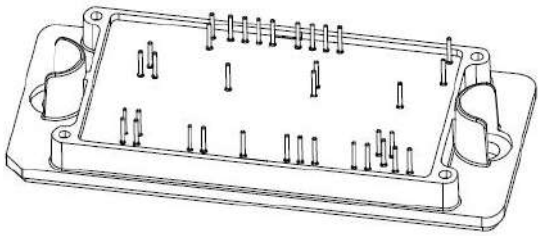
HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Features

- Neutral Point Clamped Three−Level Inverter Module
- Low Inductive Layout
- Solderable Pins



Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Low Conduction Losses Over Temperature

Applications

- Solar Inverters
- Uninterruptable Power Supplies Systems

Table 1 Absolute Maximum Ratings (Ta = 25℃)

Parameter	Symbol	Value	Unit
OUTER IGBT (Q1, Q4)			
Collector−Emitter Voltage	V_{CES}	650	V
Gate−Emitter Voltage	V_{GE}	±20	V
Continuous Collector Current @ Tc = 80°C，Tj = 175°C	I_C	270	A
Pulsed Collector Current @ Tj = 175°C	I_{CP}	810	A
Junction Temperature	T_j	-40 to +175	°C
INNER IGBT (Q2, Q3)			
Collector−Emitter Voltage	V_{CES}	650	V
Gate−Emitter Voltage	V_{GE}	±20	V
Continuous Collector Current @ Tc = 80°C，Tj = 175°C	I_C	293	A
Pulsed Collector Current @ Tj = 175°C	I_{CP}	880	A
Junction Temperature	T_j	-40 to +175	°C
DIODE (D1, D2, D3, D4)			
Peak Repetitive Reverse Voltage	V_{RRM}	650	V
Continuous Forward Current @ Tc = 80°C，Tj = 175°C	I_F	188	A
Repetitive Peak Forward Current @ Tj = 175°C	I_{FRM}	563	A
I^2t-value@VR = 0 V, tP = 10 ms, Tvj = 150°C	I^2t	1800	A^2s
Junction Temperature	T_j	-40 to +175	°C

HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Parameter	Symbol	Value	Unit
DIODE (D5, D6)			
Peak Repetitive Reverse Voltage	V_{RRM}	650	V
Continuous Forward Current @ Tc = 80°C，Tj = 175°C	I_F	230	A
Repetitive Peak Forward Current @ Tj = 175°C	I_{FRM}	690	A
I^2t-value@VR = 0 V, tP = 10 ms, Tvj = 150°C	I^2t	9800	A^2s
Junction Temperature	T_j	-40 to +175	°C
INSULATION PROPERTIES			
Isolation Test Voltage, t = 1 s, 50 Hz	Viso	4000	V_{RMS}
RECOMMENDED TEMPERATURE			
Storage Temperature	T_{stg}	-40 to +125	°C
Operating Temperature	T_{op}	-40 to +150	°C

Table 2 Characteristics values

OUTER IGBT (Q1, Q4)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Collector−Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15 V, I_C = 450 A	T_j = 25°C	-	1.6	2.2	V
		V_{GE} = 15 V, I_C = 450 A	T_j = 150°C	-	1.85	-	
Gate−Emitter Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 4 mA	T_j = 25°C	3.2	3.8	4.4	V
Total Gate Charge	Q_g	V_{GE} = ±15 V, V_{CE} = 480 V	T_j = 25°C	-	1.6	-	µC
Gate-Source Leakage Current	I_{GES}	V_{GE} = 20 V, V_{CE} = 0 V	T_j = 25°C	-	-	100	nA
Collector−Emitter Voltage	$V_{(BR)CES}$	V_{GE} = 0 V	T_j = 25°C	650	-	-	V
Collector−Emitter Cutoff Current	I_{CES}	V_{CE} = 650 V, V_{GE} = 0 V	T_j = 25°C	-	-	100	µA
Input Capacitance	C_{iss}	V_{GE} = 0 V, V_{CE} = 20 V, f = 10 KHz	T_j = 25°C	-	24054	-	pF
Output Capacitance	C_{oss}		T_j = 25°C	-	1942	-	
Reverse Transfer Capacitance	C_{rss}		T_j = 25°C	-	140	-	
Turn-on delay time,inductive load	$t_{d\ on}$	V_{GE} = -7 V / +15 V, V_{CE} = 400 V, I_C = 150 A, R_{Gon} = 9.4 Ω, R_{Goff} = 15.7 Ω	T_j = 25°C	-	75	-	ns
			T_j = 150°C	-	58	-	
Rise time (inductive load)	t_r		T_j = 25°C	-	33	-	
			T_j = 150°C	-	38	-	
Turn-off delay time,inductive load	$t_{d\ off}$		T_j = 25°C	-	757	-	
			T_j = 150°C	-	804	-	
Fall time (inductive load)	t_f		T_j = 25°C	-	44	-	
			T_j = 150°C	-	54	-	

HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

OUTER IGBT (Q1, Q4) (continued)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Turn - on Switching Loss	E_{on}	V_{GE} = -7 V / +15 V V_{CE} = 400 V I_C = 150 A R_{Gon} = 9.4 Ω R_{Goff} = 15.7 Ω	T_j = 25°C	-	4.7	-	mJ
			T_j = 150°C	-	7.2	-	
Turn - off Switching Loss	E_{off}		T_j = 25°C	-	2.6	-	
			T_j = 150°C	-	3.3	-	
Thermal Resistance – Chip–to–Heatsink	R_{thJH}	Thermal grease， λ = 2.8 W/mK		-	0.24	-	°C/W
Thermal Resistance – Chip–to–Case	R_{thJC}			-	0.16	-	°C/W

