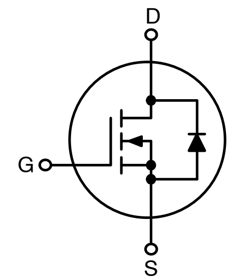
MOSFET – N-Channel, SUPERFET® II, Easy-Drive

600 V, 15 A, 260 mΩ

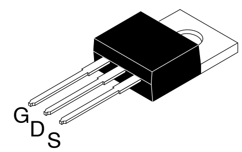
FCP260N60E, FCPF260N60E

V_{DS}	$R_{DS(ON)}$ MAX	I_D MAX
600 V	260 mΩ @ 10 V	15 A*

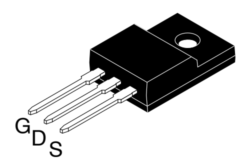
*Drain current limited by maximum junction temperature.



N−Channel



TO−220−3LD
CASE 340AT



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

Description

SUPERFET II MOSFET is **onsemi**'s brand−new high voltage super−junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on−resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SUPERFET II MOSFET easy−drive series offers slightly slower rise and fall times compared to the SUPERFET II MOSFET series. Noted by the "E" part number suffix, this family helps manage EMI issues and allows for easier design implementation. For faster switching in applications where switching losses must be at an absolute minimum, please consider the SUPERFET II MOSFET series.

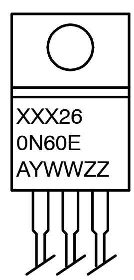
Features

- 650 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 220 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 48 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 129 pF)
- 100% Avalanche Tested
- An Integrated Gate Resistor
- RoHS Compliant

Applications

- LCD / LED / PDP TV Lighting
- Solar Inverter
- AC−DC Power Supply

MARKING DIAGRAM



XXX260N60E	=	Device Code (XXX = FCP, FCPF)
A	=	Assembly Location
YWW	=	Date Code (Year & Week)
ZZ	=	Assembly Lot

ORDERING INFORMATION

Device	Package	Shipping
FCP260N60E	TO−220	800 Units / Tube
FCPF260N60E	TO−220F	1000 Units / Tube

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

Symbol	Parameter		FCP260N60E	FCPF260N60E	Unit
V_{DSS}	Drain to Source Voltage		600		V
V_{GSS}	Gate to Source Voltage	−DC	±20		V
		−AC (f > 1 Hz)	±30		
I_D	Drain Current	− Continuous (T_C = 25°C)	15	15*	A
		− Continuous (T_C = 100°C)	9.5	9.5*	
I_{DM}	Drain Current	− Pulsed (Note 1)	45	45*	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		292.5		mJ
I_{AR}	Avalanche Current (Note 1)		3.0		A
E_{AR}	Repetitive Avalanche Energy (Note 1)		1.56		mJ
dv/dt	MOSFET dv/dt		100		V/ns
	Peak Diode Recovery dv/dt (Note 3)		20		
P_D	Power Dissipation	(T_C = 25°C)	156	36	W
		−Derate above 25°C	1.25	0.29	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. I_{AS} = 3 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \le 7.5$ A, di/dt ≤ 200 A/μs, $V_{DD} \le BV_{DSS}$, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	FCP260N60E	FCPF260N60E	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.8	3.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0 V, I_D = 10 mA, T_J = 25°C	600	–	–	V
		V_{GS} = 0 V, I_D = 10 mA, T_J = 150°C	650	–	–	
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, referenced to 25°C	–	0.67	–	V/°C
BV_{DS}	Drain to Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 15 A	–	700	–	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	–	–	1	μA
		V_{DS} = 480 V, T_C = 125°C	–	2.6	–	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V	–	–	±100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	2.5	–	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 7.5 A	–	0.22	0.26	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 7.5 A	–	15.5	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	–	1880	2500	pF
C_{oss}	Output Capacitance		–	1330	1770	pF
C_{rss}	Reverse Transfer Capacitance		–	85	130	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0 V, f = 1 MHz	–	32	–	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	–	129	–	pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	V_{DS} = 380 V, I_D = 7.5 A, V_{GS} = 10 V (Note 4)	–	48	62	nC
Q_{gs}	Gate to Source Gate Charge		–	7.4	–	nC
Q_{gd}	Gate to Drain "Miller" Charge		–	17	–	nC
ESR	Equivalent Series Resistance	f = 1 MHz	–	5.8	–	Ω
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 380 V, I_D = 7.5 A, V_{GS} = 10 V, R_G = 4.7 Ω (Note 4)	–	20	50	ns
t_r	Turn−On Rise Time		–	11	32	ns
$t_{d(off)}$	Turn−Off Delay Time		–	89	188	ns
t_f	Turn−Off Fall Time		–	13	36	ns
DRAIN−SOURCE DIODE CHARACTERISTICS						
I_S	Maximum Continuous Drain to Source Diode Forward Current		–	–	15	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		–	–	45	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 7.5 A	–	–	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 7.5 A, dI_F/dt = 100 A/μs	–	270	–	ns
Q_{rr}	Reverse Recovery Charge		–	3.6	–	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.

