FAIRCHILD

SEMICONDUCTOR®

July 2006

HCPL062N
3.3V Dual Channel High Speed-10 MBit/s Logic Gate Optocouplers

Features

■ Compact SO8 package

■ Very high speed – 10MBit/s

■ Superior CMR – 25kV/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
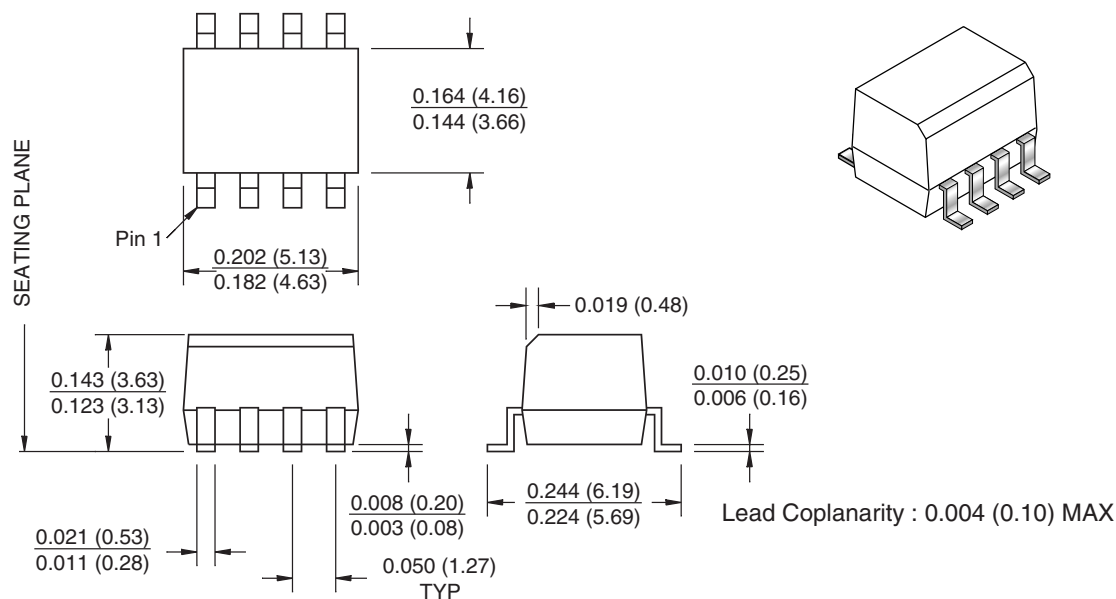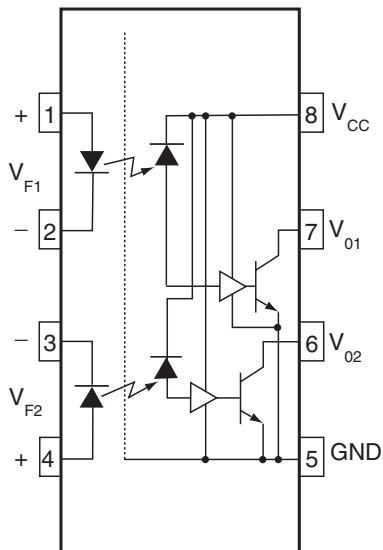
■ Instrumentation input/output isolation

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.

Package Dimensions

0.164 (4.16)
0.144 (3.66)

SEATING PLANE

Pin 1

0.202 (5.13)
0.182 (4.63)

0.019 (0.48)

0.143 (3.63)
0.123 (3.13)

0.010 (0.25)
0.006 (0.16)

0.008 (0.20)
0.003 (0.08)

0.244 (6.19)
0.224 (5.69)

0.021 (0.53)
0.011 (0.28)

0.050 (1.27)
TYP

Lead Coplanarity : 0.004 (0.10) MAX

Note:
All dimensions are in inches (millimeters)

Circuit Drawing[1]

Note:

1. The V_{CC} supply to each optoisolator must be bypassed by a 0.1µF 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 3mm from the V_{CC} and GND pins of each device.

