

# FODM352

## Product Preview

# Photodarlington Optocoupler with a Base-Emitter Resistor in a 4-Pin Full Pitch Mini-Flat Package

### Description

The FODM352 consists of one gallium arsenide (GaAs) infrared light emitting diode, optically coupled to a photodarlington output with a base-emitter resistor, in a compact, mini-flat, 4-pin package. The input-output isolation voltage,  $V_{ISO}$ , is rated at 3,750 VAC<sub>RMS</sub>.

### Features

- Current Transfer Ratio Min 1000% at  $I_F = 1 \text{ mA}$ ,  $V_{CE} = 2 \text{ V}$ ,  $T_A = 25^\circ\text{C}$
- Safety and Regulatory Approvals:
  - UL1577, 3750 VAC<sub>RMS</sub> for 1 min
  - DIN EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage
- Applicable to Infrared Reflow, 260°C

### Typical Applications

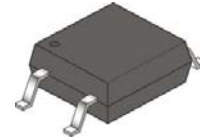
- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs
- Programmable Controllers

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.



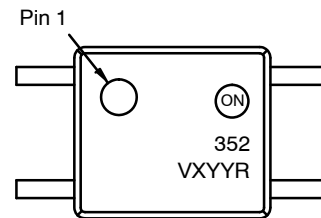
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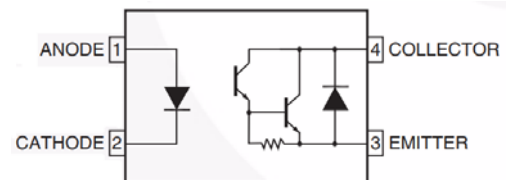
MFP4  
CASE 100AP

### MARKING DIAGRAM



|     |                              |
|-----|------------------------------|
| 352 | = Specific Device Code       |
| V   | = DIN EN/IEC60747-5-5 Option |
| X   | = One-Digit Year Code        |
| YY  | = Work Week                  |
| R   | = Assembly Package Code      |

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# FODM352

**Table 1. SAFETY AND INSULATIONS RATING** 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   |                        | 55/110/21       |
| 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   | 6,000             | 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 (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.

**Table 2. ABSOLUTE MAXIMUM RATINGS** (Note 2) T<sub>A</sub> = 25°C unless otherwise specified.

| Symbol           | Parameter   | Value          | Units |
|------------------|---|----------------|-------|
| T <sub>STG</sub> | Storage Temperature   | -55 to +150    | °C    |
| T <sub>OPR</sub> | Operating Temperature   | -55 to +110    | °C    |
| T <sub>J</sub>   | Junction Temperature  | -55 to +125    | °C    |
| T <sub>SOL</sub> | Lead Solder Temperature (Refer to Reflow Temperature Profile) | 260 for 10 sec | °C    |

## EMITTER

|                         |                            |    |    |
|-------------------------|----------------------------|----|----|
| I <sub>F(average)</sub> | Continuous Forward Current | 50 | mA |
| V <sub>R</sub>          | Reverse Input Voltage      | 6  | V  |
| PD <sub>LED</sub>       | Power Dissipation (Note 3) | 70 | mW |

## DETECTOR

|                         |                                      |     |    |
|-------------------------|--------------------------------------|-----|----|
| I <sub>C(average)</sub> | Continuous Collector Current         | 150 | mA |
| V <sub>CEO</sub>        | Collector-Emitter Voltage            | 300 | V  |
| V <sub>ECO</sub>        | Emitter-Collector Voltage            | 0.1 | V  |
| PD <sub>C</sub>         | Collector Power Dissipation (Note 3) | 150 | mW |

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. 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.

