

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 guestions@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 EDA 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 officer



August 2013

HCPL0600, HCPL0601, HCPL0611, HCPL0637, HCPL0638, HCPL0639 High Speed-10 MBit/s Logic Gate Optocouplers

Single Channel: HCPL0600, HCPL0601, HCPL0611 Dual Channel: HCPL0637, HCPL0638, HCPL0639

Features

- Compact SO8 package
- Very high speed-10 MBit/s
- Superior CMR
- Logic gate output
- Strobable output (single channel devices)
- Wired OR-open collector
- U.L. recognized (File # E90700)
- IEC60747-5-2 approved (VDE option)
 HCPL0600, HCPL0601, HCPL0611 only

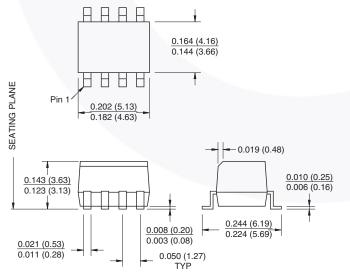
Applications

- Ground loop elimination
- LSTTL to TTL, LSTTL or 5-volt CMOS
- Line receiver, data transmission
- Data multiplexing
- Switching power supplies
- Pulse transformer replacement
- Computer-peripheral interface

Description

The HCPL06XX optocouplers consist of an AlGaAS LED, optically coupled to a very high speed integrated photo-detector logic gate with a strobable output (single channel devices). The devices are housed in a compact small-outline package. This output features an open collector, thereby permitting wired OR outputs. The HCPL0600, HCPL0601 and HCPL0611 output consists of bipolar transistors on a bipolar process while the HCPL0637, HCPL0638, and HCPL0639 output consists of bipolar transistors on a CMOS process for reduced power consumption. The coupled parameters are guaranteed over the temperature range of -40°C to +85°C. An internal noise shield provides superior common mode rejection.

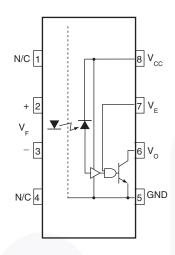
Package Dimensions



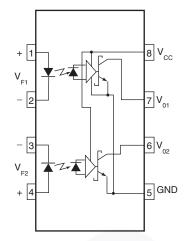
Lead Coplanarity: 0.004 (0.10) MAX

Note:

All dimensions are in inches (millimeters)



Single-channel circuit drawing (HCPL0600, HCPL0601 and HCPL0611)



Dual-channel circuit drawing (HCPL0637, HCPL0638 and HCPL0639)

Truth Table (Positive Logic)

Input	Enable	Output
Н	Н	L
L	Н	Н
Н	L	Н
L	L	Н
H*	NC*	L*
L*	NC*	H*

*Dual channel devices or single channel devices with pin 7 not connected. A $0.1\mu F$ bypass capacitor must be connected between pins 8 and 5. (See note 1)

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

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	°C
T _{OPR}	Operating Temperature			-40 to +85	°C
EMITTER					
I _F	DC/Average Forward Input Cur	rent	Single Channel	50	mA
	(each channel)		Dual Channel		
V _E	Enable Input Voltage Not to exceed VCC by more that	an 500mV	Single Channel	5.5	V
V _R	Reverse Input Voltage (each ch	nannel)		5.0	V
P _I	Power Dissipation		Single Channel	45	mW
			Dual Channel		
DETECTOR					
V _{CC} (1 minute max)	Supply Voltage			7.0	V
I _O	Output Current (each channel)		Single Channel	50	mA
			Dual Channel	15	
Vo	Output Voltage (each channel)		·	7.0	V
Po	Collector Output Power Dissipa	ation	Single Channel	85	mW
			Dual Channel	85	

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Paramet	Min.	Max.	Units	
I _{FL}	Input Current, Low Level		0	250	μΑ
I _{FH}	Input Current, High Level		*6.3	15	mA
V _{CC}	Supply Voltage, Output		4.5	5.5	V
V _{EL}	Enable Voltage, Low Level	Single Channel only	0	0.8	V
V _{EH}	Enable Voltage, High Level	Single Channel only	2.0	V _{CC}	V
T _A	Operating Temperature	•	-40	+85	°C
N	Fan Out (TTL load)	Single Channel		8	TTL Loads
		Dual Channel		5	
R_L	Output Pull-up		330	4K	Ω

