

PSMN014-60LS

N-channel QFN3333 60 V 14 m Ω standard level MOSFET

Rev. 2 — 18 August 2010

Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in QFN3333 package qualified to 150 °C. This product is designed and qualified for use in a wide range of industrial, communications and power supply equipment.

1.2 Features and benefits

- High efficiency due to low switching and conduction losses
- Small footprint for compact designs
- Suitable for standard level gate drive sources

1.3 Applications

- DC-to-DC converters
- Lithium-ion battery protection
- Load switching

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 150 °C	-	-	60	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; see Figure 1	-	-	40	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; see Figure 2	-	-	65	W
T _j	junction temperature		-55	-	150	°C

Static characteristics

R _{DS(on)}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 10 A; T _j = 100 °C; see Figure 11	-	-	22	m Ω
		V _{GS} = 10 V; I _D = 10 A; T _j = 25 °C; see Figure 12	-	11	14	m Ω

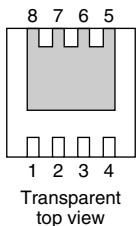
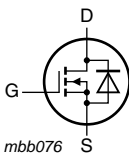


Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 15\text{ A};$	-	4.5	-	nC
$Q_{G(\text{tot})}$	total gate charge	$V_{DS} = 30\text{ V};$ see Figure 13 ; see Figure 14	-	19.6	-	nC
Avalanche ruggedness						
$E_{DS(\text{AL})S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C};$ $I_D = 40\text{ A}; V_{\text{sup}} \leq 60\text{ V};$ unclamped; $R_{GS} = 50\text{ }\Omega$	-	-	42	mJ

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>Transparent top view</p>	 <p>mbb076</p>
2	S	source		
3	S	source		
4	G	gate		
5,6,7,8	D	drain		
mb	D	mounting base; connected to drain		

SOT873-1 (QFN3333)

3. Ordering information

Table 3. Ordering information

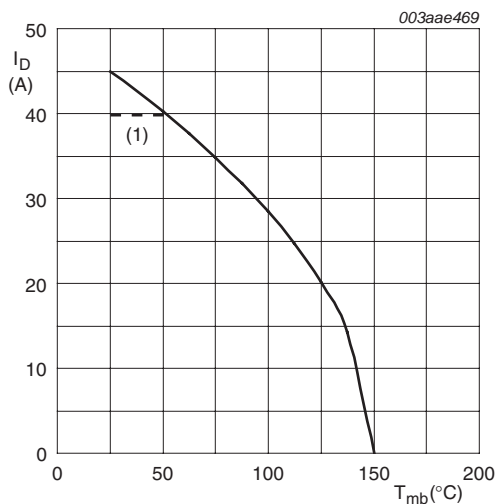
Type number	Package		Version
	Name	Description	
PSMN014-60LS	QFN3333	plastic thermal enhanced very thin small outline package; no leads; 8 terminals	SOT873-1

4. Limiting values

Table 4. Limiting values

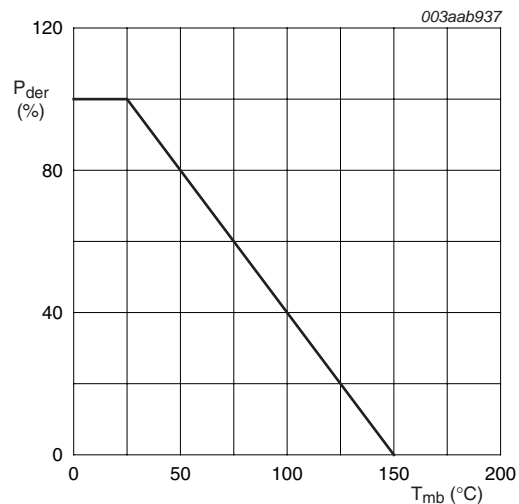
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}$	-	60	V
V_{DGR}	drain-gate voltage	$T_j \leq 150\text{ °C}; T_j \geq 25\text{ °C}; R_{GS} = 20\text{ k}\Omega$	-	60	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C}$; see Figure 1	-	28	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$; see Figure 1	-	40	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; see Figure 3	-	180	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	65	W
T_{stg}	storage temperature		-55	150	°C
T_j	junction temperature		-55	150	°C
$T_{sld(M)}$	peak soldering temperature		-	260	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ °C}$	-	40	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$	-	180	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 40\text{ A}; V_{sup} \leq 60\text{ V}$; unclamped; $R_{GS} = 50\text{ }\Omega$	-	42	mJ



