



BUK6Y33-60P

60 V, P-channel Trench MOSFET

21 January 2021

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 load switch
- Motor drive

4. Quick reference data

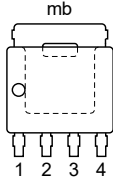
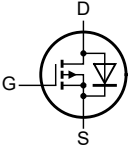
Table 1. Quick reference data

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	$V_{GS} = -10\text{ V}; T_{mb} = 25\text{ °C}$	-	-	-30	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$	-	-	110	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = -10\text{ V}; I_D = -7\text{ A}; T_j = 25\text{ °C}$	-	26	33	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
BUK6Y33-60P	LFPAK56; Power-SO8	plastic, single-ended surface-mounted package; 4 terminals	SOT669

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK6Y33-60P	6Y3360P

8. Limiting values

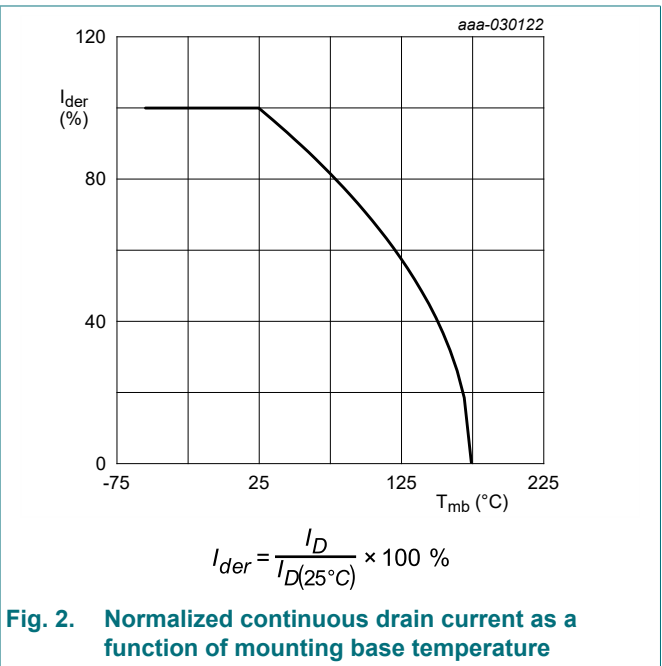
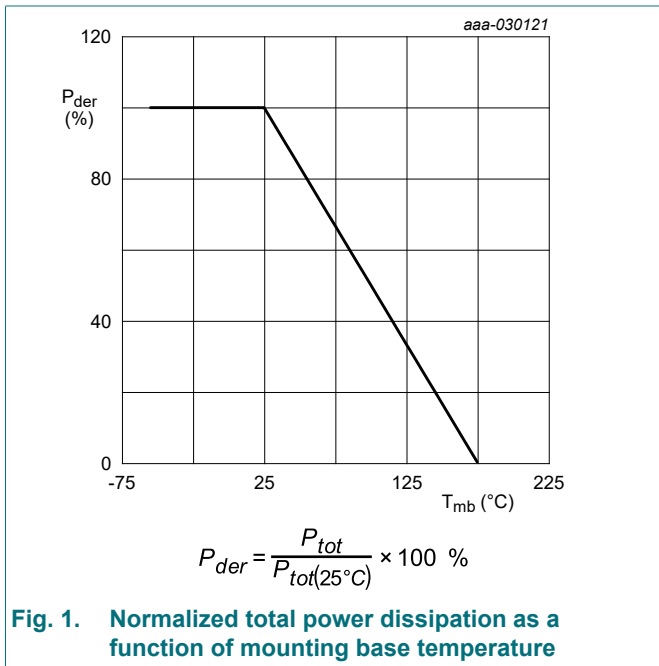
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V _{DS}	drain-source voltage	T _j = 25 °C	-	-60	V
V _{GS}	gate-source voltage	[1]	-20	20	V
I _D	drain current	V _{GS} = -10 V; T _{mb} = 25 °C	-	-30	A
		V _{GS} = -10 V; T _{mb} = 100 °C	-	-21	A
I _{DM}	peak drain current	single pulse; t _p ≤ 10 μs; T _{mb} = 25 °C	-	-120	A
P _{tot}	total power dissipation	T _{mb} = 25 °C	-	110	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 °C	-	-30	A
I _{SM}	peak source current	single pulse; t _p ≤ 10 μs; T _{mb} = 25 °C	-	-120	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	T _{j(initial)} = 25 °C; I _D = -2.8 A; DUT in avalanche (unclamped)	-	85	mJ

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

[2] Measured between all pins.



