GSX25N65EF

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

Super Junction MOSFET
650V Super Junction Power Transistor
GSX25N65EF
Intrinsc Fast-Recovery Body Diode

Data Sheet
Ver 1.1
2022-2-28

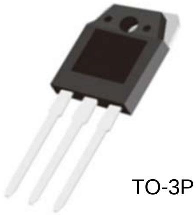
650V 25A Power MOSFET

■Description

Group Semiconductor(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 25A 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.

TO-247



TO-3P

TO-220

TO-220FullPAK

TO-263

■ Features

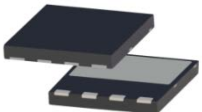
RDS(ON)=0.14Ω @VGS = 10V

VDS = 650V

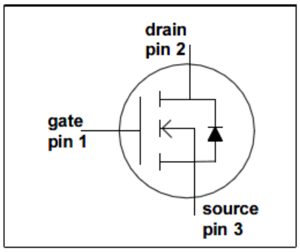
ID (@ VGS=10V) = 12A

Intrinsc fast-recovery body diode.

DFN5*6



DFN8*8



■ PKG

GSA25N65EF	GSP25N65EF	GSB25N65EF		
TO-220Fullpak	TO-220	TO-263		
GSW25N65EF	GSJ25N65EF	GSN25N65EF	GSM25N65EF	
TO-247	TO-3P	DFN5*6	DFN8*8	

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

Symbol	Parameter	GSP25N65EF	GSA25N65EF	Unit
V_{DSS}	Drain-Source Voltage	650		V
I_D	Drain Current -Continuous (TC = 25℃) -Continuous (TC = 100℃)	25* 15*		A
I_{DM}	Drain Current - Pulsed (Note 1)	53		A
V_{GSS}	Gate-Source voltage	±30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	500		mJ
I_{AR}	Avalanche Current (Note 1)	4		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	1.2		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		℃

■ 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 -Tj=25 ℃ -T_J = 150℃	--	-- 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	--	4	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 12A	--	0.12	0.14	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 12A	--	16	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	1650	-	pF
C_{oss}	Output Capacitance		--	90	-	pF
C_{rss}	Reverse Transfer Capacitance		--	9	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 520V (Note 4)	--	28	--	ns
t_r	Turn-On Rise Time		--	19	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	140	--	ns
t_f	Turn-Off Fall Time		--	12	--	ns
Q_g	Total Gate Charge	V_{DS} = 520V, I_D = 12A V_{GS} = 10V (Note 4)	--	110	140	nC
Q_{gs}	Gate-Source Charge		--	9	--	nC
Q_{gd}	Gate-Drain Charge		--	15	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	25	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	75	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 12A	--	0.9	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 12A dI_F/dt =100A/µs	--	190	--	ns
Q_{rr}	Reverse Recovery Charge		--	6	--	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

■Thermal Characteristics

Symbol	Parameter	GSA25N65EF	GSP25N65EF	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

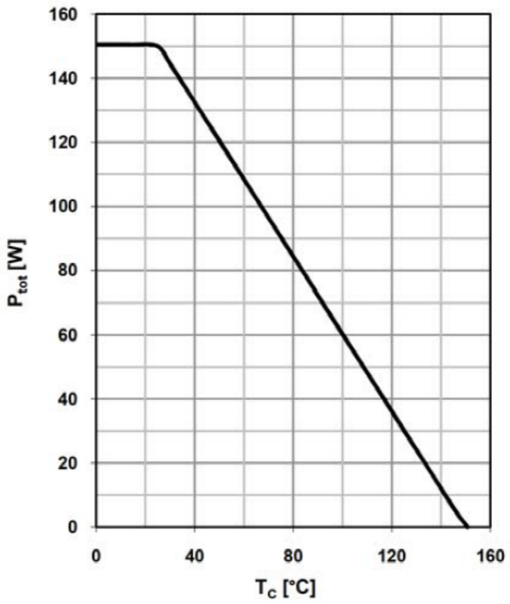
Symbol	Parameter	Value (TO220)	Unit
$R_{\theta JA}$ (6)	Maximum Junction-to-Ambient	82	℃/W
$R_{\theta CS}$ (6)	Maximum Case-to-sink	0.6	℃/W
$R_{\theta JC}$ (7),(8)	Maximum Junction-to-Case θ	4.1	℃/W

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.

