

NP89N04MUK, NP89N04NUK

R07DS0599EJ0100

Rev.1.00

Jan 11, 2012

MOS FIELD EFFECT TRANSISTOR

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

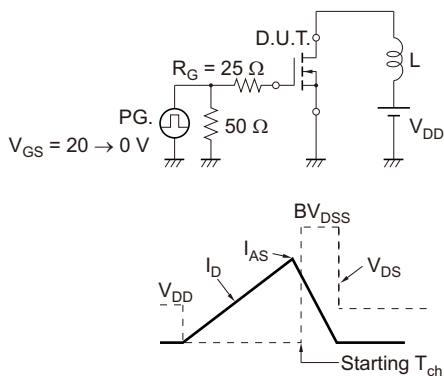
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.02	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	$^\circ\text{C/W}$

Electrical Characteristics (T_A = 25°C)

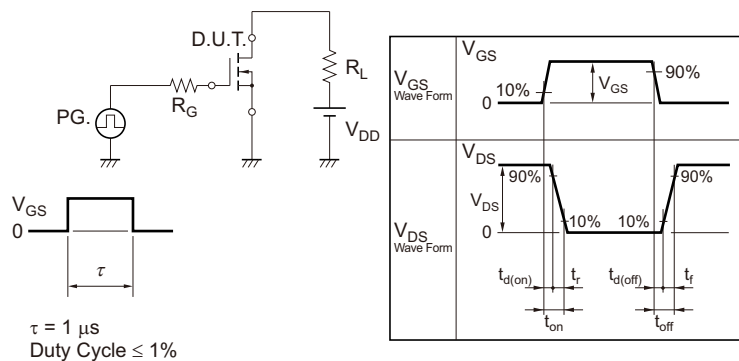
Item	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	I _{DSS}	—	—	1	μA	V _{DS} = 40 V, V _{GS} = 0 V
Gate Leakage Current	I _{GSS}	—	—	±100	nA	V _{GS} = ±20 V, V _{DS} = 0 V
Gate to Source Threshold Voltage	V _{GS(th)}	2.0	3.0	4.0	V	V _{DS} = V _{GS} , I _D = 250 μA
Forward Transfer Admittance *1	y _{fs}	30	60	—	S	V _{DS} = 5 V, I _D = 45 A
Drain to Source On-state Resistance *1	R _{DS(on)}	—	2.75	3.30	mΩ	V _{GS} = 10 V, I _D = 45 A
Input Capacitance	C _{iss}	—	3900	5850	pF	V _{DS} = 25 V V _{GS} = 0 V f = 1 MHz
Output Capacitance	C _{oss}	—	530	800	pF	
Reverse Transfer Capacitance	C _{rss}	—	200	360	pF	
Turn-on Delay Time	t _{d(on)}	—	25	60	ns	V _{DD} = 20 V, I _D = 45 A V _{GS} = 10 V R _G = 0 Ω
Rise Time	t _r	—	12	30	ns	
Turn-off Delay Time	t _{d(off)}	—	65	130	ns	
Fall Time	t _f	—	8	20	ns	
Total Gate Charge	Q _G	—	68	102	nC	V _{DD} = 32 V
Gate to Source Charge	Q _{GS}	—	18	—	nC	V _{GS} = 10 V
Gate to Drain Charge	Q _{GD}	—	18	—	nC	I _D = 90 A
Body Diode Forward Voltage *1	V _{F(S-D)}	—	0.95	1.5	V	I _F = 90 A, V _{GS} = 0 V
Reverse Recovery Time	t _{rr}	—	47	—	ns	I _F = 90 A, V _{GS} = 0 V
Reverse Recovery Charge	Q _{rr}	—	68	—	nC	di/dt = 100 A/μs

