

CNY171, CNY172, CNY173, CNY174, CNY17F1, CNY17F2, CNY17F3, CNY17F4, MOC8101, MOC8102, MOC8103, MOC8104, MOC8105, MOC8106, MOC8107, MOC8108 Phototransistor Optocouplers

Features

- CNY171/2/3/4 and CNY17F1/2/3/4 are also available in white package by specifying M suffix (eg. CNY17F2M)
- UL recognized (File # E90700)
- VDE recognized
 - Add option V for white package (e.g., CNY17F2VM)
 - File #102497
 - Add option '300' for black package (e.g., CNY17F2300)
 - File #94766
- Current transfer ratio in select groups
- High BV_{CEO} —70V minimum (CNY17X/M, CNY17FX/M, MOC8106/7/8)
- Closely matched current transfer ratio (CTR) minimizes unit-to-unit variation.
- Very low coupled capacitance along with no chip to pin 6 base connection for minimum noise susceptibility (CNY17FX/M, MOC810X)

Applications

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs
- Appliance sensor systems
- Industrial controls

Description

The CNY17, CNY17F and MOC810X devices consist of a Gallium Arsenide IRED coupled with an NPN phototransistor in a dual in-line package.

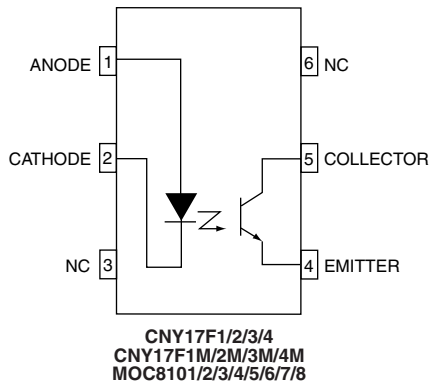
White Package (-M Suffix)



Black Package (No -M Suffix)



Schematic



Absolute Maximum Ratings

| Parameters | Symbol | Device | Value | Units |
|---|------------|-------------------------------------|----------------|-------|
| TOTAL DEVICE | | | | |
| Storage Temperature | T_{STG} | M | -40 to +150 | °C |
| | | non M | -55 to +150 | |
| Operating Temperature | T_{OPR} | M | -40 to +100 | °C |
| | | non M | -55 to +100 | |
| Lead Solder Temperature | T_{SOL} | All | 260 for 10 sec | °C |
| Total Device Power Dissipation @ 25°C (LED plus detector) | P_D | M | 250 | mW |
| Derate Linearly From 25°C | | non M | 250 | |
| | | M | 2.94 | mW/°C |
| | | non M | 3.30 | |
| EMITTER | | | | |
| Continuous Forward Current | I_F | M | 60 | mA |
| | | non M | 100 | |
| Reverse Voltage | V_R | All | 6 | V |
| Forward Current - Peak (1 μ s pulse, 300 pps) | I_F (pk) | M | 1.5 | A |
| | | non M | 1.0 | |
| LED Power Dissipation 25°C Ambient | P_D | M | 120 | mW |
| Derate Linearly From 25°C | | non M | 150 | |
| | | M | 1.41 | mW/°C |
| | | non M | 1.8 | |
| DETECTOR | | | | |
| Continuous Collector Current | I_C | All | 50 | mA |
| Collector-Emitter Voltage | V_{CEO} | CNY17X/M, CNY17FX/M, MOC8106/7/8 | 70 | V |
| | | MOC8101/2/3/4/5 | 30 | V |
| Emitter Collector Voltage | V_{ECO} | All | 7 | V |
| Detector Power Dissipation @ 25°C | P_D | M | 150 | mW |
| Derate Linearly from 25°C | | non M | 150 | |
| | | M | 1.76 | mW/°C |
| | | non M | 2.0 | |

Electrical Characteristics ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)⁽¹⁾

