



PSMN057-200P

N-channel TrenchMOS SiliconMAX standard level FET

27 March 2023

Product data sheet

1. General description

SiliconMAX standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

2. Features and benefits

- Higher operating power due to low thermal resistance
- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics

3. Applications

- DC-to-DC converters
- Switched-mode power supplies

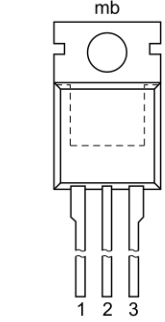
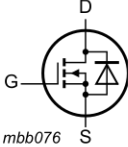
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	-	200	V
I_D	drain current	$T_{mb} = 100\text{ °C}$	-	-	27.5	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$	-	-	250	W
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 17\text{ A}; T_j = 175\text{ °C}$	-	-	165	mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$I_D = 39\text{ A}; V_{DS} = 160\text{ V}; V_{GS} = 10\text{ V}; T_j = 25\text{ °C}$	-	37	50	nC

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 TO-220AB (SOT78)	
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN057-200P	TO-220AB	plastic, single-ended package (heatsink mounted, 1 mounting hole); 3 leads; 2.54 mm pitch; 15.6 mm x 10 mm x 4.4 mm body	SOT78

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN057-200P	

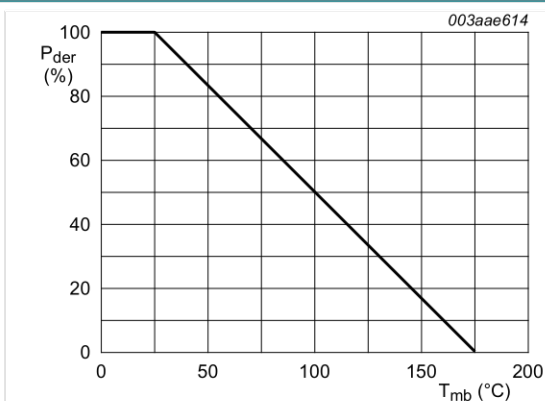
8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

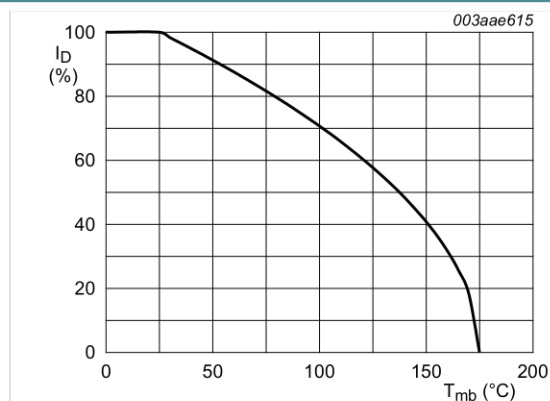
Symbol	Parameter	Conditions	Min	Max	Unit
V _{DS}	drain-source voltage	25 °C ≤ T _j ≤ 175 °C	-	200	V
V _{DGR}	drain-gate voltage	25 °C ≤ T _j ≤ 175 °C; R _{GS} = 20 kΩ	-	200	V
V _{GS}	gate-source voltage		-20	20	V
P _{tot}	total power dissipation	T _{mb} = 25 °C	-	250	W
I _D	drain current	T _{mb} = 100 °C	-	27.5	A
		T _{mb} = 25 °C	-	39	A
I _{DM}	peak drain current	pulsed; T _{mb} = 25 °C	-	156	A
T _{stg}	storage temperature		-55	175	°C
T _j	junction temperature		-55	175	°C
Source-drain diode					
I _S	source current	T _{mb} = 25 °C	-	39	A

Symbol	Parameter	Conditions	Min	Max	Unit
I_{SM}	peak source current	pulsed; $T_{mb} = 25\text{ }^{\circ}\text{C}$	-	156	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 23\text{ A}$; $V_{sup} \leq 50\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$; unclamped; $t_p = 240\text{ }\mu\text{s}$	-	925	mJ
I_{AS}	non-repetitive avalanche current	$V_{sup} \leq 50\text{ V}$; $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	23	A



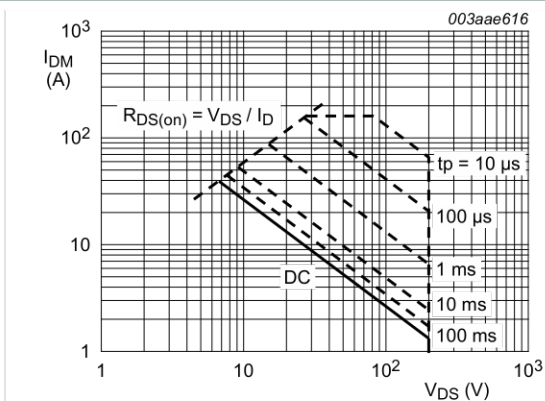
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100\%$$

