STARPOWER

SEMICONDUCTOR **IGBT**

GD100PIA120C5SNF

1200V/100A PIM in one-package

General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as general inverters and UPS.

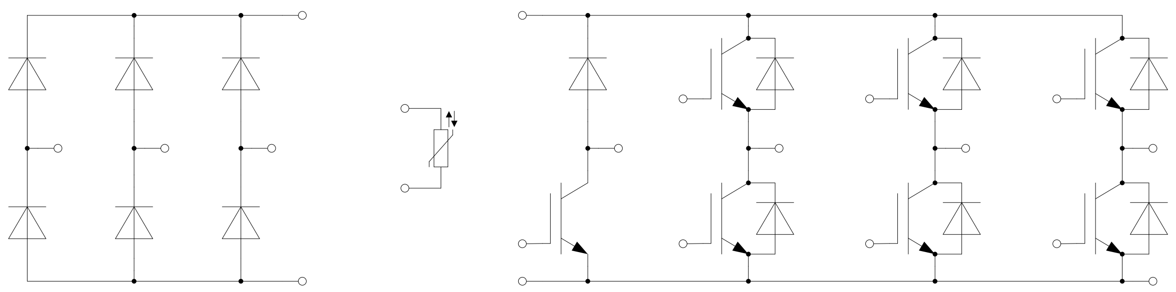
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 8μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology
- PressFIT contact technology

Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

IGBT-inverter

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=100°C	100	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	200	A

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	100	A
I_{FRM}	Repetitive Peak Forward Current tp limited by $T_{vj op}$	200	A
I_{FSM}	Surge Forward Current t_p=10ms @ T_{vj}=125°C @ T_{vj}=150°C	446 408	A
I^2t	I^2t-value,t_p=10ms @ T_{vj}=125°C @ T_{vj}=150°C	994 832	A^2s

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_{FRMSM}	Maximum RMS Forward Current per Chip @ T_C=100°C	100	A
I_{RMSM}	Maximum RMS Current at Rectifier Output @ T_C=100°C	100	A
I_{FSM}	Surge Forward Current t_p=10ms @ T_{vj}=25°C @ T_{vj}=150°C	683 538	A
I^2t	I^2t-value,t_p=10ms @ T_{vj}=25°C @ T_{vj}=150°C	2332 1447	A^2s

IGBT-brake

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=100°C	50	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	100	A

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	35	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	70	A
I_{FSM}	Surge Forward Current t_p=10ms @ T_{vj}=125°C @ T_{vj}=150°C	161 152	A
I^2t	I^2t-value,t_p=10ms @ T_{vj}=125°C @ T_{vj}=150°C	129 115	A^2s

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature(inverter,brake) Maximum Junction Temperature (rectifier)	175 150	^{o}C
T_{vjop}	Operating Junction Temperature(inverter,brake) Operating Junction Temperature(rectifier)	-40 to +175 -40 to +150	^{o}C
T_{STG}	Storage Temperature Range	-40 to +125	^{o}C
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V

Note: T_{vjop} > 150^{o}C is allowed for operation at overload conditions.

IGBT-inverter Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=100A,V_{GE}=15V, T_{vj}=25°C		1.50	1.95	V
		I_C=100A,V_{GE}=15V, T_{vj}=125°C		1.70		
		I_C=100A,V_{GE}=15V, T_{vj}=150°C		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.00mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.4	6.2	7.0	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_{vj}=25°C			50	uA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_{vj}=25°C			100	nA
R_{Gint}	Internal Gate Resistance			0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		8.84		nF
C_{res}	Reverse Transfer Capacitance			0.08		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.64		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=100A, R_G=3.9Ω,L_S=35nH, V_{GE}= ±15V,T_{vj}=25°C		60		ns
t_r	Rise Time			32		ns
$t_{d(off)}$	Turn-Off Delay Time			266		ns
t_f	Fall Time			169		ns
E_{on}	Turn-On Switching Loss			5.68		mJ
E_{off}	Turn-Off Switching Loss			7.78		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=100A, R_G=3.9Ω,L_S=35nH, V_{GE}= ±15V,T_{vj}=125°C		65		ns
t_r	Rise Time			34		ns
$t_{d(off)}$	Turn-Off Delay Time			322		ns
t_f	Fall Time			273		ns
E_{on}	Turn-On Switching Loss			7.67		mJ
E_{off}	Turn-Off Switching Loss			10.9		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=100A, R_G=3.9Ω,L_S=35nH, V_{GE}= ±15V,T_{vj}=150°C		66		ns
t_r	Rise Time			36		ns
$t_{d(off)}$	Turn-Off Delay Time			334		ns
t_f	Fall Time			301		ns
E_{on}	Turn-On Switching Loss			8.24		mJ
E_{off}	Turn-Off Switching Loss			11.5		mJ
I_{SC}	SC Data	t_P≤8μs,V_{GE}=15V, T_{vj}=150°C,V_{CC}=600V, V_{CEM}≤1200V		300		A

