

General Description

The WSF6012 is the highest performance trench N-ch and P-ch MOSFET with extreme high cell density, which provide excellent RDS(on) and gate charge for most of the synchronous buck converter applications.

The WSF6012 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- 100% EAS Guaranteed
- Green Device Available

Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
V_{DS}	Drain-Source Voltage	60	-60	V
V_{GS}	Gate-Source Voltage	± 20	± 20	V
$I_D@T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	20	-15	A
$I_D@T_C=70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	15	-10	A
I_{DM}	Pulsed Drain Current ²	46	-36	A
EAS	Single Pulse Avalanche Energy ³	200	180	mJ
I_{AS}	Avalanche Current	59	-50	A
$P_D@T_C=25^\circ C$	Total Power Dissipation ⁴	34.7	34.7	W
T_{STG}	Storage Temperature Range	-55 to 150	-55 to 150	$^\circ C$
T_J	Operating Junction Temperature Range	-55 to 150	-55 to 150	$^\circ C$

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	---	85	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	---	50	$^\circ C/W$

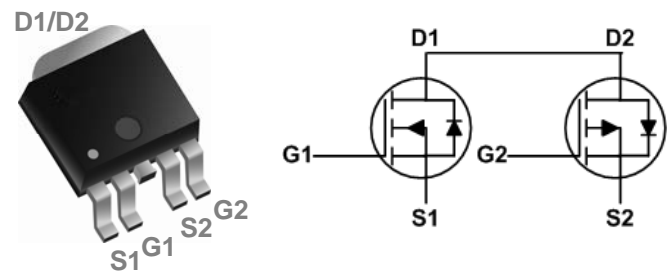
Product Summary

BVDSS	RDS(on)	ID
60V	28m Ω	20A
-60V	46m Ω	-15A

Applications

- High Frequency Point-of-Load Synchronous Buck Converter.
- Networking DC-DC Power System
- Load Switch

TO-252-4L Pin Configuration



N-Channel Electrical Characteristics (T_J=25 °C, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =250uA	60	---	---	V
ΔBV _{DSS} /ΔT _J	BV _{DSS} Temperature Coefficient	Reference to 25°C, I _D =1mA	---	0.063	---	V/°C
R _{DS(ON)}	Static Drain-Source On-Resistance ²	V _{GS} =10V, I _D =8A	---	28	37	mΩ
		V _{GS} =4.5V, I _D =5A	---	37	45	
V _{GS(th)}	Gate Threshold Voltage	V _{GS} =V _{DS} , I _D =250uA	1	---	2.5	V
ΔV _{GS(th)}	V _{GS(th)} Temperature Coefficient		---	-5.24	---	mV/°C
I _{DSS}	Drain-Source Leakage Current	V _{DS} =48V, V _{GS} =0V, T _J =25°C	---	---	1	uA
		V _{DS} =48V, V _{GS} =0V, T _J =55°C	---	---	5	
I _{GSS}	Gate-Source Leakage Current	V _{GS} =±20V, V _{DS} =0V	---	---	±100	nA
g _{fs}	Forward Transconductance	V _{DS} =5V, I _D =8A	---	21	---	S
R _g	Gate Resistance	V _{DS} =0V, V _{GS} =0V, f=1MHz	---	3.0	4.5	Ω
Q _g	Total Gate Charge (4.5V)	V _{DS} =48V, V _{GS} =4.5V, I _D =8A	---	12.6	20	nC
Q _{gs}	Gate-Source Charge		---	3.5	---	
Q _{gd}	Gate-Drain Charge		---	6.3	---	
T _{d(on)}	Turn-On Delay Time	V _{DD} =30V, V _{GS} =4.5V, R _G =3.3Ω, I _D =1A	---	8	---	ns
T _r	Rise Time		---	14.2	---	
T _{d(off)}	Turn-Off Delay Time		---	24.6	---	
T _f	Fall Time		---	4.6	---	
C _{iss}	Input Capacitance	V _{DS} =15V, V _{GS} =0V, f=1MHz	---	670	---	pF
C _{oss}	Output Capacitance		---	70	---	
C _{rss}	Reverse Transfer Capacitance		---	35	---	

Guaranteed Avalanche Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
EAS	Single Pulse Avalanche Energy ⁵	V _{DD} =25V, L=0.1mH, I _{AS} =16A	100	---	---	mJ

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I _S	Continuous Source Current ^{1,6}	V _G =V _D =0V, Force Current	---	---	20	A
I _{SM}	Pulsed Source Current ^{2,6}		---	---	60	A
V _{SD}	Diode Forward Voltage ²	V _{GS} =0V, I _S =1.7A, T _J =25°C	---	---	1.4	V

Note :

- The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper, t<10sec.
- The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
- The EAS data shows Max. rating. The test condition is V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=16A
- The power dissipation is limited by 150°C junction temperature
- The Min. value is 100% EAS tested guarantee.
- The data is theoretically the same as I_D and I_{DM}, in real applications, should be limited by total power dissipation.

