

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

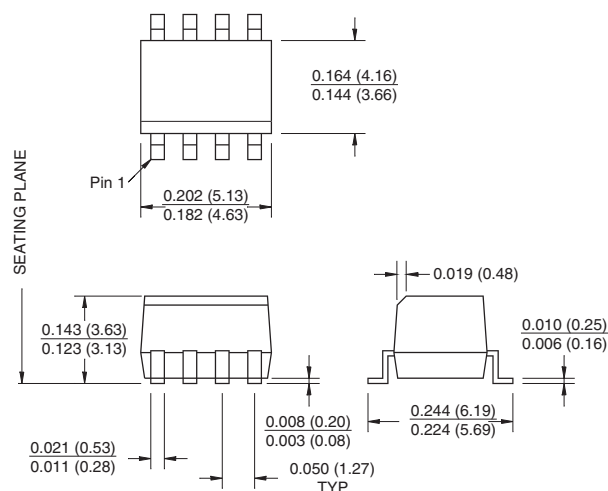
The HCPL05XX, and HCPL04XX optocouplers consist of an AlGaAs LED optically coupled to a high speed photodetector transistor housed in a compact 8-pin small outline package.

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)

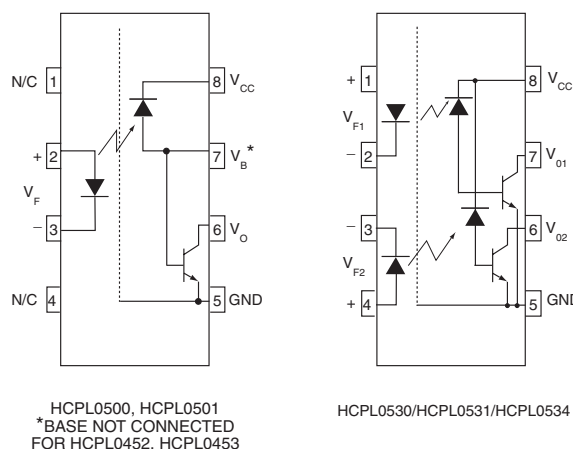
LED	V _O
ON	LOW
OFF	HIGH

Package Dimensions



NOTE

All dimensions are in inches (millimeters)



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

Parameter	Symbol	Value	Units
Storage Temperature	T_{STG}	-40 to +125	$^\circ\text{C}$
Operating Temperature	T_{OPR}	-40 to +85	$^\circ\text{C}$
Reflow Temperature Profile (Refer to page 9)			
EMITTER			
DC/Average Forward Input Current	I_F (avg)	25	mA
Peak Forward Input Current (50% duty cycle, 1 ms P.W.)	I_F (pk)	50	mA
Peak Transient Input Current - ($\leq 1 \mu\text{s}$ P.W., 300 pps)	I_F (trans)	1.0	A
Reverse Input Voltage	V_R	5	V
Input Power Dissipation	P_D	45	mW
DETECTOR			
Average Output Current (Pin 6)	I_O (avg)	8	mA
Peak Output Current	I_O (pk)	16	mA
Emitter-Base Reverse Voltage (HCPL0500/HCPL0501 only)	V_{EBR}	5	V
Supply Voltage	V_{CC}	-0.5 to 30	V
Output Voltage	V_O	-0.5 to 20	V
Base Current (HCPL0500/HCPL0501 only)	I_B	5	mA
Output power dissipation	P_D	100	mW

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

Individual Component Characteristics

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

Transfer Characteristics ($T_A = 0$ to 70°C Unless)

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
COUPLED Current transfer ratio (Note 1)	(I _F = 16 mA, V _O = 0.4 V) (V _{CC} = 4.5 V, T _A = 25°C)	CTR	HCPL0500/0530	7	2.7	50	%
			HCPL0452/3	19	27	50	
			HCPL0501/0531				
	HCPL0500		5	30			
	HCPL0452/3		15	30			
	HCPL0501/0534						
Logic low output voltage	(I _F = 16 mA, I _O = 1.1 mA) (V _{CC} = 4.5 V, T _A = 25°C)	V _{OL}	HCPL0500		0.18	0.4	V
	(I _F = 16 mA, I _O = 3 mA) (V _{CC} = 4.5 V, T _A = 25°C)		HCPL0530			0.5	
			HCPL0452/3		0.25	0.4	
	(I _F = 16 mA, I _O = 0.8 mA) (V _{CC} = 4.5)		HCPL0501/0531/4				
			HCPL0500 HCPL0530		0.13	0.5	
	(I _F = 16 mA, I _O = 2.4 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°C unless otherwise specified., $V_{CC} = 5\text{ V}$)

