



December 2014

4N29M, 4N30M, 4N32M, 4N33M, H11B1M, TIL113M 6-Pin DIP General Purpose Photodarlington Optocoupler

Features

- High Sensitivity to Low Input Drive Current
- Meets or Exceeds All JEDEC Registered Specifications
- Safety and Regulatory Approvals:
 - UL1577, 4,170 VAC_{RMS} for 1 Minute
- DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

Description

The 4N29M, 4N30M, 4N32M, 4N33M, H11B1M, and TIL113M have a gallium arsenide infrared emitter optically coupled to a silicon planar photodarlington.

Applications

- Low Power Logic Circuits
- Telecommunications Equipment
- Portable Electronics
- Solid State Relays
- Interfacing Coupling Systems of Different Potentials and Impedances

Schematic

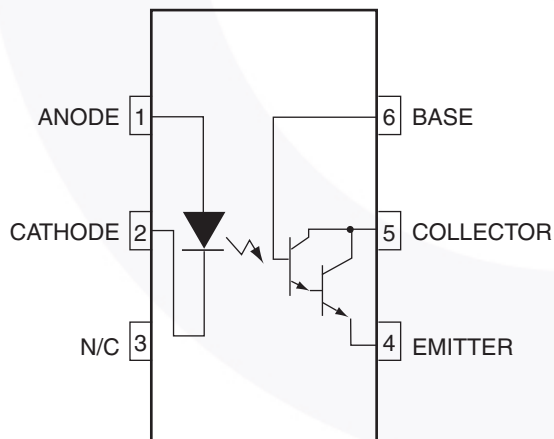


Figure 1. Schematic

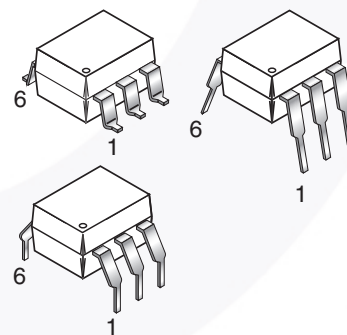


Figure 2. Package Outlines

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–IV |
| Climatic Classification | | 55/100/21 |
| 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 | 1360 | 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 | 1594 | 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 |
| | External Clearance (for Option TV, 0.4" Lead Spacing) | ≥ 10 | mm |
| DTI | Distance Through Insulation (Insulation Thickness) | ≥ 0.5 | mm |
| T _S | Case Temperature ⁽¹⁾ | 175 | °C |
| I _{S,INPUT} | Input Current ⁽¹⁾ | 350 | mA |
| P _{S,OUTPUT} | Output Power ⁽¹⁾ | 800 | 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.

| Symbol | Parameter | Value | Unit |
|---------------------|--|--------------------|-------|
| TOTAL DEVICE | | | |
| 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 @ $T_A = 25^\circ\text{C}$ | 270 | mW |
| | Derate Above 25°C | 3.3 | mW/°C |
| EMITTER | | | |
| I_F | Continuous Forward Current | 80 | mA |
| V_R | Reverse Voltage | 3 | V |
| $I_F(pk)$ | Forward Current – Peak (300 μs , 2% Duty Cycle) | 3.0 | A |
| P_D | LED Power Dissipation @ $T_A = 25^\circ\text{C}$ | 120 | mW |
| | Derate above 25°C | 2.0 | mW/°C |
| DETECTOR | | | |
| BV_{CEO} | Collector-Emitter Breakdown Voltage | 30 | V |
| BV_{CBO} | Collector-Base Breakdown Voltage | 30 | V |
| BV_{ECO} | Emitter-Collector Breakdown Voltage | 5 | V |
| P_D | Detector Power Dissipation @ $T_A = 25^\circ\text{C}$ | 150 | mW |
| | Derate Above 25°C | 2.0 | mW/°C |
| I_C | Continuous Collector Current | 150 | mA |

