Features

- High isolation 5000 V_{RMS}
- DC input with transistor output
- Operating temperature range - 40°C to 100 °C
- REACH compliance
- Halogen free (Optional)
- MSL class 1
- Regulatory Approvals
  - UL - UL1577
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC - GB4943.1

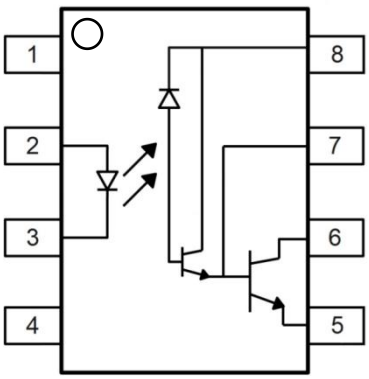
Applications

- Low current line receivers
- Current loop receivers
- Out interface to CMOS-LSTTL-TTL
- Pulse transformer replacement
- Computer-peripheral interface

Description

The 6N138 and 6N139 series combine an AlGaAs infrared emitting diode as the emitter which is optically coupled to a silicon high speed photo darlington transistor in a plastic DIP8 package with different lead forming options.

A separate design between photodiode and darlington transistor reduces the base-collector capacitance of the input transistor which improves the speed by several orders of magnitude over conventional phototransistor optocouplers.



Truth Table

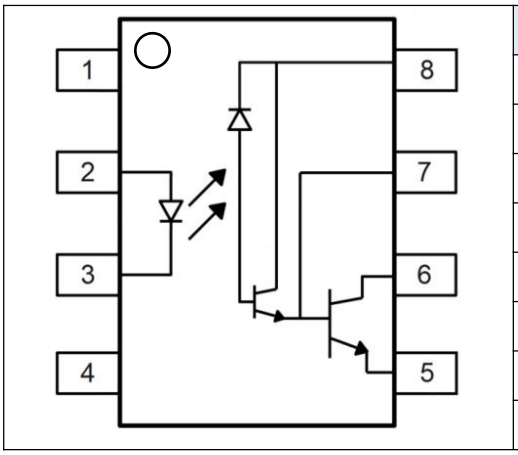
LED	Vo
ON	L
OFF	H

ORDERING INFORMATION

Outline	Part Number	Package	Marking	Packing	Packing Size	Quantity
	6N138-000E 6N139-000E	DIP8	6N13X /YYWW A	Tube	500mm	40
	6N138-100E 6N139-100E	DIP8-M		Tube	500mm	40
	6N138-500E 6N139-500E	DIP8-SL		Reel	13 "	1000

CONTENTS

PIN CONFIGURATION AND FUNCTIONS



Pin	Name
1	NC
2	Anode
3	Cathode
4	NC
5	GND
6	V_O
7	V_B
8	V_{CC}

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit	Note
INPUT				
Forward Current	I_F	25	mA	
Peak Forward Current	I_{FP}	50	mA	1
Peak Transient Current	$I_{F(trans)}$	1	A	2
Reverse Voltage	V_R	5	V	
Input Power Dissipation	P_I	100	mW	
OUTPUT				
Supply Voltage	V_{CC}	-0.5~18	V	
Output Voltage	V_O	-0.5~18	V	
Output Current	I_O	60	mA	
Emitter-Base Reverse Voltage	V_{EBR}	0.5	V	
Output Power Dissipation	P_O	100	mW	
COMMON				
Total Power Dissipation	P_{tot}	200	mW	
Isolation Voltage	V_{iso}	5000	Vrms	3
Operating Temperature	T_{opr}	-40~100	°C	
Storage Temperature	T_{stg}	-55~125	°C	
Soldering Temperature	T_{sol}	260	°C	4

Note 1. 50% duty, 1ms P.W
Note 2. ≤1μs P.W,300pps
Note 3. AC For 1 Minute, R.H. = 40 ~ 60%
Note 4. For 10 seconds

ELECTRICAL OPTICAL CHARACTERISTICS

Parameter		Symbol	Min	Typ	Max	Unit	Test Condition	Note
INPUT(T_a=0 to 70°C , unless specified otherwise)								
Forward Voltage		V_F	-	1.28	1.7	V	I_F=1.6mA	
Reverse Current		I_R	-	-	10	μA	V_R=5V	
Input Capacitance		C_{in}	-	60	-	pF	V=0, f=1MHz	
OUTPUT(T_a=0 to 70°C , unless specified otherwise)								
High Level Supply Current		I_{CCH}	-	0.05	10	μA	I_F=0mA, V_O=Open, V_{CC}=18V	
Low Level Supply Current		I_{CCL}	-	0.6	1.5	mA	I_F=1.6mA, V_O=Open, V_{CC}=18V	
Logic High Output Current	6N138	I_{OH}	-	0.01	100	μA	I_F=0mA, V_O=V_{CC}=18V,	
	6N139		-	-	250	μA		
TRANSFER CHARACTERISTICS(at Ta=0 to 70°C , unless specified otherwise)								
Current Transfer Ratio	6N139	CTR	400	2500	-	%	I_F = 0.5mA ,V_O = 0.4V, V_{CC}=4.5V	
			500	2600	-		I_F = 1.6mA ,V_O = 0.4V, V_{CC}=4.5V	
	6N138		300	2600	-			
Logic Low Output Voltage	6N139	V_{OL}	-	0.04	0.4	V	I_F = 0.5mA ,I_O = 2mA, V_{CC}=4.5V	
			-	0.07	0.4		I_F = 1.6mA ,I_O = 8mA, V_{CC}=4.5V	
			-	0.11	0.4		I_F = 5mA ,I_O = 15mA, V_{CC}=4.5V	
			-	0.15	0.4		I_F = 12mA ,I_O = 24mA, V_{CC}=4.5V	
	6N138		-	0.05	0.4		I_F = 1.6mA ,I_O = 4.8mA, V_{CC}=4.5V	
Isolation Resistance		R_{iso}	10^12	10^14	-	Ω	DC500V, 40 ~ 60% R.H.	
Floating Capacitance		C_{iO}	-	0.3	1	pF	V=0, f=1MHz	