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

# FODM352

**Table 3. ELECTRICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol         | Parameter            | Conditions                         | Min | Typ | Max | Units         |
|----------------|----------------------|------------------------------------|-----|-----|-----|---------------|
| <b>EMITTER</b> |                      |                                    |     |     |     |               |
| $V_F$          | Forward Voltage      | $I_F = 10\text{ mA}$               |     | 1.2 | 1.4 | V             |
| $I_R$          | Reverse Current      | $V_R = 4\text{ V}$                 |     |     | 10  | $\mu\text{A}$ |
| $C_T$          | Terminal Capacitance | $V = 0\text{ V}, f = 1\text{ kHz}$ |     | 30  | 250 | pF            |

**DETECTOR**

|            |                                     |  |     |  |     |    |
|------------|-------------------------------------|--|-----|--|-----|----|
| $BV_{CEO}$ | Collector–Emitter Breakdown Voltage | $I_C = 0.1\text{ mA}, I_F = 0\text{ mA}$   | 300 |  |     | V  |
| $BV_{ECO}$ | Emitter–Collector Breakdown Voltage | $I_E = 10\ \mu\text{A}, I_F = 0\text{ mA}$ | 0.1 |  |     | V  |
| $I_{CEO}$  | Collector Dark Current              | $V_{CE} = 200\text{ V}, I_F = 0\text{ mA}$ |     |  | 200 | nA |

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.

**Table 4. TRANSFER CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol        | Parameter                            | Conditions                                | Min  | Typ  | Max | Units |
|---------------|--------------------------------------|---|------|------|-----|-------|
| $I_C$         | Collector Current                    | $I_F = 1\text{ mA}, V_{CE} = 2\text{ V}$  | 10   |      |     | mA    |
| CTR           | Current Transfer Ratio               | $I_F = 1\text{ mA}, V_{CE} = 2\text{ V}$  | 1000 | 5000 |     | %     |
| $V_{CE(SAT)}$ | Collector–Emitter Saturation Voltage | $I_F = 20\text{ mA}, I_C = 100\text{ mA}$ |      |      | 1.2 | V     |

**Table 5. SWITCHING CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol | Parameter                   | Conditions   | Min | Typ | Max | Units         |
|--------|-----------------------------|--|-----|-----|-----|---------------|
| $t_R$  | Output Rise Time (10% –90%) | $I_F = 20\text{ mA}, V_{CC} = 2\text{ V}, R_L = 100\ \Omega$ |     | 20  | 100 | $\mu\text{s}$ |
| $t_F$  | Output Fall Time (90% –10%) | $I_F = 20\text{ mA}, V_{CC} = 2\text{ V}, R_L = 100\ \Omega$ |     | 100 | 300 | $\mu\text{s}$ |

**Table 6. ISOLATION CHARACTERISTICS**

| Symbol    | Parameter                      | Conditions  | Min                | Typ | Max | Units          |
|-----------|--------------------------------|---|--------------------|-----|-----|----------------|
| $V_{ISO}$ | Input–Output Isolation Voltage | Freq = 60 Hz, $t = 1.0\text{ min}, I_{I-O} \leq 10\ \mu\text{A}$ (Notes 4, 5) | 3,750              |     |     | $V_{AC_{RMS}}$ |
| $R_{ISO}$ | Isolation Resistance           | $V_{I-O} = 500\text{ V}$ (Note 4)   | $5 \times 10^{10}$ |     |     | $\Omega$       |
| $C_{ISO}$ | Isolation Capacitance          | Frequency = 1 MHz   |                    | 0.6 | 1.0 | pF             |

4. Device is considered a two terminal device: Pin 1 and 2 are shorted together and Pins 3 and 4 are shorted together.

5. 3,750  $V_{AC_{RMS}}$  for 1 minute duration is equivalent to 4,500  $V_{AC_{RMS}}$  for 1 second duration.

**ORDERING INFORMATION**

| Part Number | Package  | Packing Method             |
|-------------|--|----------------------------|
| FODM352     | SOP 4–Pin  | Tube (100 units)           |
| FODM352R2   | SOP 4–Pin  | Tape and Reel (2500 units) |
| FODM352V    | SOP 4–Pin, DIN EN/IEC60747–5–5 Option (pending approval) | Tube (100 units)           |
| FODM352R2V  | SOP 4–Pin, DIN EN/IEC60747–5–5 Option (pending approval) | Tape and Reel (2500 units) |

†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.

