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August 2016

# MCT6, MCT61, MCT62
# 8-Pin Dual Channel Phototransistor Optocouplers

## Features

- Two Isolated Channels Per Package
- Safety and Regulatory Approvals:
  - UL1577, 5,000 $VAC_{RMS}$ for 1 Minute
  - DIN-EN/IEC60747-5-5, 890 V Peak Working Insulation Voltage

## Applications

- AC line/digital logic – isolate high voltage transients
- Digital logic/digital logic – eliminate spurious grounds
- Digital logic/AC triac control – isolate high voltage
- transients
- Twisted pair line receiver – eliminate ground loop
- feedthrough
- Telephone/telegraph line receiver – isolate high
- voltage transients
- High frequency power supply feedback control –
- maintain floating grounds and transients
- Relay contact monitor – isolate floating grounds and
- transients
- Power supply monitor – isolate transients

## Description

The general purpose optocouplers, MCT6, MCT61, and MCT62, have two isolated channels in a standard plastic 8-pin dual-in-line (DIP) package for density applications. Each channel consists of a gallium arsenide infrared emitting diode driving a NPN silicon planar phototransistor. For four channel applications, two packages fit into a standard 16-pin DIP socket.

## Functional Schematic

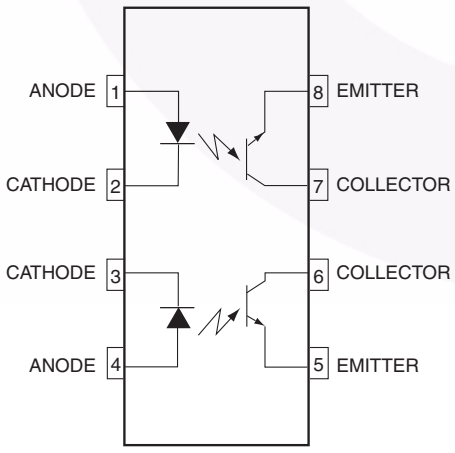



**Figure 1. Schematic**

## Package Outlines

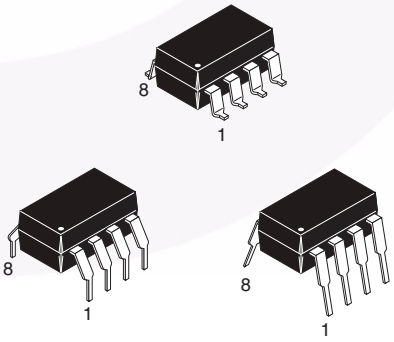



**Figure 2. Package Outlines**

## 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–IV |
| Climatic Classification | | 55/115/21 |
| 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 | 1424 | $V_{peak}$ |
| | 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 | 1668 | $V_{peak}$ |
| $V_{IORM}$ | Maximum Working Insulation Voltage | 890 | $V_{peak}$ |
| $V_{IOTM}$ | Highest Allowable Over-Voltage | 8000 | $V_{peak}$ |
| | 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) | 60 | mA |
| $P_{S,OUTPUT}$ | Output Power(1) | 150 | 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°C unless otherwise specified.

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $T_{STG}$ | Storage Temperature | -55 to +150 | °C |
| $T_{OPR}$ | Operating Temperature | -55 to +100 | °C |
| $T_J$ | Junction Temperature | -55 to +125 | °C |
| $T_{SOL}$ | Lead Solder Temperature | 260 for 10 seconds | °C |
| $P_D$ | Total Device Power Dissipation @ $T_A$ = 25°C | 400 | mW |
| | Derate Above 25°C | 5.33 | mW/°C |
| **EMITTER (Each channel)** | | | |
| $I_F$ | DC / Average Forward Input Current | 60 | mA |
| $I_F$(pk) | Forward Current - Peak (PW = 1µs, 300pps) | 3 | A |
| $V_R$ | Reverse Input Voltage | 3 | V |
| $P_{D(EMITTER)}$ | Total Power Dissipation @ $T_A$ = 25°C | 100 | mW |
| | Derate Above 25°C | 1.3 | mW/°C |
| **DETECTOR** | | | |
| $I_C$ | Continuous Collector Current | 30 | mA |
| $P_{D(DETECTOR)}$ | Total Power Dissipation @ $T_A$ = 25°C | 150 | mW |
| | Derate Above 25°C | 2.0 | mW/°C |

## Electrical Characteristics

$T_A$ = 25°C unless otherwise specified.

