洛克易半导体
ROCK
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ROCK ETERNAL SEMICONDUCTOR (SUZHOU) CO.; LTD.

A9 Standard housing PIM MODULE

CCGM35P120HFP PIM module

VCES	VCEsat typ.		I_{cnom}/I_{CRM}
1200V	T_{vj}=25℃	1.90V	35A/70A
	Tvj=150℃	2.15V	

DESCRIPTION

CCGM35P120HFP standard housing PIM module with high speed Planar-FS IGBT and Fast Recovery Diode chip.

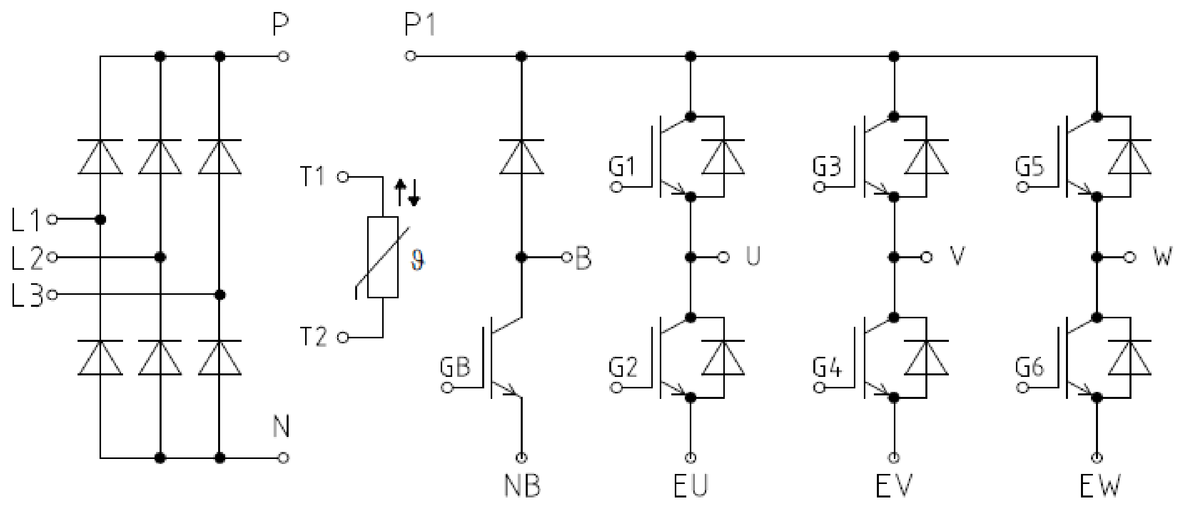
FEATURES

- Half-bridge module
- Increased blocking voltage to 1200V
- Low switching losses
- Positive temperature coefficient
- Low reverse recovery charge
- high flexibility and reliability
- AECQ-101 Qualified

APPLICATIONS

- Welding
- High Frequency Switching Application
- High Power Converters
- UPS systems

EQUIVALENT CIRCUIT



CHARACTERISTICS VALUES

MAXIMUM RATED VALUES(IGBT)

Parameter	Symbol	Conditions	Values	Units
Collector-emitter voltage	V_{CES}	T_{vj}=25℃, V_{GE}=0V	1200	V
Continuous collector current	I_{cnom}	T_c=100℃, T_{vjmax}=175℃	35	A
Repetitive peak collector current	I_{CRM}	t_p=1ms, T_{vj}=25℃	70	A
Gate-emitter peak voltage	V_{GES}	T_{vj}=25℃	±20	V
Total power dissipation	P_{tot}	T_c=25℃, $T_{vj\ max}$=175℃	215	W

CHARACTERISTICS VALUES(IGBT)

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	V_{GE}=0V,I_C=100μA		1200			V
Collector-emitter saturation voltage	$V_{CE\ sat}$	I_C=35A, V_{GE}=15V, T_{vj}=25℃			1.90	2.35	V
		I_C=35A, V_{GE}=15V, T_{vj}=150℃			2.15		V
Gate-emitter threshold voltage	V_{GEth}	V_{CE}=V_{GE}, I_C=1.2mA, T_{vj}=25℃		5.5	6.0	6.6	V
Gate charge	Q_G	V_{GE}=-15V...+15V			0.32		μC
Integrated gate resistor	R_G	T_{vj}=25℃			2		Ω
Input capacitance	C_{ies}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=25V			2.5		nF
Reverse transfer capacitance	C_{res}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=25V			0.06		nF
Collector-emitter cut-off current	I_{CES}	V_{CE}=1200V, V_{GE}=0V, T_{vj}=25℃				500	μA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V, T_{vj}=25℃				200	nA
Turn-on delay time, inductive load	$t_{d\ on}$	I_C=35A, V_{CE}=600V, V_{GE}=±15V, R_{Gon}=12Ω, R_{Goff}=12Ω,	T_{vj}=25℃		26		ns
			T_{vj}=150℃		28		ns
Rise time, inductive load	t_r		T_{vj}=25℃		11		ns
			T_{vj}=150℃		19		ns
Turn-off delay time, inductive load	$t_{d\ off}$		T_{vj}=25℃		235		ns
			T_{vj}=150℃		312		ns
Fall time, inductive load	t_f		T_{vj}=25℃		135		ns
			T_{vj}=150℃		205		ns
Turn-on energy loss per pulse	E_{on}	I_C=35A, V_{CE}=600V, V_{GE}=±15V, R_{Gon}=12Ω, R_{Goff}=12Ω,L_s=35nH	T_{vj}=25℃		2.3		mJ
			T_{vj}=150℃		3.35		mJ
Turn-off energy loss per pulse	E_{off}		T_{vj}=25℃		2.2		mJ
			T_{vj}=150℃		3.40		mJ
SC data	I_{SC}	V_{GE}≤15V, V_{CC}=800V,t_p≤10μs, V_{CEmax}=V_{CES}-L_{sCE}*di/dt,T_{vj}=150℃			130		A
IGBT, thermal resistance, junction to case	$R_{thjc\ IGBT}$	Per IGBT			0.63	0.75	K/W
IGBT, thermal resistance, case to heatsink	$R_{thch\ IGBT}$	Per IGBT			0.61		K/W

