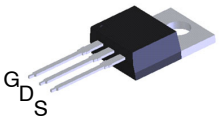
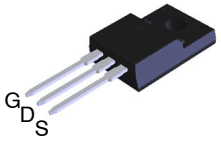
MOSFET – N-Channel, Shielded Gate POWERTRENCH®

100 V, 128 A, 4.5 mΩ

FDP4D5N10C, FDPF4D5N10C



TO−220
CASE 221A



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

Description

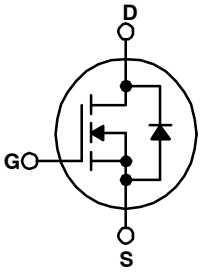
This N−Channel MV MOSFET is produced using **onsemi**'s advanced PowerTrench process that incorporates Shielded Gate technology. This Process has been Optimized to minimize on−state resistance and yet maintain superior switching performance with best in class soft body diode.

Features

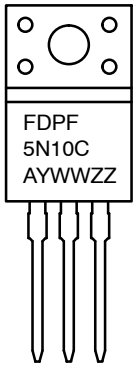
- Max $R_{DS(on)}$ = 4.5 mΩ at V_{GS} = 10 V, I_D = 100 A
- Extremely Low Reverse Recovery Charge, Qrr
- 100% UIL Tested
- This Device is Pb−Free Halide, Free and RoHS Compliant.

Applications

- Synchronous Rectification for ATX / Server / Telecom PSU
- Motor Drives and Uninterruptible Power Supplies
- Micro Solar Inverter



MARKING DIAGRAM



FDPF4D5N10C, FQD45N10C	= Specific Device Code
A	= Assembly Location
YWW	= Date Code (Year and Week)
ZZ	= Assembly Lot Code

ORDERING INFORMATION

Device	Package	Shipping†
FDPF4D5N10C	TO−220F (Pb−Free)	1000 Units / Tube
FDP4D5N10C	TO−220 (Pb−Free)	800 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
		FDP4D5N10C	FDPF4D5N10C	
V_{DS}	Drain to Source Voltage	100	100	V
V_{GS}	Gate to Source Voltage	±20	±20	V
I_D	Drain Current – Continuous (T_C = 25°C) (Note 3) – Continuous (T_C = 100°C) (Note 3) – Pulsed (Note 1)	 128* 91 512	 128* 91 512	A
E_{AS}	Single Pulsed–Avalanche Energy (Note 2)	486		mJ
P_D	Power Dissipation (T_C = 25°C)	150	37.5	W
	Power Dissipation (T_A = 25°C)	2.4	2.4	
T_J,T_{STG}	Operating and Storage Temperature Range	–55 to +175	–55 to +175	°C

*Drain current limited by maximum junction temperature. Package limitation current is 120 A.
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	1.0	4.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	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 to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	100	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	–	53	–	mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 80 V, V_{GS} = 0 V	–	–	1	μA
		V_{DS} = 80 V, T_J = 150°C	–	–	500	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V	–	–	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 310 μA	2.0	3.2	4.0	V
$R_{DS(on)}$	Static Drain to Source On–Resistance	V_{GS} = 10 V, I_D = 100 A	–	4.0	4.5	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 100 A	–	134	–	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 50 V, V_{GS} = 0 V, f = 1 MHz	–	3615	5065	pF
C_{oss}	Output Capacitance		–	2330	3265	pF
C_{rss}	Reverse Transfer Capacitance		–	18	35	pF
R_g	Gate Resistance		0.1	1.1	2.2	S
Switching Characteristics						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 50 V, I_D = 100 A, V_{GS} = 10 V, R_{GEN} = 6 Ω	–	29	47	ns
t_r	Rise Time		–	49	79	ns
$t_{d(off)}$	Turn–Off Delay Time		–	41	66	ns
t_f	Fall Time		–	13	24	ns
Q_g	Total Gate Charge	V_{GS} = 0 V to 10 V V_{DD} = 50 V, I_D = 100 A	–	48	68	nC
Q_{gs}	Gate to Source Gate Charge		–	19	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	9	–	nC
Q_{oss}	Output Charge	V_{DD} = 50 V, V_{GS} = 0 V	–	150	–	nC

