

BUK9508-55A

TrenchMOS™ logic level FET

22 March 2017

Product data sheet

1. Description

N-channel enhancement mode field-effect power transistor in a plastic package using TrenchMOS™ technology, featuring very low on-state resistance.

2. Features

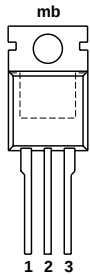
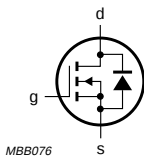
- TrenchMOS™ technology
- Q101 compliant
- 175 °C rated
- Logic level compatible.

3. Applications

- Automotive and general purpose power switching:
 - ◆ 12 V and 24 V loads
 - ◆ Motors, lamps and solenoids.

4. Pinning information

Table 1: Pinning - SOT78, simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1	gate (g)		
2	drain (d)		
3	source (s)		
mb	mounting base; connected to drain (d)		

SOT78A (TO-220AB)

5. Quick reference data

Table 2: Quick reference data

Symbol	Parameter	Conditions	Typ	Max	Unit
V_{DS}	drain-source voltage (DC)		-	55	V
I_D	drain current (DC)	$T_{mb} = 25\text{ °C}$; $V_{GS} = 5\text{ V}$	-	125	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$	-	253	W
T_j	junction temperature		-	175	°C
$R_{DS(on)}$	drain-source on-state resistance	$T_j = 25\text{ °C}$; $V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$	6.8	8	mΩ
		$T_j = 25\text{ °C}$; $V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$	-	8.5	mΩ
		$T_j = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$	6.4	7.5	mΩ

6. Limiting values

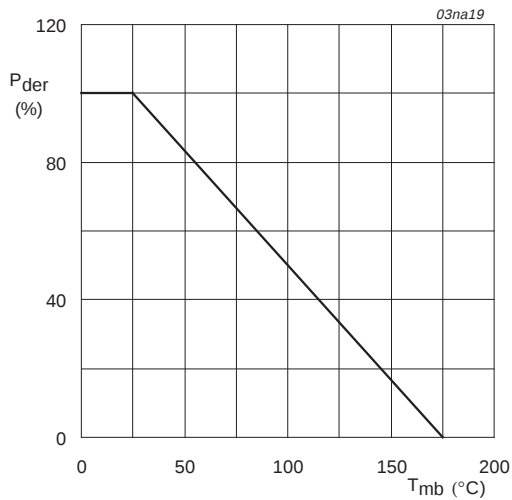
Table 3: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)		-	55	V
V_{DGR}	drain-gate voltage (DC)	$R_{GS} = 20\text{ k}\Omega$	-	55	V
V_{GS}	gate-source voltage (DC)		-	±15	V
I_D	drain current (DC)	$T_{mb} = 25\text{ °C}$; $V_{GS} = 5\text{ V}$; Figure 2 and 3	[1] -	125	A
			[2] -	75	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 5\text{ V}$; Figure 2	[2] -	75	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; Figure 3	-	503	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Figure 1	-	253	W
T_{stg}	storage temperature		-55	+175	°C
T_j	junction temperature		-55	+175	°C
Source-drain diode					
I_{DR}	reverse drain current (DC)	$T_{mb} = 25\text{ °C}$	[1] -	125	A
			[2] -	75	A
I_{DRM}	peak reverse drain current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	503	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 75\text{ A}$; $V_{DS} \leq 55\text{ V}$; $V_{GS} = 5\text{ V}$; $R_{GS} = 50\text{ }\Omega$; starting $T_{mb} = 25\text{ °C}$	-	670	mJ

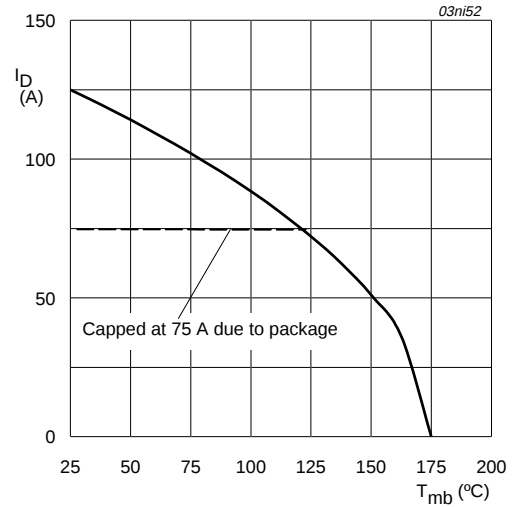
[1] Current is limited by power dissipation chip rating

[2] Continuous current is limited by package.



