

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)

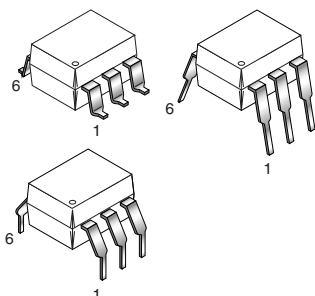
Applications

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

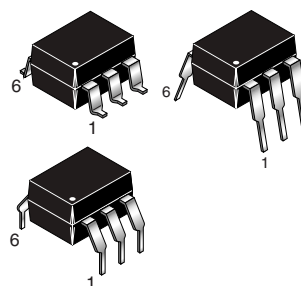
Description

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

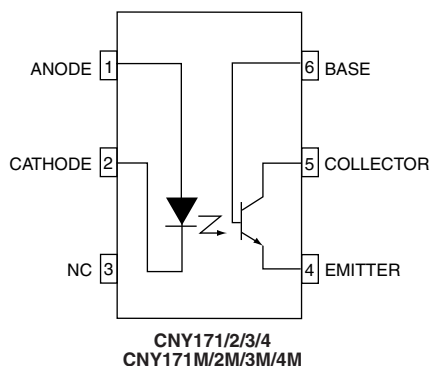
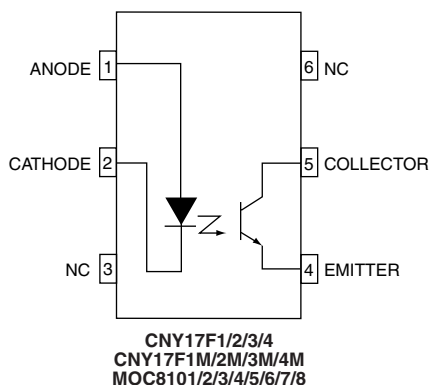
White Package (-M Suffix)



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	

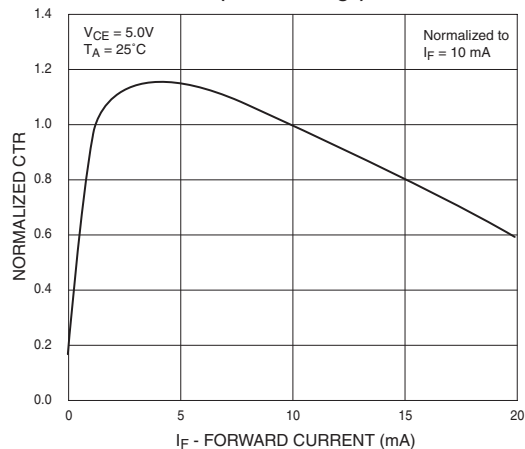
Transfer Characteristics (Continued) ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)⁽¹⁾

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				

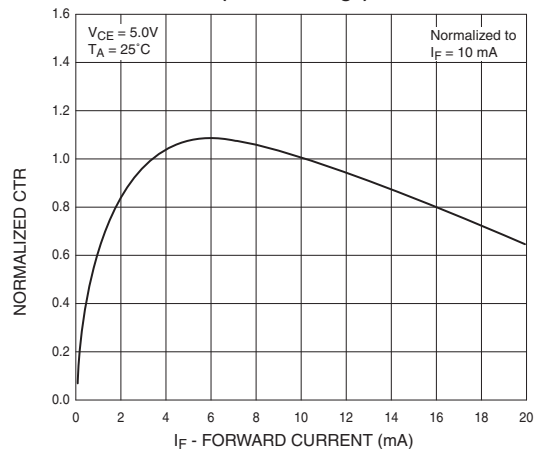
** All typicals at $T_A = 25^\circ\text{C}$ **Notes:**

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.

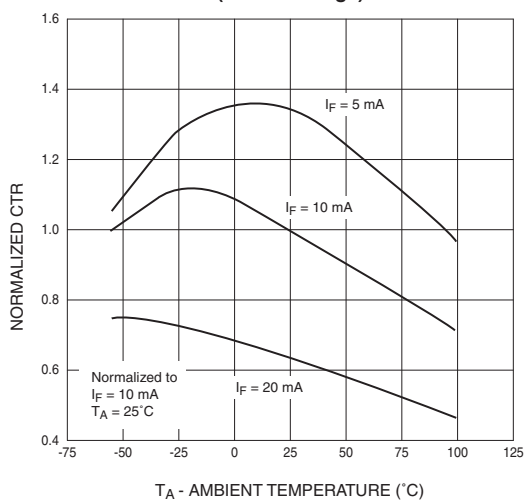
**Fig.1 Normalized CTR vs. Forward Current
(Black Package)**



