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November 2015

FODM121 Series, FODM124, FODM2701, FODM2705 4-Pin Full Pitch Mini-Flat Package Phototransistor Optocouplers

Features

- More than 5 mm Creepage/Clearance
- Compact 4-Pin Surface Mount Package (2.4 mm Maximum Standoff Height)
- Current Transfer Ratio in Selected Groups:

  DC Input:
  FODM121: 50–600%
  FODM121A: 100–300%
  FODM121B: 50–150%
  FODM121C: 100–200%
  FODM124: 100% MIN
  FODM2701: 50–300%
  AC Input:
  FODM2705: 50–300%
- Safety and Regulatory Approvals:
  - UL1577, 3,750 VAC$_{RMS}$ for 1 Minute
  - DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage

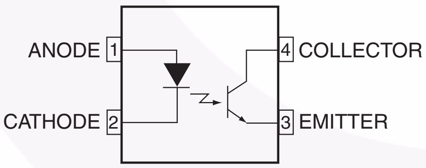
Applications

- Digital Logic Inputs
- Microprocessor Inputs
- Power Supply Monitor
- Twisted Pair Line Receiver
- Telephone Line Receiver

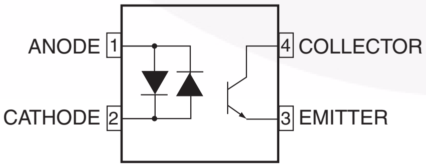
Description

The FODM121 series, FODM124, and FODM2701 consists of a gallium arsenide infrared emitting diode driving a phototransistor in a compact 4-pin mini-flat package. The lead pitch is 2.54 mm. The FODM2705 consists of two gallium arsenide infrared emitting diodes connected in inverse parallel for AC operation.

Functional Block Diagram



Equivalent Circuit
FODM121, FODM124, FODM2701



Equivalent Circuit
FODM2705

Figure 1. Schematic

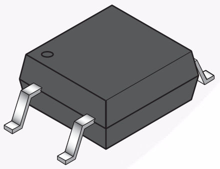


Figure 2. Package Outlines

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–III
Climatic Classification		40/110/21
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	904	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)	≥ 0.4	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 +125	°C
T_{OPR}	Operating Temperature		-40 to +110	°C
T_J	Junction Temperature		-40 to +125	°C
T_{SOL}	Lead Solder Temperature		260 for 10 sec	°C
EMITTER				
$I_{F\ (avg)}$	Continuous Forward Current		50	mA
$I_{F\ (pk)}$	Peak Forward Current (1 µs pulse, 300 pps.)		1	A
V_R	Reverse Voltage		6	V
P_D	Power Dissipation		70	mW
	Derate linearly (Above 75°C)		1.41	mW/°C
DETECTOR				
I_C	Continuous Collector Current		80	mA
V_{CEO}	Collector-Emitter Voltage	FODM121 Series, FODM124	80	V
		FODM2701, FODM2705	40	
V_{ECO}	Emitter-Collector Voltage		6	V
P_D	Power Dissipation		150	mW
	Derate linearly (Above 80°C)		3.27	mW/°C

Electrical Characteristics

$T_A = 25°C$ unless otherwise specified.

