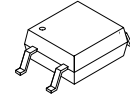


5-Pin Mini Flat Package High Speed Transistor Optocoupler



MFP5 4.1X4.4, 2.54P
 CASE 100AM

FODM452, FODM453

Description

The FODM452 and FODM453 optocouplers consist of an AlGaAs LED optically coupled to a high speed photo-detector transistor. The devices are housed in a compact 5-pin mini flat package for optimum mounting density.

The FODM453 features a high CMR rating for optimum common mode transient immunity.

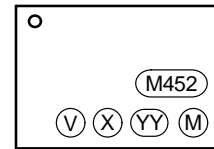
Features

- Compact 5-pin Mini Flat Package
- High Speed – 1 MBit/s
- Superior CMR – 15 kV/μs at $V_{CM} = 1500$ V (FODM453)
- Performance Guaranteed over Temperature (0 – 70°C)
- U.L. Recognized (File # E90700)
- VDE0884 Recognized (File # 136480)
 – Ordering Option V, e.g., FODM452V
- 260°C Reflow Capability for Pb-free Assembly
- These are Pb-Free Devices

Applications

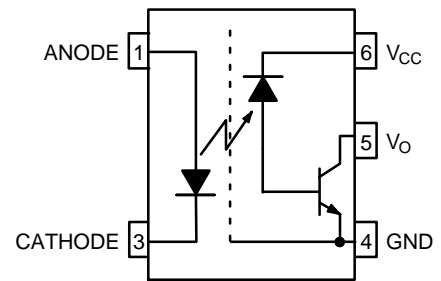
- Line Receivers
- Pulse Transformer Replacement
- Output Interface to CMOS–LSTTL–TTL
- Wide Bandwidth Analog Coupling

MARKING DIAGRAM



- M45x = Device Number (x = 2, 3)
 V = DIN EN/IEC60747-5-5 Mark (Note: Only Appears on Parts Ordered with VDE Option – See Order Entry Table)
 X = One Digit Year Code, e.g., '7'
 YY = Two Digit Work Week Ranging from '01' to '53'
 M = Assembly Package Code

FUNCTIONAL SCHEMATIC



TRUTH TABLE

| LED | Output |
|-----|--------|
| Off | High |
| On | Low |

ORDERING INFORMATION

See detailed ordering and shipping information on page 10 of this data sheet.

FODM452, FODM453

PIN DEFINITIONS

| Number | Name | Function Description |
|--------|----------|-----------------------|
| 1 | ANODE | Anode |
| 3 | CATHODE | Cathode |
| 4 | GND | Output Ground |
| 5 | V_O | Output Voltage |
| 6 | V_{CC} | Output Supply Voltage |

SAFETY AND INSULATION RATINGS FOR MINI-FLAT PACKAGE (SO5 PIN)

(As per DIN EN/IEC60747-5-5. 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.)

| Symbol | Parameter | Min | Typ | Max | Unit |
|------------|---|--------|----------|-----|------------|
| | Installation Classifications per DIN VDE 0110/1.89 Table 1 | - | - | - | |
| | For Rated Main Voltage <150 Vrms | - | I-IV | - | |
| | For Rated Main Voltage <300 Vrms | - | I-III | - | |
| | Climatic Classification | - | 40/85/21 | - | |
| | Pollution Degree (DIN VDE 0110/1.89) | - | 2 | - | |
| CTI | Comparative Tracking Index | 175 | - | - | |
| V_{PR} | Input to Output Test Voltage, Method b, $V_{IORM} \times 1.875 = V_{PR}$, 100% Production Test with $t_m = 1$ s, Partial Discharge <5 pC | 1060 | - | - | |
| V_{PR} | Input to Output Test Voltage, Method a, $V_{IORM} \times 1.5 = V_{PR}$, Type and Sample Test with $t_m = 60$ s, Partial Discharge <5 pC | 848 | - | - | |
| V_{IORM} | Max Working Insulation Voltage | 565 | - | - | V_{peak} |
| V_{IOTM} | Highest Allowable Over Voltage | 4000 | - | - | V_{peak} |
| | External Creepage | 5.0 | - | - | mm |
| | External Clearance | 5.0 | - | - | mm |
| | Insulation thickness | 0.5 | - | - | mm |
| T_{Case} | Safety Limit Values, Maximum Values Allowed in the Event of a Failure, Case Temperature | 150 | - | - | °C |
| R_{IO} | Insulation Resistance at T_S , $V_{IO} = 500$ V | 10^9 | - | - | Ω |