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Drain−Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		–	–	128	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		–	–	512	A
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 100 A	–	1.0	1.3	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, V_{DD} = 50 V, I_F = 100 A, dI_F/dt = 100 A/μs	–	82	132	ns
Q_{rr}	Reverse Recovery Charge		–	106	170	nC
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, V_{DD} = 50 V, I_F = 100 A, dI_F/dt = 300 A/μs	–	71	114	ns
Q_{rr}	Reverse Recovery Charge		–	258	413	nC

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. Pulsed Id please refer to Figure “Forward Bias Safe Operating Area” for more details.
2. E_{AS} of 486 mJ is based on starting T_J = 25°C, L = 3 mH, I_{AS} = 18 A, V_{DD} = 100 V, V_{GS} = 10 V. 100% test at L = 0.1 mH, I_{AS} = 58 A.
3. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro−mechanical application board design.

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

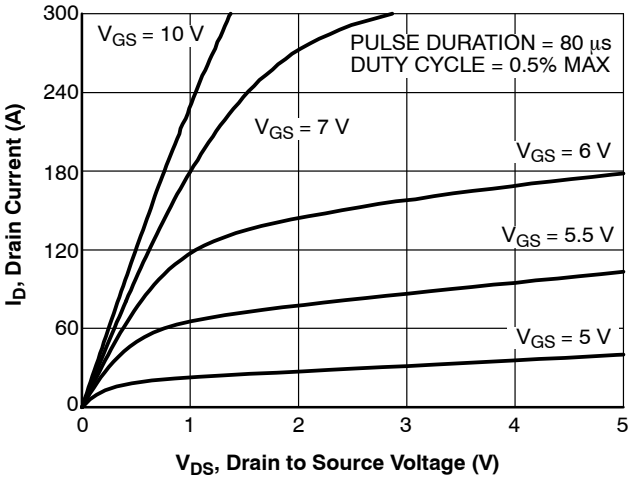


Figure 1. On−Region Characteristics

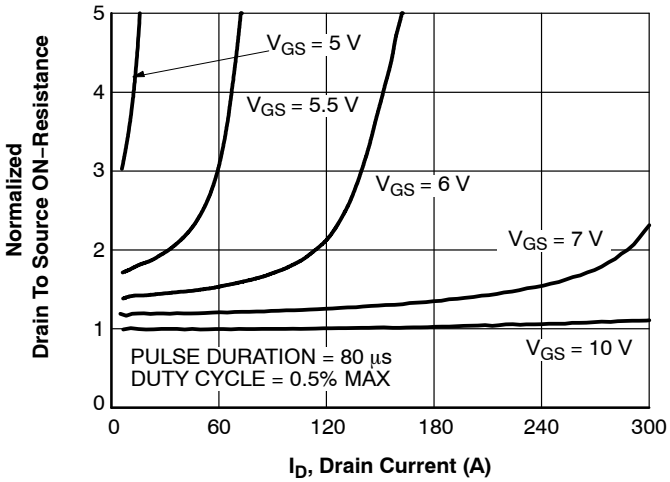


Figure 2. Normalized On−Resistance vs Drain Current and Gate Voltage

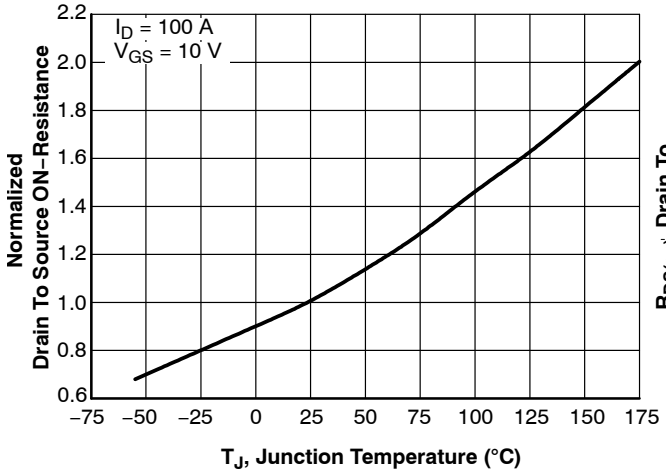


Figure 3. Normalized On Resistance vs Junction Temperature

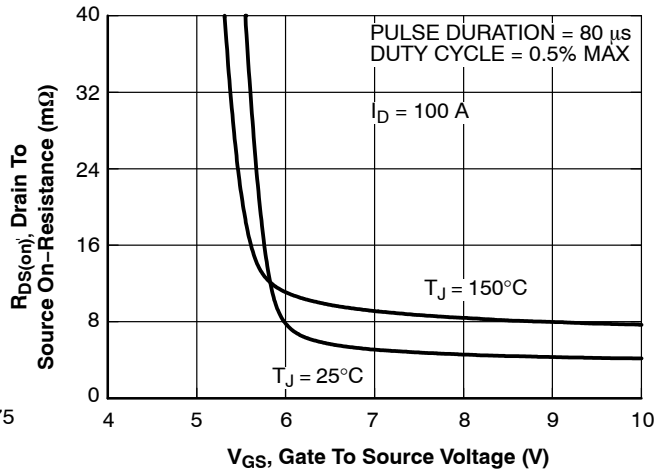


Figure 4. On−Resistance vs. Gate to Source Voltage

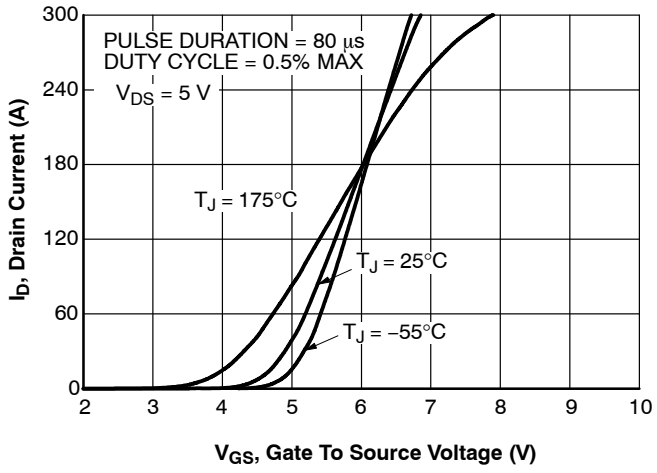


Figure 5. Transfer Characteristics

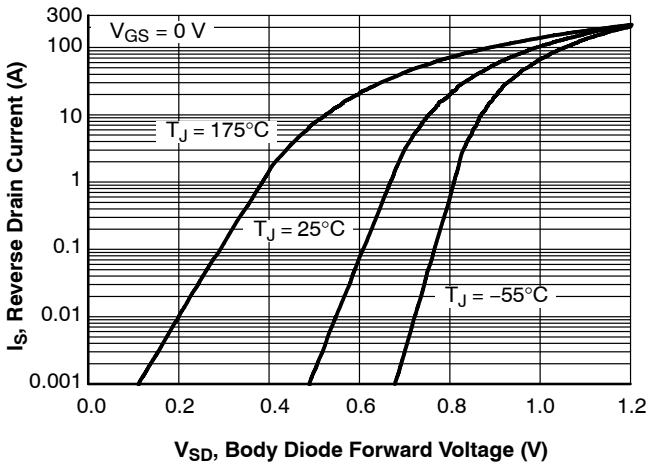


