

# NP36N10SDE

R07DS0508EJ0100

Rev.1.00

## MOS FIELD EFFECT TRANSISTOR

Sep 21, 2011

### Description

The NP36N10SDE is N-channel MOS Field Effect Transistor designed for high current switching applications.

### Features

- Low on-state resistance  
 $R_{DS(on)1} = 33 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 18 \text{ A)}$   
 $R_{DS(on)2} = 39 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 18 \text{ A)}$
- Low  $C_{iss}$ :  $C_{iss} = 3500 \text{ pF TYP. (} V_{DS} = 25 \text{ V)}$
- Designed for automotive application and AEC-Q101 qualified

### Ordering Information

Part No.	Lead Plating	Packing		Package
NP36N10SDE-E1-AY <sup>*1</sup>	Pure Sn (Tin)	Tape 2500 p/reel	Taping (E1 type)	TO-252 (MP-3ZK)
NP36N10SDE-E2-AY <sup>*1</sup>			Taping (E2 type)	

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

### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ )

Item	Symbol	Ratings	Unit
Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	100	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 36$	A
Drain Current (pulse) <sup>*1</sup>	$I_{D(pulse)}$	$\pm 100$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	142	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ ) <sup>*2</sup>	$P_{T2}$	1.2	W
Channel Temperature	$T_{ch}$	175	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	$-55 \text{ to } +175$	$^\circ\text{C}$
Single Avalanche Current <sup>*3</sup>	$I_{AS}$	31	A
Single Avalanche Energy <sup>*3</sup>	$E_{AS}$	99	mJ

### Thermal Resistance

Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.06	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance <sup>*2</sup>	$R_{th(ch-A)}$	125	$^\circ\text{C/W}$

Notes: <sup>\*1</sup>.  $T_C = 25^\circ\text{C}$ ,  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

<sup>\*2</sup>. Mounted on glass epoxy substrate of  $40 \text{ mm} \times 40 \text{ mm} \times 1.6 \text{ mm}$  with 4% Copper area ( $35 \mu\text{m}$ )

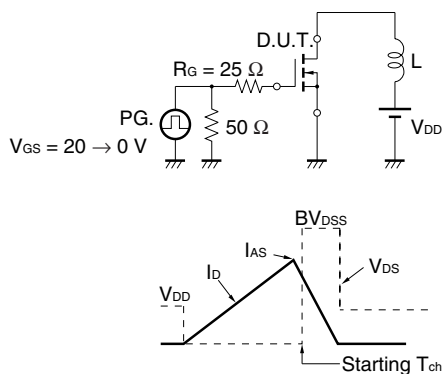
<sup>\*3</sup>.  $T_{ch(start)} = 25^\circ\text{C}$ ,  $V_{DD} = 50 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $L = 100 \mu\text{H}$ ,  $V_{GS} = 20 \text{ V} \rightarrow 0 \text{ V}$

Electrical Characteristics ( $T_A = 25^\circ\text{C}$ )

