

MOS FIELD EFFECT TRANSISTOR

NP36N055HLE, NP36N055ILE, NP36N055SLE

SWITCHING

N-CHANNEL POWER MOSFET

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
 $R_{DS(on)1} = 13 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 18 \text{ A)}$
 $R_{DS(on)2} = 16 \text{ m}\Omega \text{ MAX. (} V_{GS} = 5 \text{ V, } I_D = 18 \text{ A)}$
- Low C_{iss} : $C_{iss} = 2900 \text{ pF TYP.}$
- Built-in gate protection diode

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

Drain to Source Voltage	V_{DSS}	55	V
Gate to Source Voltage	V_{GSS}	± 20	V
Drain Current (DC)	$I_{D(DC)}$	± 36	A
Drain Current (Pulse) ^{Note1}	$I_{D(pulse)}$	± 144	A
Total Power Dissipation ($T_A = 25^\circ\text{C}$)	P_T	1.2	W
Total Power Dissipation ($T_C = 25^\circ\text{C}$)	P_T	120	W
Single Avalanche Current ^{Note2}	I_{AS}	36 / 33	A
Single Avalanche Energy ^{Note2}	E_{AS}	12 / 108	mJ
Channel Temperature	T_{ch}	175	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to + 175	$^\circ\text{C}$

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

2. Starting $T_{ch} = 25^\circ\text{C}$, $R_G = 25 \Omega$, $V_{GS} = 20 \rightarrow 0 \text{ V}$ (See Figure 4.)

THERMAL RESISTANCE

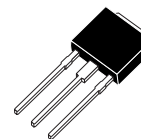
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.25	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	125	$^\circ\text{C/W}$

★ ORDERING INFORMATION

PART NUMBER	PACKAGE
NP36N055HLE	TO-251 (JEITA) / MP-3
NP36N055ILE ^{Note}	TO-252 (JEITA) / MP-3Z
NP36N055SLE	TO-252 (JEDEC) / MP-3ZK

Note Not for new design.

(TO-251)



(TO-252)



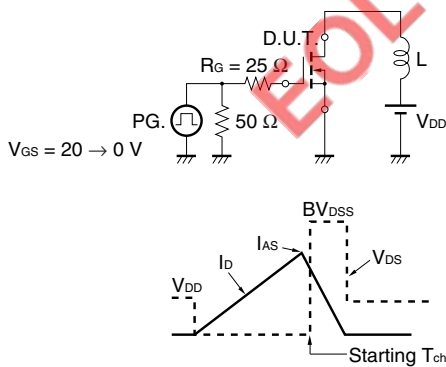
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ELECTRICAL CHARACTERISTICS (T_A = 25°C)

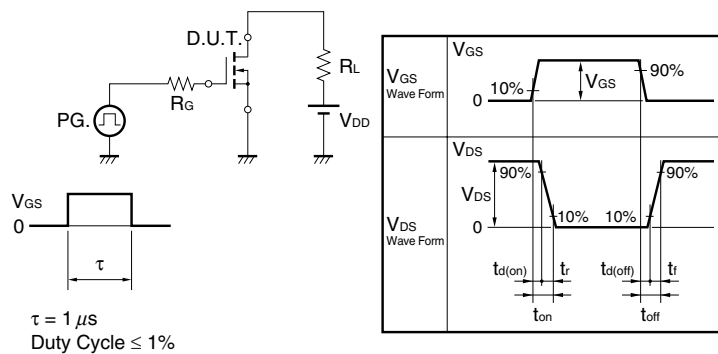
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 55 V, V _{GS} = 0 V			10	μA
Gate Leakage Current	I _{GSS}	V _{GS} = ±20 V, V _{DS} = 0 V			±10	μA
Gate to Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1.5	2	2.5	V
Forward Transfer Admittance ^{Note}	y _{fs}	V _{DS} = 10 V, I _D = 18 A	11	23		S
Drain to Source On-state Resistance ^{Note}	R _{DS(on)1}	V _{GS} = 10 V, I _D = 18 A		10	13	mΩ
	R _{DS(on)2}	V _{GS} = 5 V, I _D = 18 A		12	16	mΩ
	R _{DS(on)3}	V _{GS} = 4.5 V, I _D = 18 A		13	18	mΩ
Input Capacitance	C _{iss}	V _{DS} = 25 V		2900	4400	pF
Output Capacitance	C _{oss}	V _{GS} = 0 V		370	560	pF
Reverse Transfer Capacitance	C _{rss}	f = 1 MHz		180	330	pF
Turn-on Delay Time	t _{d(on)}	V _{DD} = 28 V, I _D = 18 A		22	48	ns
Rise Time	t _r	V _{GS} = 10 V		14	36	ns
Turn-off Delay Time	t _{d(off)}	R _G = 1 Ω		69	140	ns
Fall Time	t _f			12	29	ns
Total Gate Charge	Q _{G1}	V _{DD} = 44 V, V _{GS} = 10 V, I _D = 18 A		53	80	nC
	Q _{G2}	V _{DD} = 44 V		30	45	nC
Gate to Source Charge	Q _{GS}	V _{GS} = 5 V		9		nC
Gate to Drain Charge	Q _{GD}	I _D = 18 A		15		nC
Body Diode Forward Voltage ^{Note}	V _{F(S-D)}	I _F = 36 A, V _{GS} = 0 V		1.0		V
Reverse Recovery Time	t _{rr}	I _F = 36 A, V _{GS} = 0 V		42		ns
Reverse Recovery Charge	Q _{rr}	di/dt = 100 A/μs		60		nC

