DFS80FB12EYQ1

1200V/80mΩ 3 Phase SiC MOSFET Module

Description

The DFS80FB12EYQ1 is a 3 Phase SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as DC/DC Converter, Motor converter, UPS, High Frequency Switching application.

Features

- Blocking voltage:1200V
- 80mΩ $R_{ds(on)}$ @ T_j =25°C
- 25A @ T_f =65°C
- Low Switching Losses
- 175°C maximum junction temperature
- Thermistor inside

Applications

- DC/DC converter
- Motor converter
- Uninterruptible Power Supplier
- High Frequency Switching application

Circuit diagram

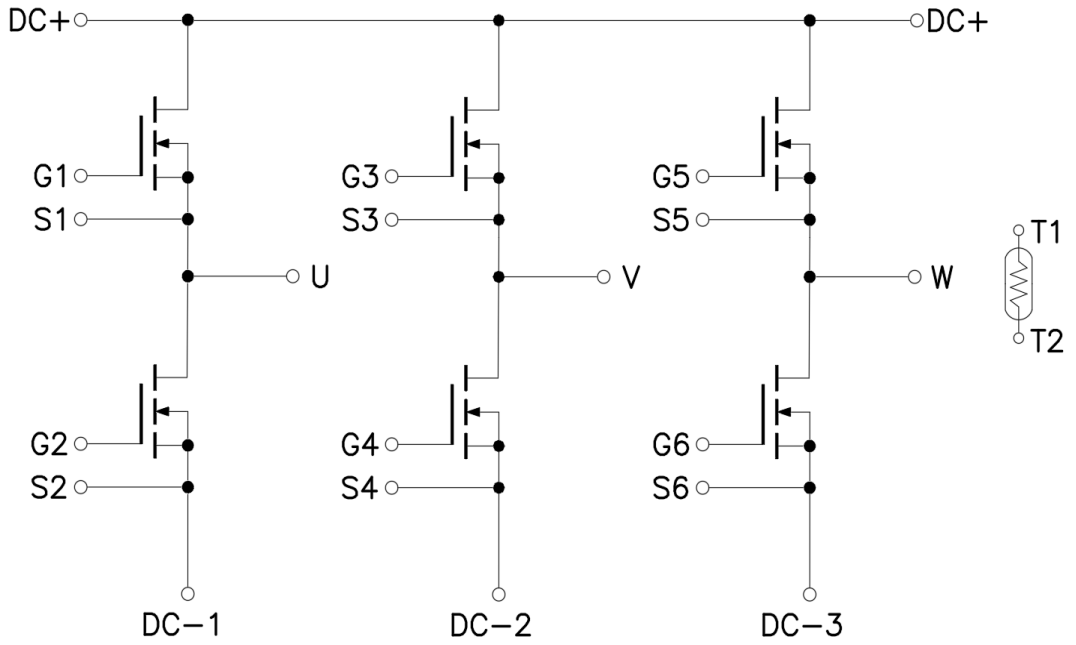


Figure 1. Out drawing & circuit diagram for DFS80FB12EYQ1

Pin Configuration and Marking Information

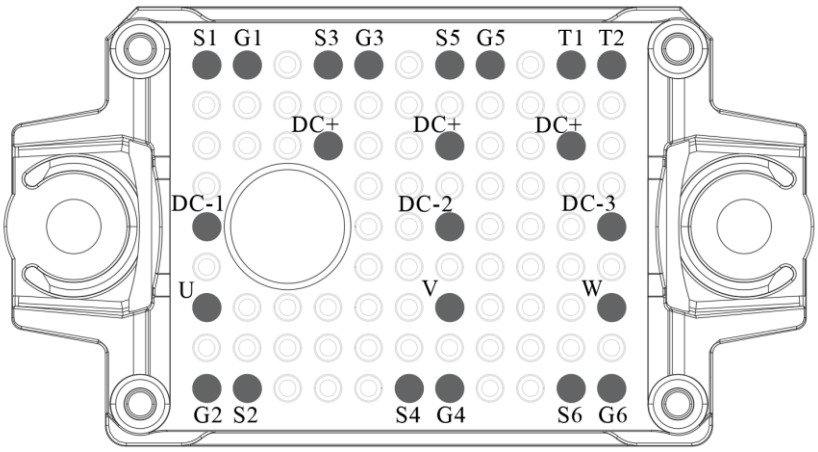


Figure 2. Pin configuration

Symbol	Description
U,V,W	Output terminal of 3 Phase
S2,S4,S6	Low side source signal terminal
G2,G4,G6	Low side gate signal terminal
DC+(3Pin)	DC+ Bus connection
DC–1,2,3	DC– Bus connection
S1,S3,S5	High side source signal terminal
G1,G3,G5	High side gate signal terminal
T1	Thermistor connection 1
T2	Thermistor connection 2

