

Silicon Carbide Enhancement Mode MOSFET

Features

- Low On-Resistance and High Current Density
- Low Capacitance for High Frequency Operation
- Positive Temperature Coefficient Device

Benefits

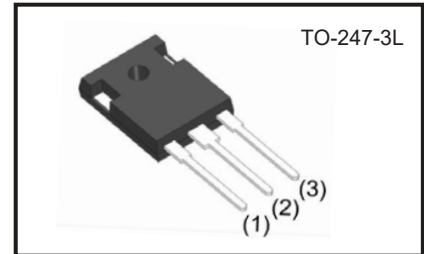
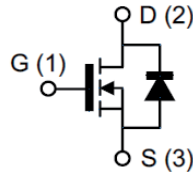
- Higher System Efficiency
- Increase Parallel Device Convenience
- Allow High Frequency Operation
- Realize Compact and Lightweight Systems

Applications

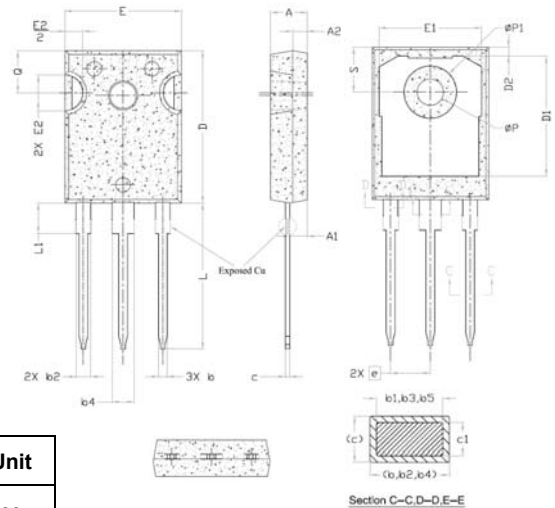
- Switching Mode Power Supply
- DC/DC Converters, UPS, and PFC
- EV Charging Station
- Motor Drives
- Power Inverters
- Solar/Wind Renewable Energy

Preliminary

V_{DSS}	1200V
$I_D(@25^{\circ}C)$	44.5A
$R_{DS(ON)}$	60m Ω



Package Dimensions



Absolute Maximum Ratings

 (T_c = 25°C unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Drain-Source Voltage	V_{DS}	1200	V
Gate-Source Voltage	V_{GS}	-5/+20	V
Drain Current-Continuous	I_D	@ T _c = 25°C 44.5 @ T _c = 110°C 30.6	A
Pulse Drain Current	$I_{D,pulse}$	90.5	A
Power Dissipation	P_D	250	W
Avalanche energy, Single Pulse	E_{AS}	1250	mJ
Storage Temperature Range	T _{STG}	-55 to +175	°C
Operating Junction Temperature Range	T _J	-55 to +175	°C
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.6	°C/W
Mounting Torque (M3 or 6-32 screw)	M _d	1.0	N·m

SYMBOL	DIMENSIONS			Note
	Min.	Typ.	Max.	
A	4.83	5.02	5.21	
A1	2.29	2.41	2.55	
A2	1.50	2.00	2.49	
b	1.12	1.20	1.33	
b1	1.12	1.20	1.28	
b2	1.91	2.00	2.39	6
b3	1.91	2.00	2.34	
b4	2.87	3.00	3.22	6, 8
b5	2.87	3.00	3.18	
c	0.55	0.60	0.69	6
c1	0.55	0.60	0.65	
D	20.80	20.95	21.10	4
D1	16.25	16.55	17.65	5
D2	0.51	1.19	1.35	
E	15.75	15.94	16.13	4
E1	13.46	14.02	14.16	5
E2	4.32	4.91	5.49	3
e	5.44 BSC			
L	19.81	20.07	20.32	
L1	4.10	4.19	4.40	6
φP	3.56	3.61	3.65	7
φP1	7.19 REF.			
Q	5.39	5.79	6.20	
S	6.04	6.17	6.30	

