

# 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)

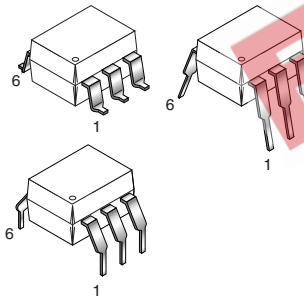
## Applications

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

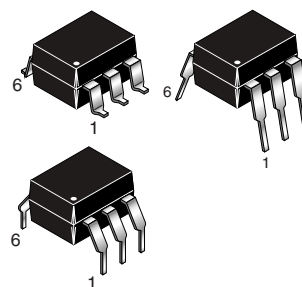
## Description

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

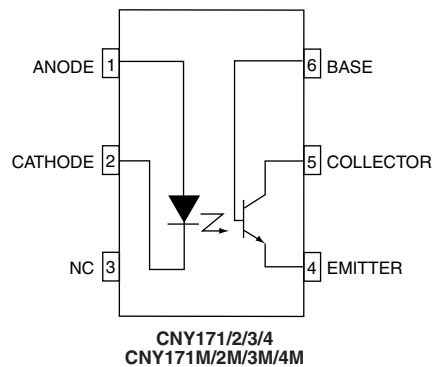
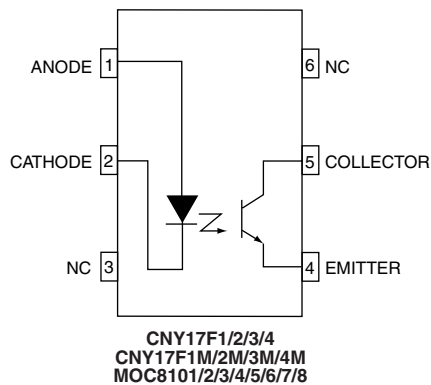
## White Package (-M Suffix)



## Black Package (No -M Suffix)



## Schematic



## Absolute Maximum Ratings

Symbol	Parameters	Device	Value	Units
<b>TOTAL DEVICE</b>				
T <sub>STG</sub>	Storage Temperature	M	-40 to +150	°C
		non M	-55 to +150	
T <sub>OPR</sub>	Operating Temperature	M	-40 to +100	°C
		non M	-55 to +100	
T <sub>SOL</sub>	Lead Solder Temperature	All	260 for 10 sec	°C
P <sub>D</sub>	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	
<b>EMITTER</b>				
I <sub>F</sub>	Continuous Forward Current	M	60	mA
		non M	100	
V <sub>R</sub>	Reverse Voltage	All	6	V
I <sub>F</sub> (pk)	Forward Current - Peak (1 μs pulse, 300 pps)	M	1.5	A
		non M	1.0	
P <sub>D</sub>	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	
<b>DETECTOR</b>				
I <sub>C</sub>	Continuous Collector Current	All	50	mA
V <sub>CEO</sub>	Collector-Emitter Voltage	CNY17X/M, CNY17FX/M, MOC8106/7/8	70	V
		MOC8101/2/3/4/5	30	V
V <sub>ECO</sub>	Emitter Collector Voltage	All	7	V
P <sub>D</sub>	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<sub>A</sub> = 25°C Unless otherwise specified.)<sup>(1)</sup>

### Individual Component Characteristics

Symbol	Parameters	Test Conditions	Device	Min.	Typ.	Max.	Units
<b>EMITTER</b>							
V <sub>F</sub>	Input Forward Voltage	I <sub>F</sub> = 60mA	CNY17FX/M CNY17X/M	1.0	1.35	1.65	V
		I <sub>F</sub> = 10mA	MOC810X	1.0	1.15	1.50	
C <sub>J</sub>	Capacitance	V <sub>F</sub> = 0 V, f = 1.0MHz	All		18		pF
I <sub>R</sub>	Reverse Leakage Current	V <sub>R</sub> = 6 V	All		0.001	10	μA
<b>DETECTOR</b>							
BV <sub>CEO</sub>	Breakdown Voltage Collector to Emitter	I <sub>C</sub> = 1.0mA, I <sub>F</sub> = 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 <sub>CBO</sub>	Collector to Base	I <sub>C</sub> = 10μA, I <sub>F</sub> = 0	CNY171/2/3/4/M	70	120		
BV <sub>ECO</sub>	Emitter to Collector	I <sub>E</sub> = 100μA, I <sub>F</sub> = 0	All	7	10		
I <sub>CEO</sub>	Leakage Current Collector to Emitter	V <sub>CE</sub> = 10 V, I <sub>F</sub> = 0	All		1	50	nA
I <sub>CBO</sub>	Collector to Base	V <sub>CB</sub> = 10 V, I <sub>F</sub> = 0	CNY171/2/3/4/M			20	nA
C <sub>CE</sub>	Capacitance Collector to Emitter	V <sub>CE</sub> = 0, f = 1MHz	All		8		pF
C <sub>CB</sub>	Collector to Base	V <sub>CB</sub> = 0, f = 1MHz	CNY171/2/3/4/M		20		pF
C <sub>EB</sub>	Emitter to Base	V <sub>EB</sub> = 0, f = 1MHz	CNY171/2/3/4/M		10		pF

### Isolation Characteristics

Symbol	Characteristic	Test Conditions	Device	Min.	Typ.**	Max.	Units
V <sub>ISO</sub>	Input-Output Isolation Voltage	f = 60 Hz, t = 1 min., I <sub>I-O</sub> ≤ 2μA <sup>(4)</sup>	Black Package	5300			Vac(rms)*
		f = 60 Hz, t = 1 sec., I <sub>I-O</sub> ≤ 2μA <sup>(4)</sup>	'M' White Package	7500			Vac(pk)
R <sub>ISO</sub>	Isolation Resistance	V <sub>I-O</sub> = 500 VDC <sup>(4)</sup>	All	10 <sup>11</sup>			Ω
C <sub>ISO</sub>	Isolation Capacitance	V <sub>I-O</sub> = ∅, f = 1MHz <sup>(4)</sup>	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<sub>A</sub> = 25°C