Parameter	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
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) $(R_L = 1.9\text{ k}\Omega, I_F = 16\text{ mA})$ (Note 3) (Fig. 9) $T_A = 25^\circ\text{C}$ $(R_L = 4.1\text{ k}\Omega, I_F = 16\text{ mA})$ (Note 2) (Fig. 9) $(R_L = 1.9\text{ k}\Omega, I_F = 16\text{ mA})$ (Note 3) (Fig. 9)	T_{PHL}	HCPL0500/0530		0.45	1.5	μs
			HCPL0452/3		0.45	0.8	
			HCPL0501/0531/4				
			HCPL0500/0530			2.0	
			HCPL0452/3			1.0	
			HCPL0501/0531/4				
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) $(R_L = 1.9\text{ k}\Omega, I_F = 16\text{ mA})$ (Note 3) (Fig. 9) $T_A = 25^\circ\text{C}$ $(R_L = 4.1\text{ k}\Omega, I_F = 16\text{ mA})$ (Note 2) (Fig. 9) $(R_L = 1.9\text{ k}\Omega, I_F = 16\text{ mA})$ (Note 3) (Fig. 9)	T_{PLH}	HCPL0500/0530		0.5	1.5	μs
			HCPL0452/3		0.3	0.8	
			HCPL0501/0531/4				
			HCPL0500/0530			2.0	
			HCPL0452/3			1.0	
			HCPL0501/0531/4				
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) $T_A = 25^\circ\text{C}$ $(I_F = 0\text{ mA}, V_{CM} = 10\text{ V}_{P-P})$ $T_A = 25^\circ\text{C}, (R_L = 1.9\text{ k}\Omega)$ (Note 4) (Fig. 10) $(I_F = 16\text{ mA}, V_{CM} = 1500\text{ V}_{P-P}, R_L = 1.9\text{ k}\Omega, T_A = 25^\circ\text{C})$ (Note 4) (Fig. 10)	ICM_{HI}	HCPL0500	1,000	10,000		$\text{V}/\mu\text{s}$
			HCPL0530				
			HCPL0452	1,000	10,000		
			HCPL0501/31				
			HCPL0534	15,000	40,000		
			HCPL0453	15,000	40,000		
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) $T_A = 25^\circ\text{C}$ $(I_F = 16\text{ mA}, V_{CM} = 10\text{ V}_{P-P})$ $T_A = 25^\circ\text{C}, (R_L = 1.9\text{ k}\Omega)$ (Note 4) (Fig. 10) $(I_F = 16\text{ mA}, T_A = 25^\circ\text{C}, V_{CM} = 1500\text{ V}_{P-P}, C_L = 15\text{ pF})$ (Note 4) (Fig. 10)	ICM_{LI}	HCPL0500	1,000	10,000		$\text{V}/\mu\text{s}$
			HCPL0530				
			HCPL0452	1,000	10,000		
			HCPL0501/31				
			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.)

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

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

NOTES

- Current Transfer Ratio is designed as a ratio of output collector current, I_O , to the forward LED input current, I_F , times 100%.
- The $4.1\text{ k}\Omega$ load represents 1 LSTTL unit load of 0.36 mA and $6.1\text{ k}\Omega$ pull-up resistor.
- The $1.9\text{ k}\Omega$ load represents 1 TTL unit load of 1.6 mA and $5.6\text{ k}\Omega$ pull-up resistor.
- 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., $V_O < 0.8\text{ V}$).
- 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.
- 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

