FAIRCHILD SEMICONDUCTOR®

February 2012

# FODM121 Series, FODM124, FODM2701, FODM2705
# 4-Pin Full Pitch Mini-Flat Package Transistor Output Optocouplers

## Features

- More than 5mm creepage/clearance
- Compact 4-pin surface mount package (2.4mm maximum standoff height)
- Current Transfer Ratio in selected groups
  DC Input:
  FODM121: 50–600%
  FODM121A: 100–300%
  FODM121B: 50–150%
  FODM121C: 100–200%
  FODM2701: 50–300%
  FODM124: 100% MIN
  AC Input:
  FODM2705: 50–300%
- Available in tape and reel quantities of 2500
- Applicable to Infrared Ray reflow (260°C max, 10 sec.)
- C-UL, UL and VDE* certifications

*option 'V' required

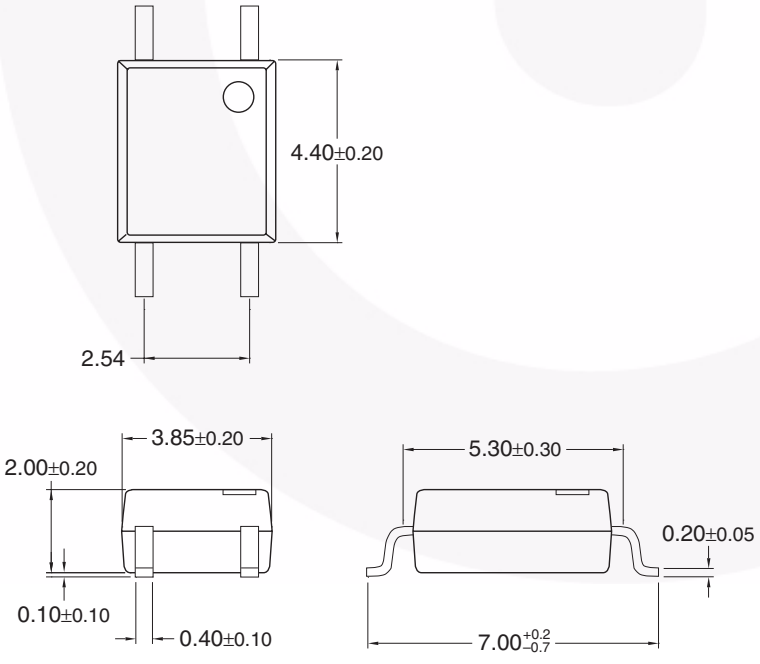
## Applications

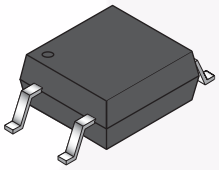
- Digital logic inputs
- Microprocessor inputs
- Power supply monitor
- Twisted pair line receiver
- Telephone line receiver

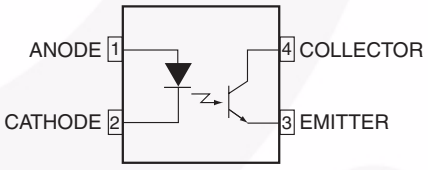
## Description

The FODM124, FODM121 series, 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 2.54mm. The FODM2705 consists of two gallium arsenide infrared emitting diodes connected in inverse parallel for AC operation.

