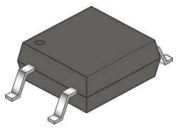
4-Pin Full Pitch Mini-Flat Package Phototransistor Optocouplers

FODM121 Series, FODM124, FODM2701, FODM2705



MFP4 3.85X4.4, 2.54P
CASE 100AP

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.

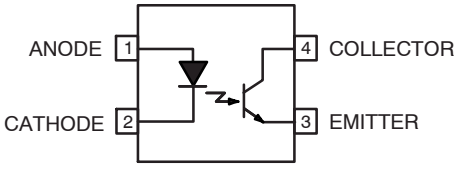
Features

- 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
- This Device is Pb−Free and is RoHS Compliant

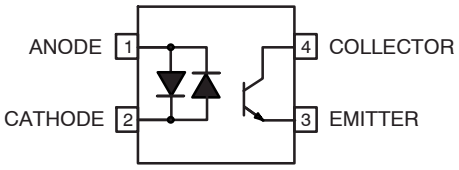
Applications

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

PIN CONNECTIONS

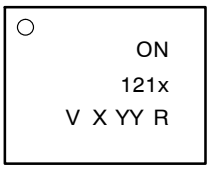


Equivalent Circuit
FODM121, FODM124, FODM2701



Equivalent Circuit
FODM2705

MARKING DIAGRAM



ON	= onsemi Logo
121x	= Device Number
V	= DIN EN/IEC60747−5−5 Option
X	= One−Digit Year Code
YY	= Digit Work Week
R	= Assembly Package Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

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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. 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 (Note 1)	150	°C
$I_{S,INPUT}$	Input Current (Note 1)	200	mA
$P_{S,OUTPUT}$	Output Power (Note 1)	300	mW
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500 V (Note 1)	> 10^9	Ω

1. Safety limit values – maximum values allowed in the event of a failure.

ABSOLUTE MAXIMUM RATINGS 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 s	°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
	Collector−Emitter Voltage, FODM2701, FODM2705	40	V
V_{ECO}	Emitter−Collector Voltage	7	V
P_D	Power Dissipation	150	mW
	Derate linearly (Above 80°C)	3.27	mW/°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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 = ±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 = ±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 = ±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 = ±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 Ω	–	3	–	μs
t_f	Fall Time (Non−Saturated)	All	I_C = 2 mA, V_{CE} = 5 V, R_L = 100 Ω	–	3	–	μs
ISOLATION CHARACTERISTICS							
V_{ISO}	Steady State Isolation Voltage (Note 2)	All	1 minute	3750	–	–	VAC_{RMS}

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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)

