



December 2014

H11G1M, H11G2M — 6-Pin DIP High Voltage Photodarlington Optocouplers

# H11G1M, H11G2M 6-Pin DIP High Voltage Photodarlington Optocouplers

## Features

- High  $BV_{CEO}$ :
  - 100 V Minimum for H11G1M
  - 80 V Minimum for H11G2M
- High Sensitivity to Low Input Current (Minimum 500% CTR at  $I_F = 1 \text{ mA}$ )
- Low Leakage Current at Elevated Temperature (Maximum 100  $\mu\text{A}$  at 80°C)
- Safety and Regulatory Approvals:
  - UL1577, 4,170  $VAC_{RMS}$  for 1 Minute
  - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

## Applications

- CMOS Logic Interface
- Telephone Ring Detector
- Low Input TTL Interface
- Power Supply Isolation
- Replace Pulse Transformer

## General Description

The H11G1M and H11G2M are photodarlington-type optically coupled optocouplers. These devices have a gallium arsenide infrared emitting diode coupled with a silicon darlington connected phototransistor which has an integral base-emitter resistor to optimize elevated temperature characteristics.

## Schematic

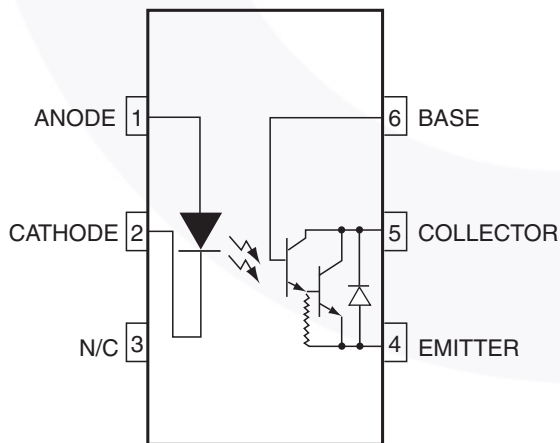


Figure 1. Schematic

## Package Outlines

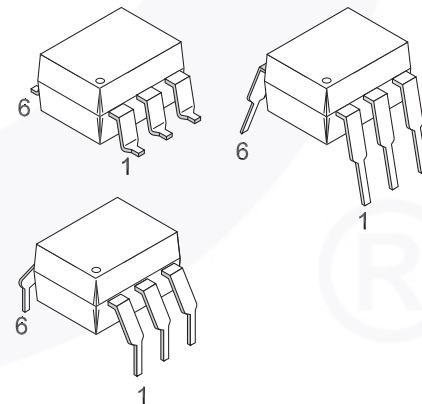


Figure 2. Package Outlines

## 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 <sub>RMS</sub> | I–IV            |
|                                                                                     | < 300 V <sub>RMS</sub> | I–IV            |
| Climatic Classification                                                             |                        | 55/100/21       |
| 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  | 1360              | 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 | 1594              | V <sub>peak</sub> |
| V <sub>IORM</sub>     | Maximum Working Insulation Voltage                                                                                                                             | 850               | V <sub>peak</sub> |
| V <sub>IOTM</sub>     | Highest Allowable Over-Voltage                                                                                                                                 | 6000              | V <sub>peak</sub> |
|                       | External Creepage                                                                                                                                              | ≥ 7               | mm                |
|                       | External Clearance                                                                                                                                             | ≥ 7               | mm                |
|                       | External Clearance (for Option TV, 0.4" Lead Spacing)                                                                                                          | ≥ 10              | mm                |
| DTI                   | Distance Through Insulation (Insulation Thickness)                                                                                                             | ≥ 0.5             | mm                |
| T <sub>S</sub>        | Case Temperature <sup>(1)</sup>                                                                                                                                | 175               | °C                |
| I <sub>S,INPUT</sub>  | Input Current <sup>(1)</sup>                                                                                                                                   | 350               | mA                |
| P <sub>S,OUTPUT</sub> | Output Power <sup>(1)</sup>                                                                                                                                    | 800               | mW                |
| R <sub>IO</sub>       | Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>                                                                               | > 10 <sup>9</sup> | 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.

