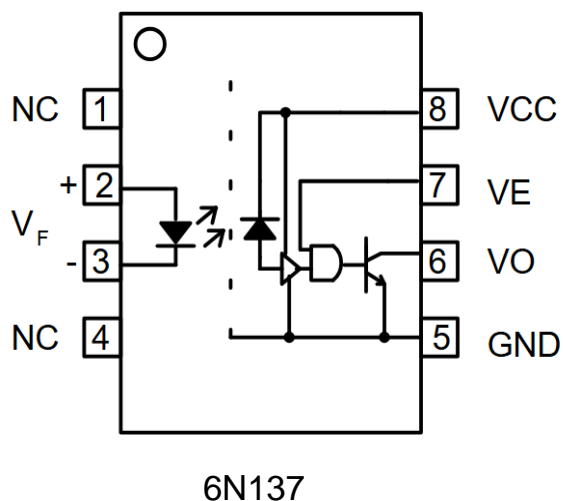


10Mbit/s High Speed Logic Gate Photo Coupler

Description

The 6N137 consists of a high efficient AlGaAs Light Emitting Diode and a high speed optical detector. The operating parameters are guaranteed over the temperature range of - 55 °C to 100 °C

Functional Diagram



Features

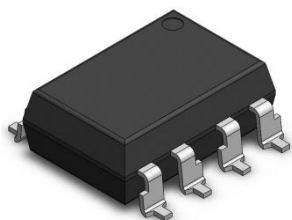
- High isolation 5000 VRMS
- DC input with logic gate output
- a very high speed integrated photo-detector logic gate with a strobable output

Applications

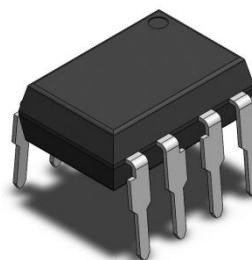
- Ground loop elimination
- LSTTL to TTL, LSTTL or CMOS
- Line receiver, data transmission
- Data multiplexing
- Switching power supply
- Pulse transformer replacement
- Computer-peripheral interface

Fruth Table (Positive Logic)

LED	VO
ON	LOW
OFF	HIGH



6N137S SMD-8



6N137 DIP-8

ABSOLUTE MAXIMUM RATINGS (TA = 25°C unless otherwise noted)				
PARAMETER	SYMBOL	VALUE	UNIT	Note
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	
Enable Voltage	V _E	VCC+0.5	V	
Input Power Dissipation	P _I	100	mW	
Supply Voltage	V _{CC}	7	V	
Output Voltage	V _O	7	V	
Output Current	I _O	50	mA	
Output Power Dissipation	P _O	85	mW	
Total Power Dissipation	P _{tot}	200	mW	
Isolation Voltage	V _{iso}	5000	V _{rms}	3
Operating Temperature	T _{opr}	-55~100	°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

RECOMMENDED OPERATION CONDITIONS				
PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Temperature	TA	-40	100	°C
Supply Voltage	VCC	2.7	3.6	V
	VCC	4.5	5.5	V
Low Level Input Current	IFL	0	250	μA
High Level Input Current	IFH	5	15	mA
Low Level Enable Voltage	VEL	0	0.8	V
High Level Enable Voltage	VEH	2	VCC	V
Output Pull-up Resistor	RL	330	4k	Ω
Fan Out (at RL=1kΩ per channel)	N	-	5	TTL Loads

ELECTRICAL OPTICAL CHARACTERISTICS (TA = 25°C unless otherwise noted)							
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
INPUT							
Forward Voltage	V _F	-	1.38	1.8	V	I _F =10mA	
Reverse Current	I _R	-	-	10	μA	V _R =5V	
Input Capacitance	C _{in}	-	13	-	pF	V=0, f=1MHz	
OUTPUT							
High Level Supply Current	I _{CCH}	-	6.3	10	mA	I _F =0mA, V _E =0.5V, V _{CC} =5.5V	
Low Level Supply Current	I _{CCL}	-	8.3	13	mA	I _F =10mA, V _{CC} =5.5V	
High Level Enable Current	I _{EH}	-	-0.52	-1.6	mA	V _E =2.0V, V _{CC} =5.5V	
Low Level Enable Current	I _{EL}	-	-0.75	-1.6	mA	V _E =0.5V, V _{CC} =5.5V	
High Level Enable Voltage	V _{EH}	2.0	-	-	V	I _F =10mA, V _{CC} =5.5V	
Low Level Enable Voltage	V _{EL}	-	-	0.8	V	I _F =10mA, V _{CC} =5.5V	
TRANSFER CHARACTERISTICS (Ta=-40 to 85°C)							
High Level Output Current	I _{OH}	-	0.73	100	μA	V _{CC} =5.5V, V _O =5.5V, I _F =250μA, V _E =2.0V	
Low Level Output Voltage	V _{OL}	-	0.28	0.6	V	V _{CC} =5.5V, I _F =5mA, V _E =2.0V, I _{CL} =13mA	
Input Threshold Current	I _{FT}	-	2.5	5	mA	V _{CC} =5.5V, V _O =0.6V, V _E =2.0V, I _{OL} =13mA	
Isolation Resistance	R _{iso}	10 ¹²	10 ¹⁴	-	Ω	DC500V, 40 ~ 60% R.H.	
Floating Capacitance	C _{IO}	-	1.0	-	pF	V=0, f=1MHz	

ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
SWITCHING CHARACTERISTICS (Ta=-40 to 85°C, V _{CC} =5V, I _F =7.5mA unless specified otherwise)							
Propagation Delay Time to Output Low Level	TPHL	-	35	75	ns	C _L =15pF, R _L =350Ω, Ta=25°C	
Propagation Delay Time to Output High Level	TPLH	-	40	75	ns	C _L =15pF, R _L =350Ω, Ta=25°C	
Pulse Width Distortion	TPHL-TPLH	-	5	35	ns	C _L =15pF, R _L =350Ω	
Rise Time	tr	-	27	-	ns	C _L =15pF, R _L =350Ω	
Fall Time	tf	-	7	-	ns	C _L =15pF, R _L =350Ω	
Enable Propagation Delay Time to Output Low Level	TEHL	-	15	-	ns	I _F =7.5mA, V _{EH} =3.5V, C _L =15pF, R _L =350Ω	
Enable Propagation Delay Time to Output High Level	TELH	-	15	-	ns	I _F =7.5mA, V _{EH} =3.5V, C _L =15pF, R _L =350Ω	
Common Mode Transient Immunity at Logic High	6N137	-	-	-		I _F = 7.5mA , V _{OH} =2.0V, R _L =350Ω, Ta=25°C V _{CM} =10Vp-p	
Common Mode Transient Immunity at Logic Low	6N137	-	-	-		I _F = 0mA , V _{OH} =0.8V, R _L =350Ω, Ta=25°C V _{CM} =10Vp-p	

ELECTRICAL OPTICAL CHARACTERISTICS (TA = 25°C unless otherwise noted)							
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
INPUT							
Forward Voltage	V _F	-	1.38	1.8	V	I _F =10mA	
Reverse Current	I _R	-	-	10	μA	V _R =5V	
Input Capacitance	C _{in}	-	13	-	pF	V=0, f=1MHz	
OUTPUT							
High Level Supply Current	I _{CCH}	-	4.3	10	mA	I _F =0mA, V _E =0.5V, V _{CC} =3.3V	
Low Level Supply Current	I _{CCL}	-	6.4	13	mA	I _F =10mA, V _{CC} =3.3V	
High Level Enable Current	I _{EH}	-	-0.21	-1.6	mA	V _E =2.0V, V _{CC} =3.3V	
Low Level Enable Current	I _{EL}	-	-0.42	-1.6	mA	V _E =0.5V, V _{CC} =3.3V	
High Level Enable Voltage	V _{EH}	2.0	-	-	V	I _F =10mA, V _{CC} =3.3V	
Low Level Enable Voltage	V _{EL}	-	-	0.8	V	I _F =10mA, V _{CC} =3.3V	
TRANSFER CHARACTERISTICS (Ta=-40 to 85°C)							
High Level Output Current	I _{OH}	-	4.1	100	μA	V _{CC} =3.3V, V _O =3.3V, I _F =250μA, V _E =2.0V	
Low Level Output Voltage	V _{OL}	-	0.29	0.6	V	V _{CC} =3.3V, I _F =5mA, V _E =2.0V, I _{CL} =13mA	
Input Threshold Current	I _{FT}	-	2.2	5	mA	V _{CC} =3.3V, V _O =0.6V, V _E =2.0V, I _{OL} =13mA	
Isolation Resistance	R _{iso}	10 ¹²	10 ¹⁴	-	Ω	DC500V, 40 ~ 60% R.H.	
Floating Capacitance	C _{io}	-	1.0	-	pF	V=0, f=1MHz	

ELECTRICAL OPTICAL CHARACTERISTICS							
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
SWITCHING CHARACTERISTICS (Ta=-40 to 85°C, V _{CC} =3.3V, I _F =7.5mA unless specified otherwise)							
Propagation Delay Time to Output Low Level	TPHL	-	35	75	ns	C _L =15pF, R _L =350Ω, Ta=25°C	
Propagation Delay Time to Output High Level	TPLH	-	47	75	ns	C _L =15pF, R _L =350Ω, Ta=25°C	
Pulse Width Distortion	TPHL-TPLH	-	12	35	ns	C _L =15pF, R _L =350Ω	
Rise Time	tr	-	30	-	ns	C _L =15pF, R _L =350Ω	
Fall Time	tf	-	8.5	-	ns	C _L =15pF, R _L =350Ω	
Enable Propagation Delay Time to Output Low Level	TEHL	-	15	-	ns	I _F =7.5mA, V _{EH} =3.3.3V, C _L =15pF, R _L =350Ω	
Enable Propagation Delay Time to Output High Level	TELH	-	15	-	ns	I _F =7.5mA, V _{EH} =3.3.3V, C _L =15pF, R _L =350Ω	
Common Mode Transient Immunity at Logic High	6N137	-	-	-		I _F = 7.5mA , V _{OH} =2.0V, R _L =350Ω, Ta=25°C V _{CM} =10Vp-p	
Common Mode Transient Immunity at Logic Low	6N137	-	-	-		I _F = 0mA , V _{OH} =0.8V, R _L =350Ω, Ta=25°C V _{CM} =10Vp-p	

