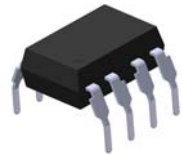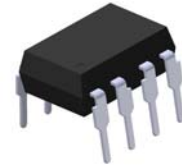# 8 PIN DIP HIGH SPEED SPLIT DARLINGTON PHOTOCOUPLER

6N138 6N139

Features:

- High isolation voltage between input
  and output (Viso=5000 Vrms)
- Guaranteed performance from 0°C to 70°C
- Pb free and RoHS compliant.

Description

   The 6N138 and 6N139 devices each consists of an infrared emitting diodes, optically coupled to a high gain split Darlington photo detectors.
   They 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
- High common mode noise line receiver
- Microprocessor bus isolation
- Current loop receiver

Schematic
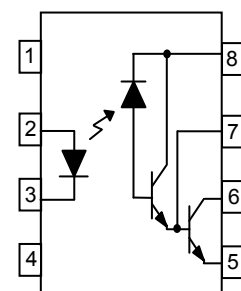
6N138/6N139

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

ISOCOM COMPONENTS

8 PIN DIP HIGH SPEED SPLIT DARLINGTON PHOTOCOUPLER

6N138 6N139

Absolute Maximum Ratings (T$_a$=25°C unless otherwise specified)

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 ($\leq 1 \mu$s P.W, 300pps)	I_{Ftrans}	1	A
	Reverse voltage	V_R	5	V
	Power dissipation	P_{IN}	35	mW
Output	Power dissipation	P_O	100	mW
	Output current	I_O	60	mA
	Emitter-Base Reverse Voltage	VER	0.5	V
	Output voltage 6N138	V_O	-0.5 to 7	V
	Output voltage 6N139		-0.5 to 18	V
	Supply voltage 6N138	V_{CC}	-0.5 to 7	V
	Supply voltage 6N139		-0.5 to 18	V
Isolation voltage [*1]		V_{ISO}	5000	V rms
Operating temperature		T_{OPR}	-55 ~ +85	°C
Storage temperature		T_{STG}	-55 ~ +125	°C
Soldering temperature [*2]		T_{SOL}	260	°C

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°C 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, TA=25°C
Temperature coefficient of forward voltage	$\Delta V_F/\Delta T_A$	-	-1.8	-	mV/°C	I_F =1.6mA

Output

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

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

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

* Typical values at T_a = 25°C

8 PIN DIP HIGH SPEED SPLIT DARLINGTON PHOTOCOUPLER

6N138 6N139

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

Parameter		Symbol	Min.	Typ.*	Max.	Unit	Condition
Propagation Delay Time to Logic Low	6N139	TPHL	-	-	25	μs	I_F = 0.5mA , R_L=4.7kΩ, T_A=25°C
			-	-	30		I_F = 0.5mA , R_L=4.7kΩ
			-	-	1		I_F = 12mA , R_L=270Ω, T_A=25°C
			-	-	2		I_F = 12mA , R_L=270Ω
	6N138		-	-	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	TPLH	-	-	60	μs	I_F = 0.5mA , R_L=4.7kΩ, T_A=25°C
			-	-	90		I_F = 0.5mA , R_L=4.7kΩ
			-	-	7		I_F = 12mA , R_L=270Ω, T_A=25°C
			-	-	10		I_F = 12mA , R_L=270Ω
	6N138		-	-	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		CM$_H$	1,000	-	-	V/μs	I_F = 0mA , V_{CM}=10Vp-p, R_L=2.2KΩ, T_A=25°C
Common Mode Transient Immunity at Logic Low		CM$_L$	1,000	-	-	V/μs	I_F = 1.6mA , V_{CM}=10Vp-p, R_L=2.2KΩ, T_A=25°C

