

Description

The DFI600HF12DFH1 is a Half Bridge IGBT Power Module. It integrates high performance IGBT chips and offers lower losses and higher energy for the applications such as motor drive, inverter and welding machines.



Features

- 1200V600A
- $V_{CE(sat)}(typ.) = 1.60V$
- Lower losses and higher energy
- High speed switching

Applications

- Motor drive
- Inverter
- Welding machines
- Power supply
- UPS

Circuit diagram

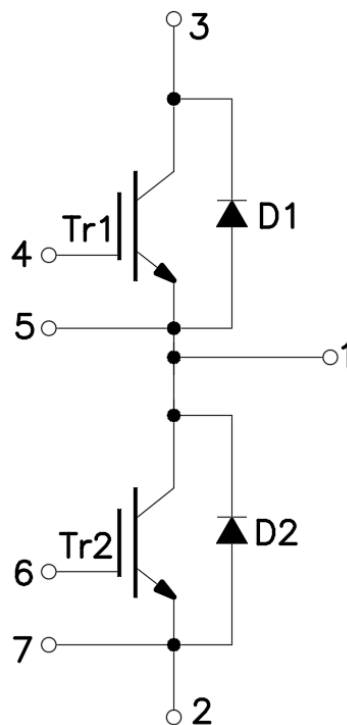


Figure 1. Out drawing & circuit diagram for DFI600HF12DFH1

Pin Configuration and Marking Information

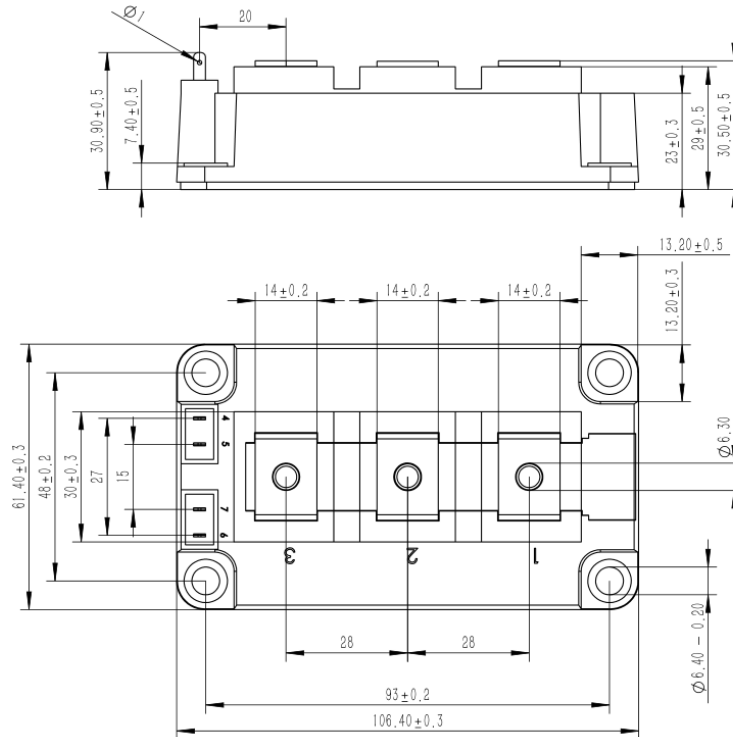


Figure 2. Pin configuration

Module

Parameter	Condition	Value	Unit
Isolation Voltage	RMS, f = 50Hz, t = 1 min	3.4	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink	47	mm
	terminal to terminal	26	
Clearance	terminal to heatsink	29	mm
	terminal to terminal	14	
CTI	-	>200	-
Module lead resistance, terminals – chip	T _C = 25°C	0.8	mΩ
Mounting torque for module mounting	M6	3 to 6	Nm
Weight	-	315	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	±20	V
I _C	DC Continuous Collector Current	T _C = 100°C	600	A
I _{CM}	Pulse Collector Current	t _p = 1ms, Note1	1200	A
P _C	Maximum Power Dissipation	T _C = 25°C, IGBT	3333	W
I _F	Diode Forward Current	-	600	A
I _{FRM}	Repetitive peak forward Current	t _p = 1ms, Note1	1200	A
T _{jmax}	junction temperature	-	-40 to 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 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	R ₂ = R ₂₅ exp [B _{25/50} (1/T ₂ - 1/(298,15 K))]	-	3375	-	K
B _{25/80}	B-value	R ₂ = R ₂₅ exp [B _{25/80} (1/T ₂ - 1/(298,15 K))]	-	3411	-	K
B _{25/100}	B-value	R ₂ = R ₂₅ exp [B _{25/100} (1/T ₂ - 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 =600A	V _{GE} =15V	T _j =25°C	-	1.60	1.92	V
				T _j =125°C	-	1.73	-	V
				T _j =150°C	-	1.80	-	V
				T _j =175°C	-	1.85	-	V
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,		T _j =25°C	-	86.4	-	nF
