

## OptiMOS® -T Power-Transistor



### Product Summary

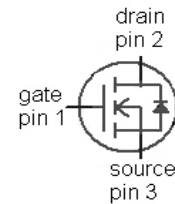
$V_{DS}$	40	V
$R_{DS(on),max}$ (SMD version)	2.0	mΩ
$I_D$	120	A

### Features

- N-channel - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green package (RoHS compliant)
- Ultra low  $R_{ds(on)}$
- 100% Avalanche tested



Type	Package	Marking
IPB120N04S3-02	PG-TO263-3-2	3PN0402
IPI120N04S3-02	PG-TO262-3-1	3PN0402
IPP120N04S3-02	PG-TO220-3-1	3PN0402



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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current <sup>1)</sup>	$I_D$	$T_C=25\text{ °C}$ , $V_{GS}=10\text{ V}$	120	A
		$T_C=100\text{ °C}$ , $V_{GS}=10\text{ V}^{2)}$	120	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$	480	
Avalanche energy, single pulse	$E_{AS}$	$I_D=80\text{ A}$	1880	mJ
Gate source voltage	$V_{GS}$		±20	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	300	W
Operating and storage temperature	$T_j, T_{stg}$		-55 ... +175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Thermal characteristics<sup>2)</sup>**

Thermal resistance, junction - case	$R_{thJC}$		-	-	0.5	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$		-	-	62	
SMD version, device on PCB	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>3)</sup>	-	-	40	

**Electrical characteristics, at  $T_j=25\text{ }^\circ\text{C}$ , unless otherwise specified**
**Static characteristics**

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=230\text{ }\mu\text{A}$	2.1	3.0	4.0	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ }^\circ\text{C}^{2)}$	-	-	100	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=80\text{ A}$	-	1.65	2.3	m $\Omega$
		$V_{GS}=10\text{ V}, I_D=80\text{ A},$ SMD version	-	1.35	2	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics<sup>2)</sup>**

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	11000	14300	pF
Output capacitance	$C_{oss}$		-	3000	3900	
Reverse transfer capacitance	$C_{rss}$		-	470	710	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20\text{ V}, V_{GS}=10\text{ V},$ $I_D=80\text{ A}, R_G=1.3\ \Omega$	-	35	-	ns
Rise time	$t_r$		-	19	-	
Turn-off delay time	$t_{d(off)}$		-	57	-	
Fall time	$t_f$		-	18	-	

**Gate Charge Characteristics<sup>2)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=32\text{ V}, I_D=80\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	54	70	nC
Gate to drain charge	$Q_{gd}$		-	38	67	
Gate charge total	$Q_g$		-	160	210	
Gate plateau voltage	$V_{plateau}$		-	5	-	V

**Reverse Diode<sup>2)</sup>**

Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	120	A
Diode pulse current	$I_{S,pulse}$		-	-	480	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=80\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.83	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=20\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	70	-	ns
Reverse recovery charge	$Q_{rr}$		-	145	-	nC

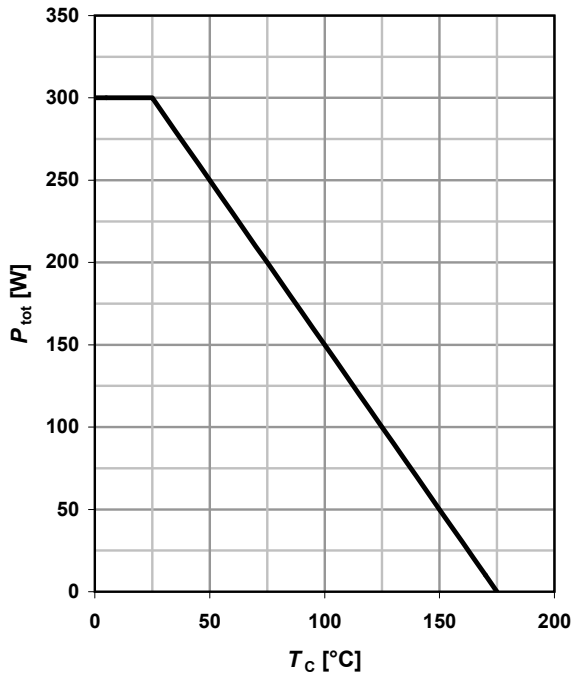
<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC} = 0.5\text{ K/W}$  the chip is able to carry 306 A at 25°C. For detailed information see Application Note ANPS071E at [www.infineon.com/optimos](http://www.infineon.com/optimos)

<sup>2)</sup> Defined by design. Not subject to production test.

