650V 20A 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 GSx20N65E 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.

TO-247

TO-220F

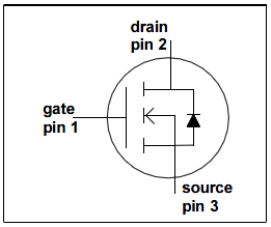
■ Features

RDS(ON)=0.19Ω @ VGS = 10V

VDS = 650V

■ PKG

GSA20N65E	GSW20N65E
TO-220F	TO-247



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

Symbol	Parameter	GSW20N65E	GSA20N65E	Unit
V_{DSS}	Drain-Source Voltage	650		V
I_D	Drain Current -Continuous (TC = 25°C) -Continuous (TC = 100°C)	20* 12*		A
I_{DM}	Drain Current - Pulsed (Note 1)	45		A
V_{GSS}	Gate-Source voltage	±30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	485		mJ
I_{AR}	Avalanche Current (Note 1)	3.5		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°C)	210	35	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		°C
T_L	Max. Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		°C

650V 20A Power MOSFET

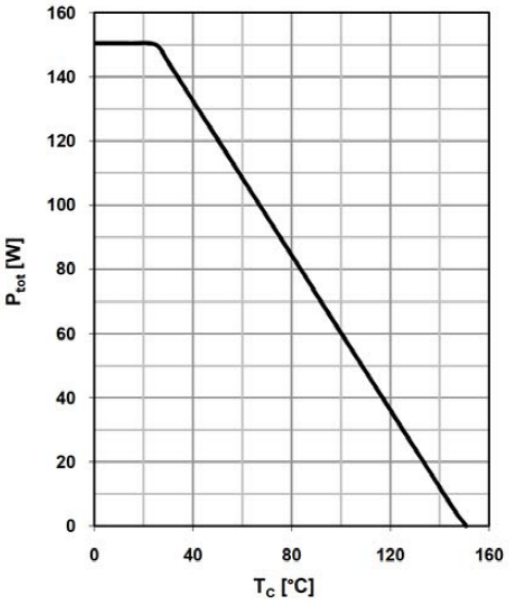
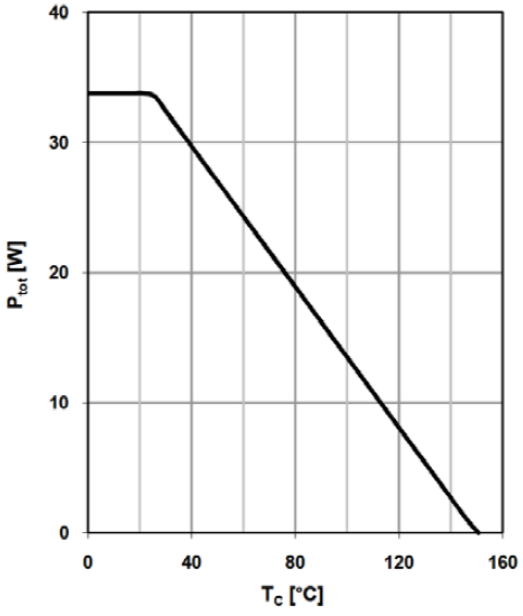
■ Electrical Characteristics (TJ=25°C unless otherwise specified)

