DFS15HF12DEA1D

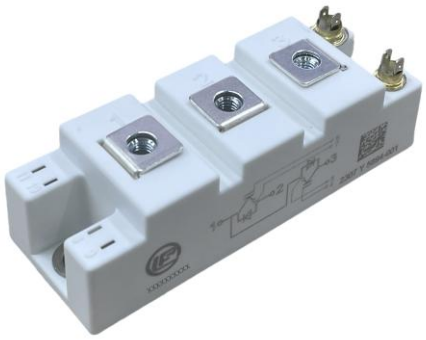
1200V/15mΩ Half Bridge SiC Module

Description

The DFS15HF12DEA1D is 34mm package SiC power module. It offers lower losses and higher energy for applications such as motor drives, inverter, UPS and welding applications.

Features

- 1200V/15mΩ
- High Frequency Operation
- AMB substrate
- Fast intrinsic diode with low reverse recovery



Applications

- Motor drives
- Solar Inverter
- UPS
- AC/DC converters
- DC/DC converters

Circuit diagram

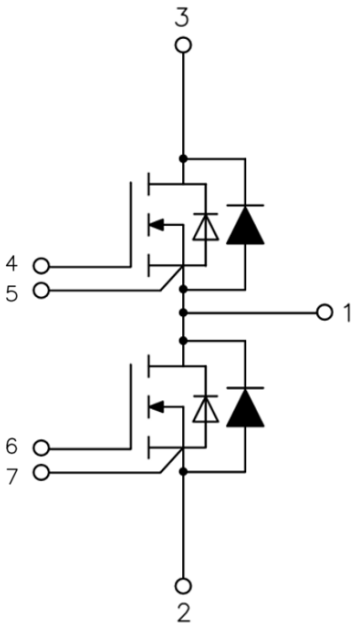
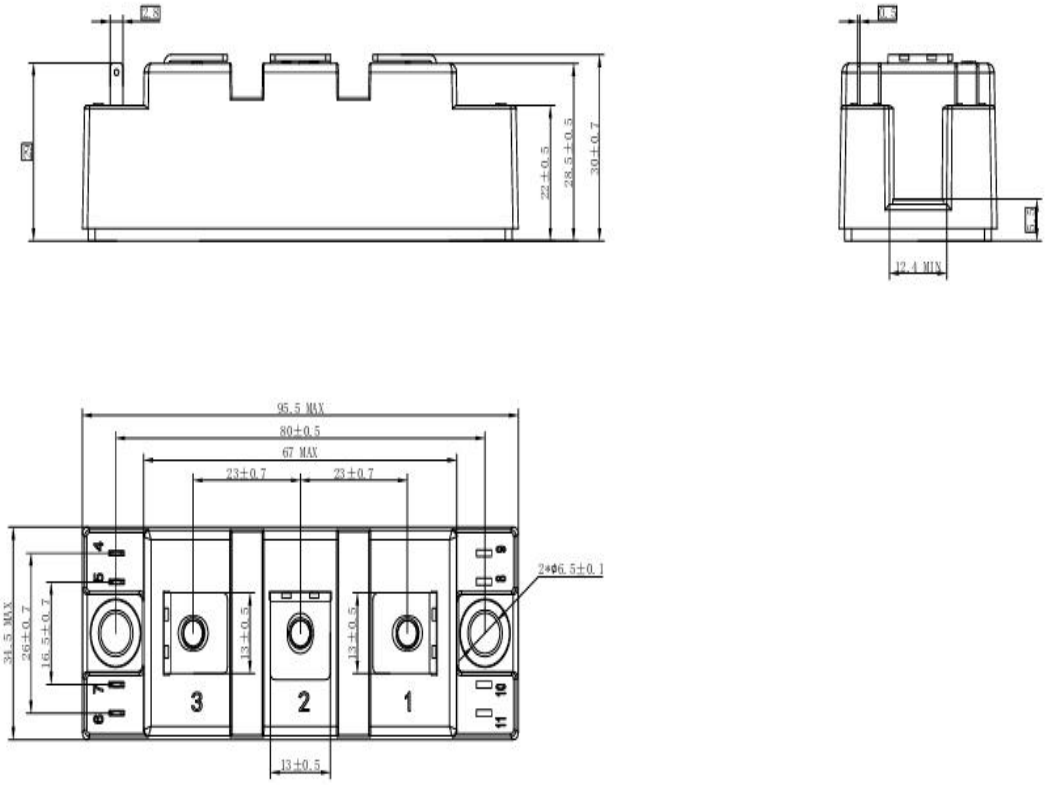


