NEC

MOS FIELD EFFECT TRANSISTOR

NP40N06CLC, NP40N06DLC, NP40N06ELC

SWITCHING
N-CHANNEL POWER MOS FET

DESCRIPTION

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

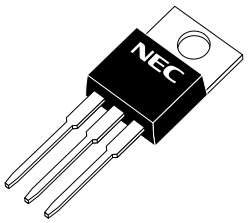
ORDERING INFORMATION

PART NUMBER	PACKAGE
NP40N06CLC	TO-220AB
NP40N06DLC	TO-262
NP40N06ELC	TO-263

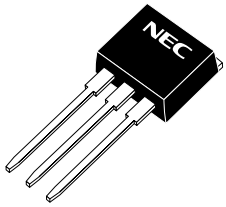
FEATURES

- Channel temperature 175 degree rated
- Super low on-state resistance
  $R_{DS(on)1}$ = 27 mΩ MAX. (V_{GS} = 10 V, I_D = 20 A)
  $R_{DS(on)2}$ = 38 mΩ MAX. (V_{GS} = 5.0 V, I_D = 18 A)
- Low C_{iss} : C_{iss} = 1200 pF TYP.
- Built-in gate protection diode

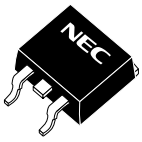
(TO-220AB)



(TO-262)



(TO-263)



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	60	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**	$I_{D(pulse)}$	±140	A
Total Power Dissipation (T_A = 25°C)	P_T	1.8	W
Total Power Dissipation (T_C = 25°C)	P_T	84	W
Single Avalanche Current **Note2**	I_{AS}	40 / 20 / 5	A
Single Avalanche Energy **Note2**	E_{AS}	1.6 / 40 / 125	mJ
Repetitive Avalanche Current **Note3**	I_{AR}	20	A
Repetitive Avalanche Energy **Note3**	E_{AR}	8.4	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} = 30 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	$R_{th(ch-C)}$	1.79	°C/W
Channel to Ambient	$R_{th(ch-A)}$	83.3	°C/W

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Document No. D13460EJ2V0DS00 (2nd edition)
Date Published September 2001 NS CP(K)
Printed in Japan

The mark ★ shows major revised points.

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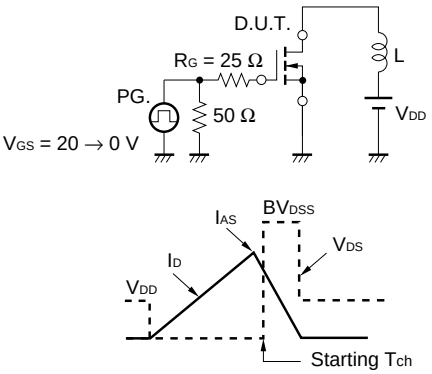
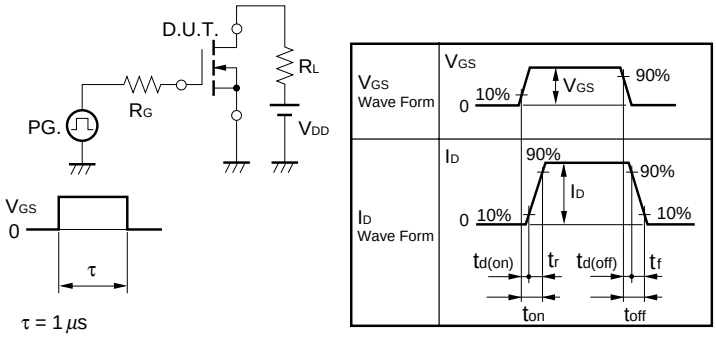
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 60 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 = 18 A	10	23		S
Drain to Source On-state Resistance	$R_{DS(on)1}$	V_{GS} = 10 V, I_D = 20 A		20	27	mΩ
	$R_{DS(on)2}$	V_{GS} = 5.0 V, I_D = 18 A		28	38	mΩ
	$R_{DS(on)3}$	V_{GS} = 4.0 V, I_D = 18 A		33	40	mΩ
Input Capacitance	C_{iss}	V_{DS} = 10 V		1200	2650	pF
Output Capacitance	C_{oss}	V_{GS} = 0 V		570	860	pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		270	500	pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 30 V, I_D = 18 A		35	80	ns
Rise Time	t_r	V_{GS} = 10 V		280	700	ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 10 Ω		160	320	ns
Fall Time	t_f			170	430	ns
Total Gate Charge	Q_G	V_{DD} = 48 V		50	80	nC
Gate to Source Charge	Q_{GS}	V_{GS} = 10 V		4.5		nC
Gate to Drain Charge	Q_{GD}	I_D = 35 A		22		nC
Body Diode Forward Voltage	$V_{F(S-D)}$	I_F = 35 A, V_{GS} = 0 V		1.0		V
Reverse Recovery Time	t_{rr}	I_F = 35 A, V_{GS} = 0 V		70		ns
Reverse Recovery Charge	Q_{rr}	di/dt = 100 A/μs		130		nC

