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Team Nexperia



PSMN7R5-30MLD

N-channel 30 V, 7.5 mΩ logic level MOSFET in LFPAK33
using NextPowerS3 Technology

11 August 2015

Product data sheet

1. General description

Logic level gate drive N-channel enhancement mode MOSFET in LFPAK33 package. NextPowerS3 portfolio utilising NXP's unique "SchottkyPlus" technology delivers high efficiency, low spiking performance usually associated with MOSFETs with an integrated Schottky or Schottky-like diode but without problematic high leakage current. NextPowerS3 is particularly suited to high efficiency applications at high switching frequencies.

2. Features and benefits

- Ultra low Q_G , Q_{GD} and Q_{OSS} for high system efficiency, especially at higher switching frequencies
- Superfast switching with soft-recovery; s-factor > 1
- Low spiking and ringing for low EMI designs
- Unique "SchottkyPlus" technology; Schottky-like performance with < 1 μA leakage at 25 °C
- Optimised for 4.5 V gate drive
- Low parasitic inductance and resistance
- High reliability clip bonded and solder die attach Mini Power SO8 package; no glue, no wire bonds, qualified to 175 °C
- Exposed leads for optimal visual solder inspection

3. Applications

- On-board DC-to-DC solutions for server and telecommunications
- Secondary-side synchronous rectification in telecommunication applications
- Voltage regulator modules (VRM)
- Point-of-Load (POL) modules
- Power delivery for V-core, ASIC, DDR, GPU, VGA and system components
- Brushed and brushless motor control

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	25 °C $\leq T_j \leq$ 175 °C	-	-	30	V
I_D	drain current	$T_{mb} = 25$ °C; $V_{GS} = 10$ V; Fig. 2	-	-	57	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; Fig. 1	-	-	45	W

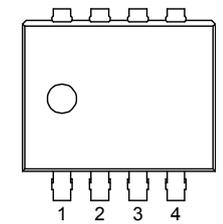
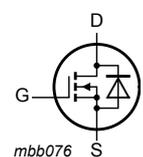


N-channel 30 V, 7.5 mΩ logic level MOSFET in LFAK33 using NextPowerS3 Technology

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_j	junction temperature		-55	-	175	°C
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 10\text{ A}; T_j = 25\text{ °C};$ Fig. 10	-	8.2	10.3	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ °C};$ Fig. 10	-	6.3	7.6	mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 4.5\text{ V}; I_D = 15\text{ A}; V_{DS} = 15\text{ V};$ Fig. 12; Fig. 13	-	1.7	2.5	nC
$Q_{G(tot)}$	total gate charge	$V_{GS} = 4.5\text{ V}; I_D = 15\text{ A}; V_{DS} = 15\text{ V};$ Fig. 12; Fig. 13	-	5.8	8.8	nC
Source-drain diode						
S	softness factor	$I_S = 15\text{ A}; V_{GS} = 0\text{ V}; di_S/dt = -100\text{ A}/\mu\text{s};$ $V_{DS} = 15\text{ V};$ Fig. 16	-	1.2	-	

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>LFAK33 (SOT1210)</p>	 <p>mbb076</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
PSMN7R5-30MLD	LFAK33	Plastic single ended surface mounted package (LFAK33); 8 leads	SOT1210

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN7R5-30MLD	7D530L

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	$25\text{ °C} \leq T_j \leq 175\text{ °C}$		-	30	V
V_{DGR}	drain-gate voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$		-	30	V
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 1		-	45	W
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 2		-	57	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; Fig. 2		-	40	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; Fig. 3		-	230	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						
I_S	source current	$T_{mb} = 25\text{ °C}$		-	38	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	230	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 15\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped; $t_p = 97\text{ }\mu\text{s}$	[1]	-	28.3	mJ

