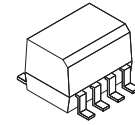


# 3.3 V Dual Channel High Speed - 10 MBit/s Logic Gate Optocouplers

## HCPL062N



SOIC8  
CASE 751DZ

### Description

The HCPL062N optocouplers consist of an AlGaAs LED, optically coupled to a very high speed integrated photo-detector logic gate consisting of bipolar transistors on a CMOS process for reduced power consumption. The output features an open collector, thereby permitting wired OR outputs. The devices are housed in a compact small-outline package. The coupled parameters are guaranteed over the temperature range of -40°C to +85°C. An internal noise shield and provides superior common mode rejection.

### Features

- Compact SO8 Package
- Very High Speed – 10 MBit/s
- Superior CMR – 25 kV/μs Minimum (1,000 Volts Common Mode)
- Logic Gate Output
- Wired OR–open Collector
- Fixed Threshold Detector Design Minimizes Thermal Impact on Switching Times
- U.L. Recognized (File # E90700)

### Applications

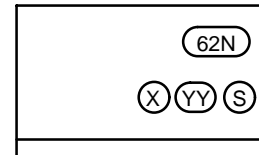
- Ground Loop Elimination
- Field Buses
- Line Receiver, Data Transmission
- Data Multiplexing
- Switching Power Supplies
- Pulse Transformer Replacement
- Computer–peripheral Interface
- Instrumentation Input/Output Isolation

### TRUTH TABLE (POSITIVE LOGIC)

Input	Output
H	L
L	H

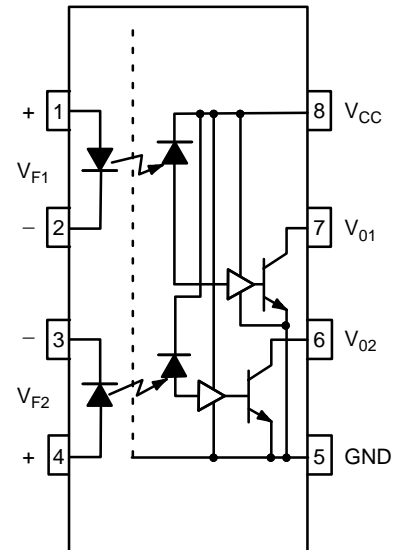
A 0.1 μF bypass capacitor must be connected between pins 8 and 5.

### MARKING DIAGRAM



- 62N = Device number
- X = One digit year code, e.g., '3'
- YY = Two digit work week ranging from '01' to '53'
- S = Assembly package code

### CIRCUIT DRAWING (Note 1)



#### NOTE:

1. The V<sub>CC</sub> supply to each optoisolator must be bypassed by a 0.1 μF capacitor or larger. This can be either a ceramic or solid tantalum capacitor with good high frequency characteristic and should be connected no further than 3 mm from the V<sub>CC</sub> and GND pins of each device.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

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

Symbol	Parameter	Value	Unit
T <sub>STG</sub>	Storage Temperature	-40 to +125	°C
T <sub>OPR</sub>	Operating Temperature	-40 to +85	°C

### EMITTER

I <sub>F</sub>	DC/Average Forward Input Current (Each Channel)	50	mA
V <sub>R</sub>	Reverse Input Voltage (Each Channel)	5.0	V
P <sub>I</sub>	Power Dissipation	45	mW

### DETECTOR

V <sub>CC</sub> (1 minute max)	Supply Voltage	7.0	V
I <sub>O</sub>	Output Current (Each Channel)	15	mA
V <sub>O</sub>	Output Voltage (Each Channel)	7.0	V
P <sub>O</sub>	Collector Output Power Dissipation	85	mW

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
I <sub>FL</sub>	Input Current, Low Level	0	250	μA
I <sub>FH</sub>	Input Current, High Level	6.3 (Note 2)	15	mA
V <sub>CC</sub>	Supply Voltage, Output	2.7	3.3	V
T <sub>A</sub>	Operating Temperature	-40	+85	°C
N	Fan Out (TTL load)	-	5	TTL Loads
R <sub>L</sub>	Output Pull-up	330	4K	Ω

2. 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

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = -40°C to +85°C, unless otherwise specified)

### INDIVIDUAL COMPONENT CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ (Note 3)	Max	Unit
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#### EMITTER

