To our customers,

Old Company Name in Catalogs and Other Documents

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

April 1st, 2010
Renesas Electronics Corporation

Not recommend for new design

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

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RENESAS

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DATA SHEET

MOS FIELD EFFECT TRANSISTOR
NP80N04MDG, NP80N04NDG, NP80N04PDG

SWITCHING
N-CHANNEL POWER MOS FET

DESCRIPTION

The NP80N04MDG, NP80N04NDG, and NP80N04PDG are N-channel MOS Field Effect Transistors designed for high current switching applications.

ORDERING INFORMATION

PART NUMBER	LEAD PLATING	PACKING	PACKAGE
NP80N04MDG-S18-AY Note	Pure Sn (Tin)	Tube 50 p/tube	TO-220 (MP-25K) typ. 1.9 g
NP80N04NDG-S18-AY Note			TO-262 (MP-25SK) typ. 1.8 g
NP80N04PDG-E1B-AY Note		Tape 1000 p/reel	TO-263 (MP-25ZP) typ. 1.5 g
NP80N04PDG-E2B-AY Note			

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

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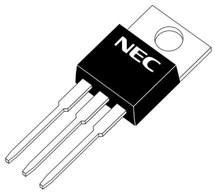
FEATURES

- Logic level
- Super low on-state resistance
  - NP80N04MDG, NP80N04NDG
    $R_{DS(on)1}$ = 4.8 mΩ MAX. (V_{GS} = 10 V, I_D = 40 A)
    $R_{DS(on)2}$ = 9.0 mΩ MAX. (V_{GS} = 4.5 V, I_D = 35 A)
  - NP80N04PDG
    $R_{DS(on)1}$ = 4.5 mΩ MAX. (V_{GS} = 10 V, I_D = 40 A)
    $R_{DS(on)2}$ = 8.7 mΩ MAX. (V_{GS} = 4.5 V, I_D = 35 A)
- High current rating
  $I_{D(DC)}$ = ±80 A
- Low input capacitance
  C_{iss} = 4600 pF TYP.
- Designed for automotive application and AEC-Q101 qualified

(TO-220)



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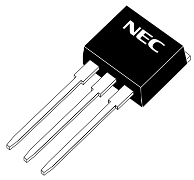

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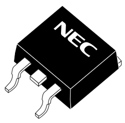

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Date Published May 2009 NS
Printed in Japan

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ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	40	V
Gate to Source Voltage (V_{DS} = 0 V)	V_{GSS}	±20	V
Drain Current (DC) (T_C = 25°C)	$I_{D(DC)}$	±80	A
Drain Current (pulse) Note1	$I_{D(pulse)}$	±300	A
Total Power Dissipation (T_C = 25°C)	P_{T1}	115	W
Total Power Dissipation (T_A = 25°C)	P_{T2}	1.8	W
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	–55 to +175	°C
Repetitive Avalanche Current Note2	I_{AR}	37	A
Repetitive Avalanche Energy Note2	E_{AR}	137	mJ

Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. T_{ch} ≤ 150°C, R_G = 25 Ω

THERMAL RESISTANCE

Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.30	°C/W
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	°C/W

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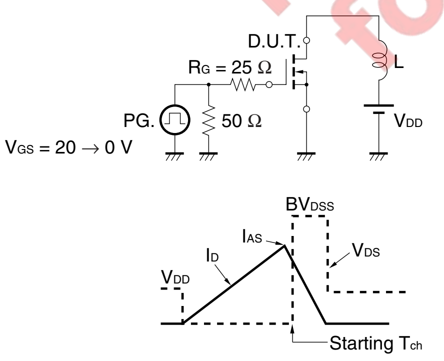
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

