



PSMN1R6-40YLC

N-channel 40 V 1.55 mΩ logic level MOSFET in LFPAK using NextPower technology

22 August 2012

Product data sheet

1. Product profile

1.1 General description

Logic level enhancement mode N-channel MOSFET in LFPAK package. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

- High reliability Power SO8 package, qualified to 150°C
- Optimised for 4.5V Gate drive utilising NextPower Superjunction technology
- Ultra low QG, QGD, & QOSS for high system efficiencies at low and high loads
- Ultra low R_{ds(on)} and low parasitic inductance

1.3 Applications

- DC-to-DC converters
- Load switching
- Power OR-ing
- Server power supplies
- Sync rectifier

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{DS}	drain-source voltage	25 °C ≤ T _j ≤ 150 °C	-	-	40	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	-	-	288	W
T _j	junction temperature		-55	-	150	°C
Static characteristics						
R _{DS(on)}	drain-source on-state resistance	V _{GS} = 4.5 V; I _D = 25 A; T _j = 25 °C; Fig. 12	-	1.45	1.8	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C; Fig. 12	-	1.25	1.55	mΩ
Dynamic characteristics						
Q _{GD}	gate-drain charge	V _{GS} = 4.5 V; I _D = 25 A; V _{DS} = 20 V; Fig. 14	-	15.3	-	nC

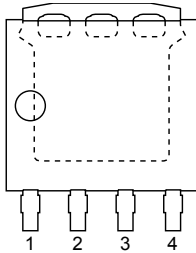
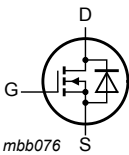
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NextPower technology

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$Q_{G(\text{tot})}$	total gate charge	$V_{GS} = 4.5 \text{ V}$; $I_D = 25 \text{ A}$; $V_{DS} = 20 \text{ V}$; Fig. 14	-	59	-	nC

[1] Continuous current is limited by package.

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p style="text-align: center;">LPAK; Power-SO8 (SOT1023)</p>	 <p style="text-align: center;"><i>mbb076</i></p>
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN1R6-40YLC	LPAK; Power-SO8	Plastic single-ended surface-mounted package (LPAK); 4 leads	SOT1023

