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 °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
P_{tot}	total power dissipation	T_{mb} = 25 °C		-	-	110	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = -10 V; I_D = -7 A; T_j = 25 °C		-	26	33	mΩ

[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

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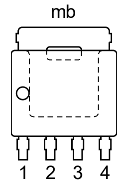
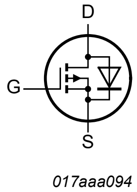
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 **LFPAK56; Power-SO8 (SOT669)**	
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

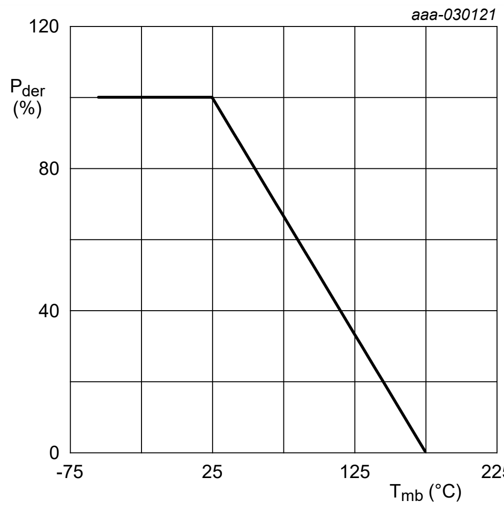
8. Limiting values

Table 5. Limiting values

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

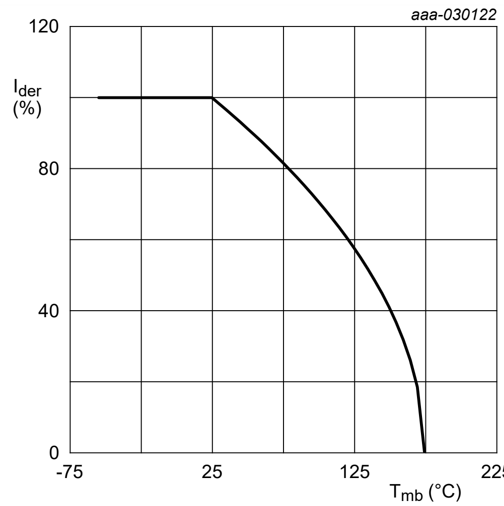
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	T_j = 25 °C		-	-60	V
V_{GS}	gate-source voltage		[1]	-20	20	V
I_D	drain current	V_{GS} = -10 V; T_{mb} = 25 °C		-	-30	A
		V_{GS} = -10 V; T_{mb} = 100 °C		-	-21	A
I_{DM}	peak drain current	single pulse; t_p ≤ 10 µs; T_{mb} = 25 °C		-	-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	$T_{j(init)}$ = 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.