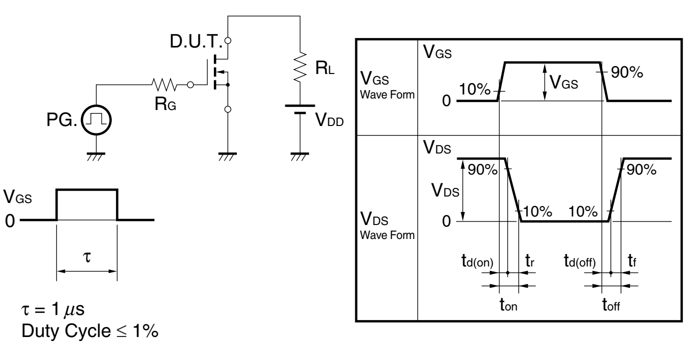
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V			1	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA
Gate to Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	1.4		2.5	V
Forward Transfer Admittance Note	| y_{fs} |	V_{DS} = 5 V, I_D = 35 A	25	63		S
Drain to Source On-state Resistance Note	$R_{DS(on)1}$	V_{GS} = 10 V, I_D = 40 A NP80N04MDG, NP80N04NDG		3.7	4.8	mΩ
		V_{GS} = 10 V, I_D = 40 A NP80N04PDG		3.2	4.5	mΩ
	$R_{DS(on)2}$	V_{GS} = 4.5 V, I_D = 35 A NP80N04MDG, NP80N04NDG		4.8	9.0	mΩ
		V_{GS} = 4.5 V, I_D = 35 A NP80N04PDG		4.3	8.7	mΩ
Input Capacitance	C_{iss}	V_{DS} = 25 V,		4600	6900	pF
Output Capacitance	C_{oss}	V_{GS} = 0 V,		480	720	pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		310	560	pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 20 V, I_D = 40 A,		17	37	ns
Rise Time	t_r	V_{GS} = 10 V,		18	45	ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 0 Ω		74	148	ns
Fall Time	t_f			8	20	ns
Total Gate Charge	Q_G	V_{DD} = 32 V,		90	135	nC
Gate to Source Charge	Q_{GS}	V_{GS} = 10 V,		13		nC
Gate to Drain Charge	Q_{GD}	I_D = 80 A		26		nC
Body Diode Forward Voltage Note	$V_{F(S-D)}$	I_F = 80 A, V_{GS} = 0 V		0.94	1.5	V
Reverse Recovery Time	t_{rr}	I_F = 80 A, V_{GS} = 0 V,		39		ns
Reverse Recovery Charge	Q_{rr}	di/dt = 100 A/μs		39		nC

Note Pulsed test

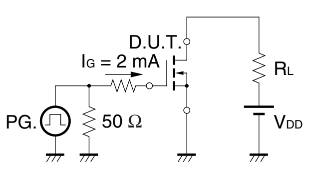
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

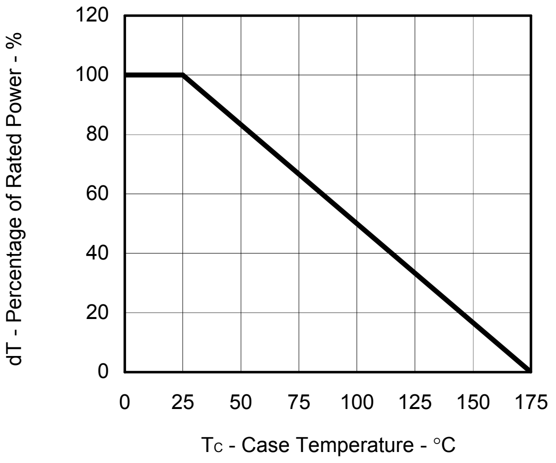


TEST CIRCUIT 3 GATE CHARGE

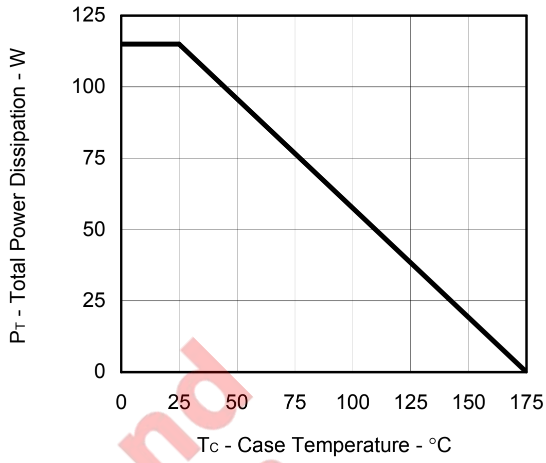


TYPICAL CHARACTERISTICS (T_A = 25°C)