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 ⁽²⁾ | $I_F = 10\text{ mA}$ | 4NXXM | | 1.2 | 1.5 | V |
| | | | H11B1M, TIL113M | 0.8 | 1.2 | 1.5 | V |
| I_R | Reverse Leakage Current ⁽²⁾ | $V_R = 3.0\text{ V}$ | 4NXXM | | 0.001 | 100 | μA |
| | | $V_R = 6.0\text{ V}$ | H11B1M, TIL113M | | 0.001 | 10 | μA |
| C | Capacitance ⁽²⁾ | $V_F = 0\text{V}, f = 1.0\text{ MHz}$ | All | | 150 | | pF |
| DETECTOR | | | | | | | |
| BV_{CEO} | Collector-Emitter Breakdown Voltage ⁽²⁾ | $I_C = 1.0\text{ mA}, I_B = 0$ | 4NXXM, TIL113M | 30 | 60 | | V |
| | | | H11B1M | 25 | 60 | | V |
| BV_{CBO} | Collector-Base Breakdown Voltage ⁽²⁾ | $I_C = 100\ \mu\text{A}, I_E = 0$ | All | 30 | 100 | | V |
| BV_{ECO} | Emitter-Collector Breakdown Voltage ⁽²⁾ | $I_E = 100\ \mu\text{A}, I_B = 0$ | 4NXXM | 5.0 | 10 | | V |
| | | | H11B1M, TIL113M | 7 | 10 | | V |
| I_{CEO} | Collector-Emitter Dark Current ⁽²⁾ | $V_{CE} = 10\text{ V}, \text{Base Open}$ | All | | 1 | 100 | nA |

Notes:

2. Indicates JEDEC registered data.

Electrical Characteristics (Continued) $T_A = 25^\circ\text{C}$ Unless otherwise specified.**Transfer Characteristics**

| Symbol | Parameter | Test Conditions | Device | Min. | Typ. | Max. | Unit |
|---------------------------|---|--|-----------------------|----------|------|------|---------------|
| DC CHARACTERISTICS | | | | | | | |
| $I_{C(CTR)}$ | Collector Output Current ⁽³⁾⁽⁴⁾⁽⁵⁾ | $I_F = 10\text{ mA}, V_{CE} = 10\text{ V}, I_B = 0$ | 4N32M, 4N33M | 50 (500) | | | mA (%) |
| | | | 4N29M, 4N30M | 10 (100) | | | mA (%) |
| | | $I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$ | H11B1M | 5 (500) | | | mA (%) |
| | | $I_F = 10\text{ mA}, V_{CE} = 1\text{ V}$ | TIL113M | 30 (300) | | | mA (%) |
| $V_{CE(SAT)}$ | Saturation Voltage ⁽³⁾⁽⁵⁾ | $I_F = 8\text{ mA}, I_C = 2.0\text{ mA}$ | 4NXXM | | | 1.0 | V |
| | | | TIL113M | | | 1.25 | V |
| | | $I_F = 1\text{ mA}, I_C = 1\text{ mA}$ | H11B1M | | | 1.0 | V |
| AC CHARACTERISTICS | | | | | | | |
| t_{on} | Turn-on Time | $I_F = 200\text{ mA}, I_C = 50\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ | 4NXXM, TIL113M | | | 5.0 | μs |
| | | $I_F = 10\text{ mA}, V_{CE} = 10\text{ V}, R_L = 100\ \Omega$ | H11B1M | | 25 | | μs |
| t_{off} | Turn-off Time | $I_F = 200\text{ mA}, I_C = 50\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\ \Omega$ | 4N32M, 4N33M, TIL113M | | | 100 | μs |
| | | | 4N29M, 4N30M | | | 40 | μs |
| | | $I_F = 10\text{ mA}, V_{CE} = 10\text{ V}, R_L = 100\ \Omega$ | H11B1M | | 18 | | μs |
| BW | Bandwidth ⁽⁶⁾⁽⁷⁾ | | | | 30 | | kHz |

Notes:

- Indicates JEDEC registered data.
- The current transfer ratio(I_C / I_F) is the ratio of the detector collector current to the LED input current.
- Pulse test: pulse width = 300 μs , duty cycle $\leq 2.0\%$.
- I_F adjusted to $I_C = 2.0\text{ mA}$ and $I_C = 0.7\text{ mA rms}$.
- The frequency at which I_C is 3 dB down from the 1 kHz value.

