GSX11N65EF

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

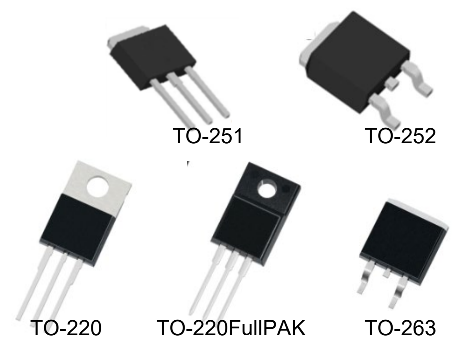
Super Junction MOSFET
650V Super Junction Power Transistor
GSX11N65EF

Data Sheet
Ver 1.1
2023-3-20

650V 11A Power MOSFET

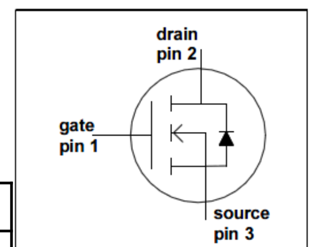
■ Description

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 11A 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.



■ Features

RDS(ON)=0.4Ω @VGS = 10V
VDS = 650V
ID (@ VGS=10V) = 6.5A
Intrinsic fast recovery diode



■ PKG

GSA11N65EF	GSP11N65EF	GSB11N65EF	GSD11N65EF	GSS11N65EF
TO-220Fullpak	TO-220	TO-263	TO-252	TO-251

■ Absolute Maximum Ratings (TC = 25° C, unless otherwise specified)

Symbol	Parameter	GSP11N65EF	GSA11N65EF	Unit
V_{DSS}	Drain-Source Voltage	650		V
I_D	Drain Current -Continuous (TC = 25℃) -Continuous (TC = 100℃)	11* 7*		A
I_{DM}	Drain Current - Pulsed (Note 1)	42		A
V_{GSS}	Gate-Source voltage	±30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	260		mJ
I_{AR}	Avalanche Current (Note 1)	2		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	1		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15		V/ns
dVds/dt	Drain Source voltage slope (Vds=480V)	50		V/ns
P_D	Power Dissipation (TC = 25℃)	151	35	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		℃
T_L	Max. Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		℃

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■Thermal Characteristics

Symbol	Parameter	GSA11N65EF	GSP11N65EF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.2	1.2	℃/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	0.5	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	62	℃/W

Symbol	Parameter	Value (TO220)	Unit
$R_{\theta JA}$ (6)	Maximum Junction-to-Ambient	82	℃/W
$R_{\theta CS}$ (6)	Maximum Case-to-sink	0.6	℃/W
$R_{\theta JC}$ (7),(8)	Maximum Junction-to-Case θ	4.1	℃/W

1. The power dissipation PD is based on TJ(MAX)=150° C in a TO251 package, using junction-to-case thermal resistance.
2. Repetitive rating, pulse width limited by junction temperature TJ(MAX)=150° C.
3. L=1mH, Starting TJ=25° C.
4. L = 10mH, starting TJ = 25° C.
5. L=60mH, starting TJ = 25° C.
6. The tests are performed with the device with T A =25° C.
7. The R □ JA is the sum of the thermal impedance from junction to case R □ JC and case to ambient.
8. These curves are based on the junction-to-case thermal impedance, assuming a maximum junction temperature of TJ(MAX)=150° C.