TYPICAL CHARACTERISTICS

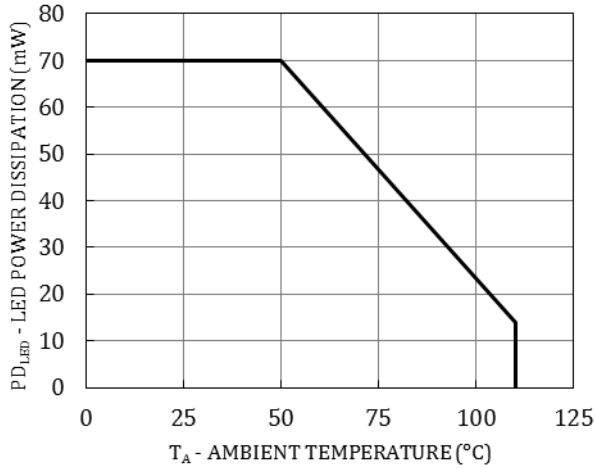


Figure 1. LED Power Dissipation vs. Ambient Temperature

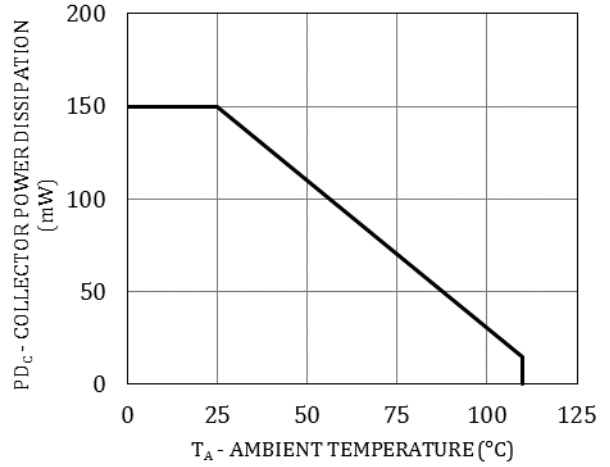


Figure 2. Collector Power Dissipation vs. Ambient Temperature

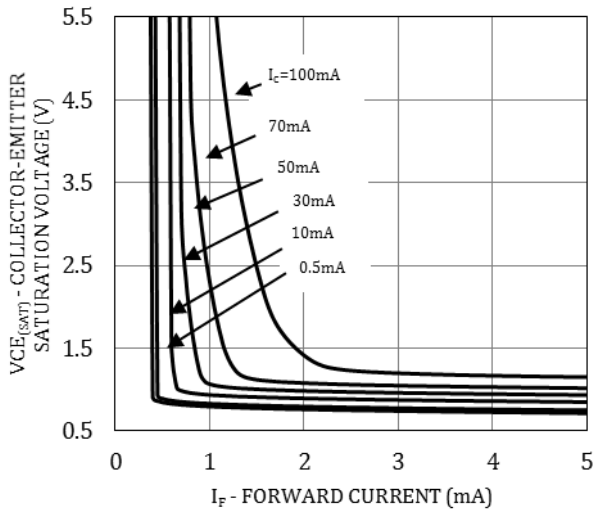


Figure 3. Collector Emitter Saturation Voltage vs. Forward Current

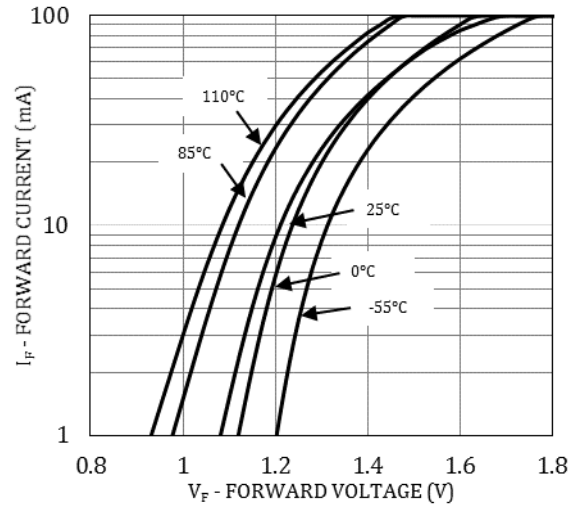


Figure 4. Forward Current vs. Forward Voltage

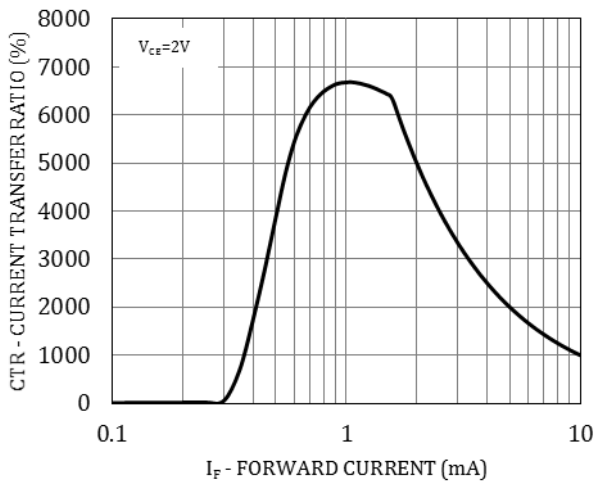


