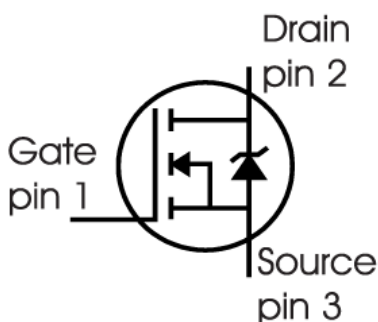


■ **Description** GroupSemiconductor(GS) has series Multi-EPI Super-Junction power MOSFET platforms for voltage up 500V to 1000 volts, both with design service and manufacturing capability, including cell, termination design and simulation.

The GS 650V 77A power MOSFET is a Low voltage N channel Multi-EPI Super-Junction power MOSFET sample with advanced technology to have better characteristics, such as fast switching time, low Ciss and Crss, low on resistance and excellent avalanche characteristics, making it especially suitable for applications which require superior power density and outstanding efficiency.



ORDERING INFORMATION

Industrial Range: -40° C to +125° C

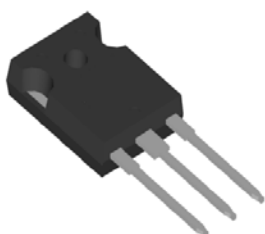
■ Features

- 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
- Intrinsic fast-recovery body diode
- $R_{DS(on)} = 0.041\Omega$ @ $V_{GS} = 10V$
- $V_{DS} = 650V$
- I_D (@ $V_{GS} = 10V$) = 35A

APPLICATIONS

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

Order Part No.	Package
GSW77N65EF	TO-247, Pb-Free
GSJ77N65EF	TO-3P, Pb-Free



TO-247



TO-3P

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

Symbol	Parameter	GSX77N65EF	Unit
V_{DSS}	Drain-Source Voltage	650	V
I_D	Drain Current -Continuous ($T_C = 25^\circ\text{C}$) -Continuous ($T_C = 100^\circ\text{C}$)	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 ($V_{ds}=480\text{V}$)	50	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	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	GSX77N65E	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	$^\circ\text{C}/\text{W}$

GSX77N65E Super Junction MOSFETs

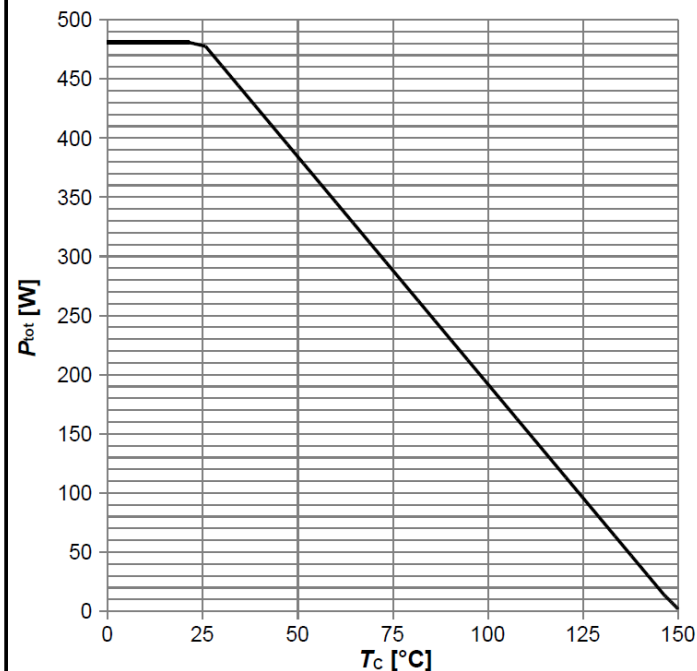
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25°C	650	--	--	V
		V _{GS} = 0V, I _D = 250μA, T _J = 150°C	--	700	--	V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced 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

