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May 2017

# FOD852
# 4-Pin DIP Photodarlington Output Optocoupler

## Features

- High Current Transfer Ratio: 1000% Minimum
- Safety and Regulatory Approvals
  - UL1577, 5,000 $VAC_{RMS}$ for 1 Minute
  - DIN EN/IEC60747-5-5

## Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs

## Description

The FOD852 consists of gallium arsenide infrared emitting diode driving a silicon photodarlington output (with integral base-emitter resistor) in a 4-pin dual in-line package.

## Functional Block Diagram

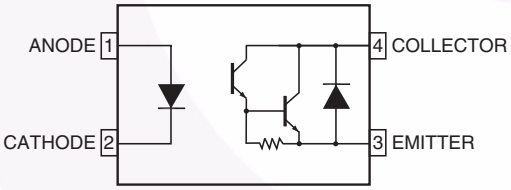



**Figure 1. Schematic**

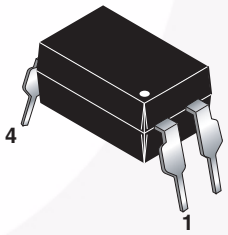



**Figure 2. Package Outlines**

## 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 | | 30/110/21 |
| 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, $V_{IORM}$ x 1.6 = $V_{PR}$, Type and Sample Test with $t_m$ = 10 s, Partial Discharge < 5 pC | 1360 | $V_{peak}$ |
| | Input-to-Output Test Voltage, Method B, $V_{IORM}$ x 1.875 = $V_{PR}$, 100% Production Test with $t_m$ = 1 s, Partial Discharge < 5 pC | 1560 | $V_{peak}$ |
| $V_{IORM}$ | Maximum Working Insulation Voltage | 850 | $V_{peak}$ |
| $V_{IOTM}$ | Highest Allowable Over-Voltage | 6000 | $V_{peak}$ |
| | External Creepage | ≥ 7 | mm |
| | External Clearance | ≥ 7 | mm |
| DTI | Distance Through Insulation (Insulation Thickness) | ≥ 0.4 | mm |
| $T_S$ | Case Temperature(1) | 175 | °C |
| $I_{S,INPUT}$ | Input Current(1) | 400 | mA |
| $P_{S,OUTPUT}$ | Output Power(1) | 700 | mW |
| $R_{IO}$ | Insulation Resistance at $T_S$, $V_{IO}$ = 500 V(1) | > $10^{11}$ | 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°C Unless otherwise specified.

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| **Total Device** | | | |
| $T_{STG}$ | Storage Temperature | -55 to +125 | °C |
| $T_{OPR}$ | Operating Temperature | -30 to +100 | °C |
| $T_J$ | Junction Temperature | -55 to +100 | °C |
| $T_{SOL}$ | Lead Solder Temperature | 260 for 10 seconds | °C |
| $P_{TOT}$ | Total Device Power Dissipation | 200 | mW |
| **Input** | | | |
| $I_F$ | Continuous Forward Current | 50 | mA |
| $V_R$ | Reverse Voltage | 6 | V |
| $P_D$ | LED Power Dissipation | 70 | mW |
| **Output** | | | |
| $V_{CEO}$ | Collector-Emitter Voltage | 300 | V |
| $V_{ECO}$ | Emitter-Collector Voltage | 0.1 | V |
| $I_C$ | Continuous Collector Current | 150 | mA |
| $P_C$ | Collector Power Dissipation | 150 | mW |

## Electrical Characteristics

$T_A$ = 25°C unless otherwise specified.

### Individual Component Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Input** | | | | | | |
| $V_F$ | Forward Voltage | $I_F$ = 10 mA | | 1.2 | 1.4 | V |
| $I_R$ | Reverse Current | $V_R$ = 4 V | | | 10 | µA |
| $C_t$ | Terminal Capacitance | V = 0, f = 1 kHz | | 30 | 250 | pF |
| **Output** | | | | | | |
| $I_{CEO}$ | Collector Dark Current | $V_{CE}$ = 200 V, $I_F$ = 0 | | | 200 | nA |
| $BV_{CEO}$ | Collector-Emitter Breakdown Voltage | $I_C$ = 0.1 mA, $I_F$ = 0 | 300 | | | V |
| $BV_{ECO}$ | Emitter-Collector Breakdown Voltage | $I_E$ = 10 µA, $I_F$ = 0 | 0.1 | | | V |

