

# 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

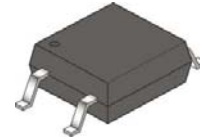
- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs
- Programmable Controllers

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



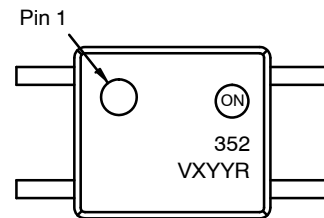
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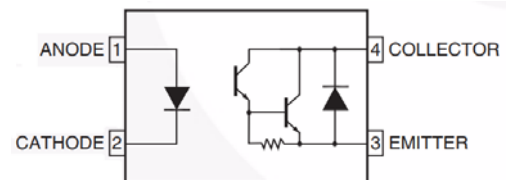
MFP4  
CASE 100AP

### 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
P <sub>DLED</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
P <sub>DC</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

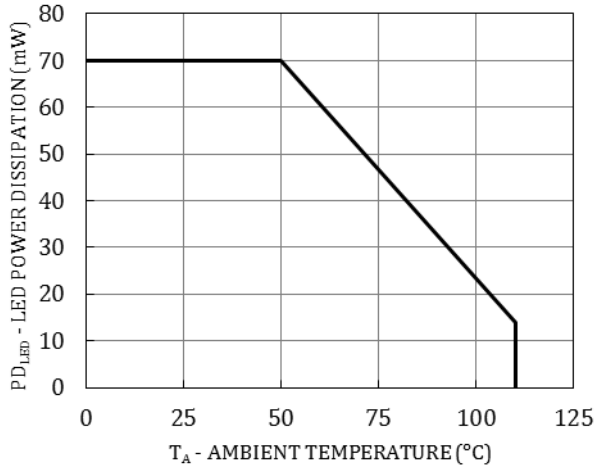


Figure 1. LED Power Dissipation vs. Ambient Temperature

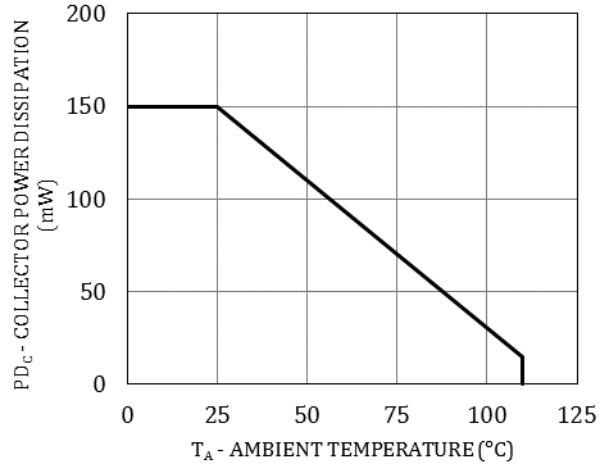


Figure 2. Collector Power Dissipation vs. Ambient Temperature

