

# MOSFET – N-Channel UniFET™

**250 V, 59 A, 49 mΩ**

## FDA59N25

### Description

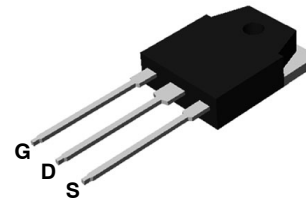
UniFET MOSFET is onsemi's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

### Features

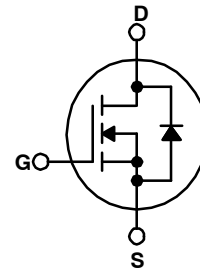
- $R_{DS(on)} = 49 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 29.5 \text{ A}$
- Low Gate Charge (Typ. 63 nC)
- Low  $C_{rSS}$  (Typ. 70 pF)
- 100% Avalanche Tested
- RoHS Compliant

### Applications

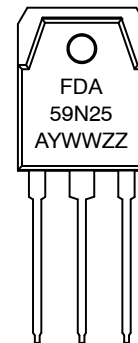
- PDP TV
- Uninterruptible Power Supply
- AC-DC Power Supply



TO-3P-3LD  
 CASE 340BZ



### MARKING DIAGRAM



FDA59N25 = Specific Device Code  
 A = Assembly Location  
 YWW = Date Code (Year & Week)  
 ZZ = Assembly Lot

### ORDERING INFORMATION

Device	Package	Shipping†
FDA59N25	TO-3P-3LD (Pb-Free)	450 Units / Tube

†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](#).

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

Symbol	Parameter		Rating	Unit
V <sub>DSS</sub>	Drain to Source Voltage		250	V
V <sub>DS(Avalanche)</sub>	Repetitive Avalanche Voltage (Notes 1, 2)		300	V
V <sub>GSS</sub>	Gate to Source Voltage		±30	V
I <sub>D</sub>	Drain Current	- Continuous (T <sub>C</sub> = 25°C)	59	A
		- Continuous (T <sub>C</sub> = 100°C)	35	
I <sub>DM</sub>	Drain Current	- Pulsed (Note 1)	236	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		1458	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)		59	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)		39.2	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C)	392	W
		- Derate Above 25°C	3.2	
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, 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. L = 0.67 mH, I<sub>AS</sub> = 59 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.

3. I<sub>SD</sub> ≤ 59 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, Max.	0.32	°C/W
R <sub>θCS</sub>	Thermal Resistance, Case to Sink, Typ.	0.24	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient, Max.	40	°C/W

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### Off Characteristics

B <sub>V</sub> DSS	Drain–Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	250	–	–	V
$\frac{\Delta B_{V_{DSS}}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	–	0.25	–	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 250 V, V <sub>GS</sub> = 0 V	–	–	1	μA
		V <sub>DS</sub> = 200 V, T <sub>C</sub> = 125°C	–	–	10	μA
I <sub>GSSF</sub>	Gate to Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	–	–	100	nA
I <sub>GSSR</sub>	Gate to Body Leakage Current, Reverse	V <sub>GS</sub> = –30 V, V <sub>DS</sub> = 0 V	–	–	–100	nA

### On Characteristics

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3.0	–	5.0	V
R <sub>DS(on)</sub>	Static Drain–Source On–Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 29.5 A	–	0.041	0.049	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 29.5 A	–	45	–	S

### Dynamic Characteristics

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz	–	3090	4020	pF
C <sub>oss</sub>	Output Capacitance		–	630	820	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		–	70	110	pF

### Switching Characteristics

t <sub>d(on)</sub>	Turn–On Delay Time	V <sub>DD</sub> = 125 V, I <sub>D</sub> = 59 A, V <sub>GS</sub> = 10 V, R <sub>G</sub> = 25 Ω (Note 4)	–	70	150	ns
t <sub>r</sub>	Turn–On Rise Time		–	480	970	ns
t <sub>d(off)</sub>	Turn–Off Delay Time		–	90	190	ns
t <sub>f</sub>	Turn–Off Fall Time		–	170	350	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 200 V, I <sub>D</sub> = 59 A, V <sub>GS</sub> = 10 V (Note 4)	–	63	82	nC
Q <sub>gs</sub>	Gate–Source Charge		–	18.5	–	nC
Q <sub>gd</sub>	Gate–Drain Charge		–	30	–	nC

