) *3		CM_H	1,000	-	-	V/µs	I_F = 0mA , V_{CM}=10Vp-p, R_L=2.2KΩ, T_A=25℃
Common Mode Transient Immunity at Logic Low (Fig. 14) *3		CM_L	1,000	-	-	V/µs	I_F = 1.6mA , V_{CM}=10Vp-p, R_L=2.2KΩ, T_A=25℃

* Typical values at T_a = 25℃

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Typical Electro-Optical Characteristics Curves

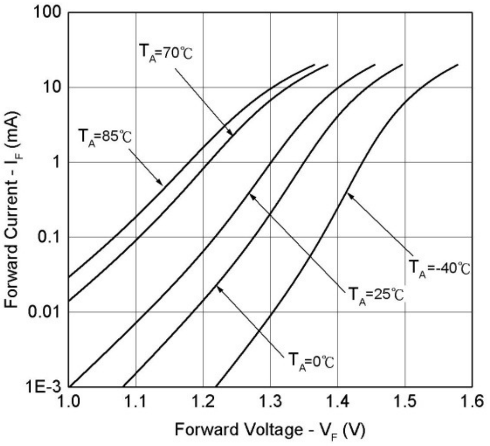


Fig.1 LED Forward Current vs. Forward Voltage

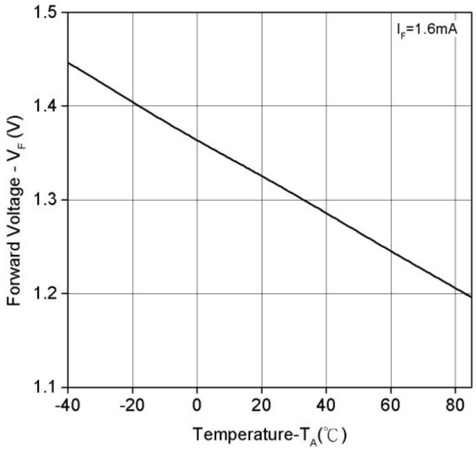


Fig.2 LED Forward Voltage vs. Temperature

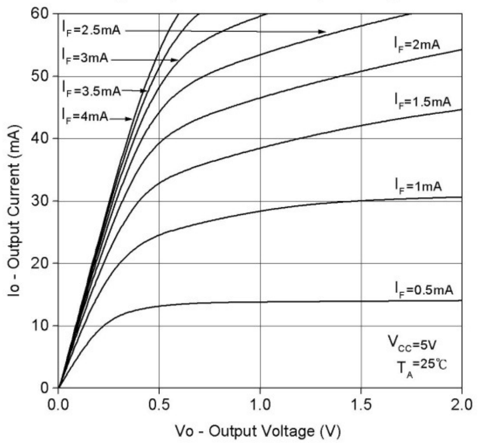


