DFH100FB12P3H1

1200V/100A 6 Units SiC Hybrid Module

Description

The DFH100FB12P3H1 offer lower losses and higher energy for application such as motor drive、inverter and soft switching applications.

Features

- 1200V100 A,V_{CE}(sat)(typ.) =1.40V
- Lower losses and higher energy
- Excellent short-circuit capability
- Zero Reverse Recovery from SiC Diodes

Applications

- Motor drive
- Inverter
- Welding machines
- UPS

Circuit diagram

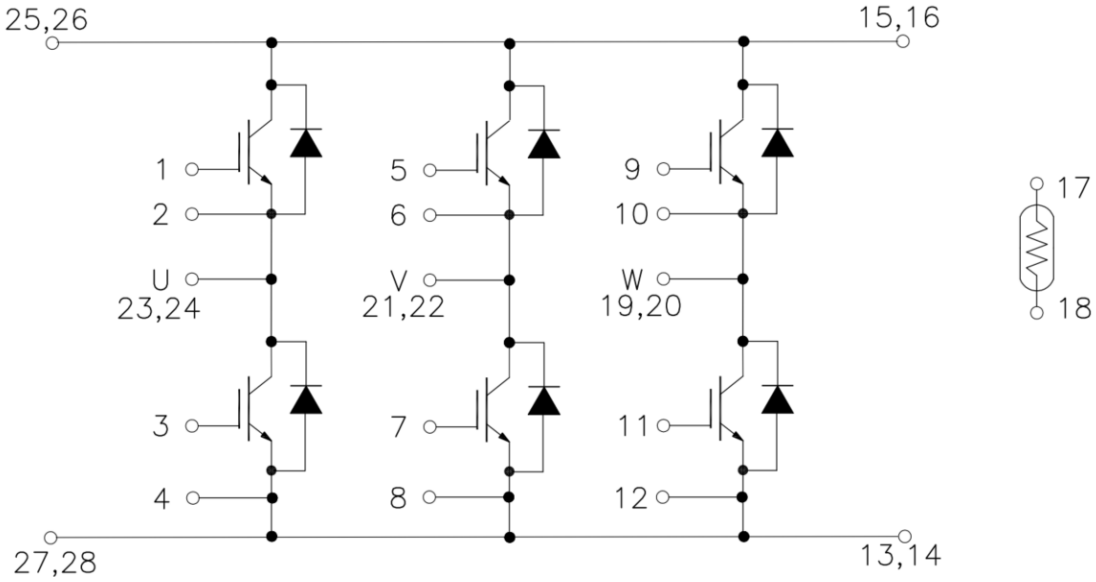

Figure 1. Out drawing & circuit diagram for DFH100FB12P3H1

Pin Configuration and Marking Information

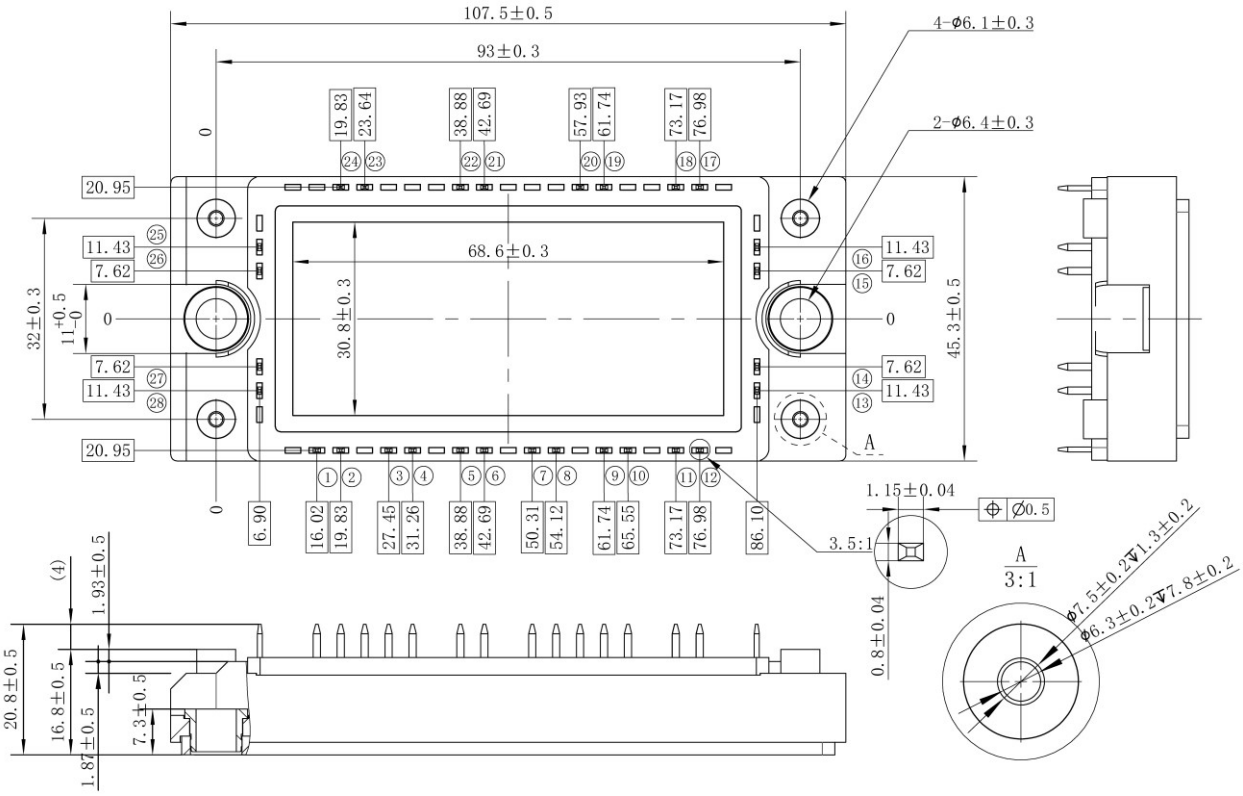

Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f = 50Hz, t =1min	2.5	KV
CTI	-	>200	-
Module lead resistance, terminals – chip	T_C =25°C	0.8	mΩ
Mounting torque for module mounting	M5	3.5	Nm
Weight	-	175	g

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

Symbol	Parameter	Conditions	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	G-E Short	1200	V
V_{GES}	Gate-Emitter Voltage	C-E Short	±20V	V
I_C	DC Continuous Collector Current	T_C=120°C, T_{vjop}=150°C(IGBT)	100	A
I_{CM}	Pulse Collector Current	t_p=1ms, Note1	200	A
P_C	Maximum Power Dissipation	T_C=25°C, T_{vjop}=150°C(IGBT)	625	W
I_F	Diode forward Current	-	100	A
I_{FRM}	Repetitive peak forward Current	t_p=1ms, Note1	200	A
t_{sc}	Short Circuit Withstand Time	V_{GE}=15V, V_{CE}=600V	10	μs
T_{jmax}	Max junction temperature	-	175	°C
T_{vjop}	Operating junction temperature	-	-40 to 150	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: 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

