



Group-Semi N/P-Channel Complementary MOSFET

Dec 2016

GENERAL DESCRIPTION

The GSN3020DT uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications. Standard Product GSN3020DT is Pb-free. GSN3020DT is electrically identical.

GENERAL FEATURES

N-channel

- $V_{DS}=30V, I_D=20A$
 $R_{DS(ON)} < 18m\Omega$ @ $V_{GS}=10V$
 $R_{DS(ON)} < 22m\Omega$ @ $V_{GS}=4.5V$

P-channel

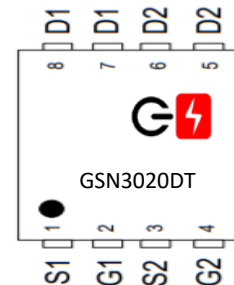
- $V_{DS}=-30V, I_D=-19A$
 $R_{DS(ON)} < 24m\Omega$ @ $V_{GS}=-10V$
 $R_{DS(ON)} < 30m\Omega$ @ $V_{GS}=-4.5V$
- High density cell design for ultra low R_{dson}
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high EAS
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

Application

- H-bridge
- Inverters

PIN CONFIGURATION

Package	Pin Configuration (Top View)
DFN3*3	



Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

Symbol	Parameter	Max N-channel	Max P-channel	Unit
V_{DS}	Drain-Source Voltage	30	-30	V
I_D	Drain Current -Continuous ($T_A = 25^\circ C$) -Continuous ($T_A = 70^\circ C$)	20 12	-19 -14	A
I_{DM}	Drain Current - Pulsed (Note 1)	75	-70	A
V_{GS}	Gate-Source voltage	± 20	± 20	V
I_{AS}	Single Pulse Avalanche Current (Note 1)	14	24	A
E_{AS}	Single Pulse Avalanche Energy $L=0.1mH$ (Note 1)	10	29	mJ
P_D	Power Dissipation - $T_A = 25^\circ C$ - $T_A = 70^\circ C$	21	21	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	-55 to +150	$^\circ C$



Thermal Characteristics

Symbol	Parameter	GSN3020DT	Unit
R _{θJA}	Maximum Junction-to-Ambient, t<10s	7	°C/W
	Maximum Junction-to-Ambient, Steady-State	20	°C/W
R _{θJL}	Maximum Junction-to-Lead, Steady-State	32	°C/W

N-Channel Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BVDSS	Drain-Source Breakdown Voltage	VGS = 0V, ID = 250μA, TJ = 25℃	30	-	-	V
IDSS	Zero Gate Voltage Drain Current	VDS = 30V, VGS = 0V -TJ = 55℃	-	-	1 5	μA μA
IGSSF	Gate-Body Leakage Current, Forward	VGS = 20V, VDS = 0V	-	-	100	nA
IGSSR	Gate-Body Leakage Current, Reverse	VGS = -20V, VDS = 0V	-	-	-100	nA
On Characteristics						
VGS(th)	Gate Threshold Voltage	VDS = VGS, ID = 250μA	1.0	1.8	3.0	V
RDS(on)	Static Drain-Source On-Resistance	VGS = 10V, ID = 6A VGS = 4.5V, ID = 5A	-	16 20	18 22	mΩ
gFS	Forward Transconductance	VDS = 5V, ID = 6A	-	15	-	S
Rg	Gate resistance	VGS=0V, VDS=0V, f=1MHz	-	3.2	-	Ω
Dynamic Characteristics						
Ciss	Input Capacitance	VDS = 15V, VGS = 0V, f=1MHz	-	400	-	pF
Coss	Output Capacitance		-	45	-	pF
Crss	Reverse Transfer Capacitance		-	70	-	pF
Switching Characteristics						
td(on)	Turn-On Delay Time	VDS = 15V, RG = 3Ω, ID = 6A , VGS = 10V (Note 5, 6)	-	4.5	-	ns
tr	Turn-On Rise Time		-	2.5	-	ns
td(off)	Turn-Off Delay Time		-	14.5	-	ns
tf	Turn-Off Fall Time		-	3.5	-	ns
Qg(10V)	Total Gate Charge	VDS = 15V, ID = 6A, VGS = 0~10V (Note 5, 6)	-	5.2	-	nC
Qg(4.5V)	Total Gate Charge		-	2.6	-	nC
Qgs	Gate-Source Charge		-	0.8	-	nC
Qgd	Gate-Drain Charge		-	1.3	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
IS	Maximum Continuous Drain-Source Diode Forward Current	-	-	-	25	A
ISM	Maximum Pulsed Drain-Source Diode Forward Current	-	-	-	50	A
VSD	Drain-Source Diode Forward Voltage	VGS = 0V, IS = 1A	-	0.7	1.0	V
trr	Reverse Recovery Time	VGS = 0V, IS =6A dIF/dt =100A/μs (Note 5)	-	8.5	-	ns
Qrr	Reverse Recovery Charge		-	2.2	-	nC