650V 25A Power Transistor

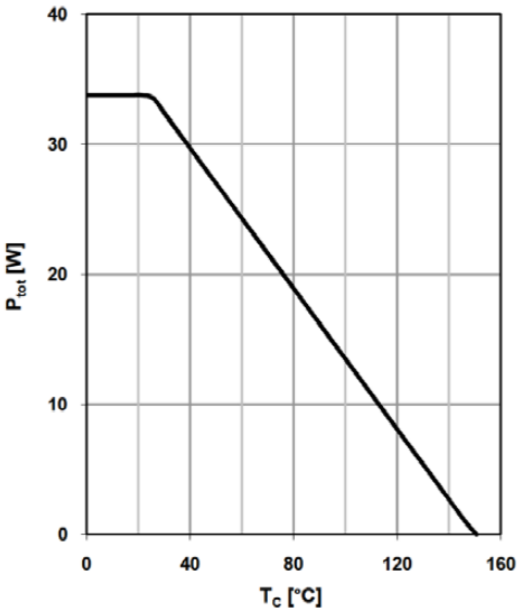
Typical Performance Characteristics

Power dissipation
Non FullPAK



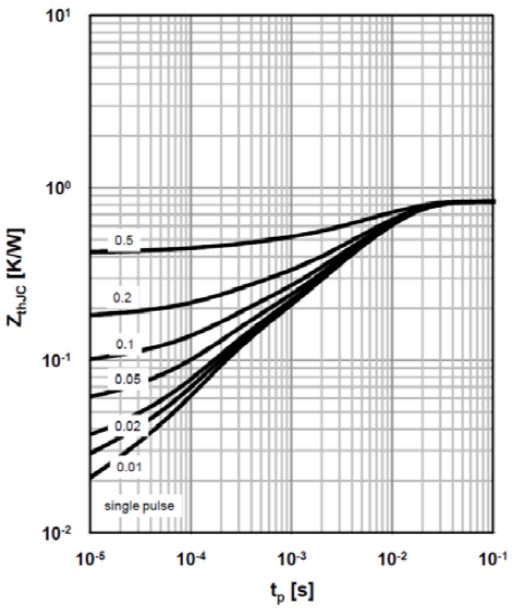
P_{tot} = f(T_C)

Power dissipation
FullPAK



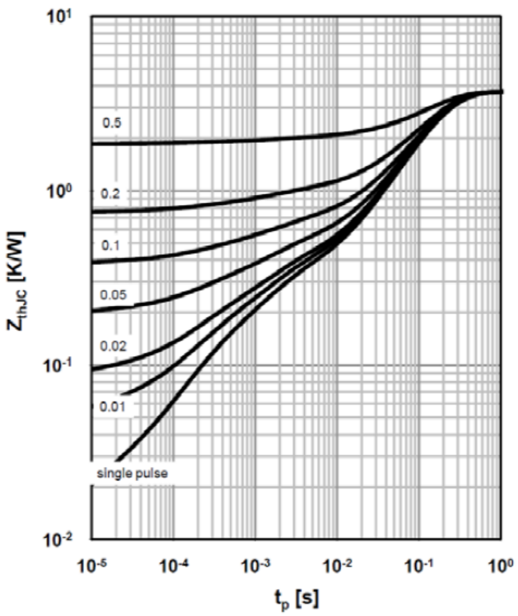
P_{tot} = f(T_C)