FODM452, FODM453

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

| Symbol | Parameter | Rating | Unit |
|------------------|-----------------------|-------------|------|
| T _{STG} | Storage Temperature | -40 to +125 | °C |
| T _{OPR} | Operating Temperature | -40 to +85 | °C |

EMITTER

| | | | |
|------------------------|---|-----|----|
| I _F (avg) | DC/Average Forward Input Current | 25 | mA |
| I _F (pk) | Peak Forward Input Current (50% Duty Cycle, 1 ms P.W.) | 50 | mA |
| I _F (trans) | Peak Transient Input Current (≤1 μs P.W., 300 pps) | 1.0 | A |
| V _R | Reverse Input Voltage | 5 | V |
| P _D | Input Power Dissipation (No Derating Required over Specified Operating Temp Range) | 45 | mW |

DETECTOR

| | | | |
|----------------------|--|------------|----|
| I _O (avg) | Average Output Current | 8 | mA |
| I _O (pk) | Peak Output Current | 16 | mA |
| V _{CC} | Supply Voltage | -0.5 to 30 | V |
| V _O | Output Voltage | -0.5 to 20 | V |
| P _D | Output Power Dissipation (No Derating Required over Specified Operating Temp Range) | 100 | 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.

FODM452, FODM453

ELECTRICAL CHARACTERISTICS (T_A = 0 to 70°C unless otherwise noted)

| Symbol | Parameter | Test Condition | Device | Min | Typ* | Max | Unit |
|--------|-----------|----------------|--------|-----|------|-----|------|
|--------|-----------|----------------|--------|-----|------|-----|------|

INDIVIDUAL COMPONENT CHARACTERISTICS

| EMITTER | | | | | | | |
|----------------------------------|--|---|--|-----|------|-----|-------|
| V _F | Input Forward Voltage | I _F = 16 mA, T _A = 25°C | | – | 1.60 | 1.7 | V |
| | | I _F = 16 mA | | – | – | 1.8 | |
| B _{VR} | Input Reverse Breakdown Voltage | I _R = 10 μA | | 5.0 | – | – | V |
| ΔV _F /ΔT _A | Temperature Coefficient of Forward Voltage | I _F = 16 mA | | – | –1.8 | – | mV/°C |
| DETECTOR | | | | | | | |
| I _{OH} | Logic High Output Current | I _F = 0 mA, V _O = V _{CC} = 5.5 V, T _A = 25°C | | – | .001 | 0.5 | μA |
| | | I _F = 0 mA, V _O = V _{CC} = 15 V, T _A = 25°C | | – | .001 | 1 | |
| | | I _F = 0 mA, V _O = V _{CC} = 15 V | | – | – | 50 | |
| I _{CCL} | Logic Low Supply Current | I _F = 16 mA, V _O = Open, V _{CC} = 15 V | | – | 100 | 200 | μA |
| I _{CCH} | Logic high Supply Current | I _F = 0 mA, V _O = Open, V _{CC} = 15 V, T _A = 25°C | | – | 0.05 | 1 | μA |
| | | I _F = 0 mA, V _O = Open, V _{CC} = 15 V | | – | – | 2 | |

TRANSFER CHARACTERISTICS

| COUPLED | | | | | | | | |
|-----------------|---------------------------------|---|--|---|----|-----|----|---|
| CTR | Current Transfer Ratio (Note 1) | I _F = 16 mA, V _{CC} = 4.5 V | T _A = 25°C, V _{OL} = 0.4 V | | 20 | – | 50 | % |
| | | | V _{OL} = 0.5 V | | 15 | – | – | |
| V _{OL} | Logic LOW Output Voltage | I _F = 16 mA, I _O = 3 mA, V _{CC} = 4.5 V, T _A = 25°C | | – | – | 0.4 | V | |
| | | I _F = 16 mA, I _O = 2.4 mA, V _{CC} = 4.5 V | | – | – | 0.5 | | |

