

# HMHA281, HMHA2801 Series 4-Pin Half-Pitch Mini-Flat Phototransistor Optocouplers

## Features

- Compact 4-pin Package
  - 2.4 mm Maximum Standoff Height
  - Half-pitch Leads for Optimum Board Space Savings
- Current Transfer Ratio:
  - HMHA281: 50% to 600%
  - HMHA2801: 80% to 600%
  - HMHA2801A: 80% to 160%
  - HMHA2801B: 130% to 260%
  - HMHA2801C: 200% to 400%
- Safety and Regulatory Approvals:
  - UL1577, 3,750 VAC<sub>RMS</sub> for 1 Minute
  - DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage

## Applications

- Digital Logic Inputs
- Microprocessor Inputs
- Power Supply Monitor
- Twisted Pair Line Receiver
- Telephone Line Receiver

## Description

The HMHA281 and HMHA2801 series devices consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a compact 4-pin mini-flat package. The lead pitch is 1.27 mm.

## Schematic

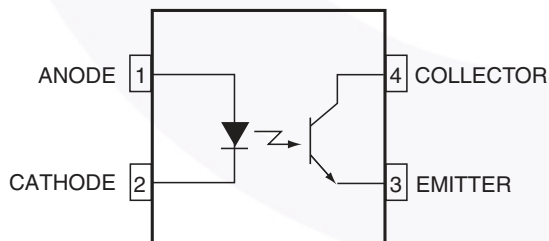


Figure 1. Schematic

## Package Outline

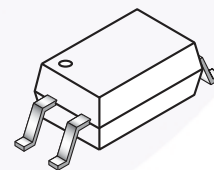


Figure 2. Package Outlines

## 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–III           |
| 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  | 904               | 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 | 1060              | V <sub>peak</sub> |
| V <sub>IORM</sub>     | Maximum Working Insulation Voltage                                                                                                                             | 565               | V <sub>peak</sub> |
| V <sub>IOTM</sub>     | Highest Allowable Over-Voltage                                                                                                                                 | 4000              | V <sub>peak</sub> |
|                       | External Creepage                                                                                                                                              | ≥ 5               | mm                |
|                       | External Clearance                                                                                                                                             | ≥ 5               | mm                |
| DTI                   | Distance Through Insulation (Insulation Thickness)                                                                                                             | ≥ 0.4             | mm                |
| T <sub>S</sub>        | Case Temperature <sup>(1)</sup>                                                                                                                                | 150               | °C                |
| I <sub>S,INPUT</sub>  | Input Current <sup>(1)</sup>                                                                                                                                   | 200               | mA                |
| P <sub>S,OUTPUT</sub> | Output Power <sup>(1)</sup>                                                                                                                                    | 300               | 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       | Units |
|----------------------|-----------------------------------------------------------|-------------|-------|
| <b>TOTAL PACKAGE</b> |                                                           |             |       |
| $T_{STG}$            | Storage Temperature                                       | -55 to +125 | °C    |
| $T_{OPR}$            | Operating Temperature                                     | -55 to +100 | °C    |
| $T_J$                | Junction Temperature                                      | -40 to +125 | °C    |
| $P_D$                | Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ | 210         | mW    |
|                      | Derate Above $25^\circ\text{C}$                           | 2.1         | mW/°C |
| <b>EMITTER</b>       |                                                           |             |       |
| $I_F$ (avg)          | Continuous Forward Current                                | 50          | mA    |
| $I_F$ (pk)           | Peak Forward Current (1 $\mu\text{s}$ pulse, 300 pps)     | 1           | A     |
| $V_R$                | Reverse Input Voltage                                     | 6           | V     |
| $P_D$                | LED Power Dissipation @ $T_A = 25^\circ\text{C}$          | 60          | mW    |
|                      | Derate Above $25^\circ\text{C}$                           | 0.6         | mW/°C |
| <b>DETECTOR</b>      |                                                           |             |       |
| $I_C$                | Continuous Collector Current                              | 50          | mA    |
| $V_{CEO}$            | Collector-Emitter Voltage                                 | 80          | V     |
| $V_{ECO}$            | Emitter-Collector Voltage                                 | 7           | V     |
| $P_D$                | Detector Power Dissipation @ $T_A = 25^\circ\text{C}$     | 150         | mW    |
|                      | Derate Above $25^\circ\text{C}$                           | 1.5         | mW/°C |

