PSMN057-200B

N-channel TrenchMOS SiliconMAX standard level FET

15 August 2013 Product data sheet

1. General description

SiliconMAX standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

2. Features and benefits

- Higher operating power due to low thermal resistance
- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics

3. Applications

- DC-to-DC converters
- Switched-mode power supplies

4. Quick reference data

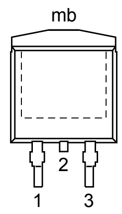
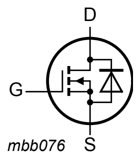
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	200	V
I_D	drain current	$T_{mb} = 25$ °C		-	-	39	A
P_{tot}	total power dissipation			-	-	250	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 17$ A; $T_j = 25$ °C		-	41	57	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10$ V; $I_D = 39$ A; $V_{DS} = 160$ V; $T_j = 25$ °C		-	37	50	nC

nexperia

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 D2PAK (SOT404)	
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
PSMN057-200B	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN057-200B	PSMN057-200B

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		-	200	V
V_{DGR}	drain-gate voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C; $R_{GS} = 20$ kΩ		-	200	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	$T_{mb} = 100$ °C		-	27.5	A
		$T_{mb} = 25$ °C		-	39	A
I_{DM}	peak drain current	pulsed; $T_{mb} = 25$ °C		-	156	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C		-	250	W
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C

Symbol	Parameter	Conditions		Min	Max	Unit
Source-drain diode						
I_S	source current	T_{mb} = 25 °C		-	39	A
I_{SM}	peak source current	pulsed; T_{mb} = 25 °C		-	156	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; I_D = 35 A; V_{sup} ≤ 50 V; unclamped; t_p = 100 μs; R_{GS} = 50 Ω		-	300	mJ
I_{AS}	non-repetitive avalanche current	V_{sup} ≤ 50 V; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; R_{GS} = 50 Ω; unclamped		-	35	A

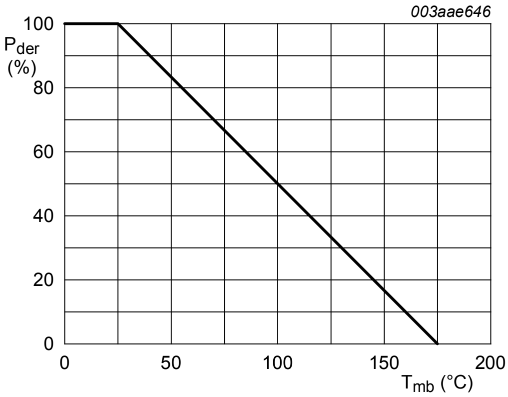


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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

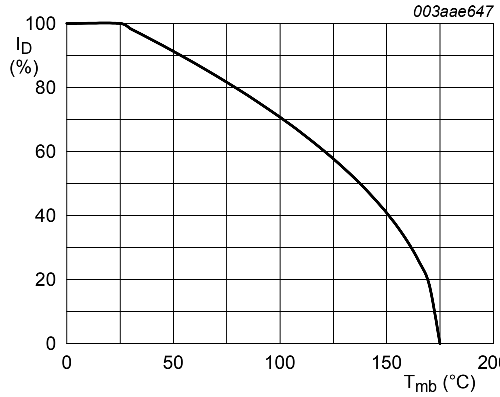
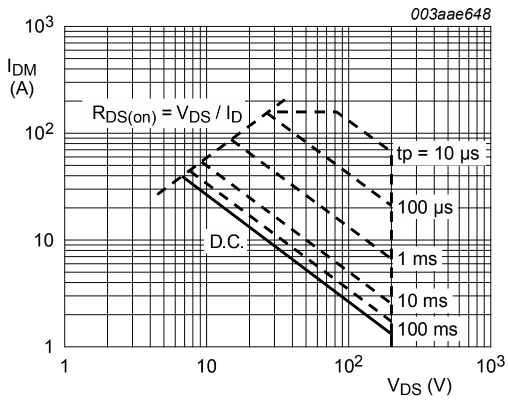


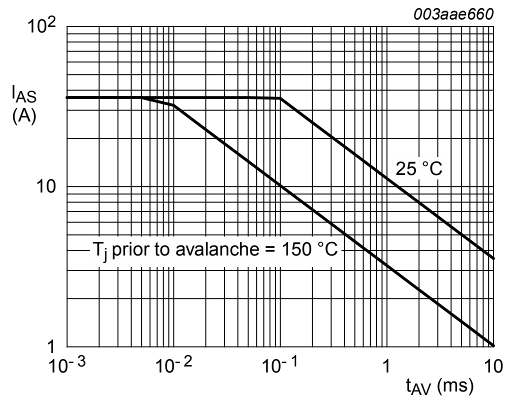
Fig. 2. Normalized continuous drain current as a function of mounting base temperature

$$I_{der} = \frac{I_D}{I_{D(25^{\circ}C)}} \times 100\,\%$$



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

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



unclamped inductive load

Fig. 4. Single-shot avalanche rating; avalanche current as a function of avalanche period

