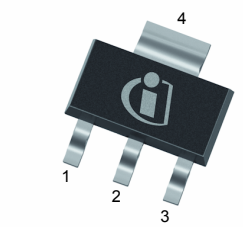
MOSFET

OptiMOS™ Small Signal Transistor, -60 V

PG-SOT223-4



Features

- P-Channel
- Very low on-resistance $R_{DS(on)}$
- Normal Level
- Enhancement mode
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Product validation

Qualified according to AEC Q101

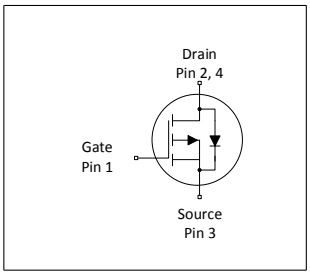


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	-60	V
$R_{DS(on),max}$	67	mΩ
I_D	-6.4	A
Q_{oss}	-17	nC
Q_G	-38	nC

Type / Ordering Code	Package	Marking	Related Links
ISP670P06NMA	PG-SOT223-4	670P06NA	-

Table of Contents

1 Maximum ratings

at T_A=25 °C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current[1]	I_D	- - -	- - -	-6.4 -4 -3.7	A	V_{GS}=-10 V, T_C=25 °C V_{GS}=-10 V, T_C=100 °C V_{GS}=-10 V,T_A=25°C,R_{thJA}=70°C/W[2]
Pulsed drain current[3]	$I_{D,pulse}$	-	-	-25.6	A	T_C=25 °C
Avalanche energy, single pulse[4]	E_{AS}	-	-	1961	mJ	I_D=-3.7 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	- -	- -	5 1.8	W	T_C=25 °C T_A=25 °C, R_{thJA}=70 °C/W[2]
Operating and storage temperature	T_j, T_{stg}	-55	-	150	°C	-

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - soldering point	R_{thJS}	-	-	25	°C/W	-
Thermal resistance, junction - ambient, 6 cm² cooling area[2]	R_{thJA}	-	-	70	°C/W	-

[1] Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature as specified. For other case temperatures please refer to Diagram 2. De-rating will be required based on the actual environmental conditions.
[2] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.
[3] See Diagram 3 for more detailed information
[4] See Diagram 13 for more detailed information. Defined by design, not subject to production test

3 Electrical characteristics

at T_j=25 °C, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	-60	-	-	V	V_{GS}=0 V, I_D=-250 µA
Gate threshold voltage	$V_{GS(th)}$	-2.1	-3.0	-4	V	V_{DS}=V_{GS}, I_D=-1037 µA
Zero gate voltage drain current	I_{DSS}	- -	-0.1 -10	-1 -100	µA	V_{DS}=-60 V, V_{GS}=0 V, T_j=25 °C V_{DS}=-60 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	-10	-100	nA	V_{GS}=-20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	-	55	67	mΩ	V_{GS}=-10 V, I_D=-3.7 A
Gate resistance	R_G	-	5.2	-	Ω	-
Transconductance	g_{fs}	-	8.2	-	S	$\|V_{DS}\|\geq 2\|I_D\|R_{DS(on)max}$, I_D=-3.7 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance[1)]	C_{iss}	-	1400	1800	pF	V_{GS}=0 V, V_{DS}=-30 V, f=1 MHz
Output capacitance[1)]	C_{oss}	-	220	290	pF	V_{GS}=0 V, V_{DS}=-30 V, f=1 MHz
Reverse transfer capacitance[1)]	C_{rss}	-	52	91	pF	V_{GS}=0 V, V_{DS}=-30 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	7	-	ns	V_{DD}=-30 V, V_{GS}=-10 V, I_D=-3.7 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	3	-	ns	V_{DD}=-30 V, V_{GS}=-10 V, I_D=-3.7 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	37	-	ns	V_{DD}=-30 V, V_{GS}=-10 V, I_D=-3.7 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	17	-	ns	V_{DD}=-30 V, V_{GS}=-10 V, I_D=-3.7 A, $R_{G,ext}$=1.6 Ω

Table 6 Gate charge characteristics[2)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	-6.1	-	nC	V_{DD}=-30 V, I_D=-3.7 A, V_{GS}=0 to -10 V
Gate charge at threshold	$Q_{g(th)}$	-	-4.3	-	nC	V_{DD}=-30 V, I_D=-3.7 A, V_{GS}=0 to -10 V
Gate to drain charge[1)]	Q_{gd}	-	-10.6	-15.9	nC	V_{DD}=-30 V, I_D=-3.7 A, V_{GS}=0 to -10 V
Switching charge	Q_{sw}	-	-12.4	-	nC	V_{DD}=-30 V, I_D=-3.7 A, V_{GS}=0 to -10 V
Gate charge total[1)]	Q_g	-	-36	-48.0	nC	V_{DD}=-30 V, I_D=-3.7 A, V_{GS}=0 to -10 V
Gate plateau voltage	$V_{plateau}$	-	-4.2	-	V	V_{DD}=-30 V, I_D=-3.7 A, V_{GS}=0 to -10 V
Output charge[1)]	Q_{oss}	-	-15	-20	nC	V_{DS}=-30 V, V_{GS}=0 V

