

Description

The DFI450HF12I4ME1 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

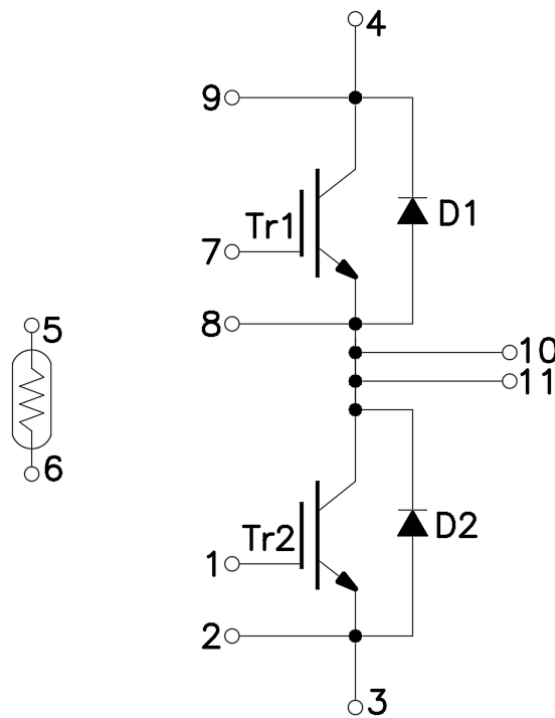


Figure 1. Out drawing & circuit diagram for DFI450HF12I4ME1

Pin Configuration and Marking Information

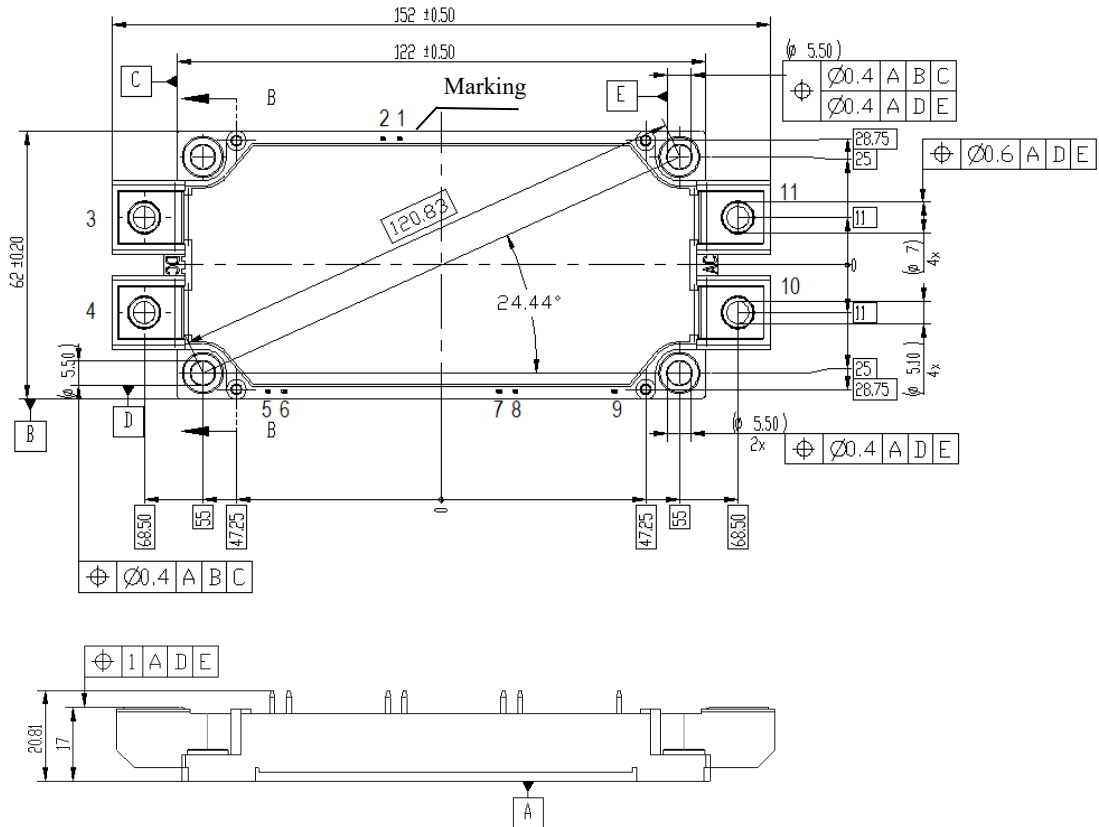


Figure 2. Pin configuration

Module

Parameter	Conditions	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	-	>200	-
Module lead resistance, terminals – chip	T _c = 25°C	0.8	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	420	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	±30V	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, T _j =175°C(IGBT)	3750	W
I _F	Diode forward Current	-	500	A
I _{FRM}	Repetitive peak forward Current	t _p =1ms, Note1	1000	A
I ² t	I ² t-value	V _R =0V, t _p =10ms, T _j =125°C(Diode)	22500	A ² s
I ² t	I ² t-value	V _R =0V, t _p =10ms, T _j =150°C(Diode)	21100	A ² s
T _j	junction temperature	-	-40 to 175	°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	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)} (Chip)	Collector-Emitter Saturation Voltage	I _C =450A V _{GE} =15V	T _j =25°C	-	1.65	1.95	V
			T _j =150°C	-	1.85	-	V
			T _j =175°C	-	1.90	-	V
V _{GE(th)}	Gate-Emitter threshold Voltage	I _C =19mA, V _{CE} =V _{GE}		5.0	-	6.8	V
Q _G	Gate charge	V _{GE} =-15V to +15V		-	3.3	-	uC
R _{Gint}	Internal gate resistor	-	T _j =25°C	-	1.5	-	Ω
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V f=1MHz	T _j =25°C	-	39	-	nF
C _{res}	Reverse transfer Capacitance			-	1.39	-	nF
I _{CES}	Collector- Emitter Cut off Current	V _{CE} =1200V, V _{GE} =0V	T _j =25°C	-	-	45	uA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =30V, V _{CE} =0V	T _j =25°C	-	-	1.13	uA
t _{d(on)}	Turn-on delay time	V _{CC} =600V I _C = 450A V _{GE} =+15V/-8V R _G =1.0Ω Inductive load	T _j =25°C	-	180	-	ns
			T _j =125°C	-	191	-	
			T _j =175°C	-	195	-	
t _r	Rise time		T _j =25°C	-	52	-	ns
			T _j =125°C	-	54	-	