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} | | | Ω |

Typical Performance Curves

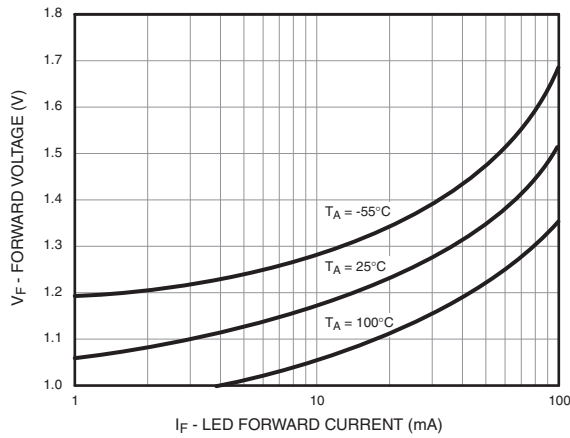


Figure 3. LED Forward Voltage vs. Forward Current

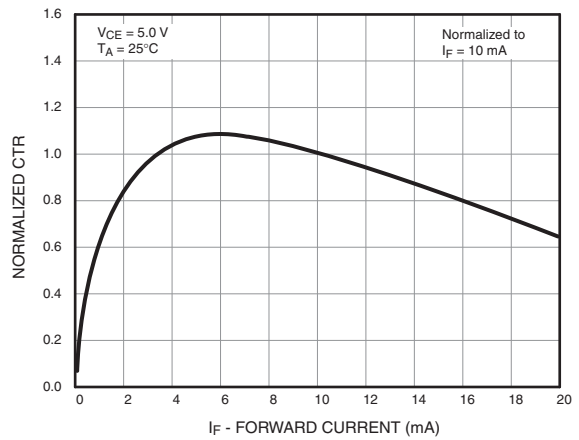


Figure 4. Normalized CTR vs. Forward Current

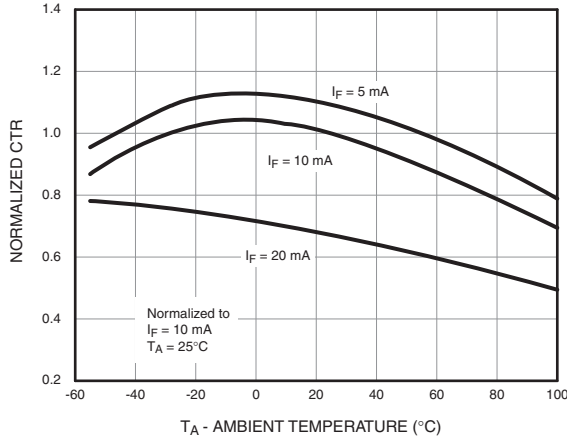


Figure 5. Normalized CTR vs. Ambient Temperature

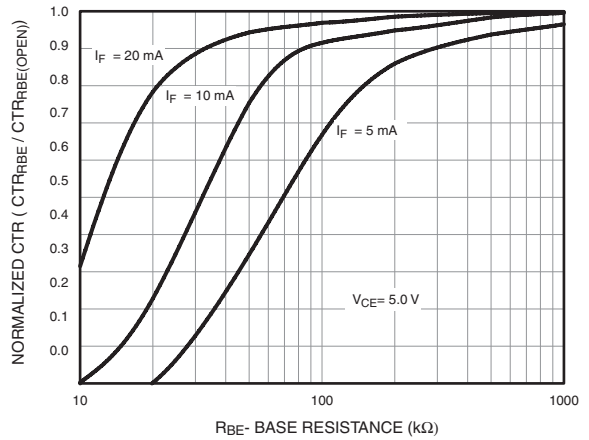


Figure 6. CTR vs. RBE (Unsaturated)

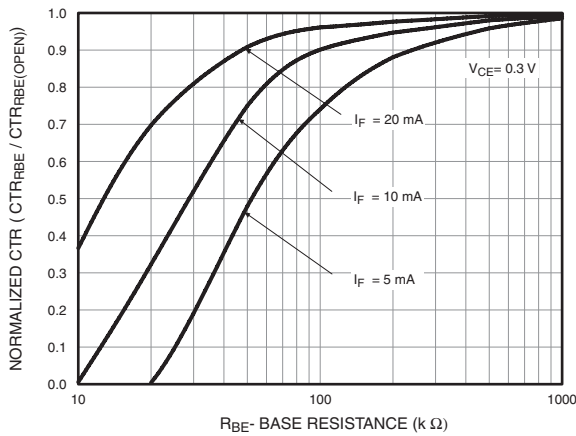


Figure 7. CTR vs. RBE (Saturated)

