

HCG450FH170D3E1

1700V / 450A D3 (size similar to Econo Dual with Cu Baseplate)

Features

- LOW $V_{CE(SAT)}$
- Low inductance module structure
- Solder pin terminals

Applications

- Inverter for motor drives AC and DC servo drives
- Uninterruptible power supply systems
- Wind turbines
- PV power conditioning systems



Table 1 Key Performance and Package Parameters

Type	V_{CE}	I_C ($T_C = 90^\circ\text{C}$)	$V_{CE(SAT)}$ ($T_{vj} = 25^\circ\text{C}$, $I_C = 450\text{A}$, $V_{GE} = 15\text{V}$)	T_{vjmax}	Package
IGBT	1700V	450A	1.62V	175°C	D3

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Table 2 Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Collector emitter voltage	V_{CE}	$T_{vj} = 25^{\circ}\text{C}$	1700	V
Continuous DC collector current	I_{CDC}	$T_C = 90^{\circ}\text{C}$	450	A
Repetitive peak collector current	I_{CRM}	$T_p=1\text{ms}$	900	
Continuous DC forward current	I_F		450	A
Repetitive peak forward current	I_{FRM}	$T_p=1\text{ms}$	900	A
I^2t -value	I^2t	$T_p=10\text{ms}, V_R=0\text{V}, T_{vj} = 175^{\circ}\text{C}$	45000	A^2S
Gate Source Voltage	V_{GE}	$T_{vj} = 25^{\circ}\text{C}$	± 20	V
Junction Temperature	T_{vj}		-40 to +175	$^{\circ}\text{C}$
Storage Temperature	T_{stg}		-40 to +125	
Operating virtual junction temperature	T_{vjop}		-40 to +150	$^{\circ}\text{C}$

Table 3 Thermal Resistance

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
IGBT Thermal resistance junction - case	R_{thJC}	Per IGBT	-	0.06	-	$^{\circ}\text{C} / \text{W}$
Diode Thermal resistance junction - case	R_{thJC}	Per diode	-	0.098	-	$^{\circ}\text{C} / \text{W}$

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Table 4 Static Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Collector emitter voltage	$V_{(BR)CES}$	$T_{vj} = 25^{\circ}\text{C}$	1700	-	-	V
Collector emitter saturation voltage	V_{CESat} (terminal)	$V_{GE} = 15\text{V}, I_C = 450\text{A},$ $T_{vj} = 25^{\circ}\text{C}$	-	1.76	-	V
		$V_{GE} = 15\text{V}, I_C = 450\text{A},$ $T_{vj} = 175^{\circ}\text{C}$	-	2.34	-	
	V_{CESat} (chip)	$V_{GE} = 15\text{V}, I_C = 450\text{A},$ $T_{vj} = 25^{\circ}\text{C}$	-	1.62	-	
		$V_{GE} = 15\text{V}, I_C = 450\text{A},$ $T_{vj} = 175^{\circ}\text{C}$	-	2.13	-	
Diode forward voltage	V_F (terminal)	$V_{GE} = 0\text{V}, I_C = 450\text{A},$ $T_{vj} = 25^{\circ}\text{C}$	-	1.72	-	V
		$V_{GE} = 0\text{V}, I_C = 450\text{A},$ $T_{vj} = 175^{\circ}\text{C}$	-	1.87	-	
	V_F (chip)	$V_{GE} = 0\text{V}, I_C = 450\text{A},$ $T_{vj} = 25^{\circ}\text{C}$	-	1.62	-	
		$V_{GE} = 0\text{V}, I_C = 450\text{A},$ $T_{vj} = 175^{\circ}\text{C}$	-	1.80	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 18\text{mA}$	-	5.87	-	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 1700\text{V}, V_{GE} = 0\text{V},$ $T_{vj} = 25^{\circ}\text{C}$	-	-	100	μA
Gate-emitter leakage current	I_{GES}	$V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$	-	-	100	nA
Input capacitance	C_{ies}	$V_{GE} = 0\text{V},$ $V_{CE} = 25\text{V},$ $f = 100\text{kHz}$	-	58.2	-	nF
Output capacitance	C_{oes}		-	2.44	-	
Reverse transfer capacitance	C_{res}		-	0.36	-	
Gate input resistance	R_G	$f = 1\text{M Hz}$	-	2.08	-	Ω
Gate charge	Q_G	$V_{GE} = -15\text{V to } 15\text{V},$ $V_{CE} = 600\text{V}$	-	3.57	-	μC

