

# 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)

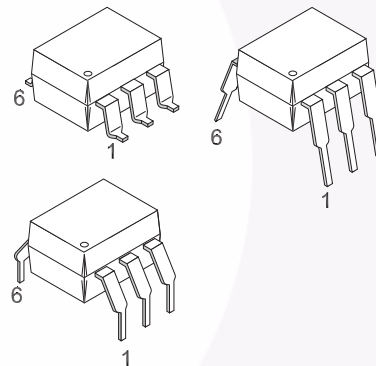
## Applications

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

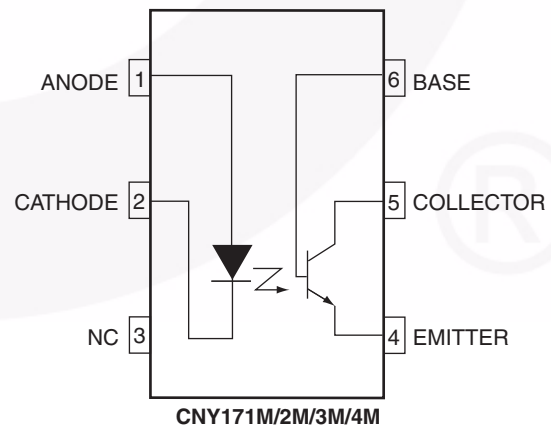
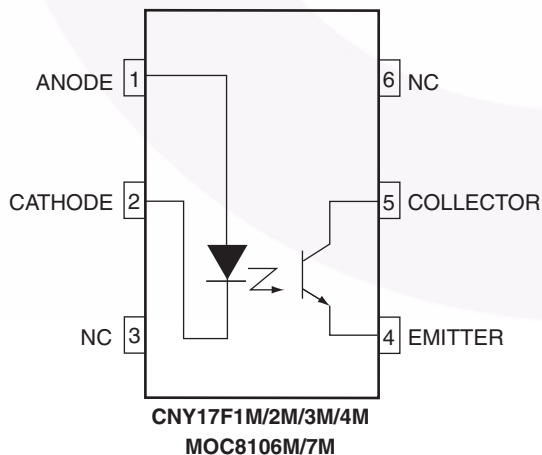
## Description

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
<b>TOTAL DEVICE</b>			
T <sub>STG</sub>	Storage Temperature	-40 to +150	°C
T <sub>OPR</sub>	Operating Temperature	-40 to +100	°C
T <sub>SOL</sub>	Lead Solder Temperature	260 for 10 sec	°C
P <sub>D</sub>	Total Device Power Dissipation @ 25°C (LED plus detector) Derate Linearly From 25°C	250	mW
		2.94	mW/°C
<b>EMITTER</b>			
I <sub>F</sub>	Continuous Forward Current	60	mA
V <sub>R</sub>	Reverse Voltage	6	V
I <sub>F</sub> (pk)	Forward Current – Peak (1µs pulse, 300pps)	1.5	A
P <sub>D</sub>	LED Power Dissipation 25°C Ambient Derate Linearly From 25°C	120	mW
		1.41	mW/°C
<b>DETECTOR</b>			
I <sub>C</sub>	Continuous Collector Current	50	mA
V <sub>CEO</sub>	Collector-Emitter Voltage	70	V
V <sub>ECO</sub>	Emitter Collector Voltage	7	V
P <sub>D</sub>	Detector Power Dissipation @ 25°C Derate Linearly from 25°C	150	mW
		1.76	mW/°C

