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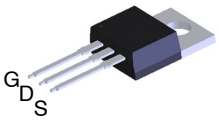
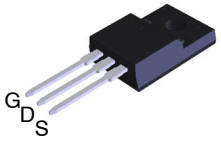
MOSFET – N-Channel, QFET®

900 V, 8.0 A, 1.4 Ω

FQP9N90C, FQPF9N90CT



TO−220
CASE 221A



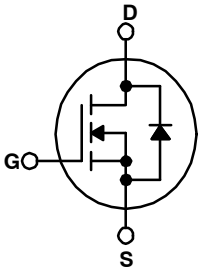
TO−220 Fullpack, 3−Lead
/ TO−220F−3SG
CASE 221AT

Description

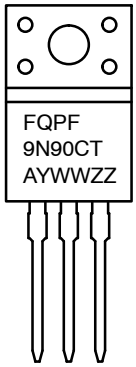
This N−Channel enhancement mode power MOSFET is produced using **onsemi**'s proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on−state resistance, and to provide superior switching performance and high avalanche energy strength. These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

Features

- 8 A 900 V, $R_{DS(on)}$ = 1.4 Ω (Max.) @ V_{GS} = 10 V, I_D = 4 A
- Low Gate Charge (Typ. 45 nC)
- Low Crss (Typ. 14 pF)
- 100% Avalanche Tested
- This Device is Pb−Free Halide, Free and RoHS Compliant.



MARKING DIAGRAM



FQP9N90C, FQPF9N90CT	= Specific Device Code
A	= Assembly Location
YWW	= Date Code (Year and Week)
ZZ	= Assembly Lot Code

ORDERING INFORMATION

Device	Package	Shipping†
FQP9N90C	TO−220 (Pb−Free)	1000 Units / Tube
FQPF9N90CT	TO−220−3F (Pb−Free)	1000 Units / Tube

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MOSFET MAXIMUM RATINGS (T_C = 25°C unless otherwise noted.)

Symbol	Parameter	Ratings		Units
		FQP9N90C	FQPF9N90CT	
V_{DSS}	Drain−Source Voltage	900		V
I_D	Drain Current − Continuous (T_C = 25°C) − Continuous (T_C = 100°C)	 8.0 2.8	 8.0* 2.8*	A
I_{DM}	Drain Current − Pulsed (Note 1)	32	32*	A
V_{GSS}	Gate−Source Voltage	±30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	900		mJ
I_{AR}	Avalanche Current (Note 1)	8.0		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	20.5		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.0		V/ns
P_D	Power Dissipation (T_C = 25°C)	205	68	W
	− Derate above 25°C	1.64	0.54	W/°C
T_J,T_{STG}	Operating and Storage Temperature Range	−55 to +175		°C
T_L	Maximum lead temperature for soldering, 1/8” from case for 5 seconds	300		°C

*Drain current limited by maximum junction temperature.
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	FDP4D5N10C	FDPF4D5N10C	Units
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case, Max.	0.61	1.85	°C/W
$R_{\theta JS}$	Thermal Resistance, Case−to−sink Typ, Max.	0.5	−	
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient, Max	62.5	62.5	

ELECTRICAL CHARACTERISTICS (T_J = 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
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	−	0.99	−	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	−	−	10	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 to Source 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 = 4 A	−	1.12	1.4	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 4 A	−	9.2	−	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	−	2100	2730	pF
C_{oss}	Output Capacitance		−	175	230	pF
C_{rss}	Reverse Transfer Capacitance		−	14	18	pF

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Switching Characteristics						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 450 V, I_D = 9.0 A, R_G = 25 Ω (Note 4)	−	50	110	ns
t_r	Turn−On Rise Time		−	120	250	ns
$t_{d(off)}$	Turn−Off Delay Time		−	100	210	ns
t_f	Turn−Off Fall Time		−	75	160	ns
Q_g	Total Gate Charge	V_{DS} = 720 V, I_D = 9.0 A, V_{GS} = 10 V (Note 4)	−	45	58	nC
Q_{gs}	Gate−Source Charge		−	13	−	nC
Q_{gd}	Gate−Drain Charge		−	18	−	nC
Drain−Source Diode Characteristics						
I_S	Maximum Continuous Drain−Source Diode Forward Current		−	−	8.0	A
I_{SM}	Maximum Pulsed Drain−Source Diode Forward Current		−	−	32.0	A
V_{SD}	Drain−Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 100 A	−	−	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, V_{DD} = 50 V, I_F = 100 A, dI_F/dt = 100 A/μs	−	550	−	ns
Q_{rr}	Reverse Recovery Charge		−	6.5	−	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.

NOTES:
1. Repetitive Rating: Pulse width−limited by maximum junction temperature.
2. L = 21 mH, I_{AS} = 9 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 9.0 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature.