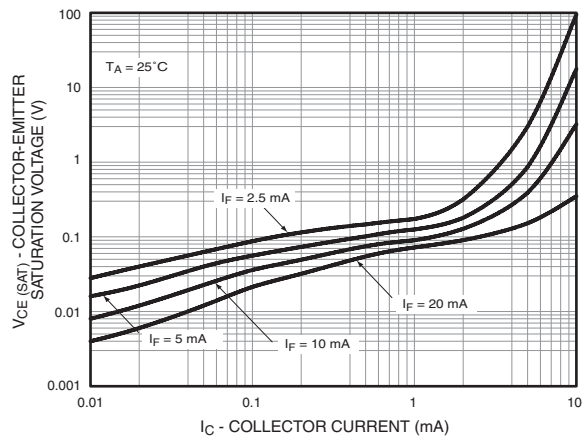


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

Typical Performance Curves (Continued)

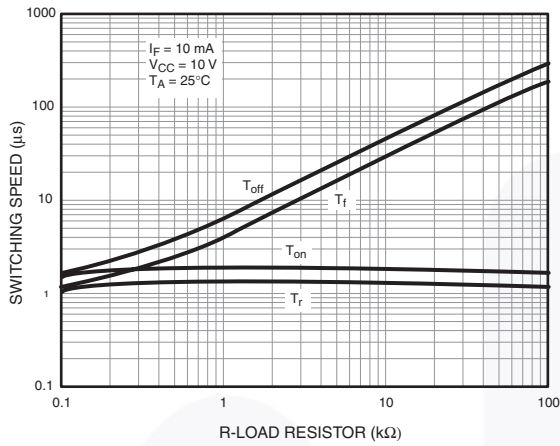


Figure 9. Switching Speed vs. Load Resistor

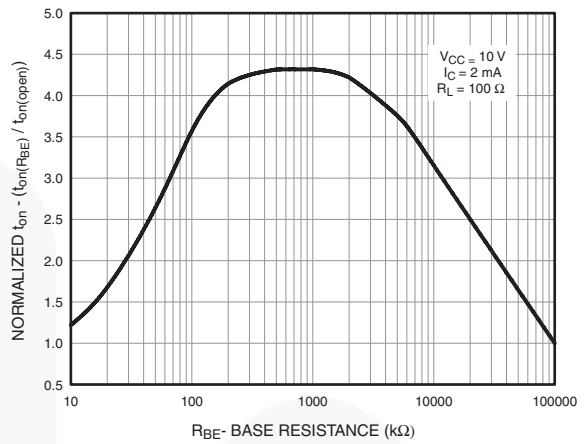


Figure 10. Normalized t_{on} vs. R_{BE}

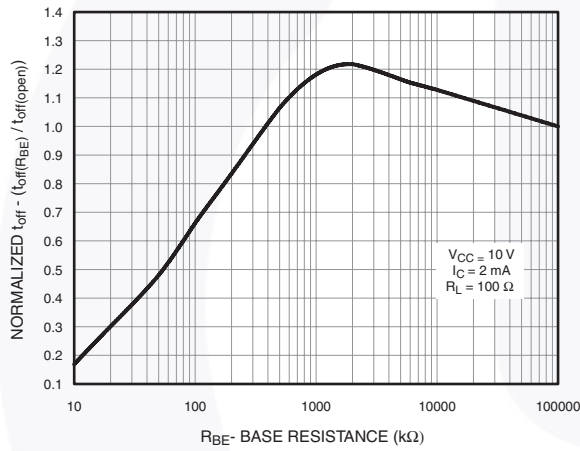


Figure 11. Normalized t_{off} vs. R_{BE}

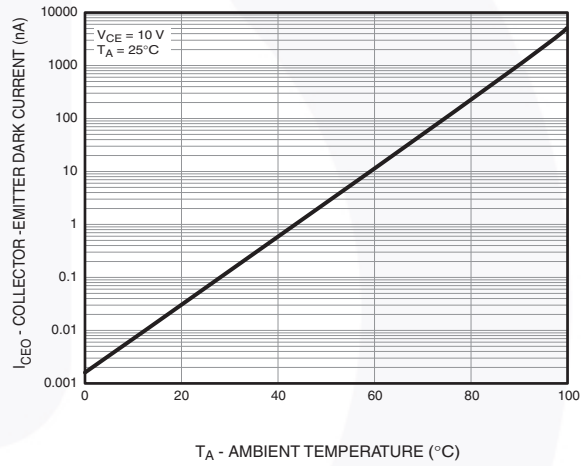


Figure 12. Dark Current vs. Ambient Temperature

Switching Time Test Circuit and Waveform

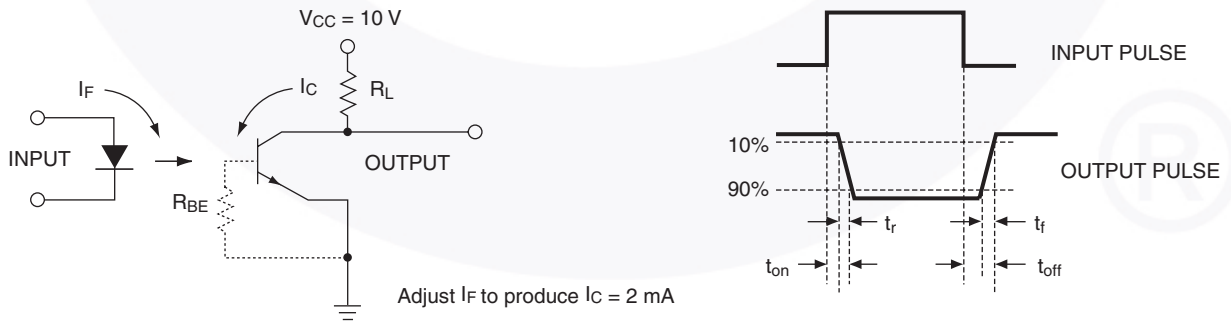


Figure 13. Switching Time Test Circuit and Waveform

Reflow Profile

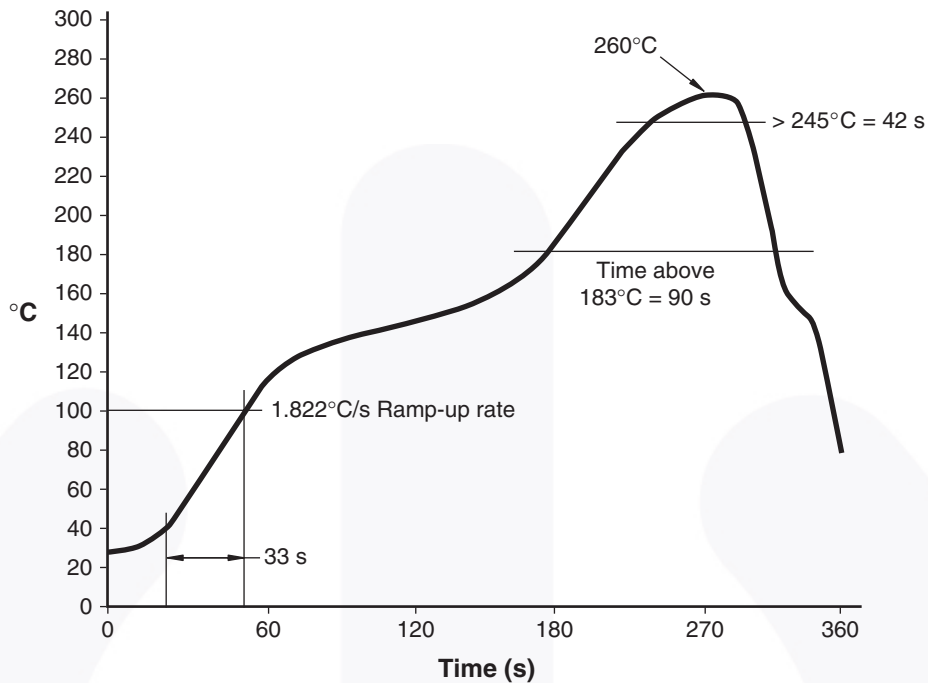


Figure 14. Reflow Profile

Ordering Information

| Part Number | Package | Packing Method |
|-------------|--|----------------------------|
| 4N29M | DIP 6-Pin | Tube (50 Units) |
| 4N29SM | SMT 6-Pin (Lead Bend) | Tube (50 Units) |
| 4N29SR2M | SMT 6-Pin (Lead Bend) | Tape and Reel (1000 Units) |
| 4N29VM | DIP 6-Pin, DIN EN/IEC60747-5-5 Option | Tube (50 Units) |
| 4N29SVM | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option | Tube (50 Units) |
| 4N29SR2VM | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option | Tape and Reel (1000 Units) |
| 4N29TVM | DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option | Tube (50 Units) |

Note:

8. The product orderable part number system listed in this table also applies to the 4N30M, 4N32M, 4N33M, H11B1M, and TIL113M devices.