Diode-inverter Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=100A,V_{GE}=0V,T_{vj}=25°C		1.60	2.05	V
		I_F=100A,V_{GE}=0V,T_{vj}=125°C		1.65		
		I_F=100A,V_{GE}=0V,T_{vj}=150°C		1.65		
Q_r	Recovered Charge	V_R=600V,I_F=100A, -di/dt=2928A/μs,L_S=35nH, V_{GE}=-15V,T_{vj}=25°C		9.22		μC
I_{RM}	Peak Reverse Recovery Current			111		A
E_{rec}	Reverse Recovery Energy			3.39		mJ
Q_r	Recovered Charge	V_R=600V,I_F=100A, -di/dt=2650A/μs,L_S=35nH, V_{GE}=-15V,T_{vj}=125°C		15.1		μC
I_{RM}	Peak Reverse Recovery Current			118		A
E_{rec}	Reverse Recovery Energy			5.93		mJ
Q_r	Recovered Charge	V_R=600V,I_F=100A, -di/dt=2555A/μs,L_S=35nH, V_{GE}=-15V,T_{vj}=150°C		17.5		μC
I_{RM}	Peak Reverse Recovery Current			121		A
E_{rec}	Reverse Recovery Energy			6.90		mJ

Diode-rectifier Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=100A,V_{GE}=0V,T_{vj}=150°C		1.15		V
I_R	Reverse Current	T_{vj}=150°C,V_R=1600V			2.0	mA

IGBT-brake Characteristics T_C=25^{o}C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=50A,V_{GE}=15V, T_{vj}=25^{o}C		1.50	1.95	V
		I_C=50A,V_{GE}=15V, T_{vj}=125^{o}C		1.70		
		I_C=50A,V_{GE}=15V, T_{vj}=150^{o}C		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.00mA,V_{CE}=V_{GE}, T_{vj}=25^{o}C	5.3	6.2	7.0	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_{vj}=25^{o}C			50	uA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_{vj}=25^{o}C			100	nA
R_{Gint}	Internal Gate Resistance			0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		4.42		nF
C_{res}	Reverse Transfer Capacitance			0.04		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.32		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_G=18Ω,L_S=35nH, V_{GE}= ±15V,T_{vj}=25^{o}C		68		ns
t_r	Rise Time			39		ns
$t_{d(off)}$	Turn-Off Delay Time			303		ns
t_f	Fall Time			165		ns
E_{on}	Turn-On Switching Loss			4.77		mJ
E_{off}	Turn-Off Switching Loss			3.64		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_G=18Ω,L_S=35nH, V_{GE}= ±15V,T_{vj}=125^{o}C		69		ns
t_r	Rise Time			42		ns
$t_{d(off)}$	Turn-Off Delay Time			370		ns
t_f	Fall Time			268		ns
E_{on}	Turn-On Switching Loss			6.06		mJ
E_{off}	Turn-Off Switching Loss			5.35		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=50A, R_G=18Ω,L_S=35nH, V_{GE}= ±15V,T_{vj}=150^{o}C		70		ns
t_r	Rise Time			44		ns
$t_{d(off)}$	Turn-Off Delay Time			380		ns
t_f	Fall Time			291		ns
E_{on}	Turn-On Switching Loss			6.45		mJ
E_{off}	Turn-Off Switching Loss			5.65		mJ
I_{SC}	SC Data	t_P≤8μs,V_{GE}=15V, T_{vj}=150^{o}C,V_{CC}=600V, V_{CEM}≤1200V		150		A

Diode-brake Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=35A,V_{GE}=0V,T_{vj}=25°C		1.60	2.05	V
		I_F=35A,V_{GE}=0V,T_{vj}=125°C		1.65		
		I_F=35A,V_{GE}=0V,T_{vj}=150°C		1.65		

NTC Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100 °C,R_{100}=493.3Ω	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}exp[B_{25/80}(1/T_2-1/(298.15K))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}exp[B_{25/100}(1/T_2-1/(298.15K))]$		3433		K

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		35		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance,Terminal to Chip		4.00 3.00		mΩ
R_{thJC}	Junction-to-Case (per IGBT-inverter) Junction-to-Case (per Diode-inverter) Junction-to-Case (per Diode-rectifier) Junction-to-Case (per IGBT-brake) Junction-to-Case (per Diode-brake)			0.304 0.537 0.640 0.484 0.986	K/W
R_{thCH}	Case-to-Sink (per IGBT-inverter) Case-to-Sink (per Diode-inverter) Case-to-Sink (per Diode-rectifier) Case-to-Sink (per IGBT-brake) Case-to-Sink (per Diode-brake)		0.148 0.158 0.146 0.153 0.161		K/W
M	Mounting Torque, Screw:M5	3.0		6.0	N.m
G	Weight of Module		200		g