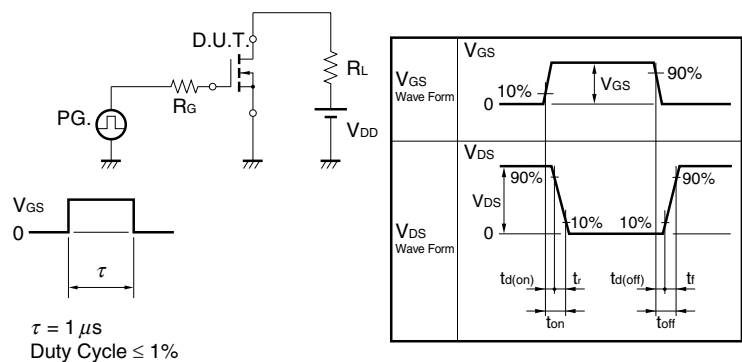
Item	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	$I_{DSS}$			10	$\mu\text{A}$	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$
Gate Leakage Current	$I_{GSS}$			$\pm 100$	nA	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$
Gate to Source Threshold Voltage	$V_{GS(th)}$	1.5	2.0	2.5	V	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$
Forward Transfer Admittance <sup>*1</sup>	$ y_{fs} $	12	23		S	$V_{DS} = 10\text{ V}, I_D = 18\text{ A}$
Drain to Source On-state Resistance <sup>*1</sup>	$R_{DS(on)1}$		27	33	m $\Omega$	$V_{GS} = 10\text{ V}, I_D = 18\text{ A}$
	$R_{DS(on)2}$		29	39	m $\Omega$	$V_{GS} = 4.5\text{ V}, I_D = 18\text{ A}$
Input Capacitance	$C_{iss}$		3500	5300	pF	$V_{DS} = 25\text{ V},$ $V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$
Output Capacitance	$C_{oss}$		230	350	pF	
Reverse Transfer Capacitance	$C_{rss}$		130	240	pF	
Turn-on Delay Time	$t_{d(on)}$		15	46	ns	$V_{DD} = 50\text{ V}, I_D = 18\text{ A},$ $V_{GS} = 10\text{ V}$ $R_G = 0\text{ }\Omega$
Rise Time	$t_r$		10	25	ns	
Turn-off Delay Time	$t_{d(off)}$		68	136	ns	
Fall Time	$t_f$		6	15	ns	
Total Gate Charge	$Q_G$		72	110	nC	$V_{DD} = 80\text{ V},$ $V_{GS} = 10\text{ V},$ $I_D = 36\text{ A}$
Gate to Source Charge	$Q_{GS}$		10		nC	
Gate to Drain Charge	$Q_{GD}$		19		nC	
Body Diode Forward Voltage <sup>*1</sup>	$V_{F(S-D)}$		1	1.5	V	$I_F = 36\text{ A}, V_{GS} = 0\text{ V}$
Reverse Recovery Time	$t_{rr}$		70		ns	$I_F = 36\text{ A}, V_{GS} = 0\text{ V},$ $di/dt = 100\text{ A}/\mu\text{s}$
Reverse Recovery Charge	$Q_{rr}$		180		nC	

