

### Description

The DFI600HF12I4ME1 is a Half Bridge IGBT Power Module. It integrates high performance IGBT chips designed for the applications such as High Power supply and Motor control.



### Features

- Blocking voltage:1200V
- Low saturation voltage  $V_{CE(sat)}$
- Low Switching Losses
- 175°C maximum junction temperature
- Thermistor inside

### Applications

- High Power Switching Applications
- Motor Drives
- Solar inverter Systems
- Wind Turbines

### Circuit diagram

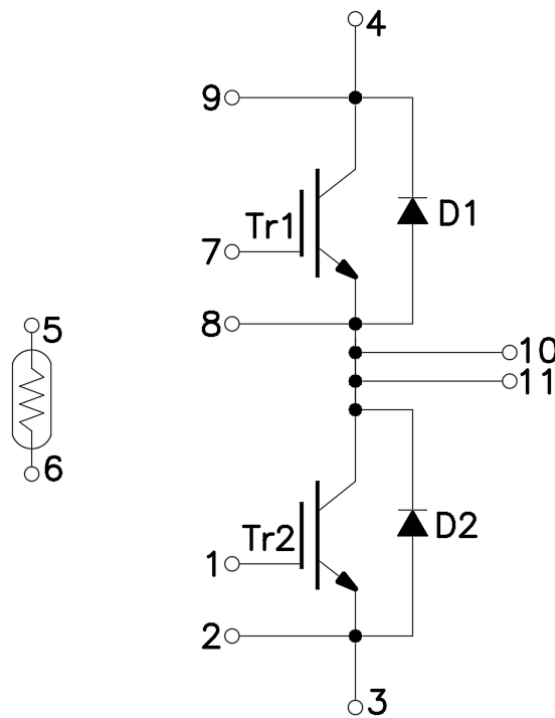


Figure 1. Out drawing & circuit diagram for DFI600HF12I4ME1

### Pin Configuration and Marking Information

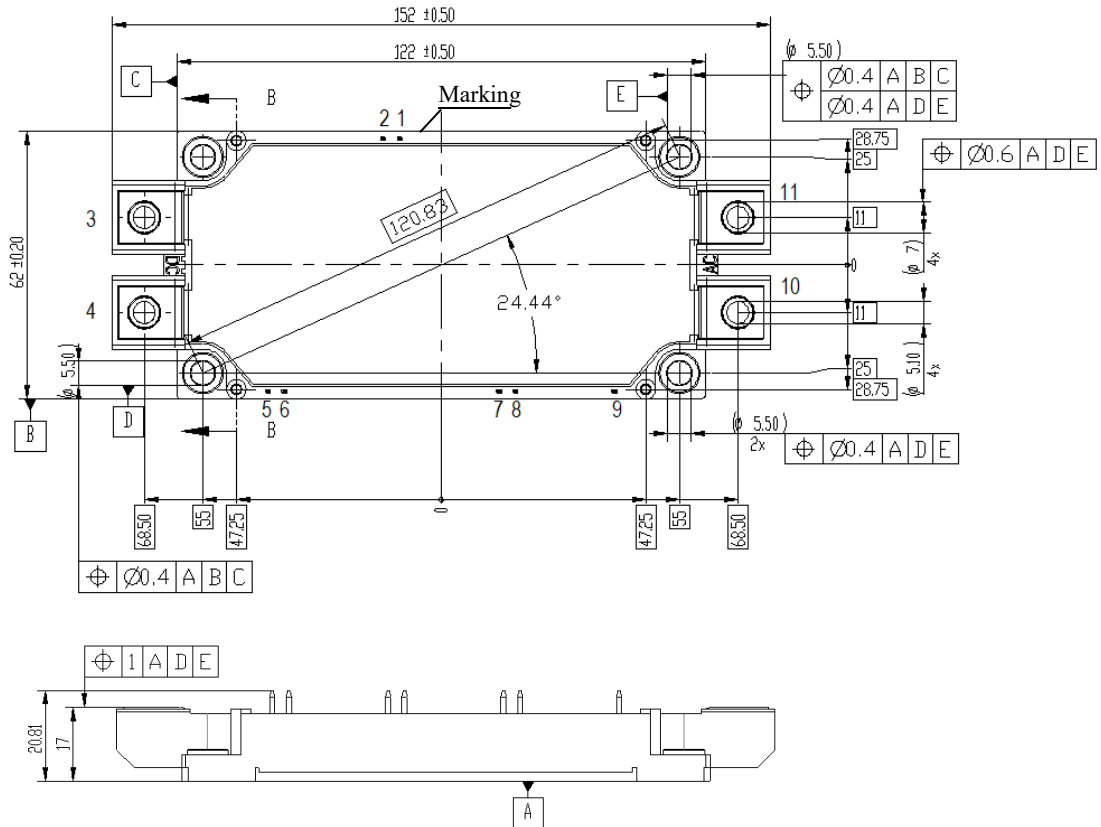


Figure 2. Pin configuration

### Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, $f = 50\text{Hz}$ , $t = 1\text{ min}$	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	-	>200	-
Module lead resistance, terminals – chip	$T_c = 25^\circ\text{C}$	0.8	m $\Omega$
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	420	g

### Maximum Ratings (T<sub>j</sub>=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>CES</sub>	Collector-Emitter Voltage	G-E Short	1200	V
V <sub>GES</sub>	Gate-Emitter Voltage	C-E Short	±30V	V
I <sub>C</sub>	DC Continuous Collector Current	T <sub>C</sub> =100°C	800	A
