DFI450HF12I4ME1

1200V/450A Half Bridge IGBT Module

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

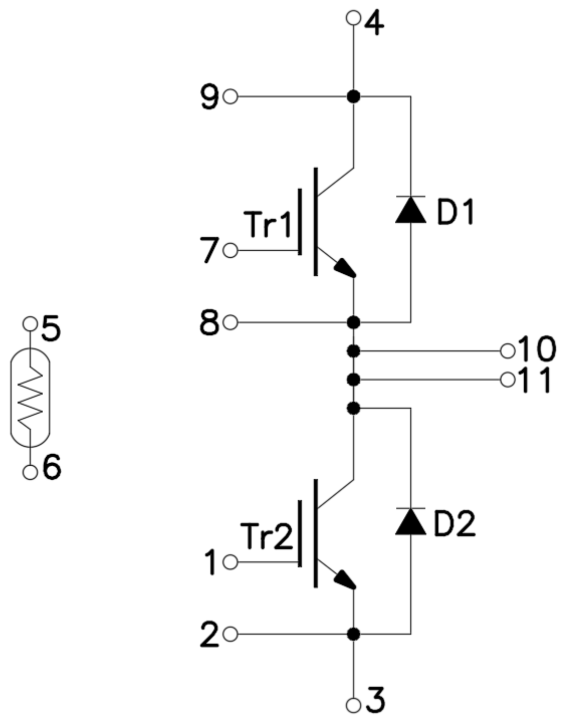

Figure 1. Out drawing & circuit diagram for DFI450HF12I4ME1

Pin Configuration and Marking Information

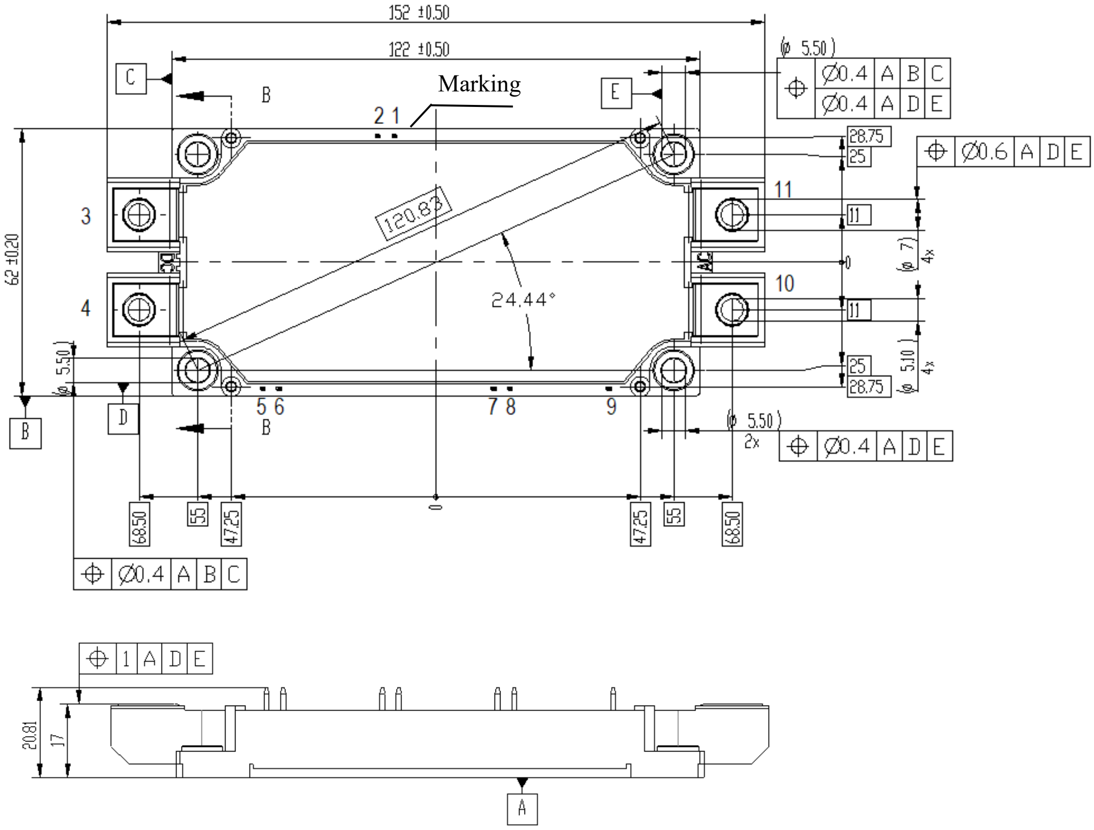

Figure 2. Pin configuration

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^2t	I^2t-value	V_R=0V, t_p=10ms, T_j=125°C(Diode)	22500	A^2s
I^2t	I^2t-value	V_R=0V, t_p=10ms, T_j=150°C(Diode)	21100	A^2s
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	$R2 = R25 \exp[B_{25/50}(1/T2 - 1/(298{,}15\ K))]$	-	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 Min.	Value Typ.	Value Max	Unit
$V_{CE(sat)}$ (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°C unless otherwise specified, chip)

