December 2014

4N38M, H11D1M, H11D3M, MOC8204M
6-Pin DIP High Voltage Phototransistor Optocouplers

Features

- High Voltage:
  - MOC8204M, BV_{CEO} = 400 V
  - H11D1M, BV_{CEO} = 300 V
  - H11D3M, BV_{CEO} = 200 V
- Safety and Regulatory Approvals:
  - UL1577, 4,170 VAC_{RMS} for 1 Minute
- DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs
- Appliance Sensor Systems
- Industrial Controls

Description

The 4N38M, H11D1M, H11D3M, and MOC8204M are phototransistor-type optically coupled optoisolators. A gallium arsenide infrared emitting diode is coupled with a high voltage NPN silicon phototransistor. The device is supplied in a standard plastic six-pin dual-in-line package.

Schematic

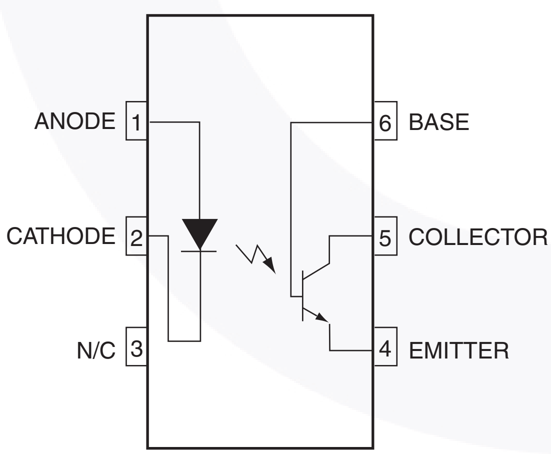


Figure 1. Schematic

Package Outlines

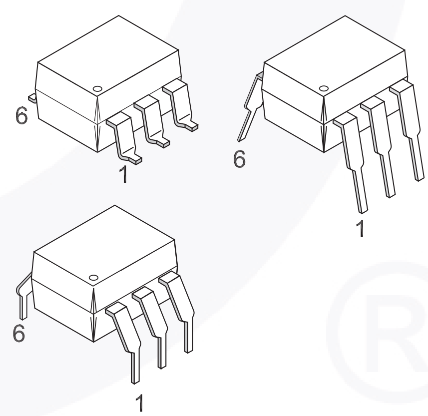


Figure 2. Package Outlines

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	Device	Value	Unit
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	-40 to +125	°C
T_{OPR}	Operating Temperature	All	-40 to +100	°C
T_J	Junction Temperature	All	-40 to +125	ºC
T_{SOL}	Lead Solder Temperature	All	260 for 10 seconds	°C
P_D	Total Device Power Dissipation @ T_A = 25°C	All	420	mW
	Derate Above 25°C		3.5	mW/°C
EMITTER				
I_F	Forward DC Current[(2)]	All	80	mA
V_R	Reverse Input Voltage[(2)]	All	6.0	V
I_F(pk)	Forward Current – Peak (1 µs pulse, 300pps)[(2)]	All	3.0	A
P_D	LED Power Dissipation @ T_A = 25°C[(2)]	All	120	mW
	Derate Above 25°C		1.41	mW/°C
DETECTOR				
P_D	Power Dissipation @ T_A = 25°C	All	300	mW
	Derate linearly above 25°C		4.0	mW/°C
V_{CEO}	Collector to Emitter Voltage[(2)]	MOC8204M	400	V
		H11D1M	300	V
		H11D3M	200	V
		4N38M	80	V
V_{CBO}	Collector Base Voltage[(2)]	MOC8204M	400	V
		H11D1M	300	V
		H11D3M	200	V
		4N38M	80	V
V_{ECO}	Emitter to Collector Voltage[(2)]	H11D1M, H11D3M, MOC8204M	7	V
I_C	Collector Current (Continuous)	All	100	mA

Note:

2. Parameters meet or exceed JEDEC registered data (for 4N38M only).

Electrical Characteristics

T_A = 25°C unless otherwise specified.

