

To our customers,

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## Old Company Name in Catalogs and Other Documents

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On April 1<sup>st</sup>, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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 NP82N04MDG, NP82N04NDG

## SWITCHING N-CHANNEL POWER MOS FET

### DESCRIPTION

The NP82N04MDG and NP82N04NDG are N-channel MOS Field Effect Transistors designed for high current switching applications.

### ORDERING INFORMATION

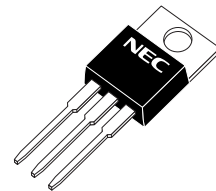
PART NUMBER	LEAD PLATING	PACKING	PACKAGE
NP82N04MDG-S18-AY <sup>Note</sup>	Pure Sn (Tin)	Tube	TO-220 (MP-25K) typ. 1.9 g
NP82N04NDG-S18-AY <sup>Note</sup>		50 p/tube	TO-262 (MP-25SK) typ. 1.8 g

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

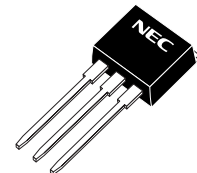
### FEATURES

- Logic level
- Super low on-state resistance
  - $R_{DS(on)1} = 4.2 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 41 \text{ A)}$
  - $R_{DS(on)2} = 8.5 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 41 \text{ A)}$
- High current rating
  - $I_{D(DC)} = \pm 82 \text{ A}$
- Low input capacitance
  - $C_{iss} = 6000 \text{ pF TYP.}$
- Designed for automotive application and AEC-Q101 qualified

(TO-220)



(TO-262)



### 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>	±82	A
Drain Current (pulse) <sup>Note1</sup>	I <sub>D(pulse)</sub>	±328	A
Total Power Dissipation (T <sub>C</sub> = 25°C)	P <sub>T1</sub>	143	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>	43	A
Repetitive Avalanche Energy <sup>Note2</sup>	E <sub>AR</sub>	185	mJ

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

**2.** T<sub>ch</sub> ≤ 150°C, R<sub>G</sub> = 25 Ω

### THERMAL RESISTANCE

Channel to Case Thermal Resistance	R <sub>th(ch-C)</sub>	1.05	°C/W
Channel to Ambient Thermal Resistance	R <sub>th(ch-A)</sub>	83.3	°C/W

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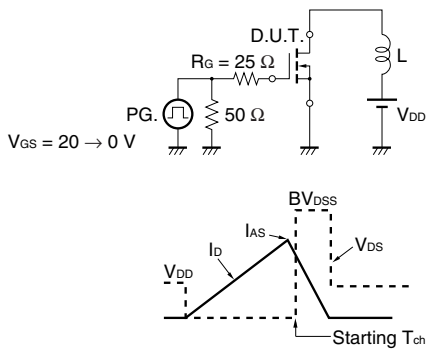
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**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