ELECTRICAL OPTICAL CHARACTERISTICS

Parameter		Symbol	Min	Typ	Max	Unit	Test Condition	Note
SWITCHING CHARACTERISTICS(T_a=0 to 70°C,V_{CC}=5V, unless specified otherwise)								
Propagation Delay Time to Logic Low	6N139	t_{PHL}	-	5	25	μs	I_F=0.5mA,R_L=4.7kΩ, T_a=25°C	Fig.13
			-	-	30		I_F=0.5mA,R_L=4.7kΩ	
			-	0.2	1		I_F=12mA,R_L=270Ω, T_a=25°C	
			-	-	2		I_F=12mA,R_L=270Ω	
	6N138		-	1.4	10		I_F=1.6mA,R_L=2.2kΩ, T_a=25°C	
			-	-	15		I_F=1.6mA,R_L=2.2kΩ	
Propagation Delay Time to Logic High	6N139	t_{PLH}	-	22	60	μs	I_F=0.5mA,R_L=4.7kΩ, T_a=25°C	Fig.13
			-	-	90		I_F=0.5mA,R_L=4.7kΩ	
			-	2.1	7		I_F=12mA,R_L=270Ω, T_a=25°C	
			-	-	10		I_F=12mA,R_L=270Ω	
	6N138		-	10.7	35		I_F=1.6mA,R_L=2.2kΩ, T_a=25°C	
			-	-	50		I_F=1.6mA,R_L=2.2kΩ	
Common Mode Transient Immunity at Logic High	6N139	CM_H	1000	-	-	V/μs	I_F = 0mA , V_{CM}=10Vpp, R_L=2.2kΩ, T_a=25°C	Fig.15
	6N138		1000	-	-			
Common Mode Transient Immunity at Logic Low	6N139	CM_L	1000	-	-	V/μs	I_F=1.6mA , V_{CM}=10Vpp, R_L=2.2kΩ, T_a=25°C	Fig.15
	6N138		1000	-	-			

