

# 6-Pin DIP High $BV_{CEO}$ Phototransistor Optocouplers

## CNY17 Series, MOC8106M

### Description

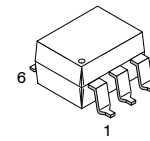
The CNY17XM, CNY17FXM, and MOC8106M devices consist of a gallium arsenide infrared emitting diode coupled with an NPN phototransistor in a dual in-line package.

### Features

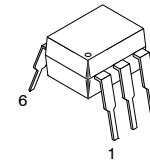
- High  $BV_{CEO}$ : 70 V Minimum (CNY17XM, CNY17FXM, MOC8106M)
- Closely Matched Current Transfer Ratio (CTR) Minimizes Unit-to-Unit Variation
- Current Transfer Ratio In Select Groups
- Very Low Coupled Capacitance Along With No Chip-to-Pin 6 Base Connection for Minimum Noise Susceptibility (CNY17FXM, MOC8106M)
- 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

### Applications

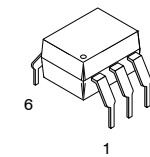
- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs
- Appliance Sensor Systems
- Industrial Controls



PDIP6  
CASE 646BY

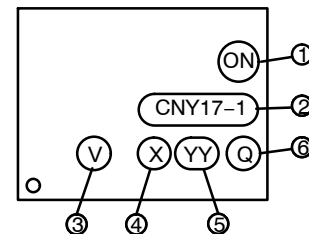


PDIP6  
CASE 646BX



PDIP6  
CASE 646BZ

### MARKING DIAGRAM



1. ON = onsemi Logo
2. CNY17 = Device Number
3. V = DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4. X = One-Digit Year Code
5. YY = Digit Work Week
6. Q = Assembly Package Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

# CNY17 Series, MOC8106M

## SCHEMATICS

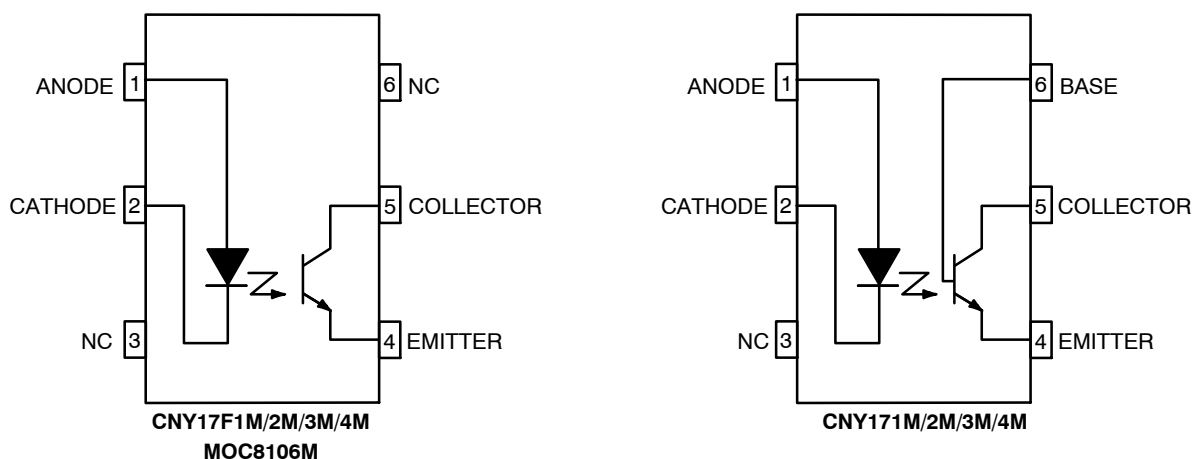


Figure 1. Schematics

## 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 (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                 |

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

## CNY17 Series, MOC8106M

### ABSOLUTE MAXIMUM RATINGS

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

#### TOTAL DEVICE

|           |                                                                                        |                    |       |
|-----------|----------------------------------------------------------------------------------------|--------------------|-------|
| $T_{STG}$ | Storage Temperature                                                                    | -40 to +125        | °C    |
| $T_A$     | Ambient 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 @ 25°C (LED plus detector)<br>Derate Linearly From 25°C | 270                | mW    |
|           |                                                                                        | 2.94               | mW/°C |

