

HCG450FF120E3ME1

1200V/450A Half Bridge IGBT Module

Description

The HCG450FF120E3ME1 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

- HighPowerSwitchingApplications
- MotorDrives
- SolarinverterSystems
- WindTurbines



Circuit diagram

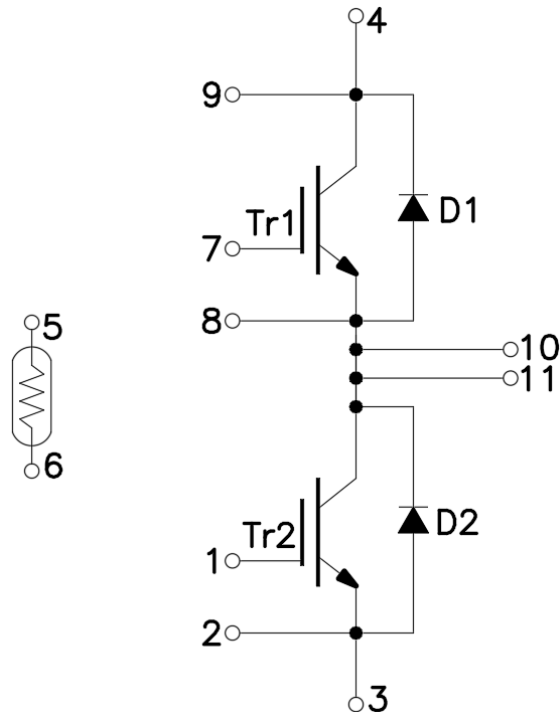


Figure 1. Out drawing & circuit diagram for HCG450FF120E3ME1

HCG450FF120E3ME1

1200V/450A Half Bridge IGBT Module

Pin Configuration and Marking Information

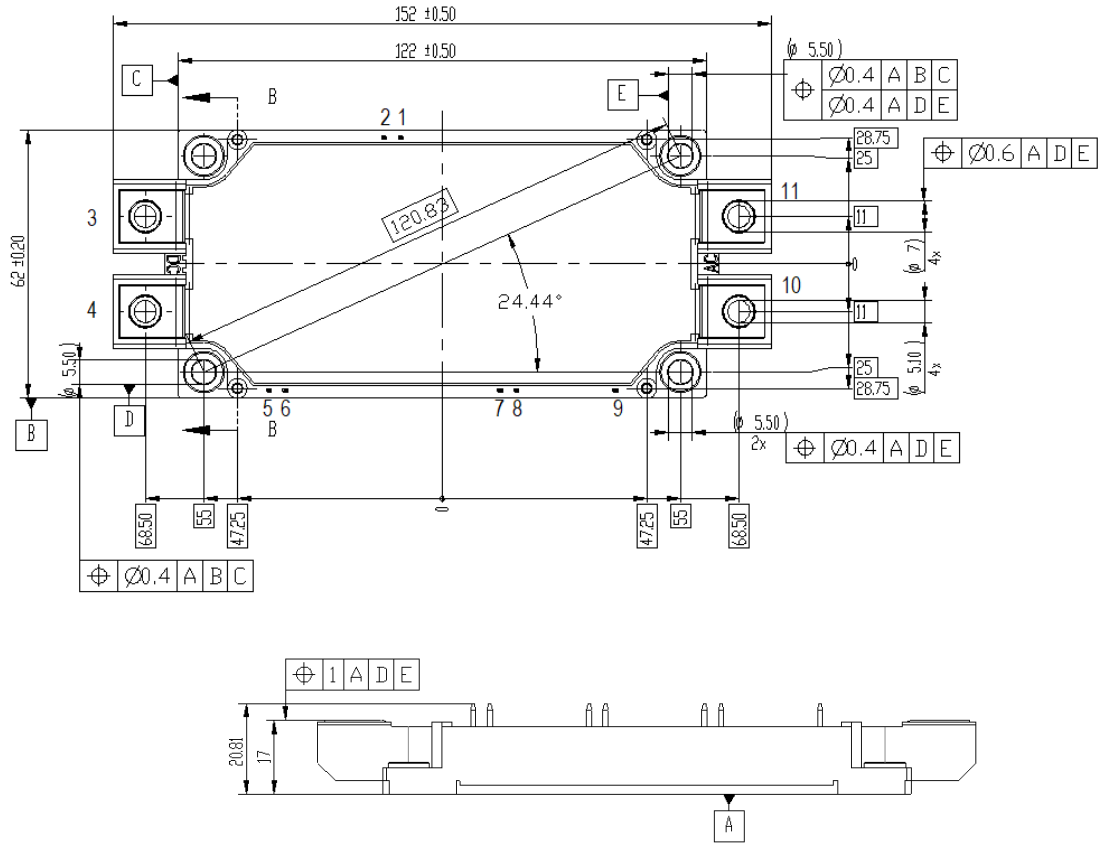


Figure 2. Pin configuration

HCG450FF120E3ME1

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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	-	>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	±20	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 _{SC}	IGBT short circuit	V _{GE} ≤15V, V _{CC} =800V, t _p ≤10 us, V _{CEmax} = V _{CES} - L _{sCE} · di/dt T _j =150°C	2000	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

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IGBT Electrical characteristics ($T_j=25^\circ\text{C}$ unless otherwise specified, chip: Target)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{CE(sat)}$ (Chip)	Collector-Emitter Saturation Voltage	$I_C=450\text{A}$ $V_{GE}=15\text{V}$	$T_j=25^\circ\text{C}$	-	1.65	1.95	V
	$T_j=150^\circ\text{C}$		-	1.85	-	V	
	$T_j=175^\circ\text{C}$		-	1.90	-	V	
$V_{GE(th)}$	Gate-Emitter threshold Voltage	$I_C=19\text{mA}, V_{CE}=V_{GE}$		5.0	-	6.8	V
Q_G	Gate charge	$V_{GE}=-15\text{V to }+15\text{V}$		-	3.3	-	μC