V <sub>F</sub>	Input Forward Voltage	I <sub>F</sub> = 10 mA	-	-	1.8	V
		I <sub>F</sub> = 10 mA, T <sub>A</sub> = 25°C	-	-	1.75	
B <sub>VR</sub>	Input Reverse Breakdown Voltage	I <sub>R</sub> = 10 μA	5.0	-	-	V
ΔV <sub>F</sub> /ΔT <sub>A</sub>	Input Diode Temperature Coefficient	I <sub>F</sub> = 10 mA	-	-1.5	-	mV/°C

#### DETECTOR

I <sub>CCH</sub>	High Level Supply Current	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = 3.3 V	-	7.1	10	mA
I <sub>CCL</sub>	Low Level Supply Current	I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 3.3 V	-	6.7	15	mA

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## SWITCHING CHARACTERISTICS ( $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ , $V_{CC} = 3.3\text{ V}$ , $I_F = 7.5\text{ mA}$ , unless otherwise specified)

Symbol	AC Characteristics	Test Conditions	Min	Typ (Note 3)	Max	Unit
$T_{PLH}$	Propagation Delay Time to Output High Level	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ Note 4, Figure 10	–	–	90	ns
$T_{PHL}$	Propagation Delay Time to Output Low Level	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ Note 5, Figure 10	–	–	75	ns
$ T_{PHL} - T_{PLH} $	Pulse Width Distortion	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ Figure 10	–	–	25	ns
$t_r$	Output Rise Time (10–90%)	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ Note 6, Figure 10	–	16	–	ns
$t_f$	Output Fall Time (90–10%)	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ Note 7, Figure 10	–	4	–	ns
$ CM_H $	Common Mode Transient Immunity (at Output High Level)	$R_L = 350\ \Omega$ , $T_A = 25^{\circ}\text{C}$ , $I_F = 0\text{ mA}$ , $V_{CC} = 3.3\text{ V}$ , $V_{O(\text{Min.})} = 2\text{ V}$ $ V_{CM}  = 1,000\text{ V}$ Notes 8, 11, Figure 11	25,000	–	–	V/ $\mu\text{s}$
$ CM_L $	Common Mode Transient Immunity (at Output Low Level)	$R_L = 350\ \Omega$ , $T_A = 25^{\circ}\text{C}$ , $I_F = 7.5\text{ mA}$ , $V_{CC} = 3.3\text{ V}$ , $V_{O(\text{Max.})} = 0.8\text{ V}$ $ V_{CM}  = 1,000\text{ V}$ Notes 9, 11, Figure 11	25,000	–	–	V/ $\mu\text{s}$

## TRANSFER CHARACTERISTICS ( $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ , unless otherwise specified)

Symbol	AC Characteristics	Test Conditions	Min	Typ (Note 3)	Max	Unit
$V_{OL}$	Low Level Output Voltage	$V_{CC} = 3.3\text{ V}$ , $I_F = 5\text{ mA}$ , $I_{OL} = 13\text{ mA}$	–	–	0.6	V
$I_{FT}$	Input Threshold Current	$V_{CC} = 3.3\text{ V}$ , $V_O = 0.6\text{ V}$ , $I_{OL} = 13\text{ mA}$	–	–	5	mA

## ISOLATION CHARACTERISTICS ( $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ , unless otherwise specified)

Symbol	AC Characteristics	Test Conditions	Min	Typ (Note 3)	Max	Unit
$I_{I-O}$	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 10	–	–	1.0	$\mu\text{A}$
$V_{ISO}$	Withstand Insulation Test Voltage	$R_H < 50\%$ , $T_A = 25^{\circ}\text{C}$ $I_{I-O} \leq 2\ \mu\text{A}$ , $t = 1\text{ min.}$ , Note 10	2500	–	–	$V_{RMS}$
$R_{I-O}$	Resistance (Input to Output)	$V_{I-O} = 500\text{ V}$ , Note 10	–	1012	–	$\Omega$
$C_{I-O}$	Capacitance (Input to Output)	$f = 1\text{ MHz}$ , Note 10	–	0.6	–	pF

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. All typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^{\circ}\text{C}$  unless otherwise specified.

4.  $t_{PLH}$  – 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.

5.  $t_{PHL}$  – 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.

