



PSMN0R9-30YLD

N-channel 30 V, 0.87 mΩ logic level MOSFET in LFPK56 using NextPowerS3 Technology

7 October 2013

Objective data sheet

1. General description

Logic level gate drive N-channel enhancement mode MOSFET in LFPK56 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 Power SO8 package; no glue, no wire bonds, qualified to 175 °C
- Wave solderable; 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
- Power OR-ing

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_J ≤ 175 °C		-	-	30	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; Fig. 1	[1]	-	-	100	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 2		-	-	349	W



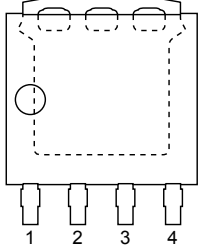
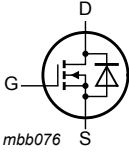
N-channel 30 V, 0.87 mΩ logic level MOSFET in LFAK56 using
NextPowerS3 Technology

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
T _j	junction temperature			-55	-	175	°C
Static characteristics							
R _{DSon}	drain-source on-state resistance	V _{GS} = 4.5 V; I _D = 25 A; T _j = 25 °C		-	0.97	1.09	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C		-	0.77	0.87	mΩ
Dynamic characteristics							
Q _{GD}	gate-drain charge	V _{GS} = 4.5 V; I _D = 25 A; V _{DS} = 15 V; Fig. 7		-	[tbd]	-	nC
Q _{G(tot)}	total gate charge	V _{GS} = 4.5 V; I _D = 25 A; V _{DS} = 15 V; Fig. 7		-	[tbd]	-	nC
Source-drain diode							
S	softness factor	I _S = 25 A; V _{GS} = 0 V; dI _S /dt = -100 A/μs; V _{DS} = 15 V; Fig. 8		-	[tbd]	-	

[1] Continuous current is limited by package.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>LFAK56; Power-SO8 (SOT1023)</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
PSMN0R9-30YLD	LFAK56; Power-SO8	Plastic single-ended surface-mounted package (LFAK56); 4 leads	SOT1023

7. Limiting values

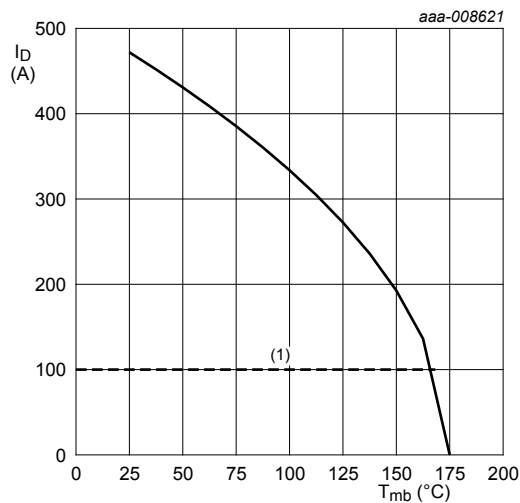
Table 4. Limiting values

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
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 1	[1]	-	100	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; Fig. 1	[1]	-	100	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	1888	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 2		-	349	W
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
V_{ESD}	electrostatic discharge voltage	HBM		[tbd]	-	V
Source-drain diode						
I_S	source current	$T_{mb} = 25\text{ °C}$	[1]	-	100	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	1888	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 25\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped; $t_p = 6.1\text{ ms}$	[2]	-	2987	mJ

[1] Continuous current is limited by package.

[2] Protected by 100% test



(1) Capped at 100A due to package

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

$V_{GS} \geq 10V$

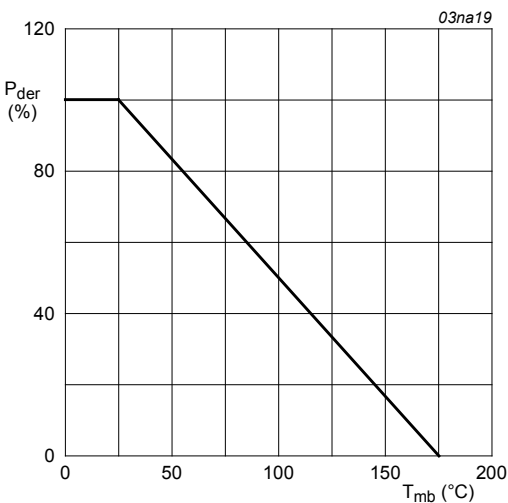


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R _{th(j-mb)}	thermal resistance from junction to mounting base	Fig. 5	-	0.35	0.43	K/W
R _{th(j-a)}	thermal resistance from junction to ambient	Fig. 3	-	50	-	K/W
		Fig. 4	-	125	-	K/W