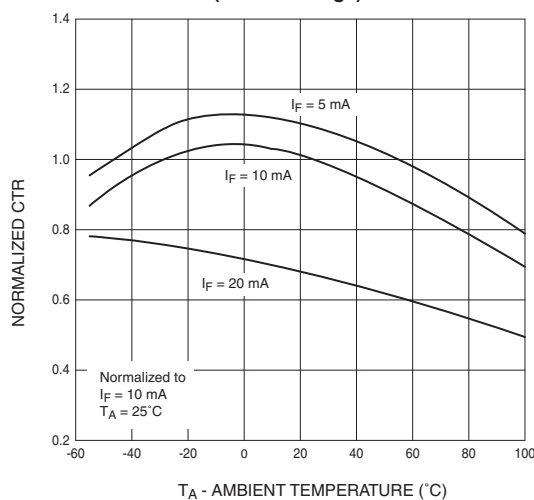
**Fig.2 Normalized CTR vs. Forward Current
(White Package)**



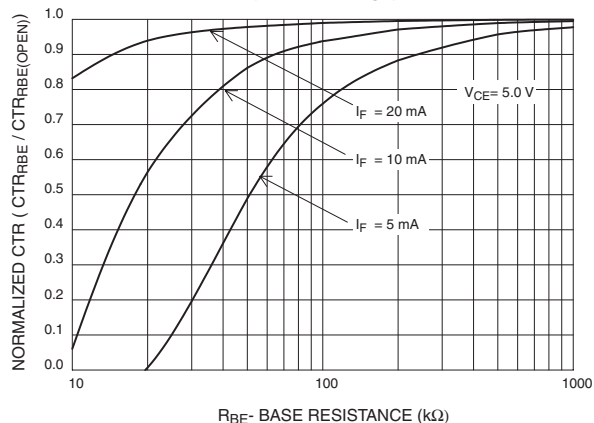
**Fig. 3 Normalized CTR vs. Ambient Temperature
(Black Package)**



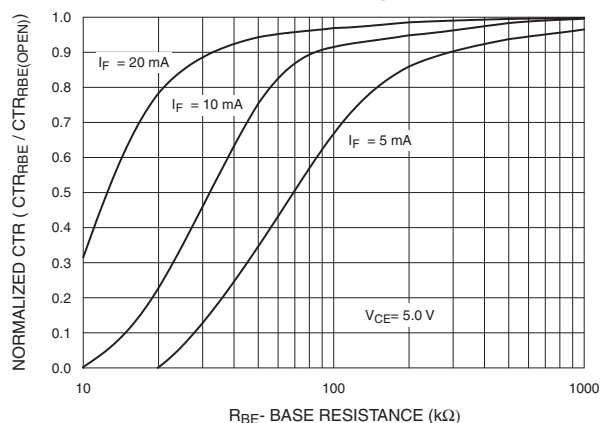
**Fig. 4 Normalized CTR vs. Ambient Temperature
(White Package)**



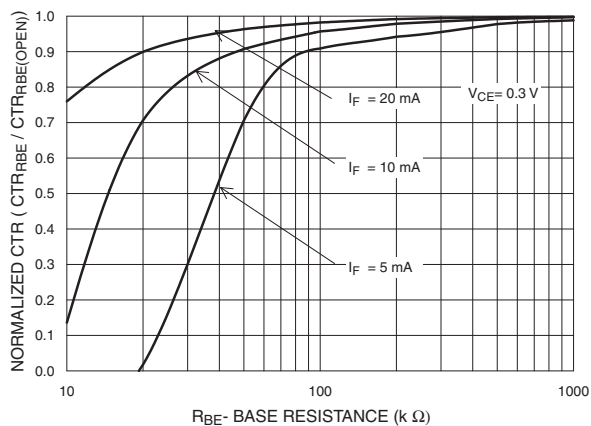
**Fig. 5 CTR vs. RBE (Unsaturated)
(Black Package)**



