

## OptiMOS™ - 6 Power-Transistor



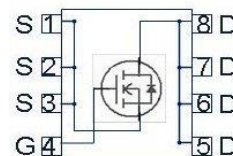
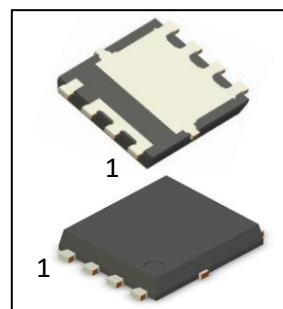
### Product Summary

$V_{DS}$	40	V
$R_{DS(on),max}$	4.0	m $\Omega$
$I_D$	60	A

### Features

- OptiMOS™ - power MOSFET for automotive applications
- N-channel - Enhancement mode - Logic Level
- AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green Product (RoHS compliant)
- 100% Avalanche tested

### PG-TDSON-8



Type	Package	Marking
IAUC60N04S6L039	PG-TDSON-8	6N04L039

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current <sup>1)</sup>	$I_D$	$T_C=25^\circ\text{C}$ , $V_{GS}=10\text{V}$	60	A
		$T_C=100^\circ\text{C}$ , $V_{GS}=10\text{V}^{2)}$	54	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25^\circ\text{C}$	240	
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	$I_D=12\text{A}$ , $R_{G,min}=25\Omega$	48.0	mJ
Avalanche current, single pulse	$I_{AS}$	$R_{G,min}=25\Omega$	12	A
Gate source voltage	$V_{GS}$	-	$\pm 16$	V
Power dissipation	$P_{tot}$	$T_C=25^\circ\text{C}$	42	W
Operating and storage temperature	$T_j$ , $T_{stg}$	-	-55 ... +175	$^\circ\text{C}$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

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

Thermal resistance, junction - case	$R_{thJC}$	-	-	-	3.6	K/W
Thermal resistance, junction - ambient	$R_{thJA}$	6 cm <sup>2</sup> cooling area <sup>3)</sup>	-	-	50	

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

#### Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=1mA$	40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=14\mu A$	1.2	1.6	2.0	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=40V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	-	1	$\mu A$
		$V_{DS}=40V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$	-	-	5	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=16V, V_{DS}=0V$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=30A$	-	4.71	5.90	m $\Omega$
		$V_{GS}=10V, I_D=30A$	-	3.28	4.02	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

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

Input capacitance	$C_{iss}$	$V_{GS}=0V, V_{DS}=25V,$ $f=1MHz$	-	907	1179	pF
Output capacitance	$C_{oss}$		-	259	337	
Reverse transfer capacitance	$C_{rss}$		-	20	30	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20V, V_{GS}=10V,$ $I_D=60A, R_G=3.5\Omega$	-	2	-	ns
Rise time	$t_r$		-	1	-	
Turn-off delay time	$t_{d(off)}$		-	7	-	
Fall time	$t_f$		-	3	-	

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

Gate to source charge	$Q_{gs}$	$V_{DD}=32V, I_D=60A,$ $V_{GS}=0 \text{ to } 10V$	-	2.9	3.9	nC
Gate to drain charge	$Q_{gd}$		-	3.1	4.7	
Gate charge total	$Q_g$		-	15	20	
Gate plateau voltage	$V_{plateau}$		-	3.2	-	V

### Reverse Diode

Diode continuous forward current <sup>2)</sup>	$I_S$	$T_C=25^\circ C$	-	-	60	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$		-	-	240	
Diode forward voltage	$V_{SD}$	$V_{GS}=0V, I_F=30A,$ $T_J=25^\circ C$	-	0.8	1.1	V
Reverse recovery time <sup>2)</sup>	$t_{rr}$	$V_R=20V, I_F=50A,$ $di_F/dt=100A/\mu s$	-	31	-	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$		-	18	-	nC