Symbol	Parameter	Device	Test Conditions	Min.	Typ.	Max.	Unit
INDIVIDUAL COMPONENT CHARACTERISTICS							
Emitter							
V_F	Forward Voltage	FODM121 Series, FODM124	$I_F = 10$ mA	1.0		1.3	V
		FODM2701	$I_F = 5$ mA			1.4	
		FODM2705	$I_F = \pm 5$ mA				
I_R	Reverse Current	FODM121 Series, FODM124, FODM2701	$V_R = 5$ V			5	µA
Detector							
BV_{CEO}	Collector-Emitter Breakdown Voltage	FODM121 Series, FODM124	$I_C = 1$ mA, $I_F = 0$	80			V
		FODM2701, FODM2705		40			
BV_{ECO}	Emitter-Collector Breakdown Voltage	All	$I_E = 100$ µA, $I_F = 0$	7			V
I_{CEO}	Collector Dark Current	All	$V_{CE} = 40$ V, $I_F = 0$			100	nA
C_{CE}	Capacitance	All	$V_{CE} = 0$ V, f = 1 MHz		10		pF
TRANSFER CHARACTERISTICS							
CTR	DC Current Transfer Ratio	FODM2701	$I_F = 5$ mA, $V_{CE} = 5$ V	50		300	%
		FODM2705	$I_F = \pm 5$ mA, $V_{CE} = 5$ V	50		300	
		FODM121	$I_F = 5$ mA, $V_{CE} = 5$ V	50		600	
		FODM121A		100		300	
		FODM121B		50		150	
		FODM121C		100		200	
		FODM124	$I_F = 1$ mA, $V_{CE} = 0.5$ V	100		1200	
			$I_F = 0.5$ mA, $V_{CE} = 1.5$ V	50			
	CTR Symmetry	FODM2705	$I_F = \pm 5$ mA, $V_{CE} = 5$ V	0.3		3.0	
$V_{CE(SAT)}$	Saturation Voltage	FODM121 Series	$I_F = 8$ mA, $I_C = 2.4$ mA			0.4	V
		FODM124	$I_F = 1$ mA, $I_C = 0.5$ mA			0.4	
		FODM2701	$I_F = 10$ mA, $I_C = 2$ mA			0.3	
		FODM2705	$I_F = \pm 10$ mA, $I_C = 2$ mA			0.3	
t_r	Rise Time (Non-Saturated)	All	$I_C = 2$ mA, $V_{CE} = 5$ V, $R_L = 100\ \Omega$		3		µs
t_f	Fall Time (Non-Saturated)	All	$I_C = 2$ mA, $V_{CE} = 5$ V, $R_L = 100\ \Omega$		3		µs
ISOLATION CHARACTERISTICS							
V_{ISO}	Steady State Isolation Voltage(2)	All	1 minute	3750			VAC_{RMS}

Note:

2. Steady state isolation voltage, V_{ISO}, is an internal device dielectric breakdown rating. For this test, pins 1 and 2 are common, and pins 3 and 4 are common.

Typical Performance Curves

T_A = 25°C unless otherwise specified.

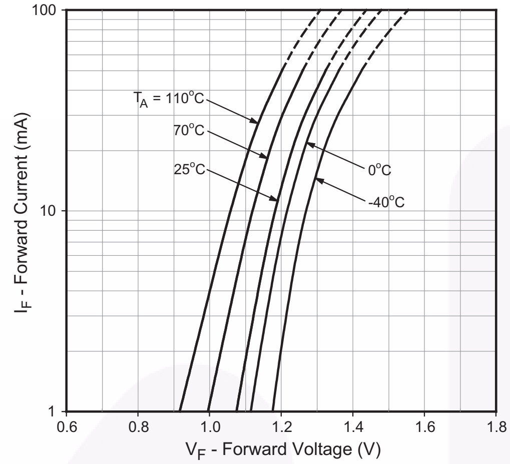


Fig. 3 Forward Current vs. Forward Voltage

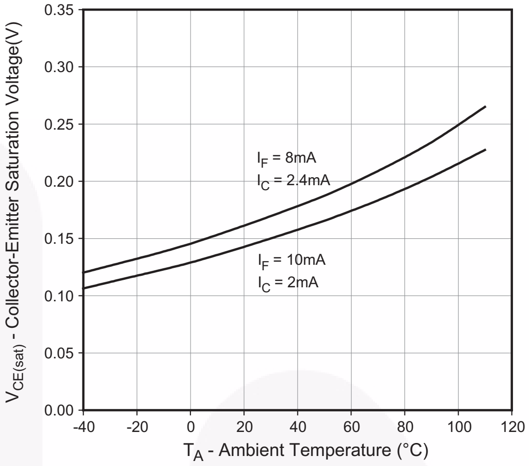


Fig. 4 Collector-Emitter Saturation Voltage vs. Ambient Temperature (FODM121/2701/2705)

