PSMN6R3-120ESQ Datasheet

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DiGi Electronics Part Number	PSMN6R3-120ESQ-DG
Manufacturer	Nexperia USA Inc.
Manufacturer Product Number	PSMN6R3-120ESQ
Description	MOSFET N-CH 120V 70A I2PAK
Detailed Description	N-Channel 120 V 70A (Tc) 405W (Tc) Through Hole I2PAK

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Purchase and inquiry

Manufacturer Product Number:	Manufacturer:
PSMN6R3-120ESQ	Nexperia USA Inc.
Series:	Product Status:
-	Obsolete
FET Type:	Technology:
N-Channel	MOSFET (Metal Oxide)
Drain to Source Voltage (Vdss):	Current - Continuous Drain (Id) @ 25°C:
120 V	70A (Tc)
Drive Voltage (Max Rds On, Min Rds On):	Rds On (Max) @ Id, Vgs:
10V	6.7mOhm @ 25A, 10V
Vgs(th) (Max) @ Id:	Gate Charge (Qg) (Max) @ Vgs:
4V @ 250µA	207.1 nC @ 10 V
Vgs (Max):	Input Capacitance (Ciss) (Max) @ Vds:
±20V	11384 pF @ 60 V
FET Feature:	Power Dissipation (Max):
-	405W (Tc)
Operating Temperature:	Mounting Type:
-55°C ~ 175°C (TJ)	Through Hole
Supplier Device Package:	Package / Case:
I2PAK	TO-262-3 Long Leads, I2PAK, TO-262AA

Environmental & Export classification

RoHS Status:	Moisture Sensitivity Level (MSL):
ROHS3 Compliant	1 (Unlimited)
REACH Status:	ECCN:
REACH Unaffected	EAR99
HTSUS:	
8541.29.0095	

PSMN6R3-120ES

N-channel 120 V 6.7 mΩ standard level MOSFET in I2PAK

8 May 2013 Product data sheet

1. General description

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

2. Features and benefits

- High efficiency due to low switching and conduction losses
- Improved dynamic avalanche performance
- Suitable for standard level gate drive
- I2PAK package for slimline adaptors & height constrained applications

3. Applications

- AC-to-DC power supply
- Synchronous rectification
- Motor control
- Slimline adaptors & chargers

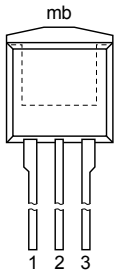
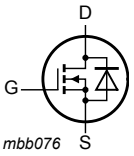
4. Quick reference data

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		-	-	120	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; Fig. 1		-	-	70	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 2		-	-	405	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 12		4	5.7	6.7	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	V_{GS} = 10 V; I_D = 25 A; V_{DS} = 60 V; Fig. 14; Fig. 15		-	61.9	-	nC
$Q_{G(tot)}$	total gate charge			-	207.1	-	nC
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; I_D = 70 A; $V_{sup} \leq 120$ V; unclamped; R_{GS} = 50 Ω; Fig. 3		-	-	532	mJ

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN6R3-120ES	I2PAK	plastic single-ended package (I2PAK); TO-262	SOT226

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	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	120	V
V_{DGR}	drain-gate voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C; $R_{GS} = 20$ kΩ		-	120	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	$V_{GS} = 10$ V; $T_{mb} = 25$ °C; Fig. 1		-	70	A
		$V_{GS} = 10$ V; $T_{mb} = 100$ °C; Fig. 1		-	70	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C; Fig. 4		-	280	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; Fig. 2		-	405	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		-	70	A
I_{SM}	peak source current	pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C		-	280	A

Symbol	Parameter	Conditions		Min	Max	Unit
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; I_D = 70 A; V_{sup} ≤ 120 V; unclamped; R_{GS} = 50 Ω; Fig. 3		-	532	mJ