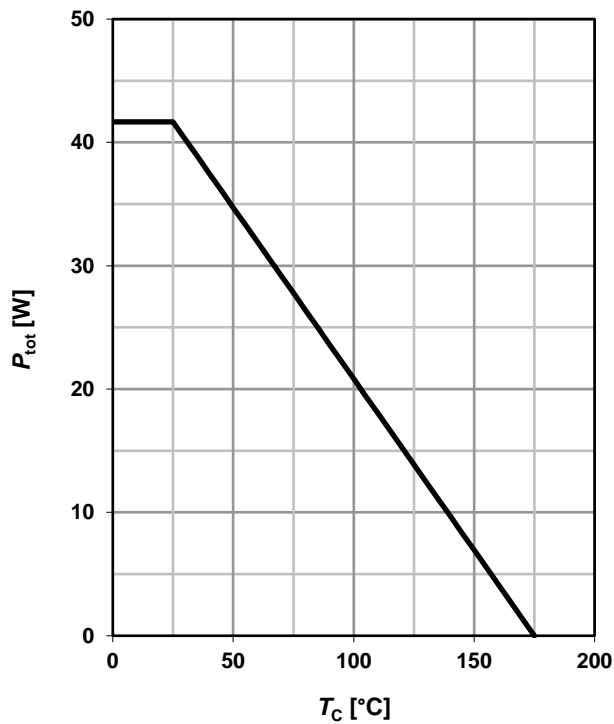
<sup>1)</sup> Current is limited by package; with an  $R_{thJC} = 3.6 \text{ K/W}$  the chip is able to carry 76 A at 25°C.

<sup>2)</sup> The parameter is not subject to production test- verified by design/characterization.

<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.

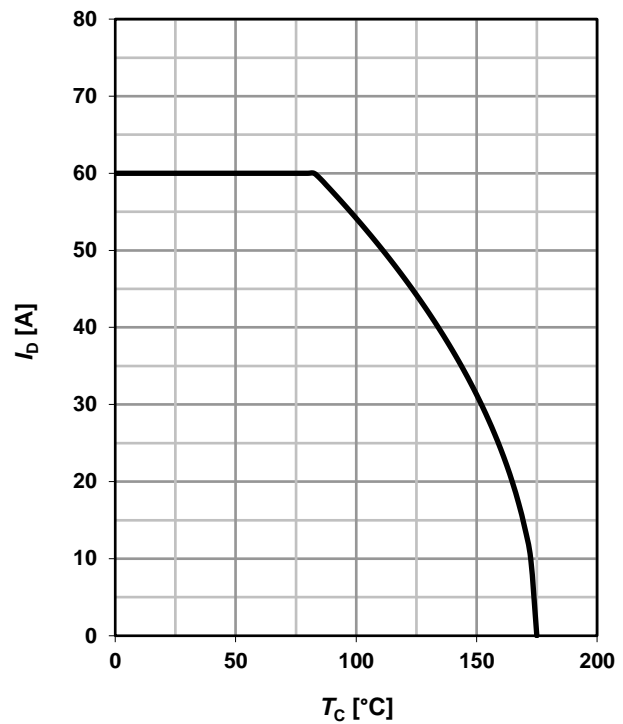
### 1 Power dissipation

$$P_{\text{tot}} = f(T_C); V_{\text{GS}} = 10 \text{ V}$$



### 2 Drain current

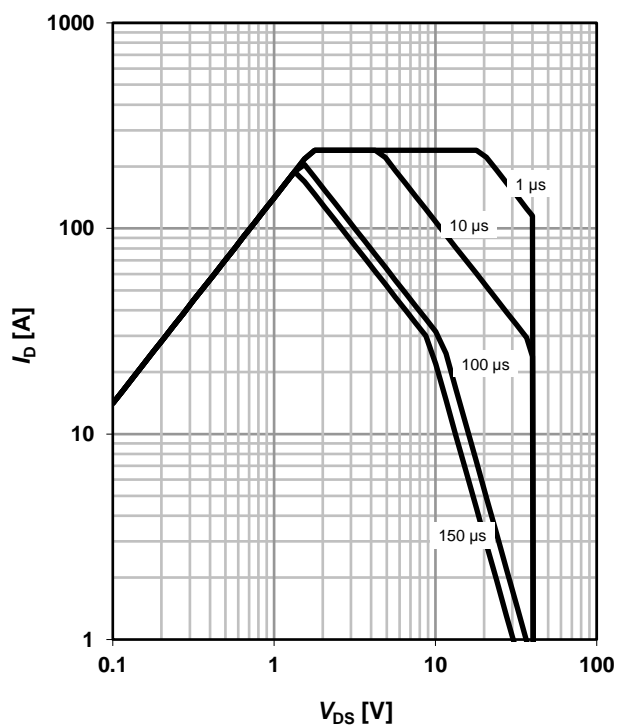
$$I_D = f(T_C); V_{\text{GS}} = 10 \text{ V}$$



