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DATA SHEET
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MOSFET – N-Channel, QFET

900 V, 4.0 A, 4.2 Ω

FQP4N90C, FQPF4N90C

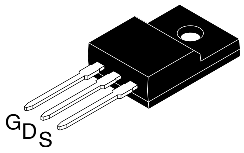
Description

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.

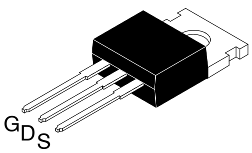
Features

- 4.0 A, 900 V, $R_{DS(on)}$ = 4.2 Ω (Max.) @ V_{GS} = 10 V, I_D = 2.0 A
- Low Gate Charge (Typ. 17 nC)
- Low Crss (Typ. 5.6 pF)
- 100% Avalanche Tested

V_{DSS}	$R_{DS(on)}$ MAX	I_D MAX
900 V	4.2 Ω @ 10 V	4.0 A

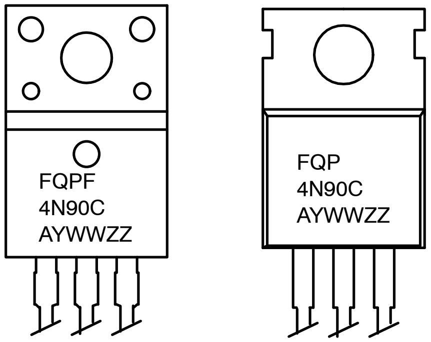


**TO−220 Fullpack,
3−Lead / TO−220F−3SG
CASE 221AT**



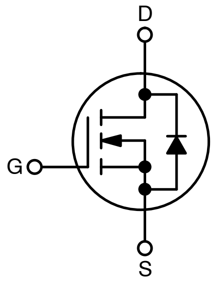
**TO−220−3LD
CASE 340AT**

MARKING DIAGRAM



FQP4N90C, FQPF4N90C = Specific Device Code
A = Assembly Location
YWW = Date Code (Year & Week)
ZZ = Assembly Lot

N−CHANNEL MOSFET



ORDERING INFORMATION

Part Number	Package	Shipping
FQP4N90C	TO−220	1000 Units / Tube
FQPF4N90C	TO−220F	1000 Units / Tube

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February, 2024 − Rev. 3

Publication Order Number:
FQPF4N90C/D

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise noted)

Symbol	Parameter		FQP4N90C	FQPF4N90C	Unit
V_{DSS}	Drain−Source Voltage		900		V
I_D	Drain Current	− Continuous (T_C = 25°C)	4	4*	A
		− Continuous (T_C = 100°C)	2.3	2.3*	
I_{DM}	Drain Current	− Pulsed (Note 1)	16	16*	A
V_{GSS}	Gate−Source Voltage		±30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		570		mJ
I_{AR}	Avalanche Current (Note 1)		4		A
E_{AR}	Repetitive Avalanche Energy (Note 1)		14		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5		V/ns
P_D	Power Dissipation	(T_C = 25°C)	140	47	W
		− Derate above 25°C	1.12	0.38	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		−55 to +150		°C
T_L	Maximum Lead Temperature for Soldering, 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.

*Drain current limited by maximum junction temperature.

1. Repetitive rating: pulse−width limited by maximum junction temperature.
2. L = 67 mH, I_{AS} = 4 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \le 4$ A, di/dt ≤ 200 A/μs, $V_{DD} \le BV_{DSS}$, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	FQP4N90C	FQPF4N90C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case, Max.	0.89	2.66	°C/W
$R_{\theta CS}$	Thermal Resistance, Case−to−Sink, Max.	0.5	−	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient, Max.	62.5	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 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
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	–	1.05	–	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	–	–	100	
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 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 = 2 A	–	3.5	4.2	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50 V, I_D = 2 A	–	5	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	–	740	960	pF
C_{oss}	Output Capacitance		–	65	85	pF
C_{rss}	Reverse Transfer Capacitance		–	5.6	7.3	pF
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 450 V, I_D = 4 A, R_G = 25 Ω (Note 4)	–	25	60	ns
t_r	Turn−On Rise Time		–	50	110	ns
$t_{d(off)}$	Turn−Off Delay Time		–	40	90	ns
t_f	Turn−Off Fall Time		–	35	80	ns
Q_g	Total Gate Charge	V_{DS} = 720 V, I_D = 4 A, V_{GS} = 10 V (Note 4)	–	17	22	nC
Q_{gs}	Gate−Source Charge		–	4.5	–	nC
Q_{gd}	Gate−Drain Charge		–	7.5	–	nC
DRAIN−SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
I_S	Maximum Continuous Drain−Source Diode Forward Current		–	–	4	A
I_{SM}	Maximum Pulsed Drain−Source Diode Forward Current		–	–	16	A
V_{SD}	Drain−Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 4 A	–	–	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 4 A, dI_F/dt = 100 A/μs	–	450	–	ns
Q_{rr}	Reverse Recovery Charge		–	3.5	–	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.

4. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

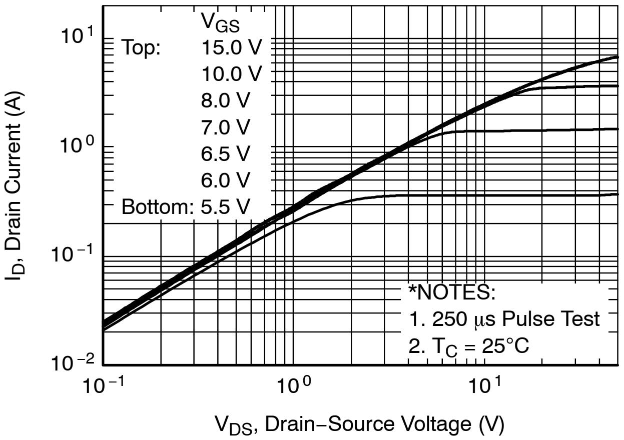


Figure 1. On−Region Characteristics

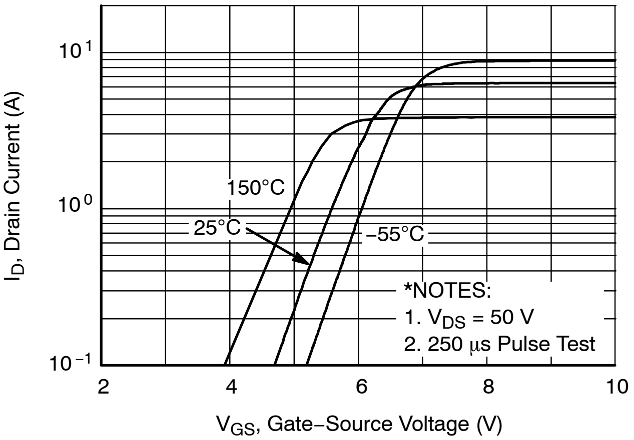


Figure 2. Transfer Characteristics

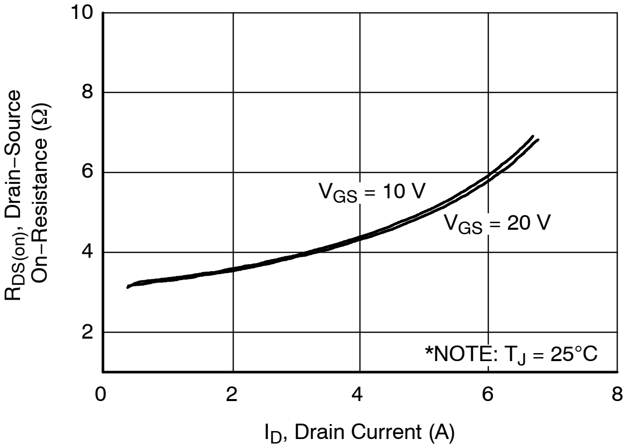


Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

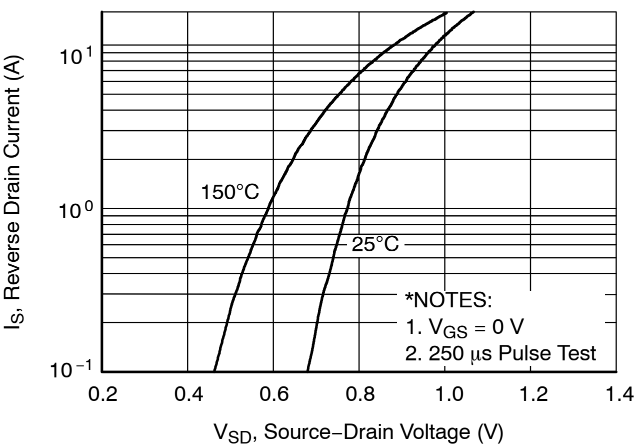


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

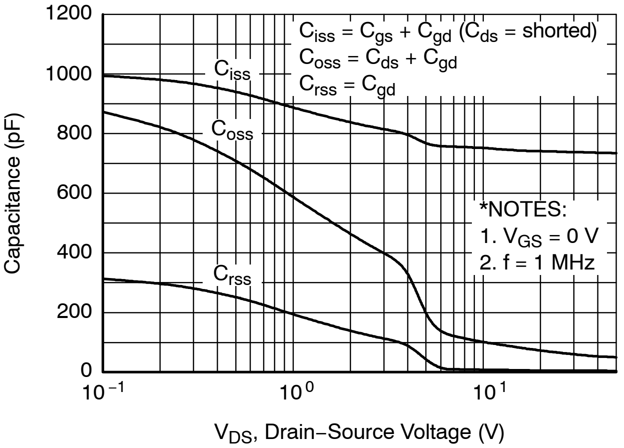


Figure 5. Capacitance Characteristics

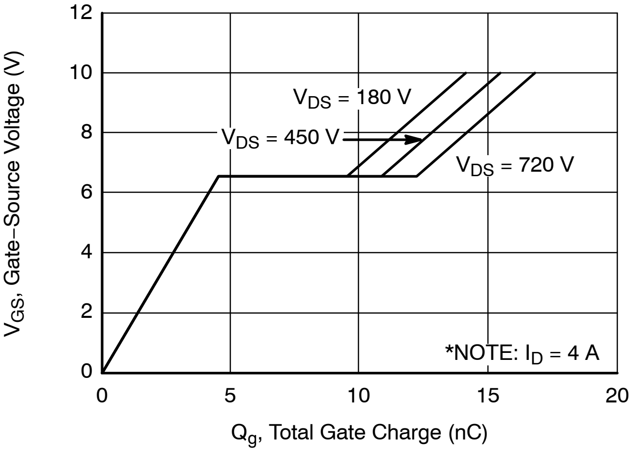


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (CONTINUED)