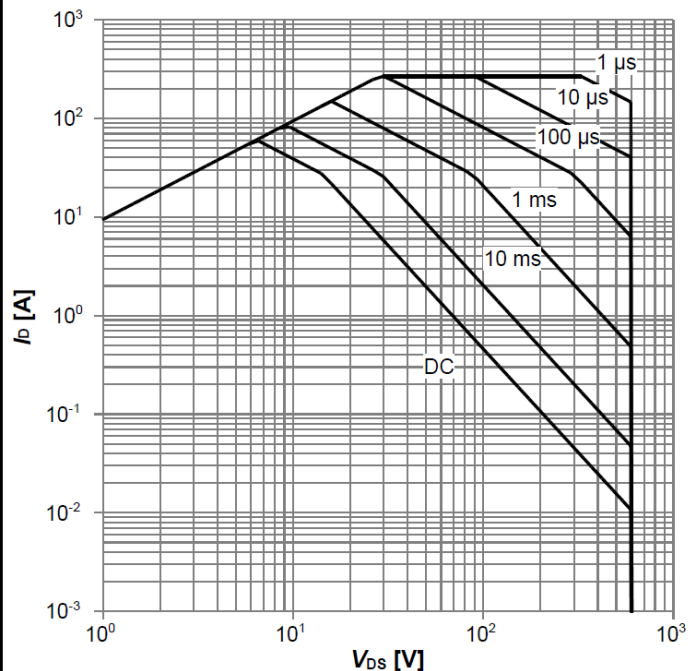
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Diagram 1: Power dissipation



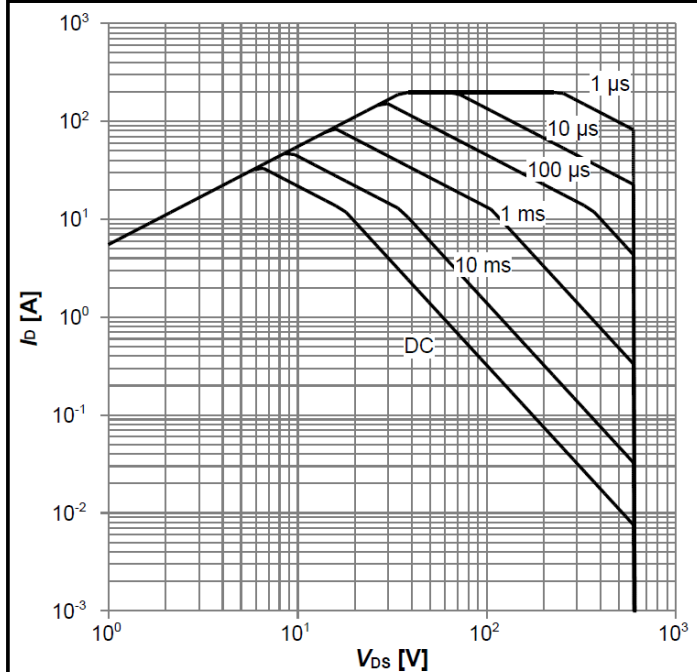
$$P_{tot}=f(T_c)$$

Diagram 2: Safe operating area



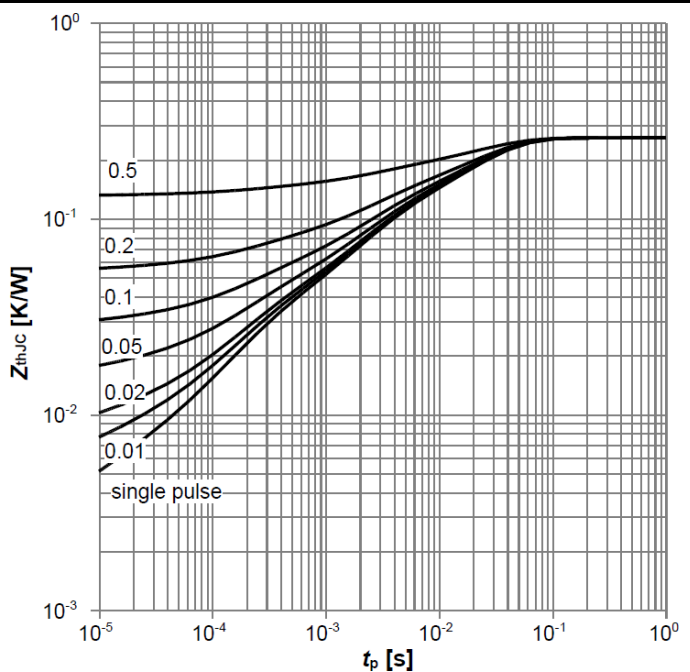
$$I_D=f(V_{DS}); T_c=25\text{ }^{\circ}\text{C}; D=0; \text{parameter: } t_p$$