6.  $t_r$  – Rise time is measured from the 90% to the 10% levels on the LOW to HIGH transition of the output pulse.

7.  $t_f$  – Fall time is measured from the 10% to the 90% levels on the HIGH to LOW transition of the output pulse.

8.  $CM_H$  – 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 (V/ $\mu\text{s}$ ).

9.  $CM_L$  – The maximum tolerable rate of fall 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 (V/ $\mu\text{s}$ ).

10. Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together, and Pins 5, 6, 7 and 8 shorted together.

11. The power supply bypass capacitors must be no further than 3 mm from the leads of the optocoupler. A low inductance ground plane width of with  $\leq 5\text{ nH}$  of series lead inductance is required.

TYPICAL PERFORMANCE CURVES

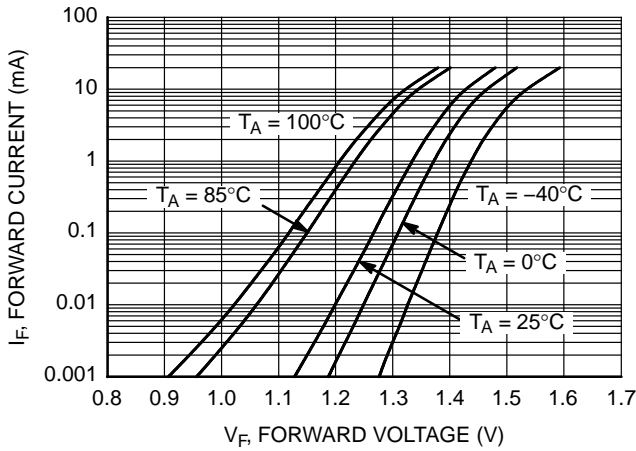


Figure 1. Forward Current vs. Forward Voltage

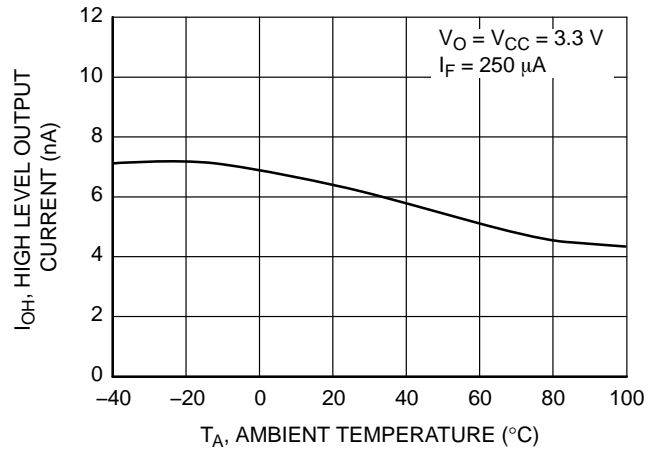


Figure 2. High Level Output Current vs. Ambient Temperature

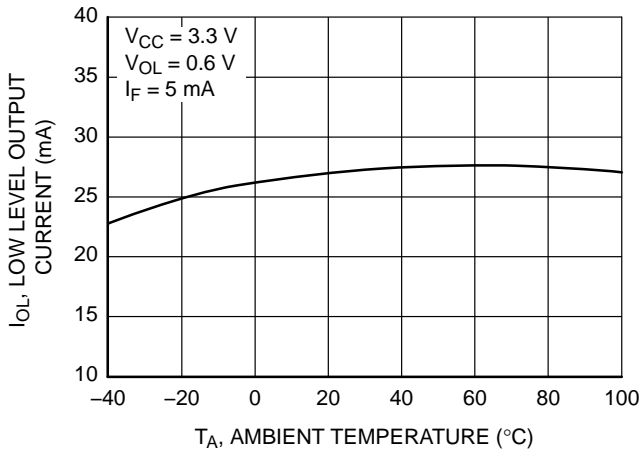


Figure 3. Low Level Output Current vs. Ambient Temperature

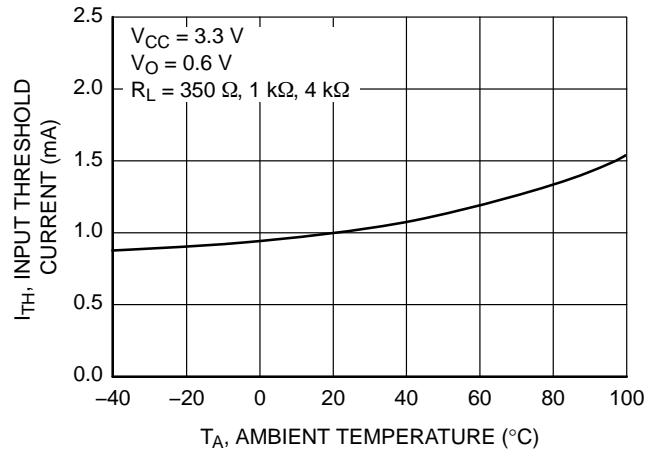


Figure 4. Input Threshold Current vs. Temperature

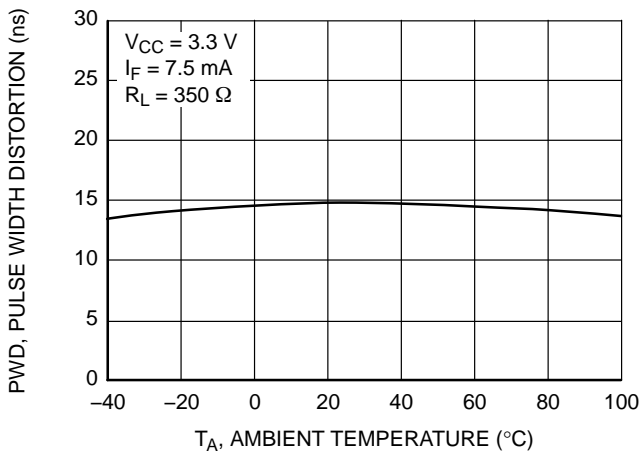


Figure 5. Pulse Width Distortion vs. Ambient Temperature

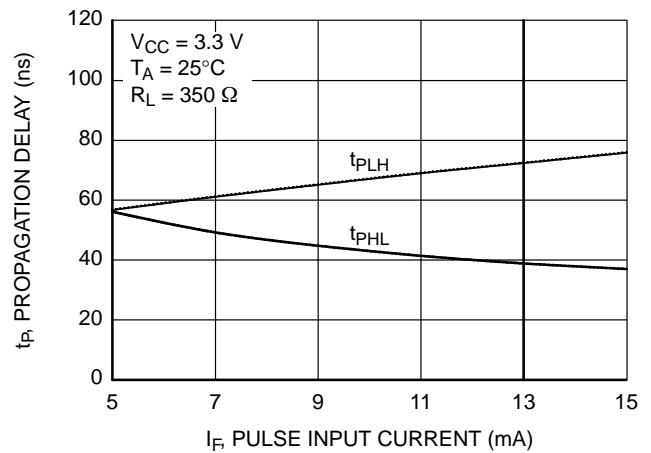
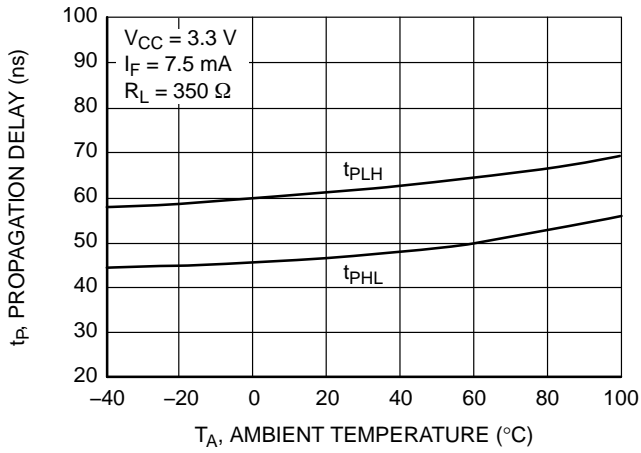


