

CNY171, CNY172, CNY173, CNY174, CNY17F1, CNY17F2, CNY17F3, CNY17F4, MOC8101, MOC8102, MOC8103, MOC8104, MOC8105, MOC8106, MOC8107, MOC8108 Phototransistor Optocouplers

Features

- UL recognized (File # E90700)
- VDE recognized
 - Add option V for white package (e.g., CNY17F2VM)
 - File #102497
 - Add option '300' for black package (e.g., CNY17F2300)
 - File #94766
- Current transfer ratio in select groups
- High BV_{CEO} —70V minimum (CNY17X/M, CNY17FX/M, MOC8106/7/8)
- 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 (CNY17FX/M, MOC810X)

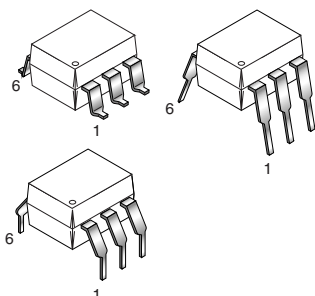
Applications

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

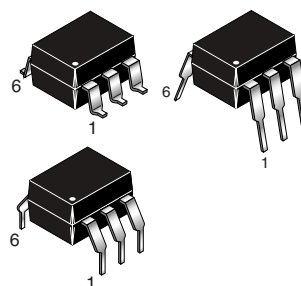
Description

The CNY17, CNY17F and MOC810X devices consist of a Gallium Arsenide IRED coupled with an NPN phototransistor in a dual in-line package.

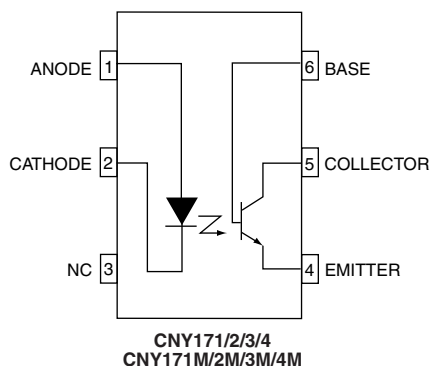
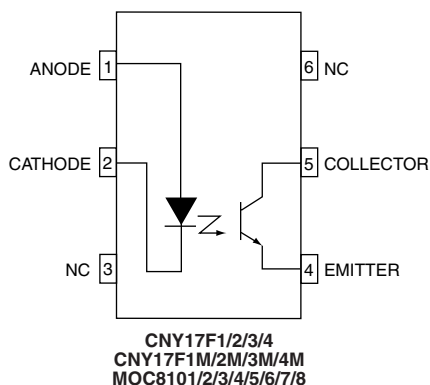
White Package (-M Suffix)



Black Package (No -M Suffix)



Schematic



Absolute Maximum Ratings

Symbol	Parameters	Device	Value	Units
TOTAL DEVICE				
T _{STG}	Storage Temperature	M	-40 to +150	°C
		non M	-55 to +150	
T _{OPR}	Operating Temperature	M	-40 to +100	°C
		non M	-55 to +100	
T _{SOL}	Lead Solder Temperature	All	260 for 10 sec	°C
P _D	Total Device Power Dissipation @ 25°C (LED plus detector) Derate Linearly From 25°C	M	250	mW
		non M	250	
		M	2.94	mW/°C
		non M	3.30	
EMITTER				
I _F	Continuous Forward Current	M	60	mA
		non M	100	
V _R	Reverse Voltage	All	6	V
I _F (pk)	Forward Current - Peak (1 μs pulse, 300 pps)	M	1.5	A
		non M	1.0	
P _D	LED Power Dissipation 25°C Ambient Derate Linearly From 25°C	M	120	mW
		non M	150	
		M	1.41	mW/°C
		non M	1.8	
DETECTOR				
I _C	Continuous Collector Current	All	50	mA
V _{CEO}	Collector-Emitter Voltage	CNY17X/M, CNY17FX/M, MOC8106/7/8	70	V
		MOC8101/2/3/4/5	30	V
V _{ECO}	Emitter Collector Voltage	All	7	V
P _D	Detector Power Dissipation @ 25°C Derate Linearly from 25°C	M	150	mW
		non M	150	
		M	1.76	mW/°C
		non M	2.0	

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	$I_F = 60\text{mA}$	CNY17FX/M CNY17X/M	1.0	1.35	1.65	V
		$I_F = 10\text{mA}$	MOC810X	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	$I_C = 1.0\text{mA}$, $I_F = 0$	MOC8101/2/3/4/5	30	100		V
			MOC8106/7/8 CNY17F1/2/3/4/M CNY171/2/3/4/M	70	100		
BV_{CBO}	Collector to Base	$I_C = 10\mu\text{A}$, $I_F = 0$	CNY171/2/3/4/M	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	$V_{CB} = 10\text{V}$, $I_F = 0$	CNY171/2/3/4/M			20	nA
C_{CE}	Capacitance Collector to Emitter	$V_{CE} = 0$, $f = 1\text{MHz}$	All		8		pF
C_{CB}	Collector to Base	$V_{CB} = 0$, $f = 1\text{MHz}$	CNY171/2/3/4/M		20		pF
C_{EB}	Emitter to Base	$V_{EB} = 0$, $f = 1\text{MHz}$	CNY171/2/3/4/M		10		pF