Diagram 3: Safe operating area



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

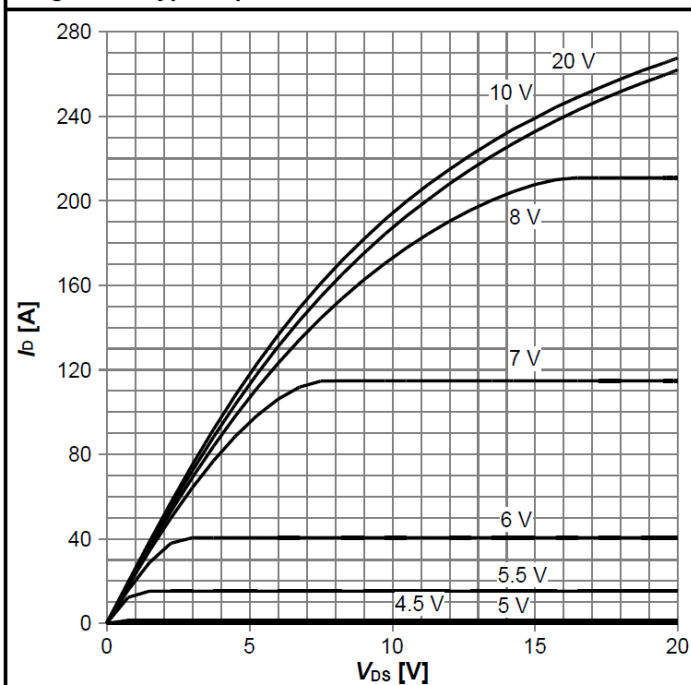
Diagram 4: Max. transient thermal impedance



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

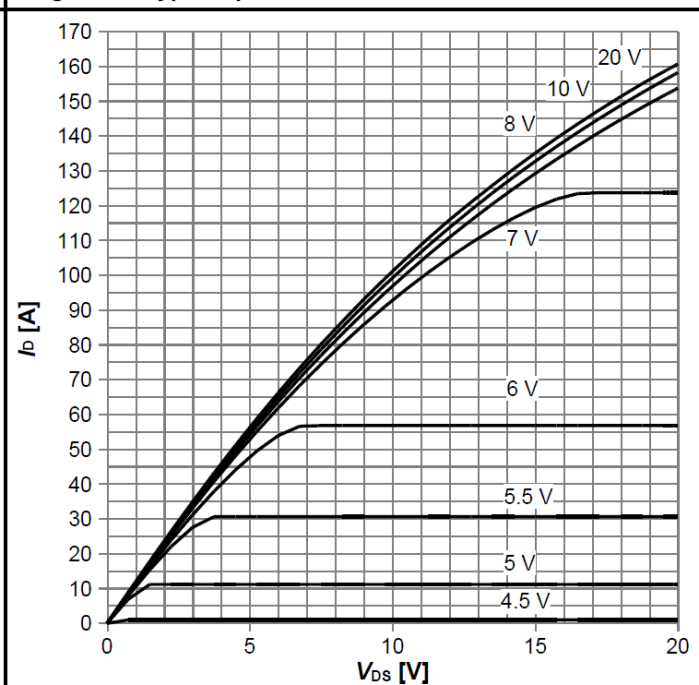
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Diagram 5: Typ. output characteristics



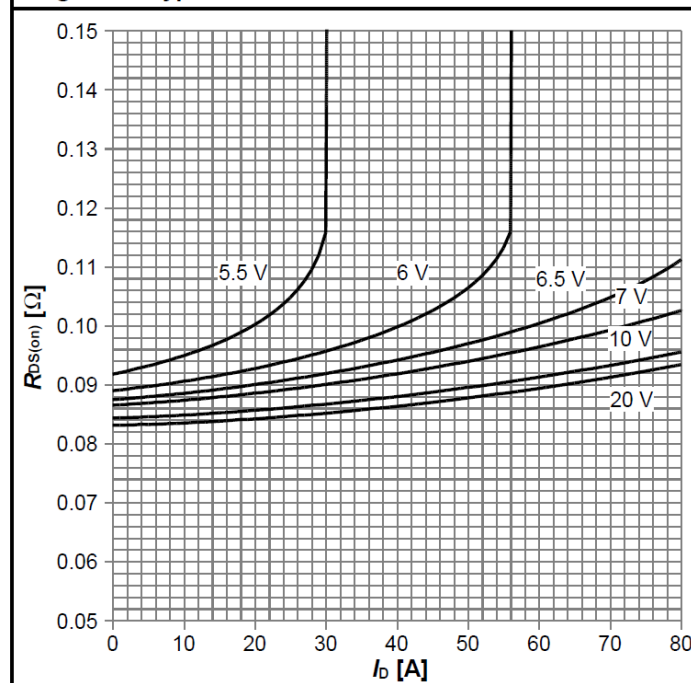
$I_D = f(V_{DS})$; $T_j = 25^\circ\text{C}$; parameter: V_{GS}

