

# FDP045N10A / FDI045N10A

## MOSFET – N-Channel, POWERTRENCH®

100 V, 164 A, 4.5 mΩ

### Description

This N-Channel MOSFET is produced using ON Semiconductor's advance POWERTRENCH process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

### Features

- $R_{DS(on)} = 3.8 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 100 \text{ A}$
- Fast Switching Speed
- Low Gate Charge,  $Q_G = 54 \text{ nC}$  (Typ.)
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- This Device is Pb-Free and is RoHS Compliant

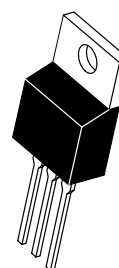
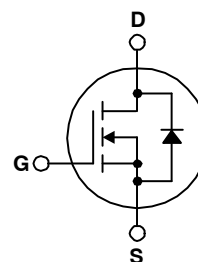
### Applications

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

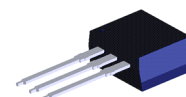


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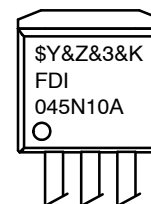
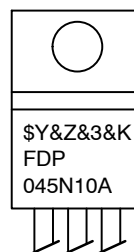


TO-220  
CASE 221A-09



I<sup>2</sup>PAK  
CASE 418AV

### MARKING DIAGRAM



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FDP/FDI045N10A	= Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDP045N10A / FDI045N10A

## MOSFET MAXIMUM RATINGS (T<sub>C</sub> = 25°C Unless Otherwise Noted)

Symbol	Parameter		FDP045N10A_F102 FDI045N10A_F102	Unit
V <sub>DSS</sub>	Drain to Source Voltage		100	V
V <sub>GSS</sub>	Gate to Source Voltage		±20	V
I <sub>D</sub>	Drain Current	- Continuous (T <sub>C</sub> = 25°C, Silicon Limited)	164*	A
		- Continuous (T <sub>C</sub> = 100°C, Silicon Limited)	116	
		- Continuous (T <sub>C</sub> = 25°C, Package Limited)	120	
I <sub>DM</sub>	Drain Current	- Pulsed (Note 1)	656	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		637	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		6.0	V/ns
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C)	263	W
		- Derate Above 25°C	1.75	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range		-55 to +175	°C
T <sub>L</sub>	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.

\*Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 120 A.

## THERMAL CHARACTERISTICS

Symbol	Parameter	FDP045N10A_F102 FDI045N10A_F102	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case, Max.	0.57	°C
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient, Max.	62.5	

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP045N10A_F102	FDP045N10A	TO-220	Tube	N/A	N/A	50 Units
FDI045N10A_F102	FDI045N10A	I <sup>2</sup> -PAK	Tube	N/A	N/A	50 Units

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C Unless Otherwise Noted)

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

BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	I <sub>D</sub> = 250 mA, V <sub>GS</sub> = 0 V	100	-	-	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 mA, Referenced to 25°C	-	0.07	-	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 80 V, V <sub>GS</sub> = 0 V	-	-	1	μA
		V <sub>DS</sub> = 80 V, T <sub>C</sub> = 150°C	-	-	500	
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V	-	-	±100	nA

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 mA	2.0	-	4.0	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 100 A	-	3.8	4.5	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 100 A	-	132	-	S

# FDP045N10A / FDI045N10A

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ Unless Otherwise Noted) (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$	-	3960	5270	pF
$C_{oss}$	Output Capacitance		-	925	1230	pF
$C_{rss}$	Reverse Transfer Capacitance		-	34	-	pF
$C_{oss(er)}$	Energy Related Output Capacitance	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$	-	1520	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{GS} = 10\text{ V}, V_{DS} = 50\text{ V},$ $I_D = 100\text{ A}$ (Note 4)	-	54	74	nC
$Q_{gs}$	Gate to Source Gate Charge		-	17	-	nC
$Q_{gs2}$	Gate Charge Threshold to Plateau		-	8	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	13	-	nC
ESR	Equivalent Series Resistance (G-S)	$f = 1\text{ MHz}$	-	1.9	-	$\Omega$

### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{ V}, I_D = 100\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 4.7\ \Omega$ (Note 4)	-	23	56	ns
$t_r$	Turn-On Rise Time		-	26	62	ns
$t_{d(off)}$	Turn-Off Delay Time		-	50	110	ns
$t_f$	Turn-Off Fall Time		-	15	40	ns

### DRAIN-SOURCE DIODE CHARACTERISTICS

$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	164*	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	656	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 100\text{ A}$	-	-	1.3	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, V_{DD} = 50\text{ V},$ $I_{SD} = 100\text{ A},$ $di_F/dt = 100\text{ A/ms}$	-	75	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	120	-	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.

1. Repetitive rating; pulse-width limited by maximum junction temperature.
2.  $L = 3\text{ mH}, I_{AS} = 20.6\text{ A}, R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 100\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

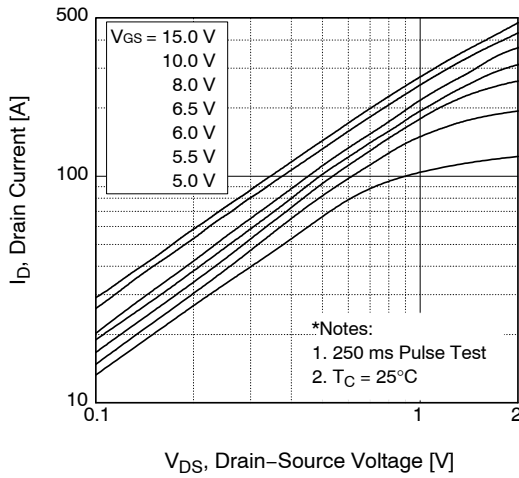


Figure 1. On-Region Characteristics

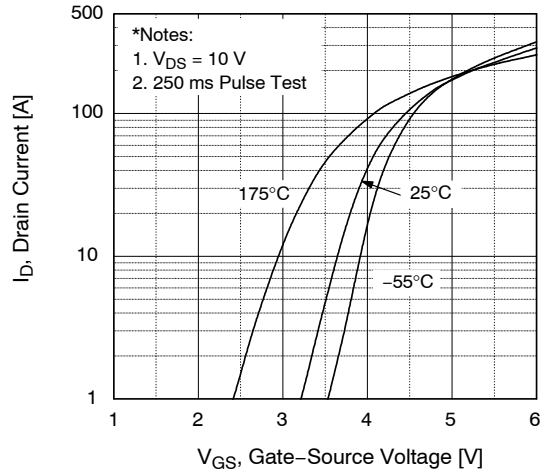


Figure 2. Transfer Characteristics

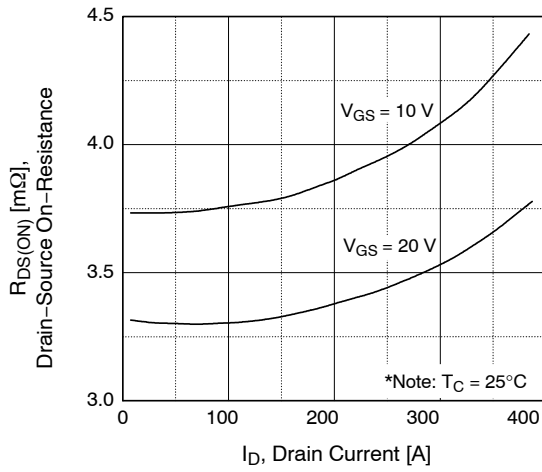


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

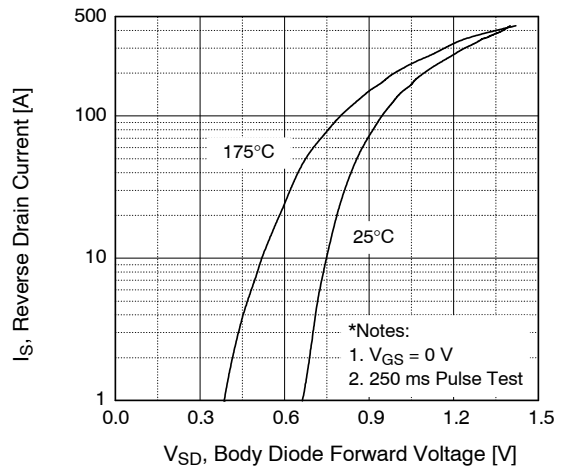


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

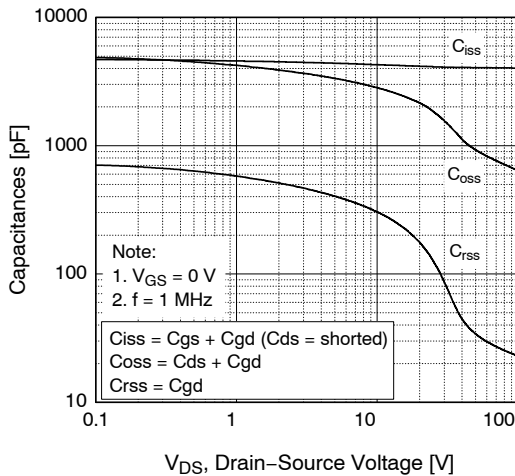


Figure 5. Capacitance Characteristics

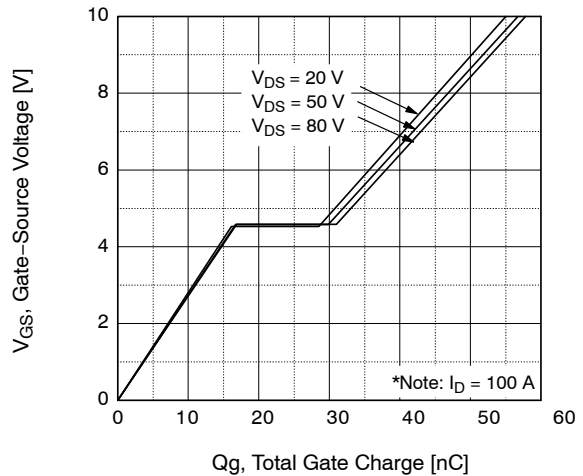
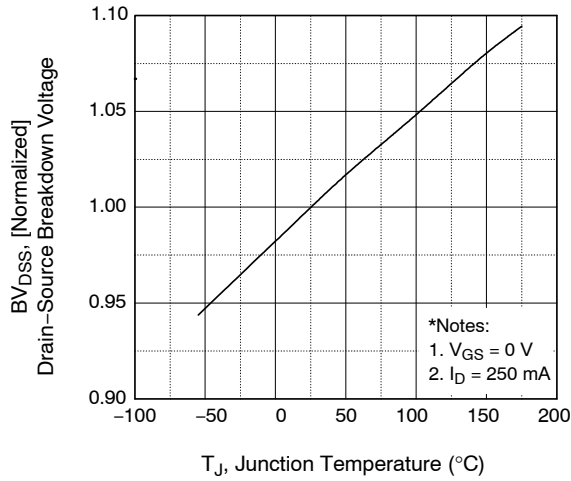


