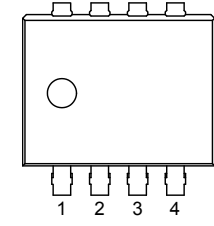
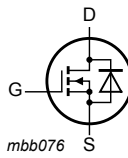


5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	Source	 LPAK33 (SOT1210)	 mbb076
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
BUK9M85-60E	LPAK33	Plastic single ended surface mounted package (LPAK33); 8 leads	SOT1210

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK9M85-60E	98560E

8. Limiting values

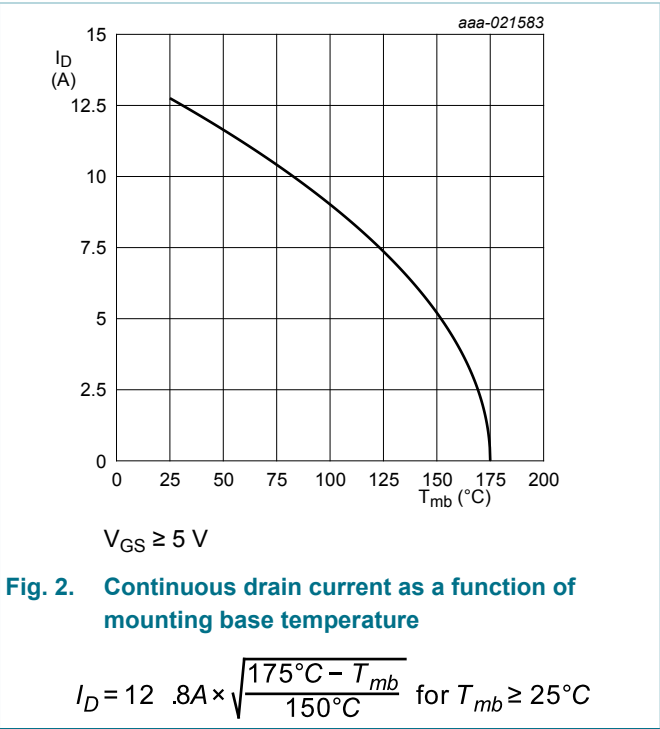
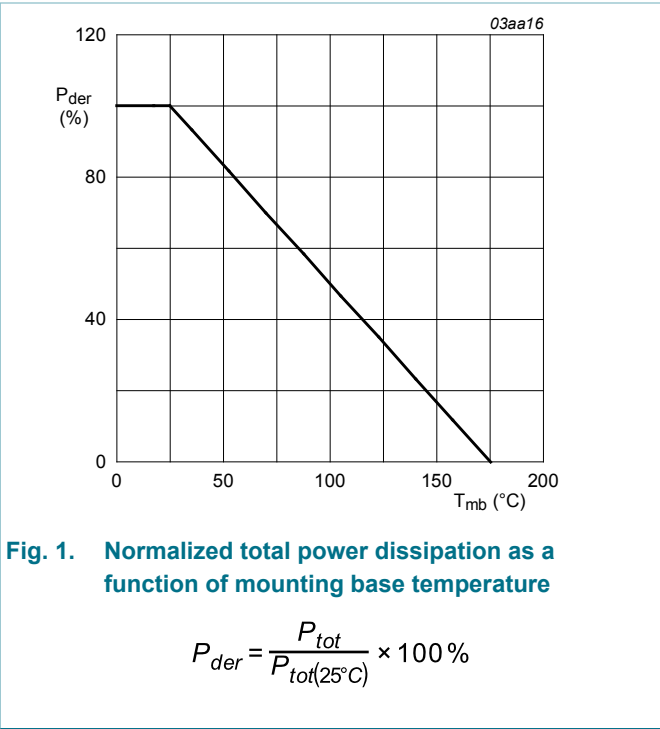
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>DS</sub>	drain-source voltage	25 °C ≤ T <sub>j</sub> ≤ 175 °C		-	60	V
V <sub>DGR</sub>	drain-gate voltage	R <sub>GS</sub> = 20 kΩ		-	60	V
V <sub>GS</sub>	gate-source voltage	DC; T <sub>j</sub> ≤ 175 °C		-10	10	V
		Pulsed; T <sub>j</sub> ≤ 175 °C	[1][2]	-15	15	V
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; Fig. 1		-	31	W
I <sub>D</sub>	drain current	V <sub>GS</sub> = 5 V; T <sub>mb</sub> = 25 °C; Fig. 2		-	12.8	A
		V <sub>GS</sub> = 5 V; T <sub>mb</sub> = 100 °C; Fig. 2		-	9	A
I <sub>DM</sub>	peak drain current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C; Fig. 3		-	51	A