### Transfer Characteristics

| Symbol | DC Characteristic | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_C$ | Collector Current | $I_F$ = 1 mA, $V_{CE}$ = 2 V | 10 | 40 | 150 | mA |
| CTR | Current Transfer Ratio[2] | | 1,000 | 4,000 | 15,000 | % |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | $I_F$ = 20 mA, $I_C$ = 100 mA | | | 1.2 | V |
| $f_C$ | Cut-Off Frequency | $V_{CE}$ = 2 V, $I_C$ = 20 mA, $R_L$ = 100 Ω, -3 dB | 1 | 7 | | kHz |
| $t_R$ | Response Time (Rise) | $V_{CE}$ = 2 V, $I_C$ = 20 mA, $R_L$ = 100 Ω | | 100 | 300 | µs |
| $t_F$ | Response Time (Fall) | | | 20 | 100 | µs |

### Isolation Characteristics

| Symbol | Characteristic | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{ISO}$ | Input-Output Isolation Voltage | f = 60 Hz, t = 1 minute, $I_{I-O} \leq$ 2 µA | 5000 | | | $VAC_{RMS}$ |
| $R_{ISO}$ | Isolation Resistance | $V_{I-O}$ = 500 $V_{DC}$ | | $10^{12}$ | | Ω |
| $C_{ISO}$ | Isolation Capacitance | $V_{I-O}$ = 0, f = 1 MHz | | 0.6 | 1.0 | pf |

**Note:**

2. Current Transfer Ratio (CTR) = $I_C$ / $I_F$ x 100%.

## Typical Electrical/Optical Characteristic Curves

$T_A$ = 25°C unless otherwise specified.