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

Symbol	DC Characteristics		Test Conditions	Min.	Typ.	Max.	Units
<b>COUPLED</b>							
(CTR) <sup>(2)</sup>	Output Collector Current	MOC8101	$I_F = 10\text{mA}, V_{CE} = 10\text{V}$	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	$I_F = 10\text{mA}, V_{CE} = 5\text{V}$	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	$I_C = 2.5\text{mA}, I_F = 10\text{mA}$			0.4	V
		MOC8101/2/3/4/5/6/7/8	$I_C = 500\mu\text{A}, I_F = 5.0\text{mA}$				
		CNY17X/FX	$I_F = 10\text{mA}, I_C = 2.5\text{mA}$			0.3	V

Symbol	AC Characteristics <sup>(3)</sup>		Test Conditions	Min.	Typ.*	Max.	Units
<b>NON-SATURATED SWITCHING TIME</b>							
$t_{on}$	Turn-On Time	MOC8101/2/3/4/5	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$		2	20	$\mu\text{s}$
		MOC8106/7/8					
		CNY17X/FX				10	
$t_{off}$	Turn-Off Time	MOC8101/2/3/4/5	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$		3	20	$\mu\text{s}$
		MOC8106/7/8					
		CNY17X/FX				10	
$t_d$	Delay Time	CNY17XM/FXM	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 75\Omega$			5.6	$\mu\text{s}$
$t_r$	Rise Time	All Devices	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$		1		$\mu\text{s}$
		CNY17XM/FXM	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 75\Omega$			4.0	
$t_s$	Storage Time	CNY17XM/FXM	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 75\Omega$			4.1	$\mu\text{s}$
$t_f$	Fall Time	All Devices	$I_C = 2.0\text{mA}, V_{CC} = 10\text{V}, R_L = 100\Omega$		2		$\mu\text{s}$
		CNY17XM/FXM	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 75\Omega$			3.5	

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

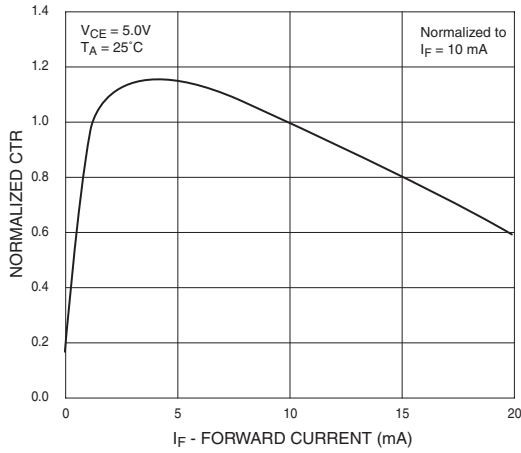
Symbol	AC Characteristics <sup>(3)</sup>	Test Conditions	Min.	Typ.	Max.	Units
<b>SATURATED SWITCHING TIMES</b>						
$t_{on}$	Turn-on Time	CNY171/F1	$I_F = 20\text{mA}, V_{CE} = 0.4\text{V}$		5.5	$\mu\text{s}$
		CNY172/F2 CNY173/F3 CNY174/F4	$I_F = 10\text{mA}, V_{CE} = 0.4\text{V}$		8.0	
$t_r$	Rise Time	CNY171/F1	$I_F = 20\text{mA}, V_{CE} = 0.4\text{V}$		4.0	$\mu\text{s}$
		CNY172/F1 CNY173/F3 CNY174/F4	$I_F = 10\text{mA}, V_{CE} = 0.4\text{V}$		6.0	
		CNY171M/F1M	$I_F = 20\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		4.0	
		CNY172M/3M/4M CNY17F2M/F3M/F4M	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		6.0	
$t_d$	Delay Time	CNY171M/F1M	$I_F = 20\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		5.5	$\mu\text{s}$
		CNY172M/3M/4M CNY17F2M/F3M/F4M	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		8.0	
$t_{off}$	Turn-off Time	CNY171/F1	$I_F = 20\text{mA}, V_{CE} = 0.4\text{V}$		34	$\mu\text{s}$
		CNY172/F2 CNY173/F3 CNY174/F4	$I_F = 10\text{mA}, V_{CE} = 0.4\text{V}$		39	
$t_f$	Fall Time	CNY171/F1	$I_F = 20\text{mA}, V_{CE} = 0.4\text{V}$		20	$\mu\text{s}$
		CNY172/F2 CNY173/F3 CNY174/F4	$I_F = 10\text{mA}, V_{CE} = 0.4\text{V}$		24	
		CNY171M/F1M	$I_F = 20\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		20.0	$\mu\text{s}$
		CNY172M/3M/4M CNY17F2M/F3M/F4M	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		24.0	
$t_s$	Storage Time	CNY171M/F1M	$I_F = 20\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		34.0	$\mu\text{s}$
		CNY172M/3M/4M CNY17F2M/F3M/F4M	$I_F = 10\text{mA}, V_{CC} = 5\text{V}, R_L = 1\text{k}\Omega$		39.0	

