

**SINGLE-CHANNEL  
6N137  
HCPL-2601  
HCPL-2611**

**DUAL-CHANNEL  
HCPL-2630  
HCPL-2631**

**DESCRIPTION**

The 6N137, HCPL-2601/2611 single-channel and HCPL-2630/2631 dual-channel optocouplers consist of a 850 nm AlGaAs LED, optically coupled to a very high speed integrated photodetector logic gate with a strobable output. This output features an open collector, thereby permitting wired OR outputs. The coupled parameters are guaranteed over the temperature range of -40°C to +85°C. A maximum input signal of 5 mA will provide a minimum output sink current of 13 mA (fan out of 8).

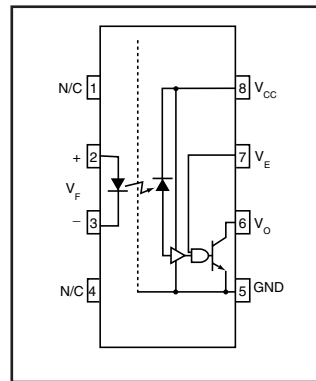
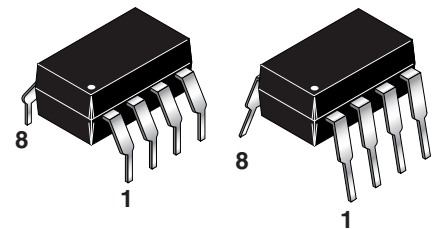
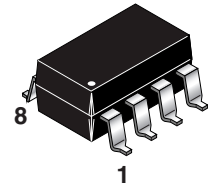
An internal noise shield provides superior common mode rejection of typically 10 kV/μs. The HCPL-2601 and HCPL-2631 has a minimum CMR of 5 kV/μs. The HCPL-2611 has a minimum CMR of 10 kV/μs.

**FEATURES**

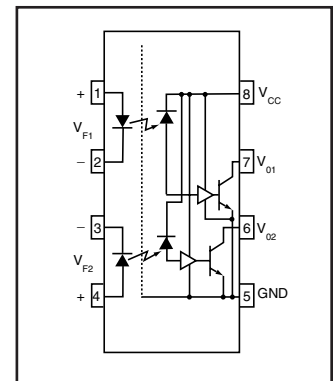
- Very high speed-10 MBit/s
- Superior CMR-10 kV/μs
- Double working voltage-480V
- Fan-out of 8 over -40°C to +85°C
- Logic gate output
- Storable output
- Wired OR-open collector
- U.L. recognized (File # E90700)

**APPLICATIONS**

- Ground loop elimination
- LSTTL to TTL, LSTTL or 5-volt CMOS
- Line receiver, data transmission
- Data multiplexing
- Switching power supplies
- Pulse transformer replacement
- Computer-peripheral interface



6N137  
HCPL-2601  
HCPL-2611



HCPL-2630  
HCPL-2631

**TRUTH TABLE**  
(Positive Logic)

Input	Enable	Output
H	H	L
L	H	H
H	L	H
L	L	H
H	NC	L
L	NC	H

A 0.1 μF bypass capacitor must be connected between pins 8 and 5.  
(See note 1)

**SINGLE-CHANNEL**

**6N137  
HCPL-2601  
HCPL-2611**

**DUAL-CHANNEL**

**HCPL-2630  
HCPL-2631**

**ABSOLUTE MAXIMUM RATINGS** (No derating required up to 85°C)

Parameter	Symbol	Value	Units
Storage Temperature	$T_{STG}$	-55 to +125	°C
Operating Temperature	$T_{OPR}$	-40 to +85	°C
Lead Solder Temperature	$T_{SOL}$	260 for 10 sec	°C
<b>EMITTER</b>			
DC/Average Forward Current	$I_F$	50	mA
Input Current		30	
Enable Input Voltage	$V_E$	5.5	V
Not to exceed $V_{CC}$ by more than 500 mV			
Reverse Input Voltage	$V_R$	5.0	V
Power Dissipation	$P_I$	100	mW
		45	
<b>DETECTOR</b>			
Supply Voltage	$V_{CC}$ (1 minute max)	7.0	V
Output Current	$I_O$	50	mA
		50	
Output Voltage	$V_O$	7.0	V
Collector Output Power Dissipation	$P_O$	85	mW
		60	