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	3.4	kV
Clearance	Terminal to Terminal	5	mm
	Terminal to Heatsink	10	mm
Creepage distance	Terminal to Terminal	6.3	mm
	Terminal to Heatsink	12.7	mm
Comparative Tracking Index	-	400	-
Weight	-	24	g

Maximum Ratings (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-Source Voltage(+)	D-S Short	20	V
V_{GSS}	Gate-Source Voltage(-)	D-S Short	-5	V
$V_{GSSSurge}$	G-S Voltage(t_{surge}<300nsec)	D-S Short, Note1	-10 to 25	V
I_{DS}	DC Continuous Drain Current	T_f =65°C, Note2	25	A
I_{SD}	Source (Body Diode) Current	T_f =65°C, with ON signal	25	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note3	50	A
T_j	junction temperature	-	-40 to 175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +20V/-5V; +18V/-5V; +15V/-4V

Note2: Case temperature(Tc) is defined on the surface of AMB substrate bottom just under the chips

Note3: Pulse width limited by maximum junction temperature

NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R_{25}	Resistance	T_C =25°C	-	5	-	kΩ
ΔR/R	Deviation of R100	T_C =100°C, R_{100} =493Ω	5	-	5	%
P_{25}	Power dissipation	T_C =25°C	-	-	20	mW
$B_{25/50}$	B-value	R2 =R25 exp [$B_{25/50}$(1/T2 - 1/(298,15 K))]	-	3375	-	K
$B_{25/80}$	B-value	R2 =R25 exp [$B_{25/80}$(1/T2 - 1/(298,15 K))]	-	3411	-	K
$B_{25/100}$	B-value	R2 =R25 exp [$B_{25/100}$(1/T2 - 1/(298,15 K))]	-	3433	-	K

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=1mA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1200V, V_{GS}=0V		-	-	80	μA
$V_{GS(th)}$	Gate-Source threshold Voltage	I_D=10mA, V_{DS}=V_{GS}		2.0	2.8	4.0	V
I_{GSS+}	Gate-Source Leakage Current	V_{GS}=20V, V_{DS}=0V, T_j=25°C		-	-	100	nA
I_{GSS-}		V_{GS}=-5V, V_{DS}=0V, T_j=25°C		-100	-	-	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=25A, V_{GS}=+20V	T_j=25°C	-	80	100	mΩ
			T_j=175°C	-	149	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D=25A, V_{GS}=+20V	T_j=25°C	-	2.0	2.5	V
			T_j=175°C	-	3.73	-	V
C_{iss}	Input Capacitance	V_{DS}=1000V, V_{GS}=0V, f=200kHz		-	1436	-	pF
C_{oss}	Output Capacitance			-	62	-	pF
C_{rss}	Reverse transfer Capacitance			-	3	-	pF
Q_G	Total gate charge	V_{DD}=800V, I_D=20A, V_{GS}=+20/-4V		-	58	-	nC
R_{Gint}	Internal Gate Resistance	T_j=25°C		-	3.0	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD}=600V, I_D=25A, V_{GS}=+15/-4V, R_G=10Ω, Inductive load switching operation	T_j=25°C	-	21	-	ns
			T_j=150°C	-	20	-	
t_r	Rise time		T_j=25°C	-	9	-	ns
			T_j=150°C	-	8	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	29	-	ns
			T_j=150°C	-	33	-	
t_f	Fall time		T_j=25°C	-	15	-	ns
			T_j=150°C	-	14	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	0.15	-	mJ
			T_j=150°C	-	0.22	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	0.055	-	mJ
			T_j=150°C	-	0.04	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case/MOSFET		-	1.03	-	K/W
$R_{th(c-f)}$	Contact thermal resistance	With thermal conductive grease /MOSFET		-	0.15	-	K/W

