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Kind regards,

Team Nexperia

PSMN2R0-60PSR

N-channel 60 V, 2.2 mΩ standard level MOSFET in TO-220 using Trench Technology

25 June 2014 | Product data sheet

1. General description

Standard level gate drive N-channel enhancement mode MOSFET in TO-220 package using advanced TrenchMOS technology. This product has been designed and qualified to 175 °C for use in a wide range of industrial, communications and Power Supply Equipment.

2. Features and benefits

- Low Q_G, Q_{GD} and Q_{OSS} for high system efficiency
- High reliability TO-220 package
- Qualified to 175 °C
- Reflow solderable

3. Applications

- Server and Telecom voltage regulator
- DC-to-DC, POL and System Power
- Motor Control
- Power OR-ing
- Sync Rectifier
- Load switching

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		-	-	60	V
I_D	drain current	$T_{mb} = 25$ °C; $V_{GS} = 10$ V; Fig. 2	[1]	-	-	120	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; Fig. 1		-	-	338	W
T_j	junction temperature			-55	-	175	°C
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 25$ °C; Fig. 12	[2]	-	1.8	2.2	mΩ
		$V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 100$ °C; Fig. 12; Fig. 13		-	3	3.5	mΩ

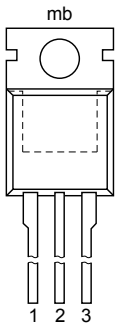
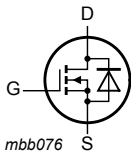
Scan or click this QR code to view the latest information for this product

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Dynamic characteristics							
Q_{GD}	gate-drain charge	V_{GS} = 10 V; I_D = 75 A; V_{DS} = 30 V; Fig. 14; Fig. 15		-	32	45	nC
$Q_{G(tot)}$	total gate charge			-	137	192	nC
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} ≤ 60 V; R_{GS} = 50 Ω; Unclamped		-	-	913	mJ

[1] Continuous current 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
PSMN2R0-60PSR	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

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 ≥ 25 °C; T_j ≤ 175 °C		-	60	V
V_{DGR}	drain-gate voltage	T_j ≥ 25 °C; T_j ≤ 175 °C; R_{GS} = 20 kΩ		-	60	V

Symbol	Parameter	Conditions		Min	Max	Unit
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	338	W
I_D	drain current	V_{GS} = 10 V; T_{mb} = 100 °C; Fig. 2	[1]	-	120	A
		V_{GS} = 10 V; T_{mb} = 25 °C; Fig. 2	[1]	-	120	A
I_{DM}	peak drain current	pulsed; t_p ≤ 10 µs; T_{mb} = 25 °C; Fig. 3		-	1135	A
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 ≤ 10 µs; T_{mb} = 25 °C		-	1135	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} ≤ 60 V; R_{GS} = 50 Ω; Unclamped		-	913	mJ

[1] Continuous current limited by package

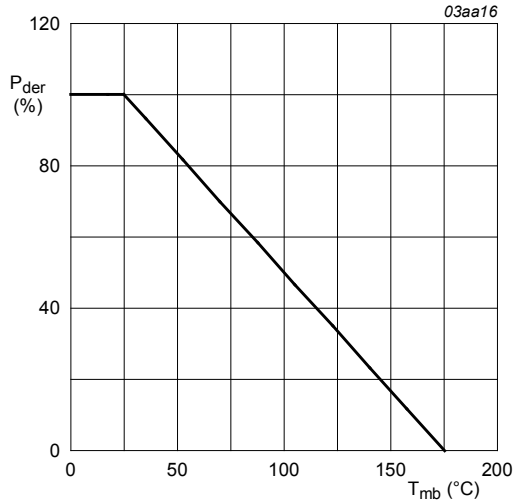


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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

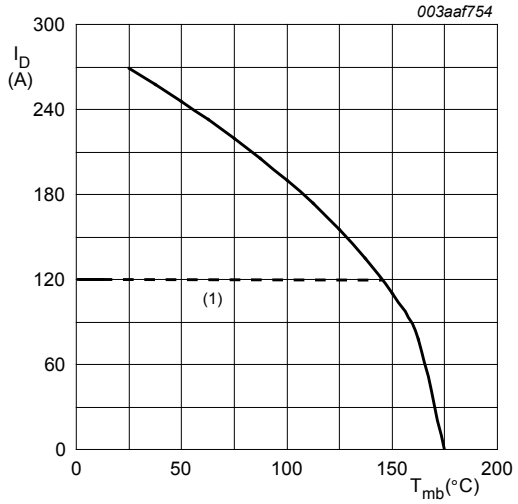


Fig. 2. Continuous drain current as a function of mounting base temperature.

