

HCG450FH170D3RE2

1700V/450A Half Bridge IGBT Module

Description

The HCG450FH170D3RE2 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 1700V
- Low saturation voltage $V_{CE(sat)}$
- Low Switching Losses
- 150 °C maximum junction temperature
- Thermistor inside

Applications

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

Circuit diagram

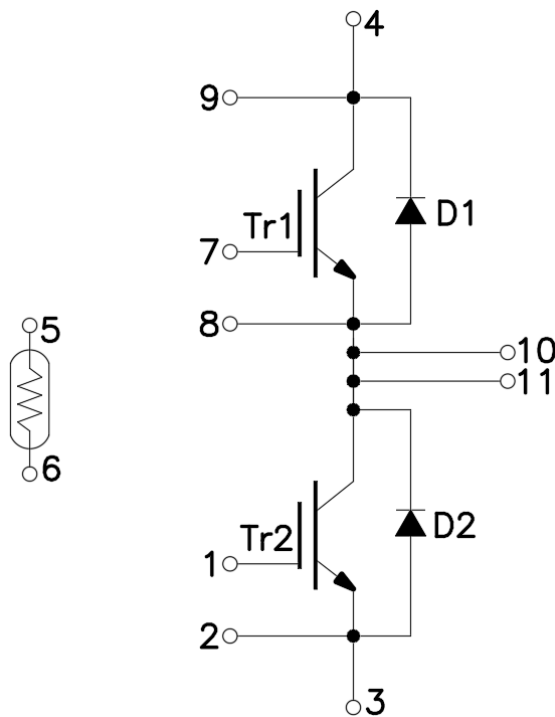


Figure 1. Out drawing & circuit diagram for HCG450FH170D3RE2

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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	-	>225	-
Module lead resistance, terminals – chip	T _C =25°C	0.8	m
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	1700	V
V _{GES}	Gate-Emitter Voltage	C-E Short	±20V	V
I _C	DC Continuous Collector Current	T _C =100°C	500	A
I _{CM}	Pulse Collector Current	t _p =1ms, Note1	1000	A
P _C	Maximum Power Dissipation	T _C =25°C, T _j =150°C(IGBT)	3125	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)	20000	A ² s
T _j	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	-	k
R/R	Deviation of R100	T _C =100°C, R ₁₀₀ =493	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

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IGBT Electrical characteristics (T_j=25°C unless otherwise specified, chip: Target)

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	-	1.85	2.20	V
			T _j =125°C	-	2.25	-	V
			T _j =150°C	-	2.35	-	V
V _{GE(th)}	Gate-Emitter threshold Voltage	I _C =18mA, V _{CE} =V _{GE}		5.2	5.8	6.4	V
Q _G	Gate charge	V _{GE} =-15V to +15V		-	4.6	-	uC
R _{Gint}	Internal gate resistor	-	T _j =25°C	-	1.7	-	
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V f =1MHz	T _j =25°C	-	36	-	nF
C _{res}	Reverse transfer Capacitance			-	1.15	-	nF
I _{CES}	Collector- Emitter Cut off Current	V _{CE} =1700V, V _{GE} =0V	T _j =25°C	-	-	3.0	mA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =20V, V _{CE} =0V	T _j =25°C	-	-	1.0	uA
t _{d(on)}	Turn-on delay time	V _{CC} =900V I _C =450A V _{GE} =+15V/-8V R _G =3.3 Inductive load	T _j =25°C	-	335	-	ns
			T _j =150°C	-	360	-	
t _r	Rise time		T _j =25°C	-	170	-	ns
			T _j =150°C	-	210	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	655	-	ns
			T _j =150°C	-	800	-	
t _f	Fall time		T _j =25°C	-	405	-	ns
			T _j =150°C	-	680	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	205	-	mJ
			T _j =150°C	-	320	-	
E _{off}	Turn-off power dissipation	T _j =25°C	-	105	-	mJ	
		T _j =150°C	-	153	-		
I _{sc}	SC data	V _{GE} <15V V _{CC} =1000V	T _j =150°C t _p <10us	-	2300	-	A
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)			-	0.015	-	°C/W