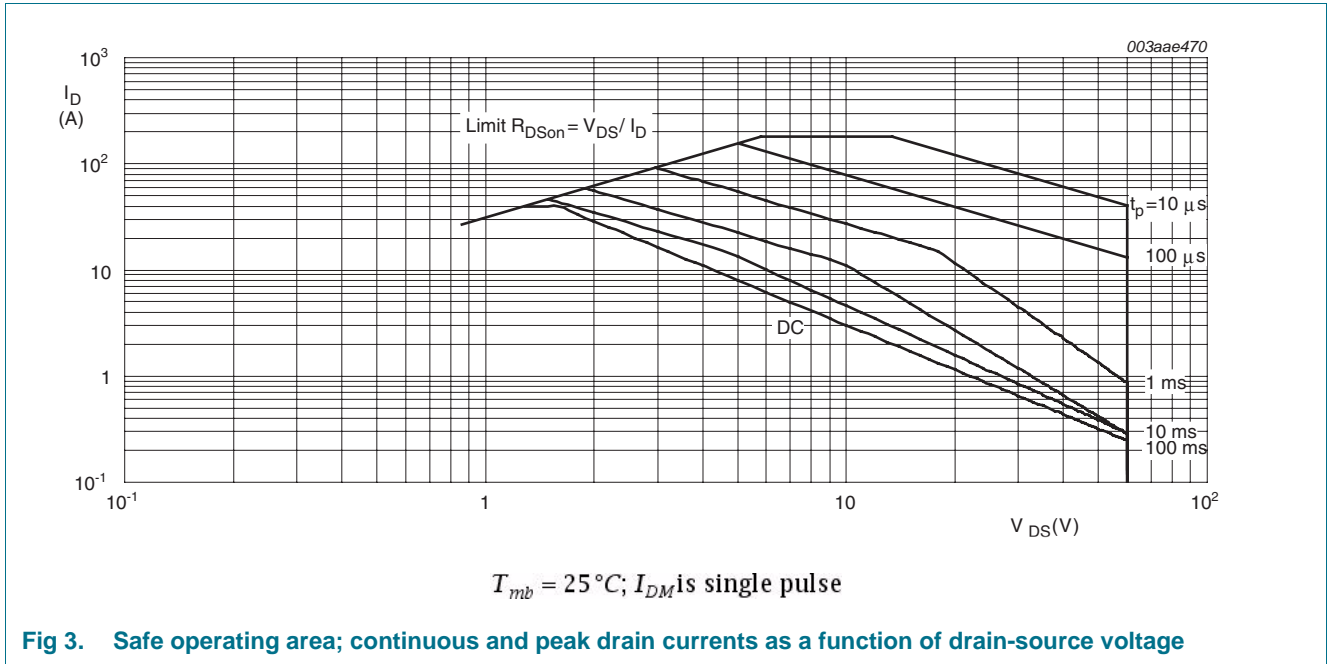
$V_{GS} \geq 10\text{ V}$; (1) Capped at 40 A due to package.

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



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

Fig 2. Normalized total power dissipation as a function of solder point temperature