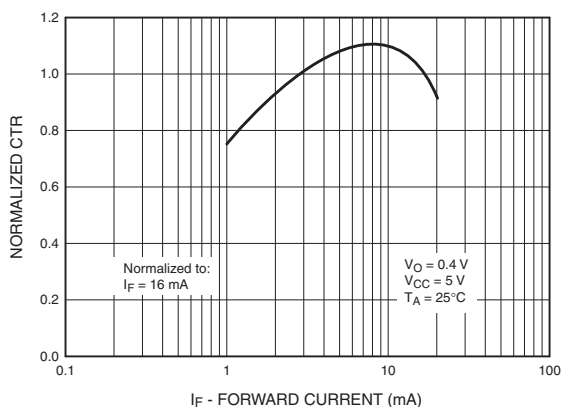


Fig. 2 Normalized CTR vs. Temperature

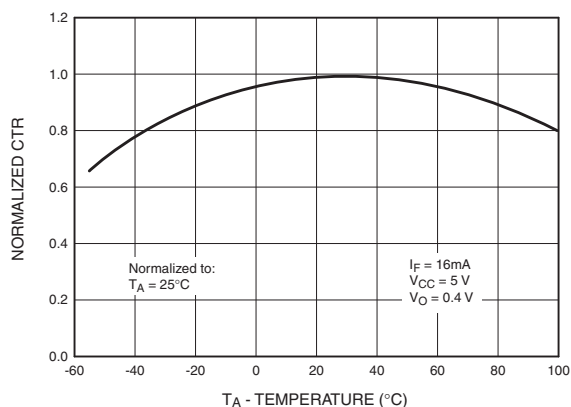


Fig. 3 Output Current vs. Output Voltage

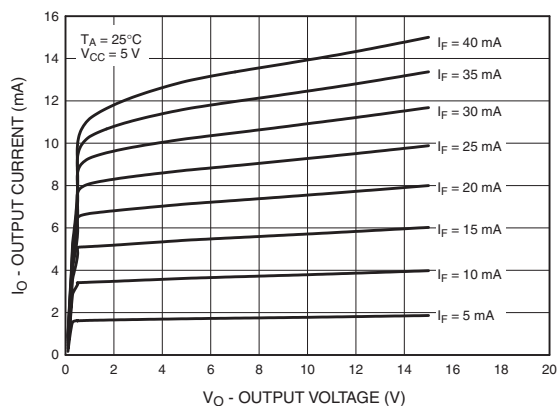


Fig. 4 Logic High Output Current vs. Temperature

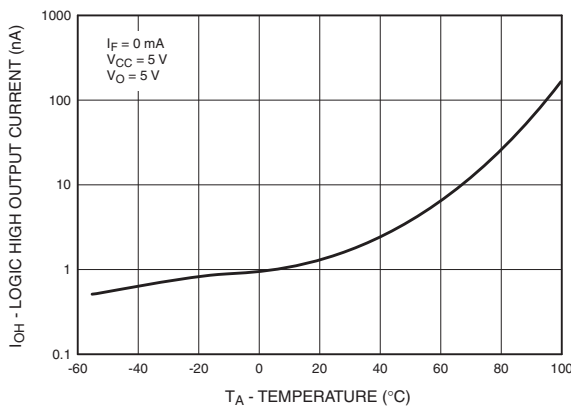


Fig. 5 Propagation Delay vs. Temperature

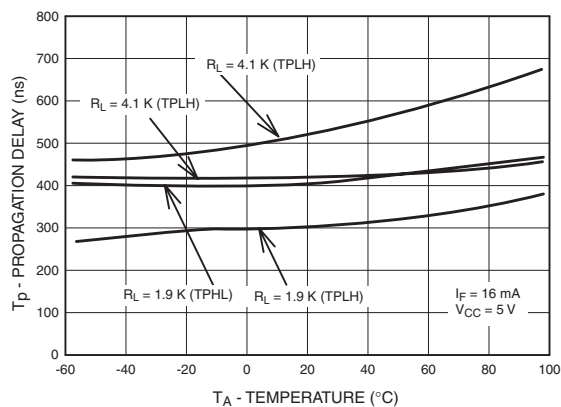
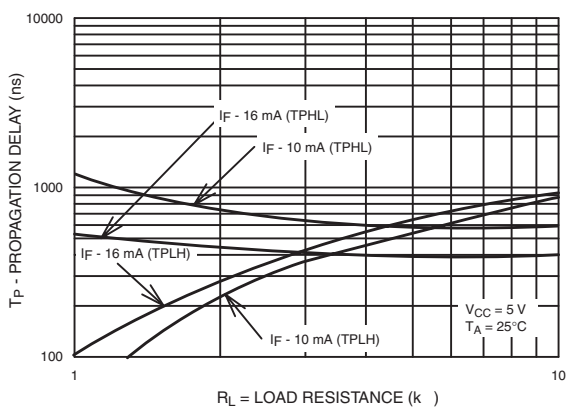