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=100A, V_{GE}=15V	T_j=25°C	-	1.30	-	V
			T_j=125°C	-	1.42	-	V
			T_j=150°C	-	1.45	-	V
			T_j=175°C	-	1.50	-	V
$V_{GE(th)}$	Gate-Emitter threshold Voltage	I_C=5.7mA, V_{CE}=V_{GE}		5.0	5.8	6.5	V
Q_G	Gate charge	V_{GE}= -15V to +15V		-	1728	-	nC
R_{Gint}	Internal gate resistor	-	T_j=25°C	-	2.1	-	Ω
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f=1MHz	T_j=25°C	-	21.6	-	nF
C_{oes}	Output Capacitance			-	0.59	-	nF
C_{res}	Reverse transfer Capacitance			-	0.17	-	nF
I_{CES}	Collector- Emitter Cut off Current	V_{CE}=1200V, V_{GE}=0V	T_j=25°C	-	-	1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=20V, V_{CE}=0V	T_j=25°C	-	-	1	μA
$t_{d(on)}$	Turn-on delay time	V_{CC}=600V, I_C=100A, V_{GE}=+15V/-8V, R_{Gon}= R_{Goff}=4.7Ω, Inductive load	T_j=25°C	-	212	-	ns
			T_j=125°C	-	210	-	
			T_j=150°C	-	209	-	
t_r	Rise time		T_j=25°C	-	22	-	ns
			T_j=125°C	-	33	-	
			T_j=150°C	-	37	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	457	-	ns
			T_j=125°C	-	532	-	
			T_j=150°C	-	549	-	
t_f	Fall time		T_j=25°C	-	216	-	ns
			T_j=125°C	-	348	-	
			T_j=150°C	-	401	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	3.99	-	mJ
			T_j=125°C	-	5.34	-	
			T_j=150°C	-	5.70	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	10.21	-	mJ
			T_j=125°C	-	14.23	-	
			T_j=150°C	-	15.27	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (IGBT)			-	0.20	-	K/W
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied)			-	0.05	-	K/W