MAXIMUM RATED VALUES(DIODE，INVERTER)

Parameter	Symbol	Conditions	Values	Units
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃	1200	V
Continuous forward current	I_F		35	A
Maximum repetitive forward current	I_{FRM}	Pulse, t_p=1ms, T_{vj}=25℃	70	A
I^2t-value	I^2t	V_R=0V, t_p=10ms, T_{vj}=125℃	240	A^2s
		V_R=0V, t_p=10ms, T_{vj}=150℃	220	

CHARACTERISTICS VALUES(DIODE，INVERTER)

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Breakdown voltage	$V_{(BR)}$	I_R=100μA,T_{vj}=25℃		1200			V
Reverse current	I_R	V_R=1200V,T_{vj}=25℃				100	μA
Forward voltage	V_F	I_F=35A, V_{GE}=0V,	T_{vj}=25℃		1.72	2.25	V
			T_{vj}=150℃		1.67		V
Peak reverse recovery current	I_{RM}	I_F=35A, V_R=600V, V_{GE}=-15V di_F/dt=2500A/μs	T_{vj}=25℃		82		A
			T_{vj}=150℃		87		A
Recovered charge	Q_r		T_{vj}=25℃		3.90		μC
			T_{vj}=150℃		7.59		μC
Reverse recovery energy	E_{rec}		T_{vj}=25℃		1.43		mJ
			T_{vj}=150℃		2.90		mJ
Thermal resistance, junction to case	$R_{thjc\ DIODE}$	Per DIODE			0.85	0.98	K/W
Thermal resistance, case to heatsink	$R_{thch\ DIODE}$	Per DIODE			0.82		K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		150	℃

MAXIMUM RATED VALUES(DIODE，RECTIFIER)

Parameter	Symbol	Conditions	Values	Units
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃	1600	V
Maximum RMS forward current per chip	I_{FRMSM}	T_C=100℃	50	A
Maximum RMS current at rectifier output	I_{RMSM}	T_C=100℃	50	A
Surge forward current	I_{FRM}	t_p=10ms, T_{vj}=25℃	450	A
		t_p=10ms, T_{vj}=150℃	375	
I^2t-value	I^2t	t_p=10ms, T_{vj}=25℃,	1000	A^2s
		t_p=10ms, T_{vj}=150℃	695	

CHARACTERISTICS VALUES(DIODE，RECTIFIER)

Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Forward voltage	V_F	T_{vj} = 150°C, I_F = 35 A		0.95		V
Reverse current	I_R	V_R=1600V,T_{vj}=150℃		1.15		mA
Thermal resistance, junction to case	$R_{thjc\ DIODE}$	Per DIODE		1.10	1.15	K/W
Thermal resistance, case to heatsink	$R_{thch\ DIODE}$	Per DIODE		1.00		K/W

MAXIMUM RATED VALUES(IGBT，BRAKE-CHOPPER)

Parameter	Symbol	Conditions	Values	Units
Collector-emitter voltage	V_{CES}	T_{vj}=25℃	1200	V
Continuous DC collector current	I_{cnom}	Tc=100℃, $T_{vj\ max}$ = 175°C	35	A
Repetitive peak collector current	I_{CRM}	t_P = 1 ms	70	A
Total power dissipation	P_{tot}	T_C = 25°C, $T_{vj\ max}$ = 175°C	215	W
Gate-emitter peak voltage	V_{GES}		±20	V

CHARACTERISTICS VALUES(IGBT，BRAKE-CHOPPER)

