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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD

April 2015

H11AA1M, H11AA4M
6-Pin DIP AC Input Phototransistor Optocouplers

Features

- Bi-polar Emitter Input
- Built-in Reverse Polarity Input Protection
- Safety and Regulatory Approvals:
  - UL1577, 4,170 VAC_{RMS} for 1 Minute
  - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

Applications

- AC Line Monitor
- Unknown Polarity DC Sensor
- Telephone Line Interface

Description

The H11AA1M and H11AA4M devices consist of two gallium-arsenide infrared emitting diodes connected in inverse parallel driving a single silicon phototransistor output.

Schematic

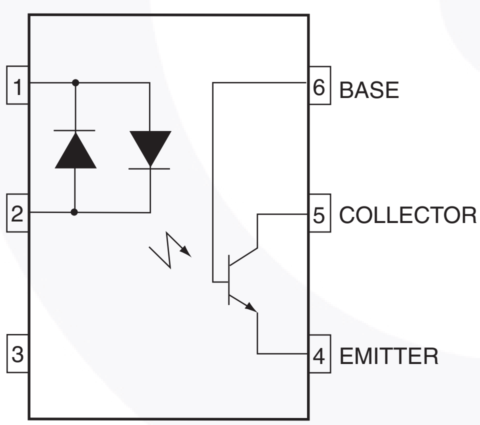


Figure 1. Schematic

Package Outlines

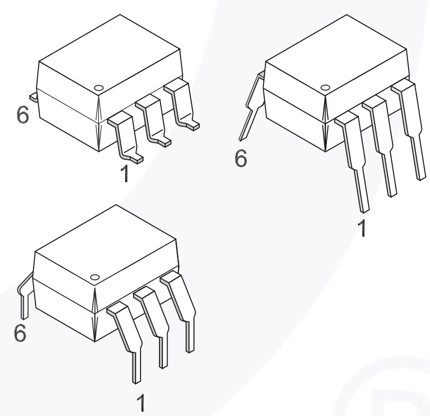


Figure 2. Package Outlines

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		55/100/21
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	1360	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	1594	V_{peak}
V_{IORM}	Maximum Working Insulation Voltage	850	V_{peak}
V_{IOTM}	Highest Allowable Over-Voltage	6000	V_{peak}
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
	External Clearance (for Option TV, 0.4" Lead Spacing)	≥ 10	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.5	mm
T_S	Case Temperature(1)	175	°C
$I_{S,INPUT}$	Input Current(1)	350	mA
$P_{S,OUTPUT}$	Output Power(1)	800	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.

Symbol	Parameter	Value	Unit
TOTAL DEVICE			
T_{STG}	Storage Temperature	-40 to +125	°C
T_{OPR}	Operating Temperature	-40 to +100	°C
T_J	Junction Temperature	-40 to +125	ºC
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	°C
P_D	Total Device Power Dissipation @ 25°C	270	mW
	Derate Linearly From 25°C	2.94	mW/°C
EMITTER			
I_F	Continuous Forward Current	60	mA
I_F(pk)	Forward Current – Peak (1 µs pulse, 300 pps)	±1.0	A
P_D	LED Power Dissipation @ 25°C	120	mW
	Derate Linearly From 25°C	1.41	mW/°C
DETECTOR			
I_C	Continuous Collector Current	50	mA
P_D	Detector Power Dissipation @ 25°C	150	mW
	Derate linearity from 25°C	1.76	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		1.17	1.50	V
C_J	Capacitance	V_F = 0 V, f = 1.0 MHz		80		pF
DETECTOR						
BV_{CEO}	Breakdown Voltage, Collector-to-Emitter	I_C = 1.0 mA, I_F = 0	30	100		V
BV_{CBO}	Breakdown Voltage, Collector-to-Base	I_C = 100 µA, I_F = 0	70	120		V
BV_{EBO}	Breakdown Voltage, Emitter-to-Base	I_E = 100 µA, I_F = 0	5	10		V
BV_{ECO}	Breakdown Voltage, Emitter-to-Collector	I_E = 100 µA, I_F = 0	7	10		V
I_{CEO}	Leakage Current, Collector-to-Emitter	V_{CE} = 10 V, I_F = 0		1	50	nA
C_{CE}	Capacitance Collector to Emitter	V_{CE} = 0, f = 1 MHz		10		pF
C_{CB}	Collector to Base	V_{CB} = 0, f = 1 MHz		80		pF
C_{EB}	Emitter to Base	V_{EB} = 0, f = 1 MHz		15		pF