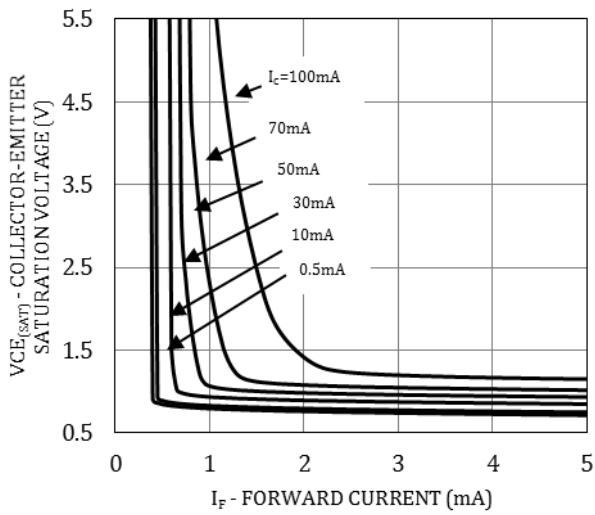


Figure 3. Collector Emitter Saturation Voltage vs. Forward Current

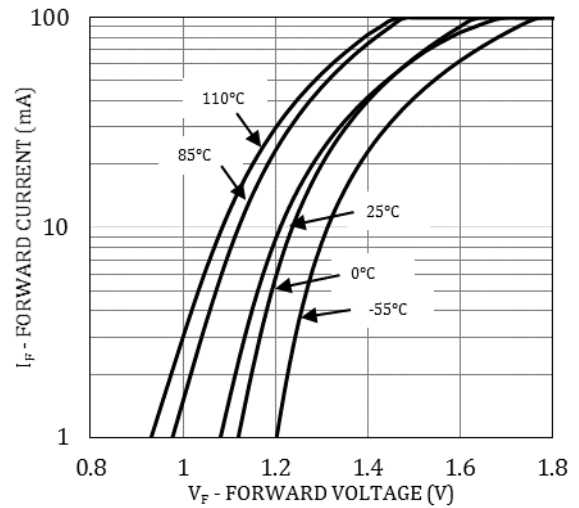


Figure 4. Forward Current vs. Forward Voltage

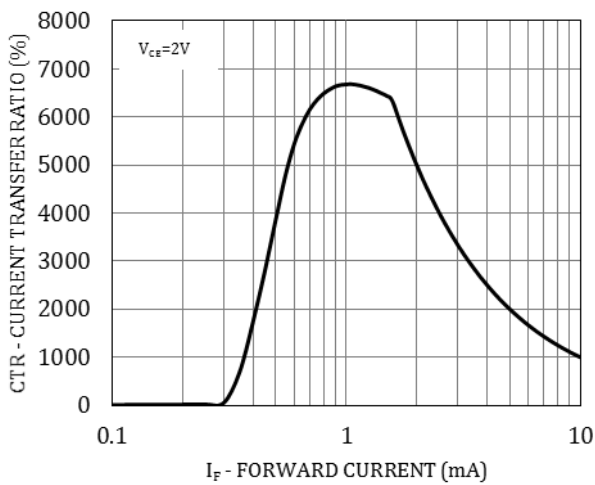


Figure 5. Current Transfer Ratio vs. Forward Current

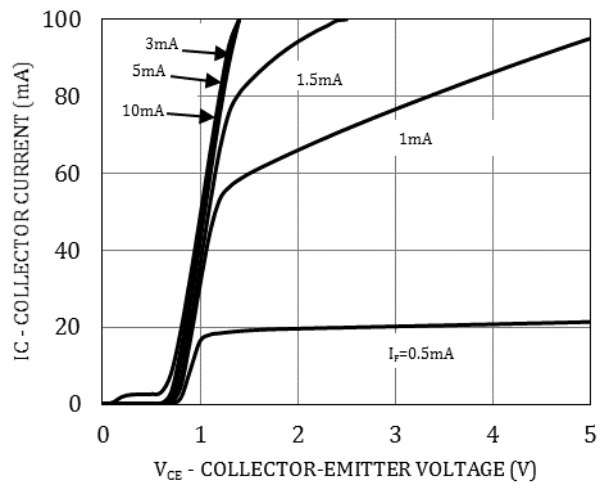


Figure 6. Collector Current vs. Collector Emitter Voltage