CHARACTERISTIC CURVES

Fig.1 Forward Current vs. Forward Voltage

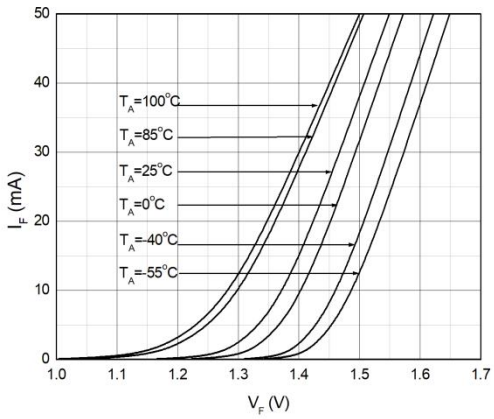


Fig.2 Current Transfer Ratio vs. Forward Current

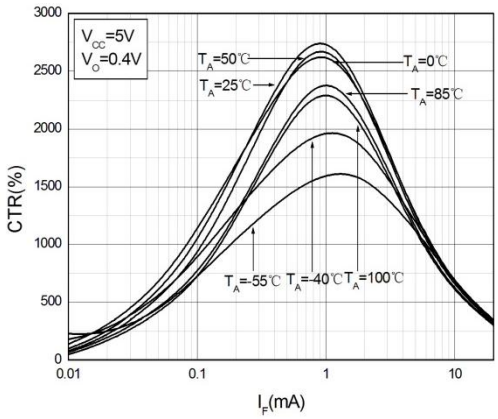


Fig.3 Normalized Current Transfer Ratio vs. Ambient Temperature

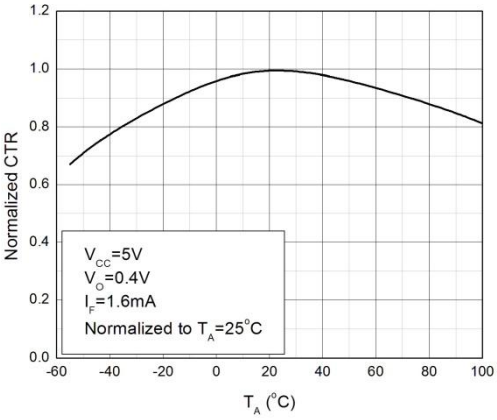


Fig.4 Current Transfer Ratio vs. Base-Emitter Resistance

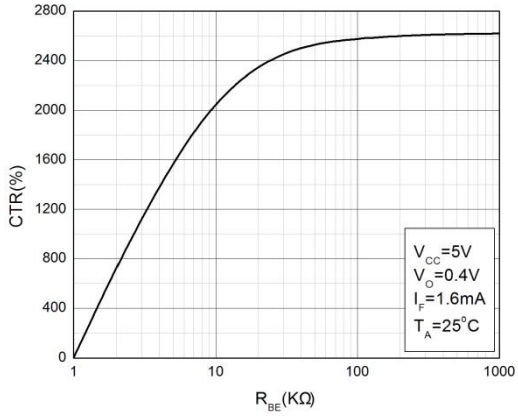


Fig.5 Low Level Output Current vs. Output Voltage

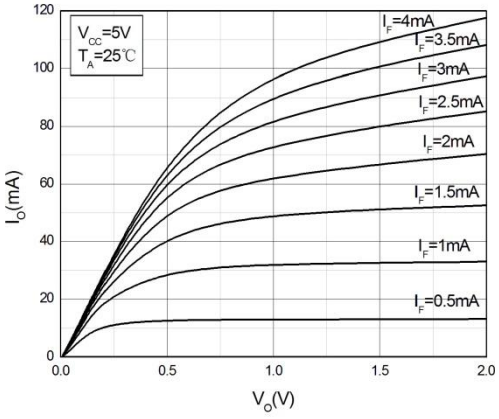


Fig.6 Low Level Output Current vs. Forward Current

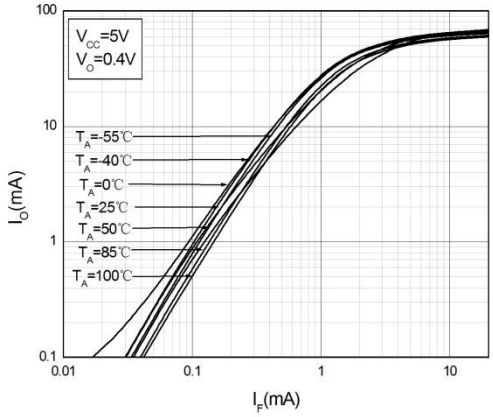


Fig.7 High Level Output Current vs. Ambient Temperature

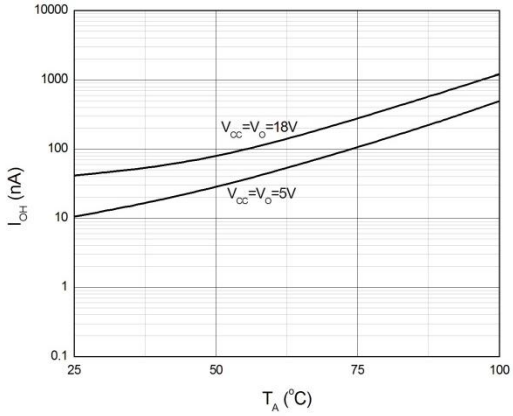


Fig.8 Propagation Delay vs. Pulse Width

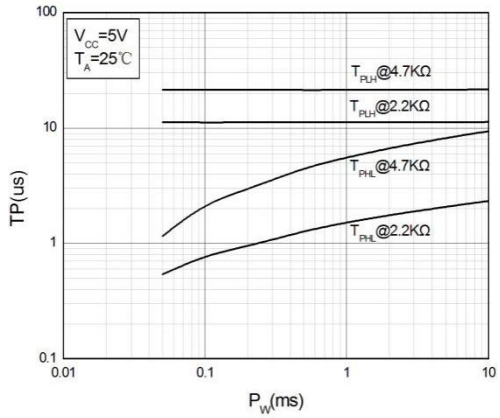


Fig.9 Rise and Fall Time vs. Load Resistance

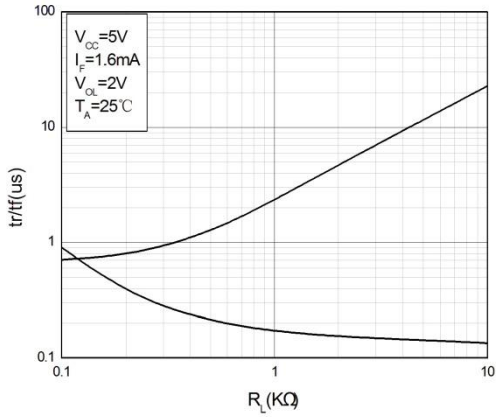


Fig.10 Propagation Delay vs. Ambient Temperature

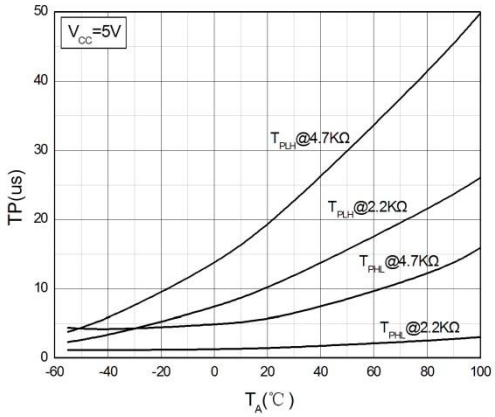


Fig.11 Propagation Delay vs. Forward Current

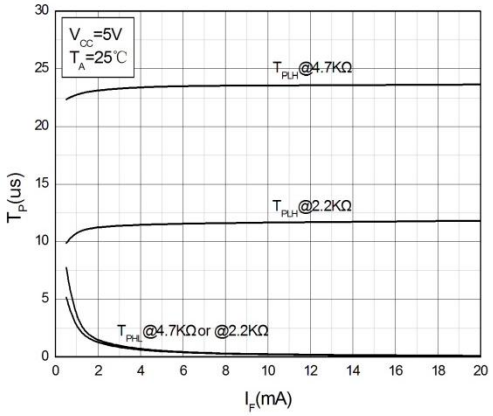
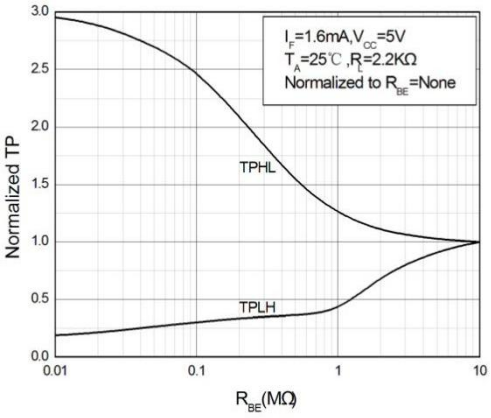


