

**PowerMOS transistor**

**PHP36N06E**

**GENERAL DESCRIPTION**

N-channel enhancement mode field-effect power transistor in a plastic envelope.  
The device is intended for use in automotive applications, Switched Mode Power Supplies (SMPS), motor control, welding, DC/DC and AC/DC converters, and in general purpose switching applications.

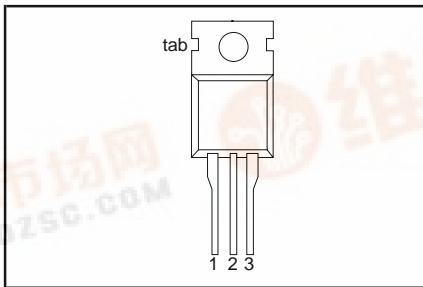
**QUICK REFERENCE DATA**

SYMBOL	PARAMETER	MAX.	UNIT
$V_{DS}$	Drain-source voltage	60	V
$I_D$	Drain current (DC)	41	A
$P_{tot}$	Total power dissipation	125	W
$T_j$	Junction temperature	175	°C
$R_{DS(ON)}$	Drain-source on-state resistance	38	mΩ

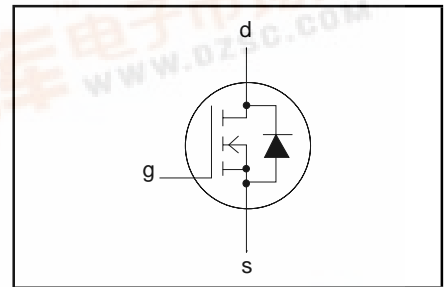
**PINNING - TO220AB**

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)	$T_{mb} = 25\text{ }^\circ\text{C}$	-	41	A
$I_D$	Drain current (DC)	$T_{mb} = 100\text{ }^\circ\text{C}$	-	29	A
$I_{DM}$	Drain current (pulse peak value)	$T_{mb} = 25\text{ }^\circ\text{C}$	-	164	A
$P_{tot}$	Total power dissipation	$T_{mb} = 25\text{ }^\circ\text{C}$	-	125	W
$T_{stg}$	Storage temperature	-	- 55	175	°C
$T_j$	Junction temperature	-	-	175	°C

**THERMAL RESISTANCES**

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\text{-j-mb}}$	Thermal resistance junction to mounting base		-	1.2	K/W
$R_{th\text{-j-a}}$	Thermal resistance junction to ambient		60	-	K/W



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**STATIC CHARACTERISTICS** $T_{mb} = 25\text{ °C}$  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	$V_{DS} = 60\text{ V}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C}$	-	1	10	$\mu\text{A}$
$I_{DSS}$	Zero gate voltage drain current	$V_{DS} = 60\text{ V}; V_{GS} = 0\text{ V}; T_j = 125\text{ °C}$	-	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	$V_{GS} = 10\text{ V}; I_D = 20\text{ A}$	-	30	38	m $\Omega$

**DYNAMIC CHARACTERISTICS** $T_{mb} = 25\text{ °C}$  unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$g_{fs}$	Forward transconductance	$V_{DS} = 25\text{ V}; I_D = 20\text{ A}$	7	14	-	S
$C_{iss}$	Input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V}; f = 1\text{ MHz}$	-	900	1600	pF
$C_{oss}$	Output capacitance		-	420	600	pF
$C_{rss}$	Feedback capacitance		-	160	275	pF
$t_{d\ on}$	Turn-on delay time	$V_{DD} = 30\text{ V}; I_D = 3\text{ A};$ $V_{GS} = 10\text{ V}; R_{GS} = 50\ \Omega;$ $R_{gen} = 50\ \Omega$	-	15	30	ns
$t_r$	Turn-on rise time		-	55	90	ns
$t_{d\ off}$	Turn-off delay time		-	75	125	ns
$t_f$	Turn-off fall time		-	60	100	ns
$L_d$	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 soldering point to source bond pad	-	7.5	-	nH

**REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS** $T_{mb} = 25\text{ °C}$  unless otherwise specified

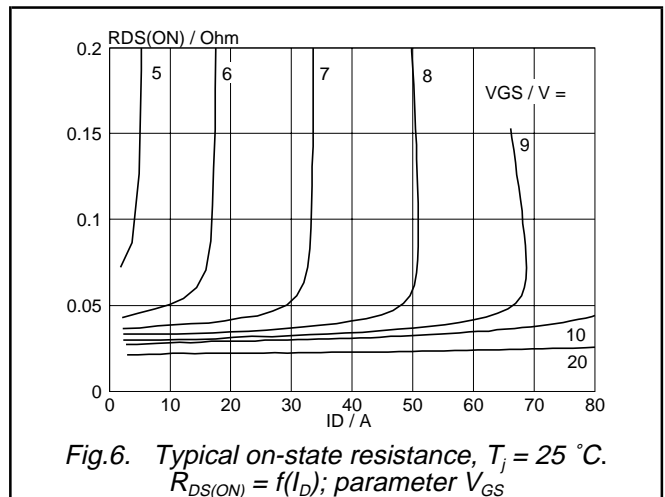
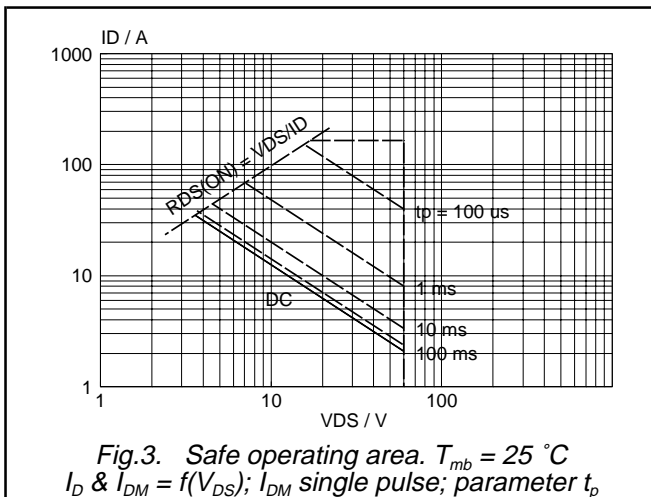
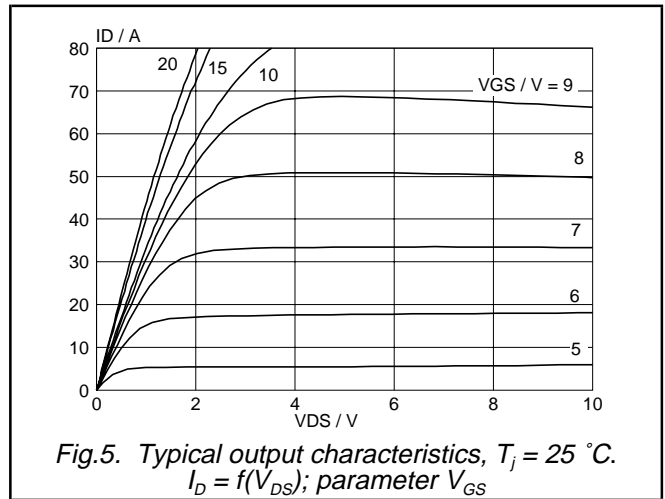
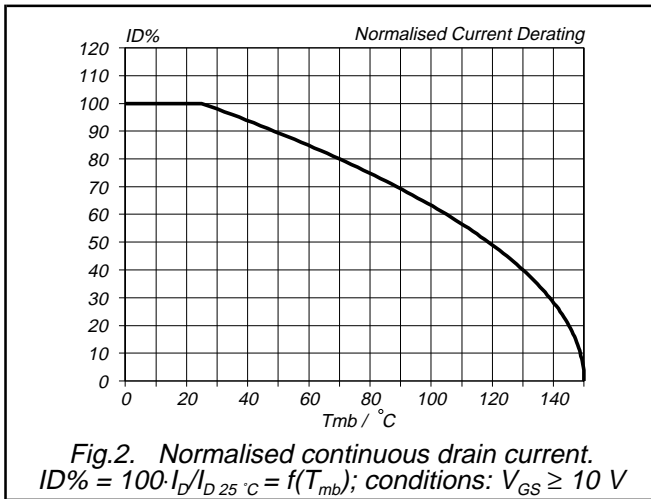
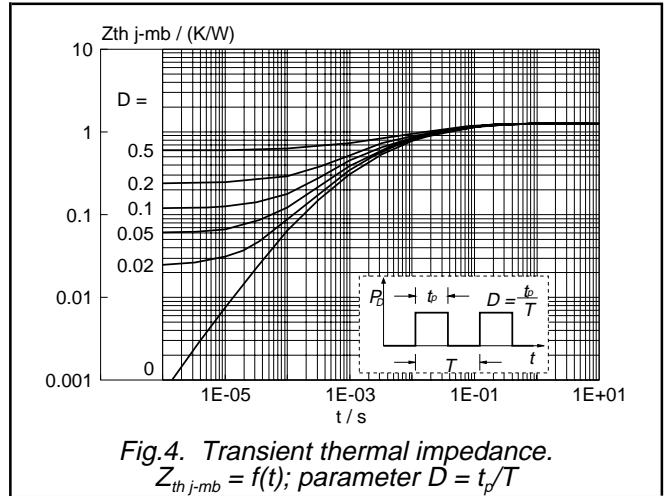
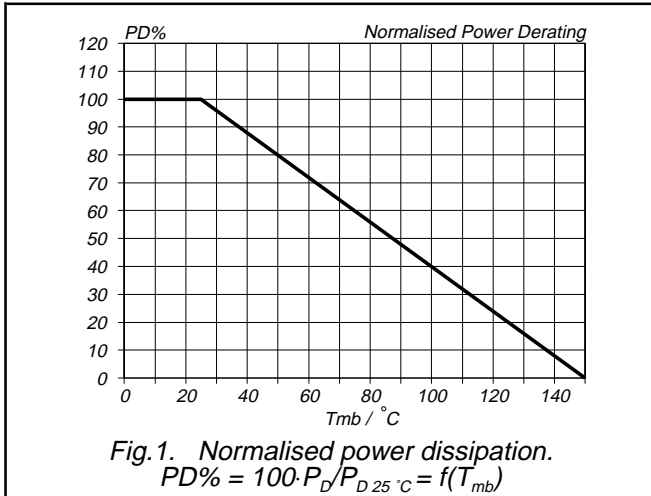
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{DR}$	Continuous reverse drain current	-	-	-	41	A
$I_{DRM}$	Pulsed reverse drain current	-	-	-	164	A
$V_{SD}$	Diode forward voltage	$I_F = 41\text{ A}; V_{GS} = 0\text{ V}$	-	0.95	2.0	V
$t_{rr}$	Reverse recovery time	$I_F = 41\text{ A}; -di_F/dt = 100\text{ A}/\mu\text{s};$ $V_{GS} = 0\text{ V}; V_R = 30\text{ V}$	-	60	-	ns
$Q_{rr}$	Reverse recovery charge		-	0.30	-	$\mu\text{C}$

