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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.

May 2017

FODM8801A, FODM8801B, FODM8801C OptoHiT™ Series, High-Temperature Phototransistor Optocoupler in Half-Pitch Mini-Flat 4-Pin Package

Features

- Utilizing Proprietary Process Technology to Achieve High Operating Temperature: up to 125°C
- Guaranteed Current Transfer Ratio (CTR) Specifications Across Full Temperature Range
  - Excellent CTR Linearity at High-Temperature
  - CTR at Very Low Input Current, I_F
- High Isolation Voltage Regulated by Safety Agency: C-UL / UL1577, 3750 VAC_{RMS} for 1 minute and DIN EN/IEC60747-5-5
- Compact Half-Pitch, Mini-Flat, 4-Pin Package (1.27 mm Lead Pitch, 2.4 mm Maximum Standoff Height)
- > 5 mm Creepage and Clearance Distance
- Applicable to Infrared Ray Reflow, 245°C

Applications

- Primarily Suited for DC-DC Converters
- Ground-Loop Isolation, Signal-Noise Isolation
- Communications – Adapters, Chargers
- Consumer – Appliances, Set-Top Boxes
- Industrial – Power Supplies, Motor Control, Programmable Logic Control

Description

In the OptoHiT™ series, the FODM8801 is a first-of-kind phototransistor, utilizing Fairchild's leading-edge proprietary process technology to achieve high operating temperature characteristics, up to 125°C. The opto-coupler consists of an aluminum gallium arsenide (AlGaAs) infrared light-emitting diode (LED) optically coupled to a phototransistor, available in a compact half-pitch, mini-flat, 4-pin package. It delivers high current transfer ratio at very low input current. The input-output isolation voltage, V_{ISO}, is rated at 3750 VAC_{RMS}.

Schematic

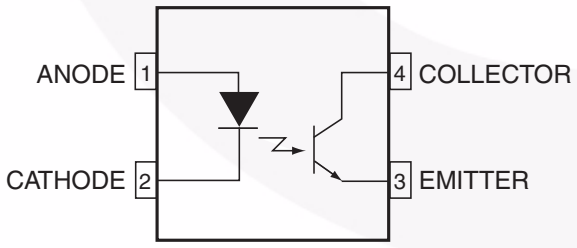


Figure 1. Schematic

Package

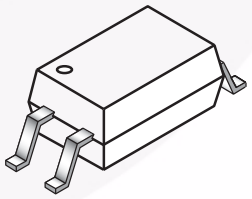


Figure 2. Half-Pitch Mini-Flat

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–III
Climatic Classification		40/125/21
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} x 1.6 = V_{PR}, Type and Sample Test with t_m = 10 s, Partial Discharge < 5 pC	848	V_{peak}
	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	1060	V_{peak}
V_{IORM}	Maximum Working Insulation Voltage	565	V_{peak}
V_{IOTM}	Highest Allowable Over-Voltage	6000	V_{peak}
	External Creepage	≥ 5	mm
	External Clearance	≥ 5	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.5	mm
T_S	Case Temperature(1)	150	°C
$I_{S,INPUT}$	Input Current(1)	200	mA
$P_{S,OUTPUT}$	Output Power(1)	300	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. T_A = 25°C unless otherwise specified.

Symbol	Parameter	Value	Unit
Total Package			
T_{STG}	Storage Temperature	-40 to +150	°C
T_{OPR}	Operating Temperature	-40 to +125	°C
T_J	Junction Temperature	-40 to +140	°C
T_{SOL}	Lead Solder Temperature	245 for 10 s	°C
Emitter			
$I_{F(average)}$	Continuous Forward Current	20	mA
V_R	Reverse Input Voltage	6	V
PD_{LED}	Power Dissipation(2)(4)	40	mW
Detector			
$I_{C(average)}$	Continuous Collector Current	30	mA
V_{CEO}	Collector-Emitter Voltage	75	V
V_{ECO}	Emitter-Collector Voltage	7	V
PD_C	Collector Power Dissipation(3)(4)	150	mW

Notes:

2. Derate linearly from 73°C at a rate of 0.24 mW/°C
3. Derate linearly from 73°C at a rate of 2.23 mW/°C.
4. Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.