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	I_C=35A, V_{GE}=15V, T_{vj}=25℃			1.90	2.35	V
		I_C=35A, V_{GE}=15V, T_{vj}=150℃			2.15		V
Gate-emitter thresholdvoltage	V_{GEth}	V_{CE}=V_{GE}, I_C=1.20mA, T_{vj}=25℃		5.5	6.0	6.6	V
Gate charge	Q_G	V_{GE}=-15V...+15V			0.32		μC
Integrated gate resistor	R_G	T_{vj}=25℃			2		Ω
Input capacitance	C_{ies}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=25V			2.5		nF
Reverse transfercapacitance	C_{res}	T_{vj}=25℃,f=1MHz,V_{GE}=0V,V_{CE}=25V			0.06		nF
Collector-emitter cut-offcurrent	I_{CES}	V_{CE}=1200V, V_{GE}=0V, T_{vj}=25℃				500	mA
Gate-emitter leakagecurrent	I_{GES}	V_{CE}=0V, V_{GE}=20V, T_{vj}=25℃				200	nA
Turn-on delay time,inductive load	$t_{d\ on}$	I_C=35A, V_{CE}=600V, V_{GE}=±15V, R_{Gon}=47Ω, R_{Goff}=47Ω,	T_{vj}=25℃		75		ns
			T_{vj}=150℃		78		ns
Rise time, inductive load	t_r		T_{vj}=25℃		47		ns
			T_{vj}=150℃		59		ns
Turn-off delay time,inductive load	$t_{d\ off}$		T_{vj}=25℃		285		ns
			T_{vj}=150℃		455		ns
Fall time, inductive load	t_f		T_{vj}=25℃		118		ns
			T_{vj}=150℃		203		ns
Turn-on energy loss perpulse	E_{on}	I_C=35A, V_{CE}=600V, V_{GE}=±15V, R_{Gon}=47Ω, R_{Goff}=47Ω	T_{vj}=25℃		5.2		mJ
			T_{vj}=150℃		7.5		mJ
Turn-off energy loss perpulse	E_{off}		T_{vj}=25℃		2.2		mJ
			T_{vj}=150℃		3.4		mJ
SC data	I_{SC}	V_{GE}≤15V, V_{CC}=800V,t_p≤10μs, V_{CEmax}=V_{CES}-L_{sCE}*di/dt,T_{vj}=150℃			130		A
IGBT, thermal resistance, junction tocase	$R_{thjc\ IGBT}$	Per IGBT			0.62	0.71	K/W
IGBT, thermal resistance, case to heatsink	$R_{thch\ IGBT}$	Per IGBT			0.61		K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		150	℃

MAXIMUM RATED VALUES(DIODE，BRAKE-CHOPPER)

Parameter	Symbol	Conditions	Values	Units
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃	1200	V
Continuous forward current	I_F		10	A
Maximum repetitive forward current	I_{FRM}	Pulse, t_p=1ms, T_{vj}=25℃	20	A
I^2t-value	I^2t	V_R=0V, t_p=10ms, T_{vj}=125℃	16	A^2s
		V_R=0V, t_p=10ms, T_{vj}=150℃	14	

CHARACTERISTICS VALUES(DIODE，BRAKE-CHOPPER)

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=10A, V_{GE}=0V,	T_{vj}=25℃		1.74	2.25	V
			T_{vj}=150℃		1.72		V
Peak reverse recovery current	I_{RM}	I_F=10A, V_R=600V, -di_F/dt=500A/µs	T_{vj}=25℃		13		A
			T_{vj}=150℃		9		A
Recovered charge	Q_r		T_{vj}=25℃		0.92		µC
			T_{vj}=150℃		2.00		µC
Reverse recovery energy	E_{rec}		T_{vj}=25℃		0.25		mJ
			T_{vj}=150℃		0.62		mJ
Thermal resistance, junction to case	$R_{thjc\ DIODE}$	Per DIODE			1.76	1.93	K/W
Thermal resistance, case to heatsink	$R_{thch\ DIODE}$	Per DIODE			1.33		K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		150	℃

CHARACTERISTICS VALUES(NTC-THERMISTOR)

Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_C = 25°C		5.05		kΩ
Deviation of R100	DR/R	T_C = 100°C, R_{100} = 493 W	-5		5	%
Power dissipation	P_{25}	T_C = 25°C			22	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15\ K))]$		3380		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15\ K))]$		3415		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\ K))]$		3438		K

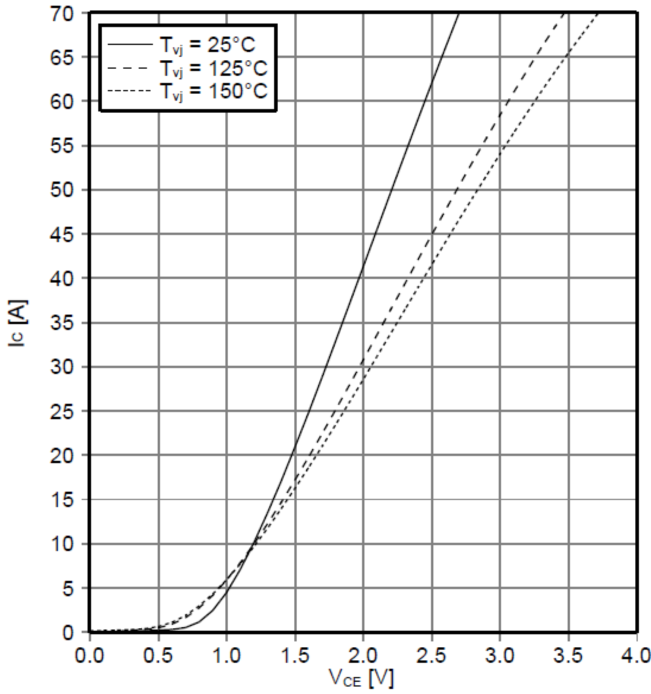
CHARACTERISTICS VALUES(MODULE)

Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Storage temperature	T_{stg}		-40		125	℃
Stray inductance module	L_{sCE}			35		nH
Module lead resistance, terminals-chip	$R_{CC'+EE'}$	T_{vj}=25℃, per switch		5.05		mΩ
Module lead resistance, terminals-chip	$R_{AA'+CC'}$	T_{vj}=25℃, per switch		6.05		mΩ
Isolation test voltage	V_{isol}	RMS, f=50Hz, t=1min		2.5		kV
Creepage distance	ds	Terminal to terminal		6.5		mm
		Terminal to base		11.7		mm
Clearance distance in air	da	Terminal to terminal		5.2		mm
		Terminal to base		10.4		mm
Comperative tracking index	CTI		>200			
Internal isolation	-	Basic insulation	Al_2O_3			-
Weight	G		37			g

