July 2016

MCT9001
8-Pin Dual Channel Phototransistor Optocoupler

Features

- Two Isolated Channels Per Package
- Safety and Regulatory Approvals:
  - UL1577, 4,170 VAC_{RMS} for 1 Minute
  - DIN-EN/IEC60747-5-5, 890 V Peak Working Insulation Voltage

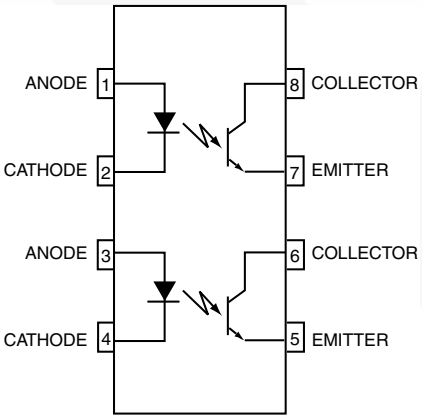
Applications

- 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 general purpose optocoupler, MCT9001, has two isolated channels in a standard plastic 8-pin dual-in-line (DIP) package for density applications. Each channel consists of a gallium arsenide infrared emitting diode driving a NPN silicon planar phototransistor. For four channel applications, two packages fit into a standard 16-pin DIP socket.

Functional Schematic



Equivalent Circuit

Figure 1. Schematic

Package Outlines

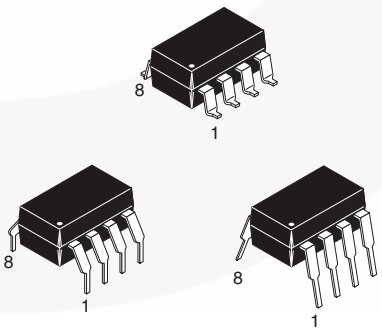


Figure 2. Package Outlines

Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V_{RMS}	I–IV
	< 300 V_{RMS}	I–IV
Climatic Classification		55/115/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V_{PR}	Input-to-Output Test Voltage, Method A, V_{IORM} x 1.6 = V_{PR}, Type and Sample Test with t_m = 10 s, Partial Discharge < 5 pC	1424	V_{peak}
	Input-to-Output Test Voltage, Method B, V_{IORM} x 1.875 = V_{PR}, 100% Production Test with t_m = 1 s, Partial Discharge < 5 pC	1668	V_{peak}
V_{IORM}	Maximum Working Insulation Voltage	890	V_{peak}
V_{IOTM}	Highest Allowable Over-Voltage	8000	V_{peak}
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.4	mm
T_S	Case Temperature(1)	175	°C
$I_{S,INPUT}$	Input Current(1)	60	mA
$P_{S,OUTPUT}$	Output Power(1)	150	mW
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500 V(1)	> 10^9	Ω

Note:

1. Safety limit values – maximum values allowed in the event of a failure.

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. T_A = 25°C unless otherwise specified.

Symbol	Parameter	Value	Unit
T_{STG}	Storage Temperature	-55 to +150	°C
T_{OPR}	Operating Temperature	-55 to +100	°C
T_J	Junction Temperature	-55 to +125	°C
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	°C
P_D	Total Device Power Dissipation @ T_A = 25°C	400	mW
	Derate Above 25°C	4.83	mW/°C
EMITTER (Each channel)			
I_F	DC / Average Forward Input Current	60	mA
I_F(pk)	Forward Current - Peak (PW = 1µs, 300pps)	3	A
V_R	Reverse Input Voltage	5.0	V
$P_{D(EMITTER)}$	Total Power Dissipation @ T_A = 25°C	100	mW
	Derate Above 25°C	1.1	mW/°C
DETECTOR			
I_C	Continuous Collector Current	30	mA
$P_{D(DETECTOR)}$	Total Power Dissipation @ T_A = 25°C	150	mW
	Derate Above 25°C	1.67	mW/°C

Electrical Characteristics

T_A = 25°C unless otherwise specified.