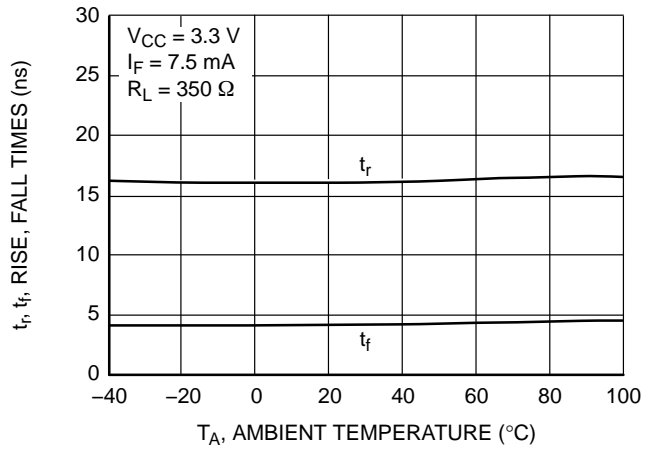
Figure 6. Propagation Delay vs. Pulse Input Current

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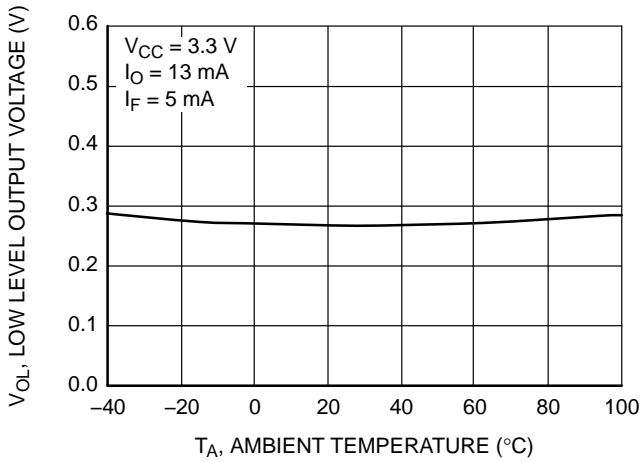
## TYPICAL PERFORMANCE CURVES (Continued)



**Figure 7. Propagation Delay vs. Ambient Temperature**



**Figure 8. Rise and Fall Times vs. Ambient Temperature**



**Figure 9. Low Level Output Voltage vs. Ambient Temperature**

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## TEST CIRCUITS

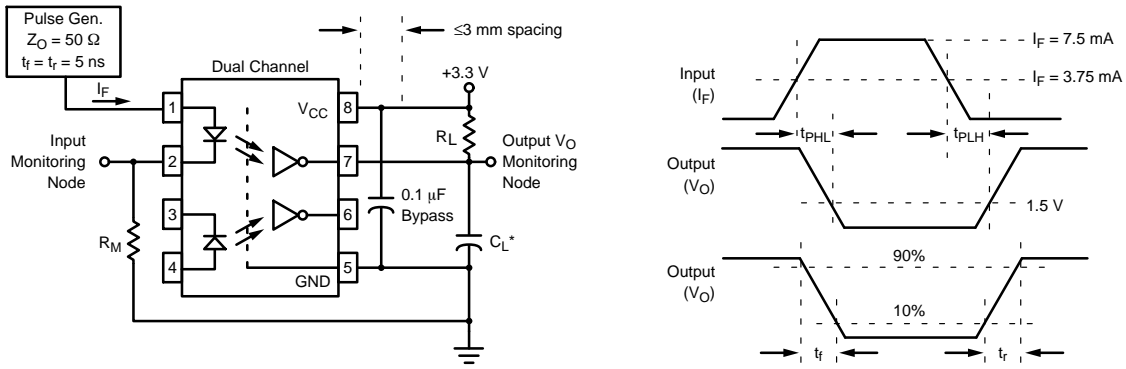


Figure 10. Test Circuit and Waveforms for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_r$  and  $t_f$