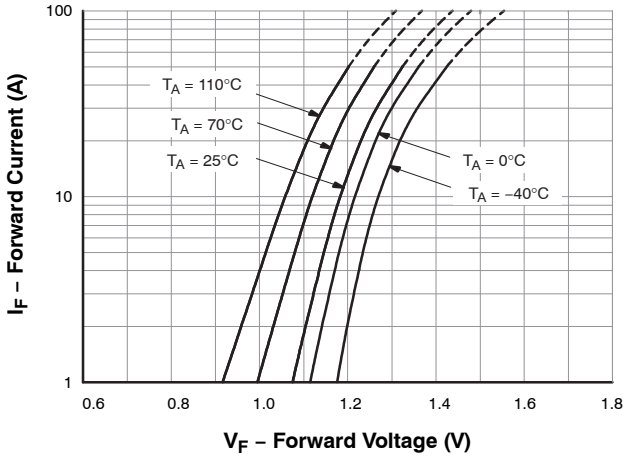


Figure 1. Forward Current vs. Forward Voltage

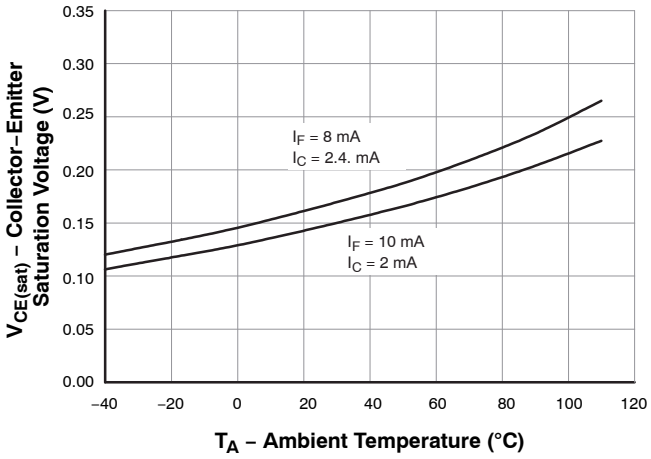


Figure 2. Collector−Emitter Saturation Voltage vs. Ambient Temperature (FODM121/2701/2705)

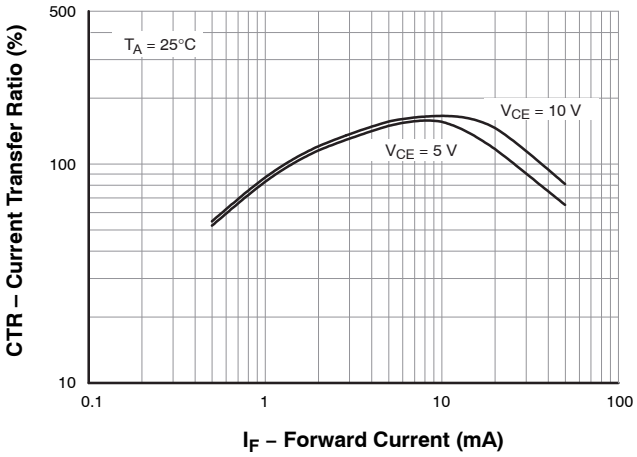


Figure 3. Current Transfer Ratio vs. Forward Current (FODM121/2701/2705)

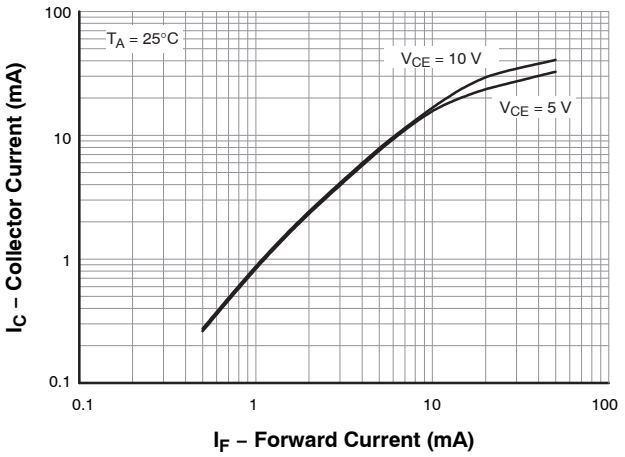


Figure 4. Collector Current vs. Forward Current (FODM121/2701/2705)

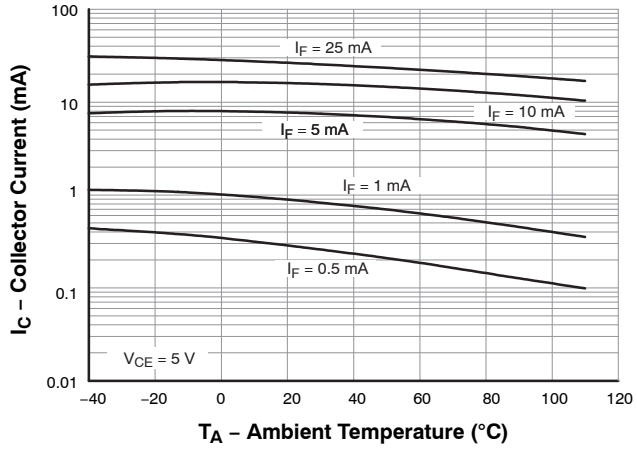


Figure 5. Collector Current vs. Ambient Temperature (FODM121/2701/2705)