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max.	
V_F	Diode Forward Voltage	I_F =100A, V_{GE} =0V	T_j =25°C	-	1.65	-	V
			T_j =125°C	-	2.15	-	
			T_j =150°C	-	2.35	-	
			T_j =175°C	-	2.55	-	
t_{rr}	Diode Reverse Recovery Time	(Switch side) V_{CC} =600V, I_C =100A V_{GE} =+15V/-8V R_{Gon} = R_{Goff} =4.7Ω (SiC SBD side) V_{rr} =600V, I_F =100A V_{GE} =-8V Inductive load switching operation	T_j =25°C		22	-	ns
			T_j =125°C	-	33	-	
			T_j =150°C		32		
Q_{rr}	Recovered charge		T_j=25°C	-	0.597	-	µC
			T_j =125°C	-	0.444	-	
			T_j =150°C	-	0.464	-	
E_{rr}	Reverse recovered energy		T_j =25°C	-	0.195	-	mJ
			T_j =125°C	-	0.114	-	
			T_j =150°C	-	0.104	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (SiC SBD)			-	0.45	-	K/W
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied)			-	0.05	-	K/W

Test Conditions

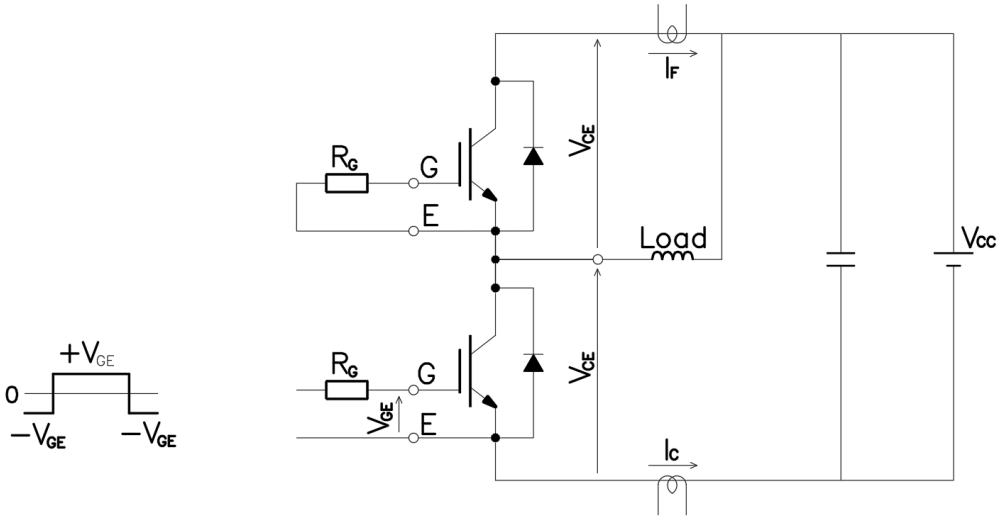

Figure 3. Switching time measure circuit

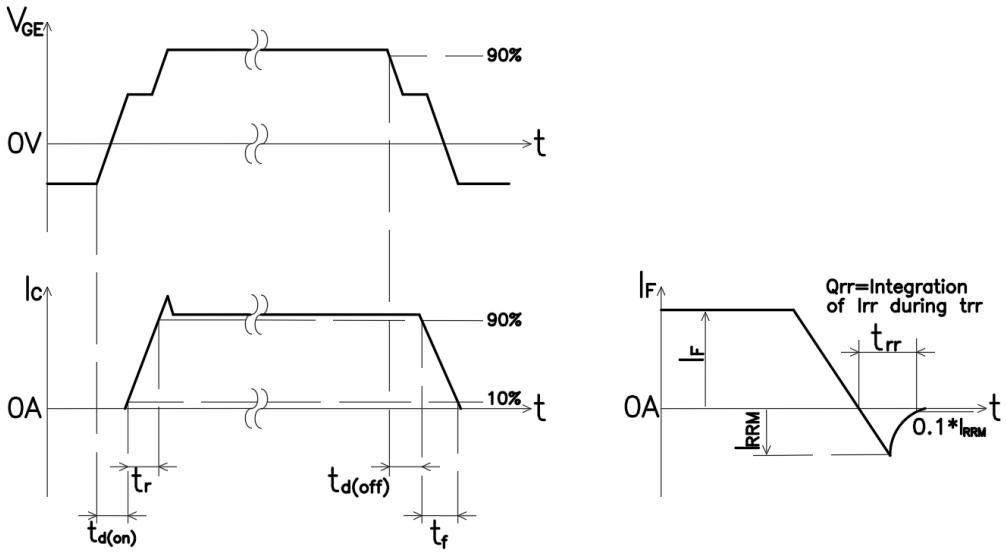

Figure 4. Switching time definition

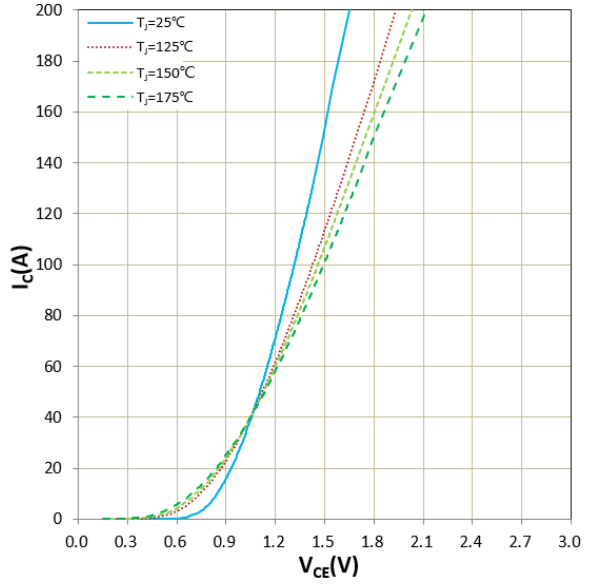

Figure 5. Ic vs V_{CE}
V_{GE}=15V

