

HCG450FH170D3RE1

1700V/450A Half Bridge IGBT Module

Description

The HCG450FH170D3RE1 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
- 175 °C maximum junction temperature
- Thermistor inside

Applications

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

Circuit diagram

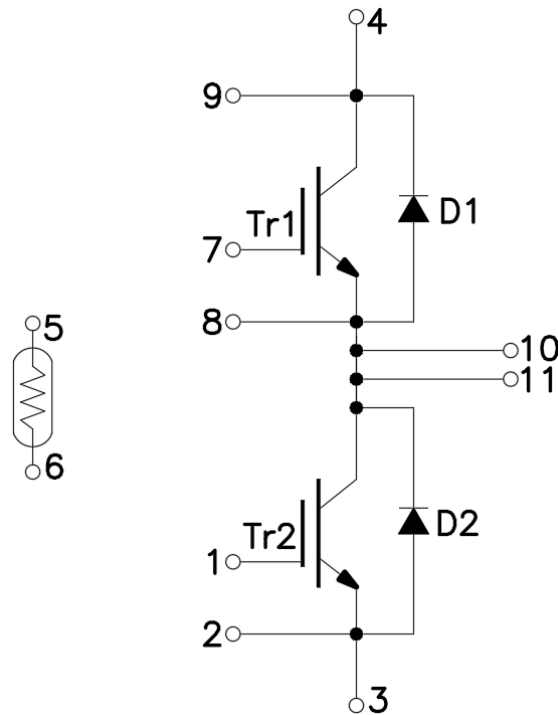


Figure 1. Out drawing & circuit diagram for HCG450FH170D3RE1

HCG450FH170D3RE1
 1700V/450A Half Bridge IGBT Module

Pin Configuration and Marking Information

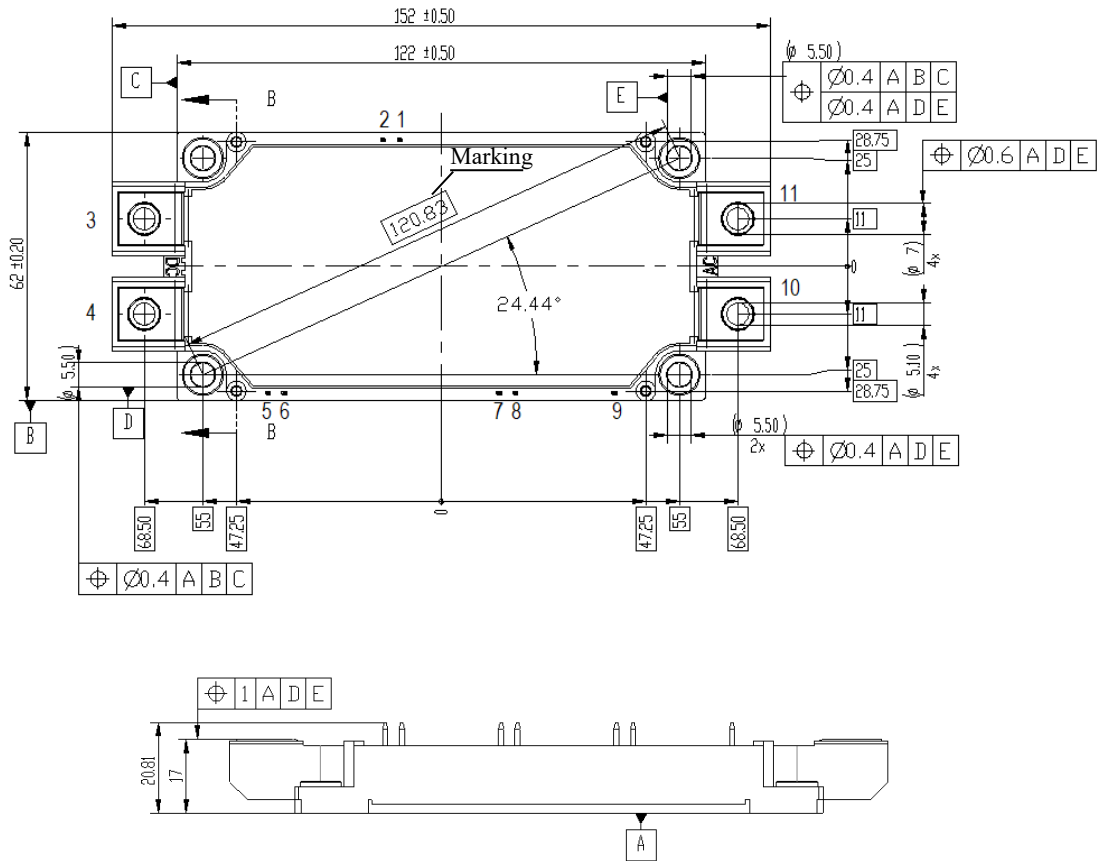


Figure 2. Pin configuration

HCG450FH170D3RE1

1700V/450A Half Bridge IGBT Module

Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f=50Hz, t=1min	4.0	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	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	1700	V
V _{GES}	Gate-Emitter Voltage	C-E Short	±20	V
I _C	DC Continuous Collector Current	T _C =95°C	450	A
I _{CM}	Pulse Collector Current	t _p =1ms, Note 1	900	A
P _C	Maximum Power Dissipation	T _C =25°C	2632	W
I _F	Diode Forward Current	-	450	A
I _{FRM}	Repetitive peak forward current	t _p =1ms, Note 1	900	A
I ² t	I ² t-value	V _R =0V, t _p =10ms, T _j =125°C(Diode)	20000	A ² s
T _{jmax}	Max junction temperature	-	175	°C
T _{vjop}	Operating junction temperature	-	-40 to 175	°C
T _{stg}	Storage temperature	-	-40 to 125	°C

Note 1: 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 =493 Ω	-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

HCG450FH170D3RE1

1700V/450A Half Bridge IGBT Module

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	-	1.60	1.90	V	