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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	$I_F=600\text{A}$ $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	-	1.9	2.2	V
			$T_j=150^\circ\text{C}$	-	2.0	-	
t_{rr}	Reverse recovery time	(Switch side) $V_{CC}=900\text{V}, I_c=450\text{A}$ $V_{GE}=+15\text{V}/-8\text{V}$	$T_j=25^\circ\text{C}$	-	1.09	-	us
			$T_j=150^\circ\text{C}$	-	1.58	-	
I_{RM}	Peak reverse recovery Current	$R_G=3.3$ (FRD side)	$T_j=25^\circ\text{C}$	-	199	-	A
			$T_j=150^\circ\text{C}$	-	250	-	
Q_{rr}	Recovered charge	$V_{rr}=900\text{V}, I_F=450\text{A}$ $V_{GE}=-8\text{V}$	$T_j=25^\circ\text{C}$	-	79	-	uC
			$T_j=150^\circ\text{C}$	-	184	-	
E_{rr}	Reverse recovered energy	Inductive load switching operation	$T_j=25^\circ\text{C}$	-	35	-	mJ
			$T_j=150^\circ\text{C}$	-	90	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)		-	0.06	-	$^\circ\text{C}/\text{W}$	
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied)		-	0.015	-	$^\circ\text{C}/\text{W}$	

