

February 2010

# MCT9001 Dual Phototransistor Optocouplers

### **Features**

- Two isolated channels per package
- Two packages fit into a 16 lead DIP socket
- Underwriters Laboratory (U.L.) recognized File E90700
- VDE approved for IEC60747-5-2

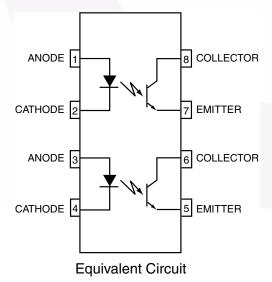
### **Applications**

- AC line/digital logic isolate high voltage transients
- Digital logic/digital logic eliminate spurious grounds
- Digital logic/AC triac control isolate high voltage transients
- Twisted pair line receiver eliminate ground loop feedthrough
- Telephone/telegraph line receiver isolate high voltage transients
- High frequency power supply feedback control maintain floating grounds and transients
- Relay contact monitor isolate floating grounds and transients
- Power supply monitor isolate transients

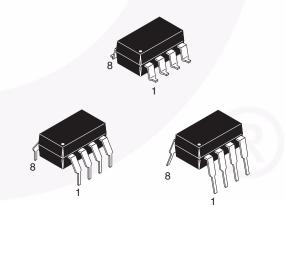
### **Description**

The MCT9001 Optocoupler has two channels for density applications. For four channel applications, two-packages fit into a standard 16-pin DIP socket. Each channel is an NPN silicon planar phototransistor optically coupled to a gallium arsenide infrared emitting diode.

### **Schematic**



### **Package Outlines**



### **Absolute Maximum Ratings**

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	Rating	Value	Unit
TOTAL DEVICE			
T <sub>STG</sub>	Storage Temperature	-55 to +150	°C
T <sub>OPR</sub>	Operating Temperature	-55 to +100	°C
T <sub>SOL</sub>	Lead Solder Temperature (Refer to Reflow Temperature Profile)	260 for 10 sec	°C
P <sub>D</sub>	Total Device Power Dissipation @ T <sub>A</sub> = 25°C	400	mW
	Derate above 25°C	4.83	mW/°C
EMITTER (Eacl	n channel)		
I <sub>F</sub>	Forward Current – Continuous	60	mA
I <sub>F</sub> (pk)	Forward Current – Peak (PW = 1µs, 300pps)	3	А
V <sub>R</sub>	Reverse Voltage	5.0	V
P <sub>D</sub>	LED Power Dissipation @ T <sub>A</sub> = 25°C	100	mW
	Derate above 25°C (Total Input)	1.1	mW/°C
DETECTOR (Ea	ach channel)		
I <sub>C</sub>	Collector Current – Continuous	30	mA
$P_{D}$	Detector Power Dissipation @ T <sub>A</sub> = 25°C	150	mW
	Derate above 25°C	1.67	mW/°C

### **Electrical Characteristics** (T<sub>A</sub> = 25°C unless otherwise specified)

### **Individual Component Characteristics**

Symbol	Parameter	Test Conditions	Min.	Тур.*	Max.	Unit
EMITTER		,		•		
V <sub>F</sub>	Input Forward Voltage	I <sub>F</sub> = 10mA		1.0	1.3	V
I <sub>R</sub>	Reverse Current	$V_R = 5V$			10	μΑ
CJ	Junction Capacitance	V <sub>F</sub> = 0 V, f = 1MHz		50		pF
DETECTO	R					
BV <sub>CEO</sub>	Collector-Emitter Breakdown Voltage	$I_C = 0.5 \text{mA}, I_F = 0$	55			V
BV <sub>ECO</sub>	Emitter-Collector Breakdown Voltage	$I_E = 100 \mu A, I_F = 0$	7			V
I <sub>CEO</sub>	Collector-Emitter Dark Current	$V_{CE} = 24V, I_F = 0$		5	100	nA
		V <sub>CE</sub> = 24V, T <sub>A</sub> = 85°C			50	μΑ
C <sub>CE</sub>	Capacitance	$V_{CE} = 0V$ , $f = 1MHz$		8		pF

### **Transfer Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.*	Max.	Units
SWITCHING TIMES (AC)						
Non-Satur	ated					
t <sub>on</sub>	Turn-on Time	$R_L = 100\Omega$ , $I_C = 2mA$ , $V_{CC} = 10V$		3		μs
t <sub>off</sub>	Turn-off Time			3		μs
t <sub>r</sub>	Rise Time			2.4		μs
t <sub>f</sub>	Fall Time			2.4		μs
Saturated						•
t <sub>on</sub>	Turn-on Time	$I_F = 16\text{mA}, R_L = 1.9\text{k}\Omega, V_{CE} = 5\text{V}$		2.4		μs
t <sub>off</sub>	Turn-off Time			25.0		μs
DC CHAR	ACTERISTICS					•
CTR	Current Transfer Ratio,	$I_F = 5mA$ , $V_{CE} = 5V$	50		600	%
CTR <sub>(sat)</sub>	Collector-Emitter	$I_F = 8mA, V_{CE} = 0.4V$	30			%
V <sub>CE(sat)</sub>	Saturation Voltage	$I_F = 8mA, I_C = 2.4mA$			0.40	V