Electrical Characteristics @ $T_c = 25^\circ\text{C}$ (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OFF Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_{DS}=0.1mA$	1200	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS}=0V, V_{DS}=1200V$	-	1	50	μA
Gate-Source Leakage Current	I_{GSS}	$V_{GS}=20V, V_{DS}=0V$	-	-	250	nA
ON Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=20V, I_{DS}=20mA$	-	2.85	-	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=20V, I_{DS}=20A$	-	60	80	m Ω
Transconductance	g_{fs}	$V_{GS}=12.5V, I_{DS}=40A$	-	10.5	-	S
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{DS}=800V$ $V_{GS}=0V$ $V_{AC}=25mV$ Freq.=1MHz	-	2200	-	pF
Output Capacitance	C_{oss}		-	115	-	
Reverse Transfer Capacitance	C_{rss}		-	18.5	-	
C_{oss} Stored Energy	E_{oss}		-	47	-	
Turn-On Switching Energy	E_{on}	$V_{DS}=800V, V_{GS}=0V/20V$	-	63	-	μJ
Turn-Off Switching Energy	E_{off}	$I_D=20A, R_{G(ext)}=2.7\Omega$	-	69	-	
Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{DS}=800V$ $V_{GS}=-4/20V$ $I_D=20A, R_L=40\Omega$ $R_{G(ext)}=2.7\Omega$	-	25	-	ns
Rise Time	t_r		-	24	-	
Turn-Off Delay Time	$t_{d(off)}$		-	20	-	
Fall Time	t_f		-	9	-	
Total Gate Charge	Q_g	$V_{DS}=800V$	-	129	-	nC
Gate to Source Charge	Q_{gs}	$V_{GS}=-5/+20V$	-	29	-	
Gate to Drain Charge	Q_{gd}	$I_D=20A$	-	64	-	
Body Diode Characteristics						
Inverse Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_{SD}=5A$	-	2.65	-	V
Continuous Diode Forward Current	I_S	$V_{GS}=0V, T_c=25^\circ\text{C}$	-	44	-	A
Reverse Recovery Time	T_{rr}	$V_{GS}=0V$	-	57	-	ns
Reverse Recovery Charge	Q_{rr}	$I_{SD}=20A, V_{DS}=400V,$ $di/dt=300A/\mu s$	-	109	-	nC
Peak Reverse Recovery Current	I_{rrm}		-	3.5	-	A

* Based on the results of calculation, note that the energy loss caused by the reverse recovery of free-wheeling diode is not included in E_{on} .