### Drain–Source Diode Characteristics and Maximum Ratings

I <sub>S</sub>	Maximum Continuous Drain–Source Diode Forward Current	–	–	59	A	
I <sub>SM</sub>	Maximum Pulsed Drain–Source Diode Forward Current	–	–	236	A	
V <sub>SD</sub>	Drain–Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 59 A	–	–	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 59 A, di <sub>F</sub> /dt = 100 A/μs	–	190	–	ns
Q <sub>rr</sub>	Reverse Recovery Charge		–	4.4	–	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.

TYPICAL PERFORMANCE CHARACTERISTICS

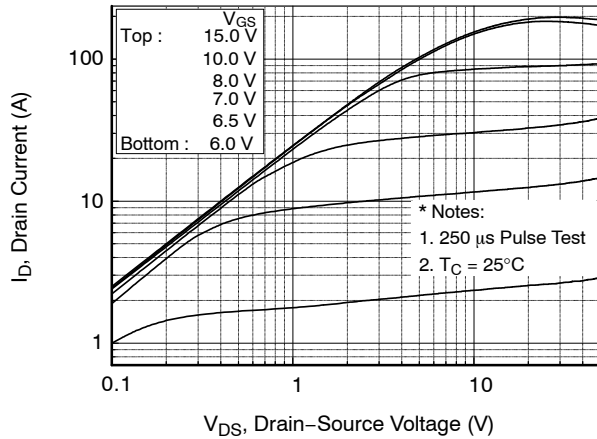


Figure 1. On-Region Characteristics

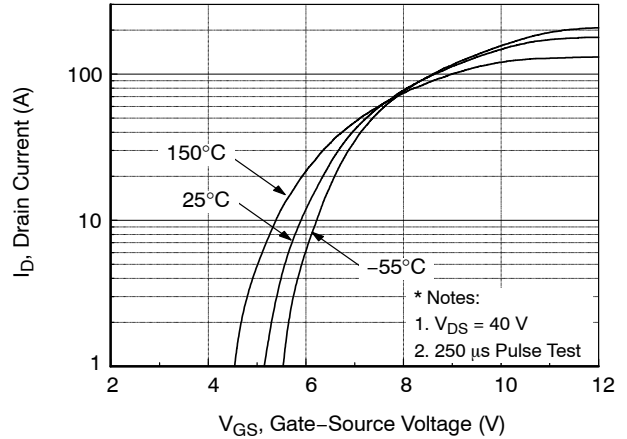


Figure 2. Transfer Characteristics

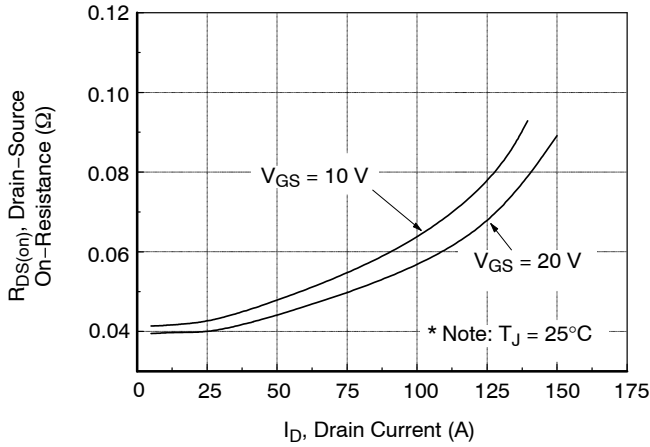


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

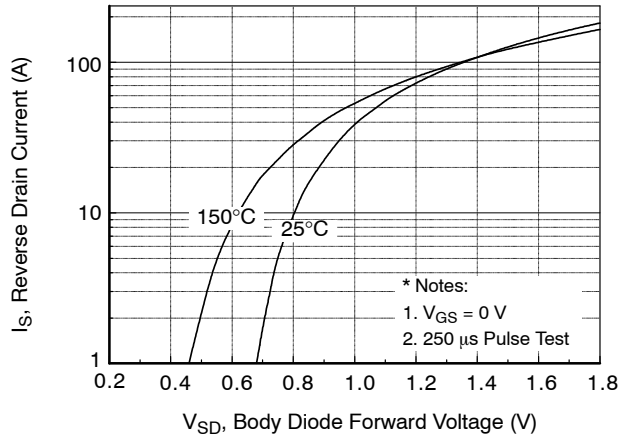


Figure 4. Body Diode Forward Voltage Variation vs. Source Current And Temperature