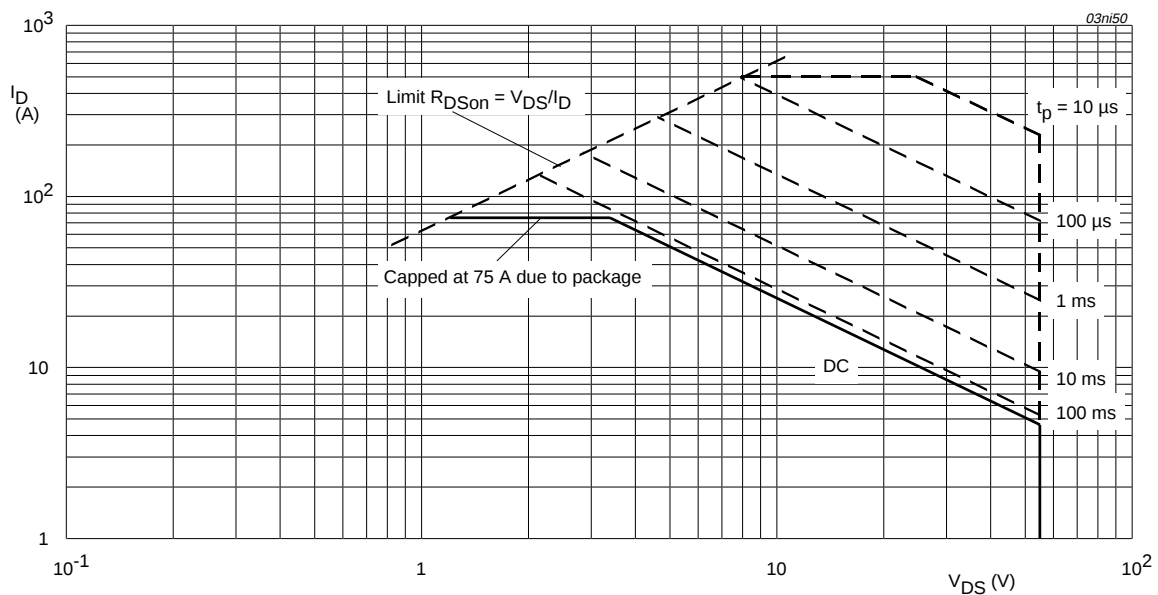
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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



$$V_{GS} \geq 4.5 \text{ V}$$

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



$T_{mb} = 25$ °C; I_{DM} single pulse.

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

7. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Figure 4	-	-	0.59	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient					
	SOT78	vertical in still air	-	60	-	K/W
	SOT404	mounted on a printed circuit board; minimum footprint	-	50	-	K/W