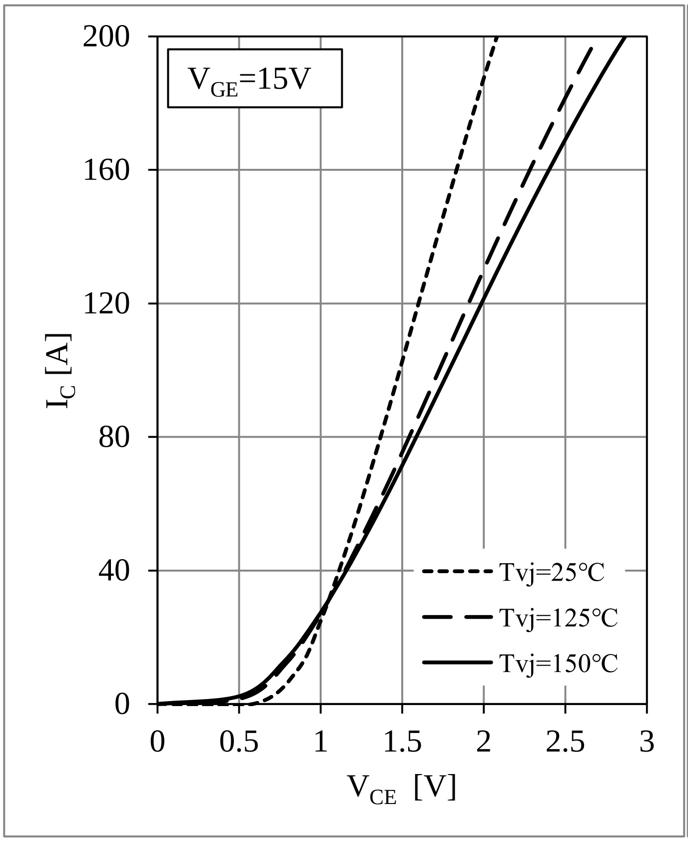


Fig 1. IGBT-inverter Output Characteristics

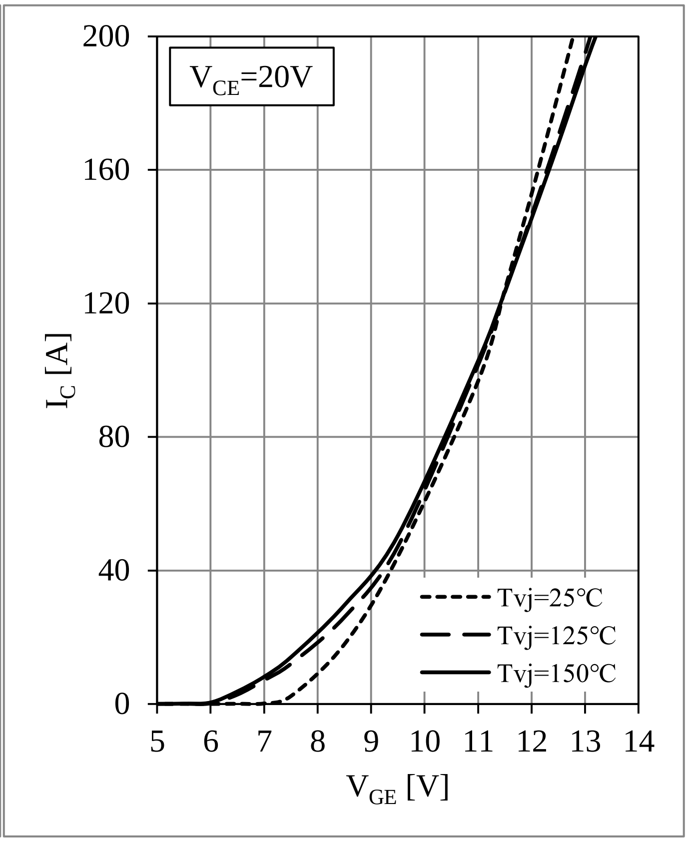


Fig 2. IGBT-inverter Transfer Characteristics

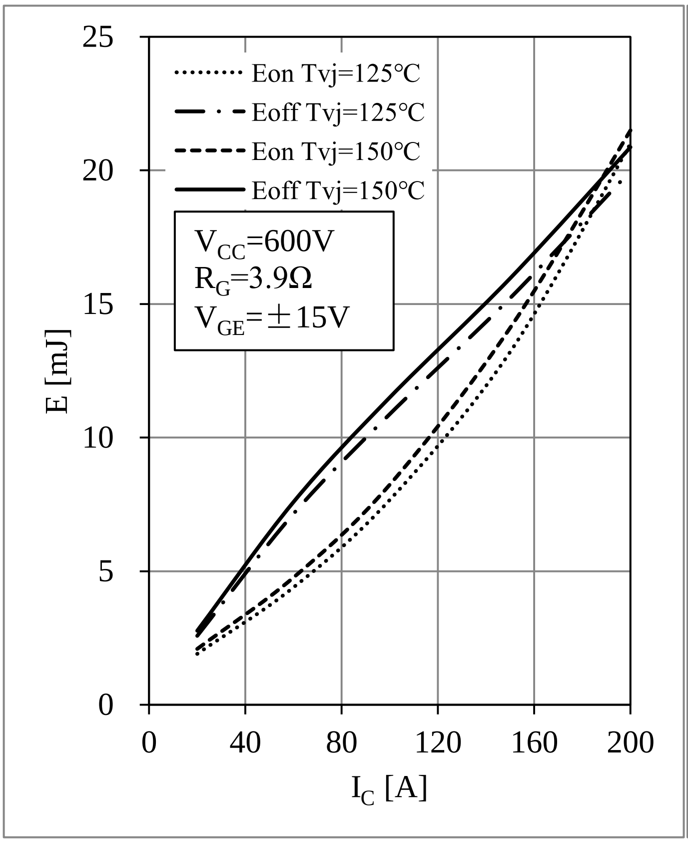


Fig 3. IGBT-inverter Switching Loss vs. I_C

