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April 2014

FQA11N90C_F109

N-Channel QFET® MOSFET

900 V, 11.0 A, 1.1 Ω

Features

- 11 A, 900 V, $R_{DS(on)}$ = 1.1 Ω (Max.) @ V_{GS} = 10 V, I_D = 5.5 A
- Low Gate Charge (Typ. 60 nC)
- Low Crss (Typ. 23 pF)
- 100% Avalanche Tested
- RoHS compliant

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.

TO-3PN
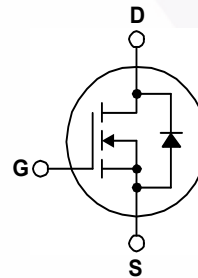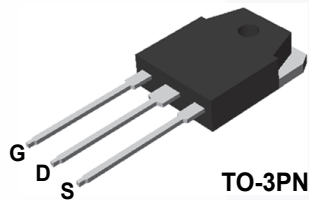
MOSFET Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter			FQA11N90C_F109	Unit
V_{DSS}	Drain to Source Voltage			900	V
I_D	Drain Current	- Continuous (T_C = 25°C)		11.0	A
		- Continuous (T_C = 100°C)		6.9	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	44.0	A
V_{GSS}	Gate to Source Voltage			± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	960	mJ
I_{AR}	Avalanche Current		(Note 1)	11.0	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°C)		300	W
		- Derate Above 25°C		2.38	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds			300	°C

Thermal Characteristics

Symbol	Parameter	FQA11N90C_F109	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	0.42	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max	40	°C/W

www.fairchildsemi.com

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQA11N90C_F109	FQA11N90C	TO-3PN	Tube	N/A	N/A	30 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	900	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	--	1.02	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 900 V, V_{GS} = 0 V	--	--	10	µA
		V_{DS} = 720 V, T_C = 125°C	--	--	100	µA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 5.5 A	--	0.91	1.1	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50 V, I_D = 5.5 A	--	9.0	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	2530	3290	pF
C_{oss}	Output Capacitance		--	215	280	pF
C_{rss}	Reverse Transfer Capacitance		--	23	30	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 450 V, I_D = 11.0 A, R_G = 25 Ω	--	60	130	ns
t_r	Turn-On Rise Time		--	130	270	ns
$t_{d(off)}$	Turn-Off Delay Time		--	130	270	ns
t_f	Turn-Off Fall Time	(Note 4)	--	85	180	ns
Q_g	Total Gate Charge	V_{DS} = 720 V, I_D = 11.0 A, V_{GS} = 10 V	--	60	80	nC
Q_{gs}	Gate-Source Charge		--	13	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4)	--	25	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	11.0	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	44.0	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 11.0 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 11.0 A, dI_F / dt = 100 A/µs	--	1000	--	ns
Q_{rr}	Reverse Recovery Charge		--	17.0	--	µC

Notes :

1. Repetitive rating : pulse width limited by maximum junction temperature.

2. L = 15 mH, I_{AS} = 11.0 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.

3. I_{SD} ≤ 11.0 A, di/dt ≤ 200 A/µs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.

4. Essentially independent of operating temperature.
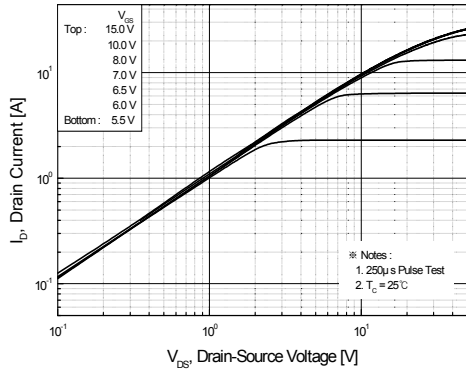
Typical Characteristics
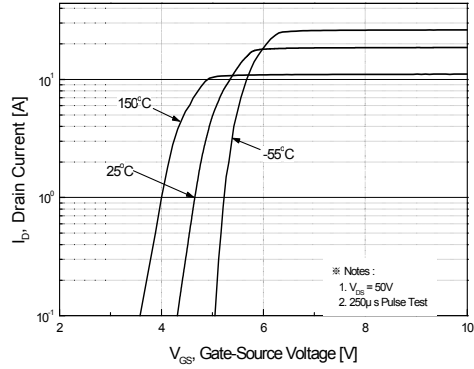

