



BUK9K52-60E

Dual N-channel 60 V, 55 mΩ logic level MOSFET

24 February 2015

Product data sheet

1. General description

Dual logic level N-channel MOSFET in an LPAK56D (Dual Power-SO8) package using TrenchMOS technology. This product has been designed and qualified to AEC Q101 standard for use in high performance automotive applications.

2. Features and benefits

- Dual MOSFET
- Q101 Compliant
- Repetitive avalanche rated
- Suitable for thermally demanding environments due to 175 °C rating
- True logic level gate with $V_{GS(th)}$ rating of greater than 0.5 V at 175 °C

3. Applications

- 12 V Automotive systems
- Motors, lamps and solenoid control
- Transmission control
- Ultra high performance power switching

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	-	60	V
I_D	drain current	$V_{GS} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 2	-	-	16	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 1	-	-	32	W
Static characteristics FET1 and FET2						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}$; $I_D = 5\text{ A}$; $T_j = 25\text{ °C}$; Fig. 12	-	47.3	55	mΩ
Dynamic characteristics FET1 and FET2						
Q_{GD}	gate-drain charge	$I_D = 5\text{ A}$; $V_{DS} = 48\text{ V}$; $V_{GS} = 5\text{ V}$; $T_j = 25\text{ °C}$; Fig. 14 ; Fig. 15	-	2.3	-	nC

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source1	 LFPAK56D (SOT1205)	 mbk725
2	G1	gate1		
3	S2	source2		
4	G2	gate2		
5	D2	drain2		
6	D2	drain2		
7	D1	drain1		
8	D1	drain1		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK9K52-60E	LFPAK56D	Plastic single ended surface mounted package (LFPAK56D); 8 leads	SOT1205

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK9K52-60E	95260E

8. Limiting values

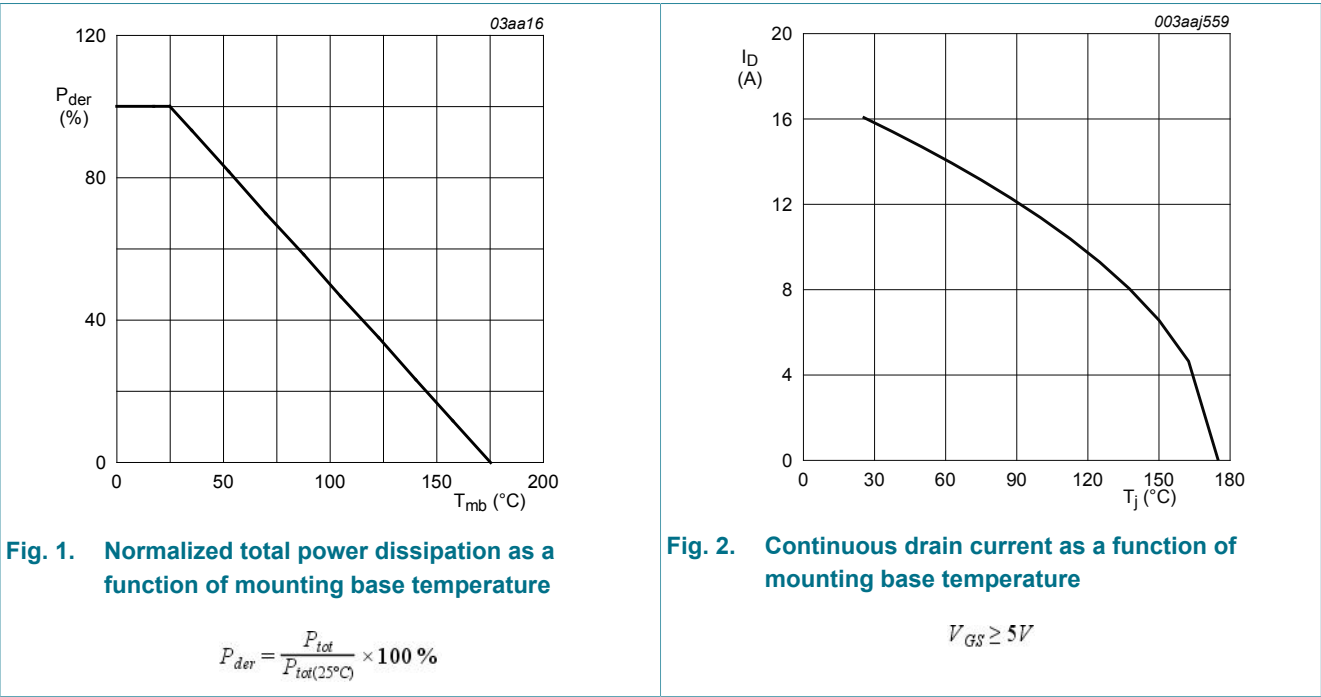
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	60	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$; $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	60	V
V_{GS}	gate-source voltage	$T_j \leq 175\text{ °C}$; DC	-10	10	V
		$T_j \leq 175\text{ °C}$; Pulsed	[1][2] -15	15	V
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 1	-	32	W
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 5\text{ V}$; Fig. 2	-	16	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 5\text{ V}$; Fig. 2	-	11	A

