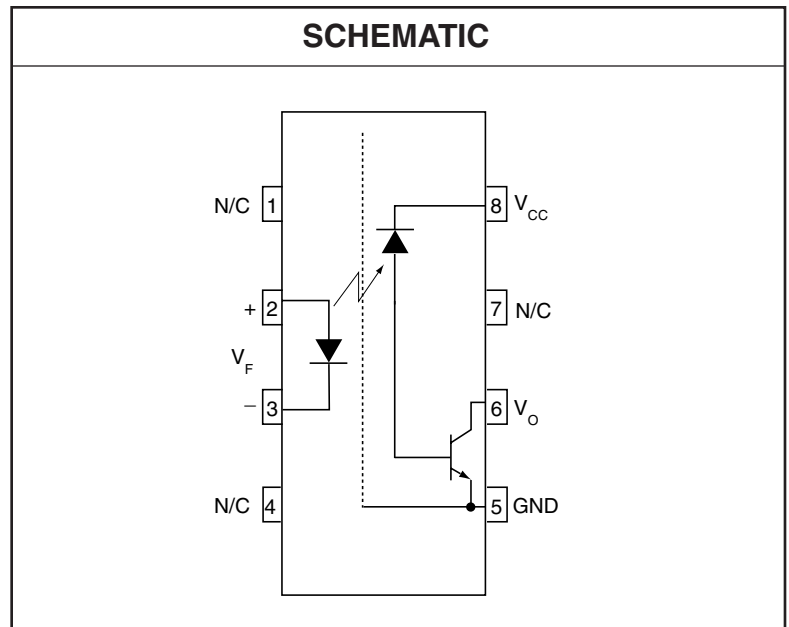
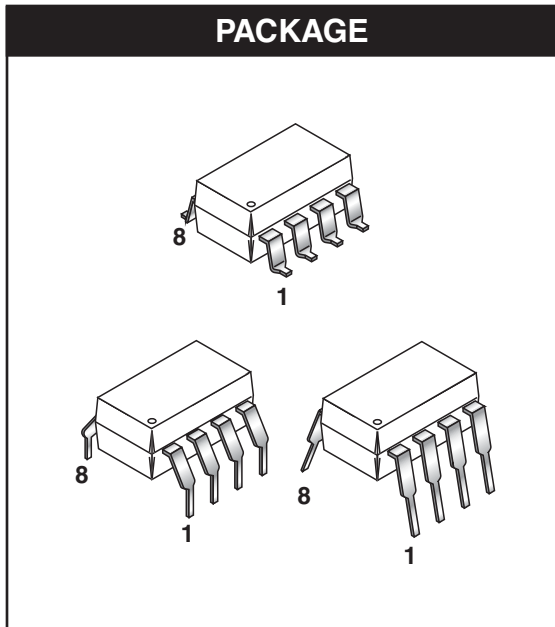


## HCPL4503M



### DESCRIPTION

The HCPL4503M optocoupler consists of an AlGaAs LED optically coupled to a high speed photodetector transistor.

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 base of the phototransistor is not bonded out to a pin for improved noise immunity.

An internal noise shield provides superior common mode rejection of 15kV/μs minimum.

### FEATURES

- VISO = 5kV RMS is standard for all devices
- High speed-1 MBit/s
- Superior CMR,  $CM_H = 50 \text{ kV/ms}$  (typical);  $CM_L = 30 \text{ kV/ms}$  (typical)
- No base connection for improved noise immunity
- CTR guaranteed 0-70°C
- U.L. recognized (File # E90700, Vol 2)
- VDE approval pending

### APPLICATIONS

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

**HCPL4503M**

**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 +100	$^\circ\text{C}$
Lead Solder Temperature	$T_{SOL}$	260 for 10 sec	$^\circ\text{C}$
<b>EMITTER</b>			
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	$P_D$	100	mW
<b>DETECTOR</b>			
Average Output Current	$I_O$ (avg)	8	mA
Peak Output Current	$I_O$ (pk)	16	mA
Supply Voltage	$V_{CC}$	-0.5 to 30	V
Output Voltage	$V_O$	-0.5 to 20	V
Output power dissipation	$P_D$	100	mW

