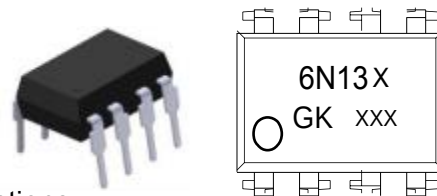


General Description

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.



DIP-8

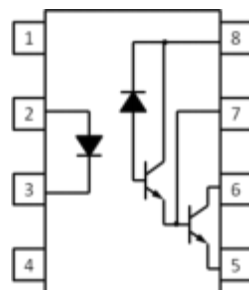
Features

- High current transfer ratio—2000% typical
- High isolation voltage between input and output (Viso=5000 Vrms)
- Guaranteed performance from 0°C to 70°C
- Pb free and RoHS compliant.

Applications

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

Schematic



Pin Configuration

1. No Connection
2. Anode
3. Cathode
4. No Connection
5. Gnd
6. V_{out}
7. V_B
8. V_{CC}

Absolute Maximum Ratings (Ta=25°C)

	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

Absolute Maximum Ratings (Ta=25°C)

Output	Power dissipation	P _O	100	mW
	Output current	I _O	60	mA
	Emitter-Base Reverse Voltage	V _{ER}	0.5	V
	Output voltage	V _O	-0.5 to 7 -0.5 to 18	V
	Supply voltage	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	°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

Transfer Characteristics

(T_a=0 to 70°C unless specified otherwise, V_{CC}=4.5V)

Parameter	Symbol	Min	Typ.	Max.	Unit	Condition
Current Transfer Ratio	6N139	400	2500	-	%	I _F = 0.5mA, V _O = 0.4V, V _{CC} =4.5V
	CTR	500	2000	-		I _F = 1.6mA, V _O = 0.4V, V _{CC} =4.5V
	6N138	300	2000	-		
Logic Low Output Voltage	6N139	-	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
		-	0.06	0.4		I _F = 1.6mA, I _O = 4.8mA, V _{CC} =4.5V
	6N138	-	0.06	0.4		

Electrical Characteristics ($T_A=0$ to 70°C unless specified otherwise)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	V_F	-	1.3	1.7	V	$I_F = 1.6\text{mA}$
Reverse Voltage	V_R	5.0	-	-	V	$I_R = 10\mu\text{A}$, $T_A=25^{\circ}\text{C}$
Temperature coefficient of forward voltage	$\Delta V_F/\Delta T_A$	-	-1.8	-	mV/ $^{\circ}\text{C}$	$I_F = 1.6\text{mA}$

Output

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

Switching Characteristics ($T_A=0$ to 70°C unless specified otherwise)