Truth Table (Positive Logic)

Input	Output
H	L
L	H

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

Absolute Maximum Ratings (No derating required up to 85°C)

Symbol	Parameter	Value	Units
T_{STG}	Storage Temperature	-40 to +125	°C
T_{OPR}	Operating Temperature	-40 to +85	°C
EMITTER			
I_F	DC/Average Forward Input Current (each channel)	50	mA
V_R	Reverse Input Voltage (each channel)	5.0	V
P_I	Power Dissipation	45	mW
DETECTOR			
V_{CC} (1 minute max)	Supply Voltage	7.0	V
I_O	Output Current (each channel)	15	mA
V_O	Output Voltage (each channel)	7.0	V
P_O	Collector Output Power Dissipation	85	mW

Recommended Operating Conditions

Symbol	Parameter	Min.	Max.	Units
I_{FL}	Input Current, Low Level	0	250	µA
I_{FH}	Input Current, High Level	6.3[2]	15	mA
V_{CC}	Supply Voltage, Output	2.7	3.3	V
T_A	Operating Temperature	-40	+85	°C
N	Fan Out (TTL load)	–	5	TTL Loads
R_L	Output Pull-up	330	4K	Ω

Note:

2. 6.3mA is a guard banded value which allows for at least 20% CTR degradation. Initial input current threshold value is 5.0mA or less

Electrical Characteristics (T_A = -40°C to +85°C Unless otherwise specified.)

Individual Component Characteristics

Symbol	Parameter	Test Conditions		Min.	Typ.[3]	Max.	Unit
EMITTER							
V_F	Input Forward Voltage	I_F = 10mA		–	–	1.8	V
			T_A =25°C	–	–	1.75	
B_{VR}	Input Reverse Breakdown Voltage	I_R = 10µA		5.0	–	–	V
$\Delta V_F/\Delta T_A$	Input Diode Temperature Coefficient	I_F = 10mA		–	-1.5	–	mV/°C
DETECTOR							
I_{CCH}	High Level Supply Current	I_F = 0mA, V_{CC} = 3.3V		–	7.1	10	mA
I_{CCL}	Low Level Supply Current	I_F = 10mA, V_{CC} = 3.3V		–	6.7	15	mA

Switching Characteristics (T_A = -40°C to +85°C, V_{CC} = 3.3V, I_F = 7.5 mA Unless otherwise specified.)

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

Transfer Characteristics (T_A = -40°C to +85°C Unless otherwise specified.)

Symbol	DC Characteristics	Test Conditions	Min.	Typ.[3]	Max.	Unit
V_{OL}	Low Level Output Voltage	V_{CC} = 3.3V, I_F = 5mA, I_{OL} = 13mA	–	–	0.6	V
I_{FT}	Input Threshold Current	V_{CC} = 3.3V, V_O = 0.6V, I_{OL} = 13mA	–	–	5	mA

Isolation Characteristics (T_A = -40°C to +85°C Unless otherwise specified.)

Symbol	Characteristics	Test Conditions	Min.	Typ.[3]	Max.	Unit
I_{I-O}	Input-Output Insulation Leakage Current	Relative humidity = 45% T_A = 25°C, t = 5 sec. V_{I-O} = 3000 VDC, Note 10	–	–	1.0	µA
V_{ISO}	Withstand Insulation Test Voltage	R_H < 50%, T_A = 25°C $I_{I-O} \leq 2$µA, t = 1 min., Note 10	2500	–	–	V_{RMS}
R_{I-O}	Resistance (Input to Output)	V_{I-O} = 500V, Note 10	–	10^{12}	–	Ω
C_{I-O}	Capacitance (Input to Output)	f = 1MHz, Note 10	–	0.6	–	pF

Notes:
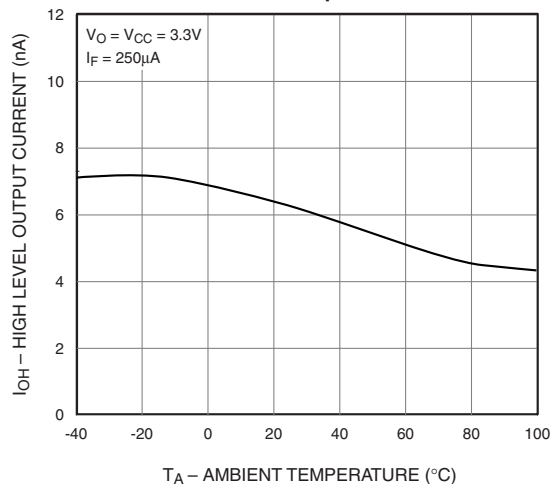
3. All typical values are at V_{CC} = 3.3V, T_A = 25°C unless otherwise specified.