[1)] Defined by design. Not subject to production test.
[2)] See ″Gate charge waveforms″ for parameter definition

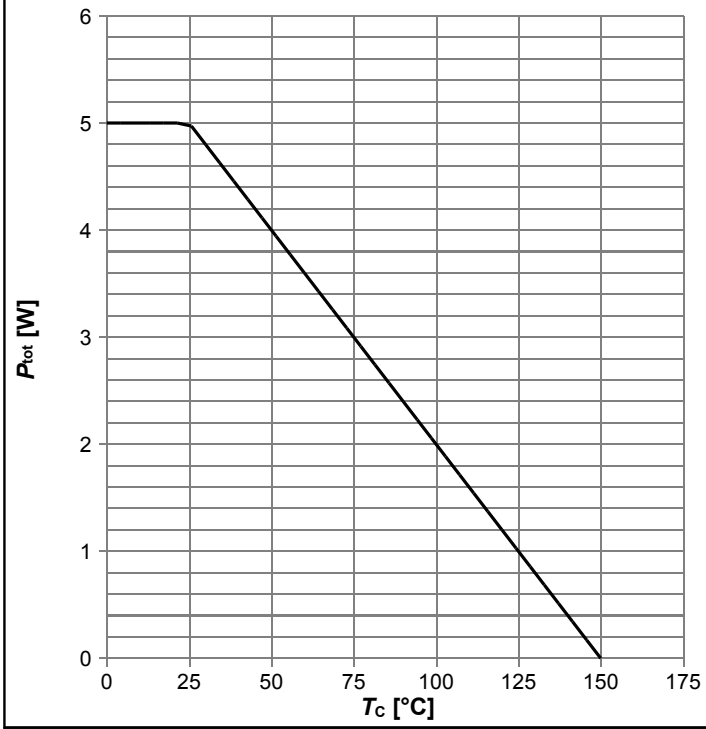
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	-4.6	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	-25.6	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	-0.81	-1.2	V	V_{GS}=0 V, I_F=-3.7 A, T_j=25 °C
Reverse recovery time[1)]	t_{rr}	-	43	86	ns	V_R=-30 V, I_F=-3.7 A, di_F/dt=-100 A/µs
Reverse recovery charge[1)]	Q_{rr}	-	122	244	nC	V_R=-30 V, I_F=-3.7 A, di_F/dt=-100 A/µs

[1)] Defined by design. Not subject to production test.

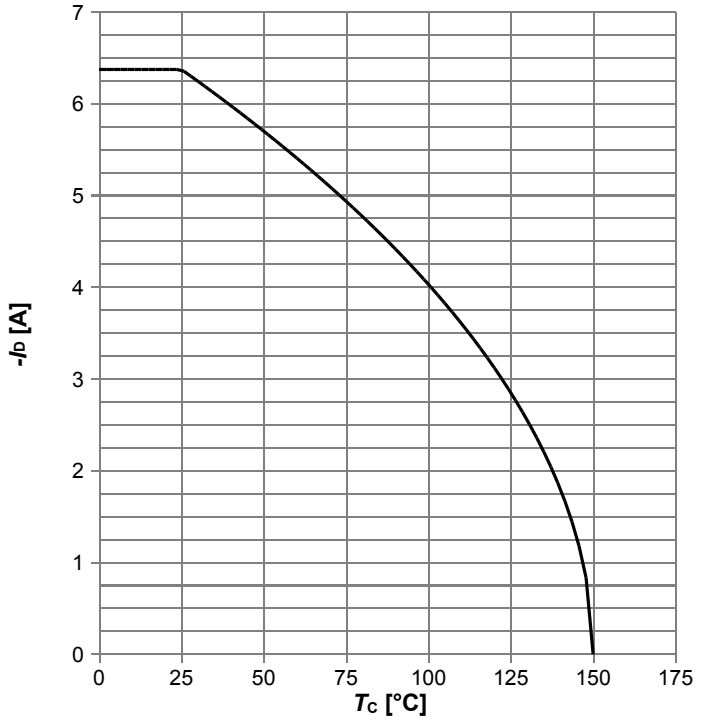
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



