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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

May 2010

FODM611
High Noise Immunity, 5V, 10Mbit/sec Logic Gate Output (Open Collector) Optocoupler

Features

- High Noise Immunity characterized by common mode transient immunity (CMTi)
  - 20kV/μs Minimum CMTi
- High Speed
  - 10Mbit/sec Date Rate (NRZ)
  - 100ns max. Propagation Delay
  - 35ns max. Pulse Width Distortion
  - 40ns max. Propagation Delay Skew
- -40 to +85°C temperature range
- Safety and regulatory approvals
  - UL1577, 3750 VAC_{RMS} for 1 min.
  - IEC60747-5-2 (pending approval)

Applications

- Microprocessor system interface
  - SPI, I^2C
- Industrial fieldbus communications
  - DeviceNet, CAN, RS485
- Programmable logic control
- Isolated data acquisition system
- Voltage level translator
- Isolating MOSFET/IGBT gate drivers

Description

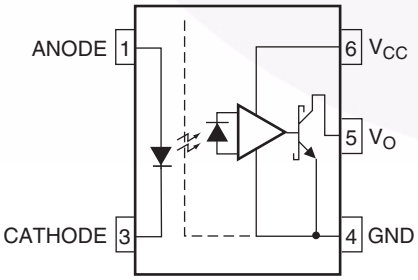
The FODM611 is a 5V high-speed logic gate output (open collector) optocoupler, which supports isolated communications allowing digital signals to communicate between systems without conducting ground loops or hazardous voltages. It utilizes Fairchild's proprietary coplanar packaging technology, Optoplanar®, and optimized IC design to achieve high noise immunity, characterized by high common mode transient immunity specifications.

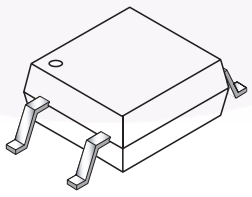
This optocoupler consists of an AlGaAS LED at the input, optically coupled to a high speed integrated photo-detector logic gate. The output of the detector IC is an open collector schottky-clamped transistor. The coupled parameters are guaranteed over the wide temperature range of -40°C to +85°C. A maximum input signal of 5mA will provide a minimum output sink current of 13mA (fan out of 8).

Related Resources

- www.fairchildsemi.com/products/opto/
- www.fairchildsemi.com/pf/FO/FODM8061.html
- www.fairchildsemi.com/pf/FO/FODM8071.html

Functional Schematic





Truth Table

LED	Output
Off	High
On	Low

Pin Definitions

Number	Name	Function Description
1	ANODE	Anode
3	CATHODE	Cathode
4	GND	Output Ground
5	V_O	Output Voltage
6	V_{CC}	Output Supply Voltage

Safety and Insulation Ratings for Mini-Flat Package (SO5 Pin)

As per IEC60747-5-2 (Pending Certification). 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-III		
	Climatic Classification		40/85/21		
	Pollution Degree (DIN VDE 0110/1.89)		2		
CTI	Comparative Tracking Index	175			
V_{PR}	Input to Output Test Voltage, Method b, VIORM x 1.875 = V_{PR}, 100% Production Test with t_m = 1 sec, Partial Discharge < 5 pC	1060			
V_{PR}	Input to Output Test Voltage, Method a, VIORM x 1.5 = V_{PR}, Type and Sample Test with t_m = 60 sec, Partial Discharge < 5 pC	848			
V_{IORM}	Max Working Insulation Voltage	565			V_{peak}
V_{IOTM}	Highest Allowable Over Voltage	4000			V_{peak}
	External Creepage	5.0			mm
	External Clearance	5.0			mm
	Insulation thickness	0.5			mm
T_{Case}	Safety Limit Values, Maximum Values allowed in the event of a failure, Case Temperature	150			°C
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500V	10^9			Ω

Absolute Maximum Ratings (T_A=25ºC unless otherwise specified)