Symbol	Parameter	Conditions		Min	Max	Unit
I _{DM}	peak drain current	T _{mb} = 25 °C; pulsed; t _p ≤ 10 μs; Fig. 3		-	64	A
T _{stg}	storage temperature			-55	175	°C
T _j	junction temperature			-55	175	°C
T _{sld(M)}	peak soldering temperature			-	260	°C
Source-drain diode FET1 and FET2						
I _S	source current	T _{mb} = 25 °C		-	16	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C		-	64	A
Avalanche ruggedness FET1 and FET2						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I _D = 16 A; V _{sup} ≤ 60 V; V _{GS} = 5 V; T _{j(init)} = 25 °C; Fig. 4	[3][4]	-	11.9	mJ

- [1] Accumulated Pulse duration up to 50 hours delivers zero defect ppm
- [2] Significantly longer life times are achieved by lowering T_j and or V_{GS}
- [3] Refer to application note AN10273 for further information
- [4] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C



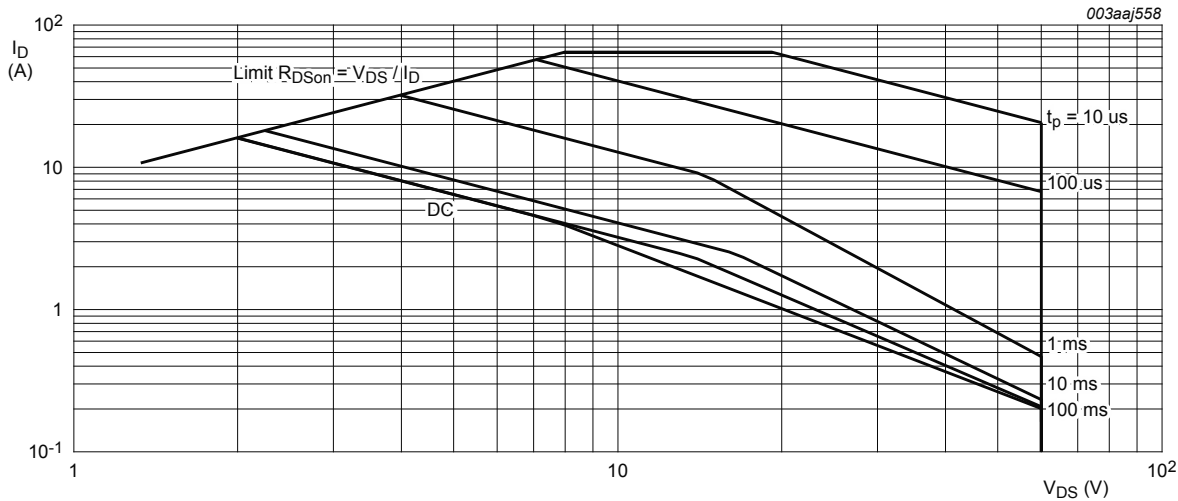


Fig. 3. Safe operating area; continuous and peak drain current as a function of drain-source voltage

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

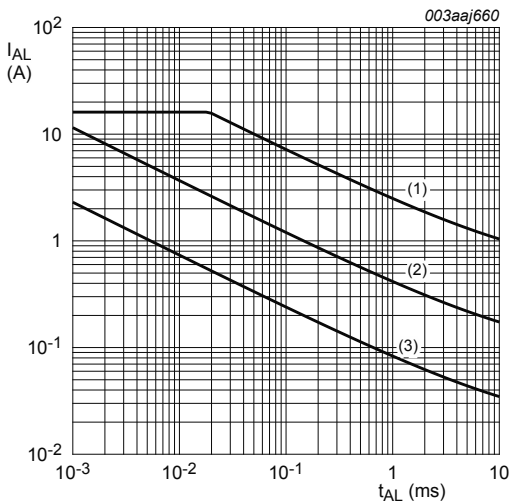


Fig. 4. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time, FET1 and FET2

- (1) Single-pulse; $T_j = 25^{\circ}C$.
- (2) Single-pulse; $T_j = 150^{\circ}C$.
- (3) Repetitive.

