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May 2017

FODM3011, FODM3012, FODM3022, FODM3023, FODM3052, FODM3053

4-Pin Full Pitch Mini-Flat Package Random-Phase Triac Driver Output Optocouplers

Features

- Compact 4-pin Surface Mount Package (2.4 mm Maximum Standoff Height)
- Peak Blocking Voltage
 - 250V (FODM301X)
 - 400V (FODM302X)
 - 600V (FODM305X)
- Safety and Regulatory Approvals:
 - UL1577, 3,750 VAC_{RMS} for 1 Minute
 - DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage

Applications

- Industrial Controls
- Traffic Lights
- Vending Machines
- Solid State Relay
- Lamp Ballasts
- Solenoid/Valve Controls
- Static AC Power Switch
- Incandescent Lamp Dimmers
- Motor Control

Description

The FODM301X, FODM302X, and FODM305X series consists of a GaAs infrared emitting diode driving a silicon bilateral switch housed in a compact 4-pin mini-flat package. The lead pitch is 2.54 mm. They are designed for interfacing between electronic controls and power triacs to control resistive and inductive loads for 115 V/240 V operations.

Functional Schematic

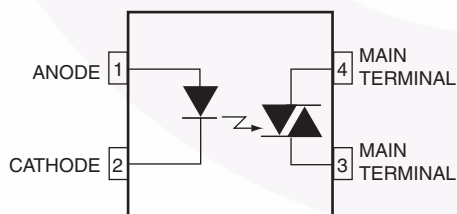


Figure 1. Functional Schematic

Package Outlines

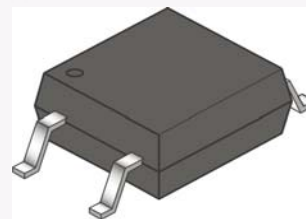


Figure 2. Package Outlines

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 _{RMS} | I–IV |
| | < 300 V _{RMS} | I–III |
| Climatic Classification | | 40/100/21 |
| Pollution Degree (DIN VDE 0110/1.89) | | 2 |
| Comparative Tracking Index | | 175 |

| Symbol | Parameter | Value | Unit |
|-----------------------|--|-------------------|-------------------|
| V _{PR} | Input-to-Output Test Voltage, Method A, V _{IORM} × 1.6 = V _{PR} , Type and Sample Test with t _m = 10 s, Partial Discharge < 5 pC | 904 | V _{peak} |
| | Input-to-Output Test Voltage, Method B, V _{IORM} × 1.875 = V _{PR} , 100% Production Test with t _m = 1 s, Partial Discharge < 5 pC | 1060 | V _{peak} |
| V _{IORM} | Maximum Working Insulation Voltage | 565 | V _{peak} |
| V _{IOTM} | Highest Allowable Over-Voltage | 6000 | V _{peak} |
| | External Creepage | ≥ 5 | mm |
| | External Clearance | ≥ 5 | mm |
| DTI | Distance Through Insulation (Insulation Thickness) | ≥ 0.4 | mm |
| T _S | Case Temperature ⁽¹⁾ | 150 | °C |
| I _{S,INPUT} | Input Current ⁽¹⁾ | 200 | mA |
| P _{S,OUTPUT} | Output Power ⁽¹⁾ | 300 | mW |
| R _{IO} | Insulation Resistance at T _S , V _{IO} = 500 V ⁽¹⁾ | > 10 ⁹ | Ω |

Note:

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

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. $T_A = 25^\circ\text{C}$ unless otherwise specified.

