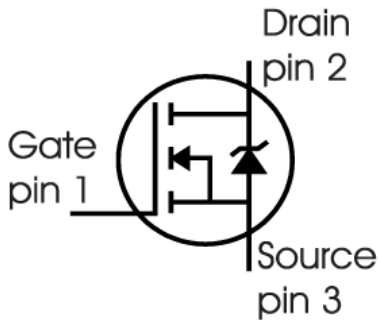


650V 77A Power MOSFET

■ Description

XCH Semiconductor(XCH)has series Multi-EPI Super-Junction power MOSFET platforms for voltage up 500V to 1000 volts, bothwith design service and manufacturing capability, including cell,termination design and simulation.

The GSW77N65E is a Low voltage N channel Multi-EPI Super-Junction power MOSFET sample with advanced technology to have better characteristics, such as fast switchingtime. low Ciss and Crss. low on resistance and excell entavalanche characteristics.



ORDERING INFORMATION

Industrial Range: -40° C to +125° C

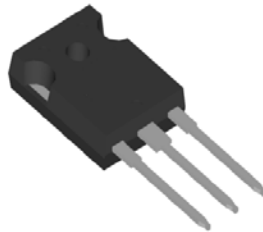
■ Features

- New revolutionary high voltage technology
- Better $R_{DS(on)}$ in TO-247
- Ultra Low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- Ultra low effective capacitances
- Pb-free lead planting
- Intrinsc fast-recovery body diode
- $R_{DS(on)}=0.041\Omega$ @VGS = 10V
- $V_{DS} = 650V$
- I_D (@ VGS=10V) = 35A

APPLICATIONS

- Consumer
- EV Charger
- PFC stages for server & telecom
- SMPS
- UPS
- Solar
- Lighting

Order Part No.	Package
GSW77N65EF	TO-247, Pb-Free



TO-247

Maximum rating sat $T_j = 25\text{ }^{\circ}\text{C}$, unless otherwise specified.

Symbol	Parameter	GSW77N65EF	Unit
V_{DSS}	Drain-Source Voltage	650	V
I_D	Drain Current -Continuous (TC = 25°C) -Continuous (TC = 100°C)	77* 45*	A
I_{DM}	Drain Current - Pulsed (Note 1)	260	A
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1950	mJ
I_{AR}	Repetitive Avalanche Current (Note 1)	13	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	2.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
dV_{ds}/dt	Drain Source voltage slope ($V_{ds}=480V$)	50	V/ns
P_D	Power Dissipation (TC = 25°C)	400	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^{\circ}\text{C}$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^{\circ}\text{C}$

1) Limited by $T_{j,max}$. Maximum duty cycle $D=0.75$

2) Pulse width t_p limited by $T_{j,max}$

3) Identical low side and high side switch with identical R_G ; $V_{peak} < V(BR)_{DSS}$; $T_j < T_{j,max}$

Thermal Characteristics

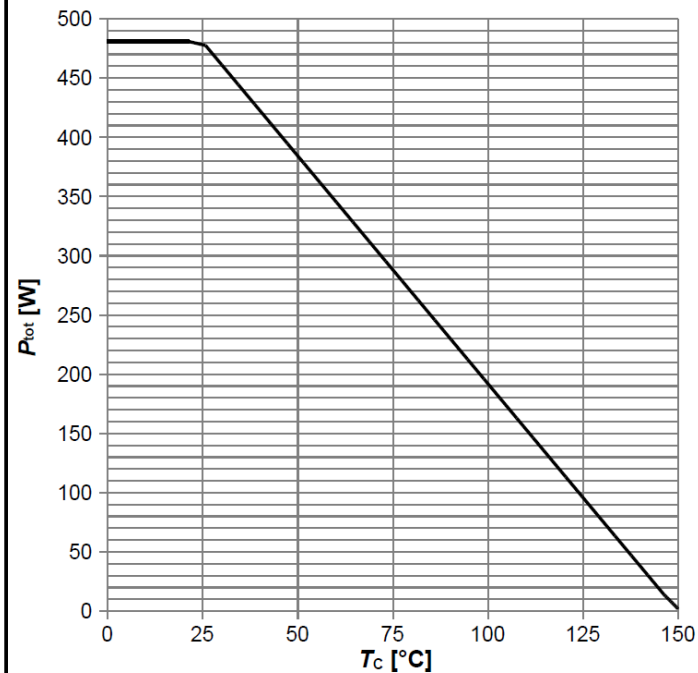
Symbol	Parameter	GSW77N65E	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.32	$^{\circ}\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	$^{\circ}\text{C}/\text{W}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25°C	650	--	--	V
		V _{GS} = 0V, I _D = 250μA, T _J = 150°C	--	700	--	V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	--	0.6	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650V, V _{GS} = 0V -T _J = 25°C -T _J = 150°C	--	-- 10	1 -	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30V, V _{DS} = 0V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30V, V _{DS} = 0V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	2.5	--	4.5	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 35A	--	35	41	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 40V, I _D = 35A	--	30	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz	--	6200	-	pF
C _{oss}	Output Capacitance		--	300	-	pF
C _{rss}	Reverse Transfer Capacitance		--	12	--	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 520V, I _D = 35A R _G = 20Ω (Note 4)	--	39	--	ns
t _r	Turn-On Rise Time		--	20	--	ns
t _{d(off)}	Turn-Off Delay Time		--	100	--	ns
t _f	Turn-Off Fall Time		--	5	--	ns
Q _g	Total Gate Charge	V _{DS} = 520V, I _D = 35A V _{GS} = 10V (Note 4)	--	300	-	nC
Q _{gs}	Gate-Source Charge		--	59	--	nC
Q _{gd}	Gate-Drain Charge		--	195	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	77	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	260	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _S = 35A	--	0.9	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 35A dI _F /dt = 100A/μs	--	290	--	ns
Q _{rr}	Reverse Recovery Charge		--	12	--	μC