Transfer Characteristics

Symbol	Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Unit
CTR_{CE}	Current Transfer Ratio, Collector-to-Emitter	I_F = ±10 mA, V_{CE} = 10 V	H11AA1M	20			%
			H11AA4M	100			%
	Current Transfer Ratio, Symmetry	I_F = ±10 mA, V_{CE} = 10 V (Figure 13)	All	0.33		3.00	
$V_{CE(SAT)}$	Saturation Voltage, Collector-to-Emitter	I_F = ±10 mA, I_{CE} = 0.5 mA	All			0.40	V

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	t = 1 Minute	4170			VAC_{RMS}
C_{ISO}	Isolation Capacitance	V_{I-O} = 0 V, f = 1 MHz		0.7		pF
R_{ISO}	Isolation Resistance	V_{I-O} = ±500 VDC, T_A = 25°C	10^{11}			Ω

Typical Performance Characteristics

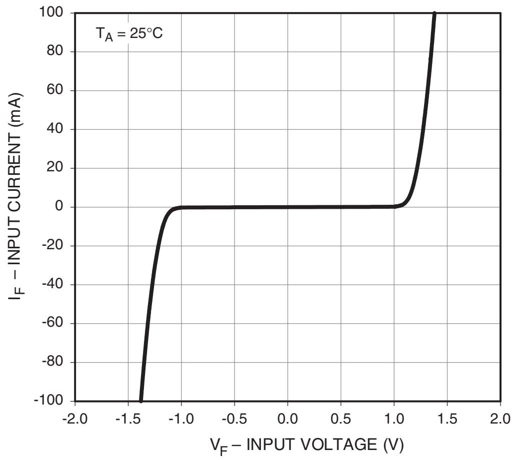


Figure 3. Input Voltage vs. Input Current

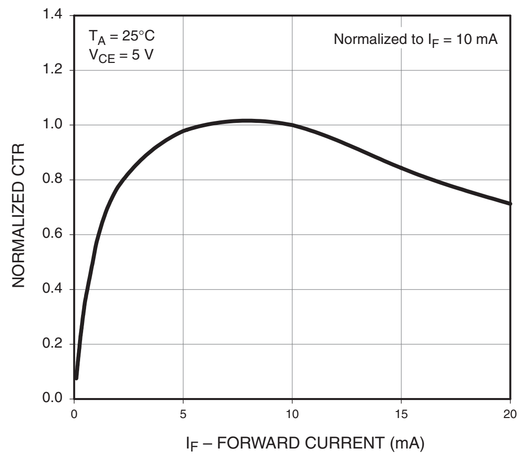


Figure 4. Normalized CTR vs. Forward Current

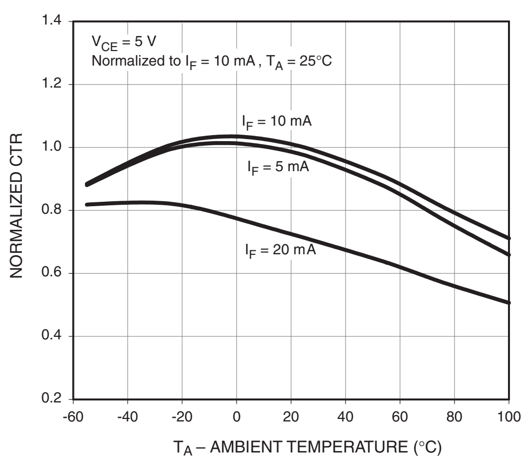


Figure 5. Normalized CTR vs. Ambient Temperature

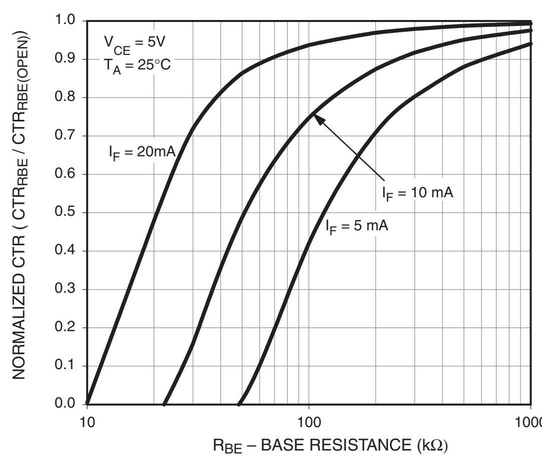


Figure 6. CTR vs. RBE (Unsaturated)

