

CNY171M, CNY172M, CNY173M, CNY174M, CNY17F1M, CNY17F2M, CNY17F3M, CNY17F4M, MOC8106M, MOC8107M Phototransistor Optocouplers

Features

- UL recognized (File # E90700, Vol. 2)
- VDE recognized
 - Add option V (e.g., CNY17F2VM)
 - File #102497
- Current transfer ratio in select groups
- High BV_{CEO} : 70V minimum (CNY17XM, CNY17FXM, MOC810XM)
- 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 (CNY17FXM, MOC810XM)

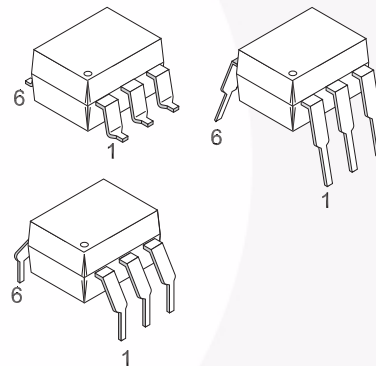
Applications

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

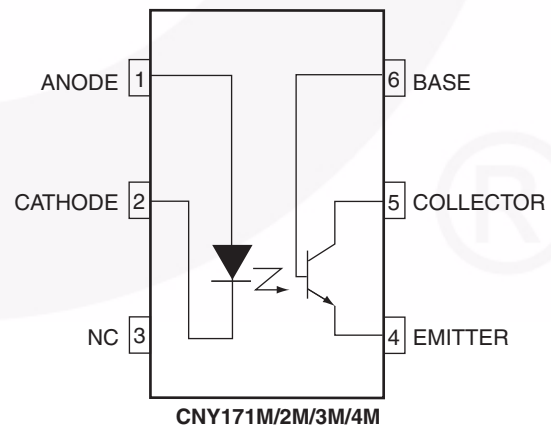
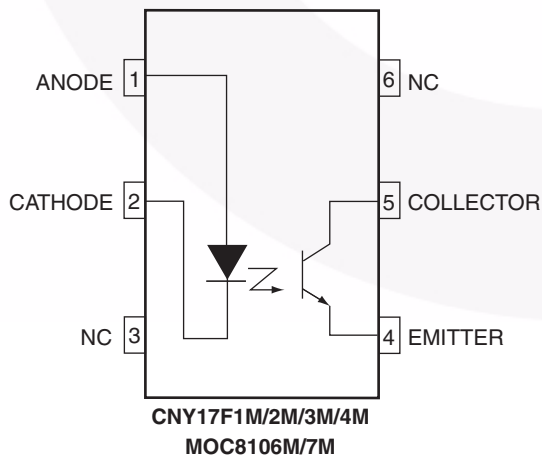
Description

The CNY17XM, CNY17FXM and MOC810XM devices consist of a Gallium Arsenide IRED coupled with an NPN phototransistor in a dual in-line package.

Package Outlines



Schematics



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 | Parameters | Value | Units |
|---------------------|--|----------------|-------|
| TOTAL DEVICE | | | |
| T _{STG} | Storage Temperature | -40 to +150 | °C |
| T _{OPR} | Operating Temperature | -40 to +100 | °C |
| T _{SOL} | Lead Solder Temperature | 260 for 10 sec | °C |
| P _D | Total Device Power Dissipation @ 25°C (LED plus detector) Derate Linearly From 25°C | 250 | 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 (1µs pulse, 300pps) | 1.5 | A |
| P _D | LED Power Dissipation 25°C Ambient 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 Derate Linearly from 25°C | 150 | mW |
| | | 1.76 | mW/°C |