Fig. 6 Propagation Delay vs. Load Resistance



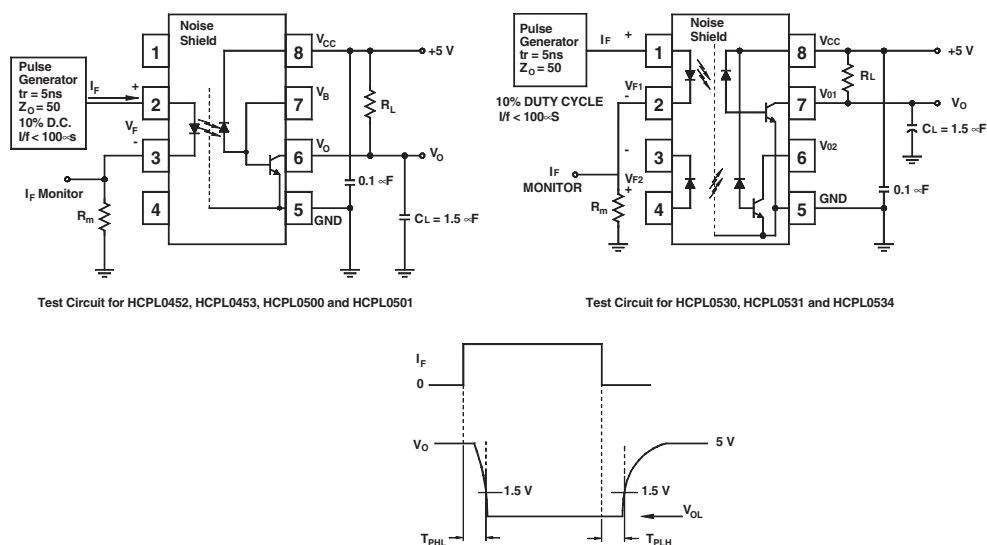


Fig. 7 Switching Time Test Circuit

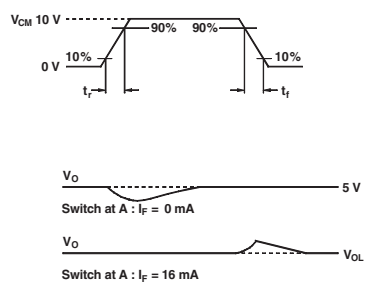
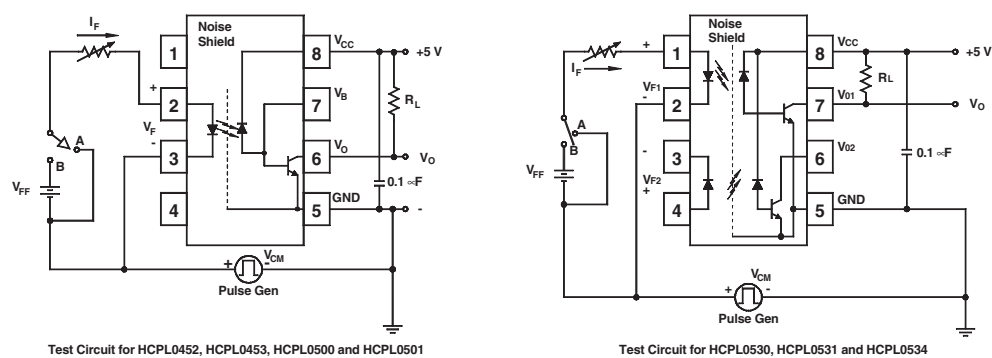
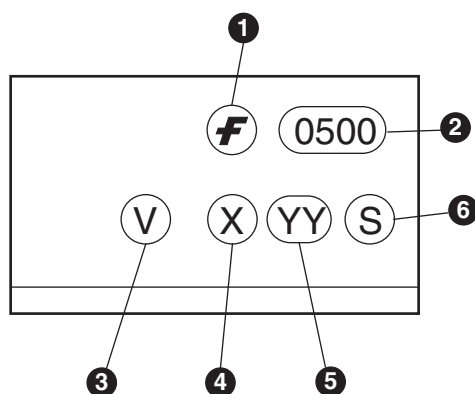


