

NP89N04MUK, NP89N04NUK

MOS FIELD EFFECT TRANSISTOR

R07DS0599EJ0100

Rev.1.00

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

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

Thermal Resistance

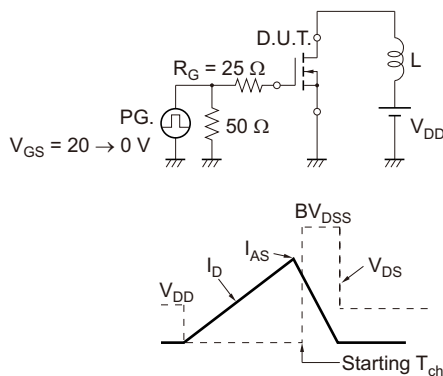
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.02	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	$^\circ\text{C/W}$

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

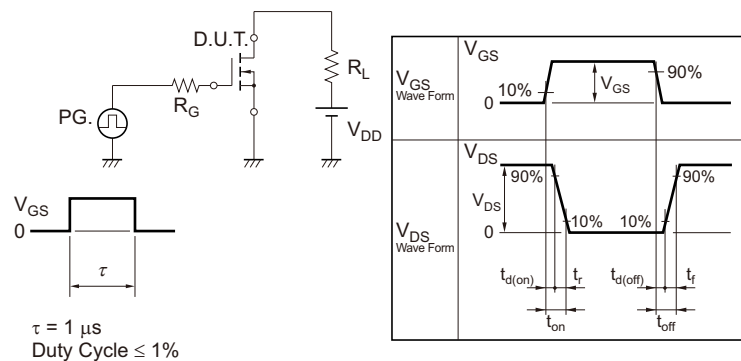
Item	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	μA	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$
Gate Leakage Current	I_{GSS}	—	—	± 100	nA	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$
Gate to Source Threshold Voltage	$V_{GS(th)}$	2.0	3.0	4.0	V	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$
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	$V_{DS} = 25\text{ V}$ $V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$
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	$V_{DD} = 20\text{ V}, I_D = 45\text{ A}$ $V_{GS} = 10\text{ V}$ $R_G = 0\text{ }\Omega$
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	$V_{DD} = 32\text{ V}$
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

