

PowerMOS transistor

PHP5N40E

GENERAL DESCRIPTION

N-channel enhancement mode field-effect power transistor in a plastic envelope featuring high avalanche energy capability, stable blocking voltage, fast switching and high thermal cycling performance with low thermal resistance. Intended for use in Switched Mode Power Supplies (SMPS), motor control circuits and general purpose switching applications.

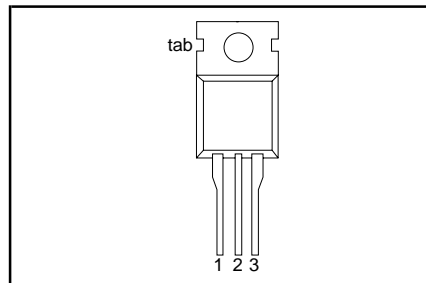
QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	UNIT
V_{DS}	Drain-source voltage	400	V
I_D	Drain current (DC)	6.5	A
P_{tot}	Total power dissipation	100	W
$R_{DS(ON)}$	Drain-source on-state resistance	1.0	Ω

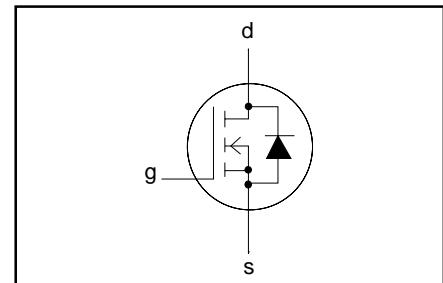
PINNING - TO220AB

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		-	400	V
V_{DGR}	Drain-gate voltage	$R_{GS} = 20 \text{ k}\Omega$	-	400	V
$\pm V_{GS}$	Gate-source voltage		-	30	V
I_D	Drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	6.5	A
		$T_{mb} = 100 \text{ }^\circ\text{C}$	-	4.1	A
I_{DM}	Drain current (pulse peak value)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	26	A
I_{DR}	Source-drain diode current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	6.5	A
I_{DRM}	Source-drain diode current (pulse peak value)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	26	A
P_{tot}	Total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	100	W
T_{stg}	Storage temperature		-55	150	$^\circ\text{C}$
T_j	Junction temperature		-	150	$^\circ\text{C}$

AVALANCHE LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
W_{DSS}	Drain-source non-repetitive unclamped inductive turn-off energy	$I_D = 6.5 \text{ A}$; $V_{DD} \leq 50 \text{ V}$; $V_{GS} = 10 \text{ V}$; $R_{GS} = 50 \text{ }\Omega$	-	290	mJ
		$T_j = 25 \text{ }^\circ\text{C}$ prior to surge	-	46	mJ
		$T_j = 100 \text{ }^\circ\text{C}$ prior to surge	-	7.4	mJ
W_{DSR}^1	Drain-source repetitive unclamped inductive turn-off energy	$I_D = 6.5 \text{ A}$; $V_{DD} \leq 50 \text{ V}$; $V_{GS} = 10 \text{ V}$; $R_{GS} = 50 \text{ }\Omega$; $T_j \leq 150 \text{ }^\circ\text{C}$	-	7.4	mJ

1. Pulse width and frequency limited by $T_{j(max)}$

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THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th\ j-mb}$	Thermal resistance junction to mounting base		-	-	1.25	K/W
$R_{th\ j-a}$	Thermal resistance junction to ambient		-	60	-	K/W