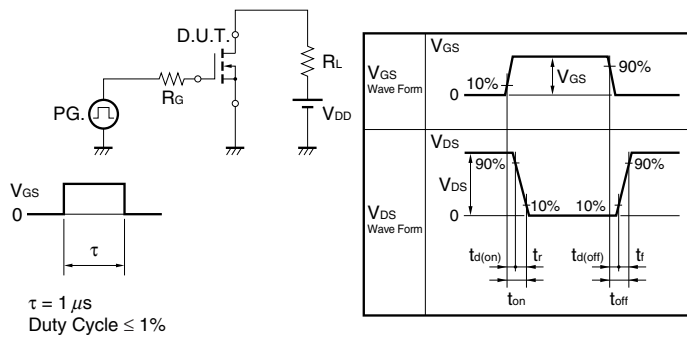
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			$\pm 100$	nA
Gate to Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1.4		2.5	V
Forward Transfer Admittance <sup>Note</sup>	$ y_{fs} $	$V_{DS} = 5\text{ V}, I_D = 41\text{ A}$	20	65		S
Drain to Source On-state Resistance <sup>Note</sup>	$R_{DS(on)1}$	$V_{GS} = 10\text{ V}, I_D = 41\text{ A}$		3.4	4.2	m $\Omega$
	$R_{DS(on)2}$	$V_{GS} = 4.5\text{ V}, I_D = 41\text{ A}$		5.4	8.5	m $\Omega$
Input Capacitance	$C_{iss}$	$V_{DS} = 25\text{ V},$ $V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$		6000	9000	pF
Output Capacitance	$C_{oss}$			580	870	pF
Reverse Transfer Capacitance	$C_{rss}$			370	670	pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{ V}, I_D = 41\text{ A},$ $V_{GS} = 10\text{ V},$ $R_G = 0\ \Omega$		26	60	ns
Rise Time	$t_r$			68	170	ns
Turn-off Delay Time	$t_{d(off)}$			73	150	ns
Fall Time	$t_f$			11	30	ns
Total Gate Charge	$Q_G$	$V_{DD} = 32\text{ V},$ $V_{GS} = 10\text{ V},$ $I_D = 82\text{ A}$		100	150	nC
Gate to Source Charge	$Q_{GS}$			19		nC
Gate to Drain Charge	$Q_{GD}$			32		nC
Body Diode Forward Voltage <sup>Note</sup>	$V_{F(S-D)}$	$I_F = 82\text{ A}, V_{GS} = 0\text{ V}$		0.9	1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = 82\text{ A}, V_{GS} = 0\text{ V},$ $di/dt = 100\text{ A}/\mu\text{s}$		43		ns
Reverse Recovery Charge	$Q_{rr}$			47		nC

**Note** Pulsed test

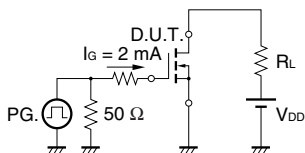
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



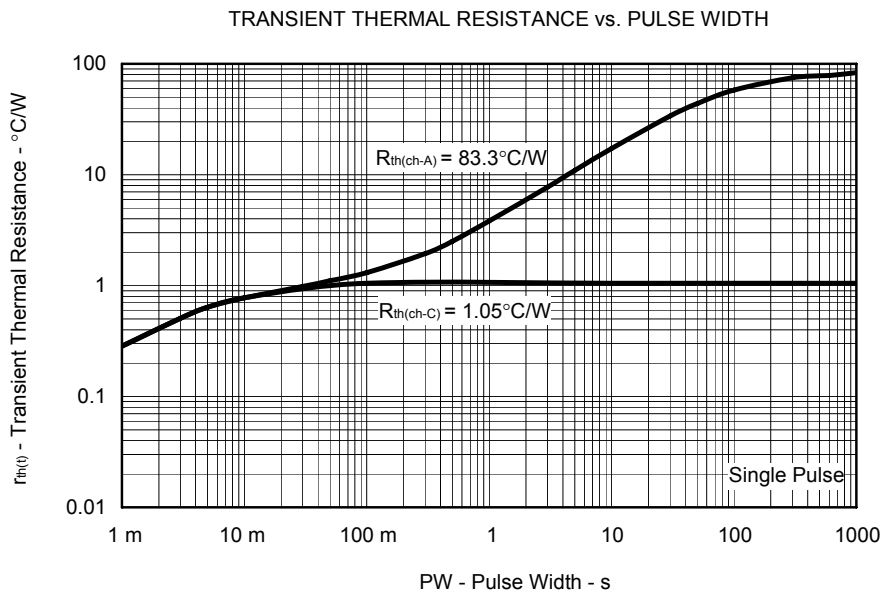
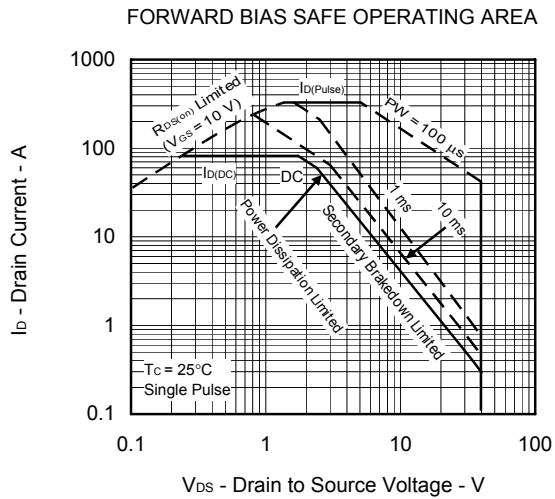
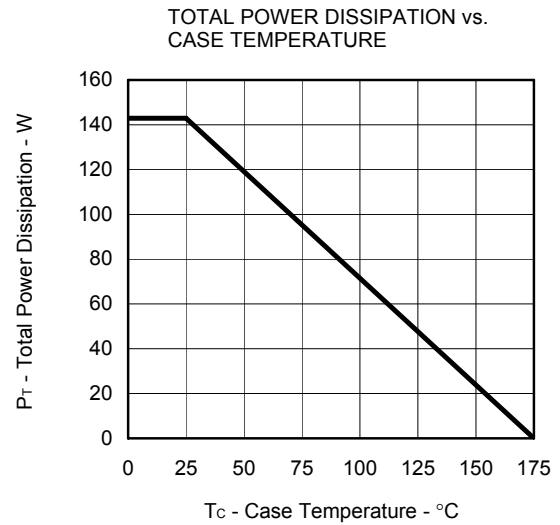
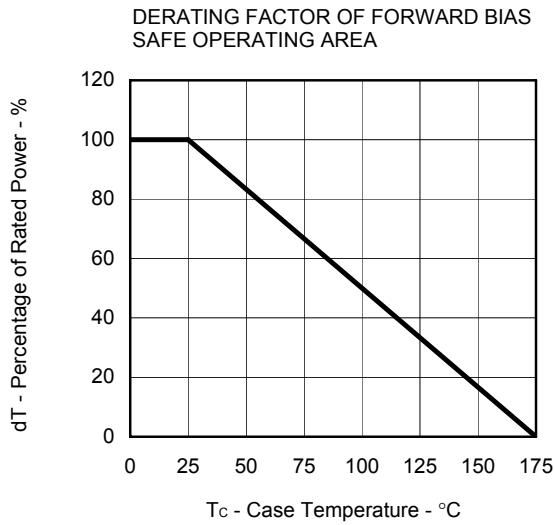
**TEST CIRCUIT 2 SWITCHING TIME**