SWITCHING CHARACTERISTICS (V_{CC} = 5 V)

| | | | | | | | |
|------------------|--|---|---------|----|------|-----|-------|
| T _{PHL} | Propagation Delay Time to Logic LOW | R _L = 1.9 kΩ, I _F = 16 mA, T _A = 25°C (Note 2) (Figure 9) | | – | 0.40 | 0.8 | μs |
| | | R _L = 1.9 kΩ, I _F = 16 mA (Note 2) (Figure 9) | | – | – | 1.0 | |
| T _{PLH} | Propagation Delay Time to Logic HIGH | R _L = 1.9 kΩ, I _F = 16 mA, T _A = 25°C (Note 2) (Figure 9) | | – | 0.35 | 0.8 | μs |
| | | R _L = 1.9 kΩ, I _F = 16 mA (Note 2) (Figure 9) | | – | – | 1.0 | |
| CM _H | Common Mode Transient Immunity at Logic HIGH | I _F = 0 mA, V _{CM} = 10 V _{P-P} , R _L = 1.9 kΩ, T _A = 25°C (Note 3) (Figure 10) | FODM452 | 5 | 15 | – | KV/μs |
| | | I _F = 0 mA, V _{CM} = 1500 V _{P-P} , R _L = 1.9 kΩ, T _A = 25°C (Note 3) (Figure 10) | FODM453 | 15 | 40 | – | |
| CM _L | Common Mode Transient Immunity at Logic LOW | I _F = 16 mA, V _{CM} = 10 V _{P-P} , R _L = 1.9 kΩ, T _A = 25°C (Note 3) (Figure 10) | FODM452 | 5 | 15 | – | KV/μs |
| | | I _F = 16 mA, V _{CM} = 1500 V _{P-P} , R _L = 1.9 kΩ, T _A = 25°C (Note 3) (Figure 10) | FODM453 | 15 | 40 | – | |
| BW | Bandwidth | R _L = 100 Ω | | – | 3 | – | MHz |

ISOLATION CHARACTERISTICS

| | | | | | | | |
|------------------|-----------------------------------|--|--|------|-----|---|------------------|
| V _{ISO} | Withstand Insulation Test Voltage | RH ≤ 50%, T _A = 25°C, t = 1 min. (Note 4) | | 3750 | – | – | V _{RMS} |
| C _{I-O} | Capacitance (Input to Output) | f = 1 MHz (Note 4) | | – | 0.2 | – | pF |

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.

*All Typicals at T_A = 25°C

- Current Transfer Ratio is defined as a ratio of output collector current, I_O, to the forward LED input current, I_F, times 100%.
- The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and 5.6 kΩ pull-up resistor.
- Common mode transient immunity in logic high level is the maximum tolerable (positive) dV_{cm}/dt on the leading edge of the common mode pulse signal V_{CM}, to assure that the output will remain in a logic high state (i.e., V_O > 2.0 V). Common mode transient immunity in logic low level is the maximum tolerable (negative) dV_{cm}/dt on the trailing edge of the common mode pulse signal, V_{CM}, to assure that the output will remain in a logic low state (i.e., V_O < 0.8 V).
- Device is considered a two terminal device: Pins 1, and 3 are shorted together and Pins 4, 5, and 6 are shorted together.