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

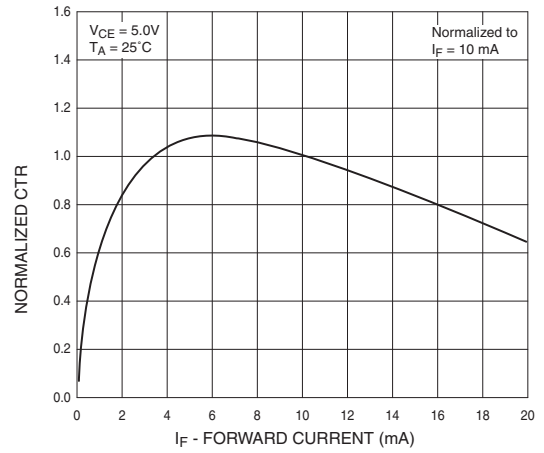
**Notes:**

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

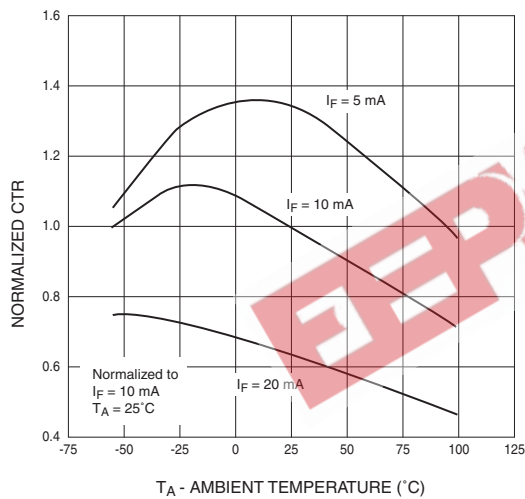
**Fig.1 Normalized CTR vs. Forward Current (Black Package)**



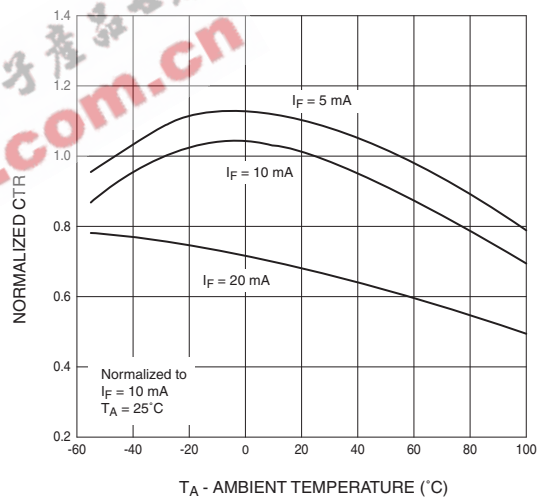
**Fig.2 Normalized CTR vs. Forward Current (White Package)**



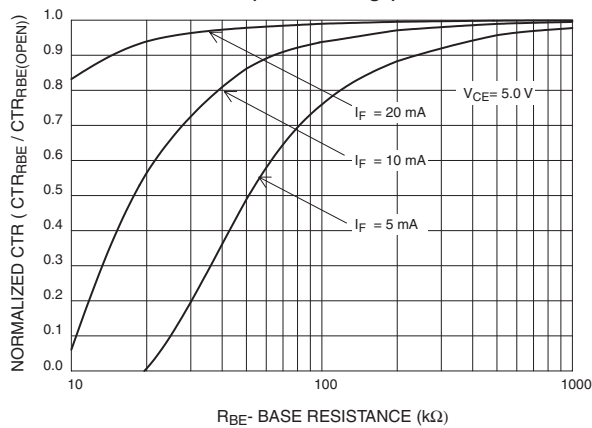
**Fig.3 Normalized CTR vs. Ambient Temperature (Black Package)**



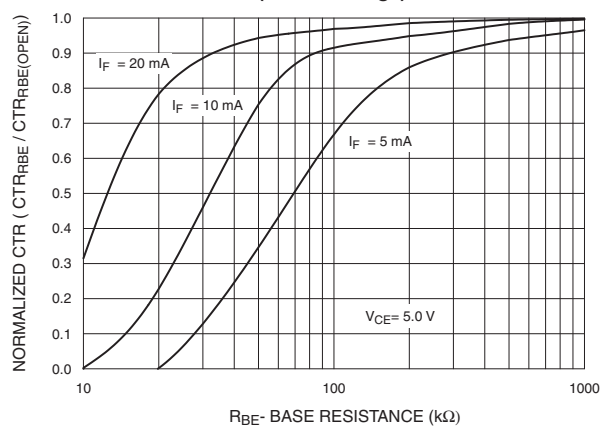
**Fig.4 Normalized CTR vs. Ambient Temperature (White Package)**



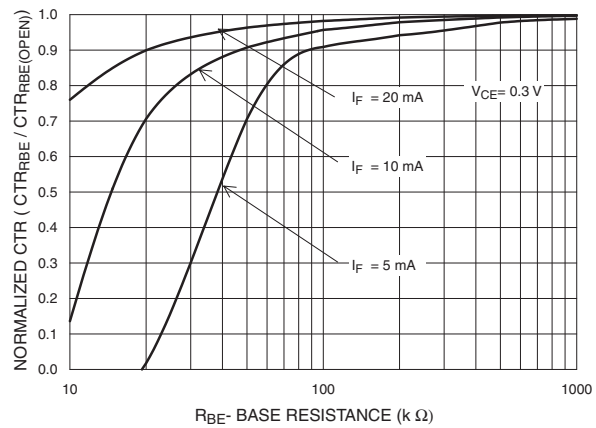
**Fig.5 CTR vs. RBE (Unsaturated) (Black Package)**



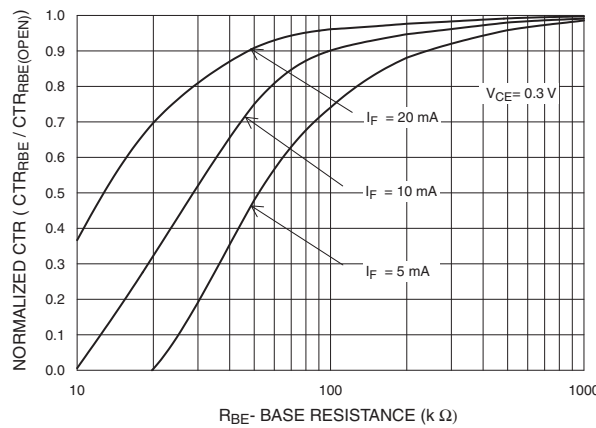
**Fig.6 CTR vs. RBE (Unsaturated) (White Package)**