Typical Device Performance

Fig.1 Forward Output Characteristics at $T_J=25^\circ\text{C}$

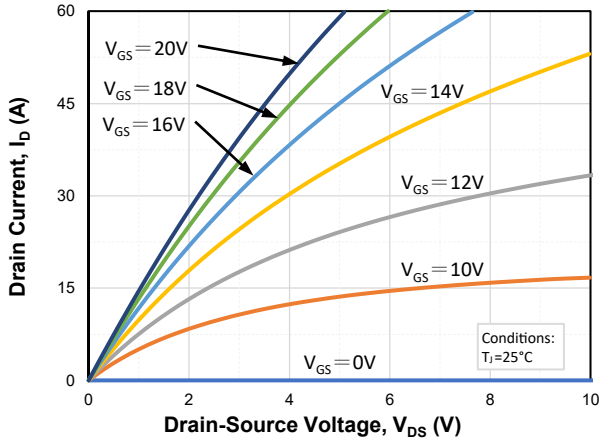


Fig.2 Forward Output Characteristics at $T_J=175^\circ\text{C}$

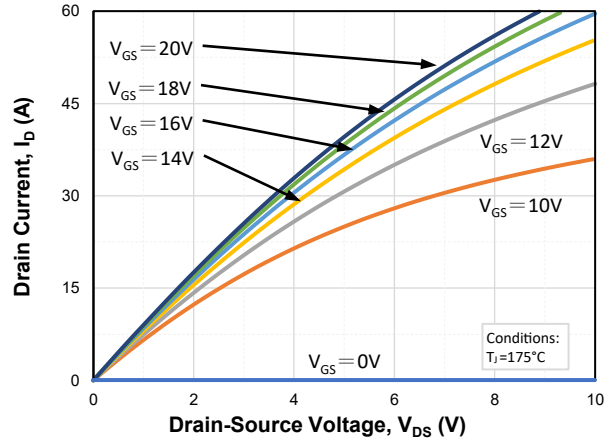


Fig.3 On-Resistance vs. Drain Current for Various T_J

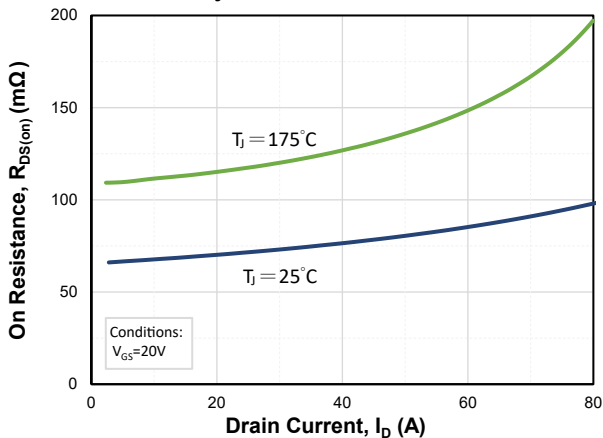


Fig.4 Transfer Characteristics for Various T_J

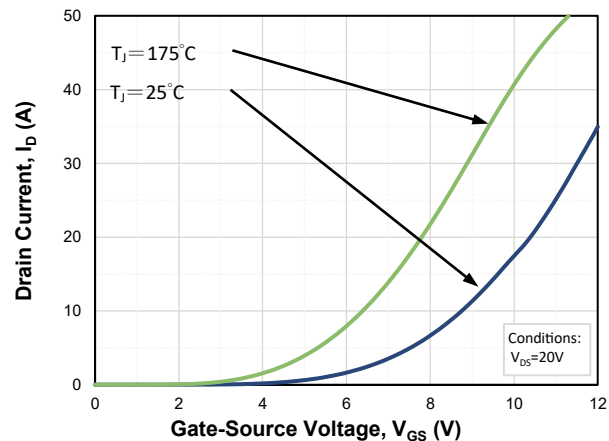


