NEC

MOS FIELD EFFECT TRANSISTOR

NP24N10CLB, NP24N10DLB, NP24N10ELB

SWITCHING
N-CHANNEL POWER MOS FET

DESCRIPTION

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

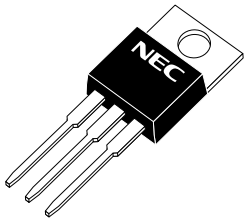
ORDERING INFORMATION

PART NUMBER	PACKAGE
NP24N10CLB	TO-220AB
NP24N10DLB	TO-262
NP24N10ELB	TO-263

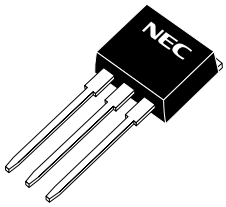
FEATURES

- Channel temperature 175 degree rated
- Super low on-state resistance
  $R_{DS(on)1}$ = 80 mΩ MAX. (V_{GS} = 10 V, I_D = 12 A)
  $R_{DS(on)2}$ = 93 mΩ MAX. (V_{GS} = 5.0 V, I_D = 10 A)
- Low C_{iss}: C_{iss} = 1300 pF TYP.
- Built-in gate protection diode

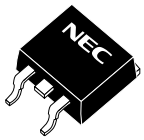
(TO-220AB)



(TO-262)



(TO-263)



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	100	V
Gate to Source Voltage (V_{DS} = 0 V)	V_{GSS}	±20	V
Drain Current (DC) (T_C = 25°C)	$I_{D(DC)}$	±24	A
Drain Current (Pulse) Note1	$I_{D(pulse)}$	±80	A
Total Power Dissipation (T_A = 25°C)	P_T	1.8	W
Total Power Dissipation (T_C = 25°C)	P_T	100	W
Single Avalanche Current Note2	I_{AS}	24 / 7	A
Single Avalanche Energy Note2	E_{AS}	57 / 245	mJ
Repetitive Avalanche Current Note3	I_{AR}	20	A
Repetitive Avalanche Energy Note3	E_{AR}	10	mJ
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	–55 to +175	°C

Notes 1. PW ≤ 10 μs, Duty cycle ≤ 1%

2. Starting T_{ch} = 25°C, V_{DD} = 50 V, R_G = 25 Ω , V_{GS} = 20 → 0 V

3. T_{ch} ≤ 175°C, R_G = 25 Ω , V_{GS} = 20 → 0 V, Duty cycle ≤ 3%

THERMAL RESISTANCE

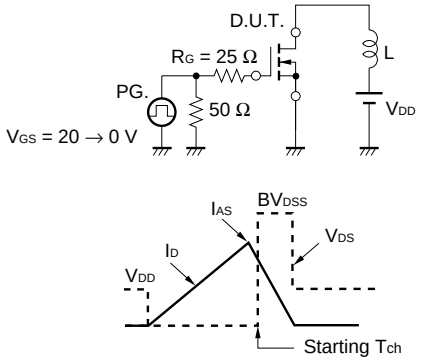
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.50	°C/W
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	°C/W

Document No. D13465EJ1V0DS00 (1st edition)
Date Published December 2001 NS CP(K)
Printed in Japan