## Electrical Characteristics (T<sub>A</sub> = 25°C Unless otherwise specified.)<sup>(1)</sup>

### Individual Component Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Units
<b>EMITTER</b>							
V <sub>F</sub>	Input Forward Voltage	I <sub>F</sub> = 60mA	CNY17XM, CNY17FXM	1.0	1.35	1.65	V
		I <sub>F</sub> = 10mA	MOC810XM	1.0	1.15	1.50	
C <sub>J</sub>	Capacitance	V <sub>F</sub> = 0 V, f = 1.0MHz	All		18		pF
I <sub>R</sub>	Reverse Leakage Current	V <sub>R</sub> = 6V	All		0.001	10	μA
<b>DETECTOR</b>							
BV <sub>CEO</sub>	Breakdown Voltage Collector to Emitter	I <sub>C</sub> = 1.0mA, I <sub>F</sub> = 0	All	70	100		V
BV <sub>CBO</sub>	Collector to Base	I <sub>C</sub> = 10μA, I <sub>F</sub> = 0	CNY171M/2M/3M/4M	70	120		
BV <sub>ECO</sub>	Emitter to Collector	I <sub>E</sub> = 100μA, I <sub>F</sub> = 0	All	7	10		
I <sub>CEO</sub>	Leakage Current Collector to Emitter	V <sub>CE</sub> = 10 V, I <sub>F</sub> = 0	All		1	50	nA
I <sub>CBO</sub>	Collector to Base	V <sub>CB</sub> = 10 V, I <sub>F</sub> = 0	CNY171M/2M/3M/4M			20	nA
C <sub>CE</sub>	Capacitance Collector to Emitter	V <sub>CE</sub> = 0, f = 1MHz	All		8		pF
C <sub>CB</sub>	Collector to Base	V <sub>CB</sub> = 0, f = 1MHz	CNY171M/2M/3M/4M		20		pF
C <sub>EB</sub>	Emitter to Base	V <sub>EB</sub> = 0, f = 1MHz	CNY171M/2M/3M/4M		10		pF

### Isolation Characteristics

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

### Transfer Characteristics (T<sub>A</sub> = 25°C Unless otherwise specified.)<sup>(3)</sup>

Symbol	DC Characteristics	Test Conditions	Min.	Typ.*	Max.	Units	
<b>COUPLED</b>							
(CTR) <sup>(2)</sup>	Output Collector Current	MOC8106M	I <sub>F</sub> = 10mA, V <sub>CE</sub> = 10V		50	%	
		MOC8107M			100		
		CNY17F1M	I <sub>F</sub> = 10mA, V <sub>CE</sub> = 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 <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	CNY17XM/FXM	I <sub>C</sub> = 2.5mA, I <sub>F</sub> = 10mA		0.4	V	
		MOC8106M/7M	I <sub>C</sub> = 500μA, I <sub>F</sub> = 5.0mA				

\*All typicals at T<sub>A</sub> = 25°C

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

**Transfer Characteristics** (Continued)<sup>(3)</sup>

Symbol	AC Characteristics <sup>(4)</sup>		Test Conditions	Min.	Typ.*	Max.	Units
<b>NON-SATURATED SWITCHING TIME</b>							
$t_{on}$	Turn-On Time	All Devices	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$		2	10	$\mu\text{s}$
$t_{off}$	Turn-Off Time	All Devices	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$		3	10	$\mu\text{s}$
$t_d$	Delay Time	CNY17XM/XFM	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 75\Omega$			5.6	$\mu\text{s}$
$t_r$	Rise Time	All Devices	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$		1		$\mu\text{s}$
		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	$\mu\text{s}$
$t_f$	Fall Time	All Devices	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$		2		$\mu\text{s}$
		CNY17XM/FXM	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 75\Omega$			3.5	
<b>SATURATED SWITCHING TIMES</b>							
$t_{on}$	Turn-on Time	CNY171M/F1M	$I_F = 20\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$			5.5	$\mu\text{s}$
		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	$\mu\text{s}$
		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	$\mu\text{s}$
		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	$\mu\text{s}$
		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	$\mu\text{s}$
		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	$\mu\text{s}$
		CNY172M/3M/4M CNY17F2M/F3M/F4M	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$			39.0	

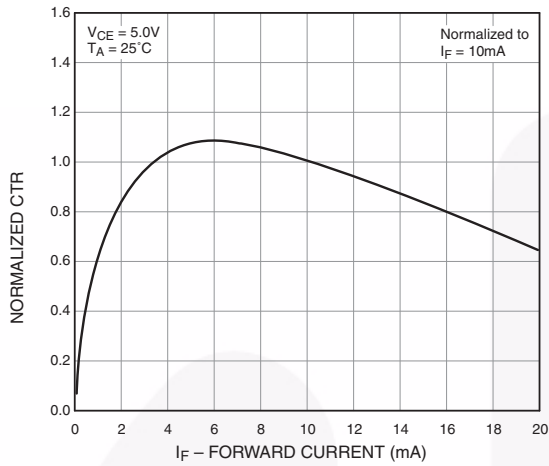
\*All typicals at  $T_A = 25^\circ\text{C}$