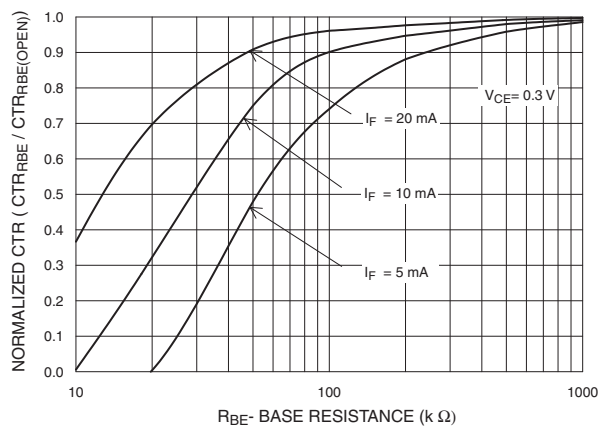
**Fig. 6 CTR vs. RBE (Unsaturated)
(White Package)**



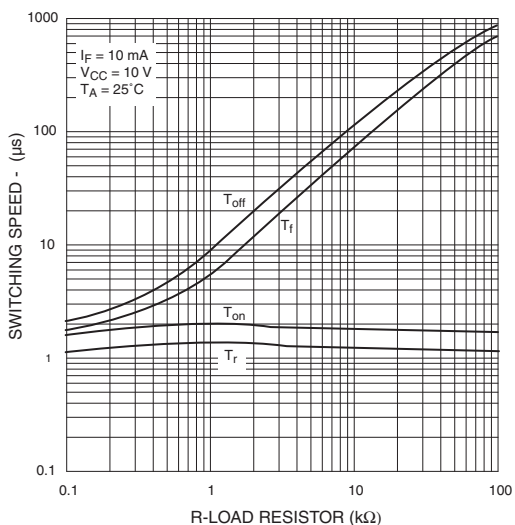
**Fig. 7 CTR vs. R_{BE} (Saturated)
(Black Package)**



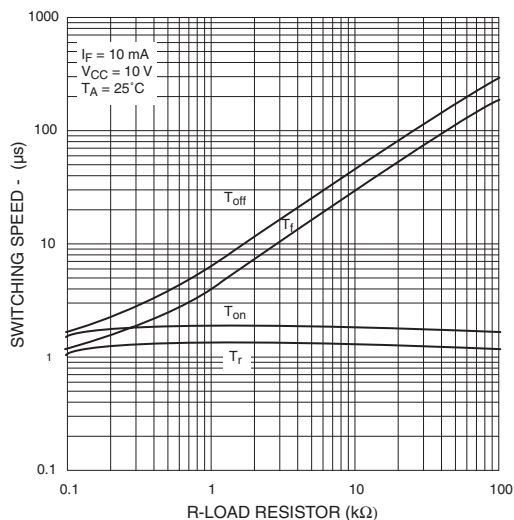
**Fig. 8 CTR vs. R_{BE} (Saturated)
(White Package)**



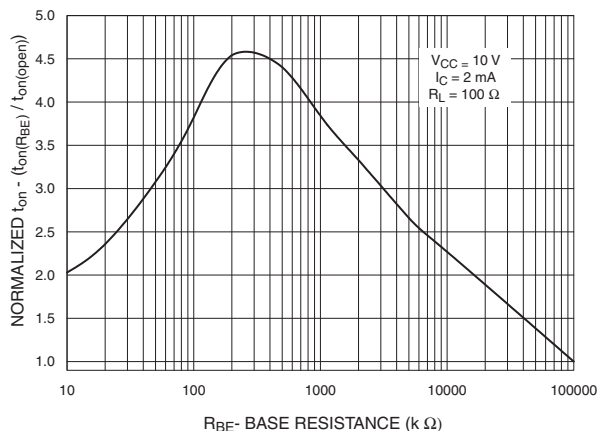
**Fig. 9 Switching Speed vs. Load Resistor
(Black Package)**



**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)**

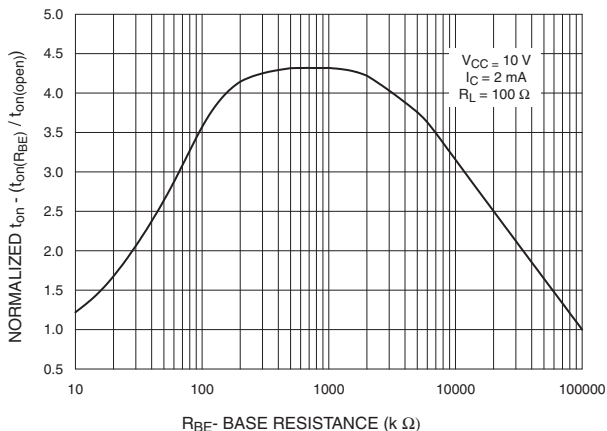


Fig. 13 Normalized t_{off} vs. R_{BE}
(Black Package)

