FAIRCHILD SEMICONDUCTOR®

September 2009

4N38M, H11D1M, H11D2M, H11D3M, MOC8204M
High Voltage Phototransistor Optocouplers

Features

- High voltage:
  - MOC8204M, BV_{CER} = 400V
  - H11D1M, H11D2M, BV_{CER} = 300V
  - H11D3M, BV_{CER} = 200V
- High isolation voltage:
  - 7500 V_{AC} peak, 1 second
- Underwriters Laboratory (UL) recognized File # E90700, Volume 2
- IEC 60747-5-2 approved (ordering option V)

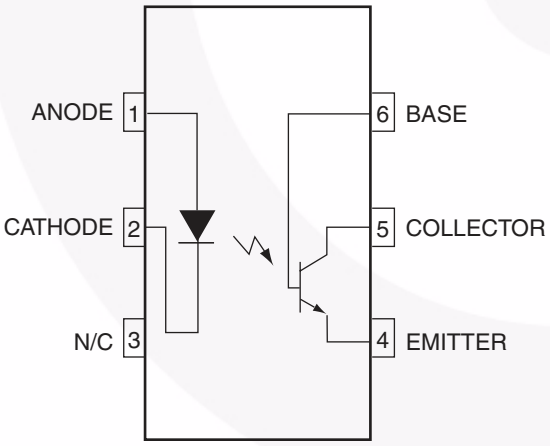
Applications

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs
- Appliance sensor systems
- Industrial controls

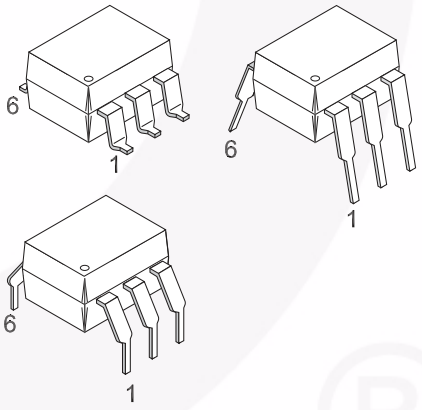
General Description

The 4N38M, H11DXM 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



Package Outlines



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	Units
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	-40 to +150	°C
T_{OPR}	Operating Temperature	All	-40 to +100	°C
T_{SOL}	Lead Solder Temperature (Wave Solder)	All	260 for 10 sec	°C
P_D	Total Device Power Dissipation @ T_A = 25°C	All	260	mW
	Derate Above 25°C		3.5	mW/°C
EMITTER				
I_F	Forward DC Current(1)	All	80	mA
V_R	Reverse Input Voltage(1)	All	6.0	V
I_F(pk)	Forward Current – Peak (1µs pulse, 300pps)(1)	All	3.0	A
P_D	LED Power Dissipation @ T_A = 25°C(1)	All	150	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_{CER}	Collector to Emitter Voltage(1)	MOC8204M	400	V
		H11D1M, H11D2M	300	
		H11D3M	200	
		4N38M	80	
V_{CBO}	Collector Base Voltage(1)	MOC8204M	400	V
		H11D1M, H11D2M	300	
		H11D3M	200	
		4N38M	80	
V_{ECO}	Emitter to Collector Voltage(1)	H11D1M, H11D2M, H11D3M, MOC8204M	7	V
I_C	Collector Current (Continuous)	All	100	mA

Note:

1. 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(2)	I_F = 10mA	All		1.15	1.5	V
$\frac{\Delta V_F}{\Delta T_A}$	Forward Voltage Temp. Coefficient		All		-1.8		mV/°C
BV_R	Reverse Breakdown Voltage	I_R = 10µA	All	6	25		V
C_J	Junction Capacitance	V_F = 0V, f = 1MHz	All		50		pF
		V_F = 1V, f = 1MHz			65		pF
I_R	Reverse Leakage Current(2)	V_R = 6V	All		0.05	10	µA
DETECTOR							
BV_{CER}	Breakdown Voltage Collector to Emitter(2)	R_{BE} = 1MΩ, I_C = 1.0mA, I_F = 0	MOC8204M	400			V
			H11D1M/2M	300			
			H11D3M	200			
BV_{CEO}		No RBE, I_C = 1.0mA	4N38M	80			
BV_{CBO}	Collector to Base(2)	I_C = 100µA, I_F = 0	MOC8204M	400			V
			H11D1M/2M	300			
			H11D3M	200			
			4N38M	80			
BV_{EBO}	Emitter to Base	I_E = 100µA, I_F = 0	4N38M	7			V
BV_{ECO}	Emitter to Collector	I_E = 100µA, I_F = 0	All	7	10		V
I_{CER}	Leakage Current Collector to Emitter(2) (R_{BE} = 1MΩ)	V_{CE} = 300V, I_F = 0, T_A = 25°C	MOC8204M			100	nA
		V_{CE} = 300V, I_F = 0, T_A = 100°C				250	µA
		V_{CE} = 200V, I_F = 0, T_A = 25°C	H11D1M/2M			100	nA
		V_{CE} = 200V, I_F = 0, T_A = 100°C				250	µA
		V_{CE} = 100V, I_F = 0, T_A = 25°C	H11D3M			100	nA
		V_{CE} = 100V, I_F = 0, T_A = 100°C				250	µA
I_{CEO}		No R_{BE}, V_{CE} = 60V, I_F = 0, T_A = 25°C	4N38M			50	nA