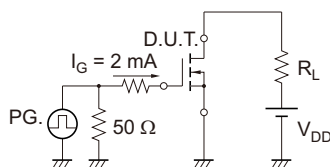
TEST CIRCUIT 1 AVALANCHE CAPABILITY

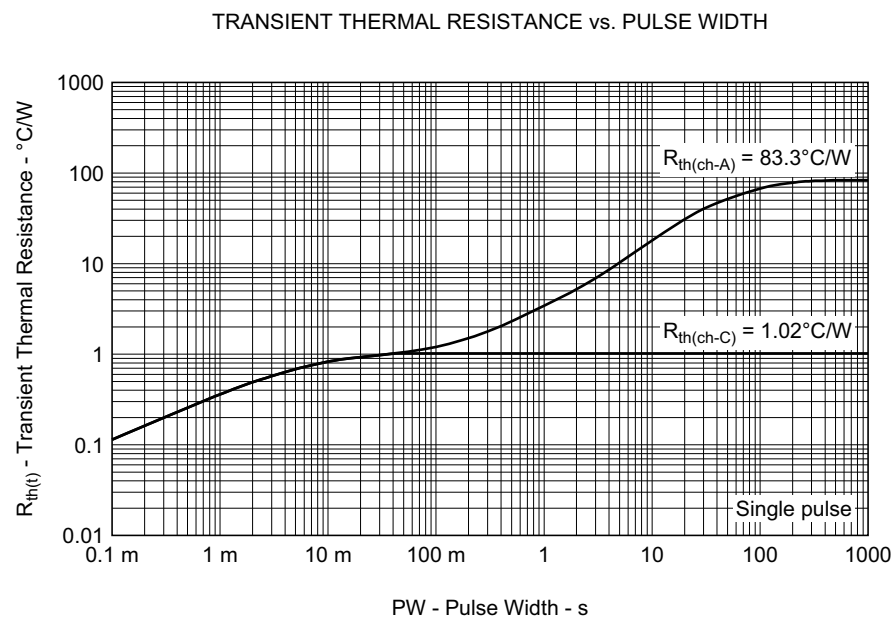
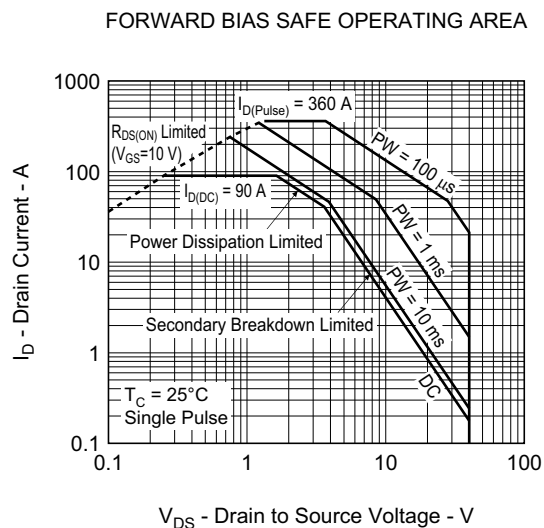
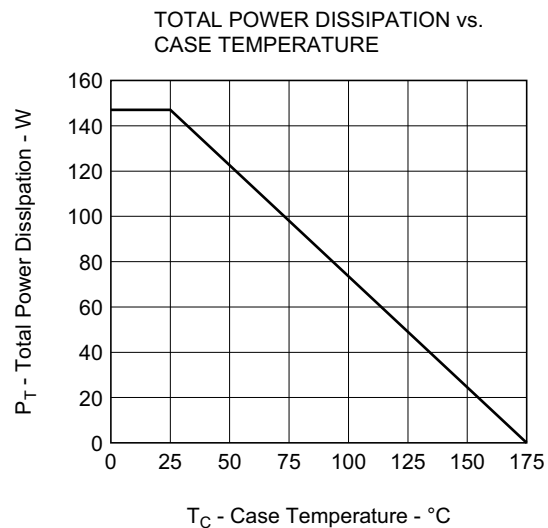
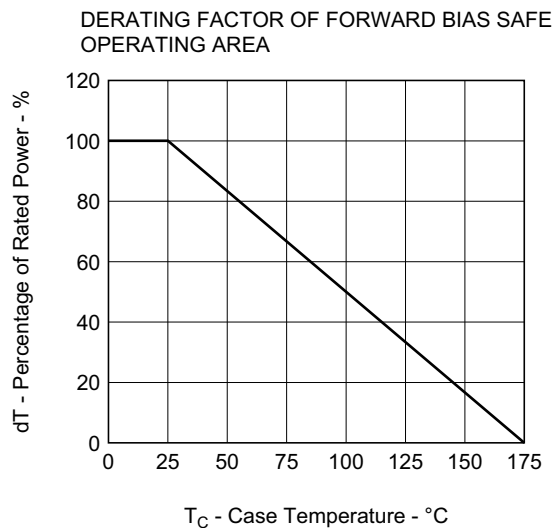