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	Fig. 5	-	-	4.68	K/W

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	Minimum footprint; mounted on a printed circuit board		-	95	-	K/W

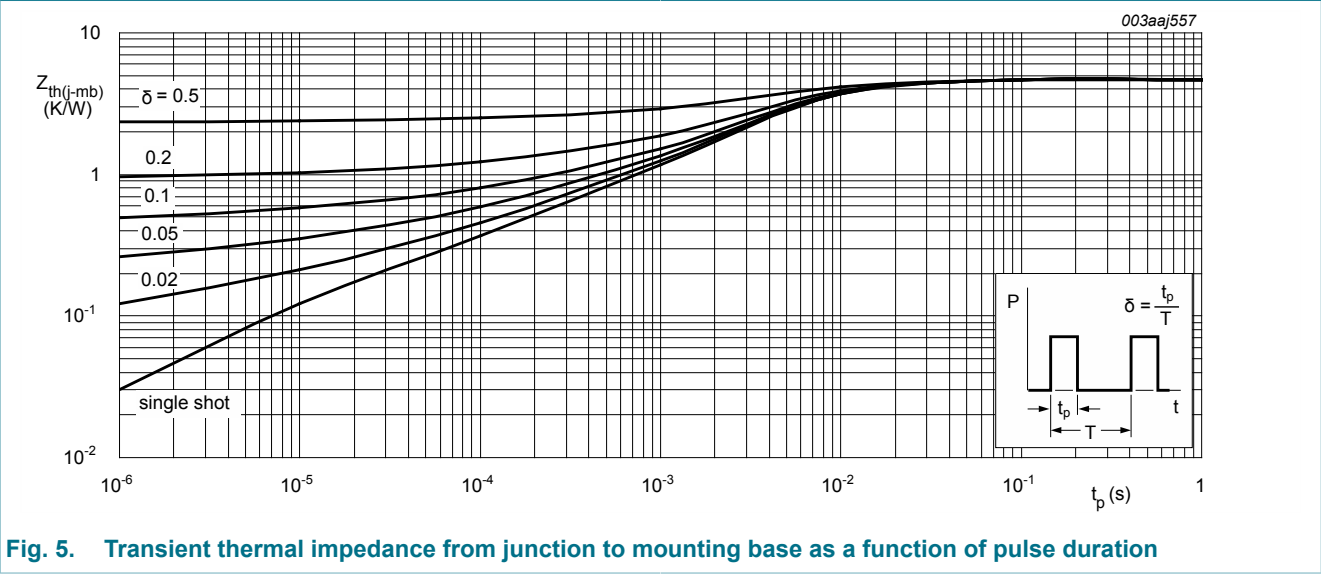


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics FET1 and FET2							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu A$; $V_{GS} = 0\ V$; $T_J = -55\ ^\circ C$		54	-	-	V
		$I_D = 250\ \mu A$; $V_{GS} = 0\ V$; $T_J = 25\ ^\circ C$		60	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ mA$; $V_{DS} = V_{GS}$; $T_J = 25\ ^\circ C$; Fig. 10 ; Fig. 11		1.4	1.7	2.1	V
		$I_D = 1\ mA$; $V_{DS} = V_{GS}$; $T_J = 175\ ^\circ C$; Fig. 10 ; Fig. 11		0.5	-	-	V
		$I_D = 1\ mA$; $V_{DS} = V_{GS}$; $T_J = -55\ ^\circ C$; Fig. 10 ; Fig. 11		-	-	2.45	V
I_{DSS}	drain leakage current	$V_{DS} = 60\ V$; $V_{GS} = 0\ V$; $T_J = 25\ ^\circ C$		-	0.02	1	μA
		$V_{DS} = 60\ V$; $V_{GS} = 0\ V$; $T_J = 175\ ^\circ C$		-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = -10\ V$; $V_{DS} = 0\ V$; $T_J = 25\ ^\circ C$		-	2	100	nA
		$V_{GS} = 10\ V$; $V_{DS} = 0\ V$; $T_J = 25\ ^\circ C$		-	2	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 5\ V$; $I_D = 5\ A$; $T_J = 25\ ^\circ C$; Fig. 12		-	47.3	55	mΩ
		$V_{GS} = 5\ V$; $I_D = 5\ A$; $T_J = 175\ ^\circ C$; Fig. 12 ; Fig. 13		-	106.9	124.3	mΩ
		$V_{GS} = 10\ V$; $I_D = 5\ A$; $T_J = 25\ ^\circ C$; Fig. 12		-	41.4	49	mΩ

