

# NP89N04MUK, NP89N04NUK

R07DS0599EJ0100

Rev.1.00

## MOS FIELD EFFECT TRANSISTOR

Jan 11, 2012

### Description

These products are N-channel MOS Field Effect Transistors designed for high current switching applications.

### Features

- Super low on-state resistance  
 $R_{DS(on)} = 3.3 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 45 \text{ A)}$
- Low  $C_{iss}$ :  $C_{iss} = 3900 \text{ pF TYP. (} V_{DS} = 25 \text{ V)}$
- Designed for automotive application and AEC-Q101 qualified

### Ordering Information

Part No.	Lead Plating	Packing	Package
NP89N04MUK-S18-AY *1	Pure Sn (Tin)	Tube 50 p/tube	TO-220 (MP-25K)
NP89N04NUK-S18-AY *1			TO-262 (MP-25SK)

Note: \*1 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 ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	40	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 90$	A
Drain Current (pulse) *1	$I_{D(pulse)}$	$\pm 360$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	147	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T2}$	1.8	W
Channel Temperature	$T_{ch}$	175	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to 175	$^\circ\text{C}$
Repetitive Avalanche Current *2	$I_{AR}$	37	A
Repetitive Avalanche Energy *2	$E_{AR}$	136	mJ

Notes: \*1  $T_C = 25^\circ\text{C}$ ,  $P_W \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

\*2  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$

### Thermal Resistance

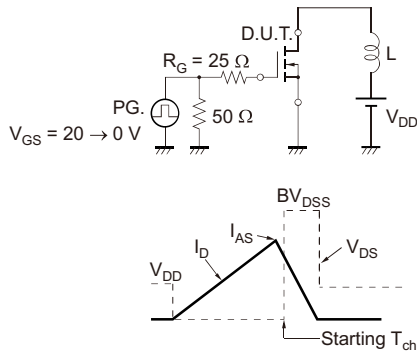
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.02	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	$^\circ\text{C/W}$

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

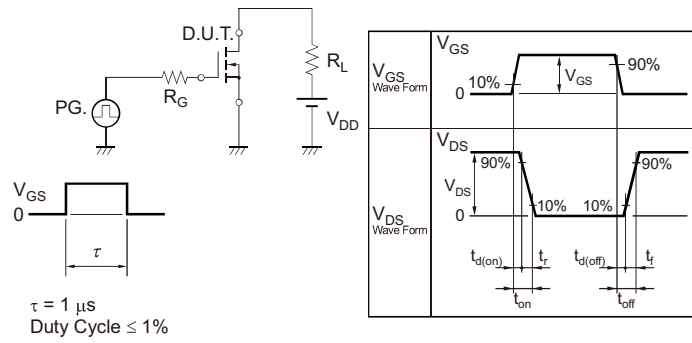
Item	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	1	$\mu\text{A}$	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$
Gate Leakage Current	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$
Gate to Source Threshold Voltage	$V_{GS(th)}$	2.0	3.0	4.0	V	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$
Forward Transfer Admittance *1	$ y_{fs} $	30	60	—	S	$V_{DS} = 5\text{ V}, I_D = 45\text{ A}$
Drain to Source On-state Resistance *1	$R_{DS(on)}$	—	2.75	3.30	m $\Omega$	$V_{GS} = 10\text{ V}, I_D = 45\text{ A}$
Input Capacitance	$C_{iss}$	—	3900	5850	pF	$V_{DS} = 25\text{ V}$
Output Capacitance	$C_{oss}$	—	530	800	pF	$V_{GS} = 0\text{ V}$
Reverse Transfer Capacitance	$C_{rss}$	—	200	360	pF	$f = 1\text{ MHz}$
Turn-on Delay Time	$t_{d(on)}$	—	25	60	ns	$V_{DD} = 20\text{ V}, I_D = 45\text{ A}$
Rise Time	$t_r$	—	12	30	ns	$V_{GS} = 10\text{ V}$
Turn-off Delay Time	$t_{d(off)}$	—	65	130	ns	$R_G = 0\ \Omega$
Fall Time	$t_f$	—	8	20	ns	
Total Gate Charge	$Q_G$	—	68	102	nC	$V_{DD} = 32\text{ V}$
Gate to Source Charge	$Q_{GS}$	—	18	—	nC	$V_{GS} = 10\text{ V}$
Gate to Drain Charge	$Q_{GD}$	—	18	—	nC	$I_D = 90\text{ A}$
Body Diode Forward Voltage *1	$V_{F(S-D)}$	—	0.95	1.5	V	$I_F = 90\text{ A}, V_{GS} = 0\text{ V}$
Reverse Recovery Time	$t_{rr}$	—	47	—	ns	$I_F = 90\text{ A}, V_{GS} = 0\text{ V}$
Reverse Recovery Charge	$Q_{rr}$	—	68	—	nC	$di/dt = 100\text{ A}/\mu\text{s}$

