



BUK9Y12-55B

N-channel TrenchMOS logic level FET

Rev. 04 — 7 April 2010

Product data sheet

1. Product profile

1.1 General description

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

1.2 Features and benefits

- Low conduction losses due to low on-state resistance
- Q101 compliant
- Suitable for logic level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

1.3 Applications

- 12 V and 24 V loads
- Advanced braking systems (ABS)
- Automotive systems
- General purpose power switching
- Motors, lamps and solenoids

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}$	-	-	55	V
I_D	drain current	$V_{GS} = 5\text{ V}; T_{mb} = 25^\circ\text{C}$; see Figure 1 ; see Figure 4	-	-	61.8	A
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}$; see Figure 2	-	-	106	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 20\text{ A}; T_j = 25^\circ\text{C}$	-	8.1	11	$\text{m}\Omega$
		$V_{GS} = 5\text{ V}; I_D = 20\text{ A}; T_j = 25^\circ\text{C}$; see Figure 12 ; see Figure 13	-	9.1	12	$\text{m}\Omega$

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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	$I_D = 61.8 \text{ A}$; $V_{sup} \leq 55 \text{ V}$; $R_{GS} = 50 \Omega$; $V_{GS} = 5 \text{ V}$; $T_{j(init)} = 25 \text{ }^\circ\text{C}$; unclamped	-	-	129	mJ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 5 \text{ V}$; $I_D = 20 \text{ A}$; $V_{DS} = 44 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$; see Figure 14	-	13	-	nC

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source		
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		
SOT669 (LFPAK)				

3. Ordering information

Table 3. Ordering information

Type number	Package			Version
	Name	Description		
BUK9Y12-55B	LFPAK	plastic single-ended surface-mounted package (LFPAK); 4 leads		SOT669

4. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25^\circ\text{C}$; $T_j \leq 175^\circ\text{C}$	-	-	55	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	-	55	V
V_{GS}	gate-source voltage		-15	-	15	V
I_D	drain current	$T_{mb} = 25^\circ\text{C}$; $V_{GS} = 5\text{ V}$; see Figure 1 ; see Figure 4	-	-	61.8	A
		$T_{mb} = 100^\circ\text{C}$; $V_{GS} = 5\text{ V}$; see Figure 1	-	-	43.8	A
I_{DM}	peak drain current	$T_{mb} = 25^\circ\text{C}$; $t_p \leq 10\text{ }\mu\text{s}$; pulsed; see Figure 4	-	-	247	A
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}$; see Figure 2	-	-	106	W
T_{stg}	storage temperature		-55	-	175	°C
T_j	junction temperature		-55	-	175	°C
Source-drain diode						
I_S	source current	$T_{mb} = 25^\circ\text{C}$	-	-	61.8	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25^\circ\text{C}$	-	-	247	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 61.8\text{ A}$; $V_{sup} \leq 55\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25^\circ\text{C}$; unclamped	-	-	129	mJ
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	see Figure 3	[1][2][3]	-	-	J

