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October 2014

# CNY171M, CNY172M, CNY173M, CNY174M, CNY17F1M, CNY17F2M, CNY17F3M, CNY17F4M, MOC8106M 6-Pin DIP High $BV_{CEO}$ Phototransistor Optocouplers

## 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 Susceptability (CNY17FXM, MOC8106M)
- Safety and Regulatory Approvals:
  - UL1577, 4,170  $VAC_{RMS}$  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

## 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.

## Package Outlines



Figure 1. Package Outlines

## Schematics

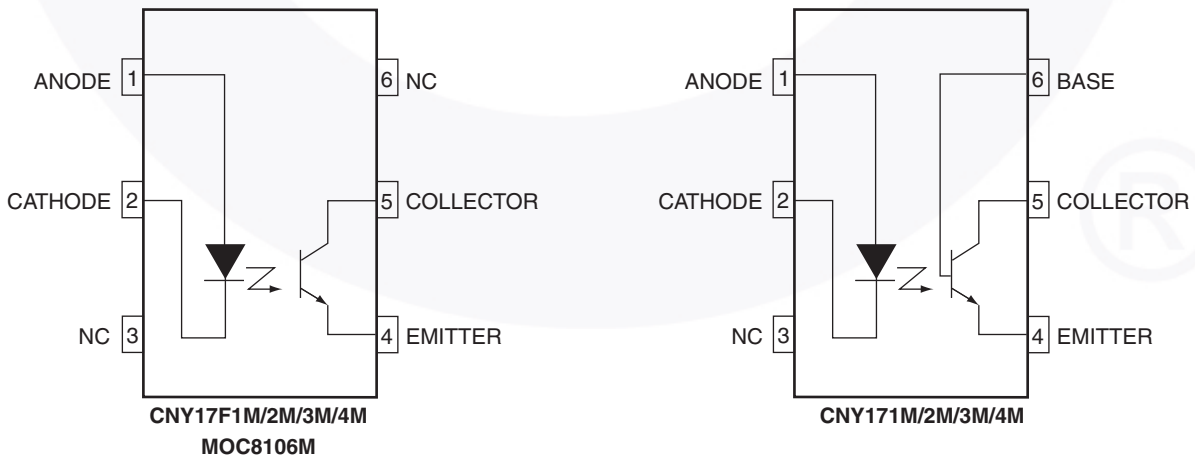


Figure 2. Schematics

CNY17XM, CNY17FXM, MOC8106M — 6-Pin DIP High  $BV_{CEO}$  Phototransistor Optocouplers

## 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 <sup>(1)</sup>	175	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	350	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	800	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>	> 10 <sup>9</sup>	Ω

### Note:

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

## 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 +125	°C
T <sub>A</sub>	Ambient Operating Temperature	-40 to +100	°C
T <sub>J</sub>	Junction Temperature	-40 to +125	°C
T <sub>SOL</sub>	Lead Solder Temperature	260 for 10 seconds	°C
P <sub>D</sub>	Total Device Power Dissipation @ 25°C (LED plus detector) Derate Linearly From 25°C	270	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 (1 μs pulse, 300 pps)	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

$T_A = 25^\circ\text{C}$  unless otherwise specified.

### Individual Component Characteristics

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

### Transfer Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Units
<b>COUPLED</b>							
CTR	Current Transfer Ratio	$I_F = 10\text{ mA}, V_{CE} = 10\text{ V}$	MOC8106M	50		150	%
		$I_F = 10\text{ mA}, V_{CE} = 5\text{ V}$	CNY171M, CNY17F1M	40		80	%
		$I_F = 10\text{ mA}, V_{CE} = 5\text{ V}$	CNY172M, CNY17F2M	63		125	%
		$I_F = 10\text{ mA}, V_{CE} = 5\text{ V}$	CNY173M, CNY17F3M	100		200	%
		$I_F = 10\text{ mA}, V_{CE} = 5\text{ V}$	CNY174M, CNY17F4M	160		320	%
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$I_C = 0.5\text{ mA}, I_F = 5\text{ mA}$	MOC8106M			0.4	V
		$I_C = 2.5\text{ mA}, I_F = 10\text{ mA}$	CNY17XM/CNY17FXM			0.4	V