Fig.5 On-Resistance vs. Gate Voltage for Various T_J

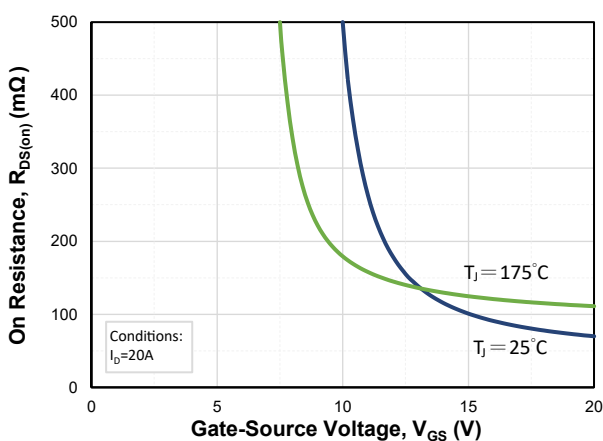


Fig.6 On-Resistance vs. Temperature for Various Gate Voltage

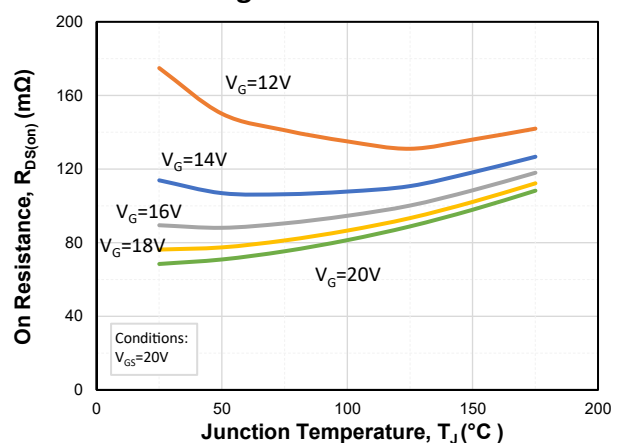


Fig.7 Normalized On-Resistance vs. Temperature

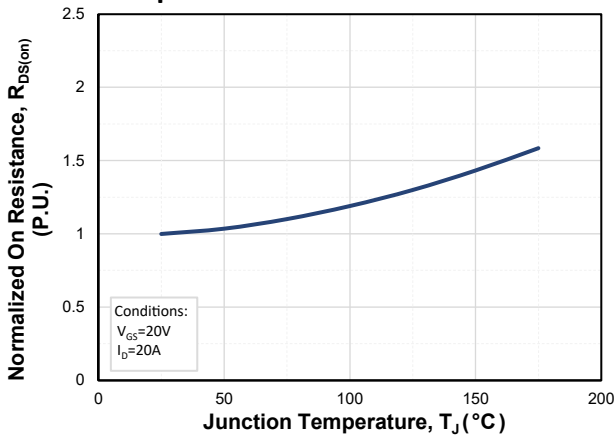


Fig.8 Reverse Output Characteristics at T_J = 25°C

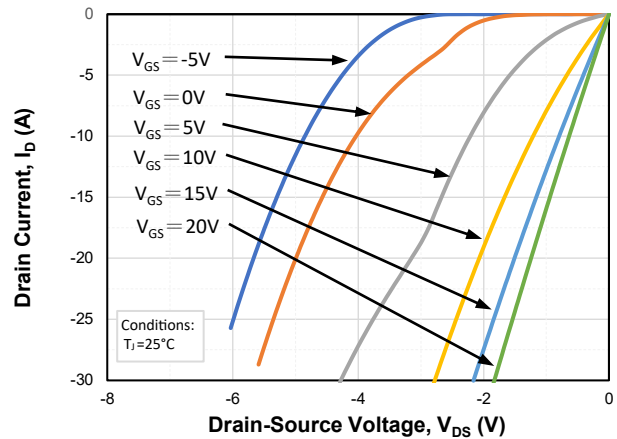


Fig.9 Reverse Output Characteristics at T_J = 175°C