| Symbol              | Parameter                                                  | Value              | Unit  |
|---------------------|------------------------------------------------------------|--------------------|-------|
| <b>TOTAL DEVICE</b> |                                                            |                    |       |
| $T_{STG}$           | Storage Temperature                                        | -40 to +125        | °C    |
| $T_{OPR}$           | Operating Temperature                                      | -40 to +100        | °C    |
| $T_J$               | Junction Temperature                                       | -40 to +125        | °C    |
| $T_{SOL}$           | Lead Solder Temperature                                    | 260 for 10 seconds | °C    |
| $P_D$               | Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$  | 290                | mW    |
|                     | Derate Above $25^\circ\text{C}$                            | 3.5                | mW/°C |
| <b>EMITTER</b>      |                                                            |                    |       |
| $I_F$               | Forward Input Current                                      | 60                 | mA    |
| $V_R$               | Reverse Input Voltage                                      | 6.0                | V     |
| $I_F(pk)$           | Forward Current – Peak (1 $\mu\text{s}$ pulse, 300 pps)    | 3.0                | A     |
| $P_D$               | LED Power Dissipation @ $T_A = 25^\circ\text{C}$           | 90                 | mW    |
|                     | Derate Above $25^\circ\text{C}$                            | 1.8                | mW/°C |
| <b>DETECTOR</b>     |                                                            |                    |       |
| $V_{CEO}$           | Collector-Emitter Voltage<br>H11G1M                        | 100                | V     |
|                     | H11G2M                                                     | 80                 | V     |
| $P_D$               | Photodetector Power Dissipation @ $T_A = 25^\circ\text{C}$ | 200                | mW    |
|                     | Derate Above $25^\circ\text{C}$                            | 2.67               | mW/°C |

## Electrical Characteristics

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

### Individual Component Characteristics

| Symbol                          | Characteristic                          | Test Conditions                                         | Device | Min. | Typ.  | Max. | Unit          |
|---------------------------------|-----------------------------------------|---------------------------------------------------------|--------|------|-------|------|---------------|
| <b>EMITTER</b>                  |                                         |                                                         |        |      |       |      |               |
| $V_F$                           | Forward Voltage                         | $I_F = 10\text{ mA}$                                    | All    |      | 1.3   | 1.5  | V             |
| $\frac{\Delta V_F}{\Delta T_A}$ | Forward Voltage Temperature Coefficient |                                                         | All    |      | -1.8  |      | mV/°C         |
| $BV_R$                          | Reverse Breakdown Voltage               | $I_R = 10\ \mu\text{A}$                                 | All    | 3.0  | 25    |      | V             |
| $C_J$                           | Junction Capacitance                    | $V_F = 0\text{ V}, f = 1\text{ MHz}$                    | All    |      | 50    |      | pF            |
|                                 |                                         | $V_F = 1\text{ V}, f = 1\text{ MHz}$                    |        |      | 65    |      | pF            |
| $I_R$                           | Reverse Leakage Current                 | $V_R = 3.0\text{ V}$                                    | All    |      | 0.001 | 10   | $\mu\text{A}$ |
| <b>DETECTOR</b>                 |                                         |                                                         |        |      |       |      |               |
| $BV_{CEO}$                      | Breakdown Voltage Collector to Emitter  | $I_C = 1.0\text{ mA}, I_F = 0$                          | H11G1M | 100  |       |      | V             |
|                                 |                                         |                                                         | H11G2M | 80   |       |      | V             |
| $BV_{CBO}$                      | Collector to Base                       | $I_C = 100\ \mu\text{A}$                                | H11G1M | 100  |       |      | V             |
|                                 |                                         |                                                         | H11G2M | 80   |       |      | V             |
| $BV_{EBO}$                      | Emitter to Base                         |                                                         | All    | 7    | 10    |      | V             |
| $I_{CEO}$                       | Leakage Current Collector to Emitter    | $V_{CE} = 80\text{ V}, I_F = 0$                         | H11G1M |      |       | 100  | nA            |
|                                 |                                         | $V_{CE} = 60\text{ V}, I_F = 0$                         | H11G2M |      |       | 100  | nA            |
|                                 |                                         | $V_{CE} = 80\text{ V}, I_F = 0, T_A = 80^\circ\text{C}$ | H11G1M |      |       | 100  | $\mu\text{A}$ |
|                                 |                                         | $V_{CE} = 60\text{ V}, I_F = 0, T_A = 80^\circ\text{C}$ | H11G2M |      |       | 100  | $\mu\text{A}$ |