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

Test Conditions

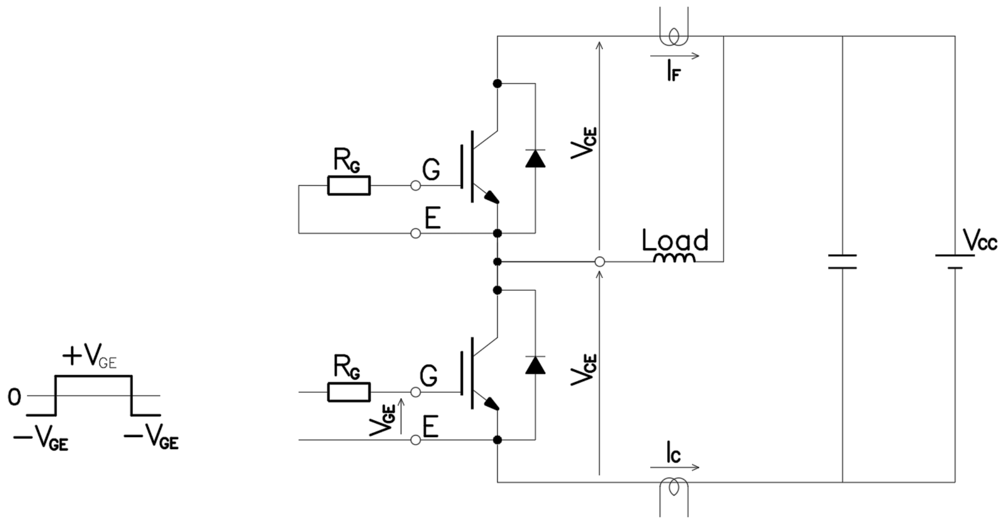

Figure 3. Switching time measure circuit

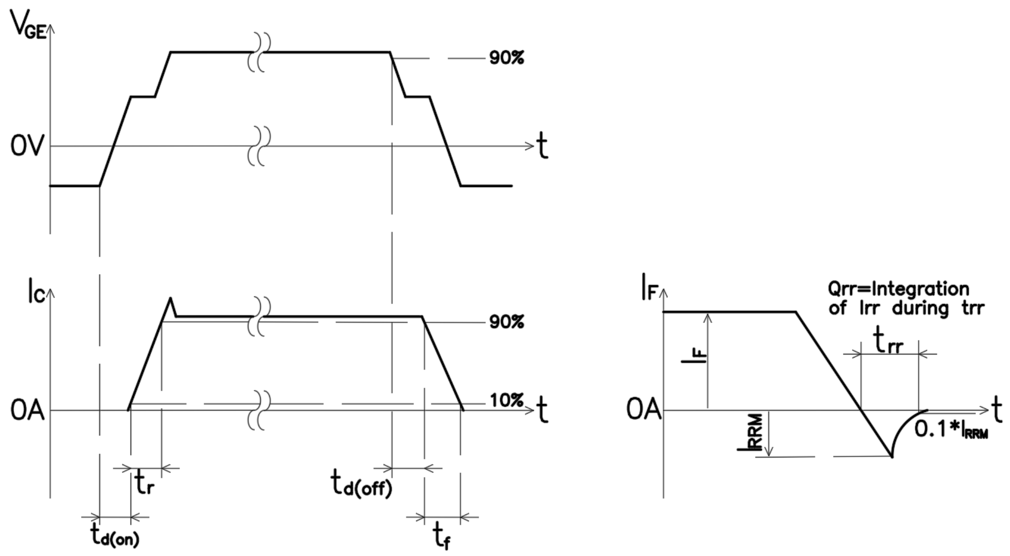

