



BUK6Y57-60P

60 V, P-channel Trench MOSFET

5 July 2018

Product data sheet

1. General description

P-channel enhancement mode MOSFET in an LFPAK56 (Power SO8) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

This product has been designed and qualified to AEC-Q101 standard for use in high-performance automotive applications such as reverse battery protection.

2. Features and benefits

- High thermal power dissipation capability
- Suitable for thermally demanding environments due to 175 °C rating
- Trench MOSFET technology
- AEC-Q101 qualified

3. Applications

- Reverse battery protection
- Power management
- High-side loadswitch
- Motor drive

4. Quick reference data

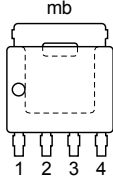
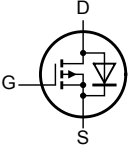
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$	-	-	-60	V
V_{GS}	gate-source voltage	[1]	-20	-	20	V
I_D	drain current	$V_{GS} = -10\text{ V}; T_{mb} = 25\text{ °C}$	-	-	-23	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$	-	-	66	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = -10\text{ V}; I_D = -4.8\text{ A}; T_j = 25\text{ °C}$	-	45	57	mΩ

[1] $V_{GS} = -20\text{ V}/+5\text{ V}$ according AEC-Q101 at $T_j = 175\text{ °C}$; $V_{GS} = -20\text{ V}/+20\text{ V}$ according AEC-Q101 at $T_j = 150\text{ °C}$

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>LFPAK56; Power-SO8 (SOT669)</p>	 <p>017aaa094</p>
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK6Y57-60P	LFPAK56; Power-SO8	plastic, single-ended surface-mounted package; 4 terminals	SOT669

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK6Y57-60P	6Y5760P

8. Limiting values

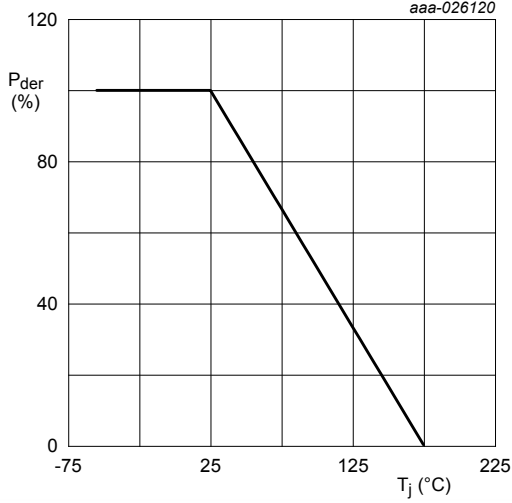
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$		-	-60	V
V_{GS}	gate-source voltage		[1]	-20	20	V
I_D	drain current	$V_{GS} = -10\text{ V}; T_{mb} = 25\text{ °C}$		-	-23	A
		$V_{GS} = -10\text{ V}; T_{mb} = 100\text{ °C}$		-	-16	A
I_{DM}	peak drain current	single pulse; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$		-	-91	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$		-	66	W
T_j	junction temperature			-55	175	°C
T_{amb}	ambient temperature			-55	175	°C
T_{stg}	storage temperature			-65	175	°C
Source-drain diode						
I_S	source current	$T_{mb} = 25\text{ °C}$		-	-23	A
I_{SM}	peak source current	single pulse; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$		-	-91	A
ESD maximum rating						
V_{ESD}	electrostatic discharge voltage	HBM	[2]	-	1000	V
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{sup} \leq -60\text{ V}; V_{GS} = -10\text{ V}; T_{j(init)} = 25\text{ °C}; I_D = -4.8\text{ A};$ DUT in avalanche (unclamped)		-	3.9	mJ