R_{Gint}	Internal gate resistor	-	$T_j=25^\circ\text{C}$	-	1.5	-	\square
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}$ $f=1\text{MHz}$	$T_j=25^\circ\text{C}$	-	39	-	nF
C_{res}	Reverse transfer Capacitance			-	1.39	-	nF
I_{CES}	Collector- Emitter Cut off Current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	-	-	1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=20\text{V}, V_{CE}=0\text{V}$	$T_j=25^\circ\text{C}$	-	-	1.13	μA
$t_{d(on)}$	Turn-on delay time	$V_{CC}=600\text{V}$ $I_C=450\text{A}$ $V_{GE}=+15\text{V}/-8\text{V}$ $R_G=1.0\square$ Inductive load	$T_j=25^\circ\text{C}$	-	180	-	ns
			$T_j=125^\circ\text{C}$	-	191	-	
			$T_j=175^\circ\text{C}$	-	195	-	
t_r	Rise time		$T_j=25^\circ\text{C}$	-	52	-	ns
			$T_j=125^\circ\text{C}$	-	54	-	
			$T_j=175^\circ\text{C}$	-	58	-	
$t_{d(off)}$	Turn-off delay time		$T_j=25^\circ\text{C}$	-	422	-	ns
			$T_j=125^\circ\text{C}$	-	480	-	
			$T_j=175^\circ\text{C}$	-	515	-	
t_f	Fall time		$T_j=25^\circ\text{C}$	-	113	-	ns
			$T_j=125^\circ\text{C}$	-	160	-	
			$T_j=175^\circ\text{C}$	-	255	-	
E_{on}	Turn-on power dissipation	$T_j=25^\circ\text{C}$	-	45.2	-	mJ	
		$T_j=125^\circ\text{C}$	-	63.53	-		
		$T_j=175^\circ\text{C}$	-	78.9	-		
E_{off}	Turn-off power dissipation	$T_j=25^\circ\text{C}$	-	35.38	-	mJ	
		$T_j=125^\circ\text{C}$	-	43.99	-		
		$T_j=175^\circ\text{C}$	-	52.21	-		
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (IGBT)		-	0.04	-	$^\circ\text{C/W}$	
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied)		-	0.02	-	$^\circ\text{C/W}$	

