



# BUK752R3-40E

N-channel TrenchMOS standard level FET

11 September 2012

Product data sheet

## 1. Product profile

### 1.1 General description

Standard level N-channel MOSFET in a SOT78 package using TrenchMOS technology. This product has been designed and qualified to AEC Q101 standard for use in high performance automotive applications.

### 1.2 Features and benefits

- AEC Q101 compliant
- Repetitive avalanche rated
- Suitable for thermally demanding environments due to 175 °C rating
- True standard level gate with VGS(th) rating of greater than 1V at 175 °C

### 1.3 Applications

- 12 V Automotive systems
- Motors, lamps and solenoid control
- Start-Stop micro-hybrid applications
- Transmission control
- Ultra high performance power switching

### 1.4 Quick reference data

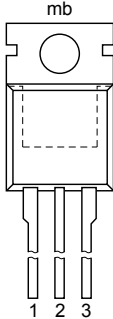
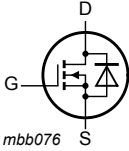
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C		-	-	40	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 25 °C; <a href="#">Fig. 1</a>	[1]	-	-	120	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; <a href="#">Fig. 2</a>		-	-	293	W
<b>Static characteristics</b>							
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 11</a>		-	1.95	2.3	mΩ
<b>Dynamic characteristics</b>							
Q <sub>GD</sub>	gate-drain charge	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; V <sub>DS</sub> = 32 V; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	33.4	-	nC

[1] Continuous current is limited by package.

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 TO-220AB (SOT78A)	 mbb076
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK752R3-40E	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78A

## 4. Marking

Table 4. Marking codes

Type number	Marking code
BUK752R3-40E	BUK752R3-40E

## 5. Limiting values

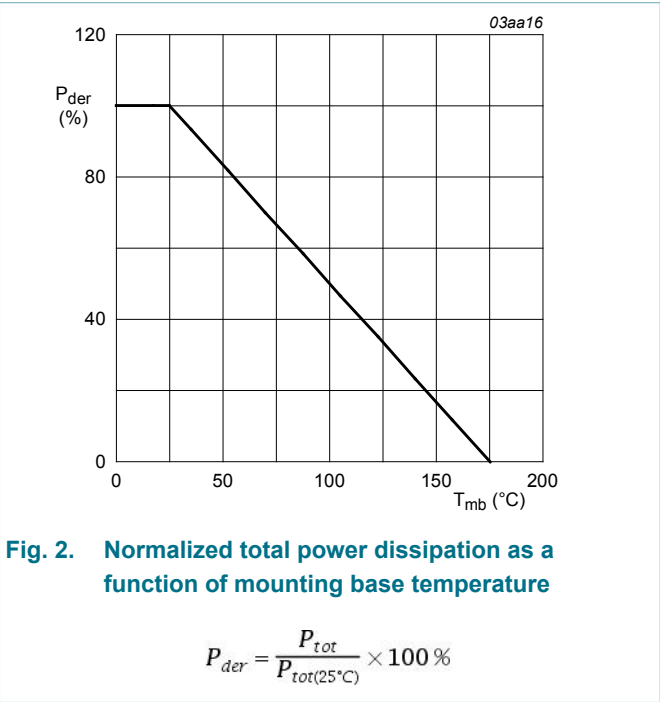
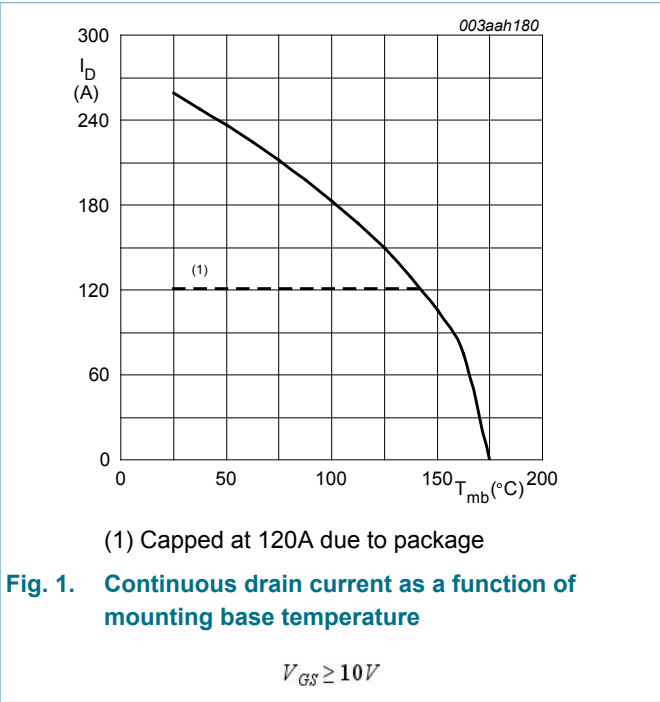
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$		-	40	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$		-	40	V
$V_{GS}$	gate-source voltage	$T_j \leq 175\text{ °C}$ ; DC		-20	20	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; Fig. 1	[1]	-	120	A
		$T_{mb} = 100\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; Fig. 1	[1]	-	120	A
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; Fig. 4		-	1035	A