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	Value	Unit
T_A	Operating Temperature	-40 to +125	°C
$V_{FL(OFF)}$	Input Low Voltage	-5.0 to +0.8	V
I_{FH}	Input High Forward Current	1 to 10	mA

Isolation Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	f = 60 Hz, t = 1 min., $I_{I-O} \le 10$ μA(5)(6)	3,750			VAC_{RMS}
R_{ISO}	Isolation Resistance	V_{I-O} = 500 V(5)	10^{12}			Ω
C_{ISO}	Isolation Capacitance	f = 1 MHz		0.3	0.5	pF

Notes:

5. Device is considered a two-terminal device: pins 1 and 2 are shorted together and pins 3 and 4 are shorted together.
6. 3,750 VAC_{RMS} for 1 minute is equivalent to 4,500 VAC_{RMS} for 1 second.

Electrical Characteristics

Apply over all recommended conditions (T_A = -40°C to +125°C unless otherwise specified).
All typical values are measured at T_A = 25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Emitter						
V_F	Forward Voltage	I_F = 1 mA	1.00	1.35	1.80	V
$\Delta V_F / \Delta T_A$	Forward-Voltage Coefficient	I_F = 1 mA		-1.6		mV / °C
I_R	Reverse Current	V_R = 6 V			10	µA
C_T	Terminal Capacitance	V = 0 V, f = 1 MHz		30		pF
Detector						
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 0.5 mA, I_F = 0 mA	75	130		V
BV_{ECO}	Emitter-Collector Breakdown Voltage	I_E = 100 µA, I_F = 0 mA	7	12		V
I_{CEO}	Collector Dark Current	V_{CE} = 75 V, I_F = 0 mA, T_A = 25°C			100	nA
		V_{CE} = 50 V, I_F = 0 mA			50	µA
		V_{CE} = 5 V, I_F = 0 mA			30	µA
C_{CE}	Capacitance	V_{CE} = 0 V, f = 1 MHz		8		pF

Transfer Characteristics

Apply over all recommended conditions (T_A = -40°C to +125°C unless otherwise specified).
All typical values are measured at T_A = 25°C.

Symbol	Parameter	Device	Conditions	Min.	Typ.	Max.	Unit
CTR_{CE}	Current Transfer Ratio (Collector-Emitter)	FODM8801A	I_F = 1.0 mA, V_{CE} = 5 V @ T_A = 25°C	80	120	160	%
			I_F = 1.0 mA, V_{CE} = 5 V	35	120	230	
			I_F = 1.6 mA, V_{CE} = 5 V	40	125		
			I_F = 3.0 mA, V_{CE} = 5 V	45	138		
		FODM8801B	I_F = 1.0 mA, V_{CE} = 5 V @ T_A = 25°C	130	195	260	
			I_F = 1.0 mA, V_{CE} = 5 V	65	195	360	
			I_F = 1.6 mA, V_{CE} = 5 V	70	202		
			I_F = 3.0 mA, V_{CE} = 5 V	75	215		
		FODM8801C	I_F = 1.0 mA, V_{CE} = 5 V @ T_A = 25°C	200	300	400	
			I_F = 1.0 mA, V_{CE} = 5 V	100	300	560	
			I_F = 1.6 mA, V_{CE} = 5 V	110	312		
			I_F = 3.0 mA, V_{CE} = 5 V	115	330		
$CTR_{CE(SAT)}$	Saturated Current Transfer Ratio (Collector-Emitter)	FODM8801A	I_F = 1.0 mA, V_{CE} = 0.4 V @ T_A = 25°C	65	108	150	%
			I_F = 1.0 mA, V_{CE} = 0.4 V	30	108		
			I_F = 1.6 mA, V_{CE} = 0.4 V	25	104		
			I_F = 3.0 mA, V_{CE} = 0.4 V	20	92		
		FODM8801B	I_F = 1.0 mA, V_{CE} = 0.4 V @ T_A = 25°C	90	168	245	
			I_F = 1.0 mA, V_{CE} = 0.4 V	45	168		
			I_F = 1.6 mA, V_{CE} = 0.4 V	40	155		
			I_F = 3.0 mA, V_{CE} = 0.4 V	35	132		
		FODM8801C	I_F = 1.0 mA, V_{CE} = 0.4 V @ T_A = 25°C	140	238	380	
			I_F = 1.0 mA, V_{CE} = 0.4 V	75	238		
			I_F = 1.6 mA, V_{CE} = 0.4 V	65	215		
			I_F = 3.0 mA, V_{CE} = 0.4 V	55	177		
$V_{CE(SAT)}$	Saturation Voltage	FODM8801A	I_F = 1.0 mA, I_C = 0.3 mA		0.17	0.40	V
			I_F = 1.6 mA, I_C = 0.4 mA		0.16	0.40	
			I_F = 3.0 mA, I_C = 0.6 mA		0.15	0.40	
		FODM8801B	I_F = 1.0 mA, I_C = 0.45 mA		0.17	0.40	
			I_F = 1.6 mA, I_C = 0.6 mA		0.16	0.40	
			I_F = 3.0 mA, I_C = 1.0 mA		0.16	0.40	
		FODM8801C	I_F = 1.0 mA, I_C = 0.75 mA		0.18	0.40	
			I_F = 1.6 mA, I_C = 1.0 mA		0.17	0.40	
			I_F = 3.0 mA, I_C = 1.6 mA		0.17	0.40	