### Transfer Characteristics

| Symbol                 | Characteristics                              | Test Conditions                                                                                                                | Device | Min.       | Typ. | Max. | Unit          |
|------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------|------------|------|------|---------------|
| <b>EMITTER</b>         |                                              |                                                                                                                                |        |            |      |      |               |
| CTR                    | Current Transfer Ratio, Collector to Emitter | $I_F = 10\text{ mA}, V_{CE} = 1\text{ V}$                                                                                      | All    | 100 (1000) |      |      | mA (%)        |
|                        |                                              | $I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$                                                                                       | All    | 5 (500)    |      |      | mA (%)        |
| $V_{CE(SAT)}$          | Saturation Voltage                           | $I_F = 16\text{ mA}, I_C = 50\text{ mA}$                                                                                       | All    |            | 0.85 | 1.0  | V             |
|                        |                                              | $I_F = 1\text{ mA}, I_C = 1\text{ mA}$                                                                                         | All    |            | 0.75 | 1.0  | V             |
| <b>SWITCHING TIMES</b> |                                              |                                                                                                                                |        |            |      |      |               |
| $t_{ON}$               | Turn-on Time                                 | $R_L = 100\ \Omega, I_F = 10\text{ mA},$<br>$V_{CE} = 5\text{ V}, f \leq 30\text{ Hz},$<br>Pulse Width $\leq 300\ \mu\text{s}$ | All    |            | 5    |      | $\mu\text{s}$ |
| $t_{OFF}$              | Turn-off Time                                |                                                                                                                                | All    |            | 100  |      | $\mu\text{s}$ |

### Isolation Characteristics

| Symbol    | Characteristic                 | Test Conditions                                        | Min.      | Typ. | Max. | Unit           |
|-----------|--------------------------------|--------------------------------------------------------|-----------|------|------|----------------|
| $V_{ISO}$ | Input-Output Isolation Voltage | $t = 1\text{ Minute}$                                  | 4170      |      |      | $V_{AC_{RMS}}$ |
| $C_{ISO}$ | Isolation Capacitance          | $V_{I-O} = 0\text{ V}, f = 1\text{ MHz}$               |           | 0.2  |      | pF             |
| $R_{ISO}$ | Isolation Resistance           | $V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$ | $10^{11}$ |      |      | $\Omega$       |