CHARACTERISTICS DIAGRAMS

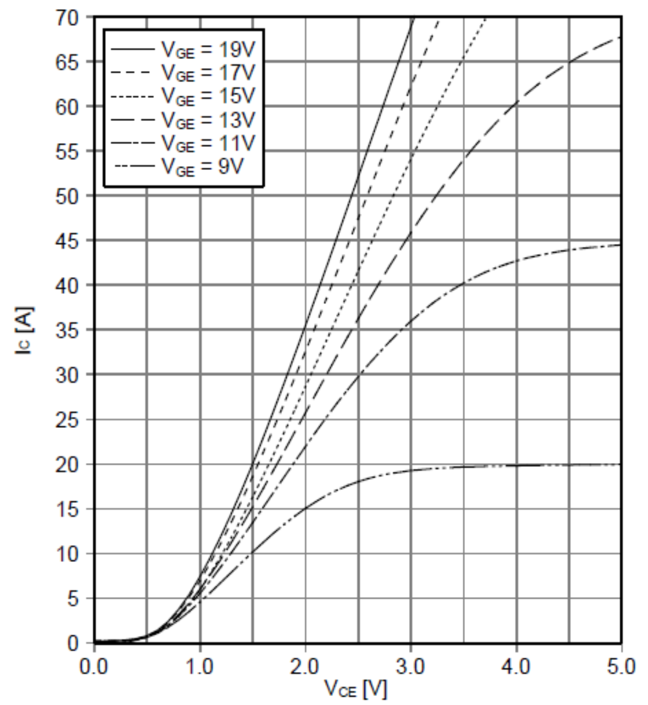
Output characteristic IGBT, Inverter(typical)

$I_C=f(V_{CE})$, $V_{GE}=15V$



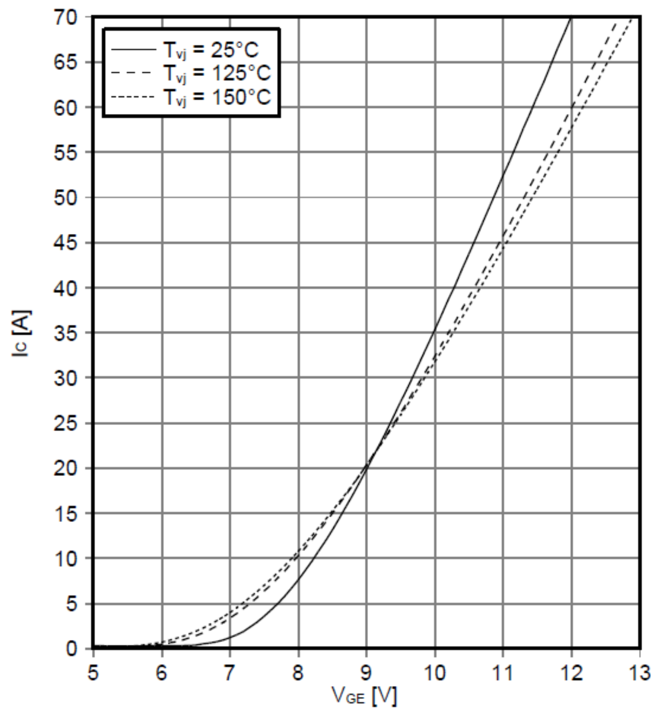
Output characteristic IGBT, Inverter(typical)

$I_C=f(V_{CE})$,$T_{vj}=150$℃



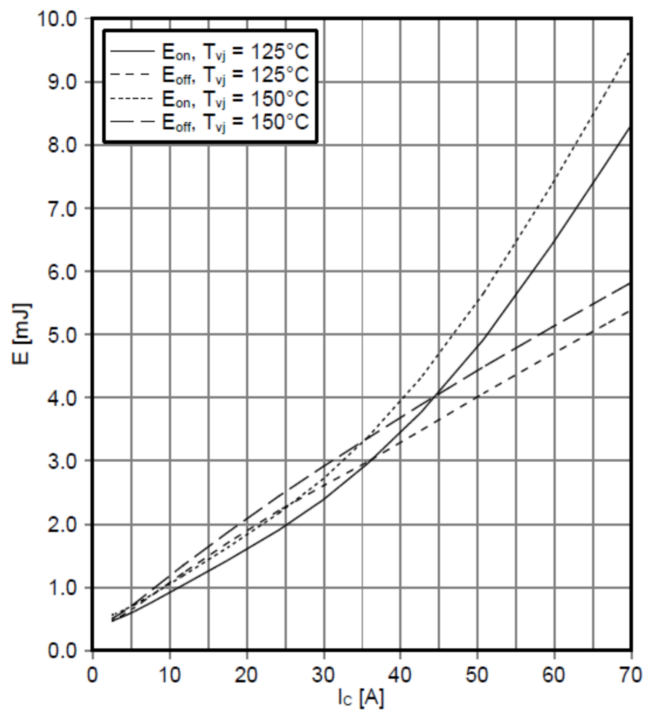
Transfer characteristic IGBT, Inverter(typical)

