

# 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

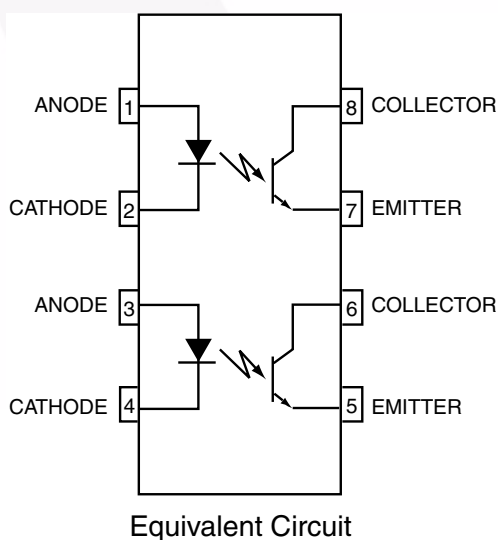
### Applications

- 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

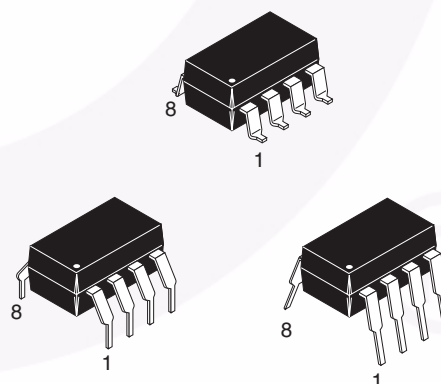
### Description

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 Derate above 25°C	400	mW
		4.83	mW/°C
EMITTER (Each channel)			
I <sub>F</sub>	Forward Current – Continuous	60	mA
I <sub>F(pk)</sub>	Forward Current – Peak (PW = 1μs, 300pps)	3	A
V <sub>R</sub>	Reverse Voltage	5.0	V
P <sub>D</sub>	LED Power Dissipation @ T <sub>A</sub> = 25°C Derate above 25°C (Total Input)	100	mW
		1.1	mW/°C
DETECTOR (Each channel)			
I <sub>C</sub>	Collector Current – Continuous	30	mA
P <sub>D</sub>	Detector Power Dissipation @ T <sub>A</sub> = 25°C Derate above 25°C	150	mW
		1.67	mW/°C

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)**Individual Component Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.*	Max.	Unit
<b>EMITTER</b>						
$V_F$	Input Forward Voltage	$I_F = 10\text{mA}$		1.0	1.3	V
$I_R$	Reverse Current	$V_R = 5\text{V}$			10	$\mu\text{A}$
$C_J$	Junction Capacitance	$V_F = 0\text{V}$ , $f = 1\text{MHz}$		50		pF
<b>DETECTOR</b>						
$BV_{CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 0.5\text{mA}$ , $I_F = 0$	55			V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	$I_E = 100\mu\text{A}$ , $I_F = 0$	7			V
$I_{CEO}$	Collector-Emitter Dark Current	$V_{CE} = 24\text{V}$ , $I_F = 0$		5	100	nA
		$V_{CE} = 24\text{V}$ , $T_A = 85^\circ\text{C}$			50	$\mu\text{A}$
$C_{CE}$	Capacitance	$V_{CE} = 0\text{V}$ , $f = 1\text{MHz}$		8		pF

**Transfer Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.*	Max.	Units
SWITCHING TIMES (AC)						
Non-Saturated						
t <sub>on</sub>	Turn-on Time	R <sub>L</sub> = 100Ω, I <sub>C</sub> = 2mA, V <sub>CC</sub> = 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 <sub>F</sub> = 16mA, R <sub>L</sub> = 1.9kΩ, V <sub>CE</sub> = 5V		2.4		μs
t <sub>off</sub>	Turn-off Time			25.0		μs
DC CHARACTERISTICS						
CTR	Current Transfer Ratio, Collector-Emitter	I <sub>F</sub> = 5mA, V <sub>CE</sub> = 5V	50		600	%
CTR <sub>(sat)</sub>		I <sub>F</sub> = 8mA, V <sub>CE</sub> = 0.4V	30			%
V <sub>CE(sat)</sub>	Saturation Voltage	I <sub>F</sub> = 8mA, I <sub>C</sub> = 2.4mA			0.40	V