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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	$I_F=450\text{A}$, $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	-	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) $V_{CC}=600\text{V}$ $I_C=450\text{A}$	$T_j=25^\circ\text{C}$	-	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	$V_{GE}=+15\text{V}/-8\text{V}$ $R_G=1.0\Omega$ (FRD side)	$T_j=25^\circ\text{C}$	-	283	-	A
			$T_j=125^\circ\text{C}$	-	262	-	
			$T_j=175^\circ\text{C}$	-	266	-	
Q_{rr}	Recovered charge	$V_{rr}=600\text{V}$ $I_F=450\text{A}$ $V_{GE}=-8\text{V}$	$T_j=25^\circ\text{C}$	-	33.41	-	uC
			$T_j=125^\circ\text{C}$	-	62.63	-	
			$T_j=175^\circ\text{C}$	-	84.87	-	
E_{rr}	Reverse recovered energy	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	-	$^\circ\text{C}/\text{W}$	

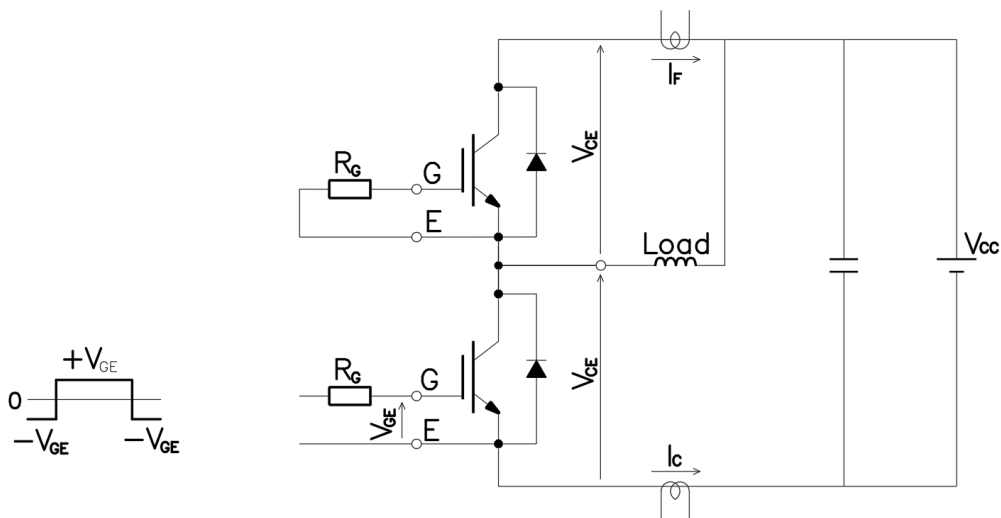
Test Conditions


Figure 3. Switching time measure circuit

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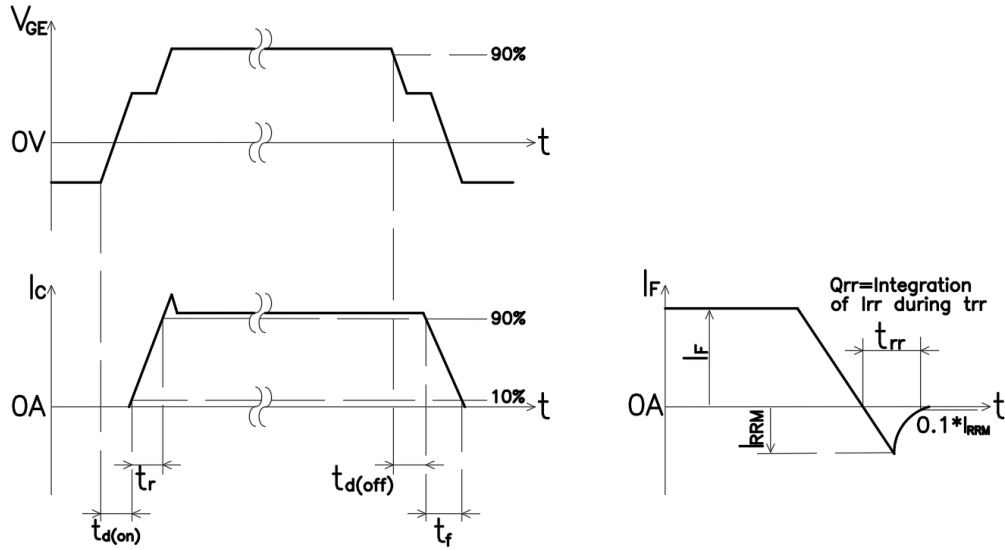
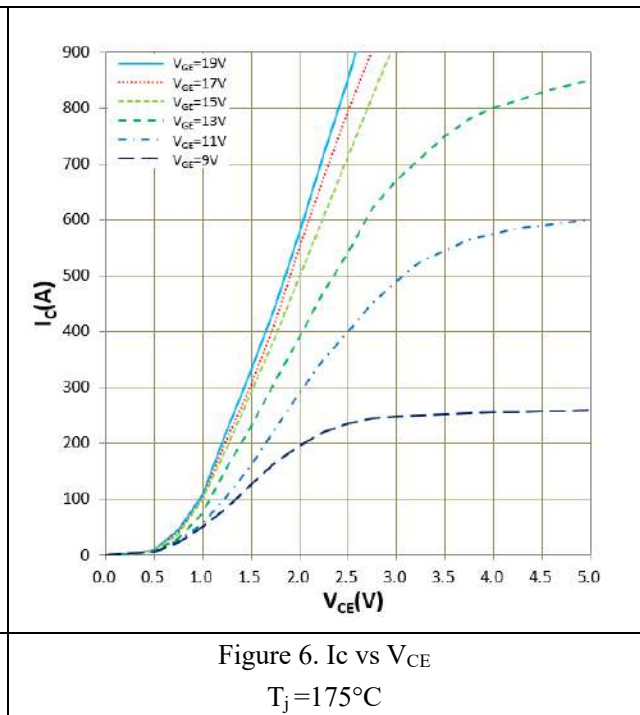
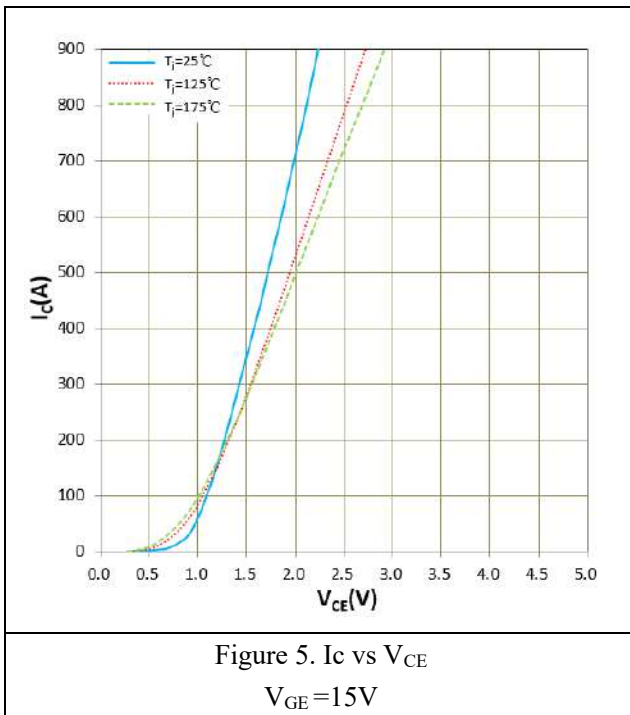