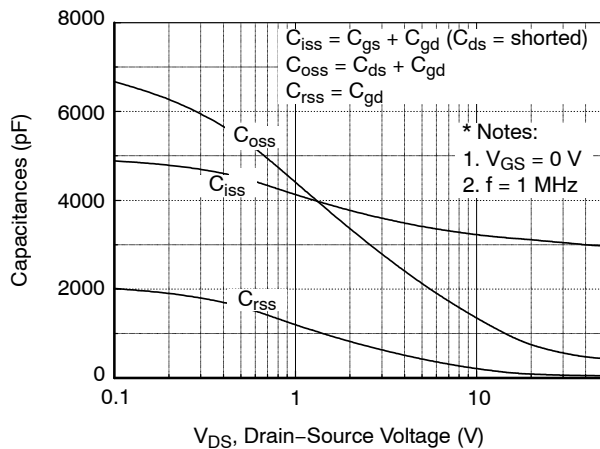


Figure 5. Capacitance Characteristics

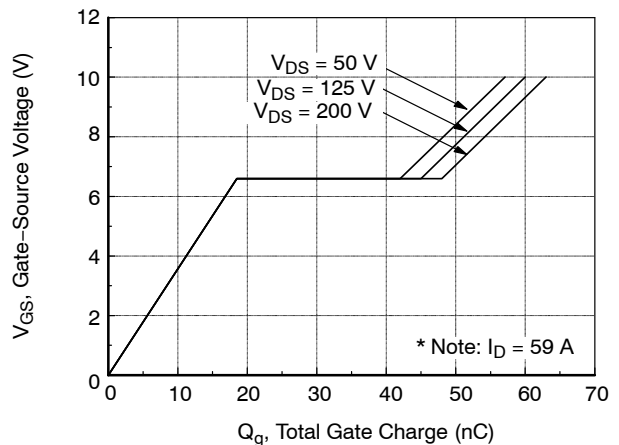


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

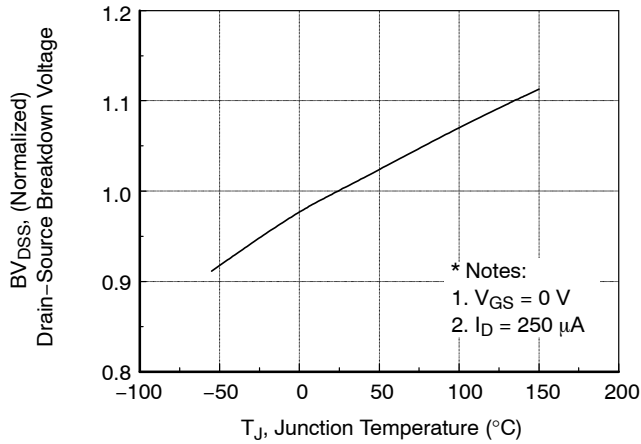


