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

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DATA SHEET

MOS FIELD EFFECT TRANSISTOR

NP40N055ELE, NP40N055KLE
NP40N055CLE, NP40N055DLE, NP40N055MLE, NP40N055NLE

SWITCHING
N-CHANNEL POWER MOS FET

DESCRIPTION

These products are N-channel MOS Field Effect Transistors designed for high current switching applications.

<R> ORDERING INFORMATION

PART NUMBER	LEAD PLATING	PACKING	PACKAGE
NP40N055ELE-E1-AY Note1, 2	Pure Sn (Tin)	Tape 800 p/reel	TO-263 (MP-25ZJ) typ. 1.4 g
NP40N055ELE-E2-AY Note1, 2			
NP40N055KLE-E1-AY Note1			TO-263 (MP-25ZK) typ. 1.5 g
NP40N055KLE-E2-AY Note1			
NP40N055CLE-S12-AZ Note1, 2	Sn-Ag-Cu	Tube 50 p/tube	TO-220 (MP-25) typ. 1.9 g
NP40N055DLE-S12-AY Note1, 2	Pure Sn (Tin)		TO-262 (MP-25 Fin Cut) typ. 1.8 g
NP40N055MLE-S18-AY Note1			TO-220 (MP-25K) typ. 1.9 g
NP40N055NLE-S18-AY Note1			TO-262 (MP-25SK) typ. 1.8 g

Notes 1. Pb-free (This product does not contain Pb in the external electrode.)

2. Not for new design

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FEATURES

- Channel temperature 175 degree rated
- Super low on-state resistance

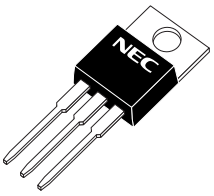
  $R_{DS(on)1}$ = 23 mΩ MAX. (V_{GS} = 10 V, I_D = 20 A)

  $R_{DS(on)2}$ = 28 mΩ MAX. (V_{GS} = 5.0 V, I_D = 20 A)

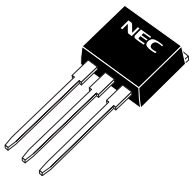
  $R_{DS(on)3}$ = 32 mΩ MAX. (V_{GS} = 4.5 V, I_D = 20 A)
- Low input capacitance

  C_{iss} = 1300 pF TYP.
- Built-in gate protection diode

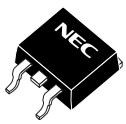
(TO-220)



(TO-262)



(TO-263)



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Printed in Japan

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ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	55	V
Gate to Source Voltage (V_{DS} = 0 V)	V_{GSS}	±20	V
Drain Current (DC) (T_C = 25°C)	$I_{D(DC)}$	±40	A
Drain Current (pulse) Note1	$I_{D(pulse)}$	±100	A
Total Power Dissipation (T_A = 25°C)	P_T	1.8	W
Total Power Dissipation (T_C = 25°C)	P_T	66	W
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	–55 to +175	°C
Single Avalanche Current Note2	I_{AS}	29/21/8	A
Single Avalanche Energy Note2	E_{AS}	0.8/44/64	mJ

Notes 1. PW ≤ 10 μs, Duty cycle ≤ 1%

2. Starting T_{ch} = 25°C, V_{DD} = 28 V, R_G = 25 Ω, V_{GS} = 20 → 0 V (see **Figure 4.**)

THERMAL RESISTANCE

Channel to Case Thermal Resistance	$R_{th(ch-C)}$	2.27	°C/W
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	°C/W

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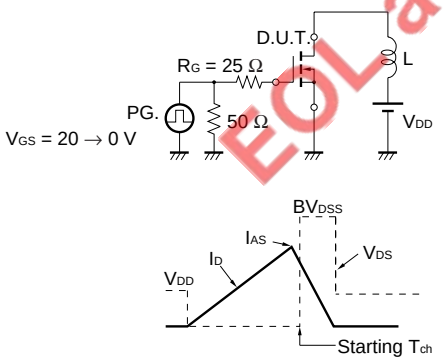
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ELECTRICAL CHARACTERISTICS (T_A = 25°C)

