



PSMN040-100MSE

N-channel 100 V 36.6 mΩ standard level MOSFET in LFPAK33 designed specifically for high power PoE applications

26 March 2013

Product data sheet

1. General description

New standards and proprietary approaches are enabling Power-over-Ethernet (PoE) systems capable of delivering up to 90W to each powered device (PD). Such solutions place increased demands on the power sourcing equipment (PSE) in terms of “soft-start”, thermal management and power density requirements.

2. Features and benefits

- Enhanced forward biased safe operating area for superior linear mode operation
- Low R_{DSon} for low conduction losses
- Ultra reliable LFPAK33 package for superior thermal and ruggedness performance
- Very low I_{DSS}

3. Applications

- High power PoE applications (60W and higher)
- IEEE802.3at and proprietary solutions

4. Quick reference data

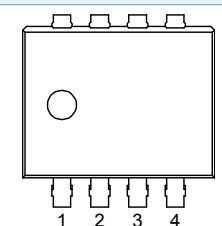
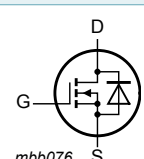
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	100	V
I_D	drain current	$T_j = 25\text{ °C}; V_{GS} = 10\text{ V}; \text{Fig. 1}$	-	-	30	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}; \text{Fig. 2}$	-	-	91	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 10\text{ A}; T_j = 25\text{ °C}; \text{Fig. 13}$	-	29.4	36.6	mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 10\text{ A}; V_{DS} = 50\text{ V}; T_j = 25\text{ °C}; \text{Fig. 14}; \text{Fig. 15}$	-	10.7	-	nC
$Q_{G(tot)}$	total gate charge		-	30	-	nC
Avalanche Ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C}; I_D = 30\text{ A}; V_{sup} \leq 100\text{ V}; R_{GS} = 50\text{ }\Omega; \text{unclamped}; \text{Fig. 3}$	-	-	54	mJ

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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>LFAK33 (SOT1210)</p>	
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
PSMN040-100MSE	LFAK33	Plastic single ended surface mounted package (LFAK33); 4 leads	SOT1210

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN040-100MSE	M40E10

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	$T_j \geq 25\text{ }^\circ\text{C}$; $T_j \leq 175\text{ }^\circ\text{C}$	-	100	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ }^\circ\text{C}$; $T_j \leq 175\text{ }^\circ\text{C}$; $R_{GS} = 20\text{ k}\Omega$	-	100	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 1	-	30	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ }^\circ\text{C}$; Fig. 1	-	21	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ }^\circ\text{C}$; Fig. 4	-	121	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ }^\circ\text{C}$; Fig. 2	-	91	W
T_{stg}	storage temperature		-55	175	$^\circ\text{C}$

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Symbol	Parameter	Conditions		Min	Max	Unit
T_j	junction temperature			-55	175	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
Source-drain diode						
I_S	source current	$T_{mb} = 25\text{ °C}$	[1]	-	70	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\ \mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	121	A
Avalanche Ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 30\text{ A}$; $V_{sup} \leq 100\text{ V}$; $R_{GS} = 50\ \Omega$; unclamped; Fig. 3		-	54	mJ

[1] Continuous current is limited by package.