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

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

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

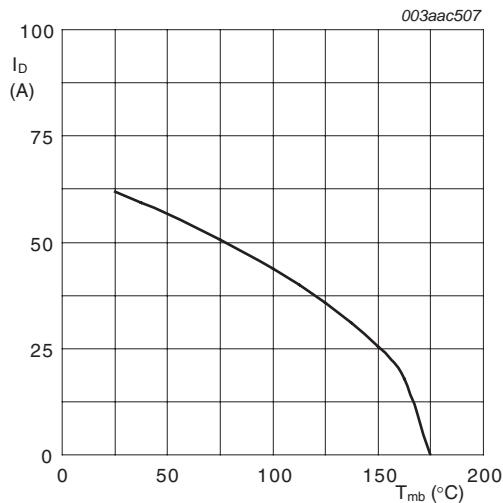


Fig 1. Continuous drain current as a function of mounting base temperature

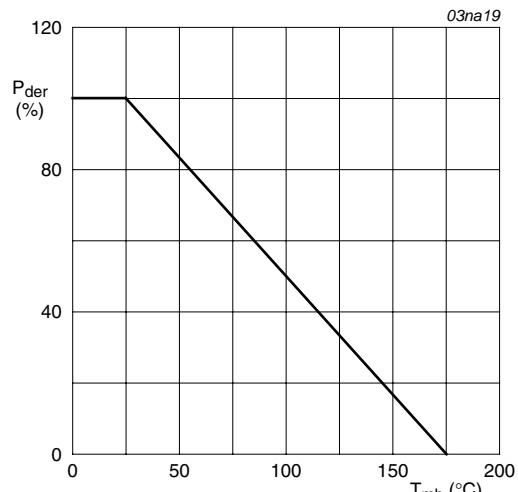


Fig 2. Normalized total power dissipation as a function of mounting base temperature

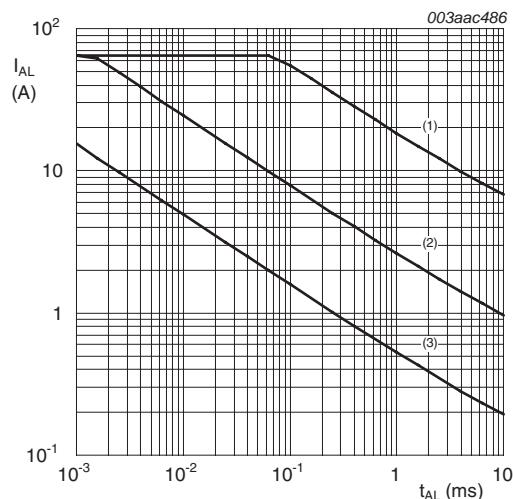
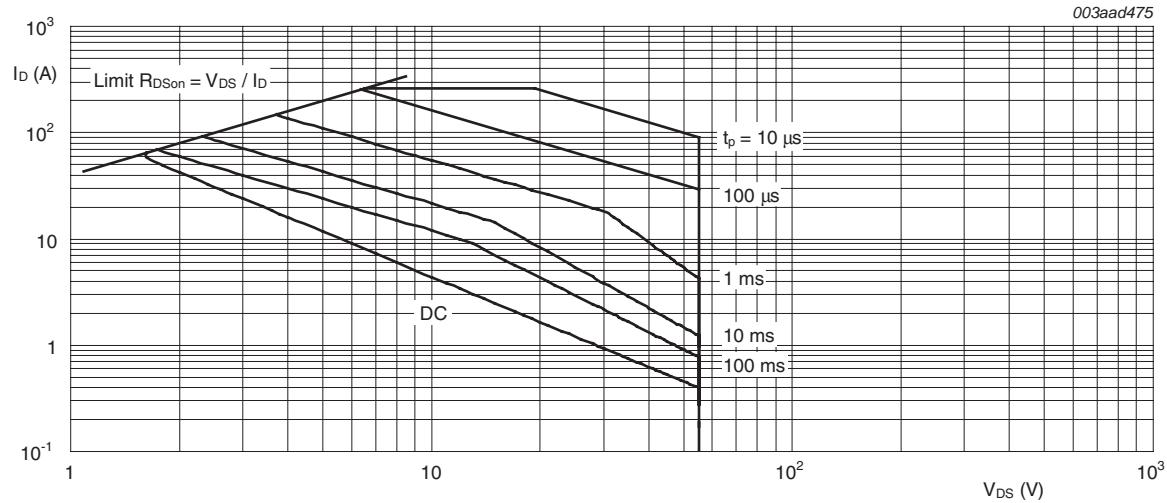


Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time



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

Fig 4. 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
$R_{th(j\text{-mb})}$	thermal resistance from junction to mounting base	see Figure 5	-	-	1.42	K/W