[1] Protected by 100% test

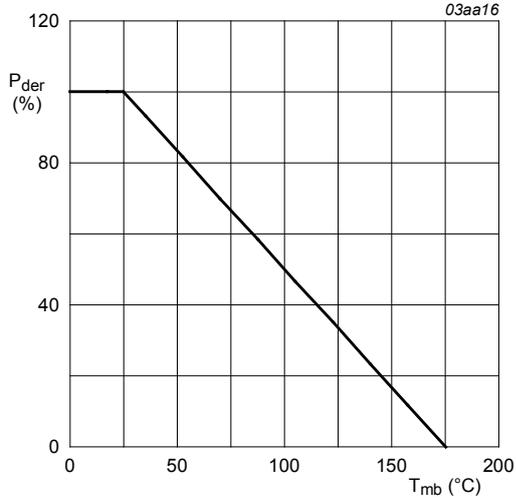


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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

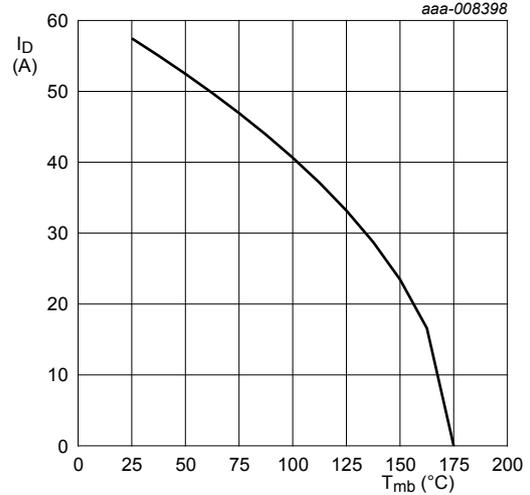


Fig. 2. Continuous drain current as a function of mounting base temperature

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

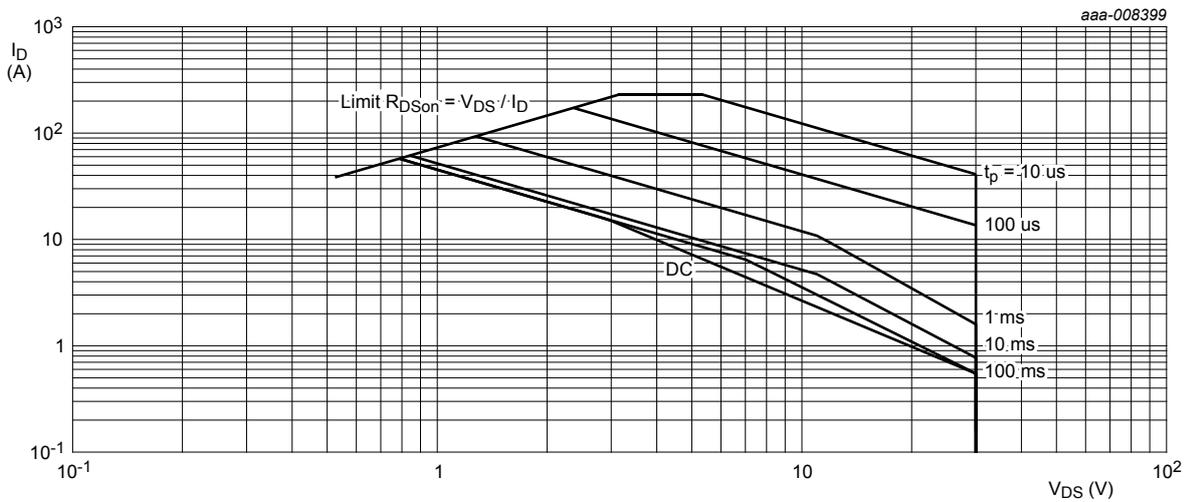


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

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. 4	-	3.1	3.32	K/W

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	Fig. 5	-	57	-	K/W
		Fig. 6	-	178	-	K/W

