DFI600HF12I4ME7

1200V/600A Half Bridge IGBT Module

Description

The DFI600HF12I4ME7 is a Half Bridge IGBT Power Module. It integrates high performance IGBT chips designed for the applications such as High Power Switching supply and Motor control.

Features

- Blocking voltage:1200V
- Low saturation voltage $V_{CE(sat)}$
- Low Switching Losses
- Thermistor inside

Applications

- High Power Switching Applications
- Motor Drives
- Solar inverter Systems
- Uninterrupted Power Supply

Circuit diagram

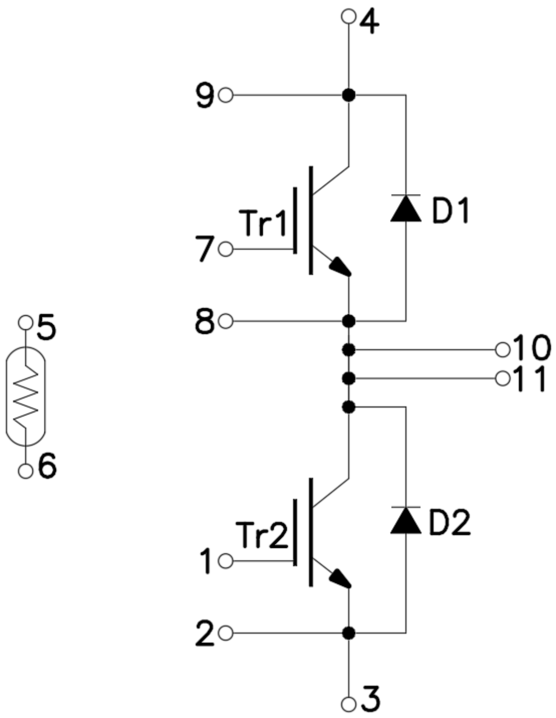


Figure 1. Out drawing & circuit diagram for DFI600HF12I4ME7

Pin Configuration and Marking Information

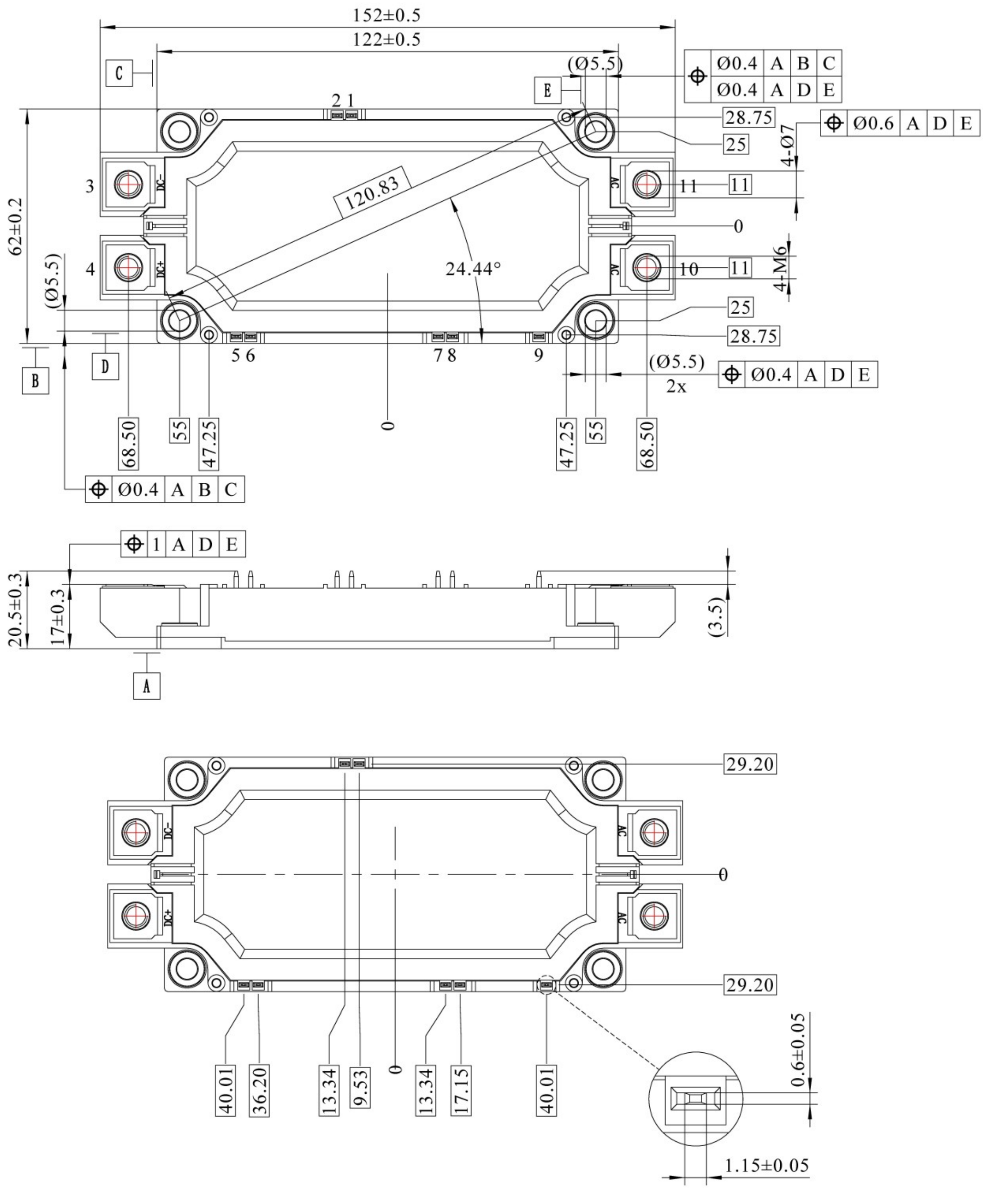


Figure 2. Pin configuration

Module

Parameter	Condition	Value	Unit
Isolation Voltage	RMS, f = 50Hz, t =1min	3.4	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	14.5 13	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	600	-
Module lead resistance, terminals – chip	T_C =25°C	0.8	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	350	g

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

Symbol	Parameter	Condition	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	G-E Short	1200	V
V_{GES}	Gate-Emitter Voltage	C-E Short	±20	V
I_C	DC Continuous Collector Current	T_C =95°C	600	A
I_{CM}	Pulse Collector Current	t_p =1ms, Note1	1200	A
P_C	Maximum Power Dissipation	T_C =25°C, IGBT	3000	W
I_F	Diode Forward Current	-	600	A
I_{FRM}	Repetitive peak forward Current	t_p =1ms, Note1	1200	A
T_{vjop}	Operating junction temperature	Note2	-40 to 175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature

Note2: T_{vjop} > 150°C is only allowed for operation at overload conditions

NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R_{25}	Resistance	T_C =25°C	-	5	-	kΩ
ΔR/R	Deviation of R_{100}	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.	
$V_{CE(sat)}$ (Chip)	Collector-Emitter Saturation Voltage	I_C =600A V_{GE} =15V	T_j =25°C	-	1.60	1.92	V
			T_j =125°C	-	1.73	-	
			T_j =150°C	-	1.80	-	
			T_j =175°C	-	1.85	-	
$V_{GE(th)}$	Gate-Emitter threshold Voltage	I_C =23mA, V_{CE} =V_{GE}		5.0	5.8	6.5	V
Q_G	Gate charge	V_{GE} = -15V to +15V		-	6.9	-	uC
R_{Gint}	Internal gate resistor	-	T_j =25°C	-	0.53	-	Ω
C_{ies}	Input Capacitance	V_{CE} =25V V_{GE} =0V f =1MHz	T_j =25°C	-	86.4	-	nF
C_{oes}	Output Capacitance			-	2.35	-	nF
C_{res}	Reverse transfer Capacitance			-	0.66	-	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	uA
$t_{d(on)}$	Turn-on delay time	V_{CC} =600V I_C =600A V_{GE} =+15V/-8V R_G =1.0Ω Inductive load	T_j =25°C	-	222	-	ns
			T_j =125°C	-	196	-	
			T_j =150°C	-	196	-	
t_r	Rise time		T_j =25°C	-	56	-	ns
			T_j =125°C	-	58	-	
			T_j =150°C	-	63	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	690	-	ns
			T_j =125°C	-	861	-	
			T_j =150°C	-	924	-	
t_f	Fall time		T_j =25°C	-	144	-	ns
			T_j=125°C	-	273	-	
			T_j =150°C	-	302	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	26.62	-	mJ
			T_j =125°C	-	36.97	-	
			T_j =150°C	-	45.01	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	42.61	-	mJ
			T_j =125°C	-	77.19	-	
			T_j =150°C	-	80.63	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (IGBT)			-	0.05	-	°C/W
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied) , Note1			-	0.015	-	°C/W

