

CNY17 Series, MOC8106M

6-Pin DIP High $B_{V_{CEO}}$ Phototransistor Optocouplers

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.

Features

- High $B_{V_{CEO}}$: 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 Susceptibility (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

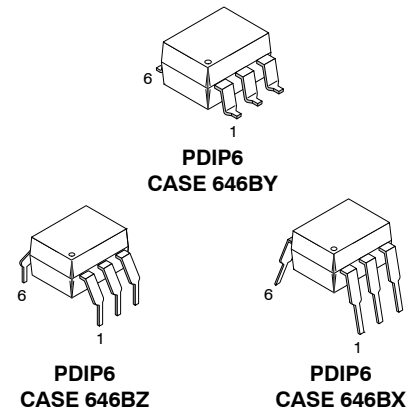
Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs
- Appliance Sensor Systems
- Industrial Controls

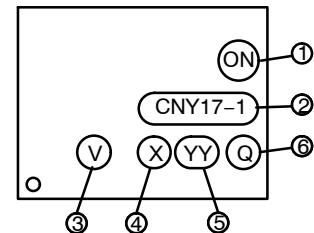


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MARKING DIAGRAM



1. ON = Company Logo
2. CNY17 = Device Number
3. V = DIN EN/IEC60747-5-5 Option
(only appears on component ordered with this option)
4. X = One-Digit Year Code
5. YY = Digit Work Week
6. Q = Assembly Package Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

CNY17 Series, MOC8106M

SCHEMATICS

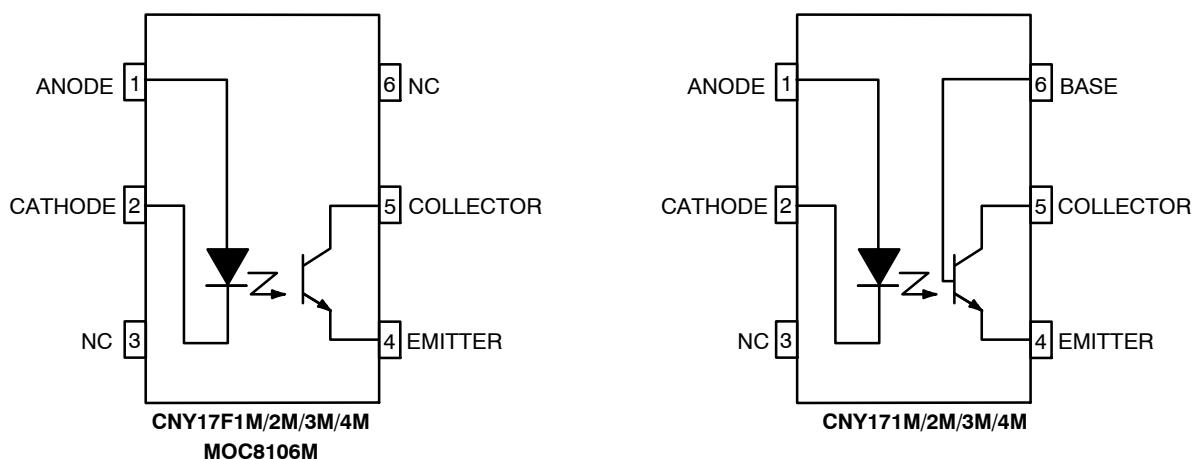


Figure 1. Schematics

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 _{RMS}	I–IV
	< 300 V _{RMS}	I–III
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V _{PR}	Input-to-Output Test Voltage, Method A, V _{IORM} × 1.6 = V _{PR} , Type and Sample Test with t _m = 10 s, Partial Discharge < 5 pC	1360	V _{peak}
	Input-to-Output Test Voltage, Method B, V _{IORM} × 1.875 = V _{PR} , 100% Production Test with t _m = 1 s, Partial Discharge < 5 pC	1594	V _{peak}
V _{IORM}	Maximum Working Insulation Voltage	850	V _{peak}
V _{IOTM}	Highest Allowable Over-Voltage	6000	V _{peak}
	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 _S	Case Temperature (Note 1)	175	°C
I _{S, INPUT}	Input Current (Note 1)	350	mA
P _{S, OUTPUT}	Output Power (Note 1)	800	mW
R _{IO}	Insulation Resistance at T _S , V _{IO} = 500 V (Note 1)	> 10 ⁹	Ω

