

MOS FIELD EFFECT TRANSISTOR  
NP45N06CLC, NP45N06DLC, NP45N06ELC

SWITCHING  
N-CHANNEL POWER MOS FET

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  
 $R_{DS(on)1} = 20 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 23 \text{ A)}$   
 $R_{DS(on)2} = 25 \text{ m}\Omega \text{ MAX. (} V_{GS} = 5.0 \text{ V, } I_D = 20 \text{ A)}$
- Low  $C_{iss}$  :  $C_{iss} = 1590 \text{ pF TYP.}$
- Built-in gate protection diode

ORDERING INFORMATION

PART NUMBER	PACKAGE
NP45N06CLC	TO-220AB
NP45N06DLC	TO-262
NP45N06ELC	TO-263

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	60	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 45$	A
Drain Current (Pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 160$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_T$	105	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_T$	1.8	W
Channel Temperature	$T_{ch}$	175	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	$-55 \text{ to } +175$	$^\circ\text{C}$
Single Avalanche Current <sup>Note2</sup>	$I_{AS}$	45 / 20 / 7	A
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	2 / 40 / 245	mJ
Repetitive Avalanche Current <sup>Note3</sup>	$I_{AR}$	20	A
Repetitive Avalanche Energy <sup>Note3</sup>	$E_{AR}$	10.5	mJ

Notes 1.  $PW \leq 10 \mu\text{s}$ , Duty cycle  $\leq 1\%$

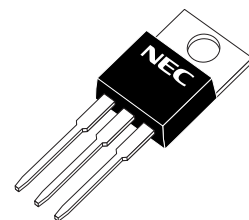
2. Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 30 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$  (See Figure4.)

3.  $T_{ch} \leq 175^\circ\text{C}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$ , Duty cycle  $\leq 3\%$

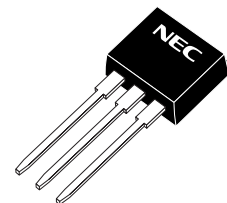
THERMAL RESISTANCE

Channel to Case	$R_{th(ch-C)}$	1.43	$^\circ\text{C/W}$
Channel to Ambient	$R_{th(ch-A)}$	83.3	$^\circ\text{C/W}$

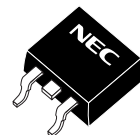
(TO-220AB)



(TO-262)



(TO-263)

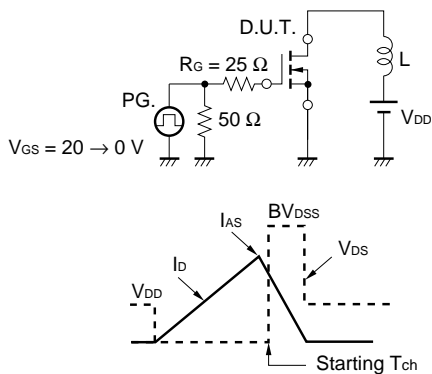


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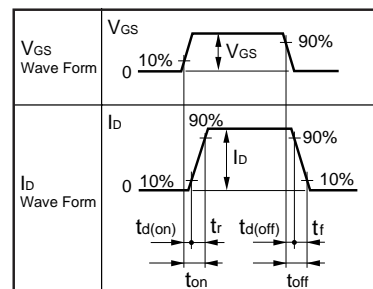
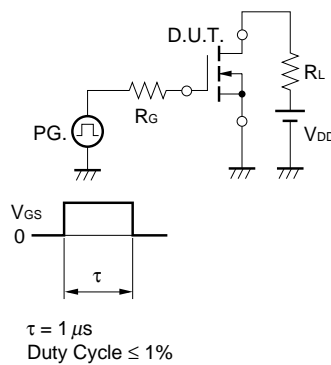
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V			10	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±10	μA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	1.0	1.5	2.0	V
Forward Transfer Admittance	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 20 A	13	31		S
Drain to Source On-state Resistance	R <sub>DS(on)1</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23 A		16	20	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 5.0 V, I <sub>D</sub> = 20 A		18	25	mΩ
	R <sub>DS(on)3</sub>	V <sub>GS</sub> = 4.0 V, I <sub>D</sub> = 20 A		20	30	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		1590	2400	pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		770	1200	pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		340	700	pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 20 A		40	80	ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 10 V		380	950	ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		220	440	ns
Fall Time	t <sub>f</sub>			300	750	ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 48 V		70	110	nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V		5.0		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 40 A		26		nC
Body Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 40 A, V <sub>GS</sub> = 0 V		1.0		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 40 A, V <sub>GS</sub> = 0 V		72		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		130		nC