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

* Typical values at $T_a = 25^\circ\text{C}$

RATING AND CHARACTERISTIC CURVES

Fig.1 LED Forward Current vs. Forward Voltage

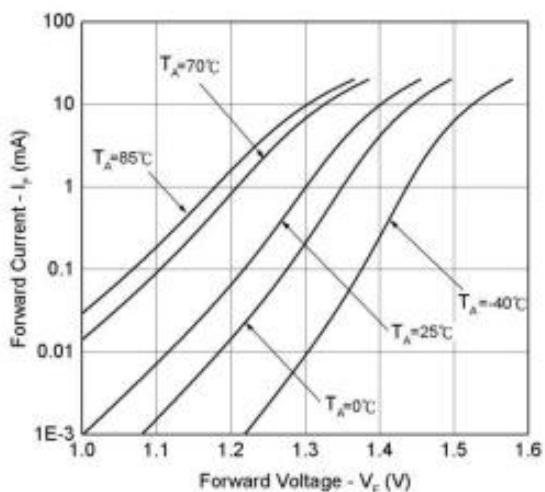


Fig.2 LED Forward Voltage vs. Temperature

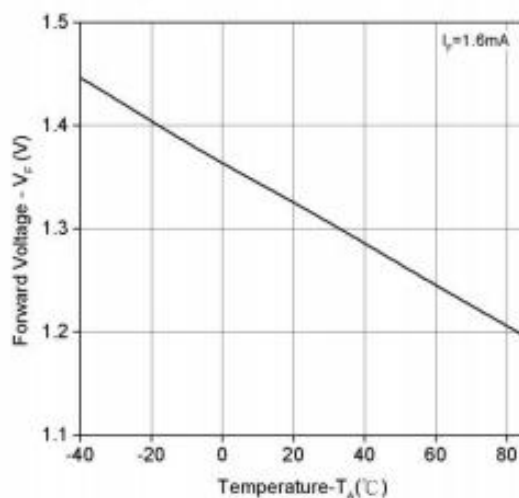


Fig.3 Output Current vs. Output Voltage

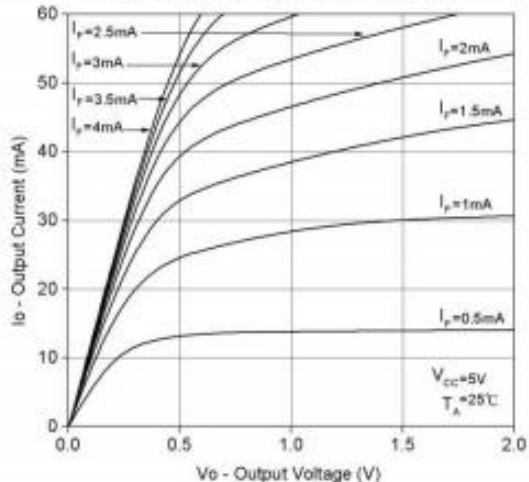


Fig.4 Output Current vs. Input Diode Forward Current

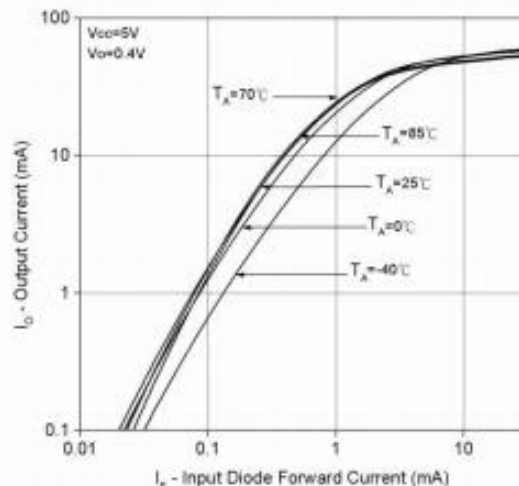


Fig.5 Current Transfer Ratio vs. Forward Current

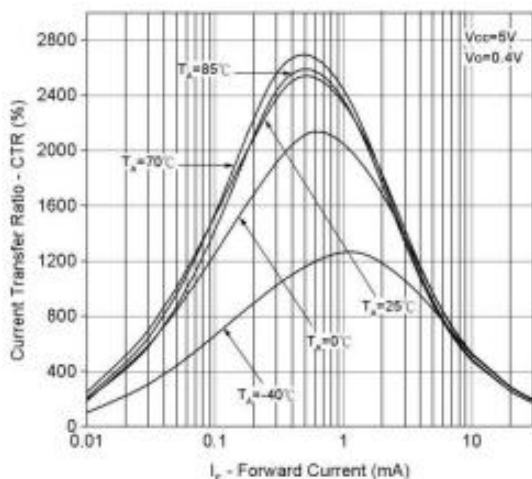
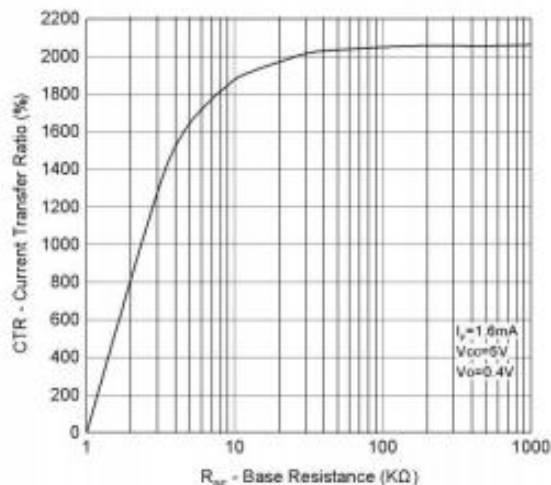


