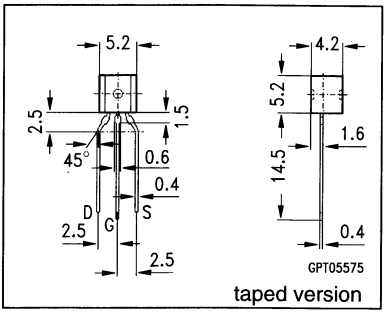
SIEMENS

SIPMOS® Small-Signal Transistor — SN 7000

V_{DS} = 60 V
I_D = 0.25 A
$R_{DS(on)}$ = 5.0 Ω

- N channel
- Enhancement mode
- Package: TO-92 c [1)]



taped version

Type	Ordering code for version in bulk	Ordering code for version on tape
SN 7000	Q67000-S062	–
SN 7000 E 6288	–	Q62702-S638
SN 7000 E 6296	–	Q62702-S637
SN 7000 E 6325	–	Q62702-S382

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	60	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	60	
Gate-source voltage	V_{GS}	± 14	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, T_A = 25 °C	I_D	0.25	A
Pulsed drain current, T_A = 25 °C	$I_{D\,puls}$	1.0	
Max. power dissipation, T_A = 25 °C	P_{tot}	0.63	W
Operating and storage temperature range	T_j, T_{stg}	– 55 ... + 150	°C

Thermal resistance, chip-ambient (without heat sink)	R_{thJA}	≤ 200	K/W
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

[1)] See chapter Packing Information and Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	60	–	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	0.8	1.4	2.0	
Zero gate voltage drain current V_{DS} = 60 V, V_{GS} = 0 T_j = 25 °C T_j = 125 °C	I_{DSS}	 – –	 0.1 –	 1.0 5	µA
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}	–	1	10	nA
Drain-source on-resistance V_{GS} = 10 V, I_D = 0.5 A V_{GS} = 4.5 V, I_D = 0.075 A	$R_{DS(on)}$	 – –	 2.0 3.0	 5.0 5.3	Ω
Dynamic Characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = 0.2 A	g_{fs}	0.1	0.2	–	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{iss}	–	60	80	pF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	15	25	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	–	5	8	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{DD} = 30 V, V_{GS} = 10 V, R_{GS} = 50 Ω, I_D = 0.29 A	$t_{d(on)}$ t_r	– –	5 5	8 8	ns
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{DD} = 30 V, V_{GS} = 10 V, R_{GS} = 50 Ω, I_D = 0.29 A	$t_{d(off)}$ t_f	– –	12 13	16 17	

Electrical Characteristics (cont'd)

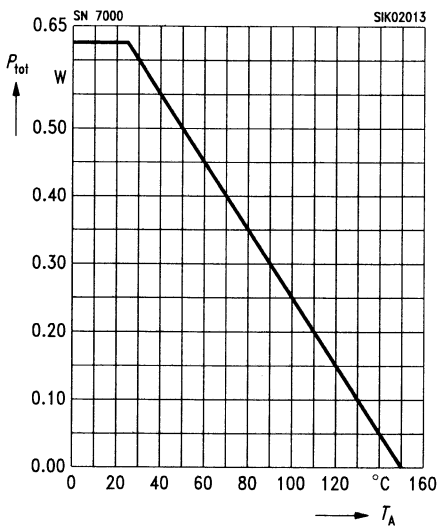
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current T_A = 25 °C	I_S	–	–	0.17	A
Pulsed reverse drain current T_A = 25 °C	I_{SM}	–	–	0.68	
Diode forward on-voltage I_F = 0.5 A, V_{GS} = 0	V_{SD}	–	0.9	1.2	V

Characteristics

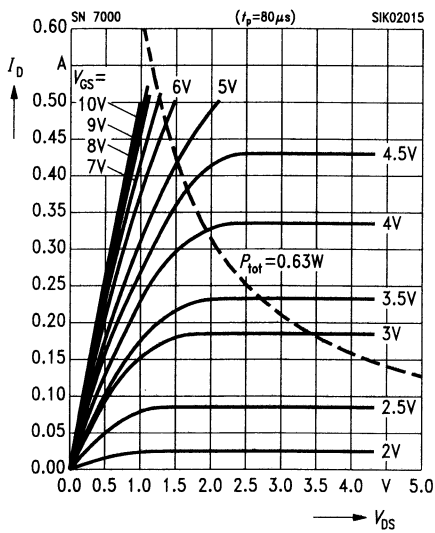
at T_j = 25 °C, unless otherwise specified.

Total power dissipation $P_{tot} = f(T_A)$

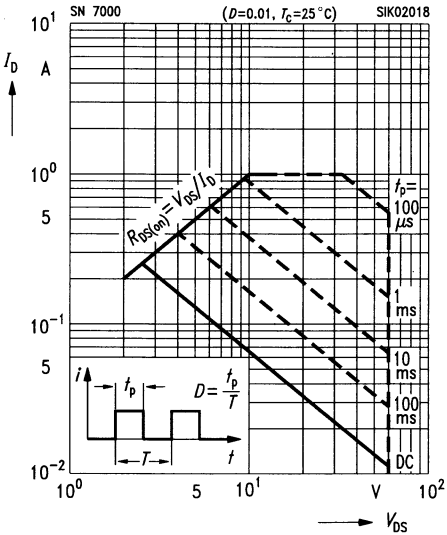


Typ. output characteristics $I_D = f(V_{DS})$

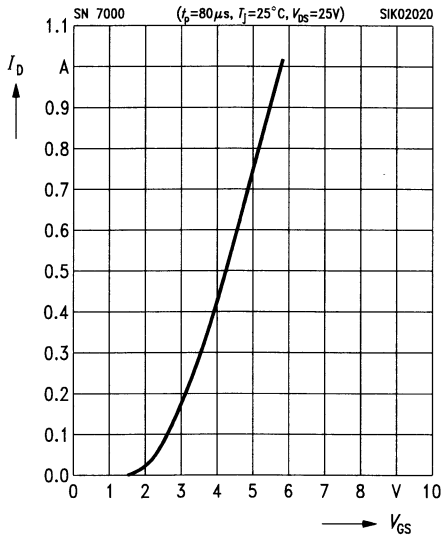
parameter: t_p = 80 µs



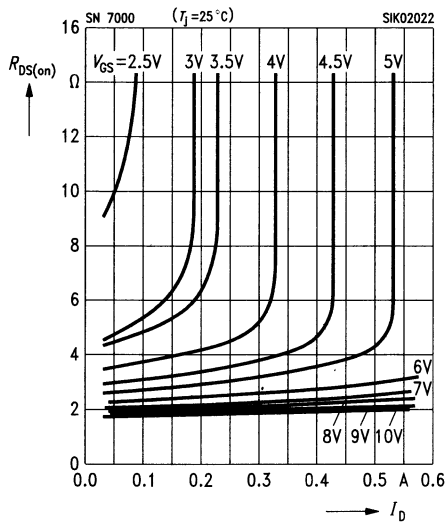
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



