



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

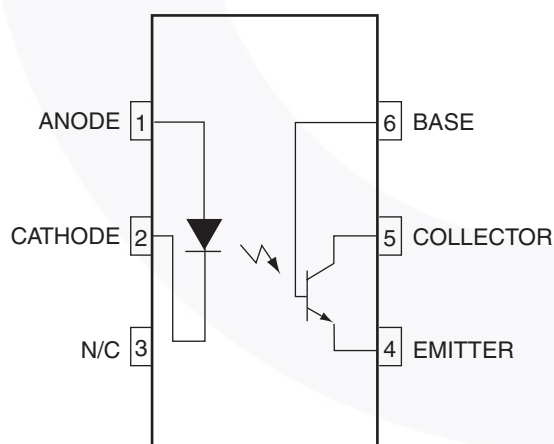


Figure 1. Schematic

Package Outlines

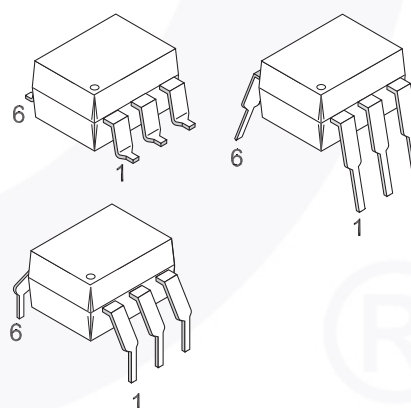


Figure 2. Package Outlines

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			V
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	nA

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	$V_{CE} = 10\text{ V}, I_C = 2\text{ mA}, R_L = 100\text{ }\Omega$	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