TEST CIRCUIT 1 AVALANCHE CAPABILITY

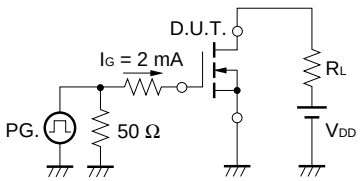


TEST CIRCUIT 2 SWITCHING TIME



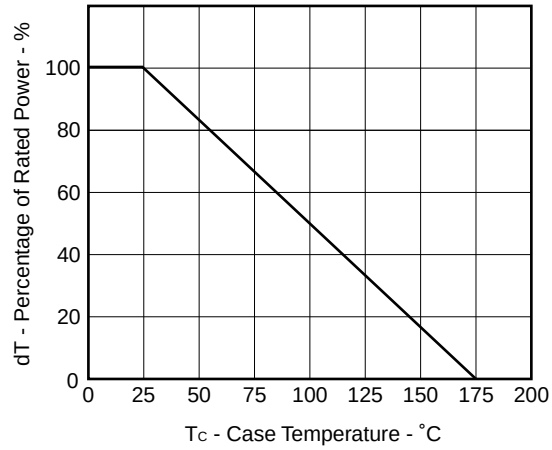
τ = 1 μs
Duty Cycle ≤ 1%

TEST CIRCUIT 3 GATE CHARGE

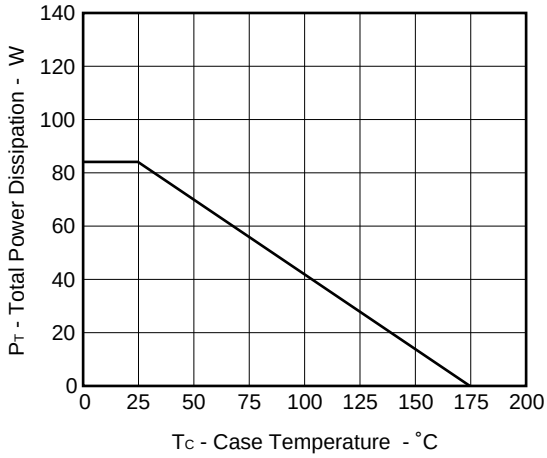


★ TYPICAL CHARACTERISTICS (T_A = 25°C)

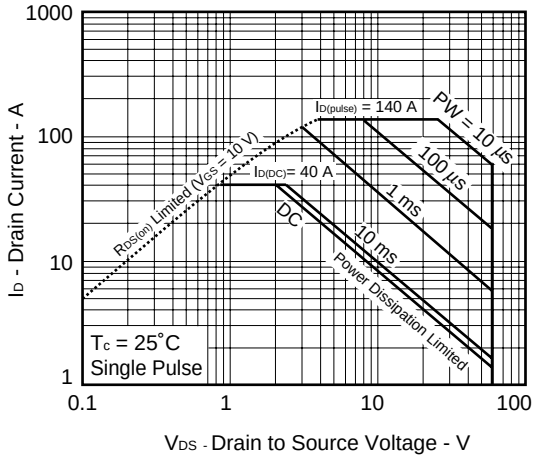
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



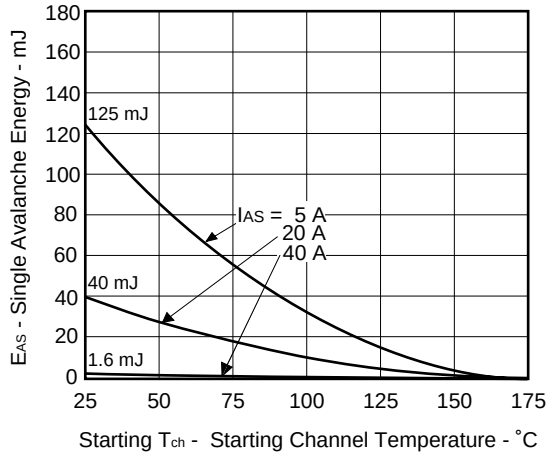
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



