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June 2016

## 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/µs minimum commone mode transient immunity at V<sub>CM</sub> = 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
- HCPL0452/0500/0501 C

### Applications

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

### Description

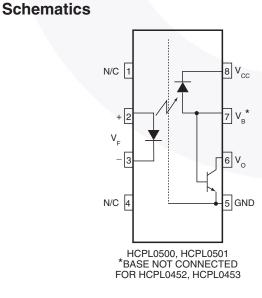
The HCPL05XX, and HCPL04XX optocouplers consist of an AlGaAs LED optically coupled to a high speed photodetector transistor housed in a compact 8-pin small outline package.

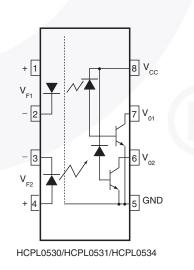
A separate connection for the bias of the photodiode improves the speed by several orders of magnitude over conventional phototransistor optocouplers by reducing the base-collector capacitance of the input transistor. The HCPL04XX devices do not have the base bonded out to a lead for additional noise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

### **Truth Table**

#### (positive Logic)

	,
LED	Vo
ON	LOW
OFF	HIGH





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**Absolute Maximum Ratings** ( $T_A = 25^{\circ}C$  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 <sub>STG</sub>	Storage Temperature	-40 to +125	°C
T <sub>OPR</sub>	Operating Temperature	-40 to +85	°C
	Reflow Temperature Profile (Refer to page 11)		
EMITTER			
I <sub>F</sub> (avg)	DC/Average Forward Input Current	25	mA
I <sub>F</sub> (pk)	Peak Forward Input Current (50% duty cycle, 1ms P.W.)	50	mA
I <sub>F</sub> (trans)	Peak Transient Input Current - ([≤1µs P.W., 300 pps)	1.0	А
V <sub>R</sub>	Reverse Input Voltage	5	V
P <sub>D</sub>	Input Power Dissipation	45	mW
DETECTOR			
I <sub>O</sub> (avg)	Average Output Current (Pin 6)	8	mA
I <sub>O</sub> (pk)	Peak Output Current	16	mA
V <sub>EBR</sub>	Emitter-Base Reverse Voltage (HCPL0500/HCPL0501 only)	5	V
V <sub>CC</sub>	Supply Voltage	-0.5 to 30	V
V <sub>O</sub>	Output Voltage	-0.5 to 20	V
Ι <sub>Β</sub>	Base Current (HCPL0500/HCPL0501 only)	5	mA
P <sub>D</sub>	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.	Тур.*	Max.	Unit
EMITTER			1	1			1
V <sub>F</sub>	Input Forward Voltage	$I_{F} = 16mA, T_{A} = 25^{\circ}C$	All		1.45	1.7	V
		I <sub>F</sub> = 16mA				1.8	]
BV <sub>R</sub>	Input Reverse Breakdown Voltage	Ι <sub>R</sub> = 10μΑ	All	5.0			V
$\Delta V_{F} / \Delta T_{A}$	Temperature Coefficient of Forward Voltage	I <sub>F</sub> = 16mA	All		-1.6		mV/°C
DETECTO	R					•	
I <sub>ОН</sub>	Logic High Output Current	$I_{F} = 0mA, V_{O} = V_{CC} = 5.5V,$ $T_{A} = 25^{\circ}C$	All		0.001	0.5	μA
		$I_{F} = 0mA, V_{O} = V_{CC} = 15V,$ $T_{A} = 25^{\circ}C$	All		0.005	1	
		$I_{\rm F} = 0  {\rm mA},  {\rm V}_{\rm O} = {\rm V}_{\rm CC} = 15 {\rm V}$	All			50	]
I <sub>CCL</sub>	Logic Low Supply Current	$I_F = 16mA, V_O = Open,$ $V_{CC} = 15V$	HCPL0452/3/ 0500/1		120	200	μA
			HCPL0530/1/4			400	
I <sub>CCH</sub>	Logic High Supply Current	$\label{eq:IF} \begin{array}{l} I_F = 0mA,  V_O = Open, \\ V_{CC} = 15V,  T_A = 25^\circ C \end{array}$	All		0.01	1	μA
		$I_F = 0mA, V_O = Open,$ $V_{CC} = 15V$	HCPL0452/3/ 0500/1			2	
			HCPL0530/1/4			4	