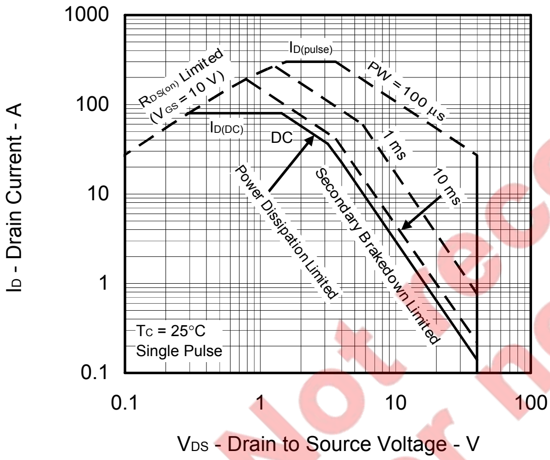
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



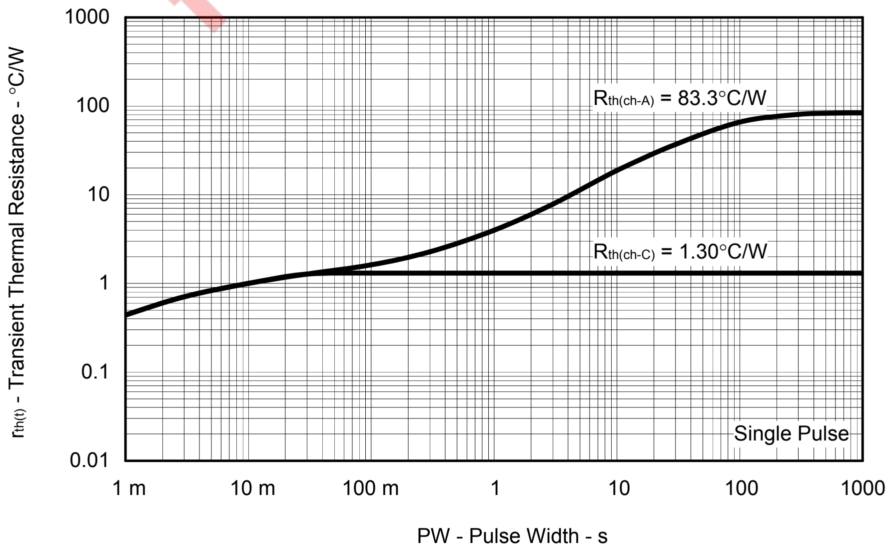
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