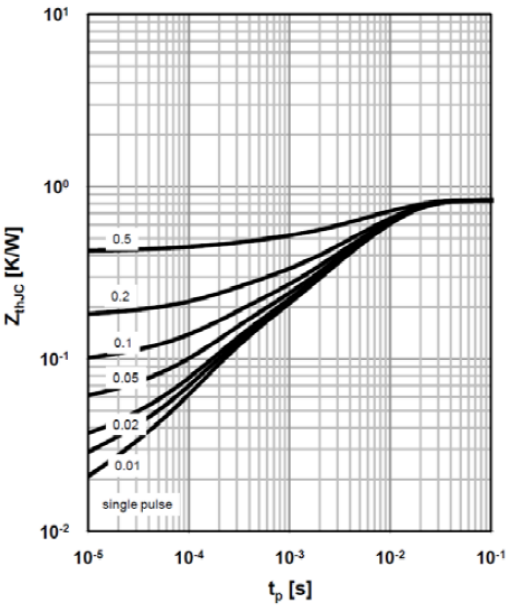
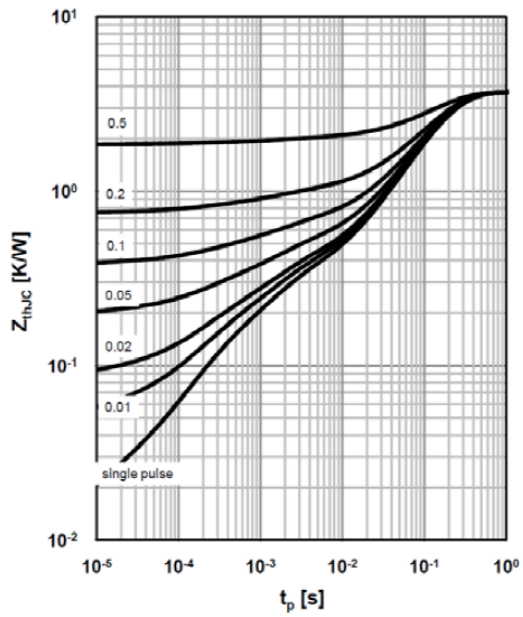
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA, T_J = 25℃	650	--	--	V
		V_{GS} = 0V, I_D = 250μA, T_J = 150℃	--	700	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25℃	--	0.6	--	V/℃
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 500V, V_{GS} = 650V -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 = 10A	--	0.17	0.19	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 10A	--	16	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	1510	-	pF
C_{oss}	Output Capacitance		--	75	-	pF
C_{rss}	Reverse Transfer Capacitance		--	6	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 520Ω (Note 4)	--	25	--	ns
t_r	Turn-On Rise Time		--	17	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	130	--	ns
t_f	Turn-Off Fall Time		--	11	--	ns
Q_g	Total Gate Charge	V_{DS} = 520V, I_D = 10A V_{GS} = 10V (Note 4)	--	90	120	nC
Q_{gs}	Gate-Source Charge		--	8.5	--	nC
Q_{gd}	Gate-Drain Charge		--	13	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	20	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	60	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 10A	--	0.9	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 10A dI_F/dt =100A/μs	--	475	--	ns
Q_{rr}	Reverse Recovery Charge		--	5.8	--	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

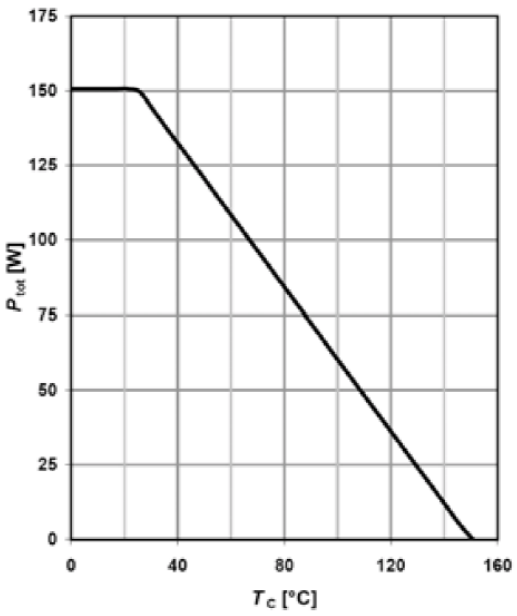
Typical Performance Characteristics

Power dissipation Non FullPAK	Power dissipation FullPAK
	
$P_{tot} = f(T_C)$	$P_{tot} = f(T_C)$

Max. transient thermal impedance Non FullPAK	Max. transient thermal impedance FullPAK
	