Fig. 8 Common Mode Immunity Test Circuit

Ordering Information

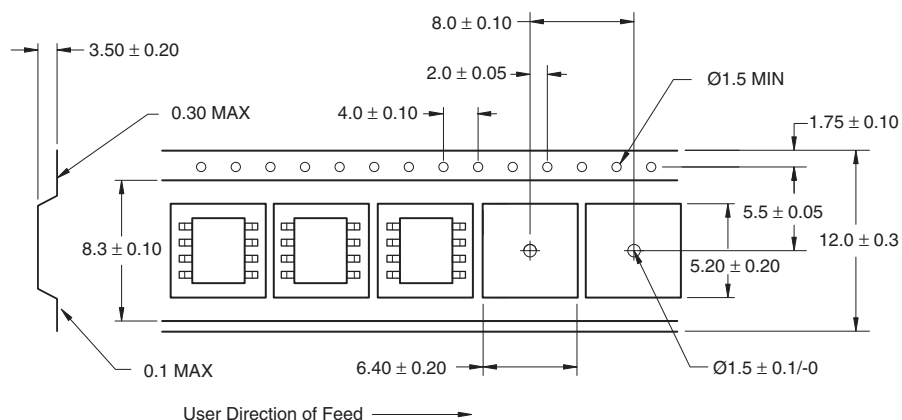
Option	Order Entry Identifier	Description
V	V	VDE 0884 (approval pending for HCPL0530, HCPL0531 & HCPL0534)
R1	R1	Tape and reel (500 units per reel)
R1V	R1V	VDE 0884 (approval pending for HCPL0530, HCPL0531 & HCPL0534), Tape and reel (500 units per reel)
R2	R2	Tape and reel (2500 units per reel)
R2V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

Marking Information

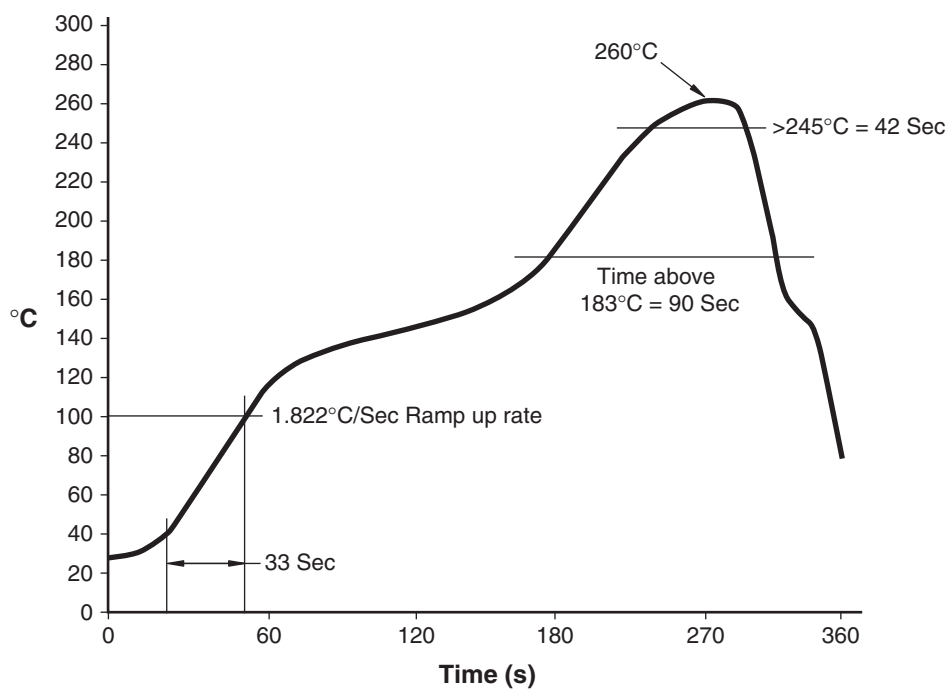


Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '3'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

Carrier Tape Specifications



Reflow Profile



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EcoSPARK™	I ² C™	MSXPro™	RapidConnect™	UniFET™
E ² C MOS™	i-Lo™	OCX™	µSerDes™	VCX™
EnSigna™	ImpliedDisconnect™	OCXPro™	SILENT SWITCHER®	Wire™
FACT™	IntelliMAX™	OPTOLOGIC®	SMART START™	
FACT Quiet Series™		OPTOPLANAR™	SPM™	
Across the board. Around the world.™		PACMAN™	Stealth™	
The Power Franchise®		POP™	SuperFET™	
Programmable Active Droop™		Power247™	SuperSOT™-3	
		PowerEdge™	SuperSOT™-6	

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PRODUCT STATUS DEFINITIONS

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Datasheet Identification	Product Status	Definition
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