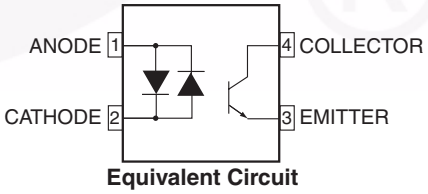
## Package Dimensions






**Equivalent Circuit**
**FODM121, FODM124, FODM2701**




**Equivalent Circuit**
**FODM2705**

**Note:**
All dimensions are in millimeters.

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## Absolute Maximum Ratings ($T_A$ = 25°C 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 |
|---|---|---|---|---|
| **TOTAL PACKAGE** | | | | |
| $T_{STG}$ | Storage Temperature | | -40 to +125 | °C |
| $T_{OPR}$ | Operating Temperature | | -40 to +110 | °C |
| **EMITTER** | | | | |
| $I_{F\ (avg)}$ | Continuous Forward Current | | 50 | mA |
| $I_{F\ (pk)}$ | Peak Forward Current (1µs pulse, 300 pps.) | | 1 | A |
| $V_R$ | Reverse Input Voltage | | 6 | V |
| $P_D$ | Power Dissipation | | 70 | mW |
| | Derate linearly (above 25°C) | | 0.65 | mW/°C |
| **DETECTOR** | | | | |
| | Continuous Collector Current | | 80 | mA |
| $P_D$ | Power Dissipation | | 150 | mW |
| | Derate linearly (above 25°C) | | 2.0 | mW/°C |
| $V_{CEO}$ | Collector-Emitter Voltage | FODM2701, FODM2705 | 40 | V |
| | | FODM121 Series, FODM124 | 80 | |
| $V_{ECO}$ | Emitter-Collector Voltage | | 7 | V |

## Electrical Characteristics ($T_A$ = 25°C)

### Individual Component Characteristics

| Symbol | Parameter | Test Conditions | Device | Min. | Typ.* | Max. | Unit |
|---|---|---|---|---|---|---|---|
| **EMITTER** | | | | | | | |
| $V_F$ | Forward Voltage | $I_F$ = 10mA | FODM121 Series, FODM124 | 1.0 | | 1.3 | V |
| | | $I_F$ = 5mA | FODM2701 | | | 1.4 | |
| | | $I_F$ = ±5mA | FODM2705 | | | | |
| $I_R$ | Reverse Current | $V_R$ = 5V | FODM2701 | | | 5 | µA |
| | | | FODM121 Series | | | | |
| | | | FODM124 | | | | |
| **DETECTOR** | | | | | | | |
| $BV_{CEO}$ | Breakdown Voltage Collector to Emitter | $I_C$ = 1mA, $I_F$ = 0 | FODM121 Series, FODM124 | 80 | | | V |
| | | | FODM2701, FODM2705 | 40 | | | |
| $BV_{ECO}$ | Emitter to Collector | $I_E$ = 100µA, $I_F$ = 0 | All | 7 | | | V |
| $I_{CEO}$ | Collector Dark Current | $V_{CE}$ = 40V, $I_F$ = 0 | All | | | 100 | nA |
| $C_{CE}$ | Capacitance | $V_{CE}$ = 0V, f = 1MHz | All | | 10 | | pF |

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## Electrical Characteristics (Continued) ($T_A$ = 25°C)

### Transfer Characteristics

| Symbol | Characteristic | Test Conditions | Device | Min. | Typ.* | Max. | Unit |
|---|---|---|---|---|---|---|---|
| CTR | DC Current Transfer Ratio | $I_F$ = ±5mA, $V_{CE}$ = 5V | FODM2705 | 50 | | 300 | % |
| | | $I_F$ = 5mA, $V_{CE}$ = 5V | FODM2701 | 50 | | 300 | |
| | | $I_F$ = 5mA, $V_{CE}$ = 5V | FODM121 | 50 | | 600 | |
| | | | FODM121A | 100 | | 300 | |
| | | | FODM121B | 50 | | 150 | |
| | | | FODM121C | 100 | | 200 | |
| | | $I_F$ = 1mA, $V_{CE}$ = 0.5V | FODM124 | 100 | | 1200 | |
| | | $I_F$ = 0.5mA, $V_{CE}$ = 1.5V | | 50 | | | |
| | CTR Symmetry | $I_F$ = ±5mA, $V_{CE}$ = 5V | FODM2705 | 0.3 | | 3.0 | |
| $V_{CE\ (SAT)}$ | Saturation Voltage | $I_F$ = ±10mA, $I_C$ = 2mA | FODM2705 | | | 0.3 | V |
| | | $I_F$ = 10mA, $I_C$ = 2mA | FODM2701 | | | 0.3 | |
| | | $I_F$ = 8mA, $I_C$ = 2.4mA | FODM121 Series | | | 0.4 | |
| | | $I_F$ = 1mA, $I_C$ = 0.5mA | FODM124 | | | 0.4 | |
| $t_r$ | Rise Time (Non-Saturated) | $I_C$ = 2mA, $V_{CE}$ = 5V, $R_L$ = 100Ω | All | | 3 | | µs |
| $t_f$ | Fall Time (Non-Saturated) | $I_C$ = 2mA, $V_{CE}$ = 5V, $R_L$ = 100Ω | All | | 3 | | µs |

### Isolation Characteristics

| Characteristic | Test Conditions | Symbol | Device | Min. | Typ.* | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Steady State Isolation Voltage[1] | 1 Minute | $V_{ISO}$ | All | 3750 | | | VRMS |

*All typicals at $T_A$ = 25°C

**Note:**

1. 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.