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Min	Max	Units
Input Current, Low Level	$I_{FL}$	0	250	μA
Input Current, High Level	$I_{FH}$	*6.3	15	mA
Supply Voltage, Output	$V_{CC}$	4.5	5.5	V
Enable Voltage, Low Level	$V_{EL}$	0	0.8	V
Enable Voltage, High Level	$V_{EH}$	2.0	$V_{CC}$	V
Low Level Supply Current	$T_A$	-40	+85	°C
Fan Out (TTL load)	N		8	

\* 6.3 mA is a guard banded value which allows for at least 20 % CTR degradation. Initial input current threshold value is 5.0 mA or less

**SINGLE-CHANNEL**

**6N137  
HCPL-2601  
HCPL-2611**

**DUAL-CHANNEL**

**HCPL-2630  
HCPL-2631**

**ELECTRICAL CHARACTERISTICS** ( $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$  Unless otherwise specified.)

**INDIVIDUAL COMPONENT CHARACTERISTICS**

Parameter	Test Conditions	Symbol	Min	Typ**	Max	Unit
<b>EMITTER</b>	( $I_F = 10\text{ mA}$ )				1.8	
Input Forward Voltage	$T_A = 25^\circ\text{C}$	$V_F$		1.4	1.75	V
Input Reverse Breakdown Voltage	( $I_R = 10\ \mu\text{A}$ )	$B_{VR}$	5.0			V
Input Capacitance	( $V_F = 0$ , $f = 1\text{ MHz}$ )	$C_{IN}$		60		pF
Input Diode Temperature Coefficient	( $I_F = 10\text{ mA}$ )	$\Delta V_F/\Delta T_A$		-1.4		mV/ $^\circ\text{C}$
<b>DETECTOR</b>						
High Level Supply Current	Single Channel ( $V_{CC} = 5.5\text{ V}$ , $I_F = 0\text{ mA}$ ) Dual Channel ( $V_E = 0.5\text{ V}$ )	$I_{CCH}$		7	10	mA
Low Level Supply Current	Single Channel ( $V_{CC} = 5.5\text{ V}$ , $I_F = 10\text{ mA}$ ) Dual Channel ( $V_E = 0.5\text{ V}$ )	$I_{CCL}$		9	13	mA
Low Level Enable Current	( $V_{CC} = 5.5\text{ V}$ , $V_E = 0.5\text{ V}$ )	$I_{EL}$		-0.8	-1.6	mA
High Level Enable Current	( $V_{CC} = 5.5\text{ V}$ , $V_E = 2.0\text{ V}$ )	$I_{EH}$		-0.6	-1.6	mA
High Level Enable Voltage	( $V_{CC} = 5.5\text{ V}$ , $I_F = 10\text{ mA}$ )	$V_{EH}$	2.0			V
Low Level Enable Voltage	( $V_{CC} = 5.5\text{ V}$ , $I_F = 10\text{ mA}$ ) (Note 3)	$V_{EL}$			0.8	V

**SWITCHING CHARACTERISTICS** ( $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{CC} = 5\text{ V}$ ,  $I_F = 7.5\text{ mA}$  Unless otherwise specified.)

AC Characteristics	Test Conditions	Symbol	Min	Typ**	Max	Unit
Propagation Delay Time to Output High Level	(Note 4) ( $T_A = 25^\circ\text{C}$ ) ( $R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ ) (Fig. 12)	$T_{PLH}$	20	45	75	ns
Propagation Delay Time to Output Low Level	(Note 5) ( $T_A = 25^\circ\text{C}$ ) ( $R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ ) (Fig. 12)	$T_{PHL}$	25	45	75	ns
Pulse Width Distortion	( $R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ ) (Fig. 12)	$ T_{PHL} - T_{PLH} $		3	35	ns
Output Rise Time (10-90%)	( $R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ ) (Note 6) (Fig. 12)	$t_r$		50		ns
Output Fall Time (90-10%)	( $R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ ) (Note 7) (Fig. 12)	$t_f$		12		ns
Enable Propagation Delay Time to Output High Level	( $I_F = 7.5\text{ mA}$ , $V_{EH} = 3.5\text{ V}$ ) ( $R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ ) (Note 8) (Fig. 13)	$t_{ELH}$		20		ns
Enable Propagation Delay Time to Output Low Level	( $I_F = 7.5\text{ mA}$ , $V_{EH} = 3.5\text{ V}$ ) ( $R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ ) (Note 9) (Fig. 13)	$t_{EHL}$		20		ns
Common Mode Transient Immunity (at Output High Level)	( $T_A = 25^\circ\text{C}$ ) $ V_{CM}  = 50\text{ V}$ , (Peak) ( $I_F = 0\text{ mA}$ , $V_{OH}(\text{Min.}) = 2.0\text{ V}$ ) 6N137, HCPL-2630 ( $R_L = 350\ \Omega$ ) (Note 10) HCPL-2601, HCPL-2631 (Fig. 14) HCPL-2611 $ V_{CM}  = 400\text{ V}$	$ CM_H $		10,000		V/ $\mu\text{s}$
Common Mode Transient Immunity (at Output Low Level)	( $R_L = 350\ \Omega$ ) ( $I_F = 7.5\text{ mA}$ , $V_{OL}(\text{Max.}) = 0.8\text{ V}$ ) 6N137, HCPL-2630 $ V_{CM}  = 50\text{ V}$ (Peak) HCPL-2601, HCPL-2631 ( $T_A = 25^\circ\text{C}$ ) (Note 11) (Fig. 14) HCPL-2611 ( $T_A = 25^\circ\text{C}$ ) $ V_{CM}  = 400\text{ V}$	$ CM_L $		10,000		V/ $\mu\text{s}$
			5000	10,000		
			10,000	15,000		

