



April 2014

## FQA13N80\_F109

### N-Channel QFET® MOSFET

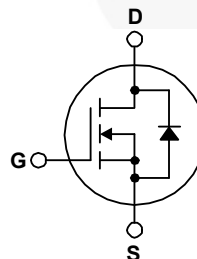
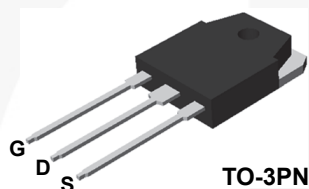
800 V, 12.6 A, 750 mΩ

#### Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

#### Features

- 12.6 A, 800 V,  $R_{DS(on)} = 750 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 6.3 \text{ A}$
- Low Gate Charge (Typ. 68 nC)
- Low  $C_{rss}$  (Typ. 30 pF)
- 100% Avalanche Tested



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

Symbol	Parameter	FQA13N80_F109	Unit
$V_{DSS}$	Drain-Source Voltage	800	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	12.6	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	8.0	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	50.4	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	1100	mJ
$I_{AR}$	Avalanche Current (Note 1)	12.6	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	30	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)	4.0	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	300	W
	- Derate above $25^\circ\text{C}$	2.38	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

#### Thermal Characteristics

Symbol	Parameter	FQA13N80_F109	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.42	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.24	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQA13N80_F109	FQA13N80	TO-3PN	Tube	N/A	N/A	30 units

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	800	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	--	0.95	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 800 V, V <sub>GS</sub> = 0 V	--	--	10	μA
		V <sub>DS</sub> = 640 V, T <sub>C</sub> = 125°C	--	--	100	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	--	--	100	nA
I <sub>GSSR</sub>	Gate-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> = 6.3A	--	0.58	0.75	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 6.3A	--	13	--	S
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	--	2700	3500	pF
C <sub>oss</sub>	Output Capacitance		--	275	360	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	30	39	pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 12.6A, R <sub>G</sub> = 25 Ω  (Note 4)	--	60	130	ns
t <sub>r</sub>	Turn-On Rise Time		--	150	310	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	155	320	ns
t <sub>f</sub>	Turn-Off Fall Time		--	110	230	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 640 V, I <sub>D</sub> = 12.6A, V <sub>GS</sub> = 10 V  (Note 4)	--	68	88	nC
Q <sub>gs</sub>	Gate-Source Charge		--	15	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	32	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	12.6	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	50.4	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 12.6A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 12.6 A, dI <sub>F</sub> / dt = 100 A/μs	--	850	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	11.3	--	μC

### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 13\text{ mH}$ ,  $I_{AS} = 12.6\text{ A}$ ,  $V_{DD} = 50\text{ V}$ ,  $R_G = 25\text{ }\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 12.6\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially independent of operating temperature