Fig.6 Current Transfer Ratio vs. Base-Emitter Resistance



RATING AND CHARACTERISTIC CURVES

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

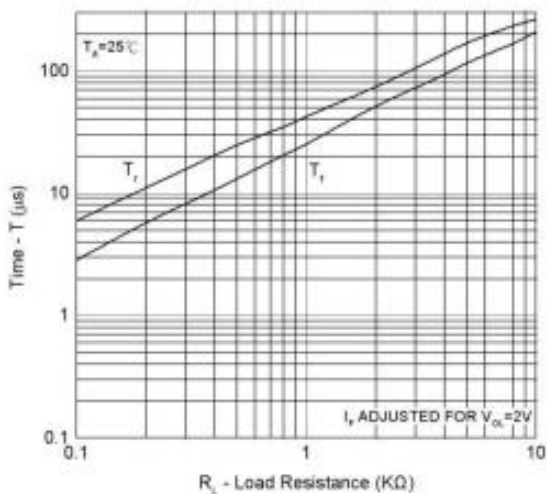


Fig.8 Propagation Delay To Logic Low
vs. Base-Emitter Resistance

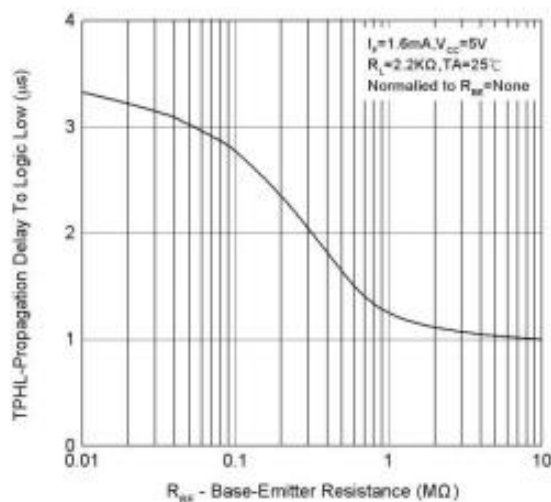


