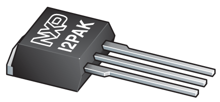


PSMN1R5-40ES

N-channel 40 V 1.6 mΩ standard level MOSFET in I2PAK.

Rev. 01 — 19 April 2011 Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in I2PAK (SOT226) package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

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

1.3 Applications

- DC-to-DC convertors
- Load switching
- Motor control
- Server power supplies

1.4 Quick reference data

Table 1. Quick reference data

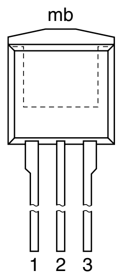
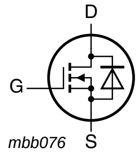
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	40	V
I_D	drain current	$T_{mb} = 25$ °C; $V_{GS} = 10$ V; see Figure 1	[1]	-	-	120	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	-	338	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 25$ °C; see Figure 13	[2]	-	1.3	1.6	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10$ V; $I_D = 75$ A; $V_{DS} = 20$ V; see Figure 14; see Figure 15		-	32	-	nC
$Q_{G(tot)}$	total gate charge			-	136	-	nC

[1] Continuous current is limited by package

[2] Measured 3 mm from package.

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 SOT226 (I2PAK)	
2	D	drain		
3	S	source		
mb	D	drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN1R5-40ES	I2PAK	plastic single-ended package (I2PAK); TO-262	SOT226

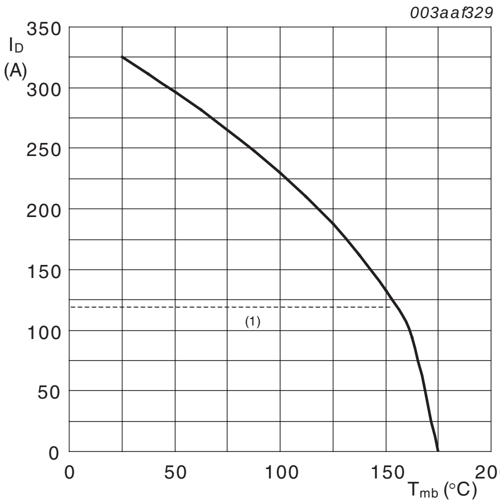
4. Limiting values

Table 4. Limiting values

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

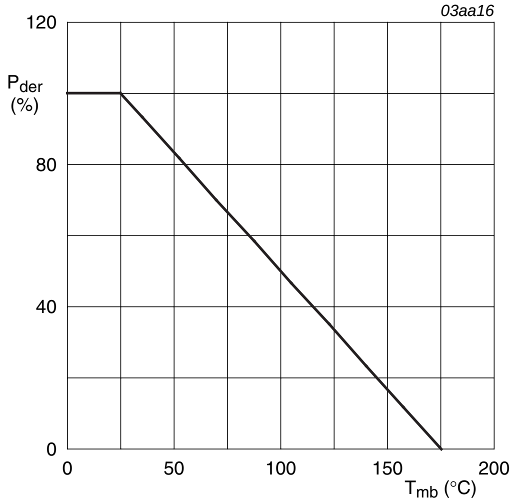
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	40	V
V_{DGR}	drain-gate voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C; $R_{GS} = 20$ kΩ		-	40	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	$V_{GS} = 10$ V; $T_{mb} = 100$ °C	[1]	-	120	A
		$V_{GS} = 10$ V; $T_{mb} = 25$ °C; see Figure 1	[1]	-	120	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C; see Figure 3		-	1301	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	338	W
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	$T_{mb} = 25$ °C	[1]	-	120	A
I_{SM}	peak source current	pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C		-	1301	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 120$ A; $V_{sup} \leq 40$ V; unclamped; $R_{GS} = 50$ Ω; $t_p = 0.1$ ms		-	1.4	J

[1] Continuous current is limited by package.