Figure 7. Breakdown Voltage Variation vs. Temperature

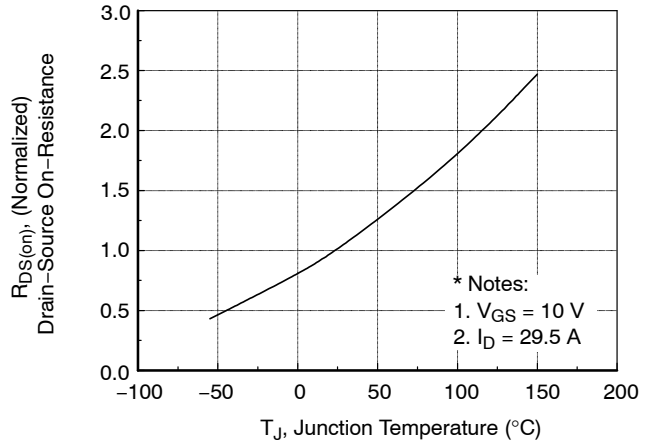


Figure 8. On-Resistance Variation vs. Temperature

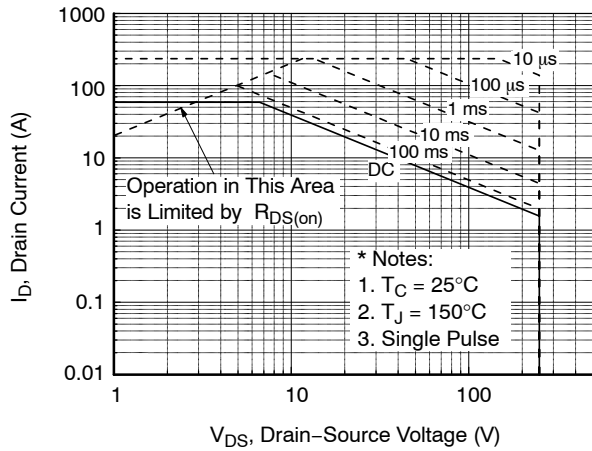


Figure 9. Maximum Safe Operating Area