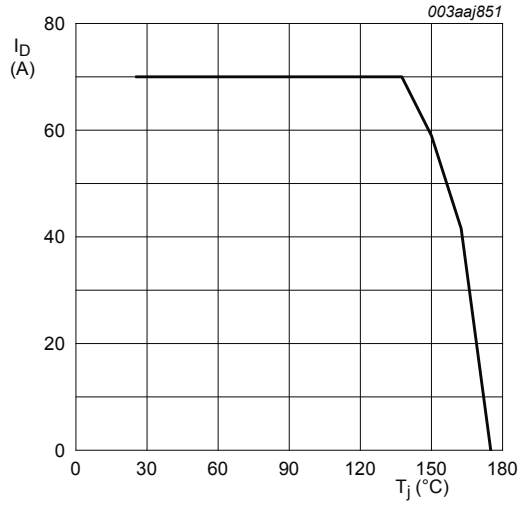


Fig. 1. Continuous drain current as a function of mounting base temperature

$V_{GS} \geq 10V$

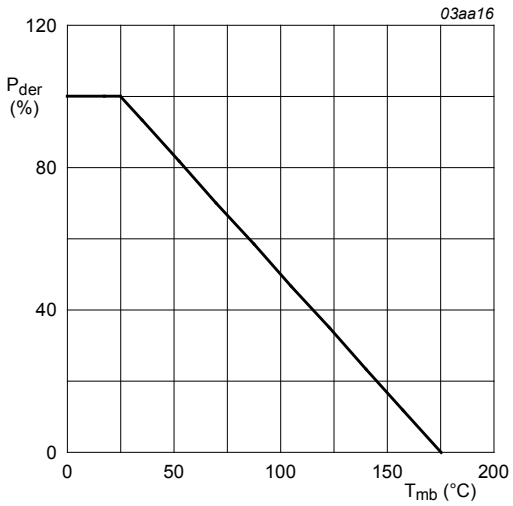


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

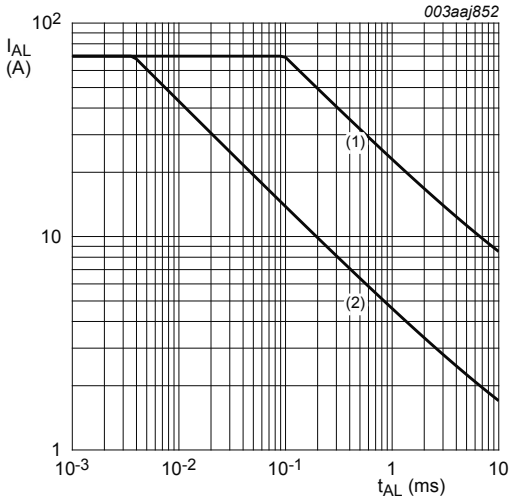


Fig. 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

(1) Single-pulse; $T_j = 25\,°C$.
(2) Single-pulse; $T_j = 125\,°C$.

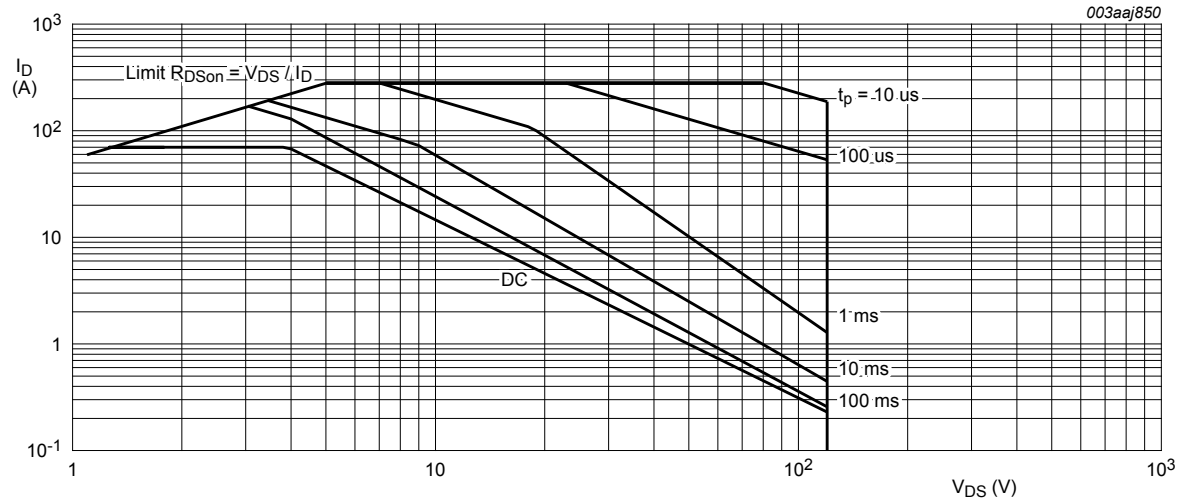


Fig. 4. Safe operating area; continuous and peak drain current as a function of drain-source voltage

