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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

ANODE 1 6 BASE 5 COLLECTOR N/C 3 4 EMITTER

Figure 1. Schematic

Package Outlines

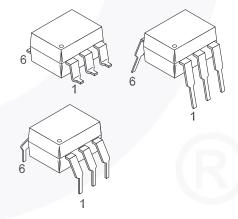


Figure 2. Package Outlines

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	< 150 V _{RMS}	I–IV
0110/1.89 Table 1, For Rated Mains Voltage	< 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
\/	Input-to-Output Test Voltage, Method A, $V_{IORM} \times 1.6 = V_{PR}$, Type and Sample Test with $t_m = 10$ s, Partial Discharge < 5 pC	1360	V _{peak}
V _{PR}	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 DEV	ICE			
T _{STG}	Storage Temperature	All	-40 to +125	°C
T _{OPR}	Operating Temperature	All	-40 to +100	°C
TJ	Junction Temperature	All	-40 to +125	°C
T _{SOL}	Lead Solder Temperature	All	260 for 10 seconds	°C
Б	Total Device Power Dissipation @ T _A = 25°C	A.II	420	mW
P _D	Derate Above 25°C	All	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	А
Б	LED Power Dissipation @ T _A = 25°C ⁽²⁾		120	mW
P_{D}	Derate Above 25°C	All	1.41	mW/°C
DETECTOR				
В	Power Dissipation @ T _A = 25°C	All	300	mW
P_{D}	Derate linearly above 25°C	All	4.0	mW/°C
		MOC8204M	400	V
V	Collector to Emitter Voltage ⁽²⁾	H11D1M	300	V
V _{CEO}	Collector to Emitter Voltage	H11D3M	200	V
		4N38M	80	V
		MOC8204M	400	V
V	Collector Base Voltage ⁽²⁾	H11D1M	300	V
V_{CBO}	Collector base voltage.	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.	Тур.	Max.	Unit
EMITTER			1			•	
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
	hunation Connectors	$V_F = 0 V, f = 1 MHz$	A.II		50		pF
СЛ	Junction Capacitance	V _F = 1 V, f = 1 MHz	All		65		pF
I _R	Reverse Leakage Current ⁽³⁾	V _R = 6 V	All		0.05	10	μA
DETECTO	DR .						
- 2		_	MOC8204M	400			V
D) /	Breakdown Voltage	$R_{BE} = 1 M\Omega,$ $I_{C} = 1.0 \text{ mA}, I_{F} = 0$	H11D1M	300			V
BV _{CEO}	Collector-to-Emitter ⁽³⁾	10 - 1.0 m/v, 1 _F - 0	H11D3M	200			V
		No RBE, I _C = 1.0 mA	4N38M	80			V
		MOC8204M	400			V	
D) (Collector to Base ⁽³⁾	I _C = 100 μA, I _F = 0	H11D1M	300			V
BV _{CBO}			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
		V _{CE} = 300 V, I _F = 0, T _A = 25°C	MOCOCOANA			100	nA
		V _{CE} = 300 V, I _F = 0, T _A = 100°C	MOC8204M			250	μΑ
	Landana Ourrant	$V_{CE} = 200V, I_{F} = 0,$ $T_{A} = 25^{\circ}C$	H11D1M			100	nA
I _{CEO}	Leakage Current Collector to Emitter ⁽³⁾ ($R_{BE} = 1 \text{ M}\Omega$)	V _{CE} = 200 V, I _F = 0, T _A = 100°C	THIBIM			250	μΑ
		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	TTTDSW		3	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		Тур.	Max.	Unit
EMITTER						•	•	
CTR Current Transfer Ratio, Collector-to-Emitter		, OL ,		1D1M, H11D3M, MOC8204M	2 (20)			mA (%)
		I _F = 10 mA, V _{CE} = 10 V		4N38M	2 (20)			mA (%)
V _{CE(SAT)}	$I_F = 10 \text{ mA}, I_C = 0.5 \text{ mA}$ Saturation Voltage ⁽⁴⁾ $R_{BE} = 1 \text{ M}\Omega$		H1	1D1M, H11D3M, MOC8204M		0.1	0.4	V
-(/		I _F = 20 mA, I _C = 4 mA		4N38M			1.0	V
SWITCHII	SWITCHING TIMES						•	
t _{ON}	Non-Saturated Turn-on Time	V _{CE} = 10 V, I _C = 2 mA,		All		5		μs
t _{OFF}	Turn-off Time	$R_L = 100 \Omega$		All		5		μs

Note:

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

Isolation Characteristics

Symbol	Characteristic		Test Conditions	Min.	Тур.	Max.	Unit
V _{ISO}	Input-Output Isolation Voltage	t =	1 Minute	4170			VAC _{RMS}
C _{ISO}	Isolation Capacitance	V _{I-0}	_O = 0 V, f = 1 MHz		0.2		pF
R _{ISO}	Isolation Resistance	V _{I-0}	$_{O}$ = ±500 VDC, T_{A} = 25°C	10 ¹¹			Ω