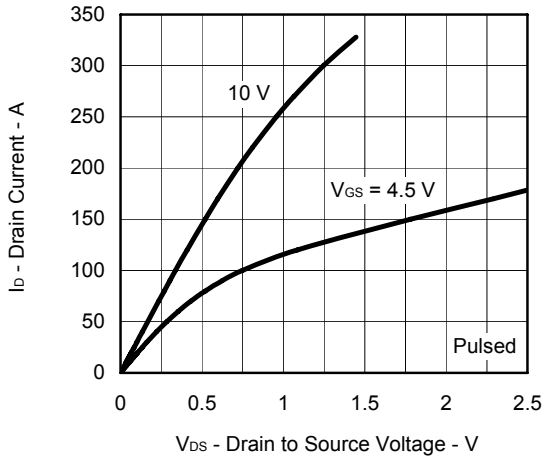
**TEST CIRCUIT 3 GATE CHARGE**



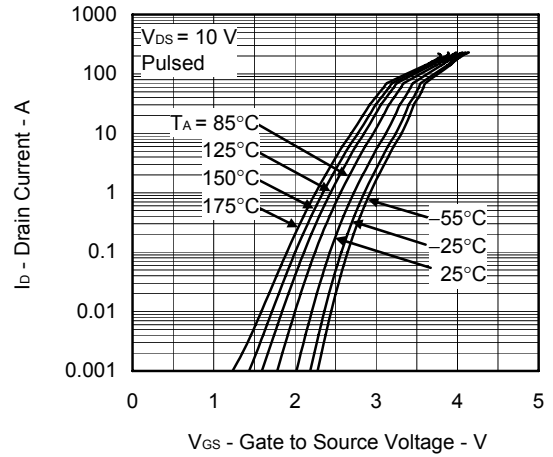
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