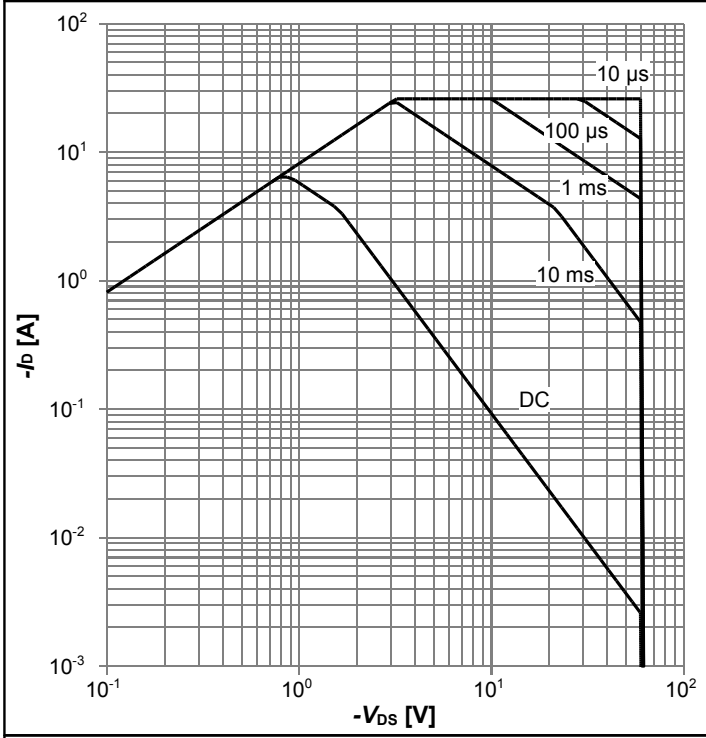
$P_{tot}=f(T_C)$

Diagram 2: Drain current



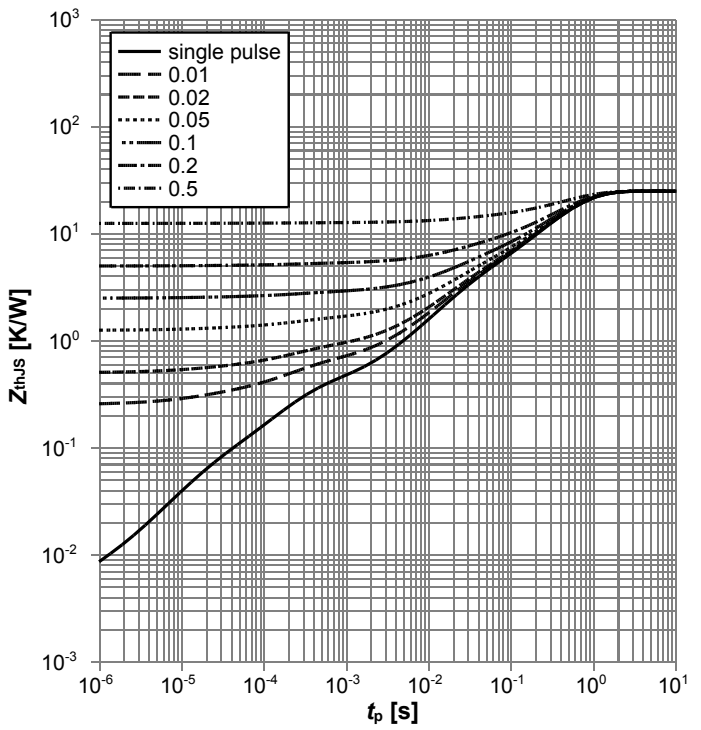
$I_D=f(T_C)$; $|V_{GS}|\geq 10$ V

Diagram 3: Safe operating area



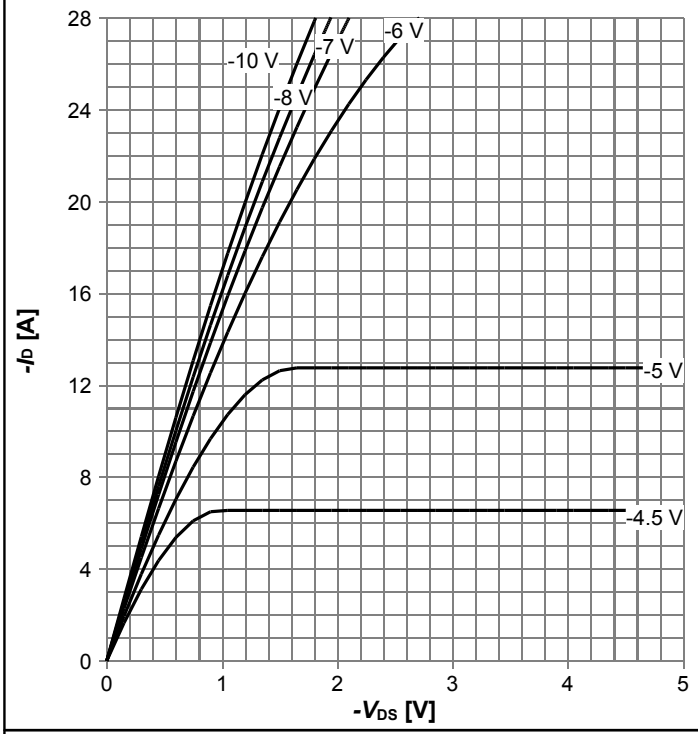
$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$; parameter: t_p