Symbol	Parameter	Conditions		Min	Max	Unit
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; <a href="#">Fig. 2</a>		-	293	W
T <sub>stg</sub>	storage temperature			-55	175	°C
T <sub>j</sub>	junction temperature			-55	175	°C
Source-drain diode						
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C	<a href="#">[1]</a>	-	120	A
I <sub>SM</sub>	peak source current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C		-	1035	A
Avalanche ruggedness						
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	I <sub>D</sub> = 120 A; V <sub>sup</sub> ≤ 40 V; R <sub>GS</sub> = 50 Ω; V <sub>GS</sub> = 10 V; T <sub>j(init)</sub> = 25 °C; unclamped; <a href="#">Fig. 3</a>	<a href="#">[2][3]</a>	-	622	mJ

- [1] Continuous current is limited by package.
- [2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [3] Refer to application note AN10273 for further information.



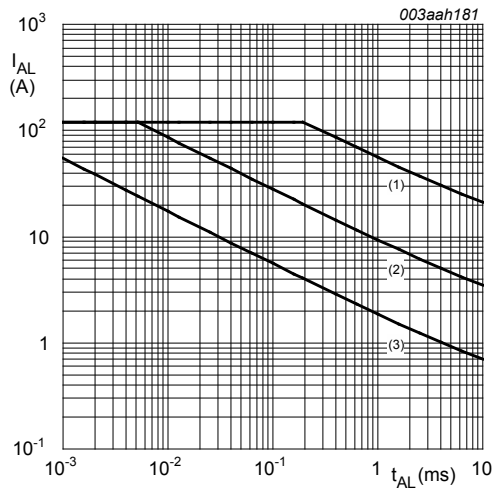


Fig. 3. Single pulse avalanche rating; avalanche current as a function of avalanche time

(1)  $T_{j\ (init)} = 25^{\circ}C$ ; (2)  $T_{j\ (init)} = 150^{\circ}C$ ; (3) Repetitive Avalanche