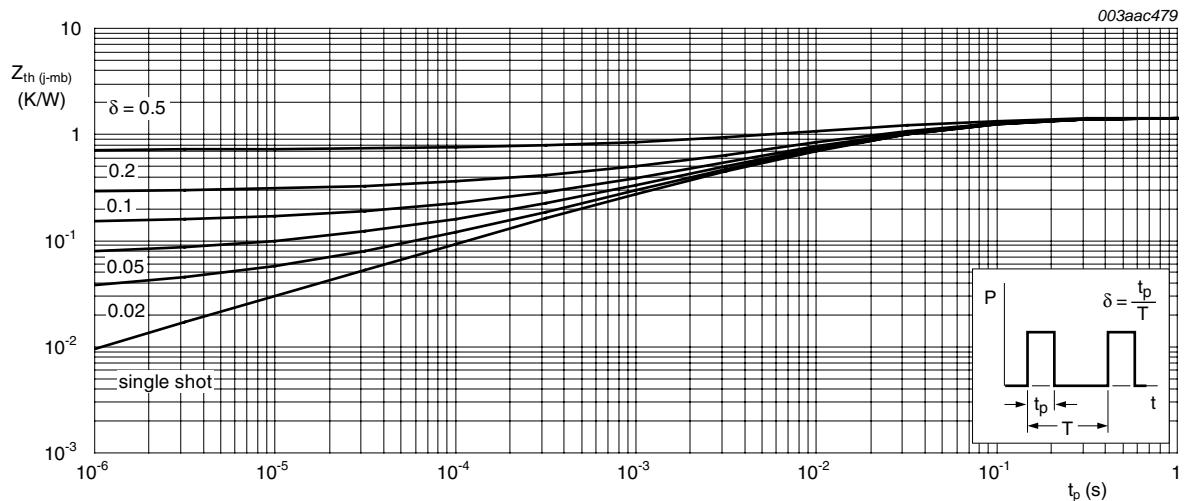


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration.

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	55	-	-	V
$V_{GS(\text{th})}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 10 ; see Figure 11	-	-	2.45	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 10 ; see Figure 11	1.25	1.65	2.15	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 10 ; see Figure 11	0.5	-	-	V
I_{DSS}	drain leakage current	$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$	-	-	500	μA
		$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.02	1	μA
I_{GSS}	gate leakage current	$V_{DS} = 0 \text{ V}; V_{GS} = 15 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
		$V_{DS} = 0 \text{ V}; V_{GS} = -15 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 20 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	-	13	$\text{m}\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	8.1	11	$\text{m}\Omega$
		$V_{GS} = 5 \text{ V}; I_D = 20 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 12 ; see Figure 13	-	9.1	12	$\text{m}\Omega$
		$V_{GS} = 5 \text{ V}; I_D = 20 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 13	-	-	27.6	$\text{m}\Omega$
Dynamic characteristics						
$Q_{G(\text{tot})}$	total gate charge	$I_D = 20 \text{ A}; V_{DS} = 44 \text{ V}; V_{GS} = 5 \text{ V};$	-	32	-	nC
Q_{GS}	gate-source charge	$T_j = 25 \text{ }^\circ\text{C};$ see Figure 14	-	6	-	nC
Q_{GD}	gate-drain charge		-	13	-	nC
C_{iss}	input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz};$	-	2160	2880	pF
C_{oss}	output capacitance	$T_j = 25 \text{ }^\circ\text{C};$ see Figure 15	-	315	378	pF
C_{rss}	reverse transfer capacitance		-	175	240	pF
$t_{d(\text{on})}$	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 1.5 \text{ }\Omega; V_{GS} = 5 \text{ V};$	-	29	-	ns
t_r	rise time	$R_{G(\text{ext})} = 10 \text{ }\Omega; T_j = 25 \text{ }^\circ\text{C}$	-	78	-	ns
$t_{d(\text{off})}$	turn-off delay time		-	100	-	ns
t_f	fall time		-	63	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 20 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 16	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s};$	-	44	-	ns
Q_r	recovered charge	$V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	83	-	nC

