BUK655R0-75C

N-channel TrenchMOS FET

Rev. 02 — 14 October 2010 Product data sheet

1. Product profile

1.1 General description

Intermediate level gate drive N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using advanced TrenchMOS technology. This product has been designed and qualified to the appropriate AEC Q101 standard for use in high performance automotive applications.

1.2 Features and benefits

- AEC Q101 compliant
- Suitable for intermediate level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

1.3 Applications

- 12 V, 24 V and 42 V Automotive systems
- Electric and electro-hydraulic power steering
- 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_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	75	V
I_D	drain current	$V_{GS} = 10$ V; $T_{mb} = 25$ °C; see Figure 1	[1]	-	-	120	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	-	263	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 25$ °C; see Figure 11		-	4.6	5.3	mΩ

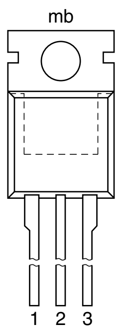
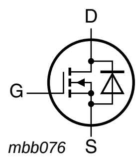
Table 1. Quick reference data *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 120 A; $V_{sup} \leq$ 75 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped	-	-	329	mJ
Dynamic characteristics						
Q_{GD}	gate-drain charge	I_D = 25 A; V_{DS} = 60 V; V_{GS} = 10 V; see Figure 13; see Figure 14	-	46.7	-	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		
2	D	Drain		
3	S	source		
mb	D	mounting base; connected to drain		

SOT78A (TO-220AB)

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK655R0-75C	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78A

4. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	75	V
V_{GS}	gate-source voltage	DC	[1]	-16	16	V
		Pulsed	[2]	-20	20	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; see Figure 1	[3]	-	120	A
		T_{mb} = 100 °C; V_{GS} = 10 V; see Figure 1		-	98	A
I_{DM}	peak drain current	T_{mb} = 25 °C; $t_p \leq 10$ µs; pulsed; see Figure 3		-	553	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 2		-	263	W
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	[3]	-	120	A
I_{SM}	peak source current	$t_p \leq 10$ µs; pulsed; T_{mb} = 25 °C		-	553	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 120 A; $V_{sup} \leq 75$ V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped		-	329	mJ
$E_{DS(AL)R}$	repetitive drain-source avalanche energy		[4][5][6]	-	-	J

[1] -16V accumulated duration not to exceed 168 hrs

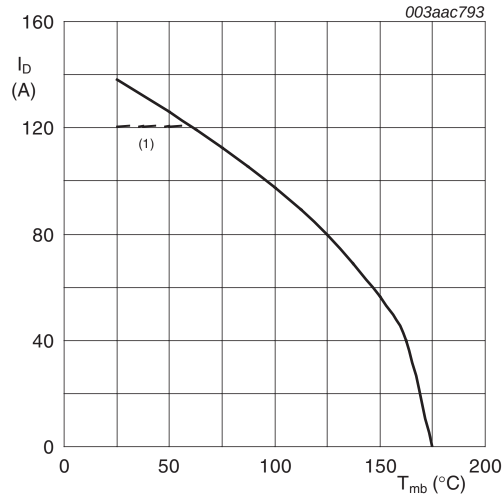
[2] Accumulated pulse duration not to exceed 5mins.

[3] Continuous current is limited by package.

[4] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

[5] Repetitive avalanche rating limited by an average junction temperature of 170 °C.

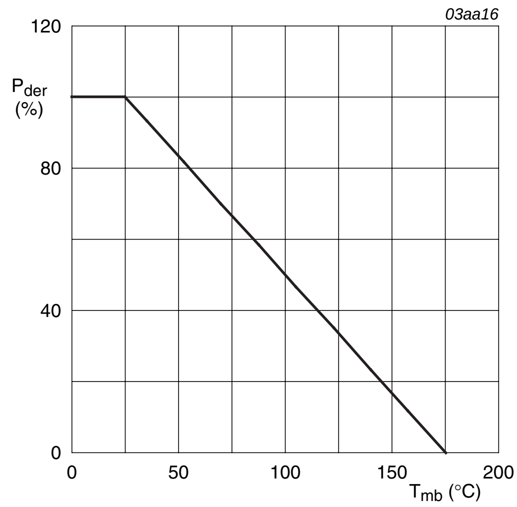
[6] Refer to application note AN10273 for further information.