**Isolation Characteristics**

Symbol	Characteristic	Test Conditions	Min.	Typ.*	Max.	Units
$V_{ISO}$	Input-Output Isolation Voltage	$I_{I-O} \leq 10\mu\text{A}$ , $t = 1\text{min.}$	5000			Vac(rms)
$R_{ISO}$	Isolation Resistance	$V_{I-O} = 500\text{VDC}$	$10^{11}$			$\Omega$
$C_{ISO}$	Isolation Capacitance	$f = 1\text{MHz}$		0.5		pF

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

## Typical Performance Curves

Fig. 1 Normalized CTR vs. Forward Current

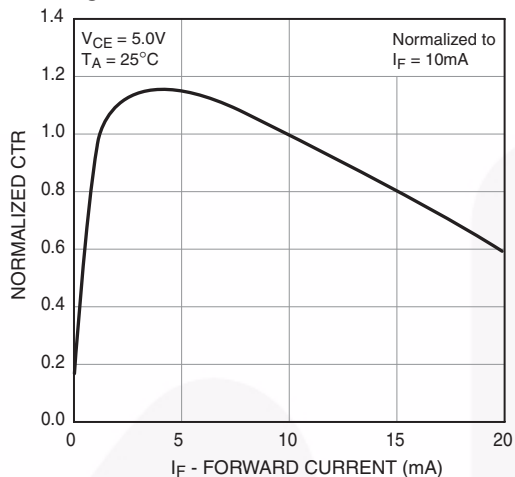


Fig. 2 Normalized CTR vs. Ambient Temperature

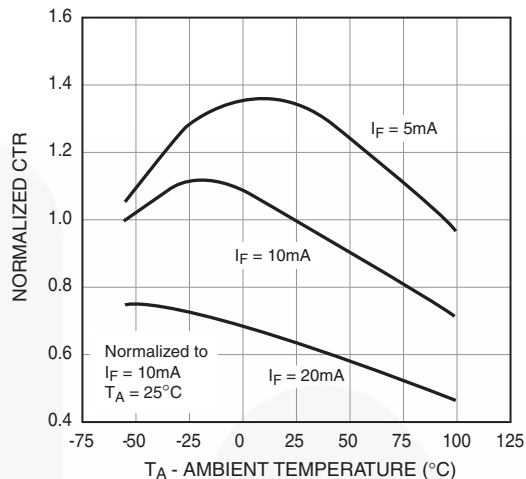


Fig. 3 Dark Current vs. Ambient Temperature

