

# MOSFET – N-Channel, QFET

800 V, 3.0 A, 4.8 mΩ

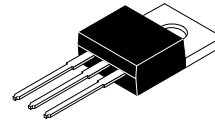
## FQP3N80C, FQPF3N80C

### Description

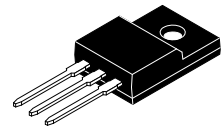
This N-Channel enhancement mode power MOSFET is produced using onsemi's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices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

### Features

- 3.0 A, 800 V,  $R_{DS(on)} = 4.8 \Omega$  (Max.) @  $V_{GS} = 10$  V,  $I_D = 1.5$  A
- Low Gate Charge (Typ. 13 nC)
- Low  $C_{rss}$  (Typ. 5.5 pF)
- 100% Avalanche Tested

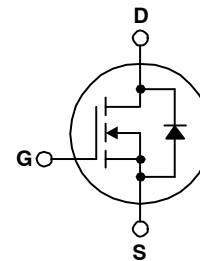


TO-220-3LD  
CASE 340AT

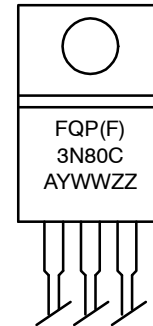


TO-220 Fullpack,  
3-Lead /  
TO-220F-3SG  
CASE 221AT

### N-CHANNEL MOSFET



### MARKING DIAGRAM



FQP(F)3N80C = Specific Device Code  
 A = Assembly Location  
 YWW = Date Code (Year & Week)  
 ZZ = Assembly Lot

### ORDERING INFORMATION

Device	Package	Shipping
FQP3N80C	TO-220-3LD	1,000 Units / Tube
FQPF3N80C	TO-220 Fullpack	1,000 Units / Tube

# FQP3N80C, FQPF3N80C

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

Symbol	Parameter	FQP3N80C	FQPF3N80C	Unit	
$V_{DSS}$	Drain-Source Voltage	800	800	V	
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	3*	A	
		- Continuous ( $T_C = 100^\circ\text{C}$ )	1.9*	A	
$I_{DM}$	Drain Current	12	12*	A	
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	$\pm 30$	V	
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	320	320	mJ	
$I_{AR}$	Avalanche Current (Note 1)	3	3	A	
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	10.7	10.7	mJ	
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	4.5	V/ns	
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	107	39	W
		- Derate Above $25^\circ\text{C}$	0.85	0.31	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	-55 to +150	$^\circ\text{C}$	
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	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.

## THERMAL CHARACTERISTICS

Symbol	Parameter	FQP3N80C	FQPF3N80C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.17	3.2	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	$^\circ\text{C}/\text{W}$

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	800	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	1	-	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = 640\text{ V}, T_C = 125^\circ\text{C}$	-	-	10	$\mu\text{A}$
			-	-	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	$V_{GS} = 10\text{ V}, I_D = 1.5\text{ A}$	-	4.0	4.8	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 50\text{ V}, I_D = 1.5\text{ A}$	-	3	-	S

### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	-	543	705	pF
$C_{oss}$	Output Capacitance		-	54	70	pF
$C_{rss}$	Reverse Transfer Capacitance		-	5.5	7.5	pF

# FQP3N80C, FQPF3N80C

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 400\text{ V}$ , $I_D = 3\text{ A}$ , $R_G = 25\ \Omega$ (Note 4)	–	15	40	ns
$t_r$	Turn-On Rise Time		–	43.5	95	ns
$t_{d(off)}$	Turn-Off Delay Time		–	22.5	55	ns
$t_f$	Turn-Off Fall Time		–	32	75	ns
$Q_g$	Total Gate Charge	$V_{DS} = 640\text{ V}$ , $I_D = 3\text{ A}$ , $V_{GS} = 10\text{ V}$ (Note 4)	–	13	16.5	nC
$Q_{gs}$	Gate-Source Charge		–	3.4	–	nC
$Q_{gd}$	Gate-Drain Charge		–	5.8	–	nC

### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

$I_S$	Maximum Continuous Drain-Source Diode Forward Current		–	–	3.0	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		–	–	12	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 3.0\text{ A}$	–	–	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}$ , $I_S = 3.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$	–	642	–	ns
$Q_{rr}$	Reverse Recovery Charge		–	4.0	–	$\mu\text{C}$

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.