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Device	Min.	Typ.**	Max.	Units
V_{ISO}	Input-Output Isolation Voltage	$f = 60\text{Hz}$, $t = 1\text{min.}$, $I_{I-O} \leq 2\mu\text{A}^{(4)}$	Black Package	5300			Vac(rms)*
		$f = 60\text{Hz}$, $t = 1\text{sec.}$, $I_{I-O} \leq 2\mu\text{A}^{(4)}$	'M' White Package	7500			Vac(pk)
R_{ISO}	Isolation Resistance	$V_{I-O} = 500\text{VDC}^{(4)}$	All	10^{11}			Ω
C_{ISO}	Isolation Capacitance	$V_{I-O} = 0$, $f = 1\text{MHz}^{(4)}$	Black Package		0.5		pF
			'M' White Package		0.2		

Note:

* 5300 Vac(rms) for 1 minute equates to approximately 9000 Vac (pk) for 1 second

** Typical values at $T_A = 25^\circ\text{C}$

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

Symbol	DC Characteristics		Test Conditions	Min.	Typ.	Max.	Units
COUPLED							
(CTR) ⁽²⁾	Output Collector Current	MOC8101	I _F = 10mA, V _{CE} = 10V	50		80	%
		MOC8102		73		117	
		MOC8103		108		173	
		MOC8104		160		256	
		MOC8105		65		133	
		MOC8106		50		150	
		MOC8107		100		300	
		MOC8108		250		600	
		CNY17F1/1M	I _F = 10mA, V _{CE} = 5V	40		80	
		CNY17F2/2M		63		125	
		CNY17F3/3M		100		200	
		CNY17F4/4M		160		320	
		CNY171/1M		40		80	
		CNY172/2M		63		125	
		CNY173/3M		100		200	
		CNY174/4M		160		320	
V _{CE(sat)}	Collector-Emitter Saturation Voltage	CNY17XM/FXM	I _C = 2.5mA, I _F = 10mA			0.4	V
		MOC8101/2/3/4/5/6/7/8	I _C = 500μA, I _F = 5.0mA				
			CNY17X/FX	I _F = 10mA, I _C = 2.5mA			0.3

Symbol	AC Characteristics ⁽³⁾		Test Conditions	Min.	Typ.*	Max.	Units
NON-SATURATED SWITCHING TIME							
t _{on}	Turn-On Time	MOC8101/2/3/4/5	I _C = 2.0mA, V _{CC} = 10V, R _L = 100Ω		2	20	μs
		MOC8106/7/8					
		CNY17X/FX				10	
t _{off}	Turn-Off Time	MOC8101/2/3/4/5	I _C = 2.0mA, V _{CC} = 10V, R _L = 100Ω		3	20	
		MOC8106/7/8					
		CNY17X/FX				10	
t _d	Delay Time	CNY17XM/FXM	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	

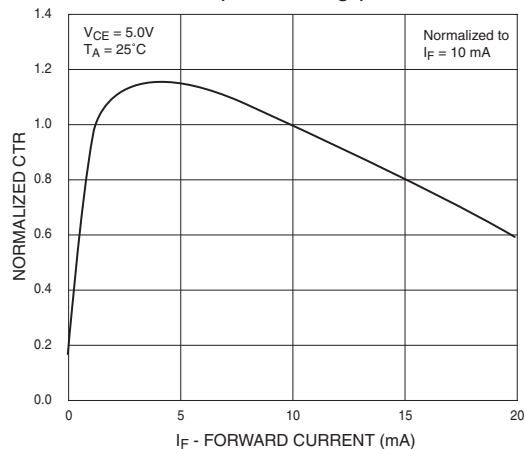
Transfer Characteristics (Continued) ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)⁽¹⁾

Symbol	AC Characteristics ⁽³⁾	Test Conditions	Min.	Typ.	Max.	Units
SATURATED SWITCHING TIMES						
t_{on}	Turn-on Time	CNY171/F1	$I_F = 20\text{mA}, V_{CE} = 0.4\text{V}$		5.5	μs
		CNY172/F2	$I_F = 10\text{mA}, V_{CE} = 0.4\text{V}$		8.0	
		CNY173/F3				
		CNY174/F4				
t_r	Rise Time	CNY171/F1	$I_F = 20\text{mA}, V_{CE} = 0.4\text{V}$		4.0	μs
		CNY172/F1	$I_F = 10\text{mA}, V_{CE} = 0.4\text{V}$		6.0	
		CNY173/F3				
		CNY174/F4				
		CNY171M/F1M	$I_F = 20\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		4.0	
		CNY172M/3M/4M	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		6.0	
		CNY17F2M/F3M/F4M				
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	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		8.0	
		CNY17F2M/F3M/F4M				
t_{off}	Turn-off Time	CNY171/F1	$I_F = 20\text{mA}, V_{CE} = 0.4\text{V}$		34	μs
		CNY172/F2	$I_F = 10\text{mA}, V_{CE} = 0.4\text{V}$		39	
		CNY173/F3				
		CNY174/F4				
t_f	Fall Time	CNY171/F1	$I_F = 20\text{mA}, V_{CE} = 0.4\text{V}$		20	μs
		CNY172/F2	$I_F = 10\text{mA}, V_{CE} = 0.4\text{V}$		24	
		CNY173/F3				
		CNY174/F4				
		CNY171M/F1M	$I_F = 20\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		20.0	μs
		CNY172M/3M/4M	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		24.0	
		CNY17F2M/F3M/F4M				
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	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		39.0	
		CNY17F2M/F3M/F4M				