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

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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Units
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TOTAL DEVICE

T_{STG}	Storage Temperature	-40 to +125	°C
T_A	Ambient Operating Temperature	-40 to +100	°C
T_J	Junction Temperature	-40 to +125	°C
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	°C
P_D	Total Device Power Dissipation @ 25°C (LED plus detector) Derate Linearly From 25°C	270	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 (1 μ s pulse, 300 pps)	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

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise specified)

INDIVIDUAL COMPONENT CHARACTERISTICS

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
EMITTER							
V _F	Input Forward Voltage	I _F = 10 mA	All Devices	1.0	1.15	1.50	V
		I _F = 60 mA	CNY17XM, CNY17FXM	1.0	1.35	1.65	V
C _J	Capacitance	V _F = 0 V, f = 1.0 MHz	All Devices		18		pF
I _R	Reverse Leakage Current	V _R = 6 V	All Devices		0.001	10	μA

DETECTOR

BV _{CEO}	Breakdown Voltage Collector-to-Emitter	I _C = 1 mA, I _F = 0	All Devices	70	100		V
BV _{CBO}	Collector-to-Base	I _C = 10 μA, I _F = 0	CNY17XM	70	120		V
BV _{ECO}	Emitter-to-Collector	I _E = 100 μA, I _F = 0	All Devices	7	10		V
I _{CEO}	Leakage Current Collector-to-Emitter	V _{CE} = 10 V, I _F = 0	All Devices		1	50	nA
I _{CBO}	Collector-to-Base	V _{CB} = 10 V, I _F = 0	CNY17XM			20	nA
C _{CE}	Capacitance Collector-to-Emitter	V _{CE} = 0, f = 1 MHz	All Devices		8		pF
C _{CB}	Collector-to-Base	V _{CB} = 0, f = 1 MHz	CNY17XM		20		pF
C _{EB}	Emitter-to-Base	V _{EB} = 0, f = 1 MHz	CNY17XM		10		pF

TRANSFER CHARACTERISTICS

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
COUPLED							
CTR	Current Transfer Ratio	I _F = 10 mA, V _{CE} = 10 V	MOC8106M	50		150	%
		I _F = 10 mA, V _{CE} = 5 V	CNY171M, CNY17F1M	40		80	%
		I _F = 10 mA, V _{CE} = 5 V	CNY172M, CNY17F2M	63		125	%
		I _F = 10 mA, V _{CE} = 5 V	CNY173M, CNY17F3M	100		200	%
		I _F = 10 mA, V _{CE} = 5 V	CNY174M, CNY17F4M	160		320	%
V _{CE(SAT)}	Collector-Emitter Saturation Voltage	I _C = 0.5 mA, I _F = 5 mA	MOC8106M			0.4	V
		I _C = 2.5 mA, I _F = 10 mA	CNY17XM/CNY17FXM				

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AC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
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NON-SATURATED SWITCHING TIME

t_{on}	Turn-On Time	$I_C = 2.0 \text{ mA}$, $V_{CC} = 10 \text{ V}$, $R_L = 100 \Omega$	All Devices		2.0	10.0	μs
t_{off}	Turn-Off Time	$I_C = 2.0 \text{ mA}$, $V_{CC} = 10 \text{ V}$, $R_L = 100 \Omega$	All Devices		3.0	10.0	μs
t_d	Delay Time	$I_F = 10 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 75 \Omega$	CNY17XM/CNY17FXM			5.6	μs
t_r	Rise Time	$I_F = 10 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 75 \Omega$	CNY17XM/CNY17FXM			4.0	μs
t_s	Storage Time	$I_F = 10 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 75 \Omega$	CNY17XM/CNY17FXM			4.1	μs
t_f	Fall Time	$I_F = 10 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 75 \Omega$	CNY17XM/CNY17FXM			3.5	μs