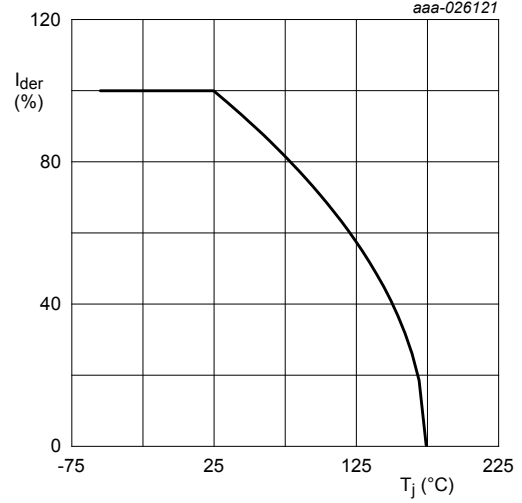
[1] $V_{GS} = -20\text{ V}/+5\text{ V}$ according AEC-Q101 at $T_j = 175\text{ °C}$; $V_{GS} = -20\text{ V}/+20\text{ V}$ according AEC-Q101 at $T_j = 150\text{ °C}$

[2] Measured between all pins.



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

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



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

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

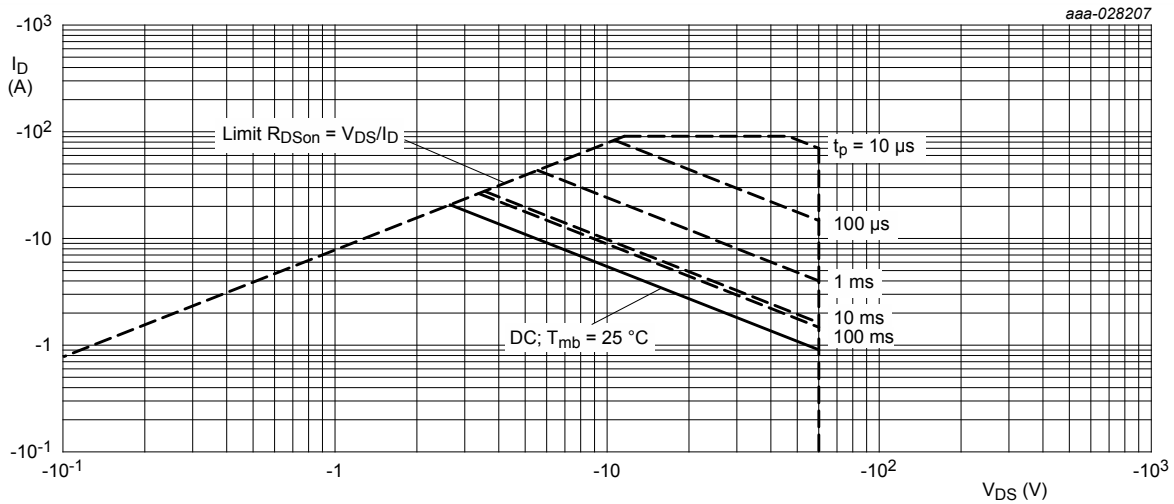


Fig. 3. Safe operating area; junction to mounting base; continuous and peak drain currents as a function of drain-source voltage