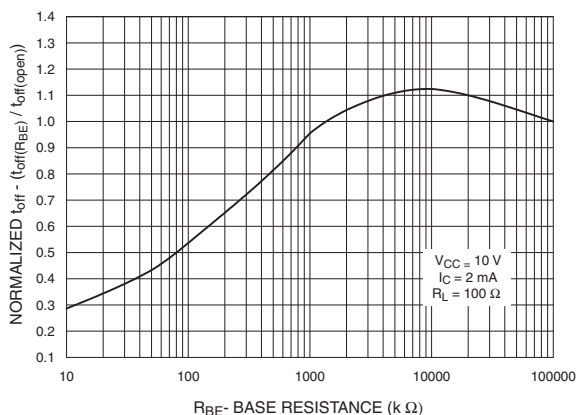


Fig. 14 Normalized t_{off} vs. R_{BE}
(White Package)

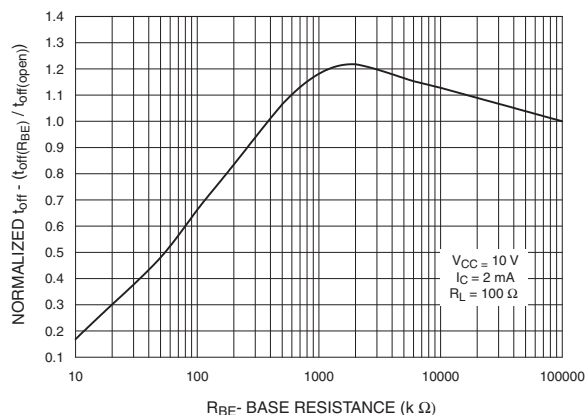


Fig. 15 LED Forward Voltage vs. Forward Current
(Black Package)

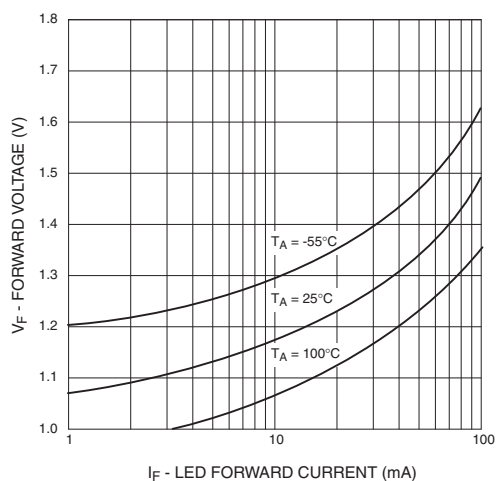


Fig. 16 LED Forward Voltage vs. Forward Current
(White Package)

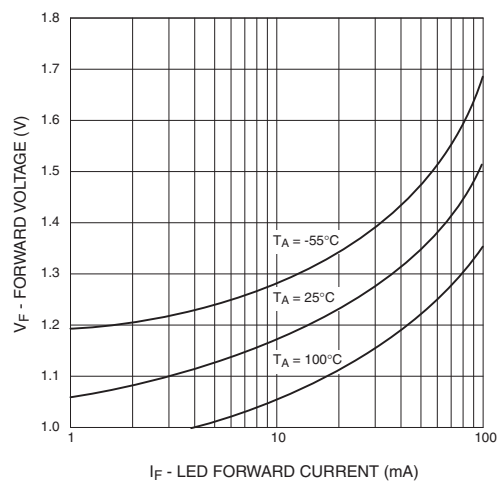


Fig. 17 Collector-Emitter Saturation Voltage vs Collector Current
(Black Package)

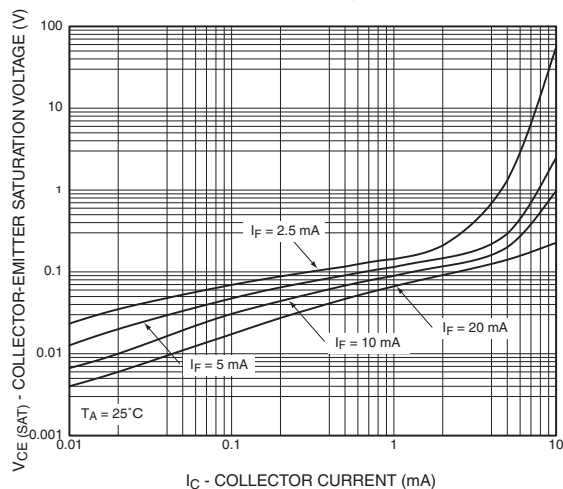


Fig. 18 Collector-Emitter Saturation Voltage vs Collector Current
(White Package)

