

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}	± 20	V
Drain Current (DC) ($T_C = 25^\circ\text{C}$)	$I_{D(DC)}$	± 90	A
Drain Current (pulse) *1	$I_{D(pulse)}$	± 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

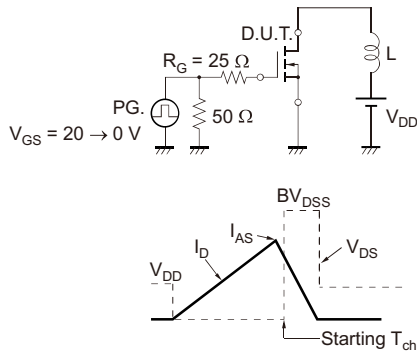
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.02	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	$^\circ\text{C/W}$

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

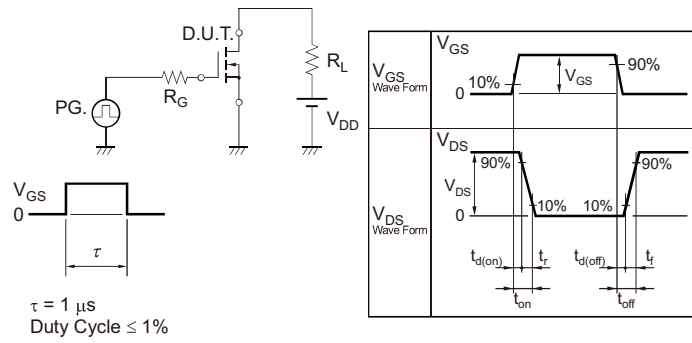
Item	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	μA	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$
Gate Leakage Current	I_{GSS}	—	—	± 100	nA	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$
Gate to Source Threshold Voltage	$V_{GS(th)}$	2.0	3.0	4.0	V	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$
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 Ω	$V_{GS} = 10\text{ V}, I_D = 45\text{ A}$
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

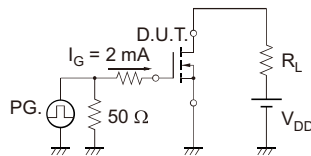
TEST CIRCUIT 1 AVALANCHE CAPABILITY



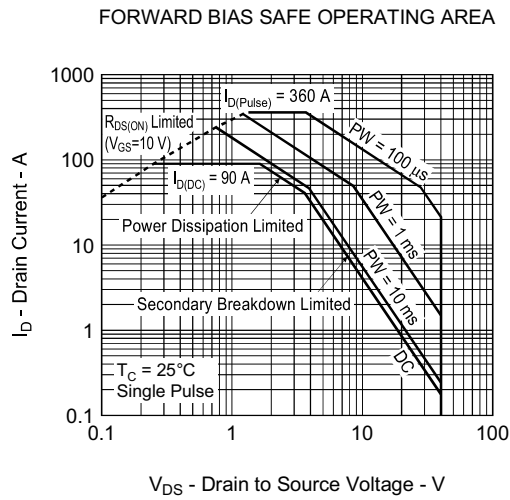
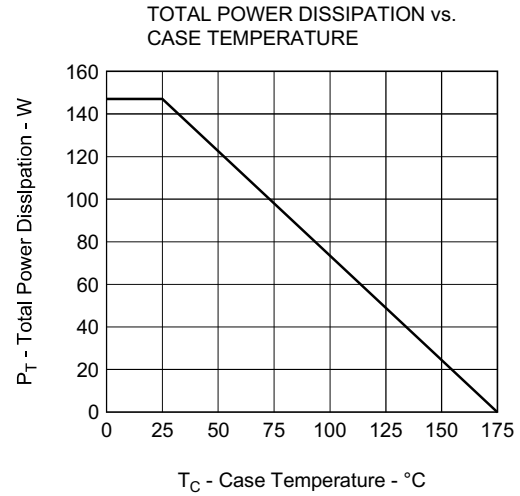
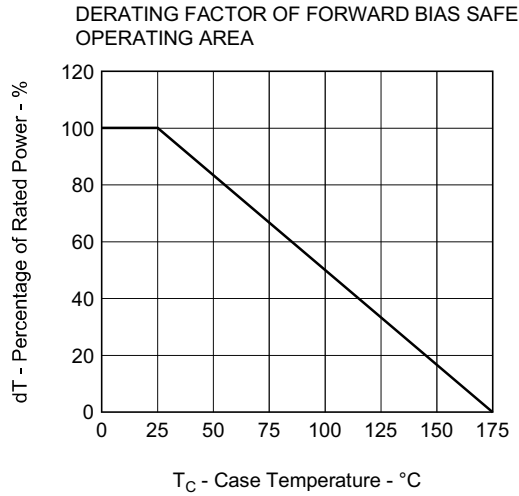
TEST CIRCUIT 2 SWITCHING TIME



