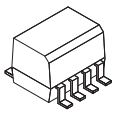
Low Input Current High Gain Split Darlington Optocouplers

Single Channel: HCPL0700, HCPL0701,
Dual Channel: HCPL0731

HCPL0700, HCPL0701, HCPL0731



SOIC8
CASE 751DZ

MARKING DIAGRAM



XXX	= Specific Device Code XXX = 700, 701, 731
V	= VDE Mark (only appears on parts ordered with VDE option)
X	= Year Code
YY	= Work Week
S	= Assembly Package Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 9 of this data sheet.

Description

The HCPL0700, HCPL0701 and HCPL0731 optocouplers consist of an AlGaAs LED optically coupled to a high gain split darlington photodetector housed in a compact 8−pin small outline package. The HCPL0731 device have two channels per package for optimum mounting density.

The split darlington configuration separating the input photodiode and the first stage gain from the output transistor permits lower output saturation voltage and higher speed operation than possible with conventional darlington phototransistor optocoupler.

The combination of a very low input current of 0.5 mA and a high current transfer ratio of 2000% makes this family particularly useful for input interface to MOS, CMOS, LSTTL and EIA RS232C, while output compatibility is ensured to CMOS as well as high fan−out TTL requirements.

Features

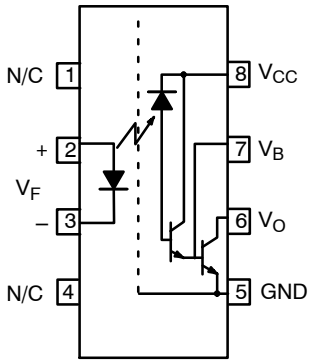
- Low input current: 0.5 mA
- Superior CTR: 2000%
- Superior CMR – 10 kV/μs
- CTR guaranteed 0°C to 70°C
- U.L. Recognized (file# E90700)
- VDE 0884 recognized (file# 136616)
- BSI recognized (file# 8661, 8662)
  – HCPL0700/0701 only
- These are Pb−Free Devices

Applications

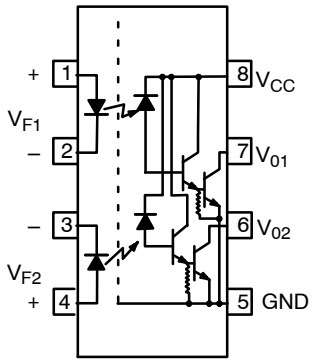
- Digital Logic Ground Isolation
- Telephone Ring Detector
- EIA−RS−232C Line Receiver
- High Common Mode Noise Line Receiver
- μP Bus Isolation
- Current Loop Receiver

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SCHEMATICS



HCPL0700 / HCPL0701



HCPL0731

TRUTH TABLE

LED	V_O
ON	LOW
OFF	HIGH

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Symbol	Rating		Value	Unit
T_{STG}	Storage Temperature		–40 to +125	°C
T_{OPR}	Operating Temperature		–40 to +85	°C
	Reflow Temperature Profile (Refer to page 9)			
EMITTER				
I_F (avg)	DC/Average Forward Input Current		20	mA
I_F (pk)	Peak Forward Input Current (50% duty cycle, 1 ms P.W.)		40	mA
I_F (trans)	Peak Transient Input Current – (≤1 μs P.W., 300 pps)		1.0	A
V_R	Reverse Input Voltage		5	V
P_D	Input Power Dissipation		35	mW
DETECTOR				
I_O (avg)	Average Output Current (Pin 6)		60	mA
V_{EBR}	Emitter–Base Reverse Voltage	HCPL0700/HCPL0701	0.5	V
V_{CC}, V_O	Supply Voltage, Output Voltage	HCPL0700	–0.5 to 7	V
		HCPL0701/HCPL0731	–0.5 to 18	
P_D	Output Power Dissipation		100	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.