**AVALANCHE LIMITING VALUE** $T_{mb} = 25\text{ °C}$  unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$W_{DSS}$	Drain-source non-repetitive unclamped inductive turn-off energy	$I_D = 41\text{ A}; V_{DD} \leq 25\text{ V};$ $V_{GS} = 10\text{ V}; R_{GS} = 50\ \Omega$	-	-	100	mJ

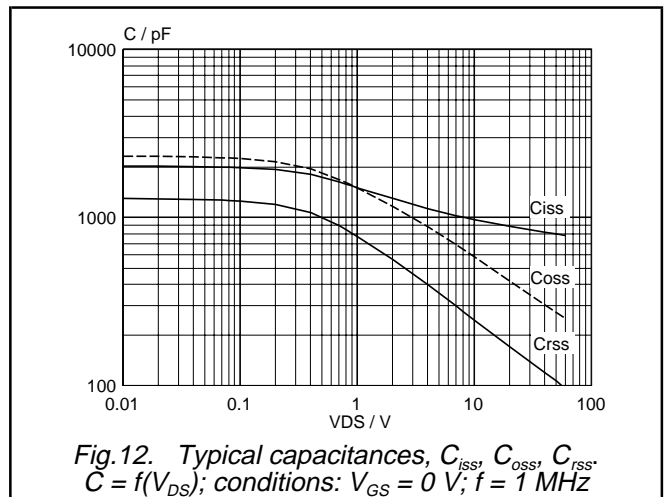