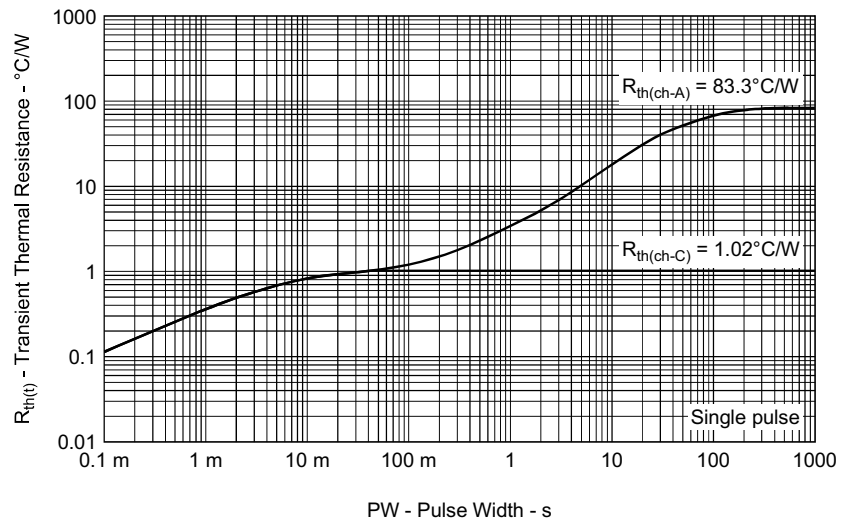
TEST CIRCUIT 3 GATE CHARGE

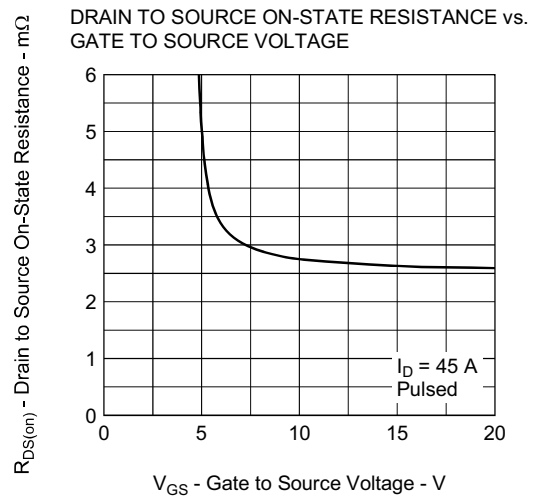
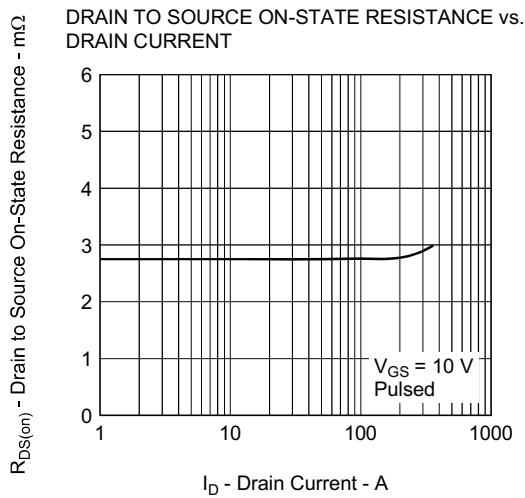
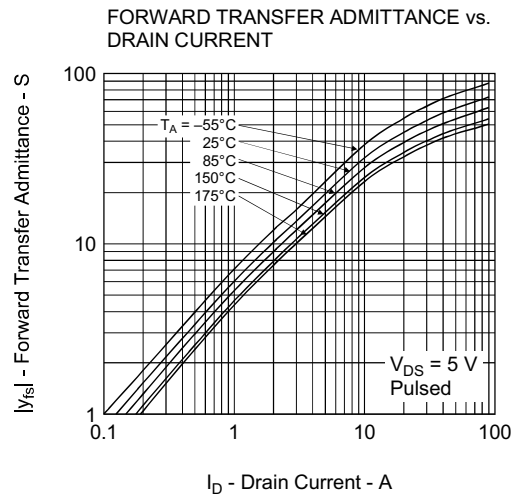
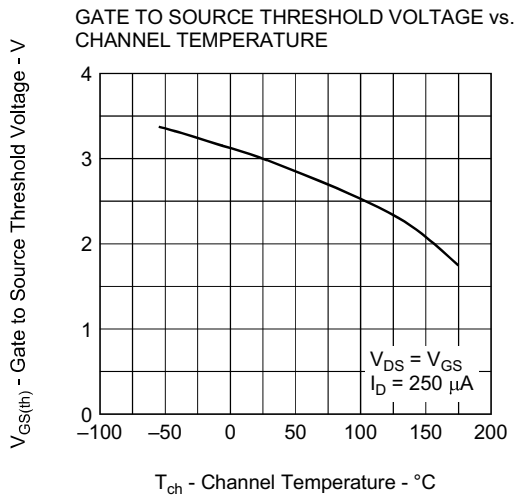
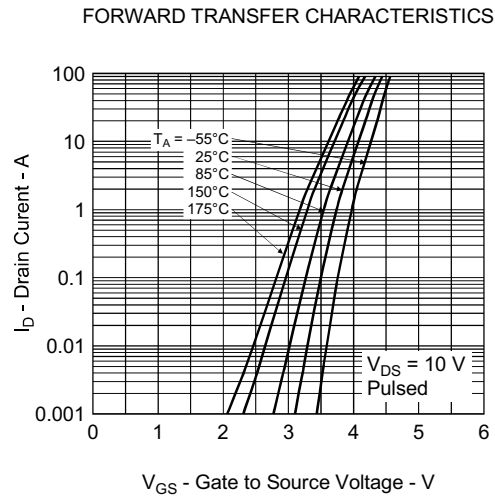
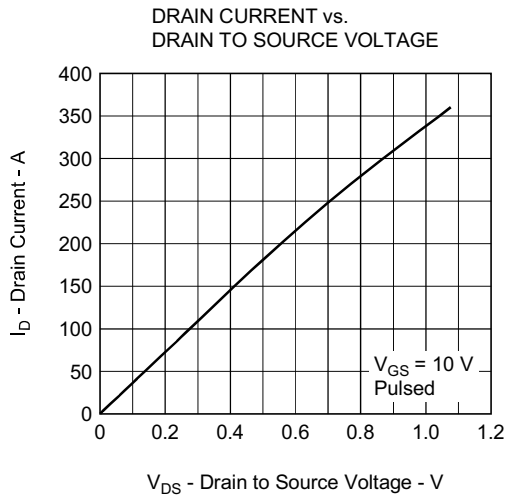