Diagram 6: Typ. output characteristics



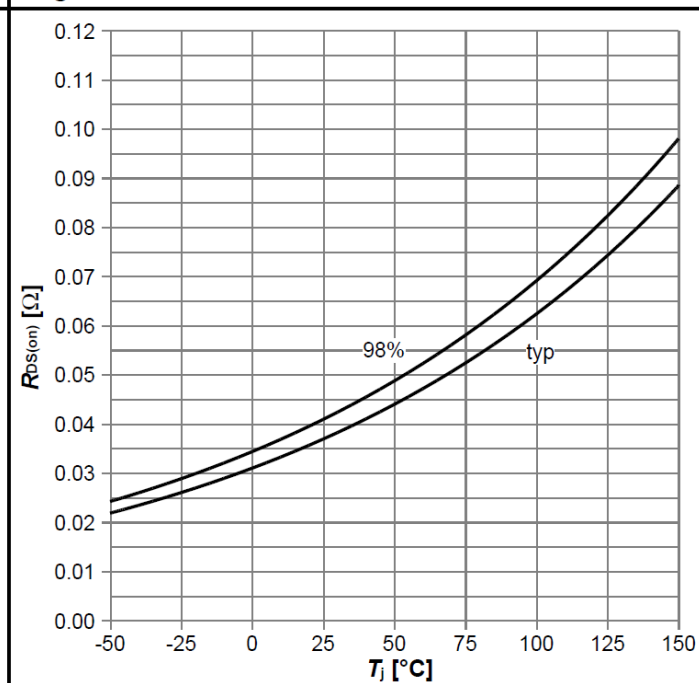
$I_D = f(V_{DS})$; $T_j = 125^\circ\text{C}$; parameter: V_{GS}

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



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

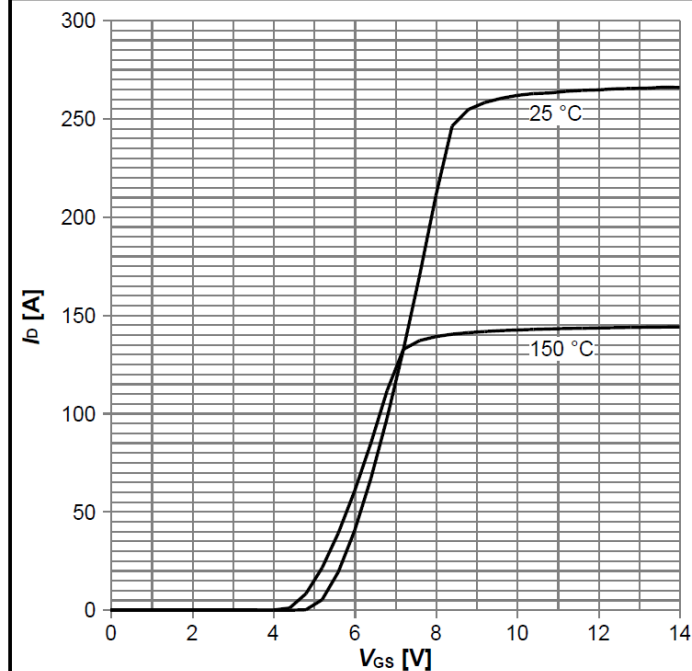
Diagram 8: Drain-source on-state resistance



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

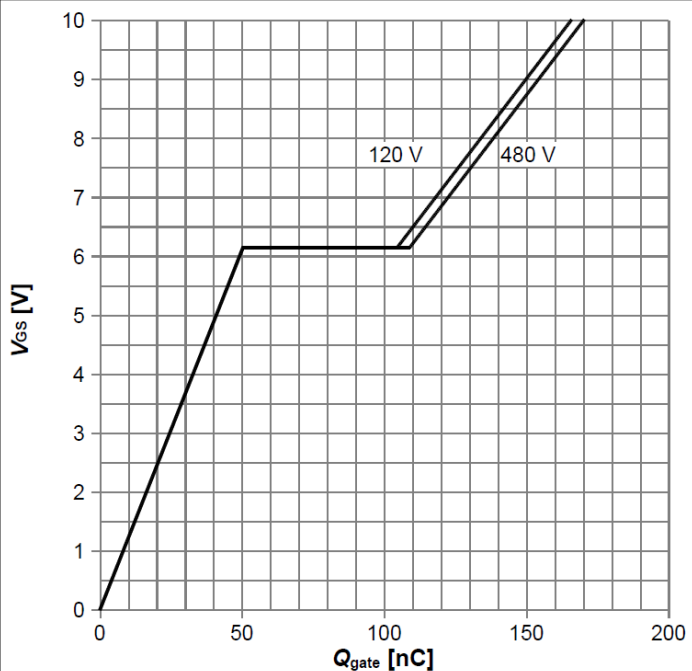
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Diagram 9: Typ. transfer characteristics