NEUTRAL POINT DIODE (D5, D6)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	I_F = 450 A	T_j = 25°C	-	1.65	2.05	V
		I_F = 450 A	T_j = 150°C	-	1.75	-	
Reverse Recovery Time	T_{RR}	V_{GE} = -7 V / +15 V V_{CE} = 400 V I_C = 150 A R_{Gon} = 9.4 Ω R_{Goff} = 15.7 Ω	T_j = 25°C	-	173	-	ns
			T_j = 150°C	-	215	-	
Reverse Recovery Charge	Q_{RR}		T_j = 25°C	-	8.68	-	µC
			T_j = 150°C	-	20.4	-	
Peak Reverse Recovery Current	I_{RRM}		T_j = 25°C	-	120	-	A
			T_j = 150°C	-	184	-	
Reverse Recovery Energy	E_{RR}		T_j = 25°C	-	1.94	-	mJ
			T_j = 150°C	-	4.55	-	
Thermal Resistance – Chip–to–Heatsink	R_{thJH}	Thermal grease， λ = 2.8 W/mK		-	0.29	-	°C/W
Thermal Resistance – Chip–to–Case	R_{thJC}			-	0.19	-	°C/W

HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

INNER IGBT (Q2, Q3)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Collector−Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15 V, I_C = 450 A	T_j = 25°C	-	1.28	1.8	V
		V_{GE} = 15 V, I_C = 450 A	T_j = 150°C	-	1.45	-	
Gate−Emitter Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 4 mA	T_j = 25°C	4.2	4.85	5.4	V
Total Gate Charge	Q_g	V_{GE} = ±15 V, V_{CE} = 480 V	T_j = 25°C	-	3.7	-	μC
Gate-Source Leakage Current	I_{GES}	V_{GE} = 20 V, V_{CE} = 0 V	T_j = 25°C	-	-	100	nA
Collector−Emitter Voltage	$V_{(BR)CES}$	V_{GE} = 0 V	T_j = 25°C	650	-	-	V
Collector−Emitter Cutoff Current	I_{CES}	V_{CE} = 650 V, V_{GE} = 0 V	T_j = 25°C	-	-	100	μA
Input Capacitance	C_{iss}	V_{GE} = 0 V, V_{CE} = 20 V, f = 10 KHz	T_j = 25°C	-	46942	-	pF
Output Capacitance	C_{oss}		T_j = 25°C	-	982	-	
Reverse Transfer Capacitance	C_{rss}		T_j = 25°C	-	263	-	
Turn-on delay time,inductive load	$t_{d\ on}$	V_{GE} = -7 V / +15 V, V_{CE} = 400 V, I_C = 150 A, R_{Gon} = 40 Ω, R_{Goff} = 40 Ω	T_j = 25°C	-	826	-	ns
			T_j = 150°C	-	689	-	
Rise time (inductive load)	t_r		T_j = 25°C	-	149	-	
			T_j = 150°C	-	180	-	
Turn-off delay time,inductive load	$t_{d\ off}$		T_j = 25°C	-	3790	-	
			T_j = 150°C	-	4167	-	
Fall time (inductive load)	t_f		T_j = 25°C	-	118	-	
			T_j = 150°C	-	108	-	
Turn - on Switching Loss	E_{on}		T_j = 25°C	-	12.3	-	mJ
			T_j = 150°C	-	16.15	-	
Turn - off Switching Loss	E_{off}		T_j = 25°C	-	8.8	-	
			T_j = 150°C	-	9.3	-	
Thermal Resistance−Chip−to−Heatsink	R_{thJH}	Thermal grease, λ = 2.8 W/mK		-	0.28	-	℃/W
Thermal Resistance−Chip−to−Case	R_{thJC}			-	0.18	-	℃/W

HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

INVERSE DIODE (D1, D2, D3, D4)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	I_F = 100 A	T_j = 25°C	-	1.23	1.65	V
		I_F = 100 A	T_j = 150°C	-	1.18	-	
		I_F = 200 A	T_j = 25°C		1.58	-	
		I_F = 200 A	T_j = 150°C		1.64		
Reverse Recovery Time	T_{RR}	V_{GE} = -7 V / +15 V V_{CE} = 400 V I_C = 150 A R_{Gon} = 40 Ω R_{Goff} = 40 Ω	T_j = 25°C	-	363	-	ns
			T_j = 150°C	-	436	-	
Reverse Recovery Charge	Q_{RR}		T_j = 25°C	-	6.48	-	µC
			T_j = 150°C	-	10.6	-	
Peak Reverse Recovery Current	I_{RRM}		T_j = 25°C	-	43.3	-	A
			T_j = 150°C	-	48.1	-	
Reverse Recovery Energy	E_{RR}		T_j = 25°C	-	0.85	-	mJ
			T_j = 150°C	-	1.38	-	
Thermal Resistance – Chip–to–Heatsink	R_{thJH}	Thermal grease， λ = 2.8 W/mK		-	0.41	-	℃/W
Thermal Resistance – Chip–to–Case	R_{thJC}			-	0.32	-	℃/W

Table 3 NTC-Thermistor

Parameter	Symbol	Min	Typ.	Max	Unit	Conditions
Rated resistance	R_{25}	-	22	-	kΩ	T_C = 25°C
Deviation of R100	△R/R	-5	-	5	%	T_C = 100°C, R_{100} = 1486 Ω
Power Dissipation	P_{25}	-	-	20	mW	TNTC = 25°C
B-value	$B_{25/50}$	-	3950	-	K	B (25/50), tolerance ±3%
B-value	$B_{25/100}$	-	3998	-	K	B (25/100), tolerance ±3%

HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Table 4 Module Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit	Conditions
Stray Inductance	L_{CE}	-	17	-	nH	
Mounting Torque Screw:M5	M	3.0	-	5.0	N.m	
Creepage distance	terminal to heatsink		12.7			
Clearance	terminal to heatsink		12.7			
CTI			⩾600			
RTI			130		℃	
Flatness of base plate				0.3	mm	
Weight			176.5		g	