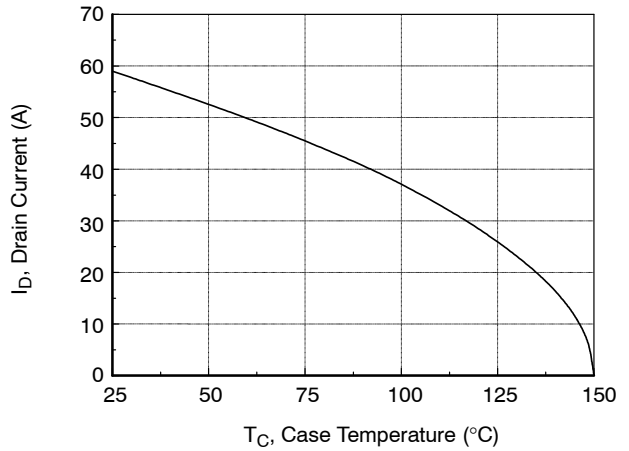


Figure 10. Maximum Drain Current vs. Case Temperature

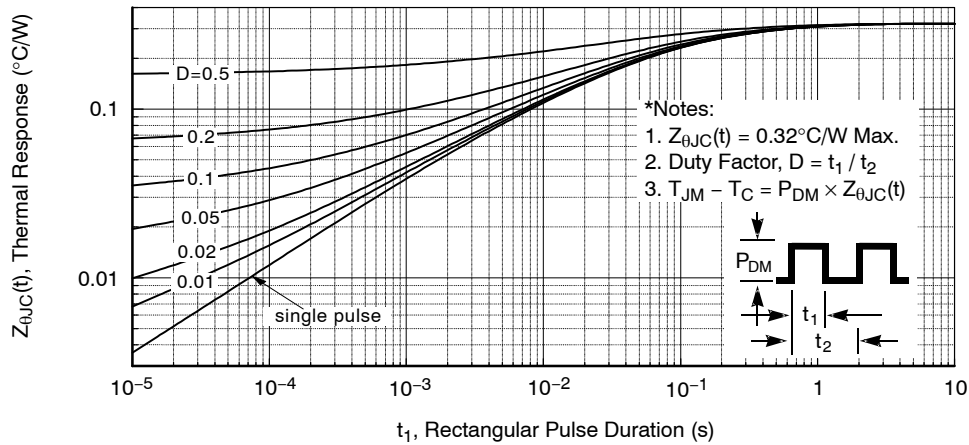


Figure 11. Transient Thermal Response Curve

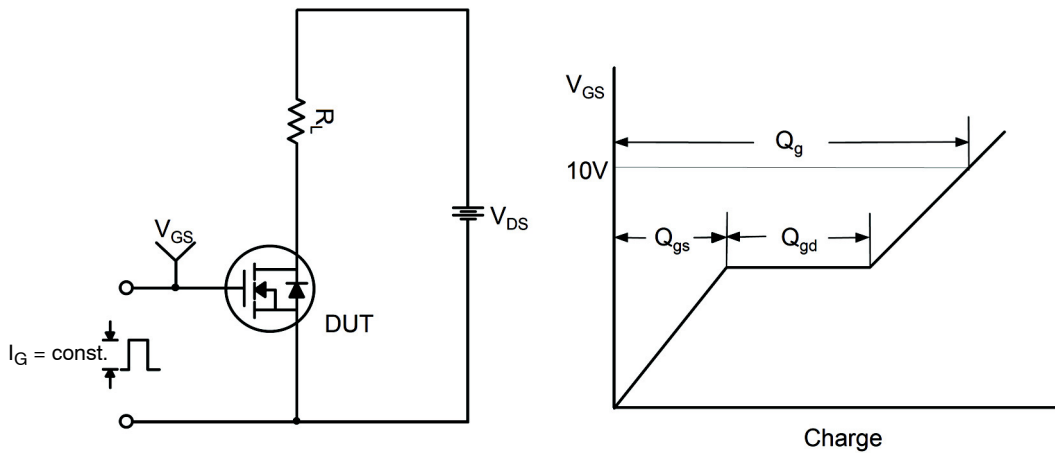