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

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	V_{GS} =-4V I_{SD} =25A	T_j=25°C	-	4.5	-	V
			T_j=175°C	-	4.0	-	
T_{rr}	Reverse recovery time	V_{DD}=600V I_D=25A V_{GS}=+15/-4V R_G=10Ω Inductive load switching operation	T_j=25°C	-	27	-	ns
			T_j=150°C	-	28	-	
Q_{rr}	Reverse recovery charge		T_j=25°C	-	0.33	-	μC
			T_j=150°C	-	0.89	-	
E_{rr}	Diode switching power dissipation		T_j=25°C	-	0.17	-	mJ
			T_j=150°C	-	0.49	-	

Test Conditions

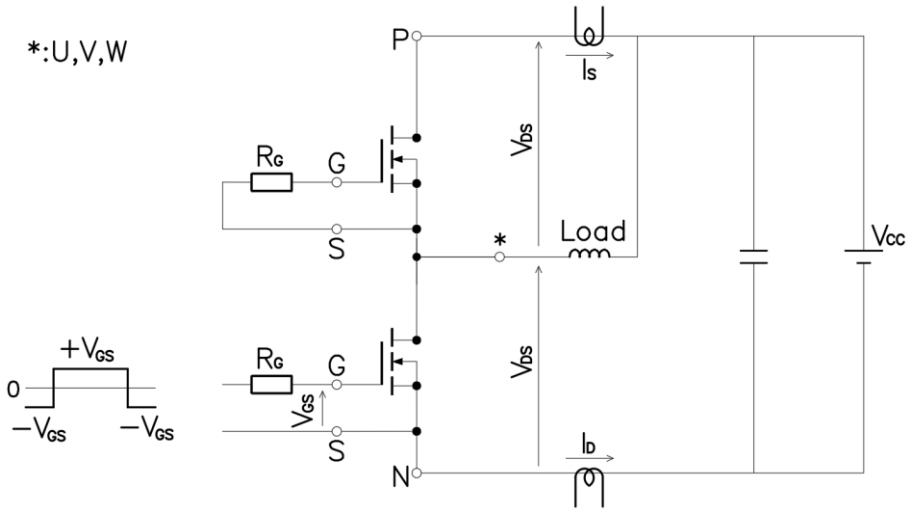