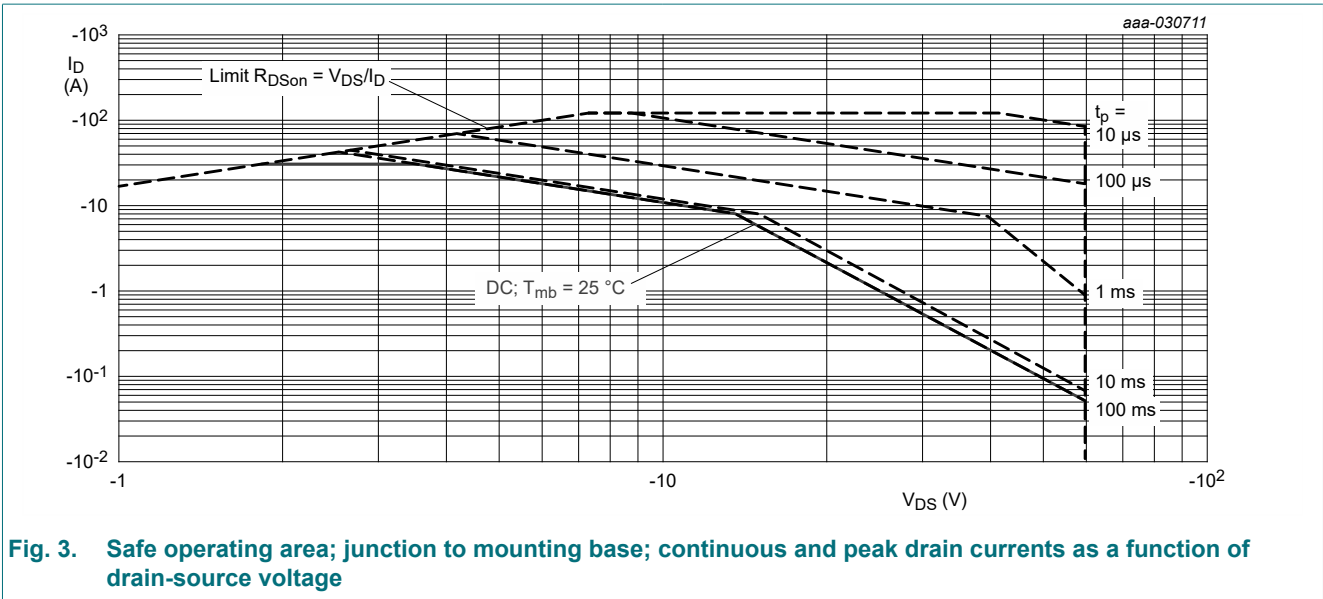


Fig. 3. Safe operating area; junction to mounting base; continuous and peak drain currents as a function of drain-source voltage

