

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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# MOS FIELD EFFECT TRANSISTOR NP90N04MUG

## SWITCHING N-CHANNEL POWER MOS FET

### DESCRIPTION

The NP90N04MUG is N-channel MOS Field Effect Transistor designed for high current switching applications.

### ORDERING INFORMATION

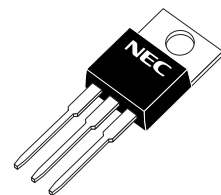
PART NUMBER	LEAD PLATING	PACKING	PACKAGE
NP90N04MUG-S18-AY <sup>Note</sup>	Pure Sn (Tin)	Tube 50 p/tube	TO-220 (MP-25K) typ. 1.9 g

**Note** Pb-free (This product does not contain Pb in the external electrode).

### FEATURES

- Super low on-state resistance  
 $R_{DS(on)} = 3.0 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 45 \text{ A)}$
- Channel temperature 175 degree rated

(TO-220)



### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

Drain to Source Voltage (V <sub>GS</sub> = 0 V)	V <sub>DSS</sub>	40	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	V <sub>GSS</sub>	±20	V
Drain Current (DC) (T <sub>C</sub> = 25°C)	I <sub>D(DC)</sub>	±90	A
Drain Current (pulse) <sup>Note1</sup>	I <sub>D(pulse)</sub>	±360	A
Total Power Dissipation (T <sub>C</sub> = 25°C)	P <sub>T1</sub>	217	W
Total Power Dissipation (T <sub>A</sub> = 25°C)	P <sub>T2</sub>	1.8	W
Channel Temperature	T <sub>ch</sub>	175	°C
Storage Temperature	T <sub>stg</sub>	-55 to +175	°C
Repetitive Avalanche Current <sup>Note2</sup>	I <sub>AR</sub>	60	A
Repetitive Avalanche Energy <sup>Note2</sup>	E <sub>AR</sub>	360	mJ

**Notes 1.** PW ≤ 10 μs, Duty Cycle ≤ 1%

**2.** T<sub>ch</sub> ≤ 150°C, V<sub>DD</sub> = 20 V, R<sub>G</sub> = 25 Ω, V<sub>GS</sub> = 20 → 0 V, L = 100 μH

### THERMAL RESISTANCE

Channel to Case Thermal Resistance	R <sub>th(ch-C)</sub>	0.69	°C/W
Channel to Ambient Thermal Resistance	R <sub>th(ch-A)</sub>	83.3	°C/W

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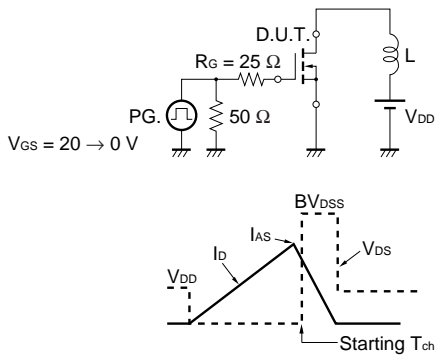
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

<R>

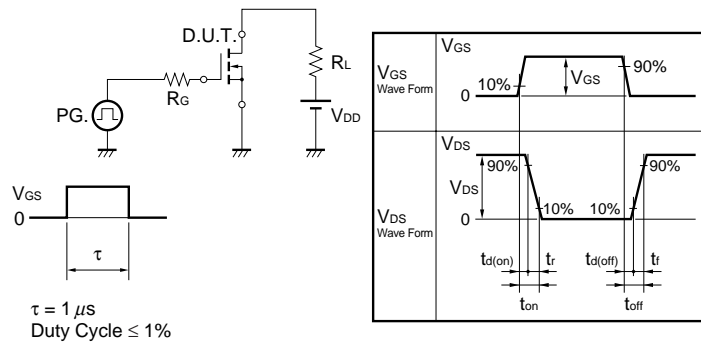
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V			1	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±100	nA
Gate to Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2.0		4.0	V
Forward Transfer Admittance <sup>Note</sup>	y <sub>fs</sub>	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 45 A	44	87		S
Drain to Source On-state Resistance <sup>Note</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 45 A		2.4	3.0	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,		11200		pF
Output Capacitance	C <sub>oss</sub>	f = 1 MHz		970		pF
Reverse Transfer Capacitance	C <sub>rss</sub>			630		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, I <sub>D</sub> = 45 A,		42		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 10 V,		12		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 0 Ω		92		ns
Fall Time	t <sub>f</sub>			17		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 32 V,		182		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V,		39		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 90 A		64		nC
Body Diode Forward Voltage <sup>Note</sup>	V <sub>F(S-D)</sub>	I <sub>F</sub> = 90 A, V <sub>GS</sub> = 0 V		0.9	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 90 A, V <sub>GS</sub> = 0 V,		52		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		72		nC