Note: \*1 Pulsed test

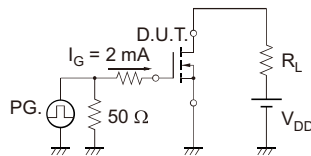
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



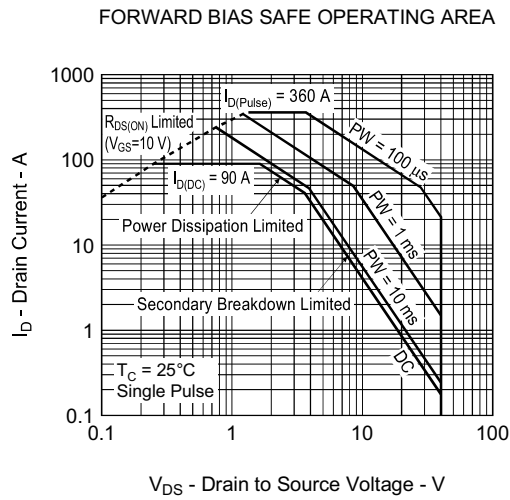
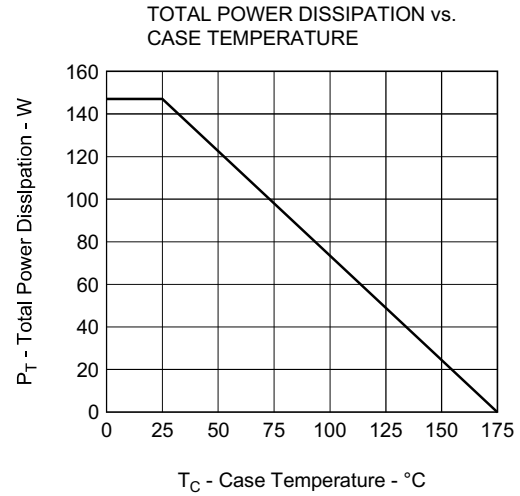
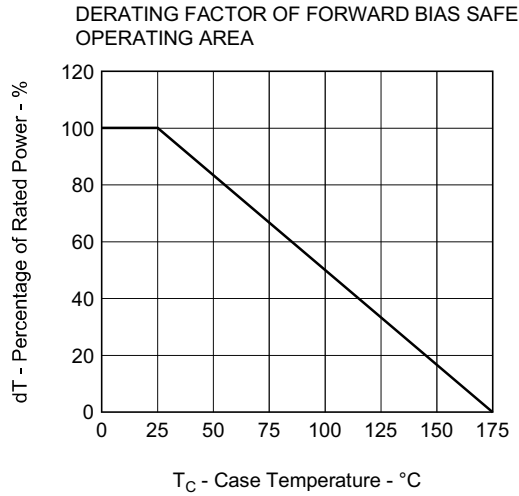
**TEST CIRCUIT 2 SWITCHING TIME**



