

# FDU5N50NZTU

## Power MOSFET, N-Channel, UniFET™ II

500 V, 4 A, 1.5 Ω

UniFET II MOSFET is ON Semiconductor's high voltage MOSFET family based on advanced planar stripe and DMOS technology. This advanced MOSFET family has the smallest on-state resistance among the planar MOSFET, and also provides superior switching performance and higher avalanche energy strength. In addition, internal gate-source ESD diode allows UniFET II MOSFET to withstand over 2 kV HBM surge stress. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

### Features

- $R_{DS(on)} = 1.38 \Omega$  (Typ.) @  $V_{GS} = 10 V, I_D = 2 A$
- Low Gate Charge (Typ. 9 nC)
- Low  $C_{RSS}$  (Typ. 4 pF)
- 100% Avalanche Tested
- Improved  $dv/dt$  Capability
- ESD Improved Capability
- These Devices are Pb-Free and are RoHS Compliant

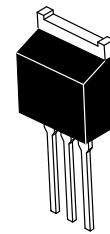
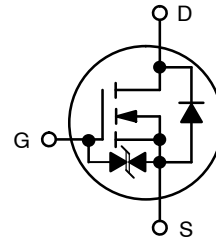
### Applications

- LCD / LED TV
- Lighting
- Charger / Adapter



ON Semiconductor®

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IPAK3  
CASE 369AR

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 2 of this data sheet.

# FDU5N50NZTU

## MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain-to-Source Voltage	500	V
V <sub>GSS</sub>	Gate-to-Source Voltage	±25	V
I <sub>D</sub>	Drain Current	Continuous (T <sub>C</sub> = 25°C)	4
		Continuous (T <sub>C</sub> = 100°C)	2.4
I <sub>DM</sub>	Drain Current	Pulsed (Note 1)	16
E <sub>AS</sub>	Single Pulse Avalanche Energy (Note 2)	304	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	4	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	6.2	mJ
dv/dt	Peak Diode Recovery (Note 3)	10	V/ns
P <sub>D</sub>	Power Dissipation	T <sub>C</sub> = 25°C	62
		Derate Above 25°C	0.5
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purposes (1/8" from case for 5 seconds)	300	°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.

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. I<sub>AS</sub> = 4 A, V<sub>DD</sub> = 50 V, L = 38 mH, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.
3. I<sub>SD</sub> ≤ 4 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C.

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	2.0	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	90	

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDU5N50NZTU	FDU5N50NZ	IPAK	Tube	N/A	N/A	75 units

# FDU5N50NZTU

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 25°C	500			V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C		0.5		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 400 V, T <sub>C</sub> = 125°C			10	
I <sub>GSS</sub>	Gate-to-Body Leakage Current	V <sub>GS</sub> = ±25 V, V <sub>DS</sub> = 0 V			±10	μA

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	3.0		5.0	V
R <sub>DS(on)</sub>	Static Drain-to-Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2 A		1.38	1.5	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 20 V, I <sub>D</sub> = 2 A		3.54		S

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz		330	440	pF
C <sub>oss</sub>	Output Capacitance			50	70	
C <sub>rss</sub>	Reverse Transfer Capacitance			4	6	
Q <sub>g(tot)</sub>	Total Gate Charge at 10 V	V <sub>DS</sub> = 400 V, I <sub>D</sub> = 4 A, V <sub>GS</sub> = 10 V (Note 4)		9	12	nC
Q <sub>gs</sub>	Gate-to-Source Gate Charge			2		
Q <sub>gd</sub>	Gate-to-Drain "Miller" Charge			4		

### SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 250 V, I <sub>D</sub> = 4 A, V <sub>GS</sub> = 10 V, R <sub>G</sub> = 25 Ω (Note 4)		12	35	ns
t <sub>r</sub>	Turn-On Rise Time			22	55	
t <sub>d(off)</sub>	Turn-Off Delay Time			28	65	
t <sub>f</sub>	Turn-Off Fall Time			21	50	

### DRAIN-SOURCE DIODE CHARACTERISTICS

I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current			4	A
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current			16	
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 4 A		1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 4 A, dI <sub>F</sub> /dt = 100 A/μs		210	ns
Q <sub>rr</sub>	Reverse Recovery Charge			1.1	μC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Essentially independent of Operating Temperature Typical Characteristics.

