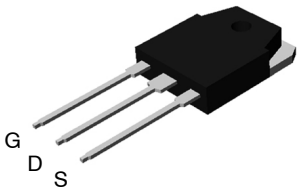
MOSFET – N-Channel QFET

250 V, 40 A, 70 mΩ

FQA40N25



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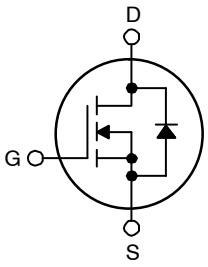
CASE 340BZ



Description

This N−Channel enhancement mode power MOSFET is produced using **onsemi**'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

- 40 A, 250 V, $R_{DS(on)}$ = 70 mΩ (Max) @ V_{GS} = 10 V, I_D = 20 A
- Low Gate Charge (Typ. 85 nC)
- Low Crss (Typ. 70 pF)
- 100% Avalanche Tested
- This is a Pb−Free Device

ABSOLUTE MAXIMUM RATINGS

(T_C = 25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V_{DSS}	Drain−Source Voltage	250	V
I_D	Drain Current Continuous (T_C = 25°C) Continuous (T_C = 100°C)	 40 25	A
I_{DM}	Drain Current − Pulsed (Note 1)	160	A
V_{GSS}	Gate to Source Voltage	±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	800	mJ
I_{AR}	Avalanche Current (Note 1)	40	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	28	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P_D	Power Dissipation (T_C = 25°C) − Derate above 25°C	 280 2.22	 W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range	−55 to +150	°C
T_L	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.

MARKING DIAGRAM



FQA40N25	= Specific Device Code
A	= Assembly Location
YWW	= Date Code (Year & Week)
ZZ	= Assembly Lot

ORDERING INFORMATION

Device	Package	Shipping
FQA40N25	TO−3P (Pb−Free)	450 Unit / Tube

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THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case, Max	0.45	°C/W
$R_{\theta CS}$	Thermal Resistance, Junction−to−Sink, Typ	0.24	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient, Max	40	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTIC						
BV_{DSS}	Drain−Source Breakdown Voltage	V_{GS} = 0 V, $_D$ = 250 μA	250	–	–	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	–	0.24	–	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 250 V, V_{GS} = 0 V	–	–	1	μA
		V_{DS} = 200 V, T_C = 125°C	–	–	10	
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	
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 = 20 A	–	0.051	0.07	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50 V, I_D = 20 A	–	29	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	–	3100	4000	pF
C_{oss}	Output Capacitance		–	620	800	pF
C_{rss}	Reverse Transfer Capacitance		–	70	90	pF
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 125 V, I_D = 40 A, R_G = 25 Ω (Note 4)	–	70	150	ns
t_r	Turn−On Rise Time		–	580	1150	ns
$t_{d(off)}$	Turn−Off Delay Time		–	120	250	ns
t_f	Turn−Off Fall Time		–	165	340	ns
Q_g	Total Gate Charge	V_{DS} = 200 V, I_D = 40 A, V_{GS} = 10 V (Note 4)	–	85	110	nC
Q_{gs}	Gate−Source Charge		–	25	–	nC
Q_{gd}	Gate−Drain Charge		–	46	–	nC
DRAIN−SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
I_S	Maximum Continuous Drain−Source Diode Forward Current		–	–	40	A
I_{SM}	Maximum Pulsed Drain−Source Diode Forward Current		–	–	160	A
V_{SD}	Drain−Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 40 A	–	–	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 40 A, dI_F/dt = 100 A/μs	–	220	–	ns
Q_{rr}	Reverse Recovery Charge		–	2.0	–	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.

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. L = 0.8 mH, I_{AS} = 40 A, V_{DD} = 50 V, R_G = 25 Ω, Starting T_J = 25°C.
3. I_{SD} ≤ 40 A, di/dt ≤ 300 A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C.
4. Essentially independent of operating temperature.

