PSMN2R8-40PS

N-channel TO220 40 V 2.8 mΩ standard level MOSFET

11 February 2013 **Product data sheet**

1. General description

Standard level N-channel MOSFET in TO220 package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

2. Features and benefits

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

3. Applications

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

4. Quick reference data

Table 1. Quick reference data

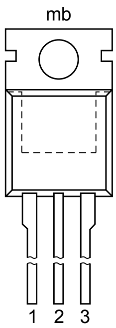
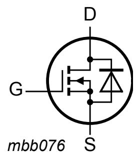
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	40	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; Fig. 1	[1]	-	-	100	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 2		-	-	211	W
T_j	junction temperature			-55	-	175	°C
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 10 A; T_j = 100 °C; Fig. 12; Fig. 13		-	-	4.5	mΩ
		V_{GS} = 10 V; I_D = 10 A; T_j = 25 °C; Fig. 13	[2]	-	2.3	2.8	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	V_{GS} = 10 V; I_D = 25 A; V_{DS} = 20 V; Fig. 14; Fig. 15		-	17	-	nC
$Q_{G(tot)}$	total gate charge			-	71	-	nC

Symbol	Parameter	Conditions		Min	Typ	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 = 100 A; V_{sup} ≤ 40 V; unclamped; R_{GS} = 50 Ω		-	-	407	mJ

[1] Continuous current rating is limited by package.
[2] Measured 3 mm from package.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 **TO-220AB (SOT78)**	
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN2R8-40PS	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN2R8-40PS	PSMN2R8-40PS

8. Limiting values

Table 5. 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; Fig. 1	[1]	-	100	A
		$V_{GS} = 10$ V; $T_{mb} = 25$ °C; Fig. 1	[1]	-	100	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C; Fig. 3		-	797	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; Fig. 2		-	211	W
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
Source-drain diode						
I_S	source current	$T_{mb} = 25$ °C		-	100	A
I_{SM}	peak source current	pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C		-	797	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 100$ A; $V_{sup} \leq 40$ V; unclamped; $R_{GS} = 50$ Ω		-	407	mJ

[1] Continuous current rating is limited by package.

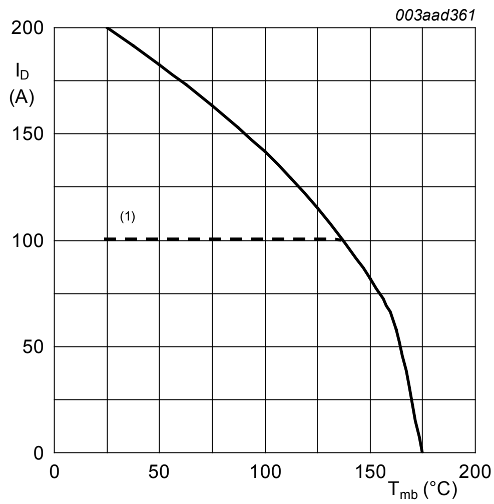


Fig. 1. Continuous drain current as a function of mounting base temperature

$V_{GS} \geq 10\,V$

(1) Capped at 100 A due to package.