| Symbol | Parameter | Value | Unit |
|-----------------|---|--------------------|------------------|
| T_{STG} | Storage Temperature | -55 to +150 | $^\circ\text{C}$ |
| T_{OPR} | Operating Temperature | -40 to +100 | $^\circ\text{C}$ |
| T_J | Junction Temperature | -40 to +125 | $^\circ\text{C}$ |
| T_{SOL} | Lead Solder Temperature | 260 for 10 sec | $^\circ\text{C}$ |
| EMITTER | | | |
| I_F (avg) | Continuous Forward Current | 60 | mA |
| I_F (pk) | Peak Forward Current (1 μs pulse, 300 pps.) | 1 | A |
| V_R | Reverse Input Voltage | 3 | V |
| P_D | Power Dissipation (No derating required over operating temp. range) | 100 | mW |
| DETECTOR | | | |
| $I_{T(RMS)}$ | On-State RMS Current | 70 | mA (RMS) |
| V_{DRM} | Off-State Output Terminal Voltage | FODM3011, FODM3012 | 250 |
| | | FODM3022, FODM3023 | 400 |
| | | FODM3052, FODM3053 | 600 |
| P_D | Power Dissipation (No derating required over operating temp. range) | 300 | mW |

Electrical Characteristics

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

Individual Component Characteristics

| Symbol | Parameter | Test Conditions | Device | Min. | Typ. | Max. | Unit |
|------------------|--|--|--|-------|------|------|------------------------|
| EMITTER | | | | | | | |
| V_F | Input Forward Voltage | $I_F = 10\text{ mA}$ | All | | 1.20 | 1.50 | V |
| I_R | Reverse Leakage Current | $V_R = 3\text{ V}, T_A = 25^\circ\text{C}$ | All | | 0.01 | 100 | μA |
| DETECTOR | | | | | | | |
| I_{DRM} | Peak Blocking Current Either Direction | Rated $V_{\text{DRM}}, I_F = 0^{(2)}$ | All | | 2 | 100 | nA |
| dv/dt | Critical Rate of Rise of Off-State Voltage | $I_F = 0$ (Figure 8) ⁽³⁾ | FODM3011, FODM3012, FODM3022, FODM3023 FODM3052, FODM3053 | | 10 | | $\text{V}/\mu\text{s}$ |
| | | | | 1,000 | | | |

Notes:

- Test voltage must be applied within dv/dt rating.
- This is static dv/dt . See Figure 1 for test circuit. Commutating dv/dt is function of the load-driving thyristor(s) only.

Transfer Characteristics

| Symbol | Parameter | Test Conditions | Device | Min. | Typ. | Max. | Unit |
|-----------------|--|--|--|------|------|---------|---------------|
| I_T | LED Trigger Current | Main Terminal Voltage = $3\text{ V}^{(4)}$ | FODM3011, FODM3022, FODM3052 FODM3012, FODM3023, FODM3053 | | | 10 5 | mA |
| I_H | Holding Current, Either Direction | | All | | 450 | | μA |
| V_{TM} | Peak On-State Voltage Either Direction | $I_{\text{TM}} = 100\text{ mA peak}$ | All | | 2.2 | 3 | V |

Notes:

- All devices are guaranteed to trigger at an I_F value of less than or equal to the max I_{FT} specification. For optimum operation over temperature and lifetime of the device, the LED should be biased with an I_F that is at least 50% higher than the maximum I_{FT} specification. The I_{FT} should not exceed the absolute maximum rating of 60 mA.
Example: For FODM0353M, the minimum I_F bias should be $5\text{ mA} \times 150\% = 7.5\text{ mA}$

Isolation Characteristics

| Symbol | Parameter | Test Conditions | Device | Min. | Typ. | Max. | Unit |
|------------------|--------------------------------|--------------------------------|--------|-------|------|------|---------------------------|
| V_{ISO} | Steady State Isolation Voltage | 1 Minute, R.H. = 40% to 60% | All | 3,750 | | | VAC_{RMS} |

