FAIRCHILD
SEMICONDUCTOR®

July 2011

FDP045N10A_F102 / FDI045N10A_F102

N-Channel PowerTrench® MOSFET
### 100V, 164A, 4.5mΩ

Features

- $R_{DS(on)}$ = 3.8mΩ (Typ.)@ V_{GS} = 10V, I_D = 100A
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advance PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

Application

- DC to DC Converters
- Synchronous Rectification for Telecommunication PSU
- Battery Charger
- AC motor drives and Uninterruptible Power Supplies
- Off-line UPS

TO-220

G D S

I²-PAK
FDI Series

G D S

D

G

S
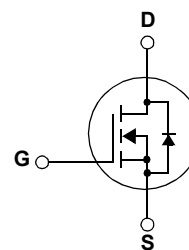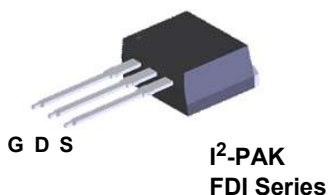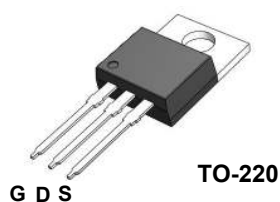
MOSFET Maximum Ratings T_C = 25ºC unless otherwise noted

Symbol	Parameter		FDP045N10A_F102 FDI045N10A_F102	Units
V_{DSS}	Drain to Source Voltage		100	V
V_{GSS}	Gate to Source Voltage		±20	V
I_D	Drain Current	- Continuous (T_C = 25ºC, Silicon Limited)	164*	A
		- Continuous (T_C = 100ºC, Silicon LImited)	116	
		- Continuous (T_C = 25ºC, Package Limited)	120	
I_{DM}	Drain Current	- Pulsed (Note 1)	656	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		637	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		6.0	V/ns
P_D	Power Dissipation	(T_C = 25ºC)	263	W
		- Derate above 25ºC	1.75	W/ºC
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +175	ºC
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300	ºC

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

Thermal Characteristics

Symbol	Parameter	Ratings	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.57	ºC/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	

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Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP045N10A	FDP045N10A_F102	TO-220	-	-	50
FDI045N10A	FDI045N10A_F102	I2PAK	-	-	50

Electrical Characteristics T_C = 25°C unless otherwise noted

| Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV$_{DSS}$	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	100	-	-	V
ΔBV$_{DSS}$ ΔT$_J$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	-	0.07	-	V/^{o}C
I$_{DSS}$	Zero Gate Voltage Drain Current	V_{DS} = 80V, V_{GS} = 0V	-	-	1	μA
		V_{DS} = 80V, T_C = 150°C	-	-	500	
I$_{GSS}$	Gate to Body Leakage Current	V_{GS} = ±20V, V_{DS} = 0V	-	-	±100	nA
On Characteristics						
V$_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	2.0	-	4.0	V
R$_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10V, I_D = 100A	-	3.8	4.5	mΩ
g$_{FS}$	Forward Transconductance	V_{DS} = 10V, I_D = 100A (Note 4)	-	132	-	S
Dynamic Characteristics						
C$_{iss}$	Input Capacitance	V_{DS} = 50V, V_{GS} = 0V f = 1MHz	-	3960	5270	pF
C$_{oss}$	Output Capacitance		-	925	1230	pF
C$_{rss}$	Reverse Transfer Capacitance		-	34	-	pF
C$_{oss}$(er)	Engry Releted Output Capacitance	V_{DS} = 50V, V_{GS} = 0V	-	1520	-	pF
Q$_{g(tot)}$	Total Gate Charge at 10V	V_{GS} = 10V, V_{DS} = 50V I_D = 100A	-	57	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	(Note 4, 5)	-	13	-	nC
Switching Characteristics						
t$_{d(on)}$	Turn-On Delay Time	V_{DD} = 50V, I_D = 100A V_{GS} = 10V, R_{GEN} = 4.7Ω	-	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	(Note 4, 5)	-	15	40	ns
ESR	Equivalent Series Resistance (G-S)	Drain Open, f = 1MHz	-	1.9	-	Ω
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} = 0V, I_{SD} = 100A	-	-	1.3	V
t$_{rr}$	Reverse Recovery Time	V_{GS} = 0V, V_{DD} = 50V, I_{SD} = 100A dI$_F$/dt = 100A/μs (Note 4)	-	75	-	ns
Q$_{rr}$	Reverse Recovery Charge		-	120	-	nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. L = 3mH, I_{AS} = 20.6A, R_G = 25Ω, Starting T_J = 25°C