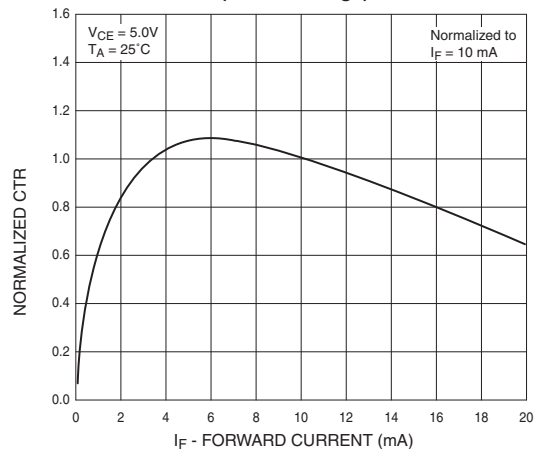
** All typicals at $T_A = 25^\circ\text{C}$ **Notes:**

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 20.
4. For this test, Pins 1 and 2 are common, and Pins 4 and 5 are common.

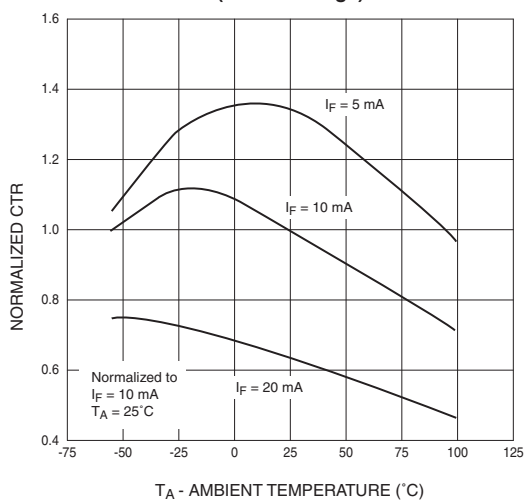
**Fig.1 Normalized CTR vs. Forward Current
(Black Package)**



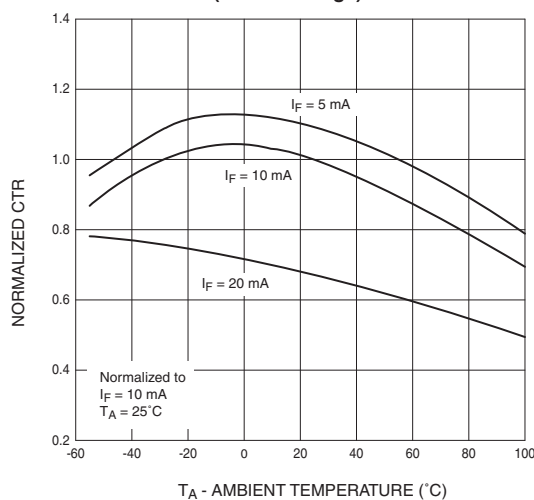
**Fig.2 Normalized CTR vs. Forward Current
(White Package)**



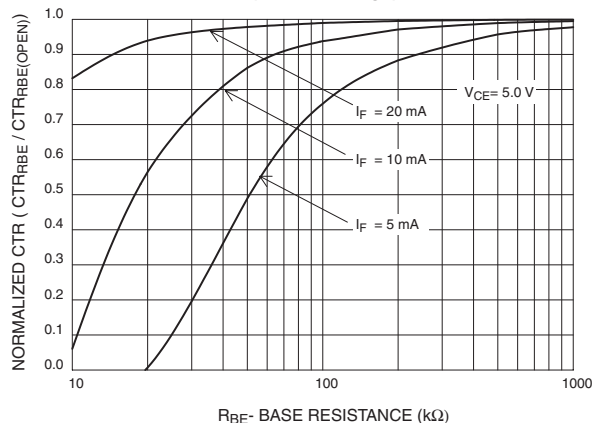
**Fig. 3 Normalized CTR vs. Ambient Temperature
(Black Package)**



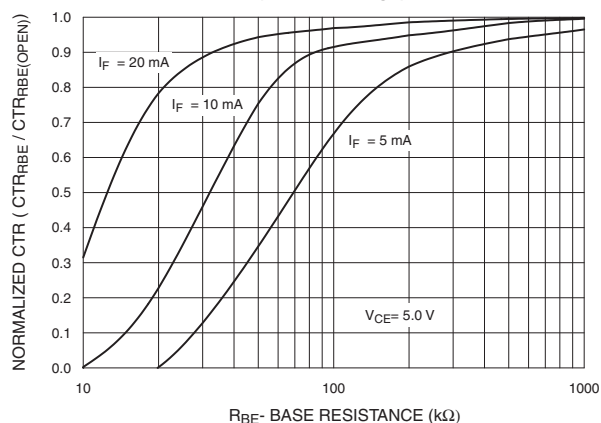
**Fig. 4 Normalized CTR vs. Ambient Temperature
(White Package)**