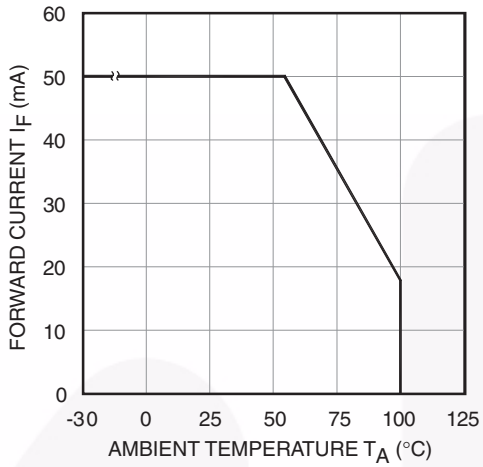



**Figure 3. Forward Current vs. Ambient Temperature**

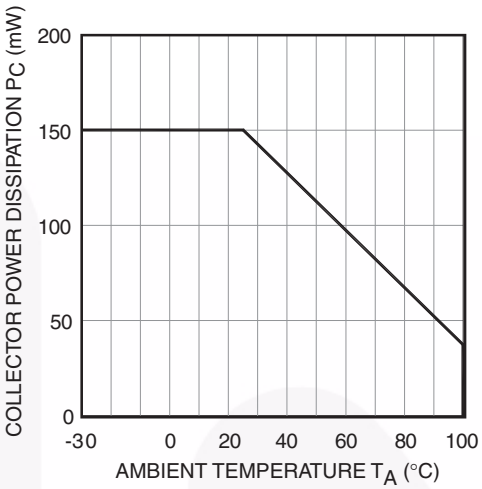



**Figure 4. Collector Power Dissipation vs. Ambient Temperature**

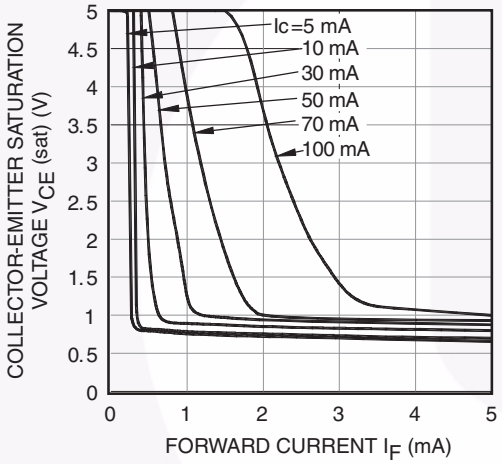



**Figure 5. Collector-Emitted Saturation Voltage vs. Forward Current**

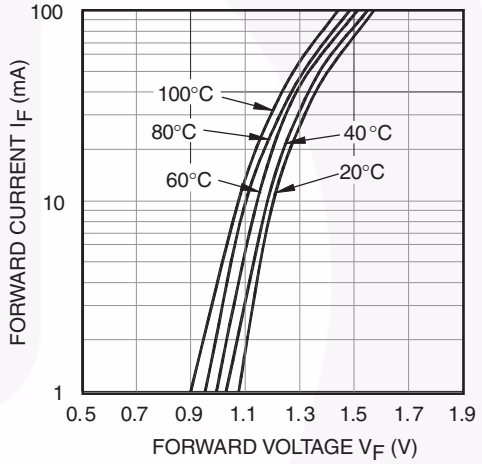



**Figure 6. Forward Current vs. Forward Voltage**

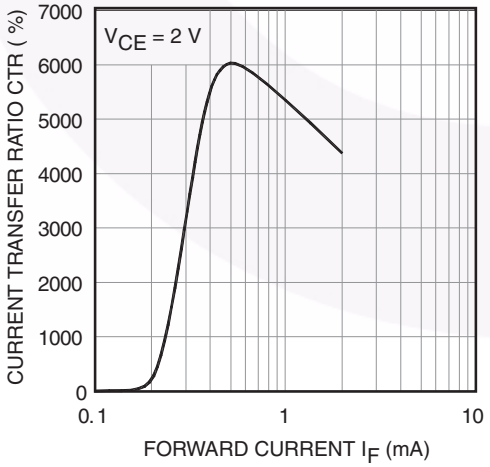



**Figure 7. Current Transfer Ratio vs. Forward Current**

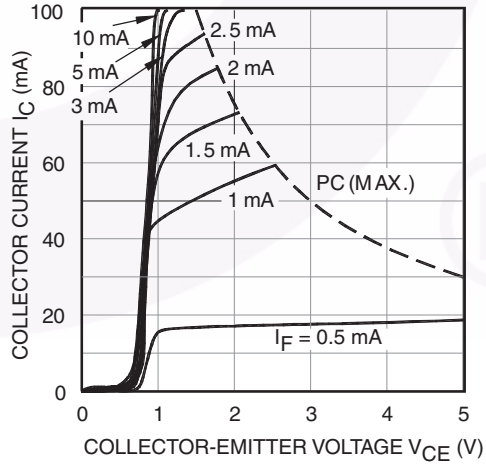



**Figure 8. Collector Current vs. Collector-Emitter Voltage**

## Typical Electrical/Optical Characteristic Curves (Continued)

$T_A$ = 25°C unless otherwise specified.