* Typical values at T$_a$ = 25°C

Typical Performance Curves

Fig.1 LED Forward Current vs. Forward Voltage
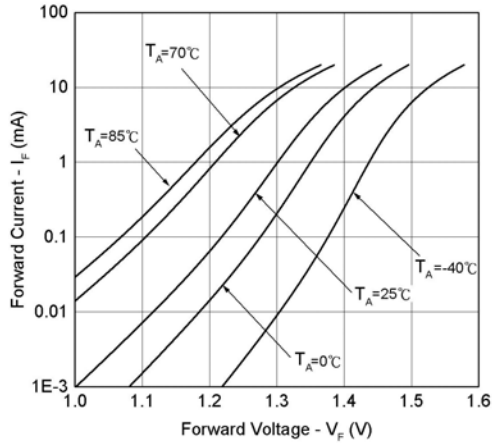
Fig.2 LED Forward Voltage vs. Temperature
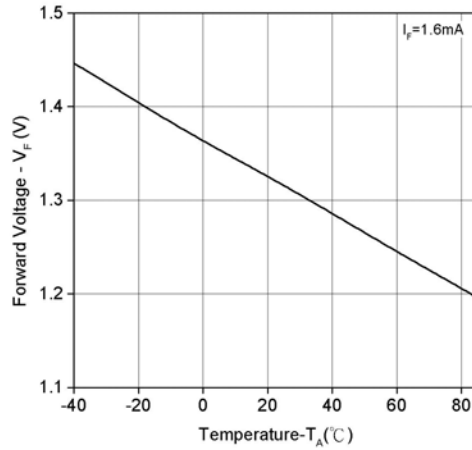
Fig.3 Output Current vs. Output Voltage
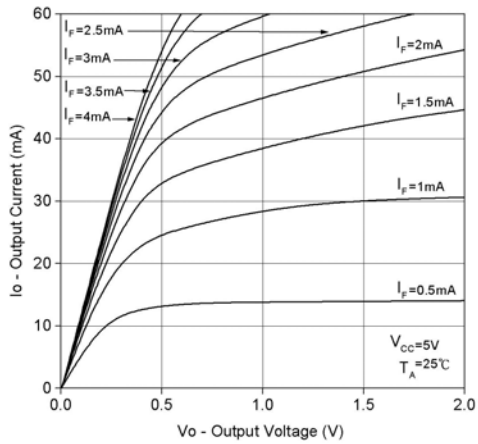
Fig.4 Output Current vs. Input Diode Forward Current
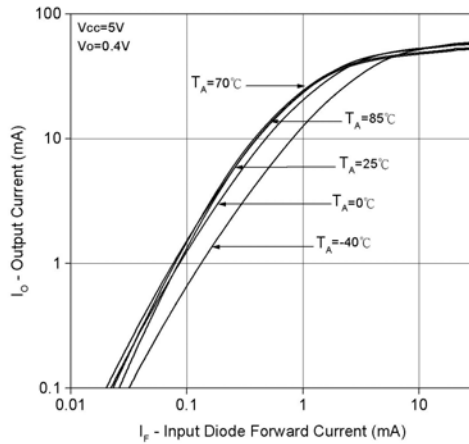
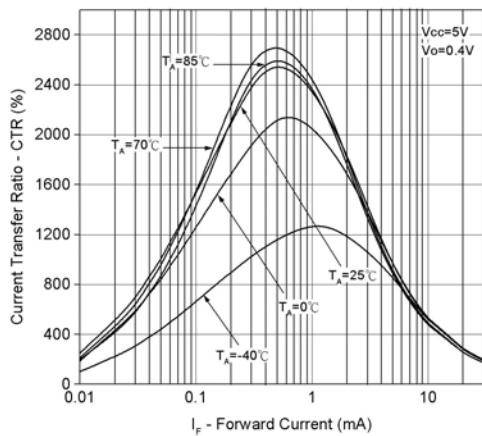Fig.5 Current Transfer Ratio vs. Forward Current
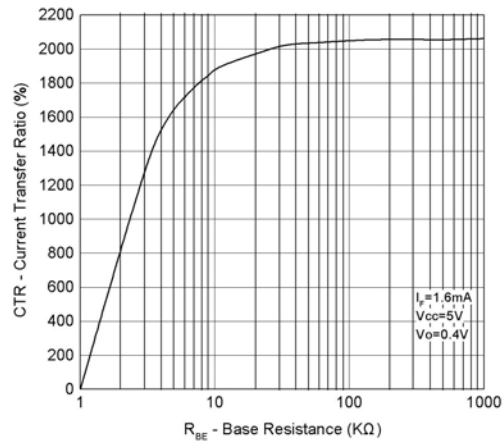