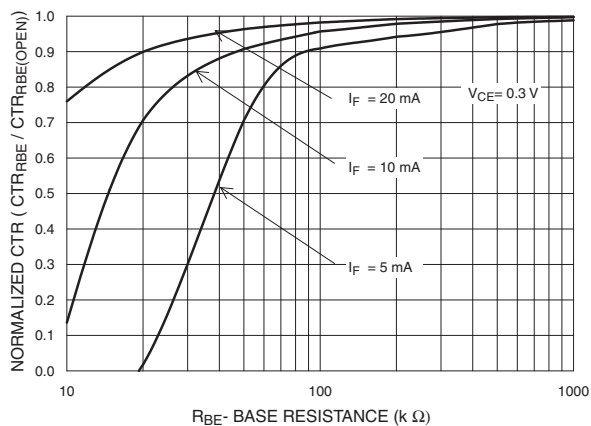
**Fig. 5 CTR vs. RBE (Unsaturated)
(Black Package)**



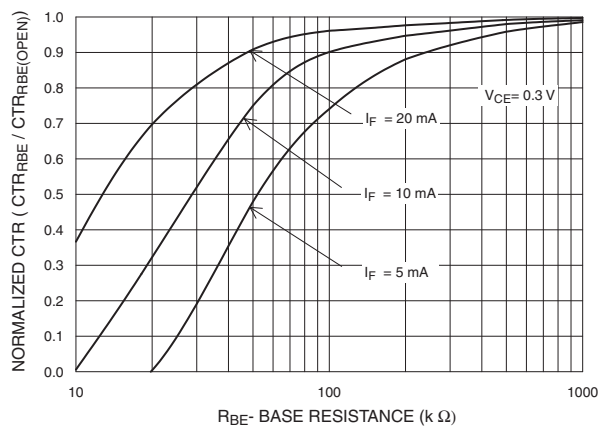
**Fig. 6 CTR vs. RBE (Unsaturated)
(White Package)**



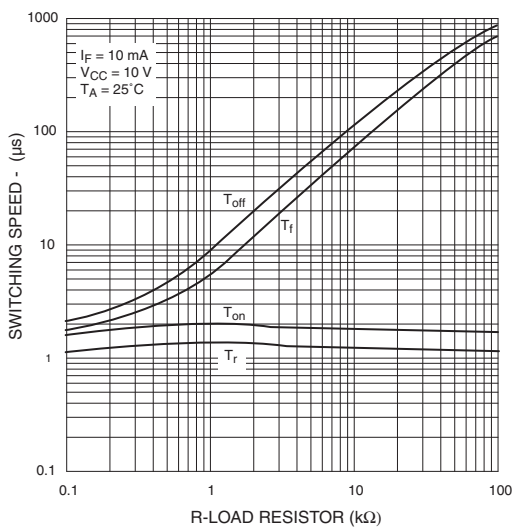
**Fig. 7 CTR vs. R_{BE} (Saturated)
(Black Package)**



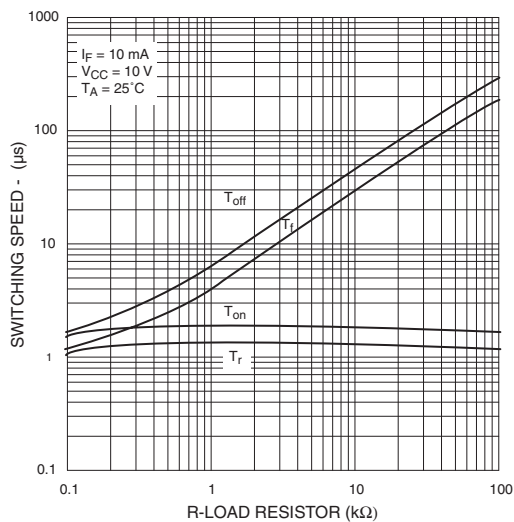
**Fig. 8 CTR vs. R_{BE} (Saturated)
(White Package)**



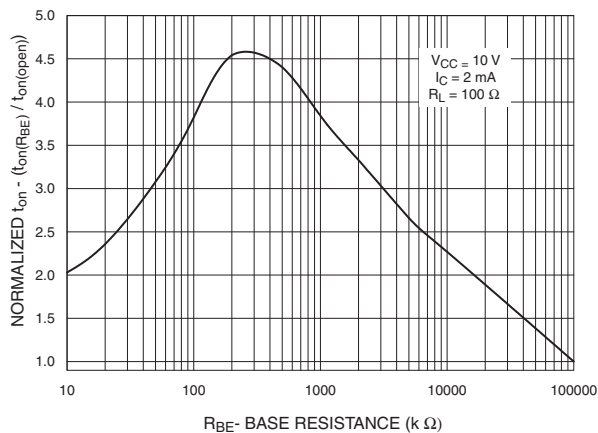
**Fig. 9 Switching Speed vs. Load Resistor
(Black Package)**