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■ Electrical Characteristics (TJ=25° C unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA, T_J = 25℃	650	--	--	V
		V_{GS} = 0V, I_D = 250μA, T_J = 150℃	--	700	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25℃	--	0.6	--	V/℃
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650V, V_{GS} = 0V -T_J = 150℃	--	-- 10	5 -	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	3.5	--	4.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 5.5A	--	0.38	0.40	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 5.5A	--	16	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	720	-	pF
C_{oss}	Output Capacitance		--	20	-	pF
C_{rss}	Reverse Transfer Capacitance		--	1.5	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400V, I_D = 5.5A R_G = 20Ω (Note 4)	--	15	--	ns
t_r	Turn-On Rise Time		--	10	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	110	--	ns
t_f	Turn-Off Fall Time		--	9	--	ns
Q_g	Total Gate Charge	V_{DS} = 400V, I_D = 5.5A V_{GS} = 10V (Note 4)	--	32	--	nC
Q_{gs}	Gate-Source Charge		--	4	--	nC
Q_{gd}	Gate-Drain Charge		--	16	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	9.2	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	30	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 5.5A	--	0.9	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 5.5A dI_F/dt =100A/μs	--	65	90	ns
Q_{rr}	Reverse Recovery Charge		--	3.3	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L=60mH, I_{AS}=3A, VDD=150V, Starting TJ=25 ℃
3. I_{SD}≤4.5A, di/dt ≤ 200A/us, V_{DD} ≤ BV_{DSS}, Starting TJ = 25 ℃
4. Pulse Test: Pulse width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

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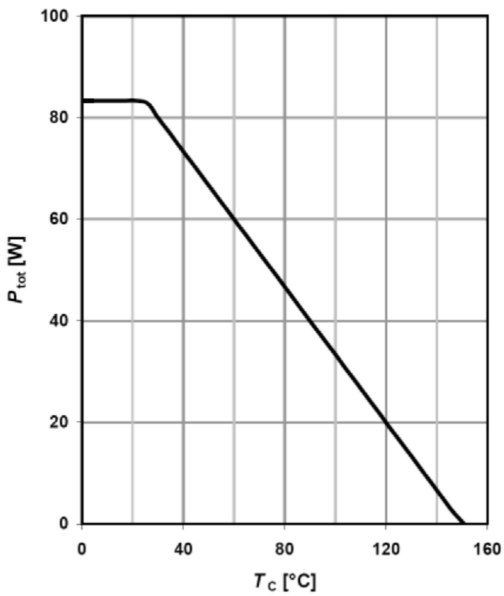
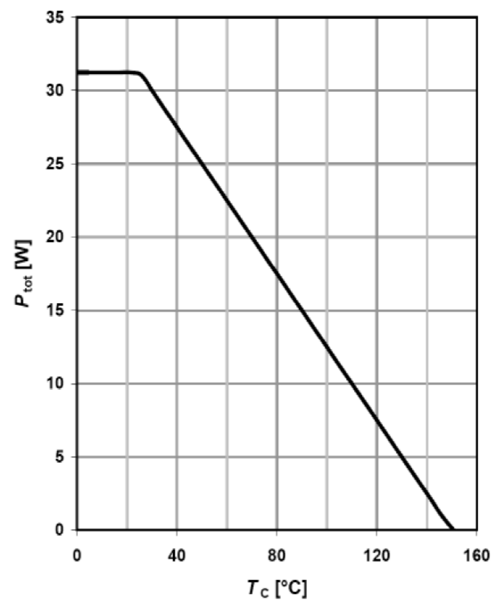
Typical Performance Characteristics

Power dissipation
TO-220, TO-247, TO-3P



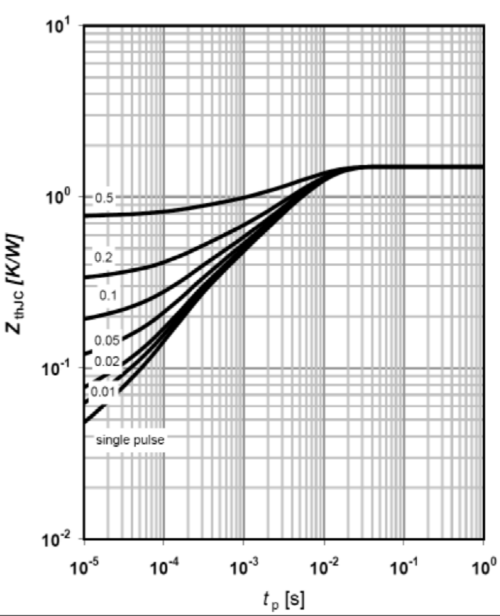
P_{tot} = f(T_C)