4. Limiting values

Table 4. Limiting values

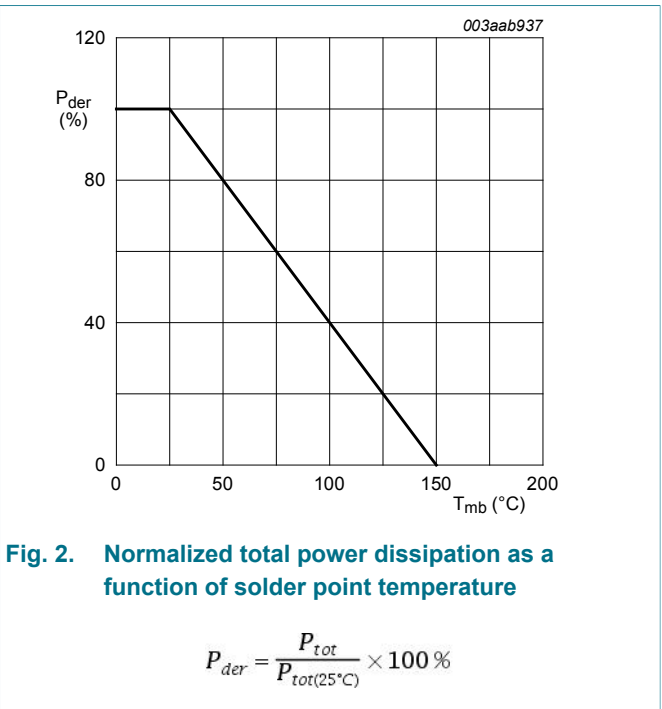
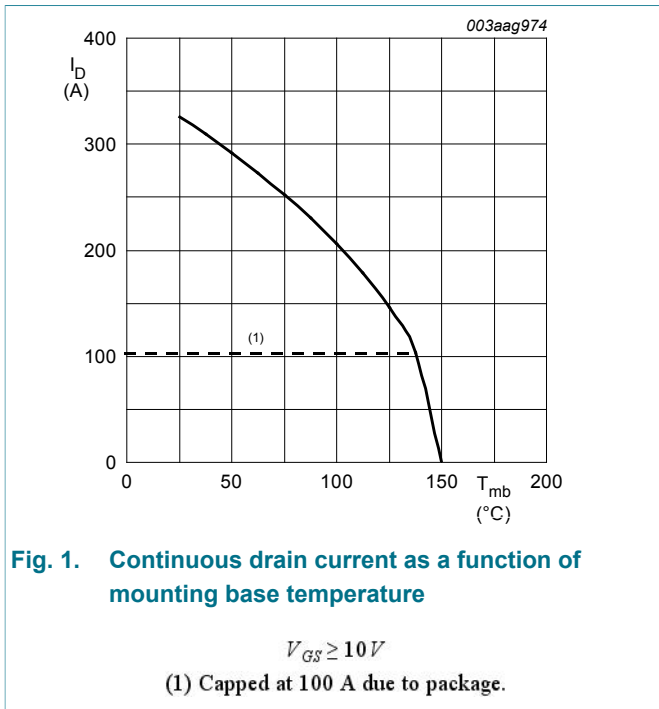
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit	
V_{DS}	drain-source voltage	$25 \text{ °C} \leq T_j \leq 150 \text{ °C}$	-	40	V	
V_{DGR}	drain-gate voltage	$25 \text{ °C} \leq T_j \leq 150 \text{ °C}$; $R_{GS} = 20 \text{ k}\Omega$	-	40	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; $t_p \leq 10 \text{ }\mu\text{s}$; $T_{mb} = 25 \text{ °C}$; Fig. 4	-	1304	A	
P_{tot}	total power dissipation	$T_{mb} = 25 \text{ °C}$; Fig. 2	-	288	W	
T_{stg}	storage temperature		-55	150	°C	

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Symbol	Parameter	Conditions		Min	Max	Unit
T_j	junction temperature			-55	150	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
V_{ESD}	electrostatic discharge voltage	MM (JEDEC JESD22-A115)		1	-	kV
Source-drain diode						
I_S	source current	$T_{mb} = 25\text{ °C}$	[1]	-	100	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\ \mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	1304	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 100\text{ A}$; $V_{sup} \leq 40\text{ V}$; $R_{GS} = 50\ \Omega$; unclamped; Fig. 3		-	391	mJ

[1] Continuous current is limited by package.



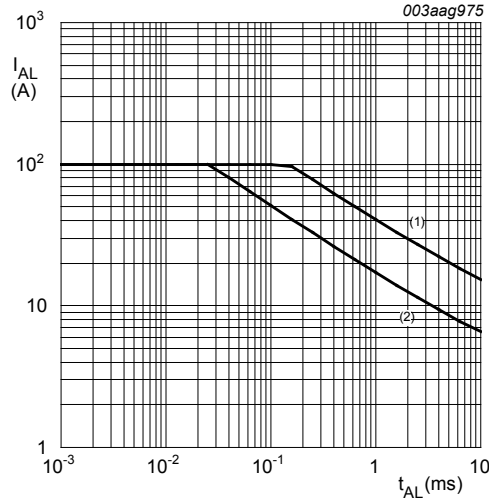


Fig. 3. Single pulse avalanche rating; avalanche current as a function of avalanche time

