

# N0413N

R07DS0555EJ0100

Rev.1.00

Nov 07, 2011

## N-CHANNEL MOSFET FOR SWITCHING

### Description

The N0413N is N-channel MOS Field Effect Transistor designed for high current switching applications.

### Features

- Low on-state resistance  
 $R_{DS(on)} = 3.3 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 50 \text{ A)}$
- Low input capacitance  
 $C_{iss} = 5550 \text{ pF TYP. (} V_{DS} = 25 \text{ V, } V_{GS} = 0 \text{ V)}$
- High current  
 $I_{D(DC)} = \pm 100 \text{ A}$
- RoHS Compliant

### Ordering Information

Part No.	Lead Plating	Packing	Package
N0413N-ZK-E1-AY <sup>*1</sup>	Pure Sn (Tin)	Tape	TO-263
N0413N-ZK-E2-AY <sup>*1</sup>		800 p/reel	1.39 g TYP.

Note: <sup>\*1</sup>. Pb-free (This product does not contain Pb in the external electrode.)

### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ , all terminals are connected)

Item	Symbol	Ratings	Unit
Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	40	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 100$	A
Drain Current (pulse) <sup>*1</sup>	$I_{D(pulse)}$	$\pm 400$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	119	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T2}$	1.5	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Single Avalanche Current <sup>*2</sup>	$I_{AS}$	55	A
Single Avalanche Energy <sup>*2</sup>	$E_{AS}$	300	mJ

### Thermal Resistance

Channel to Case (Drain) Thermal Resistance	$R_{th(ch-C)}$	1.05	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance <sup>*2</sup>	$R_{th(ch-A)}$	83.3	$^\circ\text{C/W}$

Notes: <sup>\*1</sup>.  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

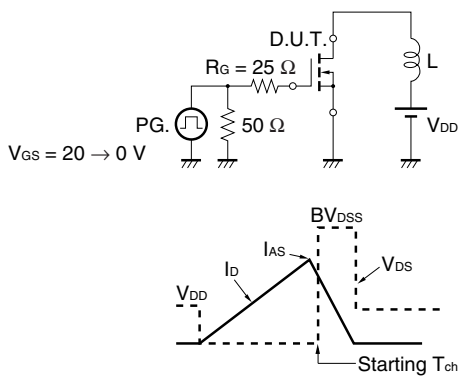
<sup>\*2</sup>. Starting  $T_{ch} = 25^\circ\text{C}$ ,  $R_G = 25 \Omega$ ,  $V_{DD} = 25 \text{ V}$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$ ,  $L = 100 \mu\text{H}$