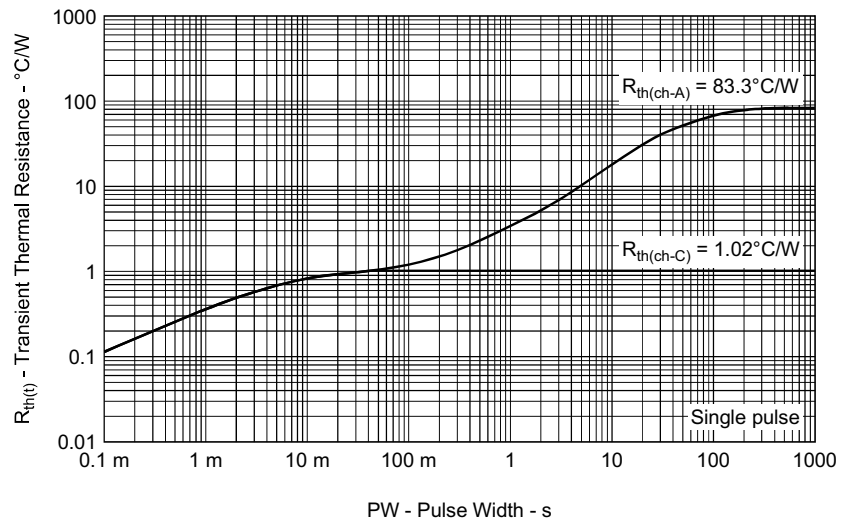
**TEST CIRCUIT 3 GATE CHARGE**

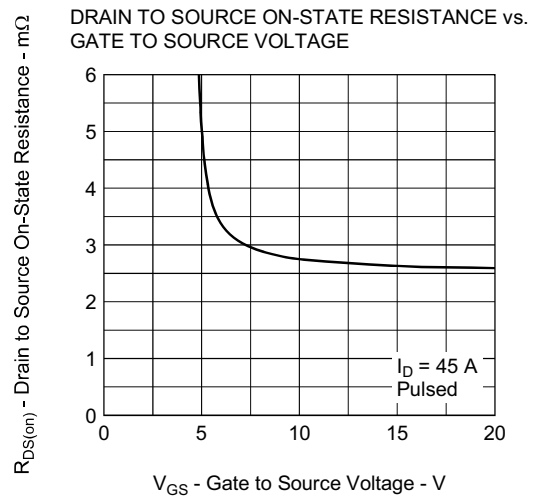
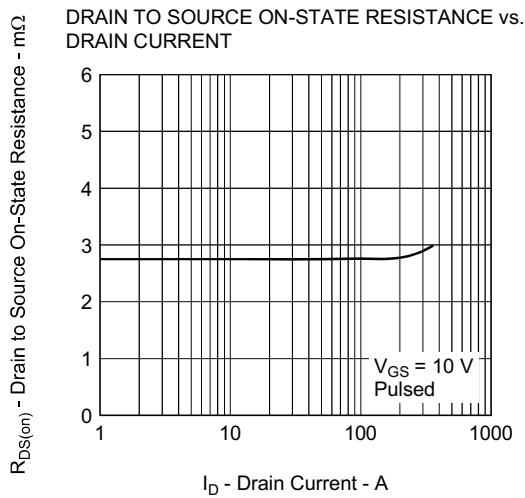
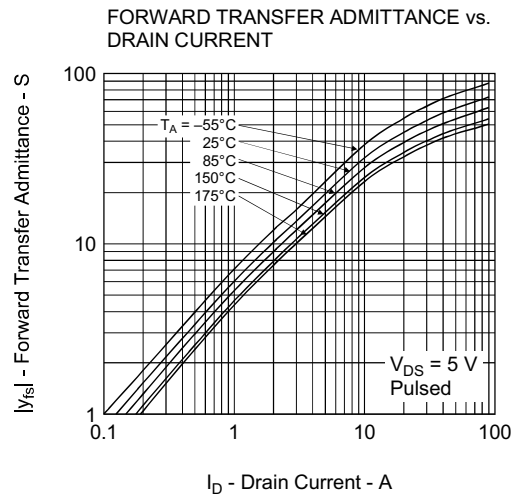
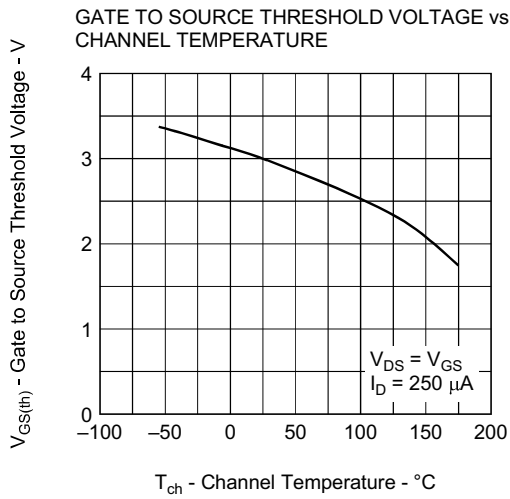
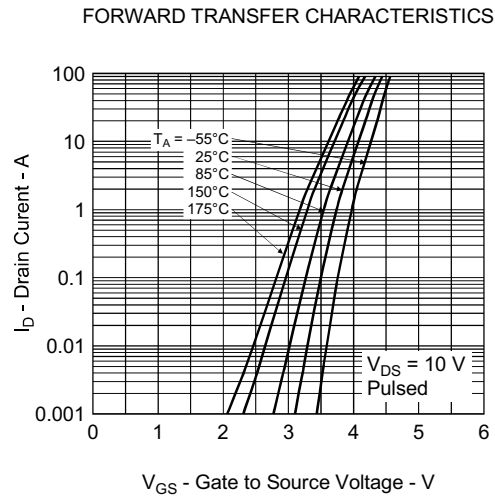
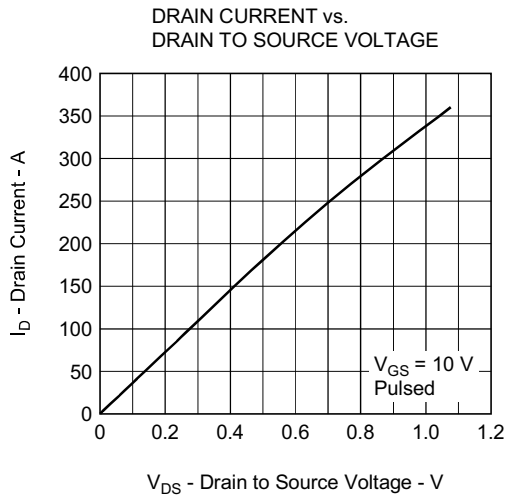