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

Freewheeling Diode 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 =600A, V_{GE} =0V	T_j=25°C	-	1.64	1.97	V
			T_j=125°C	-	1.48	-	
			T_j=150°C	-	1.49	-	
			T_j=175°C	-	1.44	-	
t_{rr}	Reverse recovery time	(Switch side) V_{CC}=600V I_C=600A V_{GE}=+15V/-8V R_G=1.0Ω (FRD side) V_{rr}=600V I_F=600A V_{GE}=-8V Inductive load switching operation	T_j=25°C	-	0.566	-	us
			T_j=125°C	-	0.858	-	
			T_j=150°C	-	0.944	-	
I_{RM}	Peak reverse recovery Current		T_j=25°C	-	382	-	A
			T_j=125°C	-	495	-	
			T_j=150°C	-	521	-	
Q_{rr}	Recovered charge		T_j=25°C	-	88.32	-	uC
			T_j=125°C	-	161.9	-	
			T_j=150°C	-	183.6	-	
E_{rr}	Reverse recovered energy		T_j=25°C	-	41.55	-	mJ
			T_j=125°C	-	75.71	-	
			T_j=150°C	-	85.68	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)			-	0.07	-	°C/W
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied) , Note1			-	0.02	-	°C/W

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

Test Conditions

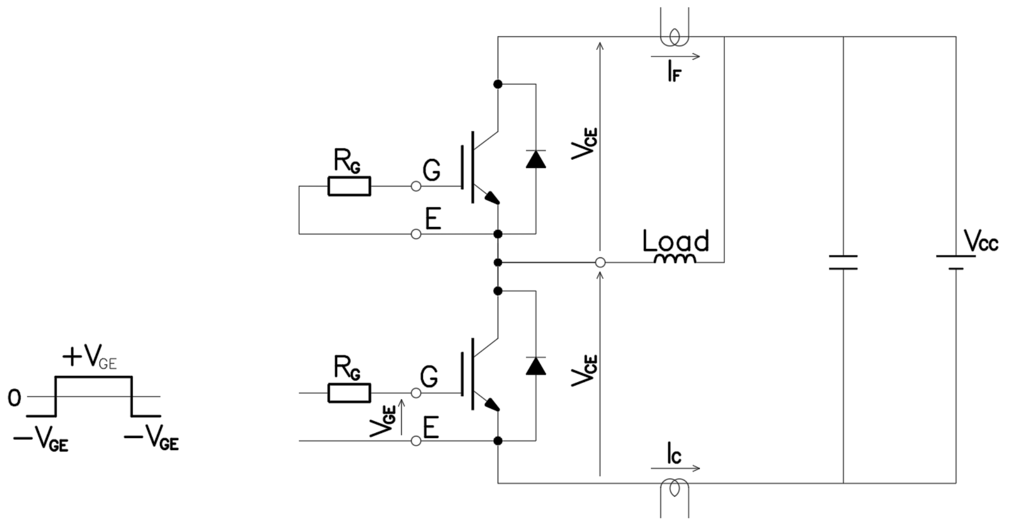


Figure 3. Switching time measure circuit

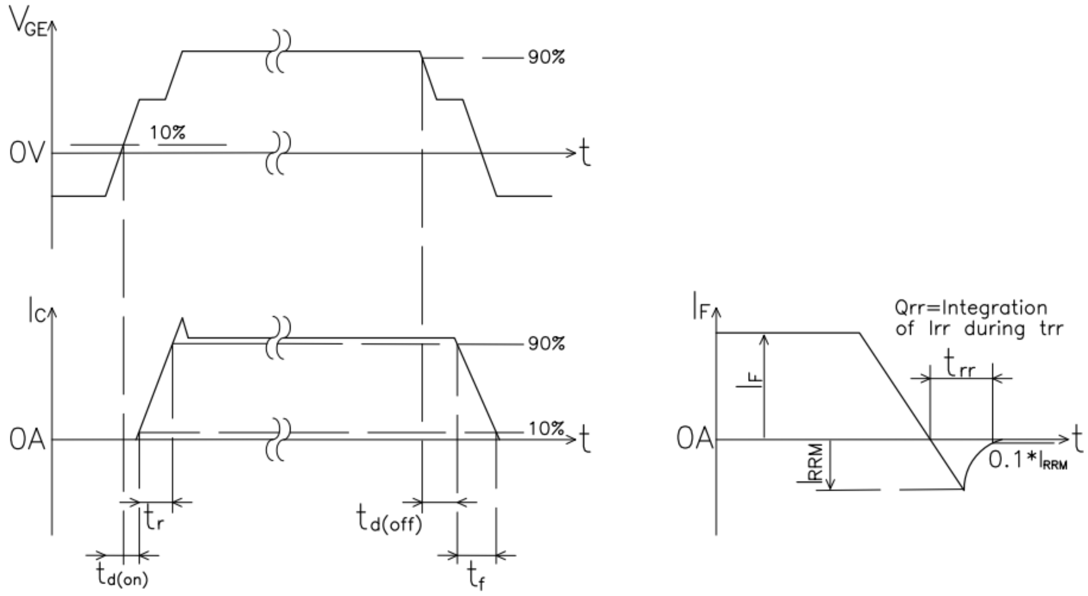


Figure 4. Switching time definition

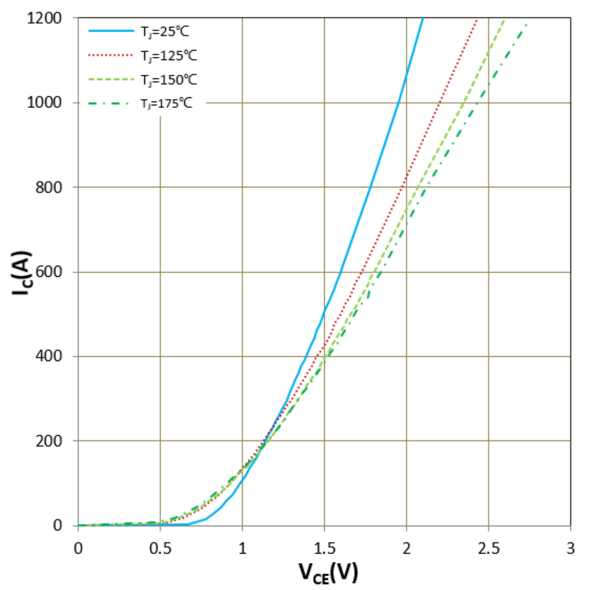


Figure 5. Ic vs V_{CE}

V_{GE} =15V

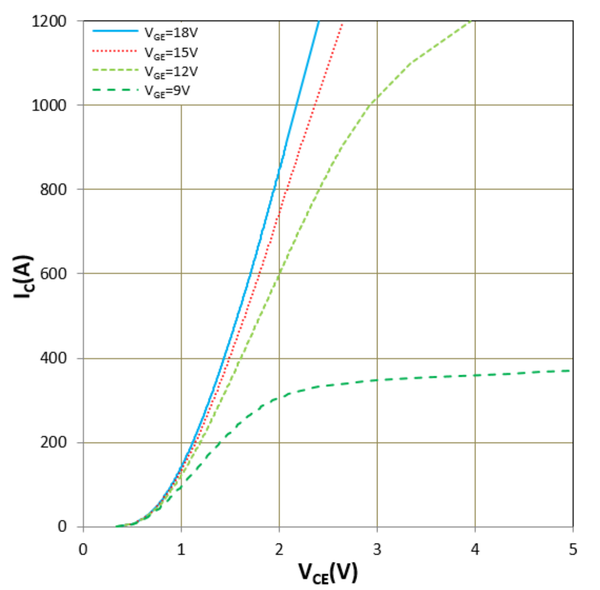


Figure 6. Ic vs V_{CE}

T_j =150°C

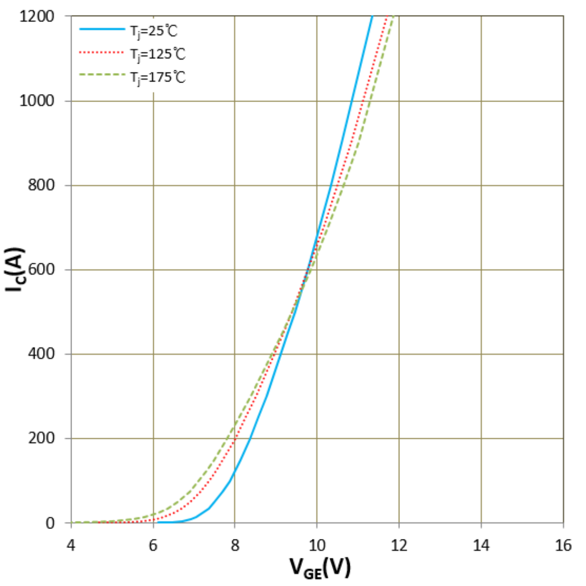


Figure 7. Ic vs V_{GE}
V_{CE} =20V

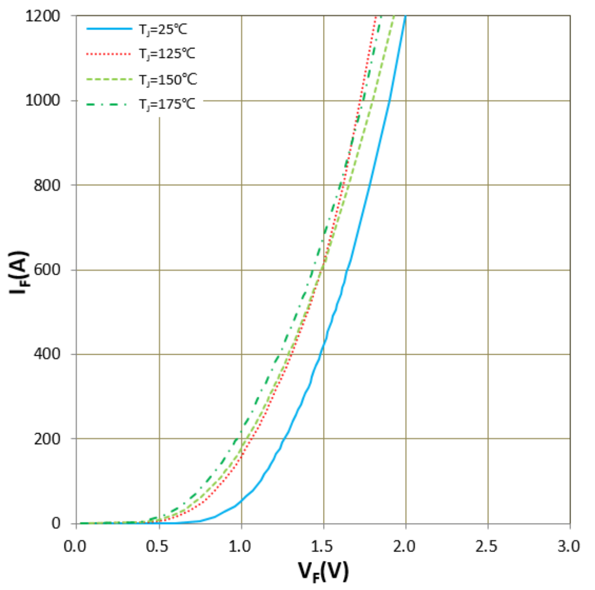


Figure 8. I_F vs V_F