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			-	-	0.6	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	minimum footprint ; FR4 board		-	50	-	K/W

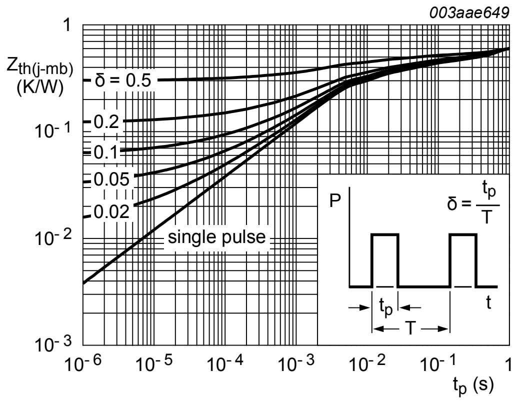


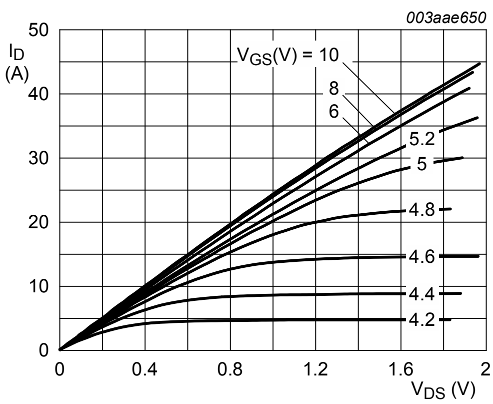
Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

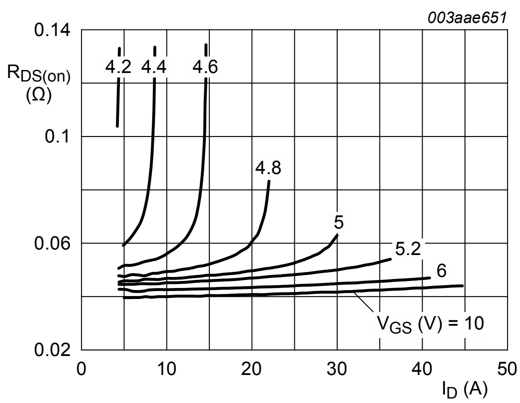
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 0.25 mA; V_{GS} = 0 V; T_j = 25 °C		200	-	-	V
		I_D = 0.25 mA; V_{GS} = 0 V; T_j = -55 °C		178	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C		1	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C		2	3	4	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C		-	-	4.4	V
I_{DSS}	drain leakage current	V_{DS} = 200 V; V_{GS} = 0 V; T_j = 175 °C		-	-	500	µA
		V_{DS} = 200 V; V_{GS} = 0 V; T_j = 25 °C		-	0.03	10	µA
I_{GSS}	gate leakage current	V_{GS} = 10 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
		V_{GS} = -10 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 = 17 A; T_j = 175 °C		-	-	165	mΩ
		V_{GS} = 10 V; I_D = 17 A; T_j = 25 °C		-	41	57	mΩ

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R_G	internal gate resistance (AC)	f = 1 MHz		-	2	4.1	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 39 A; V_{DS} = 160 V; V_{GS} = 10 V; T_j = 25 °C		-	96	135	nC
Q_{GS}	gate-source charge			-	13	-	nC
Q_{GD}	gate-drain charge			-	37	50	nC
C_{iss}	input capacitance	V_{DS} = 25 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C		-	3750	5036	pF
C_{oss}	output capacitance			-	385	520	pF
C_{rss}	reverse transfer capacitance			-	180	252	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 100 V; R_L = 2.7 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 5.6 Ω; T_j = 25 °C		-	18	-	ns
t_r	rise time			-	58	-	ns
$t_{d(off)}$	turn-off delay time			-	105	-	ns
t_f	fall time			-	78	-	ns
L_D	internal drain inductance	measured from tab to centre of die ; T_j = 25 °C		-	3.5	-	nH
L_S	internal source inductance	measured from source lead to source bond pad ; T_j = 25 °C		-	7.5	-	nH
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C		-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 20 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V; T_j = 25 °C		-	133	173	ns
Q_r	recovered charge			-	895	-	nC