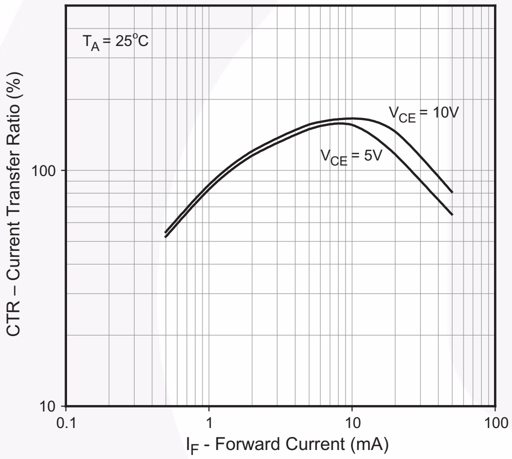


Fig. 5 Current Transfer Ratio vs. Forward Current (FODM121/2701/2705)

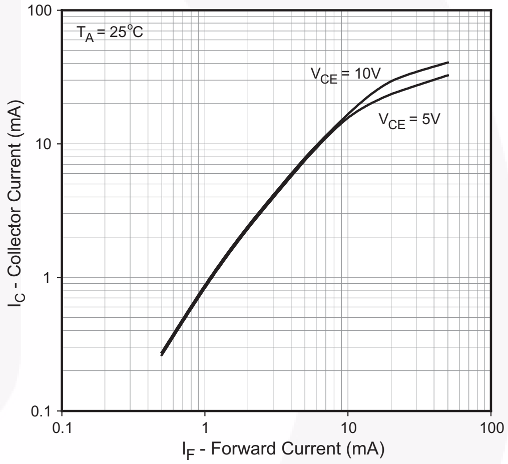


Fig. 6 Collector Current vs. Forward Current (FODM121/2701/2705)

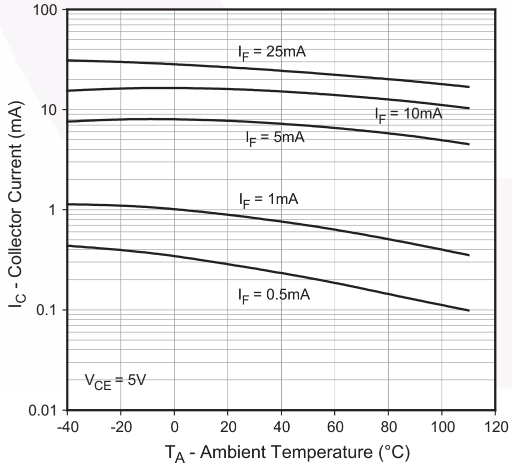


Fig. 7 Collector Current vs. Ambient Temperature (FODM121/2701/2705)

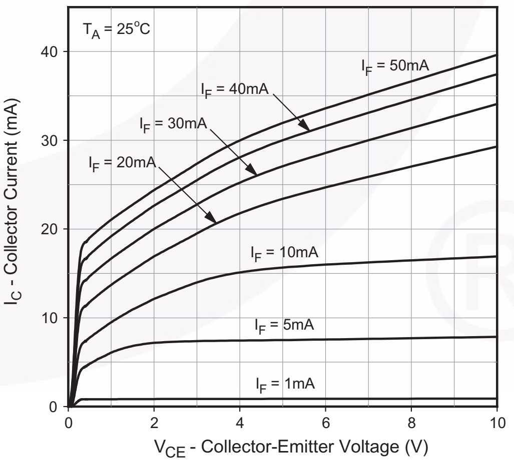


Fig. 8 Collector Current vs. Collector-Emitter Voltage (FODM121/2701/2705)

Typical Performance Curves (Continued)

T_A = 25°C unless otherwise specified.