Diagram 4: Max. transient thermal impedance



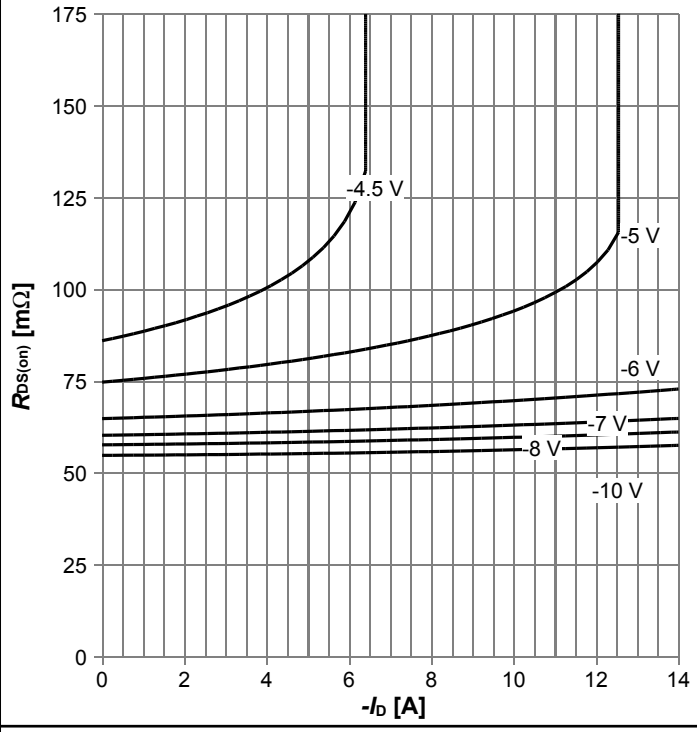
$Z_{thJS}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



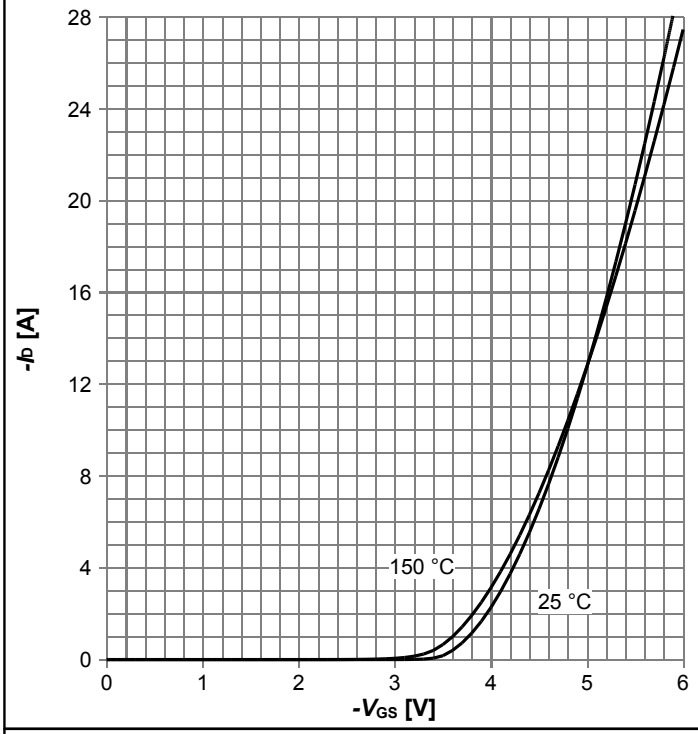
$I_D=f(V_{DS})$, $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