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 1.5V 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 1.5V 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 V). Measured in volts per microsecond (V/µs).

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 V). Measured in volts per microsecond (V/µs).

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 3mm from the leads of the optocoupler. A low inductance ground plane width of with ≤ 5nHy of series lead inductance is required.
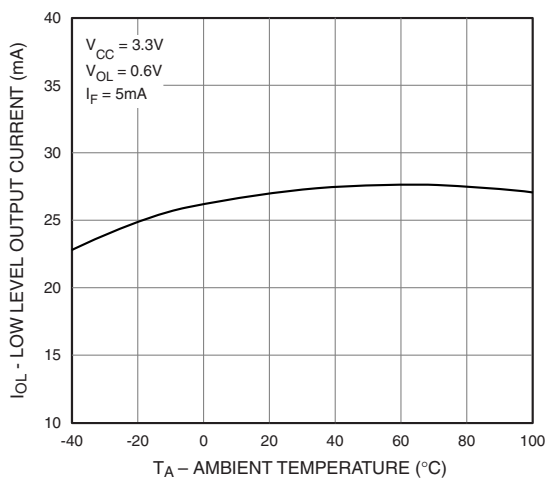
Typical Performance Curves
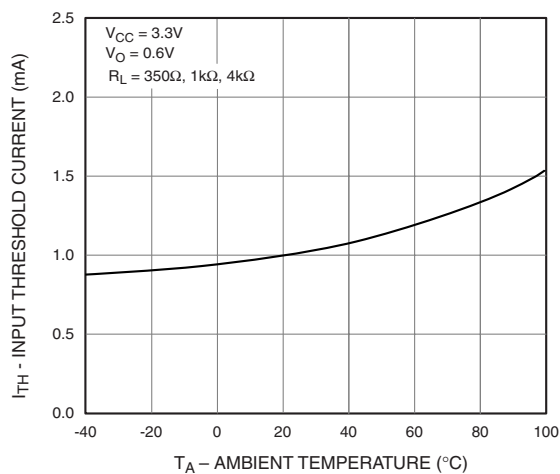
Fig. 1 Forward Current vs. Forward Voltage

Fig. 2 High Level Output Current vs. Ambient Temperature

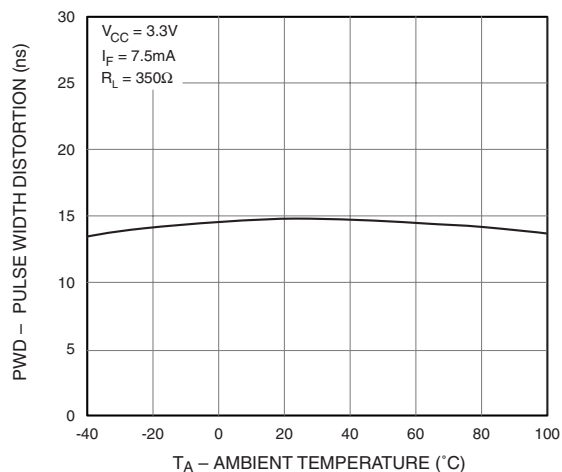### Fig. 3 Low Level Output Current vs. Ambient Temperature
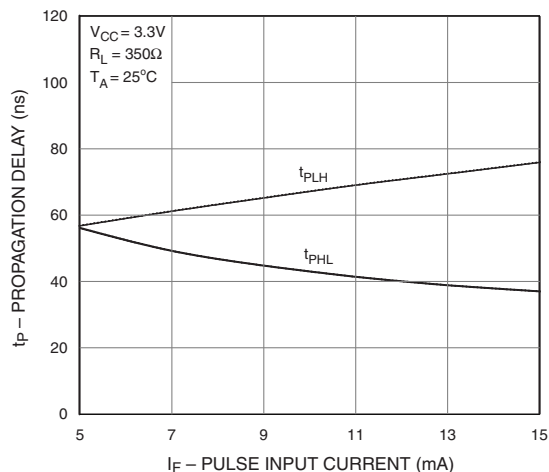