$I_C=f(V_{GE})$, $V_{CE}=20V$



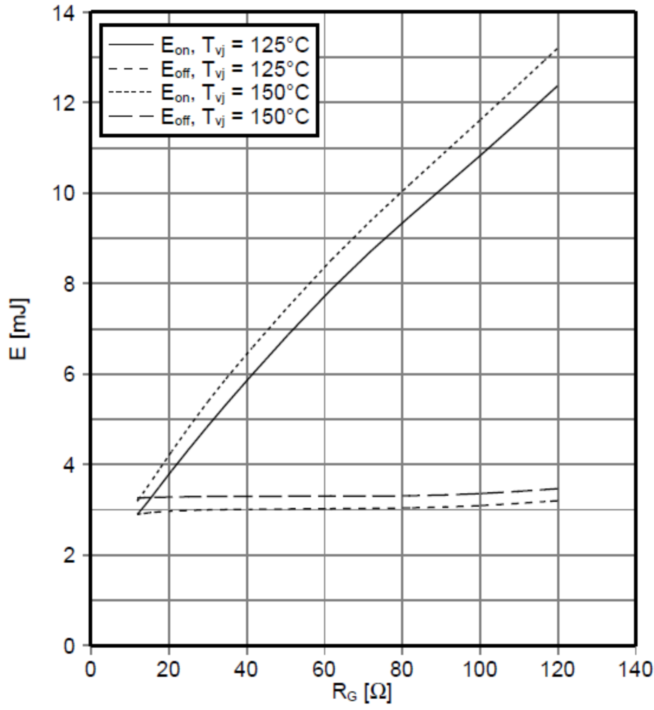
Switching losses IGBT, Inverter(typical)

$E_{on}=f(I_C)$, $E_{off}=f(I_C)$,$V_{GE}=\pm15V$, $R_{Gon}=12\Omega$, $R_{Goff}=12\Omega$, $V_{CE}=600V$



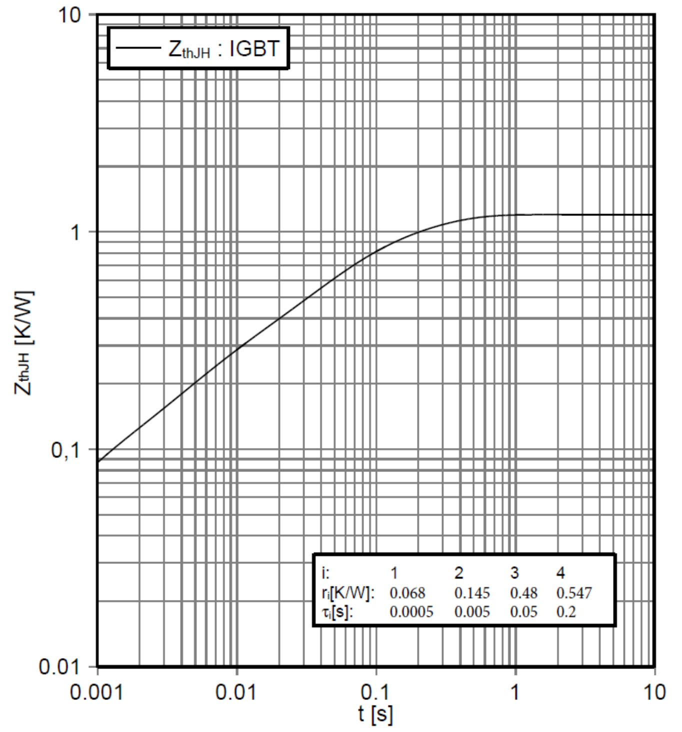
Switching losses IGBT, Inverter(typical)

$E_{on}=f(R_G)$, $E_{off}=f(R_G)$,$V_{GE}=\pm15V$, $I_C=35A$, $V_{CE}=600V$



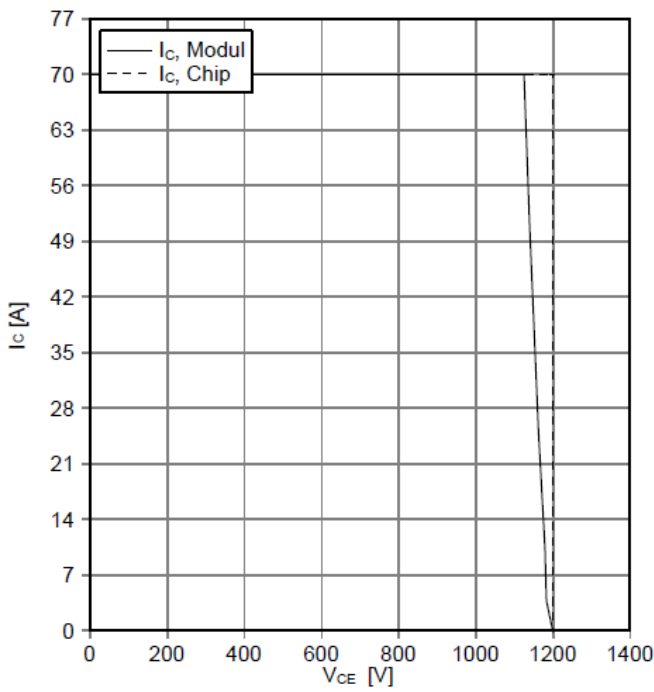
Transient thermal impedance IGBT, Inverter