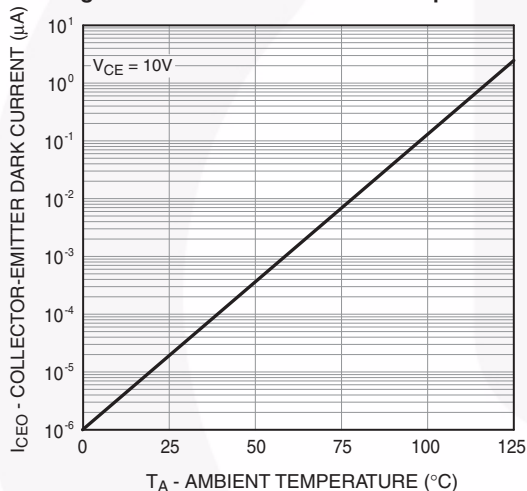


Fig. 4 Switching Speed vs. Load Resistor

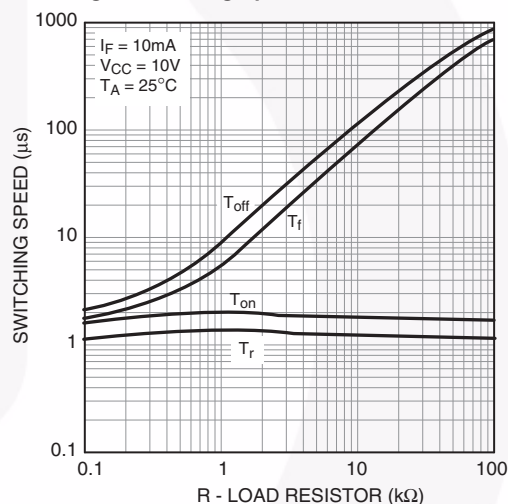


Fig. 5 LED Forward Voltage vs. Forward Current

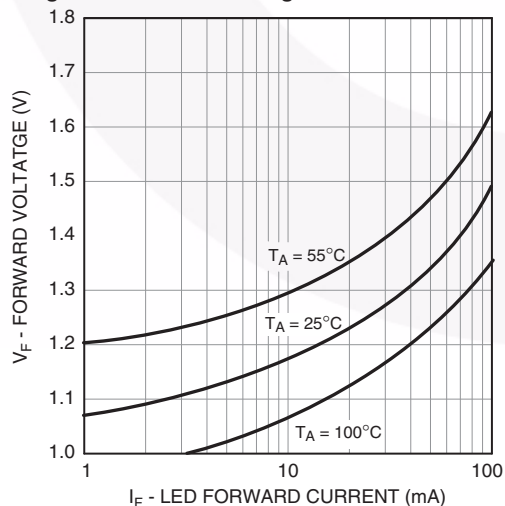
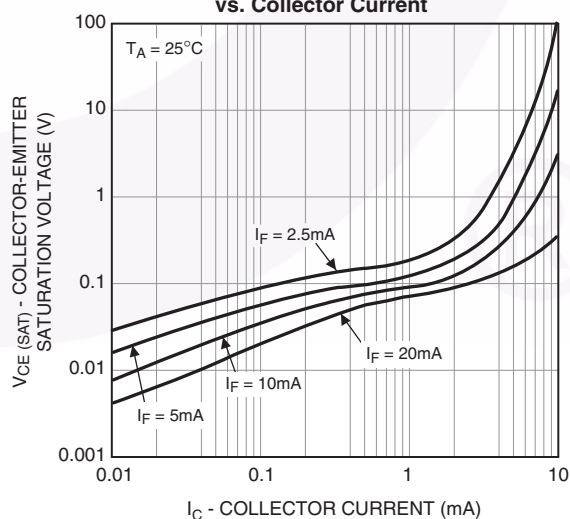


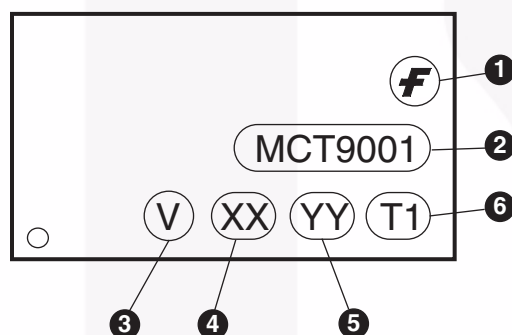
Fig. 6 Collector-Emitter Saturation Voltage vs. Collector Current



## Ordering Information

Option	Example Part Number	Description
No Option	MTC9001	Standard Through Hole
S	MTC9001S	Surface Mount Lead Bend
SD	MTC9001SD	Surface Mount; Tape and Reel
300	MTC9001300	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