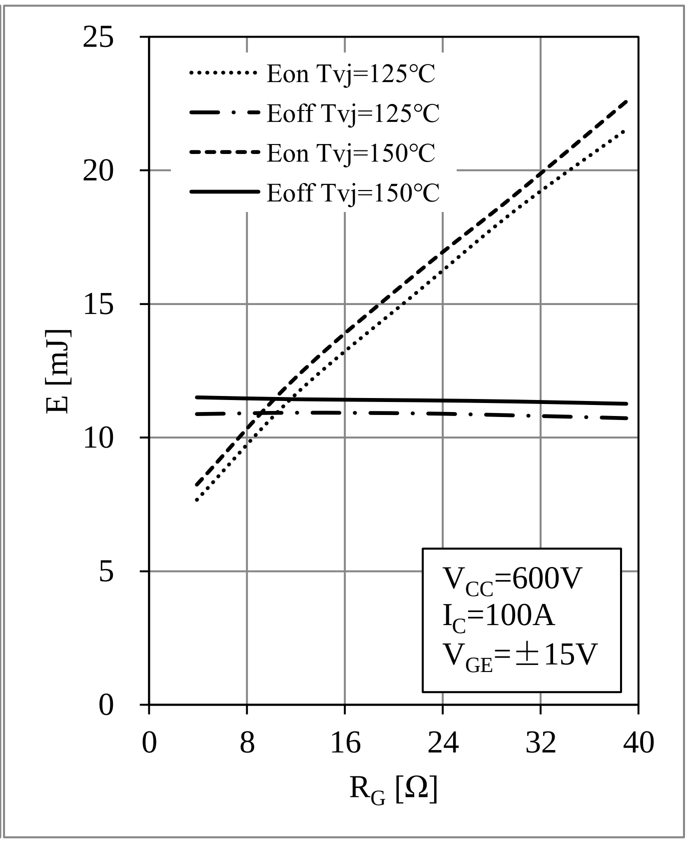


Fig 4. IGBT-inverter Switching Loss vs. R_G

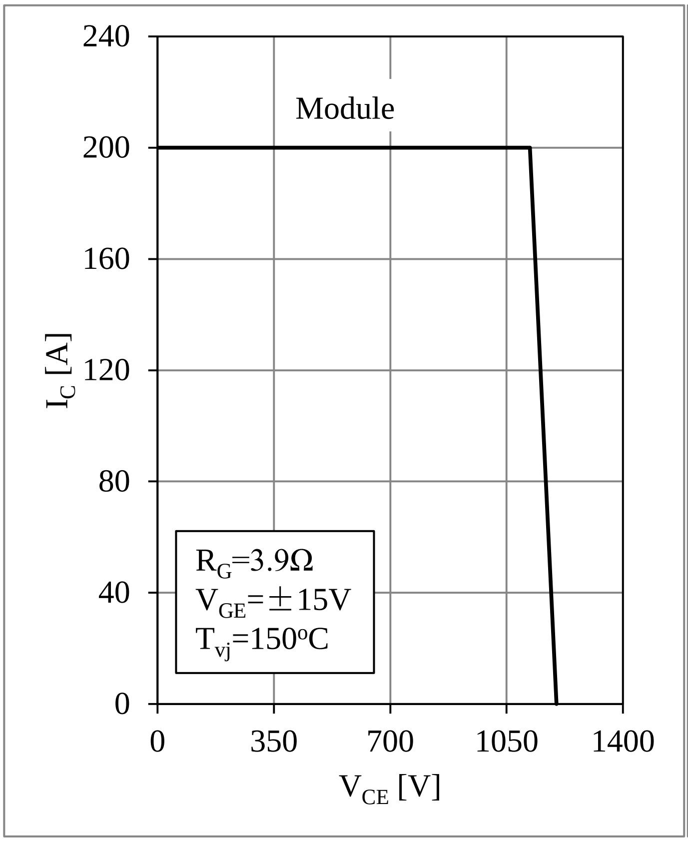


Fig 5. IGBT-inverter RBSOA

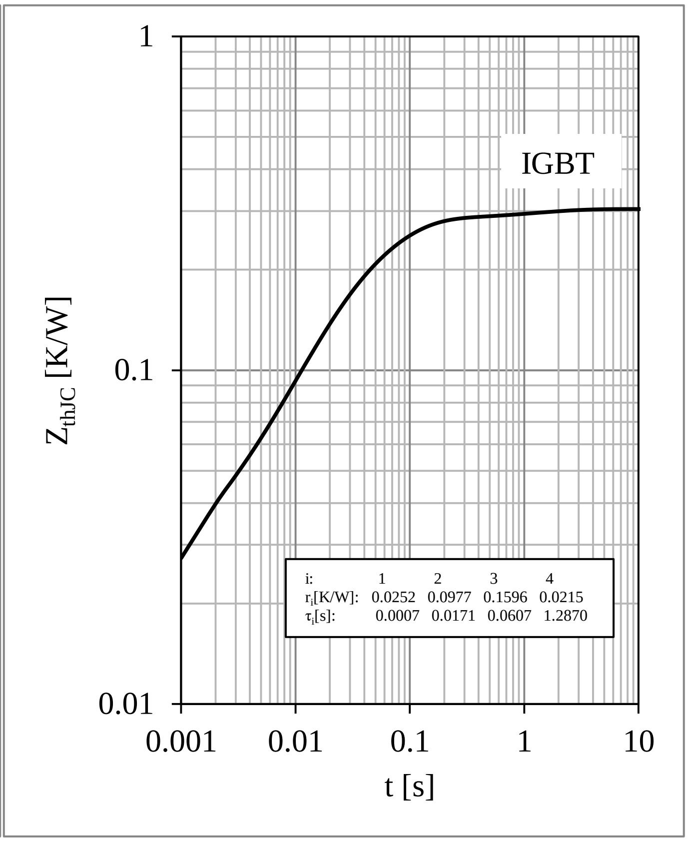


Fig 6. IGBT-inverter Transient Thermal Impedance