Switching Characteristics

Apply over all recommended conditions (T_A = -40°C to +125°C unless otherwise specified).
All typical values are measured at T_A = 25°C.

Symbol	Parameter	Device	Conditions	Min.	Typ.	Max.	Unit
t_{ON}	Turn-On Time	All Devices	I_F = 1.6 mA, V_{CC} = 5 V, R_L = 0.75 kΩ	1	6	20	µs
			I_F = 1.6 mA, V_{CC} = 5 V, R_L = 4.7 kΩ		6		
t_{OFF}	Turn-Off Time	All Devices	I_F = 1.6 mA, V_{CC} = 5 V, R_L = 0.75 kΩ	1	6	20	µs
			I_F = 1.6 mA, V_{CC} = 5 V, R_L = 4.7 kΩ		40		
t_R	Output Rise Time (10% to 90%)	All Devices	I_F = 1.6 mA, V_{CC} = 5 V, R_L = 0.75 kΩ		5		µs
t_F	Output Fall Time (90% to 10%)	All Devices	I_F = 1.6 mA, V_{CC} = 5 V, R_L = 0.75 kΩ		5.5		µs
CM_H	Common-Mode Rejection Voltage (Transient Immunity) – Output High	All Devices	T_A = 25°C, I_F = 0 mA, V_O > 2.0 V, R_L = 4.7 kΩ, V_{CM} = 1000 V[7], Figure 16		20		kV / µs
CM_L	Common-Mode Rejection Voltage (Transient Immunity) – Output Low	All Devices	T_A = 25°C, I_F = 1.6 mA, V_O < 0.8 V, R_L = 4.7 kΩ, V_{CM} = 1000 V[7], Figure 16		20		kV / µs

Note:

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, V_{CM}, to assure that the output remains high.