SATURATED SWITCHING TIME

t_d	Delay Time	$I_F = 20 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$	CNY171M/F1M			5.5	μs
		$I_F = 10 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$	CNY172M/3M/4M CNY17F2M/F3M/F4M			8.0	μs
t_r	Rise Time	$I_F = 20 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$	CNY171M/F1M			4.0	μs
		$I_F = 10 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$	CNY172M/3M/4M CNY17F2M/F3M/F4M			6.0	μs
t_s	Storage Time	$I_F = 20 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$	CNY171M/F1M			34.0	μs
		$I_F = 10 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$	CNY172M/3M/4M CNY17F2M/F3M/F4M			39.0	μs
t_f	Fall Time	$I_F = 20 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$	CNY171M/F1M			20.0	μs
		$I_F = 10 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$	CNY172M/3M/4M CNY17F2M/F3M/F4M			24.0	μs

ISOLATION CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
VISO	Input-Output Isolation Voltage	$t = 1 \text{ Minute}$	4170			$V_{AC_{RMS}}$
CISO	Isolation Capacitance	$V_{I-O} = 0 \text{ V}$, $f = 1 \text{ MHz}$		0.2		pF
RISO	Isolation Resistance	$V_{I-O} = \pm 500 \text{ VDC}$, $T_A = 25^\circ\text{C}$	10^{11}			Ω

TYPICAL PERFORMANCE CHARACTERISTICS

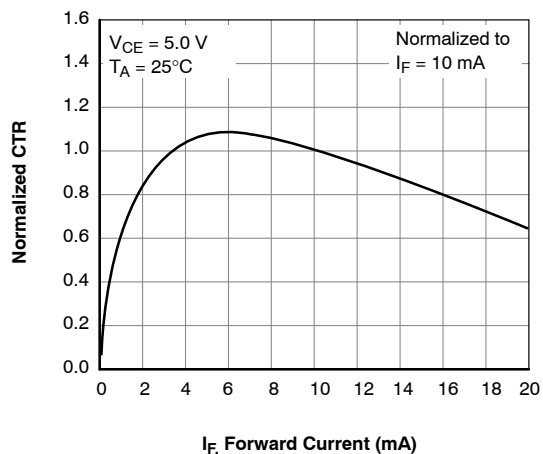


Figure 2. Normalized CTR vs. Forward Current

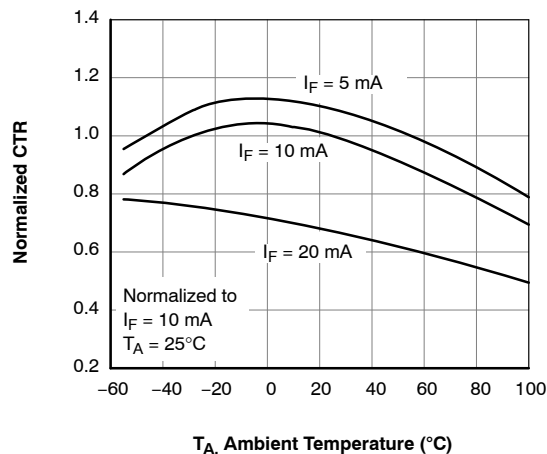


Figure 3. Normalized CTR vs. Ambient Temperature

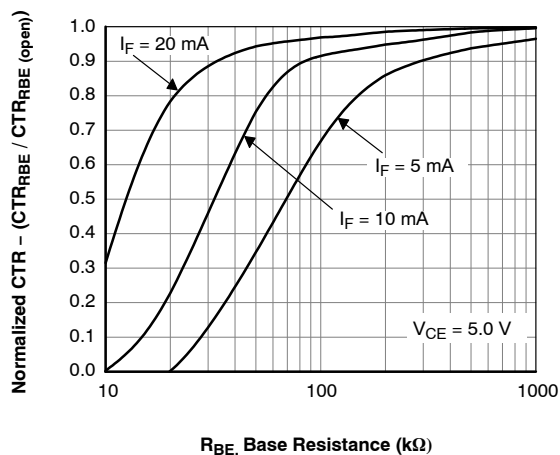


Figure 4. CTR vs. R_BE (Unsaturated)