Fig.12 Propagation Delay vs. Base-Emitter Resistance



TEST CIRCUITS

Fig.13 Test Circuits for t_{PHL}, t_{PLH}, t_r, t_f

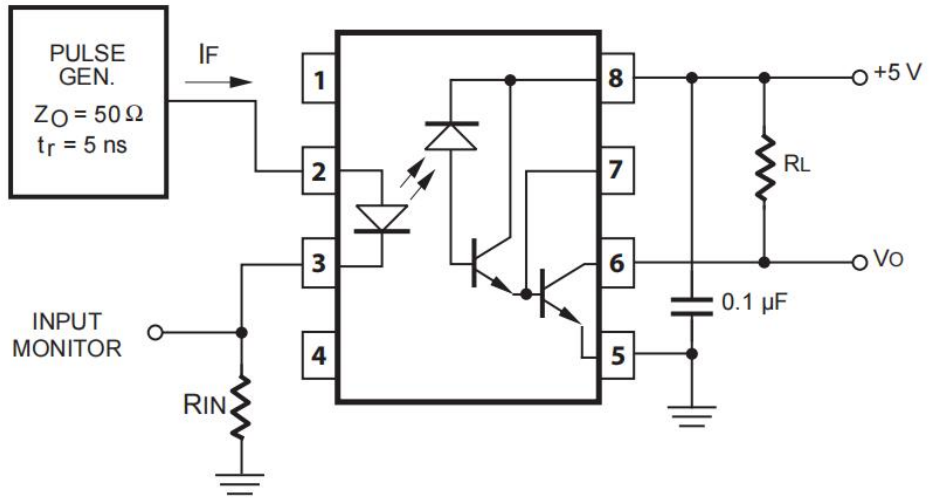
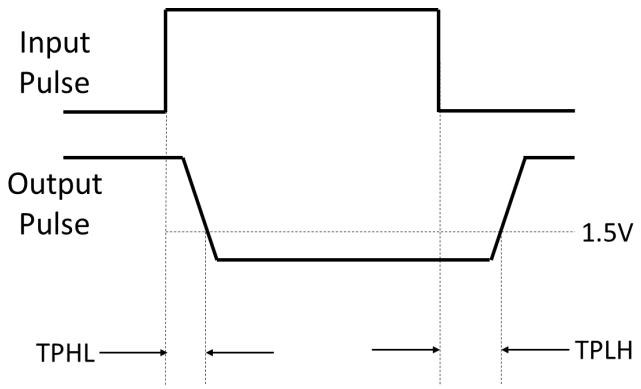
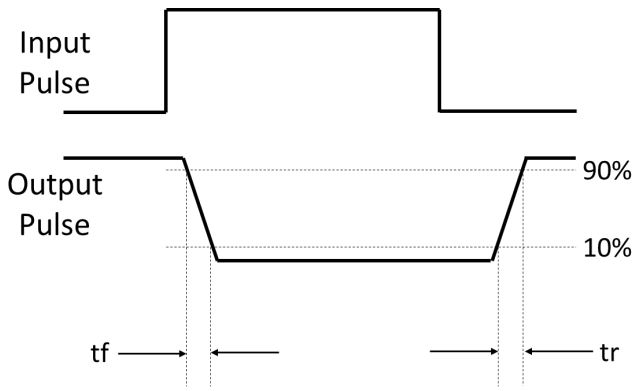


Fig.14 Waveforms of t_{PHL}, t_{PLH}, t_r, t_f





TEST CIRCUITS

Fig.15 Test Circuits for Common Mode Transient Immunity

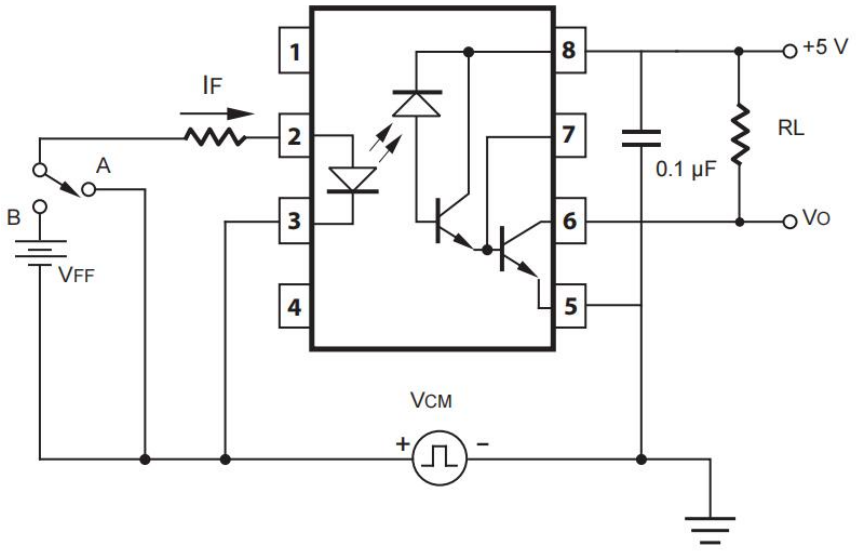
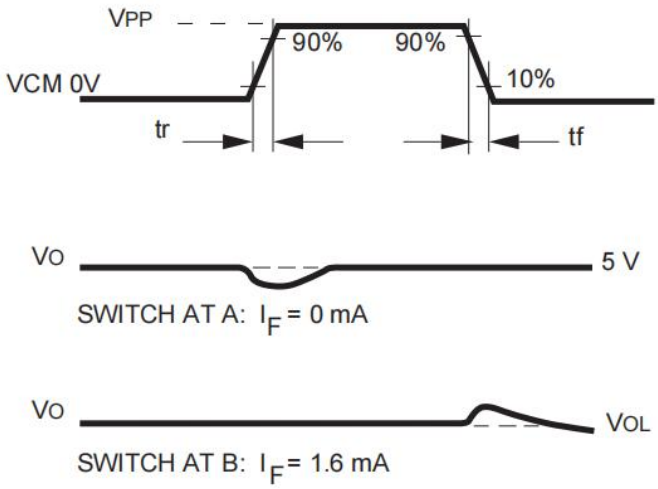
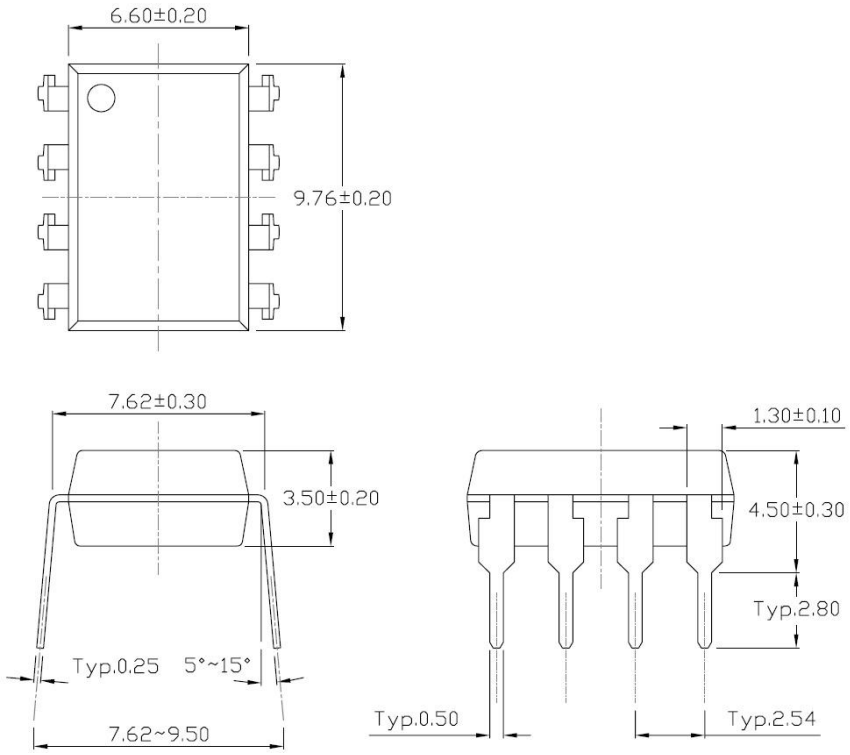