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

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



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

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

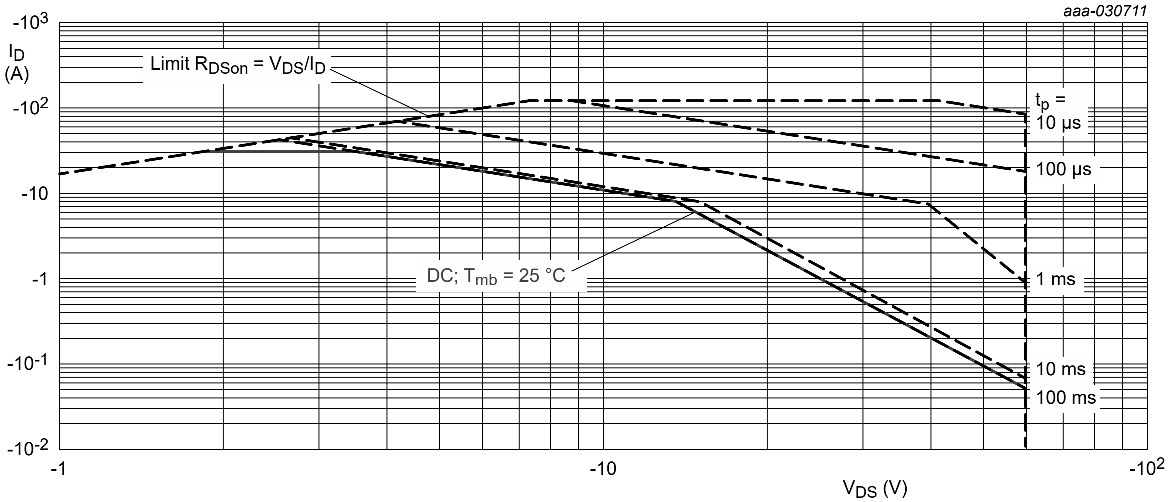


Fig. 3. Safe operating area; junction to mounting base; continuous and peak drain currents as a function of drain-source voltage

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			-	1.1	1.4	K/W

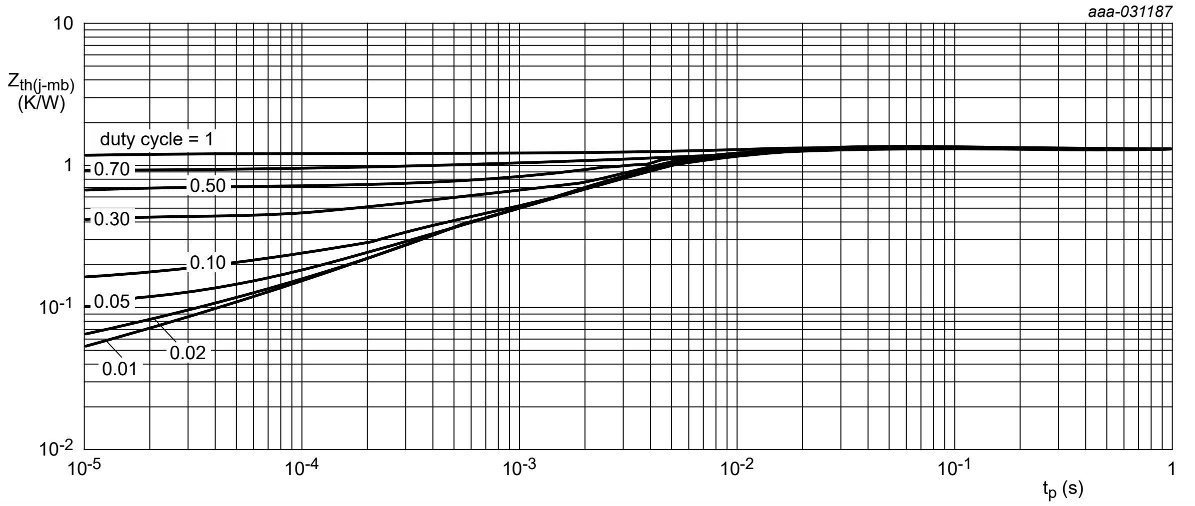
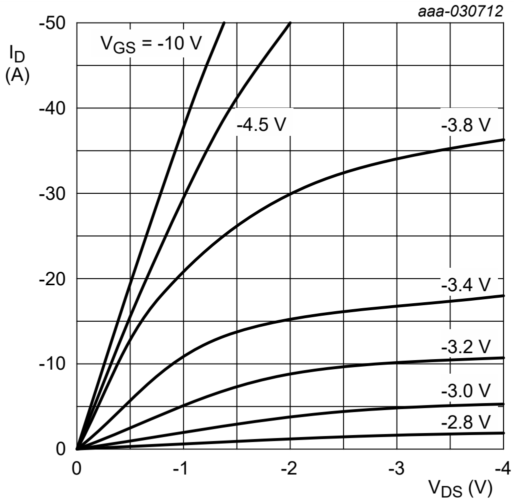