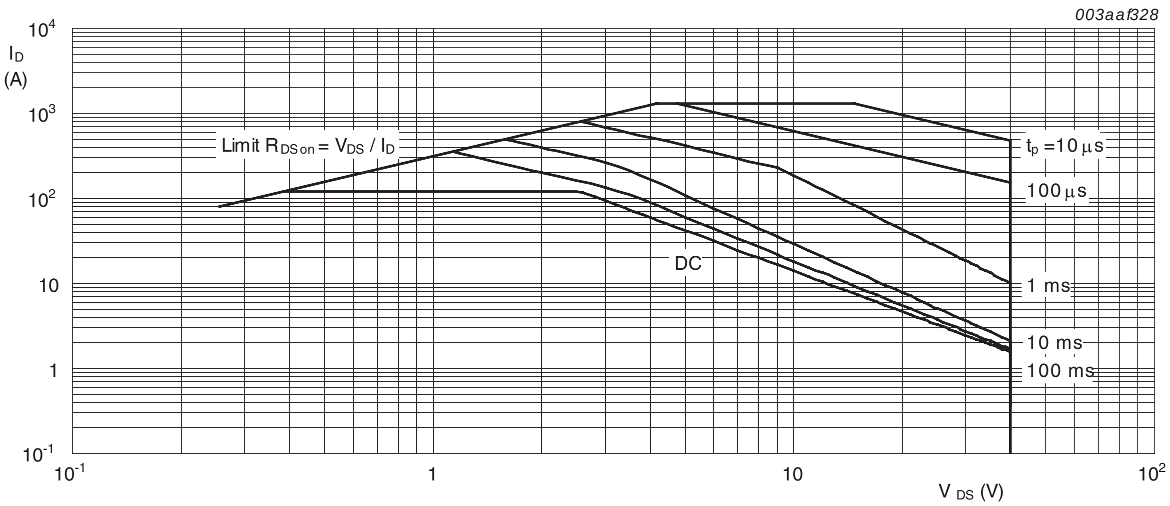
$V_{GS} \geq 10$ V(1) Capped at 120 A due to package

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



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

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



$T_{mb} = 25$ °C; I_{DM} is a single pulse; Capped at 120 A due to package

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

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	-	0.22	0.44	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Vertical in free air	-	60	-	K/W