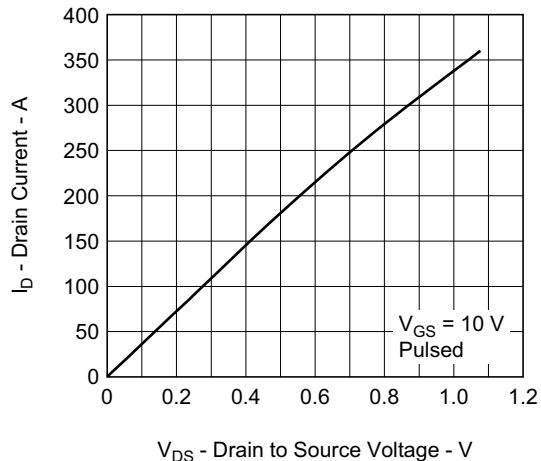
TEST CIRCUIT 2 SWITCHING TIME



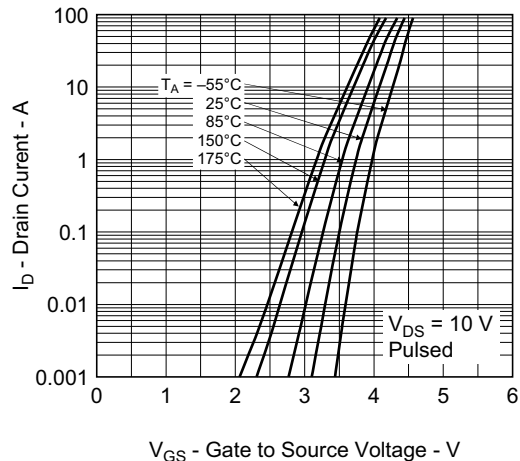
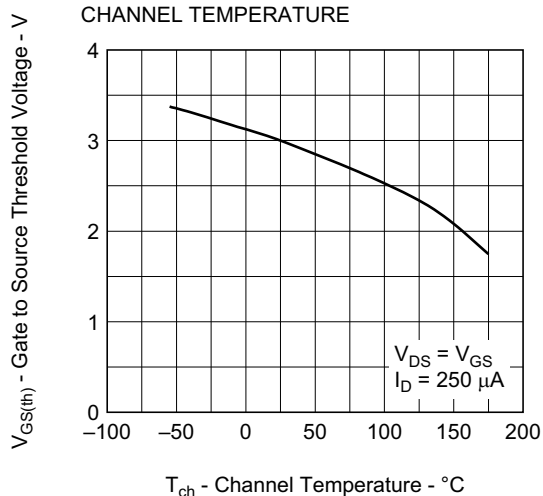
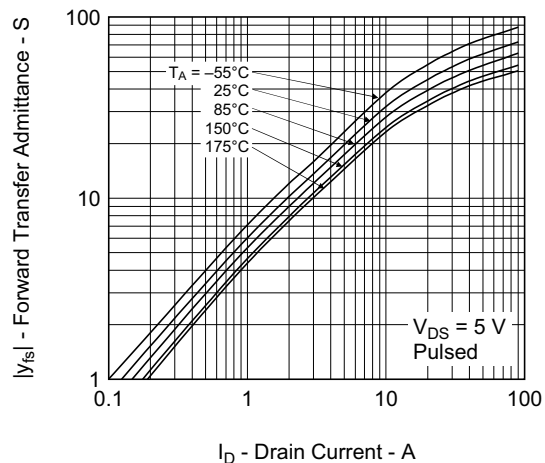
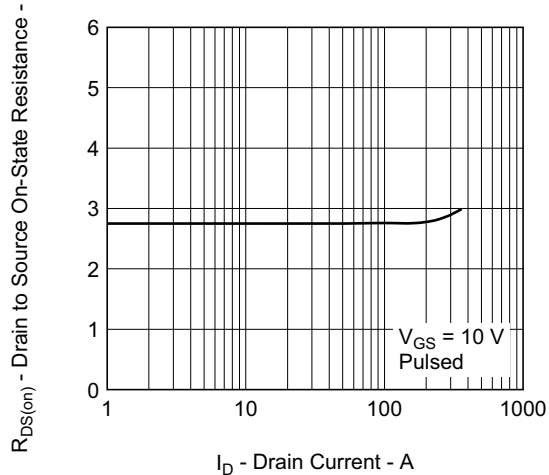
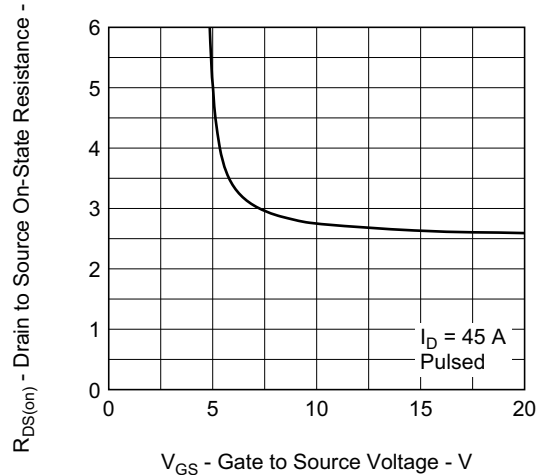
TEST CIRCUIT 3 GATE CHARGE



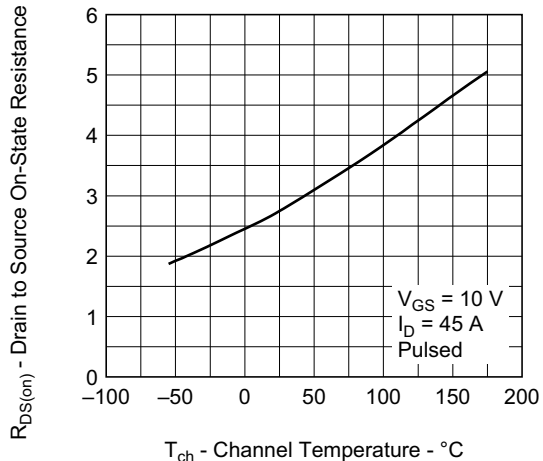
Typical Characteristics ($T_A = 25^\circ\text{C}$)

DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE

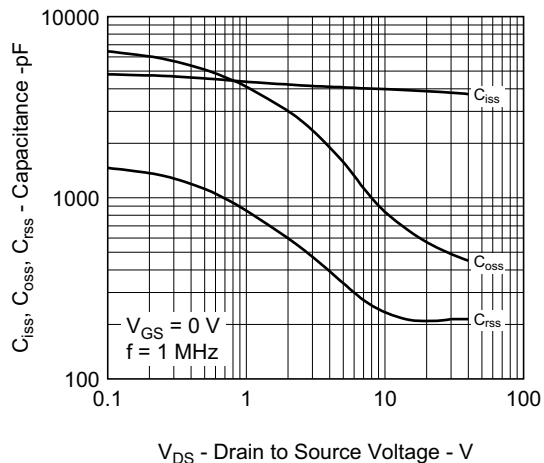
FORWARD TRANSFER CHARACTERISTICS

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

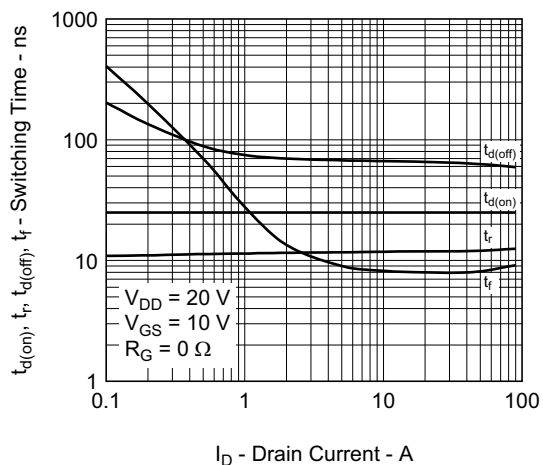
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



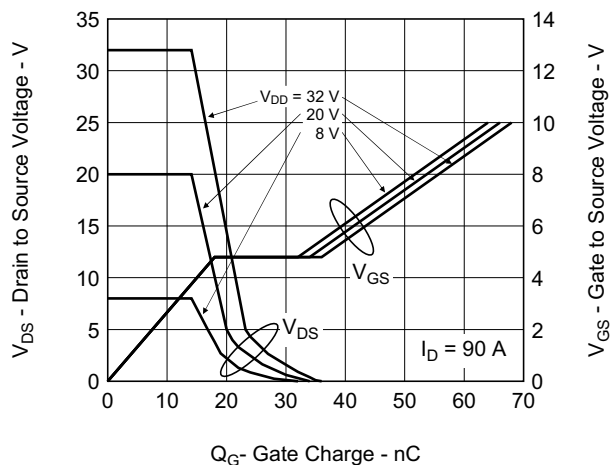
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



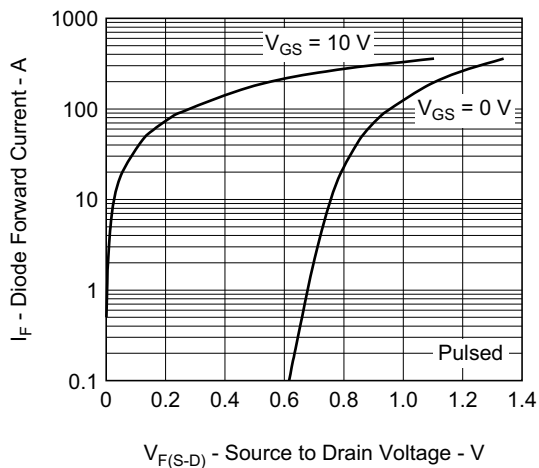
SWITCHING CHARACTERISTICS



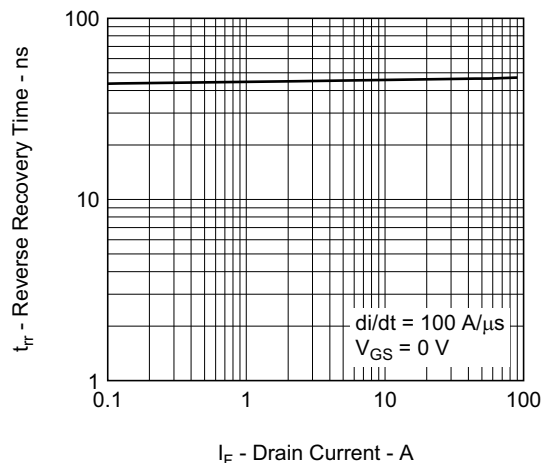
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

