

# MOSFET – N-Channel, QFET

**900 V, 7.0 A, 1.1  $\Omega$**

## FQAF11N90C

### 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

- 7.0 A, 900 V,  $R_{DS(on)} = 1.1 \Omega$  (Max.) @  $V_{GS} = 10$  V,  $I_D = 3.5$  A
- Low Gate Charge (Typ. 60 nC)
- Low  $C_{RSS}$  (Typ. 23 pF)
- 100% Avalanche Tested
- This is a Pb-Free Device

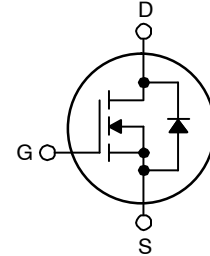
### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain-Source Voltage	900	V
$I_D$	Drain Current – Continuous ( $T_C = 25^\circ\text{C}$ )	7.0	A
	– Continuous ( $T_C = 100^\circ\text{C}$ )	4.4	A
$I_{DM}$	Drain Current – Pulsed (Note 1)	28.0	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	960	mJ
$I_{AR}$	Avalanche Current (Note 1)	7.0	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	12	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)	4.0	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	120	W
	– Derate Above $25^\circ\text{C}$	0.96	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	$^\circ\text{C}$

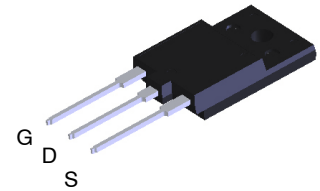
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2.  $L = 37$  mH,  $I_{AS} = 7.0$  A,  $V_{DD} = 50$  V,  $R_G = 25 \Omega$ , Starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 11.0$  A,  $di/dt \leq 200$  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
900 V	$1.1 \Omega @ 10$ V	7.0 A



N-CHANNEL MOSFET



TO-3PF-L  
CASE 340AH

### MARKING DIAGRAM

FQAF  
11N90C  
AYWWZZ

FQAF11N90 = Specific Device Code  
A = Assembly Plant Code  
YWW = Date Code (Year & Week)  
ZZ = Lot Code

### ORDERING INFORMATION

Device	Package	Shipping
FQAF11N90C	TO-3PF (Pb-Free)	30 Units / Tube

# FQAF11N90C

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.04	°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
--------	-----------	----------------	-----	-----	-----	------

### OFF CHARACTERISTICS

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	900	–	–	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$	–	1.00	–	V/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 900\text{ V}, V_{GS} = 0\text{ V}$	–	–	10	$\mu\text{A}$
		$V_{DS} = 720\text{ V}, T_C = 125^\circ\text{C}$	–	–	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	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3.0	–	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 3.5\text{ A}$	–	0.91	1.1	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 50\text{ V}, I_D = 3.5\text{ A}$	–	–	–	S

### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	–	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	$V_{DD} = 450\text{ V}, I_D = 11.0\text{ A}, R_G = 25\text{ }\Omega$ (Note 4)	–	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		–	85	180	ns
$Q_g$	Total Gate Charge	$V_{DS} = 720\text{ V}, I_D = 11.0\text{ A}, V_{GS} = 10\text{ V}$ (Note 4)	–	60	80	nC
$Q_{gs}$	Gate-Source Charge		–	13	–	nC
$Q_{gd}$	Gate-Drain Charge		–	25	–	nC

### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I <sub>S</sub>	Maximum Continuous Drain–Source Diode Forward Current		–	–	7.0	A
I <sub>SM</sub>	Maximum Pulsed Drain–Source Diode Forward Current		–	–	28.0	A
V <sub>SD</sub>	Drain–Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 7.0 A	–	–	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 11.0 A, dI <sub>F</sub> /dt = 100 A/μs	–	1000	–	ns
Q <sub>rr</sub>	Reverse Recovery Charge		–	17.0	–	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.