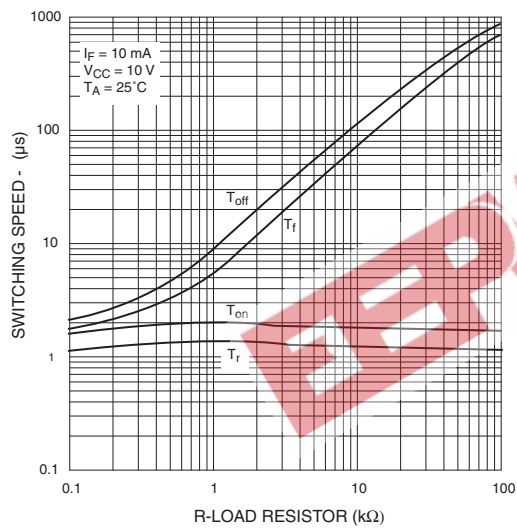
**Fig. 7 CTR vs. RBE (Saturated)**  
**(Black Package)**



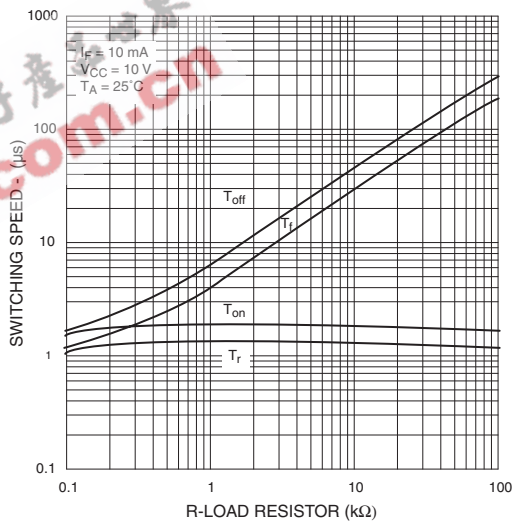
**Fig. 8 CTR vs. RBE (Saturated)**  
**(White Package)**



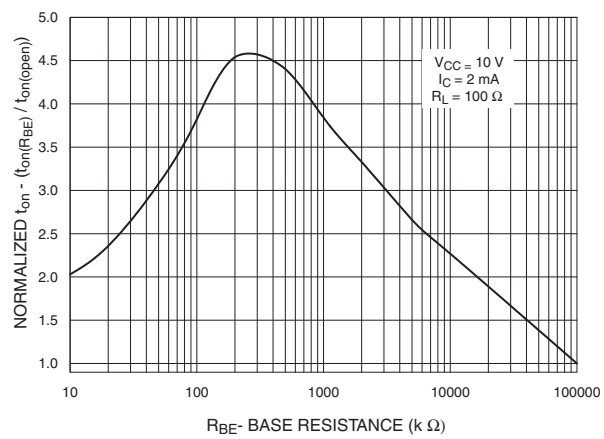
**Fig. 9 Switching Speed vs. Load Resistor**  
**(Black Package)**



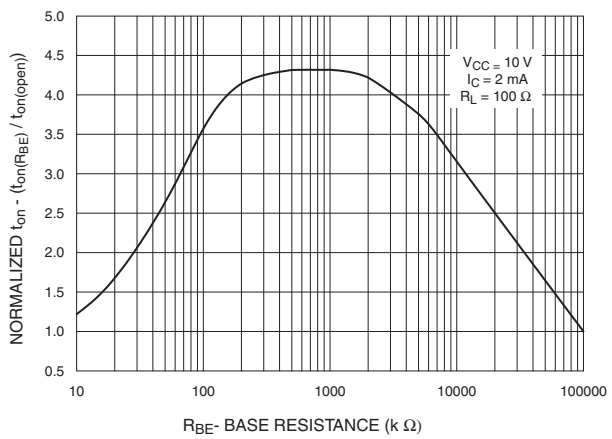
**Fig. 10 Switching Speed vs. Load Resistor**  
**(White Package)**



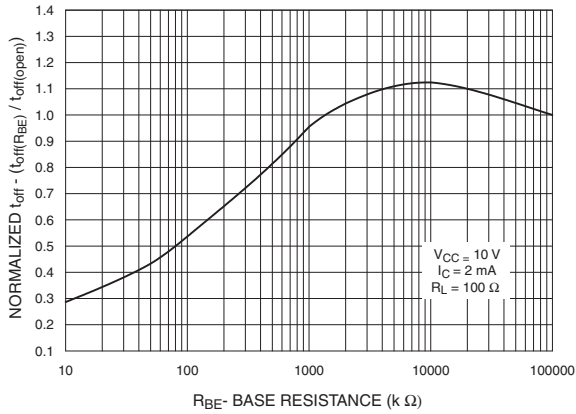
**Fig. 11 Normalized ton vs. RBE**  
**(Black Package)**



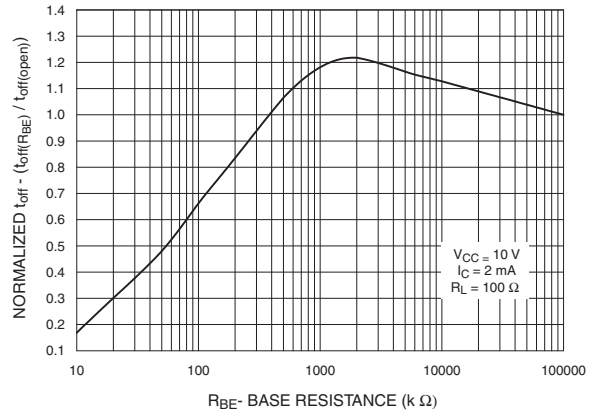
**Fig. 12 Normalized ton vs. RBE**  
**(White Package)**