**HCPL4503M**

**ELECTRICAL CHARACTERISTICS** ( $T_A = 0$  to  $70^\circ\text{C}$  Unless otherwise specified)

**INDIVIDUAL COMPONENT CHARACTERISTICS**

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

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

**HCPL4503M**

<b>TRANSFER CHARACTERISTICS</b> ( $T_A = 0$ to $70^\circ\text{C}$ Unless otherwise specified)						
Parameter	Test Conditions	Symbol	Min	Typ**	Max	Unit
<b>COUPLED</b> Current transfer ratio (Note 5)	( $I_F = 16\text{ mA}$ , $V_O = 0.4\text{ V}$ ) (Note 1) ( $V_{CC} = 4.5\text{ V}$ , $T_A = 25^\circ\text{C}$ )	CTR	19	27	50	%
	( $I_F = 16\text{ mA}$ , $V_{CC} = 4.5\text{ V}$ , $V_{OL} = 0.5\text{ V}$ )		15	30		
Logic low output voltage output voltage	( $I_F = 16\text{ mA}$ , $I_O = 3\text{ mA}$ ) ( $V_{CC} = 4.5\text{ V}$ , $T_A = 25^\circ\text{C}$ )	$V_{OL}$			0.5	V
	( $I_F = 16\text{ mA}$ , $I_O = 2.4\text{ mA}$ ) ( $V_{CC} = 4.5\text{ V}$ )				0.5	

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

<b>SWITCHING CHARACTERISTICS</b> ( $T_A = 0$ to $70^\circ\text{C}$ unless otherwise specified., $V_{CC} = 5\text{ V}$ )						
Parameter	Test Conditions	Symbol	Min	Typ**	Max	Unit
Propagation delay time to logic low	( $R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ ) (Note 2) (Fig. 7) $T_A = 25^\circ\text{C}$	$T_{PHL}$		0.45	0.8	$\mu\text{s}$
	( $R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ ) (Note 2) (Fig. 7)				1.0	$\mu\text{s}$
Propagation delay time to logic high	( $R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ ) (Note 2) (Fig. 7) $T_A = 25^\circ\text{C}$	$T_{PLH}$		0.3	0.8	$\mu\text{s}$
	( $R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ ) (Note 2) (Fig. 7)				1.0	$\mu\text{s}$
Common mode transient immunity at logic high	( $I_F = 0\text{ mA}$ , $V_{CM} = 1,500\text{ V}_{P-P}$ ) $T_A = 25^\circ\text{C}$ , ( $R_L = 1.9\text{ k}\Omega$ ) (Note 3) (Fig. 8)	$ICM_{HI}$	15,000	50,000		$\text{V}/\mu\text{s}$
Common mode transient immunity at logic low	( $I_F = 16\text{ mA}$ , $V_{CM} = 1,500\text{ V}_{P-P}$ ) ( $R_L = 1.9\text{ k}\Omega$ ) (Note 3) (Fig. 8)	$ICM_{LI}$	15,000	30,000		$\text{V}/\mu\text{s}$

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

**HCPL4503M**

**ISOLATION CHARACTERISTICS** ( $T_A = 0$  to  $70^\circ\text{C}$  Unless otherwise specified)

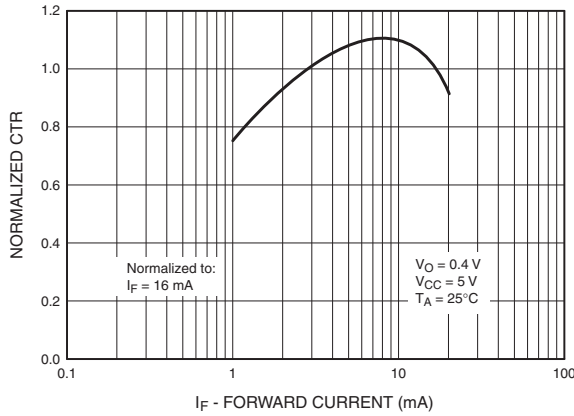
Characteristics	Test Conditions	Symbol	Min	Typ**	Max	Unit
Input-output insulation leakage current	(Relative humidity = 45%) ( $T_A = 25^\circ\text{C}$ , $t = 5$ s) ( $V_{I-O} = 3000$ VDC) (Note 4)	$I_{I-O}$			1.0	$\mu\text{A}$
Withstand insulation test voltage	( $\text{RH} \leq 50\%$ , $T_A = 25^\circ\text{C}$ ) (Note 4) ( $t = 1$ min.)	$V_{ISO}$	5,000			$V_{RMS}$
Resistance (input to output)	(Note 9) ( $V_{I-O} = 500$ VDC)	$R_{I-O}$		$10^{12}$		$\Omega$
Capacitance (input to output)	(Note 4) ( $f = 1$ MHz)	$C_{I-O}$		0.6		pF