**Electrical Characteristics (T<sub>A</sub> = 25°C, all terminals are connected)**

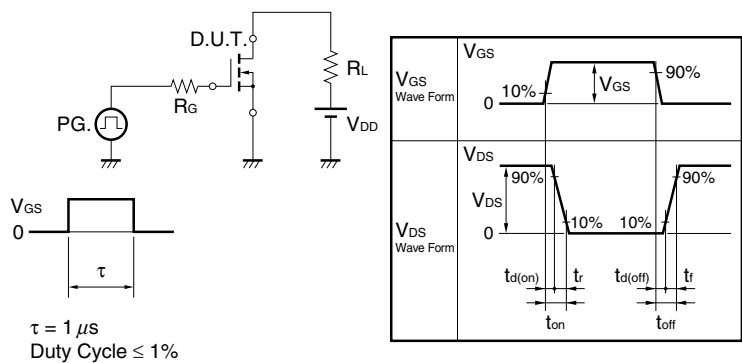
Item	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	I <sub>DSS</sub>			1	μA	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V
Gate Leakage Current	I <sub>GSS</sub>			±100	nA	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V
Gate to Source Cut-off Voltage	V <sub>GS(off)</sub>	2.0		4.0	V	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA
Forward Transfer Admittance *1	y <sub>fs</sub>	26			S	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 50 A
Drain to Source On-state Resistance *1	R <sub>DS(on)</sub>		2.3	3.3	mΩ	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A
Input Capacitance	C <sub>iss</sub>		5550		pF	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz
Output Capacitance	C <sub>oss</sub>		580		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>		320		pF	
Turn-on Delay Time	t <sub>d(on)</sub>		29.0		ns	V <sub>DD</sub> = 20 V, I <sub>D</sub> = 50 A, V <sub>GS</sub> = 10 V, R <sub>G</sub> = 0 Ω
Rise Time	t <sub>r</sub>		15.0		ns	
Turn-off Delay Time	t <sub>d(off)</sub>		64.0		ns	
Fall Time	t <sub>f</sub>		13.0		ns	
Total Gate Charge	Q <sub>G</sub>		100		nC	V <sub>DD</sub> = 32 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 100 A
Gate to Source Charge	Q <sub>GS</sub>		26		nC	
Gate to Drain Charge	Q <sub>GD</sub>		32		nC	
Body Diode Forward Voltage *1	V <sub>F(S-D)</sub>			1.5	V	I <sub>F</sub> = 100 A, V <sub>GS</sub> = 0 V
Reverse Recovery Time	t <sub>rr</sub>		40		ns	I <sub>F</sub> = 50 A, V <sub>GS</sub> = 0 V,
Reverse Recovery Charge	Q <sub>rr</sub>		44		nC	di/dt = 100 A/μs

Note: \*1. Pulsed

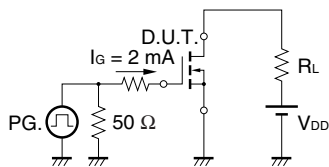
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



**TEST CIRCUIT 2 SWITCHING TIME**

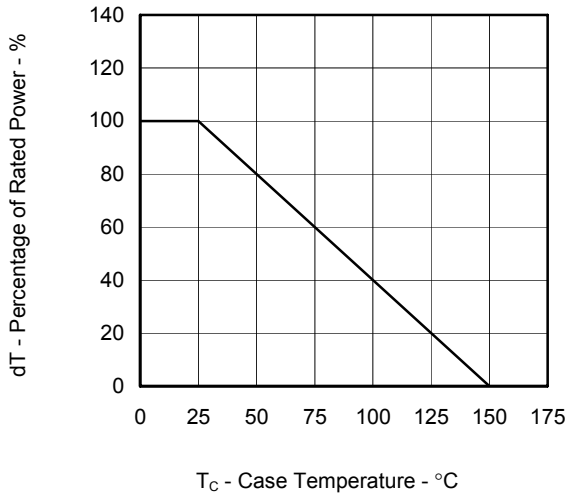


**TEST CIRCUIT 3 GATE CHARGE**

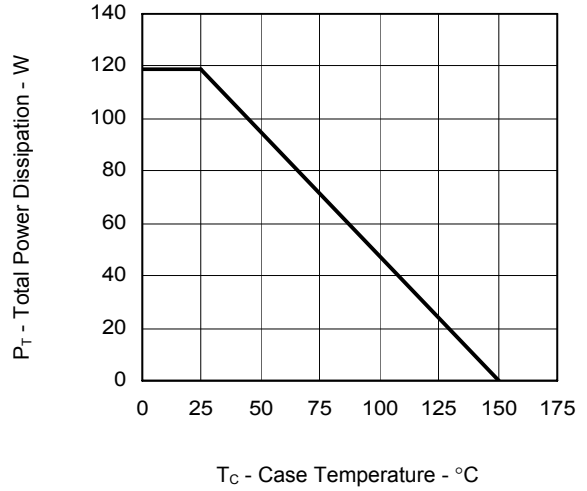


Typical Characteristics (T<sub>A</sub> = 25°C)