Figure 4. Switching time definition



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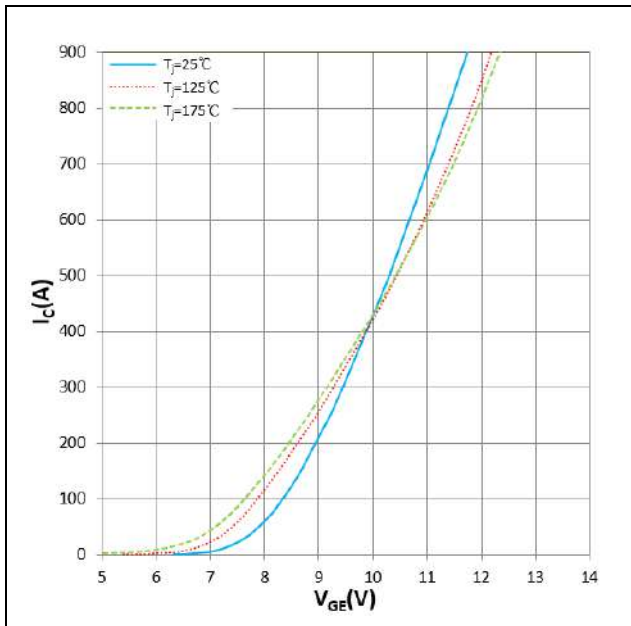


Figure 7. I_c vs V_{GE}
 $V_{CE}=20V$

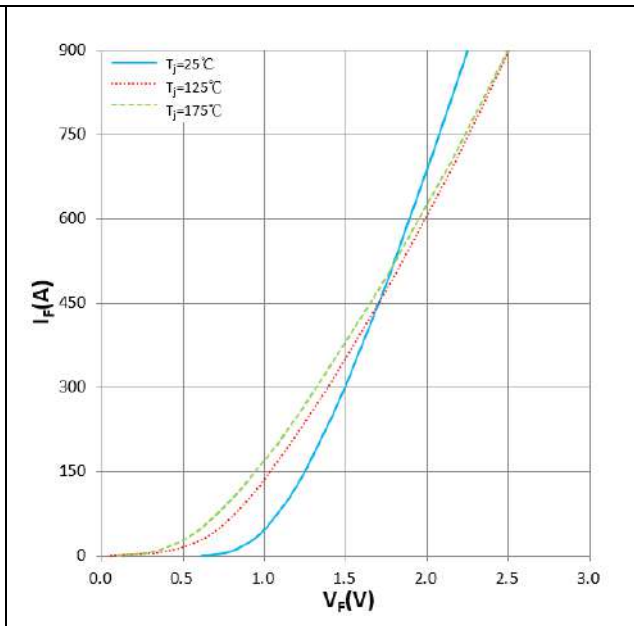


Figure 8. I_F vs V_F

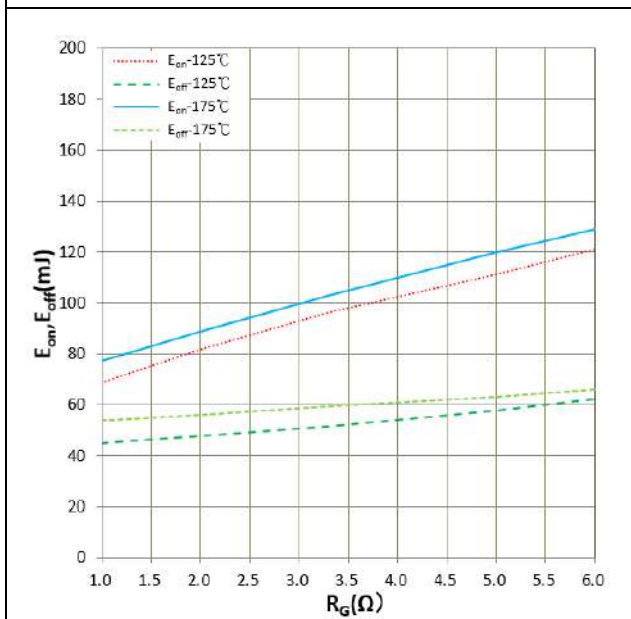


Figure 9. E_{on} , E_{off} vs R_G (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_c=450A$
Inductive Load