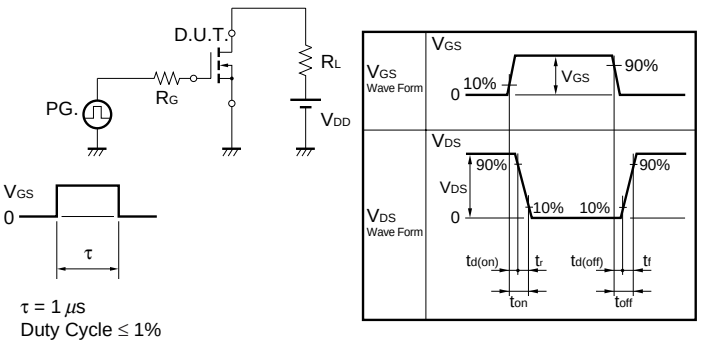
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 55 V, V_{GS} = 0 V			10	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V			±10	μA
Gate to Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	1.5	2.0	2.5	V
Forward Transfer Admittance	| y_{fs} |	V_{DS} = 10 V, I_D = 20 A	8	18		S
Drain to Source On-state Resistance	$R_{DS(on)1}$	V_{GS} = 10 V, I_D = 20 A		18	23	mΩ
	$R_{DS(on)2}$	V_{GS} = 5.0 V, I_D = 20 A		21	28	mΩ
	$R_{DS(on)3}$	V_{GS} = 4.5 V, I_D = 20 A		24	32	mΩ
Input Capacitance	C_{iss}	V_{DS} = 25 V,		1300	1950	pF
Output Capacitance	C_{oss}	V_{GS} = 0 V,		190	280	pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		92	170	pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 28 V, I_D = 20 A,		14	32	ns
Rise Time	t_r	V_{GS} = 10 V,		8.4	21	ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 1 Ω		39	78	ns
Fall Time	t_f			7.4	19	ns
Total Gate Charge	Q_{G1}	V_{DD} = 44 V, V_{GS} = 10 V, I_D = 40 A		27	41	nC
	Q_{G2}	V_{DD} = 44 V,		15	23	nC
Gate to Source Charge	Q_{GS}	V_{GS} = 5.0 V,		5		nC
Gate to Drain Charge	Q_{GD}	I_D = 40 A		8		nC
Body Diode Forward Voltage	$V_{F(S-D)}$	I_F = 40 A, V_{GS} = 0 V		1.0		V
Reverse Recovery Time	t_{rr}	I_F = 40 A, V_{GS} = 0 V,		40		ns
Reverse Recovery Charge	Q_{rr}	di/dt = 100 A/μs		50		nC

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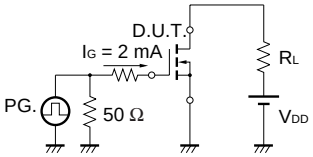
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME



TEST CIRCUIT 3 GATE CHARGE



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TYPICAL CHARACTERISTICS (T_A = 25°C)