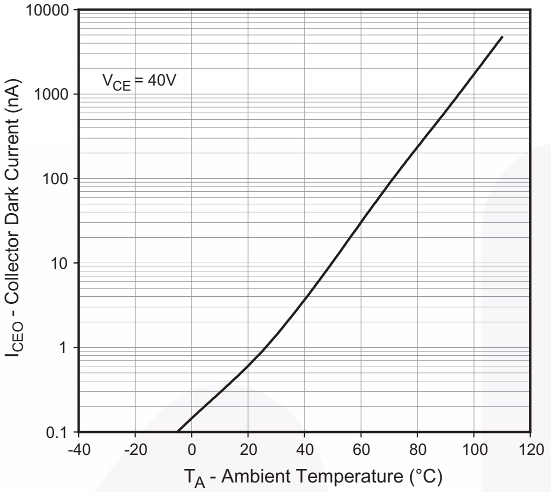


Fig 9. Collector Dark Current vs. Ambient Temperature (FODM121/2701/2705)

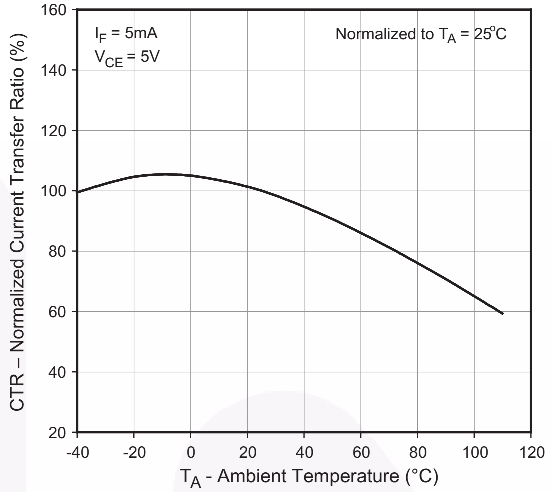


Fig. 10 Normalized Current Transfer Ratio vs. Ambient Temperature (FODM121/2701/2705)

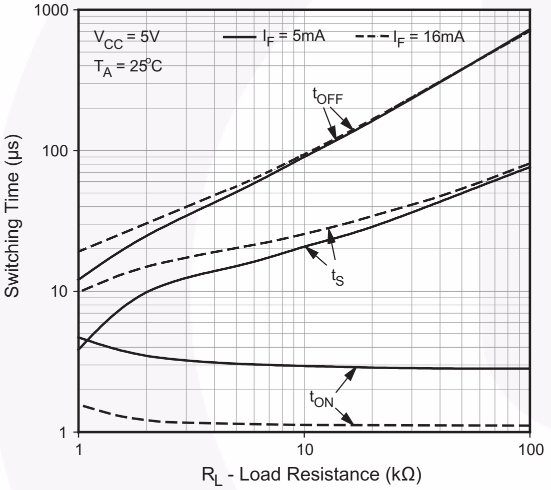


Fig. 11 Switching Time vs. Load Resistance (FODM121/2701/2705)

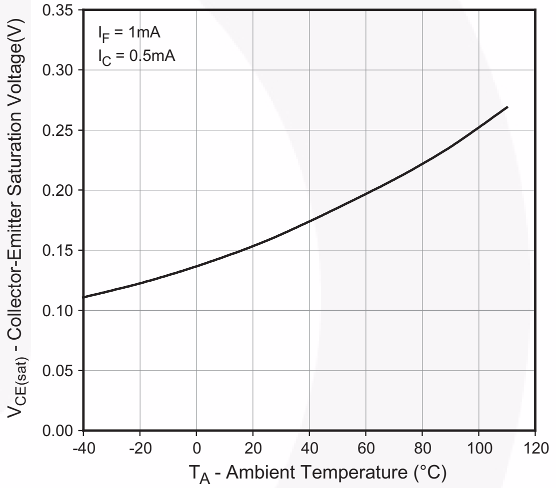


Fig. 12 Collector-Emitter Saturation Voltage vs. Ambient Temperature (FODM124)