Note Pulsed

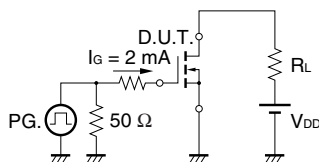
TEST CIRCUIT 1 AVALANCHE CAPABILITY



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

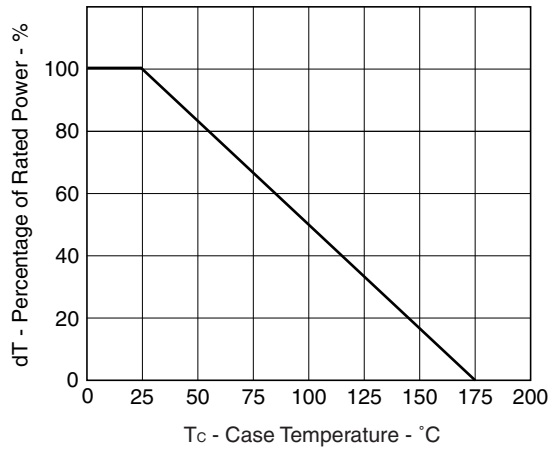


Figure2. TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

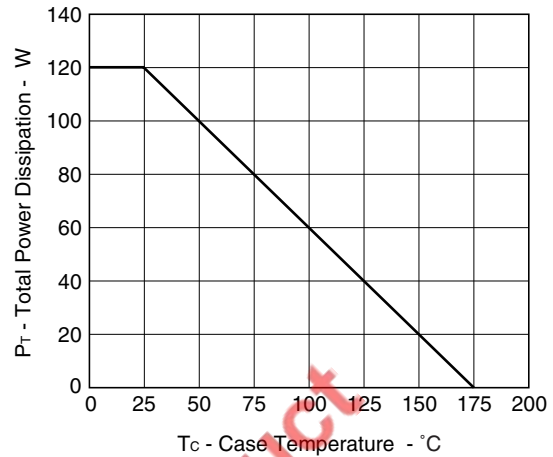


Figure3. FORWARD BIAS SAFE OPERATING AREA

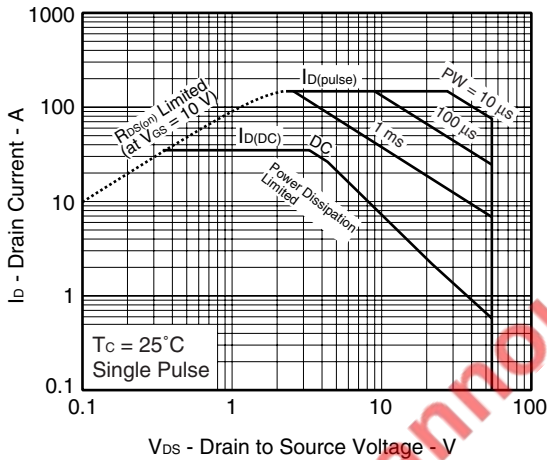


Figure4. SINGLE AVALANCHE ENERGY DERATING FACTOR