TYPICAL PERFORMANCE CURVES

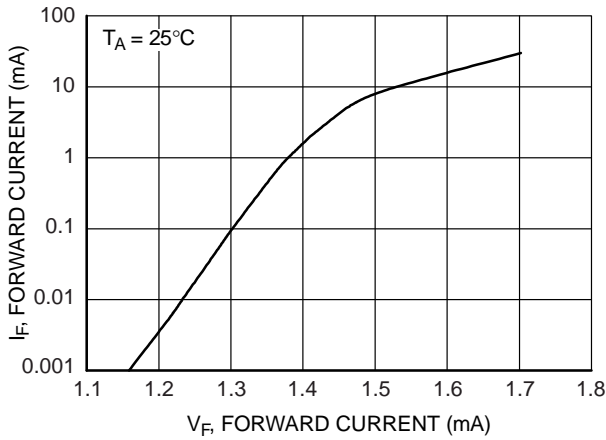


Figure 1. Input Forward Current vs Forward Voltage

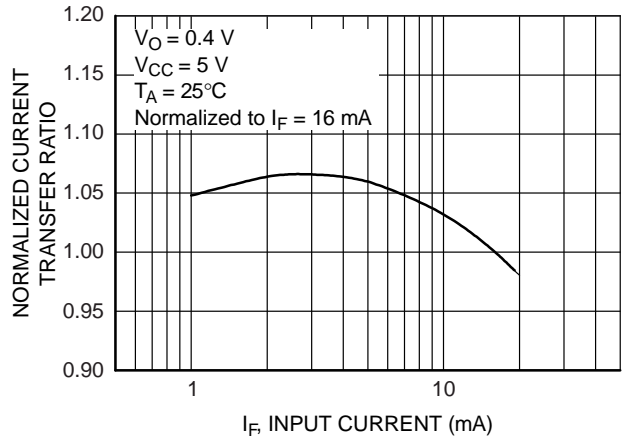


Figure 2. Normalized Current Transfer Ratio vs. Input Current

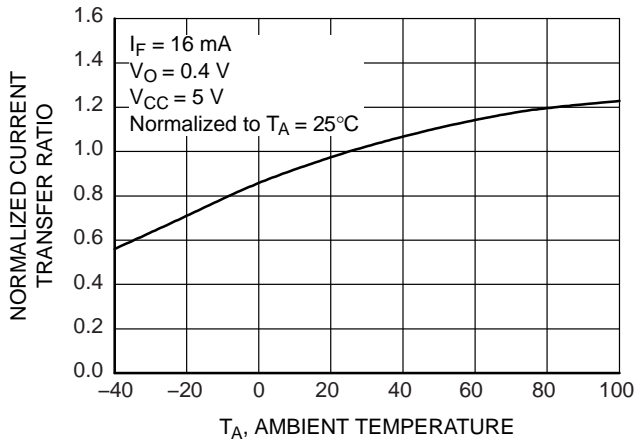


Figure 3. Normalized Current Transfer Ratio vs. Ambient Temperature

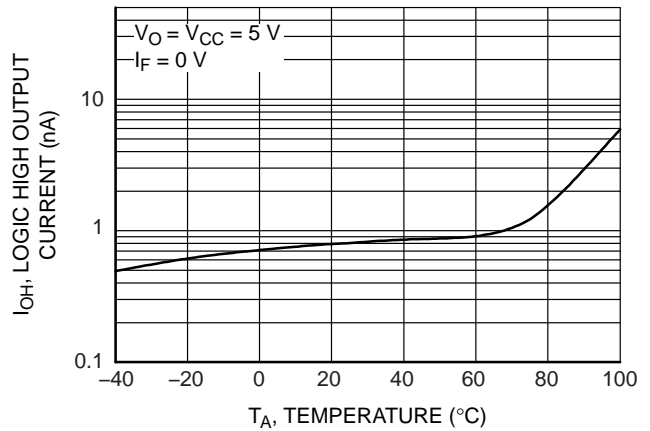


Figure 4. Logic High Output Current vs. Ambient Temperature

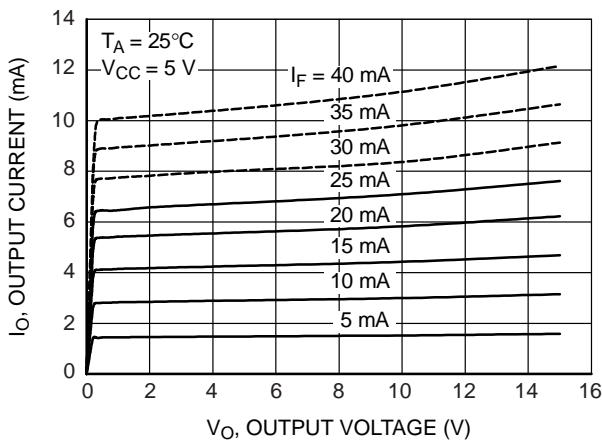


Figure 5. DC and Pulsed Transfer Characteristics

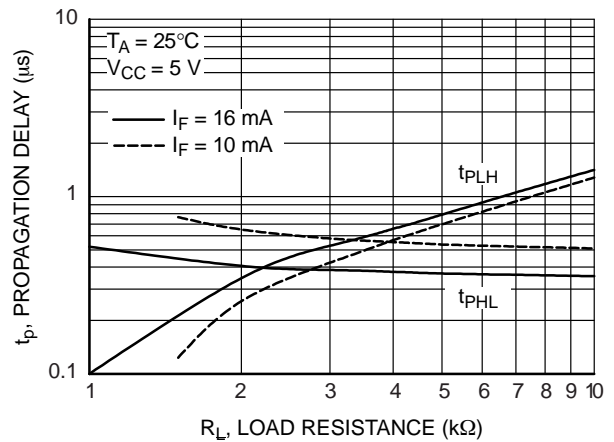


Figure 6. Propagation Delay vs. Load Resistance

FODM452, FODM453

TYPICAL PERFORMANCE CURVES (Continued)

