



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

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](http://www.onsemi.com). Please email any questions regarding the system integration to [Fairchild\\_questions@onsemi.com](mailto:Fairchild_questions@onsemi.com).

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.



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<sub>RMS</sub> for 1 Minute
  - DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage

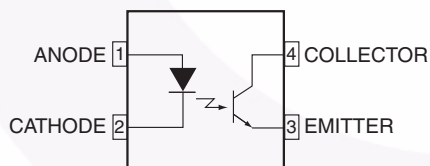
## Applications

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

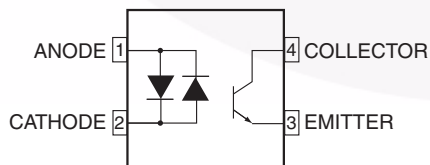
## Description

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

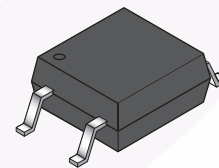


Figure 2. Package Outlines

## 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 <sub>RMS</sub> | I–IV            |
|   | < 300 V <sub>RMS</sub> | I–III           |
| Climatic Classification   |                        | 40/110/21       |
| Pollution Degree (DIN VDE 0110/1.89)  |                        | 2               |
| Comparative Tracking Index  |                        | 175             |

| Symbol                | Parameter  | Value             | Unit              |
|-----------------------|--|-------------------|-------------------|
| V <sub>PR</sub>       | Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC  | 904               | V <sub>peak</sub> |
|                       | Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC | 1060              | V <sub>peak</sub> |
| V <sub>IORM</sub>     | Maximum Working Insulation Voltage   | 565               | V <sub>peak</sub> |
| V <sub>IOTM</sub>     | Highest Allowable Over-Voltage   | 6000              | V <sub>peak</sub> |
|                       | External Creepage  | ≥ 5               | mm                |
|                       | External Clearance   | ≥ 5               | mm                |
| DTI                   | Distance Through Insulation (Insulation Thickness)   | ≥ 0.4             | mm                |
| T <sub>S</sub>        | Case Temperature <sup>(1)</sup>  | 150               | °C                |
| I <sub>S,INPUT</sub>  | Input Current <sup>(1)</sup>   | 200               | mA                |
| P <sub>S,OUTPUT</sub> | Output Power <sup>(1)</sup>  | 300               | mW                |
| R <sub>IO</sub>       | Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>   | > 10 <sup>9</sup> | 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.  $T_A = 25^\circ\text{C}$  Unless otherwise specified.

| Symbol               | Parameter  | Value                   | Unit                       |
|----------------------|--|-------------------------|----------------------------|
| <b>TOTAL PACKAGE</b> |  |                         |                            |
| $T_{STG}$            | Storage Temperature                                    | -40 to +125             | $^\circ\text{C}$           |
| $T_{OPR}$            | Operating Temperature                                  | -40 to +110             | $^\circ\text{C}$           |
| $T_J$                | Junction Temperature                                   | -40 to +125             | $^\circ\text{C}$           |
| $T_{SOL}$            | Lead Solder Temperature                                | 260 for 10 sec          | $^\circ\text{C}$           |
| <b>EMITTER</b>       |  |                         |                            |
| $I_F$ (avg)          | Continuous Forward Current                             | 50                      | mA                         |
| $I_F$ (pk)           | Peak Forward Current (1 $\mu\text{s}$ pulse, 300 pps.) | 1                       | A                          |
| $V_R$                | Reverse Voltage  | 6                       | V                          |
| $P_D$                | Power Dissipation                                      | 70                      | mW                         |
|                      | Derate linearly (Above $75^\circ\text{C}$ )            | 1.41                    | $\text{mW}/^\circ\text{C}$ |
| <b>DETECTOR</b>      |  |                         |                            |
| $I_C$                | Continuous Collector Current                           | 80                      | mA                         |
| $V_{CEO}$            | Collector-Emitter Voltage                              | FODM121 Series, FODM124 | 80                         |
|                      |  | FODM2701, FODM2705      | 40                         |
| $V_{ECO}$            | Emitter-Collector Voltage                              | 6                       | V                          |
| $P_D$                | Power Dissipation                                      | 150                     | mW                         |
|                      | Derate linearly (Above $80^\circ\text{C}$ )            | 3.27                    | $\text{mW}/^\circ\text{C}$ |

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise specified.