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

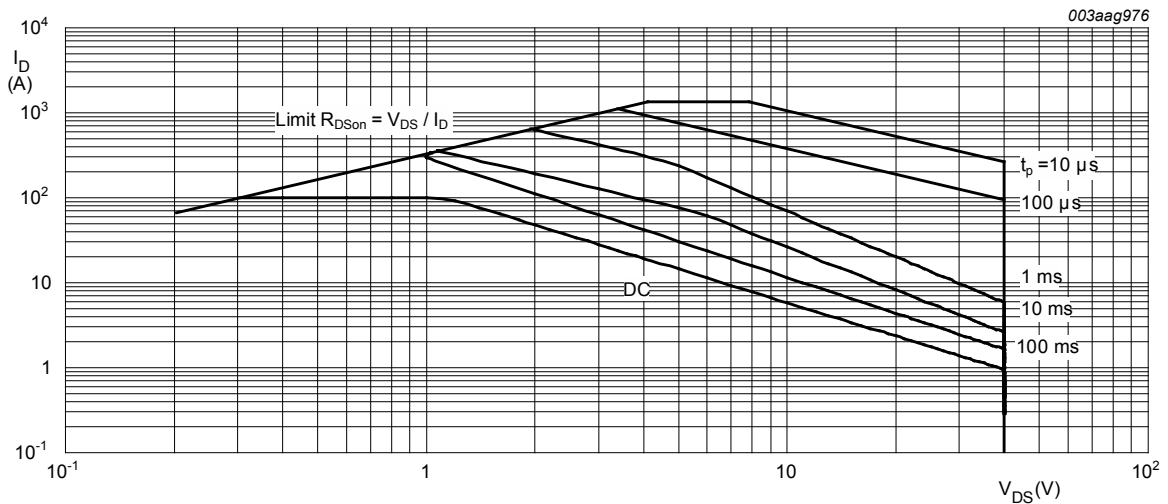


Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

5. 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

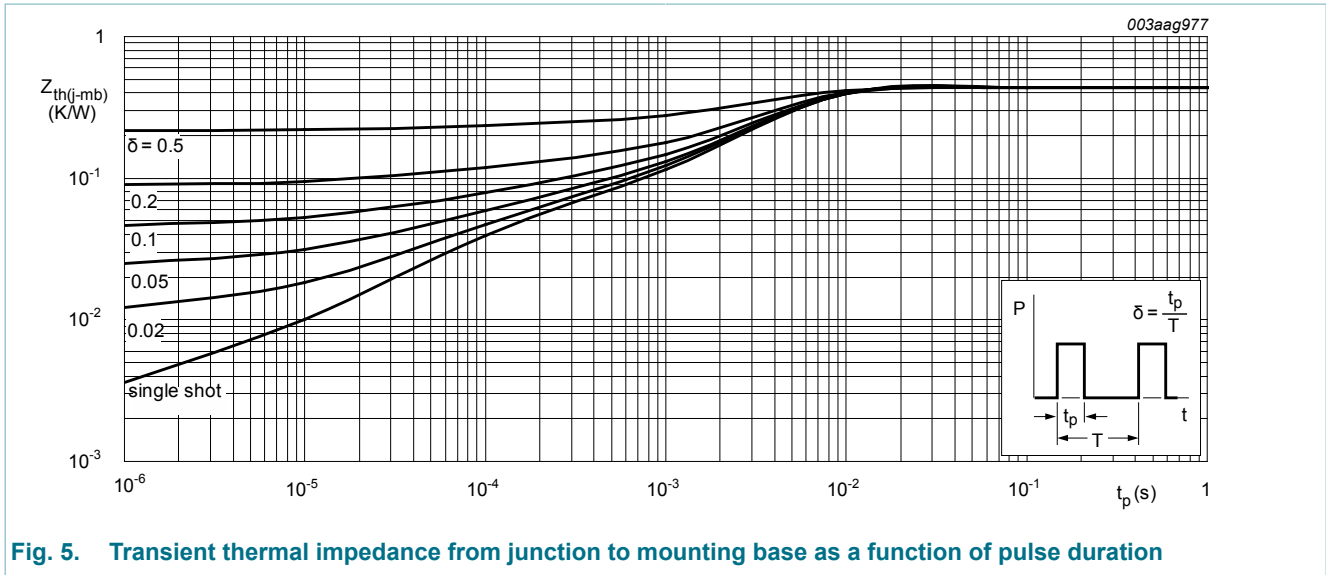


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	40	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	36	-	-	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	1.05	1.46	1.95	V
		$I_D = 10 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ C$	0.5	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C$	-	-	2.25	V
I_{DSS}	drain leakage current	$V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	-	1	μA
		$V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 150 \text{ }^\circ C$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = 16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	-	100	nA
		$V_{GS} = -16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C;$ Fig. 12	-	1.45	1.8	mΩ
		$V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 150 \text{ }^\circ C;$ Fig. 12; Fig. 13	-	-	3.2	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C;$ Fig. 12	-	1.25	1.55	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 150 \text{ }^\circ C;$ Fig. 12; Fig. 13	-	-	2.7	mΩ
R_G	gate resistance	$f = 1 \text{ MHz}$	-	1.17	2.34	Ω

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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
Q _{G(tot)}	total gate charge	I _D = 25 A; V _{DS} = 20 V; V _{GS} = 10 V; Fig. 14 ; Fig. 15	-	126	-	nC