**Fig. 10 Switching Speed vs. Load Resistor
(White Package)**



**Fig. 11 Normalized t_{on} vs. R_{BE}
(Black Package)**



**Fig. 12 Normalized t_{on} vs. R_{BE}
(White Package)**

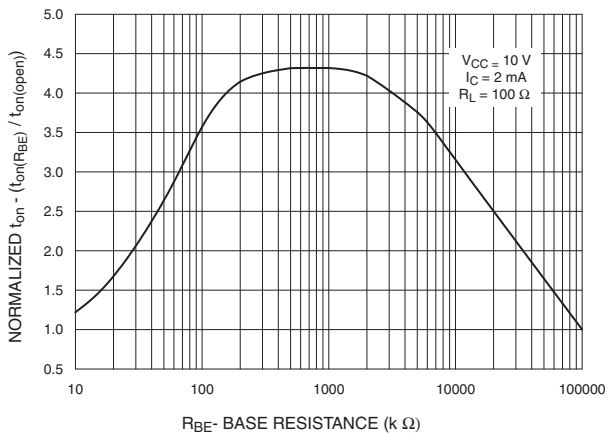


Fig. 13 Normalized t_{off} vs. R_{BE}
(Black Package)

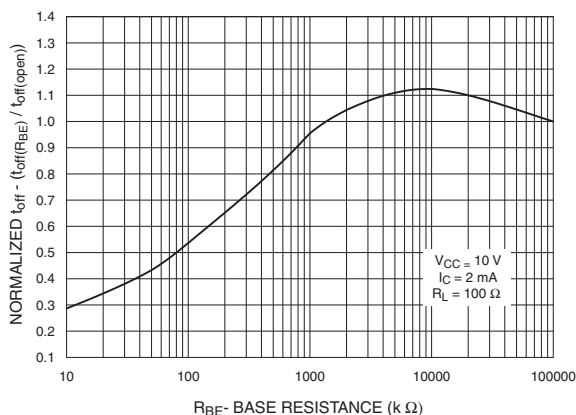


Fig. 14 Normalized t_{off} vs. R_{BE}
(White Package)

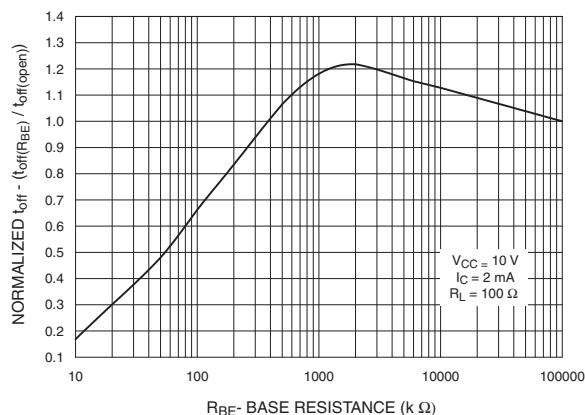


Fig. 15 LED Forward Voltage vs. Forward Current
(Black Package)

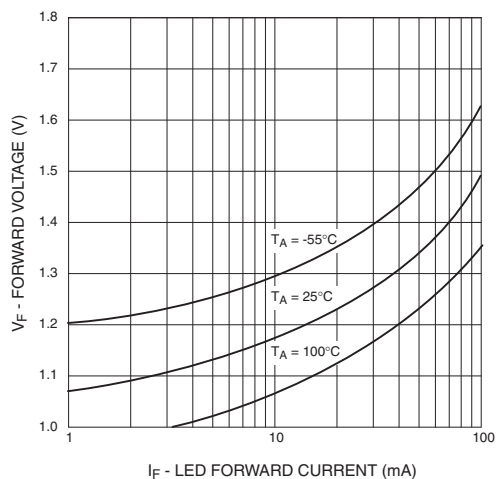


Fig. 16 LED Forward Voltage vs. Forward Current
(White Package)

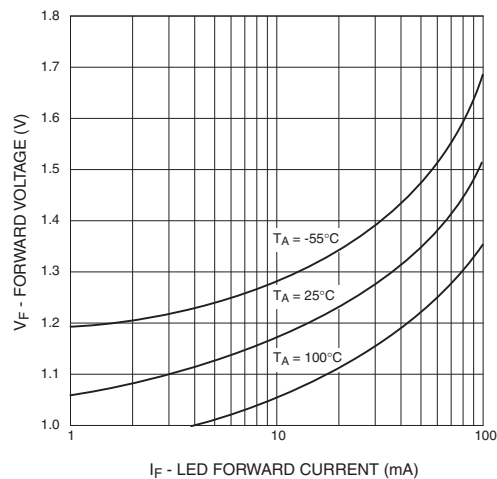


Fig. 17 Collector-Emitter Saturation Voltage vs Collector Current
(Black Package)

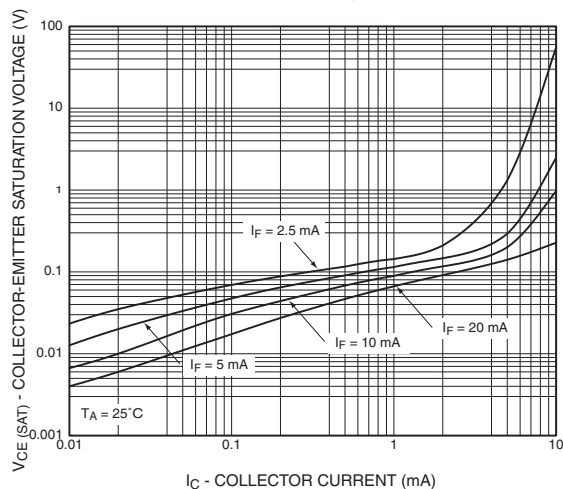
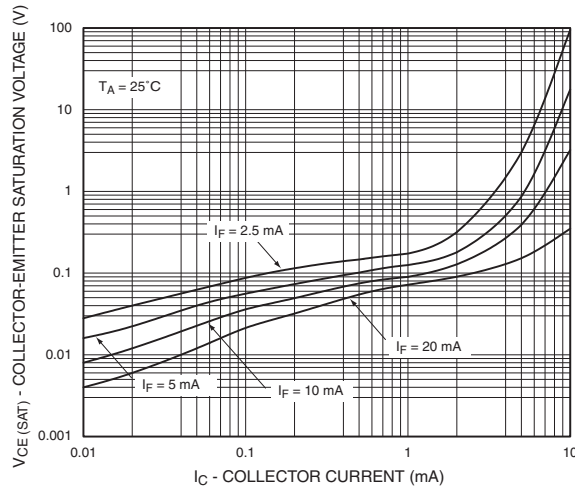