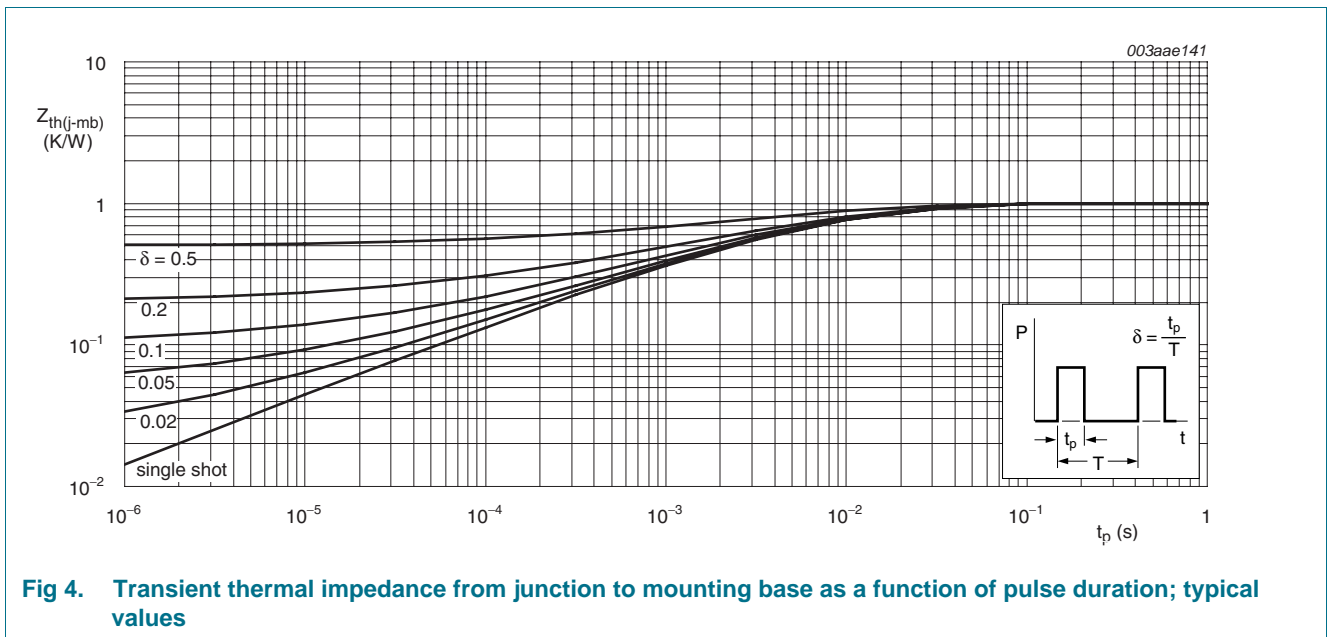


5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	1	1.3	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	[1]	-	53	60	K/W

[1] $R_{th(j-a)}$ is guaranteed by design and assumes that the device is mounted on a 40mm x 40mm x 70μm copper pad at 20°C ambient temperature. In practice $R_{th(j-a)}$ will be determined by the customer's PCB characteristics



6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	54	-	-	V
		$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	60	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 9	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 9 ; see Figure 10	2.3	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 9	-	-	4.7	V
I_{DSS}	drain leakage current	$V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.1	2	μA
		$V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$	-	-	50	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	10	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 10 \text{ A}; T_j = 100 \text{ }^\circ\text{C};$ see Figure 11	-	-	22	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 10 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 11	-	23.1	29.4	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 10 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 12	-	11	14	mΩ
R_G	internal gate resistance (AC)	$f = 1 \text{ MHz}$	-	1.1	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 15 \text{ A}; V_{DS} = 30 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 13 ; see Figure 14	-	19.6	-	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	16.8	-	nC
Q_{GS}	gate-source charge	$I_D = 15 \text{ A}; V_{DS} = 30 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 13 ; see Figure 14	-	5.7	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	3.6	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	2.1	-	nC
Q_{GD}	gate-drain charge		-	4.5	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 30 \text{ V};$ see Figure 13 ; see Figure 14	-	4.65	-	V
C_{iss}	input capacitance	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 15	-	1264	-	pF
C_{oss}	output capacitance		-	171	-	pF
C_{rss}	reverse transfer capacitance		-	91	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 2 \text{ }^\circ\Omega; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 4.7 \text{ }^\circ\Omega; T_j = 25 \text{ }^\circ\text{C}$	-	11	-	ns
t_r	rise time		-	5	-	ns
$t_{d(off)}$	turn-off delay time		-	21	-	ns
t_f	fall time		-	5	-	ns

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 15\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$; see Figure 16	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 15\text{ A}$; $di_S/dt = 100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$;	-	33	-	ns
Q_r	recovered charge	$V_{DS} = 30\text{ V}$	-	36	-	nC