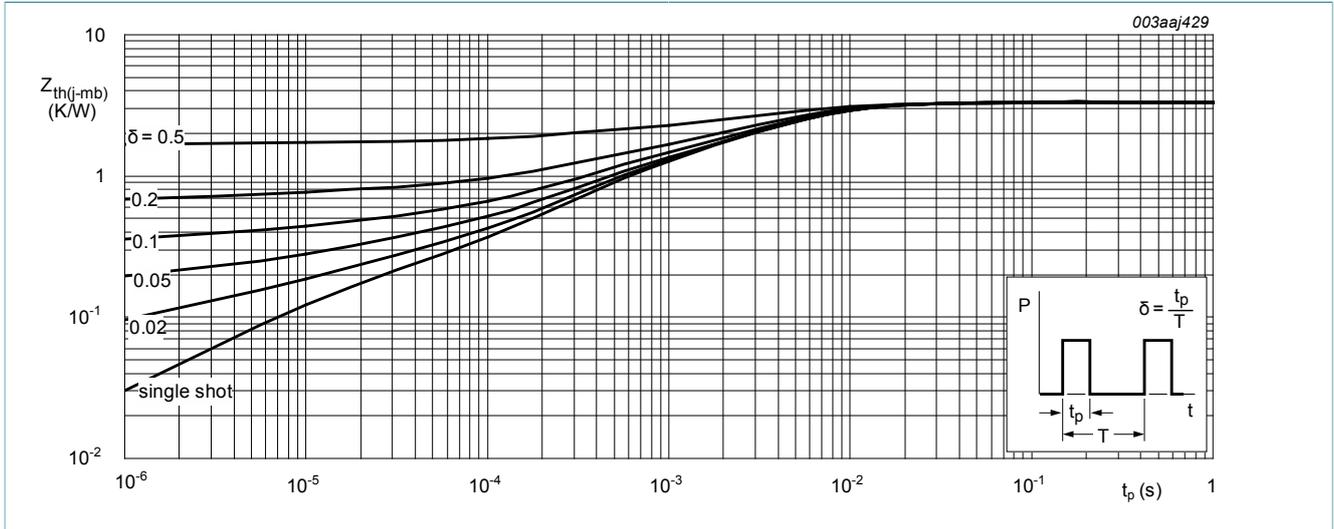


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

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Fig. 5. PCB layout for thermal resistance junction to ambient 1" square pad; FR4 Board; 2oz copper

Fig. 6. PCB layout for thermal resistance junction to ambient minimum footprint; FR4 Board; 2oz copper

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	30	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$	1.2	1.7	2.2	V

N-channel 30 V, 7.5 mΩ logic level MOSFET in LPAK33 using NextPowerS3 Technology

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	$25\text{ }^{\circ}\text{C} \leq T_j \leq 150\text{ }^{\circ}\text{C}$	-	-3.8	-	mV/K
I_{DSS}	drain leakage current	$V_{DS} = 24\text{ V}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$	-	-	1	μA
		$V_{DS} = 24\text{ V}; V_{GS} = 0\text{ V}; T_j = 125\text{ }^{\circ}\text{C}$	-	0.26	-	μA
I_{GSS}	gate leakage current	$V_{GS} = 16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$	-	-	100	nA
		$V_{GS} = -16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 10\text{ A}; T_j = 25\text{ }^{\circ}\text{C};$ Fig. 10	-	8.2	10.3	mΩ
		$V_{GS} = 4.5\text{ V}; I_D = 10\text{ A}; T_j = 150\text{ }^{\circ}\text{C};$ Fig. 11; Fig. 10	-	-	17	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ }^{\circ}\text{C};$ Fig. 10	-	6.3	7.6	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 150\text{ }^{\circ}\text{C};$ Fig. 11; Fig. 10	-	-	12.5	mΩ
R_G	gate resistance	$f = 1\text{ MHz}$	-	0.25	0.49	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 15\text{ A}; V_{DS} = 15\text{ V}; V_{GS} = 10\text{ V};$ Fig. 12; Fig. 13	-	11.3	17	nC
		$I_D = 15\text{ A}; V_{DS} = 15\text{ V}; V_{GS} = 4.5\text{ V};$ Fig. 12; Fig. 13	-	5.8	8.8	nC
		$I_D = 0\text{ A}; V_{DS} = 0\text{ V}; V_{GS} = 10\text{ V}$	-	10.2	-	nC
Q_{GS}	gate-source charge	$I_D = 15\text{ A}; V_{DS} = 15\text{ V}; V_{GS} = 4.5\text{ V};$ Fig. 12; Fig. 13	-	1.97	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	1.14	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	0.83	-	nC
Q_{GD}	gate-drain charge		-	1.7	2.5	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 15\text{ A}; V_{DS} = 15\text{ V};$ Fig. 12; Fig. 13	-	2.9	-	V
C_{iss}	input capacitance	$V_{DS} = 15\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ }^{\circ}\text{C};$ Fig. 14	-	655	982	pF
C_{oss}	output capacitance		-	578	867	pF
C_{rss}	reverse transfer capacitance		-	50	75	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15\text{ V}; R_L = 1\text{ }^{\Omega}; V_{GS} = 4.5\text{ V};$ $R_{G(ext)} = 5\text{ }^{\Omega}$	-	7.1	-	ns
t_r	rise time		-	10.4	-	ns
$t_{d(off)}$	turn-off delay time		-	8.5	-	ns
t_f	fall time		-	5.5	-	ns