Figure1. DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA

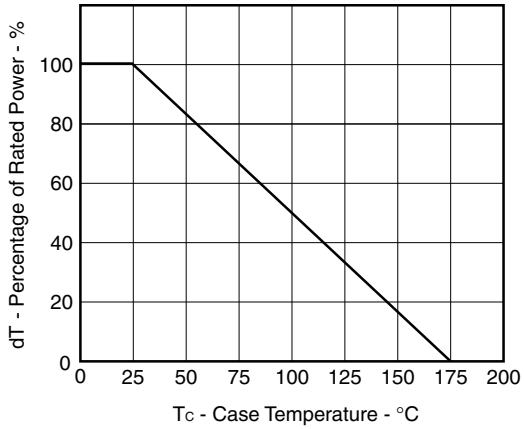


Figure2. TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

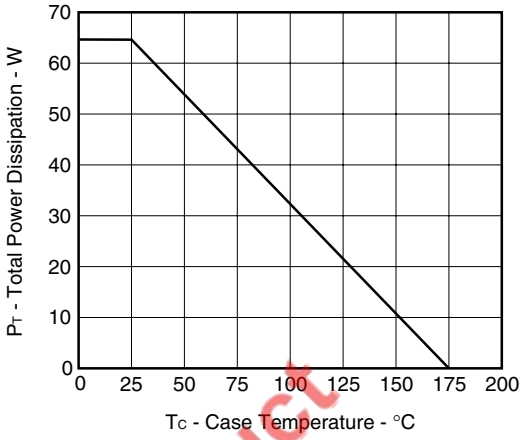


Figure.3 FORWARD BIAS SAFE OPERATING AREA

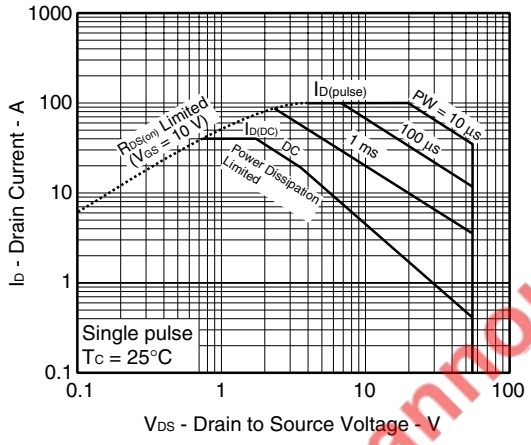
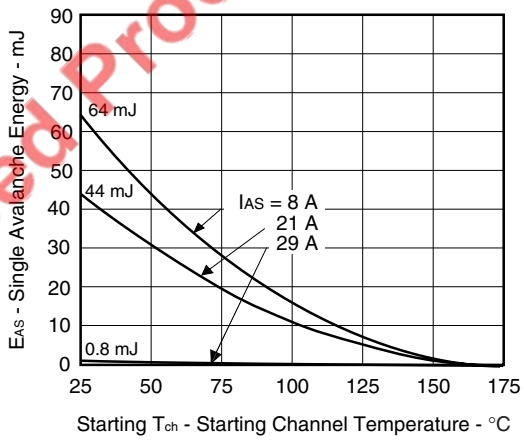
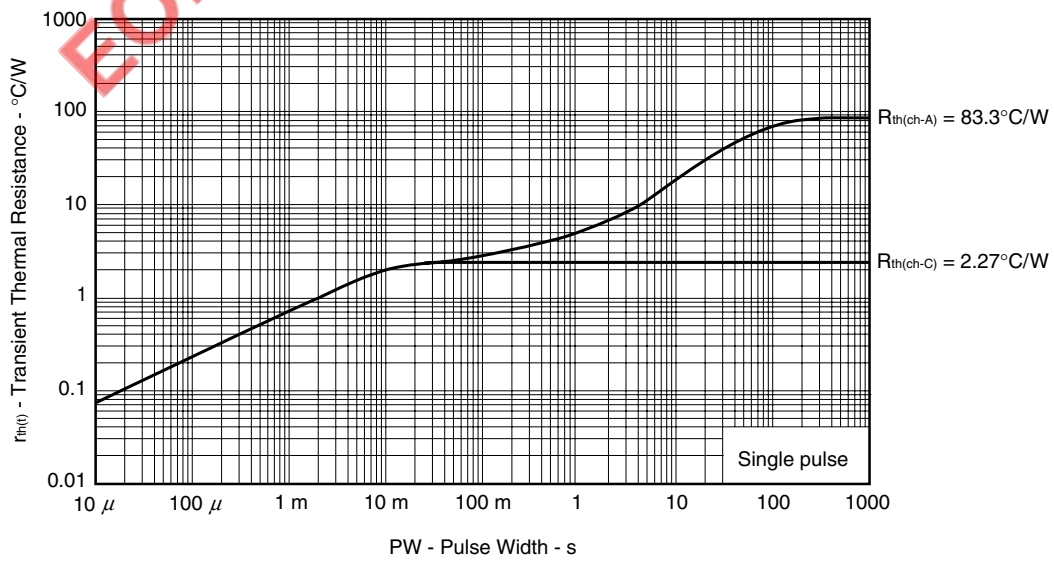