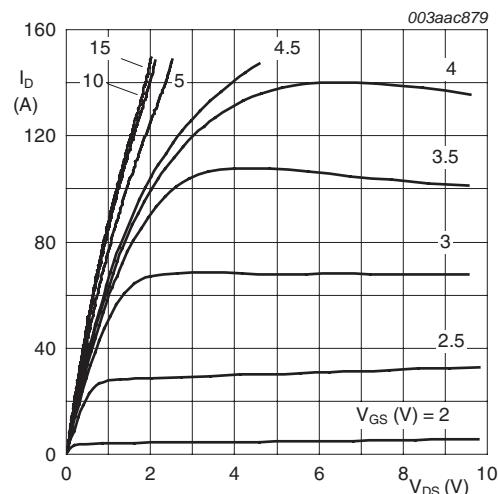


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values.

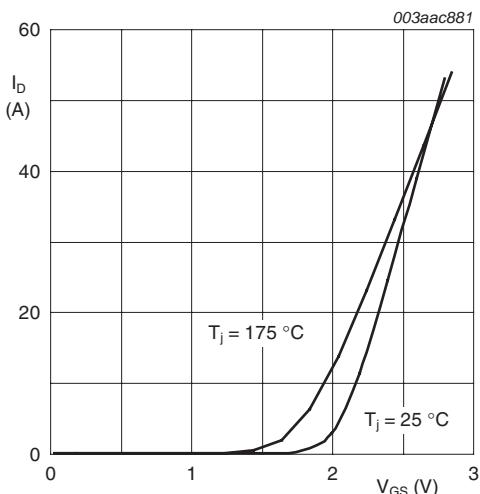


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values.

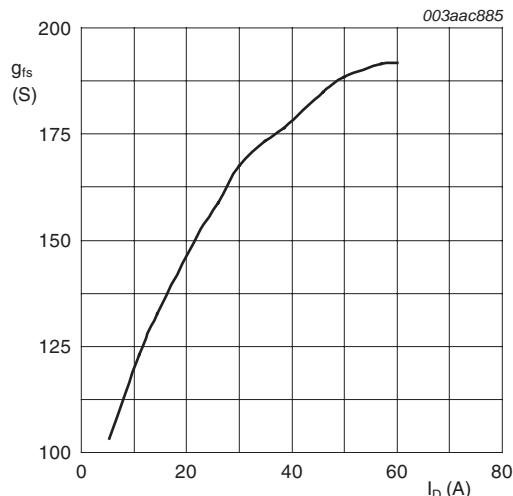


Fig 8. Forward transconductance as a function of drain current; typical values.