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## TYPICAL CHARACTERISTICS

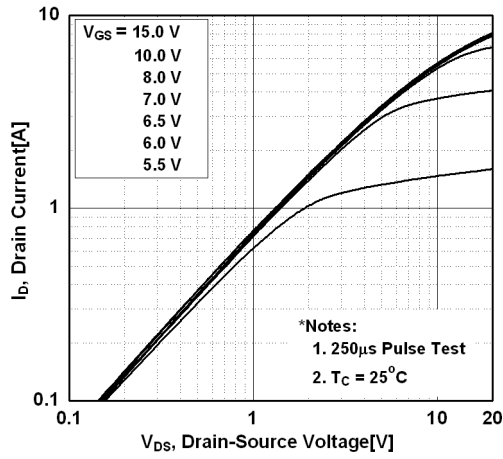


Figure 1. On-Region Characteristics

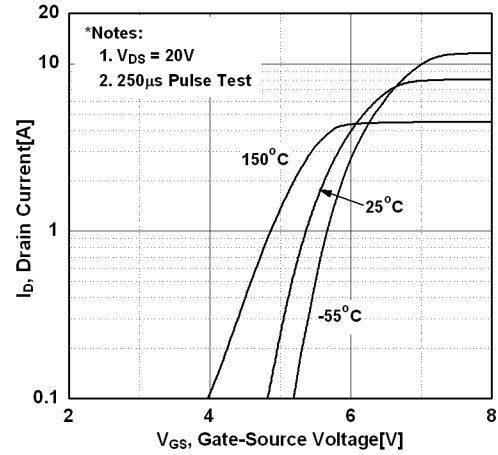


Figure 2. Transfer Characteristics

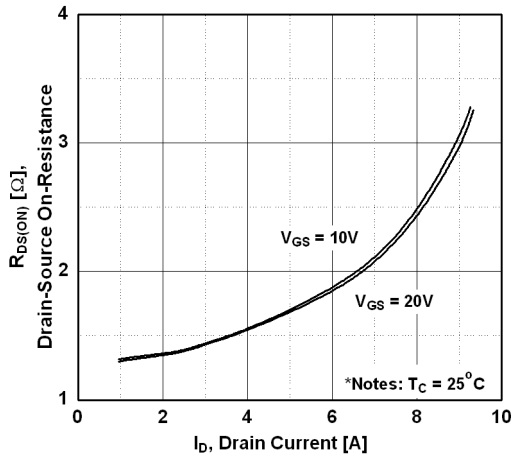


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

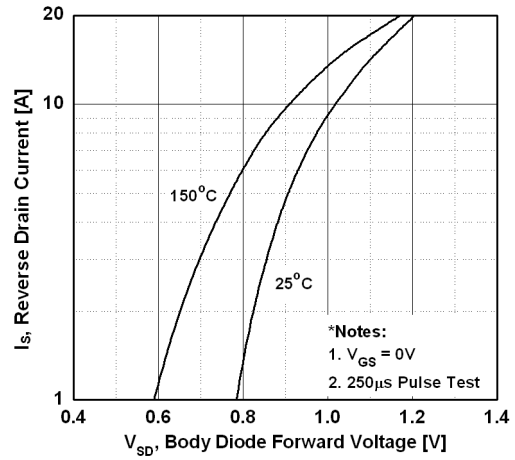


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