<sup>3)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

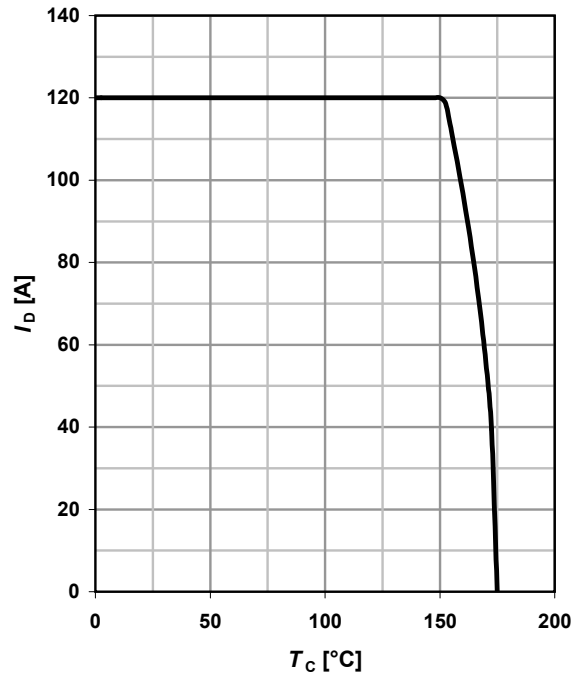
**1 Power dissipation**

$P_{tot} = f(T_C); V_{GS} \geq 6\text{ V}$



**2 Drain current**

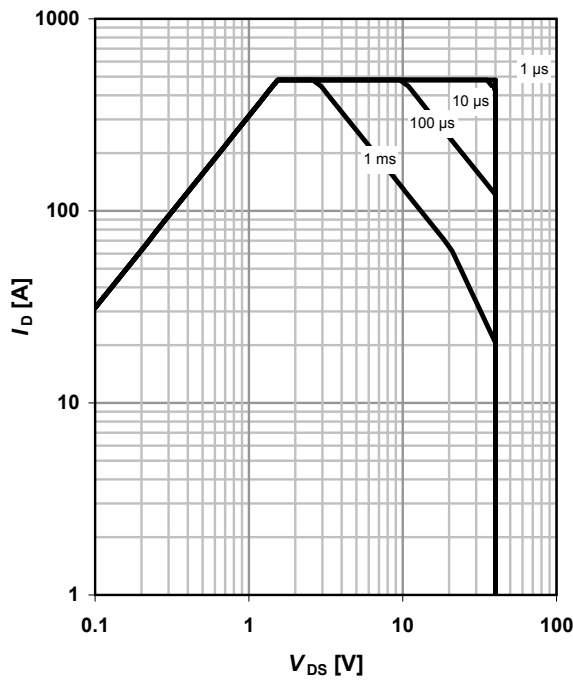
$I_D = f(T_C); V_{GS} \geq 6\text{ V}$



**3 Safe operating area**

$I_D = f(V_{DS}); T_C = 25\text{ °C}; D = 0; \text{SMD}$

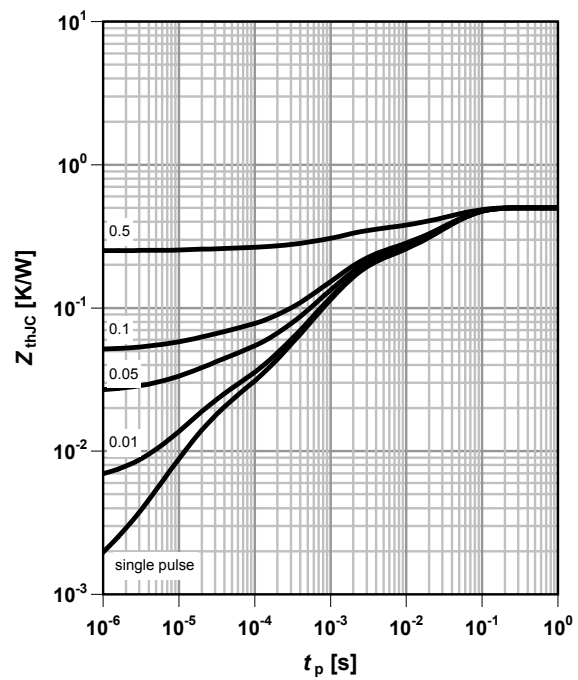
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC} = f(t_p)$