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

**Note:**

- 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

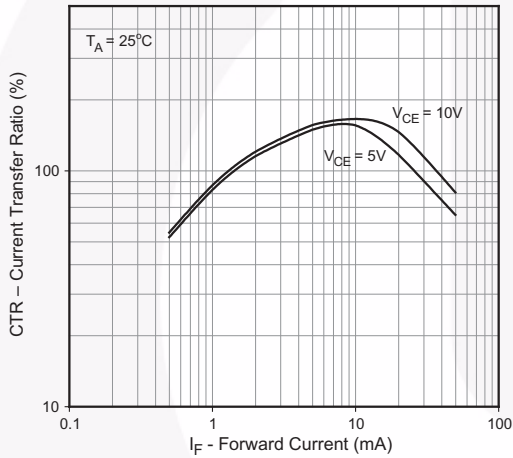
$T_A = 25^\circ\text{C}$  unless otherwise specified.



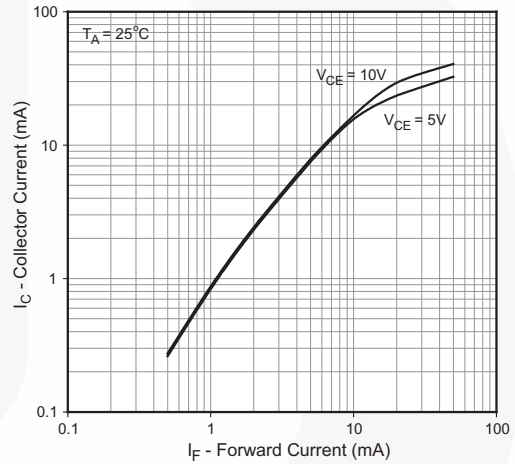
**Fig. 3 Forward Current vs. Forward Voltage**



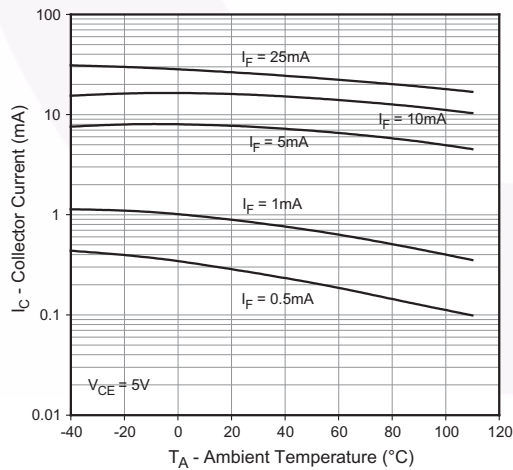
**Fig. 4 Collector-Emitter Saturation Voltage vs. Ambient Temperature (FODM121/2701/2705)**



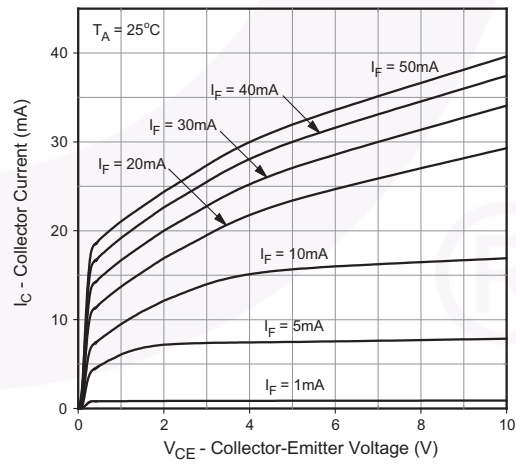
**Fig. 5 Current Transfer Ratio vs. Forward Current (FODM121/2701/2705)**