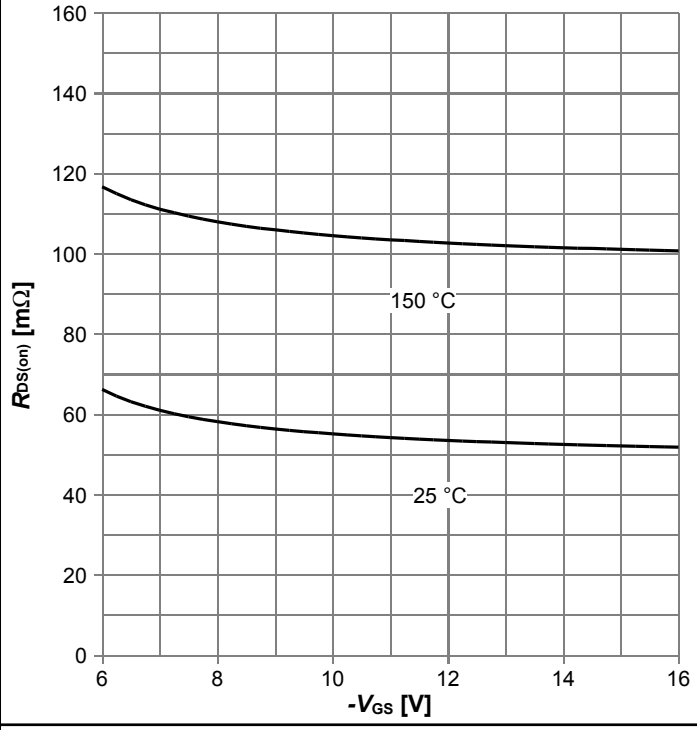
$R_{DS(on)}=f(I_D)$, $T_j=25$ °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



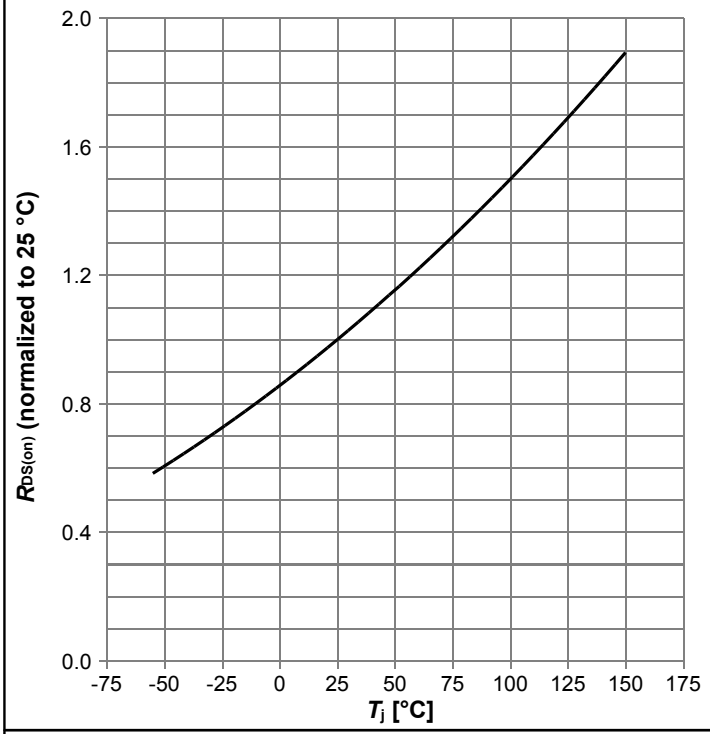
$I_D=f(V_{GS})$, $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



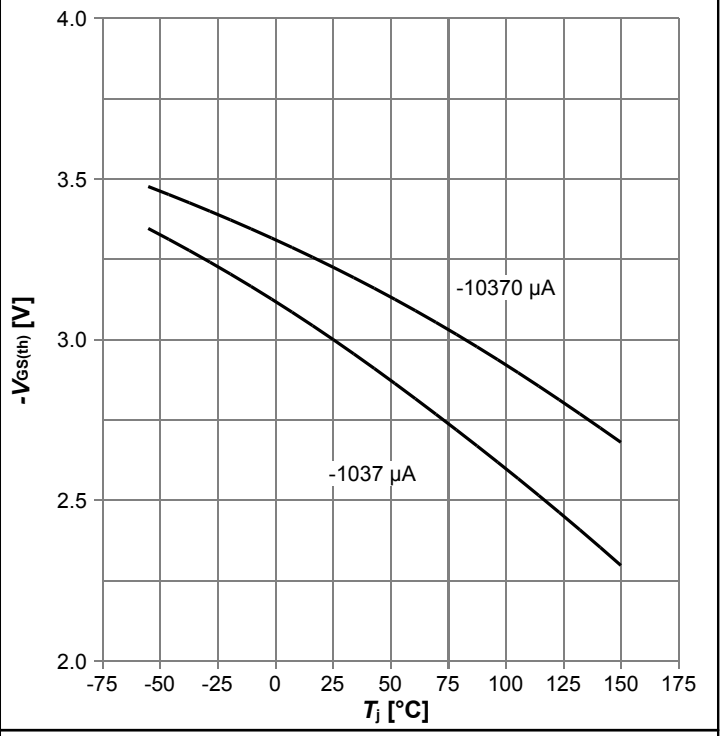
$R_{DS(on)}=f(V_{GS})$, I_D=-3.7 A; parameter: T_j