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		-	1.1	1.4	K/W



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

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = -250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-60	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = -250 \mu A$; $V_{DS} = V_{GS}$; $T_j = 25 \text{ }^\circ C$	-1.5	-2	-3	V
I_{DSS}	drain leakage current	$V_{DS} = -60 V$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	-1	μA
		$V_{DS} = -60 V$; $V_{GS} = 0 V$; $T_j = 125 \text{ }^\circ C$	-	-	-10	μA
I_{GSS}	gate leakage current	$V_{GS} = -20 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	-100	nA
		$V_{GS} = 20 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = -10 V$; $I_D = -7 A$; $T_j = 25 \text{ }^\circ C$	-	26	33	m Ω
		$V_{GS} = -10 V$; $I_D = -7 A$; $T_j = 175 \text{ }^\circ C$	-	55	69	m Ω
		$V_{GS} = -4.5 V$; $I_D = -6.7 A$; $T_j = 25 \text{ }^\circ C$	-	30	36	m Ω
g_{fs}	forward transconductance	$V_{DS} = -10 V$; $I_D = -4.8 A$; $T_j = 25 \text{ }^\circ C$	-	99	-	S
R_G	gate resistance	$f = 1 \text{ MHz}$	-	6.1	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$V_{DS} = -30 V$; $I_D = -7 A$; $V_{GS} = -10 V$; $T_j = 25 \text{ }^\circ C$	-	46	69	nC
Q_{GS}	gate-source charge		-	7.3	-	nC
Q_{GD}	gate-drain charge		-	9.4	-	nC
C_{iss}	input capacitance	$V_{DS} = -30 V$; $f = 1 \text{ MHz}$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	2590	-	pF
C_{oss}	output capacitance		-	202	-	pF
C_{rss}	reverse transfer capacitance		-	118	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = -30 V$; $I_D = -7 A$; $V_{GS} = -10 V$; $R_{G(ext)} = 6 \text{ } \Omega$; $T_j = 25 \text{ }^\circ C$	-	9	-	ns
t_r	rise time		-	16	-	ns
$t_{d(off)}$	turn-off delay time		-	81	-	ns
t_f	fall time		-	310	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = -30 A$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-0.7	-1.2	V
t_{rr}	reverse recovery time	$I_S = -30 A$; $di_S/dt = 100 A/\mu s$;	-	32	-	ns
Q_r	recovered charge	$V_{GS} = -10 V$; $V_{DS} = -30 V$; $T_j = 25 \text{ }^\circ C$	-	18	-	nC

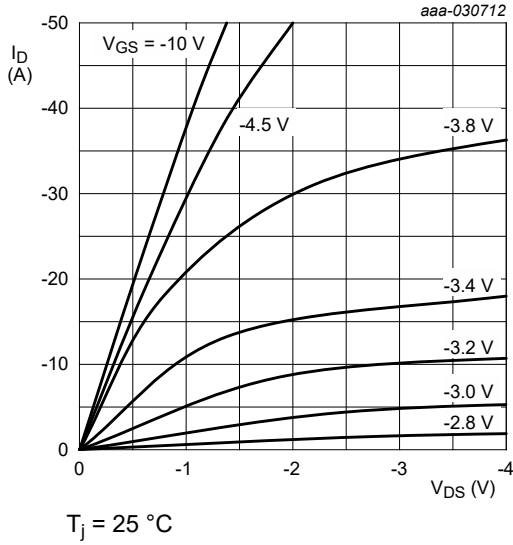


Fig. 5. Output characteristics: drain current as a function of drain-source voltage; typical values

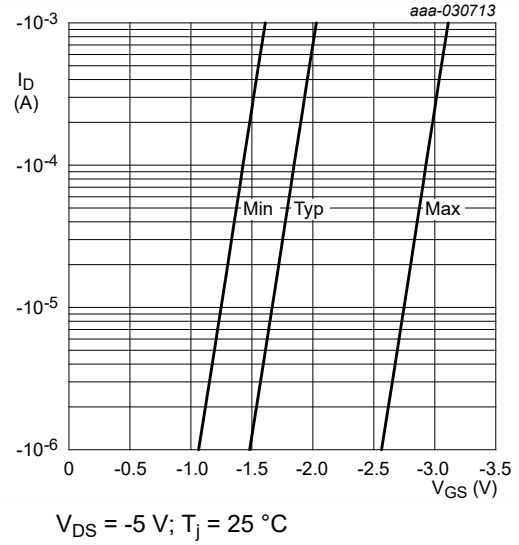


Fig. 6. Sub-threshold drain current as a function of gate-source voltage

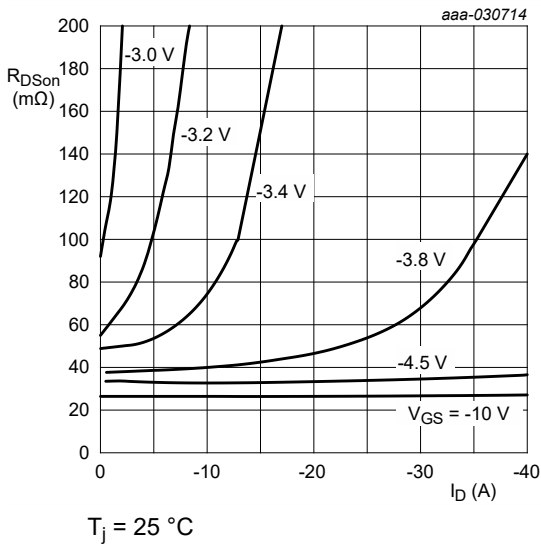


Fig. 7. Drain-source on-state resistance as a function of drain current; typical values