**Electrical Characteristics** $T_A = 25^\circ\text{C}$ 

| Symbol                                      | Parameter                                 | Test Conditions                                                        | Device                                             | Min. | Typ. | Max. | Unit           |
|---------------------------------------------|-------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------|------|------|------|----------------|
| <b>INDIVIDUAL COMPONENT CHARACTERISTICS</b> |                                           |                                                                        |                                                    |      |      |      |                |
| <b>Emitter</b>                              |                                           |                                                                        |                                                    |      |      |      |                |
| $V_F$                                       | Forward Voltage                           | $I_F = 10\text{ mA}$                                                   | All                                                | 1.0  |      | 1.3  | V              |
| $I_R$                                       | Reverse Current                           | $V_R = 5\text{ V}$                                                     | All                                                |      |      | 5    | $\mu\text{A}$  |
| <b>Detector</b>                             |                                           |                                                                        |                                                    |      |      |      |                |
| $BV_{CEO}$                                  | Breakdown Voltage<br>Collector to Emitter | $I_C = 0.5\text{ mA}, I_F = 0$                                         | All                                                | 80   |      |      | V              |
| $BV_{ECO}$                                  | Emitter to Collector                      | $I_E = 100\text{ }\mu\text{A}, I_F = 0$                                | All                                                | 7    |      |      |                |
| $I_{CEO}$                                   | Collector Dark Current                    | $V_{CE} = 80\text{ V}, I_F = 0$                                        | All                                                |      |      | 100  | nA             |
| $C_{CE}$                                    | Capacitance                               | $V_{CE} = 0\text{ V}, f = 1\text{ MHz}$                                | All                                                |      | 10   |      | pF             |
| <b>TRANSFER CHARACTERISTICS</b>             |                                           |                                                                        |                                                    |      |      |      |                |
| CTR                                         | DC Current Transfer Ratio                 | $I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$                               | HMHA281                                            | 50   |      | 600  | %              |
|                                             |                                           |                                                                        | HMHA2801                                           | 80   |      | 600  |                |
|                                             |                                           |                                                                        | HMHA2801A                                          | 80   |      | 160  |                |
|                                             |                                           |                                                                        | HMHA2801B                                          | 130  |      | 260  |                |
|                                             |                                           |                                                                        | HMHA2801C                                          | 200  |      | 400  |                |
| $V_{CE(SAT)}$                               | Saturation Voltage                        | $I_F = 8\text{ mA}, I_C = 2.4\text{ mA}$                               | HMHA281                                            |      |      | 0.4  | V              |
|                                             |                                           | $I_F = 10\text{ mA}, I_C = 2\text{ mA}$                                | HMHA2801,<br>HMHA2801A,<br>HMHA2801B,<br>HMHA2801C |      |      | 0.3  |                |
| $t_r$                                       | Rise Time<br>(Non-Saturated)              | $I_C = 2\text{ mA}, V_{CE} = 5\text{ V},$<br>$R_L = 100\text{ }\Omega$ | All                                                |      | 3    |      | $\mu\text{s}$  |
| $t_f$                                       | Fall Time<br>(Non-Saturated)              | $I_C = 2\text{ mA}, V_{CE} = 5\text{ V},$<br>$R_L = 100\text{ }\Omega$ | All                                                |      | 3    |      |                |
| <b>ISOLATION CHARACTERISTICS</b>            |                                           |                                                                        |                                                    |      |      |      |                |
| $V_{ISO}$                                   | Steady State Isolation<br>Voltage         | 1 Minute                                                               | All                                                | 3750 |      |      | $V_{AC_{RMS}}$ |