Figure 4. Switching time definition

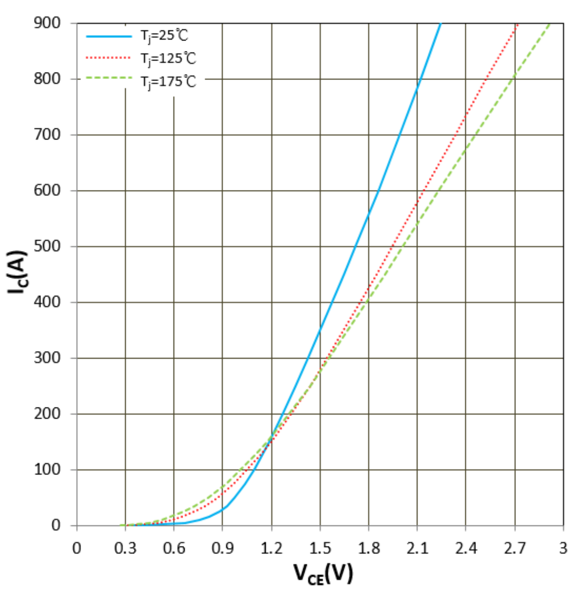	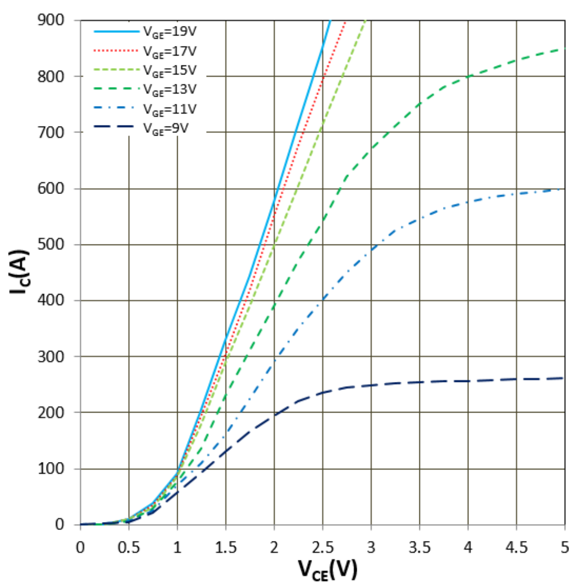
Figure 5. Ic vs V_{CE} V_{GE}=15V	Figure 6. Ic vs V_{CE} T_j=175°C