Typical Performance Curves

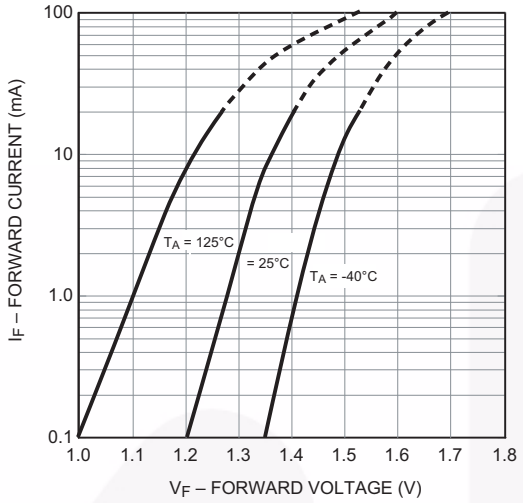


Figure 3. Forward Current vs. Forward Voltage

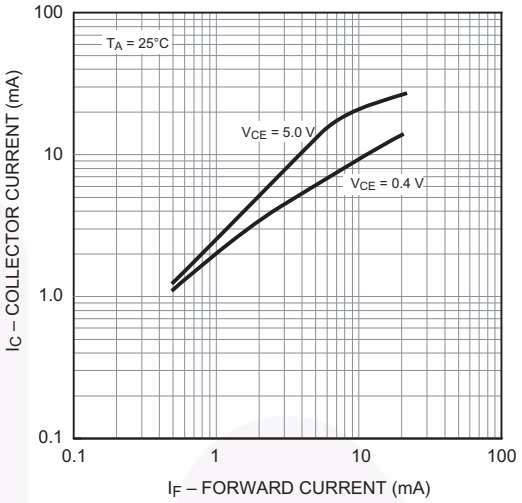


Figure 4. Collector Current vs. Forward Current

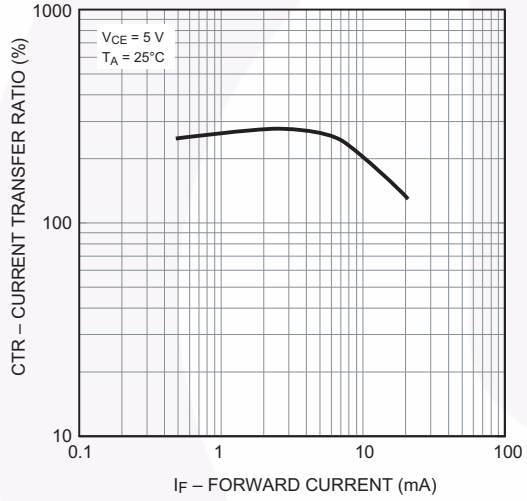


Figure 5. Current Transfer Ratio vs. Forward Current

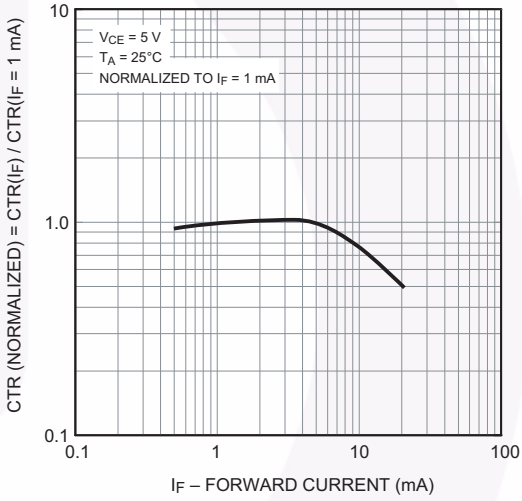


Figure 6. Normalized CTR vs. Forward Current

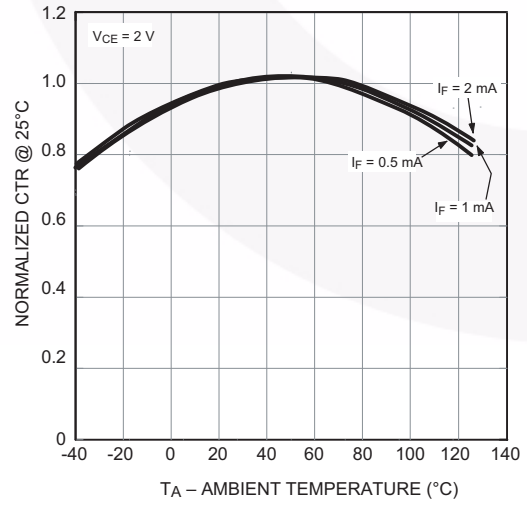


Figure 7. Normalized CTR vs. Ambient Temperature

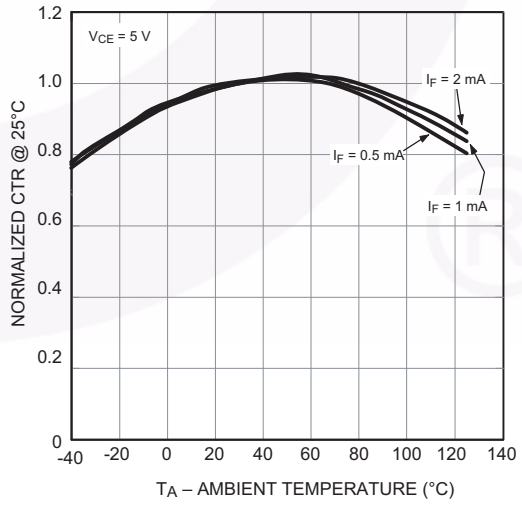


Figure 8. Normalized CTR vs. Ambient Temperature

Typical Performance Curves (Continued)