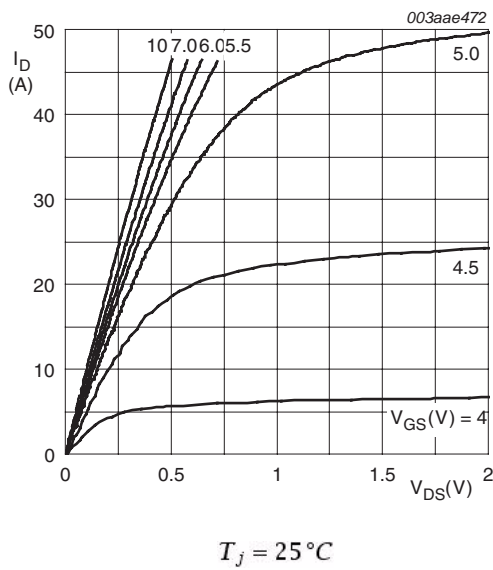


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

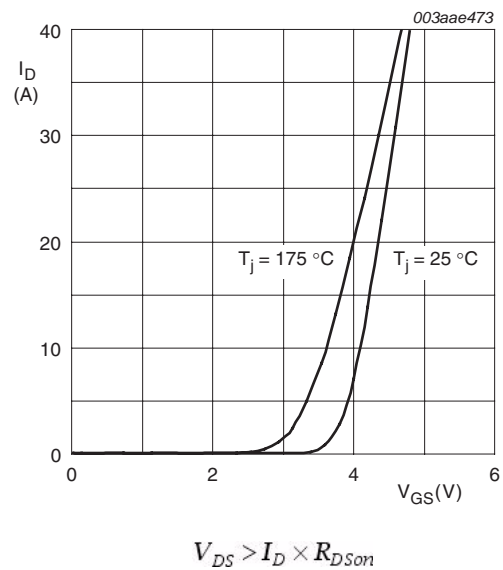


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

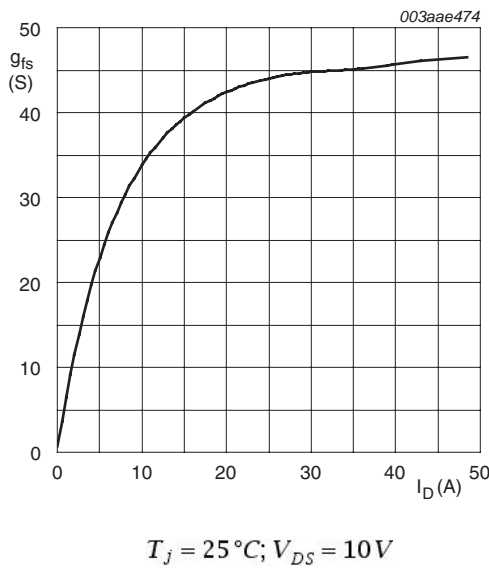


Fig 7. Forward transconductance as a function of drain current; typical values

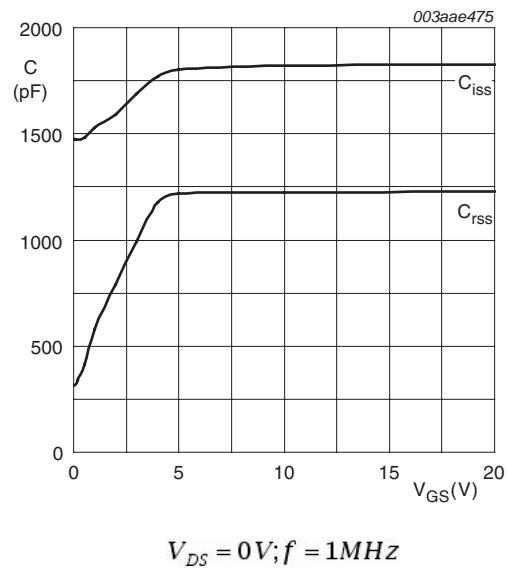
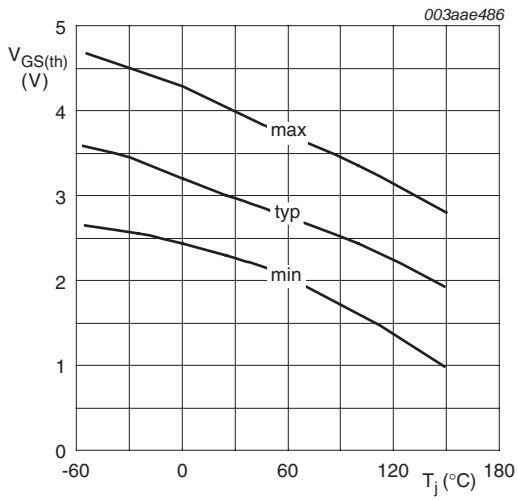