I <sub>CM</sub>	Pulse Collector Current	t <sub>p</sub> =1ms, Note1	1600	A
P <sub>C</sub>	Maximum Power Dissipation	T <sub>C</sub> =25°C, T <sub>j</sub> =175°C(IGBT)	5000	W
I <sub>F</sub>	Diode Forward Current	-	700	A
I <sub>FRM</sub>	Repetitive peak forward Current	t <sub>p</sub> =1ms, Note1	1400	A
I <sup>2</sup> t	I <sup>2</sup> t-value	V <sub>R</sub> =0V, t <sub>p</sub> =10ms, T <sub>j</sub> =125°C(Diode)	40000	A <sup>2</sup> s
I <sup>2</sup> t	I <sup>2</sup> t-value	V <sub>R</sub> =0V, t <sub>p</sub> =10ms, T <sub>j</sub> =150°C(Diode)	37500	A <sup>2</sup> s
T <sub>j</sub>	junction temperature	-	-40 to 175	°C
T <sub>stg</sub>	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 <sub>25</sub>	Resistance	T <sub>C</sub> =25°C	-	5	-	kΩ
ΔR/R	Deviation of R100	T <sub>C</sub> =100°C, R <sub>100</sub> =493Ω	5	-	5	%
P <sub>25</sub>	Power dissipation	T <sub>C</sub> =25°C	-	-	20	mW
B <sub>25/50</sub>	B-value	R <sub>2</sub> = R <sub>25</sub> exp [B <sub>25/50</sub> (1/T <sub>2</sub> - 1/(298,15 K))]	-	3375	-	K
B <sub>25/80</sub>	B-value	R <sub>2</sub> = R <sub>25</sub> exp [B <sub>25/80</sub> (1/T <sub>2</sub> - 1/(298,15 K))]	-	3411	-	K
B <sub>25/100</sub>	B-value	R <sub>2</sub> = R <sub>25</sub> exp [B <sub>25/100</sub> (1/T <sub>2</sub> - 1/(298,15 K))]	-	3433	-	K

