

PowerMOS transistor

PHP20N06E

GENERAL DESCRIPTION

N-channel enhancement mode field-effect power transistor in a plastic envelope.

The device is intended for use in Switched Mode Power Supplies (SMPS), motor control, welding, DC/DC and AC/DC converters, and in automotive and general purpose switching applications.

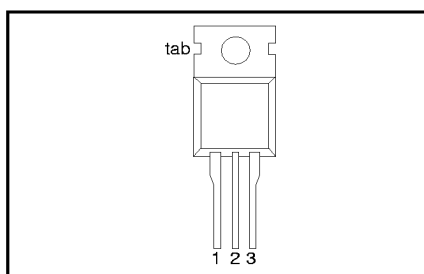
QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	UNIT
V_{DS}	Drain-source voltage	60	V
I_D	Drain current (DC)	22	A
P_{tot}	Total power dissipation	75	W
T_j	Junction temperature	175	°C
$R_{DS(ON)}$	Drain-source on-state resistance	0.08	Ω

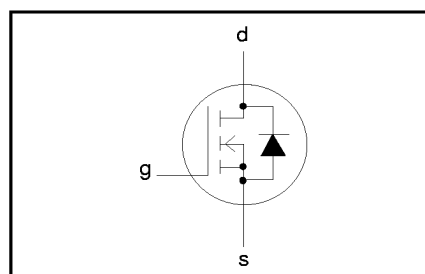
PINNING - TO220AB

PIN	DESCRIPTION
1	gate
2	drain
3	source
tab	drain

PIN CONFIGURATION



SYMBOL



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	Drain-source voltage	-	-	60	V
V_{DGR}	Drain-gate voltage	$R_{GS} = 20 \text{ k}\Omega$	-	60	V
$\pm V_{GS}$	Gate-source voltage	-	-	30	V
I_D	Drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	22	A
I_D	Drain current (DC)	$T_{mb} = 100 \text{ }^\circ\text{C}$	-	15	A
I_{DM}	Drain current (pulse peak value)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	88	A
P_{tot}	Total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	75	W
T_{stg}	Storage temperature	-	- 55	175	°C
T_j	Junction temperature	-	-	175	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th j-mb}$	Thermal resistance junction to mounting base		-	-	2	K/W
$R_{th j-a}$	Thermal resistance junction to ambient		-	60	-	K/W

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STATIC CHARACTERISTICS

 $T_{mb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 0.25\text{ mA}$	60	-	-	V
$V_{GS(TO)}$	Gate threshold voltage	$V_{DS} = V_{GS}; I_D = 1\text{ mA}$	2.1	3.0	4.0	V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 60\text{ V}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$	-	1	10	μA
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 60\text{ V}; V_{GS} = 0\text{ V}; T_j = 125\text{ }^{\circ}\text{C}$	-	0.1	1.0	mA
I_{GSS}	Gate source leakage current	$V_{GS} = \pm 30\text{ V}; V_{DS} = 0\text{ V}$	-	10	100	nA
$R_{DS(ON)}$	Drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 10\text{ A}$	-	0.07	0.08	Ω

DYNAMIC CHARACTERISTICS

 $T_{mb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	$V_{DS} = 25\text{ V}; I_D = 10\text{ A}$	4.5	6.5	-	S
C_{iss}	Input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V}; f = 1\text{ MHz}$	-	650	825	pF
C_{oss}	Output capacitance		-	240	350	pF
C_{rss}	Feedback capacitance		-	120	160	pF
t_{don}	Turn-on delay time	$V_{DD} = 30\text{ V}; I_D = 3\text{ A};$	-	10	20	ns
t_r	Turn-on rise time	$V_{GS} = 10\text{ V}; R_{GS} = 50\text{ }\Omega;$	-	35	55	ns
t_{doff}	Turn-off delay time	$R_{gen} = 50\text{ }\Omega$	-	60	90	ns
t_f	Turn-off fall time		-	55	80	ns
L_d	Internal drain inductance	Measured from contact screw on tab to centre of die	-	3.5	-	nH
L_d	Internal drain inductance	Measured from drain lead 6 mm from package to centre of die	-	4.5	-	nH
L_s	Internal source inductance	Measured from source lead 6 mm from package to source bond pad	-	7.5	-	nH

REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS

 $T_{mb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{DR}	Continuous reverse drain current	-	-	-	22	A
I_{DRM}	Pulsed reverse drain current	-	-	-	88	A
V_{SD}	Diode forward voltage	$I_F = 22\text{ A}; V_{GS} = 0\text{ V}$	-	1.3	1.7	V
t_{rr}	Reverse recovery time	$I_F = 22\text{ A}; -dI_F/dt = 100\text{ A}/\mu\text{s};$	-	60	-	ns
Q_{rr}	Reverse recovery charge	$V_{GS} = 0\text{ V}; V_R = 30\text{ V}$	-	0.25	-	μC

AVALANCHE LIMITING VALUE

 $T_{mb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
W_{DSS}	Drain-source non-repetitive unclamped inductive turn-off energy	$I_D = 22\text{ A}; V_{DD} \leq 25\text{ V};$ $V_{GS} = 10\text{ V}; R_{GS} = 50\text{ }\Omega$	-	-	50	mJ

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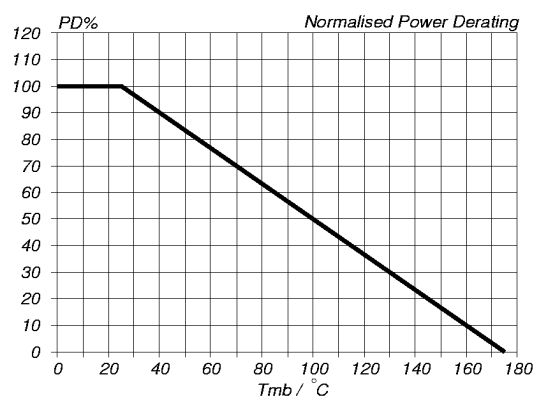


Fig. 1. Normalised power dissipation.
 $PD\% = 100 \cdot P_D / P_{D, 25^\circ\text{C}} = f(T_{mb})$

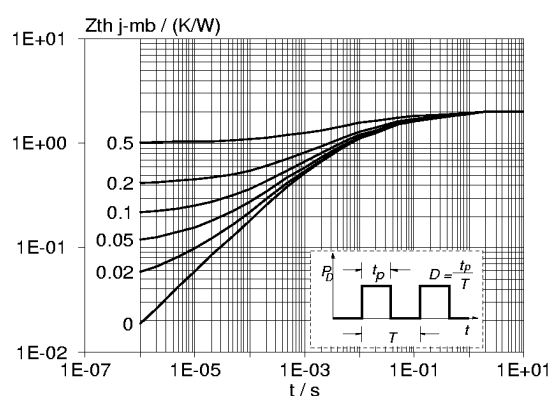


Fig. 4. Transient thermal impedance.
 $Z_{th\ j-mb} = f(t)$; parameter $D = t_p / T$

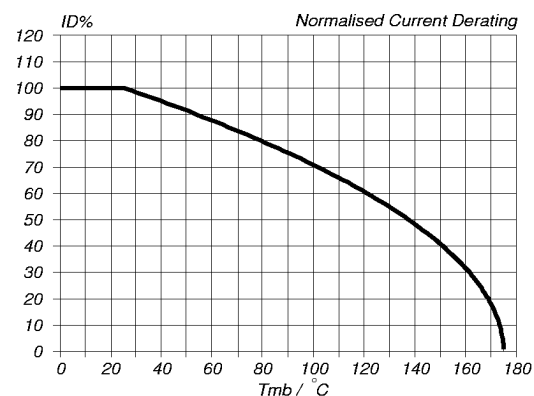


Fig. 2. Normalised continuous drain current.
 $ID\% = 100 \cdot I_D / I_{D, 25^\circ\text{C}} = f(T_{mb})$; conditions: $V_{GS} \geq 10\text{ V}$