Individual Component Characteristics

| Parameters | Test Conditions | Symbol | Device | Min | Typ | Max | Units |
|-------------------------|----------------------------|--------|-----------------------|-----|-------|------|---------|
| EMITTER | | | | | | | |
| Input Forward Voltage | $I_F = 60$ mA | V_F | CNY17FX/M CNY17X/M | 1.0 | 1.35 | 1.65 | V |
| | $I_F = 10$ mA | | MOC810X | 1.0 | 1.15 | 1.50 | |
| Capacitance | $V_F = 0$ V, $f = 1.0$ MHz | C_J | All | | 18 | | pF |
| Reverse Leakage Current | $V_R = 6$ V | I_R | All | | 0.001 | 10 | μ A |

Individual Component Characteristics (Continued)

| Parameters | Test Conditions | Symbol | Device | Min | Typ | Max | Units |
|---|---|------------|--|-----|-----|-----|-------|
| DETECTOR | | | | | | | |
| Breakdown Voltage Collector to Emitter | $I_C = 1.0 \text{ mA}, I_F = 0$ | BV_{CEO} | MOC8101/2/3/4/5 | 30 | 100 | | V |
| | | | MOC8106/7/8 CNY17F1/2/3/4/M CNY171/2/3/4/M | 70 | 100 | | |
| Collector to Base | $I_C = 10 \text{ } \mu\text{A}, I_F = 0$ | BV_{CBO} | CNY171/2/3/4/M | 70 | 120 | | |
| Emitter to Collector | $I_E = 100 \text{ } \mu\text{A}, I_F = 0$ | BV_{ECO} | All | 7 | 10 | | |
| Leakage Current Collector to Emitter | $V_{CE} = 10 \text{ V}, I_F = 0$ | I_{CEO} | All | | 1 | 50 | nA |
| Collector to Base | $V_{CB} = 10 \text{ V}, I_F = 0$ | I_{CBO} | CNY171/2/3/4/M | | | 20 | nA |
| Capacitance Collector to Emitter | $V_{CE} = 0, f = 1 \text{ MHz}$ | C_{CE} | All | | 8 | | pF |
| Collector to Base | $V_{CB} = 0, f = 1 \text{ MHz}$ | C_{CB} | CNY171/2/3/4/M | | 20 | | pF |
| Emitter to Base | $V_{EB} = 0, f = 1 \text{ MHz}$ | C_{EB} | CNY171/2/3/4/M | | 10 | | pF |

Isolation Characteristics

| Characteristic | Test Conditions | Symbol | Device | Min | Typ** | Max | Units |
|--------------------------------|--|-----------|-------------------|-----------|-------|-----|-----------|
| Input-Output Isolation Voltage | $f = 60 \text{ Hz}, t = 1 \text{ min. (4)}$ | V_{ISO} | Black Package | 5300 | | | Vac(rms)* |
| | $f = 60 \text{ Hz}, t = 1 \text{ sec. (4)}$ | | 'M' White Package | 7500 | | | Vac(pk) |
| Isolation Resistance | $V_{I-O} = 500 \text{ VDC (4)}$ | R_{ISO} | All | 10^{11} | | | Ω |
| Isolation Capacitance | $V_{I-O} = \emptyset, f = 1 \text{ MHz (4)}$ | C_{ISO} | Black Package | | 0.5 | | pF |
| | | | 'M' White Package | | 0.2 | | |

Note

* 5300 Vac(rms) for 1 minute equates to approximately 9000 Vac (pk) for 1 second

** Typical values at $T_A = 25^\circ\text{C}$

Transfer Characteristics ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)⁽¹⁾