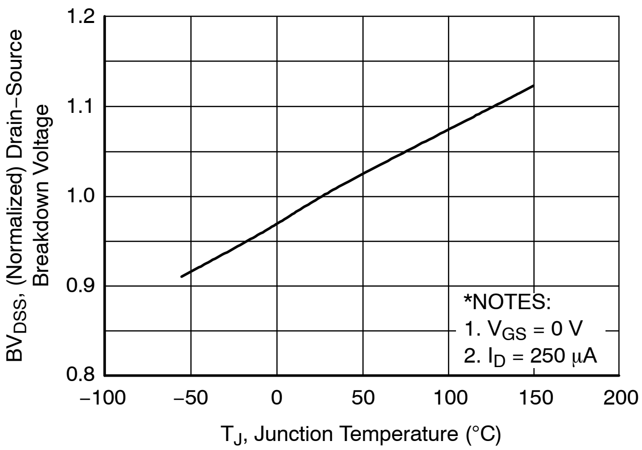


Figure 7. Breakdown Voltage Variation vs. Temperature

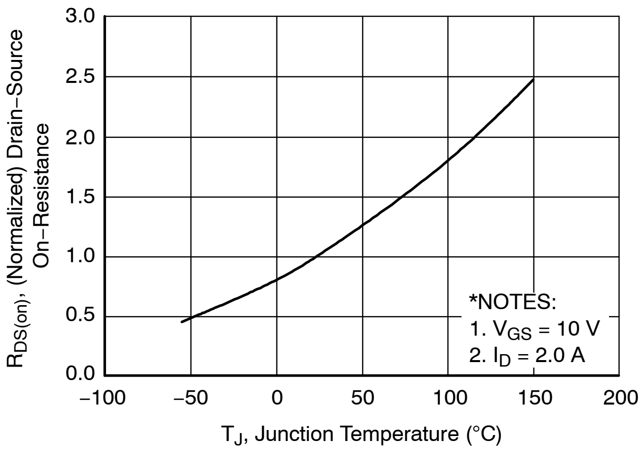


Figure 8. On−Resistance Variation vs. Temperature

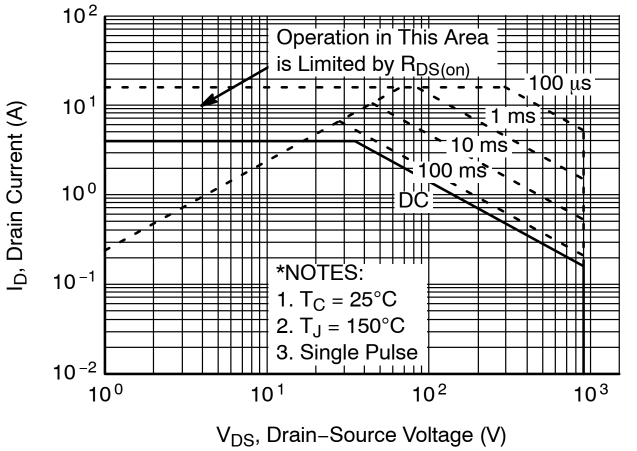


Figure 9. Maximum Safe Operating Area for FQP4N90C

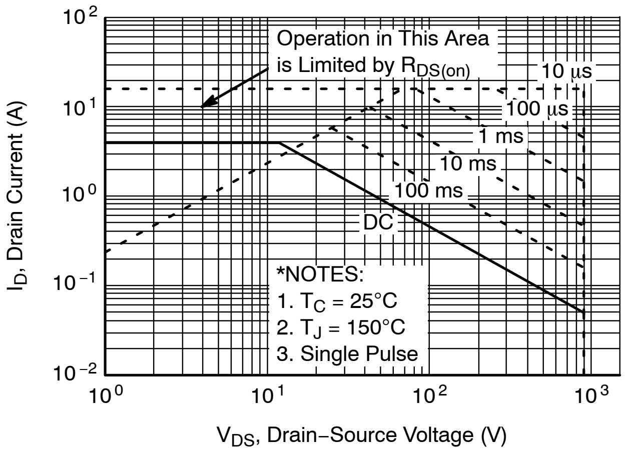


Figure 10. Maximum Safe Operating Area for FQPF4N90C

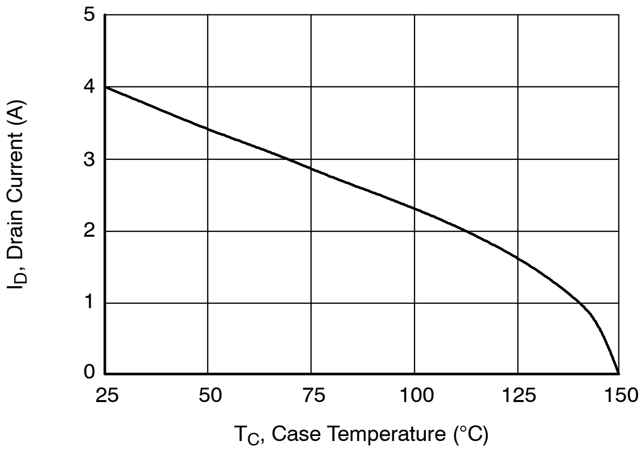


Figure 11. Maximum Drain Current vs. Case Temperature

TYPICAL CHARACTERISTICS (CONTINUED)

