

## Cool MOS Power-Transistor

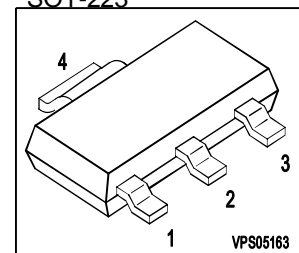
- New revolutionary high voltage technology
- Ultra low gate charge
- Extreme  $dv/dt$  rated
- Optimized capacitances
- Improved noise immunity



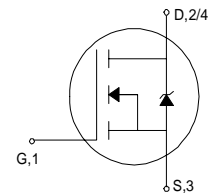
### Product Summary

$V_{DS} @ T_{jmax}$	650	V
$R_{DS(on)}$	6	$\Omega$
$I_D$	0.3	A

SOT-223



Type	Package	Ordering Code	Marking
SPN01N60S5	SOT-223	Q67040-S4208	01N60S5



**Maximum Ratings**, at  $T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous drain current $T_A = 25\text{ °C}$ $T_A = 70\text{ °C}$	$I_D$	0.3 0.2	A
Pulsed drain current <sup>1)</sup> $T_A = 25\text{ °C}$	$I_{D\text{ puls}}$	1.6	
Reverse diode $dv/dt$ $I_S = 0.3\text{ A}$ , $V_{DS} < V_{DSS}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $T_{jmax} = 150\text{ °C}$	$dv/dt$	6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$	$\pm 20$	V
Power dissipation $T_A = 25\text{ °C}$	$P_{tot}$	1.8	W
Operating and storage temperature	$T_j, T_{stg}$	-55... +150	$^{\circ}\text{C}$

**Electrical Characteristics**, at  $T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

**Thermal Characteristics**

Thermal resistance, junction - soldering point	$R_{thJS}$	-	35	-	K/W
SMD version, device on PCB:	$R_{thJA}$				K/W
@ min. footprint		-	110	-	
@ 6 cm <sup>2</sup> cooling area <sup>2)</sup>		-	-	72	

**Static Characteristics**, at  $T_j = 25\text{ °C}$ , unless otherwise specified

Drain-source breakdown voltage $V_{GS} = 0\text{ V}$ , $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	600	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 250\text{ }\mu\text{A}$ , $T_j = 25\text{ °C}$	$V_{GS(th)}$	2.3	3	3.7	
Zero gate voltage drain current, $V_{DS} = V_{DSS}$ $V_{GS} = 0\text{ V}$ , $T_j = 25\text{ °C}$ $V_{GS} = 0\text{ V}$ , $T_j = 150\text{ °C}$	$I_{DSS}$	-	0.5	1	$\mu\text{A}$
		-	-	50	
Gate-source leakage current $V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$	$I_{GSS}$	-	-	100	nA
Drain-source on-state resistance $V_{GS} = 10\text{ V}$ , $I_D = 0.2\text{ A}$	$R_{DS(on)}$	-	5.5	6	$\Omega$

<sup>1</sup> current limited by  $T_{jmax}$ 
<sup>2</sup> Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical without blown air.

**Electrical Characteristics**, at  $T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

### Dynamic Characteristics

Transconductance	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 0.2A$	-	0.45	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0V$ , $V_{DS} = 25V$ , $f = 1MHz$	-	100	-	pF
Output capacitance	$C_{oss}$		-	40	-	
Reverse transfer capacitance	$C_{rss}$		-	2.5	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 350V$ , $V_{GS} = 10V$ , $I_D = 0.3A$ , $R_G = 100\Omega$	-	45	-	ns
Rise time	$t_r$		-	30	-	
Turn-off delay time	$t_{d(off)}$		-	60	90	
Fall time	$t_f$		-	30	45	