Diagram 9: Normalized drain-source on resistance



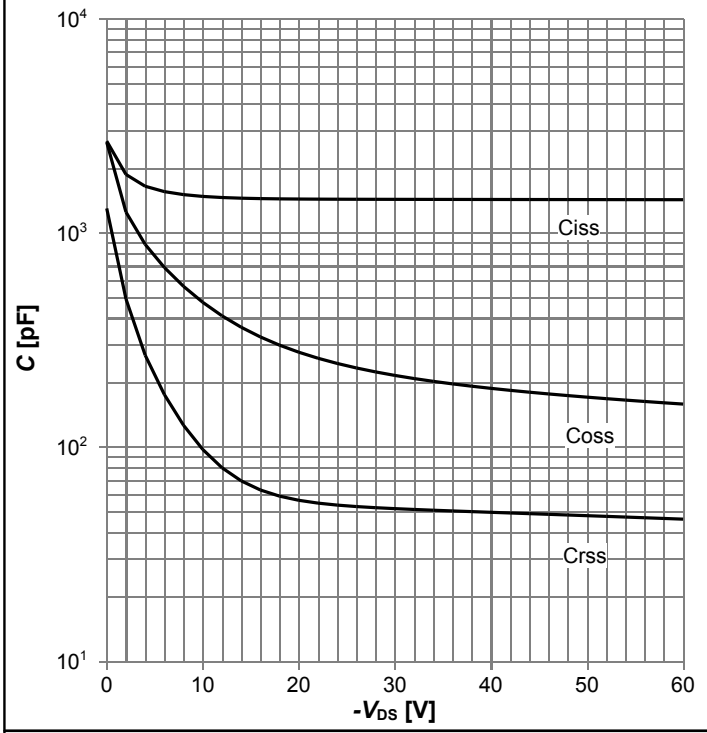
$R_{DS(on)}$=f(T_j), I_D=-3.7 A, V_{GS}=-10 V

Diagram 10: Typ. gate threshold voltage



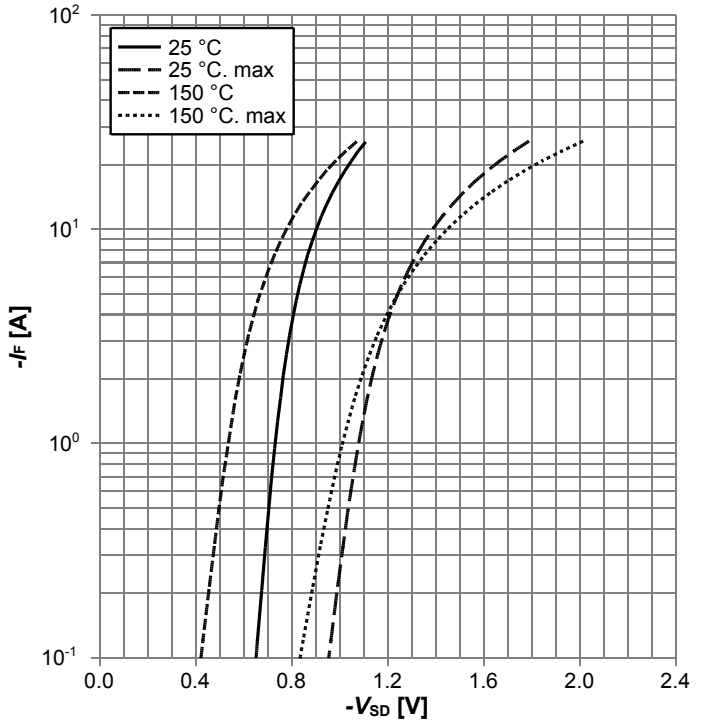
$V_{GS(th}$=f(T_j), V_{GS}=V_{DS}; parameter: I_D

Diagram 11: Typ. capacitances



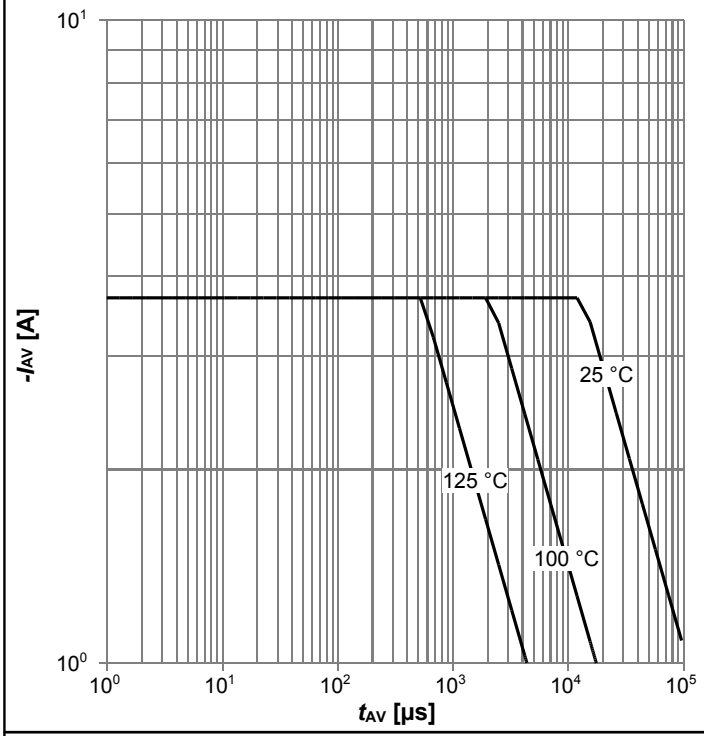
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