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

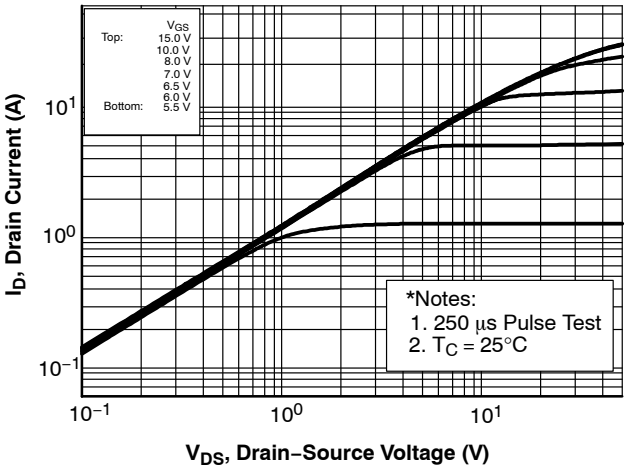


Figure 1. On−Region Characteristics

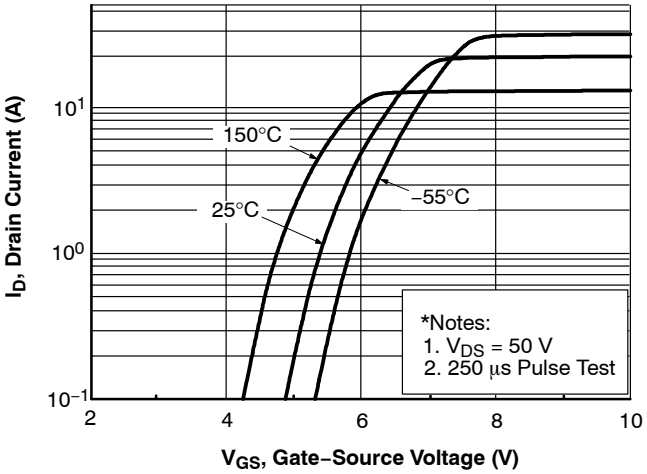


Figure 2. Transfer Characteristics

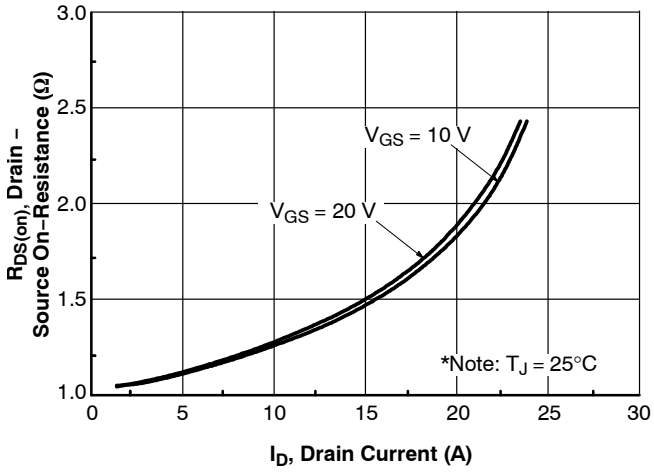


Figure 3. On−Resistance Variation vs Drain Current and Gate Voltage

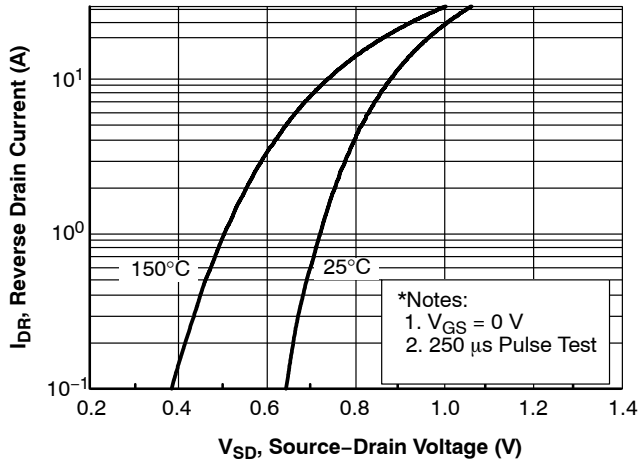


Figure 4. Body Diode Forward Voltage Variation With Source Current and Temperature