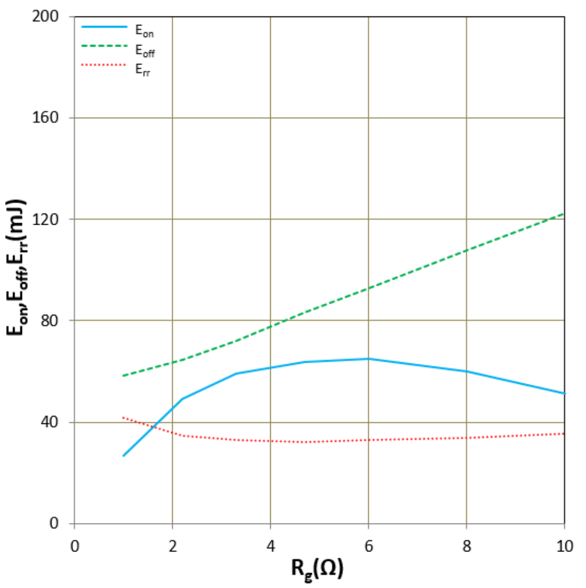


Figure 9. E_{on}, E_{off}, E_{rr} vs R_g(Typ)
V_{CC} =600V, V_{GE} =+15V/-8V, I_C =600A, T_j =25°C
Inductive Load

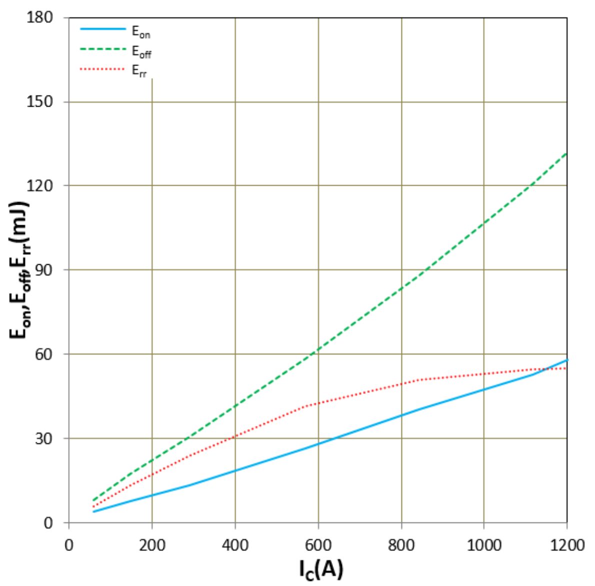


Figure 10. E_{on}, E_{off}, E_{rr} vs Ic(Typ)
V_{CC} =600V, V_{GE} =+15V/-8V, R_g =1.0Ω, T_j =25°C
Inductive Load

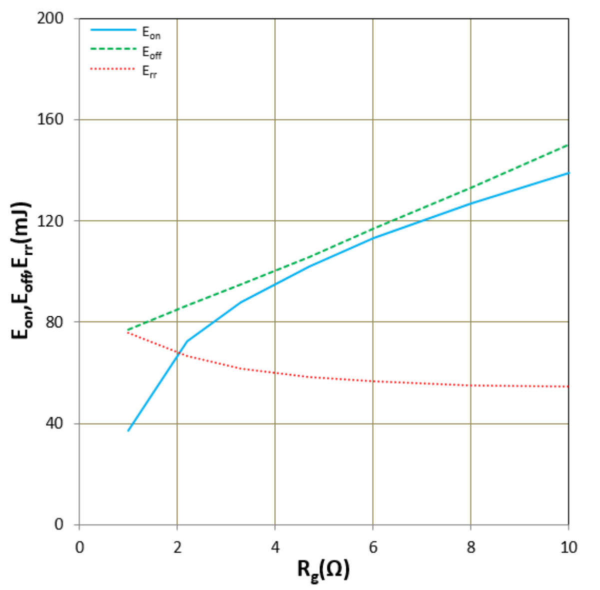


Figure 11. E_{on}, E_{off}, E_{rr} vs R_g(Typ)
V_{CC} =600V, V_{GE} =+15V/-8V, I_C =600A, T_j =125°C
Inductive Load