STATIC CHARACTERISTICS

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

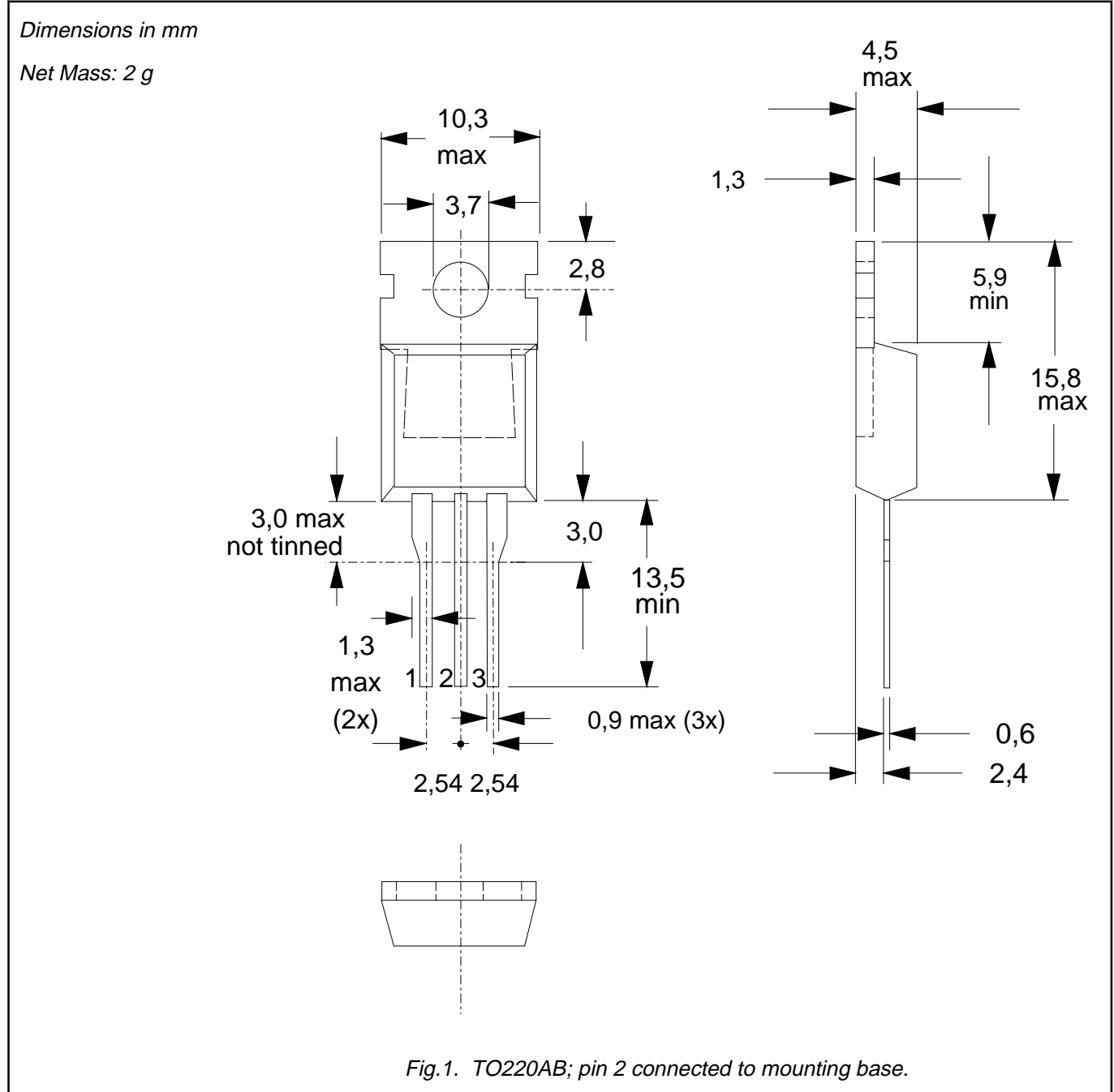
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 0.25\text{ mA}$	400	-	-	V
$V_{GS(TO)}$	Gate threshold voltage	$V_{DS} = V_{GS}; I_D = 0.25\text{ mA}$	2.0	3.0	4.0	V
I_{DSS}	Drain-source leakage current	$V_{DS} = 400\text{ V}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C}$ $V_{DS} = 320\text{ V}; V_{GS} = 0\text{ V}; T_j = 125\text{ °C}$	-	10	100	μA
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	$V_{GS} = 10\text{ V}; I_D = 3.25\text{ A}$	-	0.8	1.0	Ω
V_{SD}	Source-drain diode forward voltage	$I_F = 6.5\text{ A}; V_{GS} = 0\text{ V}$	-	1.1	1.4	V

DYNAMIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	$V_{DS} = 15\text{ V}; I_D = 3.25\text{ A}$	2.0	3.5	-	S
C_{iss}	Input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V}; f = 1\text{ MHz}$	-	750	1000	pF
C_{oss}	Output capacitance		-	120	180	pF
C_{rss}	Feedback capacitance		-	50	70	pF
$Q_{g(tot)}$	Total gate charge	$V_{GS} = 10\text{ V}; I_D = 6.5\text{ A}; V_{DS} = 320\text{ V}$	-	35	-	nC
Q_{gs}	Gate to source charge		-	4	-	nC
Q_{gd}	Gate to drain (Miller) charge		-	18	-	nC
$t_{d\ on}$	Turn-on delay time	$V_{DD} = 30\text{ V}; I_D = 2.7\text{ A};$ $V_{GS} = 10\text{ V}; R_{GS} = 50\ \Omega;$	-	10	25	ns
t_r	Turn-on rise time	$R_{GEN} = 50\ \Omega$	-	25	40	ns
$t_{d\ off}$	Turn-off delay time		-	120	140	ns
t_f	Turn-off fall time		-	40	65	ns
t_{rr}	Source-drain diode reverse recovery time	$I_F = 6.5\text{ A}; -di_F/dt = 100\text{ A}/\mu\text{s};$	-	1200	-	ns
Q_{rr}	Source-drain diode reverse recovery charge	$V_{GS} = 0\text{ V}; V_R = 100\text{ V}$	-	6.0	-	μC
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

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

Data sheet status	
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.
Limiting values	
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.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	
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