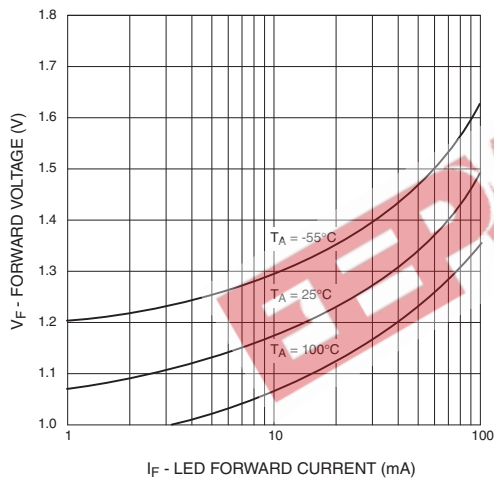
**Fig. 13 Normalized  $t_{off}$  vs.  $R_{BE}$  (Black Package)**



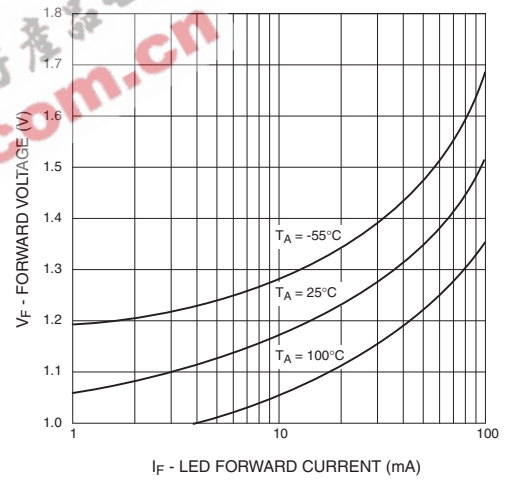
**Fig. 14 Normalized  $t_{off}$  vs.  $R_{BE}$  (White Package)**



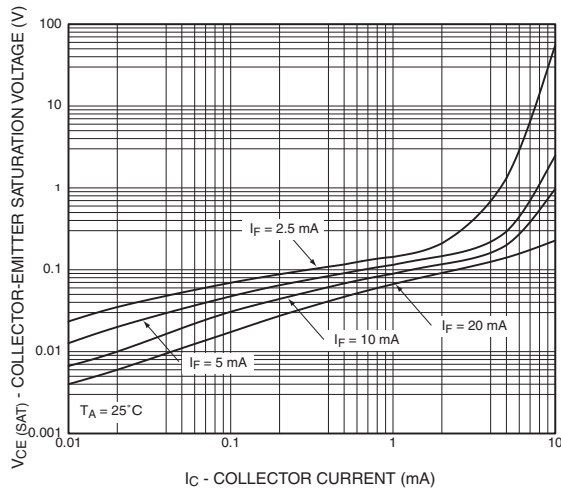
**Fig. 15 LED Forward Voltage vs. Forward Current (Black Package)**



**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)**

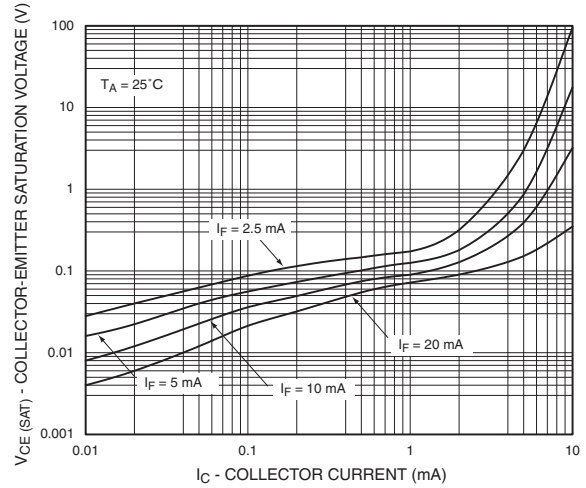




Fig. 19 Dark Current vs. Ambient Temperature (Black Package)

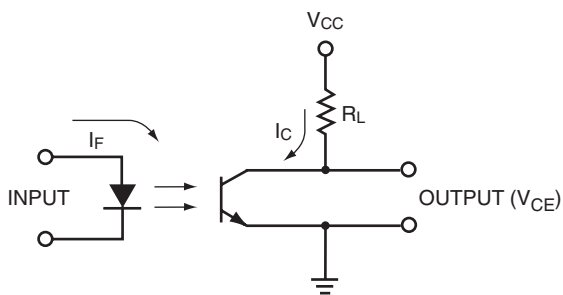
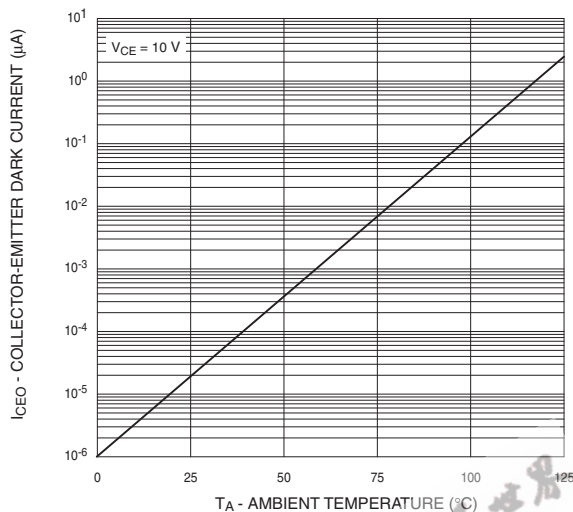