### Individual Component Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **EMITTER** | | | | | | |
| $V_F$ | Input Forward Voltage | $I_F$ = 20 mA | | 1.2 | 1.5 | V |
| $V_R$ | Reverse Voltage | $I_R$ = 10 µA | 3 | 25 | | V |
| $I_R$ | Reverse Leakage Current | $V_R$ = 5 V | | 0.001 | 10 | µA |
| $C_J$ | Junction Capacitance | $V_F$ = 0 V, f = 1 MHz | | 50 | | pF |
| **DETECTOR** | | | | | | |
| $BV_{CEO}$ | Collector-to-Emitter Breakdown Voltage | $I_C$ = 1.0 mA, $I_F$ = 0 | 30 | 85 | | V |
| $BV_{ECO}$ | Emitter-to-Collector Breakdown Voltage | $I_E$ = 100 µA, $I_F$ = 0 | 6 | 13 | | V |
| $I_{CEO}$ | Collector-to-Emitter Dark Current | $V_{CE}$ = 10 V, $I_F$ = 0 | | 5 | 100 | nA |
| $C_{CE}$ | Capacitance | $V_{CE}$ = 0 V, f = 1 MHz | | 8 | | pF |

### Transfer Characteristics

| Symbol | Parameter | Device | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| **DC CHARACTERISTICS** | | | | | | | |
| CTR | Current Transfer Ratio, Collector-to-Emitter | MCT6 | $I_F$ = 10 mA, $V_{CE}$ = 10 V | 20 | | | % |
| | | MCT61 | $I_F$ = 5 mA, $V_{CE}$ = 5 V | 50 | | | |
| | | MCT62 | | 100 | | | |
| $VCE_{(SAT)}$ | Saturation Voltage, Collector-to-Emitter | ALL | $I_F$ = 16 mA, $I_C$ = 2 mA | | 0.15 | 0.4 | V |

### AC CHARACTERISTICS

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Non-Saturated** | | | | | | |
| $T_{ON}$ | Turn-On Time | $R_L$ = 100 Ω, $I_C$ = 2 mA, $V_{CC}$ = 10 V | | 3.0 | | µs |
| $T_{OFF}$ | Turn-Off Time | | | 3.0 | | µs |
| $T_R$ | Rise Time | | | 2.4 | | µs |
| $T_F$ | Fall Time | | | 2.4 | | µs |
| **Saturated** | | | | | | |
| $T_{ON}$ | Turn-On Time | $I_F$ = 16 mA, $R_L$ = 1.9 kΩ, $V_{CE}$ = 5 V | | 2.4 | | µs |
| $T_{OFF}$ | Turn-Off Time | | | 25.0 | | µs |

### Isolation Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{ISO}$ | Input-Output Isolation Voltage | $I_{I-O} \leq$ 10 µA, t = 1 Minute | 5,000 | | | $VAC_{RMS}$ |
| $C_{ISO}$ | Isolation Capacitance | f = 1 MHz | | 0.5 | | pF |
| $R_{ISO}$ | Isolation Resistance | $V_{I-O}$ = 500 VDC | $10^{11}$ | | | Ω |

