DATA SHEET

MOS FIELD EFFECT TRANSISTOR

NP80N04CHE, NP80N04DHE, NP80N04EHE

SWITCHING
N-CHANNEL POWER MOS FET
INDUSTRIAL USE

DESCRIPTION

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

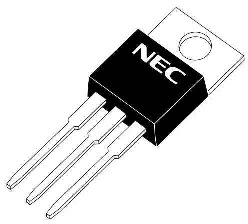
FEATURES

- Channel temperature 175 degree rated
- Super low on-state resistance
  $R_{DS(on)}$ = 8.0 mΩ MAX. (V_{GS} = 10 V, I_D = 40 A)
- Low C_{iss} : C_{iss} = 2200 pF TYP.
- Built-in gate protection diode

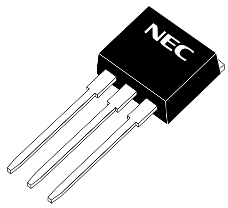
ORDERING INFORMATION

PART NUMBER	PACKAGE
NP80N04CHE	TO-220AB
NP80N04DHE	TO-262
NP80N04EHE	TO-263

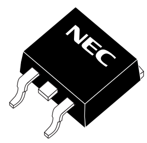
(TO-220AB)



(TO-262)



(TO-263)



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage	V_{DSS}	40	V
Gate to Source Voltage	V_{GSS}	±20	V
Drain Current (DC) Note1	$I_{D(DC)}$	±80	A
Drain Current (Pulse) Note2	$I_{D(pulse)}$	±280	A
Total Power Dissipation (T_A = 25°C)	P_T	1.8	W
Total Power Dissipation (T_C = 25°C)	P_T	120	W
Single Avalanche Current Note3	I_{AS}	52 / 31 / 13	A
Single Avalanche Energy Note3	E_{AS}	2.7 / 96 / 169	mJ
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	–55 to +175	°C

★ **Notes 1.** Calculated constant current according to MAX. allowable channel temperature.

2. PW ≤ 10 μs, Duty cycle ≤ 1 %

3. Starting T_{ch} = 25°C, R_G = 25 Ω , V_{GS} = 20 V → 0 V (See Figure 4.)

THERMAL RESISTANCE

Channel to Case	$R_{th(ch-C)}$	1.25	°C/W
Channel to Ambient	$R_{th(ch-A)}$	83.3	°C/W

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

Document No. D14239EJ3V0DS00 (3rd edition)
Date Published May 2000 NS CP(K)
Printed in Japan

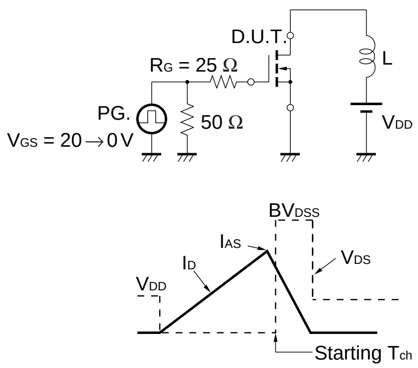
The mark ★ shows major revised points.

© NEC Corporation 1999

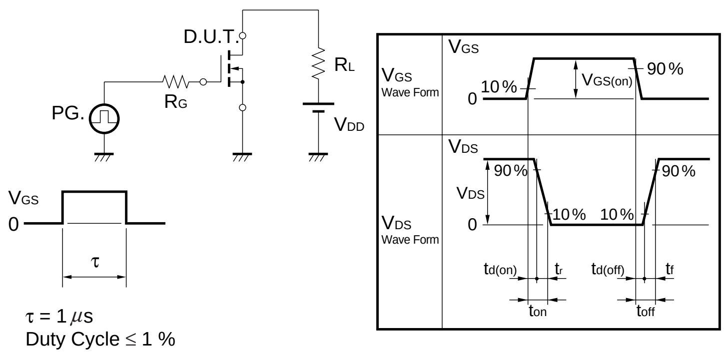
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Drain to Source On-state Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 40 A		6.2	8.0	mΩ
Gate to Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	2.0	3.0	4.0	V
Forward Transfer Admittance	$\lvert y_{fs} \rvert$	V_{DS} = 10 V, I_D = 40 A	15	31		S
Drain Leakage Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V			10	μA
Gate to Source Leakage Current	I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V			±10	μA
Input Capacitance	C_{iss}	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz		2200	3300	pF
Output Capacitance	C_{oss}			490	730	pF
Reverse Transfer Capacitance	C_{rss}			230	410	pF
Turn-on Delay Time	$t_{d(on)}$	I_D = 40 A, $V_{GS(on)}$ = 10 V, V_{DD} = 20 V,		24	52	ns
Rise Time	t_r	R_G = 1 Ω		14	36	ns
Turn-off Delay Time	$t_{d(off)}$			44	88	ns
Fall Time	t_f			15	37	ns
Total Gate Charge	Q_G	I_D = 80 A, V_{DD} = 32 V, V_{GS} = 10 V		40	60	nC
Gate to Source Charge	Q_{GS}			12		nC
Gate to Drain Charge	Q_{GD}			16		nC
Body Diode Forward Voltage	$V_{F(S-D)}$	I_F = 80 A, V_{GS} = 0 V		1.0		V
Reverse Recovery Time	t_{rr}	I_F = 80 A, V_{GS} = 0 V, di/dt = 100 A/μs		40		ns
Reverse Recovery Charge	Q_{rr}			50		nC