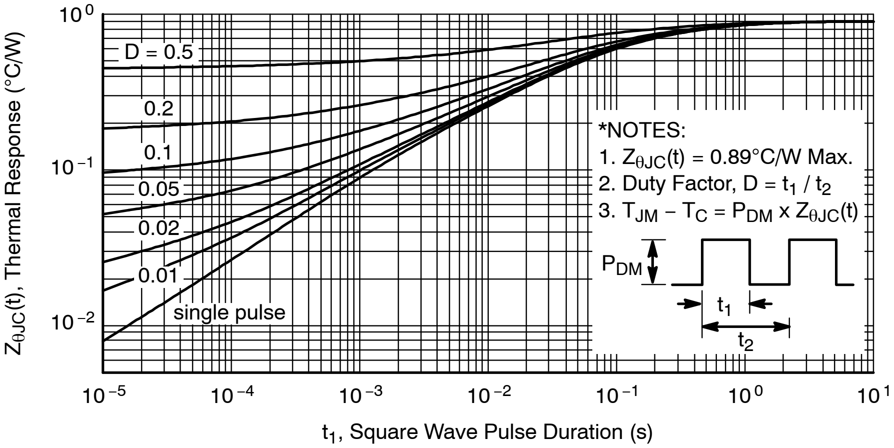


Figure 12. Transient Thermal Response Curve for FQP4N90C

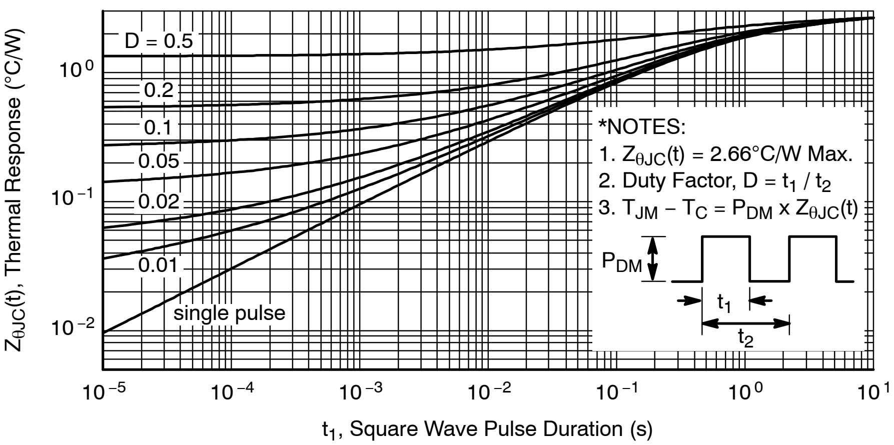


Figure 13. Transient Thermal Response Curve for FQPF4N90C