### Gate Charge Characteristics

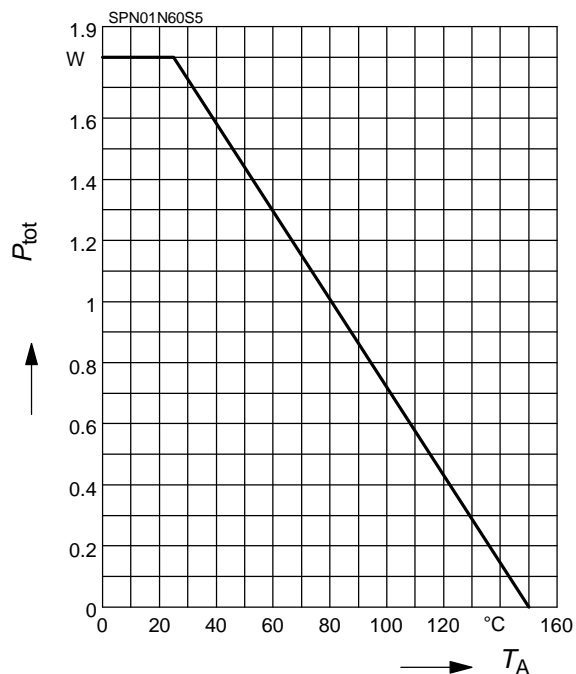
Gate to source charge	$Q_{gs}$	$V_{DD} = 350V$ , $I_D = 0.3A$	-	0.9	-	nC
Gate to drain charge	$Q_{gd}$		-	2.2	-	
Total gate charge	$Q_g$	$V_{DD} = 350V$ , $I_D = 0.3A$ , $V_{GS} = 0$ to $10V$	-	3.9	5	

### Reverse Diode

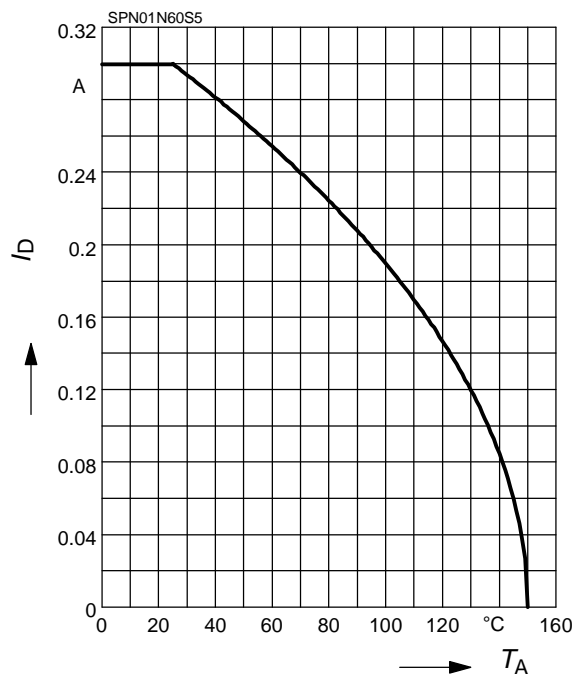
Inverse diode continuous forward current	$I_S$	$T_C = 25\text{ °C}$	-	-	0.3	A
Inverse diode direct current, pulsed	$I_{SM}$		-	-	1.6	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0V$ , $I_F = 0.3A$	-	0.85	1.05	V
Reverse recovery time	$t_{rr}$	$V_R = 100V$ , $I_F = I_S$ , $dI_F/dt = 100A/\mu s$	-	200	340	ns
Reverse recovery charge	$Q_{rr}$		-	0.45	-	

