

# Single Channel, DC Sensing Input, Phototransistor Optocoupler In Stretched Body SOP 4-Pin

## FODM100x Series

### Description

The FODM100x Series, single channel, DC sensing input, optocoupler consists of one gallium arsenide (GaAs) infrared light emitting diode optically coupled to one phototransistor, in a stretched body SOP 4-pin package. The input-output isolation voltage,  $V_{ISO}$ , is rated at 5,000 VAC<sub>RMS</sub>.

### Features

- $\geq 8$  mm Creepage and Clearance Distance, and  $\geq 0.4$  mm Insulation Distance to Achieve Reliable and High Voltage Insulation
- Safety and Regulatory Approvals
- UL1577, 5,000 VAC<sub>RMS</sub> for 1 min
- DIN\_EN/IEC60747-5-5, 890 V<sub>Peak</sub> Working Voltage
- High Breakdown Collector to Emitter Voltage,  $BV_{CEO} = 70$  V Minimum
- Extended Industrial Temperature Range,  $-40$  to  $110^{\circ}\text{C}$
- Current Transfer Ratio at  $I_F = 5$  mA,  $V_{CE} = 5$  V,  $T_A = 25^{\circ}\text{C}$
- FODM1007: 80 to 160%
- FODM1008: 130 to 260%
- FODM1009: 200 to 400%
- These are Pb-Free Devices

### Applications

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

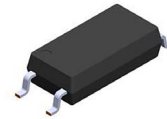
### Related Resources

- <https://www.onsemi.com/products/optoelectronics/>
- [www.onsemi.com/datsheets/HM/HMHA2801.pdf](https://www.onsemi.com/datsheets/HM/HMHA2801.pdf)



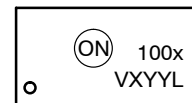
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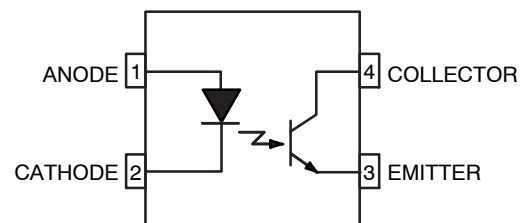
SSOP4 / LSOP04  
CASE 565BH

### MARKING DIAGRAM



100x = Specific Device Code (x = 7, 8, 9)  
V = DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)  
X = Last Digit Year Code  
YY = Two Digit Work Week  
L = Assembly Package Code

### PIN CONNECTIONS



### ORDERING INFORMATION

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

## FODM100x Series

**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  | 1,426            | 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 | 1,671            | V <sub>peak</sub> |
| V <sub>IORM</sub>     | Maximum Working Insulation Voltage                                                                                                                             | 890              | V <sub>peak</sub> |
| V <sub>IOTM</sub>     | Highest Allowable Over-Voltage                                                                                                                                 | 6,000            | V <sub>peak</sub> |
|                       | External Creepage                                                                                                                                              | ≥8.0             | mm                |
|                       | External Clearance                                                                                                                                             | ≥8.0             | mm                |
| DTI                   | Distance Through Insulation (Insulation Thickness)                                                                                                             | ≥0.4             | mm                |
| T <sub>S</sub>        | Case Temperature (Note 1)                                                                                                                                      | 150              | °C                |
| I <sub>S,INPUT</sub>  | Input Current (Note 1)                                                                                                                                         | 200              | mA                |
| P <sub>S,OUTPUT</sub> | Output Power (Note 1)                                                                                                                                          | 300              | mW                |
| R <sub>IO</sub>       | Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V (Note 1)                                                                                     | >10 <sup>9</sup> | Ω                 |

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

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise noted)

| Symbol | Parameter | Value | Unit |
|--------|-----------|-------|------|
|--------|-----------|-------|------|

#### TOTAL PACKAGE

|                  |                       |             |    |
|------------------|-----------------------|-------------|----|
| T <sub>STG</sub> | Storage Temperature   | –55 to +150 | °C |
| T <sub>OPR</sub> | Operating Temperature | –40 to +110 | °C |
| T <sub>J</sub>   | Junction Temperature  | –40 to +125 | °C |