			T _j =175°C	-	58	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	422	-	ns
			T _j =125°C	-	480	-	
			T _j =175°C	-	515	-	
t _f	Fall time		T _j =25°C	-	113	-	ns
		T _j =125°C	-	160	-		
		T _j =175°C	-	255	-		
E _{on}	Turn-on power dissipation	T _j =25°C	-	45.2	-	mJ	
		T _j =125°C	-	63.53	-		
		T _j =175°C	-	78.9	-		
E _{off}	Turn-off power dissipation	T _j =25°C	-	35.38	-	mJ	
		T _j =125°C	-	43.99	-		
		T _j =175°C	-	52.21	-		
R _{th(j-c)}	Thermal Resistance, Junction to Case (IGBT)			-	0.04	-	°C/W
R _{th(c-s)}	Thermal Resistance, Case to sink (Conductive Grease applied)			-	0.02	-	°C/W

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	$I_F=450\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	-	1.7	2.1	V
			$T_j=150^\circ\text{C}$	-	1.7	-	
			$T_j=175^\circ\text{C}$	-	1.65	-	
t_{rr}	Reverse recovery time	(Switch side) $V_{CC}=600\text{V}, I_C=450\text{A}$ $V_{GE}=+15\text{V}/-8\text{V}$ $R_G=1.0\Omega$	$T_j=25^\circ\text{C}$	-	0.34	-	us
			$T_j=125^\circ\text{C}$	-	0.598	-	
			$T_j=175^\circ\text{C}$	-	0.75	-	
I_{RM}	Peak reverse recovery Current	(FRD side) $V_{rr}=600\text{V}, I_F=450\text{A}$ $V_{GE}=-8\text{V}$ Inductive load switching operation	$T_j=25^\circ\text{C}$	-	283	-	A
			$T_j=125^\circ\text{C}$	-	262	-	
			$T_j=175^\circ\text{C}$	-	266	-	
Q_{rr}	Recovered charge	(FRD side) $V_{rr}=600\text{V}, I_F=450\text{A}$ $V_{GE}=-8\text{V}$ Inductive load switching operation	$T_j=25^\circ\text{C}$	-	33.41	-	uC
			$T_j=125^\circ\text{C}$	-	62.63	-	
			$T_j=175^\circ\text{C}$	-	84.87	-	
E_{rr}	Reverse recovered energy	(FRD side) $V_{rr}=600\text{V}, I_F=450\text{A}$ $V_{GE}=-8\text{V}$ Inductive load switching operation	$T_j=25^\circ\text{C}$	-	10.58	-	mJ
			$T_j=125^\circ\text{C}$	-	22.18	-	
			$T_j=175^\circ\text{C}$	-	29.89	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)		-	0.070	-	$^\circ\text{C}/\text{W}$	
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied)		-	0.022	-	$^\circ\text{C}/\text{W}$	