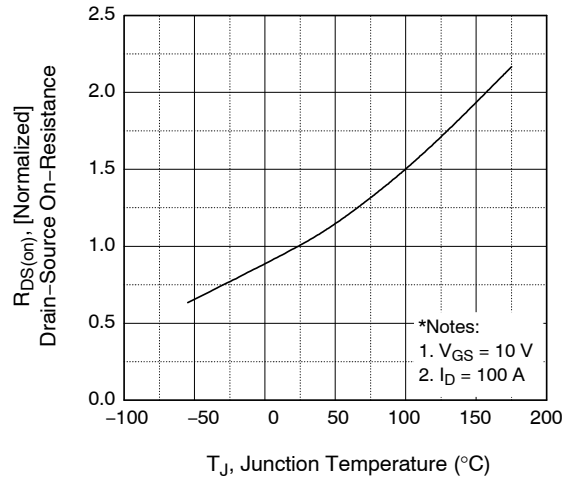
Figure 6. Gate Charge Characteristics

# FDP045N10A / FDI045N10A

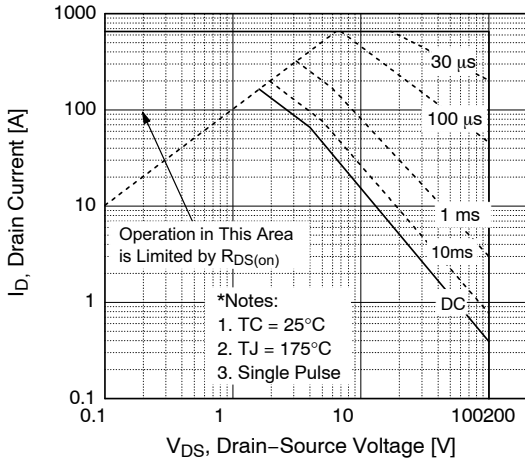
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



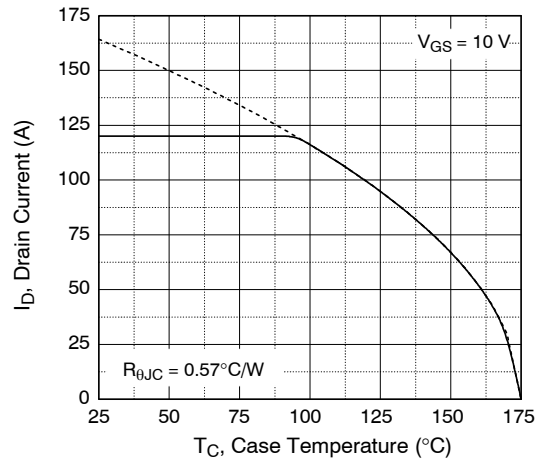
**Figure 7. Maximum Safe Operating Area**



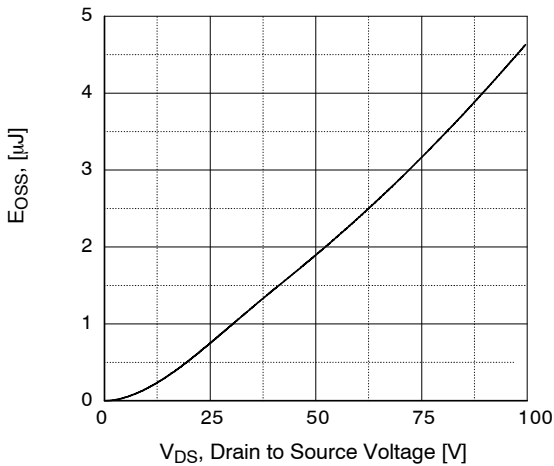
**Figure 8. On-Resistance Variation vs. Temperature**



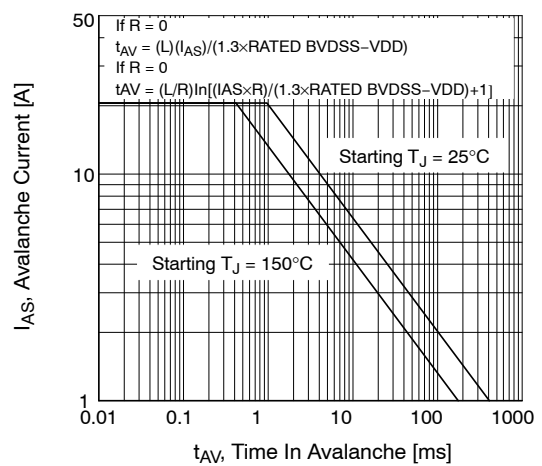
**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. E\_oss vs. Drain to Source Voltage**