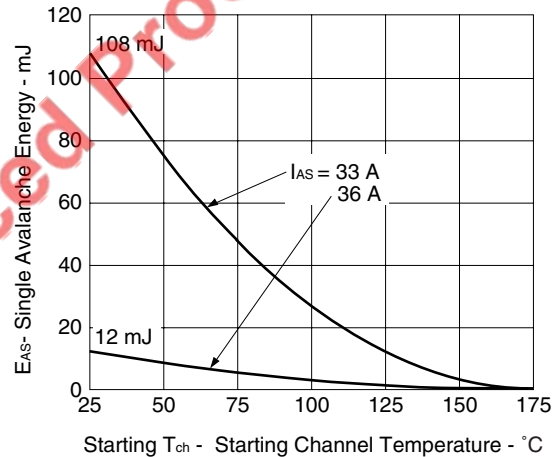


Figure5. TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

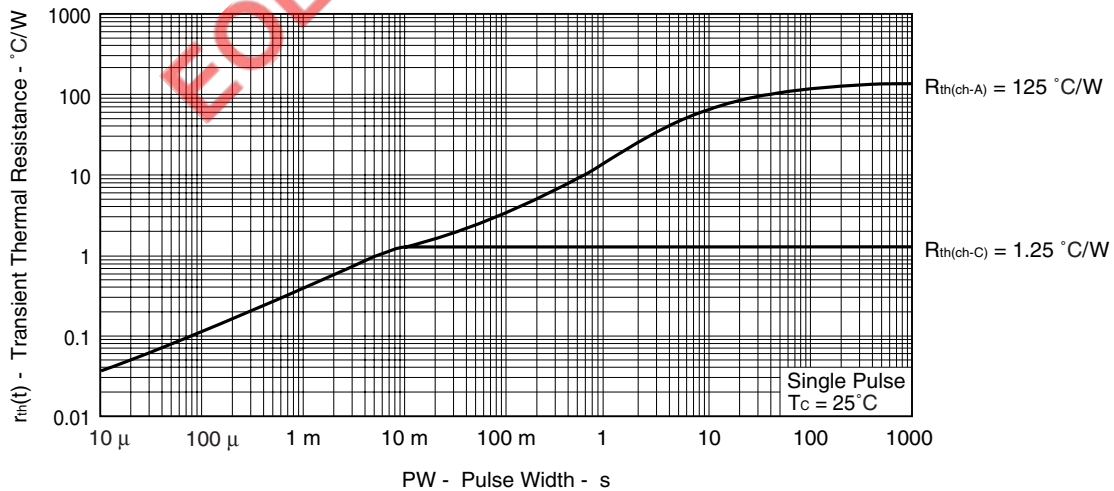


Figure6. FORWARD TRANSFER CHARACTERISTICS

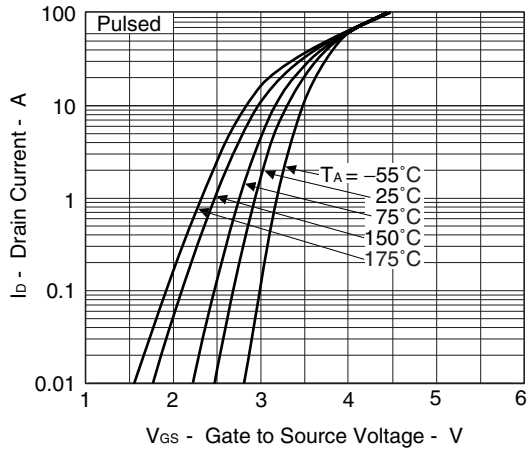


Figure7. DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

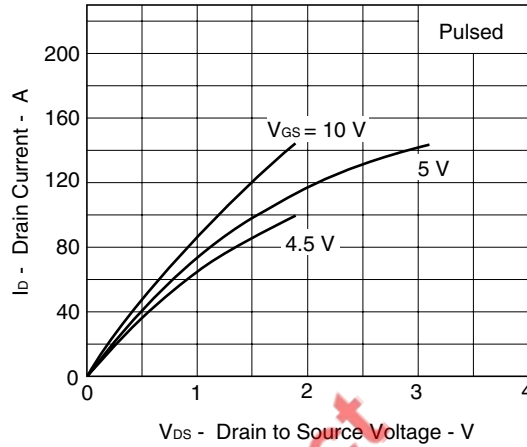


Figure8. FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

