

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)

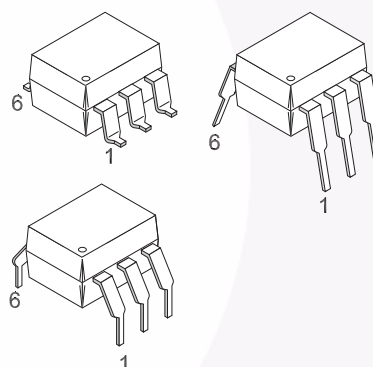
Applications

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

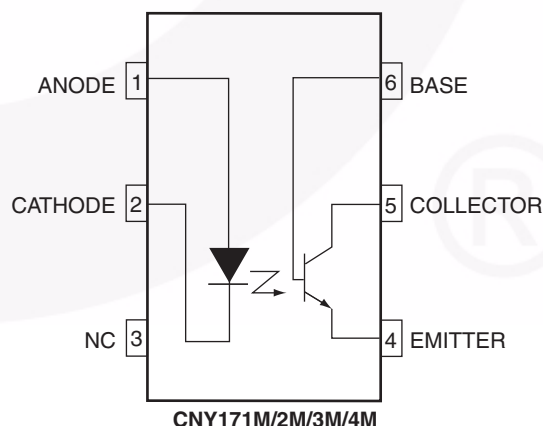
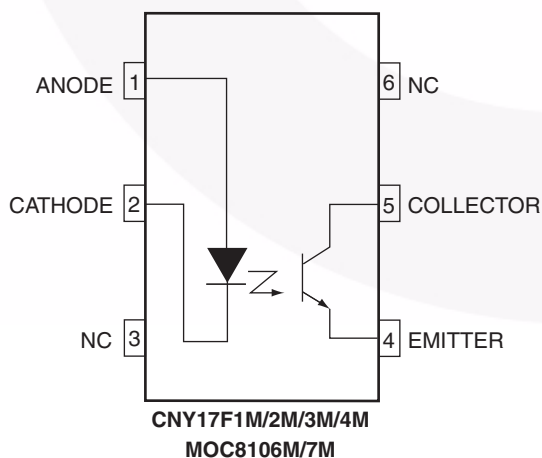
Description

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 _J	Junction Temperature	-40 to +125	°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 ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)⁽¹⁾**Individual Component Characteristics**

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Units
EMITTER							
V_F	Input Forward Voltage	$I_F = 60\text{mA}$	CNY17XM, CNY17FXM	1.0	1.35	1.65	V
		$I_F = 10\text{mA}$	MOC810XM	1.0	1.15	1.50	
C_J	Capacitance	$V_F = 0\text{V}$, $f = 1.0\text{MHz}$	All		18		pF
I_R	Reverse Leakage Current	$V_R = 6\text{V}$	All		0.001	10	μA
DETECTOR							
BV_{CEO}	Breakdown Voltage Collector to Emitter	$I_C = 1.0\text{mA}$, $I_F = 0$	All	70	100		V
BV_{CBO}	Collector to Base	$I_C = 10\mu\text{A}$, $I_F = 0$	CNY171M/2M/3M/4M	70	120		
BV_{ECO}	Emitter to Collector	$I_E = 100\mu\text{A}$, $I_F = 0$	All	7	10		
I_{CEO}	Leakage Current Collector to Emitter	$V_{CE} = 10\text{V}$, $I_F = 0$	All		1	50	nA
I_{CBO}	Collector to Base	$V_{CB} = 10\text{V}$, $I_F = 0$	CNY171M/2M/3M/4M			20	nA
C_{CE}	Capacitance Collector to Emitter	$V_{CE} = 0$, $f = 1\text{MHz}$	All		8		pF
C_{CB}	Collector to Base	$V_{CB} = 0$, $f = 1\text{MHz}$	CNY171M/2M/3M/4M		20		pF
C_{EB}	Emitter to Base	$V_{EB} = 0$, $f = 1\text{MHz}$	CNY171M/2M/3M/4M		10		pF