### 3 Safe operating area

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

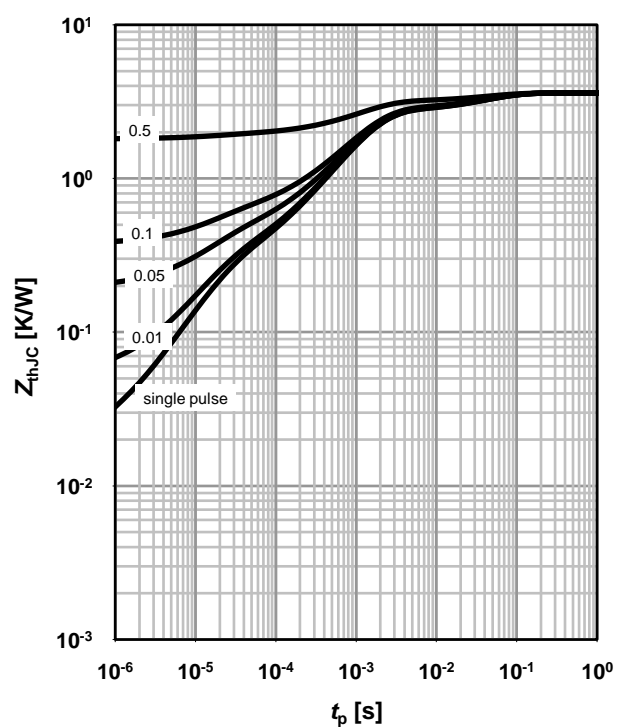
parameter:  $t_p$



### 4 Max. transient thermal impedance

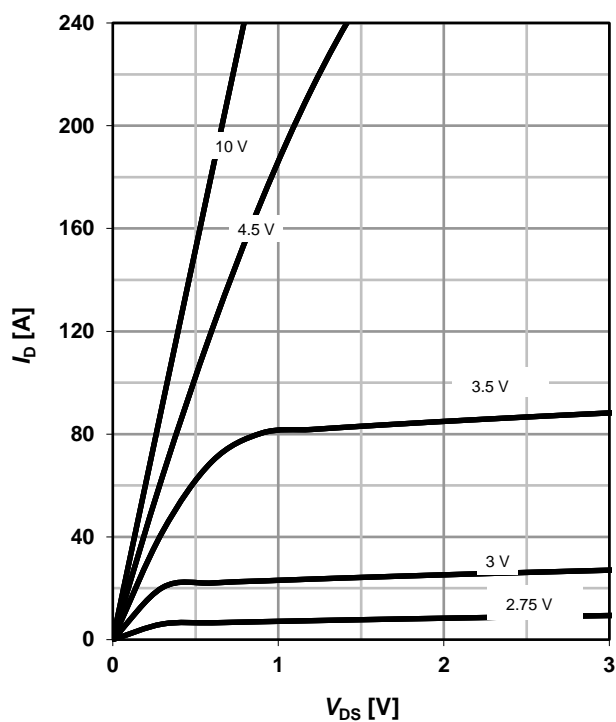
$$Z_{\text{thJC}} = f(t_p)$$