### IGBT Electrical characteristics (T<sub>j</sub>=25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V <sub>CE(sat)</sub> (Chip)	Collector-Emitter Saturation Voltage	I <sub>C</sub> =600A V <sub>GE</sub> =15V	T <sub>j</sub> =25°C	-	1.65	1.95	V
			T <sub>j</sub> =150°C	-	1.85	-	V
			T <sub>j</sub> =175°C	-	1.90	-	V
V <sub>GE(th)</sub>	Gate-Emitter threshold Voltage	I <sub>C</sub> =25mA, V <sub>CE</sub> =V <sub>GE</sub>		5.0	-	6.8	V
Q <sub>G</sub>	Gate charge	V <sub>GE</sub> = -15V to +15V		-	4.4	-	uC
R <sub>Gint</sub>	Internal gate resistor	-	T <sub>j</sub> =25°C	-	1.1	-	Ω
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V f=1MHz	T <sub>j</sub> =25°C	-	52	-	nF
C <sub>res</sub>	Reverse transfer Capacitance			-	1.85	-	nF
I <sub>CES</sub>	Collector- Emitter cut off Current	V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V	T <sub>j</sub> =25°C	-	-	60	uA
I <sub>GES</sub>	Gate-Emitter Leakage Current	V <sub>GE</sub> = 30V, V <sub>CE</sub> =0V	T <sub>j</sub> =25°C	-	-	1.5	uA
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> =600V I <sub>C</sub> = 600A V <sub>GE</sub> =+15V/-8V R <sub>G</sub> =1.0Ω Inductive load	T <sub>j</sub> =25°C	-	215	-	ns
			T <sub>j</sub> =125°C	-	220	-	
			T <sub>j</sub> =175°C	-	220	-	
t <sub>r</sub>	Rise time		T <sub>j</sub> =25°C	-	60	-	ns
			T <sub>j</sub> =125°C	-	73	-	
			T <sub>j</sub> =175°C	-	75	-	
t <sub>d(off)</sub>	Turn-off delay time		T <sub>j</sub> =25°C	-	490	-	ns
			T <sub>j</sub> =125°C	-	565	-	
			T <sub>j</sub> =175°C	-	610	-	
t <sub>f</sub>	Fall time		T <sub>j</sub> =25°C	-	85	-	ns
			T <sub>j</sub> =125°C	-	185	-	
			T <sub>j</sub> =175°C	-	295	-	
E <sub>on</sub>	Turn-on power dissipation	T <sub>j</sub> =25°C	-	73.31	-	mJ	
		T <sub>j</sub> =125°C	-	103.2	-		
		T <sub>j</sub> =175°C	-	121.6	-		
E <sub>off</sub>	Turn-off power dissipation	T <sub>j</sub> =25°C	-	50.4	-	mJ	
		T <sub>j</sub> =125°C	-	65.79	-		
		T <sub>j</sub> =175°C	-	80.39	-		
R <sub>th(j-c)</sub>	Thermal Resistance, Junction to Case (IGBT)		-	0.03	-	°C/W	
R <sub>th(c-s)</sub>	Thermal Resistance, Case to sink (Conductive Grease applied)		-	0.02	-	°C/W	

### Freewheeling Diode Electrical characteristics (T<sub>j</sub>=25°C unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max.		
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> =600A, V <sub>GE</sub> =0V	T <sub>j</sub> =25°C	-	1.7	2.1	V
			T <sub>j</sub> =150°C	-	1.7	-	
			T <sub>j</sub> =175°C	-	1.65	-	
t <sub>rr</sub>	Reverse recovery time	(Switch side)	T <sub>j</sub> =25°C	-	0.51	-	us
			T <sub>j</sub> =125°C	-	0.675	-	
			T <sub>j</sub> =175°C	-	0.9	-	
I <sub>RM</sub>	Peak reverse recovery Current	V <sub>CC</sub> =600V, I <sub>C</sub> =600A V <sub>GE</sub> =+15V/-8V R <sub>G</sub> =1.0Ω (FRD side)	T <sub>j</sub> =25°C	-	333	-	A
			T <sub>j</sub> =125°C	-	300	-	
			T <sub>j</sub> =175°C	-	291	-	
Q <sub>rr</sub>	Recovered charge	V <sub>rr</sub> =600V, I <sub>F</sub> =600A V <sub>GE</sub> =-8V Inductive load	T <sub>j</sub> =25°C	-	54.43	-	uC
			T <sub>j</sub> =125°C	-	85.92	-	
			T <sub>j</sub> =175°C	-	120.81	-	
E <sub>rr</sub>	Reverse recovered energy	switching operation	T <sub>j</sub> =25°C	-	17.65	-	mJ
			T <sub>j</sub> =125°C	-	28.16	-	
			T <sub>j</sub> =175°C	-	41.15	-	
R <sub>th(j-c)</sub>	Thermal Resistance, Junction to Case (Diode)		-	0.05	-	°C/W	
R <sub>th(c-s)</sub>	Thermal Resistance, Case to sink (Conductive Grease applied)		-	0.022	-	°C/W	