Figure 1. On-Region Characteristics

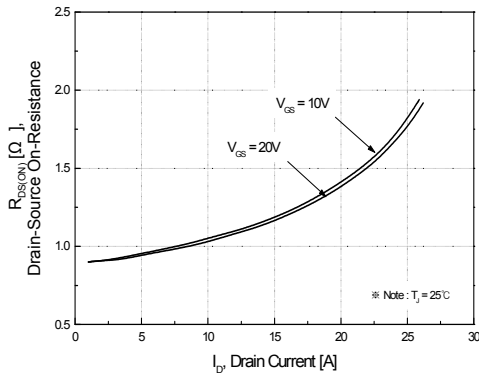**Figure 2. Transfer Characteristics**

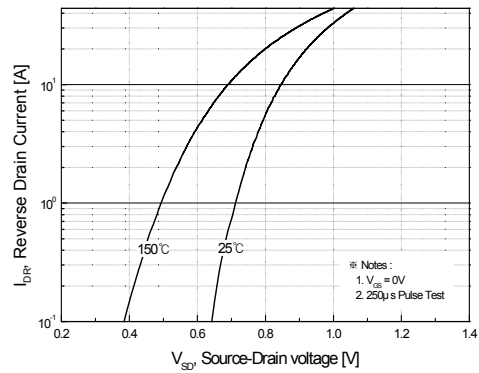**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**

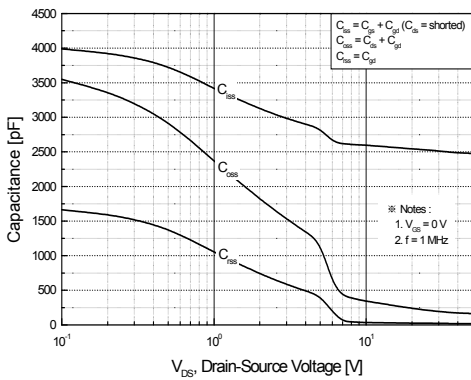**Figure 4. Body Diode Forward Voltage Variation with Source Current**
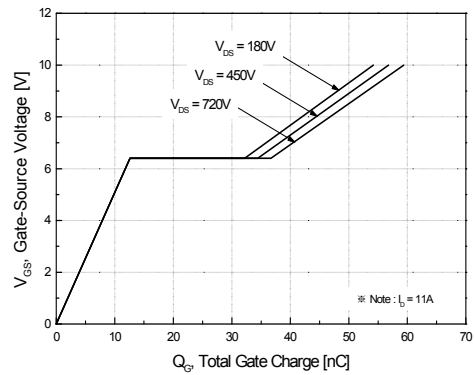

Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics
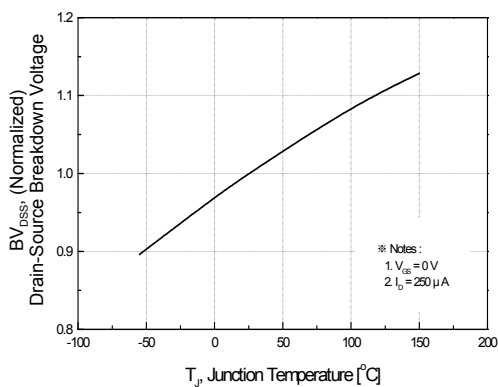
Typical Characteristics (Continued)