$Z_{(thJC)}$=f(tp); parameter: D=t_p/T	$Z_{(thJC)}$=f(tp); parameter: D=t_p/T

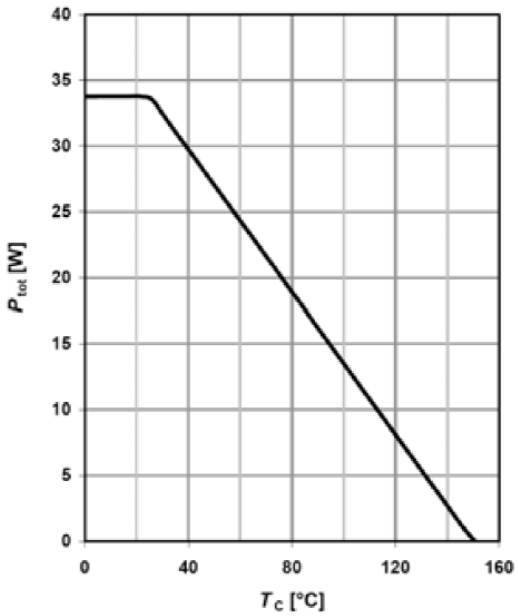
Typical Performance Characteristics

Power dissipation
TO-220, TO-247, TO-262, TO-263



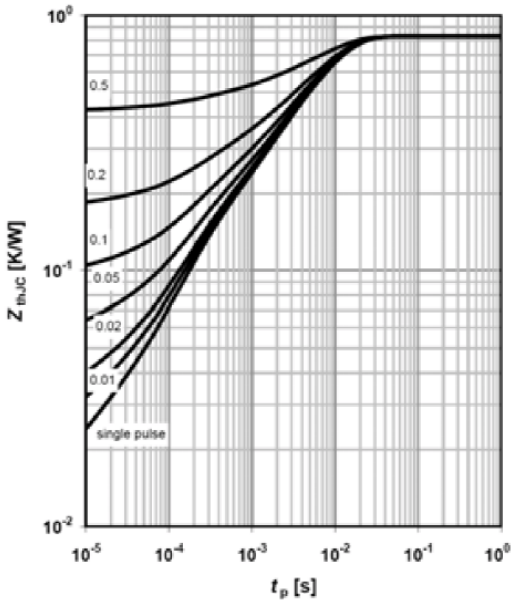
$P_{tot} = f(T_C)$

Power dissipation
TO-220 FullPAK



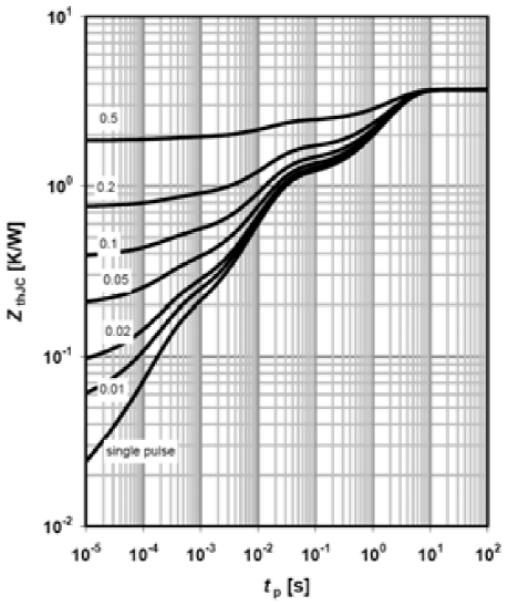