$Z_{thJC}=f(t)$



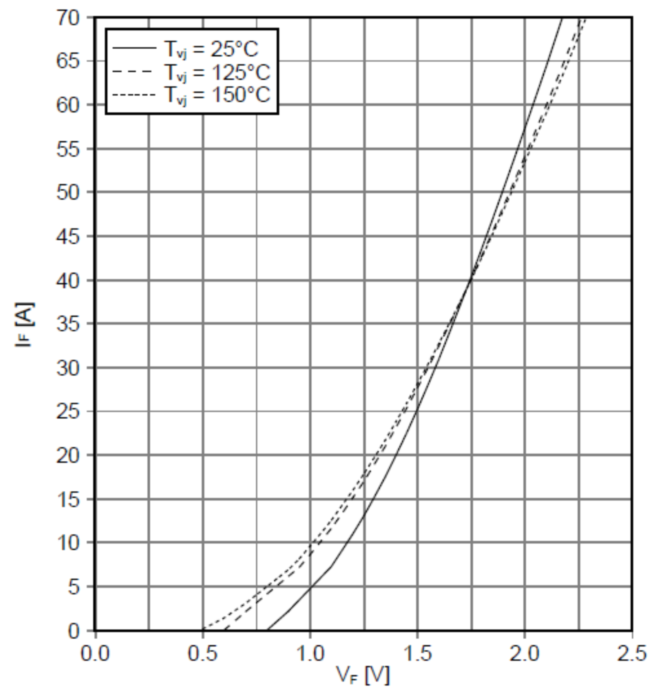
Reverse bias safe operating area IGBT, Inverter(RBSOA)

$I_C=f(V_{CE})$, $V_{GE}=\pm15V$, $R_{Goff}=12\Omega$, $T_{vj}=150$℃

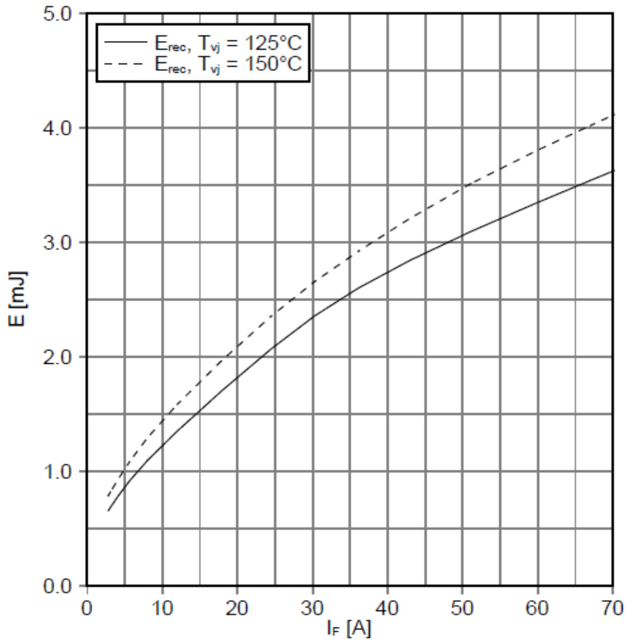


Forward characteristic of Diode, Inverter(typical)

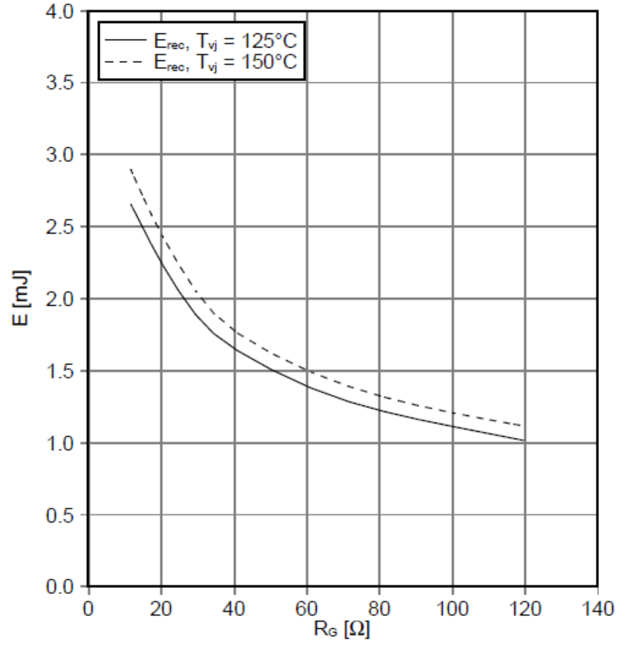
$I_F=f(V_F)$



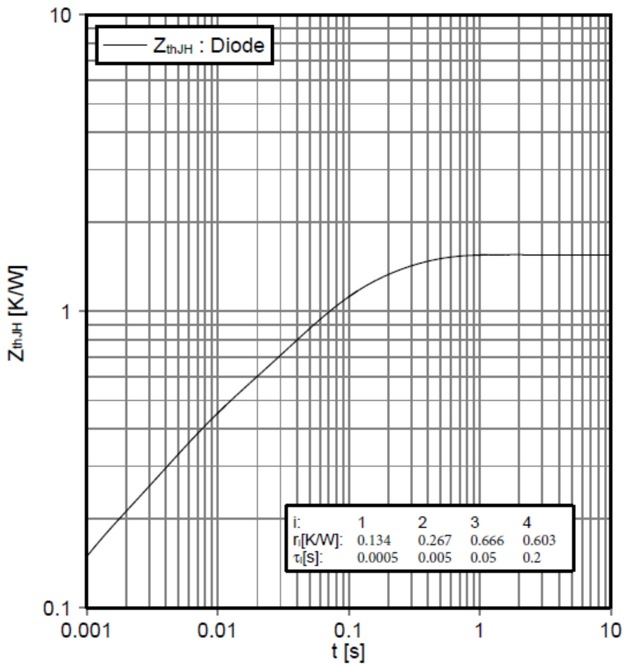
Switching losses Diode, Inverter(typical)
E_{rec}=f(I_F), R_{Gon}=12Ω, V_{CE}=600V



