

# Single Channel, AC/DC Sensing Input, Phototransistor Optocoupler In Half-Pitch Mini-Flat 4-Pin Package



MFP4 2.5x4.4, 1.27P  
CASE 100AL

## FODM214, FODM217 Series

The FODM217 series consist of a gallium arsenide infrared emitting diode driving a phototransistor. The FODM214 series consist of two gallium arsenide infrared emitting diodes connected in inverse parallel for AC operation. Both were built in a compact, half-pitch, mini-flat, 4-pin package. The lead pitch is 1.27 mm.

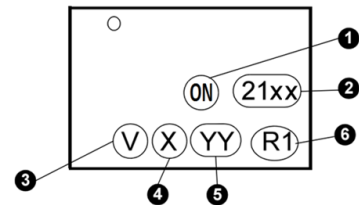
### Features

- Current Transfer Ratio Ranges from 20 to 600%
  - at  $I_F = \pm 1 \text{ mA}$ ,  $V_{CE} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ 
    - ◆ FODM214 – 20 to 400%
    - ◆ FODM214A – 50 to 250%
  - at  $I_F = 5 \text{ mA}$ ,  $V_{CE} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ 
    - ◆ FODM217A – 80 to 160%
    - ◆ FODM217B – 130 to 260%
    - ◆ FODM217C – 200 to 400%
    - ◆ FODM217D – 300 to 600%
- 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 Ray Reflow, 260°C

### Typical Applications

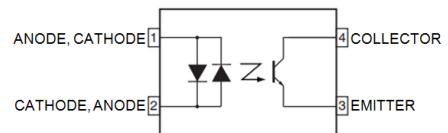
- Primarily Suited for DC-DC Converters
- For Ground Loop Isolation, Signal to Noise Isolation
- Communications – Adapters, Chargers
- Consumer – Appliances, Set Top Boxes
- Industrial – Power Supplies, Motor Control, Programmable Logic Control

### MARKING DIAGRAM

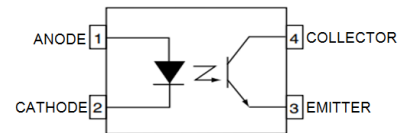


1. ON = Corporate Logo
2. 21xx = Device Number
3. V = DIN EN/IEC60747-5-5 Option
4. X = One-Digit Year Code
5. YY = Digit Work Week
6. R1 = Assembly Package Code

### PIN CONNECTIONS



FODM214



FODM217

### ORDERING INFORMATION

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

# FODM214, FODM217 Series

## 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	4,000	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.

## ABSOLUTE MAXIMUM RATINGS (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
I <sub>F(peak)</sub>	Peak Forward Current (1 μs pulse, 300 pps)	1	A
V <sub>R</sub>	Reverse Input Voltage	6	V
PD <sub>LED</sub>	Power Dissipation (Note 2)	70	mW

### DETECTOR

I <sub>C(average)</sub>	Continuous Collector Current	50	mA
V <sub>CEO</sub>	Collector-Emitter Voltage	80	V
V <sub>ECO</sub>	Emitter-Collector Voltage	7	V
PD <sub>C</sub>	Collector Power Dissipation (Note 2)	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. Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.

# FODM214, FODM217 Series

## ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Device	Conditions	Min.	Typ.	Max.	Units
<b>EMITTER</b>							
$V_F$	Forward Voltage	FODM214	$I_F = \pm 20 \text{ mA}$		1.2	1.4	V
		FODM217	$I_F = 20 \text{ mA}$				
$I_R$	Reverse Current	FODM217	$V_R = 4 \text{ V}$			10	$\mu\text{A}$
$C_T$	Terminal Capacitance	All	$V = 0 \text{ V}, f = 1 \text{ kHz}$		30	250	pF

## DETECTOR

$BV_{CEO}$	Collector-Emitter Breakdown Voltage	All	$I_C = 0.1 \text{ mA}, I_F = 0 \text{ mA}$	80			V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	All	$I_E = 10 \mu\text{A}, I_F = 0 \text{ mA}$	7			V
$I_{CEO}$	Collector Dark Current	All	$V_{CE} = 50 \text{ V}, I_F = 0 \text{ mA}$			100	nA