Fig.16 Waveforms of Common Mode Transient Immunity

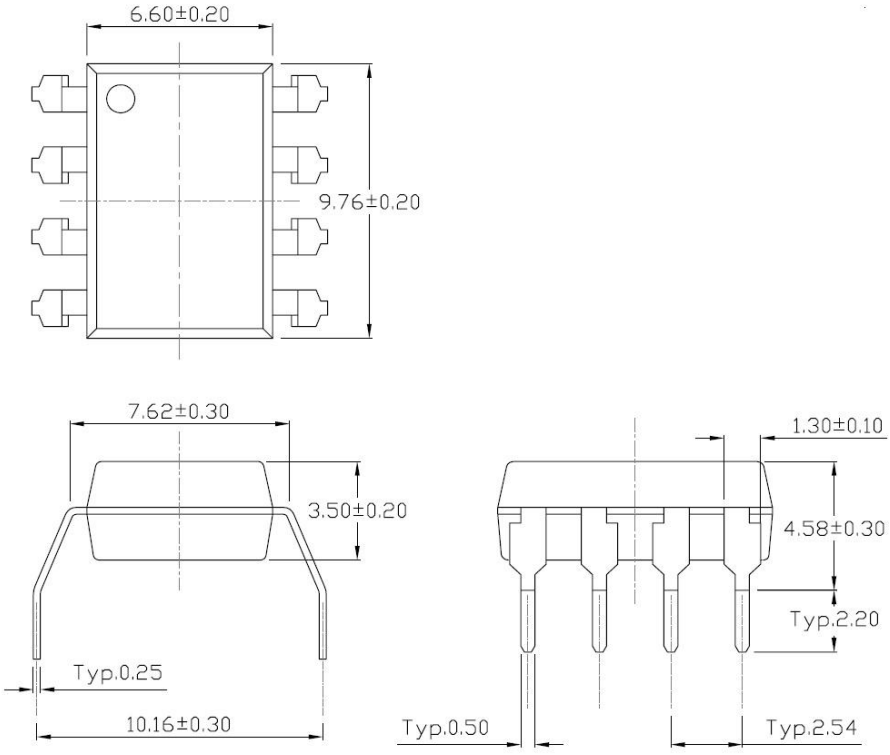


PACKAGE DIMENSIONS

Standard DIP – Through Hole (DIP Type)

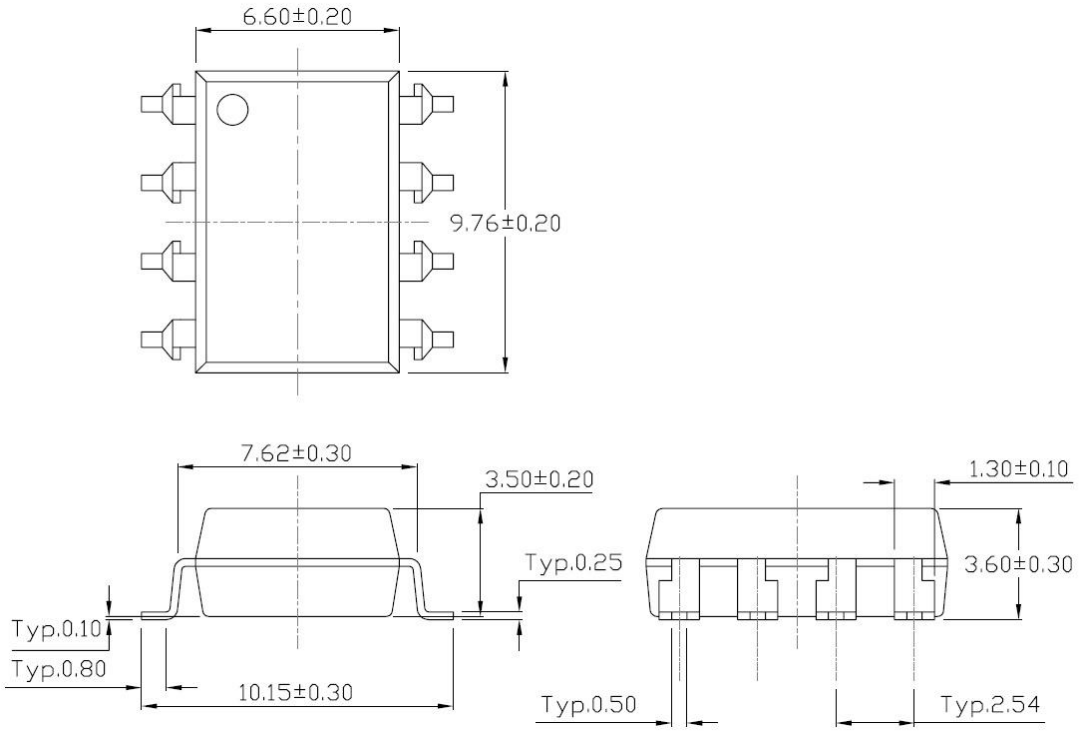


Gullwing (400mil) Lead Forming – Through Hole (M Type)