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
EMITTER						
V_F	Input Forward Voltage	I_F = 10 mA		1.0	1.3	V
I_R	Reverse Leakage Current	V_R = 5 V			10	µA
C_J	Junction Capacitance	V_F = 0 V, f = 1 MHz		50		pF
DETECTOR						
BV_{CEO}	Collector-to-Emitter Breakdown Voltage	I_C = 0.5 mA, I_F = 0	55			V
BV_{ECO}	Emitter-to-Collector Breakdown Voltage	I_E = 100 µA, I_F = 0	7			V
I_{CEO}	Collector-to-Emitter Dark Current	V_{CE} = 24 V, I_F = 0		5	100	nA
		V_{CE} = 24 V, T_A =85°C			50	µA
C_{CE}	Capacitance	V_{CE} = 0 V, f = 1 MHz		8		pF

Transfer Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
DC CHARACTERISTICS						
CTR	Current Transfer Ratio, Collector-to-Emitter	I_F = 5 mA, V_{CE} = 5 V	50		600	%
$CTR_{(SAT)}$		I_F = 8 mA, V_{CE} = 0.4 V	30			%
$VCE_{(SAT)}$	Saturation Voltage, Collector-to-Emitter	I_F = 8 mA, I_C = 2.4 mA			0.4	V
AC CHARACTERISTICS						
Non-Saturated						
T_{ON}	Turn-On Time	R_L = 100 Ω, I_C = 2 mA, V_{CC} = 10 V		3.0		µs
T_{OFF}	Turn-Off Time			3.0		µs
T_R	Rise Time			2.4		µs
T_F	Fall Time			2.4		µs
Saturated						
T_{ON}	Turn-On Time	I_F = 16 mA, R_L = 1.9 kΩ, V_{CE} = 5 V		2.4		µs
T_{OFF}	Turn-Off Time			25.0		µs

Isolation Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	I_{I-O} ≤ 10 µA, t = 1 Minute	5,000			VAC_{RMS}
C_{ISO}	Isolation Capacitance	f = 1 MHz		0.5		pF
R_{ISO}	Isolation Resistance	V_{I-O} = 500 VDC	10^{11}			Ω