parameter:  $D = t_p/T$



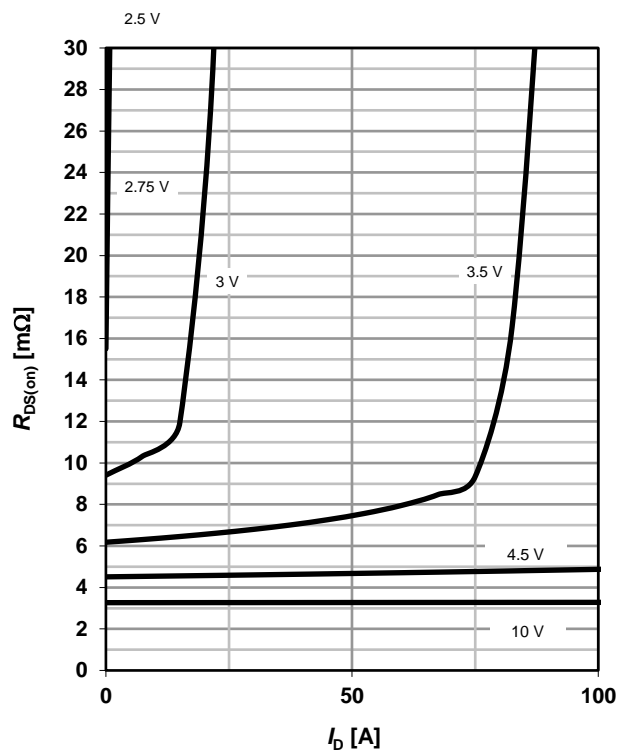
## 5 Typ. output characteristics

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

parameter:  $V_{GS}$ 


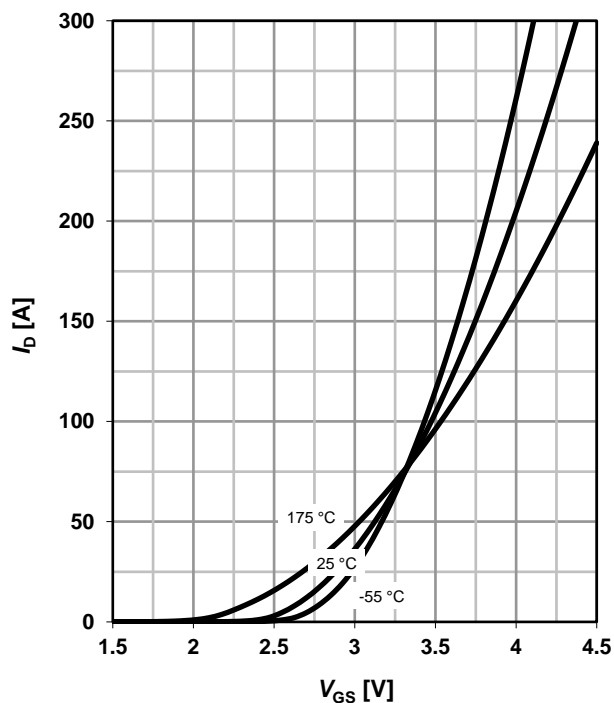
## 6 Typ. drain-source on-state resistance