$P_{tot} = f(T_C)$

Max. transient thermal impedance
TO-220, TO-247, TO-262, TO-263



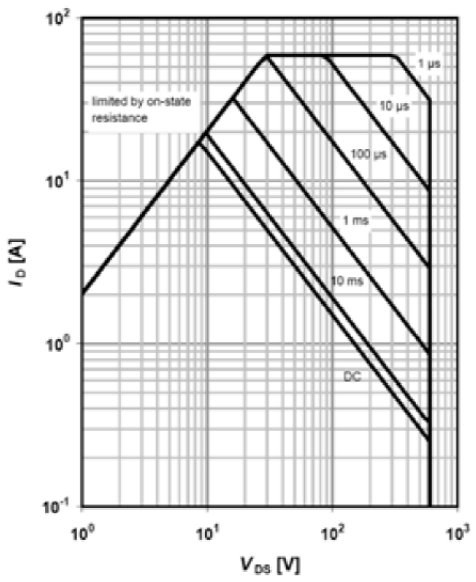
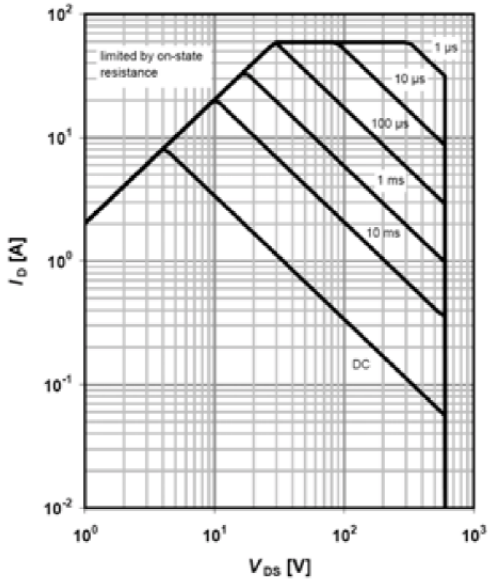
$Z_{(thJC)}$=f(tp); parameter: $D=t_p/T$

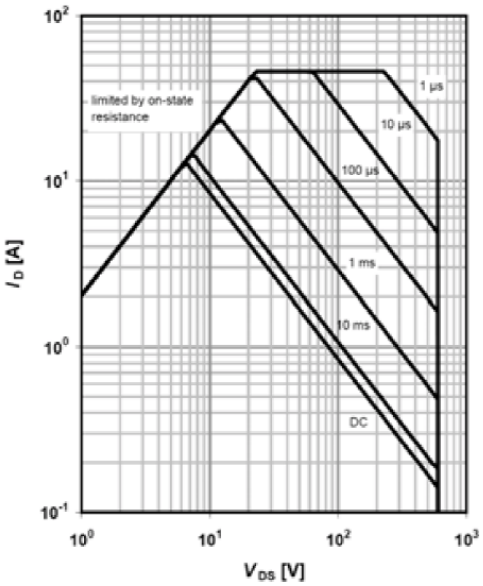
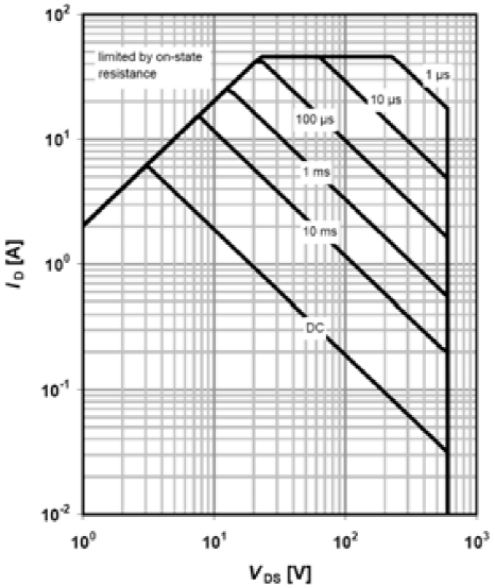
Max. transient thermal impedance
TO-220 FullPAK