3. I_{SD} ≤ 100A, di/dt ≤ 200A/μs, V_{DD} ≤ BV$_{DSS}$, Starting T_J = 25°C

4. Pulse Test: Pulse width ≤ 300μs, Dual Cycle ≤ 2%

5. Essentially Independent of Operating Temperature Typical Characteristics
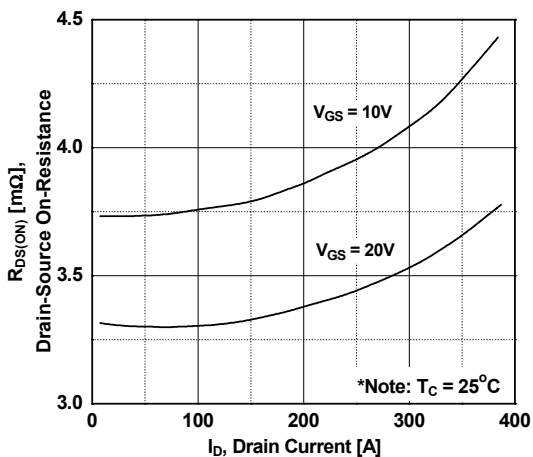
Typical Performance Characteristics
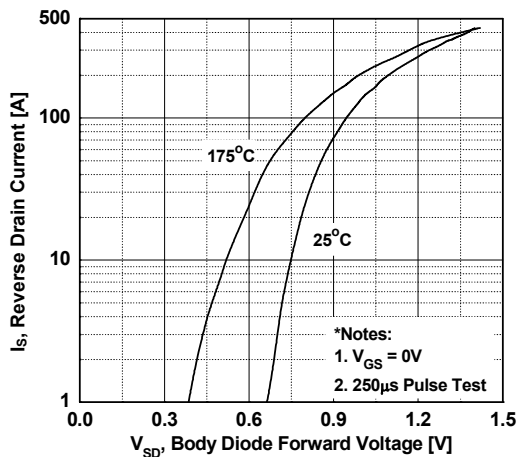
Figure 1. On-Region Characteristics
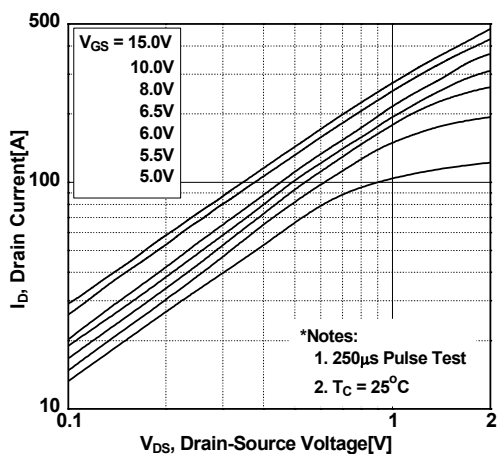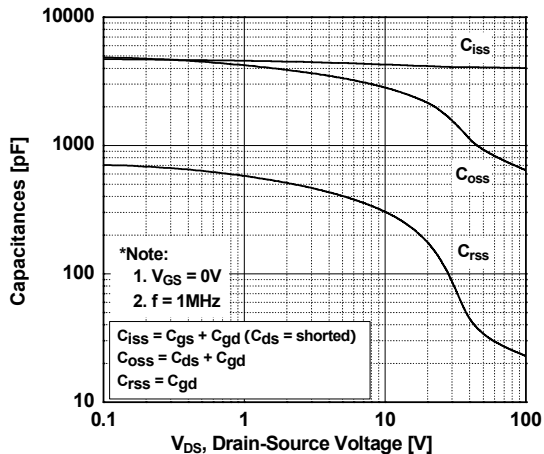