Symbol	Parameter	Conditions		Min	Max	Unit
T <sub>stg</sub>	storage temperature			-55	175	°C
T <sub>j</sub>	junction temperature			-55	175	°C
Source-drain diode						
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C		-	12.8	A
I <sub>SM</sub>	peak source current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C		-	51	A
Avalanche ruggedness						
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	I <sub>D</sub> = 12.8 A; V <sub>sup</sub> ≤ 60 V; R <sub>GS</sub> = 50 Ω; V <sub>GS</sub> = 5 V; T <sub>j(init)</sub> = 25 °C; unclamped; Fig. 4	[3][4]	-	4.55	mJ

- [1] Accumulated pulse duration up to 50 hours delivers zero defect ppm.
- [2] Significantly longer life times are achieved by lowering T<sub>j</sub> and or V<sub>GS</sub>
- [3] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [4] Refer to application note AN10273 for further information.



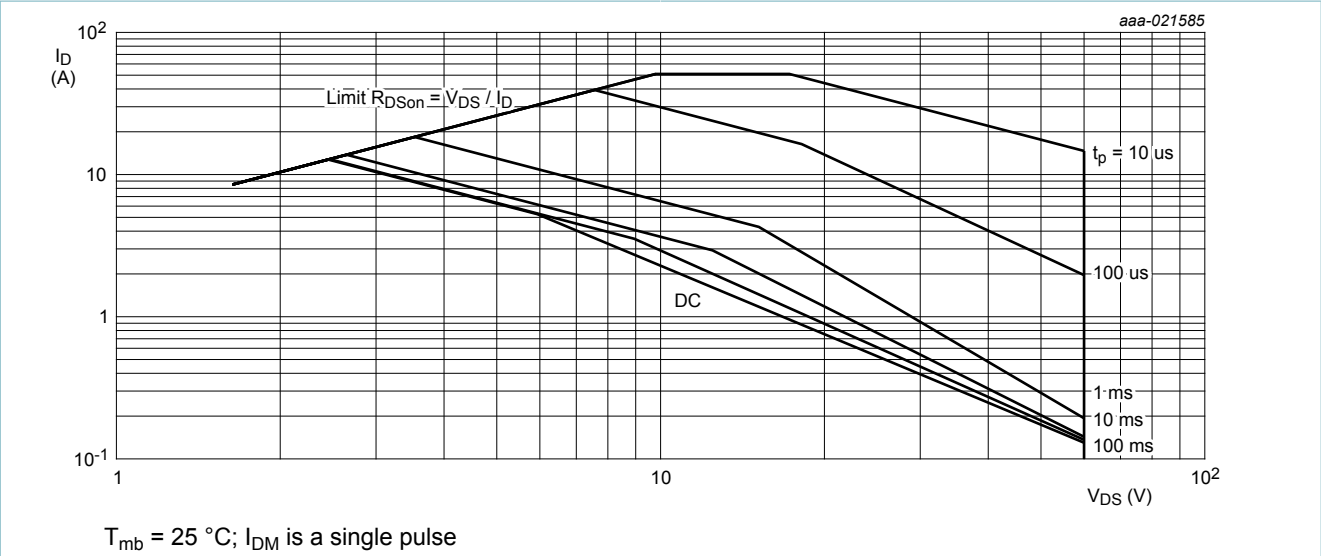


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

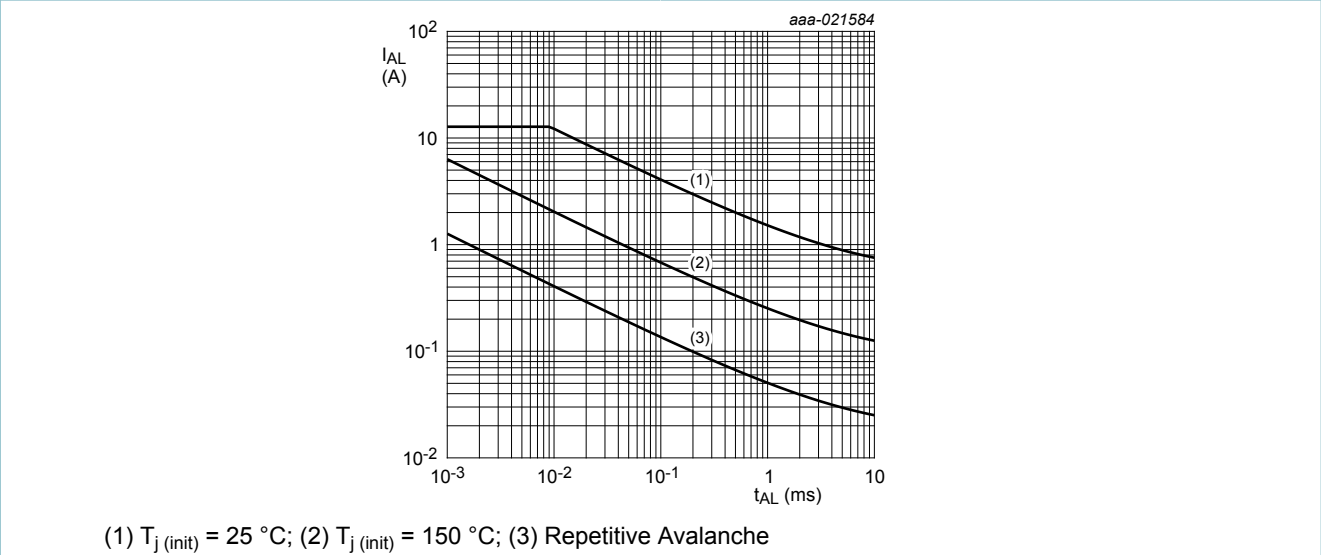
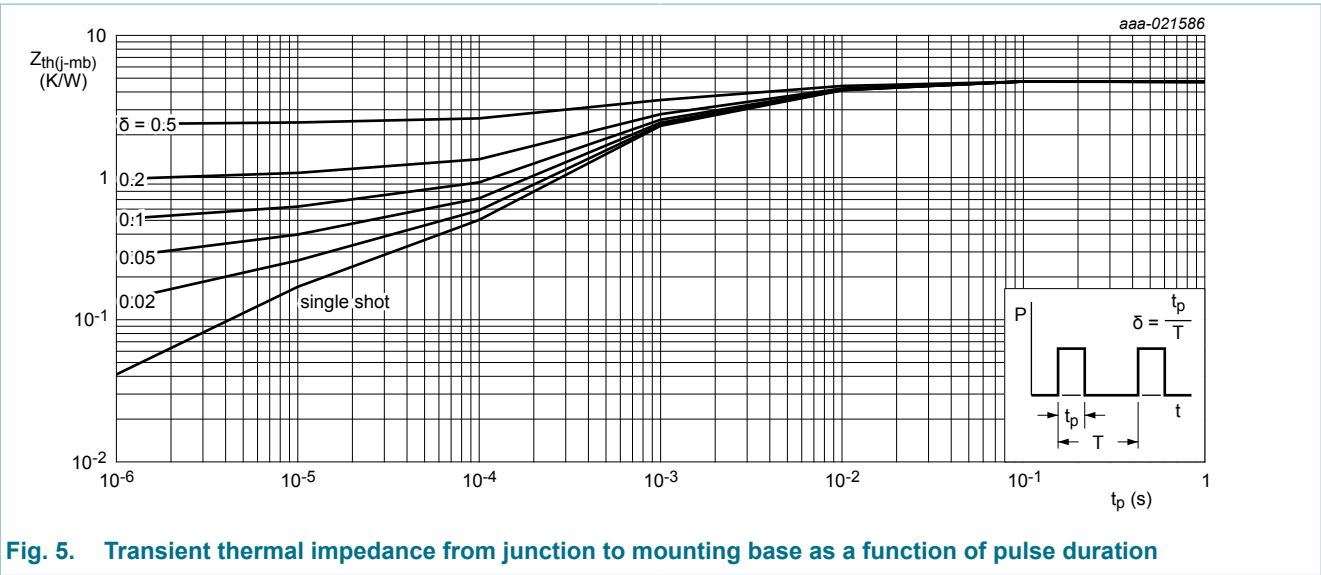


Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

## 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	-	4.27	4.8	K/W



10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C		60	-	-	V
		I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = -55 °C		54	-	-	V
V <sub>GS(th)</sub>	gate-source threshold voltage	I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = 25 °C; <a href="#">Fig. 9</a> ; <a href="#">Fig. 10</a>		1.4	1.7	2.1	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = -55 °C; <a href="#">Fig. 10</a>		-	-	2.45	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = 175 °C; <a href="#">Fig. 10</a>		0.5	-	-	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 60 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C		-	0.01	1	μA
		V <sub>DS</sub> = 60 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 175 °C		-	-	500	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 10 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C		-	2	100	nA
		V <sub>GS</sub> = -10 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C		-	2	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 5 V; I <sub>D</sub> = 5 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 11</a>		-	68	85	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 5 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 11</a>		-	59	73	mΩ
		V <sub>GS</sub> = 5 V; I <sub>D</sub> = 5 A; T <sub>J</sub> = 175 °C; <a href="#">Fig. 12</a>		-	-	192	mΩ
Dynamic characteristics							
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 5 A; V <sub>DS</sub> = 48 V; V <sub>GS</sub> = 5 V; T <sub>J</sub> = 25 °C; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	4.4	-	nC
Q <sub>GS</sub>	gate-source charge			-	1.2	-	nC
Q <sub>GD</sub>	gate-drain charge			-	2	-	nC

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C <sub>iss</sub>	input capacitance	V <sub>DS</sub> = 25 V; V <sub>GS</sub> = 0 V; f = 1 MHz; T <sub>j</sub> = 25 °C; <a href="#">Fig. 15</a>		-	326	434	pF
C <sub>oss</sub>	output capacitance			-	46	55	pF
C <sub>rss</sub>	reverse transfer capacitance			-	30	41	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 45 V; R <sub>L</sub> = 5 Ω; V <sub>GS</sub> = 5 V; R <sub>G(ext)</sub> = 5 Ω; T <sub>j</sub> = 25 °C		-	5.4	-	ns
t <sub>r</sub>	rise time			-	8.4	-	ns
t <sub>d(off)</sub>	turn-off delay time			-	6.8	-	ns
t <sub>f</sub>	fall time			-	5.2	-	ns
Source-drain diode							
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 5 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 16</a>		-	0.87	1.2	V
t <sub>rr</sub>	reverse recovery time	I <sub>S</sub> = 5 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 25 V; T <sub>j</sub> = 25 °C		-	24.8	-	ns
Q <sub>r</sub>	recovered charge			-	10.8	-	nC