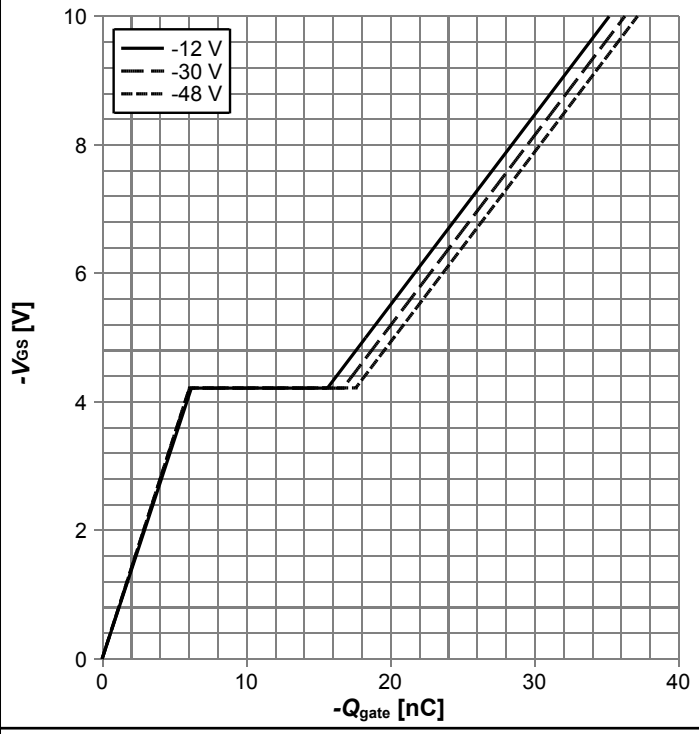
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



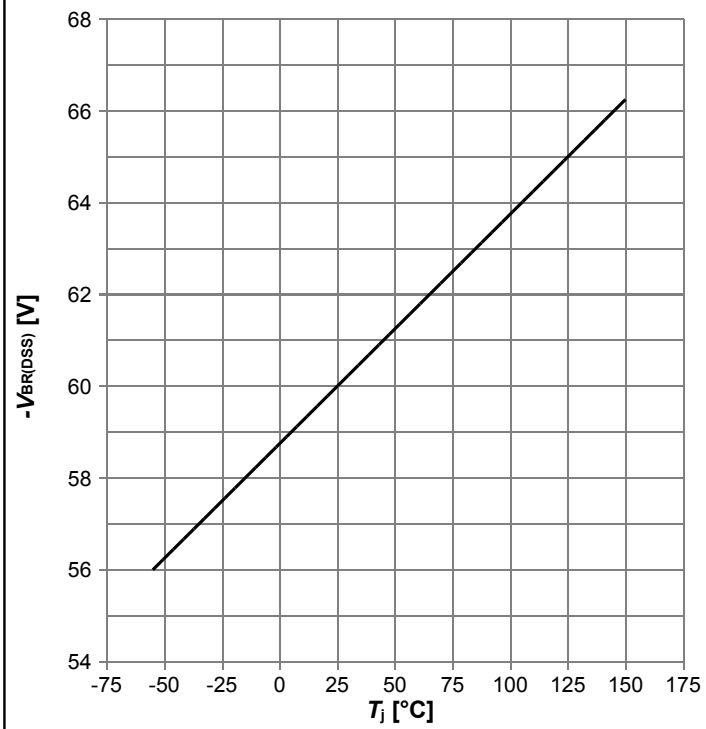
$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