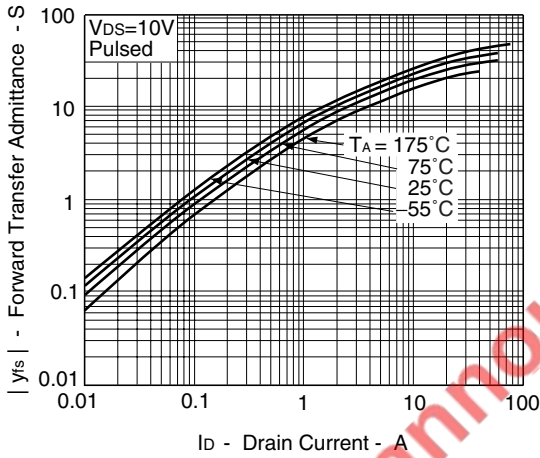


Figure9. DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

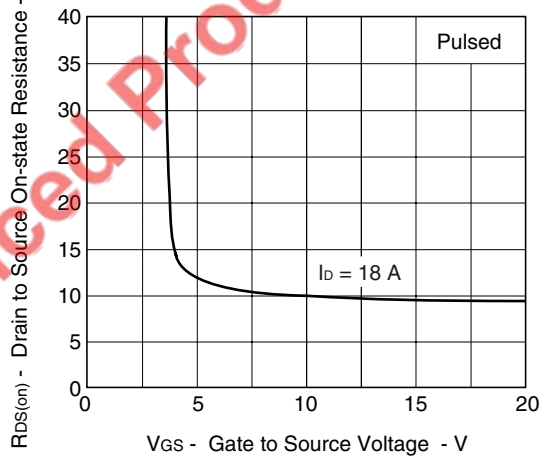


Figure10. DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

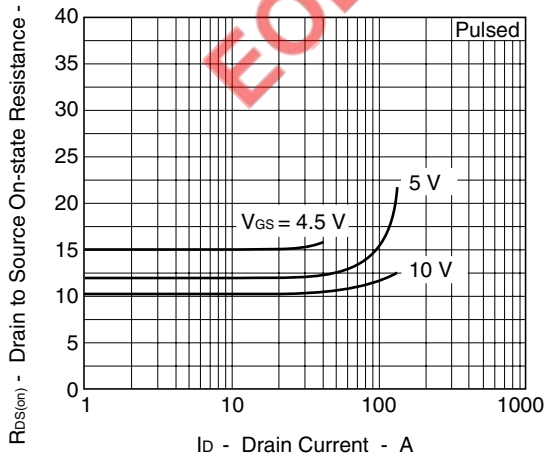


Figure11. GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE

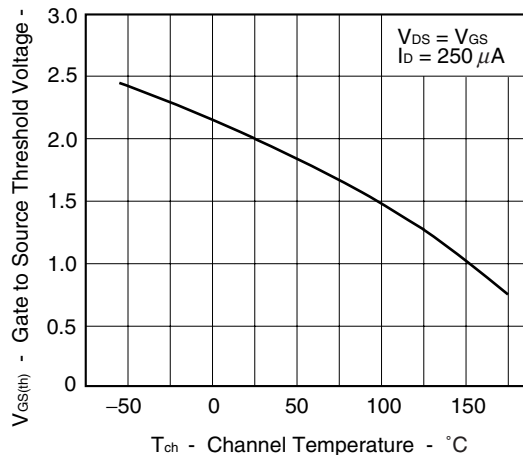


Figure12. DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