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Table 5 Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Turn-on delay time	t_{don}	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 900\text{V}$, $I_C = 450\text{A}$, $V_{GE} = -15/15\text{V}$, $R_{G(on)} = 0.51\Omega, R_{G(off)} = 0.51\Omega$	-	205	-	ns
Rise time	t_r		-	60	-	
Turn-off delay time	t_{doff}		-	350	-	
Fall time	t_f		-	485	-	
Turn-on energy	E_{on}	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 900\text{V}$, $I_C = 450\text{A}$, $V_{GE} = -15/15\text{V}$, $R_{G(on)} = 0.51\Omega, R_{G(off)} = 0.51\Omega$	-	111	-	mJ
Turn-off energy	E_{off}		-	89	-	
Total switching energy	E_{ts}		-	200	-	
Turn-on delay time	t_{don}	$T_{vj} = 150^{\circ}\text{C}$, $V_{CC} = 900\text{V}$, $I_C = 450\text{A}$, $V_{GE} = -15/15\text{V}$, $R_{G(on)} = 0.51\Omega, R_{G(off)} = 0.51\Omega$	-	250	-	ns
Rise time	t_r		-	75	-	
Turn-off delay time	t_{doff}		-	400	-	
Fall time	t_f		-	630	-	
Turn-on energy	E_{on}	$T_{vj} = 150^{\circ}\text{C}$, $V_{CC} = 900\text{V}$, $I_C = 450\text{A}$, $V_{GE} = -15/15\text{V}$, $R_{G(on)} = 0.51\Omega, R_{G(off)} = 0.51\Omega$	-	157.3	-	mJ
Turn-off energy	E_{off}		-	111.8	-	
Total switching energy	E_{ts}		-	269.1	-	
Short circuit current	I_{SC}	$T_{vj} = 175^{\circ}\text{C}$, $V_{CC} = 1000\text{V}$, $V_{GE} = 15\text{V}$, $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$ $T_P \leq 6 \mu\text{s}$	-	1800	-	A

Table 6 Diode Recovery Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse recovery Time	T_{rr}	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 900\text{V}$, $I_C = 450\text{A}$, $V_{GE} = -15/15\text{V}$, $R_{G(on)} = 0.51\Omega, R_{G(off)} = 0.51\Omega$	-	615	-	ns
Peak reverse recovery current	I_{rrm}		-	440	-	A
Reverse recovery charge	Q_{rr}		-	107	-	μC
Reverse recovery energy	E_{rec}		-	56.8	-	mJ
Reverse recovery Time	T_{rr}	$T_{vj} = 150^{\circ}\text{C}$, $V_{CC} = 900\text{V}$, $I_C = 450\text{A}$, $V_{GE} = -15/15\text{V}$, $R_{G(on)} = 0.51\Omega, R_{G(off)} = 0.51\Omega$	-	1095	-	ns
Peak reverse recovery current	I_{rrm}		-	510	-	A
Reverse recovery charge	Q_{rr}		-	196	-	μC
Reverse recovery energy	E_{rec}		-	111.1	-	mJ

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Table 7 Module Characteristics

Parameter	Symbol	Conditions	Value	Typ
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1\text{min}$	3.4	kV
Material of module baseplate			Cu+Ni	
Internal isolation		Basic insulation	Al_2O_3	
Mounting torque of screws to heat sink	M_s	M5	3.0-6.0	N·m
Mounting torque of screws to terminals	M_t	M6	3.0-6.0	N·m
Comperative tracking index	CTI		>175	

Table 8 NTC-Thermistor

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Rated resistance	R25	$TC = 25^\circ\text{C}$	-	5	-	k Ω
Deviation of R100	$\Delta R/R$	$TC = 100^\circ\text{C}$, $R100 = 493 \Omega$	-5	-	5	%
B-value	B25/50	$R2 = R25 \exp[B25/50(1/T2 - 1/(298,15K))]$	-	3375	-	K