#### EMITTER

|            |                                                                 |      |       |
|------------|-----------------------------------------------------------------|------|-------|
| $I_F$      | Continuous Forward Current                                      | 60   | mA    |
| $V_R$      | Reverse Voltage                                                 | 6    | V     |
| $I_F (pk)$ | Forward Current – Peak (1 $\mu$ s pulse, 300 pps)               | 1.5  | A     |
| $P_D$      | LED Power Dissipation 25°C Ambient<br>Derate Linearly From 25°C | 120  | mW    |
|            |                                                                 | 1.41 | mW/°C |

#### DETECTOR

|           |                                                                |      |       |
|-----------|----------------------------------------------------------------|------|-------|
| $I_C$     | Continuous Collector Current                                   | 50   | mA    |
| $V_{CEO}$ | Collector–Emitter Voltage                                      | 70   | V     |
| $V_{ECO}$ | Emitter Collector Voltage                                      | 7    | V     |
| $P_D$     | Detector Power Dissipation @ 25°C<br>Derate Linearly from 25°C | 150  | mW    |
|           |                                                                | 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.

# CNY17 Series, MOC8106M

## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = 25°C unless otherwise specified)

### INDIVIDUAL COMPONENT CHARACTERISTICS

| Symbol         | Parameter               | Test Conditions                   | Device            | Min. | Typ.  | Max. | Unit |
|----------------|-------------------------|-----------------------------------|-------------------|------|-------|------|------|
| <b>EMITTER</b> |                         |                                   |                   |      |       |      |      |
| V <sub>F</sub> | Input Forward Voltage   | I <sub>F</sub> = 10 mA            | All Devices       | 1.0  | 1.15  | 1.50 | V    |
|                |                         | I <sub>F</sub> = 60 mA            | CNY17XM, CNY17FXM | 1.0  | 1.35  | 1.65 | V    |
| C <sub>J</sub> | Capacitance             | V <sub>F</sub> = 0 V, f = 1.0 MHz | All Devices       | –    | 18    | –    | pF   |
| I <sub>R</sub> | Reverse Leakage Current | V <sub>R</sub> = 6 V              | All Devices       | –    | 0.001 | 10   | μA   |

### DETECTOR

|                   |                                           |                                             |             |    |     |    |    |
|-------------------|-------------------------------------------|---------------------------------------------|-------------|----|-----|----|----|
| BV <sub>CEO</sub> | Breakdown Voltage<br>Collector-to-Emitter | I <sub>C</sub> = 1 mA, I <sub>F</sub> = 0   | All Devices | 70 | 100 | –  | V  |
| BV <sub>CBO</sub> | Collector-to-Base                         | I <sub>C</sub> = 10 μA, I <sub>F</sub> = 0  | CNY17XM     | 70 | 120 | –  | V  |
| BV <sub>ECO</sub> | Emitter-to-Collector                      | I <sub>E</sub> = 100 μA, I <sub>F</sub> = 0 | All Devices | 7  | 10  | –  | V  |
| I <sub>CEO</sub>  | Leakage Current<br>Collector-to-Emitter   | V <sub>CE</sub> = 10 V, I <sub>F</sub> = 0  | All Devices | –  | 1   | 50 | nA |
| I <sub>CBO</sub>  | Collector-to-Base                         | V <sub>CB</sub> = 10 V, I <sub>F</sub> = 0  | CNY17XM     | –  | –   | 20 | nA |
| C <sub>CE</sub>   | Capacitance<br>Collector-to-Emitter       | V <sub>CE</sub> = 0, f = 1 MHz              | All Devices | –  | 8   | –  | pF |
| C <sub>CB</sub>   | Collector-to-Base                         | V <sub>CB</sub> = 0, f = 1 MHz              | CNY17XM     | –  | 20  | –  | pF |
| C <sub>EB</sub>   | Emitter-to-Base                           | V <sub>EB</sub> = 0, f = 1 MHz              | CNY17XM     | –  | 10  | –  | pF |

### TRANSFER CHARACTERISTICS

| Symbol               | Parameter                               | Test Conditions                                 | Device            | Min. | Typ. | Max. | Unit |
|----------------------|-----------------------------------------|-------------------------------------------------|-------------------|------|------|------|------|
| <b>COUPLED</b>       |                                         |                                                 |                   |      |      |      |      |
| CTR                  | Current Transfer Ratio                  | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V  | MOC8106M          | 50   | –    | 150  | %    |
|                      |                                         | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 5 V   | CNY171M, CNY17F1M | 40   | –    | 80   | %    |
|                      |                                         | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 5 V   | CNY172M, CNY17F2M | 63   | –    | 125  | %    |
|                      |                                         | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 5 V   | CNY173M, CNY17F3M | 100  | –    | 200  | %    |
|                      |                                         | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 5 V   | CNY174M, CNY17F4M | 160  | –    | 320  | %    |
| V <sub>CE(SAT)</sub> | Collector-Emitter<br>Saturation Voltage | I <sub>C</sub> = 0.5 mA, I <sub>F</sub> = 5 mA  | MOC8106M          | –    | –    | 0.4  | V    |
|                      |                                         | I <sub>C</sub> = 2.5 mA, I <sub>F</sub> = 10 mA | CNY17XM/CNY17FXM  | –    | –    |      |      |