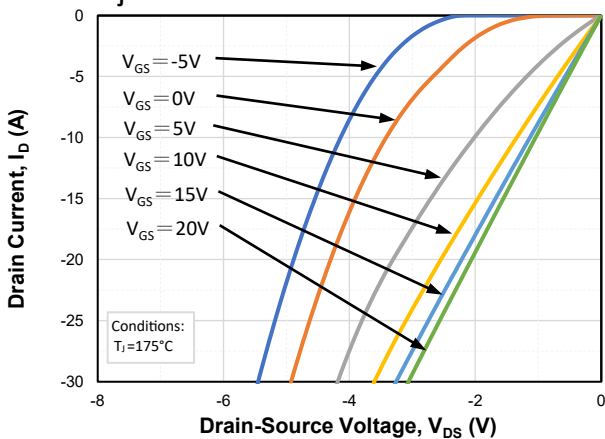


Fig.10 Capacitances vs. Drain to Source Voltage

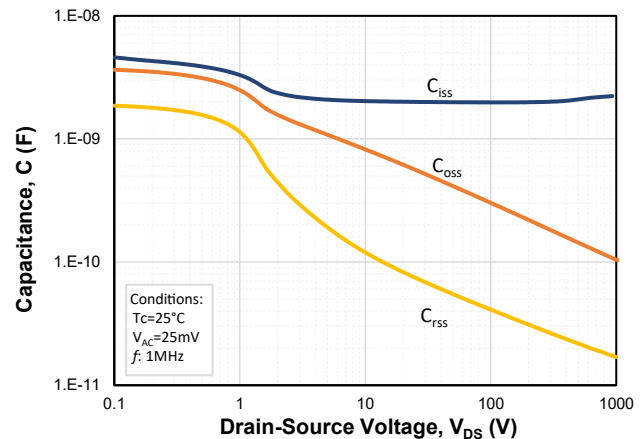


Fig.11 Threshold Voltage vs. Temperature

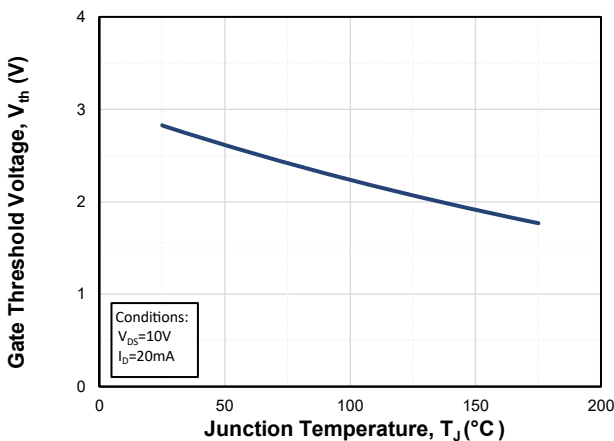


Fig.12 Output Capacitor Stored Energy

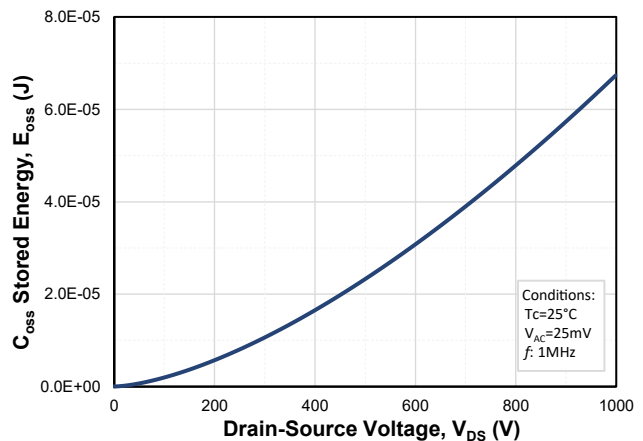


Fig.13 Maximum Power Dissipation Derating vs. Case Temperature

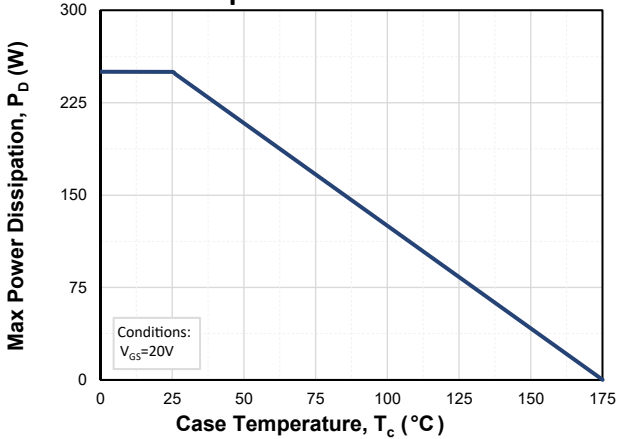