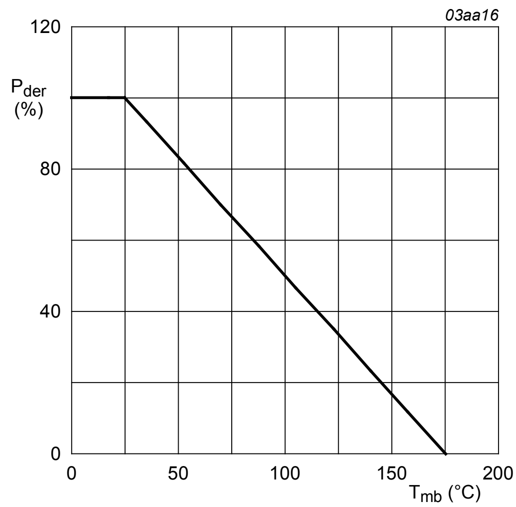


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

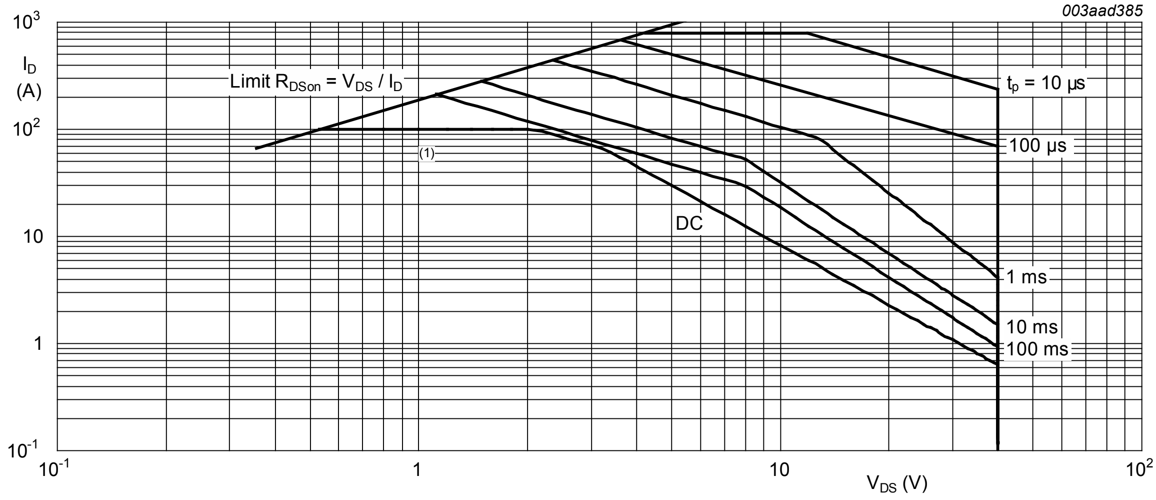


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25$ °C; I_{DM} is a single pulse; (1) Capped at 100 A due to package

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 4		-	0.4	0.7	K/W

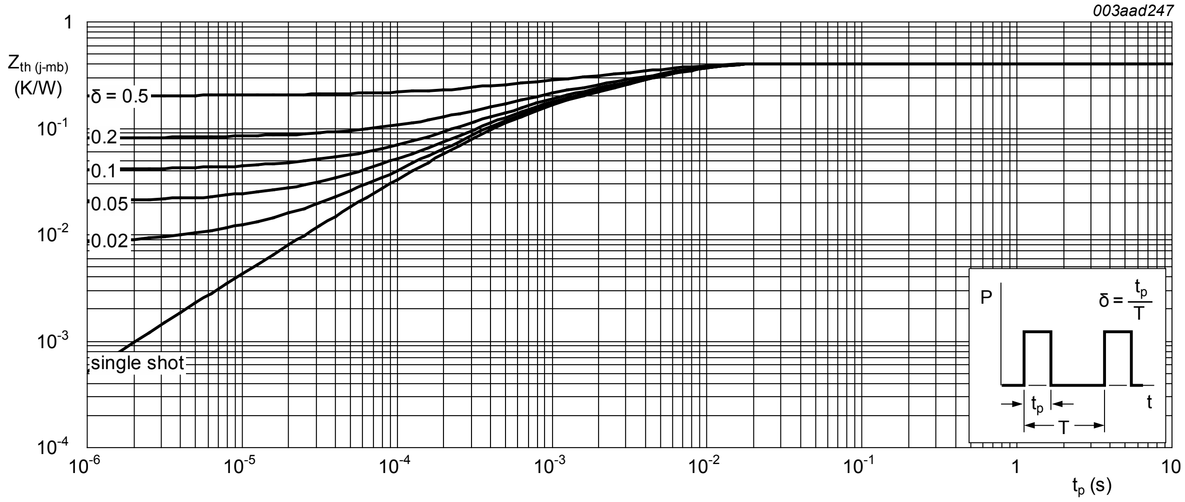


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Tested to JEDEC standards where applicable.

