



Is Now Part of



ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

HCPL0452, HCPL0453, HCPL0500, HCPL0501, HCPL0530, HCPL0531, HCPL0534 High Speed Transistor Optocouplers

Single Channel: HCPL0452 HCPL0453 HCPL0500 HCPL0501
Dual Channel: HCPL0530 HCPL0531 HCPL0534

Features

- High speed – 1 MBit/s
- 15kV/ μ s minimum common mode transient immunity at $V_{CM} = 1500V$ (HCPL0453/0534)
- Open collector output
- Guaranteed performance over temperature: 0°C to 70°C
- U.L. recognized (File # E90700)
- VDE0884 recognized (file#136616)
 - approval pending for HCPL0530/0531/0453
 - ordering option V, e.g., HCPL0500V
- BSI recognized (file# 8661, 8662)
 - HCPL0452/0500/0501 only

Applications

- Line receivers
- Pulse transformer replacement
- Output interface to CMOS-LSTTL-TTL
- Wide bandwidth analog coupling

Description

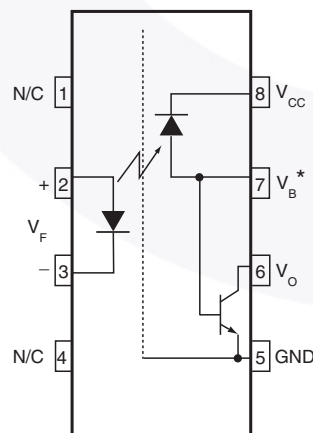
The HCPL05XX, and HCPL04XX optocouplers consist of an AlGaAs LED optically coupled to a high speed photodiode transistor housed in a compact 8-pin small out-line package.

A separate connection for the bias of the photodiode improves the speed by several orders of magnitude over conventional phototransistor optocouplers by reducing the base-collector capacitance of the input transistor. The HCPL04XX devices do not have the base bonded out to a lead for additional noise margin. The HCPL053X devices have two channels per package for optimum mounting density.

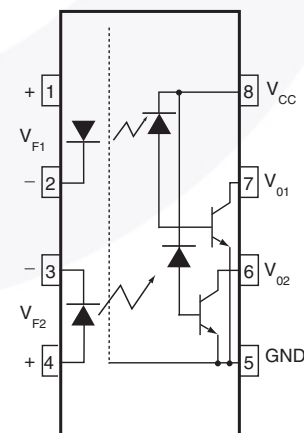
Truth Table (positive Logic)

LED	V _o
ON	LOW
OFF	HIGH

Schematics



HCPL0500, HCPL0501
*BASE NOT CONNECTED
FOR HCPL0452, HCPL0453



HCPL0530/HCPL0531/HCPL0534

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise specified)

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Value	Units
T_{STG}	Storage Temperature	-40 to +125	$^\circ\text{C}$
T_{OPR}	Operating Temperature	-40 to +85	$^\circ\text{C}$
	Reflow Temperature Profile (Refer to page 11)		
EMITTER			
I_F (avg)	DC/Average Forward Input Current	25	mA
I_F (pk)	Peak Forward Input Current (50% duty cycle, 1ms P.W.)	50	mA
I_F (trans)	Peak Transient Input Current - ($\leq 1\mu\text{s}$ P.W., 300 pps)	1.0	A
V_R	Reverse Input Voltage	5	V
P_D	Input Power Dissipation	45	mW
DETECTOR			
I_O (avg)	Average Output Current (Pin 6)	8	mA
I_O (pk)	Peak Output Current	16	mA
V_{EBR}	Emitter-Base Reverse Voltage (HCPL0500/HCPL0501 only)	5	V
V_{CC}	Supply Voltage	-0.5 to 30	V
V_O	Output Voltage	-0.5 to 20	V
I_B	Base Current (HCPL0500/HCPL0501 only)	5	mA
P_D	Output power dissipation	100	mW