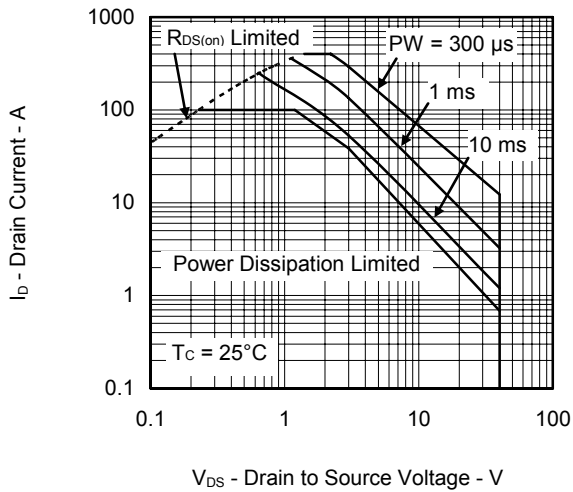
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



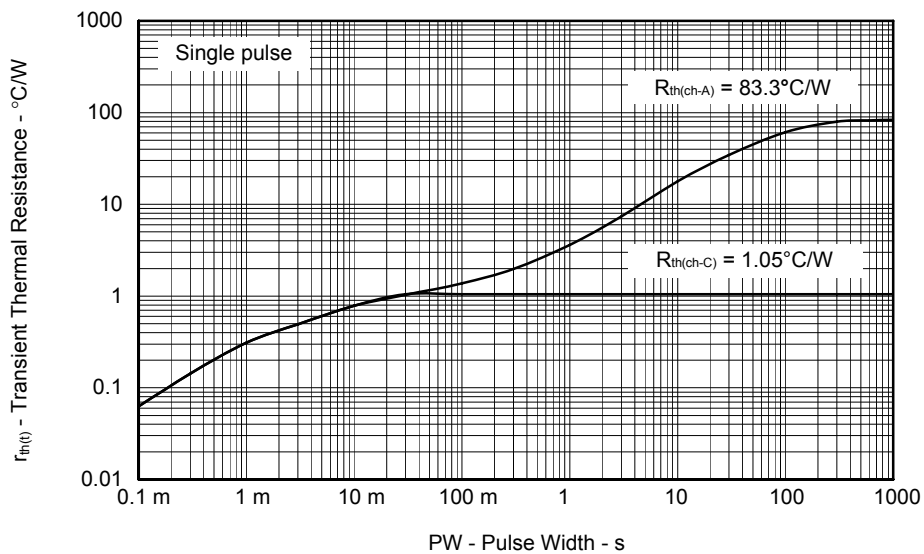
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