Fig.3 Output Current vs. Output Voltage

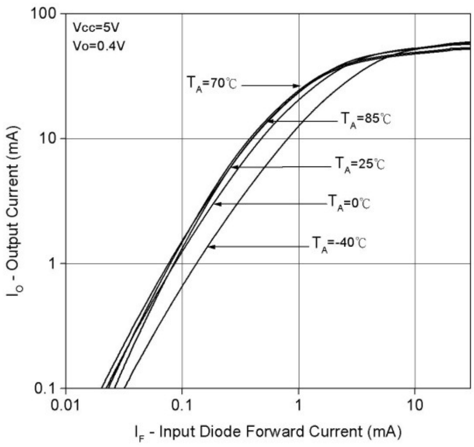


Fig.4 Output Current vs. Input Diode Forward Current

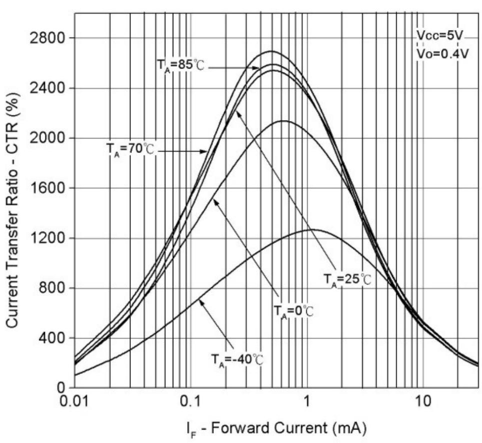


Fig.5 Current Transfer Ratio vs. Forward Current

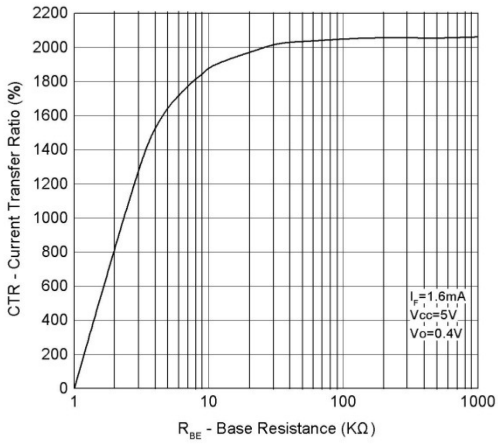


Fig.6 Current Transfer Ratio vs. Base-Emitter Resistance

Fig.7 Non-saturated Rise nand Fall Times
vs. Load Resistance

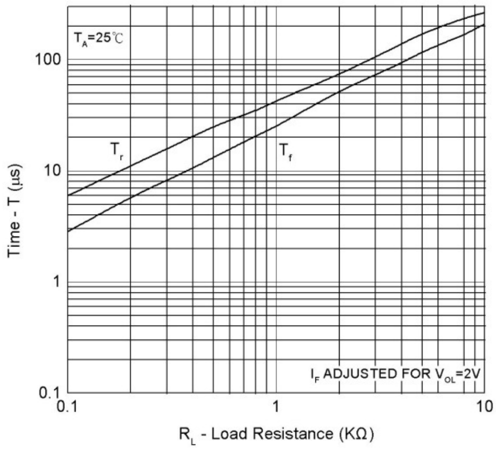


Fig.8 Propagation Delay To Logic Low
vs. Base-Emitter Resistance

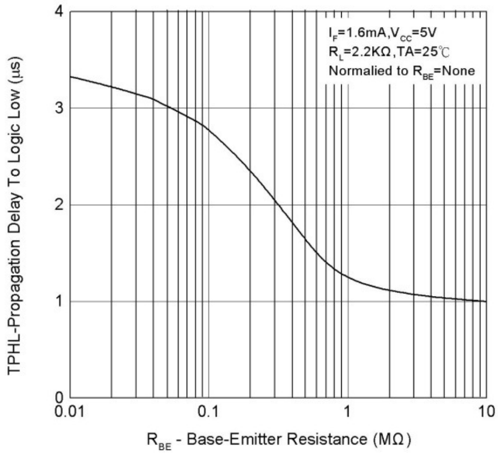