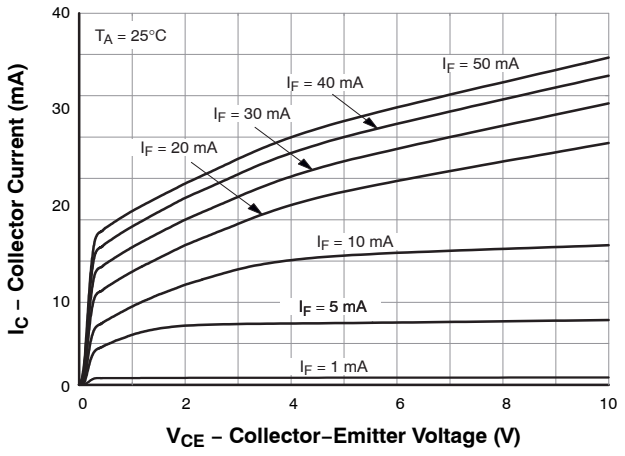


Figure 6. Collector Current vs. Ambient Temperature (FODM121/2701/2705)

TYPICAL PERFORMANCE CURVES (CONTINUED)

(T_A = 25°C UNLESS OTHERWISE SPECIFIED)

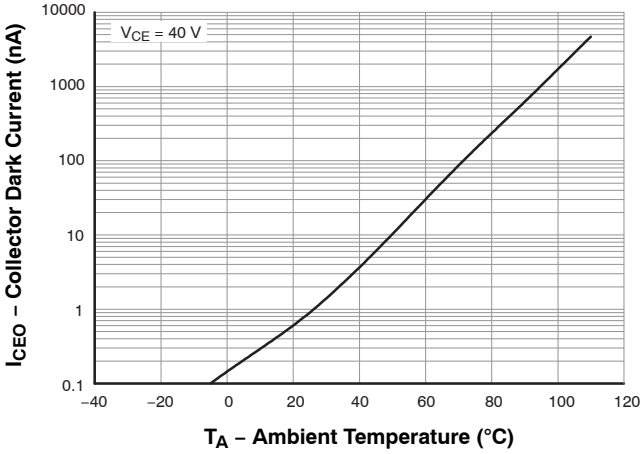


Figure 7. Collector Dark Current vs. Ambient Temperature (FODM121/2701/2705)

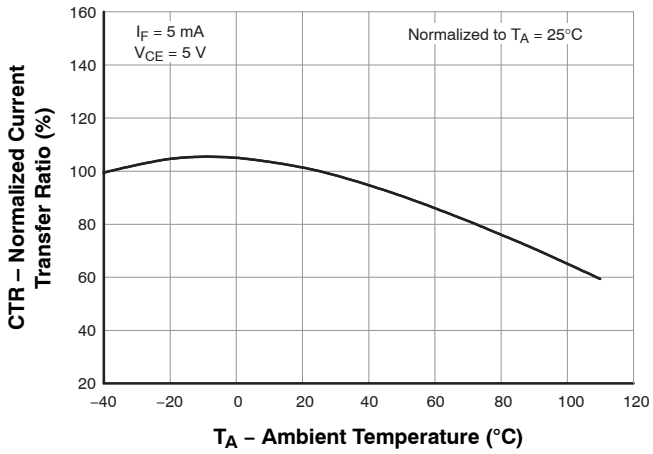


Figure 8. Normalized Current Transfer Ratio vs. Ambient Temperature (FODM121/2701/2705)

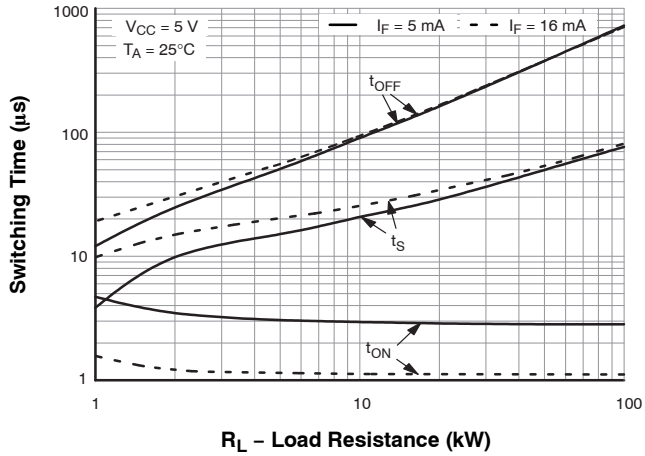


Figure 9. Switching Time vs. Load Resistance (FODM121/2701/2705)