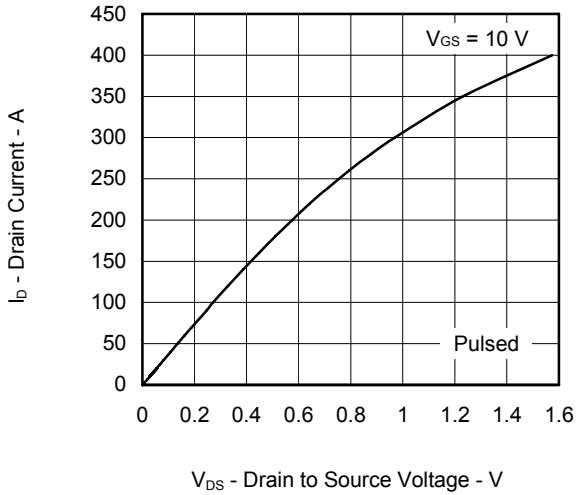
FORWARD BIAS SAFE OPERATING AREA



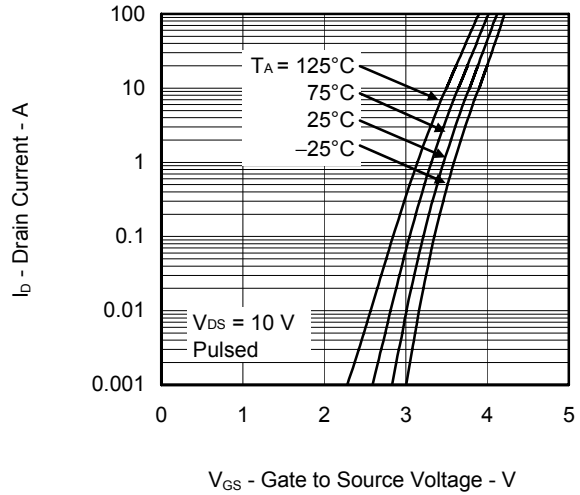
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



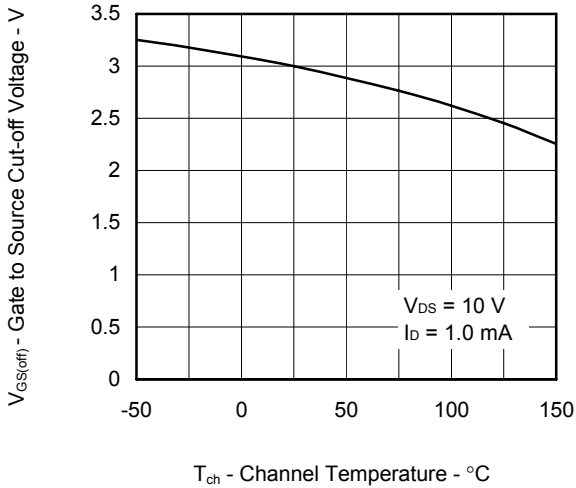
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



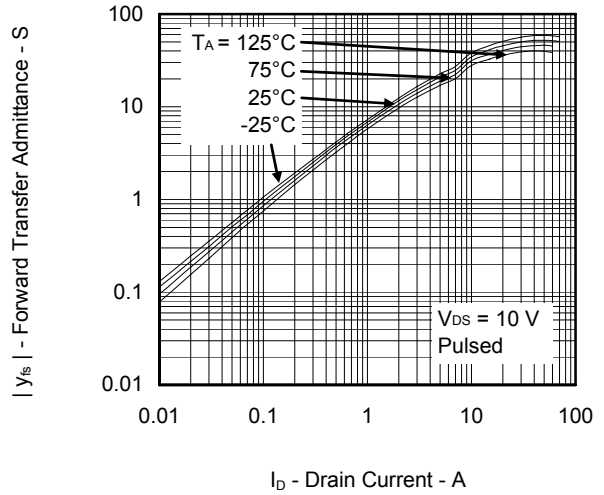
FORWARD TRANSFER CHARACTERISTICS



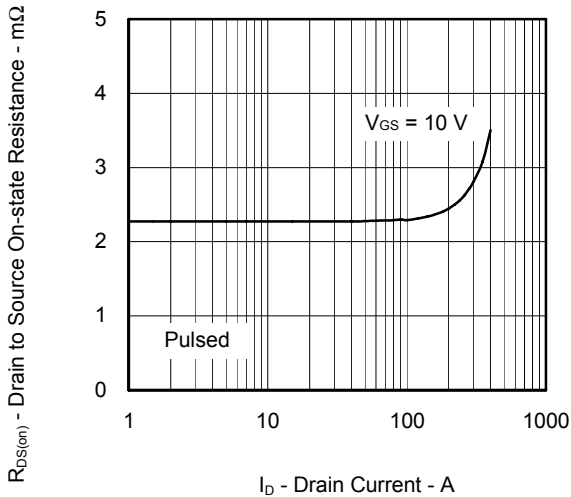
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