#### **Transfer Characteristics**

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Unit
COUPLED							
CTR	Current Tranfer Ratio	$I_{\rm F} = 16 {\rm mA}, V_{\rm O} = 0.4 {\rm V},$	HCPL0500/0530	7	27	50	%
	(Note 1)	$V_{CC} = 4.5V, T_A = 25^{\circ}C$	HCPL0452/3	19	27	50	
	$I_{F} = 16mA, V_{O} = 0.5V,$ $V_{CC} = 4.5V$		HCPL0501/0531				
			HCPL0500	5	30		
		HCPL0452/3	15	30			
			HCPL0501/0534				
V <sub>OL</sub>	Logic Low Output Voltage	I <sub>F</sub> = 16mA, I <sub>O</sub> = 1.1mA,	HCPL0500		0.18	0.4	V
		$V_{CC} = 4.5V, T_A = 25^{\circ}C$	HCPL0530			0.5	
		$I_F = 16mA, I_O = 3mA, V_{CC} = 4.5V, T_A = 25^{\circ}C$	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	R)
	I <sub>F</sub> = 16mA, I <sub>O</sub> = 2.4mA,	HCPL0452/3		0.23	0.5		
		$V_{CC} = 4.5V$	HCPL0501/0531/4				

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

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

#### Switching Characteristics $TV_{CC} = 5V$ )

Symbol	Parameter	Test Conditions	Device	Min.	Тур.*	Max.	Unit
T <sub>PHL</sub>	$\begin{array}{ll} \mbox{Propagation} & T_{A}=25^{\circ}\mbox{C}, \ \mbox{R}_{L}=4.1\mbox{k}\Omega, \ \mbox{I}_{F}=16\mbox{mA}\\ \mbox{(Note 2)} \ \mbox{(Fig. 9)} \end{array}$		HCPL0500/0530		0.45	1.5	μs
		$R_L = 1.9 k\Omega, I_F = 16 mA, T_A = 25^{\circ}C$	HCPL0452/3		0.45 0.8	0.8	
		(Note 3) (Fig. 9)	HCPL0501/0531/4				
		$R_L = 4.1k\Omega$ , $I_F = 16mA$ (Note 2) (Fig. 9)	HCPL0500/0530			2.0	
		$R_L = 1.9k\Omega, I_F = 16mA$	HCPL0452/3			1.0	1
		(Note 3) (Fig. 9)	HCPL0501/0531/4				
T <sub>PLH</sub>	Propagation Delay Time to	$T_A = 25^{\circ}C, R_L = 4.1k\Omega, I_F = 16mA$ (Note 2) (Fig. 9)	HCPL0500/0530		0.5	1.5	μs
	Logic HIGH	$ \begin{array}{l} {\sf R}_L = 1.9 {\sf k} \Omega,  {\sf I}_{\sf F} = 16 {\sf m} {\sf A},  {\sf T}_{\sf A} = 25^{\circ} {\sf C} \\ ({\sf Note} \; 3) \; ({\sf Fig.} \; 9) \end{array} $	HCPL0452/3		0.3	0.8	]
	-		HCPL0501/0531/4				
		$R_L = 4.1k\Omega$ , $I_F = 16mA$ (Note 2) (Fig. 9)	HCPL0500/0530			2.0	
		$R_{L} = 1.9k\Omega, I_{F} = 16mA$ (Note 3) (Fig. 9)	HCPL0452/3	-		1.0	1
			HCPL0501/0531/4				
ICM <sub>H</sub> I	Transient Immunity at Logic HIGH	bde $I_F = 0mA, V_{CM} = 10V_{P-P}, R_L = 4.1kV,$ $T_A = 25^{\circ}C$ (Note 4) (Fig. 10)	HCPL0500	1,000 10,000		V/µs	
			HCPL0530				
		H H $I_F = 0mA, V_{CM} = 10V_{P-P}, R_L = 1.9k\Omega$ $T_A = 25^{\circ}C, \text{ (Note 4) (Fig. 10)}$	HCPL0452	1,000	10,000		
			HCPL0501/31				
			HCPL0534	15,000	40,000		
		$\begin{split} I_{F} &= 16 \text{mA},  V_{CM} = 1500 V_{P-P} \\ R_{L} &= 1.9 \Omega,  T_{A} = 25^{\circ} \text{C} \\ (\text{Note 4})  (\text{Fig. 10}) \end{split}$	HCPL0453	15,000	40,000		
ICMLI	Common Mode	$I_{F} = 16mA, V_{CM} = 10V_{P-P} R_{L} = 4.1k\Omega,$	HCPL0500	1,000 10,000		V/µs	
	Transient Immunity at	T <sub>A</sub> = 25°C (Note 4) (Fig. 10)	HCPL0530				
	Logic LOW	$I_F = 16$ mA, $V_{CM} = 10$ $V_{P-P}$ R <sub>L</sub> = 1.9kΩ (Note 4) (Fig. 10)	HCPL0452	1,000	10,000		
	-		HCPL0501/31				
			HCPL0534	15,000	40,000		
		$\begin{split} I_{F} &= 16 \text{mA}, \ T_{A} = 25^{\circ}\text{C}, \\ V_{CM} &= 1500 \ V_{P.P} \ C_{L} = 15 \text{pF}) \\ (\text{Note 4}) \ (\text{Fig. 10}) \end{split}$	HCPL0453	15,000	40,000		