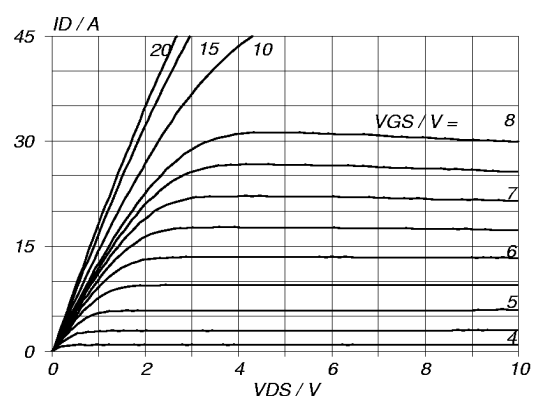


Fig. 5. Typical output characteristics, $T_j = 25^\circ\text{C}$.
 $I_D = f(V_{DS})$; parameter V_{GS}

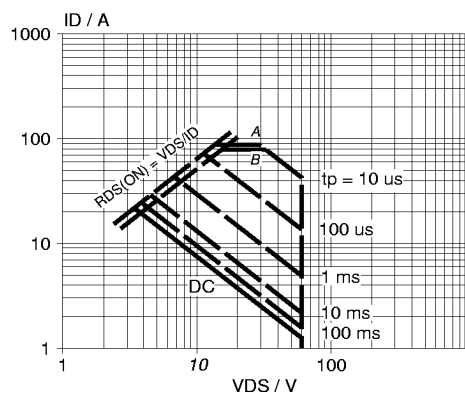


Fig. 3. Safe operating area. $T_{mb} = 25^\circ\text{C}$
 I_D & $I_{DM} = f(V_{DS})$; I_{DM} single pulse; parameter t_p

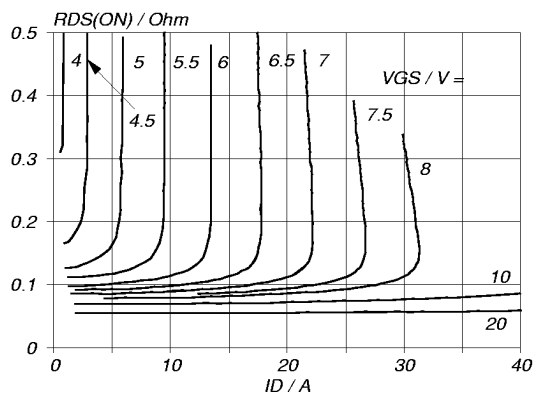


Fig. 6. Typical on-state resistance, $T_j = 25^\circ\text{C}$.
 $R_{DS(ON)} = f(I_D)$; parameter V_{GS}

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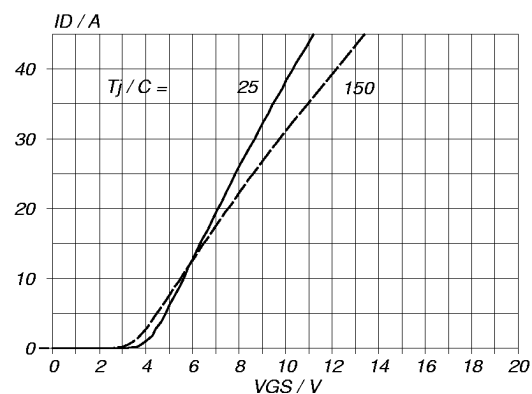


Fig. 7. Typical transfer characteristics.
 $I_D = f(V_{GS})$; conditions: $V_{DS} = 25 \text{ V}$; parameter T_j

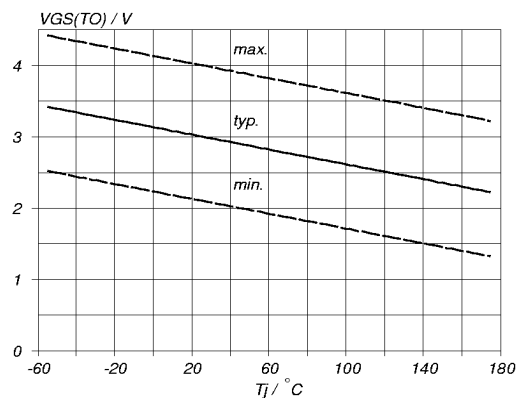


Fig. 10. Gate threshold voltage.
 $V_{GS(TO)} = f(T_j)$; conditions: $I_D = 1 \text{ mA}$; $V_{DS} = V_{GS}$