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Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Q_{oss}	output charge	$V_{GS} = 0\text{ V}; V_{DS} = 15\text{ V}; f = 1\text{ MHz}; T_j = 25\text{ }^\circ\text{C}$	-	11	-	nC	
Source-drain diode							
V_{SD}	source-drain voltage	$I_S = 10\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 15}$	-	0.82	1.2	V	
t_{rr}	reverse recovery time	$I_S = 15\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V}; V_{DS} = 15\text{ V}; \text{Fig. 16}$	-	23	46	ns	
Q_r	recovered charge		[1]	-	11	22	nC
t_a	reverse recovery rise time		-	10.2	-	ns	
t_b	reverse recovery fall time		-	12.6	-	ns	
S	softness factor		-	1.2	-		

[1] includes capacitive recovery

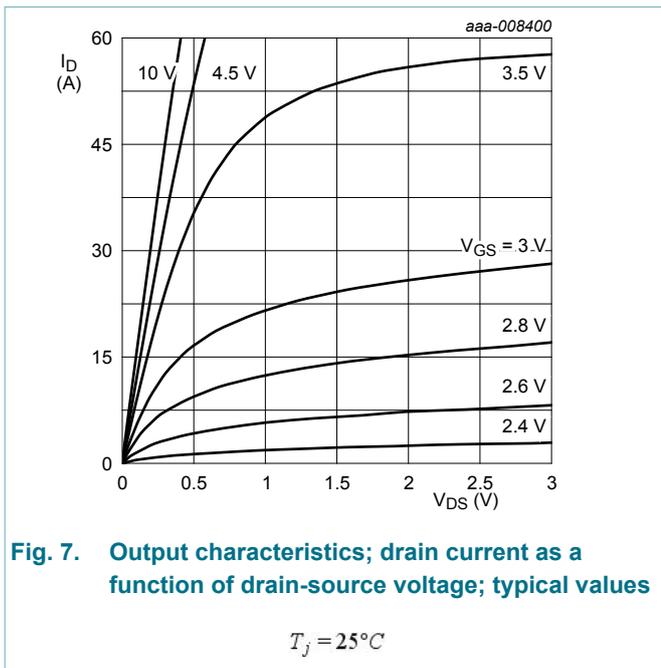


Fig. 7. Output characteristics; drain current as a function of drain-source voltage; typical values

