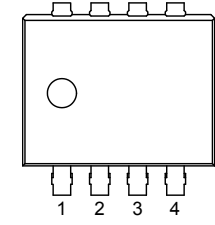
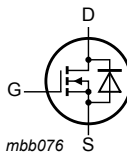


5. Pinning information

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
BUK9M12-60E	LPAK33	Plastic single ended surface mounted package (LPAK33); 8 leads	SOT1210

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK9M12-60E	91260E

8. Limiting values

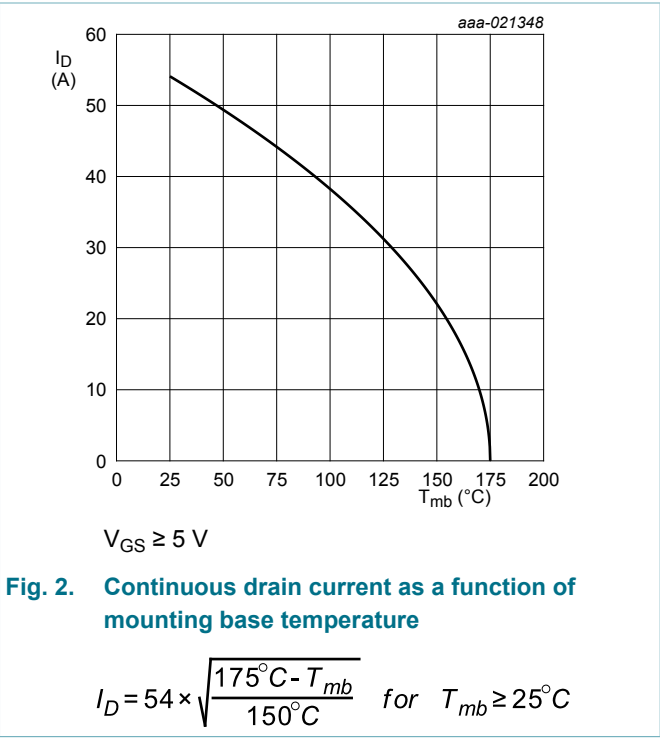
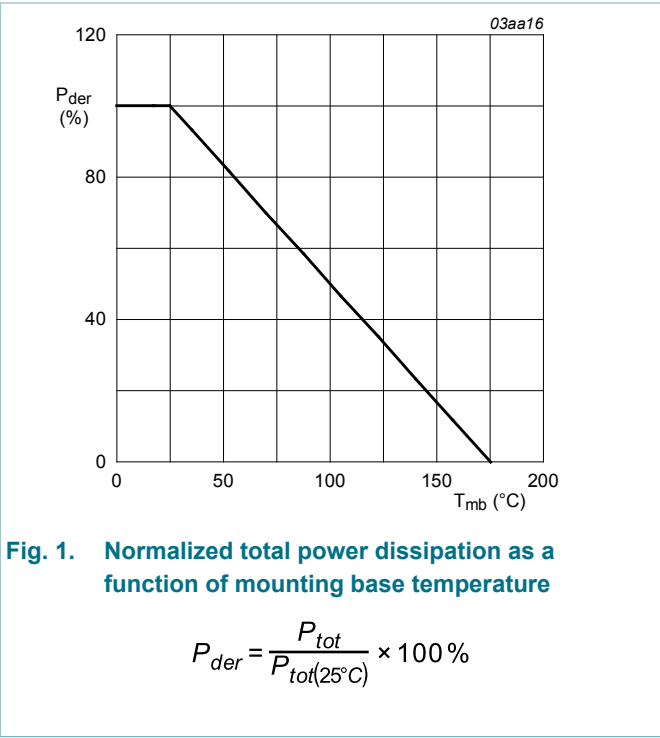
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V _{DS}	drain-source voltage	25 °C ≤ T _j ≤ 175 °C		-	60	V
V _{DGR}	drain-gate voltage	R _{GS} = 20 kΩ		-	60	V
V _{GS}	gate-source voltage	DC; T _j ≤ 175 °C		-10	10	V
		Pulsed; T _j ≤ 175 °C	[1][2]	-15	15	V
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 1		-	79	W
I _D	drain current	V _{GS} = 5 V; T _{mb} = 25 °C; Fig. 2		-	54	A
		V _{GS} = 5 V; T _{mb} = 100 °C; Fig. 2		-	38	A
I _{DM}	peak drain current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C; Fig. 3		-	216	A