Figure 12. Gate Charge Test Circuit & Waveform

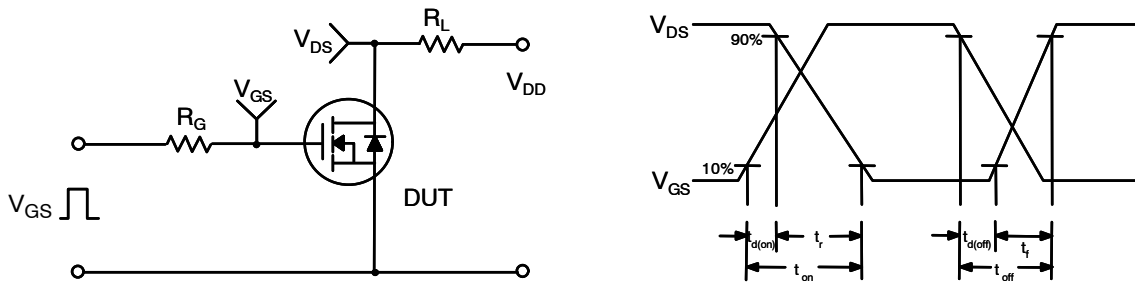


Figure 13. Resistive Switching Test Circuit & Waveforms

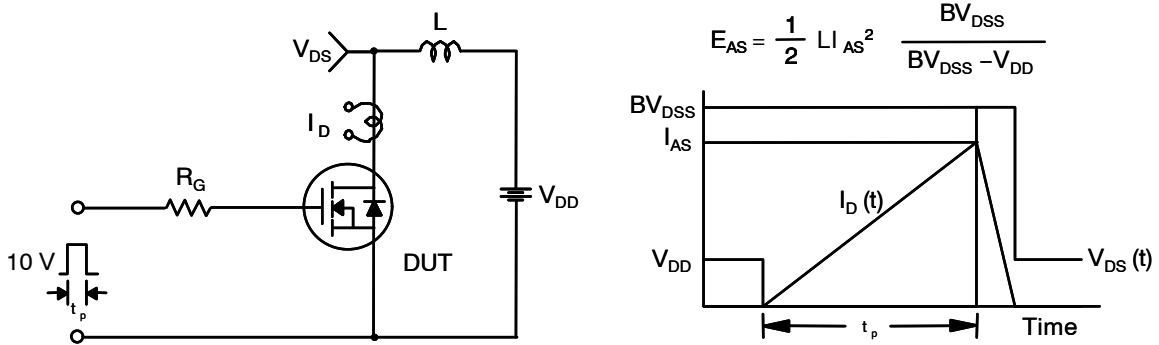
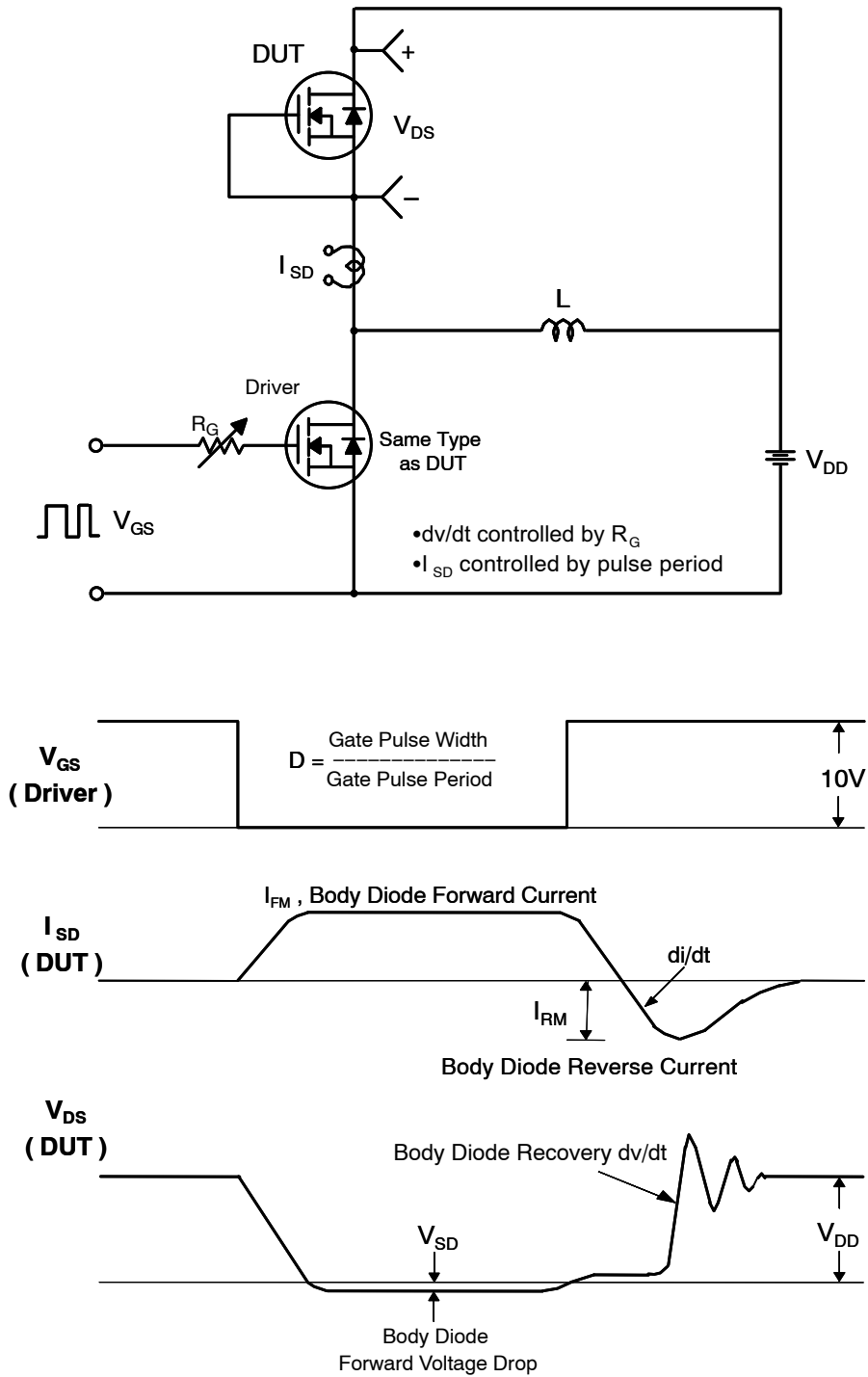


