

# HMHA281, HMHA2801 Series

## 4-Pin Half-Pitch Mini-Flat Phototransistor Optocouplers

### 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.

### 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
- These Devices are Pb-Free and are RoHS Compliant

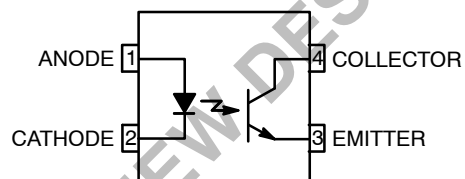
### Applications

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

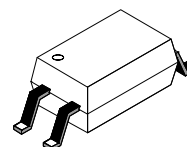


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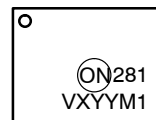


Phototransistor Optocoupler



MPF4  
CASE 100AL

### MARKING DIAGRAM



ON = ON Semiconductor Logo  
281 = Device Number  
V = DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)  
X = One-Digit Year Code, e.g., "5"  
YY = Digit Work Week, Ranging from "01" to "53"  
M1 = Assembly Package Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

## HMHA281, HMHA2801 Series

**Table 1. 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 (Note 1)                                                                                                                                      | 150              | °C                |
| I <sub>S, INPUT</sub>  | Input Current (Note 1)                                                                                                                                         | 200              | mA                |
| P <sub>S, OUTPUT</sub> | Output Power (Note 1)                                                                                                                                          | 300              | mW                |
| R <sub>IO</sub>        | Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V (Note 1)                                                                                     | >10 <sup>9</sup> | Ω                 |

1. Safety limit values – maximum values allowed in the event of a failure.

## HMHA281, HMHA2801 Series

### ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C, Unless otherwise specified)

| Symbol | Parameter | Value | Unit |
|--------|-----------|-------|------|
|--------|-----------|-------|------|

#### TOTAL PACKAGE

|                  |                                                        |             |       |
|------------------|--------------------------------------------------------|-------------|-------|
| T <sub>STG</sub> | Storage Temperature                                    | -55 to +125 | °C    |
| T <sub>OPR</sub> | Operating Temperature                                  | -55 to +100 | °C    |
| T <sub>J</sub>   | Junction Temperature                                   | -40 to +125 | °C    |
| P <sub>D</sub>   | Total Device Power Dissipation @ T <sub>A</sub> = 25°C | 210         | mW    |
|                  | Derate Above 25°C                                      | 2.1         | mW/°C |

#### EMITTER

|                      |                                               |     |       |
|----------------------|-----------------------------------------------|-----|-------|
| I <sub>F (avg)</sub> | Continuous Forward Current                    | 50  | mA    |
| I <sub>F (pk)</sub>  | Peak Forward Current (1 μs pulse, 300 pps)    | 1   | A     |
| V <sub>R</sub>       | Reverse Input Voltage                         | 6   | V     |
| P <sub>D</sub>       | LED Power Dissipation @ T <sub>A</sub> = 25°C | 60  | mW    |
|                      | Derate Above 25°C                             | 0.6 | mW/°C |

#### DETECTOR

|                  |                                                    |     |       |
|------------------|----------------------------------------------------|-----|-------|
| I <sub>C</sub>   | Continuous Collector Current                       | 50  | mA    |
| V <sub>CEO</sub> | Collector-Emitter Voltage                          | 80  | V     |
| V <sub>ECO</sub> | Emitter-Collector Voltage                          | 7   | V     |
| P <sub>D</sub>   | Detector Power Dissipation @ T <sub>A</sub> = 25°C | 150 | mW    |
|                  | Derate Above 25°C                                  | 1.5 | mW/°C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

# HMHA281, HMHA2801 Series

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

| Symbol | Parameter | Test Conditions | Device | Min | Typ | Max | Unit |
|--------|-----------|-----------------|--------|-----|-----|-----|------|
|--------|-----------|-----------------|--------|-----|-----|-----|------|

### INDIVIDUAL COMPONENT CHARACTERISTICS

#### Emitter

|       |                 |                      |     |     |   |     |               |
|-------|-----------------|----------------------|-----|-----|---|-----|---------------|
| $V_F$ | Forward Voltage | $I_F = 10\text{ mA}$ | All | 1.0 | – | 1.3 | V             |
| $I_R$ | Reverse Current | $V_R = 5\text{ V}$   | All | –   | – | 5   | $\mu\text{A}$ |