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

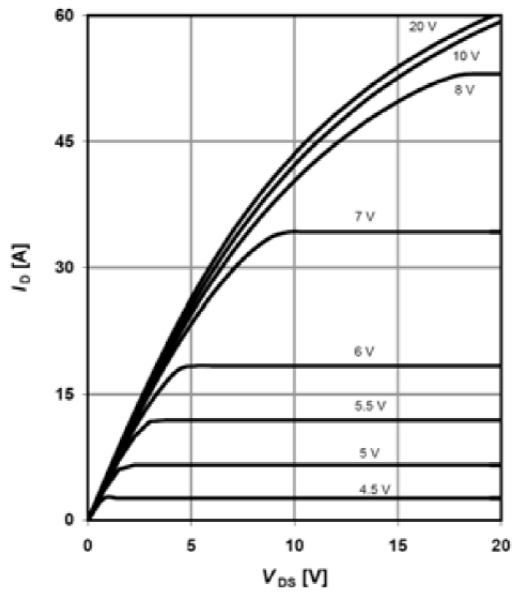
Typical Performance Characteristics

Safe operating area T_C=25 °C TO-220, TO-247, TO-262, TO-263	Safe operating area T_C=25 °C TO-220 FullPAK
	
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter t_p	I_D=f(V_{DS}); T_C=25 °C; D=0; parameter t_p

Safe operating area T_C=80 °C TO-220, TO-247, TO-262, TO-263	Safe operating area T_C=80 °C TO-220 FullPAK
	
I_D=f(V_{DS}); T_C=80 °C; D=0; parameter t_p	I_D=f(V_{DS}); T_C=80 °C; D=0; parameter t_p

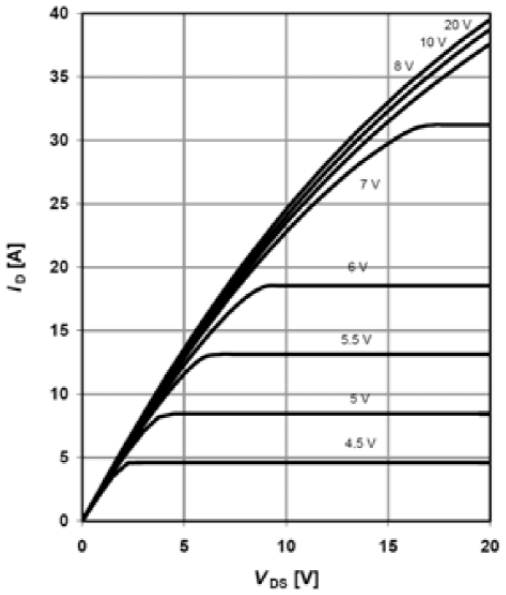
Typical Performance Characteristics

Typ. output characteristics T_C=25 °C



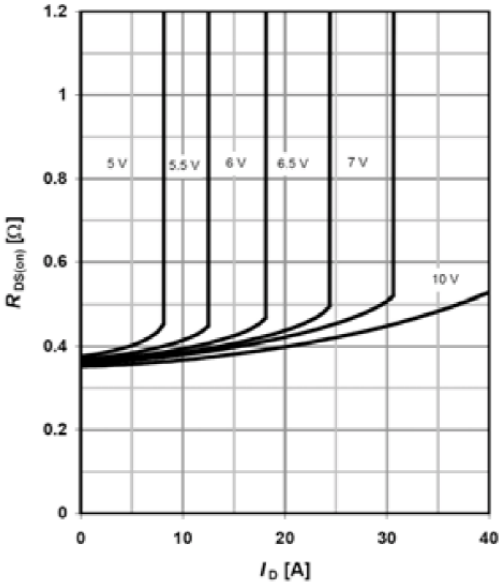
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}

Typ. output characteristics T_j=125 °C



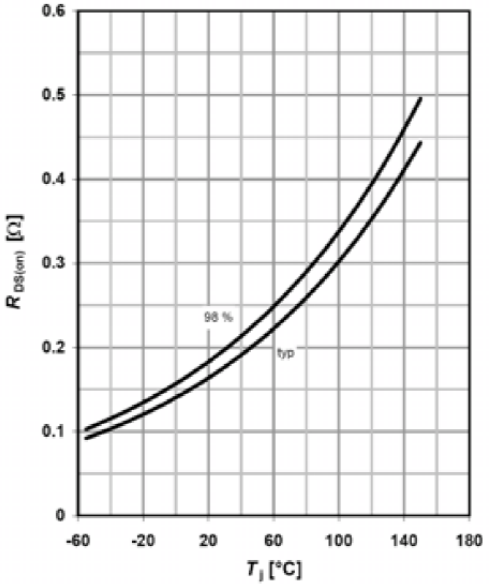
I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}