## Typical Performance Curves

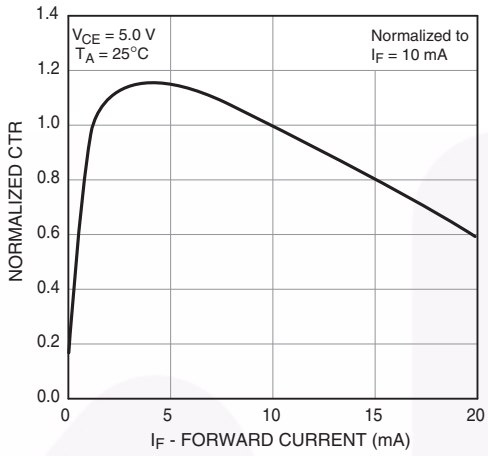



**Fig. 3 Normalized CTR vs. Forward Current**

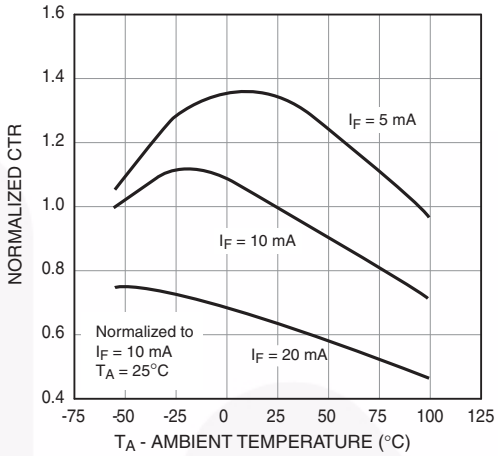



**Fig. 4 Normalized CTR vs. Ambient Temperature**

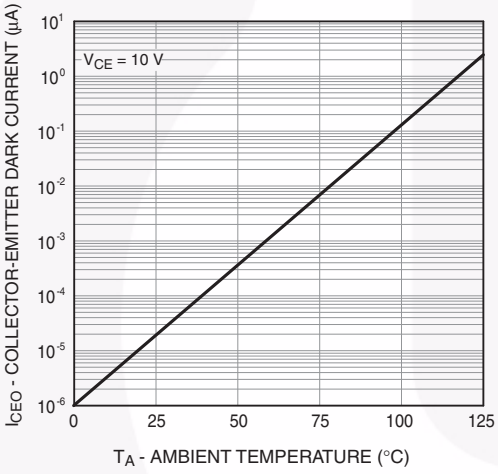



**Fig. 5 Dark Current vs. Ambient Temperature**

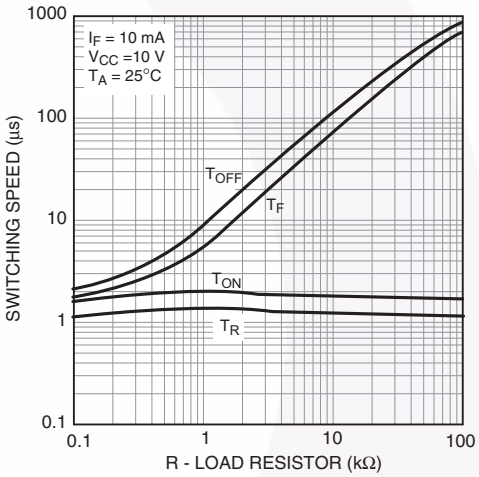