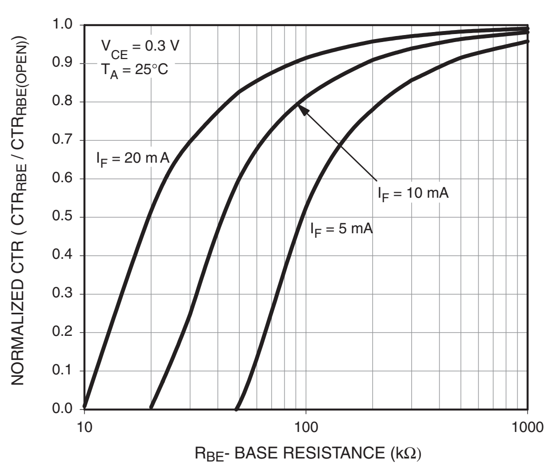


Figure 7. CTR vs. RBE (Saturated)

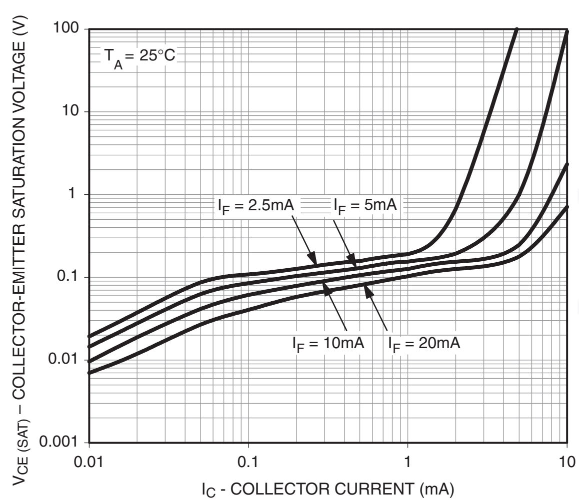


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

Typical Performance Characteristics (Continued)