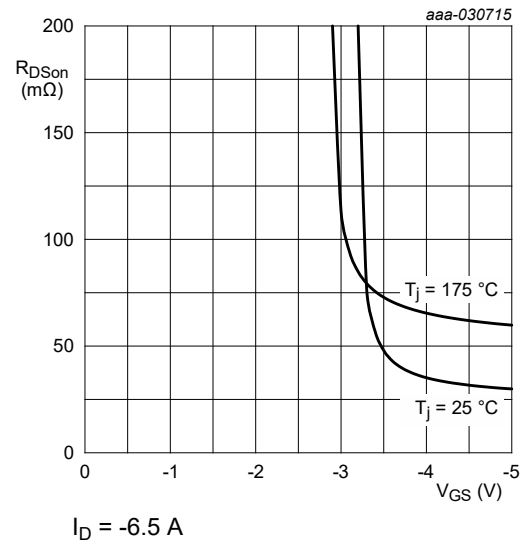


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

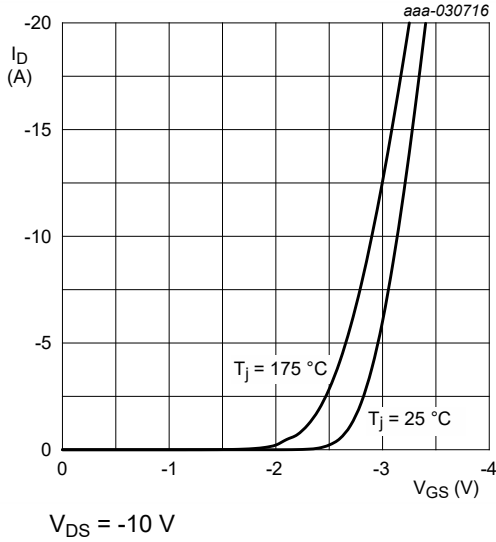
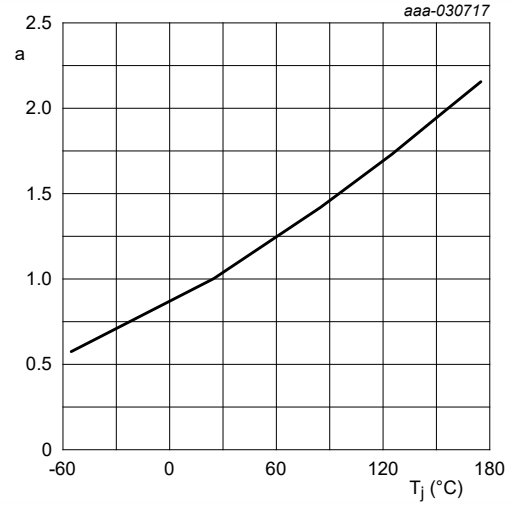
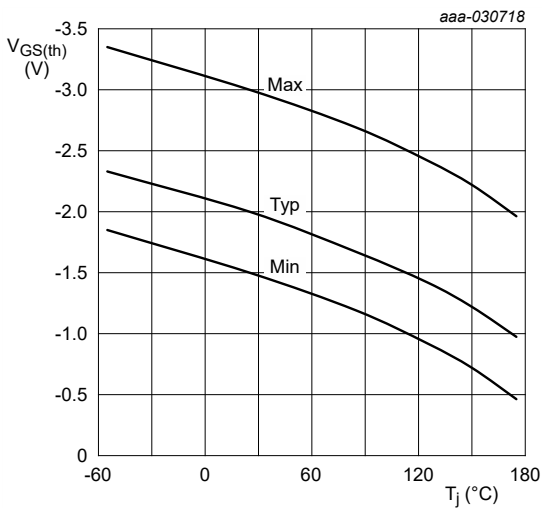


Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values



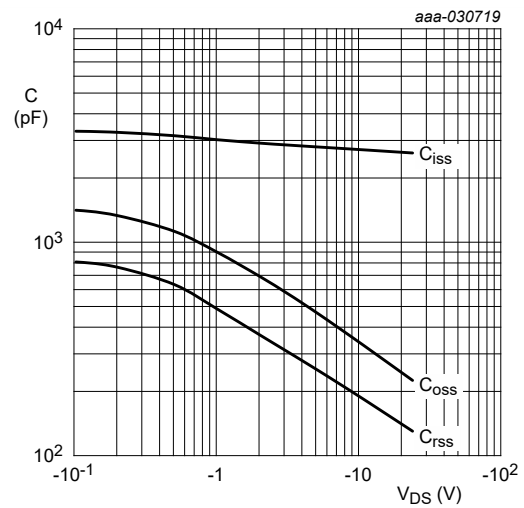
$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ\text{C})}$$

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



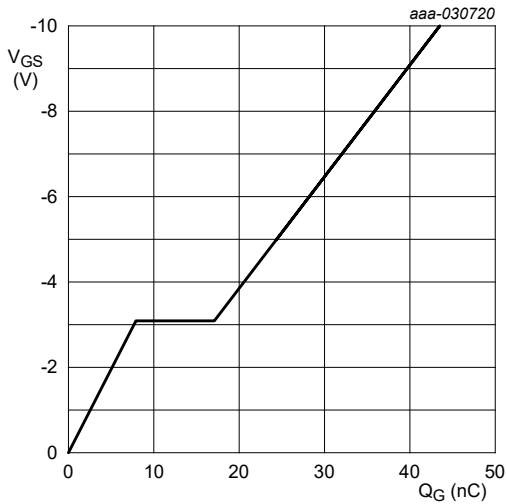
$I_D = -250\text{ }\mu\text{A}; V_{DS} = V_{GS}$

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



$V_{DS} = -30\text{ V}; I_D = -10.8\text{ A}; T_j = 25\text{ }^\circ\text{C}$

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

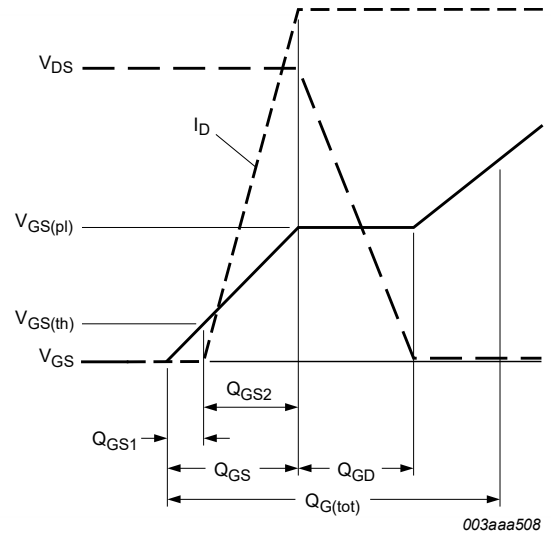
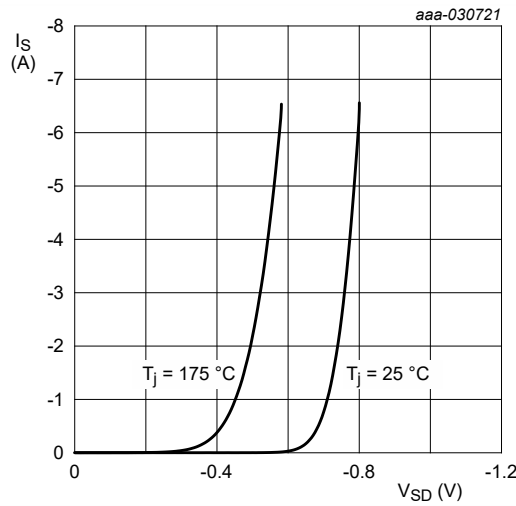