^{*6.3}mA 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 ($T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ unless otherwise specified.) **Individual Component Characteristics**

Symbol	Parameter	Test Conditions		Min.	Тур.*	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	$I_R = 10\mu A$			5.0			V
ΔVF/ΔΤΑ	Input Diode Temperature Coefficient	I _F = 10mA				-1.5		mV/°C
DETECTOR	. २				•		•	
I _{CCH}	High Level Supply Current	$I_F = 0mA$,	$V_{E} = 0.5 \text{ V}$	Single Channel			10	mA
		$V_{CC} = 5.5V$		Dual Channel			15	1
I _{CCL}	Low Level Supply Current	I _F = 10mA,	V _E = 0.5 V	Single Channel			13	mA
		$V_{CC} = 5.5V$		Dual Channel			21	
I _{EL}	Low Level Enable Current	V _{CC} = 5.5V, V _E = 0.5V Single Channel		Single Channel			-1.6	mA
I _{EH}	High Level Enable Current	V _{CC} = 5.5V, V _E = 2.0V Single Channel		Single Channel			-1.6	mA
V _{EH}	High Level Enable Voltage	$V_{CC} = 5.5V$, $I_F = 10$ mA Single		Single Channel	2.0			V
V _{EL}	Low Level Enable Voltage	$V_{CC} = 5.5V, I_{F}$	$= 10 \text{mA}^{(2)}$	Single Channel			0.8	V

Switching Characteristics ($T_A = -40$ °C to +85°C, $V_{CC} = 5$ V, $I_F = 7.5$ mA unless otherwise specified.)

Symbol	AC Characteristics	Test Conditi	ions	Device	Min.	Тур.	Max.	Unit
T _{PLH}	Propagation Delay Time	$R_L = 350\Omega, C_L = 15pF^{(3)}$	T _A = 25°C	All	20		75	ns
	to Output High Level	(Fig. 20)					100	
T _{PHL}	Propagation Delay Time	$R_L = 350\Omega, C_L = 15pF^{(4)}$	T _A = 25°C	All	25		75	ns
	to Output Low Level	(Fig. 20)					100	
IT _{PHL} -T _{PLH} I	Pulse Width Distortion	$R_L = 350\Omega$, $C_L = 15pF$ (Fig.	. 20)	All			35	ns
t _r	Output Rise Time (10-90%)	$R_L = 350\Omega$, $C_L = 15pF^{(5)}$ (F	ig. 20)	Single Ch		50		ns
				Dual Ch		17		
t _f	Output Fall Time (90-10%)	$R_L = 350\Omega, C_L = 15pF^{(6)}$ (F	ig. 20)	Single Ch		12		ns
				Dual Ch		5		
t _{ELH}	Enable Propagation Delay	$I_F = 7.5 \text{mA}, V_{EH} = 3.5 \text{V}, R_L$				20		ns
	Time to Output High Level	C _L = 15pF ⁽⁷⁾ (Fig. 21)		HCPL0601 HCPL0611				
t _{EHL}	Enable Propagation Delay	$I_F = 7.5 \text{mA}, V_{EH} = 3.5 \text{V}, R_L = 350 \Omega,$		HCPL0600		20		ns
	Time to Output Low Level	$C_L = 15 \text{ pF}^{(8)} \text{ (Fig. 21)}$		HCPL0601 HCPL0611		y		
ICM _H I	Common Mode Transient Immunity	$R_L = 350\Omega, T_A = 25^{\circ}C,$ $I_F = 0mA,$	IV _{CM} I = 10V	HCPL0600 HCPL0637	5,000			V/µs
	(at Output High Level)	V_{OH} (Min.) = 2.0 $V^{(9)}$	$ V_{CM} = 50V$	HCPL0601	10.000			
		(Fig. 22, 23)	1 v CW1 = 20 v	HCPL0638	10,000			
			IV _{CM} I = 1,000V	HCPL0611	15,000			
				HCPL0639	25,000			3/
ICM _L I	Transient Immunity $I_F = 7.5 \text{mA}$,	$I_{\rm F} = 7.5 \text{mA},$	IV _{CM} = 10V	HCPL0600 HCPL0637	5,000			V/µs
		IV _{CM} I = 50V	HCPL0601 HCPL0638	10,000				
			IV _{CM} I = 1,000V	HCPL0611	15,000			
				HCPL0639	25,000			1