Fig.6 Current Transfer Ratio vs. Base-Emitter Resistance

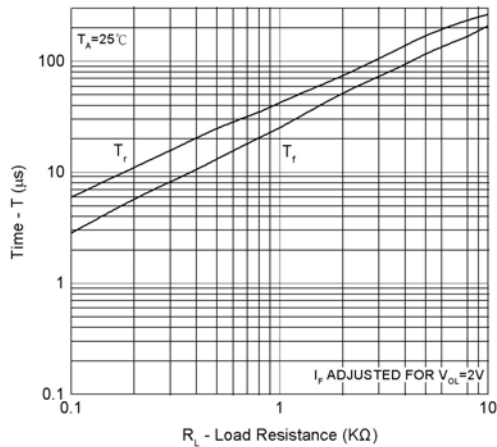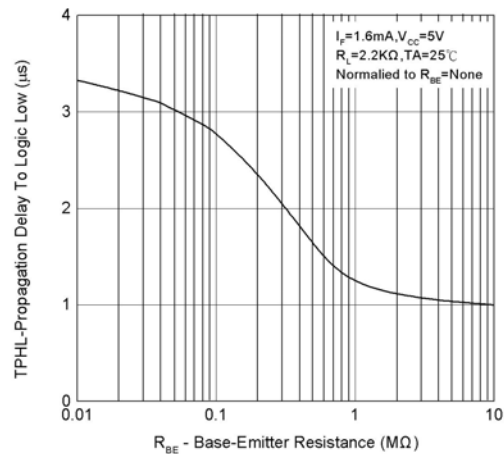Fig.7 Non-saturated Rise nand Fall Times vs. Load Resistance