Typical Characteristics
IGBT Q1, Q4 And DIODE D1, D4

Fig.1 Typical Output Characteristics (25°C)

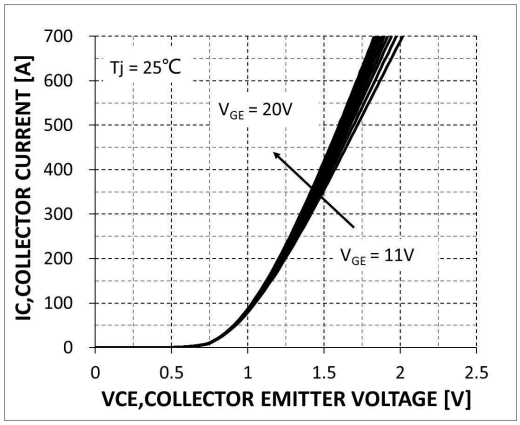


Fig.2 Typical Output Characteristics (150°C)

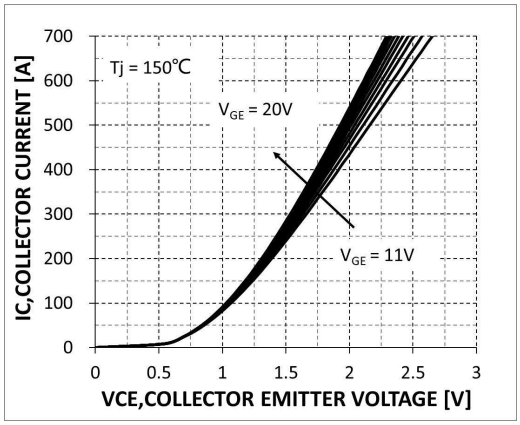


Fig.3 Body Diode Characteristics

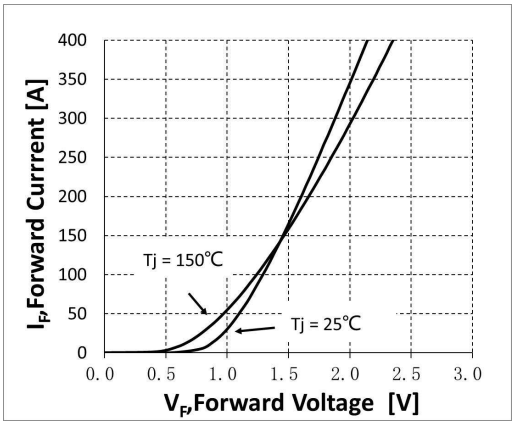
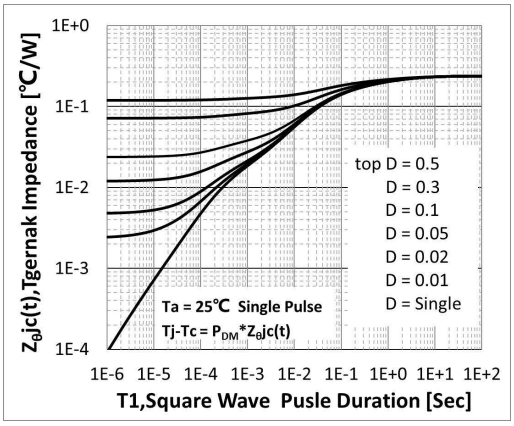


Fig.4 Transient Thermal Impedance (Q1, Q4)



HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Typical Characteristics

IGBT Q2, Q3 and DIODE D2, D3

Fig.5 Typical Output Characteristics (25°C)

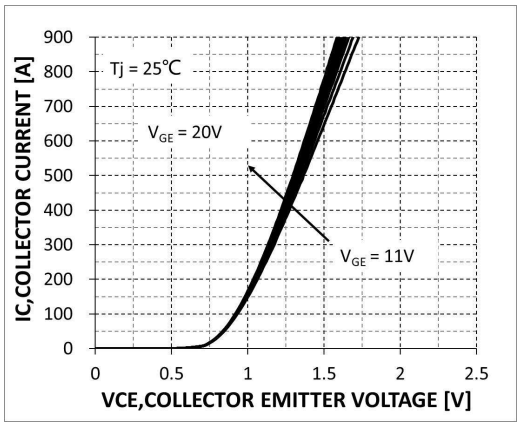


Fig.6 Typical Output Characteristics (150°C)

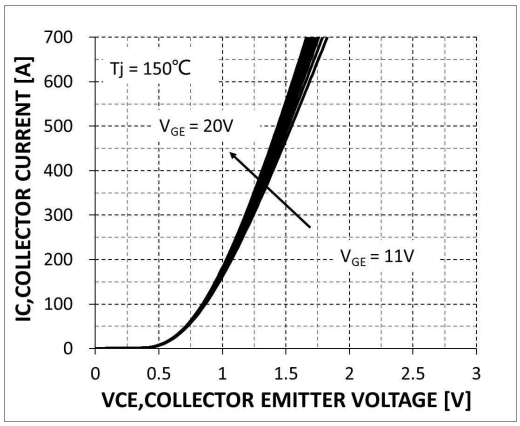


Fig.7 Body Diode Characteristics

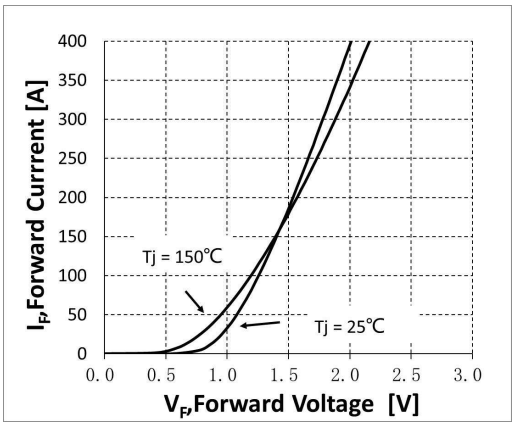


Fig.8 Transient Thermal Impedance (Q2, Q3)