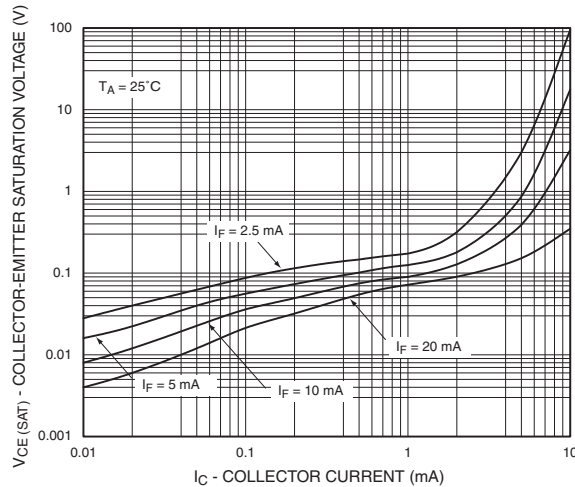


Fig. 19 Dark Current vs. Ambient Temperature
(Black Package)

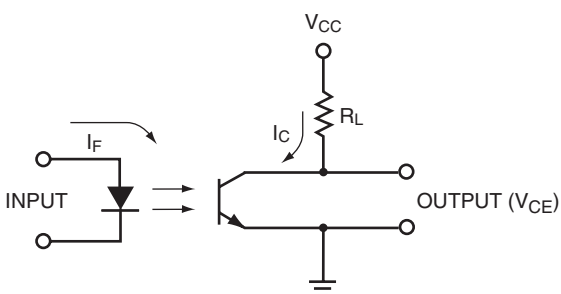
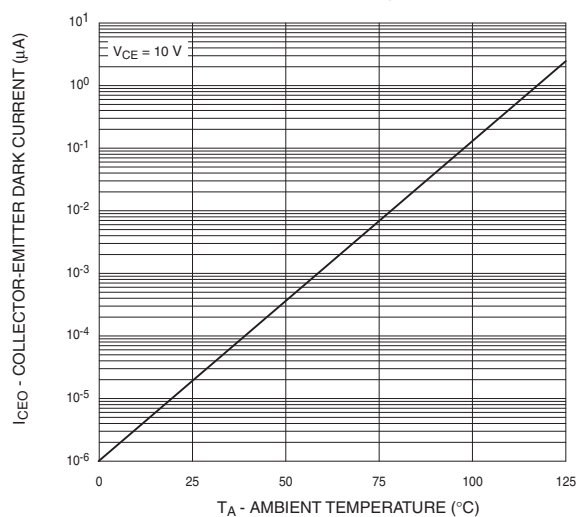


Figure 20. Switching Time Test Circuit

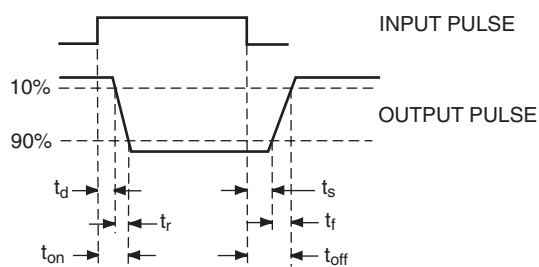
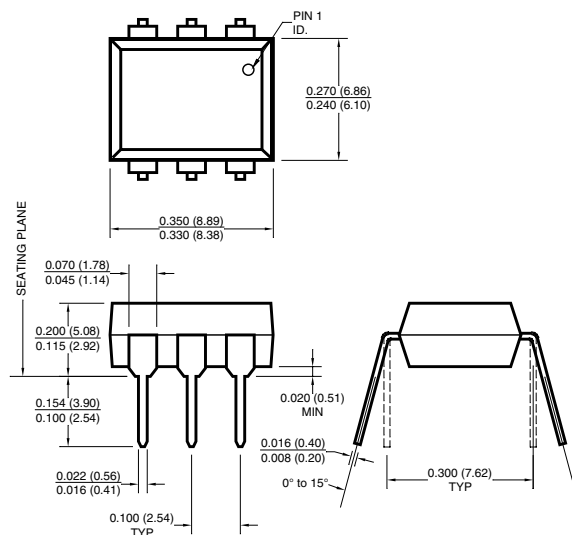