FORWARD BIAS SAFE OPERATING AREA



TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



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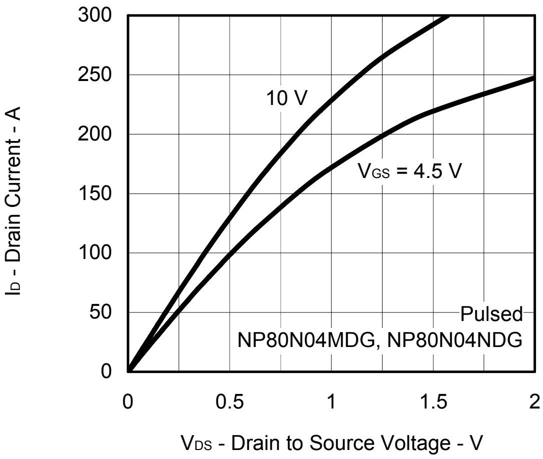
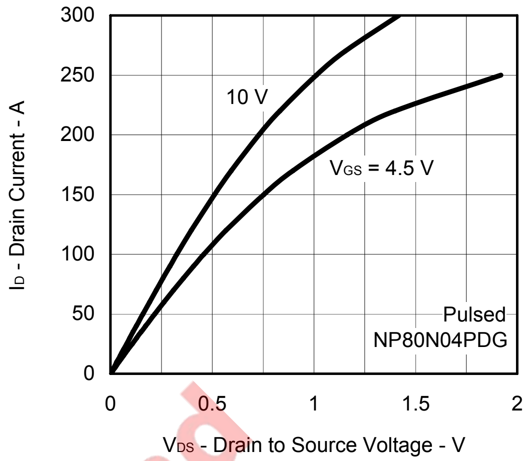
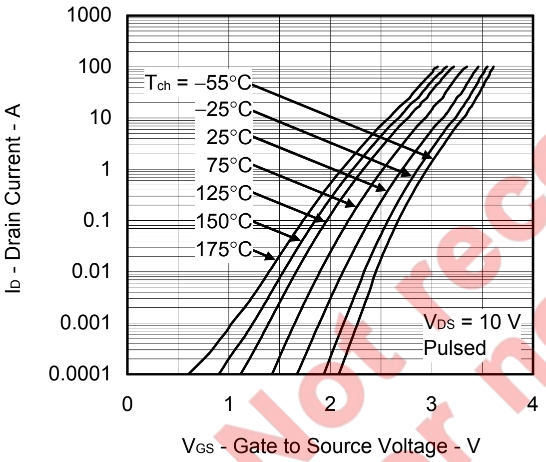
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



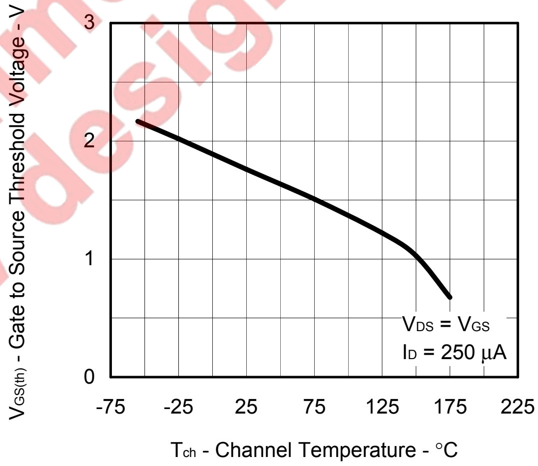
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