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

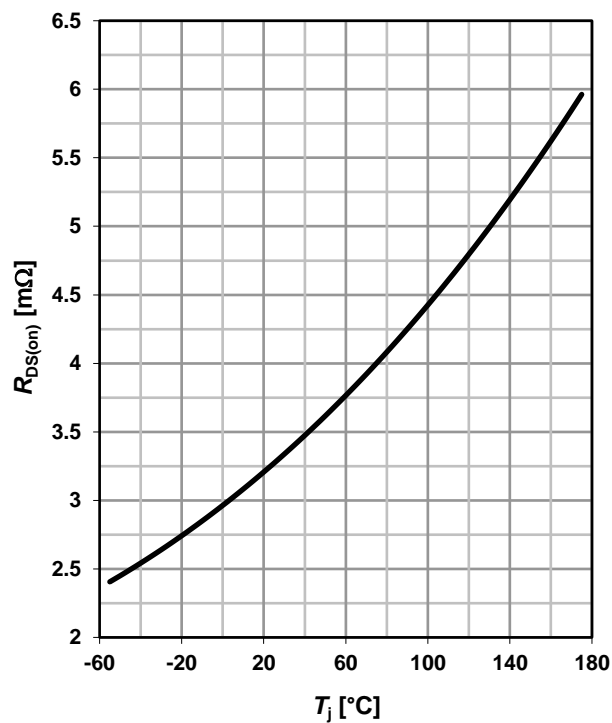
parameter:  $V_{GS}$ 


## 7 Typ. transfer characteristics

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

parameter:  $T_j$ 


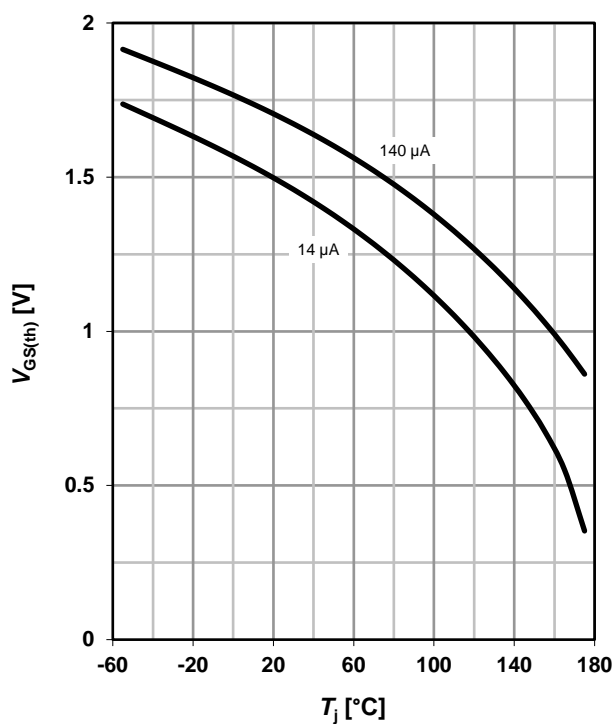
## 8 Typ. drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = 30\text{ A}; V_{GS} = 10\text{ V}$ 


## 9 Typ. gate threshold voltage

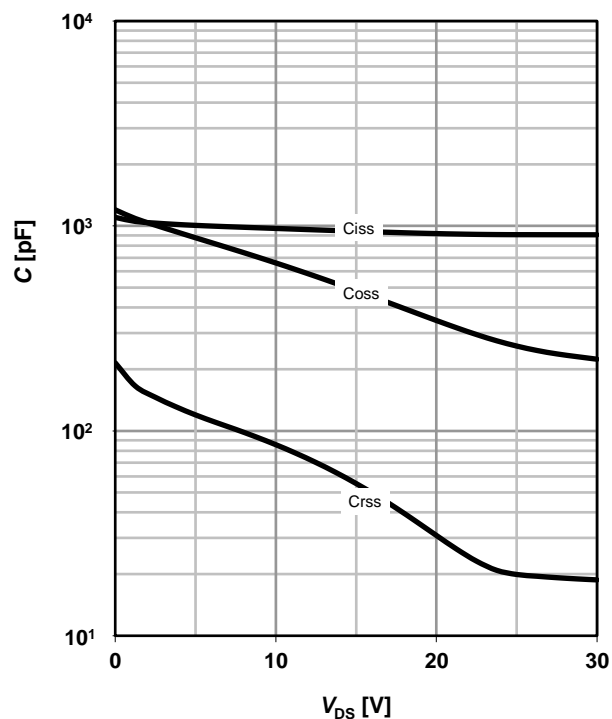
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



## 10 Typ. capacitances

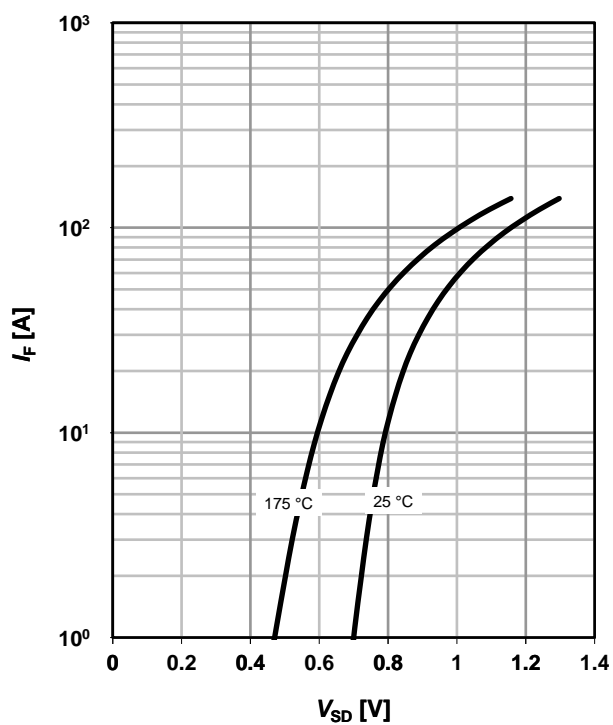
$$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$$