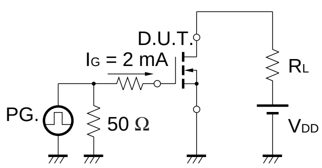
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME



TEST CIRCUIT 3 GATE CHARGE



TYPICAL CHARACTERISTICS (T_A = 25°C)

Figure1. DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA

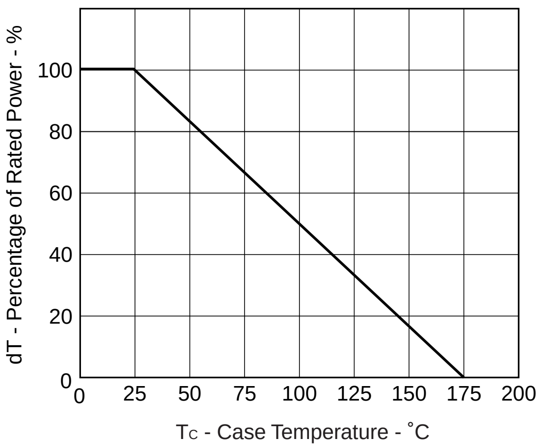


Figure2. TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

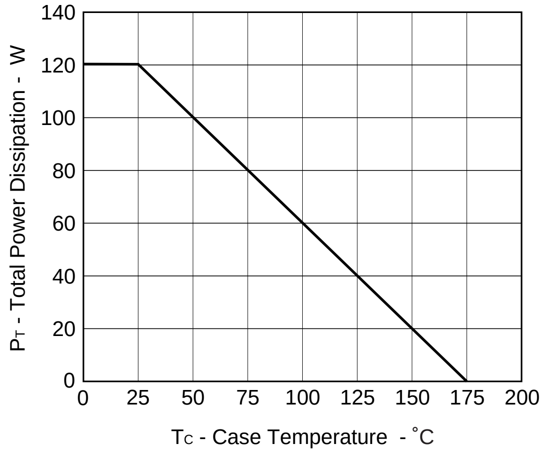


Figure.3 FORWARD BIAS SAFE OPERATING AREA

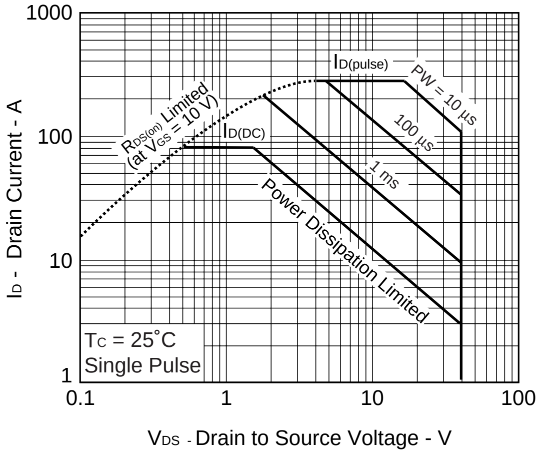