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.*	Max.	Units
V_{ISO}	Input-Output Isolation Voltage	$f = 60\text{Hz}$, $t = 1\text{sec.}$, $I_{I-O} \leq 2\mu\text{A}^{(4)}$	7500			Vac(pk)
R_{ISO}	Isolation Resistance	$V_{I-O} = 500\text{VDC}^{(4)}$	10^{11}			Ω
C_{ISO}	Isolation Capacitance	$V_{I-O} = \emptyset$, $f = 1\text{MHz}^{(4)}$		0.2		pF

Transfer Characteristics ($T_A = 25^\circ\text{C}$ 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 $T_A = 25^\circ\text{C}$

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 = 2.0mA, V _{CC} = 10V, R _L = 100Ω		2	10	μs
t _{off}	Turn-Off Time	All Devices	I _C = 2.0mA, V _{CC} = 10V, R _L = 100Ω		3	10	μs
t _d	Delay Time	CNY17XM/XFM	I _F = 10mA, V _{CC} = 5V, R _L = 75Ω			5.6	μs
t _r	Rise Time	All Devices	I _C = 2.0mA, V _{CC} = 10V, R _L = 100Ω		1		μs
		CNY17XM/FXM	I _F = 10mA, V _{CC} = 5V, R _L = 75Ω			4.0	
t _s	Storage Time	CNY17XM/FXM	I _F = 10mA, V _{CC} = 5V, R _L = 75Ω			4.1	μs
t _f	Fall Time	All Devices	I _C = 2.0mA, V _{CC} = 10V, R _L = 100Ω		2		μs
		CNY17XM/FXM	I _F = 10mA, V _{CC} = 5V, R _L = 75Ω			3.5	
SATURATED SWITCHING TIMES							
t _{on}	Turn-on Time	CNY171M/F1M	I _F = 20mA, V _{CC} = 5V, R _L = 1kΩ			5.5	μs
		CNY172M/3M/4M CNY17F2M/F3M/F4M	I _F = 10mA, V _{CC} = 5V, R _L = 1kΩ			8.0	
t _r	Rise Time	CNY171M/F1M	I _F = 20mA, V _{CC} = 5V, R _L = 1kΩ			4.0	μs
		CNY172M/3M/4M CNY17F2M/F3M/F4M	I _F = 10mA, V _{CC} = 5V, R _L = 1kΩ			6.0	
t _d	Delay Time	CNY171M/F1M	I _F = 20mA, V _{CC} = 5V, R _L = 1kΩ			5.5	μs
		CNY172M/3M/4M CNY17F2M/F3M/F4M	I _F = 10mA, V _{CC} = 5V, R _L = 1kΩ			8.0	
t _{off}	Turn-off Time	CNY171M/F1M	I _F = 20mA, V _{CE} = 0.4V			34	μs
		CNY172M/3M/4M CNY17F2M/F3M/F4M	I _F = 10mA, V _{CE} = 0.4V			39	
t _f	Fall Time	CNY171M/F1M	I _F = 20mA, V _{CC} = 5V, R _L = 1kΩ			20.0	μs
		CNY172M/3M/4M CNY17F2M/F3M/F4M	I _F = 10mA, V _{CC} = 5V, R _L = 1kΩ			24.0	
t _s	Storage Time	CNY171M/F1M	I _F = 20mA, V _{CC} = 5V, R _L = 1kΩ			34.0	μs
		CNY172M/3M/4M CNY17F2M/F3M/F4M	I _F = 10mA, V _{CC} = 5V, R _L = 1kΩ			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.

Safety and Insulation Ratings

As per IEC 60747-5-2, 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.

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1				
	For Rated Main Voltage < 150Vrms		I-IV		
	For Rated Main voltage < 300Vrms		I-IV		
	Climatic Classification		55/100/21		
	Pollution Degree (DIN VDE 0110/1.89)		2		
CTI	Comparative Tracking Index	175			
V_{PR}	Input to Output Test Voltage, Method b, $V_{IORM} \times 1.875 = V_{PR}$, 100% Production Test with $t_m = 1$ sec, Partial Discharge < 5pC	1594			V_{peak}
	Input to Output Test Voltage, Method a, $V_{IORM} \times 1.5 = V_{PR}$, Type and Sample Test with $t_m = 60$ sec, Partial Discharge < 5pC	1275			V_{peak}
V_{IORM}	Max. Working Insulation Voltage V_{peak}	850			V_{peak}
V_{IOTM}	Highest Allowable Over Voltage V_{peak}	6000			V_{peak}
	External Creepage	7			mm
	External Clearance	7			mm
	Insulation Thickness	0.5			mm
RIO	Insulation Resistance at T_s , $V_{IO} = 500V$	10^9			Ω