CHARACTERISTIC CURVES

Fig.1 Low Level Output Current vs. Ambient Temperature

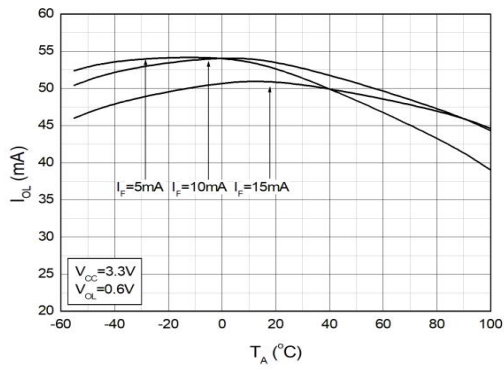


Fig.2 Low Level Output Current vs. Ambient Temperature

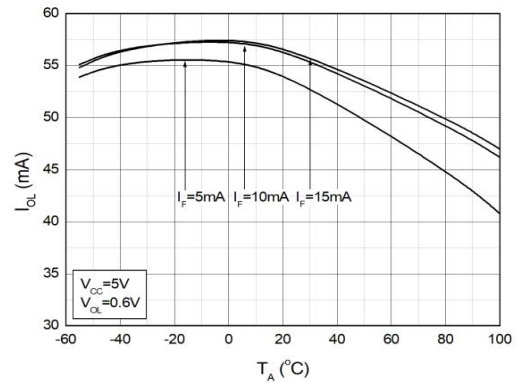


Fig.3 Input Threshold Current vs. Ambient Temperature

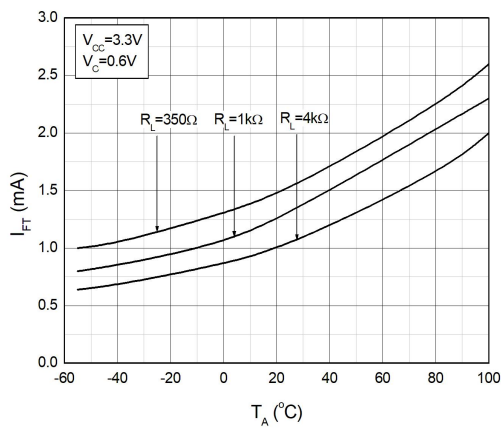


Fig.4 Input Threshold Current vs. Ambient Temperature

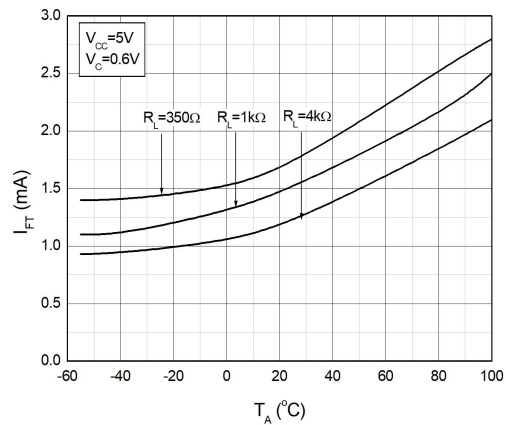


Fig.5 Forward Voltage vs. Ambient Temperature

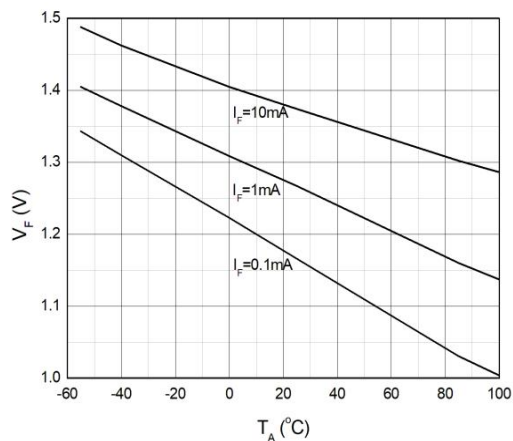
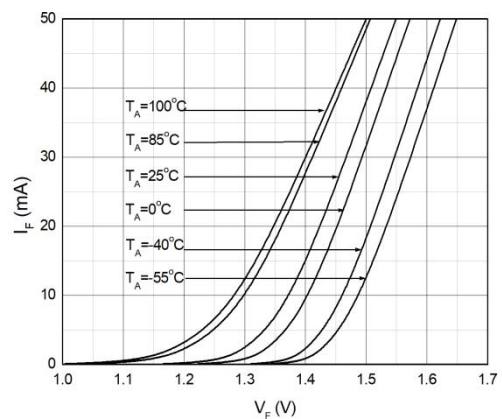


