

NUD4700 是美国安森美公司推出的一种 LED 发生开路时提供电流旁路的电子分路器。当 LED 遇到瞬态和浪涌冲击时易于损坏。在汽车前灯、灯塔、桥梁、飞机和机场跑道等场合，必须维持 LED 照明的高可靠性。在这些情况下，附加低成本 NUD4700，可保证 LED 串中有一个 LED 失效而不引起其它 LED 熄灭。NUD4700 也可以应用于要求电流连续的其它负载。

NUD4700 是一种两端器件，外型如图 1 所示。NUD4700 内含一个单向晶闸管和一个控制电路，内部结构如图 2 所示。该器件的 MT2 端为正输入电压端，MT1 为负输入电压端，采用无铅封装。

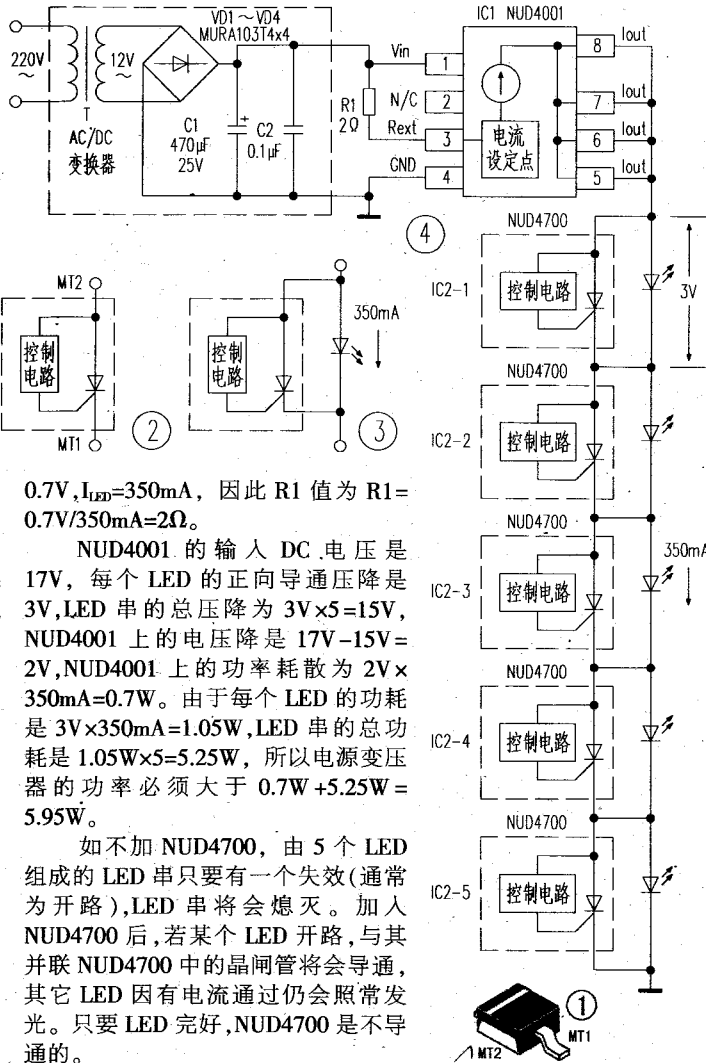
NUD4700 的平均导通电流为 0.376A，导通态电压是 1V，在 $V_{MT2}=5V$ 时的关断态电流典型值是 $100\mu A$ ，在 $I_{FM}=1mA$ 时的击穿电压为 $6.5V\pm 1V$ ，维持电流典型值是 6mA，工作温度范围为 $-40^{\circ}C\sim +150^{\circ}C$ 。

NUD4700 可用于 1W 的 LED (通常为 $I_F=350mA, V_F=3V$)。在应用中，NUD4700 的 MT2 端接 LED 的阳极，MT1 端接 LED 的阴极，如图 3 所示。

图 4 所示为采用 LED 驱动器 NUD4001 和 LED 分路器 NUD4700 的 LED 串供电电路。这种供电电路直接利用 220V/50Hz 的交流市电作为原始电源，采用电源变压器降压，再利用全波桥式整流滤波电路实现 AC/DC 转换。LED 串利用 NUD4001 (IC1) 作为驱动器。