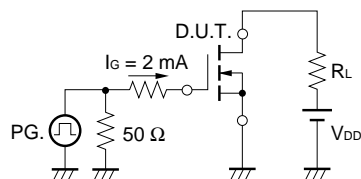
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



**TEST CIRCUIT 2 SWITCHING TIME**



**TEST CIRCUIT 3 GATE CHARGE**



★ TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

Figure1. DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA

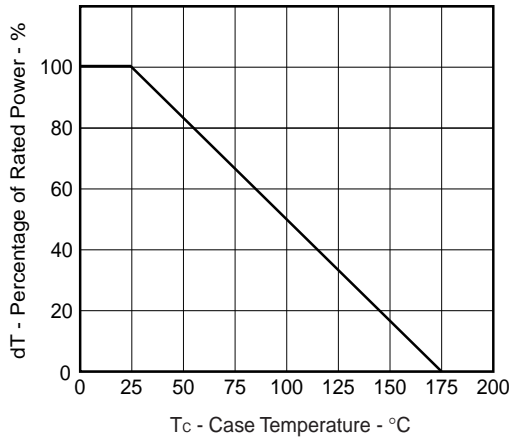


Figure2. TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

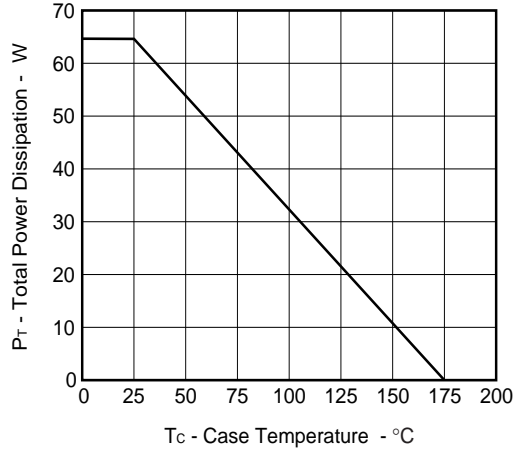


Figure3 FORWARD BIAS SAFE OPERATING AREA