## TRANSFER CHARACTERISTICS $T_A = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Device	Conditions	Min.	Typ.	Max.	Units
$CTR_{CE}$	Current Transfer Ratio (collector-emitter)	FODM214	$I_F = \pm 1 \text{ mA}, V_{CE} = 5 \text{ V}$	20		400	%
		FODM214A		50		250	
		FODM217A	$I_F = 5 \text{ mA}, V_{CE} = 5 \text{ V}$	80		160	
		FODM217B		130		260	
		FODM217C		200		400	
		FODM217D		300		600	
$I_C$	Collector Current	FODM214	$I_F = \pm 1 \text{ mA}, V_{CE} = 5 \text{ V}$	0.2		2.5	mA
		FODM217	$I_F = 5 \text{ mA}, V_{CE} = 5 \text{ V}$	4		30	
$CTR_{(SAT)}$	Saturated Current Transfer Ratio	FODM214	$I_F = \pm 8 \text{ mA}, V_{CE} = 0.4 \text{ V}$		60		%
		FODM217	$I_F = 8 \text{ mA}, V_{CE} = 0.4 \text{ V}$				
$I_{C(SAT)}$	Collector Current	FODM214	$I_F = \pm 8 \text{ mA}, V_{CE} = 0.4 \text{ V}$		4.8		mA
		FODM217	$I_F = 8 \text{ mA}, V_{CE} = 0.4 \text{ V}$				
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	FODM214	$I_F = \pm 8 \text{ mA}, I_C = 2.4 \text{ mA}$			0.4	V
		FODM217	$I_F = 8 \text{ mA}, I_C = 2.4 \text{ mA}$				

## SWITCHING CHARACTERISTICS $T_A = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$t_{ON}$	Turn On Time	$I_C = 2 \text{ mA}, V_{CE} = 10 \text{ V}, R_L = 100 \Omega$		3		$\mu\text{s}$
$t_{OFF}$	Turn Off Time	$I_C = 2 \text{ mA}, V_{CE} = 10 \text{ V}, R_L = 100 \Omega$		3		$\mu\text{s}$
$t_R$	Output Rise Time (10%-90%)	$I_C = 2 \text{ mA}, V_{CE} = 10 \text{ V}, R_L = 100 \Omega$		3		$\mu\text{s}$
$t_F$	Output Fall Time (90%-10%)	$I_C = 2 \text{ mA}, V_{CE} = 10 \text{ V}, R_L = 100 \Omega$		3		$\mu\text{s}$