Note: \*1. Pulsed test

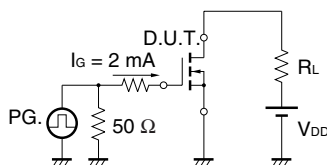
## TEST CIRCUIT 1 AVALANCHE CAPABILITY



## TEST CIRCUIT 2 SWITCHING TIME

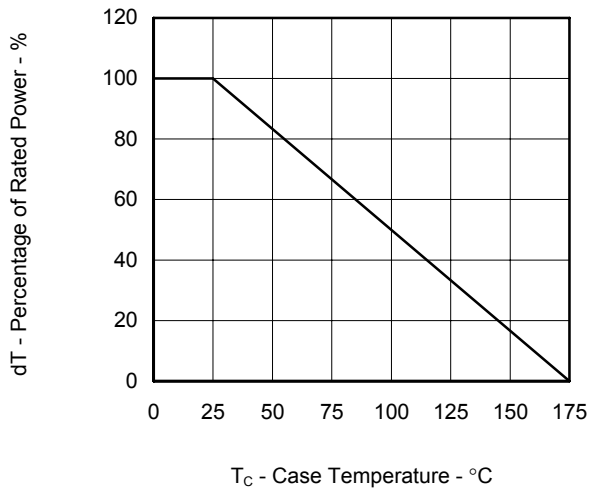


## TEST CIRCUIT 3 GATE CHARGE

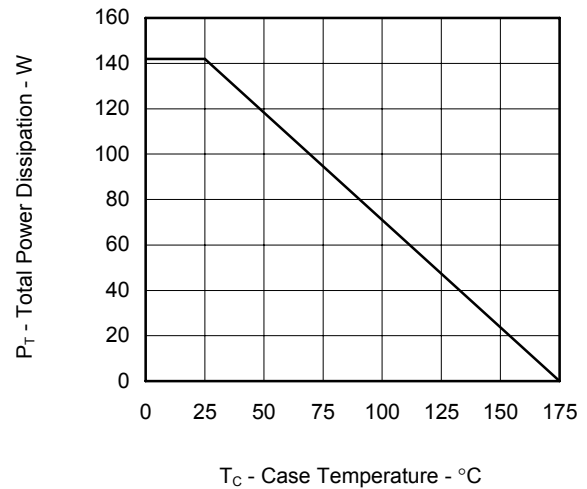


## Typical Characteristics ( $T_A = 25^\circ\text{C}$ )

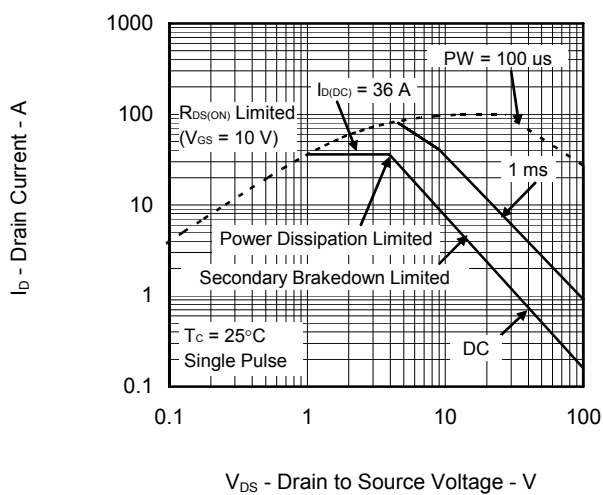
DERATING FACTOR OF FORWARD BIAS  
SAFE OPERATING AREA



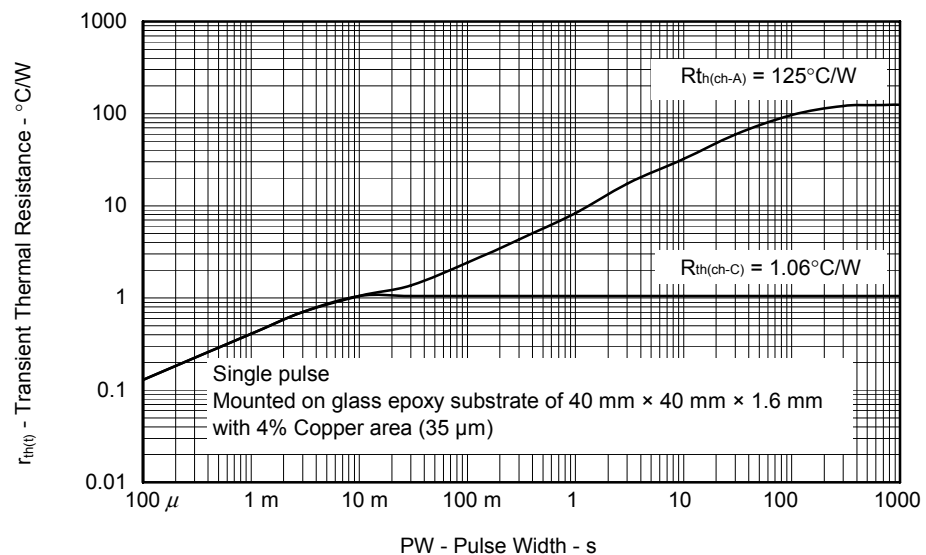
TOTAL POWER DISSIPATION vs.  
CASE TEMPERATURE