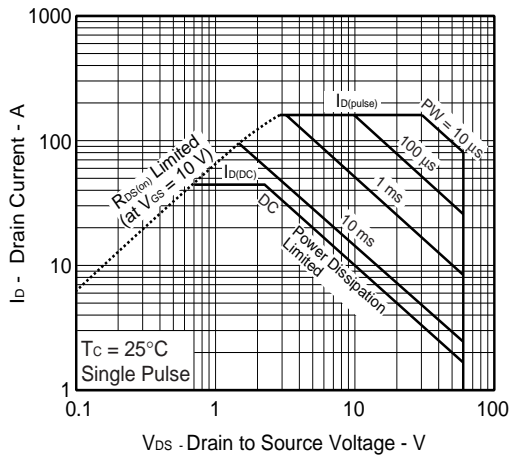


Figure4. SINGLE AVALANCHE ENERGY DERATING FACTOR

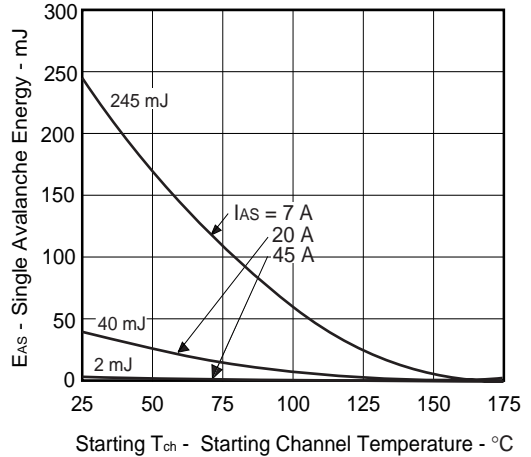


Figure5. TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

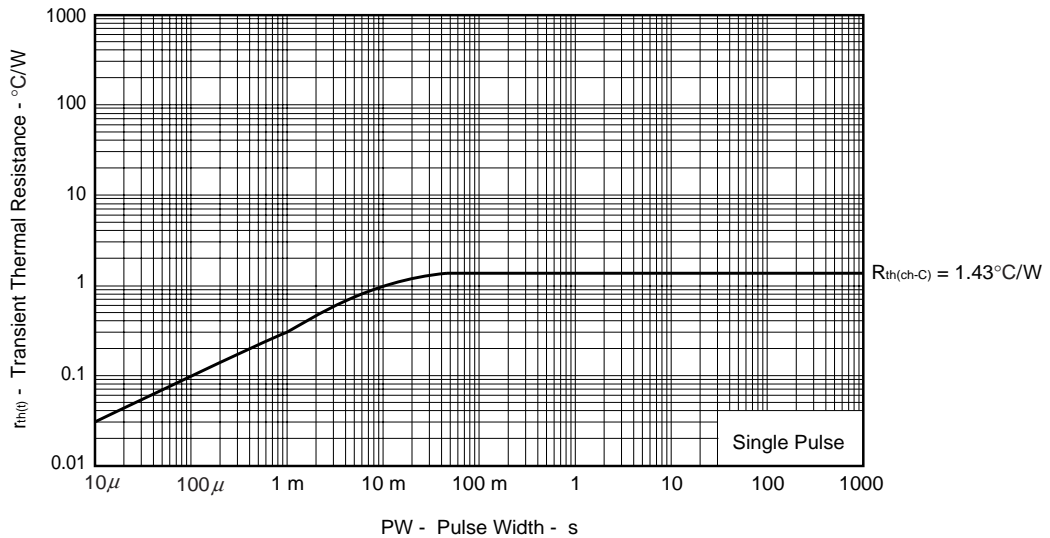


Figure6. FORWARD TRANSFER CHARACTERISTICS

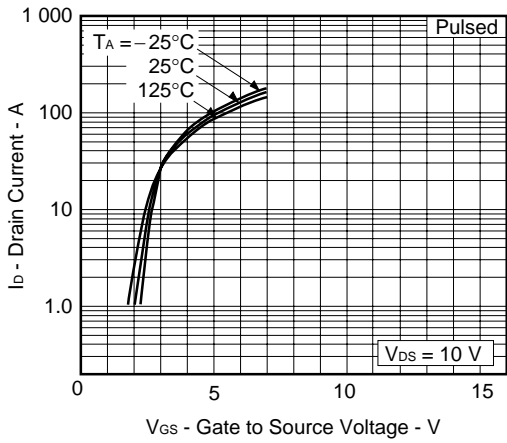


Figure7. DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

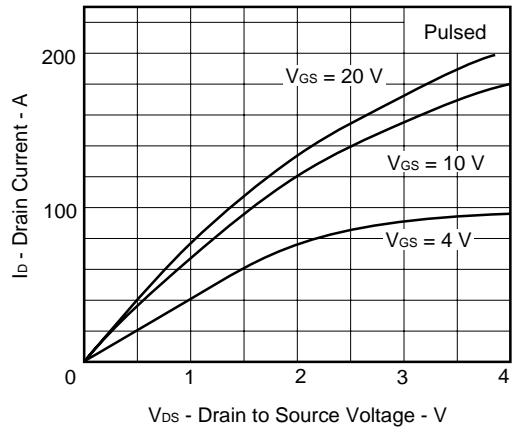


Figure8. FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