Max. transient thermal impedance
Non FullPAK



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

Max. transient thermal impedance
FullPAK

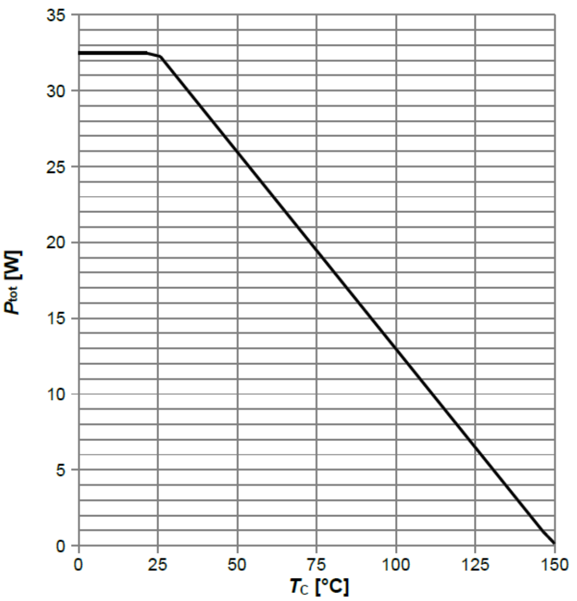


$Z_{(thJC)}$=f(tp); parameter: D=t_p/T

650V 25A Power Transistor

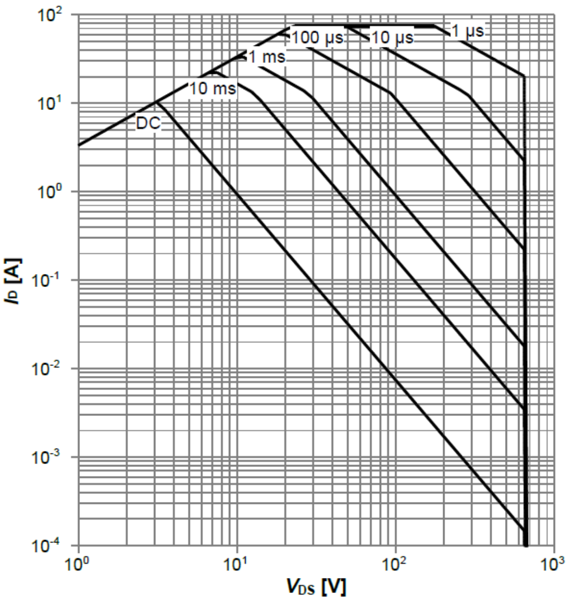
Typical Performance Characteristics

Diagram 1: Power dissipation



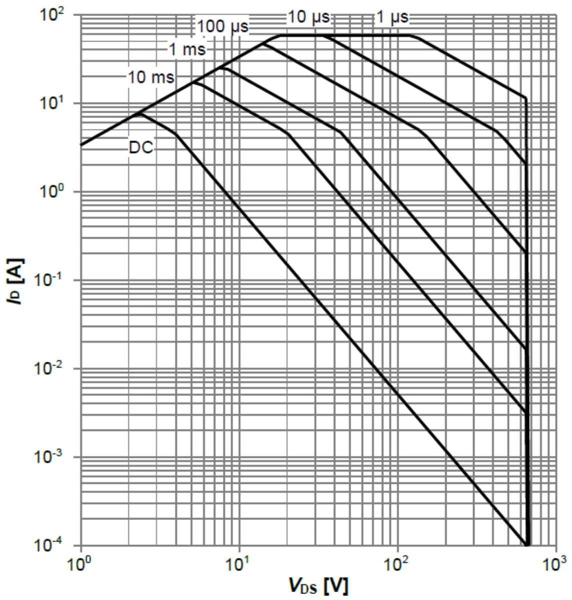
P_{tot}=f(T_C)

Diagram 2: Safe operating area



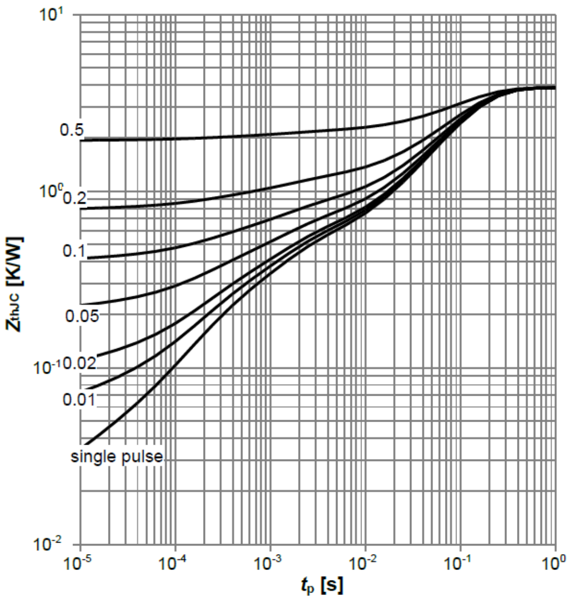
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter: t_p