Electrical Characteristics (T_A = 25°C Unless otherwise specified.)⁽¹⁾

Individual Component Characteristics

| Symbol | Parameters | Test Conditions | Device | Min. | Typ. | Max. | Units |
|-------------------|---|--|----------------------|------|-------|------|-------|
| EMITTER | | | | | | | |
| V _F | Input Forward Voltage | I _F = 60mA | CNY17XM, CNY17FXM | 1.0 | 1.35 | 1.65 | V |
| | | I _F = 10mA | MOC810XM | 1.0 | 1.15 | 1.50 | |
| C _J | Capacitance | V _F = 0 V, f = 1.0MHz | All | | 18 | | pF |
| I _R | Reverse Leakage Current | V _R = 6V | All | | 0.001 | 10 | μA |
| DETECTOR | | | | | | | |
| BV _{CEO} | Breakdown Voltage Collector to Emitter | I _C = 1.0mA, I _F = 0 | All | 70 | 100 | | V |
| BV _{CBO} | Collector to Base | I _C = 10μA, I _F = 0 | CNY171M/2M/3M/4M | 70 | 120 | | |
| BV _{ECO} | Emitter to Collector | I _E = 100μA, I _F = 0 | All | 7 | 10 | | |
| I _{CEO} | Leakage Current Collector to Emitter | V _{CE} = 10 V, I _F = 0 | All | | 1 | 50 | nA |
| I _{CBO} | Collector to Base | V _{CB} = 10 V, I _F = 0 | CNY171M/2M/3M/4M | | | 20 | nA |
| C _{CE} | Capacitance Collector to Emitter | V _{CE} = 0, f = 1MHz | All | | 8 | | pF |
| C _{CB} | Collector to Base | V _{CB} = 0, f = 1MHz | CNY171M/2M/3M/4M | | 20 | | pF |
| C _{EB} | Emitter to Base | V _{EB} = 0, f = 1MHz | CNY171M/2M/3M/4M | | 10 | | pF |

Isolation Characteristics

| Symbol | Characteristic | Test Conditions | Min. | Typ.* | Max. | Units |
|------------------|--------------------------------|---|------------------|-------|------|---------|
| V _{ISO} | Input-Output Isolation Voltage | f = 60 Hz, t = 1 sec., I _{I-O} ≤ 2μA ⁽⁴⁾ | 7500 | | | Vac(pk) |
| R _{ISO} | Isolation Resistance | V _{I-O} = 500 VDC ⁽⁴⁾ | 10 ¹¹ | | | Ω |
| C _{ISO} | Isolation Capacitance | V _{I-O} = ∅, f = 1MHz ⁽⁴⁾ | | 0.2 | | pF |

Transfer Characteristics (T_A = 25°C Unless otherwise specified.)⁽³⁾

| Symbol | DC Characteristics | Test Conditions | Min. | Typ.* | Max. | Units | |
|----------------------|--------------------------------------|-----------------|--|-------|------|-------|---|
| COUPLED | | | | | | | |
| (CTR) ⁽²⁾ | Output Collector Current | MOC8106M | I _F = 10mA, V _{CE} = 10V | 50 | | 150 | % |
| | | MOC8107M | | 100 | | 300 | |
| | | CNY17F1M | I _F = 10mA, V _{CE} = 5V | 40 | | 80 | |
| | | CNY17F2M | | 63 | | 125 | |
| | | CNY17F3M | | 100 | | 200 | |
| | | CNY17F4M | | 160 | | 320 | |
| | | CNY171M | | 40 | | 80 | |
| | | CNY172M | | 63 | | 125 | |
| | | CNY173M | | 100 | | 200 | |
| | | CNY174M | | 160 | | 320 | |
| V _{CE(sat)} | Collector-Emitter Saturation Voltage | CNY17XM/FXM | I _C = 2.5mA, I _F = 10mA | | | 0.4 | V |
| | | MOC8106M/7M | I _C = 500μA, I _F = 5.0mA | | | | |