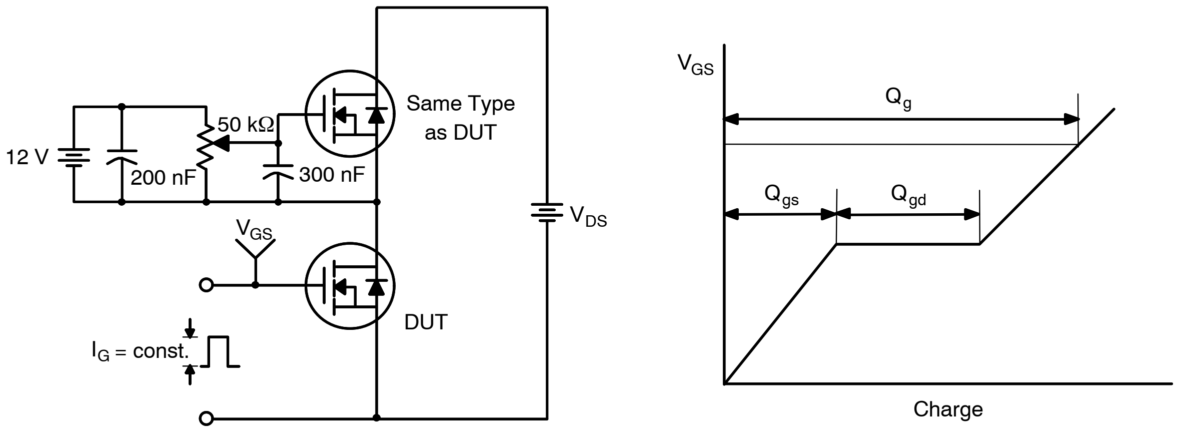


Figure 14. Gate Charge Test Circuit & Waveform

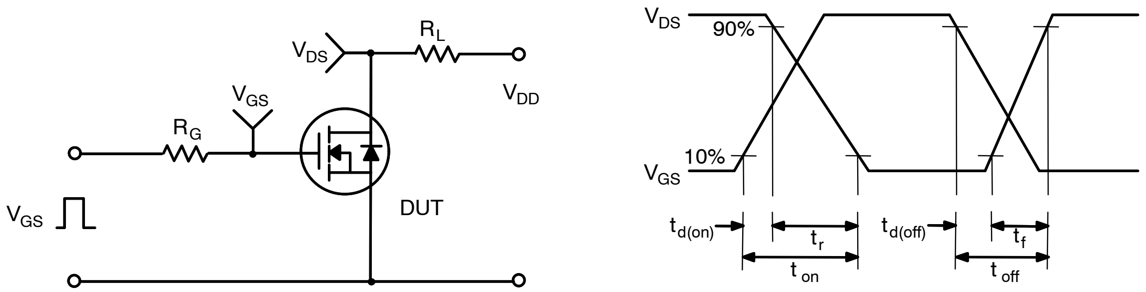
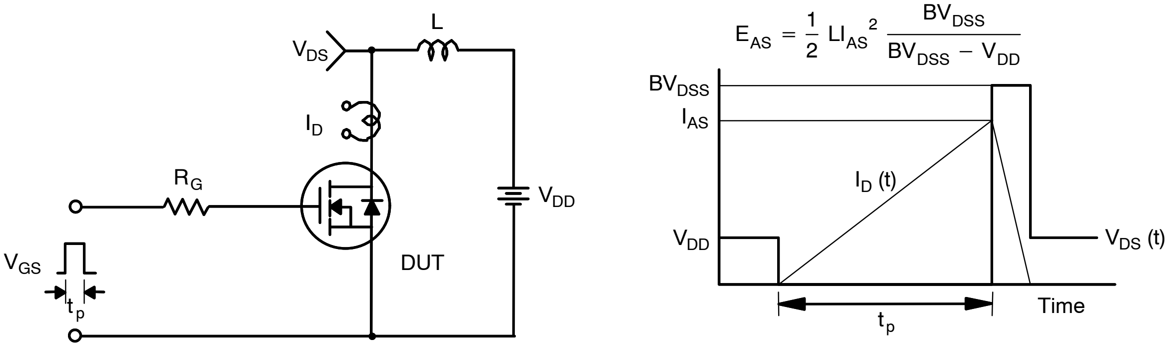


Figure 15. Resistive Switching Test Circuit & Waveforms