**Notes:**

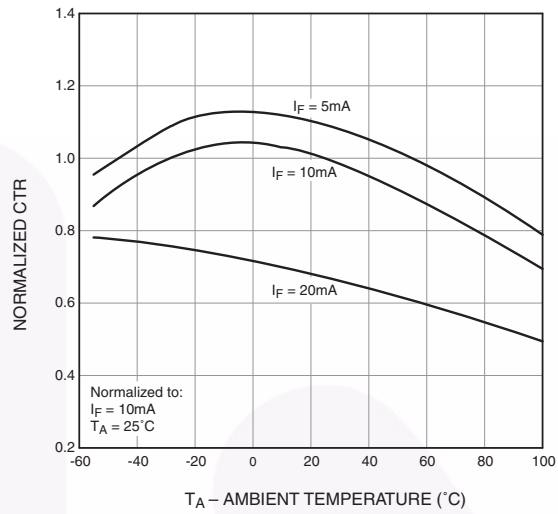
1. Always design to the specified minimum/maximum electrical limits (where applicable).
2. Current Transfer Ratio (CTR) =  $I_C/I_F \times 100\%$ .
3. For test circuit setup and waveforms, refer to Figures 10 and 11.
4. For this test, Pins 1 and 2 are common, and Pins 4 and 5 are common.

## Typical Performance Characteristics

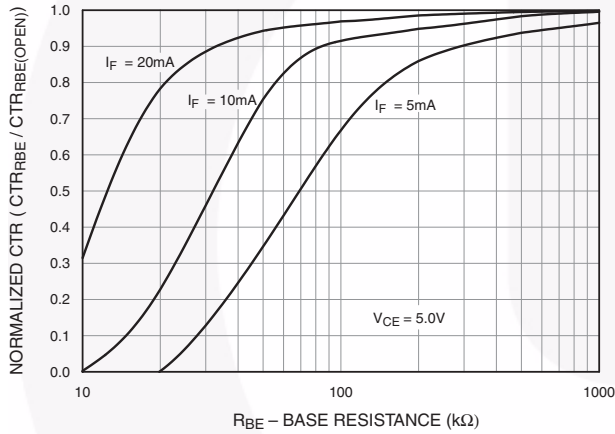
**Fig. 1 Normalized CTR vs. Forward Current**



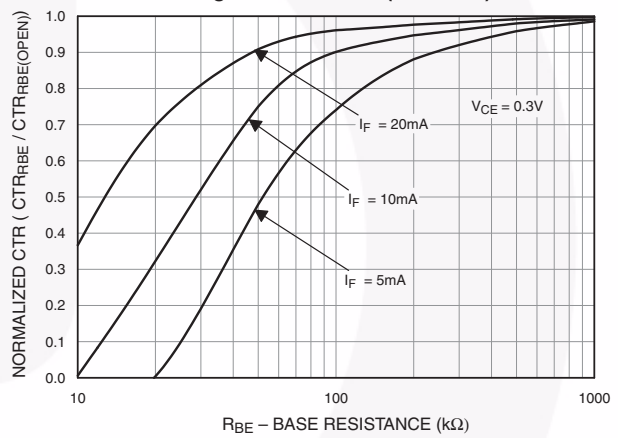
**Fig. 2 Normalized CTR vs. Ambient Temperature**



