DFS26CUCL12EYQ1

1200V/26mΩ Chopper SiC MOSFET Module

Description

The DFS26CUCL12EYQ1 is a Chopper SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Solar Inverter, UPS, Fuel cell-DC/DC converter, Energy storage Systems.

Features

- Blocking voltage:1200V
- 26mΩ $R_{ds(on)}$@T_j =25°C
- 50mΩ $R_{ds(on)}$@T_j =175°C
- Low thermal resistance with Si_3N_4 AMB
- Low Switching Losses
- 175°C maximum junction temperature
- Thermistor inside

Applications

- Solar Inverter
- UPS
- Fuel cell-DC/DC converter
- Energy Storage Systems

Circuit diagram

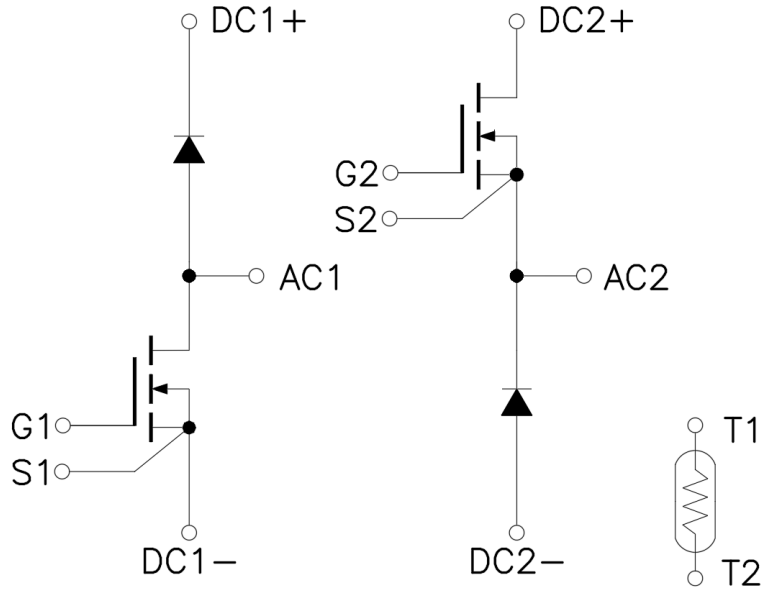


Figure 1. Out drawing & circuit diagram for DFS26CUCL12EYQ1

Pin Configuration and Marking Information

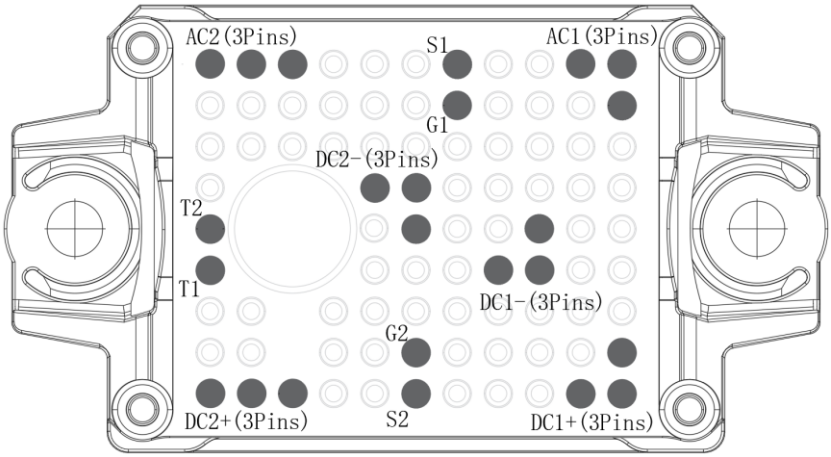


Figure 2. Pin configuration

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	-	600	-

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

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=80°C	70	A
I_{DS}	DC Continuous Drain Current	T_f=65°C	75	A
I_{DSM}	Pulse Drain Current	Less than 1ms, Note2	150	A
I_F	Forward Current (Diode)	T_f=110°C, with ON signal	75	A
I_{FRM}	Pulse Forward Current (Diode)	Less than 1ms, Note2	150	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: Pulse width limited by maximum junction temperature