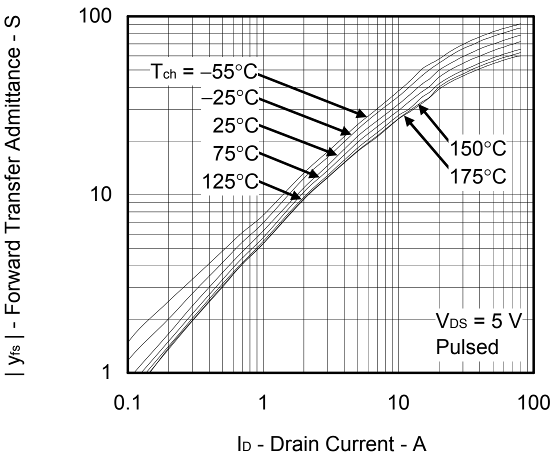
FORWARD TRANSFER CHARACTERISTICS



GATE TO SOURCE THRESHOLD VOLTAGE vs.
CHANNEL TEMPERATURE



FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



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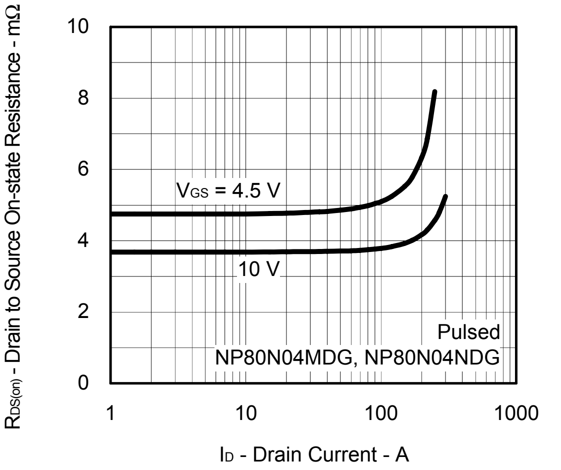
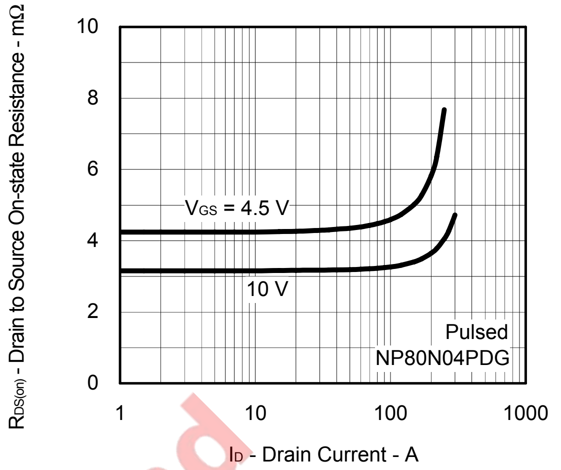
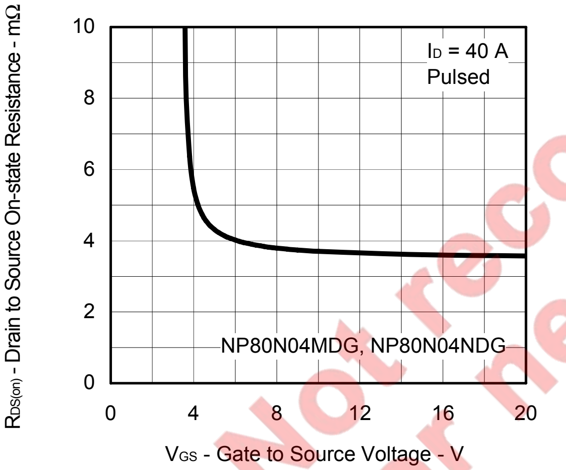
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



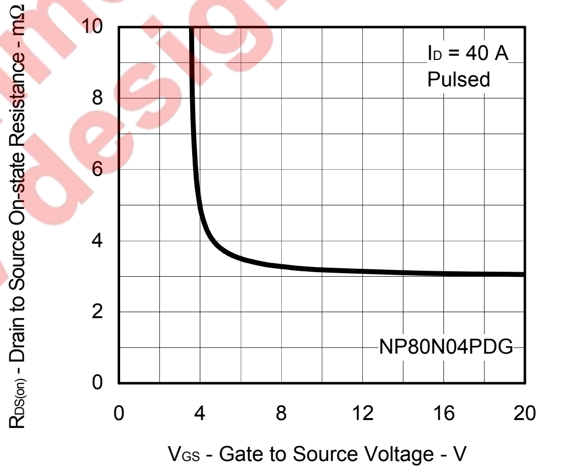
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



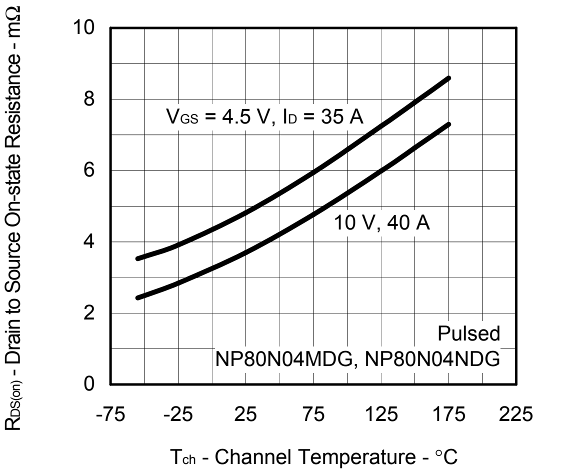
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