ELECTRICAL CHARACTERISTICS (T_A = 0 to 70°C unless otherwise noted)

Symbol	Parameter	Test Condition		Device	Min	Typ*	Max	Unit
INDIVIDUAL COMPONENT CHARACTERISTICS								
EMITTER								
V_F	Input Forward Voltage	I_F = 1.6 mA	T_A = 25°C	HCPL0700/01	1.0	1.25	1.7	V
				HCPL0731		1.35		
				All	–	–	1.75	
BV_R	Input Reverse breakdown Voltage	T_A = 25°C, I_R = 10 μA		All	5.0	–	–	V
DETECTOR								
I_{OH}	Logic High Output Current	I_F = 0 mA, V_O = V_{CC} = 18 V		HCPL0701/31	–	0.01	100	μA
		I_F = 0 mA, V_O = V_{CC} = 7 V		HCPL0700	–	0.01	250	
I_{CCL}	Logic Low Supply Current	I_F = 1.6 mA, V_O = Open, V_{CC} = 18 V		HCPL0700/01	–	0.4	1.5	mA
		V_{O1} = V_{O2} = Open, V_{CC} = 18 V		HCPL0731	–	1	–	
I_{CCH}	Logic High Supply Current	I_F = 0 mA, V_O = Open, V_{CC} = 18 V		HCPL0700/01	–	–	10	μA
		V_{O1} = V_{O2} = Open, V_{CC} = 18 V		HCPL0731	–	0.01	–	
TRANSFER CHARACTERISTICS								
CTR	COUPLED	I_F = 0.5 mA, V_O = 0.4 V, V_{CC} = 4.5 V		HCPL0700/31	400	–	5000	%
	Current Transfer Ratio (Notes 1, 2)	I_F = 1.6 mA, V_O = 0.4 V, V_{CC} = 4.5 V		HCPL0700	300	–	2600	
				HCPL0701	500	–	2600	
				HCPL0731	500	–	5000	
V_{OL}	Logic Low Output Voltage	I_F = 0.5 mA, I_O = 2 mA, V_{CC} = 4.5 V		HCPL0701 HCPL0731	–	–	0.4	V
		I_F = 1.6 mA, I_O = 8 mA, V_{CC} = 4.5 V			–	–	0.4	
		I_F = 5 mA, I_O = 15 mA, V_{CC} = 4.5 V			–	–	0.4	
		I_F = 12 mA, I_O = 24 mA, V_{CC} = 4.5 V			–	–	0.4	
		I_F = 1.6 mA, I_O = 4.8 mA, V_{CC} = 4.5 V		HCPL0700	–	–	0.4	
ISOLATION CHARACTERISTICS								
I_{I-O}	Input−Output Insulation Leakage Current	Relative humidity = 45%, T_A = 25°C, t = 5 s, V_{I-O} = 3000 VDC (Note 4)			–	–	1.0	μA
V_{ISO}	Withstand Insulation Test Voltage	$R_H \le 50\%$, T_A = 25°C, $I_{I-O} \le 2$ μA, t = 1 min. (Notes 4, 5)			2500	–	–	V_{RMS}
R_{I-O}	Resistance (Input to Output)	V_{I-O} = 500 VDC (Note 4)			–	10^{12}	–	Ω

ELECTRICAL CHARACTERISTICS (T_A = 0 to 70°C unless otherwise noted) (continued)

Symbol	Parameter	Test Condition	Device	Min	Typ*	Max	Unit
SWITCHING CHARACTERISTICS (VCC = 5 V)							
T_{PHL}	Propagation Delay Time to Logic Low (Note 2) (Figure 14)	R_L = 4.7 kΩ, I_F = 0.5 mA	HCPL0701	–	–	30	μs
			HCPL0731	–	–	120	
		T_A = 25°C	HCPL0701	–	3	25	
			HCPL0731	–	5	100	
		R_L = 270 Ω, I_F = 12 mA	HCPL0701	–	–	2	
			HCPL0731	–	–	3	
		T_A = 25°C	HCPL0701	–	0.3	1	
			HCPL0731	–	0.4	2	
		R_L = 2.2 kΩ, I_F = 1.6 mA	HCPL0700	–	–	15	
			HCPL0731	–	–	25	
		T_A = 25°C	HCPL0700	–	1	10	
			HCPL0731	–	2	20	
T_{PLH}	Propagation Delay Time to Logic High (Note 2) (Figure 14)	R_L = 4.7 kΩ, I_F = 0.5 mA	HCPL0701/31	–	–	90	μs
		T_A = 25°C	HCPL0701/31	–	12	60	
		R_L = 270 Ω, I_F = 12 mA	HCPL0701	–	–	10	
			HCPL0731	–	–	15	
		T_A = 25°C	HCPL0701	–	1.6	7	
			HCPL0731	–	1.6	10	
		R_L = 2.2 kΩ, I_F = 1.6 mA	HCPL0700/31	–	–	50	
		T_A = 25°C	HCPL0700/31	–	7	35	
$\|CM_H\|$	Common Mode Transient Immunity at Logic High	I_F = 0 mA, $\|V_{CM}\|$ = 10 V_{P-P}, T_A = 25°C, R_L = 2.2 kΩ (Note 3) (Figure 15)	All	1,000	10,000	–	V/μs
$\|CM_L\|$	Common Mode Transient Immunity at Logic Low	I_F = 1.6 mA, $\|V_{CM}\|$ = 10 V_{P-P}, T_A = 25°C, R_L = 2.2 kΩ (Note 3) (Figure 15)	All	1,000	10,000	–	V/μs