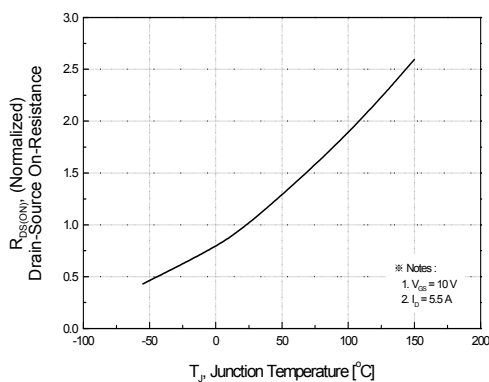**Figure 7. Breakdown Voltage Variation**
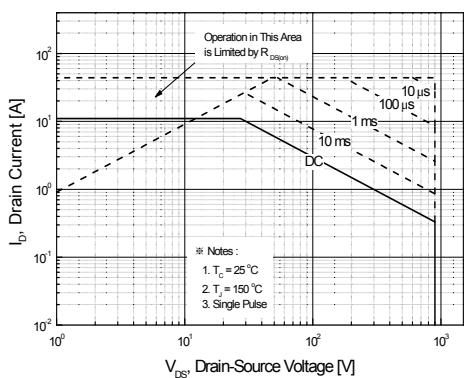

Figure 8. On-Resistance Variation
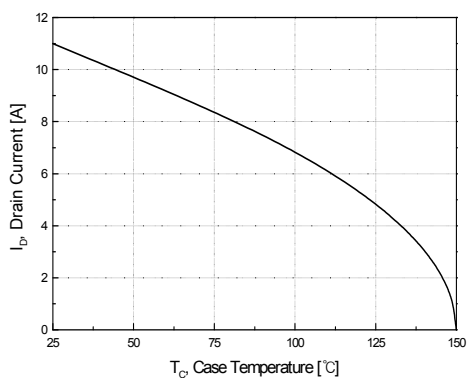

Figure 9. Maximum Safe Operating Area

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

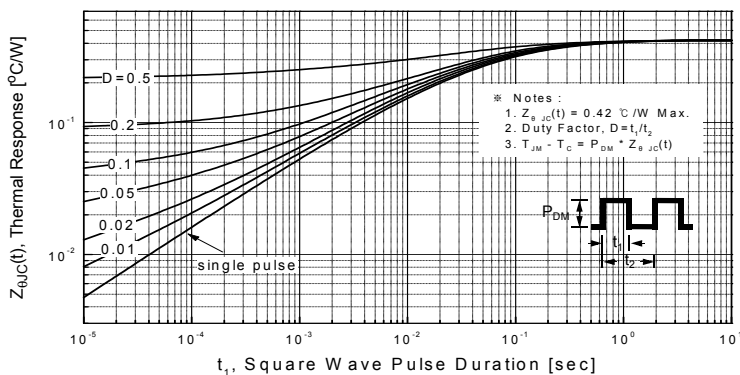**Figure 11. Transient Thermal Response Curve**
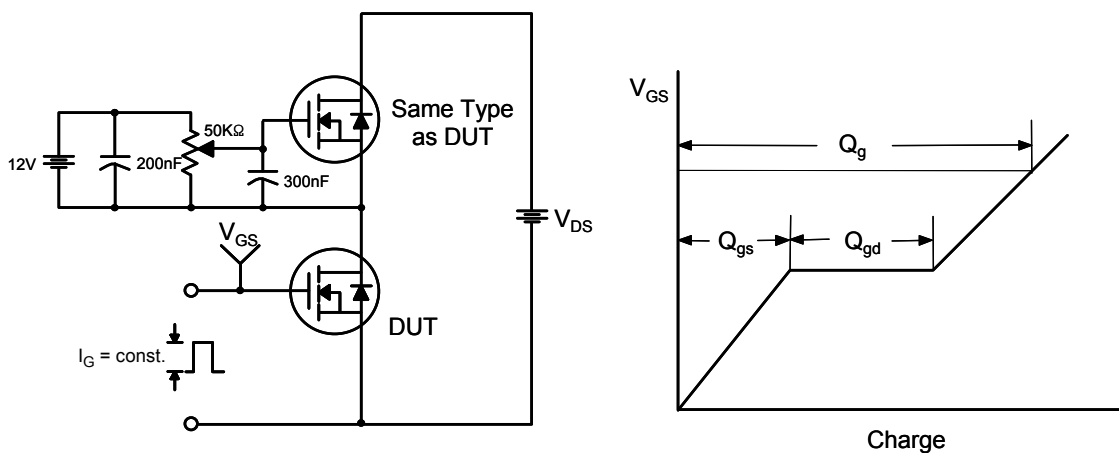
Figure 12. Gate Charge Test Circuit & Waveform