P-Channel Electrical Characteristics ($T_J=25^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-60	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BV_{DSS} Temperature Coefficient	Reference to 25°C , $I_D=-1\text{mA}$	---	-0.03	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-10V, I_D=-5A$	---	46	60	$m\Omega$
		$V_{GS}=-4.5V, I_D=-3A$	---	65	90	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1.0	---	-2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	4.56	---	$mV/^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-48V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=-48V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
gfs	Forward Transconductance	$V_{DS}=-5V, I_D=-4.5A$	---	15	---	S
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	1.5	2.7	Ω
Q_g	Total Gate Charge (-4.5V)	$V_{DS}=-48V, V_{GS}=-4.5V, I_D=-5A$	---	10	---	nC
Q_{gs}	Gate-Source Charge		---	3.1	---	
Q_{gd}	Gate-Drain Charge		---	3.0	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-20V, V_{GS}=-10V,$ $R_G=3.3\Omega, I_D=-1A,$	---	9.7	---	ns
T_r	Rise Time		---	19	---	
$T_{d(off)}$	Turn-Off Delay Time		---	46	---	
T_f	Fall Time		---	45.8	---	
C_{iss}	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$	---	500	---	pF
C_{oss}	Output Capacitance		---	66	---	
C_{rss}	Reverse Transfer Capacitance		---	32	---	

Guaranteed Avalanche Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
EAS	Single Pulse Avalanche Energy ⁵	$V_{DD}=-25V, L=0.1\text{mH}, I_{AS}=-10A$	90	---	---	mJ

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0V, \text{Force Current}$	---	---	-15	A
I_{SM}	Pulsed Source Current ^{2,6}		---	---	-50	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$	---	---	-1.2	V

Note :

- The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper, $t < 10\text{sec}$.
- The data tested by pulsed, pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- The EAS data shows Max. rating. The test condition is $V_{DD}=-25V, V_{GS}=-10V, L=0.1\text{mH}, I_{AS}=-10A$
- The power dissipation is limited by 150°C junction temperature
- The Min. value is 100% EAS tested guarantee.
- The data is theoretically the same as I_D and I_{DM} , in real applications, should be limited by total power dissipation.

N-Channel Typical Characteristics

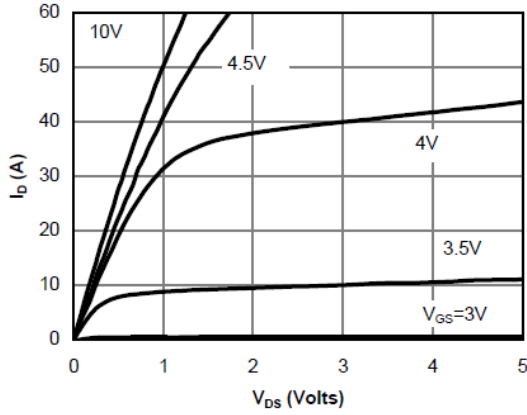


Figure 1: On-Region Characteristics (Note E)

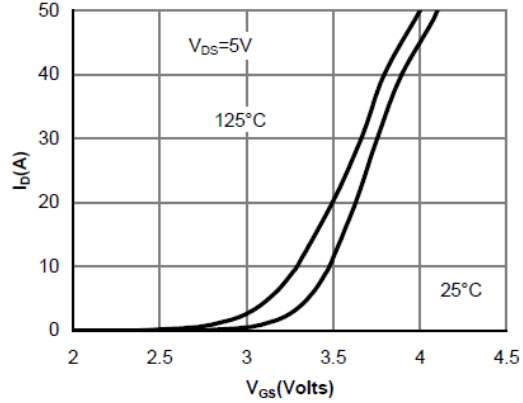


Figure 2: Transfer Characteristics (Note E)