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.

1. Current Transfer Ratio is defined as a ratio of output collector current, I_O, to the forward LED input current, $_{IF}$, times 100%.
2. Pin 7 open. Use of a resistor between pins 5 and 7 will decrease gain and delay time.
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., $V_O >$ 2.0 V). Common mode transient immunity in logic low level is the maximum tolerable (negative) dV_{CM}/dton 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., $V_O <$ 0.8 V).
4. Device is considered a two terminal device: Pins 1, 2, 3 and 4 are shorted together and Pins 5, 6, 7 and 8 are shorted together.
5. 2500 VAC RMS for 1 minute duration is equivalent to 3000 VAC RMS for 1 second duration.

*All typicals at T_A = 25°C

TYPICAL PERFORMANCE CURVES

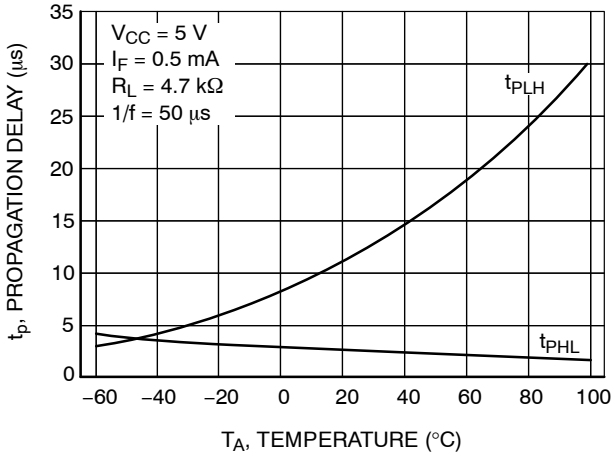


Figure 1. Propagation Delay vs. Temperature (HCPL0700, HCPL0701)

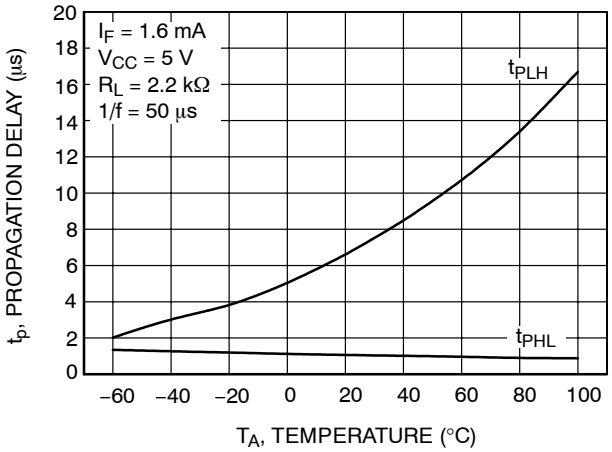


Figure 2. Propagation Delay vs. Temperature (HCPL0700, HCPL0701)

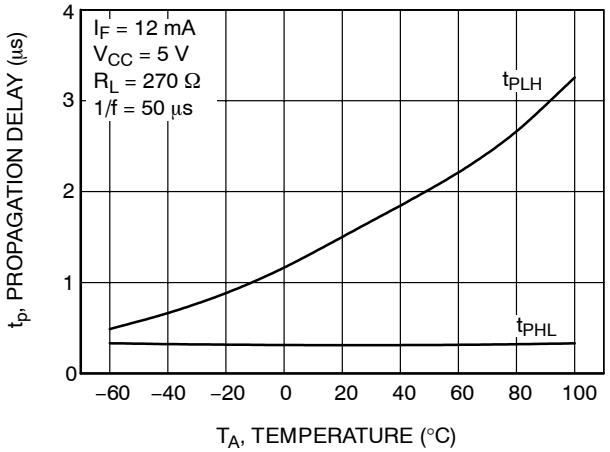


Figure 3. Propagation Delay vs. Temperature (HCPL0700, HCPL0701)