N-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

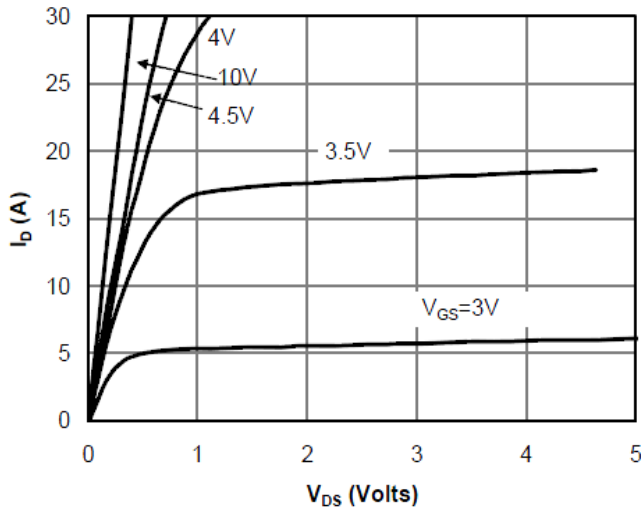


Fig 1: On-Region Characteristics

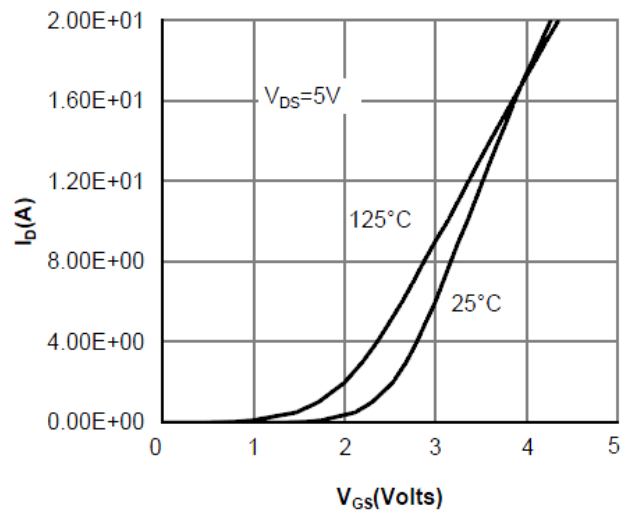


Figure 2: Transfer Characteristics

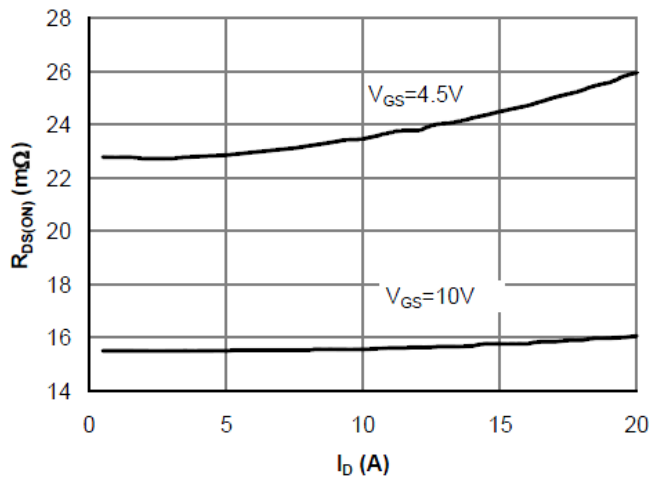


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

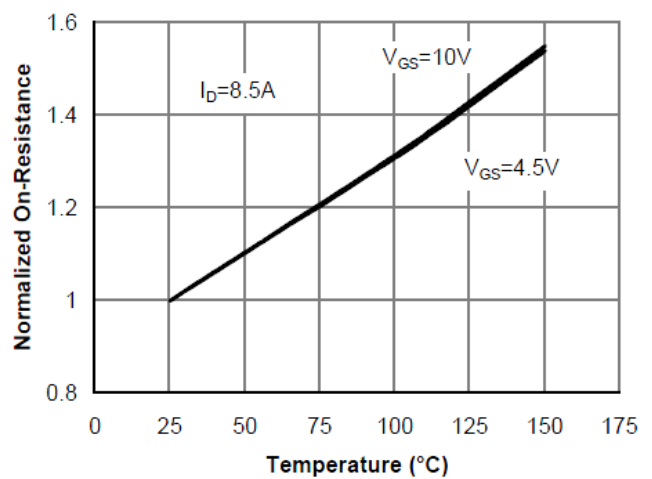


Figure 4: On-Resistance vs. Junction Temperature

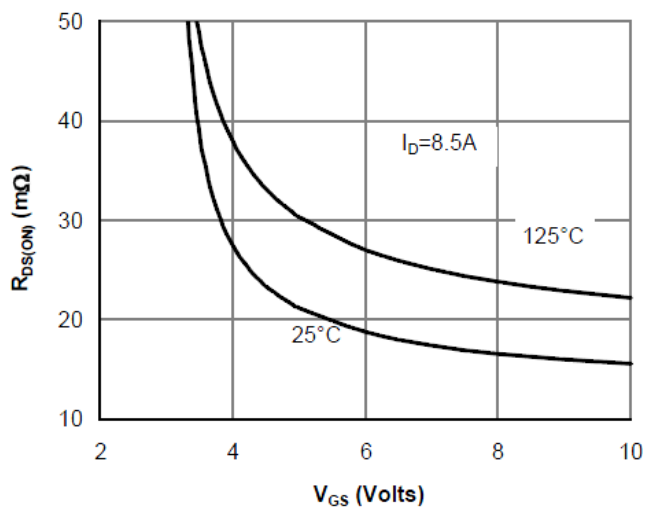


Figure 5: On-Resistance vs. Gate-Source Voltage

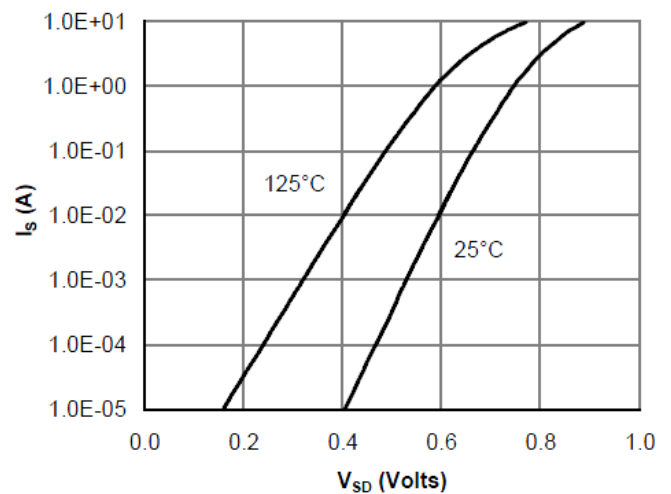


Figure 6: Body-Diode Characteristics



N-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

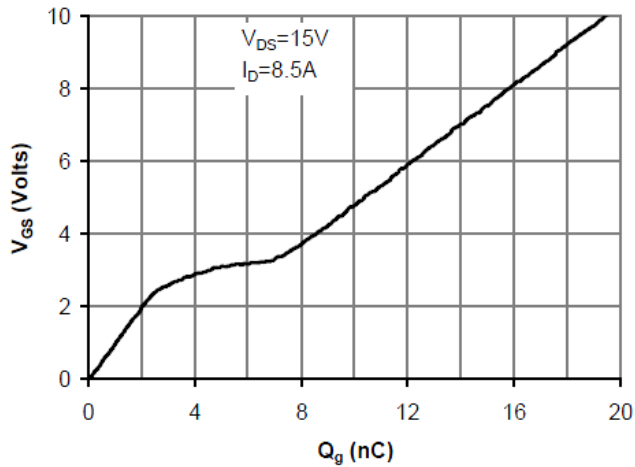


Figure 7: Gate-Charge Characteristics