TYPICAL PERFORMANCE CHARACTERISTICS

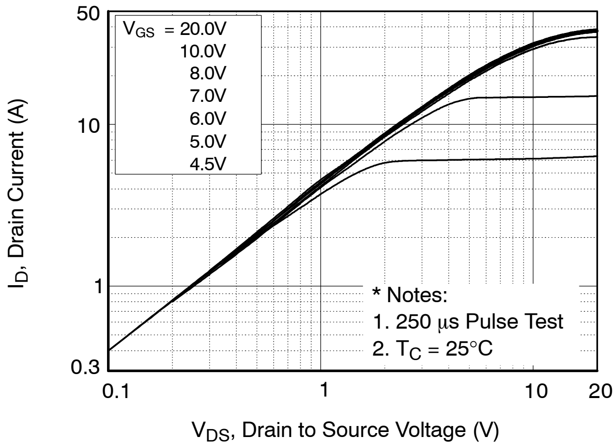


Figure 1. On−Region Characteristics

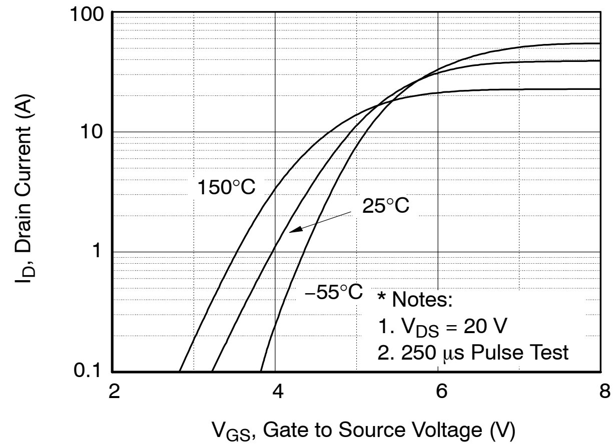


Figure 2. Transfer Characteristics

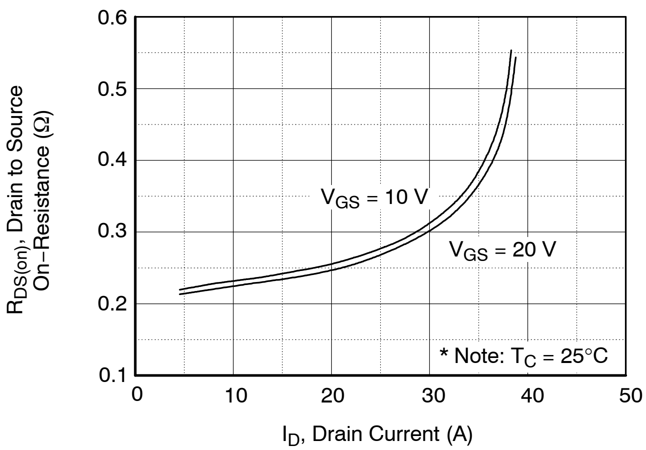


Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

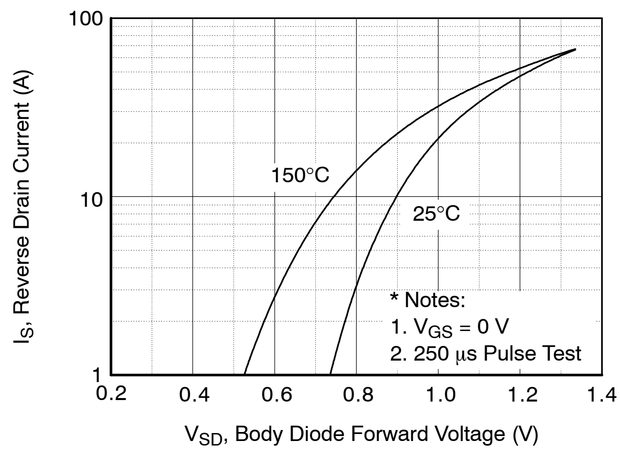


Figure 4. Body Diode Forward Voltage Variation vs. Source Current And Temperature