$T_{mb} = 25\,°C; I_{DM}$ is single pulse

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		-	0.3	0.37	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in free air		-	65	-	K/W

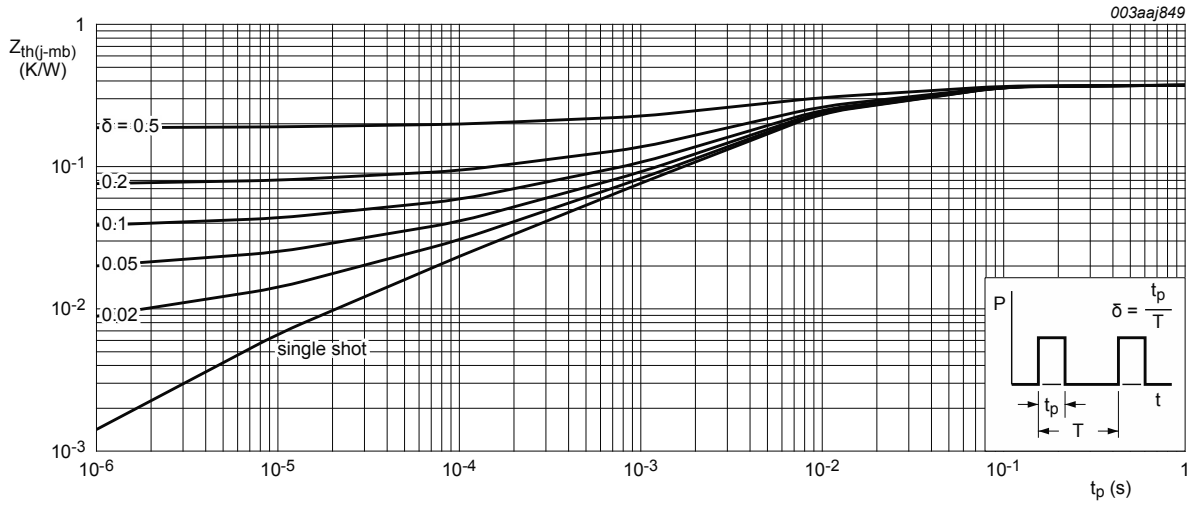


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C		120	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C		108	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; Fig. 10; Fig. 11		2	3	4	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; Fig. 10; Fig. 11		1	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; Fig. 10; Fig. 11		-	-	4.6	V
I_{DSS}	drain leakage current	V_{DS} = 120 V; V_{GS} = 0 V; T_j = 25 °C		-	0.1	1	µA
		V_{DS} = 120 V; V_{GS} = 0 V; T_j = 175 °C		-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	10	100	nA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	10	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 12		4	5.7	6.7	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 175 °C; Fig. 13; Fig. 12		-	16.5	19.4	mΩ
R_G	internal gate resistance (AC)	f = 1 MHz		0.44	0.88	1.76	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 60 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	207.1	-	nC
Q_{GS}	gate-source charge			-	43.2	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	29.8	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	13.4	-	nC
Q_{GD}	gate-drain charge			-	61.9	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	I_D = 25 A; V_{DS} = 60 V; Fig. 14; Fig. 15		-	4.3	-	V
C_{iss}	input capacitance	V_{DS} = 60 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 16		-	11384	-	pF
C_{oss}	output capacitance			-	534	-	pF
C_{rss}	reverse transfer capacitance			-	358	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 60 V; R_L = 2.4 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 5 Ω; T_j = 25 °C		-	42.1	-	ns
t_r	rise time			-	58.2	-	ns