Note: *1 Pulsed test

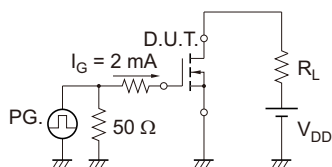
TEST CIRCUIT 1 AVALANCHE CAPABILITY



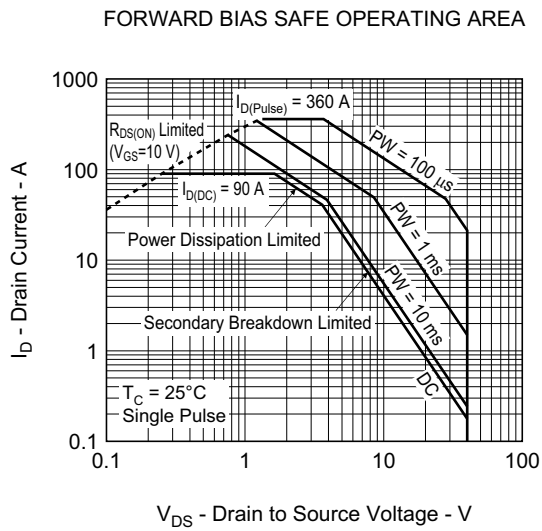
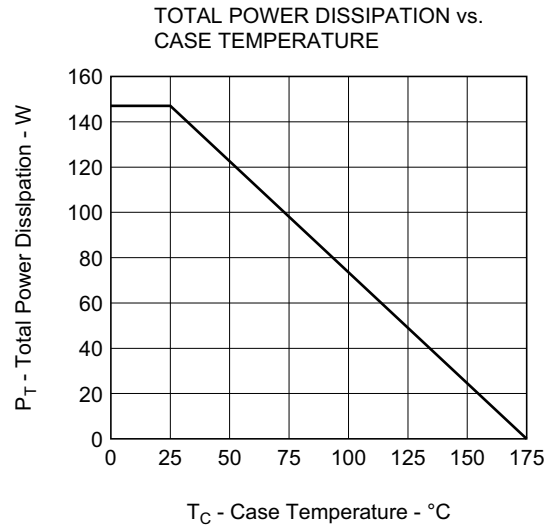
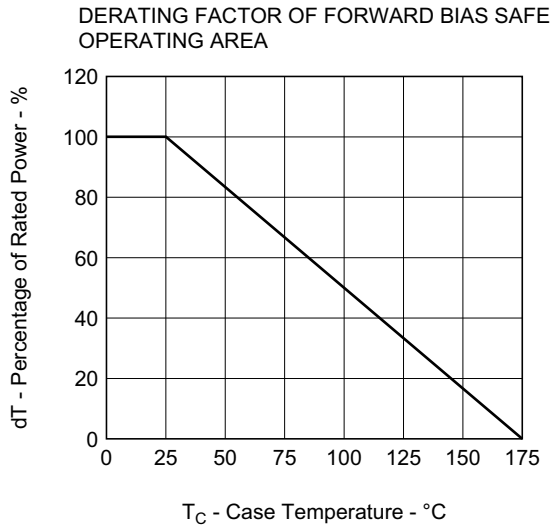
TEST CIRCUIT 2 SWITCHING TIME