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TYPICAL CHARACTERISTICS

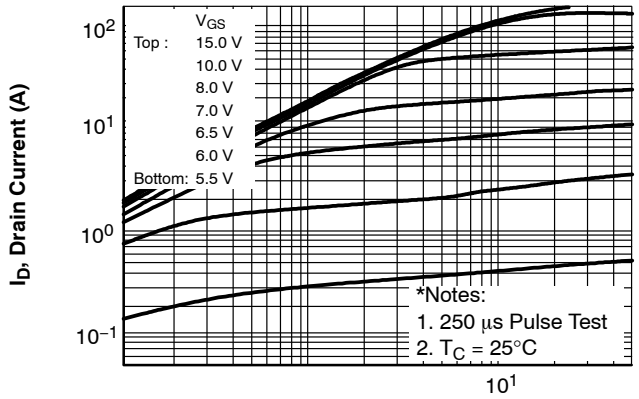

Figure 1. On−Region Characteristics

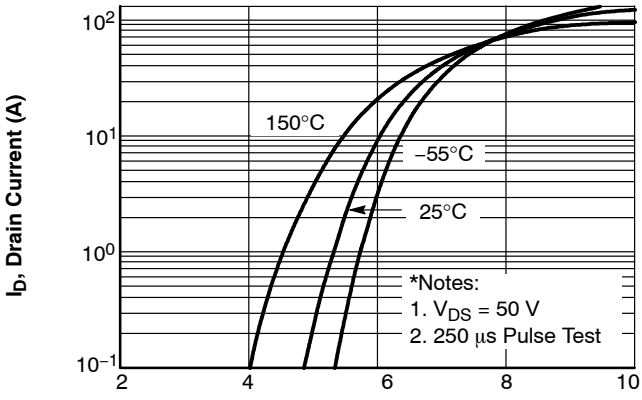

Figure 2. Transfer Characteristics

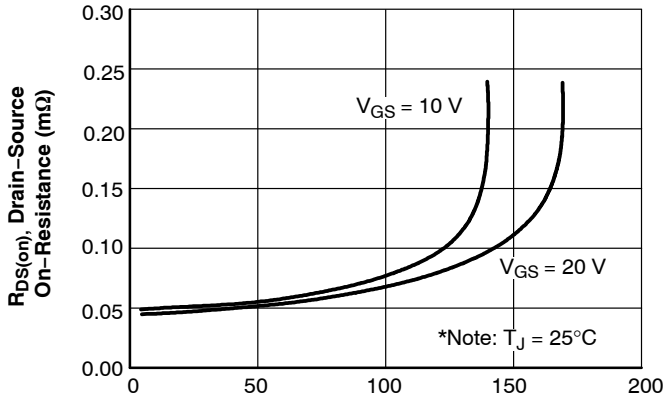

Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

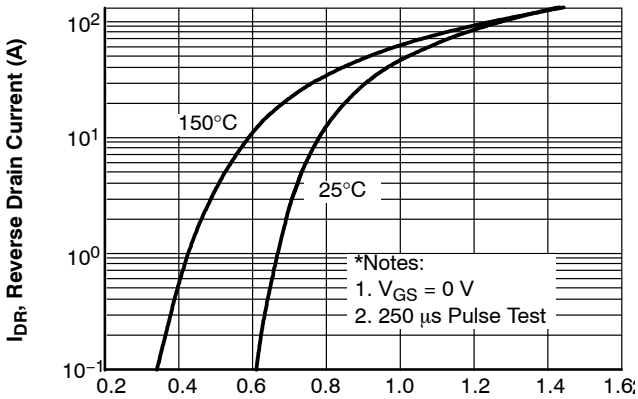

Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

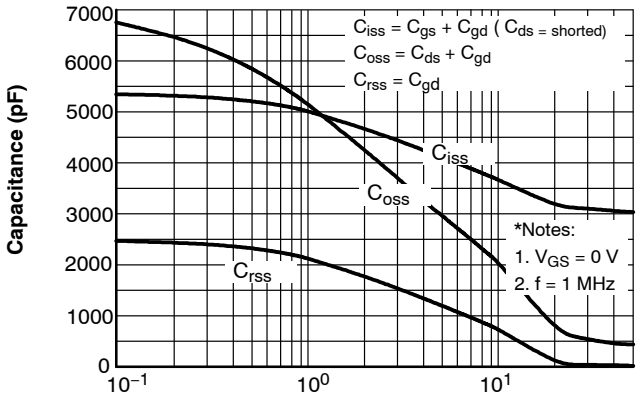

Figure 5. Capacitance Characteristics

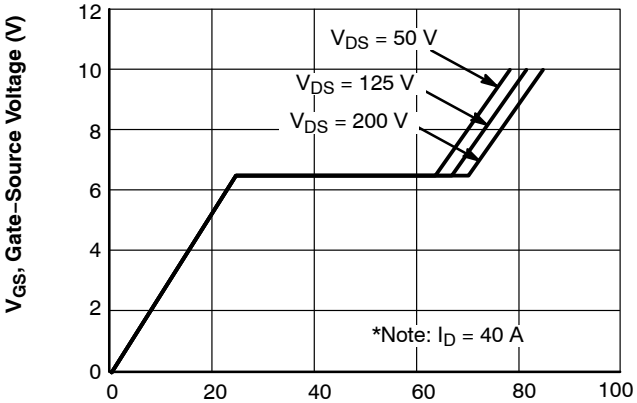

Figure 6. Gate Charge Characteristics

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TYPICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