Figure 20. Switching Time Test Circuit

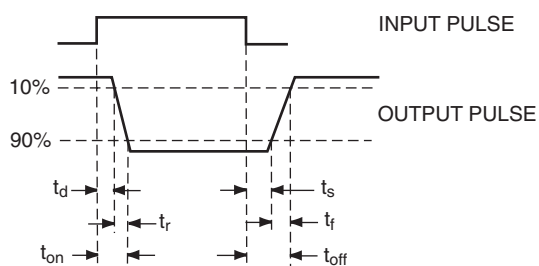
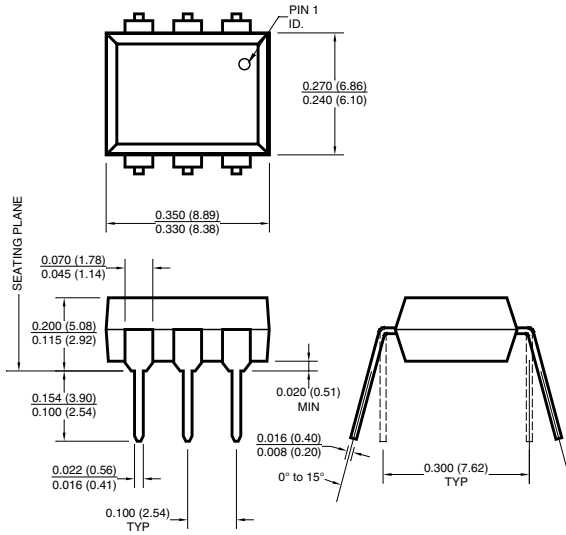


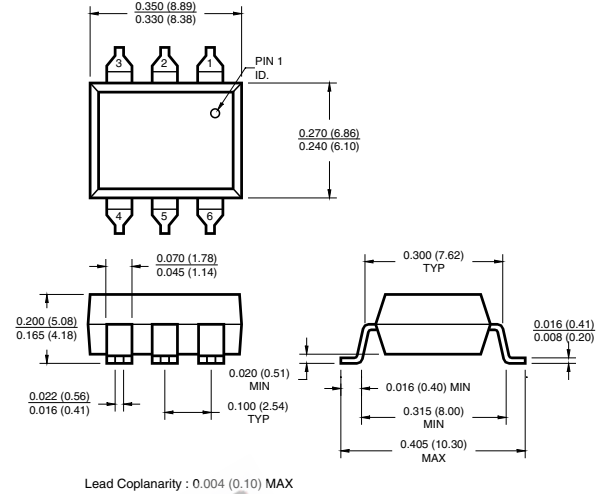
Figure 21. Switching Time Test Circuit

### Black Package (No -M Suffix)

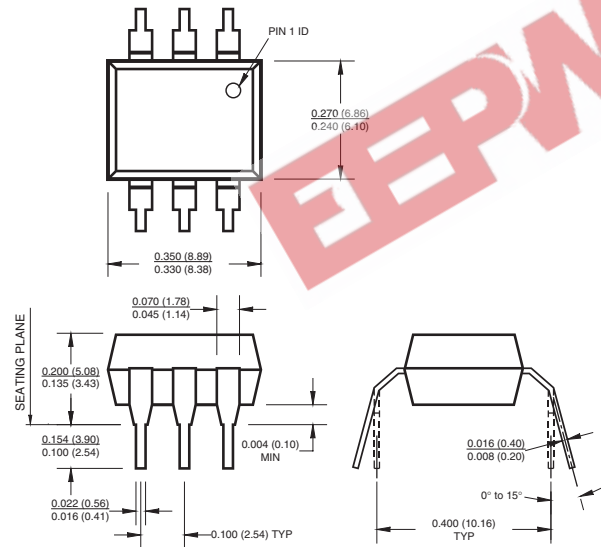
#### Package Dimensions (Through Hole)



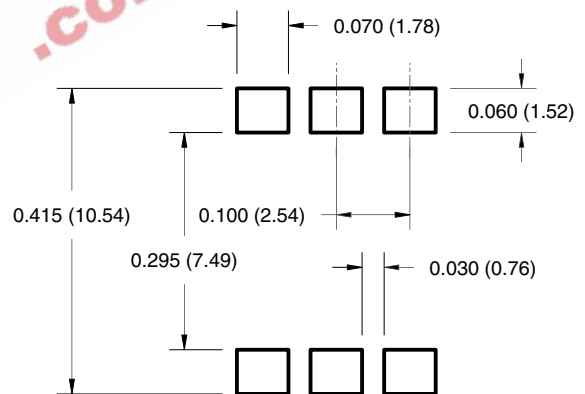
#### Package Dimensions (Surface Mount)



#### Package Dimensions (0.4" Lead Spacing)



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

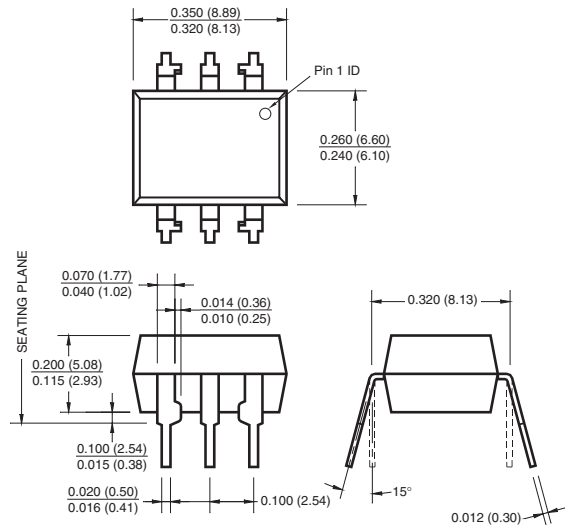


**Note:**

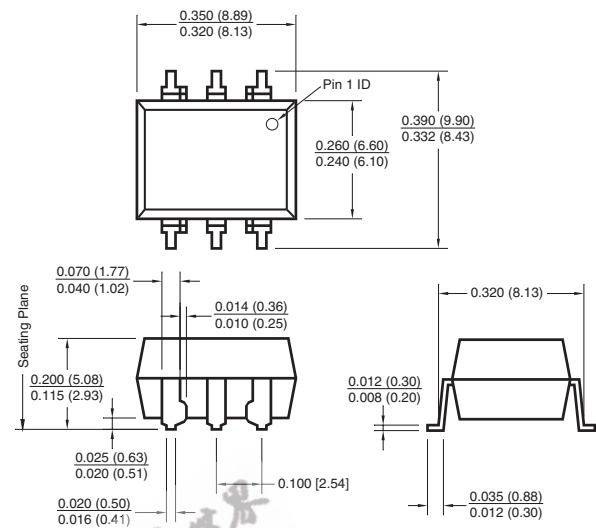
All dimensions are in inches (millimeters)