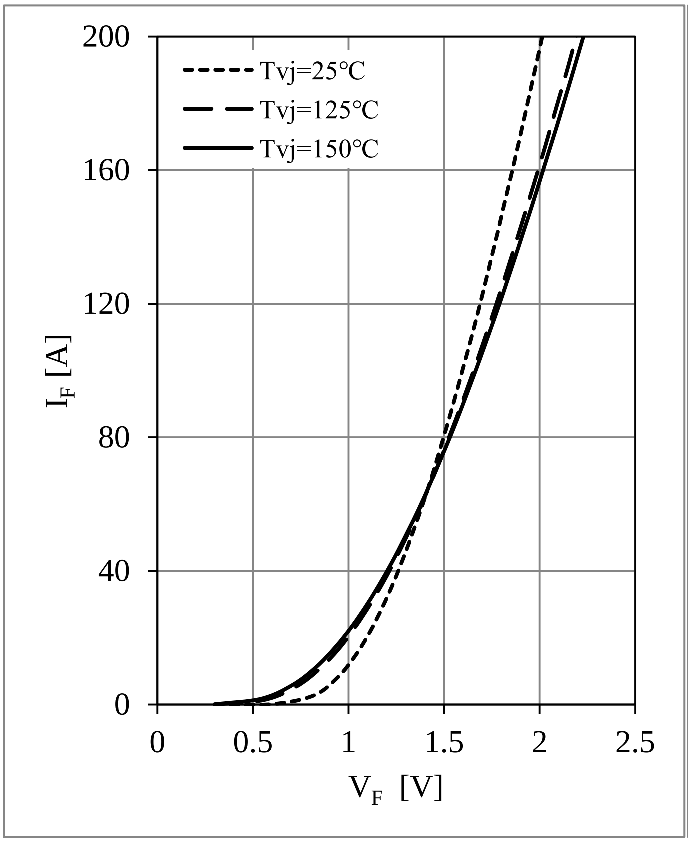


Fig 7. Diode-inverter Forward Characteristics

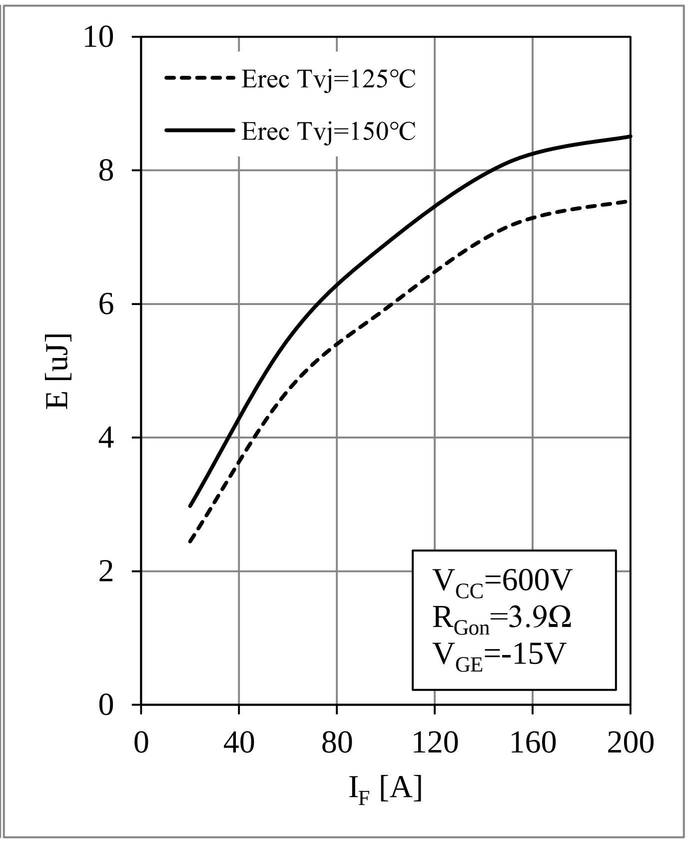


Fig 8. Diode-inverter Switching Loss vs. I_F

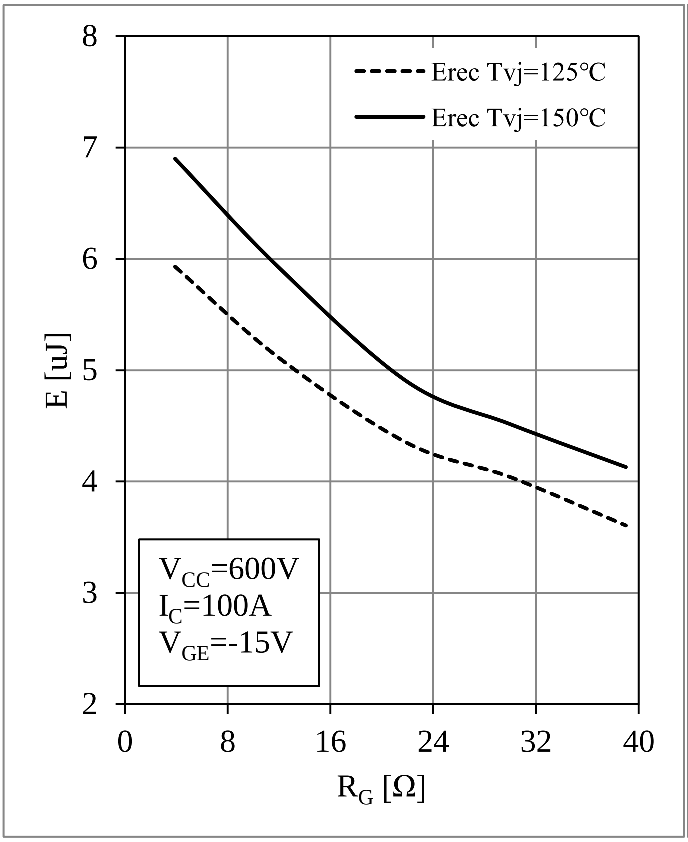