## ISOLATION CHARACTERISTICS

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

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

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

# FODM214, FODM217 Series

## TYPICAL CHARACTERISTICS

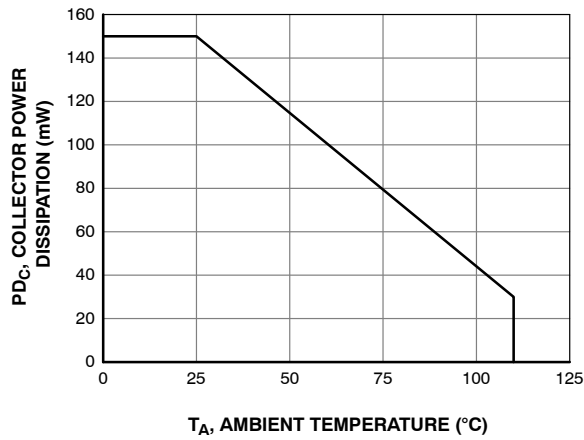


Figure 1. Collector Power Dissipation vs. Ambient Temperature

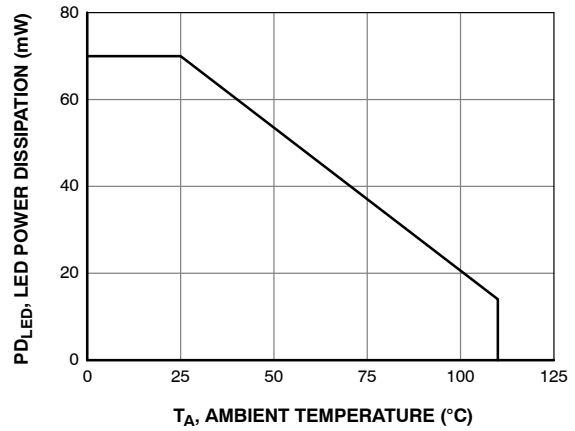


Figure 2. LED Power Dissipation vs. Ambient Temperature

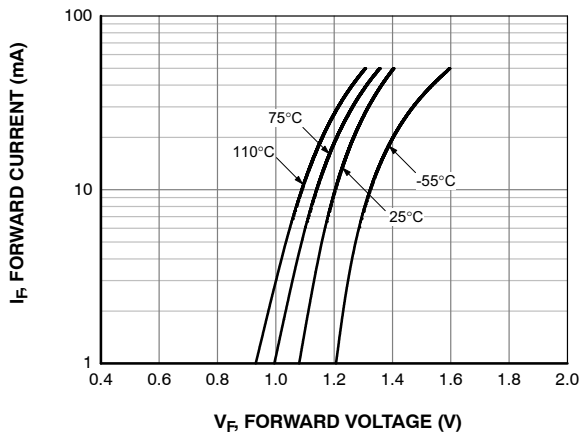


Figure 3. Forward Current vs. Forward Voltage

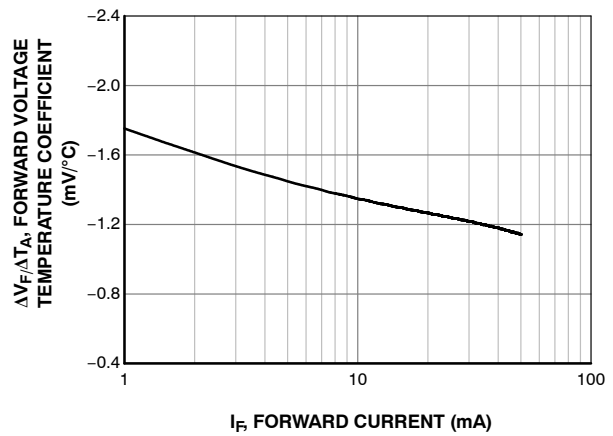