Typical Performance Characteristics

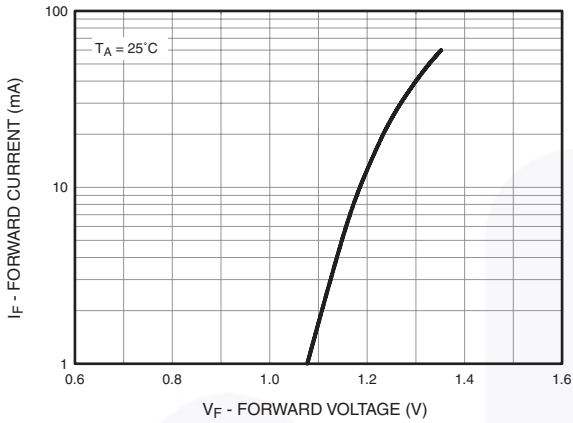


Figure 3. Forward Current vs. Forward Voltage

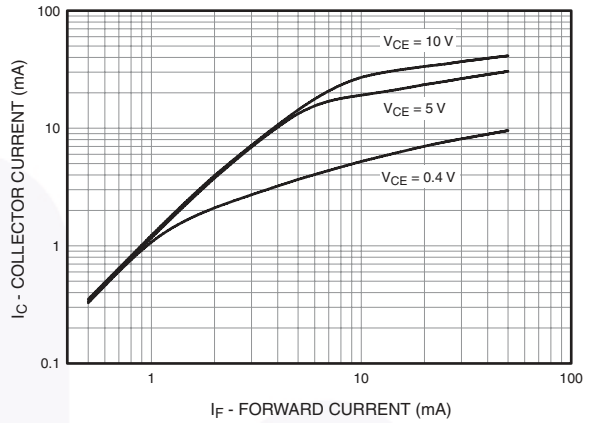


Figure 4. Collector Current vs. Forward Current

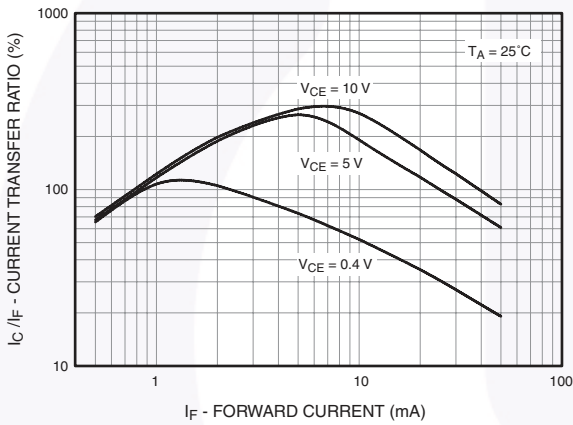


Figure 5. Current Transfer Ratio vs. Forward Current

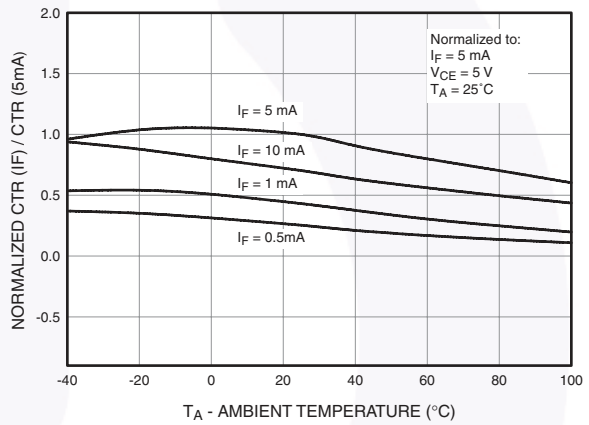


Figure 6. Normalized CTR vs. Temperature

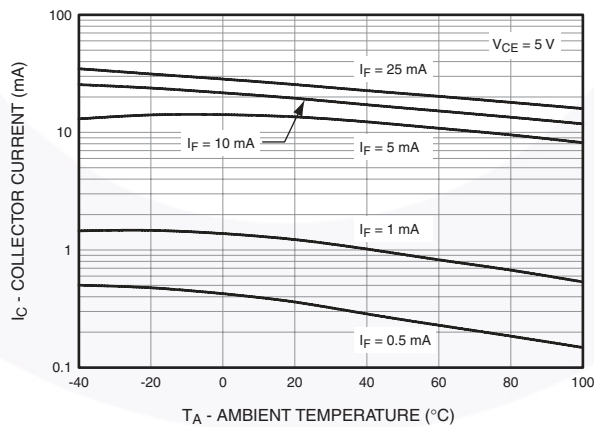


Figure 7. Collector Current vs. Temperature

Typical Performance Characteristics (Continued)