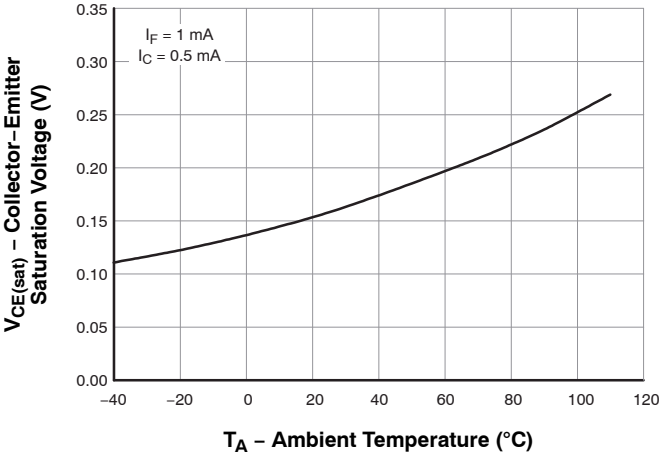


Figure 10. Collector–Emitter Saturation Voltage vs. Ambient Temperature (FODM124)

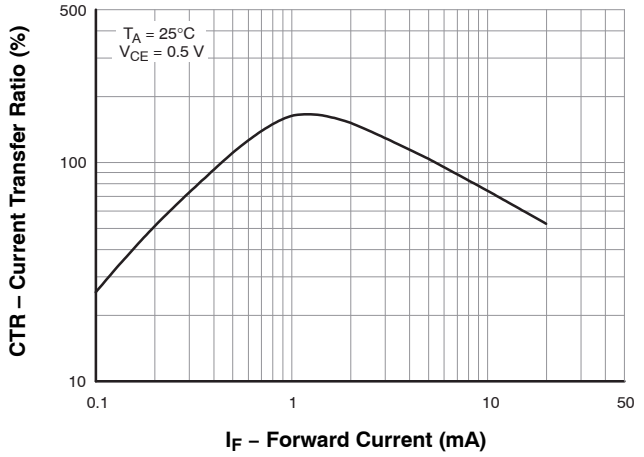


Figure 11. Current Transfer Ratio vs. Forward Current (FODM124)

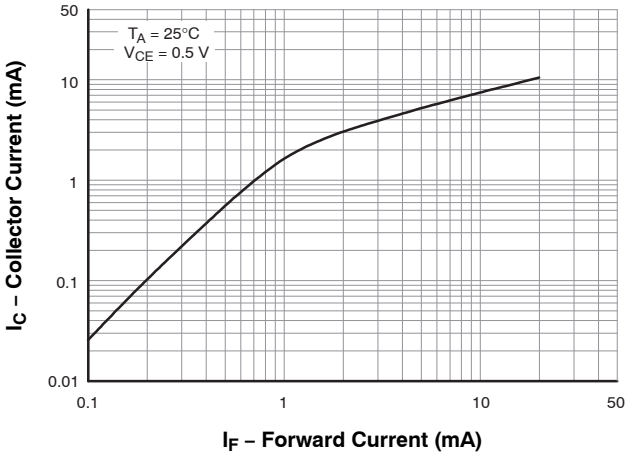


Figure 12. Collector Current vs. Forward Current (FODM124)

TYPICAL PERFORMANCE CURVES (CONTINUED)

(T_A = 25°C UNLESS OTHERWISE SPECIFIED)