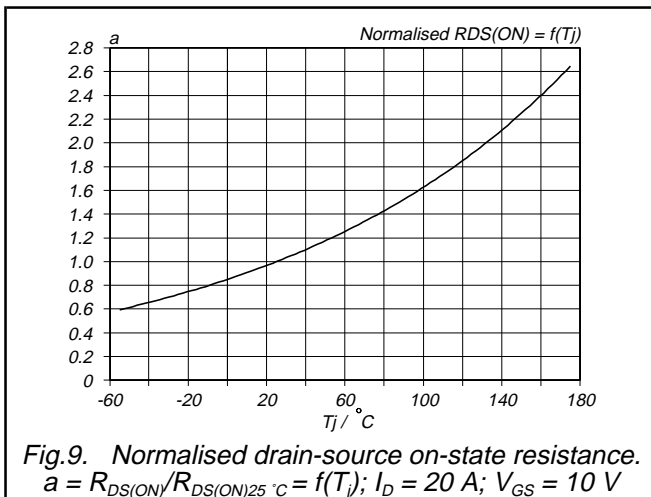
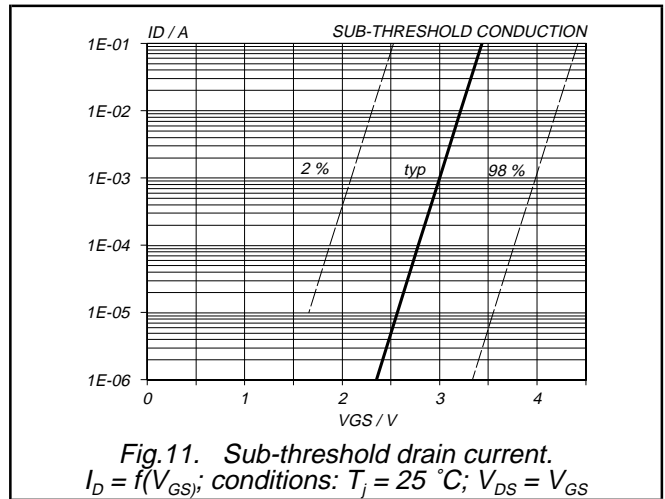
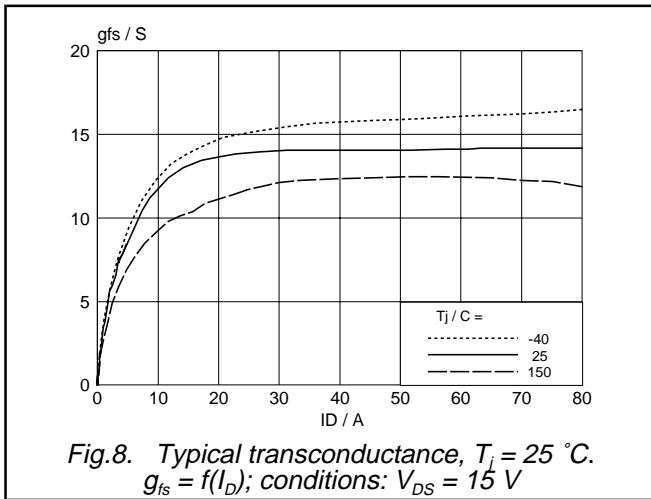
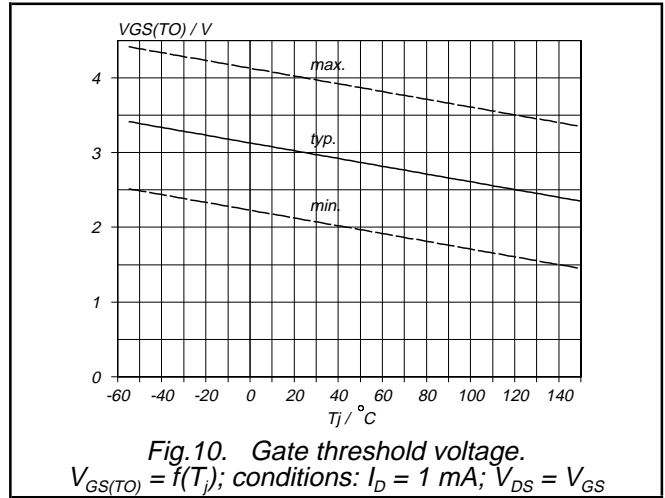
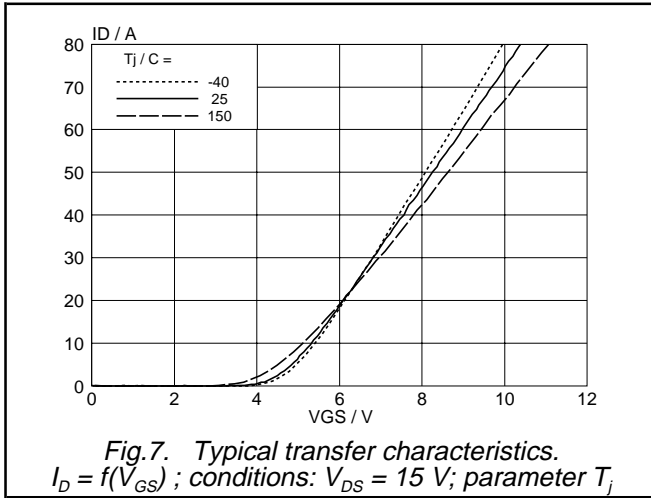
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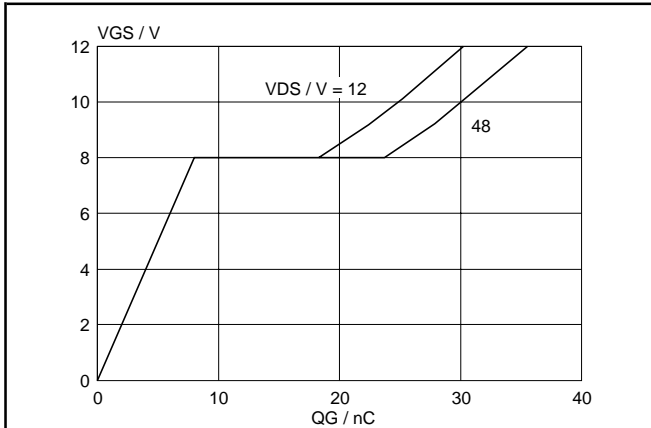