Figure4. SINGLE AVALANCHE ENERGY DERATING FACTOR

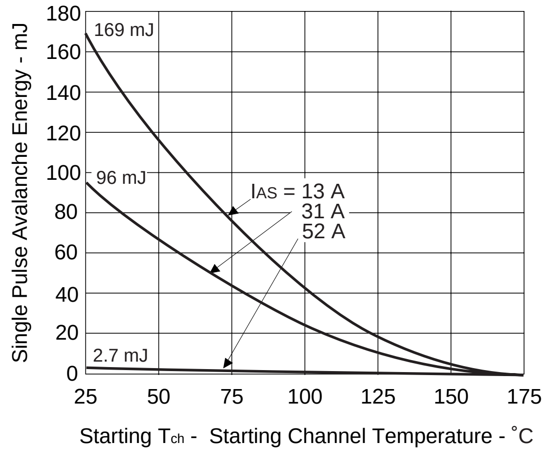


Figure5. TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

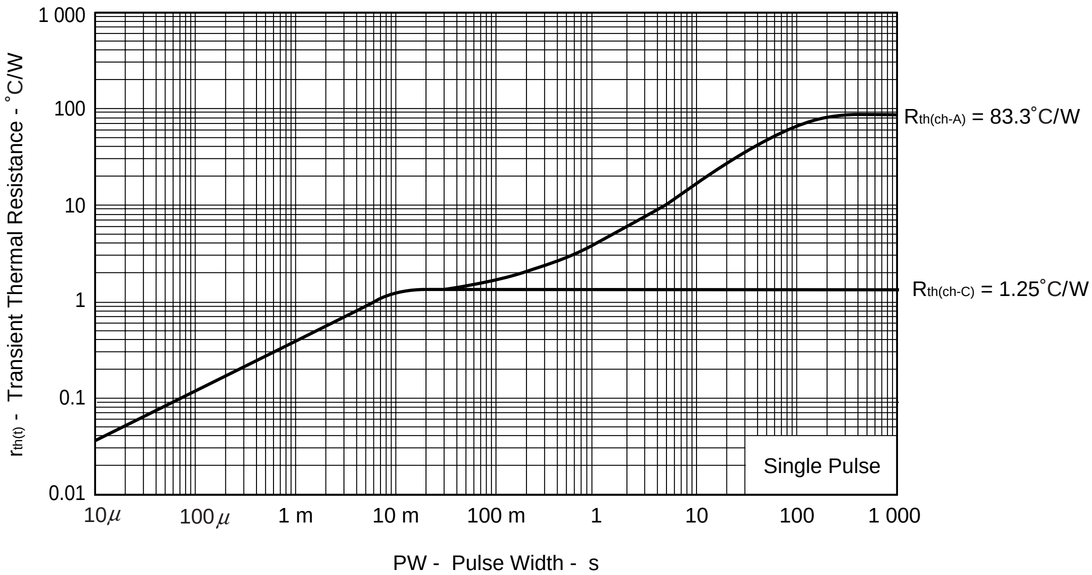


Figure6. FORWARD TRANSFER CHARACTERISTICS

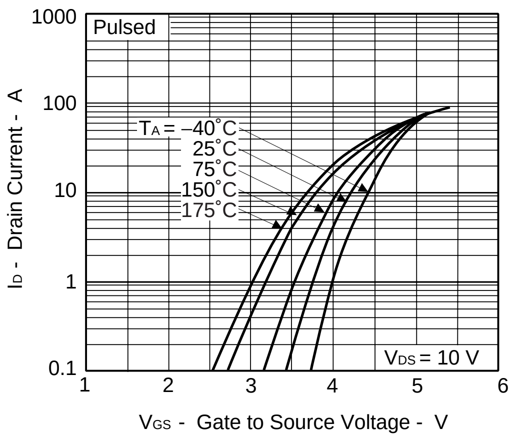


Figure7. DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

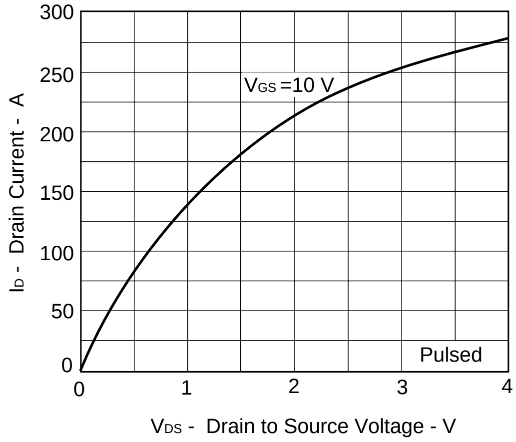


Figure8. FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