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

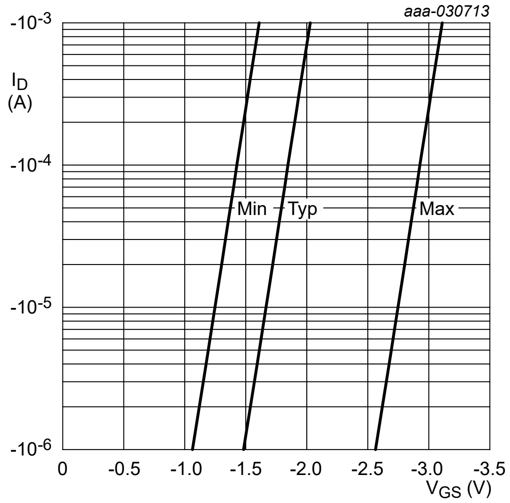
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = -250 µA; V_{GS} = 0 V; T_j = 25 °C		-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 = 125 °C		-	-	-10	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 = -7 A; T_j = 25 °C		-	26	33	mΩ
		V_{GS} = -10 V; I_D = -7 A; T_j = 175 °C		-	55	69	mΩ
		V_{GS} = -4.5 V; I_D = -6.7 A; T_j = 25 °C		-	30	36	mΩ
g_{fs}	forward transconductance	V_{DS} = -10 V; I_D = -4.8 A; T_j = 25 °C		-	99	-	S
R_G	gate resistance	f = 1 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 °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 MHz; V_{GS} = 0 V; T_j = 25 °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 Ω; T_j = 25 °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 °C		-	-0.7	-1.2	V
t_{rr}	reverse recovery time	I_S = -30 A; dI_S/dt = 100 A/µs; V_{GS} = -10 V; V_{DS} = -30 V; T_j = 25 °C		-	32	-	ns
Q_r	recovered charge			-	18	-	nC