C _{oes}	Output Capacitance	V _{GE} =0V			-	2.35	-	nF
C _{res}	Reverse transfer Capacitance	f=1MHz			-	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 _{Gon} = R _{Goff} =2.2Ω Inductive load		T _j =25°C	-	400	-	ns
				T _j =150°C	-	394	-	ns
t _r	Rise time			T _j =25°C	-	68	-	ns
				T _j =150°C	-	84	-	ns
t _{d(off)}	Turn-off delay time			T _j =25°C	-	797	-	ns
				T _j =150°C	-	858	-	ns
t _f	Fall time			T _j =25°C	-	107	-	ns
				T _j =150°C	-	258	-	ns
E _{on}	Turn-on power dissipation			T _j =25°C	-	22.6	-	mJ
				T _j =150°C	-	52.4	-	mJ
E _{off}	Turn-off power dissipation	T _j =25°C	-	77.1	-	mJ		
		T _j =150°C	-	80.0	-	mJ		
R _{th(j-c)}	Thermal Resistance, Junction to Case (IGBT)			-	0.045	-	°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 ($T_j=25^\circ\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max.		
V_F	Diode Forward Voltage	$I_F=600\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	-	1.64	1.97	V
			$T_j=125^\circ\text{C}$	-	1.48	-	V
			$T_j=150^\circ\text{C}$	-	1.49	-	V
			$T_j=175^\circ\text{C}$	-	1.44	-	V
t_{rr}	Reverse recovery time	(Switch side) $V_{CC}=600\text{V}, I_C=600\text{A}$	$T_j=25^\circ\text{C}$	-	316	-	ns
			$T_j=150^\circ\text{C}$	-	514	-	ns
I_{RM}	Peak reverse recovery Current	$V_{GE}=+15\text{V}/-8\text{V}, R_G=2.2\Omega$ (FRD side)	$T_j=25^\circ\text{C}$	-	387	-	A
			$T_j=150^\circ\text{C}$	-	555	-	A
Q_{rr}	Recovered charge	$V_{rr}=600\text{V}, I_F=600\text{A}$ $V_{GE}=-8\text{V}$	$T_j=25^\circ\text{C}$	-	46.7	-	μC
			$T_j=150^\circ\text{C}$	-	107.7	-	μC
E_{rr}	Reverse recovered energy	Inductive load switching operation	$T_j=25^\circ\text{C}$	-	23.9	-	mJ
			$T_j=150^\circ\text{C}$	-	47.2	-	mJ
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)		-	0.063	-	$^\circ\text{C}/\text{W}$	
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied), Note1		-	0.020	-	$^\circ\text{C}/\text{W}$	

Note1: Assumes Thermal Conductivity of grease is $2.8 \text{ W/m} \cdot \text{K}$ and thickness is $50\mu\text{m}$.