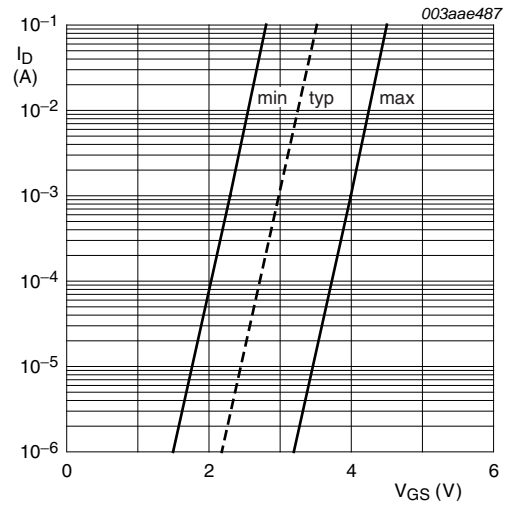


Fig 8. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



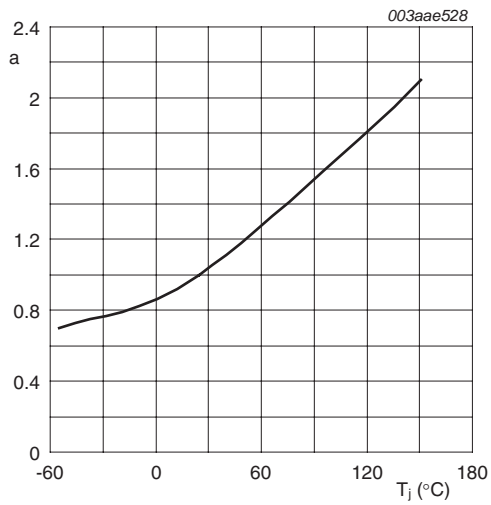
$$I_D = 1\text{mA}; V_{DS} = V_{GS}$$

Fig 9. Gate-source threshold voltage as a function of junction temperature



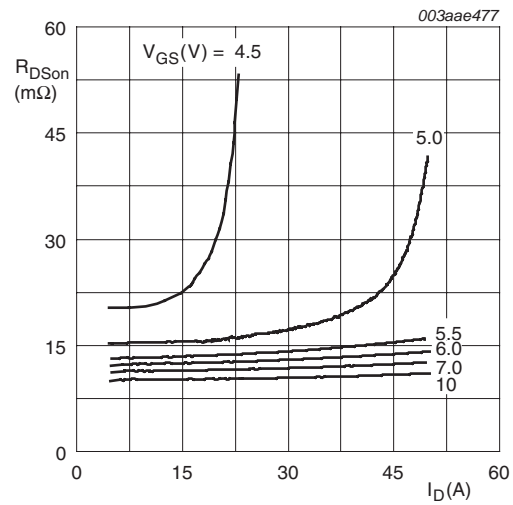
$$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$$