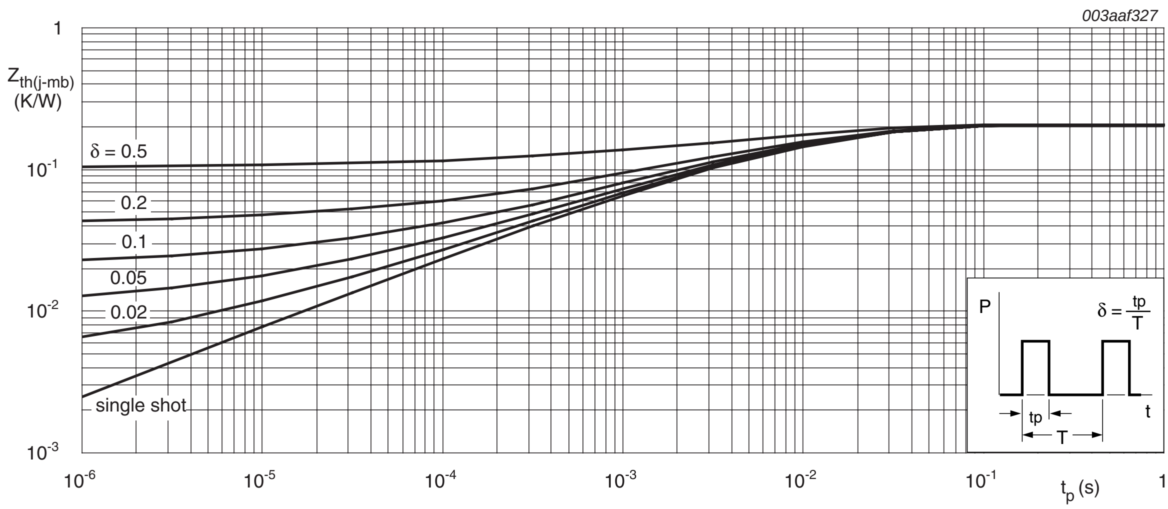


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

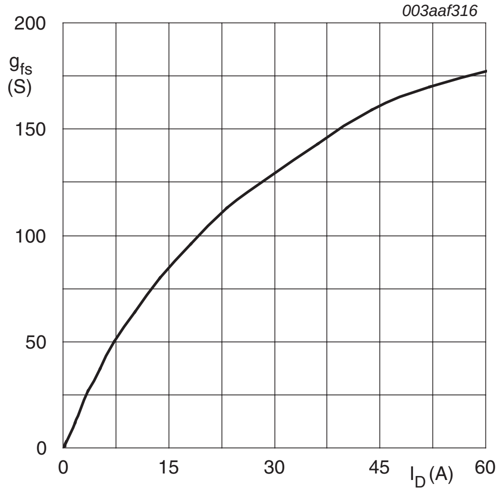
Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C		36	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C		40	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 10		-	-	4.6	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 10		1	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 11; see Figure 10		2	3	4	V
I_{DSS}	drain leakage current	V_{DS} = 40 V; V_{GS} = 0 V; T_j = 25 °C		-	0.02	10	µA
		V_{DS} = 40 V; V_{GS} = 0 V; T_j = 175 °C		-	250	500	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 100 °C; see Figure 12		-	1.9	2.3	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 175 °C; see Figure 12		-	2.6	3.2	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 13	[1]	-	1.3	1.6	mΩ
R_G	internal gate resistance (AC)	f = 1 MHz		-	1.1	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V; see Figure 14; see Figure 15		-	133	-	nC
		I_D = 75 A; V_{DS} = 20 V; V_{GS} = 10 V; see Figure 14; see Figure 15		-	136	-	nC
Q_{GS}	gate-source charge			-	52	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	30	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	22	-	nC
Q_{GD}	gate-drain charge			-	32	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	V_{DS} = 20 V; see Figure 14; see Figure 15		-	6.1	-	V
C_{iss}	input capacitance	V_{DS} = 20 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; see Figure 16		-	9710	-	pF
C_{oss}	output capacitance			-	2042	-	pF
C_{rss}	reverse transfer capacitance			-	994	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 20 V; R_L = 0.8 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 4.7 Ω		-	45	-	ns
t_r	rise time			-	66	-	ns
$t_{d(off)}$	turn-off delay time			-	111	-	ns
t_f	fall time			-	53	-	ns

Table 6. Characteristics *...continued*

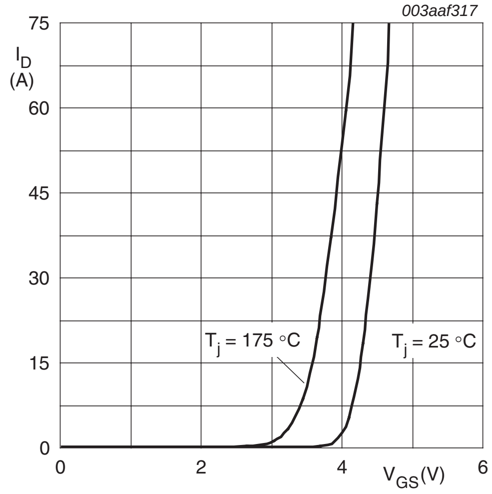
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 17	-	0.8	1.2	V
t_{rr}	reverse recovery time	I_S = 25 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 20 V	-	64	-	ns
Q_r	recovered charge	I_S = 25 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 20 V; T_j = 25 °C	-	117	-	nC

[1] Measured 3 mm from package.