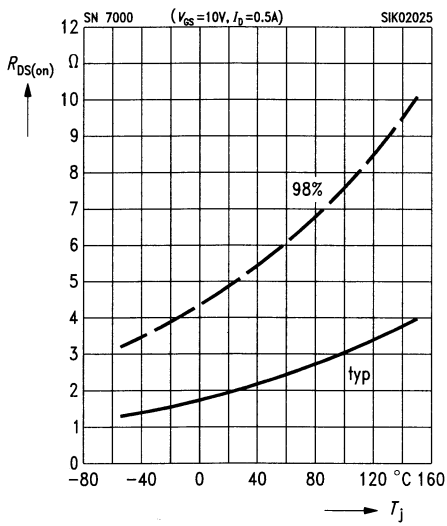
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



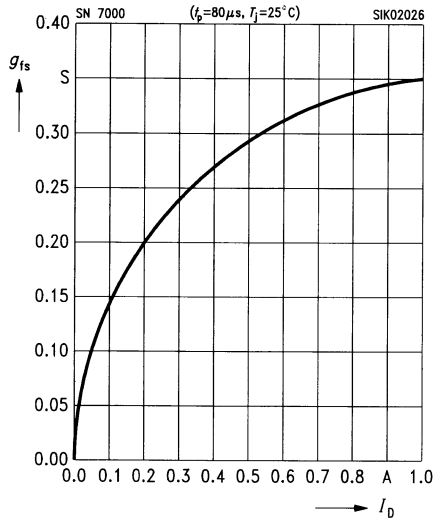
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



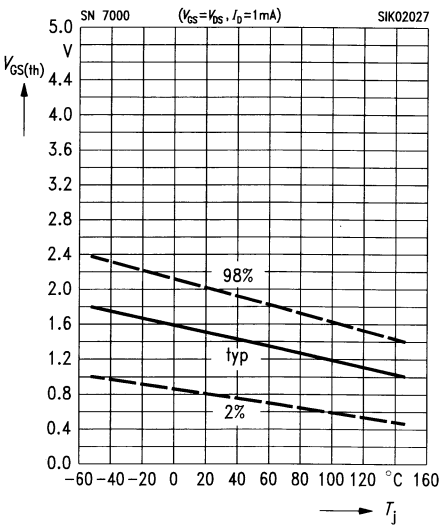
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: V_{GS}



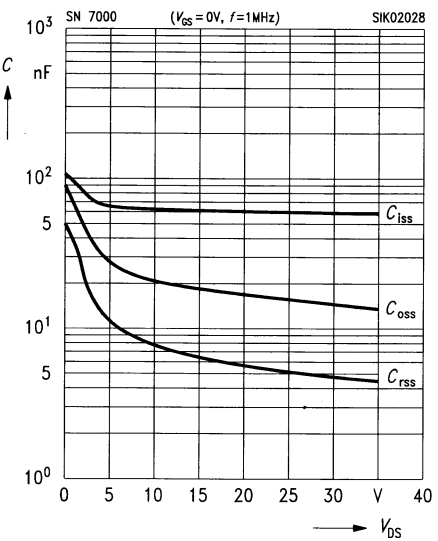
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



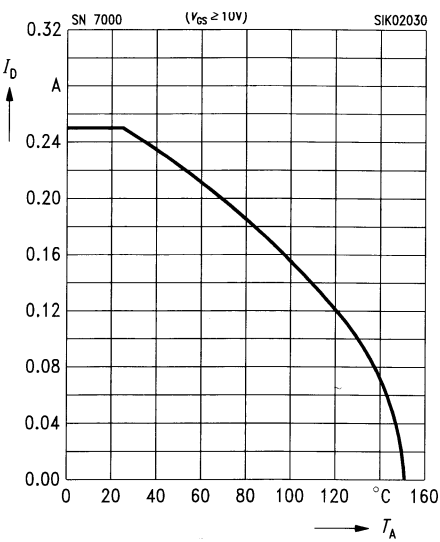
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



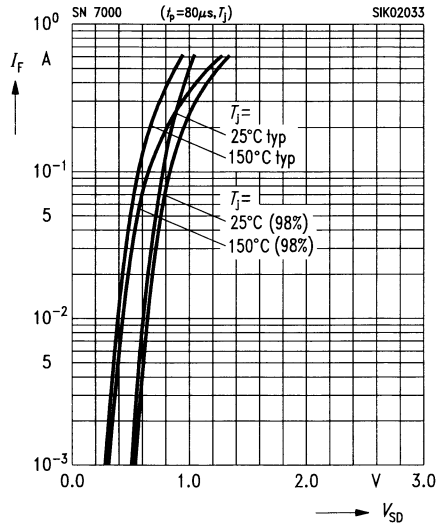
Typ. capacitances $C = f(V_{DS})$
parameter: V_{GS} = 0, f = 1 MHz



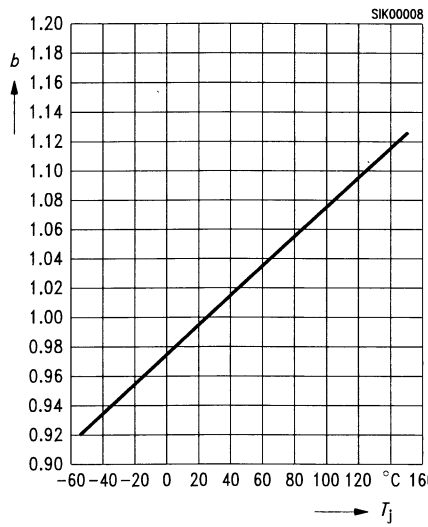
Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq$ 10 V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: t_p = 80 µs; T_j, (spread)



Drain-source breakdown voltage
$V_{(BR)\,DSS} = b \times V_{(BR)DSS}$ (25 °C)