PACKAGE DIMENSIONS

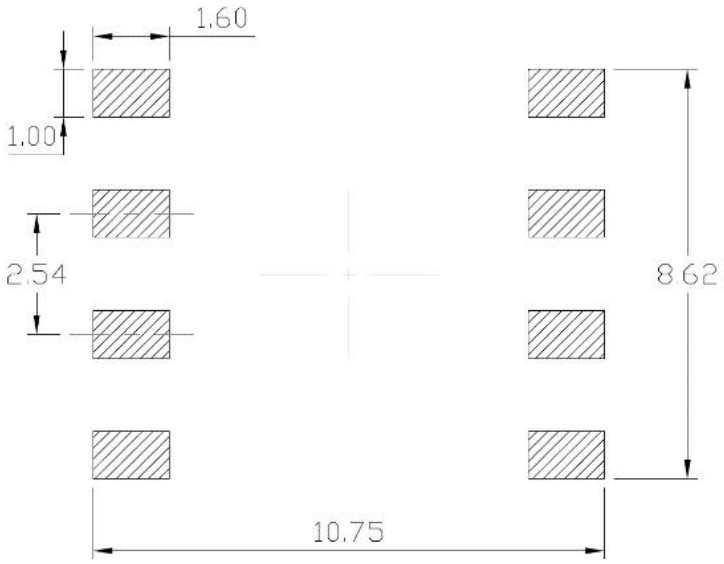
Surface Mount (Low Profile) Lead Forming (SL Type)



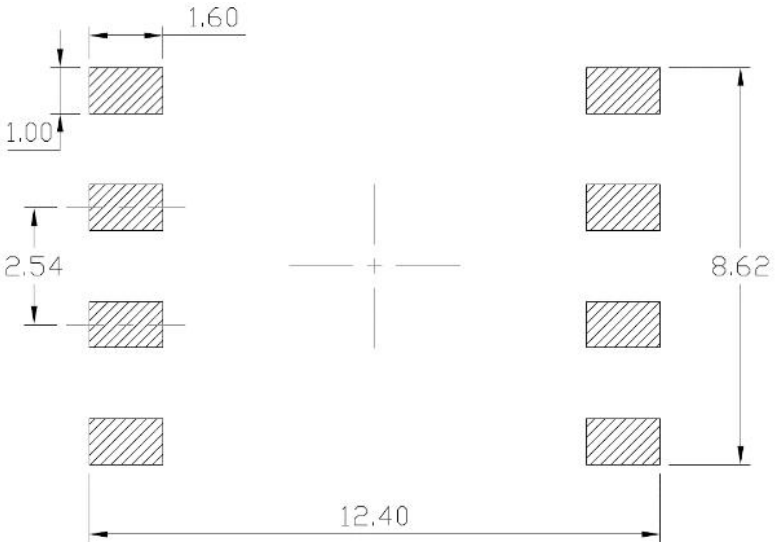
- **Dimensions in mm unless otherwise stated**