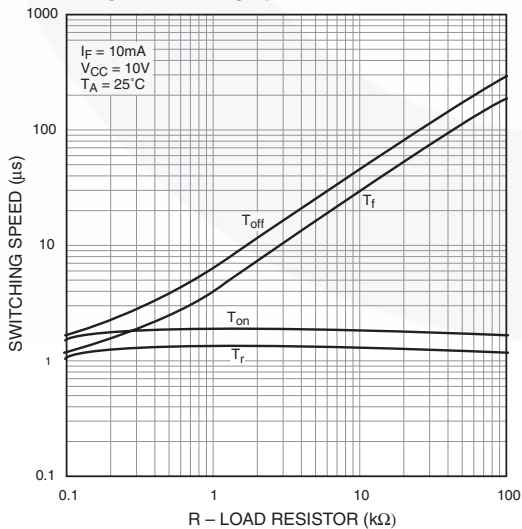
**Fig. 3 CTR vs. RBE (Unsaturated)**



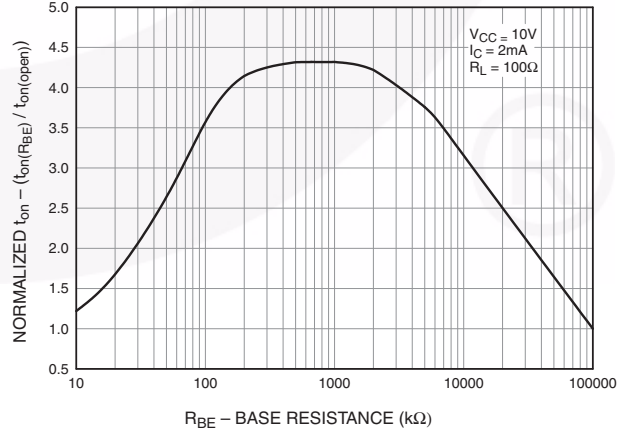
**Fig. 4 CTR vs. RBE (Saturated)**



**Fig. 5 Switching Speed vs. Load Resistor**



**Fig. 6 Normalized ton vs. RBE**



Typical Performance Characteristics (Continued)

Fig. 7 Normalized  $t_{off}$  vs.  $R_{BE}$

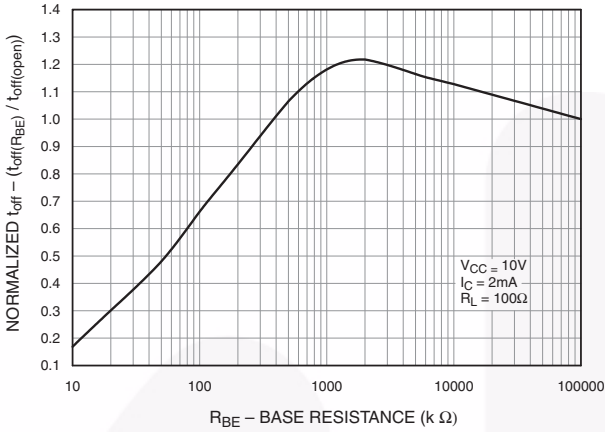


Fig. 8 LED Forward Voltage vs. Forward Current

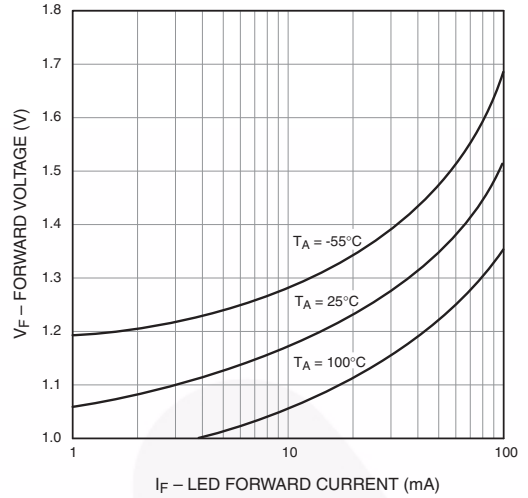


Fig. 9 Collector-Emitter Saturation Voltage vs Collector Current

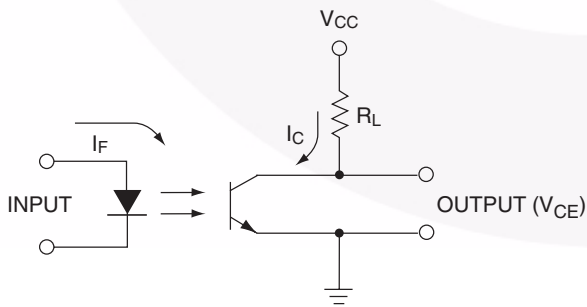
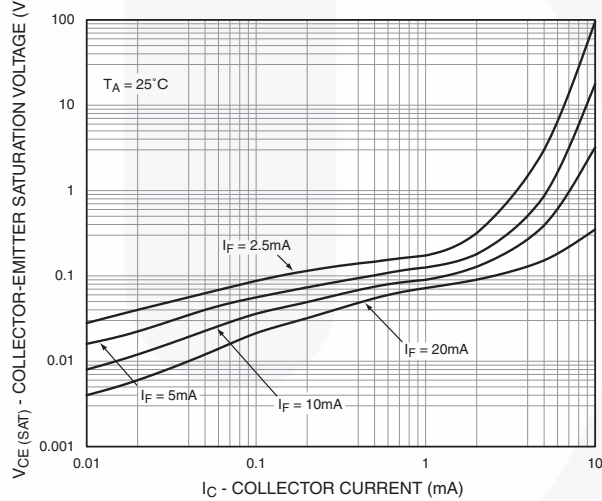