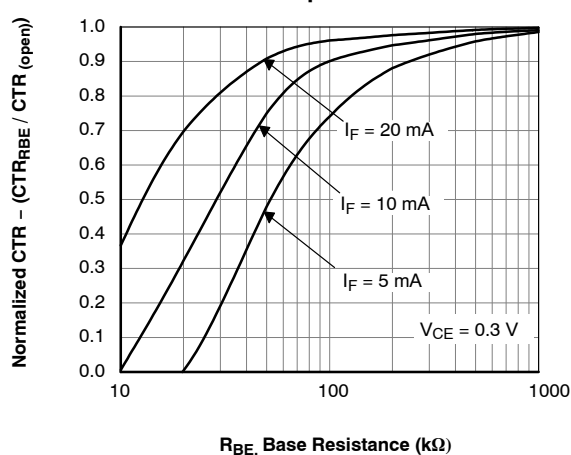


Figure 5. CTR vs. R_BE (Saturated)

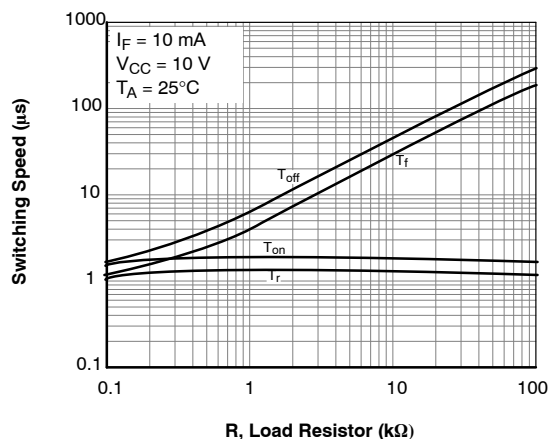


Figure 6. Switching Speed vs. Load Resistor

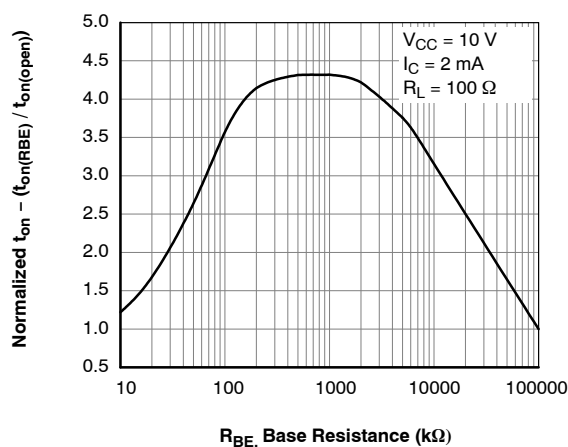


Figure 7. Normalized t_{on} vs. R_{BE}

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

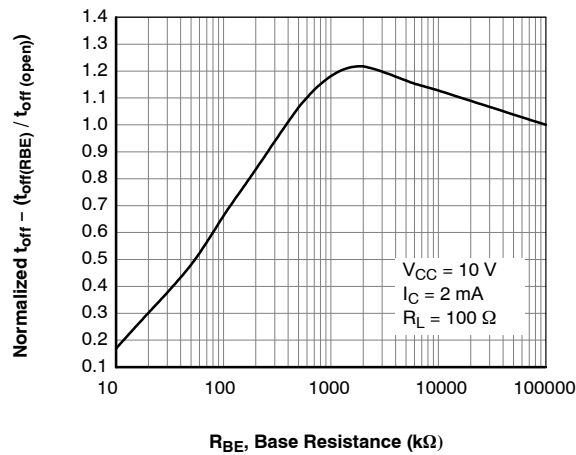


Figure 8. Normalized t_{off} vs. R_{BE}

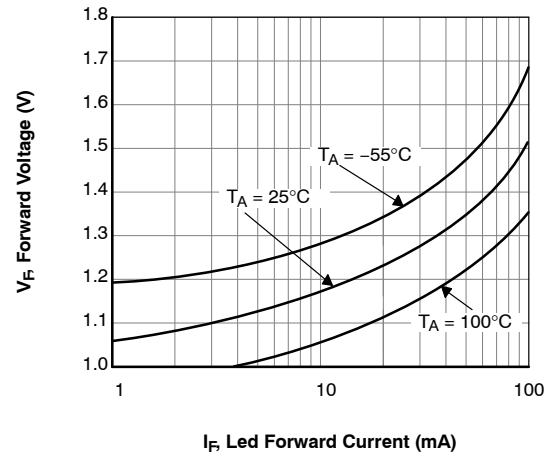


Figure 9. LED Forward Voltage vs. Forward Current

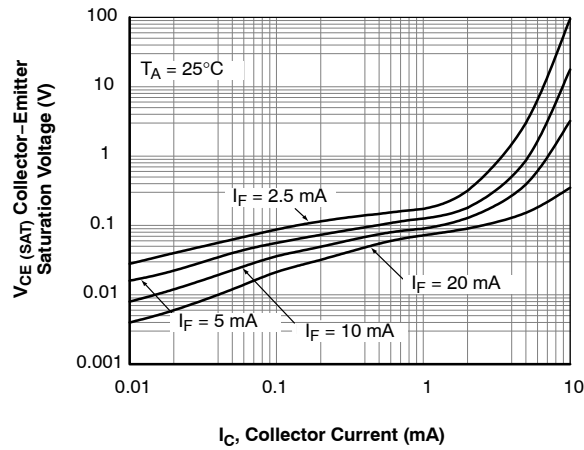


Figure 10. Collector-Emitter Saturation Voltage vs. Collector Current