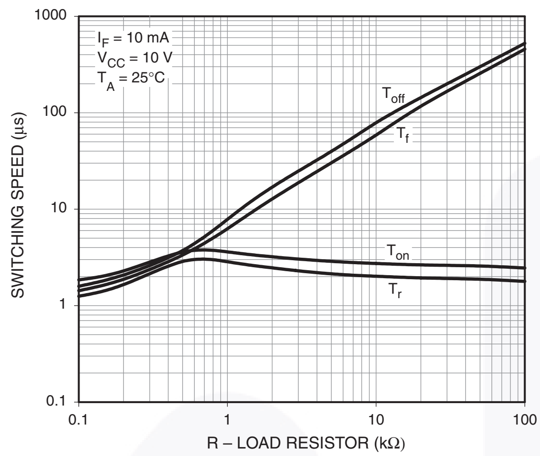


Figure 9. Switching Speed vs. Load Resistor

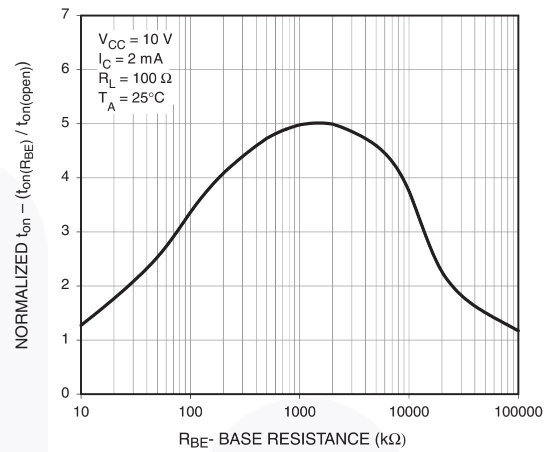


Figure 10. Normalized t_{on} vs. R_{BE}

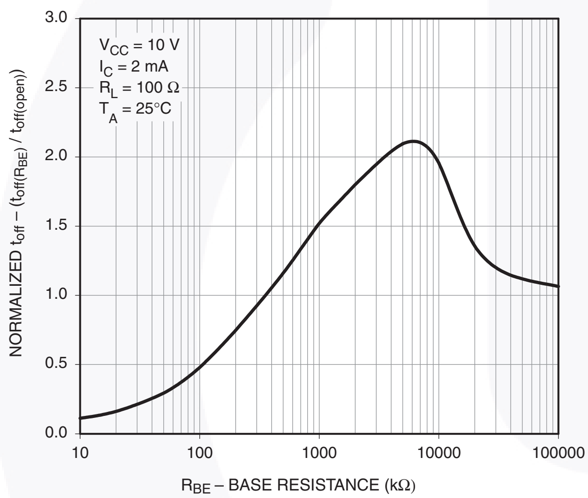


Figure 11. Normalized t_{off} vs. R_{BE}

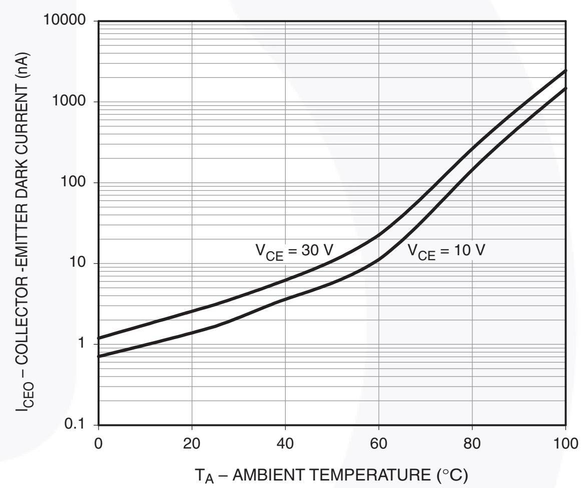


Figure 12. Dark Current vs. Ambient Temperature

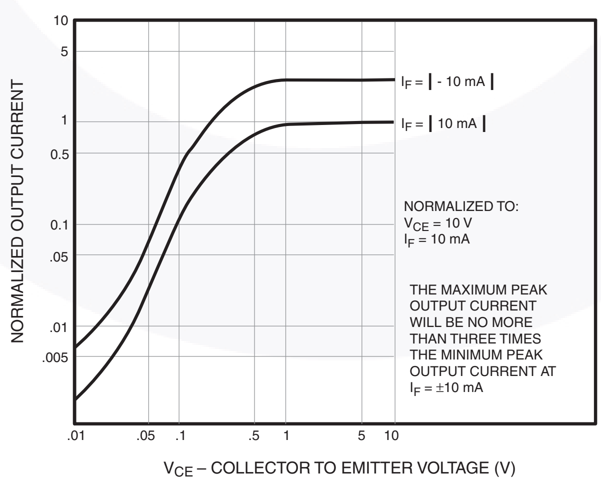


Figure 13. Output Symmetry Characteristics

Reflow Profile

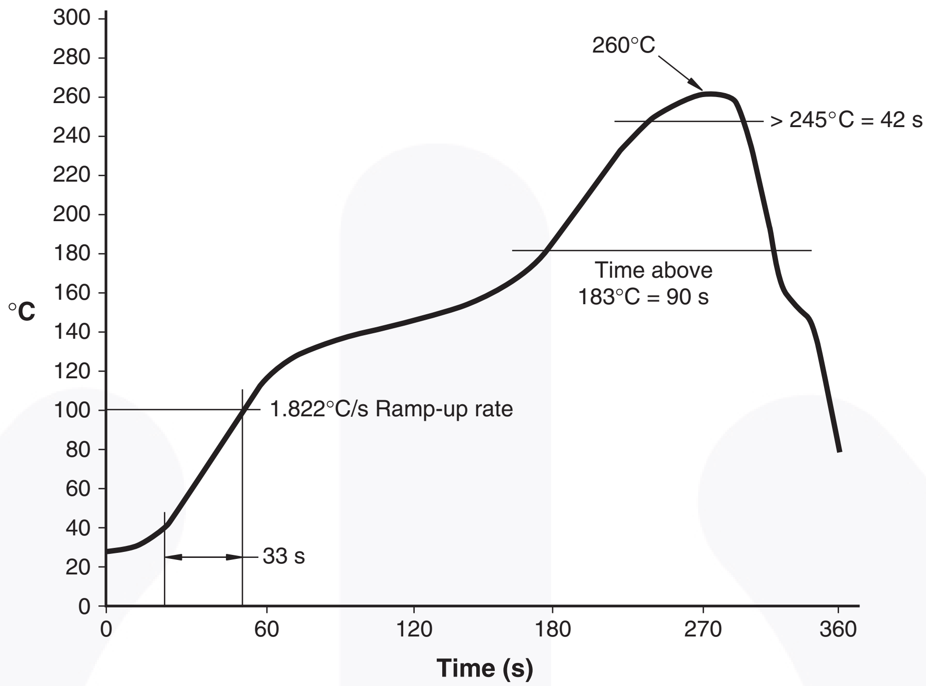


Figure 14. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
H11AA1M	DIP 6-Pin	Tube (50 Units)