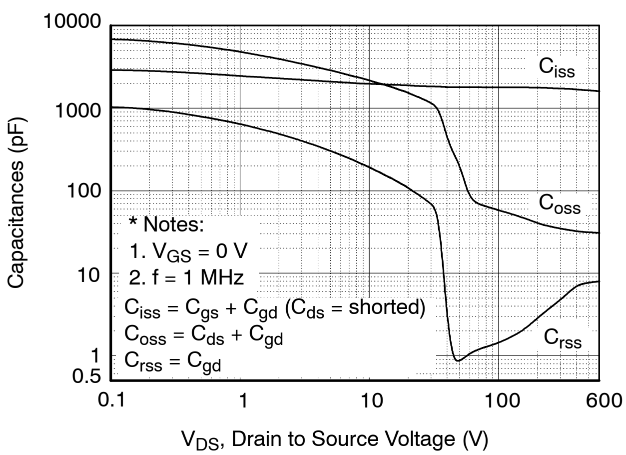


Figure 5. Capacitance Characteristics

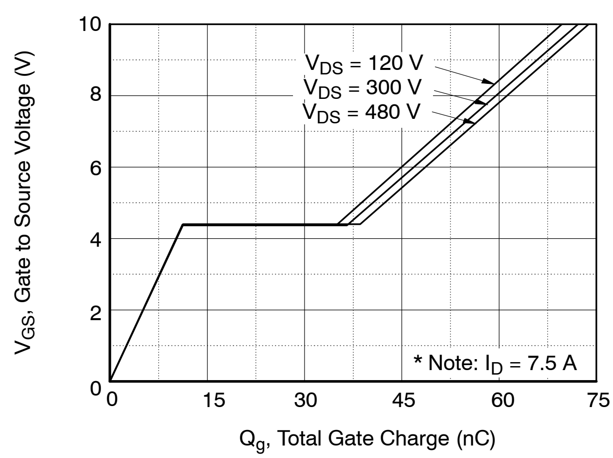


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

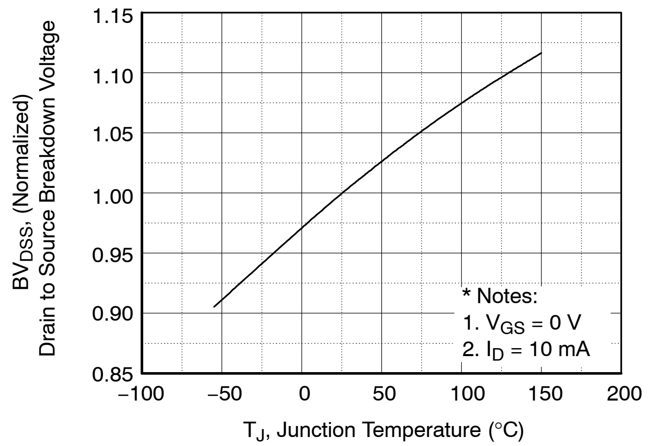


Figure 7. Breakdown Voltage Variation vs. Temperature

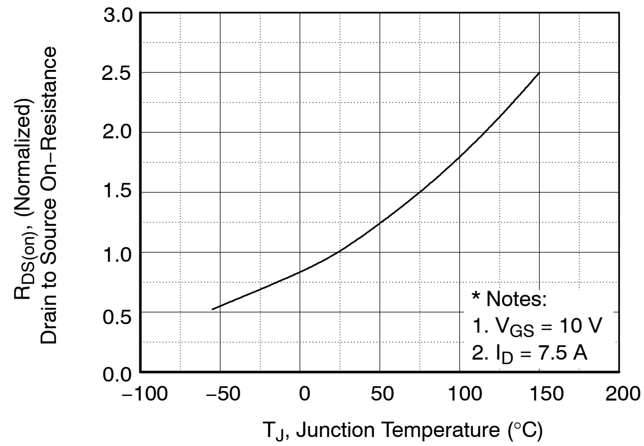


Figure 8. On−Resistance Variation vs. Temperature

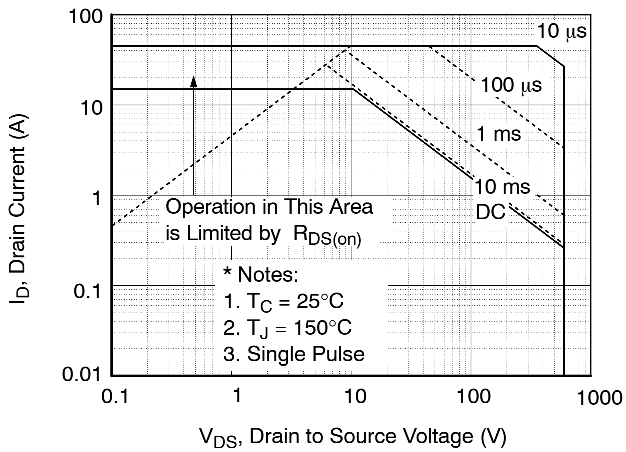