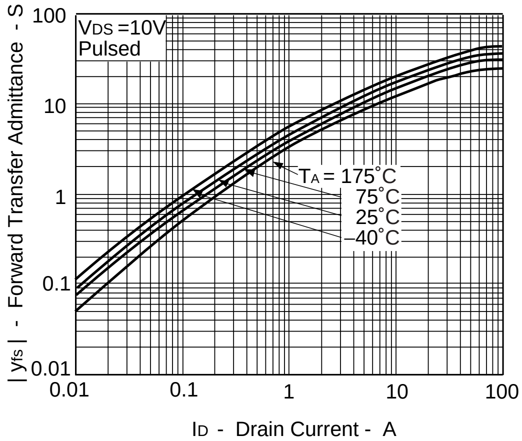


Figure9. DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

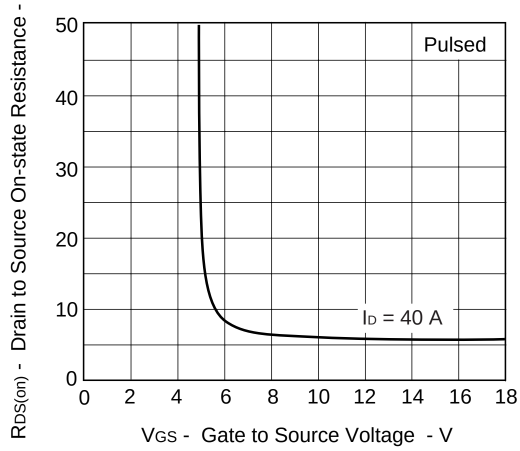


Figure10. DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

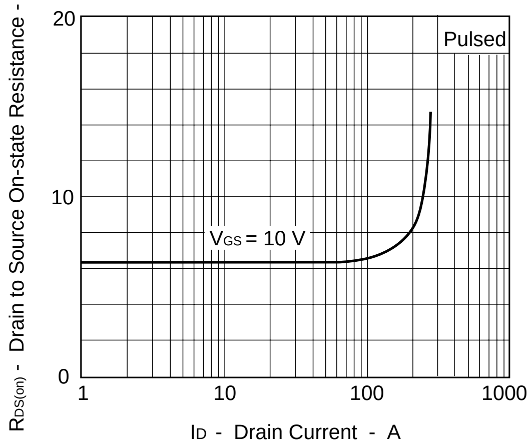


Figure11. GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE

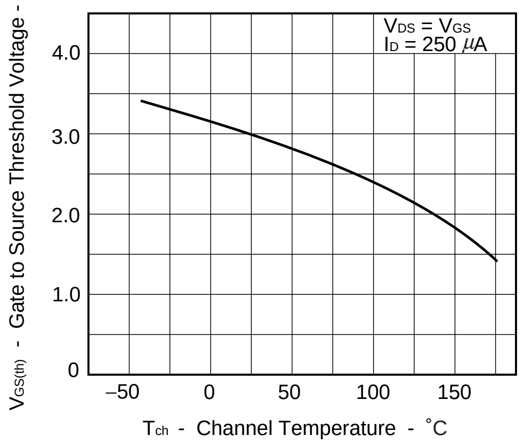


Figure12. DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

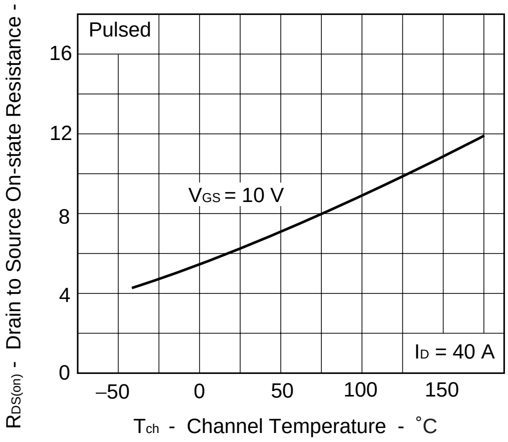