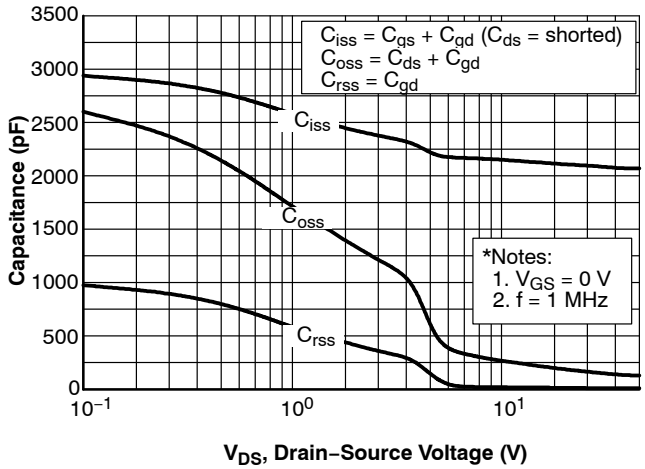


Figure 5. Capacitance Characteristics

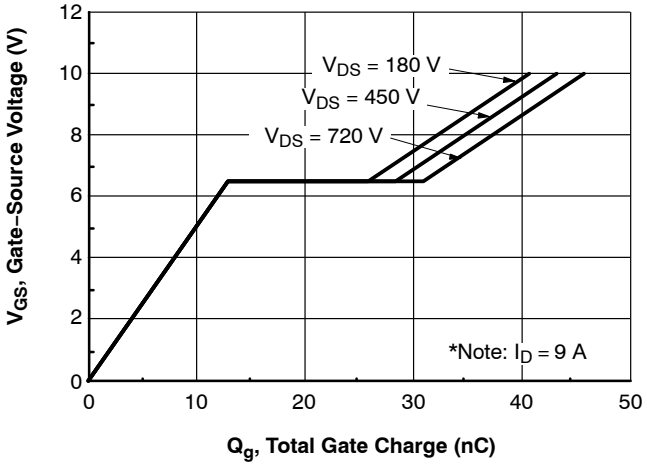


Figure 6. Gate Charge Characteristics

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

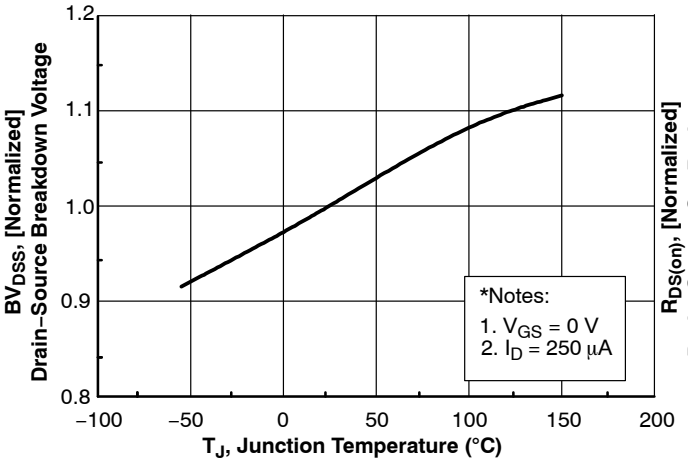


Figure 7. Breakdown Voltage Variation vs Temperature