			T _j =150°C	-	2.03	-		
			T _j =175°C	-	2.08	-		
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	-	2.2	-	Ω	
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	-	-	1	mA	
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =20V, V _{CE} =0V	T _j =25°C	-	-	1.35	uA	
t _{d(on)}	Turn-on delay time	V _{CC} =900V I _C =450A V _{GE} =+15V/-8V R _G =3.3 Ω 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	-		
R _{th(j-c)}	Thermal Resistance, Junction to Case(IGBT)			-	0.057	-	°C/W	
R _{th(c-s)}	Thermal Resistance, Case to sink(Conductive Grease applied)			-	0.015	-	°C/W	

HCG450FH170D3RE1

1700V/450A Half Bridge IGBT Module

Freewheeling Diode Electrical characteristics (T_j=25°C unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max.		
V _F	Diode Forward Voltage	I _F =450A, V _{GE} =0V	T _j =25°C	-	1.95	-	V
			T _j =150°C	-	2.21	-	
			T _j =175°C	-	2.23	-	
t _{rr}	Reverse recovery time	(Switch side) V _{CC} =900V, I _C =450A	T _j =25°C	-	1.09	-	us
			T _j =150°C	-	1.58	-	
I _{RM}	Peak reverse recovery Current	V _{GE} =+15V/-8V, R _G =3.3Ω (FRD side)	T _j =25°C	-	199	-	A
			T _j =150°C	-	250	-	
Q _{rr}	Recovered charge	V _{rr} =900V, I _F =450A V _{GE} =+15V/-8V	T _j =25°C	-	79	-	uC
			T _j =150°C	-	184	-	
E _{rr}	Reverse recovered energy	Inductive load switching operation	T _j =25°C	-	35	-	mJ
			T _j =150°C	-	90	-	
R _{th(j-c)}	Thermal Resistance, Junction to Case (Diode)		-	0.075	-	°C/W	
R _{th(c-s)}	Thermal Resistance, Case to sink (Conductive Grease applied)		-	0.020	-	°C/W	