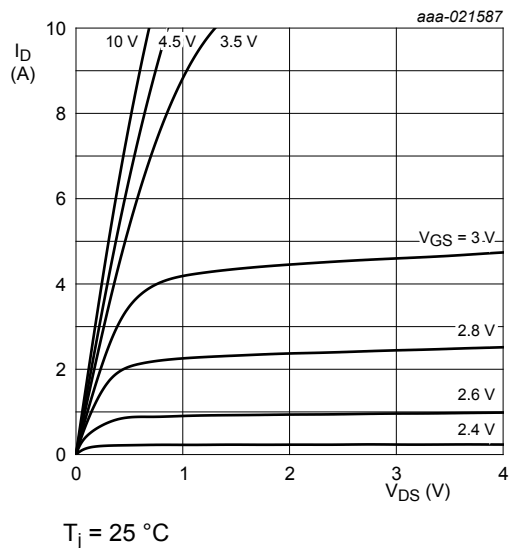


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

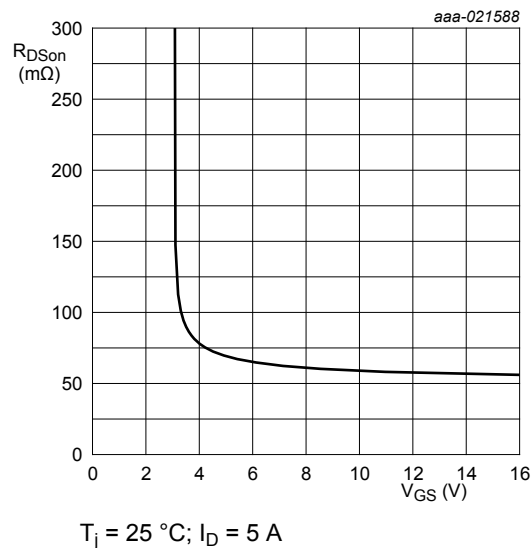


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

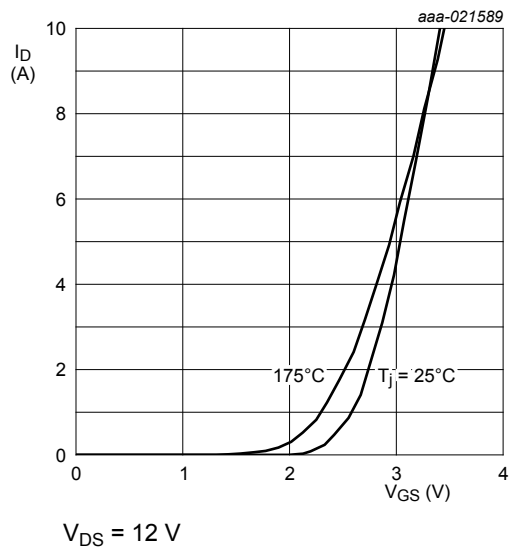


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

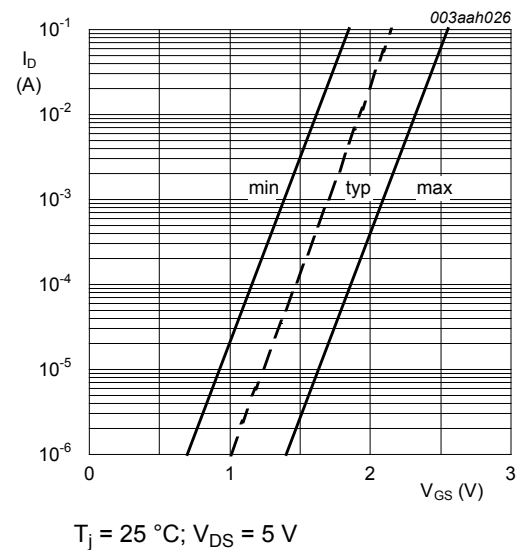


Fig. 9. Sub-threshold drain current as a function of gate-source voltage

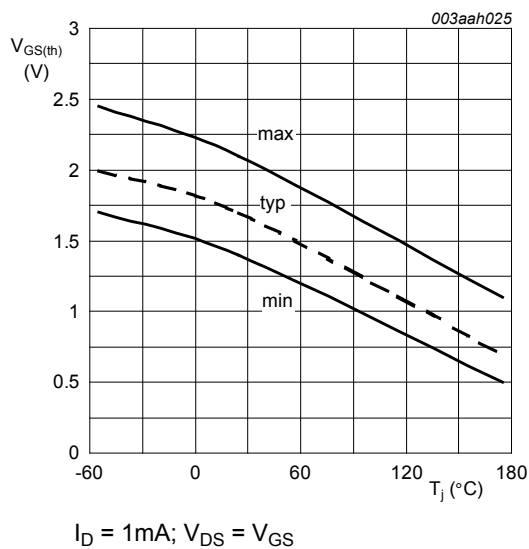


Fig. 10. Gate-source threshold voltage as a function of junction temperature

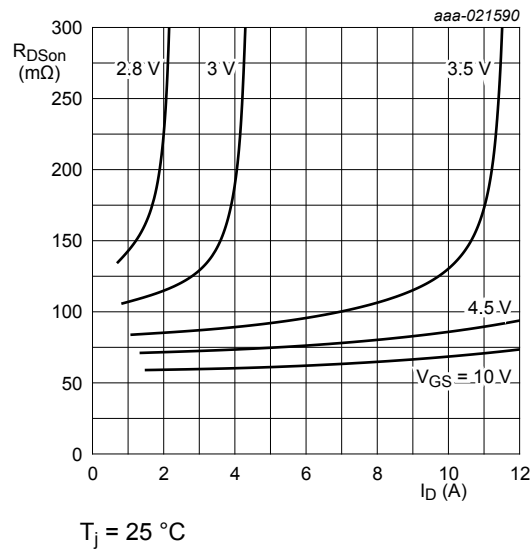


Fig. 11. Drain-source on-state resistance as a function of drain current; typical values