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



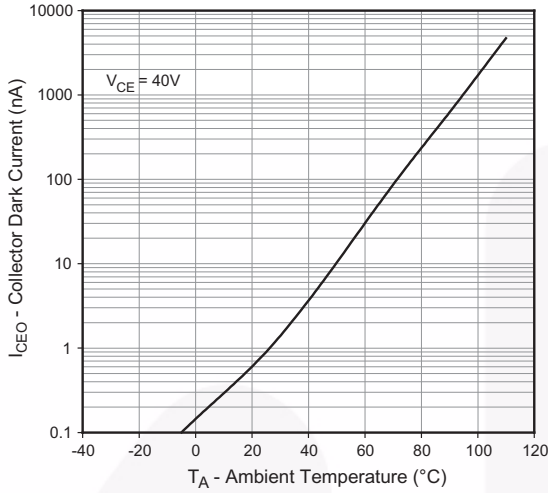
**Fig. 7 Collector Current vs. Ambient Temperature (FODM121/2701/2705)**



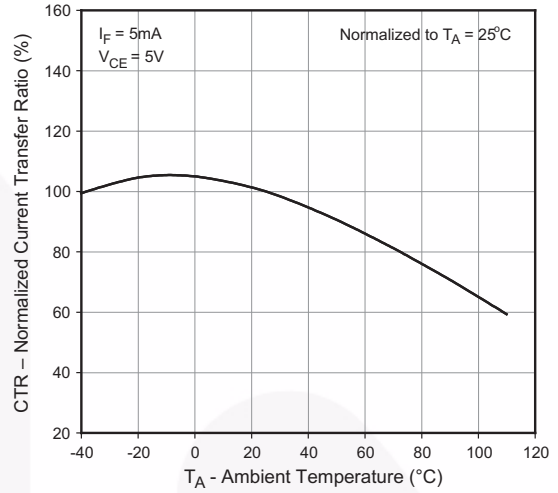
**Fig. 8 Collector Current vs. Collector-Emitter Voltage (FODM121/2701/2705)**

**Typical Performance Curves (Continued)**

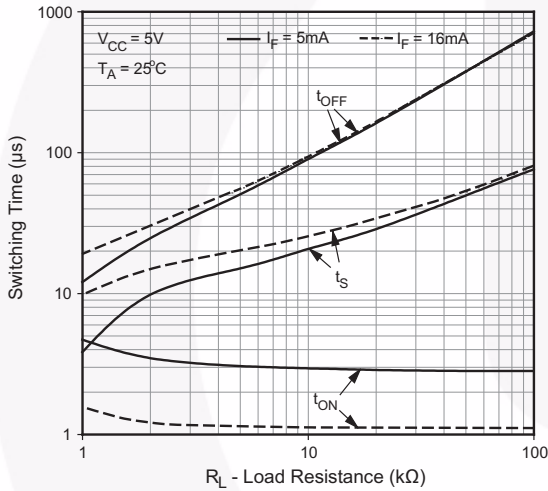
$T_A = 25^\circ\text{C}$  unless otherwise specified.



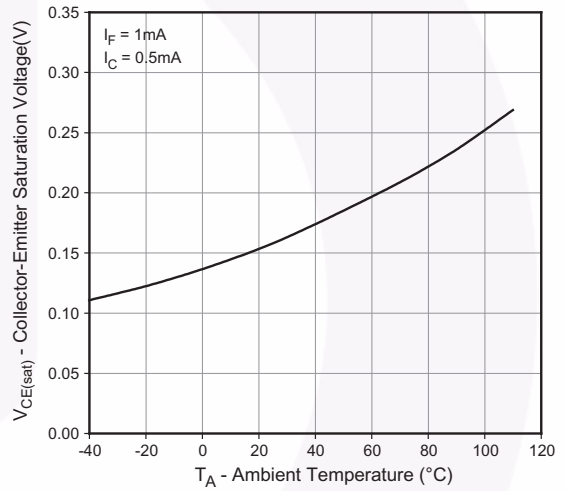
**Fig 9. Collector Dark Current vs. Ambient Temperature (FODM121/2701/2705)**