1) Co(er) is a fixed capacitance that gives the same stored energy as Coss while VDS is rising from 0 to 80% V(BR)DSS

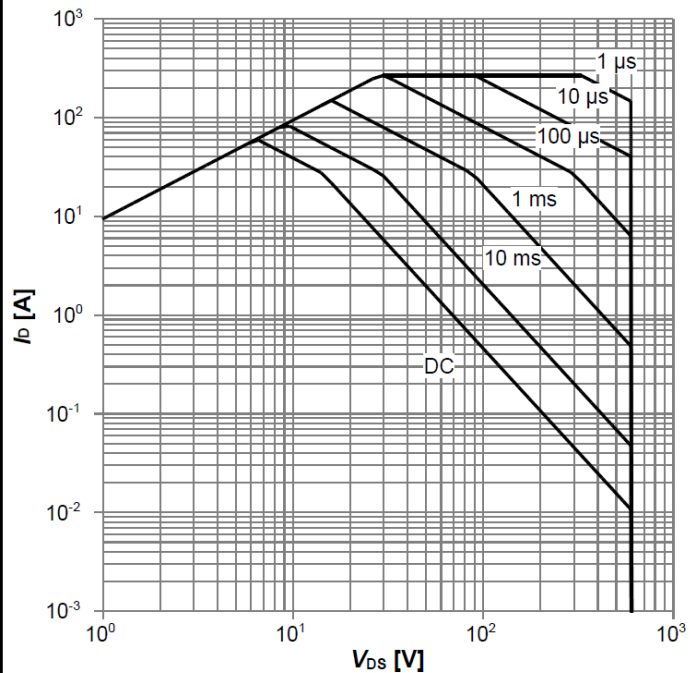
2) Co(tr) is a fixed capacitance that gives the same charging time as Coss while VDS is rising from 0 to 80% V(BR)DSS