*All typicals at T_A = 25°C

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

Transfer Characteristics (Continued)⁽³⁾

| Symbol | AC Characteristics ⁽⁴⁾ | | Test Conditions | Min. | Typ.* | Max. | Units |
|-------------------------------------|-----------------------------------|-----------------------------------|--|------|-------|------|---------------|
| NON-SATURATED SWITCHING TIME | | | | | | | |
| t_{on} | Turn-On Time | All Devices | $I_C = 2.0\text{mA}$, $V_{CC} = 10\text{V}$, $R_L = 100\Omega$ | | 2 | 10 | μs |
| t_{off} | Turn-Off Time | All Devices | $I_C = 2.0\text{mA}$, $V_{CC} = 10\text{V}$, $R_L = 100\Omega$ | | 3 | 10 | μs |
| t_d | Delay Time | CNY17XM/XFM | $I_F = 10\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 75\Omega$ | | | 5.6 | μs |
| t_r | Rise Time | All Devices | $I_C = 2.0\text{mA}$, $V_{CC} = 10\text{V}$, $R_L = 100\Omega$ | | 1 | | μs |
| | | CNY17XM/FXM | $I_F = 10\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 75\Omega$ | | | 4.0 | |
| t_s | Storage Time | CNY17XM/FXM | $I_F = 10\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 75\Omega$ | | | 4.1 | μs |
| t_f | Fall Time | All Devices | $I_C = 2.0\text{mA}$, $V_{CC} = 10\text{V}$, $R_L = 100\Omega$ | | 2 | | μs |
| | | CNY17XM/FXM | $I_F = 10\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 75\Omega$ | | | 3.5 | |
| SATURATED SWITCHING TIMES | | | | | | | |
| t_{on} | Turn-on Time | CNY171M/F1M | $I_F = 20\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 1\text{k}\Omega$ | | | 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 | |
| t_r | Rise Time | CNY171M/F1M | $I_F = 20\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 1\text{k}\Omega$ | | | 4.0 | μs |
| | | CNY172M/3M/4M CNY17F2M/F3M/F4M | $I_F = 10\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 1\text{k}\Omega$ | | | 6.0 | |
| t_d | Delay Time | CNY171M/F1M | $I_F = 20\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 1\text{k}\Omega$ | | | 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 | |
| t_{off} | Turn-off Time | CNY171M/F1M | $I_F = 20\text{mA}$, $V_{CE} = 0.4\text{V}$ | | | 34 | μs |
| | | CNY172M/3M/4M CNY17F2M/F3M/F4M | $I_F = 10\text{mA}$, $V_{CE} = 0.4\text{V}$ | | | 39 | |
| t_f | Fall Time | CNY171M/F1M | $I_F = 20\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 1\text{k}\Omega$ | | | 20.0 | μs |
| | | CNY172M/3M/4M CNY17F2M/F3M/F4M | $I_F = 10\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 1\text{k}\Omega$ | | | 24.0 | |
| t_s | Storage Time | CNY171M/F1M | $I_F = 20\text{mA}$, $V_{CC} = 5\text{V}$, $R_L = 1\text{k}\Omega$ | | | 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 10 and 11.
4. For this test, Pins 1 and 2 are common, and Pins 4 and 5 are common.

Typical Performance Characteristics

Fig. 1 Normalized CTR vs. Forward Current

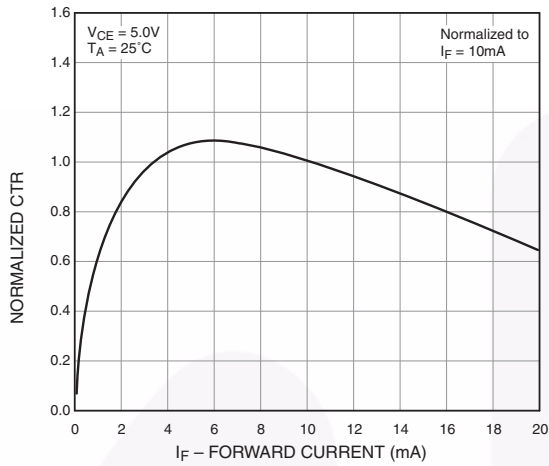


Fig. 2 Normalized CTR vs. Ambient Temperature

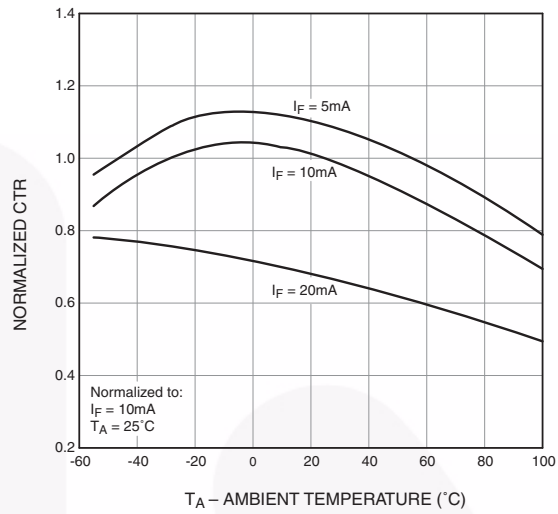


Fig. 3 CTR vs. RBE (Unsaturated)