RECOMMENDED SOLDER MASK

Surface Mount (Low Profile) Lead Forming



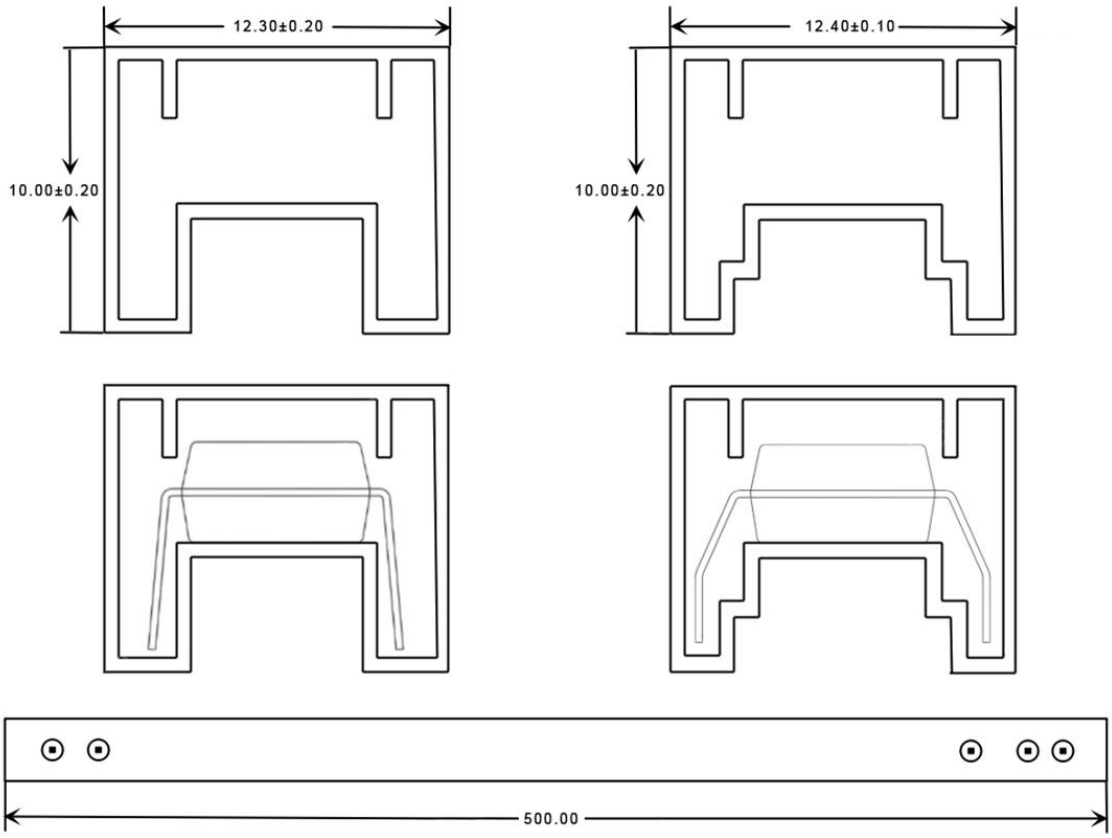
Surface Mount (Gullwing) Lead Forming



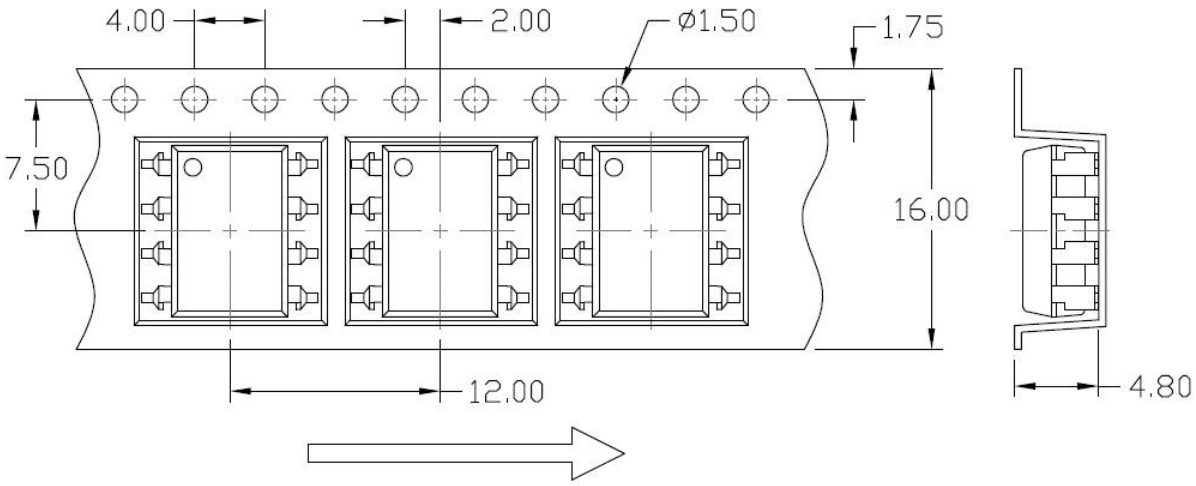
- **Dimensions in mm unless otherwise stated**

CARRIER TAPE SPECIFICATIONS

Option DIP8 & DIP8-M



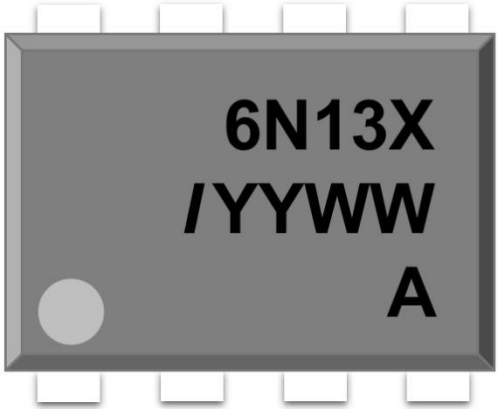
Option DIP8-SL



- **Dimensions in mm unless otherwise stated**

ORDERING AND MARKING INFORMATION

Marking Information



6N13X	:	**Product Series&Rank**
/	:	**ISOMICRON**
YY	:	**Fiscal Year**
WW	:	**Work Week**
A	:	**Manufacturing Code**

Order Code

6N13X - 5 0 0 E

Product Series

Rank
5/6/7/8/9

Lead Forming
0: DIP-Standard
1: DIP-M
5: SM-SL

Halogen Free
E: Halogen-free,Lead-free
Z: Halogen, Lead-free

CTR Rank: None

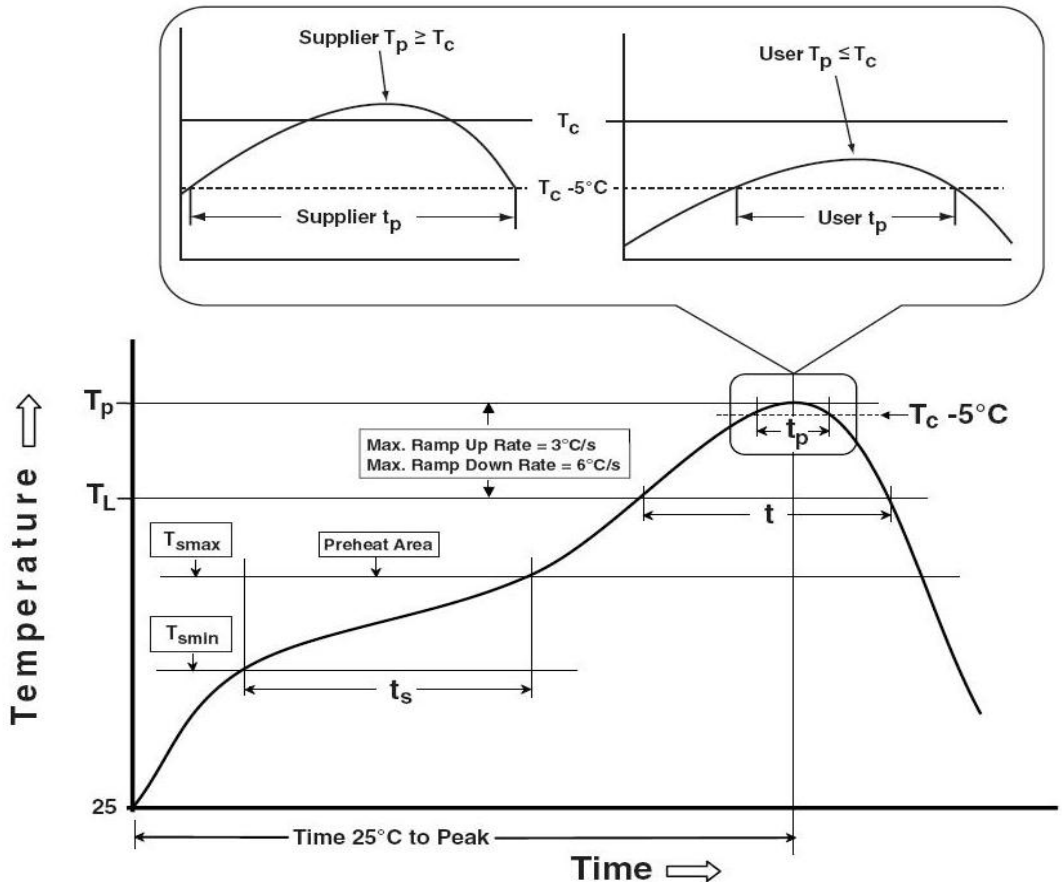
Performance
0: Normal
1: Enhanced
2: Industrial level
3: Auto level
4: Military level