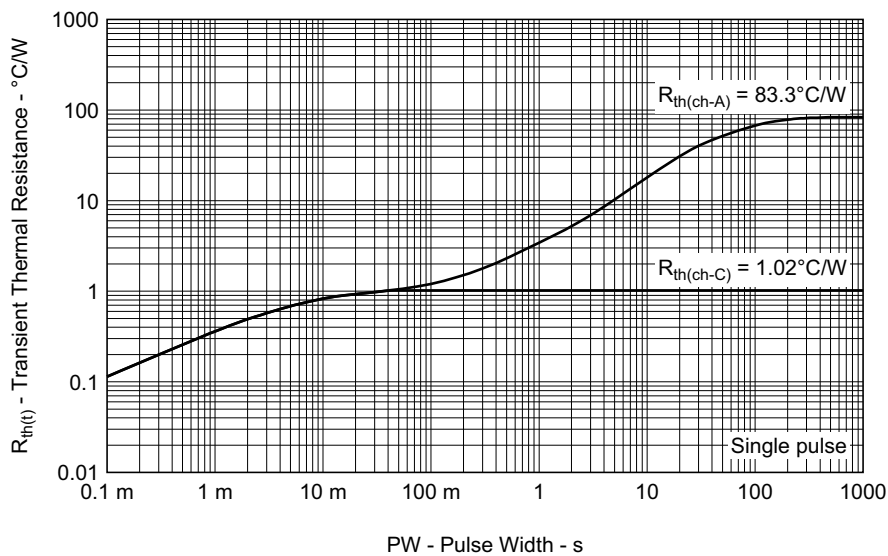
TEST CIRCUIT 3 GATE CHARGE



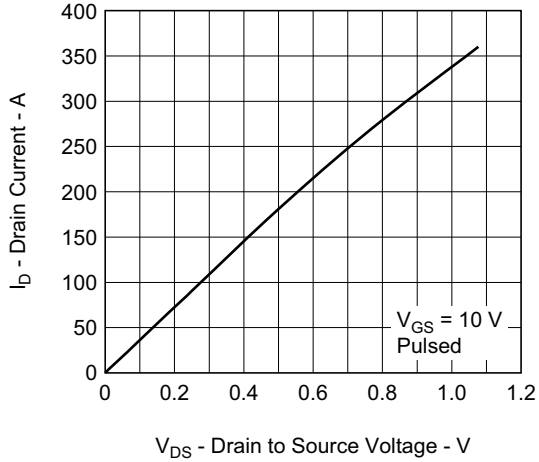
Typical Characteristics ($T_A = 25^\circ\text{C}$)



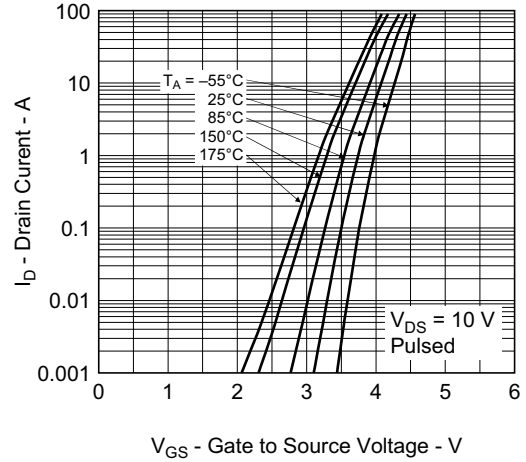
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



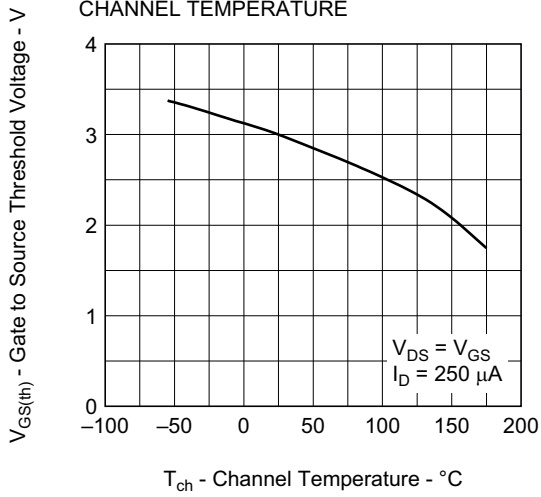
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



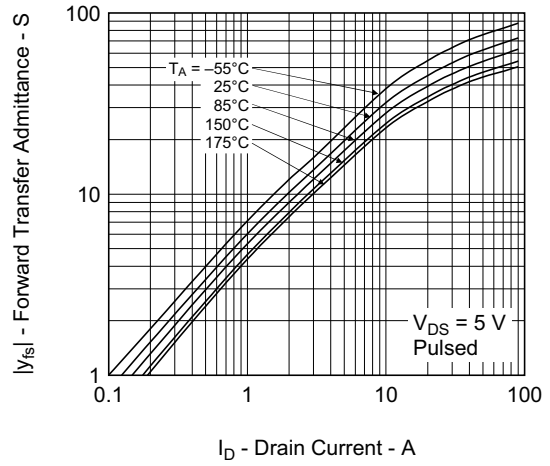
FORWARD TRANSFER CHARACTERISTICS



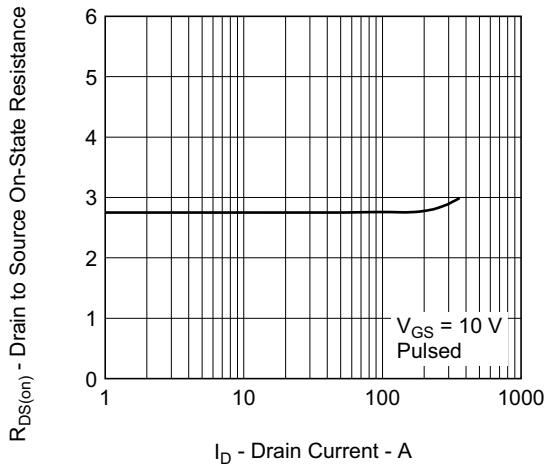
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