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	Value	Units
T_{STG}	Storage Temperature	-40 to +125	ºC
T_{OPR}	Operating Temperature	-40 to +85	ºC
T_J	Junction Temperature	-40 to +125	ºC
T_{SOL}	Lead Solder Temperature (Refer to Reflow Temperature Profile)	260 for 10sec	ºC
I_F	Forward Current	50	mA
V_R	Reverse Voltage	5.0	V
V_{CC}	Supply Voltage	0 to 7.0	V
V_O	Output Voltage	-0.5 to V_{CC}+0.5	V
I_O	Average Output Current	50	mA
PD_I	Input Power Dissipation(1)(2)	100	mW
PD_O	Output Power Dissipation(1)(2)	85	mW

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Unit
T_A	Ambient Operating Temperature	-40	+85	ºC
V_{CC}	Supply Voltages(3)	4.5	5.5	V
V_{FL}	Logic Low Input Voltage	0	0.8	V
I_{FH}	Logic High Input Current	6.3	15	mA
I_{FL}	Logic Low Input Current		250	µA
N	Fan Out (at R_L = 1kΩ)		5	TTL Loads
R_L	Output Pull-up Resistor	330	4k	Ω

Isolation Characteristics (T_A=25ºC)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{ISO}	Input-Output Isolation Voltage	freq= 60Hz, t = 1.0min, $I_{I-O} \le 10\mu A$(4)(5)	3750			Vac_{RMS}
R_{ISO}	Isolation Resistance	V_{I-O} = 500V(4)		10^{12}		Ω
C_{ISO}	Isolation Capacitance	V_{I-O} = 0V, freq=1.0MHz(4)		0.6		pF

Notes:

1. No derate required to 85ºC.
2. Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.
3. 0.1µF bypass capacitor must be connected between pins 4 and 6.
4. Device is considered a two terminal device: Pins 1 and 3 are shorted, and Pins 4, 5, and 6 are shorted together.
5. 3,750 VAC_{RMS} for 1 minute duration is equivalent to 4,500 VAC_{RMS} for 1 second duration.

Electrical Characteristics (Apply over all recommended conditions)

(T_A = -40ºC to +85ºC, 4.5V ≤ V_{CC} ≤ 5.5V), unless otherwise specified.
Typical value is measured at T_A = 25ºC and V_{CC} = 5.0V.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
INPUT CHARACTERISTICS						
V_F	Forward Voltage	I_F = 10mA, Fig. 1	1.05	1.45	1.8	V
BV_R	Input Reverse Breakdown Voltage	I_R = 10µA	5.0			V
I_{FHL}	Threshold Input Current	V_O = 0.6V, I_{OL}(sinking) = 13mA, T_A < 85ºC, Fig. 2		3.4	5.0	mA
OUTPUT CHARACTERISTICS						
V_{OL}	Logic LOW Output Voltage	I_F = rated I_{FHL}, I_{OL}(sinking) = 13mA, Fig. 3		0.4	0.6	V
I_{OH}	Logic HIGH Output Current	I_F = 250µA, V_O = 5.0V, Fig. 4		2.1	30.0	µA
I_{CCL}	Logic LOW Output Supply Current	I_F = 10mA, V_{CC} = 5.0V, Fig. 5, 7		7.5	10.0	mA
I_{CCH}	Logic HIGH Output Supply Current	I_F = 0mA, V_{CC} = 5.0V, Fig. 6, 7		6.0	9.0	mA

Switching Characteristics (Apply over all recommended conditions)

(T_A = -40ºC to +85ºC, 4.5V ≤ V_{CC} ≤ 5.5V, I_F = 7.5mA), unless otherwise specified.
Typical value is measured at T_A = 25ºC and V_{CC} = 5.0V