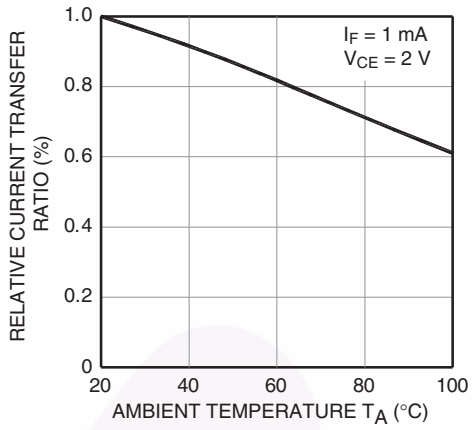



**Figure 9. Relative Current Transfer Ratio vs. Ambient Temperature**

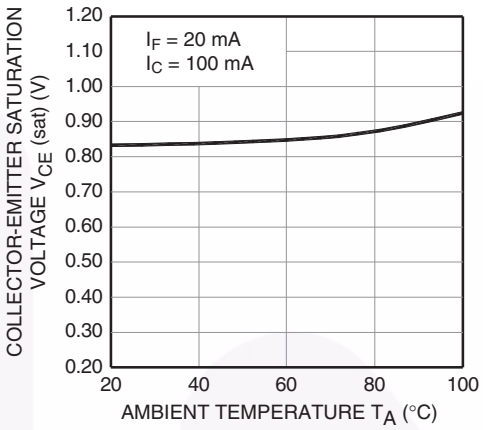



**Figure 10. Collector-Emitter Saturation Voltage vs. Ambient Temperature**

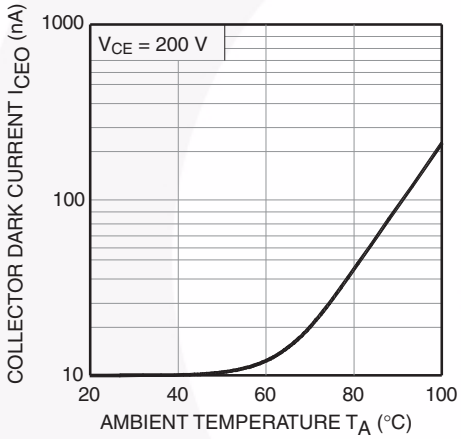



**Figure 11. Collector Dark Current vs. Ambient Temperature**

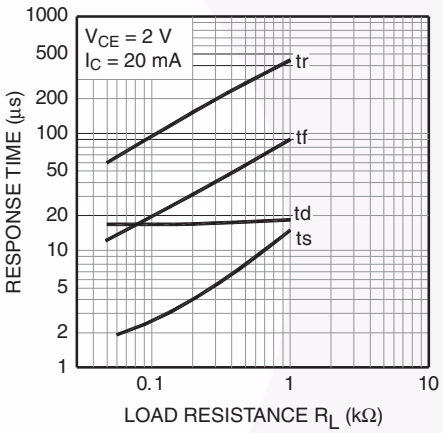



**Figure 12. Response Time vs. Load Resistance**

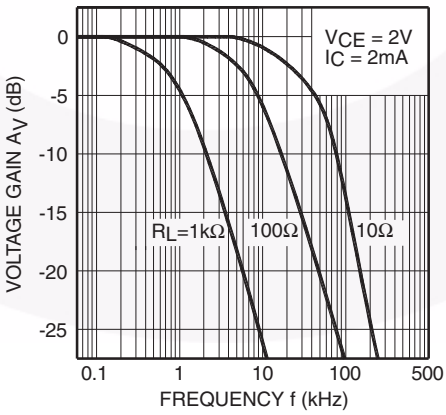



**Figure 13. Frequency Response**

## Test Circuits

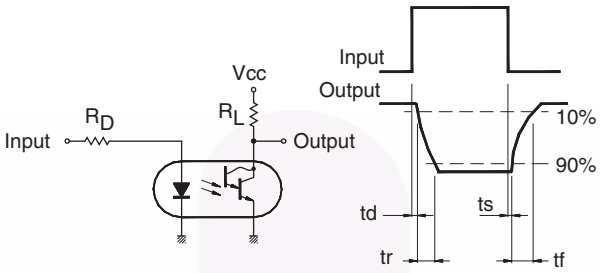



**Figure 14. Test Circuit for Response Time**

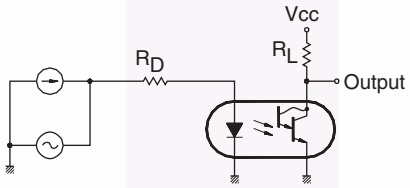
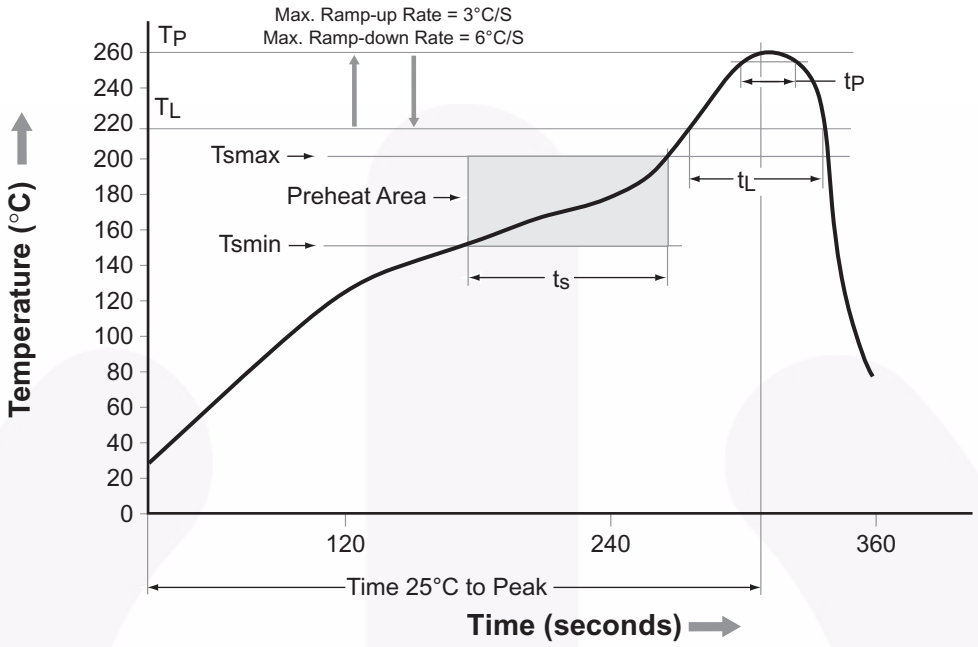