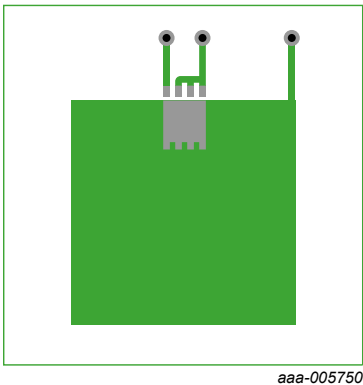


Fig. 3. PCB layout for thermal resistance junction to ambient 1" square pad; FR4 Board; 2oz copper

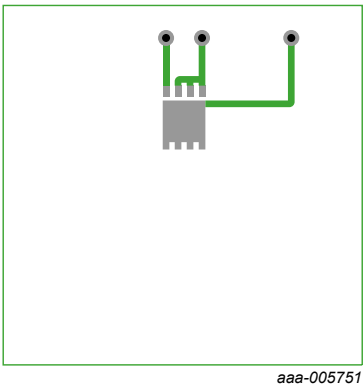


Fig. 4. PCB layout for thermal resistance junction to ambient minimum footprint; FR4 Board; 2oz copper

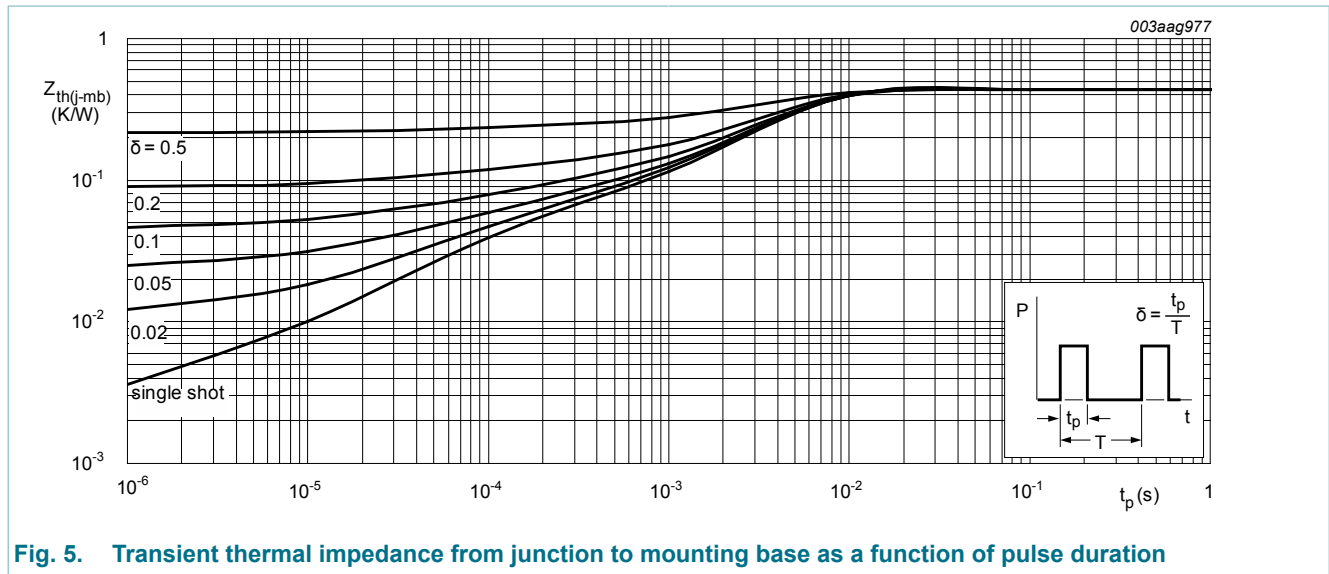


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	30	-	-	V
		$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = -55\ ^\circ\text{C}$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = 25\ ^\circ\text{C}$	1.2	[tbd]	2.2	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	$25\ ^\circ\text{C} \leq T_j \leq 150\ ^\circ\text{C}$	-	[tbd]	-	mV/K
I_{DSS}	drain leakage current	$V_{DS} = 24\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	1	μA
		$V_{DS} = 24\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 150\ ^\circ\text{C}$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = 16\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	100	nA
		$V_{GS} = -16\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 25\ ^\circ\text{C}$	-	0.97	1.09	mΩ
		$V_{GS} = 4.5\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 150\ ^\circ\text{C}$; Fig. 6	-	-	1.8	mΩ
		$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 25\ ^\circ\text{C}$	-	0.77	0.87	mΩ
		$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 150\ ^\circ\text{C}$; Fig. 6	-	-	1.44	mΩ
R_G	gate resistance	$f = 1\ \text{MHz}$	-	1.2	-	Ω