| DC Characteristics | | Test Conditions | Symbol | Min | Typ | Max | Units |
|--------------------------|--------------------------------------|---|---|---------------|-----|-----|-------|
| Coupled | | | | | | | |
| Output Collector Current | MOC8101 | $(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V})$ | $(CTR)^{(2)}$ | 50 | — | 80 | % |
| | MOC8102 | | | 73 | — | 117 | |
| | MOC8103 | | | 108 | — | 173 | |
| | MOC8104 | | | 160 | — | 256 | |
| | MOC8105 | | | 65 | — | 133 | |
| | MOC8106 | | | 50 | — | 150 | |
| | MOC8107 | | | 100 | — | 300 | |
| | MOC8108 | | | 250 | — | 600 | |
| | CNY17F1/1M | $(I_F = 10 \text{ mA}, V_{CE} = 5 \text{ V})$ | | 40 | — | 80 | |
| | CNY17F2/2M | | | 63 | — | 125 | |
| | CNY17F3/3M | | | 100 | — | 200 | |
| | CNY17F4/4M | | | 160 | — | 320 | |
| | CNY171/1M | | | 40 | — | 80 | |
| | CNY172/2M | | | 63 | — | 125 | |
| | CNY173/3M | | | 100 | — | 200 | |
| | CNY174/4M | 160 | — | 320 | | | |
| | Collector-Emitter Saturation Voltage | CNY17XM/FXM | $(I_C = 2.5 \text{ mA}, I_F = 10 \text{ mA})$ | $V_{CE(sat)}$ | — | — | 0.4 |
| MOC8101/2/3/4/5/6/7/8 | | $(I_C = 500 \mu\text{A}, I_F = 5.0 \text{ mA})$ | — | | — | 0.4 | V |
| CNY17X/FX | | $(I_F = 10 \text{ mA}, I_C = 2.5 \text{ mA})$ | — | | — | 0.3 | V |

| AC Characteristics ⁽³⁾ | | Test Conditions | Symbol | Min | Typ* | Max | Units |
|-------------------------------------|-----------------|---|-----------|-----|------|-----|---------------|
| Non-Saturated Switching Time | | | | | | | |
| Turn-On Time | MOC8101/2/3/4/5 | $(I_C = 2.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega)$ | t_{on} | — | 2 | 20 | μs |
| | MOC8106/7/8 | | | | | — | |
| | CNY17X/FX | | | | | 10 | |
| Turn-Off Time | MOC8101/2/3/4/5 | $(I_C = 2.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega)$ | t_{off} | — | 3 | 20 | μs |
| | MOC8106/7/8 | | | | | — | |
| | CNY17X/FX | | | | | 10 | |
| Delay Time | CNY17XM/FXM | $(I_F = 10 \text{ mA}, V_{CC} = 5 \text{ V}, R_L = 75 \Omega)$ | t_d | — | — | 5.6 | μs |
| Rise Time | All Devices | $(I_C = 2.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega)$ | t_r | — | 1 | — | μs |
| | CNY17XM/FXM | $(I_F = 10 \text{ mA}, V_{CC} = 5 \text{ V}, R_L = 75 \Omega)$ | | | | — | |
| Storage Time | CNY17XM/FXM | $(I_F = 10 \text{ mA}, V_{CC} = 5 \text{ V}, R_L = 75 \Omega)$ | t_s | — | — | 4.1 | μs |
| Fall Time | All Devices | $(I_C = 2.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega)$ | t_f | — | 2 | — | μs |
| | CNY17XM/FXM | $(I_F = 10 \text{ mA}, V_{CC} = 5 \text{ V}, R_L = 75 \Omega)$ | | | | — | |

Transfer Characteristics (continued) ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)⁽¹⁾

