

# 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 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

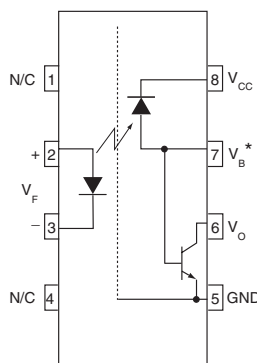
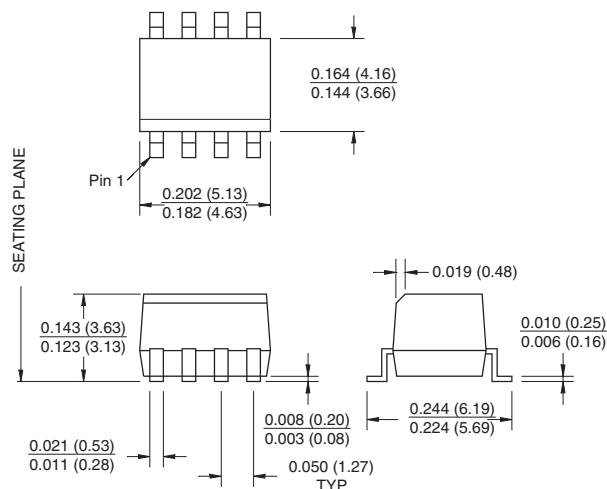
The HCPL05XX, and HCPL04XX optocouplers consist of an AlGaAs LED optically coupled to a high speed photodetector transistor housed in a compact 8-pin small outline package.

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.

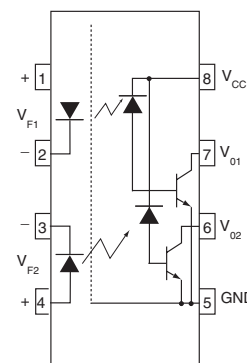
## Truth Table (positive Logic)

LED	V <sub>o</sub>
ON	LOW
OFF	HIGH

## Package Dimensions



HCPL0500, HCPL0501  
\*BASE NOT CONNECTED  
FOR HCPL0452, HCPL0453



HCPL0530/HCPL0531/HCPL0534

## NOTE

All dimensions are in inches (millimeters)

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

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 9)		
<b>EMITTER</b>			
$I_F$ (avg)	DC/Average Forward Input Current	25	mA
$I_F$ (pk)	Peak Forward Input Current (50% duty cycle, 1 ms 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
<b>DETECTOR</b>			
$I_O$ (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 $70^\circ\text{C}$ Unless otherwise specified)

#### Individual Component Characteristics

Symbol	Parameter	Test Conditions	Device	Min	Typ**	Max	Unit
$V_F$	<b>EMITTER</b>	$(I_F = 16 \text{ mA}, T_A = 25^\circ\text{C})$	All		1.45	1.7	V
	Input Forward Voltage	$(I_F = 16 \text{ mA})$				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/ $^\circ\text{C}$
$I_{OH}$	<b>DETECTOR</b>	$(I_F = 0 \text{ mA}, V_O = V_{CC} = 5.5\text{V}, T_A = 25^\circ\text{C})$	All		0.001	0.5	$\mu\text{A}$
	Logic high output current	$(I_F = 0 \text{ mA}, V_O = V_{CC} = 15 \text{ V}, T_A = 25^\circ\text{C})$	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	$\mu\text{A}$
			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	$\mu\text{A}$
			HCPL0452/3/0500/1			2	
			HCPL0530/1/4			4	

### Transfer Characteristics ( $T_A = 0$ to $70^\circ\text{C}$ Unless)

Symbol	Parameter	Test Conditions	Device	Min	Typ**	Max	Unit
CTR	<b>COUPLED</b>	$(I_F = 16 \text{ mA}, V_O = 0.4 \text{ V})$ $(V_{CC} = 4.5 \text{ V}, T_A = 25^\circ\text{C})$	HCPL0500/0530	7	2.7	50	%
			HCPL0452/3	19	27	50	
			HCPL0501/0531				
	Current transfer ratio (Note 1)	$(I_F = 16 \text{ mA}, V_O = 0.5 \text{ V})$ $(V_{CC} = 4.5 \text{ V})$	HCPL0500	5	30		
			HCPL0452/3	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				
		$(I_F = 16 \text{ mA}, I_O = 0.8 \text{ mA})$ $(V_{CC} = 4.5)$	HCPL0500		0.13	0.5	
			HCPL0530				
		$(I_F = 16 \text{ mA}, I_O = 2.4 \text{ mA})$ $(V_{CC} = 4.5)$	HCPL0452/3		0.23	0.5	
			HCPL0501/0531/4				