Typical Performance Characteristics

Fig. 1 Normalized CTR vs. Forward Current

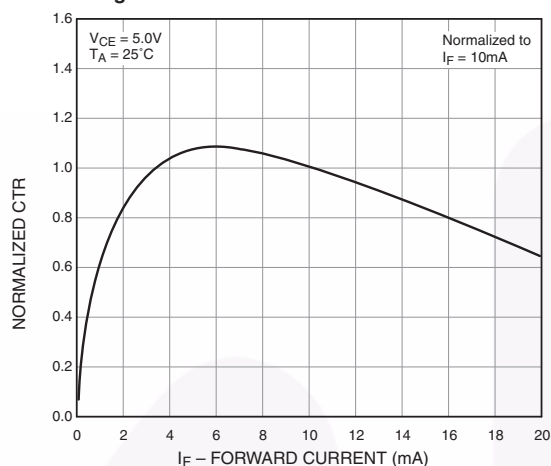


Fig. 2 Normalized CTR vs. Ambient Temperature

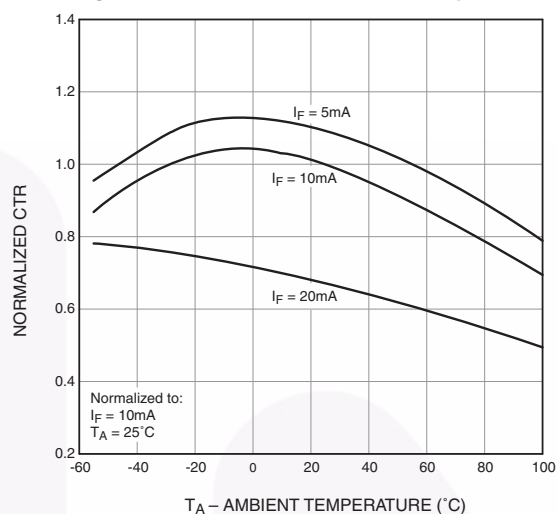


Fig. 3 CTR vs. R_{BE} (Unsaturated)

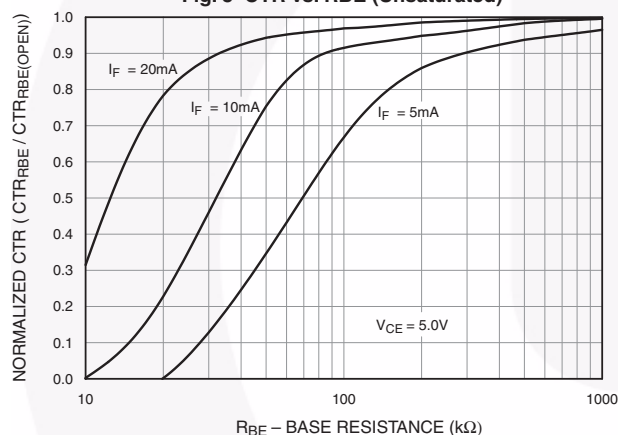


Fig. 4 CTR vs. R_{BE} (Saturated)