Figure 2. Transfer Characteristics
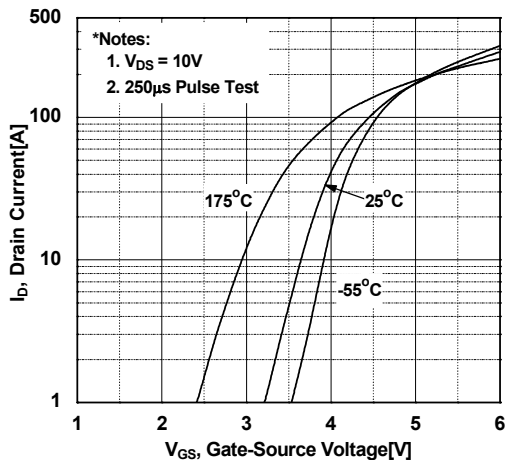
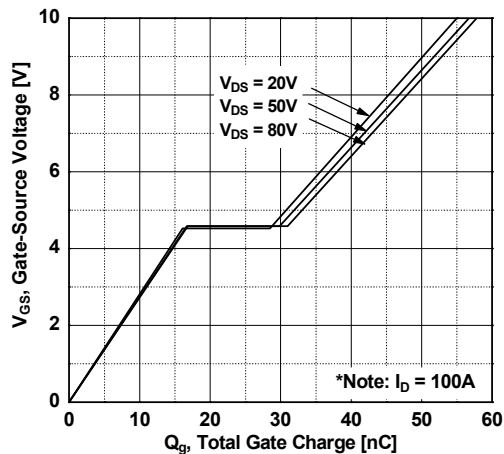### Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

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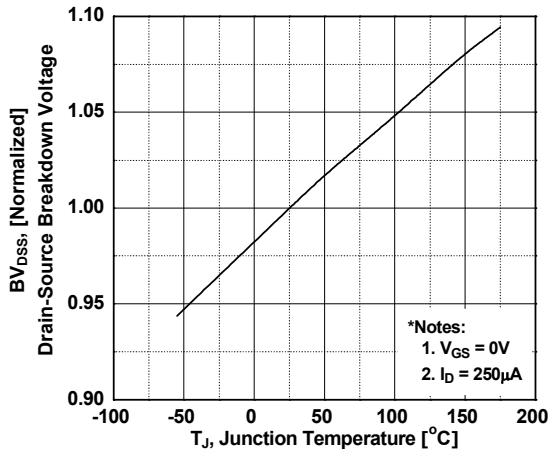

Figure 5. Capacitance Characteristics
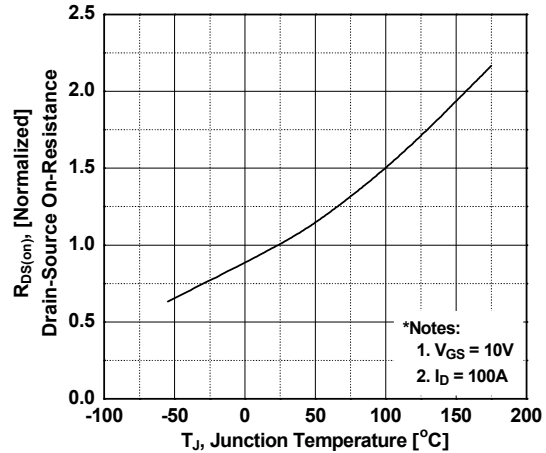

Figure 6. Gate Charge Characteristics

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Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