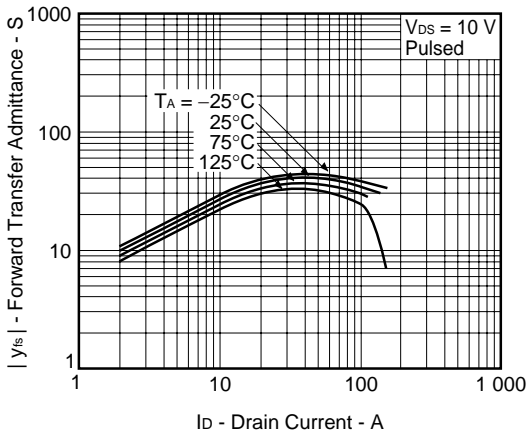


Figure9. DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

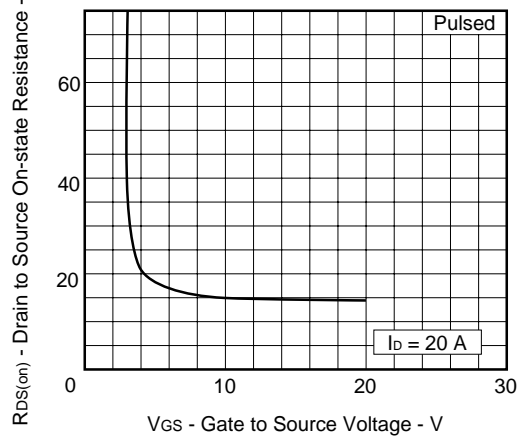


Figure10. DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

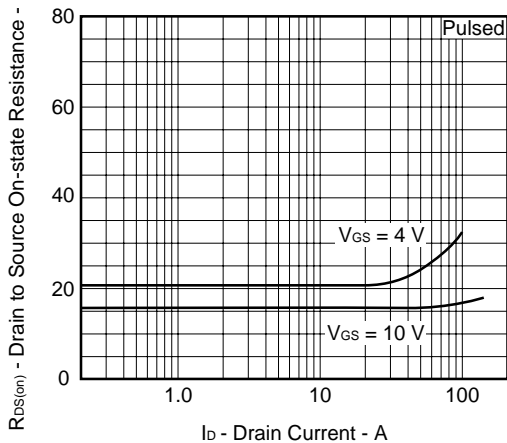


Figure11. GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE

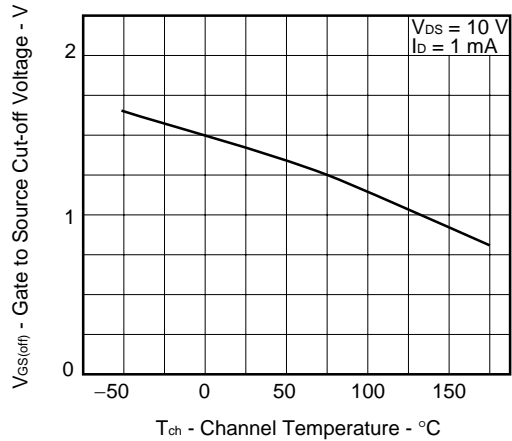


Figure12. DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