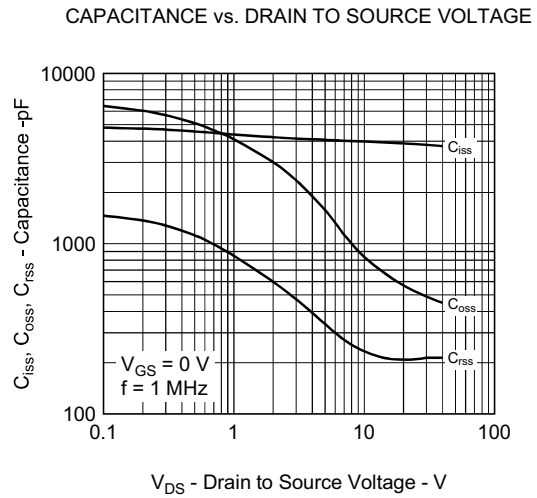
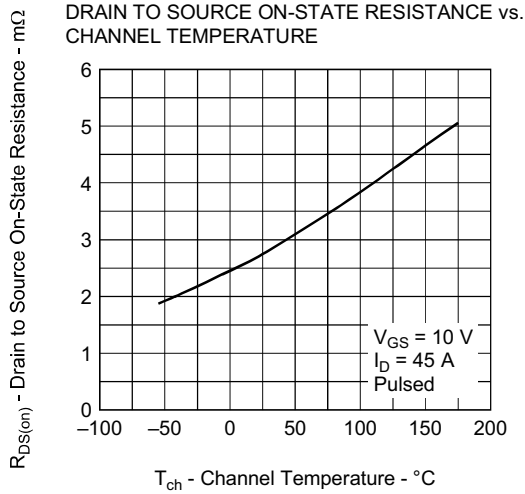
Typical Characteristics ($T_A = 25^\circ\text{C}$)