### Typical Performance Curves

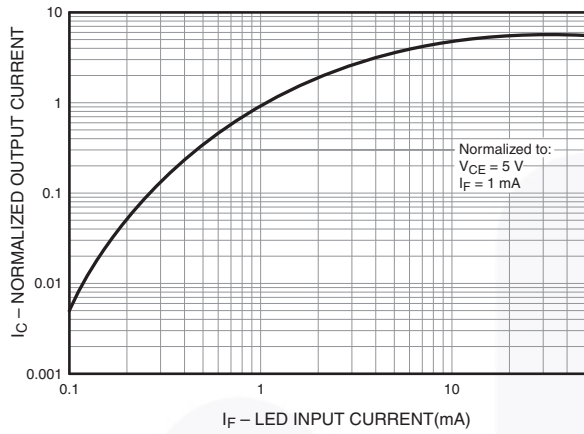


Figure 3. Output Current vs. Input Current

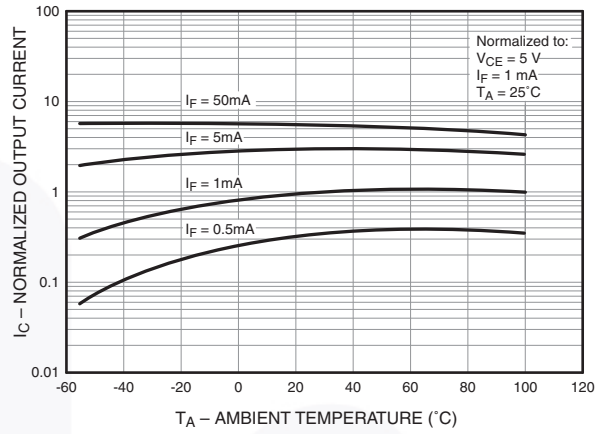


Figure 4. Normalized Output Current vs. Temperature

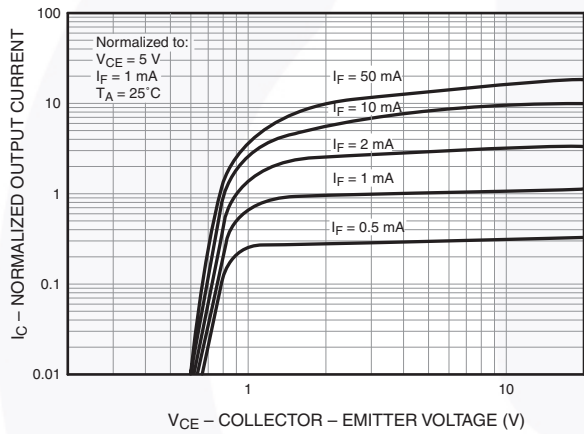


Figure 5. Output Current vs. Collector-Emitter Voltage

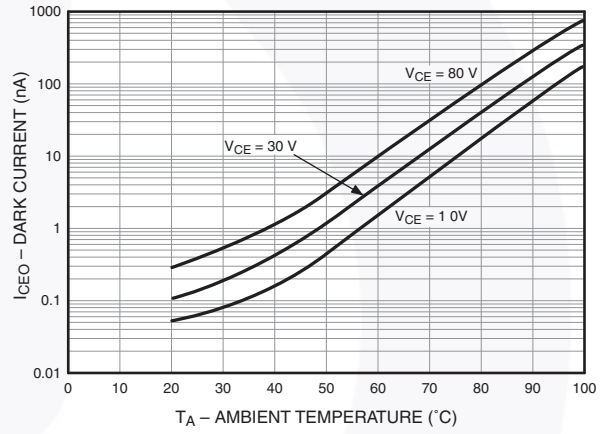


Figure 6. Collector-Emitter Dark Current vs. Ambient Temperature

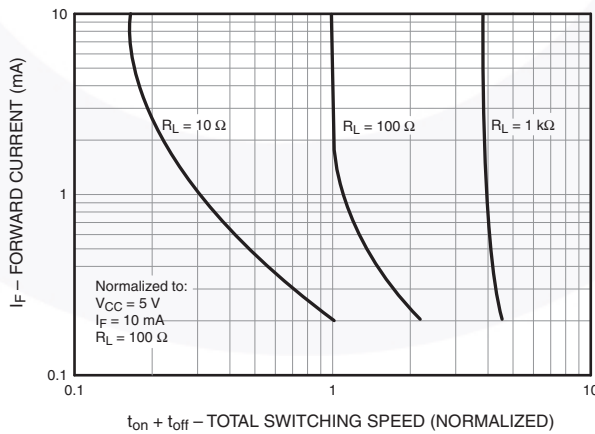


Figure 7. Input Current vs. Total Switching Speed (Typical Values)