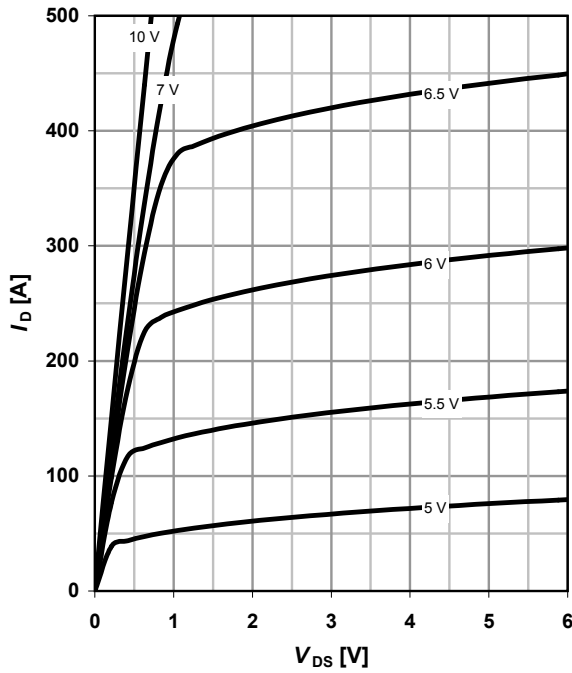
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

$I_D = f(V_{DS}); T_j = 25\text{ }^\circ\text{C}; \text{SMD}$

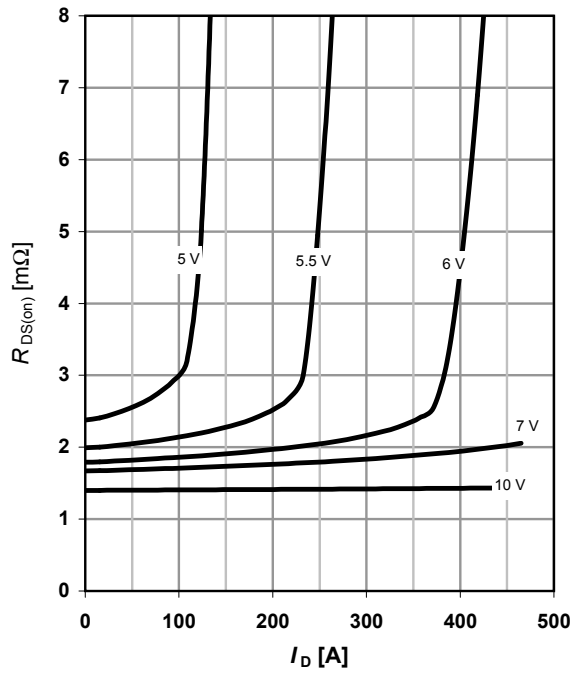
parameter:  $V_{GS}$



**6 Typ. drain-source on-state resistance**

$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}; \text{SMD}$

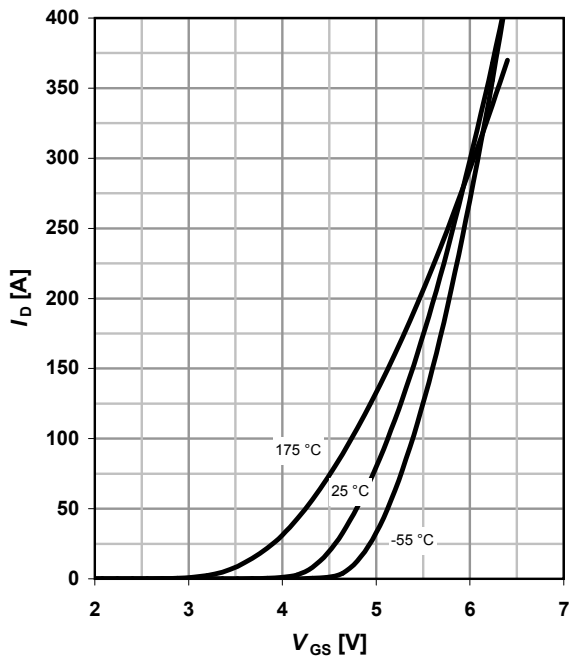
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