**Figure 12. Unclamped Inductive Switching Capability**

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

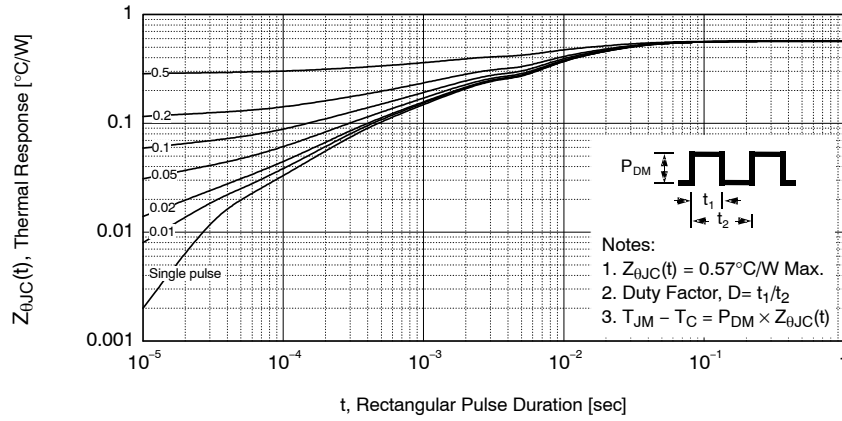


Figure 13. Transient Thermal Response Curve

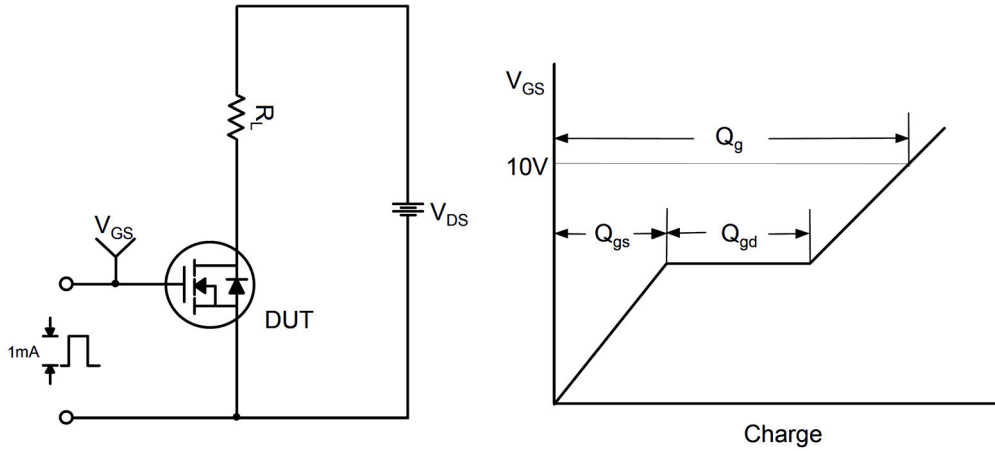
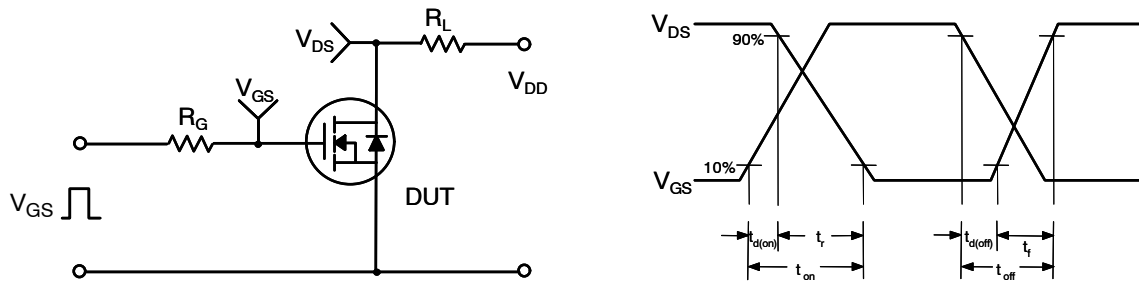
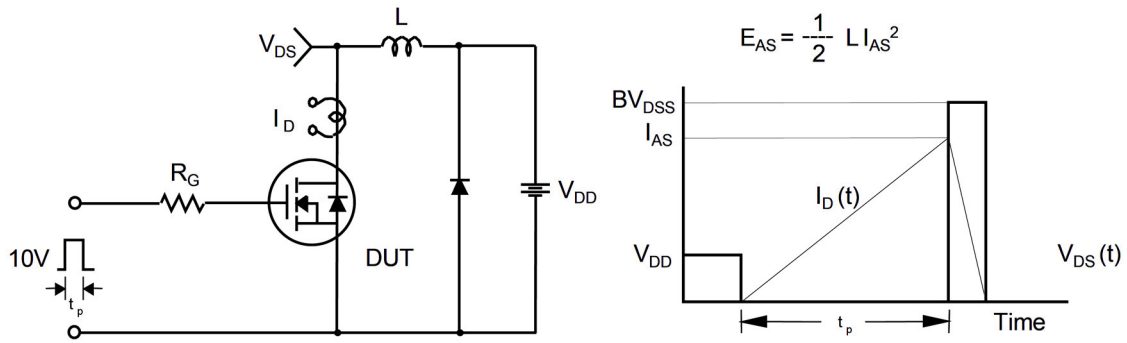