Fig.9 Propagation Delay vs. Input Diode Forward Current

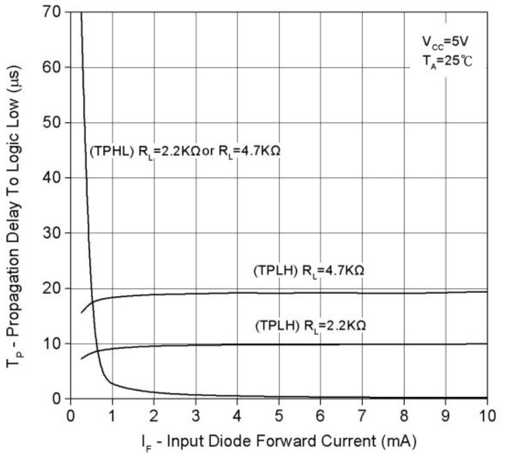


Fig.10 Propagation Delay to Logic Low vs. Pulse Period

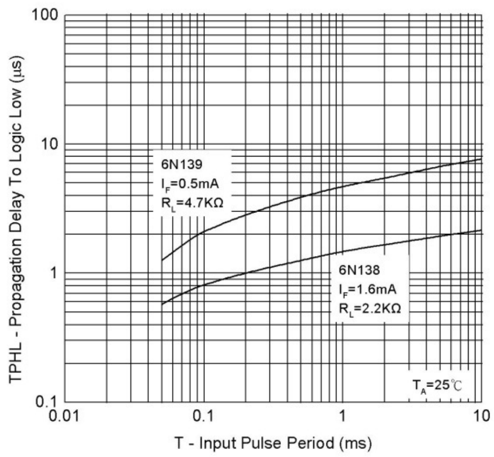


Fig.11 Propagation Delay vs. Temperature

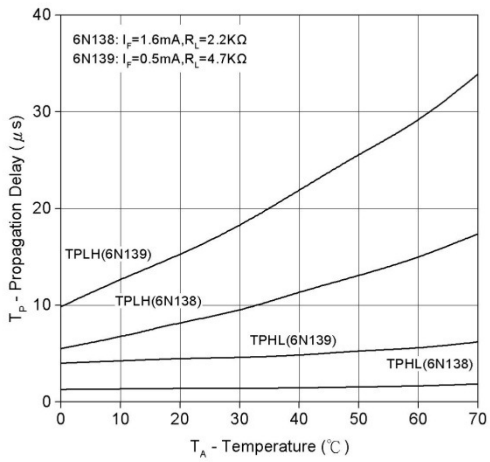


Fig.12 Logic Low Supply Current vs. Input Diode Forward Current

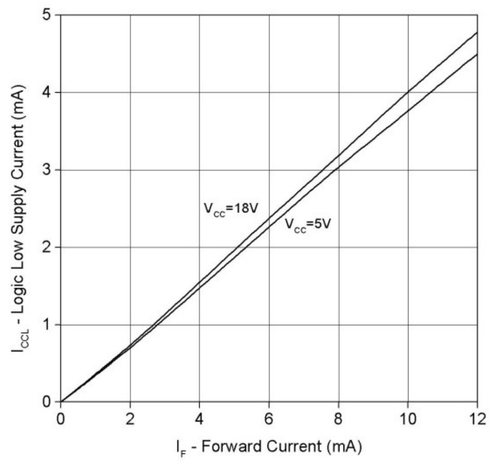


Fig. 13 Switching Time Test Circuit and Waveform

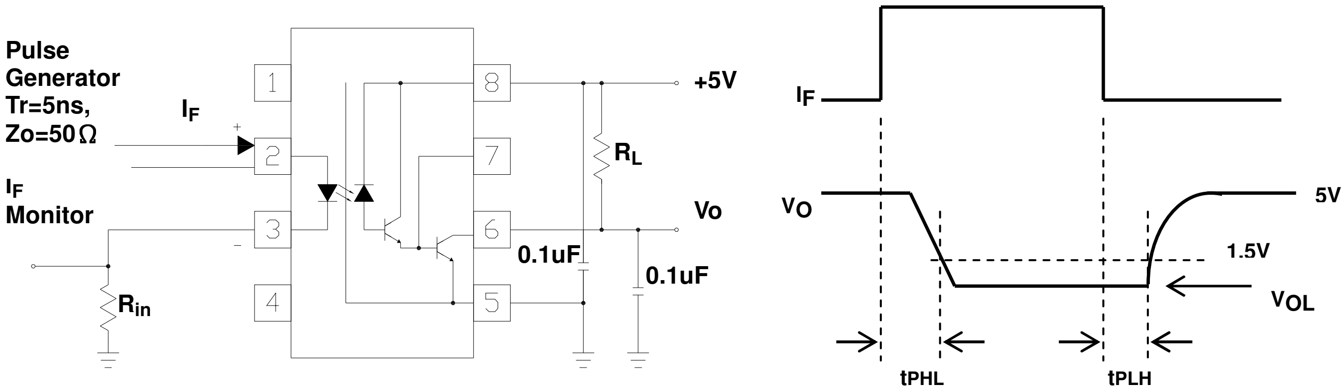
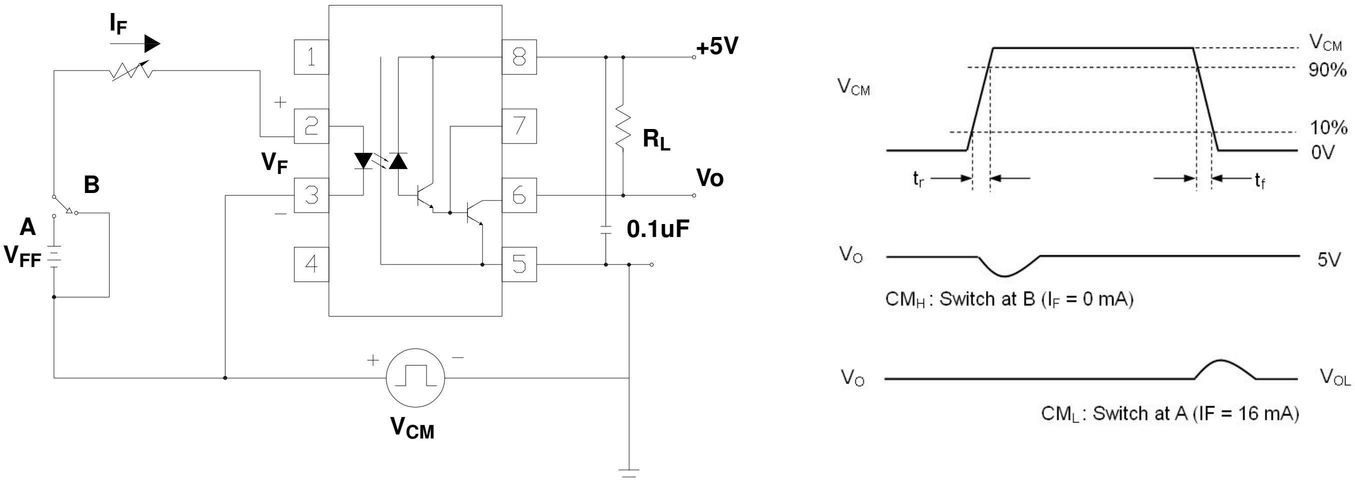


Fig. 14 Common Mode Transient Immunity Test Circuit and Waveform



Note:

*3 Common mode transient immunity in logic high level is the maximum tolerable (positive) dVcm/dt on the leading edge of the common mode pulse signal VCM, to assure that the output will remain in a logic high state (i.e., VO > 2.0V).

Common mode transient immunity in logic low level is the maximum tolerable (negative) dVcm/dt on the trailing edge of the common mode pulse signal, VCM, to assure that the output will remain in a logic low state (i.e., VO < 0.8V).