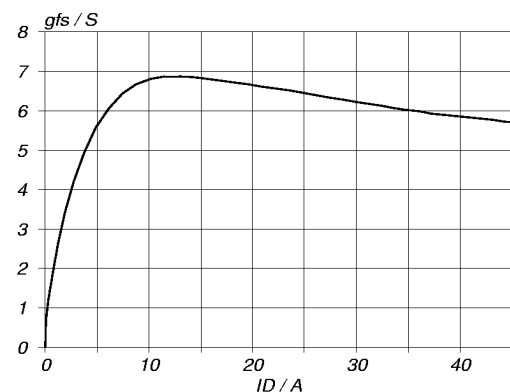


Fig. 8. Typical transconductance, $T_j = 25^\circ\text{C}$.
 $g_{fs} = f(I_D)$; conditions: $V_{DS} = 25 \text{ V}$

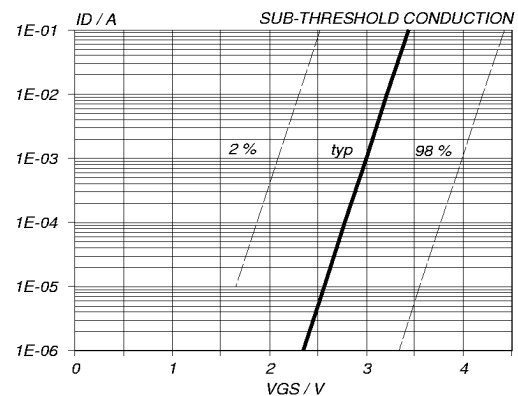


Fig. 11. Sub-threshold drain current.
 $I_D = f(V_{GS})$; conditions: $T_j = 25^\circ\text{C}$; $V_{DS} = V_{GS}$

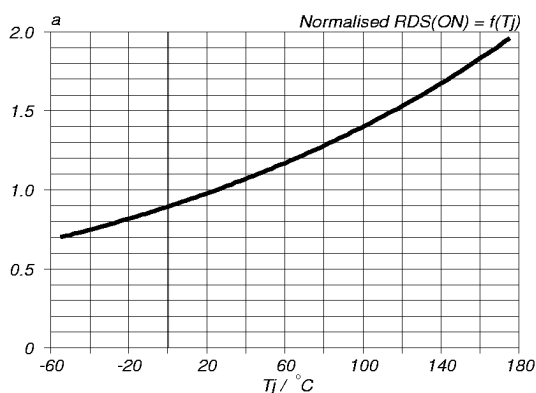


Fig. 9. Normalised drain-source on-state resistance.
 $a = R_{DS(ON)}/R_{DS(ON)25^\circ\text{C}} = f(T_j)$; $I_D = 10 \text{ A}$; $V_{GS} = 10 \text{ V}$