Test Conditions

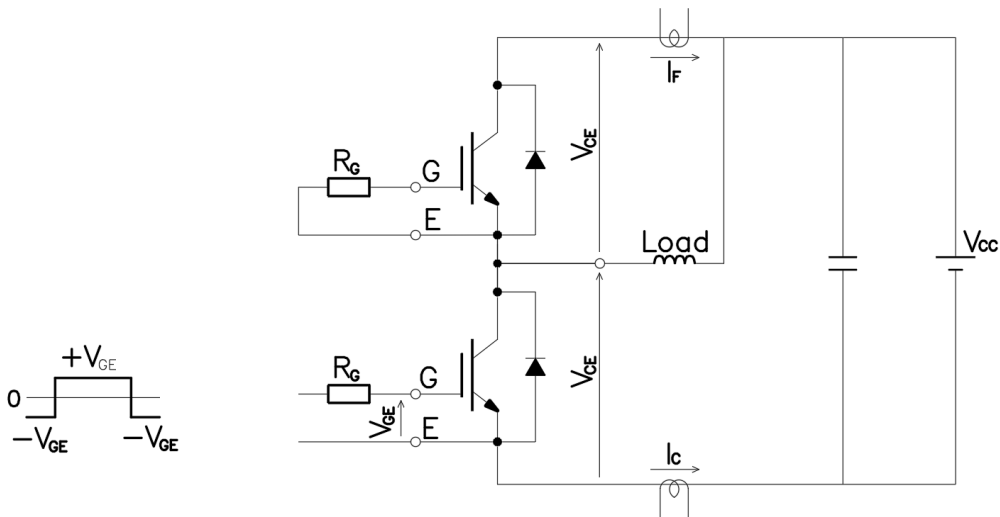


Figure 3. Switching time measure circuit

HCG450FH170D3RE1

1700V/450A Half Bridge IGBT Module