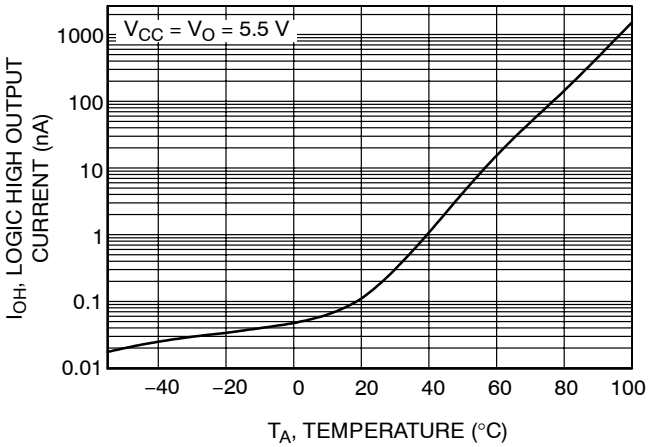


Figure 4. Logic High Output Current vs. Temperature (HCPL0700, HCPL0701)

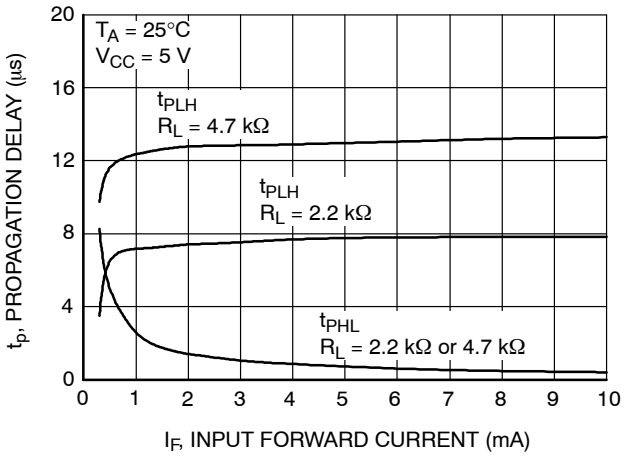


Figure 5. Propagation Delay vs. Input Forward Current (HCPL0731)

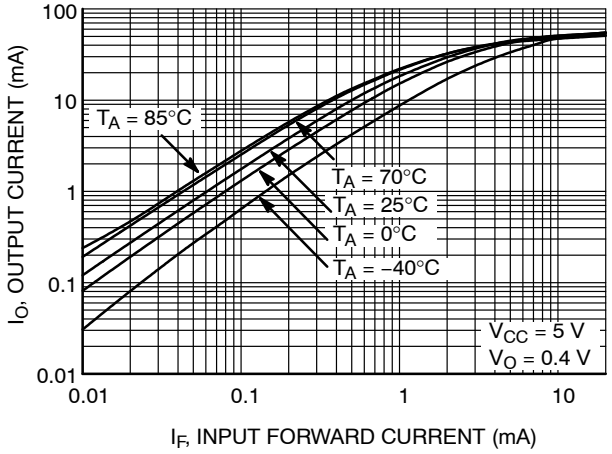


Figure 6. Output Current vs. Input Forward Current (HCPL0700, HCPL0701)

TYPICAL PERFORMANCE CURVES (continued)

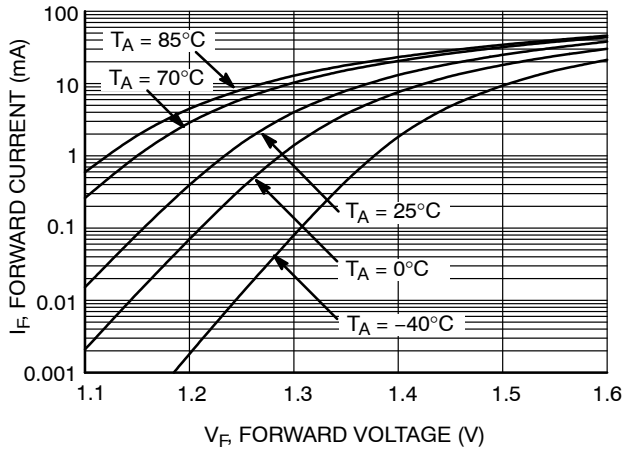


Figure 7. Input Forward Current vs. Forward Voltage (HCPL0700, HCPL0701)