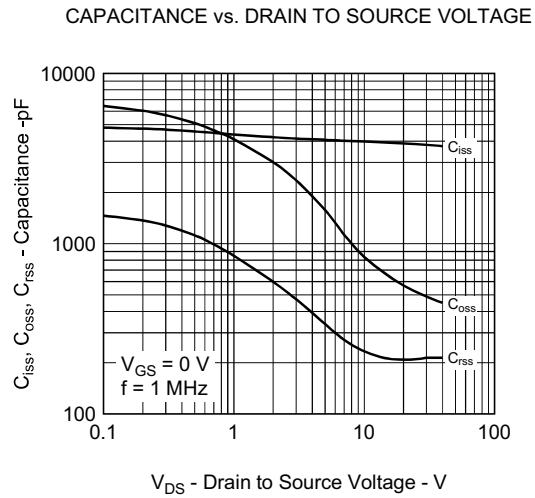
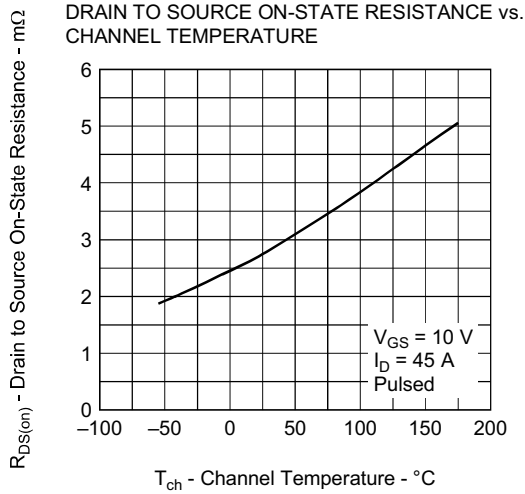
Typical Characteristics ( $T_A = 25^\circ\text{C}$ )



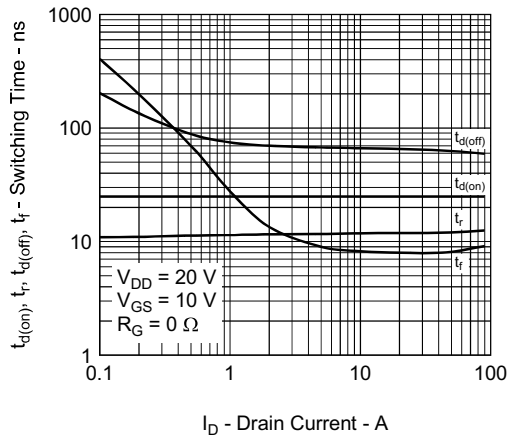
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