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

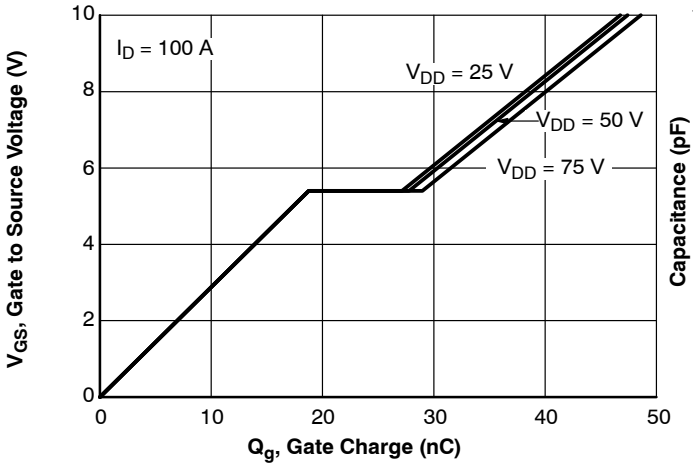


Figure 7. Gate Charge Characteristics

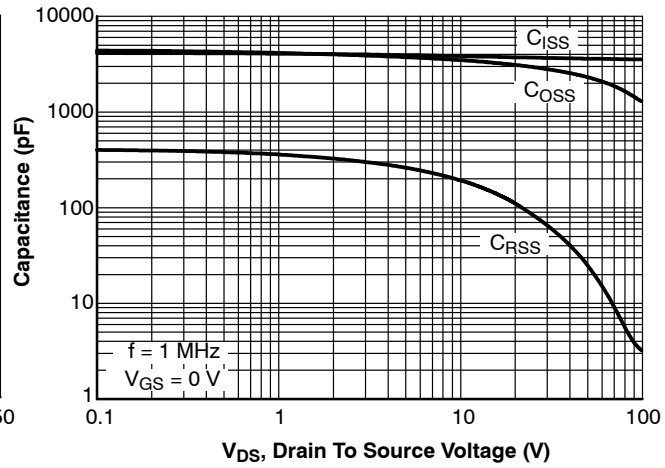


Figure 8. Capacitance vs Drain to Source Voltage

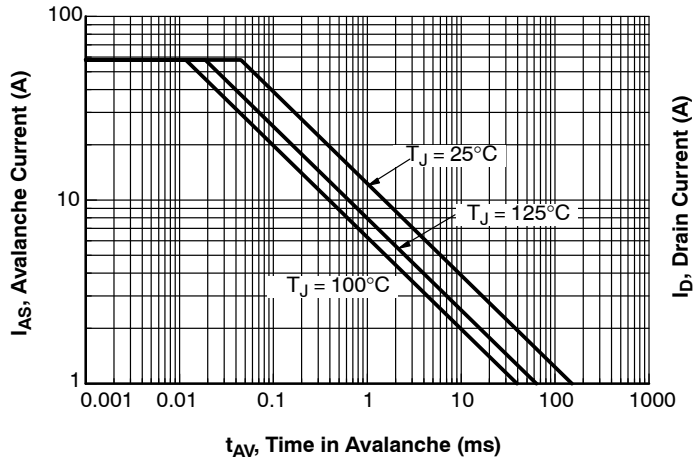


Figure 9. Unclamped Inductive Switching Capability

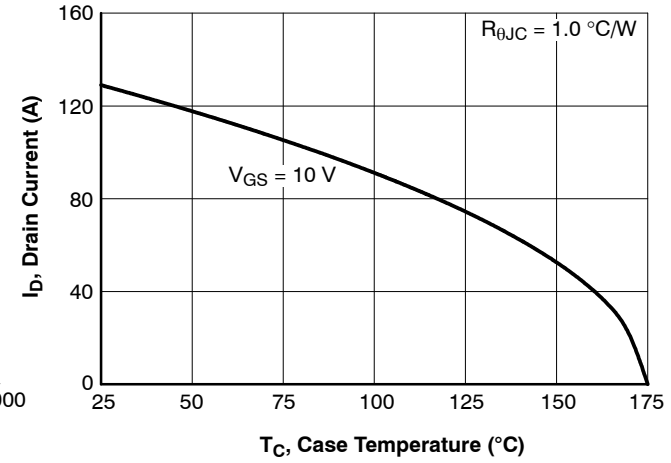


Figure 10. Maximum Continous Drain Current vs. Case Temperature

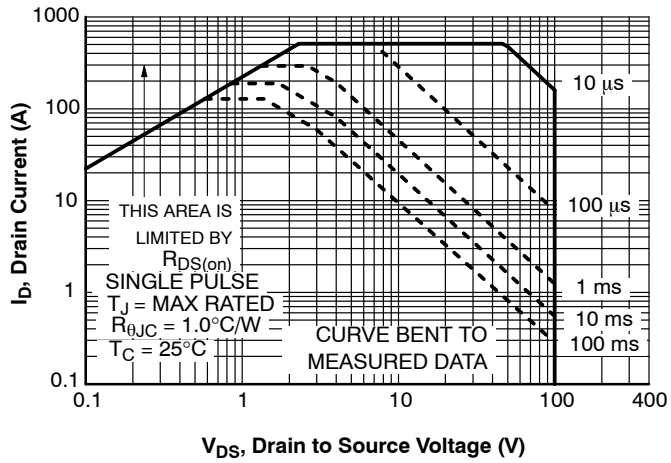


Figure 11. Forward Bias Safe Operating Area for FDP4D5N10C