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; Fig. 10; Fig. 11		-	-	4.6	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 = 25 °C; Fig. 10; Fig. 11		2.3	3	4	V
I_{DSS}	drain leakage current	V_{DS} = 40 V; V_{GS} = 0 V; T_j = 25 °C		-	0.3	10	µA
		V_{DS} = 40 V; V_{GS} = 0 V; T_j = 125 °C		-	-	150	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 = 10 A; T_j = 100 °C; Fig. 12; Fig. 13		-	-	4.5	mΩ
		V_{GS} = 10 V; I_D = 10 A; T_j = 175 °C; Fig. 12; Fig. 13		-	-	5.6	mΩ
		V_{GS} = 10 V; I_D = 10 A; T_j = 25 °C; Fig. 13	[1]	-	2.3	2.8	mΩ
R_G	internal gate resistance (AC)	f = 1 MHz		-	0.7	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V		-	61	-	nC
		I_D = 25 A; V_{DS} = 20 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	71	-	nC
Q_{GS}	gate-source charge			-	21	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	13	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	8.5	-	nC
Q_{GD}	gate-drain charge			-	17	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	I_D = 25 A; V_{DS} = 20 V; Fig. 14; Fig. 15		-	4.7	-	V
C_{iss}	input capacitance	V_{DS} = 20 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 16		-	4491	-	pF
C_{oss}	output capacitance			-	937	-	pF

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_{rss}	reverse transfer capacitance			-	464	-	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		-	28	-	ns
t_r	rise time			-	29	-	ns
$t_{d(off)}$	turn-off delay time			-	52	-	ns
t_f	fall time			-	23	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 10 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 17		-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 40 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 20 V		-	47	-	ns
Q_r	recovered charge	I_S = 40 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 20 V; T_j = 25 °C		-	61	-	nC

[1] Measured 3 mm from package.

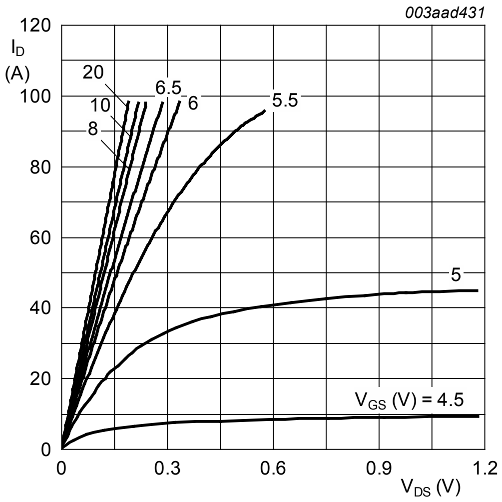


Fig. 5. Output characteristics: drain current as a function of drain-source voltage; typical values