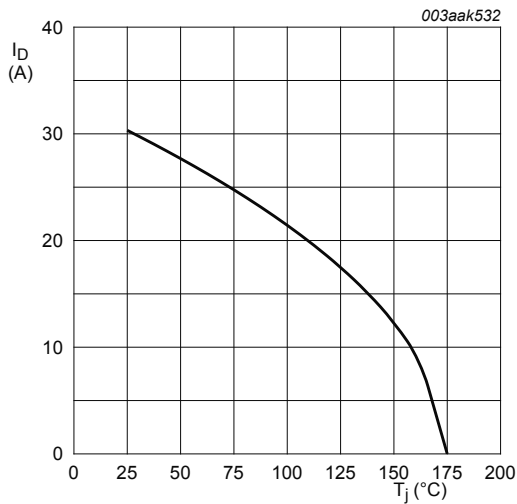


Fig. 1. Continuous drain current as a function of mounting base temperature

$$V_{GS} \geq 10V$$

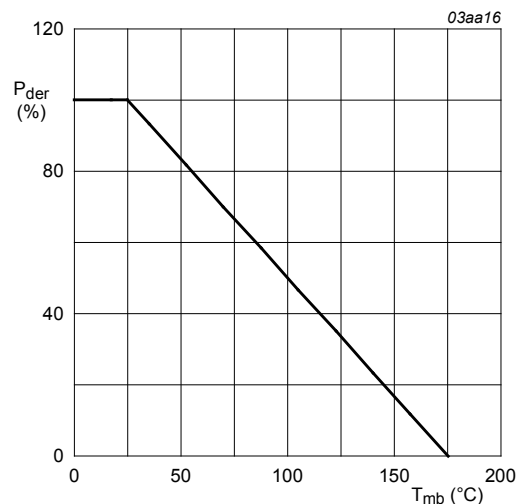


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

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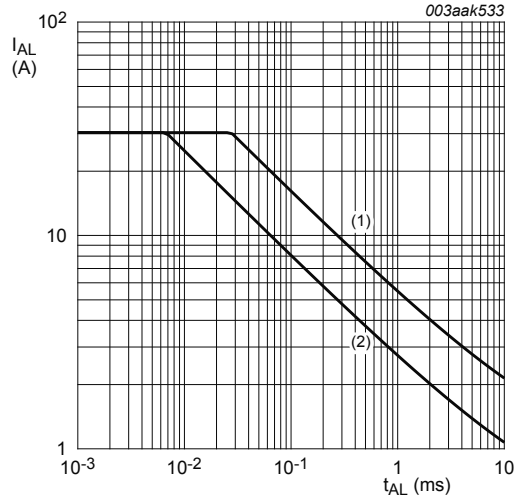


Fig. 3. Single pulse avalanche rating; avalanche current as a function of avalanche time

