

# 6-Pin DIP Photodarlington Optocoupler (No Base Connection)

## MOC8021M, MOC8050M

The MOC8021M and MOC8050M are photodarlington-type optically coupled optocouplers. The devices have a gallium arsenide infrared emitting diode coupled with a silicon darlington phototransistor.

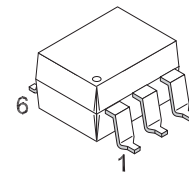
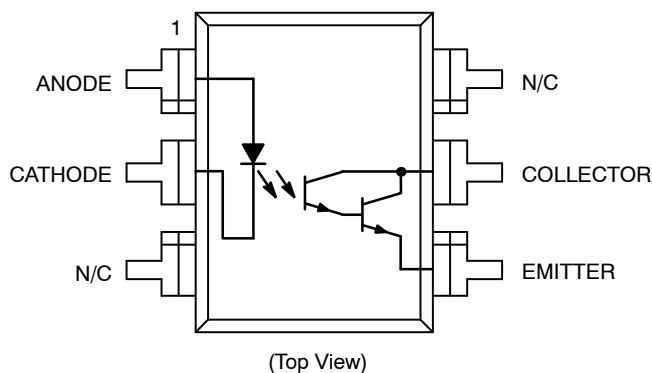
### Features

- High  $BV_{CEO}$ :
  - ♦ Minimum 50 V (MOC8021M)
  - ♦ Minimum 80 V (MOC8050M)
- High Current Transfer Ratio:
  - ♦ Minimum 1000% (MOC8021M)
  - ♦ Minimum 500% (MOC8050M)
- No Base Connection for Improved Noise Immunity
- Safety and Regulatory Approvals:
  - ♦ UL1577, 4,170 VAC<sub>RMS</sub> for 1 Minute
  - ♦ DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage
- These are Pb-Free Devices

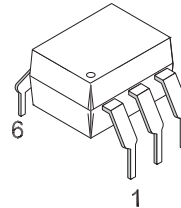
### Applications

- Appliances, Measuring Instruments
- I/O Interface for Computers
- Programmable Controllers
- Portable Electronics
- Interfacing and Coupling Systems of Different Potentials and Impedance
- Solid State Relays

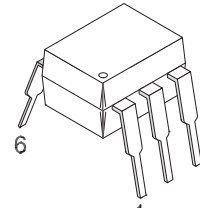
### SCHEMATIC



PDIP6  
CASE 646BY

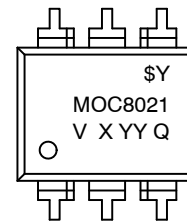


PDIP6  
CASE 646BZ



PDIP6  
CASE 646BX

### MARKING DIAGRAM



|         |                                                                                      |
|---------|--------------------------------------------------------------------------------------|
| \$Y     | = Logo                                                                               |
| MOC8021 | = Device Code                                                                        |
| V       | = DIN EN/IEC60747-5-5 Option<br>(only appears on component ordered with this option) |
| X       | = One-Digit Year Code, e.g., "5"                                                     |
| YY      | = Digit Work Week,<br>Ranging from "01" to "53"                                      |
| Q       | = Assembly Package Code                                                              |

### ORDERING INFORMATION

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

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 7.

# MOC8021M, MOC8050M

**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–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                                                                                                                                 | 6,000             | 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 (Note 1)                                                                                                                                      | 175               | °C                |
| I <sub>S,INPUT</sub>  | Input Current (Note 1)                                                                                                                                         | 350               | mA                |
| P <sub>S,OUTPUT</sub> | Output Power (Note 1)                                                                                                                                          | 800               | 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                 |