Figure 10. Switching Time Test Circuit

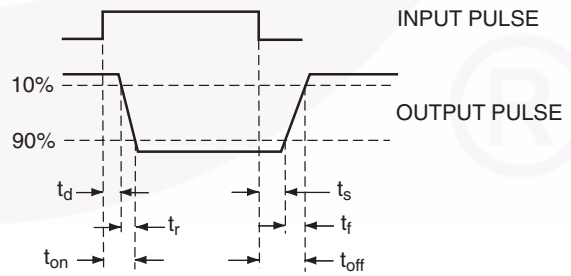
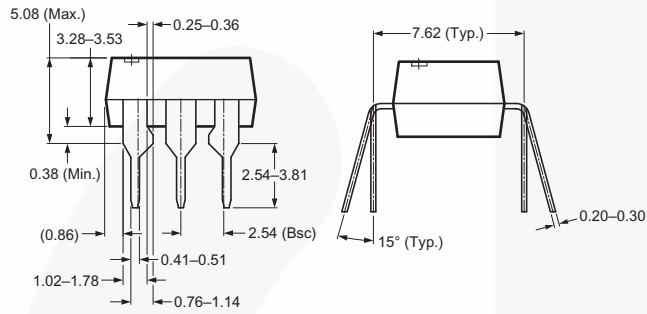
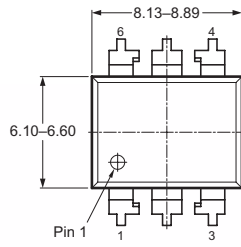


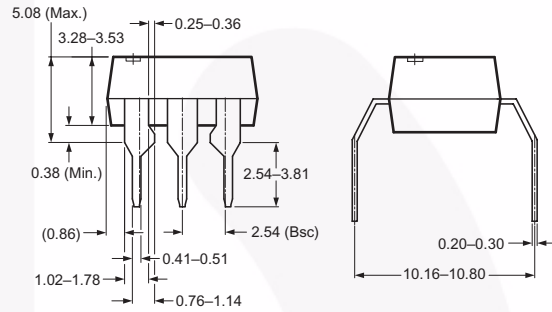
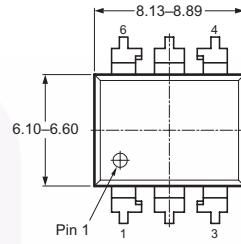
Figure 11. Switching Time Waveforms

## Package Dimensions

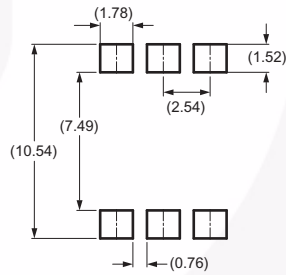
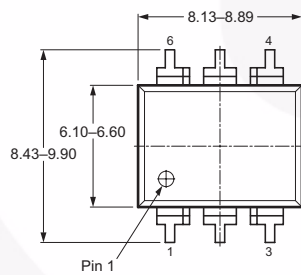
### Through Hole



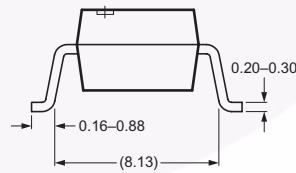
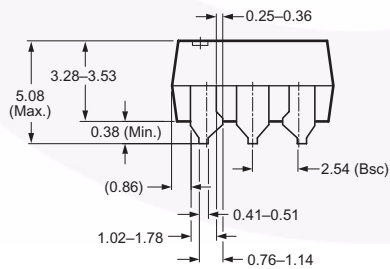
### 0.4" Lead Spacing