NUD4001 是一种大电流 LED 驱动器，采用 SO-8 表面贴装封装，输出电流达 500mA，输出电压达 28V，最小过热电压降仅为 1.4V。

在图 4 中，LED 串的电 I_{LED} 由 NUD4001 ①脚和③脚之间的电阻 R1 设定。NUD4001 ①脚与③脚之间的电压被固定在



0.7V, $I_{LED}=350mA$ ，因此 R1 值为 $R1 = 0.7V/350mA = 2\Omega$ 。

NUD4001 的输入 DC 电压是 17V，每个 LED 的正向导通电压降是 3V，LED 串的总电压降为 $3V \times 5 = 15V$ ，NUD4001 上的电压降是 $17V - 15V = 2V$ ，NUD4001 上的功率耗散为 $2V \times 350mA = 0.7W$ 。由于每个 LED 的功耗是 $3V \times 350mA = 1.05W$ ，LED 串的总功耗是 $1.05W \times 5 = 5.25W$ ，所以电源变压器的功率必须大于 $0.7W + 5.25W = 5.95W$ 。

如不加 NUD4700，由 5 个 LED 组成的 LED 串只要有一个失效 (通常为开路)，LED 串将会熄灭。加入 NUD4700 后，若某个 LED 开路，与其并联 NUD4700 中的晶闸管将会导通，其它 LED 因有电流通过仍会照常发光。只要 LED 完好，NUD4700 是不导通的。

NUD4700

LED Shunt

The NUD4700 is an electronic shunt which provides a current bypass in the case of a single LED going into open circuit. LEDs are by nature quite fragile when subjected to transients and surge conditions. There are also many cases where high reliability of the LED lighting must be maintained such as headlights, lighthouses, bridges, aircraft, runways and so forth. In these cases the low cost addition of the NUD4700 will provide full assurance that an entire string of LEDs will not extinguish should one LED fail. NUD4700 is also applicable to other loads where circuit continuity is required. This device is designed to be used with 1 W LEDs (nominally 350 mA @ 3 V).

Features

- A Simple Two Terminal Device
- Automatically Resets Itself if the LED Heals Itself or is Replaced
- ON-State Voltage Typically 1 V
- OFF-State Current less than 250 μ A
- This is a Pb-Free Device

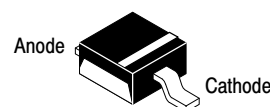
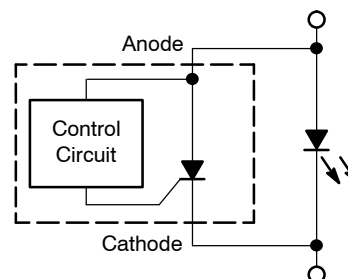
Typical Applications

- LEDs where Preventive Maintenance is Non Practical
- LED Headlights
- LEDs with High Reliability Requirements
- Crowbar Protection for Open Circuit Conditions
- Overvoltage Protection for Sensitive Circuits



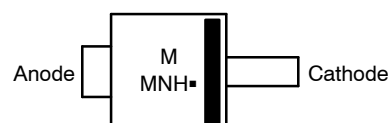
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**POWERMITE®
CASE 457
PLASTIC**

MARKING DIAGRAM



M = Date Code
MNH = Device Code
▪ = Pb-Free Package

PIN FUNCTION DESCRIPTION

Pin	Description
Anode	Positive Input Voltage to the Device
Cathode	Negative Input Voltage to the Device

ORDERING INFORMATION

Device	Package	Shipping†
NUD4700SNT1G	POWERMITE (Pb-Free)	3000/Tape & Reel

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

NUD4700

MAXIMUM RATINGS (Maximum ratings are those, that, if exceeded, may cause damage to the device. Electrical Characteristics are not guaranteed over this range)

Rating	Symbol	Value	Unit
Peak Repetitive Off State Voltage (Anode to Cathode)	V_{DM}	-0.3 to 10	V
Average On-State Current, ($T_A = 25^\circ\text{C}$), (Note 1) (Note 2)	$I_{T(AVG)}$	1.3 0.376	A
Thermal Resistance, Junction-to-Air (Note 1) (Note 2)	Q_{JA}	80 277	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Lead	Q_{JL}	35	$^\circ\text{C}/\text{W}$
Power Dissipation ($T_A = 25^\circ\text{C}$) (Note 1) (Note 2)	P_{MAX}	1.56 0.45	W
Operating Temperature Range	T_J	-40 to 150	$^\circ\text{C}$
Non-Operating Temperature Range	T_J	150	$^\circ\text{C}$
Lead Temperature, Soldering (10 Sec)	T_L	260	$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Mounted onto a 1" x 1" square copper pad.