| AC Characteristics ⁽³⁾ | | Test Conditions | Symbol | Min | Typ | Max | Units | | | |
|-----------------------------------|-------------------------------------|---|---|---|-------|------|---------------|---------------|----|---------------|
| Saturated Switching Times | | | | | | | | | | |
| Turn-on Time | CNY171/F1 | ($I_F = 20\text{ mA}, V_{CE} = 0.4\text{ V}$) | t_{on} | — | — | 5.5 | μs | | | |
| | CNY172/F2 CNY173/F3 CNY174/F4 | ($I_F = 10\text{ mA}, V_{CE} = 0.4\text{ V}$) | | — | — | 8.0 | | | | |
| | Rise Time | CNY171/F1 | ($I_F = 20\text{ mA}, V_{CE} = 0.4\text{ V}$) | t_r | — | — | 4.0 | μs | | |
| | | CNY172/F1 CNY173/F3 CNY174/F4 | ($I_F = 10\text{ mA}, V_{CE} = 0.4\text{ V}$) | | — | — | 6.0 | | | |
| CNY171M/F1M | | ($I_F = 20\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | — | | — | 4.0 | | | | |
| CNY172M/3M/4M CNY17F2M/F3M/F4M | | ($I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | — | | — | 6.0 | | | | |
| CNY171M/F1M | | ($I_F = 20\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | — | | — | 4.0 | | | | |
| Delay Time | CNY171M/F1M | ($I_F = 20\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | t_d | — | — | 5.5 | μs | | | |
| | CNY172M/3M/4M CNY17F2M/F3M/F4M | ($I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | | — | — | 8.0 | | | | |
| Turn-off Time | CNY171/F1 | ($I_F = 20\text{ mA}, V_{CE} = 0.4\text{ V}$) | t_{off} | — | — | 34 | μs | | | |
| | CNY172/F2 CNY173/F3 CNY174/F4 | ($I_F = 10\text{ mA}, V_{CE} = 0.4\text{ V}$) | | — | — | 39 | | | | |
| | Fall Time | CNY171/F1 | | ($I_F = 20\text{ mA}, V_{CE} = 0.4\text{ V}$) | t_f | — | | — | 20 | μs |
| | | CNY172/F2 CNY173/F3 CNY174/F4 | | ($I_F = 10\text{ mA}, V_{CE} = 0.4\text{ V}$) | | — | | — | 24 | |
| CNY171M/F1M | | ($I_F = 20\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | — | — | | 20.0 | | | | |
| CNY172M/3M/4M CNY17F2M/F3M/F4M | | ($I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | — | — | | 24.0 | | | | |
| CNY171M/F1M | | ($I_F = 20\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | — | — | | 20.0 | | | | |
| Storage Time | CNY171M/F1M | ($I_F = 20\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | t_s | — | — | 34.0 | μs | | | |
| | CNY172M/3M/4M CNY17F2M/F3M/F4M | ($I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 1\text{ K}\Omega$) | | — | — | 39.0 | | | | |

** All typicals at $T_A = 25^\circ\text{C}$

Notes:

1. Always design to the specified minimum/maximum electrical limits (where applicable).
2. Current Transfer Ratio (CTR) = $I_C/I_F \times 100\%$.
3. For test circuit setup and waveforms, refer to Figures 20.
4. For this test, Pins 1 and 2 are common, and Pins 4 and 5 are common.

Fig.1 Normalized CTR vs. Forward Current (Black Package)

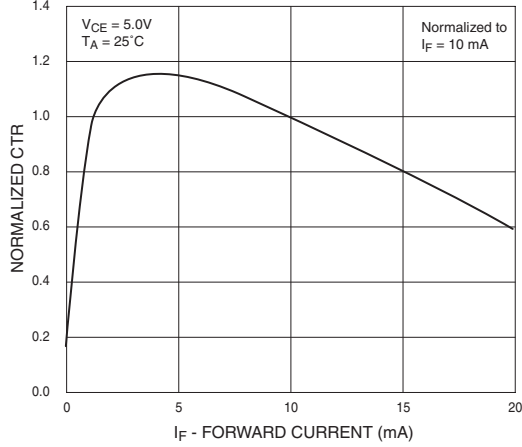


Fig.2 Normalized CTR vs. Forward Current (White Package)

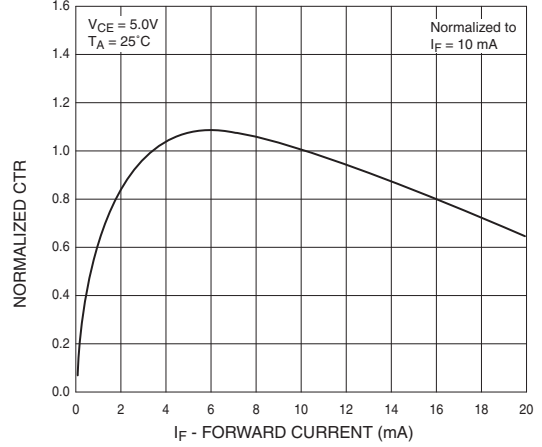


Fig. 3 Normalized CTR vs. Ambient Temperature (Black Package)