Transfer Characteristics (T_A = 25°C Unless otherwise specified.)

Symbol	Characteristics	Test Conditions	Device	Min.	Typ.*	Max.	Units
EMITTER							
CTR	Current Transfer Ratio, Collector to Emitter	I_F = 10mA, V_{CE} = 10V, R_{BE} = 1MΩ	H11D1M/2M/3M, MOC8204M	2 (20)			mA (%)
		I_F = 10mA, V_{CE} = 10V	4N38M	2 (20)			
$V_{CE(SAT)}$	Saturation Voltage(2)	I_F = 10mA, I_C = 0.5mA, R_{BE} = 1MΩ	H11D1M/2M/3M, MOC8204M		0.1	0.40	V
		I_F = 20mA, I_C = 4mA	4N38M			1.0	
SWITCHING TIMES							
t_{ON}	Non-Saturated Turn-on Time	V_{CE} = 10V, I_{CE} = 2mA, R_L = 100Ω	All		5		µs
t_{OFF}	Turn-off Time		All		5		µs

*All Typical values at T_A = 25°C

Note:

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

DC Electrical Characteristics (Continued) (T_A = 25°C unless otherwise specified.)

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Device	Min.	Typ.*	Max.	Units
V_{ISO}	Isolation Voltage	f = 60Hz, t = 1 sec.	All	7500			V_{AC}PEAK
R_{ISO}	Isolation Resistance	V_{I-O} = 500 VDC	All	10^{11}			Ω
C_{ISO}	Isolation Capacitance	f = 1MHz	All		0.2		pF

*All Typical values at T_A = 25°C

Safety and Insulation Ratings

As per IEC 60747-5-2, 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.

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1				
	For Rated Main Voltage < 150Vrms		I-IV		
	For Rated Main voltage < 300Vrms		I-IV		
	Climatic Classification		55/100/21		
	Pollution Degree (DIN VDE 0110/1.89)		2		
CTI	Comparative Tracking Index	175			
V_{PR}	Input to Output Test Voltage, Method b, V_{IORM} x 1.875 = V_{PR}, 100% Production Test with tm = 1 sec, Partial Discharge < 5pC	1594			V_{peak}
	Input to Output Test Voltage, Method a, V_{IORM} x 1.5 = V_{PR}, Type and Sample Test with tm = 60 sec, Partial Discharge < 5pC	1275			V_{peak}
V_{IORM}	Max. Working Insulation Voltage	850			V_{peak}
V_{IOTM}	Highest Allowable Over Voltage	6000			V_{peak}
	External Creepage	7			mm
	External Clearance	7			mm
	Insulation Thickness	0.5			mm
RIO	Insulation Resistance at Ts, V_{IO} = 500V	10^9			Ω