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{BR}	Breakdown Voltage	I_R=3mA		1200	-	-	V
I_R	Reverse Leakage Current	V_R=1200V	T_j=25°C	-	9	120	uA
			T_j=175°C	-	290	-	uA
V_F	Diode Forward Voltage	I_F=75A, V_{GE}=0V	T_j=25°C	-	1.55	1.8	V
			T_j=175°C	-	2.3	2.95	
Q_C	Total capacitive charge	V_R=800V	T_j=25°C	-	330	-	nC
C	Total capacitance	V_R=1V, f=1MHz	T_j=25°C	-	3715	-	pF
		V_R=400V, f=1MHz	T_j=25°C	-	312	-	
		V_R=800V, f=1MHz	T_j=25°C	-	225	-	
t_{rr}	Reverse recovery time	V_{CC}=600V, I_C=75A, V_{GE}=+15V/-4V, R_G=3.3Ω	T_j=25°C	-	0.010	-	us
			T_j=150°C	-	0.014	-	
Err	Diode switching power dissipation		T_j=25°C	-	36	-	uJ
			T_j=150°C	-	140	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)			-	0.21	-	°C/W
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied), Note1			-	0.15	-	°C/W

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

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=3mA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1200V, V_{GS}=0V		-	-	240	μA
$V_{GS(th)}$	Gate-Source threshold Voltage	I_D=30mA, 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		-	-	300	nA
I_{GSS-}		V_{GS}=-5V, V_{DS}=0V, T_j=25°C		-300	-	-	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=75A, V_{GS}=+20V	T_j=25°C	-	26	33	mΩ
			T_j=175°C	-	50	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D=75A, V_{GS}=+20V	T_j=25°C	-	2.0	2.5	V
			T_j=175°C	-	3.7	-	V
V_{SD}	Body Diode Forward Voltage	V_{GS}=-4V, I_{SD}=75A	T_j=25°C	-	4.5	-	V
			T_j=175°C	-	4.0	-	
C_{iss}	Input Capacitance	V_{DS}=1000V, V_{GS}=0V, f=200kHz		-	4308	-	pF
C_{oss}	Output Capacitance			-	186	-	pF
C_{rss}	Reverse transfer Capacitance			-	9	-	pF
Q_G	Total gate charge	V_{DD}=800V, I_D=75A, V_{GS}=+20/-4V		-	159	-	nC
R_{Gint}	Internal Gate Resistance	T_j=25°C		-	1.0	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{CC}=600V, I_D=75A, V_{GS}=+15/-4V, R_G=3.3Ω, Inductive load switching operation	T_j=25°C	-	20	-	ns
			T_j=150°C	-	19	-	
t_r	Rise time		T_j=25°C	-	10	-	ns
			T_j=150°C	-	8	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	27	-	ns
			T_j=150°C	-	33	-	
t_f	Fall time		T_j=25°C	-	14	-	ns
			T_j=150°C	-	14	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	0.45	-	mJ
			T_j=150°C	-	0.65	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	0.17	-	mJ
			T_j=150°C	-	0.12	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case/MOSFET		-	0.24	-	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.