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Characteristics Diagrams

Fig.1 Typical Output Characteristic, IGBT, Inverter
 $I_C = f(V_{CE}) / (\text{terminal})$

$V_{GE} = 15V$

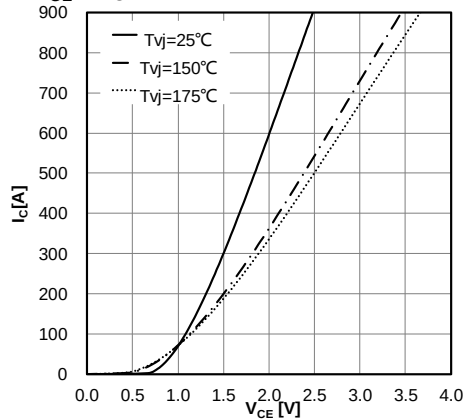


Fig.2 Typical Output Characteristic, IGBT, Inverter
 $I_C = f(V_{CE}) / (\text{terminal})$

$T_{vj} = 175^\circ C$

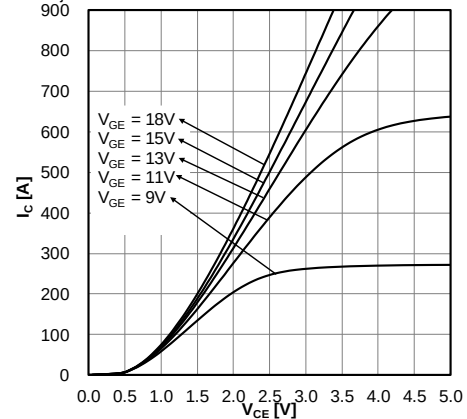


Fig.3 Typical Output Characteristic, IGBT, Inverter
 $I_C = f(V_{GE})$

$V_{CE} = 20V$

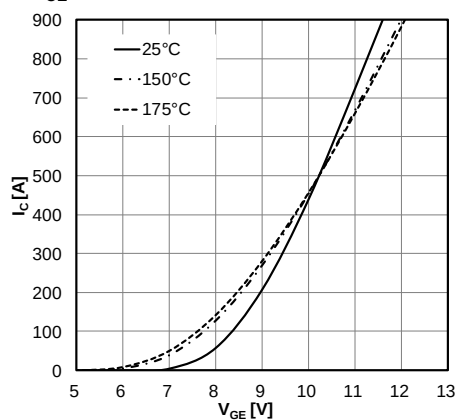


Fig.4 Switching losses, IGBT, Inverter
 $E = f(I_C)$

$R_{Goff} = 0.51\Omega$, $R_{Gon} = 0.51\Omega$, $V_{CE} = 900V$, $V_{GE} = \pm 15V$

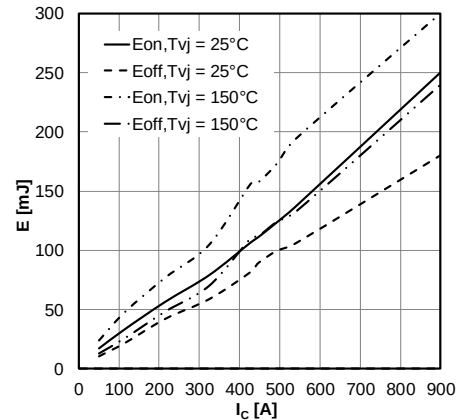


Fig.5 Switching losses, IGBT, Inverter
 $E = f(R_G)$

$I_C = 450A$, $V_{CE} = 900V$, $V_{GE} = \pm 15V$

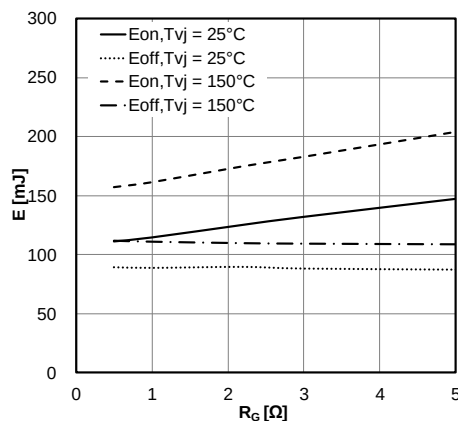
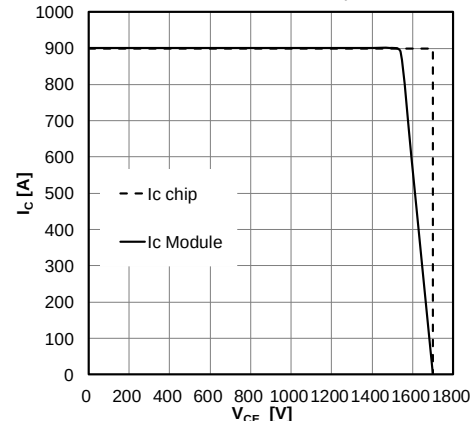