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Date Rate		R_L = 350Ω			10	Mbps
t_{PHL}	Propagation Delay Time to Logic Low Output	R_L = 350Ω, C_L = 15pF, Fig. 8 and 11		43	100	ns
t_{PLH}	Propagation Delay Time to Logic High Output	R_L = 350Ω, C_L = 15pF, Fig. 8 and 11		50	100	ns
PWD	Pulse Width Distortion, $\lvert t_{PHL} - t_{PLH} \rvert$	R_L = 350Ω, C_L = 15pF, Fig. 9		7	35	ns
t_{PSK}	Propagation Delay Skew	R_L = 350Ω, C_L = 15pF(6)			40	ns
t_R	Output Rise Time, (10% to 90%)	R_L = 350Ω, C_L = 15pF, Fig. 10 and 11		20		ns
t_F	Output Fall Time, (90% to 10%)	R_L = 350Ω, C_L = 15pF, Fig. 10 and 11		10		ns
$\lvert CM_H \rvert$	Common Mode Transient Immunity at Output High	V_I = 5.0V, V_O > 0.8 x V_{CC}, V_{CM} = 1000V(7), Fig. 12	20	40		kV/µs
$\lvert CM_L \rvert$	Common Mode Transient Immunity at Output Low	V_I = 0V, V_O < 0.8V, V_{CM} = 1000V(7), Fig. 12	20	40		kV/µs

Notes

6. t_{PSK} is equal to the magnitude of the worst case difference in t_{PHL} and/or t_{PLH} that will be seen between any two units from the same manufacturing date code that are operated at same case temperature (±5°C), at same operating conditions, with equal loads (R_L = 350Ω and C_L = 15pF), and with an input rise time less than 5ns.
7. Common mode transient immunity at output high is the maximum tolerable positive dVcm/dt on the leading edge of the common mode impulse signal, Vcm, to assure that the output will remain high. Common mode transient immunity at output low is the maximum tolerable negative dVcm/dt on the trailing edge of the common pulse signal, Vcm, to assure that the output will remain low.