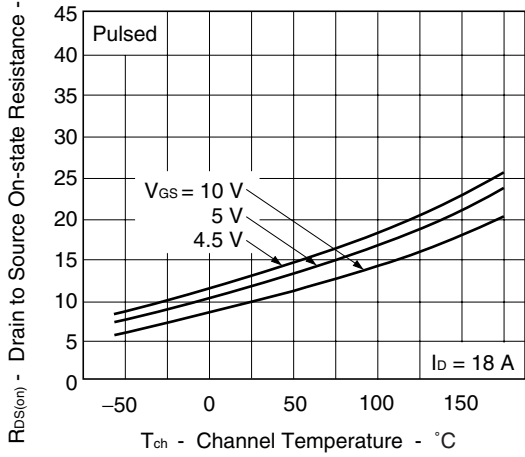


Figure13. SOURCE TO DRAIN DIODE FORWARD VOLTAGE

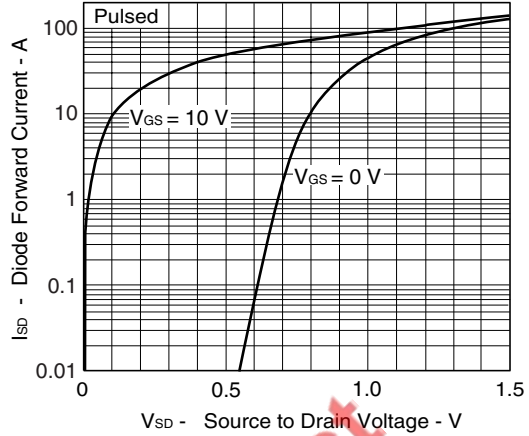


Figure14. CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

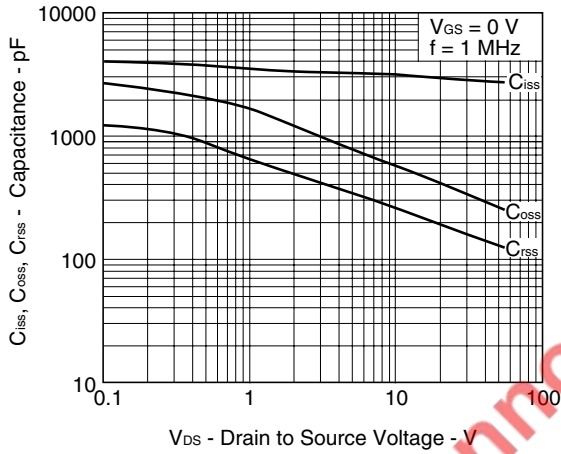


Figure15. SWITCHING CHARACTERISTICS

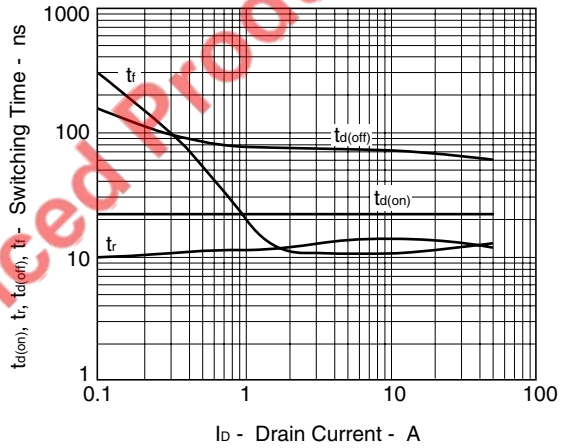


Figure16. REVERSE RECOVERY TIME vs. DRAIN CURRENT

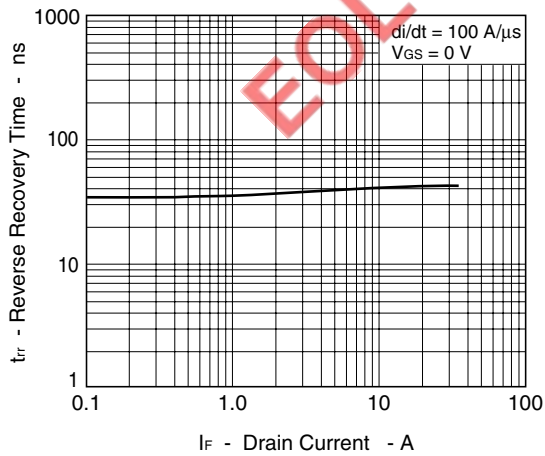