#### Detector

|            |                                        |                                            |     |    |    |     |    |
|------------|----------------------------------------|--------------------------------------------|-----|----|----|-----|----|
| $BV_{CEO}$ | Breakdown Voltage 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 |

### TRANSFER CHARACTERISTICS

|               |                           |                                                                         |                                                    |     |   |     |               |
|---------------|---------------------------|-------------------------------------------------------------------------|----------------------------------------------------|-----|---|-----|---------------|
| 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 (Non-Saturated) | $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ | All                                                | –   | 3 | –   | $\mu\text{s}$ |
| $t_f$         | Fall Time (Non-Saturated) | $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_L = 100\text{ }\Omega$ | All                                                | –   | 3 | –   |               |

### ISOLATION CHARACTERISTICS

|           |                                |          |     |      |   |   |                |
|-----------|--------------------------------|----------|-----|------|---|---|----------------|
| $V_{ISO}$ | Steady State Isolation Voltage | 1 Minute | All | 3750 | – | – | $V_{AC_{RMS}}$ |
|-----------|--------------------------------|----------|-----|------|---|---|----------------|

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# HMHA281, HMHA2801 Series

## TYPICAL PERFORMANCE CHARACTERISTICS

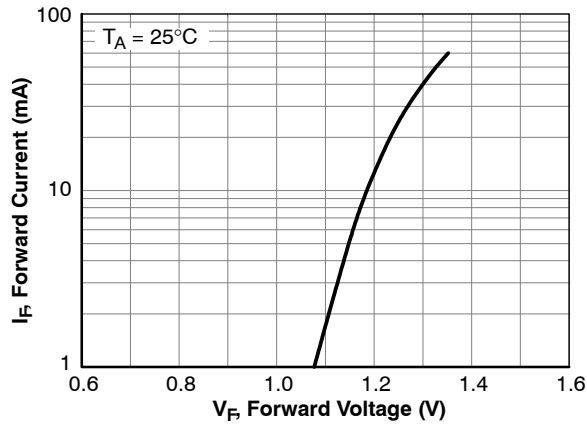


Figure 1. Forward Current vs. Forward Voltage

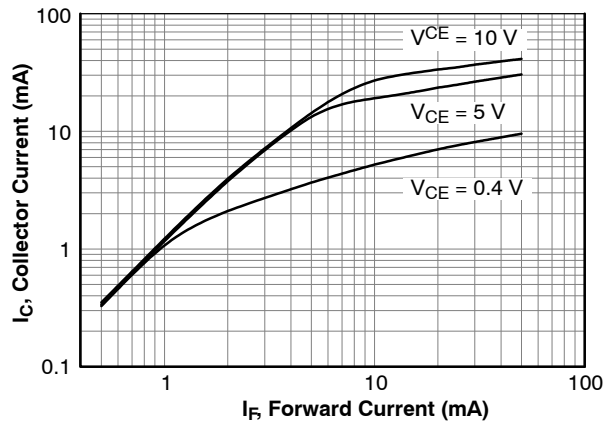


Figure 2. Collector Current vs. Forward Current

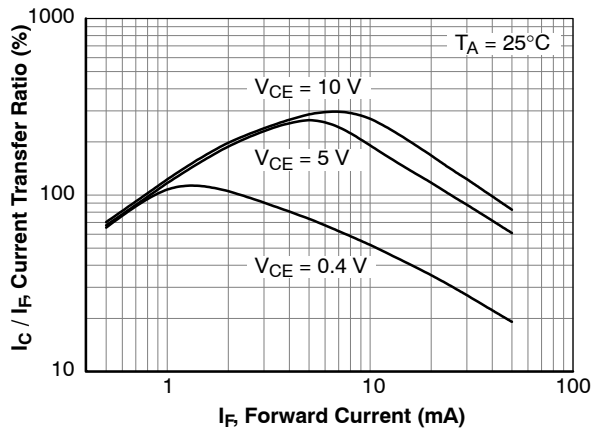


Figure 3. Current Transfer Ratio vs. Forward Current

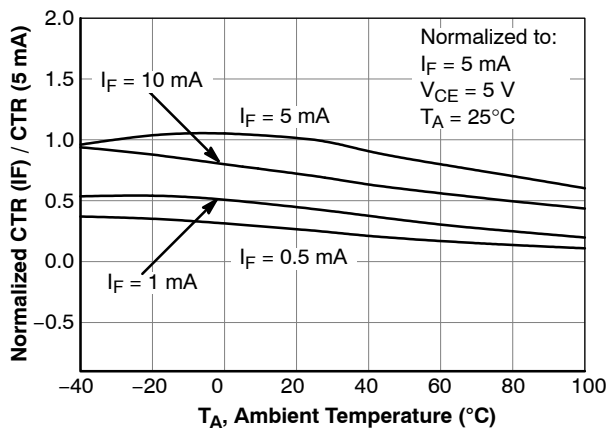


Figure 4. Normalized CTR vs. Temperature

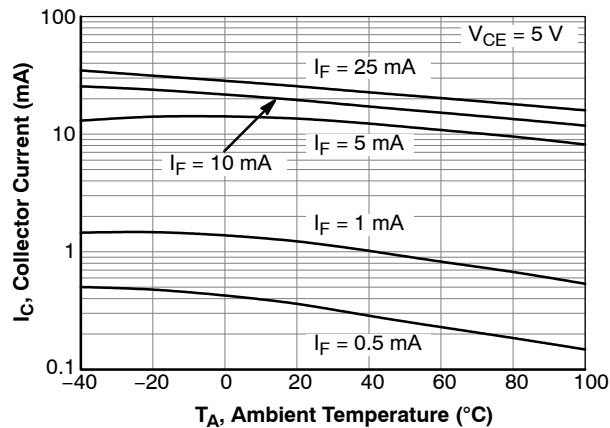


Figure 5. Collector Current vs. Temperature

# HMHA281, HMHA2801 Series

## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