**SINGLE-CHANNEL**

**6N137  
HCPL-2601  
HCPL-2611**

**DUAL-CHANNEL**

**HCPL-2630  
HCPL-2631**

<b>TRANSFER CHARACTERISTICS</b> ( $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ Unless otherwise specified.)						
DC Characteristics	Test Conditions	Symbol	Min	Typ**	Max	Unit
High Level Output Current	( $V_{CC} = 5.5\text{ V}$ , $V_O = 5.5\text{ V}$ ) ( $I_F = 250\ \mu\text{A}$ , $V_E = 2.0\text{ V}$ ) (Note 2)	$I_{OH}$			100	$\mu\text{A}$
Low Level Output Current	( $V_{CC} = 5.5\text{ V}$ , $I_F = 5\text{ mA}$ ) ( $V_E = 2.0\text{ V}$ , $I_{CL} = 13\text{ mA}$ ) (Note 2)	$V_{OL}$		.35	0.6	V
Input Threshold Current	( $V_{CC} = 5.5\text{ V}$ , $V_O = 0.6\text{ V}$ , $V_E = 2.0\text{ V}$ , $I_{OL} = 13\text{ mA}$ )	$I_{FT}$		3	5	mA

<b>ISOLATION CHARACTERISTICS</b> ( $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ Unless otherwise specified.)						
Characteristics	Test Conditions	Symbol	Min	Typ**	Max	Unit
Input-Output Insulation Leakage Current	(Relative humidity = 45%) ( $T_A = 25^{\circ}\text{C}$ , $t = 5\text{ s}$ ) ( $V_{I-O} = 3000\text{ VDC}$ ) (Note 12)	$I_{I-O}$			1.0*	$\mu\text{A}$
Withstand Insulation Test Voltage	(RH < 50%, $T_A = 25^{\circ}\text{C}$ ) (Note 12) ( $t = 1\text{ min.}$ )	$V_{ISO}$	2500			$V_{RMS}$
Resistance (Input to Output)	( $V_{I-O} = 500\text{ V}$ ) (Note 12)	$R_{I-O}$		$10^{12}$		$\Omega$
Capacitance (Input to Output)	( $f = 1\text{ MHz}$ ) (Note 12)	$C_{I-O}$		0.6		pF