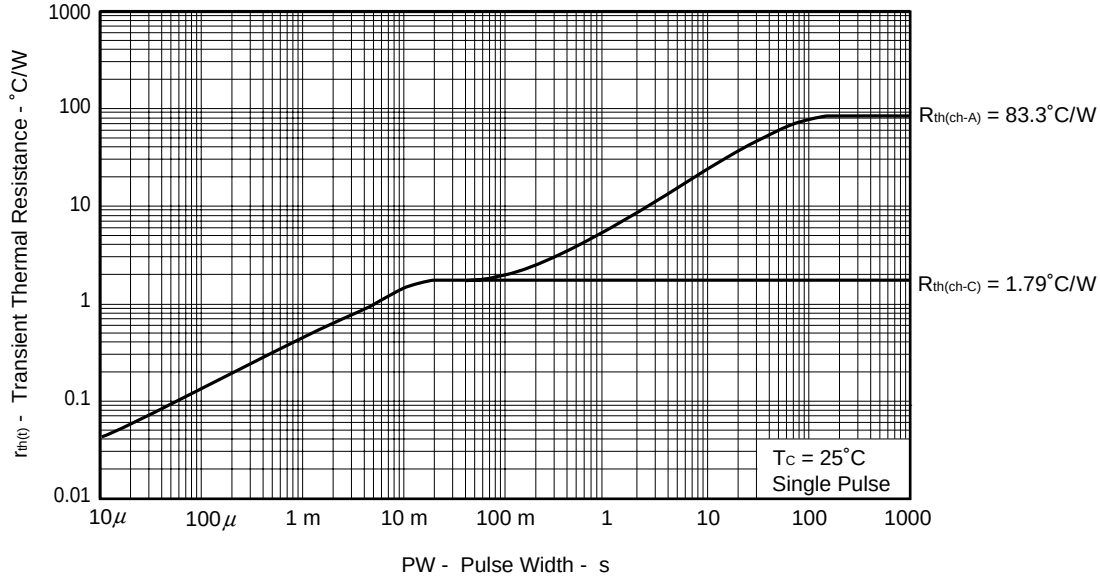
FORWARD BIAS SAFE OPERATING AREA



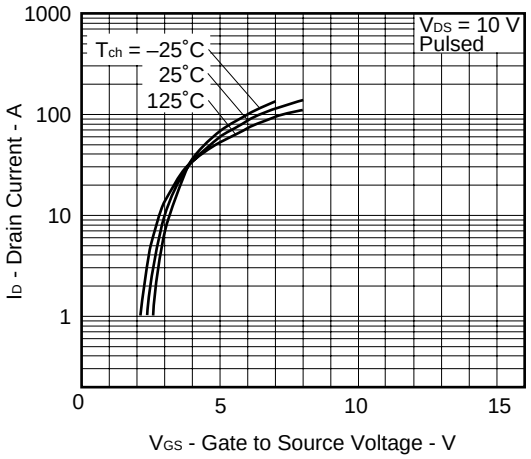
SINGLE AVALANCHE ENERGY DERATING FACTOR



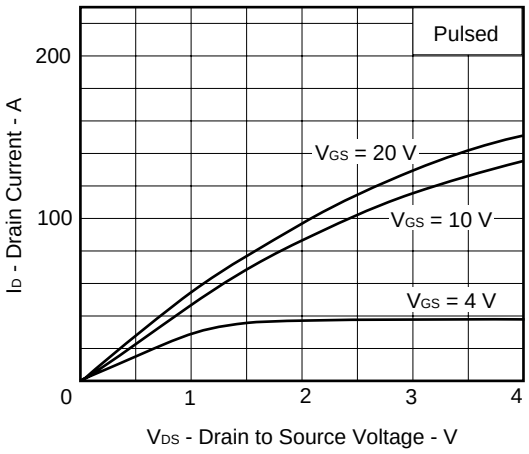
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