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

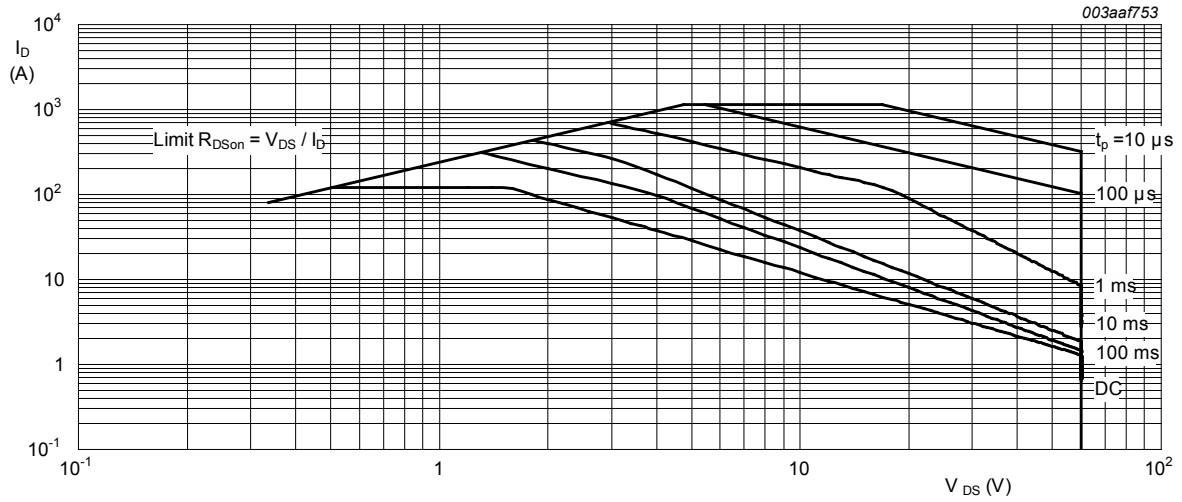


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

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. 4		-	0.22	0.44	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Vertical in free air		-	60	-	K/W