Fig. 18 Collector-Emitter Saturation Voltage vs Collector Current
(White Package)



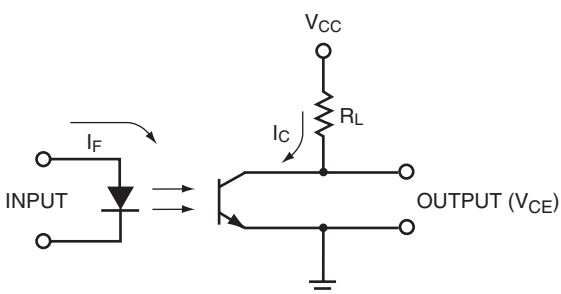
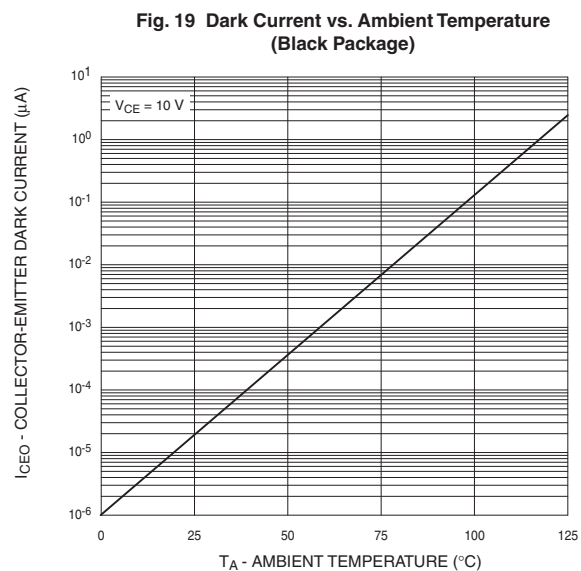


Figure 20. Switching Time Test Circuit

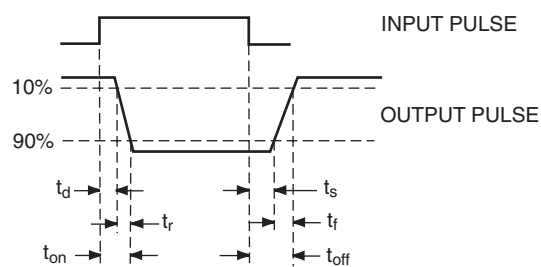
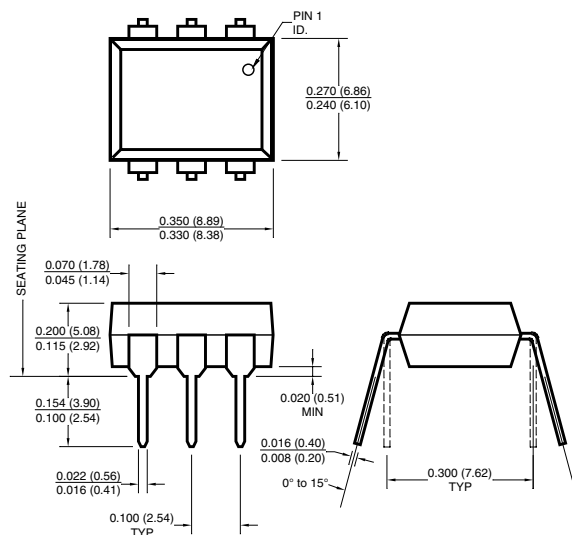


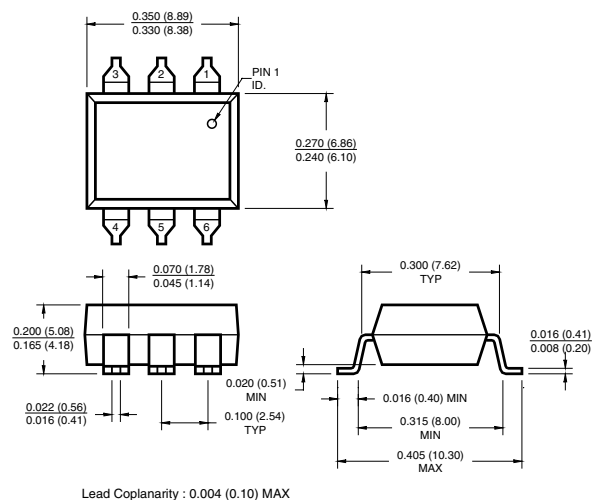
Figure 21. Switching Time Test Circuit

Black Package (No -M Suffix)