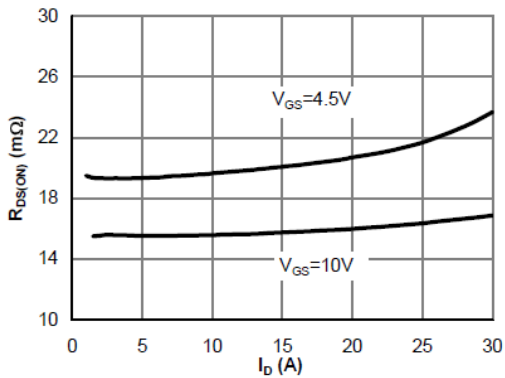


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

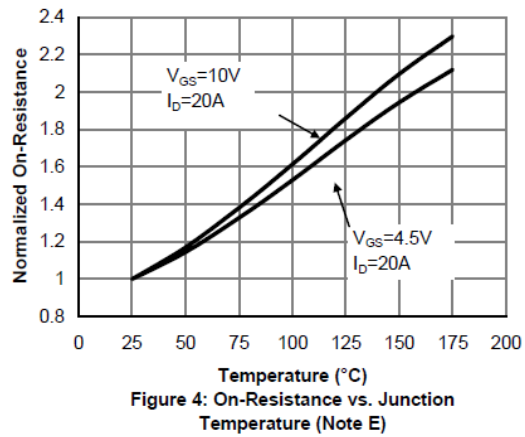


Figure 4: On-Resistance vs. Junction Temperature (Note E)

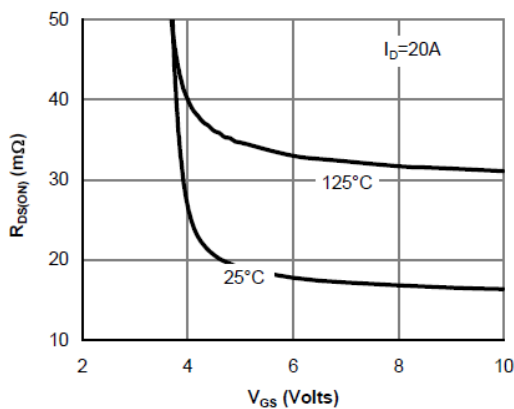


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

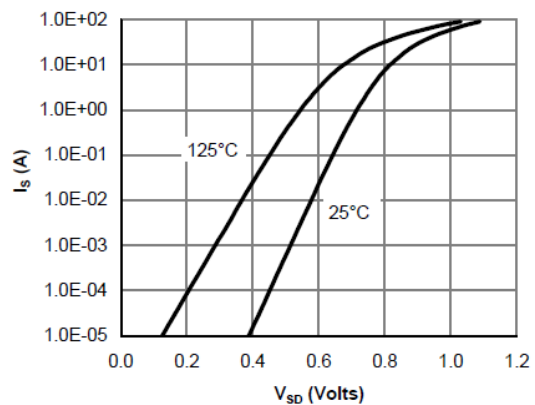


Figure 6: Body-Diode Characteristics (Note E)