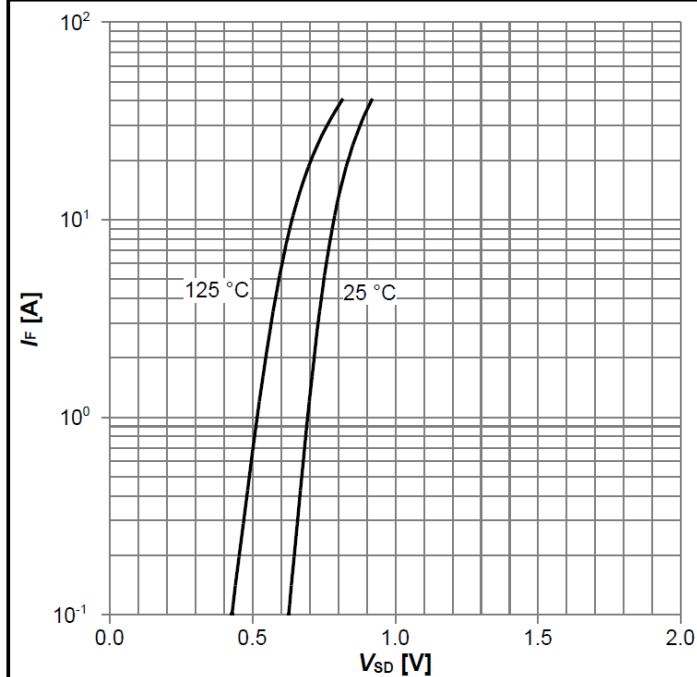
$I_D = f(V_{GS})$; $V_{DS} = 20V$; parameter: T_j

Diagram 10: Typ. gate charge



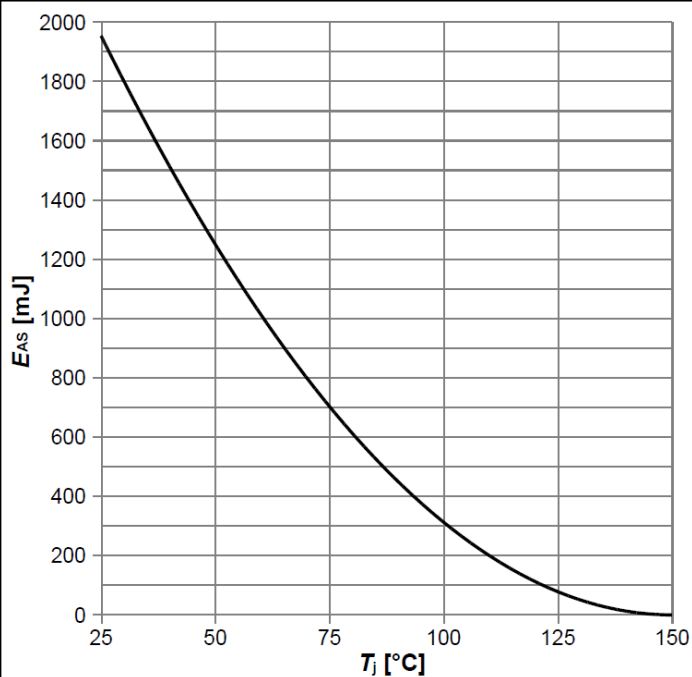
$V_{GS} = f(Q_{gate})$; $I_D = 44.4$ A pulsed; parameter: V_{DD}