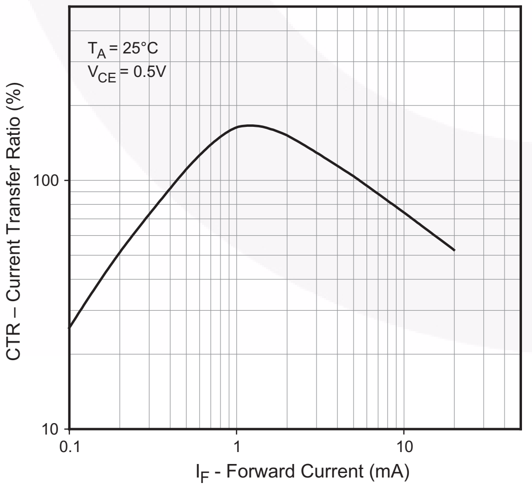


Fig. 13 Current Transfer Ratio vs. Forward Current (FODM124)

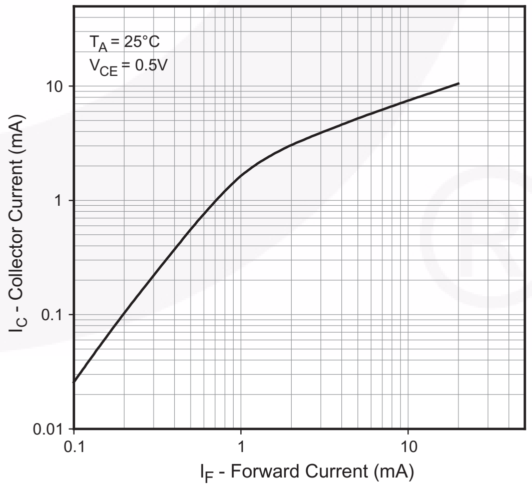


Fig 14. Collector Current vs. Forward Current (FODM124)

Typical Performance Curves (Continued)

T_A = 25°C unless otherwise specified.

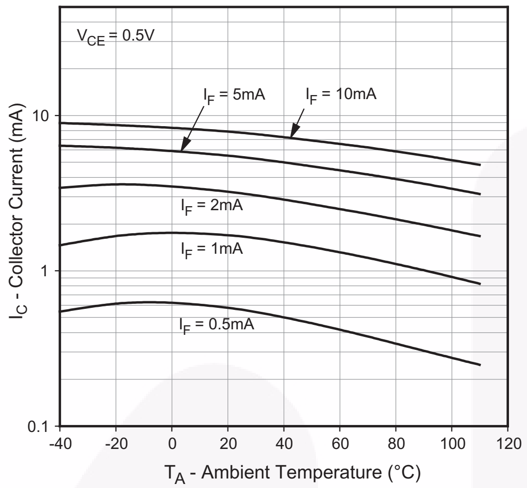


Fig 15. Collector Current vs. Ambient Temperature (FODM124)

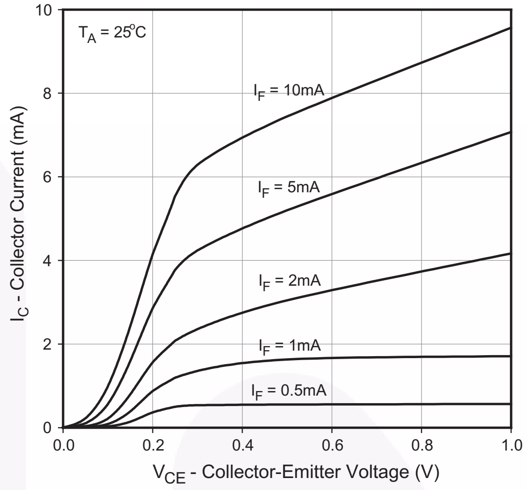


Fig. 16 Collector Current vs. Collector-Emitter Voltage (FODM124)