**Figure 15. Test Circuit for Frequency Response**

## Reflow Profile



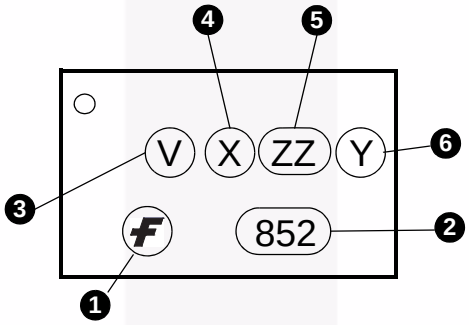

| Profile Feature | Pb-Free Assembly Profile |
|---|---|
| Temperature Min. (Tsmin) | 150°C |
| Temperature Max. (Tsmax) | 200°C |
| Time ($t_S$) from (Tsmin to Tsmax) | 60–120 seconds |
| Ramp-up Rate ($t_L$ to $t_P$) | 3°C/second max. |
| Liquidous Temperature ($T_L$) | 217°C |
| Time ($t_L$) Maintained 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. |

**Figure 16. Reflow Profile**

## Ordering Information

| Part Number | Package | Packing Method |
|---|---|---|
| FOD852 | DIP 4-Pin | Tube (100 units per tube) |
| FOD852S | SMT 4-Pin (Lead Bend) | Tube (100 units per tube) |
| FOD852SD | SMT 4-Pin (Lead Bend) | Tape and Reel (1,000 units per reel) |
| FOD852300 | DIP 4-Pin, DIN EN/IEC60747-5-5 option | Tube (100 units per tube) |
| FOD8523S | SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option | Tube (100 units per tube) |
| FOD8523SD | SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option | Tape and Reel (1,000 units per reel) |
| FOD852300W | DIP 4-Pin, 0.4” Lead Spacing, DIN EN/IEC60747-5-5 option | Tube (100 units per tube) |

## Marking Information




| Definitions | |
|---|---|
| 1 | Fairchild Logo |
| 2 | Device Number |
| 3 | DIN EN/IEC60747-5-5 Option (only appears on parts ordered with this option) |
| 4 | One-Digit Year Code, e.g., ‘5’ |
| 5 | Two-Digit Work Week, Ranging from ‘01’ to ‘53’ |
| 6 | Assembly Package Code<br>Y = Manufactured in Thailand<br>YA = Manufactured in China |

## Carrier Tape Specifications

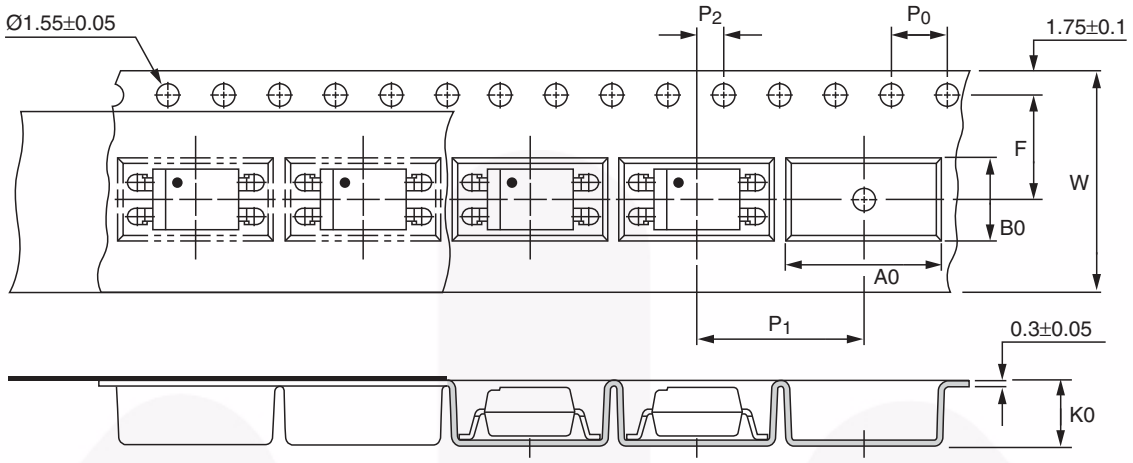
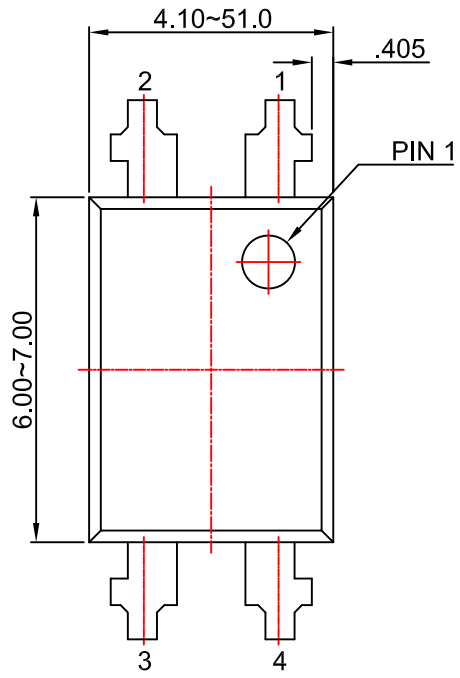