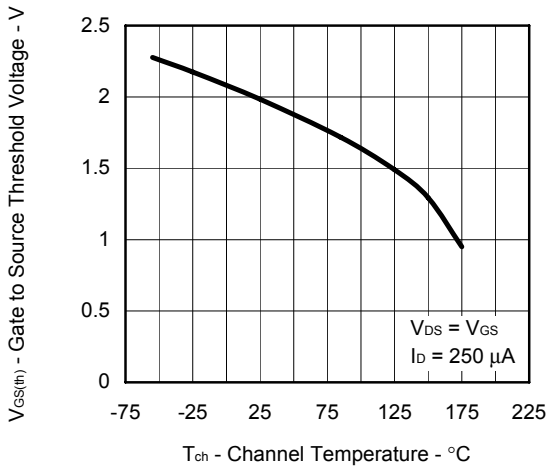
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



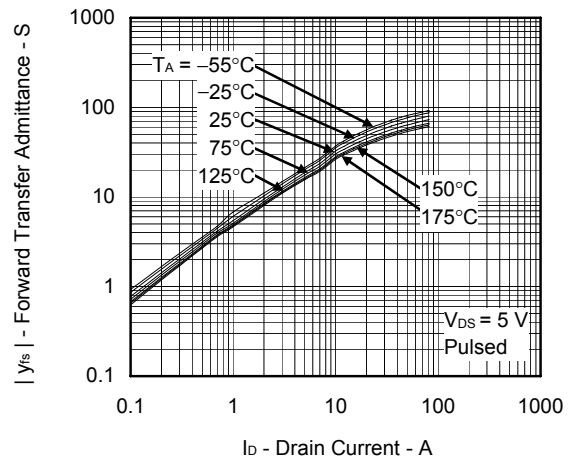
FORWARD TRANSFER CHARACTERISTICS



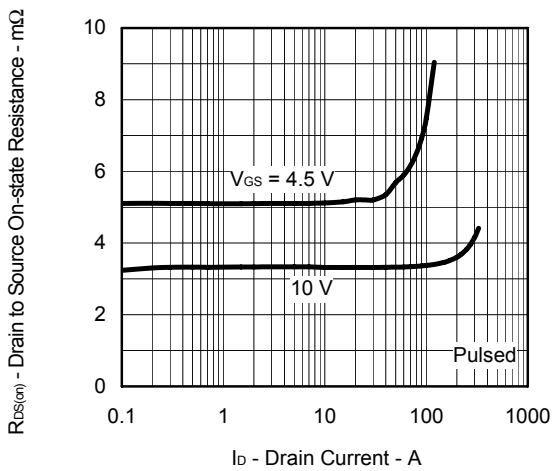
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



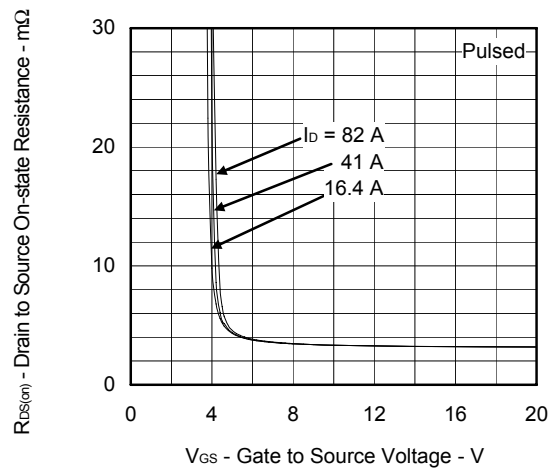
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



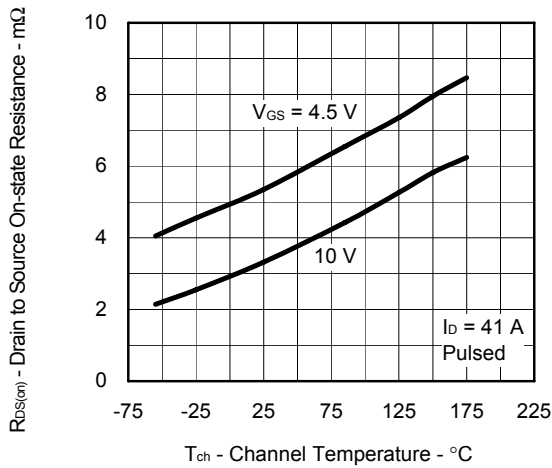
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