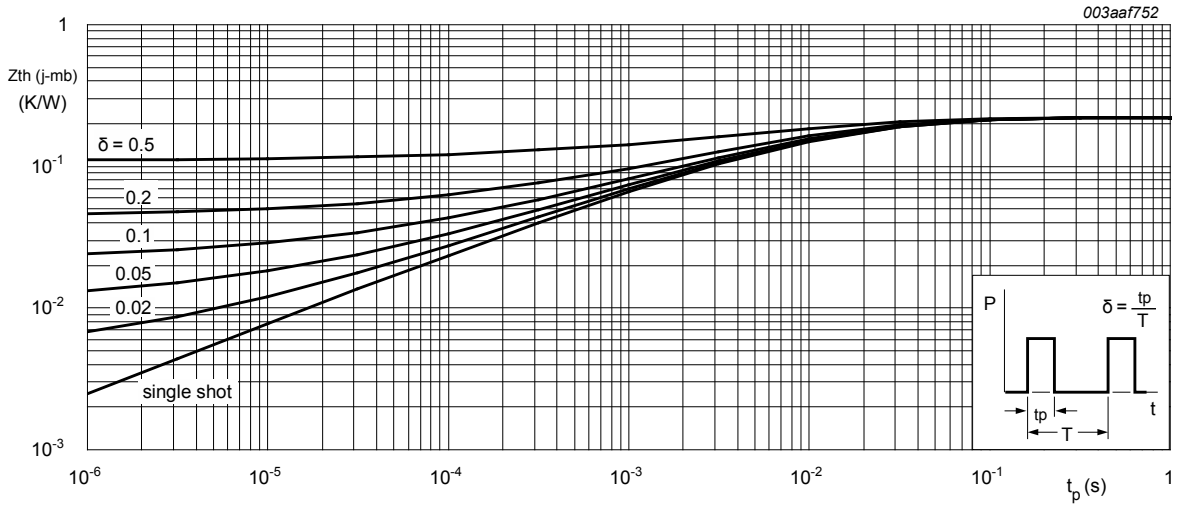


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

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 = -55 °C		54	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C		60	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; Fig. 10		1	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; Fig. 11; Fig. 10		2	3	4	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; Fig. 10		-	-	4.6	V
I_{DSS}	drain leakage current	V_{DS} = 60 V; V_{GS} = 0 V; T_j = 25 °C		-	0.03	10	µA
		V_{DS} = 60 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		-	-	100	nA
		V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	-	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 12	[1]	-	1.8	2.2	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 175 °C; Fig. 12; Fig. 13		-	4.3	5.1	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 100 °C; Fig. 12; Fig. 13		-	3	3.5	mΩ
R_G	gate resistance	f = 1 MHz		0.45	0.9	1.8	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 75 A; V_{DS} = 30 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	137	192	nC
		I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	129	181	nC
Q_{GS}	gate-source charge	I_D = 75 A; V_{DS} = 30 V; V_{GS} = 10 V		-	48	68	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	I_D = 75 A; V_{DS} = 30 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	29	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	19	-	nC
Q_{GD}	gate-drain charge			-	32	45	nC
$V_{GS(pl)}$	gate-source plateau voltage	V_{DS} = 30 V; Fig. 14; Fig. 15		-	5.7	-	V
C_{iss}	input capacitance	V_{DS} = 30 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 16		-	9997	13500	pF
C_{oss}	output capacitance			-	1210	1640	pF

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_{rss}	reverse transfer capacitance			-	594	835	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 30 V; R_L = 0.4 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 4.7 Ω; I_D = 75 A		-	42	63	ns
t_r	rise time			-	56	84	ns
$t_{d(off)}$	turn-off delay time			-	115	173	ns
t_f	fall time			-	49	74	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 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} = 30 V		-	57	75	ns
Q_r	recovered charge	I_S = 25 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V		-	80	104	nC

[1] Measured 3 mm from package.