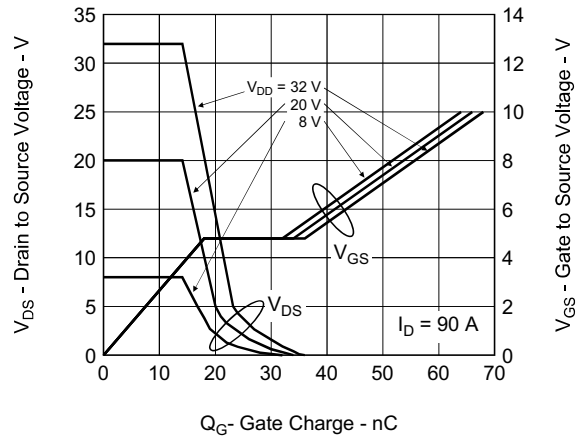




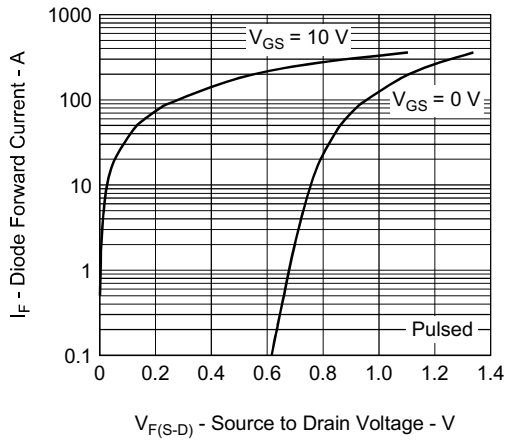
**SWITCHING CHARACTERISTICS**



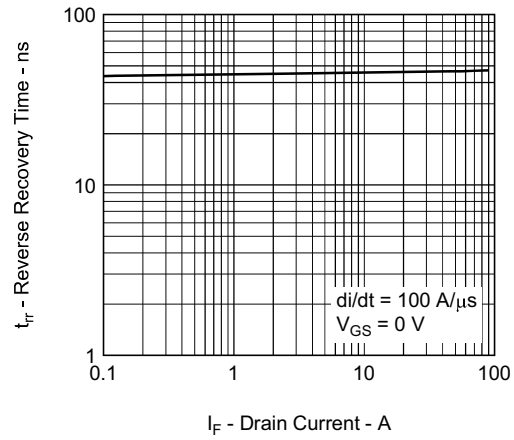
**DYNAMIC INPUT/OUTPUT CHARACTERISTICS**