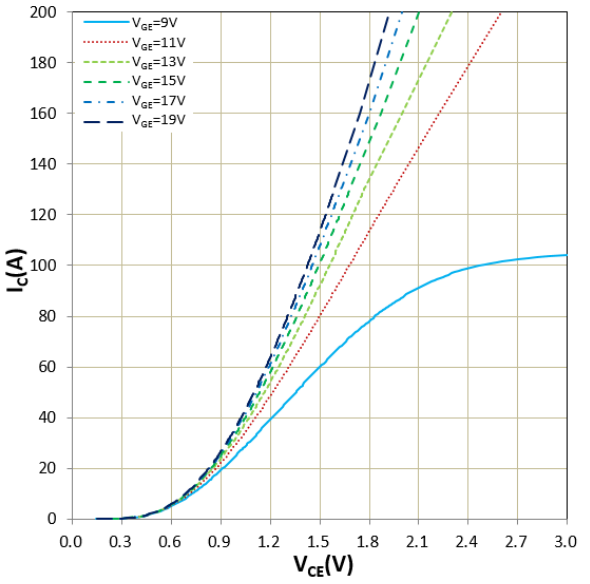

Figure 6. Ic vs V_{CE}
T_j=175°C

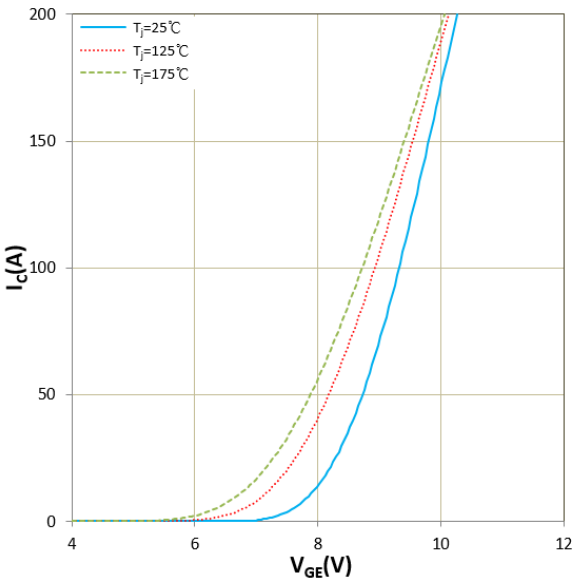

Figure 7. Ic vs V_{GE}
V_{CE} =20V

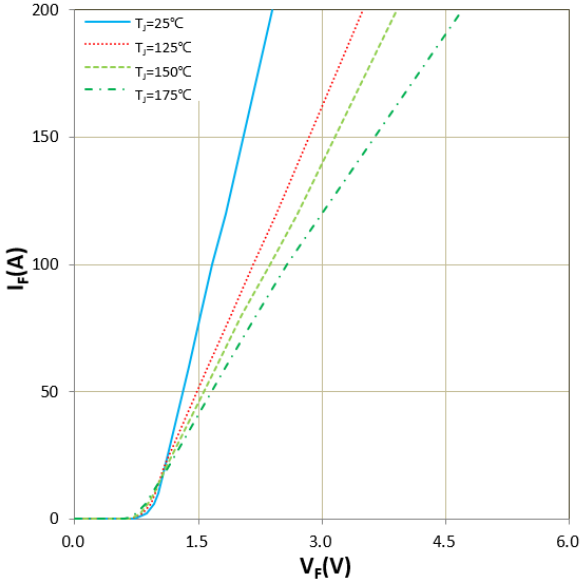

Figure 8. I_F vs V_F

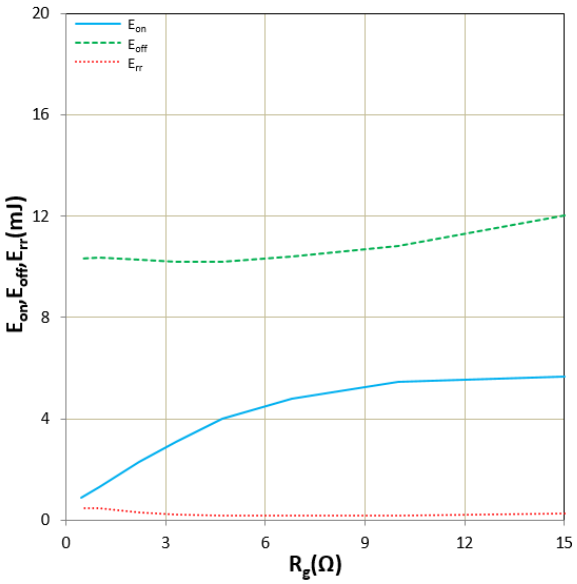

Figure 9. E_{on}, E_{off}, E_{rr} vs R_g(Typ)
V_{CC} =600V, V_{GE} =+15V/-8V, I_C =100A, T_j =25°C
Inductive Load

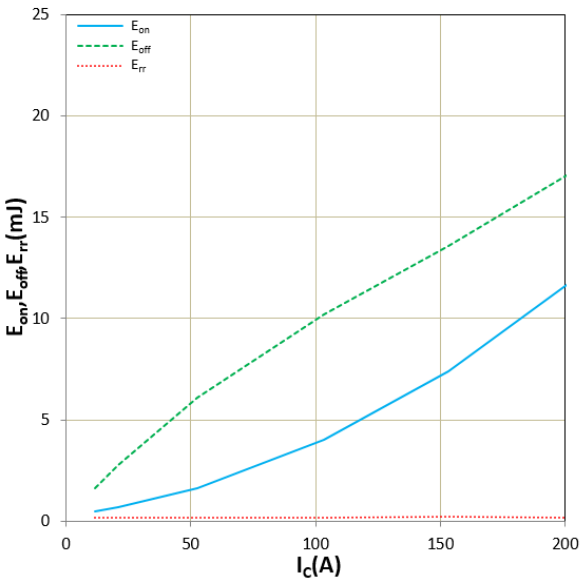

Figure 10. E_{on}, E_{off}, E_{rr} vs Ic(Typ)
V_{CC}=600V, V_{GE} =+15V/-8V, R_g =4.7Ω, T_j =25°C
Inductive Load

