



May 2014

## FQA90N15

### N-Channel QFET<sup>®</sup> MOSFET 150 V, 90 A, 18 mΩ

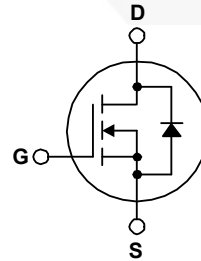
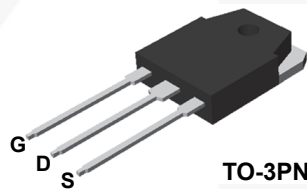
#### Features

- $R_{DS(on)} = 18 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 45 \text{ A}$
- Low Gate Charge (Typ. 220 nC)
- Low  $C_{rss}$  (Typ. 200 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating

#### Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for low voltage applications such as audio amplifier, high efficiency switching for DC/DC converters, and DC motor control, uninterrupted power supply.



#### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	FQA90N15	Unit
$V_{DSS}$	Drain-Source Voltage	150	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) - Continuous ( $T_C = 100^\circ\text{C}$ )	90 63.5	A A
$I_{DM}$	Drain Current - Pulsed (Note 1)	360	A
$V_{GSS}$	Gate-Source voltage	$\pm 25$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	1400	mJ
$I_{AR}$	Avalanche Current (Note 1)	90	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	37.5	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)	6.0	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate Above $25^\circ\text{C}$	375 2.5	W W/°C
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	°C
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	°C

#### Thermal Characteristics

Symbol	Parameter	FQA90N15	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.4	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.24	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	°C/W

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQA90N15	FQA90N15	TO-3PN	Tube	N/A	N/A	30 units

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	150	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	--	0.15	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 150V, V <sub>GS</sub> = 0V V <sub>DS</sub> = 120V, T <sub>C</sub> = 150°C	-- --	-- --	1 10	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 25V, V <sub>DS</sub> = 0V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -25V, V <sub>DS</sub> = 0V	--	--	-100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.0	--	4.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 45A	--	0.014	0.018	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 45A	--	68	--	S
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	6700	8700	pF
C <sub>oss</sub>	Output Capacitance		--	1400	1800	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	200	260	pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 75V, I <sub>D</sub> = 90A R <sub>G</sub> = 25Ω  <div>(Note 4)</div>	--	105	220	ns
t <sub>r</sub>	Turn-On Rise Time		--	760	1500	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	470	950	ns
t <sub>f</sub>	Turn-Off Fall Time		--	410	830	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 120V, I <sub>D</sub> = 90A V <sub>GS</sub> = 10V  <div>(Note 4)</div>	--	220	285	nC
Q <sub>gs</sub>	Gate-Source Charge		--	43	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	110	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	90	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	360	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 90A	--	--	1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 90A	--	175	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> /dt = 100A/μs	--	0.97	--	μC

### NOTES:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 0.29 mH, I<sub>AS</sub> = 90 A, V<sub>DD</sub> = 25 V, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.
3. I<sub>SD</sub> ≤ 90 A, di/dt ≤ 300 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C.
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