**Notes**

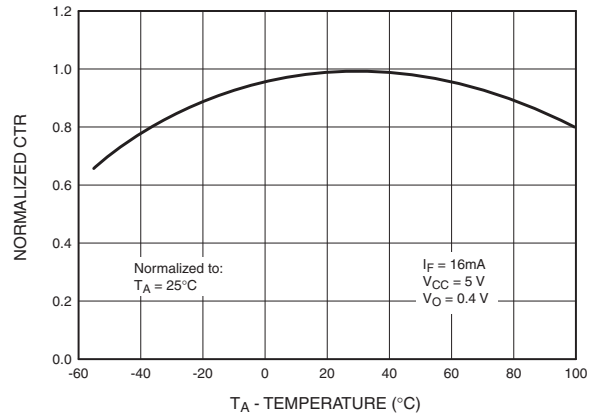
1. Current Transfer Ratio is defined as a ratio of output collector current,  $I_O$ , to the forward LED input current,  $I_F$ , times 100%.
2. The  $1.9\text{ k}\Omega$  load represents 1 TTL unit load of 1.6 mA and  $5.6\text{ k}\Omega$  pull-up resistor.
3. Common mode transient immunity in logic 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.,  $V_O < 0.8\text{ V}$ ).
4. 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.

**HCPL4503M**

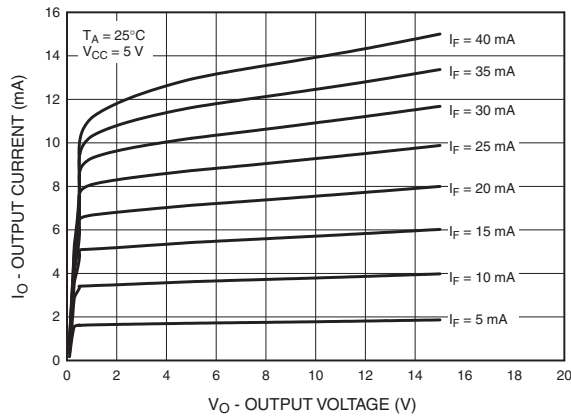
**Fig. 1 Normalized CTR vs. Forward Current**



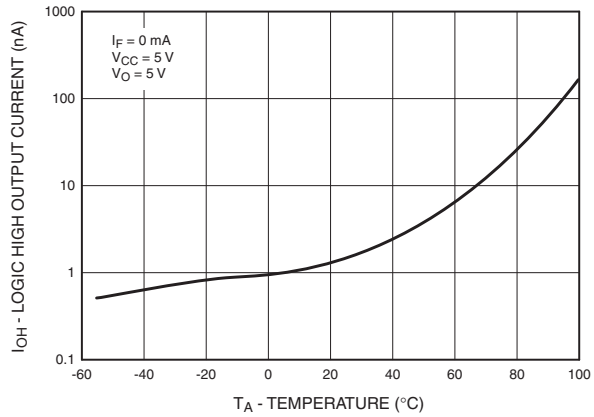
**Fig. 2 Normalized CTR vs. Temperature**



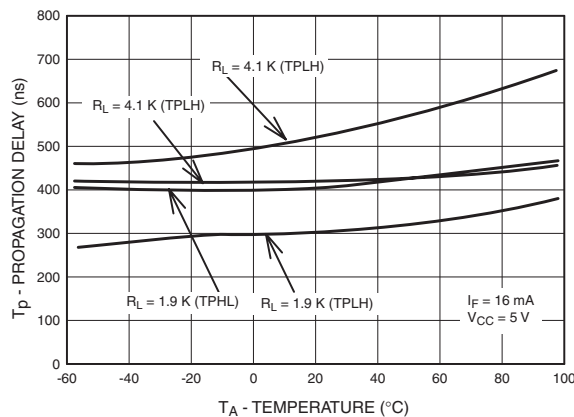
**Fig. 3 Output Current vs. Output Voltage**