## Typical Characteristics

Figure 1. On-Region Characteristics

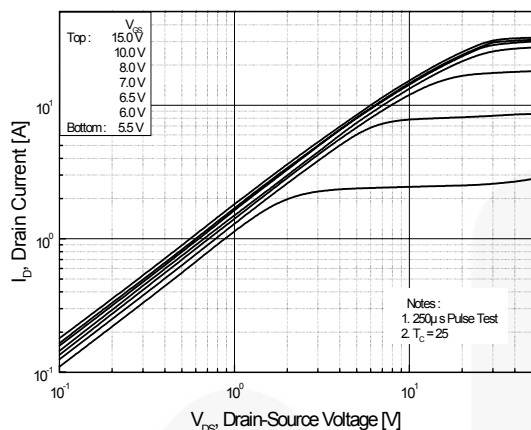


Figure 2. Transfer Characteristics

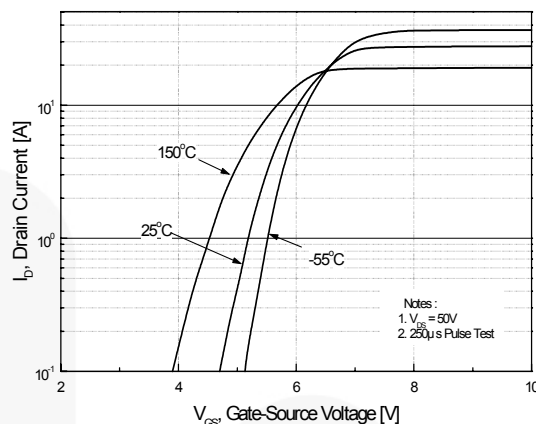


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

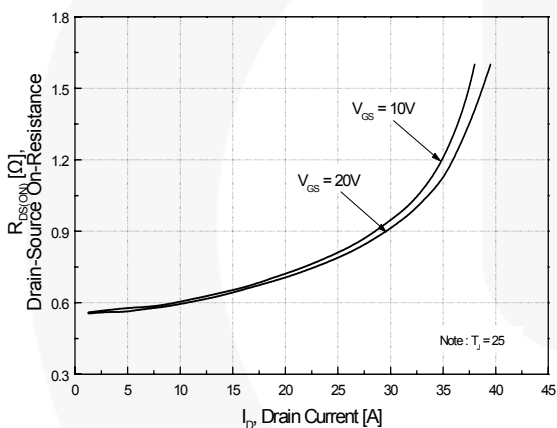


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

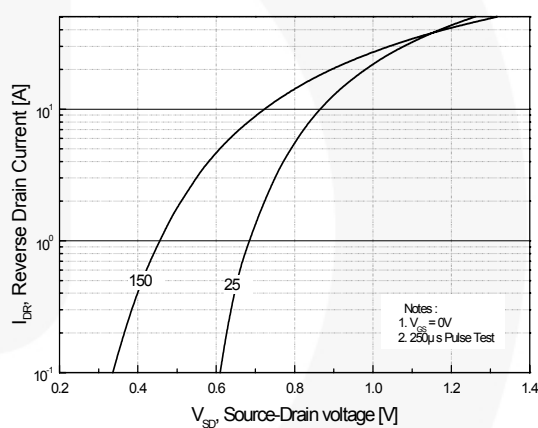


Figure 5. Capacitance Characteristics

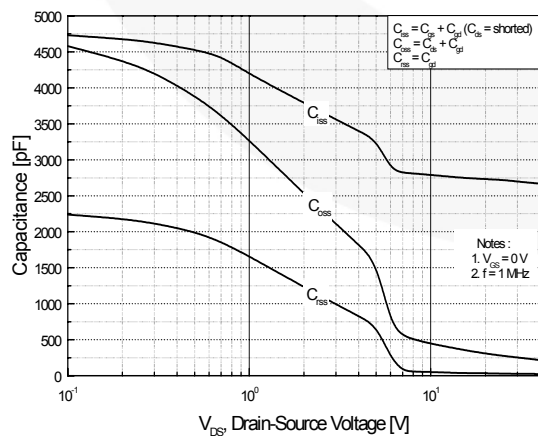
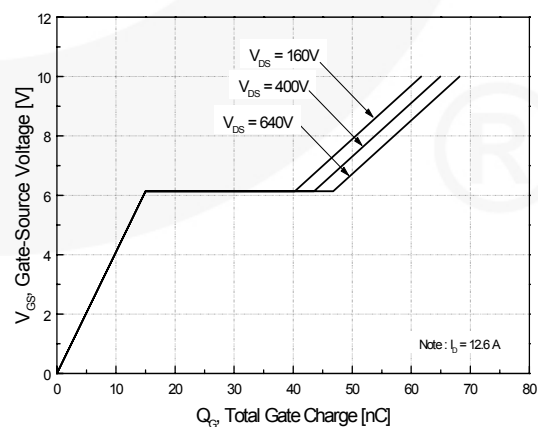
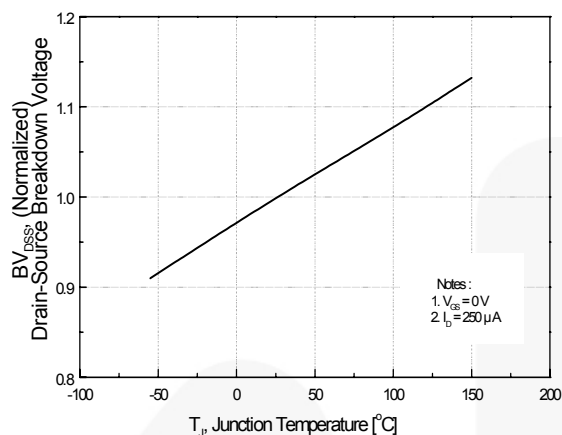