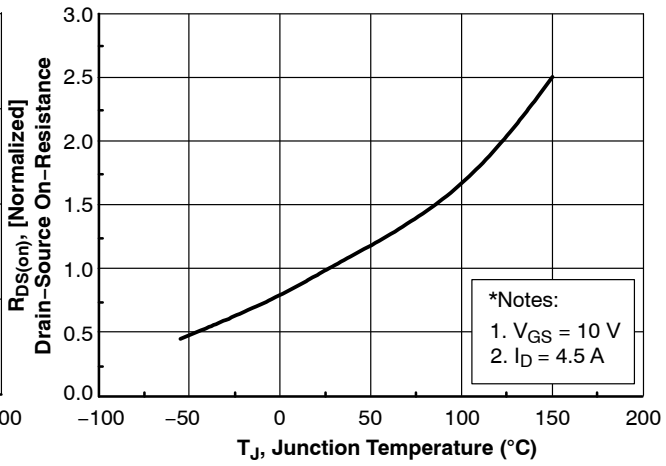


Figure 8. On−Resistance Variation vs Temperature

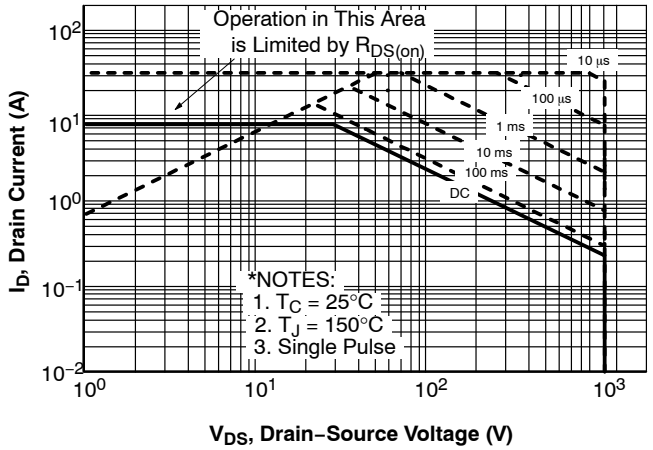


Figure 9. Maximum Safe Operating Area for FQP9N90C

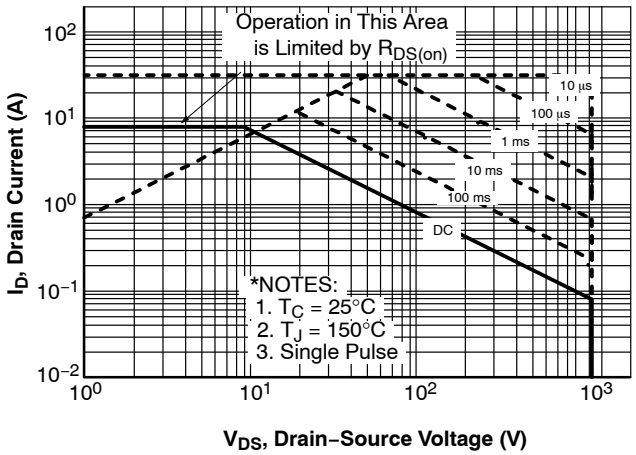


Figure 10. Maximum Safe Operating Area for FQPF9N90CT

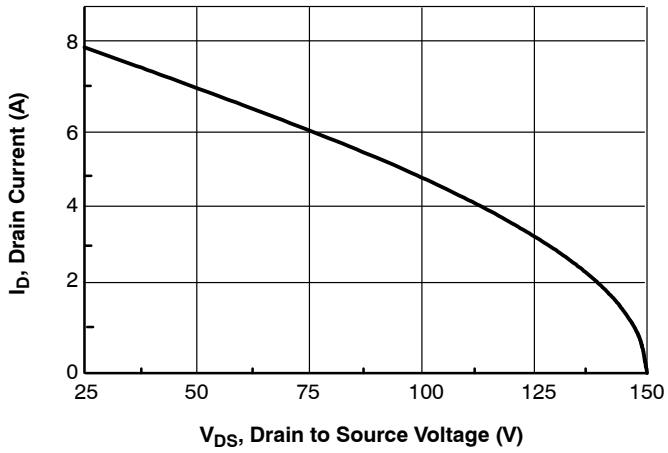