Symbol	Parameter	Conditions		Min	Max	Unit
T _{stg}	storage temperature			-55	175	°C
T _j	junction temperature			-55	175	°C
Source-drain diode						
I _S	source current	T _{mb} = 25 °C		-	54	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C		-	216	A
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I _D = 54 A; V _{sup} ≤ 60 V; R _{GS} = 50 Ω; V _{GS} = 5 V; T _{j(init)} = 25 °C; unclamped; Fig. 4	[3][4]	-	50.5	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.



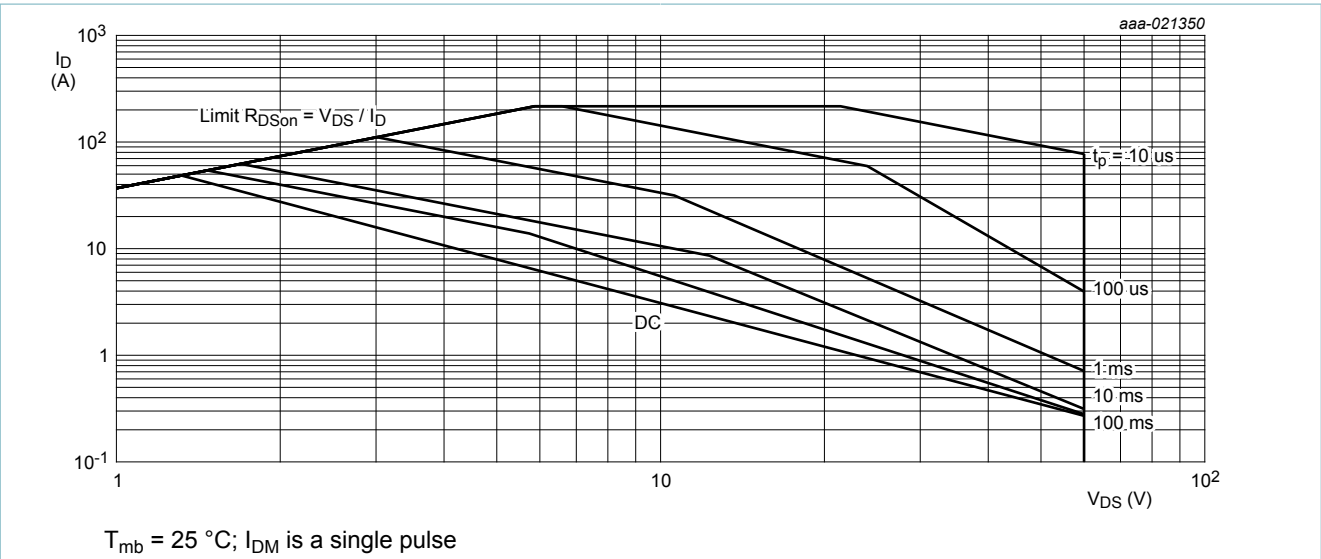


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

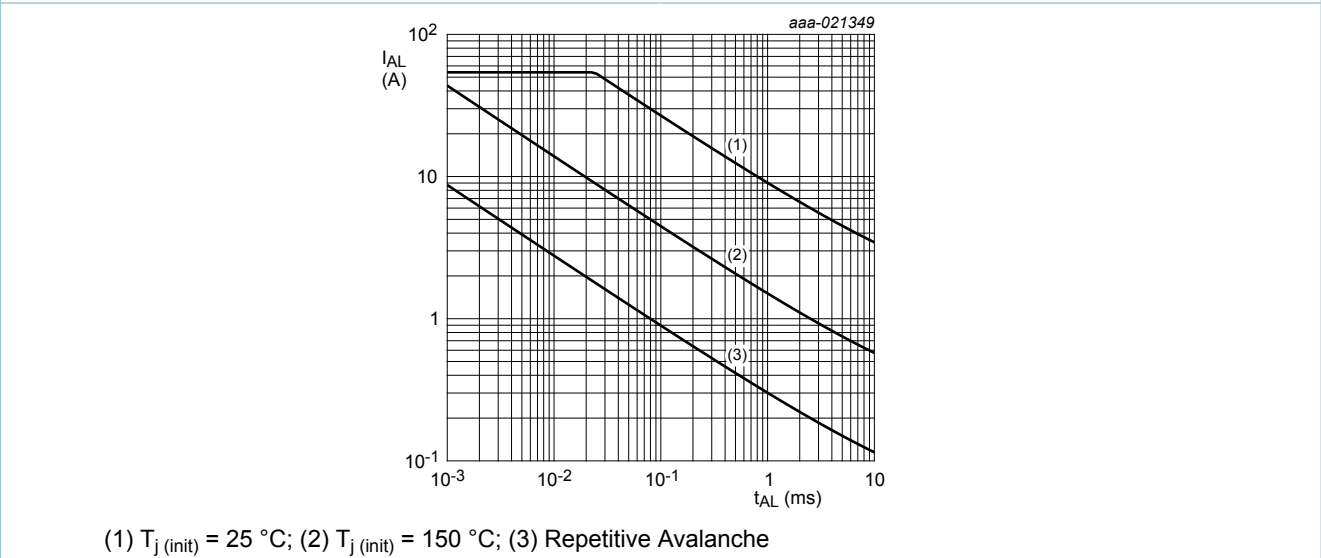
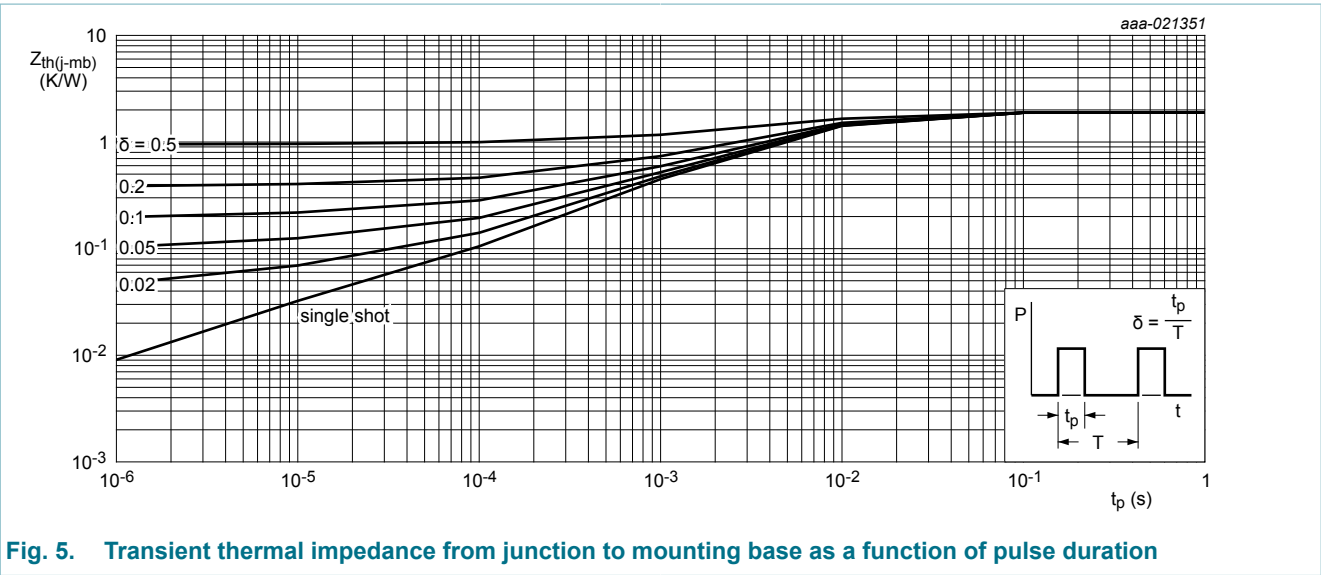


Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

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	-	1.58	1.89	K/W

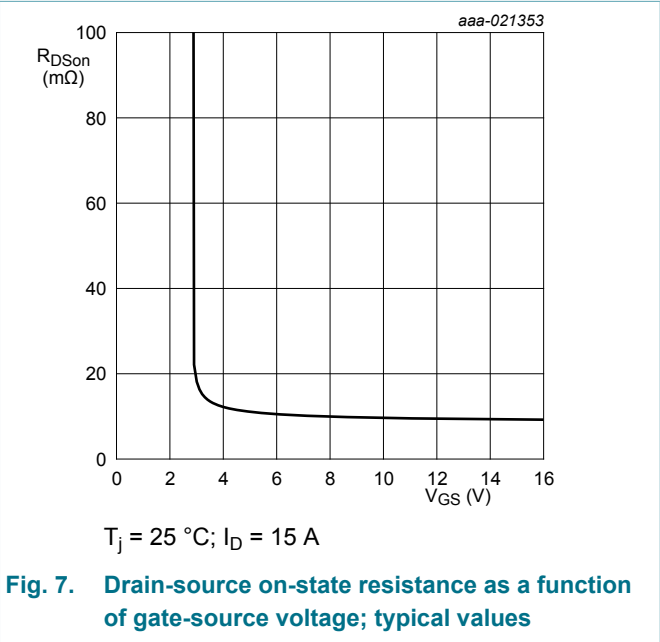
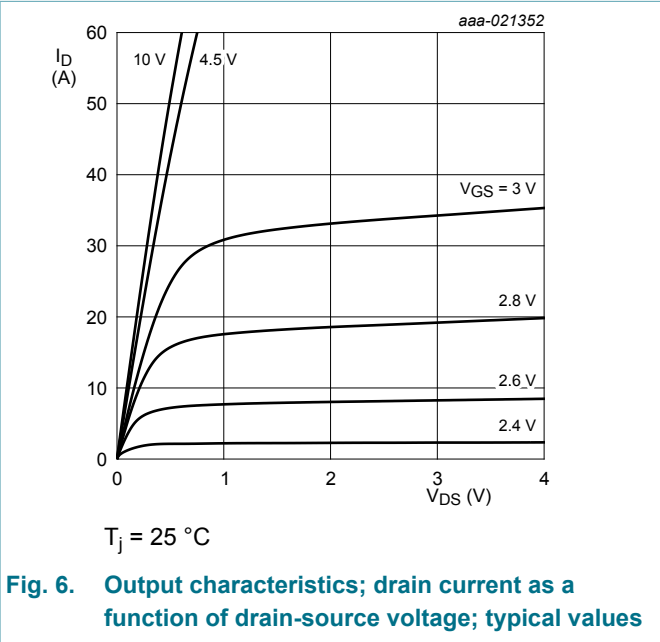