Fig.6 Reverse bias safe operating area (RBOSA), IGBT, Inverter
 $I_C = f(V_{CE})$

$R_{Goff} = 0.51\Omega$, $V_{GE} = \pm 15V$, $T_{vj} = 175^\circ C$



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Characteristics Diagrams

Fig.7 Capacity characteristic, IGBT, Inverter
 $C = f(V_{CE})$

$f = 100 \text{ KHz}$, $V_{GE} = 0V$, $T_{vj} = 25^\circ\text{C}$

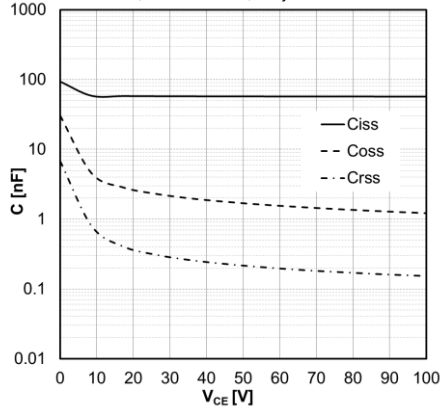


Fig.8 Transient thermal impedance IGBT, Inverter $Z_{thJC} = f(t)$

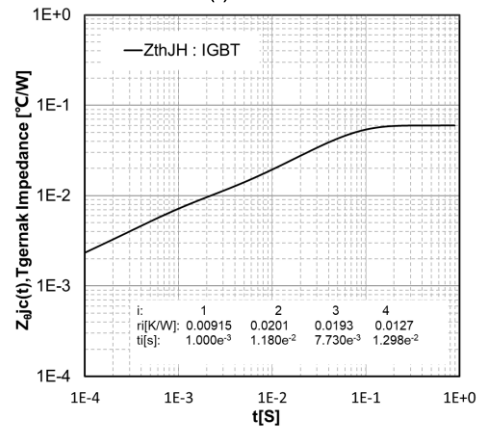


Fig.9 Forward characteristic, Diode, Inverter $I_F = f(V_F)$ / (terminal)

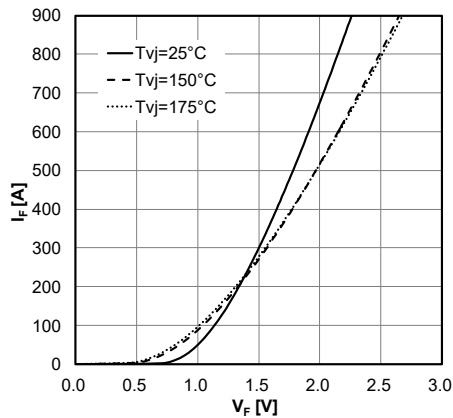


Fig.10 Switching losses, Diode, Inverter $E_{rec} = f(I_F)$

$V_{CE} = 900V$, $R_{Goff} = 0.51\Omega$, $R_{Gon} = 0.51\Omega$, $V_{GE} = \pm 15V$