#### EMITTER

|                     |                                                        |     |       |
|---------------------|--------------------------------------------------------|-----|-------|
| I <sub>F(avg)</sub> | Continuous Forward Current                             | 50  | mA    |
| I <sub>F(pk)</sub>  | Continuous Forward Current (1 μs Pulse, 300 pps)       | 1   | A     |
| V <sub>R</sub>      | Reverse Input Voltage                                  | 6   | V     |
| P <sub>DLED</sub>   | LED Power Dissipation @ T <sub>A</sub> = 25°C (Note 2) | 100 | mW    |
|                     | Derate Above 25°C                                      | 0.9 | mW/°C |

#### DETECTOR

|                  |                                                             |      |       |
|------------------|-------------------------------------------------------------|------|-------|
| I <sub>C</sub>   | Continuous Collector Current                                | 50   | mA    |
| V <sub>CEO</sub> | Collector–Emitter Voltage                                   | 70   | V     |
| V <sub>ECO</sub> | Emitter–Collector Voltage                                   | 7    | V     |
| P <sub>DC</sub>  | Detector Power Dissipation @ T <sub>A</sub> = 25°C (Note 2) | 150  | mW    |
|                  | Derate Above 25°C                                           | 1.47 | 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.

2. Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.

## FODM100x Series

### ELECTRICAL CHARACTERISTICS

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

#### INDIVIDUAL COMPONENT CHARACTERISTICS

| Symbol          | Parameter                                 | Device | Test Conditions                            | Min | Typ | Max | Unit          |
|-----------------|-------------------------------------------|--------|--------------------------------------------|-----|-----|-----|---------------|
| <b>EMITTER</b>  |                                           |        |                                            |     |     |     |               |
| $V_F$           | Forward Voltage                           | All    | $I_F = 50\text{ mA}$                       | –   | 1.4 | 1.6 | V             |
| $I_R$           | Reverse Current                           | All    | $V_R = 4\text{ V}$                         | –   | –   | 10  | $\mu\text{A}$ |
| <b>DETECTOR</b> |                                           |        |                                            |     |     |     |               |
| $BV_{CEO}$      | Breakdown Voltage<br>Collector to Emitter | All    | $I_C = 1\text{ mA}$ , $I_F = 0$            | 70  | –   | –   | V             |
| $BV_{ECO}$      | Emitter to Collector                      | All    | $I_E = 0.1\text{ mA}$ , $I_F = 0$          | 7   | –   | –   | V             |
| $I_{CEO}$       | Collector Dark Current                    | All    | $V_{CE} = 70\text{ V}$ , $I_F = 0$         | –   | –   | 100 | nA            |
| $C_{CE}$        | Capacitance                               | All    | $V_{CE} = 0\text{ V}$ , $f = 1\text{ MHz}$ | –   | 5   | –   | pF            |

#### DC TRANSFER CHARACTERISTICS

| Symbol        | Parameter                 | Device   | Test Conditions                             | Min | Typ | Max | Unit |
|---------------|---------------------------|----------|---------------------------------------------|-----|-----|-----|------|
| CTR           | DC Current Transfer Ratio | FODM1007 | $I_F = 5\text{ mA}$ , $V_{CE} = 5\text{ V}$ | 80  | –   | 160 | %    |
|               |                           | FODM1008 |                                             | 130 | –   | 260 |      |
|               |                           | FODM1009 |                                             | 200 | –   | 400 |      |
| $V_{CE(SAT)}$ | Saturation Voltage        | All      | $I_F = 10\text{ mA}$ , $I_C = 1\text{ mA}$  | –   | –   | 0.3 | V    |

#### AC TRANSFER CHARACTERISTICS

| Symbol | Parameter                    | Device | Test Conditions                                                   | Min | Typ | Max  | Unit          |
|--------|------------------------------|--------|-------------------------------------------------------------------|-----|-----|------|---------------|
| $t_r$  | Rise Time<br>(Non-Saturated) | All    | $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\ \Omega$ | –   | 5.7 | 18.0 | $\mu\text{s}$ |
| $t_f$  | Fall Time (Non-Saturated)    | All    | $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\ \Omega$ | –   | 8.5 | 18.0 |               |

#### ISOLATION CHARACTERISTICS

| Symbol    | Parameter                         | Device | Test Conditions                                                                                  | Min   | Typ | Max | Unit          |
|-----------|-----------------------------------|--------|--------------------------------------------------------------------------------------------------|-------|-----|-----|---------------|
| $V_{ISO}$ | Steady State Isolation<br>Voltage | All    | $T_A = 25^\circ\text{C}$ , R.H. < 50%,<br>$t = 1.0\text{ min.}$ , $I_{I-O} \leq 20\ \mu\text{A}$ | 5,000 | –   | –   | $V_{AC(RMS)}$ |

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.