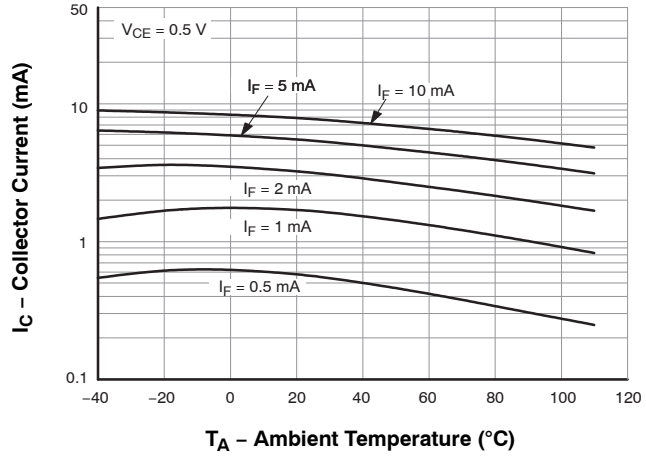


Figure 13. Collector Current vs. Ambient Temperature (FODM124)

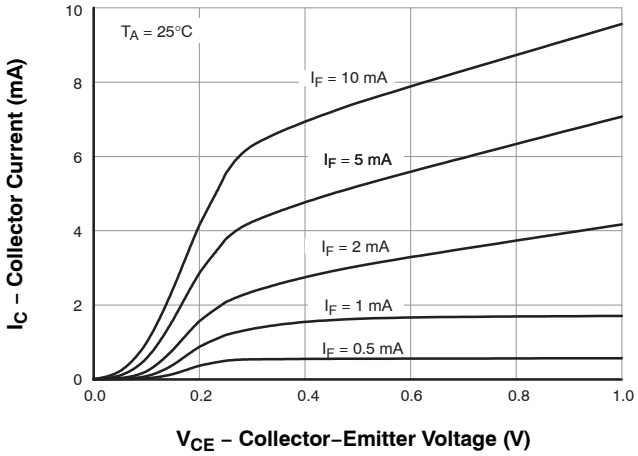


Figure 14. Collector Current vs. Collector–Emitter Voltage (FODM124)

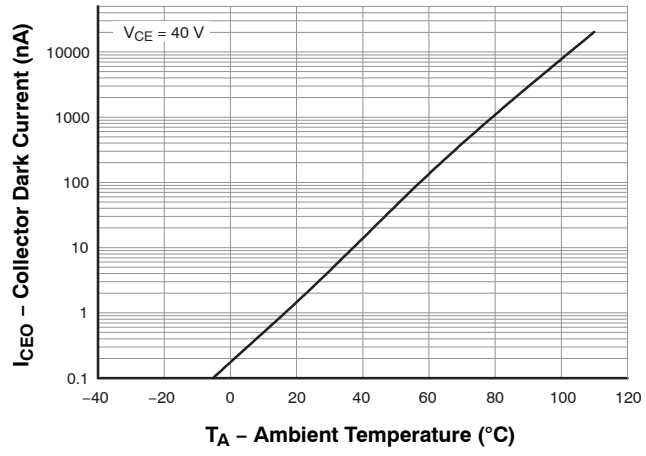


Figure 15. Collector Dark Current vs. Ambient Temperature (FODM124)

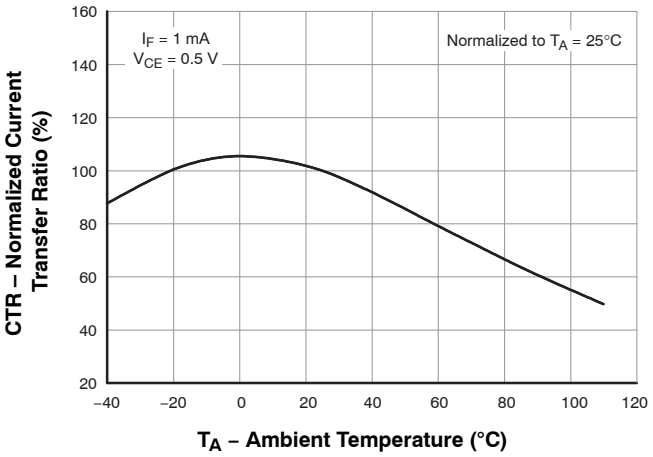


Figure 16. Normalized Current Transfer Ratio vs. Ambient Temperature (FODM124)