Packing Quantity

Option	Quantity	Quantity – Inner box	Quantity – Outer box
DIP-Standard	40 Units/Tube	25 Tube/ Inner box	6 Inner box/Outer box=6k Units
DIP-M	40 Units/Tube	25 Tube/ Inner box	6 Inner box/Outer box=6k Units
SM-SL	1000 Units/Reel	2 Reels/Inner box	5 Inner box/Outer box = 10k Units

REFLOW INFORMATION

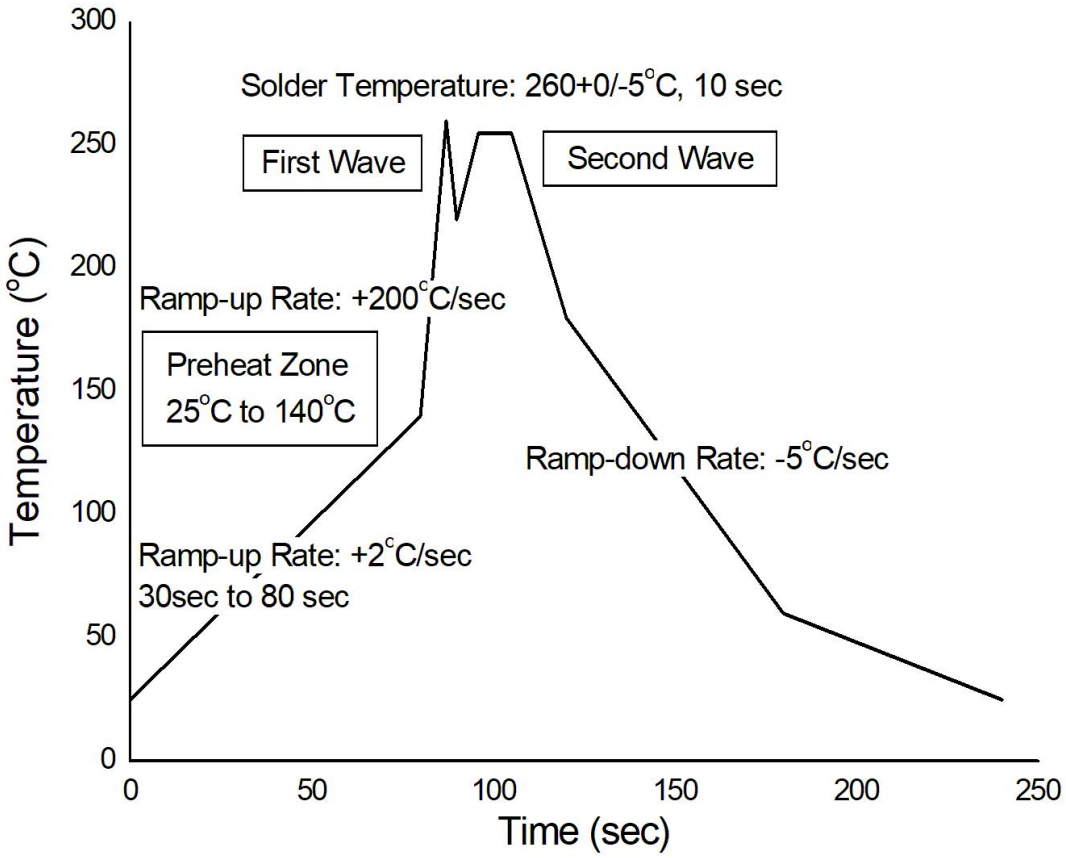
Reflow Profile



Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	100	150°C
Temperature Max. (Tsmax)	150	200°C
Time (ts) from (Tsmin to Tsmax)	60-120 seconds	60-120 seconds
Ramp-up Rate (tL to tP)	3°C/second max.	3°C/second max.
Liquidous Temperature (TL)	183°C	217°C
Time (tL) Maintained Above (TL)	60 – 150 seconds	60 – 150 seconds
Peak Body Package Temperature	235°C +0°C / -5°C	260°C +0°C / -5°C
Time (tP) within 5°C of 260°C	20 seconds	30 seconds
Ramp-down Rate (TP to TL)	6°C/second max	6°C/second max
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

TEMPERATURE PROFILE OF SOLDERING

Wave Soldering (JESD22-A111 Compliant)



Hand Soldering By Soldering Iron	
Soldering Temperature	380+0/-5°C
Soldering Time	3 sec max.

- **One time soldering is recommended for all soldering method.**
- **Do not solder more than three times for IR reflow soldering.**

DISCLAIMER

- ISOMICRON is continually improving the quality, reliability, function and design. ISOMICRON reserves the right to make changes without further notices.
- The characteristic curves shown in this datasheet are representing typical performance which are not guaranteed.
- ISOMICRON makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, ISOMICRON disclaims (a) any and all liability arising out of the application or use of any product, (b) any and all liability, including without limitation special, consequential or incidental damages, and (c) any and all implied warranties, including warranties of fitness for particular
- The products shown in this publication are designed for the general use in electronic applications such as office automation, equipment, communications devices, audio/visual equipment, electrical application and instrumentation purpose, non-infringement and merchantability.
- This product is not intended to be used for military, aircraft, automotive, medical, life sustaining or lifesaving applications or any other application which can result in human injury or death.
- Please contact ISOMICRON sales agent for special application request.
- Immerge unit’s body in solder paste is not recommended.
- Parameters provided in datasheets may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated in each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify ISOMICRON’s terms and conditions of purchase, including but not limited to the warranty expressed therein.
- Discoloration might be occurred on the package surface after soldering, reflow or long-time use. It neither impacts the performance nor reliability.