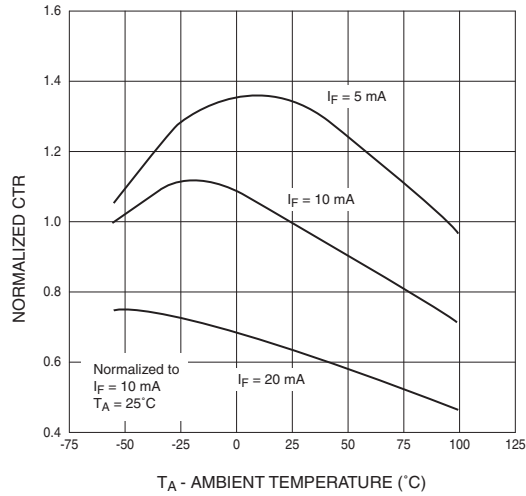


Fig. 4 Normalized CTR vs. Ambient Temperature (White Package)

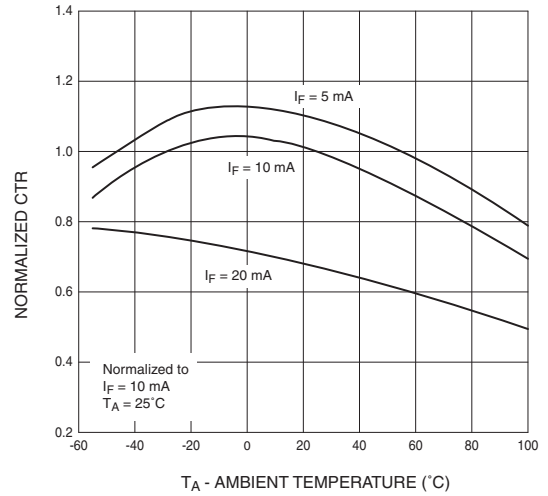
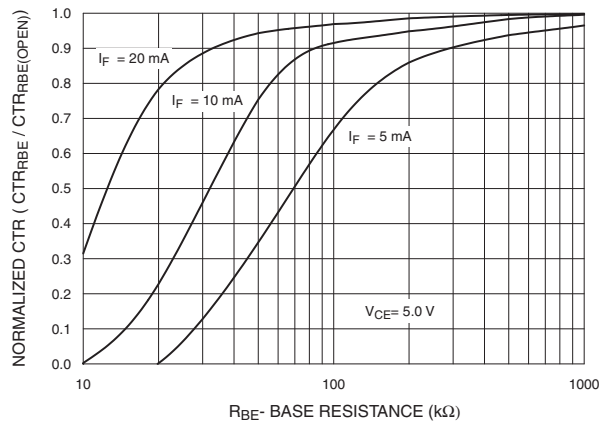


Fig. 5 CTR vs. R_{BE} (Unsaturated) (Black Package)



Fig. 6 CTR vs. R_{BE} (Unsaturated) (White Package)



**Fig. 7 CTR vs. R_{BE} (Saturated)
(Black Package)**



**Fig. 8 CTR vs. R_{BE} (Saturated)
(White Package)**



**Fig. 9 Switching Speed vs. Load Resistor
(Black Package)**



**Fig. 10 Switching Speed vs. Load Resistor
(White Package)**



**Fig. 11 Normalized t_{on} vs. R_{BE}
(Black Package)**



**Fig. 12 Normalized t_{on} vs. R_{BE}
(White Package)**



Fig. 13 Normalized t_{off} vs. R_{BE} (Black Package)



Fig. 14 Normalized t_{off} vs. R_{BE} (White Package)



Fig. 15 LED Forward Voltage vs. Forward Current (Black Package)



Fig. 16 LED Forward Voltage vs. Forward Current (White Package)



Fig. 17 Collector-Emitter Saturation Voltage vs. Collector Current (Black Package)



Fig. 18 Collector-Emitter Saturation Voltage vs. Collector Current (White Package)



Fig. 19 Dark Current vs. Ambient Temperature (Black Package)