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Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; $V_{GS} = 10\text{ V}$; Fig. 7		-	[tbd]	-	nC
		$I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; $V_{GS} = 4.5\text{ V}$; Fig. 7		-	[tbd]	-	nC
		$I_D = 0\text{ A}$; $V_{DS} = 0\text{ V}$; $V_{GS} = 10\text{ V}$		-	[tbd]	-	nC
Q_{GS}	gate-source charge	$I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; $V_{GS} = 4.5\text{ V}$; Fig. 7		-	[tbd]	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	[tbd]	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	[tbd]	-	nC
Q_{GD}	gate-drain charge			-	[tbd]	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; Fig. 7		-	[tbd]	-	V
C_{iss}	input capacitance	$V_{DS} = 15\text{ V}$; $V_{GS} = 0\text{ V}$; $f = 1\text{ MHz}$; $T_J = 25\text{ °C}$		-	[tbd]	-	pF
C_{oss}	output capacitance			-	[tbd]	-	pF
C_{rss}	reverse transfer capacitance			-	[tbd]	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15\text{ V}$; $R_L = 0.6\text{ }\Omega$; $V_{GS} = 4.5\text{ V}$; $R_{G(ext)} = 5\text{ }\Omega$		-	[tbd]	-	ns
t_r	rise time			-	[tbd]	-	ns
$t_{d(off)}$	turn-off delay time			-	[tbd]	-	ns
t_f	fall time			-	[tbd]	-	ns
Q_{oss}	output charge	$V_{GS} = 0\text{ V}$; $V_{DS} = 15\text{ V}$; $f = 1\text{ MHz}$; $T_J = 25\text{ °C}$		-	[tbd]	-	nC
Source-drain diode							
V_{SD}	source-drain voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; $T_J = 25\text{ °C}$		-	[tbd]	1.2	V
t_{rr}	reverse recovery time	$I_S = 25\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_{DS} = 15\text{ V}$; Fig. 8		-	[tbd]	-	ns
Q_r	recovered charge		[1]	-	[tbd]	-	nC
t_a	reverse recovery rise time			-	[tbd]	-	ns
t_b	reverse recovery fall time			-	[tbd]	-	ns
S	softness factor			-	[tbd]	-	

[1] includes capacitive recovery

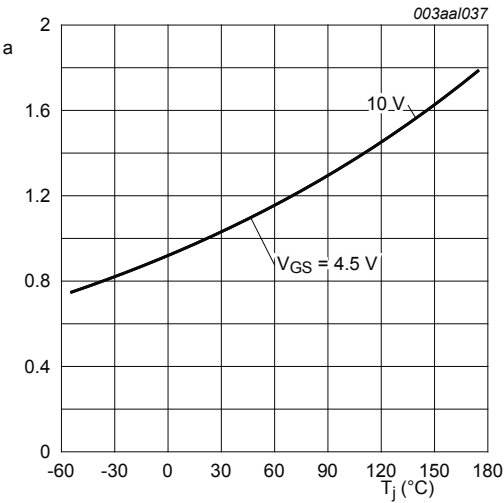


Fig. 6. Normalized drain-source on-state resistance factor as a function of junction temperature