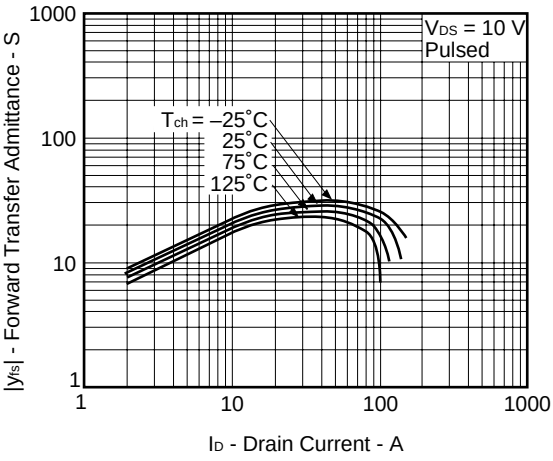
FORWARD TRANSFER CHARACTERISTICS



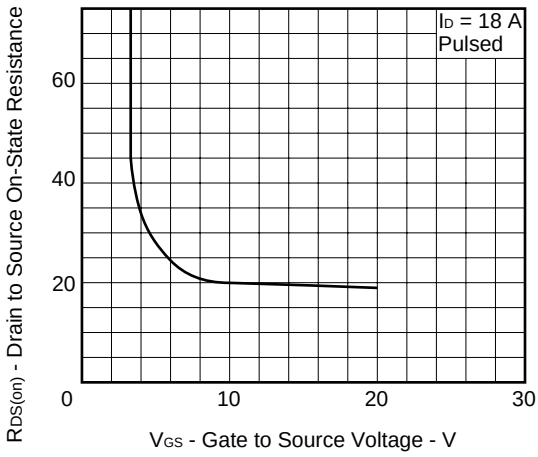
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



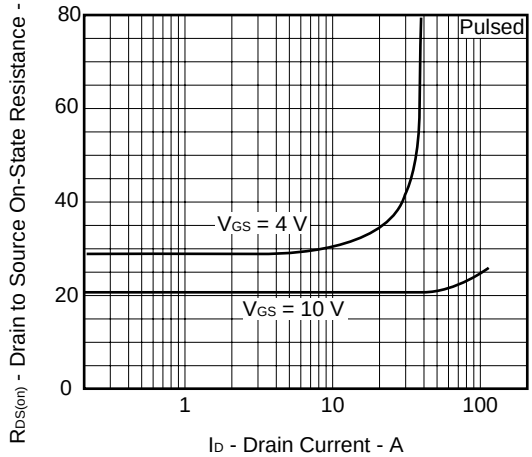
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



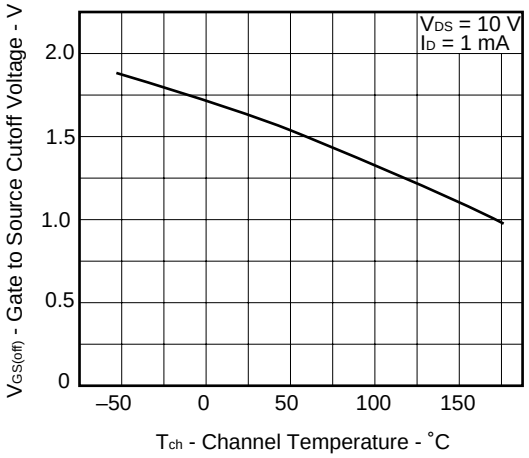
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



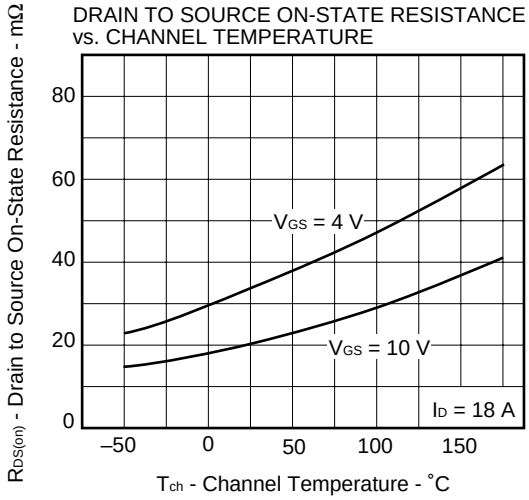
DRAIN TO SOURCE ON-STATE
RESISTANCE vs. DRAIN CURRENT



