



BUK9K22-80E

Dual N-channel 80 V, 22 mΩ logic level MOSFET

11 May 2018

Product data sheet

1. General description

Dual Logic level N-channel MOSFET in an LFPK56D (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
- AEC-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, 24 V and 48 V automotive systems
- Motors, lamps and solenoid control
- Transmission control
- Ultra high performance power switching

4. Quick reference data

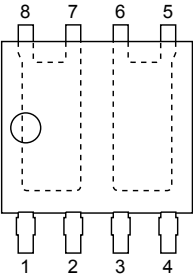
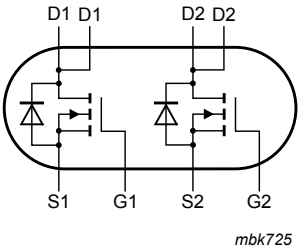
Table 1. Quick reference data

Table 14. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Limiting values FET1 and FET2							
V _{DS}	drain-source voltage	25 °C ≤ T _j ≤ 175 °C		-	-	80	V
I _D	drain current	V _{GS} = 5 V; T _{mb} = 25 °C; Fig. 2		-	-	21	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 1		-	-	64	W
T _j	junction temperature			-55	-	175	°C
Static characteristics FET1 and FET2							
R _{DSon}	drain-source on-state resistance	V _{GS} = 5 V; I _D = 10 A; T _j = 175 °C; Fig. 12		-	-	54.5	mΩ
		V _{GS} = 5 V; I _D = 10 A; T _j = 25 °C; Fig. 11		-	15.7	21.7	mΩ
Dynamic characteristics FET1 and FET2							
Q _{GD}	gate-drain charge	I _D = 10 A; V _{DS} = 64 V; V _{GS} = 5 V; T _j = 25 °C; Fig. 13 ; Fig. 14		-	8.4	-	nC
Q _{G(tot)}	total gate charge			-	23.1	-	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
BUK9K22-80E	LFPAK56D	plastic, single ended surface mounted package (LFPAK56D); 8 leads	SOT1205

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK9K22-80E	92280E

8. Limiting values

Table 5. Limiting values

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

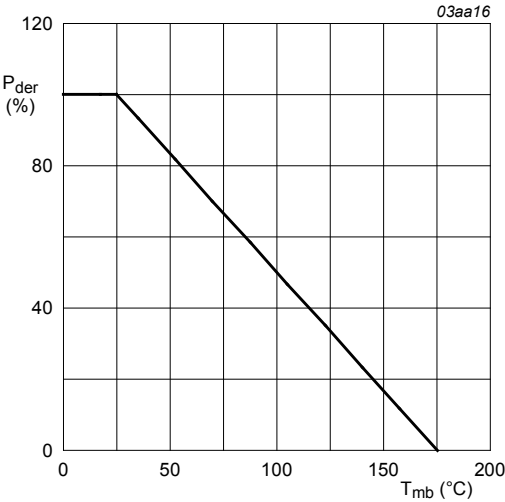
Symbol	Parameter	Conditions		Min	Max	Unit
Limiting values FET1 and FET2						
V_{DS}	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$		-	80	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$		-	80	V
V_{GS}	gate-source voltage	DC; $T_j \leq 175\text{ °C}$		-10	10	V
		Pulsed; $T_j \leq 175\text{ °C}$	[1] [2]	-15	15	V
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 1		-	64	W
I_D	drain current	$V_{GS} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 2		-	21	A
		$V_{GS} = 5\text{ V}$; $T_{sp} = 100\text{ °C}$; Fig. 2		-	15	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; Fig. 3		-	84	A
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
Source-drain diode FET1 and FET2						
I_S	source current	$T_{mb} = 25\text{ °C}$		-	21	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	84	A
Avalanche ruggedness FET1 and FET2						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 21\text{ A}$; $V_{sup} \leq 80\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped; Fig. 4	[3] [4]	-	116	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}