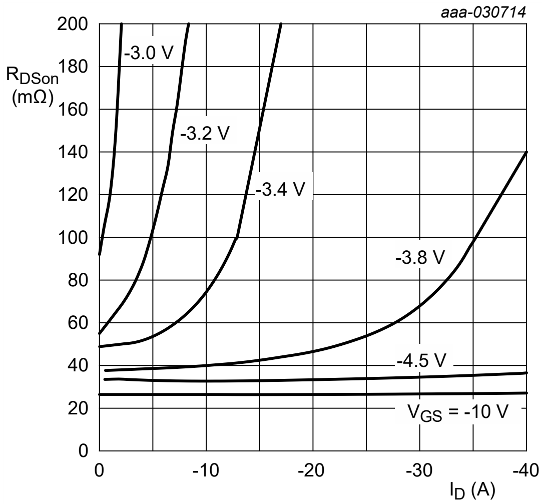
T_j = 25 °C

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



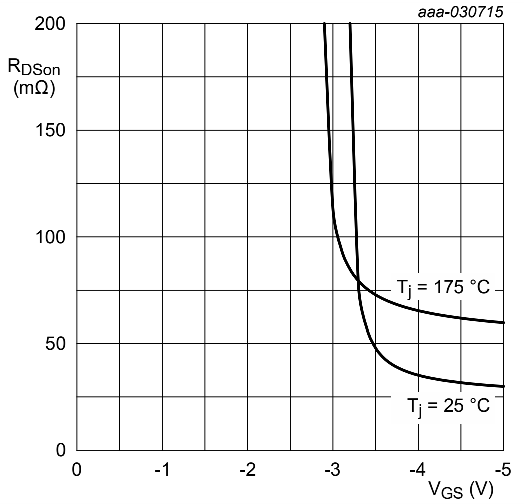
V_{DS} = -5 V; T_j = 25 °C

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



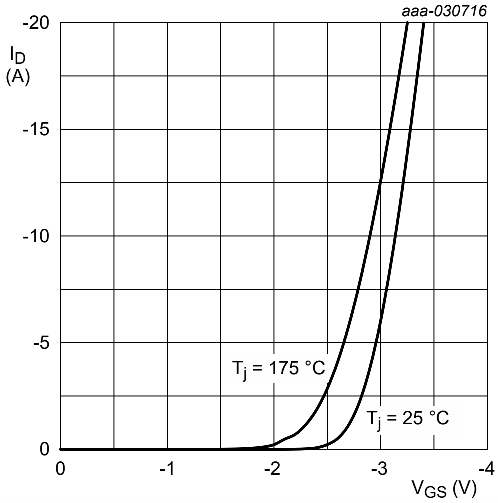
T_j = 25 °C

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



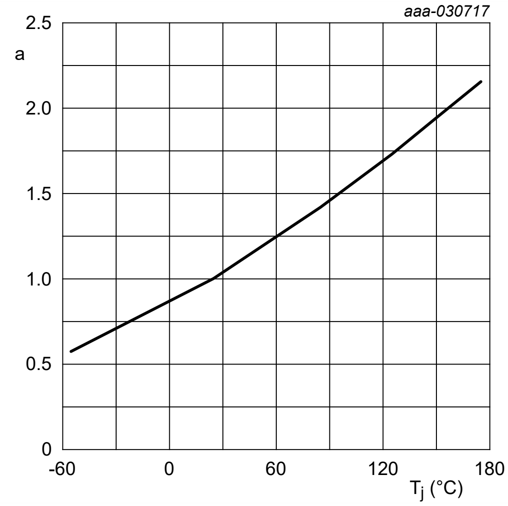
I_D = -6.5 A

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



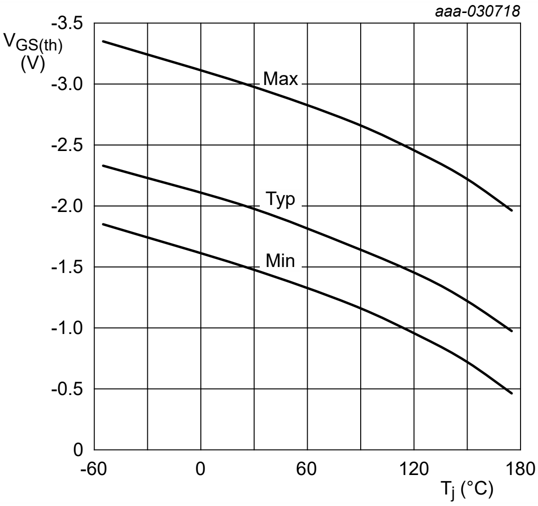
V_{DS} = -10 V

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



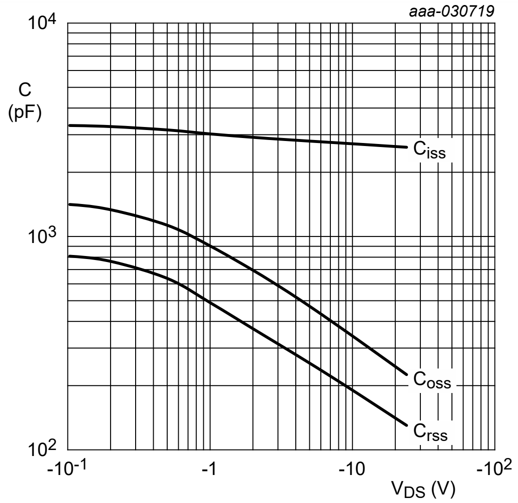
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