Figure4. SINGLE AVALANCHE ENERGY DERATING FACTOR



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Figure5. TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



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Figure6. FORWARD TRANSFER CHARACTERISTICS

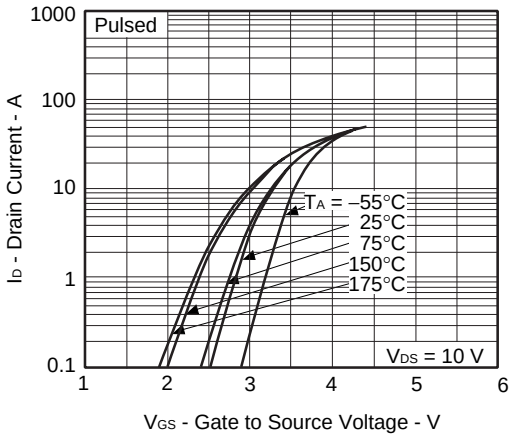


Figure7. DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

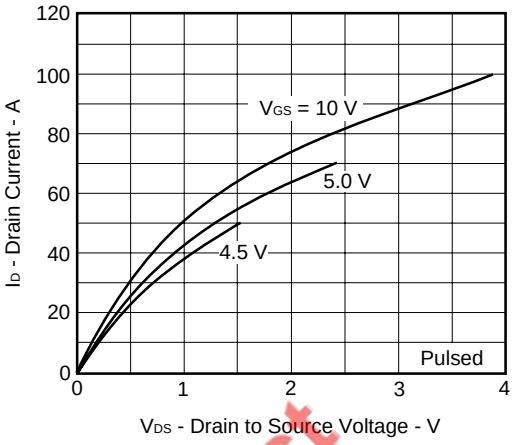


Figure8. FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

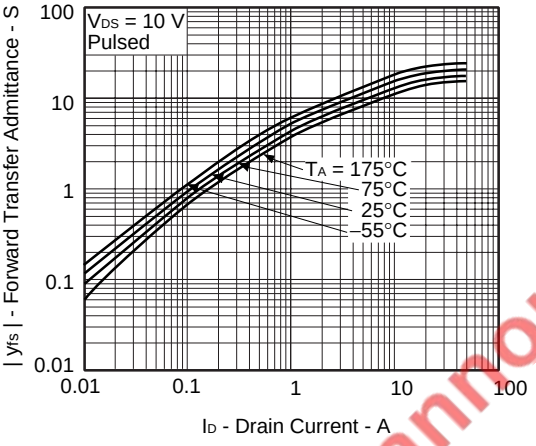


Figure9. DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

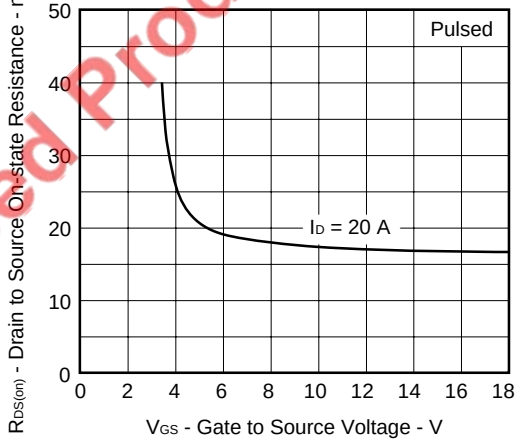


Figure10. DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

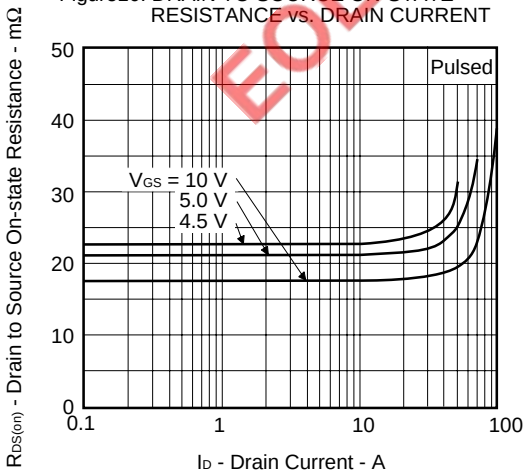
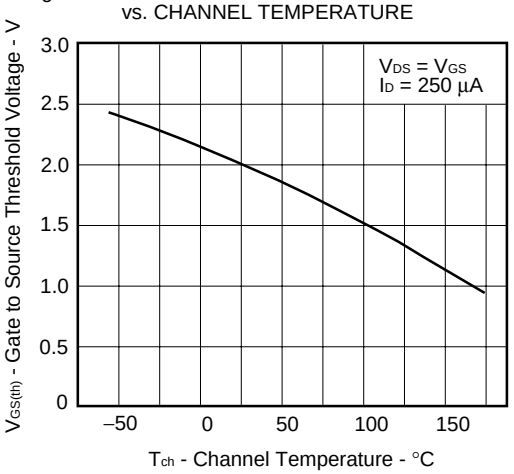


Figure11. GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



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Figure12. DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