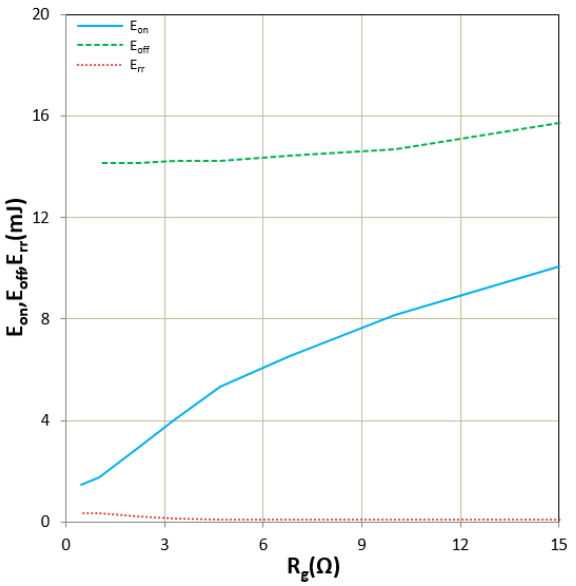

Figure 11. E_{on}, E_{off}, E_{rr} vs R_g(Typ)
V_{CC}=600V, V_{GE}=+15V/-8V, I_C=100A, T_j=125°C
Inductive Load

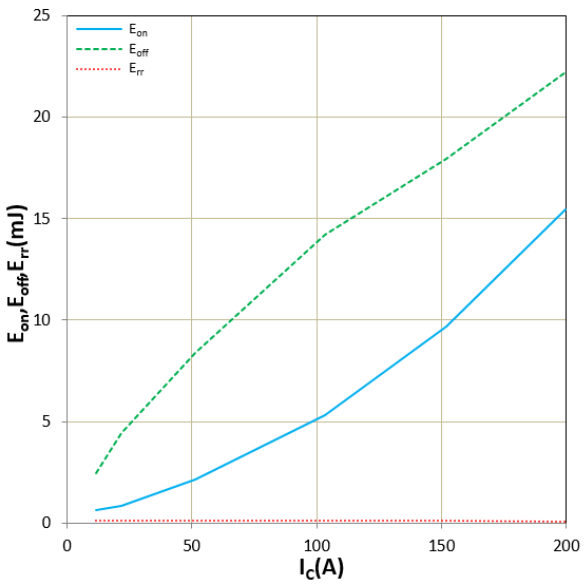

Figure 12. E_{on}, E_{off}, E_{rr} vs Ic(Typ)
V_{CC}=600V, V_{GE}=+15V/-8V, R_g=4.7Ω, T_j=125°C
Inductive Load

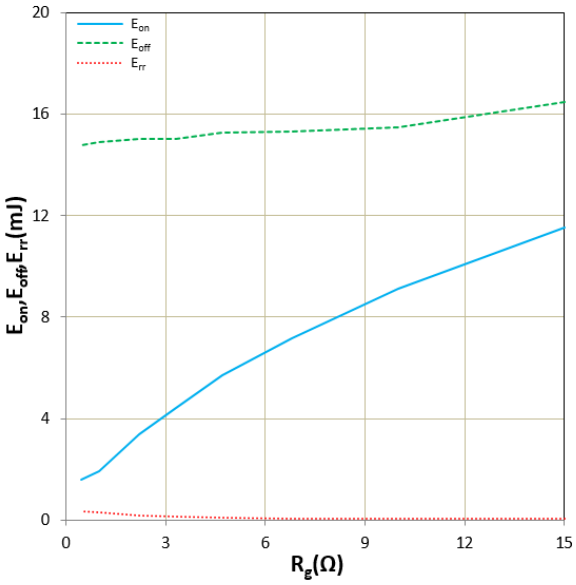

Figure 13. E_{on}, E_{off}, E_{rr} vs R_g(Typ)
V_{CC}=600V, V_{GE}=+15V/-8V, I_C=100A, T_j=150°C
Inductive Load

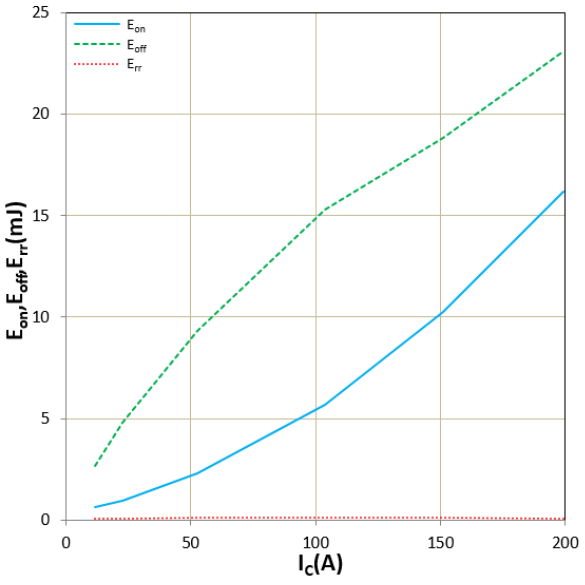

Figure 14. E_{on}, E_{off}, E_{rr} vs Ic(Typ)
V_{CC}=600V, V_{GE}=+15V/-8V, R_g=4.7Ω, T_j=150°C
Inductive Load