# FODM100x Series

## TYPICAL PERFORMANCE CHARACTERISTICS

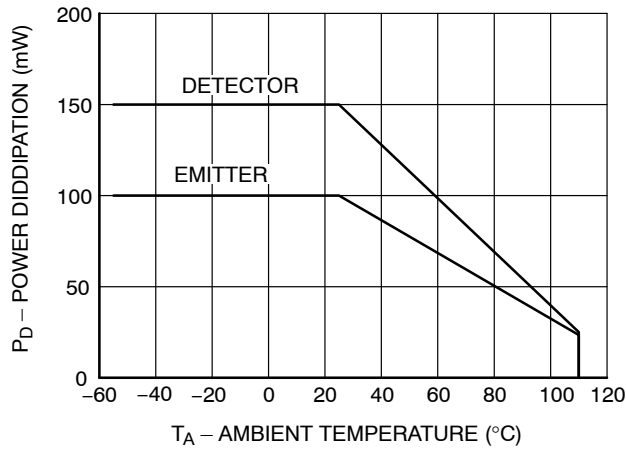


Figure 1. Power Dissipation vs. Ambient Temperature

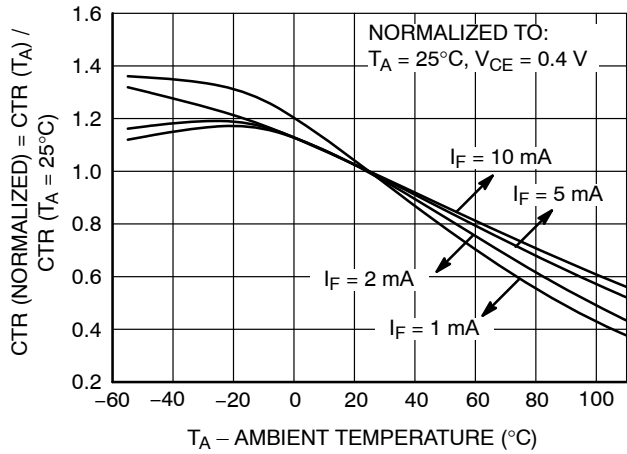


Figure 2. Saturated Normalized Current Transfer Ratio vs. Ambient temperature

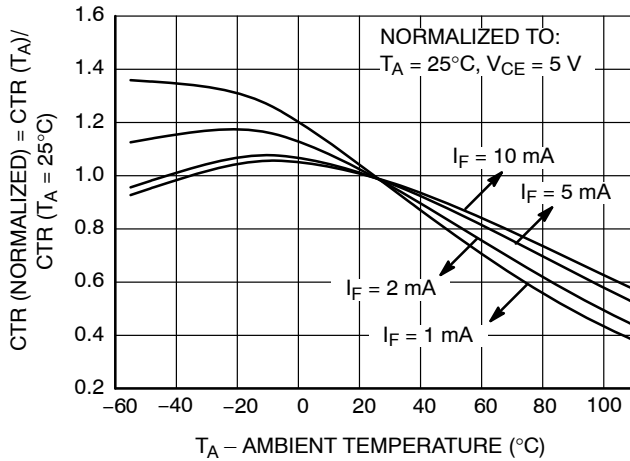


Figure 3. Non-Saturated Normalized Current Transfer Ratio vs. Ambient temperature