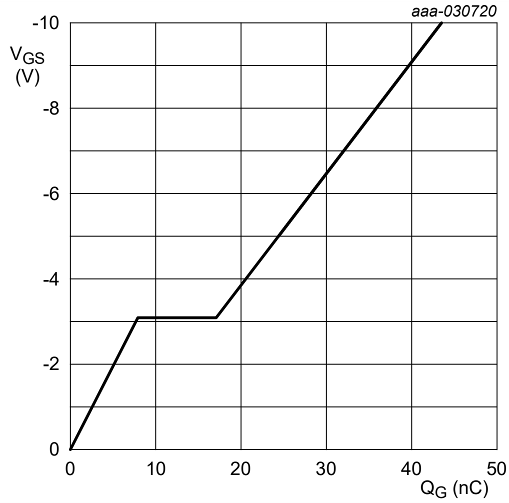
I_D = -250 µA; V_{DS} = V_{GS}

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



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

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



V_{DS} = -30 V; I_D = -10.8 A; T_j = 25 °C

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

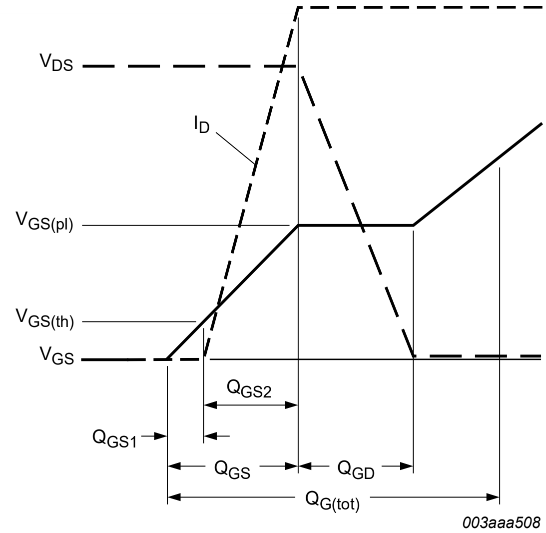
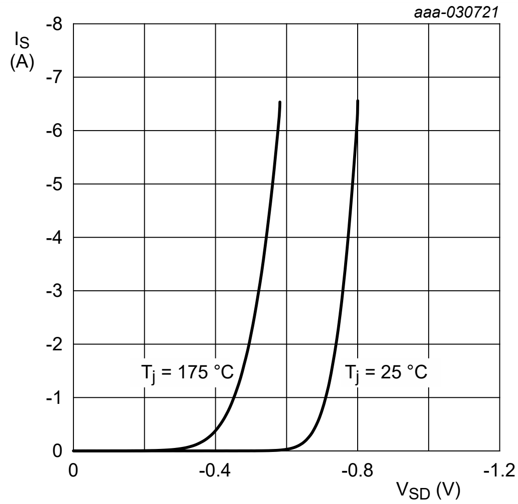