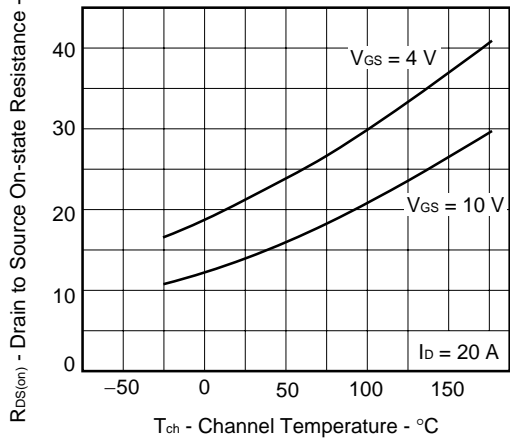


Figure13. SOURCE TO DRAIN DIODE FORWARD VOLTAGE

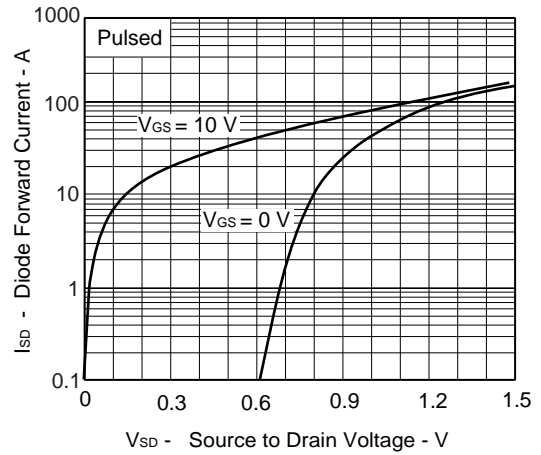


Figure14. CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

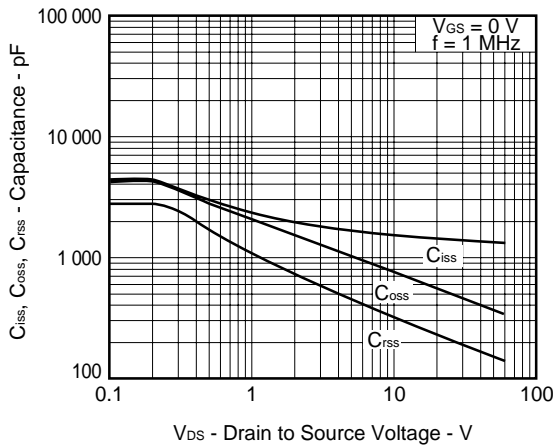


Figure15. SWITCHING CHARACTERISTICS

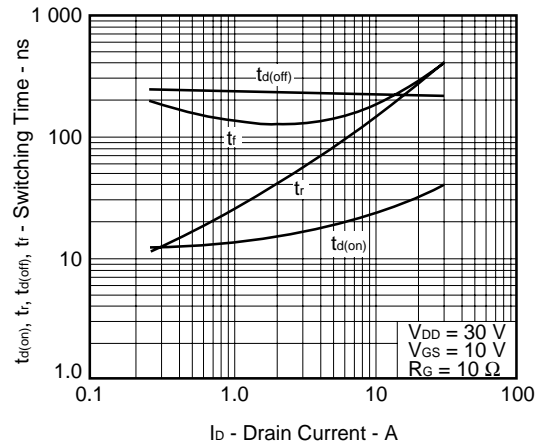


Figure16. REVERSE RECOVERY TIME vs. DRAIN CURRENT

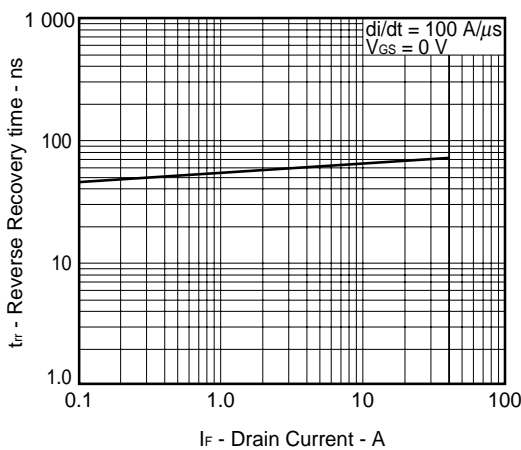
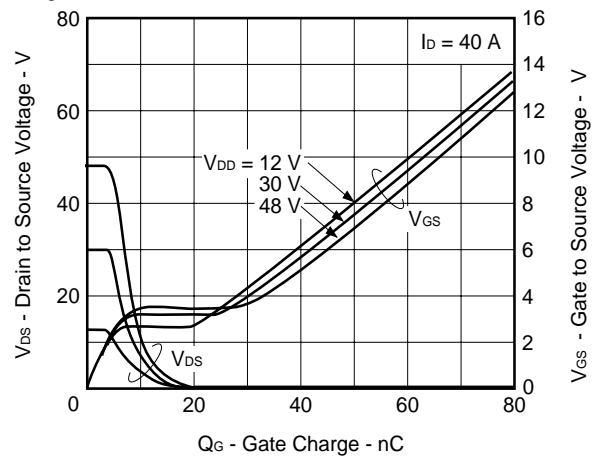
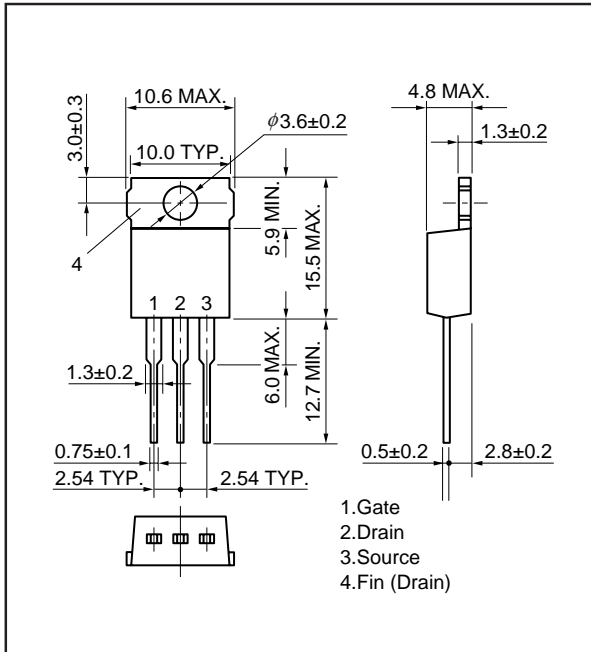