$T_j = 25\,°C$

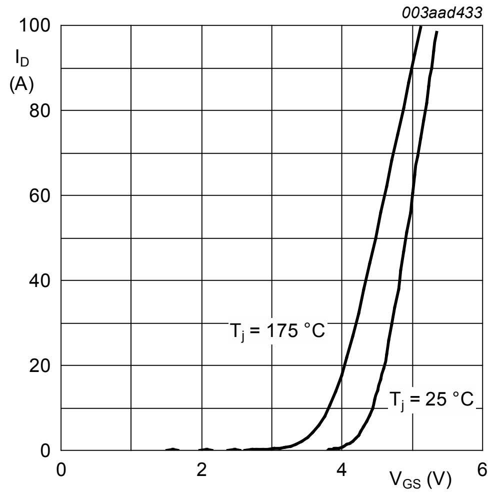


Fig. 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

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

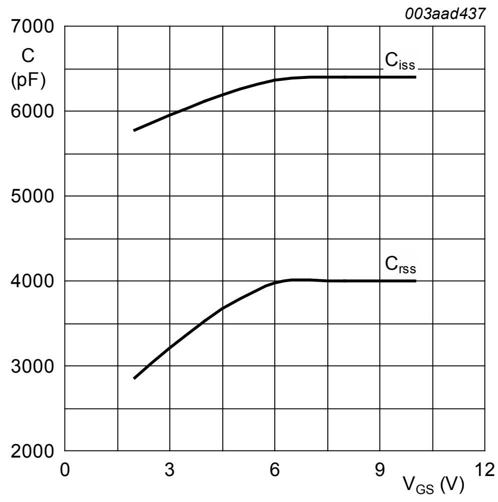


Fig. 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

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

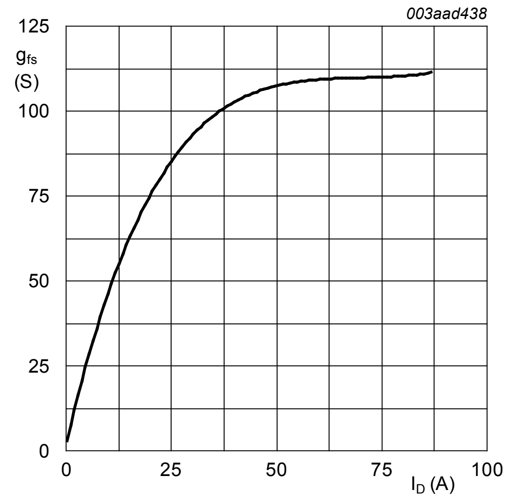


Fig. 8. Forward transconductance as a function of drain current; typical values

$T_j = 25 °C; V_{DS} = 15 V$

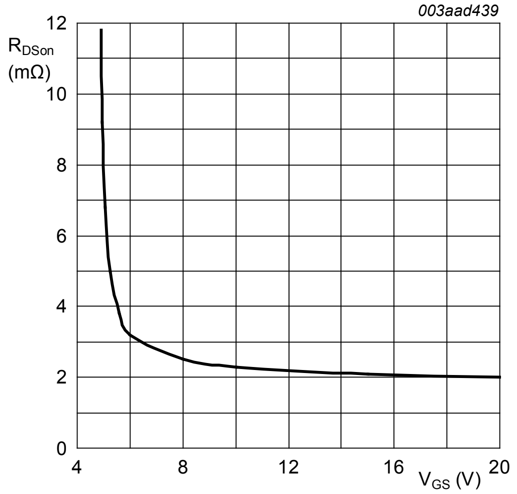


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25 °C; I_D = 25 A$

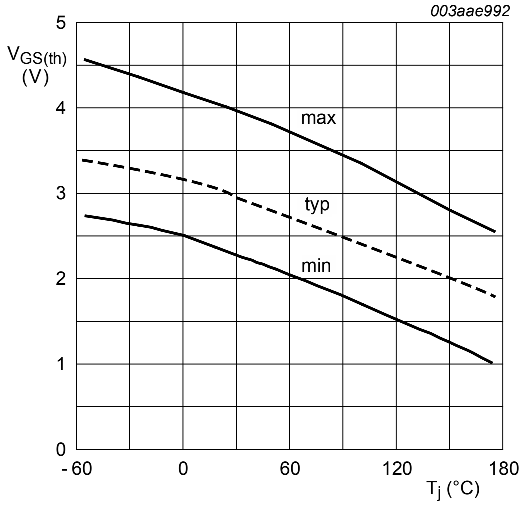


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

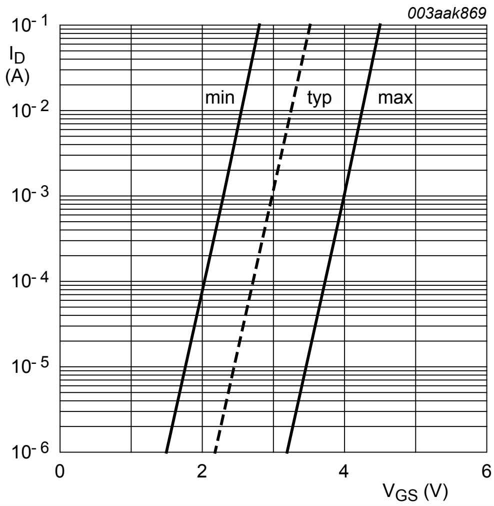