Typical Performance Characteristics

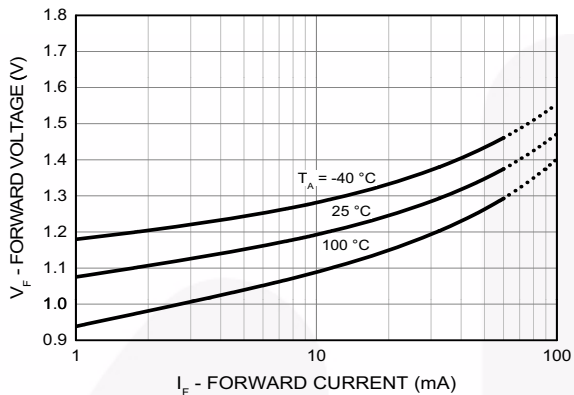


Fig 3. LED Forward Voltage vs. Forward Current

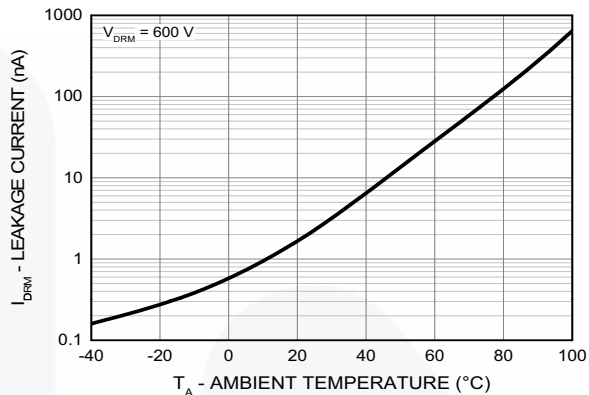


Fig 4. Leakage Current vs. Ambient Temperature

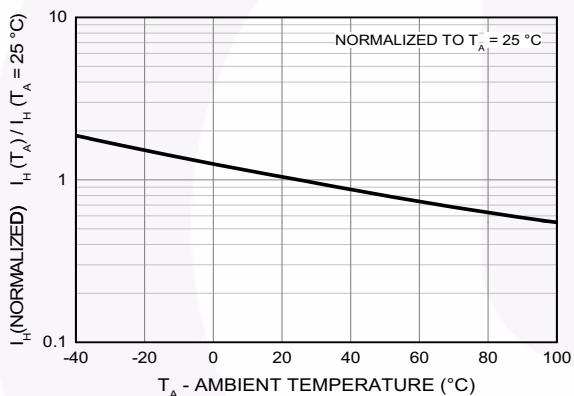


Fig 5. Normalized Holding Current vs. Ambient Temperature

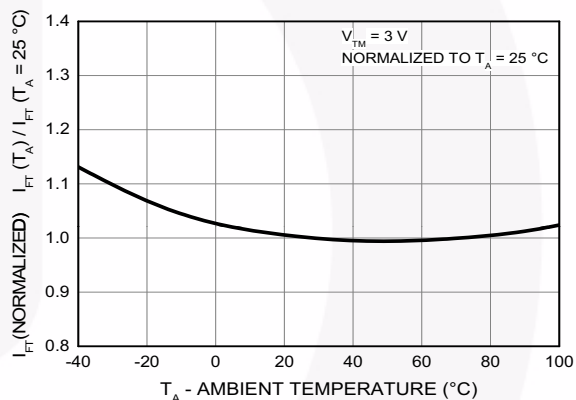


Fig 6. Normalized Trigger Current vs. Ambient Temperature

Typical Performance Characteristics (Continued)