*Notes:
1. $V_{GS} = 0V$
2. $I_D = 250\mu A$

Figure 8. On-Resistance Variation vs. Temperature

*Notes:
1. $V_{GS} = 10V$
2. $I_D = 100A$

Figure 9. Maximum Safe Operating Area vs. Case Temperature

Operation in This Area is Limited by $R_{DS(on)}$

*Notes:
1. $T_C = 25^oC$
2. $T_J = 175^oC$
3. Single Pulse
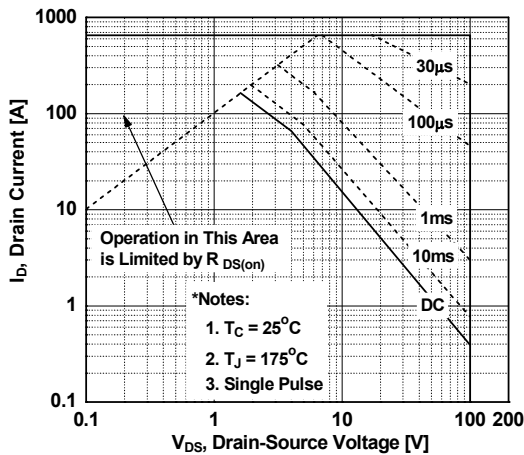
Figure 10. Maximum Drain Current

$V_{GS} = 10V$

$R_{\theta JC} = 0.57^oC/W$
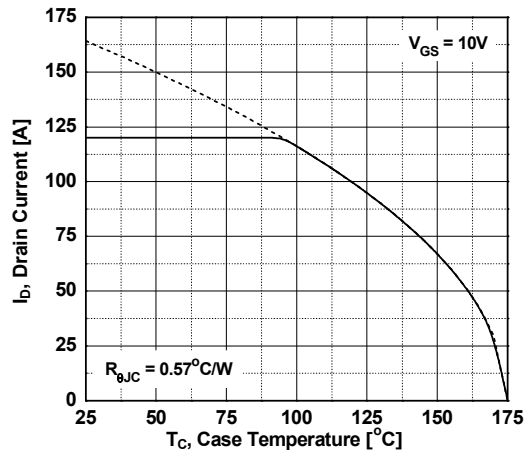
Figure 11. Eoss vs. Drain to Sourece Voltage
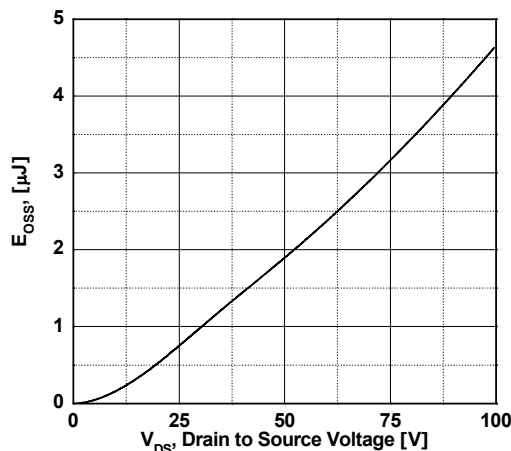
Figure 12. Unclamped Inductive Switching Capability

If R = 0
$t_{AV} = (L)(I_{AS})/(1.3*RATED\ BV_{DSS}-V_{DD})$
If R = 0
$t_{AV} = (L/R)ln[(I_{AS}*R)/(1.3*RATED\ BV_{DSS}-V_{DD})+1]$

STARTING $T_J = 25^oC$

STARTING $T_J = 150^oC$
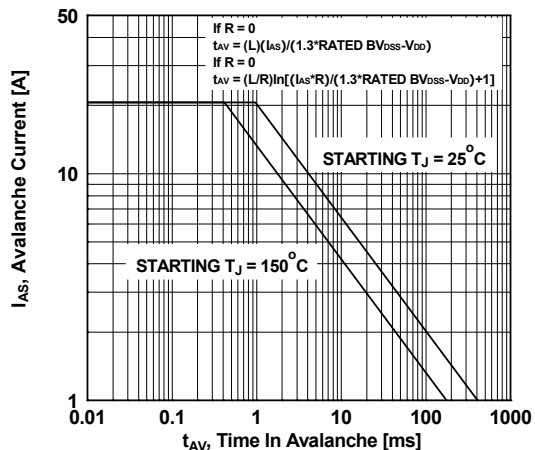
Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve

*Notes:
1. $Z_{\theta JC}(t) = 0.57^{\circ}C/W$ Max.
2. Duty Factor, $D= t_1/t_2$
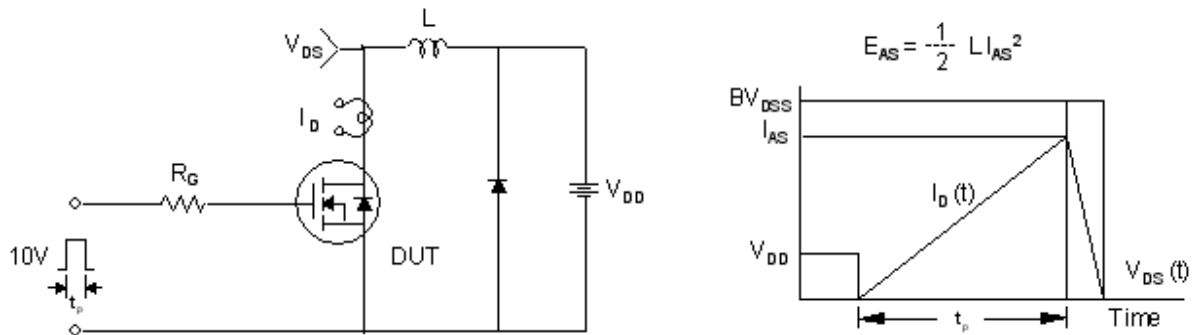3. $T_{JM} - T_C = P_{DM} * Z_{\theta JC}(t)$
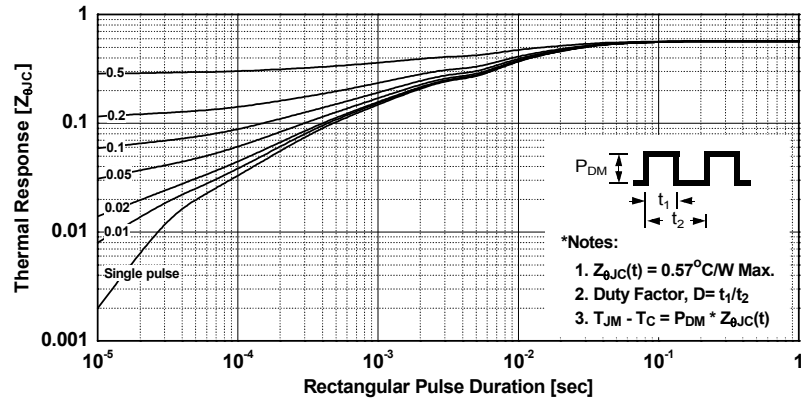
Gate Charge Test Circuit & Waveform
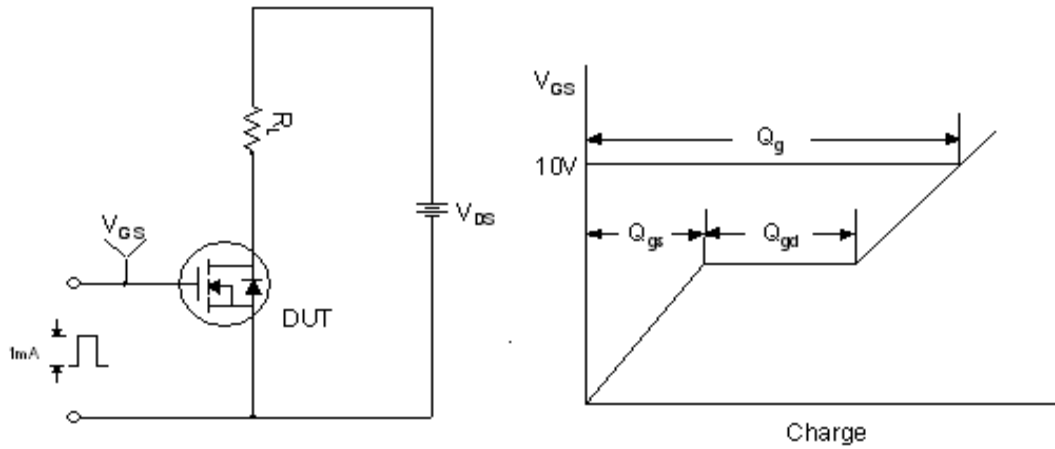
Resistive Switching Test Circuit & Waveforms
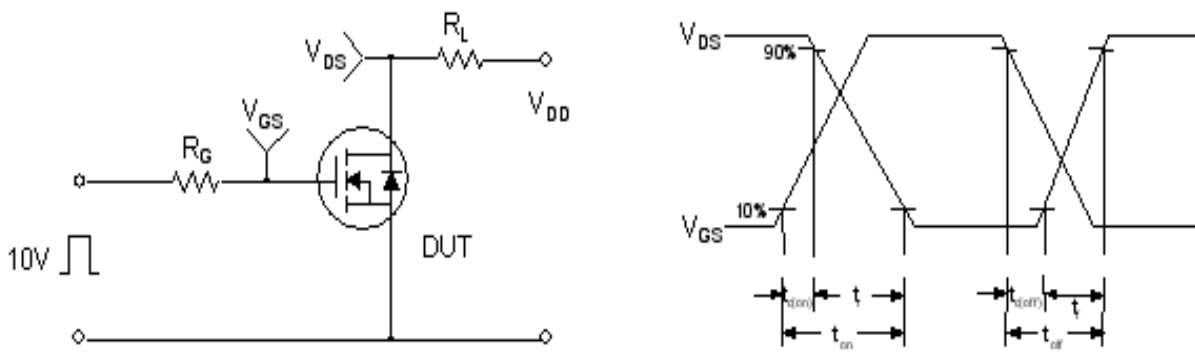
Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2$$