### Test Conditions

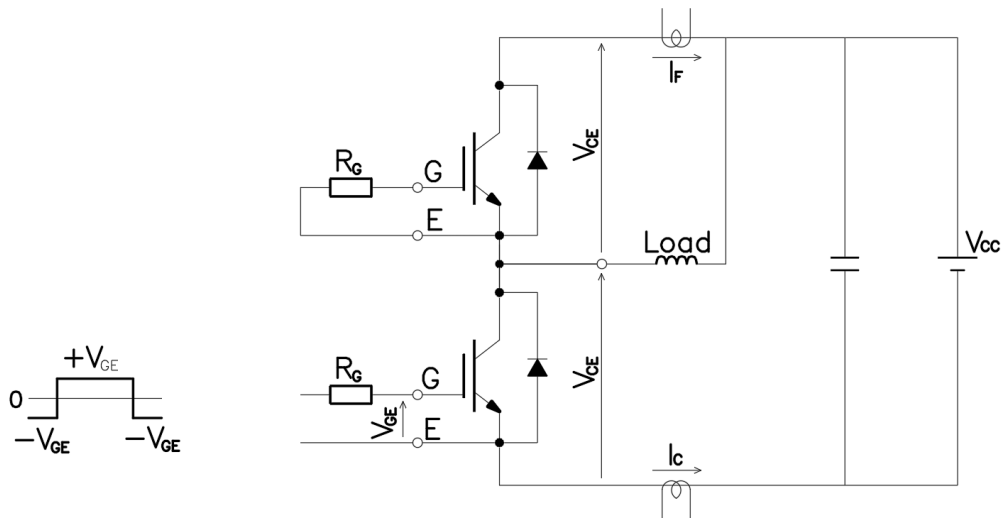


Figure 3. Switching time measure circuit