10. Characteristics

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
		I _D = 250 μA; V _{GS} = 0 V; T _J = -55 °C		54	-	-	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} = 60 V; V _{GS} = 0 V; T _J = 25 °C		-	0.02	1	μA
		V _{DS} = 60 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 = 15 A; T _J = 25 °C; Fig. 11		-	10	12	mΩ
		V _{GS} = 10 V; I _D = 15 A; T _J = 25 °C; Fig. 11		-	9	11	mΩ
		V _{GS} = 5 V; I _D = 15 A; T _J = 175 °C; Fig. 12		-	-	27	mΩ
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 15 A; V _{DS} = 48 V; V _{GS} = 5 V; T _J = 25 °C; Fig. 13 ; Fig. 14		-	21	-	nC
Q _{GS}	gate-source charge			-	5.4	-	nC

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Q _{GD}	gate-drain charge			-	7.9	-	nC
C _{iss}	input capacitance	V _{DS} = 25 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 15		-	2082	2769	pF
C _{oss}	output capacitance			-	195	234	pF
C _{rss}	reverse transfer capacitance			-	101	138	pF
t _{d(on)}	turn-on delay time	V _{DS} = 45 V; R _L = 3 Ω; V _{GS} = 5 V; R _{G(ext)} = 5 Ω; T _j = 25 °C		-	12.1	-	ns
t _r	rise time			-	21.3	-	ns
t _{d(off)}	turn-off delay time			-	26.5	-	ns
t _f	fall time			-	17.4	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 15 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 16		-	0.82	1.2	V
t _{rr}	reverse recovery time	I _S = 15 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 25 V; T _j = 25 °C		-	20.1	-	ns
Q _r	recovered charge			-	16.5	-	nC