Figure13. SOURCE TO DRAIN DIODE FORWARD VOLTAGE

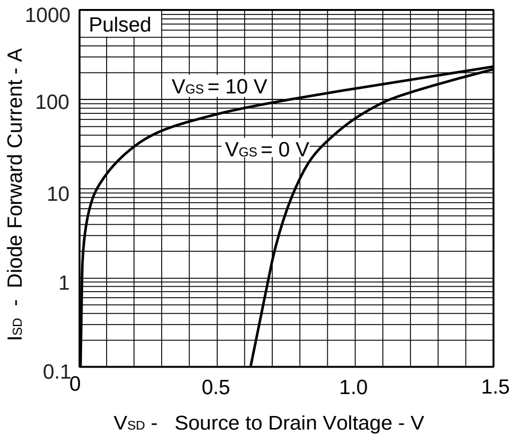


Figure14. CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

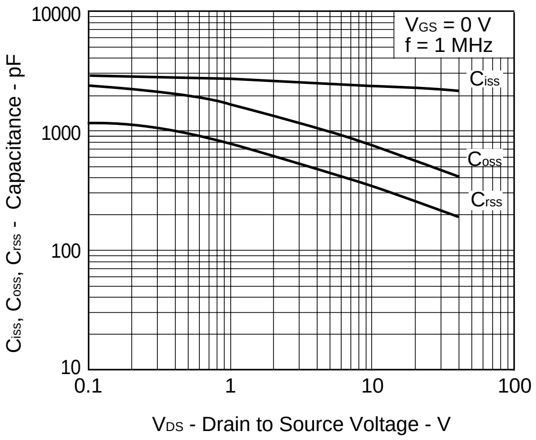


Figure15. SWITCHING CHARACTERISTICS

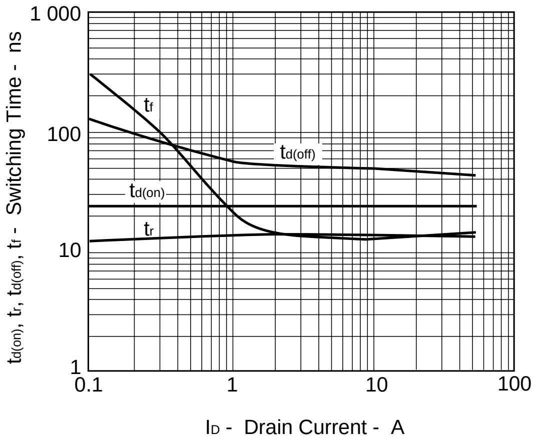


Figure16. REVERSE RECOVERY TIME vs. DRAIN CURRENT

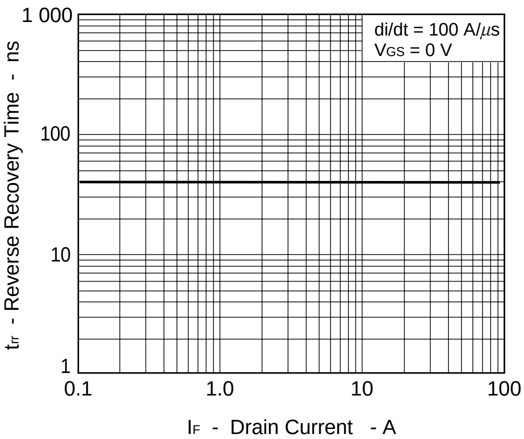
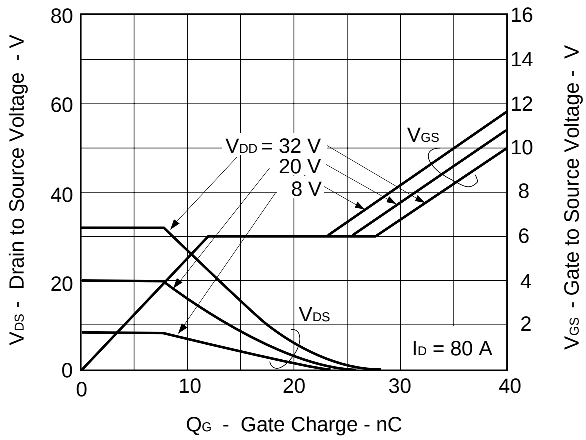
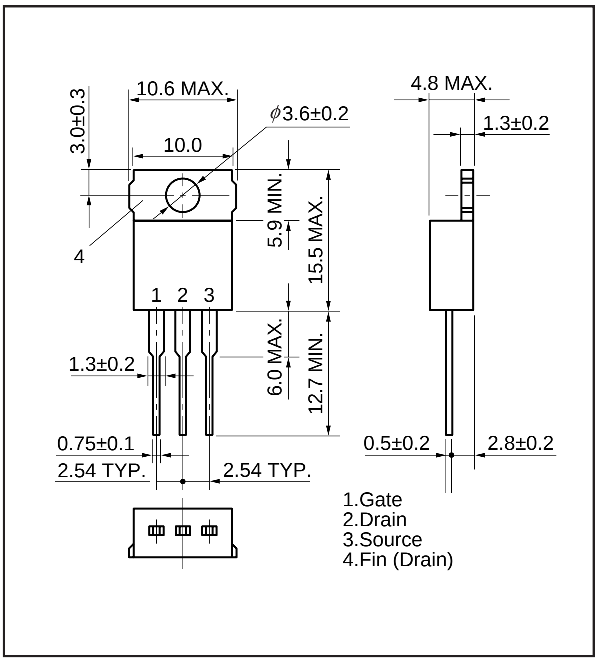