Figure 14. Gate Charge Test Circuit & Waveform

## FDP045N10A / FDI045N10A



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



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

FDP045N10A / FDI045N10A

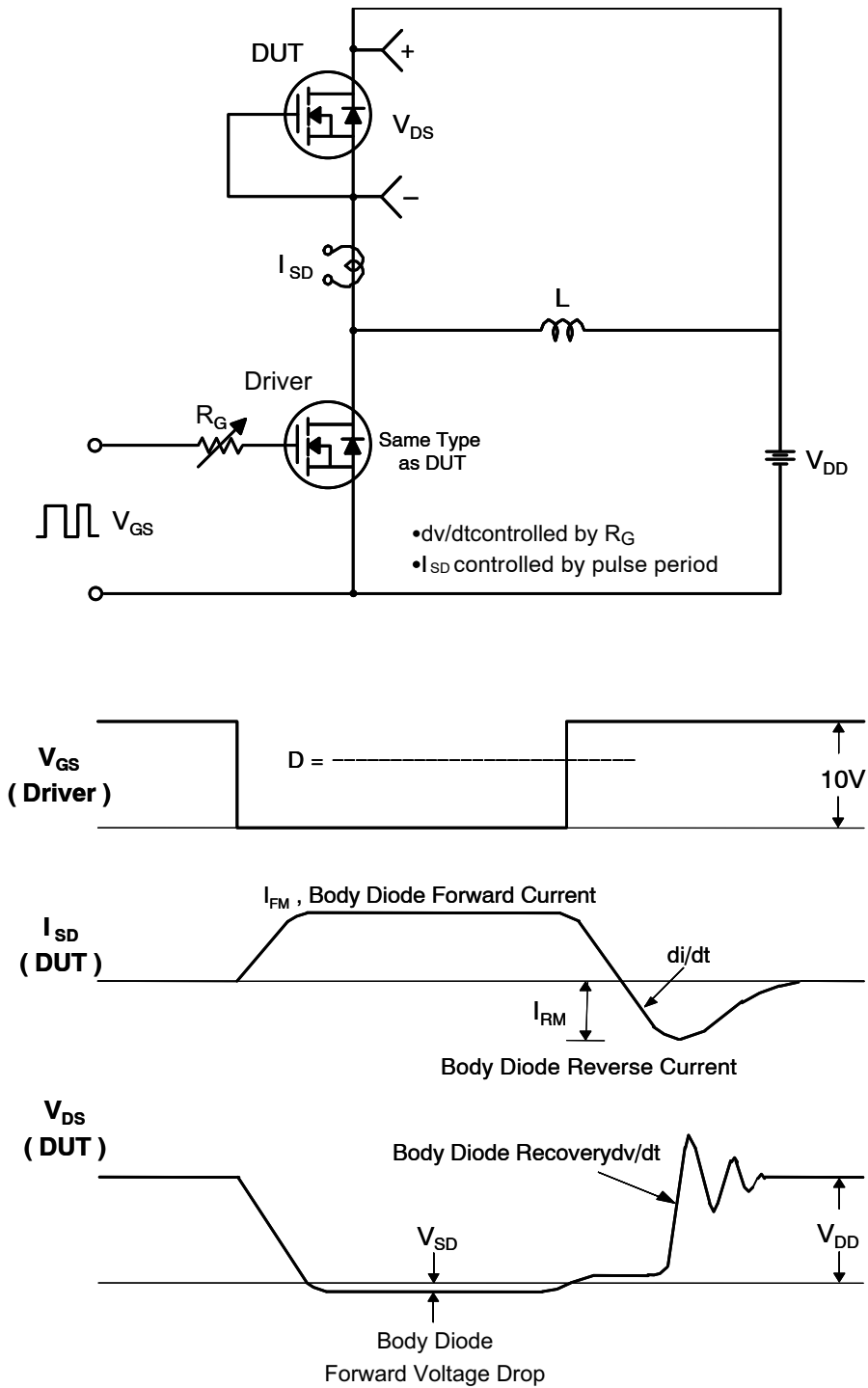
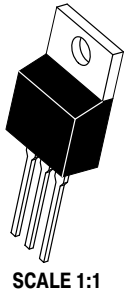