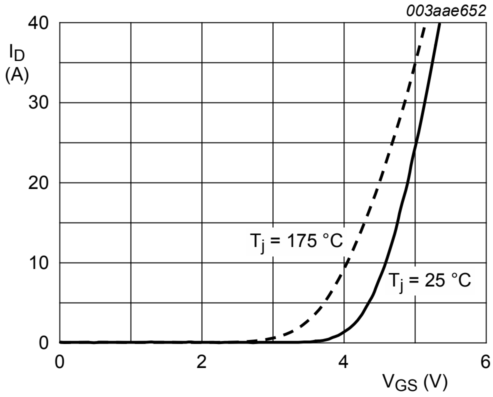
T_j = 25 °C

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



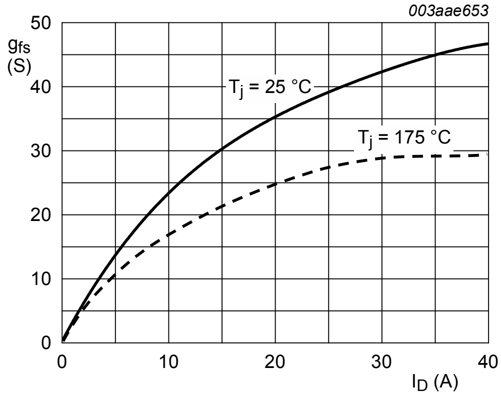
T_j = 25 °C

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



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

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



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

Fig. 9. Forward transconductance as a function of drain current; typical values

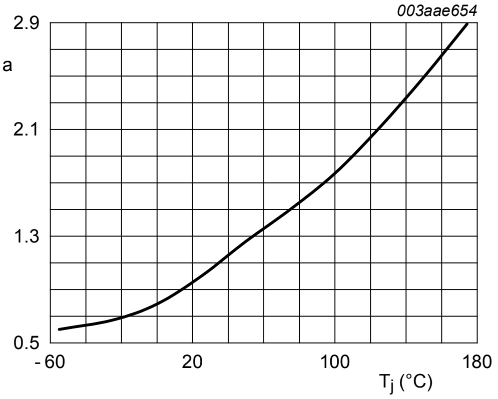
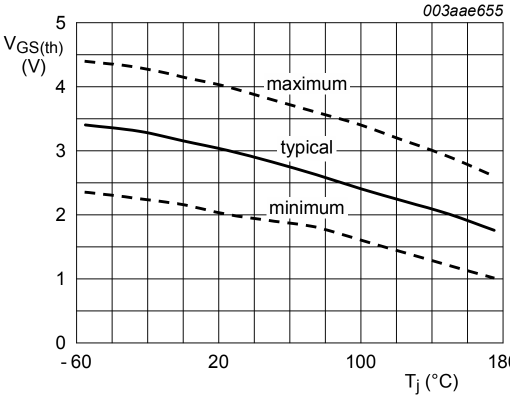


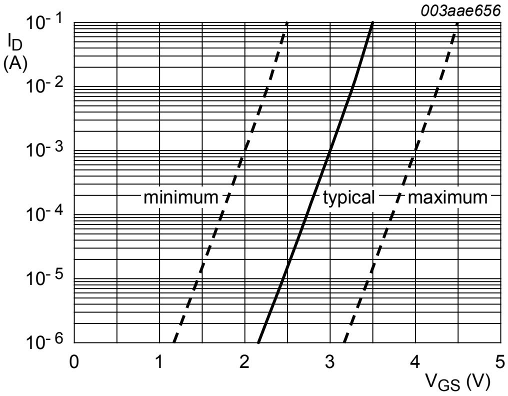
Fig. 10. Normalized drain-source on-state resistance factor as a function of junction temperature