1. Repetitive rating; pulse-width limited by maximum junction temperature.
2.  $L = 67\text{ mH}$ ,  $I_{AS} = 3.0\text{ A}$ ,  $V_{DD} = 50\text{ V}$ ,  $R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 3\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

# FQP3N80C, FQPF3N80C

## TYPICAL CHARACTERISTICS

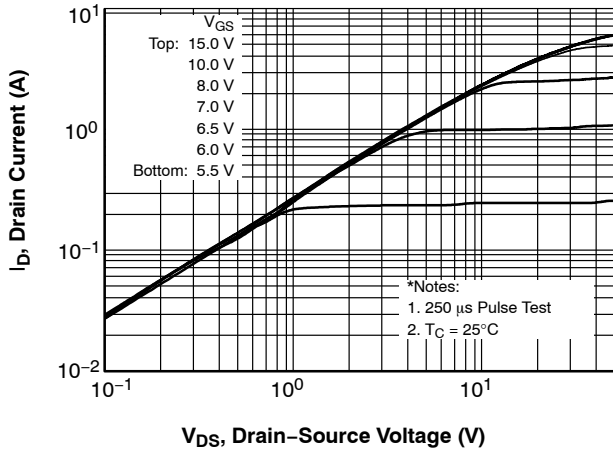


Figure 1. On-Region Characteristics