**Fig. 6 Switching Speed vs. Load Resistor**

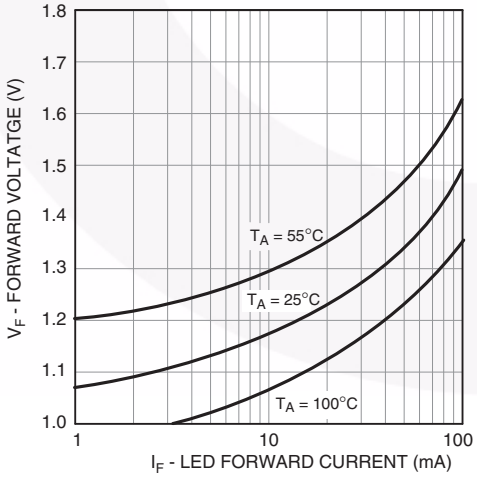



**Fig. 7 LED Forward Voltage vs. Forward Current**

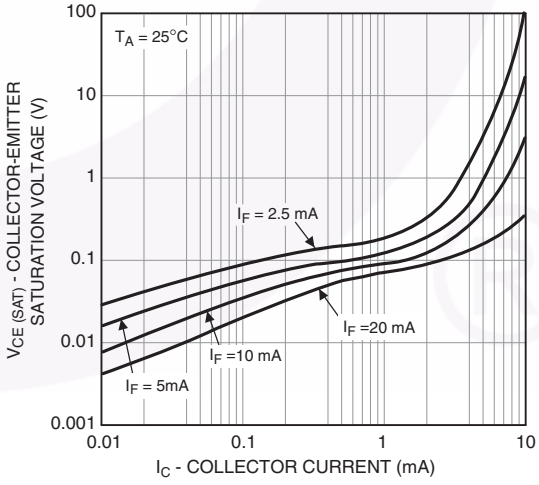



**Fig. 8 Collector-Emitter Saturation Voltage vs. Collector Current**

## Switching Time Test Circuit and Waveforms

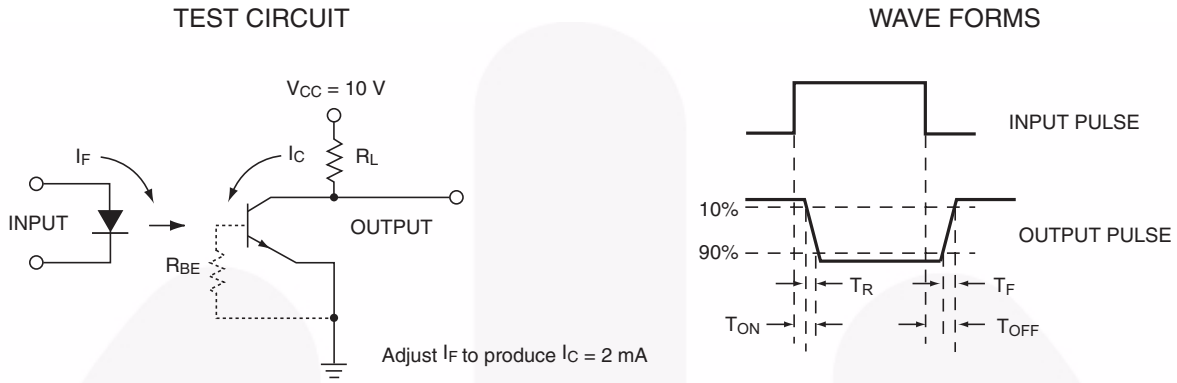
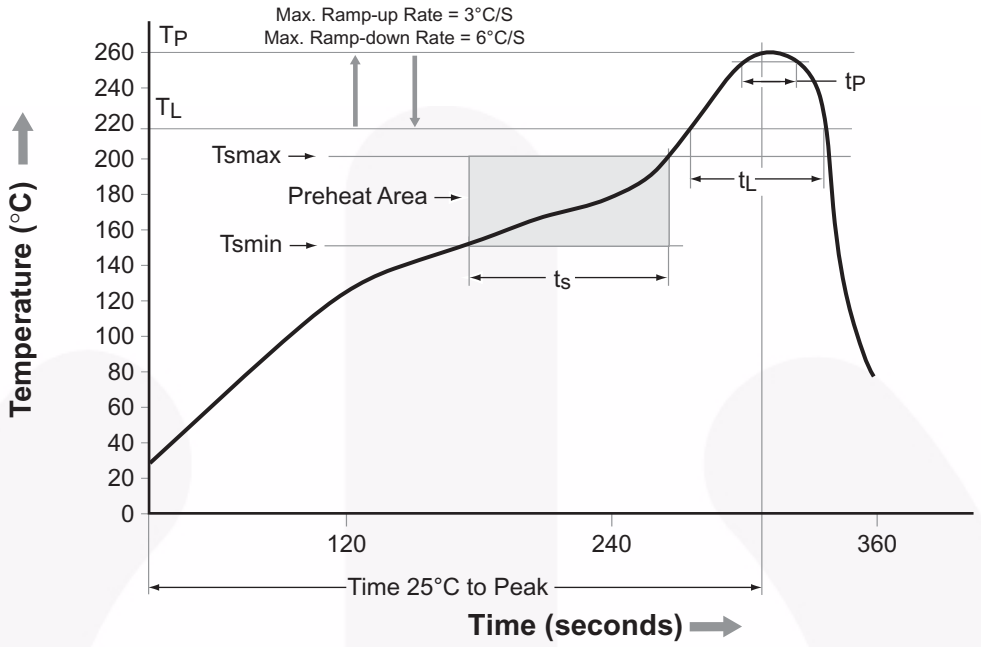