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Dynamic characteristics FET1 and FET2							
Q _{G(tot)}	total gate charge	I _D = 5 A; V _{DS} = 48 V; V _{GS} = 5 V; T _j = 25 °C; Fig. 14 ; Fig. 15		-	5.6	-	nC
Q _{GS}	gate-source charge			-	1.1	-	nC
Q _{GD}	gate-drain charge			-	2.3	-	nC
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 25 V; f = 1 MHz; T _j = 25 °C; Fig. 16		-	544	725	pF
C _{oss}	output capacitance			-	74	89	pF
C _{rss}	reverse transfer capacitance			-	40	55	pF
t _{d(on)}	turn-on delay time	V _{DS} = 48 V; R _L = 10 Ω; V _{GS} = 5 V; R _{G(ext)} = 5 Ω; T _j = 25 °C; I _D = 5 A		-	6.2	-	ns
t _r	rise time			-	10.1	-	ns
t _{d(off)}	turn-off delay time			-	10.7	-	ns
t _f	fall time			-	9	-	ns
Source-drain diode FET1 and FET2							
V _{SD}	source-drain voltage	I _S = 5 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 17		-	0.78	1.2	V
t _{rr}	reverse recovery time	I _S = 5 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 30 V; T _j = 25 °C		-	17.7	-	ns
Q _r	recovered charge			-	11.6	-	nC

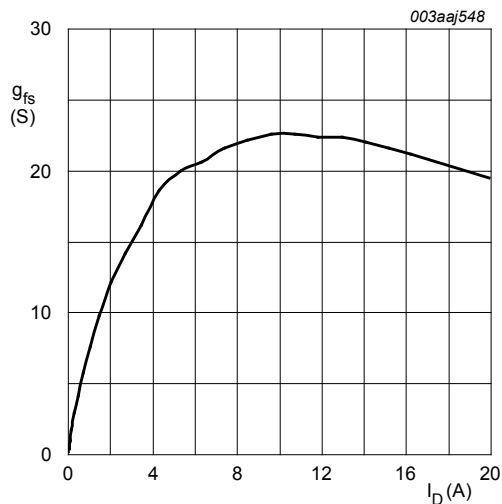


Fig. 6. Forward transconductance as a function of drain current; typical values

$$T_J = 25\text{ }^\circ\text{C}; V_{DS} = 15\text{ V}$$

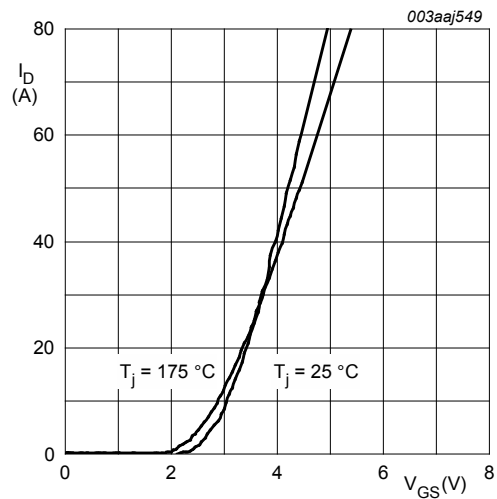


Fig. 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values

$$V_{DS} = 10\text{ V}$$

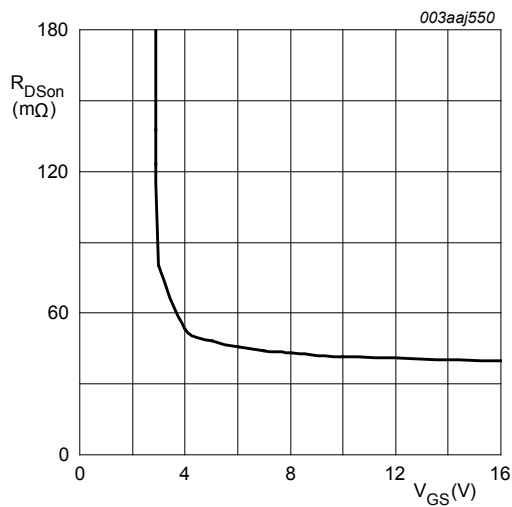


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25\text{ }^{\circ}\text{C}; I_D = 5\text{ A}$