Diagram 3: Safe operating area



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

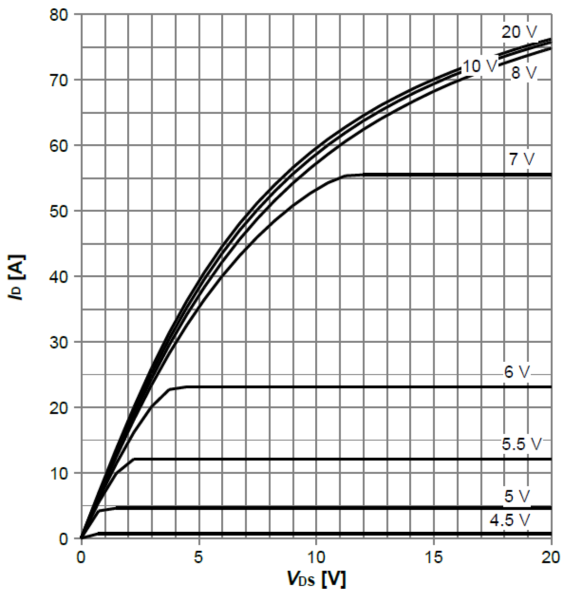
Diagram 4: Max. transient thermal impedance



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

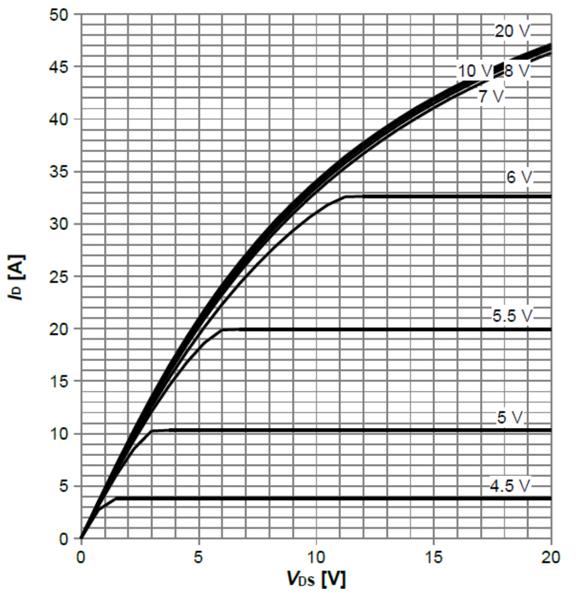
Typical Performance Characteristics

Diagram 5: Typ. output characteristics



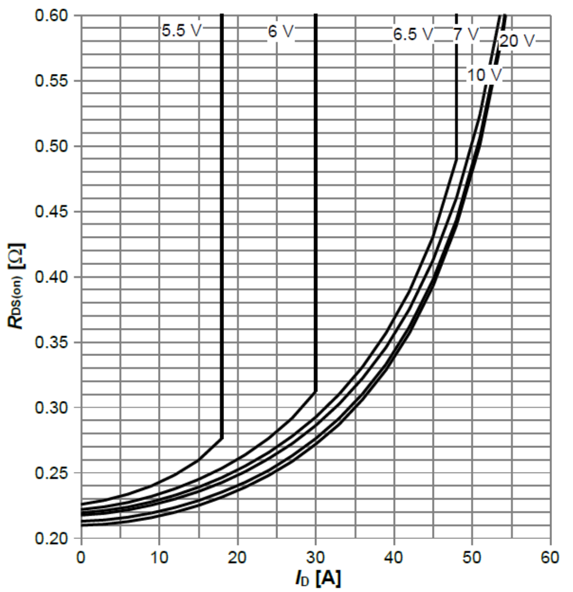
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}

Diagram 6: Typ. output characteristics



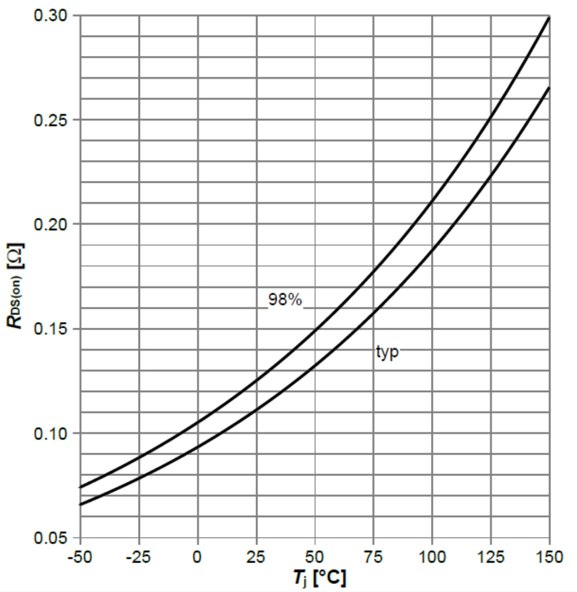
I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}