\*\* All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^{\circ}\text{C}$

**NOTES**

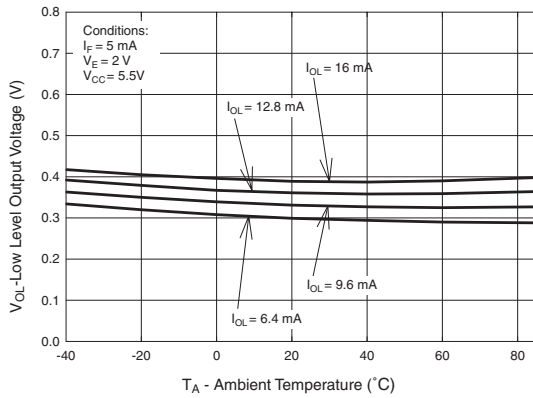
- The  $V_{CC}$  supply to each optoisolator must be bypassed by a  $0.1\ \mu\text{F}$  capacitor or larger. This can be either a ceramic or solid tantalum capacitor with good high frequency characteristic and should be connected as close as possible to the package  $V_{CC}$  and GND pins of each device.
- Each channel.
- Enable Input - No pull up resistor required as the device has an internal pull up resistor.
- $t_{PLH}$  - Propagation delay is measured from the 3.75 mA level on the HIGH to LOW transition of the input current pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.
- $t_{PHL}$  - Propagation delay is measured from the 3.75 mA level on the LOW to HIGH transition of the input current pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.
- $t_r$  - Rise time is measured from the 90% to the 10% levels on the LOW to HIGH transition of the output pulse.
- $t_f$  - Fall time is measured from the 10% to the 90% levels on the HIGH to LOW transition of the output pulse.
- $t_{ELH}$  - Enable input propagation delay is measured from the 1.5 V level on the HIGH to LOW transition of the input voltage pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.
- $t_{EHL}$  - Enable input propagation delay is measured from the 1.5 V level on the LOW to HIGH transition of the input voltage pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.
- $CM_H$  - The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the high state (i.e.,  $V_{OUT} > 2.0\text{ V}$ ). Measured in volts per microsecond ( $\text{V}/\mu\text{s}$ ).
- $CM_L$  - The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the low output state (i.e.,  $V_{OUT} < 0.8\text{ V}$ ). Measured in volts per microsecond ( $\text{V}/\mu\text{s}$ ).
- Device considered a two-terminal device: Pins 1,2,3 and 4 shorted together, and Pins 5,6,7 and 8 shorted together.

**SINGLE-CHANNEL  
6N137  
HCPL-2601  
HCPL-2611**

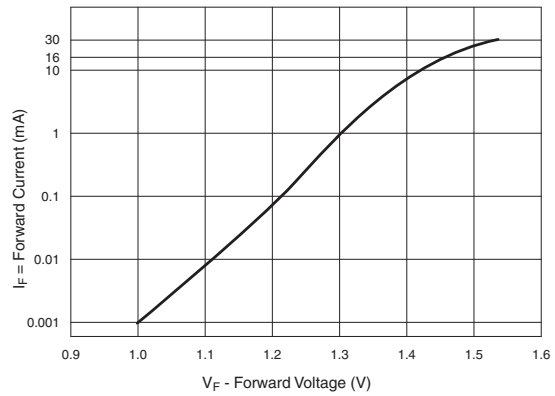
**DUAL-CHANNEL  
HCPL-2630  
HCPL-2631**

**TYPICAL PERFORMANCE CURVES**

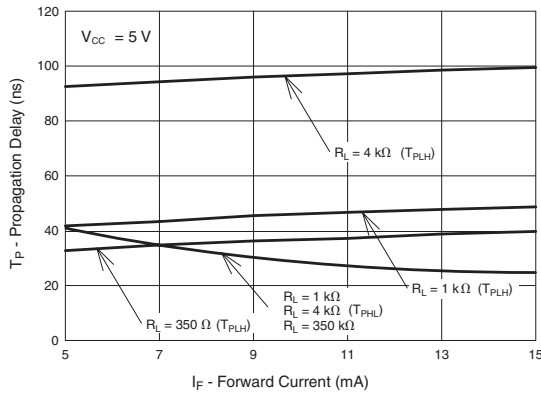
**Fig.1 Low Level Output Voltage vs. Ambient Temperature**



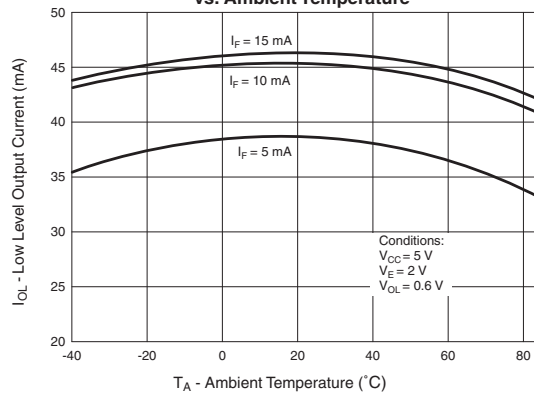
**Fig. 2 Input Diode Forward Voltage vs. Forward Current**



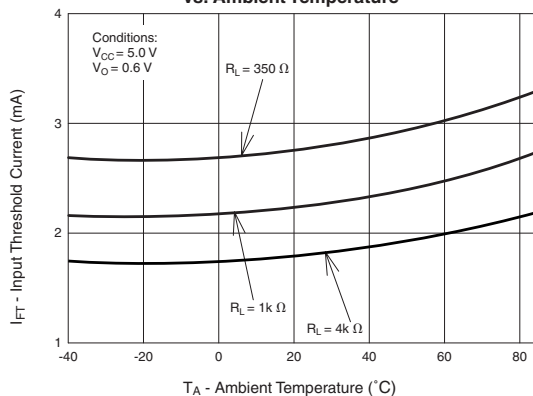
**Fig.3 Switching Time vs. Forward Current**