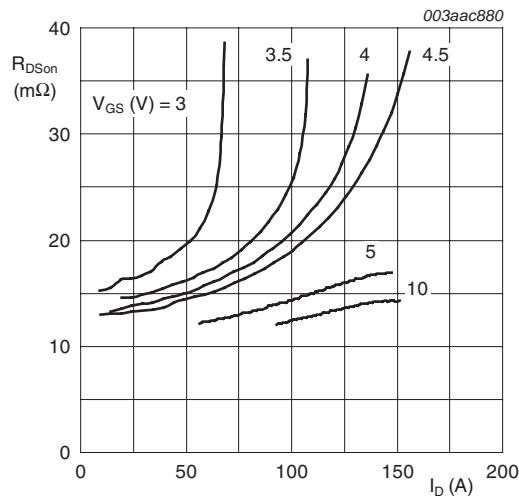
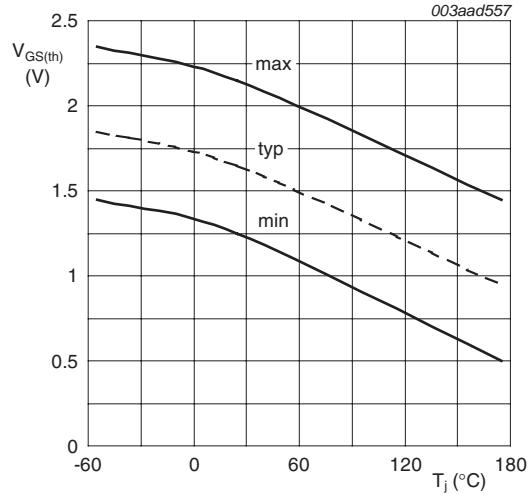
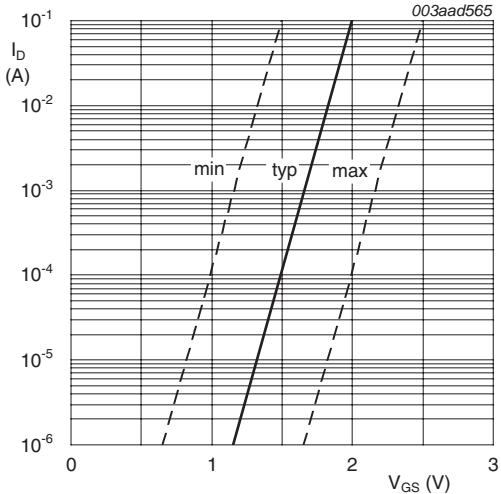


Fig 9. Drain-source on-state resistance as a function of drain current; typical values.



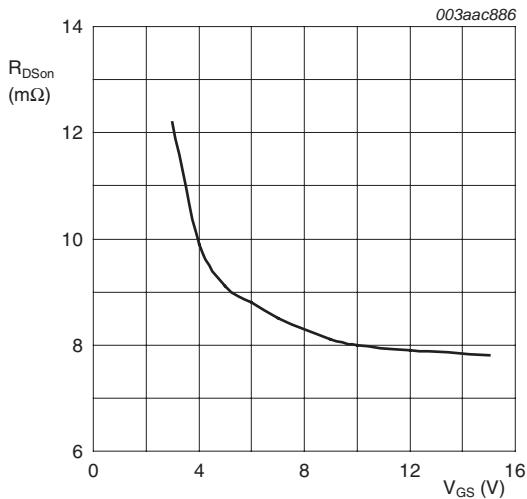
$I_D = 1mA; V_{DS} = V_{GS}$

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



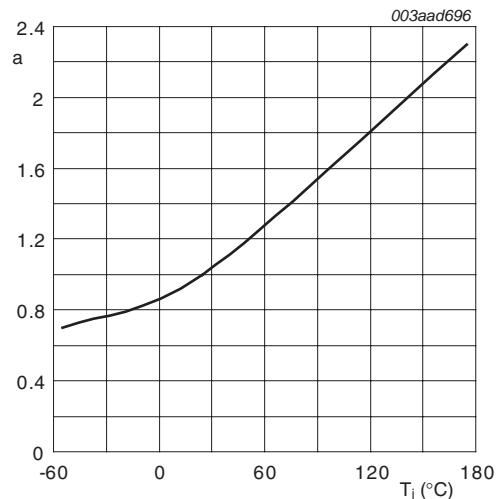
$T_j = 25^\circ C; V_{DS} = V_{GS}$

Fig 11. Sub-threshold drain current as a function of gate-source voltage



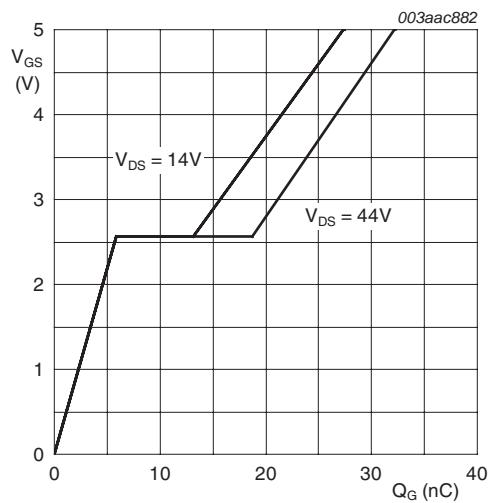
$T_j = 25^\circ C; I_D = 20A$

Fig 12. Drain-source on-state resistance as a function of gate-source voltage; typical values.