Power dissipation
TO-220F



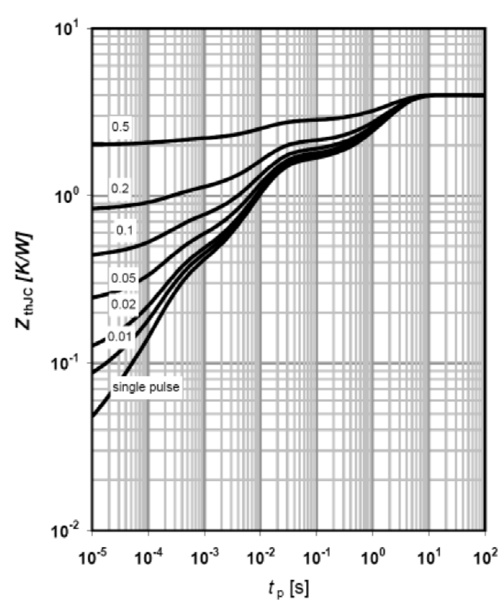
P_{tot} = f(T_C)

Max. transient thermal impedance
TO-220, TO-247, TO-3P



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

Max. transient thermal impedance
TO-220F



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

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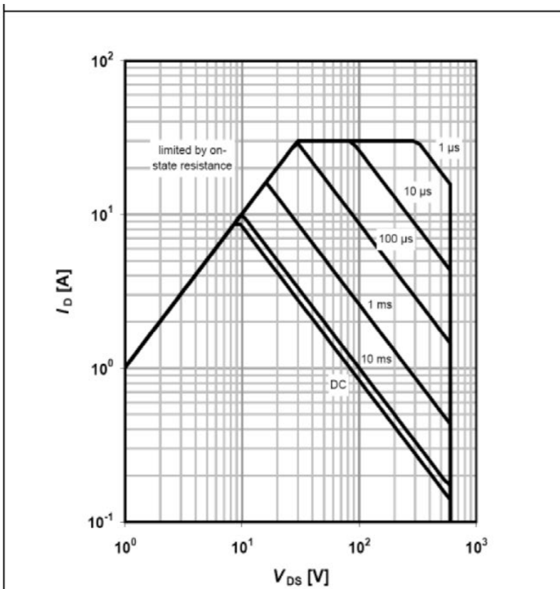
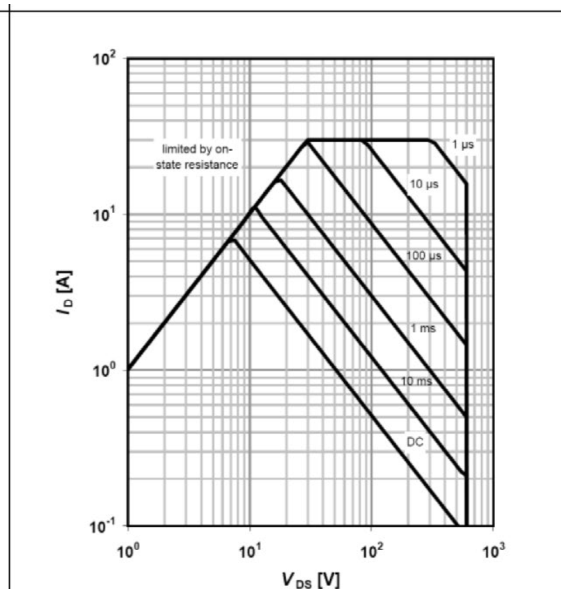
Typical Performance Characteristics

Safe operating area *TC=25 ℃*
TO-220, TO-247, TO-3P



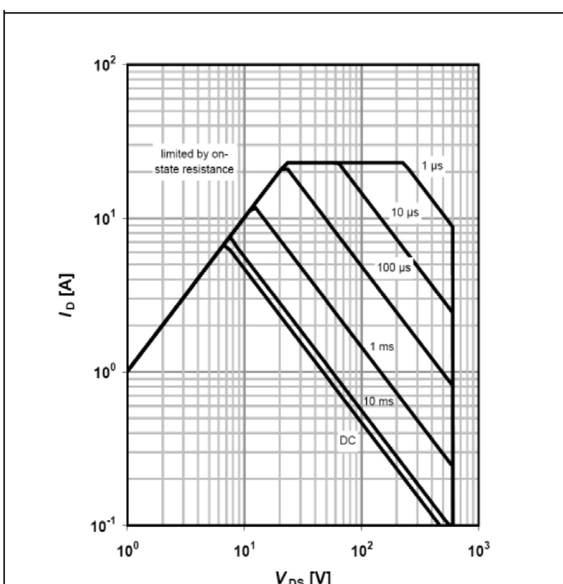
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter t_p

