

# MOSFET – N-Channel, QFET

800 V, 12.6 A, 750 mΩ

## FQA13N80-F109

### 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

- 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
- This is Pb-Free and Halide Free Device

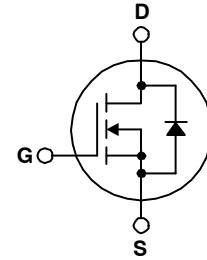
### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain to Source Voltage	800	V
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ\text{C}$ )	12.6
		-Continuous ( $T_C = 100^\circ\text{C}$ )	8.0
$I_{DM}$	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
		-Derate Above $25^\circ\text{C}$	2.38
$T_J, T_{STG}$	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	$^\circ\text{C}$

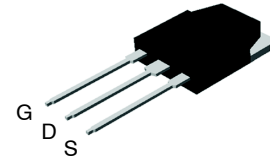
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2.  $L = 13 \text{ mH}$ ,  $I_{AS} = 12.6 \text{ A}$ ,  $V_{DD} = 50 \text{ V}$ ,  $R_G = 25 \Omega$ , 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  $T_J = 25^\circ\text{C}$ .

$V_{DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
800 V	750 mΩ @ 10 V	12.6 A

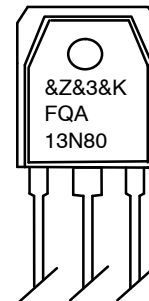


N-CHANNEL MOSFET



TO-3PN  
CASE 340BZ

### MARKING DIAGRAM



&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FQA13N80	= Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FQA13N80-F109

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.42	°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

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D = 250 \mu\text{A}$ , $V_{GS} = 0 \text{ V}$	800	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.95	-	V/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 800 \text{ V}$ , $V_{GS} = 0 \text{ V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 640 \text{ V}$ , $T_C = 125^\circ\text{C}$	-	-	100	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30 \text{ V}$ , $V_{DS} = 0 \text{ V}$	-	-	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30 \text{ V}$ , $V_{DS} = 0 \text{ V}$	-	-	-100	nA

### ON CHARACTERISTICS

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}$ , $I_D = 6.3 \text{ A}$	-	0.58	0.75	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 50 \text{ V}$ , $I_D = 6.3 \text{ A}$	-	13	-	S

### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	-	2700	3500	pF
$C_{oss}$	Output Capacitance		-	275	360	pF
$C_{rss}$	Reverse Transfer Capacitance		-	30	39	pF

### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 400 \text{ V}$ , $I_D = 12.6 \text{ A}$ , $R_G = 25 \Omega$ (Note 4)	-	60	130	ns
$t_r$	Turn-On Rise Time		-	150	310	ns
$t_{d(off)}$	Turn-Off Delay Time		-	155	320	ns
$t_f$	Turn-Off Fall Time		-	110	230	ns
$Q_g$	Total Gate Charge	$V_{DS} = 640 \text{ V}$ , $I_D = 12.6 \text{ A}$ , $V_{GS} = 10 \text{ V}$ (Note 4)	-	68	88	nC
$Q_{gs}$	Gate-Source Charge		-	15	-	nC
$Q_{gd}$	Gate-Drain Charge		-	32	-	nC

### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	-	-	12.6	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	-	-	50.4	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}$ , $I_S = 12.6 \text{ A}$	-	-	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}$ , $I_S = 12.6 \text{ A}$ , $di_F/dt = 100 \text{ A}/\mu\text{s}$	-	850	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	11.3	-	$\mu\text{C}$

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.

### PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Package Method	Reel Size	Tape Width	Quantity
FQA13N80-F109	FQA13N80	TO-3PN	Tube	N/A	N/A	30 Units

TYPICAL CHARACTERISTICS

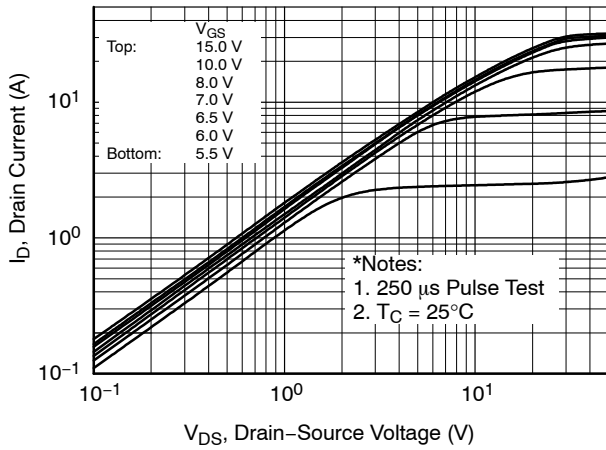


Figure 1. On-Region Characteristics

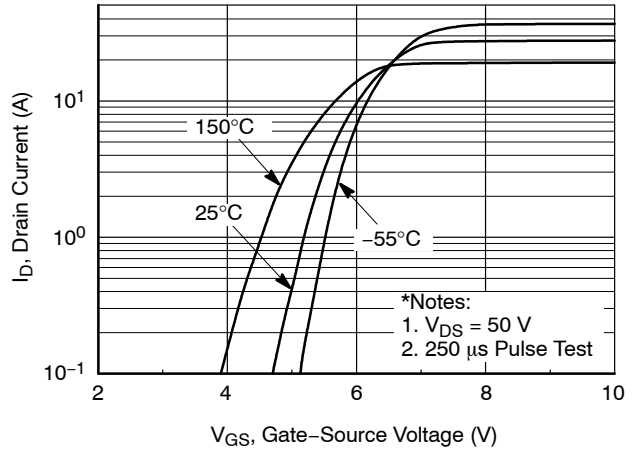