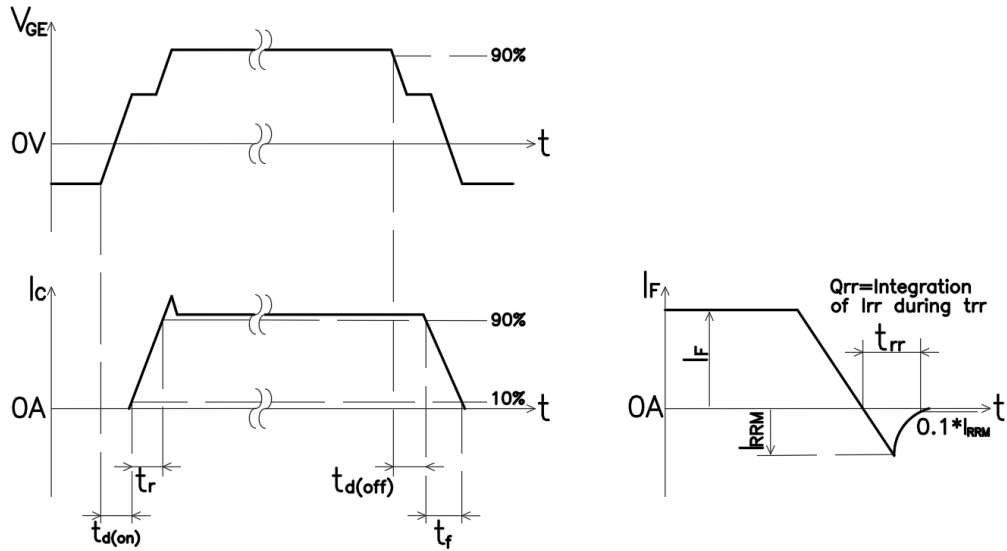
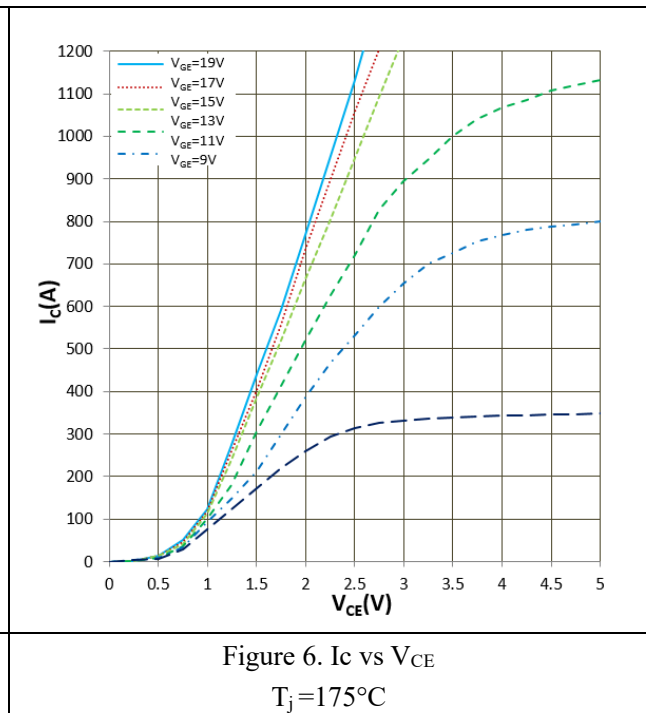
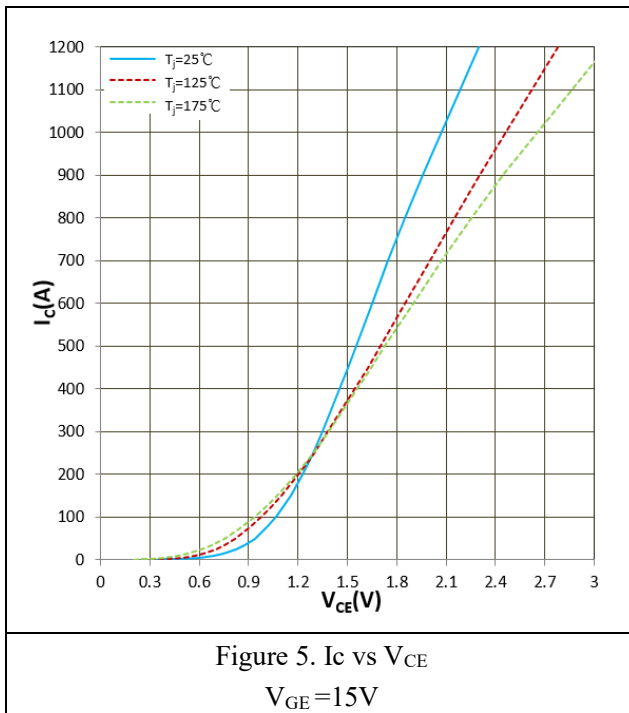