Peak Diode Recovery dv/dt Test Circuit & Waveforms

DUT

V_{DS}

I_{SD}

L

Driver

R_G

Same Type
as DUT

V_{DD}

V_{GS}

• dv/dt controlled by R_G
• I_{SD} controlled by pulse period

V_{GS}
(Driver)

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$

10V

I_{SD}
(DUT)

I_{FM} , Body Diode Forward Current

di/dt

I_{RM}

Body Diode Reverse Current

V_{DS}
(DUT)

Body Diode Recovery dv/dt

V_{SD}

V_{DD}

Body Diode
Forward Voltage Drop
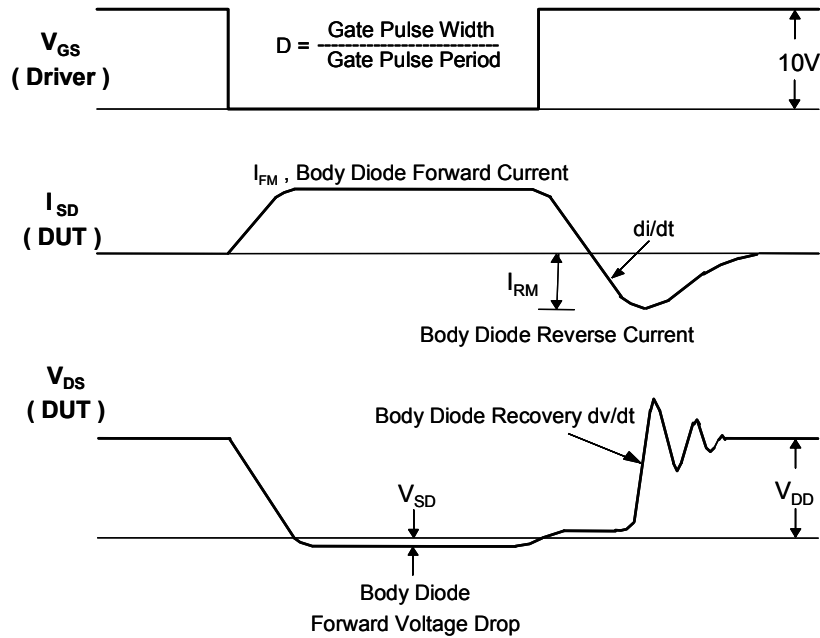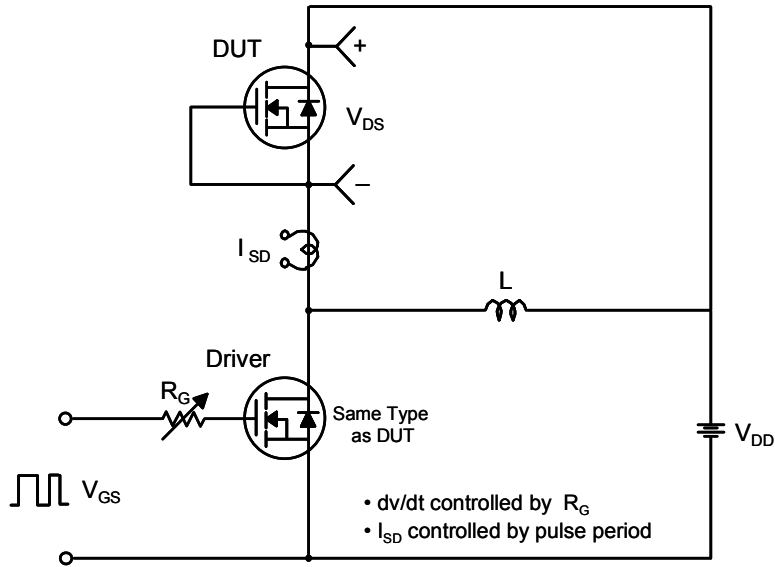
Package Dimensions
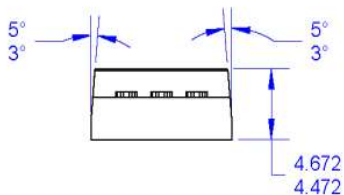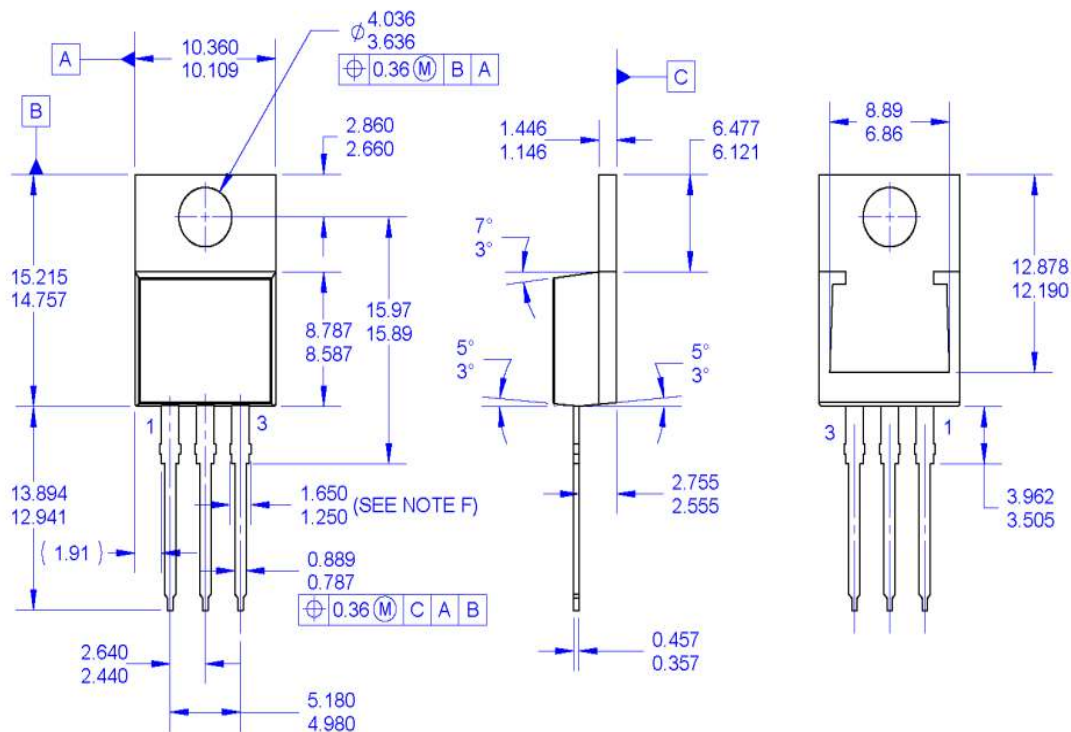
TO-220