Test Conditions

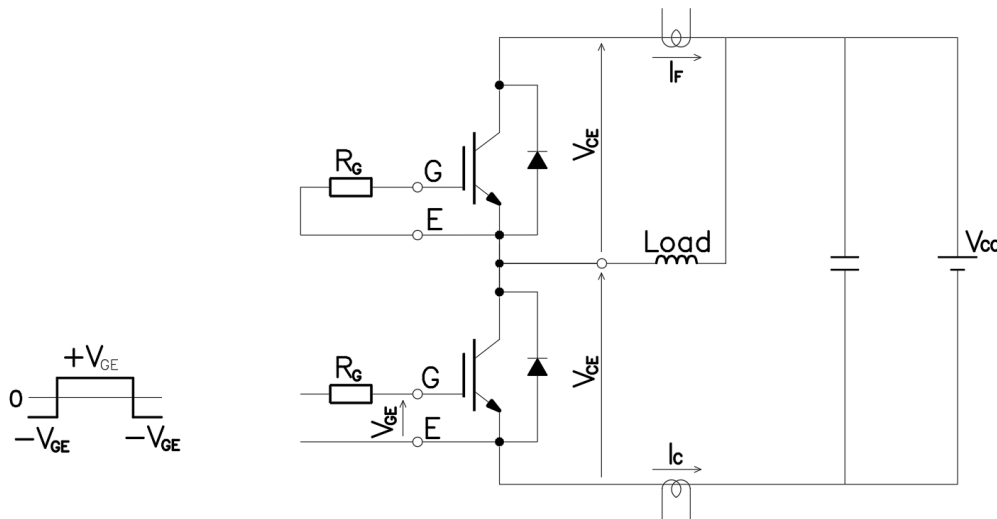


Figure 3. Switching time measure circuit

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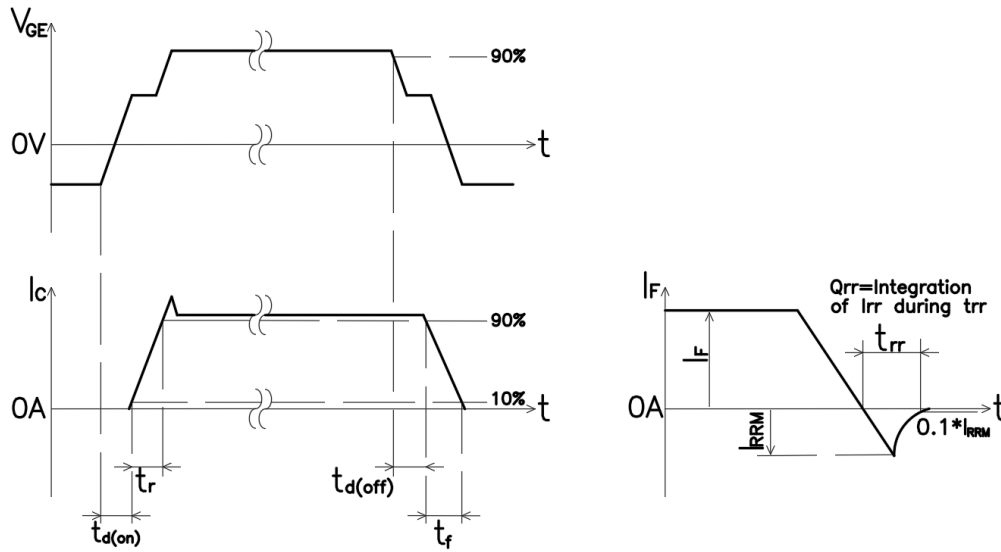
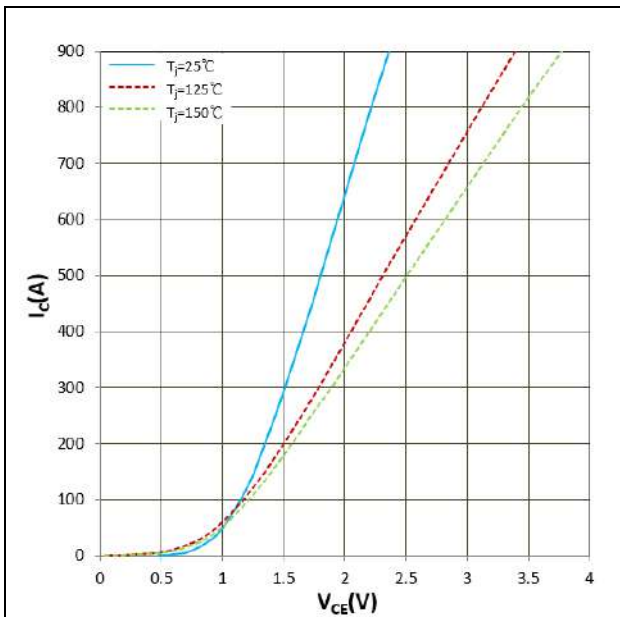
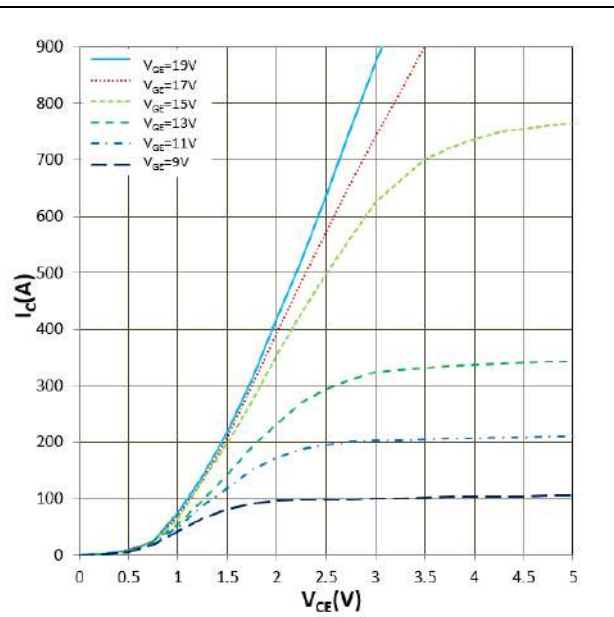


Figure 4. Switching time definition


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

 Figure 6. I_c vs V_{CE}
 $T_j=150^\circ C$

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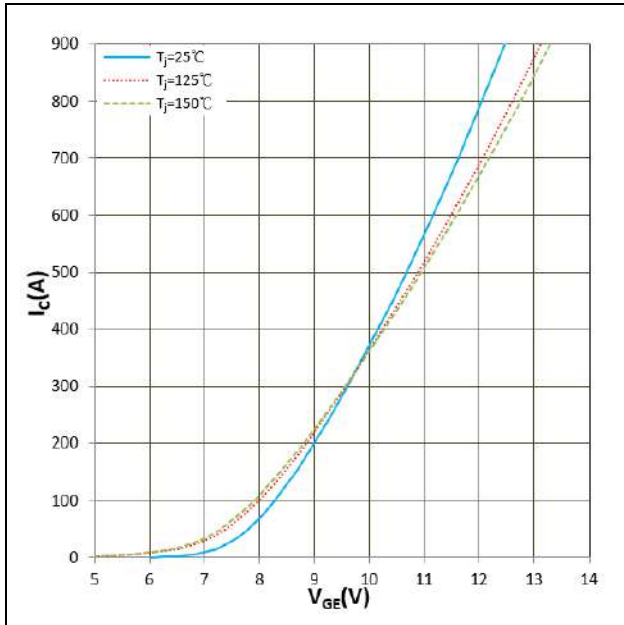