Fig.6 Forward Current vs. Forward Voltage



CHARACTERISTIC CURVES

Fig.7 Output Voltage vs. Forward Current

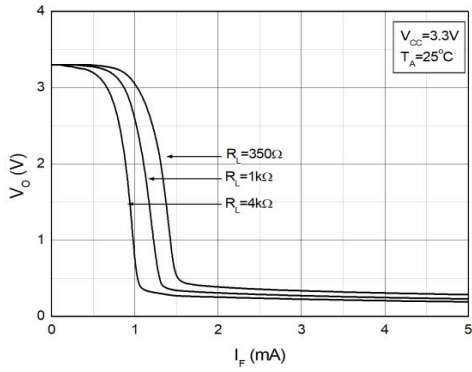


Fig.8 Output Voltage vs. Forward Current

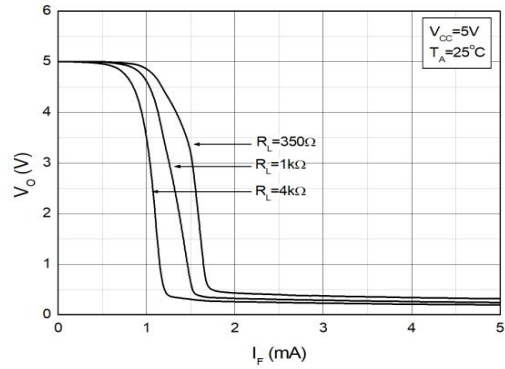


Fig.9 High Level Output Current vs. Ambient Temperature

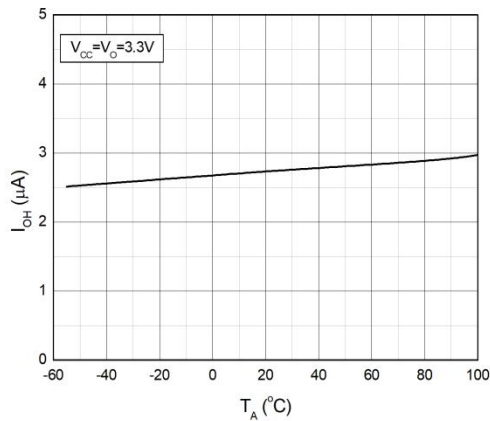


Fig.10 High Level Output Current vs. Ambient Temperature

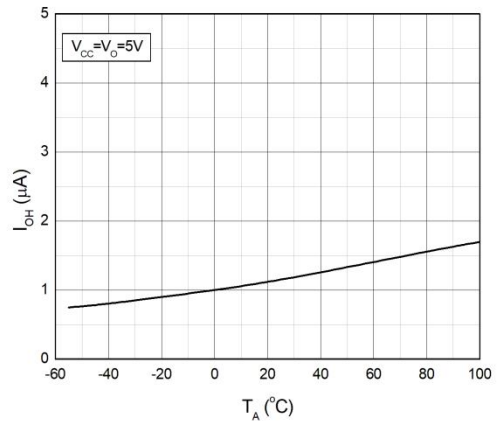


Fig.11 Low Level Output Voltage vs. Ambient Temperature

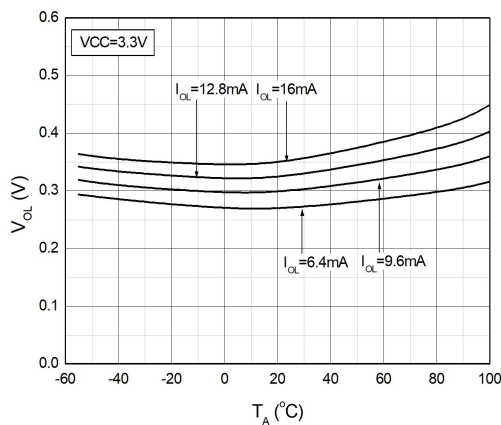
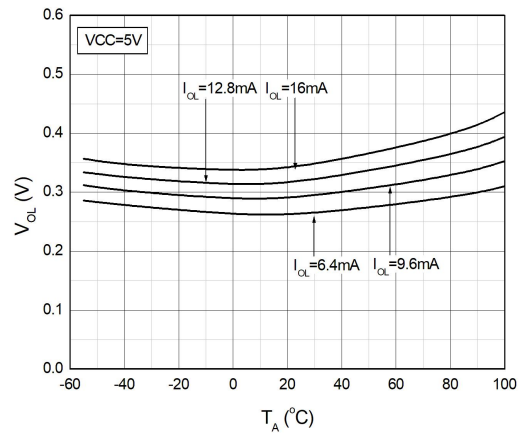


Fig.12 Low Level Output Voltage vs. Ambient Temperature



CHARACTERISTIC CURVES

Fig.13 Propagation Delay vs. Ambient Temperature

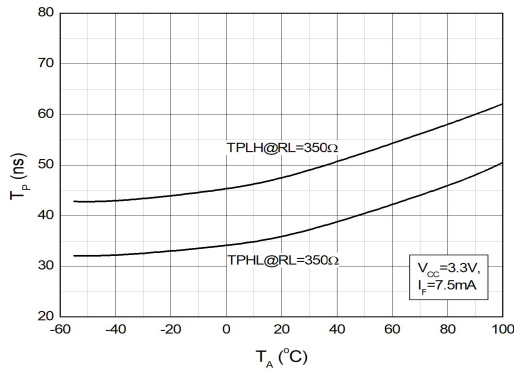


Fig.14 Propagation Delay vs. Ambient Temperature

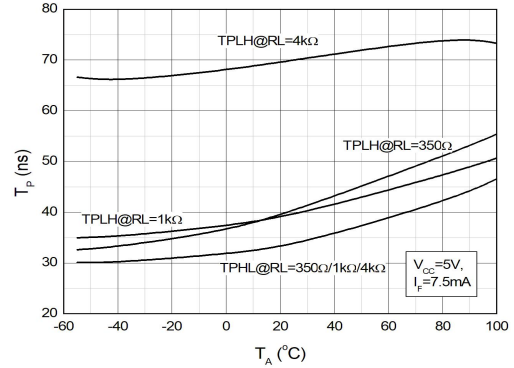


Fig.15 Rise and Fall Time vs. Ambient Temperature

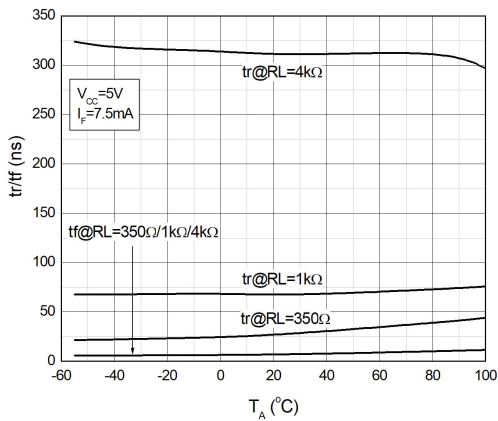


Fig.16 Rise and Fall Time vs. Ambient Temperature

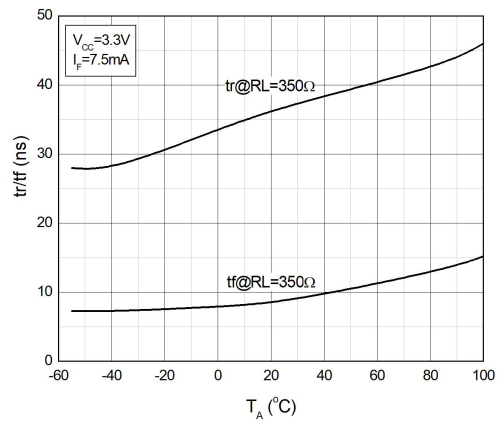


Fig.17 Propagation Delay vs. Forward Current

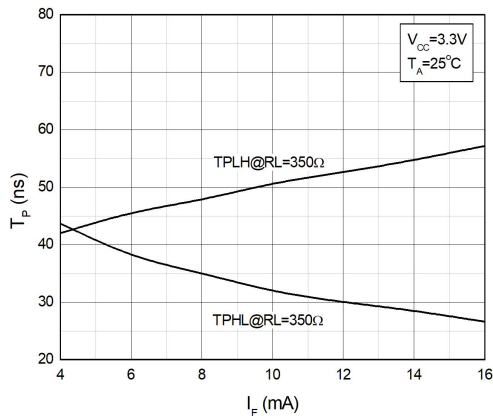
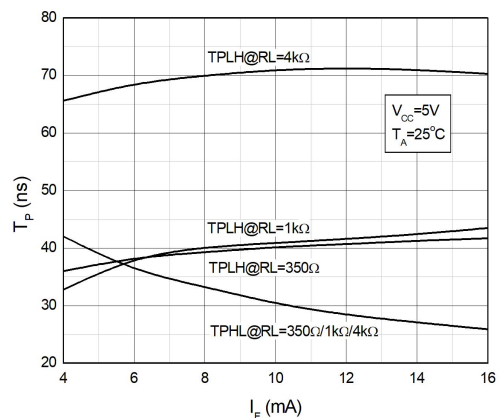