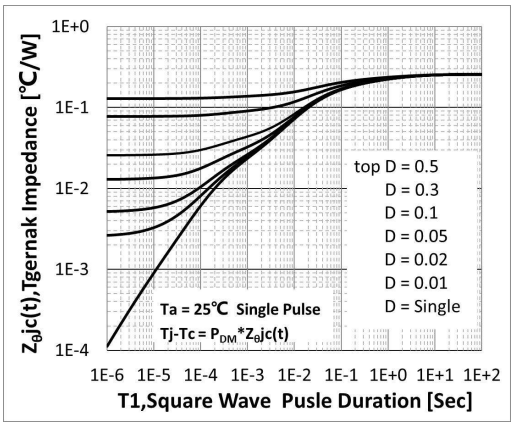


Fig.9 RBSOA (Q1, Q4)

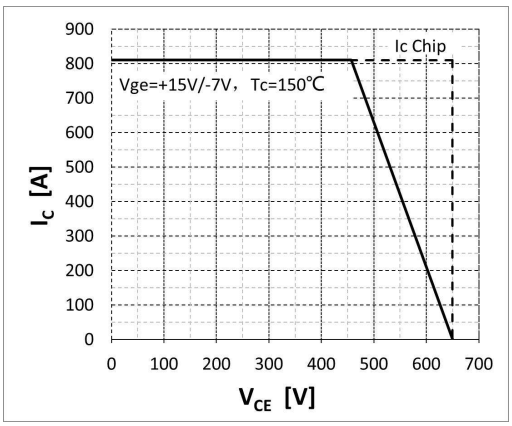
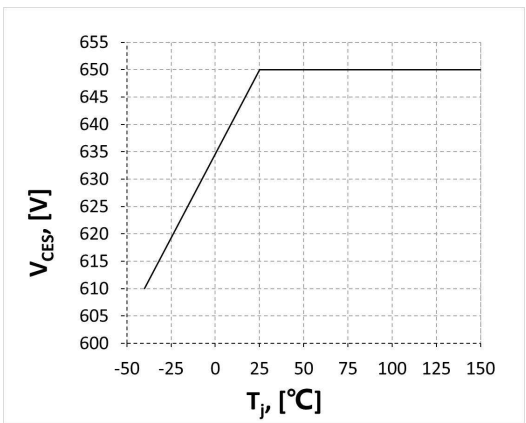


Fig.10 maximum allowed collector-emitter voltage (Q1, Q4)



HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Typical Characteristics

DIODE D5, D6

Fig.11 Diode Forward Characteristics

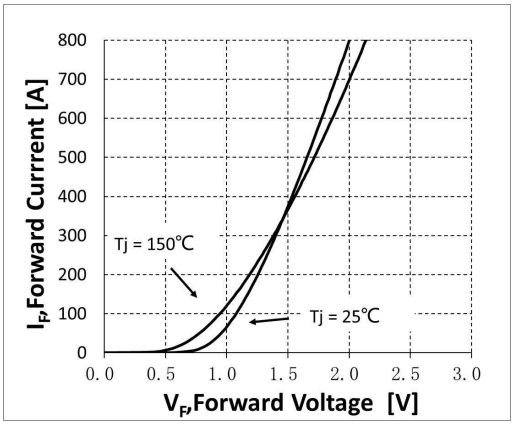


Fig.12 Transient Thermal Impedance (D5, D6)

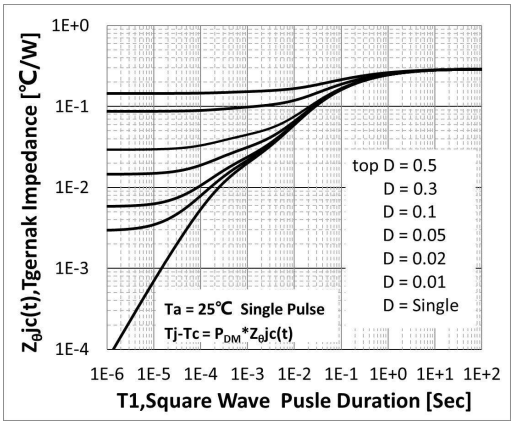
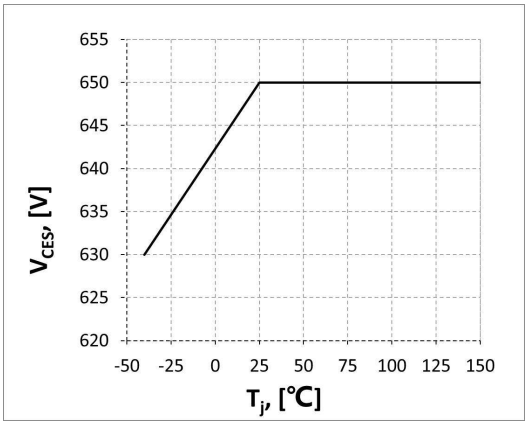


Fig.13 maximum allowed collector-emitter voltage (D5, D6)



HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Typical Characteristics

IGBT Q1, Q4 and DIODE D5, D6

Fig.14 Typical Switching Loss Eon vs. IC

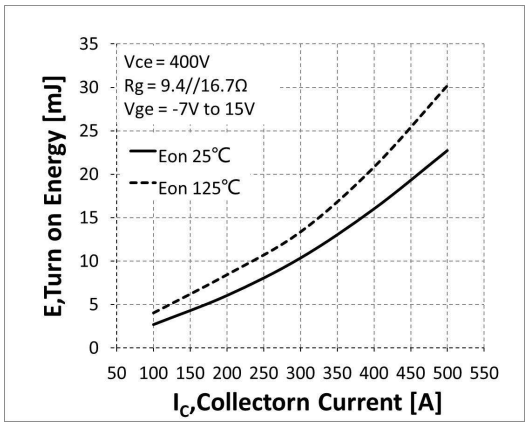


Fig.15 Typical Switching Loss Eoff vs. IC

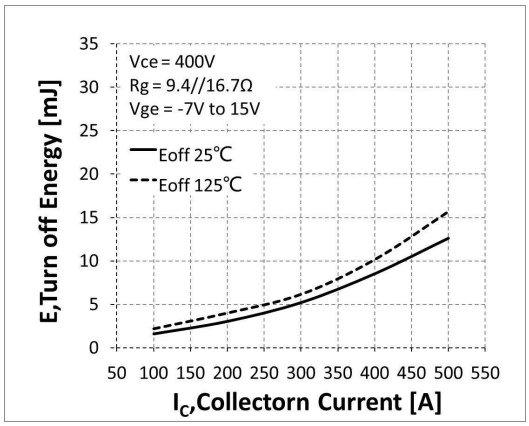


Fig.16 Typical Switching Time Ton vs. IC

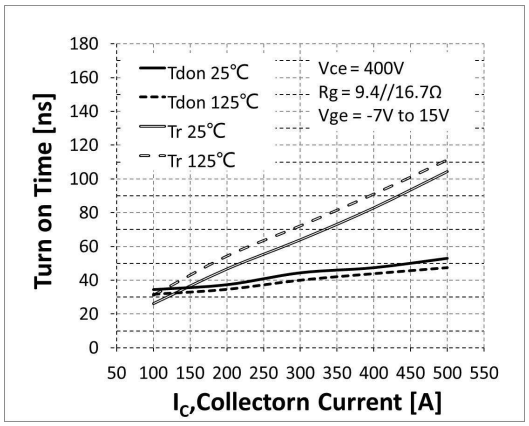


Fig.17 Typical Switching Time Toff vs. IC

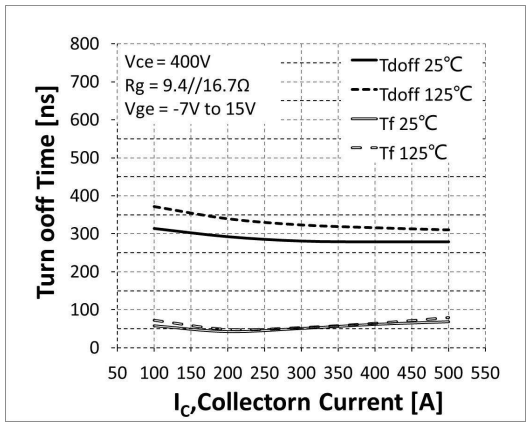


Fig.18 Typical Recovery Energy vs. IC

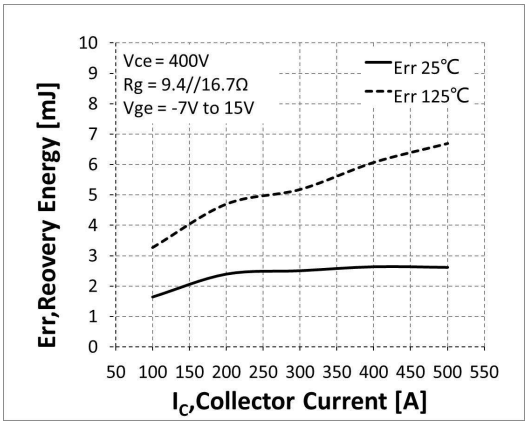
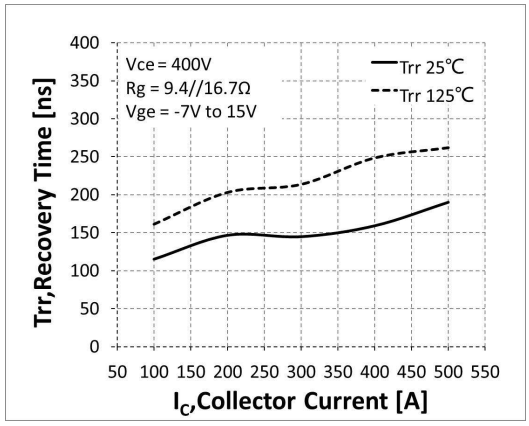


Fig.19 Typical Recovery Time vs. IC



HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Typical Characteristics

IGBT Q1, Q4 and DIODE D5, D6 (continued)

Fig.20 Typical Recovery Charge vs. IC

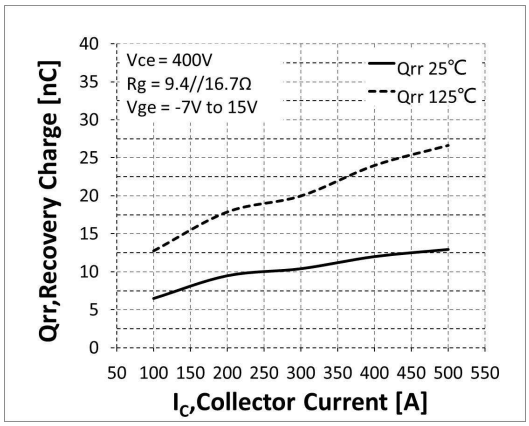


Fig.21 Typical Recovery Current vs. IC

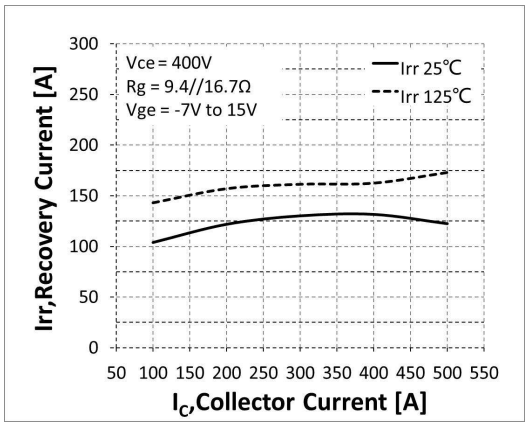
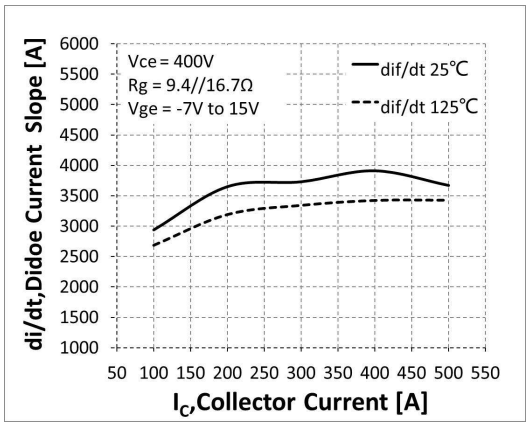