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

Symbol	DC Characteristics	Test Conditions	Min.	Тур.*	Max.	Unit
I _{OH}	High Level Output Current	$V_{CC} = 5.5V$, $V_{O} = 5.5 V$, $I_{F} = 250 \mu A$, $V_{E} = 2.0 V^{(2)}$			100	μΑ
V _{OL}	Low Level Output Voltage	$V_{CC} = 5.5V$, $I_F = 5mA$, $V_E = 2.0V$, $I_{OL} = 13mA^{(2)}$			0.6	V
I _{FT}	Input Threshold Current	$V_{CC} = 5.5V$, $V_{O} = 0.6V$, $V_{E} = 2.0V$, $I_{OL} = 13mA$			5	mA

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

Symbol	Characteristics	Test Conditions	Min.	Тур.*	Max.	Unit
I _{I-O}	Input-Output Insulation Leakage Current	Relative humidity = 45%, $T_A = 25$ °C, $t = 5$ s, $V_{I-O} = 3000 \text{ VDC}^{(11)}$			1.0*	μΑ
V _{ISO}	Withstand Insulation Test Voltage	$R_H < 50\%$, $T_A = 25$ °C, $I_{I-O} \le 2\mu A$, $t = 1 \text{ min.}^{(11)}$	3750			V _{RMS}
R _{I-O}	Resistance (Input to Output)	$V_{I-O} = 500V^{(11)}$		10 ¹²		Ω
C _{I-O}	Capacitance (Input to Output)	$f = 1MHz^{(11)}$		0.6		pF

^{*}All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}\text{C}$

Notes:

- 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 as close as possible
 to the package V_{CC} and GND pins of each device.
- 2. Enable Input No pull up resistor required as the device has an internal pull up resistor.
- 3. t_{PLH} Propagation delay is measured from the 3.75mA 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.
- 4. t_{PHL} Propagation delay is measured from the 3.75mA 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.
- 5. t_r Rise time is measured from the 90% to the 10% levels on the LOW to HIGH transition of the output pulse.
- 6. t_f Fall time is measured from the 10% to the 90% levels on the HIGH to LOW transition of the output pulse.
- 7. t_{ELH} Enable input propagation delay is measured from the 1.5V level on the HIGH to LOW transition of the input voltage pulse to the 1.5V level on the LOW to HIGH transition of the output voltage pulse.
- 8. t_{EHL} Enable input propagation delay is measured from the 1.5V level on the LOW to HIGH transition of the input voltage pulse to the 1.5V level on the HIGH to LOW transition of the output voltage pulse.
- 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} > 2.0V). Measured in volts per microsecond (V/μs).
- 10. 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., $V_{OUT} < 0.8V$). Measured in volts per microsecond (V/μ s).
- 11. Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together, and Pins 5, 6, 7 and 8 shorted together.

Typical Performance Curves (HCPL0600, HCPL0601 and HCPL0611 only)

Fig. 1 Forward Current vs. Input Forward Voltage

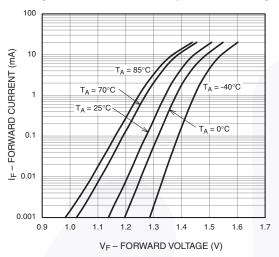


Fig. 3 Input Threshold Current vs. Temperature

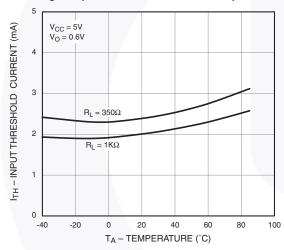
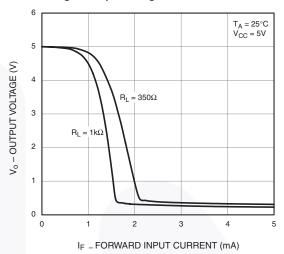
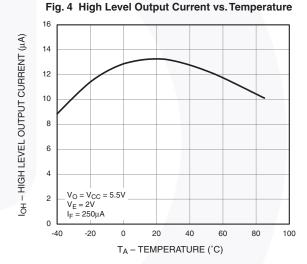