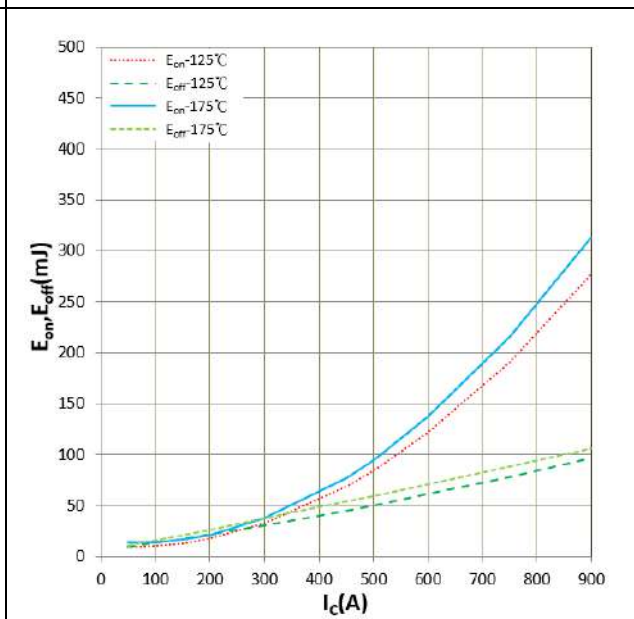


Figure 10. E_{on} , E_{off} vs I_c (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $R_G=1.0\Omega$
Inductive Load

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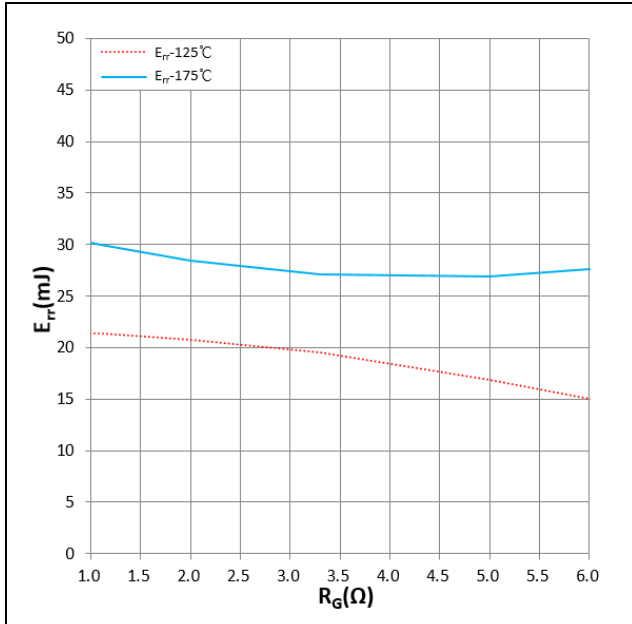


Figure 11. E_{rr} vs R_G (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_F=450A$
 Inductive Load

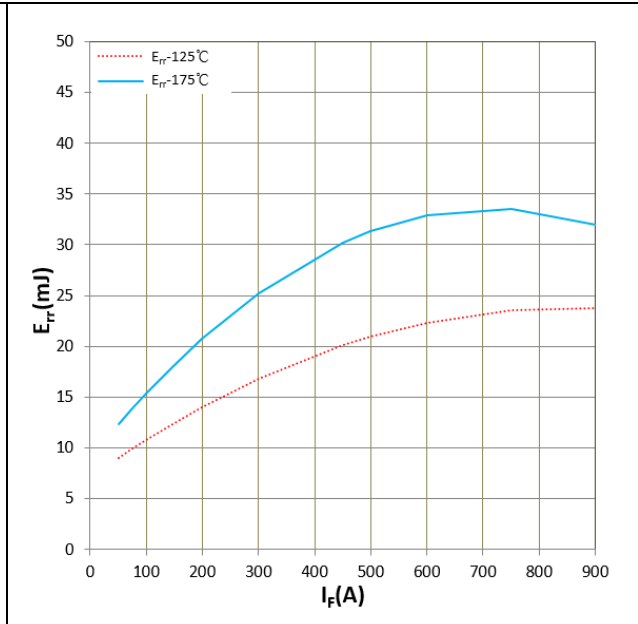


Figure 12. E_{rr} vs I_F (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $R_G=1.0\Omega$
 Inductive Load