Diagram 11: Forward characteristics of reverse diode



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

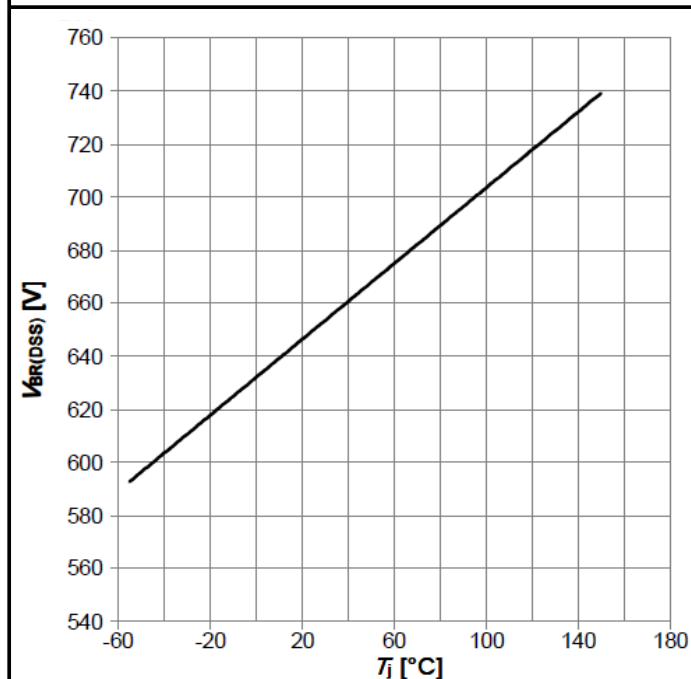
Diagram 12: Avalanche energy



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

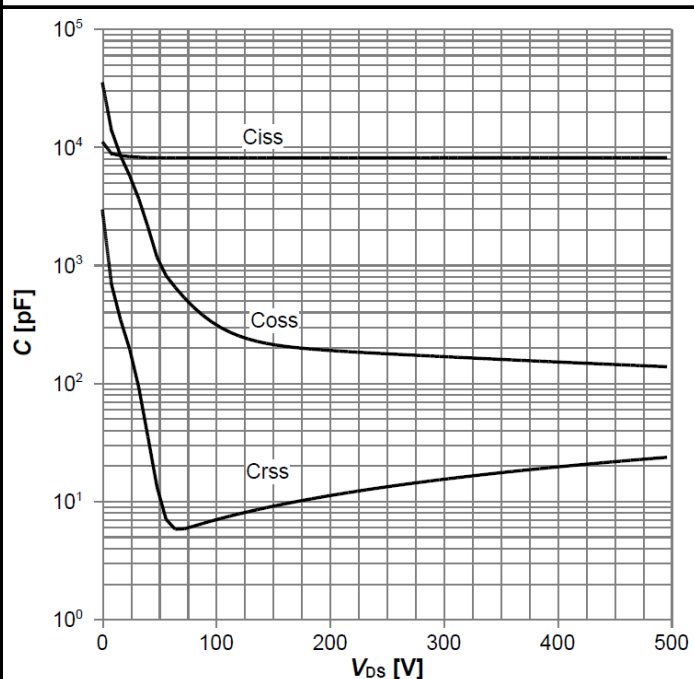
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Diagram 13: Drain-source breakdown voltage



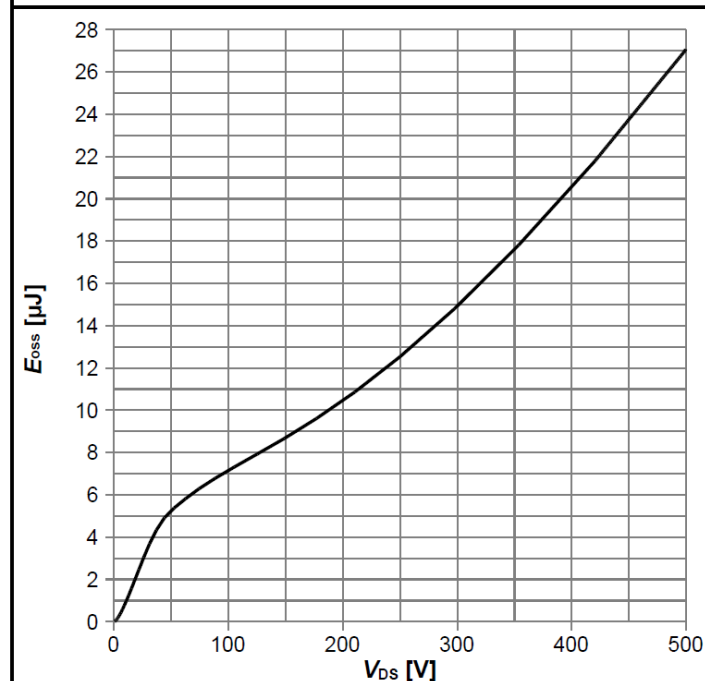
$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$