Electrical Characteristics ($T_A = 0$ to 70°C unless otherwise specified)

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Unit
EMITTER							
V_F	Input Forward Voltage	$I_F = 16\text{mA}$, $T_A = 25^\circ\text{C}$	All		1.45	1.7	V
		$I_F = 16\text{mA}$				1.8	
BV_R	Input Reverse Breakdown Voltage	$I_R = 10\mu\text{A}$	All	5.0			V
$\Delta V_F / \Delta T_A$	Temperature Coefficient of Forward Voltage	$I_F = 16\text{mA}$	All		-1.6		mV/°C
DETECTOR							
I_{OH}	Logic High Output Current	$I_F = 0\text{mA}$, $V_O = V_{CC} = 5.5\text{V}$, $T_A = 25^\circ\text{C}$	All		0.001	0.5	μA
		$I_F = 0\text{mA}$, $V_O = V_{CC} = 15\text{V}$, $T_A = 25^\circ\text{C}$	All		0.005	1	
		$I_F = 0\text{mA}$, $V_O = V_{CC} = 15\text{V}$	All			50	
I_{CCL}	Logic Low Supply Current	$I_F = 16\text{mA}$, $V_O = \text{Open}$, $V_{CC} = 15\text{V}$	HCPL0452/3/0500/1		120	200	μA
			HCPL0530/1/4			400	
I_{CCH}	Logic High Supply Current	$I_F = 0\text{mA}$, $V_O = \text{Open}$, $V_{CC} = 15\text{V}$, $T_A = 25^\circ\text{C}$	All		0.01	1	μA
			HCPL0452/3/0500/1			2	
			HCPL0530/1/4			4	

Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Unit
COUPLED							
CTR	Current Transfer Ratio (Note 1)	$I_F = 16\text{mA}$, $V_O = 0.4\text{V}$, $V_{CC} = 4.5\text{V}$, $T_A = 25^\circ\text{C}$	HCPL0500/0530	7	27	50	%
			HCPL0452/3	19	27	50	
			HCPL0501/0531				
		$I_F = 16\text{mA}$, $V_O = 0.5\text{V}$, $V_{CC} = 4.5\text{V}$	HCPL0500	5	30		
			HCPL0452/3 HCPL0501/0534	15	30		
V_{OL}	Logic Low Output Voltage	$I_F = 16\text{mA}$, $I_O = 1.1\text{mA}$, $V_{CC} = 4.5\text{V}$, $T_A = 25^\circ\text{C}$	HCPL0500		0.18	0.4	V
			HCPL0530			0.5	
		$I_F = 16\text{mA}$, $I_O = 3\text{mA}$, $V_{CC} = 4.5\text{V}$, $T_A = 25^\circ\text{C}$	HCPL0452/3		0.25	0.4	
			HCPL0501/0531/4				
		$I_F = 16\text{mA}$, $I_O = 0.8\text{mA}$, $V_{CC} = 4.5\text{V}$	HCPL0500 HCPL0530		0.13	0.5	
			HCPL0452/3 HCPL0501/0531/4		0.23	0.5	

 *All typicals at $T_A = 25^\circ\text{C}$

Electrical Characteristics (Continued) ($T_A = 0$ to 70°C unless otherwise specified)