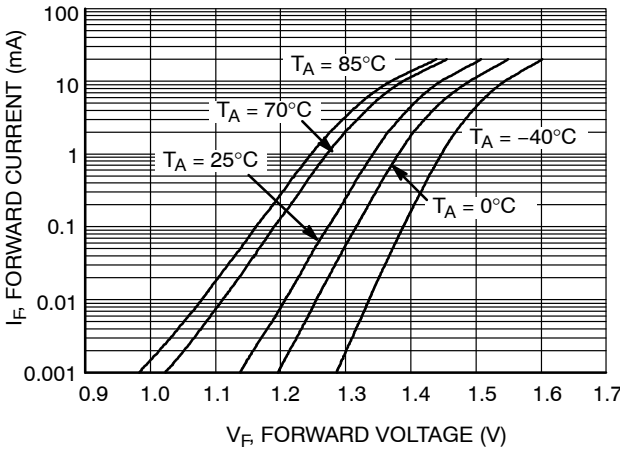


Figure 8. Input Forward Current vs. Forward Voltage (HCPL0731)

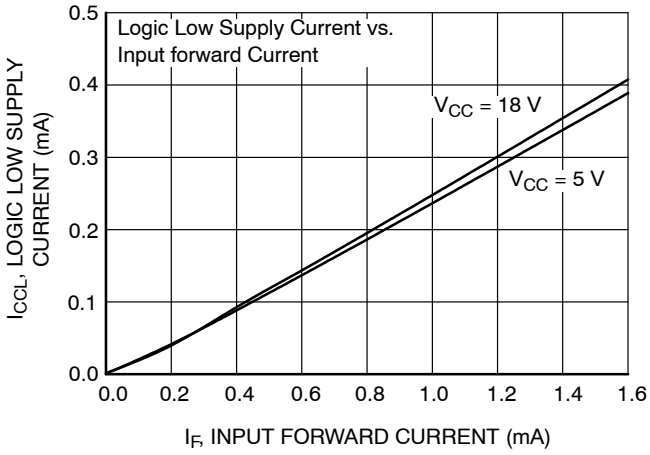


Figure 9. Logic Low Supply Current vs. Input Forward Current (HCPL0700, HCPL0701)

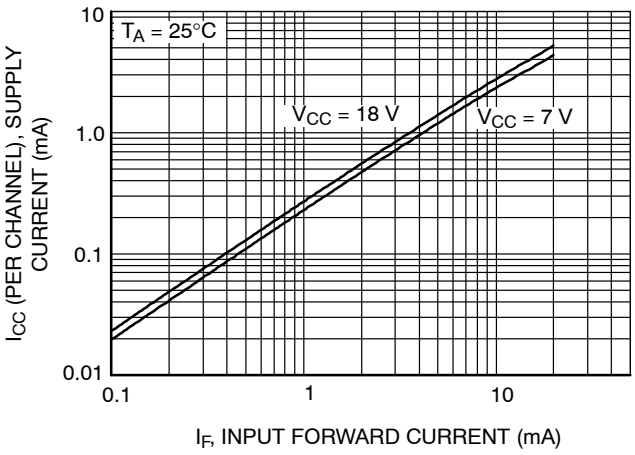


Figure 10. Supply Current vs. Input Forward Current (HCPL0731)

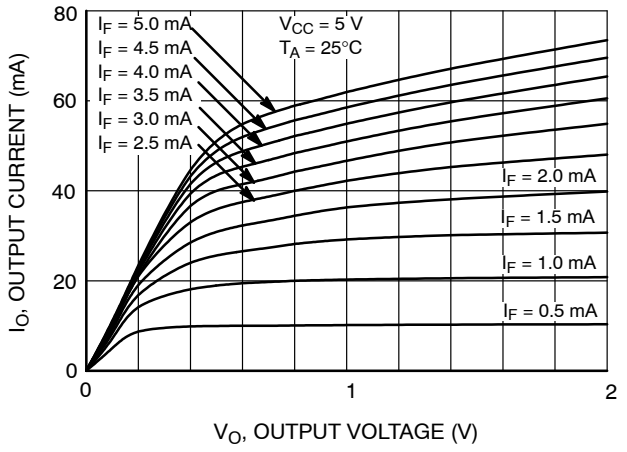


Figure 11. DC Transfer Characteristics (HCPL0700, HCPL0701)