## Electrical Characteristics (Continued)

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

### AC Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Units
<b>NON-SATURATED SWITCHING TIME</b>							
t <sub>on</sub>	Turn-On Time	I <sub>C</sub> = 2.0 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω	All Devices		2.0	10.0	μs
t <sub>off</sub>	Turn-Off Time	I <sub>C</sub> = 2.0 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω	All Devices		3.0	10.0	μs
t <sub>d</sub>	Delay Time	I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 75 Ω	CNY17XM/CNY17FXM			5.6	μs
t <sub>r</sub>	Rise Time	I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 75 Ω	CNY17XM/CNY17FXM			4.0	μs
t <sub>s</sub>	Storage Time	I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 75 Ω	CNY17XM/CNY17FXM			4.1	μs
t <sub>f</sub>	Fall Time	I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 75 Ω	CNY17XM/CNY17FXM			3.5	μs
<b>SATURATED SWITCHING TIMES</b>							
t <sub>d</sub>	Delay Time	I <sub>F</sub> = 20 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 1 kΩ	CNY171M/F1M			5.5	μs
		I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 1 kΩ	CNY172M/3M/4M CNY17F2M/F3M/F4M			8.0	μs
t <sub>r</sub>	Rise Time	I <sub>F</sub> = 20 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 1 kΩ	CNY171M/F1M			4.0	μs
		I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 1 kΩ	CNY172M/3M/4M CNY17F2M/F3M/F4M			6.0	μs
t <sub>s</sub>	Storage Time	I <sub>F</sub> = 20 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 1 kΩ	CNY171M/F1M			34.0	μs
		I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 1 kΩ	CNY172M/3M/4M CNY17F2M/F3M/F4M			39.0	μs
t <sub>f</sub>	Fall Time	I <sub>F</sub> = 20 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 1 kΩ	CNY171M/F1M			20.0	μs
		I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 1 kΩ	CNY172M/3M/4M CNY17F2M/F3M/F4M			24.0	μs

### Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Units
V <sub>ISO</sub>	Input-Output Isolation Voltage	t = 1 Minute	4170			V <sub>AC</sub> <sub>RMS</sub>
C <sub>ISO</sub>	Isolation Capacitance	V <sub>I-O</sub> = 0 V, f = 1 MHz		0.2		pF
R <sub>ISO</sub>	Isolation Resistance	V <sub>I-O</sub> = ±500 VDC, T <sub>A</sub> = 25°C	10 <sup>11</sup>			Ω

### Typical Performance Characteristics

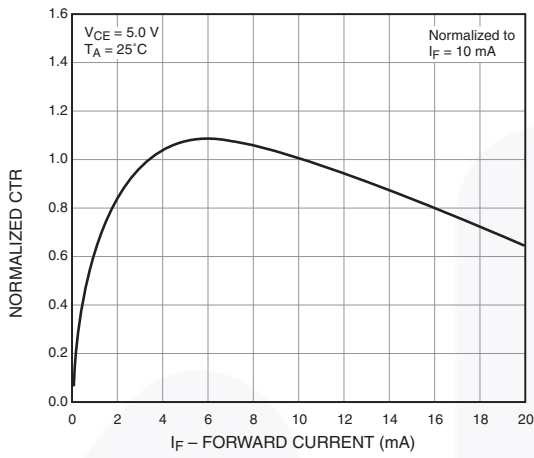


Figure 3. Normalized CTR vs. Forward Current

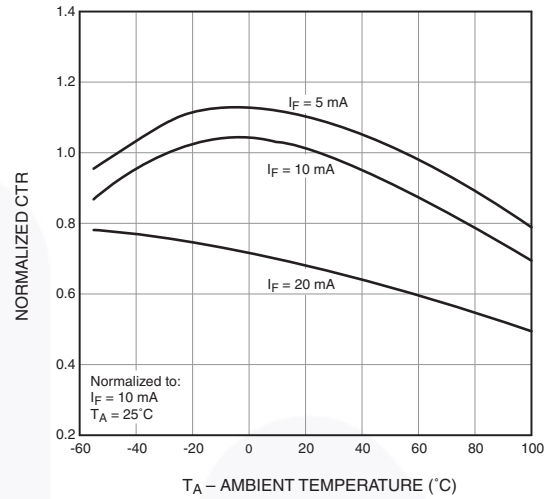


Figure 4. Normalized CTR vs. Ambient Temperature

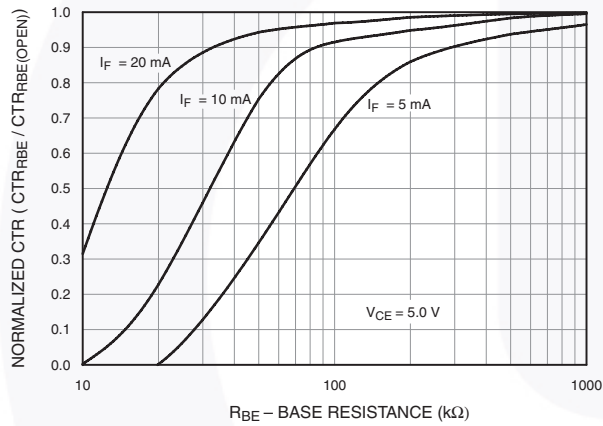


Figure 5. CTR vs. R<sub>BE</sub> (Unsaturated)