Typical Performance Curves

Fig. 1 Input LED Current vs Forward Voltage

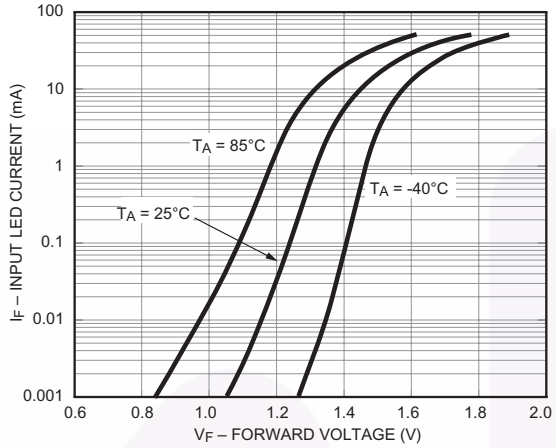


Fig. 2 Threshold Input Current vs Ambient Temperature

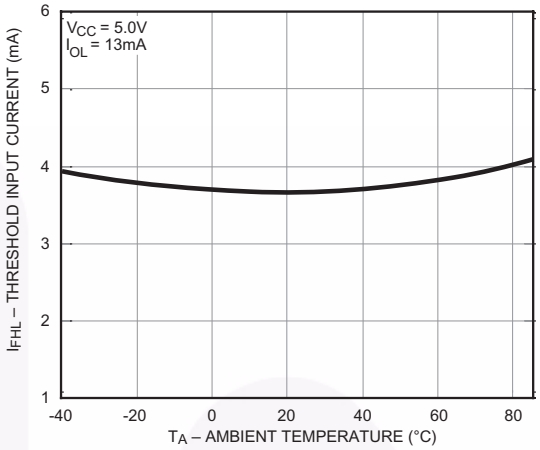


Fig. 3 Low Level Output Voltage vs. Ambient Temperature

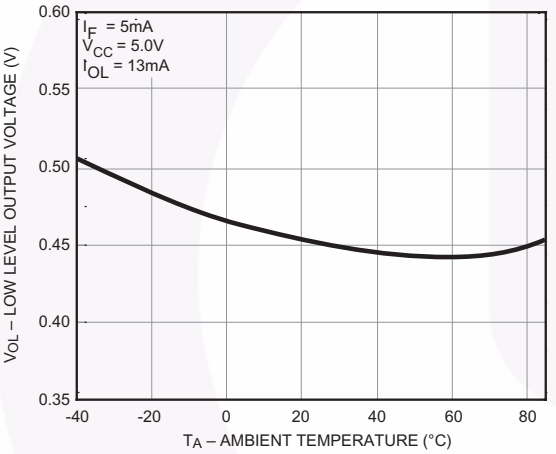


Fig. 4 Logic High Output Current vs Ambient Temperature

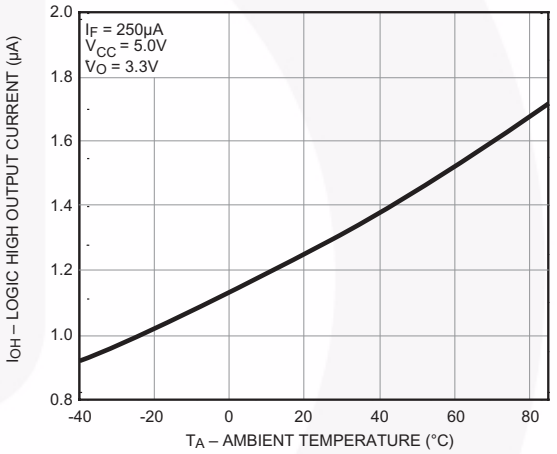


Fig. 5 Typical Logic Low Output Supply Current vs. Ambient Temperature

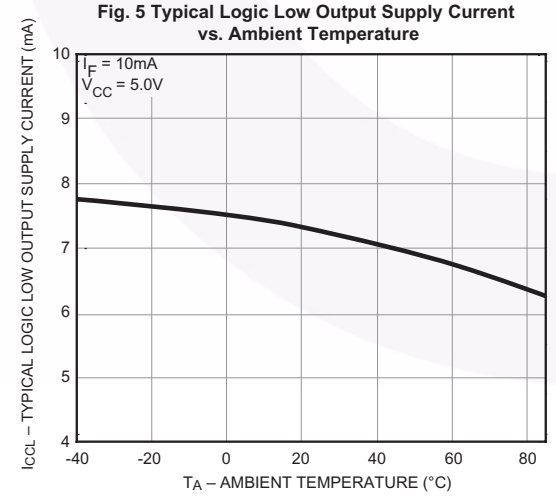
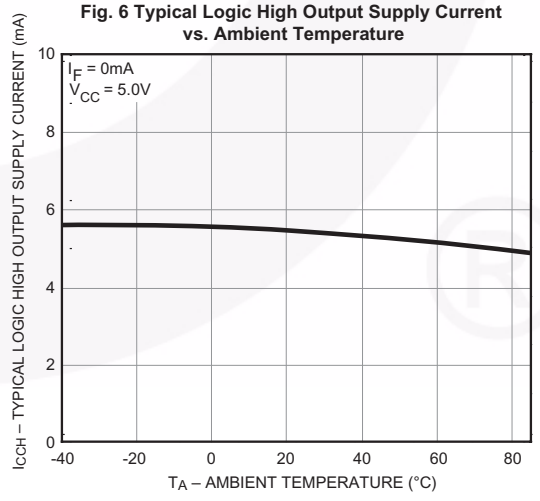


Fig. 6 Typical Logic High Output Supply Current vs. Ambient Temperature



Typical Performance Curves (Continued)