$V_{GS} \geq 10\,V$

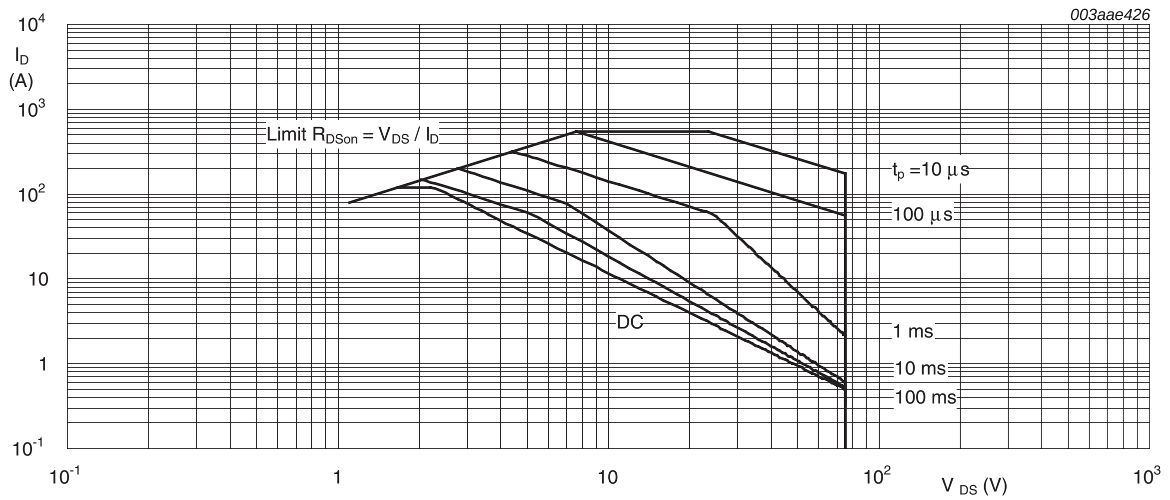
(1) Capped at 120 A due to package.

Fig 1. Continuous drain current as a function of mounting base temperature



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

Fig 2. Normalized total power dissipation as a function of mounting base temperature



T_{mb} = 25 °C; I_{DM} is a single pulse

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

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	-	0.57	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in free air	-	60	-	K/W