Typ. drain-source on-state resistance



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

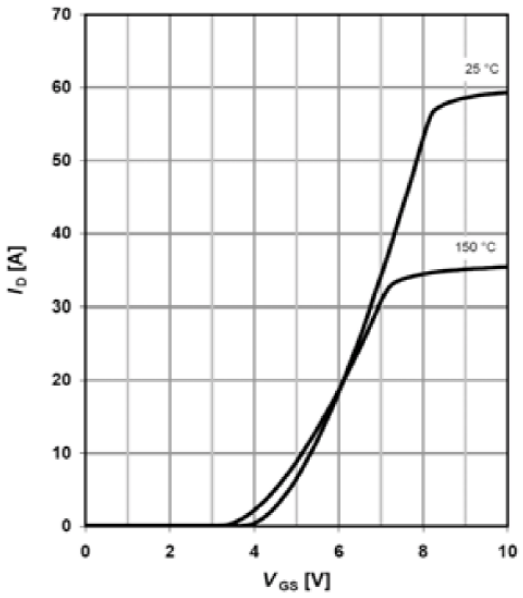
Drain-source on-state resistance



$R_{DS(on)}$=f(T_j); I_D=9.5 A; V_{GS}=10 V

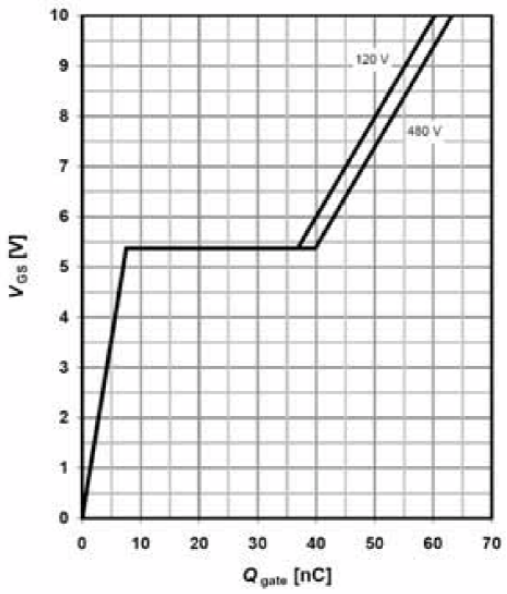
Typical Performance Characteristics

Typ. transfer characteristics



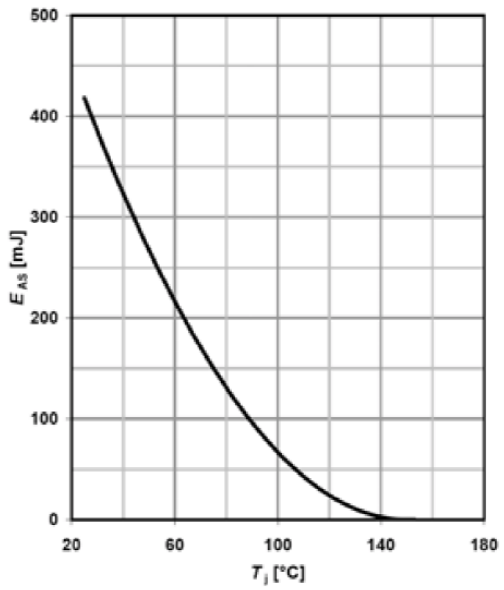
I_D=f(V_{GS}); V_{DS}=20V

Typ. gate charge



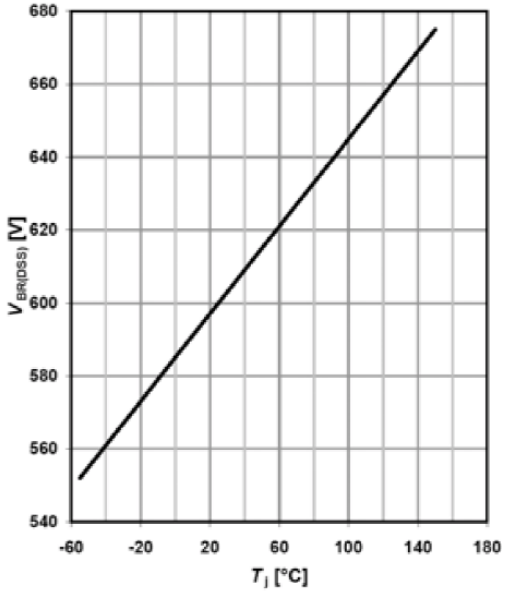
V_{GS}=f(Q_{gate}), I_D=9.5A pulsed

Avalanche energy



E_{AS}=f(T_j); I_D=3.4 A; V_{DD}=50 V

Drain-source breakdown voltage