Fig.13. Typical turn-on gate-charge characteristics.  
 $V_{GS} = f(Q_G)$ ; conditions:  $I_D = 41 \text{ A}$ ; parameter  $V_{DS}$

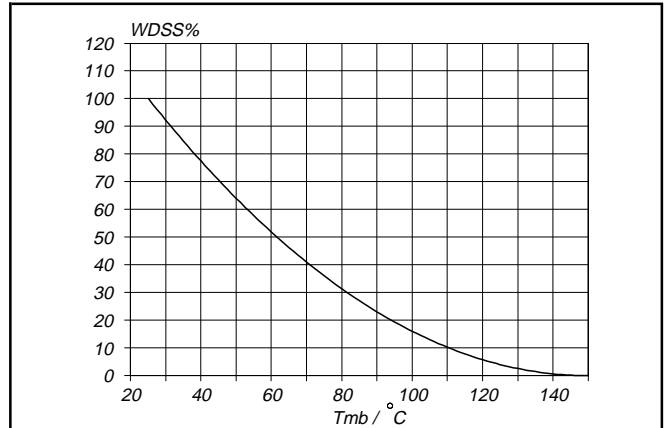


Fig.15. Normalised avalanche energy rating.  
 $W_{DSS}\% = f(T_{mb})$ ; conditions:  $I_D = 41 \text{ A}$

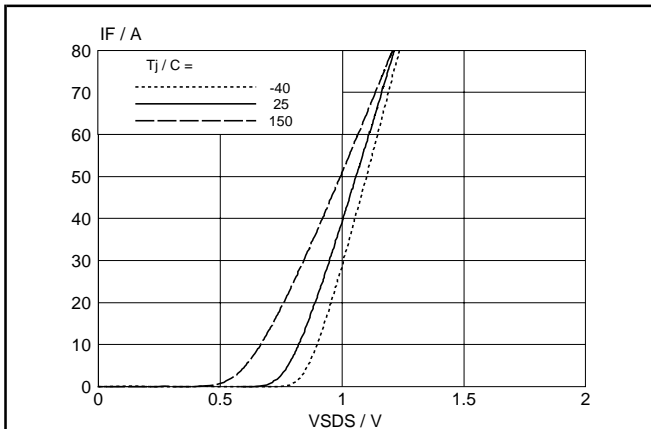


Fig.14. Typical reverse diode current.  
 $I_F = f(V_{SDS})$ ; conditions:  $V_{GS} = 0 \text{ V}$ ; parameter  $T_j$