Figure 4. Forward Voltage Temperature Coefficient vs. Forward Current

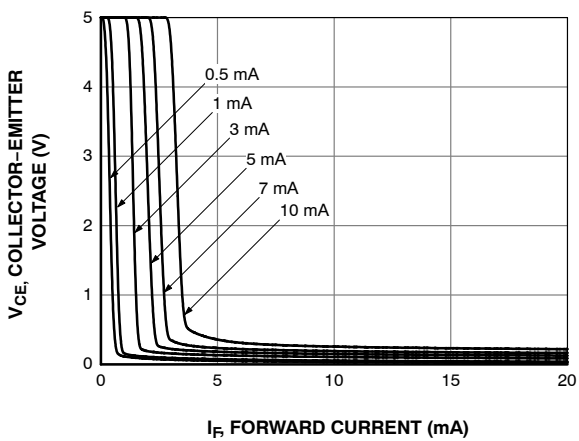


Figure 5. Collector Emitter Voltage vs. Forward Current

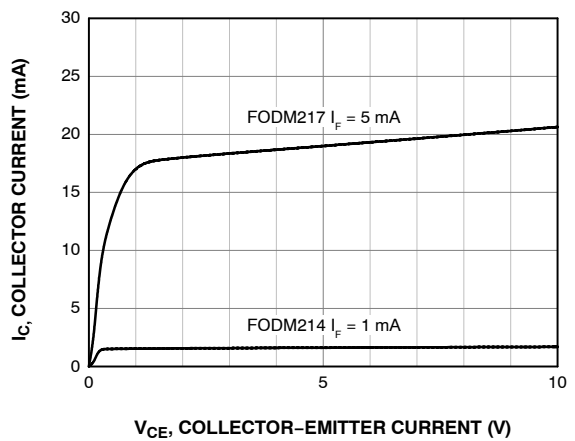
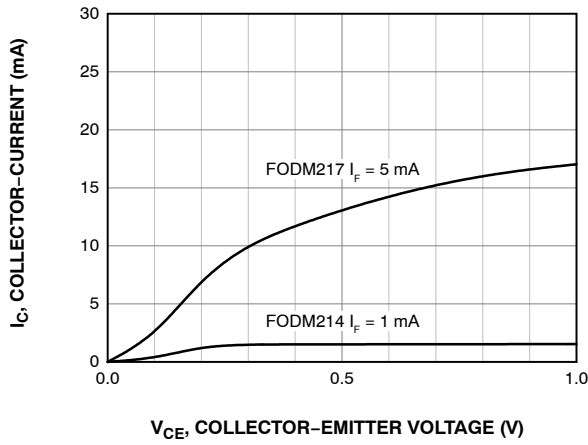
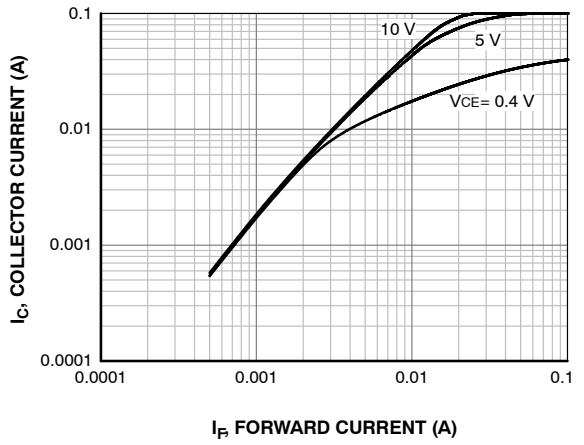


Figure 6. Collector Current vs. Collector-Emitter Voltage

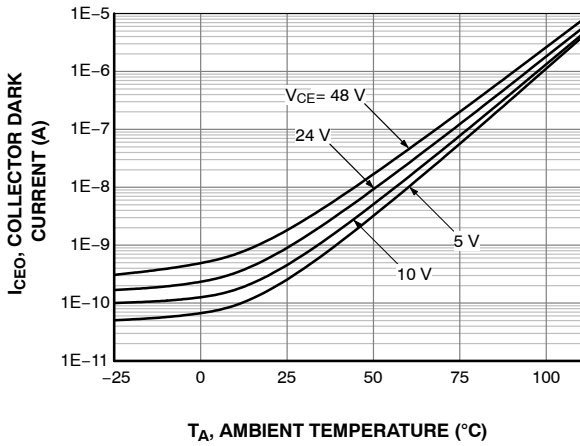
# FODM214, FODM217 Series



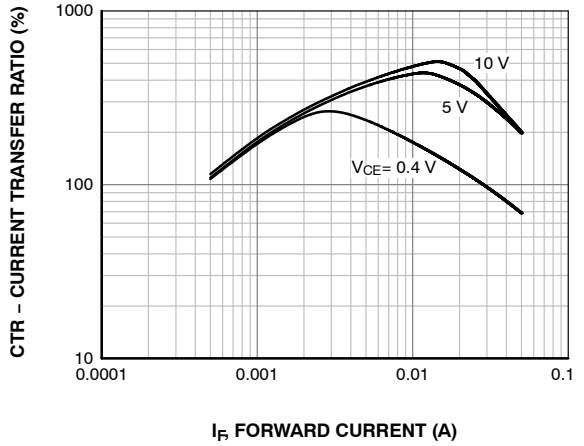
**Figure 7. Collector Current vs. Small Collector-Emitter Voltage**



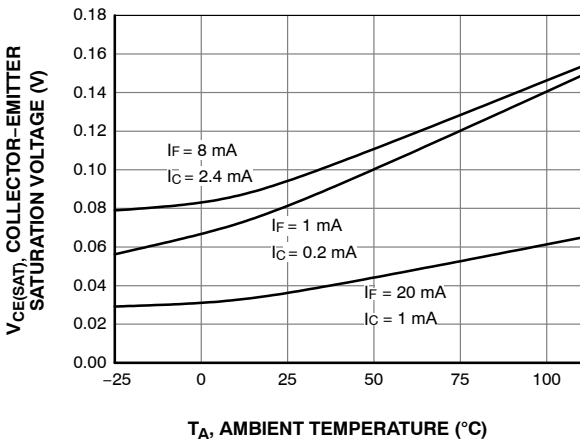
**Figure 8. Collector Current vs. Forward Current**