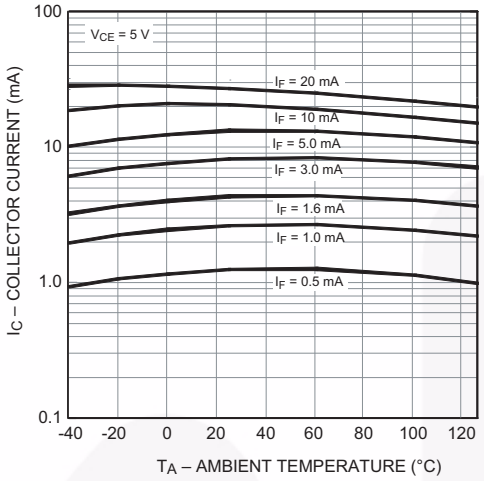


Figure 9. Collector Current vs. Ambient Temperature

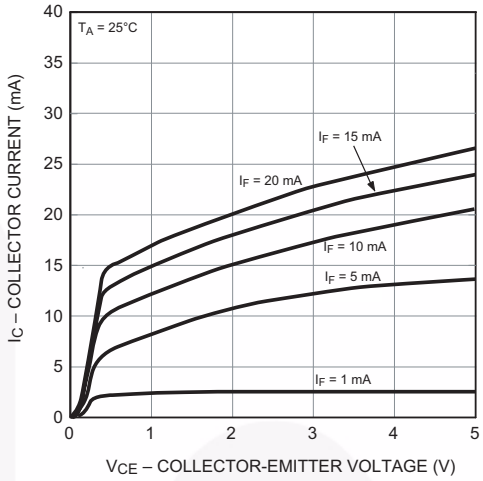


Figure 10 Collector Current vs. Collector-Emitter Voltage

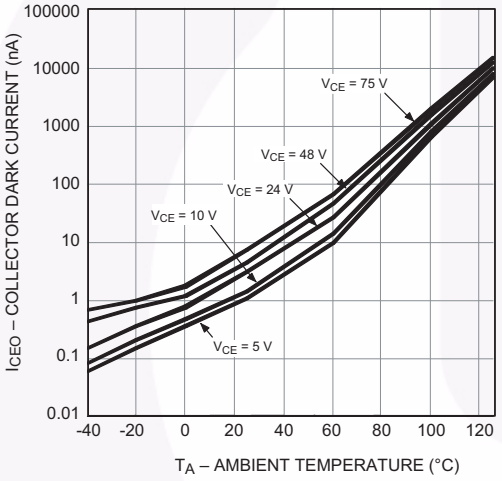


Figure 11. Collector Dark Current vs. Ambient Temperature

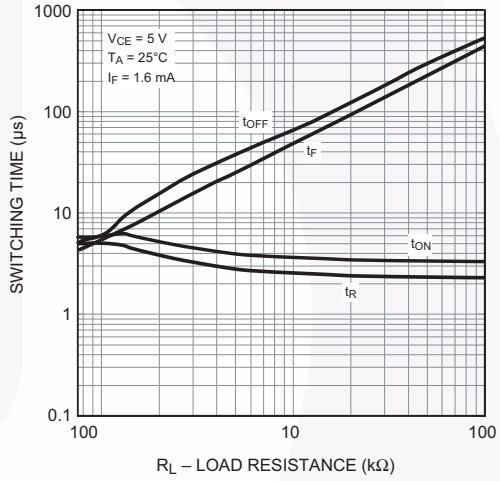


Figure 12. Switching Time vs. Load Resistance

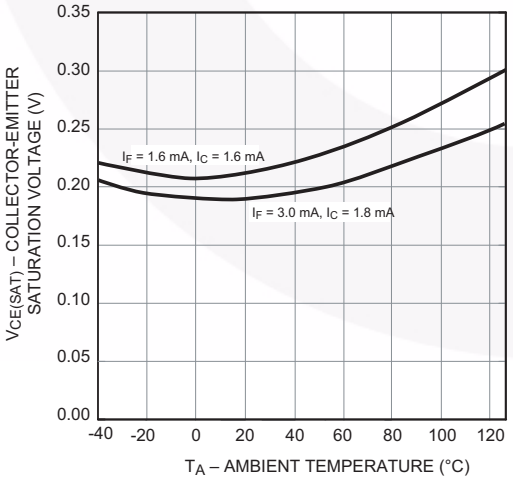


Figure 13. Collector-Emitter Saturation Voltage vs. Ambient Temperature

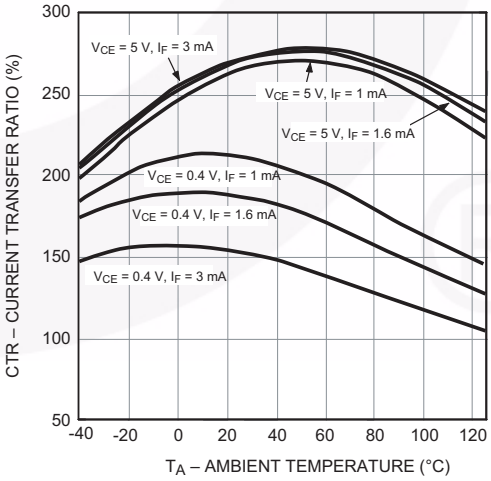


Figure 14. Current Transfer Ration vs. Ambient Temperature

Test Circuits

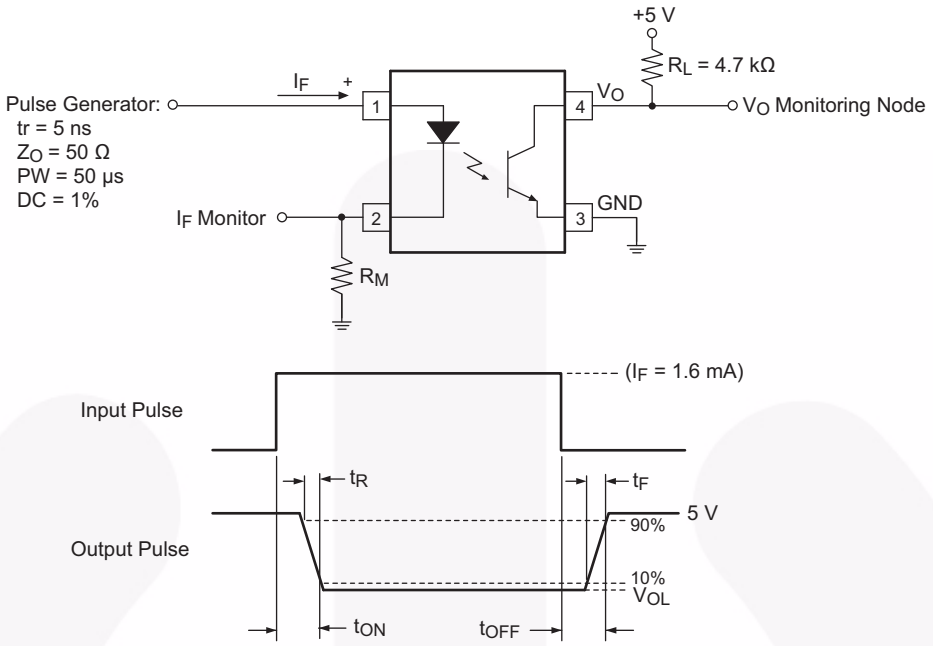