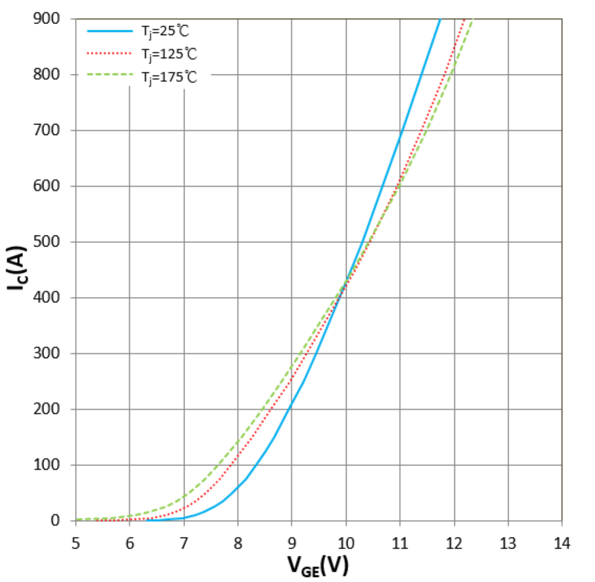

Figure 7. Ic vs V_{GE}

V_{CE} =20V

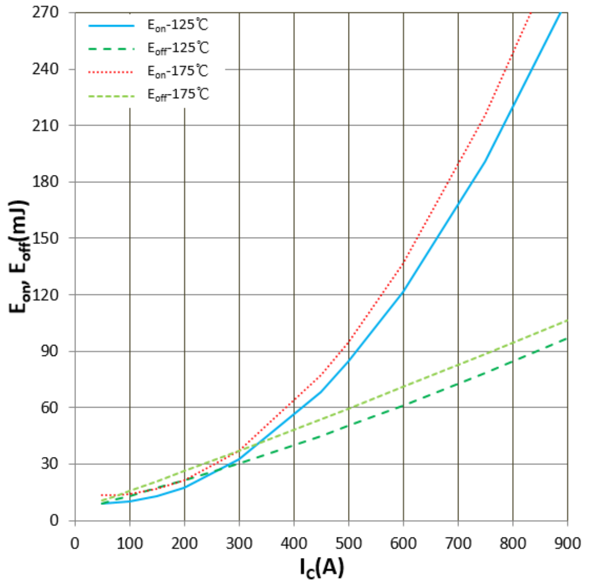

Figure8. E_{on}, E_{off} vs Ic(Typ)

V_{CC} =600V, V_{GE} =+15V/-8V, R_G =1Ω

Inductive Load

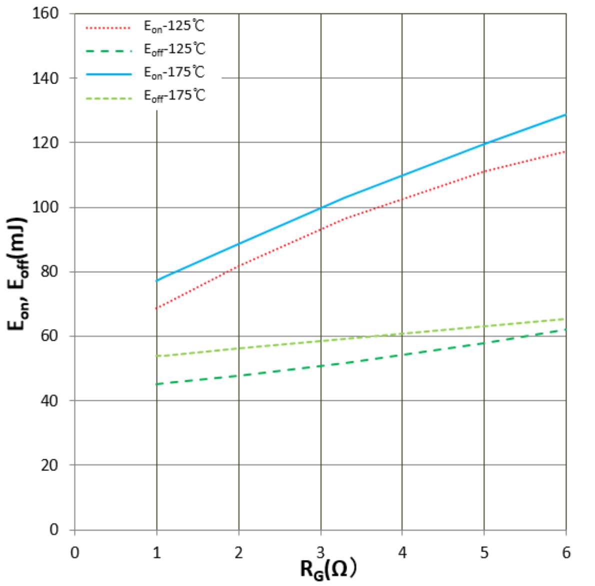

Figure 9. E_{on}, E_{off} vs R_g(Typ)

V_{CC} =600V, V_{GE} =+15V/-8V, I_C =450A

Inductive Load

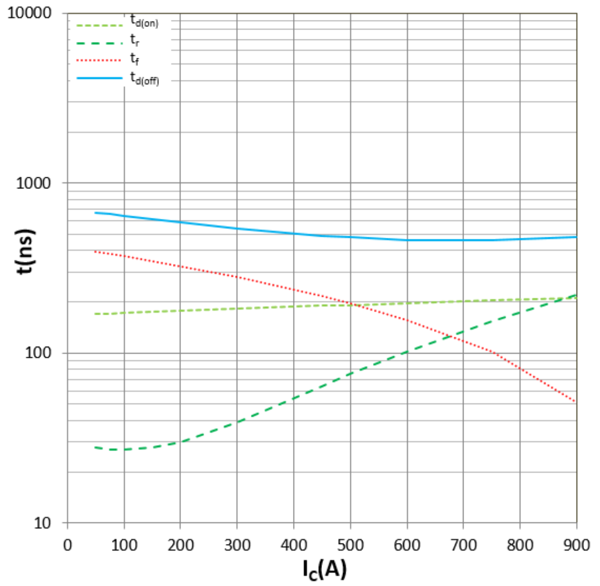

Figure 10. Switching time vs Ic(Typ)