Individual Component Characteristics

Symbol	Characteristic	Test Conditions	Device	Min.	Typ.	Max.	Unit
EMITTER							
V_F	Forward Voltage(3)	I_F = 10 mA	All		1.15	1.50	V
$\frac{\Delta V_F}{\Delta T_A}$	Forward Voltage Temperature Coefficient		All		-1.8		mV/°C
BV_R	Reverse Breakdown Voltage	I_R = 10 µA	All	6	25		V
C_J	Junction Capacitance	V_F = 0 V, f = 1 MHz	All		50		pF
		V_F = 1 V, f = 1 MHz			65		pF
I_R	Reverse Leakage Current(3)	V_R = 6 V	All		0.05	10	µA
DETECTOR							
BV_{CEO}	Breakdown Voltage Collector-to-Emitter(3)	R_{BE} = 1 MΩ, I_C = 1.0 mA, I_F = 0	MOC8204M	400			V
			H11D1M	300			V
			H11D3M	200			V
		No RBE, I_C = 1.0 mA	4N38M	80			V
BV_{CBO}	Collector to Base(3)	I_C = 100 µA, I_F = 0	MOC8204M	400			V
			H11D1M	300			V
			H11D3M	200			V
			4N38M	80			V
BV_{EBO}	Emitter to Base	I_E = 100 µA, I_F = 0	4N38M	7			V
BV_{ECO}	Emitter to Collector	I_E = 100 µA, I_F = 0	All	7	10		V
I_{CEO}	Leakage Current Collector to Emitter(3) (R_{BE} = 1 MΩ)	V_{CE} = 300 V, I_F = 0, T_A = 25°C	MOC8204M			100	nA
		V_{CE} = 300 V, I_F = 0, T_A = 100°C				250	µA
		V_{CE} = 200V, I_F = 0, T_A = 25°C	H11D1M			100	nA
		V_{CE} = 200 V, I_F = 0, T_A = 100°C				250	µA
		V_{CE} = 100 V, I_F = 0, T_A = 25°C	H11D3M			100	nA
		V_{CE} = 100 V, I_F = 0, T_A = 100°C				250	µA
		No R_{BE}, V_{CE} = 60 V, I_F = 0, T_A = 25°C	4N38M			50	nA

Note:

3. Parameters meet or exceed JEDEC registered data (for 4N38M only).

Electrical Characteristics (Continued)

T_A = 25°C unless otherwise specified.

Transfer Characteristics

Symbol	Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Unit
EMITTER							
CTR	Current Transfer Ratio, Collector-to-Emitter	I_F = 10 mA, V_{CE} = 10 V, R_{BE} = 1 MΩ	H11D1M, H11D3M, MOC8204M	2 (20)			mA (%)
		I_F = 10 mA, V_{CE} = 10 V	4N38M	2 (20)			mA (%)
$V_{CE(SAT)}$	Saturation Voltage[4]	I_F = 10 mA, I_C = 0.5 mA, R_{BE} = 1 MΩ	H11D1M, H11D3M, MOC8204M		0.1	0.4	V
		I_F = 20 mA, I_C = 4 mA	4N38M			1.0	V
SWITCHING TIMES							
t_{ON}	Non-Saturated Turn-on Time	V_{CE} = 10 V, I_C = 2 mA, R_L = 100 Ω	All		5		µs
t_{OFF}	Turn-off Time		All		5		µs

Note:
4. Parameters meet or exceed JEDEC registered data (for 4N38M only).

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		0.2		pF
R_{ISO}	Isolation Resistance	V_{I-O} = ±500 VDC, T_A = 25°C	10^{11}			Ω