Figure 2. Transfer Characteristics

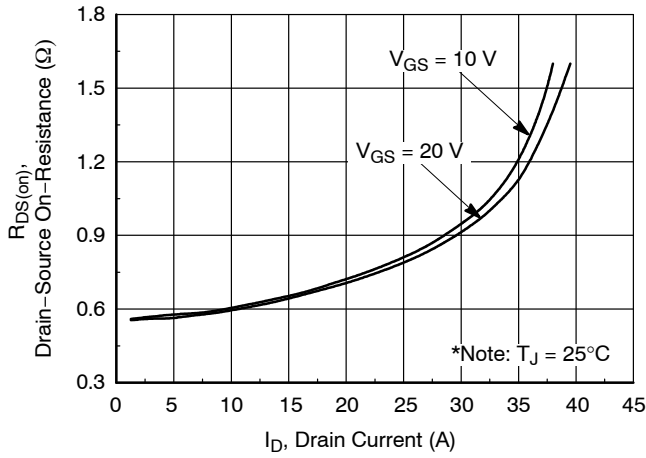


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

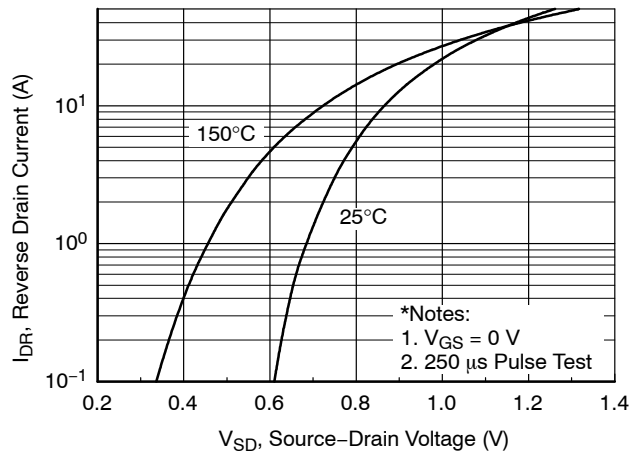


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

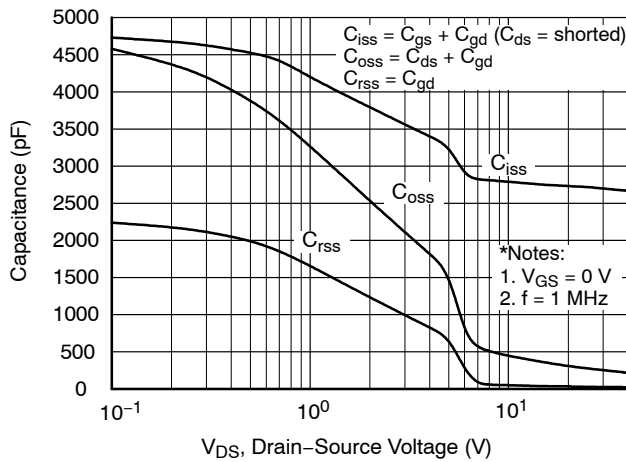


Figure 5. Capacitance Characteristics