**Figure 9. Switching Time Test Circuit and Waveforms**

## 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. |

## Ordering Information

| Part Number | Package | Packing Method |
|---|---|---|
| MCT6 | DIP 8-Pin | Tube (50 units per tube) |
| MCT6S | SMT 8-Pin (Lead Bend) | Tube (50 units per tube) |
| MCT6SD | SMT 8-Pin | Tape and Reel (1,000 units per reel) |
| MCT6300 | DIN EN/IEC 60747-5-5 Option | Tube (50 units per tube) |
| MCT63S | SMT 8-Pin (Lead Bend); DIN EN/IEC 60747-5-5 Option | Tube (50 units per tube) |
| MCT63SD | SMT 8-Pin; DIN EN/IEC 60747-5-5 Option | Tape and Reel (1,000 units per reel) |
| MCT6300W | 0.4” Lead Spacing; DIN EN/IEC 60747-5-5 Option | Tube (50 units per tube) |

**Note**

1. The product orderable part number system listed in this table also applies to the MCT61 and MCT62.

## Marking Information

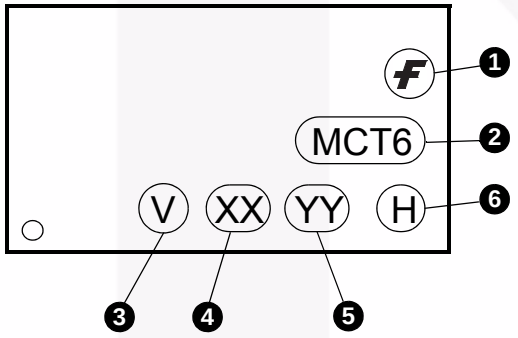
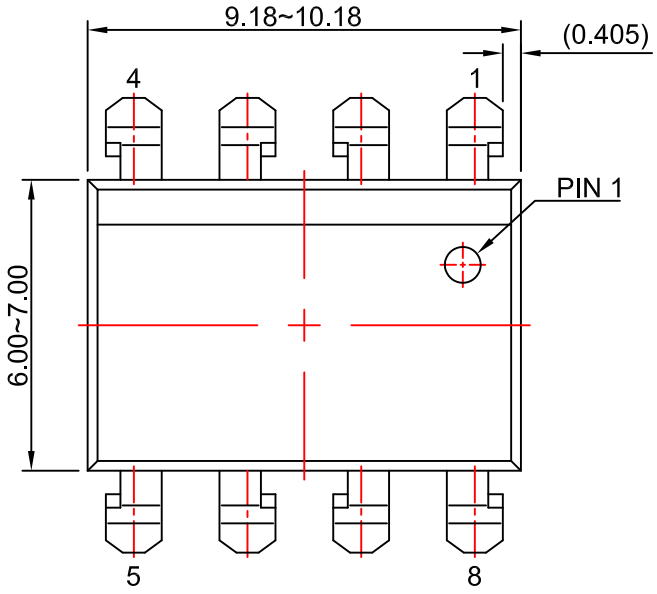
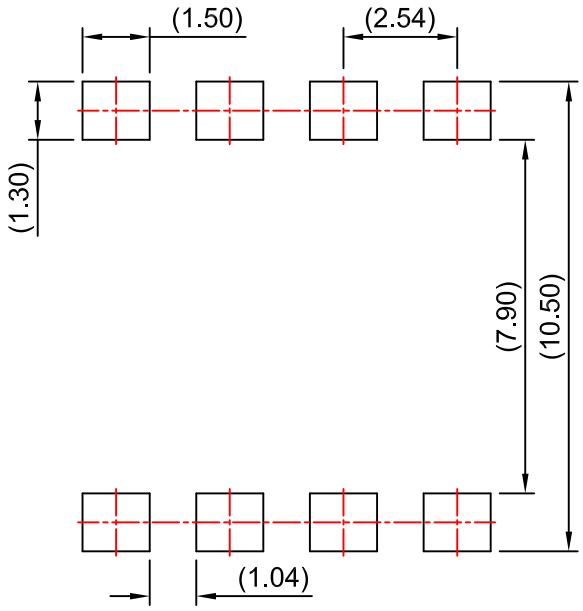