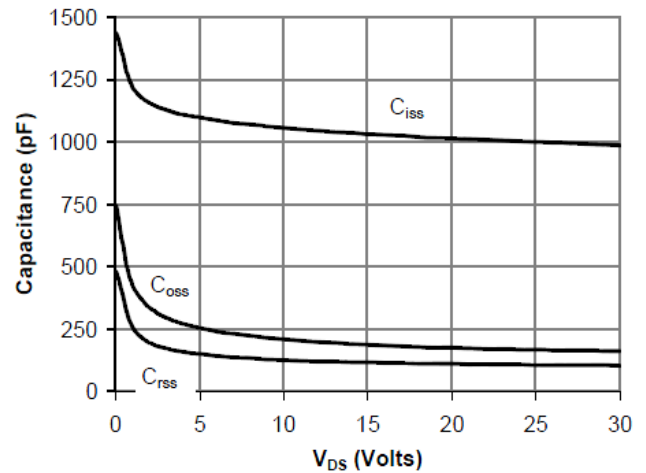


Figure 8: Capacitance Characteristics

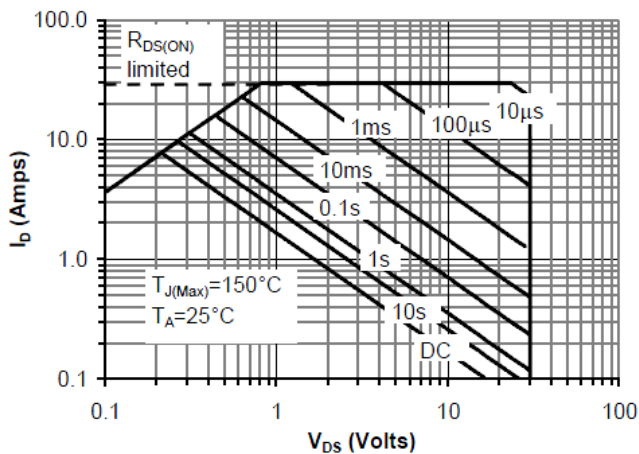


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

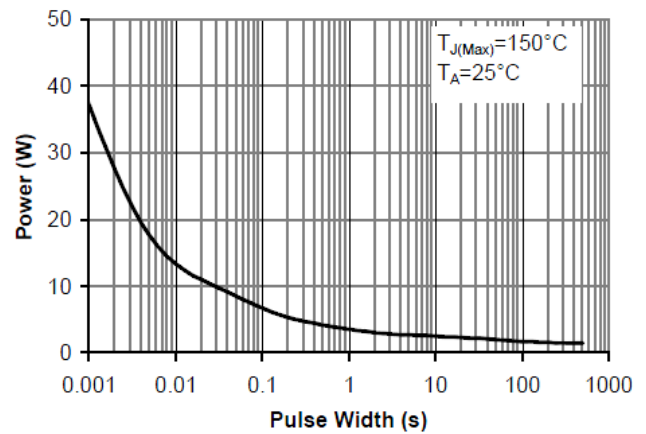


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

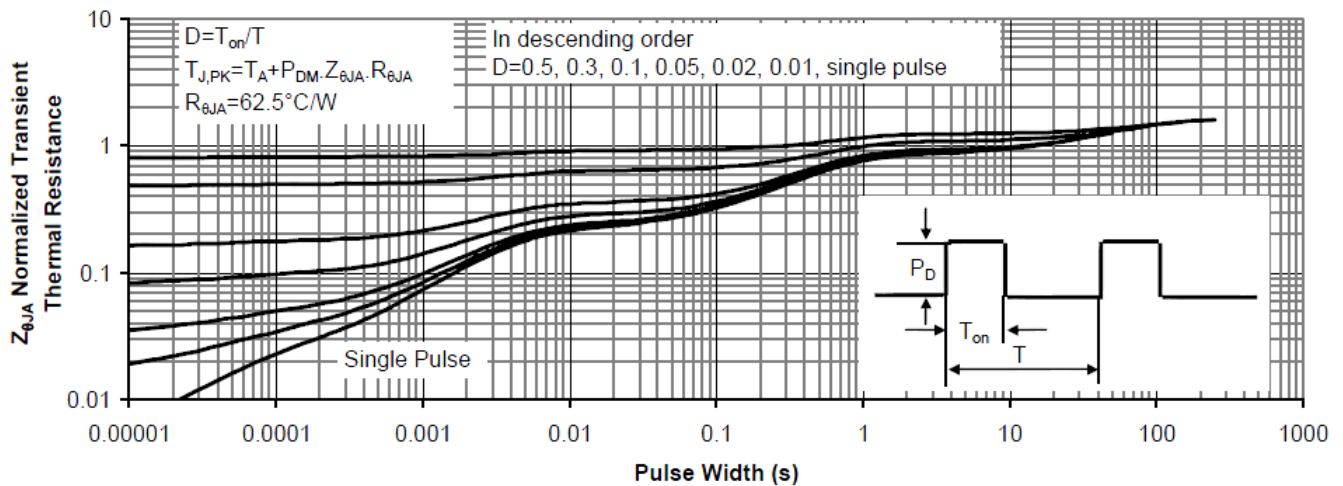


Figure 11: Normalized Maximum Transient Thermal Impedance



P-Channel Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BVDSS	Drain-Source Breakdown Voltage	VGS = 0V, ID = -250μA, TJ = 25℃	-30	-	-	V
IDSS	Zero Gate Voltage Drain Current	VDS = -30V, VGS = 0V -TJ = 55℃	-	-	-1 -5	μA μA
IGSSF	Gate-Body Leakage Current, Forward	VGS = 12V, VDS = 0V	-	-	100	nA
IGSSR	Gate-Body Leakage Current, Reverse	VGS = -12V, VDS = 0V	-	-	-100	nA