		I _D = 25 A; V _{DS} = 20 V; V _{GS} = 4.5 V; Fig. 14	-	59	-	nC
		I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V	-	115	-	nC
Q _{GS}	gate-source charge	I _D = 25 A; V _{DS} = 20 V; V _{GS} = 4.5 V; Fig. 14	-	17.7	-	nC
Q _{GS(th)}	pre-threshold gate-source charge		-	12.5	-	nC
Q _{GS(th-pl)}	post-threshold gate-source charge		-	5.2	-	nC
Q _{GD}	gate-drain charge		-	15.3	-	nC
V _{GS(pl)}	gate-source plateau voltage	I _D = 25 A; V _{DS} = 20 V; Fig. 14	-	2.4	-	V
C _{iss}	input capacitance	V _{DS} = 20 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 16	-	7790	-	pF
C _{oss}	output capacitance		-	1063	-	pF
C _{rss}	reverse transfer capacitance		-	409	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 20 V; R _L = 0.8 Ω; V _{GS} = 4.5 V; R _{G(ext)} = 4.7 Ω	-	41	-	ns
t _r	rise time		-	48	-	ns
t _{d(off)}	turn-off delay time		-	86	-	ns
t _f	fall time		-	42	-	ns
Q _{oss}	output charge	V _{GS} = 0 V; V _{DS} = 20 V; f = 1 MHz; T _j = 25 °C	-	38.7	-	nC
Source-drain diode						
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 17	-	0.77	1.1	V
t _{rr}	reverse recovery time	I _S = 25 A; di _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 20 V; Fig. 18	-	44	-	ns
Q _r	recovered charge	I _S = 25 A; di _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 20 V	-	62	-	nC
t _a	reverse recovery rise time	V _{GS} = 0 V; I _S = 25 A; di _S /dt = -100 A/μs; V _{DS} = 20 V; Fig. 18	-	26	-	ns
t _b	reverse recovery fall time		-	18	-	ns