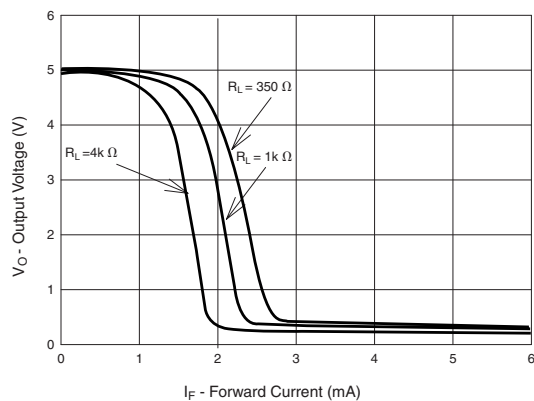
**Fig. 4 Low Level Output Current vs. Ambient Temperature**



**Fig. 5 Input Threshold Current vs. Ambient Temperature**



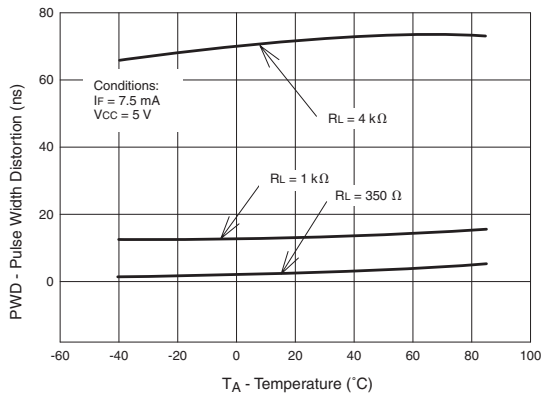
**Fig. 6 Output Voltage vs. Input Forward Current**



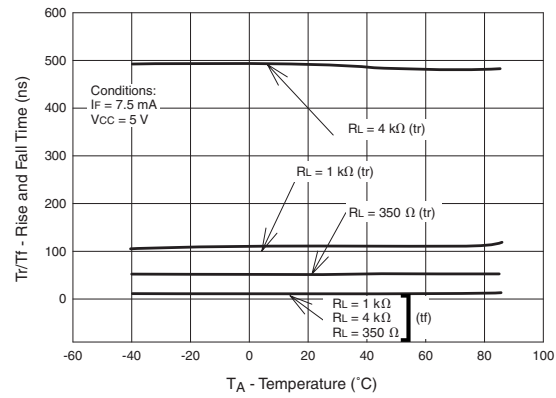
**SINGLE-CHANNEL**  
**6N137**  
**HCPL-2601**  
**HCPL-2611**

**DUAL-CHANNEL**  
**HCPL-2630**  
**HCPL-2631**

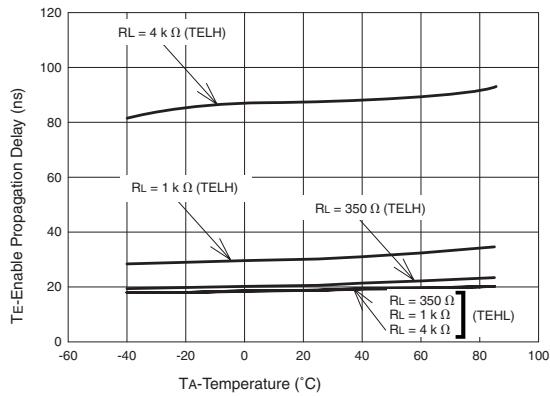
**Fig. 7 Pulse Width Distortion vs. Temperature**



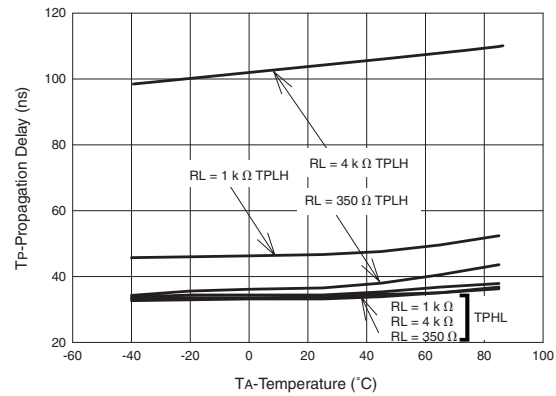
**Fig. 8 Rise and Fall Time vs. Temperature**