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$t_{d(off)}$	turn-off delay time			-	142.1	-	ns
t_f	fall time			-	67.7	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 17		-	0.79	1.2	V
t_{rr}	reverse recovery time	I_S = 25 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 60 V		-	76.1	-	ns
Q_r	recovered charge			-	264.2	-	nC

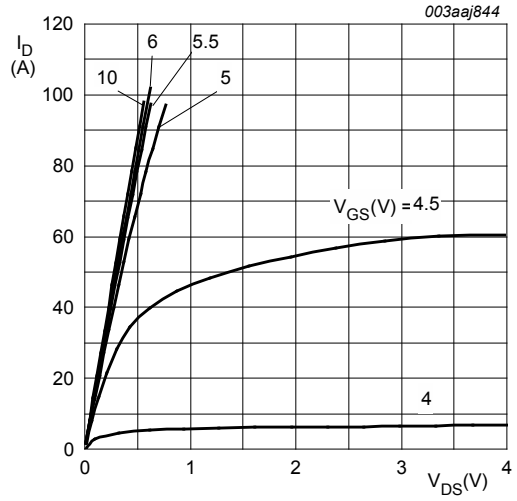


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

$T_j = 25\,°C$

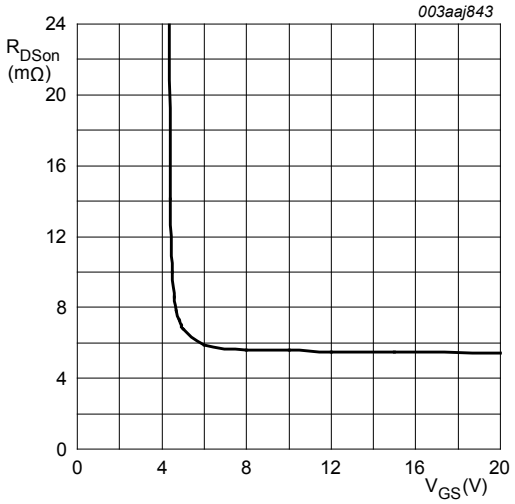


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25\,°C$

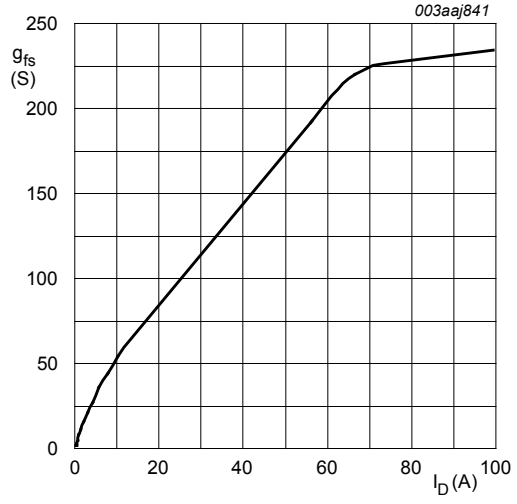


Fig. 8. Forward transconductance as a function of drain current; typical values

$T_j = 25\,°C; V_{DS} = 10\,V$