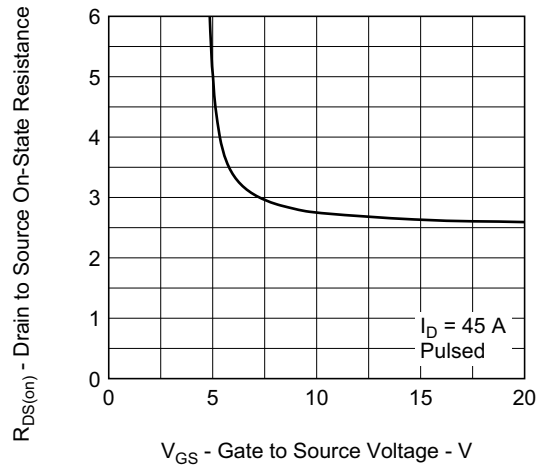
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



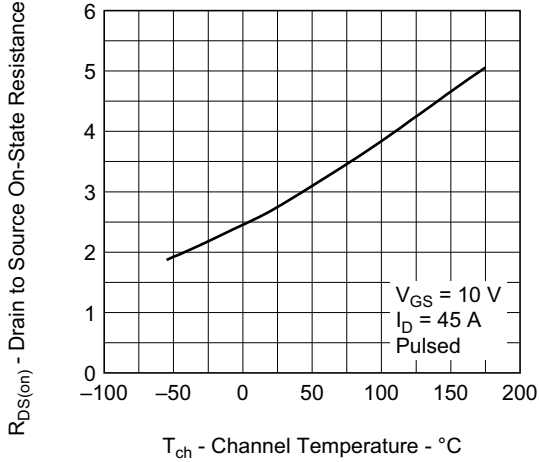
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



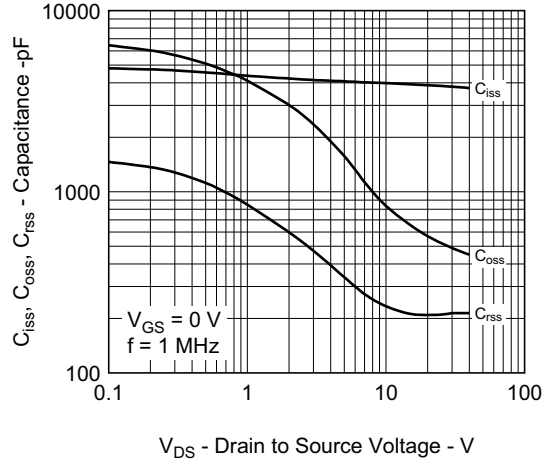
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



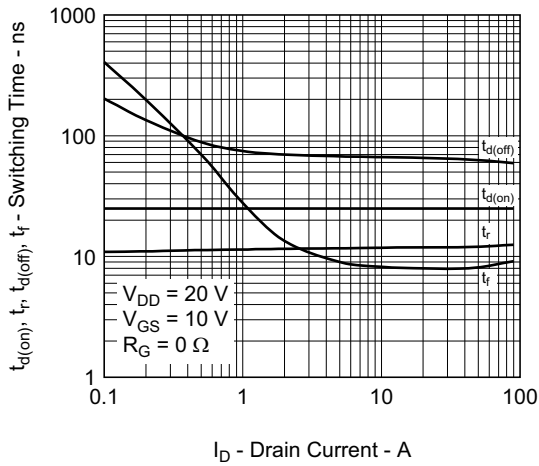
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



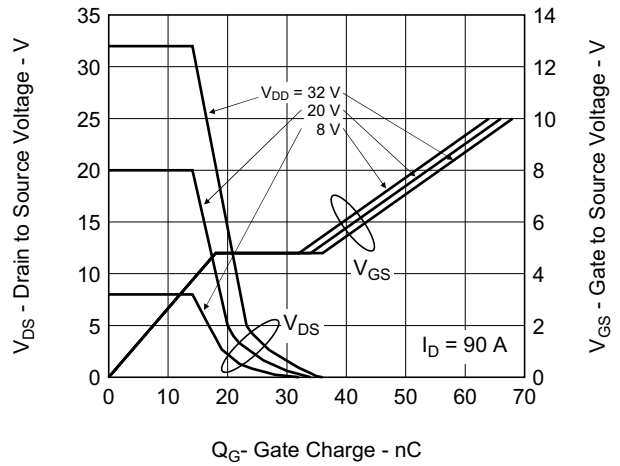
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