# CNY17 Series, MOC8106M

## AC CHARACTERISTICS

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

### NON-SATURATED SWITCHING TIME

|           |               |                                                                       |                  |   |     |      |               |
|-----------|---------------|-----------------------------------------------------------------------|------------------|---|-----|------|---------------|
| $t_{on}$  | Turn-On Time  | $I_C = 2.0 \text{ mA}$ , $V_{CC} = 10 \text{ V}$ , $R_L = 100 \Omega$ | All Devices      | – | 2.0 | 10.0 | $\mu\text{s}$ |
| $t_{off}$ | Turn-Off Time | $I_C = 2.0 \text{ mA}$ , $V_{CC} = 10 \text{ V}$ , $R_L = 100 \Omega$ | All Devices      | – | 3.0 | 10.0 | $\mu\text{s}$ |
| $t_d$     | Delay Time    | $I_F = 10 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 75 \Omega$    | CNY17XM/CNY17FXM | – | –   | 5.6  | $\mu\text{s}$ |
| $t_r$     | Rise Time     | $I_F = 10 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 75 \Omega$    | CNY17XM/CNY17FXM | – | –   | 4.0  | $\mu\text{s}$ |
| $t_s$     | Storage Time  | $I_F = 10 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 75 \Omega$    | CNY17XM/CNY17FXM | – | –   | 4.1  | $\mu\text{s}$ |
| $t_f$     | Fall Time     | $I_F = 10 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 75 \Omega$    | CNY17XM/CNY17FXM | – | –   | 3.5  | $\mu\text{s}$ |

### SATURATED SWITCHING TIME

|       |              |                                                                            |                                   |   |   |      |               |
|-------|--------------|----------------------------------------------------------------------------|-----------------------------------|---|---|------|---------------|
| $t_d$ | Delay Time   | $I_F = 20 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ | CNY171M/F1M                       | – | – | 5.5  | $\mu\text{s}$ |
|       |              | $I_F = 10 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ | CNY172M/3M/4M<br>CNY17F2M/F3M/F4M | – | – | 8.0  | $\mu\text{s}$ |
| $t_r$ | Rise Time    | $I_F = 20 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ | CNY171M/F1M                       | – | – | 4.0  | $\mu\text{s}$ |
|       |              | $I_F = 10 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ | CNY172M/3M/4M<br>CNY17F2M/F3M/F4M | – | – | 6.0  | $\mu\text{s}$ |
| $t_s$ | Storage Time | $I_F = 20 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ | CNY171M/F1M                       | – | – | 34.0 | $\mu\text{s}$ |
|       |              | $I_F = 10 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ | CNY172M/3M/4M<br>CNY17F2M/F3M/F4M | – | – | 39.0 | $\mu\text{s}$ |
| $t_f$ | Fall Time    | $I_F = 20 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ | CNY171M/F1M                       | – | – | 20.0 | $\mu\text{s}$ |
|       |              | $I_F = 10 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ | CNY172M/3M/4M<br>CNY17F2M/F3M/F4M | – | – | 24.0 | $\mu\text{s}$ |