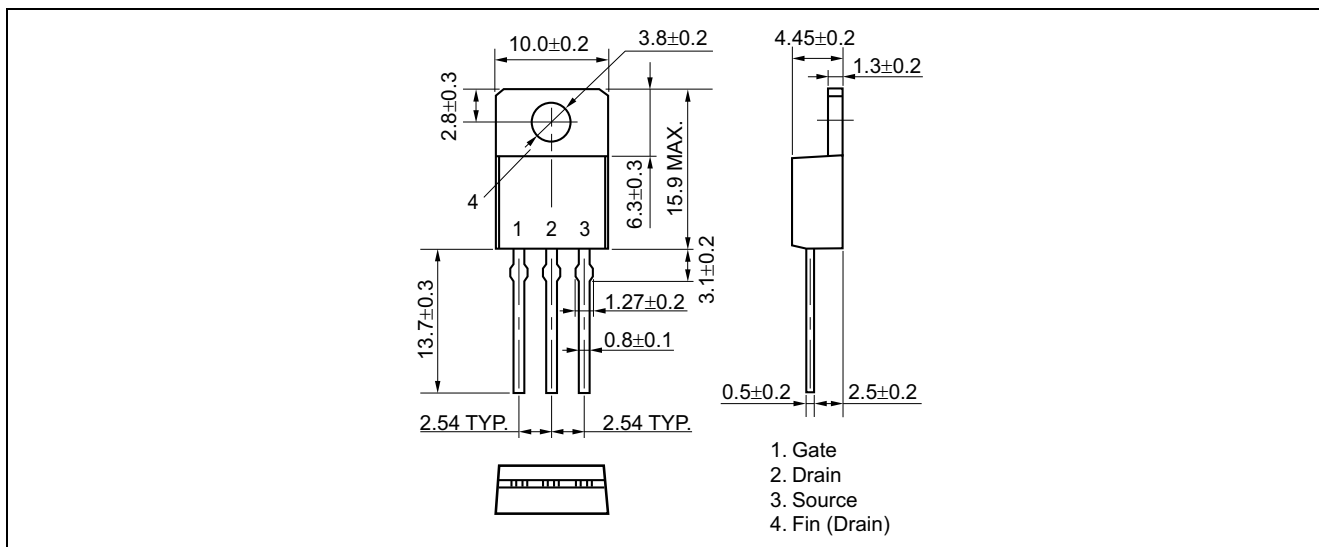


REVERSE RECOVERY TIME vs. DRAIN CURRENT

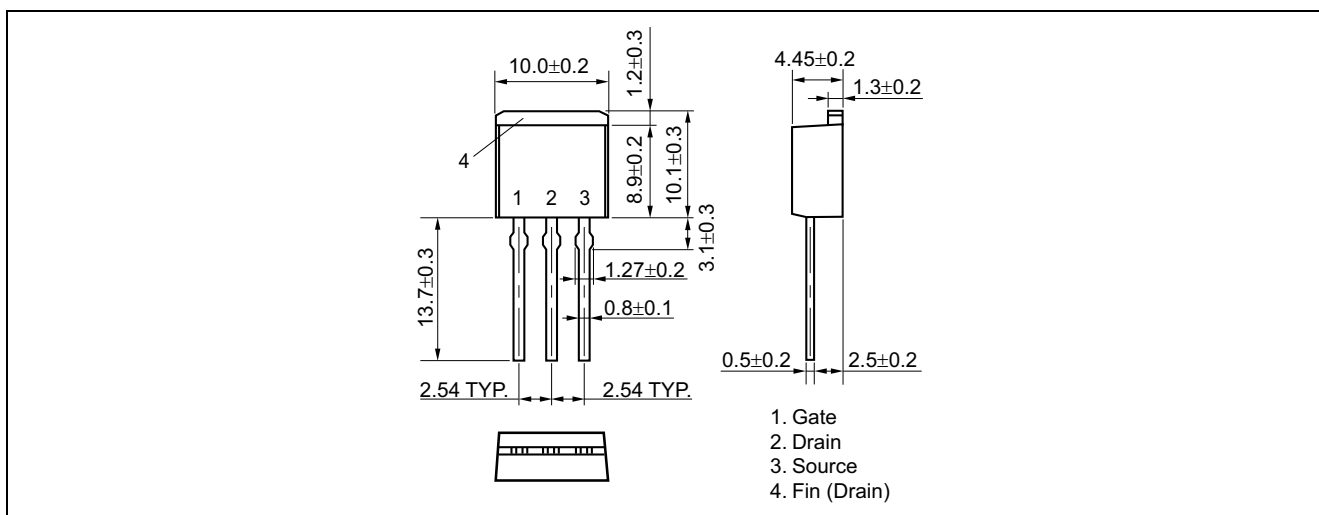


Package Drawing (Unit: mm)

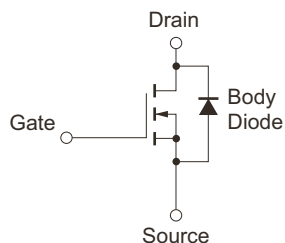
TO-220 (MP-25K) (Mass: 1.9 g TYP.)



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

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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