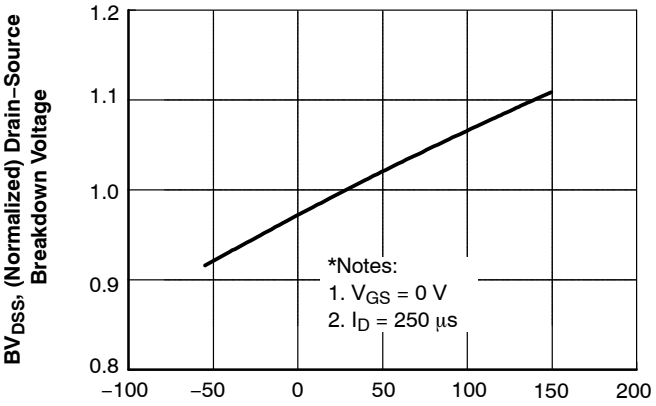

Figure 7. Breakdown Voltage Variation vs. Temperature

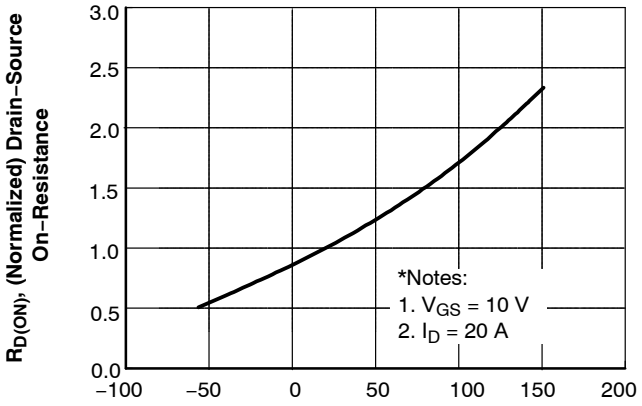

Figure 8. On–Resistance Variation vs. Temperature

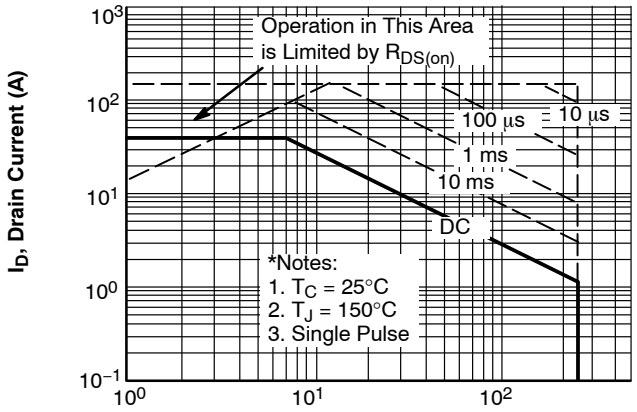

Figure 9. Maximum Safe Operating Area