V_{CC} =600V, V_{GE} =+15V/-8V, R_G =1Ω

T_j =175°C, Inductive Load

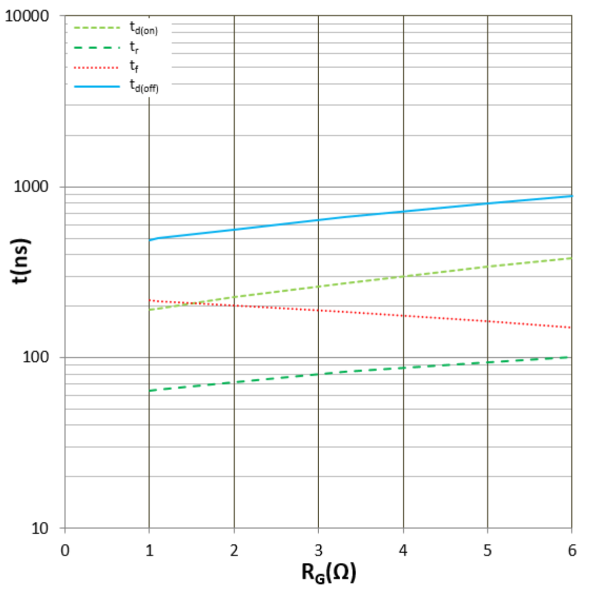

Figure 11. Switching time vs R_g(Typ)
V_{CC}=600V, V_{GE}=+15V/-8V, I_C=450A
T_j=175°C, Inductive Load

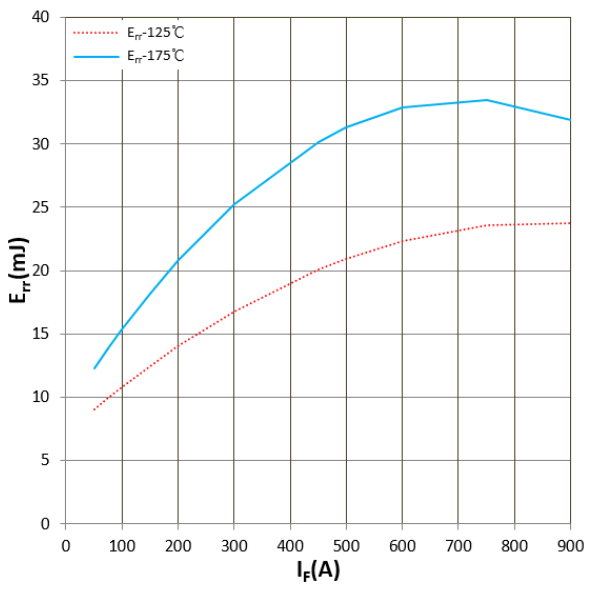

Figure 12. E_{rr} vs I_F(Typ)
V_{CC}=600V, V_{GE}=+15V/-8V, R_G=1Ω
Inductive Load

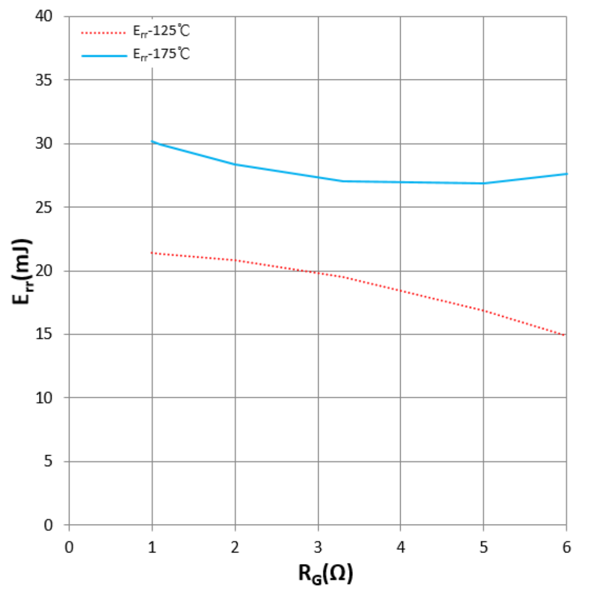

Figure 13. E_{rr} vs R_G(Typ)
V_{CC}=600V, V_{GE}=+15V/-8V, I_F=450A
Inductive Load