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		-	1.8	2.3	K/W

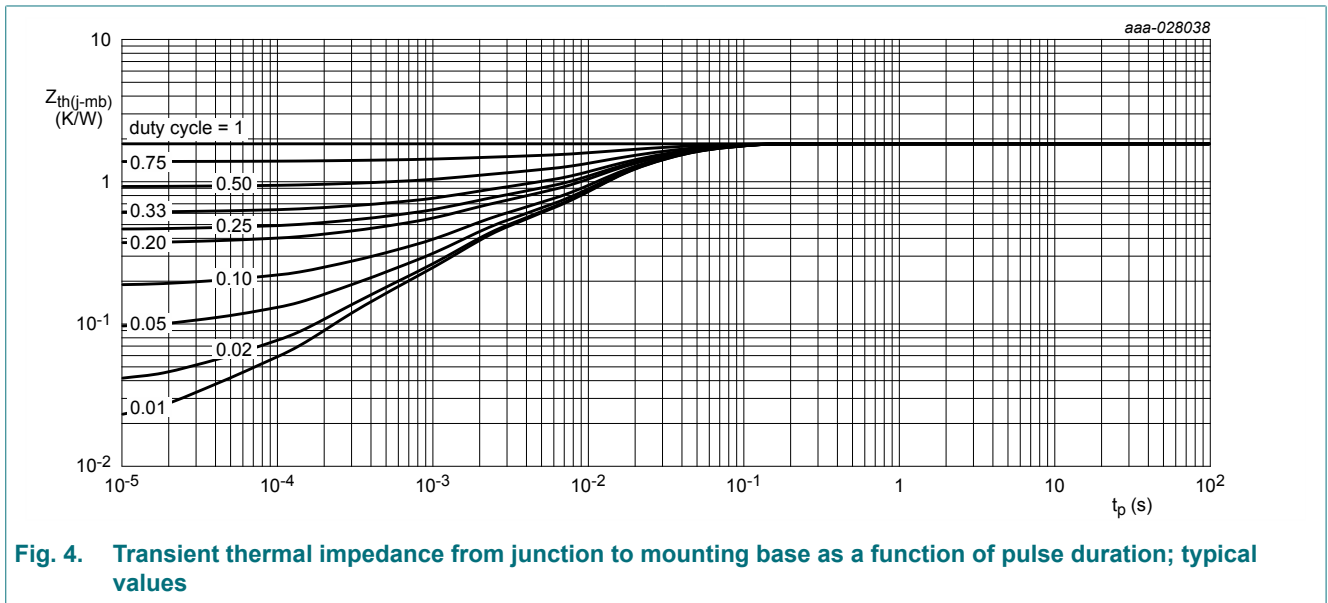


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics
T_j = 25 °C unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V _{(BR)DSS}	drain-source breakdown voltage	I _D = -250 μA; V _{GS} = 0 V	-60	-	-	V
V _{GSth}	gate-source threshold voltage	I _D = -250 μA; V _{DS} = V _{GS} ; T _j = 25 °C	-1.5	-2	-3	V
I _{DSS}	drain leakage current	V _{DS} = -60 V; V _{GS} = 0 V; T _j = 25 °C	-	-	-1	μA
		V _{DS} = -60 V; V _{GS} = 0 V; T _j = 175 °C	-	-	-100	μA
I _{GSS}	gate leakage current	V _{GS} = 20 V; V _{DS} = 0 V; T _j = 25 °C	-	-	100	nA
		V _{GS} = -20 V; V _{DS} = 0 V; T _j = 25 °C	-	-	-100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = -10 V; I _D = -4.8 A; T _j = 25 °C	-	45	57	mΩ
		V _{GS} = -10 V; I _D = -4.8 A; T _j = 175 °C	-	100	127	mΩ
		V _{GS} = -4.5 V; I _D = -3.9 A	-	58	87	mΩ
g _{fs}	forward transconductance	V _{DS} = -10 V; I _D = -2 A; T _j = 25 °C	-	65	-	S
R _G	gate resistance	f = 1 MHz	-	7	-	Ω
Dynamic characteristics						
Q _{G(tot)}	total gate charge	V _{DS} = -30 V; I _D = -5.3 A; V _{GS} = -10 V	-	21	24	nC
Q _{GS}	gate-source charge		-	3.7	-	nC
Q _{GD}	gate-drain charge		-	4.6	-	nC
C _{iss}	input capacitance	V _{DS} = -30 V; f = 1 MHz; V _{GS} = 0 V	-	1200	-	pF
C _{oss}	output capacitance		-	105	-	pF
C _{rss}	reverse transfer capacitance		-	56	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = -30 V; I _D = -4.8 A; V _{GS} = -10 V; R _{G(ext)} = 6 Ω	-	6	-	ns
t _r	rise time		-	12	-	ns
t _{d(off)}	turn-off delay time		-	39	-	ns
t _f	fall time		-	16	-	ns
Source-drain diode						
V _{SD}	source-drain voltage	I _S = -22.7 A; V _{GS} = 0 V; T _j = 25 °C	-	-0.7	-1.2	V
t _{rr}	reverse recovery time	I _S = -4.8 A; dI _S /dt = 100 A/μs; V _{GS} = 0 V; V _{DS} = -30 V; T _j = 25 °C	-	30	-	ns
Q _r	recovered charge		-	36	-	nC