4. Essentially Independent of Operating Temperature.

## TYPICAL CHARACTERISTICS

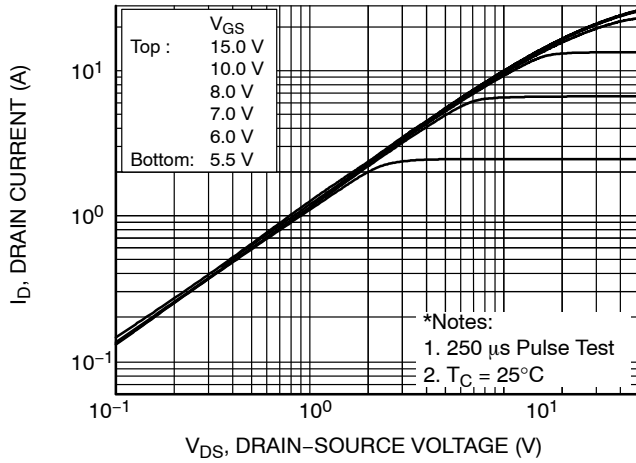


Figure 1. On-Region Characteristics

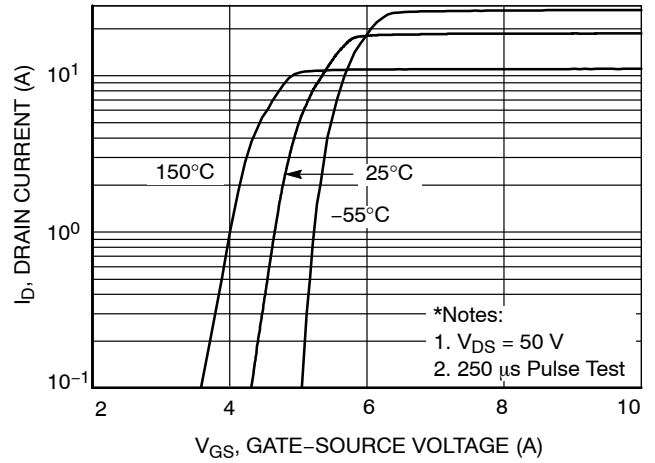


Figure 2. Transfer Characteristics