Typical Performance Curves

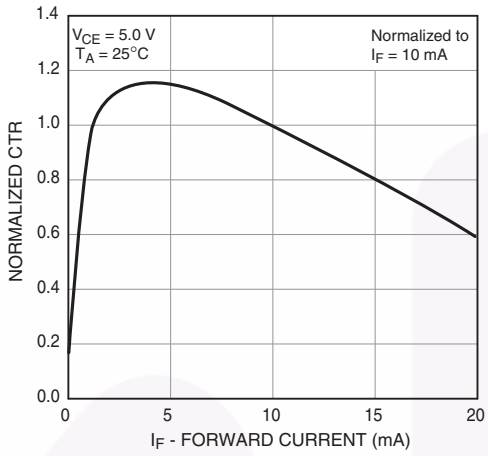


Fig. 3 Normalized CTR vs. Forward Current

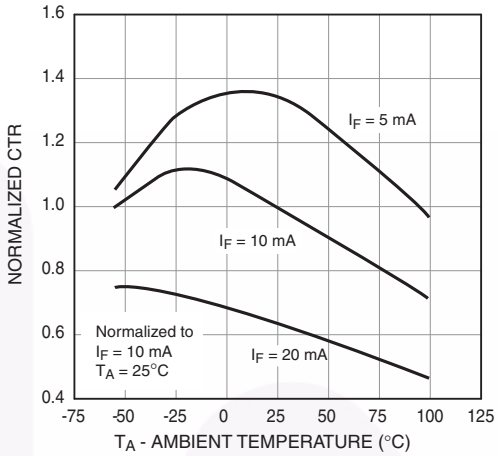


Fig. 4 Normalized CTR vs. Ambient Temperature

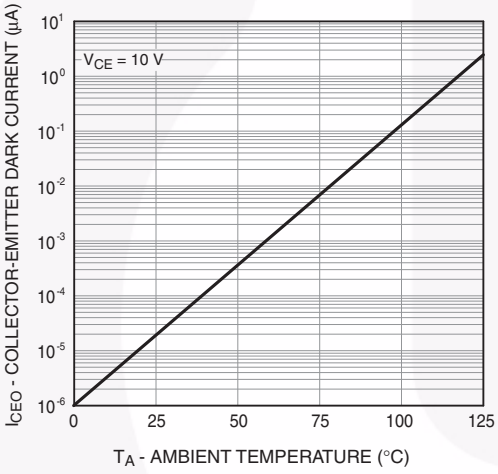


Fig. 5 Dark Current vs. Ambient Temperature

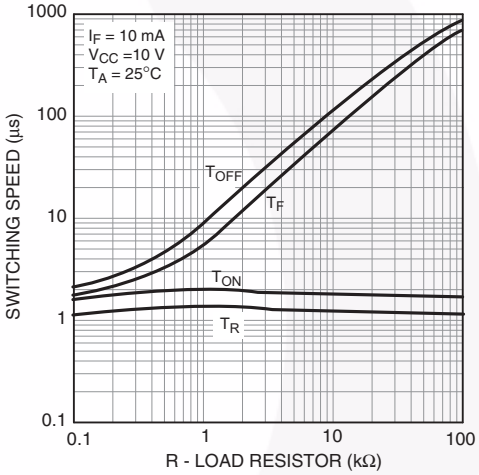


Fig. 6 Switching Speed vs. Load Resistor

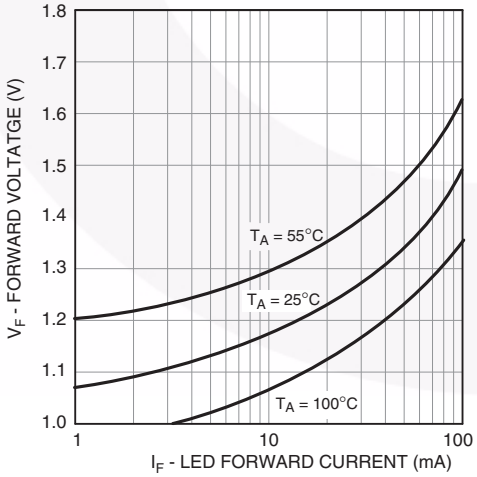


Fig. 7 LED Forward Voltage vs. Forward Current

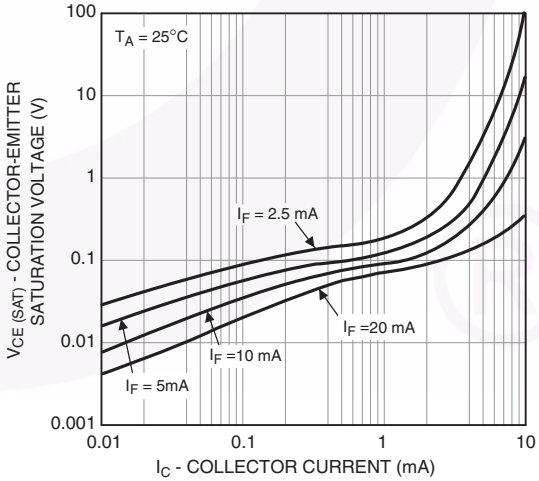


Fig. 8 Collector-Emitter Saturation Voltage vs. Collector Current

Switching Time Test Circuit and Waveforms

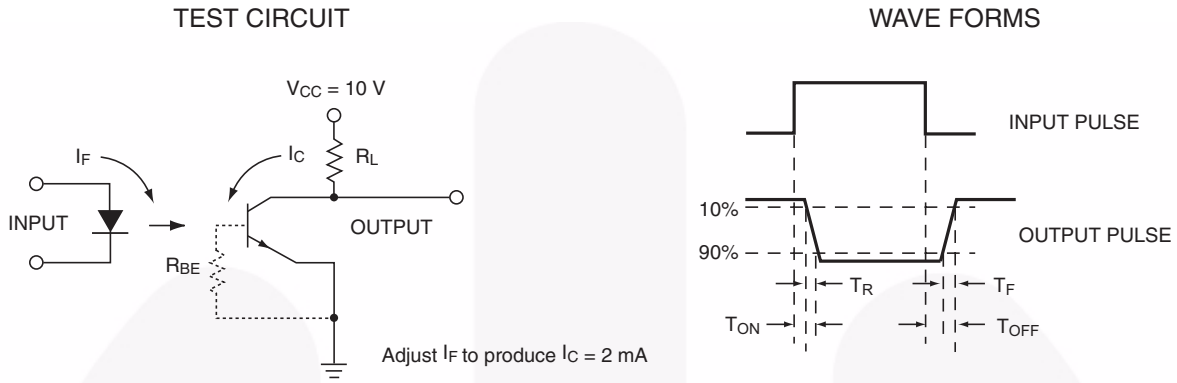
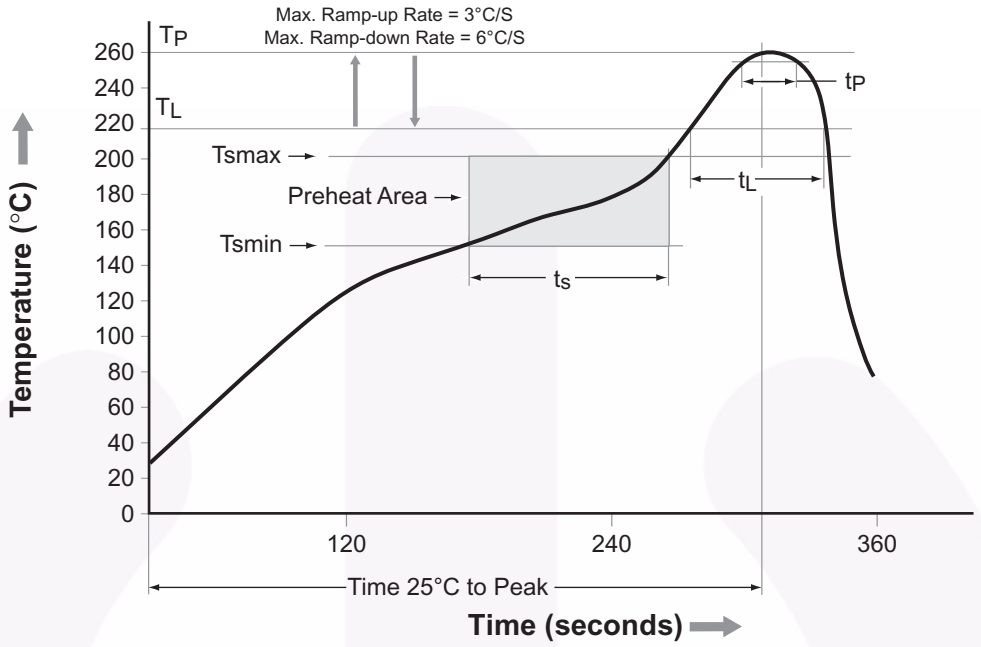


Figure 9. Switching Time Test Circuit and Waveforms

Reflow Profile



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	150°C
Temperature Max. (Tsmax)	200°C
Time (t_S) from (Tsmin to Tsmax)	60–120 seconds
Ramp-up Rate (t_L to t_P)	3°C/second max.
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60–150 seconds
Peak Body Package Temperature	260°C +0°C / –5°C
Time (t_P) within 5°C of 260°C	30 seconds
Ramp-down Rate (T_P to T_L)	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

Ordering Information

Part Number	Package	Packing Method
MCT9001	DIP 8-Pin	Tube (50 units per tube)
MCT9001S	SMT 8-Pin (Lead Bend)	Tube (50 units per tube)
MCT9001SD	SMT 8-Pin	Tape and Reel (1,000 units per reel)
MCT9001300	DIN EN/IEC 60747-5-5 Option	Tube (50 units per tube)
MCT90013S	SMT 8-Pin (Lead Bend); DIN EN/IEC 60747-5-5 Option	Tube (50 units per tube)
MCT90013SD	SMT 8-Pin; DIN EN/IEC 60747-5-5 Option	Tape and Reel (1,000 units per reel)
MCT9001300W	0.4” Lead Spacing; DIN EN/IEC 60747-5-5 Option	Tube (50 units per tube)