## ISOLATION CHARACTERISTICS

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

TYPICAL PERFORMANCE CHARACTERISTICS

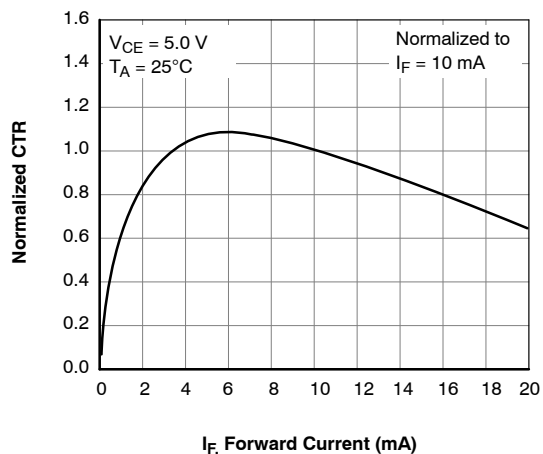


Figure 2. Normalized CTR vs. Forward Current

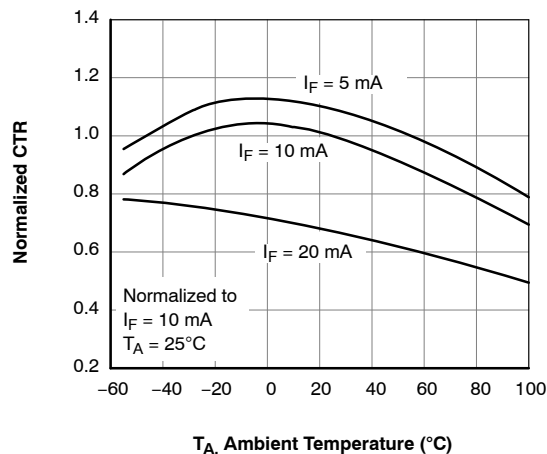


Figure 3. Normalized CTR vs. Ambient Temperature

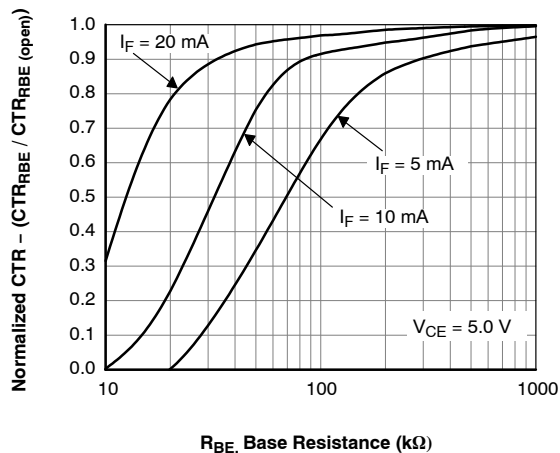


Figure 4. CTR vs. R\_BE (Unsaturated)

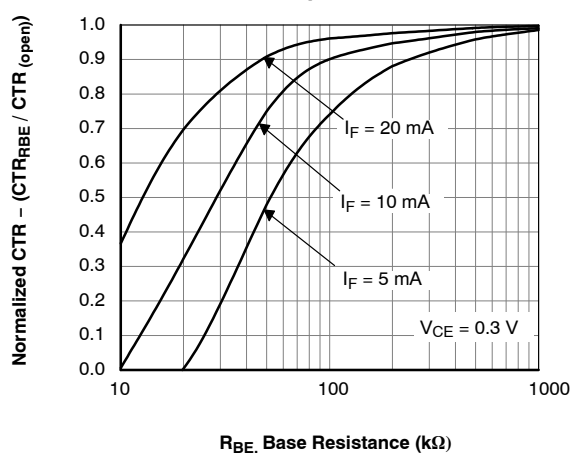


Figure 5. CTR vs. R\_BE (Saturated)