**NOTE:**

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

**Table 2. ABSOLUTE MAXIMUM RATINGS**

| Symbol              | Parameter                                              | Value              | Units |
|---------------------|--------------------------------------------------------|--------------------|-------|
| <b>TOTAL DEVICE</b> |                                                        |                    |       |
| T <sub>STG</sub>    | Storage Temperature                                    | –40 to +125        | °C    |
| T <sub>OPR</sub>    | Operating Temperature                                  | –40 to +100        | °C    |
| T <sub>J</sub>      | Junction Temperature                                   | –40 to +125        | °C    |
| T <sub>SOL</sub>    | Lead Solder Temperature                                | 260 for 10 seconds | °C    |
| P <sub>D</sub>      | Total Device Power Dissipation @ T <sub>A</sub> = 25°C | 270                | mW    |
|                     | Derate above 25°C                                      | 2.94               | mW/°C |
| <b>EMITTER</b>      |                                                        |                    |       |
| I <sub>F</sub>      | DC/Average Forward Input Current                       | 60                 | mA    |
| V <sub>R</sub>      | Reverse Input Voltage                                  | 3                  | V     |
| P <sub>D</sub>      | LED Power Dissipation @ T <sub>A</sub> = 25°C          | 120                | mW    |
|                     | Derate Above 25°C                                      | 1.41               | mW/°C |
| <b>DETECTOR</b>     |                                                        |                    |       |
| I <sub>C</sub>      | Continuous Collector Current                           | 150                | mA    |
| V <sub>CEO</sub>    | Collector–Emitter Voltage – MOC8021M                   | 50                 | V     |
|                     | Collector–Emitter Voltage – MOC8050M                   | 80                 | V     |
| P <sub>D</sub>      | Detector Power Dissipation @ T <sub>A</sub> = 25°C     | 150                | mW    |
|                     | Derate Above 25°C                                      | 1.76               | 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.

# MOC8021M, MOC8050M

**Table 3. ELECTRICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol          | Parameter                                      | Test Conditions                         | Min | Typ   | Max  | Units         |
|-----------------|------------------------------------------------|-----------------------------------------|-----|-------|------|---------------|
| <b>EMITTER</b>  |                                                |                                         |     |       |      |               |
| $V_F$           | Input Forward Voltage                          | $I_F = 10\text{ mA}$                    |     | 1.18  | 2.00 | V             |
| $I_R$           | Reverse Leakage Current                        | $V_R = 3.0\text{ V}$                    |     | 0.001 | 10   | $\mu\text{A}$ |
| <b>DETECTOR</b> |                                                |                                         |     |       |      |               |
| $BV_{CEO}$      | Collector–Emitter Breakdown Voltage (MOC8021M) | $I_C = 1.0\text{ mA}, I_F = 0$          | 50  | 100   |      | V             |
|                 | (MOC8050M)                                     |                                         | 80  | 100   |      | V             |
| $BV_{ECO}$      | Emitter–Collector Breakdown Voltage            | $I_E = 100\text{ }\mu\text{A}, I_F = 0$ | 5   | 10    |      | V             |
| $I_{CEO}$       | Collector–Emitter Dark Current                 | $V_{CE} = 60\text{ V}, I_F = 0$         |     |       | 1    | $\mu\text{A}$ |
| $C_{CE}$        | Capacitance                                    | $V_{CE} = 0\text{ V}, f = 1\text{ MHz}$ |     | 8     |      | pF            |

**Table 4. TRANSFER CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol                    | Parameter                                               | Test Conditions                                                    | Min   | Typ | Max | Units         |
|---------------------------|---------------------------------------------------------|--------------------------------------------------------------------|-------|-----|-----|---------------|
| <b>DC CHARACTERISTICS</b> |                                                         |                                                                    |       |     |     |               |
| CTR                       | Current Transfer Ratio, Collector–to–Emitter (MOC8021M) | $I_F = 10\text{ mA}, V_{CE} = 5\text{ V}$                          | 1,000 |     |     | %             |
|                           | (MOC8050M)                                              | $I_F = 10\text{ mA}, V_{CE} = 1.5\text{ V}$                        | 500   |     |     | %             |
| <b>AC CHARACTERISTICS</b> |                                                         |                                                                    |       |     |     |               |
| $t_{on}$                  | Turn–on Time                                            | $I_F = 5\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ |       | 8.5 |     | $\mu\text{s}$ |
| $t_{off}$                 | Turn–off Time                                           | $I_F = 5\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ |       | 95  |     | $\mu\text{s}$ |