Marking Information

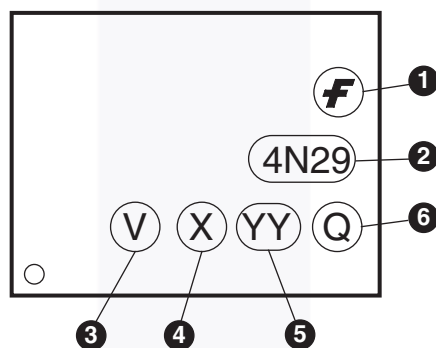
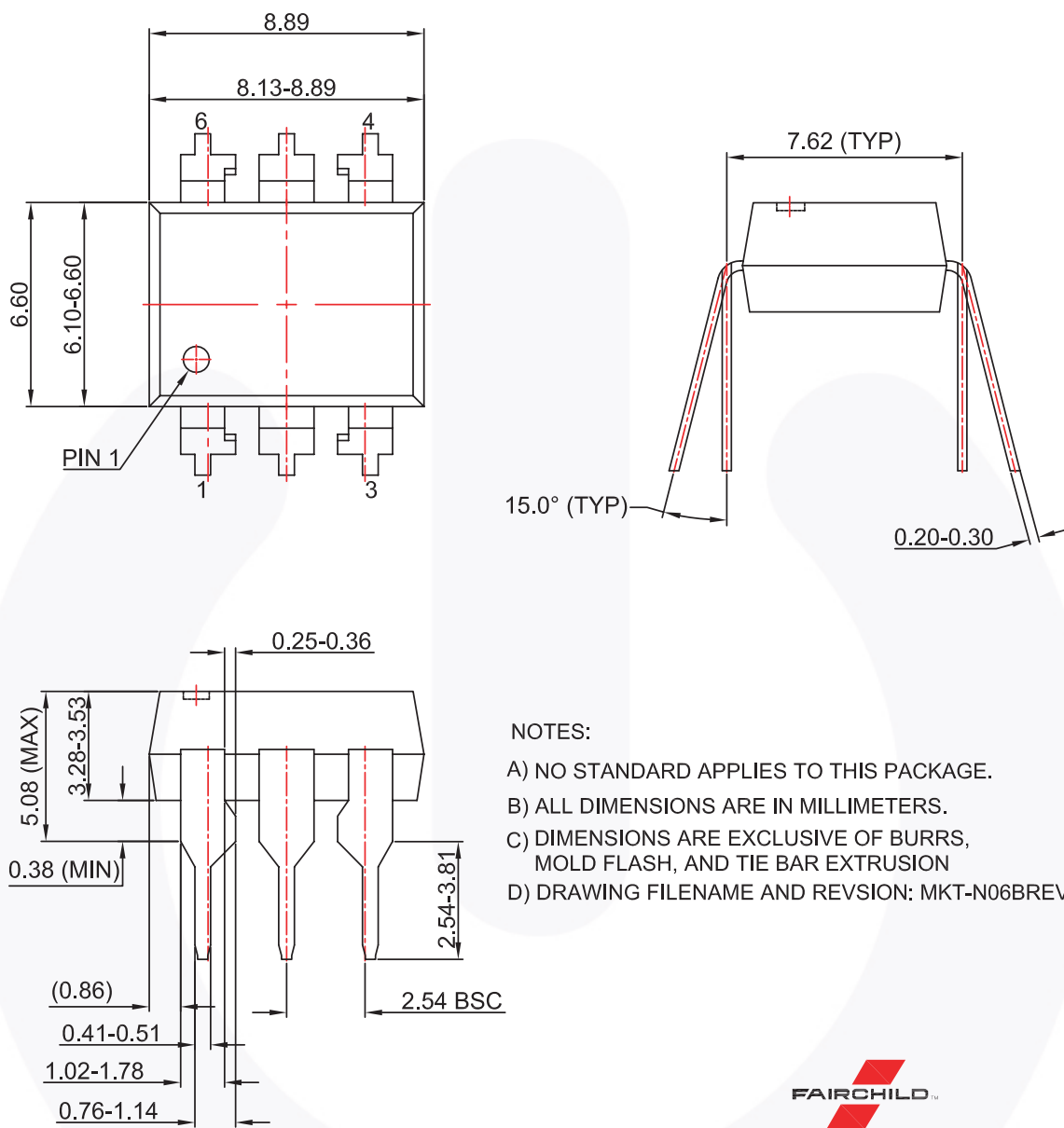