Figure 9. Maximum Safe Operating Area for FCP260N60E

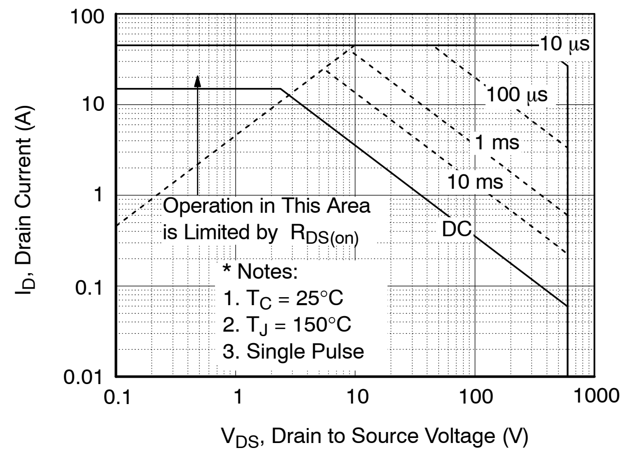


Figure 10. Maximum Safe Operating Area for FCPF260N60E

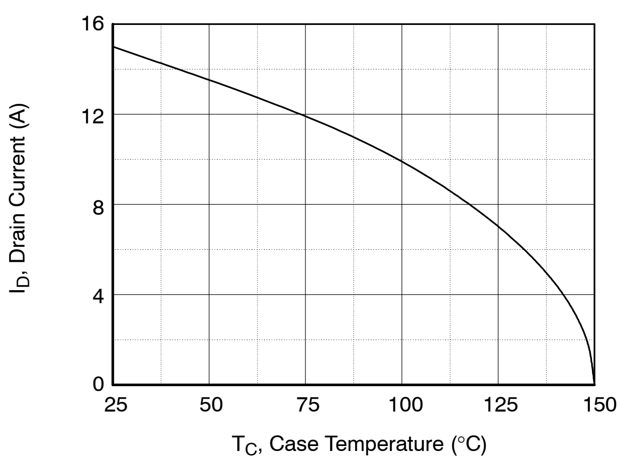


Figure 11. Maximum Drain Current vs. Case Temperature

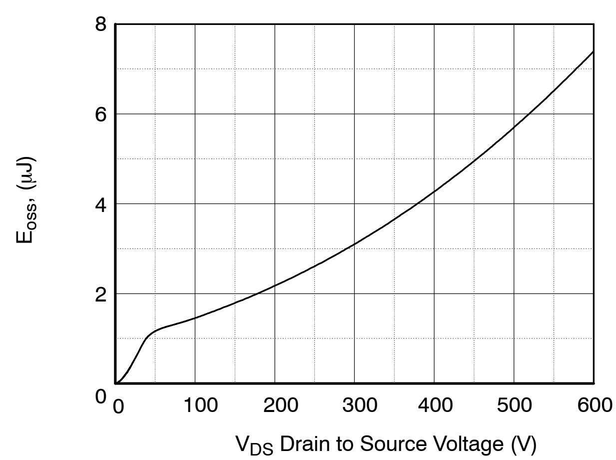


Figure 12. E_{OSS} vs. Drain to Source Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