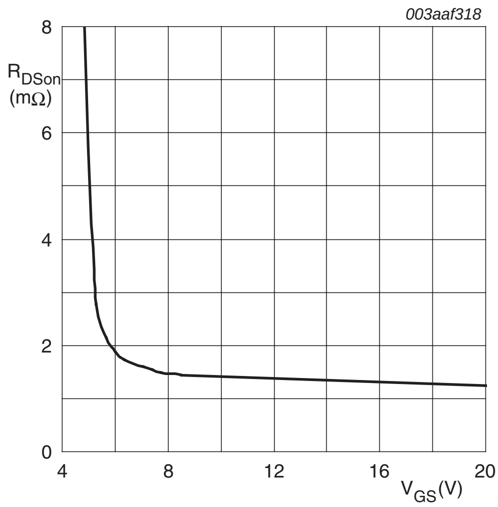
$T_j = 25\,°C; V_{DS} = 25\,V$

Fig 5. Forward transconductance as a function of drain current; typical values



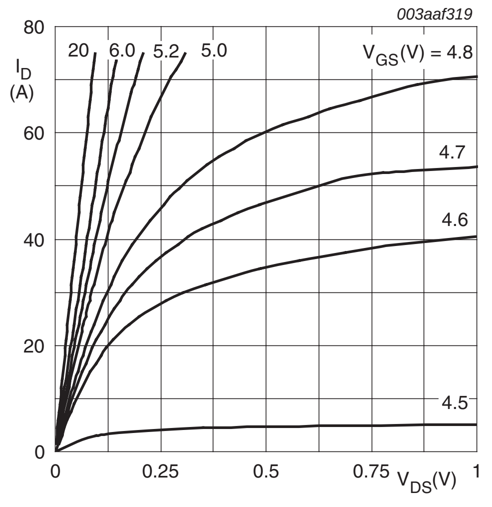
$V_{DS} > I_D \times R_{DSon}$

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



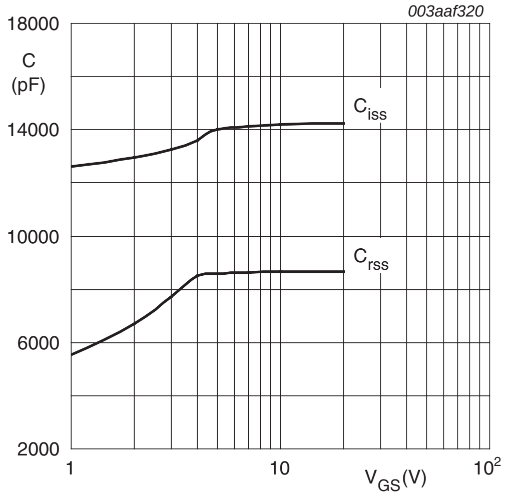
$T_j = 25\,°C; V_{DS} = 25\,V$

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



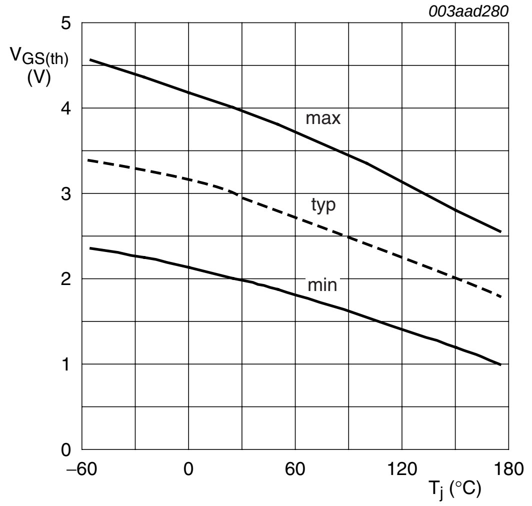
$T_j = 25\,°C$

Fig 8. Output characteristics: drain current as a function of drain-source voltage; typical values