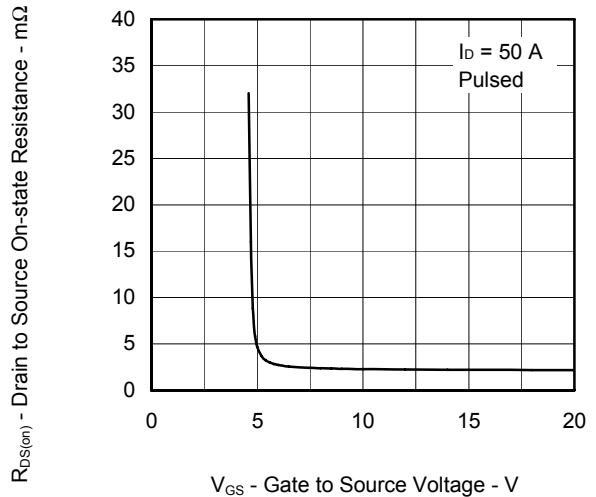
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



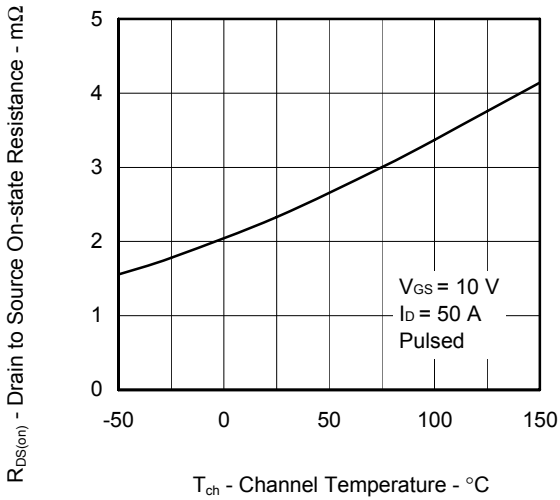
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



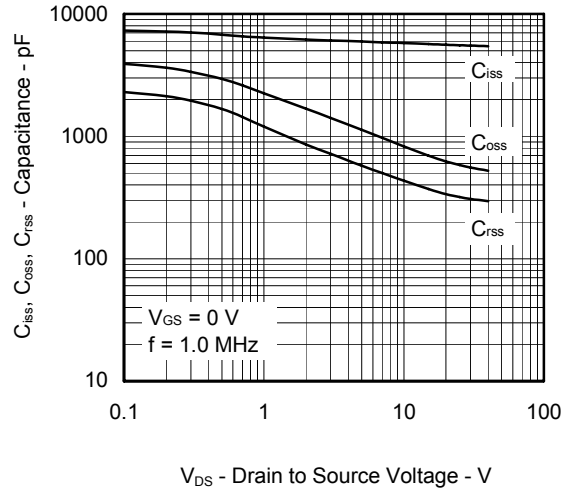
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



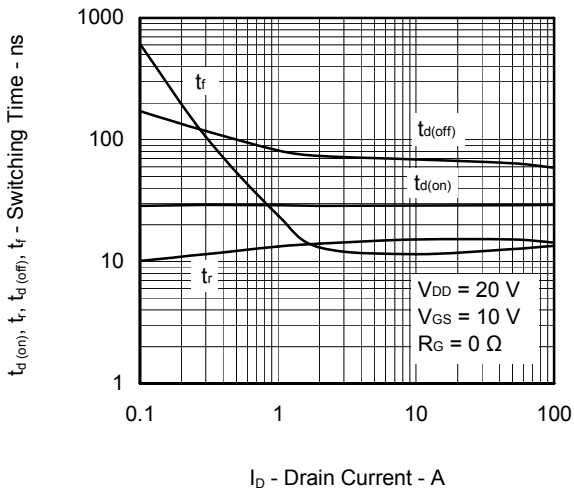
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