Switching Characteristics $T_{V_{CC}} = 5\text{V}$

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Unit
T_{PHL}	Propagation Delay Time to Logic LOW	$T_A = 25^\circ\text{C}$, $R_L = 4.1\text{k}\Omega$, $I_F = 16\text{mA}$ (Note 2) (Fig. 9)	HCPL0500/0530		0.45	1.5	μs
		$R_L = 1.9\text{k}\Omega$, $I_F = 16\text{mA}$, $T_A = 25^\circ\text{C}$ (Note 3) (Fig. 9)	HCPL0452/3		0.45	0.8	
			HCPL0501/0531/4				
		$R_L = 4.1\text{k}\Omega$, $I_F = 16\text{mA}$ (Note 2) (Fig. 9)	HCPL0500/0530				2.0
T_{PLH}	Propagation Delay Time to Logic HIGH	$T_A = 25^\circ\text{C}$, $R_L = 4.1\text{k}\Omega$, $I_F = 16\text{mA}$ (Note 2) (Fig. 9)	HCPL0500/0530		0.5	1.5	μs
		$R_L = 1.9\text{k}\Omega$, $I_F = 16\text{mA}$, $T_A = 25^\circ\text{C}$ (Note 3) (Fig. 9)	HCPL0452/3		0.3	0.8	
			HCPL0501/0531/4				
		$R_L = 4.1\text{k}\Omega$, $I_F = 16\text{mA}$ (Note 2) (Fig. 9)	HCPL0500/0530				2.0
ICM_{HI}	Common Mode Transient Immunity at Logic HIGH	$I_F = 0\text{mA}$, $V_{CM} = 10\text{V}_{P-P}$, $R_L = 4.1\text{k}\Omega$, $T_A = 25^\circ\text{C}$ (Note 4) (Fig. 10)	HCPL0500	1,000	10,000		$\text{V}/\mu\text{s}$
			HCPL0530				
		$I_F = 0\text{mA}$, $V_{CM} = 10\text{V}_{P-P}$, $R_L = 1.9\text{k}\Omega$, $T_A = 25^\circ\text{C}$, (Note 4) (Fig. 10)	HCPL0452	1,000	10,000		
			HCPL0501/31				
ICM_{LI}	Common Mode Transient Immunity at Logic LOW	$I_F = 16\text{mA}$, $V_{CM} = 10\text{V}_{P-P}$, $R_L = 4.1\text{k}\Omega$, $T_A = 25^\circ\text{C}$ (Note 4) (Fig. 10)	HCPL0500	1,000	10,000		$\text{V}/\mu\text{s}$
			HCPL0530				
		$I_F = 16\text{mA}$, $V_{CM} = 10\text{V}_{P-P}$, $R_L = 1.9\text{k}\Omega$ (Note 4) (Fig. 10)	HCPL0452	1,000	10,000		
			HCPL0501/31				
ICM_{LI}	Common Mode Transient Immunity at Logic LOW	$I_F = 16\text{mA}$, $V_{CM} = 10\text{V}_{P-P}$, $R_L = 4.1\text{k}\Omega$, $T_A = 25^\circ\text{C}$ (Note 4) (Fig. 10)	HCPL0500	1,000	10,000		$\text{V}/\mu\text{s}$
			HCPL0530				
		$I_F = 16\text{mA}$, $V_{CM} = 10\text{V}_{P-P}$, $R_L = 1.9\text{k}\Omega$ (Note 4) (Fig. 10)	HCPL0452	1,000	10,000		
			HCPL0501/31				
ICM_{LI}	Common Mode Transient Immunity at Logic LOW	$I_F = 16\text{mA}$, $T_A = 25^\circ\text{C}$, $V_{CM} = 1500\text{V}_{P-P}$, $C_L = 15\text{pF}$ (Note 4) (Fig. 10)	HCPL0453	15,000	40,000		
			HCPL0534	15,000	40,000		
		$I_F = 16\text{mA}$, $T_A = 25^\circ\text{C}$, $V_{CM} = 1500\text{V}_{P-P}$, $C_L = 15\text{pF}$ (Note 4) (Fig. 10)	HCPL0453	15,000	40,000		
			HCPL0534	15,000	40,000		

Isolation Characteristics

Symbol	Characteristics	Test Conditions	Min.	Typ.*	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	$f = 60\text{Hz}$, $t = 1.0\text{min.}$, $I_{I-O} \leq 2\mu\text{A}$ (Note 5, 6)	2500			$V_{ac_{RMS}}$
R_{ISO}	Isolation Resistance	$V_{I-O} = 500\text{V}$ (Note 5)	10^{11}			
C_{ISO}	Isolation Capacitance	$V_{I-O} = 0$, $f = 1.0\text{MHz}$ (Note 5)		0.2		pF