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

Fig.9 Propagation Delay vs. Input Diode Forward Current
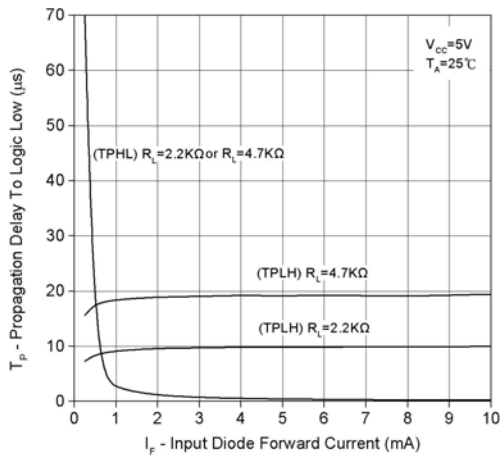
Fig.10 Propagation Delay to Logic Low vs. Pulse Period
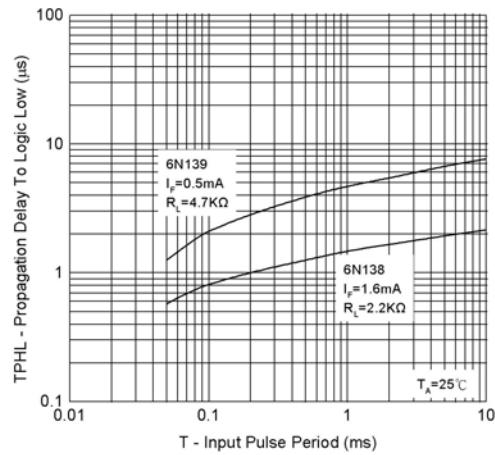
Fig.11 Propagation Delay vs. Temperature
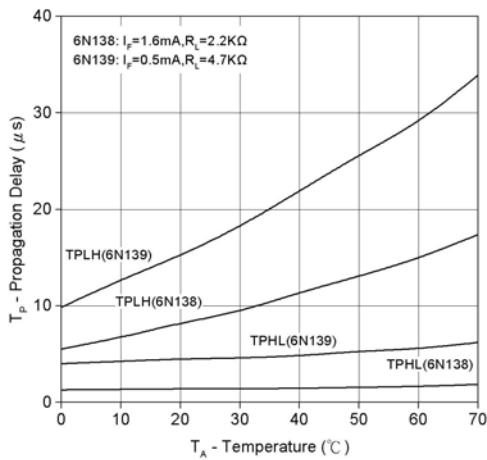
Fig.12 Logic Low Supply Current vs. Input Diode Forward Current
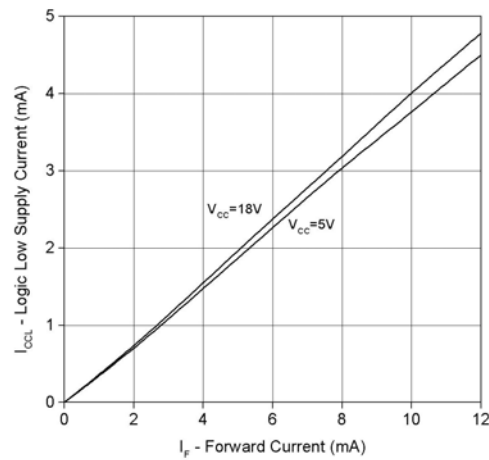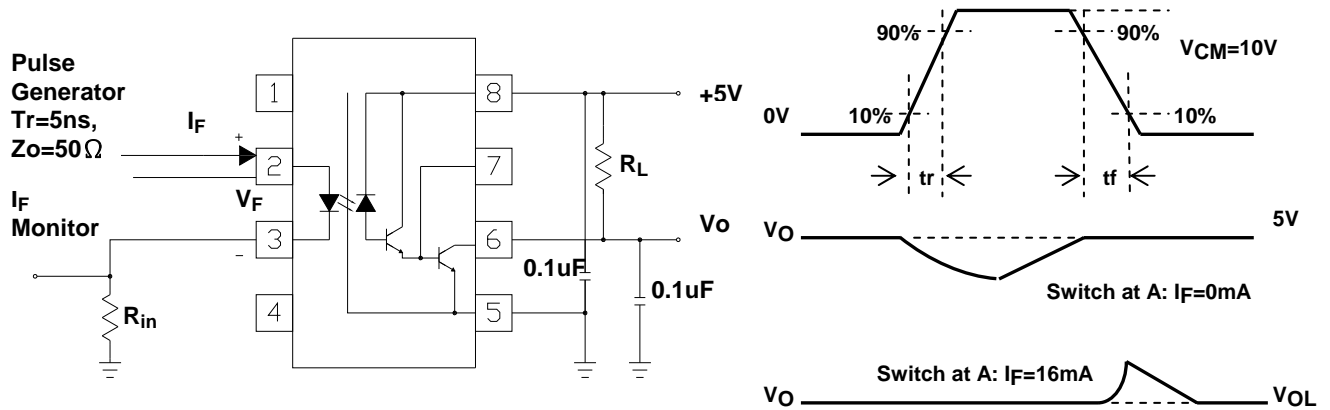
Fig. 13 Switching Time Test Circuit
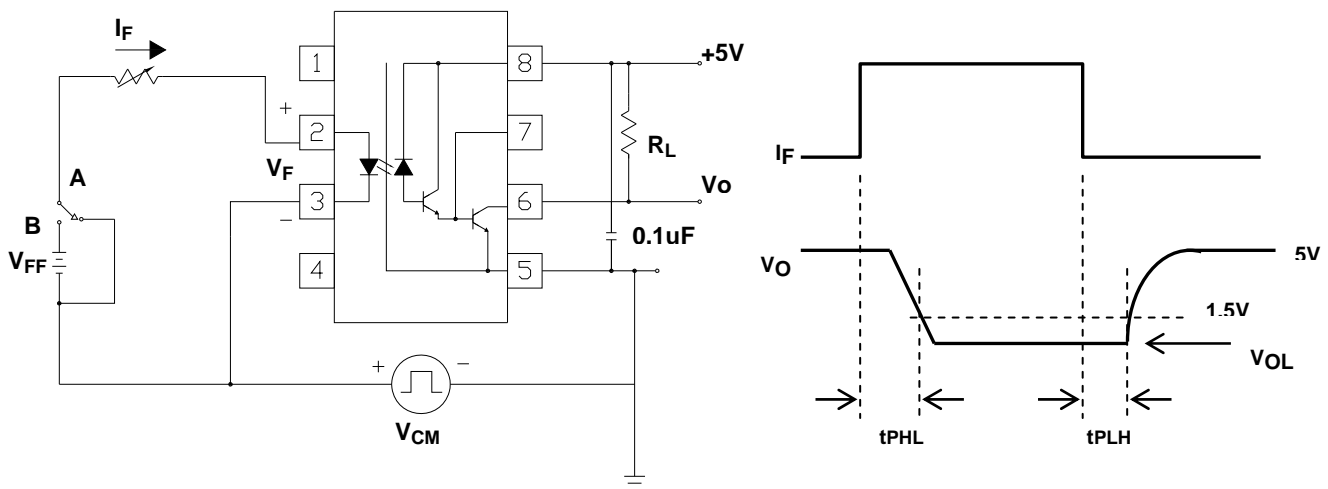
Fig. 14 Common Mode Transient Immunity Test Circuit