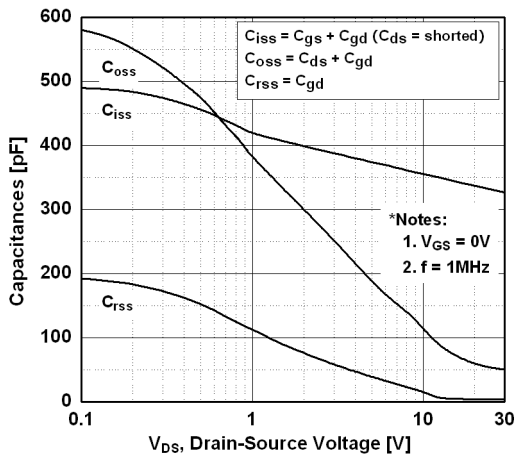


Figure 5. Capacitance Characteristics

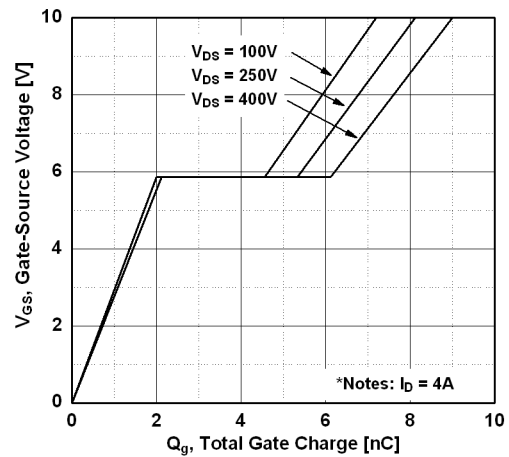


Figure 6. Gate Charge Characteristics

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## TYPICAL CHARACTERISTICS

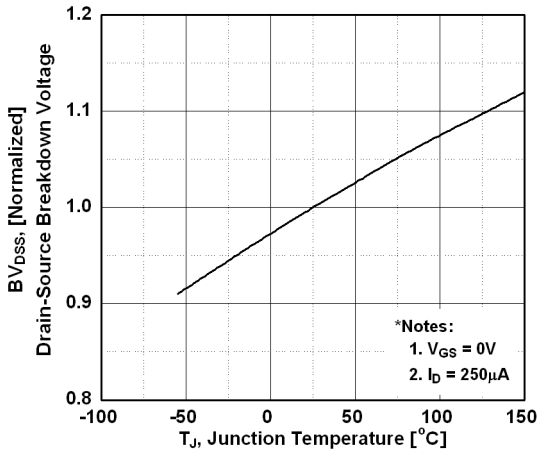


Figure 7. Breakdown Voltage Variation vs. Temperature

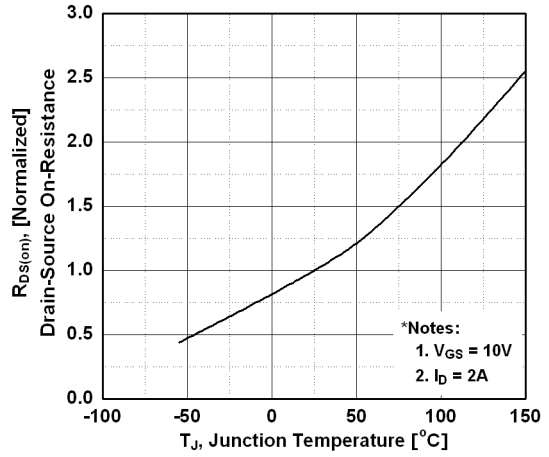