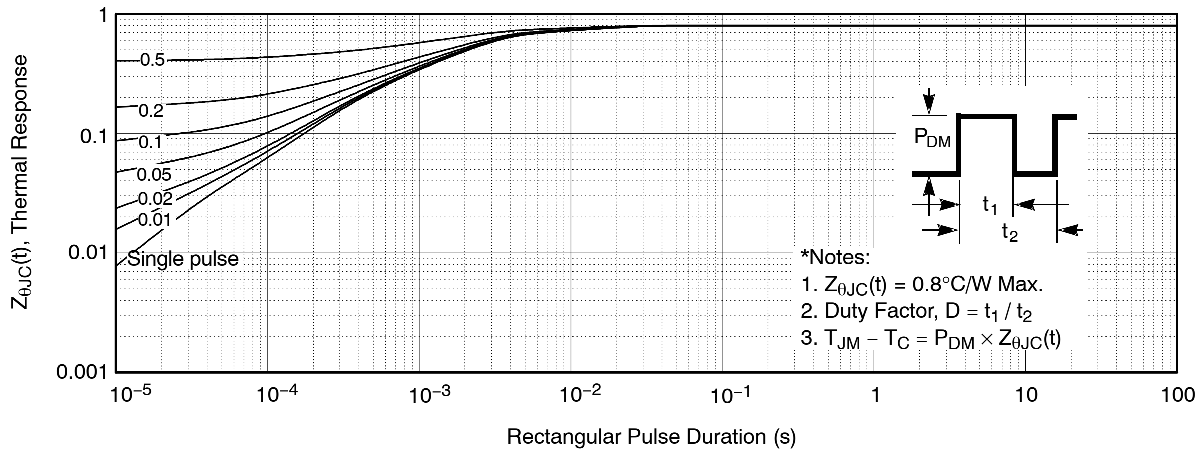


Figure 13. Transient Thermal Response Curve for FCP260N60E

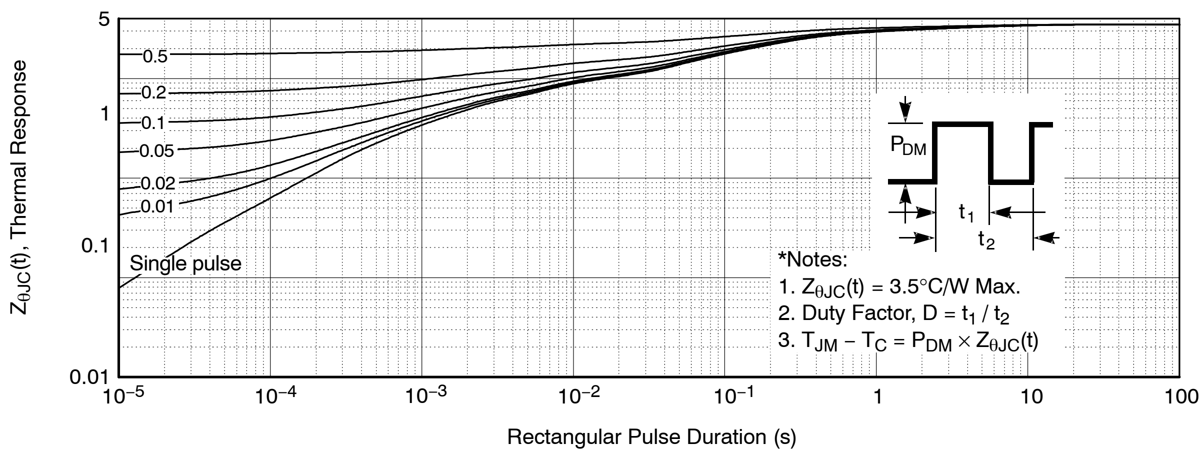


Figure 14. Transient Thermal Response Curve for FCPF260N60E

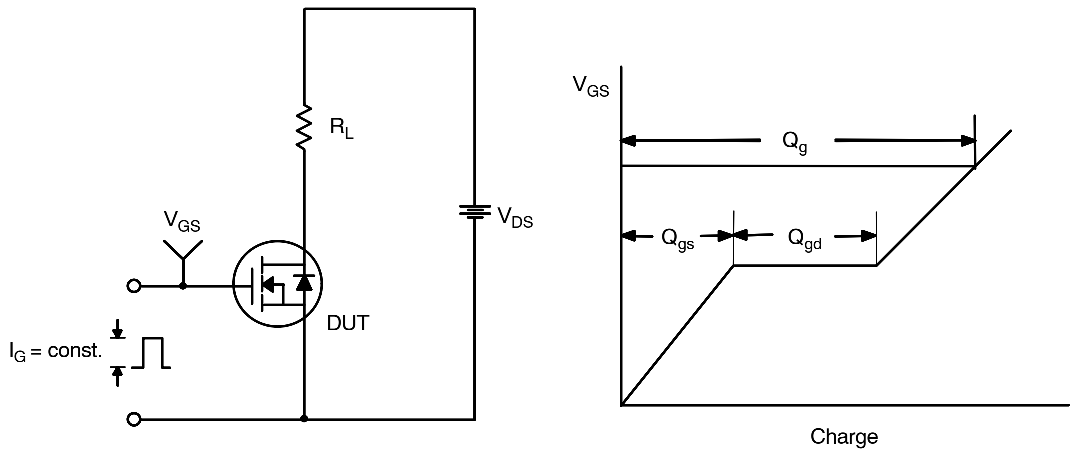