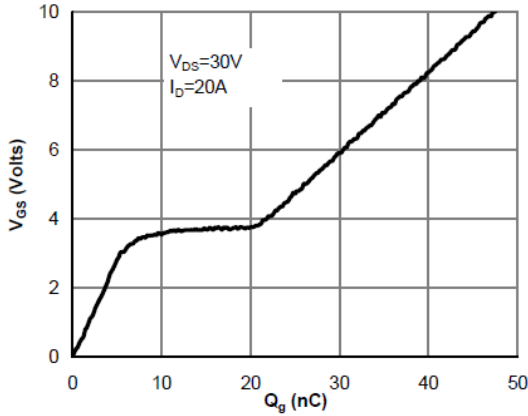


Figure 7: Gate-Charge Characteristics

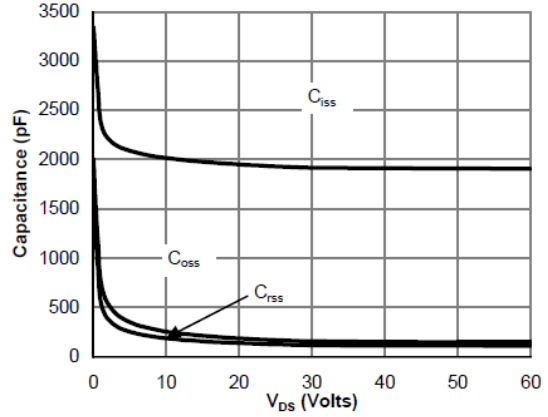


Figure 8: Capacitance Characteristics

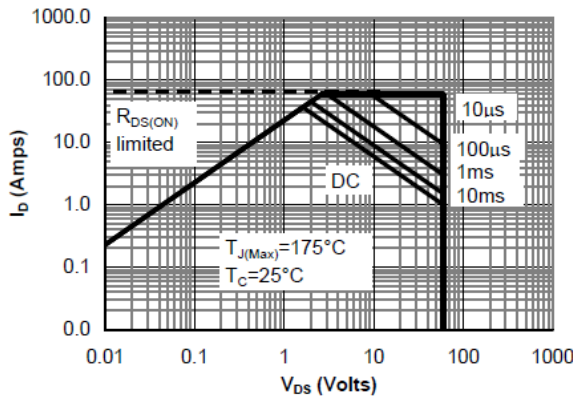


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

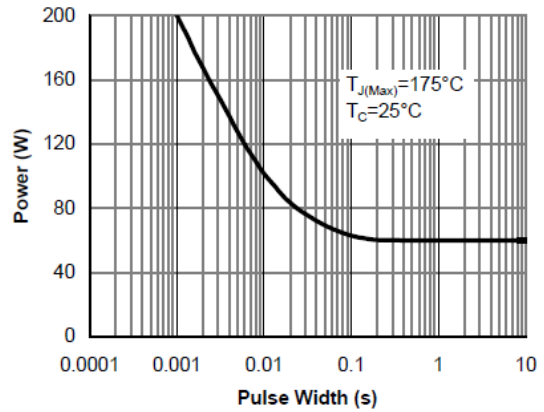


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

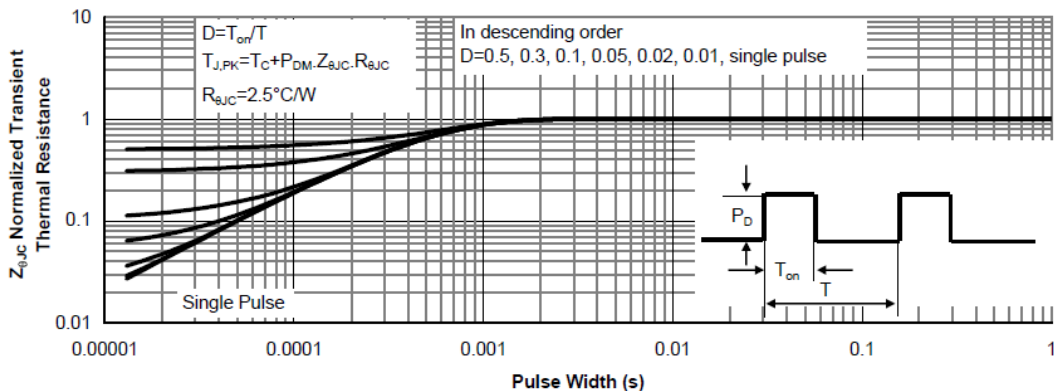


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

P-Channel Typical Characteristics