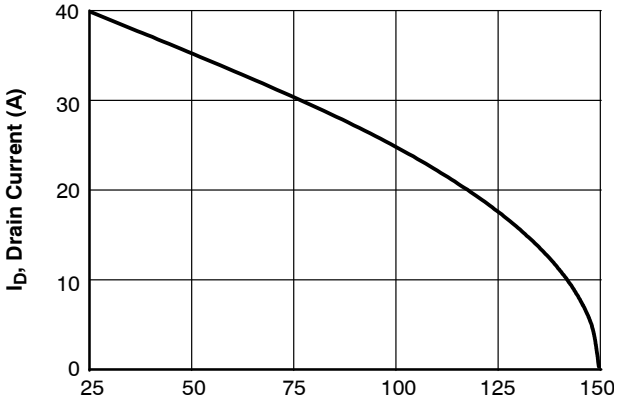

Figure 10. Maximum Drain Current vs. Case Temperature

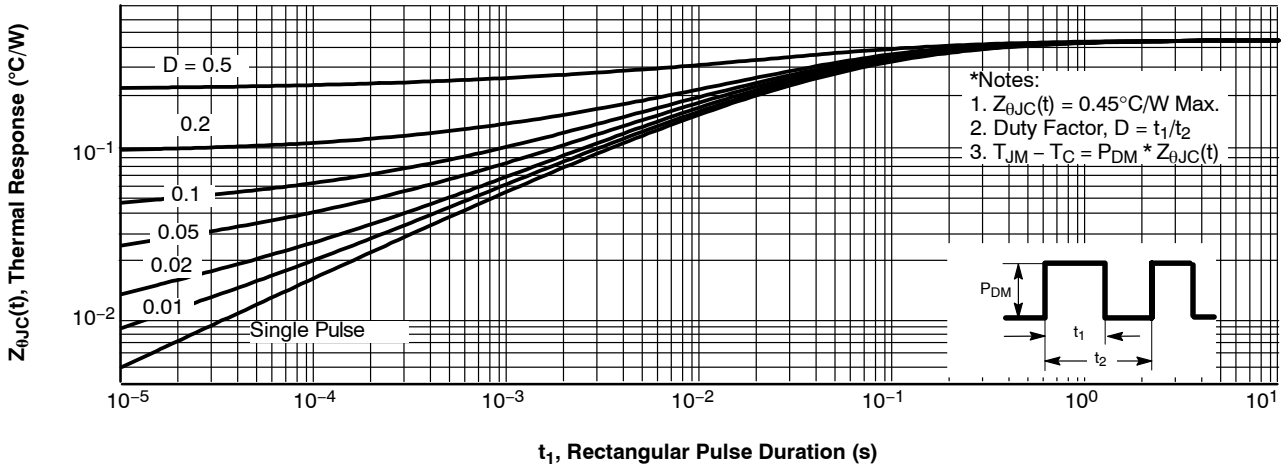

Figure 11. Transient Thermal Response Curve

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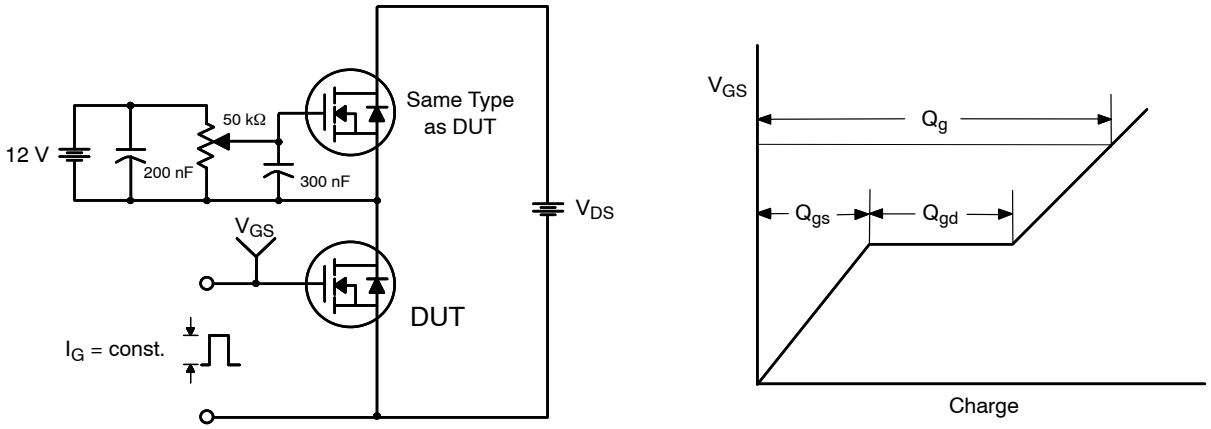