**Power Dissipation**

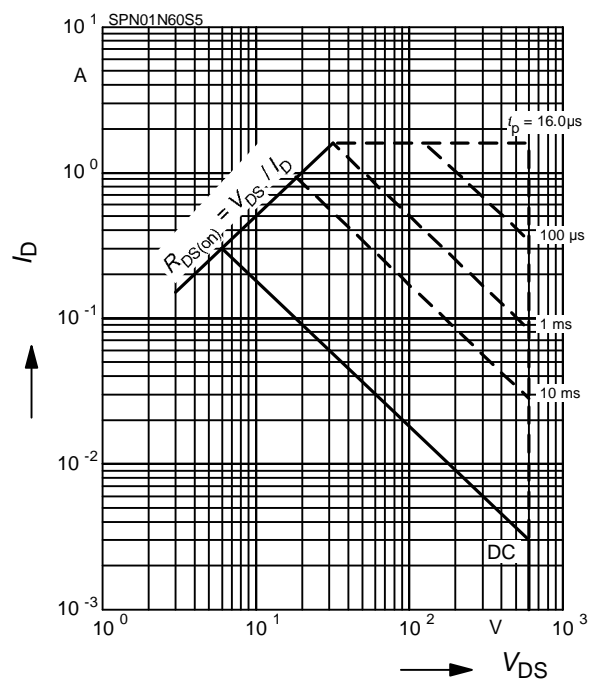
$$P_{\text{tot}} = f(T_A)$$


**Drain current**

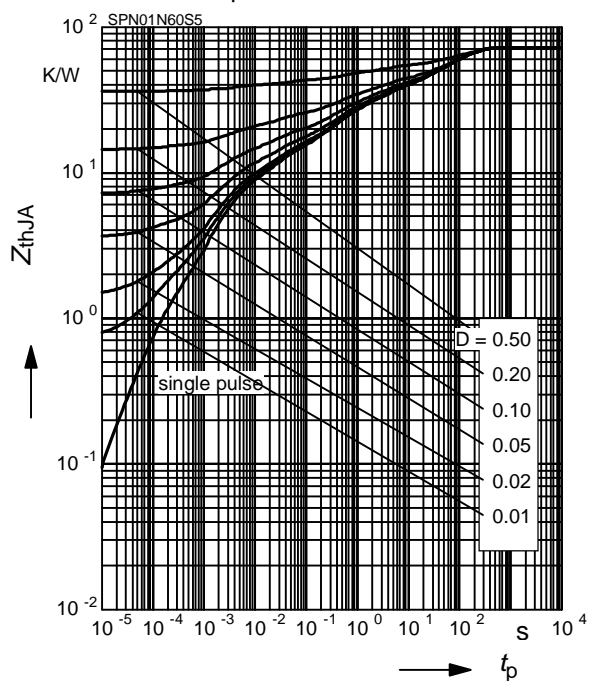
$$I_D = f(T_A)$$

parameter:  $V_{GS} \geq 10 \text{ V}$ 

**Safe operating area**

$$I_D = f(V_{DS})$$

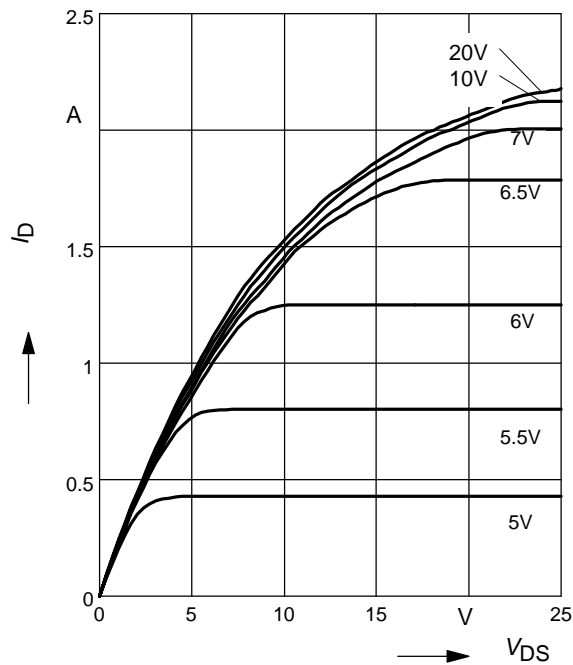
parameter:  $D=0.01$ ,  $T_C=25^\circ\text{C}$ 

