

# FDB33N25 / FDI33N25

## 250V N-Channel MOSFET

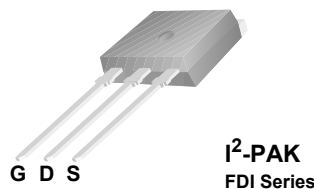
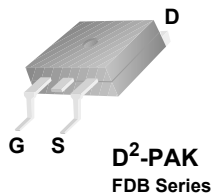
### Features

- 33A, 250V,  $R_{DS(on)} = 0.094\Omega @ V_{GS} = 10V$
- Low gate charge ( typical 36.8 nC)
- Low  $C_{rss}$  ( typical 39 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

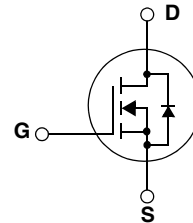
### Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies and active power factor correction.



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### Absolute Maximum Ratings

Symbol	Parameter	FDB33N25 / FDI33N25	Unit
$V_{DSS}$	Drain-Source Voltage	250	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) - Continuous ( $T_C = 100^\circ\text{C}$ )	33 20.4	A A
$I_{DM}$	Drain Current - Pulsed (Note 1)	132	A
$V_{GSS}$	Gate-Source voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	918	mJ
$I_{AR}$	Avalanche Current (Note 1)	33	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	23.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	235 1.89	W W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	Min.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.53	$^\circ\text{C}/\text{W}$
$R_{\theta JA}^*$	Thermal Resistance, Junction-to-Ambient*	--	40	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	$^\circ\text{C}/\text{W}$

\* When mounted on the minimum pad size recommended (PCB Mount)

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDB33N25	FDB33N25TM	D2-PAK	330mm	24mm	800
FDI33N25	FDI33N25TU	I2-PAK	-	-	50

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

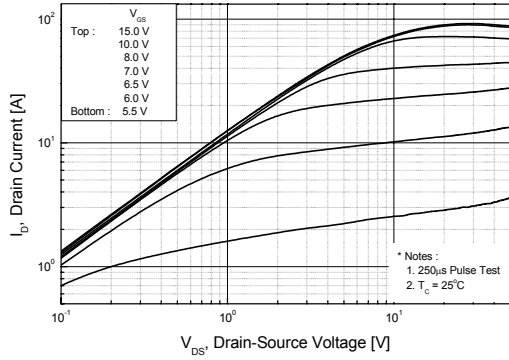
Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	250	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	--	0.25	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 250V, V <sub>GS</sub> = 0V V <sub>DS</sub> = 200V, T <sub>C</sub> = 125°C	--	--	1 10	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	--	--	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 16.5A	--	0.077	0.094	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 16.5A (Note 4)	--	26.6	--	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	1640	2135	pF
C <sub>oss</sub>	Output Capacitance		--	330	430	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	39	59	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 125V, I <sub>D</sub> = 33A R <sub>G</sub> = 25Ω  (Note 4, 5)	--	35	80	ns
t <sub>r</sub>	Turn-On Rise Time		--	230	470	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	75	160	ns
t <sub>f</sub>	Turn-Off Fall Time		--	120	250	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 200V, I <sub>D</sub> = 33A V <sub>GS</sub> = 10V  (Note 4, 5)	--	36.8	48	nC
Q <sub>gs</sub>	Gate-Source Charge		--	10	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	17	--	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	33	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	132	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 33A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 33A di <sub>F</sub> /dt = 100A/μs (Note 4)	--	220	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	1.71	--	μC

### NOTES:

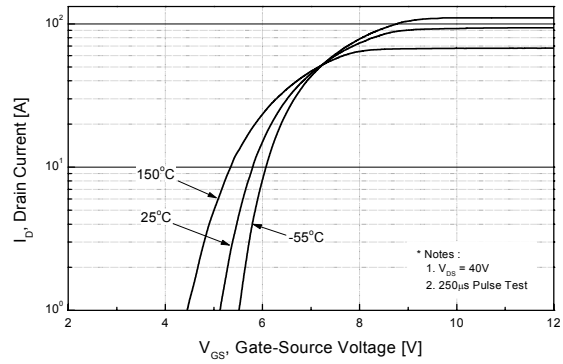
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 1.35mH, I<sub>AS</sub> = 33A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 33A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