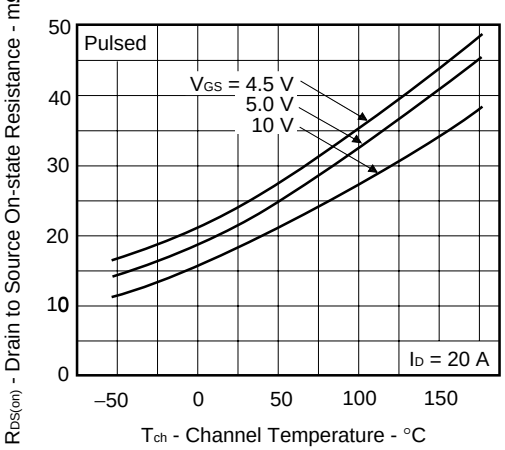


Figure13. SOURCE TO DRAIN DIODE FORWARD VOLTAGE

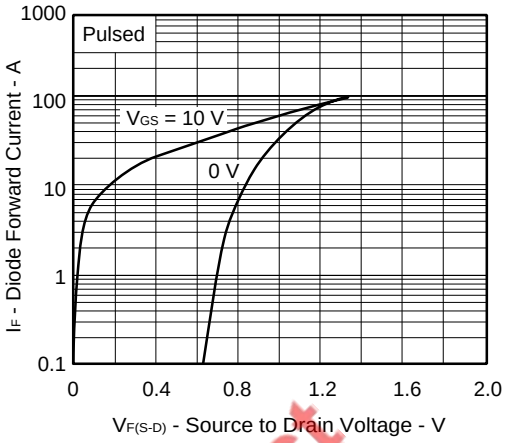


Figure14. CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

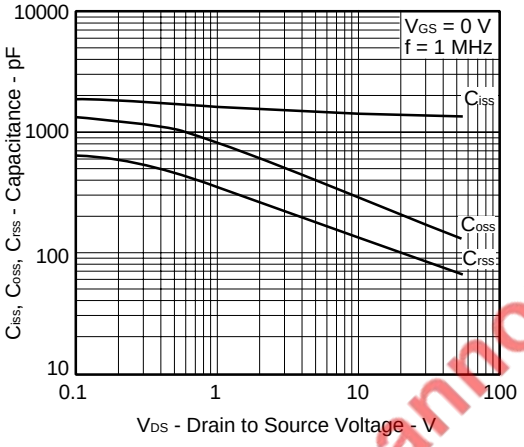


Figure15. SWITCHING CHARACTERISTICS

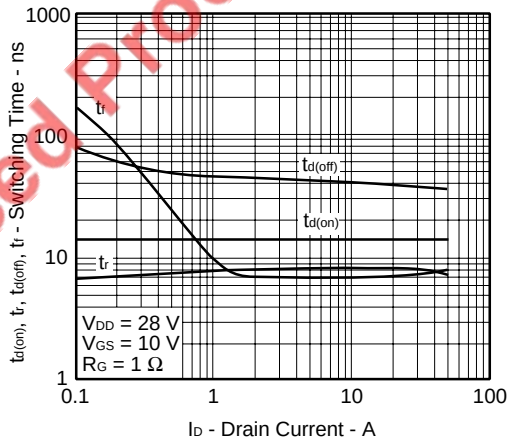


Figure16. REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