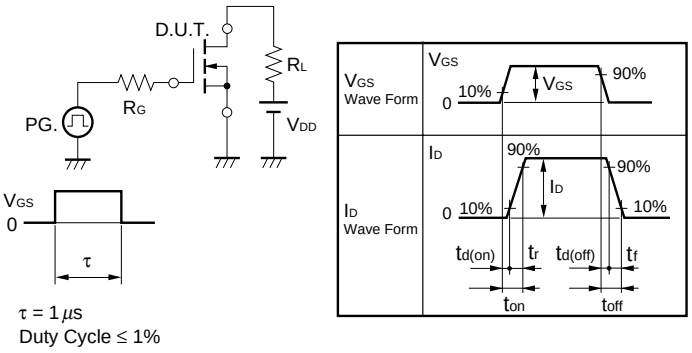
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 100 V, V_{GS} = 0 V			10	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V			±10	μA
Gate Cut-off Voltage	$V_{GS(off)}$	V_{DS} =10 V, I_D = 1 mA	1.0	1.5	2.0	V
Forward Transfer Admittance	$\|y_{fs}\|$	V_{DS} = 10 V, I_D = 10 A	12	22		S
Drain to Source On-state Resistance	$R_{DS(on)1}$	V_{GS} = 10 V, I_D = 12 A		55	80	mΩ
	$R_{DS(on)2}$	V_{GS} = 5.0 V, I_D = 10 A		61	93	mΩ
	$R_{DS(on)3}$	V_{GS} = 4.0 V, I_D = 10 A		65	100	mΩ
Input Capacitance	C_{iss}	V_{DS} = 10 V		1300	3100	pF
Output Capacitance	C_{oss}	V_{GS} = 0 V		460	700	pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		150	300	pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 50 V, I_D = 10 A		22	50	ns
Rise Time	t_r	V_{GS} = 10 V		110	280	ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 10 Ω		140	280	ns
Fall Time	t_f			120	280	ns
Total Gate Charge	Q_G	V_{DD} = 80 V		51	80	nC
Gate to Source Charge	Q_{GS}	V_{GS} = 10 V		4.9		nC
Gate to Drain Charge	Q_{GD}	I_D = 20 A		15		nC
Body Diode Forward Voltage	$V_{F(S-D)}$	I_F = 20 A, V_{GS} = 0 V		1.1		V
Reverse Recovery Time	t_{rr}	I_F = 20 A, V_{GS} = 0 V		170		ns
Reverse Recovery Charge	Q_{rr}	di/dt = 100 A/μs		770		nC

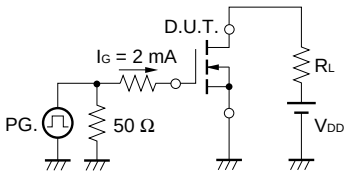
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

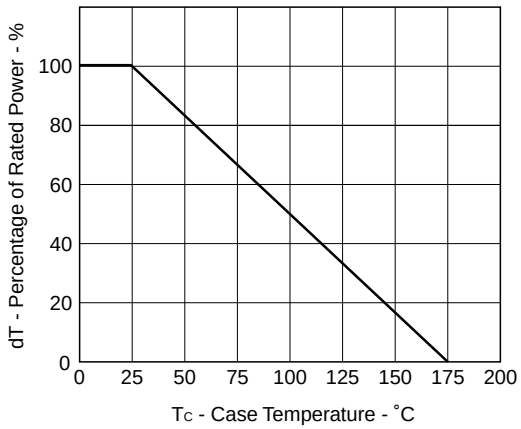


TEST CIRCUIT 3 GATE CHARGE

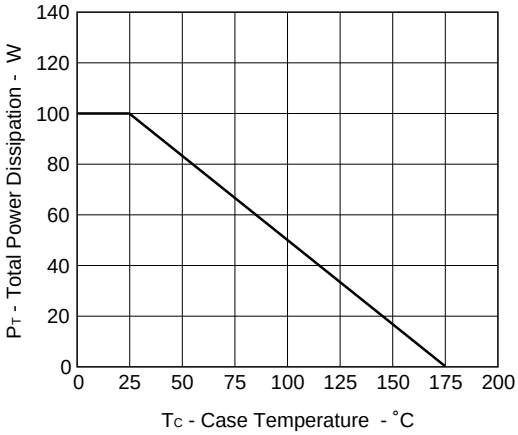


TYPICAL CHARACTERISTICS (T_A = 25°C)

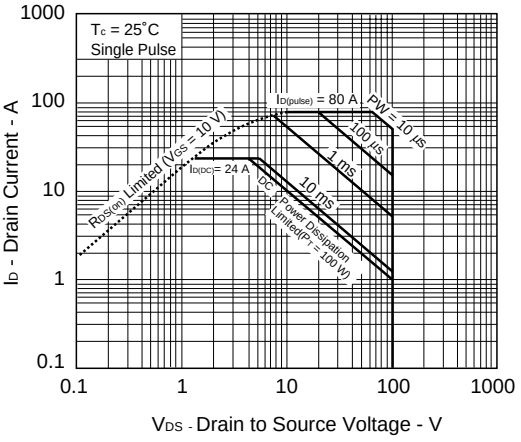
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