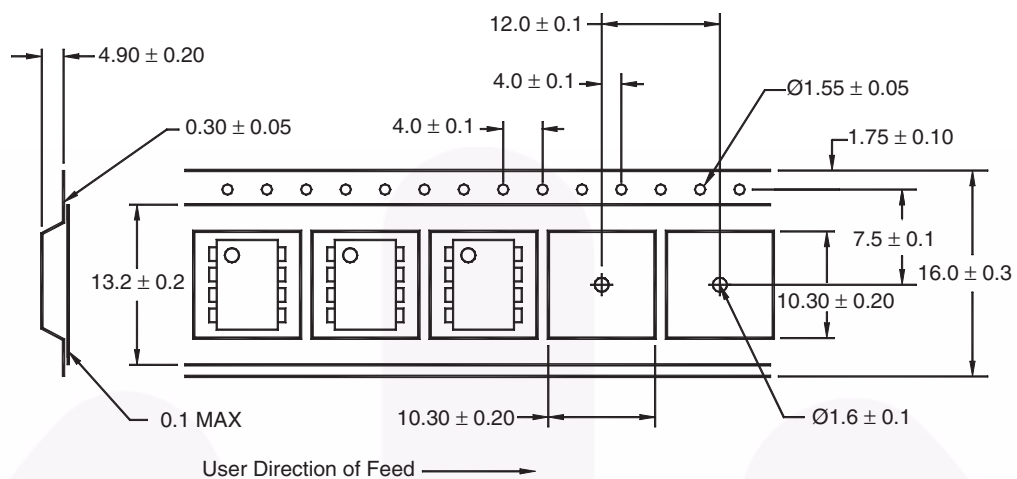
## Marking Information



### Definitions

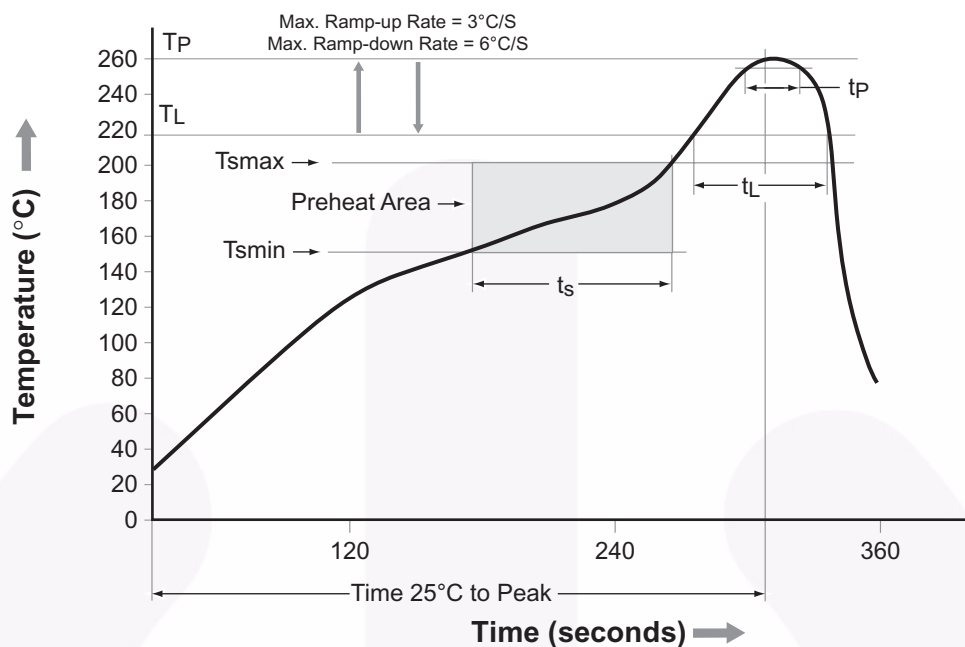
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	Two digit year code, e.g., '03'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

## Carrier Tape Specifications

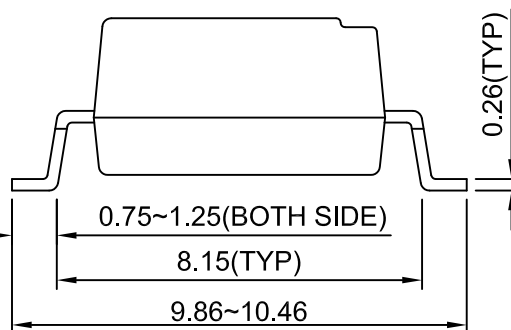
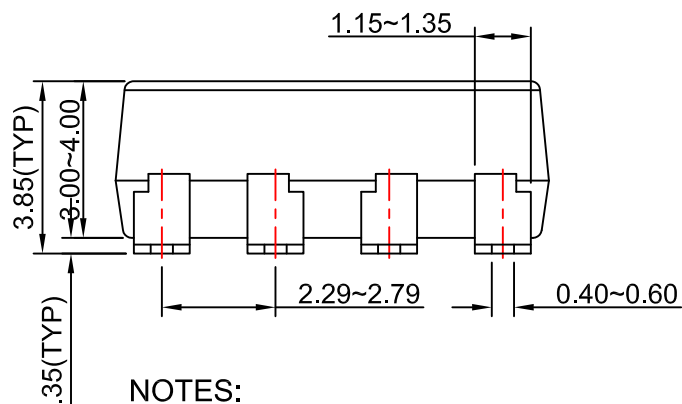
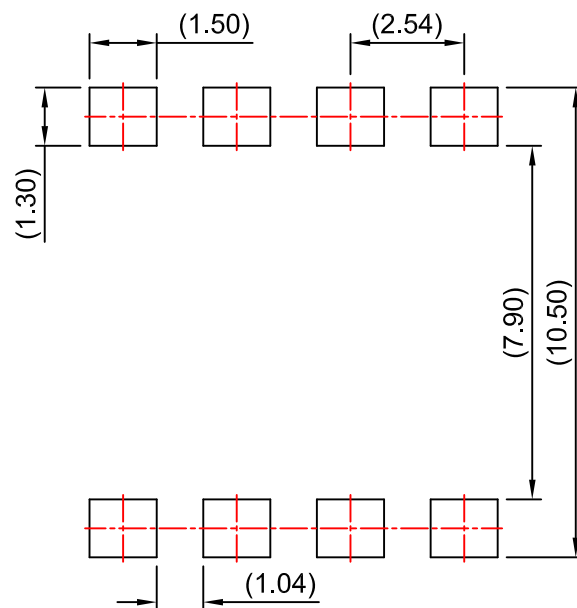
**Note:**