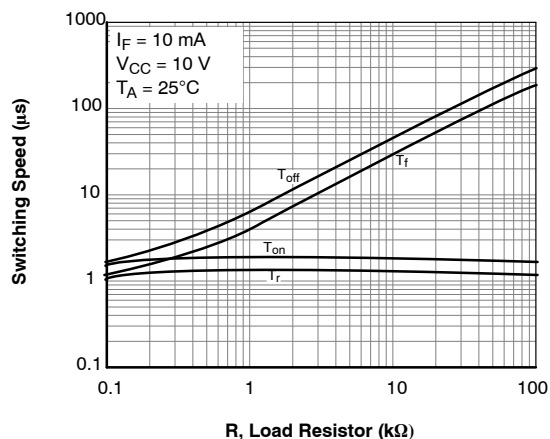


Figure 6. Switching Speed vs. Load Resistor

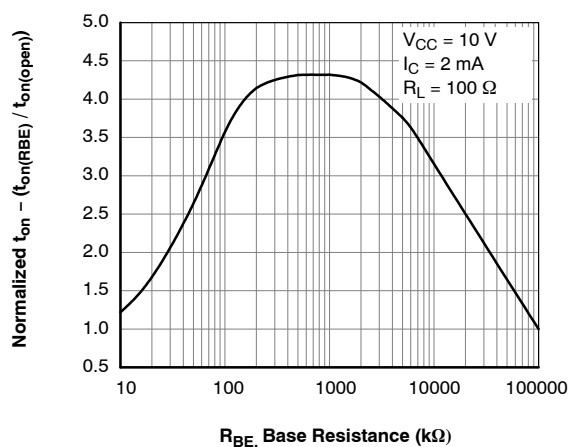


Figure 7. Normalized  $t_{on}$  vs.  $R_{BE}$

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

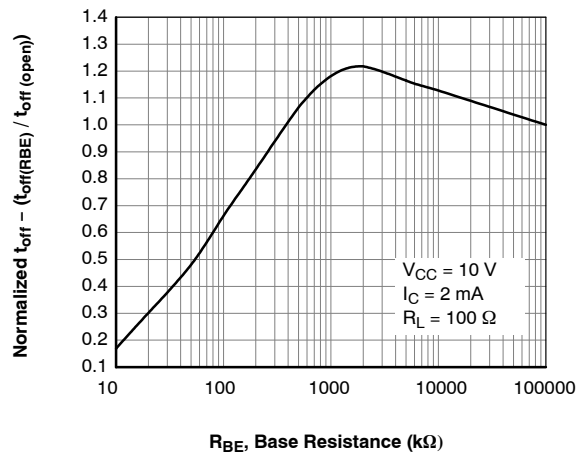


Figure 8. Normalized  $t_{off}$  vs.  $R_{BE}$

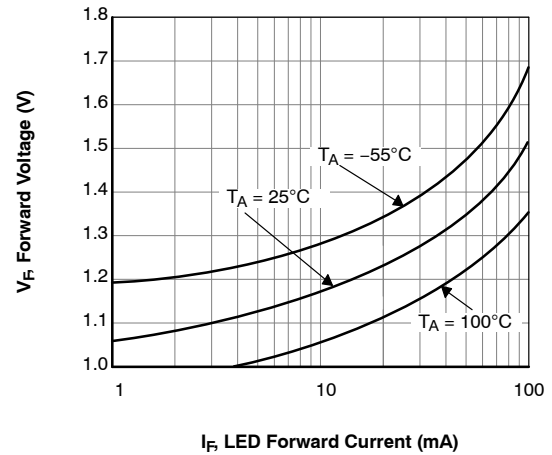


Figure 9. LED Forward Voltage vs. Forward Current

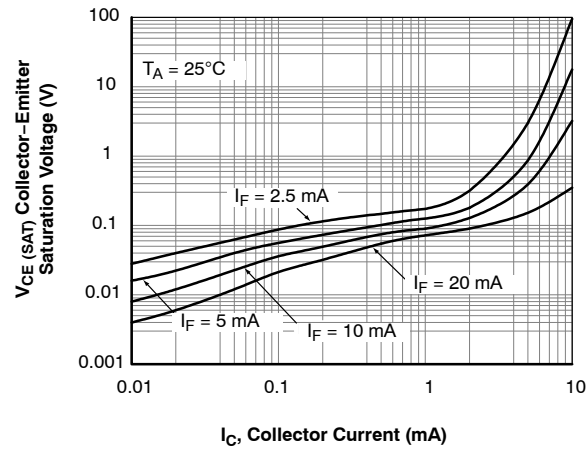


Figure 10. Collector-Emitter Saturation Voltage vs. Collector Current

SWITCHING TEST CIRCUIT AND WAVEFORMS

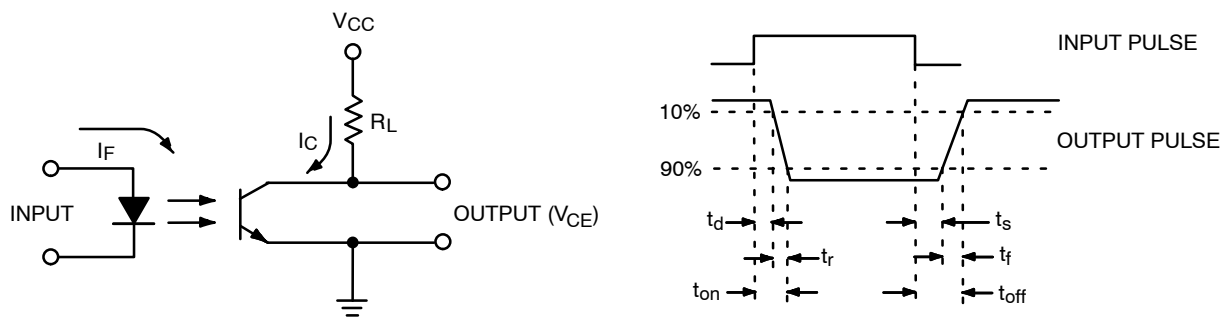


Figure 11. Switching Test Circuit and Waveforms

## REFLOW PROFILE

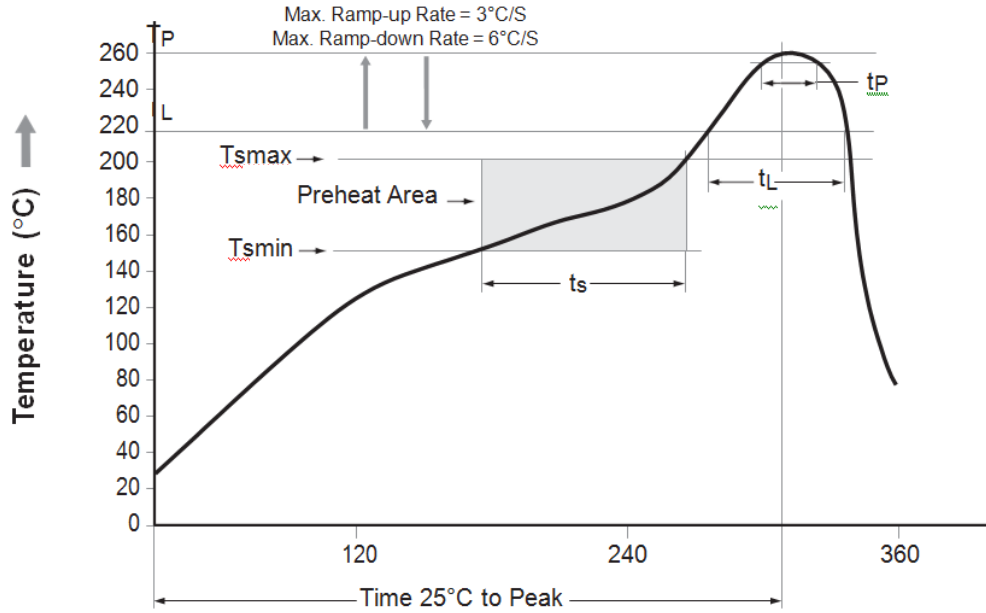


Figure 12. Reflow Profile

| Profile Feature                  | Pb – Free Assembly Profile |
|----------------------------------|----------------------------|
| Temperature Min. (Tssmin)        | 150°C                      |
| Temperature Max. (Tsmax)         | 200°C                      |
| Time (ts) from (Tssmin to Tsmax) | 60–120 seconds             |
| Ramp – up Rate (t to tp)         | 3°C/second max.            |
| Liquidous Temperature (Tl)       | 217°C                      |
| Time (tl) Maintained Above (Tl)  | 60–150 seconds             |
| Peak Body Package Temperature    | 260°C +0°C / –5°C          |
| Time (tp) within 5°C of 260°C    | 30 seconds                 |
| Ramp – down Rate (Tp to Tl)      | 6°C / second max.          |
| Time 25°C to Peak Temperature    | 8 minutes max.             |