(1) $T_{j (init)} = 25^{\circ}C$; (2) $T_{j (init)} = 100^{\circ}C$

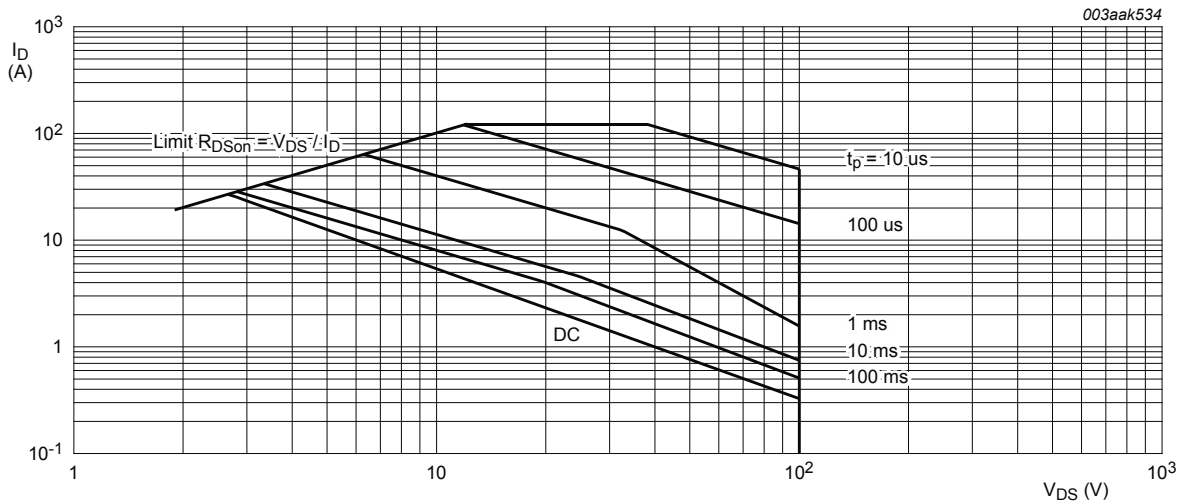


Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

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	-	1.44	1.65	K/W

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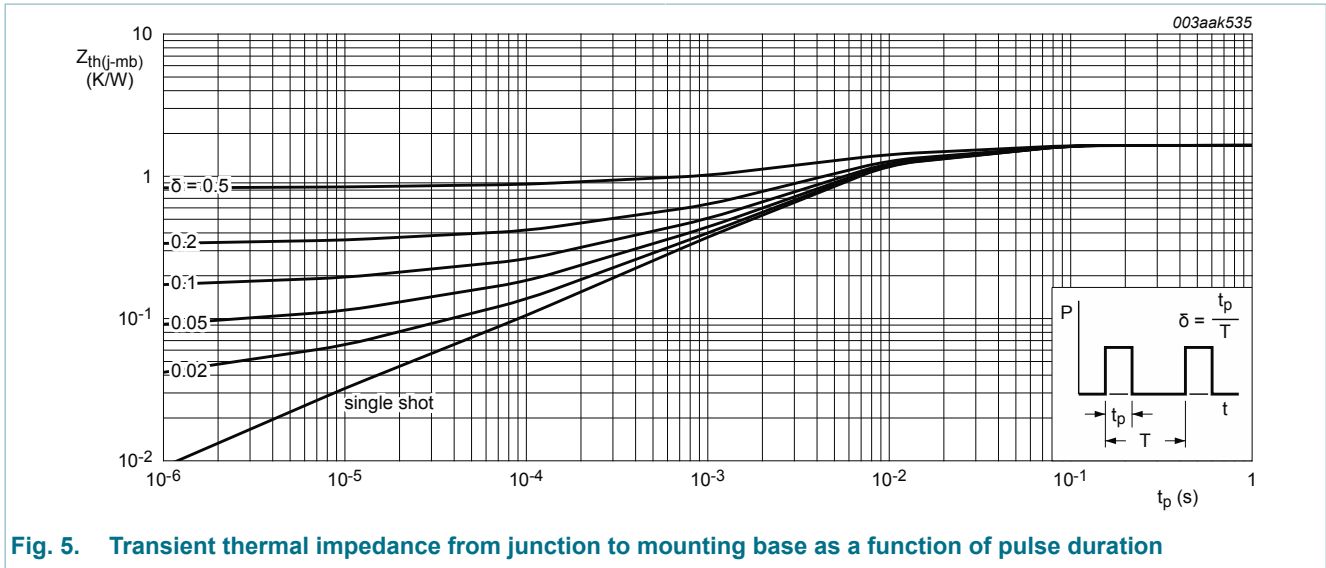


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	100	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	90	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C;$ Fig. 10; Fig. 11	2.3	3.3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C;$ Fig. 10	-	-	4.6	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C;$ Fig. 10	1	-	-	V
I_{DSS}	drain leakage current	$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	0.05	1	μA
		$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ C$	-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	10	100	nA
		$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	10	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 10 \text{ A}; T_j = 100 \text{ }^\circ C;$ Fig. 12; Fig. 13	-	-	66	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 10 \text{ A}; T_j = 175 \text{ }^\circ C;$ Fig. 12; Fig. 13	-	-	99	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 10 \text{ A}; T_j = 25 \text{ }^\circ C;$ Fig. 13	-	29.4	36.6	mΩ
R_G	gate resistance	$f = 10 \text{ MHz}$	-	1.65	-	Ω