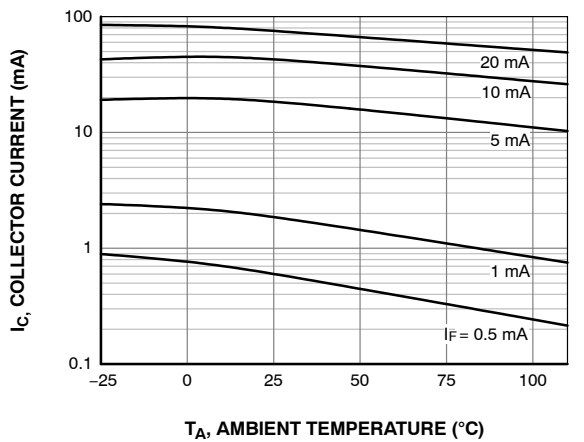
**Figure 9. Collector Dark Current vs. Ambient Temperature**



**Figure 10. Current Transfer Ratio vs. Forward Current**



**Figure 11. Collector-Emitter Saturation vs. Ambient Temperature**



**Figure 12. Collector Current vs. Ambient Temperature**

# FODM214, FODM217 Series

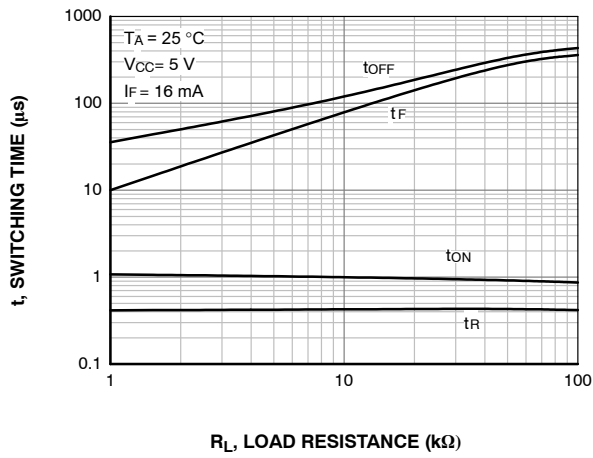


Figure 13. Switching Time vs. Load Resistance

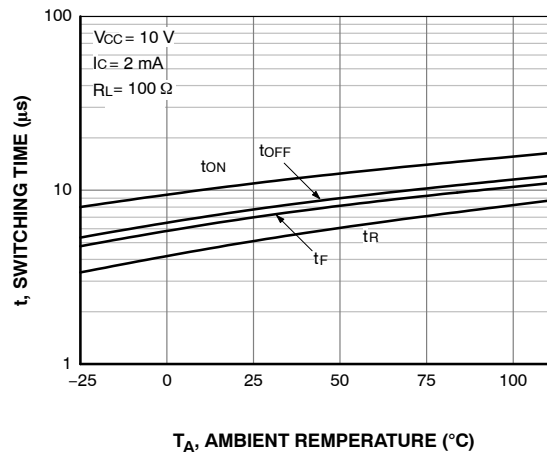