7.1 Transient thermal impedance

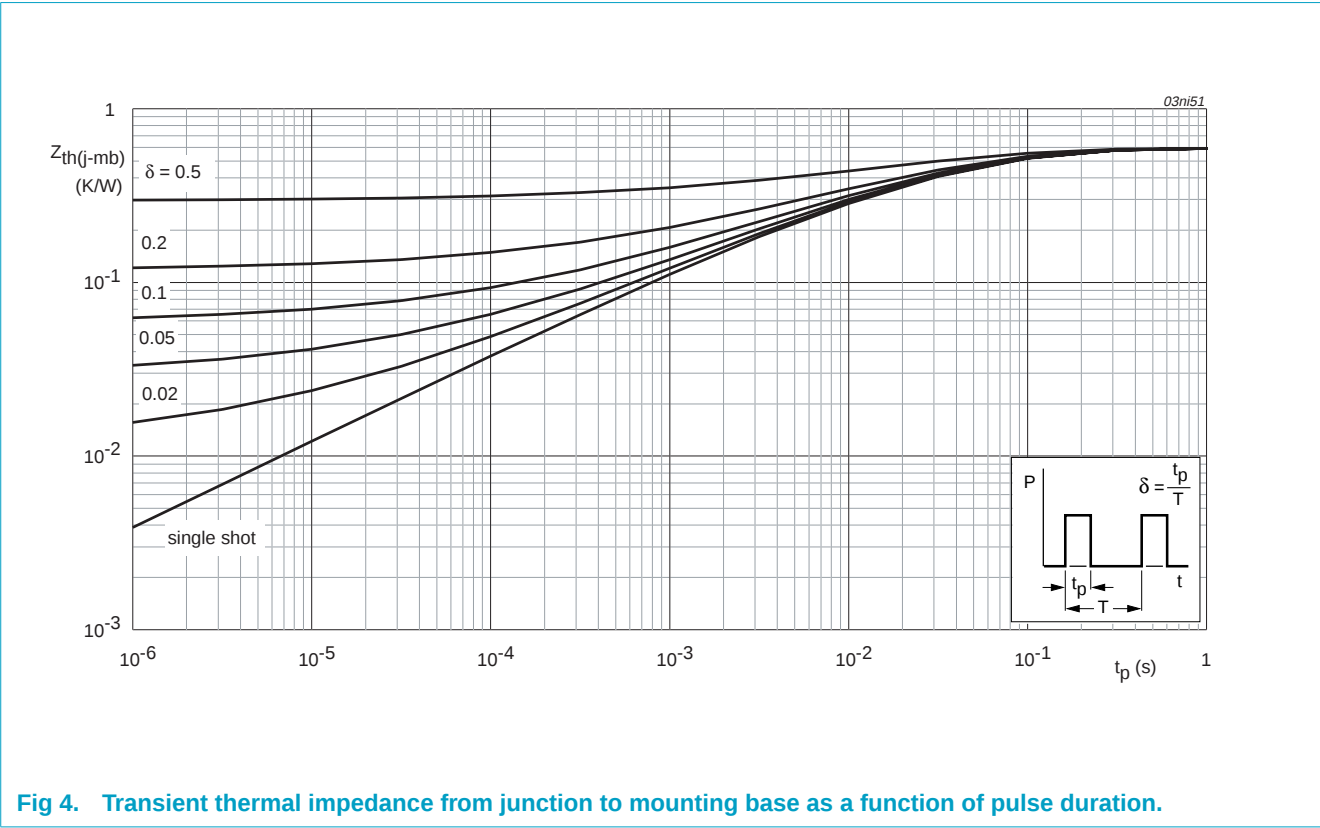


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

8. Characteristics

Table 5: Characteristics

$T_j = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25\text{ mA}$; $V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ }^{\circ}\text{C}$	55	-	-	V
		$T_j = -55\text{ }^{\circ}\text{C}$	50	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; Figure 9				
		$T_j = 25\text{ }^{\circ}\text{C}$	1	1.5	2	V
		$T_j = 175\text{ }^{\circ}\text{C}$	0.5	-	-	V
		$T_j = -55\text{ }^{\circ}\text{C}$	-	-	2.3	V
I_{DSS}	drain-source leakage current	$V_{DS} = 55\text{ V}$; $V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ }^{\circ}\text{C}$	-	0.05	10	μA
		$T_j = 175\text{ }^{\circ}\text{C}$	-	-	500	μA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 10\text{ V}$; $V_{DS} = 0\text{ V}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; Figure 7 and 8				
		$T_j = 25\text{ }^{\circ}\text{C}$	-	6.8	8	m Ω
		$T_j = 175\text{ }^{\circ}\text{C}$	-	-	16	m Ω
		$V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$	-	-	8.5	m Ω
		$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$	-	6.4	7.5	m Ω
Dynamic characteristics						
$Q_{g(tot)}$	total gate charge	$V_{GS} = 5\text{ V}$; $V_{DD} = 44\text{ V}$; $I_D = 25\text{ A}$; Figure 14	-	92	-	nC
Q_{gs}	gate-to-source charge		-	11	-	nC
Q_{gd}	gate-to-drain (Miller) charge		-	43	-	nC