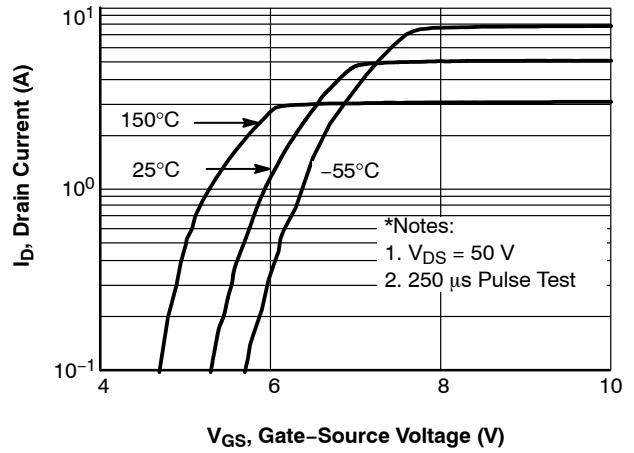


Figure 2. Transfer Characteristics

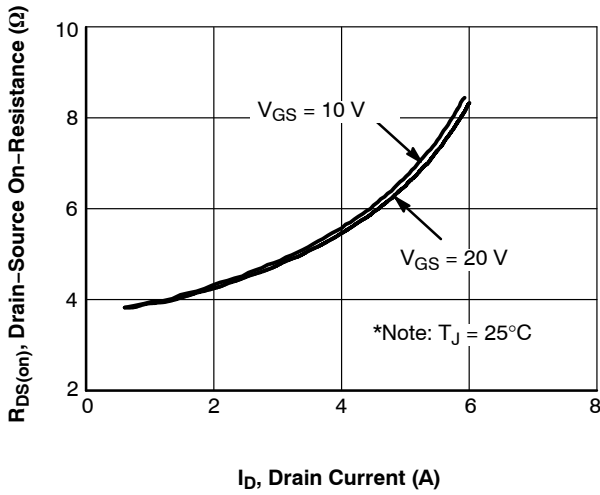


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

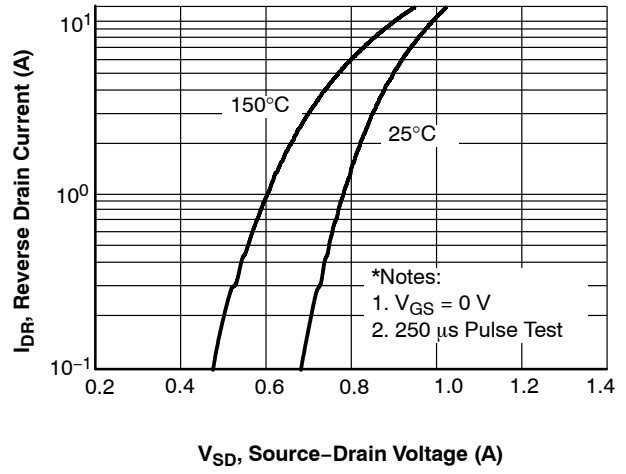


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

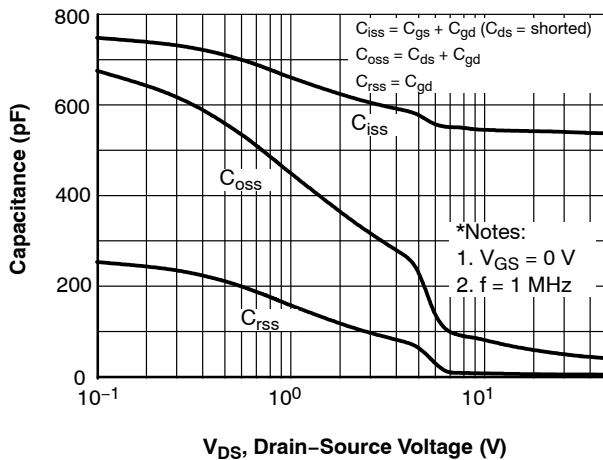


Figure 5. Capacitance Characteristics

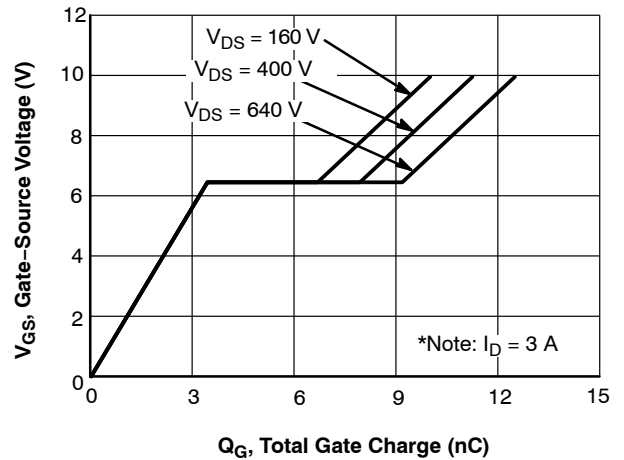
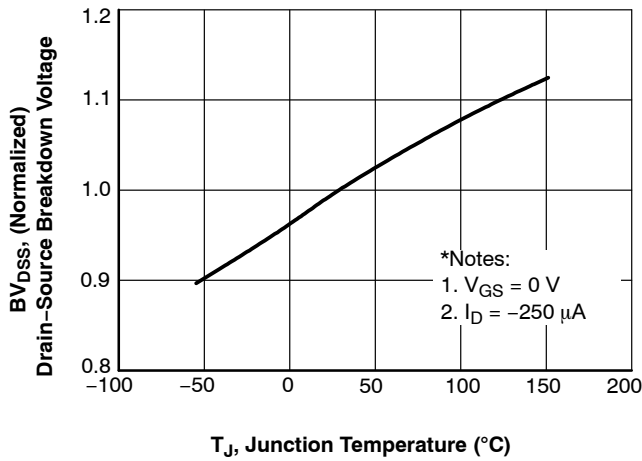