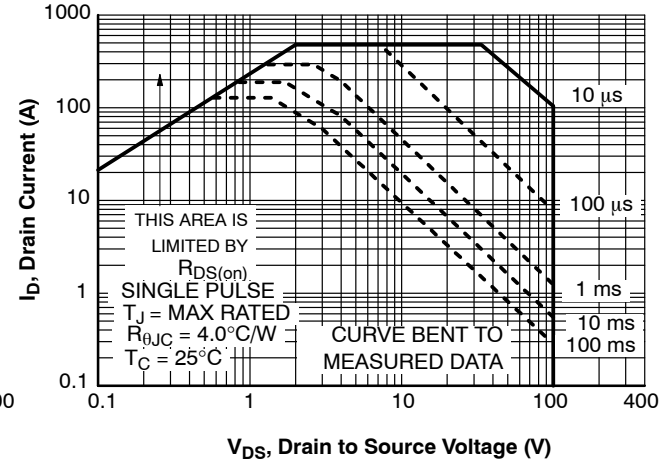


Figure 12. Forward Bias Safe Operating Area for FDPF4D5N10C

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

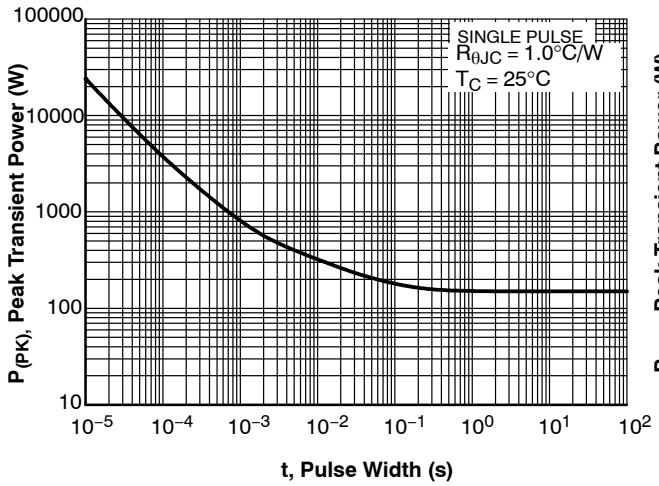


Figure 13. Single Pulse Maximum Power Dissipation for FDP4D5N10C

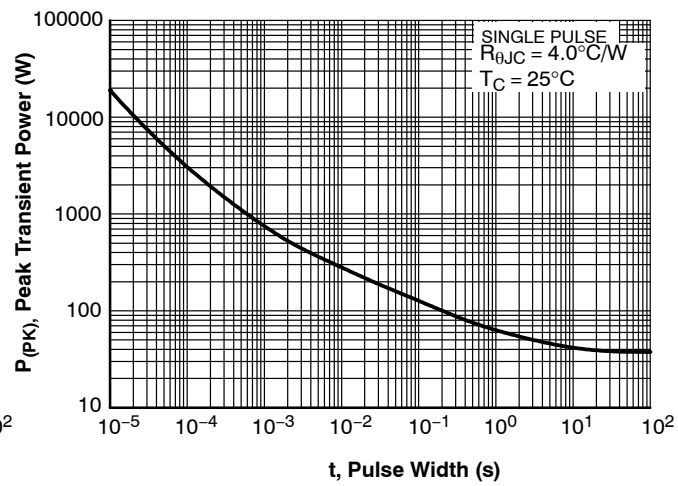


Figure 14. Single Pulse Maximum Power Dissipation for FDPF4D5N10C

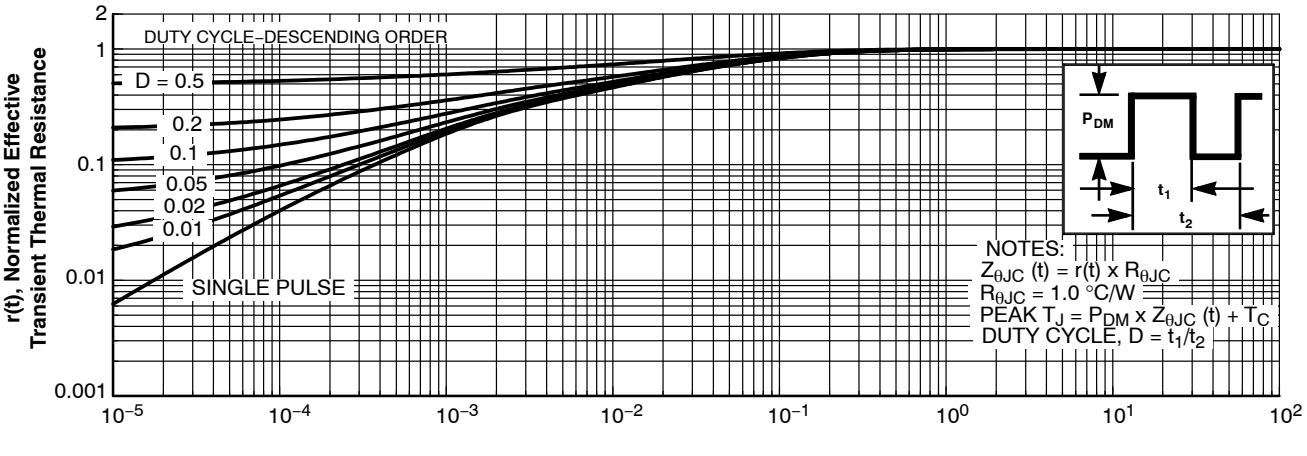


Figure 15. Junction−to−Case Transient Thermal Response Curve for FDP4D5N10C