Figure 5. Current Transfer Ratio vs. Forward Current

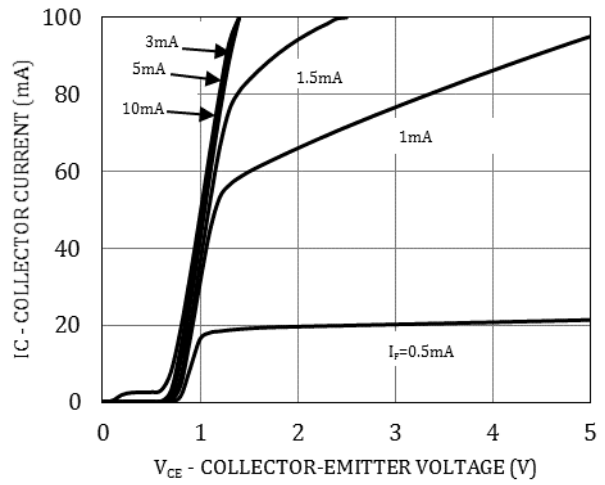


Figure 6. Collector Current vs. Collector Emitter Voltage

TYPICAL CHARACTERISTICS

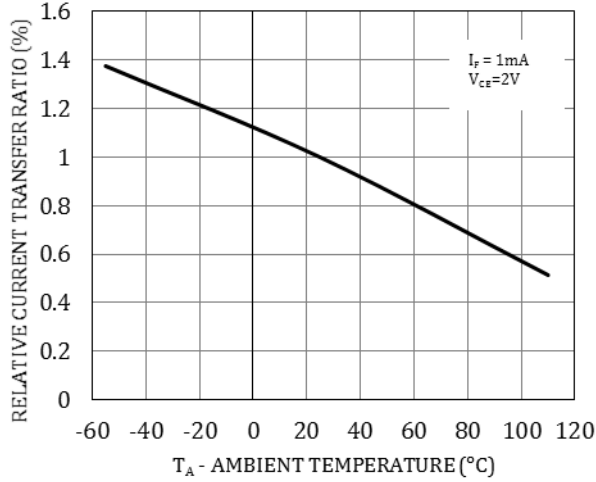


Figure 7. Relative Current Transfer Ratio vs. Ambient Temperature

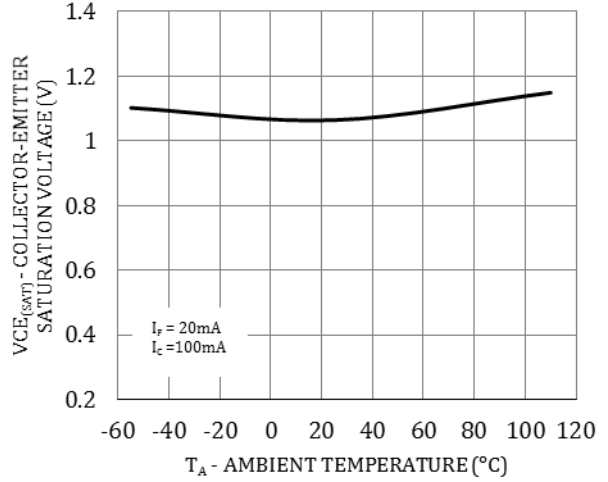


Figure 8. Collector Emitter Saturation Voltage vs. Ambient Temperature

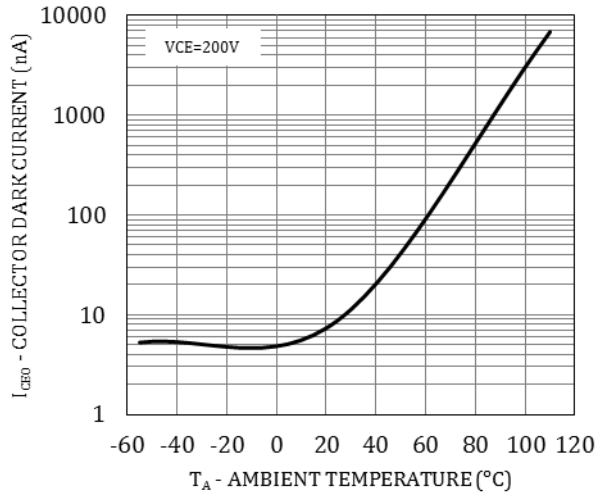


Figure 9. Collector Dark Current vs. Ambient Temperature