**Transient thermal impedance**

$$Z_{thJA} = f(t_p)$$

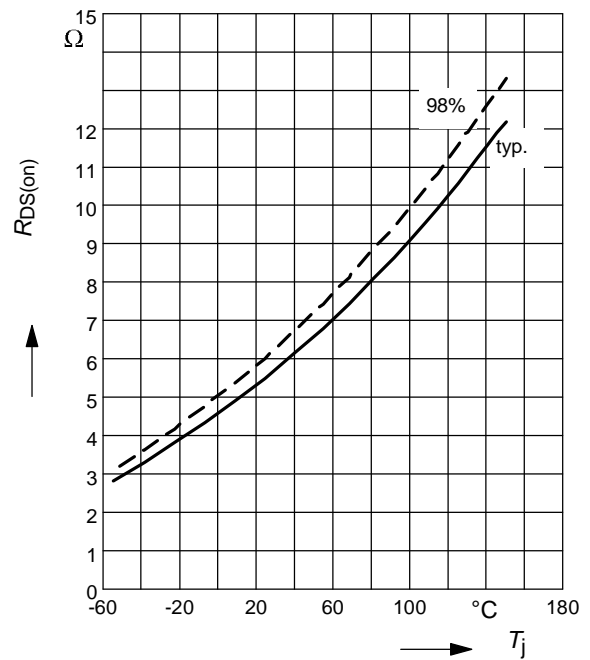
parameter:  $D = t_p / T$ 


**Typ. output characteristic**

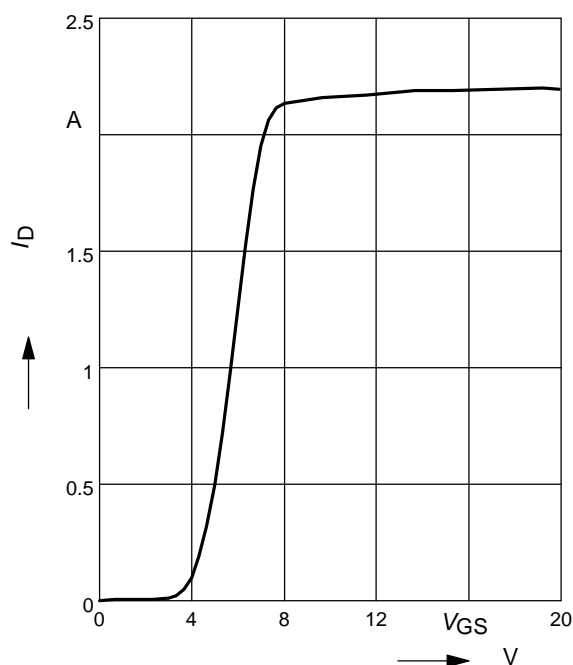
$$I_D = f(V_{DS})$$

Parameter:  $V_{GS}$ ,  $T_j = 25\text{ }^{\circ}\text{C}$ 

**Drain-source on-resistance**

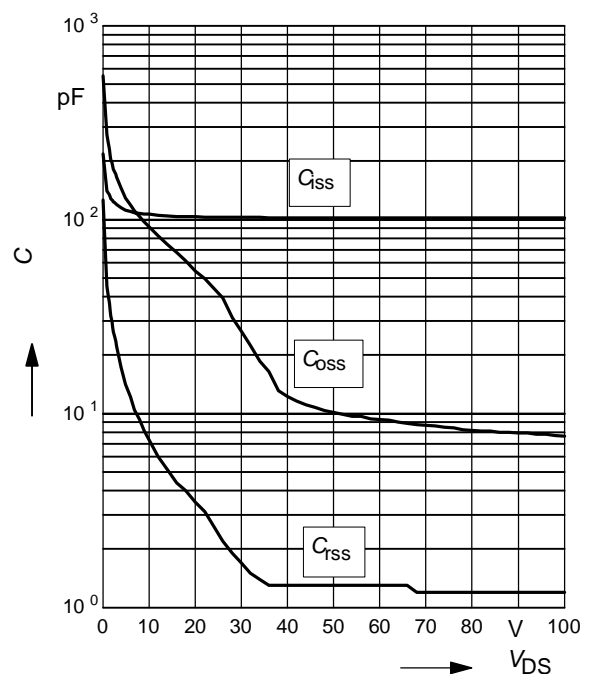
$$R_{DS(on)} = f(T_j)$$

parameter :  $I_D = 0.2\text{ A}$ ,  $V_{GS} = 10\text{ V}$ 

**Typ. transfer characteristics**

$$I_D = f(V_{GS})$$

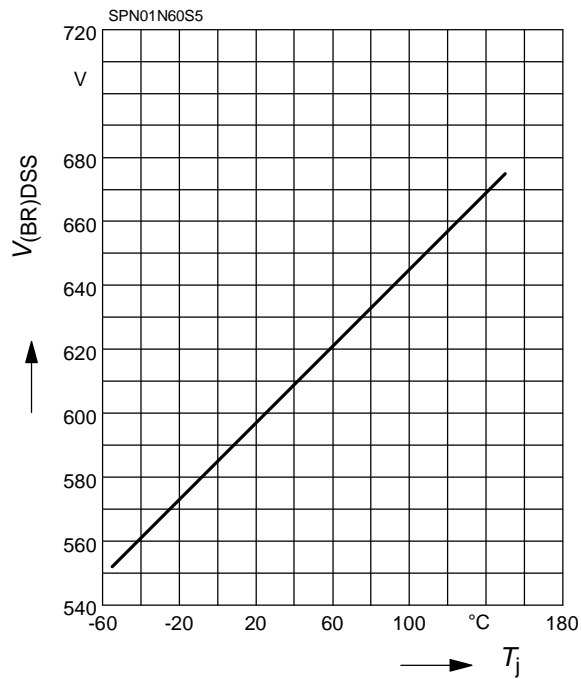
 $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$ 