12V
200nF
50KΩ
300nF
Same Type
as DUT
V_{GS}
DUT
I_G = const.
V_{DS}

V_{GS}
Q_g
Q_{gs}
Q_{gd}
Charge

Figure 13. Resistive Switching Test Circuit & Waveforms

V_{DS}
R_L
V_{GS}
R_G
V_{DD}
DUT
V_{GS}

V_{DS}
90%
V_{GS}
10%
$t_{d(on)}$
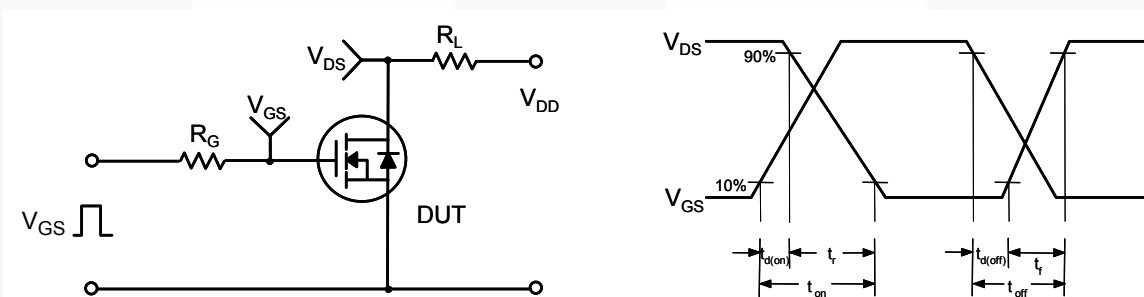t_r
$t_{d(off)}$
t_f
t_{on}
t_{off}

Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

V_{DS}
L
I_D
R_G
V_{DD}
DUT
V_{GS}
t_p

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \quad \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

BV_{DSS}
I_{AS}
I_D (t)
V_{DD}
V_{DS} (t)
t_p
Time
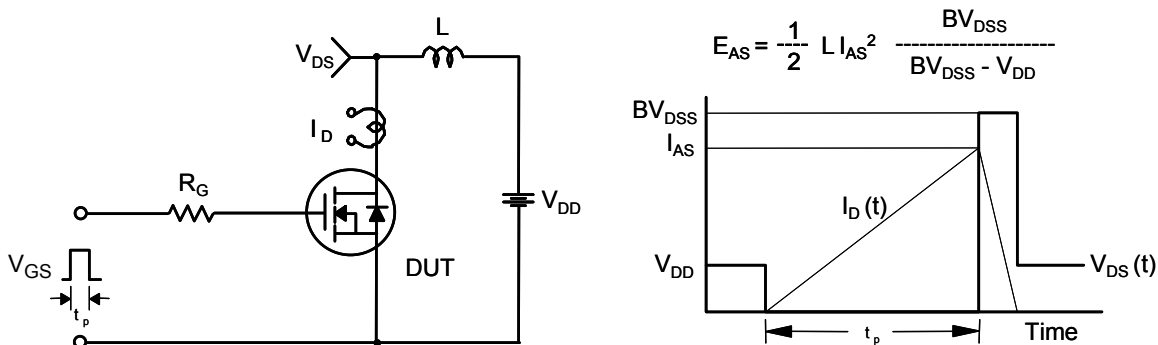
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

DUT

V_{DS}

I_{SD}

L

Driver

R_G

Same Type
as DUT

V_{DD}

V_{GS}

- dv/dt controlled by R_G
- I_{SD} controlled by pulse period

V_{GS}
(Driver)