Fig. 4 Input Threshold Current vs. Temperature
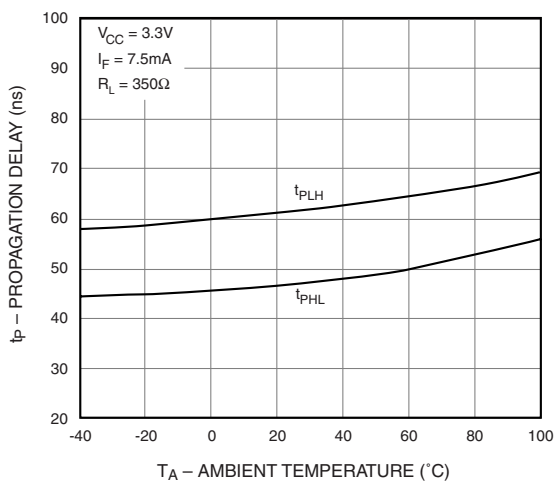
Typical Performance Curves (Continued)
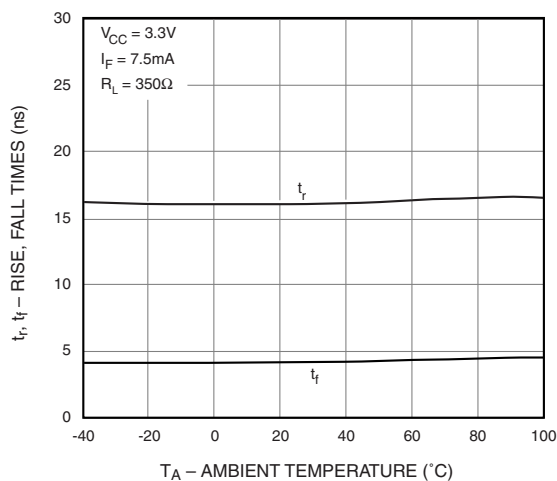
Fig. 5 Pulse Width Distortion vs. Ambient Temperature

V_{CC} = 3.3V
I_F = 7.5mA
R_L = 350Ω

PWD – PULSE WIDTH DISTORTION (ns)

T_A – AMBIENT TEMPERATURE (°C)

Fig. 6 Propagation Delay vs. Pulse Input Current

V_{CC} = 3.3V
R_L = 350Ω
T_A = 25°C

t_{PLH}

t_{PHL}

t_P – PROPAGATION DELAY (ns)

I_F – PULSE INPUT CURRENT (mA)

Fig. 7 Propagation Delay vs. Ambient Temperature

V_{CC} = 3.3V
I_F = 7.5mA
R_L = 350Ω

t_{PLH}

t_{PHL}

t_P – PROPAGATION DELAY (ns)

T_A – AMBIENT TEMPERATURE (°C)

Fig. 8 Rise and Fall Times vs. Ambient Temperature

V_{CC} = 3.3V
I_F = 7.5mA
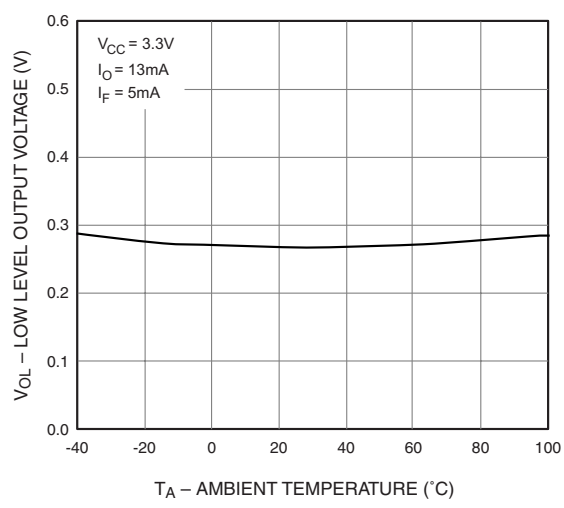R_L = 350Ω

t_r

t_f

t_r, t_f – RISE, FALL TIMES (ns)

T_A – AMBIENT TEMPERATURE (°C)

Typical Performance Curves (Continued)