### Surface Mount



Recommended Pad Layout

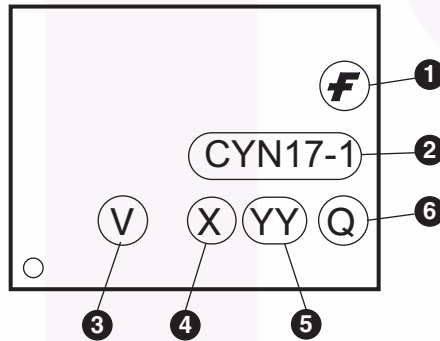


**Note:**  
All dimensions in mm.

### 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

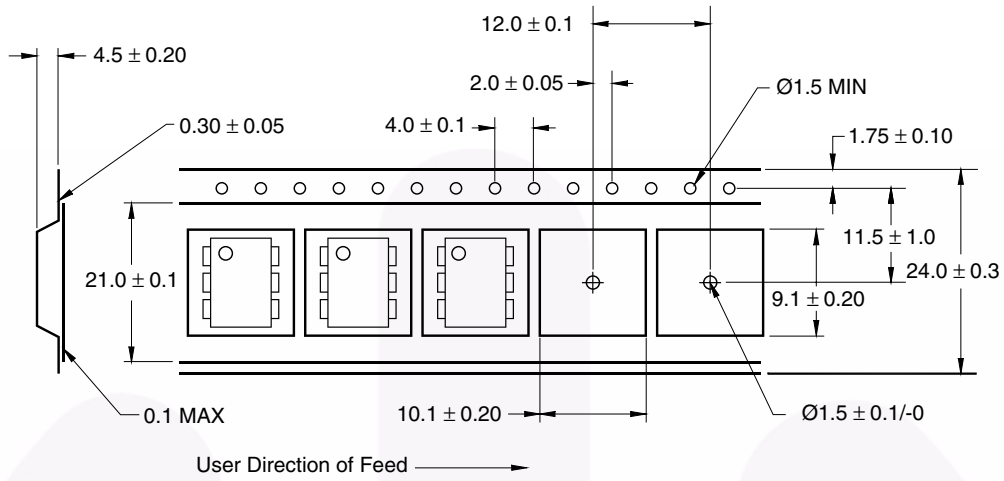
### Marking Information



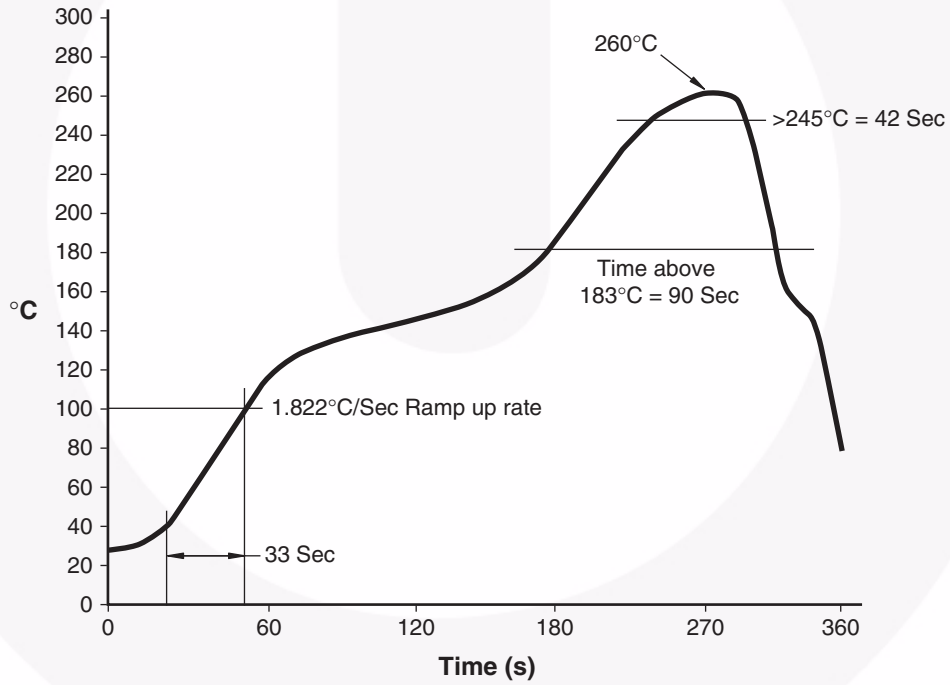
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '7'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code



### Carrier Tape Specification








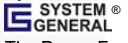
### Reflow Profile





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**Definition of Terms**

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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