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



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

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



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

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

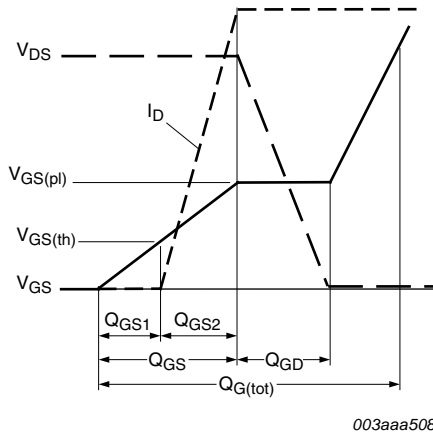


Fig 13. Gate charge waveform definitions

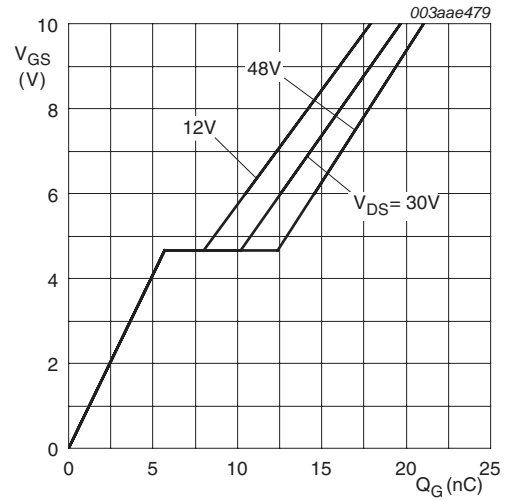


Fig 14. Gate-source voltage as a function of gate charge; typical values

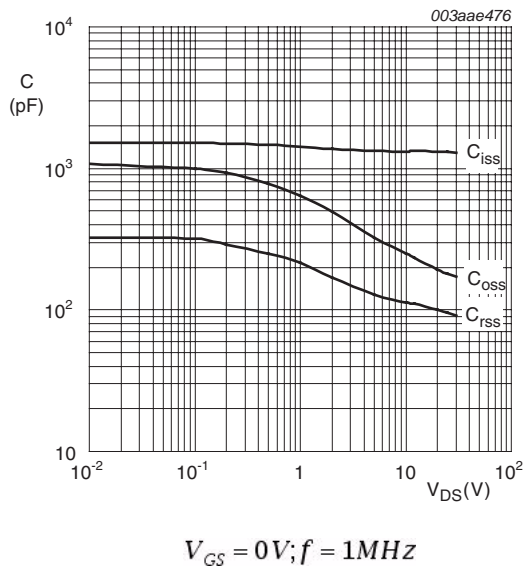


Fig 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

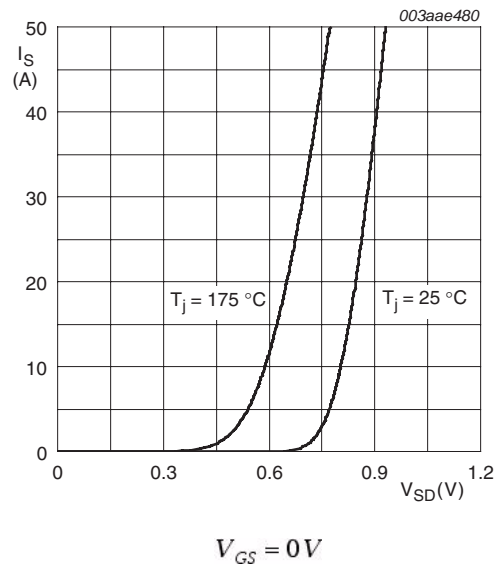
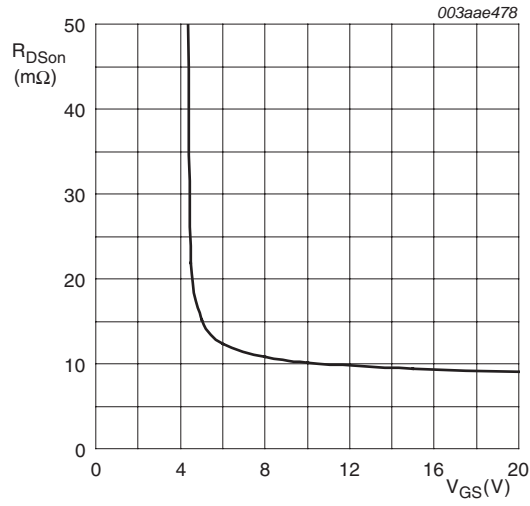


Fig 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values



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

Fig 17. Drain-source on-state resistance as a function of gate-source voltage; typical values

7. Package outline

QFN3333: plastic thermal enhanced very thin small outline package; no leads;
8 terminals; body 3.3 x 3.3 x 1.0 mm