On Characteristics						
VGS(th)	Gate Threshold Voltage	VDS = VGS, ID = 250μA	-1.0	-1.8	-3.0	V
RDS(on)	Static Drain-Source On-Resistance	VGS = -10V, ID = -6A VGS = -4.5V, ID = -5A	-	24 38	30 46	mΩ
gFS	Forward Transconductance	VDS = -5V, ID = -6A	-	3	-	S
Rg	Gate resistance	VGS=0V, VDS=0V, f=1MHz	-	3.2	-	Ω
Dynamic Characteristics						
Ciss	Input Capacitance	VDS = -15V, VGS = 0V, f=1MHz	-	1000	-	pF
Coss	Output Capacitance		-	175	-	pF
Crss	Reverse Transfer Capacitance		-	105	-	pF
Switching Characteristics						
td(on)	Turn-On Delay Time	VDS = -15V, RG = 3Ω, ID = -6A , VGS = -10V (Note 5, 6)	-	10	-	ns
tr	Turn-On Rise Time		-	31	-	ns
td(off)	Turn-Off Delay Time		-	24	-	ns
tf	Turn-Off Fall Time		-	28	-	ns
Qg(10V)	Total Gate Charge	VDS = -15V, ID = -6A, VGS =- 0~10V (Note 5, 6)	-	18	-	nC
Qg(4.5V)	Total Gate Charge		-	14	-	nC
Qgs	Gate-Source Charge		-	3.2	-	nC
Qgd	Gate-Drain Charge		-	4.4	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
IS	Maximum Continuous Drain-Source Diode Forward Current		-	-	-	A
ISM	Maximum Pulsed Drain-Source Diode Forward Current		-	-	-25	A
VSD	Drain-Source Diode Forward Voltage	VGS = 0V, IS = -1A	-	-0.7	-1.2	V
trr	Reverse Recovery Time	VGS = 0V, IS =-6A dIF/dt =- 100A/μs (Note 5)	-	24	-	ns
Qrr	Reverse Recovery Charge		-	30	-	nC



P-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

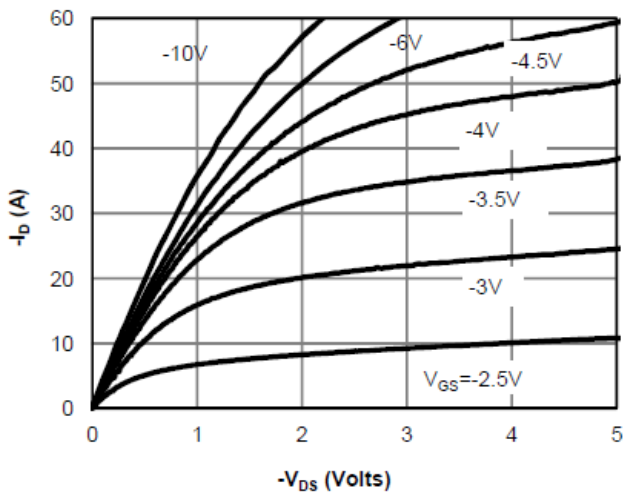


Fig 1: On-Region Characteristics (Note E)

