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December 2014

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

Features

- High Voltage:
 - MOC8204M, $BV_{CEO} = 400\text{ V}$
 - H11D1M, $BV_{CEO} = 300\text{ V}$
 - H11D3M, $BV_{CEO} = 200\text{ V}$
- 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

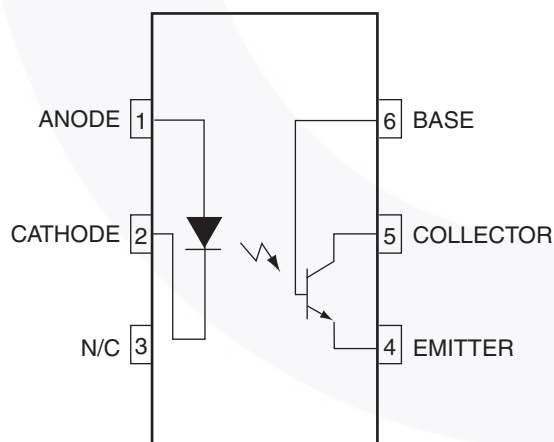


Figure 1. Schematic

Package Outlines

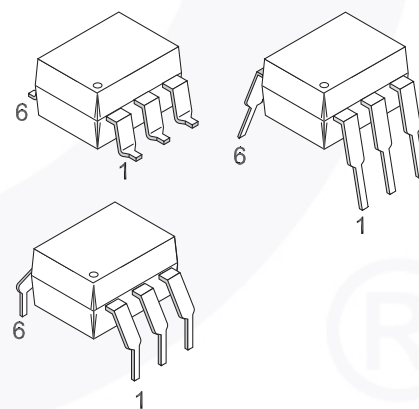


Figure 2. Package Outlines

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} × 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} × 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	°C
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

$T_A = 25^\circ\text{C}$ unless otherwise specified.

Individual Component Characteristics

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

Note:

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

Electrical Characteristics (Continued) $T_A = 25^\circ\text{C}$ unless otherwise specified.**Transfer Characteristics**

Symbol	Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Unit
EMITTER							
CTR	Current Transfer Ratio, Collector-to-Emitter	$I_F = 10\text{ mA}, V_{CE} = 10\text{ V}, R_{BE} = 1\text{ M}\Omega$	H11D1M, H11D3M, MOC8204M	2 (20)			mA (%)
		$I_F = 10\text{ mA}, V_{CE} = 10\text{ V}$	4N38M	2 (20)			mA (%)
$V_{CE(SAT)}$	Saturation Voltage ⁽⁴⁾	$I_F = 10\text{ mA}, I_C = 0.5\text{ mA}, R_{BE} = 1\text{ M}\Omega$	H11D1M, H11D3M, MOC8204M		0.1	0.4	V
		$I_F = 20\text{ mA}, I_C = 4\text{ mA}$	4N38M			1.0	V
SWITCHING TIMES							
t_{ON}	Non-Saturated Turn-on Time	$V_{CE} = 10\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$	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	$t = 1\text{ Minute}$	4170			$V_{AC(RMS)}$
C_{ISO}	Isolation Capacitance	$V_{I-O} = 0\text{ V}, f = 1\text{ MHz}$		0.2		pF
R_{ISO}	Isolation Resistance	$V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	10^{11}			Ω