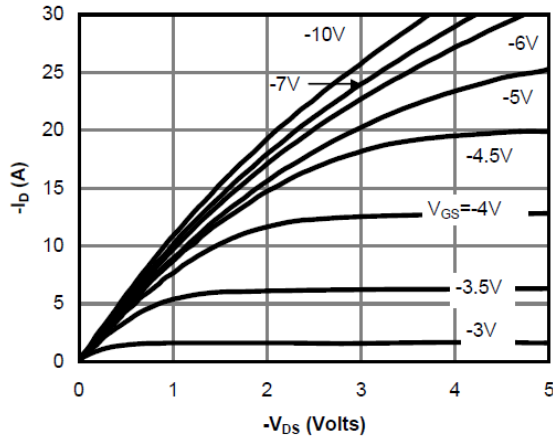


Fig 1: On-Region Characteristics

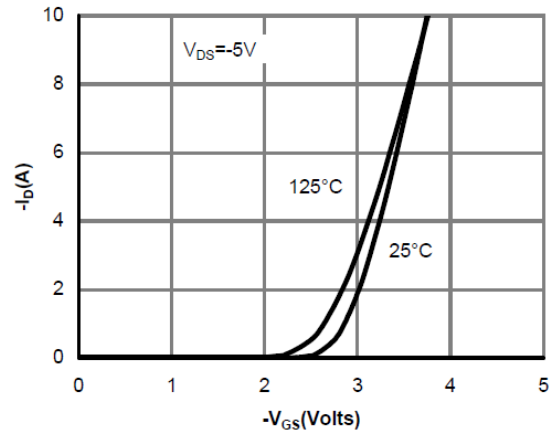


Figure 2: Transfer Characteristics

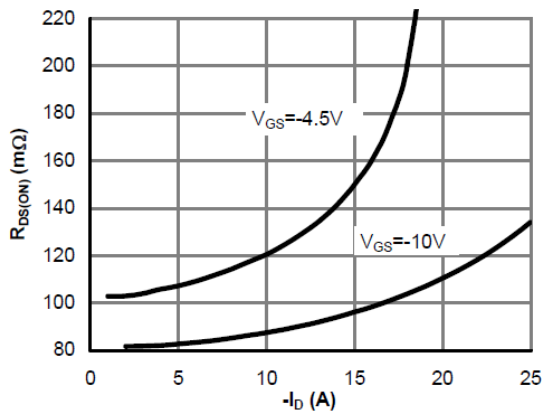


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

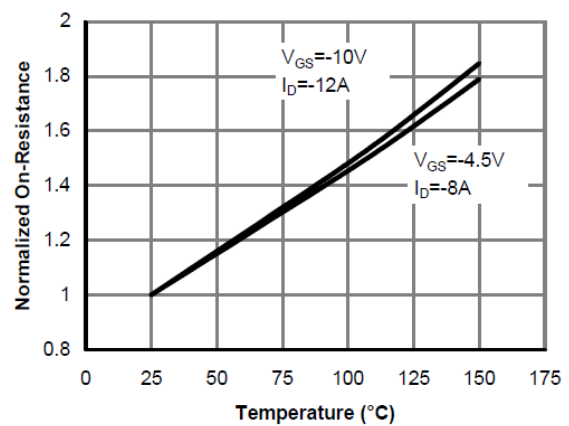


Figure 4: On-Resistance vs. Junction Temperature

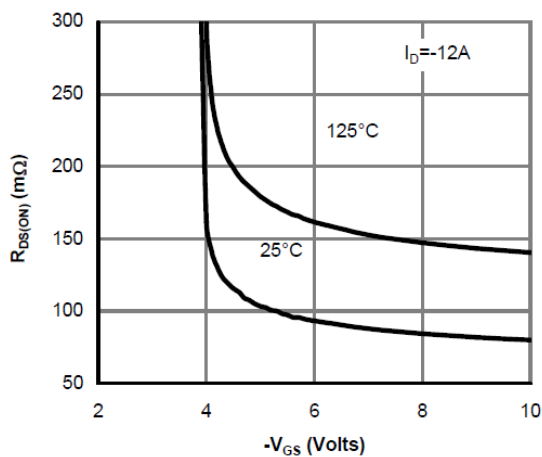


Figure 5: On-Resistance vs. Gate-Source Voltage

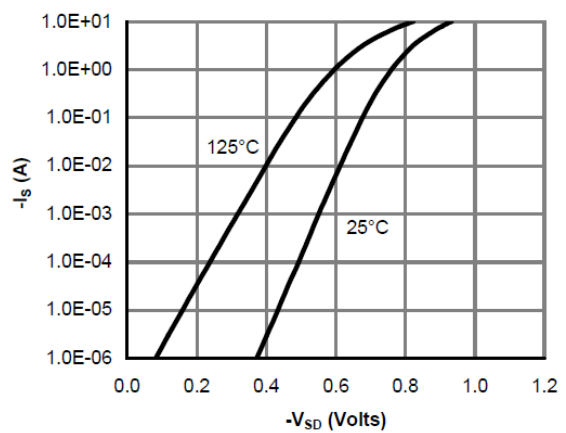


Figure 6: Body-Diode Characteristics