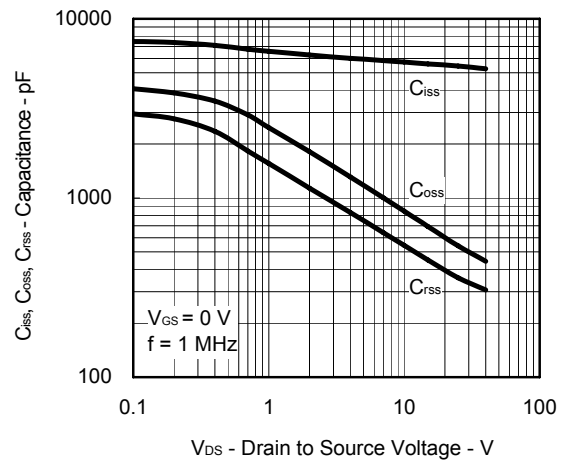
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



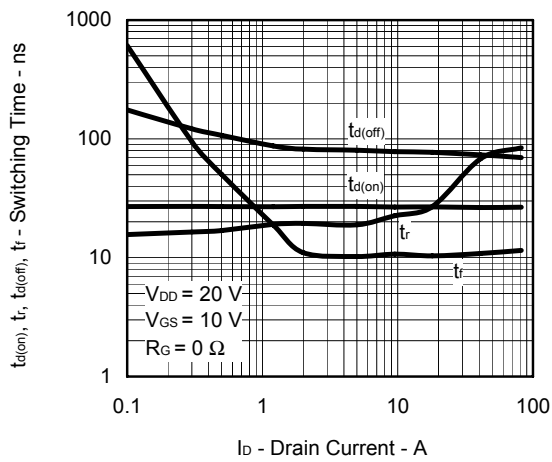
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



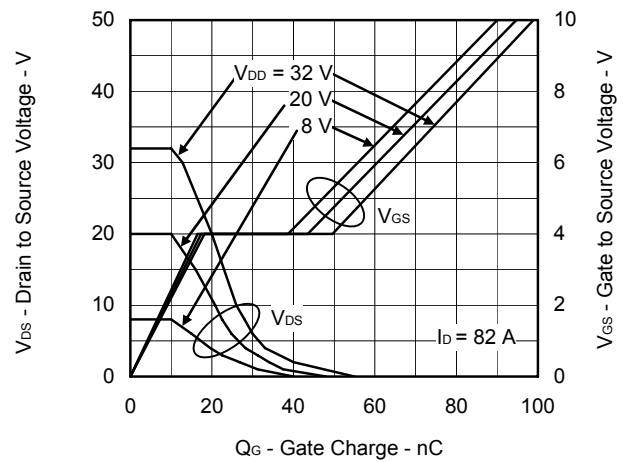
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