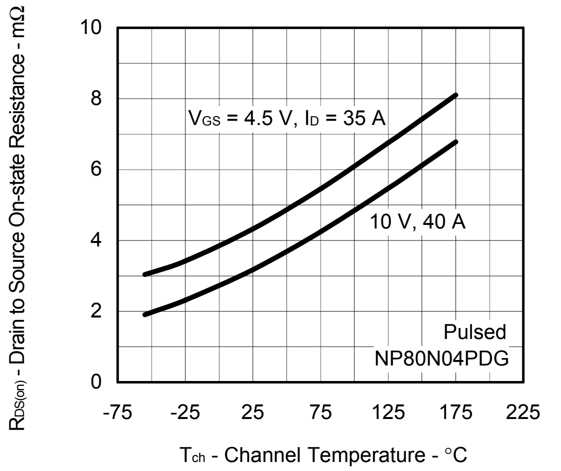
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



DRAIN TO SOURCE ON-STATE RESISTANCE vs.
CHANNEL TEMPERATURE



DRAIN TO SOURCE ON-STATE RESISTANCE vs.
CHANNEL TEMPERATURE



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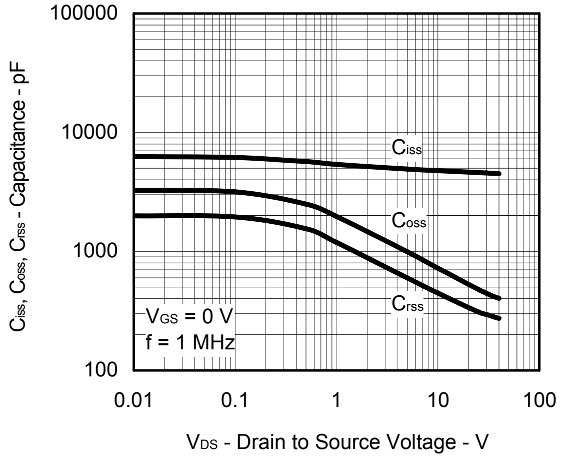
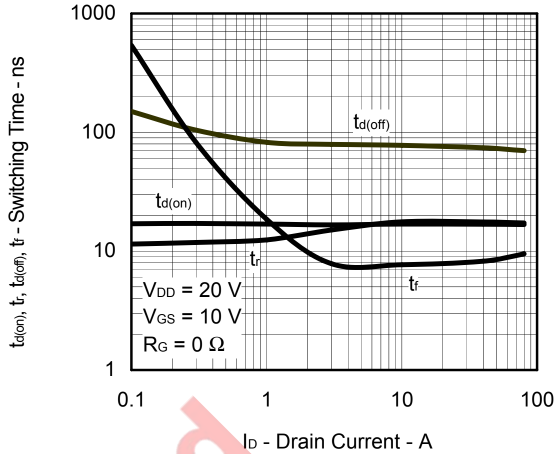
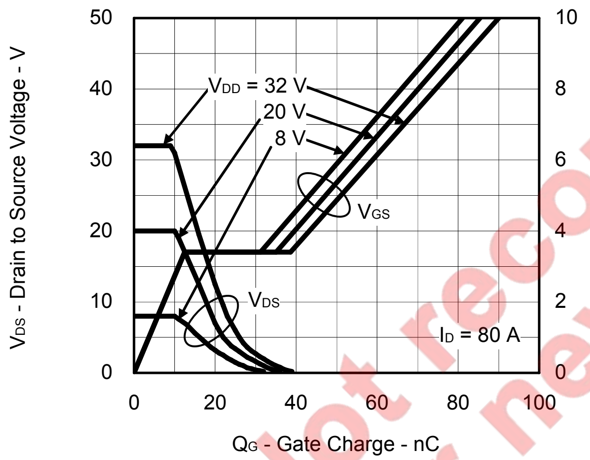
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