## 11 Typical forward diode characteristics

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

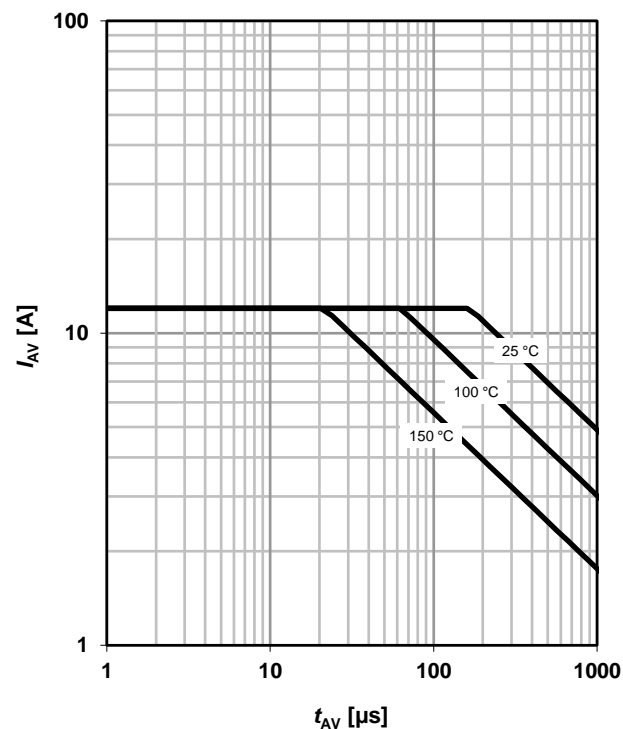
parameter:  $T_j$



## 12 Avalanche characteristics

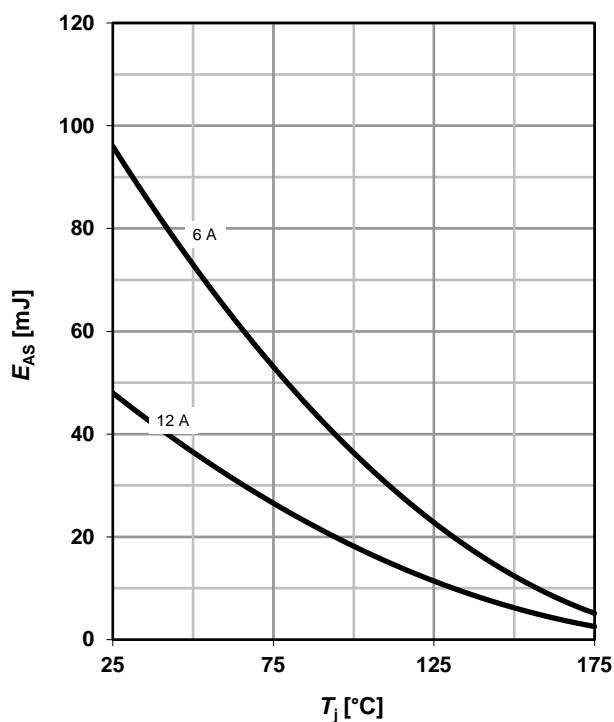
$$I_{AS} = f(t_{AV})$$

parameter:  $T_{j(start)}$



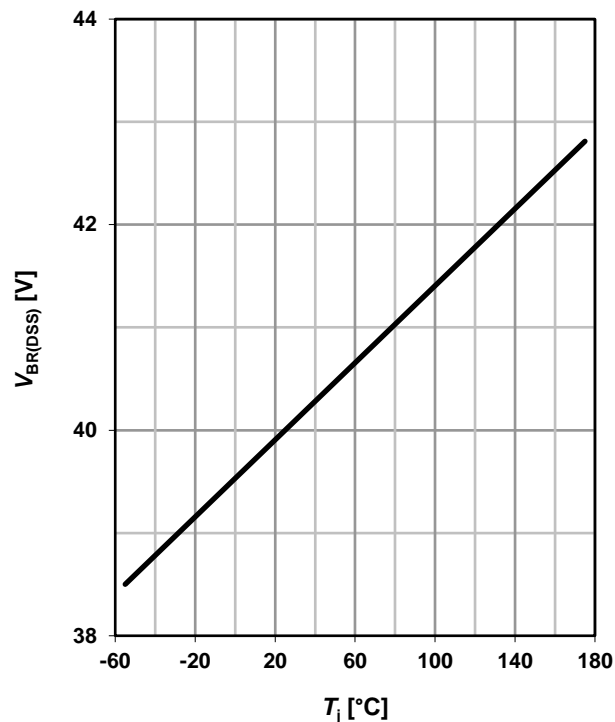
### 13 Avalanche energy

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