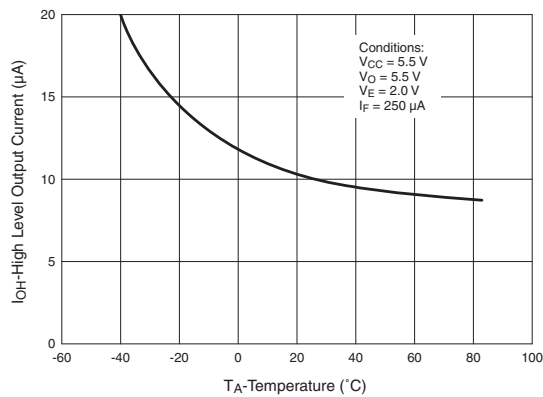
**Fig. 9 Enable Propagation Delay vs. Temperature**



**Fig. 10 Switching Time vs. Temperature**

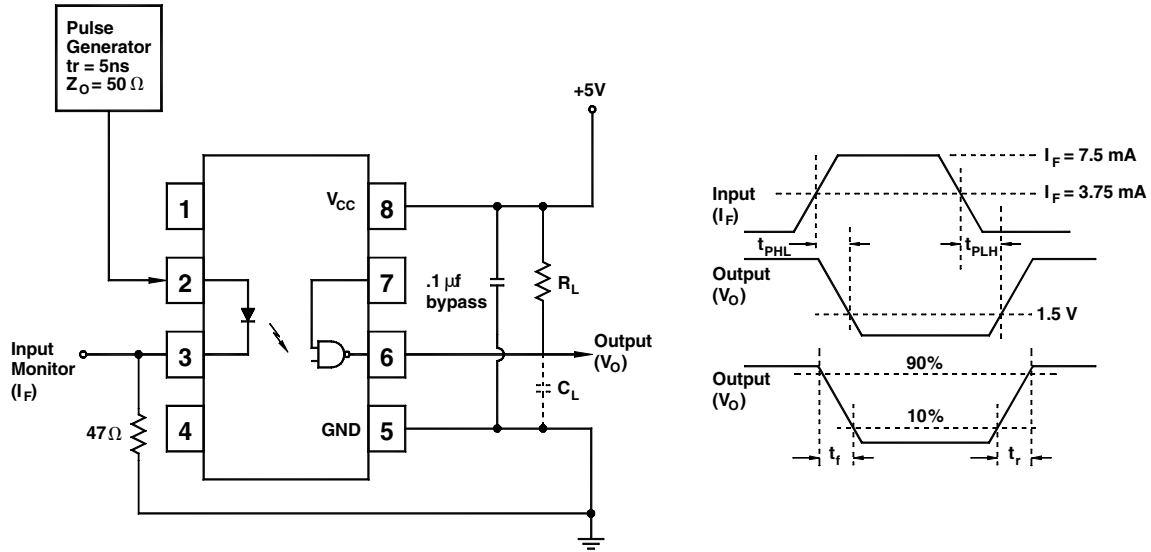


**Fig. 11 High Level Output Current vs. Temperature**

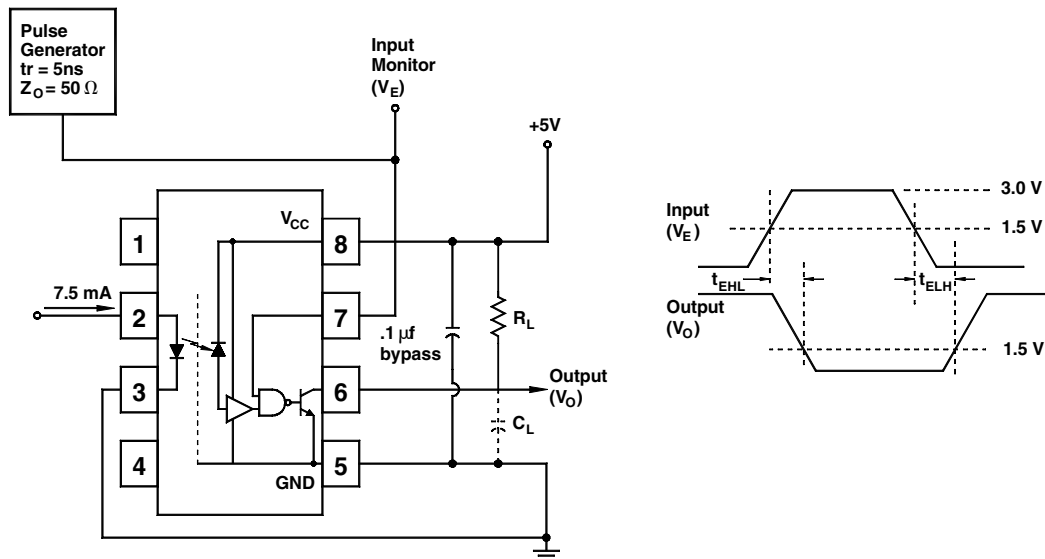