Typical Performance Curves

Fig. 1 LED Forward Voltage vs. Forward Current

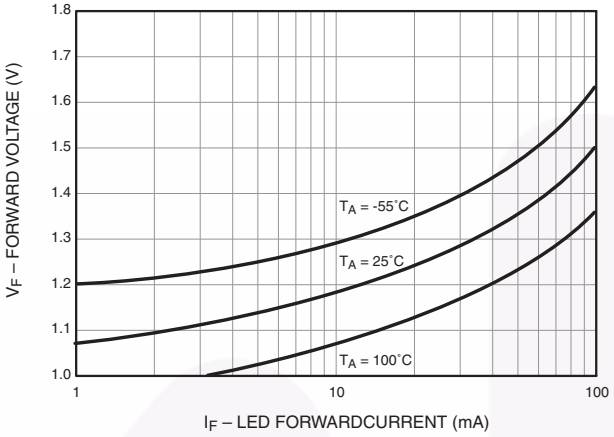


Fig. 2 Normalized Output Characteristics

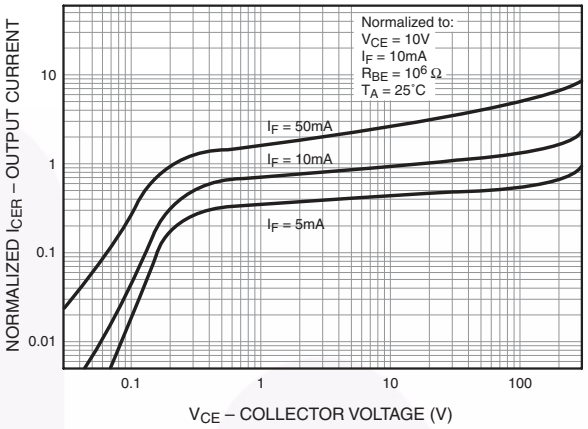


Fig. 3 Normalized Output Current vs. LED Input Current

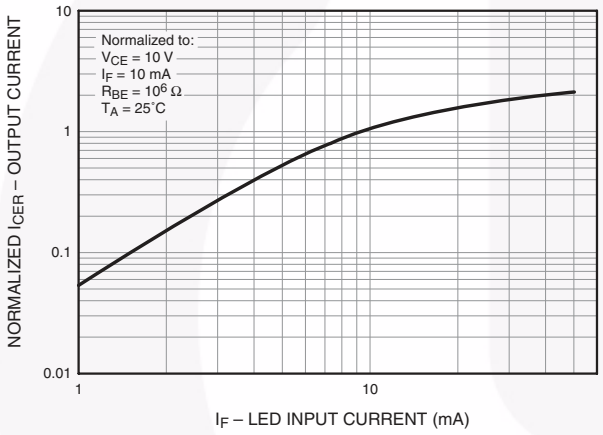


Fig. 4 Normalized Output Current vs. Temperature

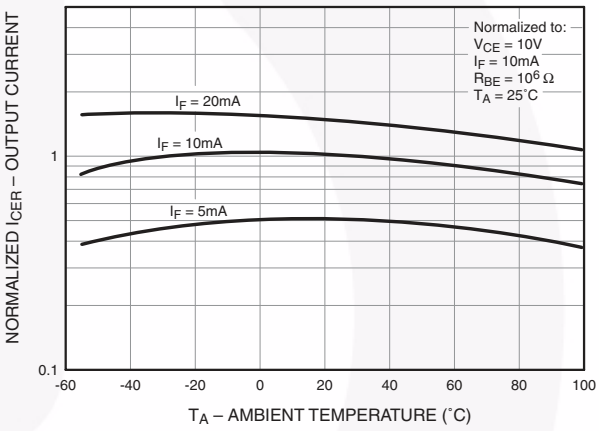


Fig. 5 Normalized Dark Current vs. Ambient Temperature

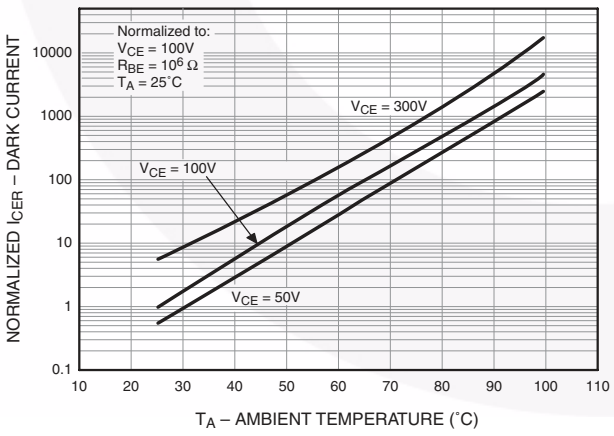
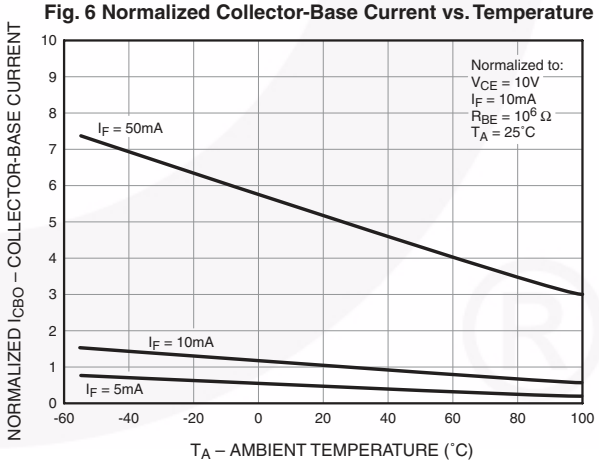
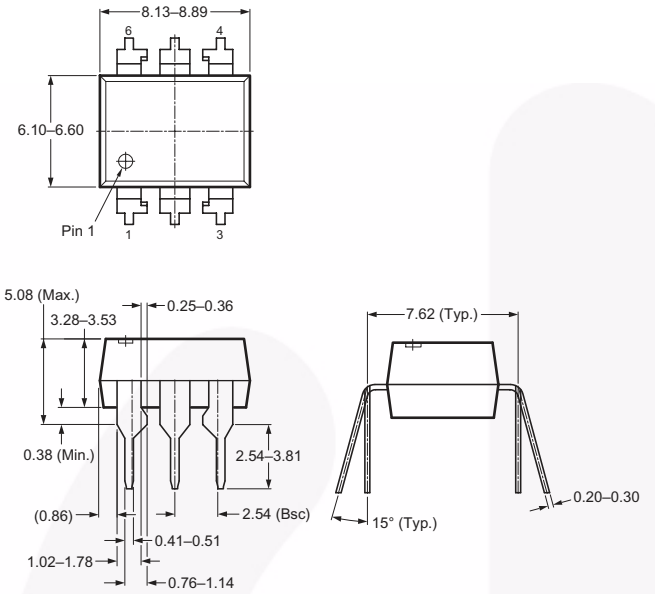