 *All typicals at $T_A = 25^\circ\text{C}$

Notes

1. Current Transfer Ratio is designed as a ratio of output collector current, I_O , to the forward LED input current, I_F times 100%.
2. The 4.1 k Ω load represents 1 LSTTL unit load of 0.36 mA and 6.1k Ω pull-up resistor.
3. The 1.9 k Ω load represents 1 TTL unit load of 1.6 mA and 5.6 k Ω pull-up resistor.
4. 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}/dt on 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).
5. 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.
6. 2500 VAC RMS for 1 minute duration is equivalent to 3000 VAC RMS for 1 second duration.

Typical Performance Curves

Fig. 1 Normalized CTR vs. Forward Current

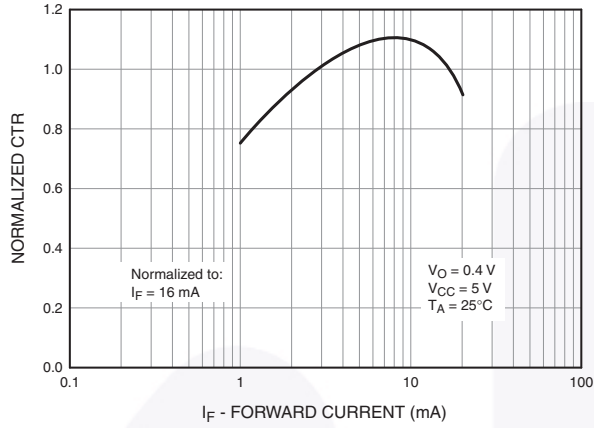


Fig. 2 Normalized CTR vs. Temperature

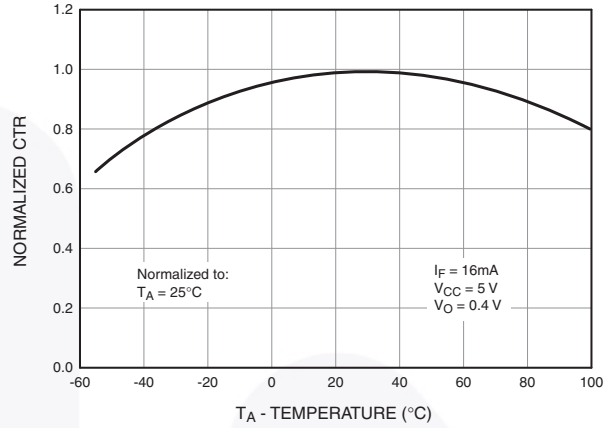


Fig. 3 Output Current vs. Output Voltage

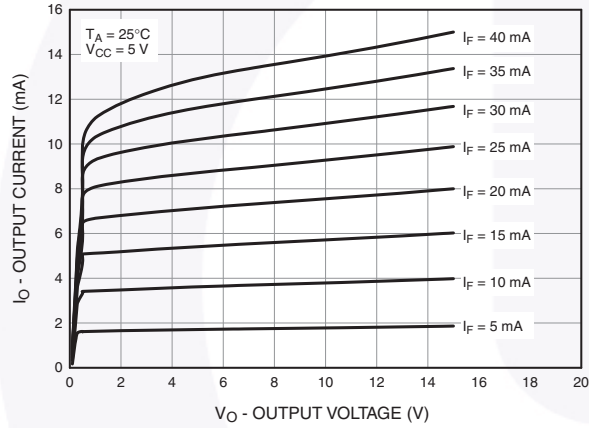


Fig. 4 Logic High Output Current vs. Temperature

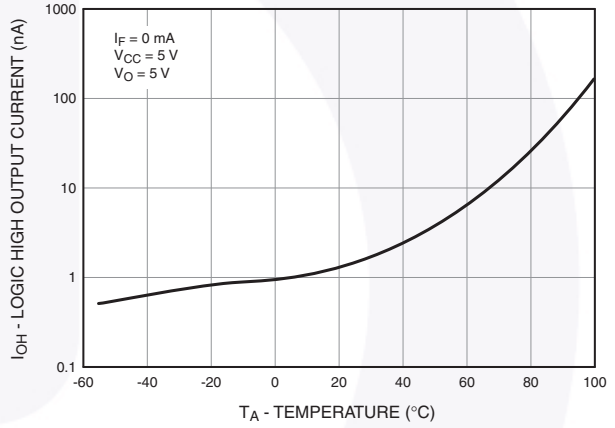


Fig. 5 Propagation Delay vs. Temperature

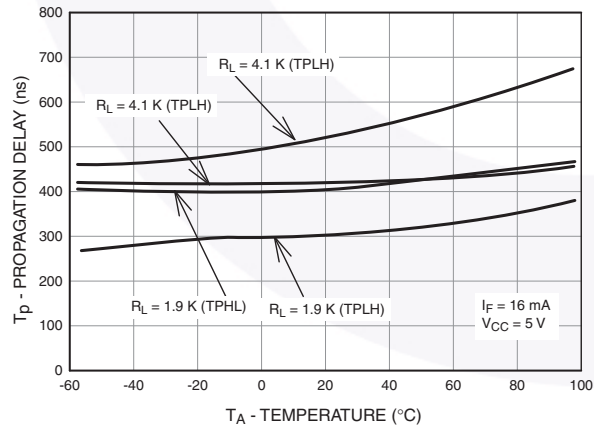
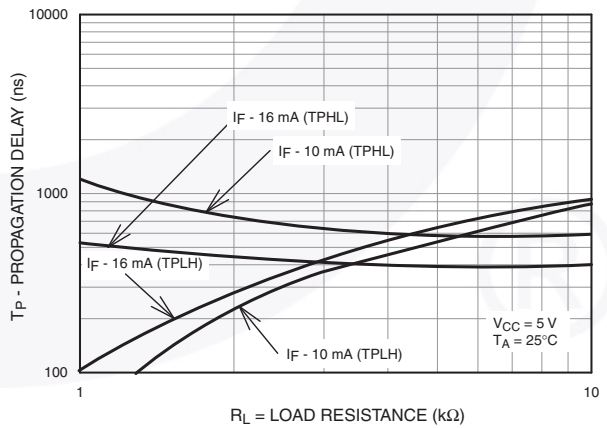
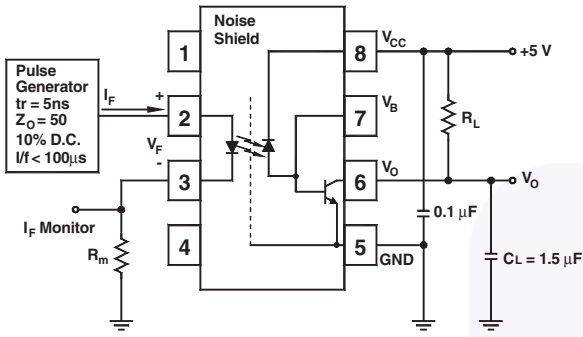
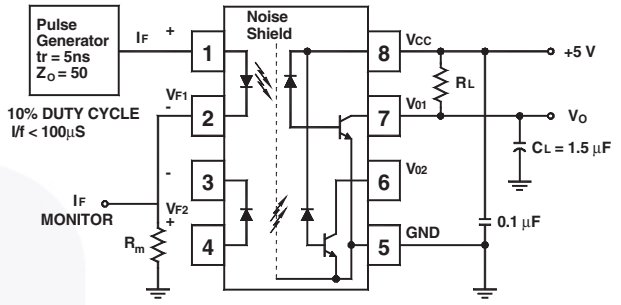