Figure17. DYNAMIC INPUT/OUTPUT CHARACTERISTICS

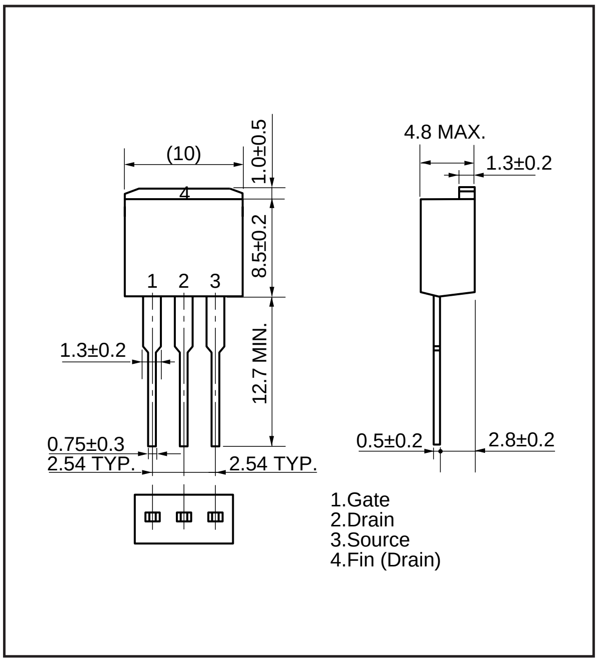


PACKAGE DRAWINGS (Unit: mm)

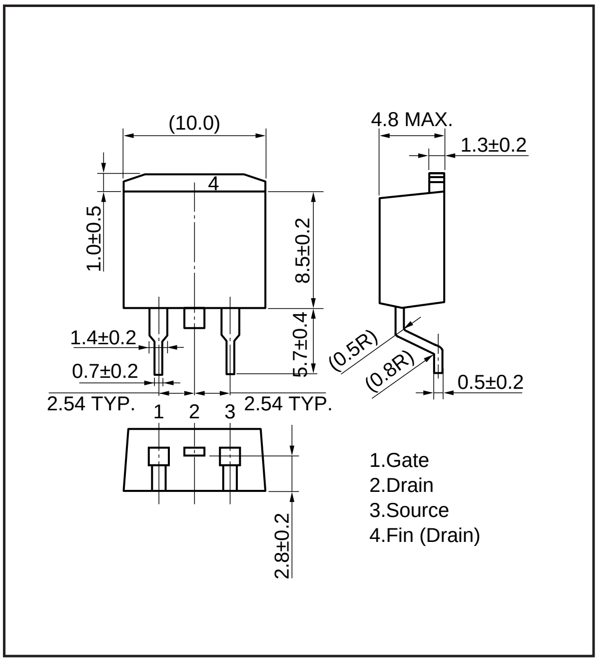
1) TO-220AB (MP-25)



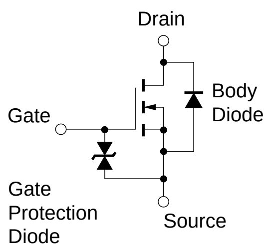
2) TO-262 (MP-25 Fin Cut)



3) TO-263 (MP-25ZJ)



EQUIVALENT CIRCUIT



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.

[MEMO]

- **The information in this document is current as of May, 2000. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
- NEC semiconductor products are classified into the following three quality grades:
  "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.
  "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 semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.
  (Note)
  (1) "NEC" as used in this statement means NEC Corporation and also includes its majority-owned subsidiaries.
  (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4