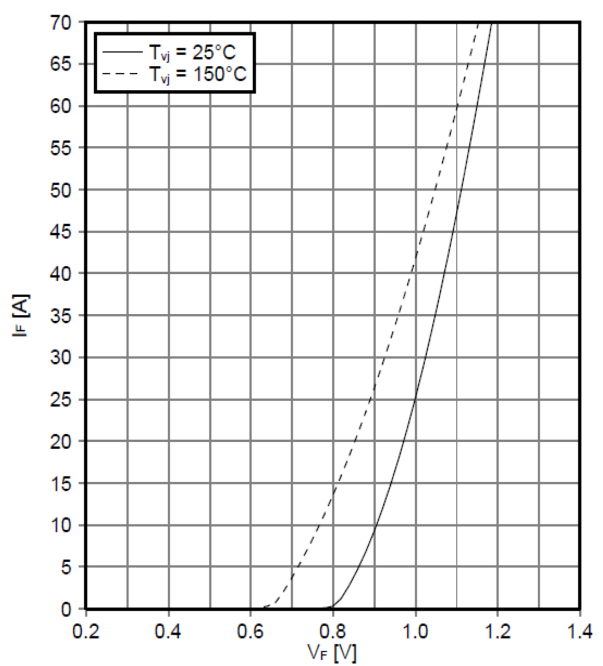
Switching losses Diode, Inverter(typical)
E_{rec}=f(R_G), I_F=35A, V_{CE}=600V



Transient thermal impedance Diode, Inverter
Z_{thJC}=f(t)

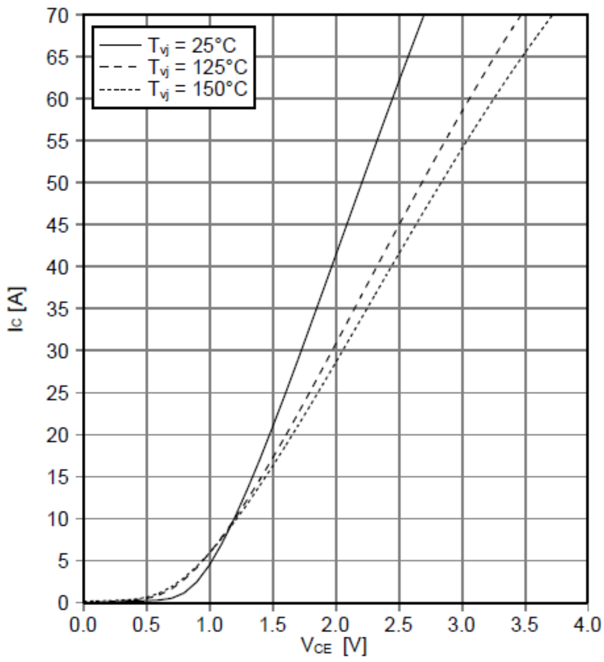


Forward characteristic of Diode, Rectifier(typical)
I_F=f(V_F)



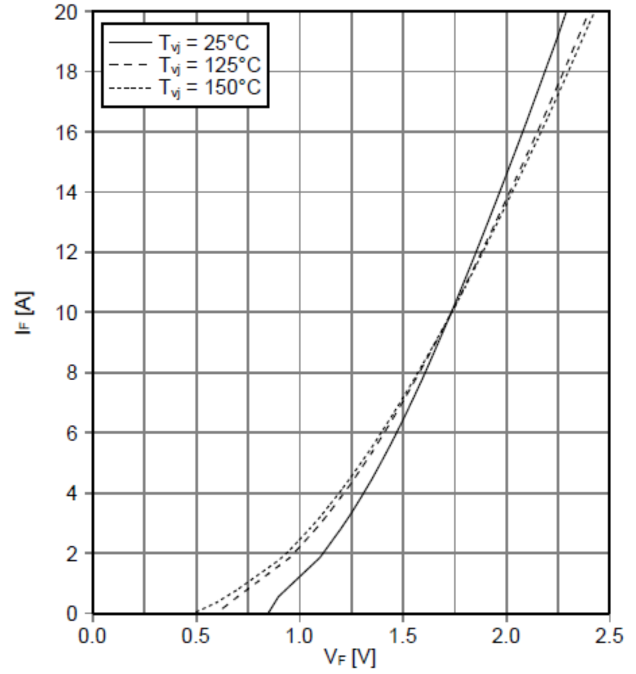
Output characteristic IGBT,Brake-Chopper(typical)