SWITCHING TEST CIRCUIT AND WAVEFORMS

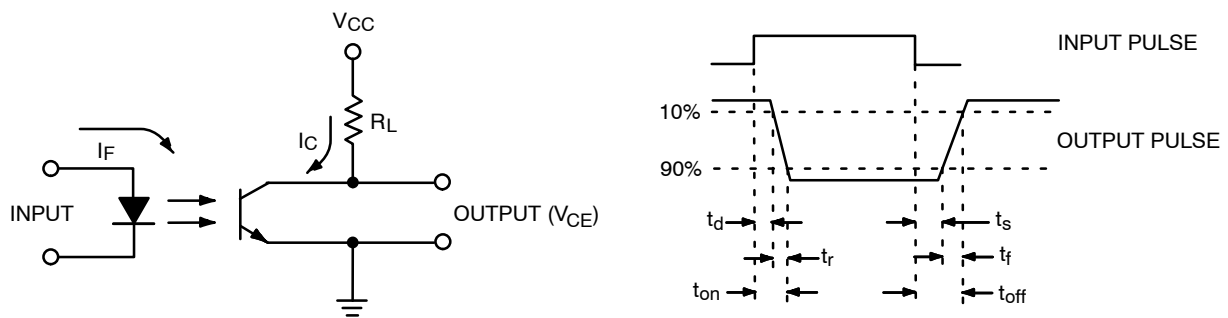


Figure 11. Switching Test Circuit and Waveforms

REFLOW PROFILE

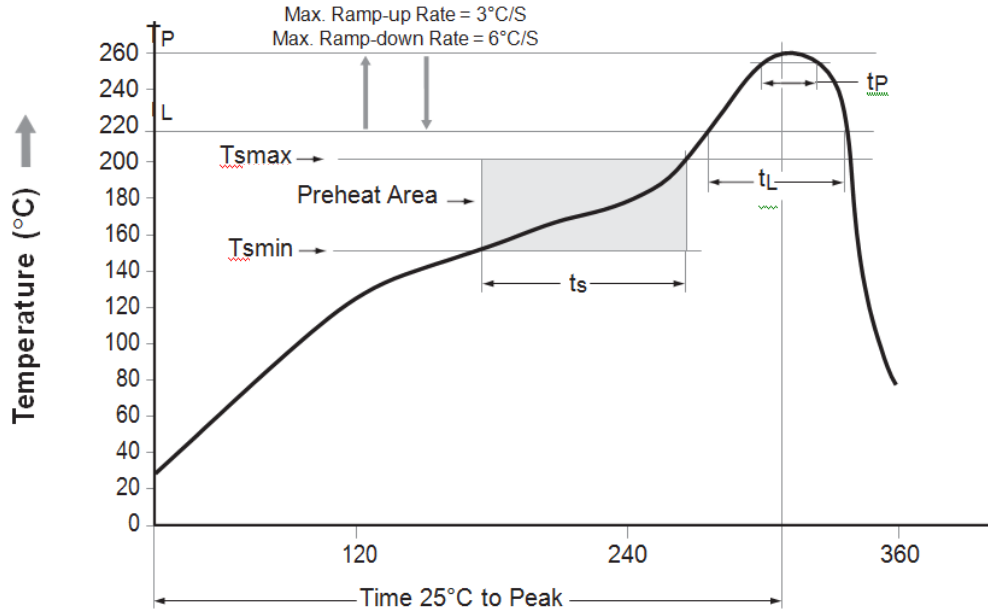


Figure 12. Reflow Profile

Profile Feature	Pb – Free Assembly Profile
Temperature Min. (Tssmin)	150°C
Temperature Max. (Tsmax)	200°C
Time (ts) from (Tssmin to Tsmax)	60–120 seconds
Ramp – up Rate (t to tp)	3°C/second max.
Liquidous Temperature (Tl)	217°C
Time (tl) Maintained Above (Tl)	60–150 seconds
Peak Body Package Temperature	260°C +0°C / –5°C
Time (tp) within 5°C of 260°C	30 seconds