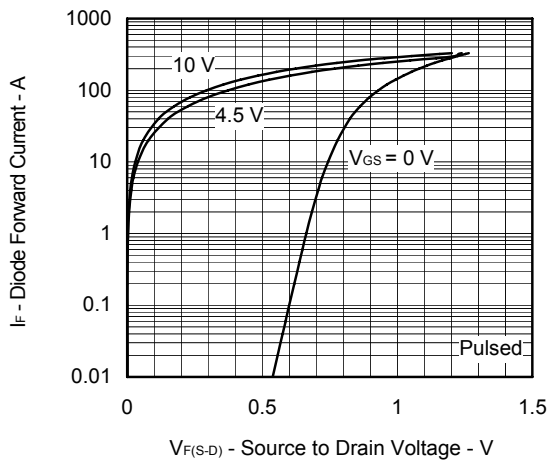
SWITCHING CHARACTERISTICS



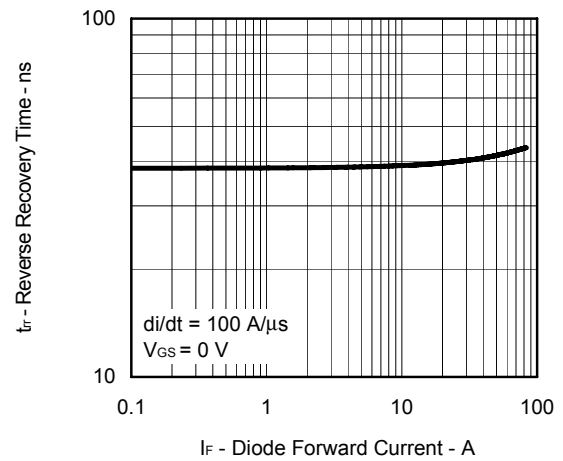
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

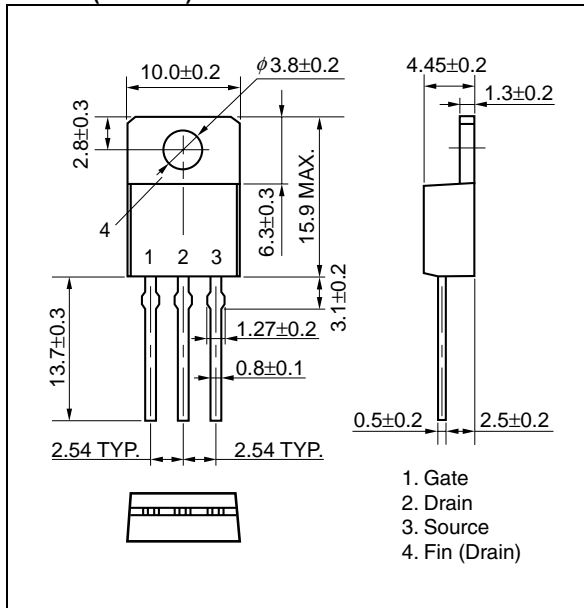


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

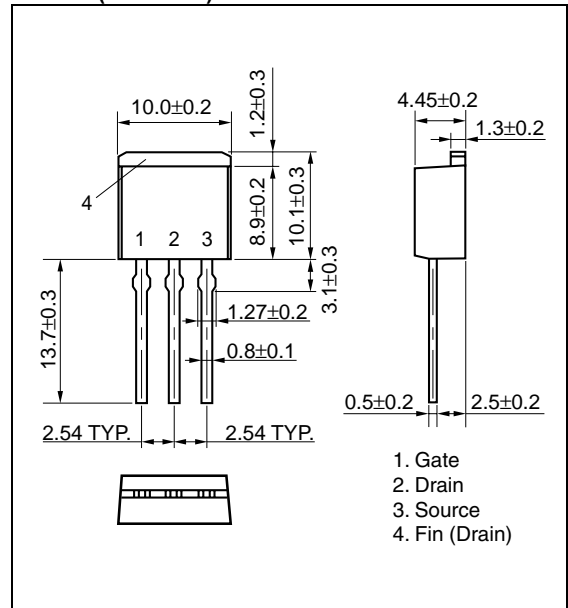


PACKAGE DRAWINGS (Unit: mm)

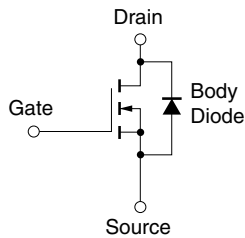
TO-220 (MP-25K)



TO-262 (MP-25SK)



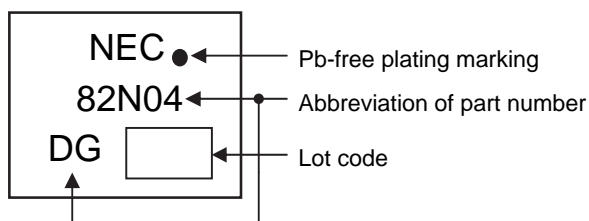
EQUIVALENT CIRCUIT



**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.



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

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Wave soldering NP82N04MDG, NP82N04NDG	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 NP82N04MDG, NP82N04NDG	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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