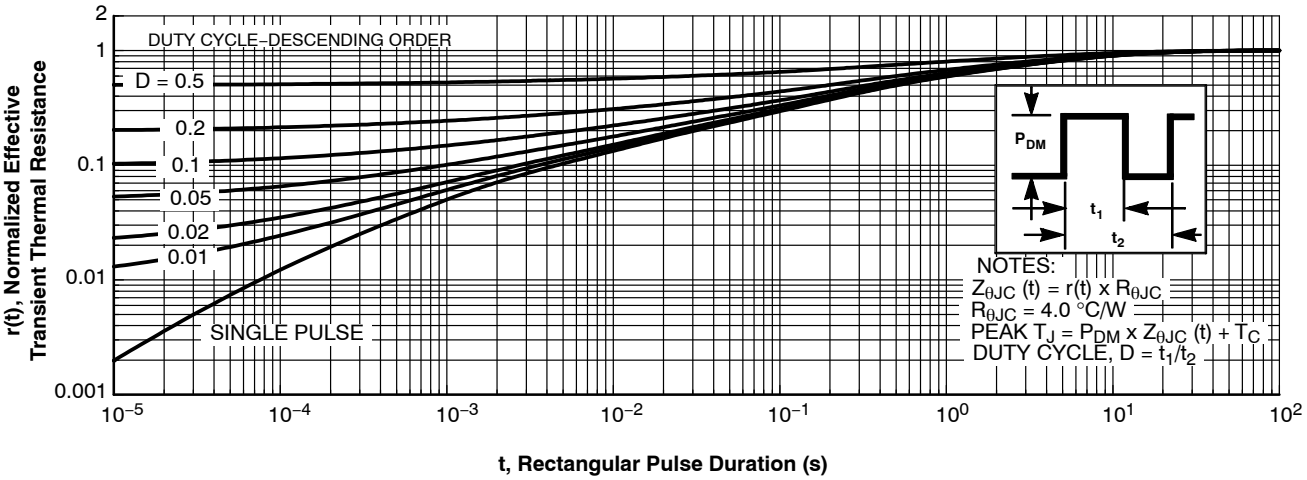
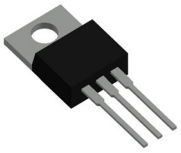
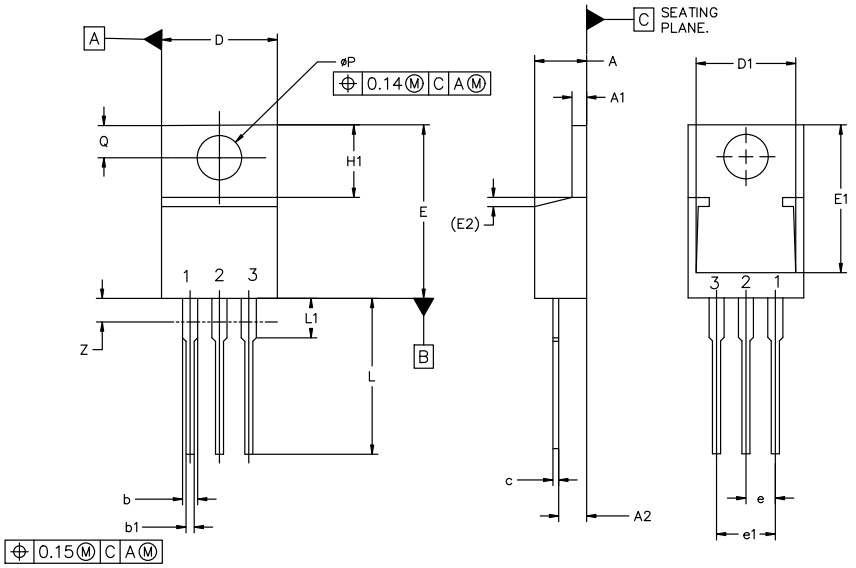


Figure 16. Junction−to−Case Transient Thermal Response Curve for FDPF4D5N10C



TO−220−3 10.10x15.12x4.45, 2.54P
CASE 221A
ISSUE AL

DATE 05 FEB 2025



MILLIMETERS			
DIM	MIN	NOM	MAX
A	4.07	4.45	4.83
A1	1.15	1.28	1.41
A2	2.04	2.42	2.79
b	1.15	1.34	1.52
b1	0.64	0.80	0.96
c	0.36	0.49	0.61
D	9.66	10.10	10.53
D1	8.43	8.63	8.83
E	14.48	15.12	15.75
E1	12.58	12.78	12.98
E2	1.27 REF		