Fig. 7 Typical Logic Output Supply Current vs. Output Supply Voltage

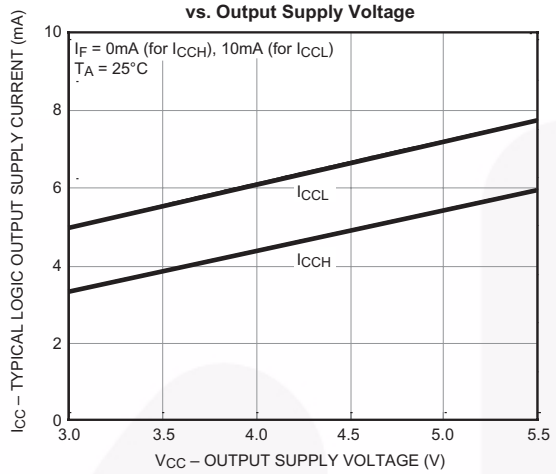


Fig. 8 Typical Propagation Delay vs. Ambient Temperature

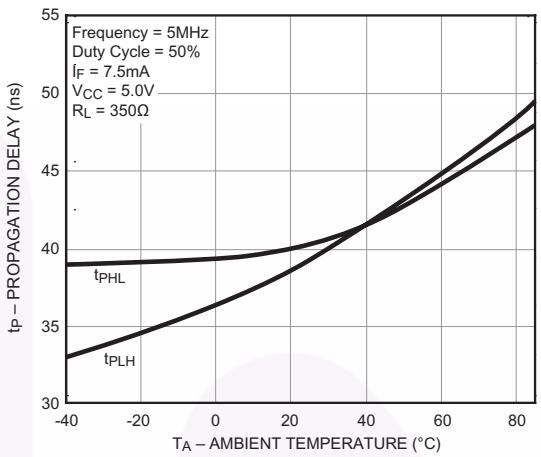


Fig. 9 Pulse Width Distortion vs. Ambient Temperature

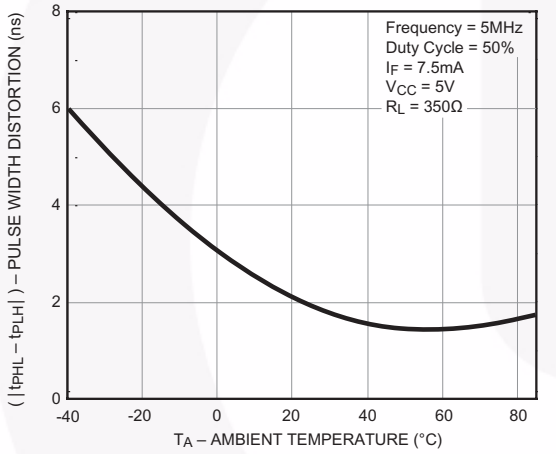
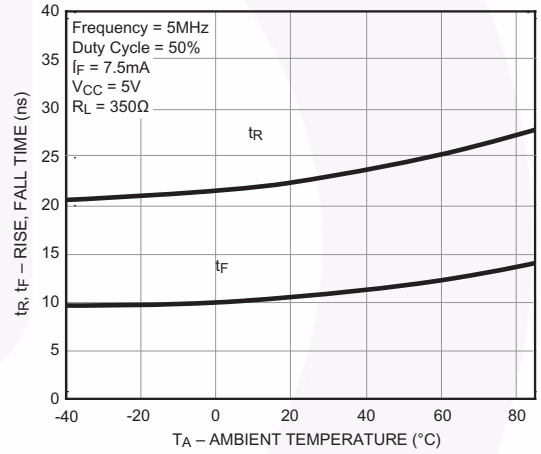