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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
Q _{G(tot)}	total gate charge	I _D = 10 A; V _{DS} = 50 V; V _{GS} = 10 V; T _j = 25 °C; Fig. 14 ; Fig. 15	-	30	-	nC
		I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V; T _j = 25 °C	-	24	-	nC
Q _{GS}	gate-source charge	I _D = 10 A; V _{DS} = 50 V; V _{GS} = 10 V; T _j = 25 °C; Fig. 14 ; Fig. 15	-	7.6	-	nC
Q _{GS(th)}	pre-threshold gate-source charge		-	4.5	-	nC
Q _{GS(th-pl)}	post-threshold gate-source charge		-	3.1	-	nC
Q _{GD}	gate-drain charge		-	10.7	-	nC
V _{GS(pl)}	gate-source plateau voltage	I _D = 10 A; V _{DS} = 50 V; T _j = 25 °C; Fig. 14 ; Fig. 15	-	5.6	-	V
C _{iss}	input capacitance	V _{DS} = 50 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 16	-	1470	-	pF
C _{oss}	output capacitance		-	110	-	pF
C _{rss}	reverse transfer capacitance		-	80	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 50 V; R _L = 5 Ω; V _{GS} = 10 V; R _{G(ext)} = 5 Ω; T _j = 25 °C	-	8.3	-	ns
t _r	rise time		-	14.1	-	ns
t _{d(off)}	turn-off delay time		-	18.7	-	ns
t _f	fall time		-	13	-	ns
Source-drain diode						
V _{SD}	source-drain voltage	I _S = 20 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 17	-	0.82	1.2	V
t _{rr}	reverse recovery time	I _S = 10 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 50 V; T _j = 25 °C	-	41	-	ns
Q _r	recovered charge		-	75	-	nC

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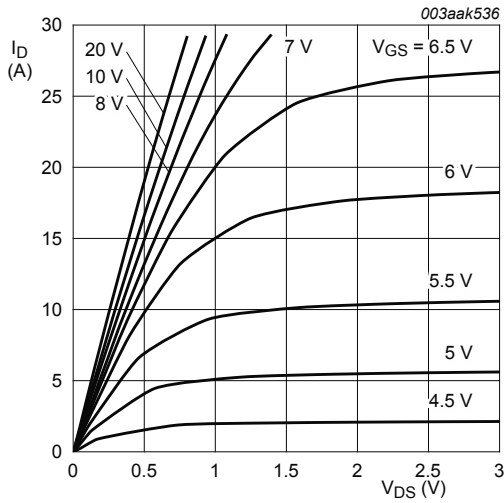


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

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

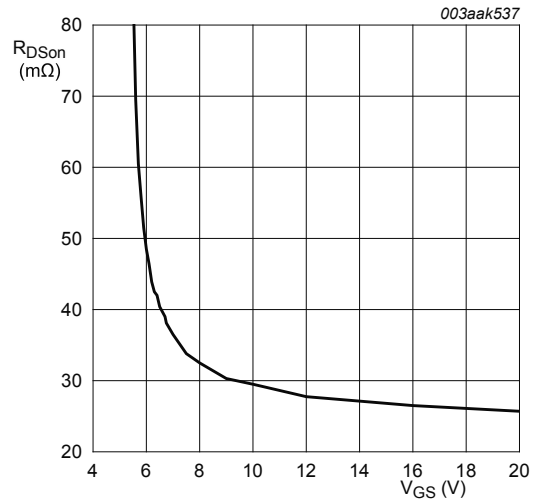


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25^\circ\text{C}; I_D = 10\text{A}$