**Note** Pulsed

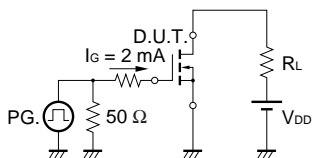
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



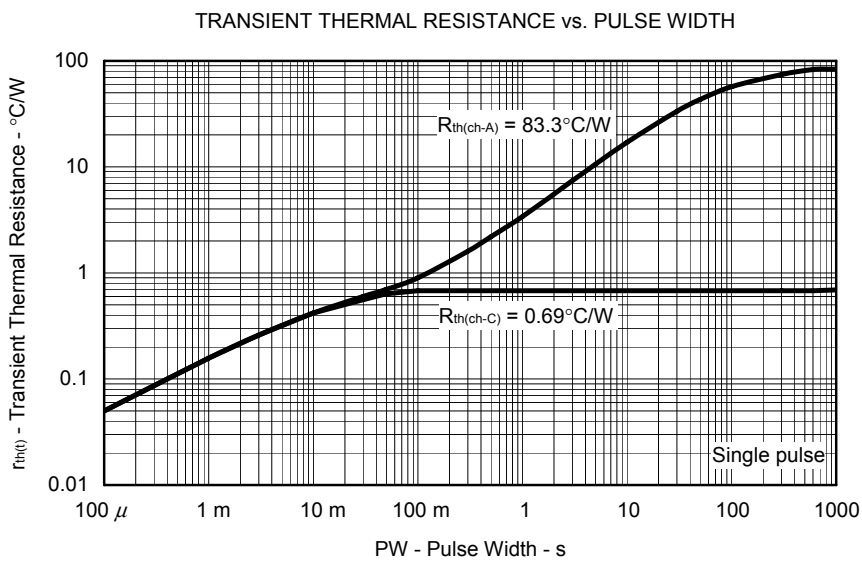
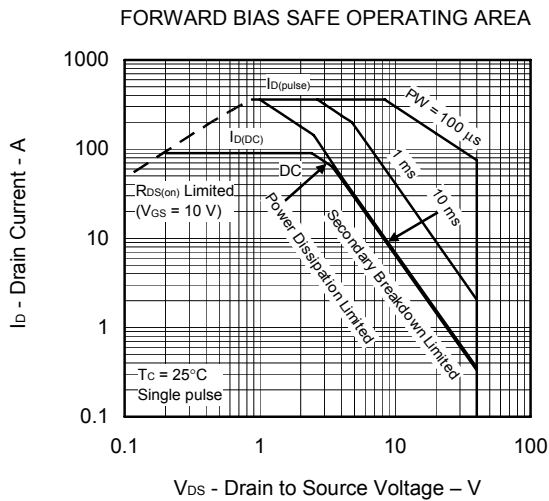
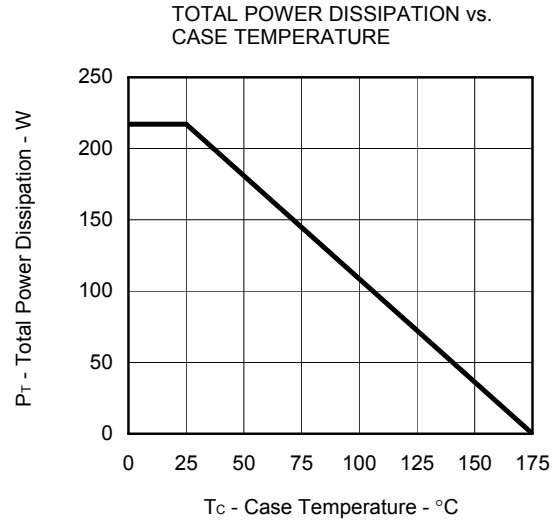
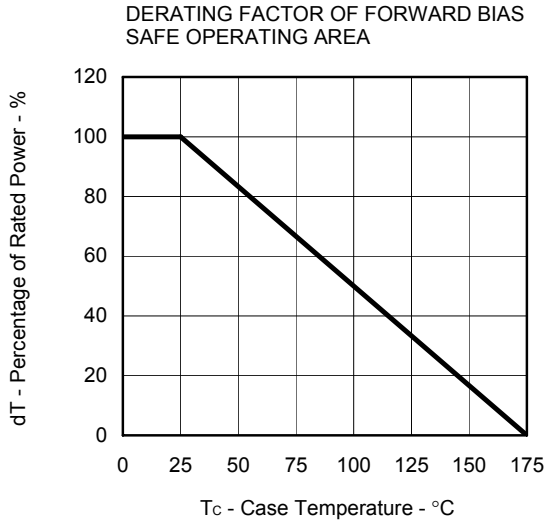
**TEST CIRCUIT 2 SWITCHING TIME**