Fig. 9 Low Level Output Voltage vs. Ambient Temperature

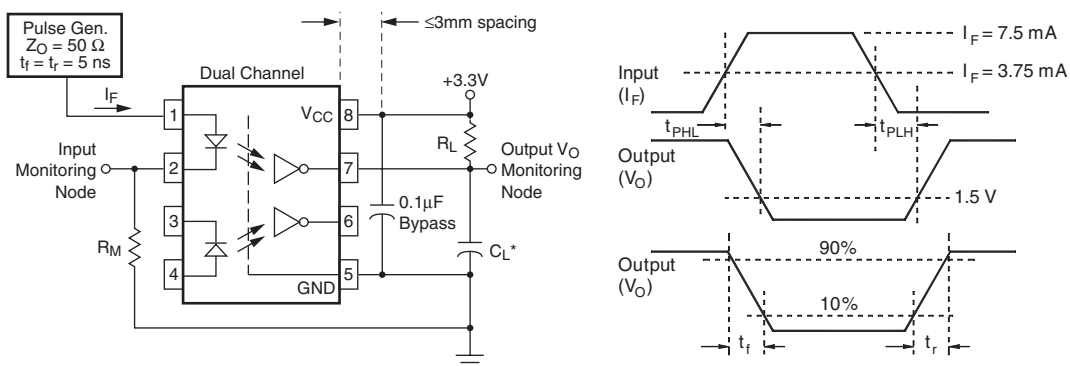$V_{CC} = 3.3V$
$I_O = 13mA$
$I_F = 5mA$

V_{OL} – LOW LEVEL OUTPUT VOLTAGE (V)
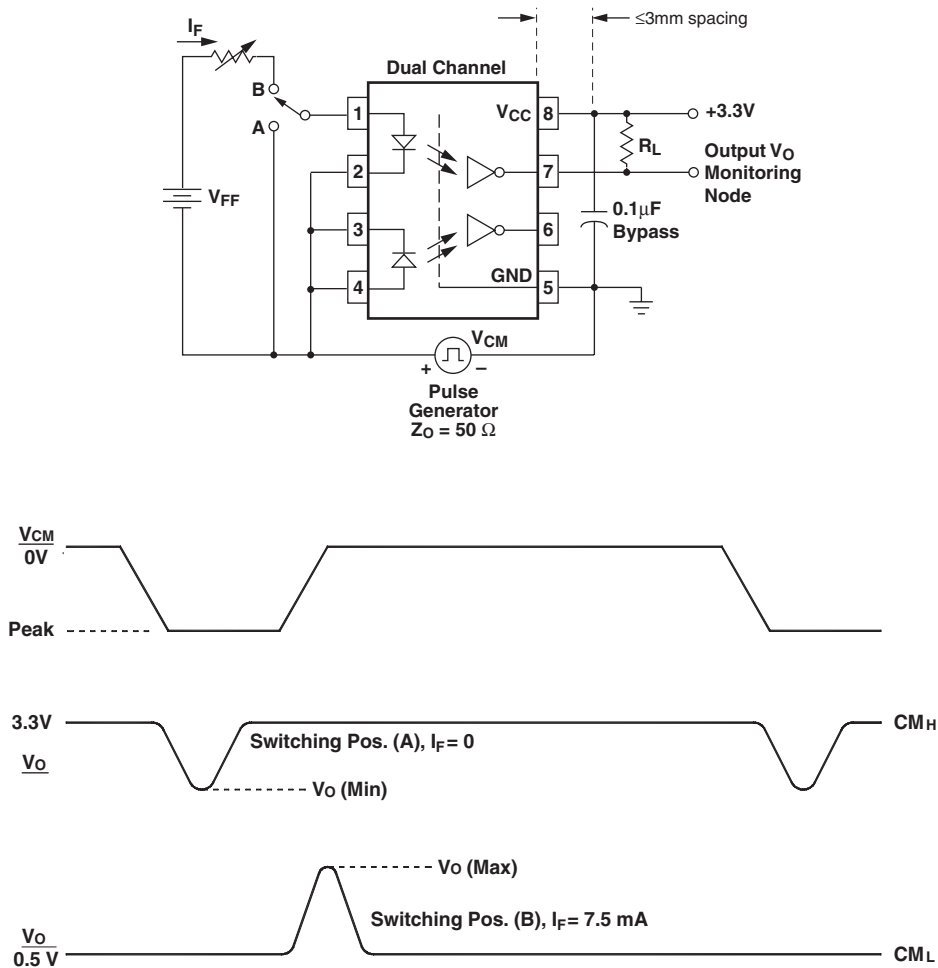
T_A – AMBIENT TEMPERATURE (˚C)