Fig. 14. Gate charge waveform definitions



V_{GS} = 0 V

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

11. Test information

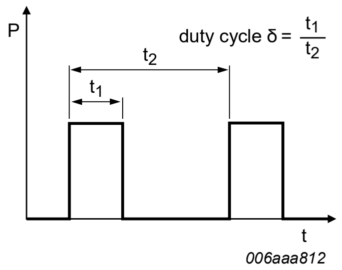


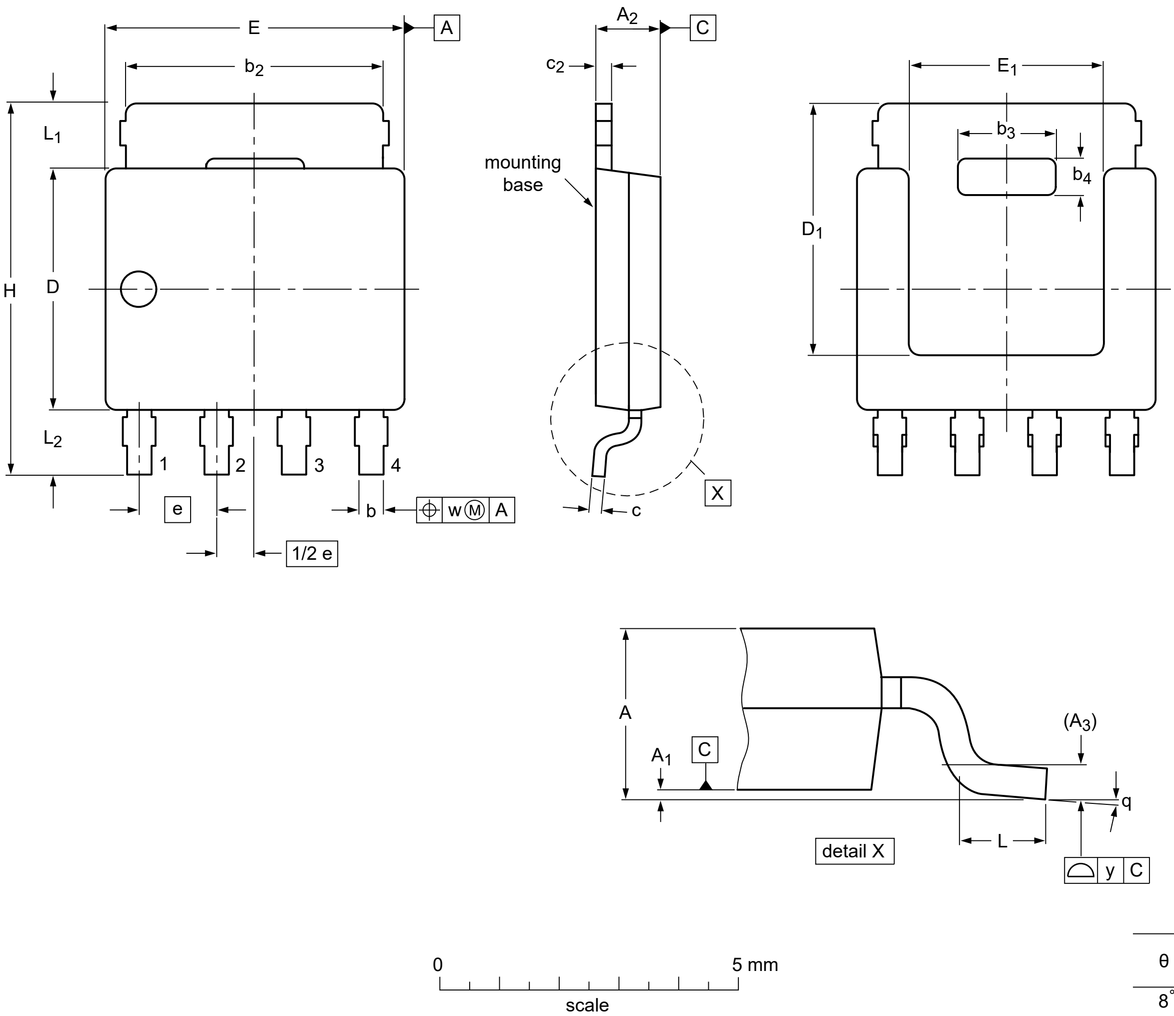
Fig. 16. Duty cycle definition

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

Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads **SOT669**



Dimensions (mm are the original dimensions)

Unit(1)		A	A_1	A_2	A_3	b	b_2	b_3	b_4	c	c_2	D(1)	D_1(1)	E(1)	E_1(1)	e	H	L	L_1	L_2	w	y	θ
mm	max	1.20	0.15	1.10		0.50	4.41	2.2	0.9	0.25	0.30	4.10	4.20	5.0	3.3		6.2	0.85	1.3	1.3			8°
	nom				0.25											1.27					0.25	0.1	
	min	1.01	0.00	0.95		0.35	3.62	2.0	0.7	0.19	0.24	3.80		4.8	3.1		5.8	0.40	0.8	0.8			0°

Note

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

sot669_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT669		MO-235				~~11-03-25~~ 13-02-27

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:	• 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.

[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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