Fig 9. Diode-inverter Switching Loss vs. R_G

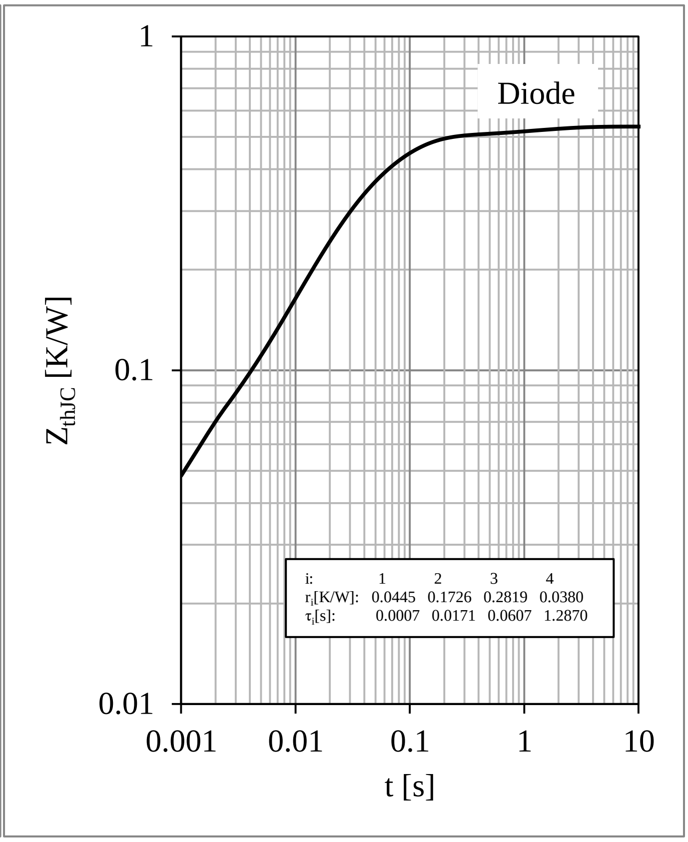


Fig 10. Diode-inverter Transient Thermal Impedance

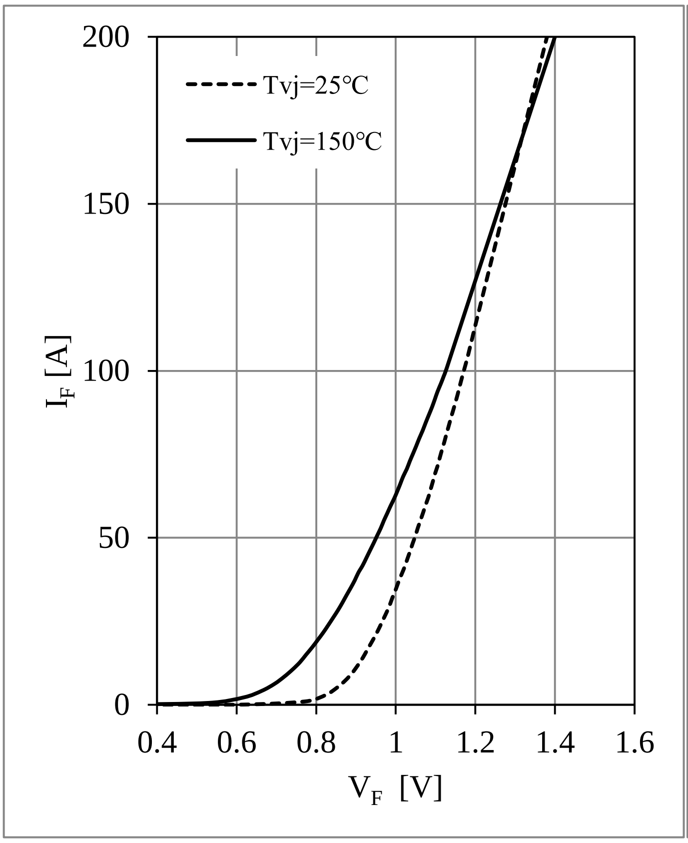


Fig 11. Diode-rectifier Forward Characteristics

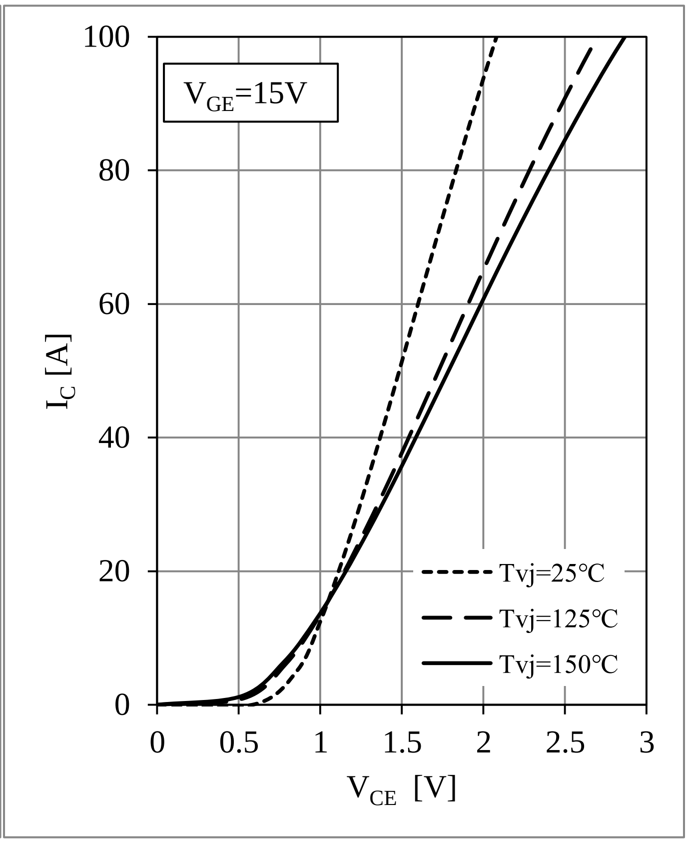