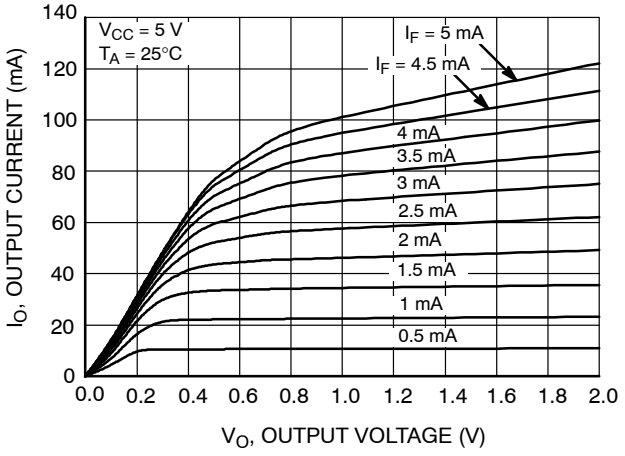


Figure 12. DC Transfer Characteristics (HCPL0731)

TYPICAL PERFORMANCE CURVES (continued)

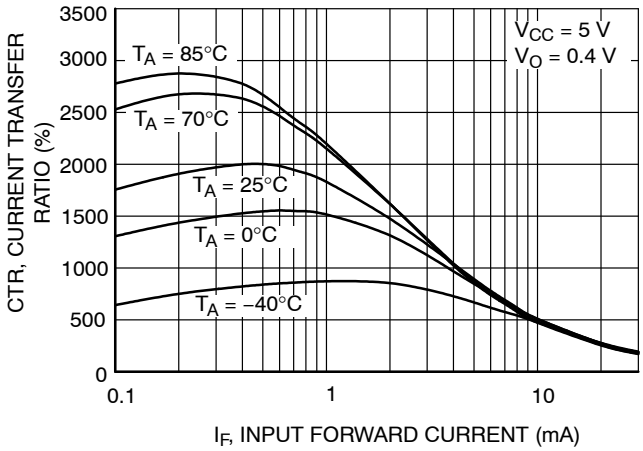
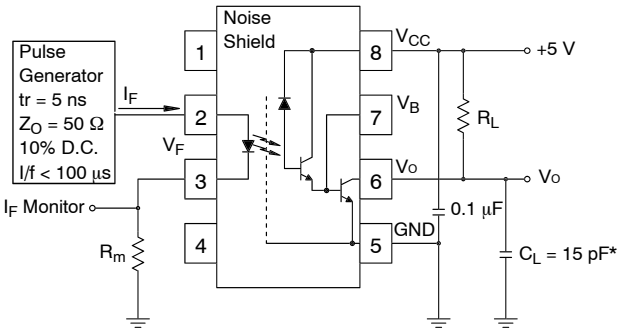
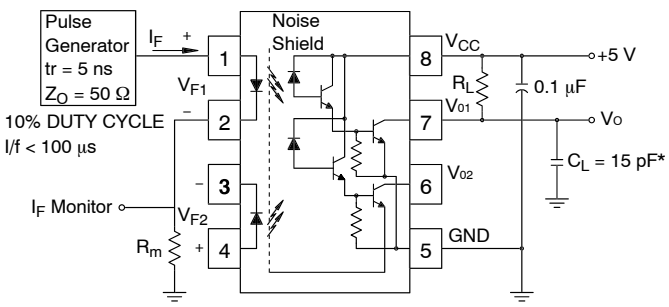


Figure 13. Current Transfer Ratio vs. Input Forward Current (HCPL0700, HCPL0701)