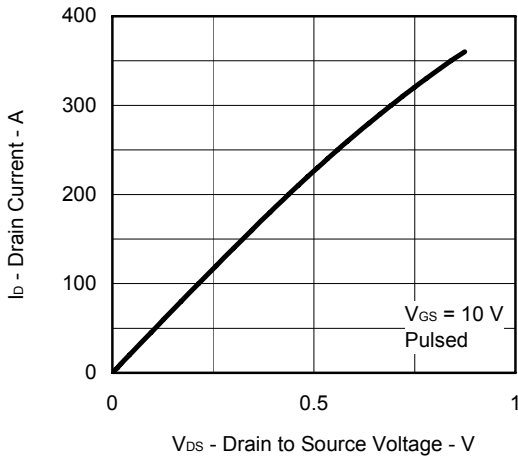
**TEST CIRCUIT 3 GATE CHARGE**



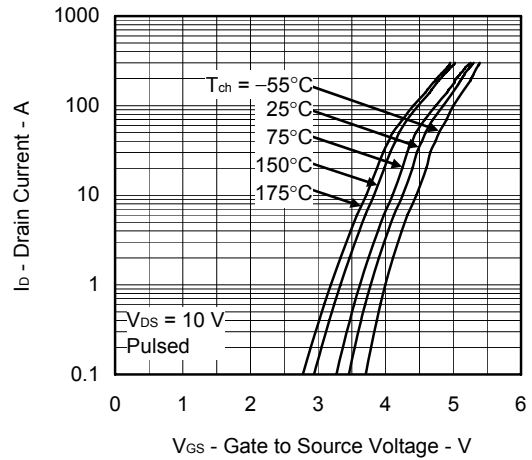
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



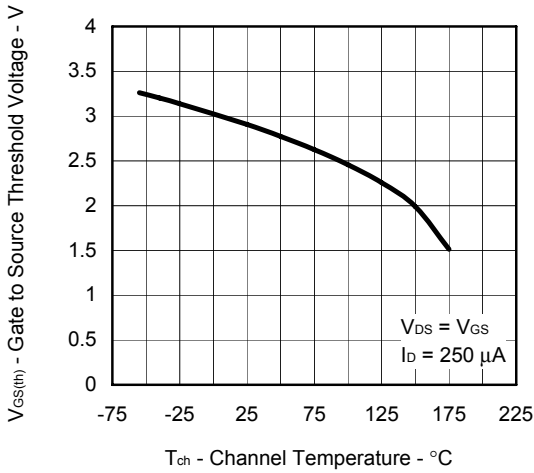
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