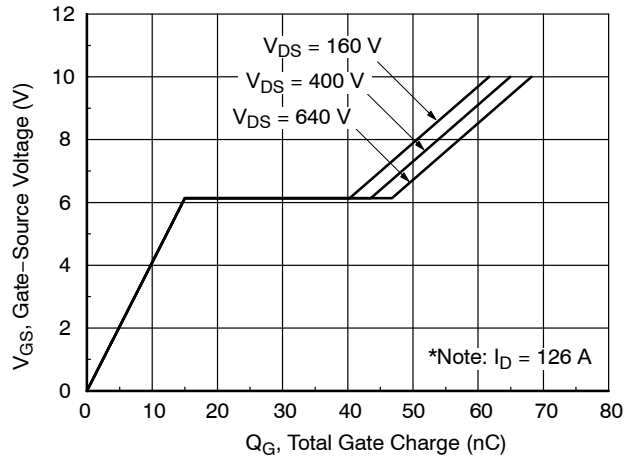


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS

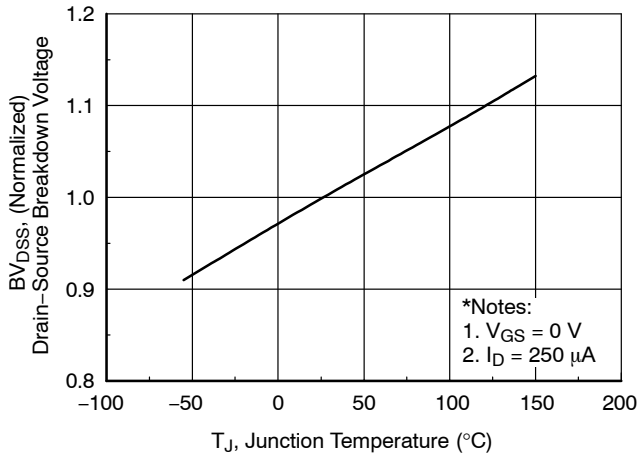


Figure 7. Breakdown Voltage Variation vs. Temperature

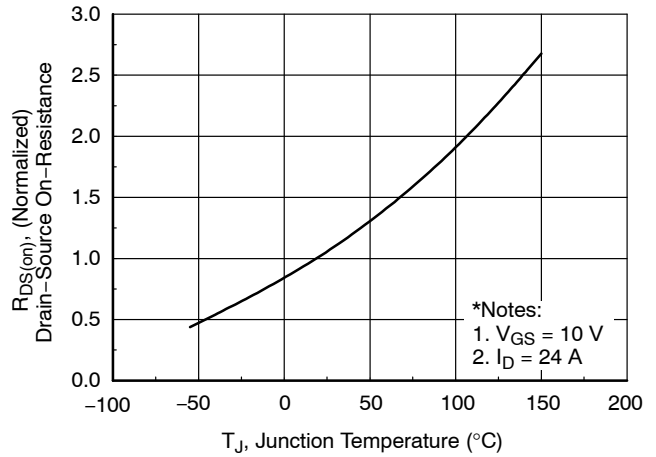


Figure 8. On-Resistance Variation vs. Temperature

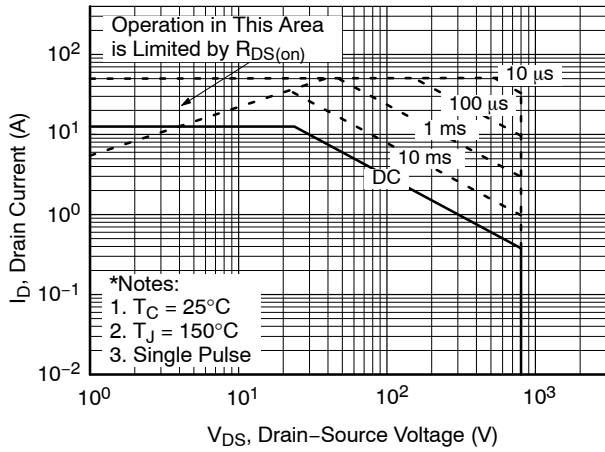