H11AA1SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
H11AA1SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
H11AA1VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11AA1SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11AA1SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
H11AA1TVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

Note:
2. The product orderable part number system listed in this table also applies to the H11AA4M device.

Marking Information

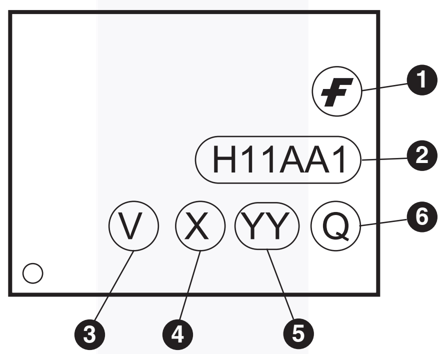
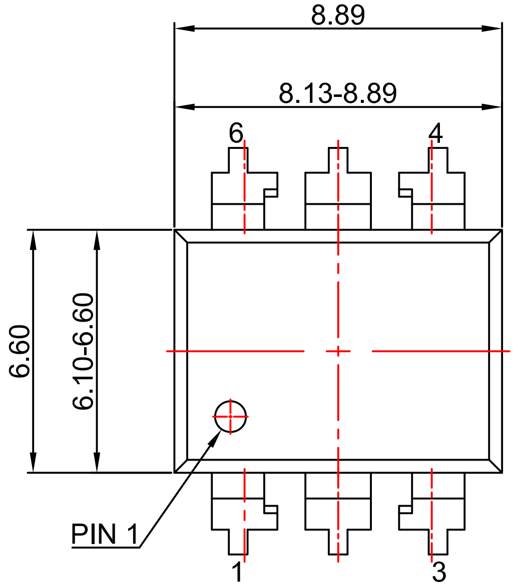
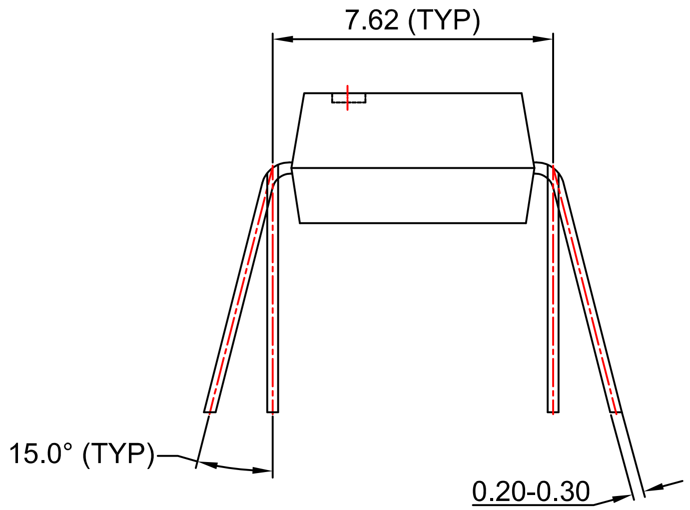