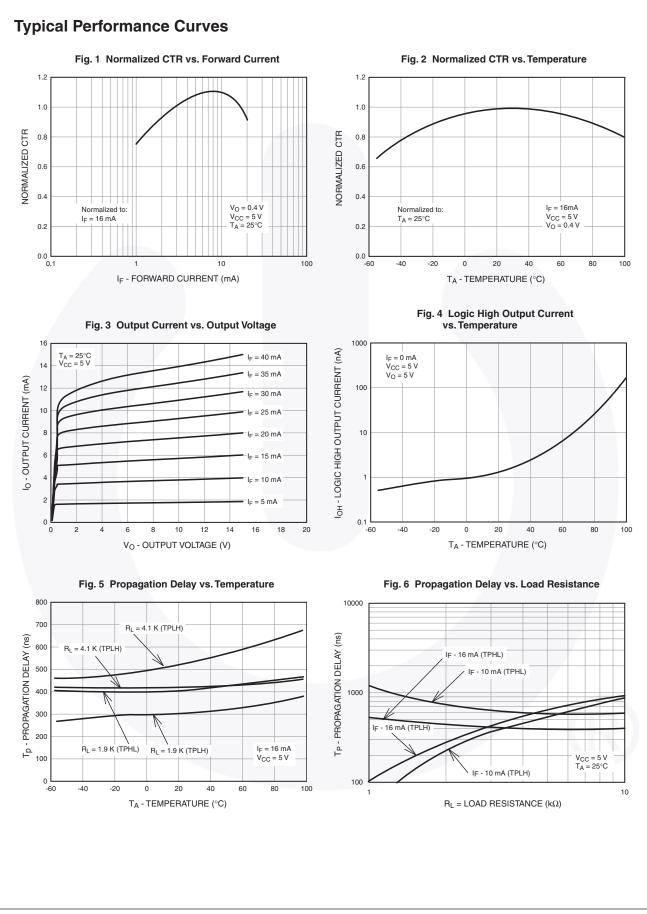
#### **Isolation Characteristics**

Symbol	Characteristics	Test Conditions	Min.	Тур.*	Max .	Unit
V <sub>ISO</sub>	Input-Output Isolation Voltage	f = 60 Hz, t = 1.0 min., $I_{I-O} \le 2\mu A$ (Note 5, 6)	2500			Vac <sub>RMS</sub>
R <sub>ISO</sub>	Isolation Resistance	V <sub>I-O</sub> = 500V (Note 5)	10 <sup>11</sup>			
C <sub>ISO</sub>	Isolation Capacitance	V <sub>I-O</sub> = 0 , f = 1.0MHz (Note 5)		0.2		pF