Figure 6. Gate Charge Characteristics

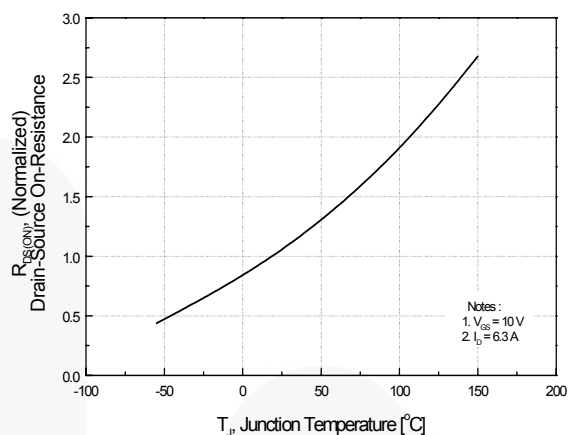


## Typical Characteristics (Continued)

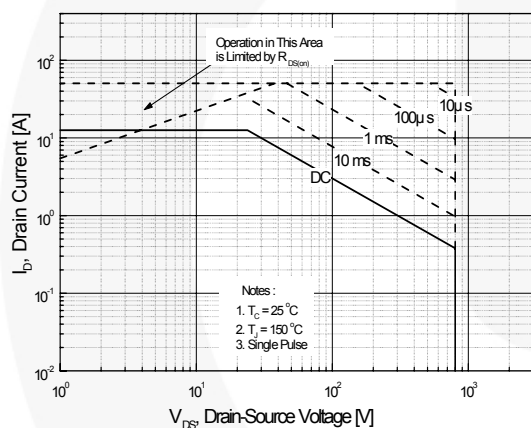
**Figure 7. Breakdown Voltage Variation vs. Temperature**



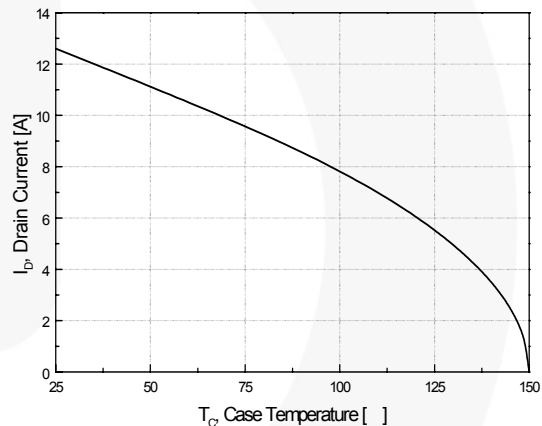
**Figure 8. On-Resistance Variation vs. Temperature**



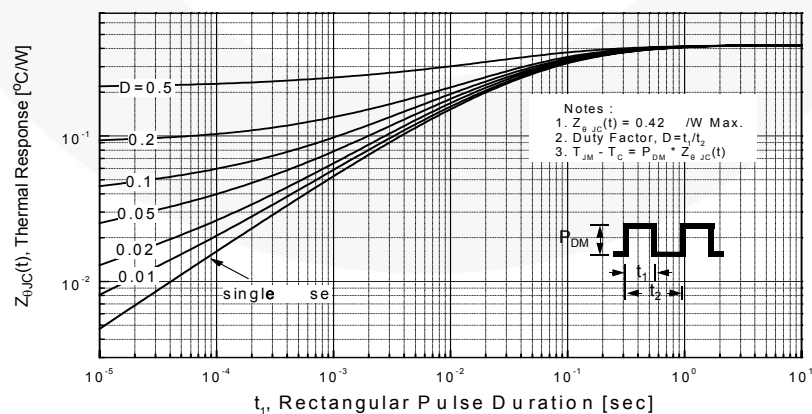
**Figure 9. Maximum Safe Operating Area**