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

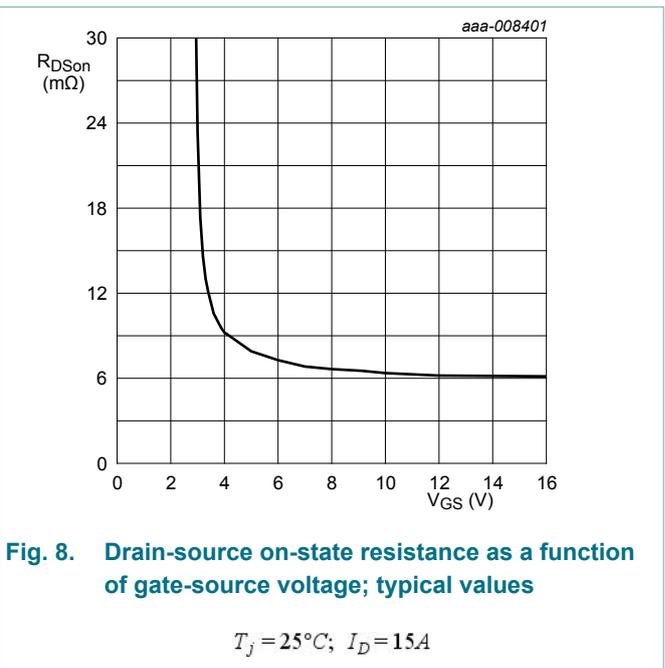


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

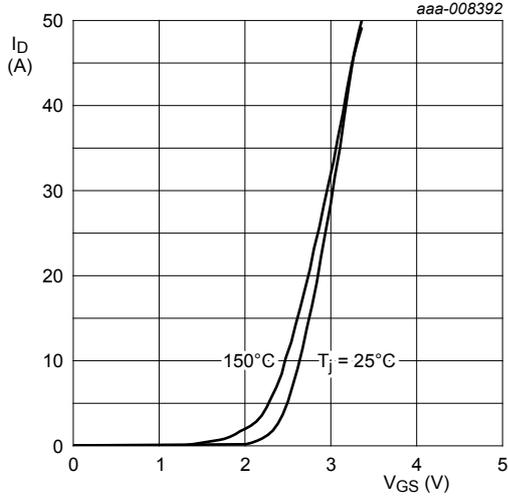


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$$V_{DS} = 10V$$

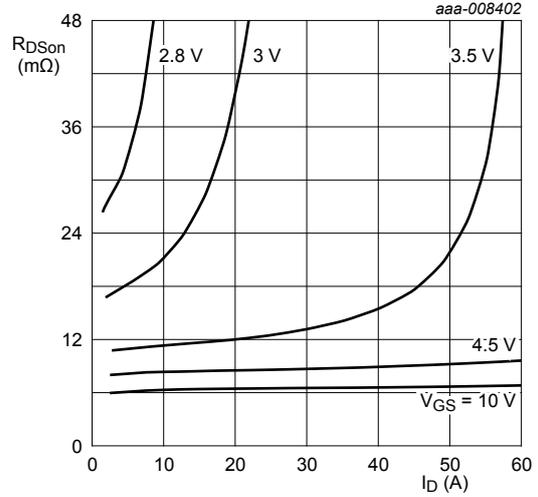


Fig. 10. Drain-source on-state resistance as a function of drain current; typical values

$$T_j = 25^\circ C$$

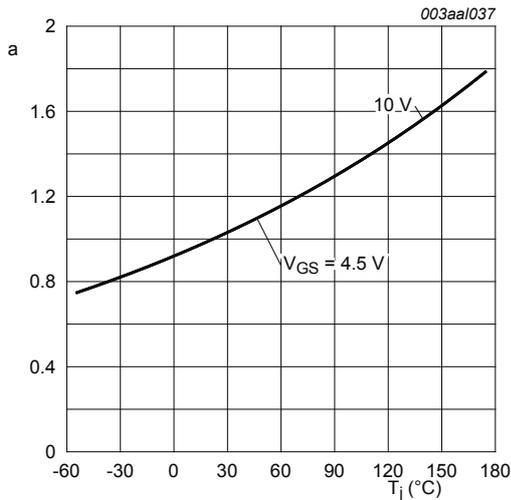


Fig. 11. Normalized drain-source on-state resistance factor as a function of junction temperature