TEST CIRCUIT



Test Circuit for HCPL−0700 and HCPL−0701



Test Circuit for HCPL−0731

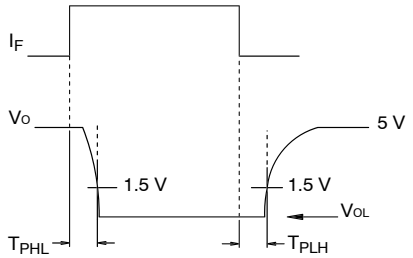
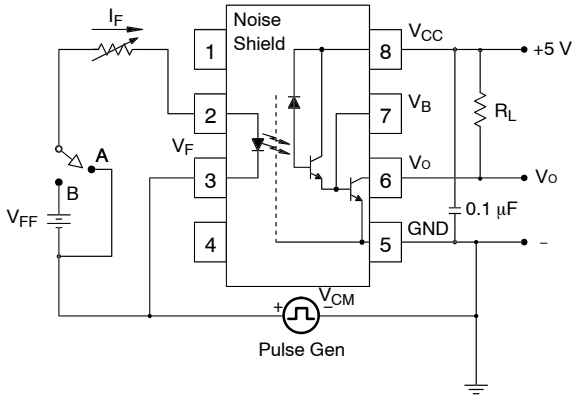
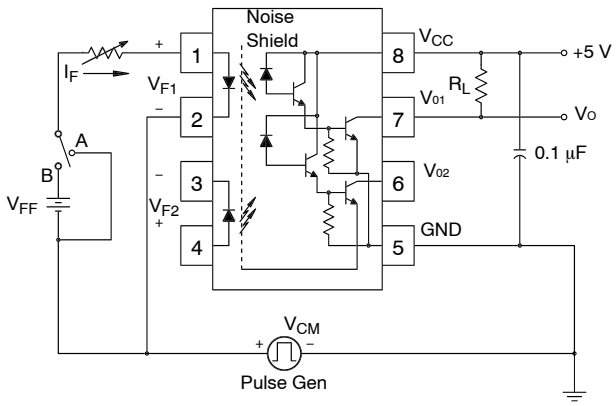


Figure 14. Switching Time Test Circuit



Test Circuit for HCPL−0700 and HCPL−0701



Test Circuit for HCPL−0731

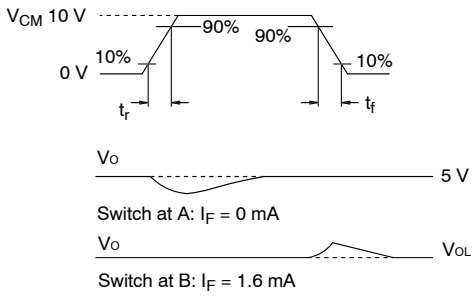


Figure 15. Common Mode Immunity Test Circuit

REFLOW PROFILE

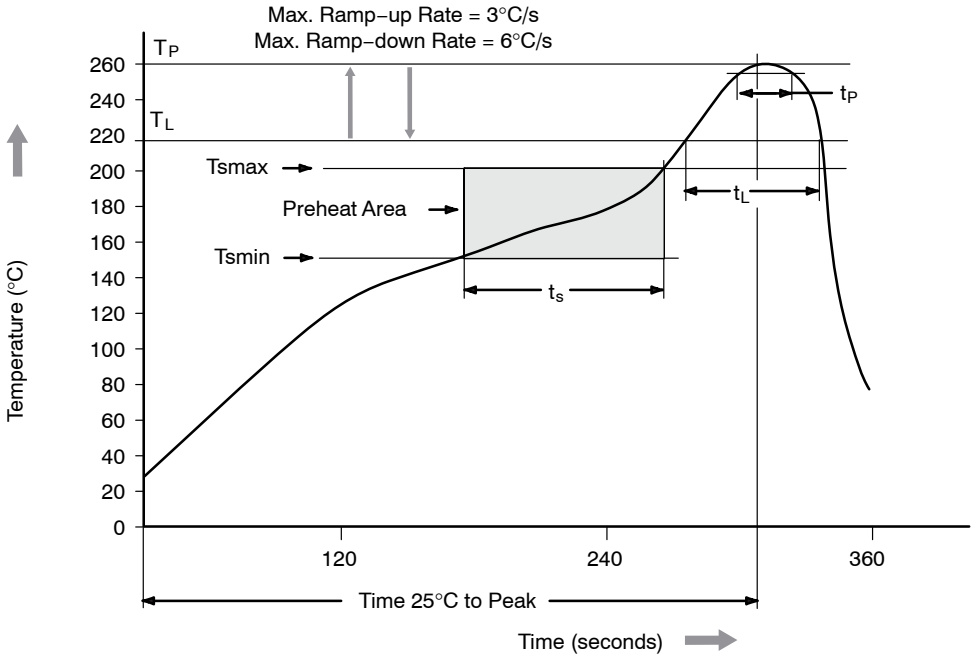


Figure 16. Reflow Profile

Table 1.