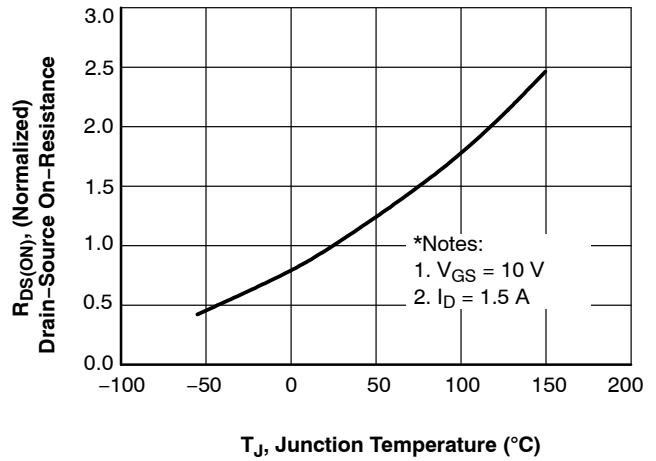
Figure 6. Gate Charge Characteristics

# FQP3N80C, FQPF3N80C

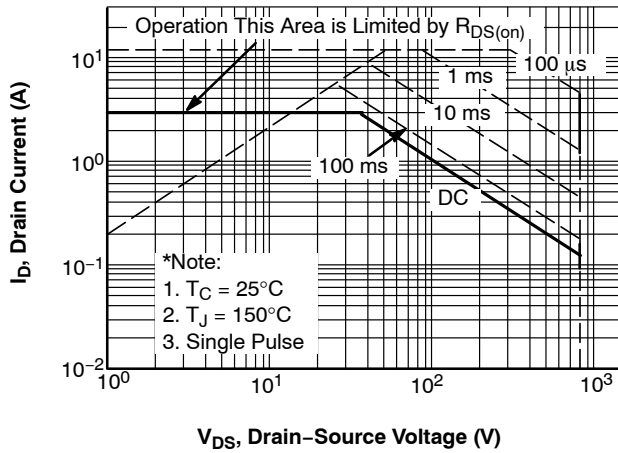
## TYPICAL CHARACTERISTICS (continued)



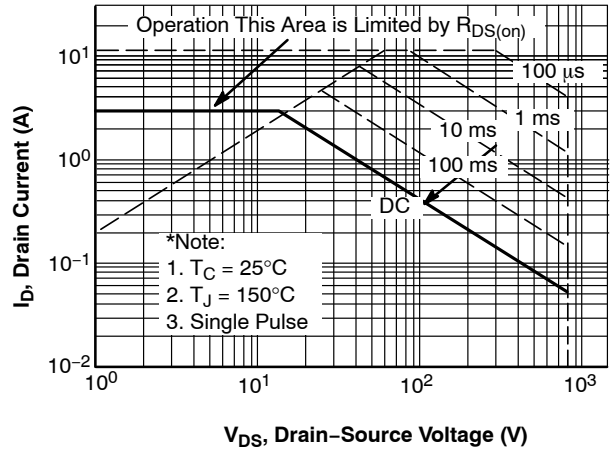
**Figure 7. Breakdown Voltage Variation vs. Temperature**



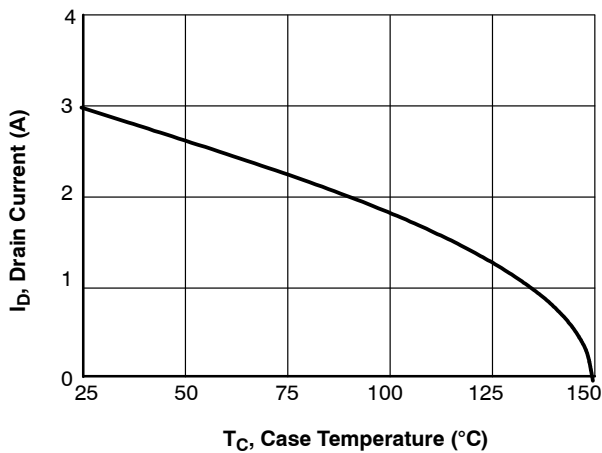
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area for FQP3N80C**