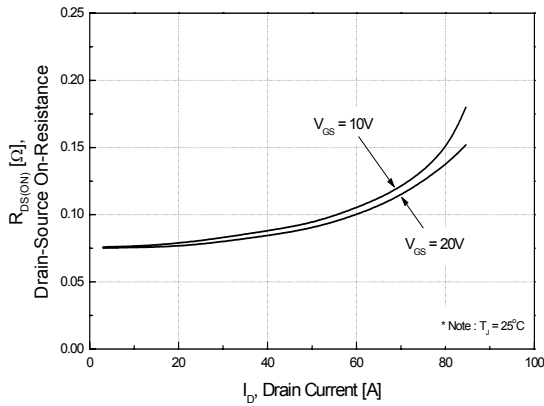
**Figure 1. On-Region Characteristics**



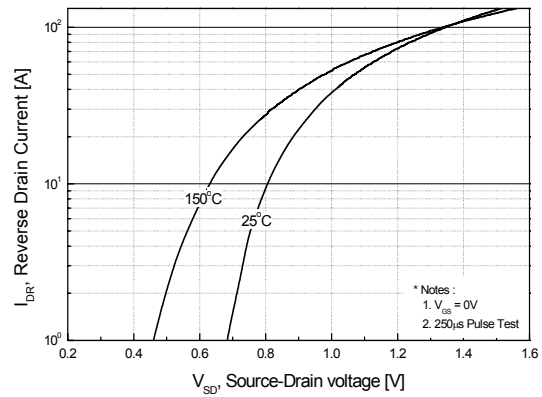
**Figure 2. Transfer Characteristics**



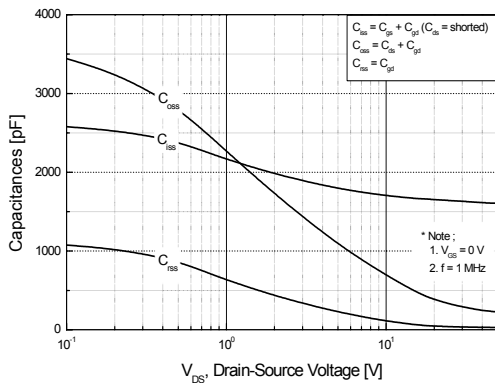
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



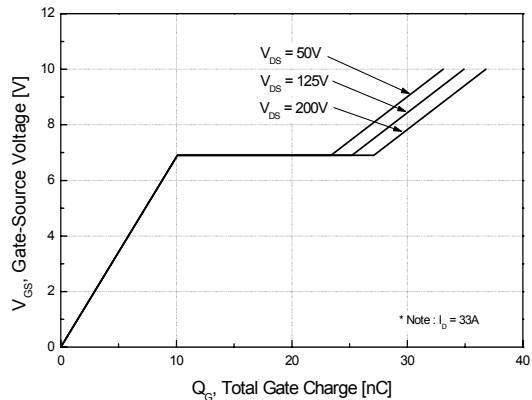
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

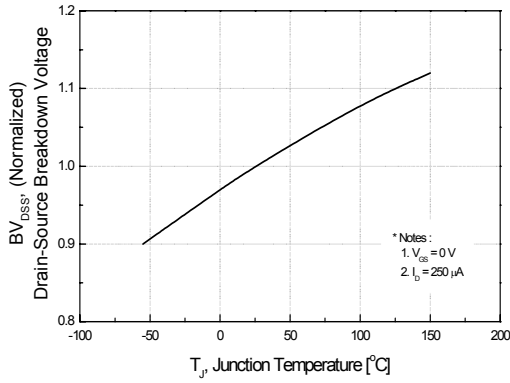


**Figure 6. Gate Charge Characteristics**

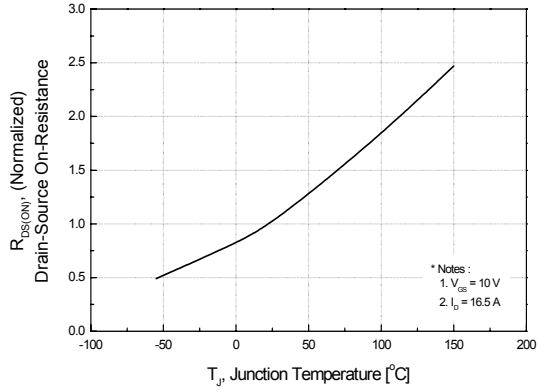


**Typical Performance Characteristics** (Continued)

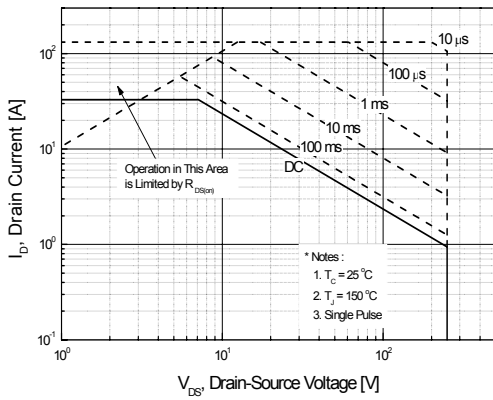
**Figure 7. Breakdown Voltage Variation vs. Temperature**