### Reflow Profile

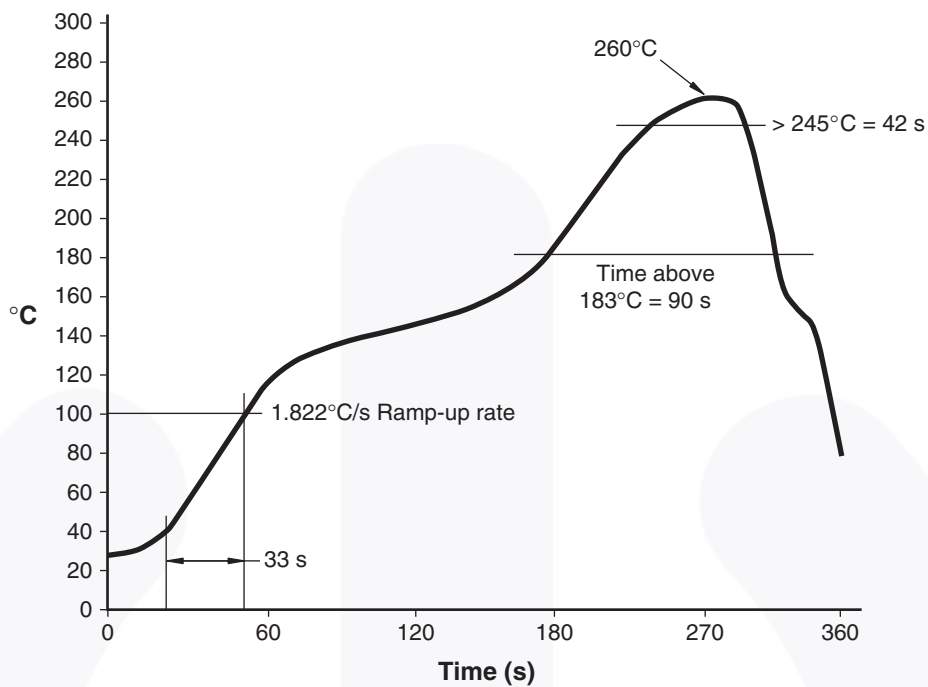


Figure 8. Reflow Profile



## Ordering Information

| Part Number | Package                                                  | Packing Method             |
|-------------|----------------------------------------------------------|----------------------------|
| H11G1M      | DIP 6-Pin                                                | Tube (50 Units)            |
| H11G1SM     | SMT 6-Pin (Lead Bend)                                    | Tube (50 Units)            |
| H11G1SR2M   | SMT 6-Pin (Lead Bend)                                    | Tape and Reel (1000 Units) |
| H11G1VM     | DIP 6-Pin, DIN EN/IEC60747-5-5 Option                    | Tube (50 Units)            |
| H11G1SVM    | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option        | Tube (50 Units)            |
| H11G1SR2VM  | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option        | Tape and Reel (1000 Units) |
| H11G1TVM    | DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option | Tube (50 Units)            |