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 25\text{ V}$; $f = 1\text{ MHz}$; Figure 12	-	4551	6021	pF
C_{oss}	output capacitance		-	760	900	pF
C_{rss}	reverse transfer capacitance		-	500	687	pF
$t_{d(on)}$	turn-on delay time	$V_{DD} = 30\text{ V}$; $R_L = 1.2\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $R_G = 10\text{ }\Omega$	-	40	-	ns
t_r	rise time		-	175	-	ns
$t_{d(off)}$	turn-off delay time		-	280	-	ns
t_f	fall time		-	167	-	ns
L_d	internal drain inductance	from drain lead 6 mm from package to centre of die	-	4.5	-	nH
		from contact screw on mounting base to centre of die SOT78	-	3.5	-	nH
		from upper edge of drain mounting base to centre of die SOT404	-	2.5	-	nH
L_s	internal source inductance	from source lead to source bond pad	-	7.5	-	nH

Table 5: Characteristics...continued
 $T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain (diode forward) voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; Figure 15	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 75\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$	-	70	-	ns
Q_r	recovered charge	$V_{GS} = -10\text{ V}$; $V_{DS} = 25\text{ V}$	-	170	-	nC

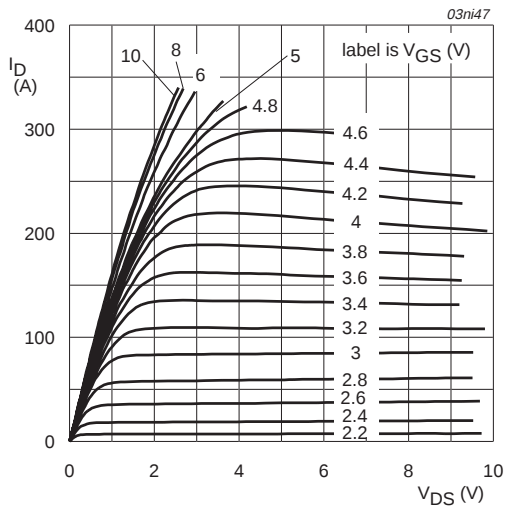


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values.

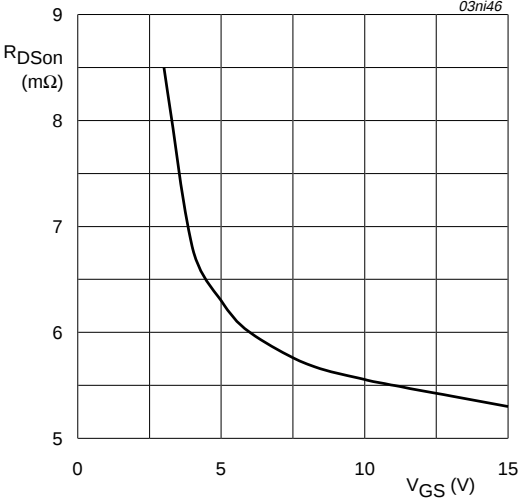


Fig 6. Drain-source on-state resistance as a function of gate-source voltage; typical values.

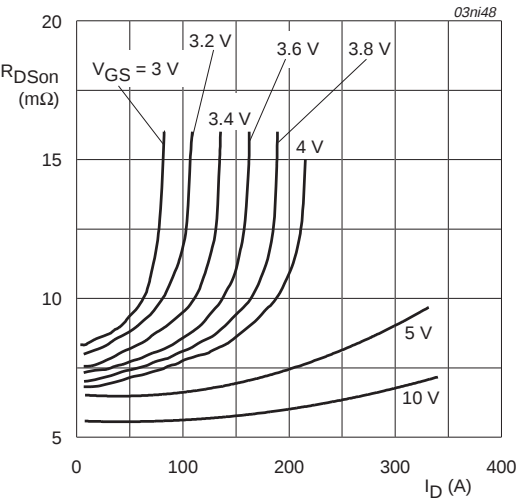


Fig 7. Drain-source on-state resistance as a function of drain current; typical values.