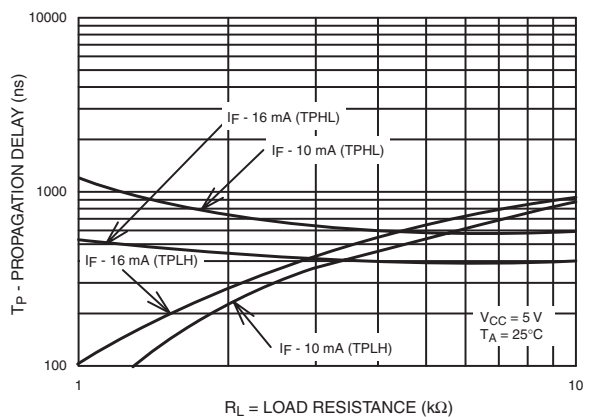
**Fig. 4 Logic High Output Current vs. Temperature**



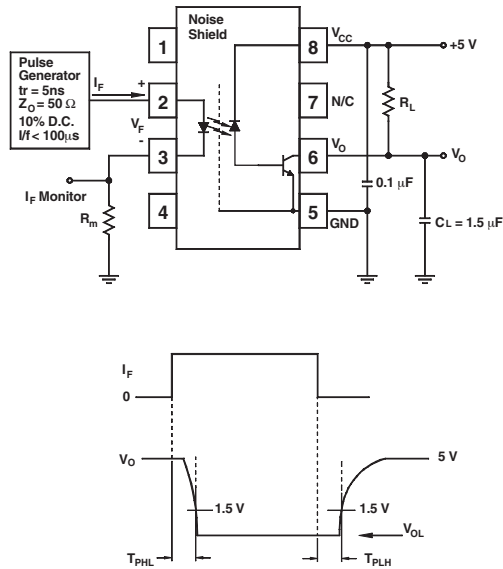
**Fig. 5 Propagation Delay vs. Temperature**



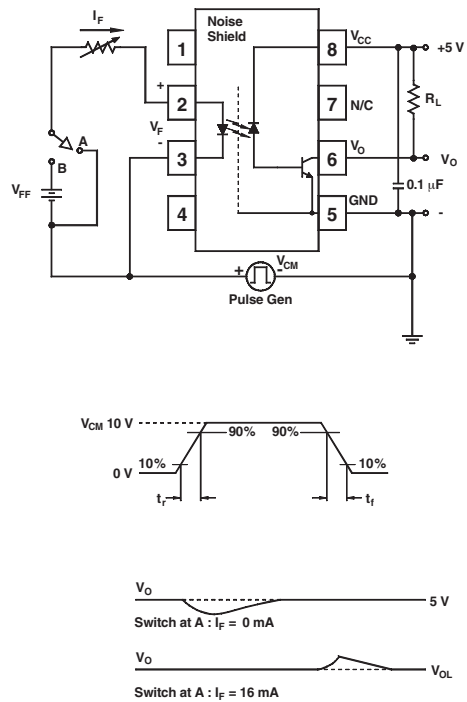
**Fig. 6 Propagation Delay vs. Load Resistance**