Figure 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

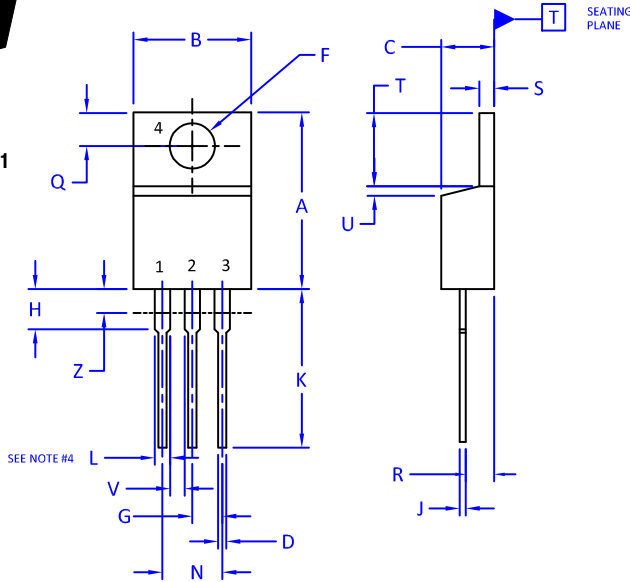


# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



## TO-220 CASE 221A ISSUE AK

DATE 13 JAN 2022



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.
4. MAX WIDTH FOR F102 DEVICE = 1.35MM

DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.570	0.620	14.48	15.75
B	0.380	0.415	9.66	10.53
C	0.160	0.190	4.07	4.83
D	0.025	0.038	0.64	0.96
F	0.142	0.161	3.60	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.161	2.80	4.10
J	0.014	0.024	0.36	0.61
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.41
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

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

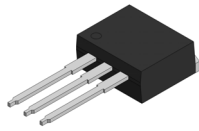
STYLE 11:  
PIN 1. DRAIN  
2. SOURCE  
3. GATE  
4. SOURCE