Marking Information

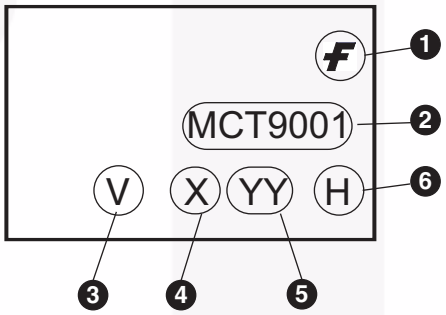
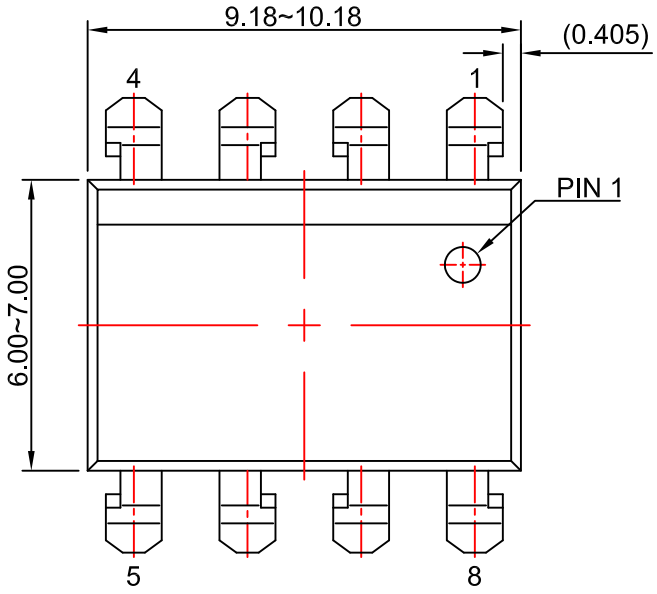
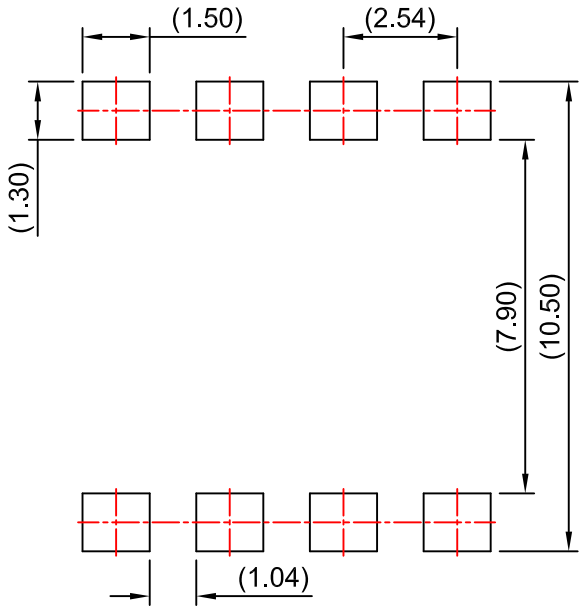


Figure 10. Top Mark

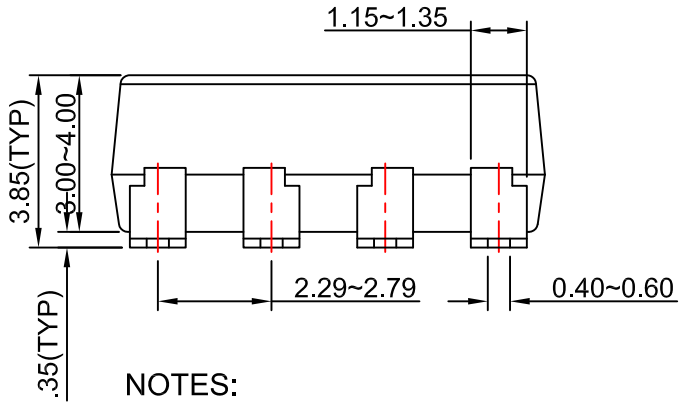
Table 1. Top Mark Definitions

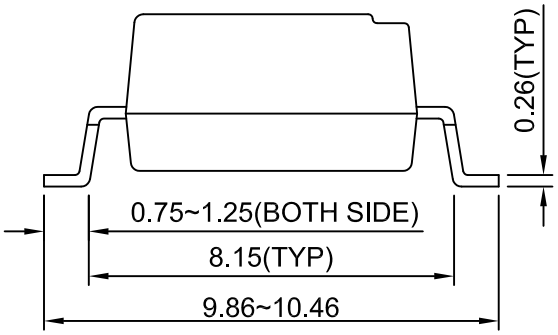
1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., “6”
5	Digit Work Week, Ranging from “01” to “53”
6	Assembly Package Code