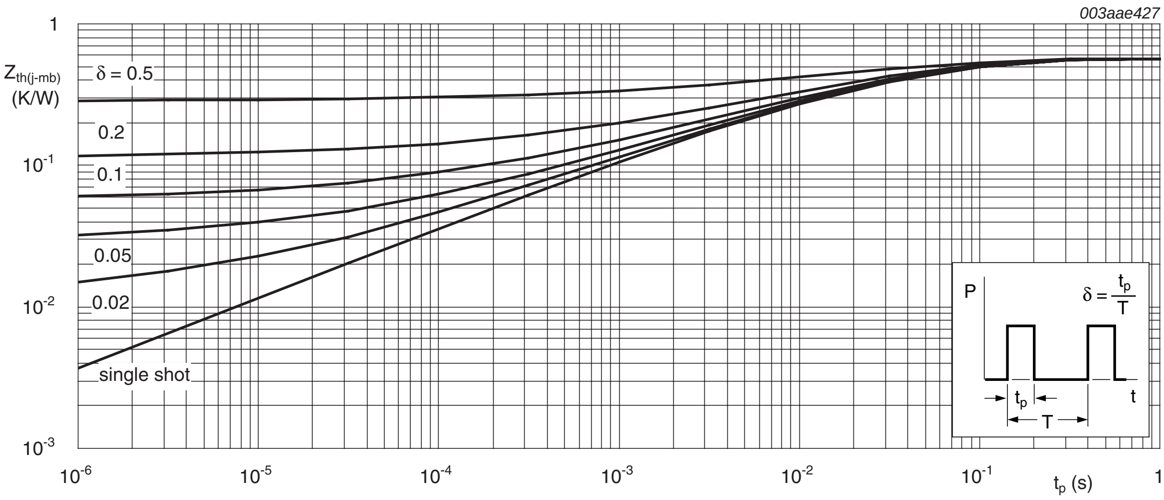


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

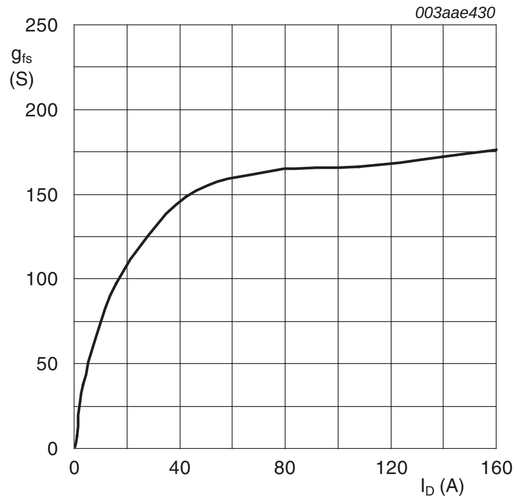
6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	75	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C	68	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 9; see Figure 10	1.8	2.3	2.8	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 10	-	-	3.3	V
		I_D = 2.5 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 10	0.8	-	-	V
I_{DSS}	drain leakage current	V_{DS} = 75 V; V_{GS} = 0 V; T_j = 175 °C	-	-	500	µA
		V_{DS} = 75 V; V_{GS} = 0 V; T_j = 25 °C	-	0.02	1	µA
I_{GSS}	gate leakage current	V_{DS} = 0 V; V_{GS} = 20 V; T_j = 25 °C	-	2	100	nA
		V_{DS} = 0 V; V_{GS} = -20 V; T_j = 25 °C	-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 11	-	4.6	5.3	mΩ
		V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 °C; see Figure 11	-	5.5	7.4	mΩ
		V_{GS} = 5 V; I_D = 25 A; T_j = 25 °C; see Figure 11	-	5.2	6.5	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 175 °C; see Figure 12; see Figure 11	-	-	13.8	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 60 V; V_{GS} = 10 V; see Figure 13; see Figure 14	-	177	-	nC
		I_D = 25 A; V_{DS} = 60 V; V_{GS} = 5 V; see Figure 13; see Figure 14	-	100	-	nC
Q_{GS}	gate-source charge	I_D = 25 A; V_{DS} = 60 V; V_{GS} = 10 V; see Figure 13; see Figure 14	-	21.8	-	nC
Q_{GD}	gate-drain charge		-	46.7	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; T_j = 25 °C; see Figure 15	-	8500	11400	pF
C_{oss}	output capacitance		-	650	780	pF
C_{rss}	reverse transfer capacitance		-	421	580	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 55 V; R_L = 2.2 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 10 Ω	-	32.6	-	ns
t_r	rise time		-	65	-	ns
$t_{d(off)}$	turn-off delay time		-	365	-	ns
t_f	fall time		-	141	-	ns
L_D	internal drain inductance	from drain lead 6 mm from package to centre of die ; T_j = 25 °C	-	4.5	-	nH
L_S	internal source inductance	from source lead to source bond pad ; T_j = 25 °C	-	7.5	-	nH

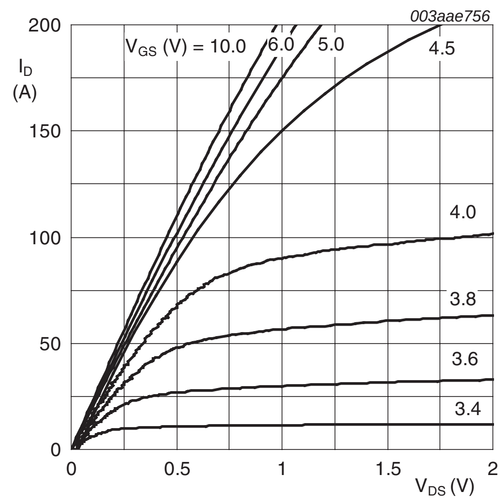
Table 6. Characteristics *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 16	-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 20 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 25 V	-	62	-	ns
Q_r	recovered charge		-	153	-	nC