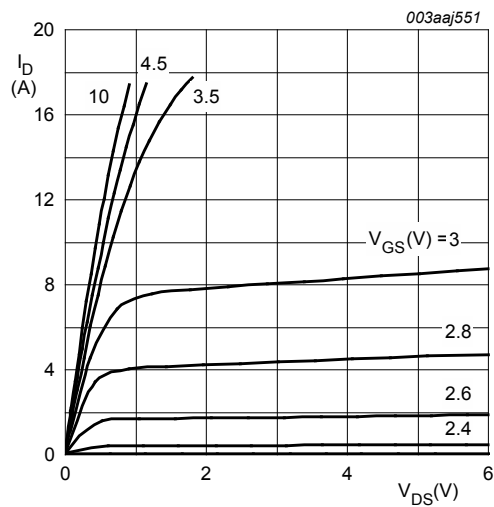


Fig. 9. Output characteristics: drain current as a function of drain-source voltage; typical values

$T_j = 25\text{ }^{\circ}\text{C}$

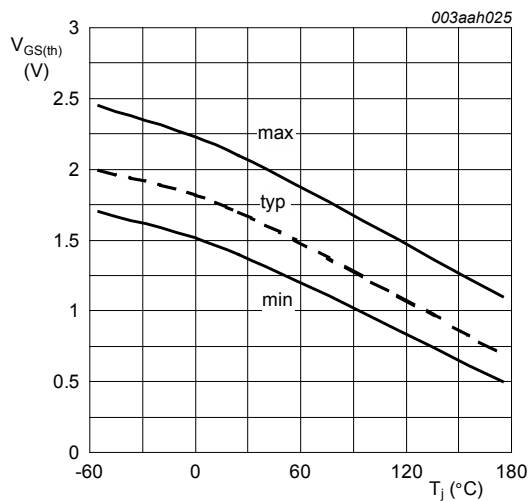


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

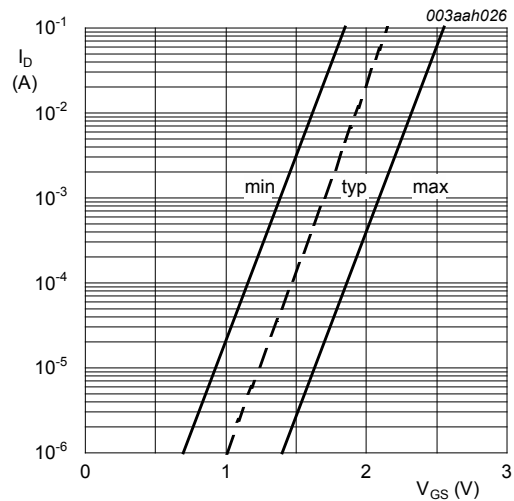


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 5\text{ V}$

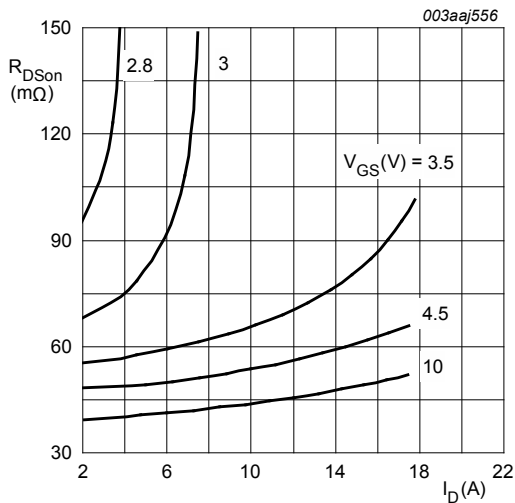


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25\text{ }^{\circ}\text{C}$

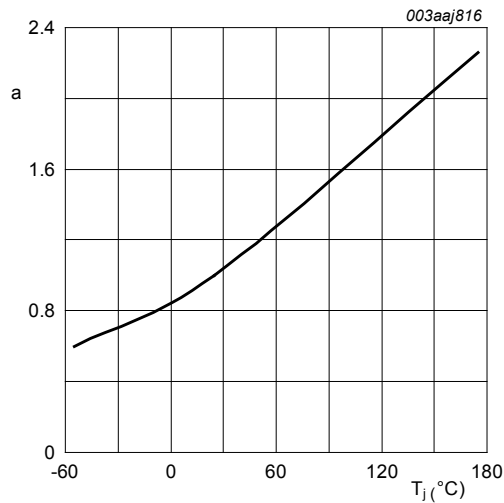


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

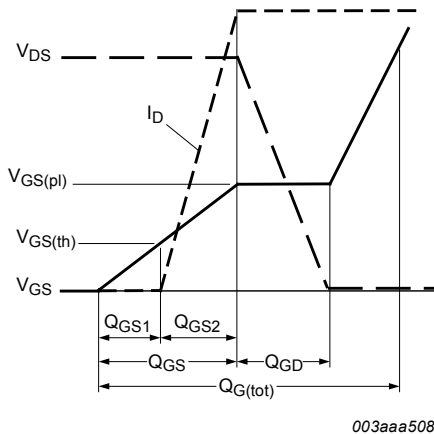


Fig. 14. Gate charge waveform definitions

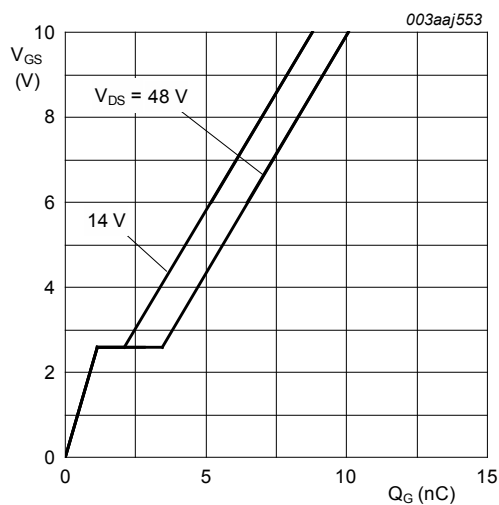


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25\text{ }^{\circ}\text{C}; I_D = 5\text{ A}$