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



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

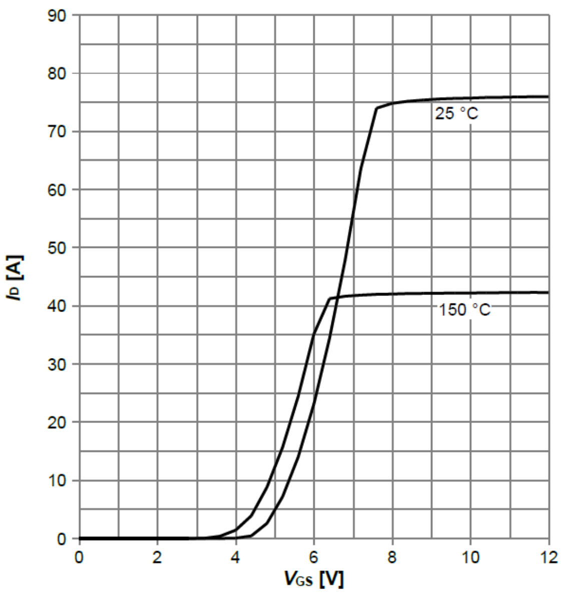
Diagram 8: Drain-source on-state resistance



$R_{DS(on)}$=f(T_j); I_D=8.9 A; V_{GS}=10 V

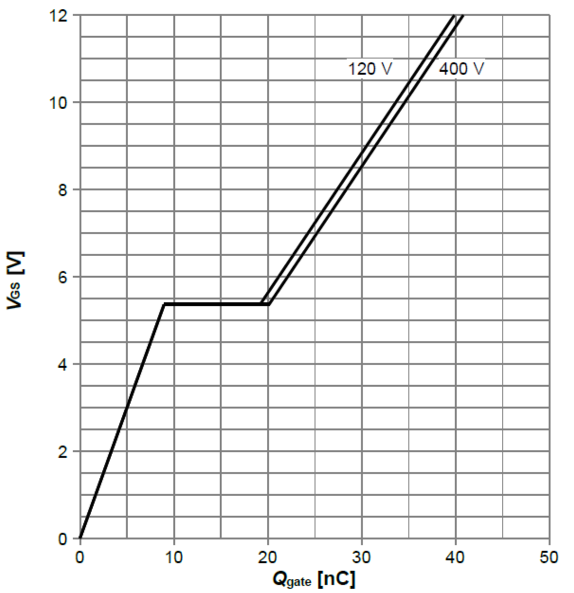
Typical Performance Characteristics

Diagram 9: Typ. transfer characteristics



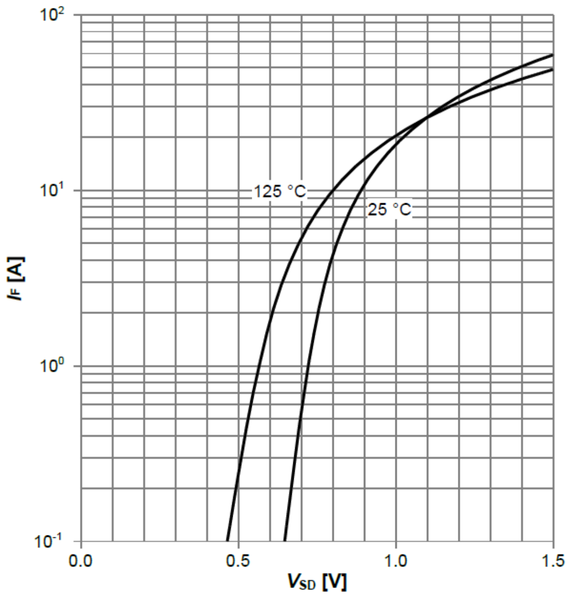
I_D=f(V_{GS}); V_{DS}=20V; parameter: T_j