Diagram 1: Power dissipation



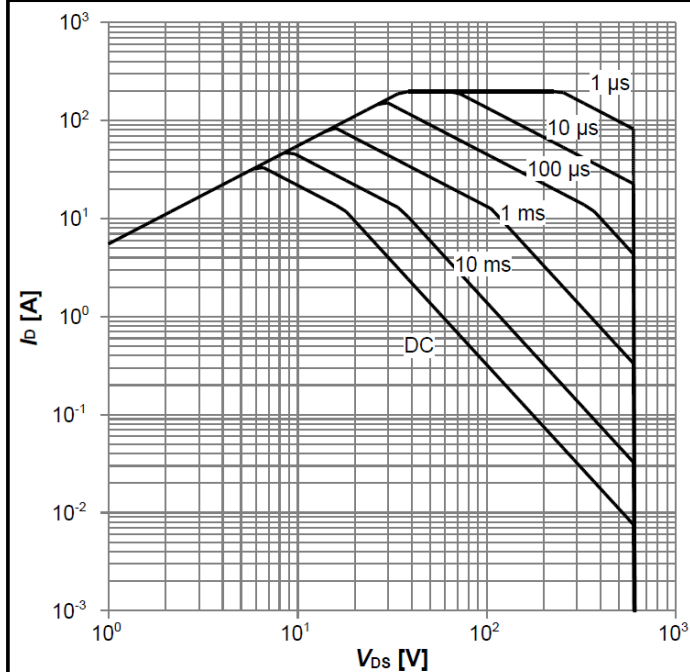
$$P_{tot}=f(T_c)$$

Diagram 2: Safe operating area



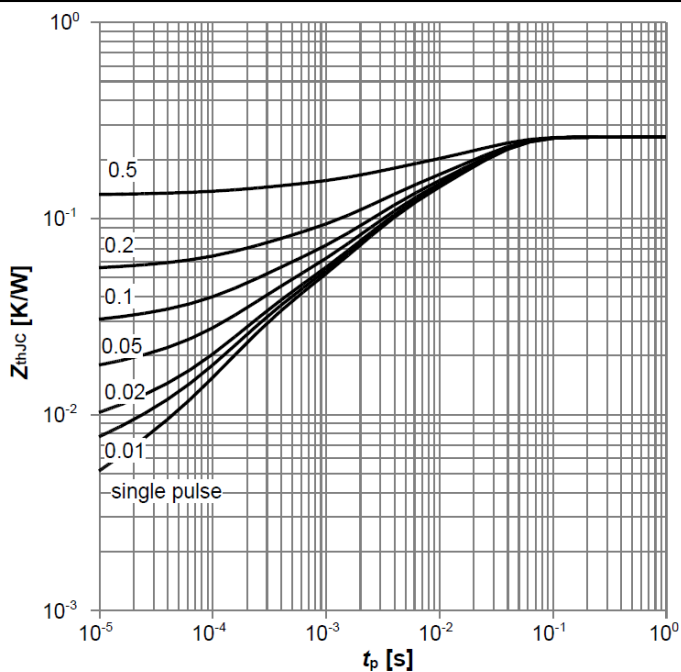
$$I_b=f(V_{DS}); T_c=25\text{ }^{\circ}\text{C}; D=0; \text{parameter: } t_p$$

Diagram 3: Safe operating area



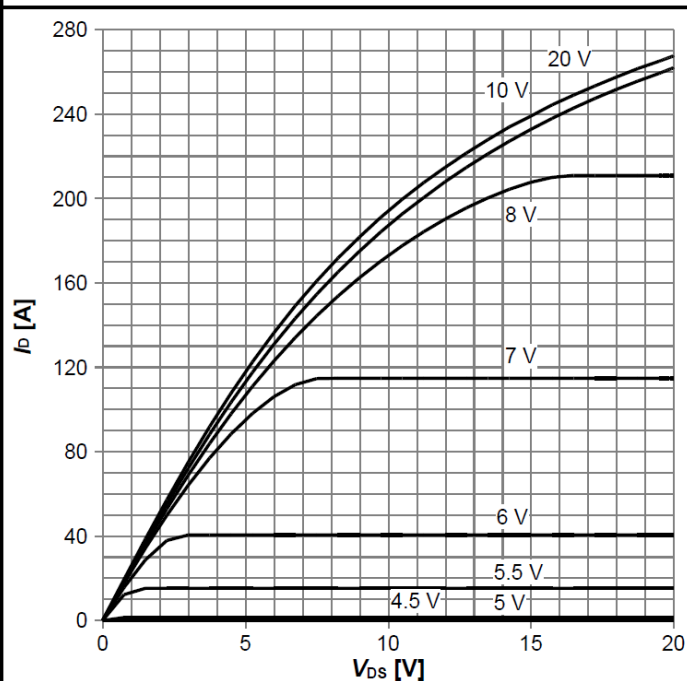
$$I_b=f(V_{DS}); T_c=80\text{ }^{\circ}\text{C}; D=0; \text{parameter: } t_p$$