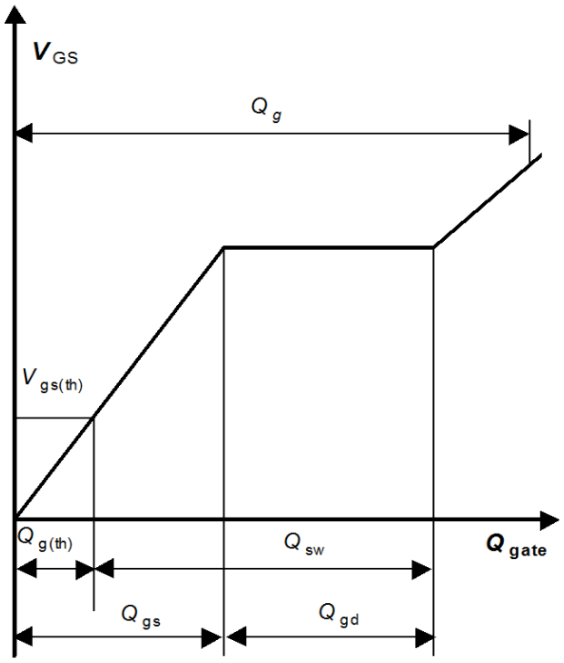
$V_{GS}=f(Q_{gate})$, I_D=-3.7 A pulsed, T_j=25 °C; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

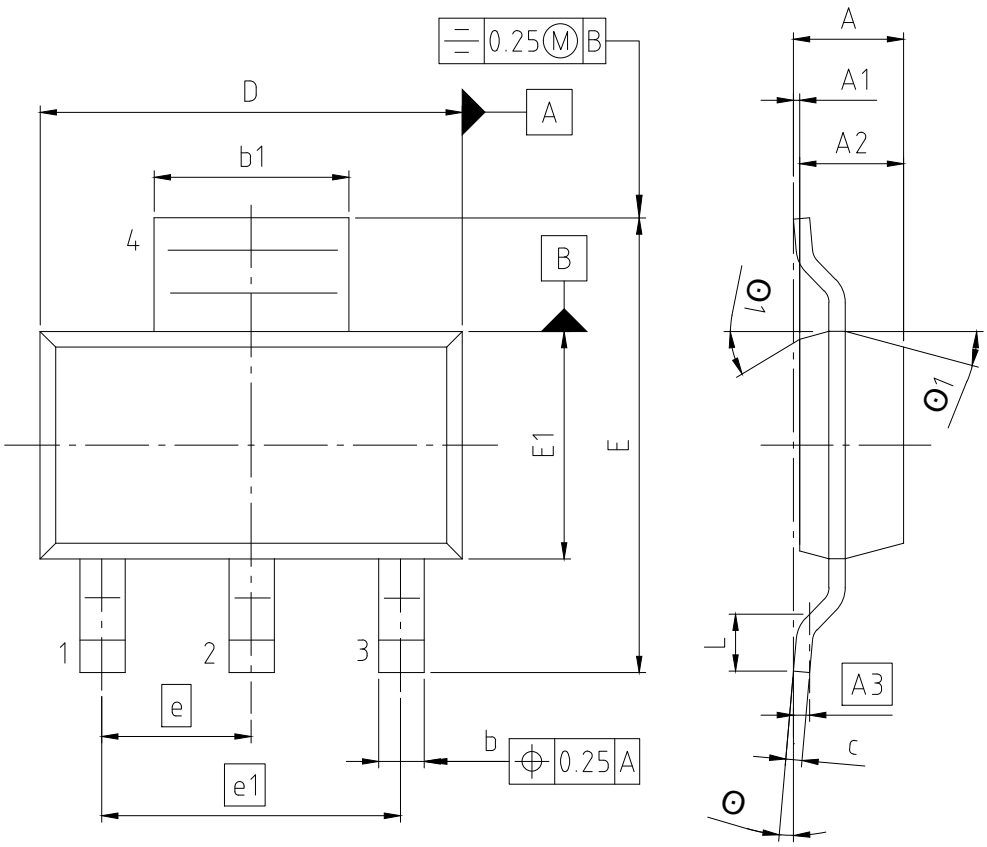


$V_{BR(DSS)}=f(T_j)$; I_D=-250 µA

Diagram Gate charge waveforms



5 Package Outlines



PACKAGE - GROUP NUMBER:	PG-SOT223-4-U01	
DIMENSIONS	**MILLIMETERS**	
	MIN.	MAX.
A	1.40	1.80
A1	0.00	0.10
A2	1.50	1.70
A3	0.25	
b	0.60	0.80
b1	2.90	3.10
c	0.23	0.32
D	6.30	6.70
E	6.70	7.30
E1	3.30	3.70
N	4	
e	2.30	
e1	4.60	
L	0.5	---
Θ	0°	10°
Θ1	10°	15°

NOTE:
DIMENSIONS DO NOT INCLUDE MOLD FLASH,
PROTRUSION OR GATE BURRS

Figure 1 Outline PG-SOT223-4, dimensions in mm

Revision History

ISP670P06NMA

Revision: 2024-03-19, Rev. 2.0

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2024-03-19	Release of final version

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