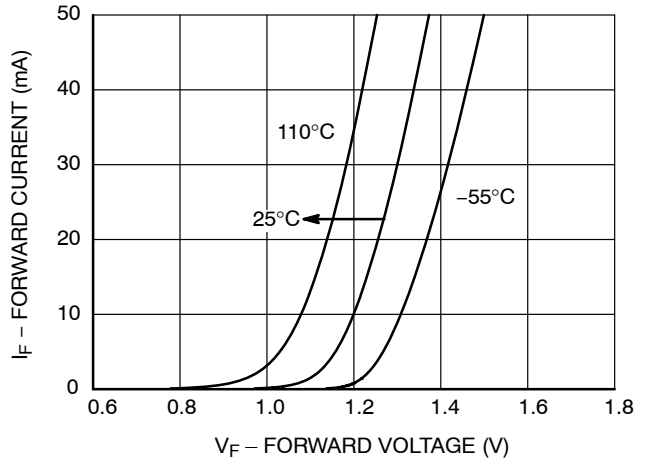


Figure 4. Forward Current vs. Forward Voltage

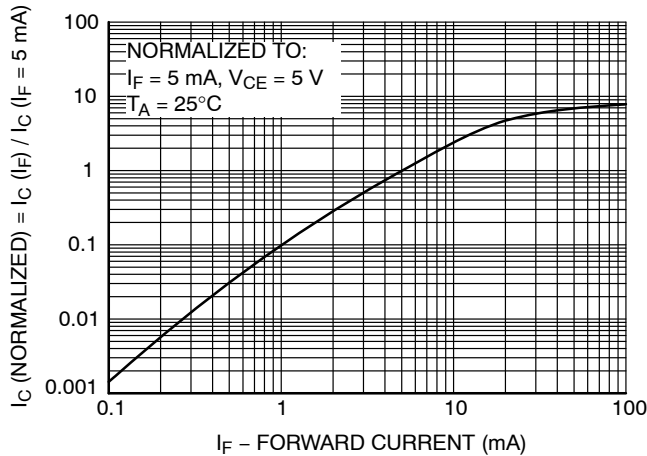


Figure 5. Normalized Current Collector vs. Forward Current

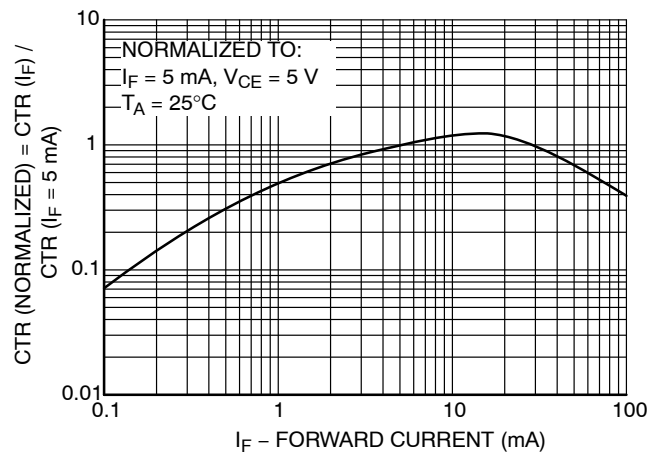
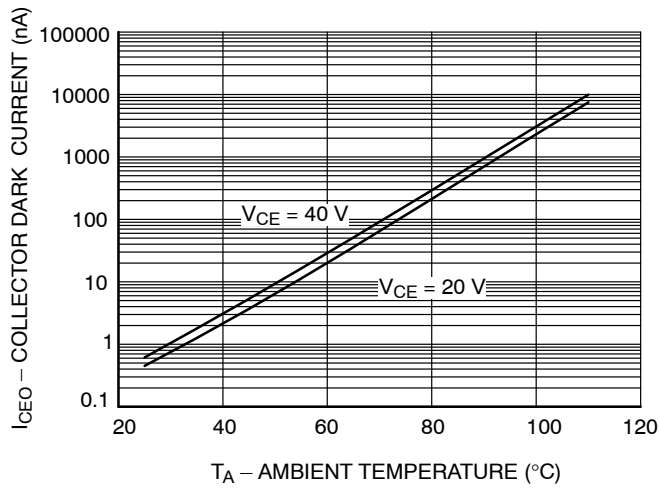


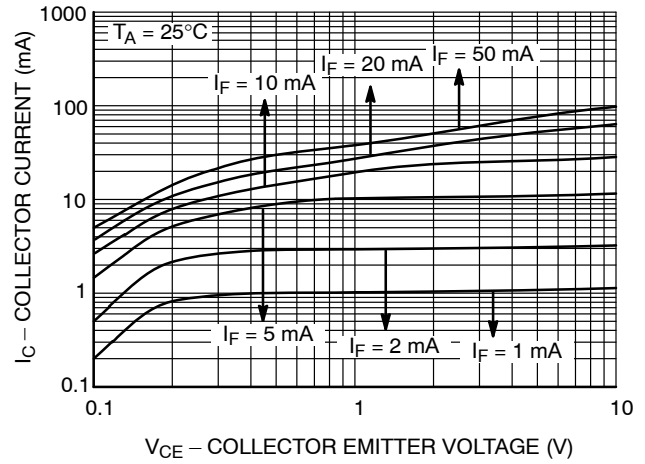
Figure 6. Normalized Current Transfer Ratio vs. Forward Current