Figure 9. Maximum Safe Operating Area

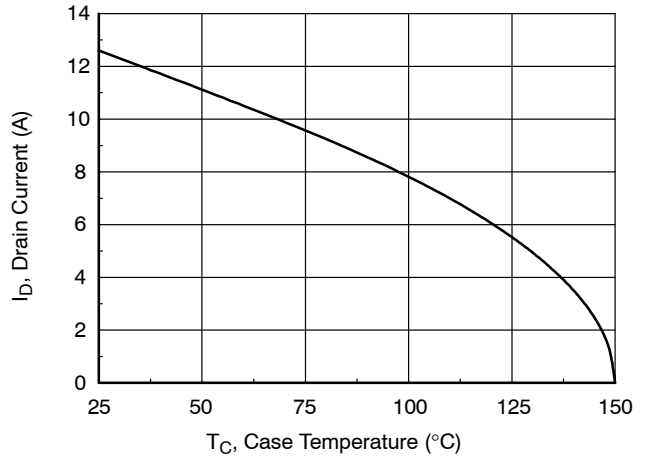


Figure 10. Maximum Drain Current vs. Case Temperature

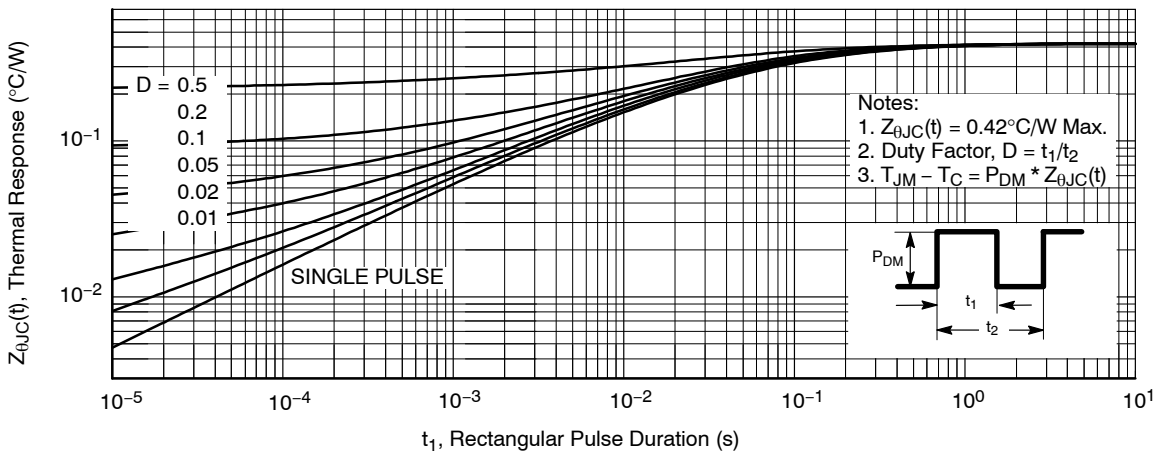


Figure 11. Transient Thermal Response Curve

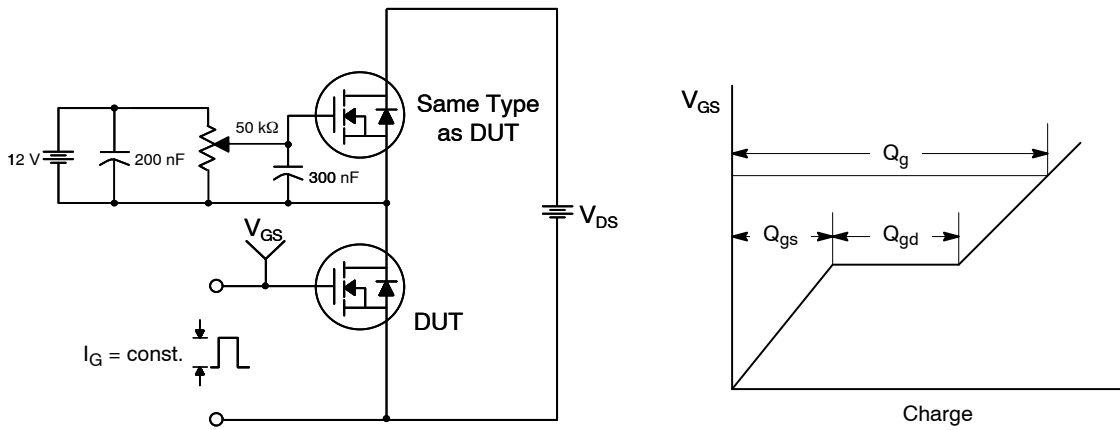


Figure 12. Gate Charge Test Circuit & Waveform