Fig 12. IGBT-brake-chopper Output Characteristics

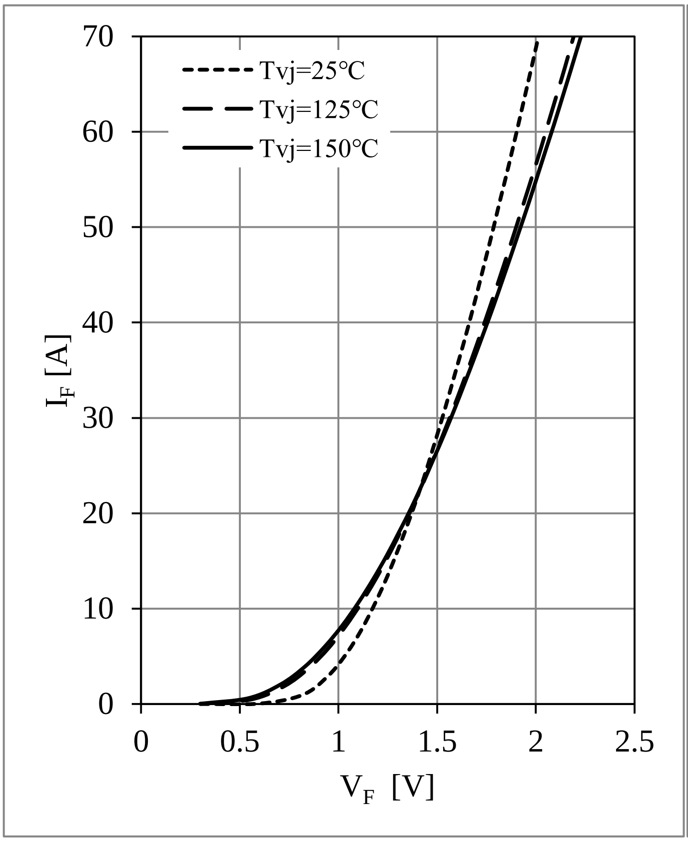


Fig 13. Diode-brake-chopper Forward Characteristics

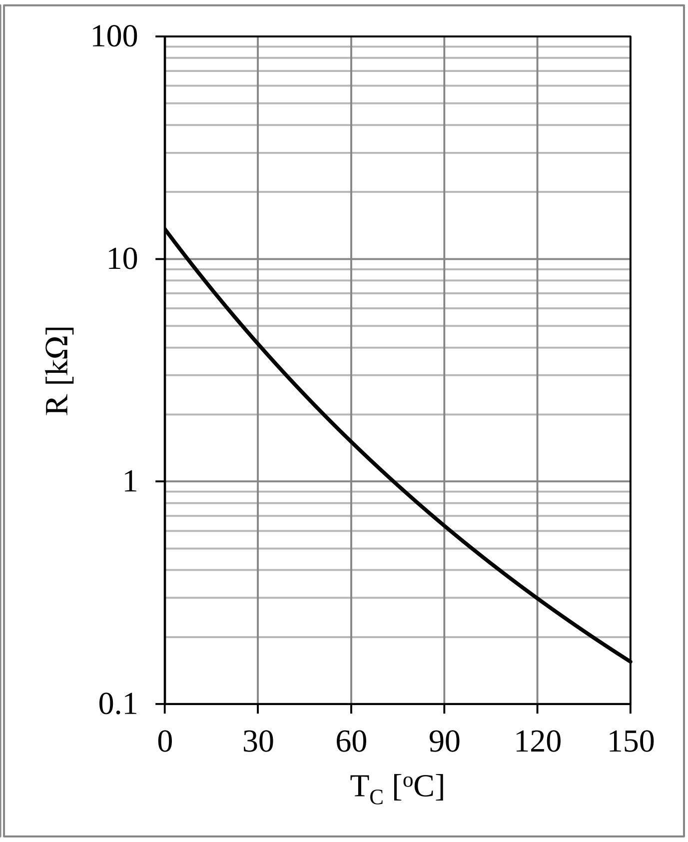
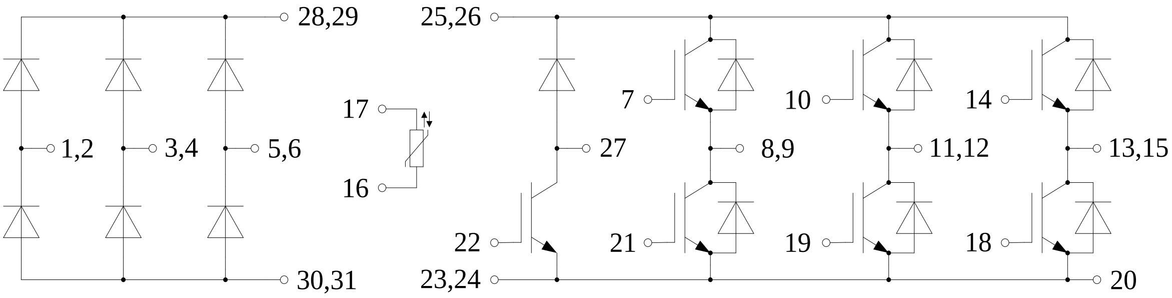