Normally this device would be mounted on the same copper heat sink and adjacent to the LED. If the LED were to go open, then the NUD4700 shunt would now dissipate the power using the same copper heat sink. Since the NUD4700 has a voltage that is nominally 30% of the LED, then the power dissipation would be easily handled by the same heat sink as the LED.

2. Device mounted on minimum copper pad.

ELECTRICAL CHARACTERISTICS (Unless otherwise noted: $T_A = 25^\circ\text{C}$)

Characteristics	Symbol	Min	Typ	Max	Unit
Off-State Current ($V_{Anode} = 5\text{ V}$)	I_{LEAK}	-	100	250	μA
Breakdown Voltage ($I_{BR} = 1\text{ mA}$)	$V_{(BR)}$	5.5	-	7.5	V
Holding Current ($V_{Anode} = 10\text{ V}$, $I_{initial} = 100\text{ mA}$)	I_H	-	6.0	12	mA
Latching Current ($V_{Anode} = 10\text{ V}$)	I_L	-	35	70	mA
On-State Voltage ($I_T = 0.350\text{ A}$)	V_T	-	1.0	1.2	V

DYNAMIC CHARACTERISTICS

Critical Rate-of-Rise of Off State Voltage ($V_{pk} = \text{Rated } V_{(BR)}$, $T_J = 125^\circ\text{C}$, Exponential Method)	dV/dt	250	-	-	V/ μs
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NUD4700

TYPICAL PERFORMANCE CURVES

($T_A = 25^\circ\text{C}$ unless otherwise noted)