### **Isolation Characteristics**

Symbol	Characteristic	Test Conditions	Min.	Тур.*	Max.	Units
V <sub>ISO</sub>	Input-Output Isolation Voltage	$I_{I-O} \le 10\mu A$ , $t = 1min$ .	5000			Vac(rms)
R <sub>ISO</sub>	Isolation Resistance	V <sub>I-O</sub> = 500VDC	10 <sup>11</sup>			Ω
C <sub>ISO</sub>	Isolation Capacitance	f = 1MHz		0.5		pF

<sup>\*</sup>All typicals at  $T_A = 25$ °C

### **Typical Performance Curves**

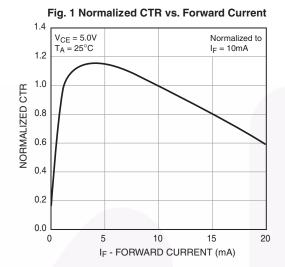


Fig. 2 Normalized CTR vs. Ambient Temperature

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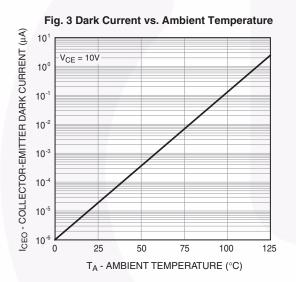
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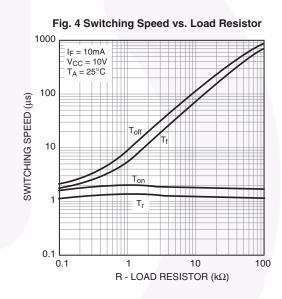
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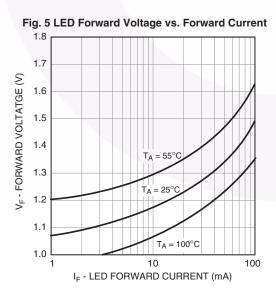
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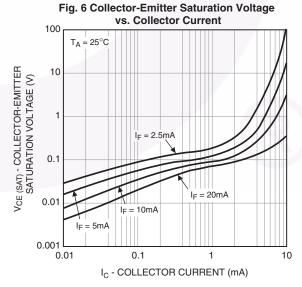
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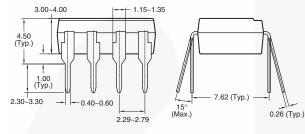




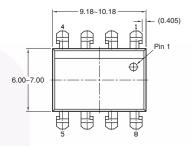
### **Package Dimensions**

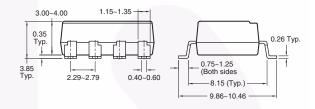
### **Through Hole**

### 9.18-10.18 4 1 (0.405) Pin 1

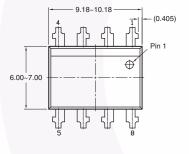


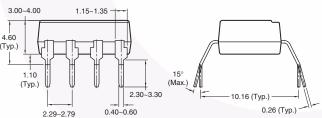
### **Surface Mount**



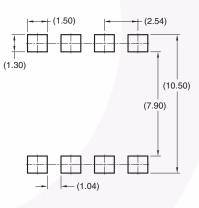


### 0.4" Lead Spacing





## Recommend Pad Layout for Surface Mount Leadform



### Note:

All dimensions are in millimeters.

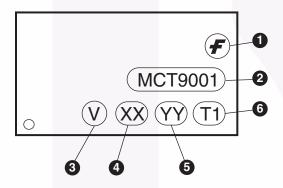
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### **Ordering Information**

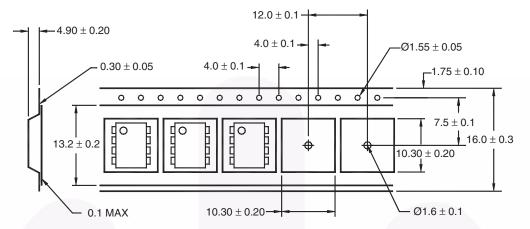
Option Example Part Number		Description
No Option	No Option MTC9001 Standard Through Hole	
S MTC9001S Surface Mount Lead Bend		Surface Mount Lead Bend
SD MTC9001SD Surface Mount; Tape and Reel		Surface Mount; Tape and Reel
300 MTC9001300 VDE Approved		VDE Approved
3S MTC90013S		Surface Mount Lead Bend; VDE Approved
3SD	MTC90013SD	Surface Mount; Tape and Reel; VDE Approved
300W	MTC9001300W	0.4" Lead Spacing; VDE Approved

### **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			

### **Carrier Tape Specifications**

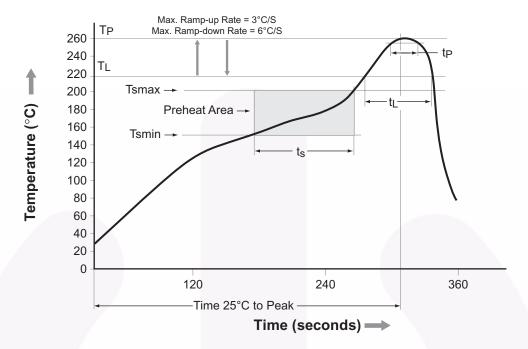


User Direction of Feed ----

### Note:

All dimensions are in inches (millimeters)

### **Reflow Profile**



Profile Feature	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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#### Definition of Terms

Definition of Terms				
Datasheet Identification		Definition		
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.		
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.		
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.		
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