Figure 15. Gate Charge Test Circuit & Waveform

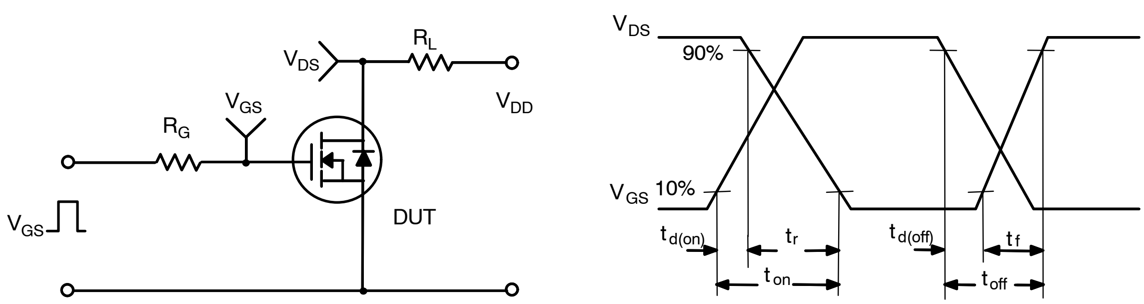


Figure 16. Resistive Switching Test Circuit & Waveforms

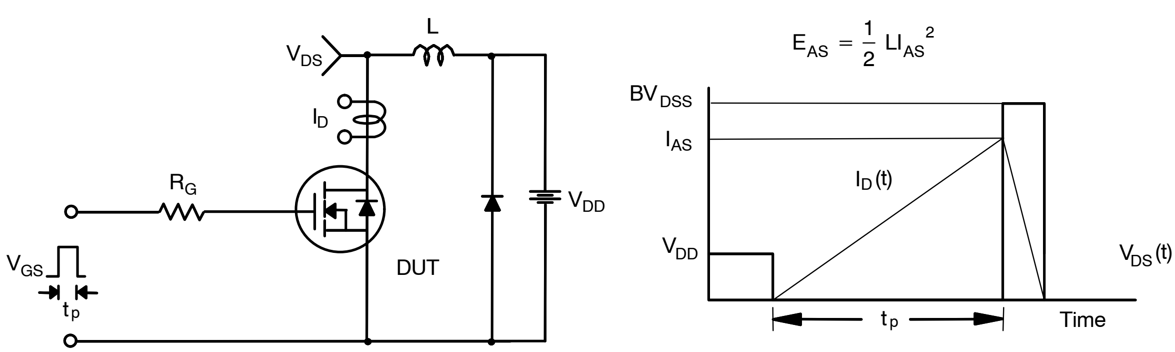