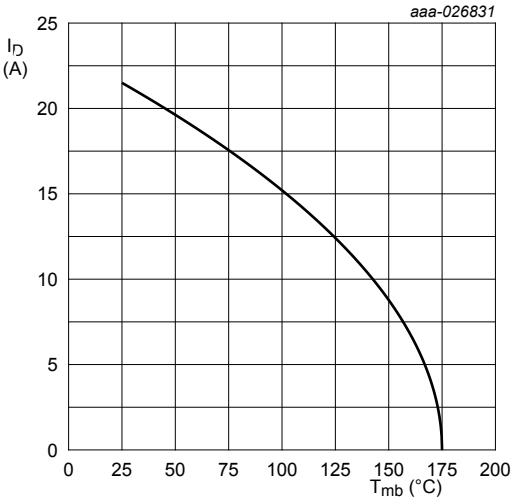
[3] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C

[4] Refer to application note AN10273 for further information



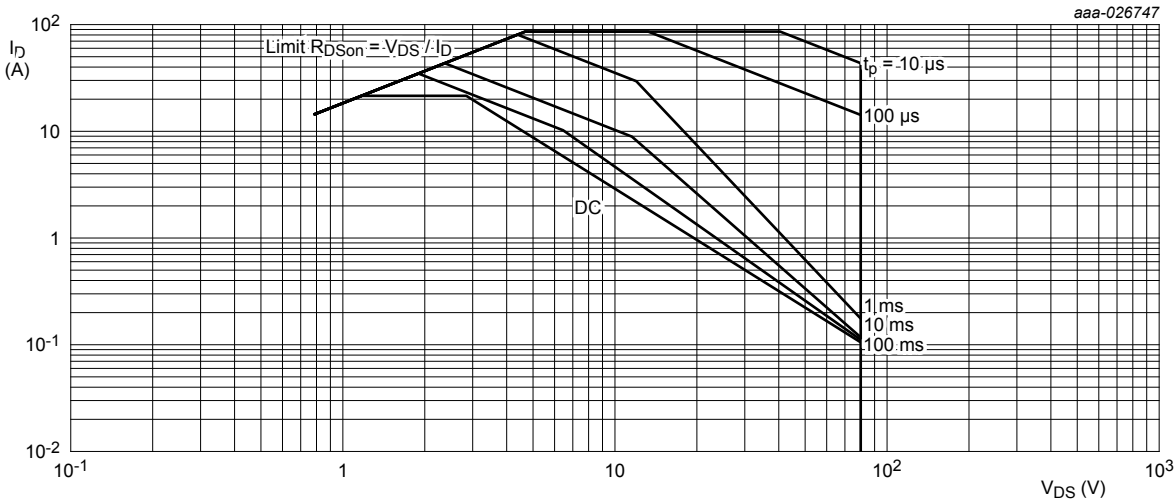
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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



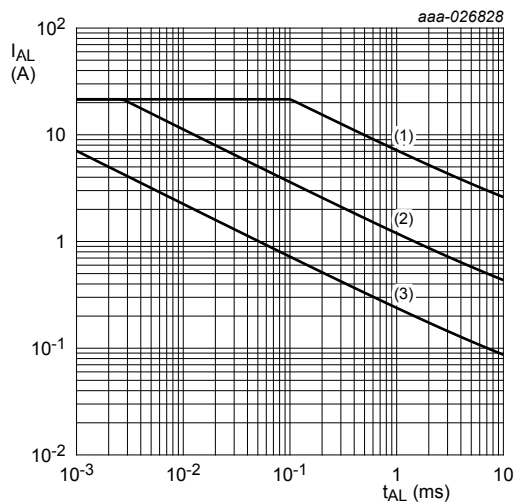
$V_{GS} \geq 5$ V

Fig. 2. Continuous drain current as a function of mounting base temperature, FET1 and FET2



$T_{mb} = 25$ °C; I_{DM} is a single pulse

Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage, FET1 and FET2



(1) $T_{j\text{ (init)}} = 25^{\circ}\text{C}$; (2) $T_{j\text{ (init)}} = 150^{\circ}\text{C}$; (3) Repetitive Avalanche