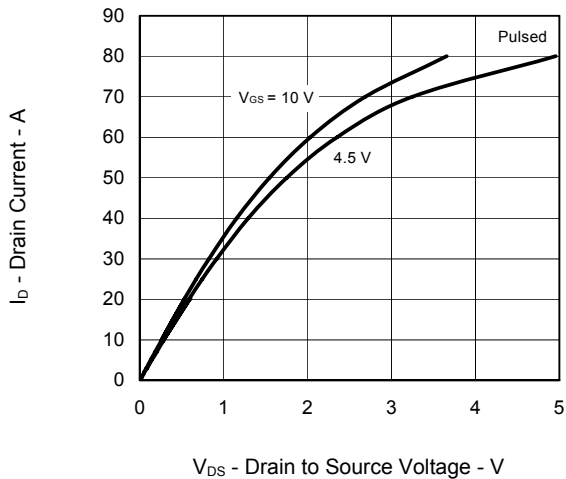


FORWARD BIAS SAFE OPERATING AREA

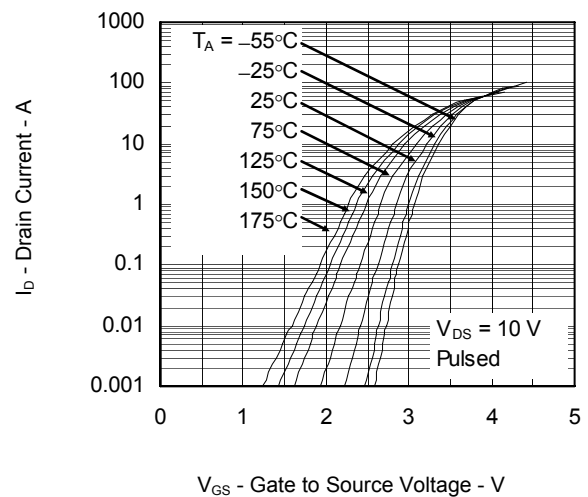
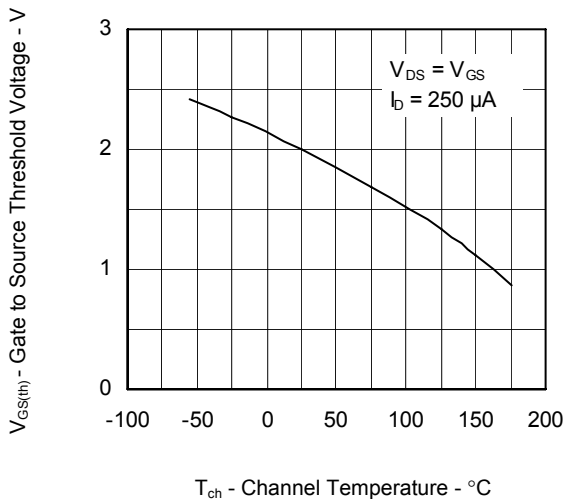
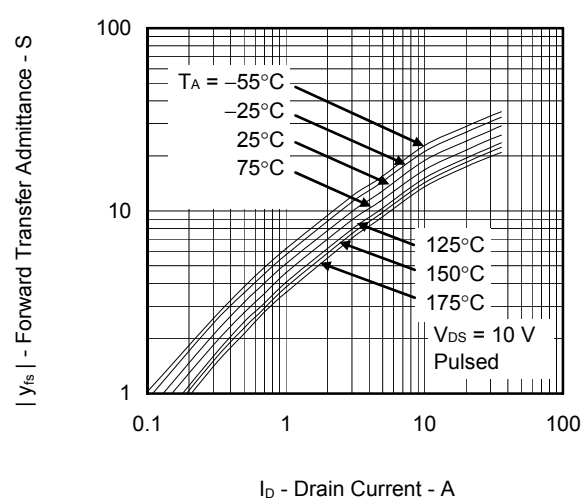
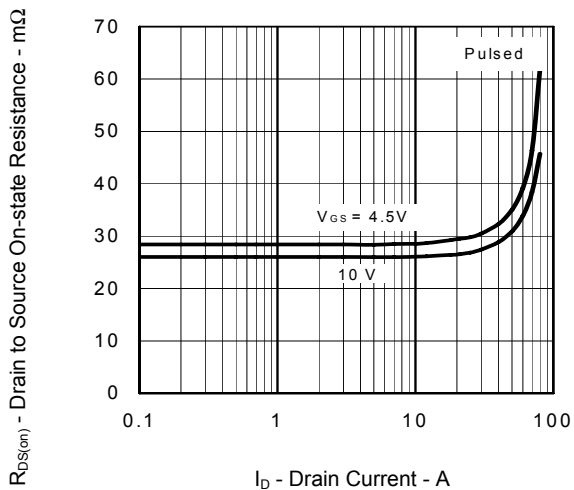
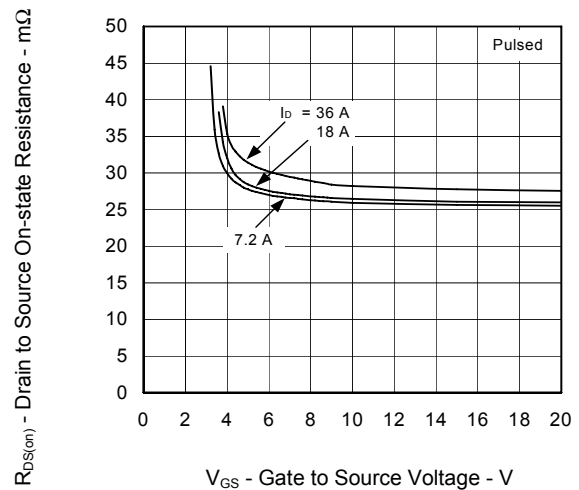