Test Conditions

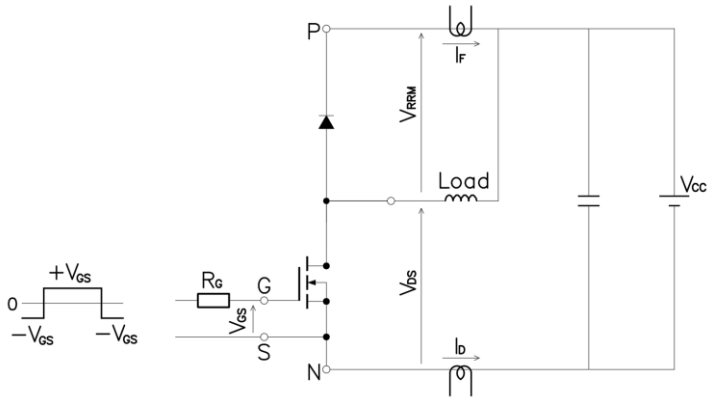


Figure 3. Switching time measure circuit

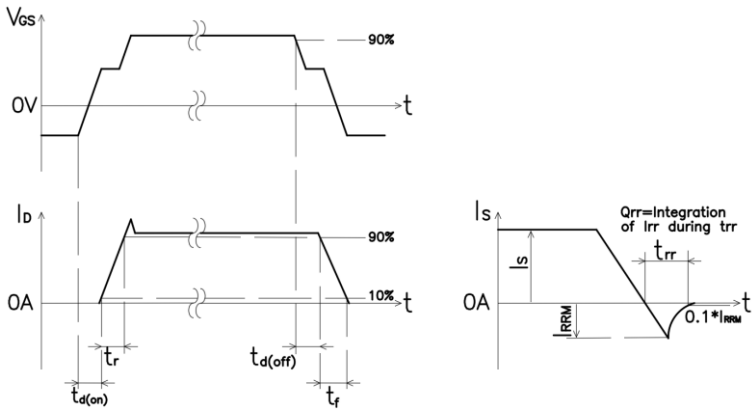


Figure 4. Switching time definition

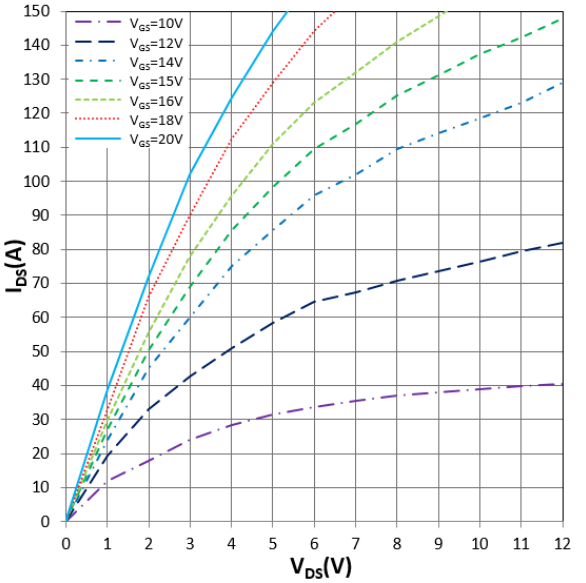


Figure 5. I_{DS} vs V_{DS}
T_j =25°C, V_{GS} parameter

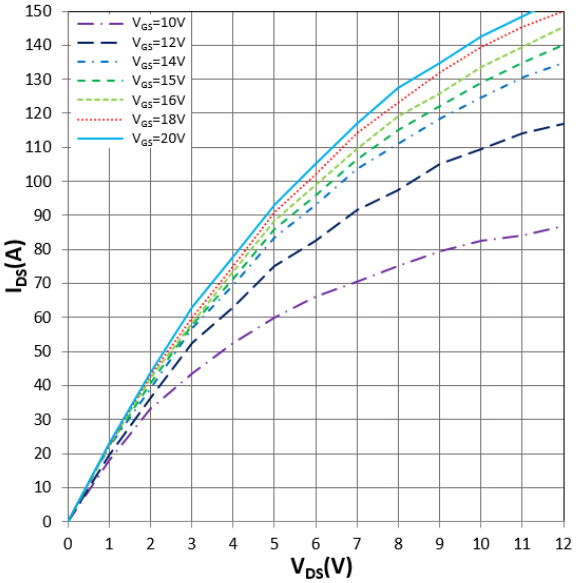


Figure 6. I_{DS} vs V_{DS}