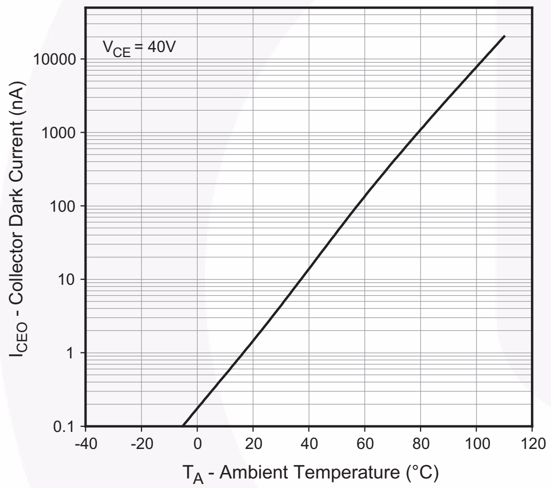


Fig. 17 Collector Dark Current vs. Ambient Temperature (FODM124)

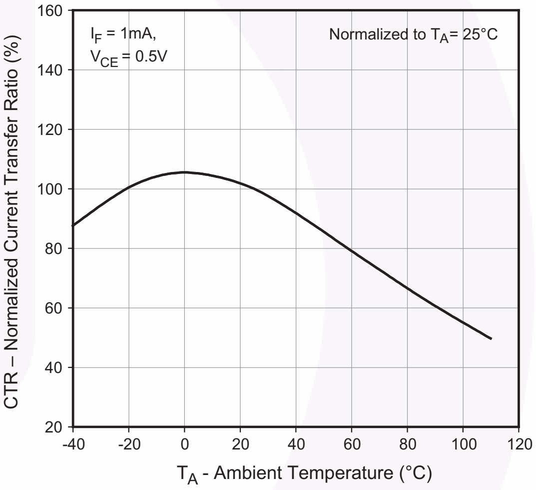


Fig. 18 Normalized Current Transfer Ratio vs. Ambient Temperature (FODM124)

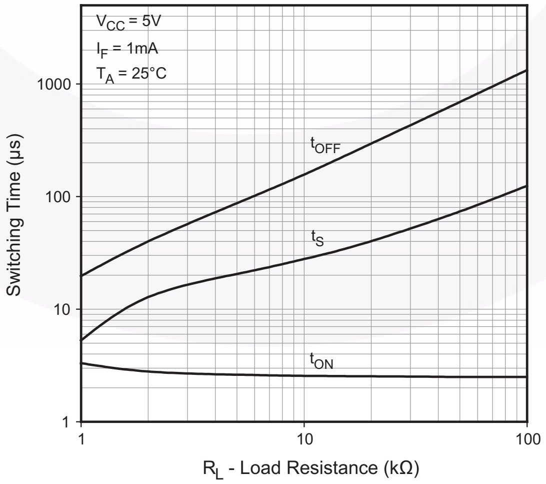
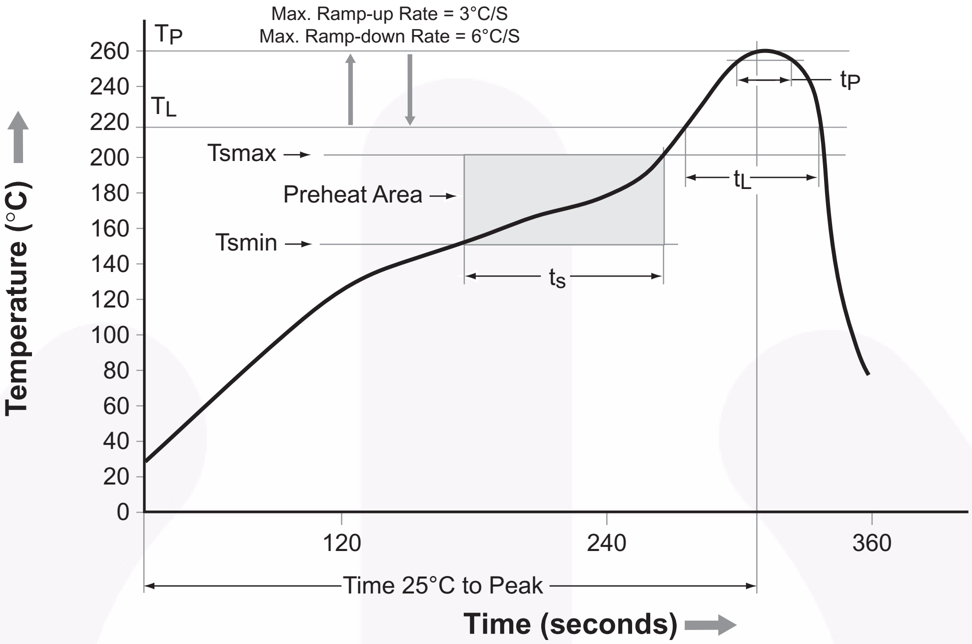