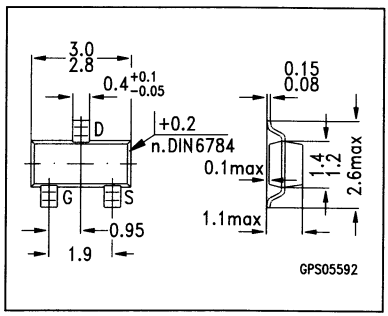


SIEMENS

SIPMOS® Small-Signal Transistor — SN 7002

V_{DS} = 60 V
I_D = 0.19 A
$R_{DS(on)}$ = 5.0 Ω

- N channel
- Enhancement mode
- Package: SOT-23 [1]



Type	Marking	Ordering code for version on 8-mm tape [2]
SN 7002	sSG	Q67000-S063

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	60	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	60	
Gate-source voltage	V_{GS}	± 14	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, T_A = 25 °C	I_D	0.19	A
Pulsed drain current, T_A = 25 °C	$I_{D\,puls}$	0.76	
Max. power dissipation, T_A = 25 °C	P_{tot}	0.36	W
Operating and storage temperature range	T_j, T_{stg}	– 55 ... + 150	°C

Thermal resistance, chip-ambient (without heat sink)	R_{thJA}	≤ 350	K/W
chip-substrate – reverse side [3]	R_{thJSR}	≤ 285	
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

[1] See chapter Package Outlines.
[2] E-6327: 3000 pieces / reel, E-6433: 10000 pieces / reel
[3] For package mounted on aluminia 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics (cont'd)

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	60	–	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	0.8	1.4	2.0	
Zero gate voltage drain current V_{DS} = 60 V, V_{GS} = 0 T_j = 25 °C T_j = 125 °C	I_{DSS}	 – –	 0.1 –	 1.0 5	µA
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}	–	1	10	nA
Drain-source on-resistance V_{GS} = 10 V, I_D = 0.5 A V_{GS} = 4.5 V, I_D = 0.050 A	$R_{DS(on)}$	 – –	 2.0 3.0	 5.0 7.5	Ω
Dynamic Characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = 0.2 A	g_{fs}	0.1	0.2	–	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{iss}	–	60	80	pF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	15	25	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	–	5	8	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{DD} = 30 V, V_{GS} = 10 V, R_{GS} = 50 Ω, I_D = 0.29 A	$t_{d(on)}$ t_r	– –	5 5	8 8	ns
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{DD} = 30 V, V_{GS} = 10 V, R_{GS} = 50 Ω, I_D = 0.29 A	$t_{d(off)}$ t_f	– –	12 13	16 17	

Electrical Characteristics (cont'd)

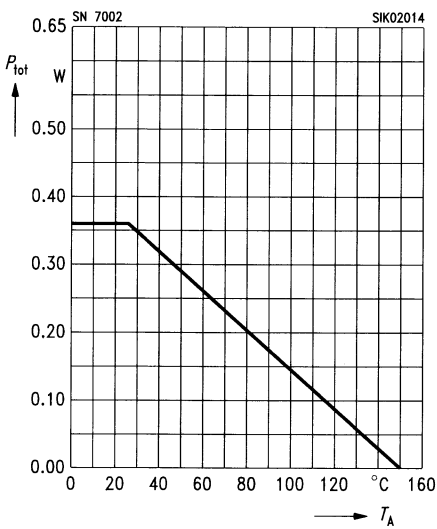
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current T_A = 25 °C	I_S	–	–	0.19	A
Pulsed reverse drain current T_A = 25 °C	I_{SM}	–	–	0.76	
Diode forward on-voltage I_F = 0.5 A, V_{GS} = 0	V_{SD}	–	0.9	1.2	V

Characteristics

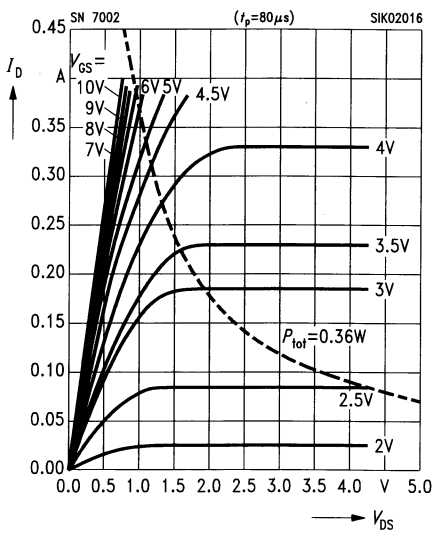
at T_j = 25 °C, unless otherwise specified.

Total power dissipation $P_{tot} = f(T_A)$

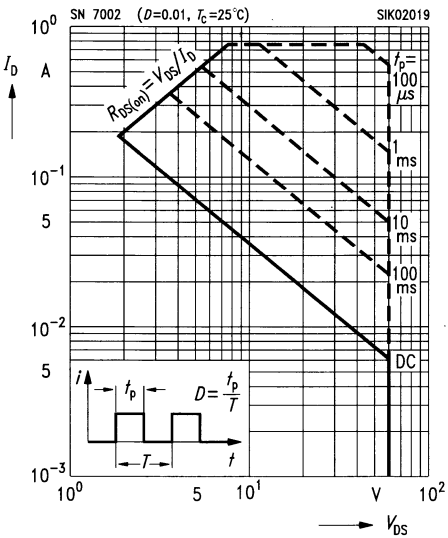


Typ. output characteristics $I_D = f(V_{DS})$

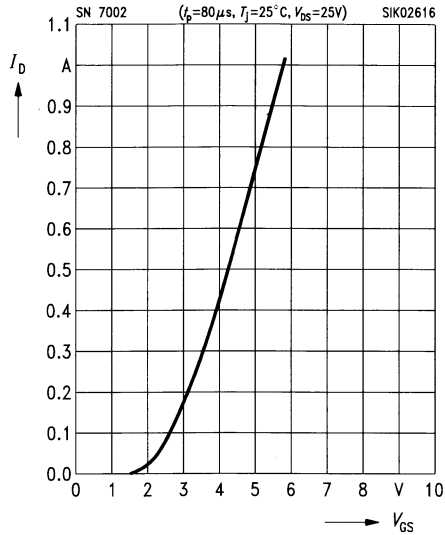
parameter: t_p = 80 µs



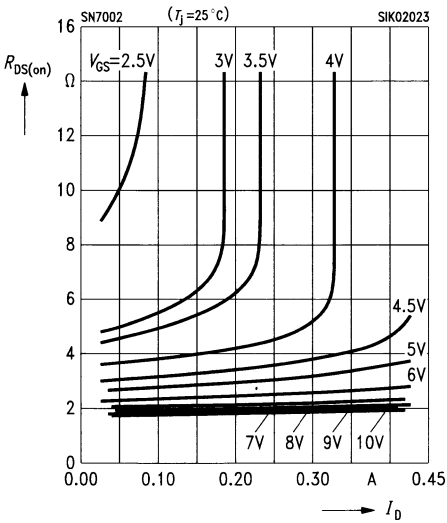
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