Figure 11. Maximum Drain Current vs Case Temperature

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

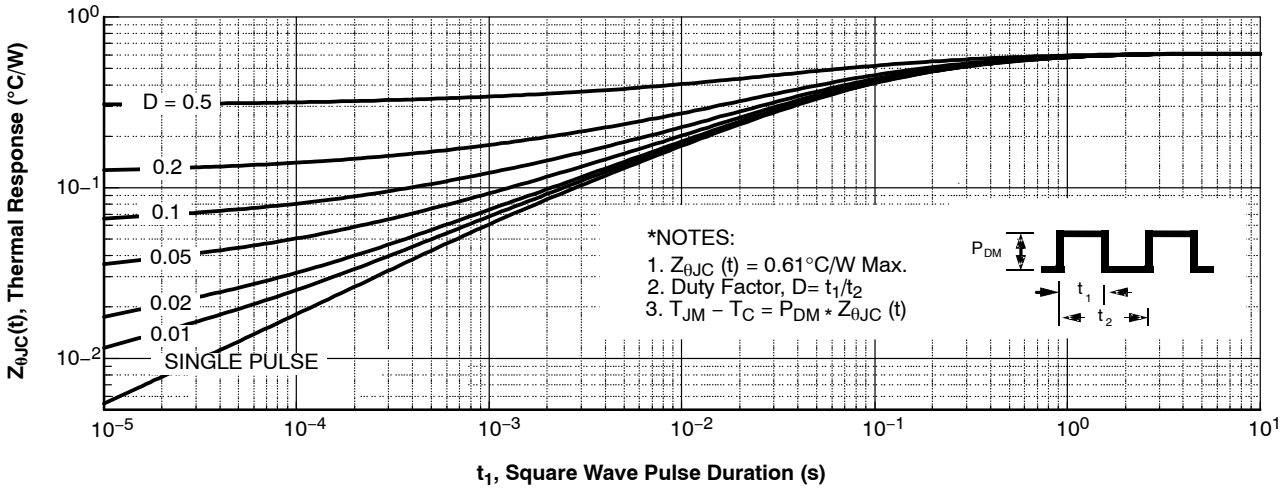


Figure 12. Transient Thermal Response Curve For FQP9N90C

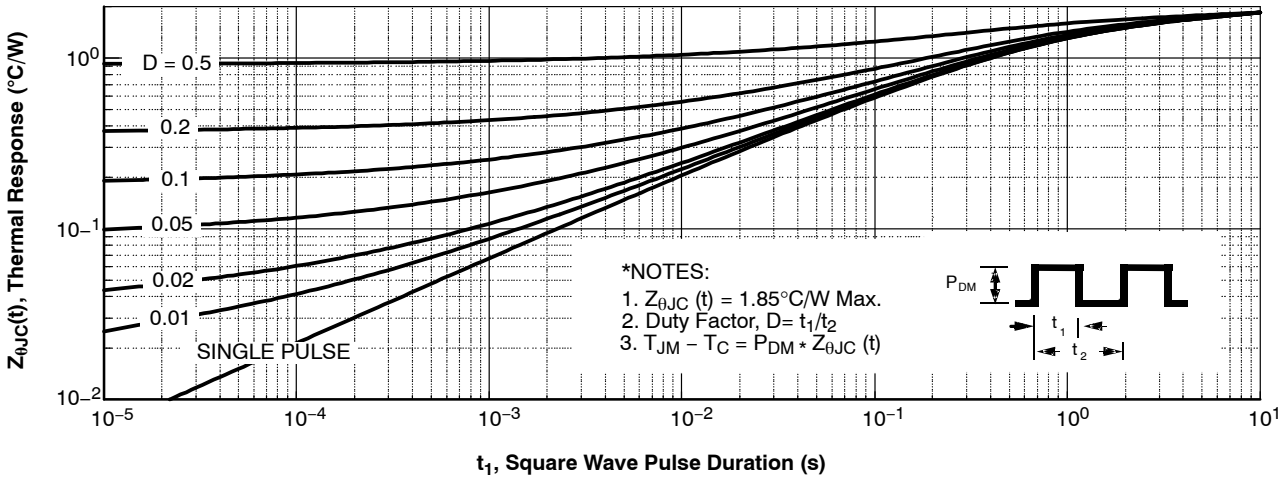


Figure 13. Transient Thermal Response Curve For FQPF9N90CT

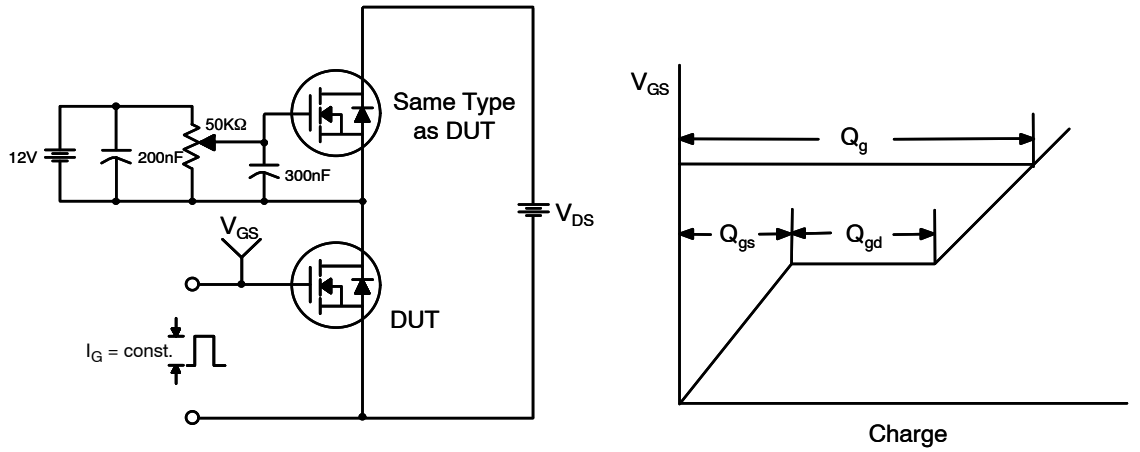