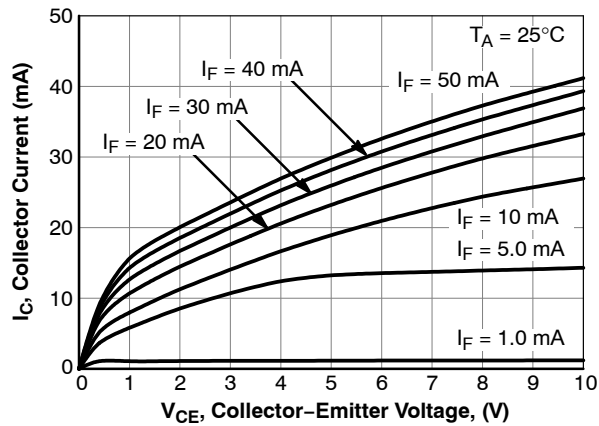


Figure 6. Collector Current vs. Collector-Emitter Voltage

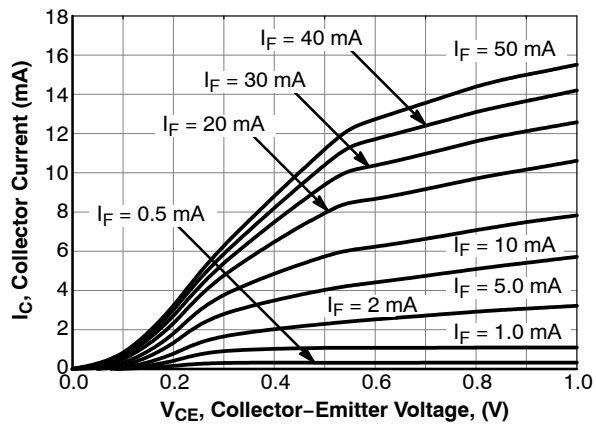


Figure 7. Collector Current vs. Collector-Emitter Voltage

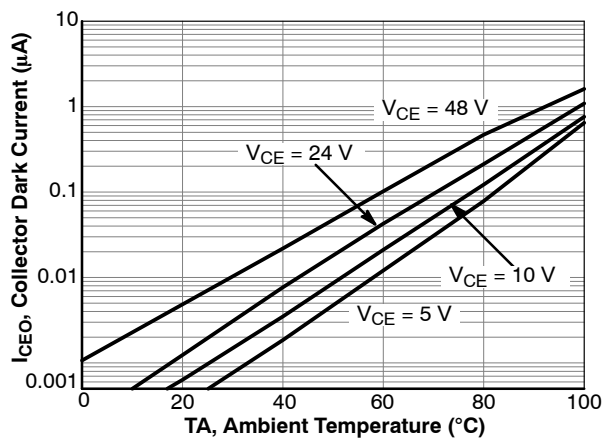


Figure 8. Collector Dark Current vs. Temperature

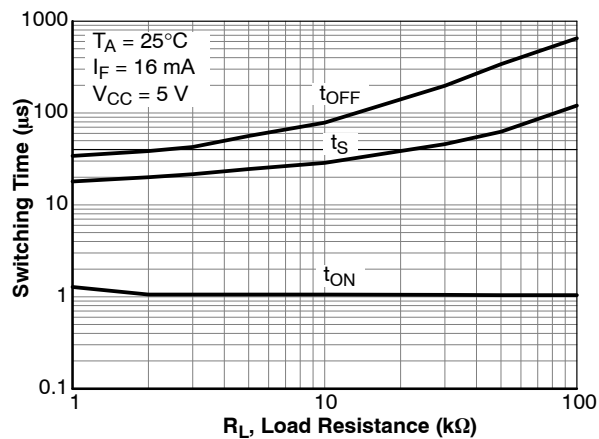


Figure 9. Switching Time vs. Load Resistance

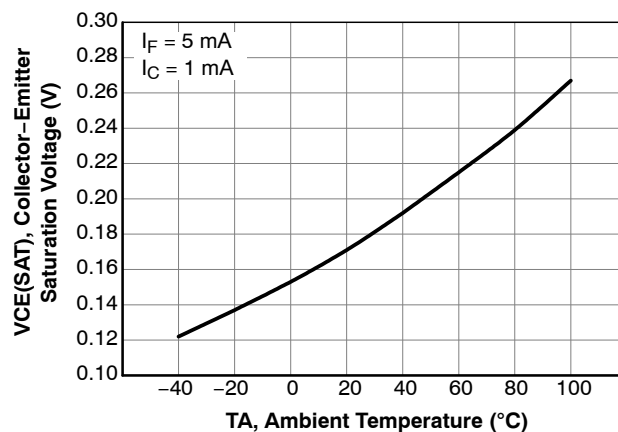


Figure 10. Collector-Emitter Saturation Voltage vs Temperature

# HMHA281, HMHA2801 Series

## REFLOW PROFILE

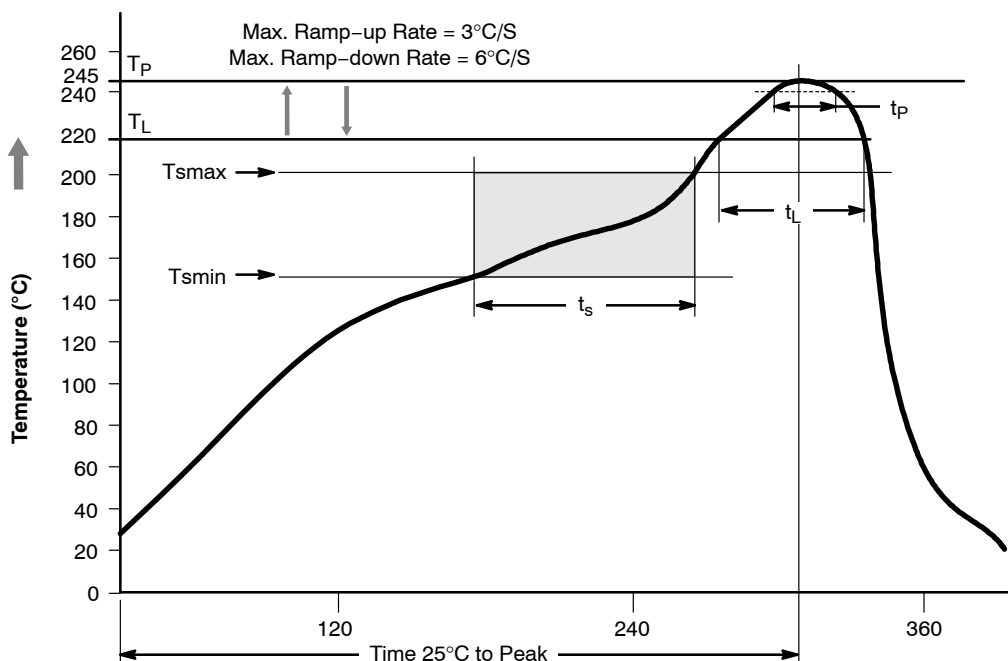


Figure 11. Reflow Profile

| Profile Feature                                                     | Pb-Free Assembly Profile |
|---------------------------------------------------------------------|--------------------------|
| Temperature Minimum (T <sub>min</sub> )                             | 150°C                    |
| Temperature Maximum (T <sub>max</sub> )                             | 200°C                    |
| Time (t <sub>s</sub> ) from (T <sub>min</sub> to T <sub>max</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        |