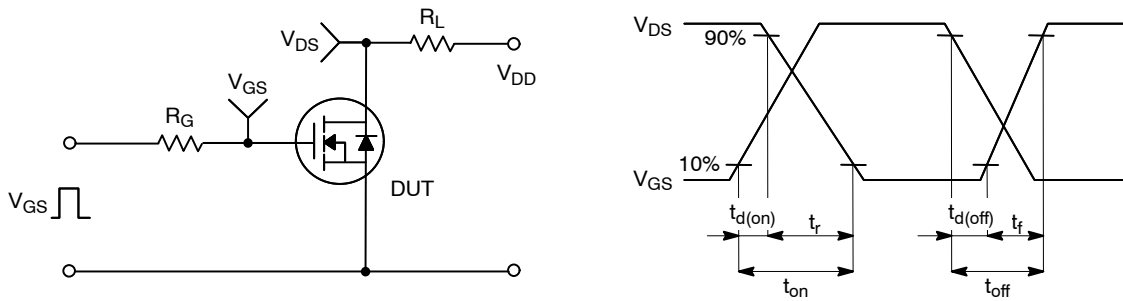


Figure 13. Resistive Switching Test Circuit & Waveforms

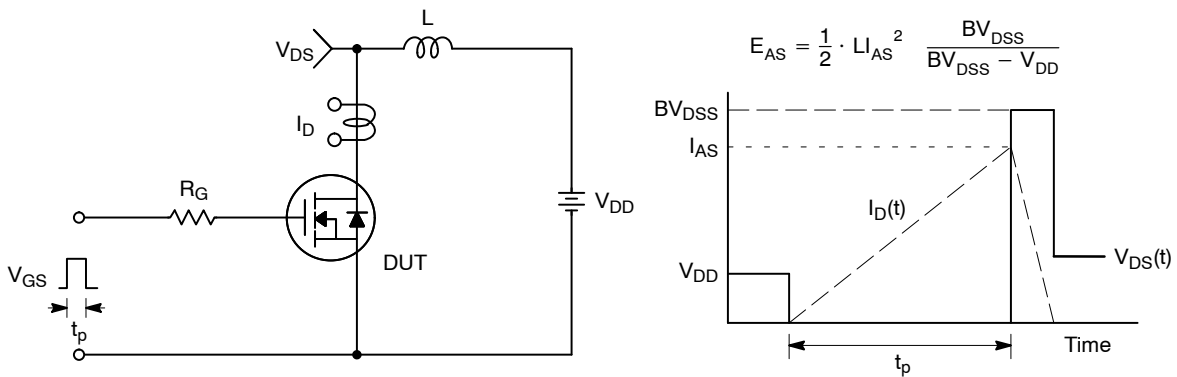


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

FQA13N80-F109

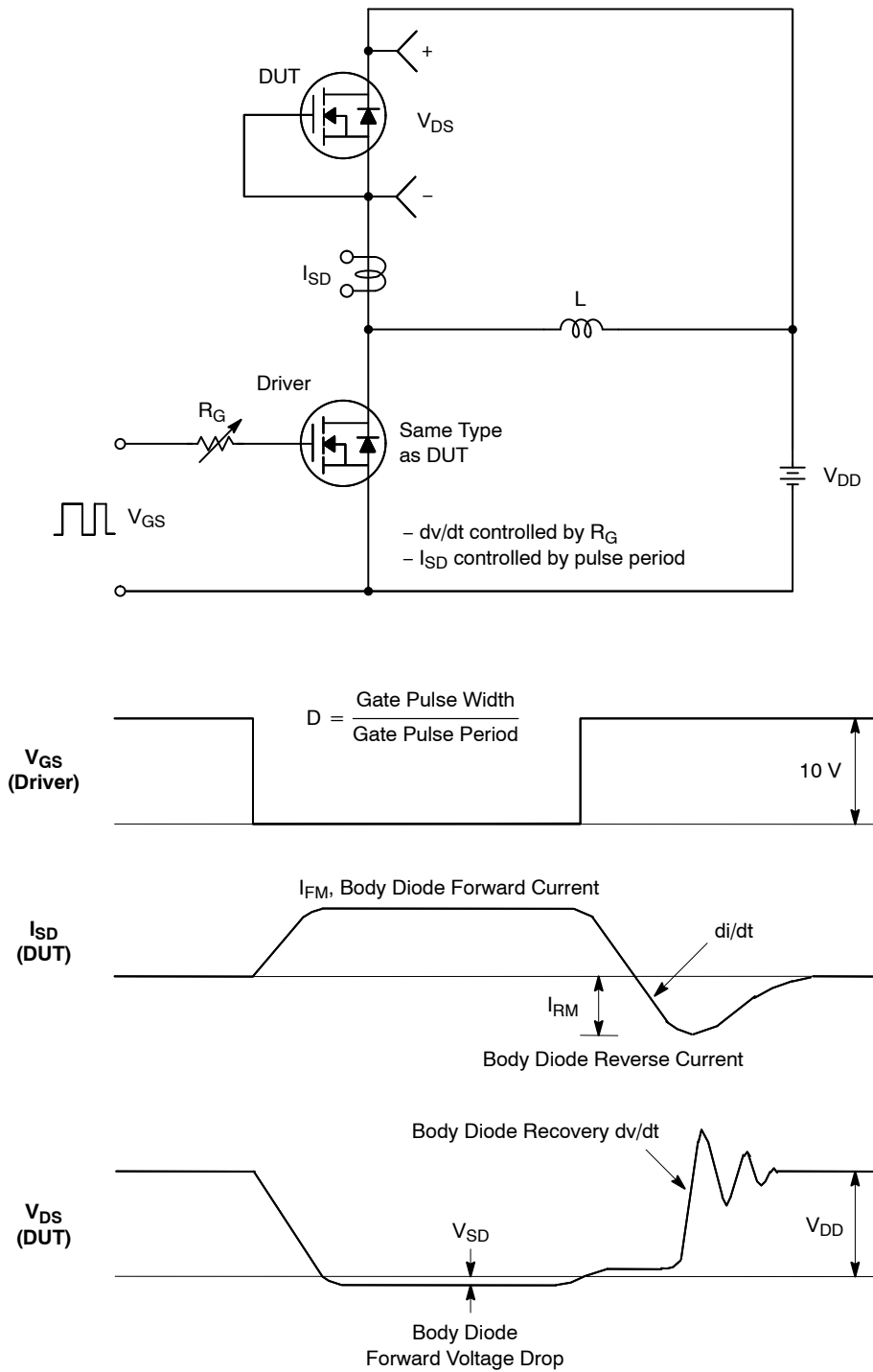


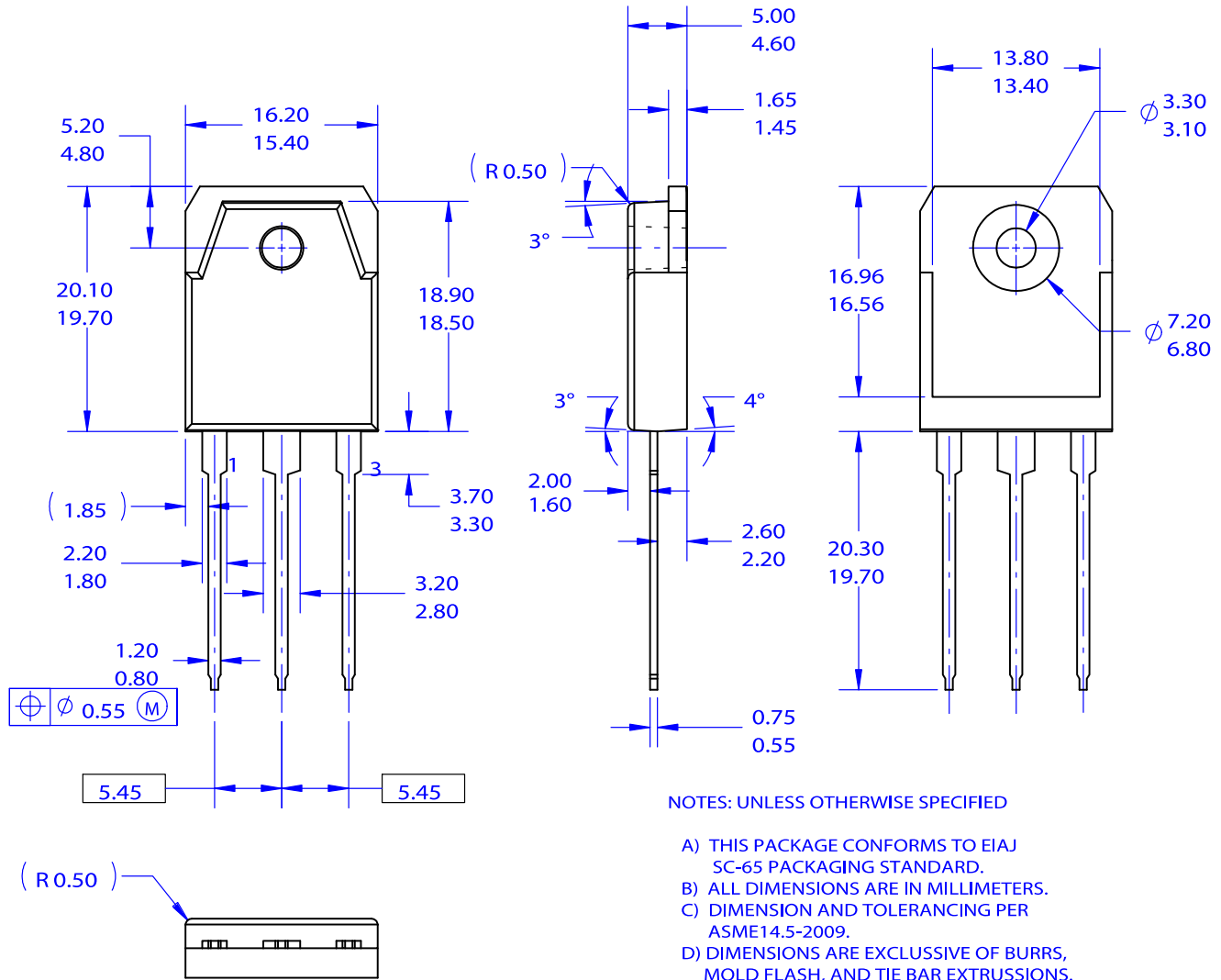
Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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


DATE 31 OCT 2016



NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5-2009.
- D) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

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