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

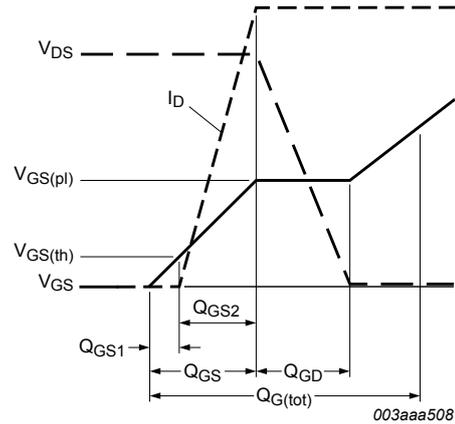


Fig. 12. Gate charge waveform definitions

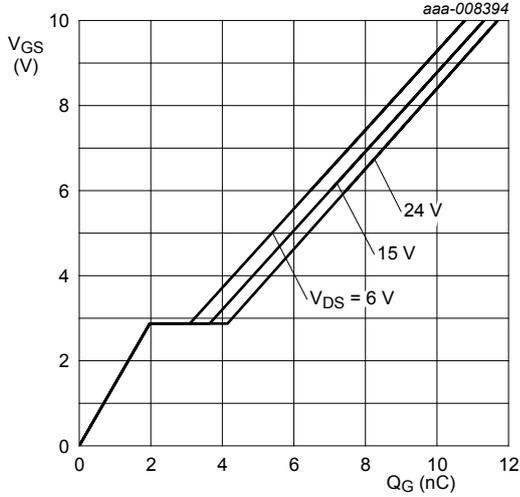


Fig. 13. Gate-source voltage as a function of gate charge; typical values

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

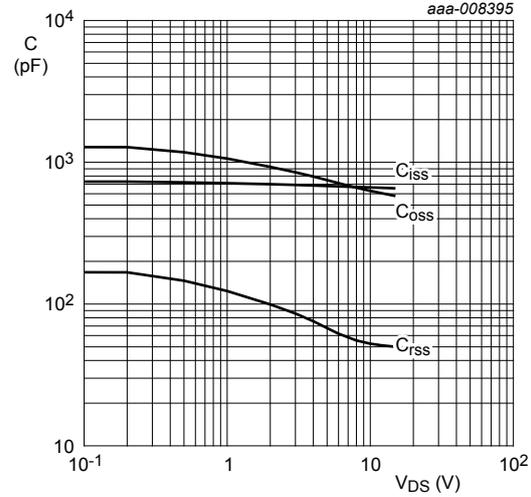


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

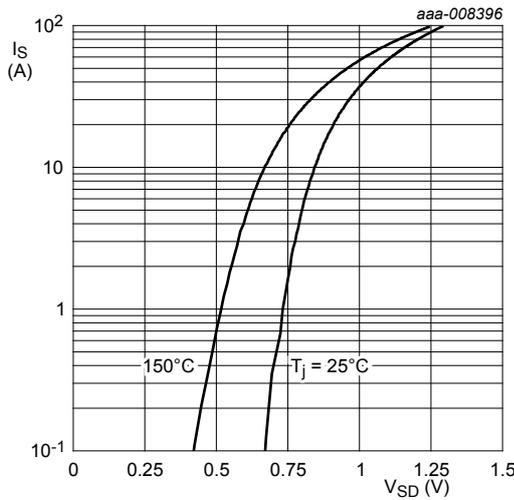