Figure 14. Gate Charge Test Circuit & Waveform

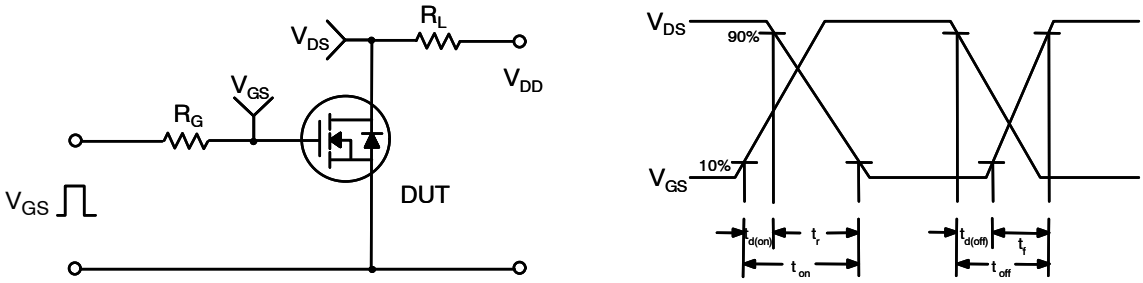


Figure 15. Resistive Switching Test Circuit & Waveforms

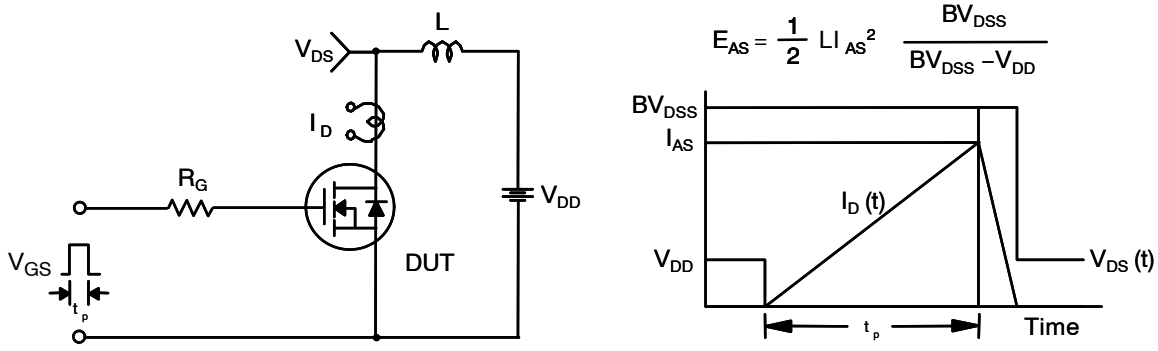


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

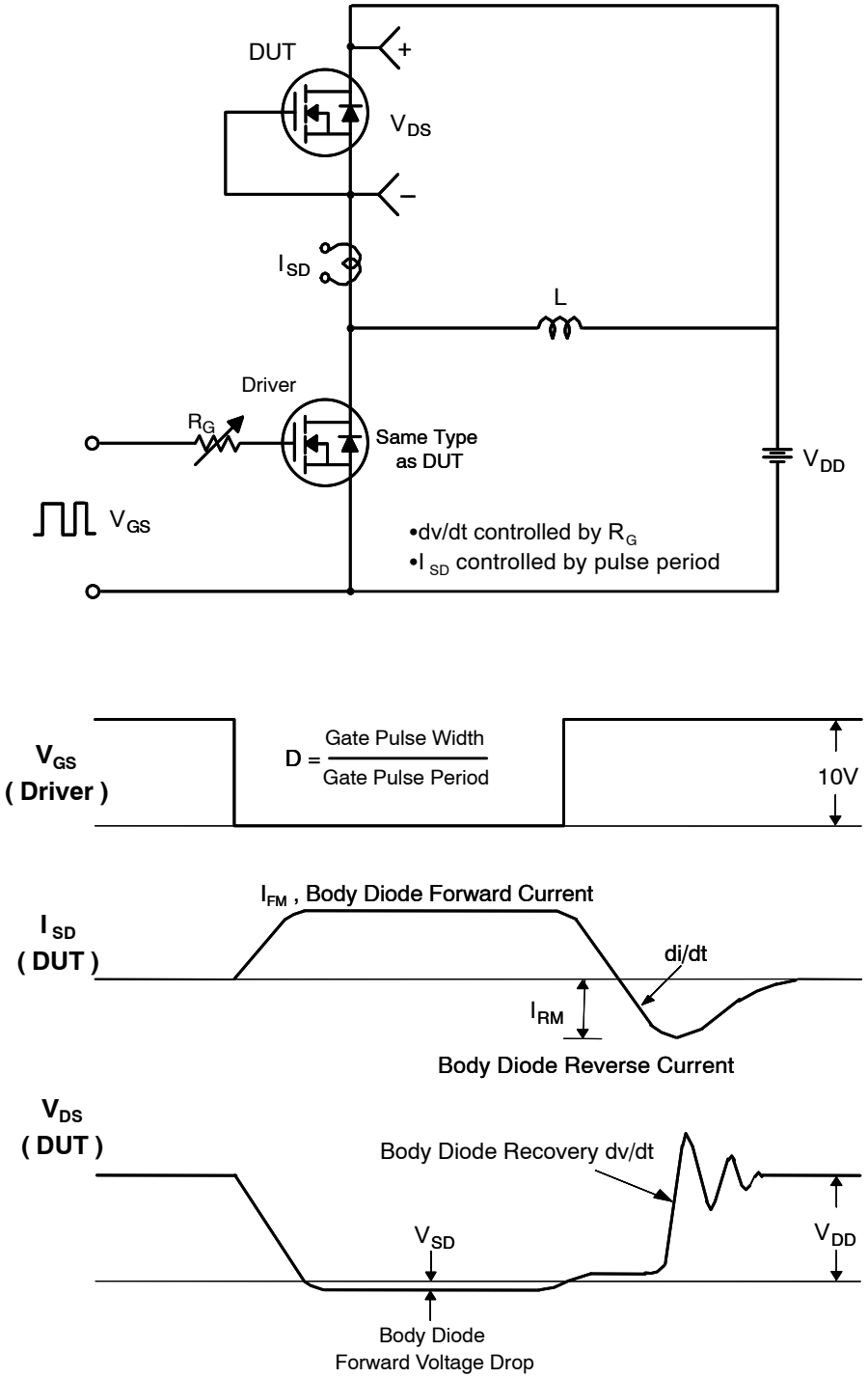
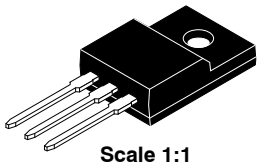