**Typ. capacitances**

$$C = f(V_{DS})$$

parameter:  $V_{GS} = 0\text{ V}$ ,  $f = 1\text{ MHz}$ 


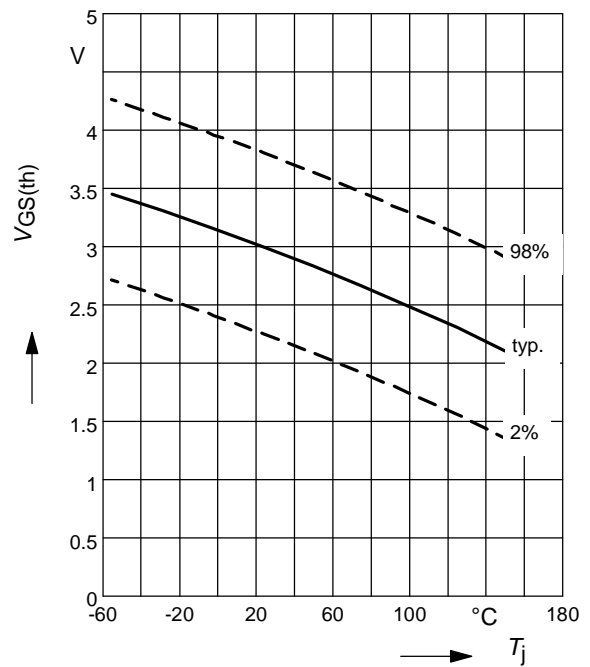
**Drain-source breakdown voltage**

$$V_{(BR)DSS} = f(T_j)$$


**Gate threshold voltage**

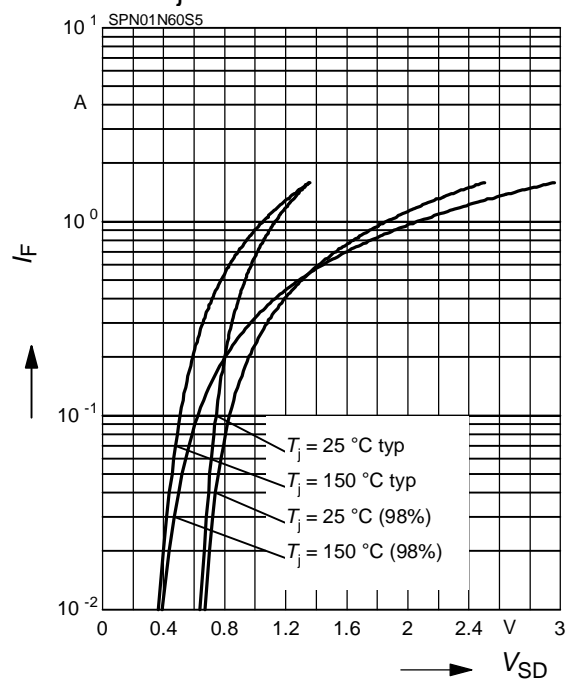
$$V_{GS(th)} = f(T_j)$$

parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 250 \mu A$


**Forward characteristics of reverse diode**

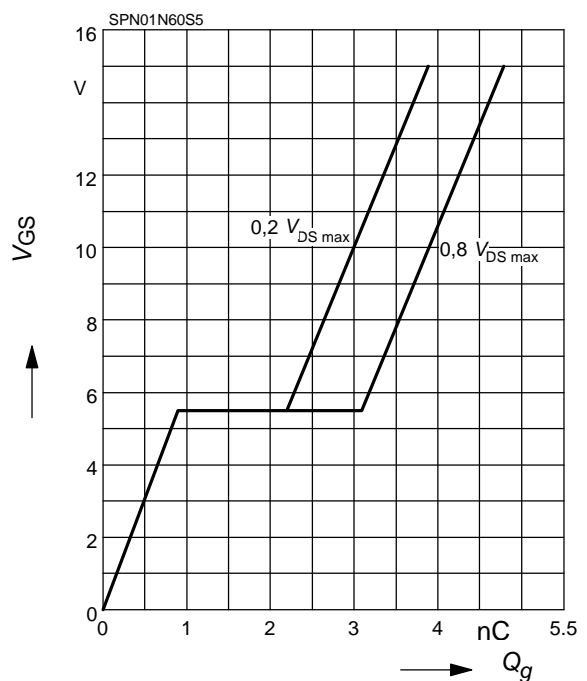
$$I_F = f(V_{SD})$$

parameter:  $T_j$ ,  $t_p = 10 \mu s$


**Typ. gate charge**

$$V_{GS} = f(Q_{Gate})$$

parameter:  $I_D = 0.3 \text{ A pulsed}$





**Published by**  
**Infineon Technologies AG,**  
**Bereichs Kommunikation**  
**St.-Martin-Strasse 53,**  
**D-81541 München**  
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