Profile Feature	Pb−Free Assembly Profile
Temperature Min. (Tsmin)	150°C
Temperature Max. (Tsmax)	200°C
Time (t_S) from (Tsmin to Tsmax)	60 – 120 seconds
Ramp−up Rate (t_L to t_P)	3°C/second maximum
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60 – 150 seconds
Peak Body Package Temperature	260°C +0°C / −5°C
Time (t_P) within 5°C of 260°C	30 seconds
Ramp−down Rate (T_P to T_L)	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

ORDERING INFORMATION (Note 6)

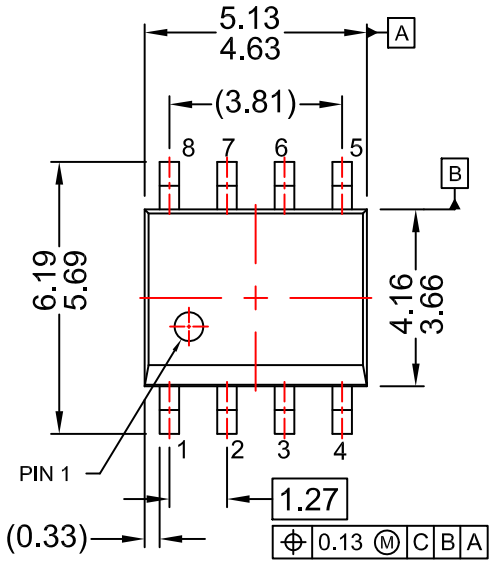
Part Number	Package	Shipping†
HCPL0700	SOIC8	50 Units / Tube
HCPL0700R2	SOIC8	2500 / Tape & Reel
HCPL0700V	SOIC8 (VDE 0884)	50 Units / Tube

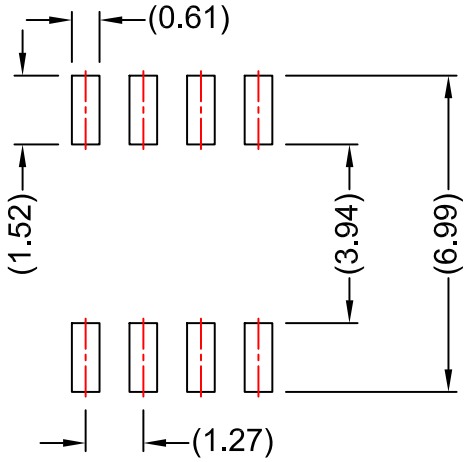
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

6. The product orderable part number system listed in this table also applies to the HCPL0701 and HCPL0731 products.

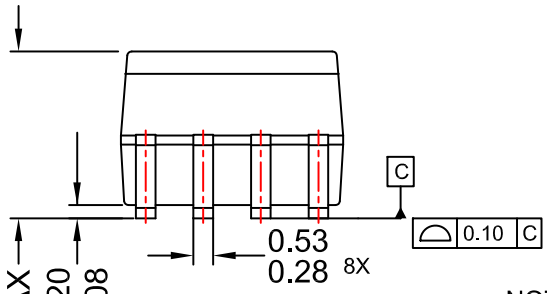
SOIC8
CASE 751DZ
ISSUE O

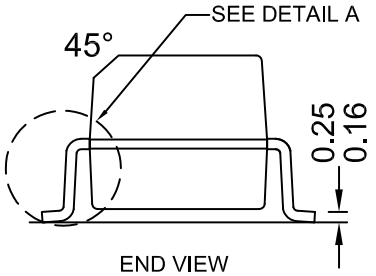
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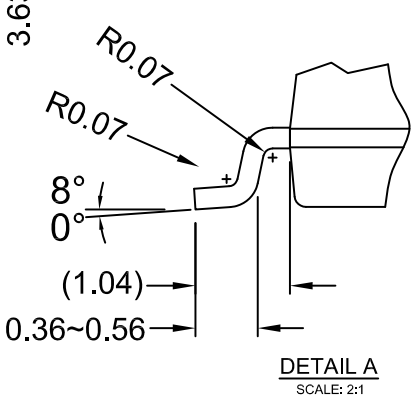


LAND PATTERN RECOMMENDATION





END VIEW



DETAIL A
SCALE: 2:1

NOTES:

A) NO STANDARD APPLIES TO THIS PACKAGE
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
D) LANDPATTERN STANDARD: SOIC127P600X175-8M.

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DESCRIPTION:	**SOIC8**		**PAGE 1 OF 1**

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