Test Conditions

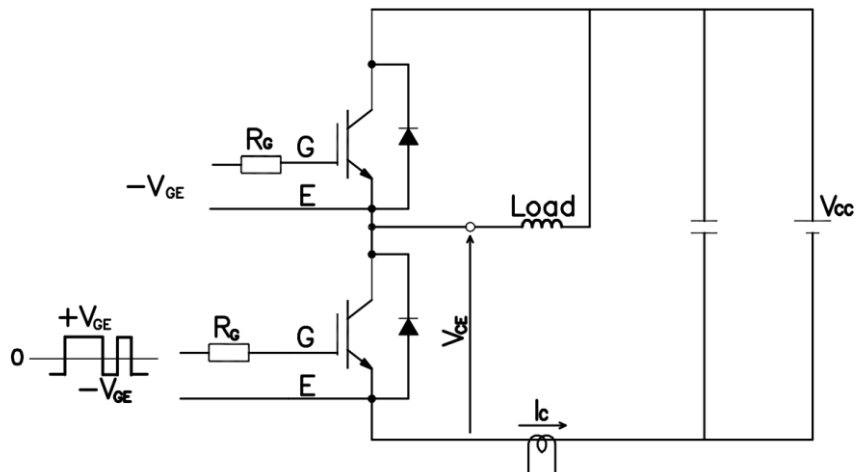


Figure 3. Switching time measure circuit