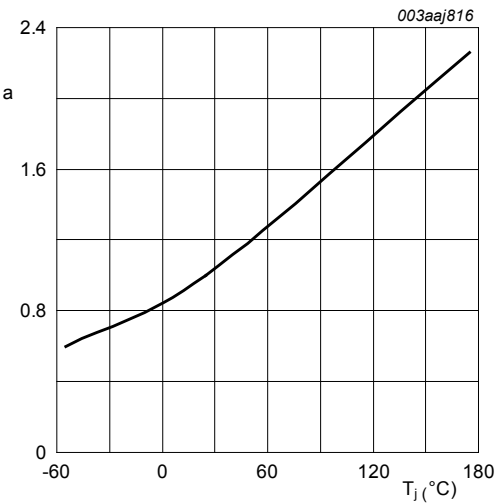
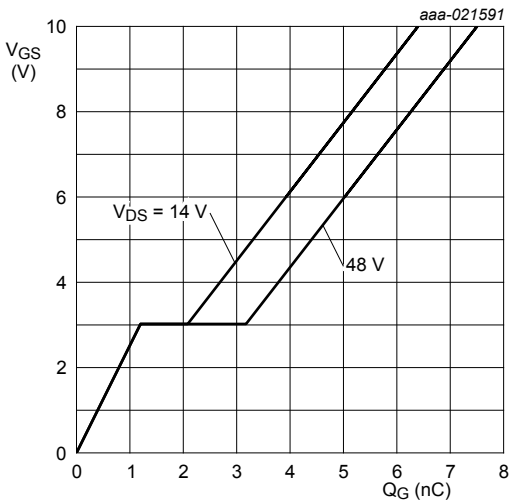


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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



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

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

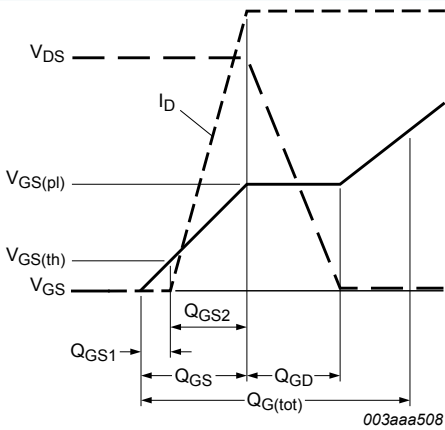
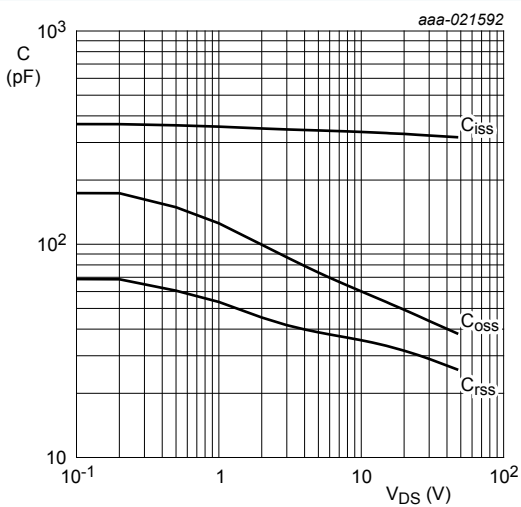
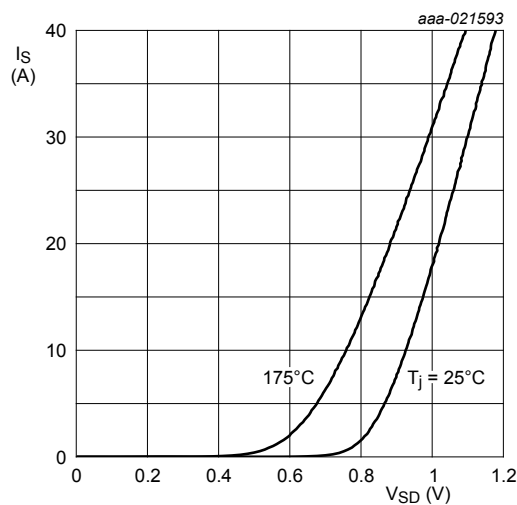


Fig. 14. Gate charge waveform definitions



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

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



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

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

## 11. Application information

For guidance on how to use and understand this datasheet, please refer to application note [AN11158](#) "Understanding power MOSFET datasheet parameters".