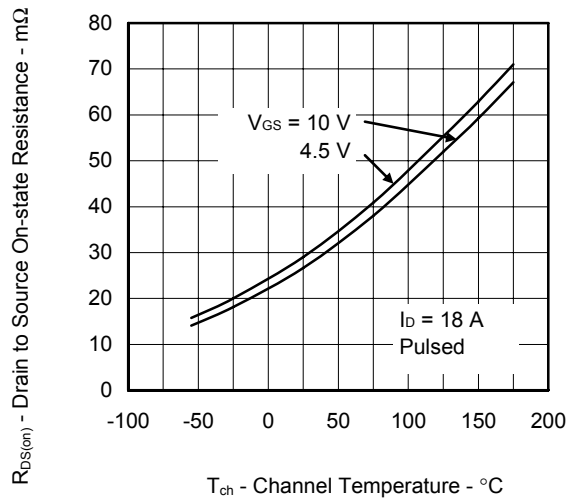
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



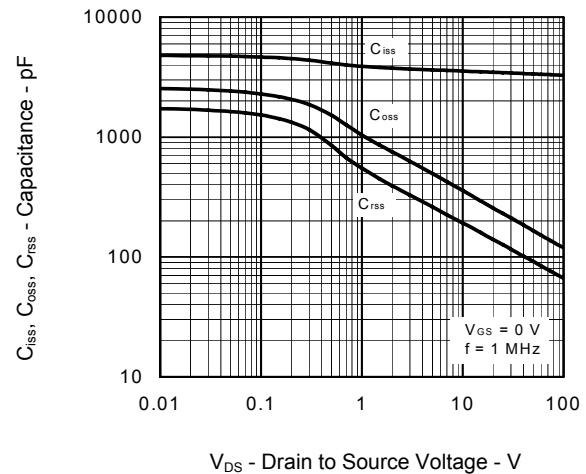
DRAIN CURRENT vs.  
DRAIN TO SOURCE VOLTAGE

FORWARD TRANSFER CHARACTERISTICS

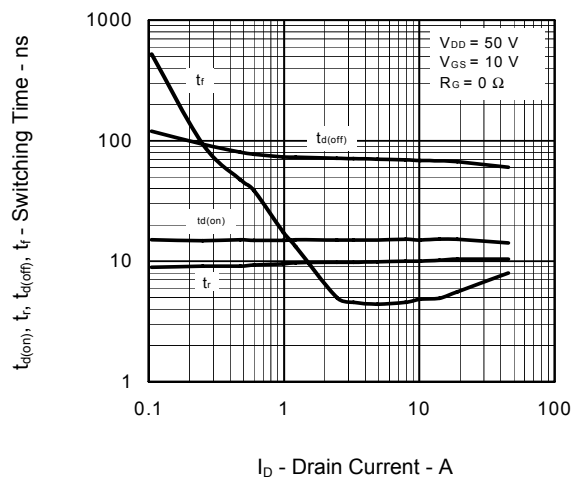
GATE TO SOURCE THRESHOLD VOLTAGE  
vs. CHANNEL TEMPERATUREFORWARD TRANSFER ADMITTANCE vs. DRAIN  
CURRENTDRAIN TO SOURCE ON-STATE RESISTANCE vs.  
DRAIN CURRENTDRAIN TO SOURCE ON-STATE RESISTANCE  
vs. GATE TO SOURCE VOLTAGE

DRAIN TO SOURCE ON-STATE RESISTANCE vs.  
CHANNEL TEMPERATURE

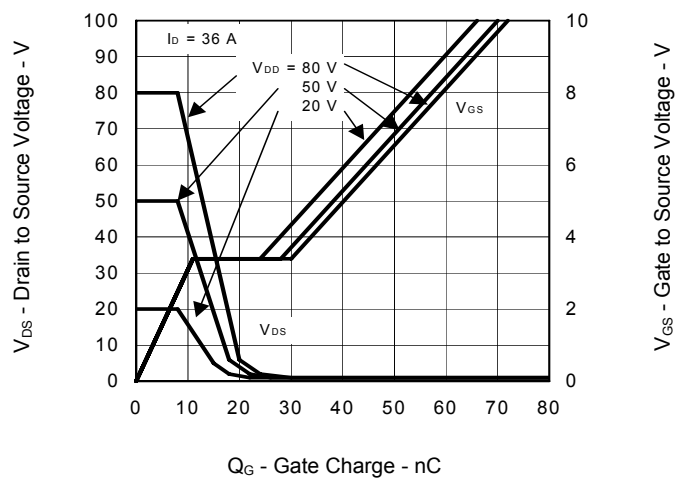
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