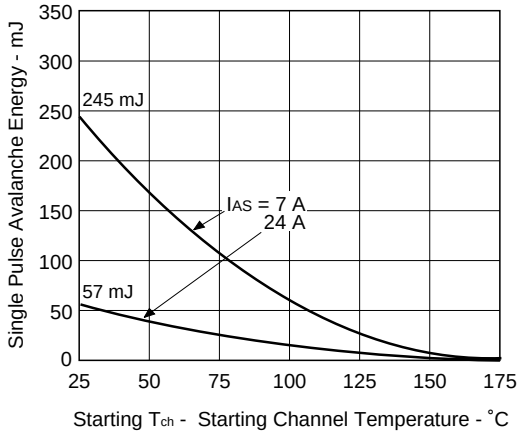
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



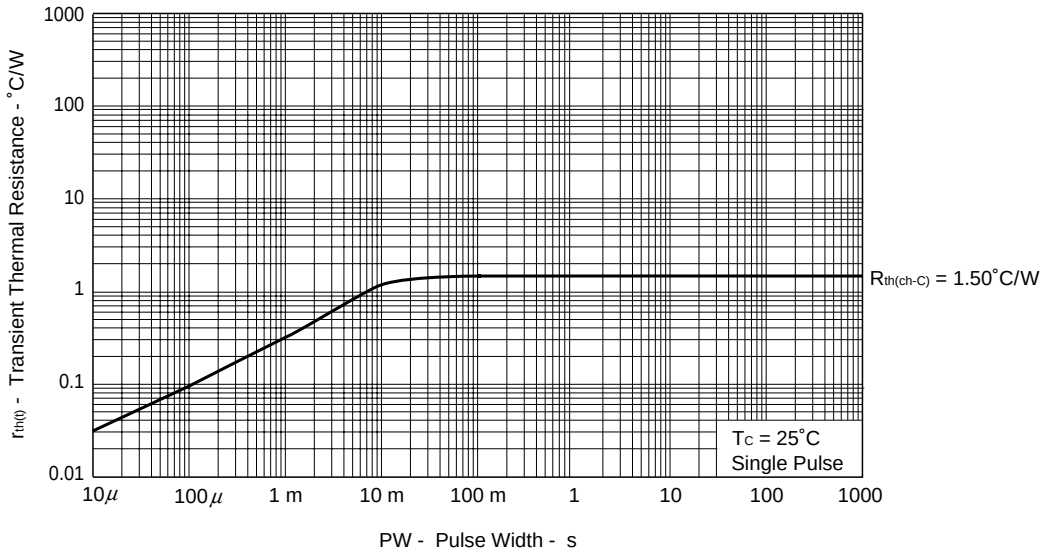
FORWARD BIAS SAFE OPERATING AREA



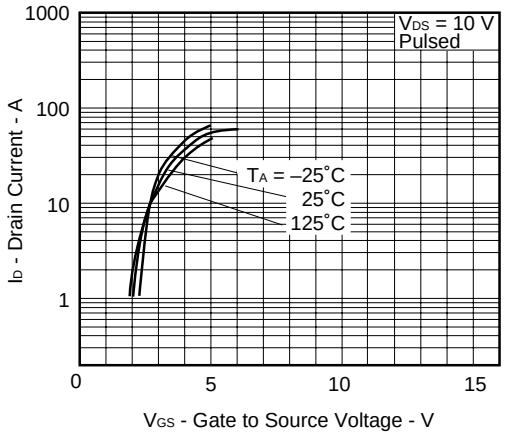
SINGLE AVALANCHE ENERGY DERATING FACTOR



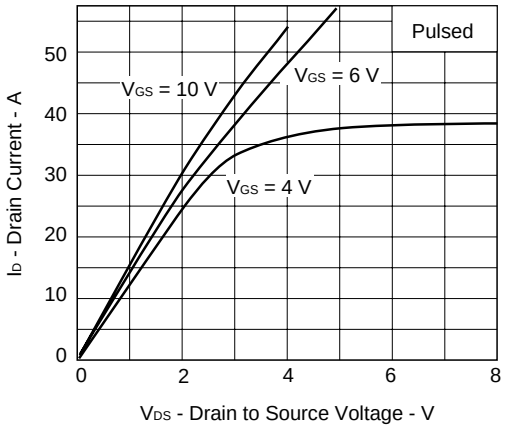
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