### 14 Drain-source breakdown voltage

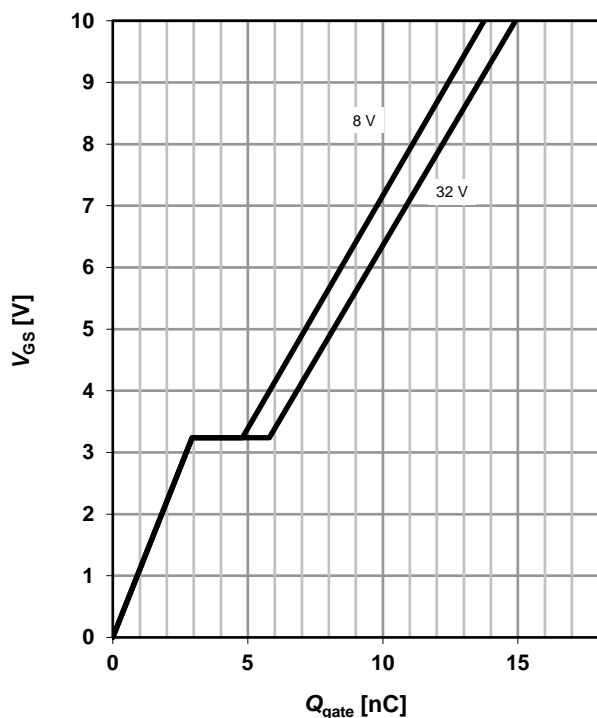
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$



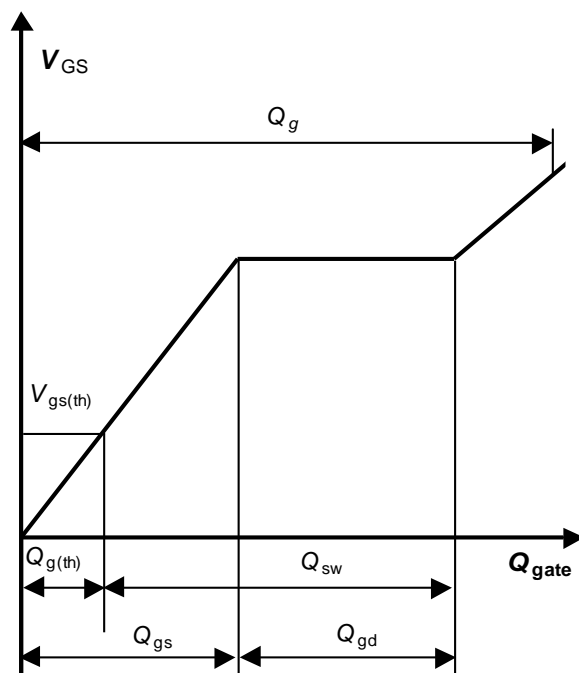
### 15 Typ. gate charge

$$V_{GS} = f(Q_{gate}); I_D = 60 \text{ A pulsed}$$

parameter:  $V_{DD}$



### 16 Gate charge waveforms



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Revision History

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Version	Date	Changes