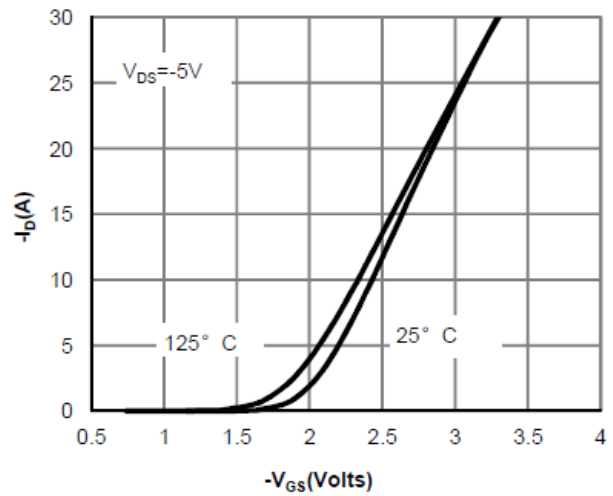


Figure 2: Transfer Characteristics (Note E)

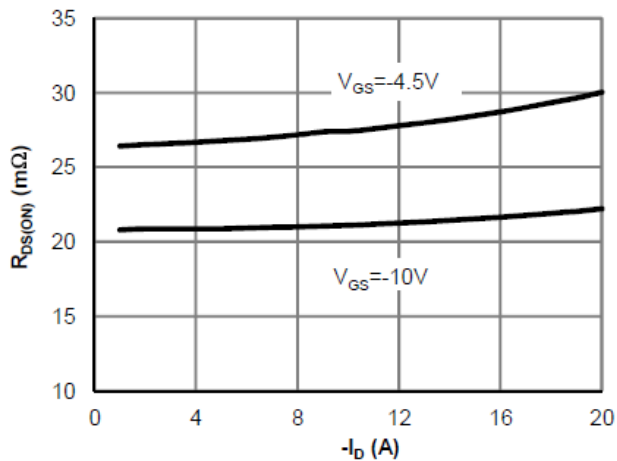


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

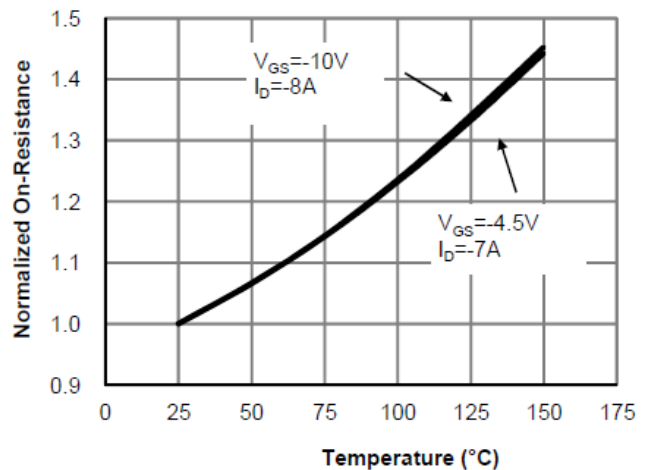


Figure 4: On-Resistance vs. Junction Temperature (Note E)

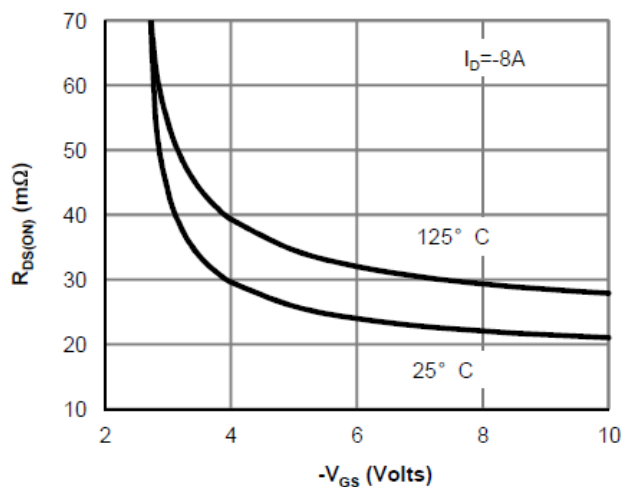


Figure 5: On-Resistance vs. Gate-Source Voltage (Note F)