Fig. 1. Normalized total power dissipation as a function of mounting base temperature



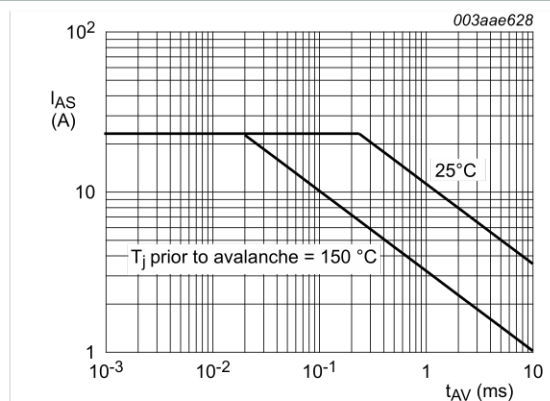
$$I_{der} = \frac{I_D}{I_{D(25^{\circ}\text{C})}} \times 100\%$$

Fig. 2. Normalized continuous drain current as a function of mounting base temperature



$T_{mb} = 25\text{ }^{\circ}\text{C}$; I_{DM} is single pulse

Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage



unclamped inductive load

Fig. 4. Single-shot avalanche rating; avalanche current as a function of avalanche period

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base		-	-	0.6	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

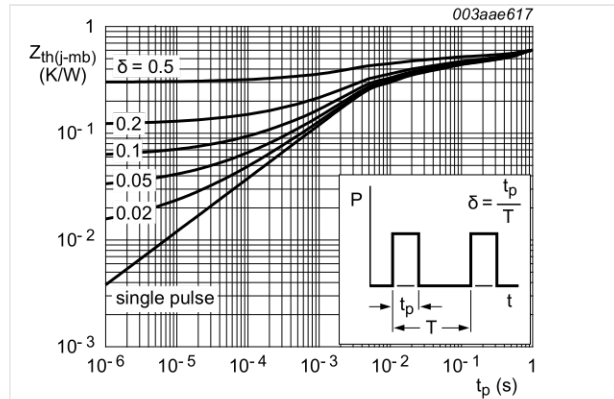


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 0.25 mA; V _{GS} = 0 V; T _j = -55 °C		178	-	-	V
		I _D = 0.25 mA; V _{GS} = 0 V; T _j = 25 °C		200	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} =V _{GS} ; T _j = -55 °C		-	-	6	V
		I _D = 1 mA; V _{DS} =V _{GS} ; T _j = 175 °C		1	-	-	V
		I _D = 1 mA; V _{DS} =V _{GS} ; T _j = 25 °C		2	3	4	V
I _{DSS}	drain leakage current	V _{DS} = 200 V; V _{GS} = 0 V; T _j = 25 °C		-	0.03	10	μA
		V _{DS} = 200 V; V _{GS} = 0 V; T _j = 175 °C		-	-	500	μA
I _{GSS}	gate leakage current	V _{GS} = 10 V; V _{DS} = 0 V; T _j = 25 °C		-	2	100	nA
		V _{GS} = -10 V; V _{DS} = 0 V; T _j = 25 °C		-	2	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 17 A; T _j = 175 °C		-	-	165	mΩ
		V _{GS} = 10 V; I _D = 17 A; T _j = 25 °C		-	41	57	mΩ
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 39 A; V _{DS} = 160 V; V _{GS} = 10 V; T _j = 25 °C		-	96	-	nC
Q _{GS}	gate-source charge			-	13	-	nC
Q _{GD}	gate-drain charge			-	37	50	nC
C _{iss}	input capacitance	V _{DS} = 25 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C		-	3750	-	pF
C _{oss}	output capacitance			-	385	-	pF
C _{rss}	reverse transfer capacitance			-	180	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 100 V; R _L = 2.7 Ω; V _{GS} = 10 V; R _{G(ext)} = 5.6 Ω; T _j = 25 °C		-	18	-	ns
t _r	rise time			-	58	-	ns
t _{d(off)}	turn-off delay time			-	105	-	ns
t _f	fall time			-	78	-	ns
L _D	internal drain inductance	measured from drain lead to centre of die; T _j = 25 °C		-	4.5	-	nH
		measured from tab to centre of die; T _j = 25 °C		-	3.5	-	nH
L _S	internal source inductance	measured from source lead to source bond pad; T _j = 25 °C		-	7.5	-	nH