Safe operating area *TC=25 ℃*
TO-220F



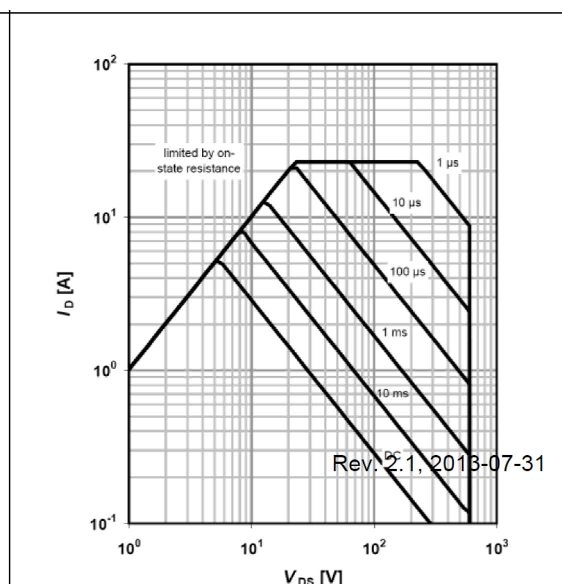
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter t_p

Safe operating area *TC=80 ℃*
TO-220, TO-247, TO-3P



I_D=f(V_{DS}); T_C=80 °C; D=0; parameter t_p

Safe operating area *TC=80 ℃*
TO-220F



I_D=f(V_{DS}); T_C=80 °C; D=0; parameter t_p

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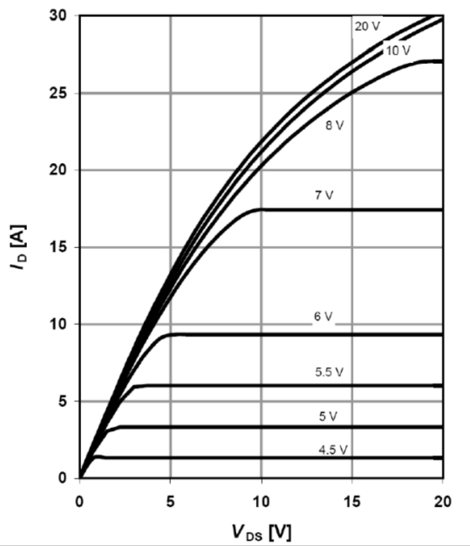
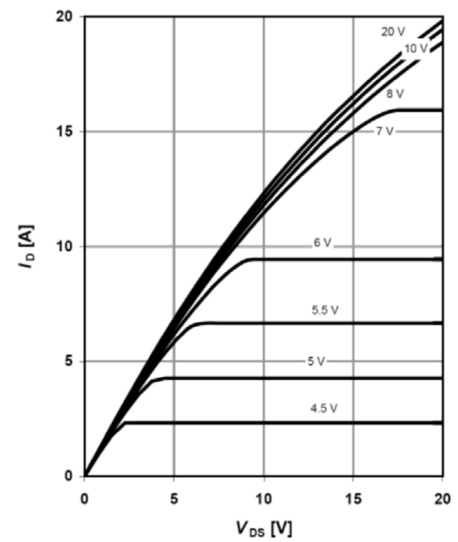
Typical Performance Characteristics