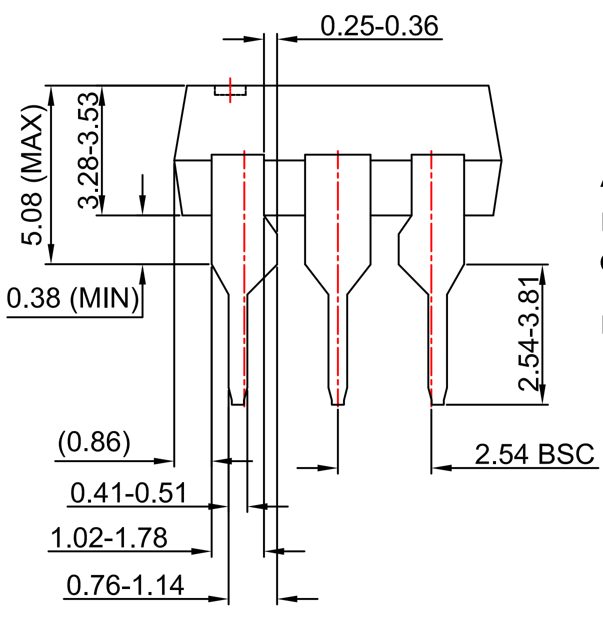
Figure 15. Top Mark

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., "5"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code







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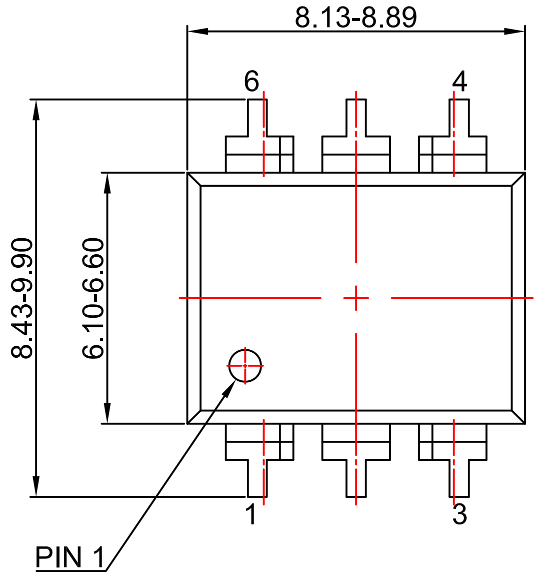
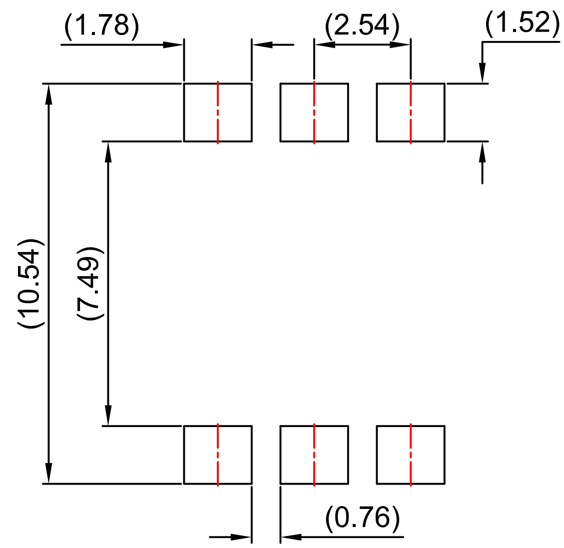
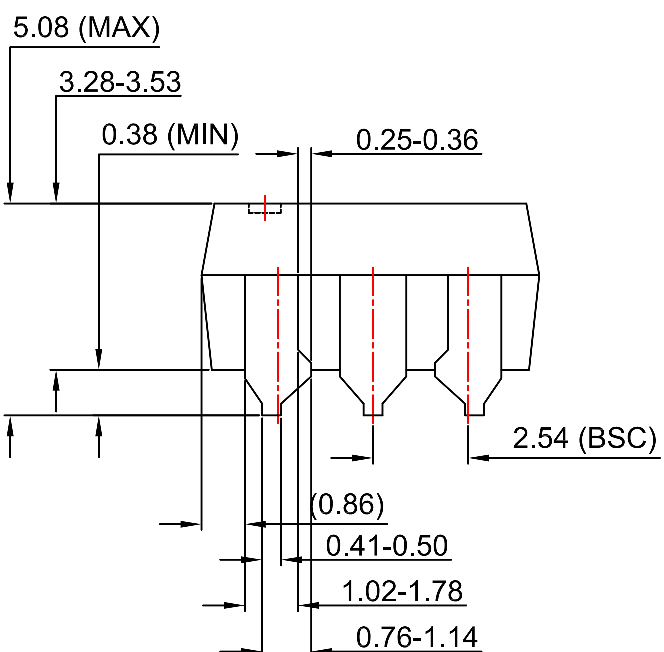
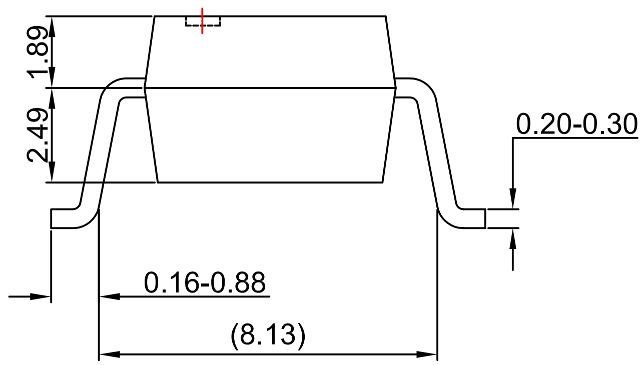