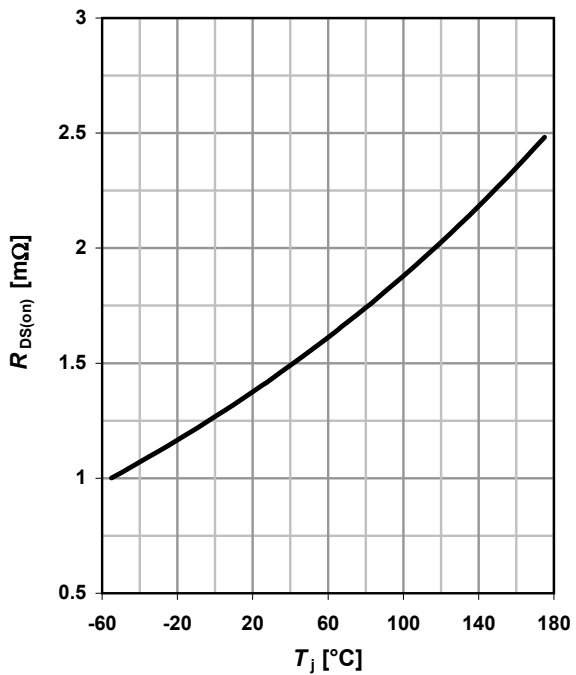
$I_D = f(V_{GS}); V_{DS} = 6\text{V}$

parameter:  $T_j$



**8 Typ. drain-source on-state resistance**

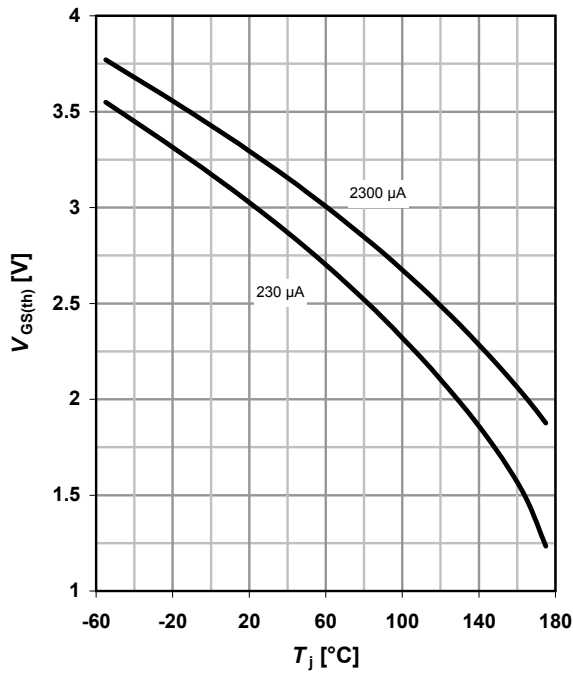
$R_{DS(on)} = f(T_j); I_D = 80\text{ A}; V_{GS} = 10\text{ V}; \text{SMD}$



**9 Typ. gate threshold voltage**

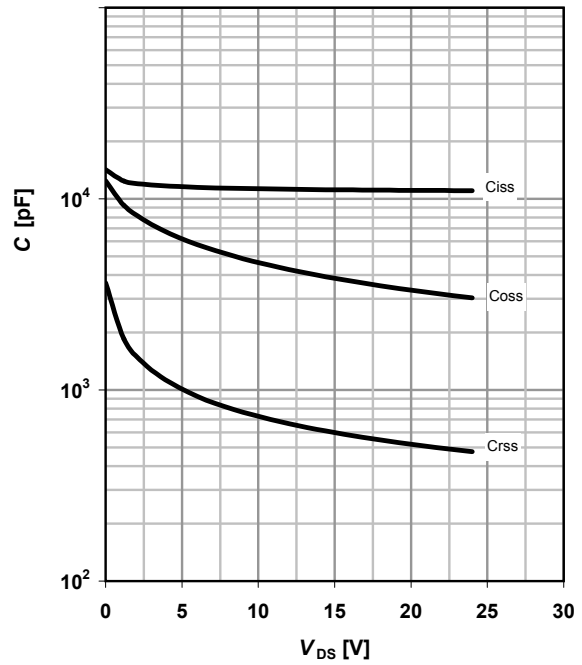
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