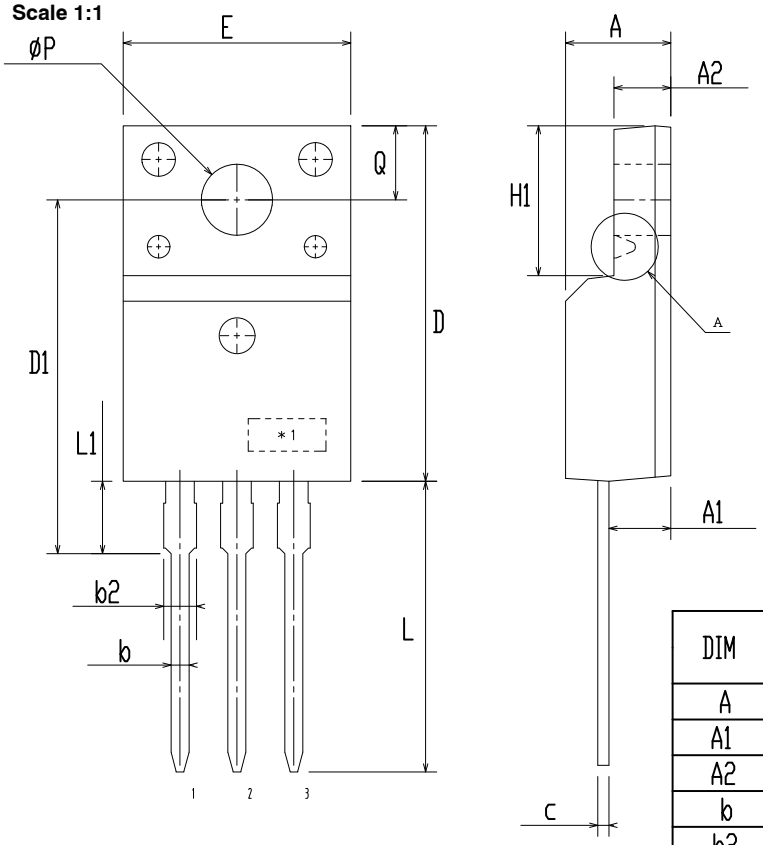
Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

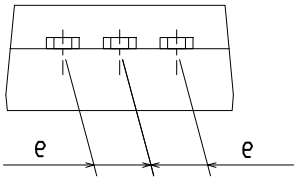
TO−220 Fullpack, 3−Lead / TO−220F−3SG
CASE 221AT
ISSUE B

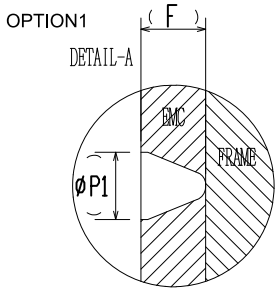
DATE 19 JAN 2021



Scale 1:1







DIM	MILLIMITERS		
	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
ø P	2.98	3.18	3.38
ø 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 PROTRUCSIONS.
C. OPTION 1 - WITH SUPPORT PIN HOLE
OPTION 2 - NO SUPPORT PIN HOLE