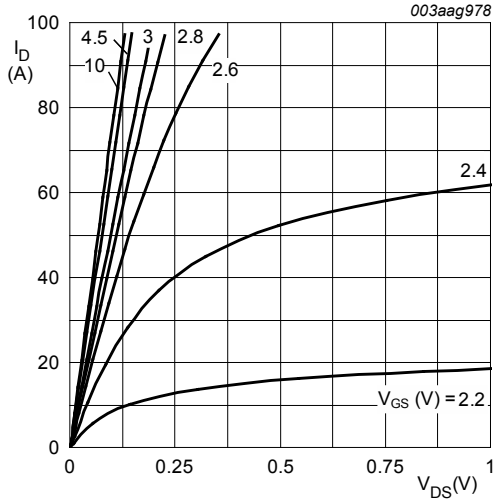


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

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

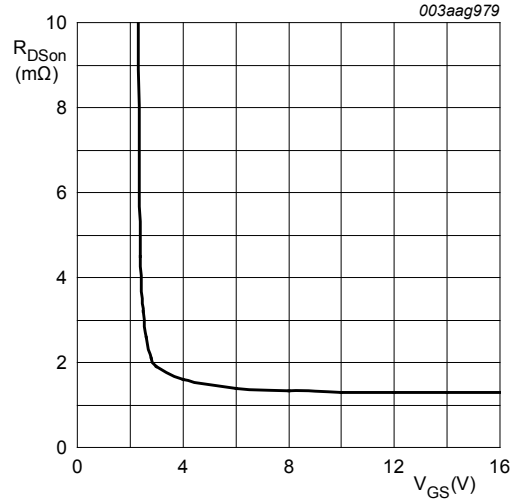


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

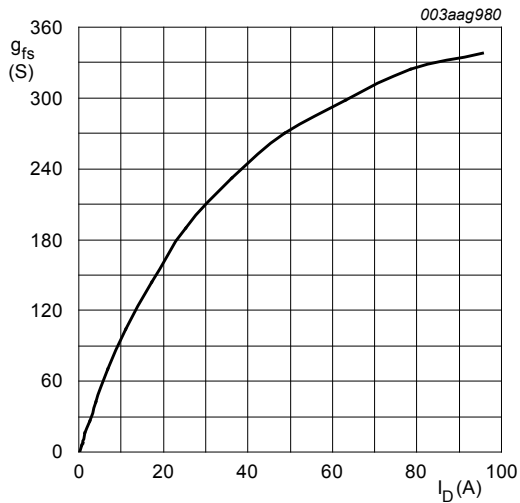


Fig. 8. Forward transconductance as a function of drain current; typical values

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

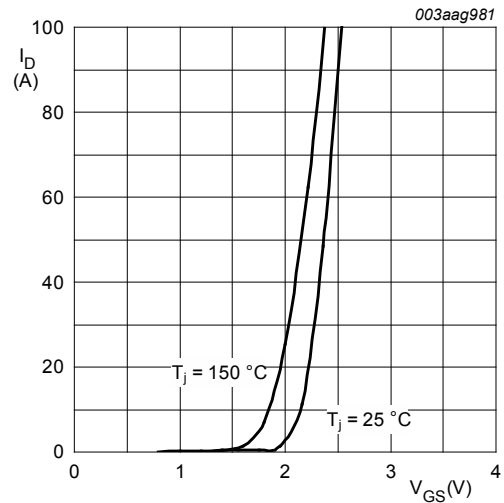


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

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

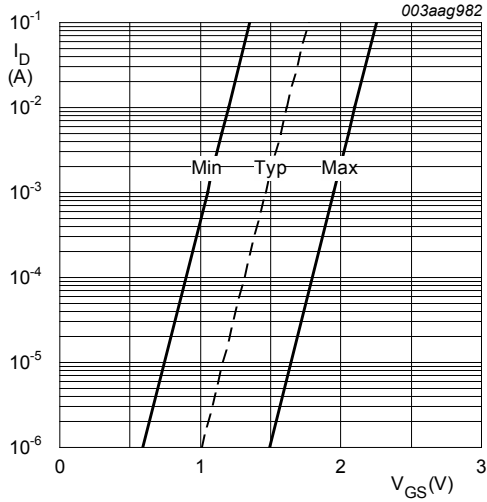


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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