Figure 7. I_c vs V_{GE}
 $V_{CE}=20V$

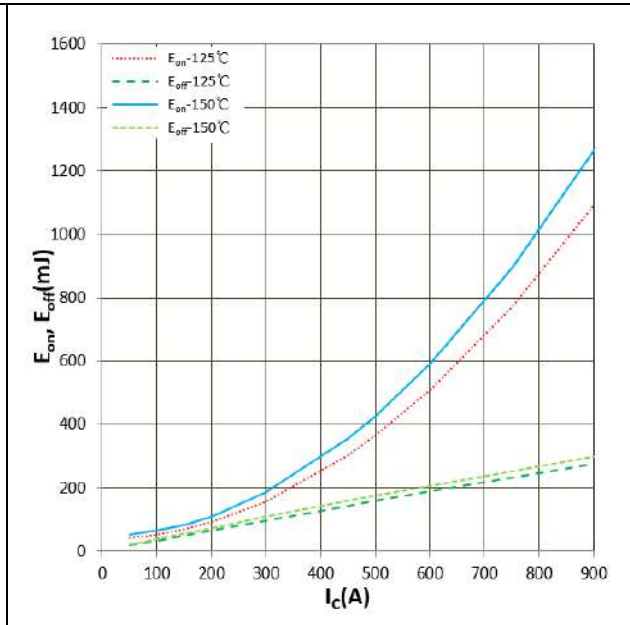


Figure 8. E_{on} , E_{off} vs I_c (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $R_G=3.3\Omega$
 Inductive Load

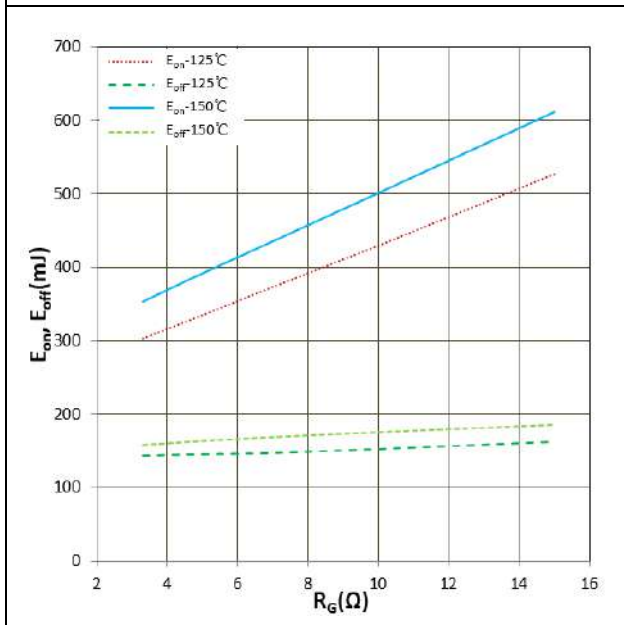


Figure 9. E_{on} , E_{off} vs R_g (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $I_c=450A$
 Inductive Load

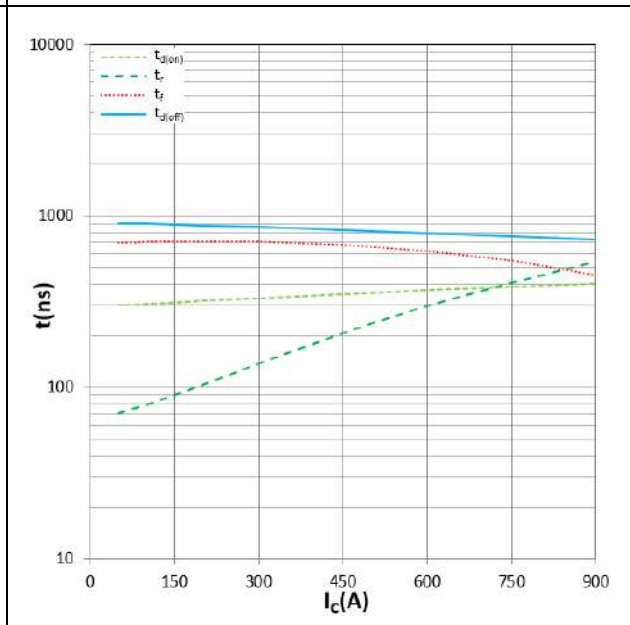


Figure 10. Switching time vs I_c (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $R_G=3.3\Omega$
 $T_j=150^\circ C$, Inductive Load