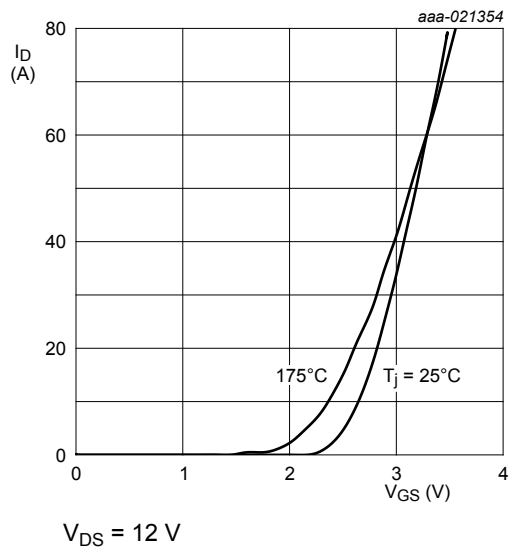


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

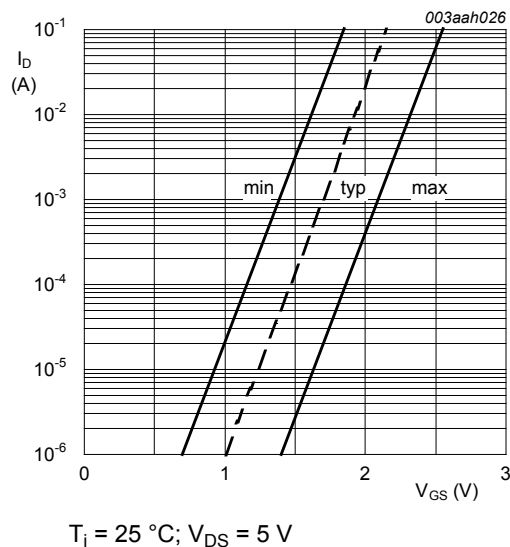


Fig. 9. Sub-threshold drain current as a function of gate-source voltage

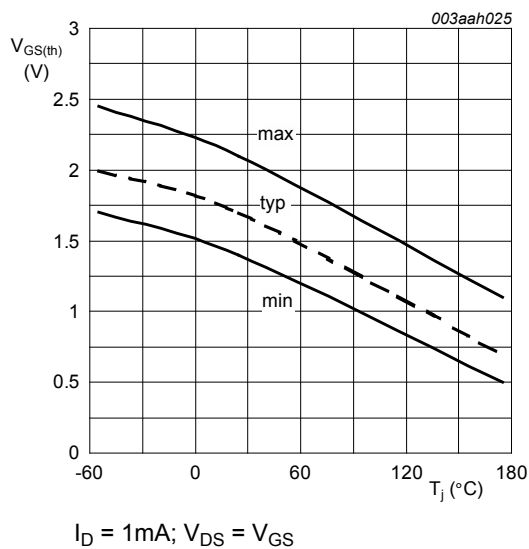


Fig. 10. Gate-source threshold voltage as a function of junction temperature

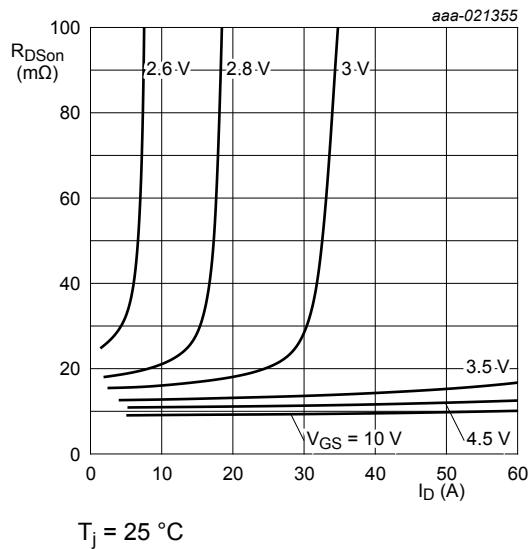


Fig. 11. Drain-source on-state resistance as a function of drain current; typical values

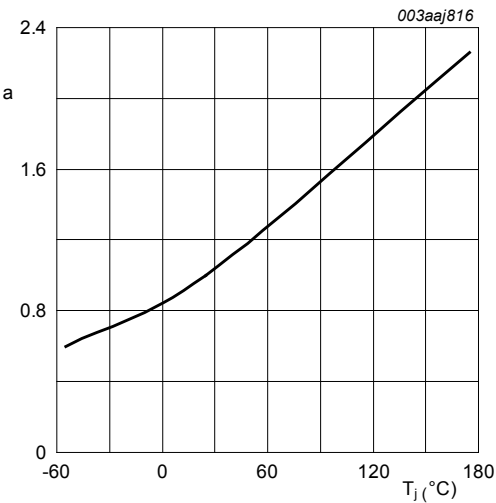
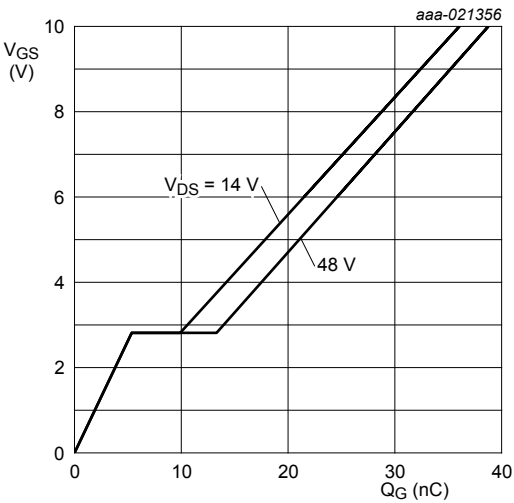


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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