Typ. output characteristics T_j=25 ℃



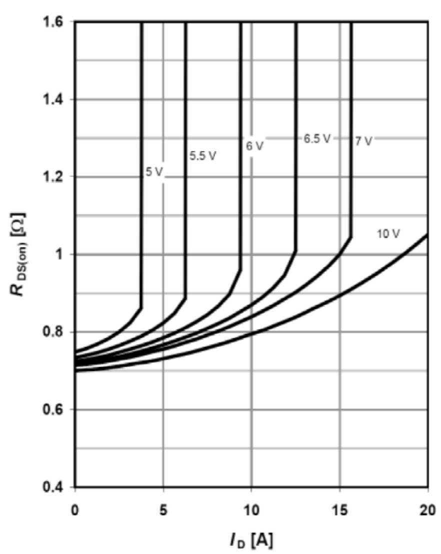
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}

Typ. output characteristics T_j=125 ℃



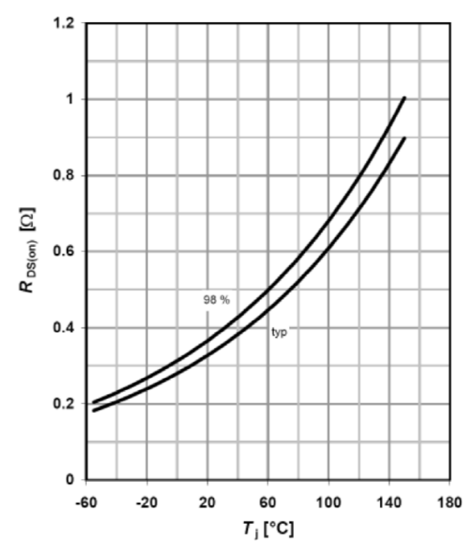
I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}

Typ. drain-source on-state resistance



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

Typ. drain-source on-state resistance



$R_{DS(on)}$=f(T_j); I_D=3.8 A; V_{GS}=10 V

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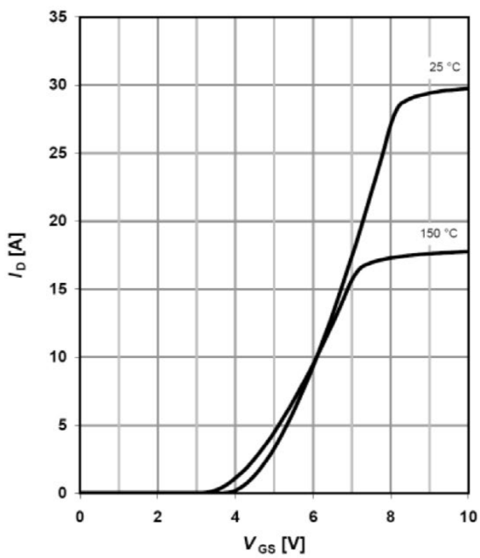
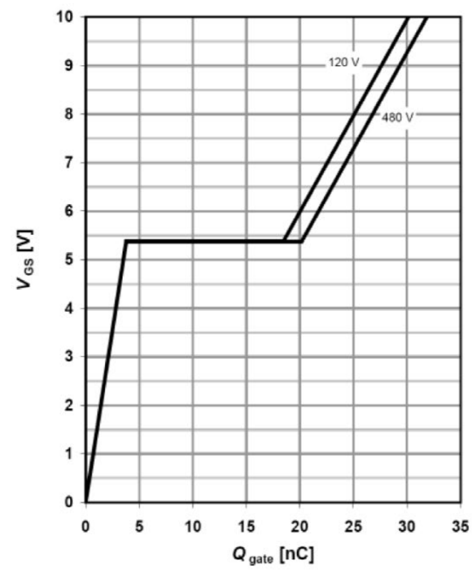
Typ. transfer characteristics