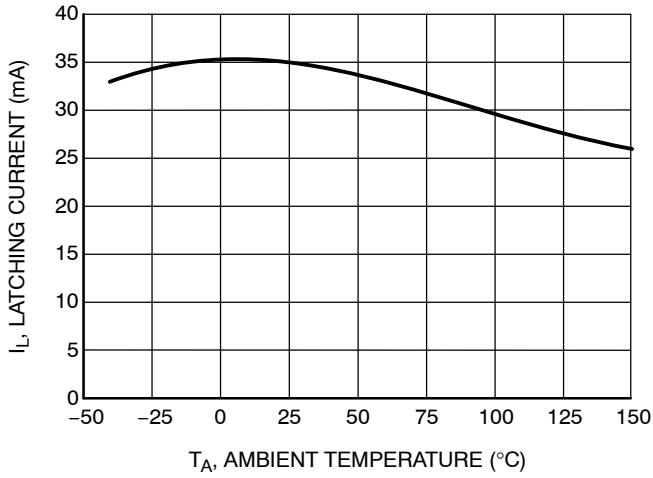


Figure 1. Latching Current vs Temperature

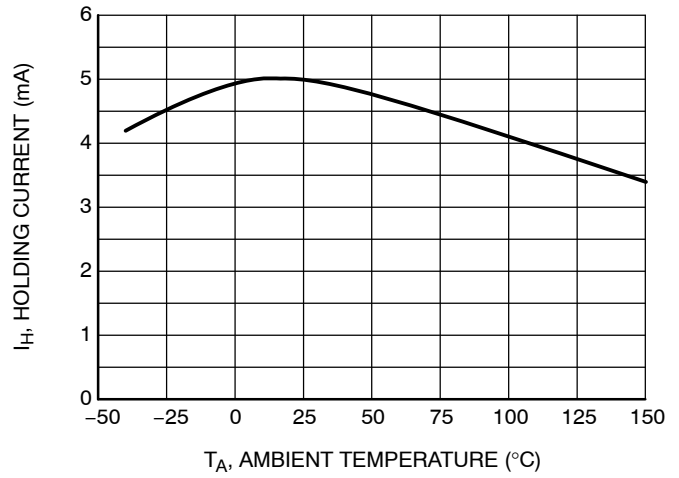


Figure 2. Holding Current vs Temperature

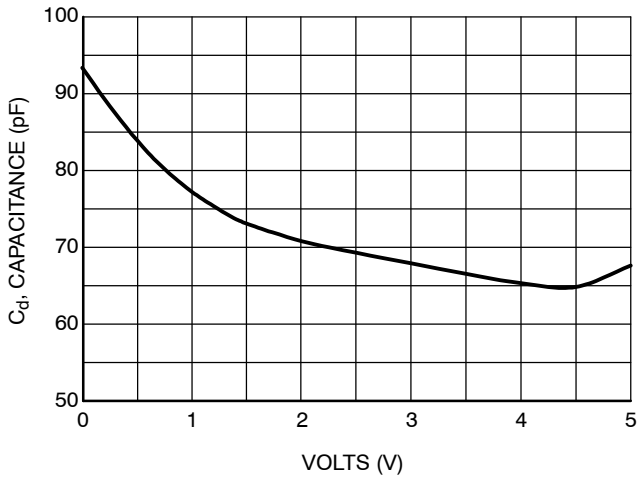


Figure 3. Capacitance vs Voltage

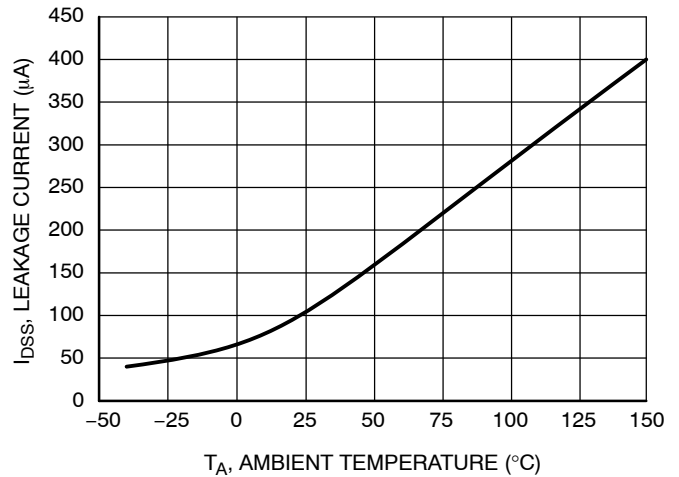


Figure 4. Leakage Current vs Temperature

NUD4700

TYPICAL APPLICATION CIRCUIT

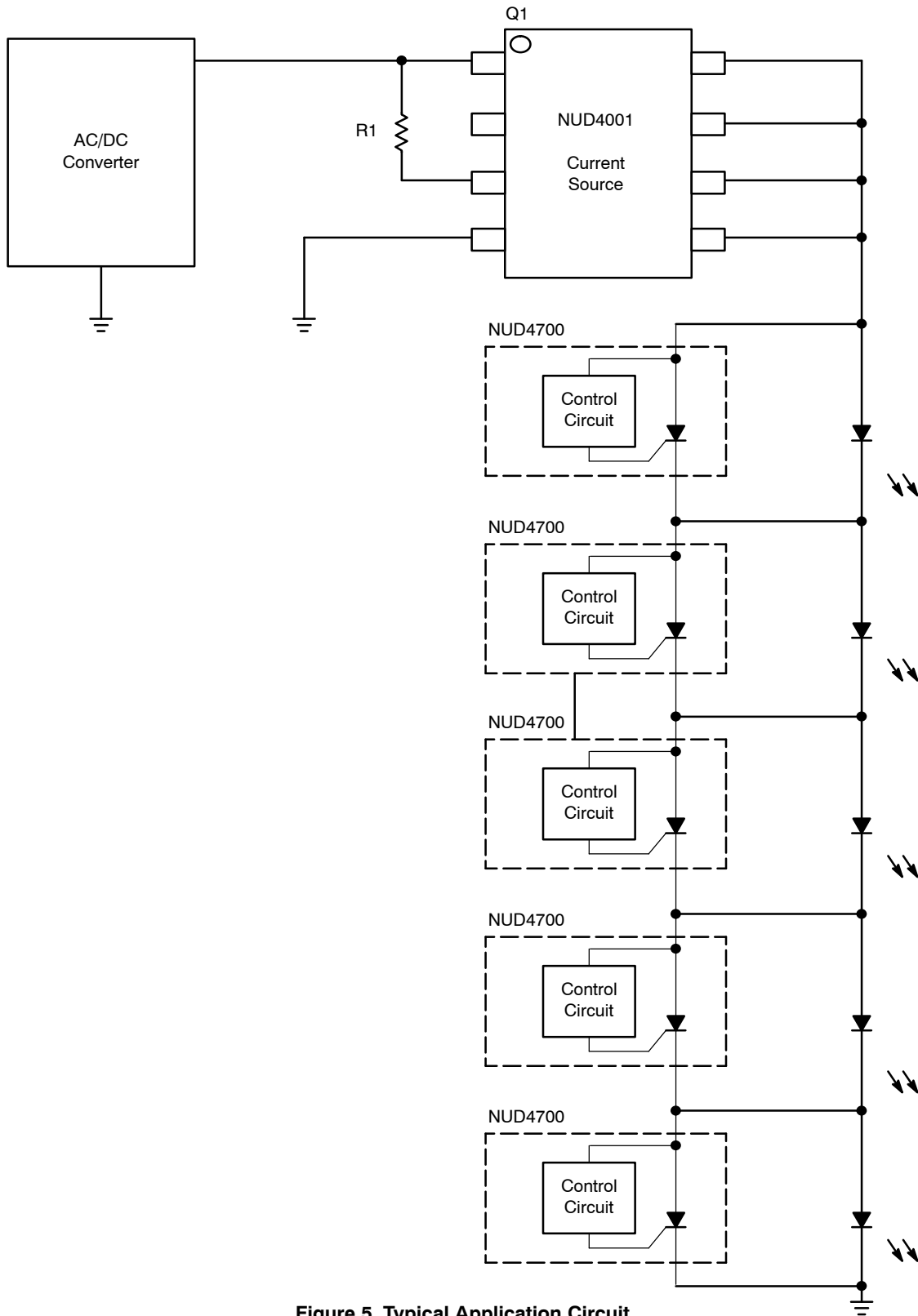