# FODM100x Series

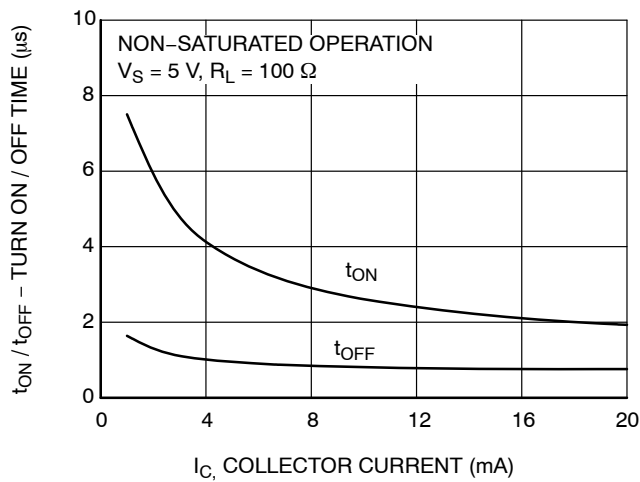
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



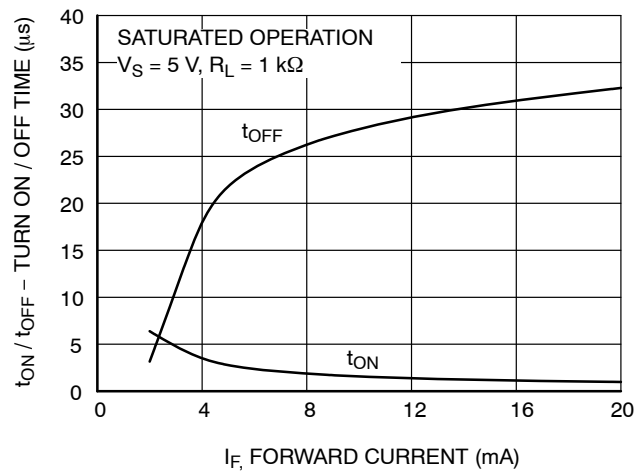
**Figure 7. Collector Dark Current vs. Ambient Temperature**