Diagram 4: Max. transient thermal impedance



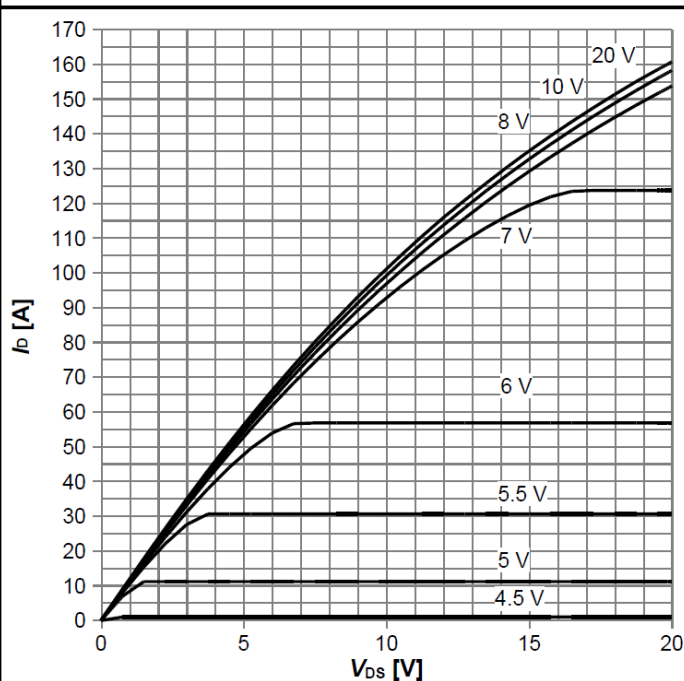
$$Z_{thJC}=f(t_p); \text{parameter: } D=t_p/T$$

Diagram 5: Typ. output characteristics



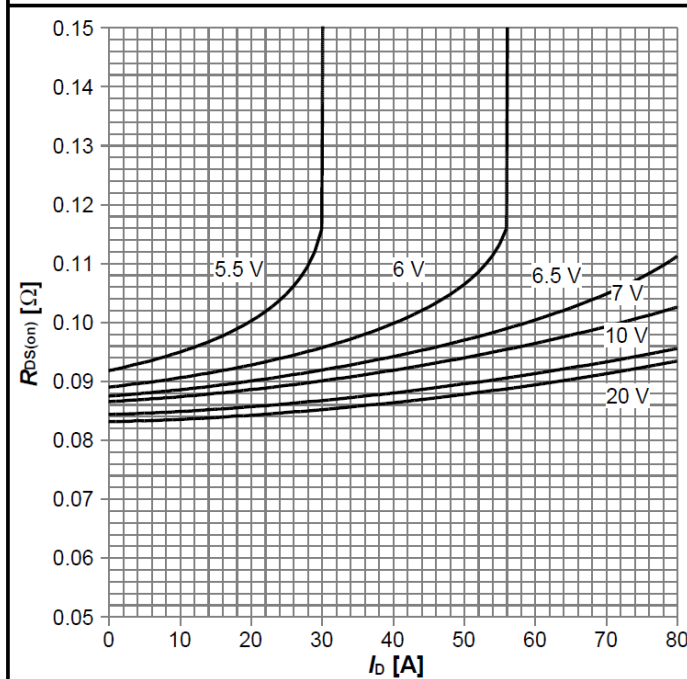
$I_D = f(V_{DS})$; $T_j = 25\text{ °C}$; parameter: V_{GS}

Diagram 6: Typ. output characteristics



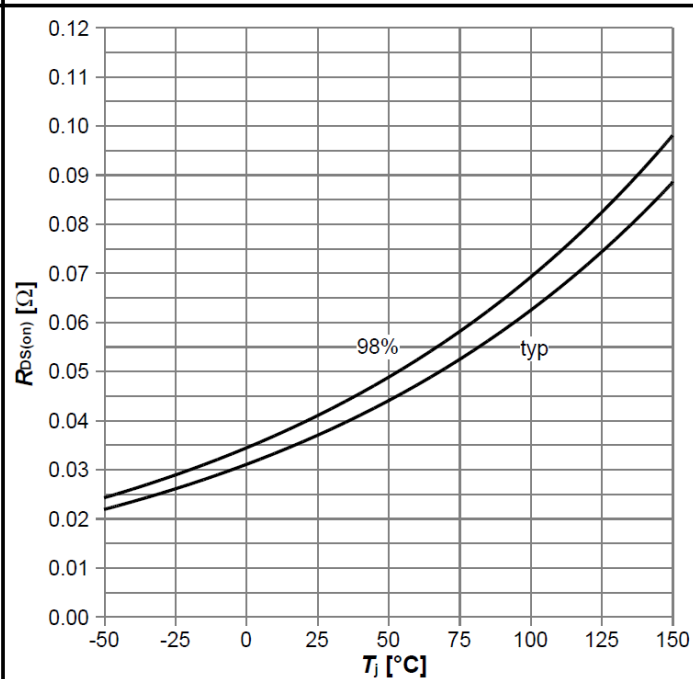
$I_D = f(V_{DS})$; $T_j = 125\text{ °C}$; parameter: V_{GS}