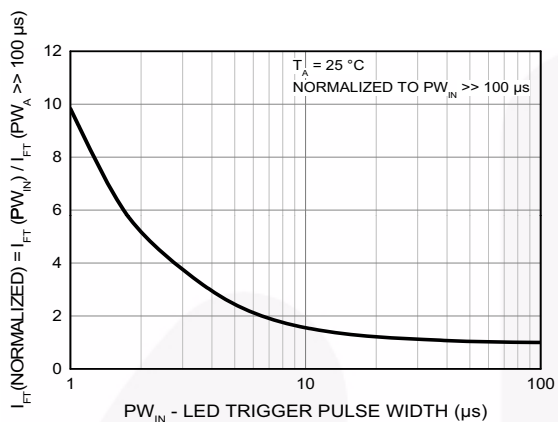


Fig 7. LED Current Required to Trigger vs. LED Pulse Width

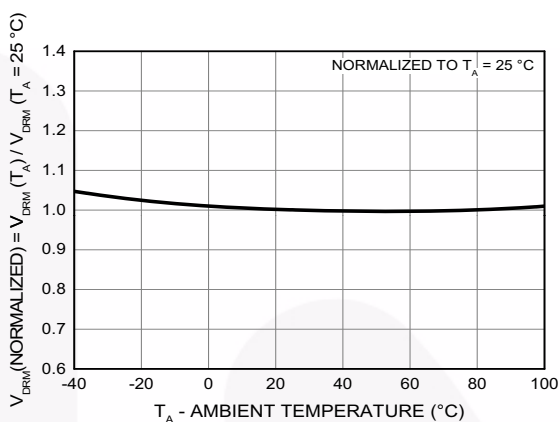


Fig 8. Normalized Off-State Output Terminal Voltage vs. Ambient Temperature

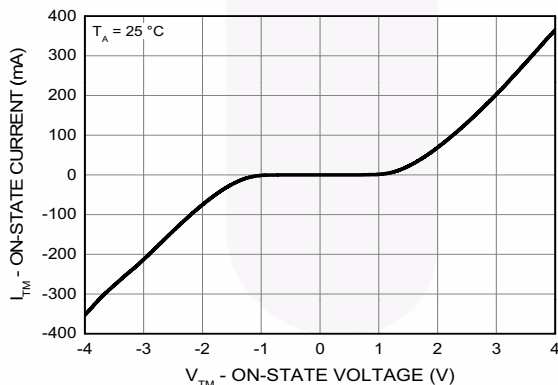


Fig 9. On-State Characteristics

Typical Application Information

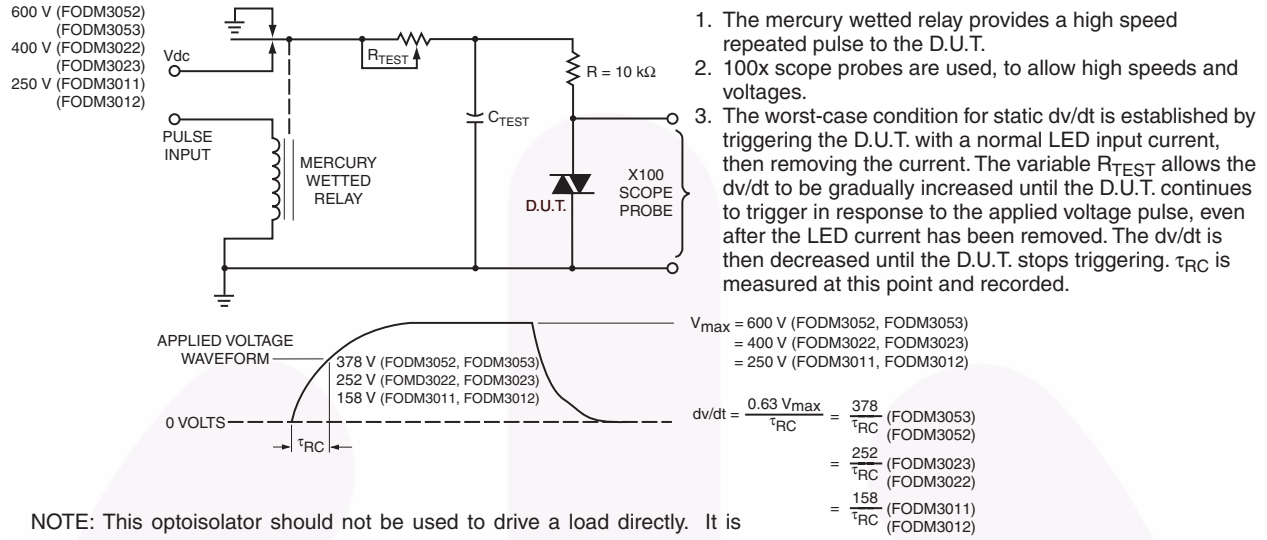


Figure 10. Static dv/dt Test Circuit