T_j =175°C, V_{GS} parameter

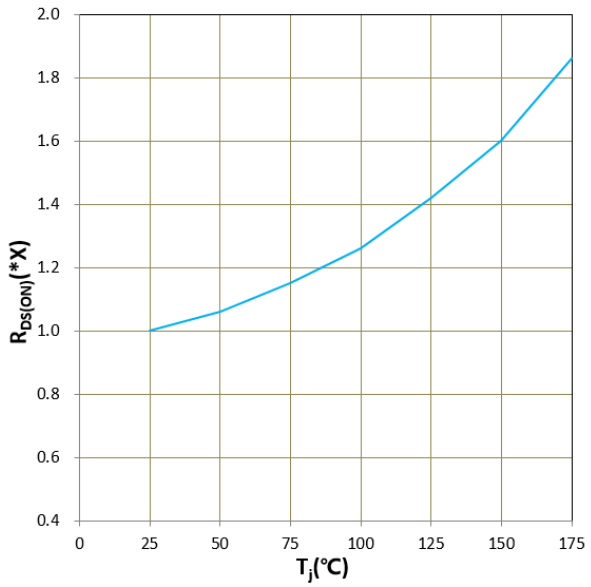


Figure 7. $R_{DS(ON)}$ vs T_j
V_{GS} =+20V, I_D =75A, 1.0X =26mΩ

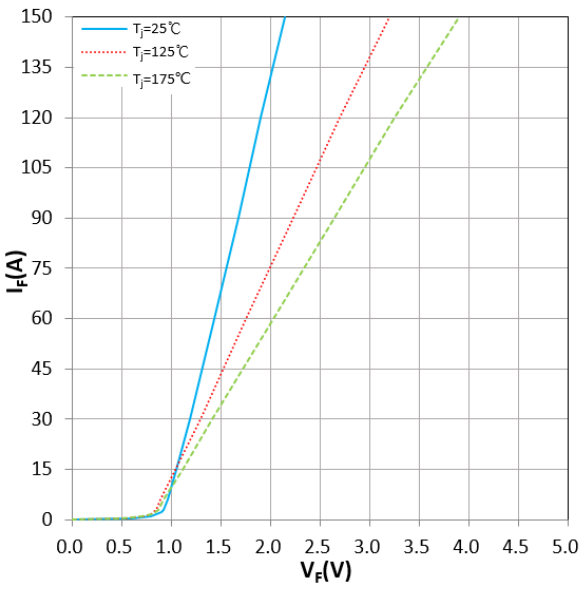


Figure 8. I_F vs V_F
T_j parameter

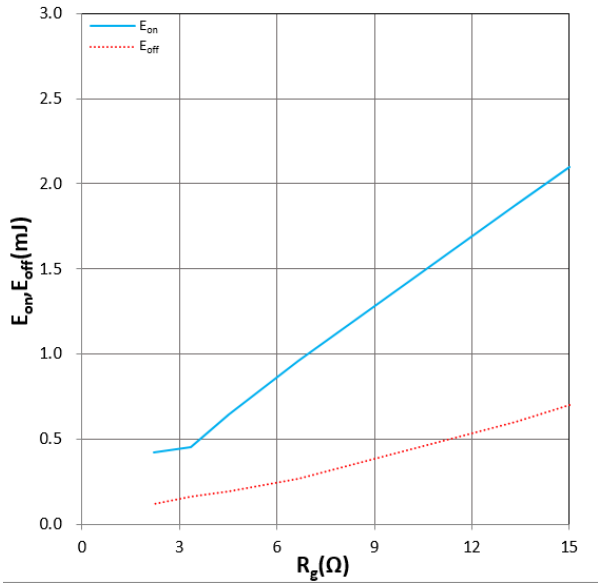


Figure 9. E_{on}, E_{off} vs R_G
V_{CC} =600V, T_j =25°C, I_D =75A, V_{GS} =+15/-4V