Fig.22 Typical di/dt vs. IC



HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Typical Characteristics

IGBT Q2, Q3 and DIODE D1, D4

Fig.23 Typical Switching Loss Eon vs. IC

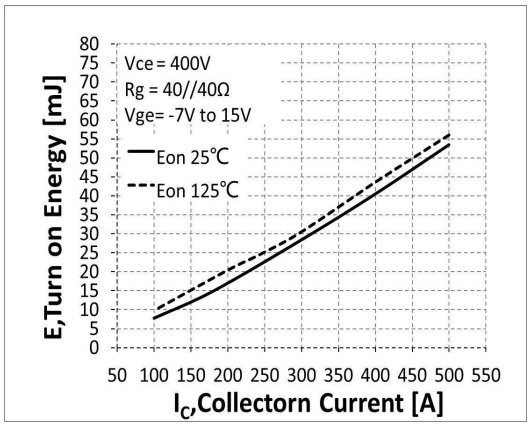


Fig.24 Typical Switching Loss Eoff vs. IC

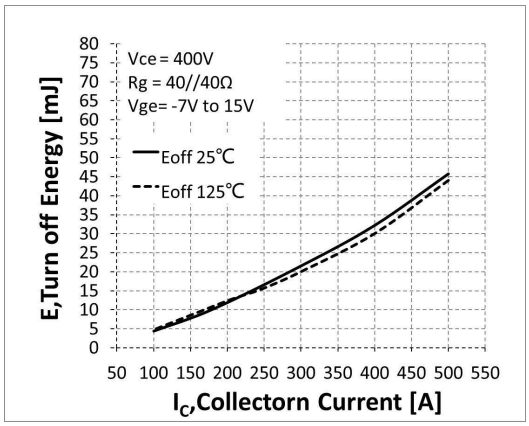


Fig.25 Typical Switching Time Ton vs. IC

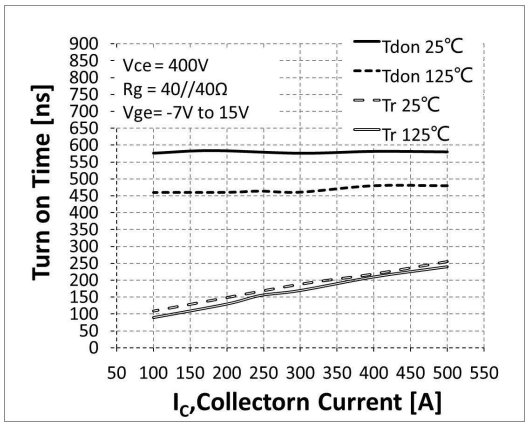


Fig.26 Typical Switching Time Toff vs. IC

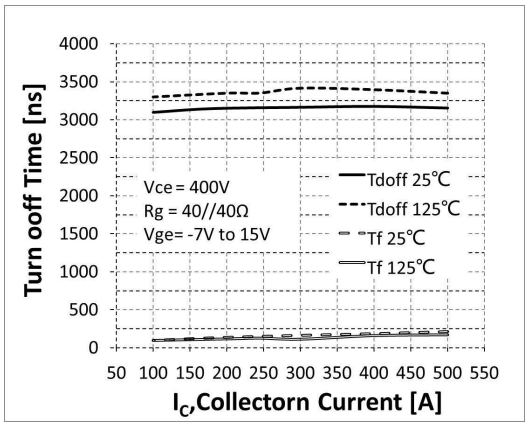


Fig.27 Typical Recovery Energy vs. IC

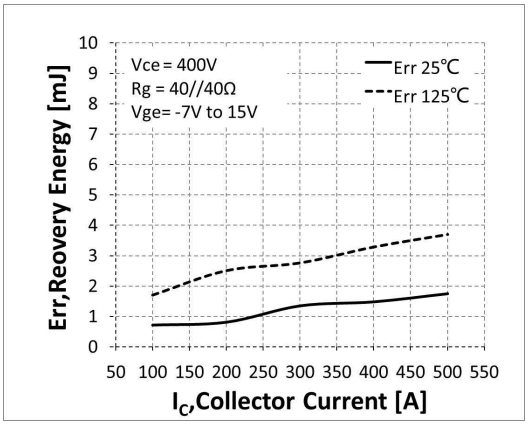
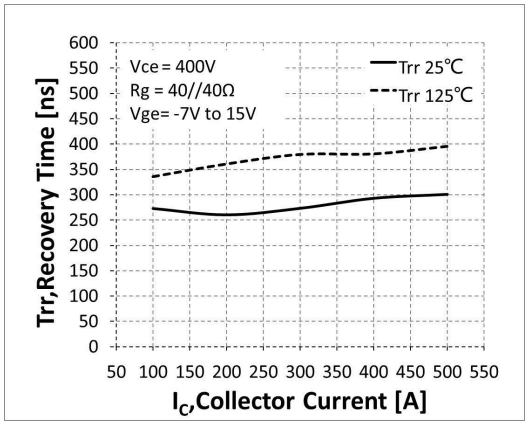


Fig28 Typical Recovery Time vs. IC



HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Typical Characteristics

IGBT Q2, Q3 and DIODE D1, D4 (continued)