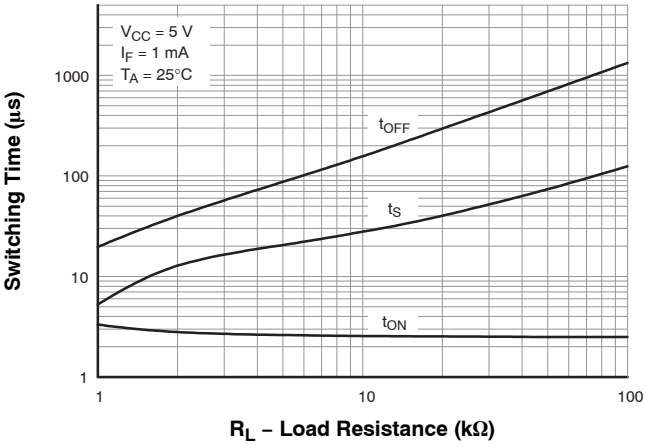
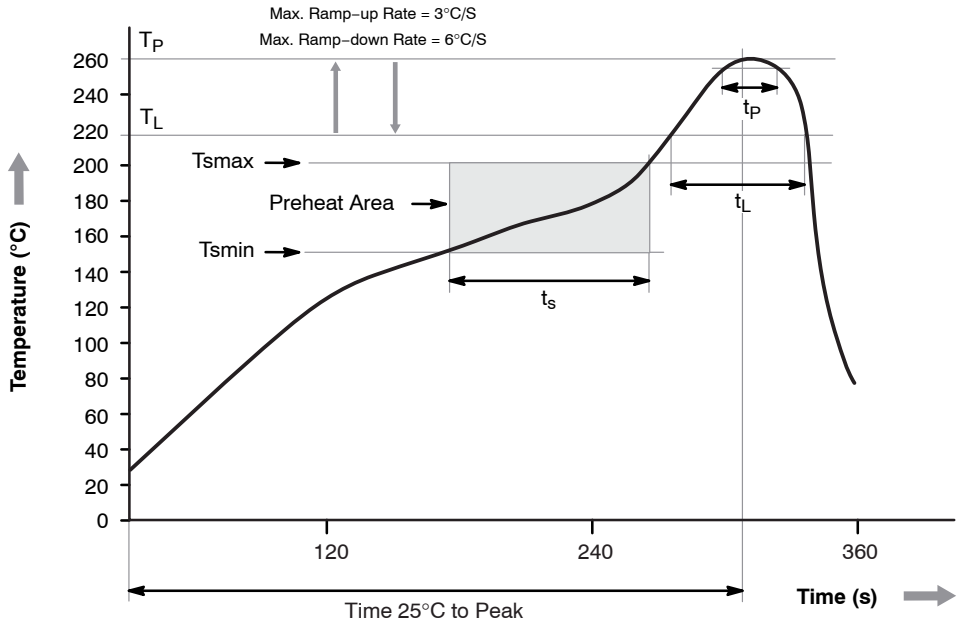


Figure 17. Switching Time vs. Load Resistance (FODM124)

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 s
Ramp−up Rate (t_L to t_P)	3°C/second max.
Liquidus Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60−150 s
Peak Body Package Temperature	260°C +0°C / −5°C
Time (t_P) within 5°C of 260°C	30 s
Ramp−down Rate (T_P to T_L)	6°C/s max.
Time 25°C to Peak Temperature	8 min max.