Diagram 7: Typ. drain-source on-state resistance



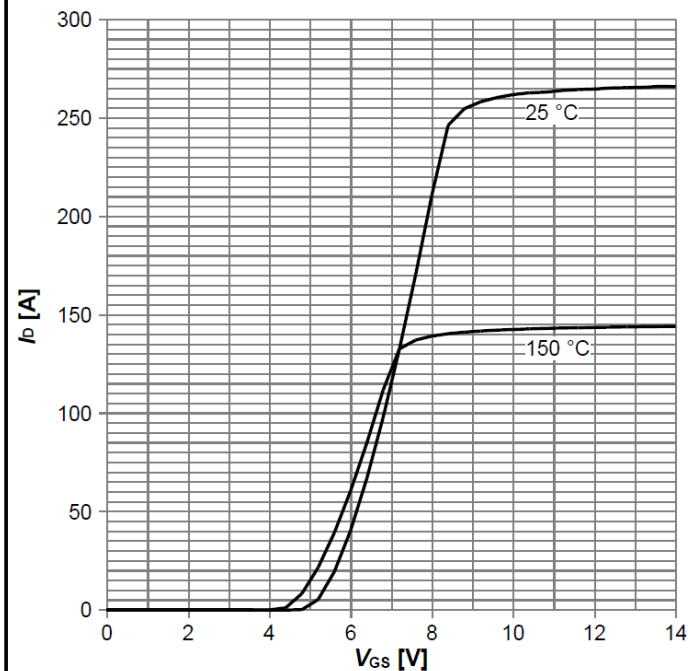
$R_{DS(on)} = f(I_D)$; $T_j = 125\text{ °C}$; parameter: V_{GS}

Diagram 8: Drain-source on-state resistance



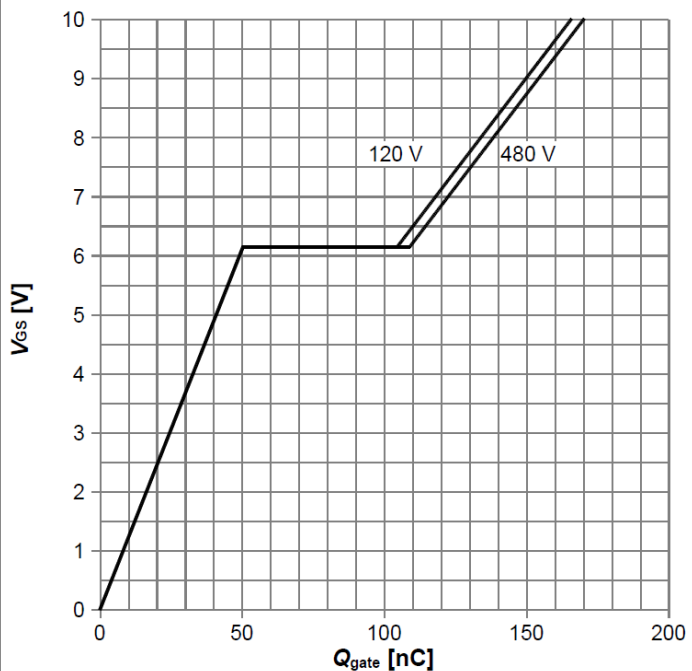
$R_{DS(on)} = f(T_j)$; $I_D = 35.5\text{ A}$; $V_{GS} = 10\text{ V}$

Diagram 9: Typ. transfer characteristics



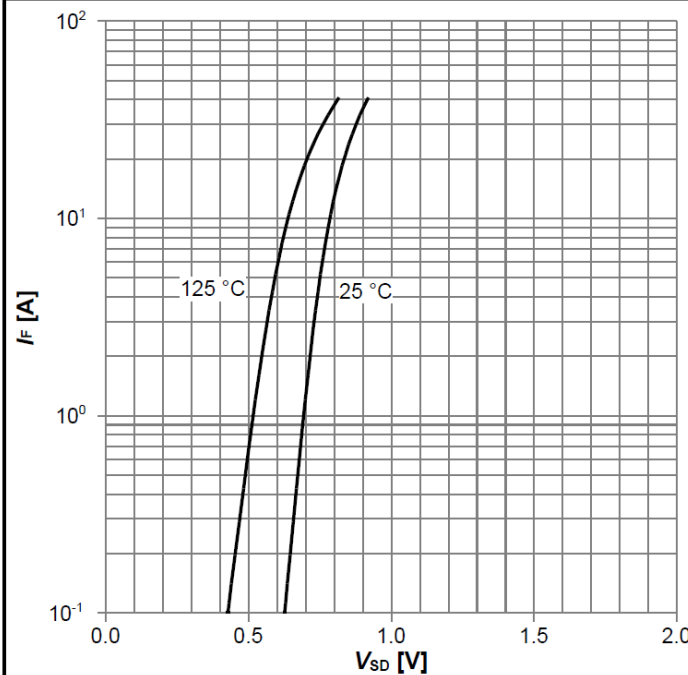
$I_D = f(V_{GS})$; $V_{DS} = 20V$; parameter: T_j