Typical Performance Curves

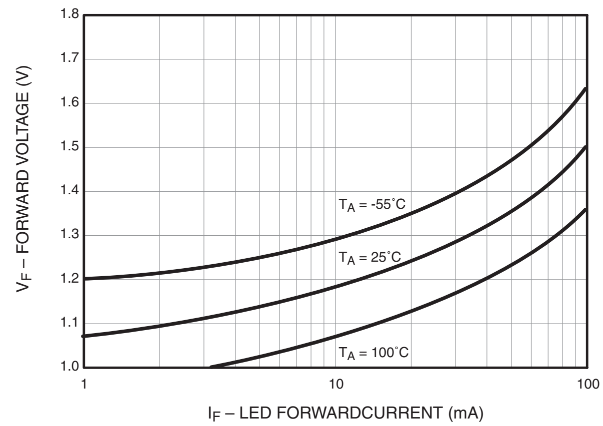


Figure 3. LED Forward Voltage vs. Forward Current

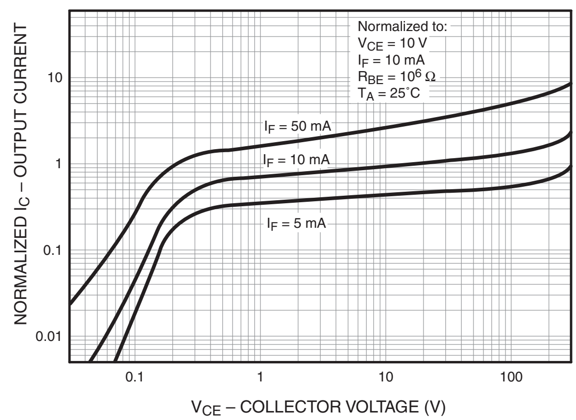


Figure 4. Normalized Output Characteristics

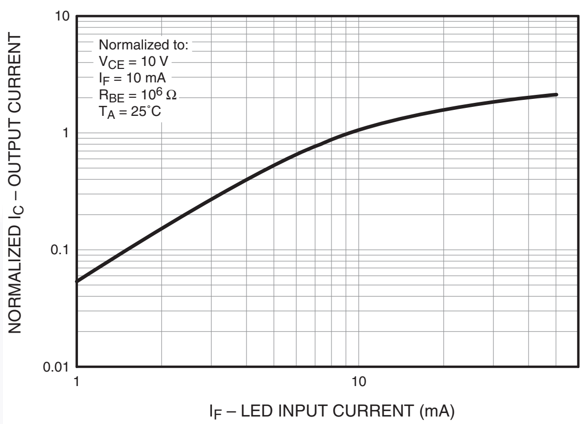


Figure 5. Normalized Output Current vs. LED Input Current

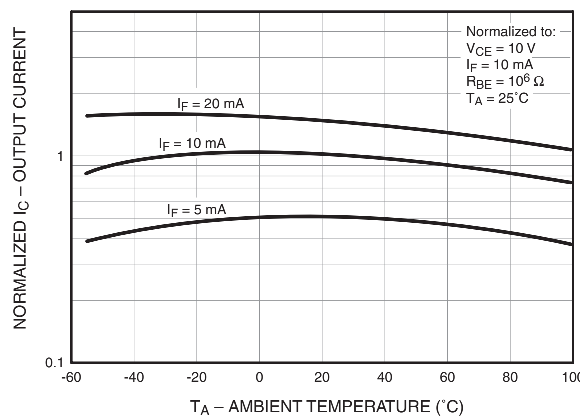


Figure 6. Normalized Output Current vs. Temperature

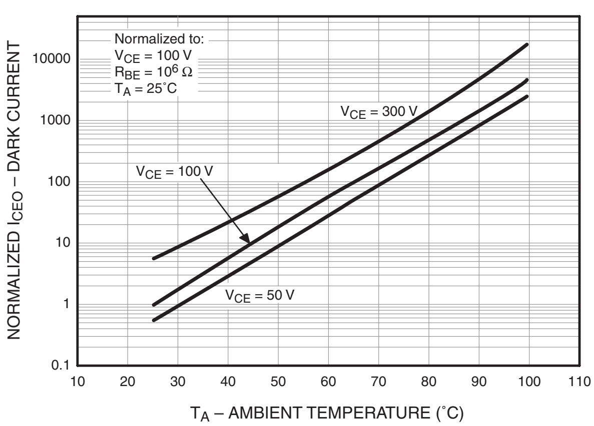


Figure 7. Normalized Dark Current vs. Ambient Temperature

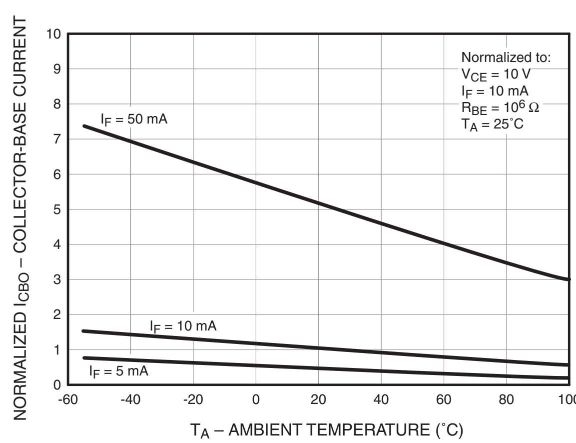


Figure 8. Normalized Collector-Base Current vs. Temperature

Reflow Profile

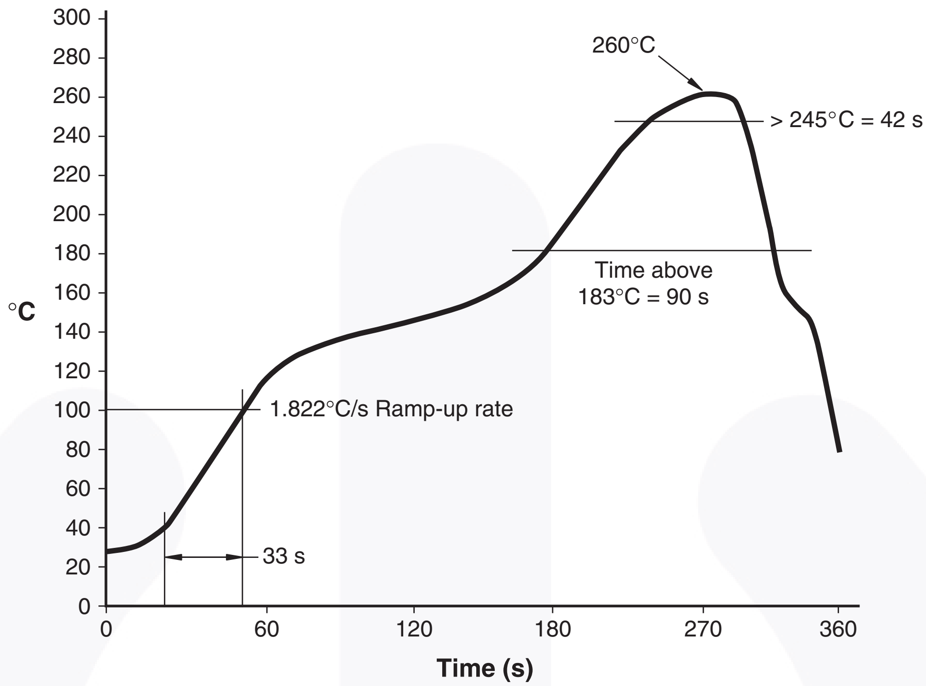


Figure 9. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
H11D1M	DIP 6-Pin	Tube (50 Units)
H11D1SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
H11D1SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
H11D1VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11D1SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11D1SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
H11D1TVM	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 4N38M, H11D3M, and MOC8204M devices.

Marking Information

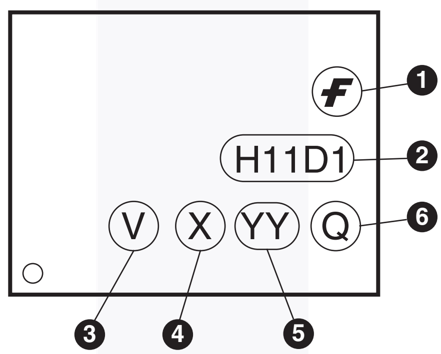


Figure 10. 12. Top Mark

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., “4”
5	Digit Work Week, Ranging from “01” to “53”
6	Assembly Package Code