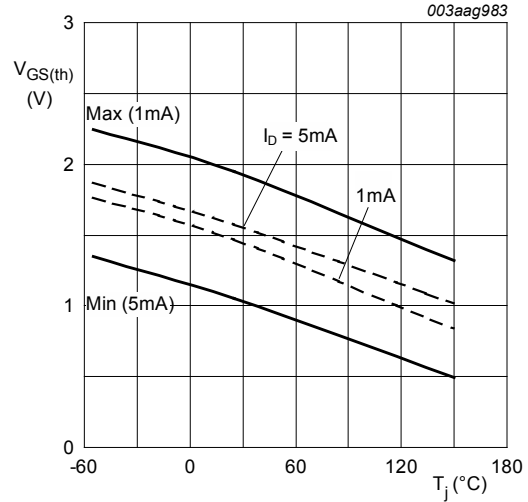


Fig. 11. Gate-source threshold voltage as a function of junction temperature

$$V_{DS} = V_{GS}$$

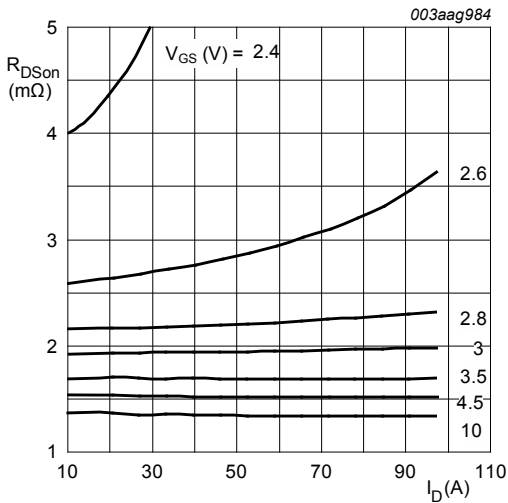


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

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

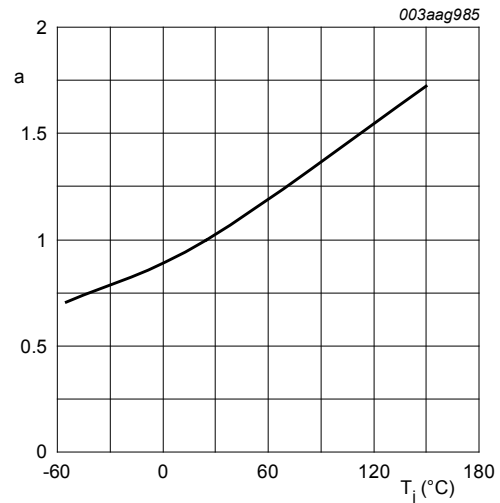


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ\text{C})}; V_{GS} \leq 10\text{V}$$