Figure 4. Switching time definition



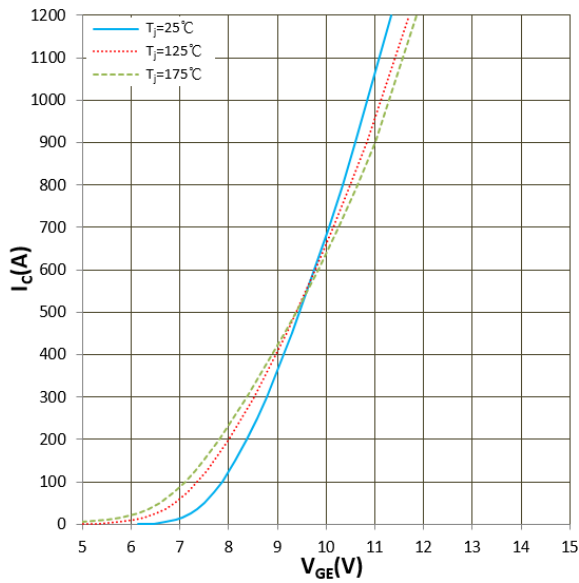


Figure 7.  $I_c$  vs  $V_{GE}$   
 $V_{CE} = 20V$

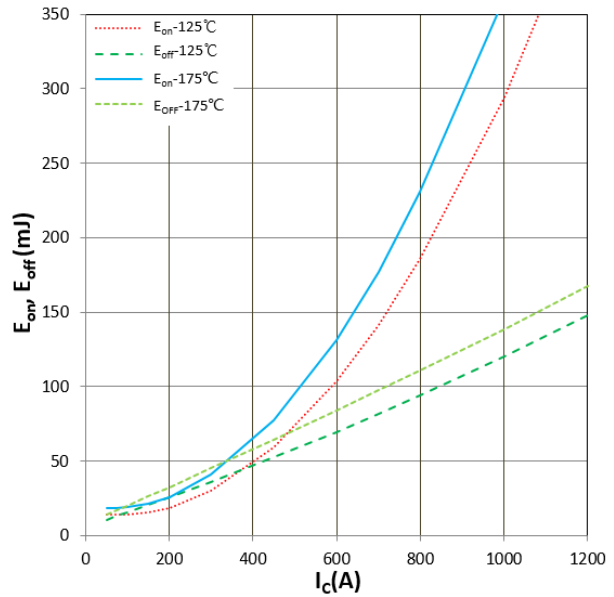


Figure 8.  $E_{on}, E_{off}$  vs  $I_c$ (Typ)  
 $V_{CC} = 600V, V_{GE} = +15V/-8V, R_G = 1\Omega$   
Inductive Load

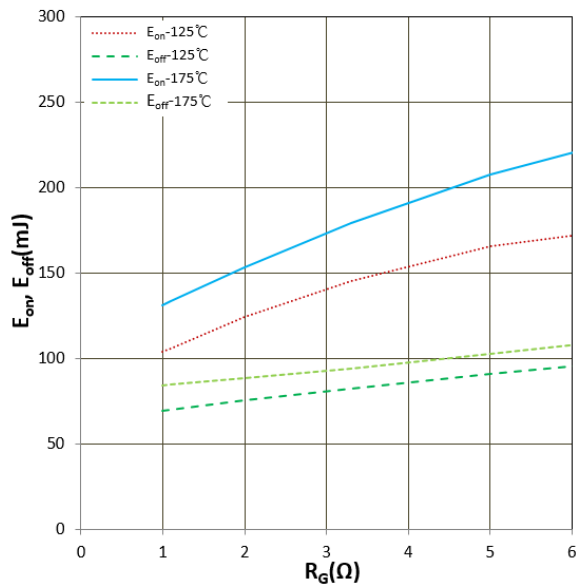


Figure 9.  $E_{on}, E_{off}$  vs  $R_g$ (Typ)  
 $V_{CC} = 600V, V_{GE} = +15V/-8V, I_c = 600A$   
Inductive Load

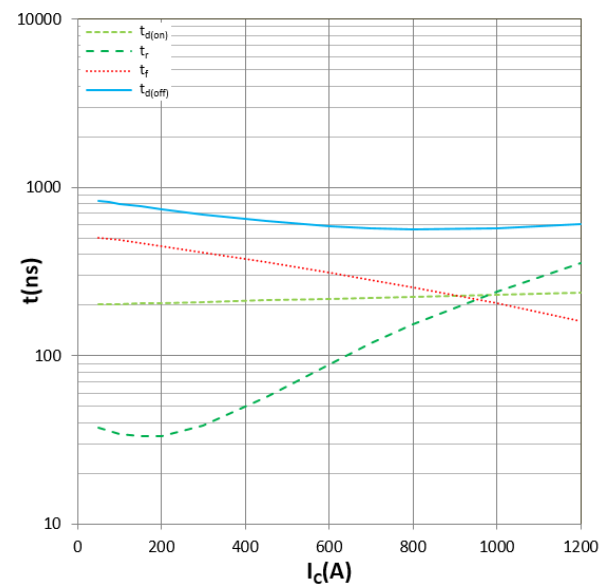


Figure 10. Switching time vs  $I_c$ (Typ)  
 $V_{CC} = 600V, V_{GE} = +15V/-8V, R_G = 1\Omega$   
 $T_j = 175^\circ C$ , Inductive Load