**Figure 8. Collector Current vs. Collector Emitter Voltage**



**Figure 9. Turn On / Turn Off Time vs. Collector Current**



**Figure 10. Turn On / Turn Off Time vs. Forward Current**

# FODM100x Series

## REFLOW PROFILE

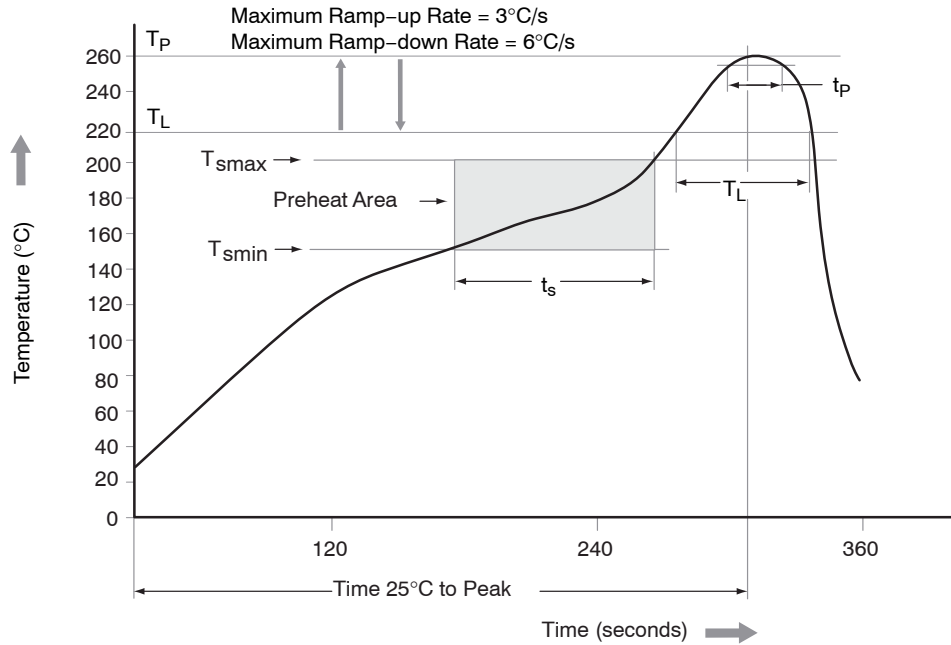


Figure 11. Reflow Profile

Table 1. REFLOW PROFILE

| Profile Feature                                  | Pb-Free Assembly Profile |
|--------------------------------------------------|--------------------------|
| Temperature Minimum ( $T_{smin}$ )               | 150°C                    |
| Temperature Maximum ( $T_{smax}$ )               | 200°C                    |
| Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ ) | 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                    | 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 maximum       |
| Time 25°C to Peak Temperature                    | 8 minutes maximum        |

## FODM100x Series

### ORDERING INFORMATION

| Part Number | Package                                                 | Shipping <sup>†</sup> |
|-------------|---------------------------------------------------------|-----------------------|
| FODM1007    | Stretched Body SOP 4-Pin                                | 100 Units / Tube      |
| FODM1007R2  | Stretched Body SOP 4-Pin                                | 3000 / Tape & Reel    |
| FODM1007V   | Stretched Body SOP 4-Pin,<br>DIN EN/IEC60747-5-5 Option | 100 Units / Tube      |
| FODM1007R2V | Stretched Body SOP 4-Pin,<br>DIN EN/IEC60747-5-5 Option | 3000 / Tape & Reel    |

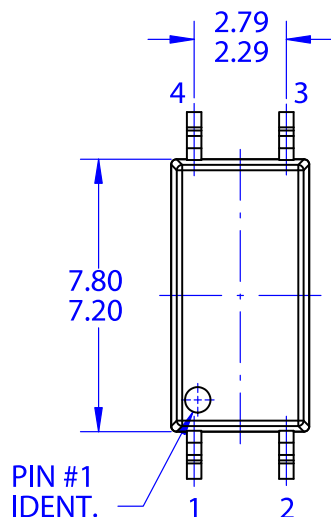
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

NOTE: The product orderable part number system listed in this table also applies to the FODM1008, FODM1009 products.

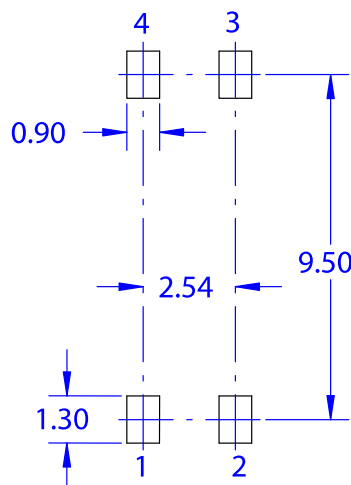
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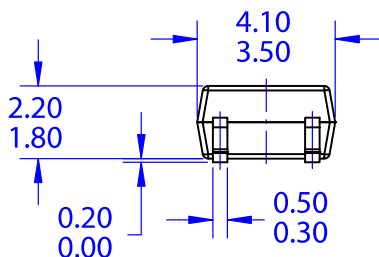
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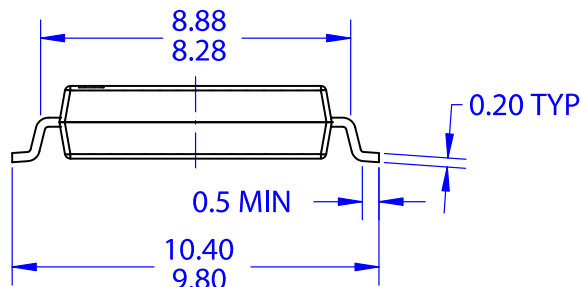
TOP VIEW



LAND PATTERN RECOMMENDATION



FRONT VIEW



SIDE VIEW

#### NOTES:

- A. NO INDUSTRY STANDARD APPLIES TO THIS PACKAGE
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS

|                  |                |                                                                                                                                                                                     |
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