Typical Performance Curves

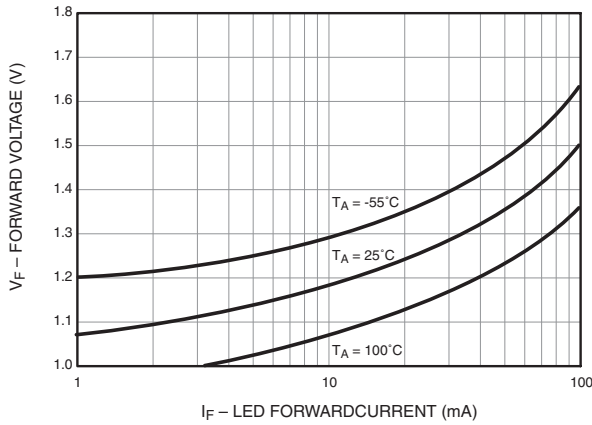


Figure 3. LED Forward Voltage vs. Forward Current

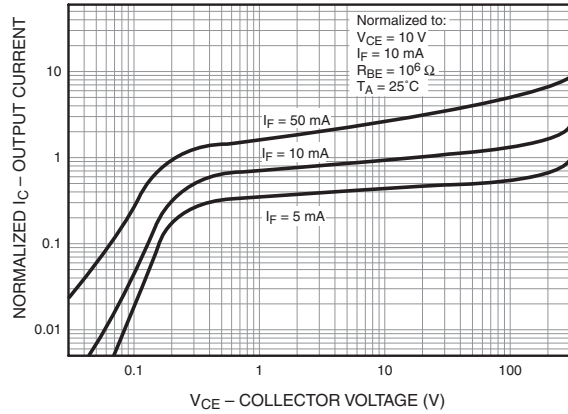


Figure 4. Normalized Output Characteristics

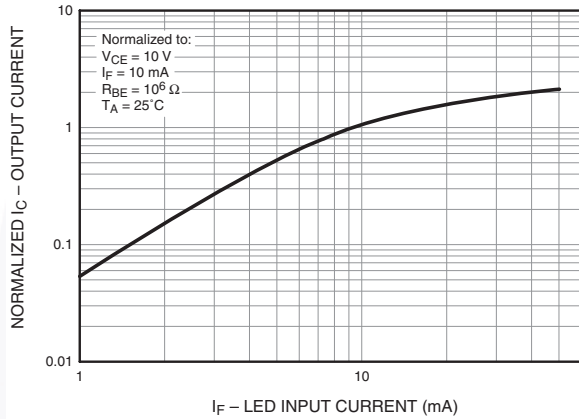


Figure 5. Normalized Output Current vs. LED Input Current

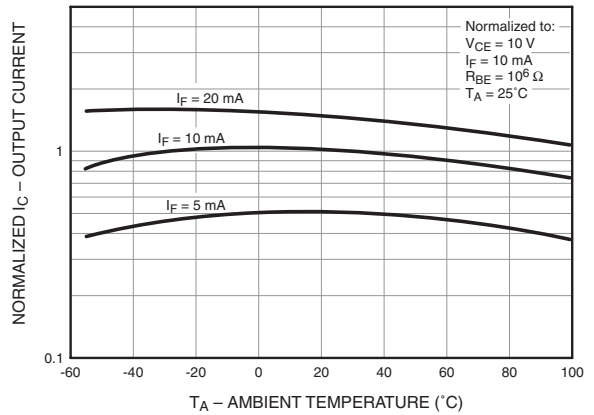


Figure 6. Normalized Output Current vs. Temperature

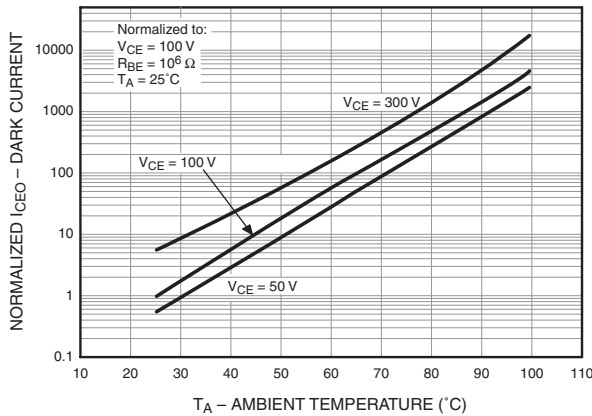


Figure 7. Normalized Dark Current vs. Ambient Temperature

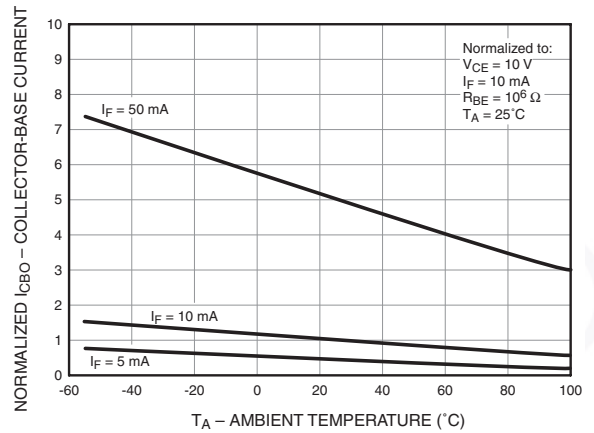


Figure 8. Normalized Collector-Base Current vs. Temperature

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

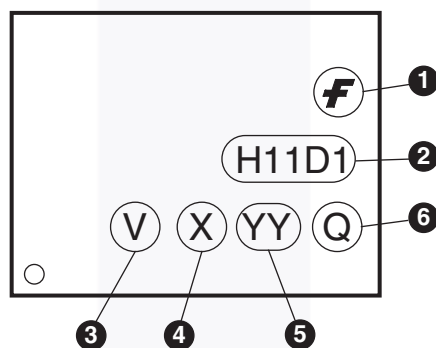


Figure 10. 12. Top Mark

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



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