Fig. 6 Normalized Collector-Base Current vs. Temperature

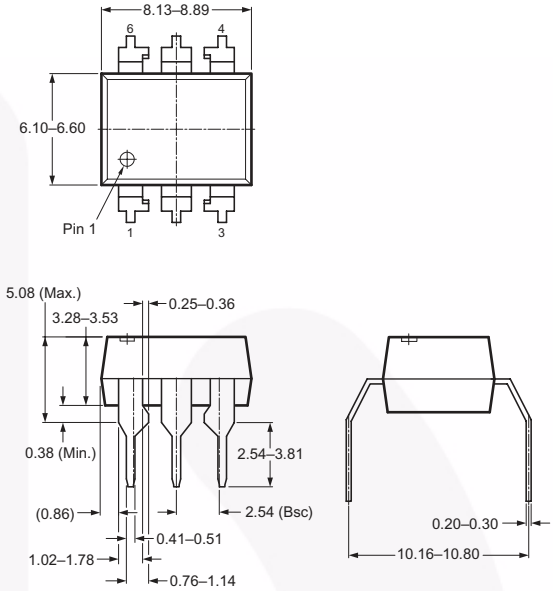


Package Dimensions

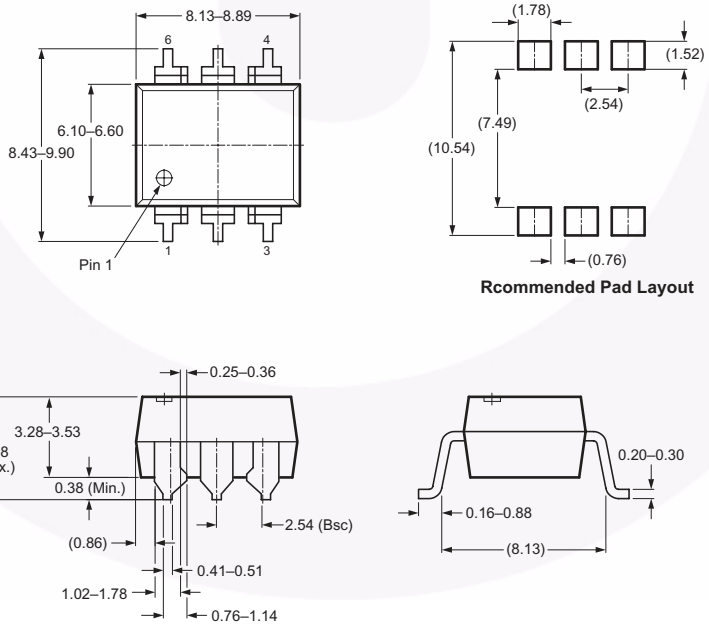
Through Hole



0.4" Lead Spacing



Surface Mount

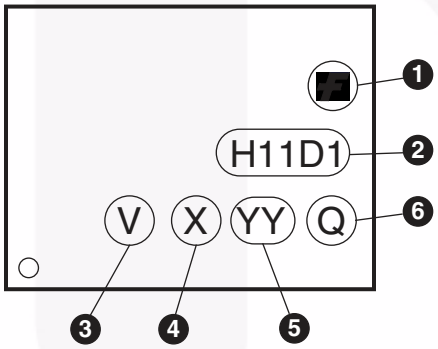


Note:
All dimensions in mm.