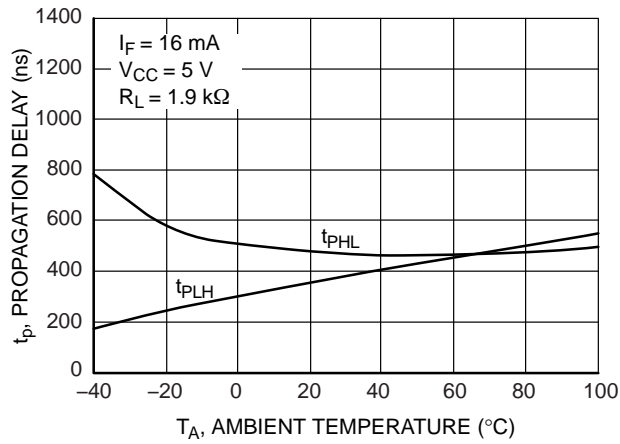


Figure 7. Propagation Delay vs. Ambient Temperature

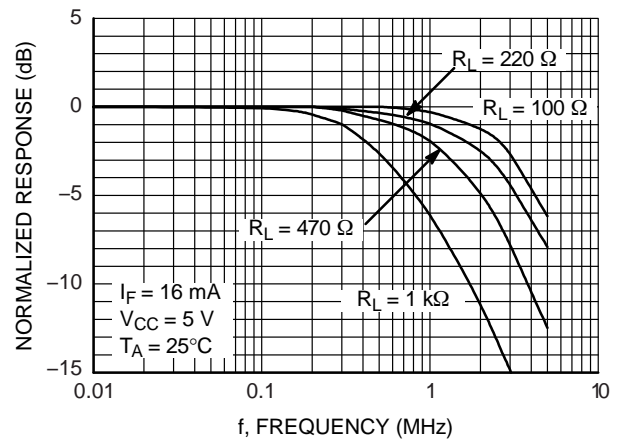


Figure 8. Frequency Response

FODM452, FODM453

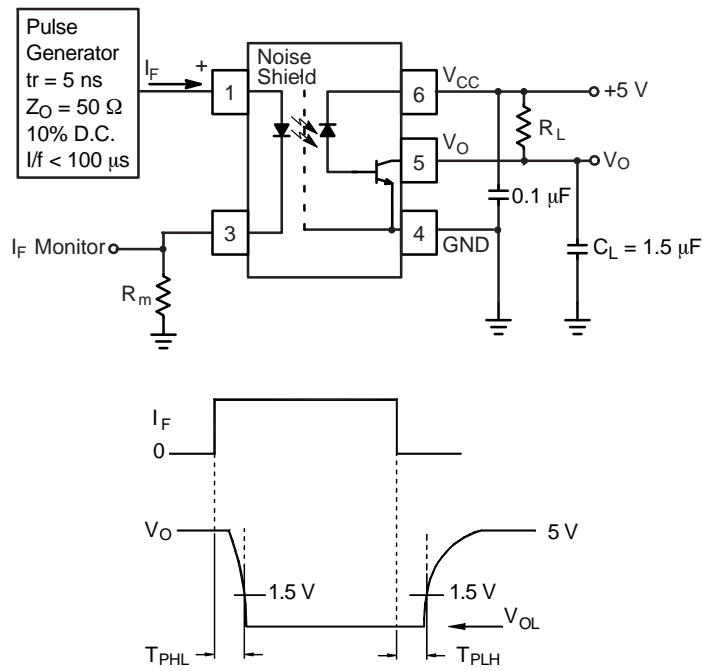


Figure 9. Switching Time Test Circuit

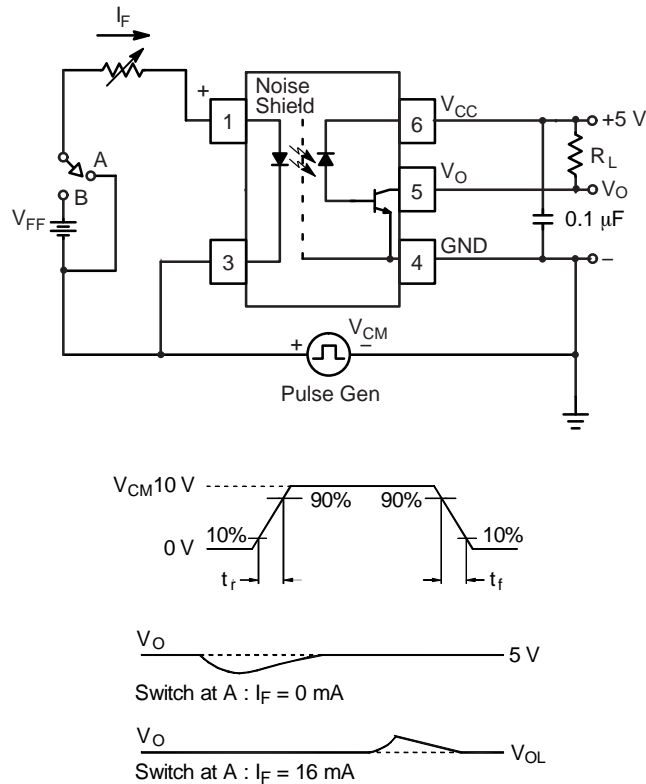


Figure 10. Common Mode Immunity Test Circuit

FODM452, FODM453

FOOTPRINT DRAWING FOR PCB LAYOUT

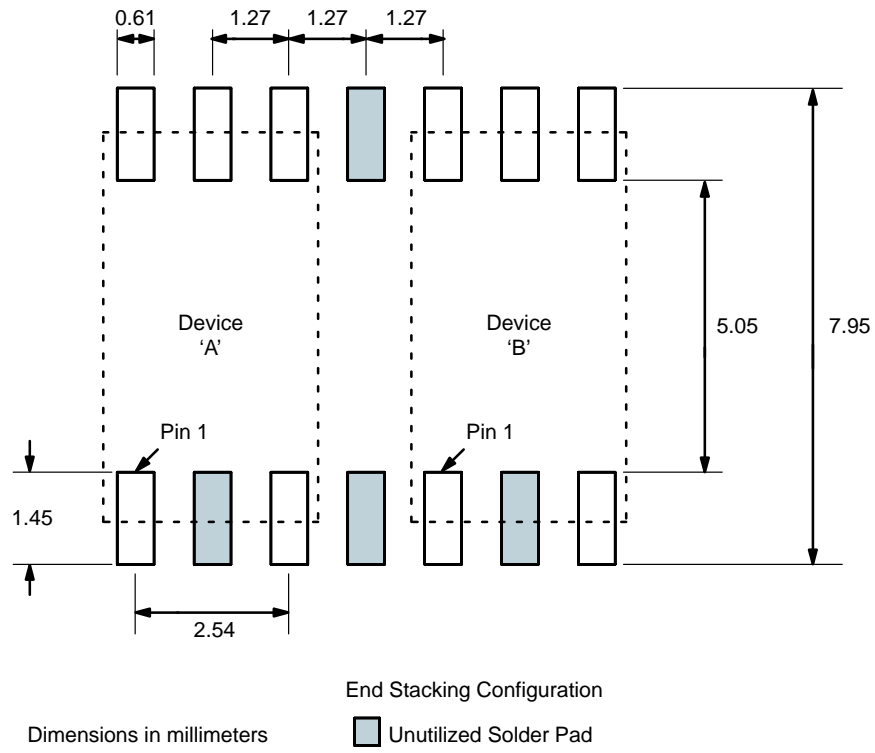


Figure 11. Footprint Drawing for PCB Layout