### White Package (-M Suffix)

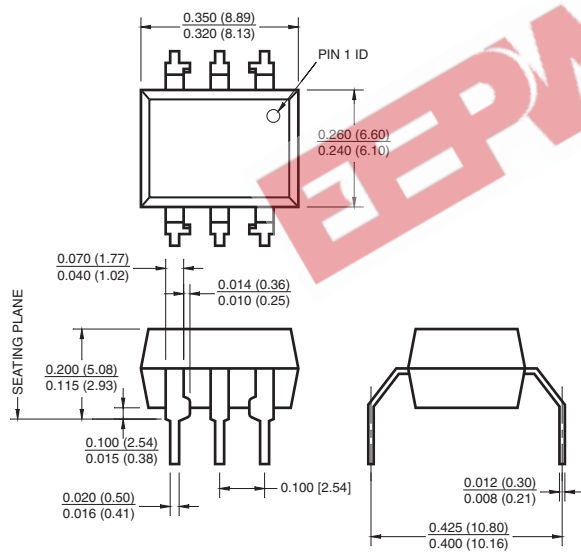
#### Package Dimensions (Through Hole)



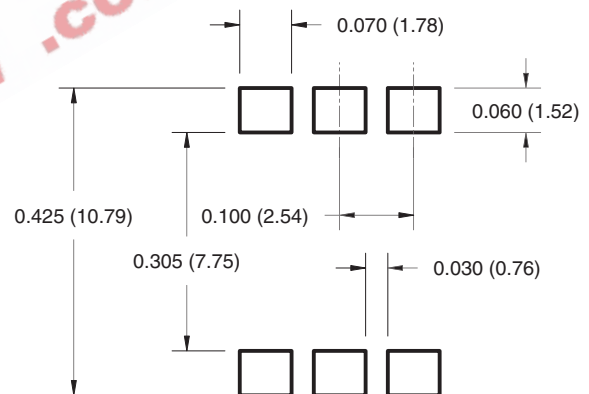
#### Package Dimensions (Surface Mount)



#### Package Dimensions (0.4" Lead Spacing)



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



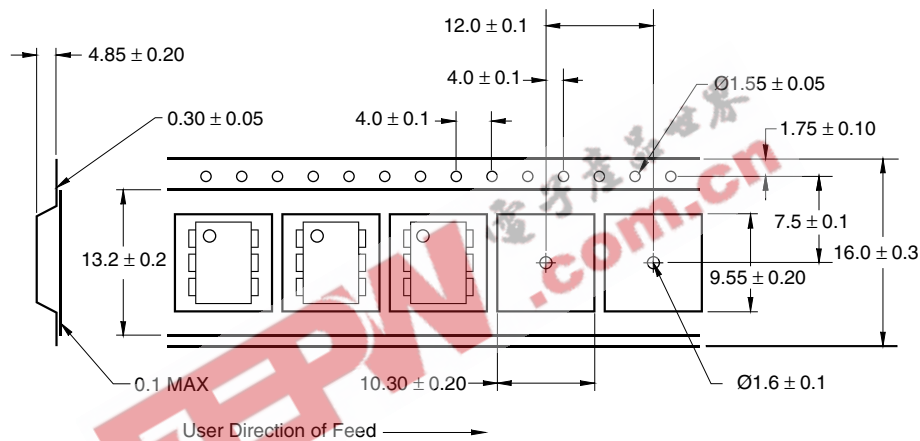
**Note:**

All dimensions are in inches (millimeters)

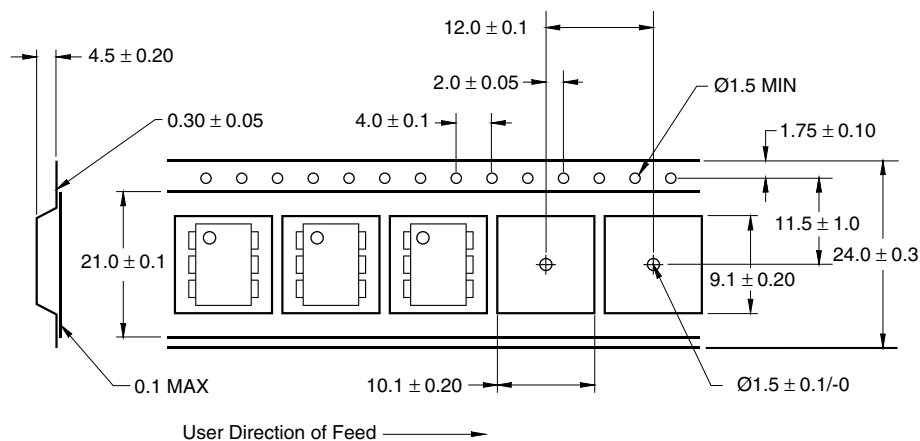
### Ordering Information

Black Package Part Number Example (No Suffix)	White Package Part Number Example (M Suffix)	Description
CNY171S	CNY171SM	Surface Mount Lead Bend
CNY171SD	CNY171SR2M	Surface Mount; Tape and reel
CNY171W	CNY171TM	0.4" Lead Spacing
CNY171300	CNY171VM	VDE Approved
CNY171300W	CNY171TVM	VDE Approved, 0.4" Lead Spacing
CNY1713S	CNY171SVM	VDE Approved, Surface Mount
CNY1713SD	CNY171SR2VM	VDE Approved, Surface Mount, Tape & Reel