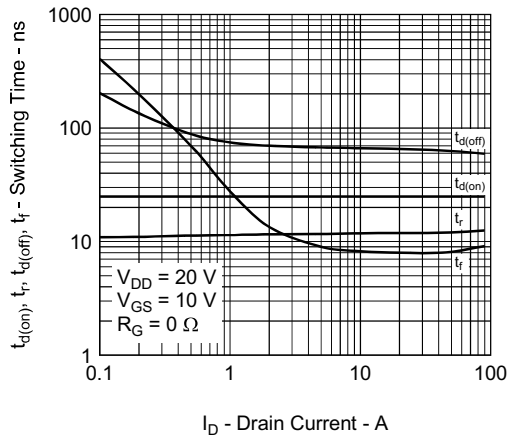
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



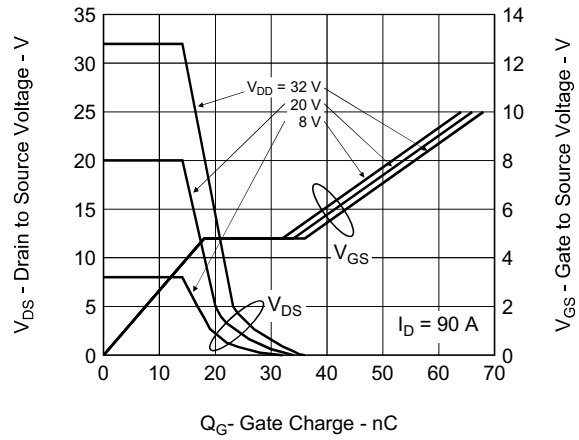




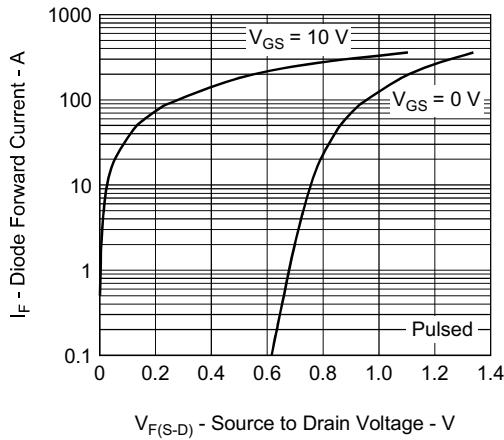
SWITCHING CHARACTERISTICS



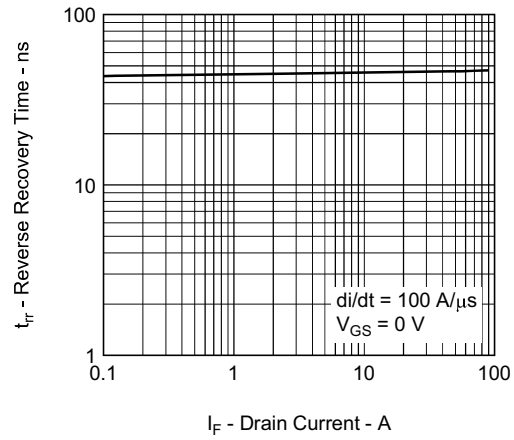
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