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## Typical Performance Curves

**Fig. 1 Forward Current vs. Forward Voltage**

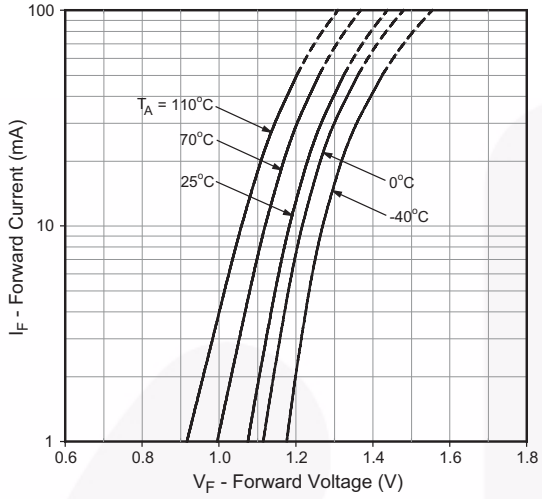



**Fig. 2 Collector-Emitter Saturation Voltage vs. Ambient Temperature (FODM121/2701/2705)**

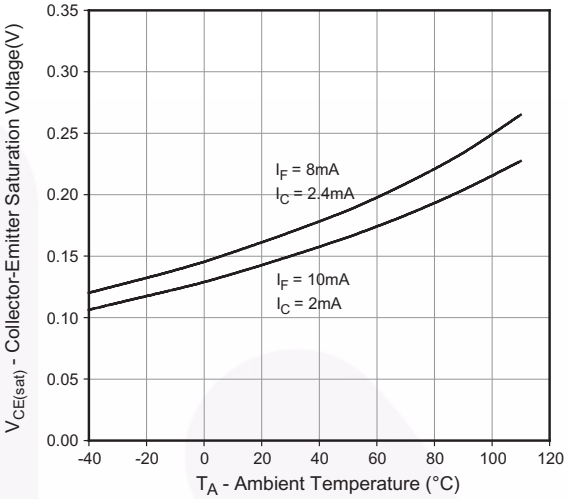



**Fig. 3 Current Transfer Ratio vs. Forward Current (FODM121/2701/2705)**

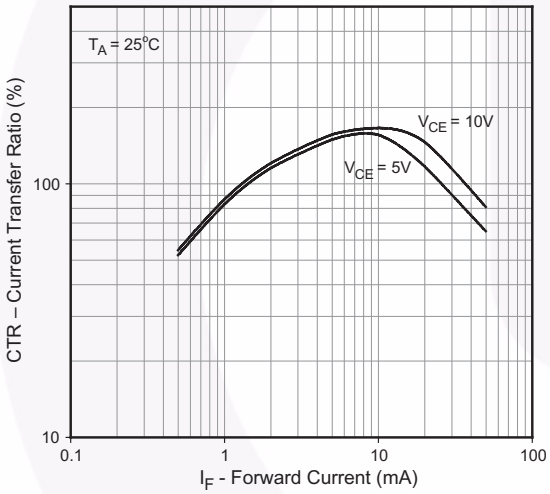



**Fig. 4 Collector Current vs. Forward Current (FODM121/2701/2705)**

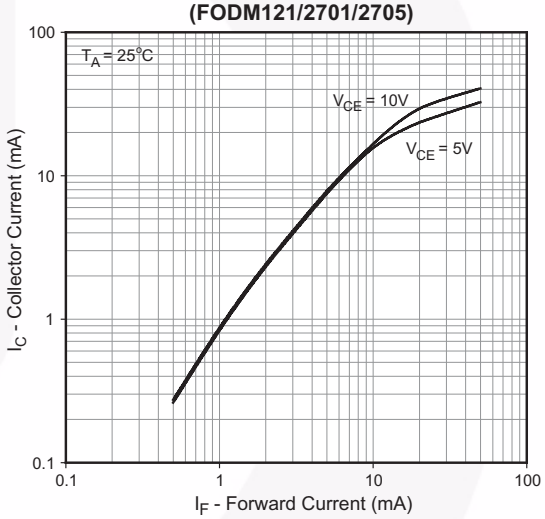



**Fig. 5 Collector Current vs. Ambient Temperature (FODM121/2701/2705)**

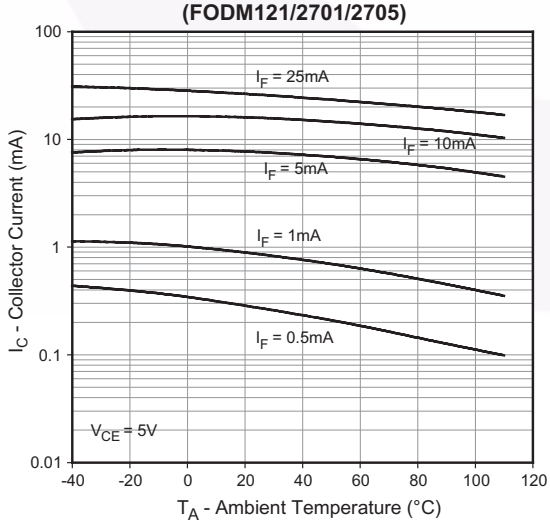
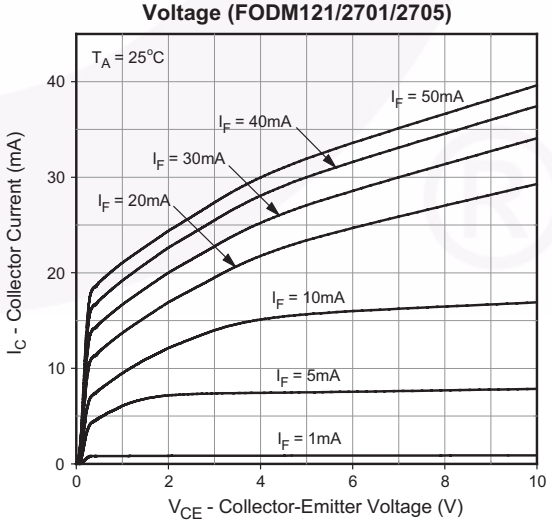