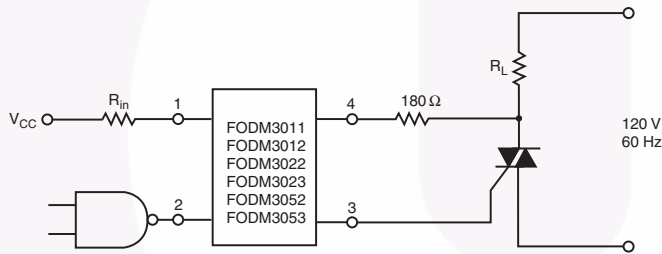


Figure 11. Resistive Load

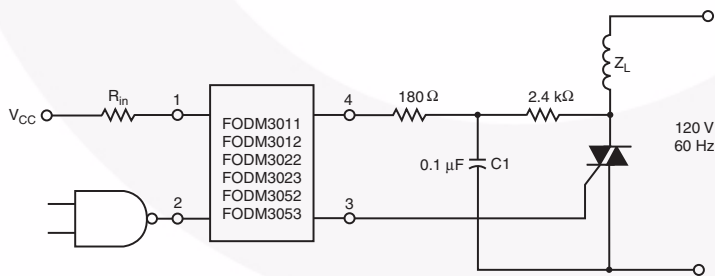
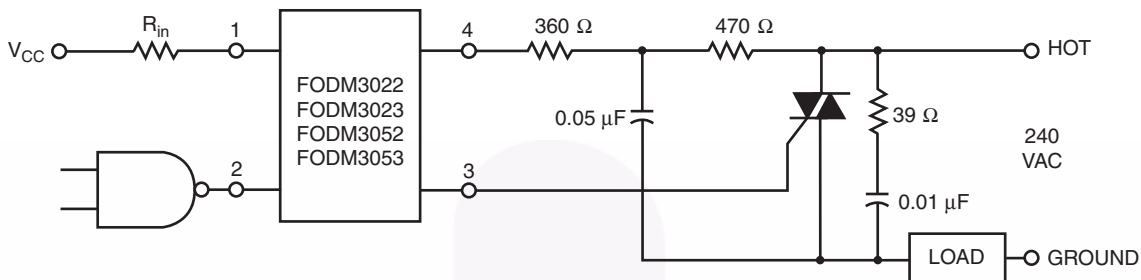


Figure 12. Inductive Load with Sensitive Gate Triac (I_{GT} ≤ 15 mA)

Typical Application Information (Continued)

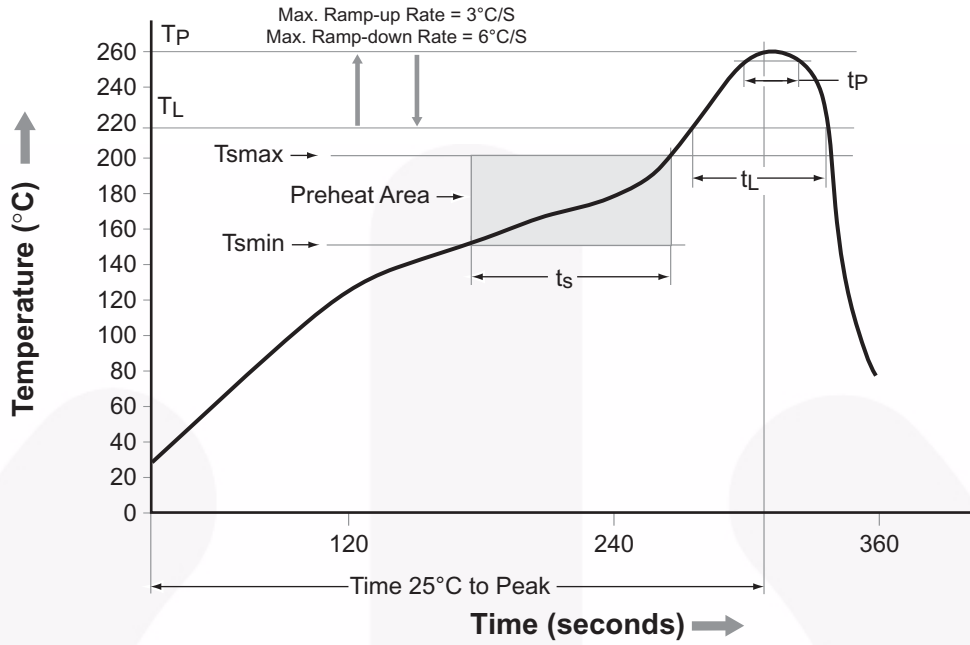


In this circuit the “hot” side of the line is switched and the load connected to the cold or ground side.