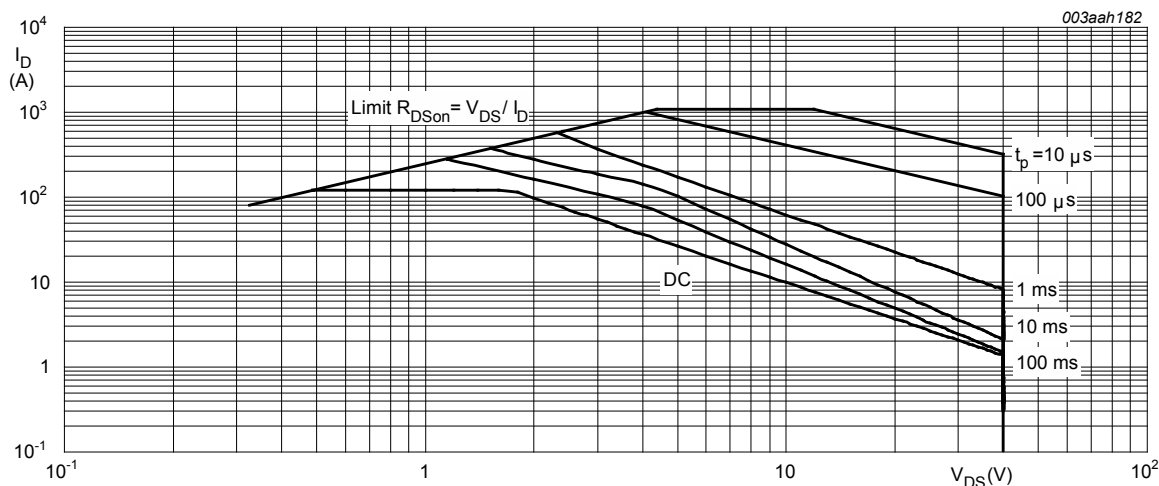


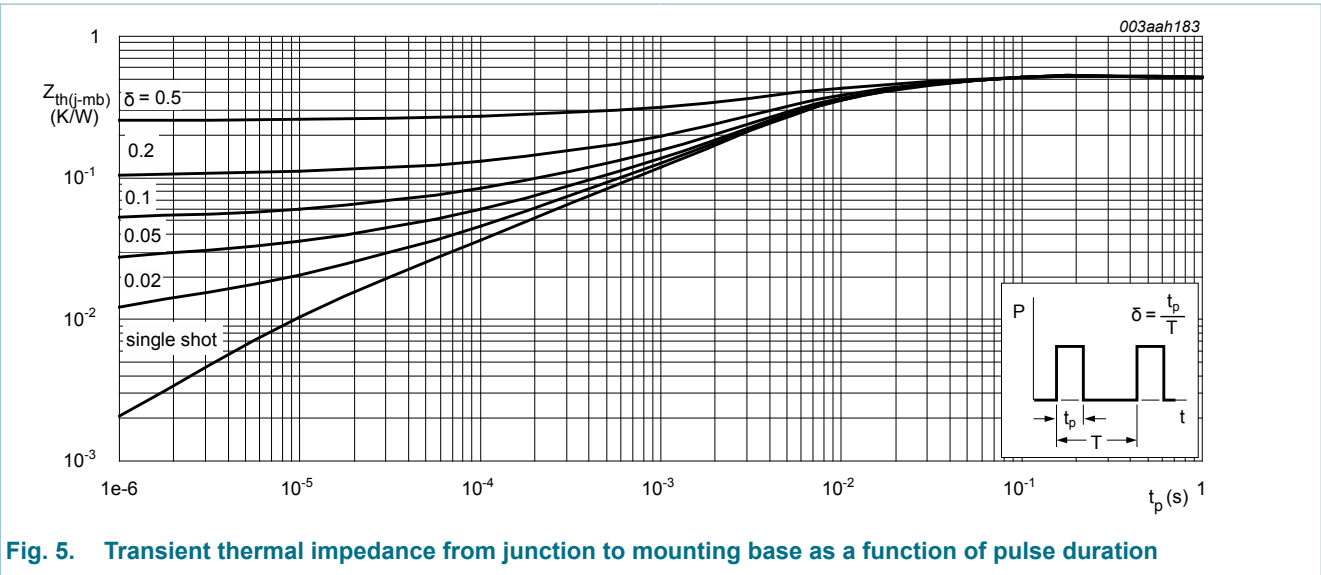
Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 5	-	-	0.51	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air	-	60	-	K/W