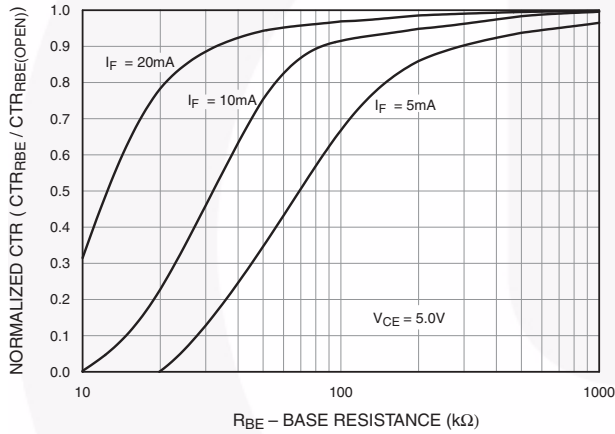


Fig. 4 CTR vs. RBE (Saturated)

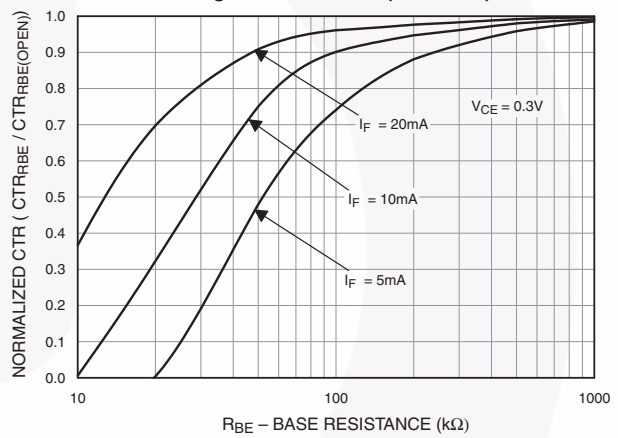


Fig. 5 Switching Speed vs. Load Resistor

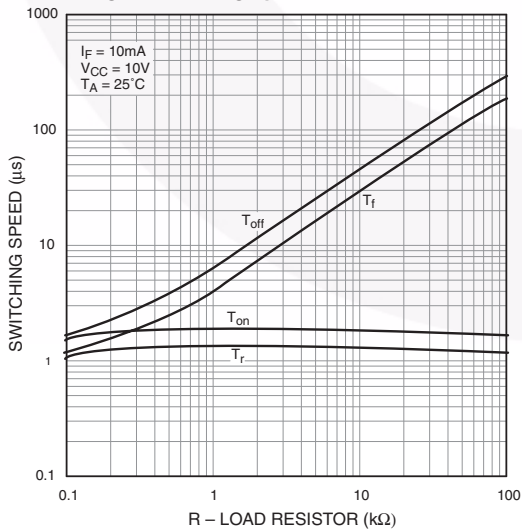
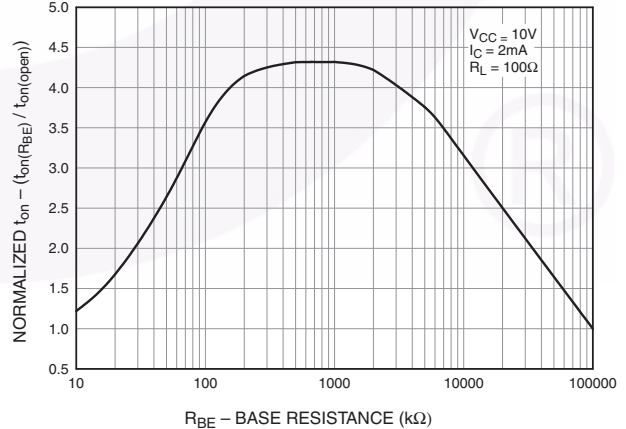


Fig. 6 Normalized ton vs. RBE



Typical Performance Characteristics (Continued)