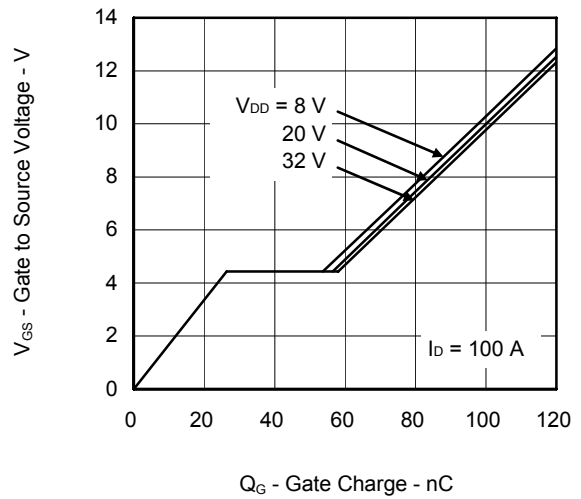
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



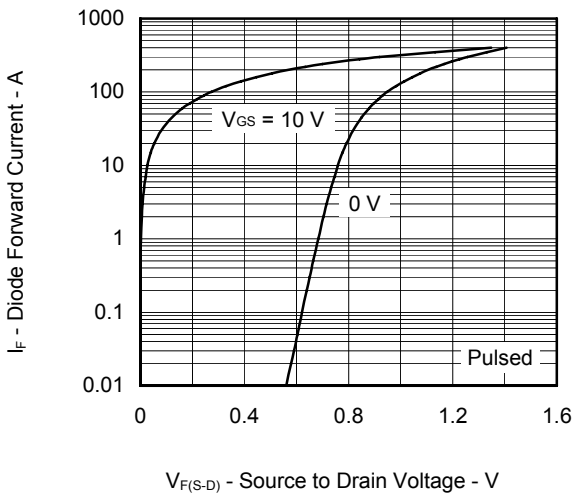
SWITCHING CHARACTERISTICS



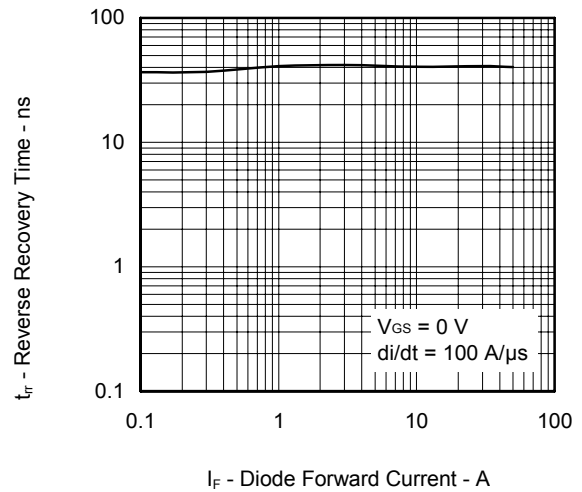
DYNAMIC INPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