Fig. 4. Avalanche rating; avalanche current as a function of avalanche time, FET1 and FET2

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	-	-	2.36	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Minimum footprint; mounted on a printed circuit board	-	95	-	K/W

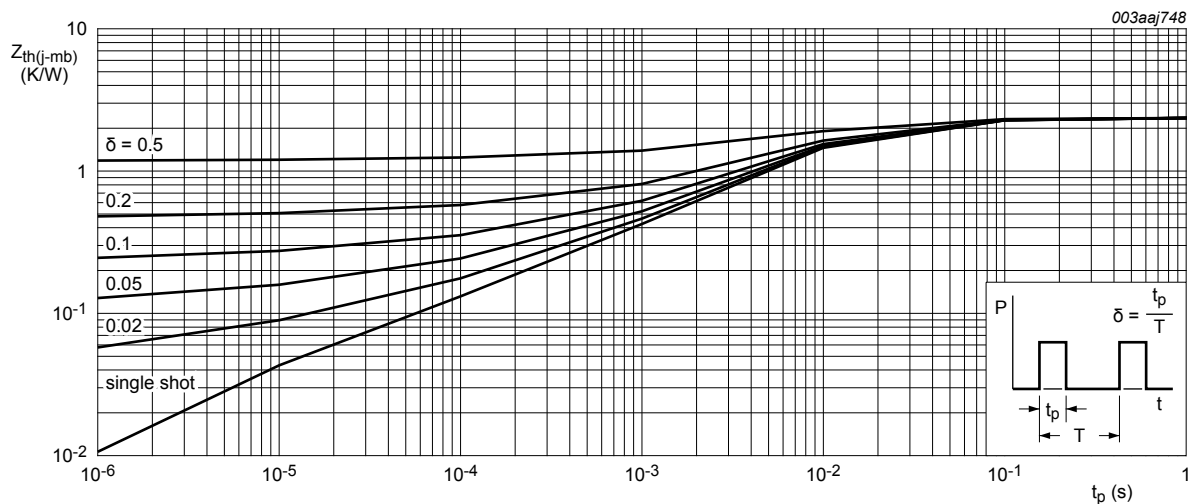


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration, FET1 and FET2

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 μA; V _{GS} = 0 V; T _j = 25 °C		80	-	-	V
		I _D = 250 μA; V _{GS} = 0 V; T _j = -55 °C		72	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} =V _{GS} ; T _j = 25 °C; Fig. 9 ; Fig. 10		1.4	1.7	2.1	V
		I _D = 1 mA; V _{DS} =V _{GS} ; T _j = -55 °C; Fig. 10		-	-	2.45	V
		I _D = 1 mA; V _{DS} =V _{GS} ; T _j = 175 °C; Fig. 10		0.5	-	-	V
I _{DSS}	drain leakage current	V _{DS} = 80 V; V _{GS} = 0 V; T _j = 25 °C		-	0.01	1	μA
		V _{DS} = 80 V; V _{GS} = 0 V; T _j = 175 °C		-	-	500	μA
I _{GSS}	gate leakage current	V _{GS} = 10 V; V _{DS} = 0 V; T _j = 25 °C		-	2	100	nA
		V _{GS} = -10 V; V _{DS} = 0 V; T _j = 25 °C		-	2	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 5 V; I _D = 10 A; T _j = 25 °C; Fig. 11		-	15.7	21.7	mΩ
		V _{GS} = 10 V; I _D = 10 A; T _j = 25 °C; Fig. 11		-	14.4	19	mΩ
		V _{GS} = 5 V; I _D = 10 A; T _j = 175 °C; Fig. 12		-	-	54.5	mΩ
Dynamic characteristics FET1 and FET2							
Q _{G(tot)}	total gate charge	I _D = 10 A; V _{DS} = 64 V; V _{GS} = 5 V; T _j = 25 °C; Fig. 13 ; Fig. 14		-	23.1	-	nC
Q _{GS}	gate-source charge			-	5.4	-	nC
Q _{GD}	gate-drain charge			-	8.4	-	nC
C _{iss}	input capacitance	V _{DS} = 25 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 15		-	2342	3115	pF
C _{oss}	output capacitance			-	170	204	pF
C _{rss}	reverse transfer capacitance			-	89	122	pF
t _{d(on)}	turn-on delay time	V _{DS} = 60 V; R _L = 5 Ω; V _{GS} = 5 V; R _{G(ext)} = 5 Ω; T _j = 25 °C		-	13.9	-	ns
t _r	rise time			-	24.9	-	ns
t _{d(off)}	turn-off delay time			-	28.6	-	ns
t _f	fall time			-	20.6	-	ns
Source-drain diode FET1 and FET2							
V _{SD}	source-drain voltage	I _S = 10 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 16		-	0.8	1.2	V
t _{rr}	reverse recovery time	I _S = 10 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 25 V; T _j = 25 °C		-	28.4	-	ns
Q _r	recovered charge			-	33	-	nC