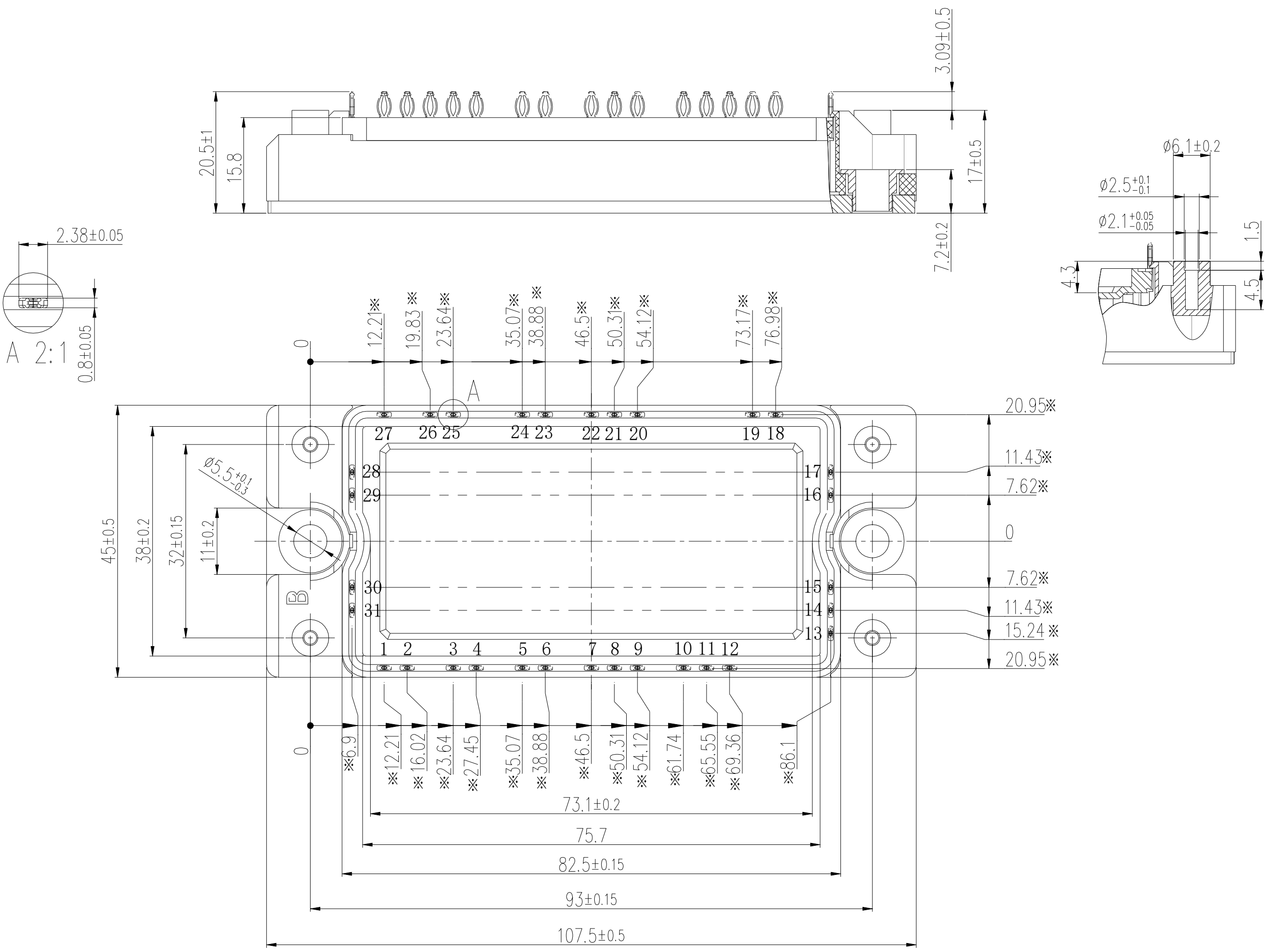
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



※all dimensions with a tolerance of ⊕φ0.4

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