All dimensions are in inches (millimeters)

## Reflow Profile



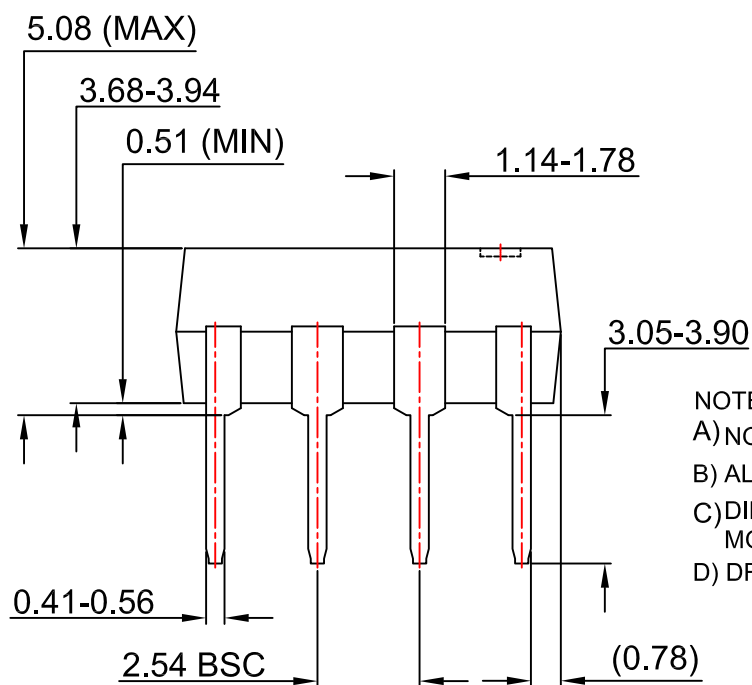
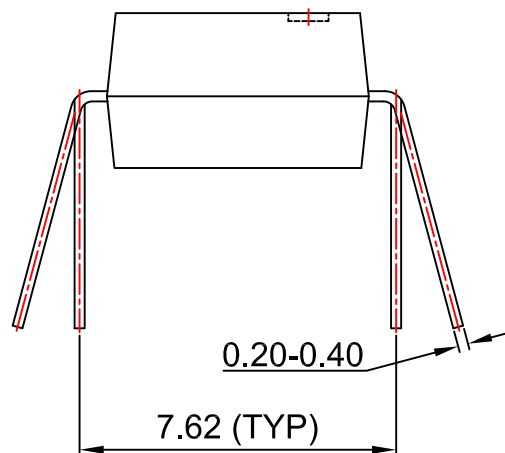
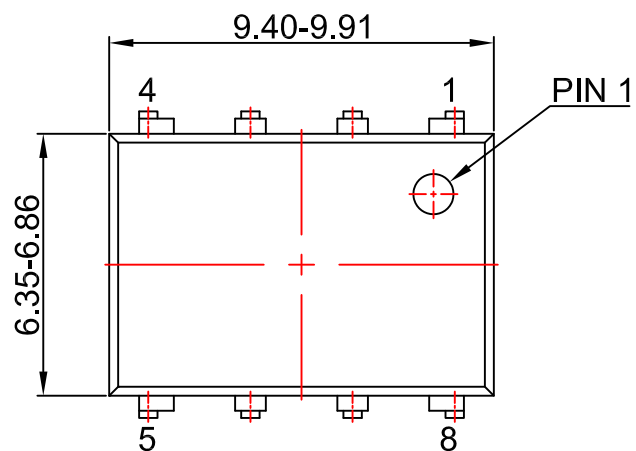
Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	150°C
Temperature Max. (T <sub>smax</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60–120 seconds
Ramp-up Rate (t <sub>L</sub> to t <sub>p</sub> )	3°C/second max.
Liquidous Temperature (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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