ISOCOM
COMPONENTS

8 PIN DIP HIGH SPEED SPLIT DARLINGTON PHOTOCOUPLER

6N138 6N139

Order Information

Part Number

6N13XY

Note

X   = Part No. (X = 8 or 9)
Y   = Lead form option (G SM T+R or none)

Option	Description	Packing quantity
None	Standard DIP-8	45 units per tube
G	Wide lead bend (0.4 inch spacing)	45 units per tube
SM	Surface mount lead form	45 units per tube
SM T+R	Surface mount lead form + tape & reel	1000 units per reel

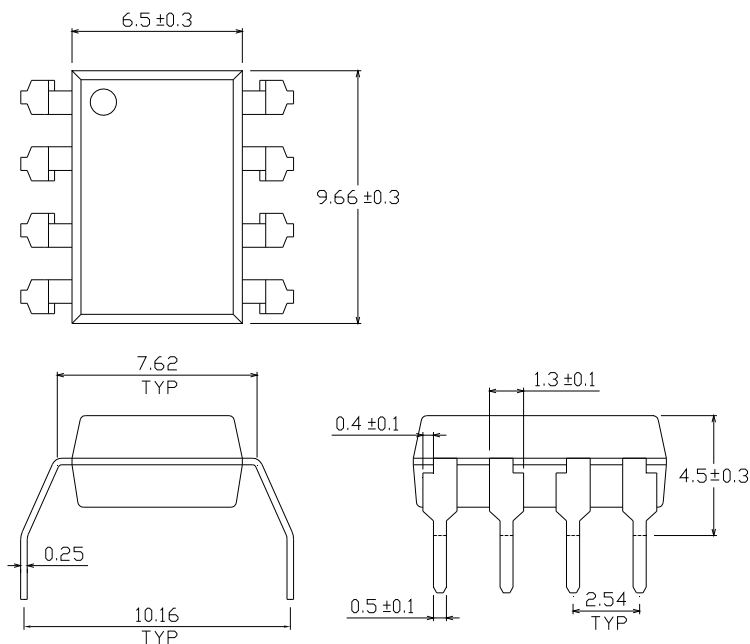# 8 PIN DIP HIGH SPEED SPLIT DARLINGTON PHOTOCOUPLER

6N138 6N139

Package Drawing

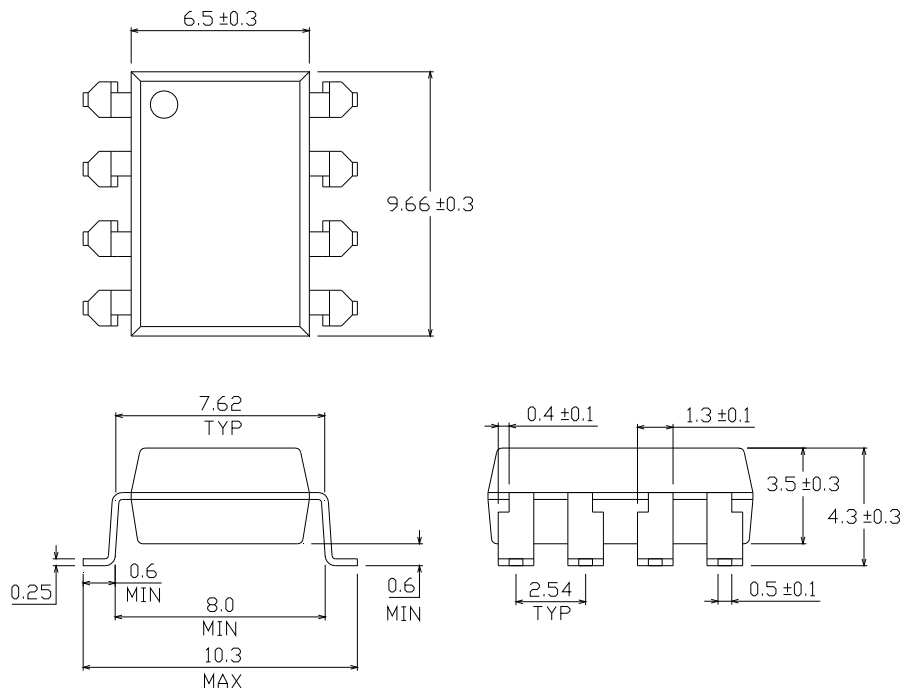### (Dimensions in mm)

Standard DIP Type
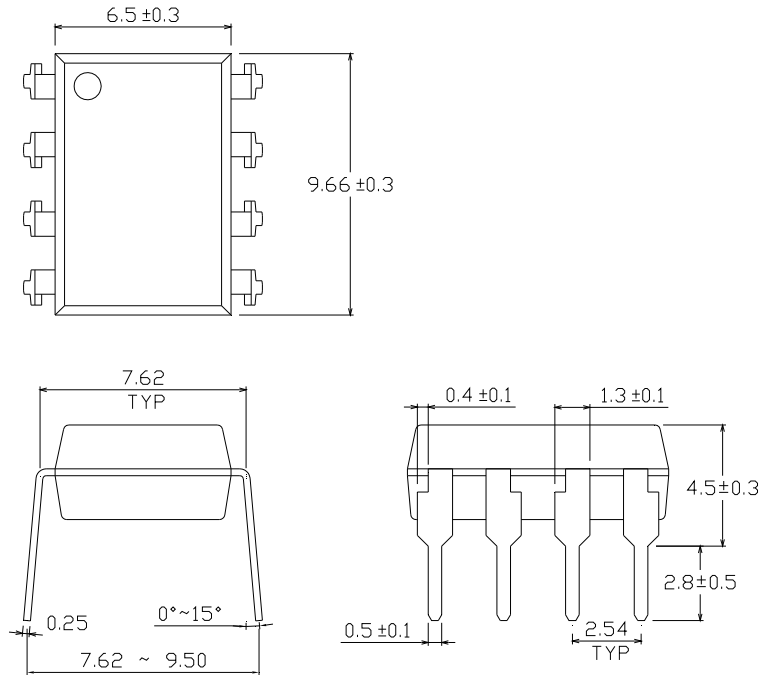
Option G Type
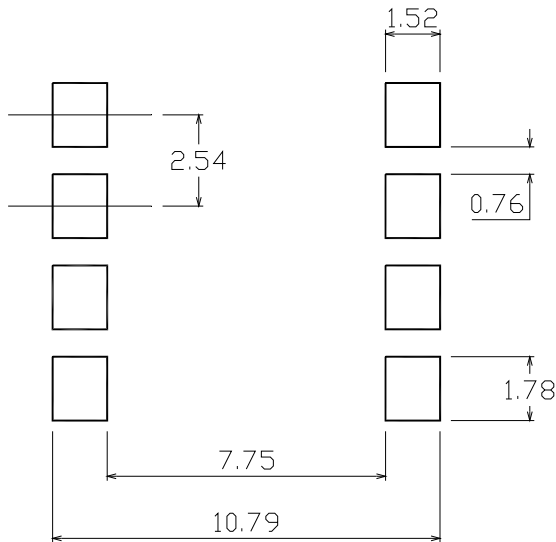
8 PIN DIP HIGH SPEED SPLIT DARLINGTON PHOTOCOUPLER
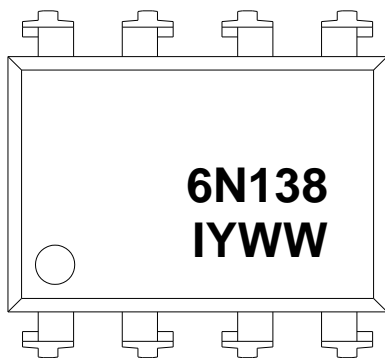
6N138 6N139