**SINGLE-CHANNEL**  
**6N137**  
**HCPL-2601**  
**HCPL-2611**

**DUAL-CHANNEL**  
**HCPL-2630**  
**HCPL-2631**



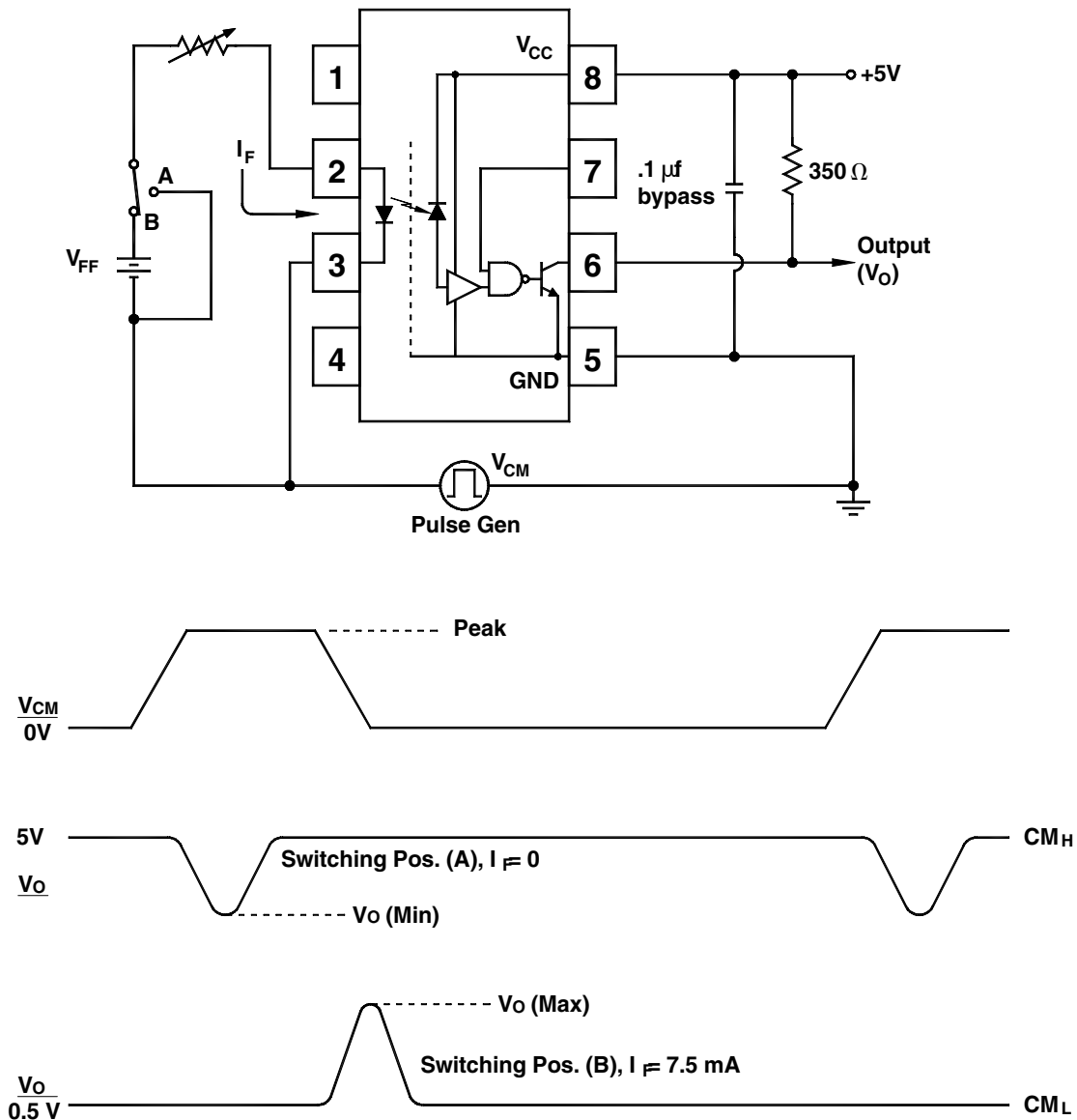
**Fig. 12 Test Circuit and Waveforms for t<sub>PLH</sub>, t<sub>PHL</sub>, t<sub>r</sub> and t<sub>f</sub>.**