$T_j = 25^{\circ}C$; $I_D = 15\text{ A}$

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

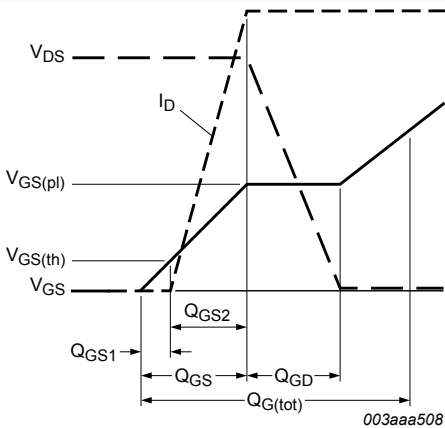
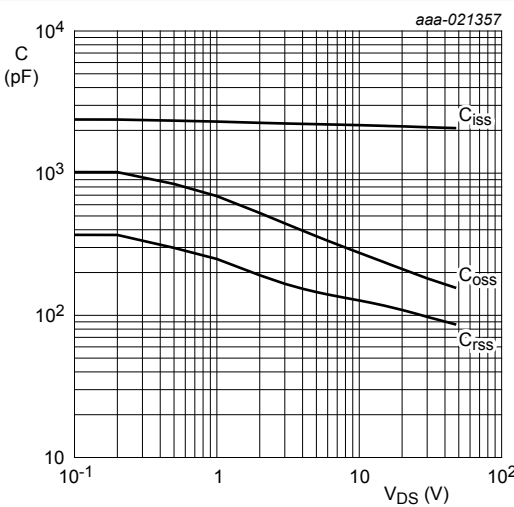
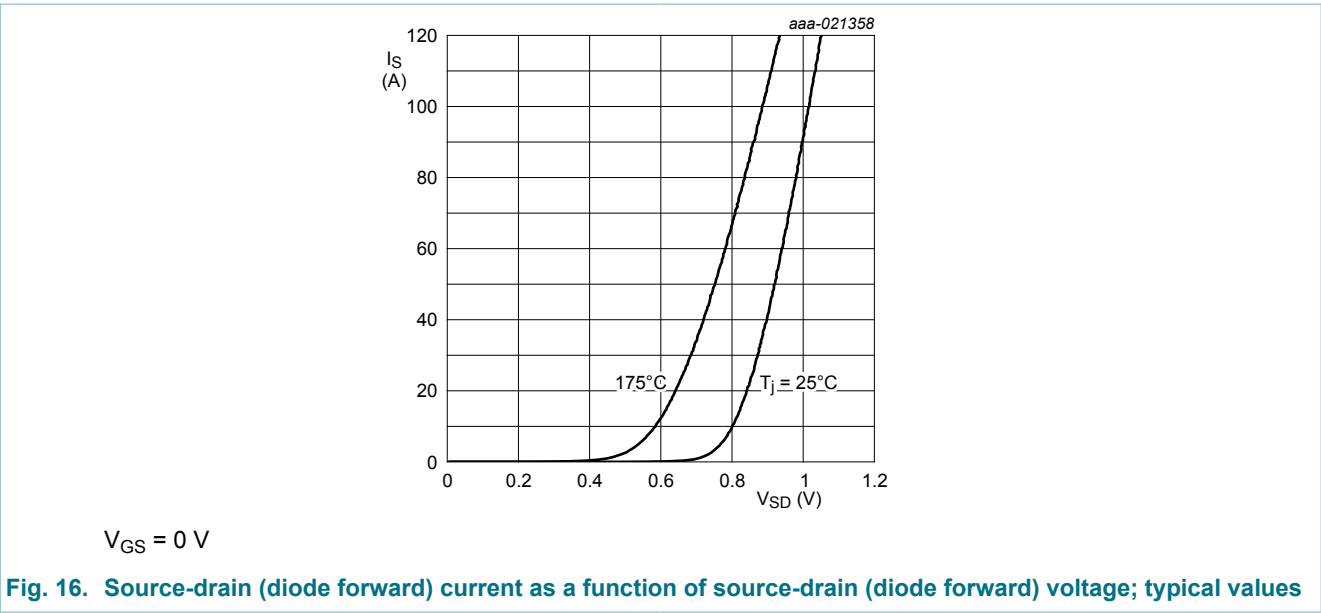