12. Package outline

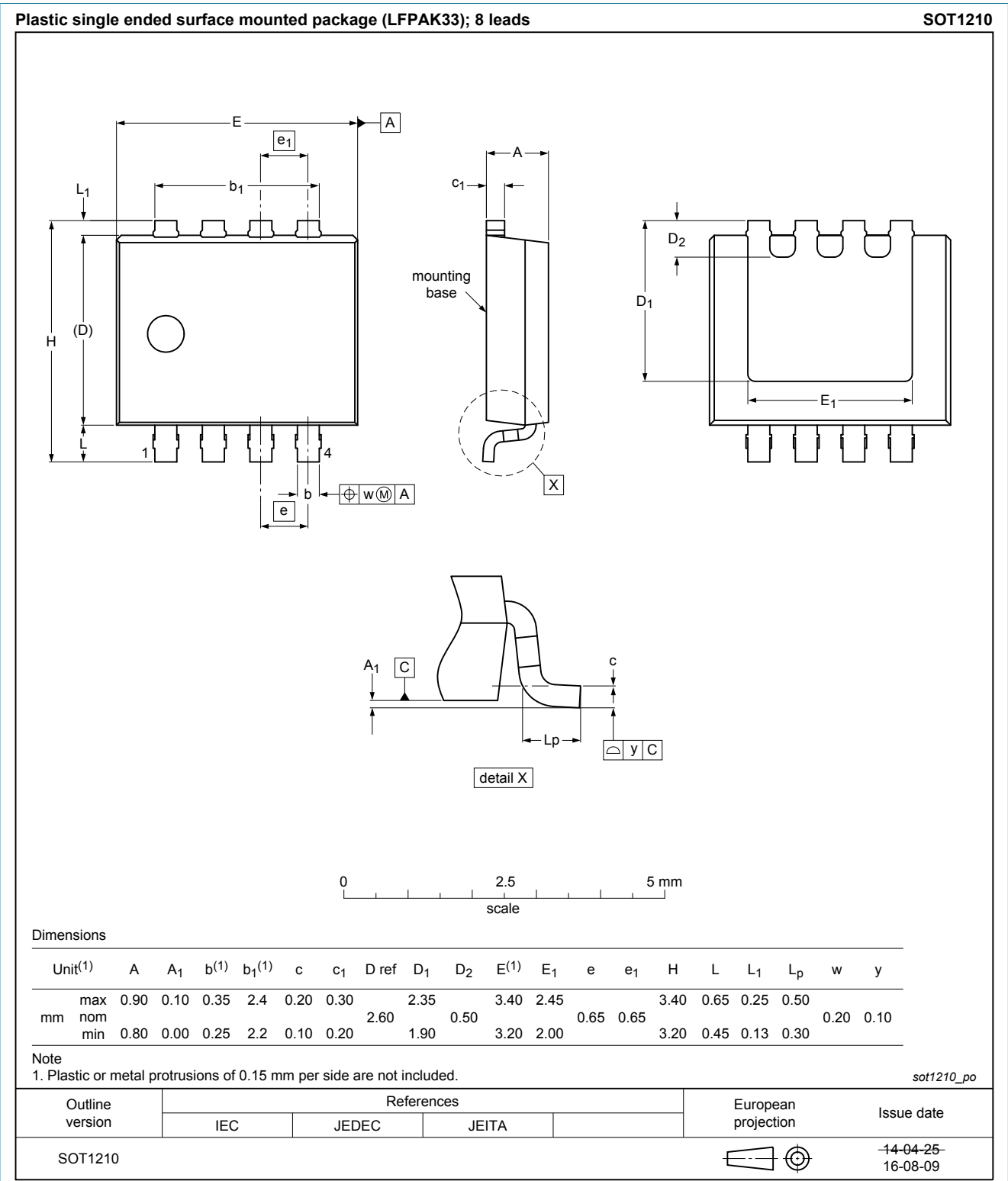


Fig. 17. Package outline LPAK33 (SOT1210)

## 13. 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.
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