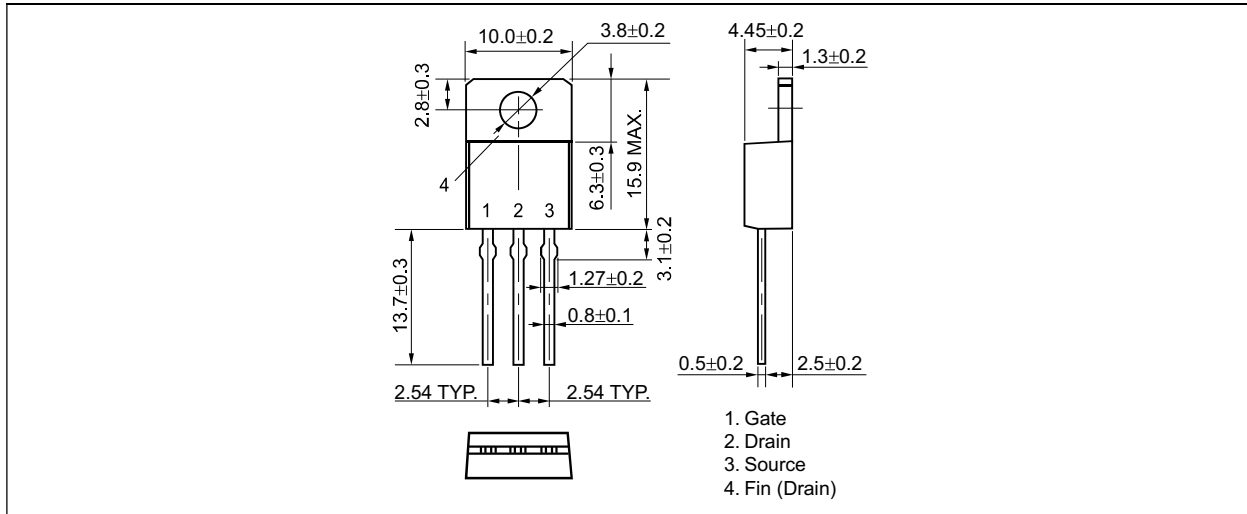


REVERSE RECOVERY TIME vs. DRAIN CURRENT

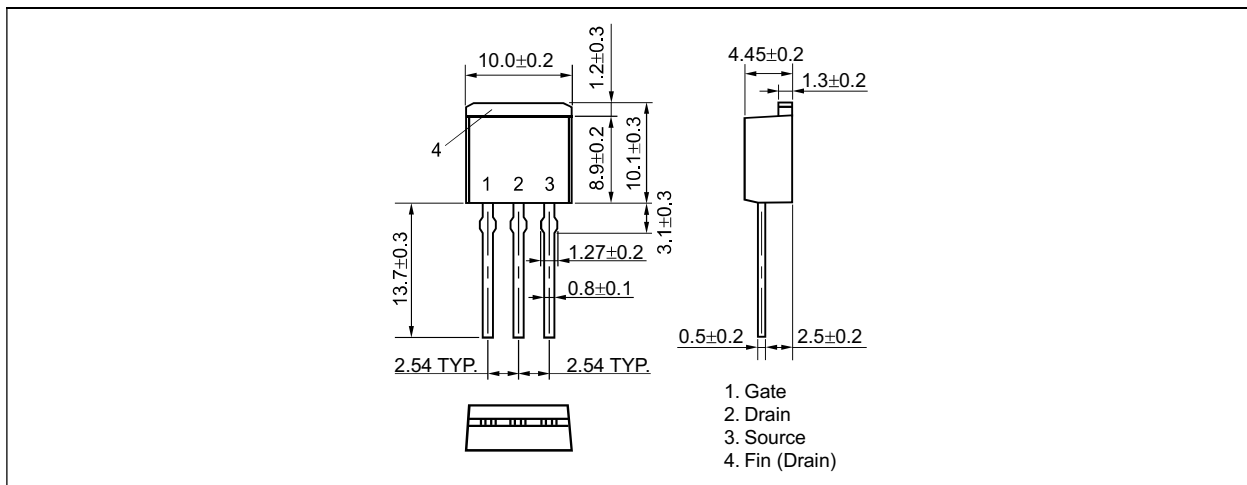


Package Drawing (Unit: mm)

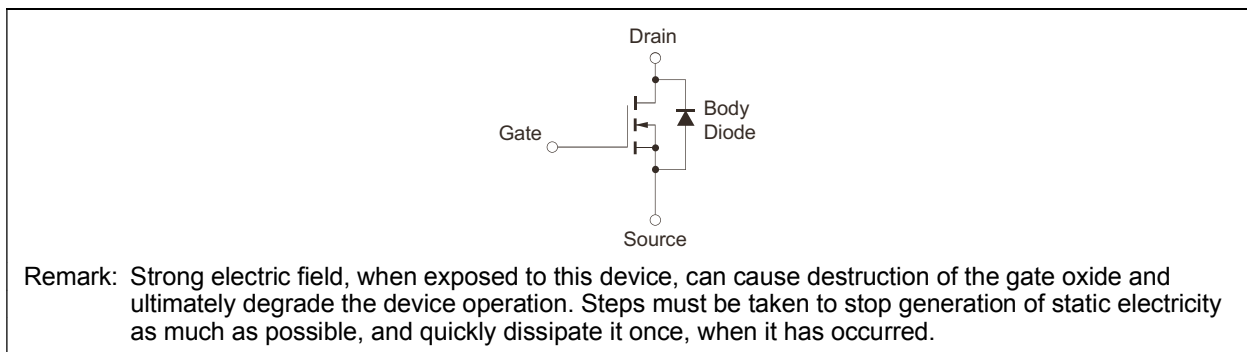
TO-220 (MP-25K) (Mass: 1.9 g TYP.)



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



Equivalent Circuit



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

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