Package Dimensions

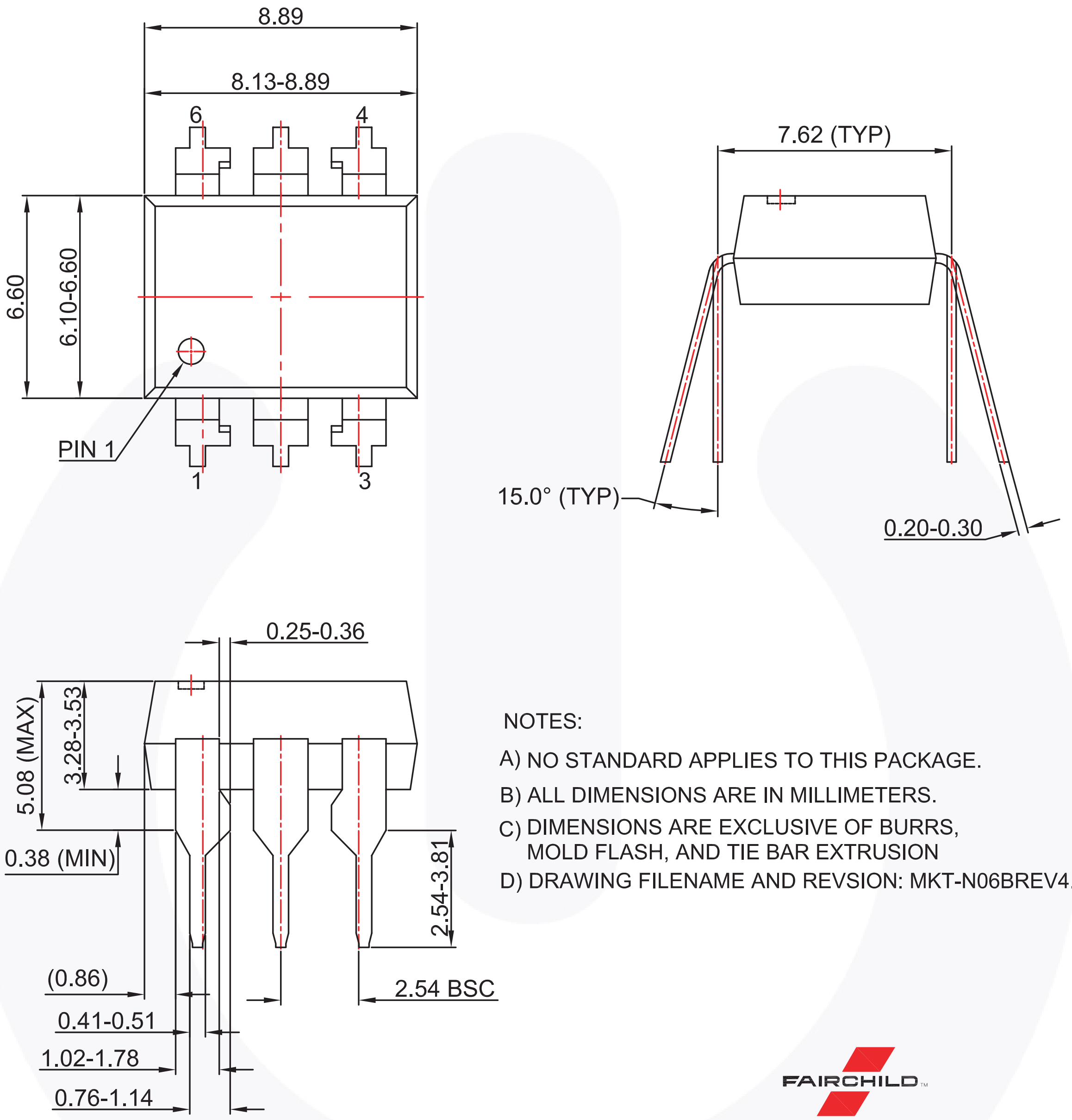