Figure 8. On-Resistance Variation vs. Temperature

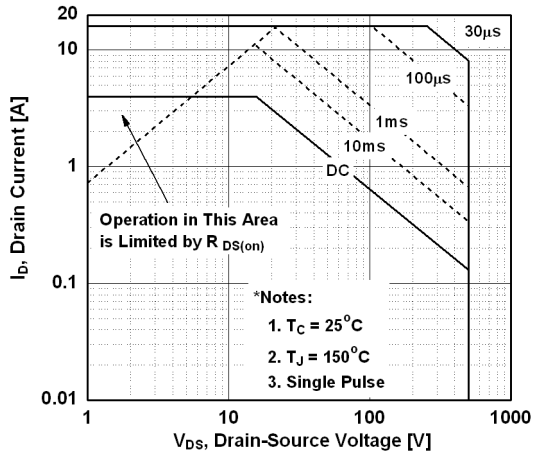


Figure 9. Maximum Safe Operating Area vs. Case Temperature

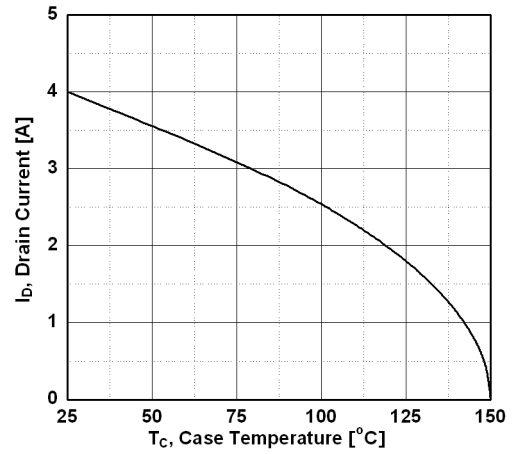


Figure 10. Maximum Drain Current vs. Case Temperature

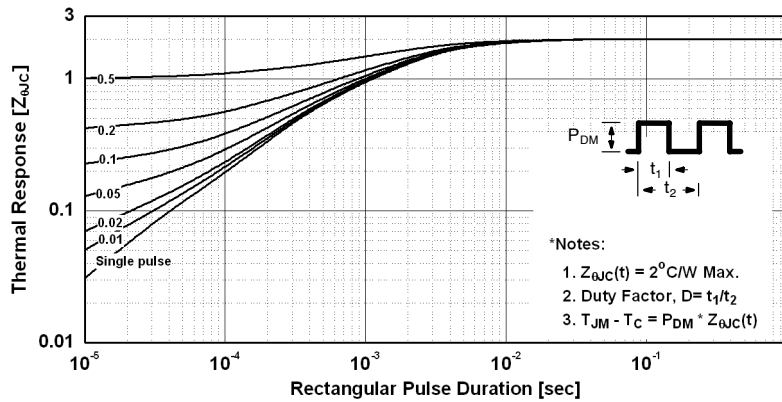


Figure 11. Transient Thermal Response Curve

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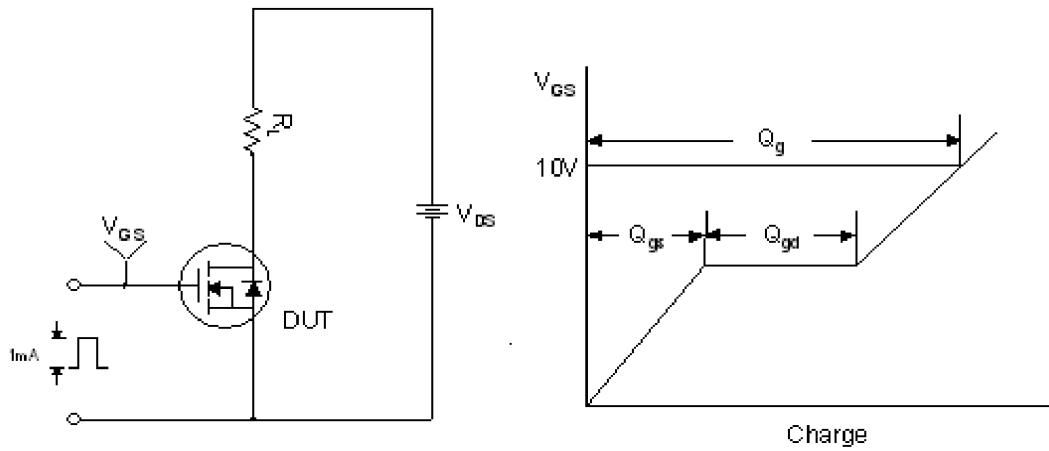