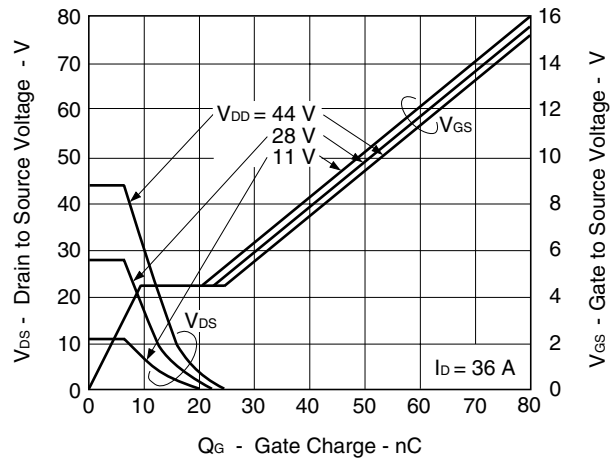
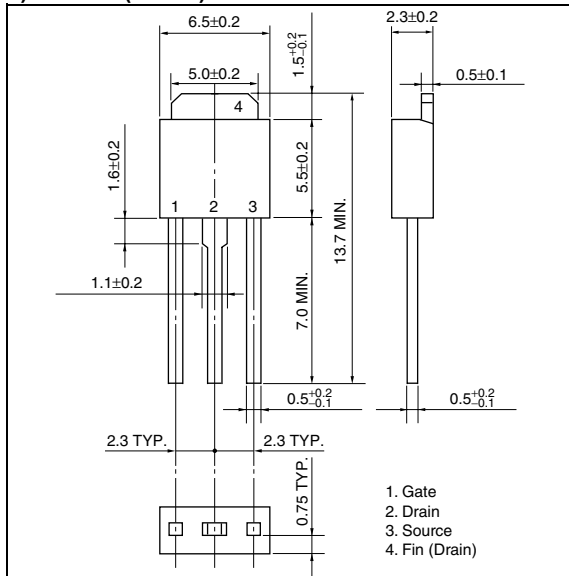


Figure17. DYNAMIC INPUT/OUTPUT CHARACTERISTICS

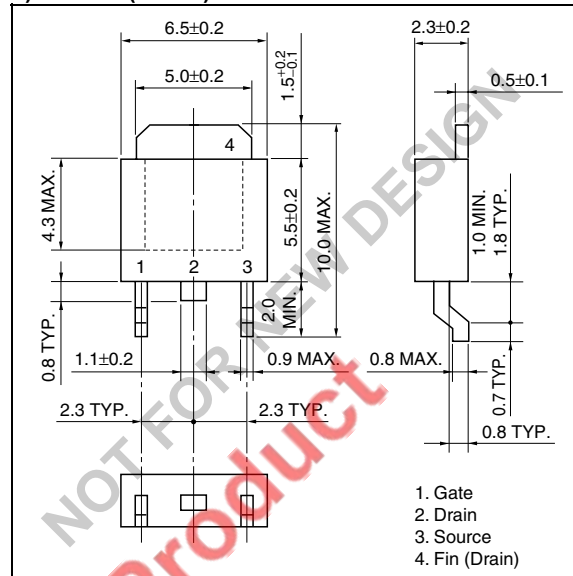


★ PACKAGE DRAWINGS (Unit: mm)

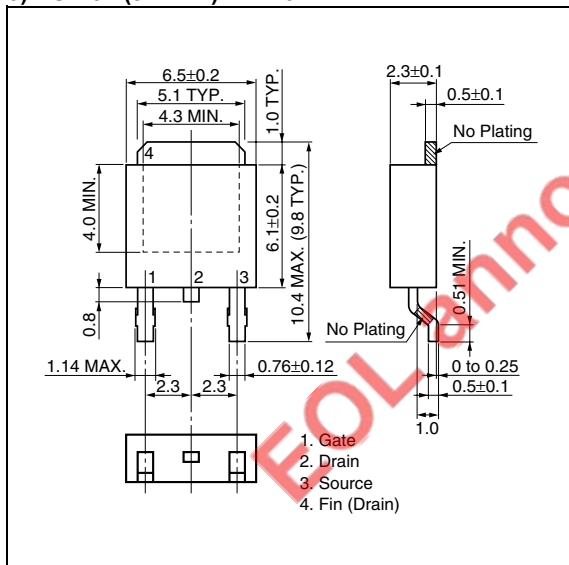
1) TO-251 (JEITA) / MP-3



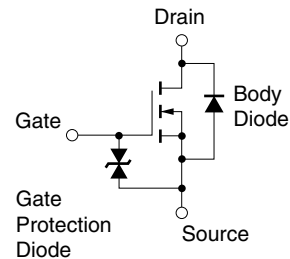
2) TO-252 (JEITA) / MP-3Z



3) TO-252 (JEDEC) / MP-3ZK



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.