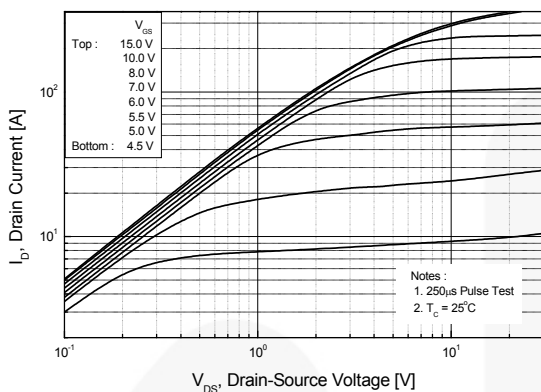


Figure 2. Transfer Characteristics

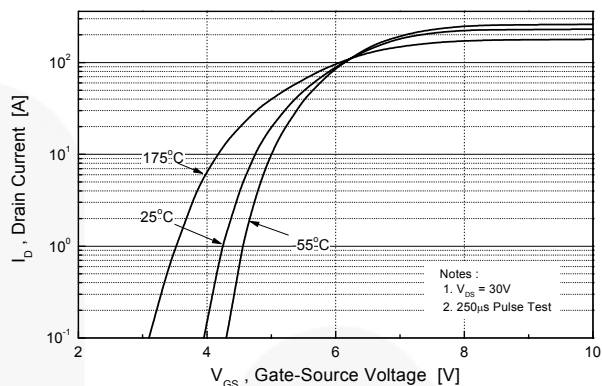


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

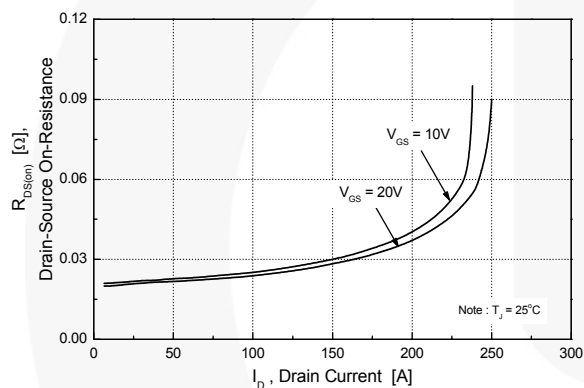


Figure 4. Body Diode Forward Voltage Variation vs. Source Current

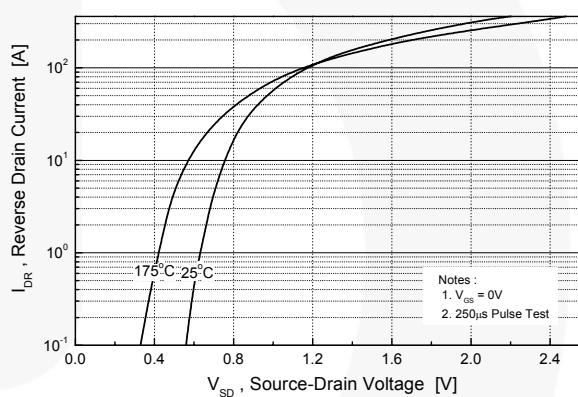


Figure 5. Capacitance Characteristics

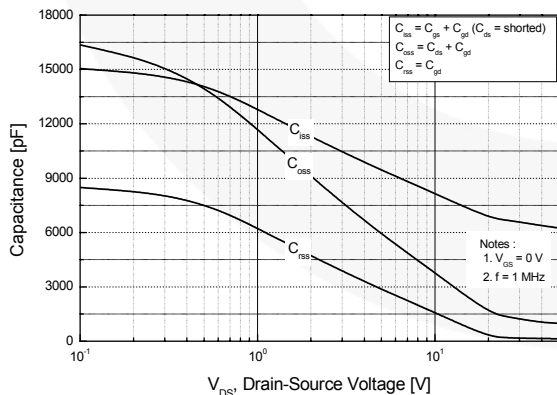
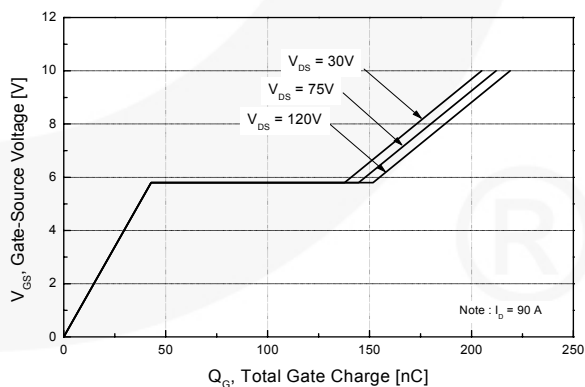
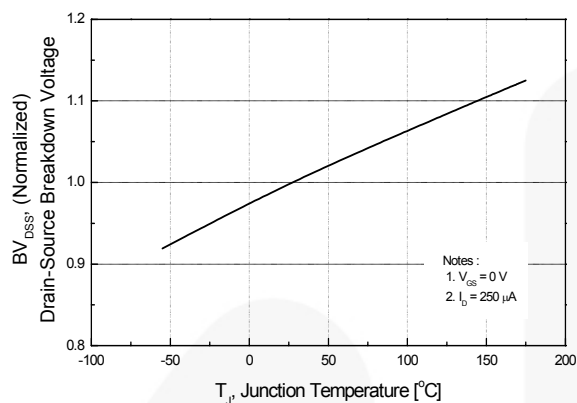