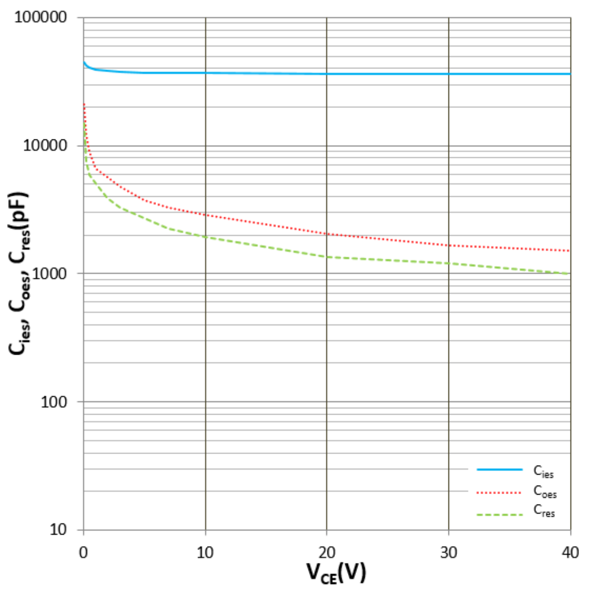

Figure 14. C_{ies}, C_{oes}, C_{res} vs V_{CE}
T_j=25°C, f=100KHz

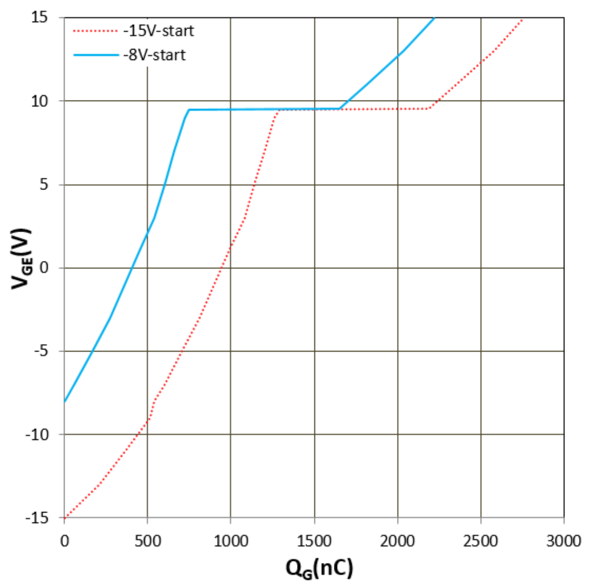

Figure 15. Gate charge

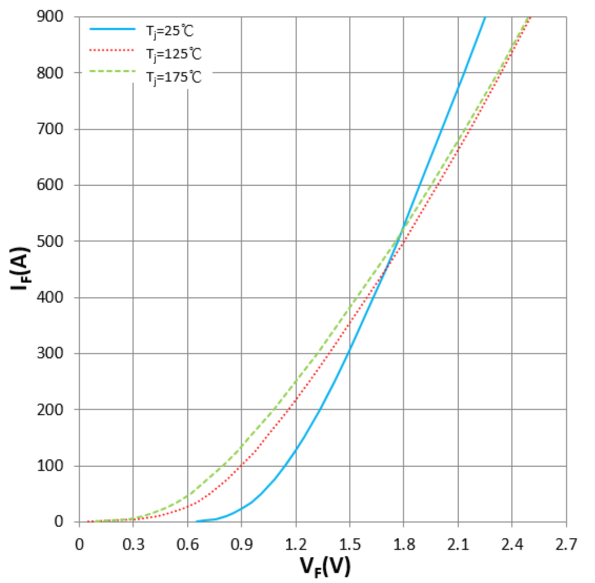

Figure 16. I_F vs V_F

Editing record:

Version	Content	Data
A	First edition	2021.11.15

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