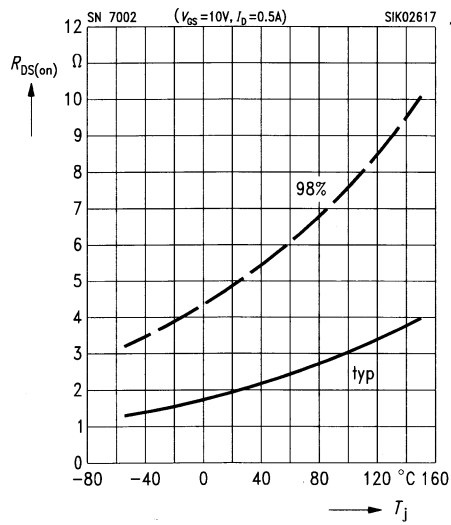
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} = 25$ V



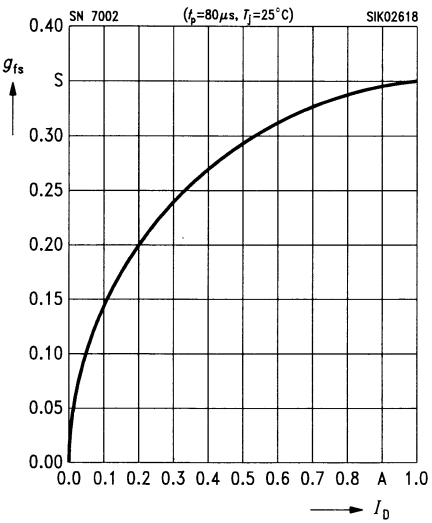
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



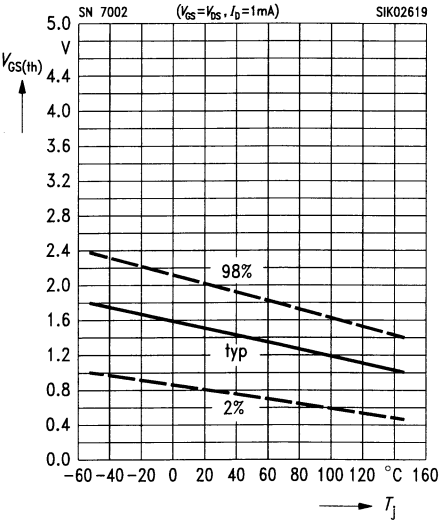
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.5$ A, $V_{GS} = 10$ V, (spread)



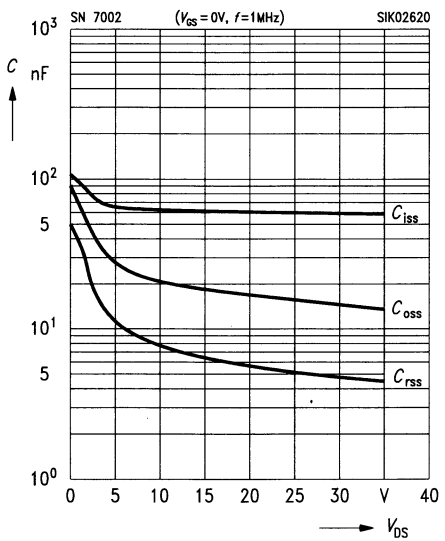
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80\ \mu s$



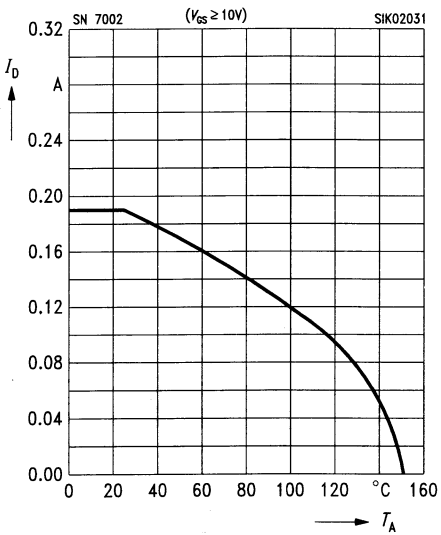
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, f = 1 MHz



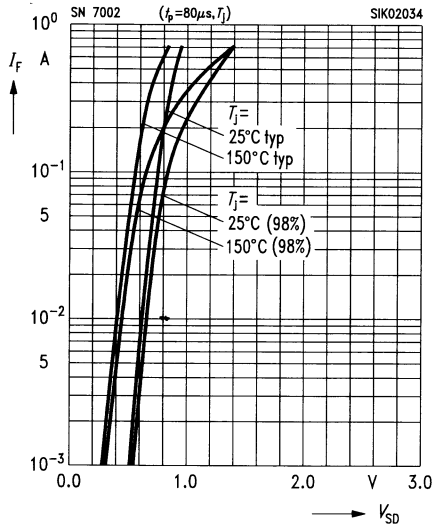
Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 10$ V



Forward characteristics of reverse diode

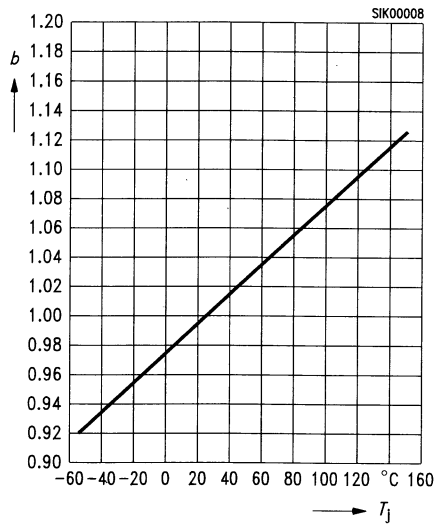
$I_F = f(V_{SD})$

parameter: t_p = 80 µs; T_j, (spread)



Drain-source breakdown voltage

$V_{(BR)\,DSS} = b \times V_{(BR)DSS}$ (25 °C)