Figure 6. Gate Charge Characteristics

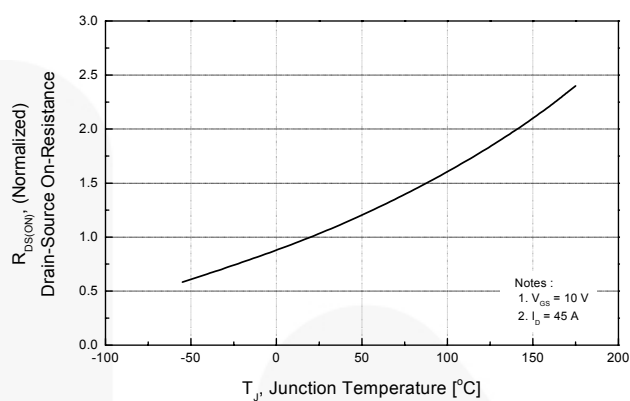


# Typical Performance Characteristics (Continued)

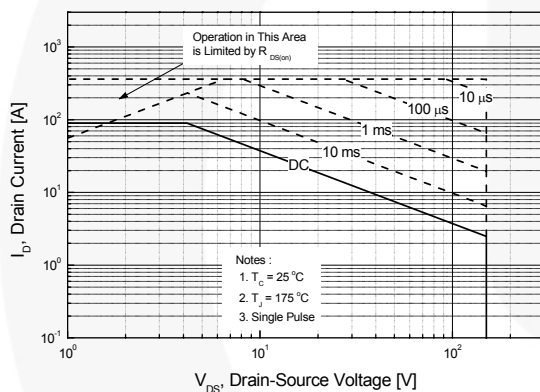
**Figure 7. Breakdown Voltage Variation vs. Temperature**



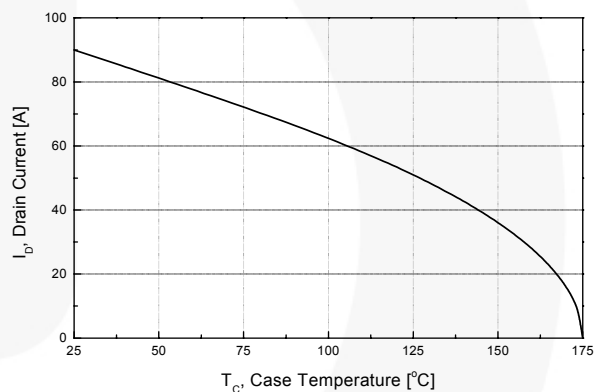
**Figure 8. On-Resistance Variation vs. Temperature**



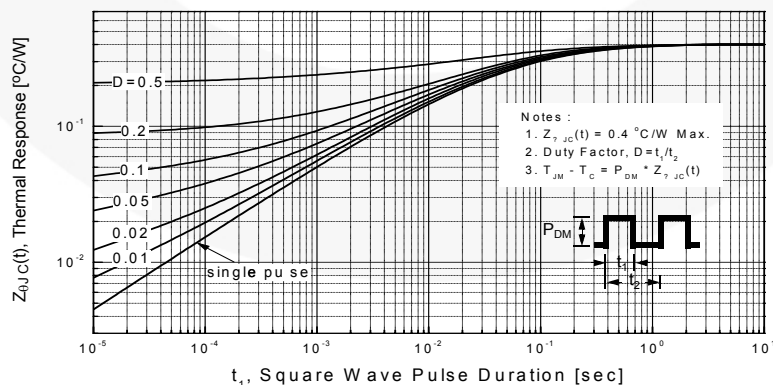
**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Transient Thermal Response Curve**