Fig.18 Propagation Delay vs. Forward Current



CHARACTERISTIC CURVES

Fig.19 Enable Propagation Delay vs. Ambient Temperature

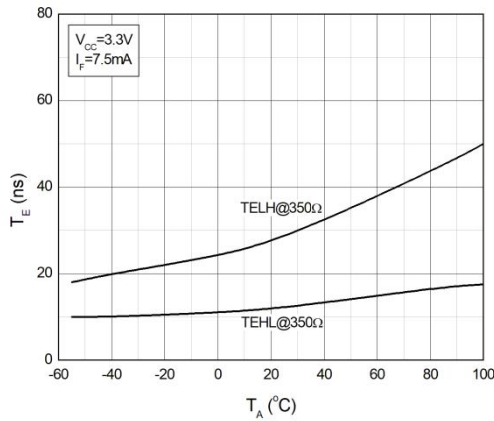


Fig.20 Enable Propagation Delay vs. Ambient Temperature

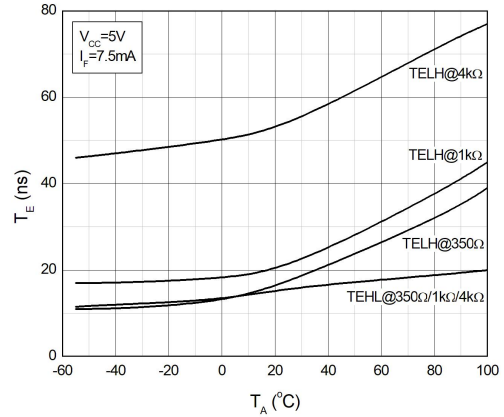


Fig.21 Pulse Width Distortion vs. Ambient Temperature

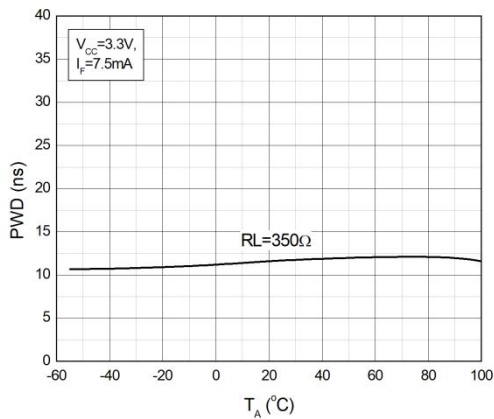
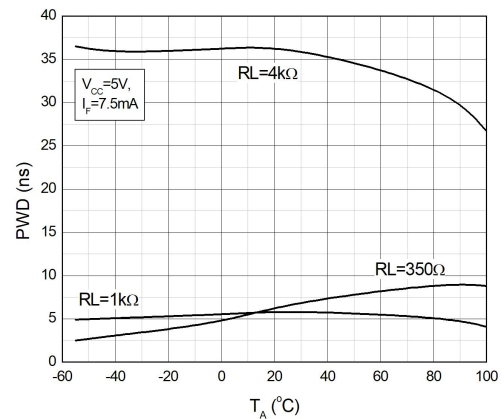


Fig.22 Pulse Width Distortion vs. Ambient Temperature



TEST CIRCUITS

Fig.23 Test Circuits for TPHL, TPLH, tr, tf

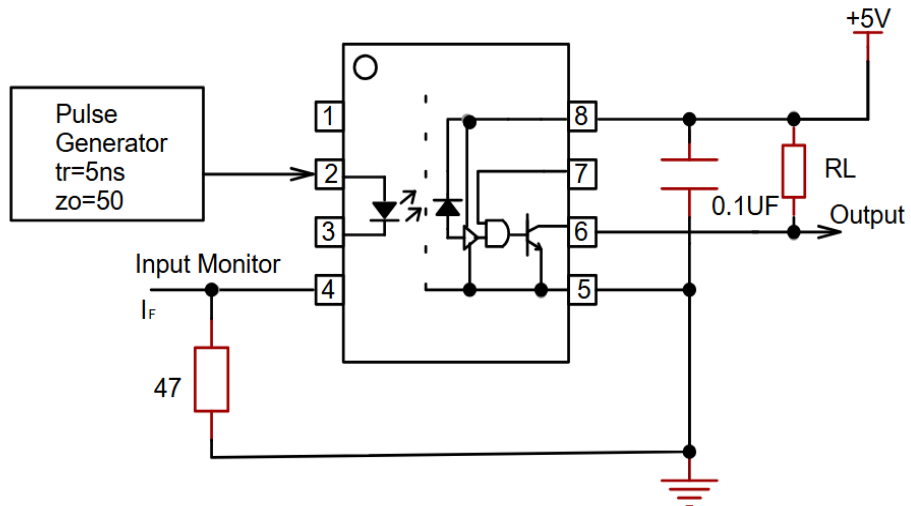
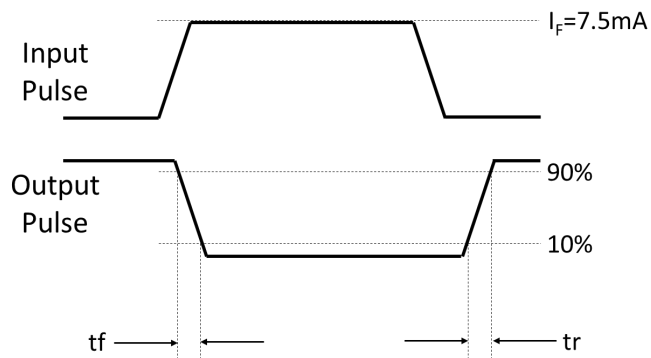
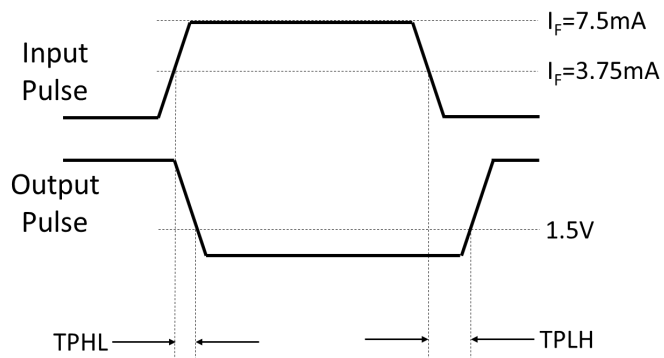