Test Conditions

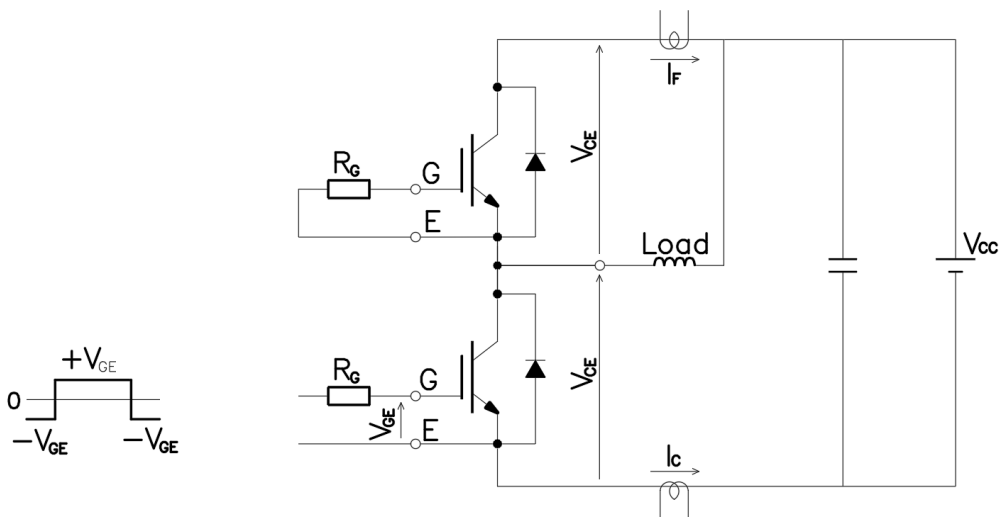


Figure 3. Switching time measure circuit

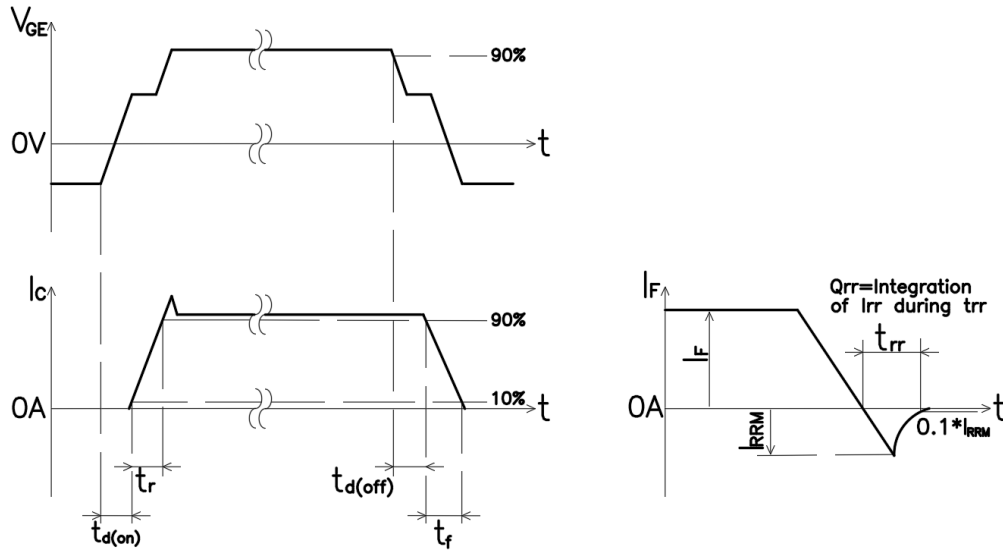


Figure 4. Switching time definition

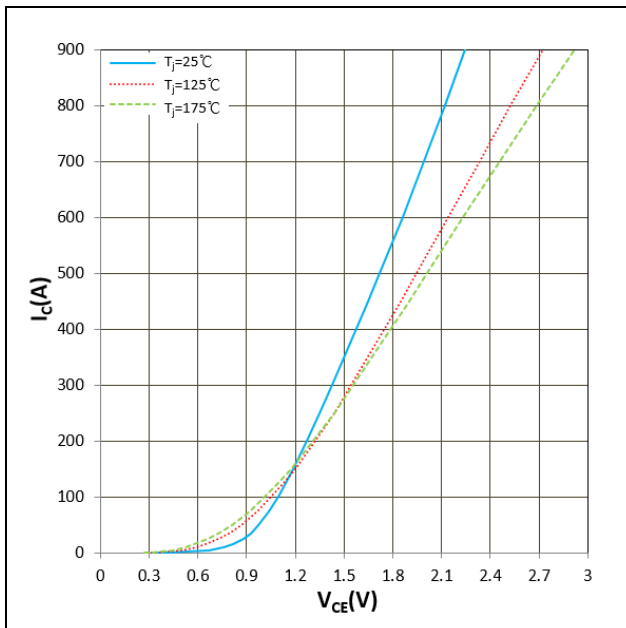


Figure 5. I_c vs V_{CE}
 $V_{GE} = 15V$

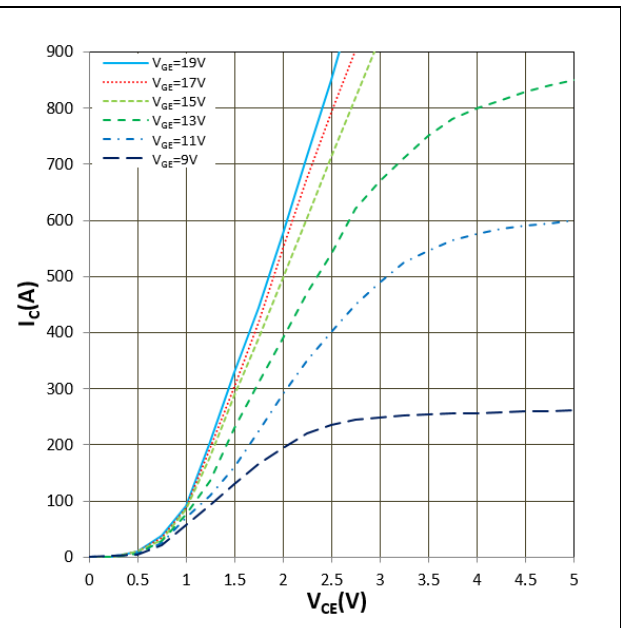