**Fig. 6 Collector Current vs. Collector-Emitter Voltage (FODM121/2701/2705)**




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

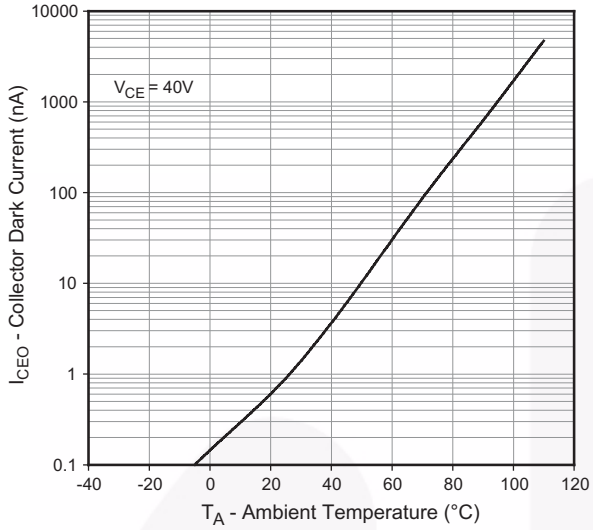



**Fig. 8 Normalized Current Transfer Ratio vs. Ambient Temperature (FODM121/2701/2705)**

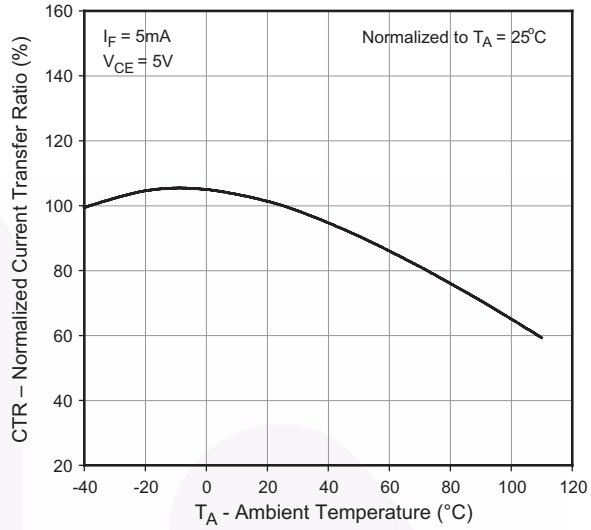