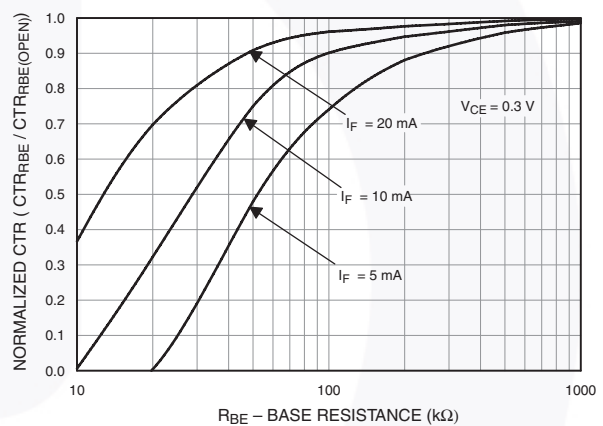


Figure 6. CTR vs. R<sub>BE</sub> (Saturated)

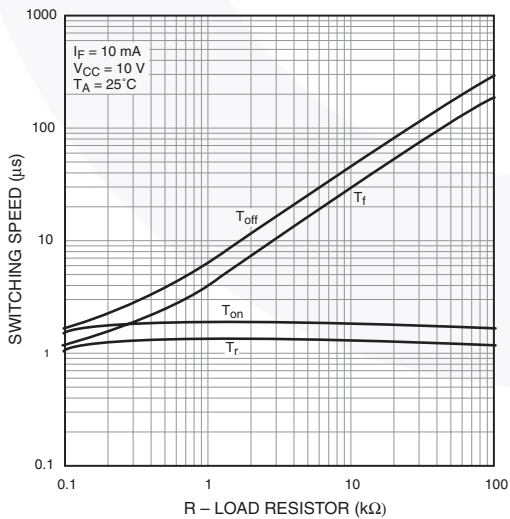


Figure 7. Switching Speed vs. Load Resistor

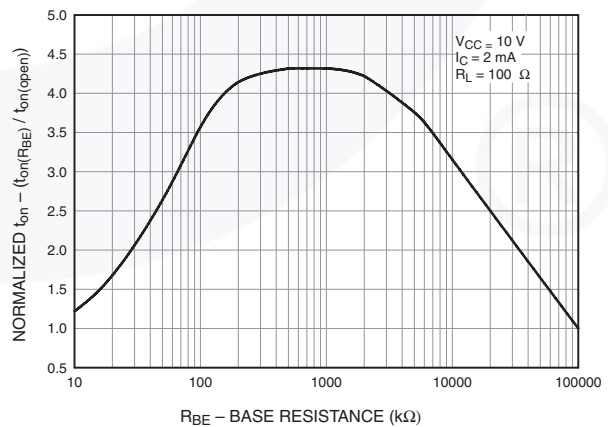


Figure 8. Normalized  $t_{on}$  vs. R<sub>BE</sub>

Typical Performance Characteristics (Continued)



Figure 9. Normalized  $t_{off}$  vs.  $R_{BE}$



Figure 10. LED Forward Voltage vs. Forward Current



Figure 11. Collector-Emitter Saturation Voltage vs. Collector Current



### Switching Test Circuit and Waveforms

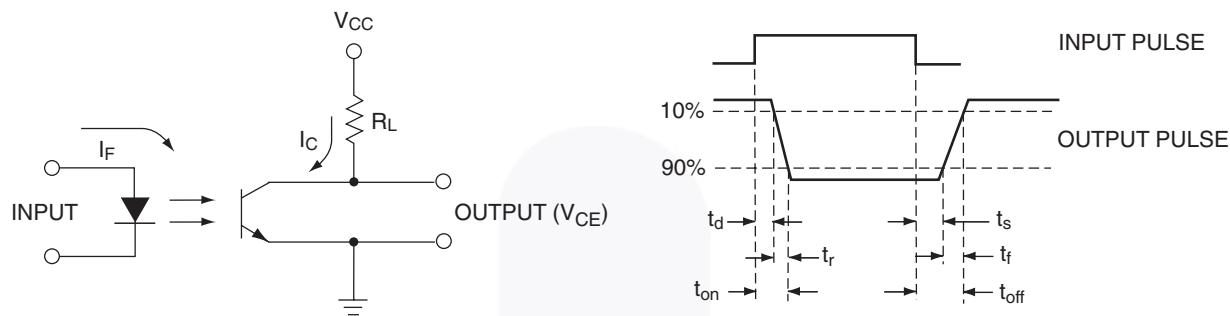


Figure 12. Switching Test Circuit and Waveforms

### Reflow Profile



Figure 13. Reflow Profile

## 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)

**Note:**

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

## Marking Information



Figure 14. Top Mark

Table 1. Top Mark Definitions

1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "4"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code



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