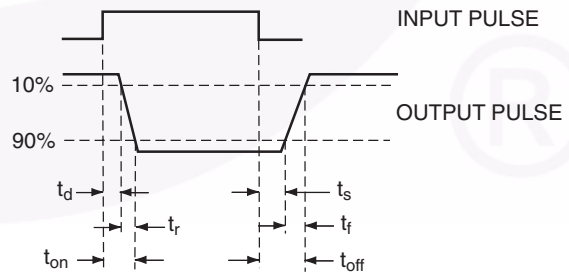
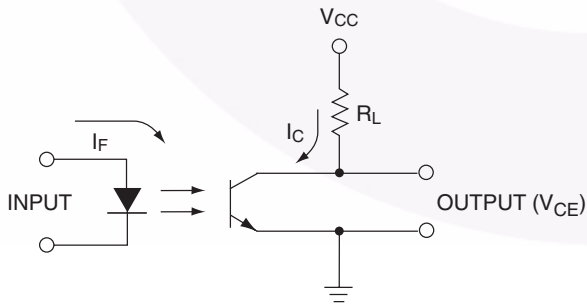
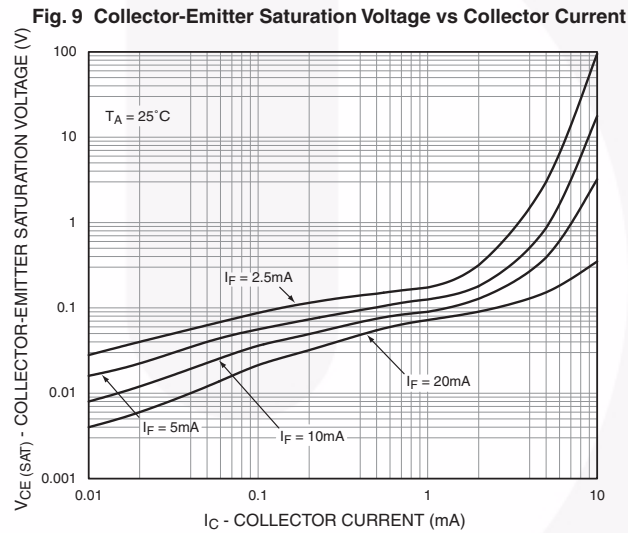
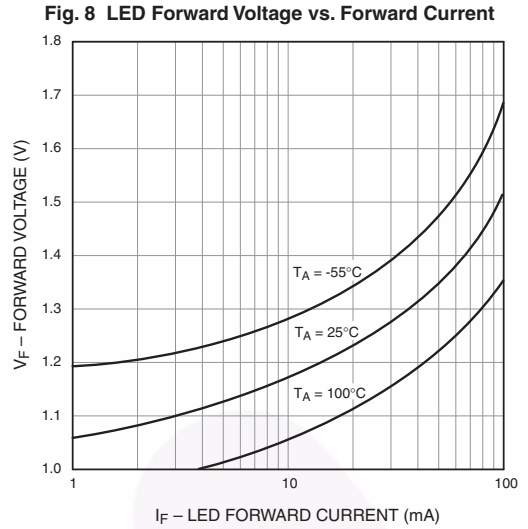
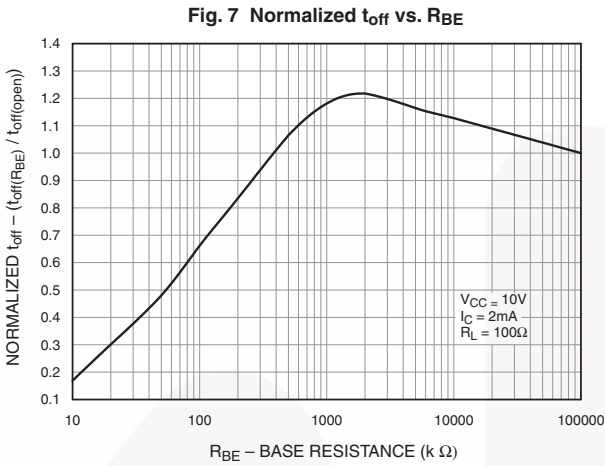
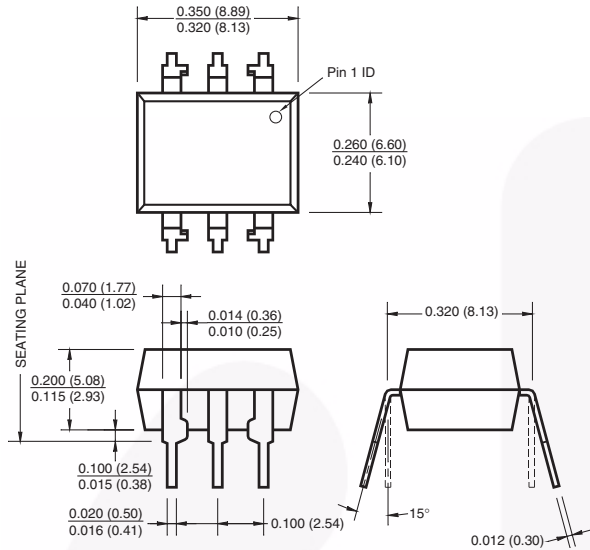