Fig.24 Waveforms of TPHL, TPLH, tr, tf



TEST CIRCUITS

Fig.25 Test Circuits for TEHL, TELH

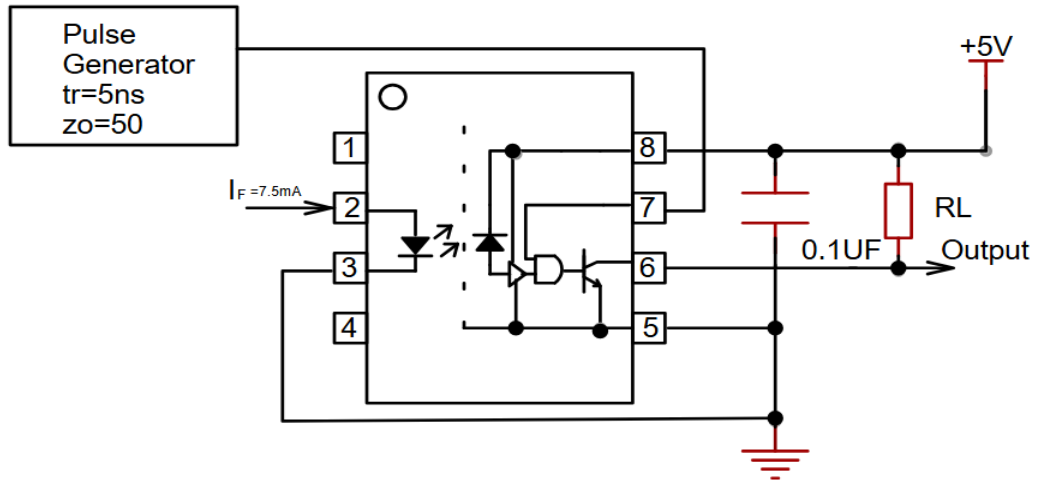
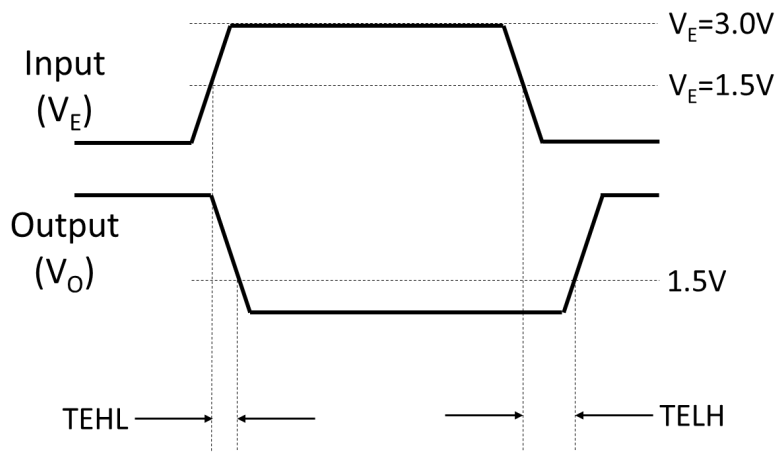