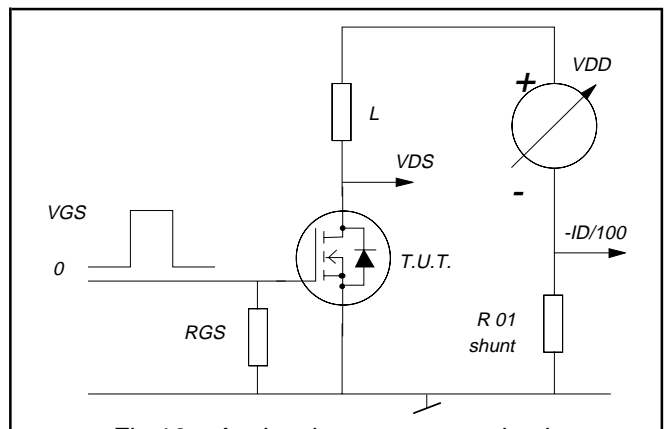
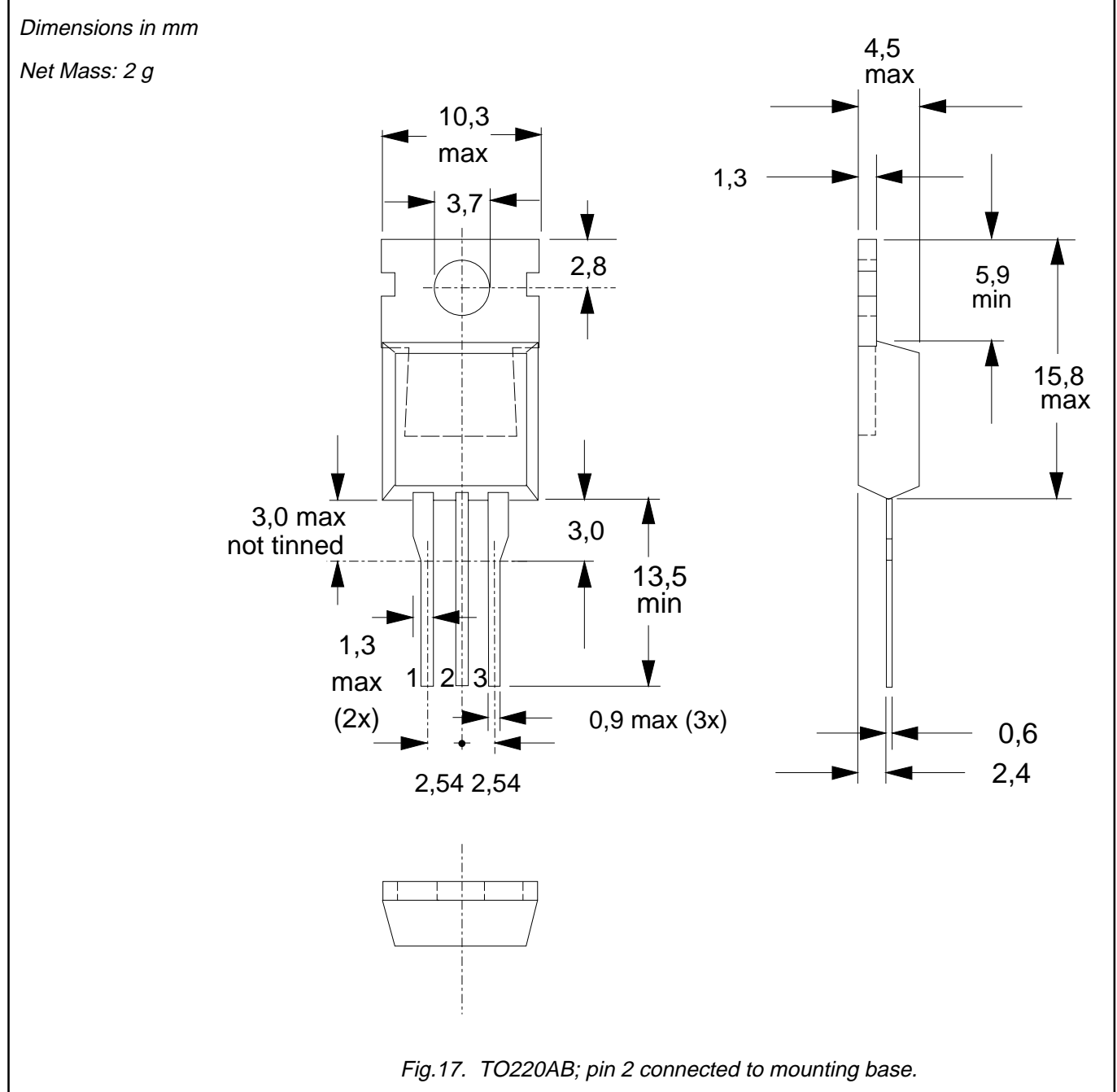


Fig.16. Avalanche energy test circuit.  
 $W_{DSS} = 0.5 \cdot L I_D^2 \cdot BV_{DSS} / (BV_{DSS} - V_{DD})$

**MECHANICAL DATA**



**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".

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**DEFINITIONS**

<b>Data sheet status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
Limiting values are given in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	
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