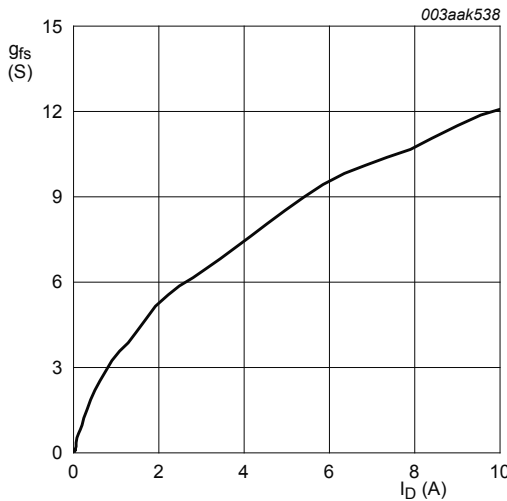


Fig. 8. Forward transconductance as a function of drain current; typical values

$T_j = 25^\circ\text{C}; V_{DS} = 10\text{V}$

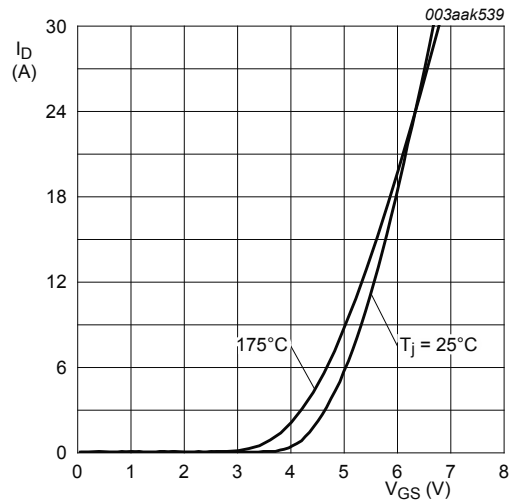


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

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

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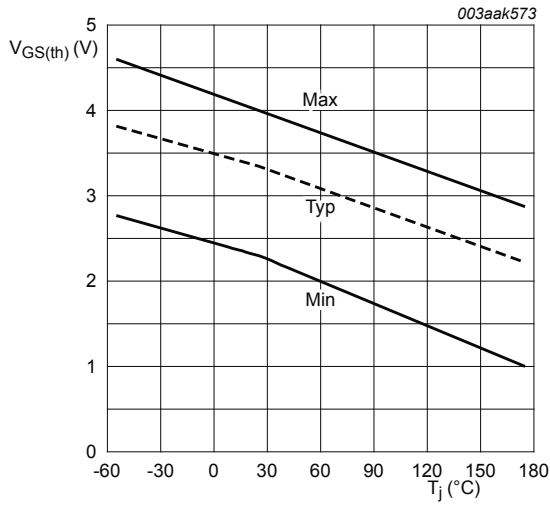


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

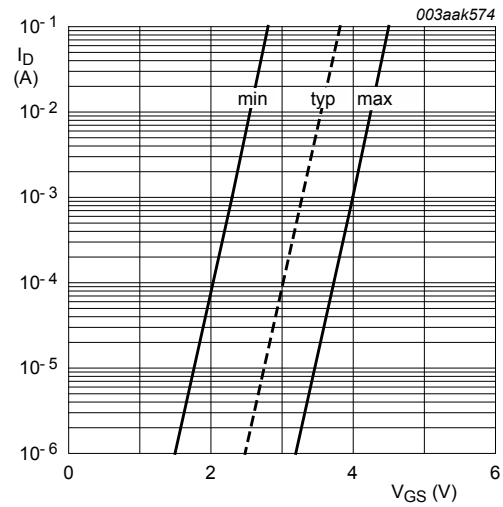


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

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

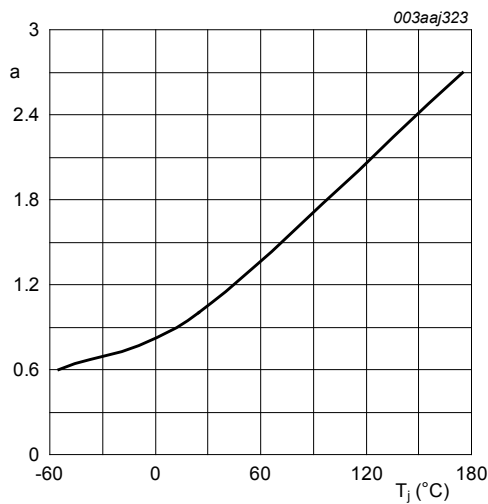


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

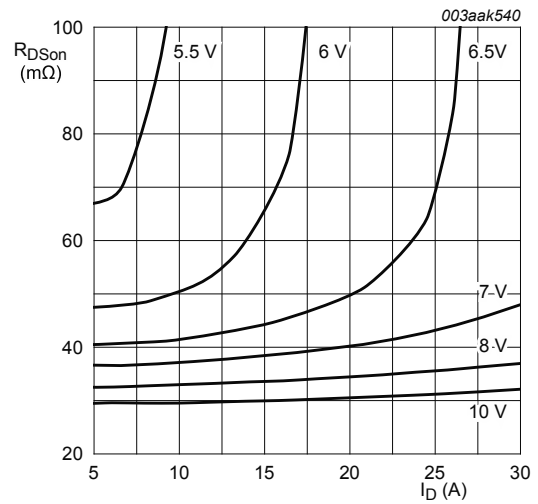


Fig. 13. Drain-source on-state resistance as a function of drain current; typical values