Fig.29 Typical Recovery Charge vs. IC

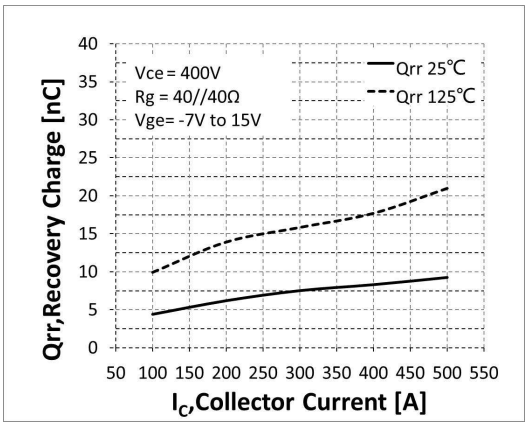


Fig.30 Typical Recovery Current vs. IC

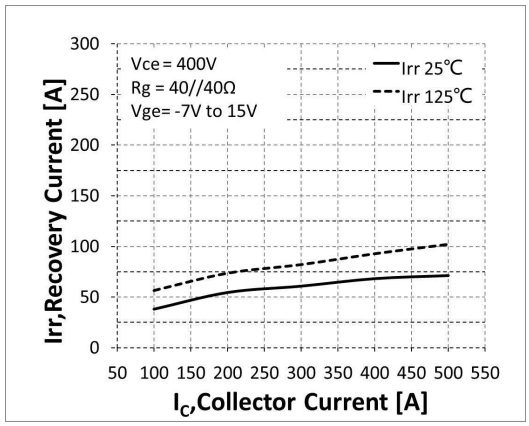


Fig.31 Typical di/dt vs. IC

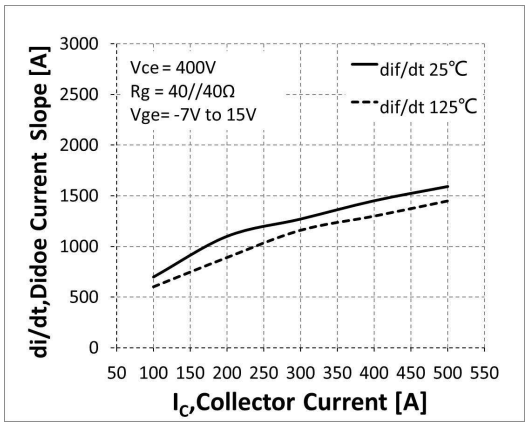


Fig.32 Typical Thermistor vs. T_{NTC}

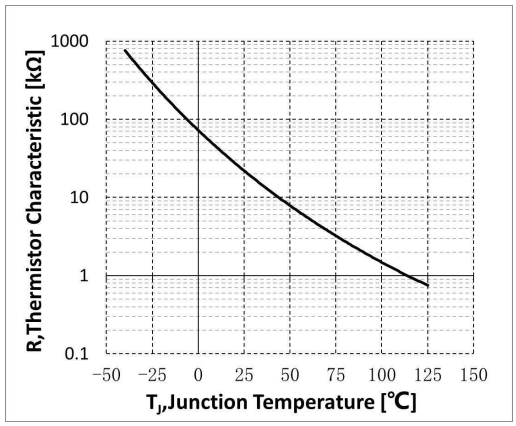


Fig.33 RBSOA (Q2, Q3)

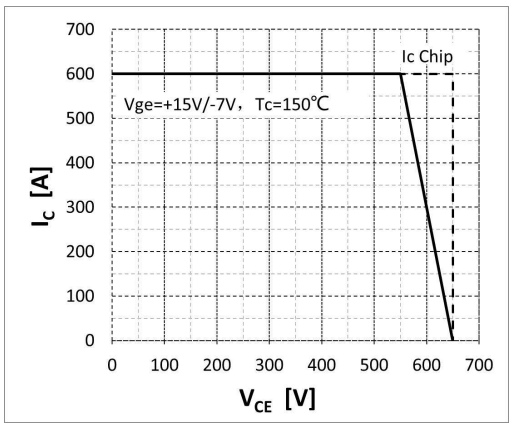
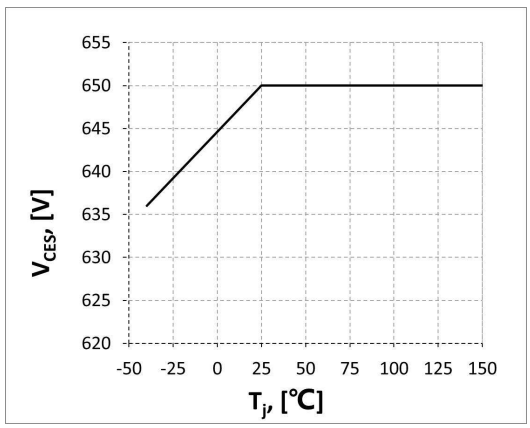