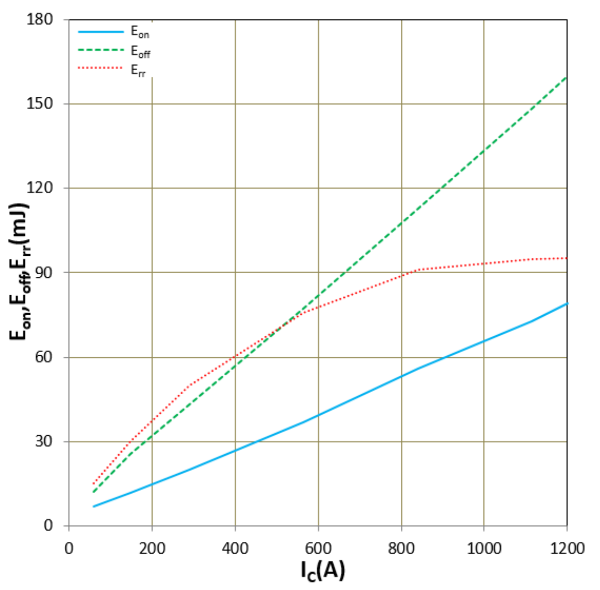


Figure 12. E_{on}, E_{off}, E_{rr} vs Ic(Typ)
V_{CC} =600V, V_{GE} =+15V/-8V, R_g =1.0Ω, T_j =125°C
Inductive Load

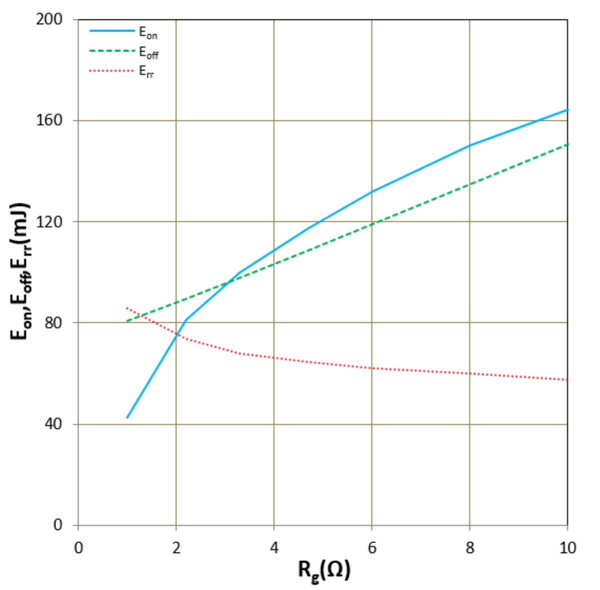


Figure 13. E_{on}, E_{off}, E_{rr} vs R_g(Typ)
V_{CC} =600V, V_{GE} =+15V/-8V, I_C =600A, T_j =150°C
Inductive Load

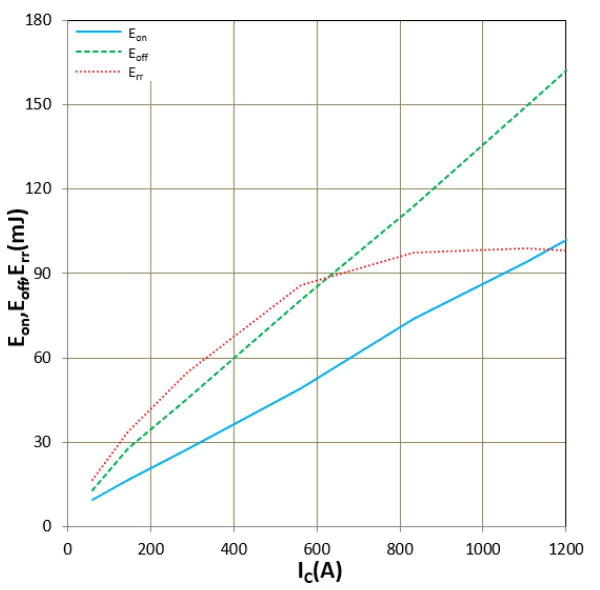


Figure 14. E_{on}, E_{off}, E_{rr} vs Ic(Typ)
V_{CC} =600V, V_{GE} =+15V/-8V, R_g =1.0Ω, T_j =150°C
Inductive Load