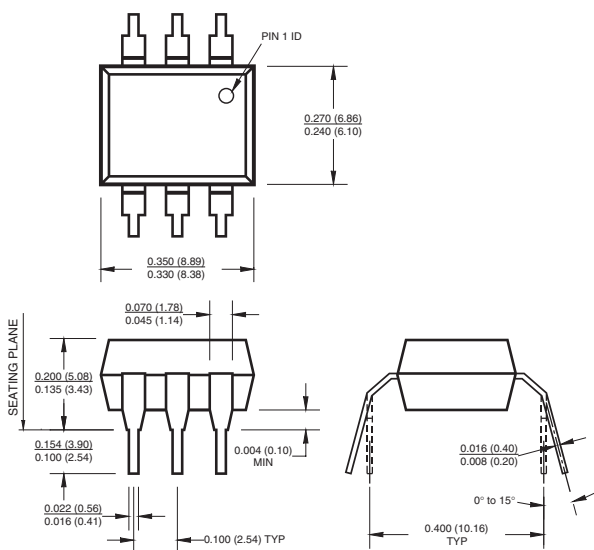
Package Dimensions (Through Hole)



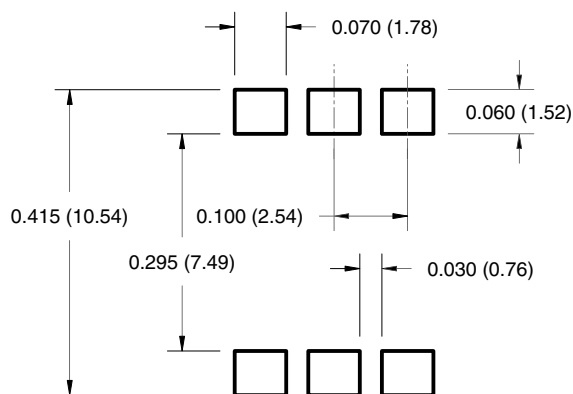
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform (Black Package Only)

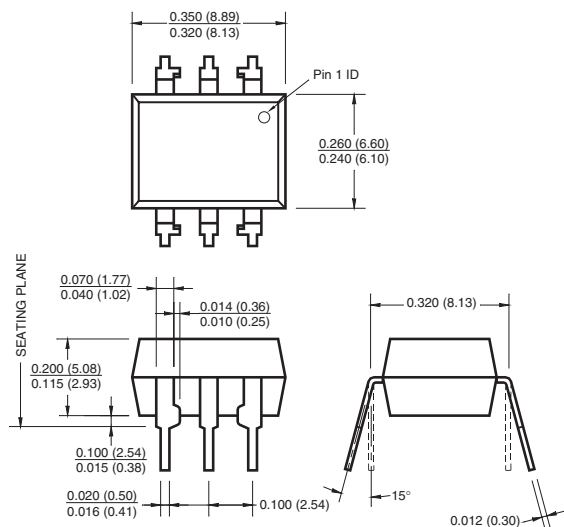


Note:

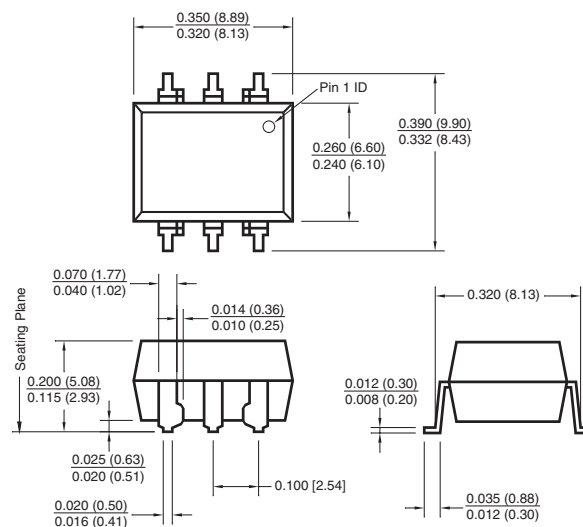
All dimensions are in inches (millimeters)

White Package (-M Suffix)

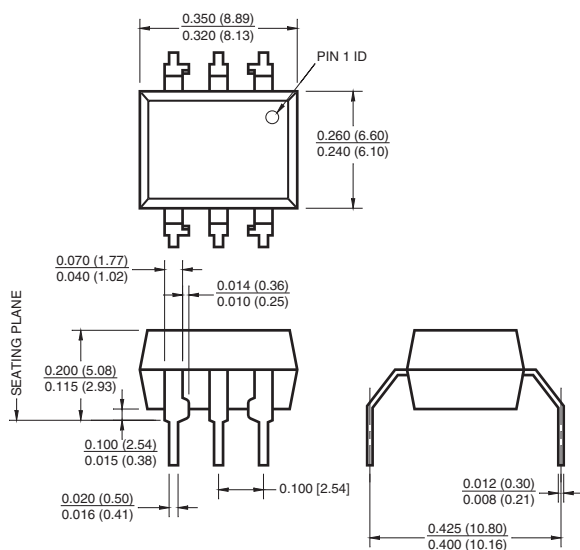
Package Dimensions (Through Hole)