Option SM Type

Recommended pad layout for surface mount leadform

1.52

2.54

0.76

1.78

7.75

10.79

Device Marking

6N138
IYWW

Notes

6N138	denotes Device Number
Y	denotes 1 digit Year code
WW	denotes 2 digit Week code
I	denotes Isocom

Tape & Reel Packing Specifications

Option TA
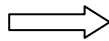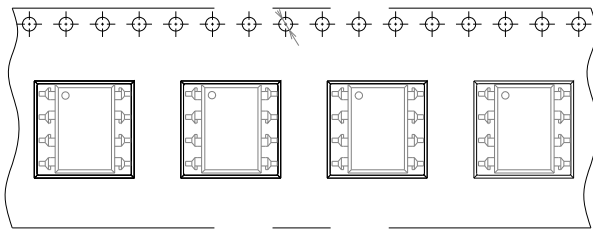
Direction of feed from reel

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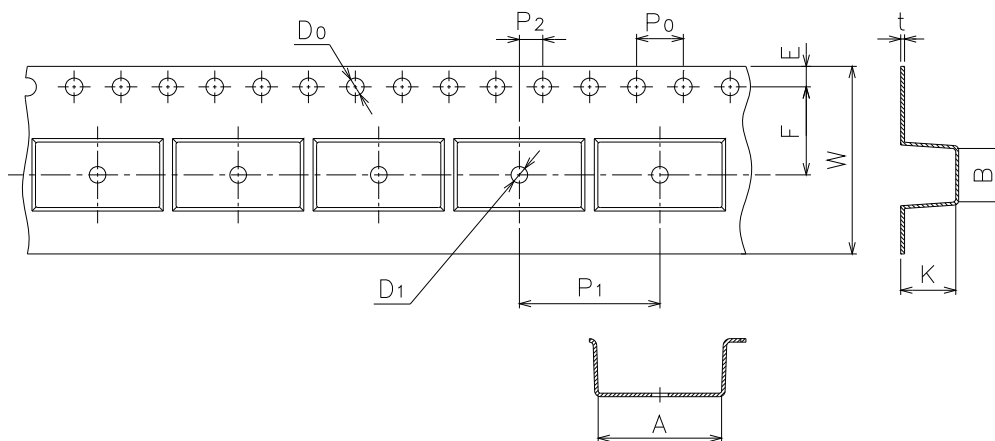
Dimension No.	**A**	**B**	**Do**	**D1**	**E**	**F**
Dimension(mm)	10.4±0.1	10.0±0.1	1.5±0.1	1.5±0.1	1.75±0.1	7.5±0.1
Dimension No.	**Po**	**P1**	**P2**	**t**	**W**	**K**
Dimension(mm)	4.0±0.1	12.0±0.1	2.0±0.1	0.4±0.1	16.0+0.3/ -0.1	4.5±0.1