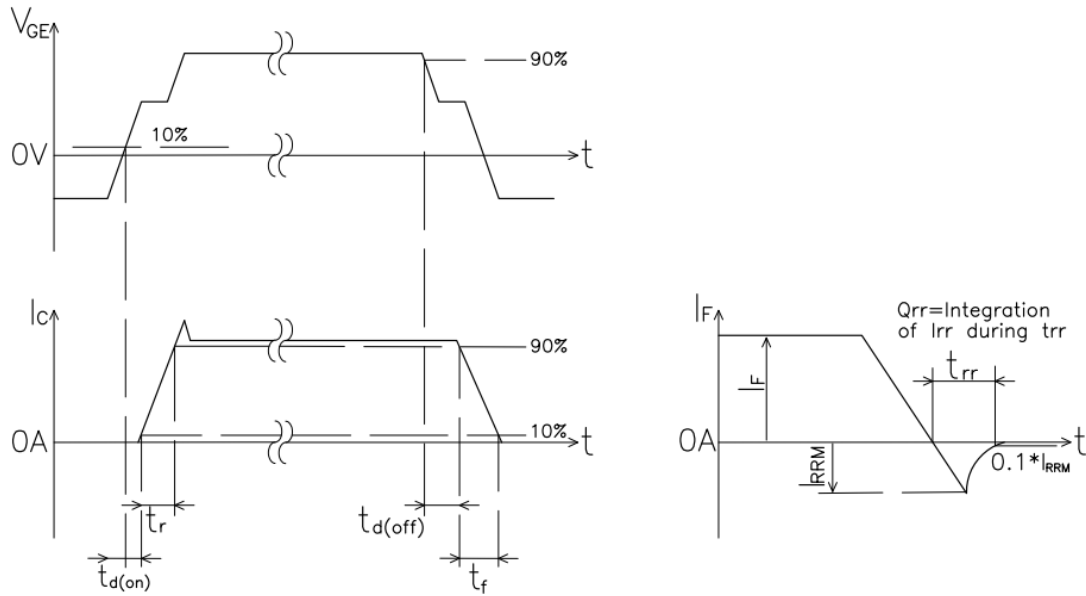
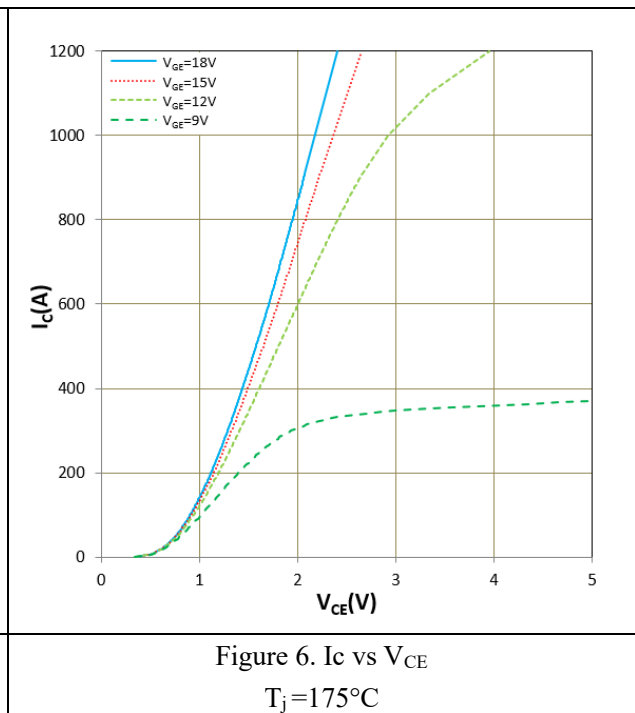
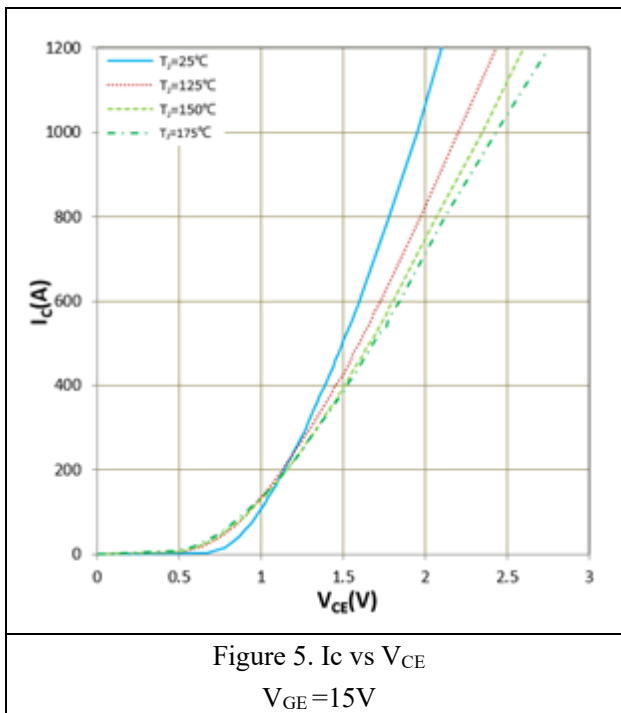