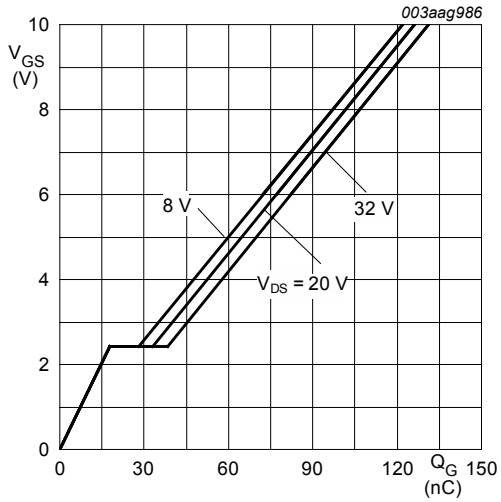


Fig. 14. Gate-source voltage as a function of gate charge; typical values

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

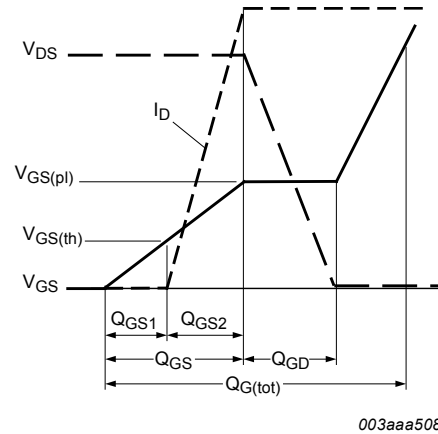


Fig. 15. Gate charge waveform definitions

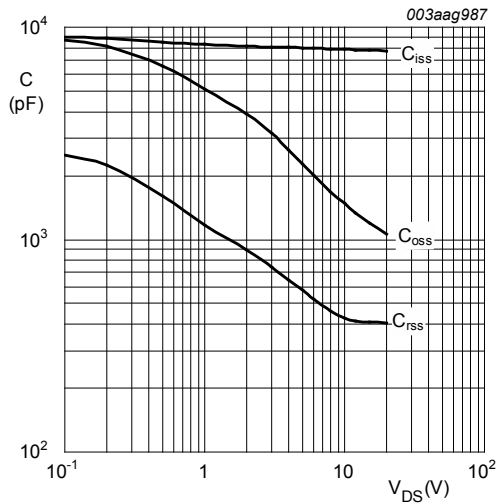


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

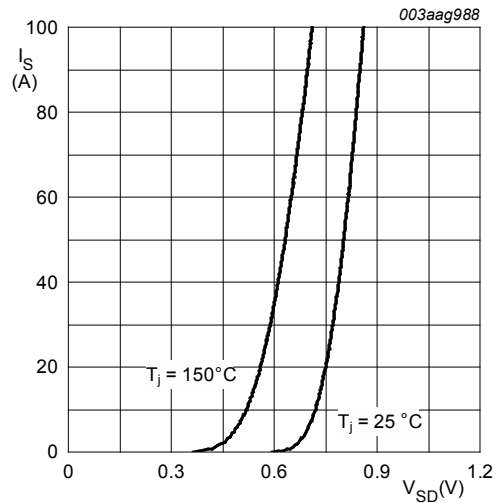


Fig. 17. Source current as a function of source-drain voltage; typical values

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

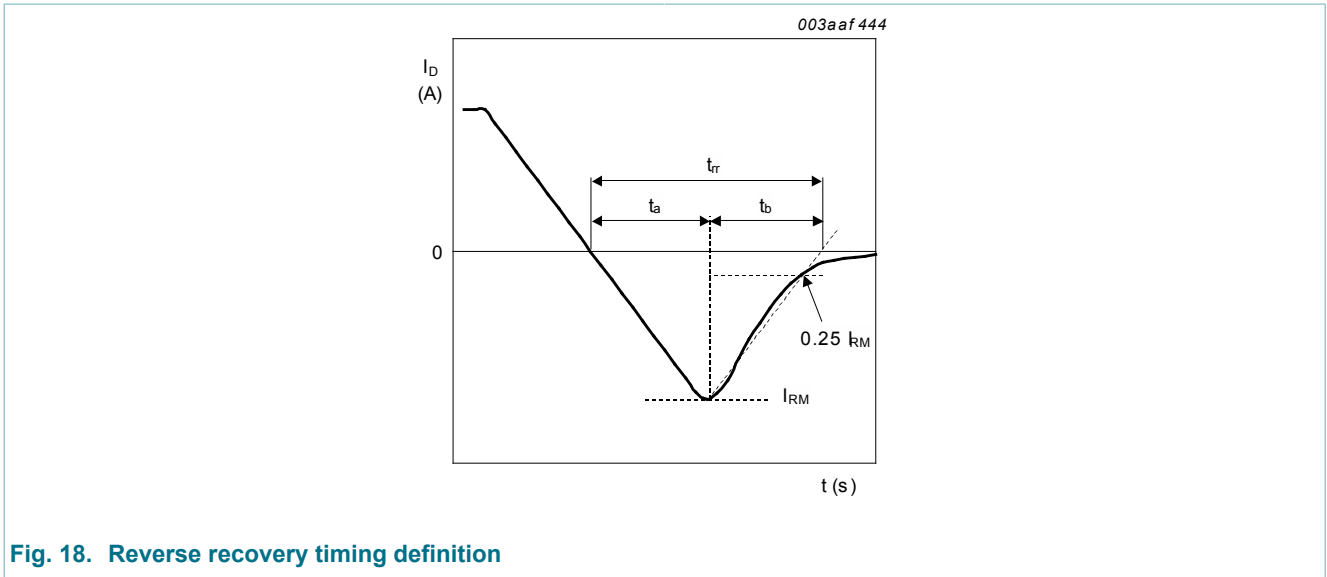