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

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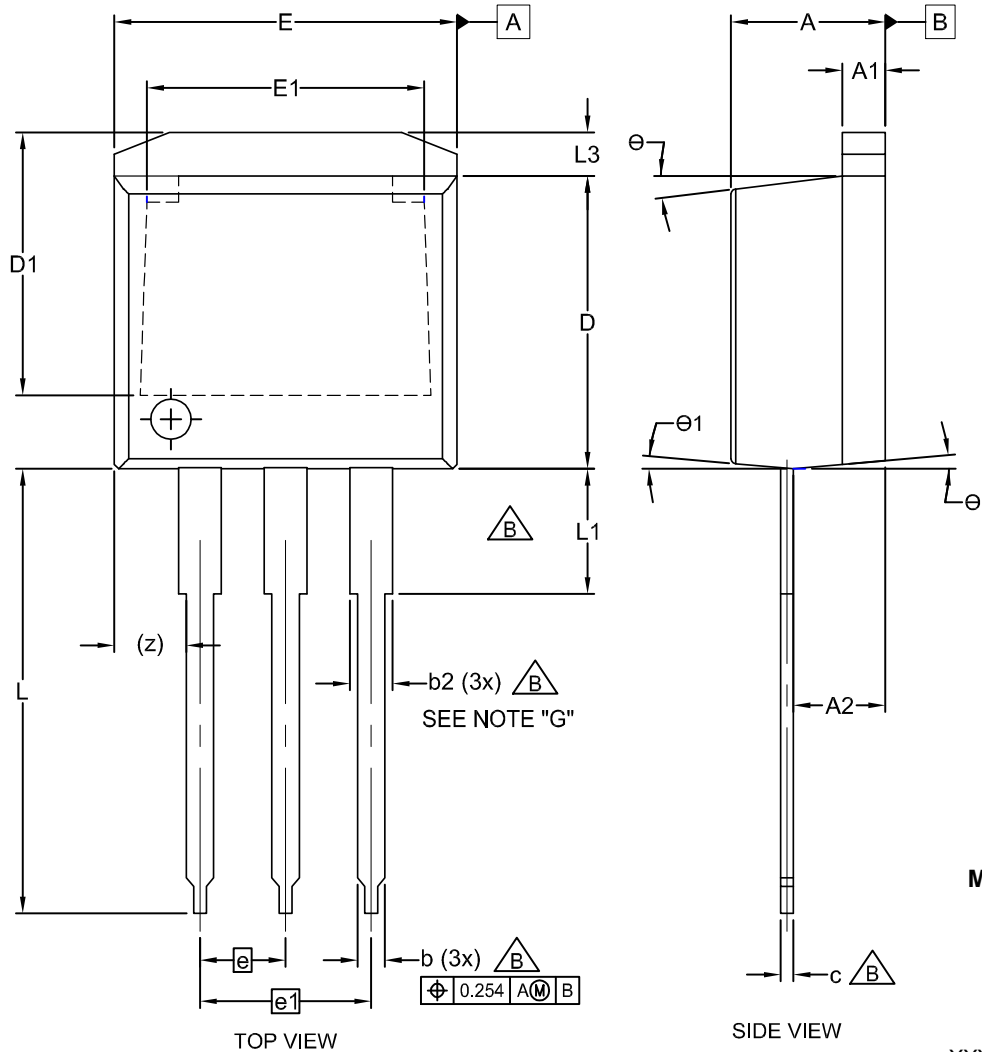
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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



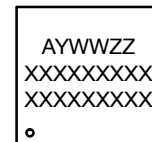
I2PAK (TO-262 3 LD)  
CASE 418AV  
ISSUE A

DATE 30 AUG 2022



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.06	4.45	4.83
A1	1.14	1.27	1.40
A2	2.03	2.41	2.79
b	0.64	0.77	0.90
b2	1.14	1.46	1.78
c	0.33	0.49	0.64
D	8.64	9.15	9.65
D1	6.86	7.37	7.88
E	9.65	9.97	10.29
E1	6.22	7.28	8.33
e	2.54 BSC		
e1	5.08 BSC		
L	12.70	13.72	14.73
L1	2.80	3.38	3.96
L3	1.00	1.20	1.40
z	2.13 REF		
θ	0°	--	7°
θ1	0°	--	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. EXCEPT WHERE NOTED CONFORMS TO TO262 JEDEC VARIATION AA.
- B. DOES NOT COMPLY JEDEC STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ANSI Y14.5-1994.
- F. LOCATION OF PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF PACKAGE)
- G. MAXIMUM WIDTH FOR F102 DEVICE = 1.35 MAX.

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<b>DESCRIPTION:</b>	<b>I2PAK (TO-262 3 LD)</b>	<b>PAGE 1 OF 1</b>

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