Fig.9 Propagation Delay vs. Input Diode Forward Current

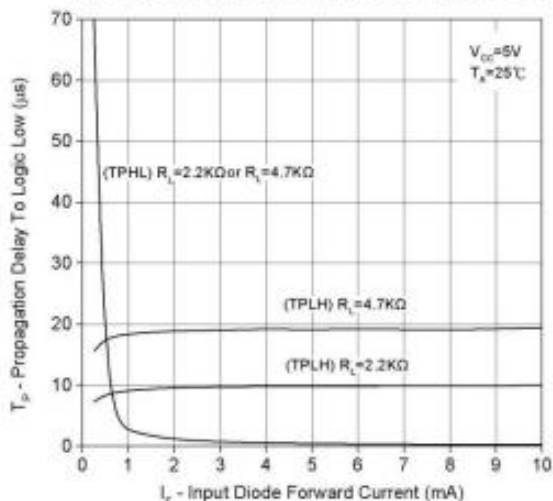


Fig.10 Propagation Delay to Logic Low vs. Pulse Period

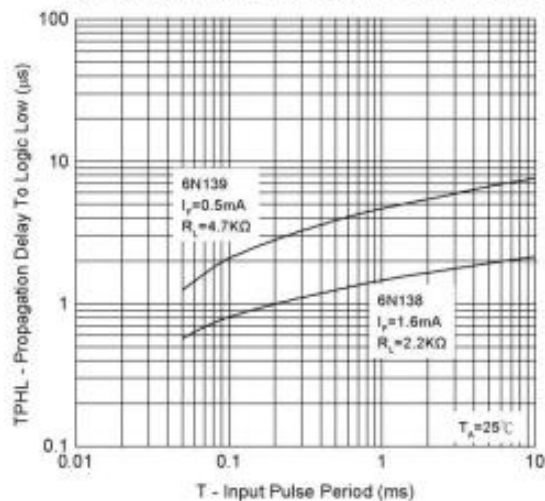


Fig.11 Propagation Delay vs. Temperature

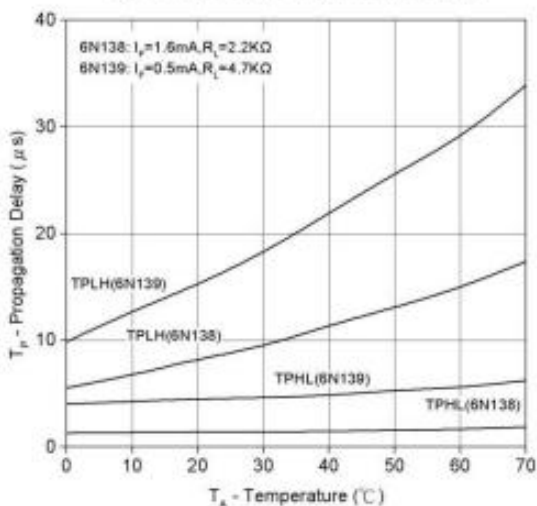
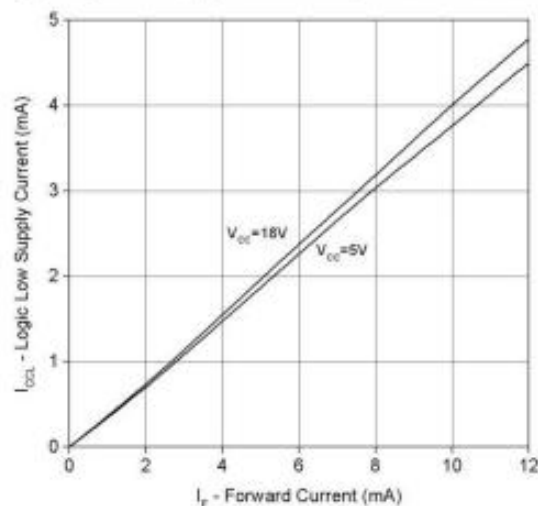