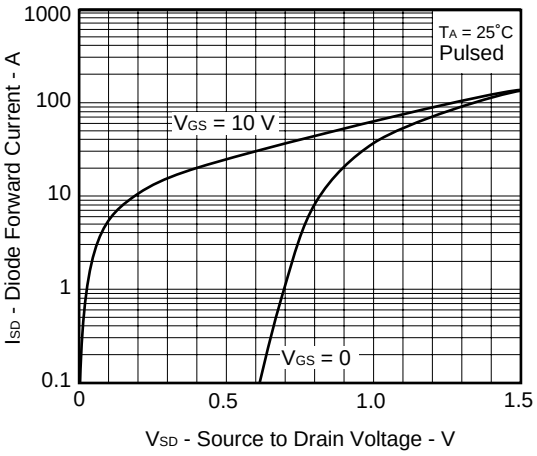
GATE TO SOURCE CUTOFF VOLTAGE vs.
CHANNEL TEMPERATURE



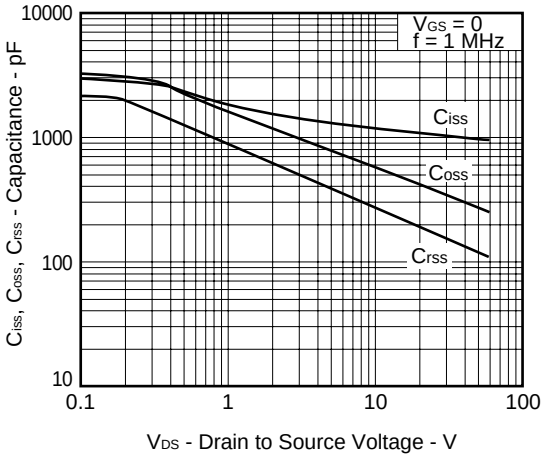
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



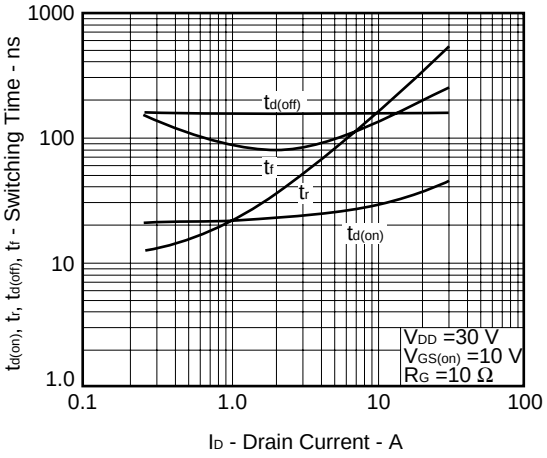
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



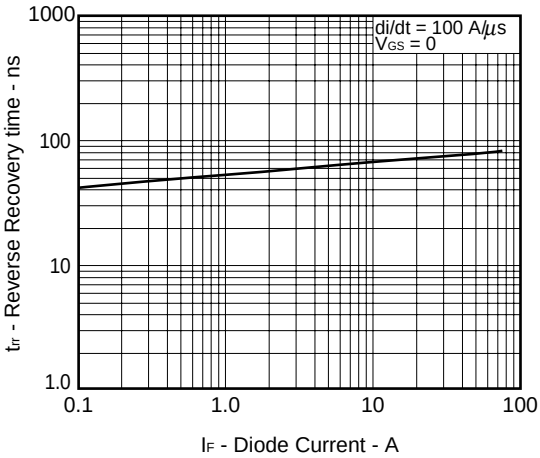
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