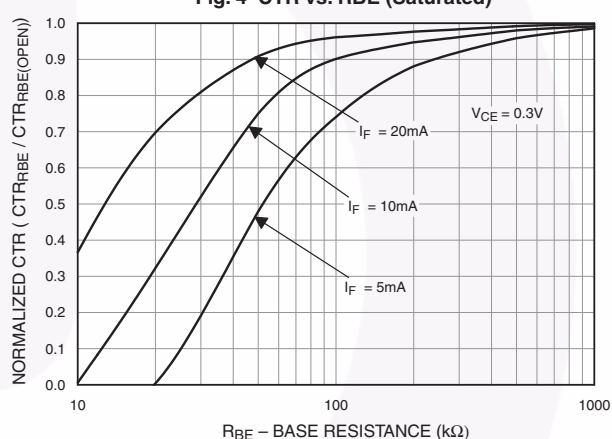


Fig. 5 Switching Speed vs. Load Resistor

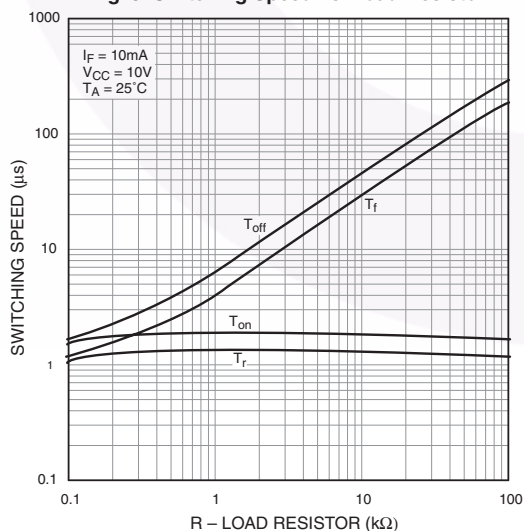
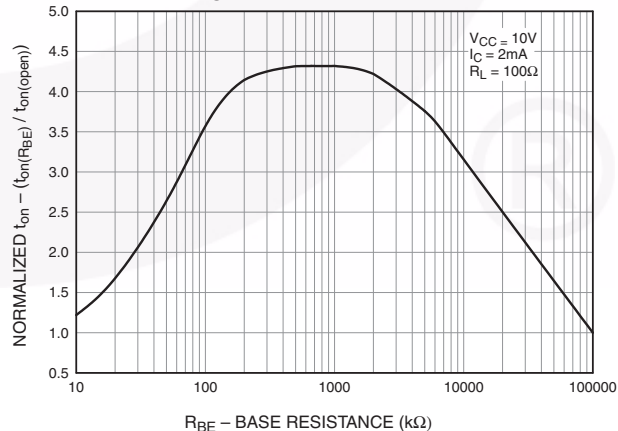


Fig. 6 Normalized t_{on} vs. R_{BE}



Typical Performance Characteristics (Continued)