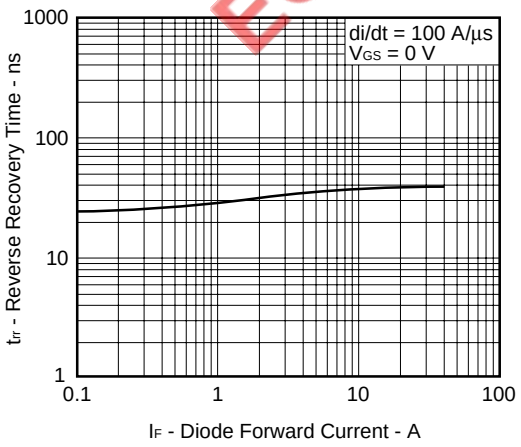
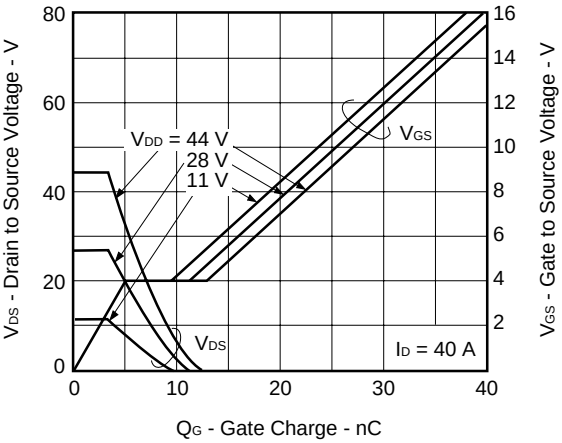


Figure17. DYNAMIC INPUT/OUTPUT CHARACTERISTICS

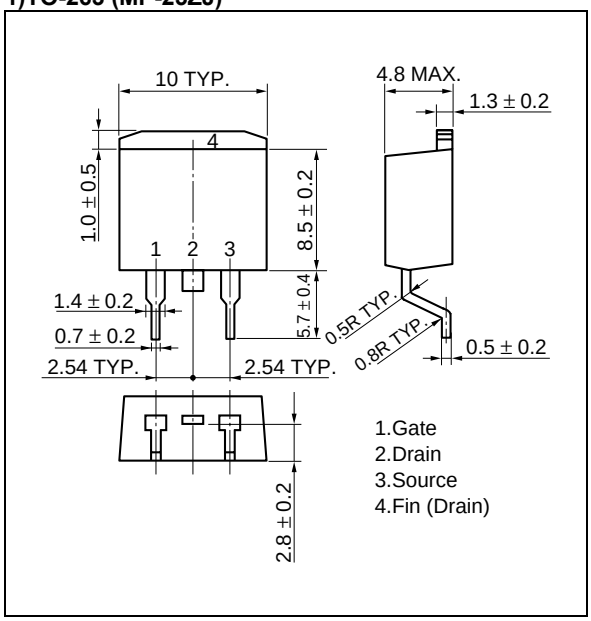


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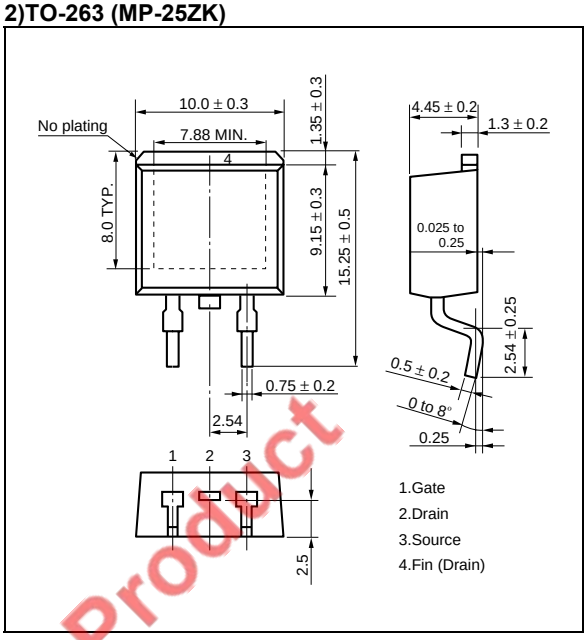
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<R> PACKAGE DRAWINGS (Unit: mm)