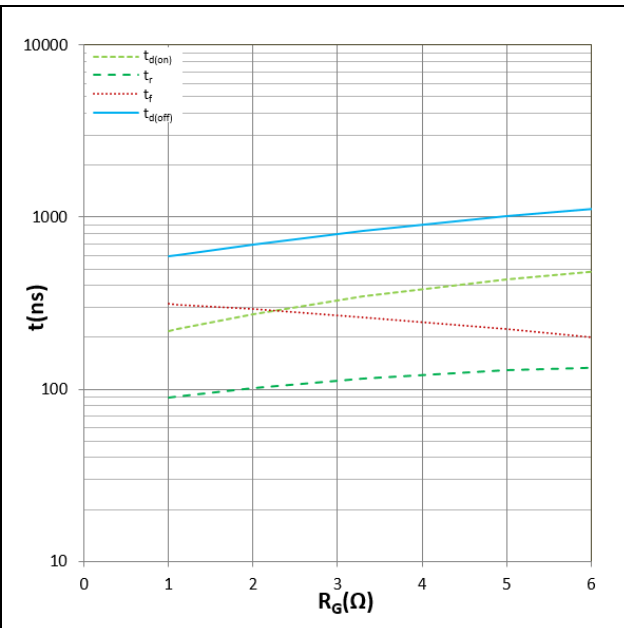


Figure 11. Switching time vs  $R_g$ (Typ)  
 $V_{CC}=600V$ ,  $V_{GE}=+15V/-8V$ ,  $I_C=600A$   
 $T_j=175^\circ C$ , Inductive Load

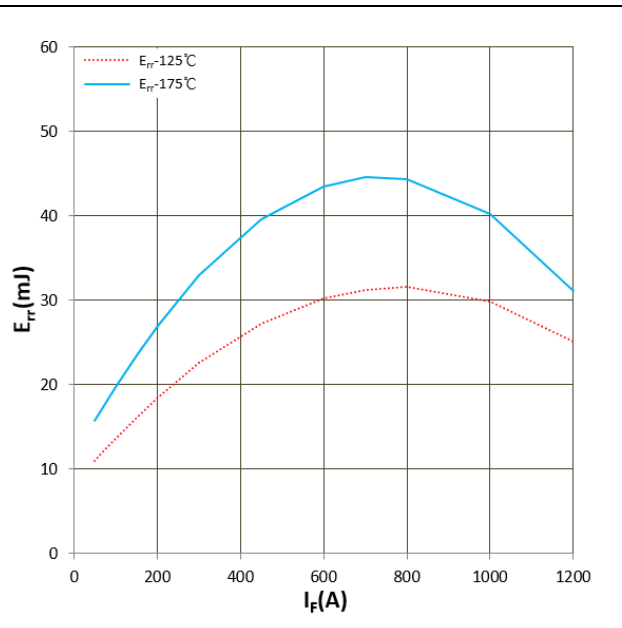


Figure 12.  $E_{rr}$  vs  $I_F$ (Typ)  
 $V_{CC}=600V$ ,  $V_{GE}=+15V/-8V$ ,  $R_G=1\Omega$   
 Inductive Load

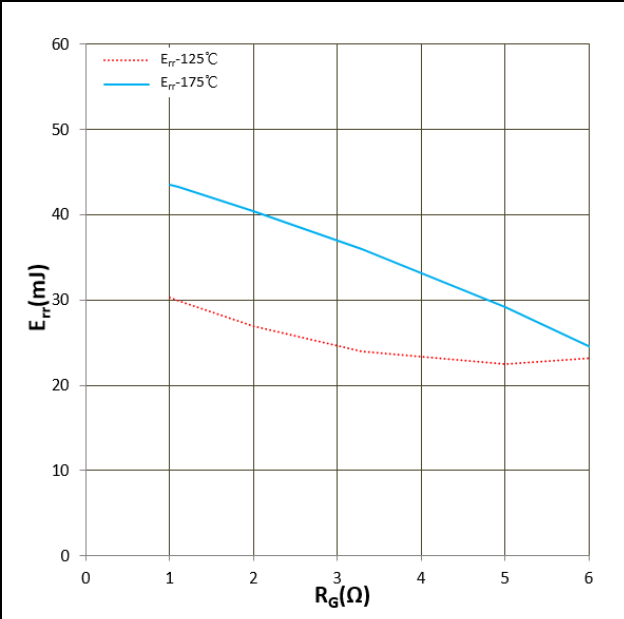


Figure 13.  $E_{rr}$  vs  $R_g$ (Typ)  
 $V_{CC}=600V$ ,  $V_{GE}=+15V/-8V$ ,  $I_F=600A$   
 Inductive Load