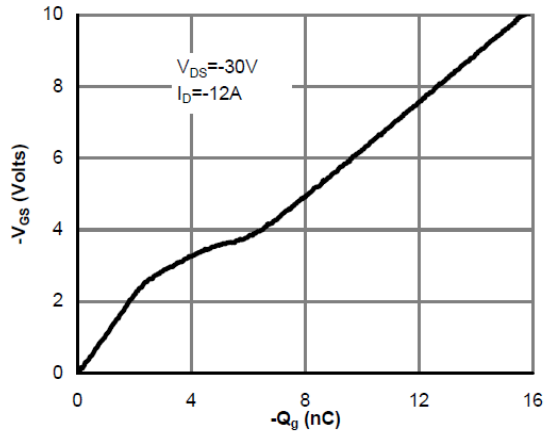


Figure 7: Gate-Charge Characteristics

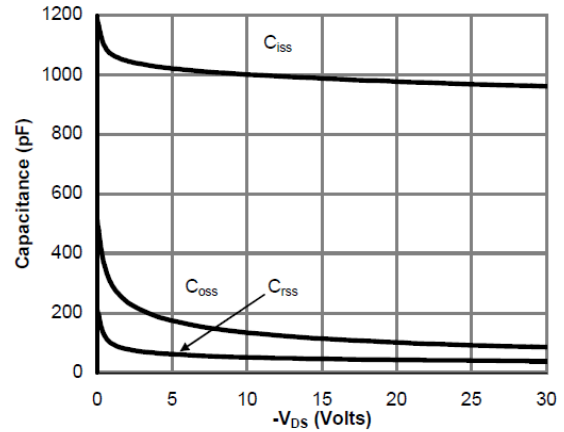


Figure 8: Capacitance Characteristics

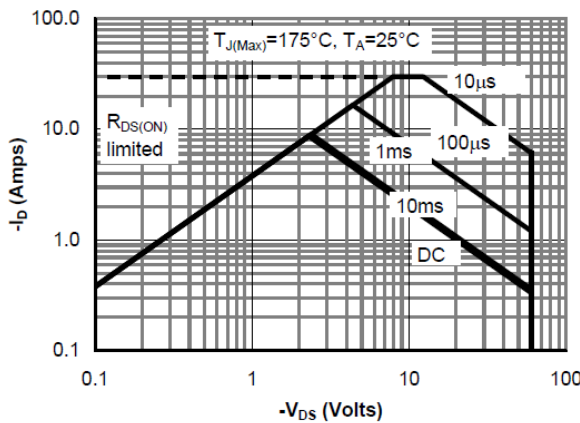


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

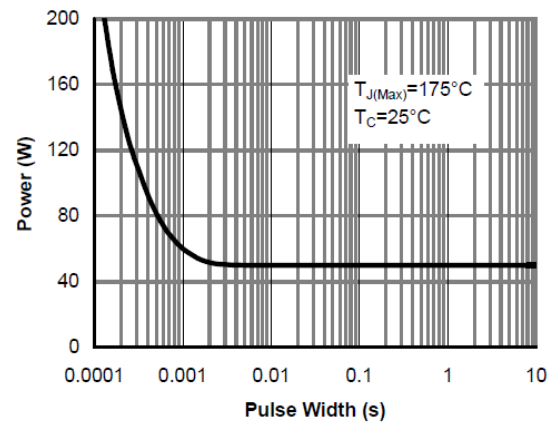


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

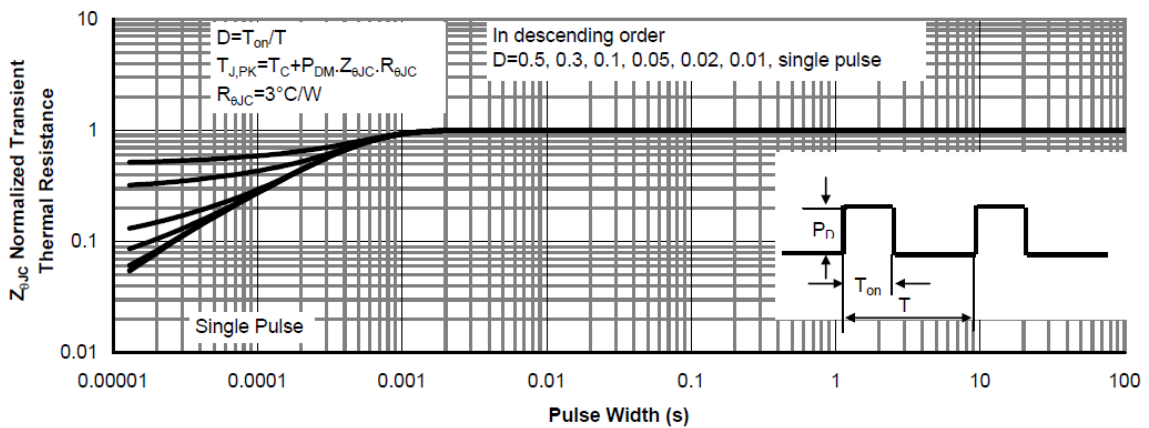


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)



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