**Fig. 9 Switching Time vs. Load Resistance (FODM121/2701/2705)**

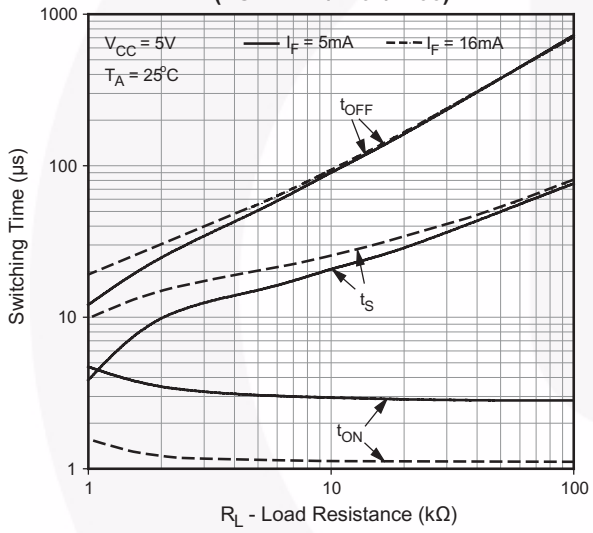



**Fig. 10 Collector-Emitter Saturation Voltage vs. Ambient Temperature (FODM124)**

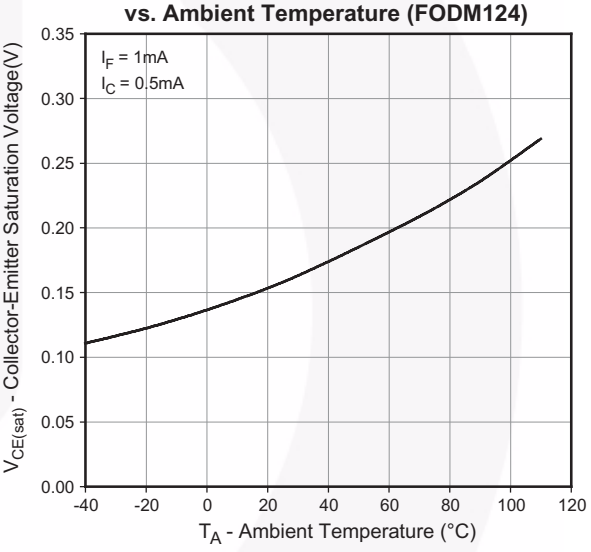



**Fig. 11 Current Transfer Ratio vs. Forward Current (FODM124)**

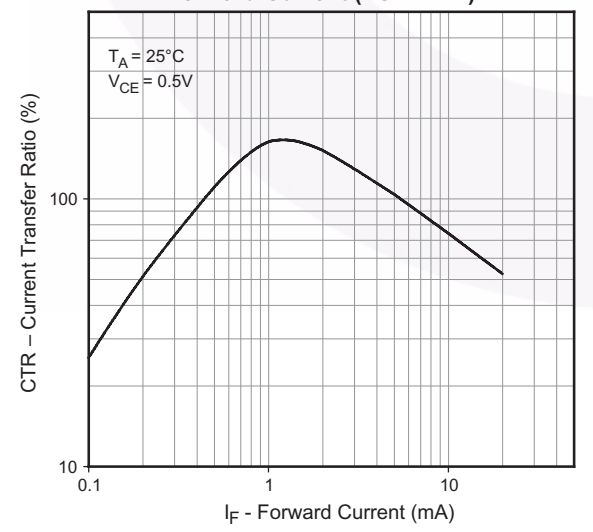
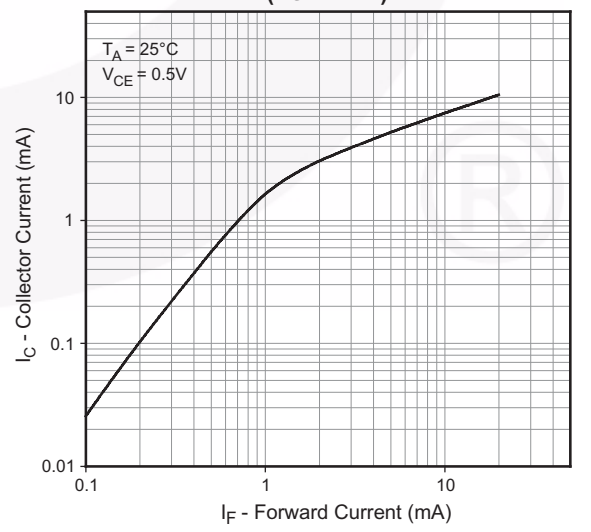