Test Circuits

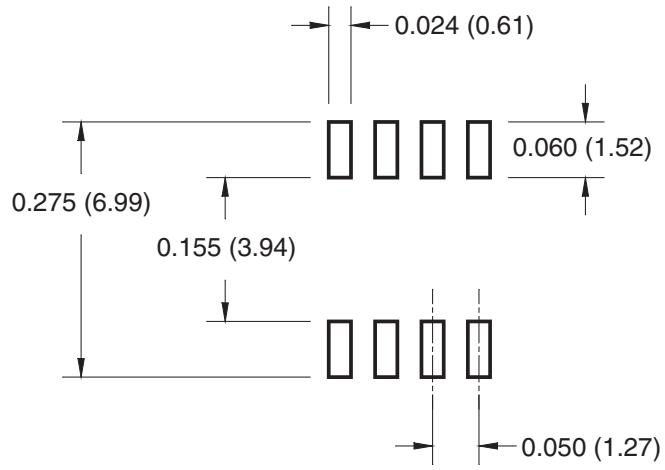### Fig. 10 Test Circuit and Waveforms for t_{PLH}, t_{PHL}, t_r and t_f

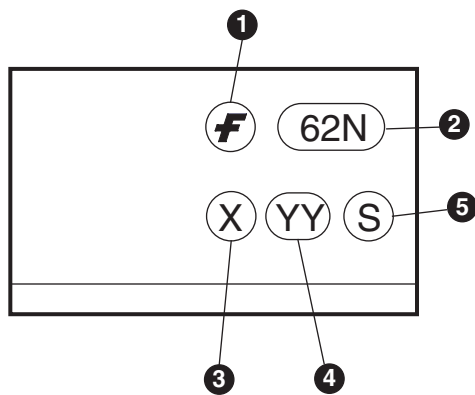### Fig. 11 Test Circuit and Waveforms for Common Mode Transient Immunity
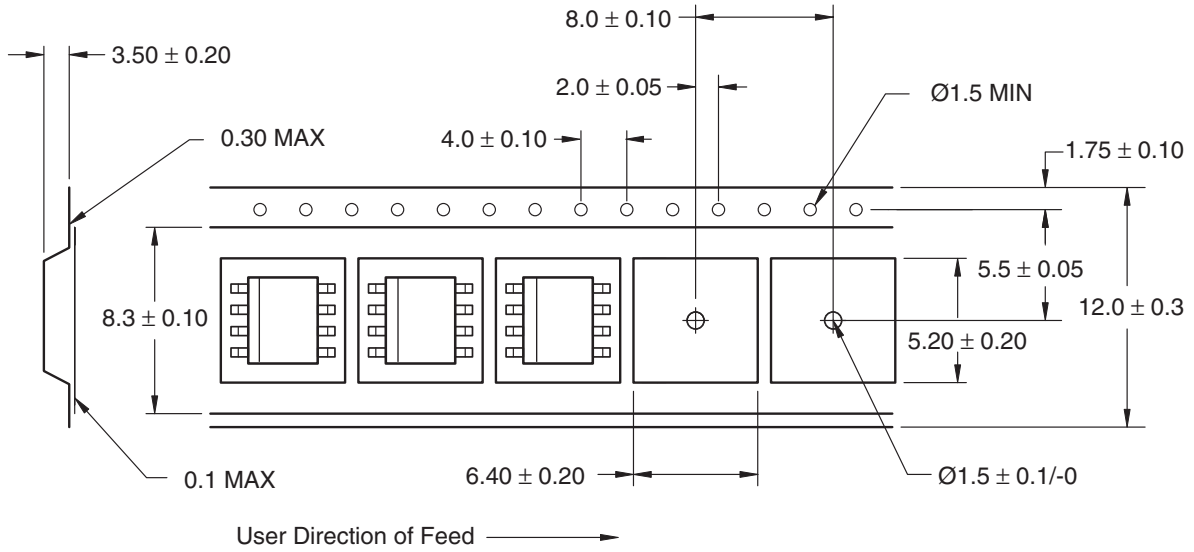
Footprint

8-Pin Small Outline

0.024 (0.61)

0.275 (6.99)

0.060 (1.52)

0.155 (3.94)