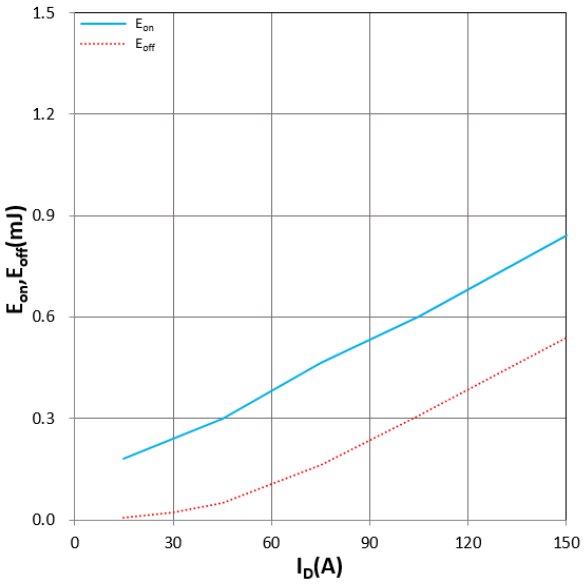


Figure 10. E_{on}, E_{off} vs I_D
V_{CC} =600V, T_j =25°C, R_G =3.3Ω, V_{GS} =+15/-4V

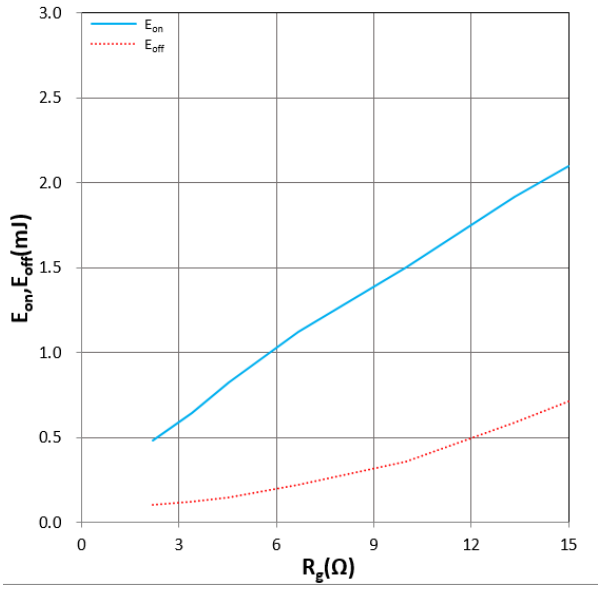


Figure 11. E_{on}, E_{off} vs R_G
V_{CC} =600V, T_j =150°C, I_D =75A, V_{GS} =+15/-4V

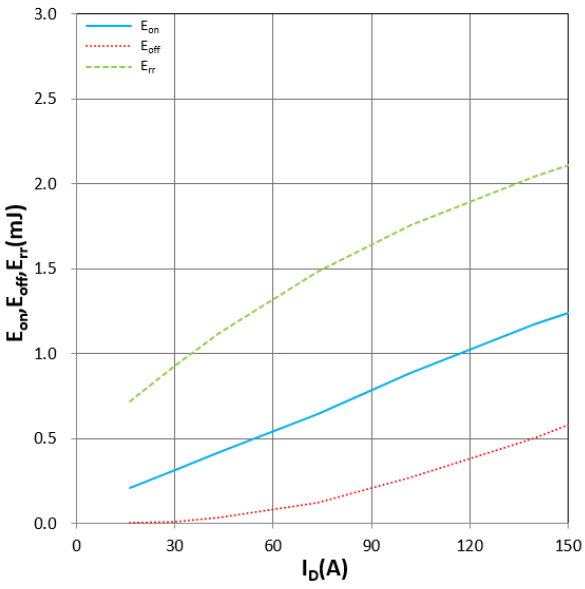


Figure 12. E_{on}, E_{off} vs I_D
V_{CC} =600V, T_j =150°C, R_G =3.3Ω, V_{GS} =+15/-4V