$V_{BR(DSS)}$=f(T_j); I_D=0.25 mA

Table 20 Switching times test circuit and waveform for inductive load

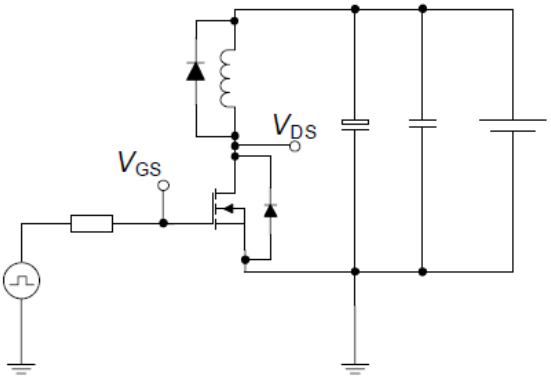
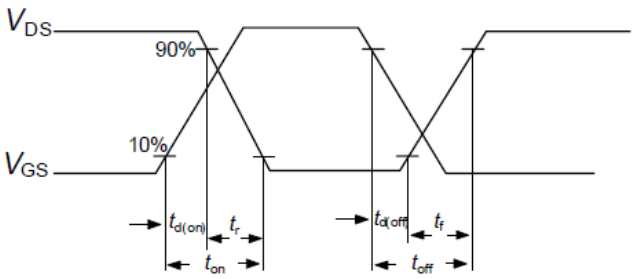
Switching times test circuit for inductive load	Switching time waveform
	

Table 21 Unclamped inductive load test circuit and waveform

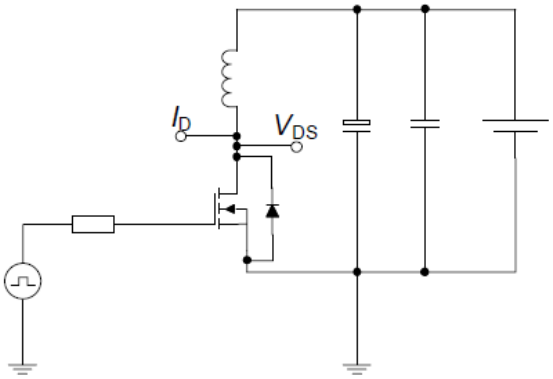
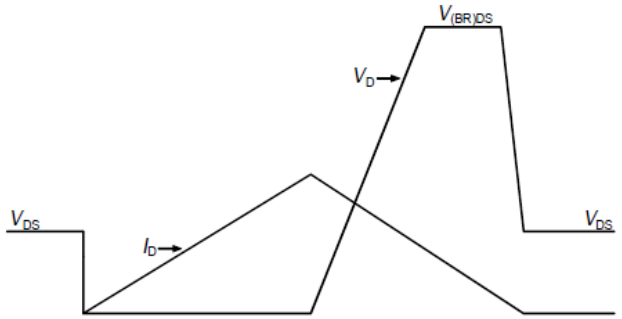
Unclamped inductive load test circuit	Unclamped inductive waveform
	

Table 22 Test circuit and waveform for diode characteristics

Test circuit for diode characteristics	Diode recovery waveform