Order Information

Part Number

6N13XY(Z)-V

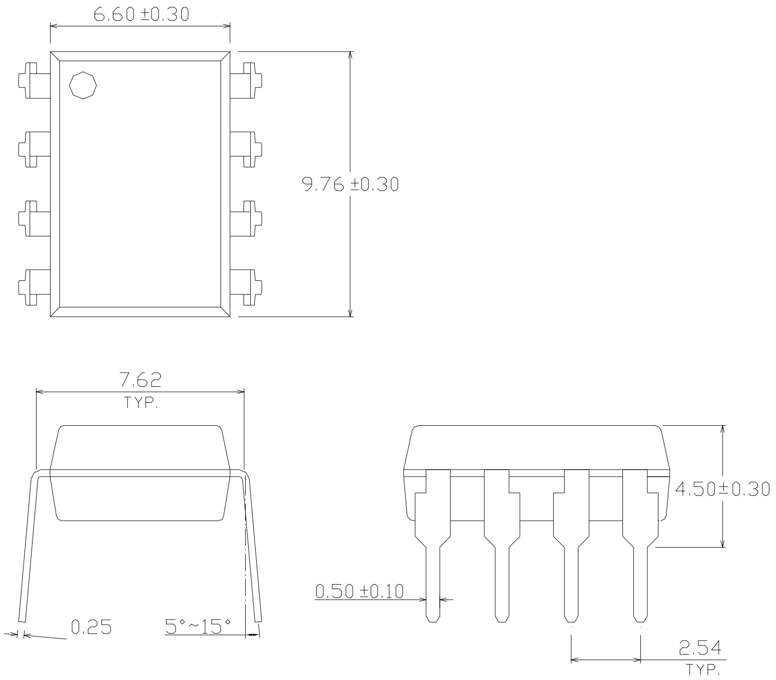
Note

X = Part No. (X = 8 or 9)
Y = Lead form option (S, S1, M or none)
Z = Tape and reel option (TA, TB or none).
V = VDE (optional)

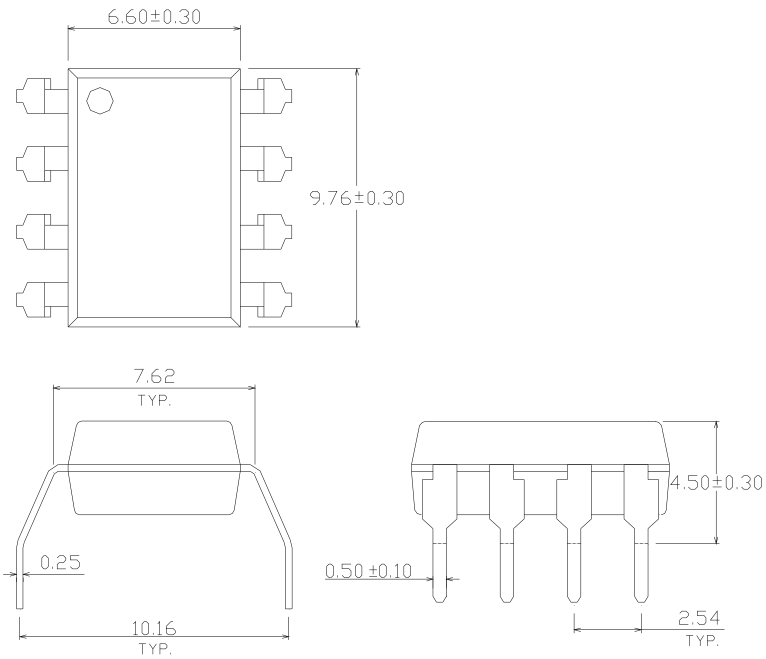
Option	Description	Packing quantity
None	Standard DIP-8	45 units per tube
M	Wide lead bend (0.4 inch spacing)	45 units per tube
S (TA)	Surface mount lead form + TA tape & reel option	1000 units per reel
S (TB)	Surface mount lead form + TB tape & reel option	1000 units per reel
S1 (TA)	Surface mount lead form (low profile) + TA tape & reel option	1000 units per reel
S1 (TB)	Surface mount lead form (low profile) + TB tape & reel option	1000 units per reel

Package Dimension
(Dimensions in mm)