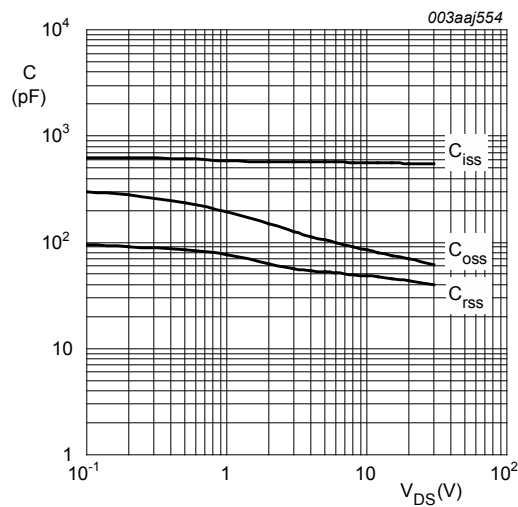


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

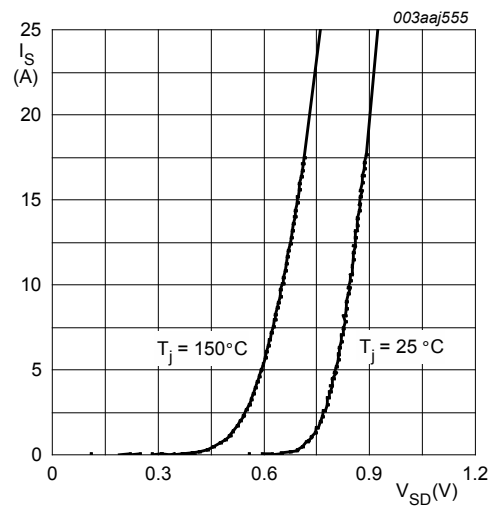


Fig. 17. Source current as a function of source-drain voltage; typical values

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

11. Package outline

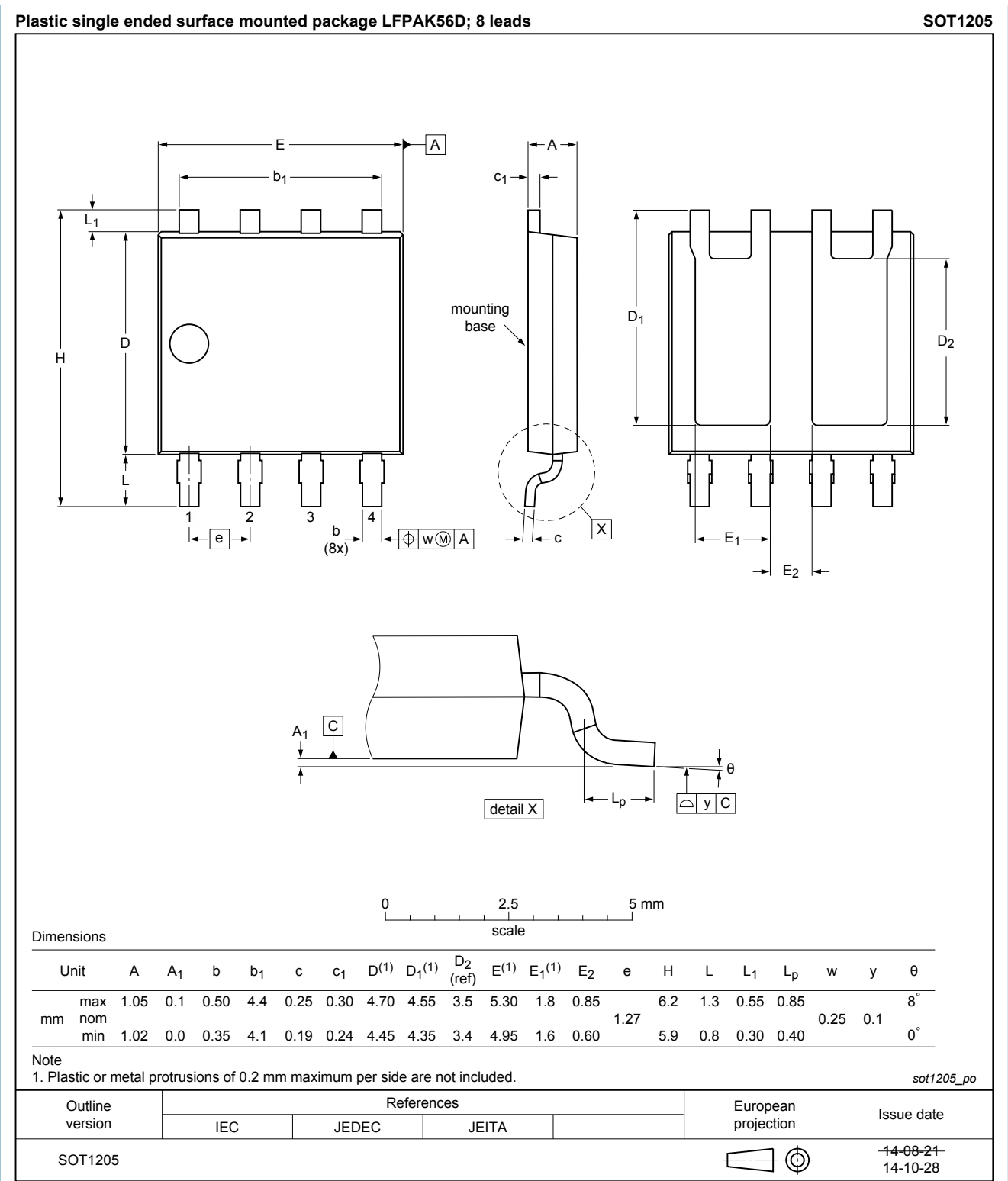


Fig. 18. Package outline LFPAK56D (SOT1205)

12. Legal information

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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.
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13. Contents

1 General description 1

2 Features and benefits 1

3 Applications 1

4 Quick reference data 1

5 Pinning information 2

6 Ordering information 2

7 Marking 2

8 Limiting values 2

9 Thermal characteristics 4

10 Characteristics 5

11 Package outline 10

12 Legal information 11

12.1 Data sheet status 11

12.2 Definitions 11

12.3 Disclaimers 11

12.4 Trademarks 12

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