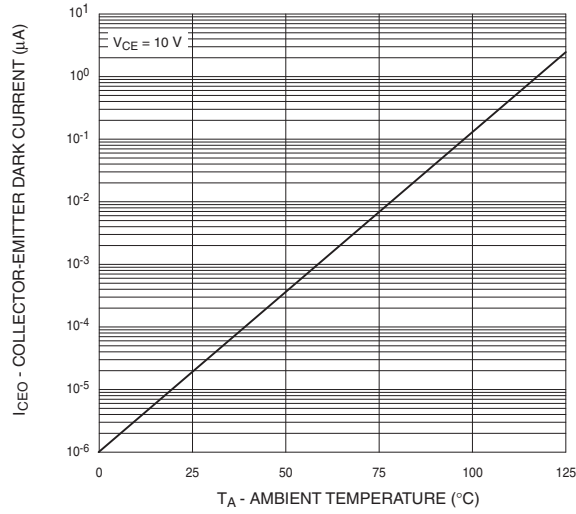


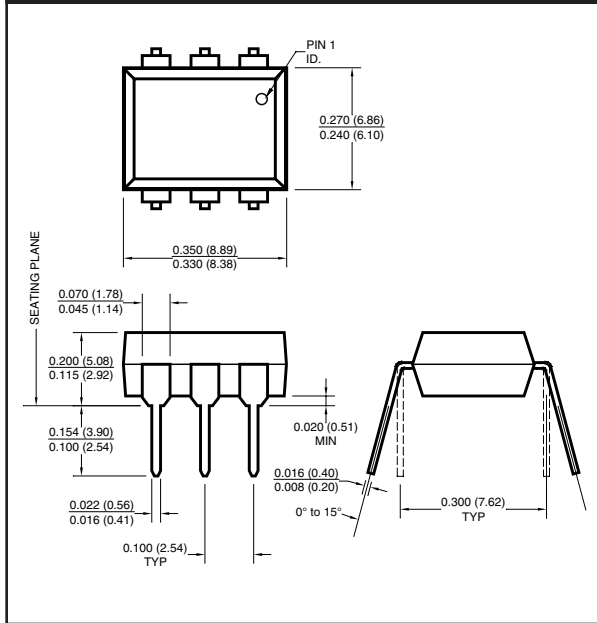
Figure 20. Switching Time Test Circuit



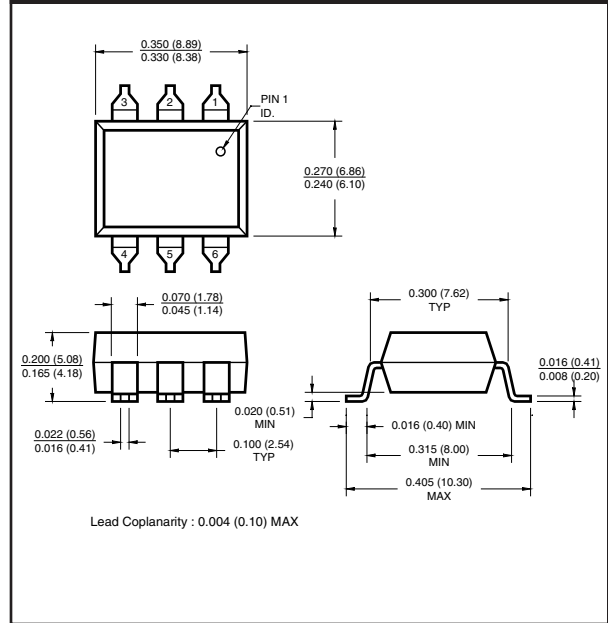
Figure 21. Switching Time Test Circuit

Black Package (No -M Suffix)

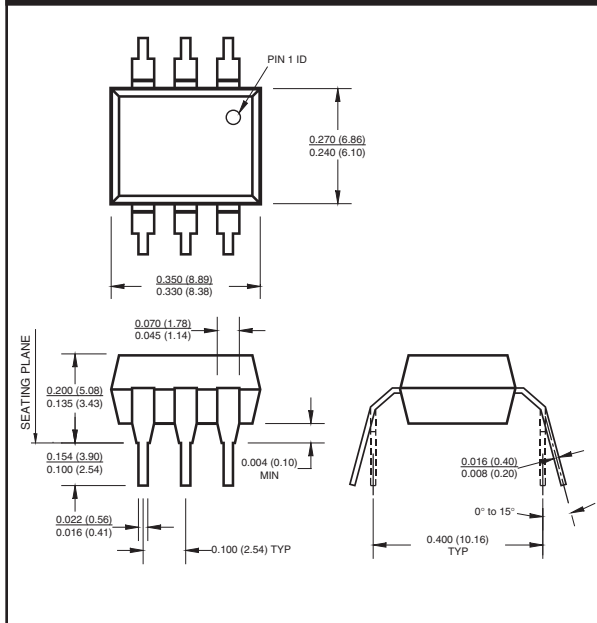
Package Dimensions (Through Hole)