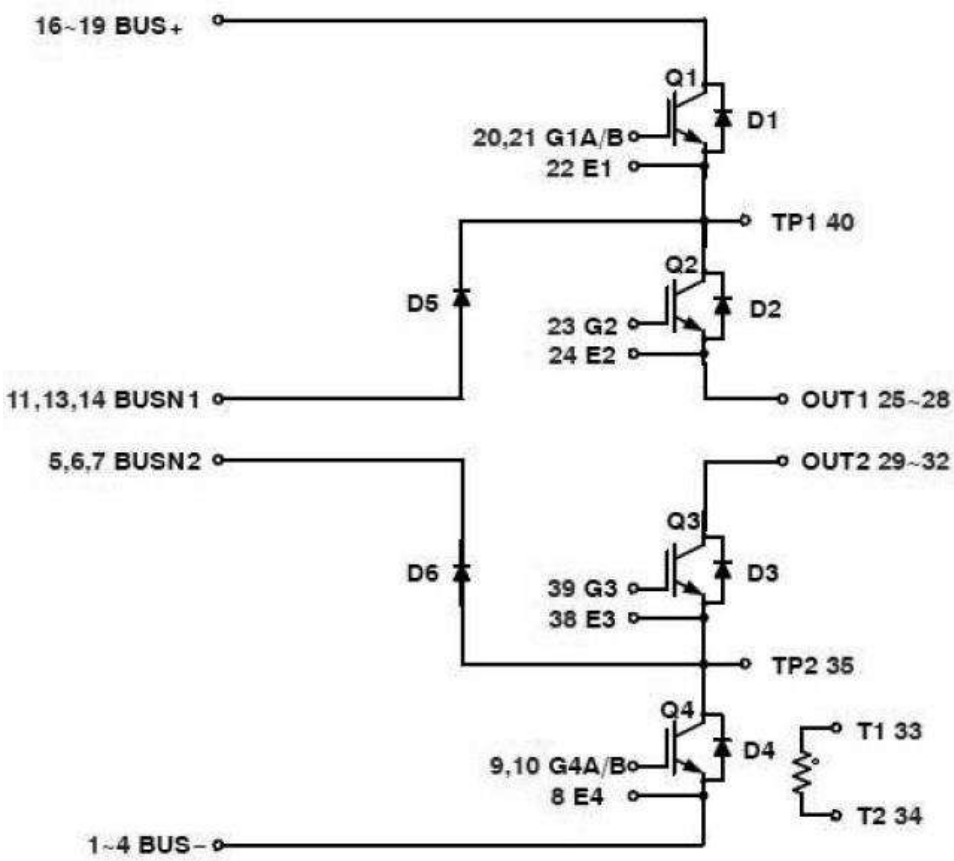
Fig.34 maximum allowed collector-emitter voltage (Q2, Q3)



HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

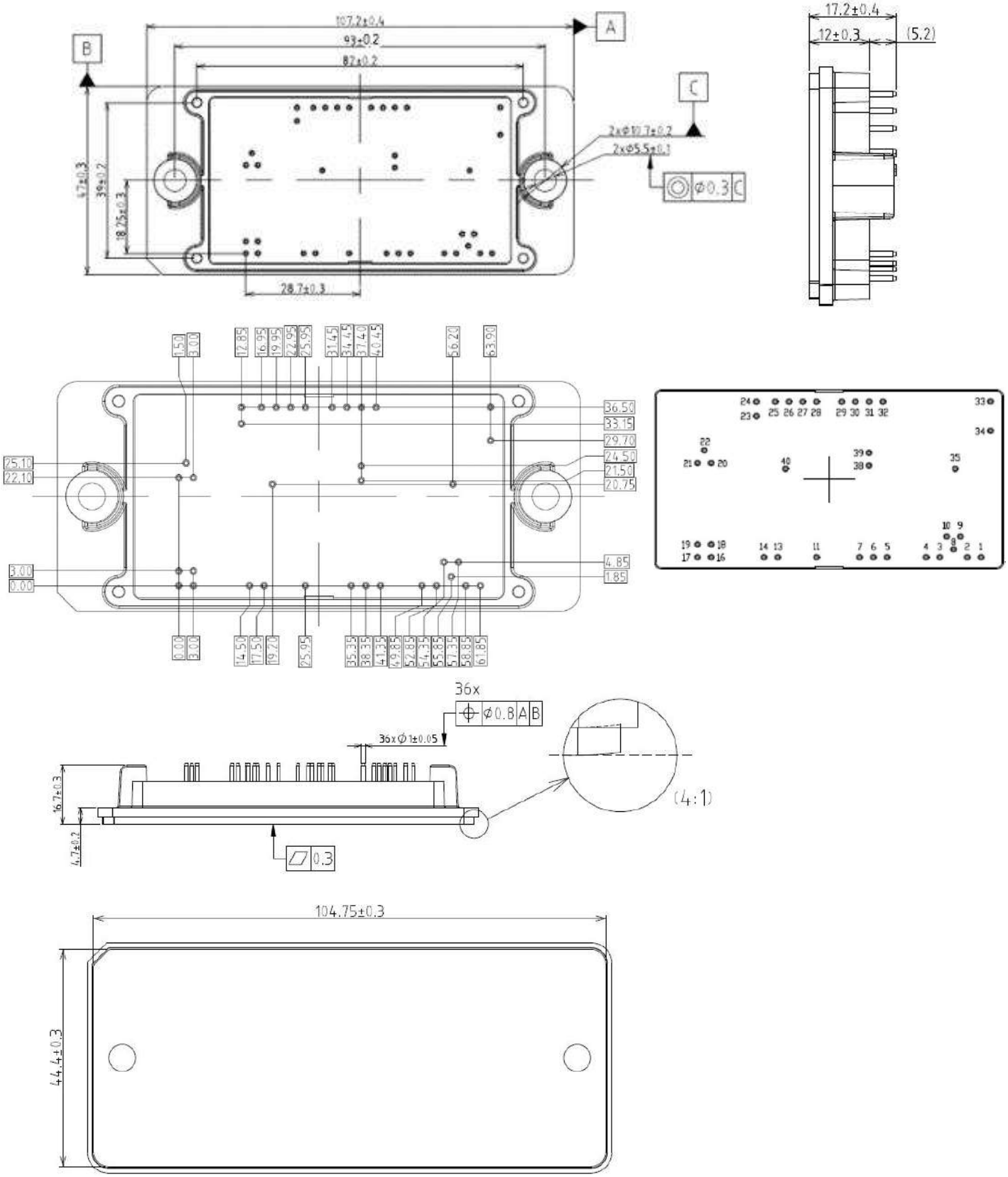
Circuit Diagram



HCG450FL065K1E1

650V / 450A C2 (size similar to Flow 2 with Cu Baseplate)

Package Outlines



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

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.