**Table 5. ISOLATION CHARACTERISTICS**

| Symbol    | Parameter                      | Test Conditions                                        | Min       | Typ | Max | Units          |
|-----------|--------------------------------|--------------------------------------------------------|-----------|-----|-----|----------------|
| $V_{ISO}$ | 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           | $V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$ | $10^{11}$ |     |     | $\Omega$       |

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.

TYPICAL CHARACTERISTICS

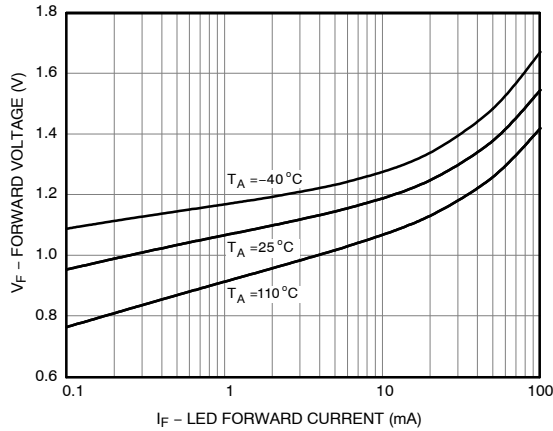


Figure 1. LED Forward Voltage vs. Forward Current