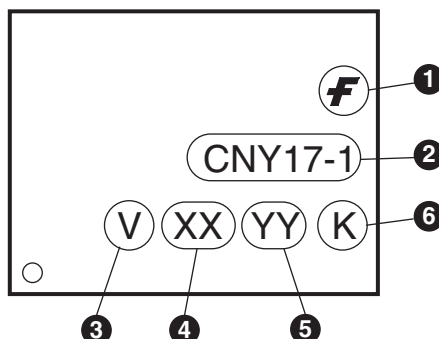
### Carrier Tape Specifications (Black Package, No Suffix)



### Carrier Tape Specifications (White Package, M Suffix)

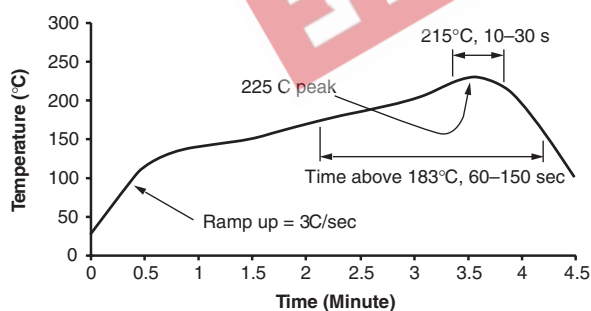


### Marking Information (Black package non 'M' suffix)



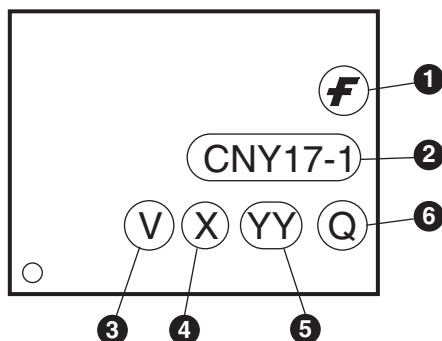
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	Two digits year code, e.g., '03'; One digit year code for 'M' version, e.g. '5'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

### Reflow Profile (Black Package, No Suffix)



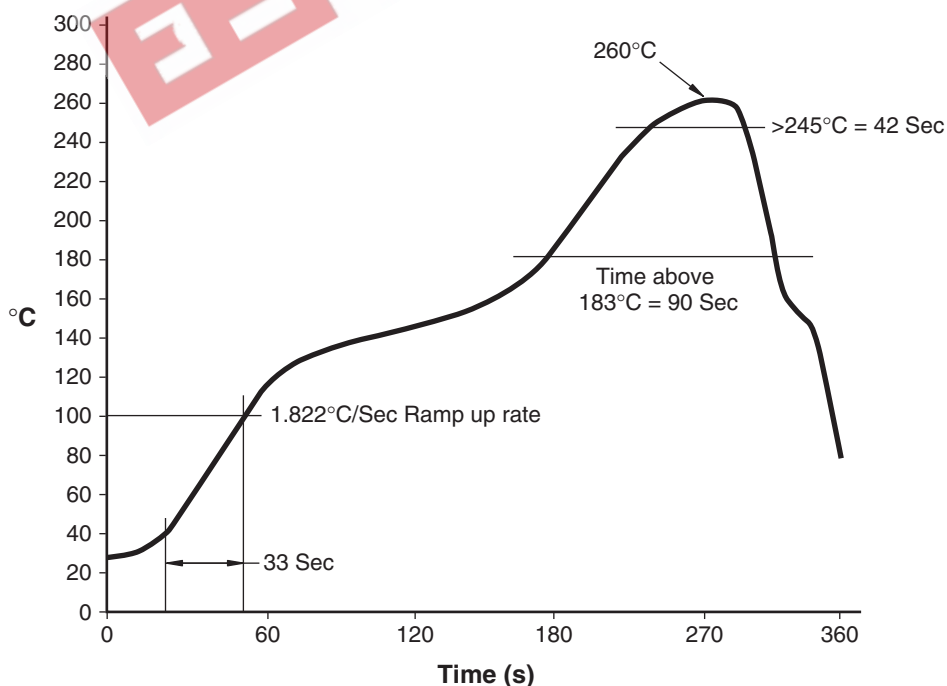
- Peak reflow temperature: 225°C (package surface temperature)
- Time of temperature higher than 183°C for 60–150 seconds
- One time soldering reflow is recommended

### 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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ActiveArray™	GlobalOptoisolator™	OCXPro™	SMART START™	UltraFET®
Bottomless™	GTO™	OPTOLOGIC®	SPM™	VCX™
Build it Now™	HiSeC™	OPTOPLANAR™	Stealth™	Wire™
CoolFET™	I <sup>2</sup> C™	PACMAN™	SuperFET™	
CROSSVOLT™	i-Lo™	POP™	SuperSOT™-3	
DOMET™	ImpliedDisconnect™	Power247™	SuperSOT™-6	
EcoSPARK™	IntelliMAX™	PowerEdge™	SuperSOT™-8	
E <sup>2</sup> CMOS™	ISOPLANAR™	PowerSaver™	SyncFET™	
EnSigna™	LittleFET™	PowerTrench®	TCM™	
FACT™	MICROCOUPLER™	QFET®	TinyBoost™	
FAST®	MicroFET™	QS™	TinyBuck™	
FASTr™	MicroPak™	QT Optoelectronics™	TinyPWM™	
FPS™	MICROWIRE™	Quiet Series™	TinyPower™	
FRFET™	MSX™	RapidConfigure™	TinyLogic®	
	MSXPro™	RapidConnect™	TINYOPTO™	
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The Power Franchise®		ScalarPump™	UHC™	
Programmable Active Droop™				

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## PRODUCT STATUS DEFINITIONS

### Definition of Terms

Datasheet Identification	Product Status	Definition
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