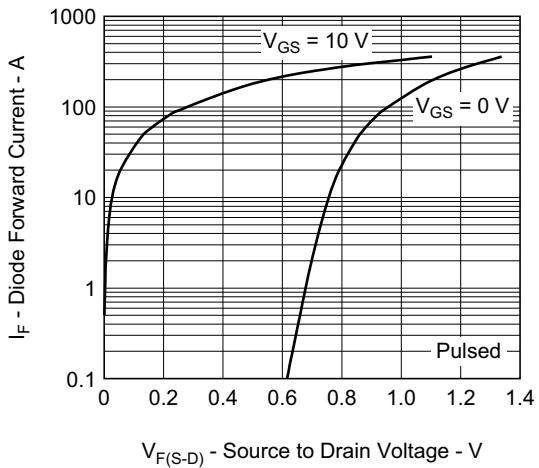
SWITCHING CHARACTERISTICS



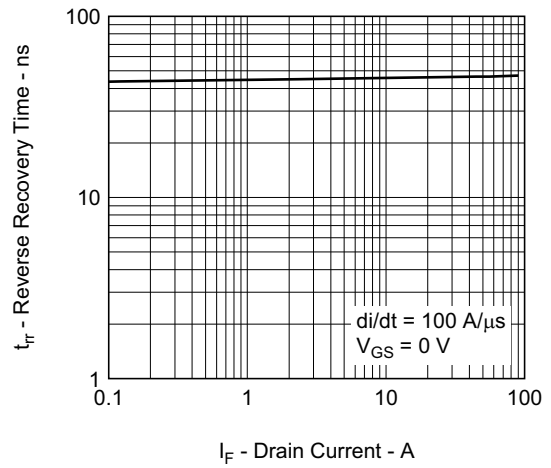
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