**HCPL4503M**



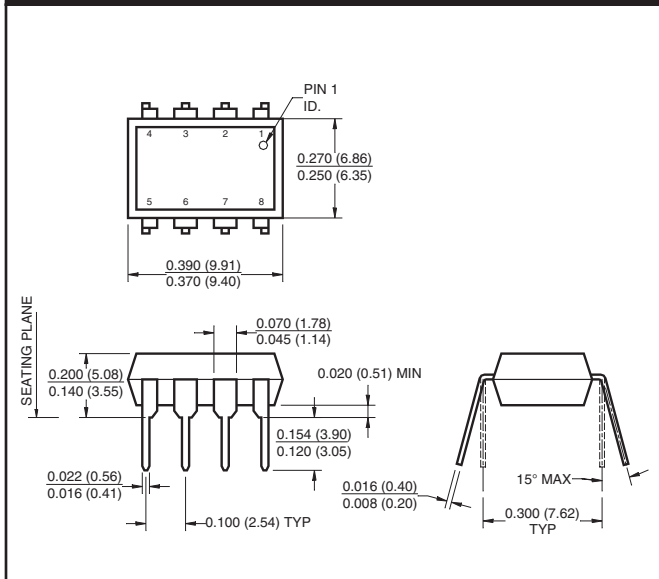
**Fig. 7 Switching Time Test Circuit**



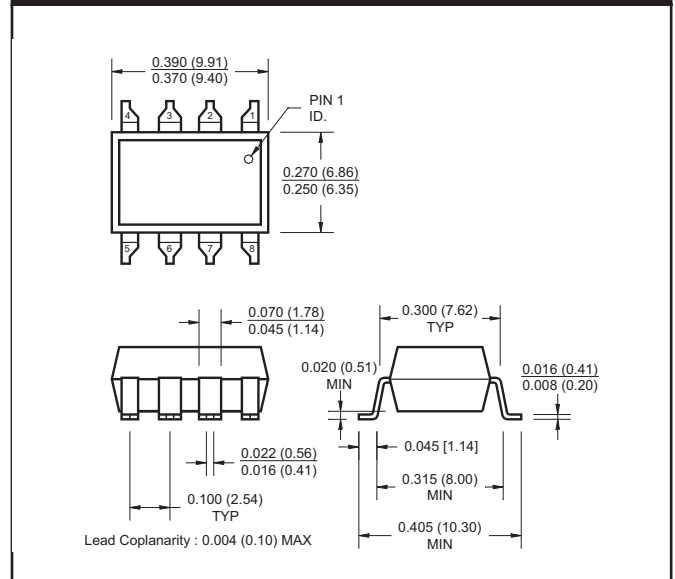
**Fig. 8 Common Mode Immunity Test Circuit**

**HCPL4503M**

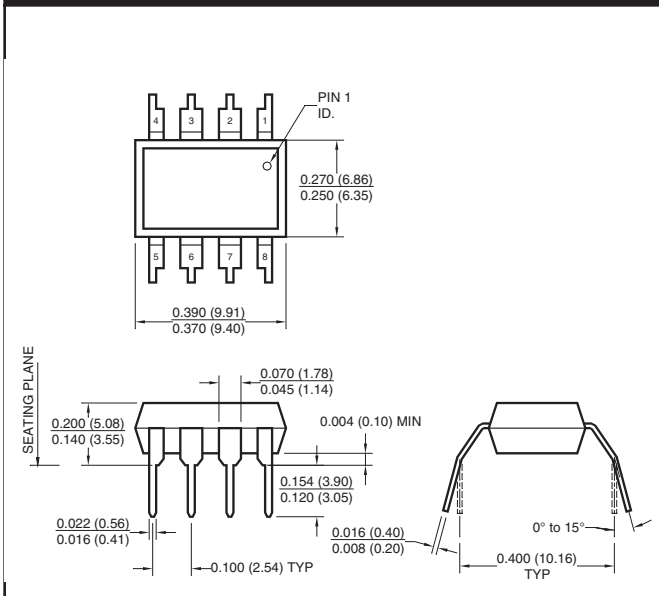
**Package Dimensions (Through Hole)**



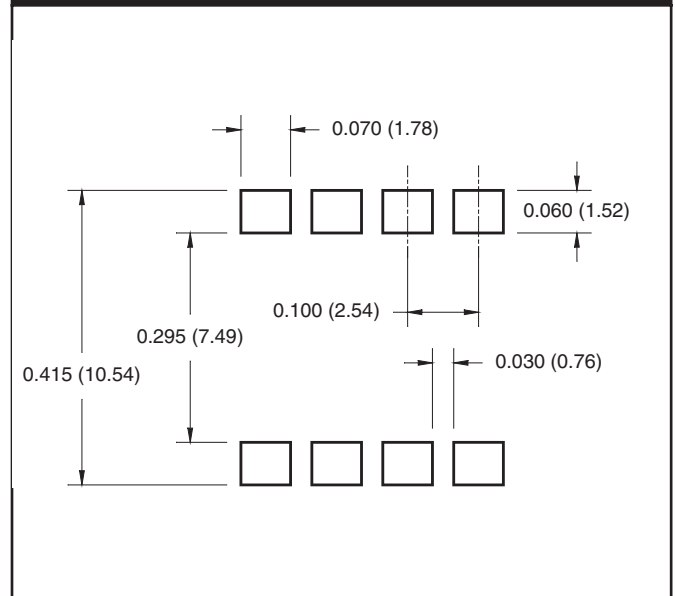
**Package Dimensions (Surface Mount)**



**Package Dimensions (0.4" Lead Spacing)**



**8 - Pin Dip**



**NOTE**

All dimensions are in inches (millimeters)