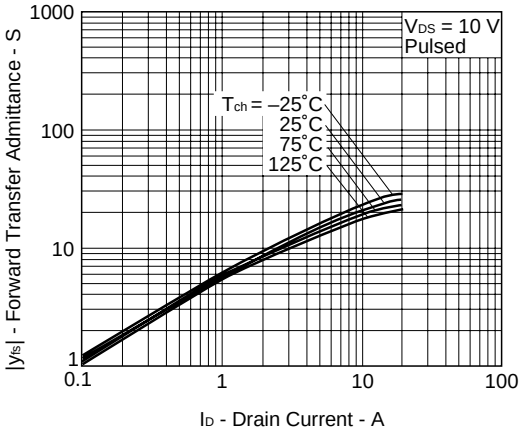
FORWARD TRANSFER CHARACTERISTICS



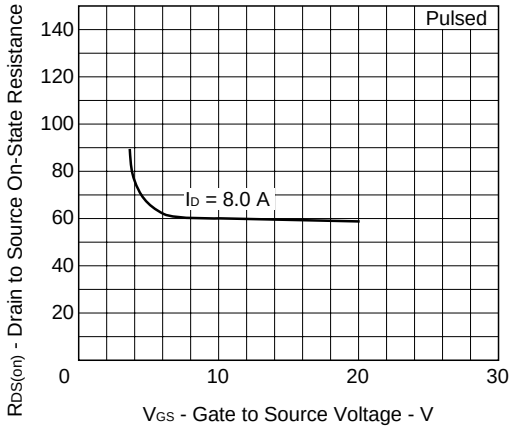
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



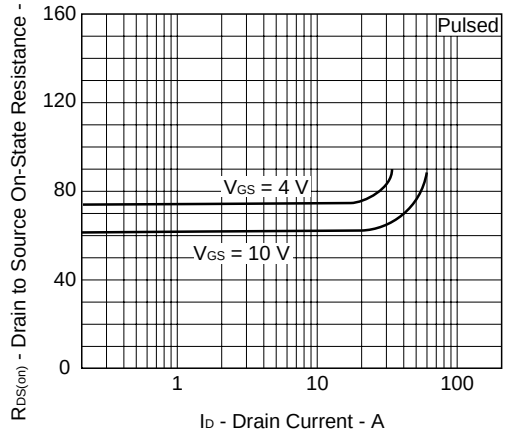
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



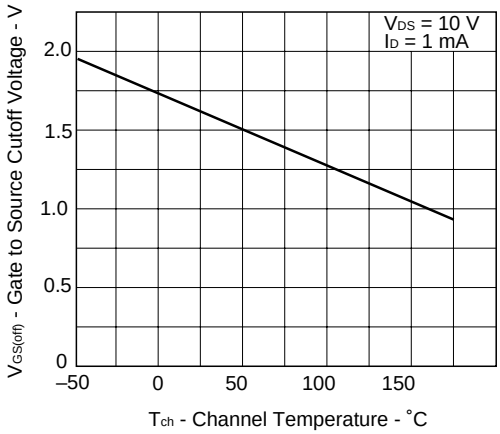
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



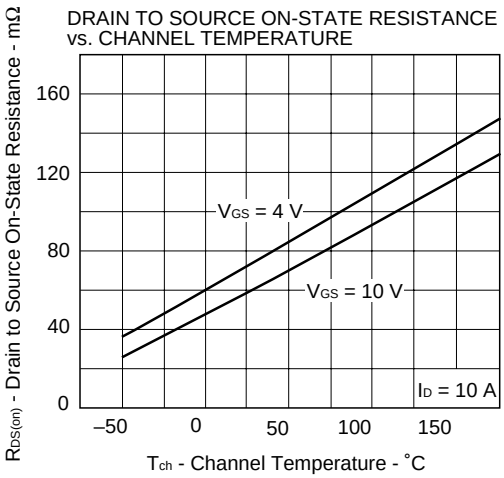
DRAIN TO SOURCE ON-STATE
RESISTANCE vs. DRAIN CURRENT