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25\,°C; V_{DS} = 5V$

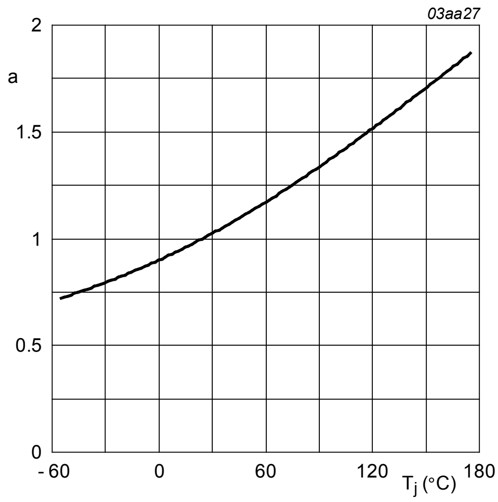


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

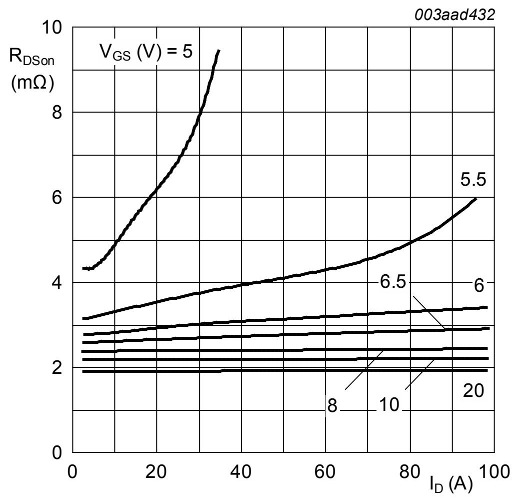


Fig. 13. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25\,°C$

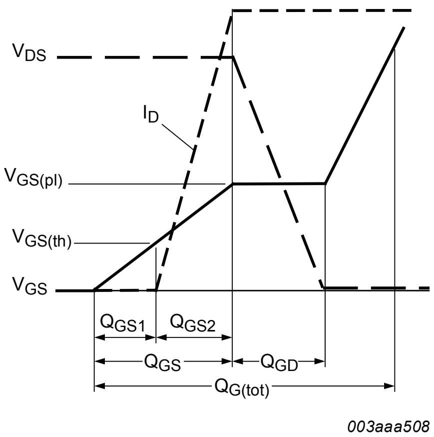


Fig. 14. Gate charge waveform definitions

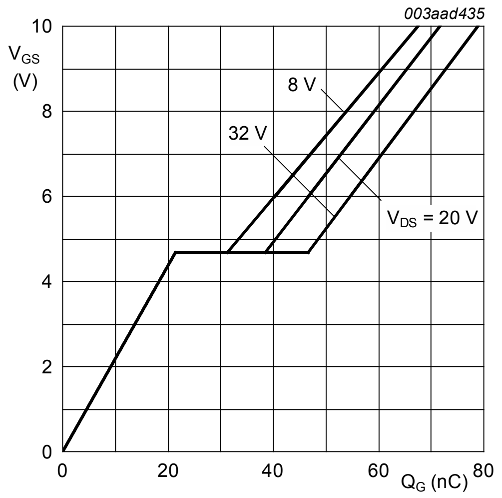


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25\,°C; I_D = 10\,A$

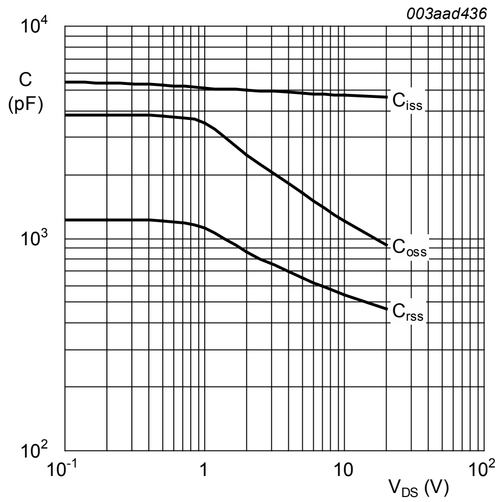


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

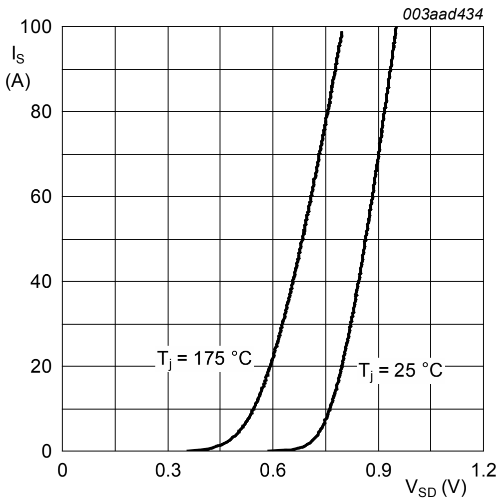
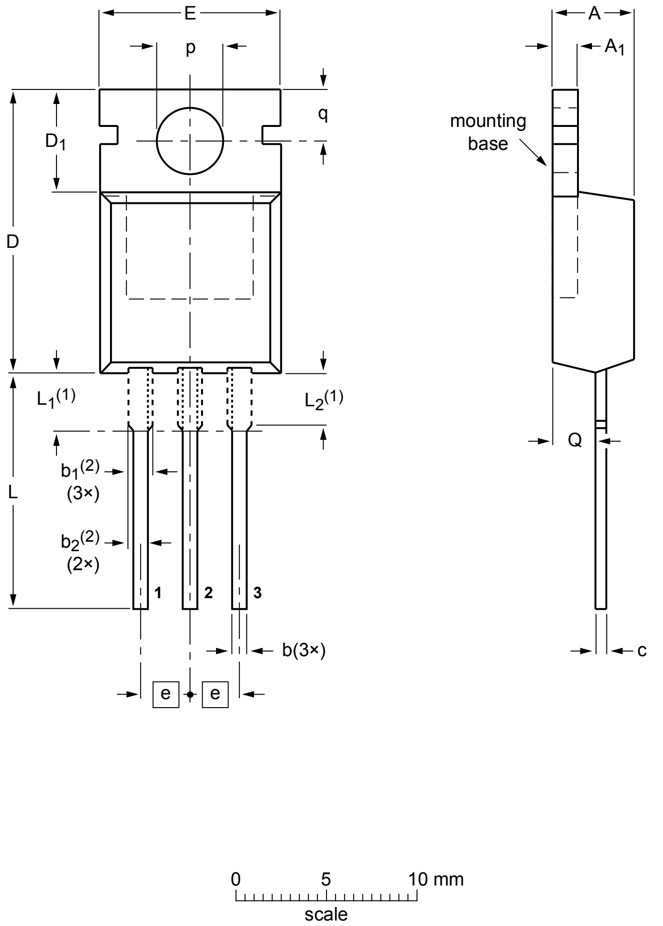


Fig. 17. Source current as a function of source-drain voltage; typical values

$V_{GS} = 0\,V$

11. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB **SOT78**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1(2)	b_2(2)	c	D	D_1	E	e	L	L_1(1)	L_2(1) max.	p	q	Q
mm	4.7 4.1	1.40 1.25	0.9 0.6	1.6 1.0	1.3 1.0	0.7 0.4	16.0 15.2	6.6 5.9	10.3 9.7	2.54	15.0 12.8	3.30 2.79	3.0	3.8 3.5	3.0 2.7	2.6 2.2

Notes

1. Lead shoulder designs may vary.
2. Dimension includes excess dambar.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			~~08-04-23~~ 08-06-13

Fig. 18. Package outline TO-220AB (SOT78)

12. Legal information

12.1 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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13. Contents

Date of release: 11 February 2013