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

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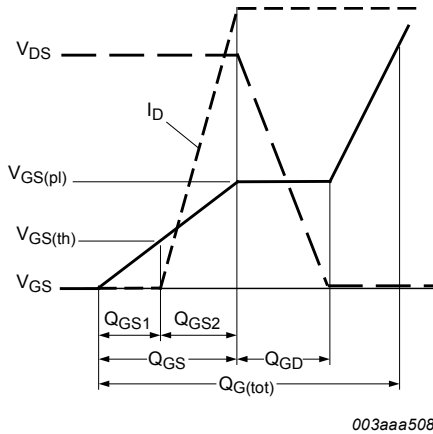


Fig. 14. Gate charge waveform definitions

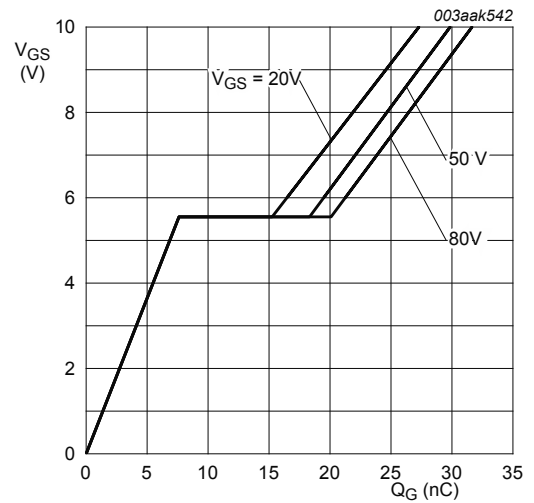


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25^\circ\text{C}; I_D = 10\text{A}$