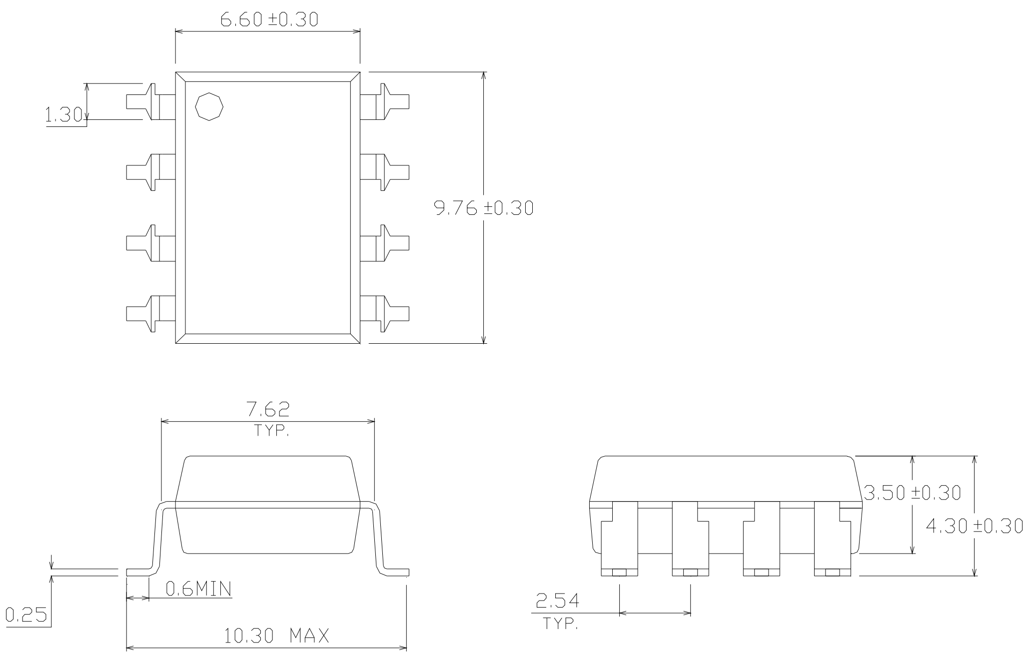
Standard DIP Type



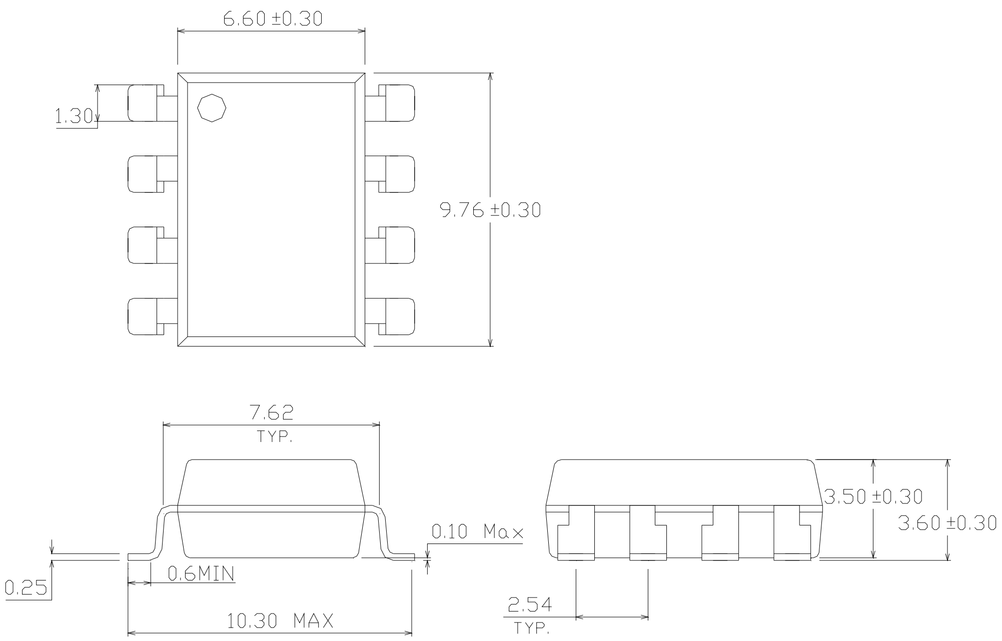
Option M Type



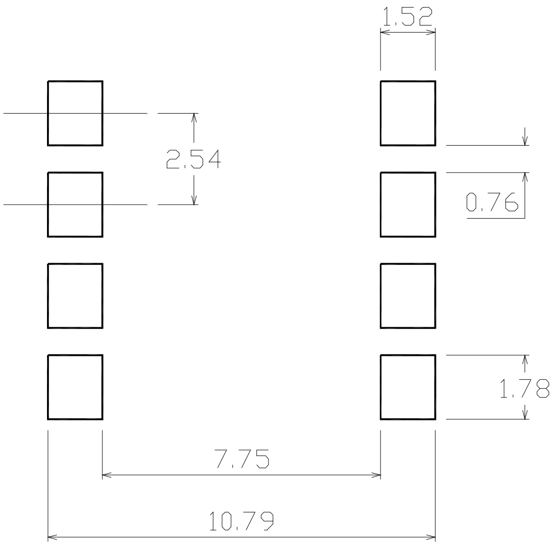
Option S Type



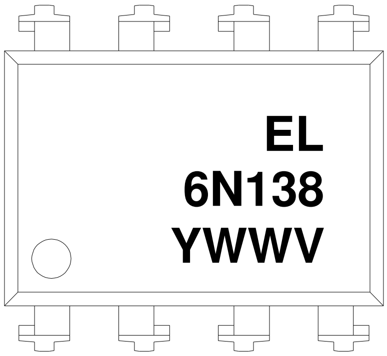
Option S1 Type



Recommended pad layout for surface mount leadform



Device Marking

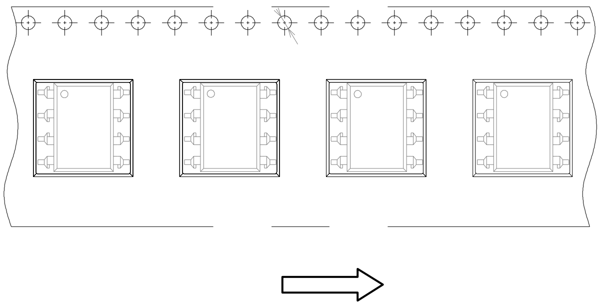


Notes

EL	denotes EVERLIGHT
6N138	denotes Device Number
Y	denotes 1 digit Year code
WW	denotes 2 digit Week code
V	denotes VDE (Optional)