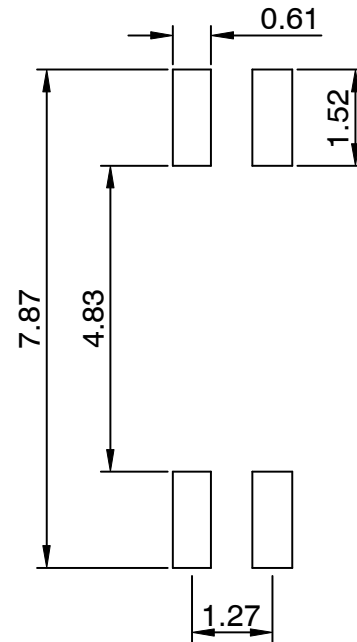
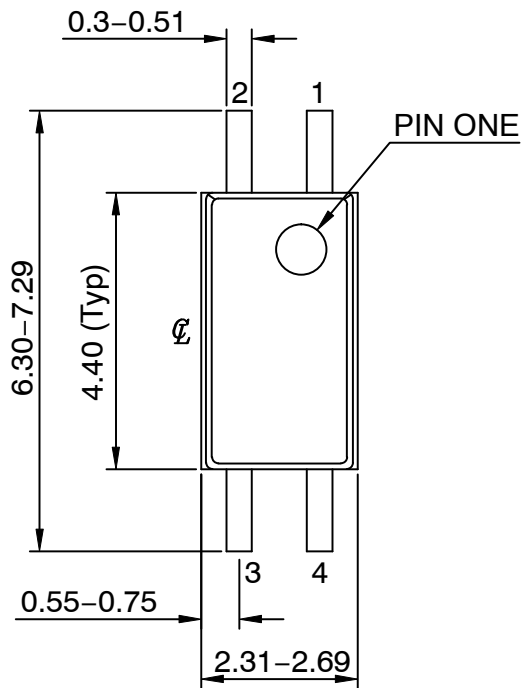
## ORDERING INFORMATION

| Part Number | Package                                                | Shipping†          |
|-------------|--------------------------------------------------------|--------------------|
| HMHA2801    | Half Pitch Mini-Flat 4-Pin                             | 100 Units / Tube   |
| HMHA2801R2  | Half Pitch Mini-Flat 4-Pin                             | 2500 / Tape & Reel |
| HMHA2801V   | Half Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option | 100 Units / Tube   |
| HMHA2801R2V | Half Pitch Mini-Flat 4-Pin, DIN EN/IEC60747-5-5 Option | 2500 / Tape & Reel |

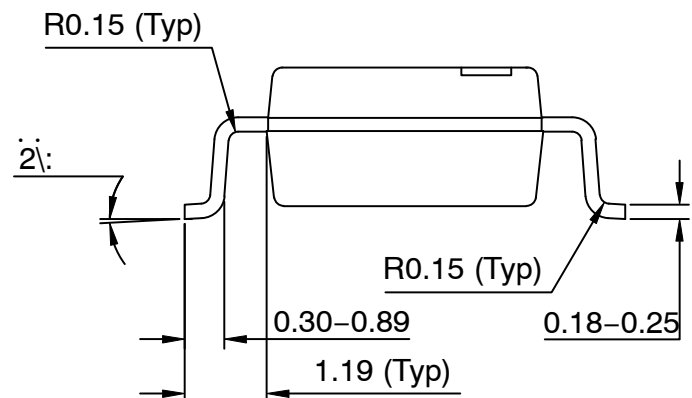
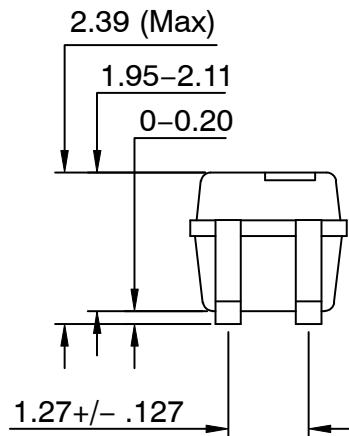
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

**MFP4 2.5X4.4, 1.27P**  
CASE 100AL  
ISSUE O

DATE 31 AUG 2016



**LAND PATTERN RECOMMENDATION**



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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

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