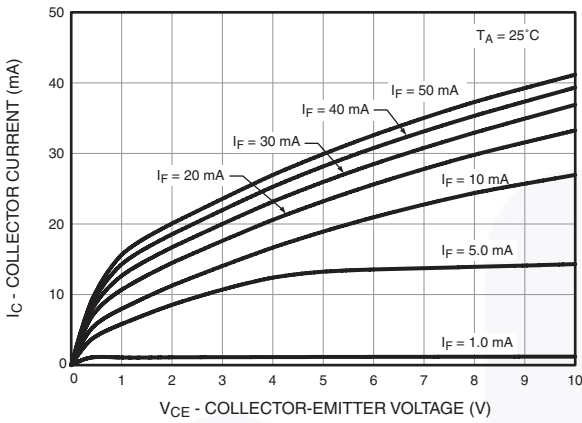


Figure 8. Collector Current vs. Collector-Emitter Voltage

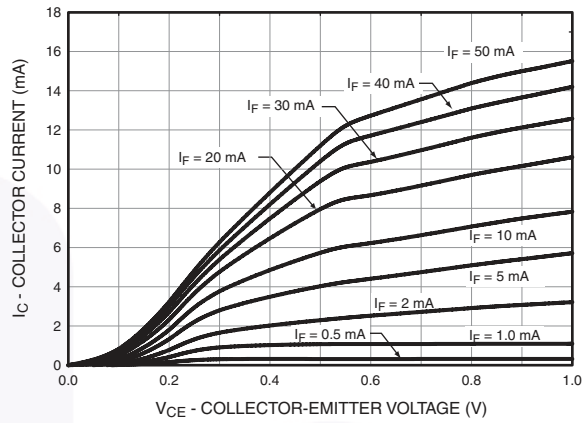


Figure 9. Collector Current vs. Collector-Emitter Voltage

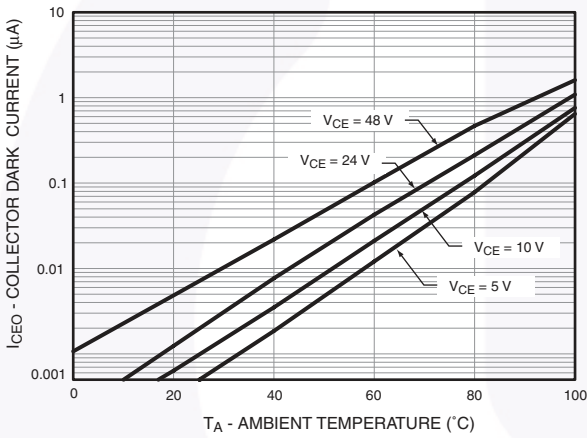


Figure 10. Collector Dark Current vs. Temperature

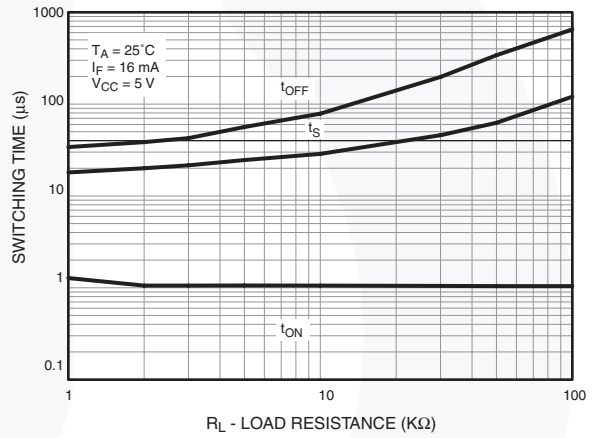


Figure 11. Switching Time vs. Load Resistance

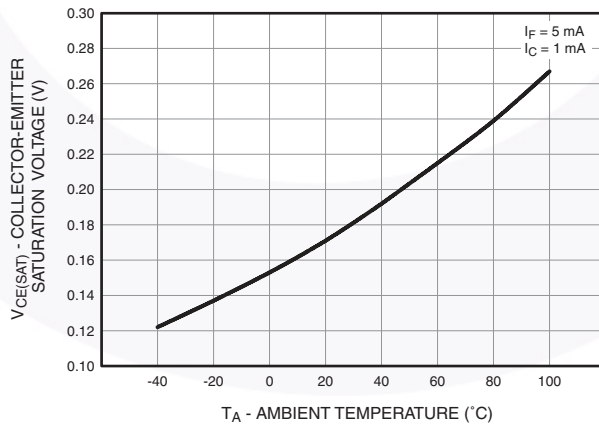
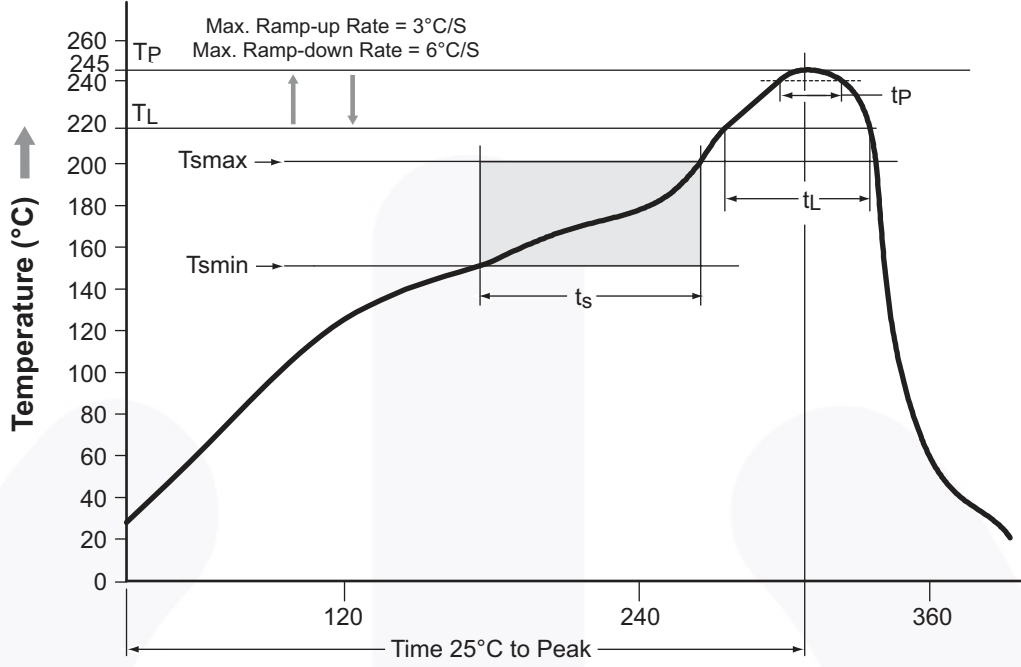


Figure 12. Collector-Emitter Saturation Voltage vs. Temperature

**Reflow Profile**



**Figure 13. Reflow Profile**

| Profile Feature                                                       | Pb-Free Assembly Profile |
|-----------------------------------------------------------------------|--------------------------|
| Temperature Minimum (T <sub>smin</sub> )                              | 150°C                    |
| Temperature Maximum (T <sub>smax</sub> )                              | 200°C                    |
| Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> ) | 60–120 seconds           |
| Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )                      | 3°C/second maximum       |
| Liquidous Temperature (T <sub>L</sub> )                               | 217°C                    |
| Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )             | 60–150 seconds           |
| Peak Body Package Temperature                                         | 245°C +0°C / -5°C        |
| Time (t <sub>P</sub> ) within 5°C of 245°C                            | 30 seconds               |
| Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )                    | 6°C/second maximum       |
| Time 25°C to Peak Temperature                                         | 8 minutes maximum        |