Figure 4. Switching time definition



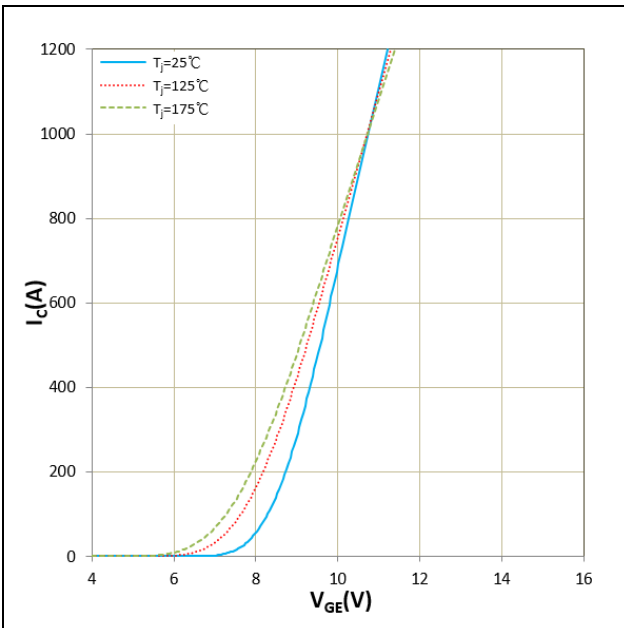


Figure 7. I_c vs V_{GE}
 $V_{CE}=20V$

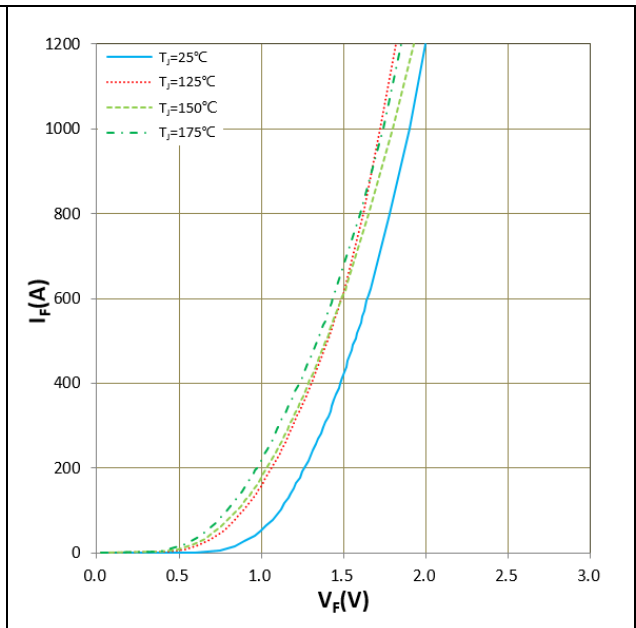


Figure 8. I_F vs V_F

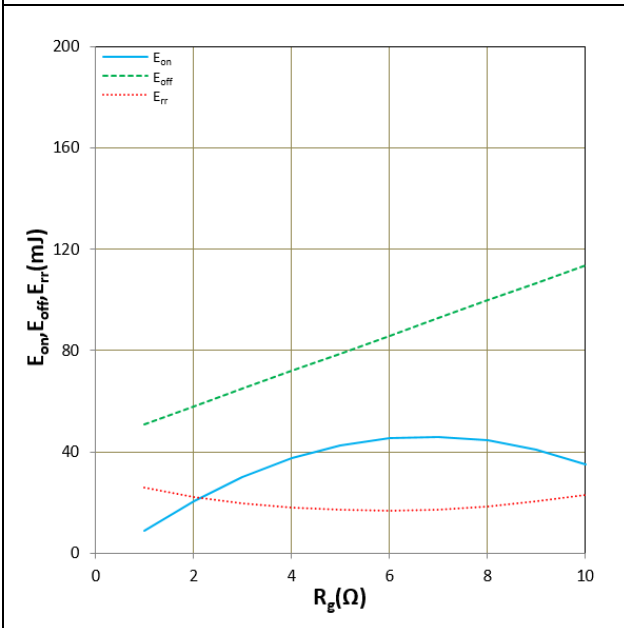


Figure 9. E_{on} , E_{off} , E_{rr} vs R_g (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_c=600A$, $T_j=25^\circ C$
Inductive Load

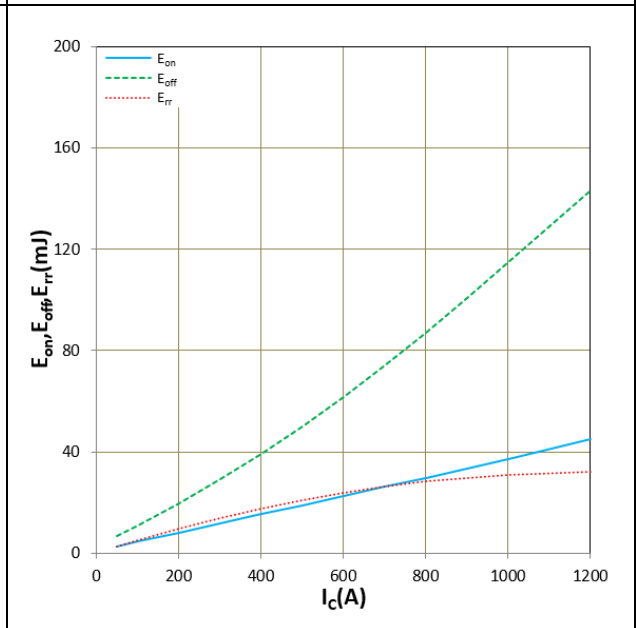


Figure 10. E_{on} , E_{off} , E_{rr} vs I_c (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $R_g=2.2\Omega$, $T_j=25^\circ C$
Inductive Load