**Figure 17. Carrier Tape Specification**

| Symbol | Description | Dimensions in mm (inches) |
|---|---|---|
| W | Tape wide | 16 ± 0.3 (0.63) |
| $P_0$ | Pitch of sprocket holes | 4 ± 0.1 (0.15) |
| F<br>$P_2$ | Distance of compartment | 7.5 ± 0.1 (0.295)<br>2 ± 0.1 (0.079) |
| $P_1$ | Distance of compartment to compartment | 12 ± 0.1 (0.472) |
| A0 | Compartment | 10.45 ± 0.1 (0.411) |
| B0 | | 5.30 ± 0.1 (0.209) |
| K0 | | 4.25 ± 0.1 (0.167) |

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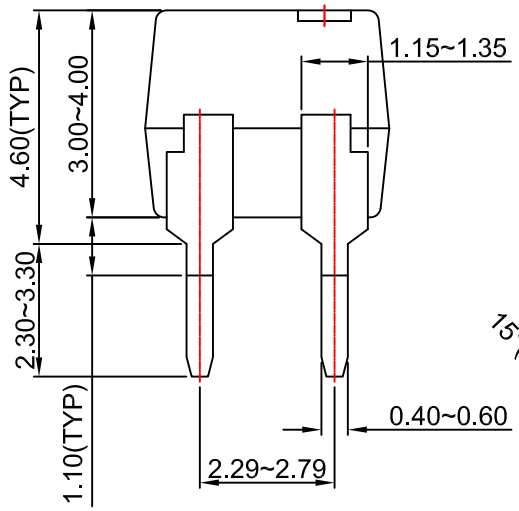
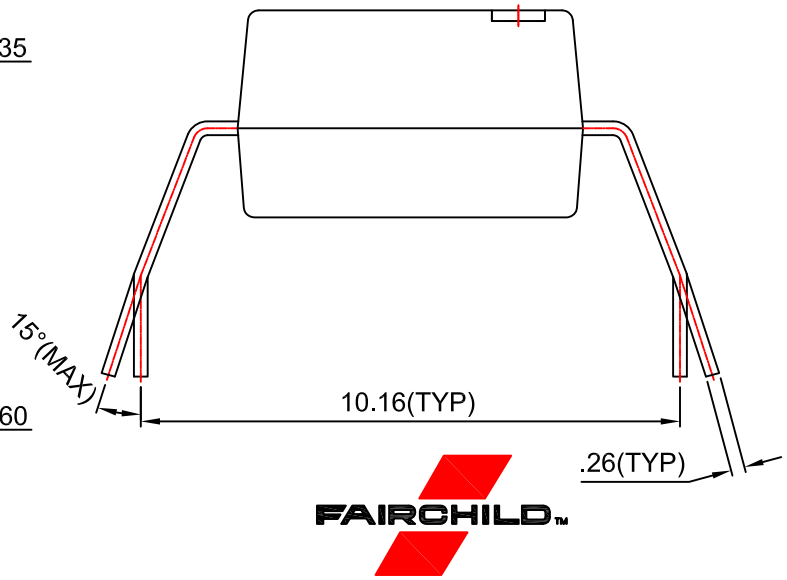
D) DRAWING FILENAME AND REVSION: MKT-N04Brev2.