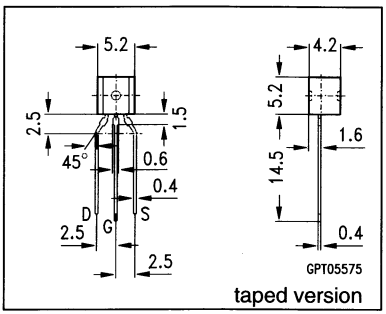


SIEMENS

SIPMOS® Small-Signal Transistor — SP 0610L

V_{DS} = – 60 V
I_D = – 0.18 A
$R_{DS(on)}$ = 10 Ω

- P channel
- Enhancement mode
- Package: TO-92 c [1]



taped version

Type	Ordering code for version in bulk
SP 0610 L	Q67000-S065

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	– 60	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	– 60	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_A = 25 °C	I_D	– 0.18	A
Pulsed drain current, T_A = 25 °C	$I_{D\,puls}$	– 0.72	
Max. power dissipation, T_A = 25 °C	P_{tot}	0.63	W
Operating and storage temperature range	T_j, T_{stg}	– 55 ... + 150	°C

Thermal resistance, chip-ambient [3] (without heat sink)	R_{thJA}	≤ 200	K/W
	R_{thJSR}	–	
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

[1] See chapter Packing Information and Package Outlines.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	– 60	–	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	– 1.0	– 1.5	– 2.0	
Zero gate voltage drain current V_{DS} = – 60 V, V_{GS} = 0 T_j = 25 °C	I_{DSS}	–	– 0.1	– 1	µA
Gate-source leakage current V_{GS} = – 20 V, V_{DS} = 0	I_{GSS}	–	– 1	– 10	nA
Drain-source on-resistance V_{GS} = – 10 V, I_D = – 0.5 A	$R_{DS(on)}$	–	7	10	Ω
Dynamic Characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = – 0.5 A	g_{fs}	0.08	0.13	–	S
Input capacitance V_{GS} = 0, V_{DS} = – 25 V, f = 1 MHz	C_{iss}	–	30	40	pF
Output capacitance V_{GS} = 0, V_{DS} = – 25 V, f = 1 MHz	C_{oss}	–	17	25	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = – 25 V, f = 1 MHz	C_{rss}	–	8	12	
Turn-on time t_{on}, (t_{on} = $t_{d(on)}$ + t_r) V_{DD} = – 30 V, V_{GS} = –10 V, R_{GS} = 50 Ω, I_D = – 0.27 A	$t_{d(on)}$	–	7	10	ns
	t_r	–	12	18	
Turn-off time t_{off}, (t_{off} = $t_{d(off)}$ + t_f) V_{DD} = – 30 V, V_{GS} = –10 V, R_{GS} = 50 Ω, I_D = – 0.27 A	$t_{d(off)}$	–	10	13	
	t_f	–	20	27	

Electrical Characteristics (cont'd)

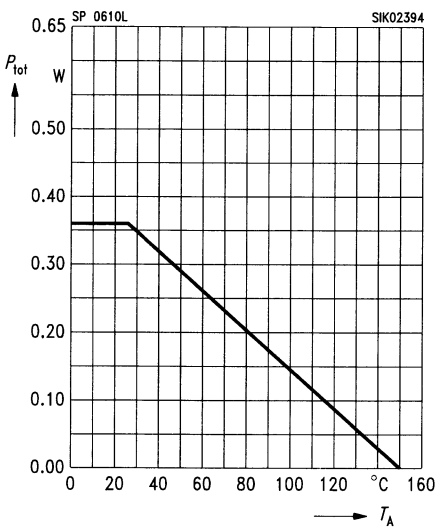
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current T_A = 25 °C	I_S	–	–	– 0.18	A
Pulsed reverse drain current T_A = 25 °C	I_{SM}	–	–	– 0.72	
Diode forward on-voltage I_F = – 0.18 A, V_{GS} = 0	V_{SD}	–	– 0.85	– 1.2	V

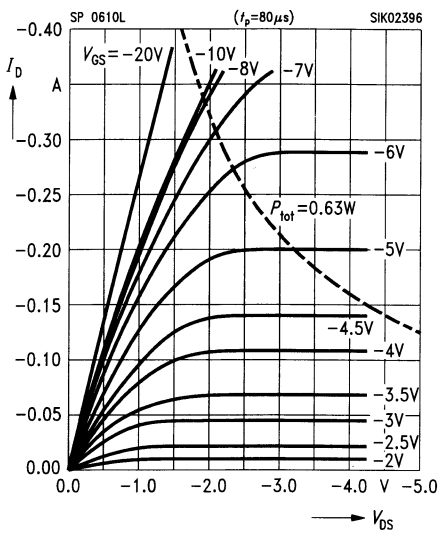
Characteristics

at T_j = 25 °C, unless otherwise specified.

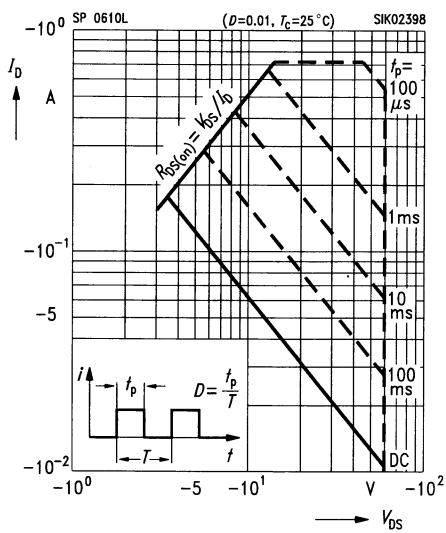
Total power dissipation $P_{tot} = f(T_A)$



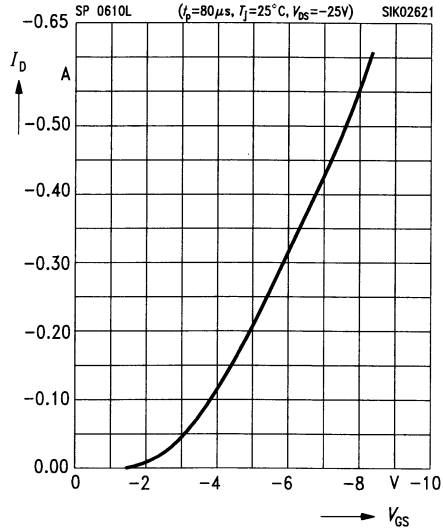
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



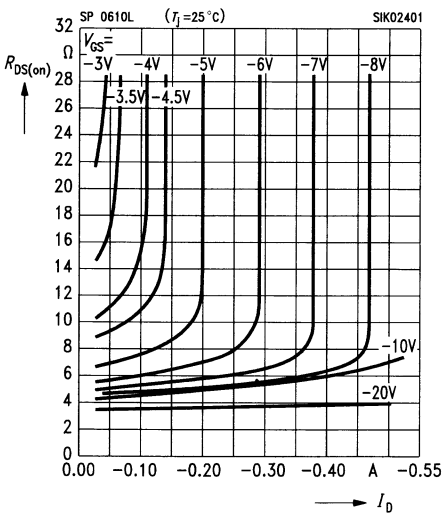
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