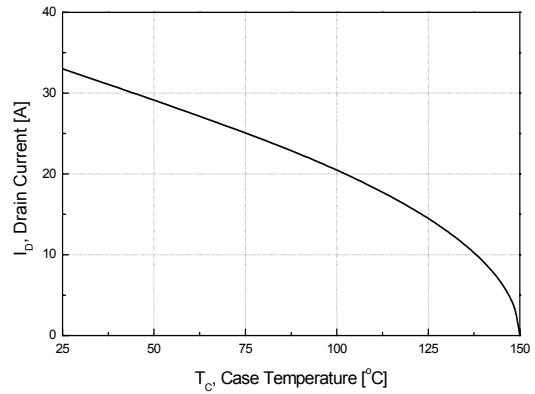
**Figure 8. On-Resistance Variation vs. Temperature**



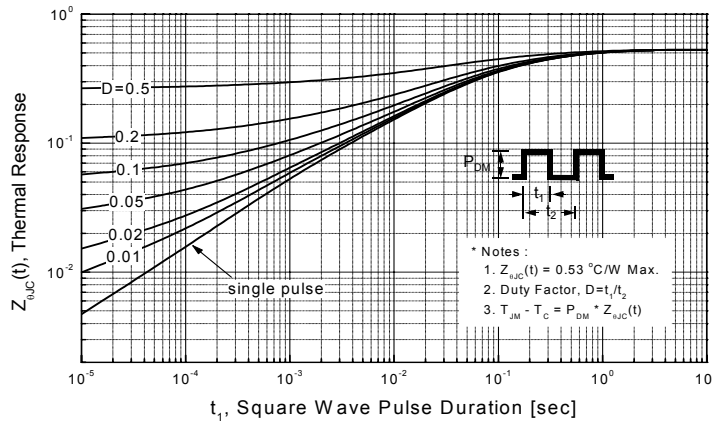
**Figure 9. Maximum Safe Operating Area**



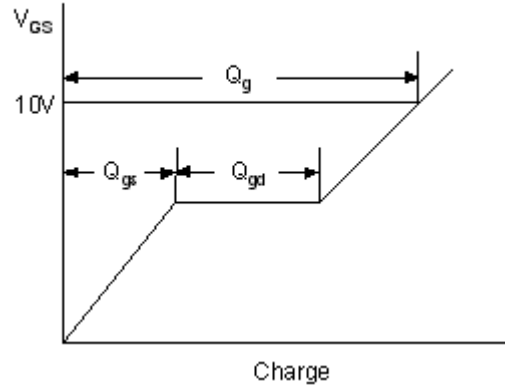
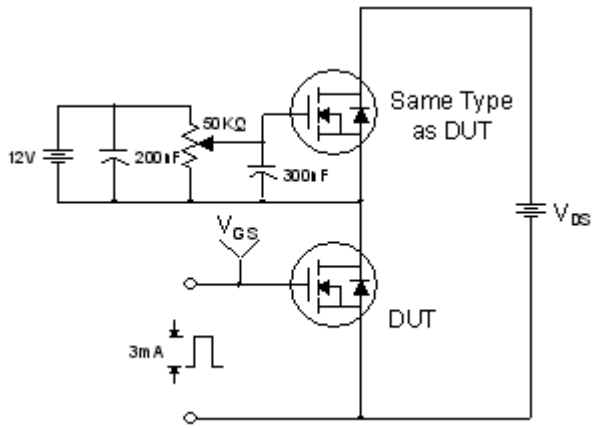
**Figure 10. Maximum Drain Current vs. Case Temperature**



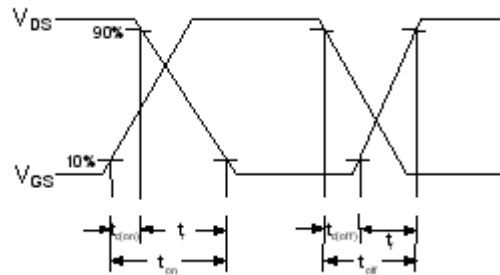
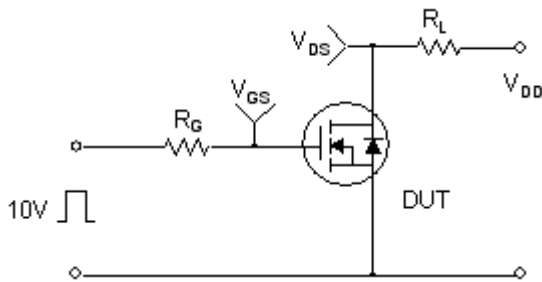
**Figure 11. Transient Thermal Response Curve**