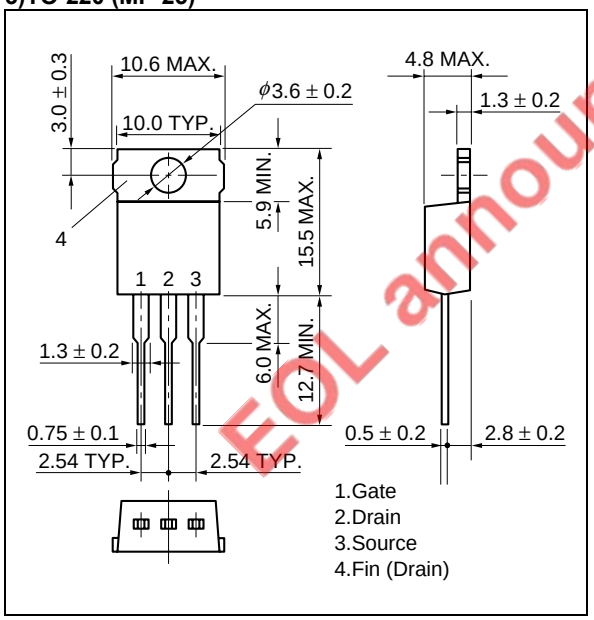
1)TO-263 (MP-25ZJ) Note



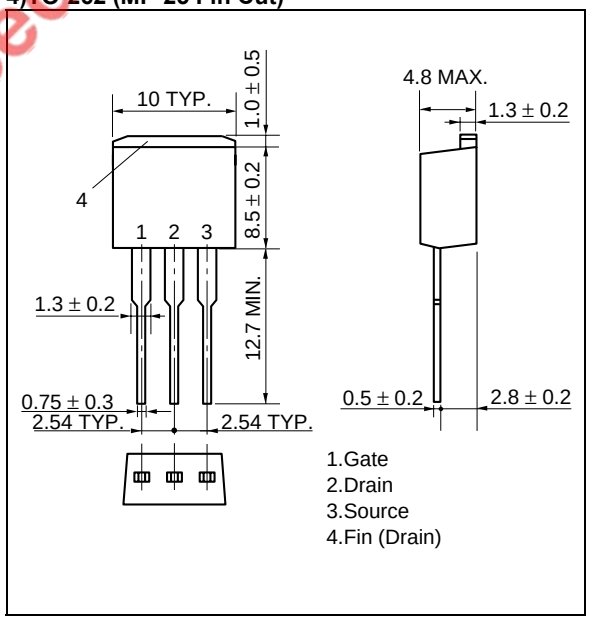
2)TO-263 (MP-25ZK)