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$;	-	133	-	ns
Q_r	recovered charge	$V_{DS} = 30\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$	-	895	-	nC

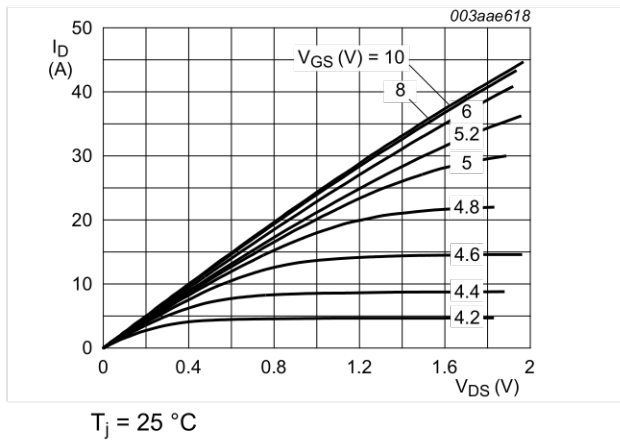


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

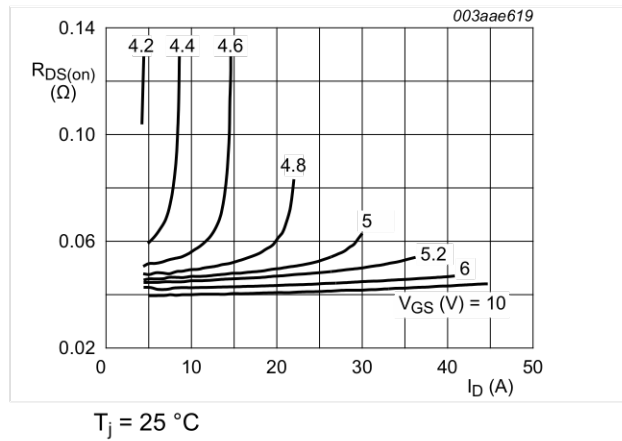


Fig. 7. Drain-source on-state resistance as a function of drain current; typical values

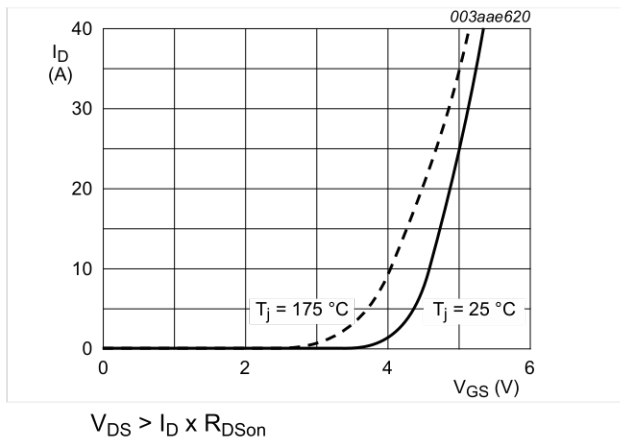


Fig. 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values

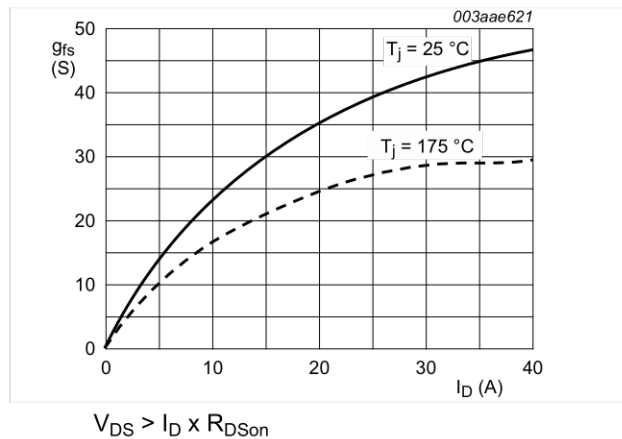


Fig. 9. Forward transconductance as a function of drain current; typical values

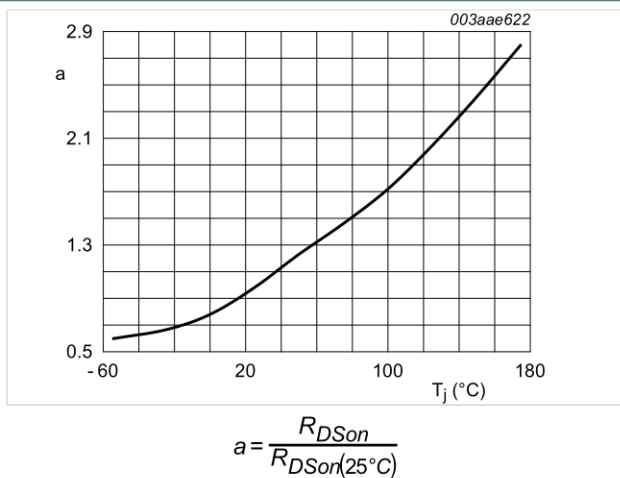


Fig. 10. Normalized drain-source on-state resistance factor as a function of junction temperature