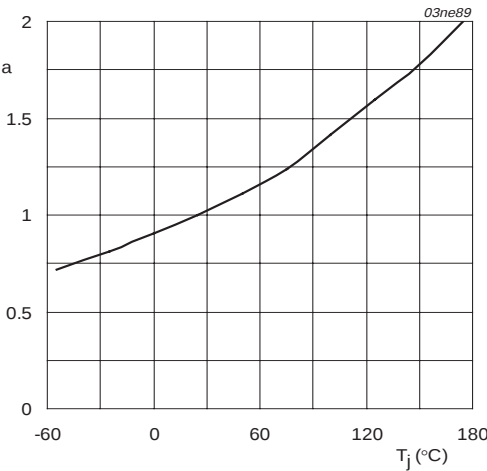
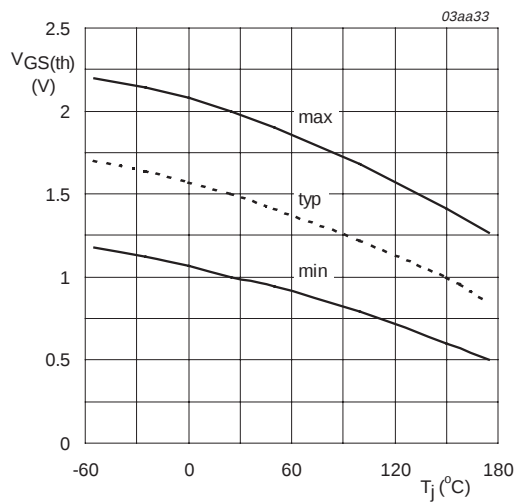
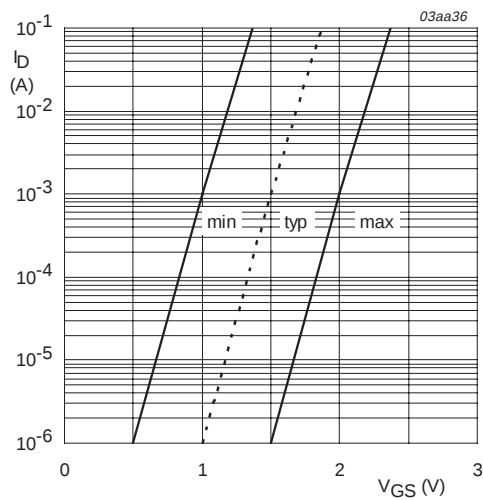


Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature.



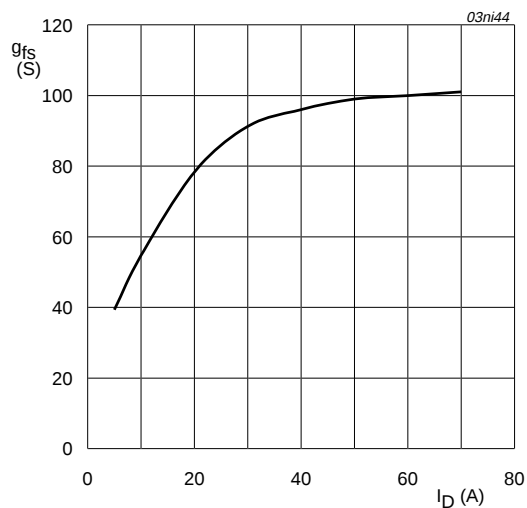
$I_D = 1 \text{ mA}$; $V_{DS} = V_{GS}$

Fig 9. Gate-source threshold voltage as a function of junction temperature.