**Figure 10. Maximum Safe Operating Area for FQPF3N80C**



**Figure 11. Maximum Drain Current vs. Case Temperature**

# FQP3N80C, FQPF3N80C

## TYPICAL CHARACTERISTICS (continued)

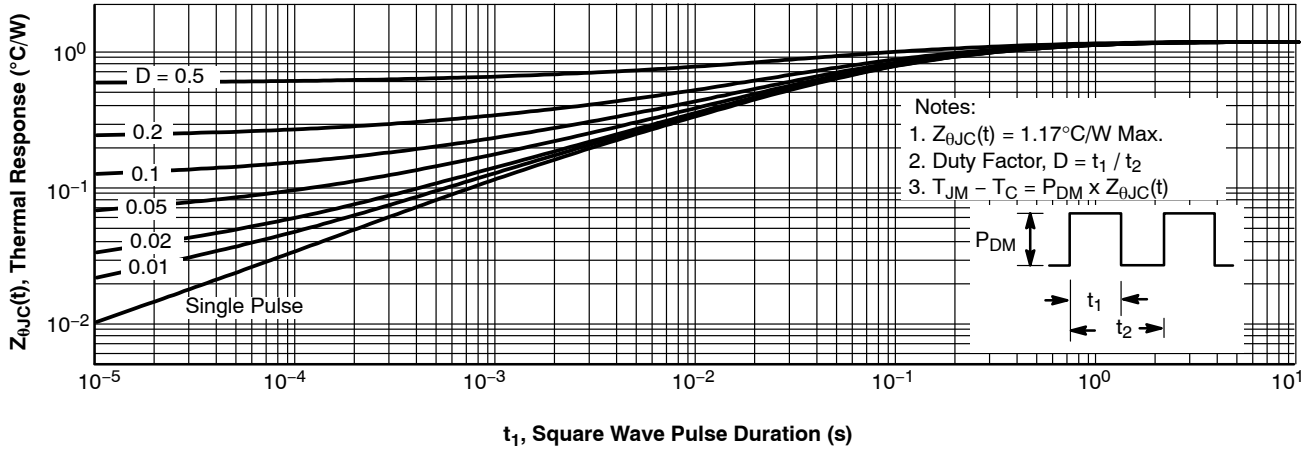