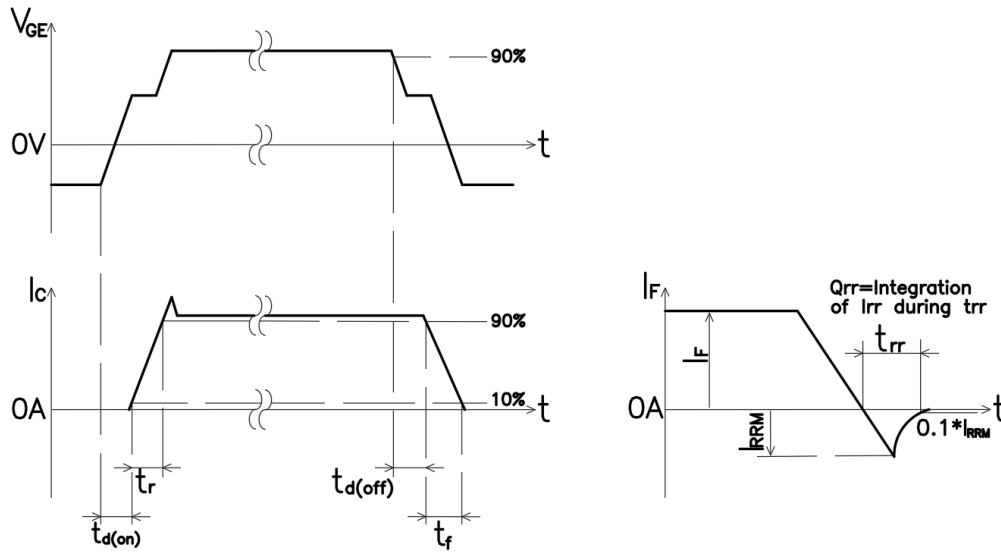
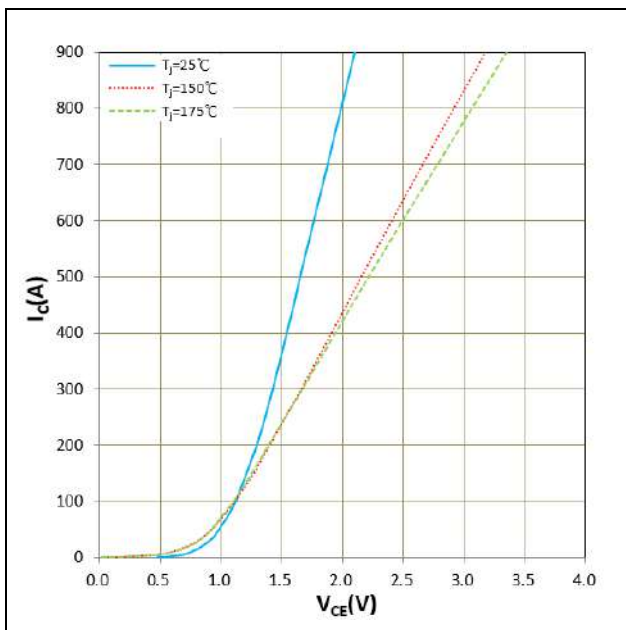
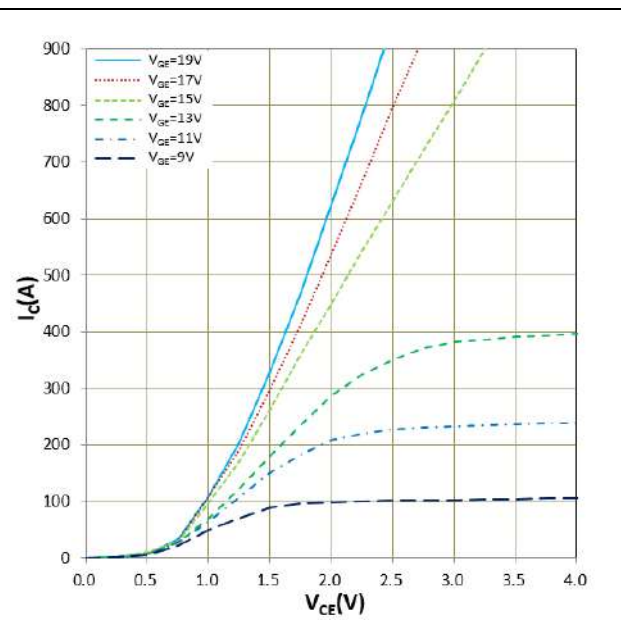