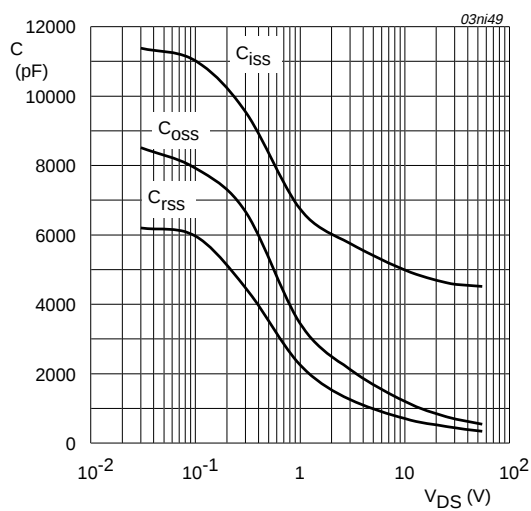
$T_j = 25 \text{ °C}$; $V_{DS} = V_{GS}$

Fig 10. Sub-threshold drain current as a function of gate-source voltage.



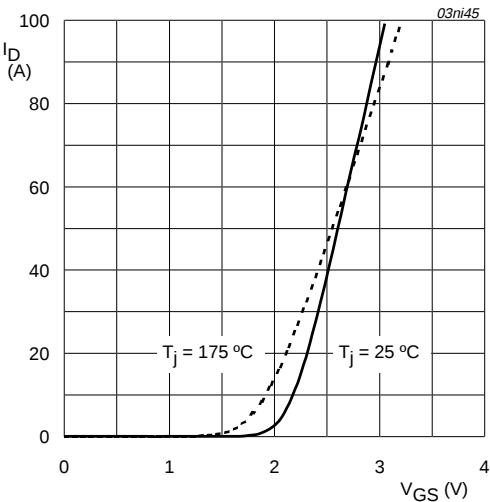
$T_j = 25 \text{ °C}$; $V_{DS} = 25 \text{ V}$

Fig 11. Forward transconductance as a function of drain current; typical values.



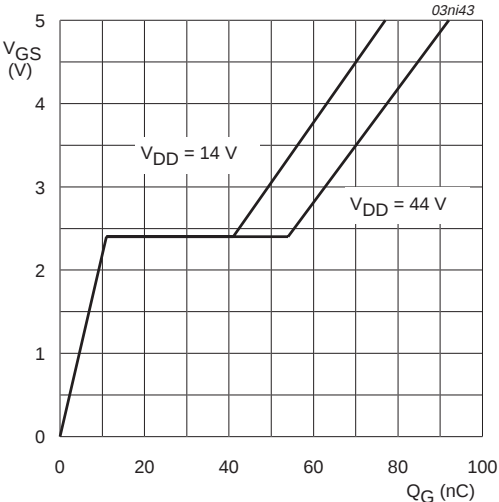
$V_{GS} = 0 \text{ V}$; $f = 1 \text{ MHz}$

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



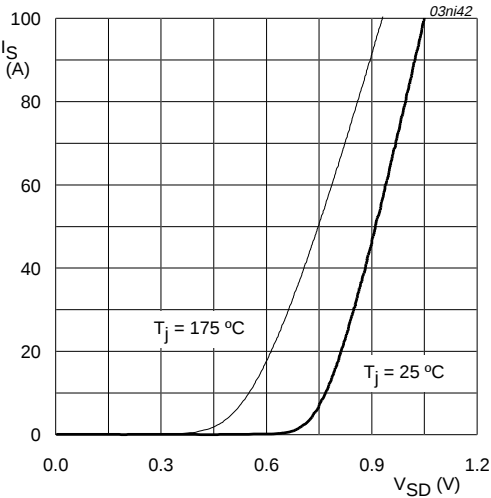
$V_{DS} = 25\text{ V}$

Fig 13. Transfer characteristics: drain current as a function of gate-source voltage; typical values.



$T_j = 25\text{ }^{\circ}\text{C}; I_D = 25\text{ A}$

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



$V_{GS} = 0\text{ V}$

Fig 15. Reverse diode current as a function of reverse diode voltage; typical values.