**Figure 10. Top Mark**

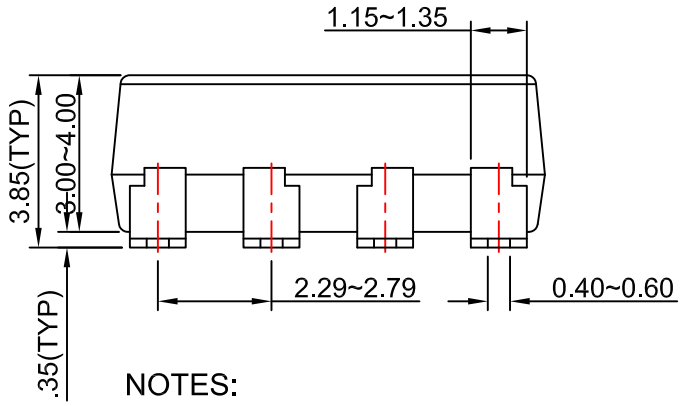
**Table 1. Top Mark Definitions**

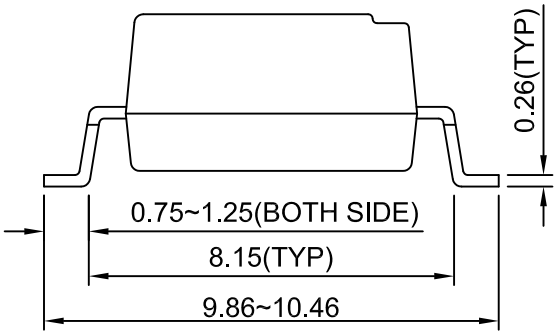
| | |
|---|---|
| 1 | Fairchild Logo |
| 2 | Device Number |
| 3 | DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option) |
| 4 | Two-Digit Year Code, e.g., “16” |
| 5 | Digit Work Week, Ranging from “01” to “53” |
| 6 | Assembly Package Code |




LAND PATTERN RECOMMENDATION

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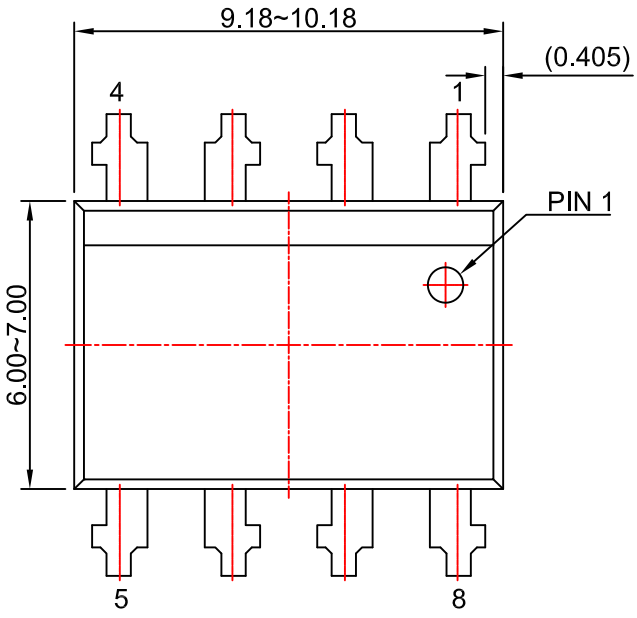