ORDERING INFORMATION

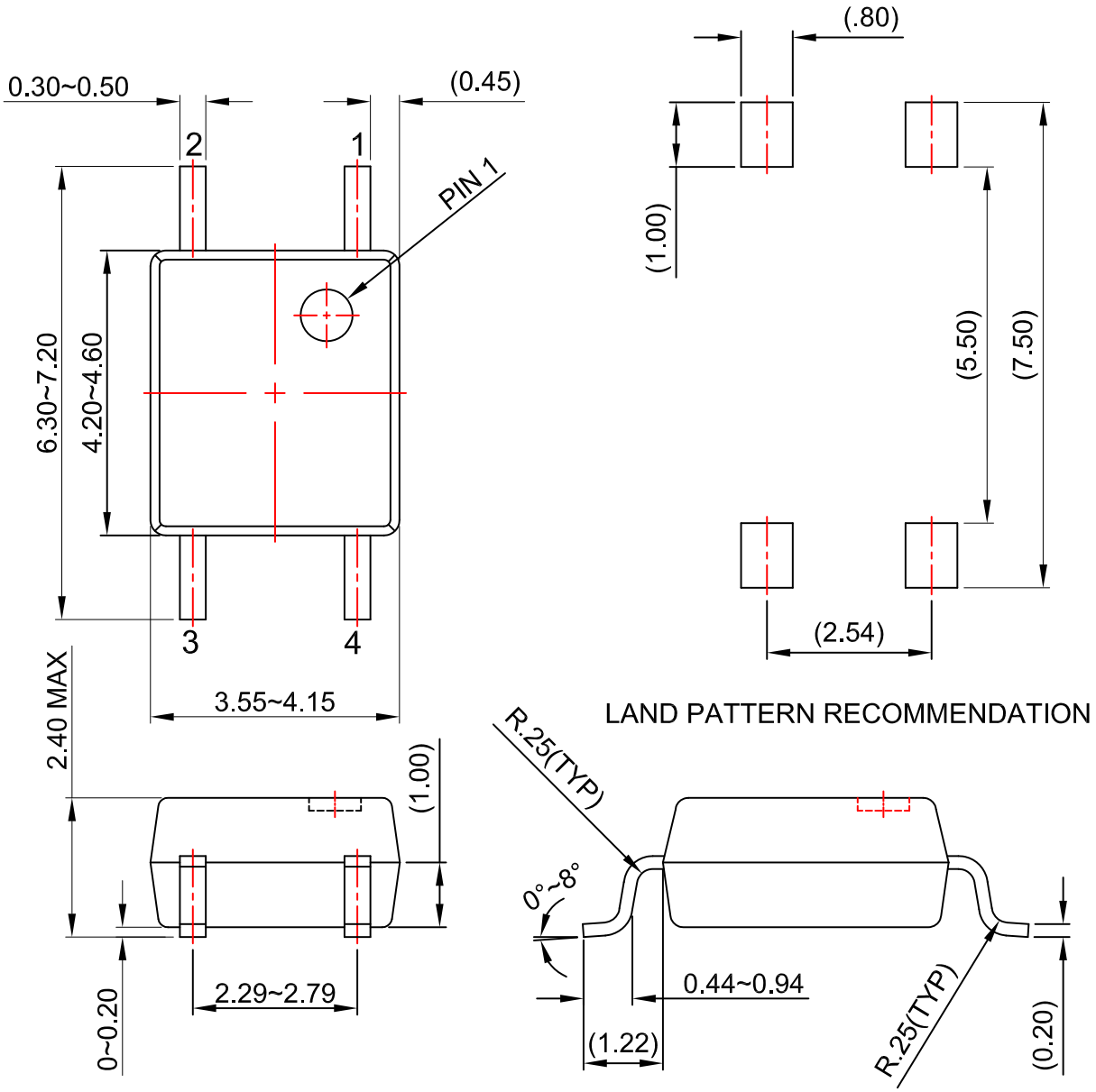
Part Number (Note 3)	**Package**	**Shipping**†
FODM121	Full Pitch Mini−Flat 4−Pin	100 / Tube
FODM121R2	Full Pitch Mini−Flat 4−Pin	2,500 / Tape and Reel
FODM121V	Full Pitch Mini−Flat 4−Pin, DIN EN/IEC60747−5−5 Option	100 / Tube
FODM121R2V	Full Pitch Mini−Flat 4−Pin, DIN EN/IEC60747−5−5 Option	2,500 / Tape and Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

MFP4 3.85X4.4, 2.54P
CASE 100AP
ISSUE O

DATE 31 AUG 2016



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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DESCRIPTION:	**MFP4 3.85X4.4, 2.54P**		**PAGE 1 OF 1**

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