Figure 6. I_c vs V_{CE}
 $T_j = 175^\circ C$

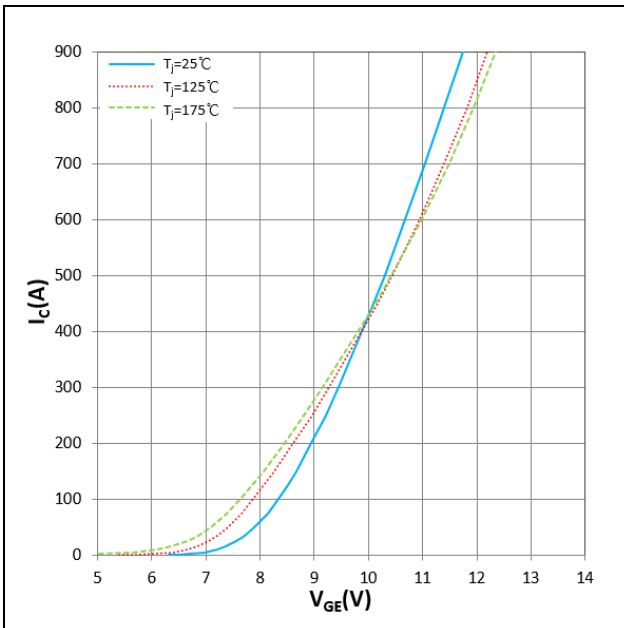


Figure 7. I_c vs V_{GE}
 $V_{CE} = 20V$

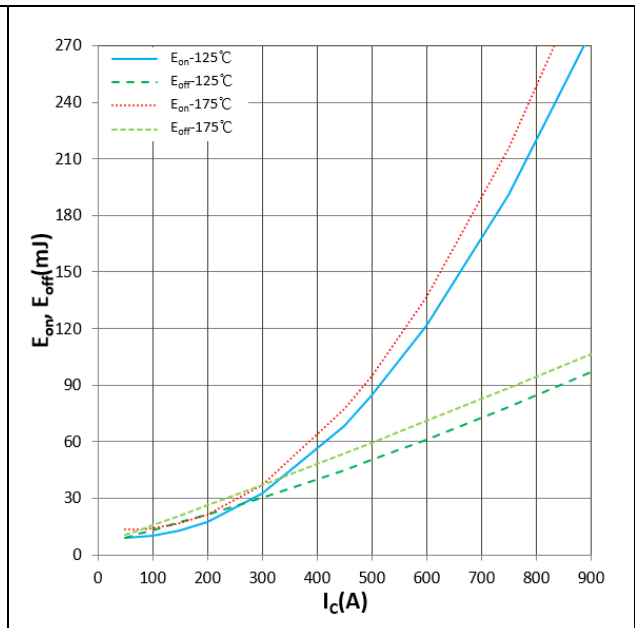


Figure 8. E_{on} , E_{off} vs I_c (Typ)
 $V_{CC} = 600V$, $V_{GE} = +15V/-8V$, $R_G = 1\Omega$
Inductive Load