**10 Typ. capacitances**

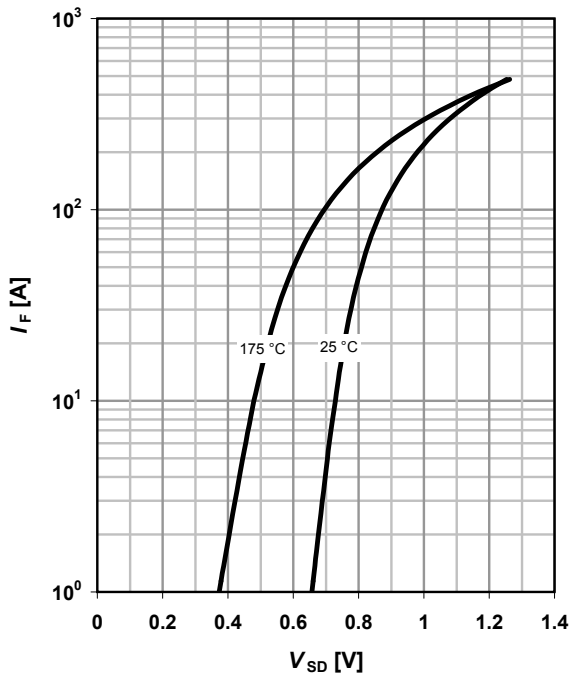
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