**Fig 12. Collector Current vs. Forward Current (FODM124)**




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**Fig 13. Collector Current vs. Ambient Temperature (FODM124)**

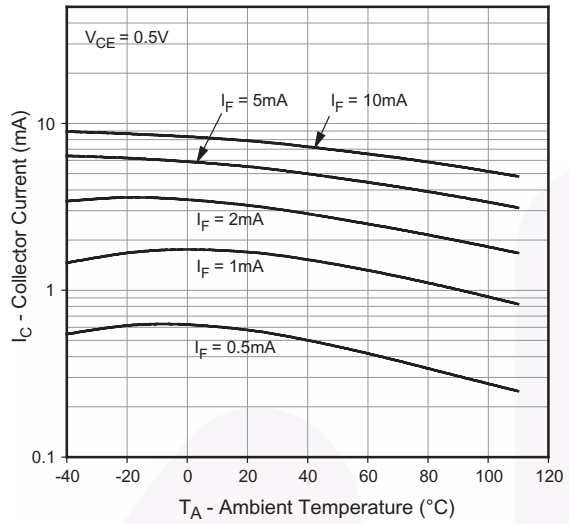



**Fig. 14 Collector Current vs. Collector-Emitter Voltage (FODM124)**

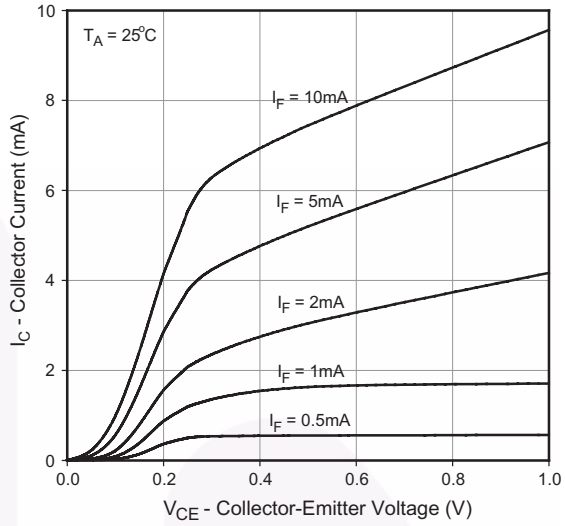



**Fig. 15 Collector Dark Current vs. Ambient Temperature (FODM124)**

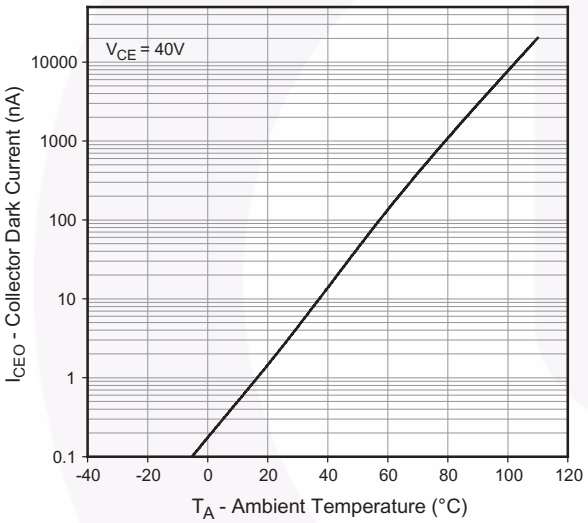