Figure 12. Transient Thermal Response Curve for FQP3N80C

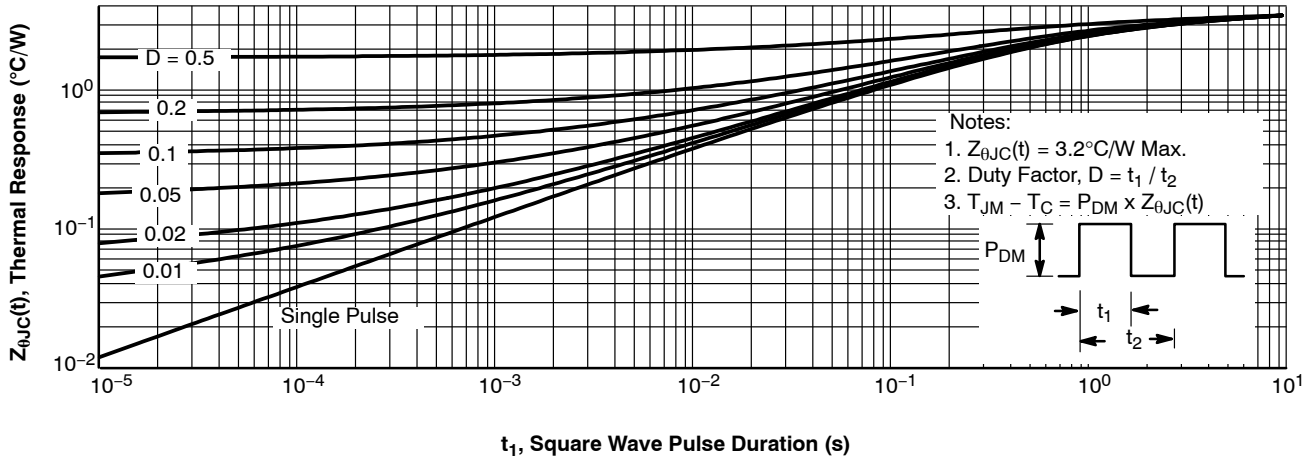
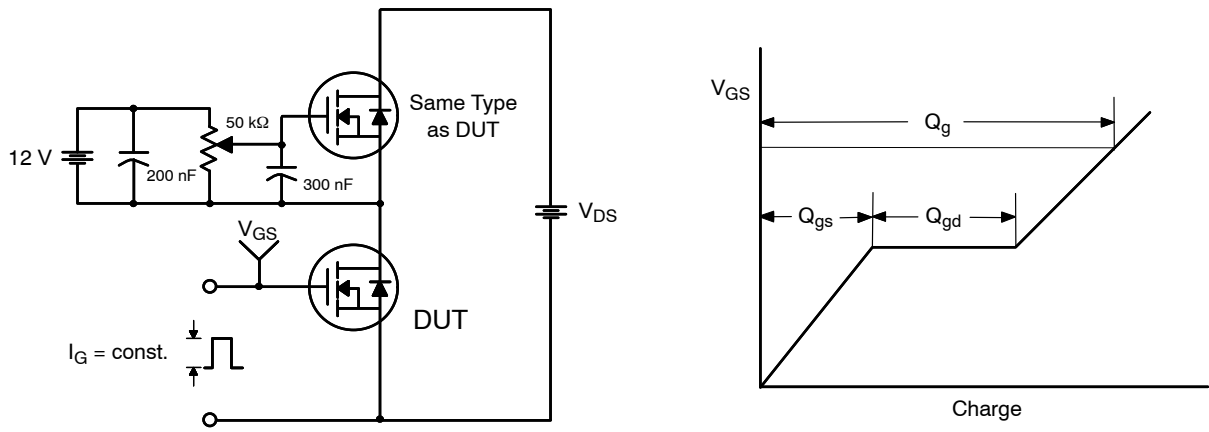
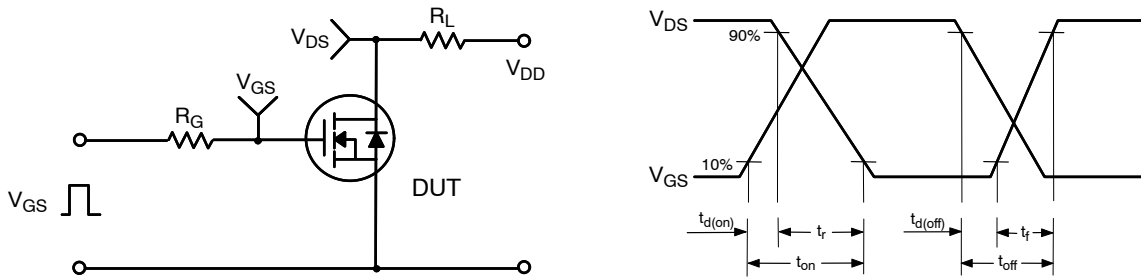