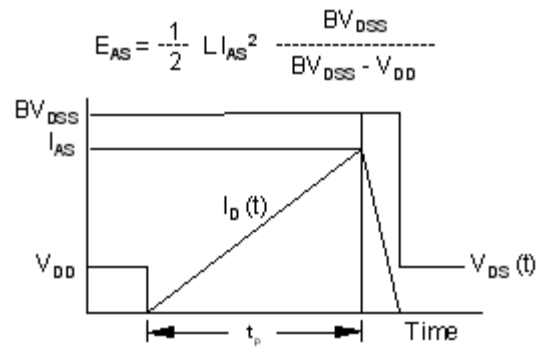
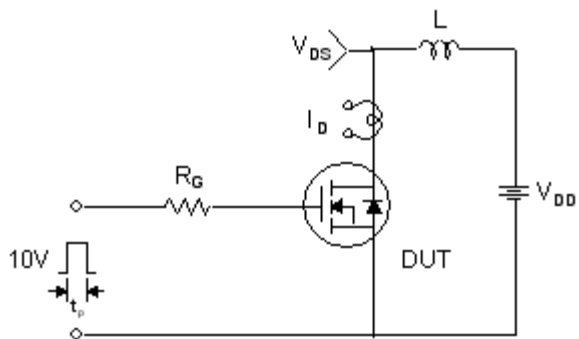
**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

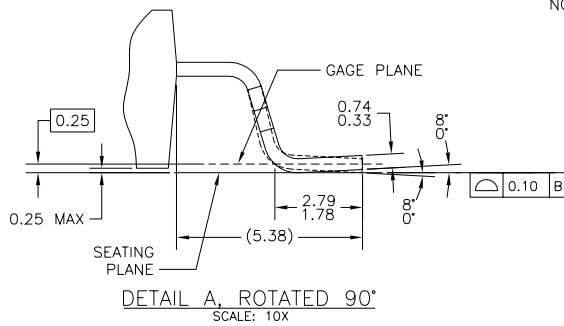
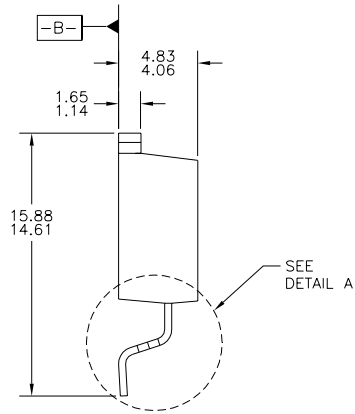
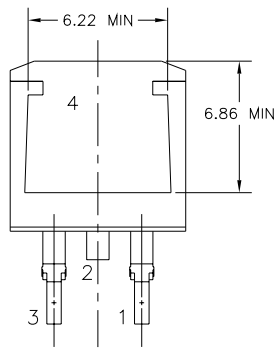
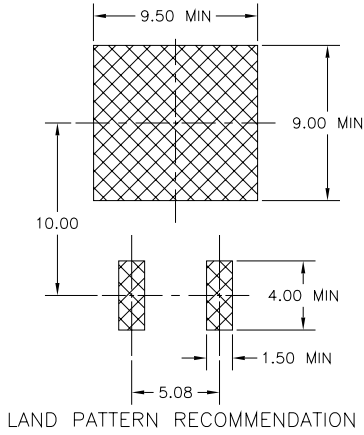
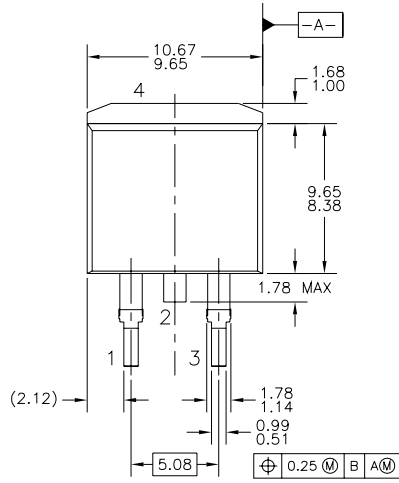