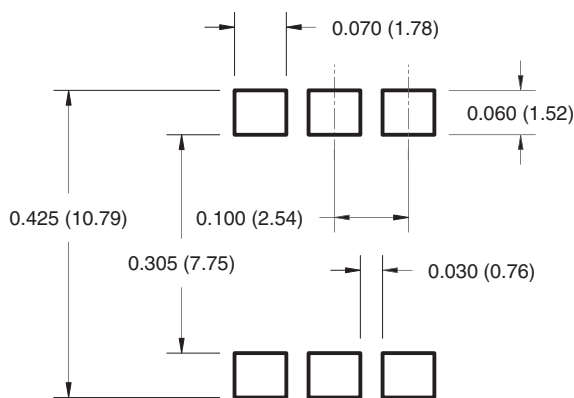
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



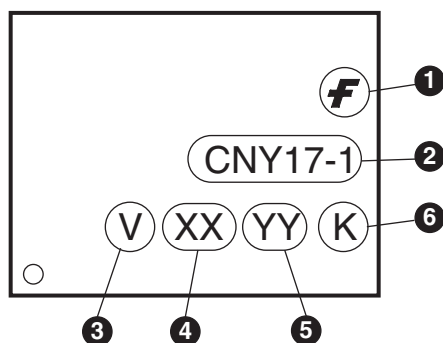
Recommended Pad Layout for Surface Mount Leadform (White Package Only)



Note:

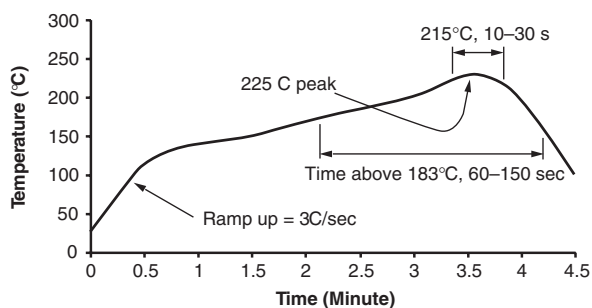
All dimensions are in inches (millimeters)

Marking Information (Black package non 'M' suffix)



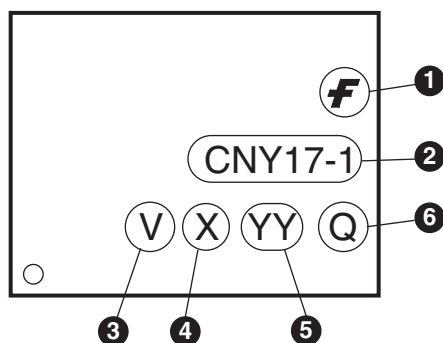
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	Two digits year code, e.g., '03'; One digit year code for 'M' version, e.g. '5'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

Reflow Profile (Black Package, No Suffix)



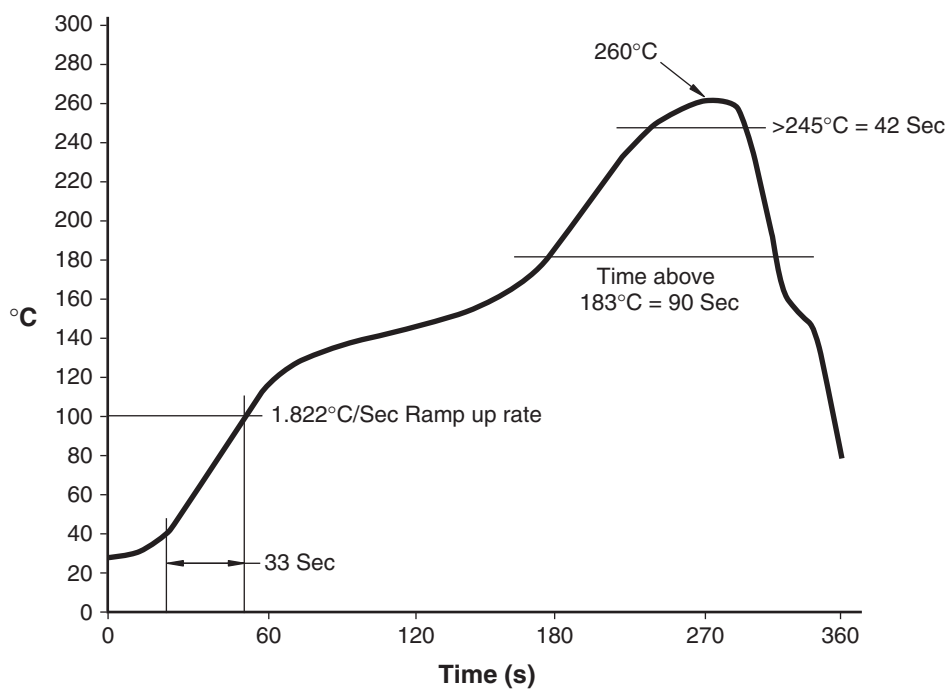
- Peak reflow temperature: 225°C (package surface temperature)
- Time of temperature higher than 183°C for 60-150 seconds
- One time soldering reflow is recommended

Marking Information (White package M suffix)



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

Reflow Profile (White Package, M Suffix)



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CoolFET [™]	I ² C [™]	PACMAN [™]	SuperFET [™]	
CROSSVOLT [™]	i-Lo [™]	POP [™]	SuperSOT [™] -3	
DOME [™]	ImpliedDisconnect [™]	Power247 [™]	SuperSOT [™] -6	
EcoSPARK [™]	IntelliMAX [™]	PowerEdge [™]	SuperSOT [™] -8	
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