LAND PATTERN RECOMMENDATION





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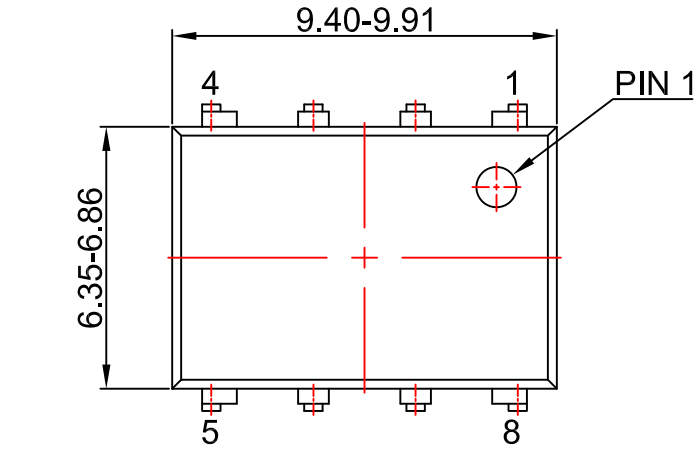

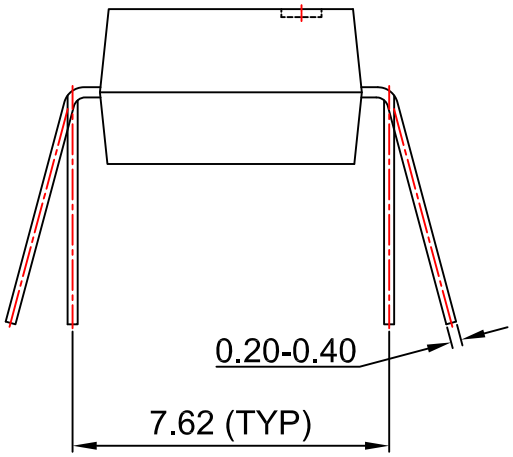

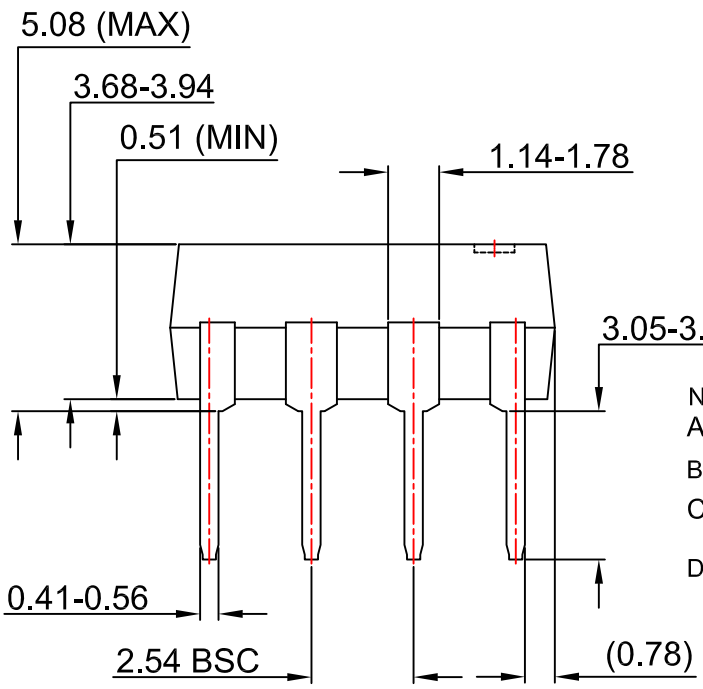

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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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