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

### Switching Characteristics ( $T_A = 0$ to $70^\circ\text{C}$ unless otherwise specified., $V_{CC} = 5 \text{ V}$ )

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	$\mu\text{s}$
			HCPL0452/3		0.45	0.8	
		HCPL0501/0531/4					
		$(R_L = 1.9 \text{ k}\Omega, I_F = 16 \text{ mA})$ (Note 3) (Fig. 9) $T_A = 25^\circ\text{C}$	HCPL0500/0530			2.0	
			HCPL0452/3			1.0	
$T_{PLH}$	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	$\mu\text{s}$
			HCPL0452/3		0.3	0.8	
		HCPL0501/0531/4					
		$(R_L = 1.9 \text{ k}\Omega, I_F = 16 \text{ mA})$ (Note 3) (Fig. 9) $T_A = 25^\circ\text{C}$	HCPL0500/0530			2.0	
			HCPL0452/3			1.0	
$ICM_H$	Common mode transient immunity at logic high	$(I_F = 0 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P}, R_L = 4.1 \text{ k}\Omega)$ (Note 4) (Fig. 10) $T_A = 25^\circ\text{C}$	HCPL0500	1,000	10,000		V/ $\mu\text{s}$
			HCPL0530				
		$(I_F = 0 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P})$ $T_A = 25^\circ\text{C}, (R_L = 1.9 \text{ k}\Omega)$ (Note 4) (Fig. 10)	HCPL0452	1,000	10,000		
			HCPL0501/31				
		$(I_F = 16 \text{ mA}, V_{CM} = 1500 \text{ V}_{P-P}, R_L = 1.9 \text{ k}\Omega,$ $T_A = 25^\circ\text{C})$ (Note 4) (Fig. 10)	HCPL0534	15,000	40,000		
$ICM_L$	Common mode transient immunity at logic low	$(I_F = 16 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P}, R_L = 4.1 \text{ k}\Omega)$ (Note 4) (Fig. 10) $T_A = 25^\circ\text{C}$	HCPL0500	1,000	10,000		V/ $\mu\text{s}$
			HCPL0530				
		$(I_F = 16 \text{ mA}, V_{CM} = 10 \text{ V}_{P-P})$ $T_A = 25^\circ\text{C}, (R_L = 1.9 \text{ k}\Omega)$ (Note 4) (Fig. 10)	HCPL0452	1,000	10,000		
			HCPL0501/31				
		$(I_F = 16 \text{ mA}, T_A = 25^\circ\text{C}, V_{CM} = 1500 \text{ V}_{P-P},$ $C_L = 15 \text{ pF})$ (Note 4) (Fig. 10)	HCPL0534	15,000	40,000		
	HCPL0453	15,000	40,000				

**Isolation Characteristics** ( $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$  Unless otherwise specified.)

Symbol	Characteristics	Test Conditions	Min	Typ**	Max	Unit
$V_{ISO}$	Input-Output Isolation Voltage	(note 5, 6) ( $f = 60 \text{ Hz}$ , $t = 1.0 \text{ min}$ ) ( $I_{I-O} \leq 2 \mu\text{A}$ )	2500	—	—	$V_{ac_{RMS}}$
$R_{ISO}$	Isolation Resistance	(note 5) ( $V_{I-O} = 500 \text{ V}$ ) <sup>(9)</sup>	$10^{11}$	—	—	—
$C_{ISO}$	Isolation Capacitance	(note 5) ( $V_{I-O} = 0$ , $f = 1.0 \text{ MHz}$ ) <sup>(9)</sup>	—	0.2	—	pF

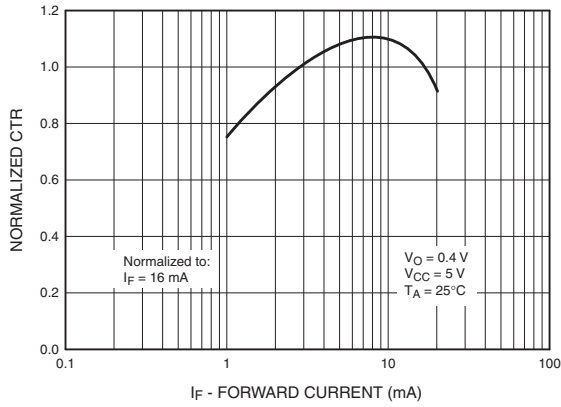
\*\* All typicals at  $T_A = 25^\circ\text{C}$