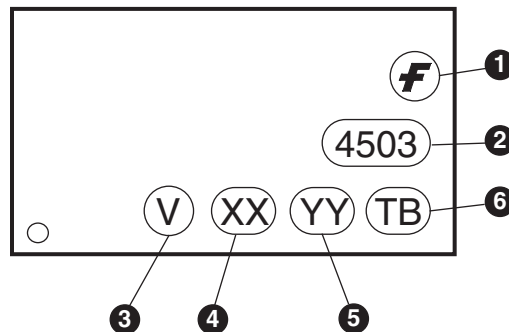


## HCPL4503M

### ORDERING INFORMATION

Option	Example Part Number	Description
S	HCPL4503SM	Surface Mount Lead Bend
SD	HCPL4503SDM	Surface Mount; Tape and reel (1,000 units per reel)
T	HCPL4503TM	0.4" Lead Spacing
V	HCPL4503VM	VDE0884 (approval pending)
TV	HCPL4503TVM	VDE0884 (approval pending); 0.4" lead spacing
SV	HCPL4503SVM	VDE0884 (approval pending); surface mount
SDV	HCPL4503SDVM	VDE0884 (approval pending); surface mount; tape and reel (1,000 units per reel)

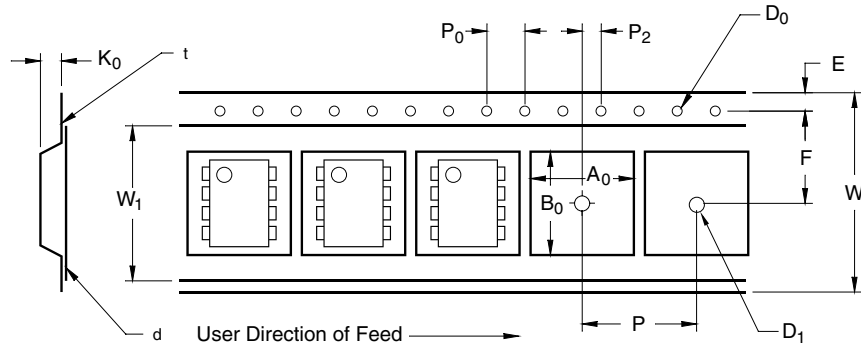
### MARKING INFORMATION



Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	Two digit year code, e.g., '03'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

**HCPL4503M**

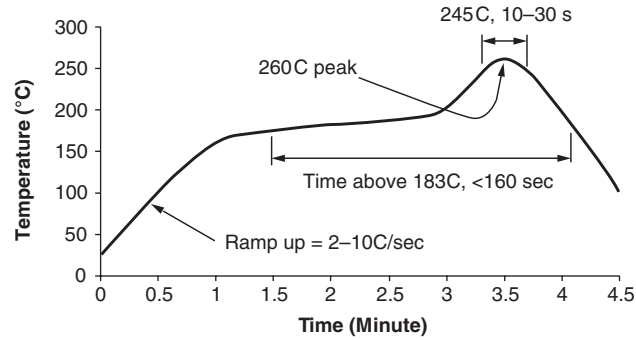
**Carrier Tape Specifications**



Description	Symbol	Dimension in mm
Tape Width	W	16.0 ± 0.3
Tape Thickness	t	0.30 ± 0.05
Sprocket Hole Pitch	P <sub>0</sub>	4.0 ± 0.1
Sprocket Hole Diameter	D <sub>0</sub>	1.55 ± 0.05
Sprocket Hole Location	E	1.75 ± 0.10
Pocket Location	F	7.5 ± 0.1
	P <sub>2</sub>	4.0 ± 0.1
Pocket Pitch	P	12.0 ± 0.1
Pocket Dimensions	A <sub>0</sub>	10.30 ± 0.20
	B <sub>0</sub>	10.30 ± 0.20
	K <sub>0</sub>	4.90 ± 0.20
Cover Tape Width	W <sub>1</sub>	1.6 ± 0.1
Cover Tape Thickness	d	0.1 max
Max. Component Rotation or Tilt		10°
Min. Bending Radius	R	30

**HCPL4503M**

**Reflow Profile**



- Peak reflow temperature: 260C (package surface temperature)
- Time of temperature higher than 183C for 160 seconds or less
- One time soldering reflow is recommended

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## **HCPL4503M**

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2. A critical component in 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.