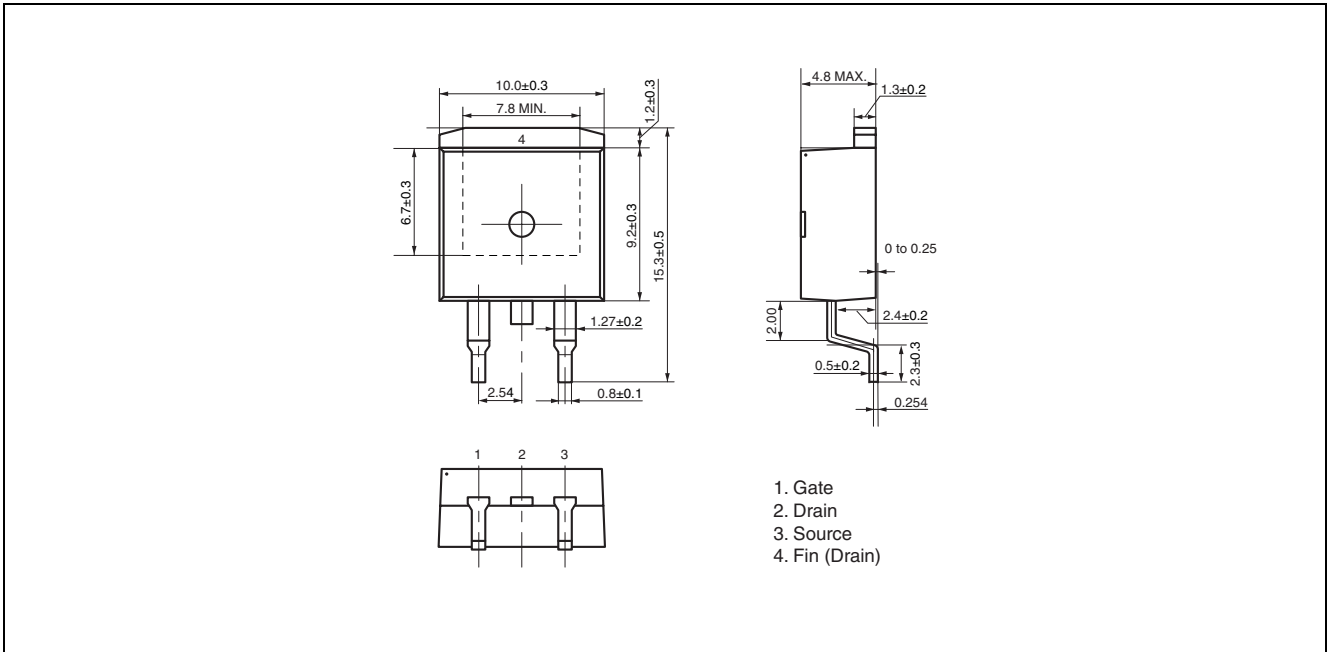


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

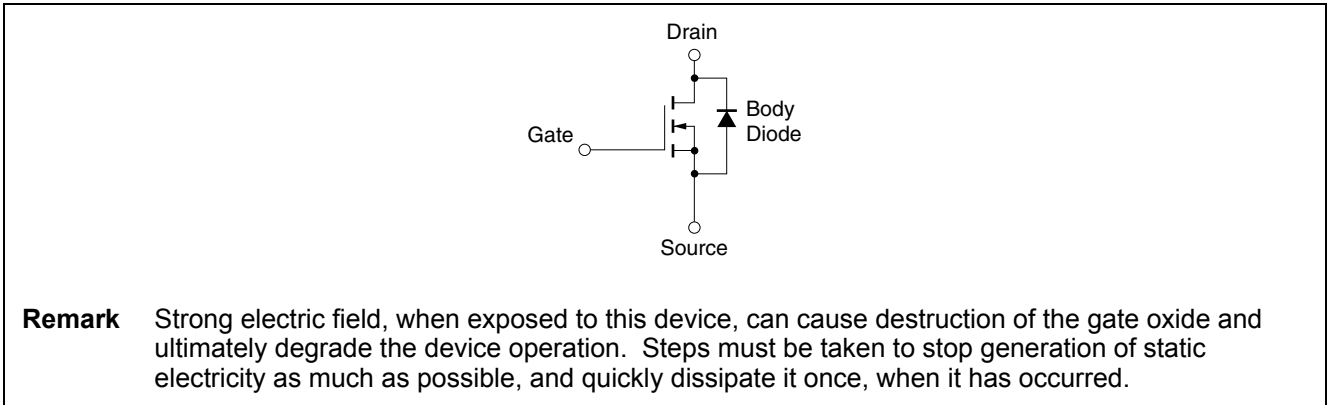


Package Drawing (Unit: mm)

TO-263



Equivalent Circuit



**Remark** Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

<b>Revision History</b>	<b>N0413N Data Sheet</b>
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Rev.	Date	Description	
		Page	Summary
1.00	Nov 07, 2011	-	First Edition Issued

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