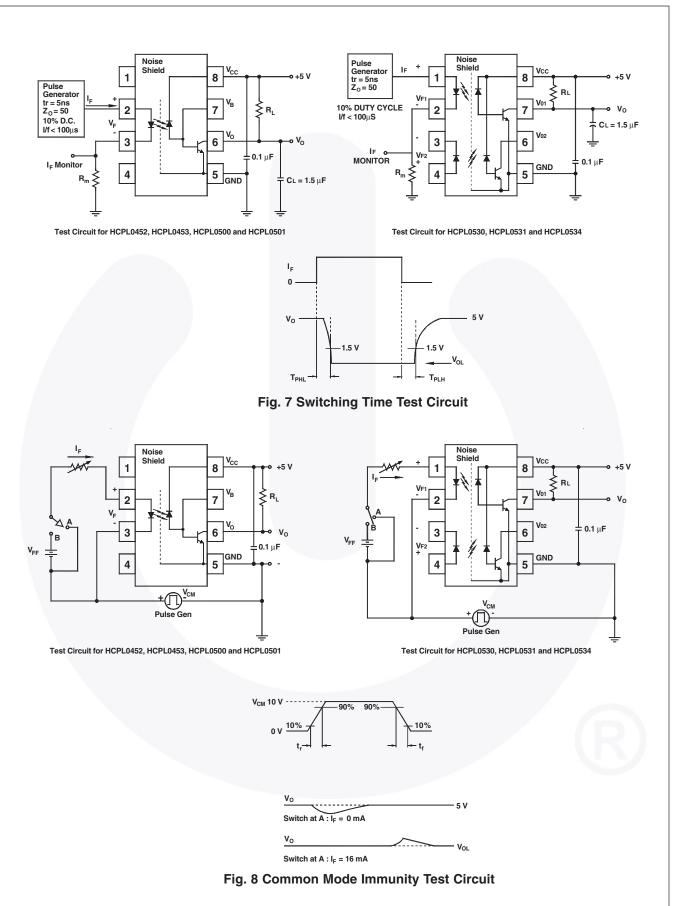
\*All typicals at  $T_A=25^\circ C$ 

#### Notes

- 1 Current Transfer Ratio is designed as a ratio of output collector current, I<sub>O</sub>, to the forward LED input current, I<sub>F</sub> times 100%.
- 2. The 4.1 k\Omega load represents 1 LSTTL unit load of 0.36 mA and 6.1k $\Omega$  pull-up resistor.
- 3. The 1.9 k $\Omega$  load represents 1 TTL unit load of 1.6 mA and 5.6 k $\Omega$  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.,  $V_O>2.0$  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.



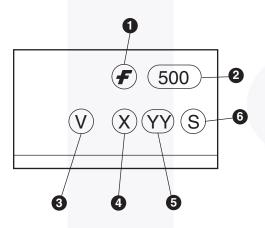
HCPL0XXX — High Speed Transistor Optocouplers