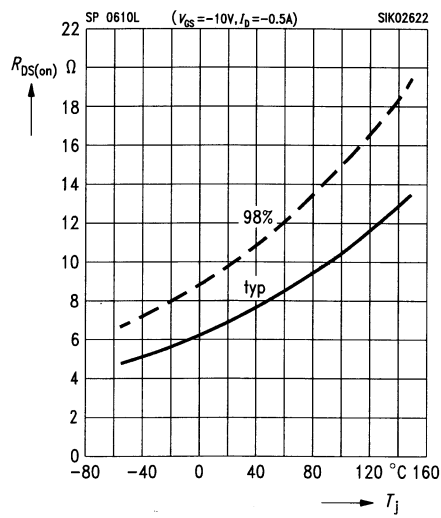
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



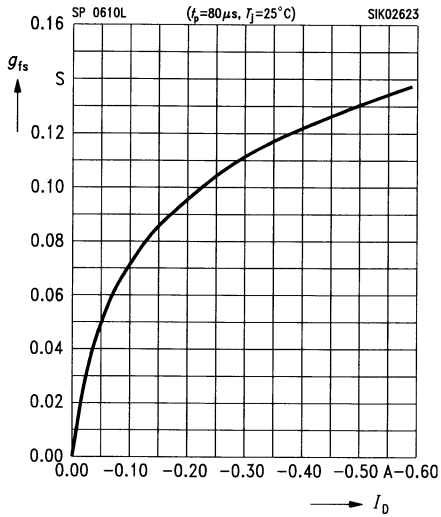
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



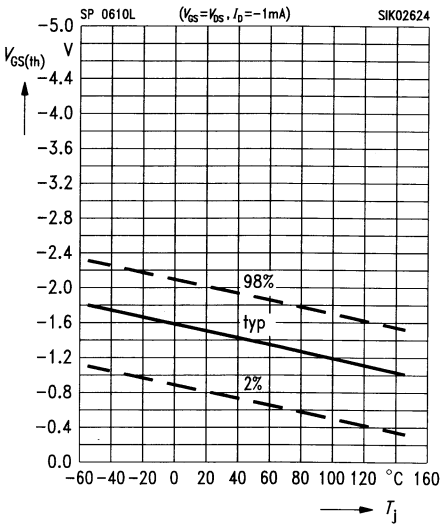
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.5 A, V_{GS} = 10 V, (spread)



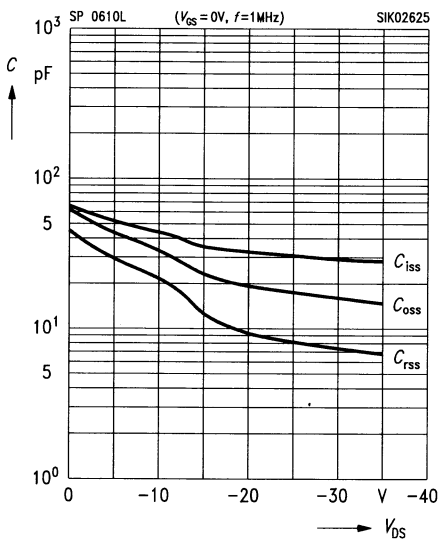
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



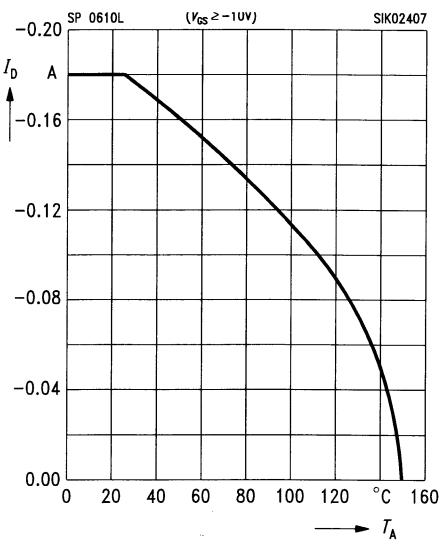
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



Typ. capacitances $C = f(V_{DS})$
parameter: V_{GS} = 0, f = 1 MHz



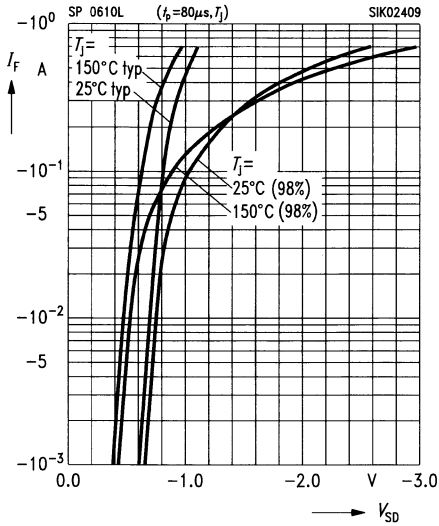
Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq$ 10 V



Forward characteristics of reverse diode

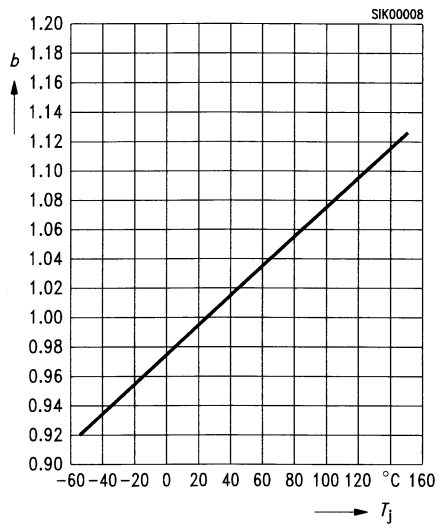
$I_F = f(V_{SD})$

parameter: t_p = 80 µs, T_j, (spread)



Drain-source breakdown voltage

$V_{(BR)\,DSS} = b \times V_{(BR)DSS}$ (25 °C)

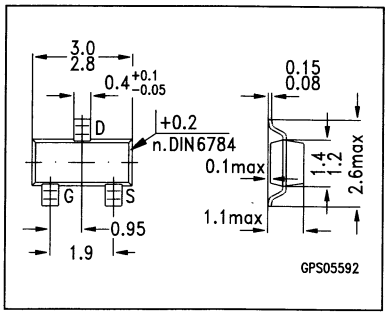


SIEMENS

SIPMOS® Small-Signal Transistor — SP 0610T

V_{DS} = – 60 V
I_D = – 0.13
$R_{DS(on)}$ = 10 Ω

- P channel
- Enhancement mode
- Package: SOT-23 [1]