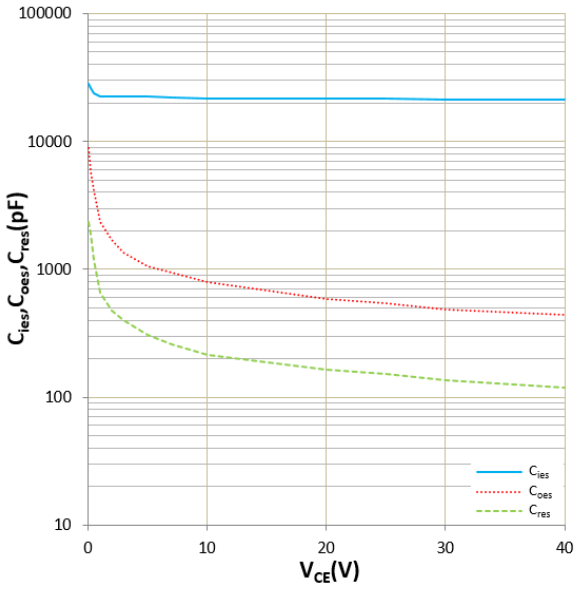

Figure 15. C_{ies}, C_{oes}, C_{res} vs V_{CE}
T_j=25°C, f=1MHz

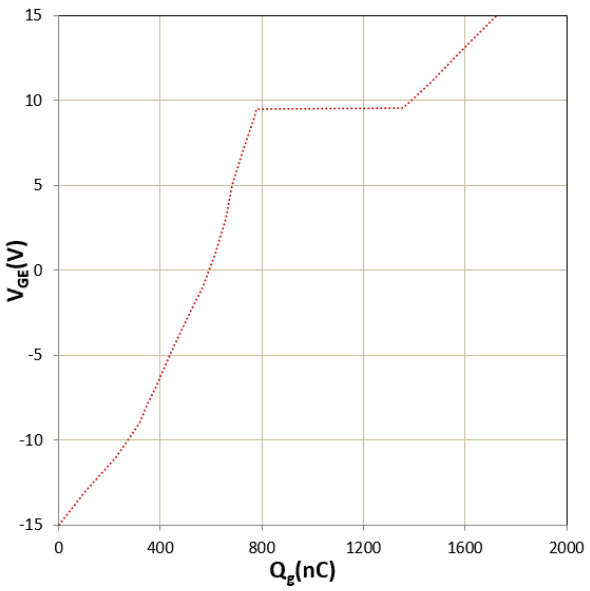

Figure 16. Gate charge
T_j=25°C

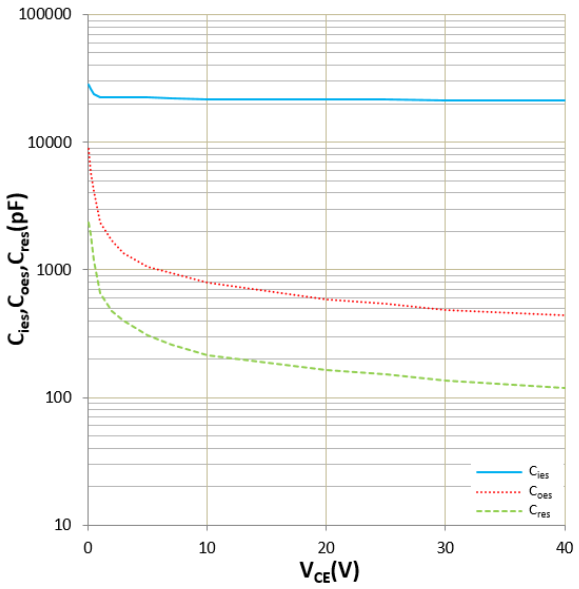

Figure 17. Transient thermal resistance

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