Figure 4. Switching time definition


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

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

HCG450FH170D3RE1
1700V/450A Half Bridge IGBT Module

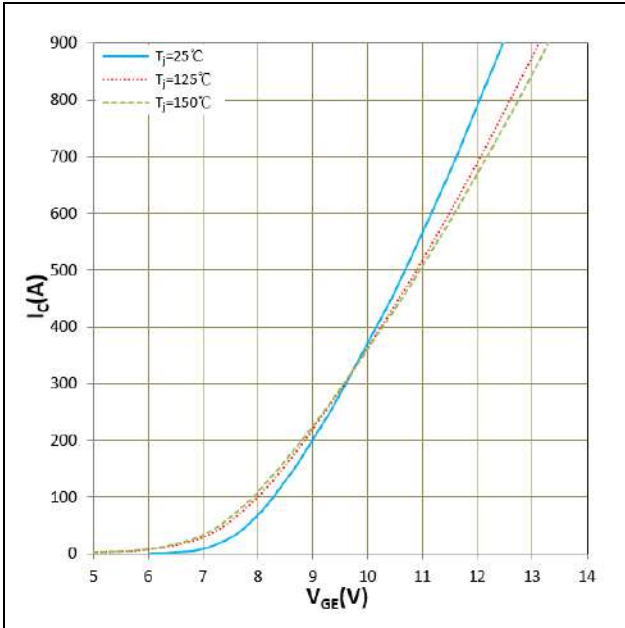


Figure 7. I_c vs V_{GE}
 $V_{CE} = 20V$

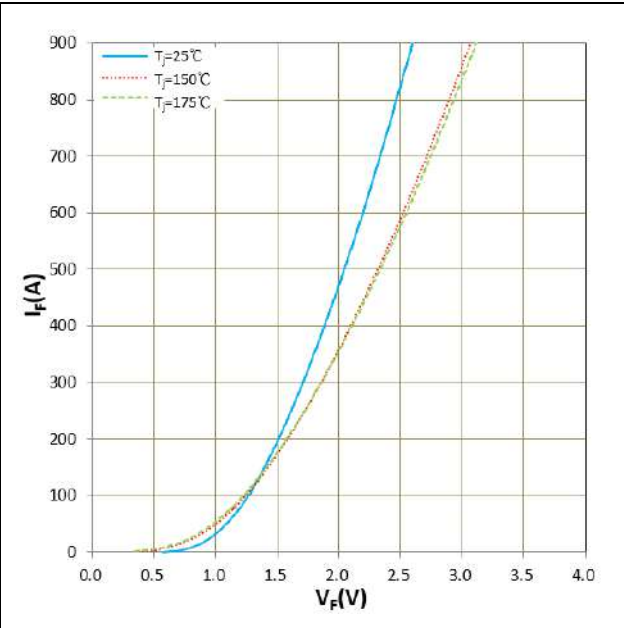


Figure 8. I_f vs V_F

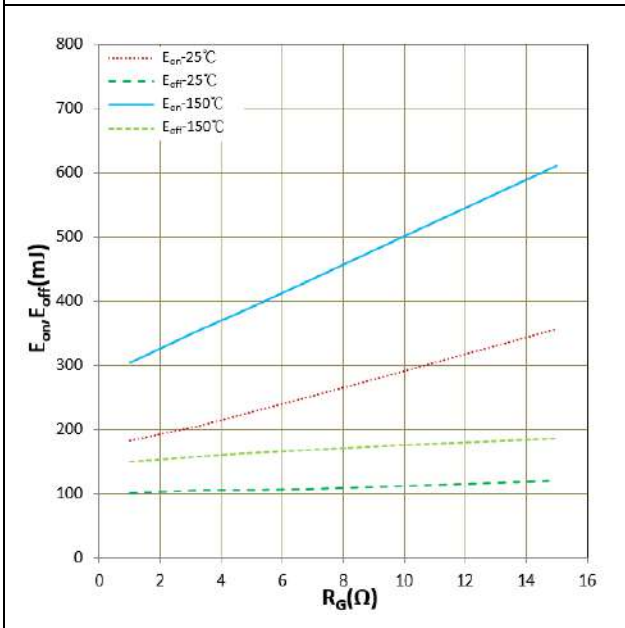


Figure 9. E_{on} , E_{off} vs R_G (Typ)
 $V_{CC} = 900V$, $V_{GE} = +15V/-8V$, $I_c = 450A$
Inductive Load

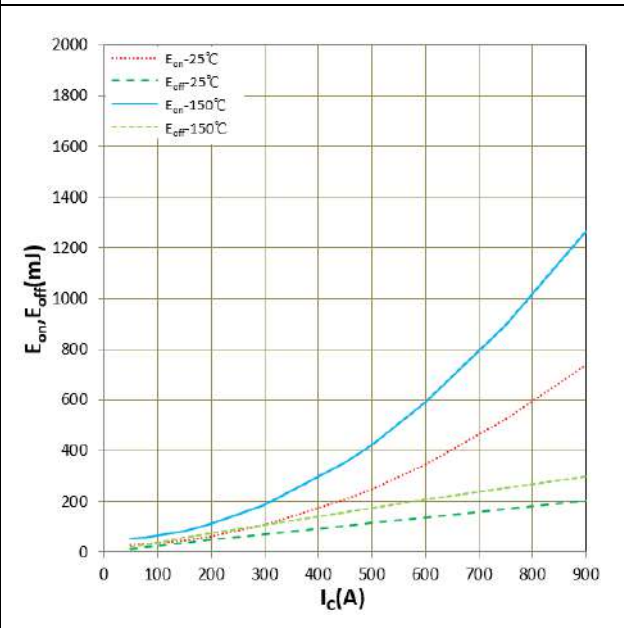


Figure 10. E_{on} , E_{off} vs I_c (Typ)
 $V_{CC} = 900V$, $V_{GE} = +15V/-8V$, $R_G = 3.3\Omega$
Inductive Load