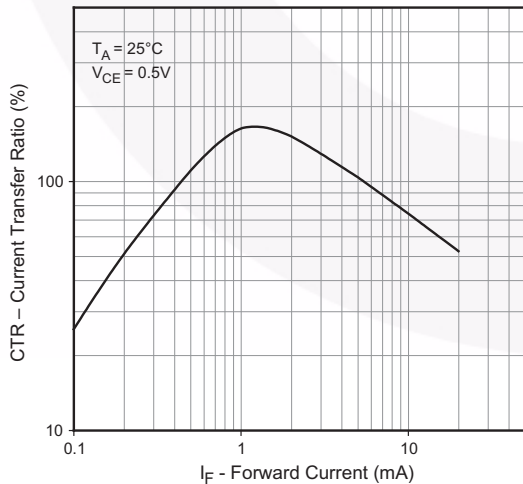
**Fig 10. Normalized Current Transfer Ratio vs. Ambient Temperature (FODM121/2701/2705)**



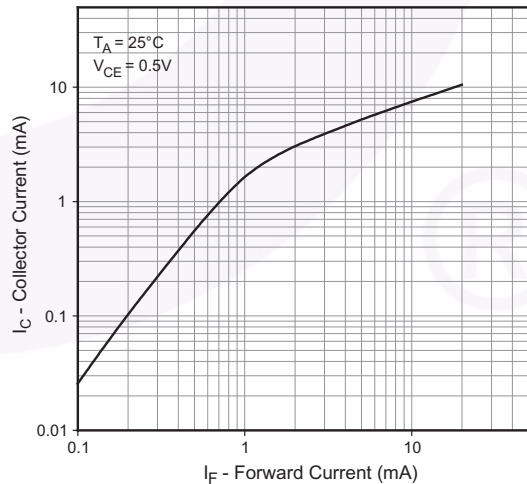
**Fig 11. Switching Time vs. Load Resistance (FODM121/2701/2705)**



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



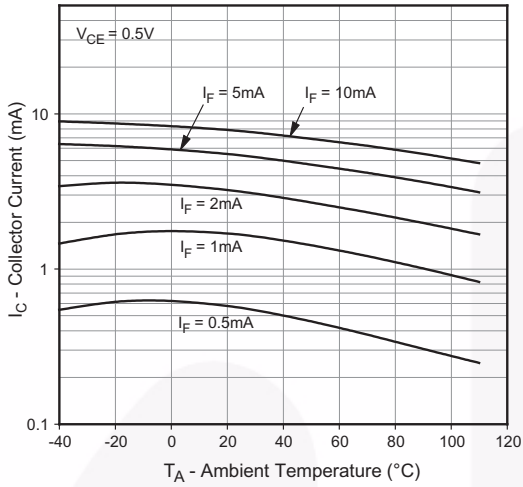
**Fig 13. Current Transfer Ratio vs. Forward Current (FODM124)**



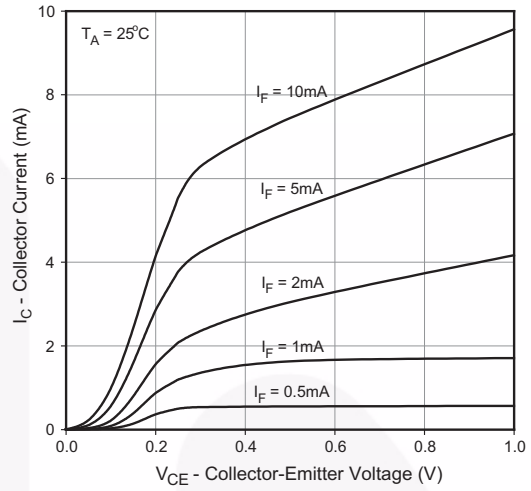
**Fig 14. Collector Current vs. Forward Current (FODM124)**

**Typical Performance Curves** (Continued)

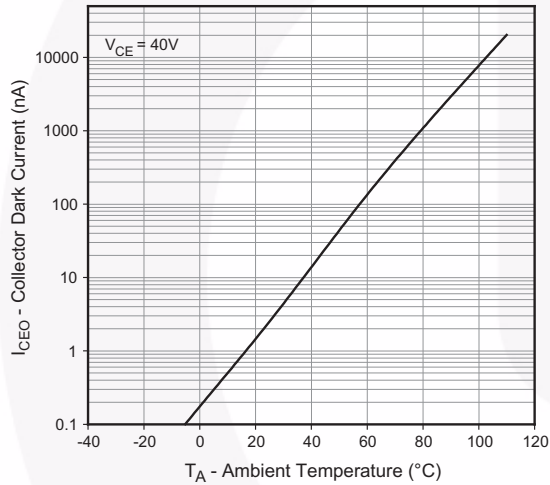
$T_A = 25^\circ\text{C}$  unless otherwise specified.