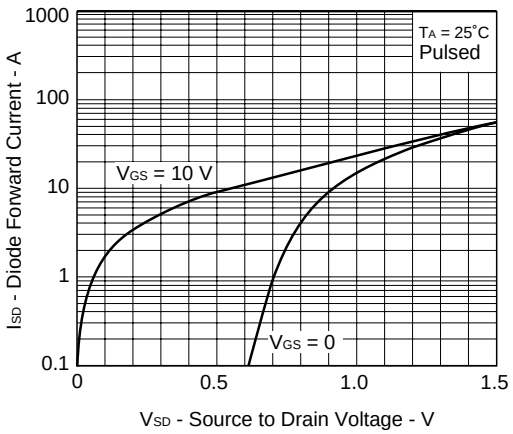
GATE TO SOURCE CUTOFF VOLTAGE vs.
CHANNEL TEMPERATURE



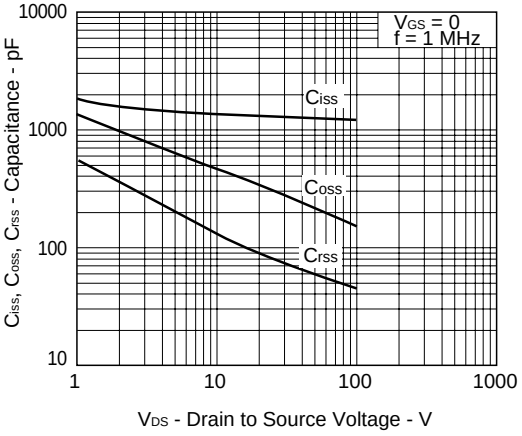
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



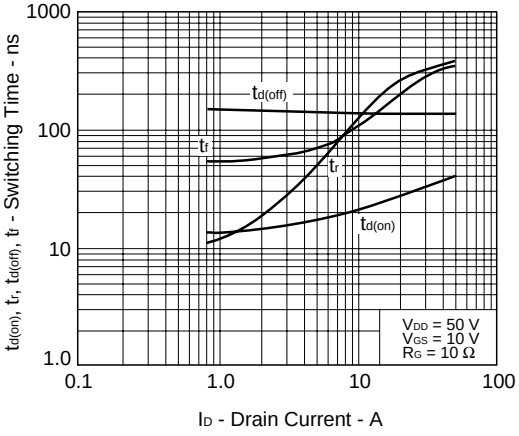
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



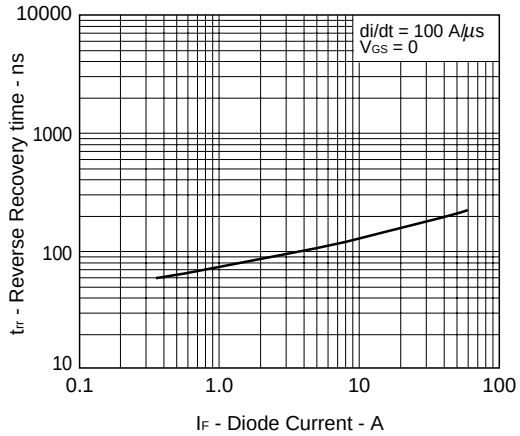
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