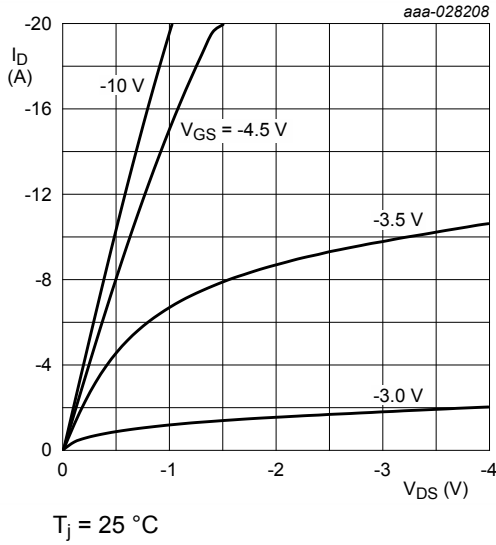


Fig. 5. Output characteristics: drain current as a function of drain-source voltage; typical values

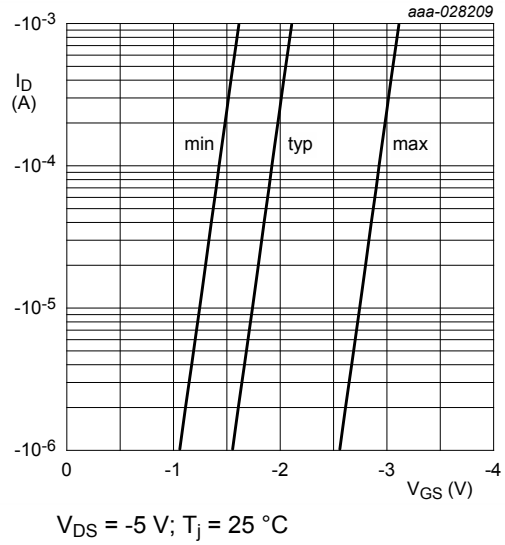


Fig. 6. Sub-threshold drain current as a function of gate-source voltage

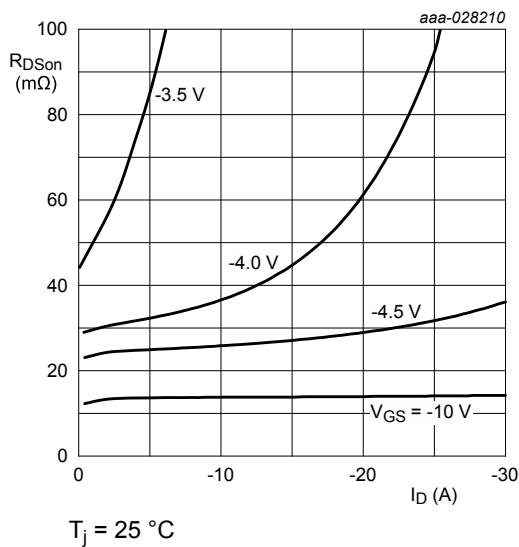


Fig. 7. Drain-source on-state resistance as a function of drain current; typical values