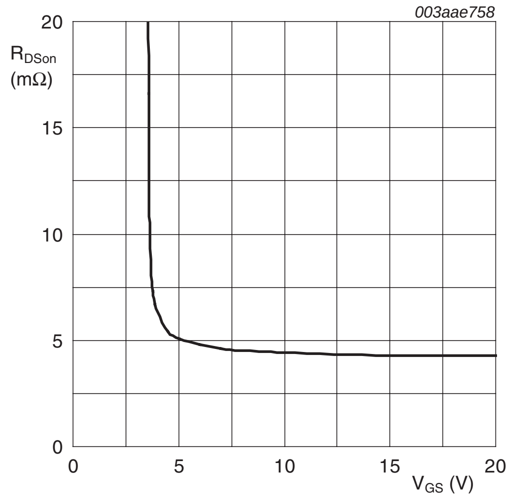
$T_j = 25\,°C; V_{DS} = 25\,V$

Fig 5. Forward transconductance as a function of drain current; typical values



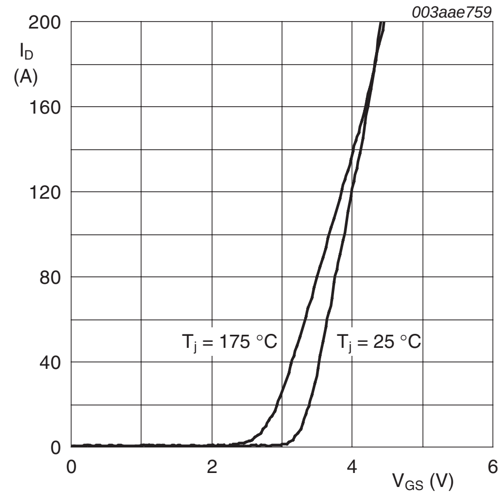
$T_j = 25\,°C;\ t_p = 300\,\mu s$

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



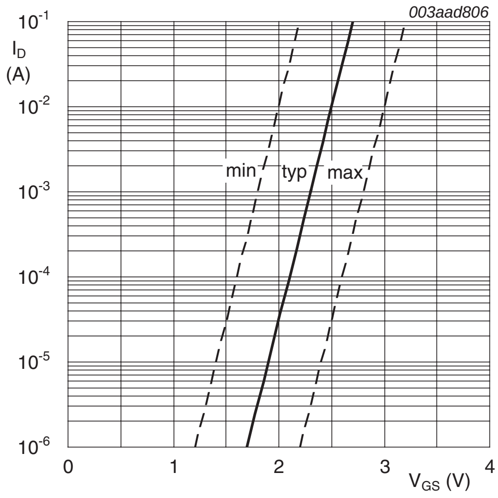
$T_j = 25\,°C;\ I_D = 25\,A$

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



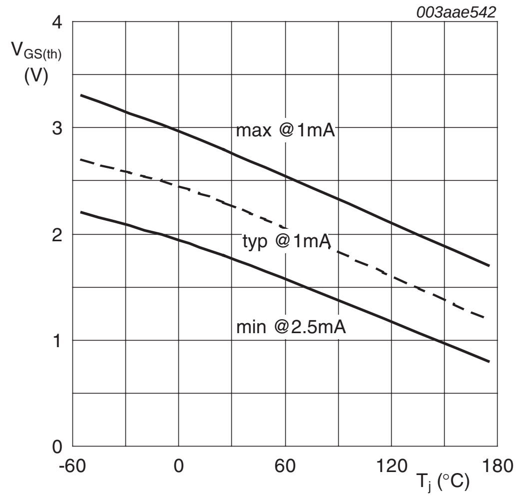
$V_{DS} > I_D \times R_{DSon}$

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