Figure 1. Out drawing & circuit diagram for DFS15HF12DEA1D

Outline drawing (Unit :mm)



NPW0016_001 A0

Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f = 50Hz, t =1min	2.5	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	26 21	mm
Clearance	terminal to heatsink terminal to terminal	23.6 10	mm
CTI	-	>200	-
Module lead resistance, terminals – chip	T_C =25°C	0.8	m
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	160	g

Maximum Ratings (SiC MOSFET, T_j =25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
V_{GSS}	Gate-Sourse Voltage	D-S Short, AC frequency ⩾1Hz	-10/+23	V
$V_{GS(OP)}$			-4/+18	
I_{DS}	DC Continuous Drain Current	T_C =80°C, V_{GS} =18V	80	A
I_{DSM}	Pulse Drain Current	T_C =80°C, Pulse width =1ms, V_{GS} =18V, Note1	160	A
I_F	Continuous forward current	T_C =80°C, V_{GS} =18V	80	A
I_{FSM}	non-repetitive forward current	T_C =80°C, Pulse width =1ms, V_{GS} =-4V, Note1	160	A
P_{tot}	Total Power Dissipation	T_C =25°C	265	W
T_{jmax}	Operating Junction Temperature	-	-40 to 175	°C
T_{stg}	Storage Temperature	-	-40 to 150	°C

Note1: Pulse width limited by maximum junction temperature

SiC MOSFET Electrical characteristics (T_j =25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} =0V, I_D =100μA		1200	-	-	V
$V_{GS(th)}$	Gate-source threshold Voltage	I_D =27mA, V_{DS} =V_{GS}	T_j =25°C	-	2.9	-	V
			T_j =150°C	-	2.2	-	
			T_j =175°C	-	2.1	-	
I_{DSS}	Zero gate voltage drain Current	V_{DS} =1200V, V_{GS} =0V	Tj =25°C	-	1	-	μA
I_{GSS+}	Gate-Source Leakage Current	V_{GS} =18V, V_{DS} =0V	T_j =25°C	-	1	-	nA
I_{GSS-}	Gate-Source Leakage Current	V_{GS} =-4V, V_{DS} =0V	T_j =25°C	-	-1	0	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =80A V_{GS} =+18V	T_j =25°C	-	15	-	mΩ
			Tj =150°C	-	25	-	
			T_j =175°C	-	28	-	
C_{iss}	Input Capacitance	V_D =1000V, V_{GS} =0V f =1MHz, V_{AC} =25mV		-	5.2	-	nF
C_{oss}	Output Capacitance			-	0.225	-	
C_{rss}	Reverse transfer Capacitance			-	0.019	-	
R_{Gint}	Internal gate resistor	f =1MHz, I_D=0V		-	6.8	-	Ω
Q_g	Total gate charge	V_{DD} =800V, I_D =80A, V_{GS} =+18/-4V		-	246	-	nC
Q_{gs}	Gate-source charge			-	60	-	
Q_{gd}	Gate-drain charge			-	97	-	
t_{don}	Turn-On Delay Time	V_{DS} = 800 V V_{GS} = -4V/+18V I_D = 80A $Rg_{(on)}$=8.2Ω $Rg_{(off)}$=12Ω Inductive load switching operation		-	63	-	ns
t_r	Rise Time			-	62	-	ns
t_{doff}	Turn-Off Delay Time			-	125	-	ns
t_f	Fall Time			-	35	-	ns
E_{on}	Turn-On Switching Energy			-	2665	-	μJ
E_{off}	Turn-Off Switching Energy			-	1180	-	μJ
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case, Note1		-	0.564	-	°C /W

Note1: Assumes Thermal Conductivity of grease is 2.8 W/m・K and thickness is 50um.