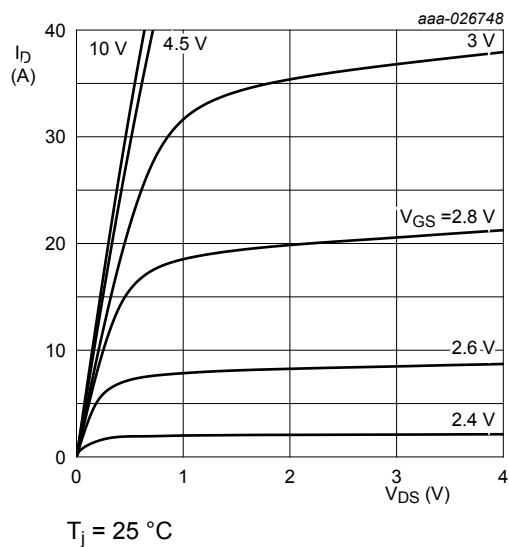


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values, FET1 and FET2

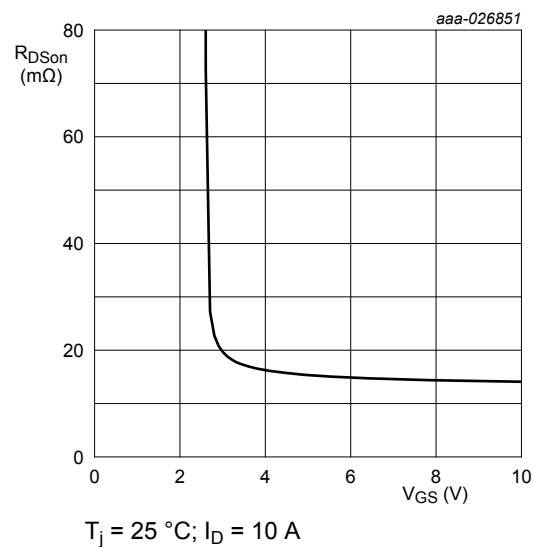


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values, FET1 and FET2

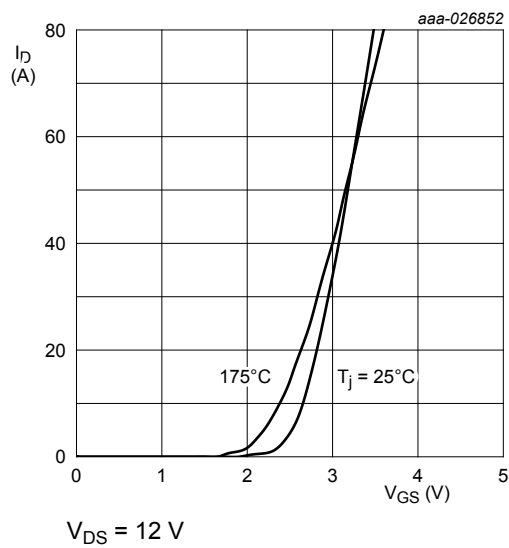


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values, FET1 and FET2

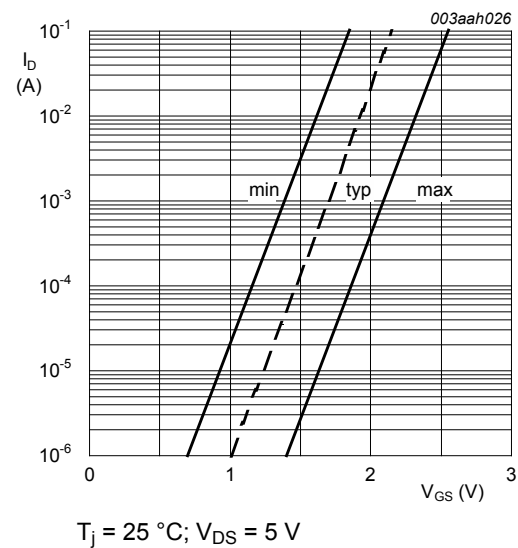