Fig. 10 Rise and Fall Time vs. Ambient Temperature



Schematics

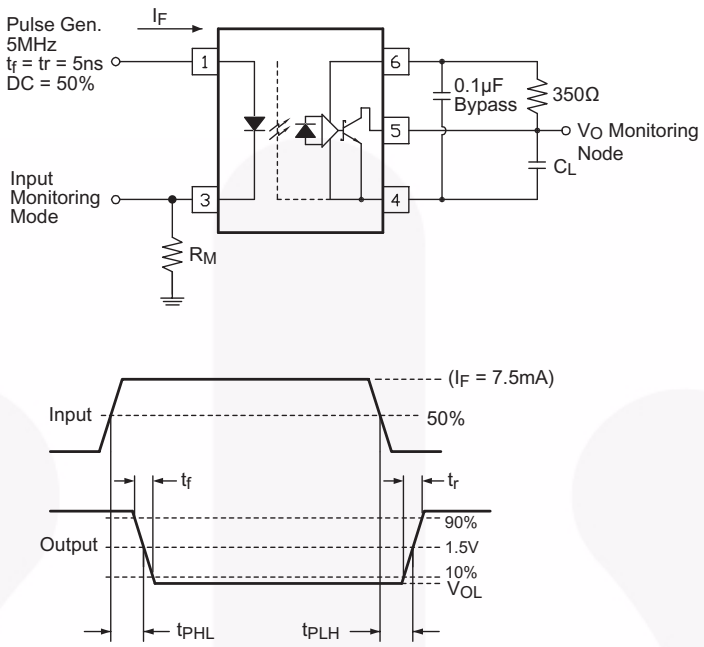


Figure 11. Test Circuit for Propagation Delay Time, Rise Time and Fall Time

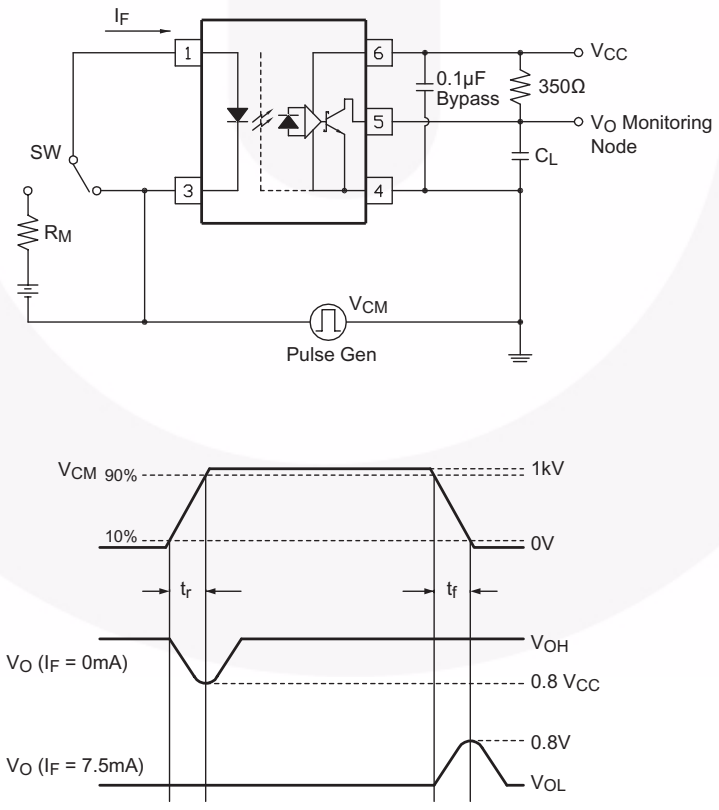
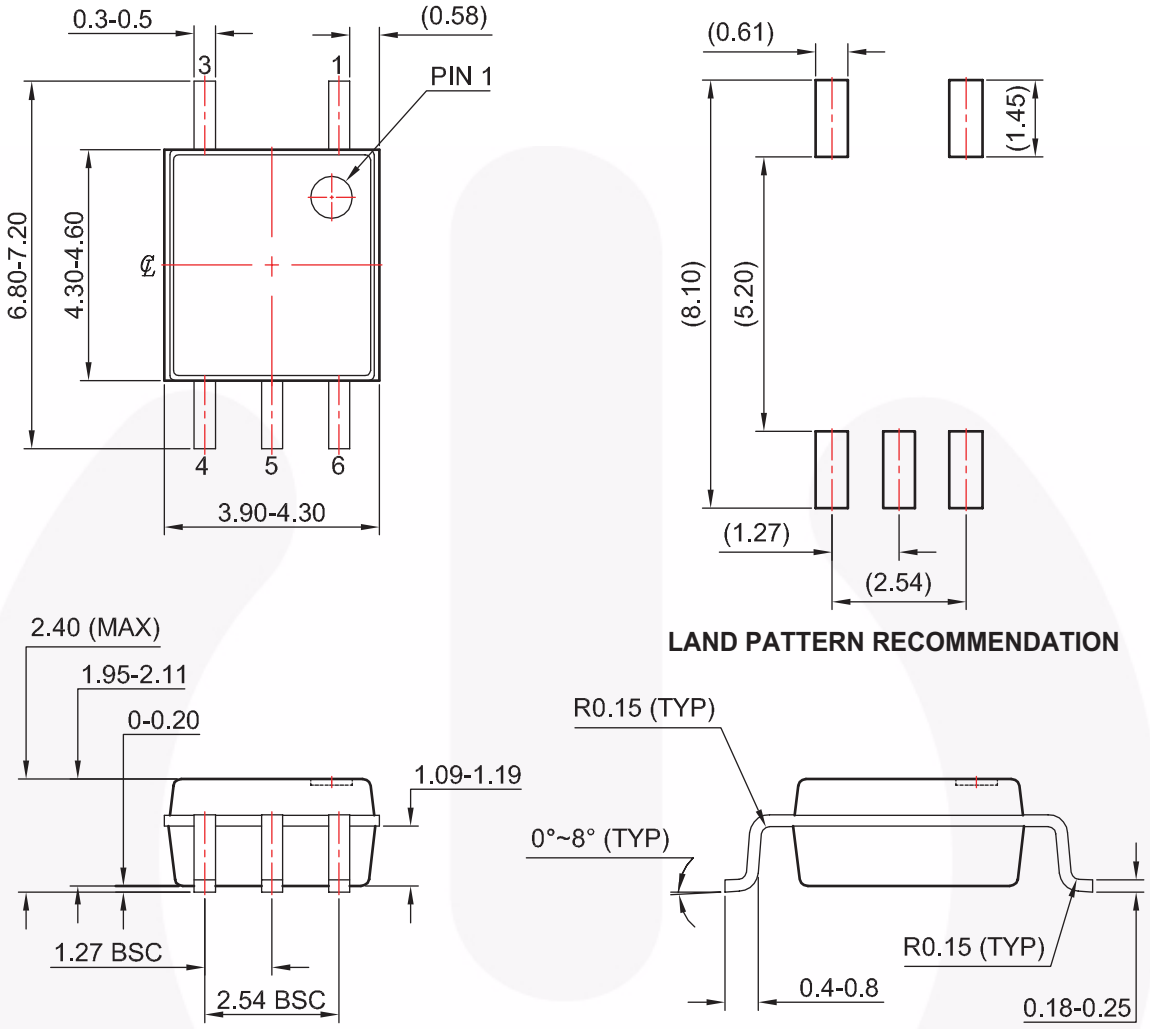