Type	Marking	Ordering code for version on 8-mm tape [2]
SP 0610 T	sSF	Q67000-S088

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	– 60	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	– 60	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_A = 36 °C	I_D	– 0.13	A
Pulsed drain current, T_A = 25 °C	$I_{D\,puls}$	– 0.52	
Max. power dissipation, T_A = 25 °C	P_{tot}	0.36	W
Operating and storage temperature range	T_j, T_{stg}	– 55 ... + 150	°C

Thermal resistance, chip-ambient (without heat sink)	R_{thJA}	≤ 350	K/W
chip-substrate – reverse side [3]	R_{thJSR}	≤ 285	
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

[1] See chapter Package Outlines.
[2] E-6327: 3000 pieces / reel, E-6433: 10000 pieces / reel
[3] For package mounted on aluminia 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	– 60	–	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	– 1.0	– 1.5	– 2.0	
Zero gate voltage drain current V_{DS} = – 60 V, V_{GS} = 0 T_j = 25 °C	I_{DSS}	–	– 0.1	– 1	µA
Gate-source leakage current V_{GS} = – 20 V, V_{DS} = 0	I_{GSS}	–	– 1	– 10	nA
Drain-source on-resistance V_{GS} = – 10 V, I_D = – 0.5 A	$R_{DS(on)}$	–	7	10	Ω
Dynamic Characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = – 0.5 A	g_{fs}	0.08	0.13	–	S
Input capacitance V_{GS} = 0, V_{DS} = – 25 V, f = 1 MHz	C_{iss}	–	30	40	pF
Output capacitance V_{GS} = 0, V_{DS} = – 25 V, f = 1 MHz	C_{oss}	–	17	25	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = – 25 V, f = 1 MHz	C_{rss}	–	8	12	
Turn-on time t_{on}, (t_{on} = $t_{d(on)}$ + t_r) V_{DD} = – 30 V, V_{GS} = –10 V, R_{GS} = 50 Ω, I_D = – 0.27 A	$t_{d(on)}$	–	7	10	ns
	t_r	–	12	18	
Turn-off time t_{off}, (t_{off} = $t_{d(off)}$ + t_f) V_{DD} = – 30 V, V_{GS} = –10 V, R_{GS} = 50 Ω, I_D = – 0.27 A	$t_{d(off)}$	–	10	13	
	t_f	–	20	27	

Electrical Characteristics (cont'd)

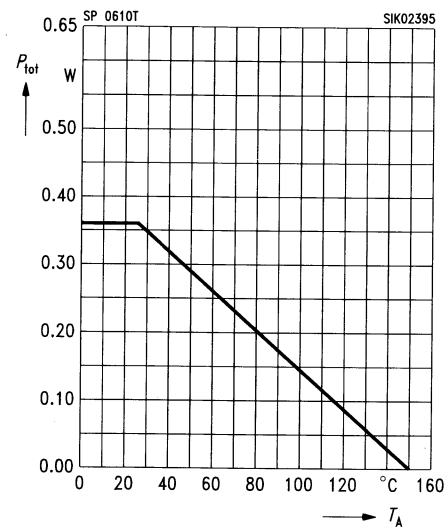
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse Diode					
Continuous reverse drain current T_A = 25 °C	I_S	–	–	– 0.13	A
Pulsed reverse drain current T_A = 25 °C	I_{SM}	–	–	– 0.52	
Diode forward on-voltage I_F = – 0.18 A, V_{GS} = 0	V_{SD}	–	– 0.85	– 1.2	V

Characteristics

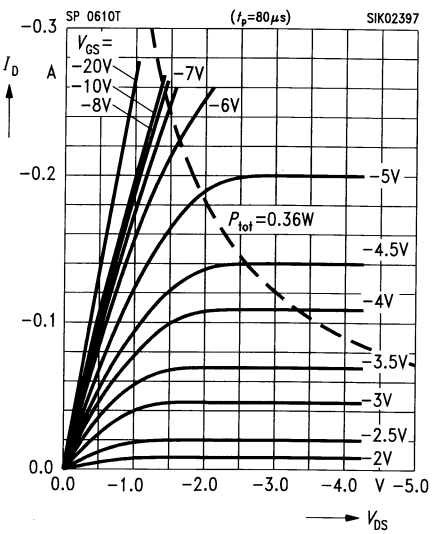
at T_j = 25 °C, unless otherwise specified.

Total power dissipation $P_{tot} = f(T_A)$

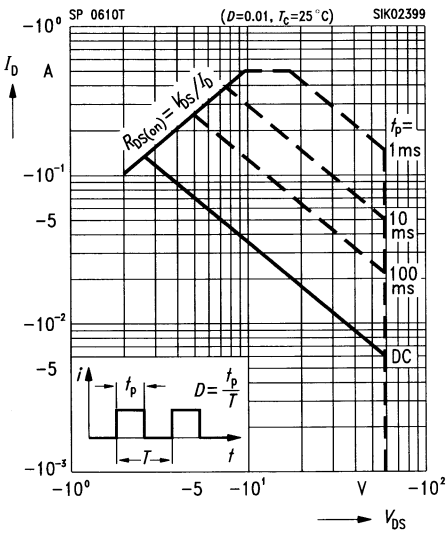


Typ. output characteristics $I_D = f(V_{DS})$

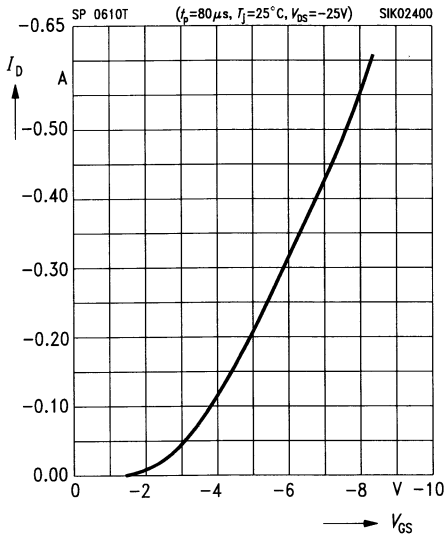
parameter: t_p = 80 µs



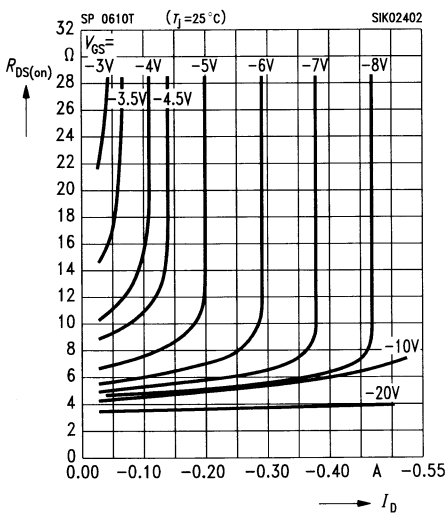
Safe operating area $I_D = f(V_{DS})$
parameter: D = 0.01, T_C = 25 °C