Figure 15. Test Circuit for Propagation Delay, Rise Time, and Fall Time

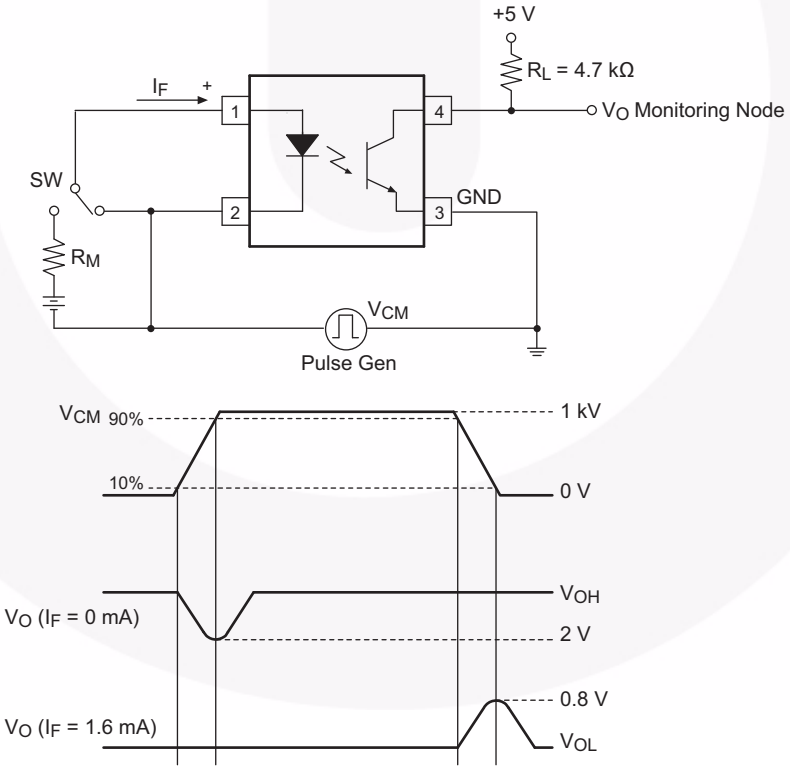


Figure 16. Test Circuit for Instantaneous Common-Mode Rejection Voltage

Reflow Profile

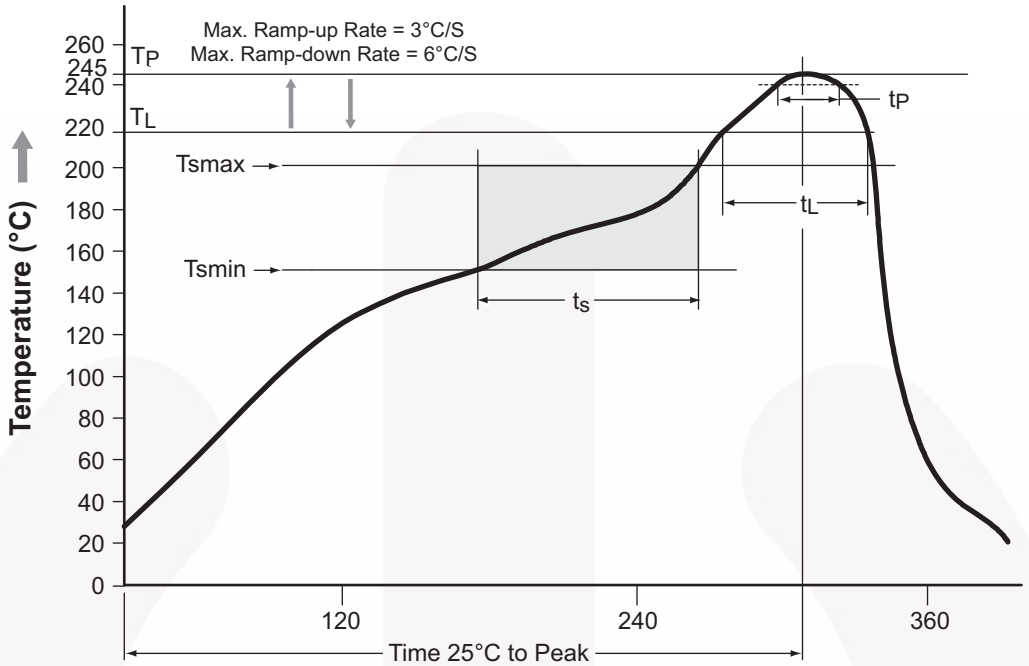


Figure 13. Reflow Profile

Profile Freature	Pb-Free Assembly Profile
Temperature Minimum (Tsmin)	150°C
Temperature Maximum (Tsmax)	200°C
Time (t_S) from (Tsmin to Tsmax)	60–120 seconds
Ramp-up Rate (t_L to t_P)	3°C/second maximum
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60–150 seconds
Peak Body Package Temperature	245°C +0°C / –5°C
Time (t_P) within 5°C of 245°C	30 seconds