Figure 3. Switching time measure circuit

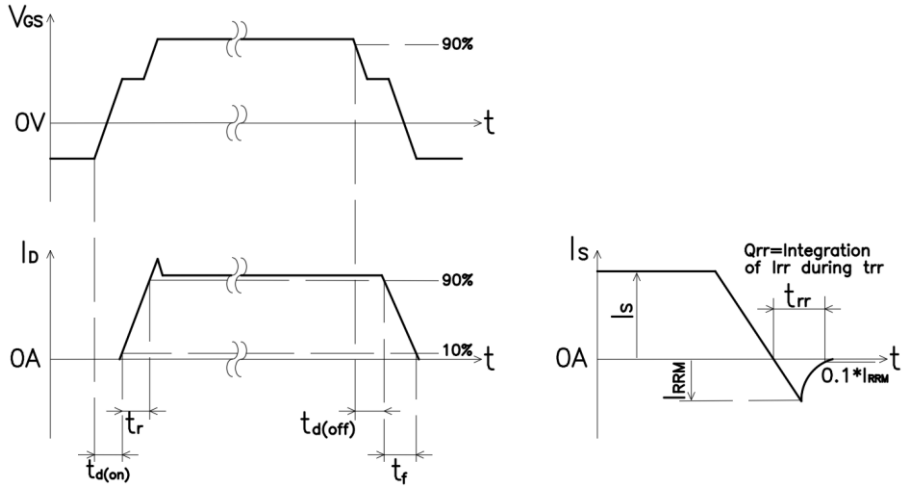


Figure 4. Switching time definition

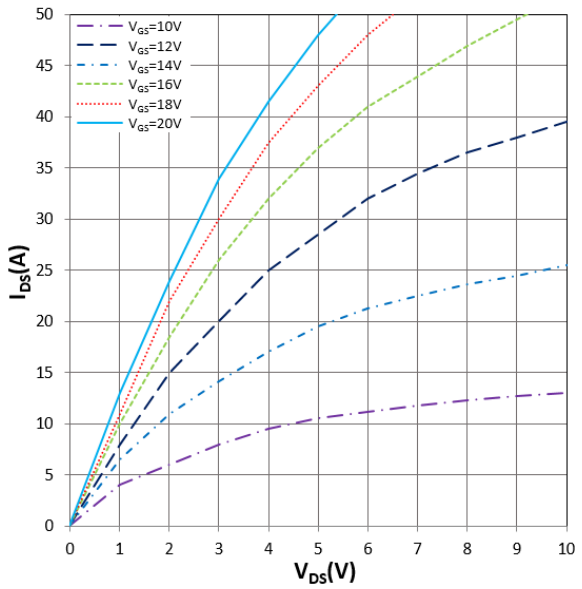


Figure 5. I_{DS} vs V_{DS}
T_j =25°C, V_{GS} parameter

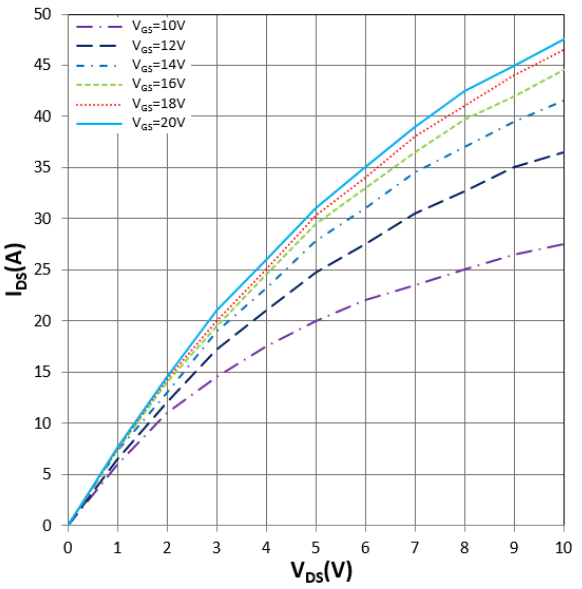


Figure 6. I_{DS} vs V_{DS}
T_j =175°C, V_{GS} parameter

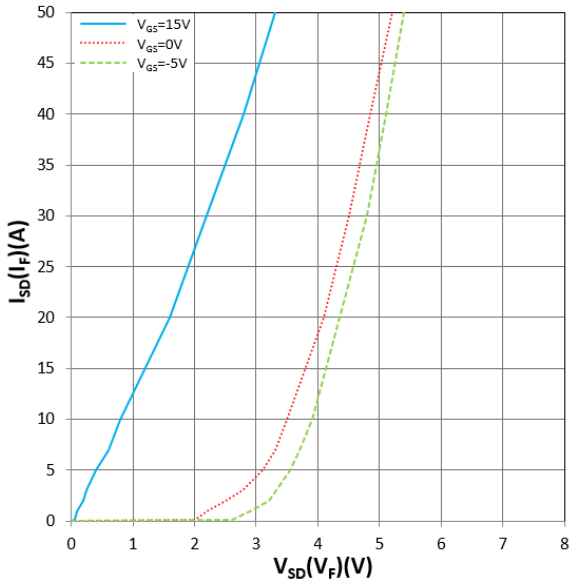


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
T_j =25°C, V_{GS} parameter

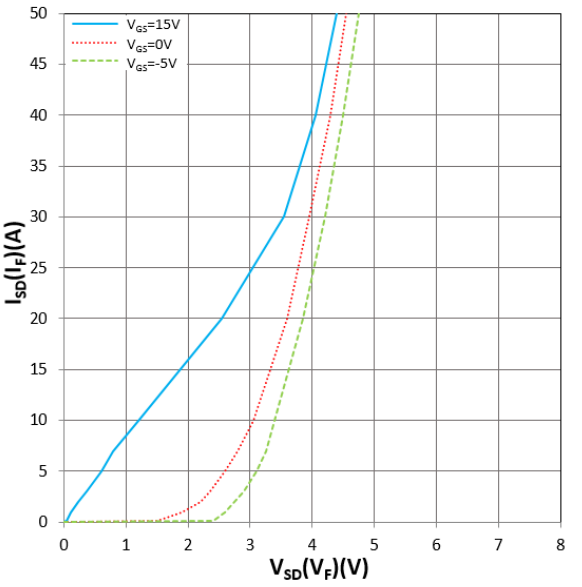


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
T_j =175°C, V_{GS} parameter