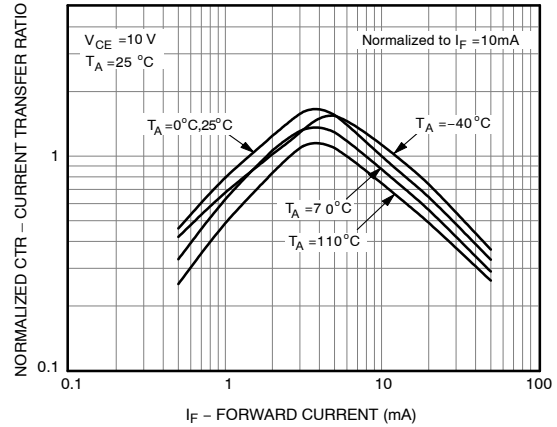


Figure 2. Normalized CTR vs. Forward Current

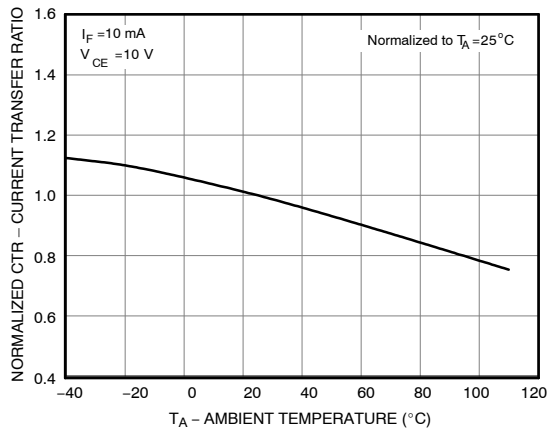


Figure 3. Normalized CTR vs. Ambient Temperature

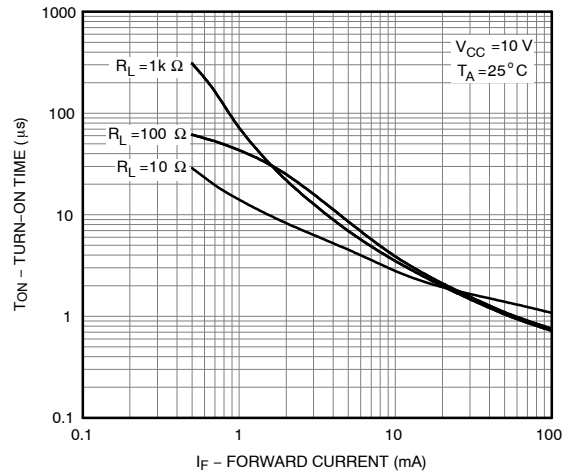


Figure 4. Turn-on Time vs. Forward Current

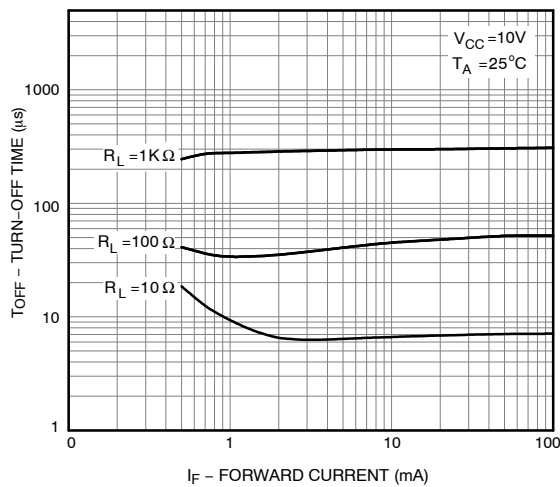


Figure 5. Turn-off Time vs. Forward Current

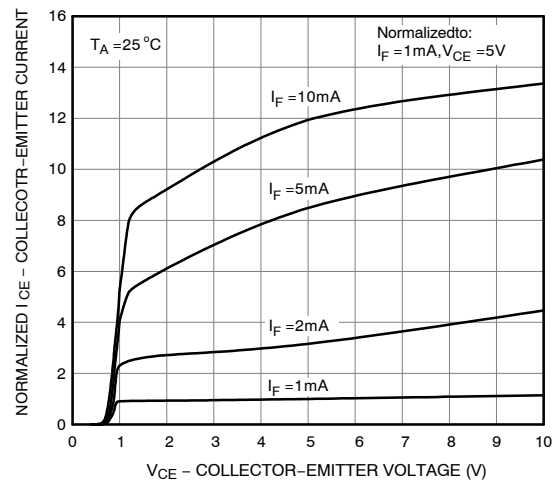


Figure 6. Normalized Collector-Emitter Current vs. Collector-Emitter Voltage

## Typical Performance Curves (Continued)

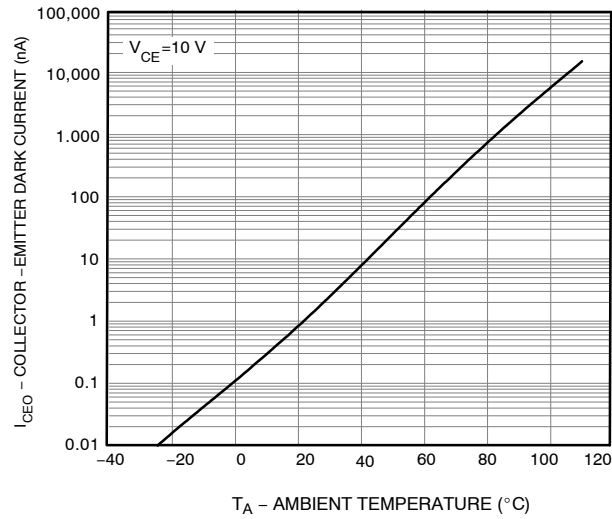


Figure 7. Dark Current vs. Ambient Temperature

## Switching Time Test Circuit and Waveform

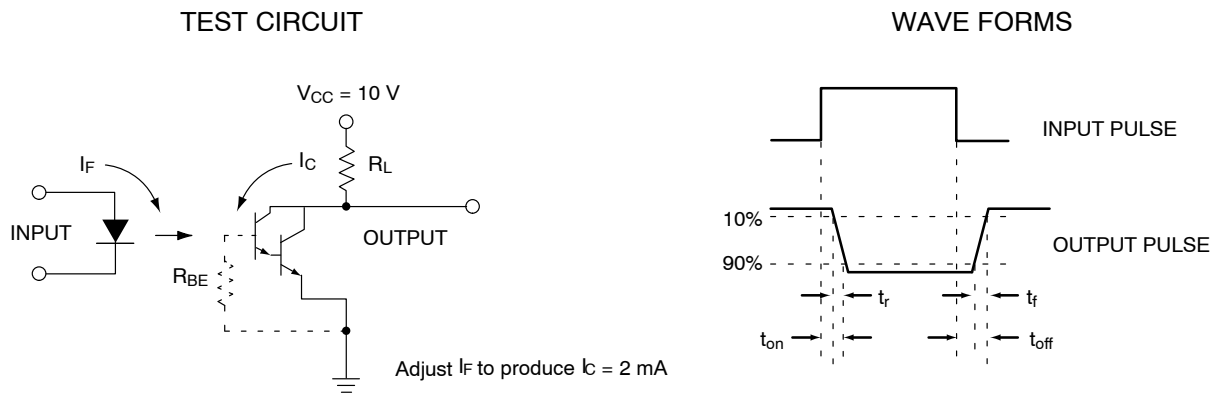