FODM452, FODM453

REFLOW PROFILE

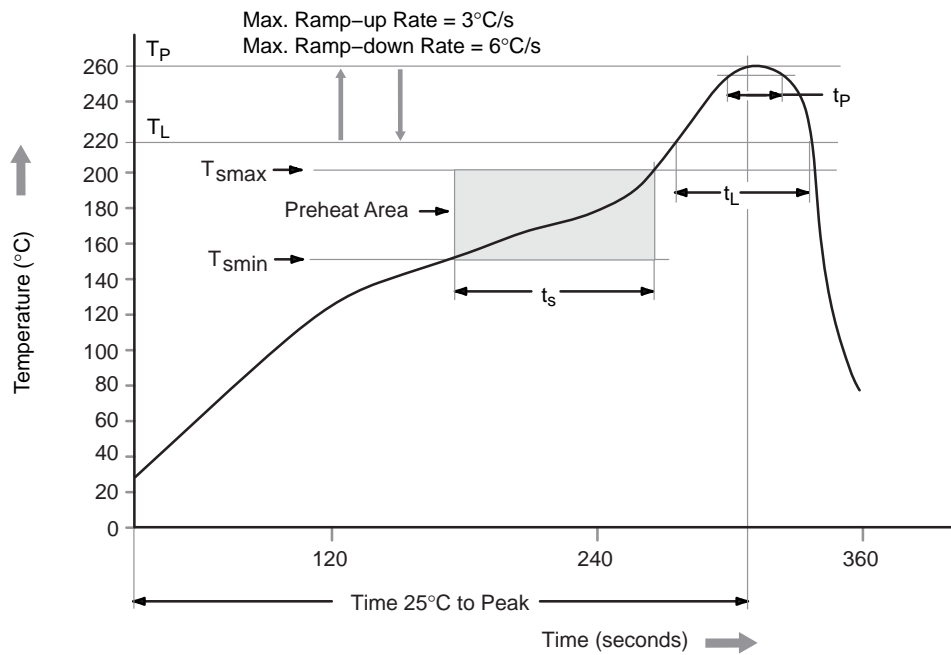


Figure 12. Reflow Profile

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 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. |

FODM452, FODM453

ORDERING INFORMATION

| Part Number | Package | Shipping† |
|-------------|--|--------------------|
| FODM452 | MFP5 4.1X4.4, 2.54P (Pb-Free) | 100 Units / Tube |
| FODM452R2 | MFP5 4.1X4.4, 2.54P (Pb-Free) | 2500 / Tape & Reel |
| FODM452V | MFP5 4.1X4.4, 2.54P IEC60747-5-2 (Pb-Free) | 100 Units / Tube |
| FODM452R2V | MFP5 4.1X4.4, 2.54P IEC60747-5-2 (Pb-Free) | 2500 / Tape & Reel |
| FODM453 | MFP5 4.1X4.4, 2.54P (Pb-Free) | 100 Units / Tube |
| FODM453R2 | MFP5 4.1X4.4, 2.54P (Pb-Free) | 2500 / Tape & Reel |
| FODM453V | MFP5 4.1X4.4, 2.54P IEC60747-5-2 (Pb-Free) | 100 Units / Tube |
| FODM453R2V | MFP5 4.1X4.4, 2.54P IEC60747-5-2 (Pb-Free) | 2500 / Tape & Reel |

†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.