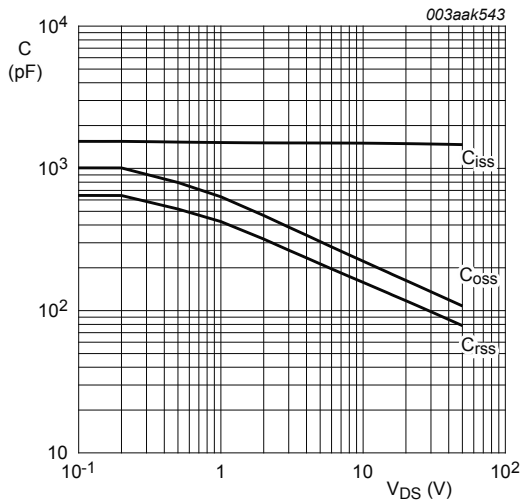


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

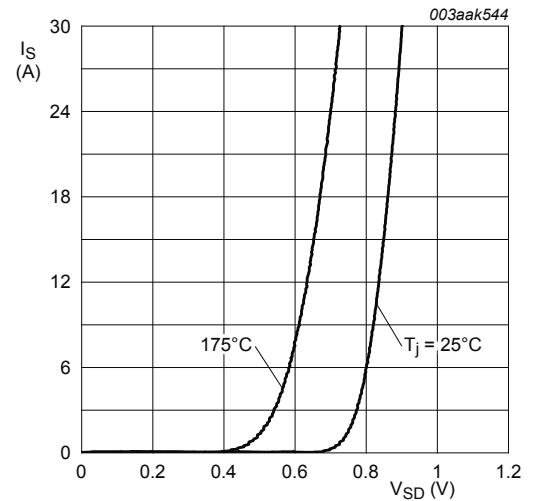


Fig. 17. Source current as a function of source-drain voltage; typical values

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

11. Package outline

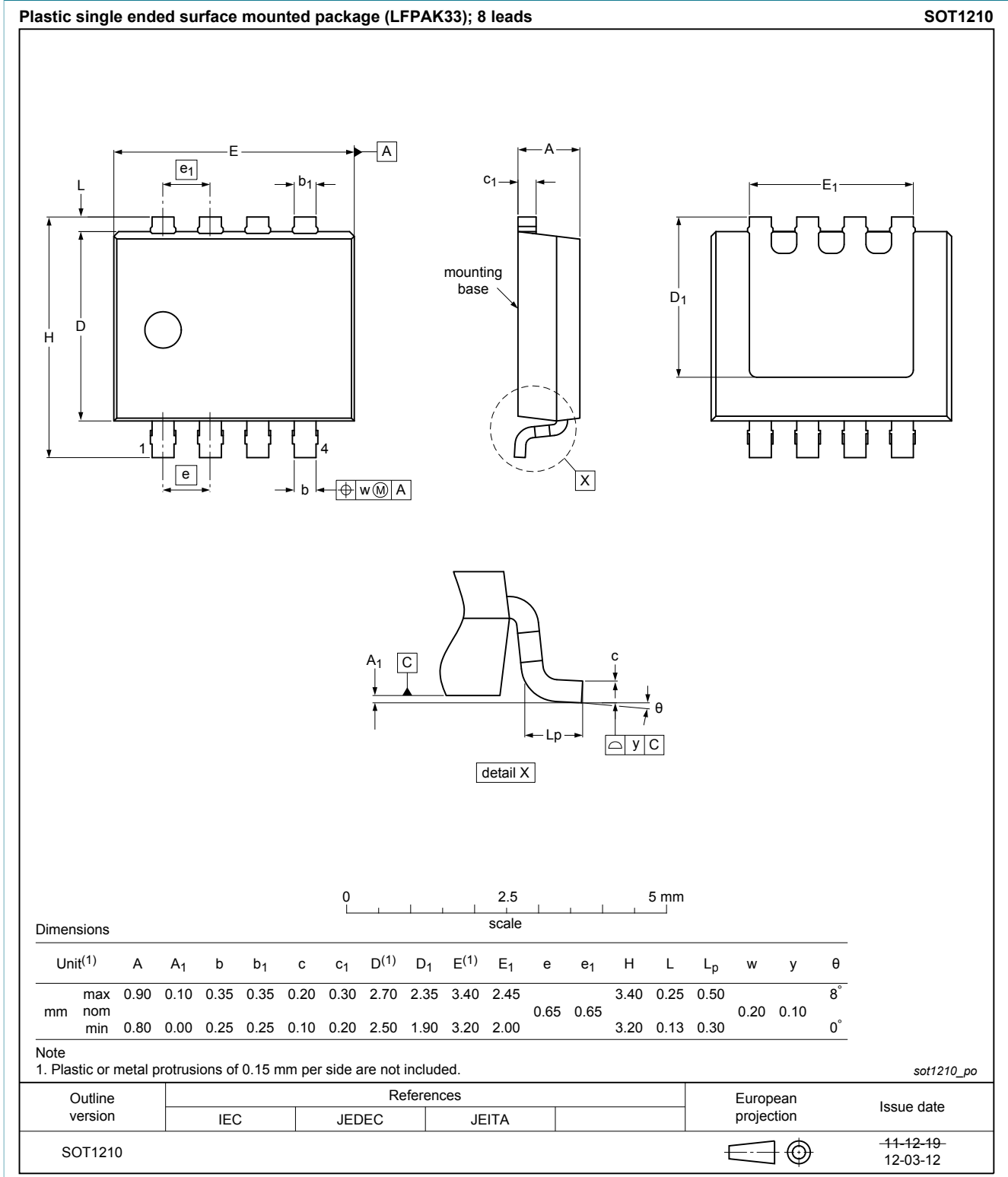


Fig. 18. Package outline LPAK33 (SOT1210)

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12. Legal information

12.1 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.

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