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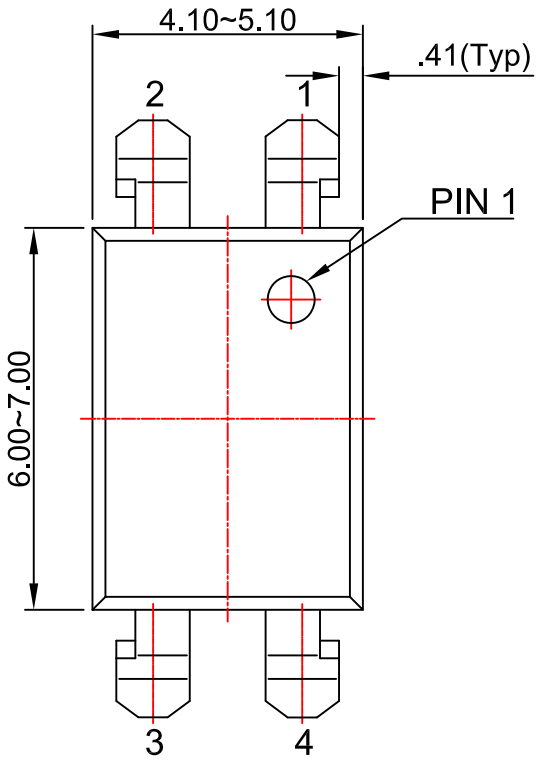
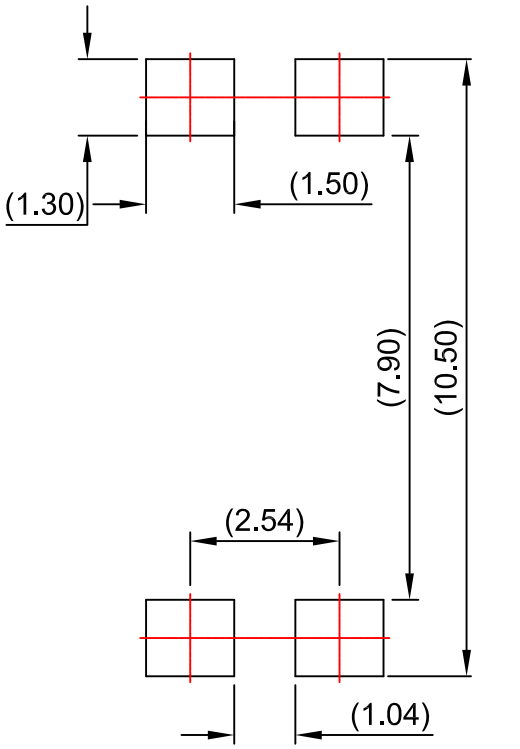
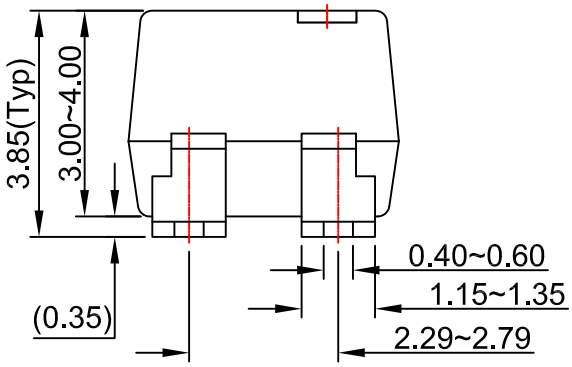
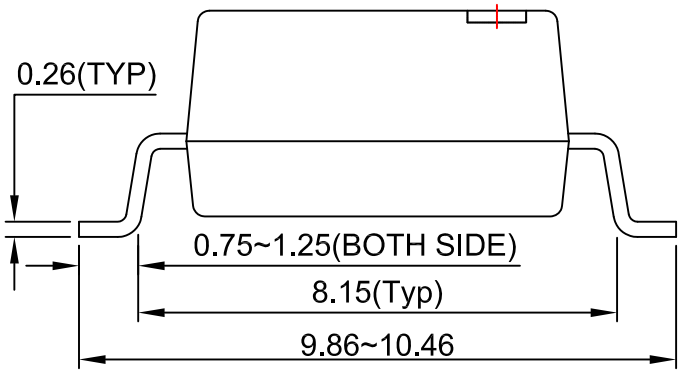