Figure 10. Switching Time Test Circuit

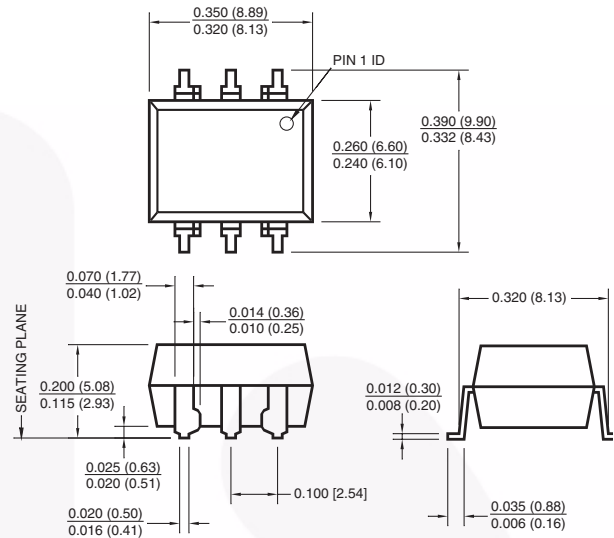
Figure 11. Switching Time Waveforms

Package Dimensions

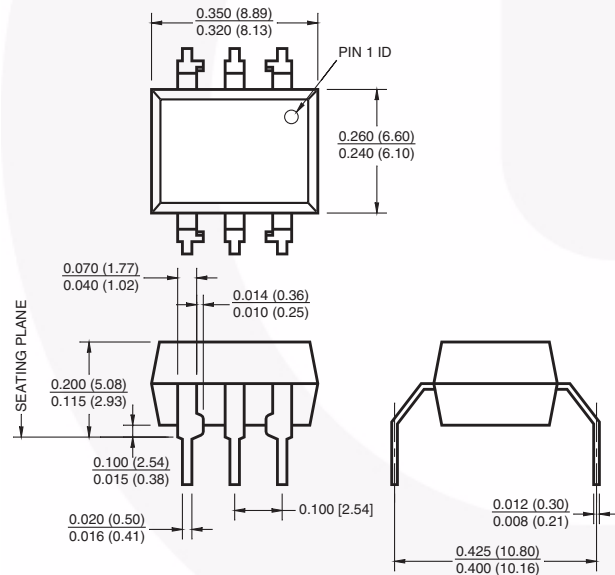
Through Hole



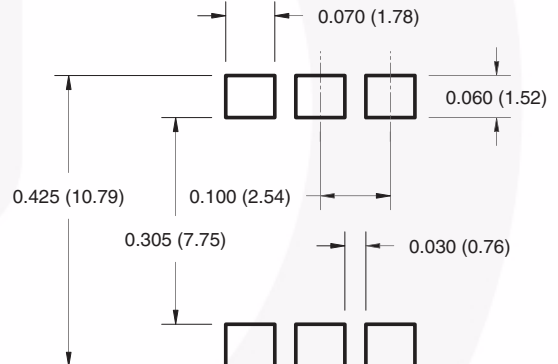
Surface Mount



0.4" Lead Spacing



Recommended Pad Layout for Surface Mount Leadform



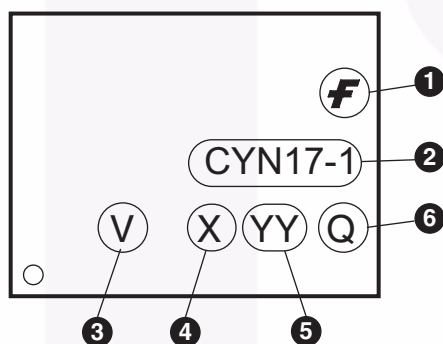
Note:

All dimensions are in inches (millimeters)