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



**Figure 11. Transient Thermal Response Curve**



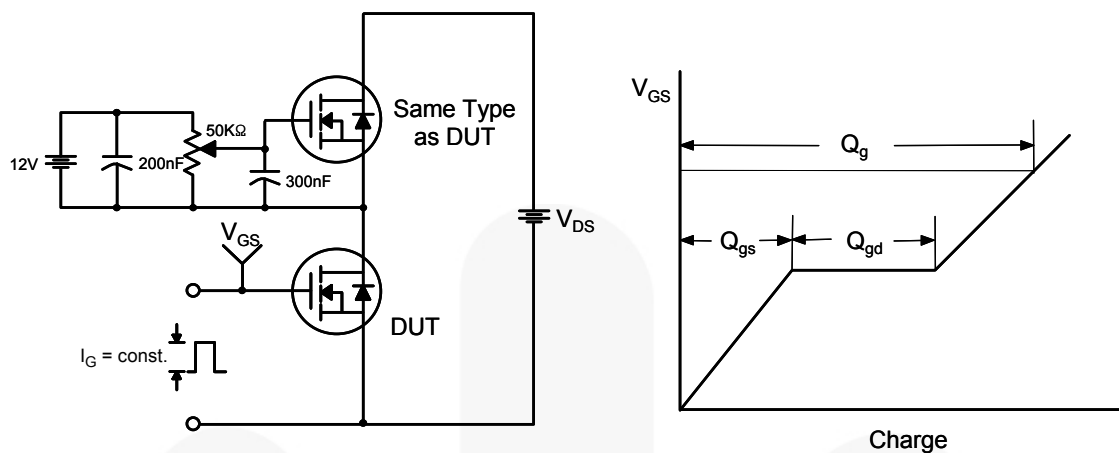


Figure 12. Gate Charge Test Circuit & Waveform

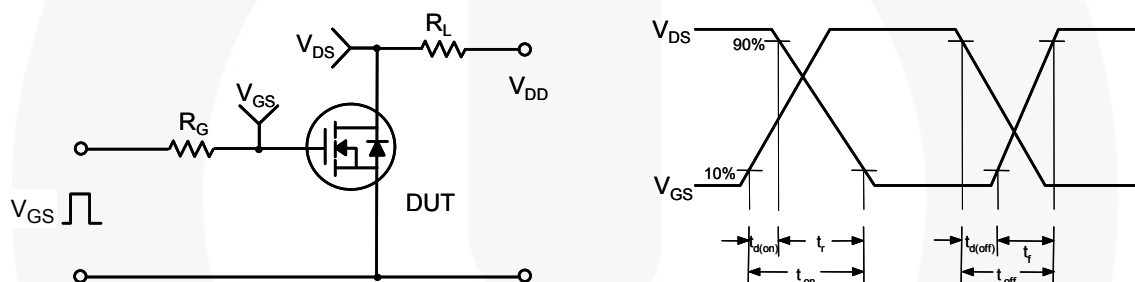