Ramp – down Rate (Tp to Tl)	6°C / second max.
Time 25°C to Peak Temperature	8 minutes max.

Table 1. 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)

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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

MECHANICAL CASE OUTLINE

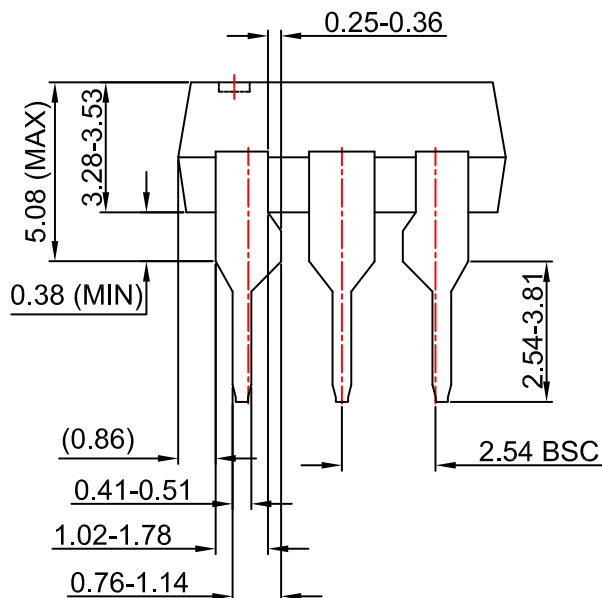
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ISSUE A

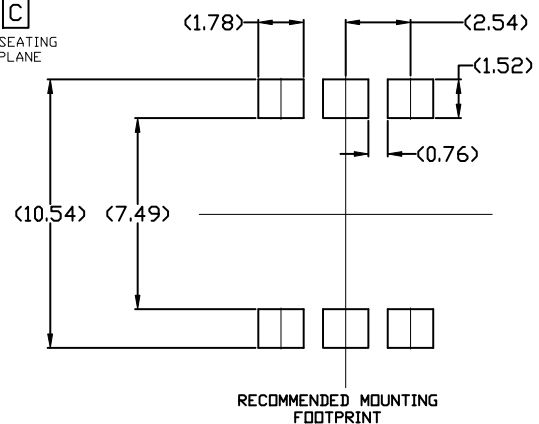
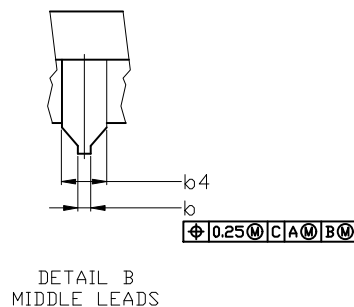
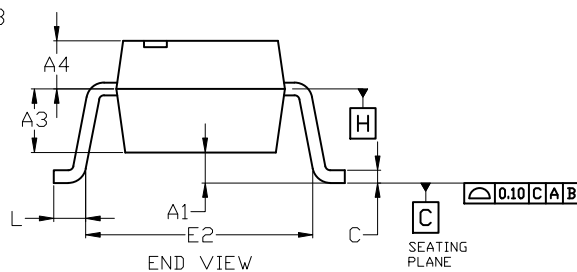
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NOTES:

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5. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).
6. CENTER LINE OF CORNER LEADS IS LOCATED BY LOCATING THE CENTER OF FEATURE b2 AND b3.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	4.80
A1	0.38	---	---
A2	3.28	3.40	3.53
A3	2.49 REF		
A4	1.89 REF		
b	0.41	0.46	0.51
b1	0.76	0.92	1.14
b2	0.25	0.28	0.36
b3	1.02	1.40	1.78
b4	1.778 REF		
c	0.20	0.25	0.30
D	8.13	8.51	8.89
D1	0.86 REF		
E	6.10	6.35	6.60
E1	8.43	9.17	9.90
E2	8.13 REF		
e	2.54 BSC		
L	0.16	0.52	0.88



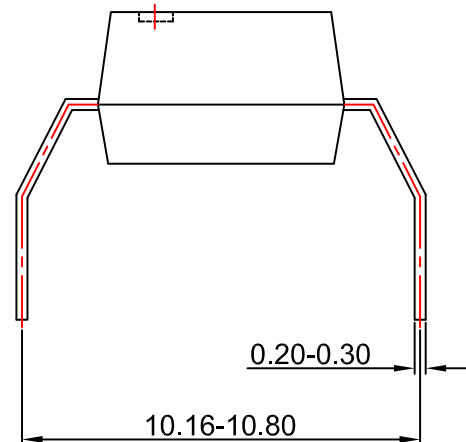
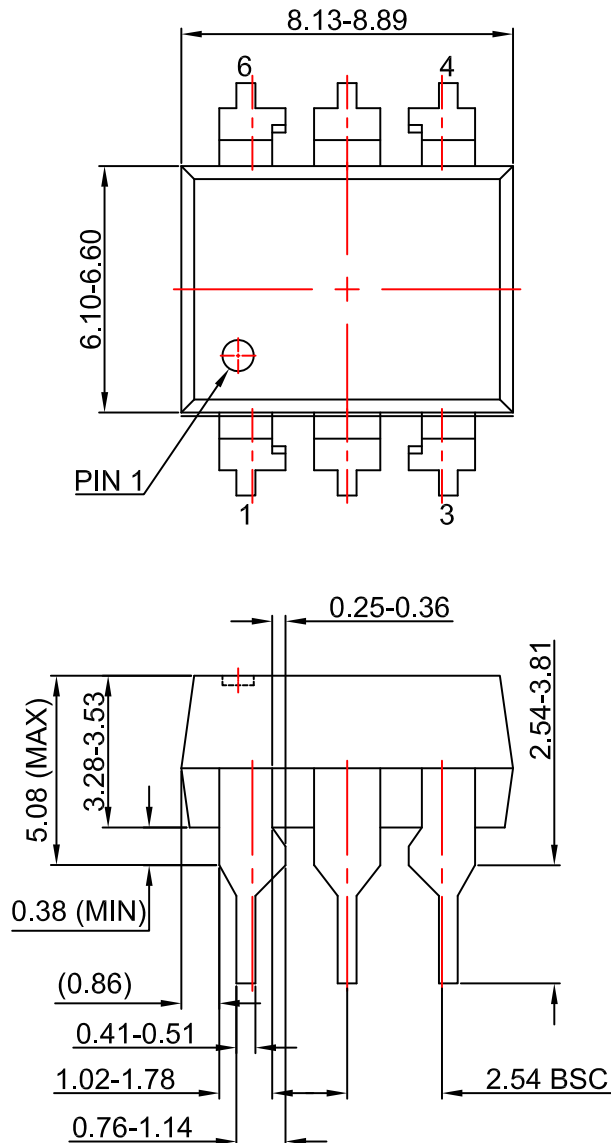
- For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

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