**Fig. 16 Normalized Current Transfer Ratio vs. Ambient Temperature (FODM124)**

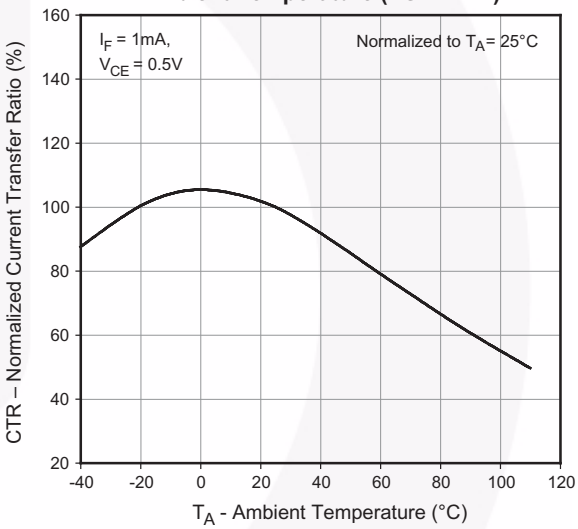
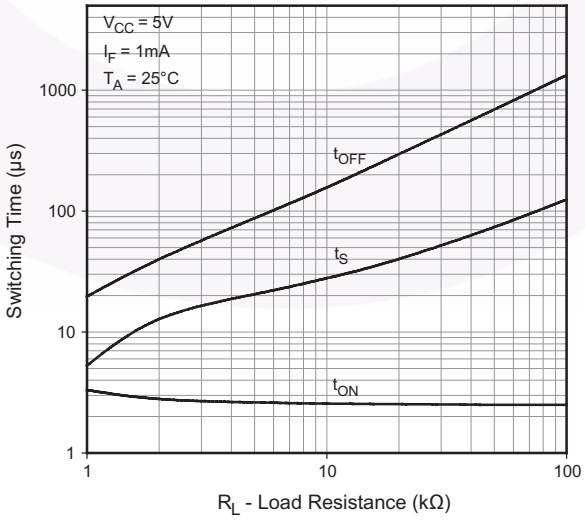


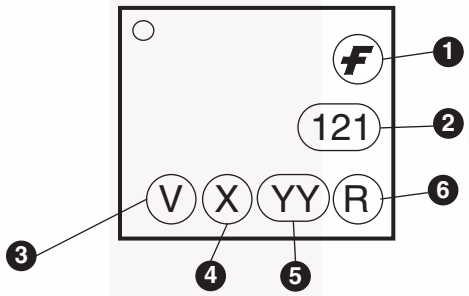

**Fig. 17 Switching Time vs. Load Resistance (FODM124)**



## Ordering Information

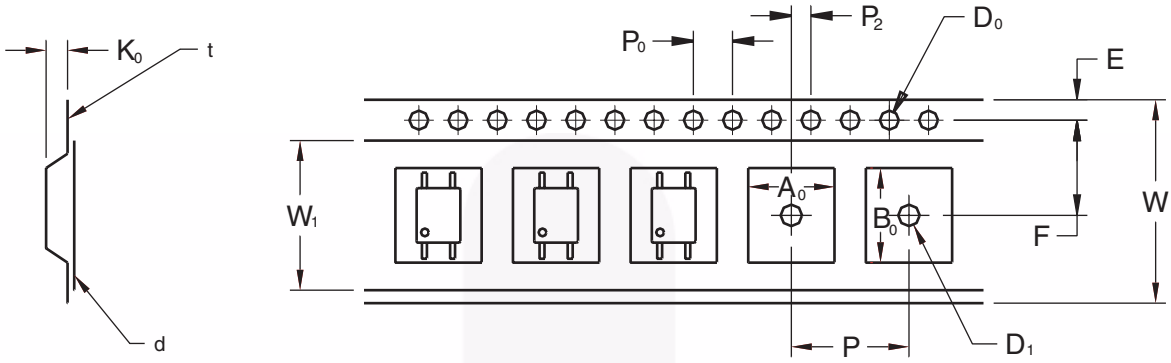
| Option | Description |
|---|---|
| V | VDE Approved |
| R2 | Tape and Reel (2500 units) |
| R2V | Tape and Reel (2500 units) and VDE Approved |