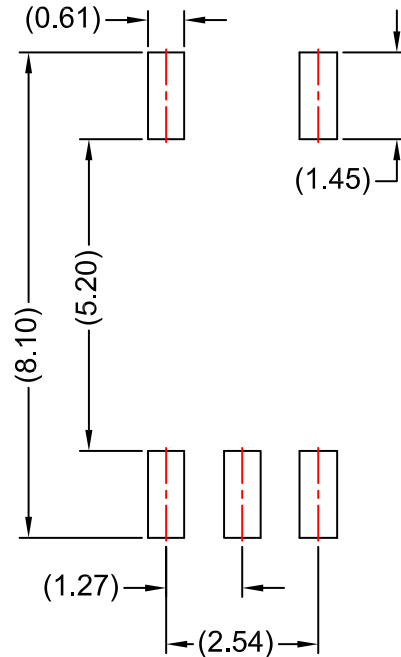
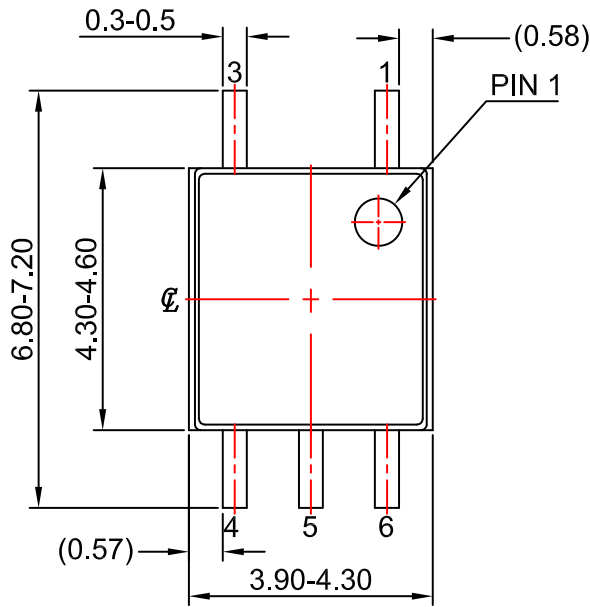
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

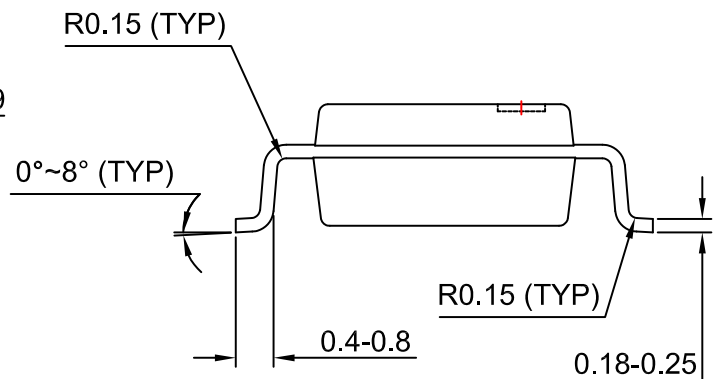
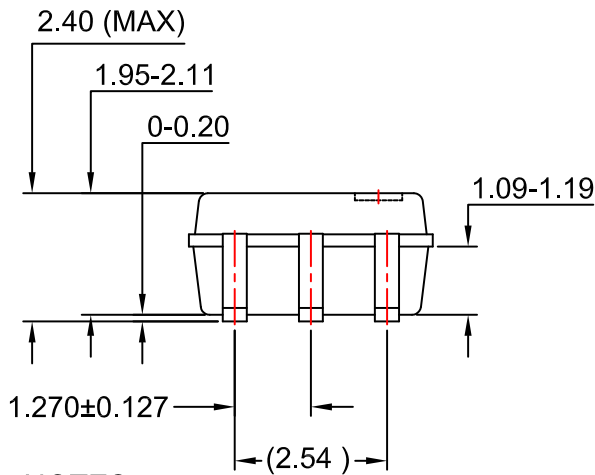


MFP5 4.1X4.4, 2.54P
CASE 100AM
ISSUE O

DATE 31 AUG 2016



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

| | | |
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