Fig. 9. Sub-threshold drain current as a function of gate-source voltage, FET1 and FET2

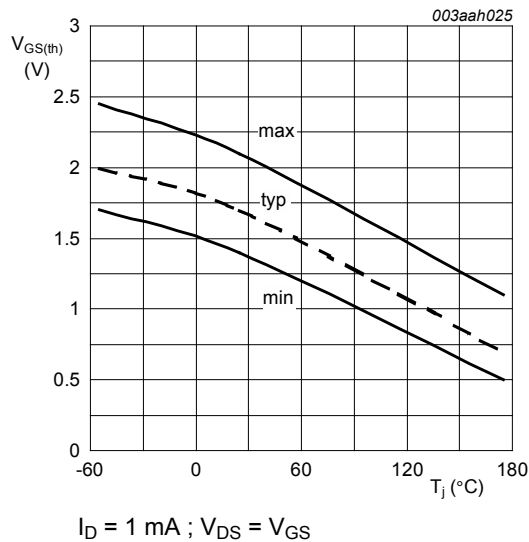


Fig. 10. Gate-source threshold voltage as a function of junction temperature, FET1 and FET2

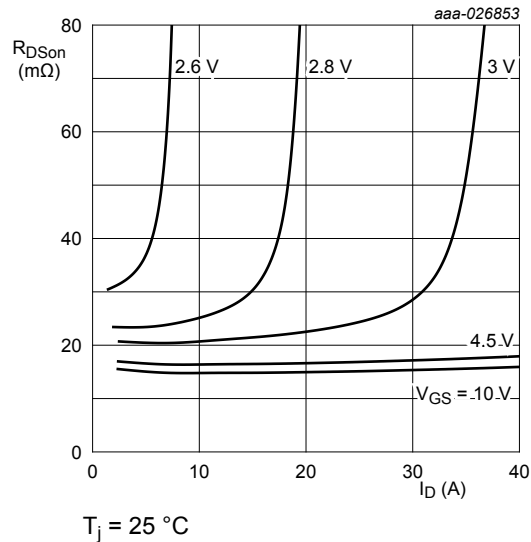


Fig. 11. Drain-source on-state resistance as a function of drain current; typical values, FET1 and FET2