**SOURCE TO DRAIN DIODE FORWARD VOLTAGE**

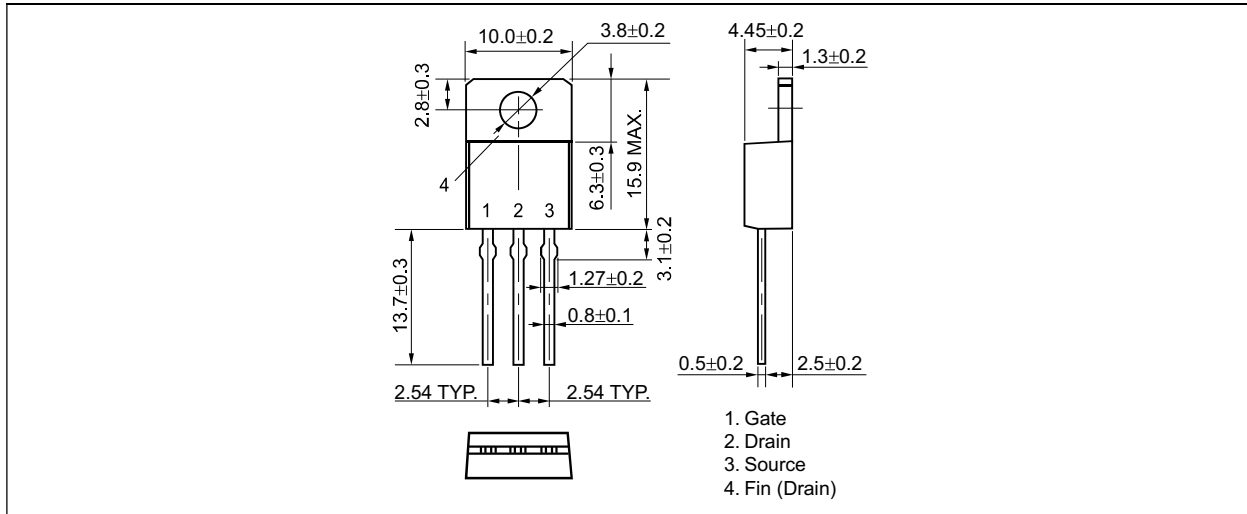


**REVERSE RECOVERY TIME vs. DRAIN CURRENT**

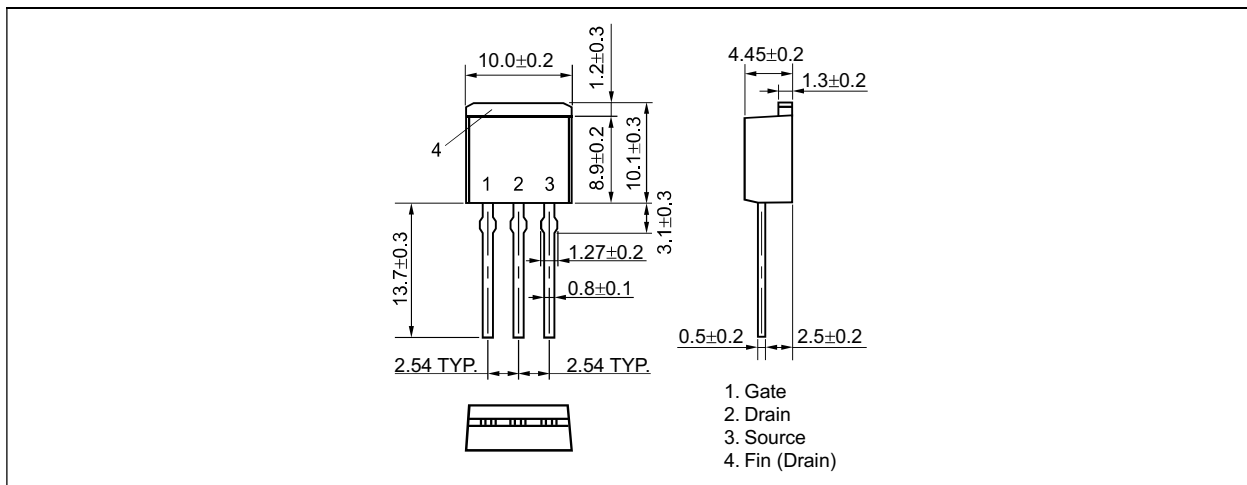


Package Drawing (Unit: mm)

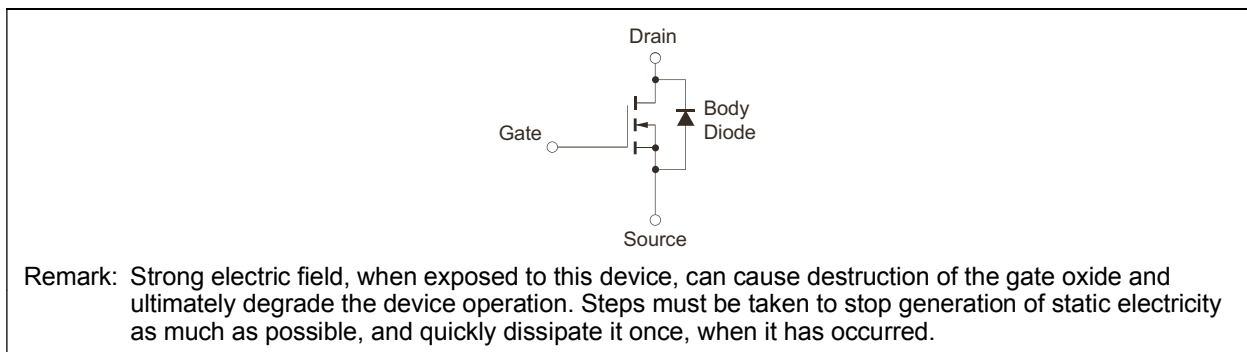
TO-220 (MP-25K) (Mass: 1.9 g TYP.)



TO-262 (MP-25SK) (Mass: 1.8 g TYP.)



Equivalent Circuit



<b>Revision History</b>	<b>NP89N04MUK, NP89N04NUK Data Sheet</b>
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<b>Rev.</b>	<b>Date</b>	<b>Description</b>	
		<b>Page</b>	<b>Summary</b>
1.00	Jan 11, 2012	—	First Edition Issued

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