TYPICAL CHARACTERISTICS

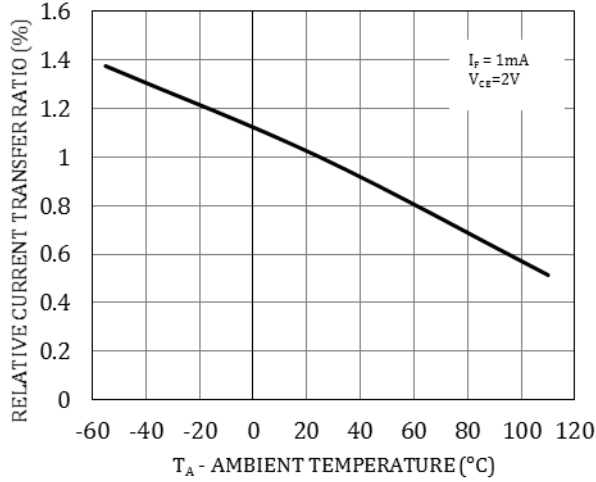


Figure 7. Relative Current Transfer Ratio vs. Ambient Temperature

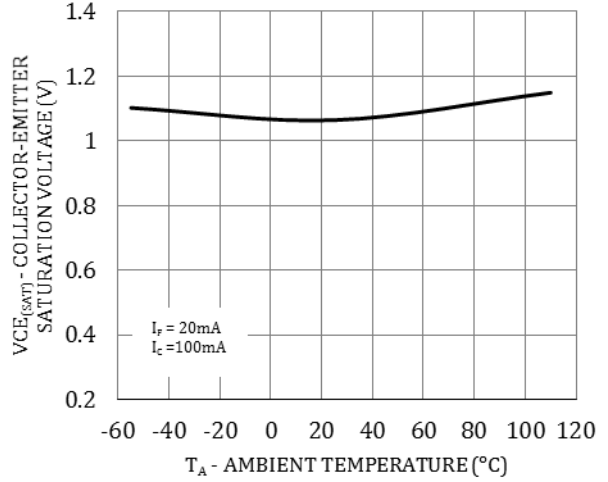


Figure 8. Collector Emitter Saturation Voltage vs. Ambient Temperature

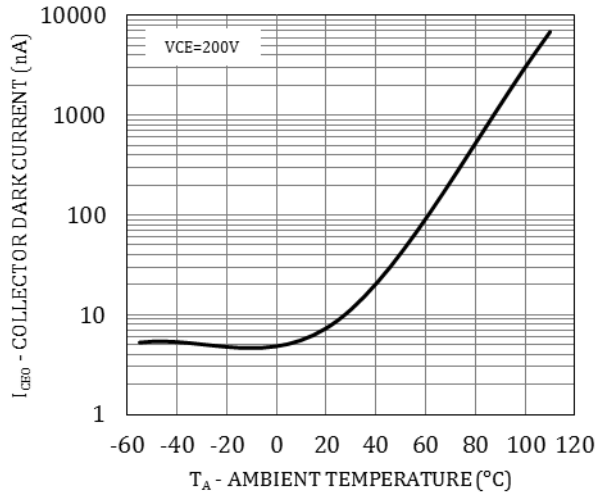


Figure 9. Collector Dark Current vs. Ambient Temperature