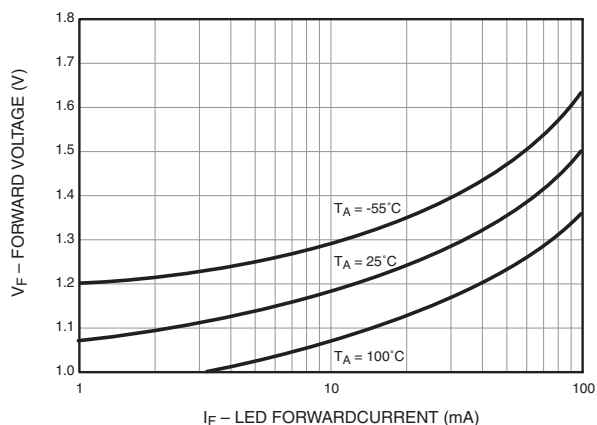


Figure 3. LED Forward Voltage vs. Forward Current

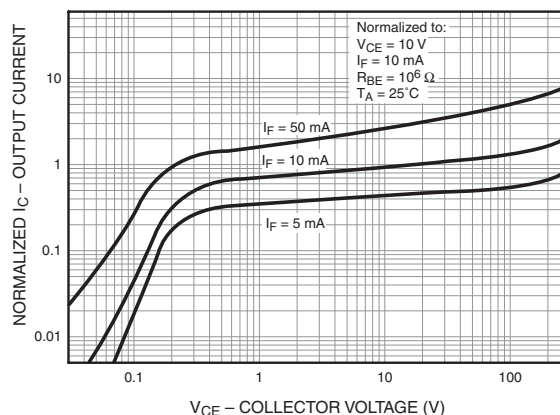


Figure 4. Normalized Output Characteristics

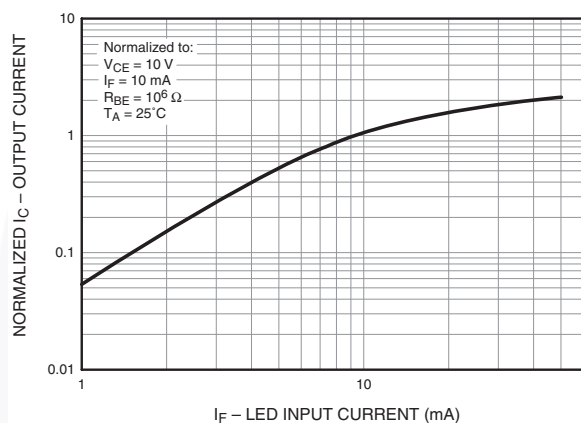


Figure 5. Normalized Output Current vs. LED Input Current

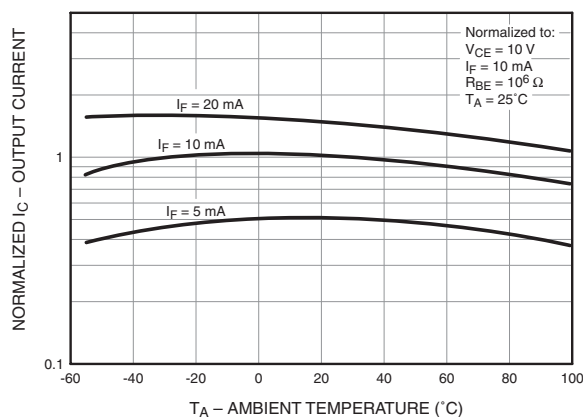


Figure 6. Normalized Output Current vs. Temperature

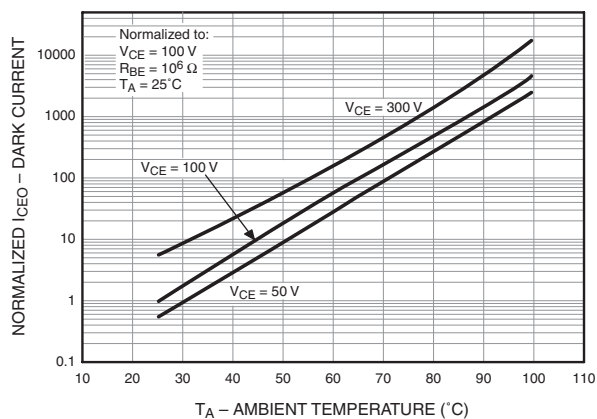


Figure 7. Normalized Dark Current vs. Ambient Temperature

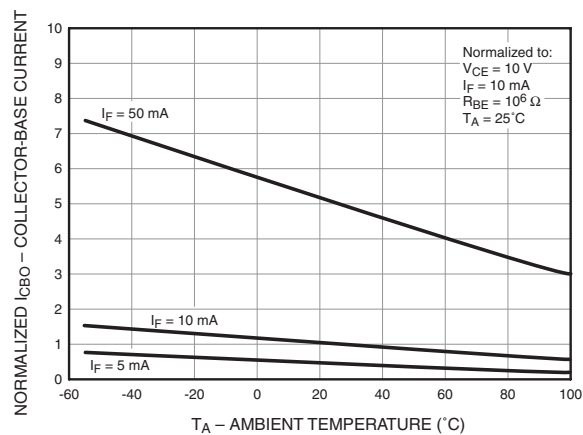


Figure 8. Normalized Collector-Base Current vs. Temperature

Reflow Profile

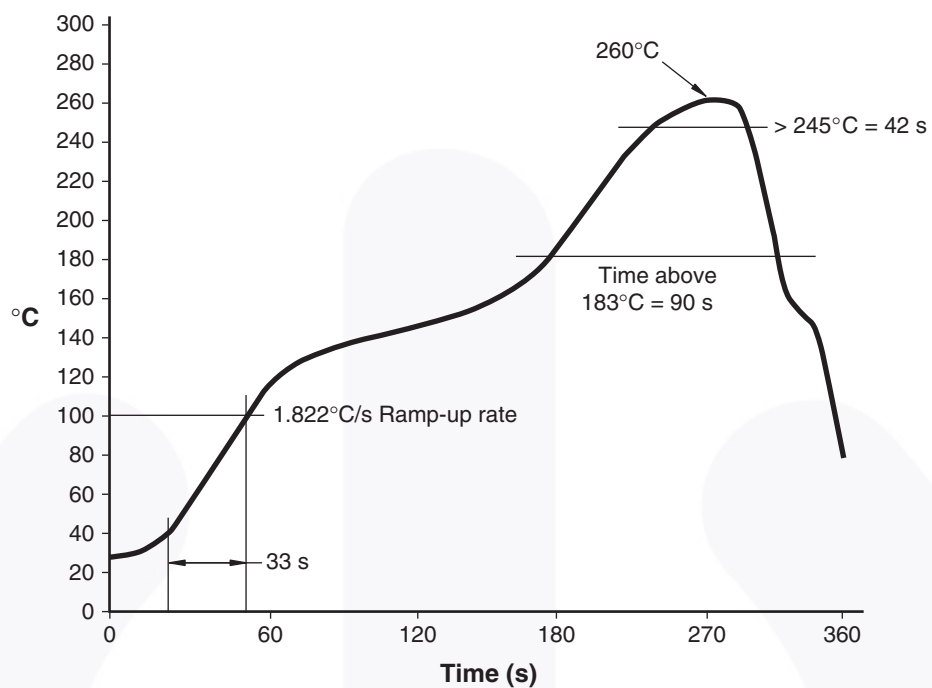


Figure 9. Reflow Profile

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:

- The product orderable part number system listed in this table also applies to the 4N38M, H11D3M, and MOC8204M devices.