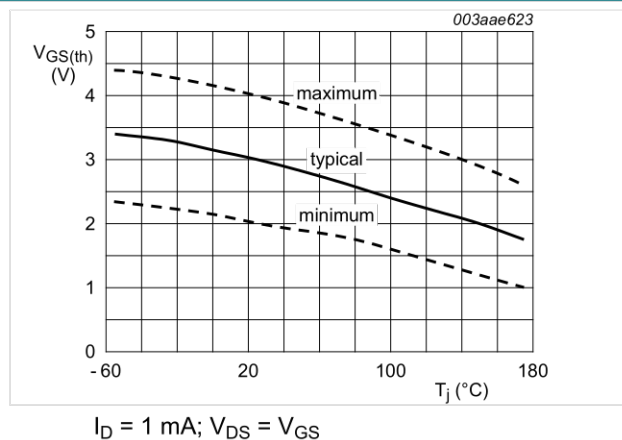


Fig. 11. Gate-source threshold voltage as a function of junction temperature

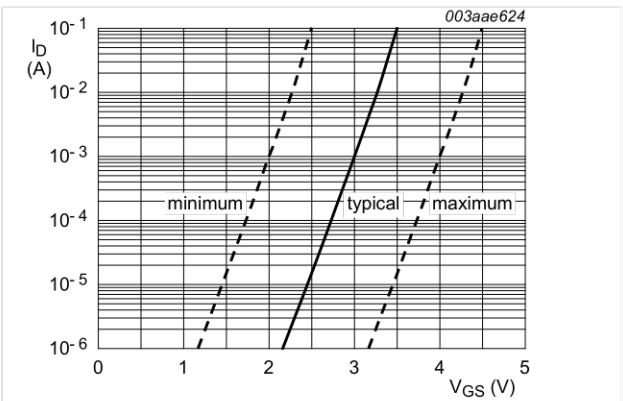


Fig. 12. Sub-threshold drain current as a function of gate-source voltage

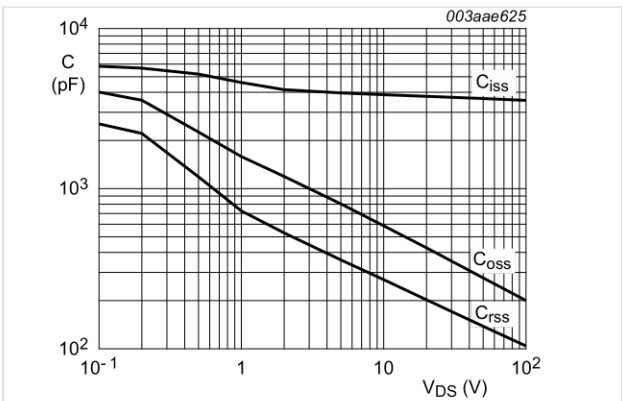


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

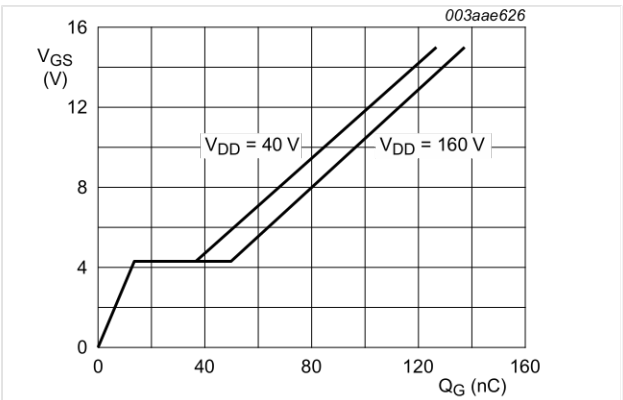