The 39 Ω resistor and 0.01 μ F capacitor are for snubbing of the triac, and the 470 Ω resistor and 0.05 μ F capacitor are for snubbing the coupler. These components may or may not be necessary depending upon the particular and load used.

Figure 13. Typical Application Circuit

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

| Part Number | Package | Packing Method |
|-------------|--|----------------------------|
| FODM3011 | Full Pitch Mini-Flat 4-Pin | Tube (100 units) |
| FODM3011R2 | Full Pitch Mini-Flat 4-Pin | Tape and Reel (2500 Units) |
| FODM3011V | Full Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option | Tube (100 Units) |
| FODM3011R2V | Full Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option | Tape and Reel (2500 Units) |

Note:

The product orderable part number system listed in this table also applies to the FODM3012, FODM3022, FODM3023, FODM3052, and FODM3053 products.

Marking Information

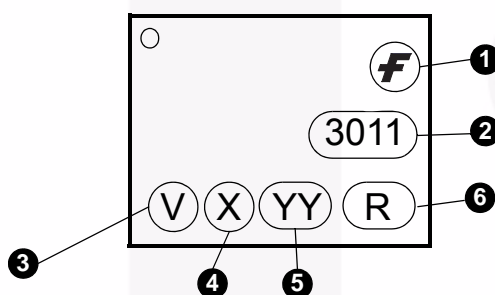
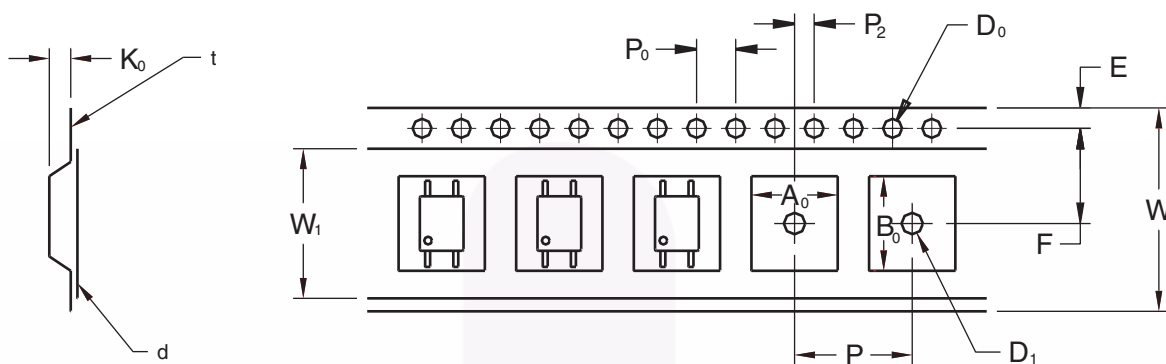