Diagram 10: Typ. gate charge



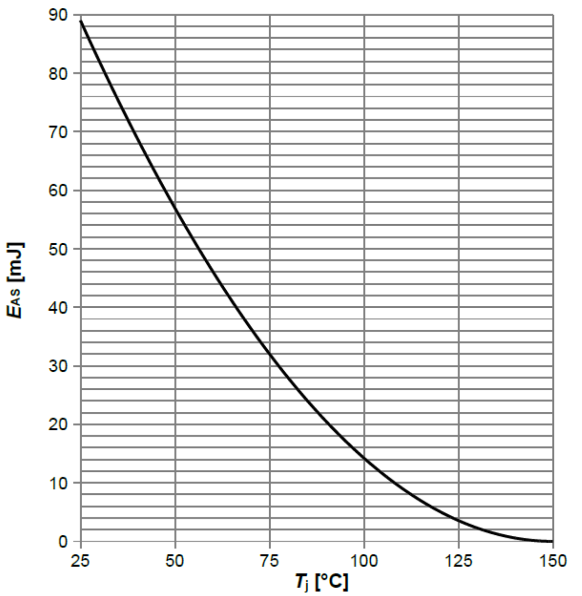
V_{GS}=f(Q_{gate}); I_D=8.9A pulsed; parameter: V_{DD}