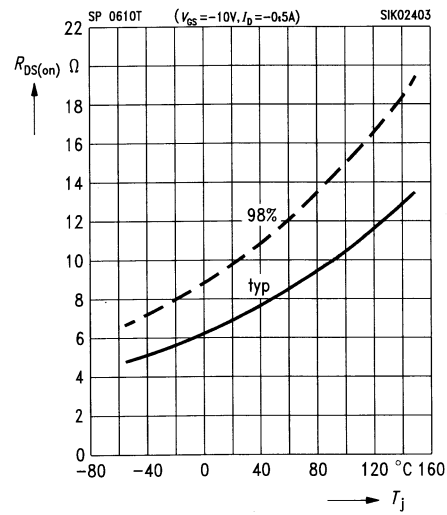
Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: t_p = 80 µs, V_{DS} = 25 V



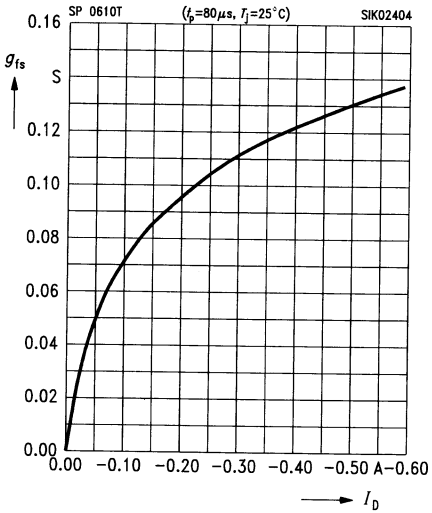
Typ. drain-source on-resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}



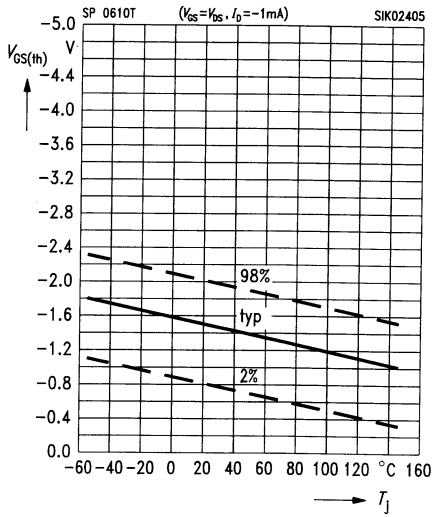
Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: I_D = 0.5 A, V_{GS} = 10 V, (spread)



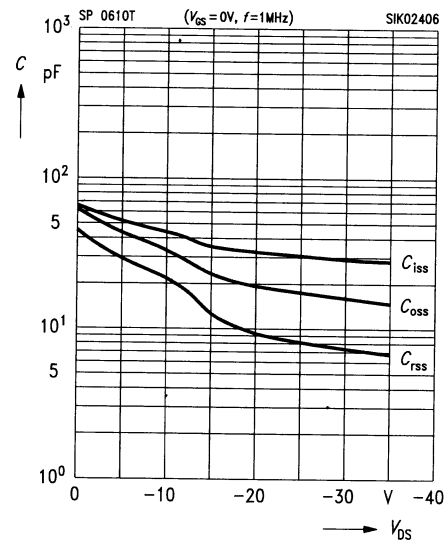
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, t_p = 80 µs



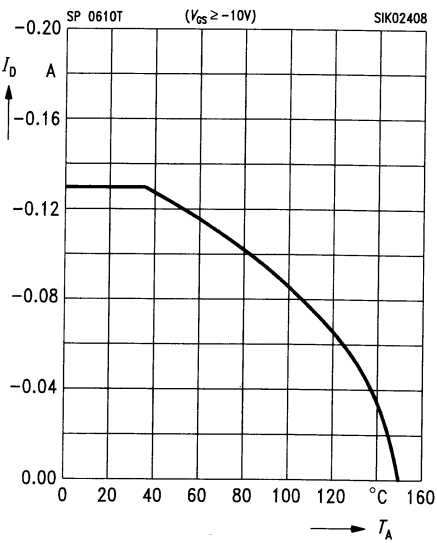
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA, (spread)



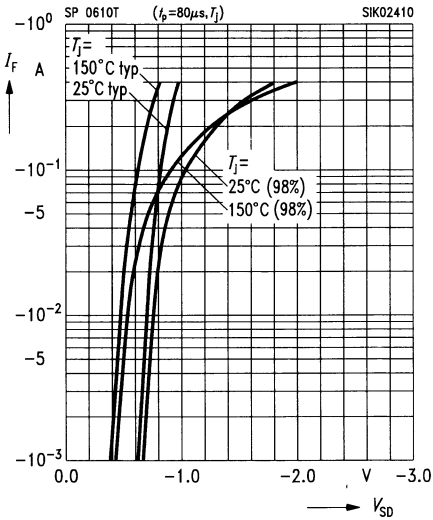
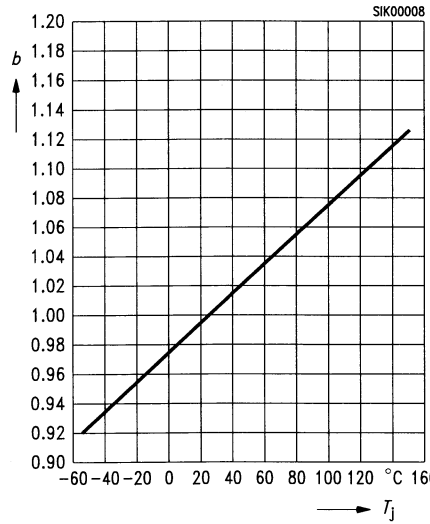
Typ. capacitances $C = f(V_{DS})$
parameter: V_{GS} = 0, f = 1 MHz



Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq$ 10 V



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: t_p = 80 µs, T_j, (spread)



Drain-source breakdown voltage
$V_{(BR)\,DSS} = b \times V_{(BR)DSS}$ (25 °C)