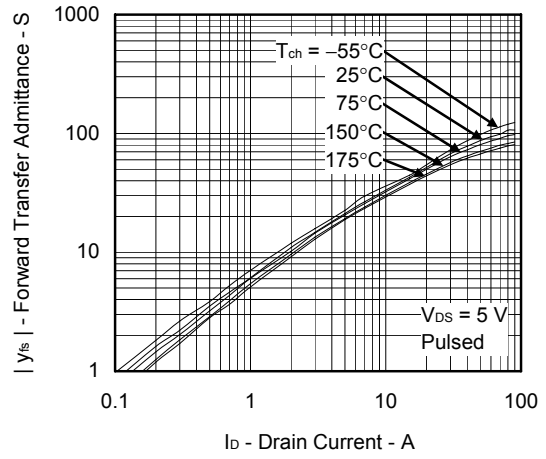
FORWARD TRANSFER CHARACTERISTICS



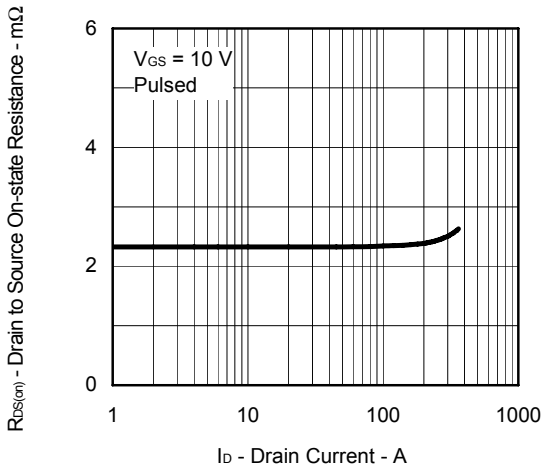
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



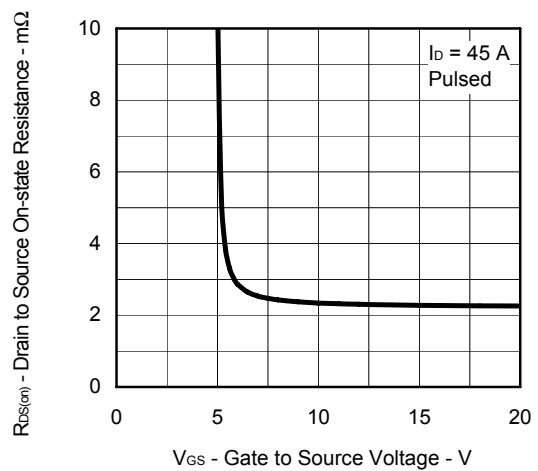
<R> FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



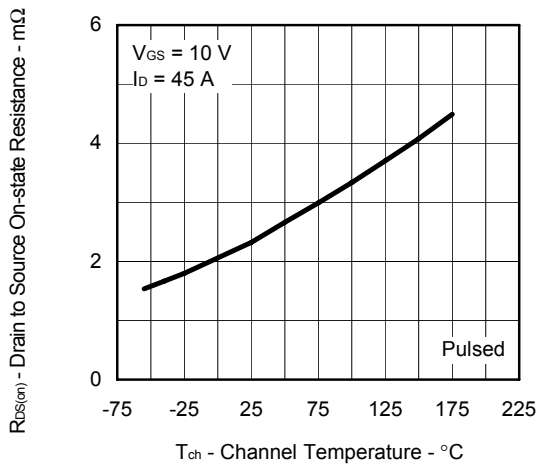
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



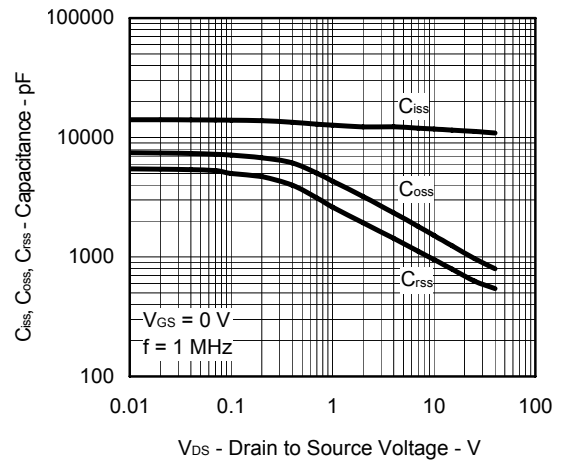
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



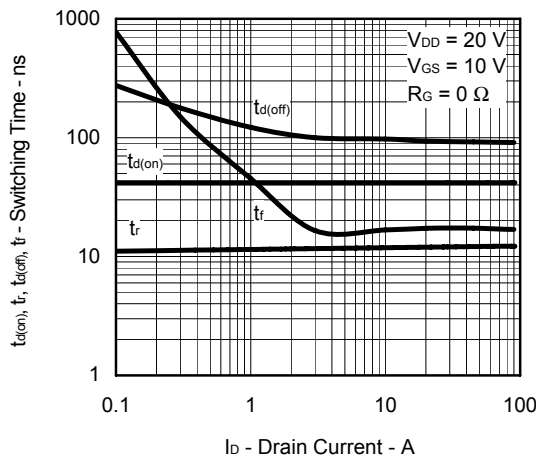
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