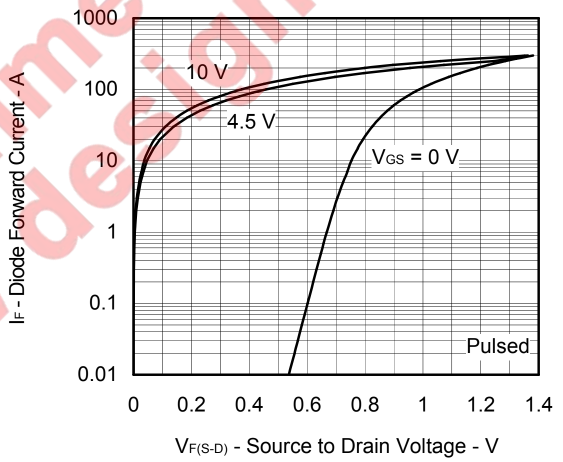
SWITCHING CHARACTERISTICS



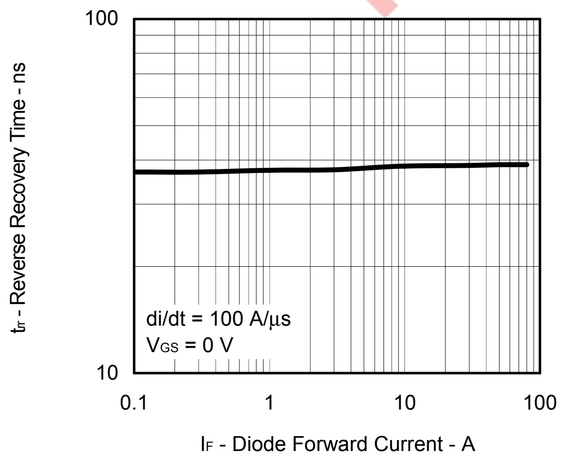
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



REVERSE RECOVERY TIME vs.
DIODE FORWARD CURRENT



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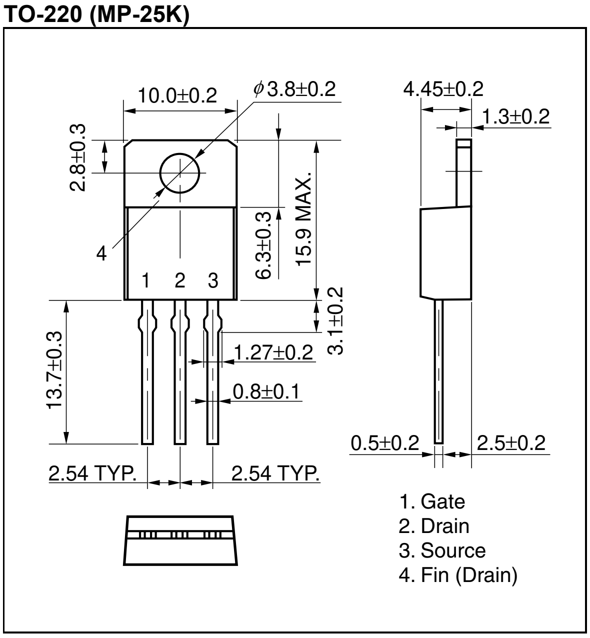
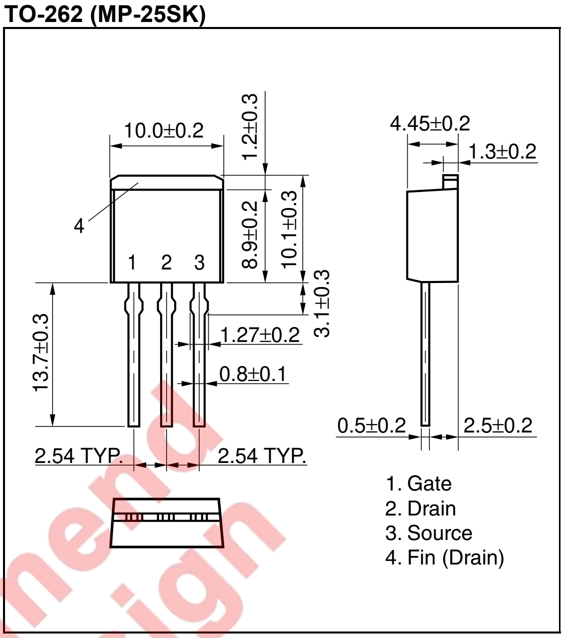
PACKAGE DRAWINGS (Unit: mm)