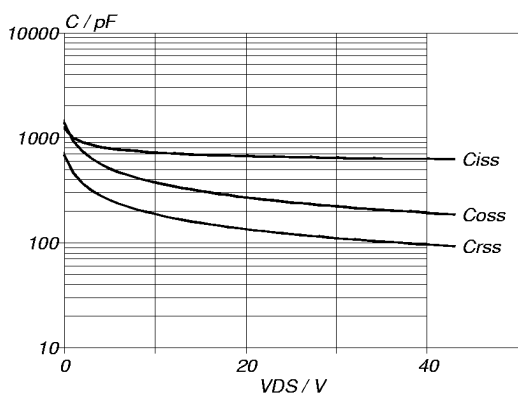
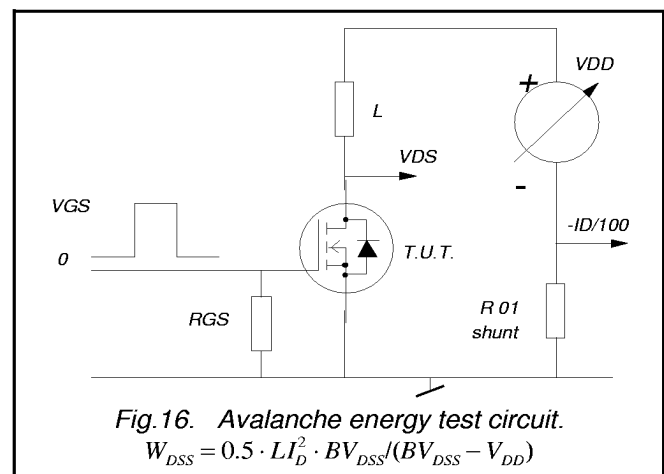
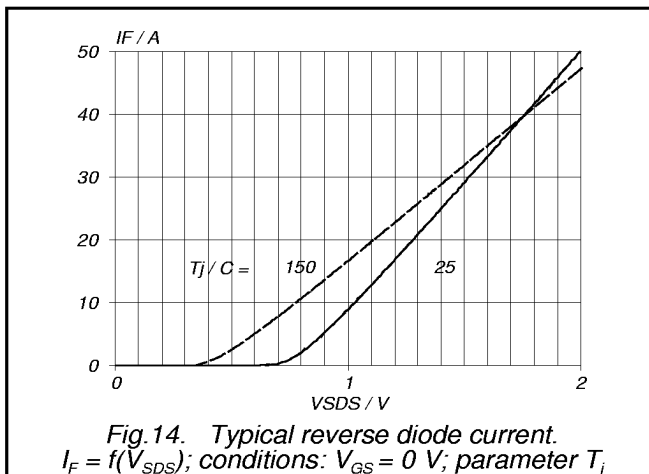
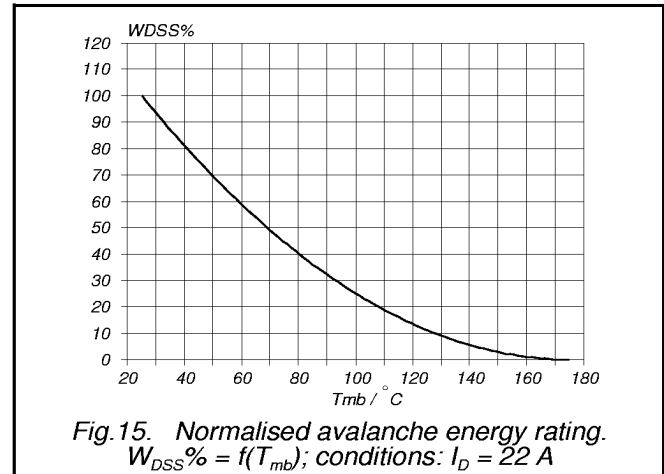
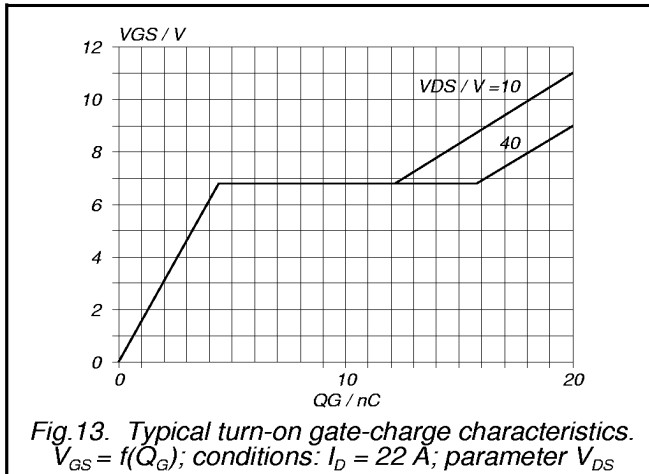


Fig. 12. Typical capacitances, C_{iss} , C_{oss} , C_{rss} .
 $C = f(V_{DS})$; conditions: $V_{GS} = 0 \text{ V}$; $f = 1 \text{ MHz}$