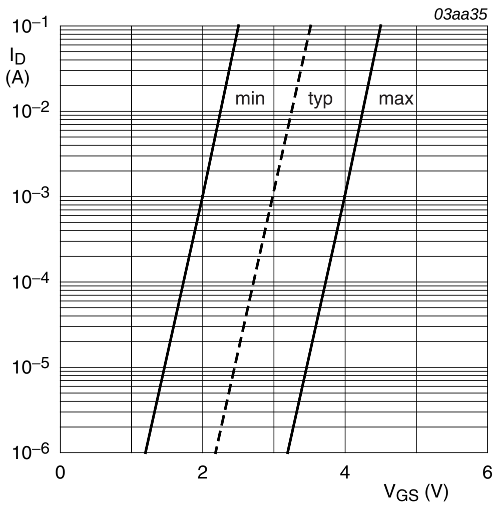
$V_{DS} = 0\,V; f = 1\,MHz$

Fig 9. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



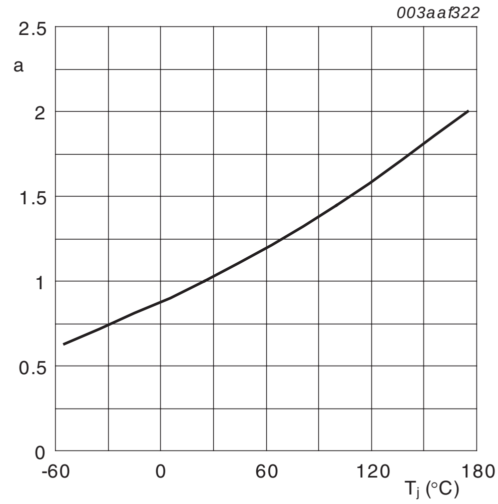
$I_D = 1\,mA; V_{DS} = V_{GS}$

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



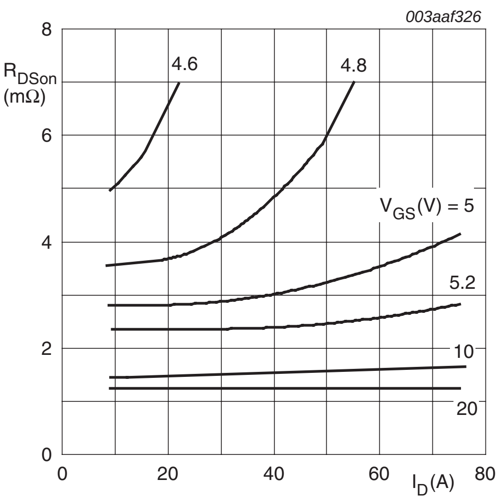
$$T_j = 25\,°C;\, V_{DS} = 5V$$

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



$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



$$T_j = 25\,°C$$

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

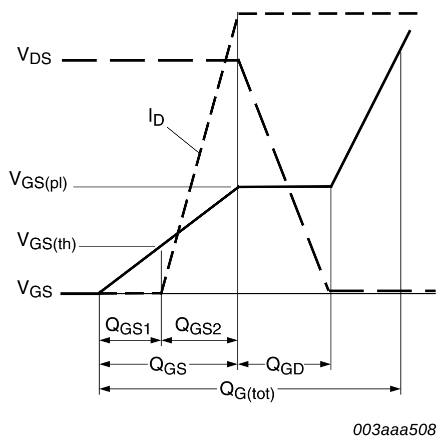
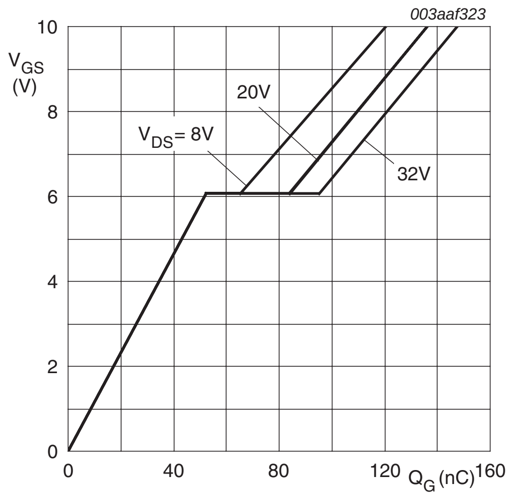
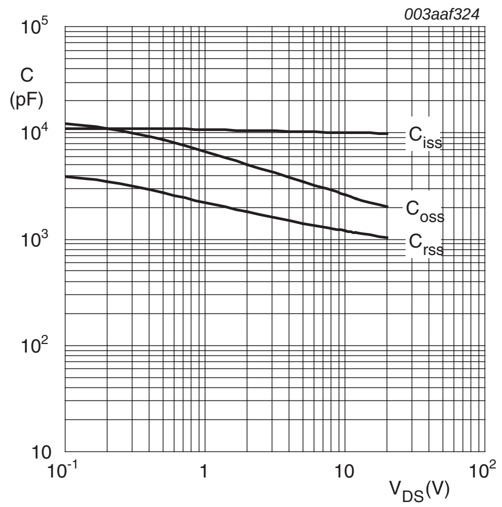