Fig. 19 Switching Time vs. Load Resistance (FODM124)

Reflow Profile



Profile Freature	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.

Ordering Information

Part Number	Package	Packing Method
FODM121	Full Pitch Mini-Flat 4-Pin	Tube (100 units)
FODM121R2	Full Pitch Mini-Flat 4-Pin	Tape and Reel (2500 Units)
FODM121V	Full Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 Units)
FODM121R2V	Full Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (2500 Units)

Note:

The product orderable part number system listed in this table also applies to the FODM121A, FODM121B, FODM121C, FODM124, FODM2701, and FODM2705 products.

Marking Information

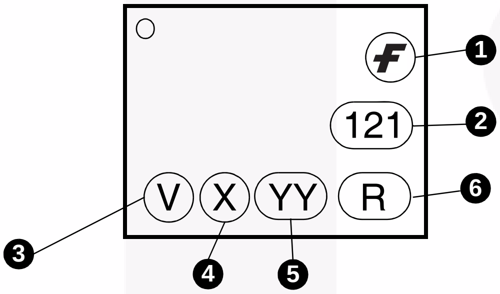
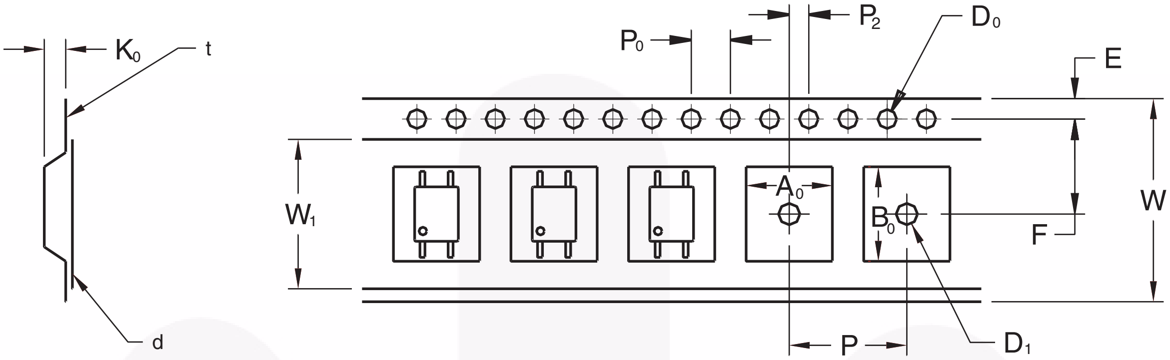