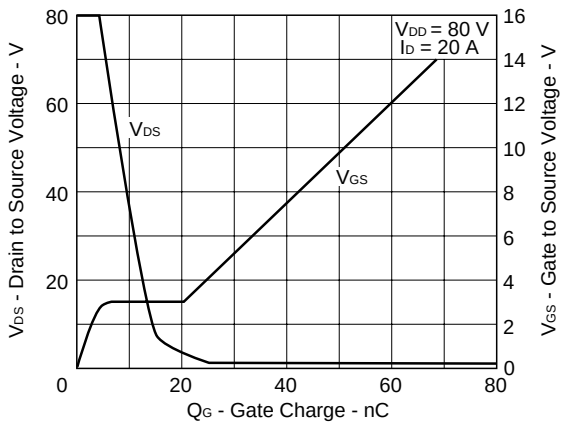
SWITCHING CHARACTERISTICS



REVERSE RECOVERY TIME vs. DRAIN CURRENT

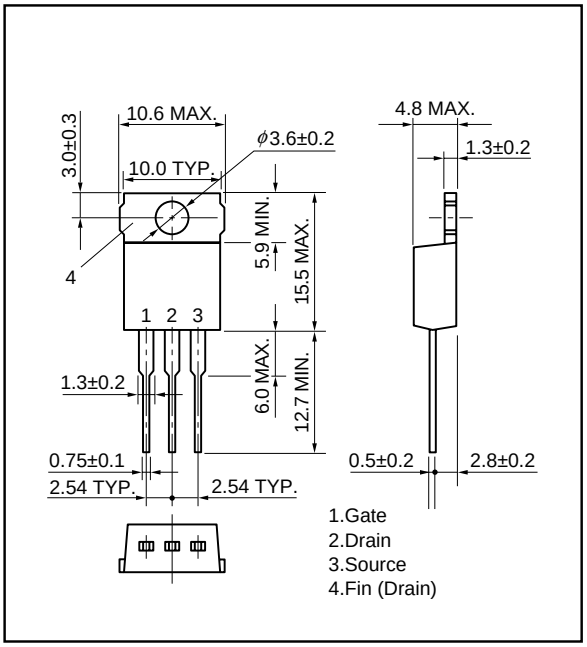


DYNAMIC INPUT/OUTPUT CHARACTERISTICS

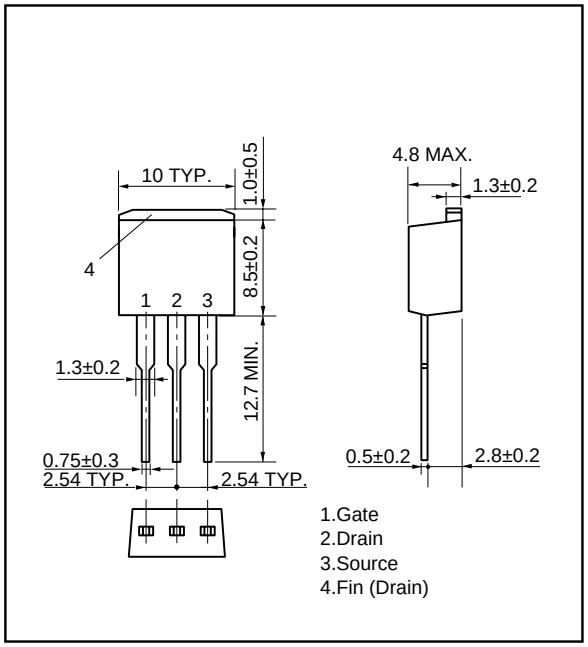


PACKAGE DRAWINGS (Unit: mm)

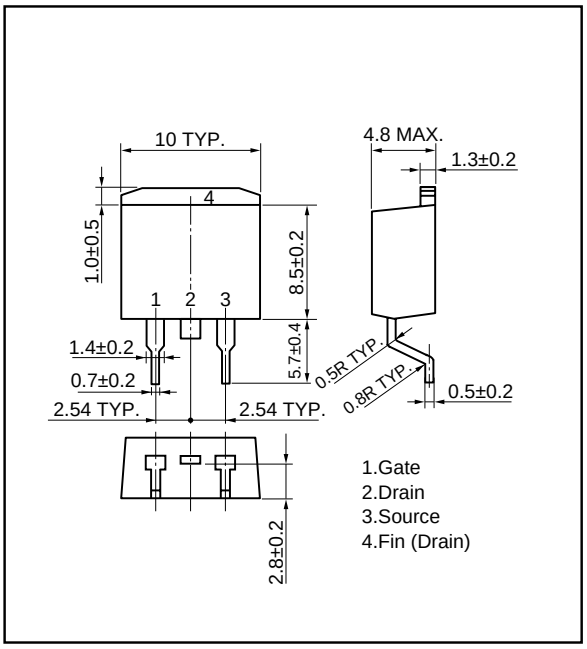
1) TO-220AB (MP-25)



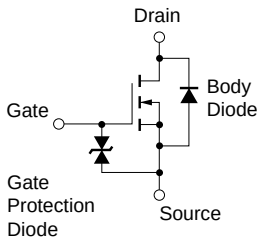
2) TO-262 (MP-25 Fin Cut)



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 December, 2001. 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