Fig.14 Drain Current Derating vs. Case Temperature

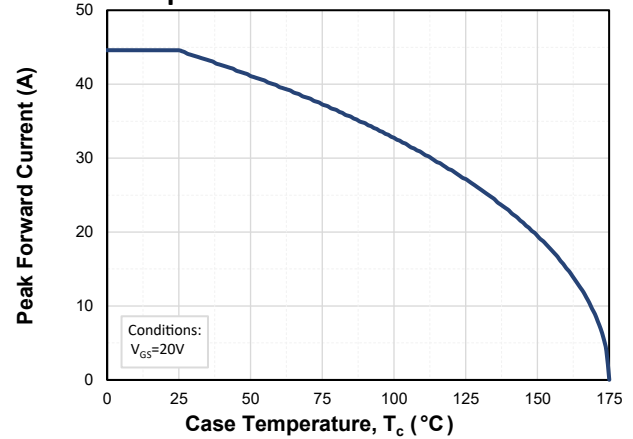


Fig.15 Safe Operating Area

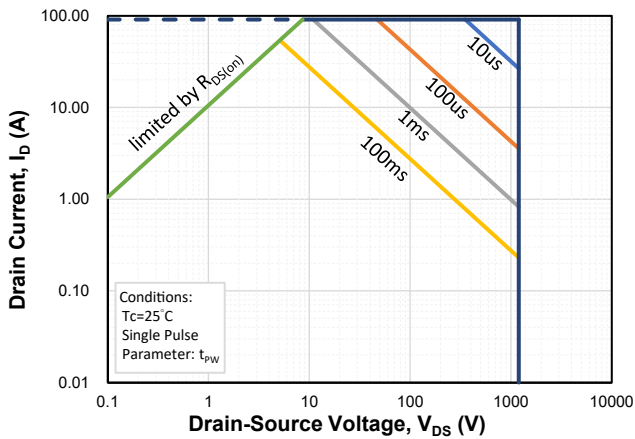


Fig.16 Gate Charge Characteristics

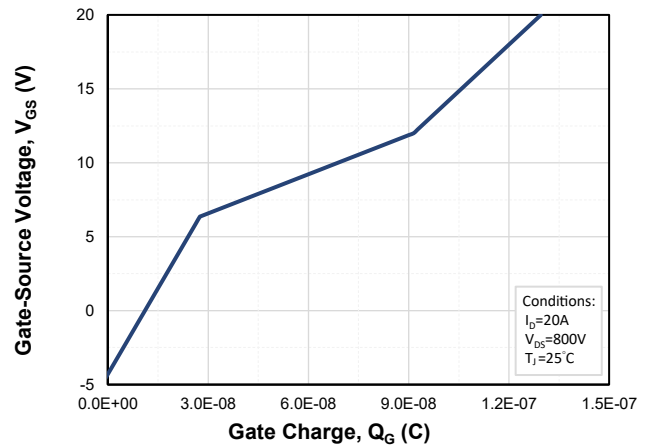


Fig.17 Clamped Inductive Switching Energy vs. Drain Current

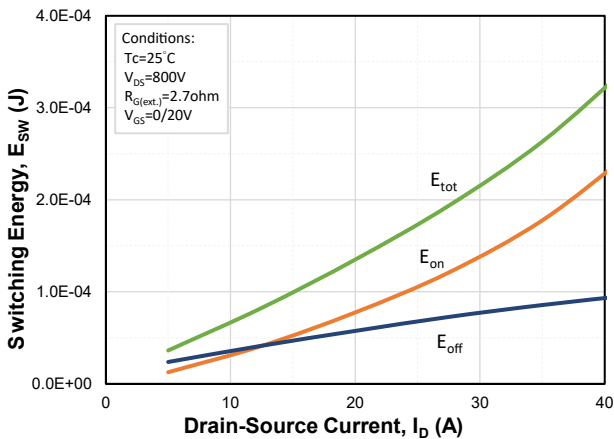


Fig.18 Clamped Inductive Switching Energy vs. External Gate Resistor ($R_{G(ext.)}$)