Fig.26 Waveforms of TEHL, TELH



TEST CIRCUITS

Fig.27 Test Circuits for Common Mode Transient Immunity

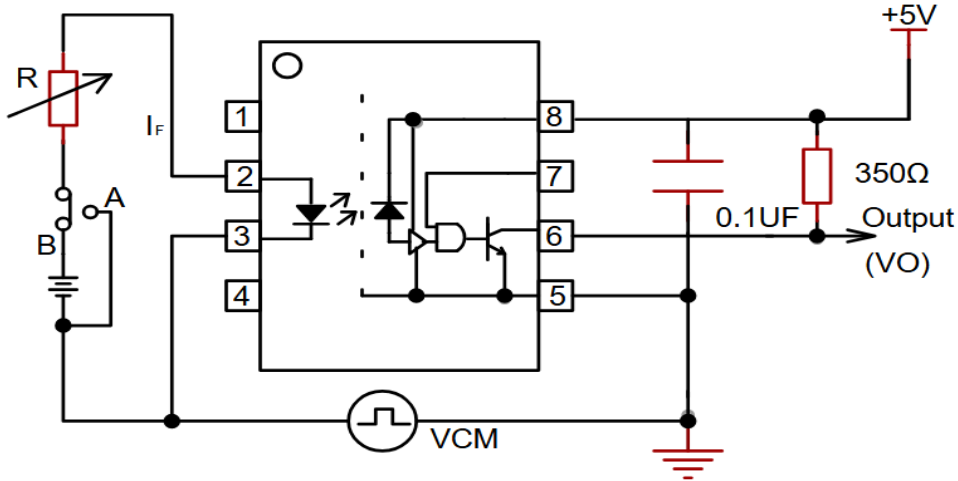
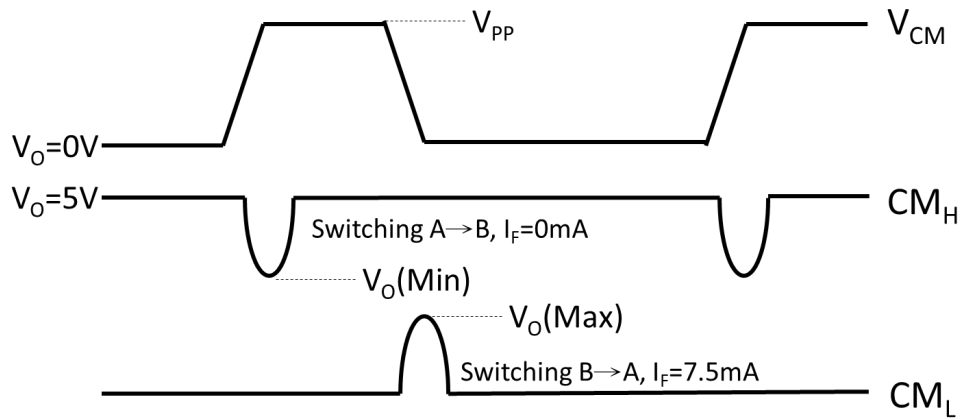
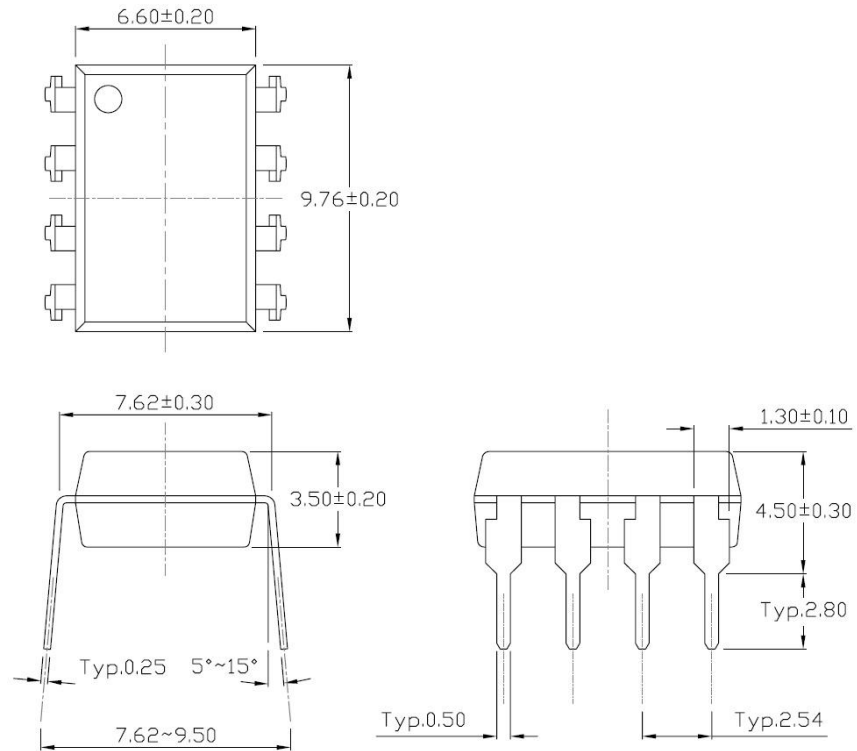