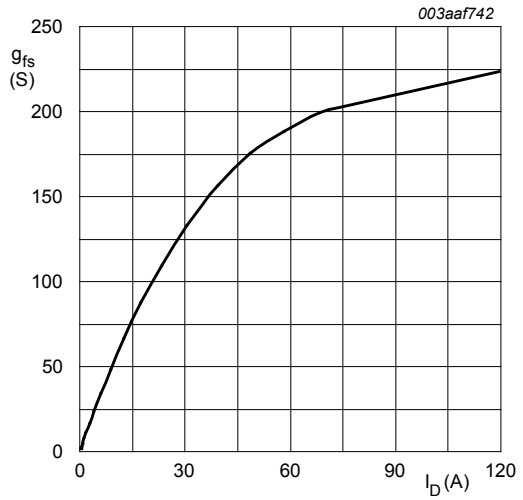


Fig. 5. Forward transconductance as a function of drain current; typical values

$T_j = 25\ °C;\ V_{DS} = 30V$

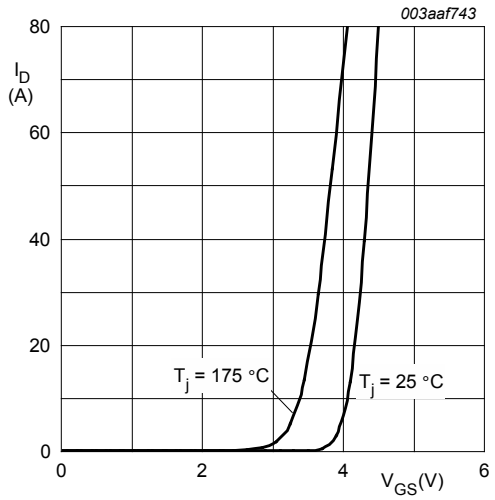


Fig. 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

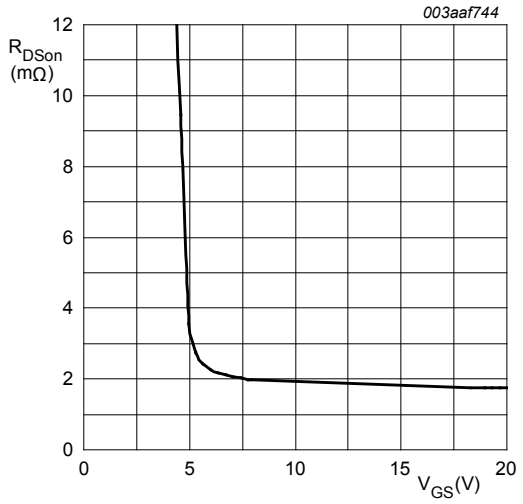


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25$ °C; $I_D = 25$ A

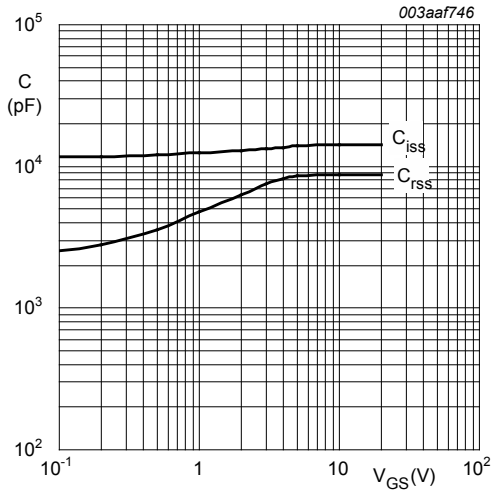


Fig. 8. Input and reverse transfer capacitances as a function of gate-source voltage, typical values

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

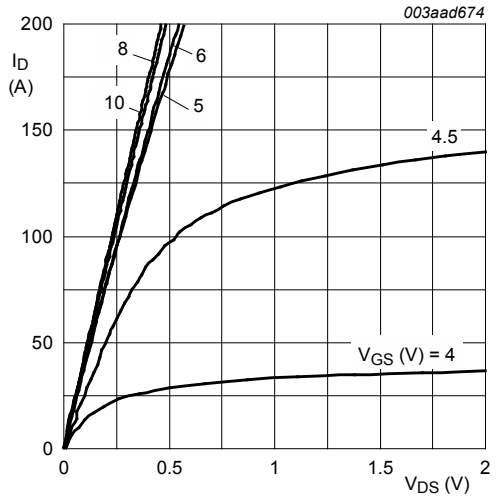


Fig. 9. Output characteristics: drain current as a function of drain-source voltage; typical values