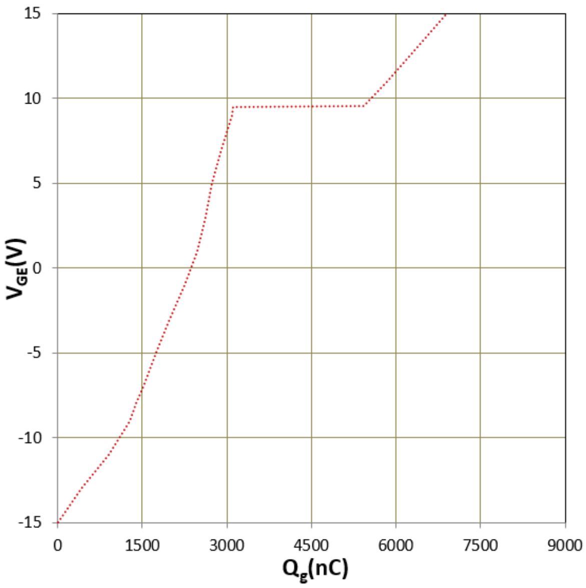


Figure 15. Gate charge

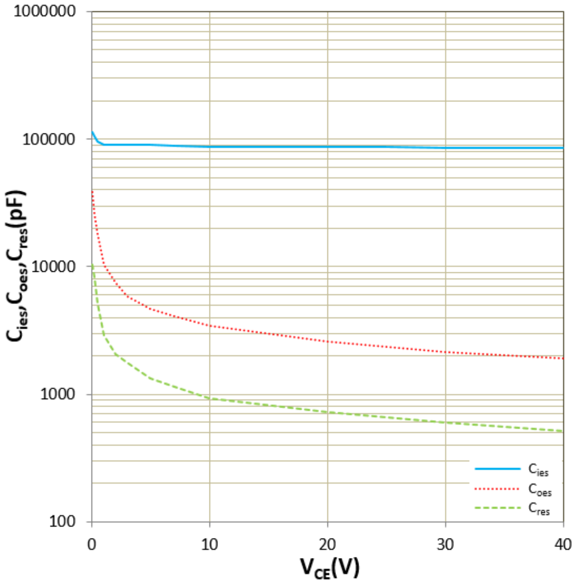
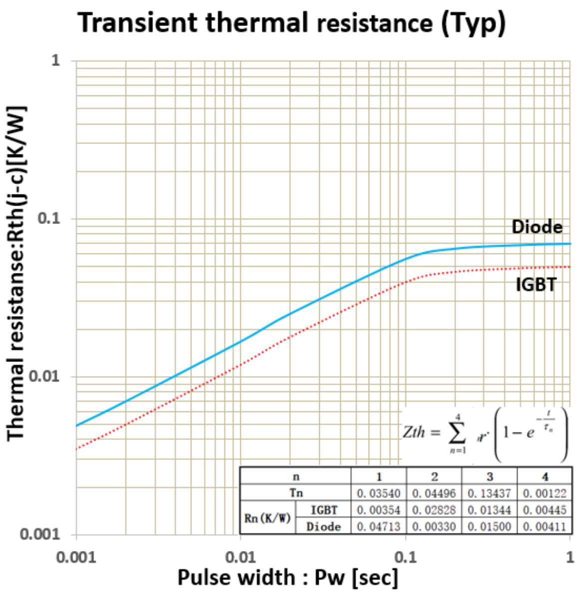


Figure 16. C_{ies}, C_{oes}, C_{res} vs V_{CE}
T_j =25°C, f =1MHz



$$Zth = \sum_{n=1}^{4} r_n \left(1 - e^{-\frac{t}{\tau_n}}\right)$$

n		1	2	3	4
Tn		0. 03540	0. 04496	0. 13437	0. 00122
Rn (K/W)	IGBT	0. 00354	0. 02828	0. 01344	0. 00445
	Diode	0. 04713	0. 00330	0. 01500	0. 00411

Figure 17. transient thermal impedance
IGBT/Diode

IMPORTANT NOTICE:

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