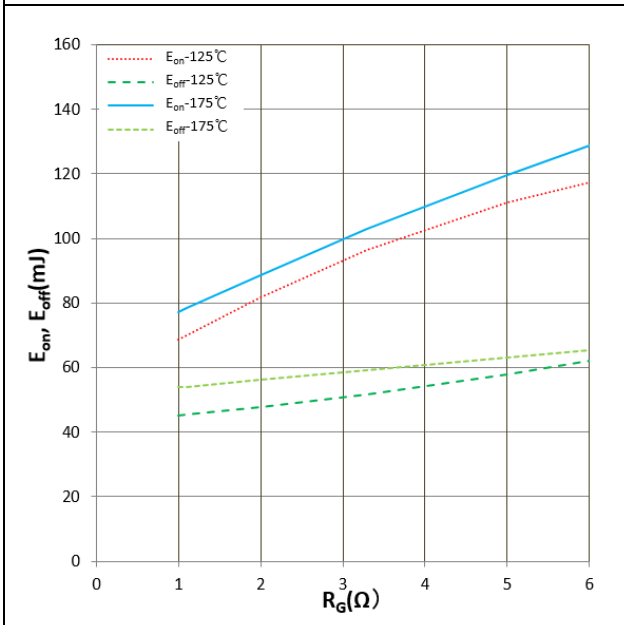


Figure 9. E_{on} , E_{off} vs R_g (Typ)
 $V_{CC} = 600V$, $V_{GE} = +15V/-8V$, $I_c = 450A$
Inductive Load

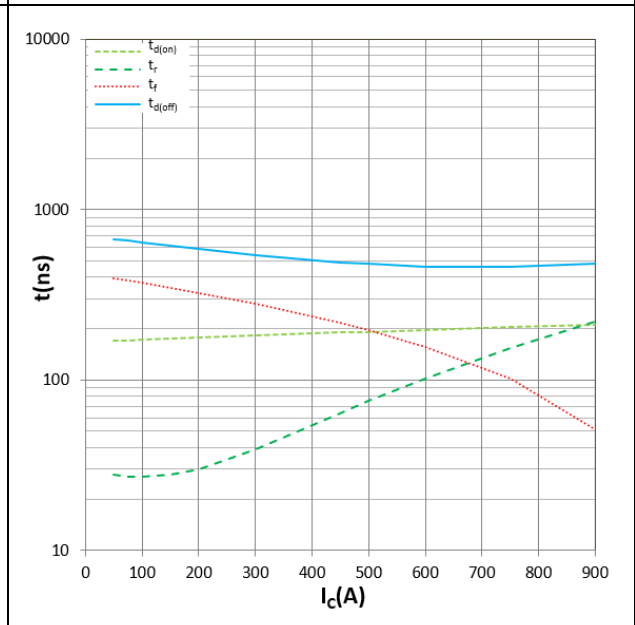


Figure 10. Switching time vs I_c (Typ)
 $V_{CC} = 600V$, $V_{GE} = +15V/-8V$, $R_G = 1\Omega$
 $T_j = 175^\circ C$, Inductive Load