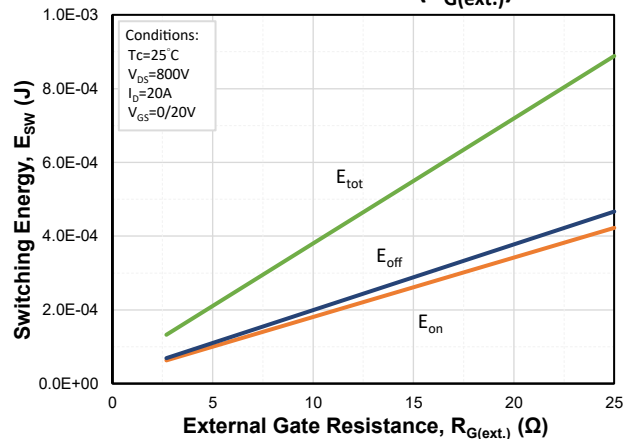
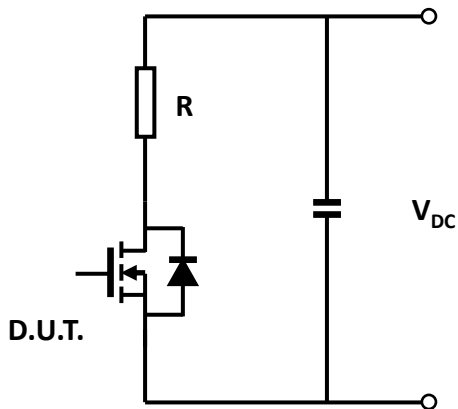
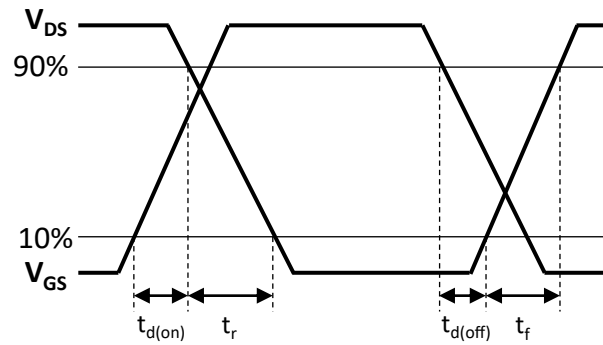
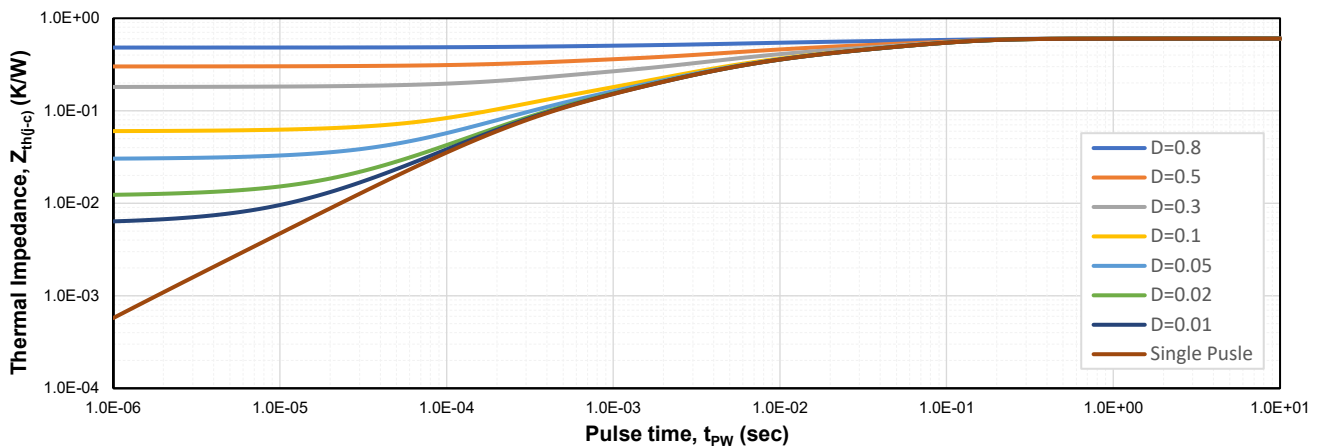


Fig.19 Schematic of Resistive Switching

Fig.20 Switching Times Definition

Fig.21 Transient Junction to Case Thermal Impedance


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