Fig. 14. Gate charge waveform definitions



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

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

11. Test information

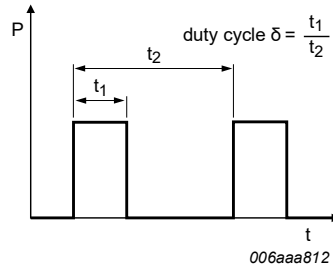


Fig. 16. Duty cycle definition

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

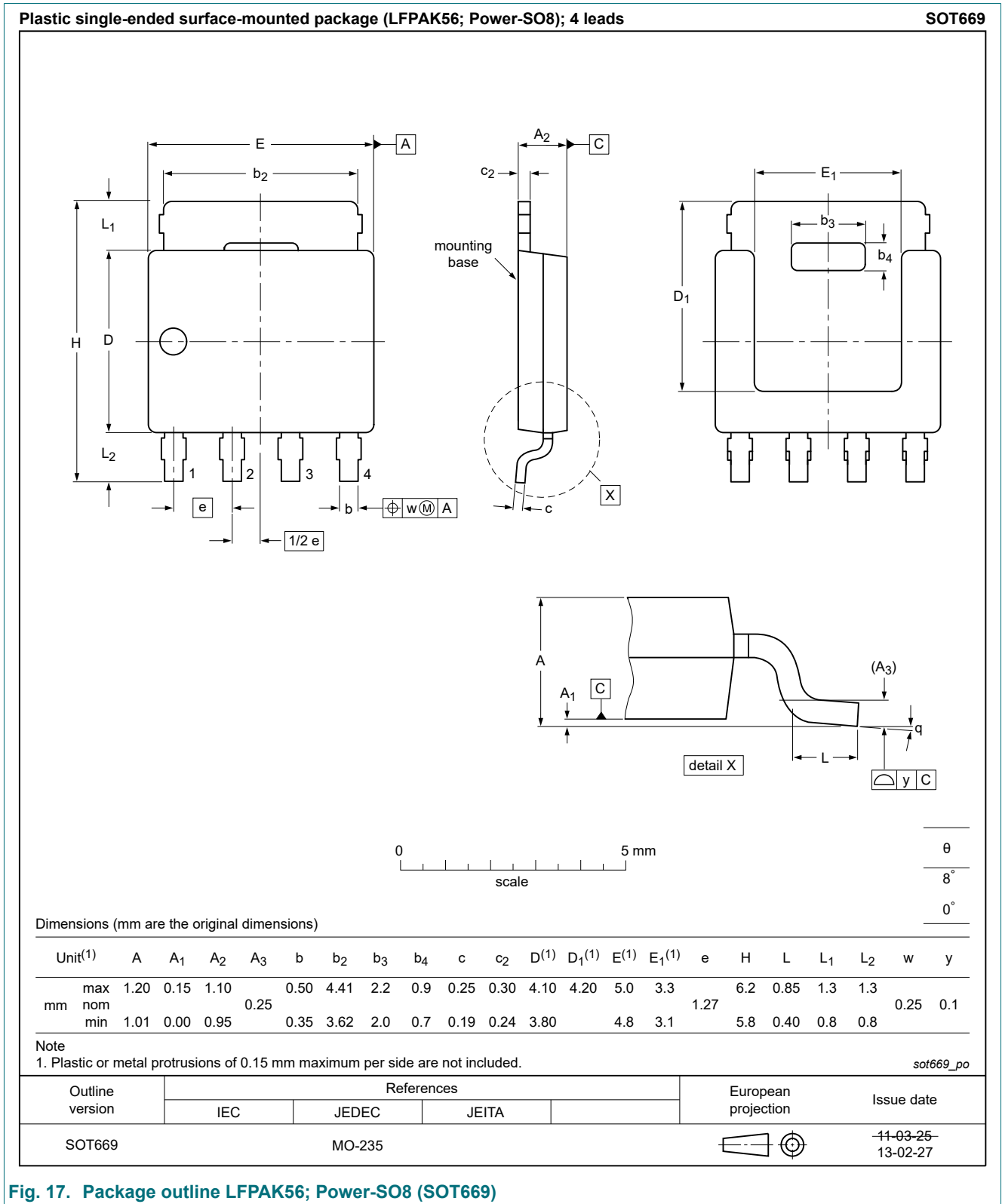


Fig. 17. Package outline LFPAK56; Power-SO8 (SOT669)

13. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BUK6Y33-60P v.3	20210121	Product data sheet	-	BUK6Y33-60P v.2
Modifications:	<ul style="list-style-type: none">Chapter "Characteristics": Typo correction at parameter t_f. Correction of the conditions for the source-drain diode parameters V_{SD}, t_{rr}, Q_r.			
BUK6Y33-60P v.2	20200318	Product data sheet	-	BUK6Y33-60P v.1
BUK6Y33-60P v.1	20200316	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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