Figure17. DYNAMIC INPUT/OUTPUT CHARACTERISTICS

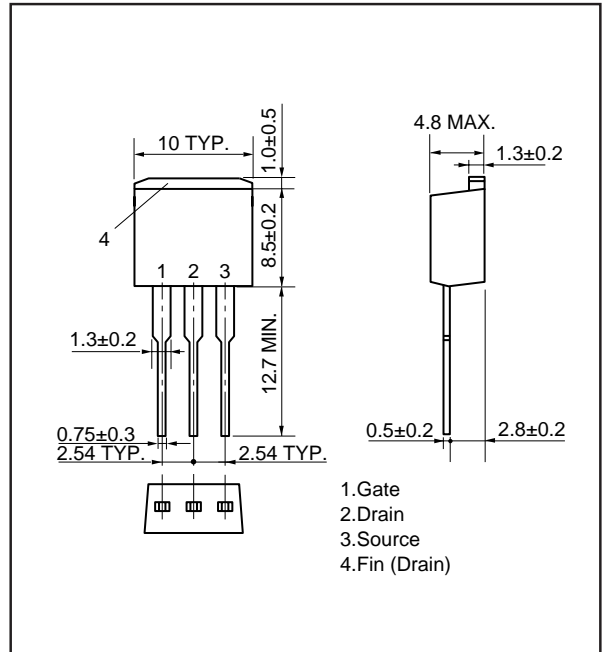


PACKAGE DRAWINGS (Unit: mm)

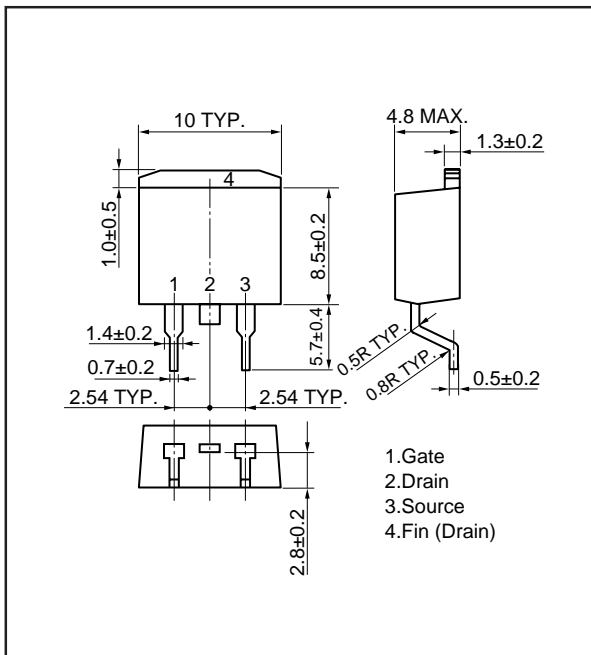
1) TO-220AB (MP-25)



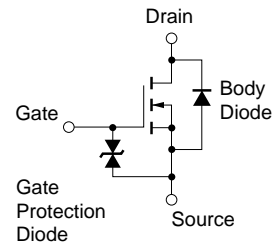
2) TO-262 (MP-25 Fin Cut)



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]

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