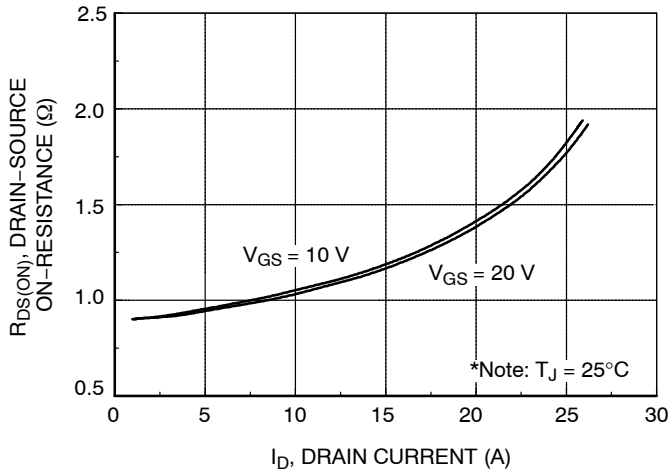


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

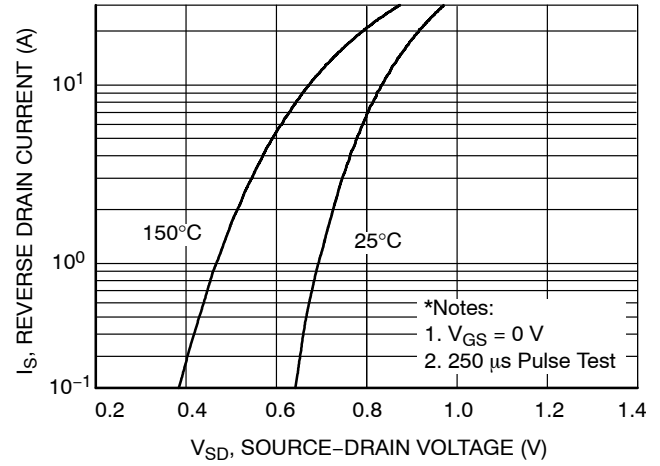


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

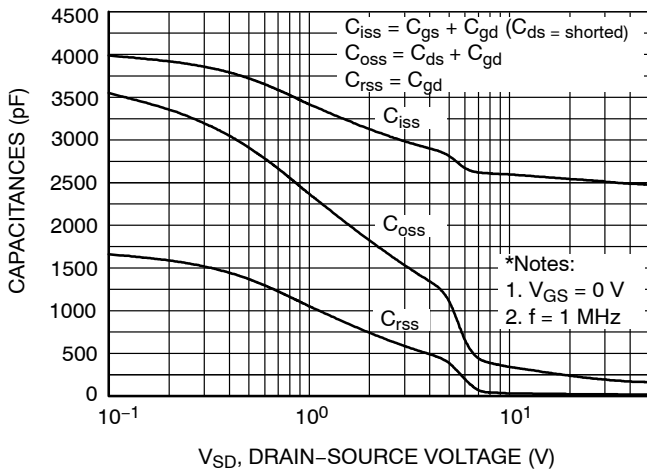


Figure 5. Capacitance Characteristics