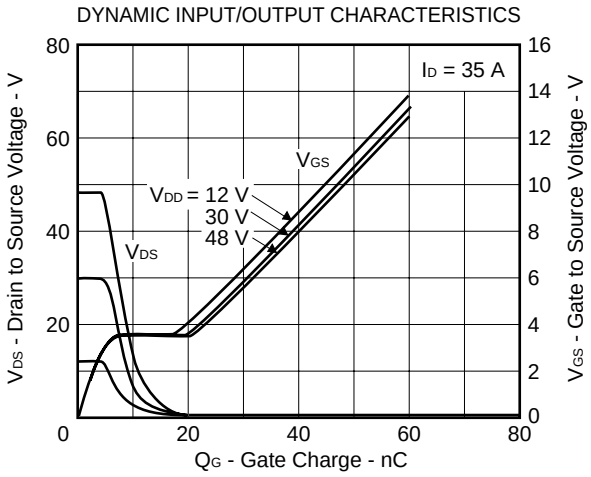
SWITCHING CHARACTERISTICS



REVERSE RECOVERY TIME vs. DRAIN CURRENT

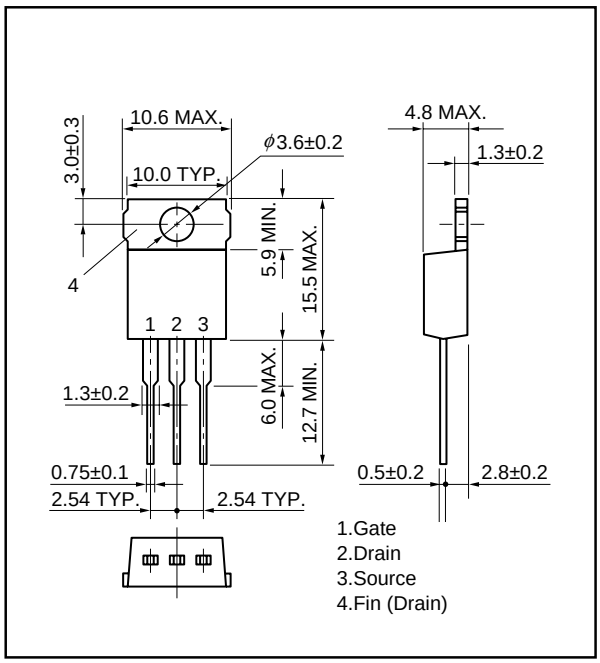


DYNAMIC INPUT/OUTPUT CHARACTERISTICS

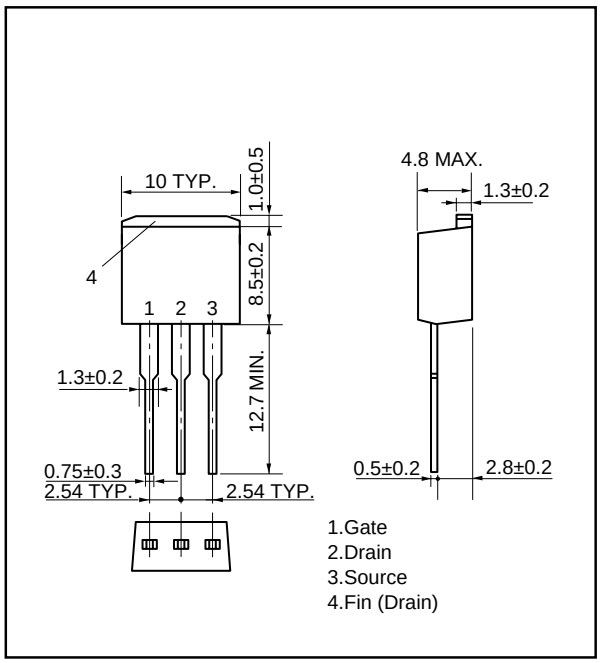


PACKAGE DRAWINGS (Unit: mm)

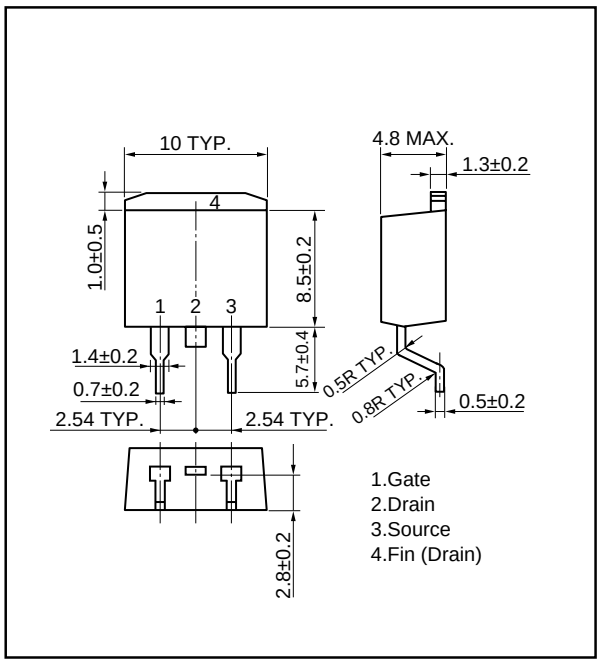
1) TO-220AB (MP-25)



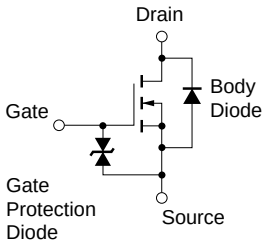
2) TO-262 (MP-25 Fin Cut)



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]

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