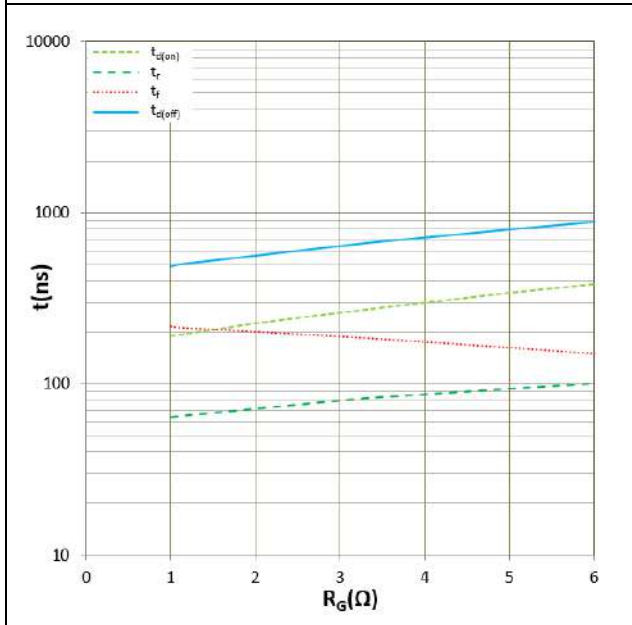


Figure 13. Switching time vs R_G (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_C=450A$
 $T_j=175^\circ C$, Inductive Load

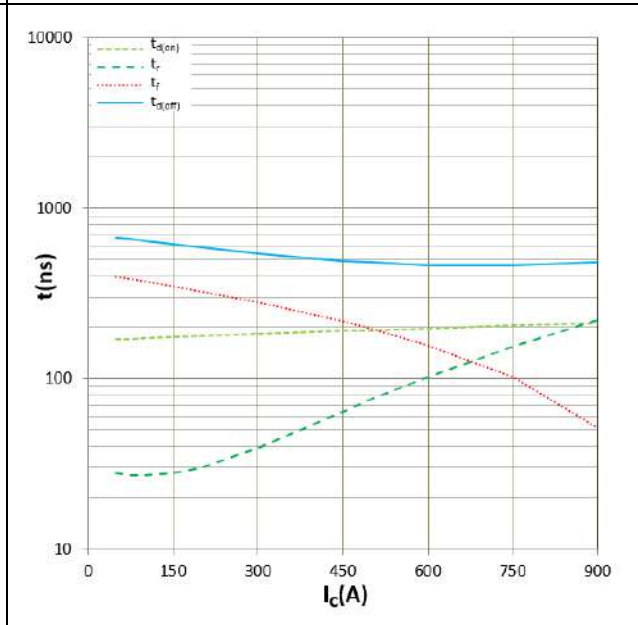


Figure 14. Switching time vs I_C (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $R_G=1.0\Omega$
 $T_j=175^\circ C$, Inductive Load

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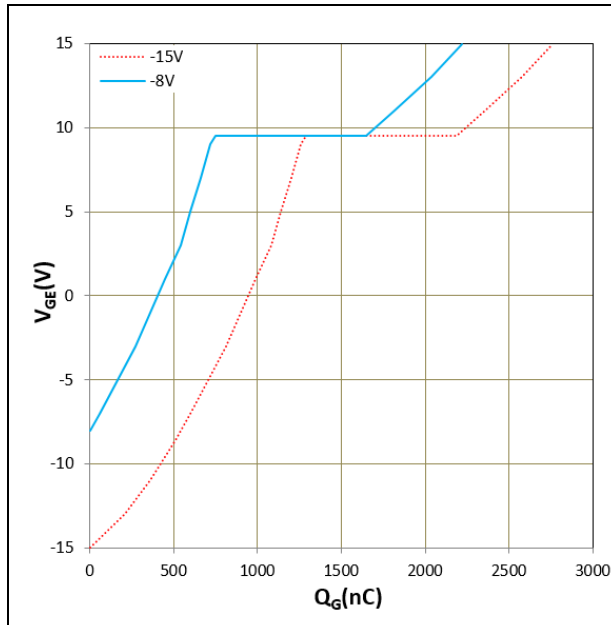