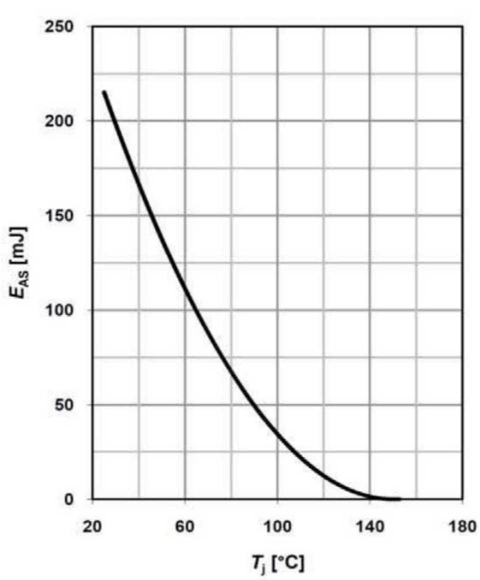
I_D=f(V_{GS}); V_{DS}=20V

Typ. gate charge



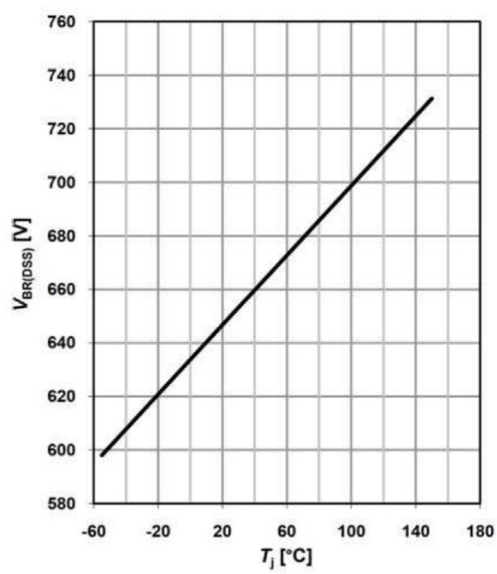
V_{GS}=f(Q_{gate}), I_D=4.8A pulsed

Avalanche energy



E_{AS}=f(T_j); I_D=1.8 A; V_{DD}=50 V

Drain-source breakdown voltage



$V_{BR(DSS)}$=f(T_j); I_D=1.0 mA

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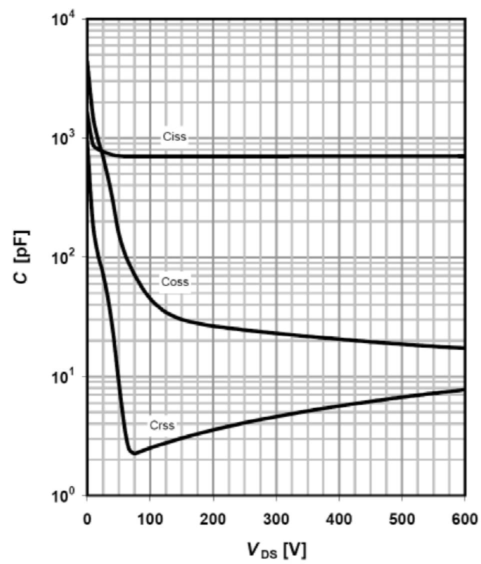
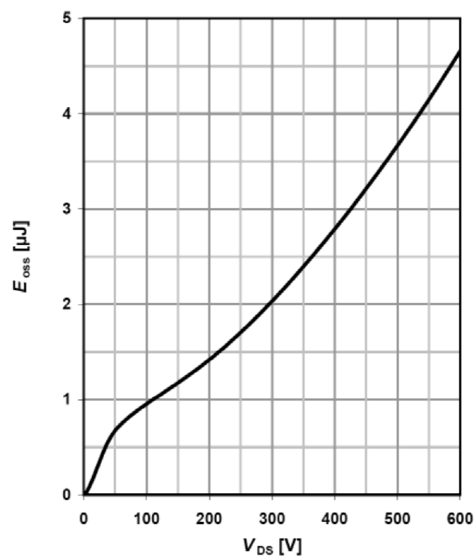
Typ. capacitances



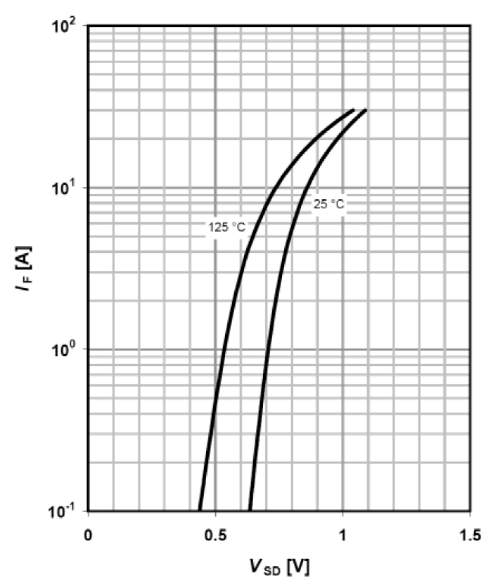
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Typ. *Coss stored energy*