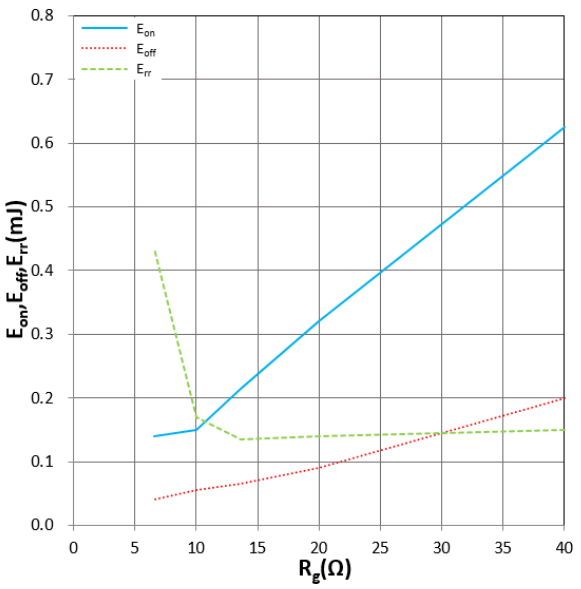


Figure 8. E_{on}, E_{off}, E_{rr} vs R_G
T_j =25°C, I_D =25A, V_{GS} =+15/-4V

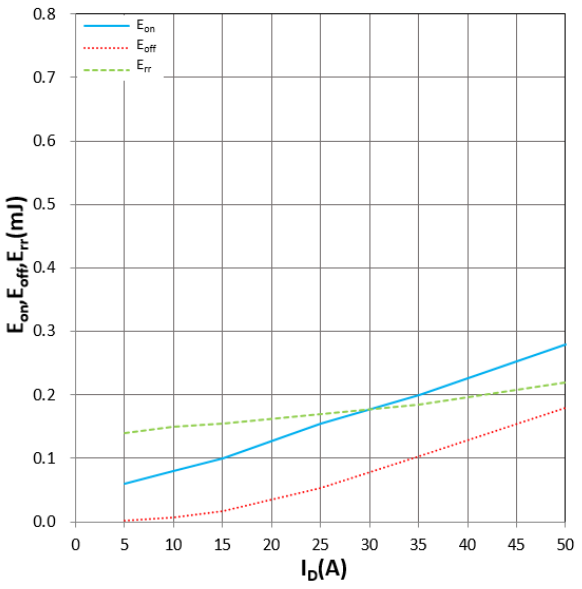


Figure 9. E_{on}, E_{off}, E_{rr} vs I_D
T_j =25°C, R_G =10Ω, V_{GS} =+15/-4V

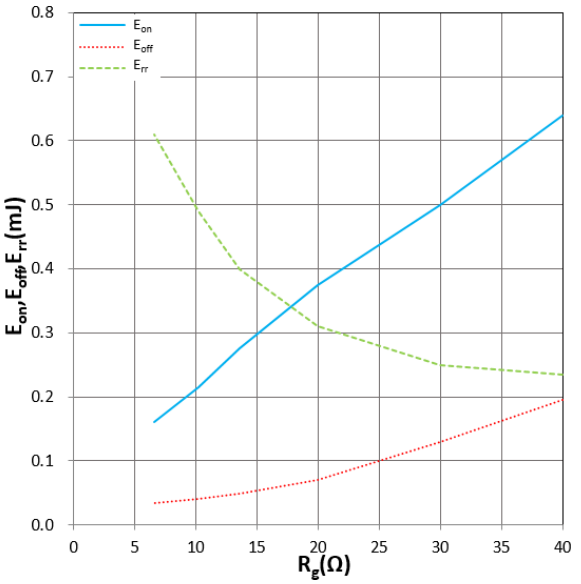


Figure 10. E_{on}, E_{off}, E_{rr} vs R_G
T_j =150°C, I_D =25A, V_{GS} =+15/-4V

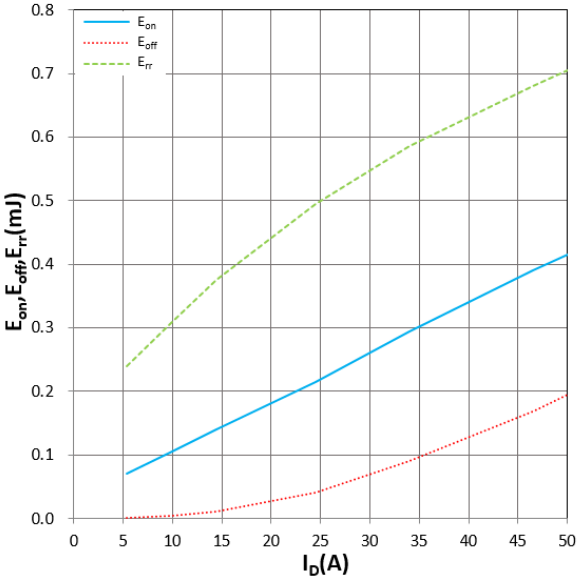