7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C		40	-	-	V
		I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = -55 °C		36	-	-	V
V <sub>GS(th)</sub>	gate-source threshold voltage	I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = 25 °C; <a href="#">Fig. 9</a> ; <a href="#">Fig. 10</a>		2.4	3	4	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = -55 °C; <a href="#">Fig. 10</a>		-	-	4.5	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = 175 °C; <a href="#">Fig. 10</a>		1	-	-	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 40 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C		-	0.36	3	μA
		V <sub>DS</sub> = 40 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 175 °C		-	-	500	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 20 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C		-	2	100	nA
		V <sub>GS</sub> = -20 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C		-	2	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 11</a>		-	1.95	2.3	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>J</sub> = 175 °C; <a href="#">Fig. 12</a> ; <a href="#">Fig. 11</a>		-	-	4.4	mΩ
Dynamic characteristics							
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 25 A; V <sub>DS</sub> = 32 V; V <sub>GS</sub> = 10 V; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	109.2	-	nC
Q <sub>GS</sub>	gate-source charge			-	27.5	-	nC
Q <sub>GD</sub>	gate-drain charge			-	33.4	-	nC

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C <sub>iss</sub>	input capacitance	V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 25 V; f = 1 MHz; T <sub>j</sub> = 25 °C; <a href="#">Fig. 15</a>		-	6250	8500	pF
C <sub>oss</sub>	output capacitance			-	1210	1450	pF
C <sub>rss</sub>	reverse transfer capacitance			-	605	840	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 30 V; R <sub>L</sub> = 1.2 Ω; V <sub>GS</sub> = 10 V; R <sub>G(ext)</sub> = 5 Ω		-	29	-	ns
t <sub>r</sub>	rise time			-	36	-	ns
t <sub>d(off)</sub>	turn-off delay time			-	79	-	ns
t <sub>f</sub>	fall time			-	46	-	ns
L <sub>D</sub>	internal drain inductance	from upper edge of drain mounting base to center of die		-	2.5	-	nH
L <sub>S</sub>	internal source inductance	from source lead to source bonding pad		-	7.5	-	nH
Source-drain diode							
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 25 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 16</a>		-	0.8	1.2	V
t <sub>rr</sub>	reverse recovery time	I <sub>S</sub> = 20 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V;		-	43	-	ns
Q <sub>r</sub>	recovered charge	V <sub>DS</sub> = 25 V		-	54	-	nC