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

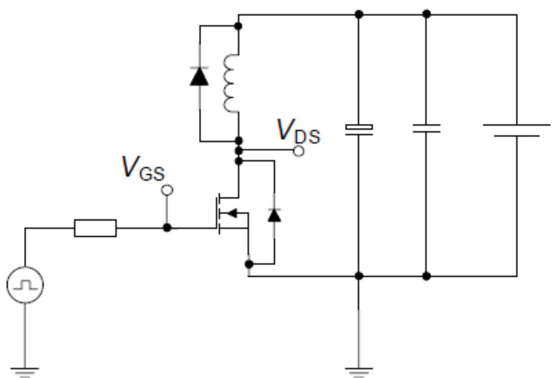
Forward characteristics of reverse diode



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

Table 20 Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load



Switching time waveform

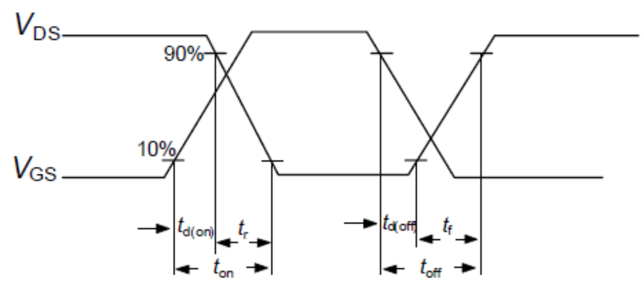
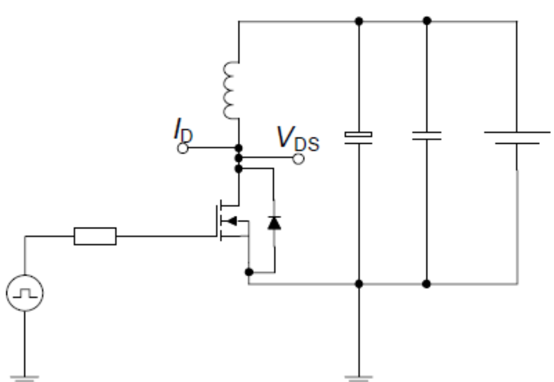


Table 21 Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit



Unclamped inductive waveform

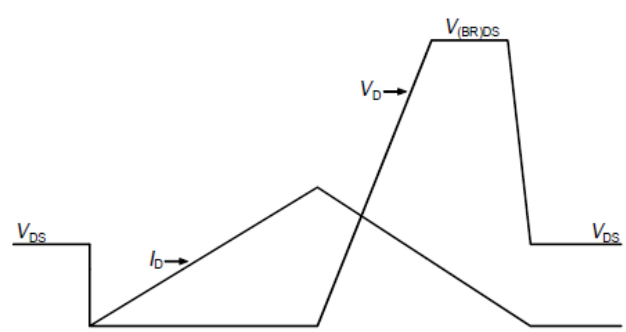
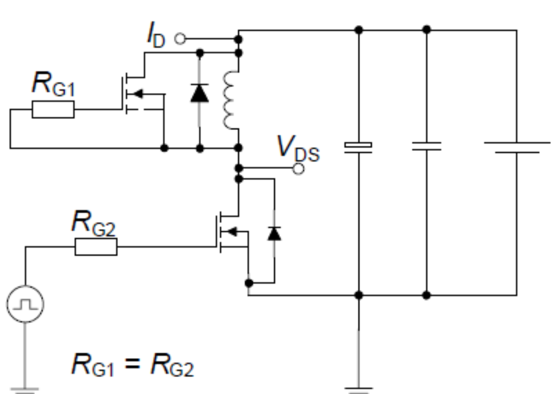


Table 22 Test circuit and waveform for diode characteristics

Test circuit for diode characteristics



Diode recovery waveform