Figure 8. Switching Time Test Circuit and Waveform

## REFLOW PROFILE

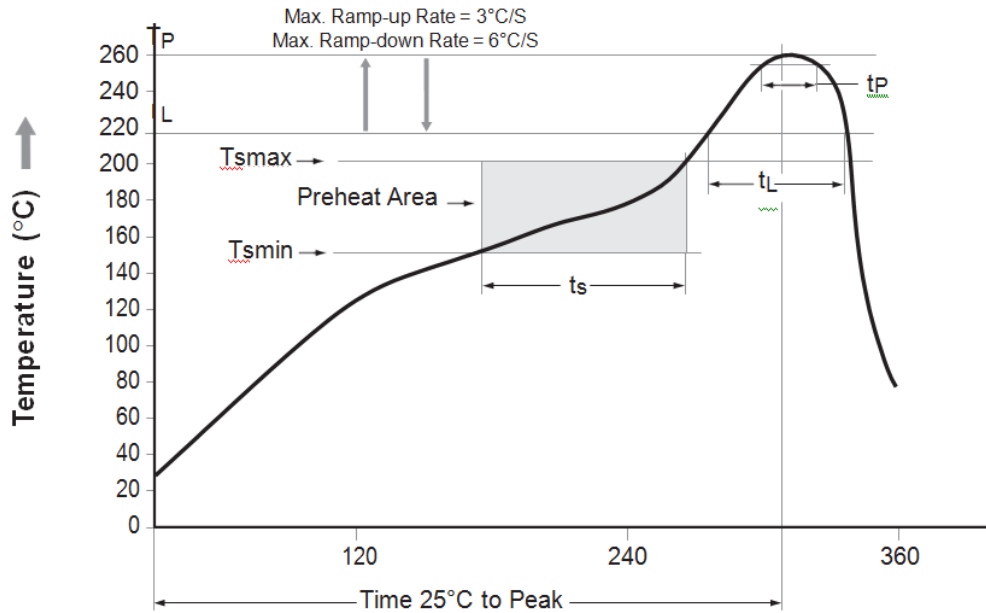


Figure 9. Reflow Profile

| Profile Feature                                  | Pb – Free Assembly Profile |
|--------------------------------------------------|----------------------------|
| Temperature Min. ( $T_{smin}$ )                  | 150°C                      |
| Temperature Max. ( $T_{smax}$ )                  | 200°C                      |
| Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ ) | 60–120 seconds             |
| Ramp – up Rate ( $t$ 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.             |