$T_j = 25\,°C$

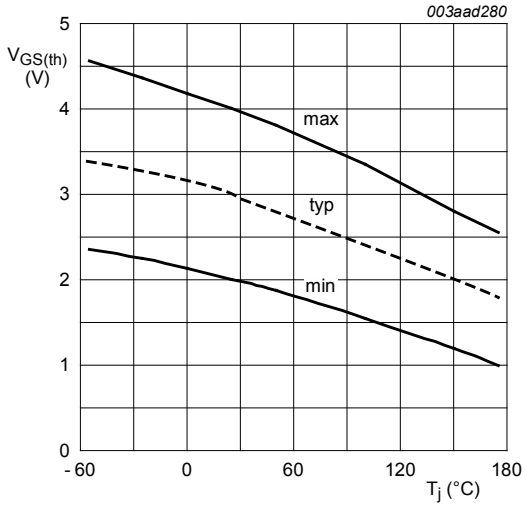


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

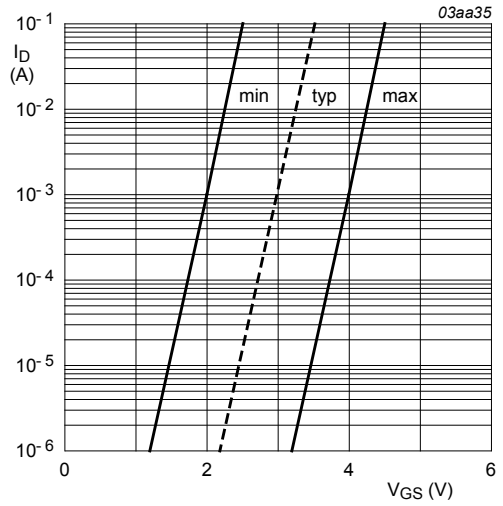


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25\,°C; V_{DS} = 5V$

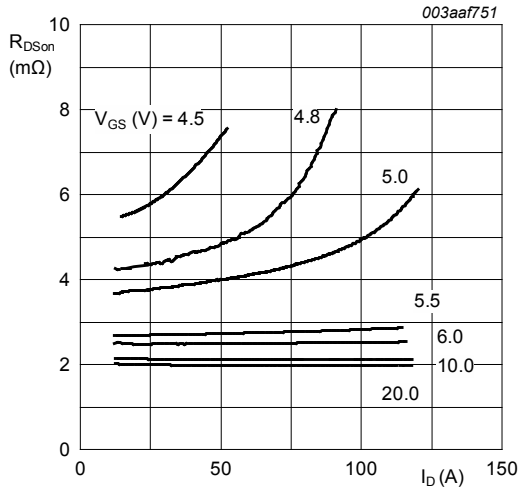


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25\,°C$

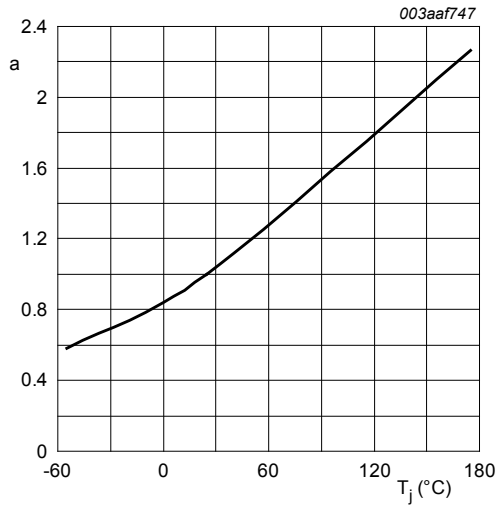


Fig. 13. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25\ °C; I_D = 25\ A$