$$E_{AS} = \frac{1}{2} L I_{AS}{}^{2} \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

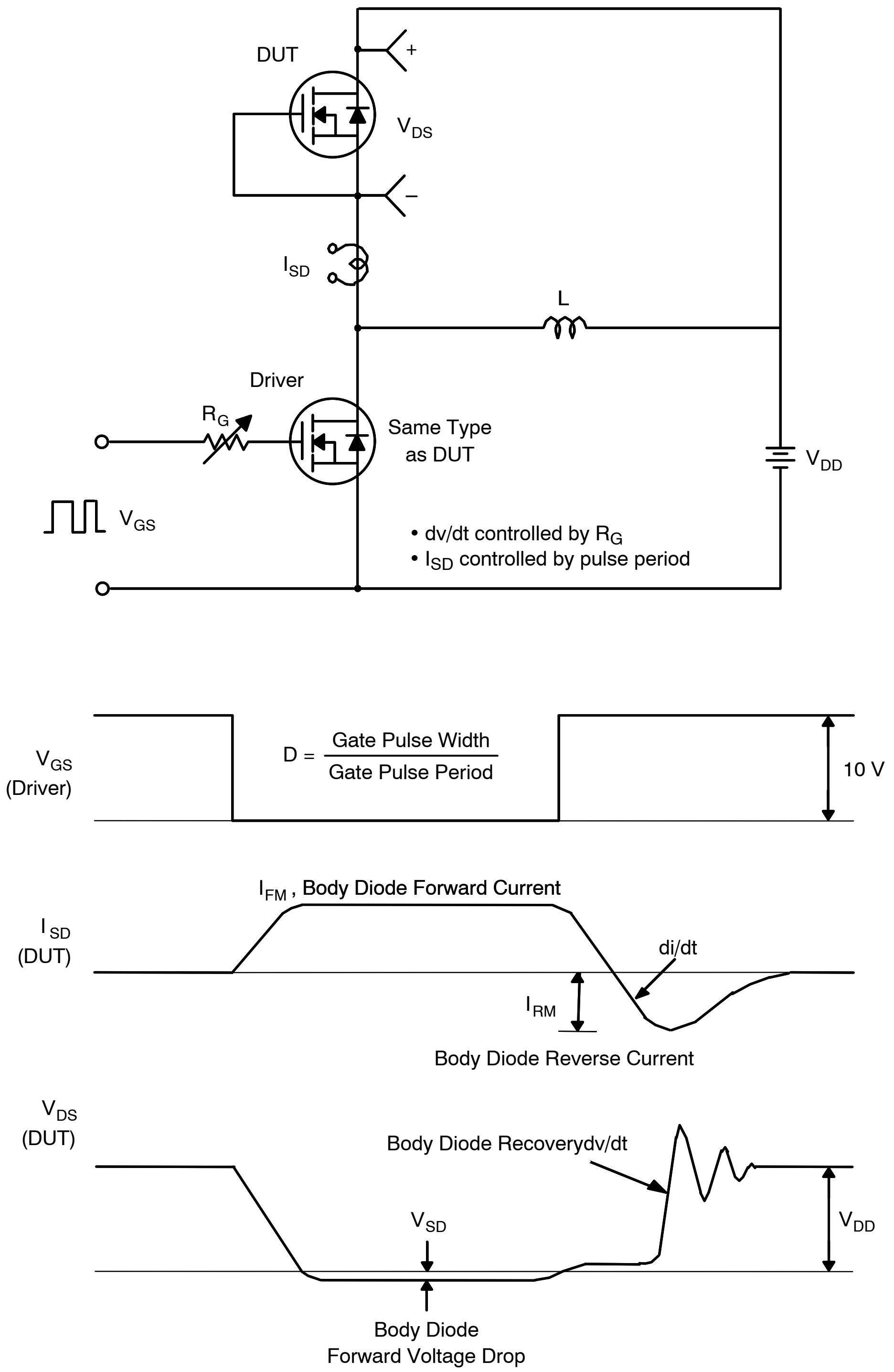
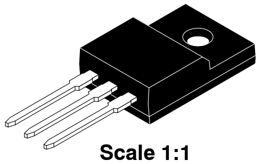