Diagram 11: Forward characteristics of reverse diode



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

Diagram 12: Avalanche energy

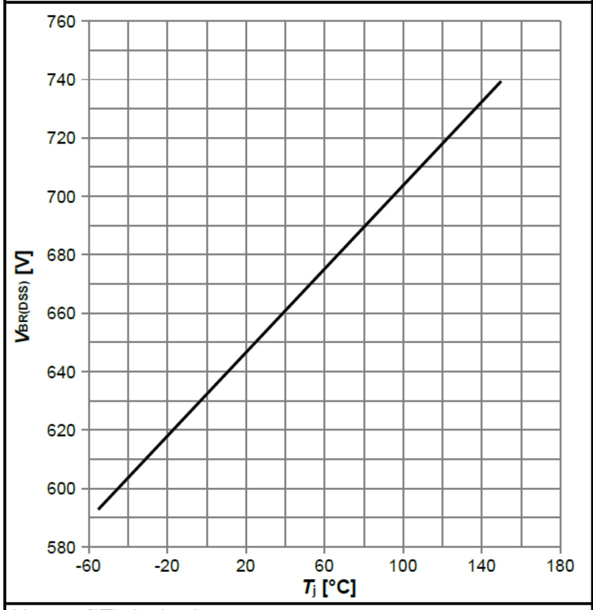


E_{AS}=f(T_j); I_D=7.1 A; V_{DD}=50 V

650V 25A Power Transistor

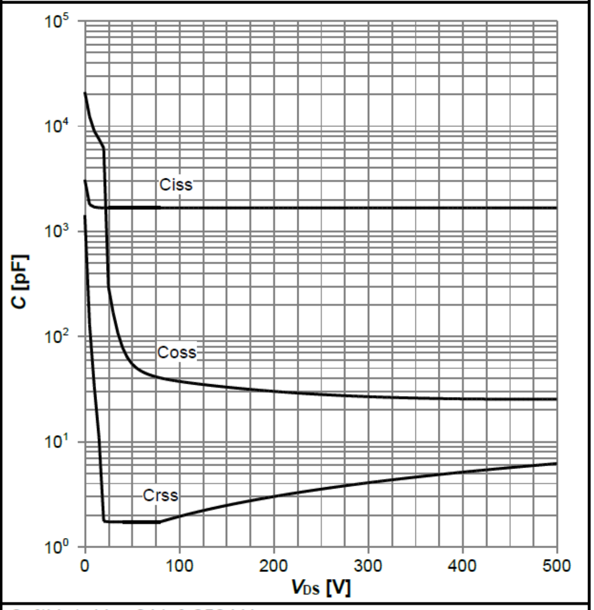
Typical Performance Characteristics

Diagram 13: Drain-source breakdown voltage



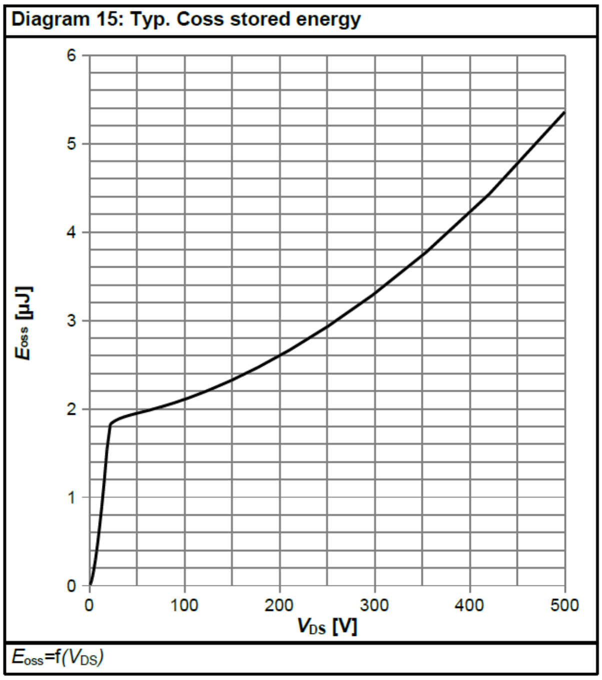
$V_{BR(DSS)}$=f(T_j); I_D=1 mA

Diagram 14: Typ. capacitances



C=f(V_{DS}); V_{GS}=0 V; f=250 kHz

Diagram 15: Typ. Coss stored energy



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

650V 25A Power Transistor

Table 20 Switching times test circuit and waveform for inductive load

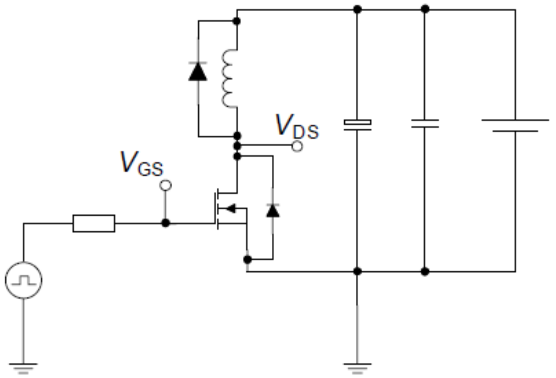
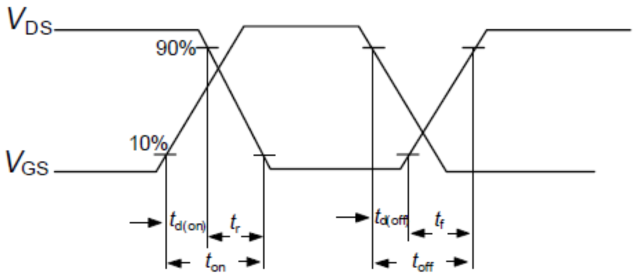
Switching times test circuit for inductive load	Switching time waveform
	

Table 21 Unclamped inductive load test circuit and waveform

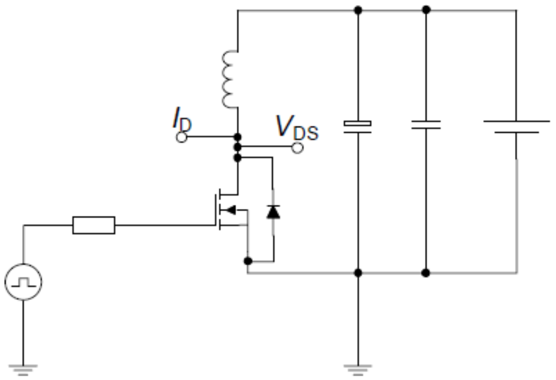
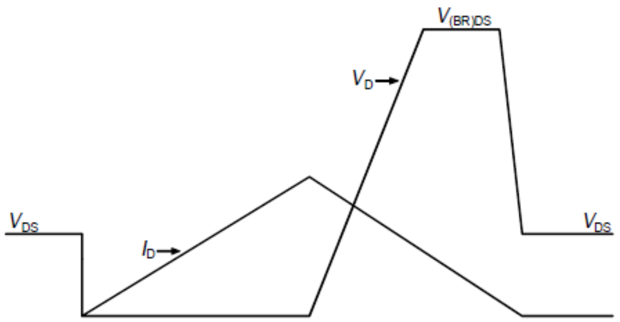
Unclamped inductive load test circuit	Unclamped inductive waveform
	

Table 22 Test circuit and waveform for diode characteristics

Test circuit for diode characteristics	Diode recovery waveform