Figure 20. Top Mark

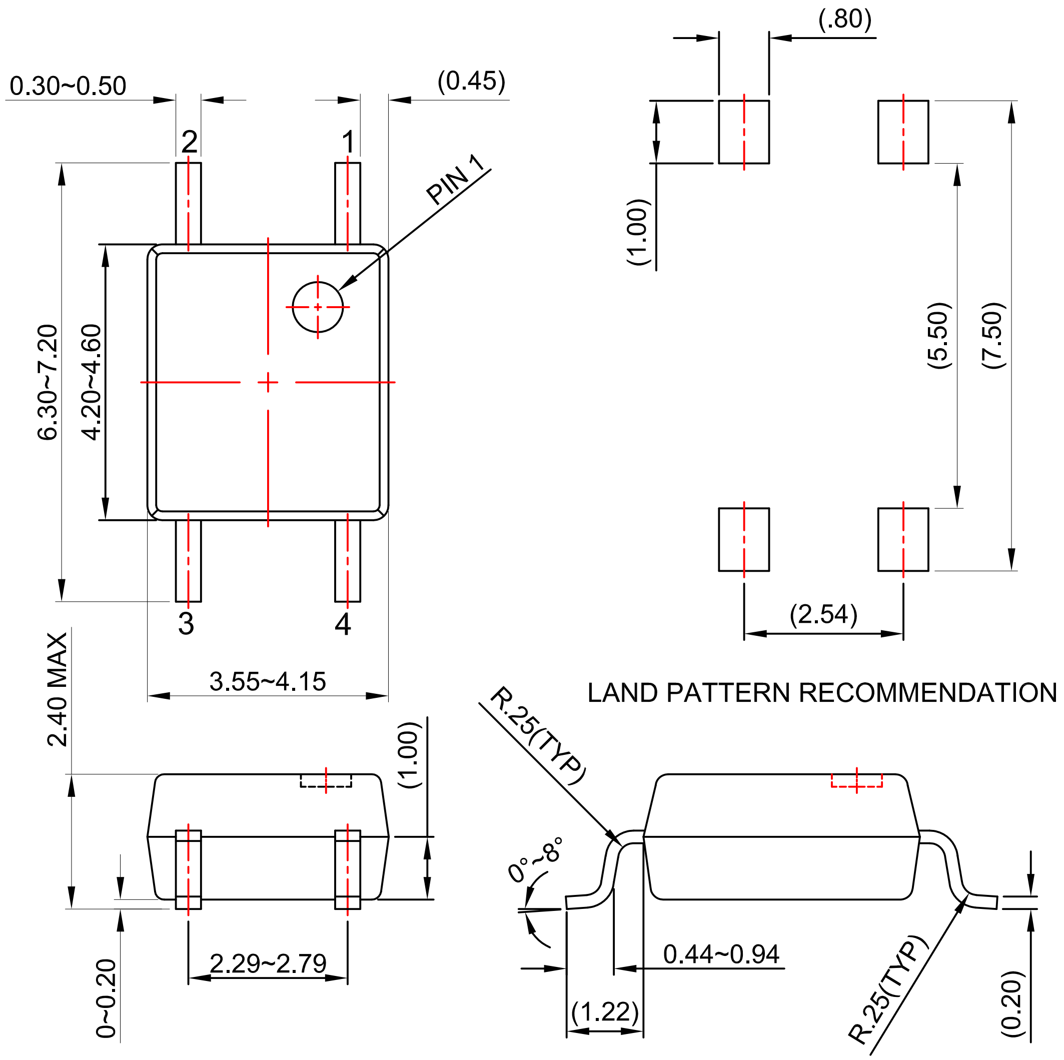
Table 1. Top Mark Definitions

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., “5”
5	Digit Work Week, Ranging from “01” to “53”
6	Assembly Package Code

Carrier Tape Specifications



Description	Symbol	2.54 Pitch Dimensions
Tape Width	W	12.00±0.4
Tape Thickness	t	0.35±0.02
Sprocket Hole Pitch	P_0	4.00±0.20
Sprocket Hole Dia.	D_0	1.55±0.20
Sprocket Hole Location	E	1.75±0.20
Pocket Location	F	5.50±0.20
	P_2	2.00±0.20
Pocket Pitch	P	8.00±0.20
Pocket Dimension	A_0	4.75±0.20
	B_0	7.30±0.20
	K_0	2.30±0.20
Pocket Hole Dia.	D_1	1.55±0.20
Cover Tape Width	W_1	9.20
Cover Tape Thickness	d	0.065±0.02
Max. Component Rotation or Tilt		20° max
Devices Per Reel		2500
Reel Diameter		330 mm (13")



LAND PATTERN RECOMMENDATION

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B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS ARE EXCLUSIVE OF BURRS,
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D) DRAWING FILENAME AND REVISION:
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ANTI-COUNTERFEITING POLICY

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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.

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