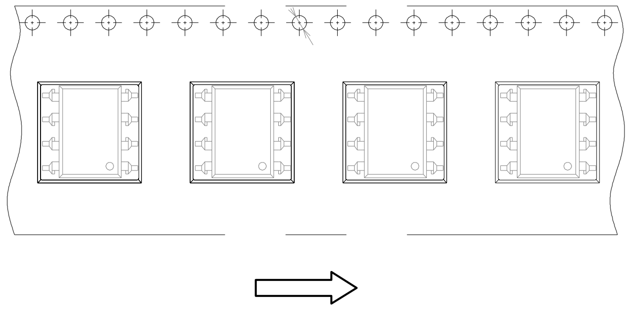
Tape & Reel Packing Specifications

Option TA



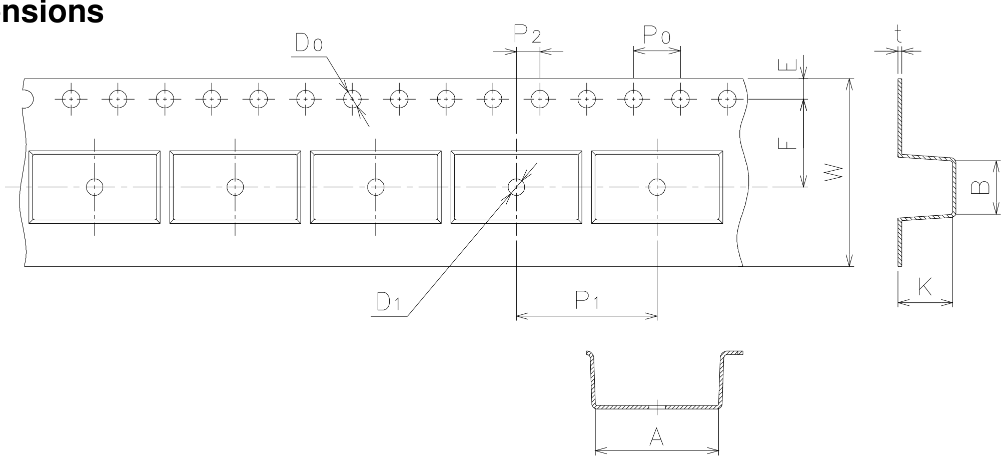
Direction of feed from reel

Option TB



Direction of feed from reel

Tape dimensions

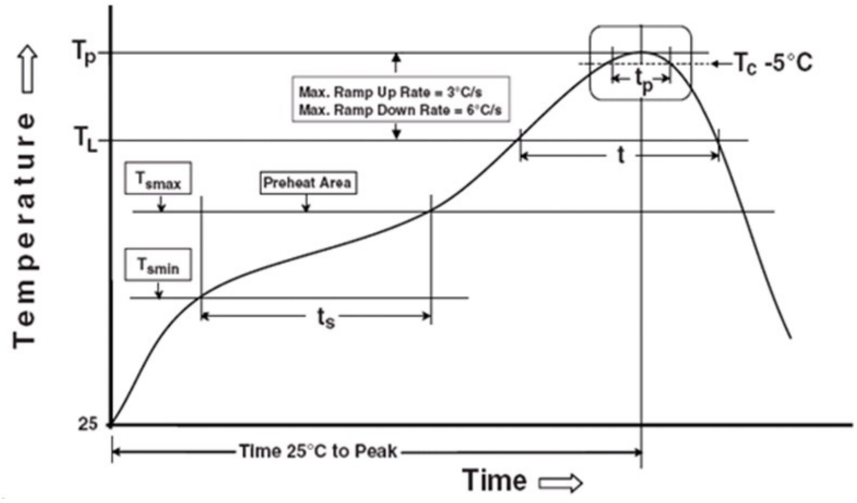


Dimension No.	**A**	**B**	**Do**	**D1**	**E**	**F**
Dimension(mm)	10.4±0.1	10.0±0.1	1.5+0.1/-0	1.5±0.25/-0	1.75±0.1	7.5±0.1
Dimension No.	**Po**	**P1**	**P2**	**t**	**W**	**K**
Dimension(mm)	4.0±0.1	12.0±0.1	2.0±0.05	0.4±0.05	16.0±0.3/	4.5±0.1

Precautions for Use

1. Soldering Condition

1.1 (A) Maximum Body Case Temperature Profile for evaluation of Reflow Profile



Note: Reference: IPC/JEDEC J-STD-020D

Preheat	
Temperature min (T_{smin})	150 ℃
Temperature max (T_{smax})	200℃
Time (T_{smin} to T_{smax}) (t_s)	60-120 seconds
Average ramp-up rate (T_{smax} to T_p)	3 ℃/second max
Other	
Liquidus Temperature (T_L)	217 ℃
Time above Liquidus Temperature (t_L)	60-100 sec
Peak Temperature (T_P)	260℃
Time within 5 ℃ of Actual Peak Temperature: T_P - 5℃	30 s
Ramp- Down Rate from Peak Temperature	6℃ /second max.
Time 25℃ to peak temperature	8 minutes max.
Reflow times	3 times

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