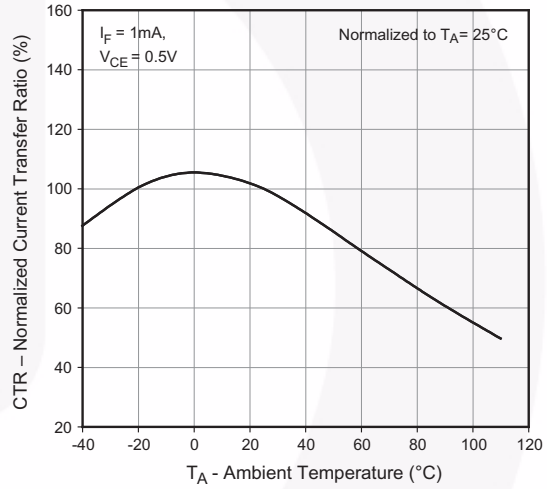
**Fig. 15. Collector Current vs. Ambient Temperature (FODM124)**



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



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

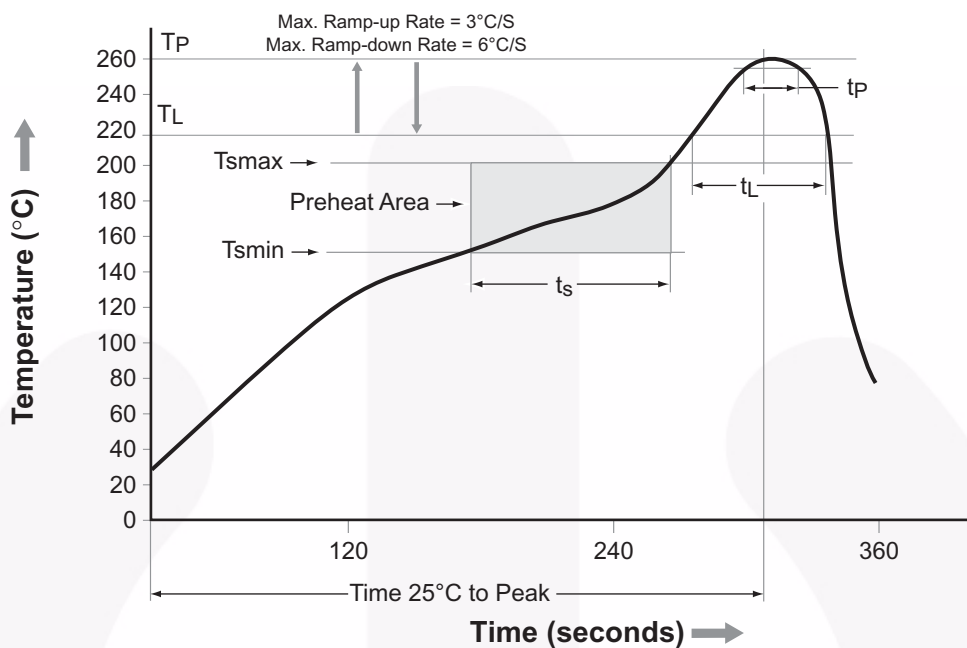


**Fig. 18. Normalized Current Transfer Ratio vs. Ambient Temperature (FODM124)**



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

## Reflow Profile



| Profile Feature                 | Pb-Free Assembly Profile |
|---------------------------------|--------------------------|
| Temperature Min. (Tsmín)        | 150°C                    |
| Temperature Max. (Tsmáx)        | 200°C                    |
| Time (ts) from (Tsmín to Tsmáx) | 60–120 seconds           |
| Ramp-up Rate (tL to tp)         | 3°C/second max.          |
| Liquidous Temperature (TL)      | 217°C                    |
| Time (tL) Maintained Above (TL) | 60–150 seconds           |
| Peak Body Package Temperature   | 260°C +0°C / -5°C        |
| Time (tp) within 5°C of 260°C   | 30 seconds               |
| Ramp-down Rate (TP to TL)       | 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