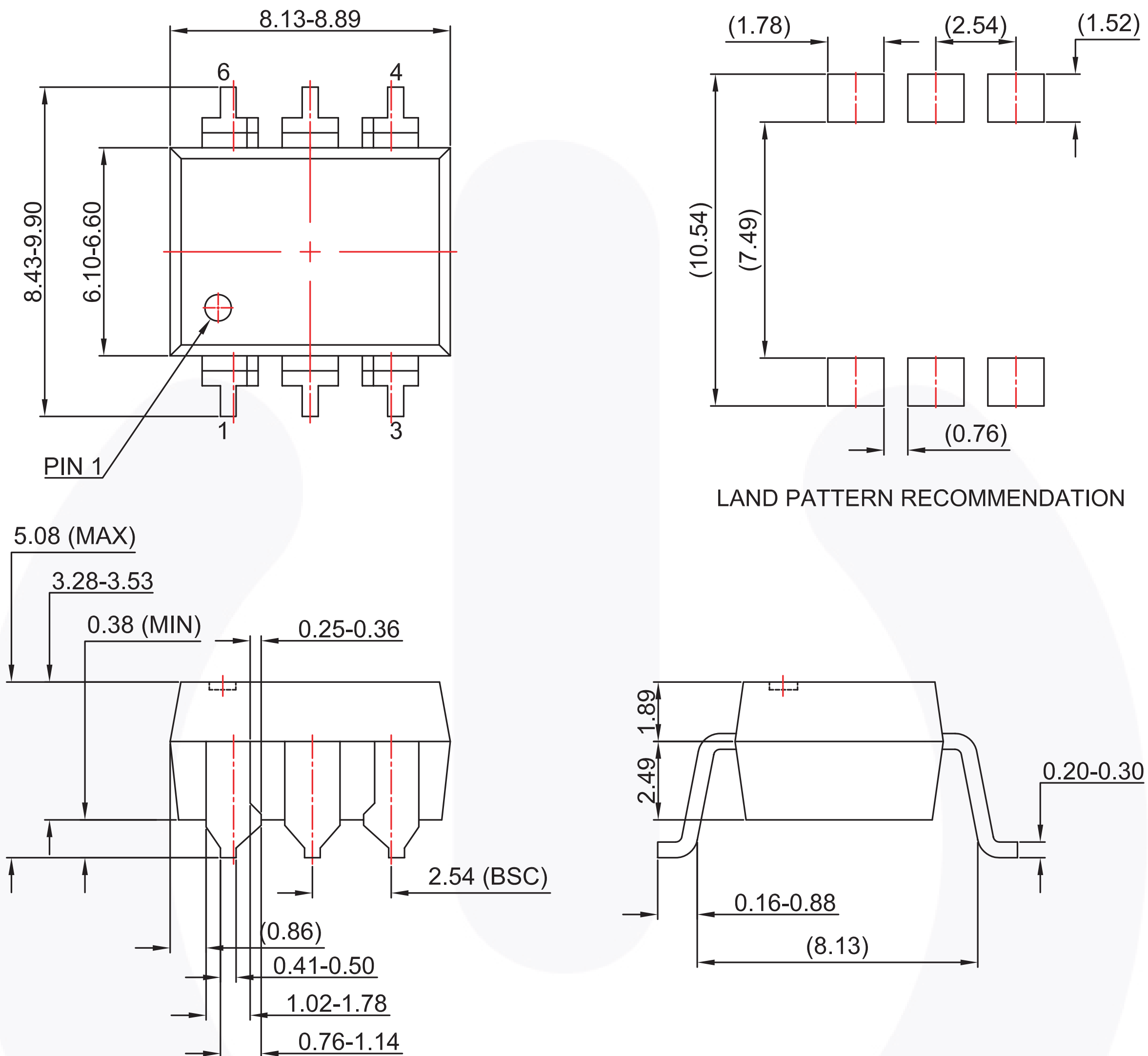