Fig 14. Gate charge waveform definitions



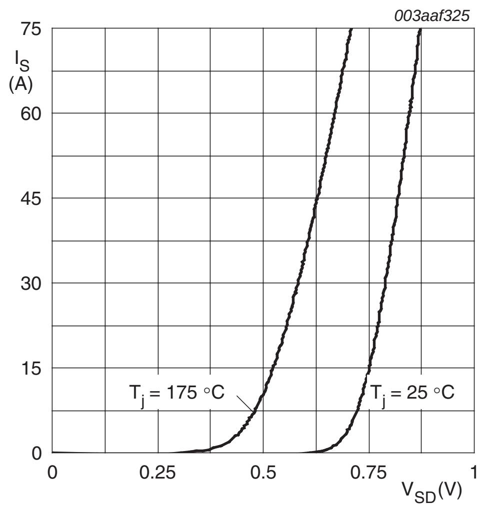
$I_D = 75A$

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



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

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

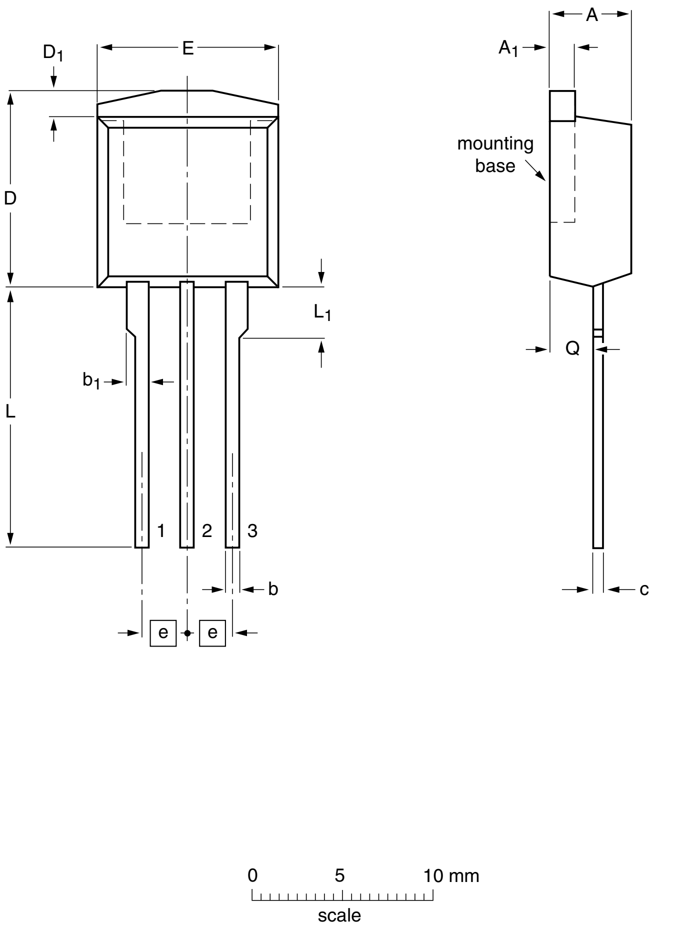


$V_{GS} = 0V$

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

7. Package outline

Plastic single-ended package (I2PAK); low-profile 3-lead TO-262 **SOT226**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	c	D max	D_1	E	e	L	L_1	Q
mm	4.5 4.1	1.40 1.27	0.85 0.60	1.3 1.0	0.7 0.4	11	1.6 1.2	10.3 9.7	2.54	15.0 13.5	3.30 2.79	2.6 2.2

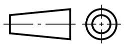
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT226		TO-262				~~06-02-14~~ 09-08-25

Fig 18. Package outline SOT226 (I2PAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN1R5-40ES v.1	20110419	Product 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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11. Contents

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