## Marking Information



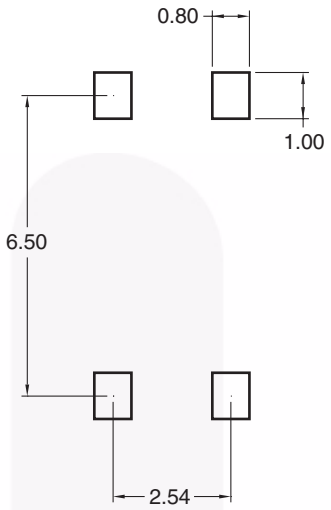

| Definitions | |
|---|---|
| 1 | Fairchild logo |
| 2 | Device number |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | One digit year code |
| 5 | Two digit work week ranging from ‘01’ to ‘53’ |
| 6 | Assembly package code |

## Carrier Tape Specifications



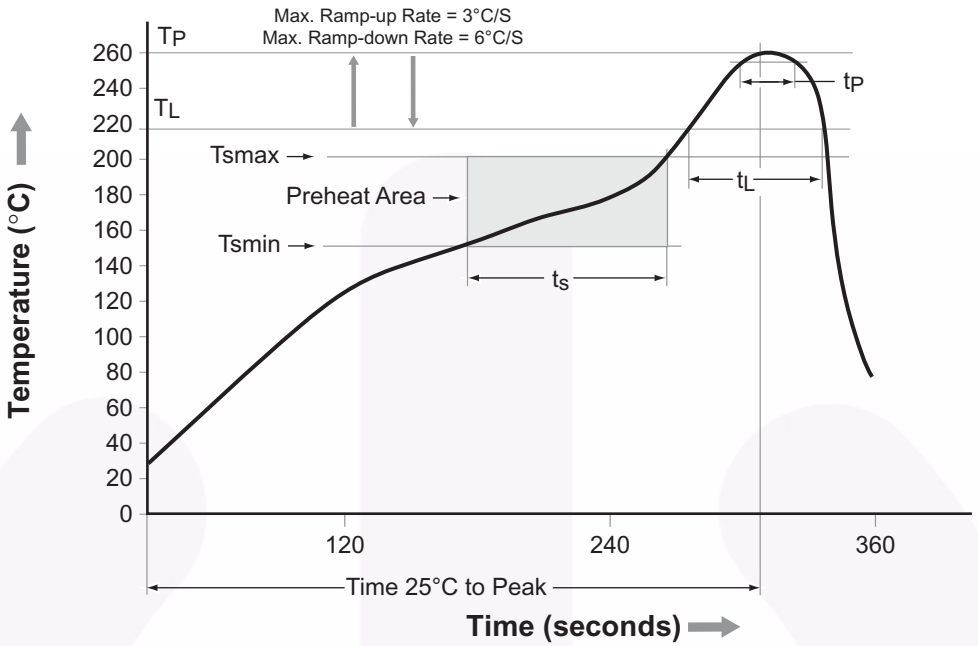

| Description | Symbol | 2.54 Pitch Dimensions |
|---|---|---|
| Tape Width | W | 12.00±0.4 |
| Tape Thickness | t | 0.35±0.02 |
| Sprocket Hole Pitch | $P_0$ | 4.00±0.20 |
| Sprocket Hole Dia. | $D_0$ | 1.55±0.20 |
| Sprocket Hole Location | E | 1.75±0.20 |
| Pocket Location | F | 5.50±0.20 |
| | $P_2$ | 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") |

## Footprint Drawing for PCB Layout




**Note:**
All dimensions are in mm.

## 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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Green FPS™
Green FPS™ e-Series™
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MegaBuck™
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SuperSOT™-6
SuperSOT™-8
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TinyWire™
TranSiC™
TriFault Detect™
TRUECURRENT®*
μSerDes™
SerDes
UHC®
Ultra FRFET™
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VCX™
VisualMax™
VoltagePlus™
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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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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. |
| 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. |
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