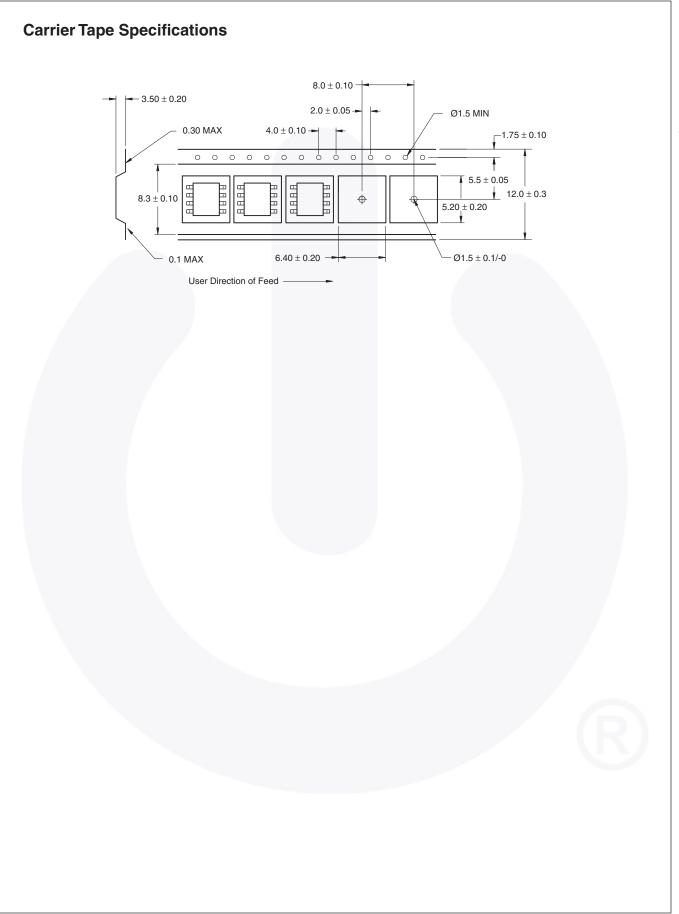
### **Ordering Information**

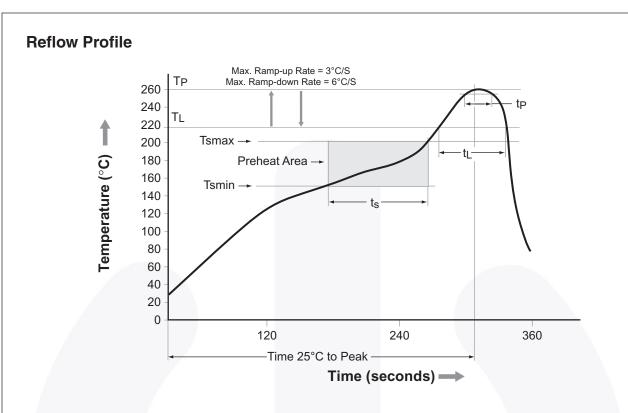
Option	Order Entry Identifier	Description
V V VDE 0884 (approval pending for HCPL0530)		VDE 0884 (approval pending for HCPL0530, HCPL0531 & HCPL0534)
R2	R2	Tape and reel (2500 units per reel)
R2V	R2V	VDE 0884 (approval pending for HCPL0530, HCPL0531 & HCPL0534), Tape and reel (2500 units per reel)

## Marking Infomation

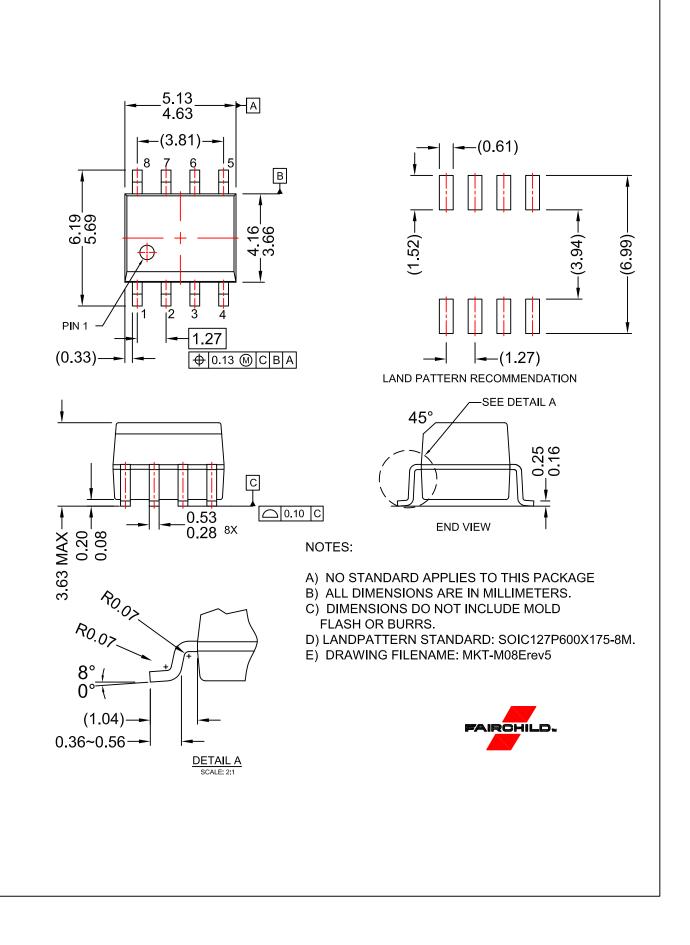


	Definitions			
1	Fairchild logo			
2	Device number			
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)			
4	One digit year code, e.g., '3'			
5	Two digit work week ranging from '01' to '53'			
6	Assembly package code			





Profile Freature	Pb-Free Assembly Profile		
Temperature Min. (Tsmin)	150°C		
Temperature Max. (Tsmax)	200°C		
Time (t <sub>S</sub> ) from (Tsmin to Tsmax)	60–120 seconds		
Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second max.		
Liquidous Temperature (T <sub>L</sub> )	217°C		
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60–150 seconds		
Peak Body Package Temperature	260°C +0°C / -5°C		
Time (t <sub>P</sub> ) within 5°C of 260°C	30 seconds		
Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/second max.		
Time 25°C to Peak Temperature	8 minutes max.		





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No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.			
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.			

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