## MOC8021M, MOC8050M

### ORDERING INFORMATION

| Device Order Number | Package               | Packing Method <sup>†</sup> |
|---------------------|-----------------------|-----------------------------|
| MOC8021M            | DIP 6-Pin             | Tube (50 Units)             |
| MOC8021SM           | SMT 6-Pin (Lead Bend) | Tube (50 Units)             |

### DISCONTINUED (Note 3)

|              |                                                          |                            |
|--------------|----------------------------------------------------------|----------------------------|
| MOC8021SR2M  | SMT 6-Pin (Lead Bend)                                    | Tape and Reel (1000 Units) |
| MOC8021VM    | DIP 6-Pin, DIN EN/IEC60747-5-5 Option                    | Tube (50 Units)            |
| MOC8021SVM   | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option        | Tube (50 Units)            |
| MOC8021SR2VM | SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option        | Tape and Reel (1000 Units) |
| MOC8021TVM   | DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option | Tube (50 Units)            |

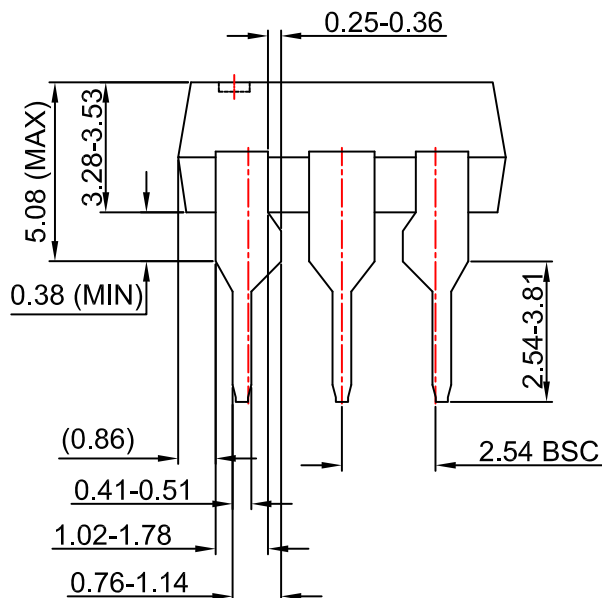
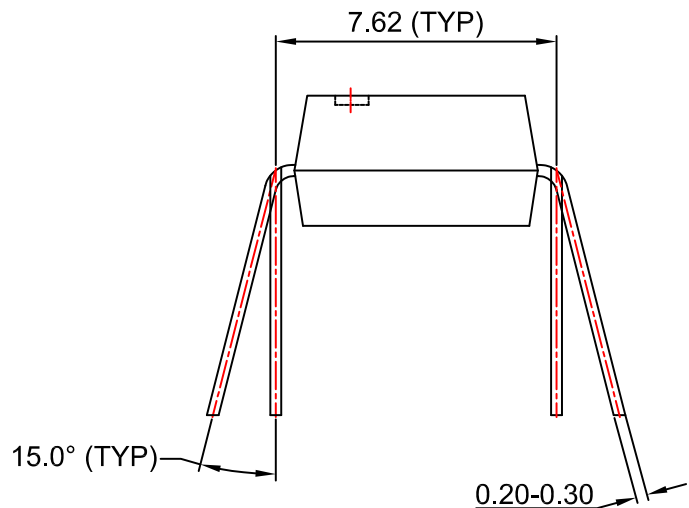
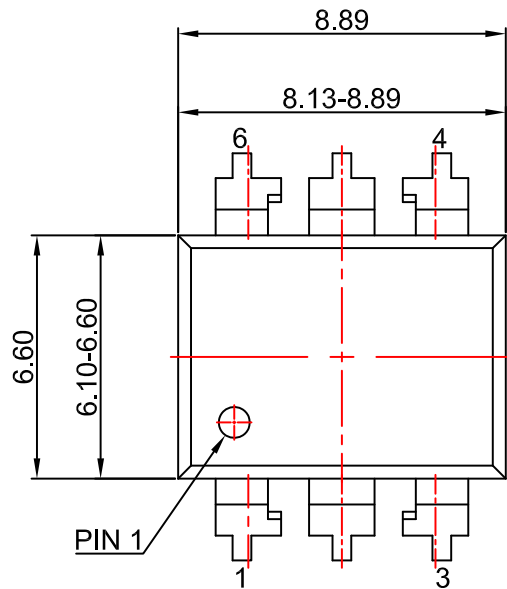
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, [BRD8011/D](#).