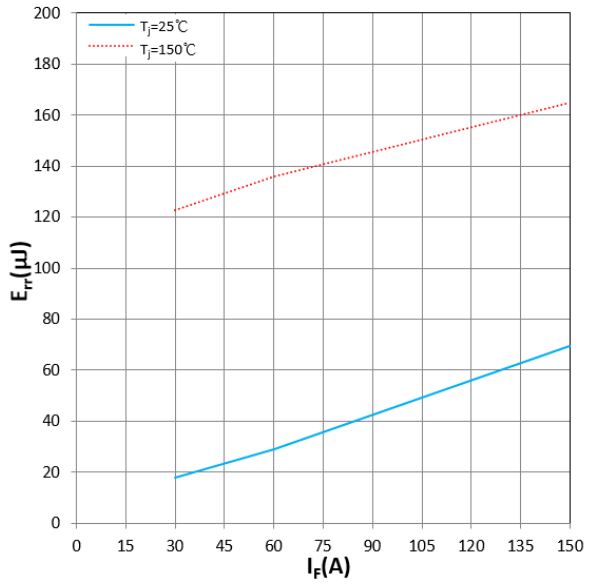


Figure 13. E_{rr} vs I_F
V_{CC} =600V, T_j =150°C, R_G =3.3Ω, V_{GS} =+15/-4V

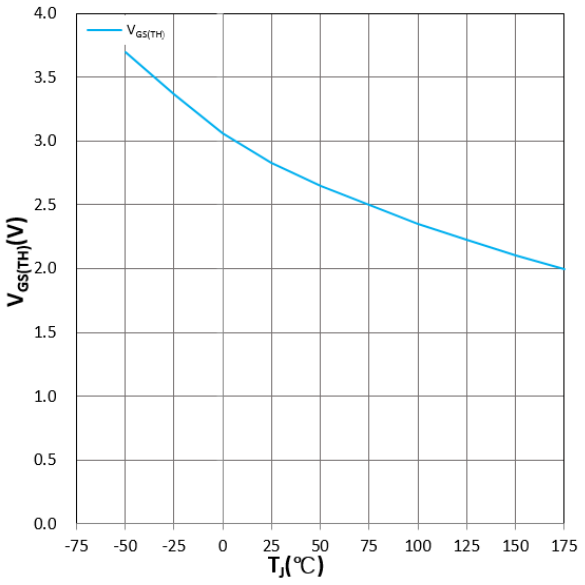


Figure 14. $V_{GS(TH)}$ vs T_J
V_{DS} =V_{GS}, I_{DS} =30mA

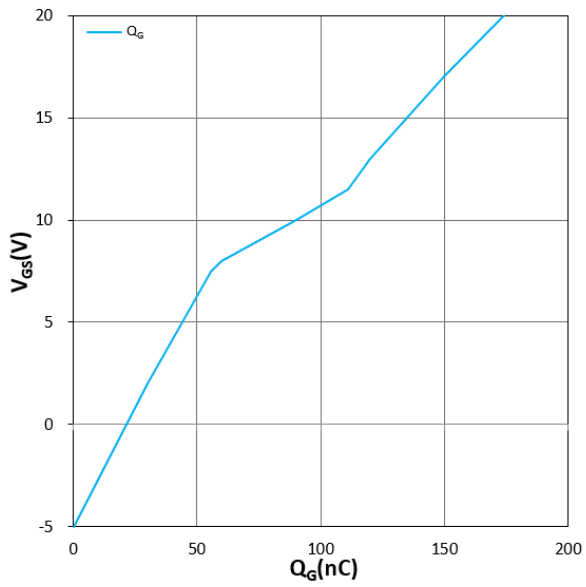


Figure 15. V_{GS} vs Q_G
V_{DD} =800V, I_D =75A

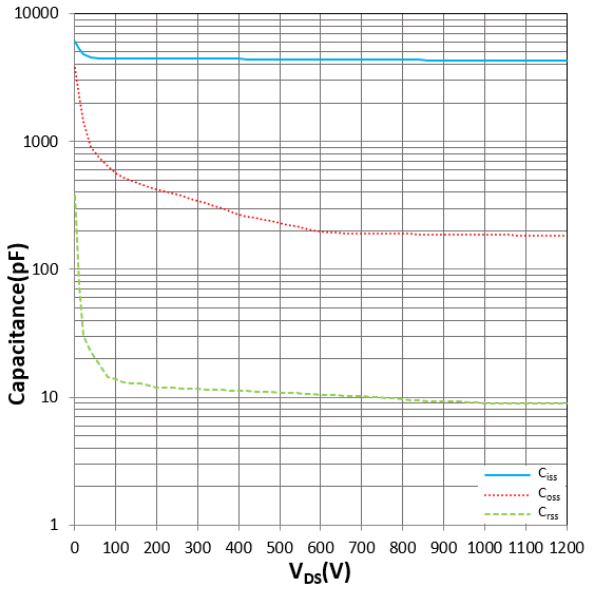
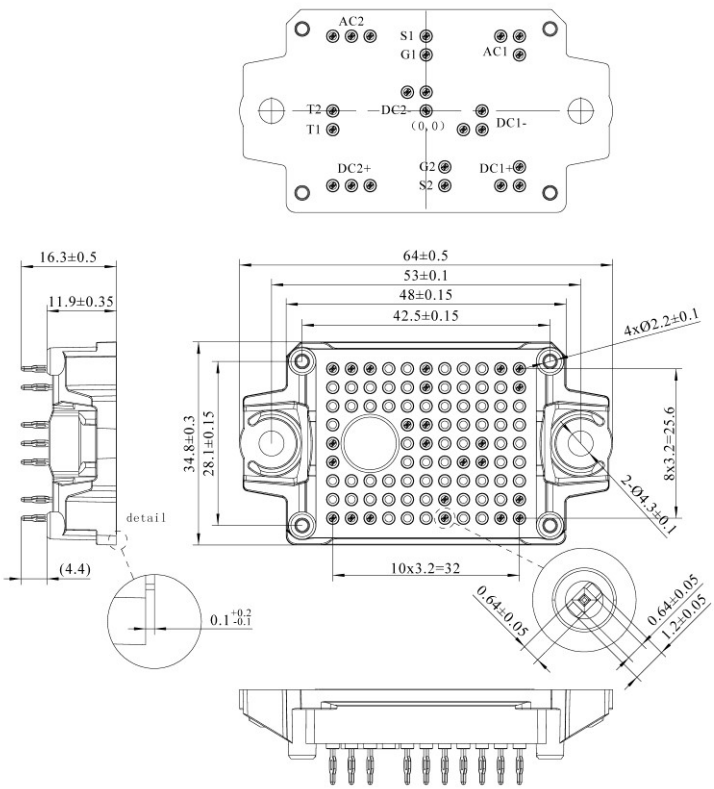


Figure 16. C_{iss}, C_{oss}, C_{rss} vs V_{DS}
T_j =25°C

Package dimensions



Pin table			
Pin		X	Y
DC1+	1	12.8	-12.8
	2	16	-12.8
	3	16	-9.6
DC1-	1	9.6	-3.2
	2	6.4	-3.2
	3	9.6	0
AC1	1	16	9.6
	2	12.8	12.8
	3	16	12.8
DC2+	1	-16	-12.8
	2	-12.8	-12.8
	3	-9.6	-12.8
DC2-	1	-3.2	3.2
	2	0	3.2
	3	0	0
AC2	1	-16	12.8
	2	-12.8	12.8
	3	-9.6	12.8
S1		0	12.8
G1		0	9.6
T1		-16	-3.2
S2		3.2	-12.8
G2		3.2	-9.6
T2		-16	0

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