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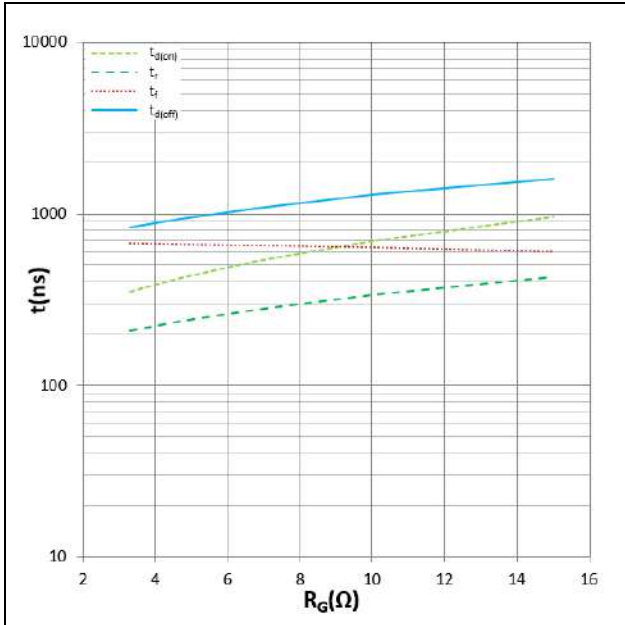


Figure 11. Switching time vs R_g (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $I_C=450A$,
 $T_j=150^\circ C$, Inductive Load

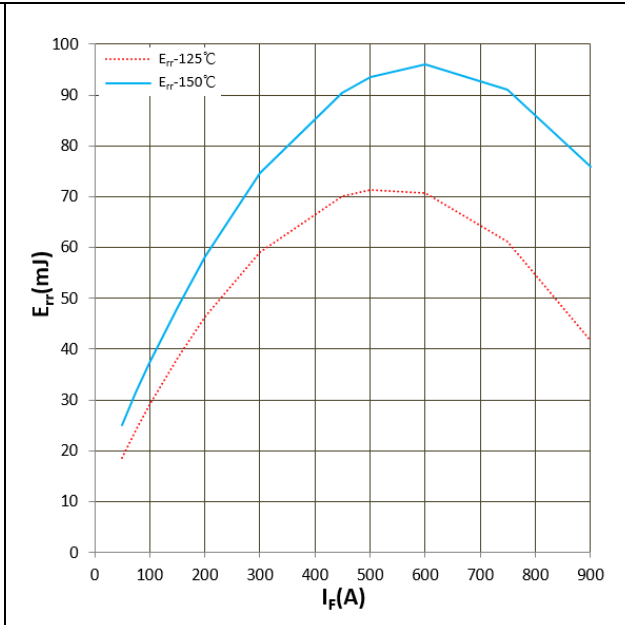


Figure 12. E_{rr} vs I_F (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $R_G=3.3\Omega$
 Inductive Load

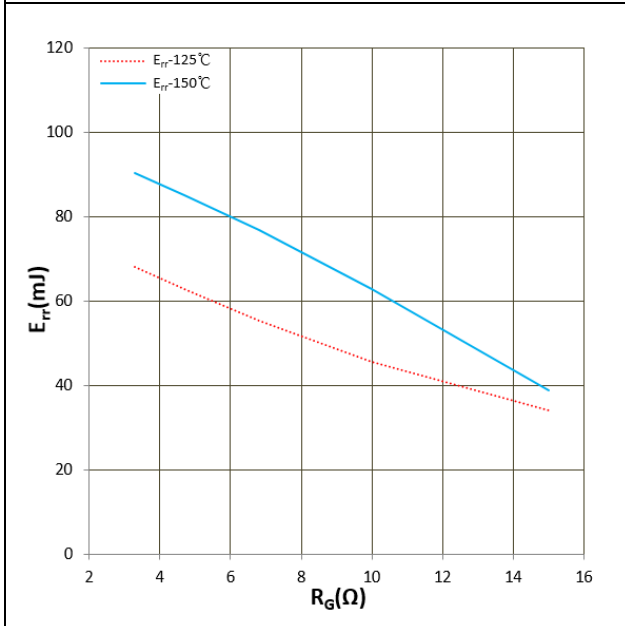


Figure 13. E_{rr} vs R_G (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $I_F=450A$
 Inductive Load