Fig. 2 Output Voltage vs. Forward Current





Typical Performance Curves (HCPL0600, HCPL0601 and HCPL0611 only)

Fig. 5 Low Level Output Voltage vs. Temperature

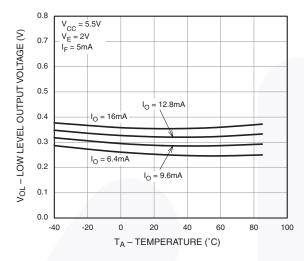


Fig. 7 Propagation Delay vs. Temperature

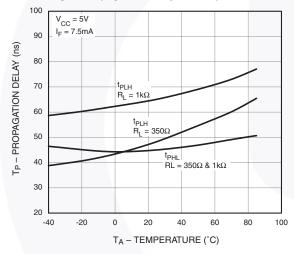


Fig. 6 Low Level Output Current vs. Temperature

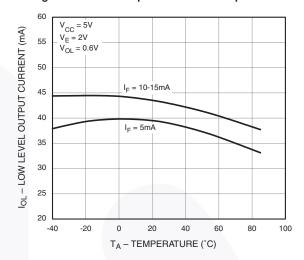
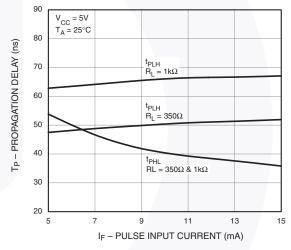


Fig. 8 Propagation Delay vs. Pulse Input Current



Typical Performance Curves (HCPL0600, HCPL0601 and HCPL0611 only)

Fig. 9 Typical Enable Propagation Delay vs. Temparature

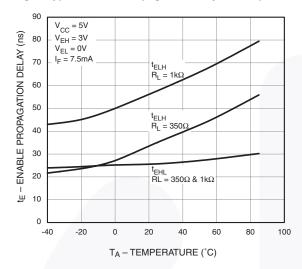


Fig. 10 Typical Rise and Fall Time vs. Temperature

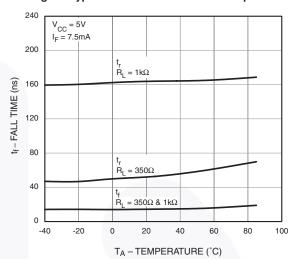
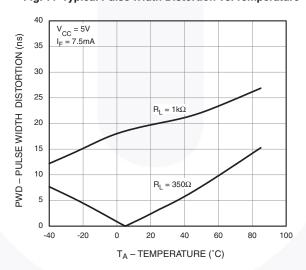


Fig. 11 Typical Pulse Width Distortion vs. Temperature



Typical Performance Curves (HCPL0637, HCPL0638 and HCPL0639 only)

Fig. 12 Input Forward Current vs. Forward Voltage

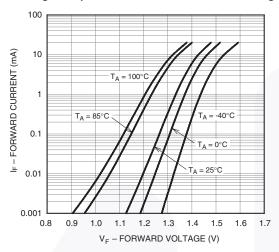


Fig. 14 High Level Output Current vs. Ambient Temperature

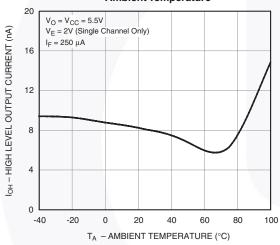


Fig. 16 Low Level Output Voltage vs. Ambient Temperature

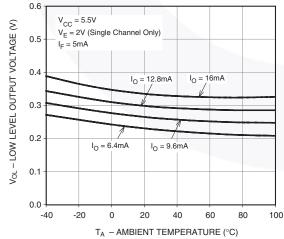


Fig. 13 Input Threshold Current vs. Ambient Temperature

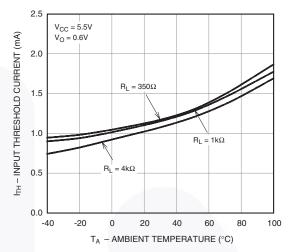


Fig. 15 Low Level Output Current vs.
Ambient Temperature

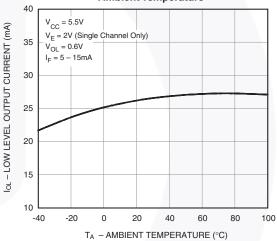
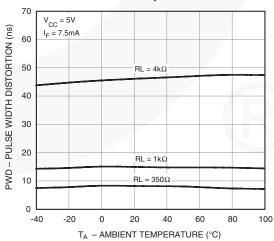