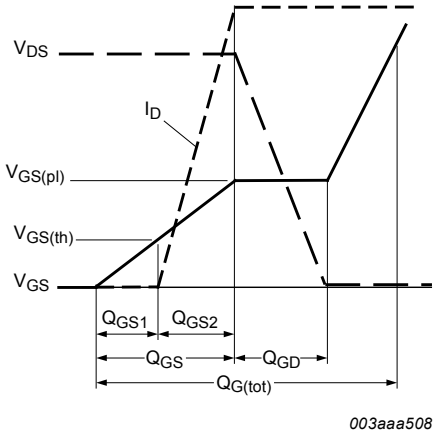


Fig. 14. Gate charge waveform definitions

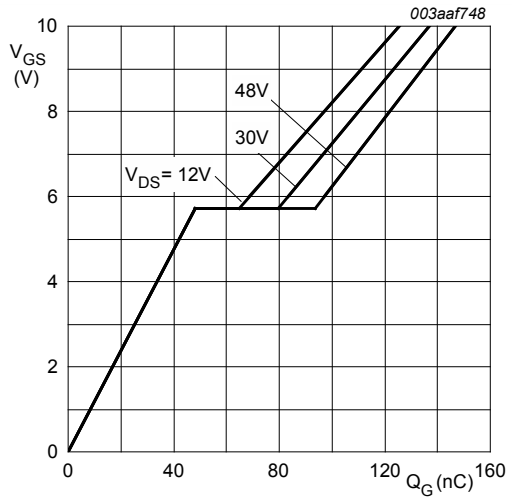


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25$ °C; $I_D = 75$ A

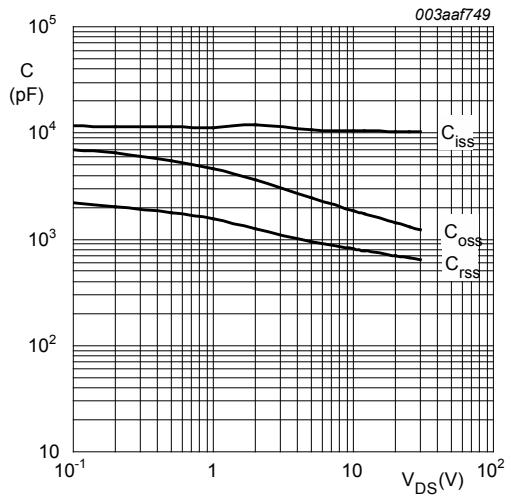


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

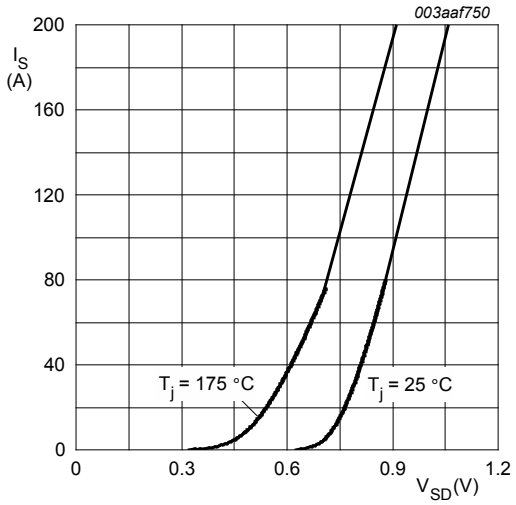
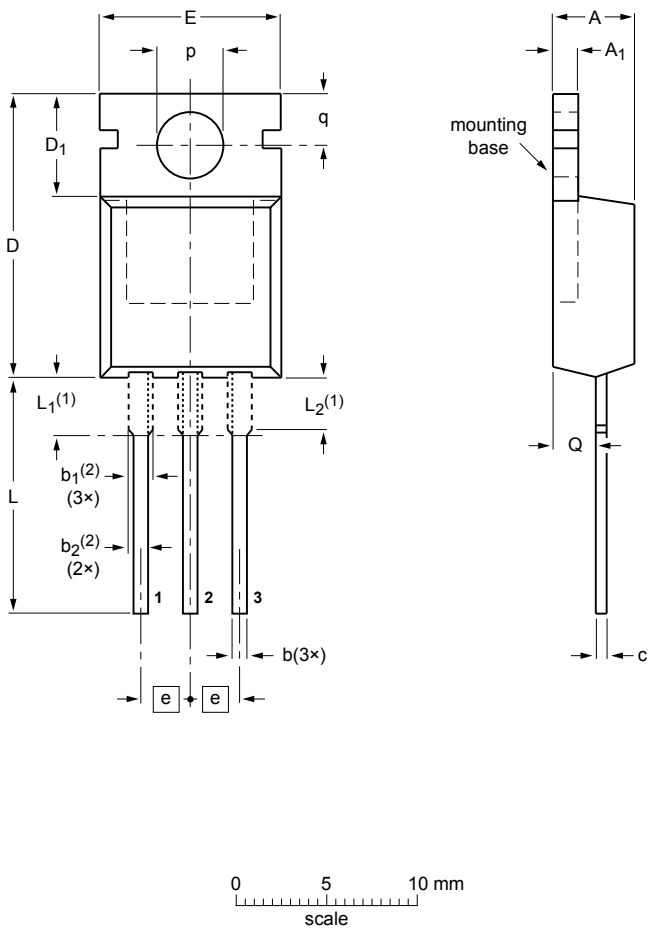


Fig. 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0$ V

10. Package outline

Plastic single-ended package; 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)

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.nxp.com.

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