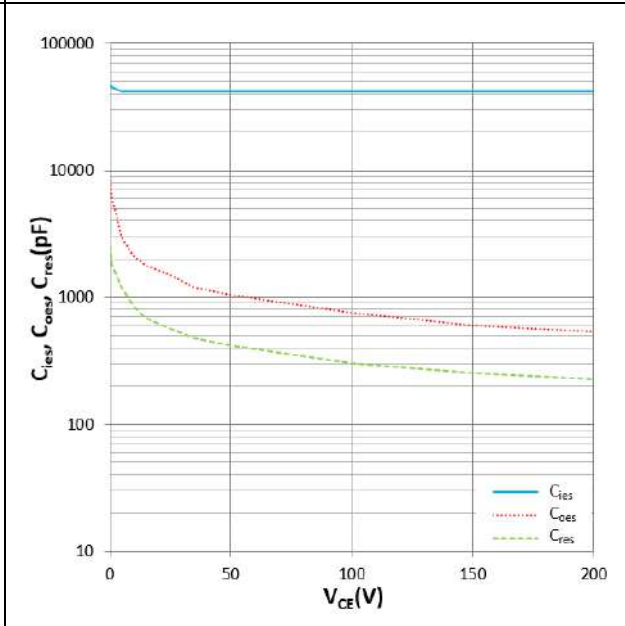


Figure 14. C_{ies} , C_{oes} , C_{res} vs V_{CE}
 $T_j=25^\circ C$, $f=1MHz$

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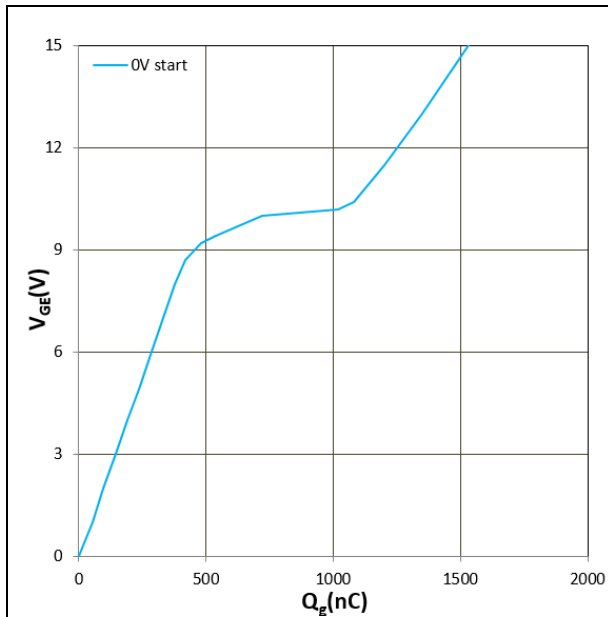
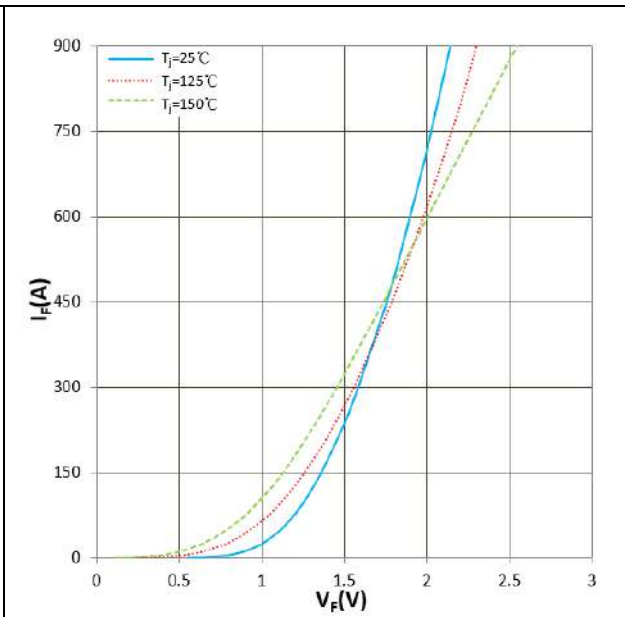


Figure 15. Gate charge


 Figure 16. I_F vs V_F

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Revision History

Document Version	Description of Changes
RevX.0.1	Released

Zhejiang HIITIO New Energy Co., Ltd

ADD : NO.1125 Zhixing Road,Qiaonan District, Xiaoshan Economic and Technological Development Zone, Hangzhou, Zhejiang

TEL :400-667-9977