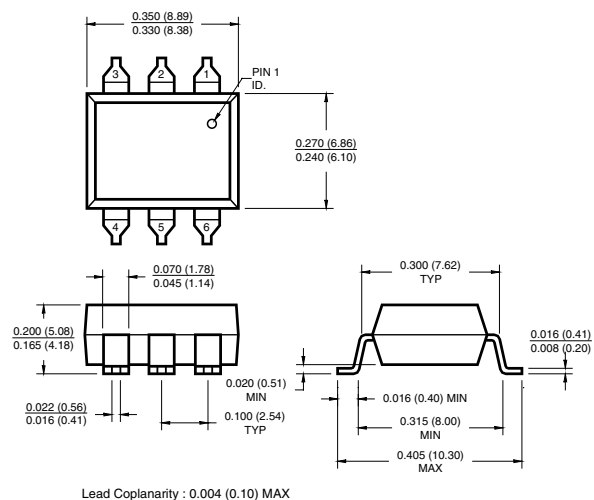
Figure 21. Switching Time Test Circuit

Black Package (No -M Suffix)

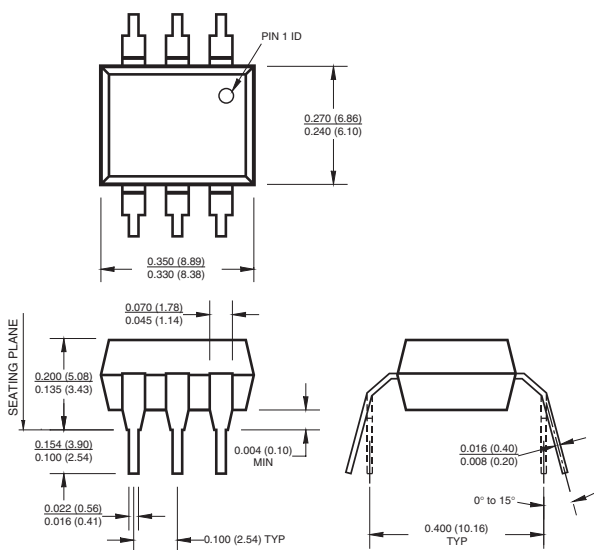
Package Dimensions (Through Hole)



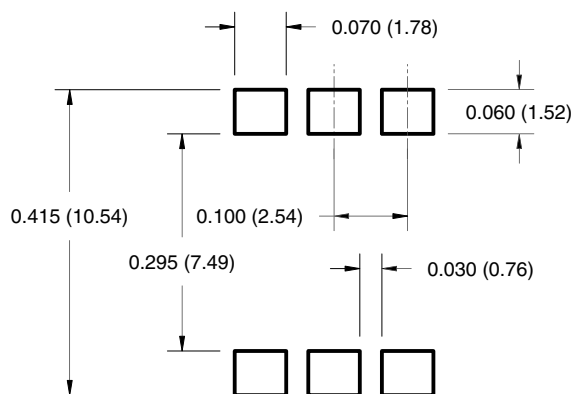
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



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

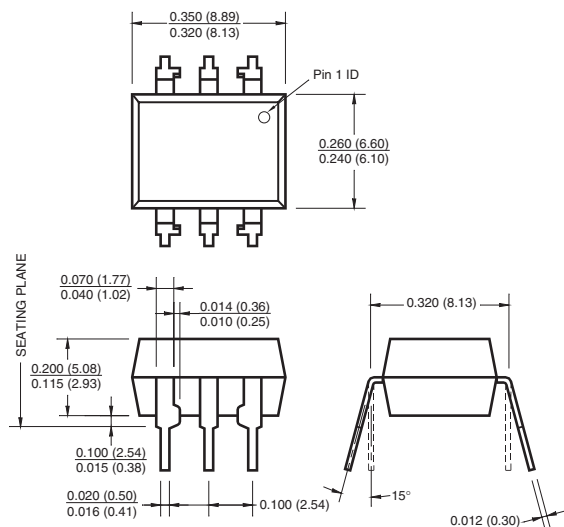


Note:

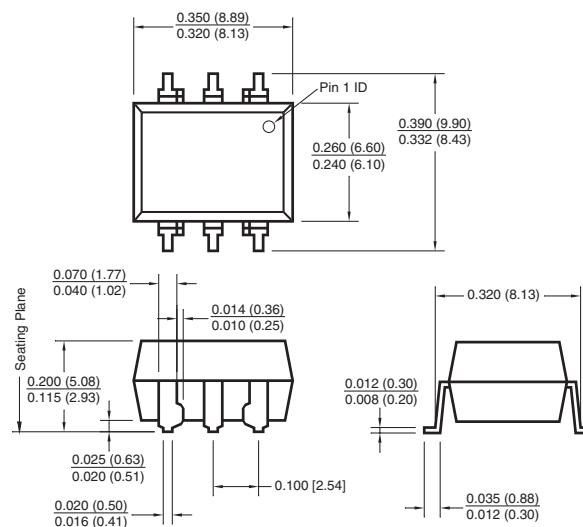
All dimensions are in inches (millimeters)

White Package (-M Suffix)

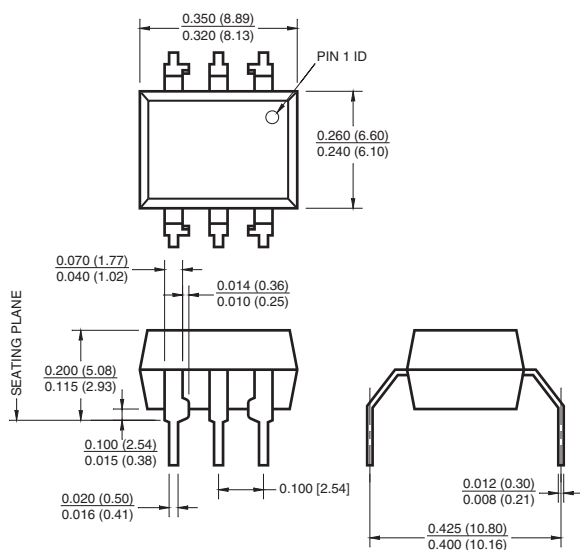
Package Dimensions (Through Hole)



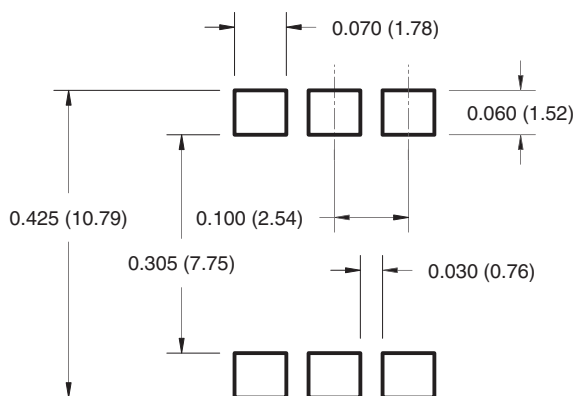
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



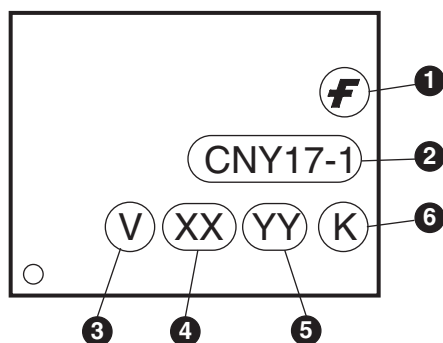
Recommended Pad Layout for Surface Mount Leadform (White Package Only)



Note:

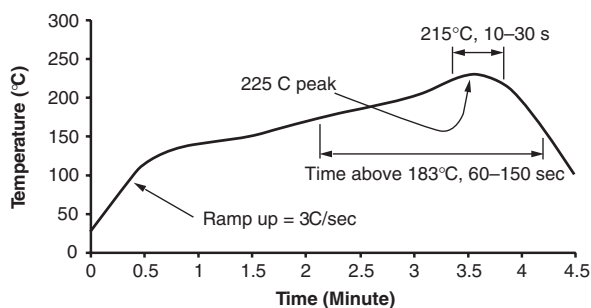
All dimensions are in inches (millimeters)

Marking Information (Black package non 'M' suffix)



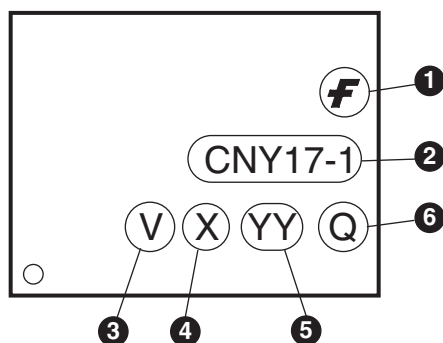
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	Two digits year code, e.g., '03'; One digit year code for 'M' version, e.g. '5'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