Figure 13. Transient Thermal Response Curve for FQPF3N80C

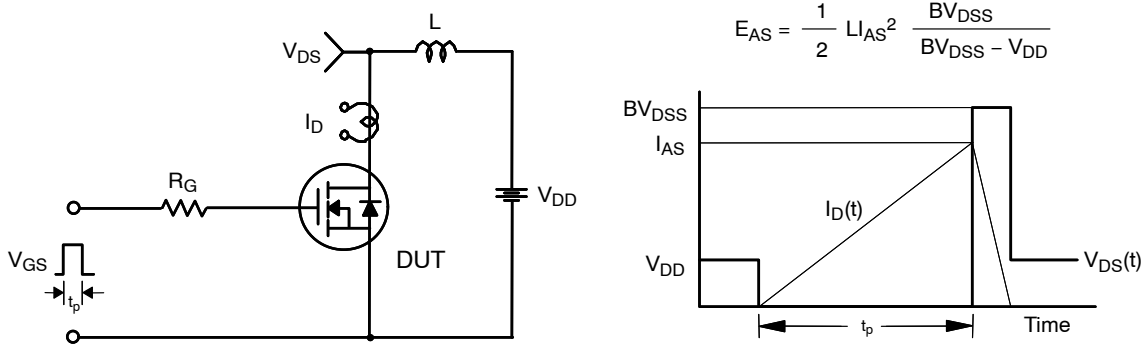
## FQP3N80C, FQPF3N80C



**Figure 14. Gate Charge Test Circuit & Waveform**



**Figure 15. Resistive Switching Test Circuit & Waveforms**



**Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms**

# FQP3N80C, FQPF3N80C

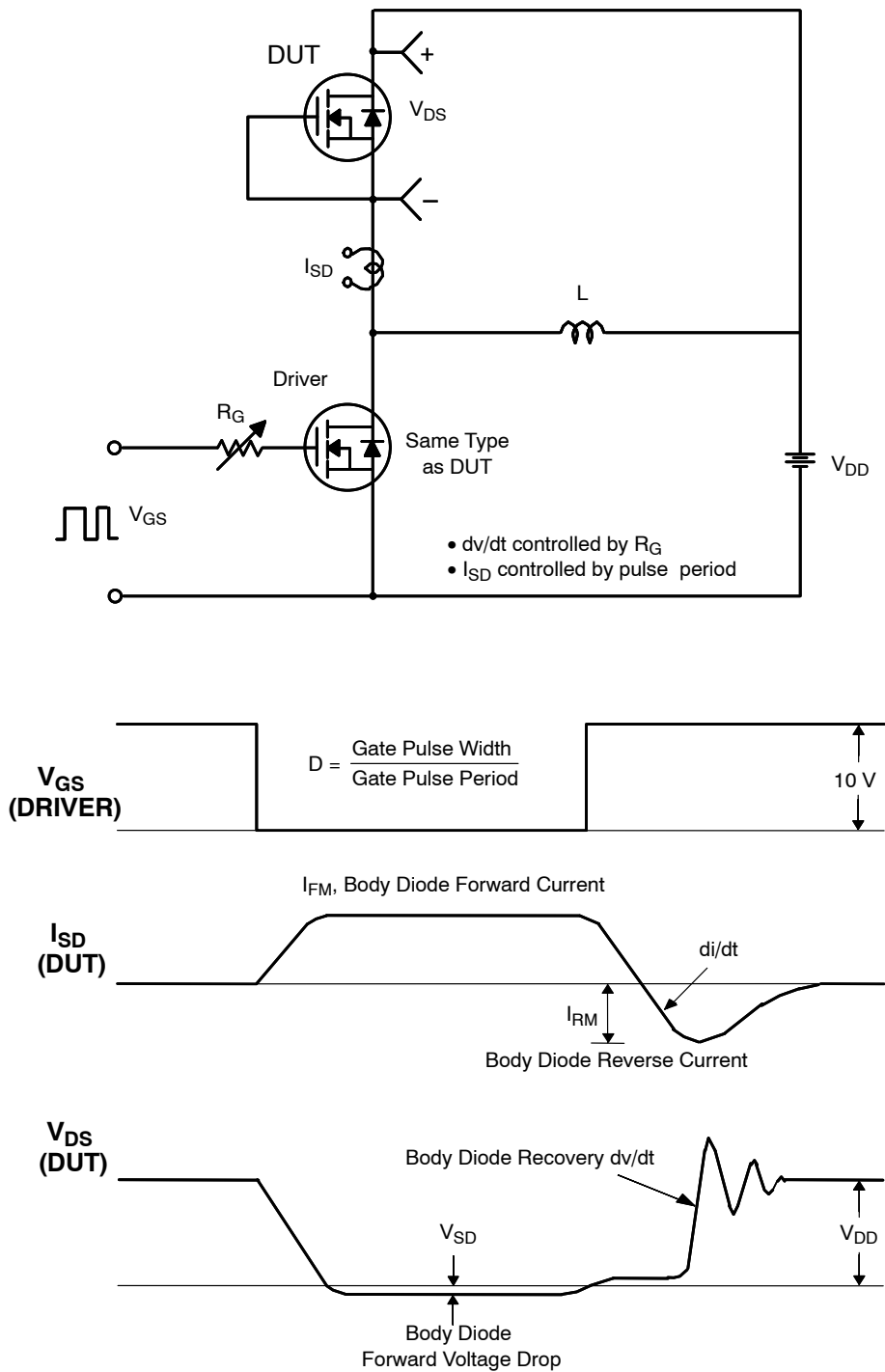


Figure 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms



# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®

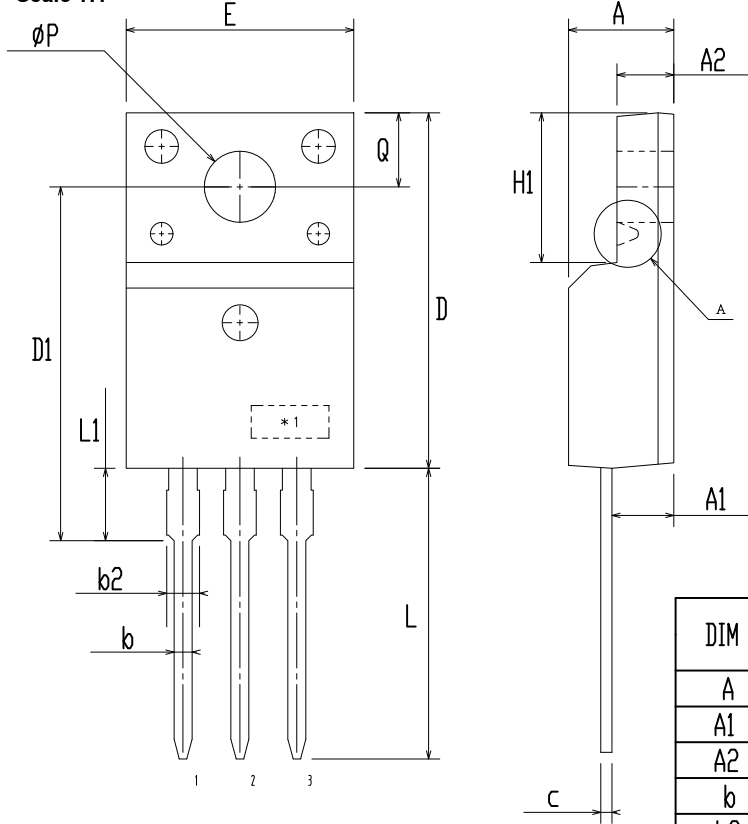


### TO-220 Fullpack, 3-Lead / TO-220F-3SG CASE 221AT ISSUE B

DATE 19 JAN 2021



Scale 1:1



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.50	4.70	4.90
A1	2.56	2.76	2.96
A2	2.34	2.54	2.74
b	0.70	0.80	0.90
b2	~	~	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.60	15.80	16.00
E	9.96	10.16	10.36
e	2.34	2.54	2.74
F	~	0.84	~
H1	6.48	6.68	6.88
L	12.78	12.98	13.18
L1	3.03	3.23	3.43
phi P	2.98	3.18	3.38
phi P1	~	1.00	~
Q	3.20	3.30	3.40

**NOTES:**

- A. DIMENSION AND TOLERANCE AS ASME Y14.5-2009
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUCTIONS.
- C. OPTION 1 - WITH SUPPORT PIN HOLE  
OPTION 2 - NO SUPPORT PIN HOLE

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<b>DESCRIPTION:</b>	<b>TO-220 FULLPACK, 3-LEAD / TO-220F-3SG</b>	<b>PAGE 1 OF 1</b>

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



Scale 1:1

### TO-220-3LD CASE 340AT ISSUE A

DATE 03 OCT 2017



- NOTES:
- A) REFERENCE JEDEC, TO-220, VARIATION AB
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
  - D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
  - E) DOES NOT COMPLY JEDEC STANDARD VALUE.
  - F) "A1" DIMENSIONS AS BELOW:  
 SINGLE GAUGE = 0.51 - 0.61  
 DUAL GAUGE = 1.10 - 1.45
  - G) PRESENCE IS SUPPLIER DEPENDENT
  - H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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