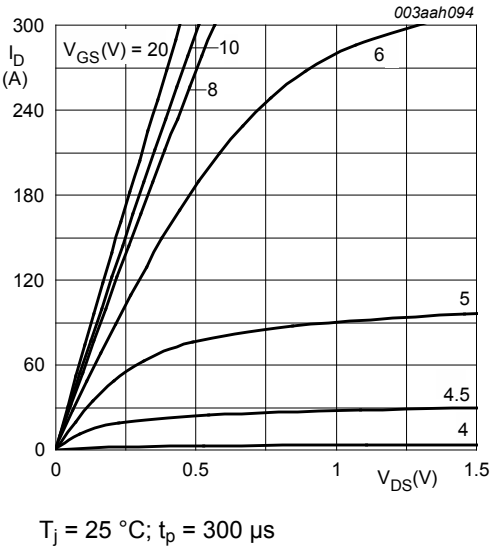


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

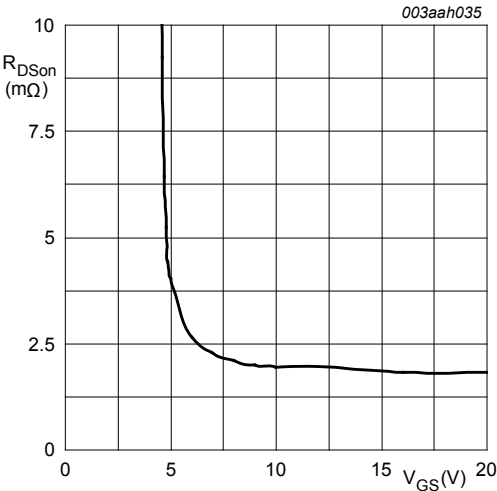


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

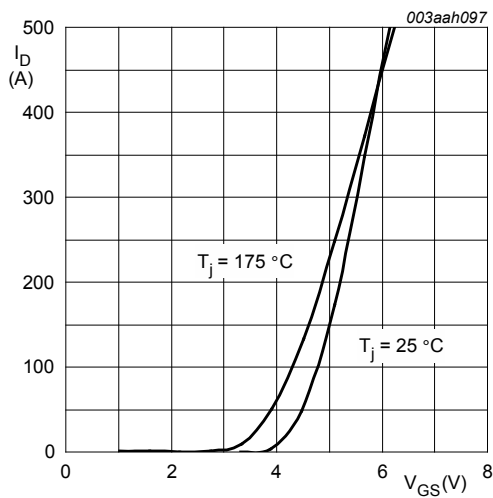


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10V$

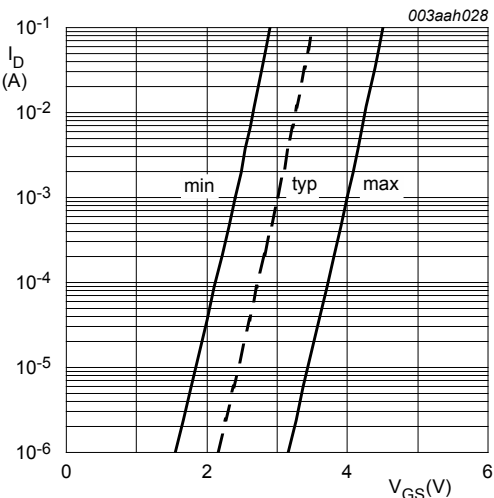


Fig. 9. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25^{\circ}C; V_{DS} = 5V$

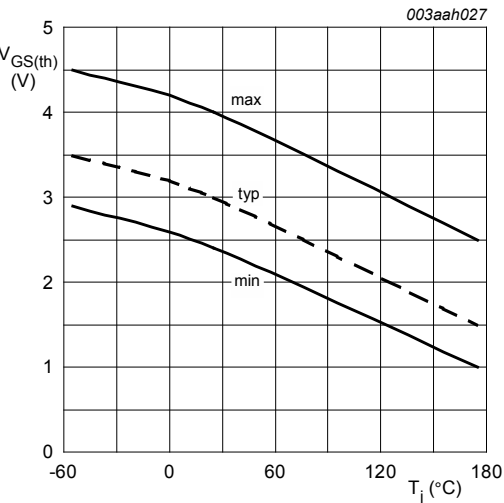


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

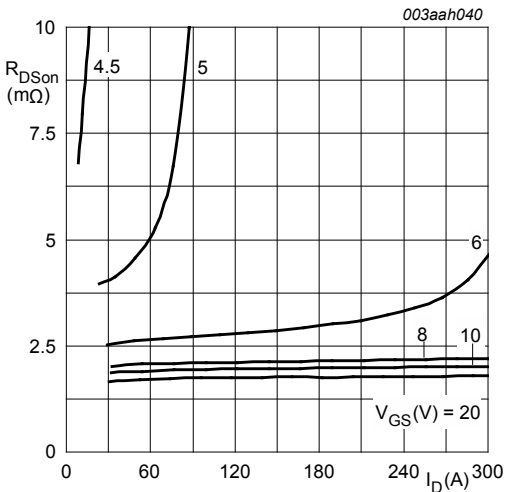


Fig. 11. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25^{\circ}C; t_p = 300\text{ }\mu s$