Figure 11. E_{on}, E_{off}, E_{rr} vs I_D
T_j =150°C, R_G =10Ω, V_{GS} =+15/-4V

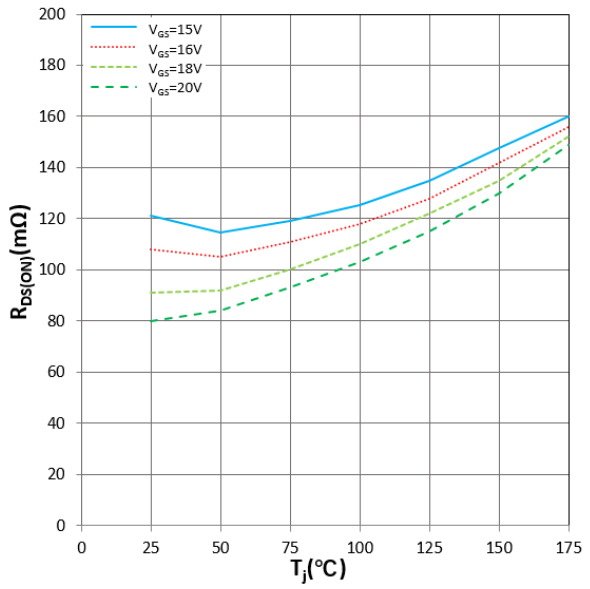


Figure 12. $R_{DS(ON)}$ vs T_j
I_D =25A

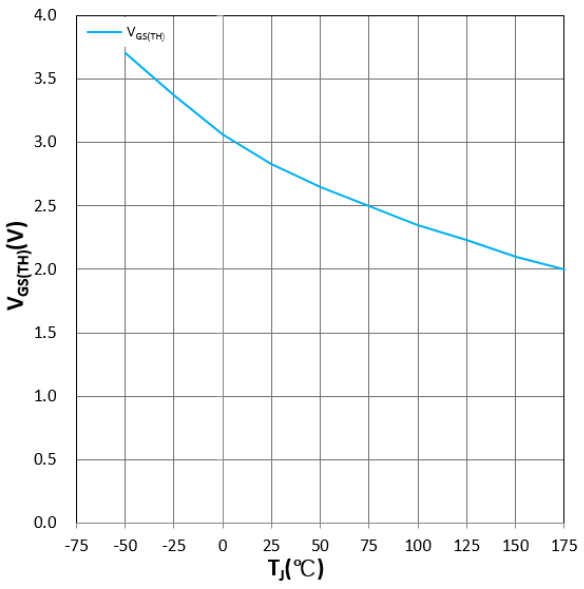


Figure 13. $V_{GS(TH)}$ vs T_j
V_{DS} =V_{GS}, I_{DS} =10mA

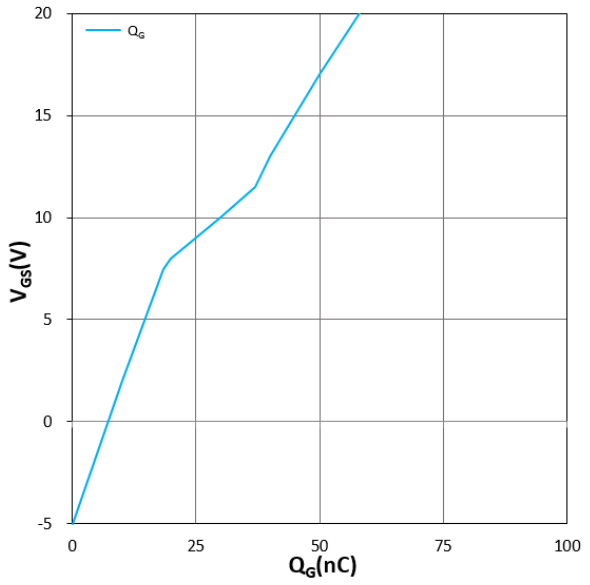


Figure 14. V_{GS} vs Q_G
V_{DD} =800V, I_D =20A

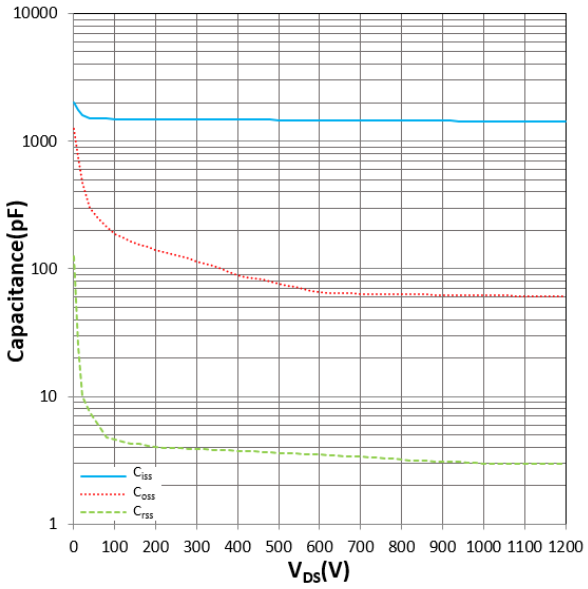
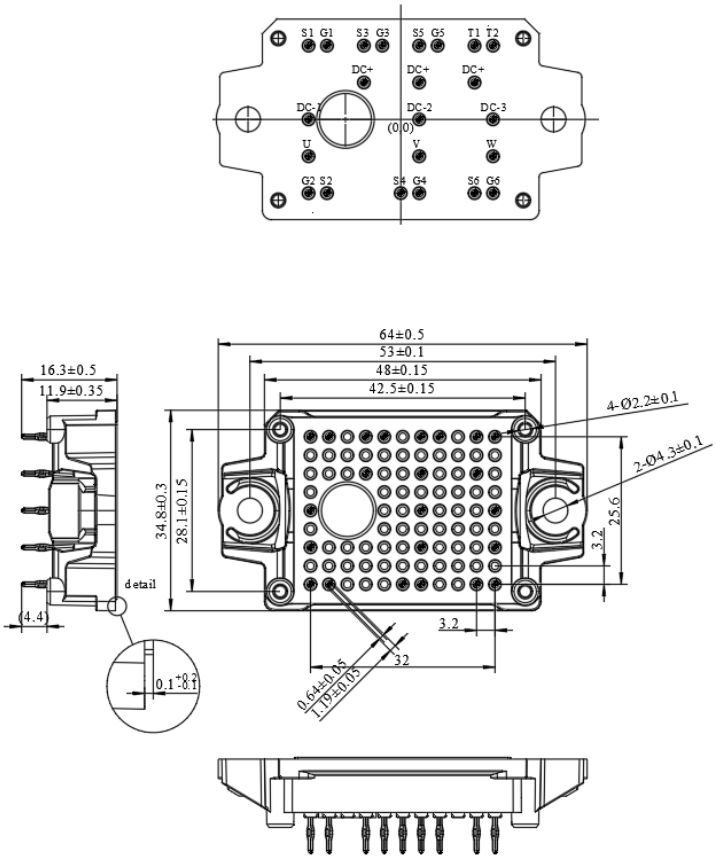


Figure 15. C_{iss}, C_{oss}, C_{rss} vs V_{DS}
T_j =25°C

Package dimensions



Pin table		
Pin	X	Y
T2	16	12.8
T1	12.8	12.8
G5	6.4	12.8
S5	3.2	12.8
G3	-3.2	12.8
S3	-6.4	12.8
G1	-12.8	12.8
S1	-16	12.8
DC+	12.8	6.4
DC+	3.2	6.4
DC+	-6.4	6.4
DC-3	16	0
DC-2	3.2	0
DC-1	-16	0
W	16	-6.4
V	3.2	-6.4
U	-16	-6.4
G6	16	-12.8
S6	12.8	-12.8
G4	3.2	-12.8
S4	0	-12.8
S2	-12.8	-12.8
G2	-16	-12.8

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