Figure 17. Unclamped Inductive Switching Test Circuit & Waveforms

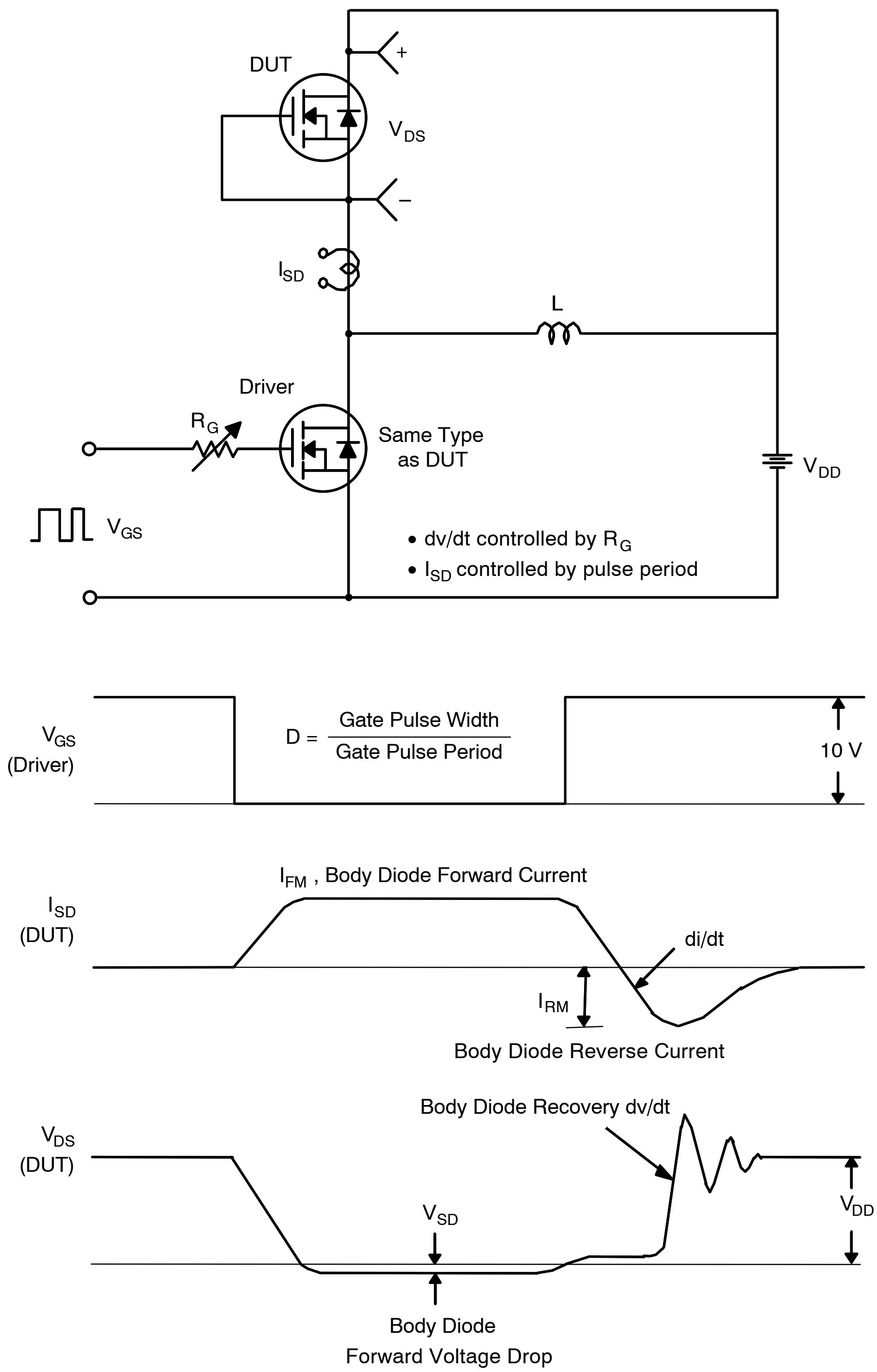
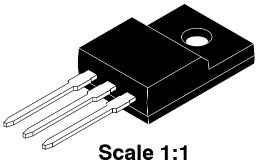


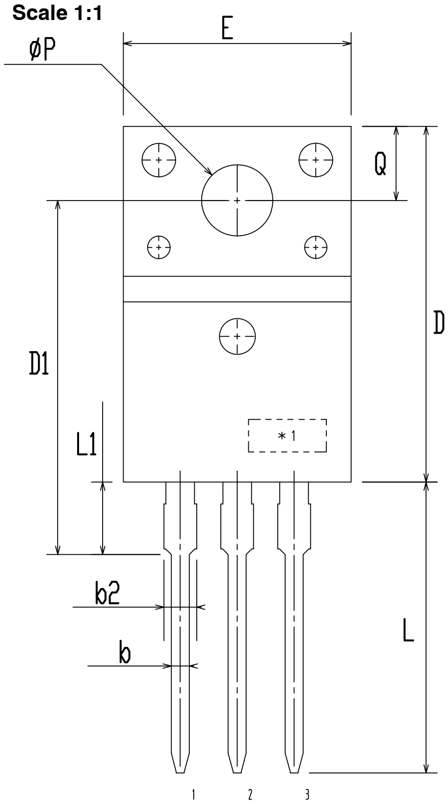
Figure 18. Peak Diode Recovery dv/dt Test Circuit & Waveforms