Diagram 10: Typ. gate charge



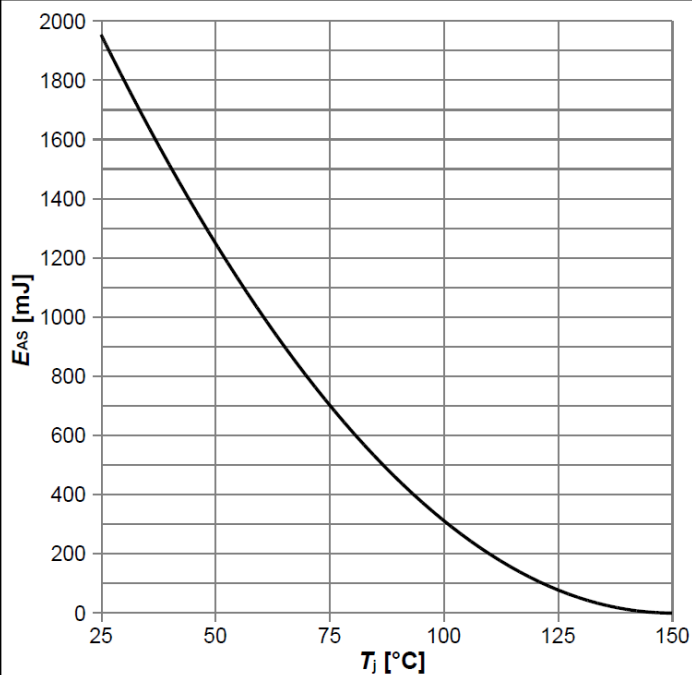
$V_{GS} = f(Q_{gate})$; $I_D = 44.4$ A pulsed; parameter: V_{DD}