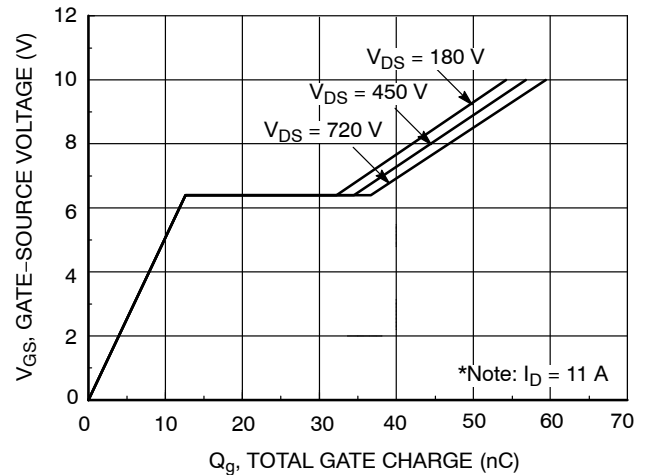
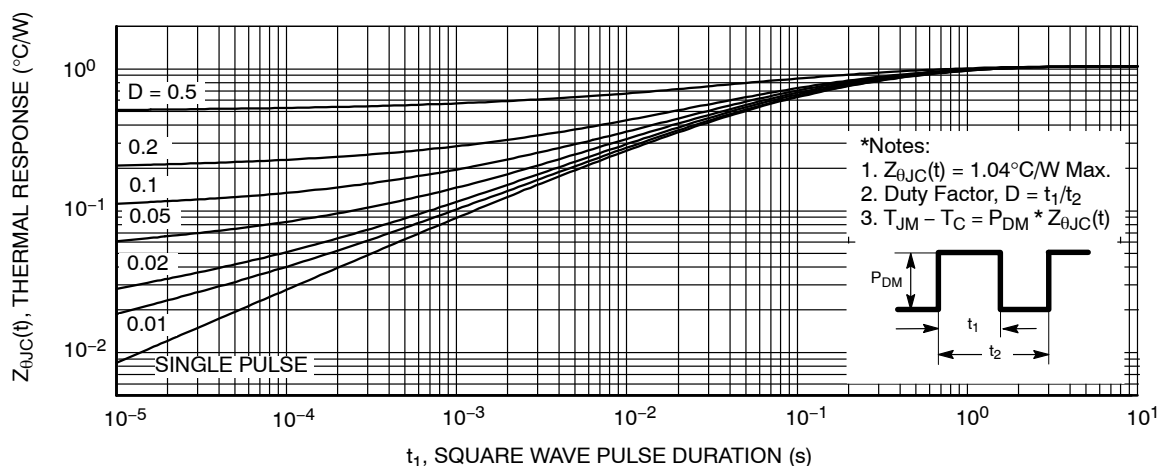
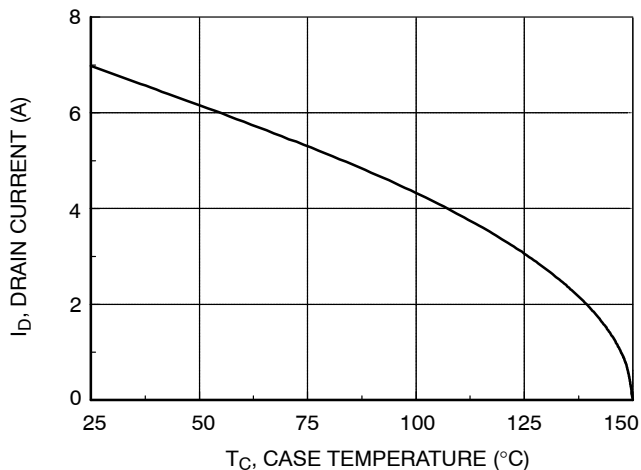
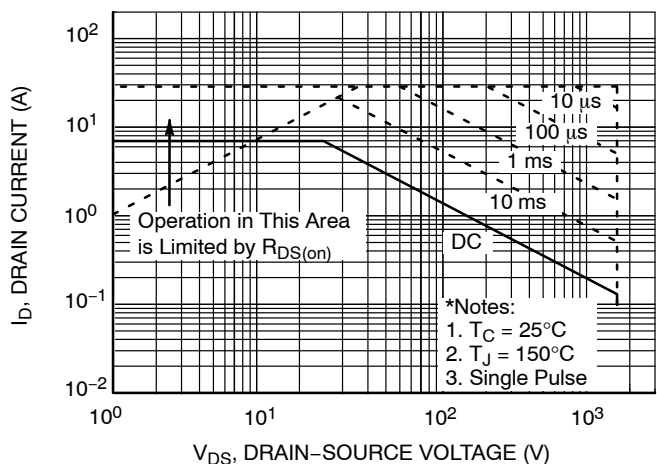
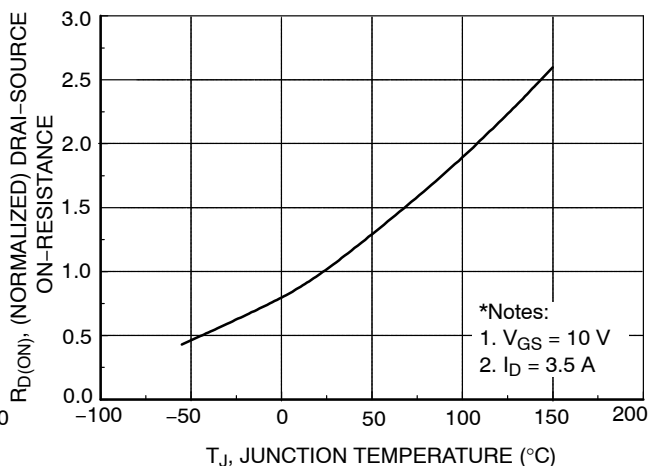
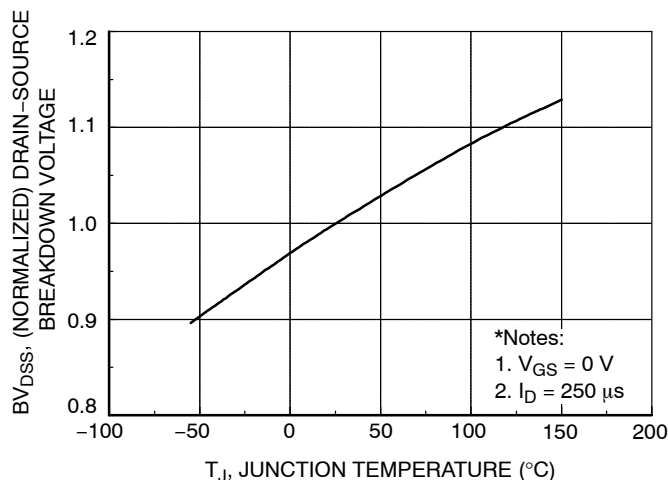