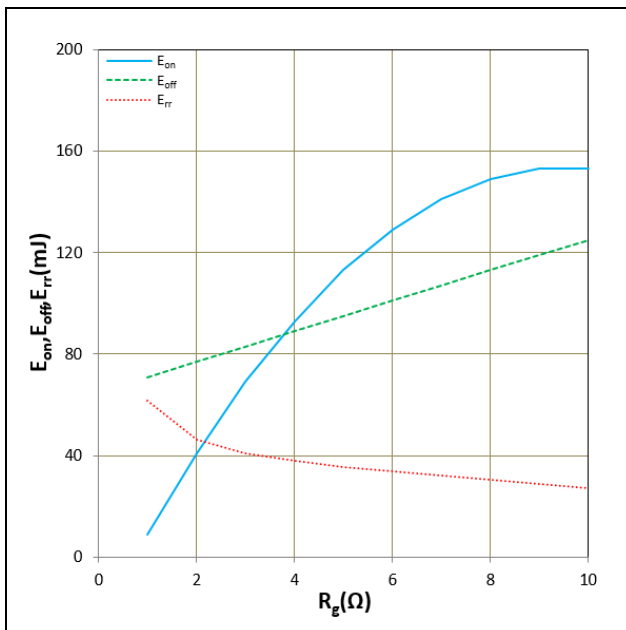


Figure 11. E_{on} , E_{off} , E_{rr} vs R_g (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_C=600A$, $T_j=150^\circ C$
 Inductive Load

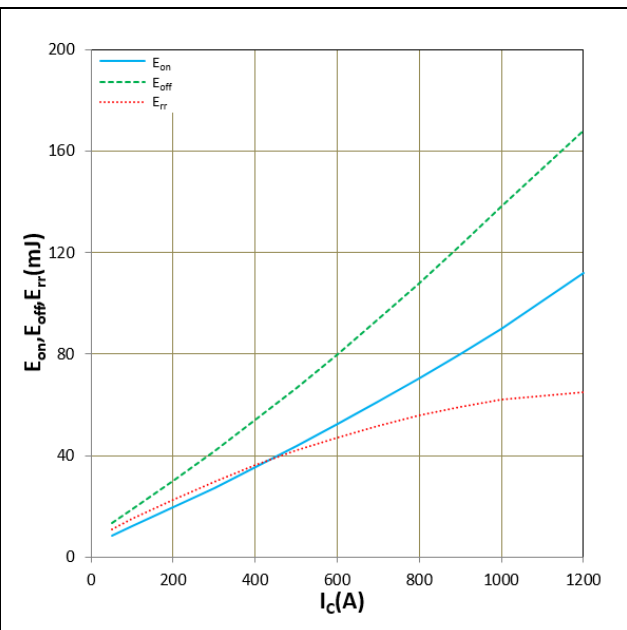


Figure 12. E_{on} , E_{off} , E_{rr} vs I_c (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $R_g=2.2\Omega$, $T_j=150^\circ C$
 Inductive Load