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



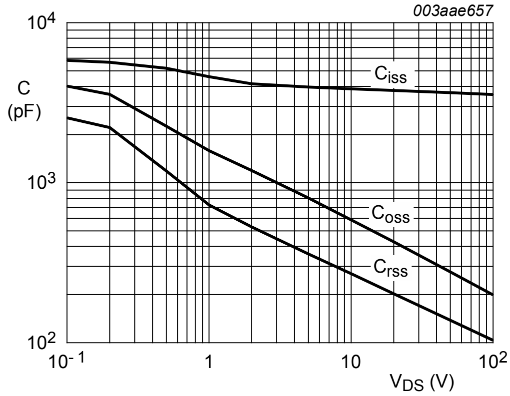
I_D = 1 mA; $V_{DS} = V_{GS}$

Fig. 11. Gate-source threshold voltage as a function of junction temperature



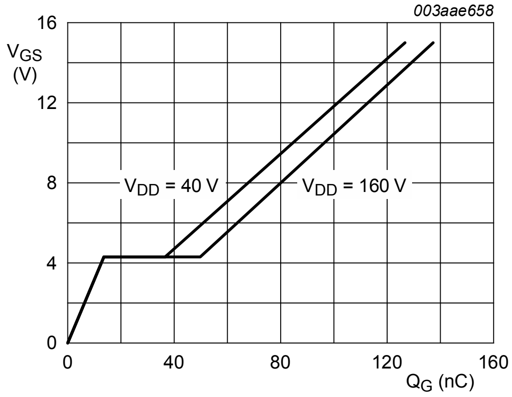
T_j = 25 °C; $V_{DS} = V_{GS}$

Fig. 12. Sub-threshold drain current as a function of gate-source voltage



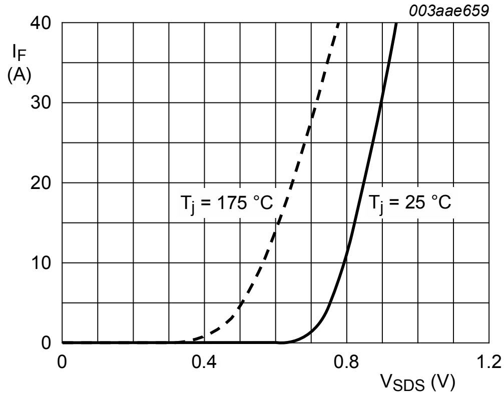
V_{GS} = 0 V; f = 1 MHz

Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



T_j = 25 °C; I_D = 39 A

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

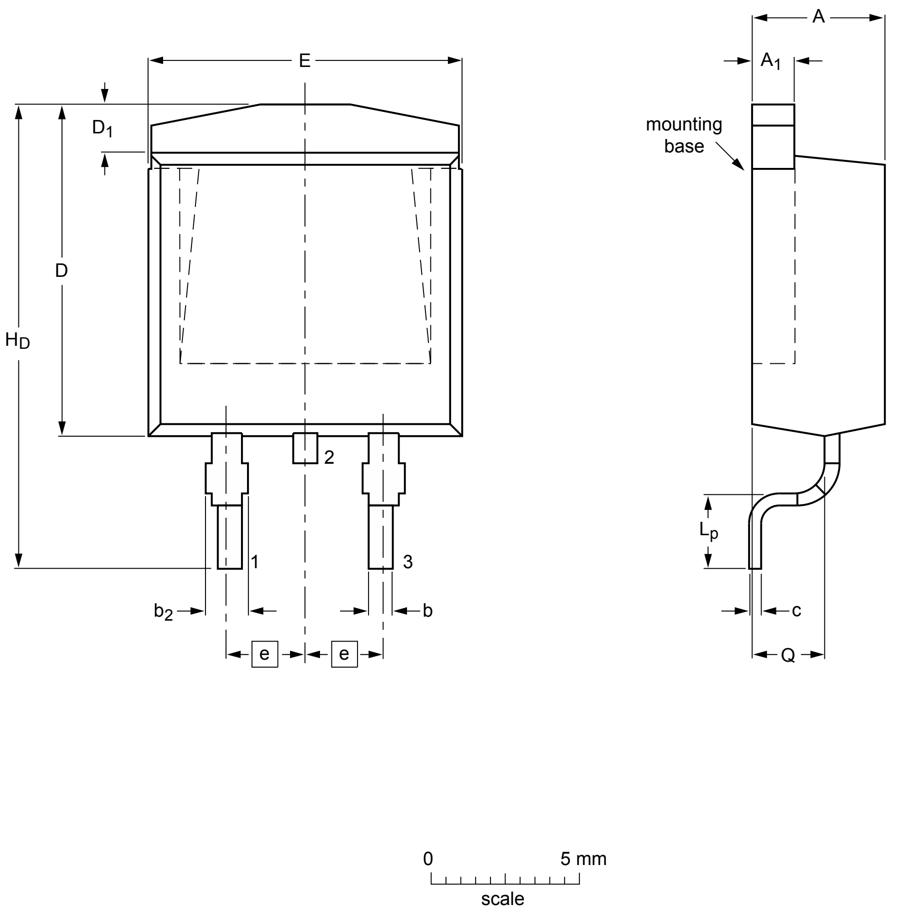


V_{GS} = 0 V

Fig. 15. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

11. Package outline

Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped) **SOT404**



Dimensions (mm are the original dimensions)

Unit		A	A_1	b	b_2	c	D	D_1	E	e	H_D	L_p	Q
	max	4.5	1.40	0.85	1.45	0.64	11	1.6	10.3		15.8	2.9	2.6
mm	nom									2.54			
	min	4.1	1.27	0.60	1.05	0.46		1.2	9.7		14.8	2.1	2.2

sot404_po

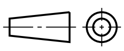
Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT404						~~06-03-16~~ 13-02-25

Fig. 16. Package outline D2PAK (SOT404)

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.
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Product [short] data sheet	Production	This document contains the product specification.

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13. Contents

Date of release: 15 August 2013