Fig. 15. Source current as a function of source-drain voltage; typical values

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

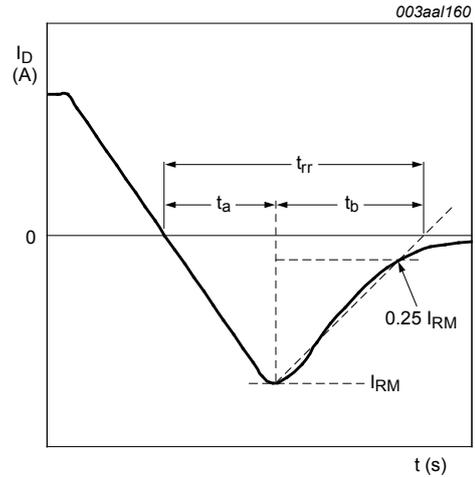


Fig. 16. Reverse recovery timing definition

11. Package outline

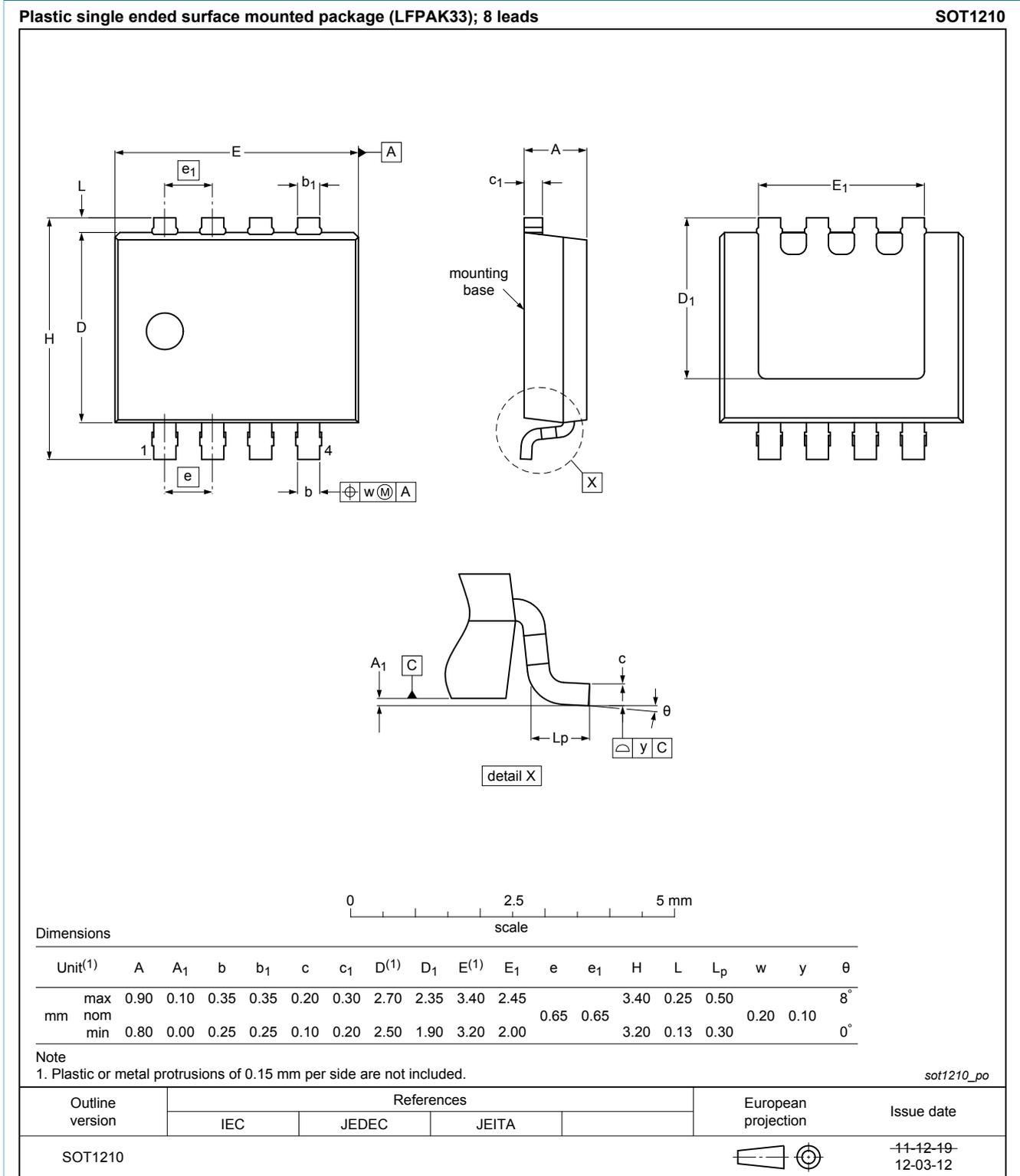


Fig. 17. Package outline LFAK33 (SOT1210)

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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