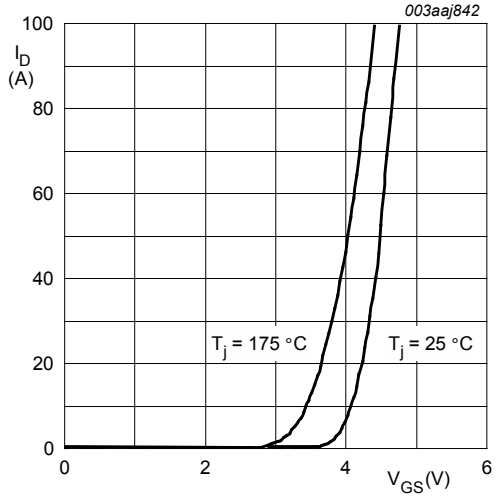


Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

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

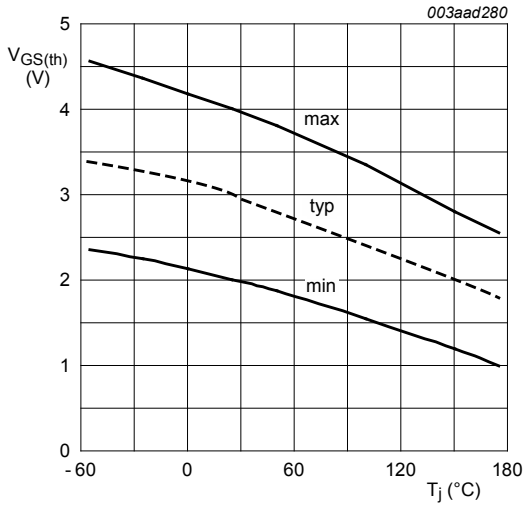


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

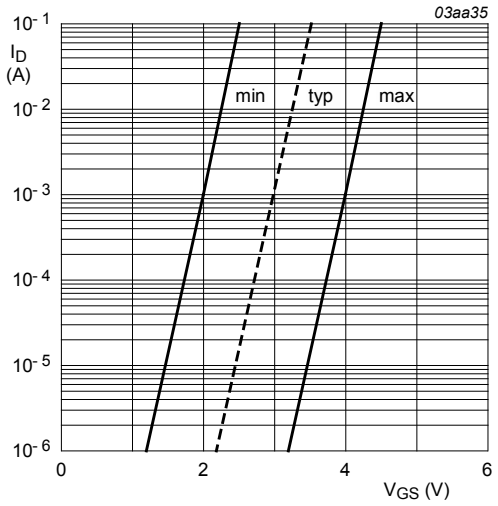


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25\,°C;\ V_{DS} = 5V$

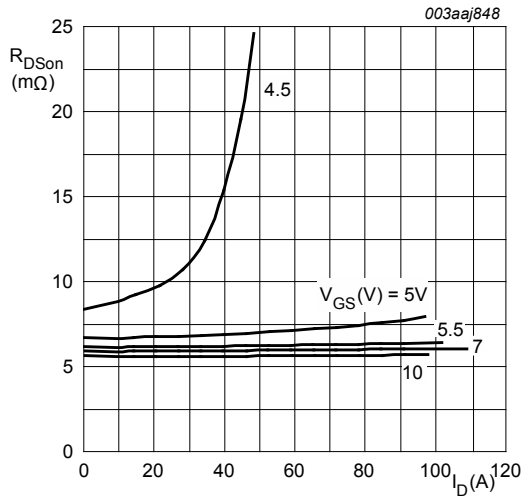


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25\,°C$

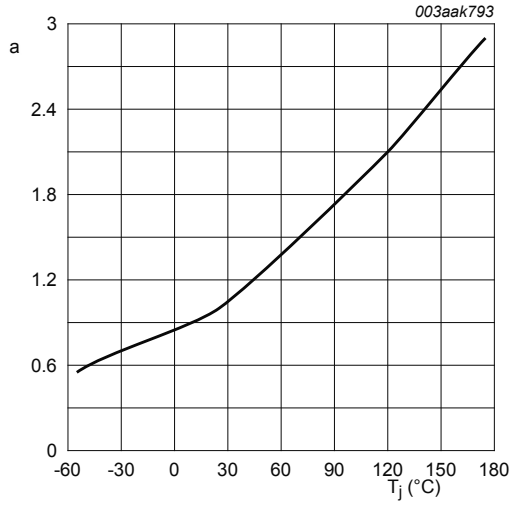


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

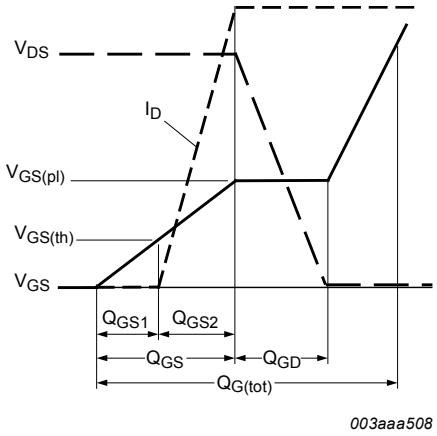


Fig. 14. Gate charge waveform definitions

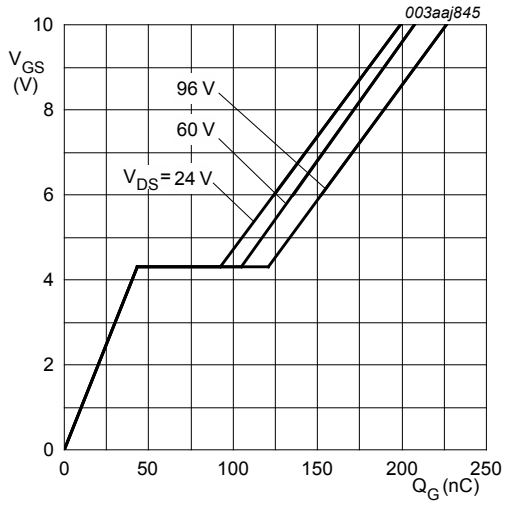