Ordering Information

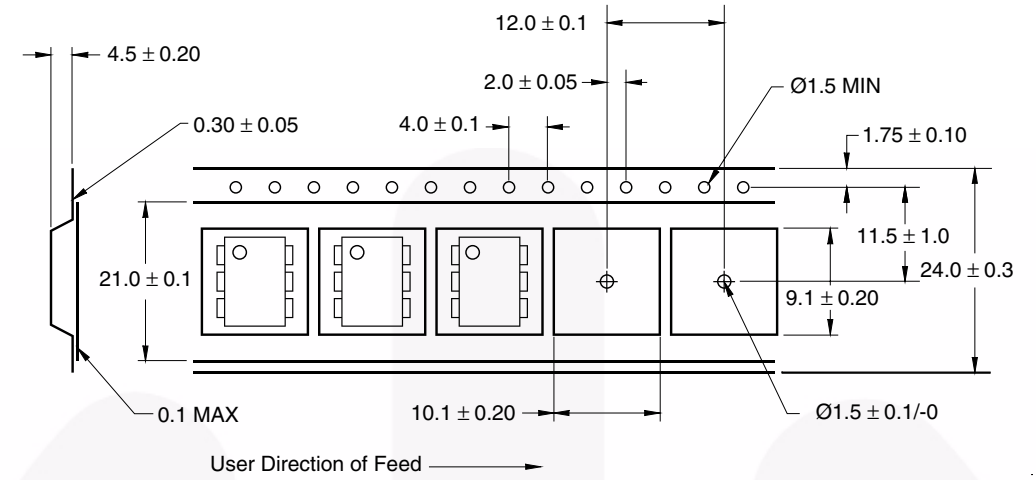
Option	Order Entry Identifier (Example)	Description
No option	H11D1M	Standard Through Hole Device (50 units per tube)
S	H11D1SM	Surface Mount Lead Bend
SR2	H11D1SR2M	Surface Mount; Tape and Reel
T	H11D1TM	0.4" Lead Spacing
V	H11D1VM	VDE 0884
TV	H11D1TVM	VDE 0884, 0.4" Lead Spacing
SV	H11D1SVM	VDE 0884, Surface Mount
SR2V	H11D1SR2VM	VDE 0884, Surface Mount, Tape and Reel

Marking Information

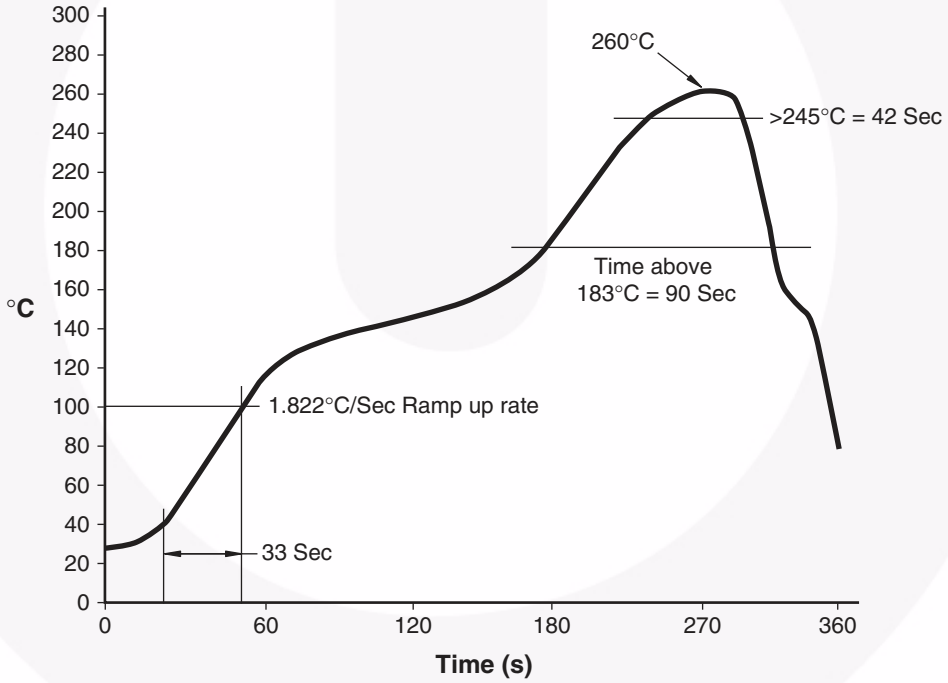


Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., ‘7’
5	Two digit work week ranging from ‘01’ to ‘53’
6	Assembly package code

Carrier Tape Specification



Reflow Profile



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