Figure 15. Top Mark

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 |

Package Dimensions



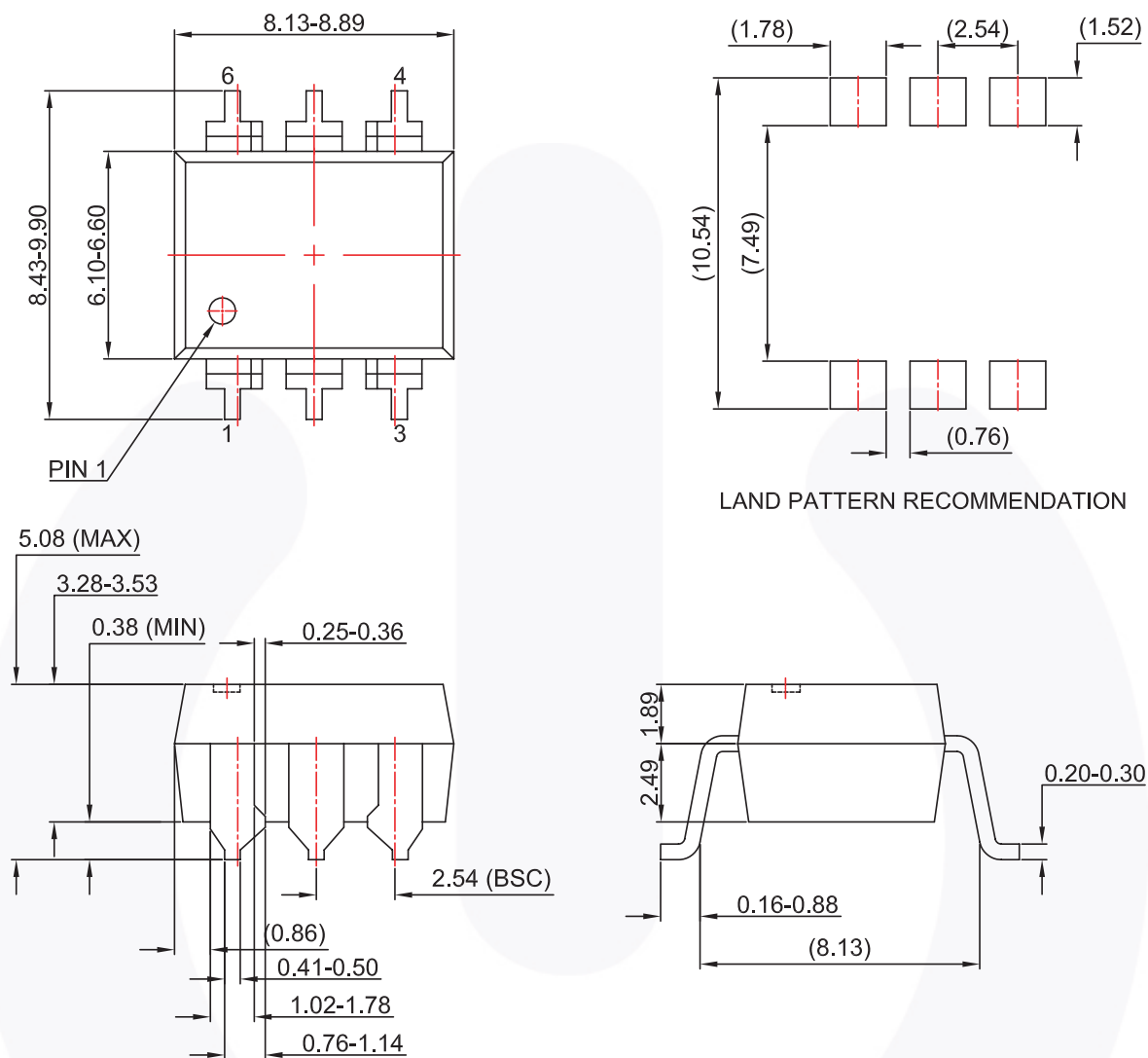
NOTES:

- 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
- D) DRAWING FILENAME AND REVISION: MKT-N06BREV4.