**11 Typical forward diode characteristics**

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

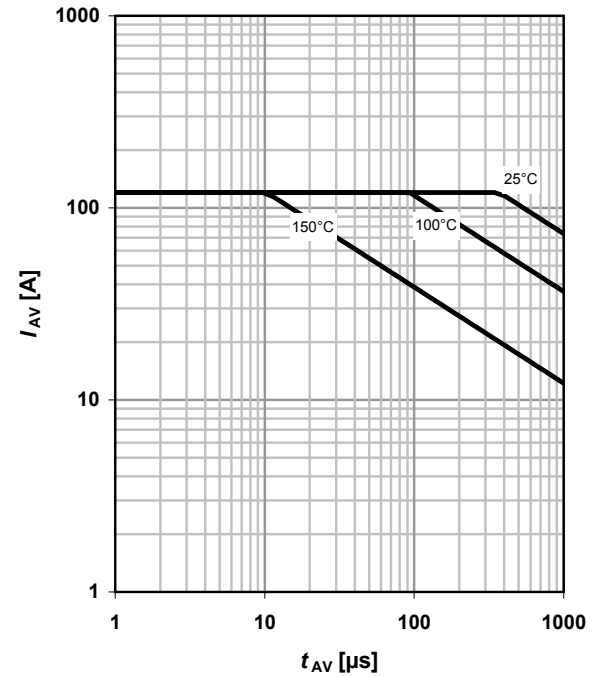
parameter:  $T_j$



**12 Typ. avalanche characteristics**

$$I_{AS} = f(t_{AV})$$

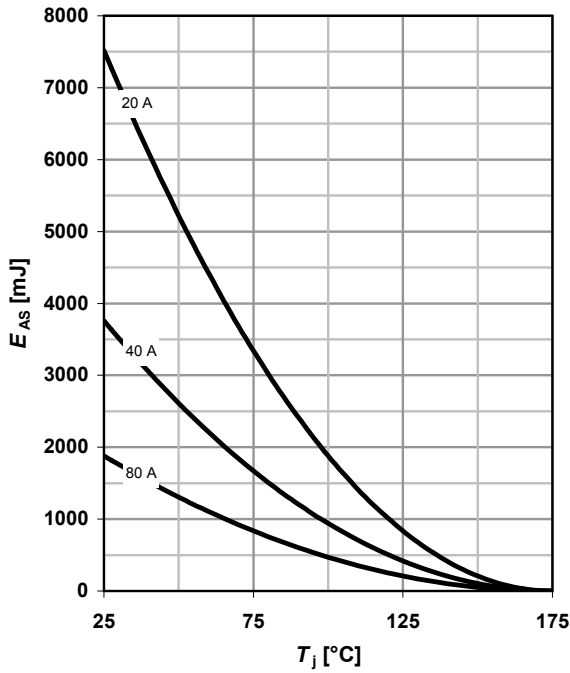
parameter:  $T_{j(start)}$



**13 Typical avalanche energy**

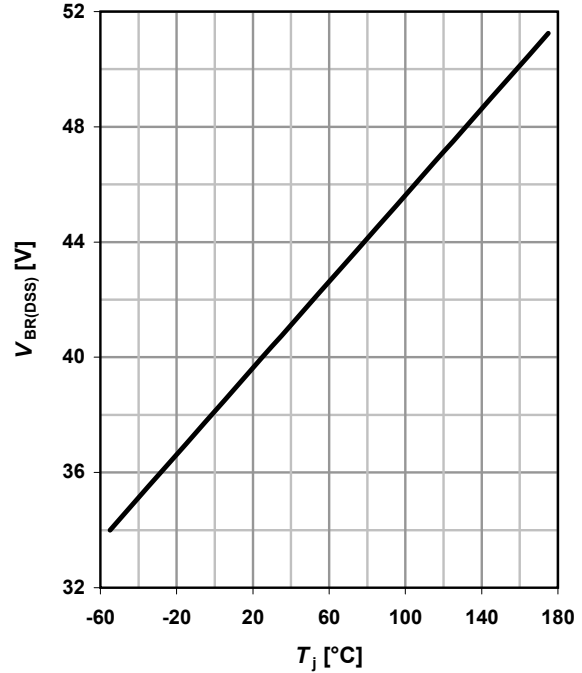
$$E_{AS} = f(T_j)$$

parameter:  $I_D$



**14 Typ. drain-source breakdown voltage**

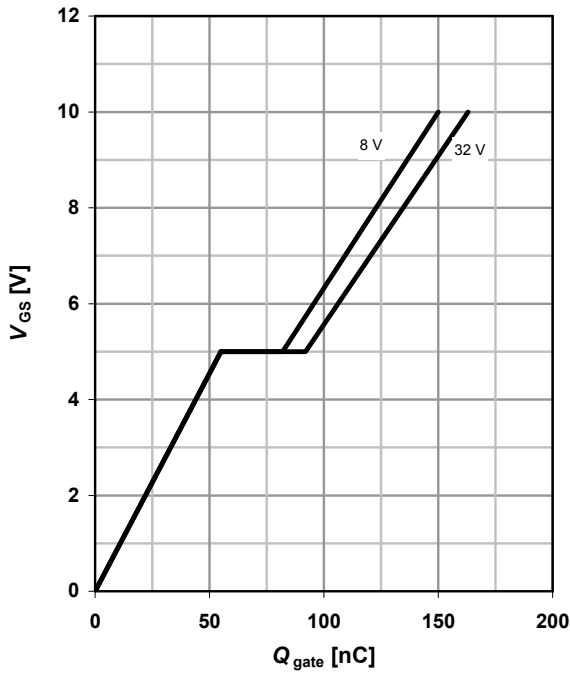
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



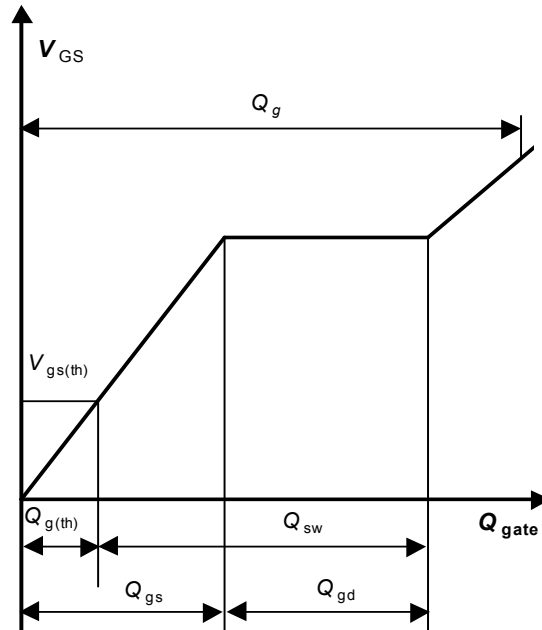
**15 Typ. gate charge**

$$V_{GS} = f(Q_{gate}); I_D = 80 \text{ A pulsed}$$

parameter:  $V_{DD}$



**16 Gate charge waveforms**



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Revision History

Version	Date	Changes