HCG450FH170D3RE1

1700V/450A Half Bridge IGBT Module

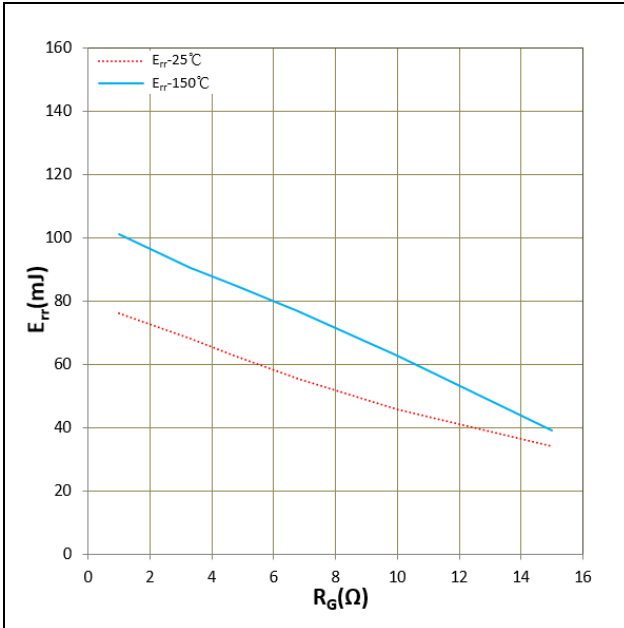


Figure 11. E_{rr} vs R_G (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $I_F=450A$
 Inductive Load

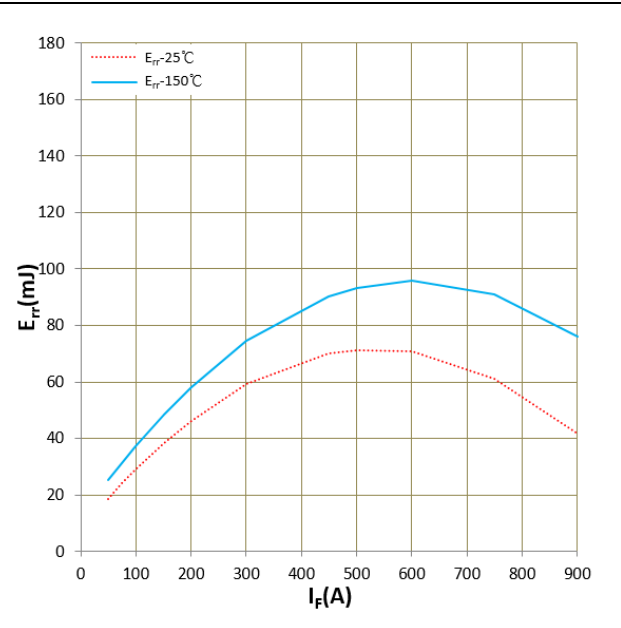


Figure 12. E_{rr} vs I_F (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $R_G=3.3\Omega$
 Inductive Load

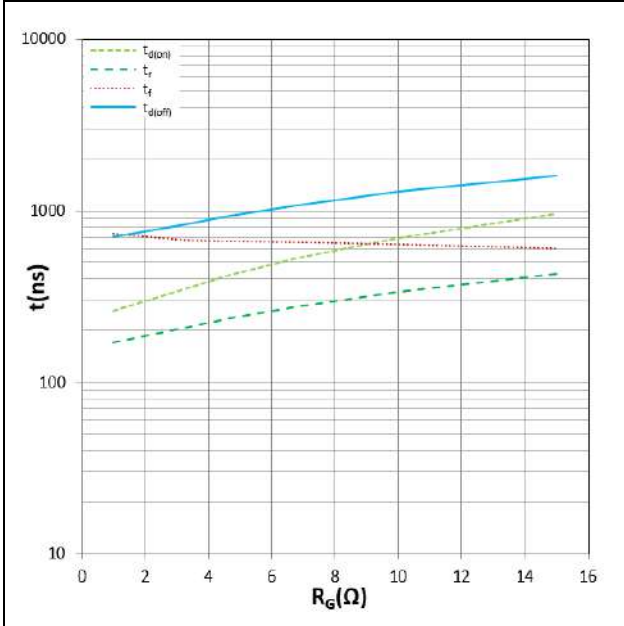


Figure 13. Switching time vs R_G (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $I_C=450A$,
 $T_j=150^\circ C$, Inductive Load