**Peak Diode Recovery dv/dt Test Circuit & Waveforms**



**Mechanical Dimensions**

**D2-PAK**

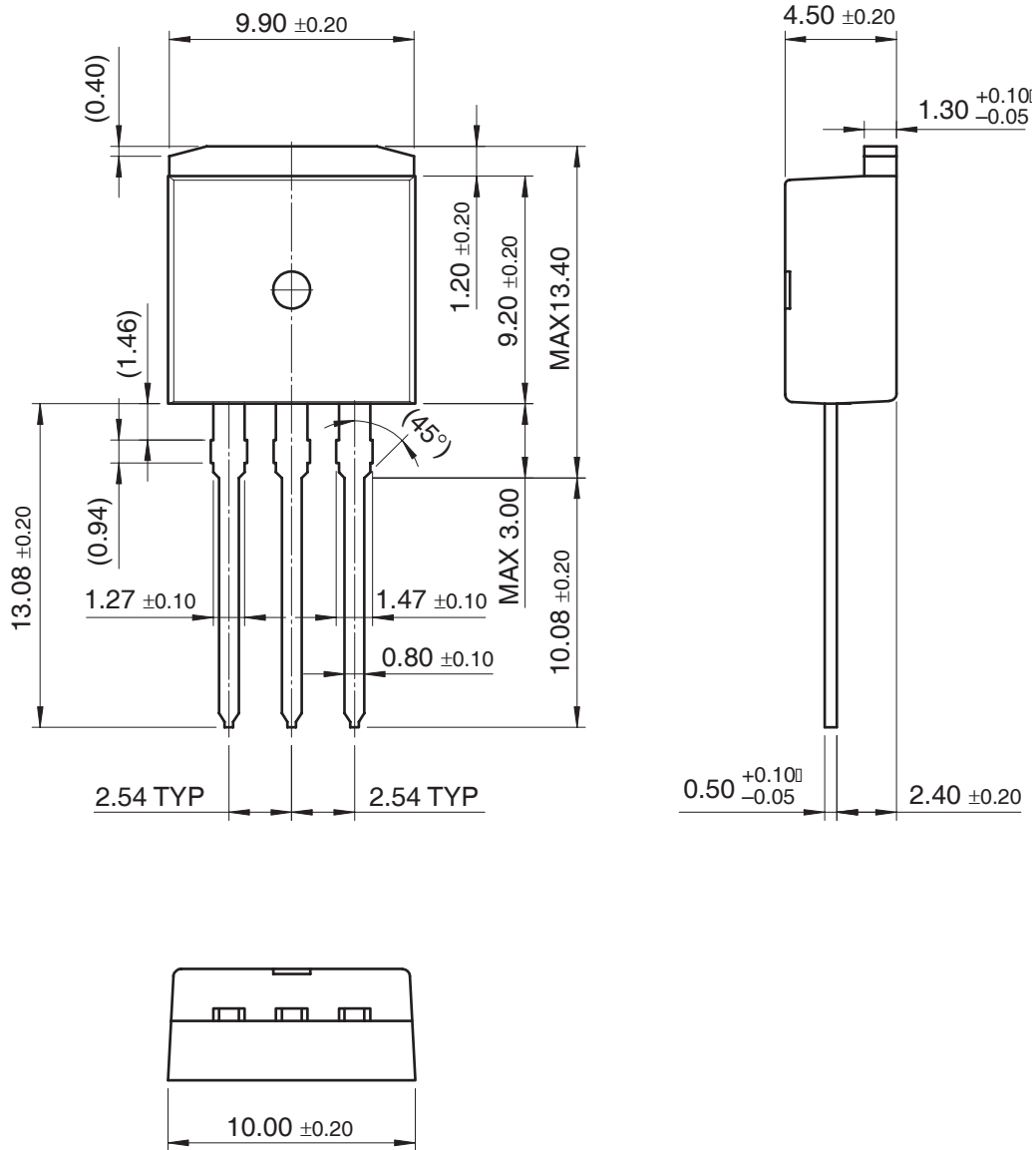


- NOTES: UNLESS OTHERWISE SPECIFIED
- A) ALL DIMENSIONS ARE IN MILLIMETERS.
  - B) REFERENCE JEDEC, TO-263, ISSUE D, VARIATION AB, DATED JULY 2003.
  - C) DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1982.
  - D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE).
  - E) PRESENCE OF TRIMMED CENTER LEAD IS OPTIONAL.

T0263A02REVD

# Mechanical Dimensions

## I2-PAK



FDB33N25 / FDI33N25 250V N-Channel MOSFET



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Rev. 119