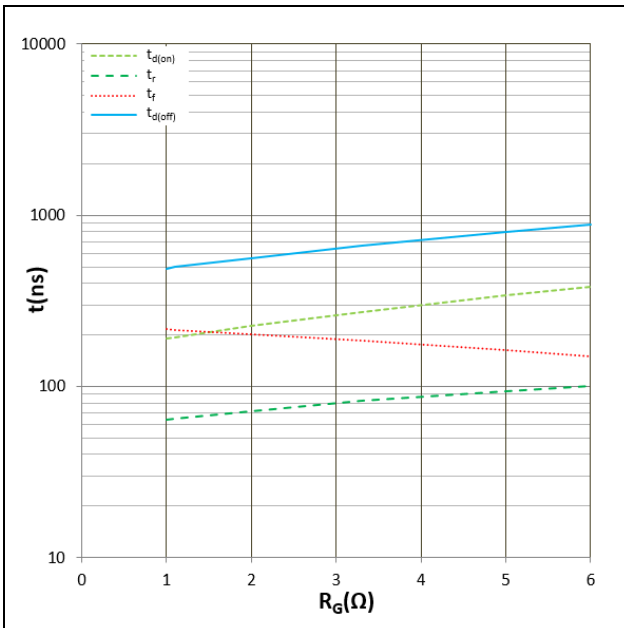


Figure 11. Switching time vs R_g (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_C=450A$
 $T_j=175^\circ C$, Inductive Load

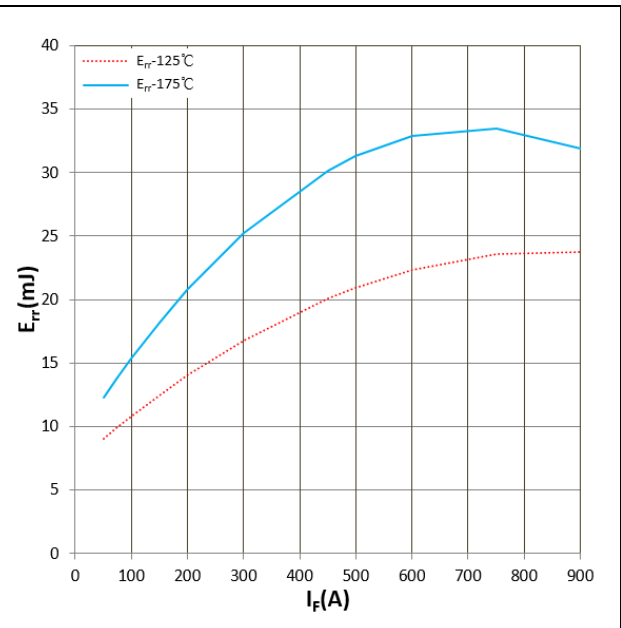


Figure 12. E_{rr} vs I_F (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $R_g=1\Omega$
 Inductive Load

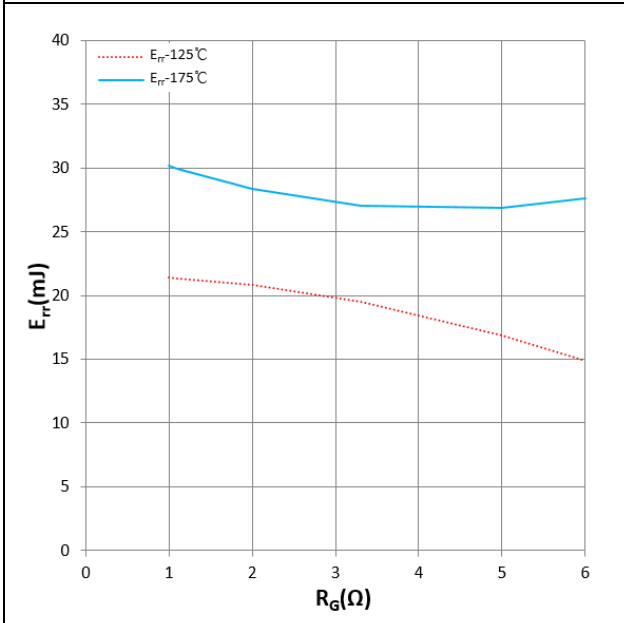


Figure 13. E_{rr} vs R_g (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_F=450A$
 Inductive Load