Fig. 17 Pulse Width Distortion vs.
Ambient Temperature



Typical Performance Curves (HCPL0637, HCPL0638 and HCPL0639 only)

Fig. 18 Propagation Delay vs. Ambient Temperature

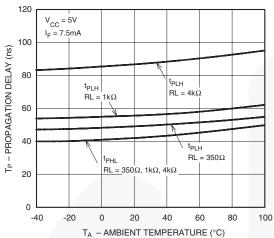
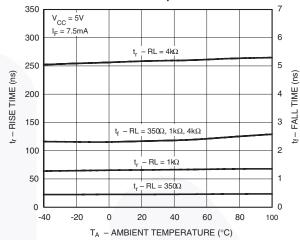


Fig. 19 Rise and Fall Times vs. Ambient Temperature



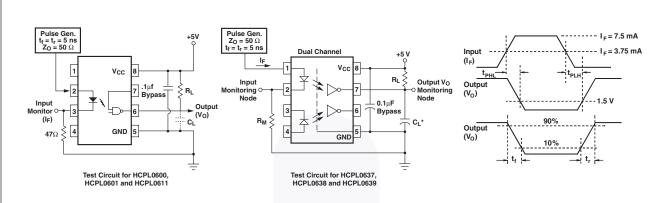


Fig. 20 Test Circuit and Waveforms for $t_{\text{PLH}},\,t_{\text{PHL}},\,t_{\text{r}}$ and $t_{\text{f}}.$

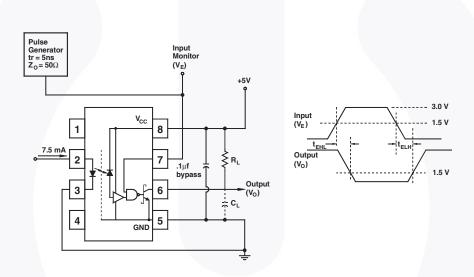
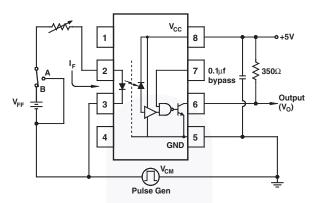


Fig. 21 Test Circuit $\rm t_{EHL}$ and $\rm t_{ELH}.$



Test Circuit for HCPL0600, HCPL0601, and HCPL0611

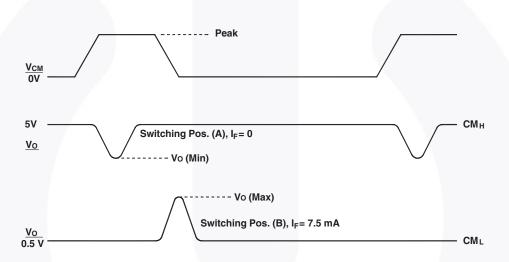
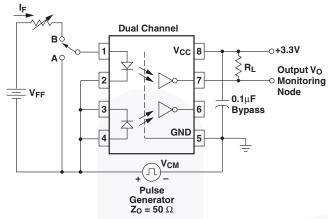


Fig. 22 Test Circuit Common Mode Transient Immunity (HCPL0600, HCPL0601 and HCPL0611)



Test Circuit for HCPL0637, HCPL0638 and HCPL0639

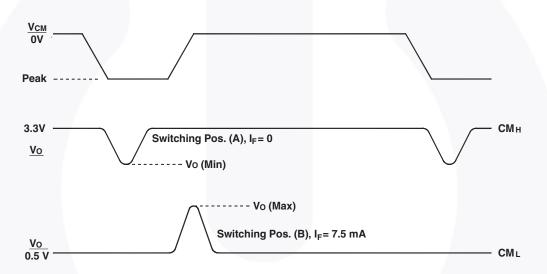
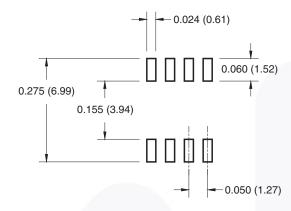