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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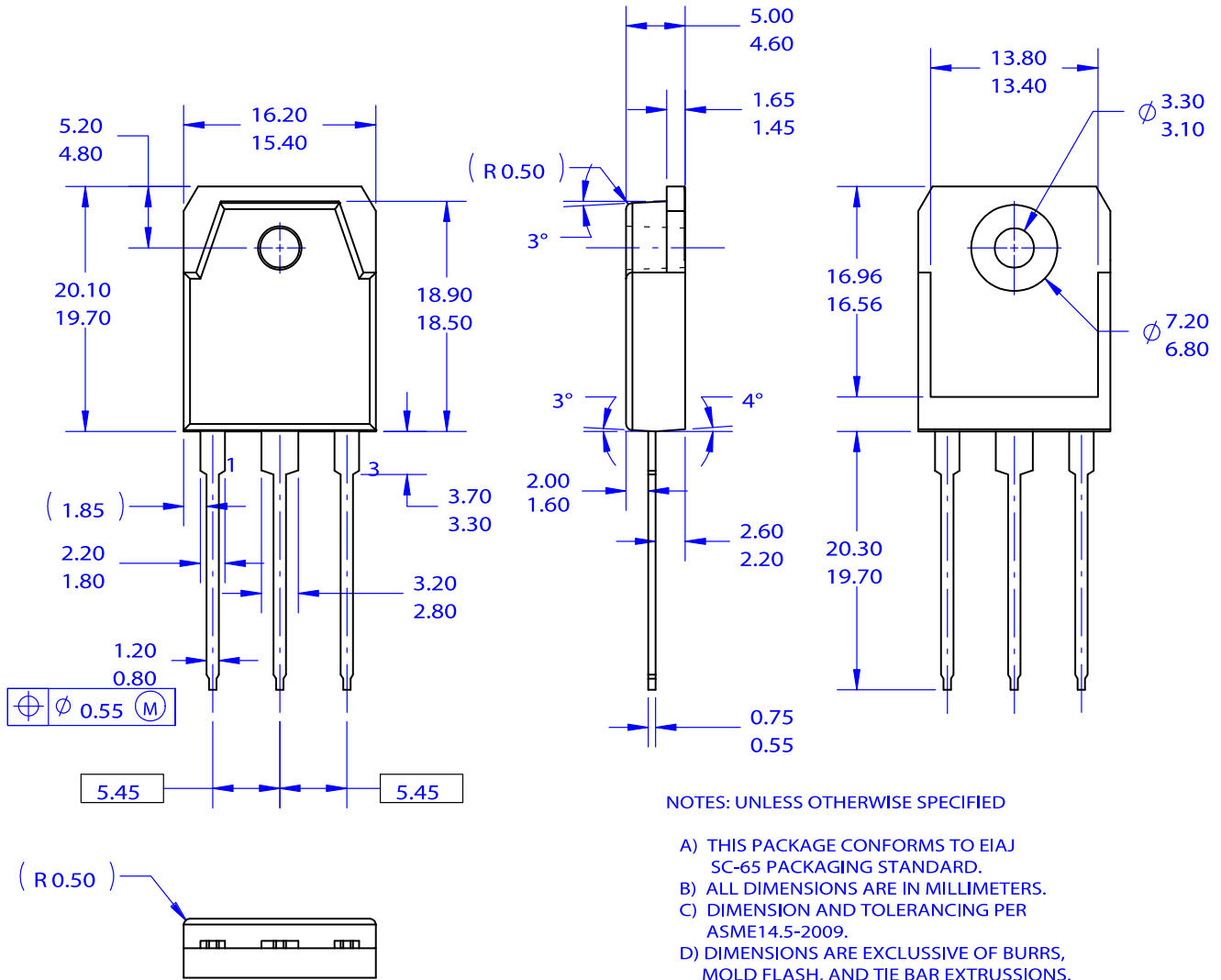


**Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms**

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**TO-3P-3LD / EIAJ SC-65, ISOLATED**  
**CASE 340BZ**  
**ISSUE O**

DATE 31 OCT 2016



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