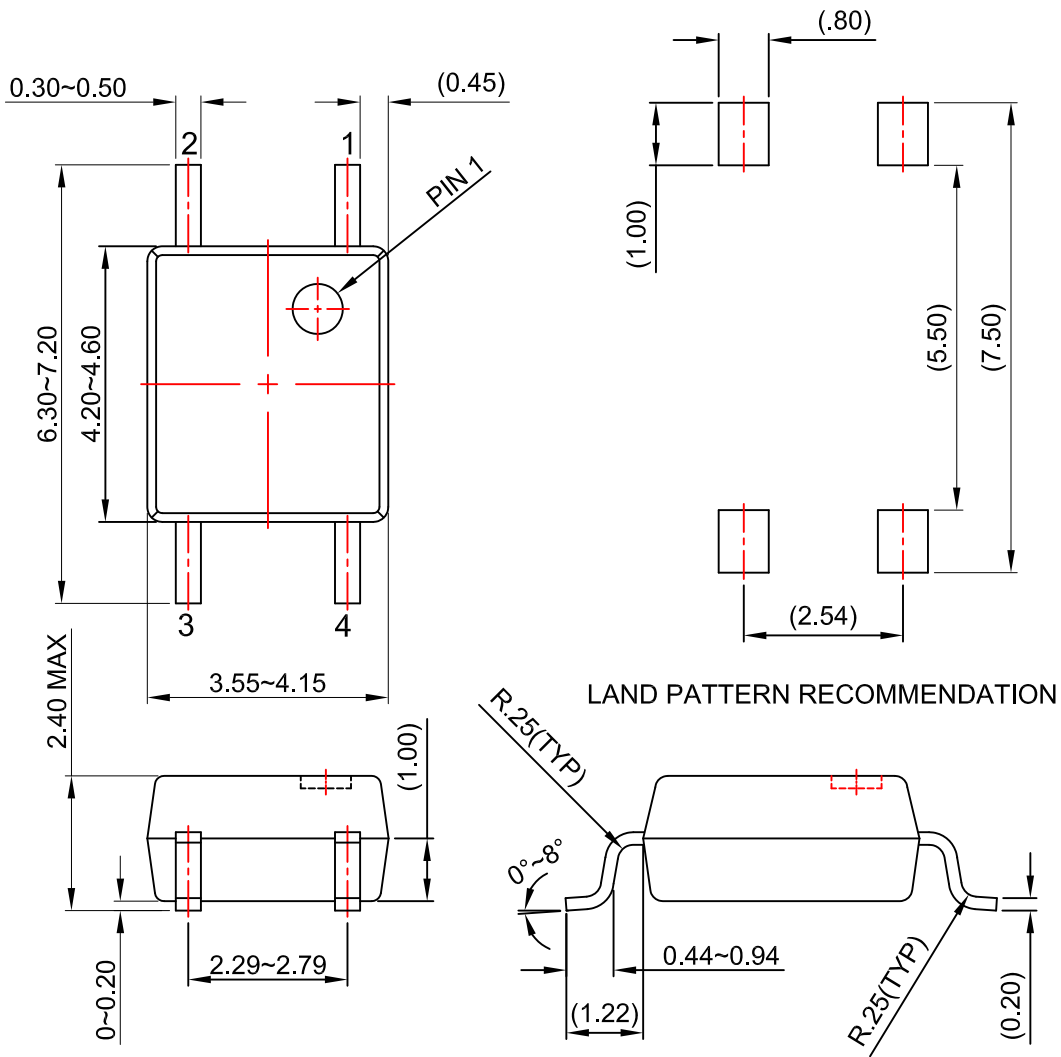
Table 1. Top Mark Definitions

|   |   |
|---|---|
| 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



|                                 |        | 2.54 Pitch   |
|---------------------------------|--------|--------------|
| Description                     | Symbol | 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") |



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-MFP04Crev3.



ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:



Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

-  [View FODM121 on WIN SOURCE](#)
-  [Fairchild/ON Semiconductor Information](#)

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management