Fig. 18. Reverse recovery timing definition

7. Package outline

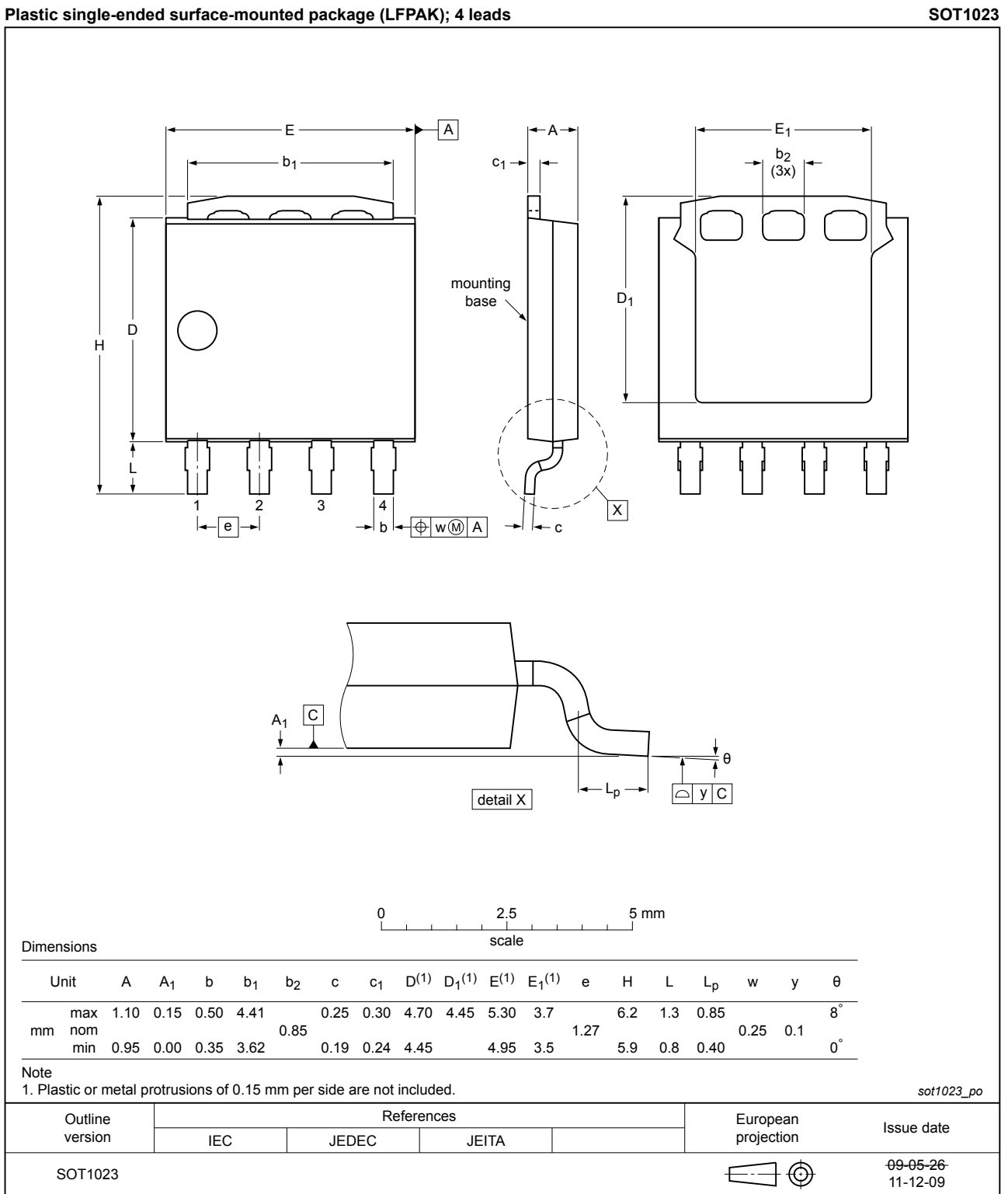


Fig. 19. Package outline LPAK; Power-SO8 (SOT1023)

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8.1 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.
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[NTE2903](#) [NTE2941](#) [NTE2945](#) [NTE2946](#) [NTE2960](#) [NTE2967](#) [NTE2969](#) [NTE2976](#) [NTE455](#) [NTE6400A](#) [NTE2910](#) [NTE2916](#) [NTE2956](#)
[NTE2911](#) [US6M2GTR](#) [TK10A80W,S4X\(S](#) [SSM6P69NU,LF](#)