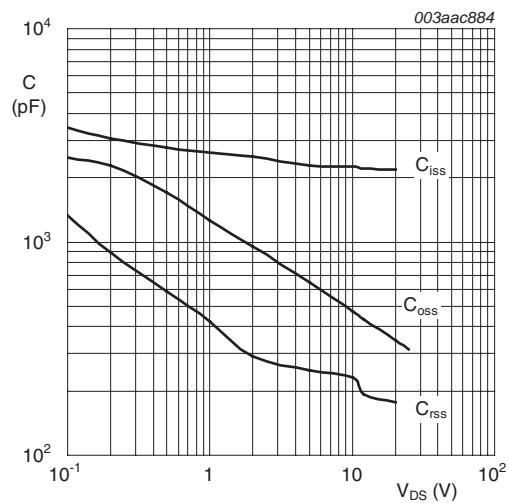
$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ C)}$$

Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature.



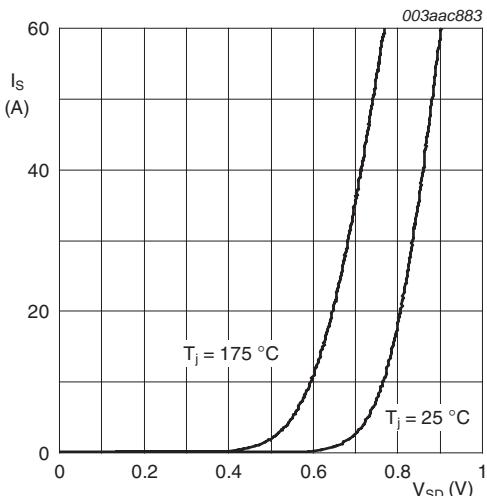
$T_j = 25^\circ C; I_D = 20A$

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



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

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



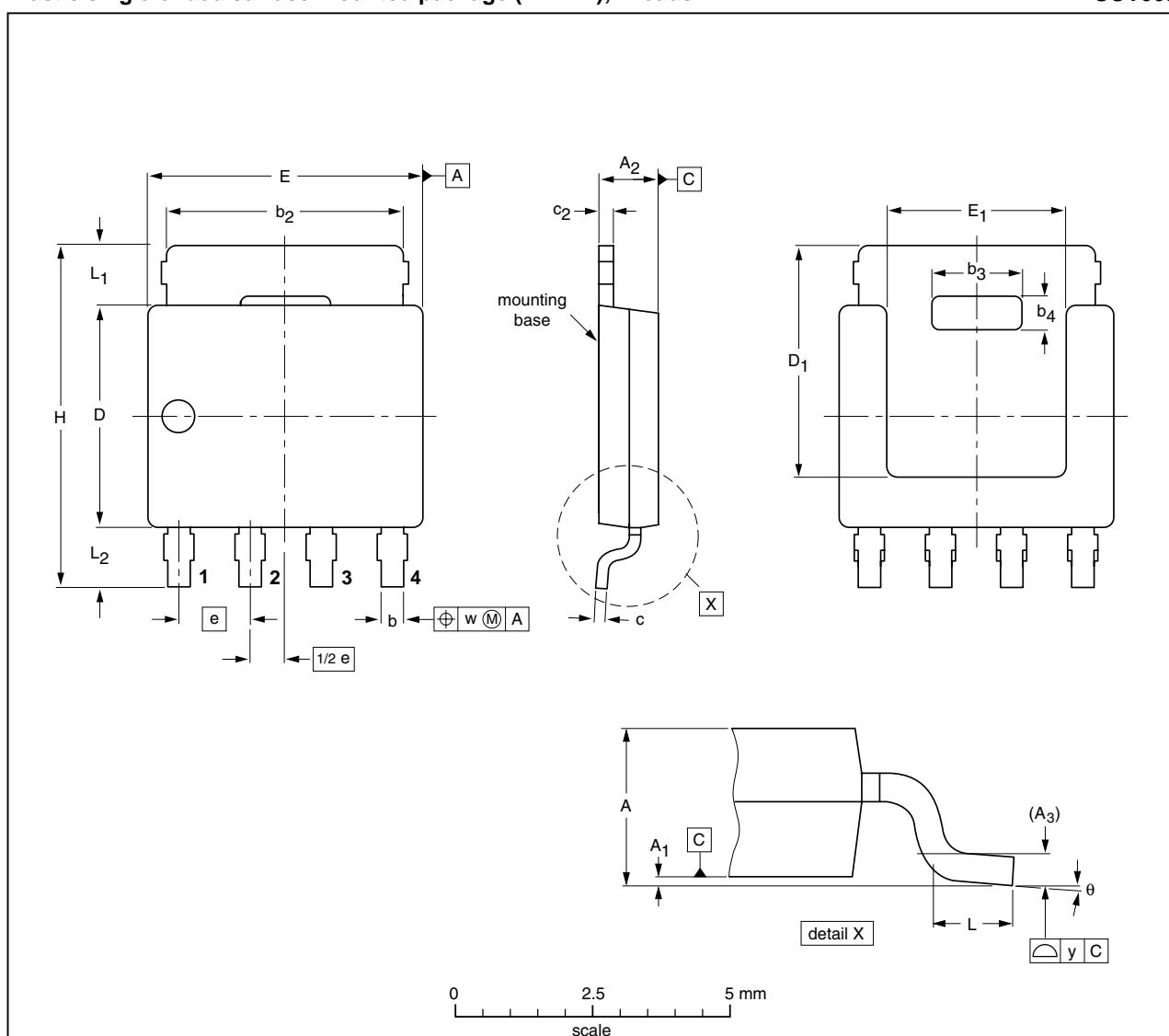
$V_{GS} = 0V$

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

7. Package outline

Plastic single-ended surface-mounted package (LFPAK); 4 leads

SOT669



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	A ₂	A ₃	b	b ₂	b ₃	b ₄	c	c ₂	D ⁽¹⁾	D ₁ ⁽¹⁾ max	E ⁽¹⁾	E ₁ ⁽¹⁾	e	H	L	L ₁	L ₂	w	y	θ
mm	1.20 1.01	0.15 0.00	1.10 0.95	0.25	0.50 0.35	4.41 3.62	2.2 2.0	0.9 0.7	0.25 0.19	0.30 0.24	4.10 3.80	4.20	5.0 4.8	3.3 3.1	1.27	6.2 5.8	0.85 0.40	1.3 0.8	1.3 0.8	0.25	0.1	8° 0°

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT669		MO-235				-04-10-13 06-03-16

Fig 17. Package outline SOT669 (LFPAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9Y12-55B_4	20100407	Product data sheet	-	BUK9Y12-55B_3
Modifications:		• Status changed from objective to product.		
BUK9Y12-55B_3	20100216	Objective data sheet	-	BUK9Y12-55B_2

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

1	Product profile	1
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
1.4	Quick reference data	1
2	Pinning information	2
3	Ordering information	2
4	Limiting values	3
5	Thermal characteristics	5
6	Characteristics	6
7	Package outline	10
8	Revision history	11
9	Legal information	12
9.1	Data sheet status	12
9.2	Definitions	12
9.3	Disclaimers	12
9.4	Trademarks	13
10	Contact information	13

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