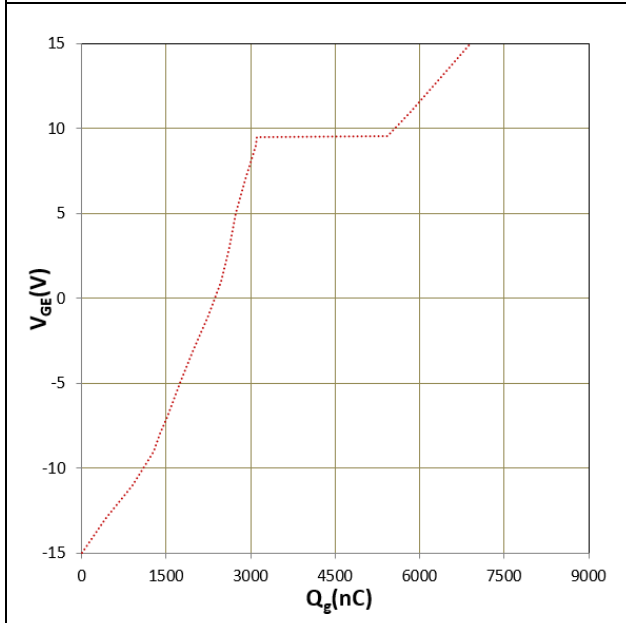


Figure 13. Gate charge

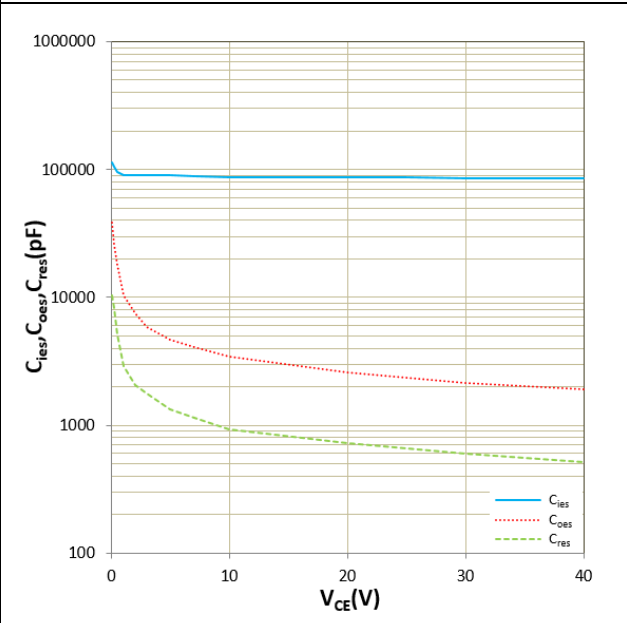


Figure 14. C_{ies} , C_{oes} , C_{res} vs V_{CE}
 $T_j=25^\circ C$, $f=1MHz$

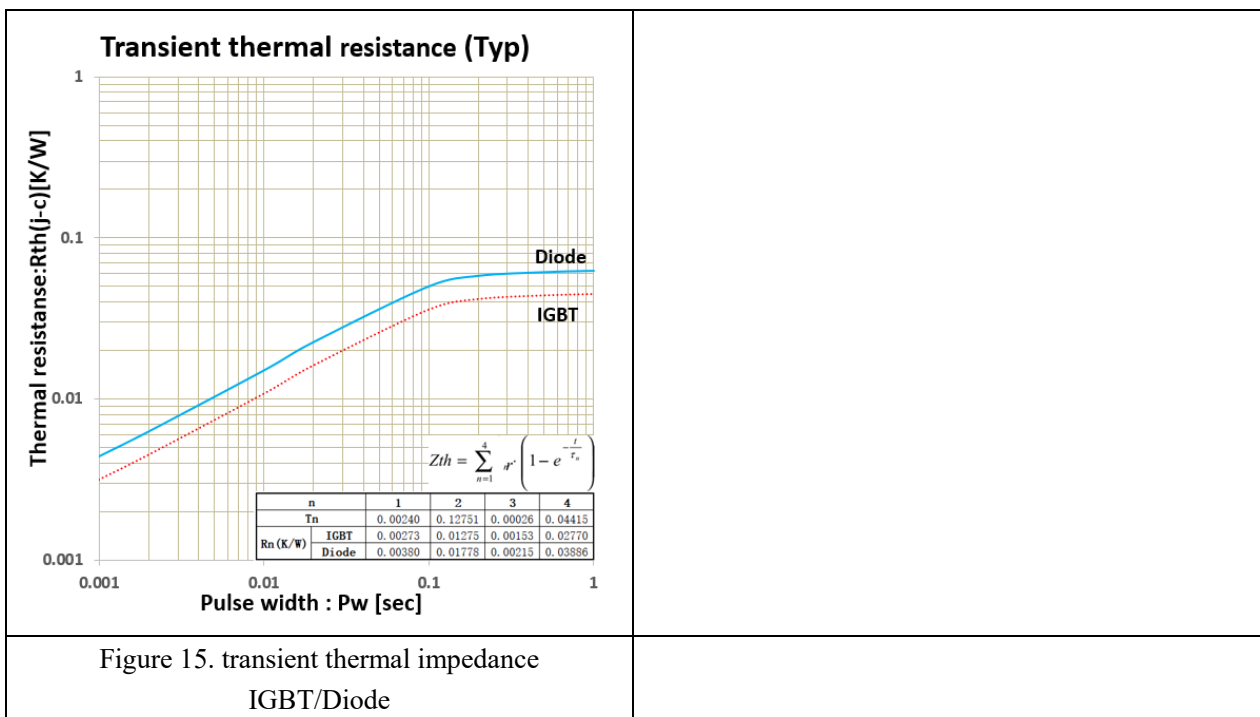


Figure 15. transient thermal impedance
IGBT/Diode

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