Fig. 14. Gate charge waveform definitions



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

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



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

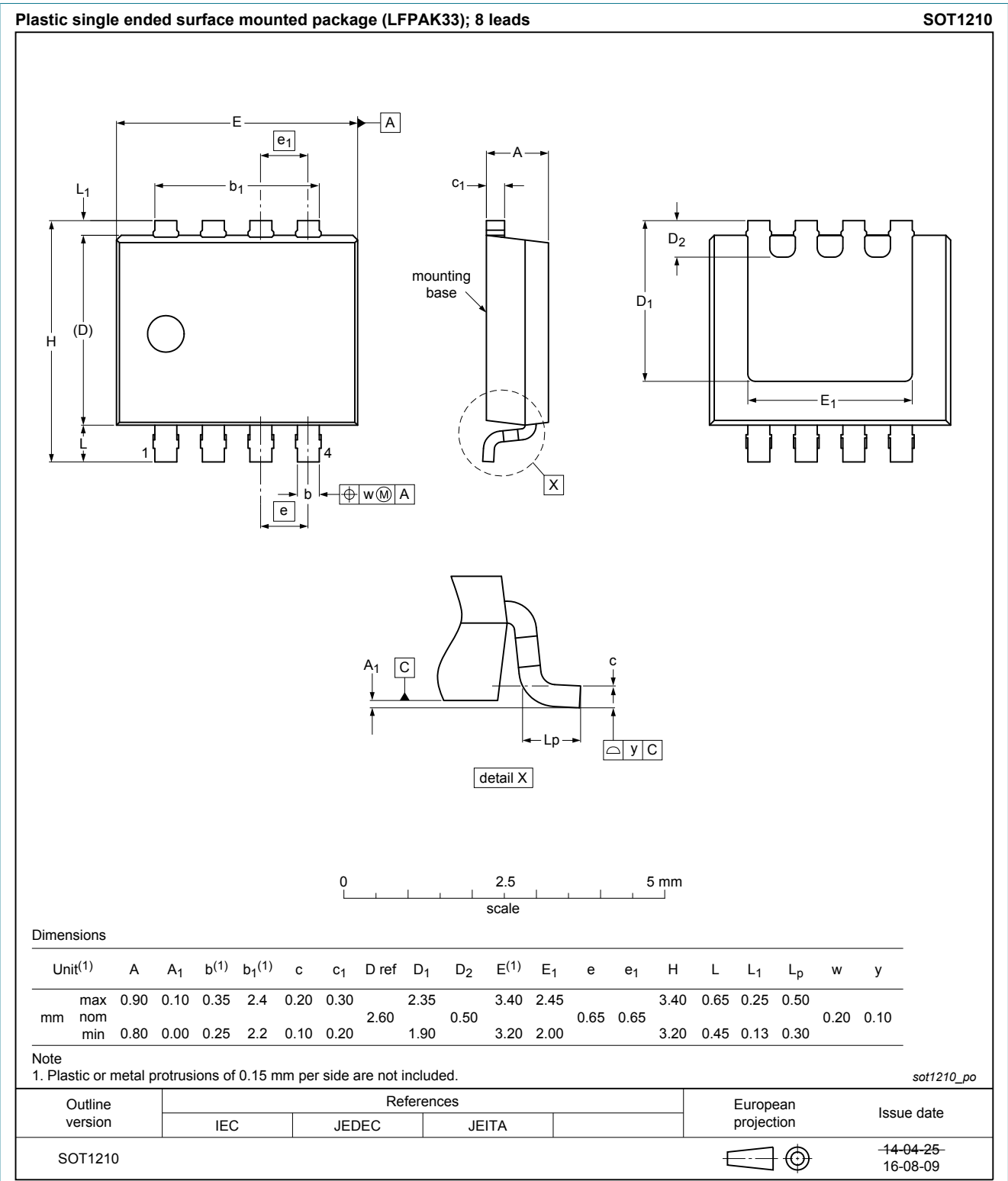


Fig. 17. Package outline LPAK33 (SOT1210)

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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