SOT873-1

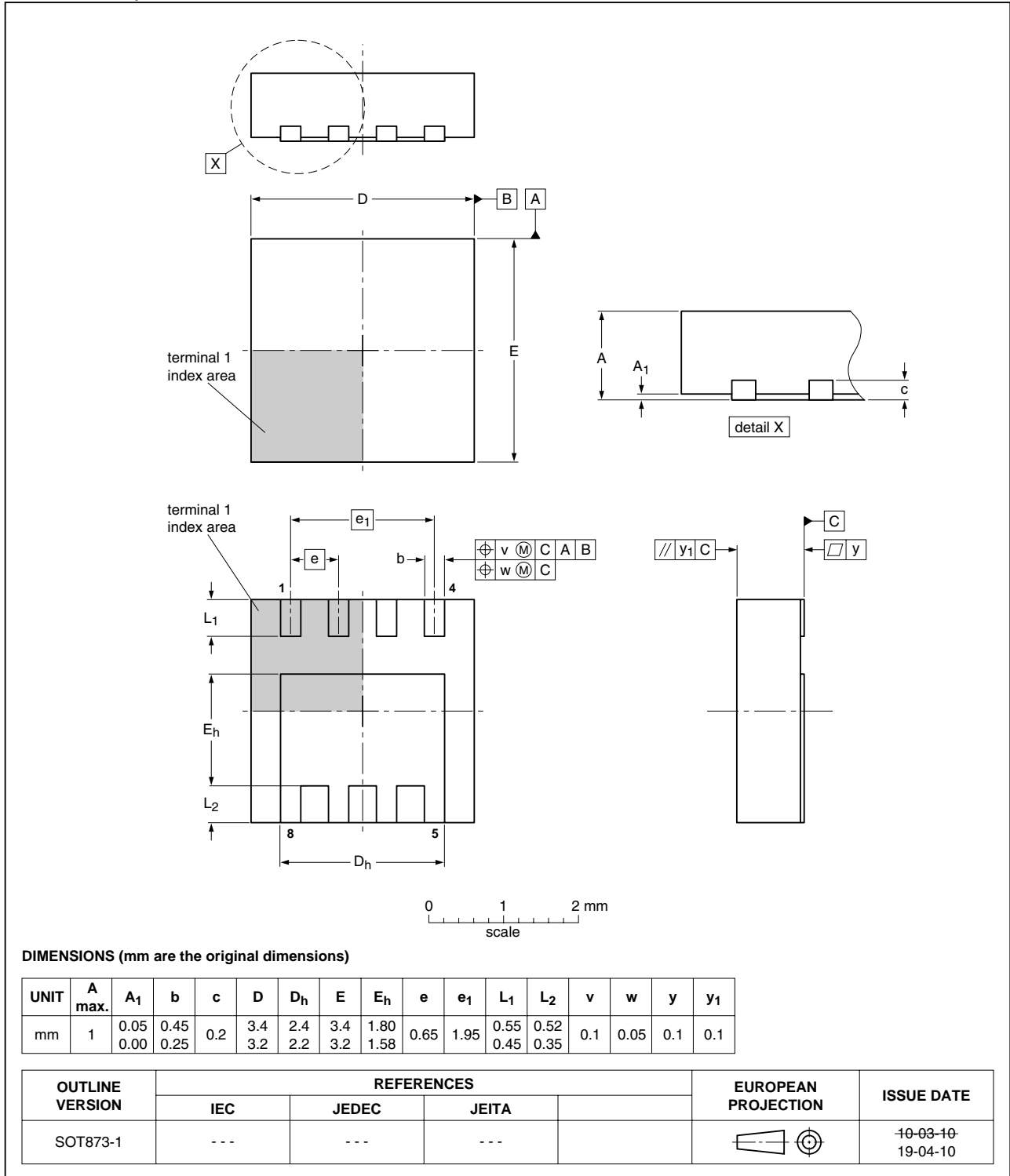


Fig 18. Package outline SOT873-1 (QFN3333)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN014-60LS v.2	20100818	Product data sheet	-	PSMN014-60LS v.1
Modifications:	• Status changed from objective to product.			
PSMN014-60LS v.1	20100625	Objective data sheet	-	-

9. Legal information

9.1 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.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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