**Note:**

2. The product orderable part number system listed in this table also applies to the H11G2M device.

## Marking Information

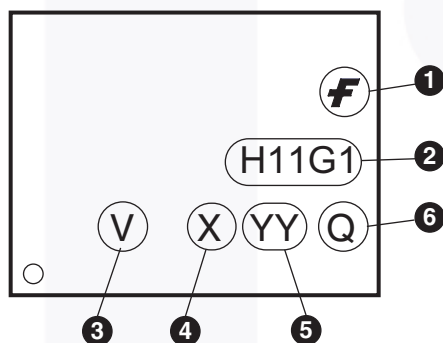
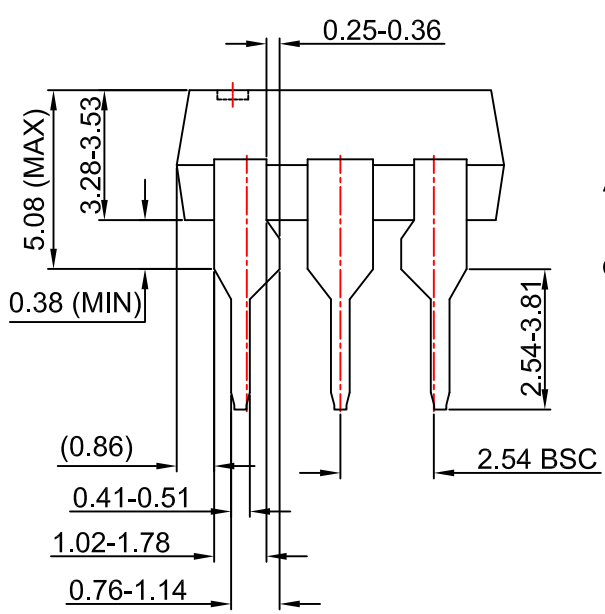
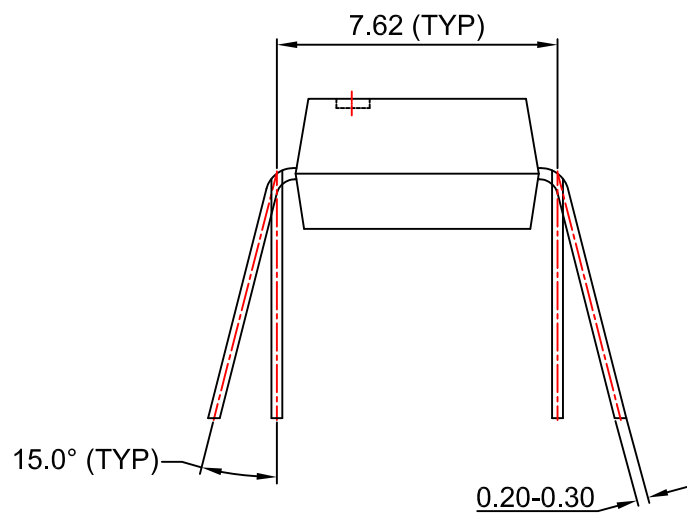
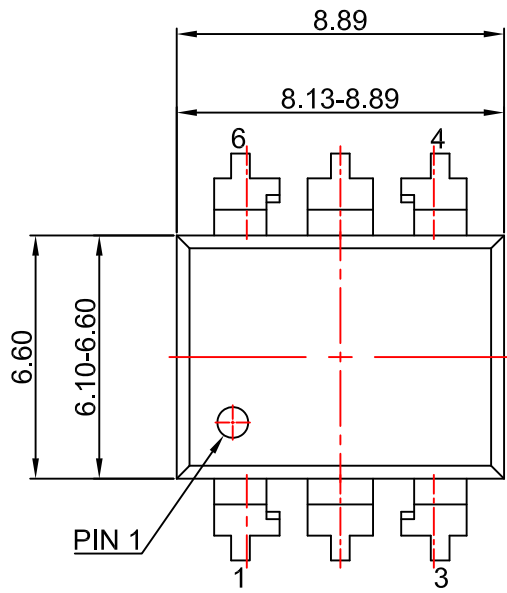


Figure 9. Top Mark

Table 1. Top Mark Definitions

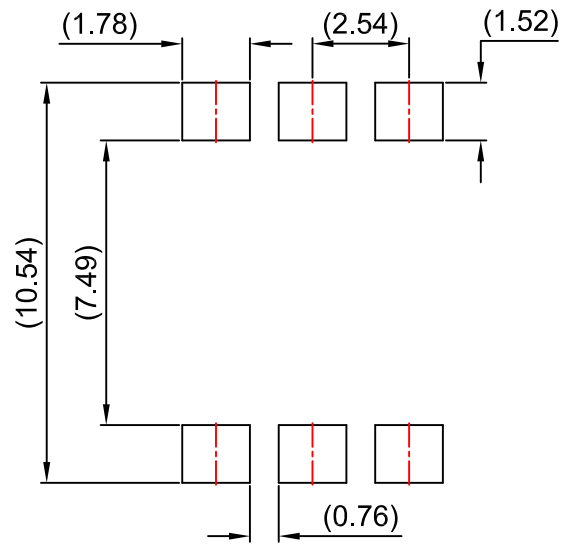
|   |                                                                                 |
|---|---------------------------------------------------------------------------------|
| 1 | Fairchild Logo                                                                  |
| 2 | Device Number                 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