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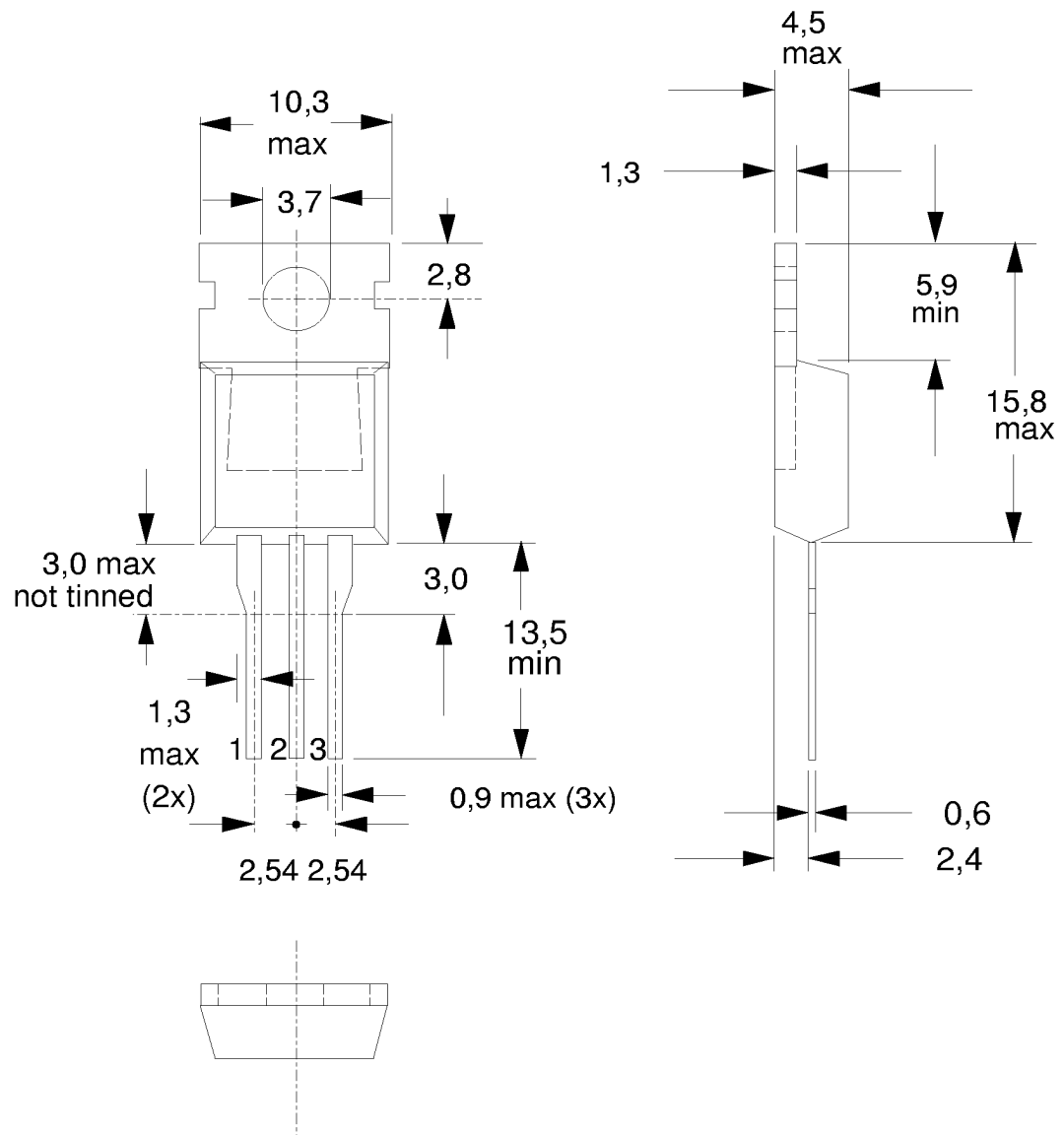
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MECHANICAL DATA

*Dimensions in mm**Net Mass: 2 g**Fig.17. TO220AB; pin 2 connected to mounting base.***Notes**

1. Observe the general handling precautions for electrostatic-discharge sensitive devices (ESDs) to prevent damage to MOS gate oxide.
2. Refer to mounting instructions for TO220 envelopes.
3. Epoxy meets UL94 V0 at 1/8".