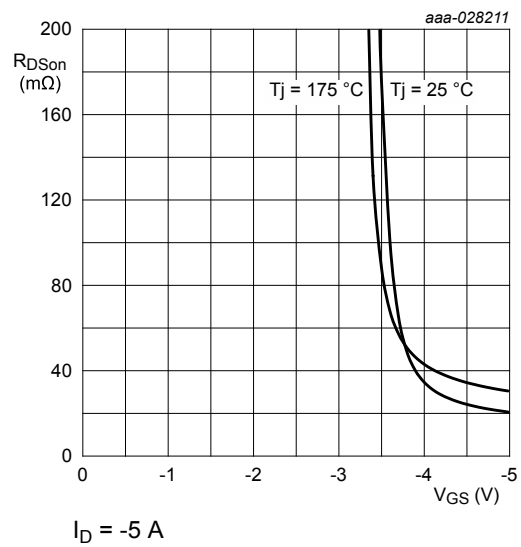
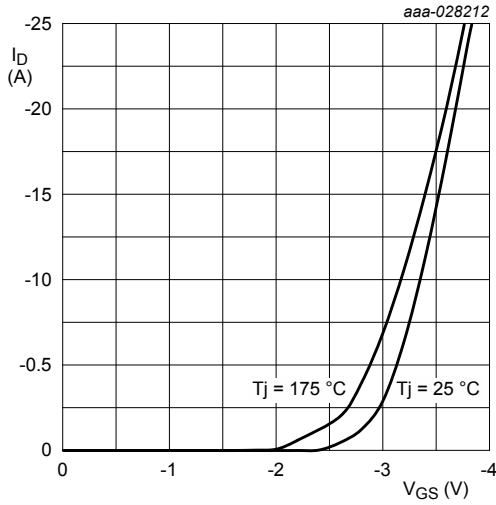
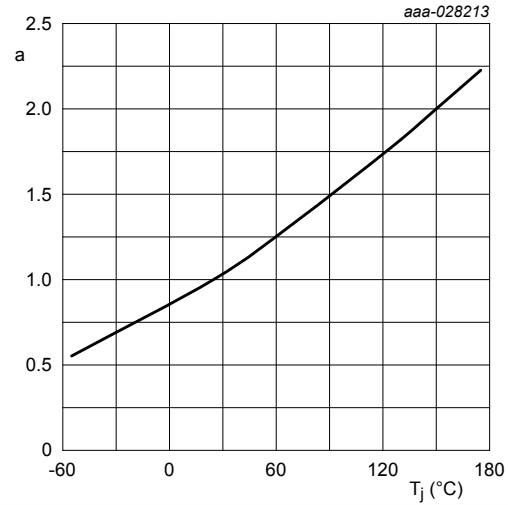


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values



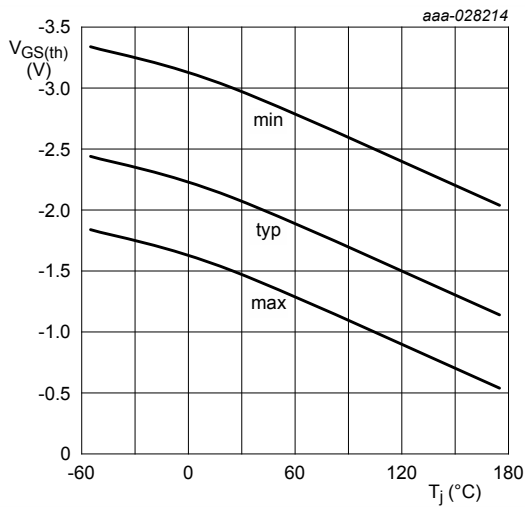
$$V_{DS} > I_D \times R_{DSon}$$

Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values



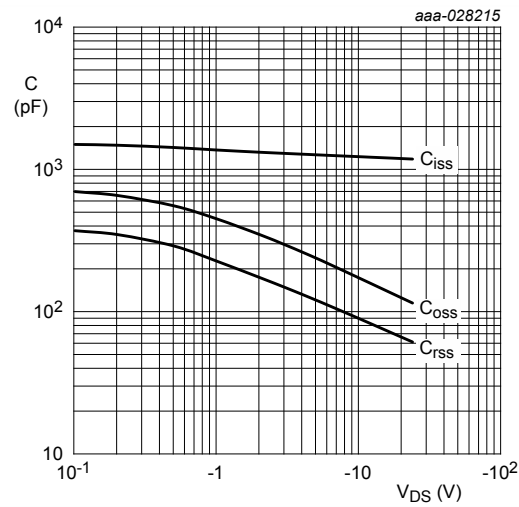
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ C)}}$$