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (CONTINUED)



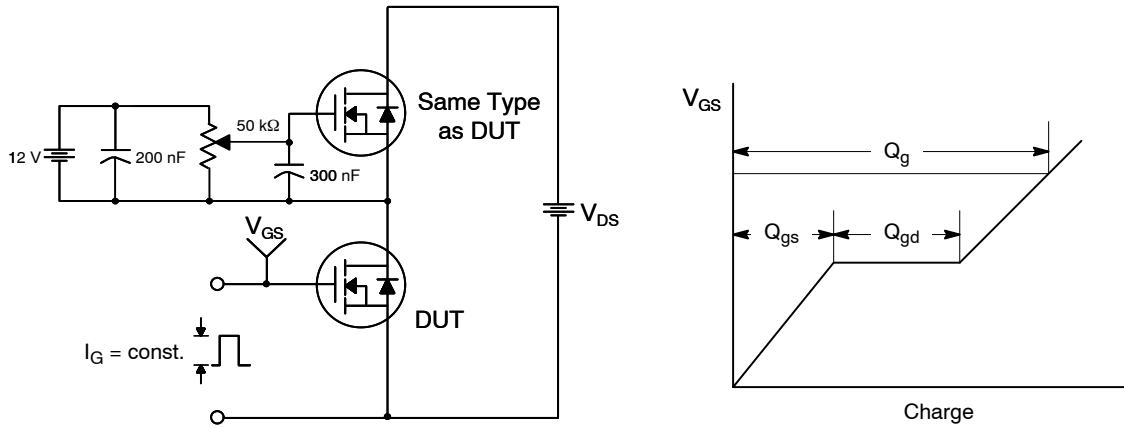


Figure 12. Gate Charge Test Circuit & Waveform