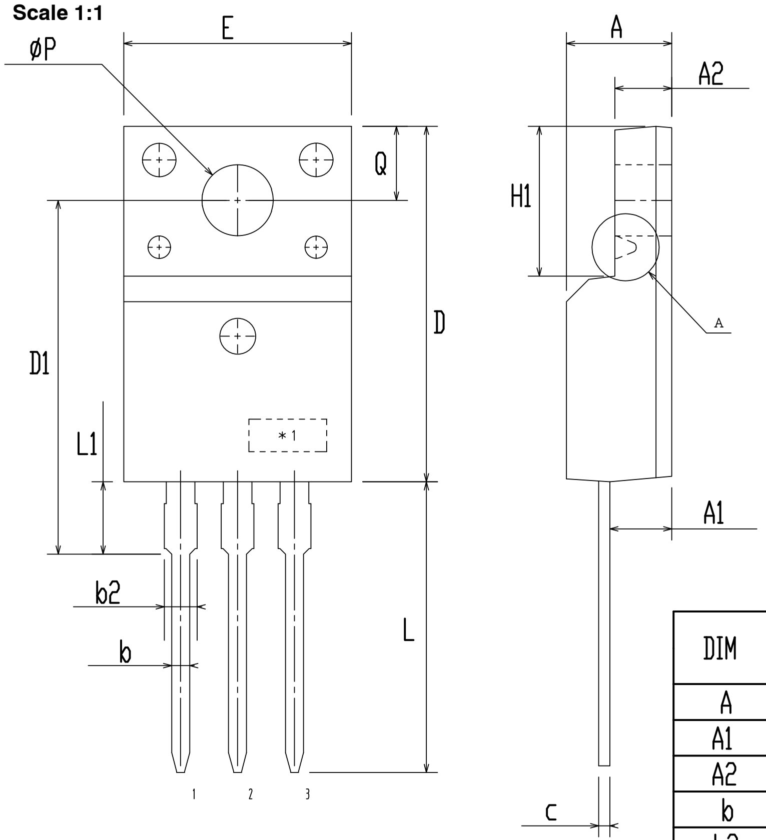
Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

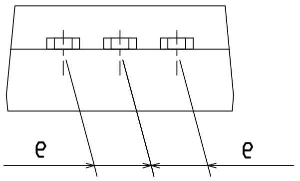


Scale 1:1

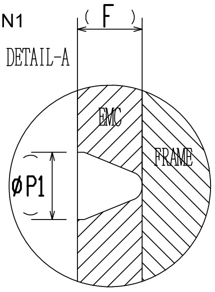
TO−220 Fullpack, 3−Lead / TO−220F−3SG
CASE 221AT
ISSUE B