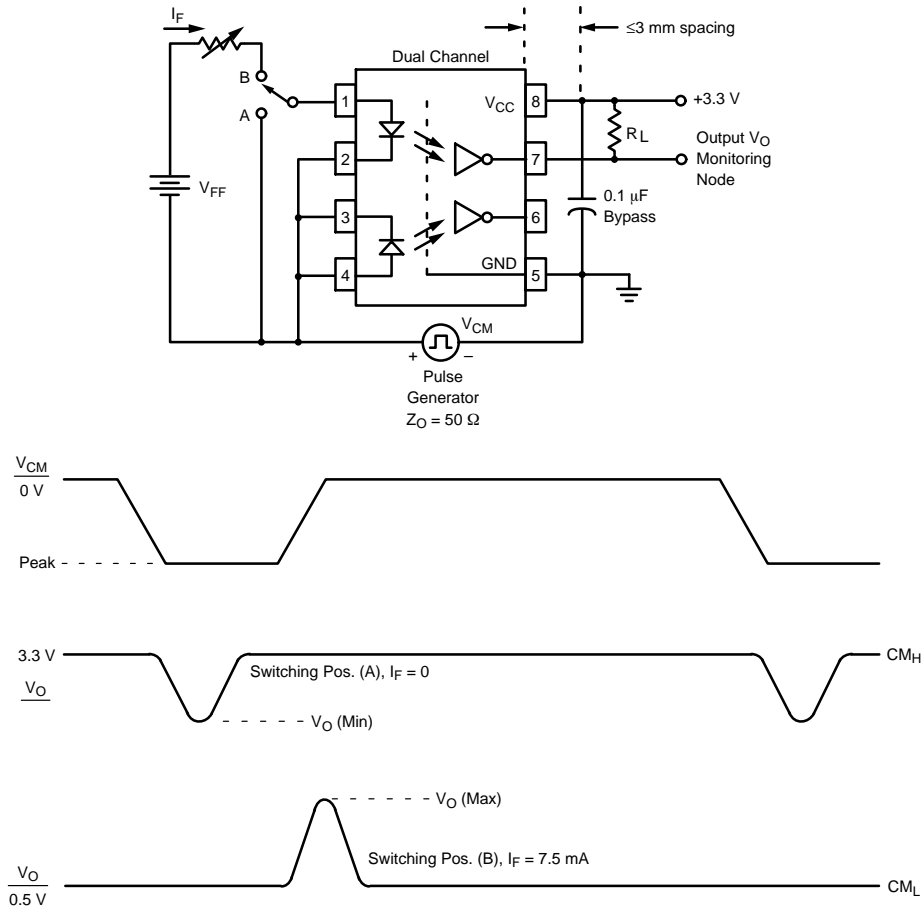


Figure 11. Test Circuit and Waveforms for Common Mode Transient Immunity

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## REFLOW PROFILE

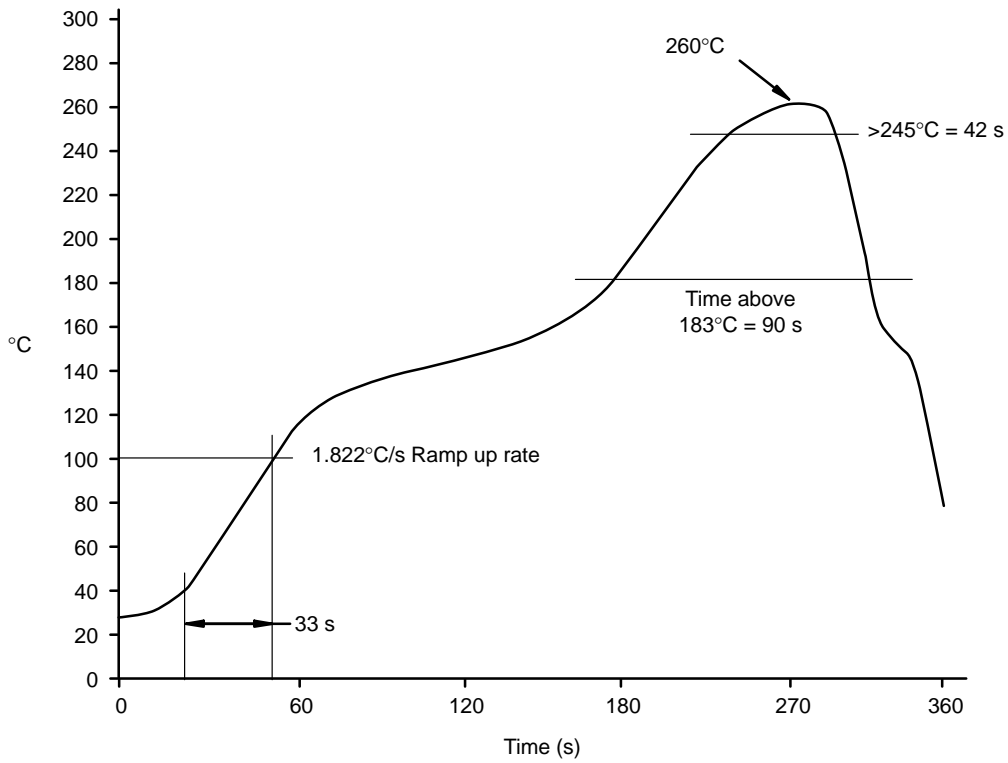


Figure 12. Reflow Profile

### ORDERING INFORMATION

Option	Order Entry Identifier	Package Type	Shipping <sup>†</sup>
No Suffix	HCPL062N	SOIC8 (Pb-Free)	50 Units / Tube
R2	HCPL062NR2		2500 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MECHANICAL CASE OUTLINE