Figure 12. Test Circuit for Instantaneous Common Mode Rejection Voltage

Package Dimensions



Notes:

1. No standard applies to this package.
2. All dimensions are in millimeters.
3. Dimensions are exclusive of burrs, mold flash, and tie bar extrusion.
4. Drawings filesname and revision: MKT-MFP05A.

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

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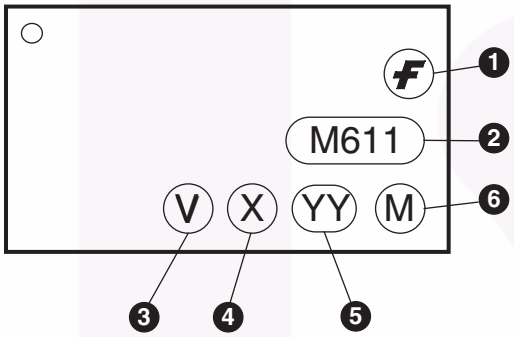
http://www.fairchildsemi.com/packaging/

Ordering Information

Option	Order Entry Identifier (Example)	Description
No Suffix	FODM611	Mini-Flat 5-pin, shipped in tubes (100 units per tube)
R2	FODM611R2	Mini-Flat 5-pin, tape and reel (2,500 units per reel)

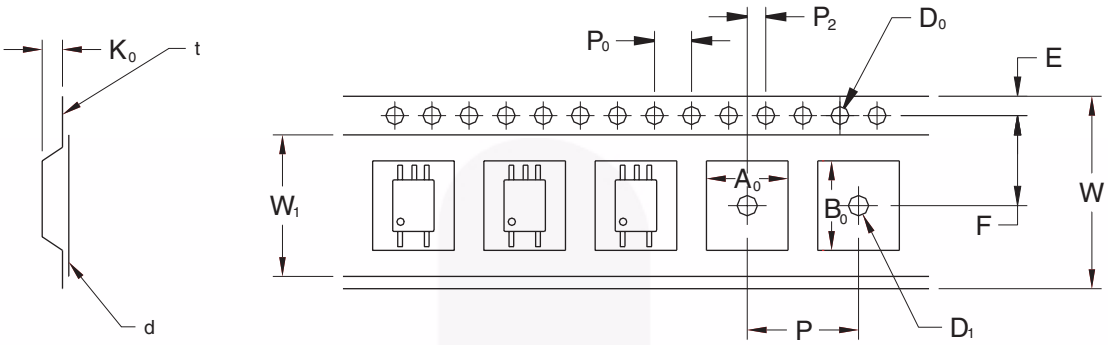
All packages are lead free per JEDEC: J-STD-020B standard.