Figure 14. Switching Time vs. Ambient Temperature

## TEST CIRCUIT

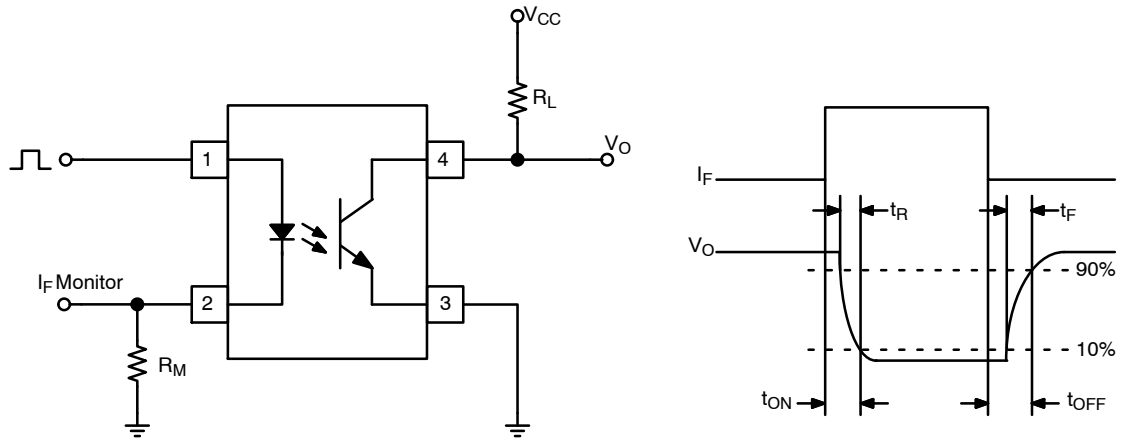


Figure 15. Test Circuit for Switching Time

# FODM214, FODM217 Series

## REFLOW PROFILE

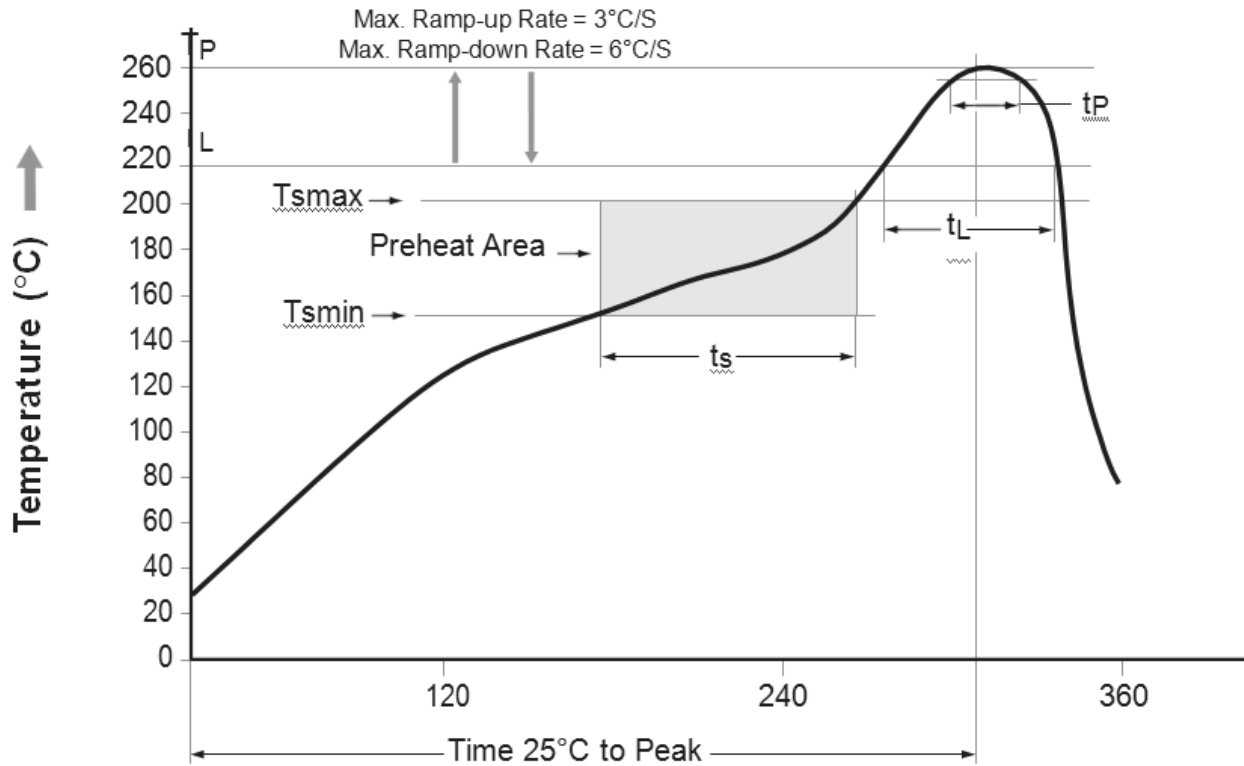


Figure 16. Reflow Profile

Profile Feature	Pb-Free Assembly Profile
Temperature Min. ( $T_{smin}$ )	150°C
Temperature Max. ( $T_{smax}$ )	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 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.