Fig.28 Waveforms of Common Mode Transient Immunity

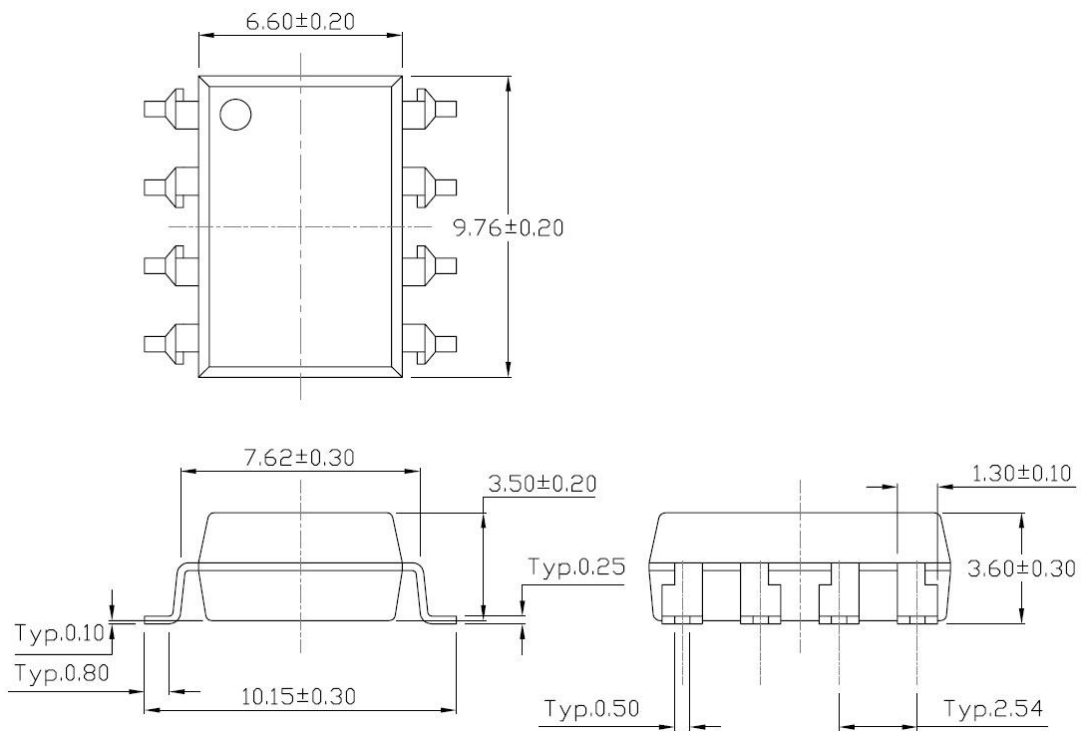


PACKAGE DIMENSIONS Dimensions in mm unless otherwise stated

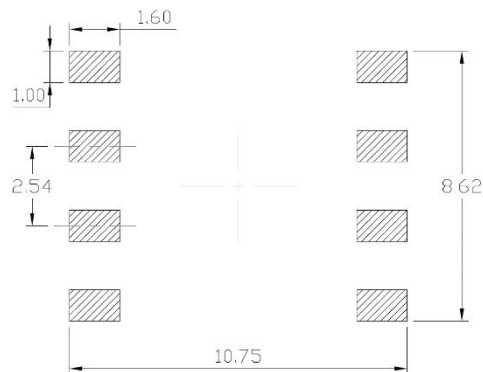
DIP-8



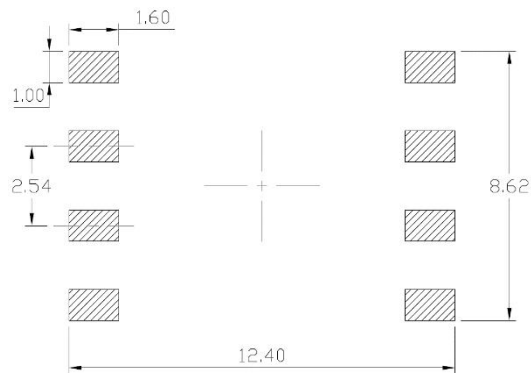
SMD-8



Recommended Solder Mask Dimensions in mm unless otherwise stated

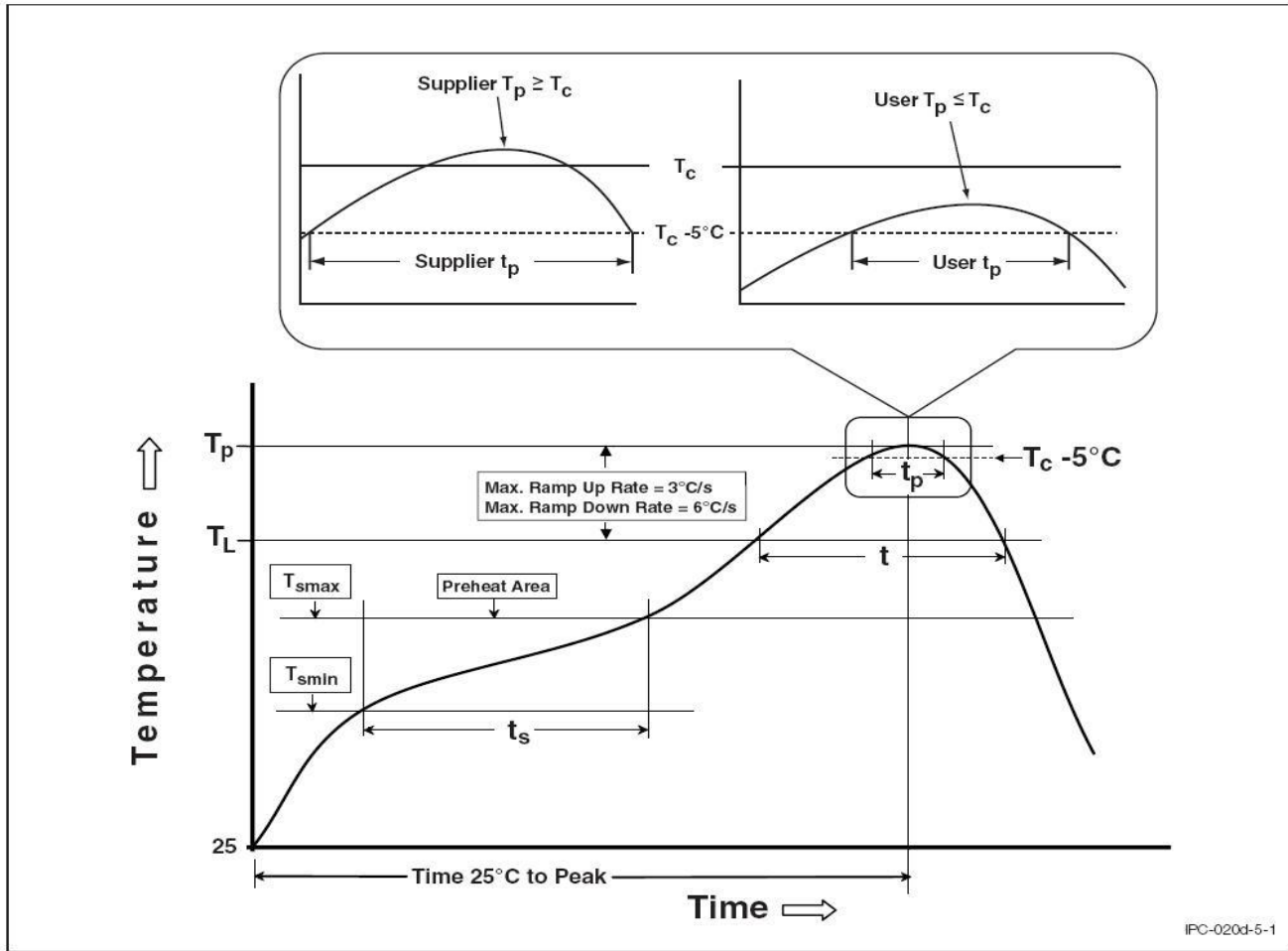


Surface Mount Lead Forming & Surface Mount (Low Profile) Lead Forming



Surface Mount (Gullwing) Lead Forming

REFLOW INFORMATION



REFLOW PROFILE

Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (Tsmmin)	100	150°C
Temperature Max. (Tsmmax)	150	200°C
Time (ts) from (Tsmmin to Tsmmax)	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.