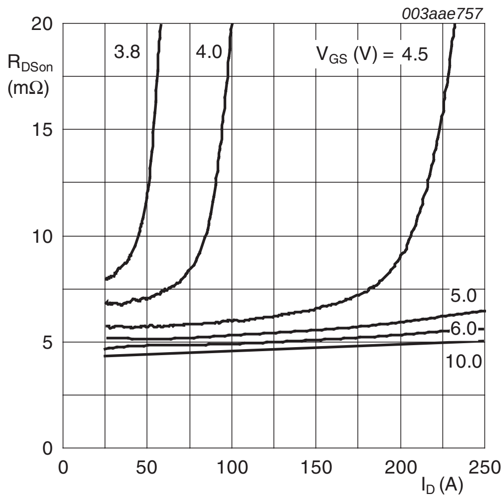
$T_j = 25\,°C; V_{DS} = 5V$

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



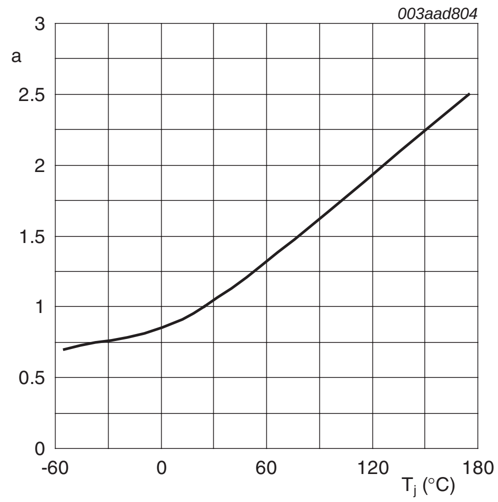
$I_D = 1mA; V_{DS} = V_{GS}$

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



$T_j = 25\,°C; t_p = 300\,\mu s$

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



$$a = \frac{R_{DSon}}{R_{DSon(25\,°C)}}$$

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

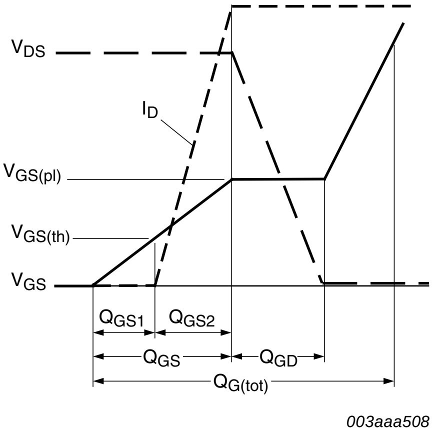
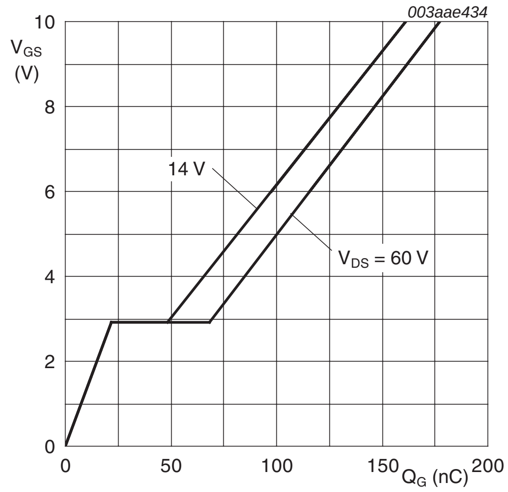
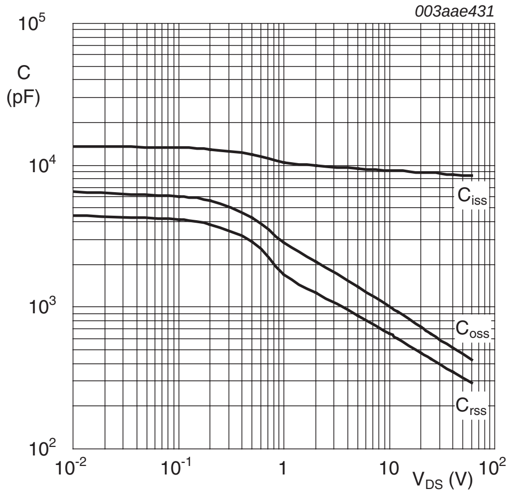