**Fig. 13 Test Circuit t<sub>EHL</sub> and t<sub>ELH</sub>.**

**SINGLE-CHANNEL**  
6N137  
HCPL-2601  
HCPL-2611

**DUAL-CHANNEL**  
HCPL-2630  
HCPL-2631



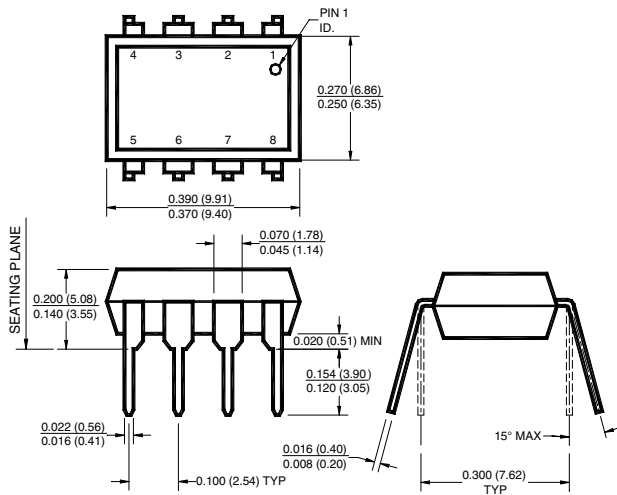
**Fig. 14 Test Circuit Common Mode Transient Immunity**



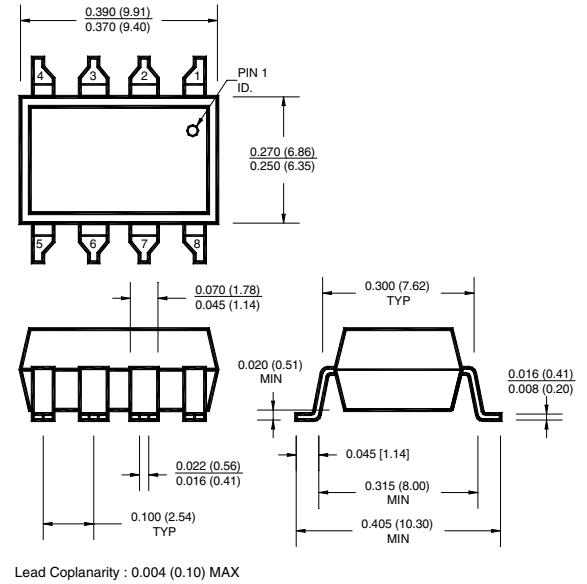
**SINGLE-CHANNEL  
6N137  
HCPL-2601  
HCPL-2611**

**DUAL-CHANNEL  
HCPL-2630  
HCPL-2631**

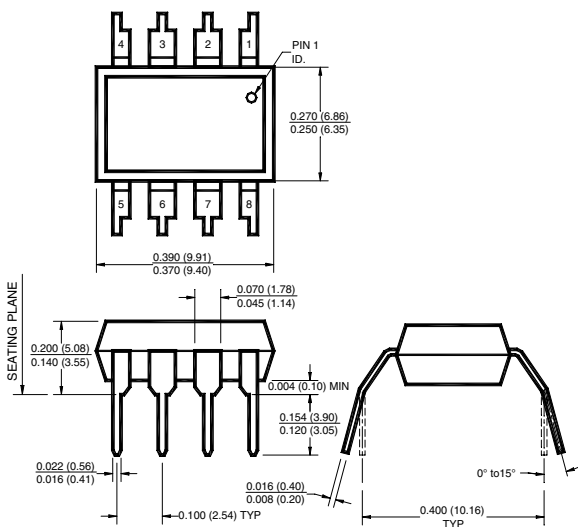
**Package Dimensions (Through Hole)**



**Package Dimensions (Surface Mount)**



**Package Dimensions (0.4" Lead Spacing)**



**NOTE**

All dimensions are in inches (millimeters)

**SINGLE-CHANNEL**  
6N137  
HCPL-2601  
HCPL-2611

**DUAL-CHANNEL**  
HCPL-2630  
HCPL-2631

**ORDERING INFORMATION**

Option	Order Entry Identifier	Description
S	.S	Surface Mount Lead Bend
SD	.SD	Surface Mount; Tape and reel
W	.W	0.4" Lead Spacing

**QT Carrier Tape Specifications ("D" Taping Orientation)**