### Ordering Information

| Part Number | Package                                                | Packing Method             |
|-------------|--------------------------------------------------------|----------------------------|
| HMHA2801    | Half Pitch Mini-Flat 4-Pin                             | Tube (100 units)           |
| HMHA2801R2  | Half Pitch Mini-Flat 4-Pin                             | Tape and Reel (2500 Units) |
| HMHA2801V   | Half Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option | Tube (100 Units)           |
| HMHA2801R2V | Half Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option | Tape and Reel (2500 Units) |

**Note:**

2. The product orderable part number system listed in this table also applies to the HMHA281, HMHA2801A, HMHA2801B, and HMHA2801C products.

### Marking Information

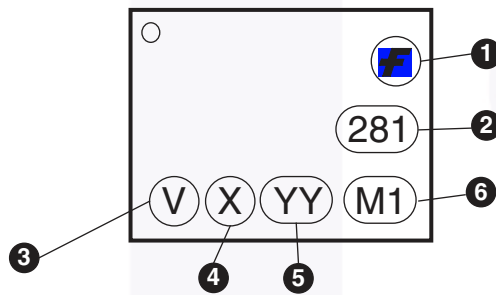
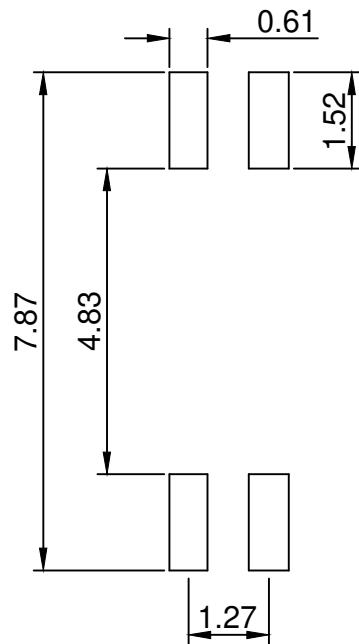
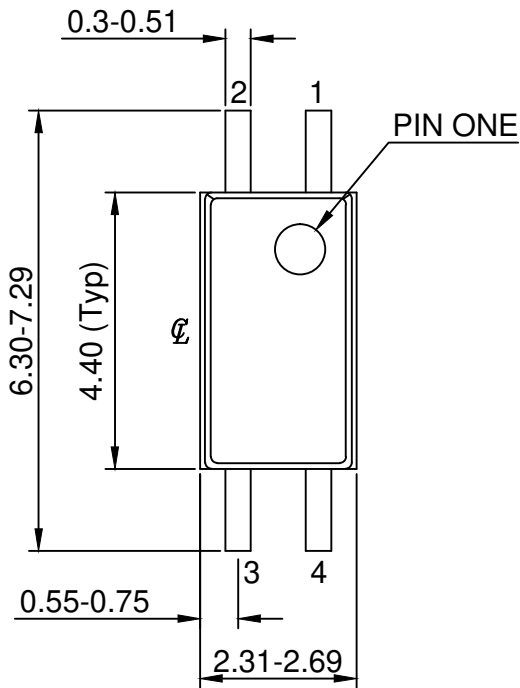