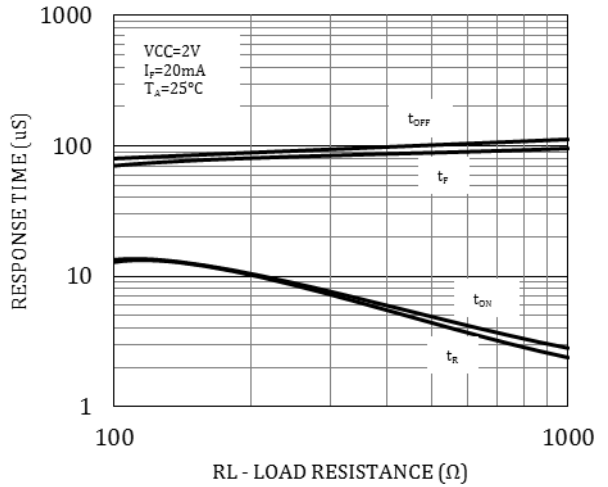


Figure 10. Response Time vs. Load Resistance

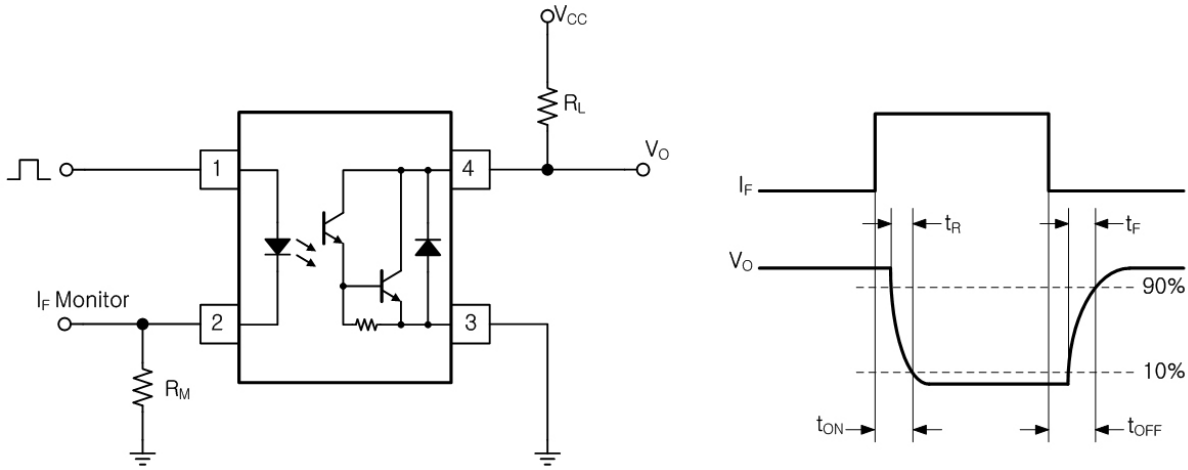


Figure 11. Test Circuit for Switching Time

REFLOW PROFILE

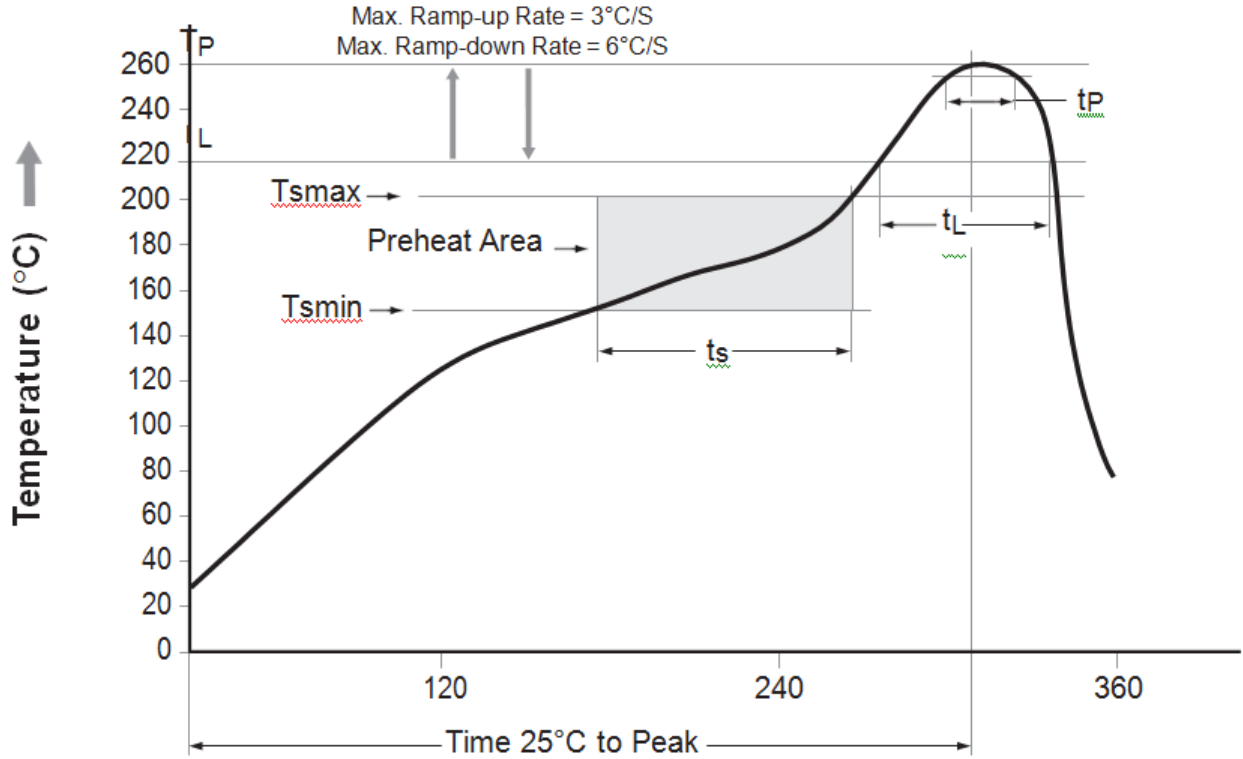


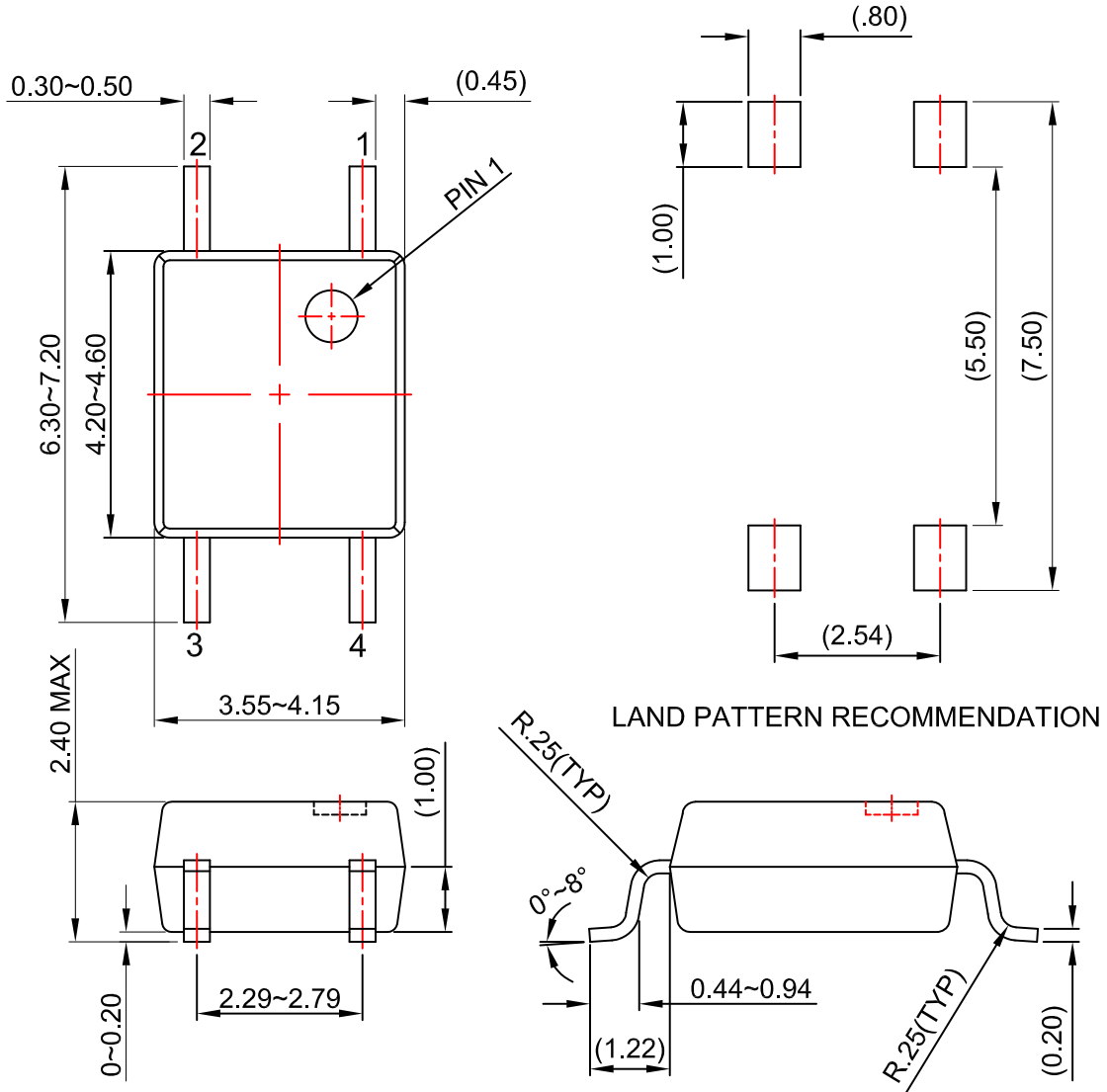
Figure 12. Reflow Profile

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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