MILLIMETERS			
DIM	MIN	NOM	MAX
e	2.42	2.54	2.66
e1	4.83	5.08	5.33
H1	5.97	6.22	6.47
L	12.70	13.49	14.27
L1	2.80	3.45	4.10
Q	2.54	2.79	3.04
øP	3.60	3.85	4.09
Z	−.−−	−.−−	3.48

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. EMITTER

STYLE 3:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE

STYLE 12:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. NOT CONNECTED

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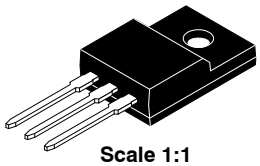
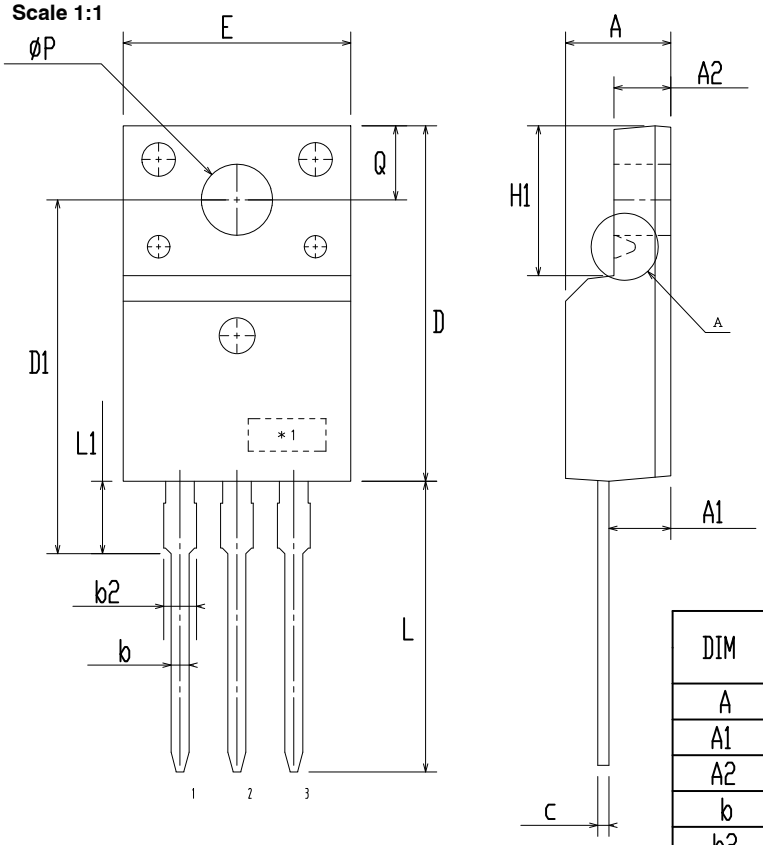
DESCRIPTION:	**TO−220−3 10.10x15.12x4.45, 2.54P**	**PAGE 1 OF 1**

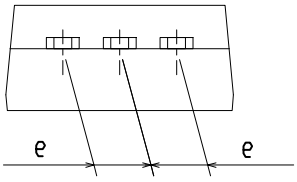
TO−220 Fullpack, 3−Lead / TO−220F−3SG
CASE 221AT
ISSUE B

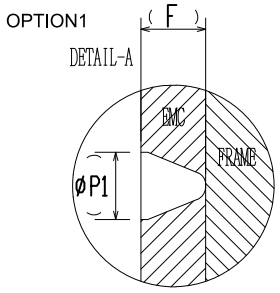
DATE 19 JAN 2021



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**

ADDITIONAL INFORMATION

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