#### NOTES:

2. The product orderable part number system listed in this table also applies to the MOC8050M device.
3. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on [www.onsemi.com](http://www.onsemi.com).

**PDIP6 8.51x6.35, 2.54P**  
CASE 646BX  
ISSUE O

DATE 31 JUL 2016



**NOTES:**

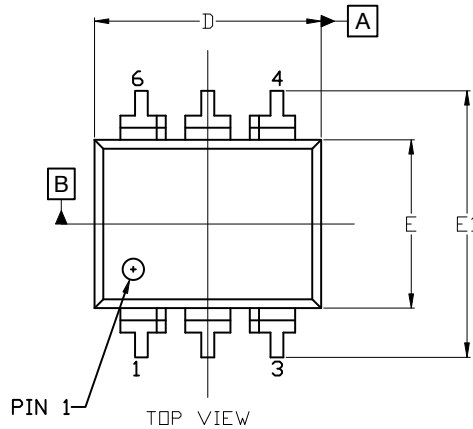
- A) NO STANDARD APPLIES TO THIS PACKAGE.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
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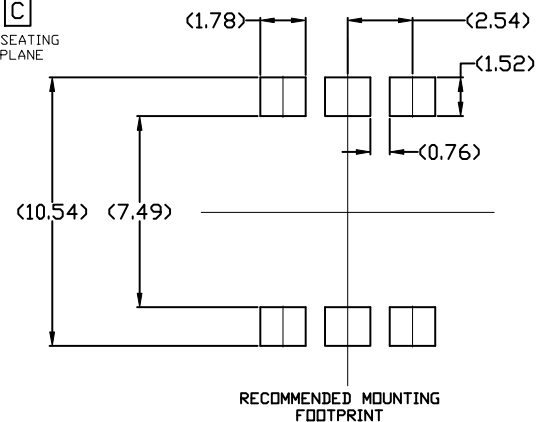
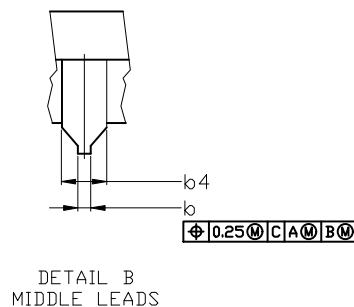
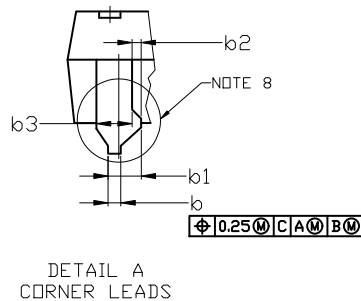
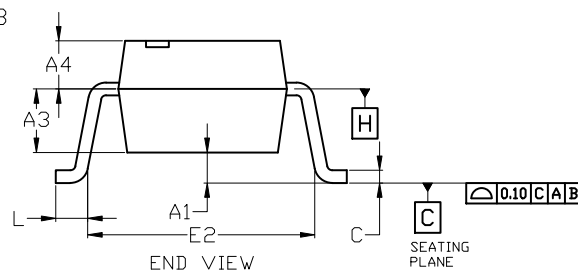
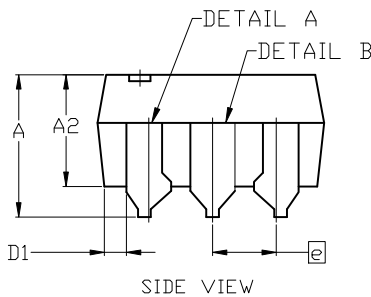
**PDIP6 8.51x6.35, 2.54P**  
**CASE 646BY**  
**ISSUE A**