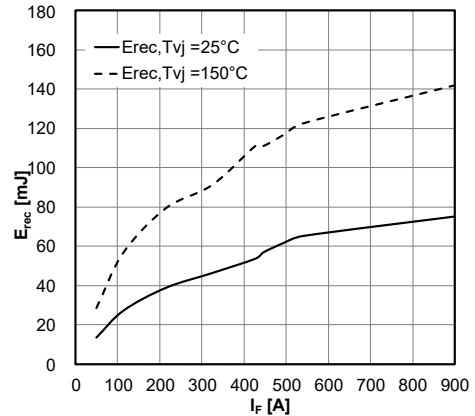


Fig.11 Switching losses, Diode, Inverter $E_{rec} = f(R_G)$

$V_{CE} = 900V$, $I_F = 450A$

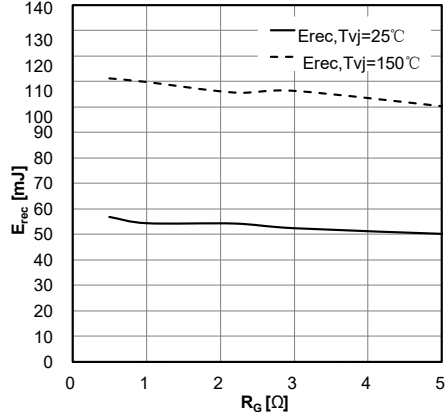
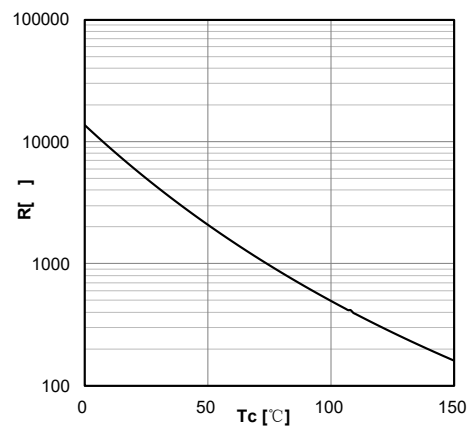


Fig.12 Temperature characteristic, NTC - Thermistor



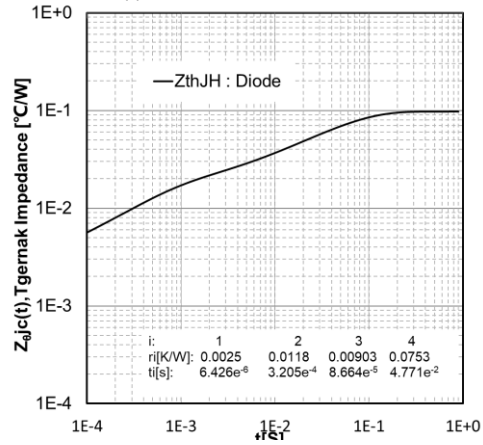
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Characteristics Diagrams