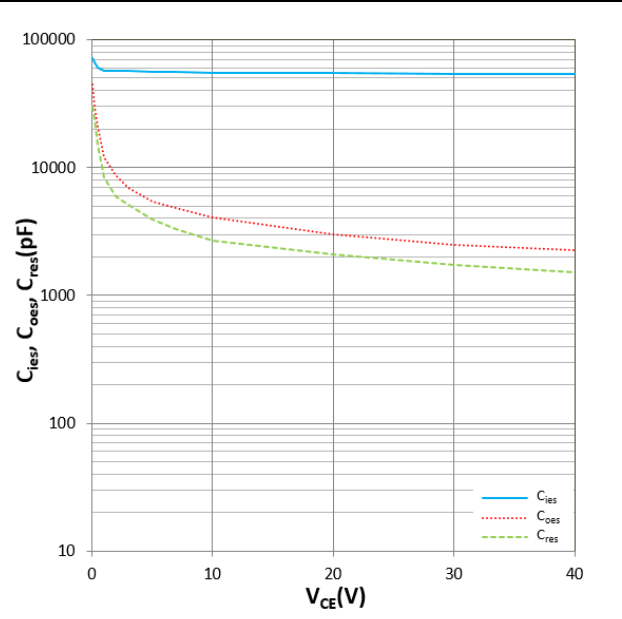


Figure 14.  $C_{ies}$ ,  $C_{oes}$ ,  $C_{res}$  vs  $V_{CE}$   
 $T_j=25^\circ C$ ,  $f=100KHz$



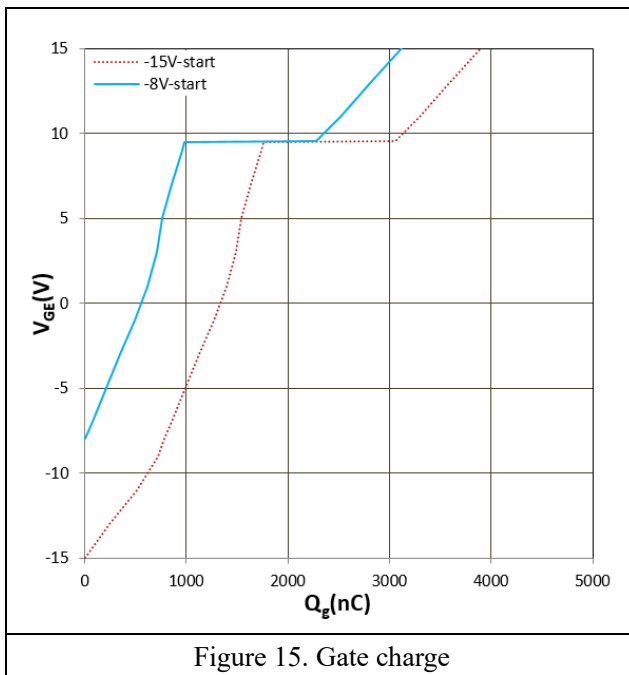


Figure 15. Gate charge

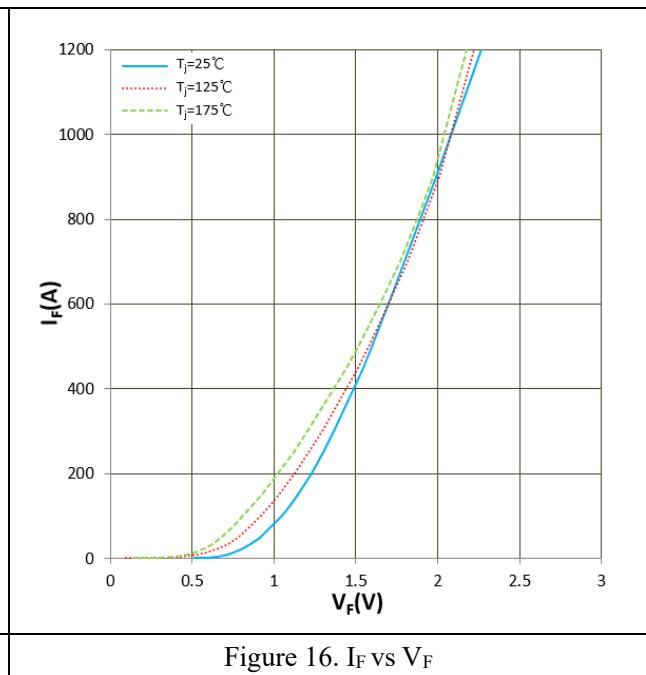


Figure 16.  $I_F$  vs  $V_F$

### Editing record:

Version	Content	Data
A	First edition	2021.11.15

### IMPORTANT NOTICE

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