### ORDERING INFORMATION (Note 5)

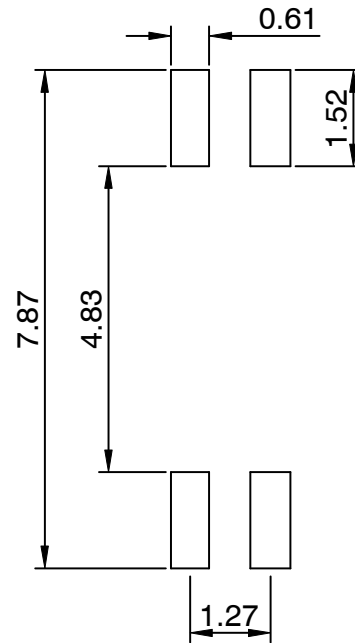
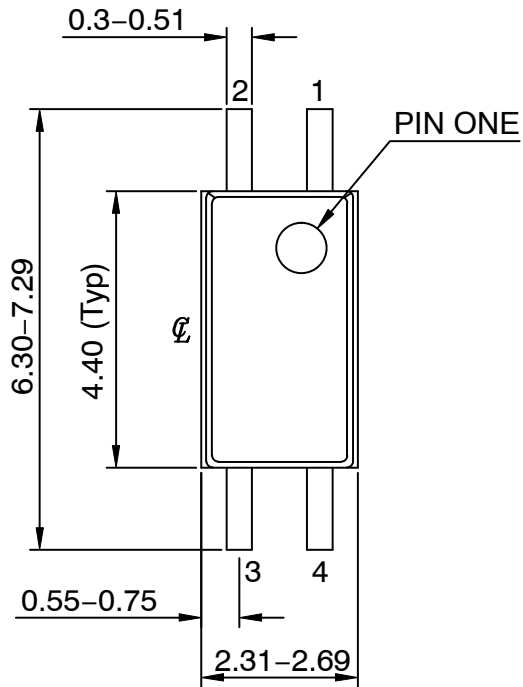
Part Number	Package	Packing Method
FODM214A	SOP 4-Pin	Tube (100 units)
FODM214AR2	SOP 4-Pin	Tape and Reel (3000 units)
FODM214AV	SOP 4-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 units)
FODM214AR2V	SOP 4-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (3000 units)

5. The product orderable part number system listed in this table also applies to the FODM214, FODM217A, FODM217B, FODM217C, and FODM217D products.

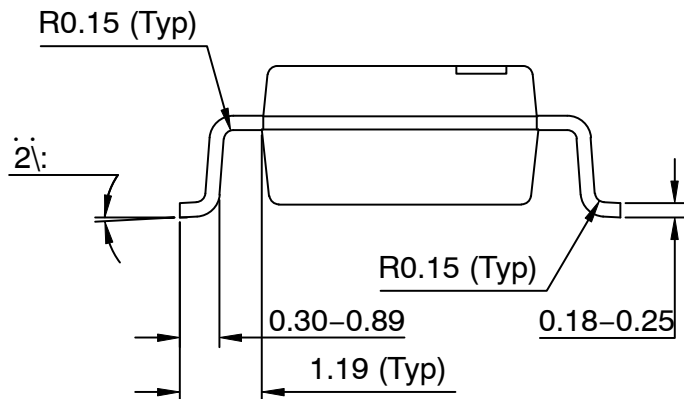
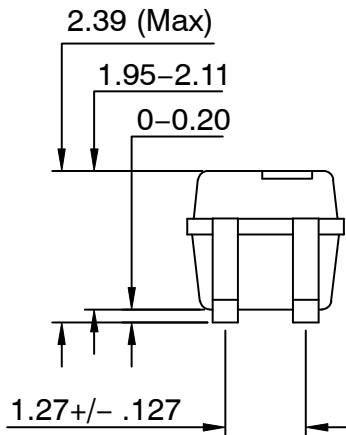
# FODM214, FODM217 Series

## PACKAGE DIMENSIONS

MFP4 2.5x4.4, 1.27P  
CASE 100AL  
ISSUE O



## LAND PATTERN RECOMMENDATION



## 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



# FODM214, FODM217 Series

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