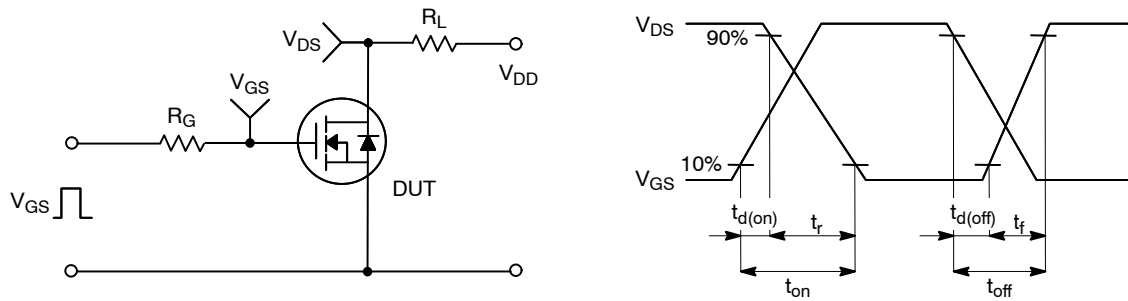


Figure 13. Resistive Switching Test Circuit & Waveforms

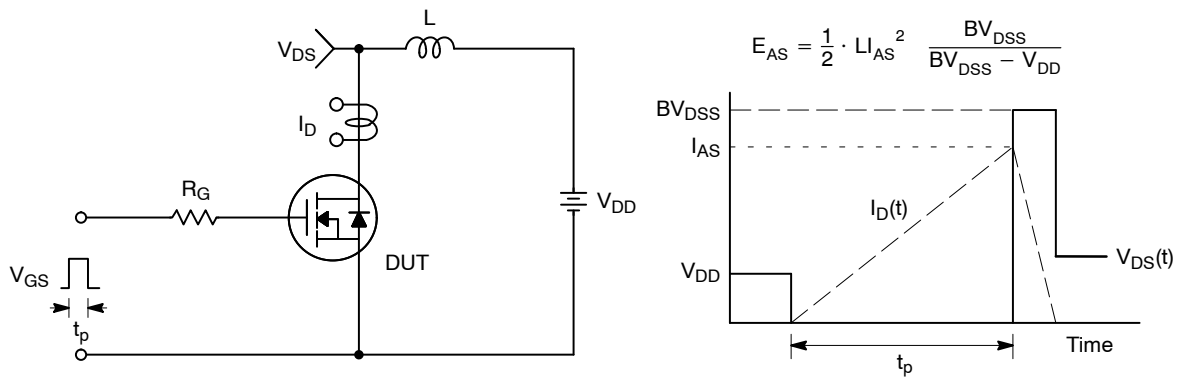
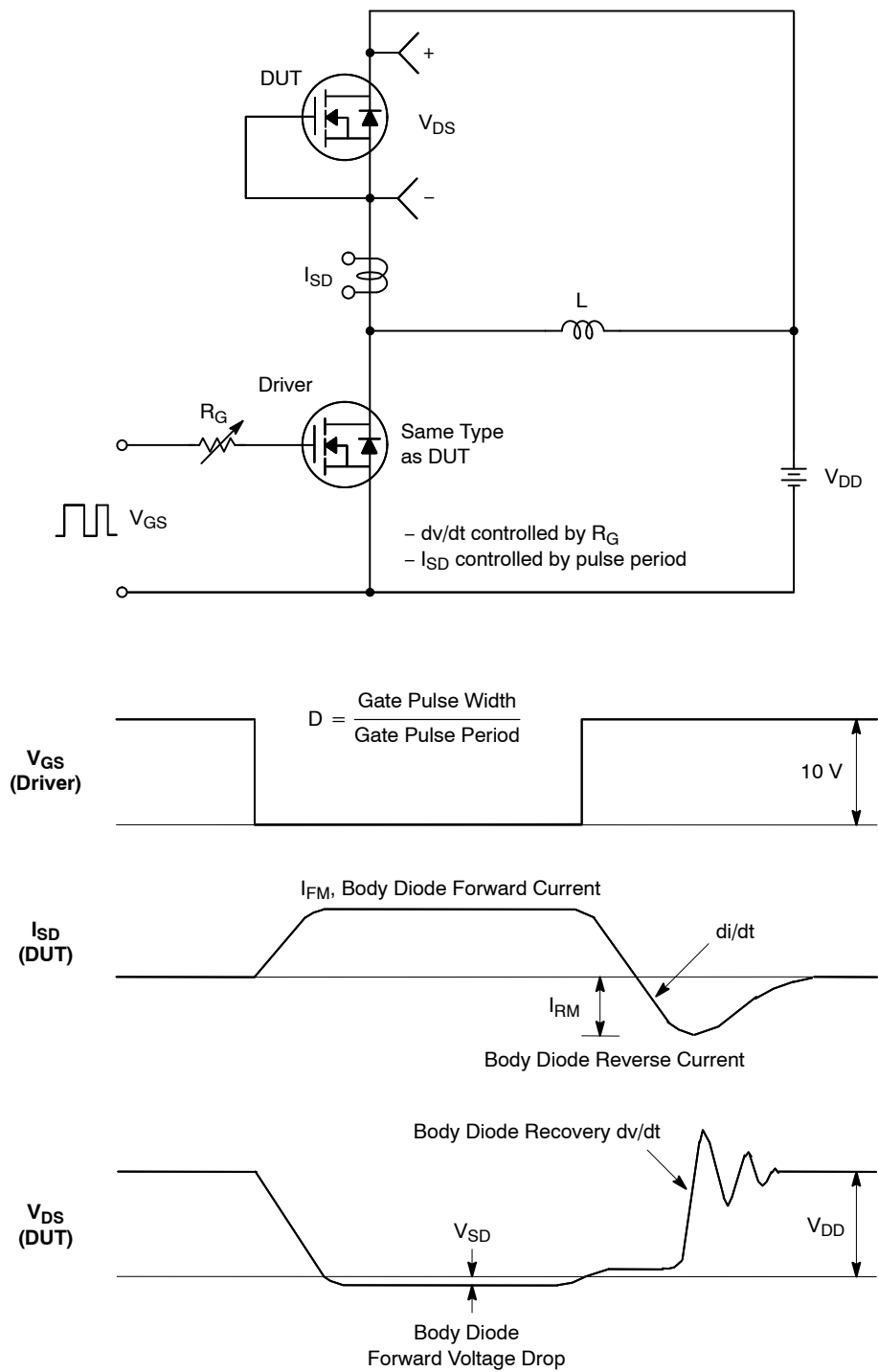