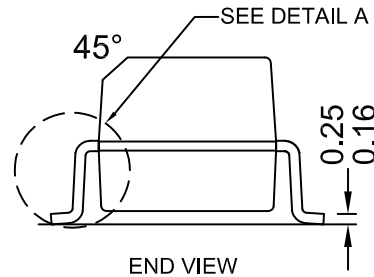
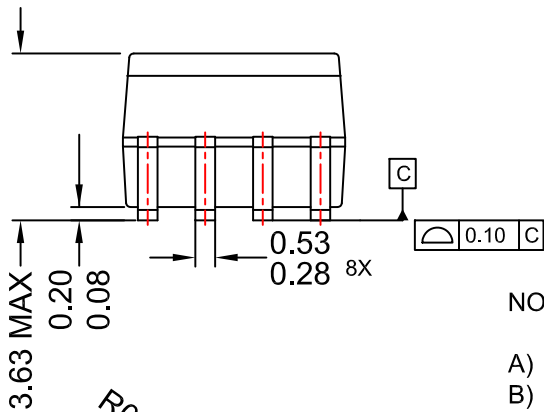
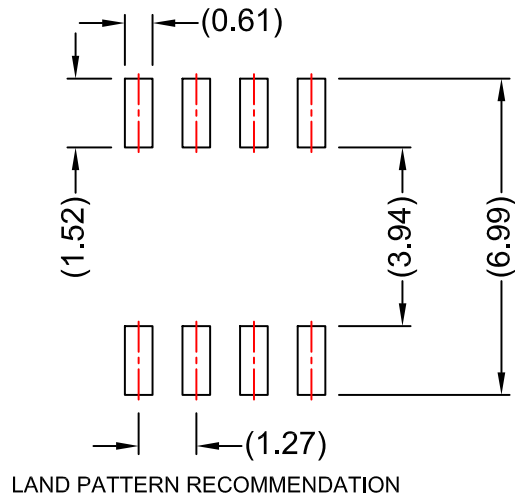
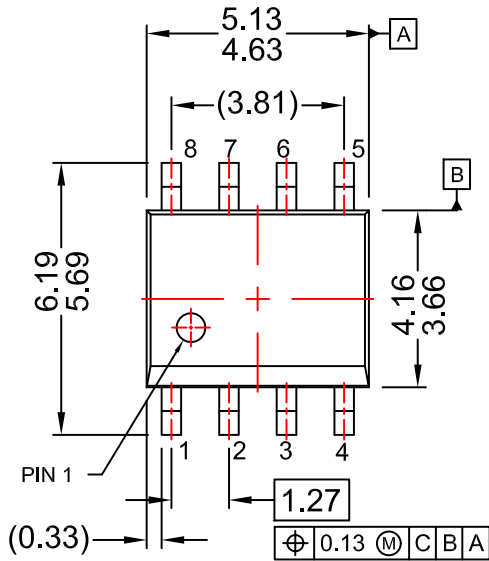
## PACKAGE DIMENSIONS

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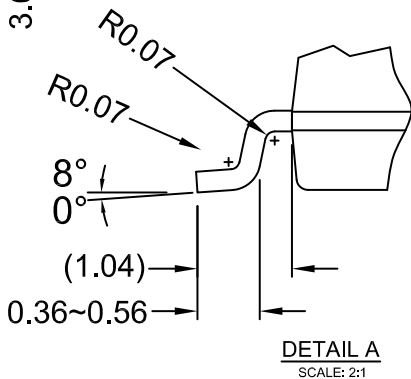
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**NOTES:**

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M.



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