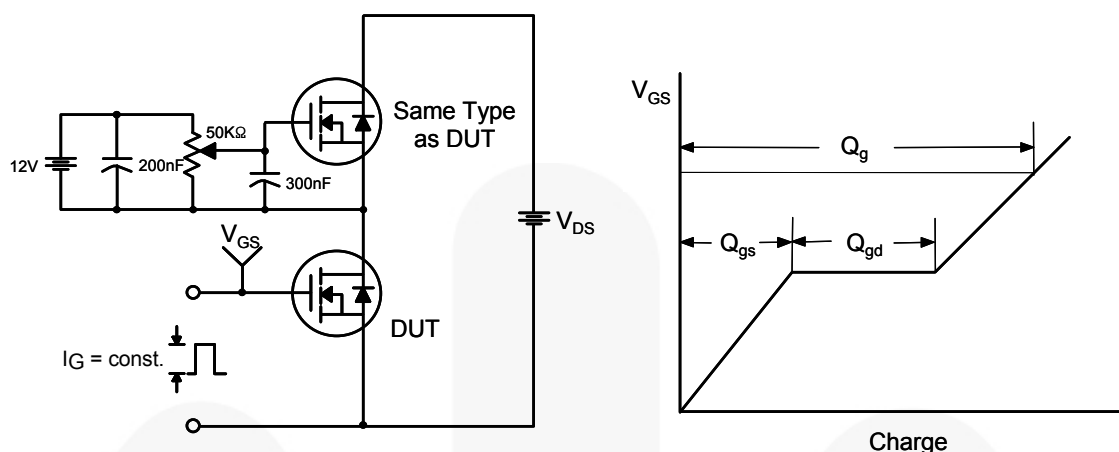


Figure 12. Gate Charge Test Circuit &amp; Waveform

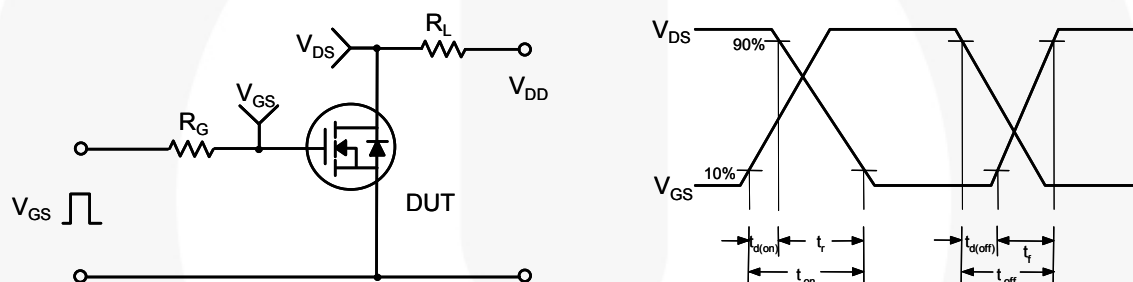


Figure 13. Resistive Switching Test Circuit &amp; Waveforms

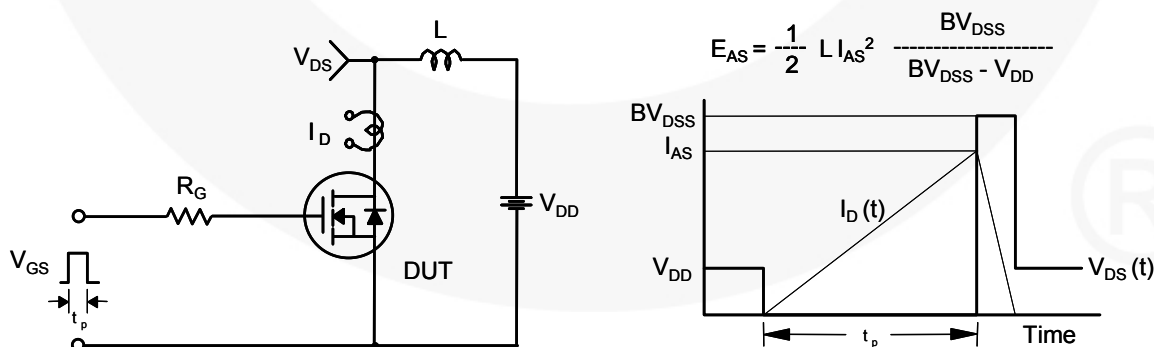