Figure 16. 6-pin DIP Through Hole

Package Dimensions (Continued)



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
- D) DRAWING FILENAME AND REVISION : MKT-N06CREV4.



Figure 17. 6-pin DIP Surface Mount

Package Dimensions (Continued)

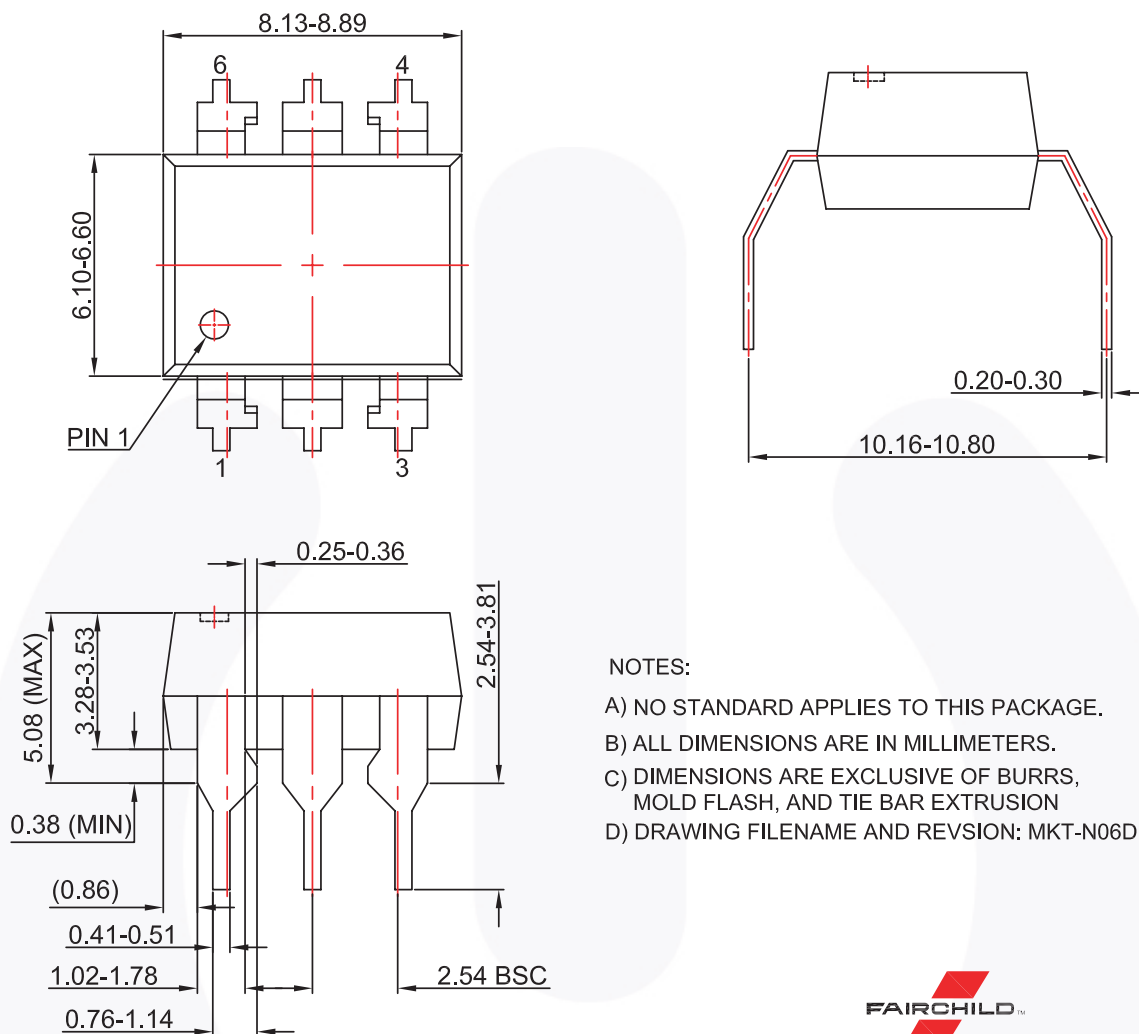







Figure 18. 6-pin DIP 0.4" Lead Spacing



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