SiC SBD Diode Electrical characteristics (T_j=25°C unless otherwise specified, chip: Target)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Diode Forward Voltage	V_{GS} =-4V, I_F =50A	T_j=25°C	-	1.43	1.63	V
			T_j=150°C	-	1.9	-	
			T_j=175°C	-	2.03	2.63	
T_{rr}	Reverse recovery time	V_{DD}=800V I_D=50A V_{GS}= -4V/+18V $Rg_{(on)}$=8.2Ω $Rg_{(off)}$= 12Ω Inductive load switching operation	T_j=25°C	-	24.2	-	ns
Q_{rr}	Reverse recovery charge		T_j=25°C	-	1363	-	nC
I_{rr}	Reverse recovery current		T_j=25°C	-	36	-	A
E_{rr}	Reverse recovery energy		T_j=25°C	-	0.97	-	mJ
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)	Junction to Case, Note1		-	0.503	-	°C /W

Note1: Assumes Thermal Conductivity of grease is 2.8 W/m・K and thickness is 50um.

Test Conditions

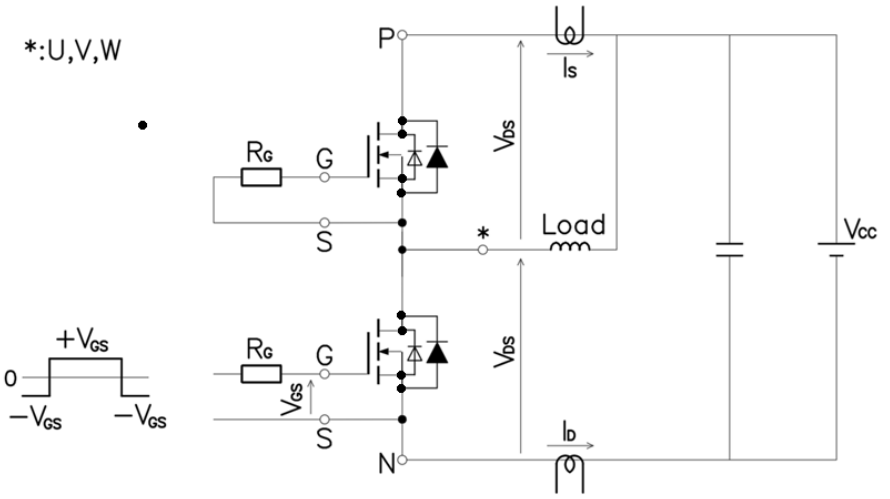


Figure 3. Switching time measure circuit

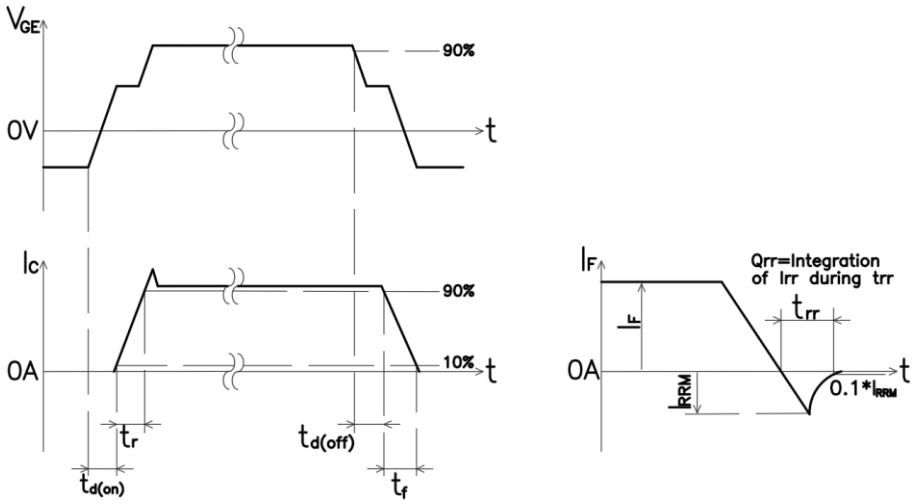


Figure 4. Switching time definition

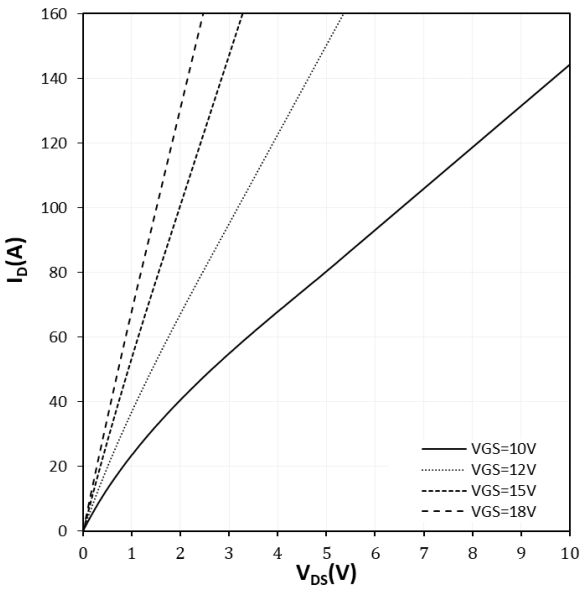


Figure 5. I_{DS} vs V_{DS}
T_j =25°C

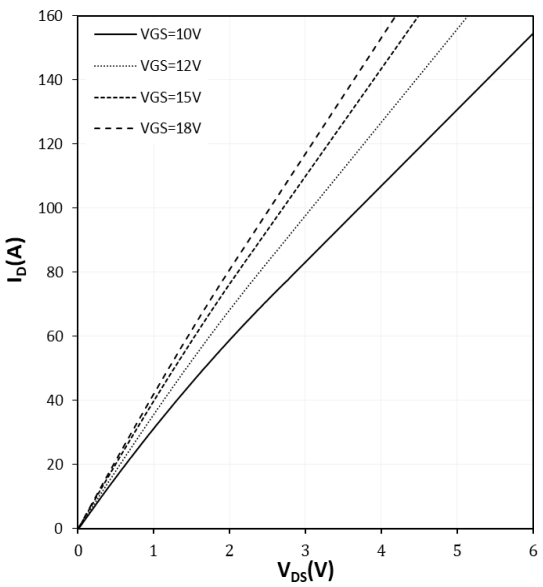