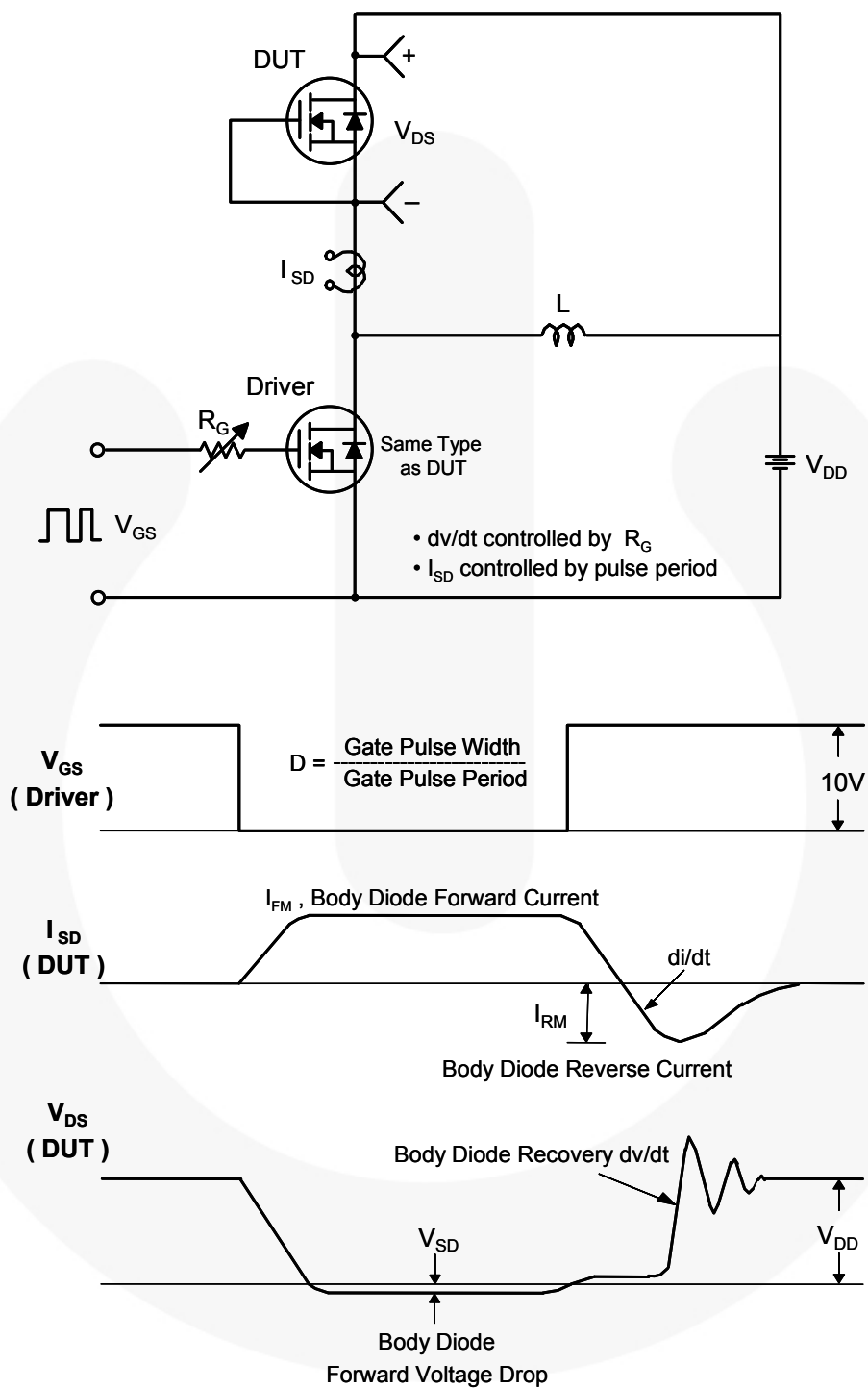
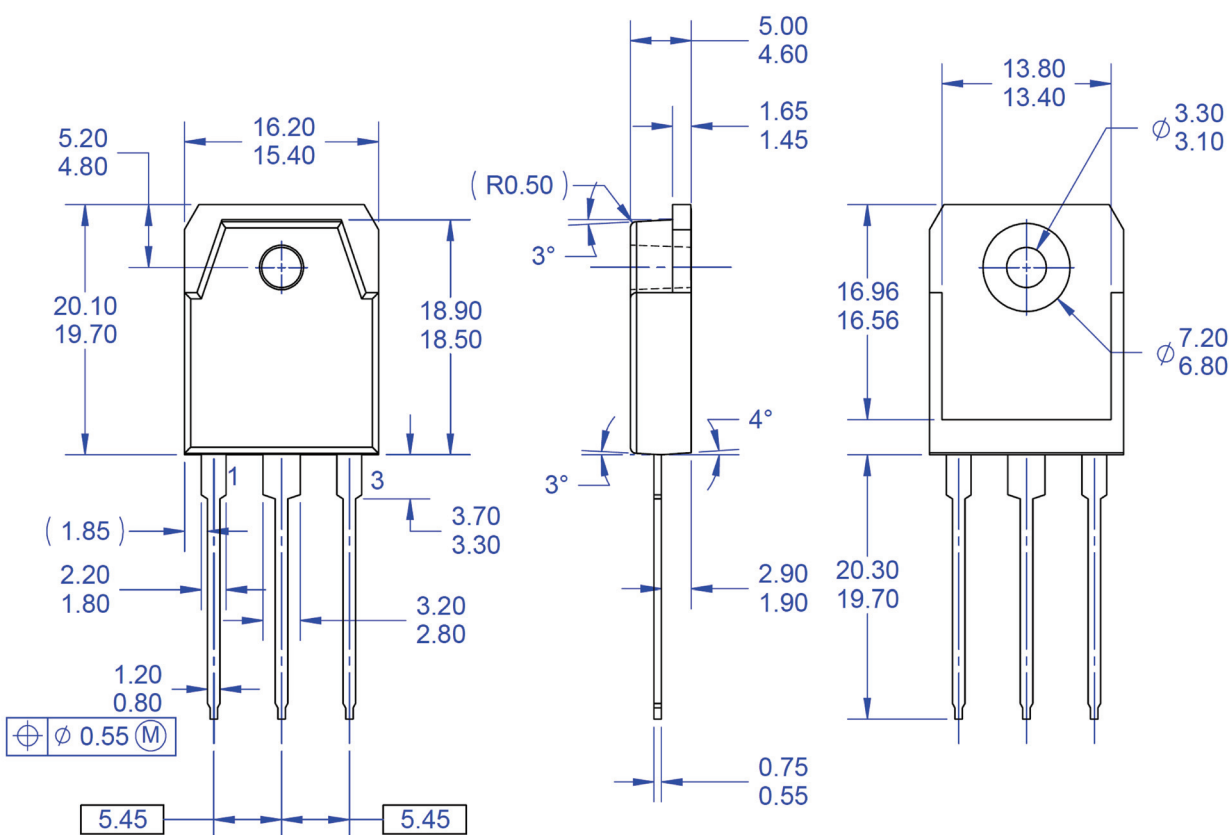


Figure 14. Unclamped Inductive Switching Test Circuit &amp; Waveforms

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

## Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5-2009.
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- E) DRAWING FILE NAME: TO3PN03AREV1.
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Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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