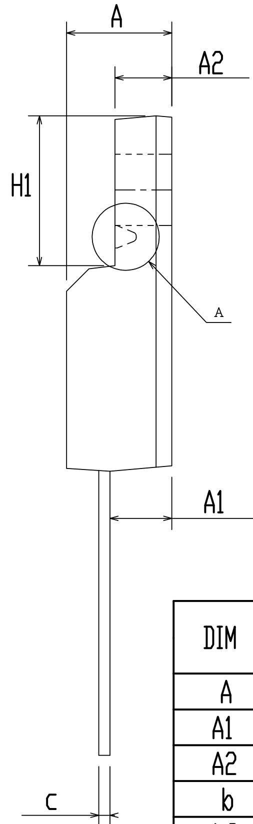


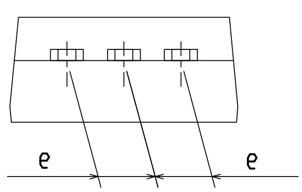
Scale 1:1

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

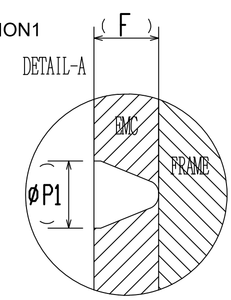
DATE 19 JAN 2021







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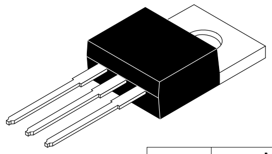
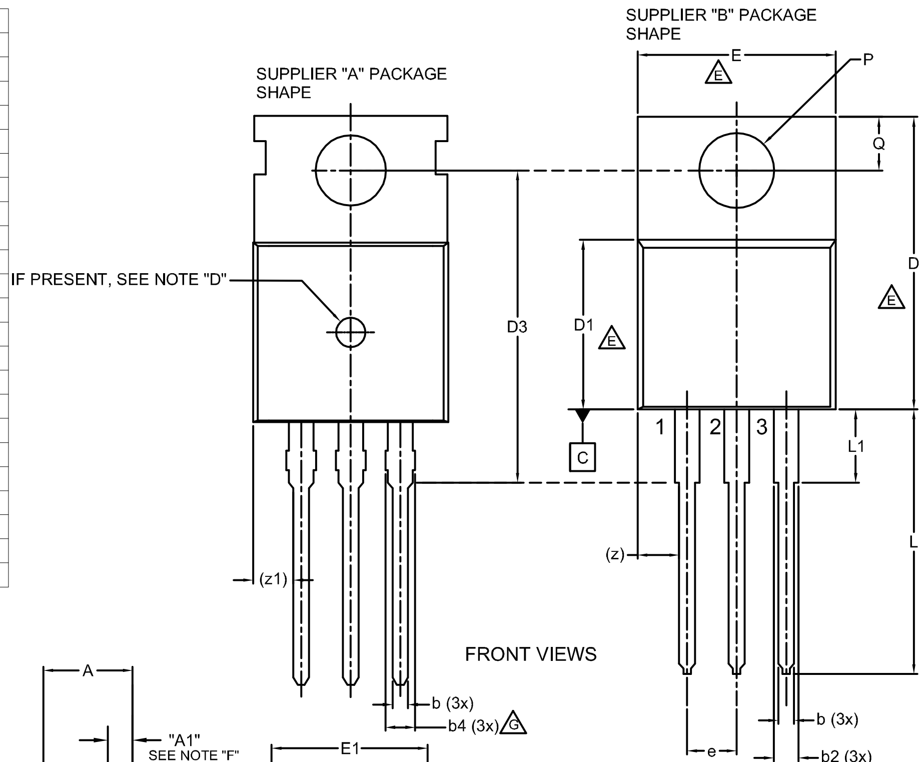
DESCRIPTION:	TO−220 FULLPACK, 3−LEAD / TO−220F−3SG	PAGE 1 OF 1



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°

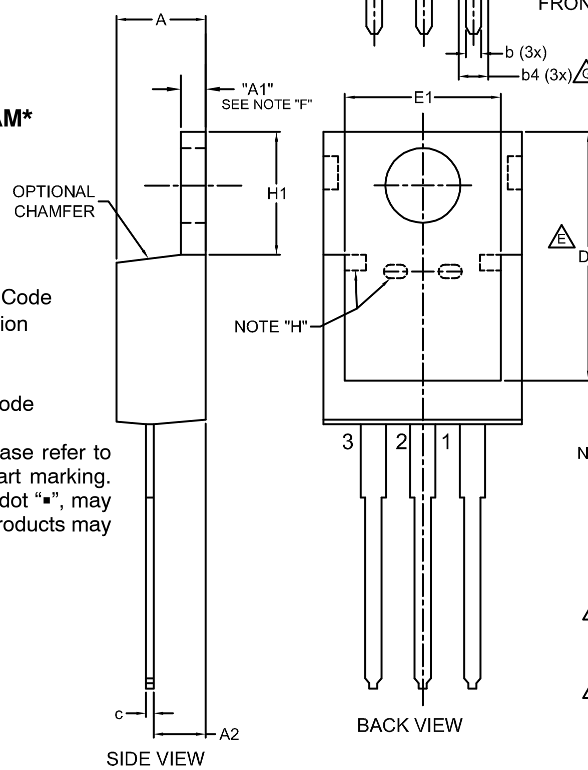


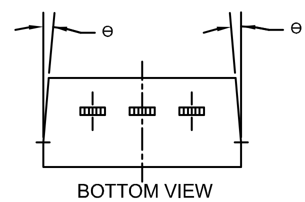
GENERIC MARKING DIAGRAM*

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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DESCRIPTION:	TO−220−3LD	PAGE 1 OF 1

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