**NOTES**

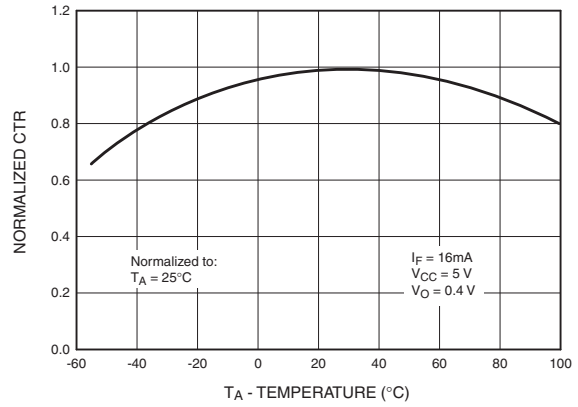
1. Current Transfer Ratio is designed as a ratio of output collector current,  $I_O$ , to the forward LED input current,  $I_F$  times 100%.
2. The 4.1 k $\Omega$  load represents 1 LSTTL unit load of 0.36 mA and 6.1k $\Omega$  pull-up resistor.
3. The 1.9 k $\Omega$  load represents 1 TTL unit load 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.,  $V_O > 2.0 \text{ V}$ ). 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.,  $V_O < 0.8 \text{ V}$ ).
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

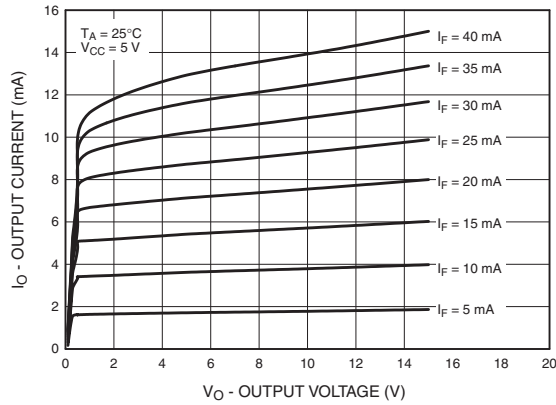
**Fig. 1 Normalized CTR vs. Forward Current**



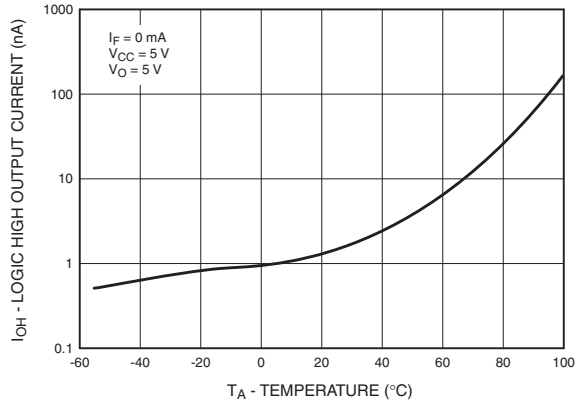
**Fig. 2 Normalized CTR vs. Temperature**



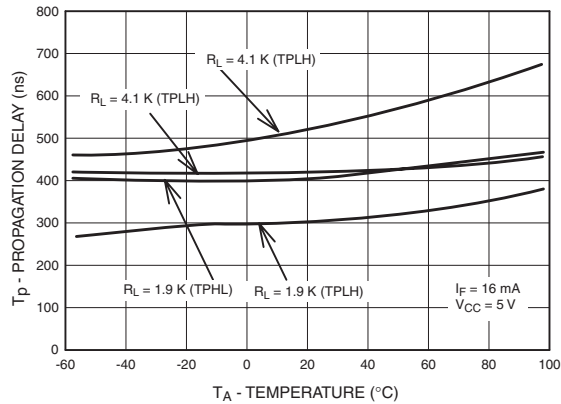
**Fig. 3 Output Current vs. Output Voltage**