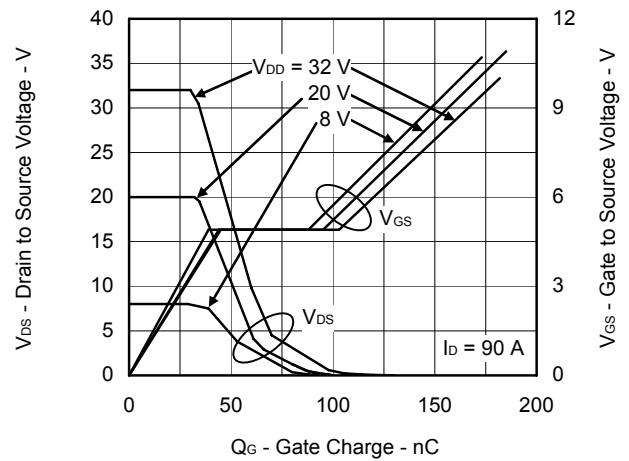
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



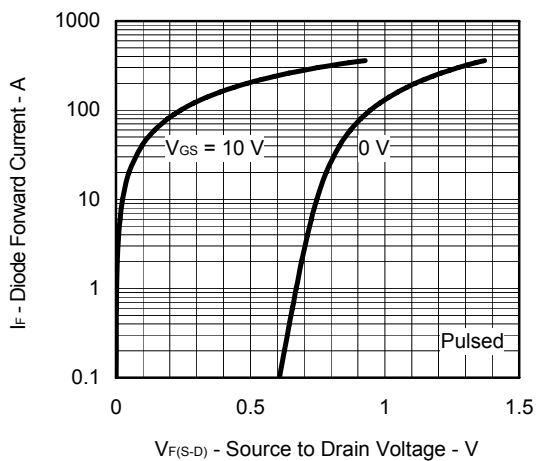
SWITCHING CHARACTERISTICS



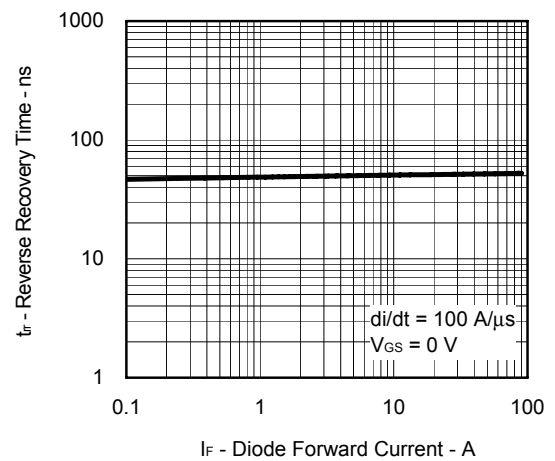
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

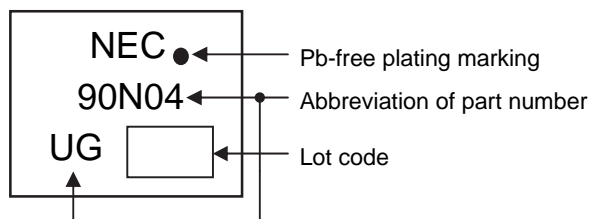


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT





**MARKING INFORMATION**



**RECOMMENDED SOLDERING CONDITIONS**

The NP90N04MUG should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, please contact an NEC Electronics sales representative.

For technical information, see the following website.

Semiconductor Device Mount Manual (<http://www.necel.com/pkg/en/mount/index.html>)

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Wave soldering MP-25K	Maximum temperature (Solder temperature): 260°C or below Time: 10 seconds or less Maximum chlorine content of rosin flux: 0.2% (wt.) or less	THDWS
Partial heating MP-25K	Maximum temperature (Pin temperature): 350°C or below Time (per side of the device): 3 seconds or less Maximum chlorine content of rosin flux: 0.2% (wt.) or less	P350

**Caution Do not use different soldering methods together (except for partial heating).**

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