Typical Performance Curves

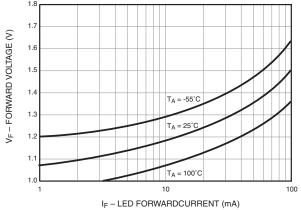


Figure 3. LED Forward Voltage vs. Forward Current

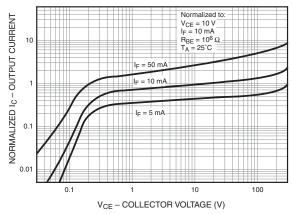


Figure 4. Normalized Output Characteristics

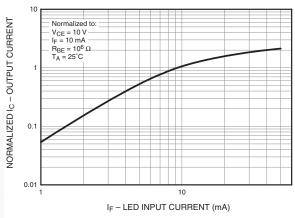


Figure 5. Normalized Output Current vs. LED Input Current

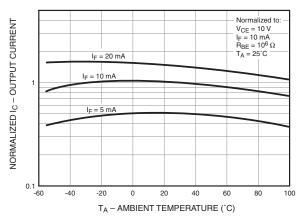


Figure 6. Normalized Output Current vs. Temperature

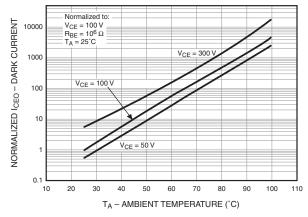


Figure 7. Normalized Dark Current vs. Ambient Temperature

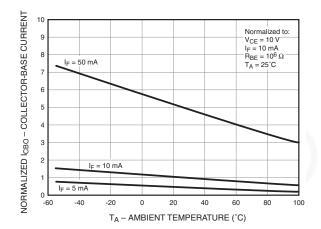


Figure 8. Normalized Collector-Base Current vs. Temperature

Reflow Profile

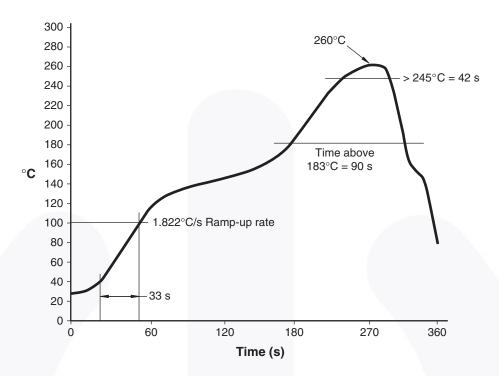


Figure 9. Reflow Profile

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

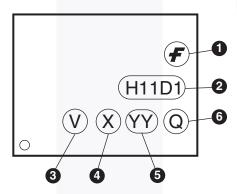
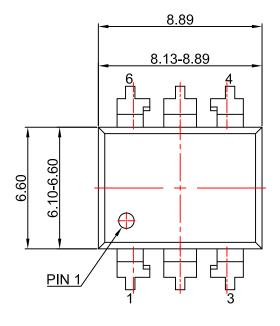
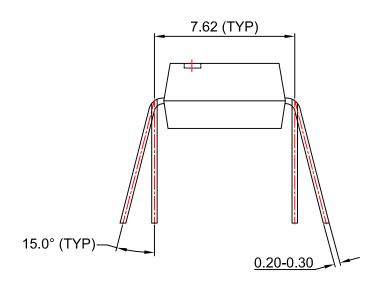


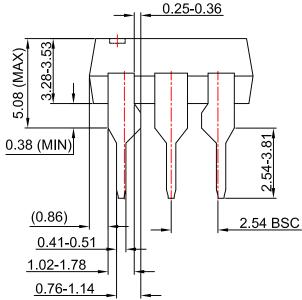
Figure 10. 12. Top Mark

Table 1. Top Mark Definitions

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



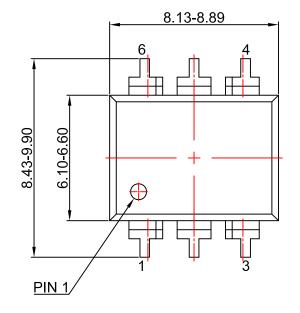


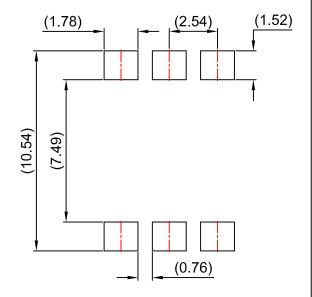


NOTES:

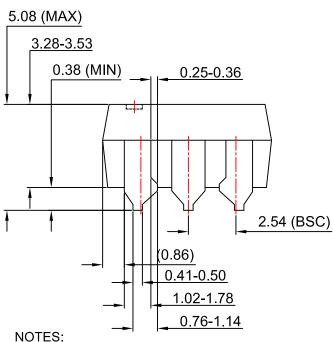
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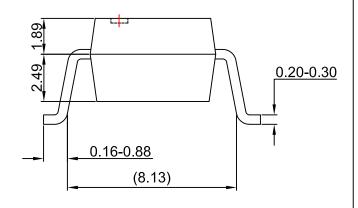






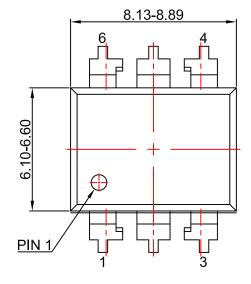
LAND PATTERN RECOMMENDATION

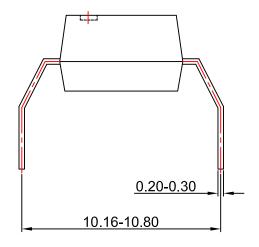


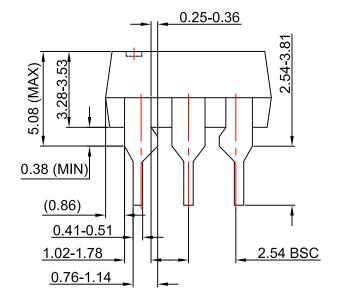


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