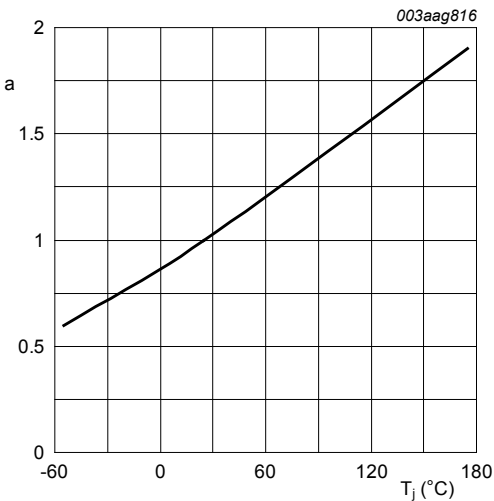


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

$$a = \frac{R_{DSon}}{R_{DSon(25\text{ }^{\circ}\text{C})}}$$

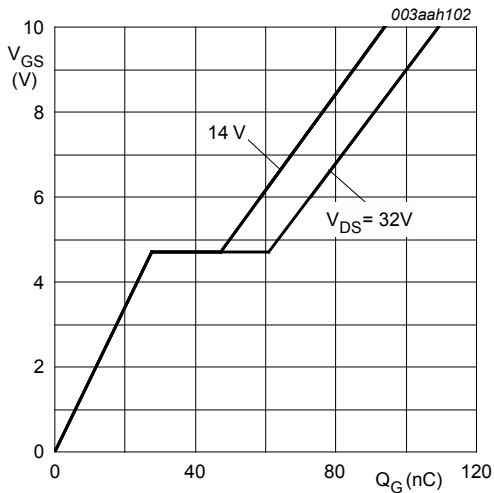


Fig. 14. Gate-source voltage as a function of gate charge; typical values

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

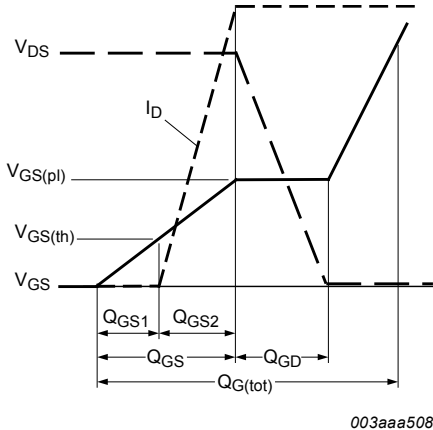


Fig. 13. Gate charge waveform definitions

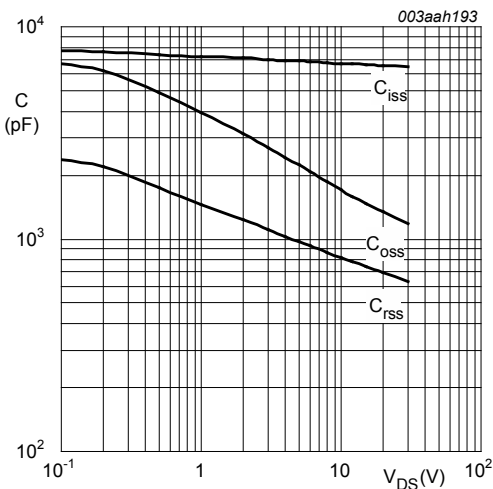


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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