Figure 14. Top Mark

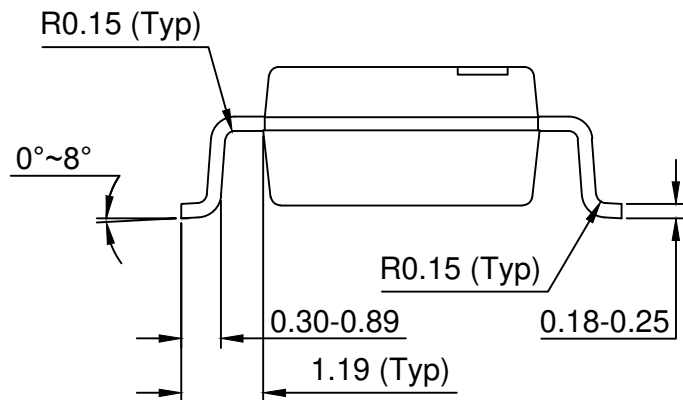
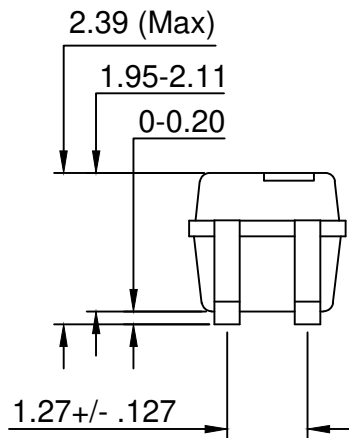
Table 1. Top Mark Definitions

|   |                                                                                 |
|---|---------------------------------------------------------------------------------|
| 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., "5"                                                  |
| 5 | Digit Work Week, Ranging from "01" to "53"                                      |
| 6 | Assembly Package Code                                                           |





LAND PATTERN RECOMMENDATION



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
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| AccuPower™                                                                        | F-PFS™                                         | OPTOPLANAR®                                                                       |  |
| AttitudeEngine™                                                                   | FRFET®                                         |  | TinyBoost®                                                                          |
| Awinda®                                                                           | Global Power Resource <sup>SM</sup>            | PowerTrench®                                                                      | TinyBuck®                                                                           |
| AX-CAP®*                                                                          | GreenBridge™                                   | PowerXS™                                                                          | TinyCalc™                                                                           |
| BitSiC™                                                                           | Green FPS™                                     | Programmable Active Droop™                                                        | TinyLogic®                                                                          |
| Build it Now™                                                                     | Green FPS™ e-Series™                           | QFET®                                                                             | TINYOPTO™                                                                           |
| CorePLUS™                                                                         | Gmax™                                          | QS™                                                                               | TinyPower™                                                                          |
| CorePOWER™                                                                        | GTO™                                           | Quiet Series™                                                                     | TinyPWM™                                                                            |
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| DEUXPEED®                                                                         | MegaBuck™                                      | SignalWise™                                                                       | TRUECURRENT®*                                                                       |
| Dual Cool™                                                                        | MICROCOUPLER™                                  | SmartMax™                                                                         | μSerDes™                                                                            |
| EcoSPARK®                                                                         | MicroFET™                                      | SMART START™                                                                      |  |
| EfficientMax™                                                                     | MicroPak™                                      | Solutions for Your Success™                                                       | UHC®                                                                                |
| ESBC™                                                                             | MicroPak2™                                     | SPM®                                                                              | Ultra FRFET™                                                                        |
|  | MillerDrive™                                   | STEALTH™                                                                          | UniFET™                                                                             |
| Fairchild®                                                                        | MotionMax™                                     | SuperFET®                                                                         | VCX™                                                                                |
| Fairchild Semiconductor®                                                          | MotionGrid®                                    | SuperSOT™-3                                                                       | VisualMax™                                                                          |
| FACT Quiet Series™                                                                | MTi®                                           | SuperSOT™-6                                                                       | VoltagePlus™                                                                        |
| FACT®                                                                             | MTX®                                           | SuperSOT™-8                                                                       | XS™                                                                                 |
| FastvCore™                                                                        | MVN®                                           | SupreMOS®                                                                         | Xsens™                                                                              |
| FETBench™                                                                         | mWSaver®                                       | SyncFET™                                                                          | 仙童®                                                                                 |
| FPS™                                                                              | OptoHiT™                                       | Sync-Lock™                                                                        |                                                                                     |
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| Datasheet Identification | Product Status        | Definition                                                                                                                                                                                          |
|--------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                       |
| Preliminary              | First Production      | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
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