Ramp-down Rate (T_P to T_L)	6°C/second maximum
Time 25°C to Peak Temperature	8 minutes maximum

Figure 17. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
FODM8801A	Half Pitch Mini-Flat 4-Pin	Tube (100 units)
FODM8801AR2	Half Pitch Mini-Flat 4-Pin	Tape and Reel (2500 Units)
FODM8801AV	Half Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 Units)
FODM8801AR2V	Half Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (2500 Units)

Note:

8. The product orderable part number system listed in this table also applies to the FODM8801B, FODM8801C products.

Marking Information

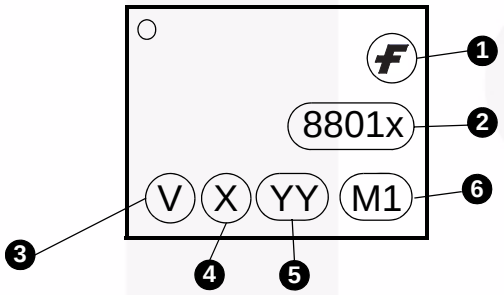
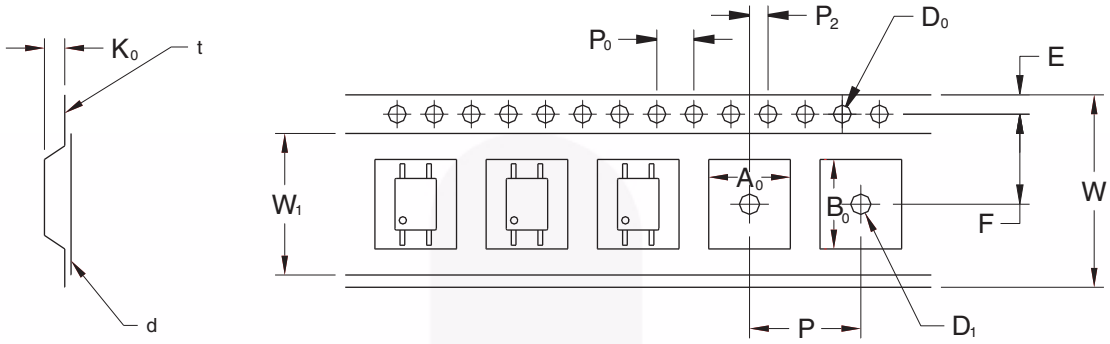