Fig. 6 Propagation Delay vs. Load Resistance





Test Circuit for HCPL0452, HCPL0453, HCPL0500 and HCPL0501



Test Circuit for HCPL0530, HCPL0531 and HCPL0534

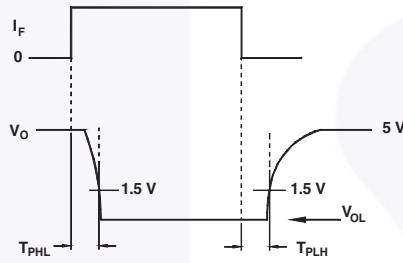
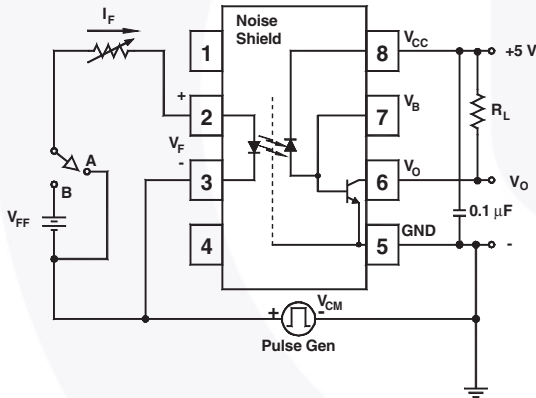
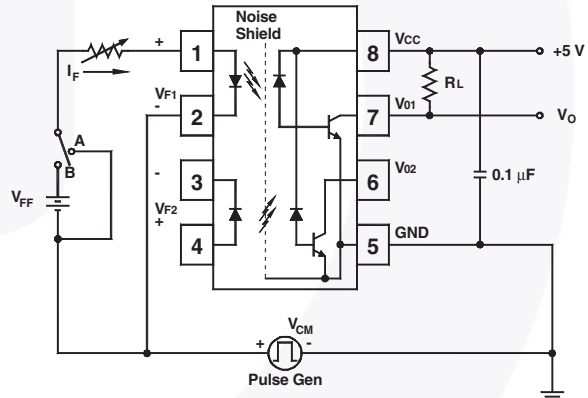


Fig. 7 Switching Time Test Circuit



Test Circuit for HCPL0452, HCPL0453, HCPL0500 and HCPL0501



Test Circuit for HCPL0530, HCPL0531 and HCPL0534

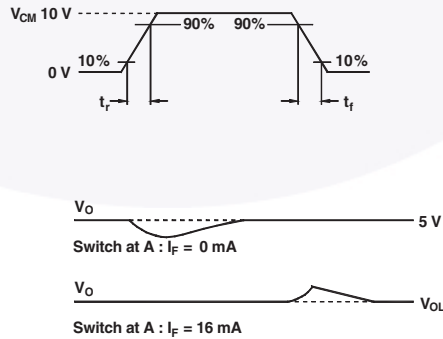
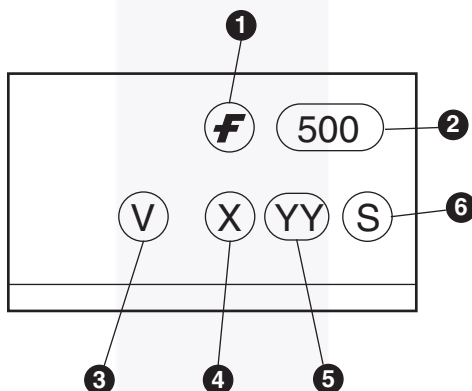