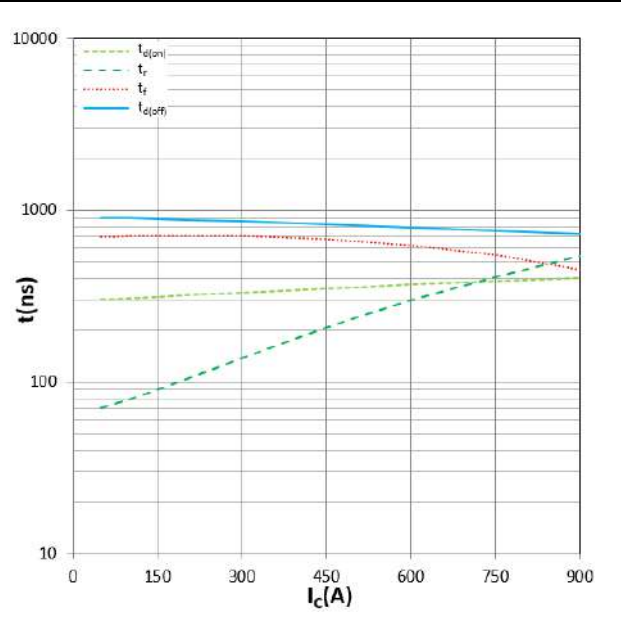


Figure 14. Switching time vs I_C (Typ)
 $V_{CC}=900V$, $V_{GE}=+15V/-8V$, $R_G=3.3\Omega$
 $T_j=150^\circ C$, Inductive Load

HCG450FH170D3RE1

1700V/450A Half Bridge IGBT Module

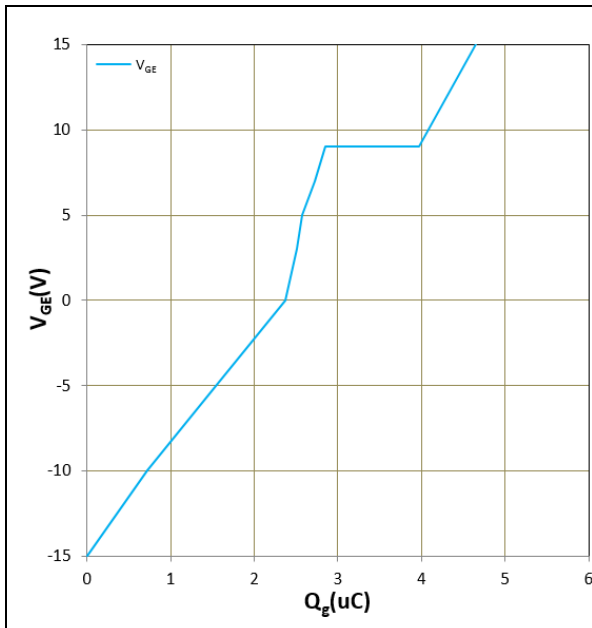
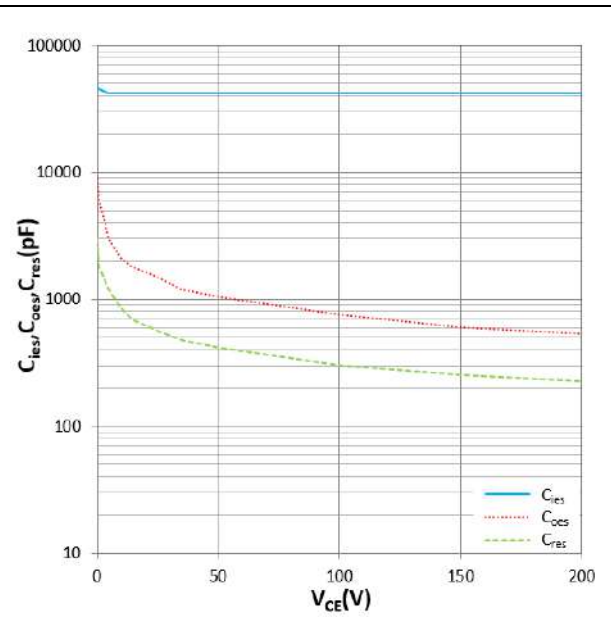


Figure 15. Gate charge


 Figure 16. C_{ies} , C_{oes} , C_{res} vs V_{ce}
 $T_j = 25^\circ\text{C}$, $f = 1\text{MHz}$

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Changes to this product data sheet are reserved.

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Revision History

Document Version	Description of Changes
RevX.0.1	Released

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