$I_C=f(V_{CE})$, $V_{GE}=15V$



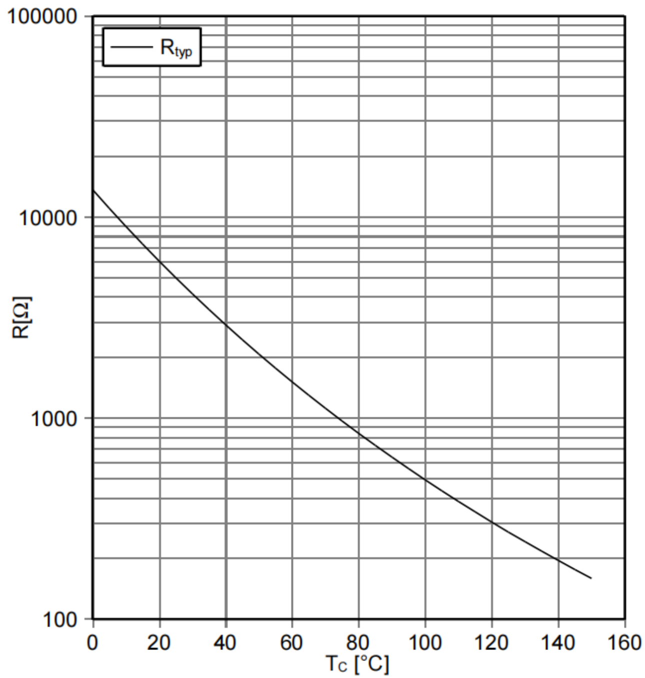
Forward characteristic of Diode, Brake-Chopper(typical)

$I_F=f(V_F)$

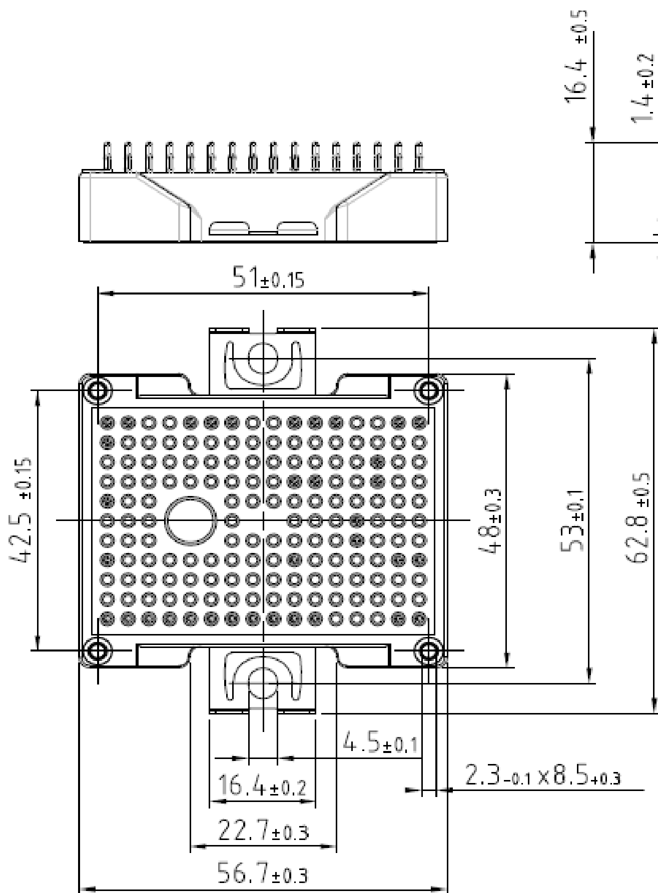


NTC-Thermistor-temperature characteristic(typical)

R=f(T)



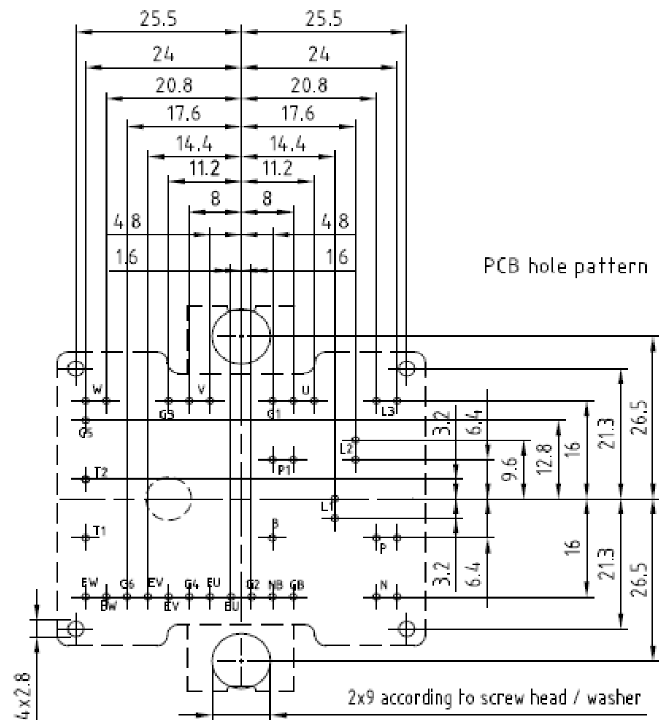
A9 PACKAGE OUTLINES



- Pin-Grid 3.2mm
- Tolerance of PCB hole pattern Ø0.1
- Hole specification for contacts see AN 2009-01:

Diameters of drill Ø 1.15mm

and copper thickness in hole 25-50µm



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Date of change	Rev #	revise content
2023/02/09	A/0	/