Figure 12. Gate Charge Test Circuit & Waveform

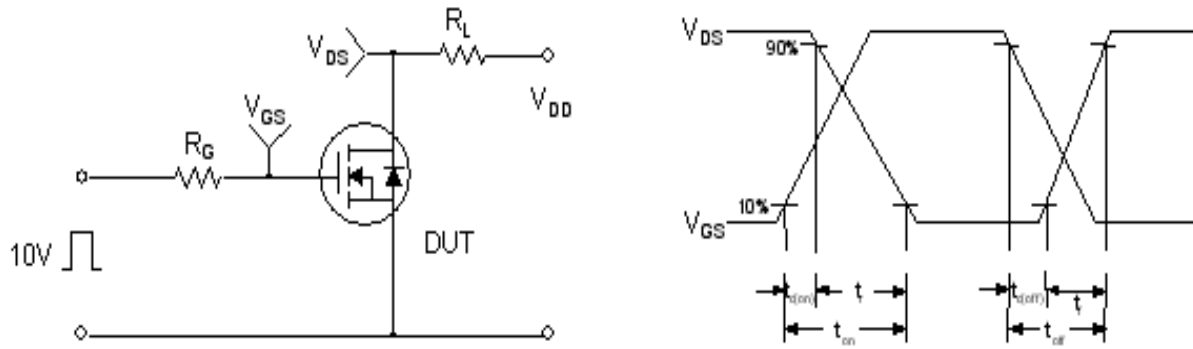


Figure 13. Resistive Switching Test Circuit & Waveforms

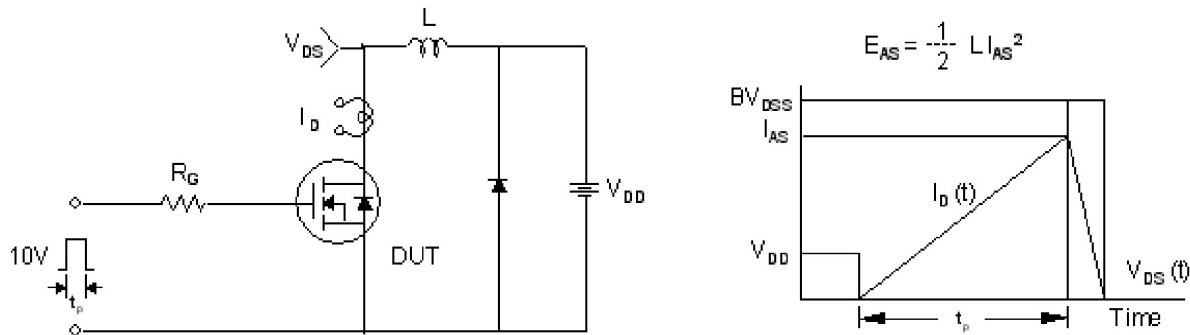


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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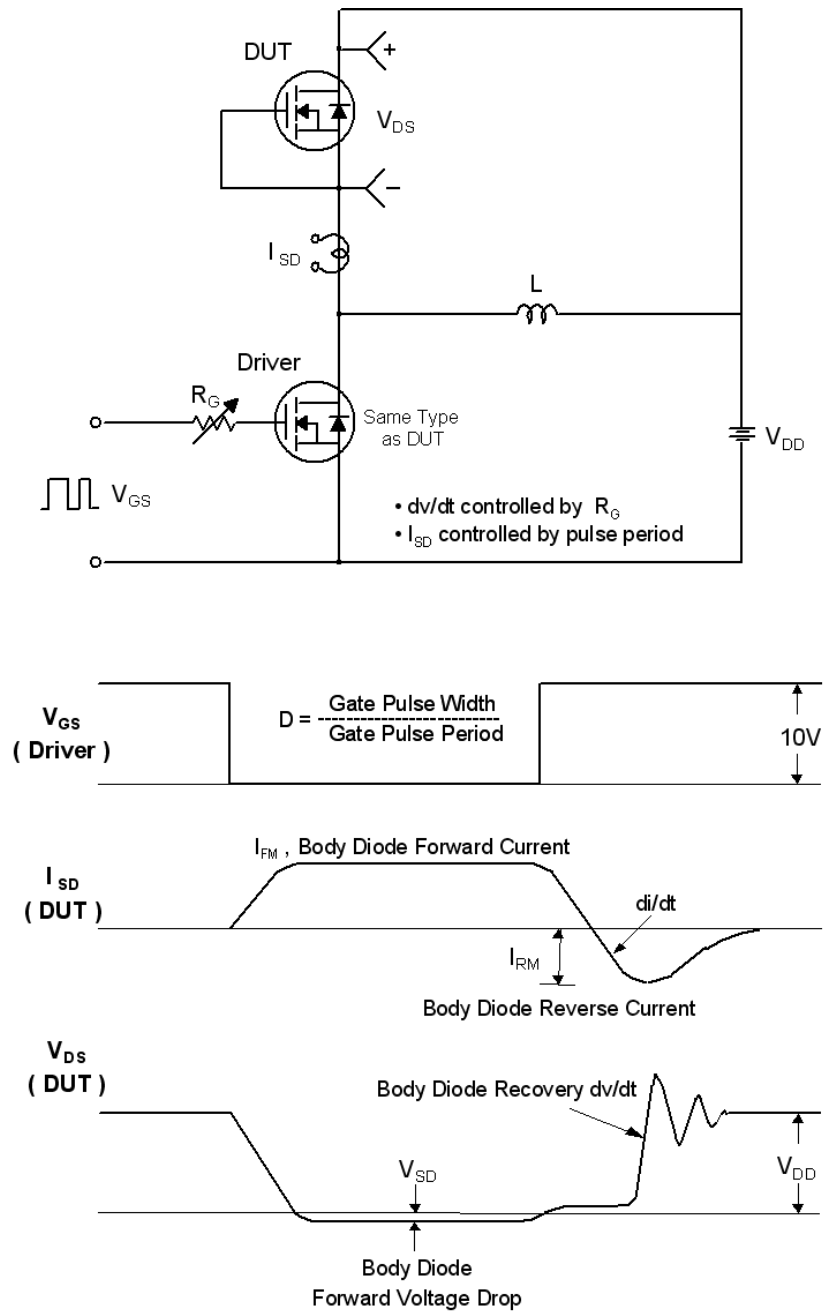
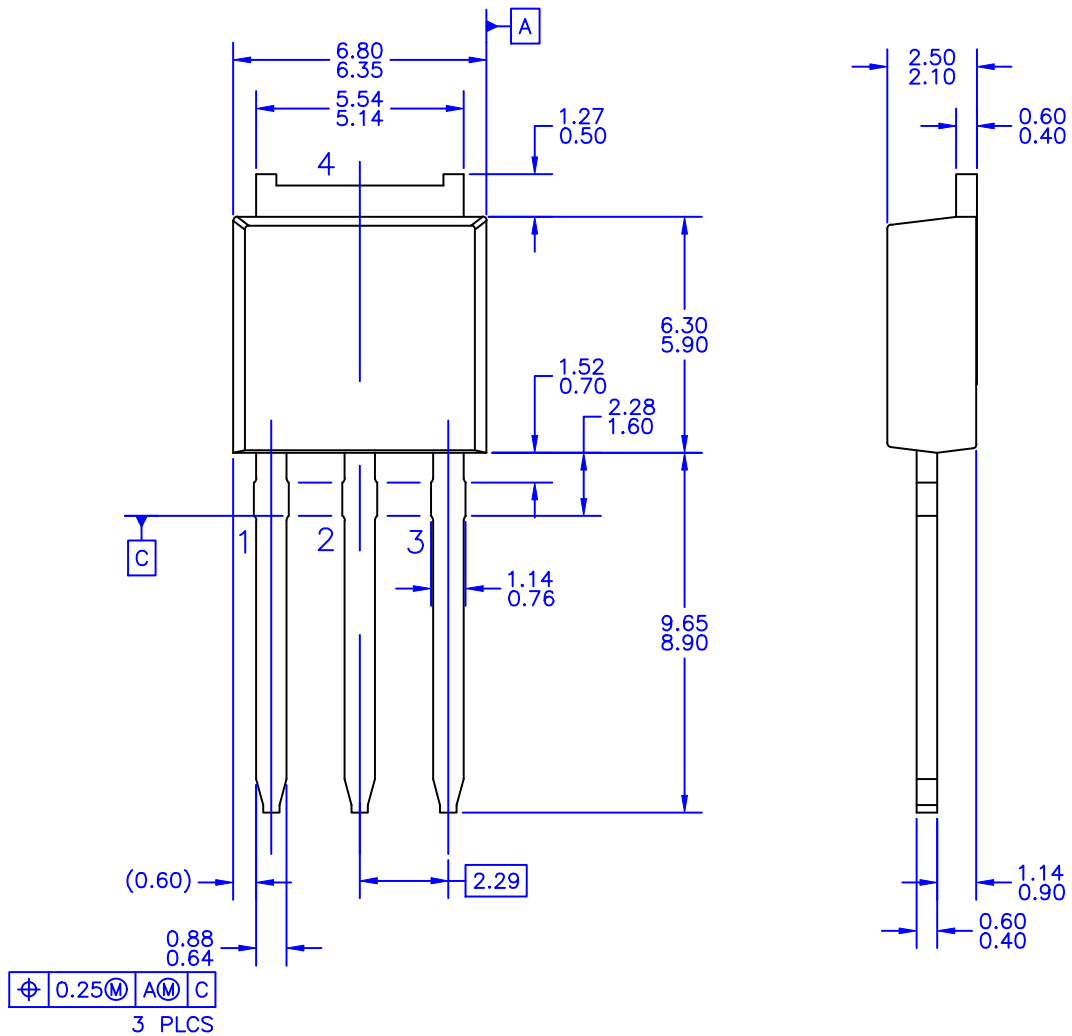


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

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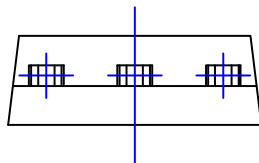
## PACKAGE DIMENSIONS

**DPAK3 (IPAK)**  
CASE 369AR  
ISSUE O



NOTES: UNLESS OTHERWISE SPECIFIED


- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) THIS PACKAGE CONFORMS TO JEDEC, TO-251, ISSUE C, VARIATION AA, DATED SEP 1988.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.





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