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25\,°C; I_D = 25\,A$

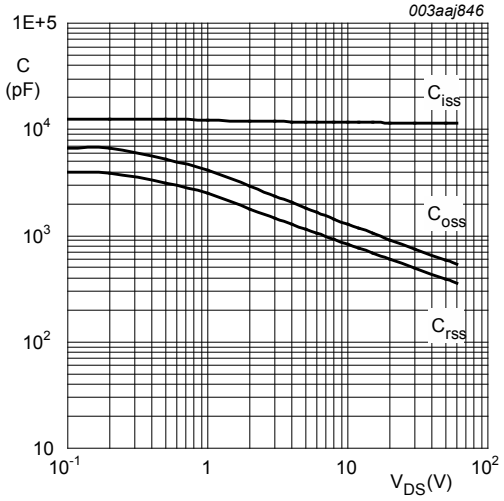


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

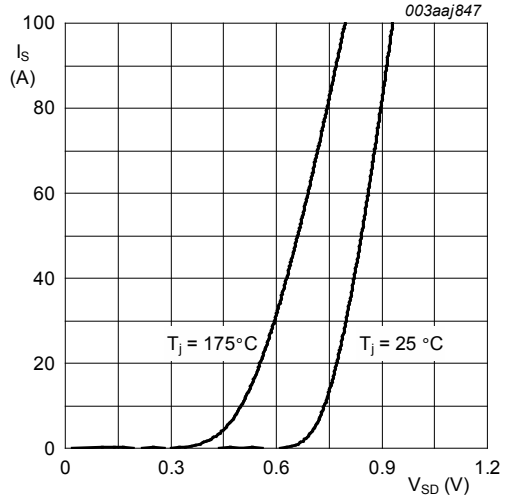
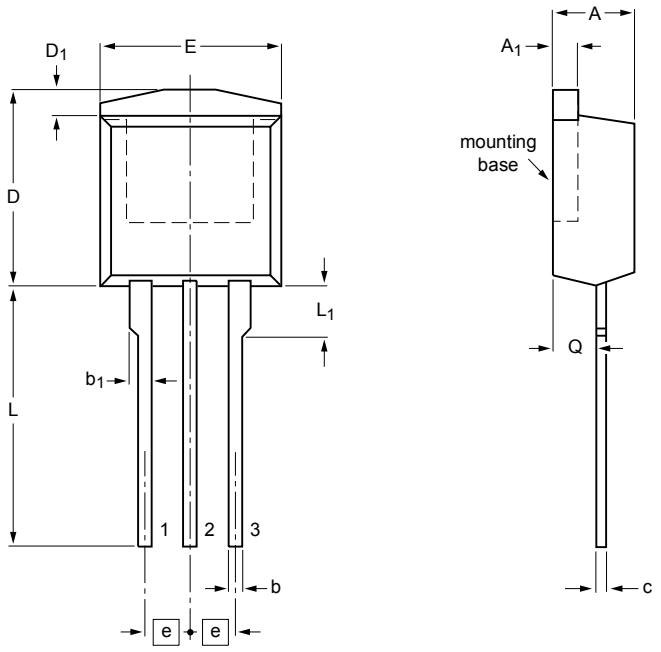


Fig. 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0\,V$

10. 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 I2PAK (SOT226)

11. Legal information

11.1 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.nexperia.com.

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12. Contents

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Date of release: 08 May 2013

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