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

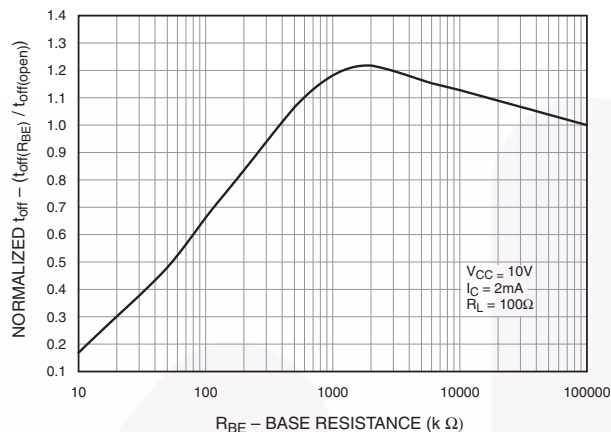


Fig. 8 LED Forward Voltage vs. Forward Current

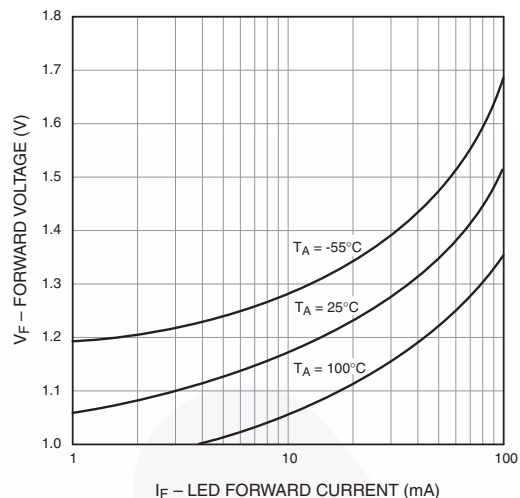


Fig. 9 Collector-Emitter Saturation Voltage vs Collector Current

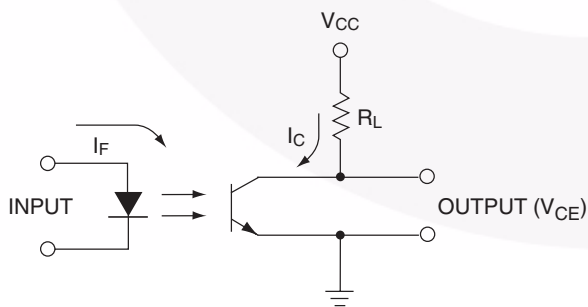
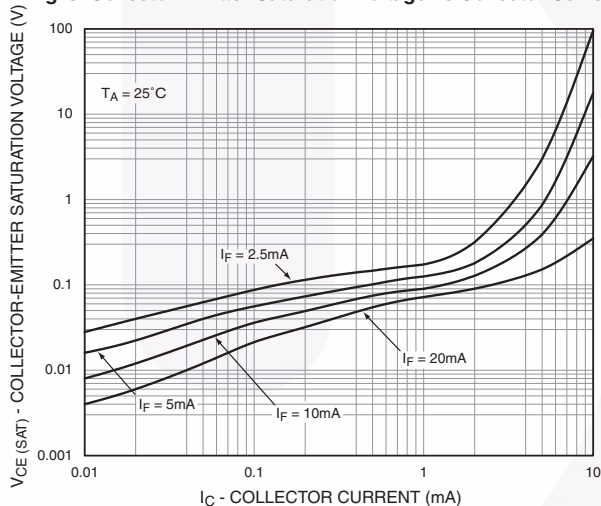


Figure 10. Switching Time Test Circuit

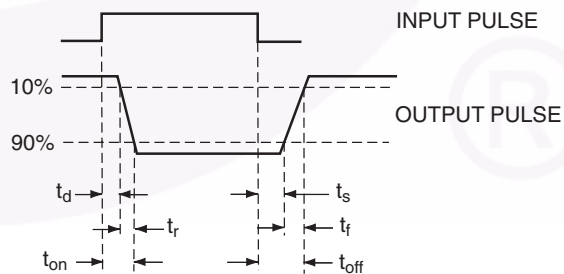
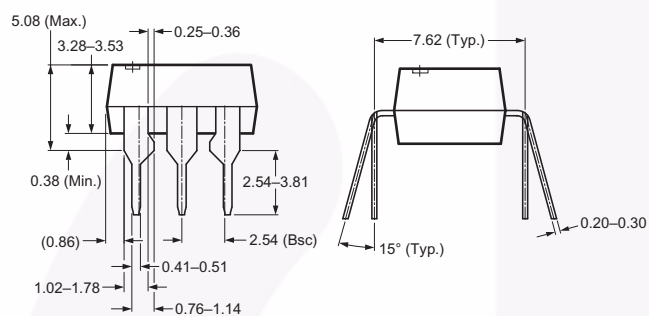
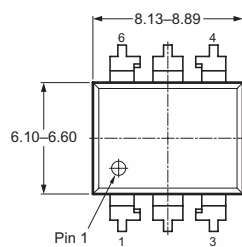


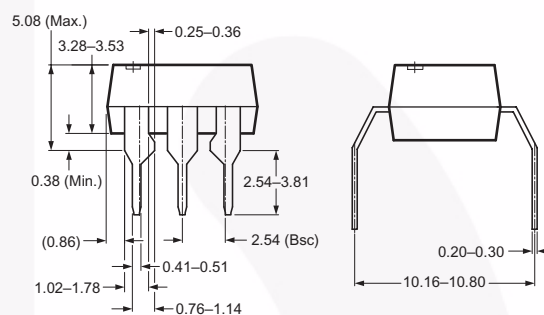
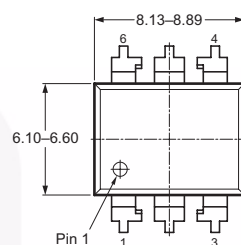
Figure 11. Switching Time Waveforms