Table 1. ORDERING INFORMATION

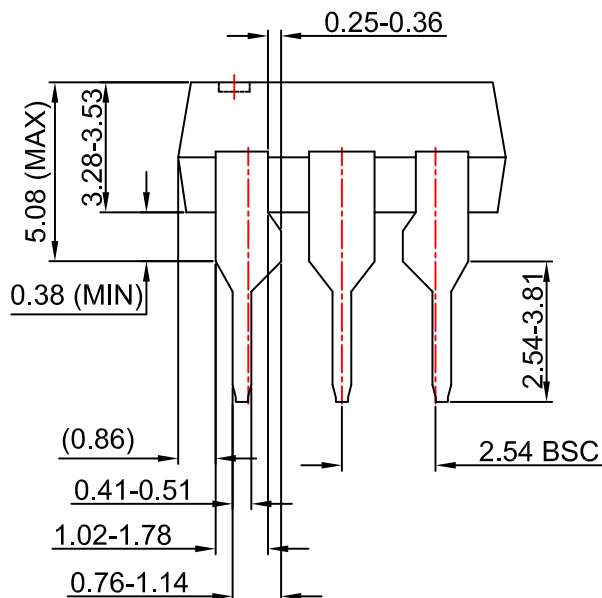
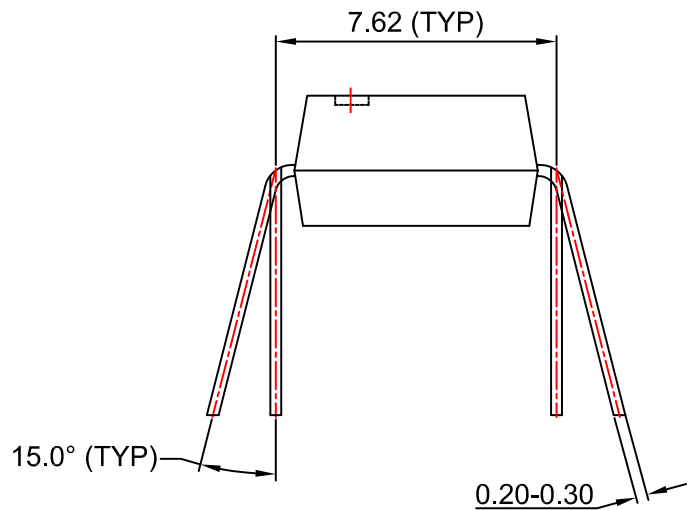
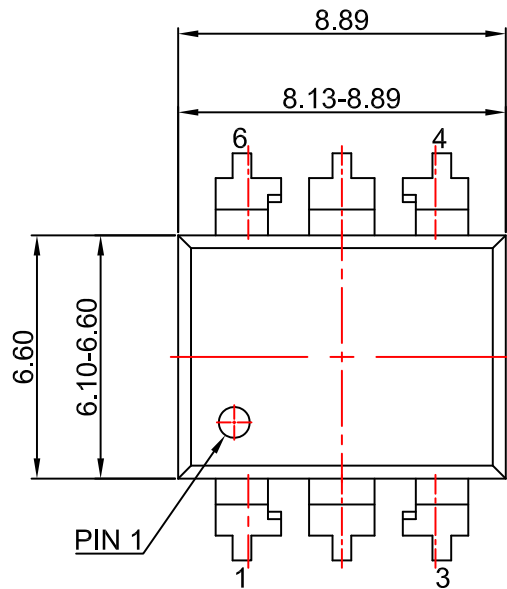
| Part Number | Package                                                  | Packing Method†            |
|-------------|----------------------------------------------------------|----------------------------|
| CNY171M     | DIP 6-Pin                                                | Tube (50 Units)            |
| CNY171SM    | SMT 6-Pin (Lead Bend)                                    | Tube (50 Units)            |
| CNY171SR2M  | SMT 6-Pin (Lead Bend)                                    | Tape and Reel (1000 Units) |
| CNY171TM    | DIP 6-Pin, 0.4" Lead Spacing                             | Tube (50 Units)            |
| CNY171VM    | DIP 6-Pin, DIN EN/IEC60747–5–5 Option                    | Tube (50 Units)            |
| CNY171SVM   | SMT 6-Pin (Lead Bend), DIN EN/IEC60747–5–5 Option        | Tube (50 Units)            |
| CNY171SR2VM | SMT 6-Pin (Lead Bend), DIN EN/IEC60747–5–5 Option        | Tape and Reel (1000 Units) |
| CNY171TVM   | DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747–5–5 Option | Tube (50 Units)            |

†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.

2. The product orderable part number system listed in this table also applies to the CNY17FXM product family and the MOC8106M device.

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

DATE 31 JUL 2016



**NOTES:**

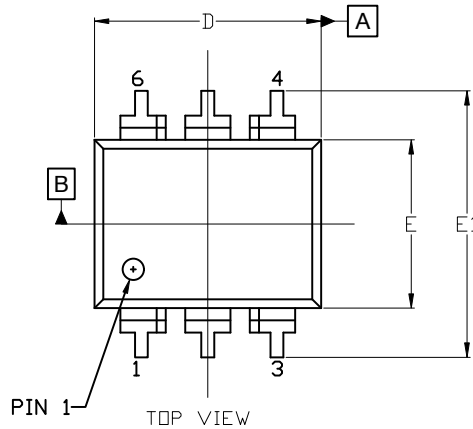
- A) NO STANDARD APPLIES TO THIS PACKAGE.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