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$

10V

I_{SD}
(DUT)

I_{FM} , Body Diode Forward Current

di/dt

I_{RM}

Body Diode Reverse Current

V_{DS}
(DUT)

Body Diode Recovery dv/dt

V_{SD}

V_{DD}

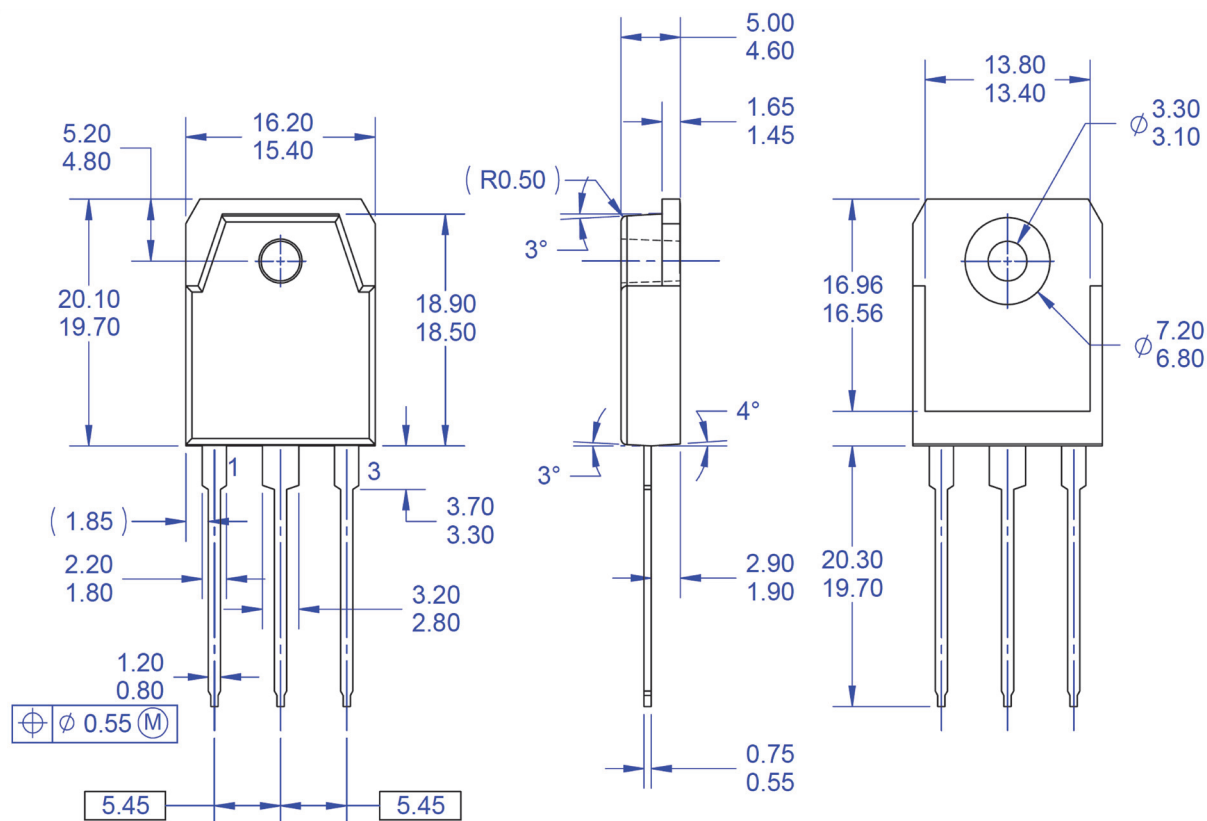Body Diode
Forward Voltage Drop
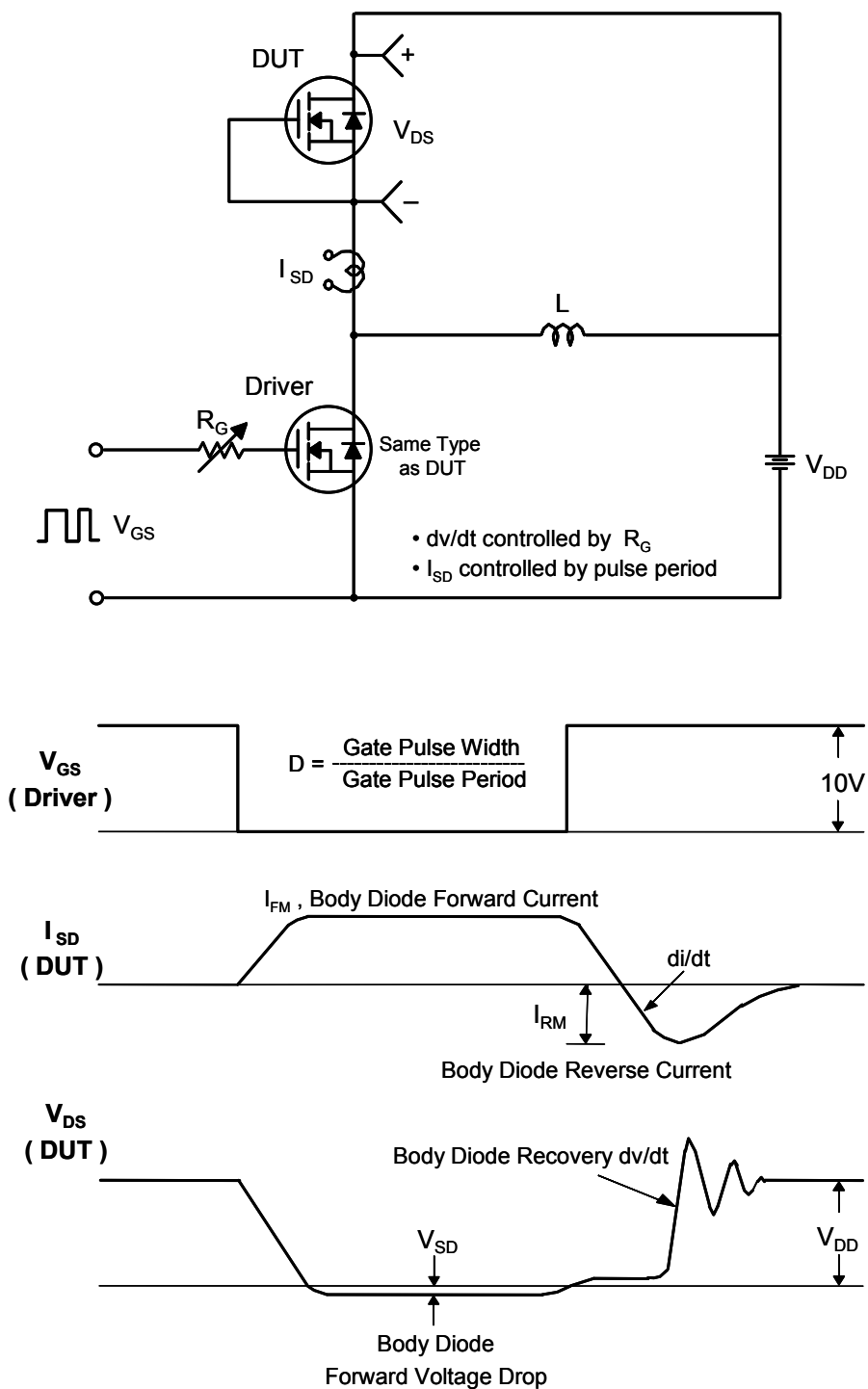
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NOTES: UNLESS OTHERWISE SPECIFIED

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E) DRAWING FILE NAME: TO3PN03AREV1.
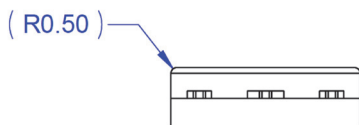F) FAIRCHILD SEMICONDUCTOR.

Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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