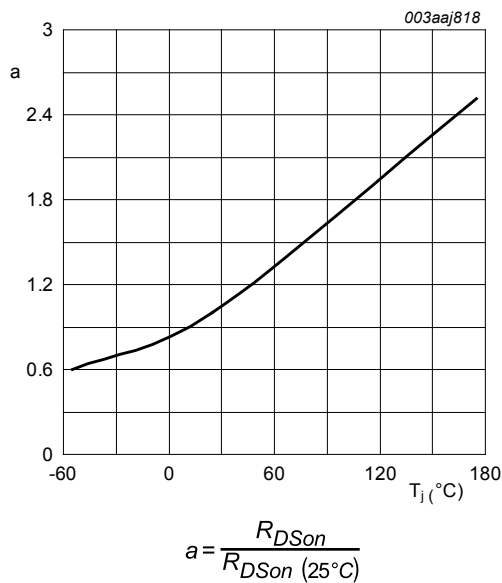


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature, FET1 and FET2

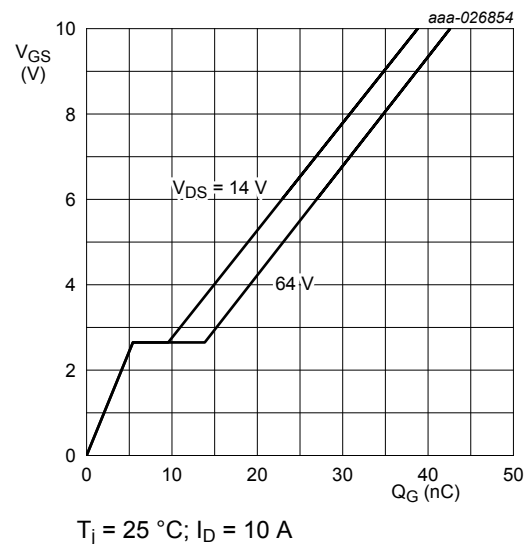


Fig. 13. Gate-source voltage as a function of gate charge; typical values, FET1 and FET2

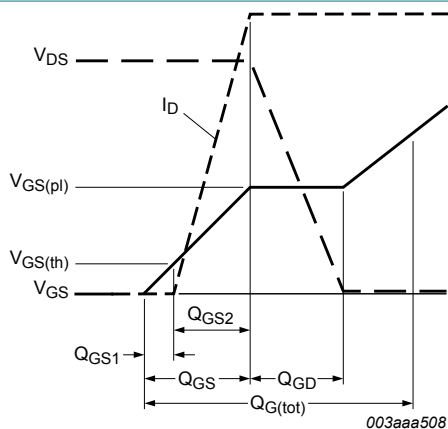
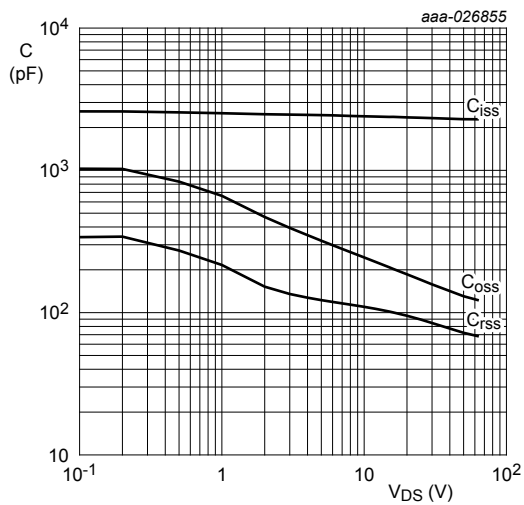
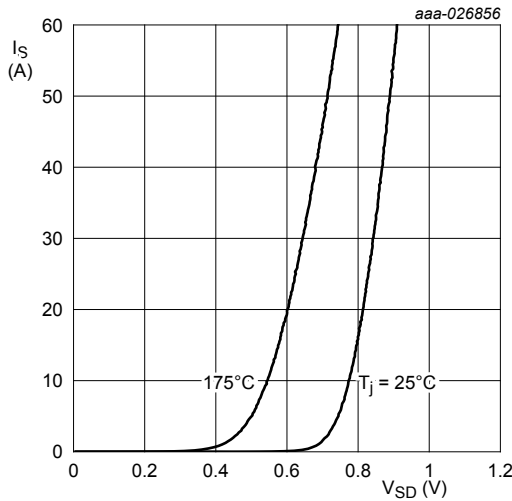


Fig. 14. Gate charge waveform definitions



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

Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values, FET1 and FET2



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

Fig. 16. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values, FET1 and FET2