Fig. 14. Gate-source voltage as a function of gate charge; typical values

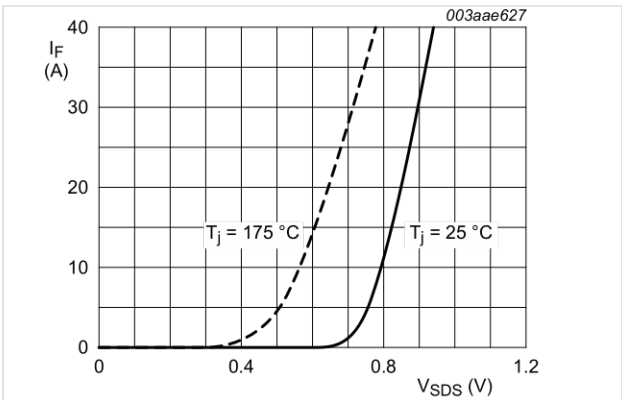


Fig. 15. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

11. Package outline

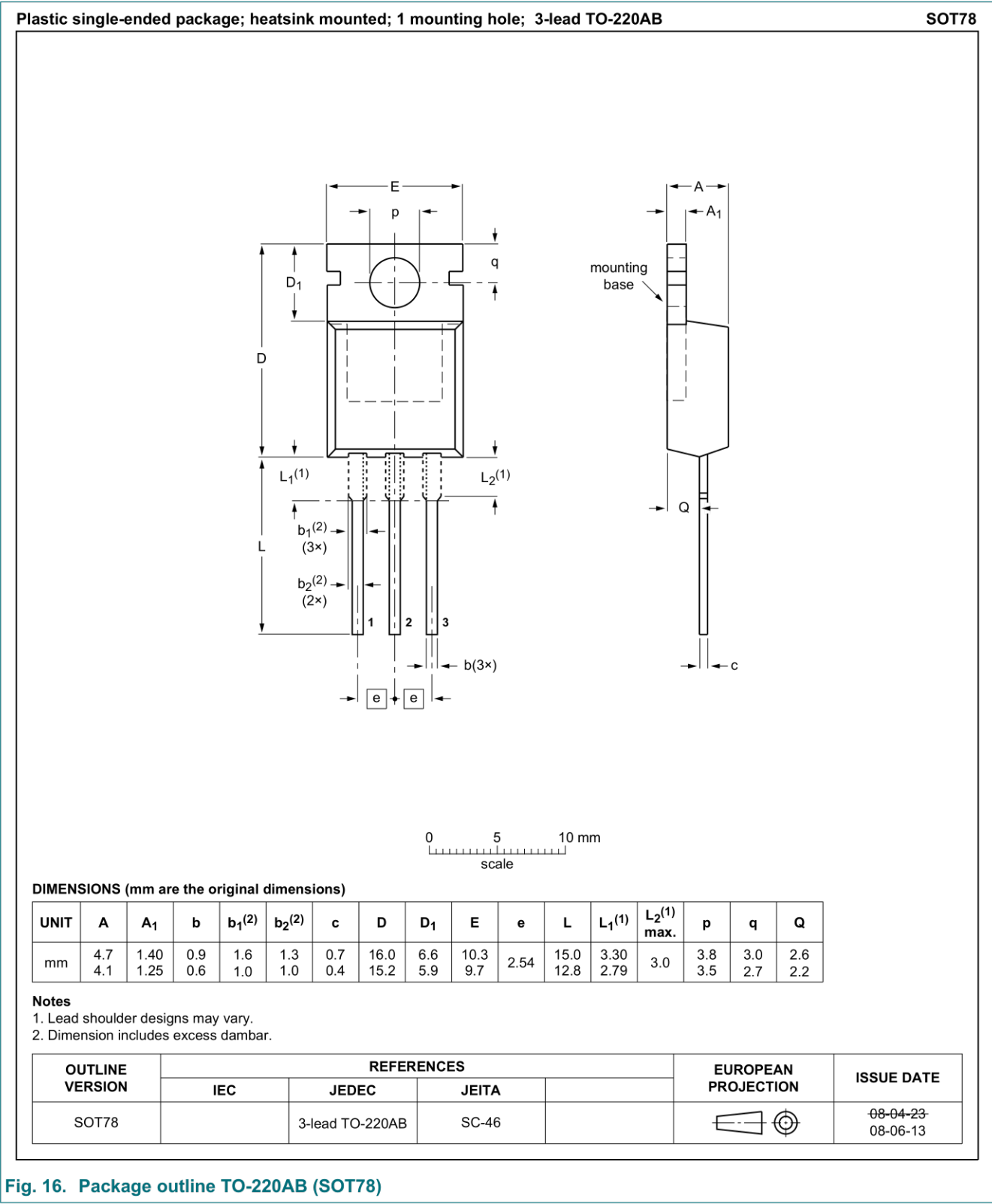


Fig. 16. Package outline TO-220AB (SOT78)

12. Legal information

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 27 March 2023