Figure 11. 6-pin DIP Through Hole

Package Dimensions (Continued)



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D) DRAWING FILENAME AND REVSION : MKT-N06CREV4.

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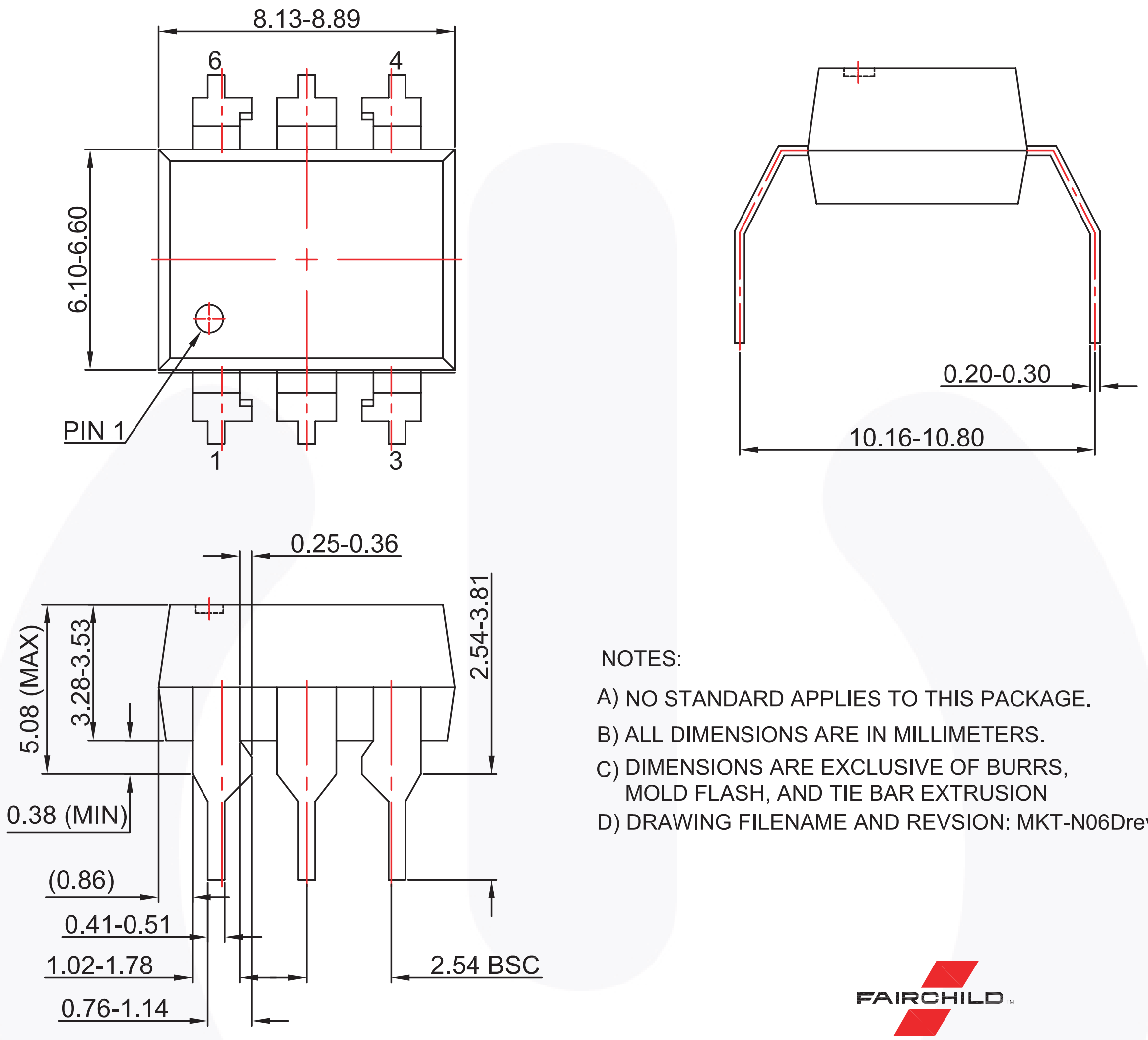
Figure 12. 6-pin DIP Surface Mount

Package Dimensions (Continued)



NOTES:

A) NO STANDARD APPLIES TO THIS PACKAGE.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

D) DRAWING FILENAME AND REVSION: MKT-N06Drev4

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Figure 13. 6-pin DIP 0.4" Lead Spacing

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