Marking Information

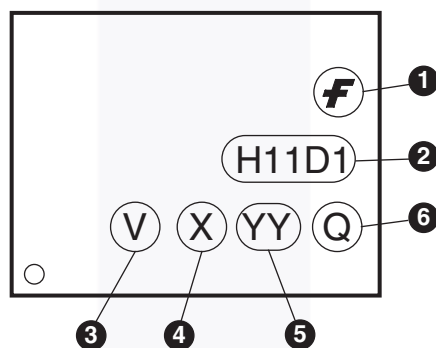
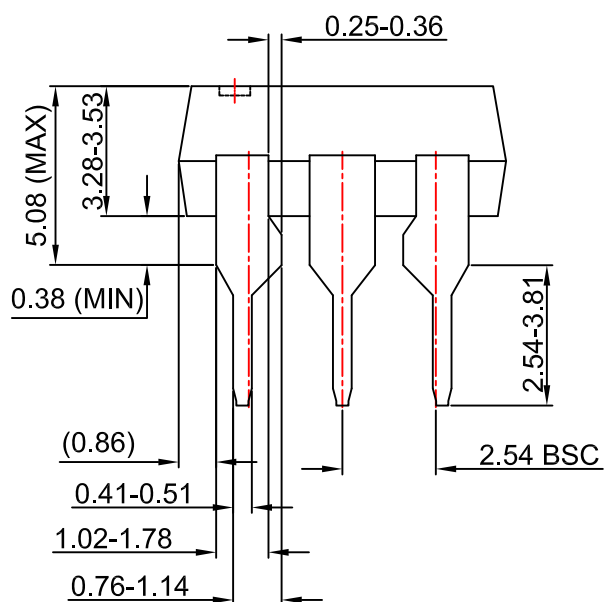
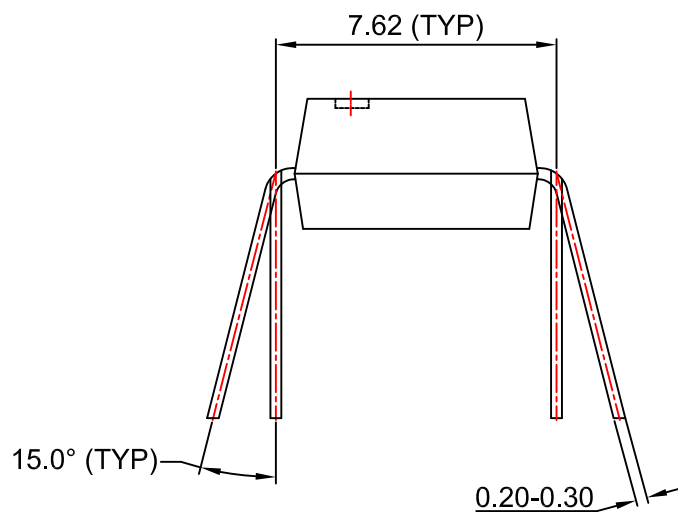
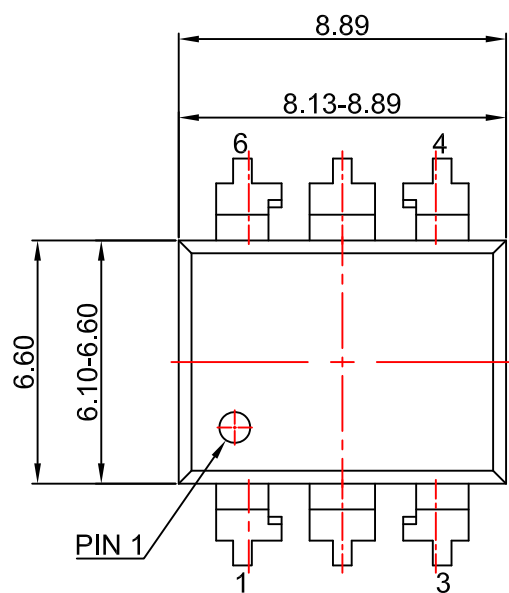


Figure 10. 12. Top Mark

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



NOTES:

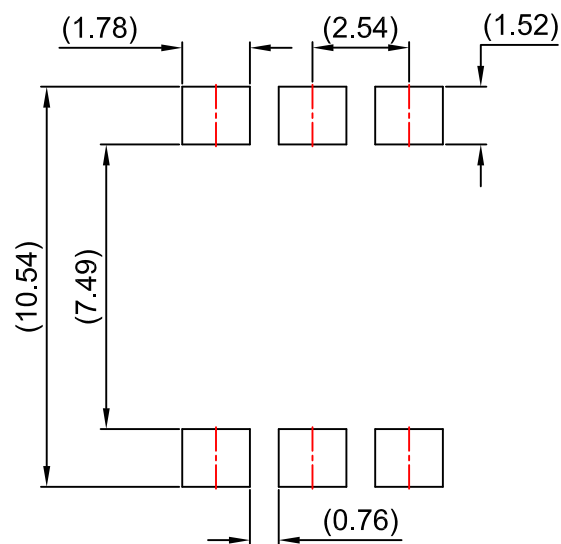
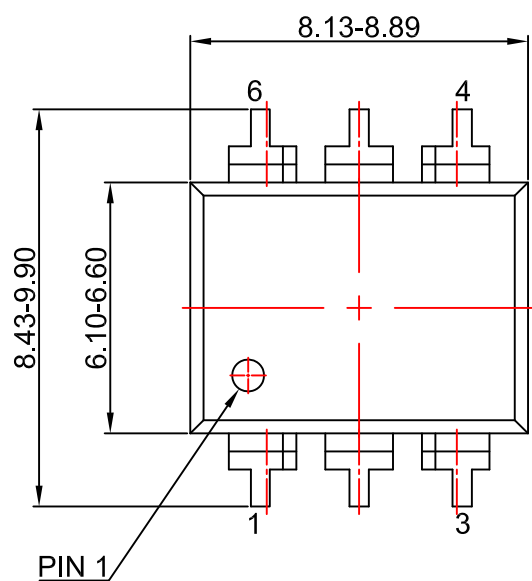
A) NO STANDARD APPLIES TO THIS PACKAGE.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

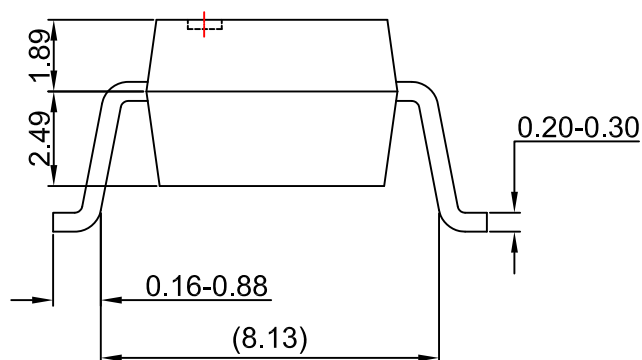
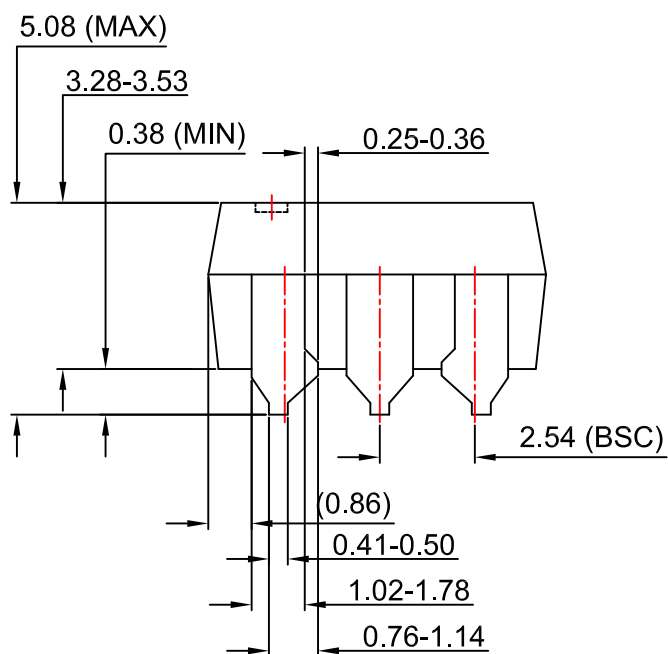
C) DIMENSIONS ARE EXCLUSIVE OF BURRS,
MOLD FLASH, AND TIE BAR EXTRUSION

D) DRAWING FILENAME AND REVISION: MKT-N06BREV4.