Solder Reflow Temperature Profile

Graph labels:
- 260 °C (peak,10 Sec Max)
- >255 °C (30s Max)
- 217°
- 200°
- 150°C
- 1-3 °C/Sec Max
- 60 – 140 Sec
- 70 – 170 Sec
- 1-3 °C/Sec Max
- TIME (S)
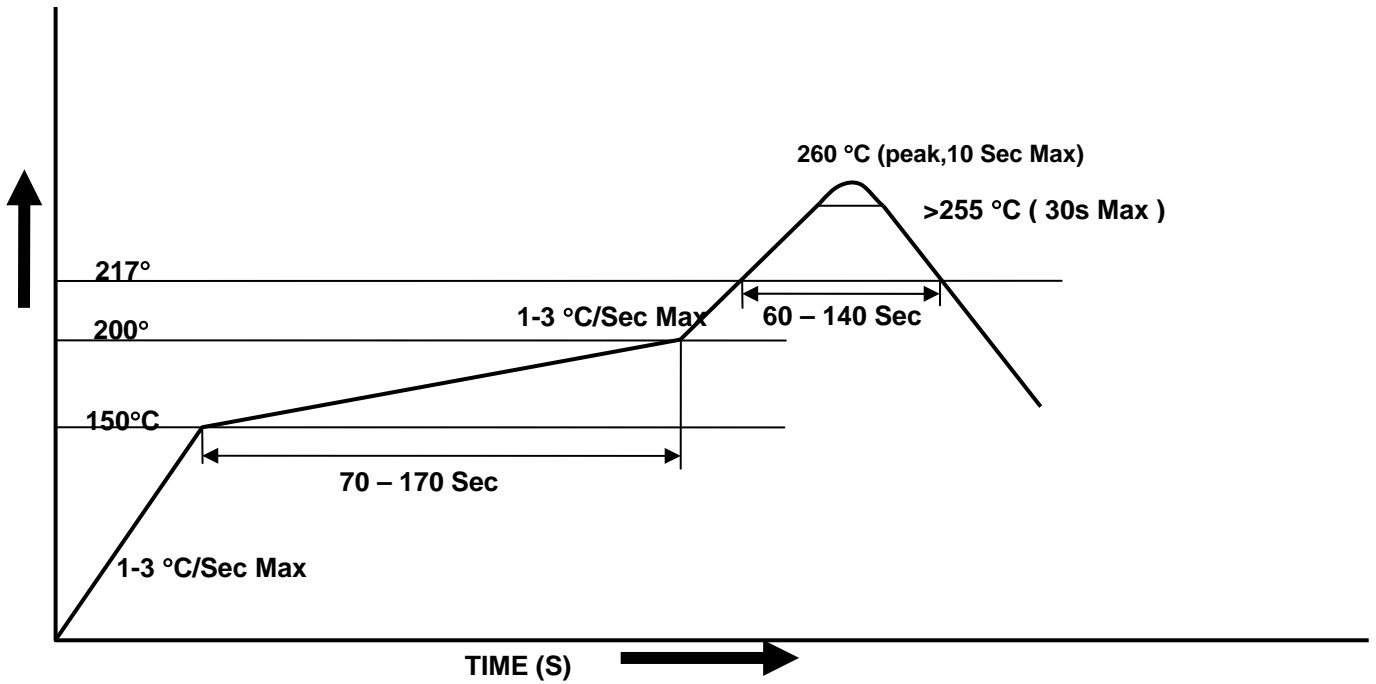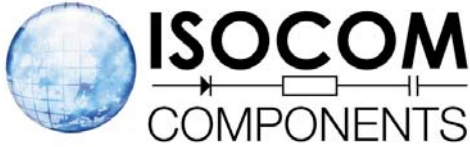
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