Figure 13. Resistive Switching Test Circuit & Waveforms

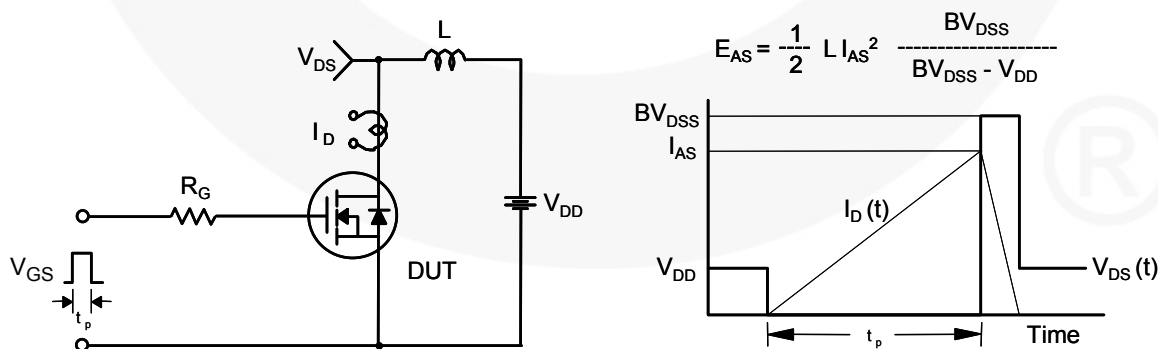
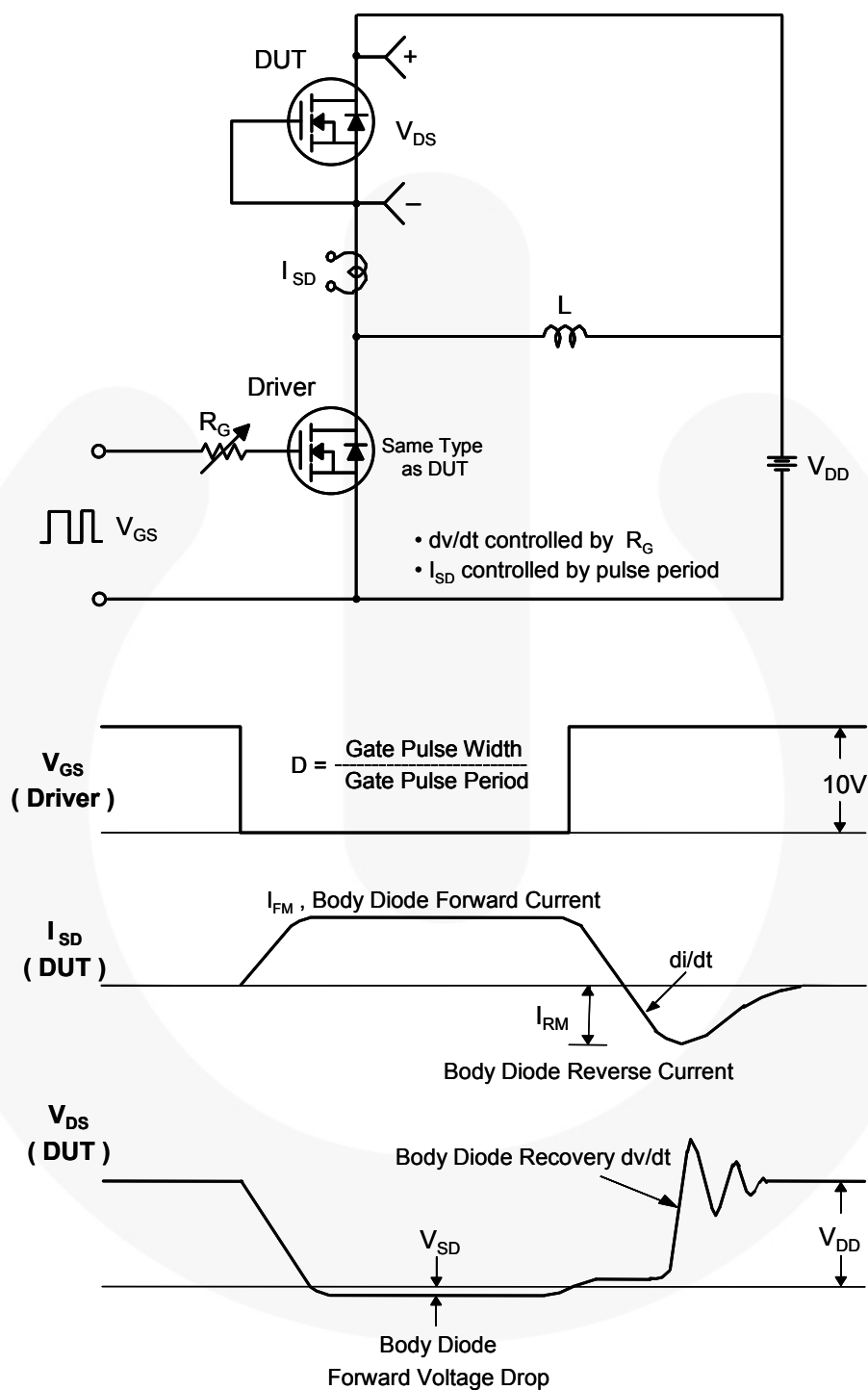
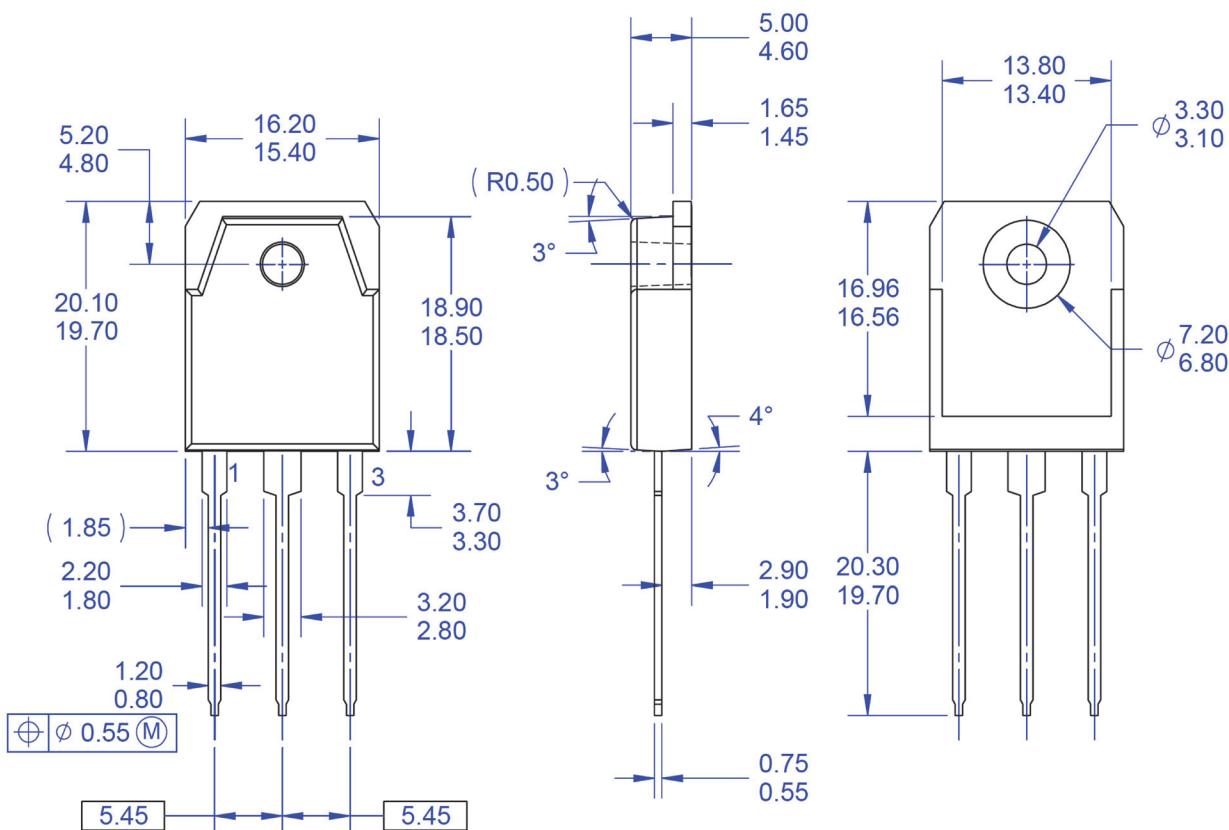


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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

## Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

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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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