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



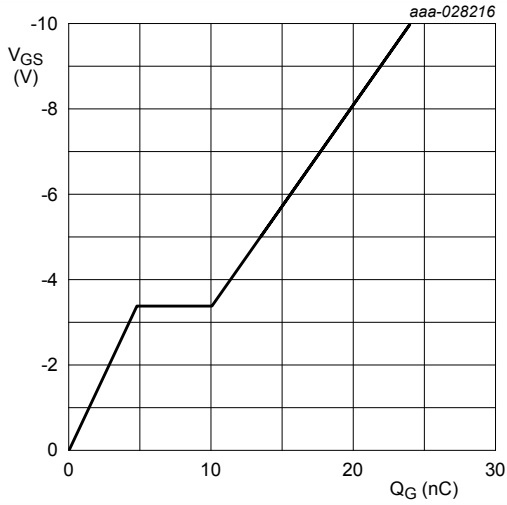
$$I_D = -250 \mu A; V_{DS} = V_{GS}$$

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



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

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



$V_{DS} = -30\text{ V}$; $I_D = -5.3\text{ A}$; $T_{amb} = 25\text{ }^\circ\text{C}$

Fig. 13. Gate-source voltage as a function of gate charge; typical values

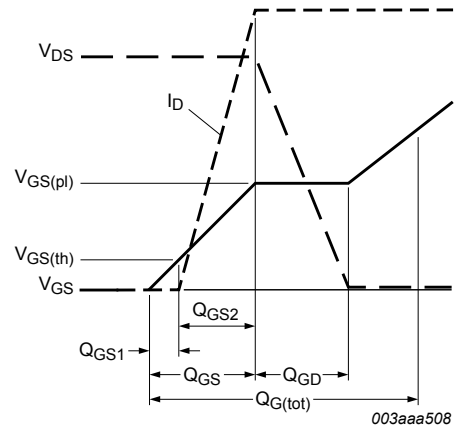
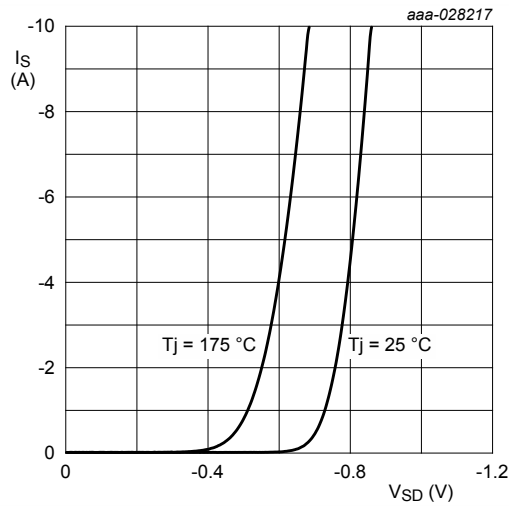