0.050 (1.27)

Ordering Information

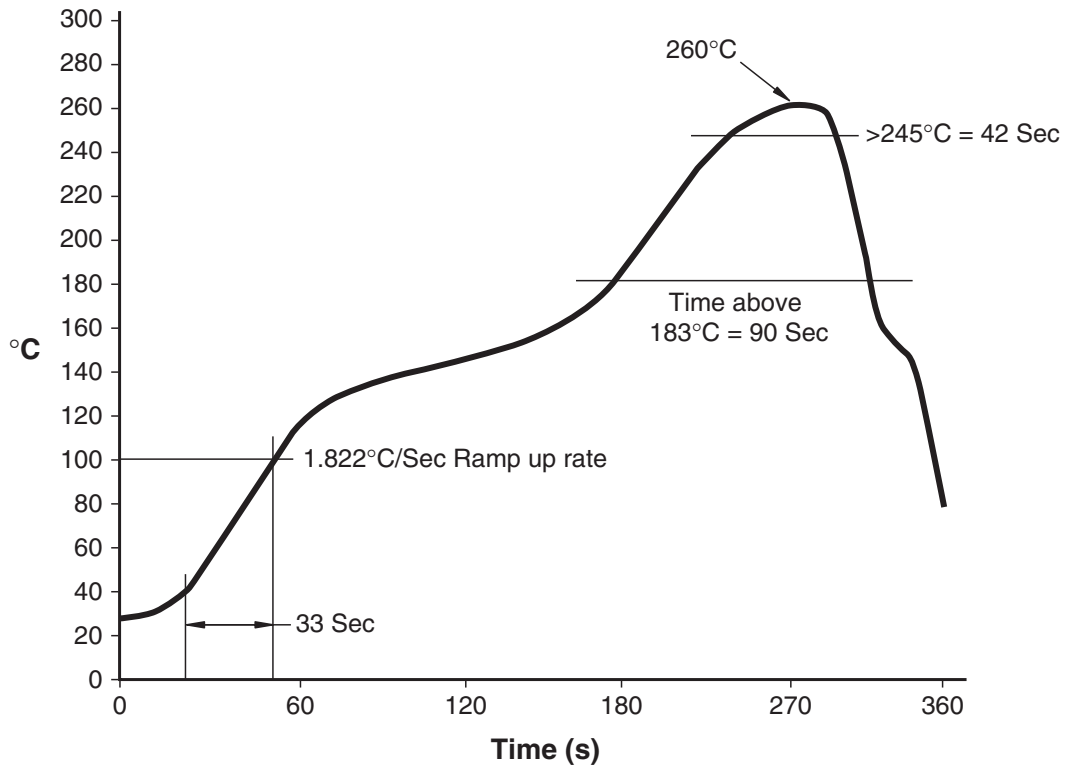| Option	Order Entry Identifier	Description
No Suffix	HCPL062N	Shipped in tubes (50 units per tube)
R1	HCPL062NR1	Tape and Reel (500 units per reel)
R2	HCPL062NR2	Tape and Reel (2500 units per reel)

Marking Information

Definitions	
1	Fairchild logo
2	Device number
3	One digit year code, e.g., '3'
4	Two digit work week ranging from '01' to '53'
5	Assembly package code

Carrier Tape Specification

3.50 ± 0.20
0.30 MAX
4.0 ± 0.10
8.0 ± 0.10
2.0 ± 0.05
Ø1.5 MIN
1.75 ± 0.10
8.3 ± 0.10
5.5 ± 0.05
12.0 ± 0.3
5.20 ± 0.20
0.1 MAX
6.40 ± 0.20
Ø1.5 ± 0.1/-0

User Direction of Feed ⟶

Reflow Profile

260°C
>245°C = 42 Sec
Time above
183°C = 90 Sec
1.822°C/Sec Ramp up rate
33 Sec

°C — Time (s)

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GTO™

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Power247®
PowerEdge™
PowerSaver™
PowerTrench®

Programmable Active Droop™
QFET®
QS™
QT Optoelectronics™
Quiet Series™
RapidConfigure™
RapidConnect™
ScalarPump™
SMART START™
SPM®
STEALTH™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SyncFET™
TCM™
The Power Franchise®
™
TinyBoost™
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UniFET™
VCX™
Wire™

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PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
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Rev. I24