Figure 18. Top Mark

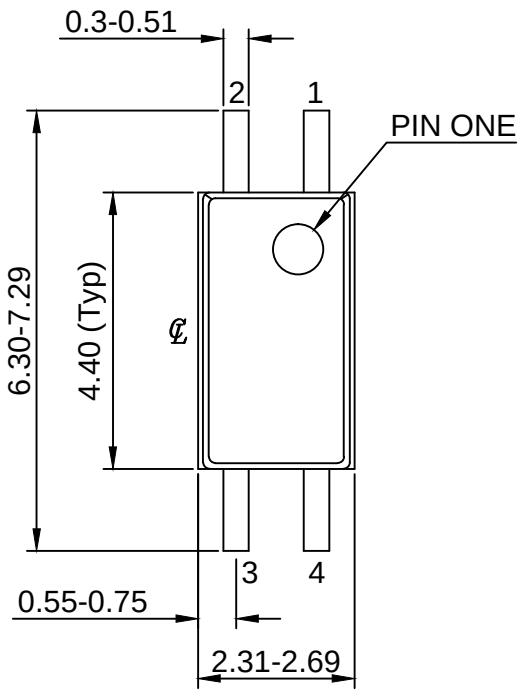
Table 1. Top Mark Definitions

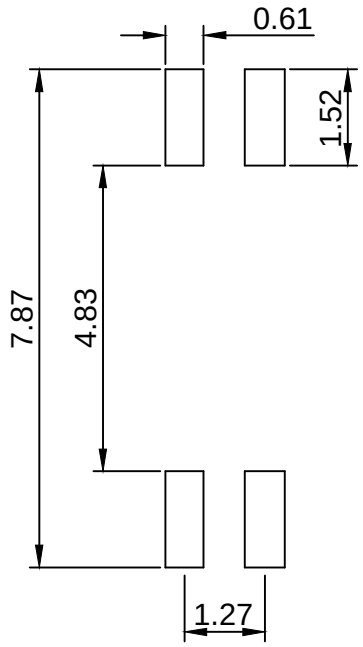
1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., “6”
5	Digit Work Week, Ranging from “01” to “53”
6	Assembly Package Code

Tape and Reel Dimensions

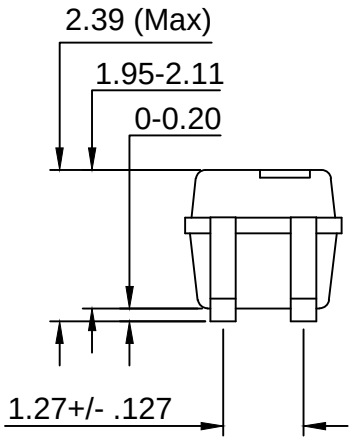


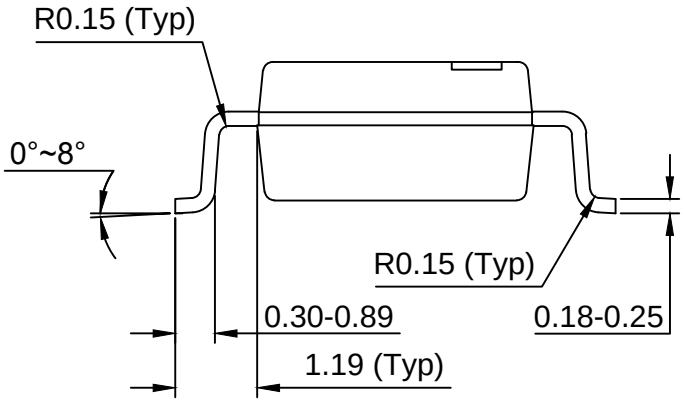
		1.27 Pitch
Description	**Symbol**	**Dimensions (mm)**
Tape Width	W	12.00 +0.30/-0.10
Tape Thickness	t	0.30 ±0.05
Sprocket Hole Pitch	P_0	4.00 ±0.10
Sprocket Hole Diameter	D_0	1.50 +0.10/-0.0
Sprocket Hole Location	E	1.75 ±0.10
Pocket Location	F	5.50 ±0.10
	P_2	2.00 ±0.10
Pocket Pitch	P	8.00 ±0.10
Pocket Dimension	A_0	2.80 ±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		330 mm (13")





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

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