Figure 6. I_{DS} vs V_{DS}
T_j =175°C

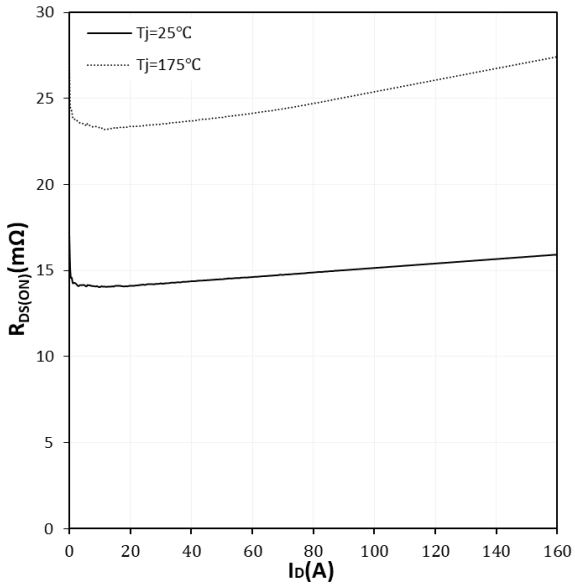


Figure 7.$R_{DS(ON)}$ vs I_{DS}
V_{GS}=+18V

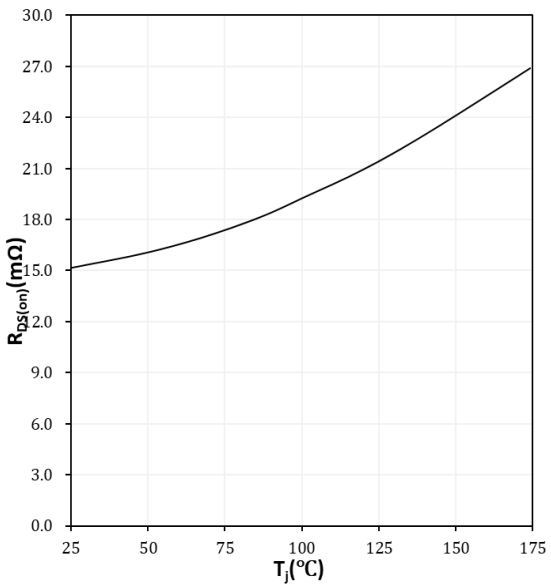


Figure 8.$R_{DS(ON)}$ vs T_j
I_{DS}=80A

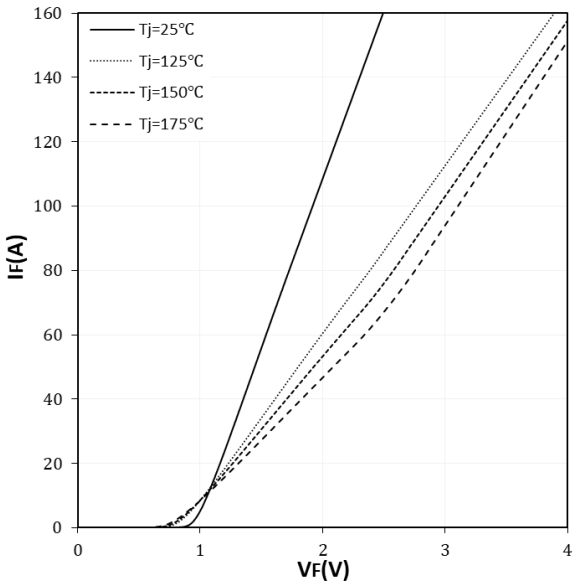


Figure 9. I_F vs V_F
V_{GS}=-4V

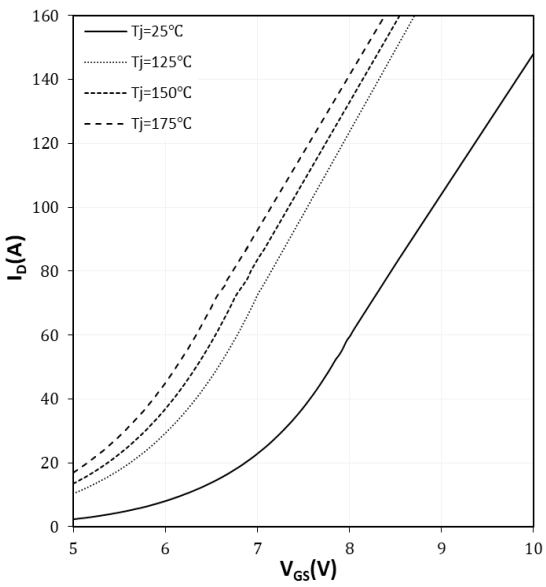


Figure 10. I_D VS V_{GS}
V_{DS}=20V

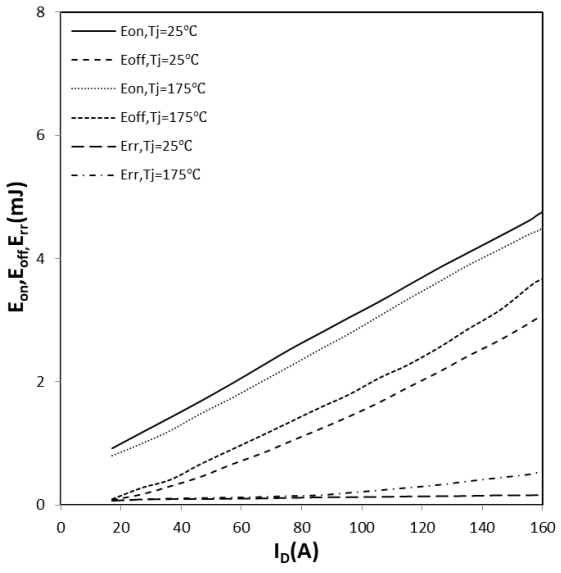


Figure 11
Typical Switching Energy vs. Drain Current
V_{DS}=800V,V_{GS}=+18/-4V,$R_{G(on)}$=8.2Ω,$R_{G\ (off)}$ =12Ω