Fig.12 Logic Low Supply Current vs. Input Diode Forward Current



RATING AND CHARACTERISTIC CURVES

Fig. 13 Switching Time Test Circuit and Waveform

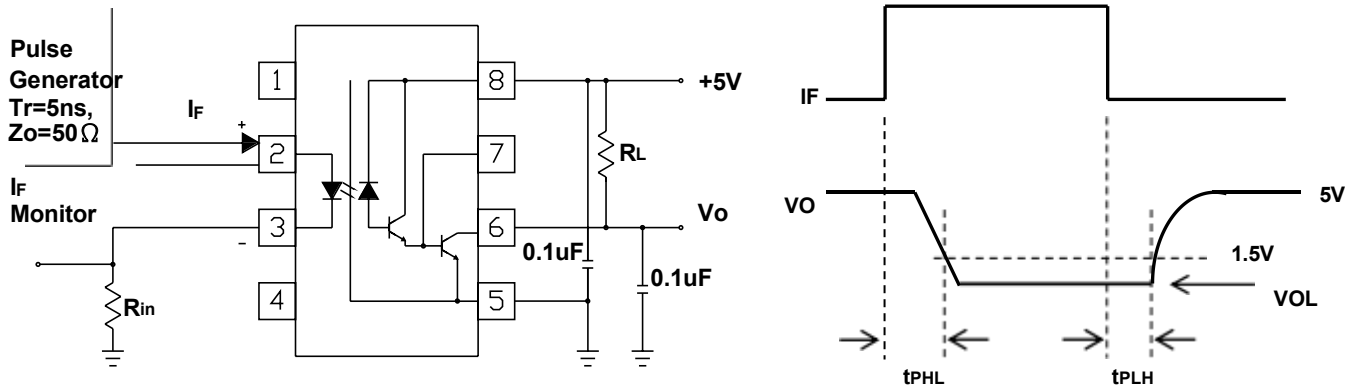
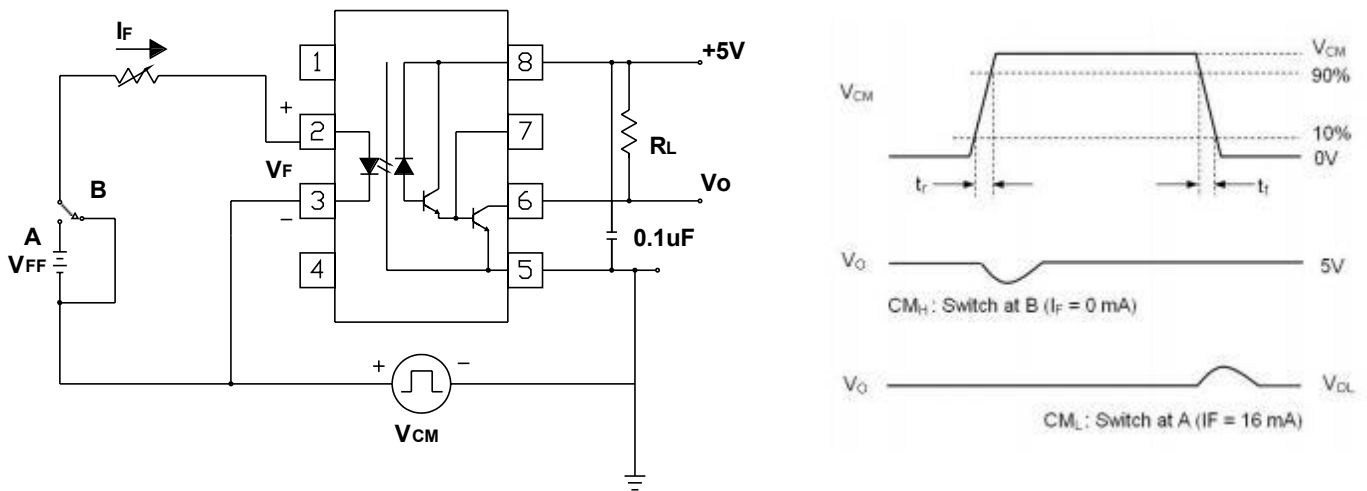


Fig. 14 Common Mode Transient Immunity Test Circuit and Waveform



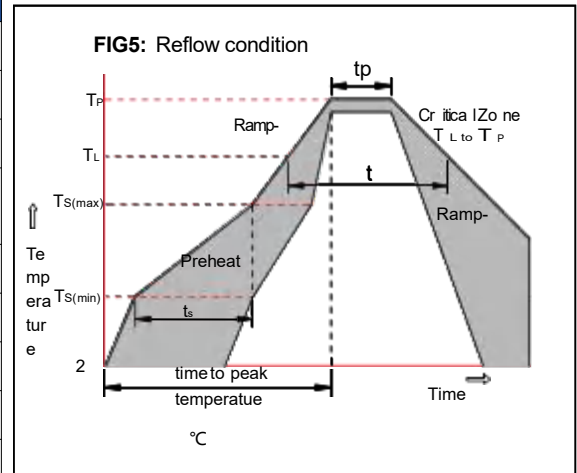
Note:

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

Common mode transient immunity in logic low level is the maximum tolerable (negative) dV_{cm}/dt on the trailing edge of the common mode pulse signal, V_{cm} , to assure that the output will remain in a logic low state (i.e., $V_O < 0.8V$).

Soldering parameters

Reflow Condition		Pb-Free assembly (see as below)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150°C
	-Temperature Max($T_{s(max)}$)	+200°C
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3°C/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3°C/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217°C
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_P)		+260(+0/-5)°C
Time within 5°C of actual Peak Temp (t_P)		30 secs. Max
Ramp-down Rate		6°C/sec. Max
Time 25°C to Peak Temp (T_P)		8 min. Max
Do not exceed		+260°C



Package Dimensions & Suggested Pad Layout

DIP -8