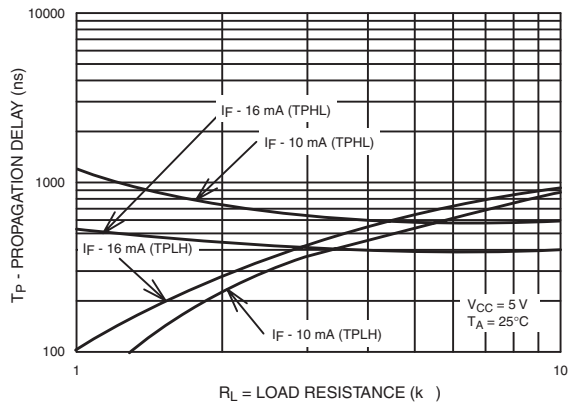
**Fig. 4 Logic High Output Current vs. Temperature**



**Fig. 5 Propagation Delay vs. Temperature**



**Fig. 6 Propagation Delay vs. Load Resistance**



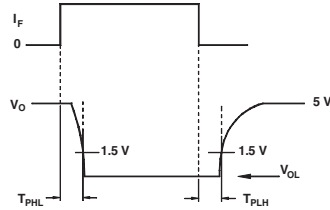
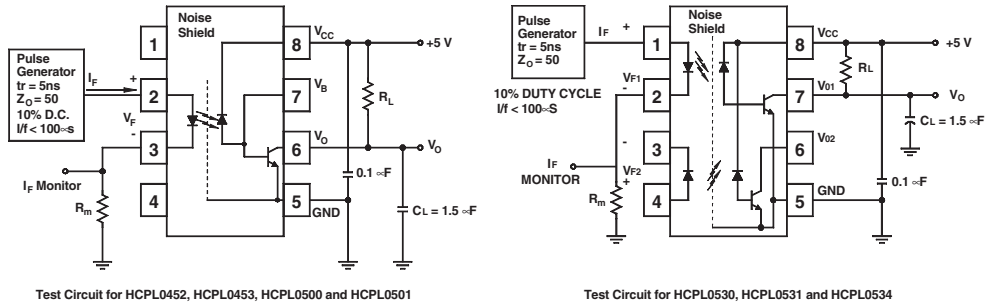


Fig. 7 Switching Time Test Circuit

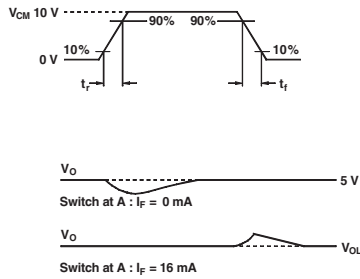
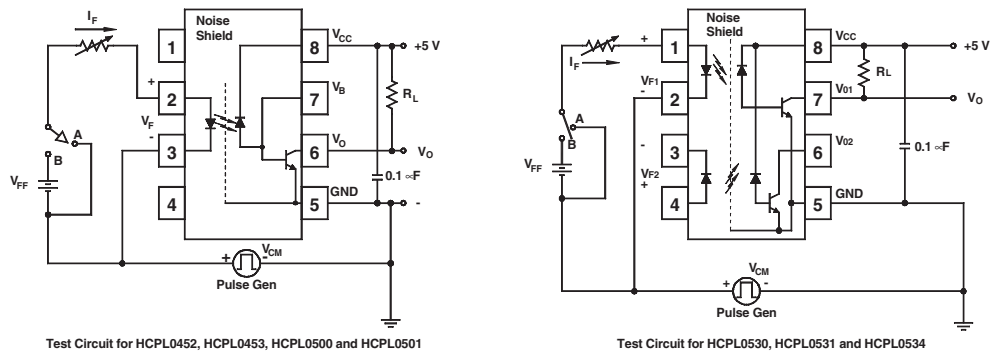
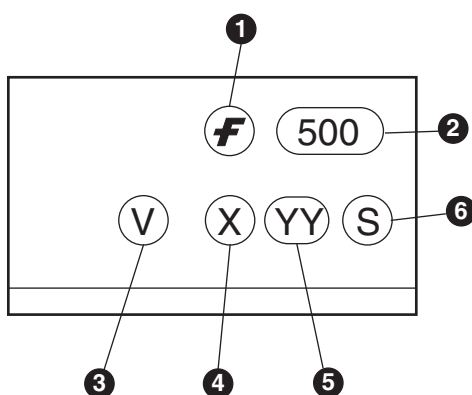