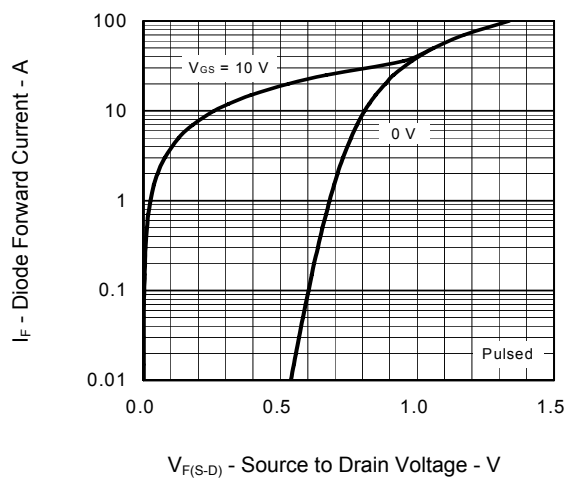
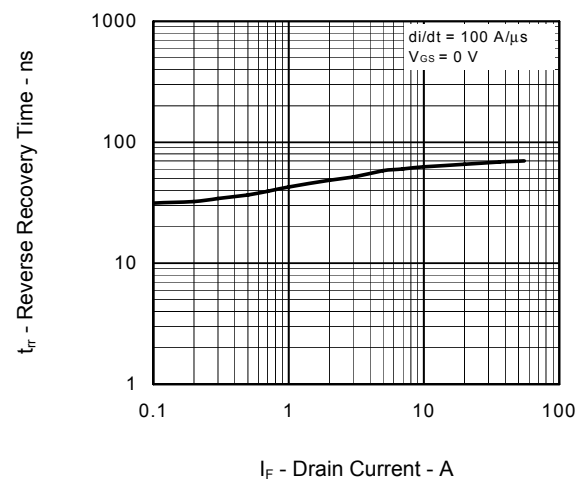
SWITCHING CHARACTERISTICS



DYNAMIC INPUT/OUTPUT CHARACTERISTICS

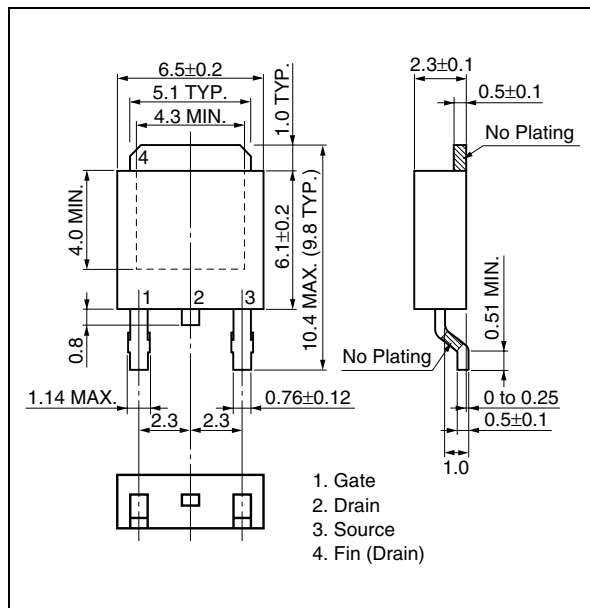


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

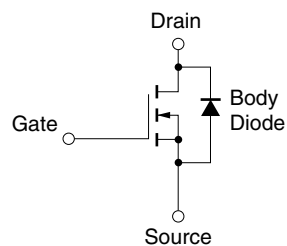
REVERSE RECOVERY TIME vs.  
DRAIN CURRENT

## Package Drawing (Unit: mm)

TO-252 (MP-3ZK) (Mass: 0.27 g TYP.)



## 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>NP36N10SDE Data Sheet</b>
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<b>Rev.</b>	<b>Date</b>	<b>Description</b>	
		<b>Page</b>	<b>Summary</b>
1.00	Sep 21, 2011	–	First Edition Issued

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