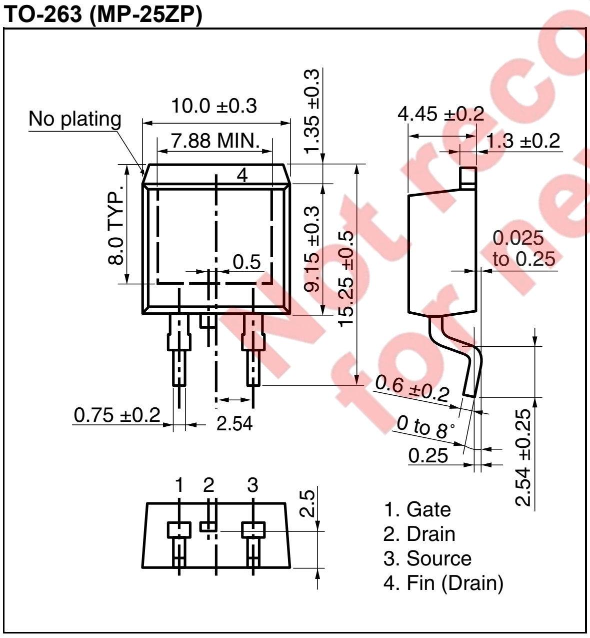
TO-220 (MP-25K)



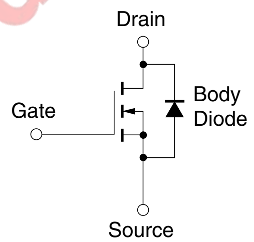
TO-262 (MP-25SK)



TO-263 (MP-25ZP)



EQUIVALENT CIRCUIT



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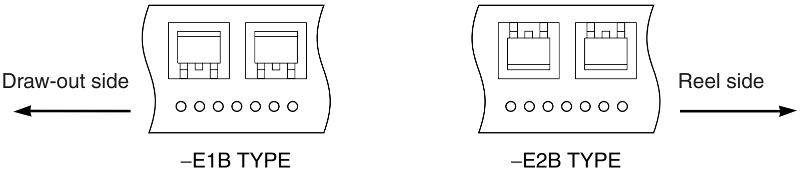
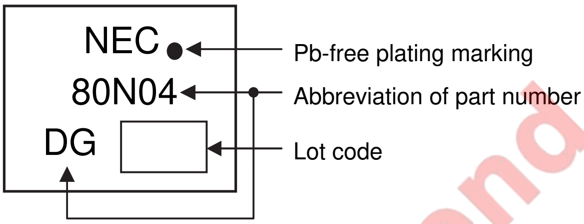
Remark Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

TAPE INFORMATION (NP80N04PDG)

There are two types (-E1B, -E2B) of taping depending on the direction of the device.



MARKING INFORMATION



RECOMMENDED SOLDERING CONDITIONS

These products 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
Infrared reflow NP80N04PDG	Maximum temperature (Package's surface temperature): 260°C or below Time at maximum temperature: 10 seconds or less Time of temperature higher than 220°C: 60 seconds or less Preheating time at 160 to 180°C: 60 to 120 seconds Maximum number of reflow processes: 3 times Maximum chlorine content of rosin flux (percentage mass): 0.2% or less	IR60-00-3
Wave soldering NP80N04MDG, NP80N04NDG	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 NP80N04MDG, NP80N04NDG, NP80N04PDG	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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  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.

  "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).

  "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)

(1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.

(2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

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