$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^{\circ}\text{C})}}$$

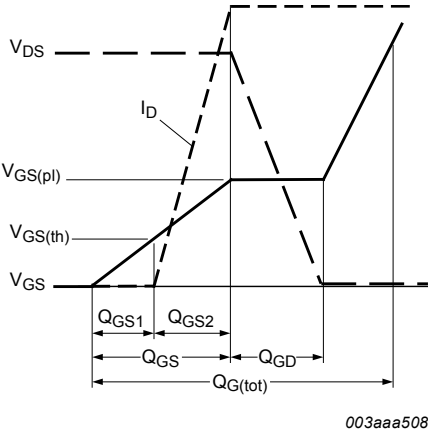


Fig. 7. Gate charge waveform definitions

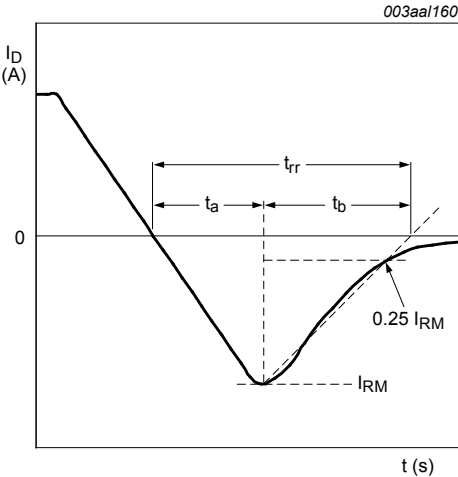


Fig. 8. Reverse recovery timing definition

10. Package outline

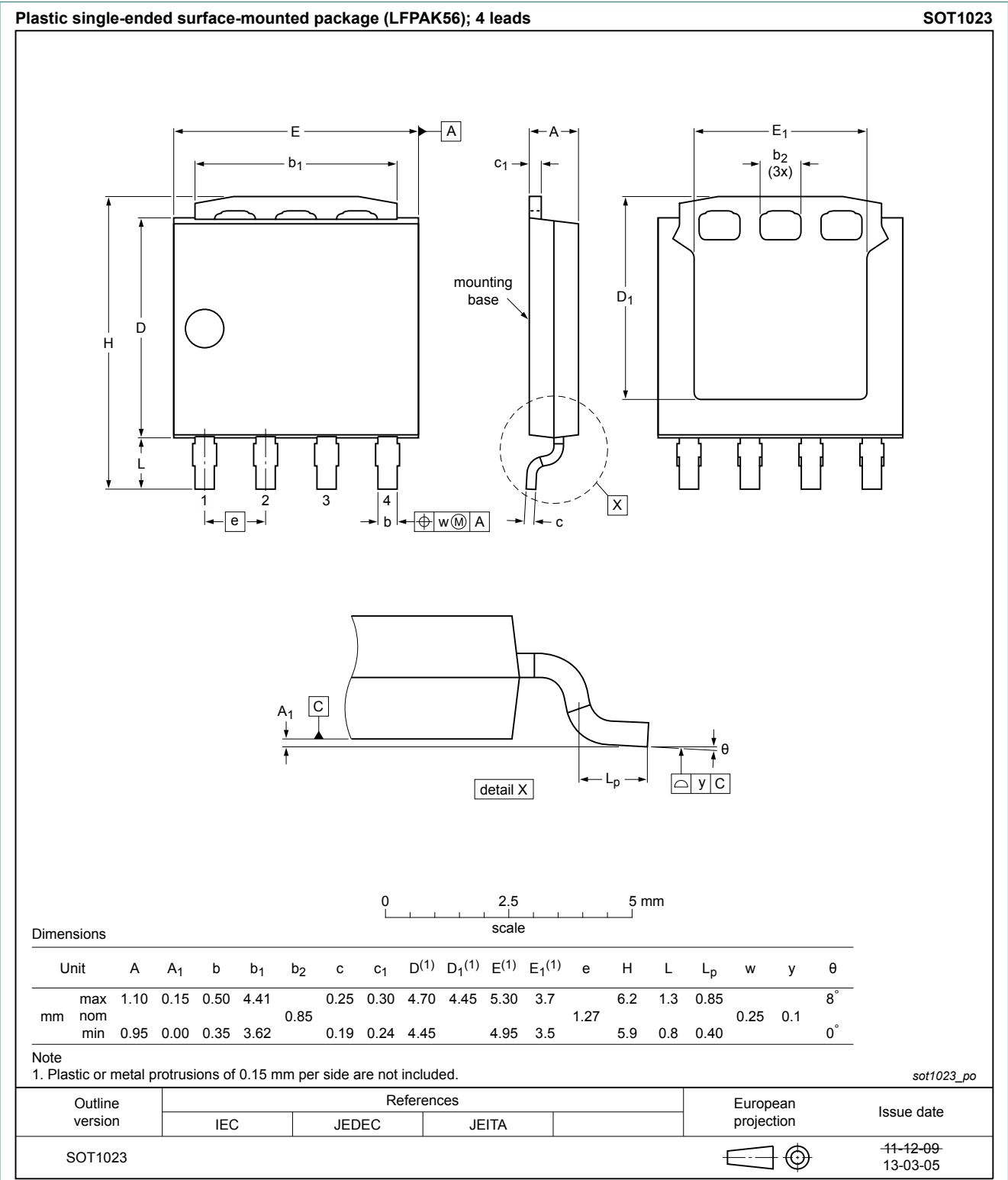


Fig. 9. Package outline LPAK56; Power-SO8 (SOT1023)

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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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12. Contents

1	General description	1
2	Features and benefits	1
3	Applications	1
4	Quick reference data	1
5	Pinning information	2
6	Ordering information	2
7	Limiting values	3
8	Thermal characteristics	4
9	Characteristics	5
10	Package outline	8
11	Legal information	9
11.1	Data sheet status	9
11.2	Definitions	9
11.3	Disclaimers	9
11.4	Trademarks	10

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