Fig.13 Transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$

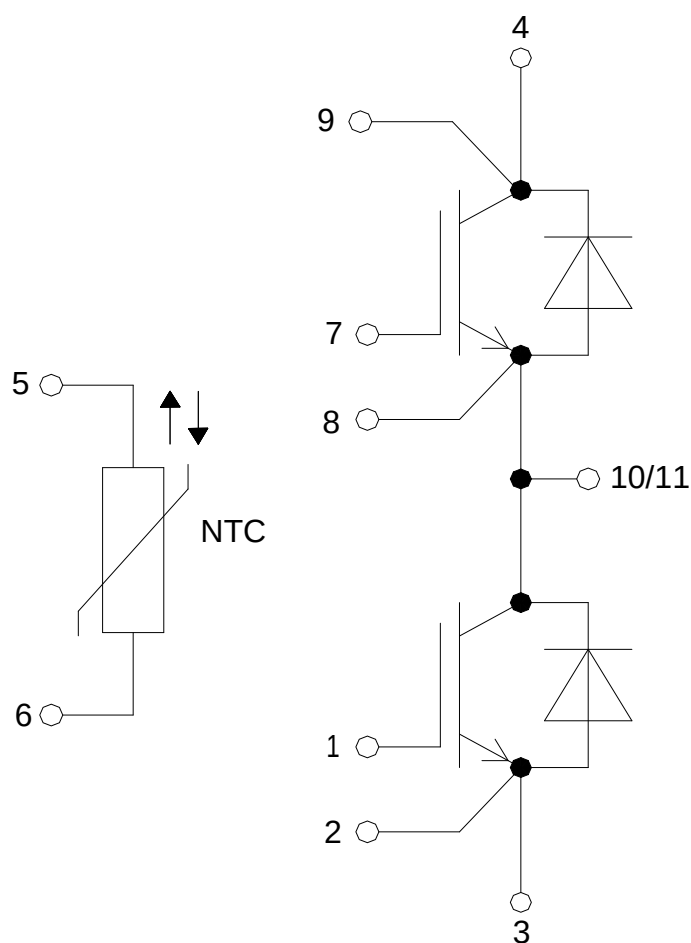


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Package Information

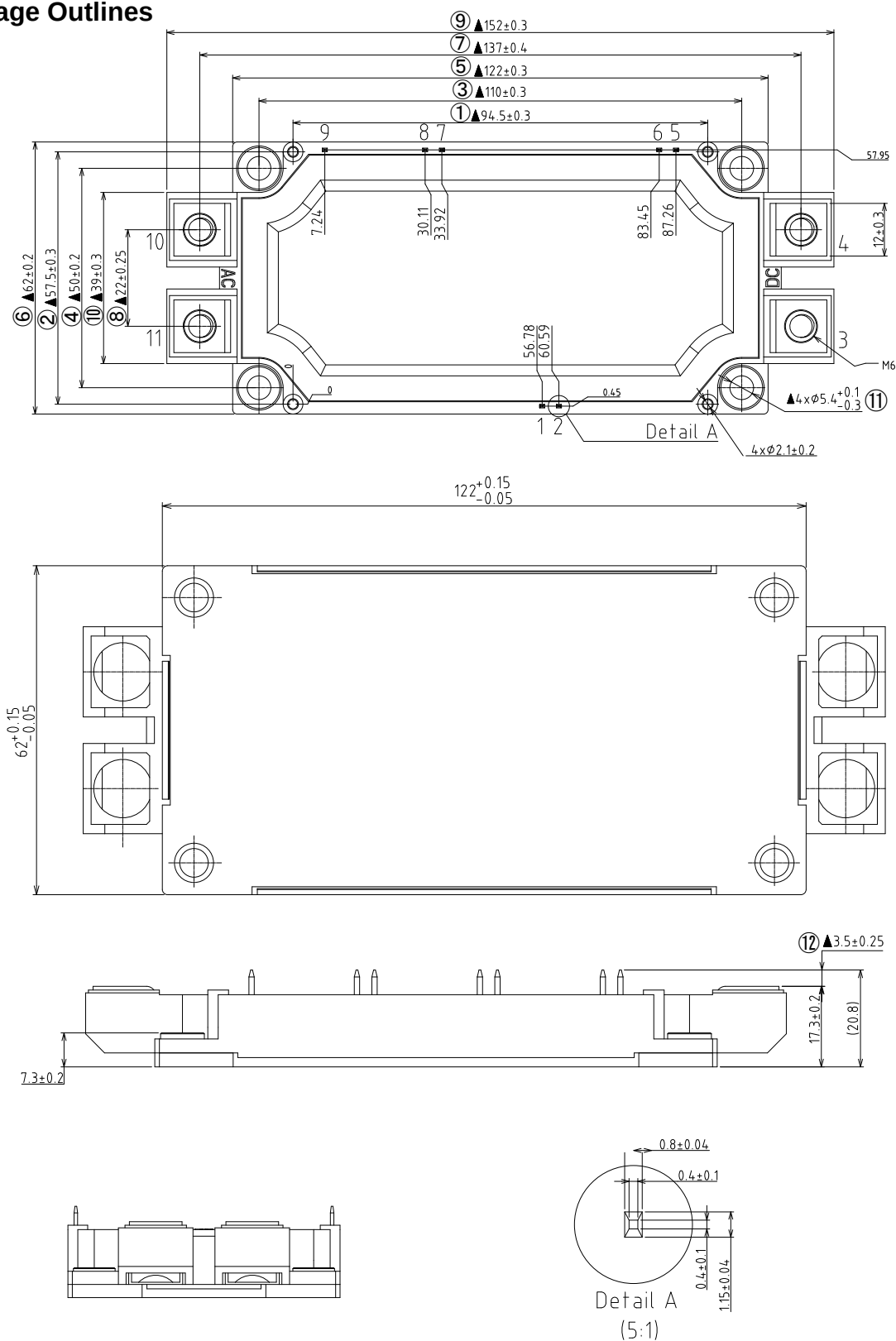
Circuit Diagram



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Package Outlines



Revision History

Document Version	Description of Changes
RevX.0.1	Released

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