Ordering Information

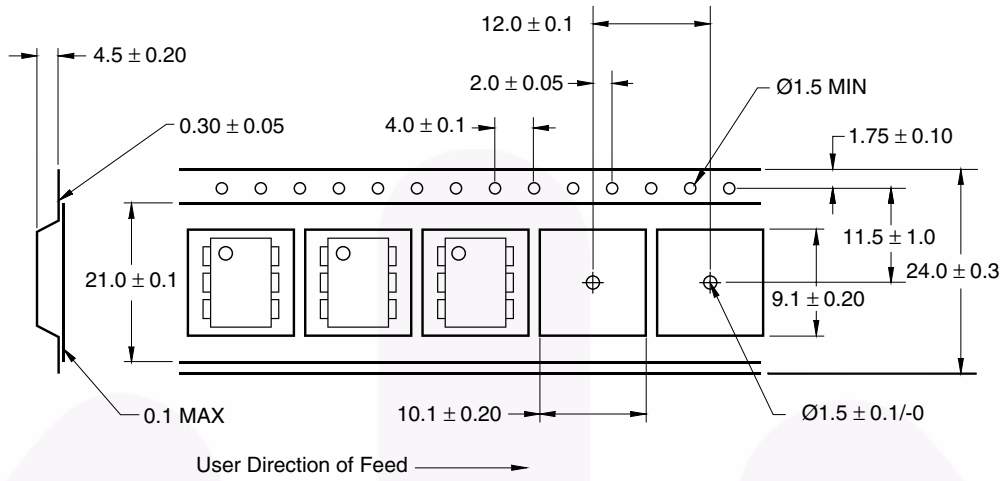
| Option | Order Entry Identifier (Example) | Description |
|-----------|----------------------------------|--|
| No option | CYN171M | Standard Through Hole Device |
| S | CYN171SM | Surface Mount Lead Bend |
| SR2 | CYN171SR2M | Surface Mount; Tape and Reel |
| T | CYN171TM | 0.4" Lead Spacing |
| V | CYN171VM | VDE 0884 |
| TV | CYN171TVM | VDE 0884, 0.4" Lead Spacing |
| SV | CYN171SVM | VDE 0884, Surface Mount |
| SR2V | CYN171SR2VM | VDE 0884, Surface Mount, Tape and Reel |

Marking Information

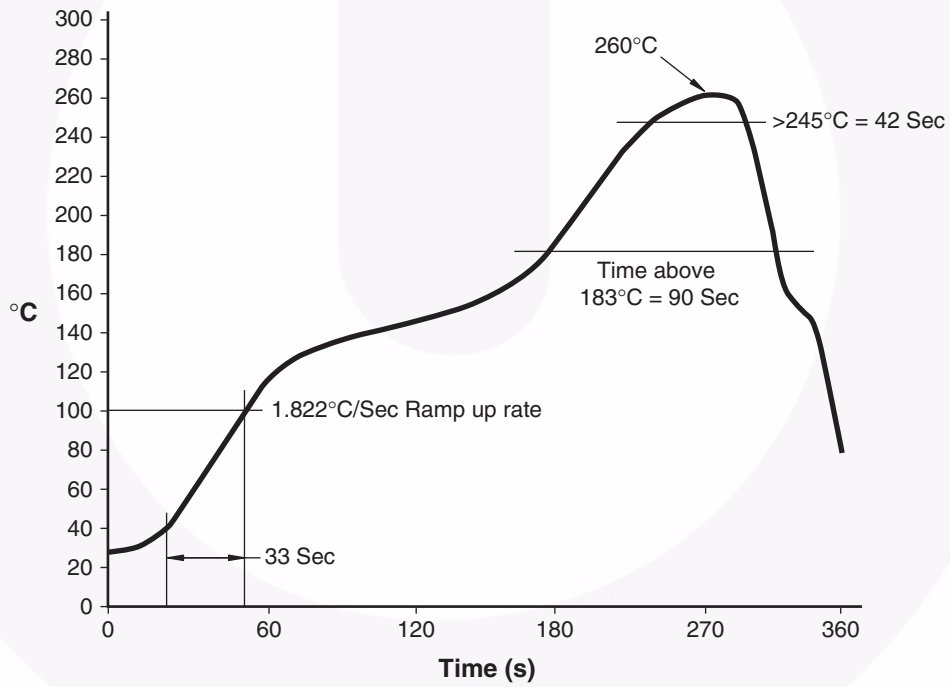


| Definitions | |
|-------------|--|
| 1 | Fairchild logo |
| 2 | Device number |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | One digit year code, e.g., '7' |
| 5 | Two digit work week ranging from '01' to '53' |
| 6 | Assembly package code |

Carrier Tape Specification







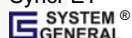
Reflow Profile





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PRODUCT STATUS DEFINITIONS

Definition of Terms

| Datasheet Identification | Product Status | Definition |
|--------------------------|-----------------------|--|
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