Figure 15. Gate charge

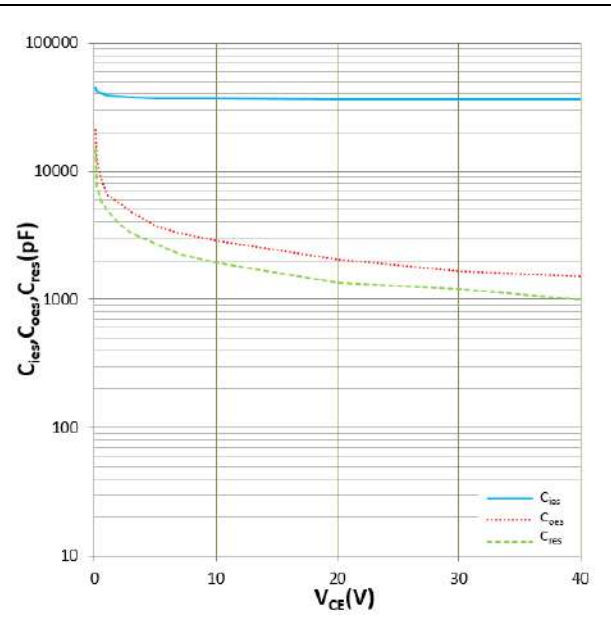


Figure 16. C_{ies} , C_{oes} , C_{res} VS V_{CE}
 $T_j = 25^\circ\text{C}$, $f = 100\text{KHz}$

IMPORTANT NOTICE:

This product data sheet describes the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively under the terms and conditions of the supply agreement. There will be no guarantee or of any kind for the product and its characteristics.

The data contained in this document is exclusively intended for technically trained staff. You and your technical departments will have to evaluate the product's suitability for the intended application and the completeness of the product data concerning such application.

Due to technical requirements, our product may contain dangerous substances. For information on the types in question, please contact the sales staff responsible for you.

Changes to this product data sheet are reserved.

Please contact the sales staff (sales@hiitio.com) for further information on the product, technology, delivery terms, conditions and prices.

Instruction note

Naming rules for power module product models (Industrial module)

Product Model																																							
	HC	G	450	FF	1200	E3	A																																
Hecheng Code																																							
Module type G : IGBT module D : FRD module S : SiC module H : Si/SiC hybrid																																							
Current level (A) 50~900																																							
Topology structure FZ : A switch unit FF : Half bridge FS : Three phase F4 : H Bridge F3L : Three level DF : Boost Circuit FD : Braking Circuit FP : Rectification+Inverter+Control move AL : ANPC CL : Chopper																																							
Voltage level (x10) (V) 650~2200																																							
Packaging form+features (A...Z) <table border="0" style="width:100%; border:none;"> <tr> <td>A1: 34 mm</td> <td>A2: 62 mm</td> <td></td> <td></td> </tr> <tr> <td>B1: Easy 1B</td> <td>B1A</td> <td>B1B...</td> <td></td> </tr> <tr> <td>B2: Easy 2B...</td> <td>B3: Easy 3B...</td> <td></td> <td></td> </tr> <tr> <td>D1: Flow0</td> <td>D2: Flow1</td> <td>D3: Flow2</td> <td></td> </tr> <tr> <td>E0: E0</td> <td>E1: Econo 2...</td> <td>E2: E2</td> <td></td> </tr> <tr> <td>E3: ED3</td> <td>E4: E4</td> <td>E5: ED3S</td> <td></td> </tr> <tr> <td>E6: EPM2</td> <td>E7: EPM3</td> <td>E8: EconoPIM3</td> <td></td> </tr> <tr> <td>E9: ED3H</td> <td>F0: F0</td> <td>P2: EPM2</td> <td></td> </tr> </table>								A1: 34 mm	A2: 62 mm			B1: Easy 1B	B1A	B1B...		B2: Easy 2B...	B3: Easy 3B...			D1: Flow0	D2: Flow1	D3: Flow2		E0: E0	E1: Econo 2...	E2: E2		E3: ED3	E4: E4	E5: ED3S		E6: EPM2	E7: EPM3	E8: EconoPIM3		E9: ED3H	F0: F0	P2: EPM2	
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E9: ED3H	F0: F0	P2: EPM2																																					
Feature :A: Special Code Nil: Standard																																							

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