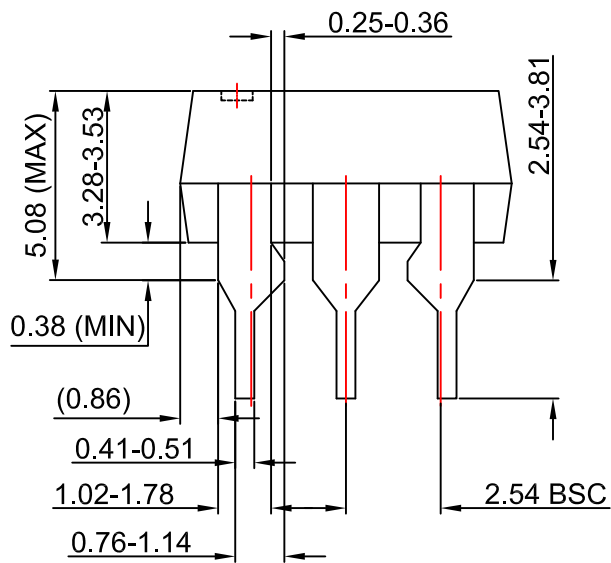
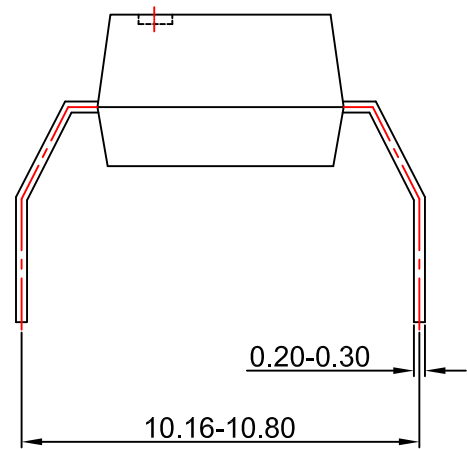
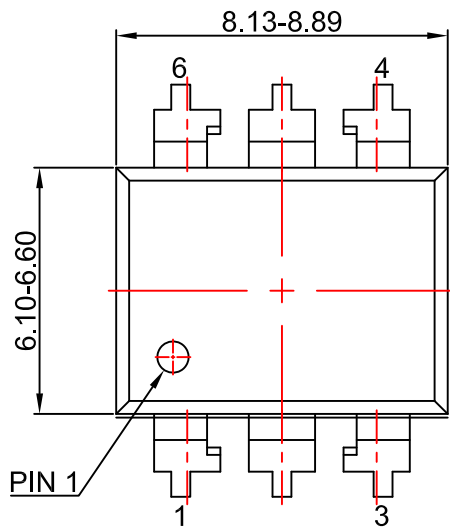
LAND PATTERN RECOMMENDATION



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-N06CREV4.





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





TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™
AttitudeEngine™
Awinda®
AX-CAP®*
BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficientMax™
ESBC™
F®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FastvCore™
FETBench™
FPS™
F-PFS™
FRFET®
Global Power Resource™
GreenBridge™
Green FPS™
Green FPS™ e-Series™
Gmax™
GTO™
IntelliMAX™
ISOPLANAR™
Making Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
MotionGrid®
MTI®
MTX®
MVN®
mWSaver®
OptoHit™
OPTOLOGIC®

OPTOPLANAR®
Power Supply WebDesigner™
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
Solutions for Your Success™
SPM®
STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™

SYSTEM GENERAL®*
TinyBoost®
TinyBuck®
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TranSiC™
TriFault Detect™
TRUECURRENT®*
μSerDes™
SerDes®
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
VoltagePlus™
XS™
Xsens™
仙童®

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. TO OBTAIN THE LATEST, MOST UP-TO-DATE DATASHEET AND PRODUCT INFORMATION, VISIT OUR WEBSITE AT [HTTP://WWW.FAIRCHILDSEMI.COM](http://www.fairchildsemi.com). FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

AUTHORIZED USE

Unless otherwise specified in this data sheet, this product is a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability. This product may not be used in the following applications, unless specifically approved in writing by a Fairchild officer: (1) automotive or other transportation, (2) military/aerospace, (3) any safety critical application – including life critical medical equipment – where the failure of the Fairchild product reasonably would be expected to result in personal injury, death or property damage. Customer's use of this product is subject to agreement of this Authorized Use policy. In the event of an unauthorized use of Fairchild's product, Fairchild accepts no liability in the event of product failure. In other respects, this product shall be subject to Fairchild's Worldwide Terms and Conditions of Sale, unless a separate agreement has been signed by both Parties.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Terms of Use

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I77