11. Package outline

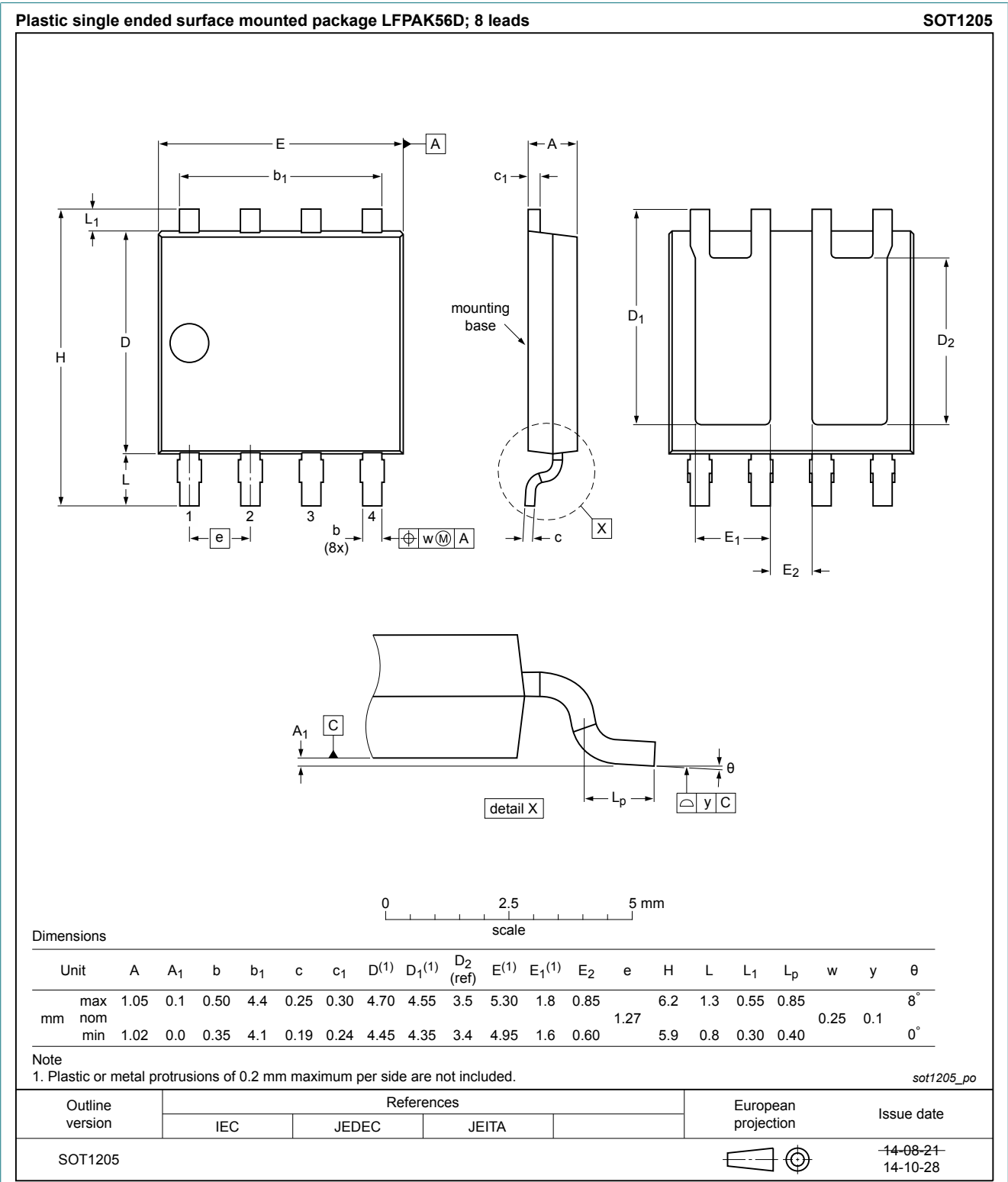


Fig. 17. Package outline LFAK56D (SOT1205)

12. Legal information

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Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Date of release: 11 May 2018

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