Package Dimensions

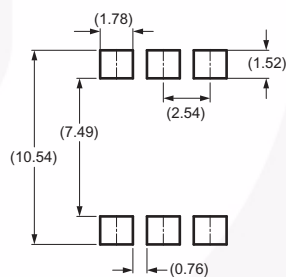
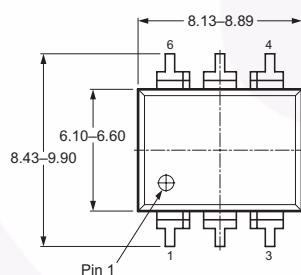
Through Hole



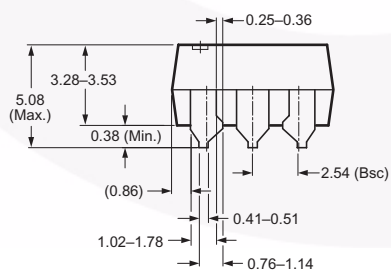
0.4" Lead Spacing



Surface Mount



Recommended Pad Layout

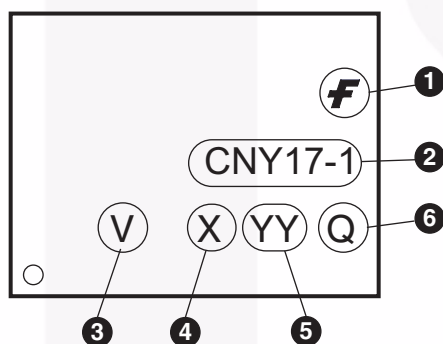


Note:
All dimensions in mm.

Ordering Information

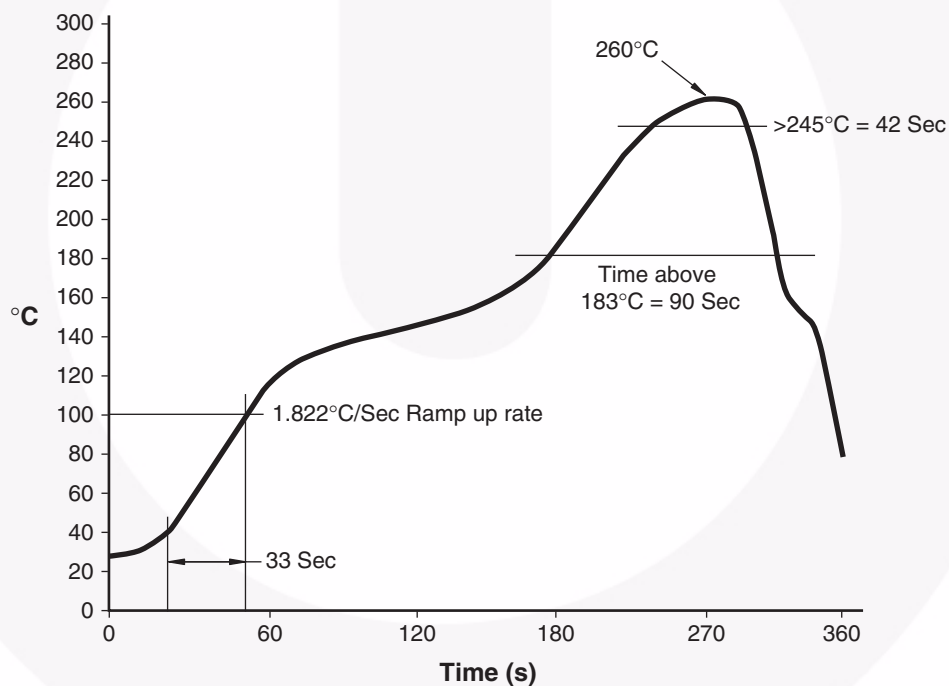
Option	Order Entry Identifier (Example)	Description
No option	CNY171M	Standard Through Hole Device
S	CNY171SM	Surface Mount Lead Bend
SR2	CNY171SR2M	Surface Mount; Tape and Reel
T	CNY171TM	0.4" Lead Spacing
V	CNY171VM	IEC60747-5-2
TV	CNY171TVM	IEC60747-5-2, 0.4" Lead Spacing
SV	CNY171SVM	IEC60747-5-2, Surface Mount
SR2V	CNY171SR2VM	IEC60747-5-2, 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

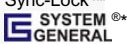
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Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary 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.
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