Diagram 11: Forward characteristics of reverse diode



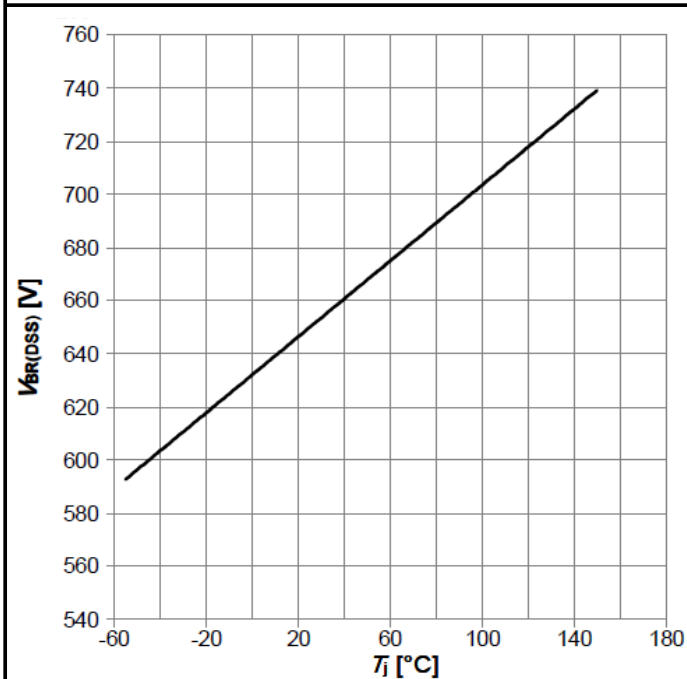
$I_F = f(V_{SD})$; parameter: T_j

Diagram 12: Avalanche energy



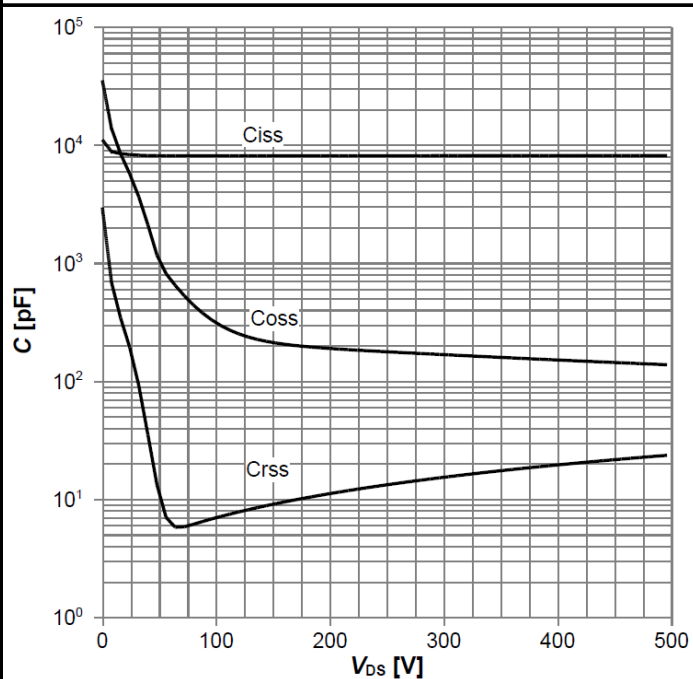
$E_{AS} = f(T_j)$; $I_D = 13.4$ A; $V_{DD} = 50$ V

Diagram 13: Drain-source breakdown voltage



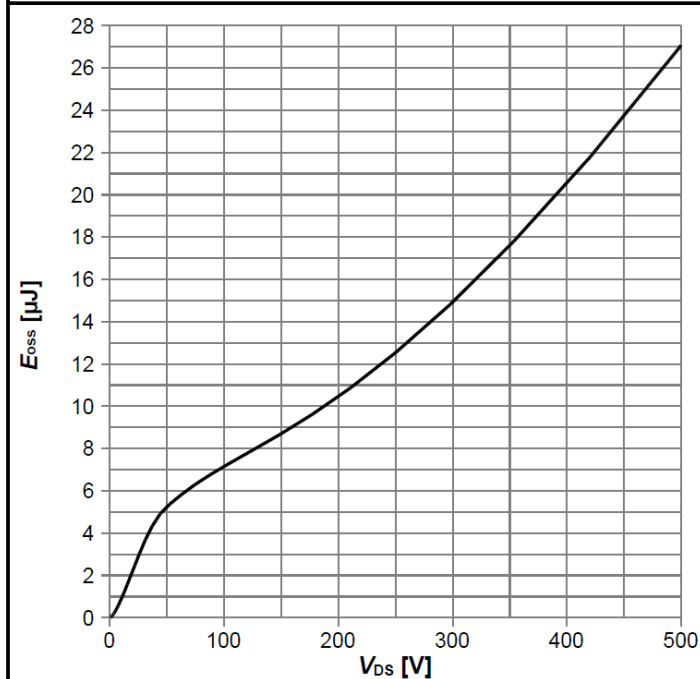
$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$