Reflow Profile (Black Package, No Suffix)



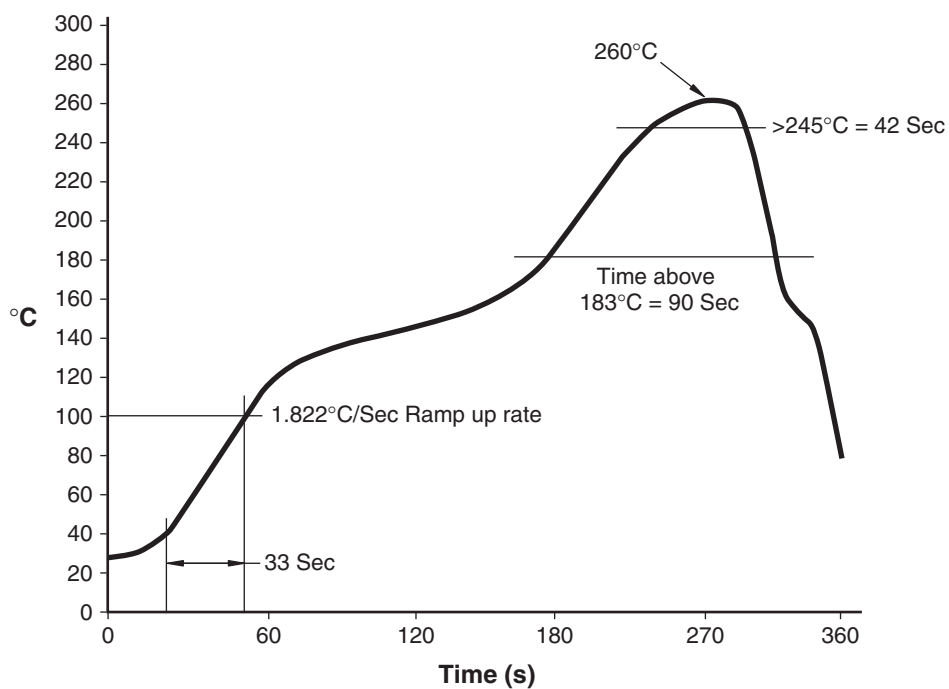
- Peak reflow temperature: 225°C (package surface temperature)
- Time of temperature higher than 183°C for 60-150 seconds
- One time soldering reflow is recommended

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)



TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE [™]	FACT Quiet Series [™]	OCX [™]	SILENT SWITCHER [®]	UniFET [™]
ActiveArray [™]	GlobalOptoisolator [™]	OCXPro [™]	SMART START [™]	UltraFET [®]
Bottomless [™]	GTO [™]	OPTOLOGIC [®]	SPM [™]	VCX [™]
Build it Now [™]	HiSeC [™]	OPTOPLANAR [™]	Stealth [™]	Wire [™]
CoolFET [™]	I ² C [™]	PACMAN [™]	SuperFET [™]	
CROSSVOLT [™]	i-Lo [™]	POP [™]	SuperSOT [™] -3	
DO [™]	ImpliedDisconnect [™]	Power247 [™]	SuperSOT [™] -6	
EcoSPARK [™]	IntelliMAX [™]	PowerEdge [™]	SuperSOT [™] -8	
E ² C [™]	ISOPLANAR [™]	PowerSaver [™]	SyncFET [™]	
EnSigna [™]	LittleFET [™]	PowerTrench [®]	TCM [™]	
FACT [™]	MICROCOUPLER [™]	QFET [®]	TinyBoost [™]	
FAST [®]	MicroFET [™]	QS [™]	TinyBuck [™]	
FAST [™]	MicroPak [™]	QT Optoelectronics [™]	TinyPWM [™]	
FPS [™]	MICROWIRE [™]	Quiet Series [™]	TinyPower [™]	
FRFET [™]	MSX [™]	RapidConfigure [™]	TinyLogic [®]	
	MSXPro [™]	RapidConnect [™]	TINYOPTO [™]	
Across the board. Around the world. [™]		μSerDes [™]	TruTranslation [™]	
The Power Franchise [®]		ScalarPump [™]	UHC [™]	
Programmable Active Droop [™]				

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and 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	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. I20