Marking Information



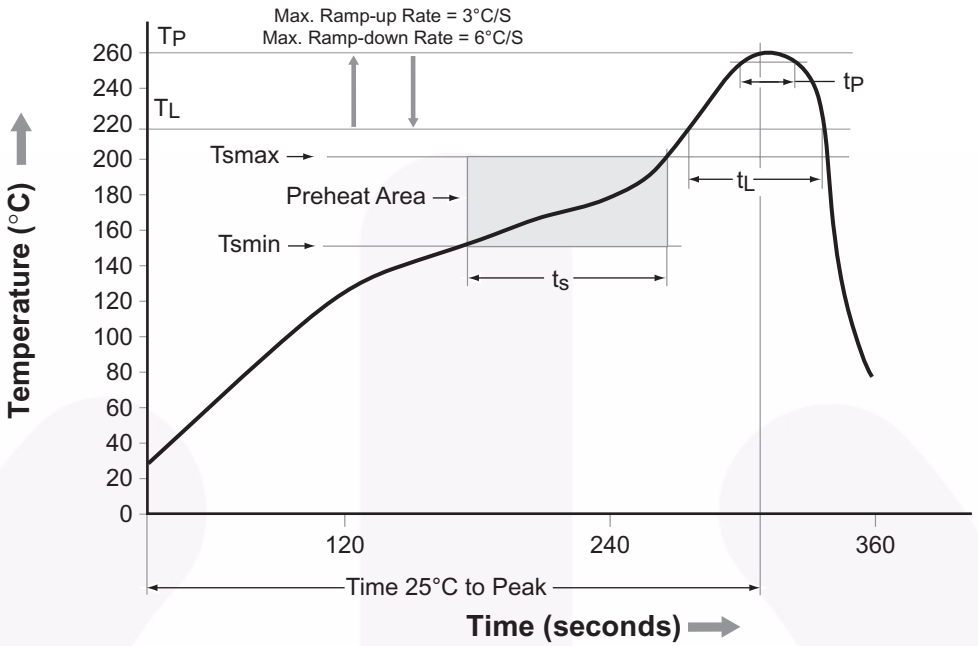
Definitions	
1	Fairchild logo
2	Device number
3	IEC60747-5-2 (VDE marking)
4	One digit year code, e.g., ‘9’
5	Two digit work week ranging from ‘01’ to ‘53’
6	Assembly package code

Tape and Reel Dimensions



		2.54 Pitch
Description	**Symbol**	**Dimensions (mm)**
Tape Width	W	12.00 +0.30/-0.10
Tape Thickness	t	0.30 ±0.05
Sprocket Hole Pitch	P_0	4.00 ±0.10
Sprocket Hole Diameter	D_0	1.50 +0.10/-0.0
Sprocket Hole Location	E	1.75 ±0.10
Pocket Location	F	5.50 ±0.10
	P_2	2.00 ±0.10
Pocket Pitch	P	8.00 ±0.10
Pocket Dimension	A_0	4.40 ±0.10
	B_0	7.30 ±0.10
	K_0	2.30 ±0.10
Pocket Hole Diameter	D_1	1.50 Min.
Cover Tape Width	W_1	9.20
Cover Tape Thickness	d	0.065 ±0.010
Max. Component Rotation or Tilt		10° Max.
Devices Per Reel		2500
Reel Diameter		330mm (13")

Reflow Profile



Profile Feature	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	150°C
Temperature Max. (Tsmax)	200°C
Time (t_S) from (Tsmin to Tsmax)	60–120 seconds
Ramp-up Rate (t_L to t_P)	3°C/second max.
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60–150 seconds
Peak Body Package Temperature	260°C +0°C / –5°C
Time (t_P) within 5°C of 260°C	30 seconds
Ramp-down Rate (T_P to T_L)	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

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STEALTH™
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SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™
SYSTEM GENERAL®*
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TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TranSiC™
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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.
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