Fig. 8 Common Mode Immunity Test Circuit

### Ordering Information

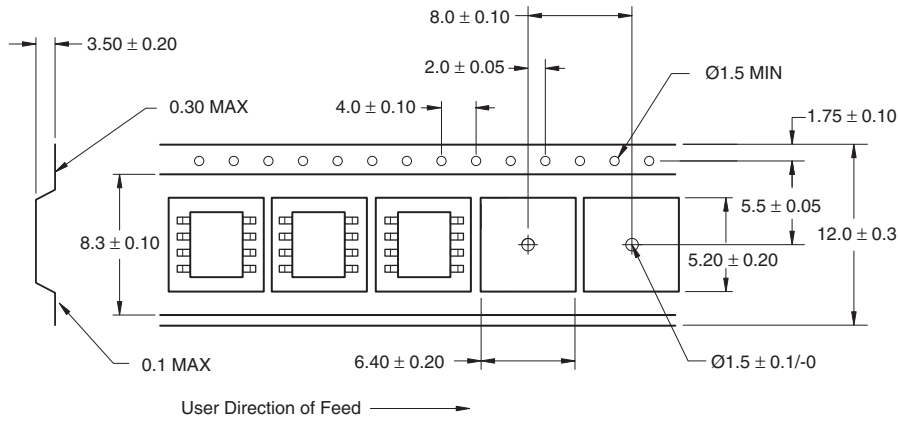
Option	Order Entry Identifier	Description
V	V	VDE 0884 (approval pending for HCPL0530, HCPL0531 & HCPL0534)
R1	R1	Tape and reel (500 units per reel)
R1V	R1V	VDE 0884 (approval pending for HCPL0530, HCPL0531 & HCPL0534), Tape and reel (500 units per reel)
R2	R2	Tape and reel (2500 units per reel)
R2V	R2V	VDE 0884 (approval pending for HCPL0530, HCPL0531 & HCPL0534), Tape and reel (2500 units per reel)

### Marking Information

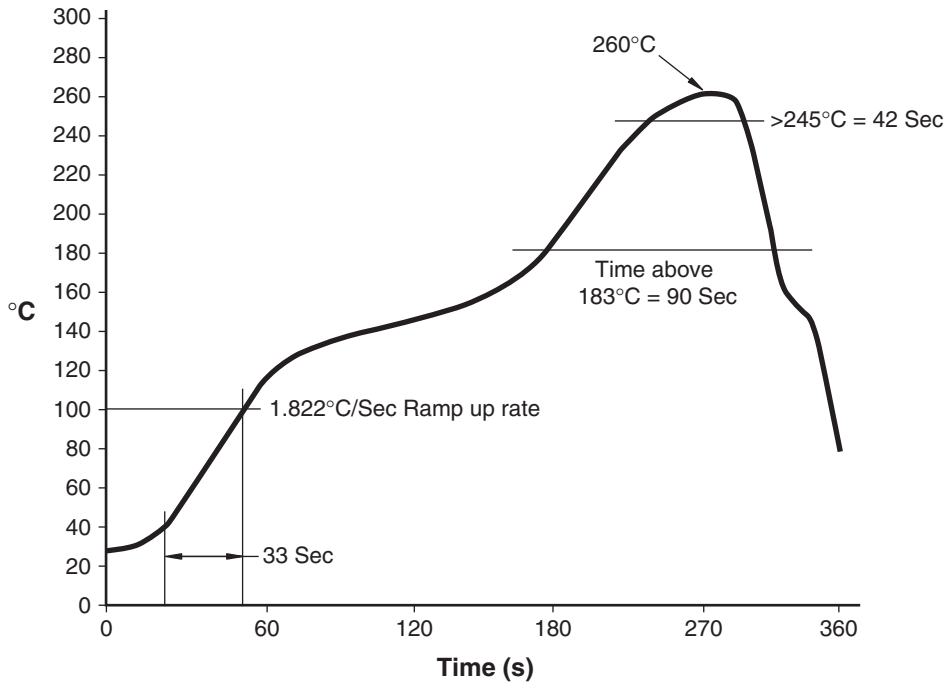


Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

### Carrier Tape Specifications



### Reflow Profile





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CROSSVOLT™	GTO™	MICROWIRE™	QT Optoelectronics™	TCM™
DOME™	HiSeC™	MSX™	Quiet Series™	TinyLogic®
EcoSPARK™	I <sup>2</sup> C™	MSXPro™	RapidConfigure™	TINYOPTO™
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EnSigna™	ImpliedDisconnect™	OCXPro™	μSerDes™	UHC™
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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## 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.
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