DATE 19 JAN 2021





OPTION1



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**

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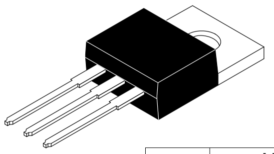
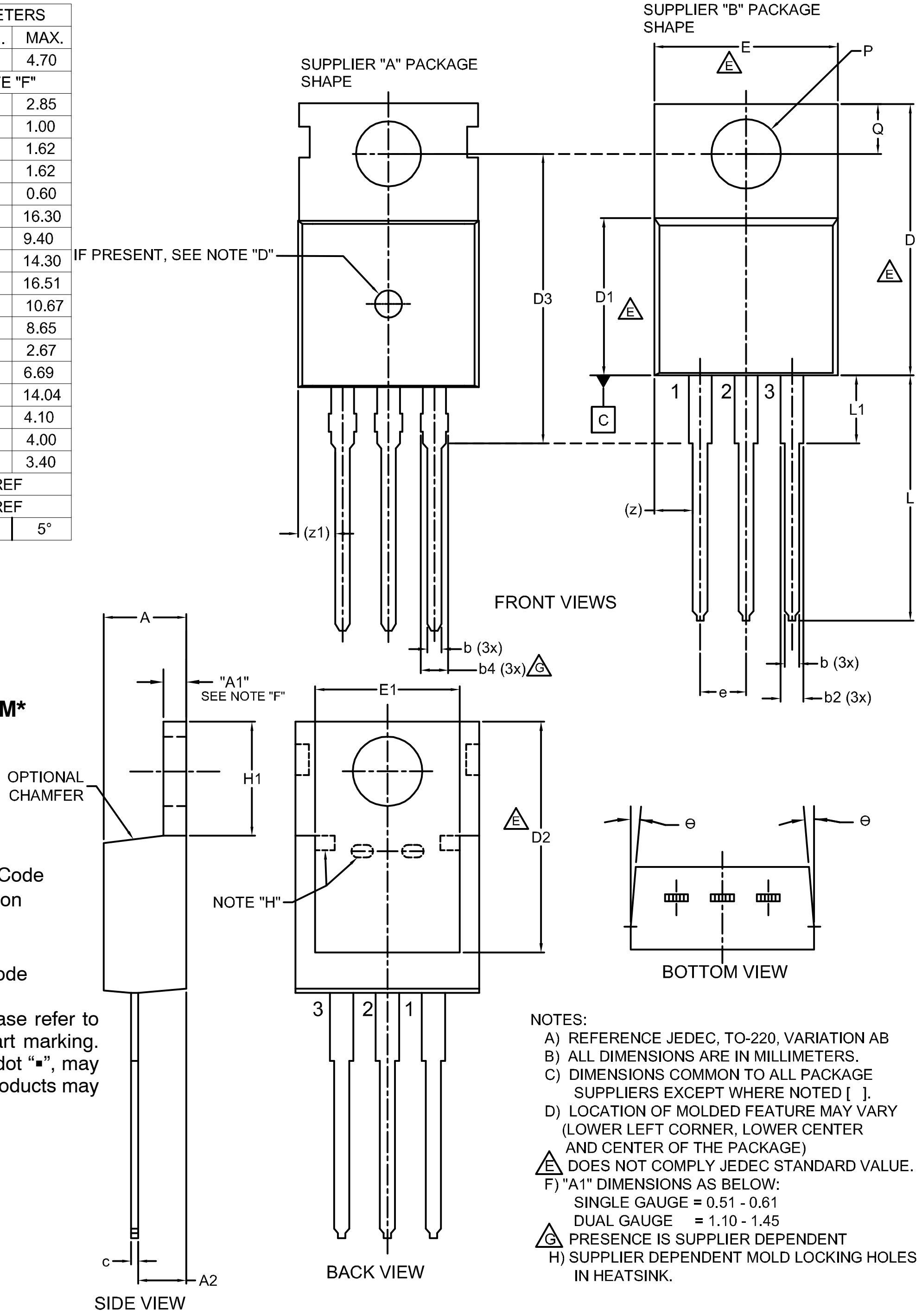


TO−220−3LD
CASE 340AT
ISSUE B

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*

XXXXX
XXXXX
AYWWZZ

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.

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