9. Package outline

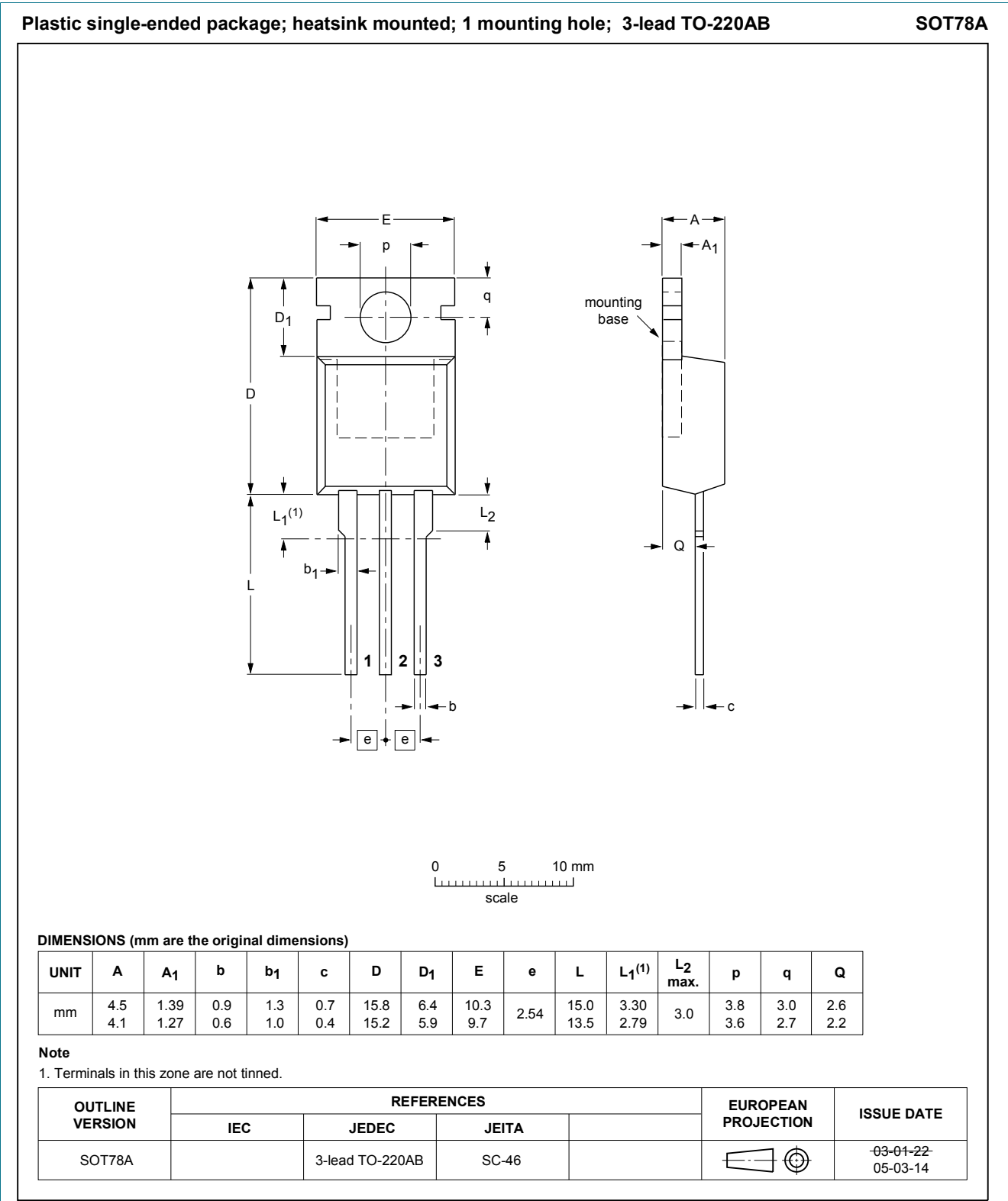


Fig. 16. Package outline TO-220AB (SOT78A)

10. 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.
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Date of release: 22 March 2017