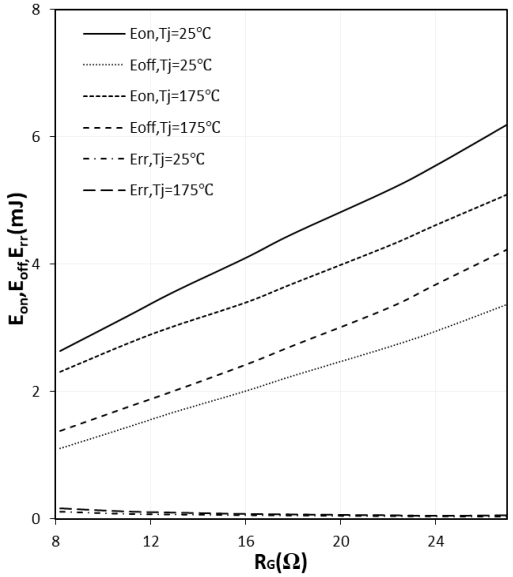


Figure 12
Typical Switching Energy vs. External Gate Resistance
V_{DS}=800V,V_{GS}=+18/-4V, I_D=80A

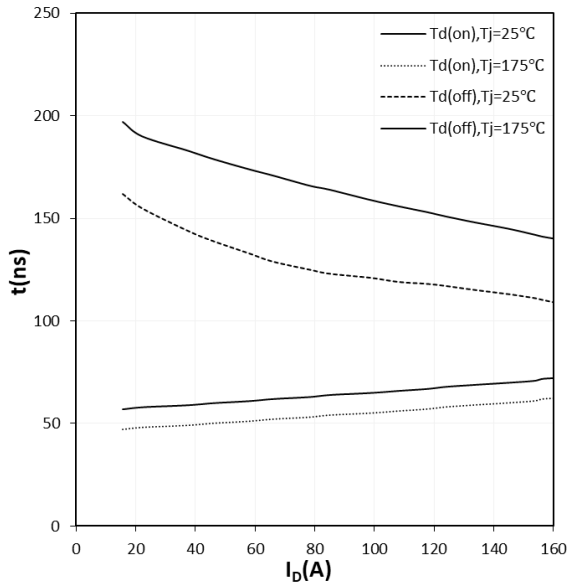


Figure 13
Typical Switching Time vs. Drain Current
V_{DS}=800V,V_{GS}=+18/-4V,$R_{G(on)}$=8.2Ω,$R_{G\ (off)}$ =12Ω

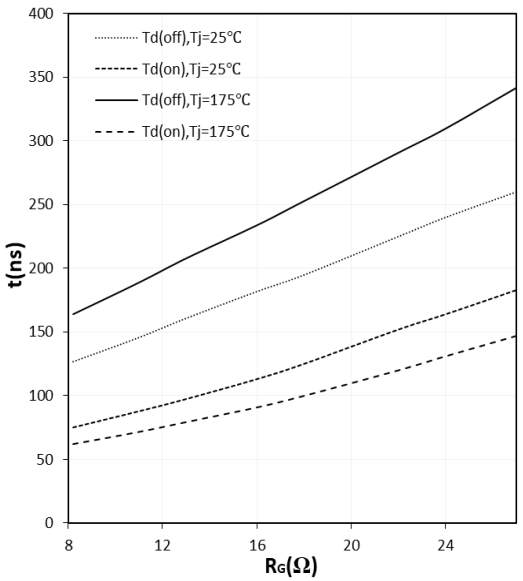


Figure 14
Typical Switching Time vs External Gate Resistance
V_{DS}=800V,V_{GS}=+18/-4V, I_D=80A

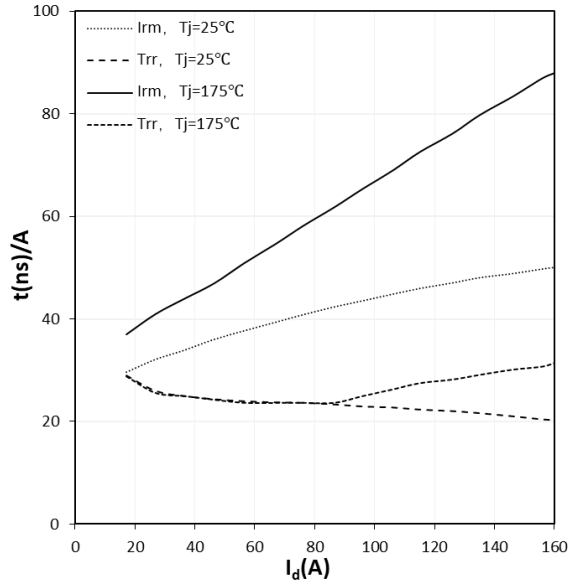


Figure 15
Typical Time and peak current of reverse recovery vs. Drain Current
V_{DS}=800V,V_{GS}=+18/-4V,$R_{G(on)}$=8.2Ω,$R_{G\ (off)}$ =12Ω