Diagram 14: Typ. capacitances



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

Diagram 15: Typ. C_{oss} stored energy

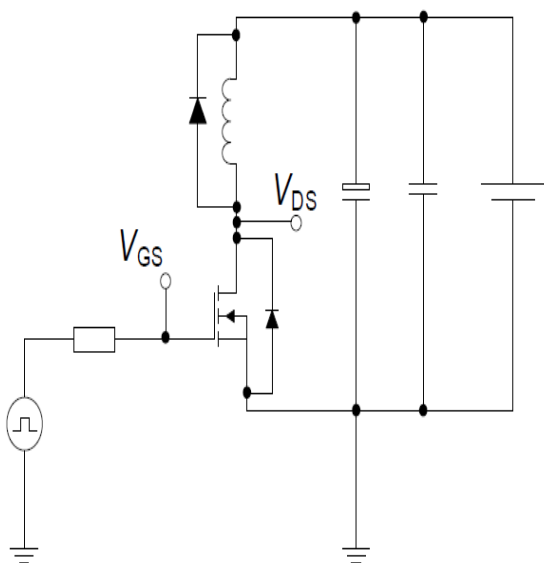


$$E_{oss} = f(V_{DS})$$

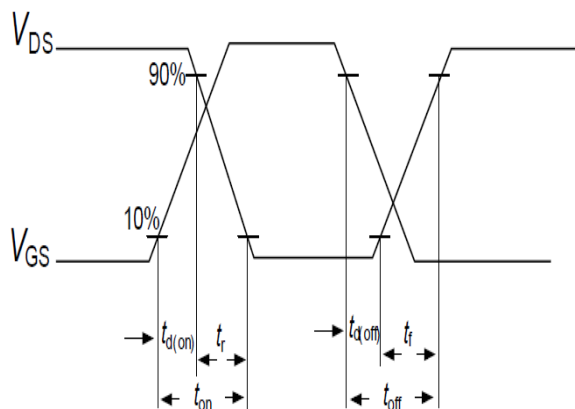
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Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load