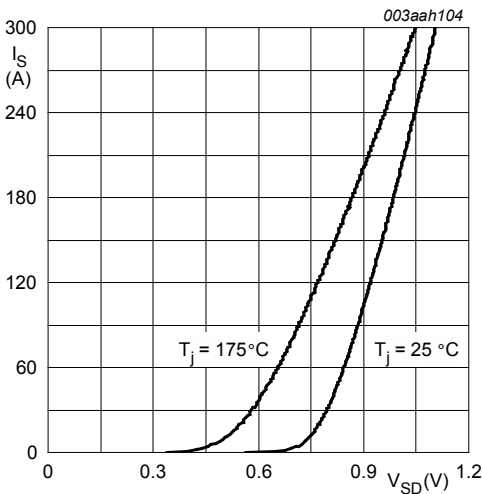


Fig. 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0V$

8. Package outline

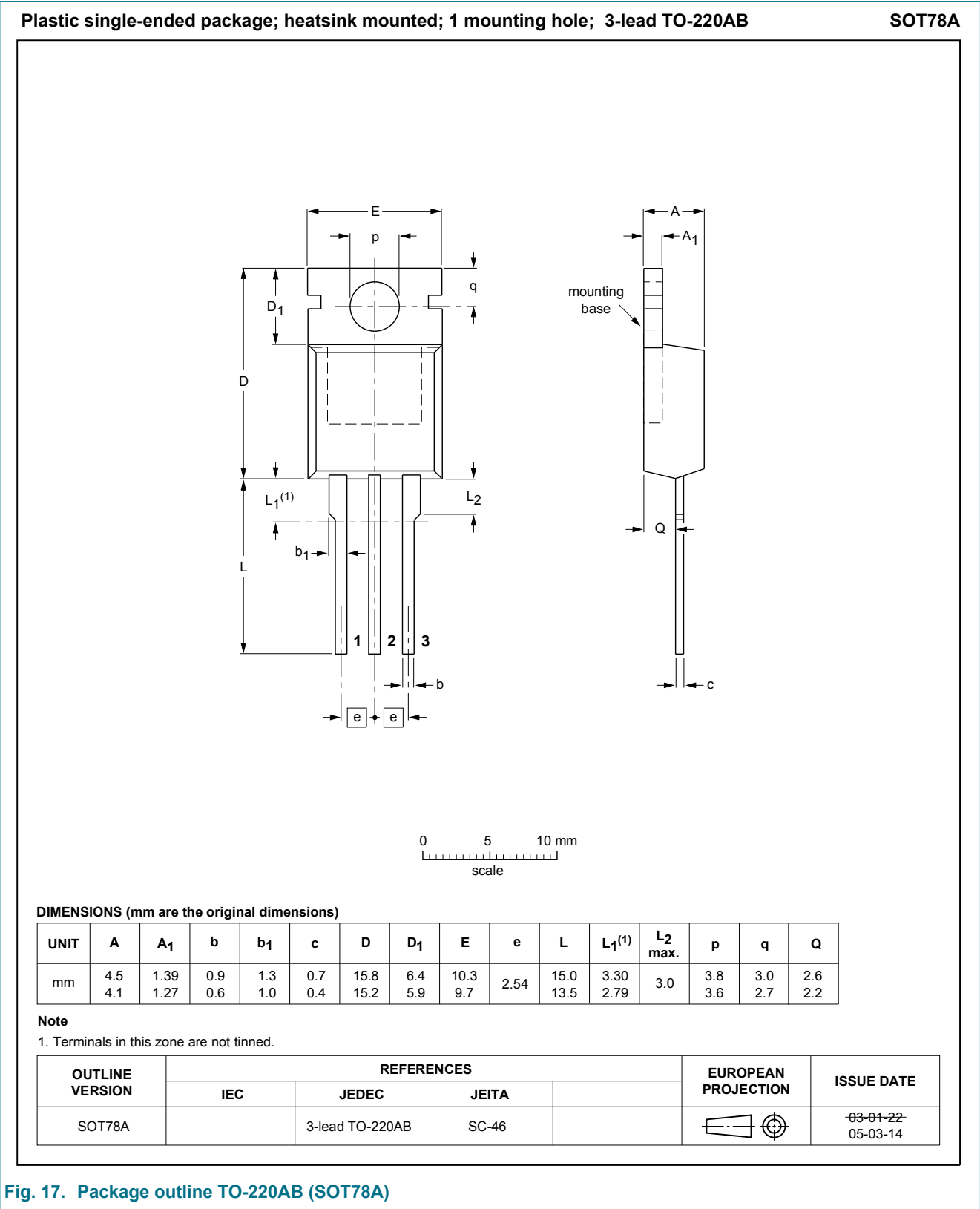


Fig. 17. Package outline TO-220AB (SOT78A)

## 9. Legal information

### 9.1 Data sheet status

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.
Product [short] data sheet	Production	This document contains the product specification.

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Date of release: 11 September 2012