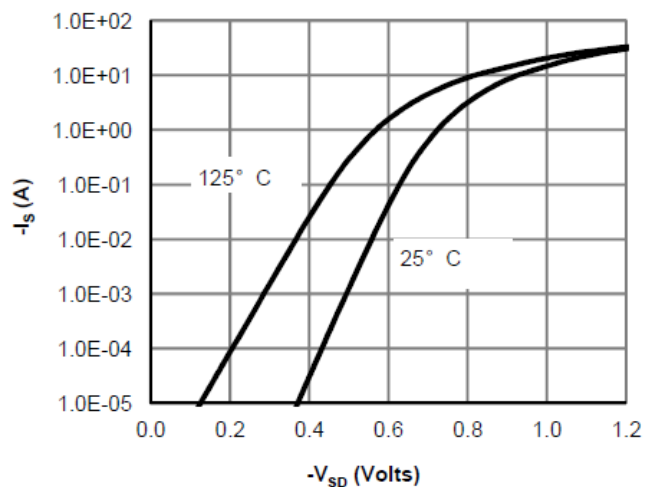
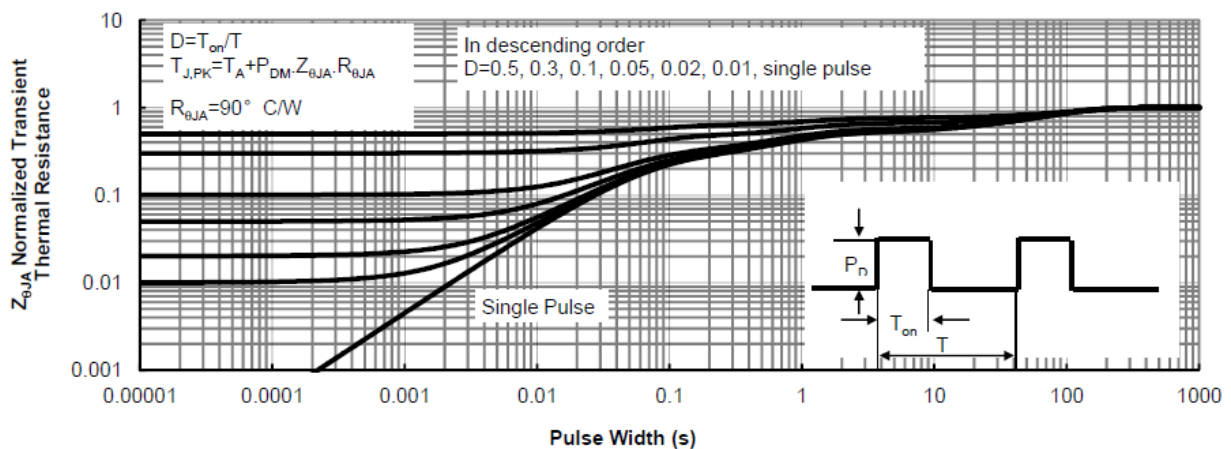
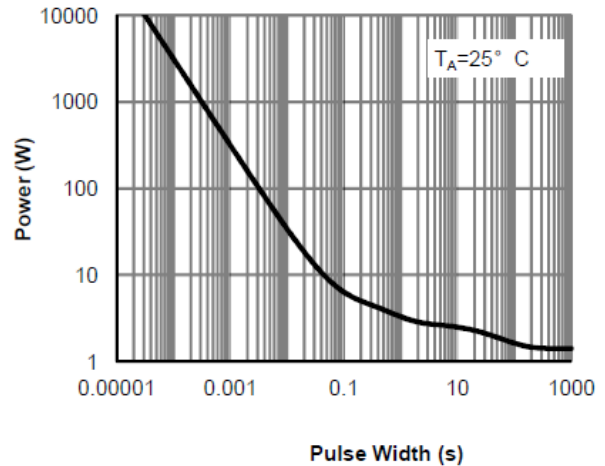
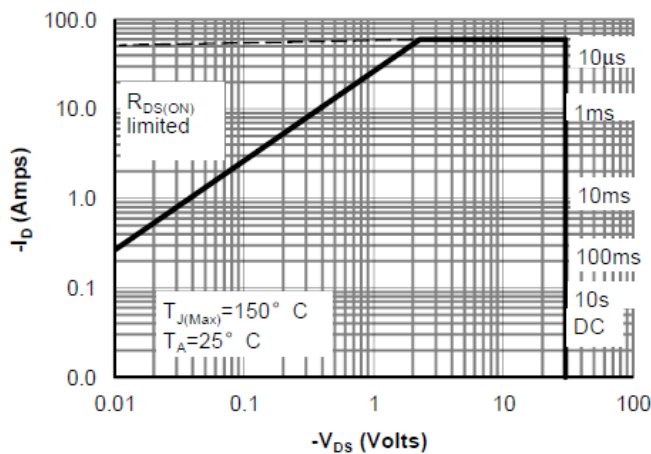
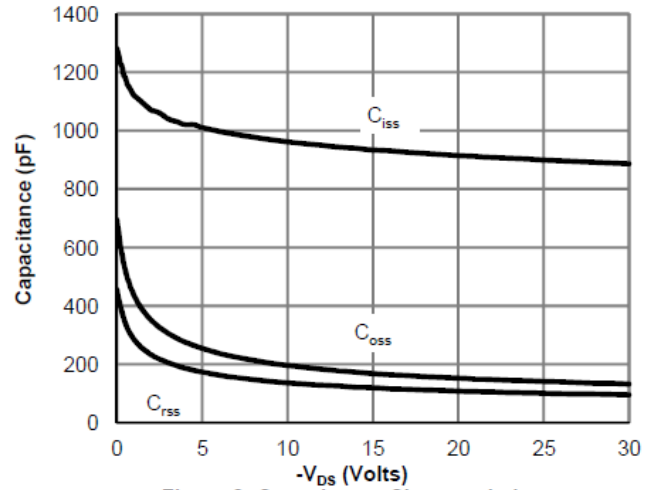
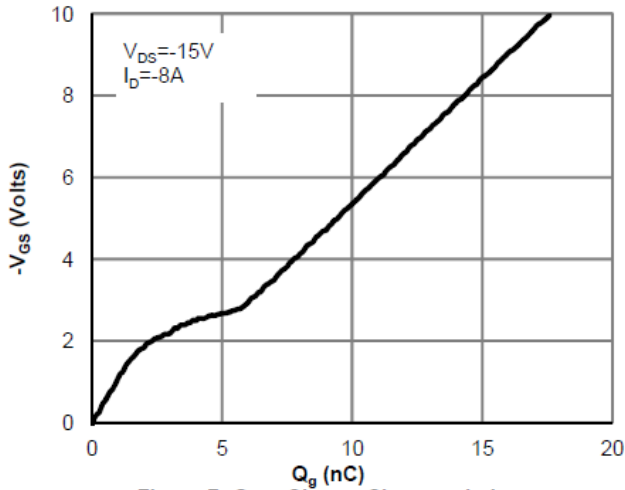