Fig 13. Gate charge waveform definitions



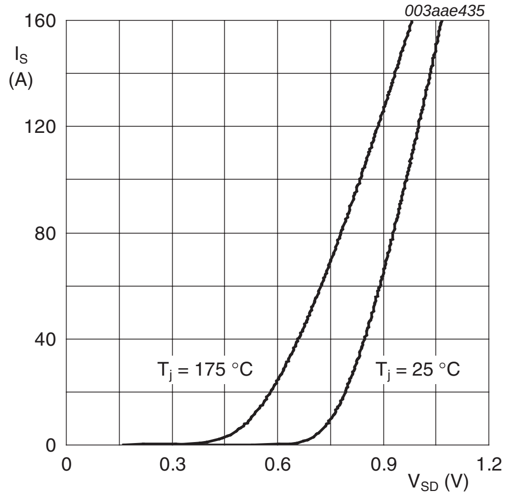
$T_j = 25\,°C; I_D = 25 A$

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



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

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

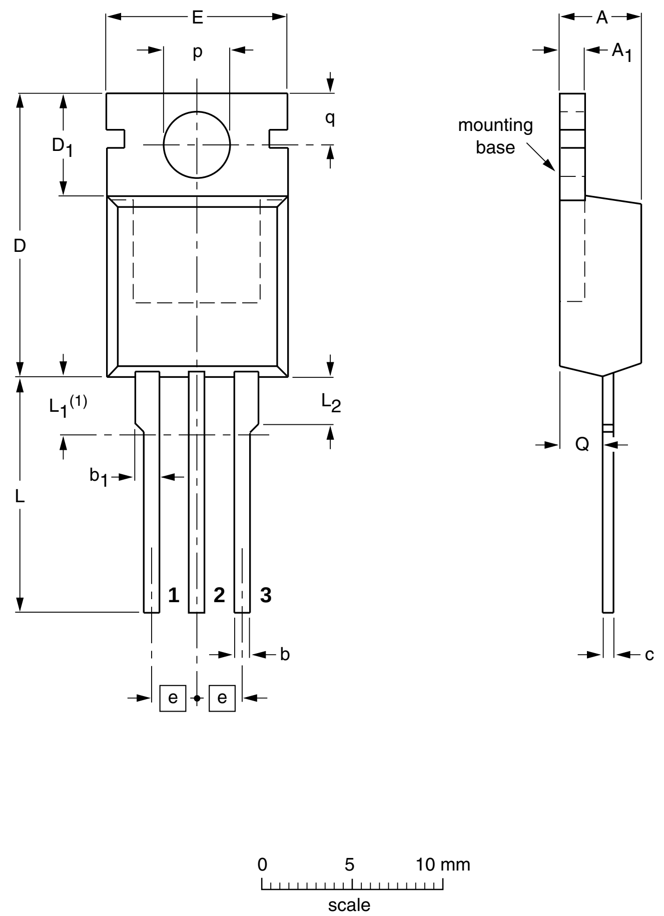


$V_{GS} = 0 V$

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

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB **SOT78A**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	c	D	D_1	E	e	L	L_1(1)	L_2 max.	p	q	Q
mm	4.5 4.1	1.39 1.27	0.9 0.6	1.3 1.0	0.7 0.4	15.8 15.2	6.4 5.9	10.3 9.7	2.54	15.0 13.5	3.30 2.79	3.0	3.8 3.6	3.0 2.7	2.6 2.2

Note

1. Terminals in this zone are not tinned.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78A		3-lead TO-220AB	SC-46			~~03-01-22~~ 05-03-14

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

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK655R0-75C v.2	20101014	Product data sheet	-	BUK655R0-75C v.1
Modifications:	• Status changed from objective to product. • Various changes to content.			
BUK655R0-75C v.1	20100706	Objective data sheet	-	-

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.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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11. Contents

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