Figure 12. Gate Charge Test Circuit & Waveform

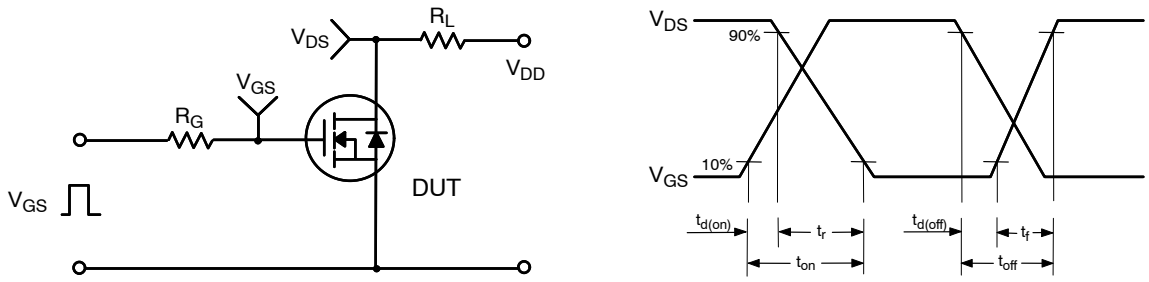

Figure 13. Resistive Switching Test Circuit & Waveforms

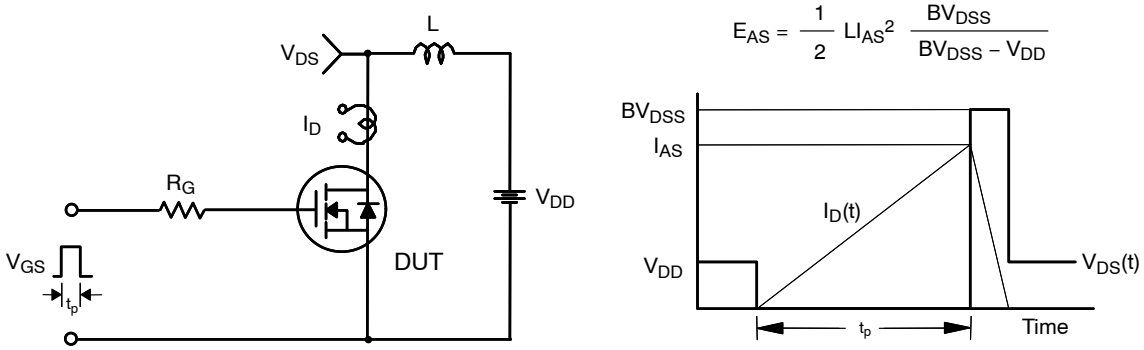

Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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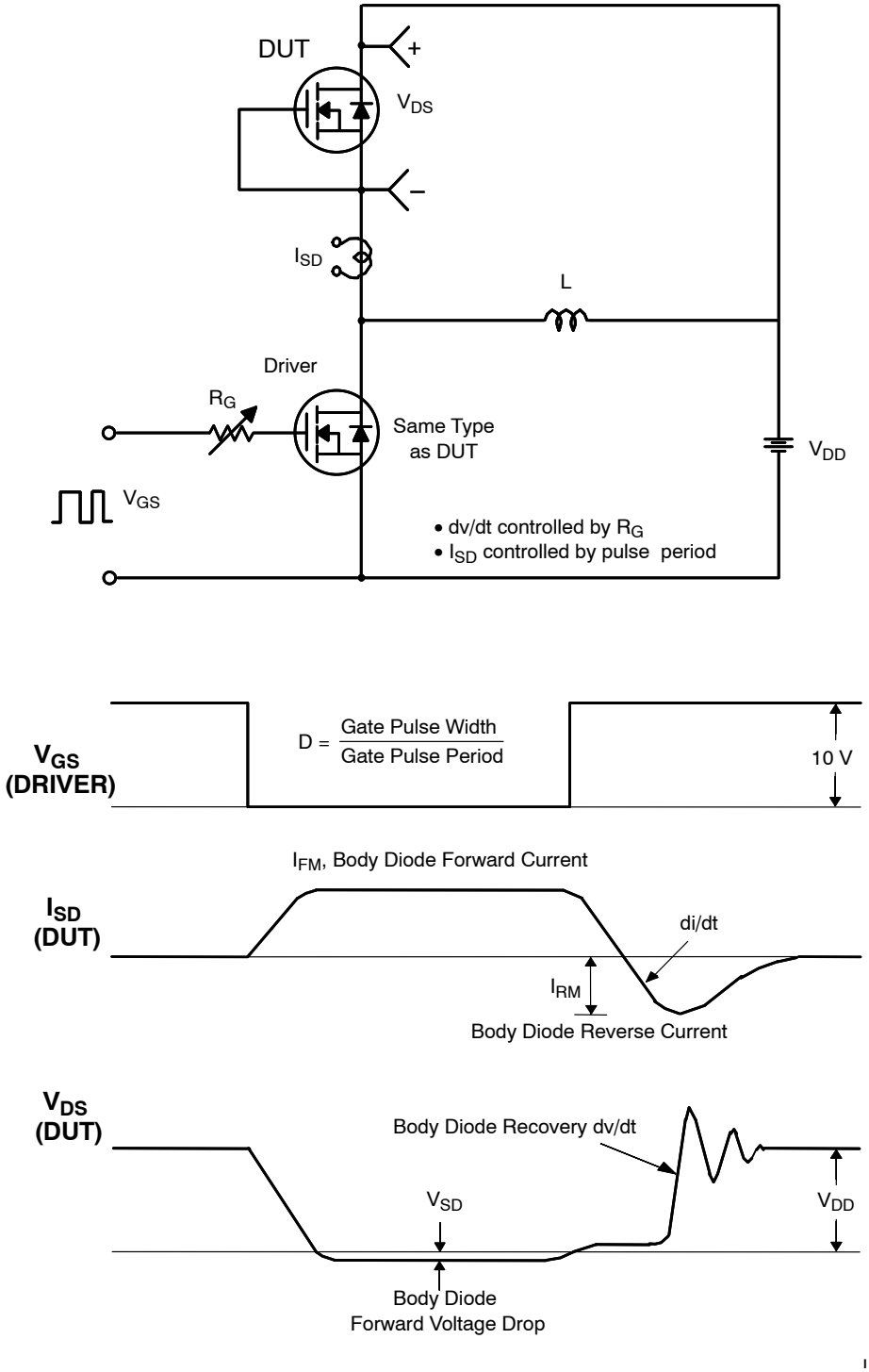

Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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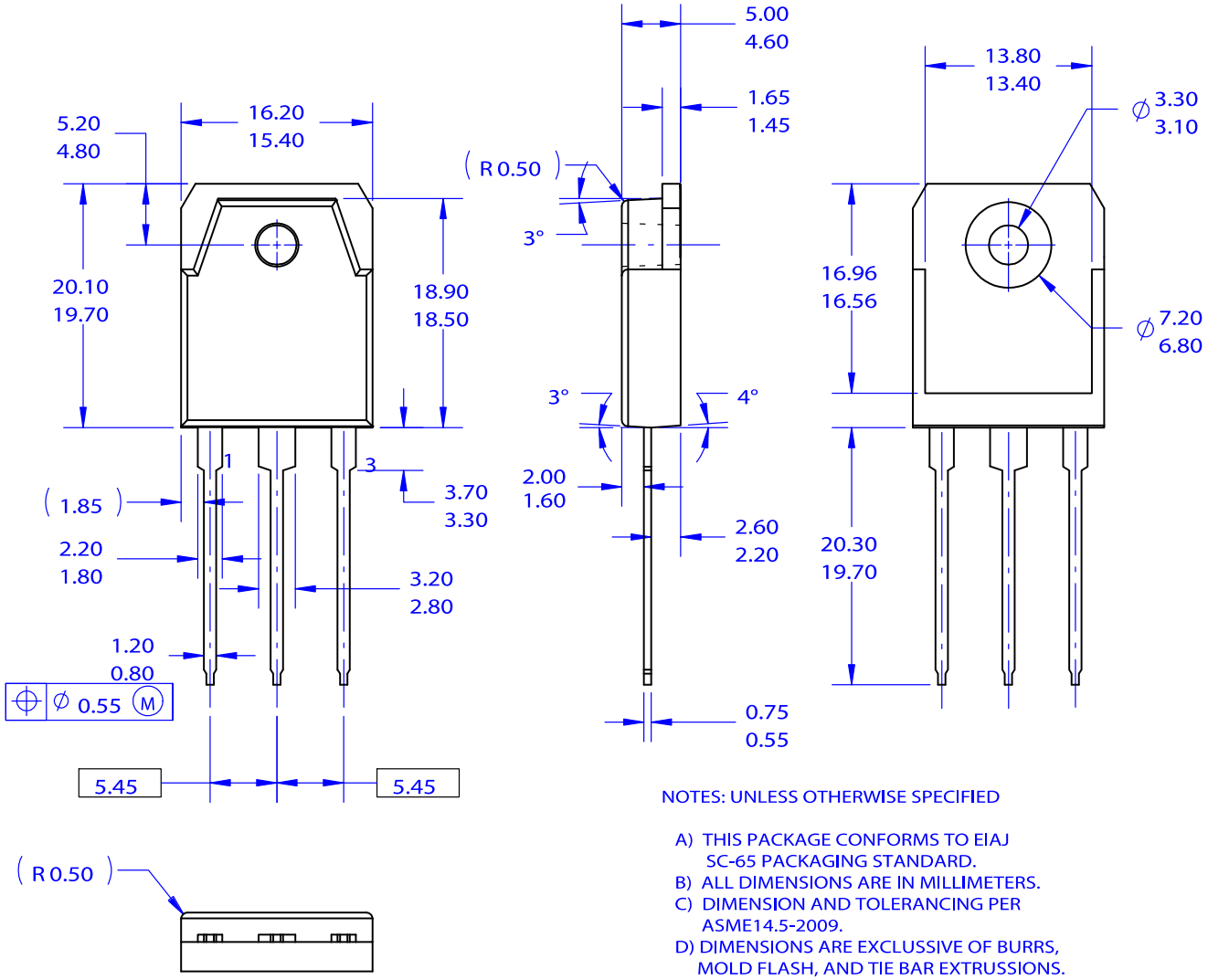

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