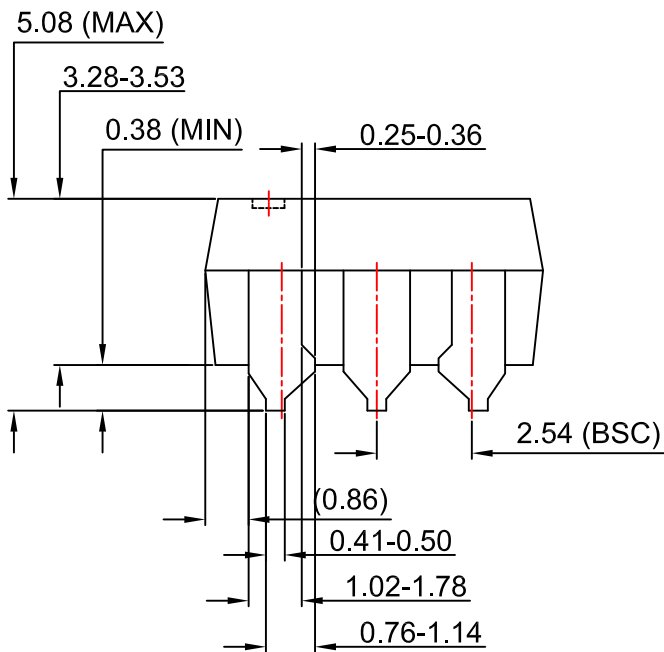
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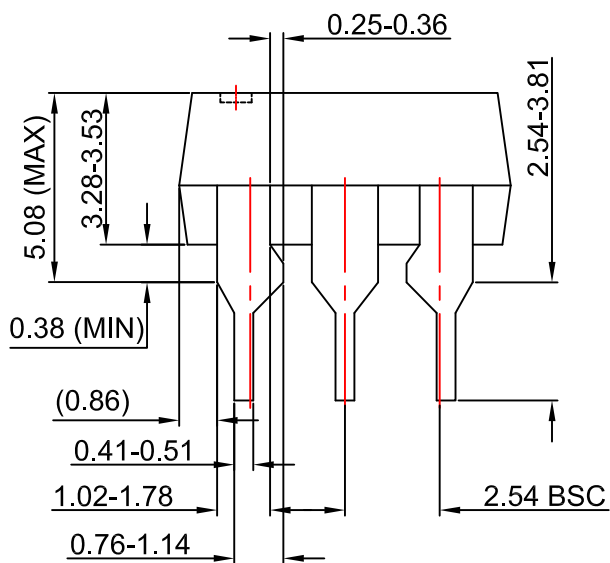
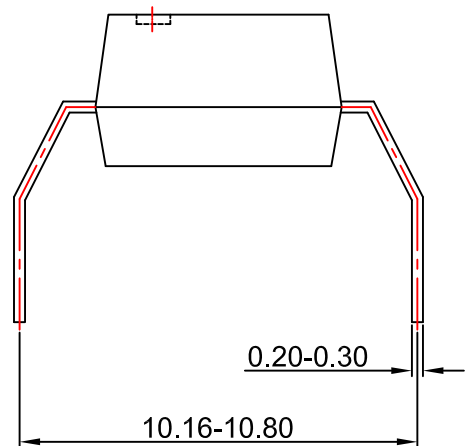
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