Fig. 8 Common Mode Immunity Test Circuit

Ordering Information

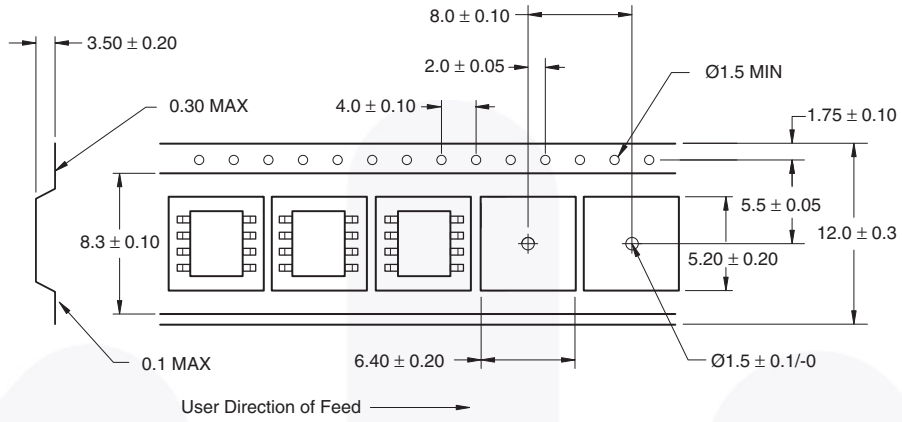
Option	Order Entry Identifier	Description
V	V	VDE 0884 (approval pending for HCPL0530, HCPL0531 & HCPL0534)
R2	R2	Tape and reel (2500 units per reel)
R2V	R2V	VDE 0884 (approval pending for HCPL0530, HCPL0531 & HCPL0534), Tape and reel (2500 units per reel)

Marking Information

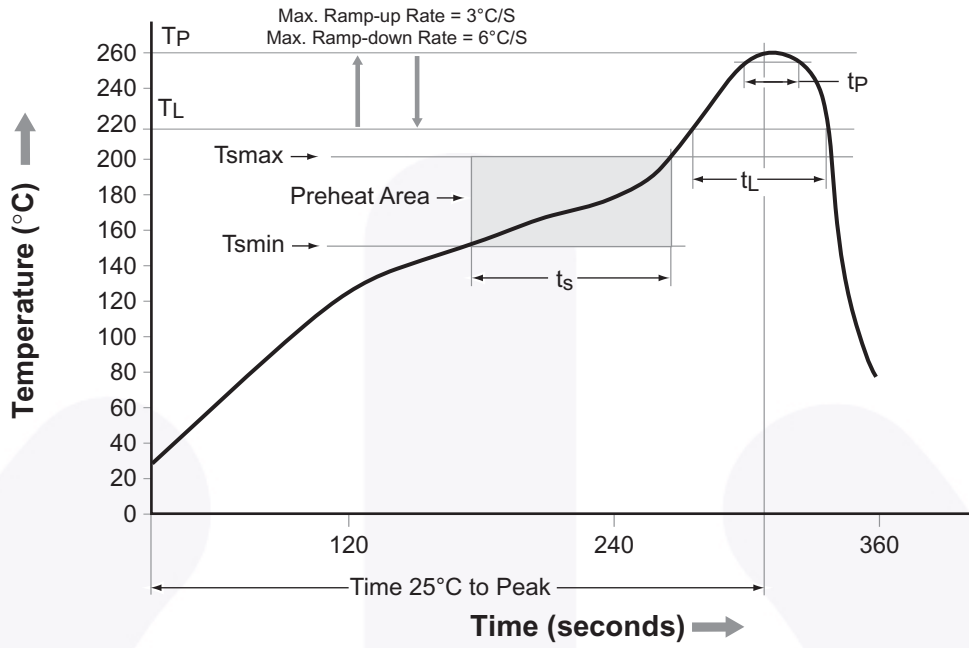


Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

Carrier Tape Specifications



Reflow Profile



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T_{smin})	150°C
Temperature Max. (T_{smax})	200°C
Time (t_s) from (T_{smin} to T_{smax})	60–120 seconds
Ramp-up Rate (t_L to t_p)	3°C/second max.
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.



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.
- E) DRAWING FILENAME: MKT-M08Erev5



ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>
For additional information, please contact your local
Sales Representative