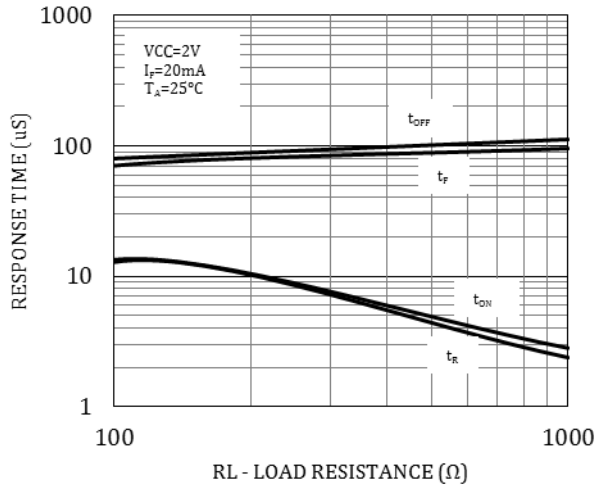


Figure 10. Response Time vs. Load Resistance

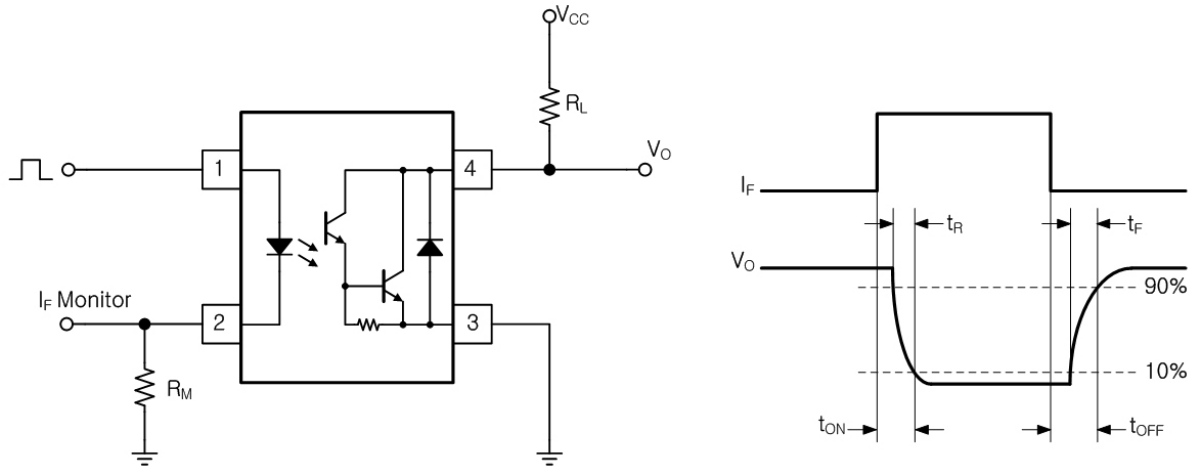


Figure 11. Test Circuit for Switching Time

REFLOW PROFILE

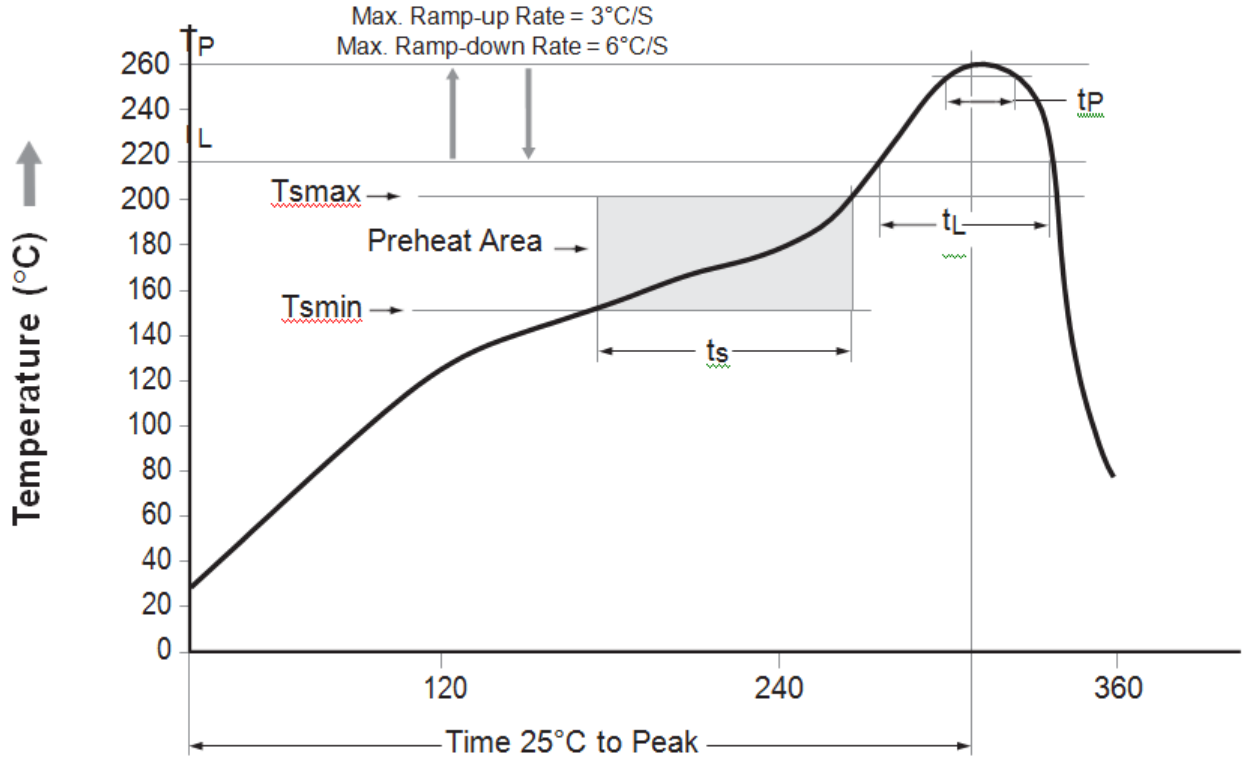


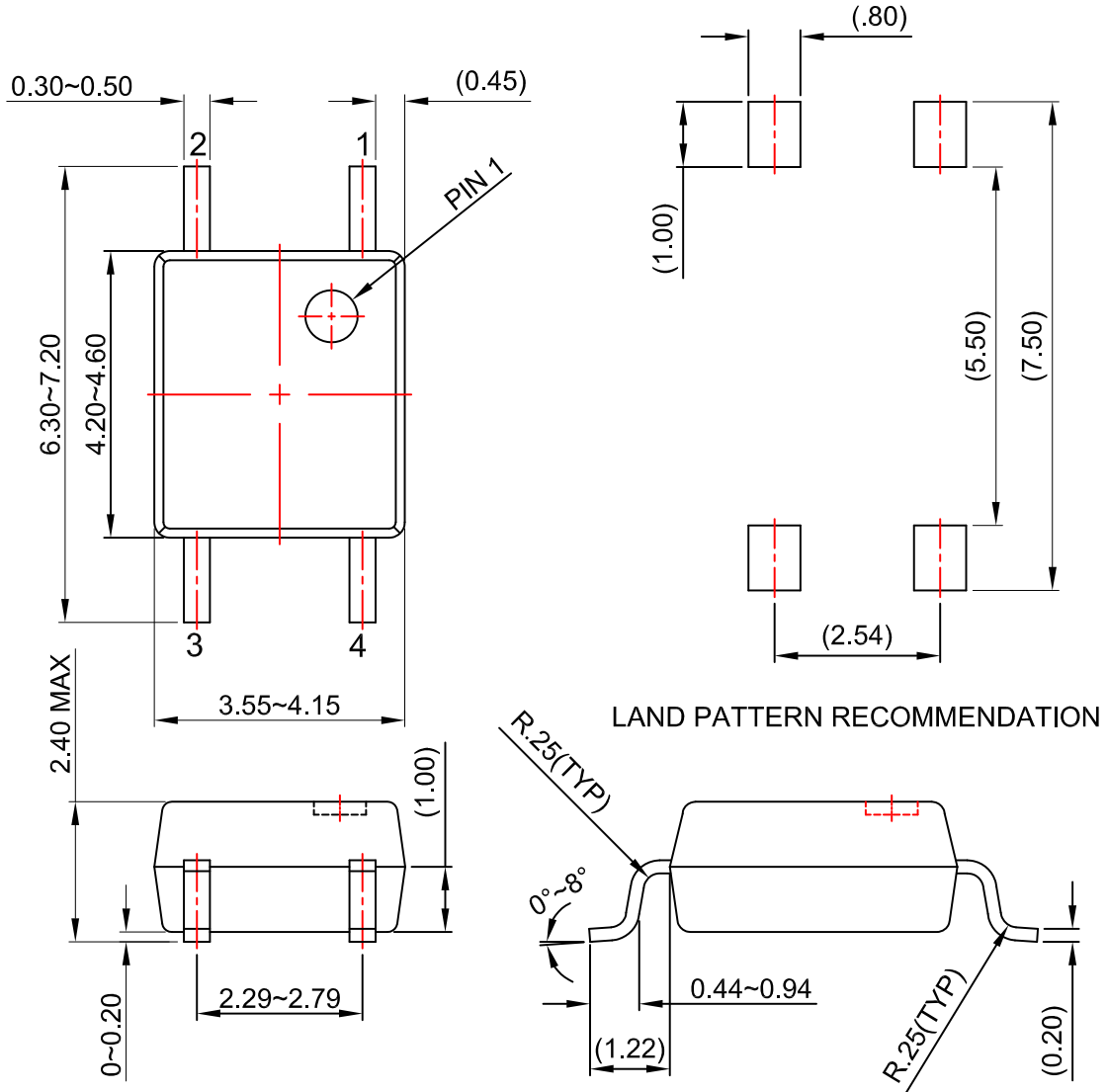
Figure 12. Reflow Profile

| Profile Feature   | Pb-Free Assembly Profile |
|---|--------------------------|
| Temperature Min. (T <sub>smín</sub> )                                 | 150°C                    |
| Temperature Max. (T <sub>smáx</sub> )                                 | 200°C                    |
| Time (t <sub>s</sub> ) from (T <sub>smín</sub> to T <sub>smáx</sub> ) | 60–120 seconds           |
| Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )                      | 3°C/second max.          |
| Liquidous Temperature (T <sub>L</sub> )                               | 217°C                    |
| Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )             | 60–150 seconds           |
| Peak Body Package Temperature   | 260°C +0°C / -5°C        |
| Time (t <sub>P</sub> ) within 5°C of 260°C                            | 30 seconds               |
| Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )                    | 6°C/second max.          |
| Time 25°C to Peak Temperature   | 8 minutes max.           |

# FODM352


## PACKAGE DIMENSIONS

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



### 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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