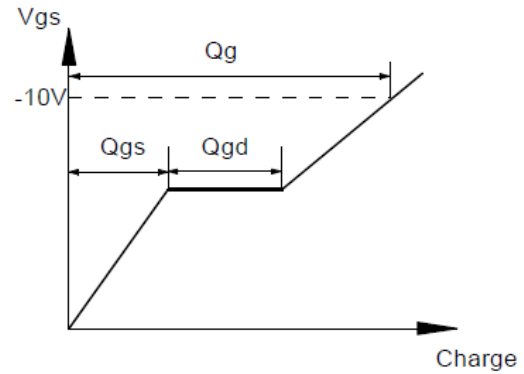
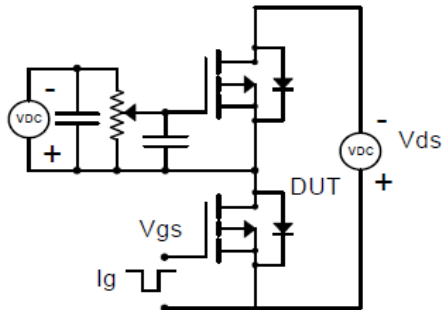
Figure 6: Body-Diode Characteristics (Note E)



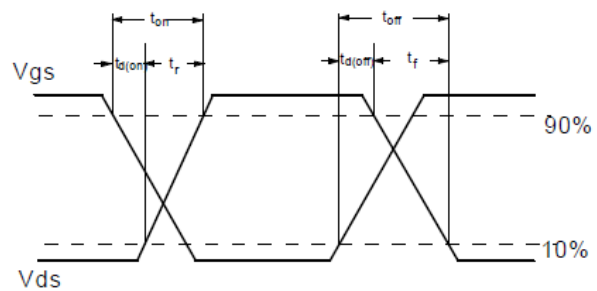
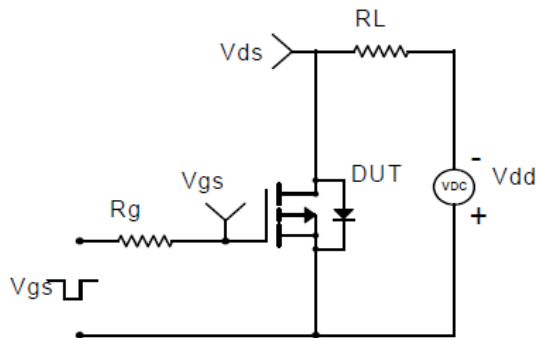
P-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