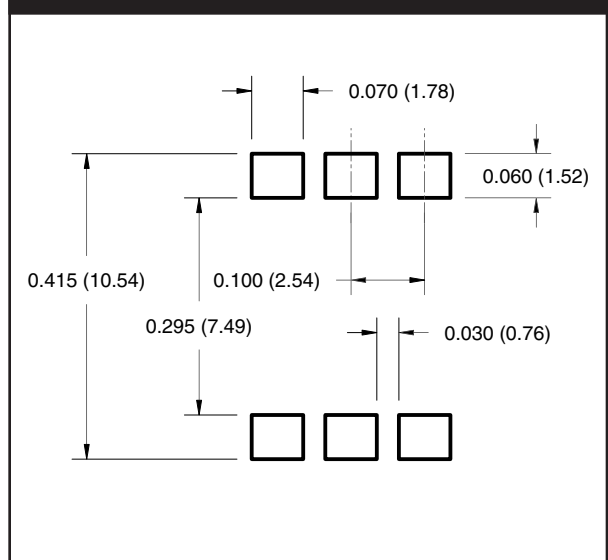
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform (Black Package Only)



NOTE

All dimensions are in inches (millimeters)

Ordering Information

| Black Package Part Number Example (No Suffix) | White Package Part Number Example (M Suffix) | Description |
|---|--|--|
| CNY171S | CNY171SM | Surface Mount Lead Bend |
| CNY171SD | CNY171SR2M | Surface Mount; Tape and reel |
| CNY171W | CNY171TM | 0.4" Lead Spacing |
| CNY171300 | CNY171VM | VDE Approved |
| CNY171300W | CNY171TVM | VDE Approved, 0.4" Lead Spacing |
| CNY1713S | CNY171SVM | VDE Approved, Surface Mount |
| CNY1713SD | CNY171SR2VM | VDE Approved, Surface Mount, Tape & Reel |

Carrier Tape Specifications (Black Package, No Suffix)



Carrier Tape Specifications (White Package, M Suffix)



Marking Information (Black package non 'M' suffix)



| Definitions | |
|-------------|--|
| 1 | Fairchild logo |
| 2 | Device number |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | Two digits year code, e.g., '03'; One digit year code for 'M' version, e.g. '5' |
| 5 | Two digit work week ranging from '01' to '53' |
| 6 | Assembly package code |

Reflow Profile (Black Package, No Suffix)



Marking Information (White package M suffix)



| Definitions | |
|-------------|--|
| 1 | Fairchild logo |
| 2 | Device number |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | Single digit year code, e.g. '5' |
| 5 | Two digit work week ranging from '01' to '53' |
| 6 | Assembly package code |

Reflow Profile (White Package, M Suffix)



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| Bottomless™ | FPS™ | MICROCOUPLER™ | QFET® | TinyLogic® |
| Build it Now™ | FRFET™ | MicroFET™ | QS™ | TINYOPTO™ |
| CoolFET™ | GlobalOptoisolator™ | MicroPak™ | QT Optoelectronics™ | TruTranslation™ |
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| EcoSPARK™ | I ² C™ | MSXPro™ | RapidConnect™ | UniFET™ |
| E ² CMOS™ | i-Lo™ | OCX™ | μSerDes™ | VCX™ |
| EnSigna™ | ImpliedDisconnect™ | OCXPro™ | SILENT SWITCHER® | Wire™ |
| FACT™ | IntelliMAX™ | OPTOLOGIC® | SMART START™ | |
| FACT Quiet Series™ | | OPTOPLANAR™ | SPM™ | |
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PRODUCT STATUS DEFINITIONS



Definition of Terms

| Datasheet Identification | Product Status | Definition |
|--------------------------|------------------------|---|
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| Preliminary | First Production | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
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Rev. 116

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