Fig. 14. Gate charge waveform definitions



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

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

11. Test information

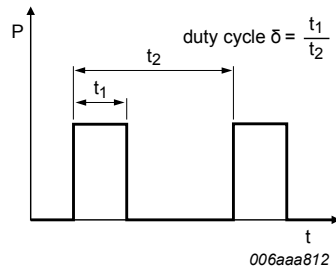


Fig. 16. Duty cycle definition

Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

12. Package outline

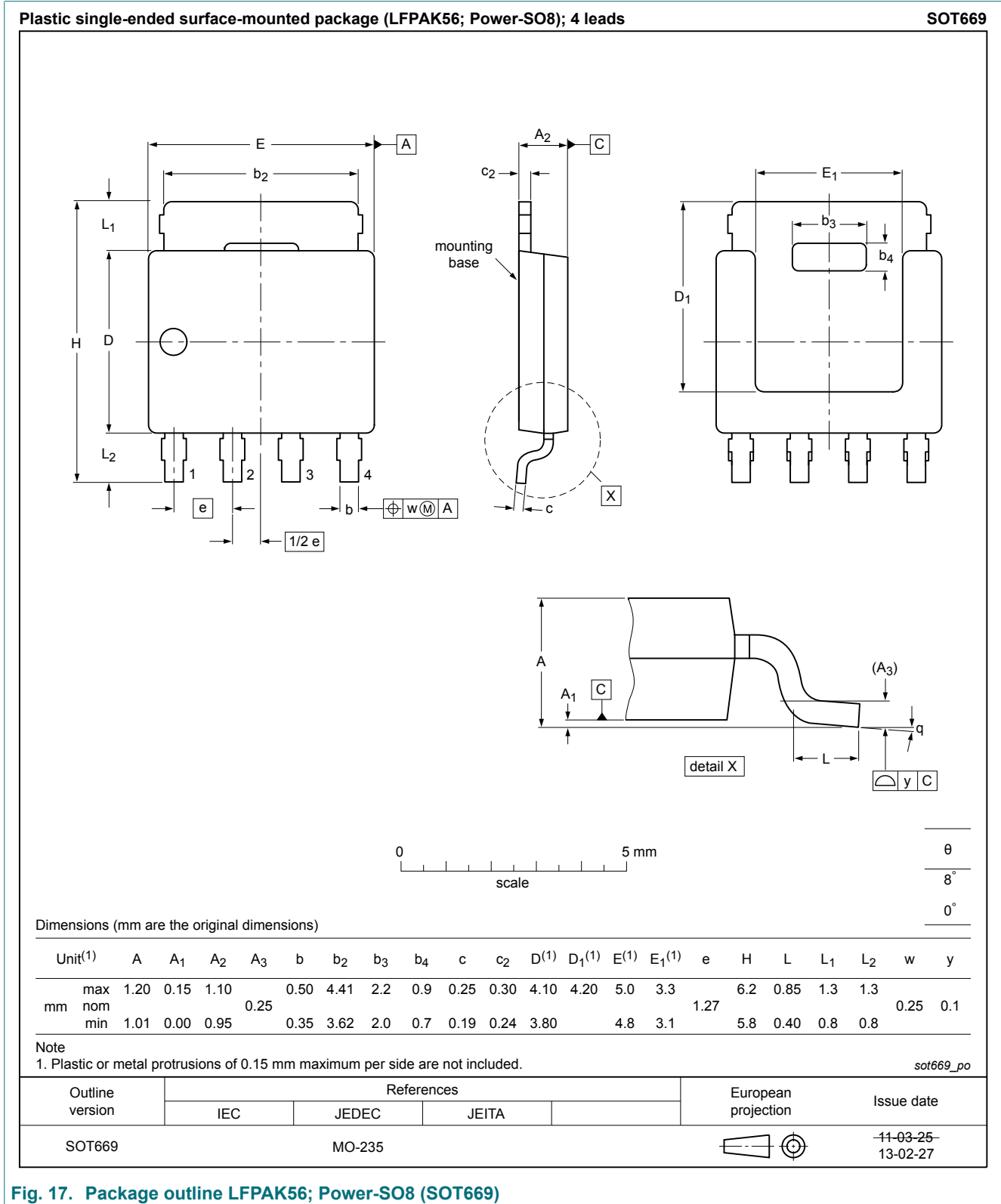


Fig. 17. Package outline LFAK56; Power-SO8 (SOT669)

13. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BUK6Y57-60P v.3	20180705	Product data sheet	-	BUK6Y57-60P v.2
Modifications:	<ul style="list-style-type: none">Characteristics: Fig. 5 updated.			
BUK6Y57-60P v.2	20180606	Product data sheet	-	BUK6Y57-60P v.1
BUK6Y57-60P v.1	20180309	Product data sheet	-	-

14. Legal information

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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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 5 July 2018