LAND PATTERN RECOMMENDATION

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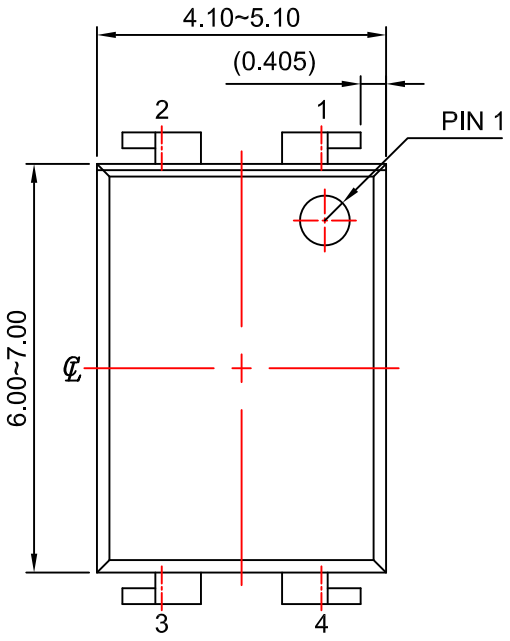


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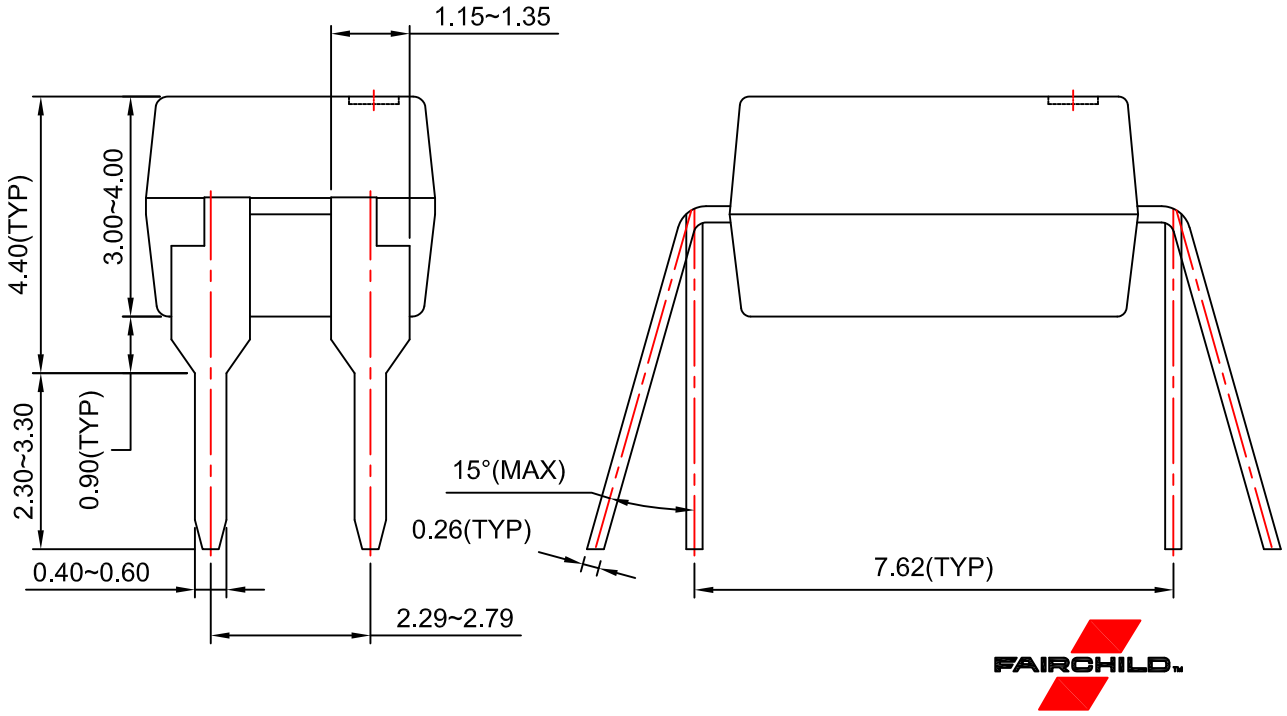


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