Diagram 14: Typ. capacitances



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

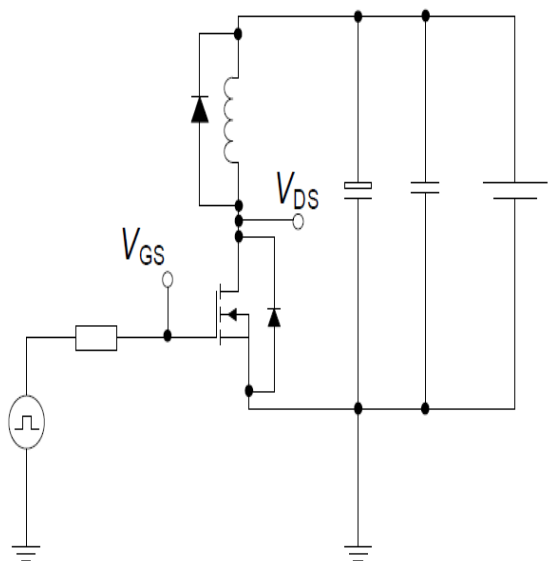
Diagram 15: Typ. Coss stored energy



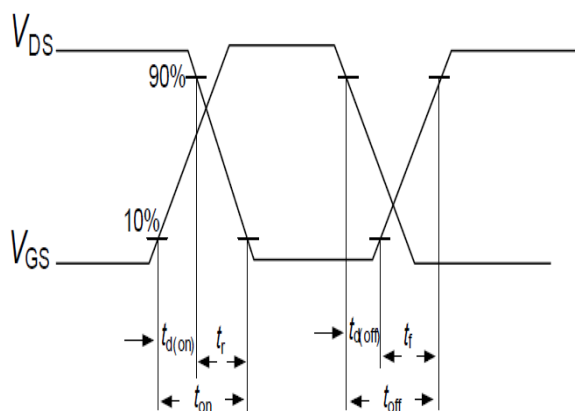
$E_{oss} = f(V_{DS})$

Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load

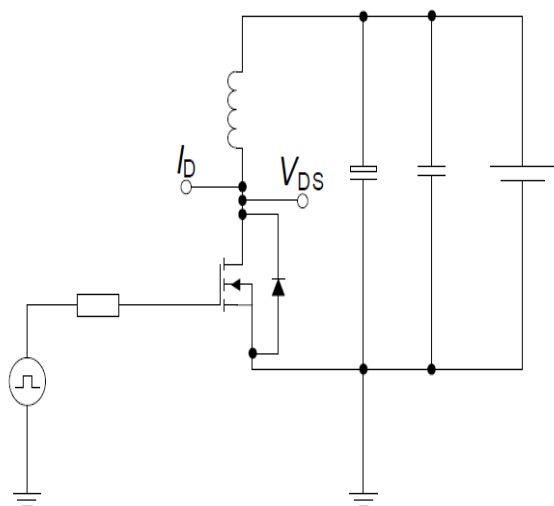


Switching time waveform

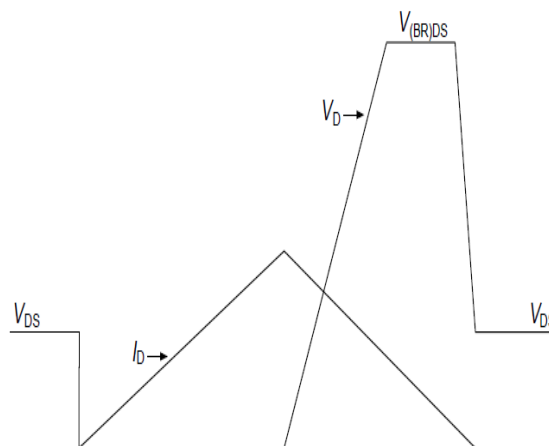


Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit

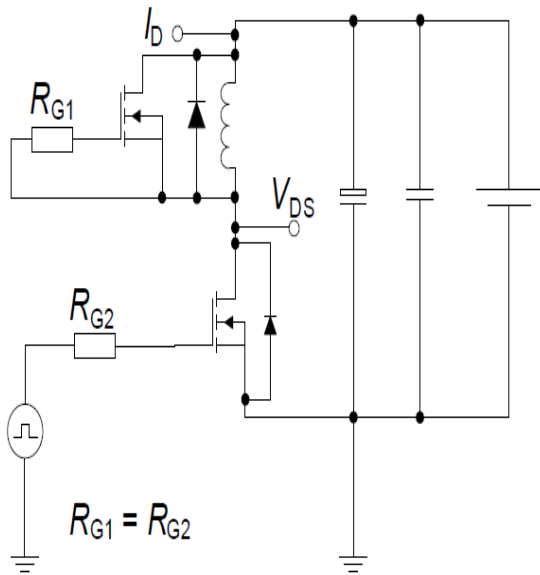


Unclamped inductive waveform

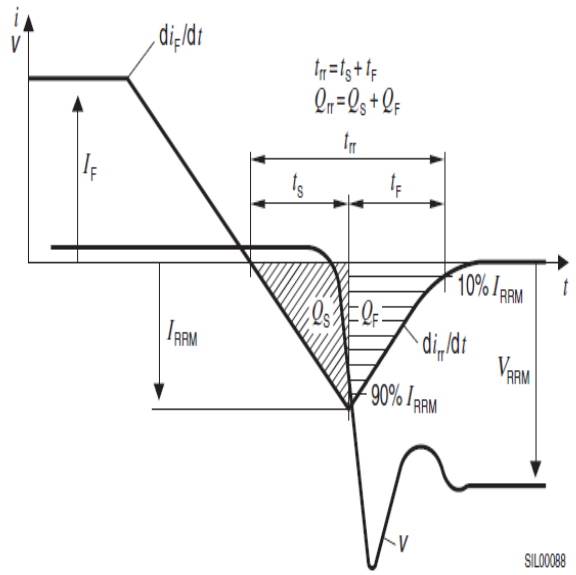


Test circuit and waveform for diode characteristics

Test circuit for diode characteristics



Diode recovery waveform



SIL00088