|                         |                               |                                                                                                                                                                                     |
|-------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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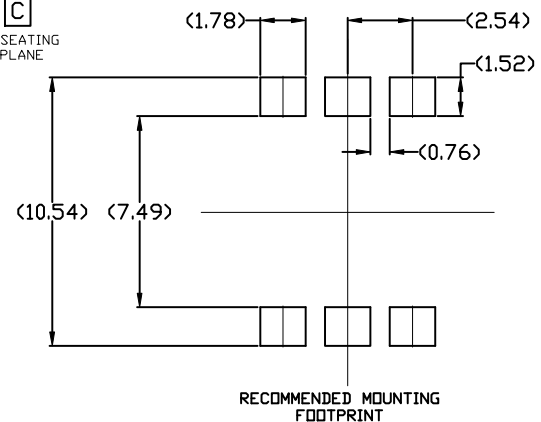
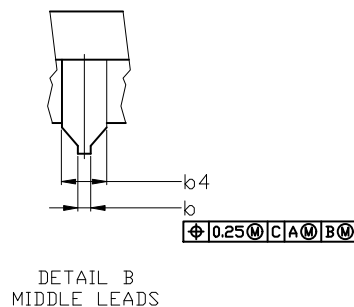
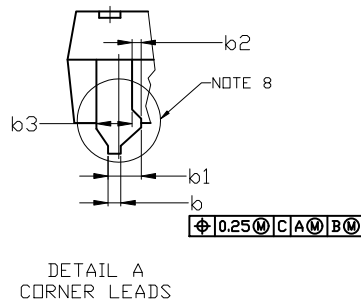
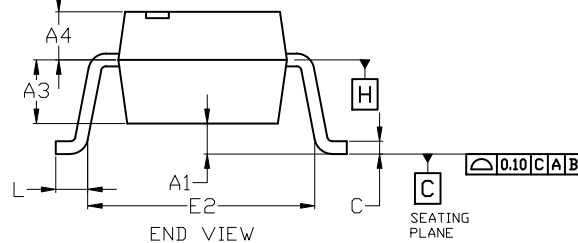
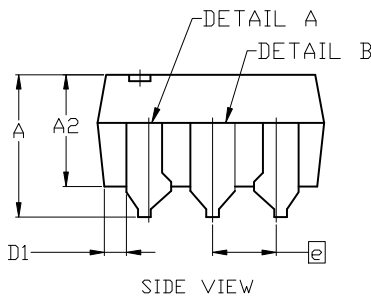
**PDIP6 8.51x6.35, 2.54P**  
**CASE 646BY**  
**ISSUE A**

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 |



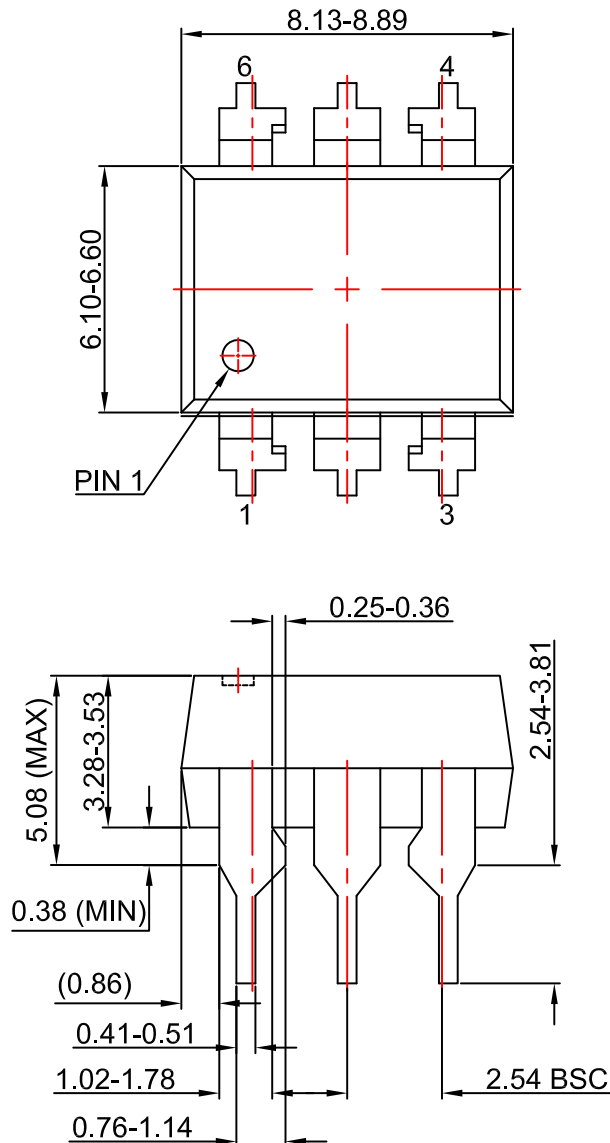
For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

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

DATE 31 JUL 2016



**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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