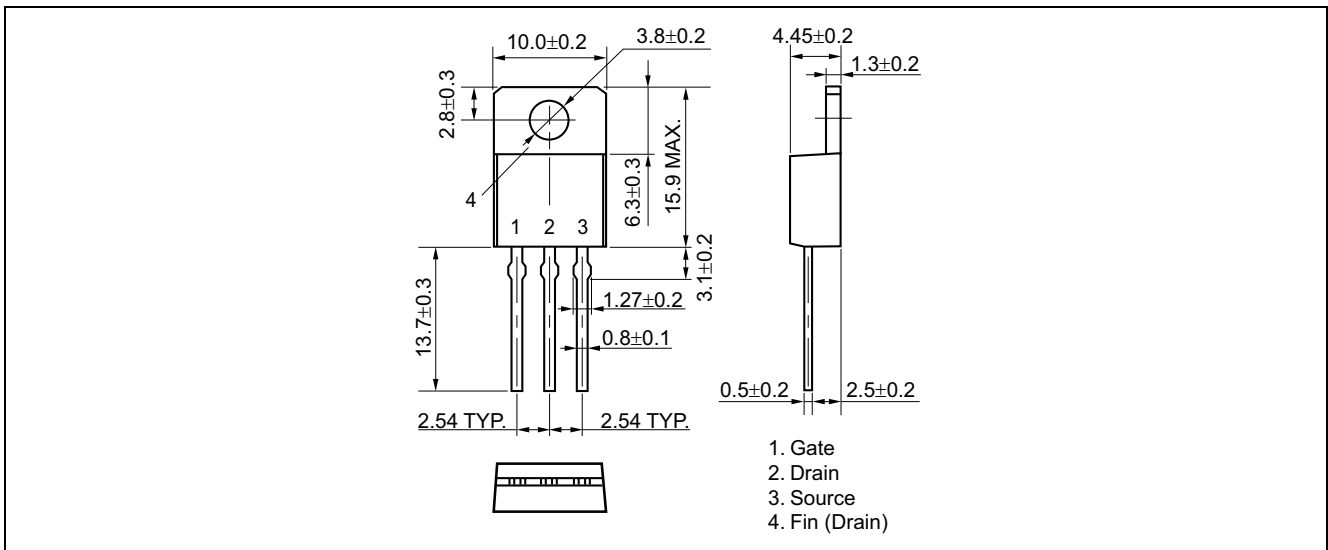


REVERSE RECOVERY TIME vs. DRAIN CURRENT

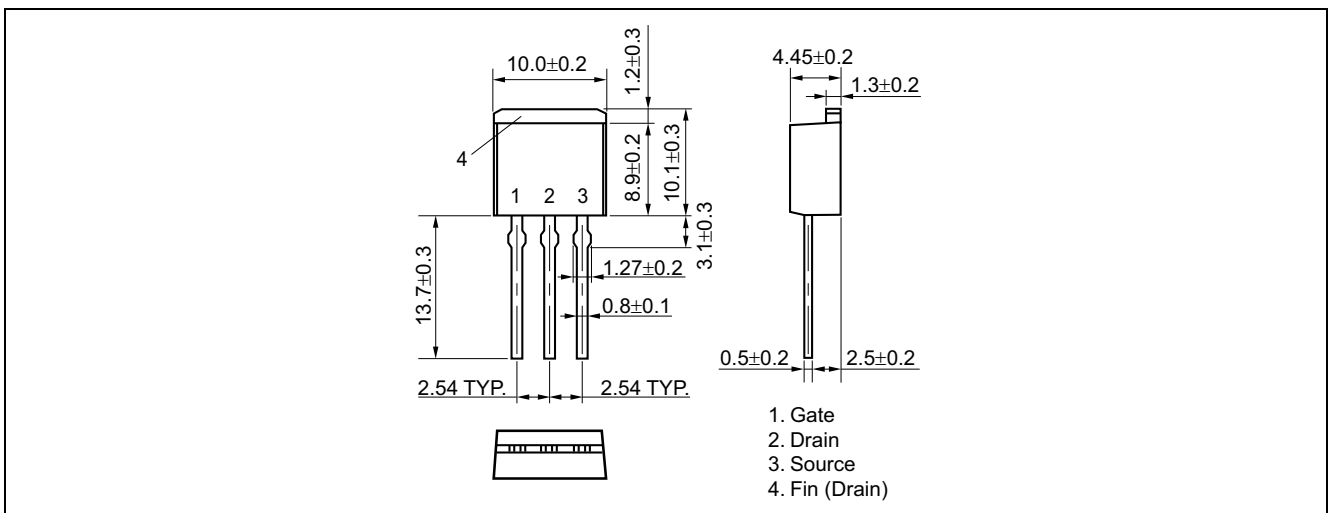


Package Drawing (Unit: mm)

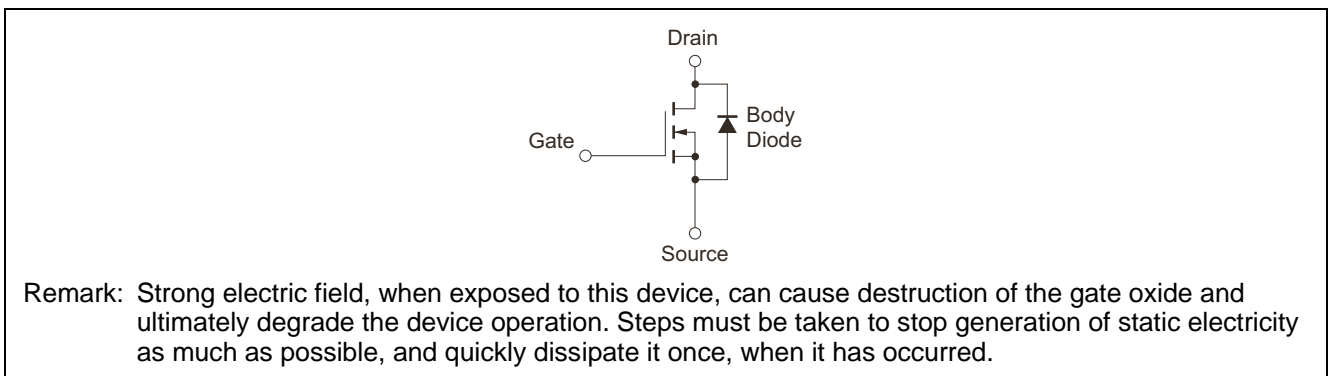
TO-220 (MP-25K) (Mass: 1.9 g TYP.)



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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