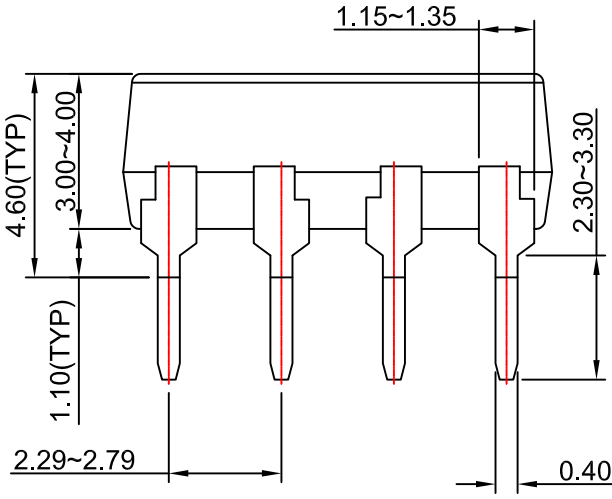


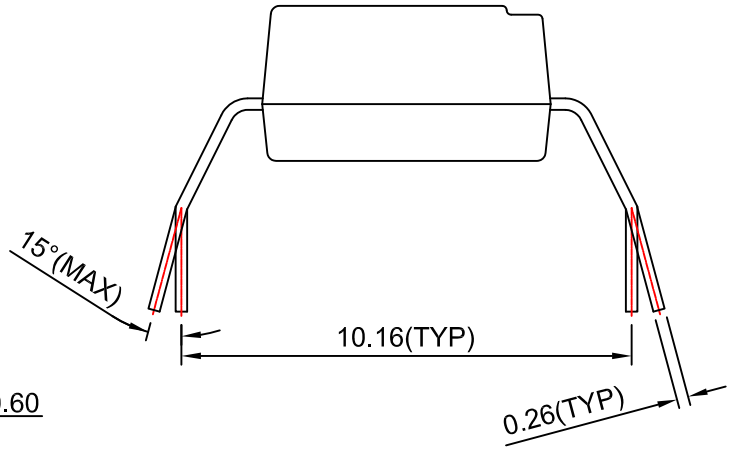


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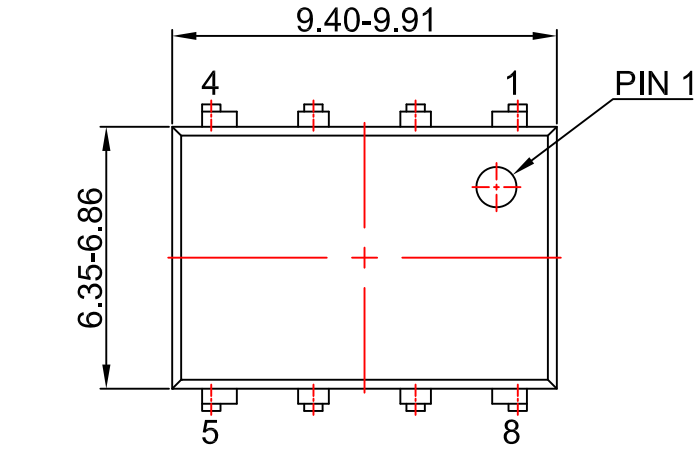


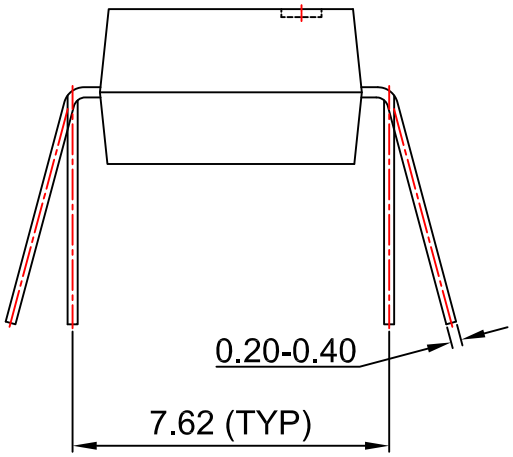


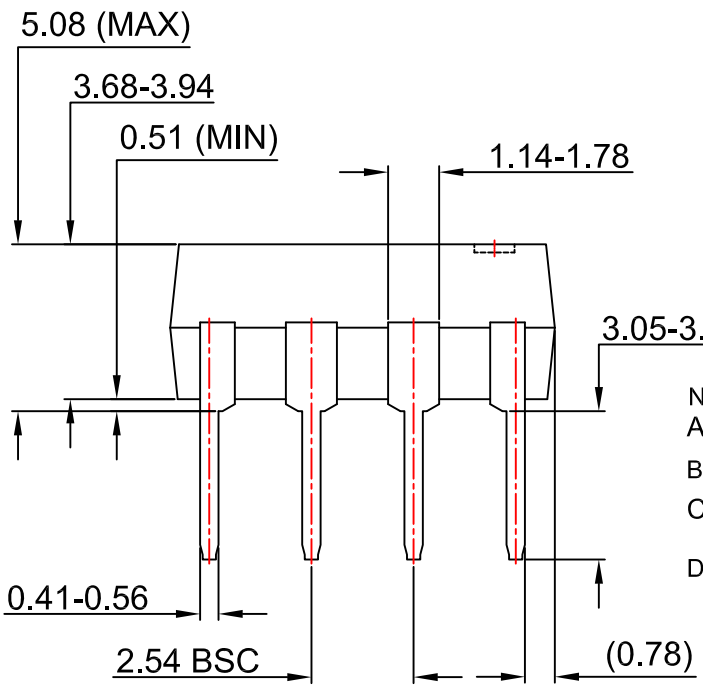


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