Fig. 23 Test Circuit Common Mode Transient Immunity (HCPL0637, HCPL0638 and HCPL0639)

8-Pin Small Outline

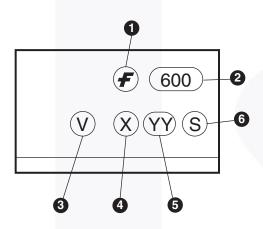


Ordering Information

Option	Order Entry Identifier	Description	
No Suffix	HCPL0600	Shipped in tubes (50 units per tube)	
V*	HCPL0600V	IEC60747-5-2 approval	
R2	HCPL0600R2	Tape and Reel (2500 units per reel)	
R2V*	HCPL0600R2V	IEC60747-5-2 approval, Tape and Reel (2500 units per reel)	

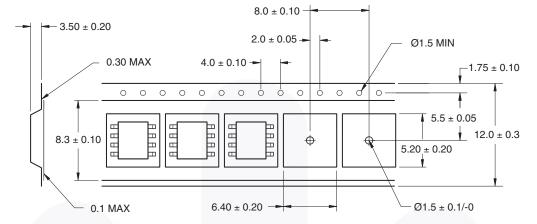
^{*}Available for HCPL0600, HCPL0601, HCPL0611 only.

Marking Information



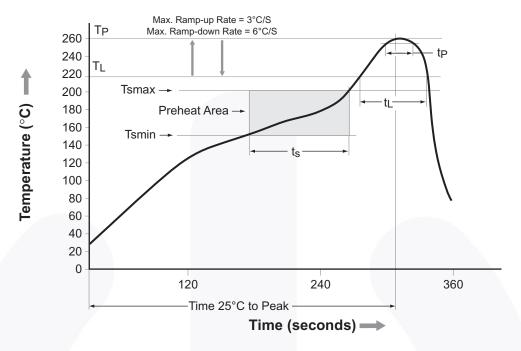
Definiti	ons			
1	Fairchild logo			
2	Device number			
3	VDE mark indicates IEC60747-5-2 approval (Note: Only appears on parts ordered with VDE option – See order entry table)			
4	One digit year code, e.g., '3'			
5	Two digit work week ranging from '01' to '53'			
6	Assembly package code			

Carrier Tape Specifications

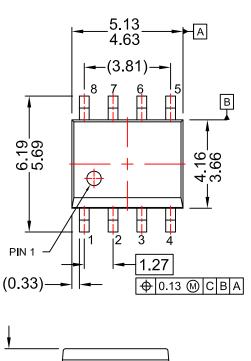


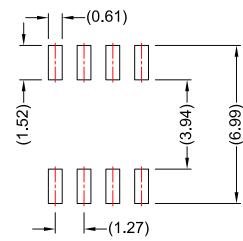
User Direction of Feed

Reflow Profile

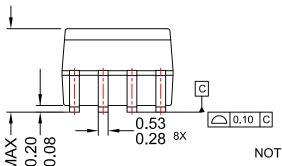


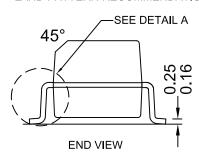
Profile Freature	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	150°C
Temperature Max. (Tsmax)	200°C
Time (t _S) from (Tsmin to Tsmax)	60-120 seconds
Ramp-up Rate (t _L to t _P)	3°C/second max.
Liquidous Temperature (T _L)	217°C
Time (t _L) Maintained Above (T _L)	60-150 seconds
Peak Body Package 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.





LAND PATTERN RECOMMENDATION



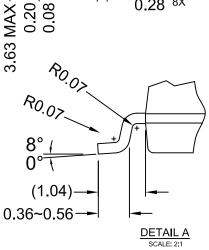






- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M.
- E) DRAWING FILENAME: MKT-M08Erev5





ON Semiconductor and in 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/pdt/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. 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 exp

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

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

ON Semiconductor: HCPL0637 HCPL0637R2