Figure 14. Top Mark

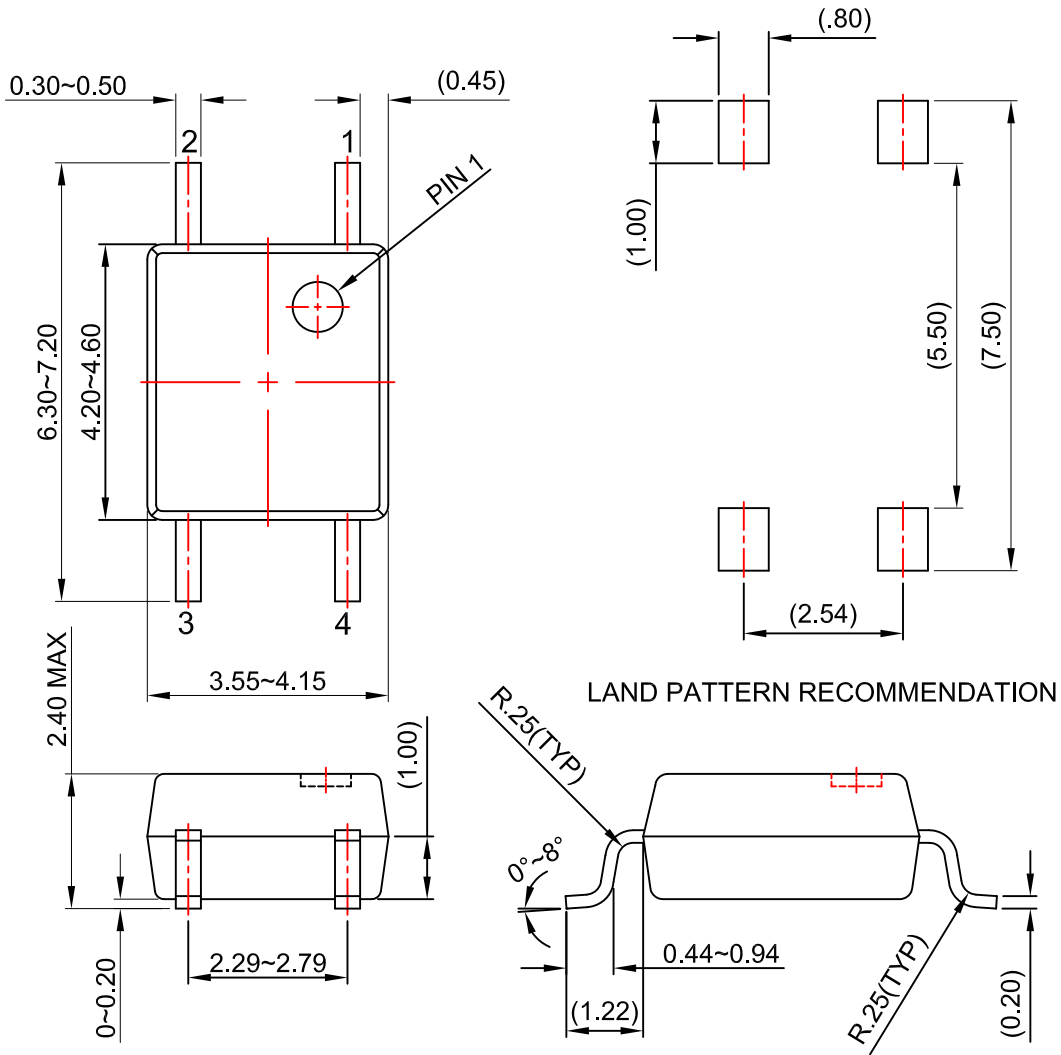
Table 1. Top Mark Definitions

| | |
|---|---|
| 1 | Fairchild Logo |
| 2 | Device Number |
| 3 | DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option) |
| 4 | One-Digit Year Code, e.g., "6" |
| 5 | Digit Work Week, Ranging from "01" to "53" |
| 6 | Assembly Package Code |

Tape Specifications



| | | 2.54 Pitch |
|---------------------------------|----------------|--------------|
| Description | Symbol | Dimensions |
| Tape Width | W | 12.00±0.4 |
| Tape Thickness | t | 0.35±0.02 |
| Sprocket Hole Pitch | P ₀ | 4.00±0.20 |
| Sprocket Hole Dia. | D ₀ | 1.55±0.20 |
| Sprocket Hole Location | E | 1.75±0.20 |
| Pocket Location | F | 5.50±0.20 |
| | P ₂ | 2.00±0.20 |
| Pocket Pitch | P | 8.00±0.20 |
| Pocket Dimension | A ₀ | 4.75±0.20 |
| | B ₀ | 7.30±0.20 |
| | K ₀ | 2.30±0.20 |
| Pocket Hole Dia. | D ₁ | 1.55±0.20 |
| Cover Tape Width | W ₁ | 9.20 |
| Cover Tape Thickness | d | 0.065±0.02 |
| Max. Component Rotation or Tilt | | 20° max |
| Devices Per Reel | | 2500 |
| Reel Diameter | | 330 mm (13") |



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