NOTES:

A. PACKAGE REFERENCE: JEDEC TO220
   VARIATION AB
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSION AND TOLERANCE AS PER ASME
   Y14.5-1994.
D. DIMENSIONS ARE EXCLUSIVE OF BURRS,
   MOLD FLASH AND TIE BAR PROTRUSIONS.
E. THIS PACKAGE IS FSZZ INTERNAL PRODUCTION
   AND INTENDED FOR DELTA CUSTOMER ONLY.
F. MAX WIDTH FOR F102 DEVICE = 1.35mm.
G. DRAWING FILE NAME: TO220T03REV2

Dimensions in Millimeters

Package Dimensions

I2PAK

NOTES:

A. EXCEPT WHERE NOTED CONFORMS TO
    TO262 JEDEC VARIATION AA.
B. DOES NOT COMPLY JEDEC STD. VALUE.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
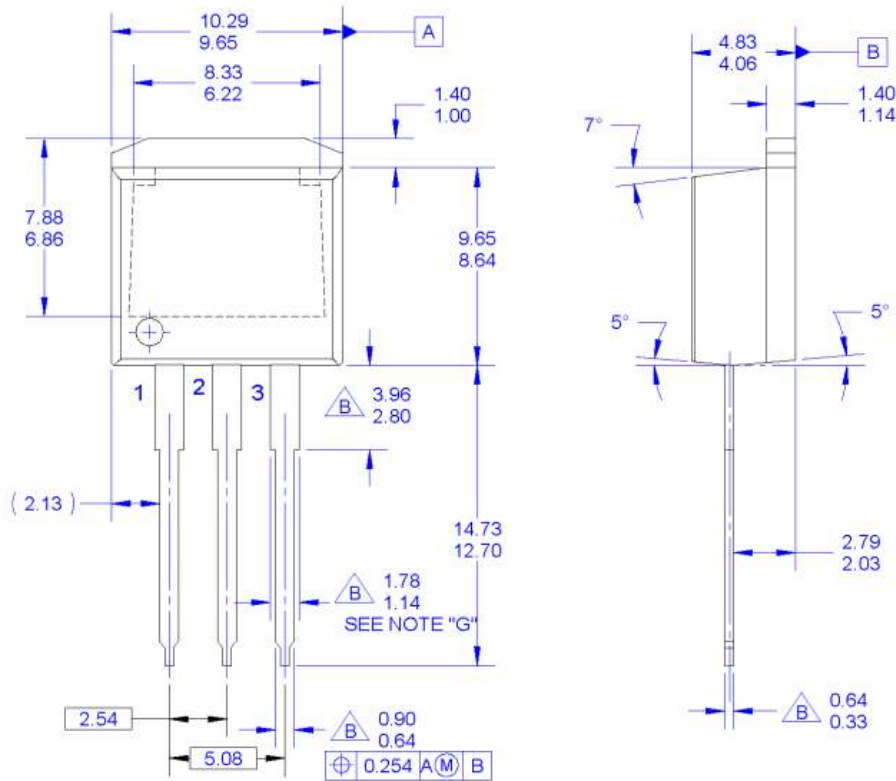D. DIMENSIONS ARE EXCLUSIVE OF BURRS,
    MOLD FLASH AND TIE BAR PROTRUSIONS.
E. DIMENSION AND TOLERANCE AS PER ANSI
    Y14.5-1994.
F. LOCATION OF PIN HOLE MAY VARY
    (LOWER LEFT CORNER, LOWER CENTER
    AND CENTER OF PACKAGE)
G. MAXIMUM WIDTH FOR F102 DEVICE = 1.35 MAX.
H. DRAWING FILE NAME: TO262A03REV5

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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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