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

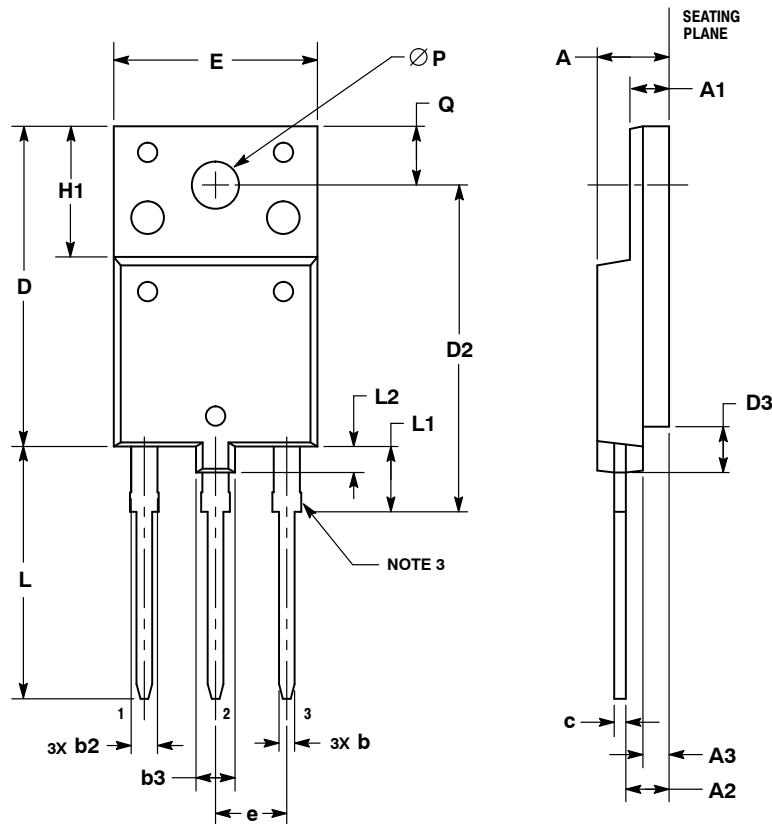
# FQAF11N90C



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

**TO-3PF-3L**  
**CASE 340AH**  
**ISSUE A**

DATE 09 JAN 2015



## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR UNCONTROLLED IN THIS AREA (6 PLACES).
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE TO BE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.
5. DIMENSION b2 DOES NOT INCLUDE DAMBAR PROTRUSION. LEAD WIDTH INCLUDING PROTRUSION SHALL NOT EXCEED 2.20.

DIM	MILLIMETERS	
	MIN	MAX
A	5.30	5.70
A1	2.80	3.20
A2	3.10	3.50
A3	1.80	2.20
b	0.65	0.95
b2	1.90	2.15
b3	3.80	4.20
c	0.80	1.10
D	24.30	24.70
D2	24.70	25.30
D3	3.30	3.70
E	15.30	15.70
e	5.35	5.55
H1	9.80	10.20
L	19.10	19.50
L1	4.80	5.20
L2	1.90	2.20
P	3.40	3.80
Q	4.30	4.70

**DOCUMENT NUMBER:** 98AON79755E

Electronic versions are uncontrolled except when accessed directly from the Document Repository.  
Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.

**DESCRIPTION:** TO-3PF-3L

**PAGE 1 OF 1**

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)