Figure 5. Typical Application Circuit

NUD4700

TYPICAL OPERATION WAVEFORMS

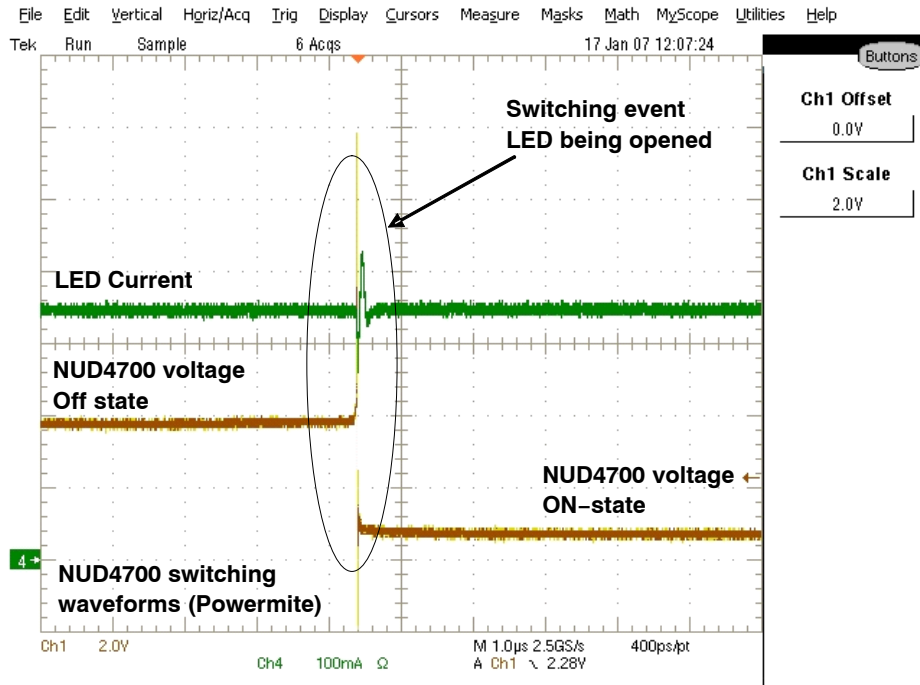


Figure 6. NUD4700 Switching Waveforms

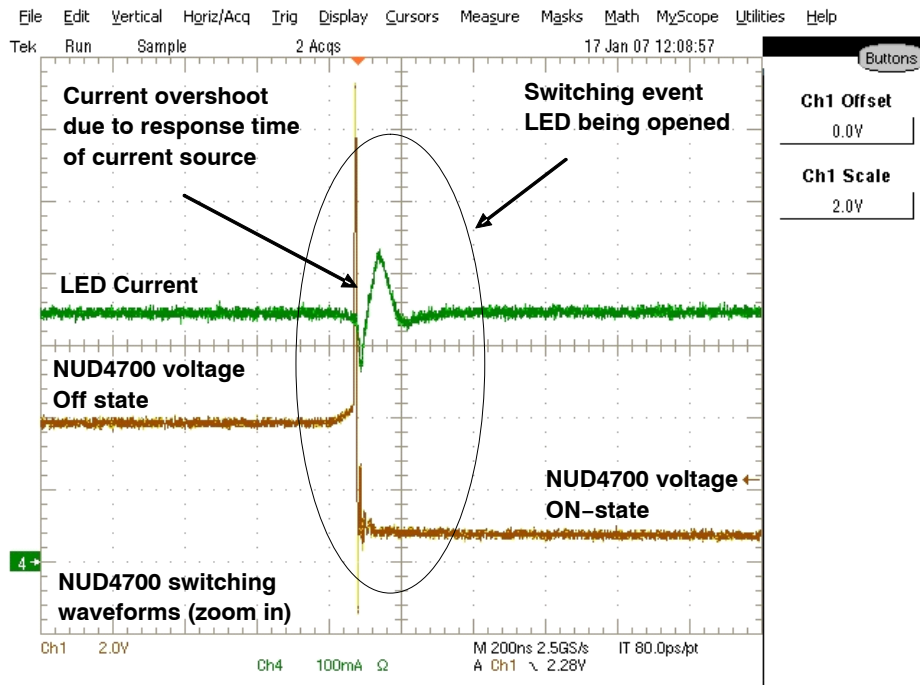
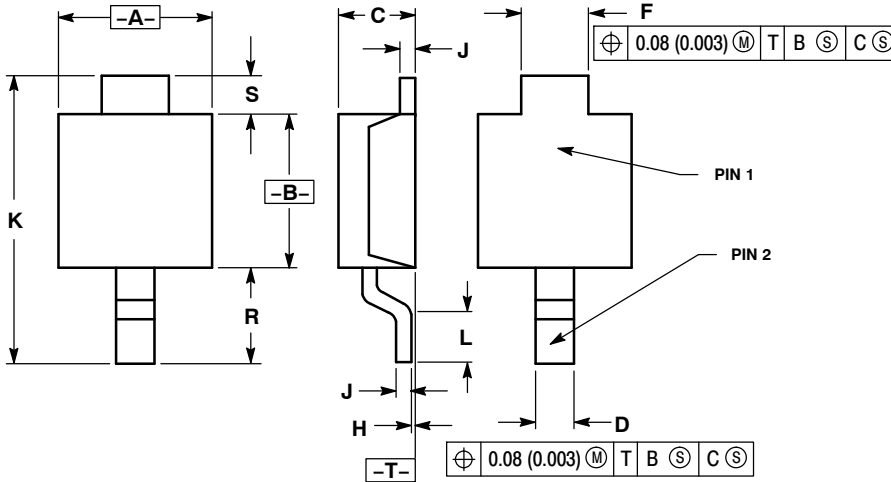


Figure 7. Zoom in of Figure 6

NUD4700

PACKAGE DIMENSIONS

POWERMITE
CASE 457-04
ISSUE E

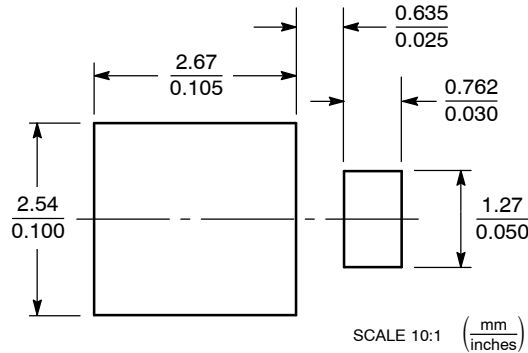


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.75	2.05	0.069	0.081
B	1.75	2.18	0.069	0.086
C	0.85	1.15	0.033	0.045
D	0.40	0.69	0.016	0.027
F	0.70	1.00	0.028	0.039
H	-0.05	+0.10	-0.002	+0.004
J	0.10	0.25	0.004	0.010
K	3.60	3.90	0.142	0.154
L	0.50	0.80	0.020	0.031
R	1.20	1.50	0.047	0.059
S	0.50 REF		0.019 REF	

SOLDERING FOOTPRINT*



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

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