DATE 15 JUL 2019


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS A, A1, AND L ARE MEASURED WITH THE PACKAGE SEATED.
4. DIMENSIONS D, D1, AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 2.54mm.
5. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).
6. CENTER LINE OF CORNER LEADS IS LOCATED BY LOCATING THE CENTER OF FEATURE b2 AND b3.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | ---         | ---  | 4.80 |
| A1  | 0.38        | ---  | ---  |
| A2  | 3.28        | 3.40 | 3.53 |
| A3  | 2.49 REF    |      |      |
| A4  | 1.89 REF    |      |      |
| b   | 0.41        | 0.46 | 0.51 |
| b1  | 0.76        | 0.92 | 1.14 |
| b2  | 0.25        | 0.28 | 0.36 |
| b3  | 1.02        | 1.40 | 1.78 |
| b4  | 1.778 REF   |      |      |
| c   | 0.20        | 0.25 | 0.30 |
| D   | 8.13        | 8.51 | 8.89 |
| D1  | 0.86 REF    |      |      |
| E   | 6.10        | 6.35 | 6.60 |
| E1  | 8.43        | 9.17 | 9.90 |
| E2  | 8.13 REF    |      |      |
| e   | 2.54 BSC    |      |      |
| L   | 0.16        | 0.52 | 0.88 |



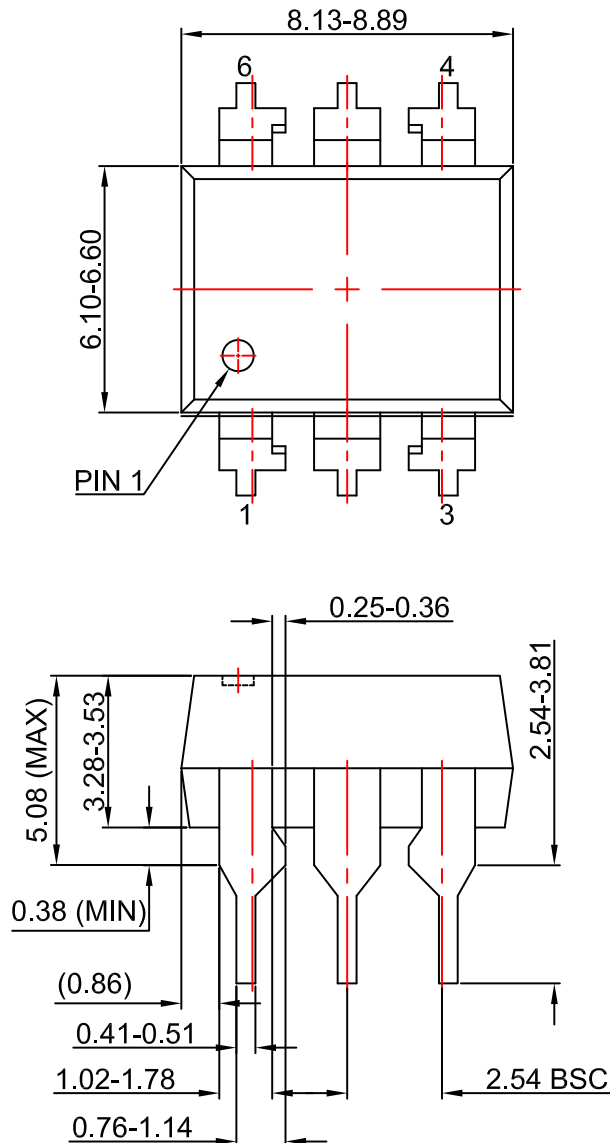
For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

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CASE 646BZ  
ISSUE O

DATE 31 JUL 2016



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