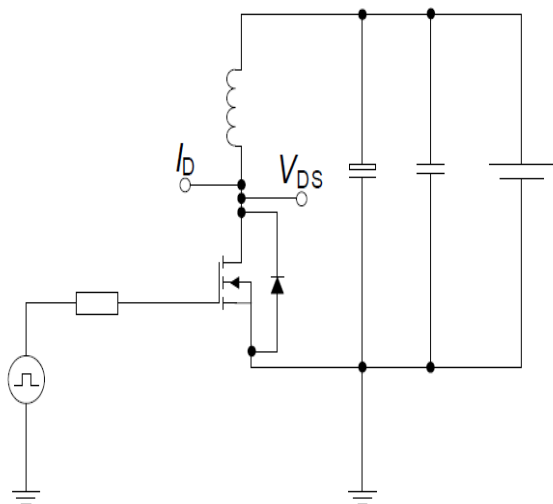


Switching time waveform

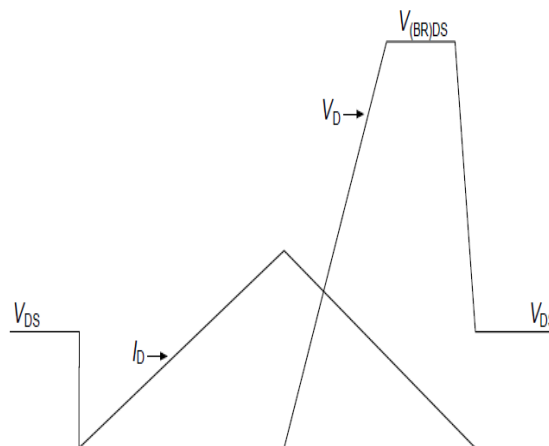


Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit



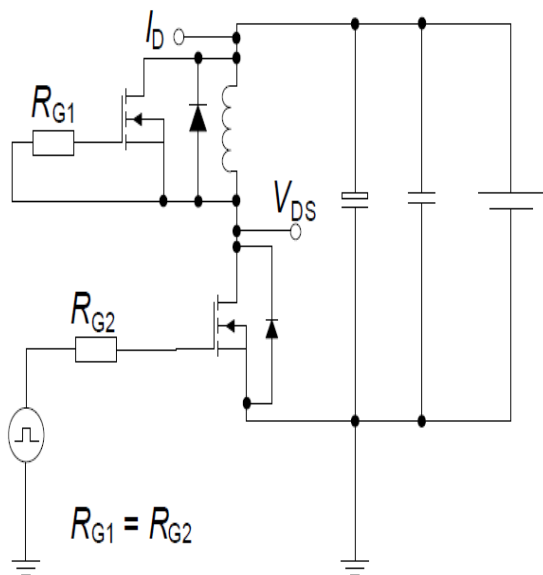
Unclamped inductive waveform



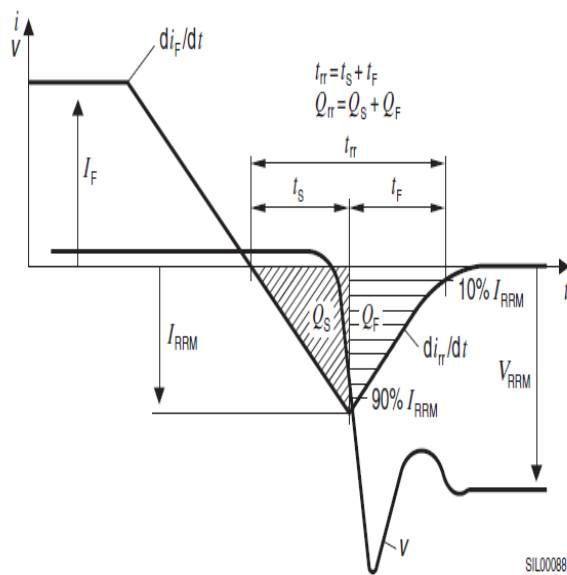
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Test circuit and waveform for diode characteristics

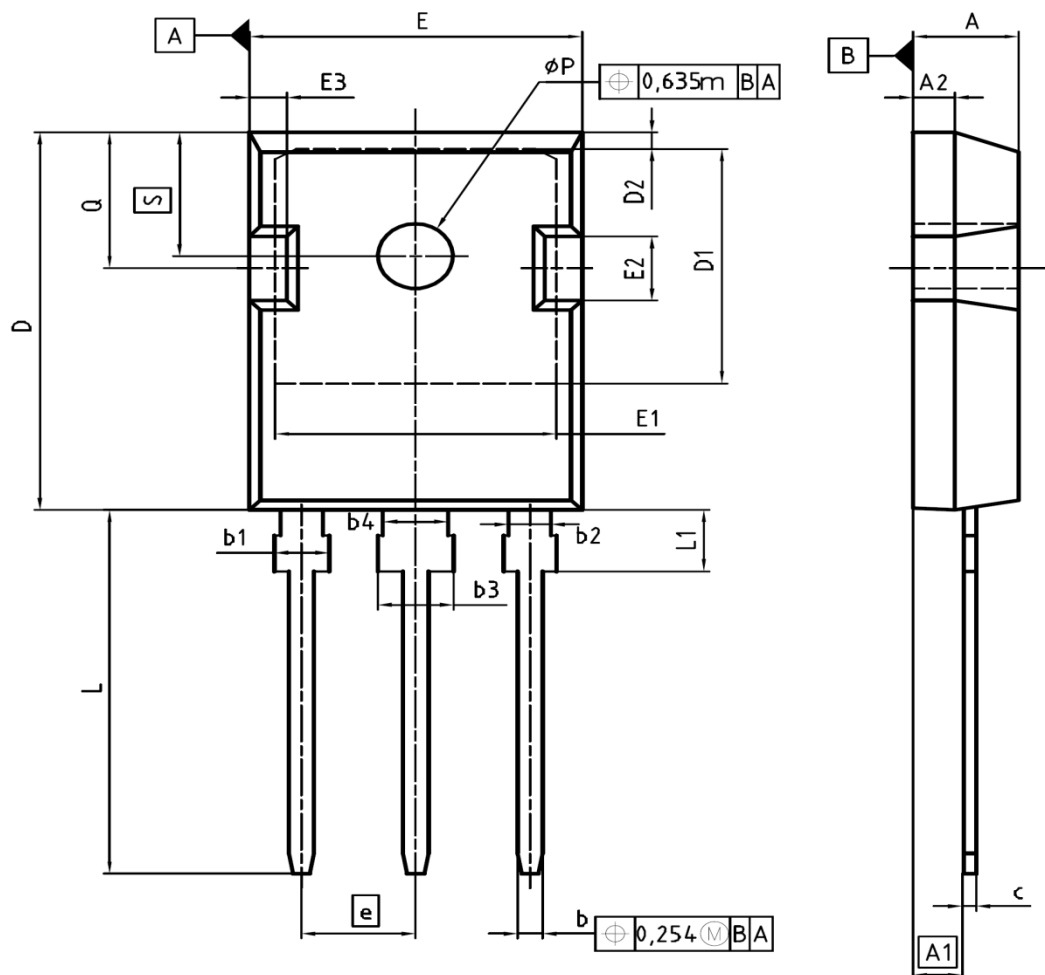
Test circuit for diode characteristics



Diode recovery waveform



GSX77N65E Super Junction MOSFETs



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44		0.214	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

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