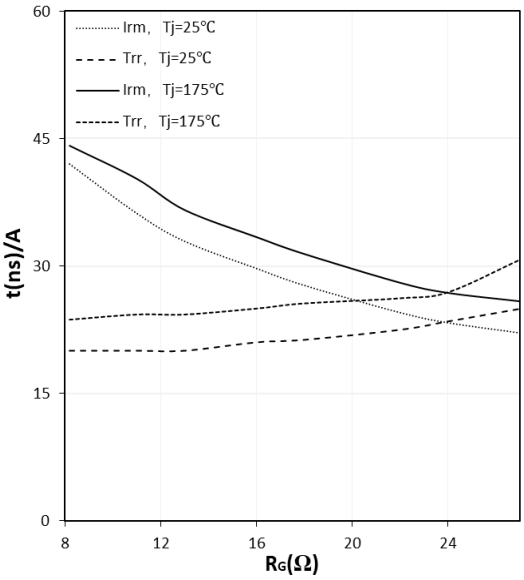
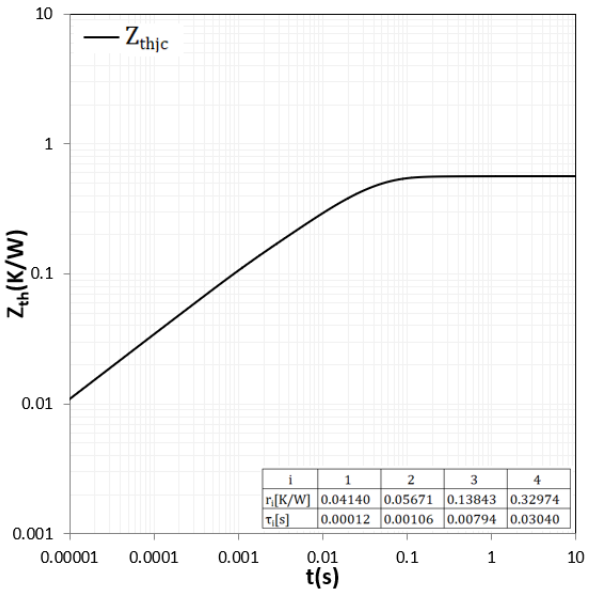
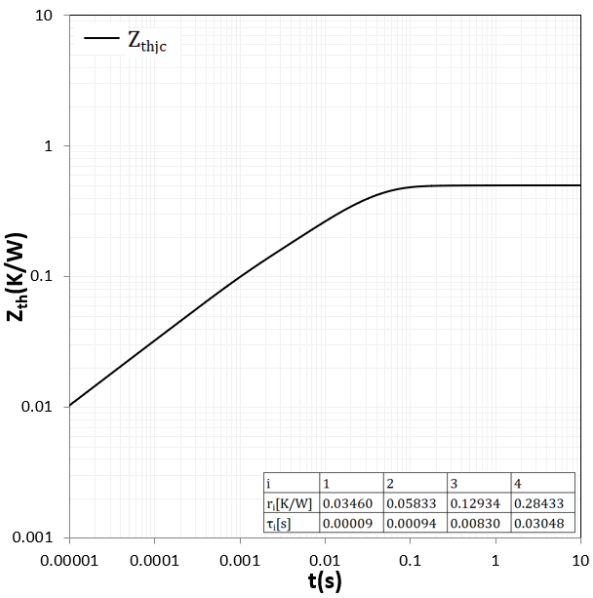


Figure 16
Typical Time and Peak Current of reverse recovery vs. External $R_{G(on)}$
V_{DS}=800V,V_{GS}=+18/-4V, I_D=80A



i	1	2	3	4
r_i[K/W]	0.04140	0.05671	0.13843	0.32974
τ_i[s]	0.00012	0.00106	0.00794	0.03040

Figure 17. Transient themal impedance Zthjc for MOSFET



i	1	2	3	4
r_i[K/W]	0.03460	0.05833	0.12934	0.28433
τ_i[s]	0.00009	0.00094	0.00830	0.03048

Figure 18. Transient themal impedance Zthjc for Diode

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