3)TO-220 (MP-25) Note



4)TO-262 (MP-25 Fin Cut) Note

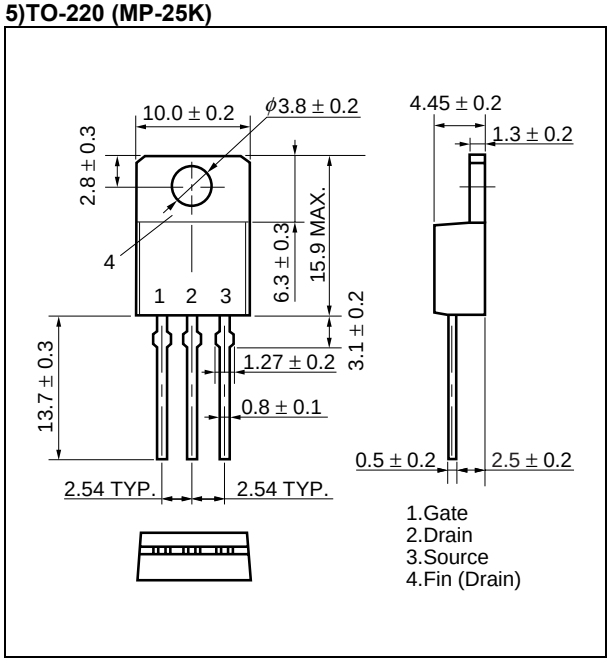


Note Not for new design

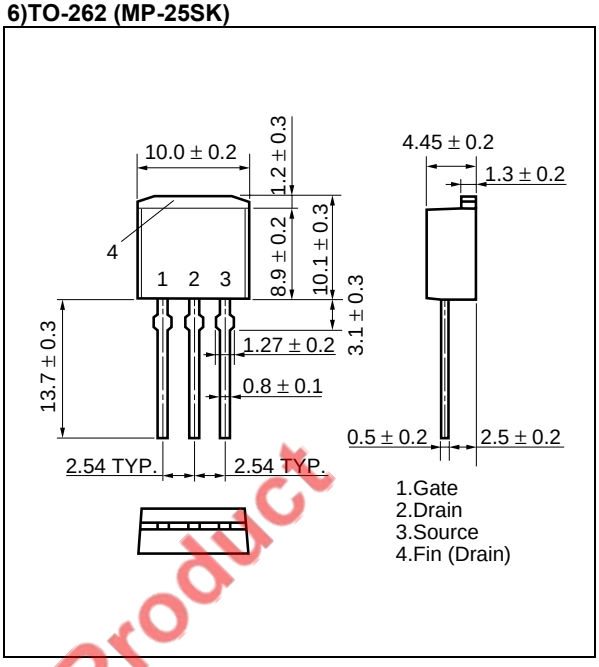
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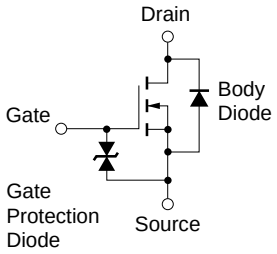
5)TO-220 (MP-25K)



6)TO-262 (MP-25SK)



EQUIVALENT CIRCUIT



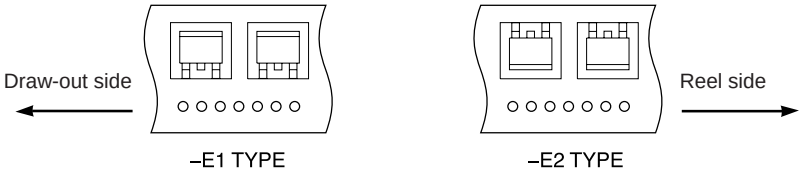
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Remark The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

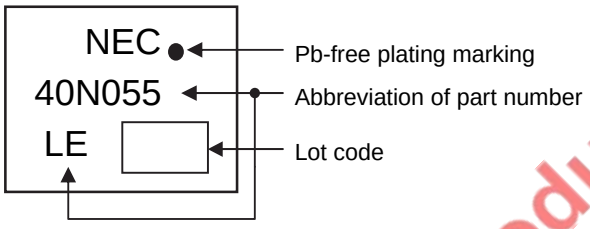
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<R> TAPE INFORMATION

There are two types (-E1, -E2) of taping depending on the direction of the device.



<R> MARKING INFORMATION



<R> 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 MP-25ZJ, MP-25ZK	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 MP-25, MP-25K, MP-25SK, MP-25 Fin Cut	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-25ZJ, MP-25ZK, MP-25K, MP-25SK	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
Partial heating MP-25, MP-25 Fin Cut	Maximum temperature (Pin temperature): 300°C or below Time (per side of the device): 3 seconds or less Maximum chlorine content of rosin flux: 0.2% (wt.) or less	P300

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

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  "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.

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