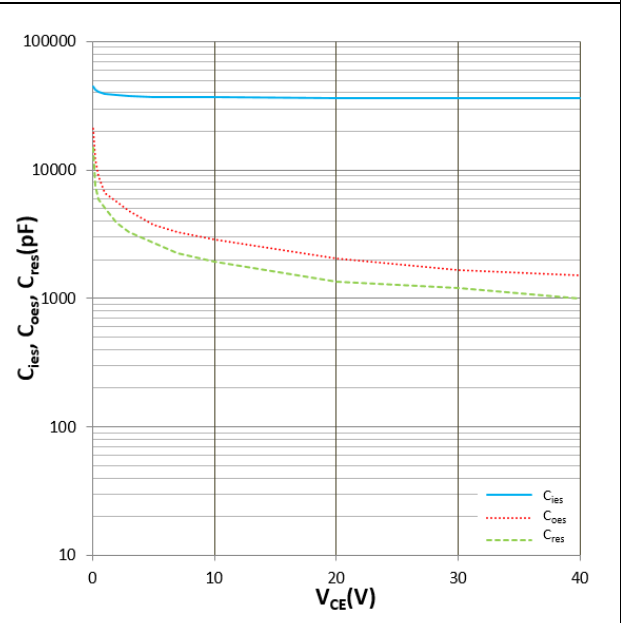


Figure 14. C_{ies} , C_{oes} , C_{res} vs V_{CE}
 $T_j=25^\circ C$, $f=100KHz$

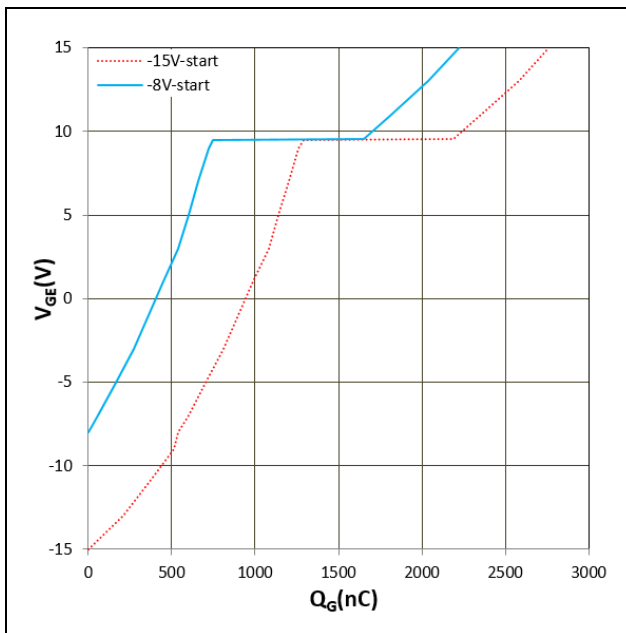


Figure 15. Gate charge

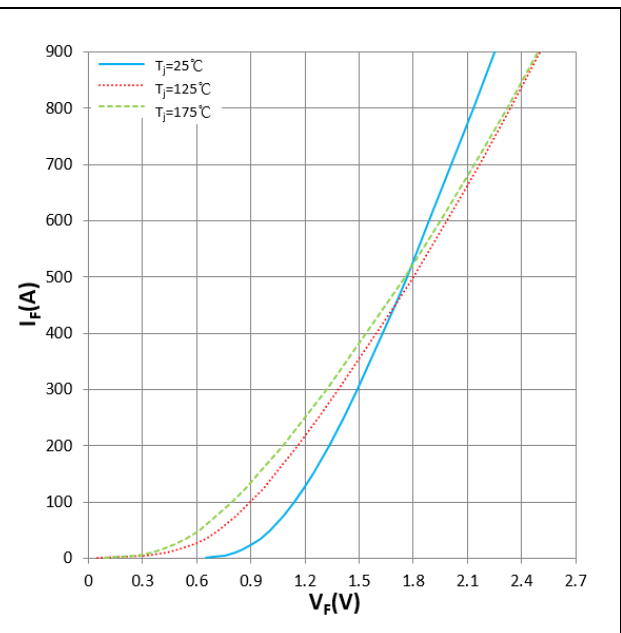


Figure 16. I_F vs V_F

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