LAND PATTERN RECOMMENDATION





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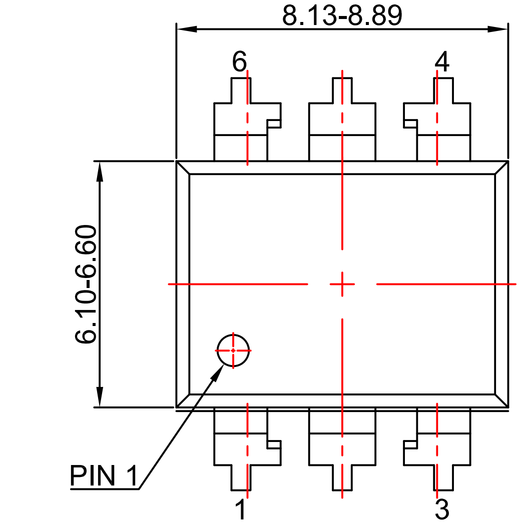

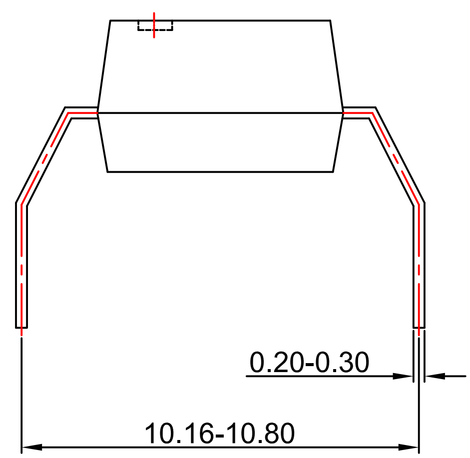

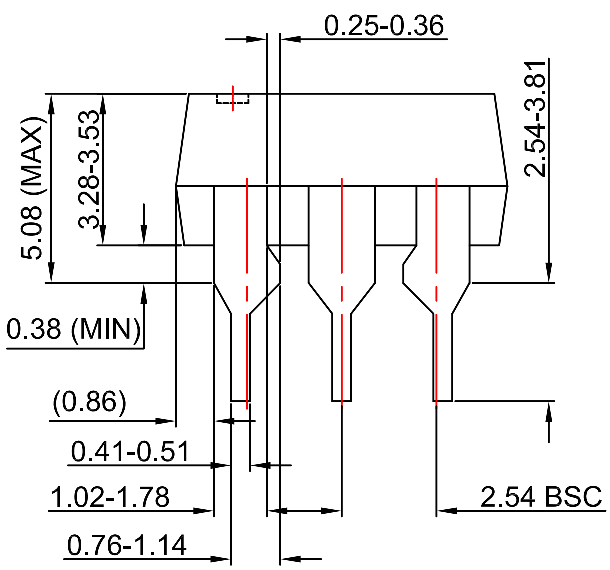

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