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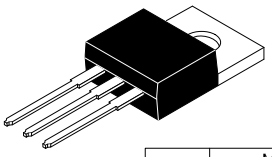
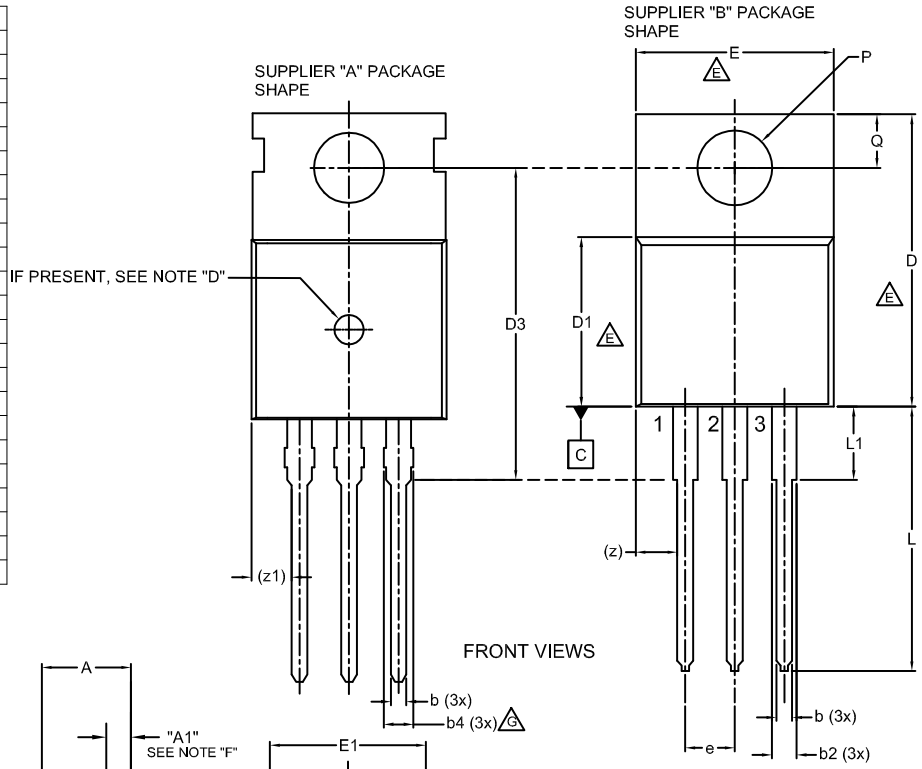
DESCRIPTION:	**TO−220 FULLPACK, 3−LEAD / TO−220F−3SG**		**PAGE 1 OF 1**

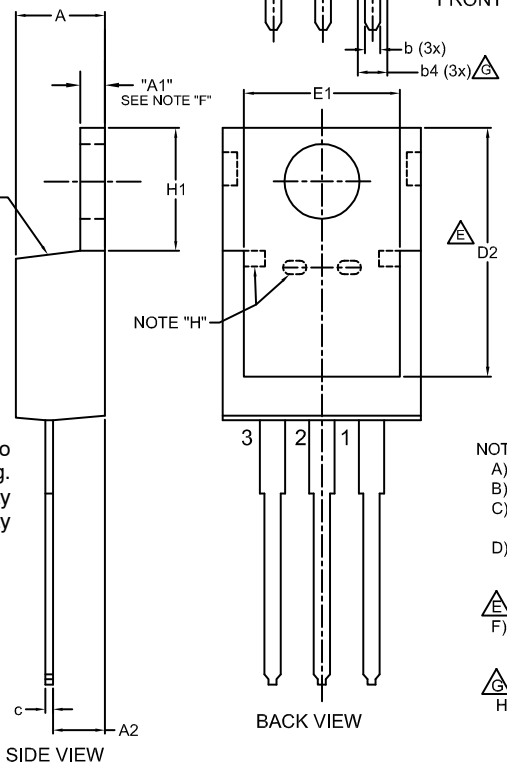


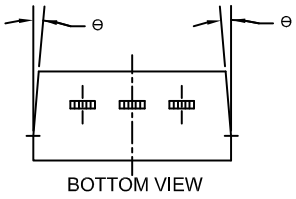
TO−220−3LD
CASE 340AT
ISSUE B

DATE 08 AUG 2022

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.00	--	4.70
A1	SEE NOTE "F"		
A2	2.10	--	2.85
b	0.55	--	1.00
b2	1.10	--	1.62
b4	1.42	--	1.62
c	0.36	--	0.60
D	13.90	--	16.30
D1	8.13	--	9.40
D2	11.50	--	14.30
D3	15.42	--	16.51
E	9.65	--	10.67
E1	7.59	--	8.65
e	2.40	--	2.67
H1	6.06	--	6.69
L	12.70	--	14.04
L1	2.70	--	4.10
P	3.50	--	4.00
Q	2.50	--	3.40
z	2.13 REF		
z1	2.06 REF		
Θ	3°	–	5°







GENERIC MARKING DIAGRAM*

XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

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.

DOCUMENT NUMBER:	**98AON13818G**	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−220−3LD**	**PAGE 1 OF 1**

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