STARPOWER

SEMICONDUCTOR **IGBT**

GD100PIY120C6SNF

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.

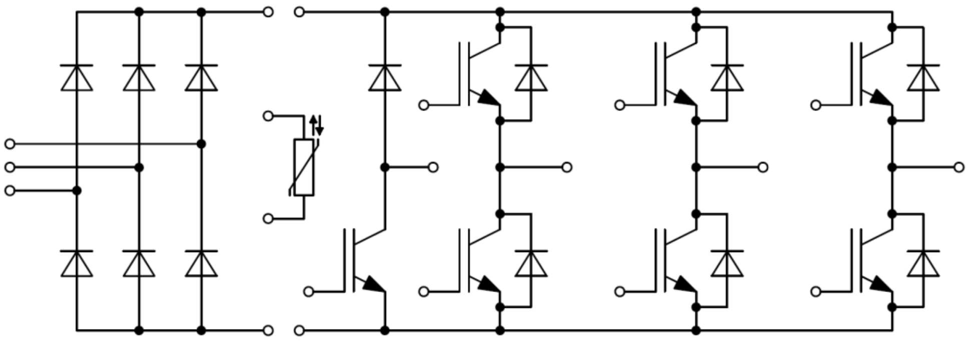
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10μs 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=25°C @ T_C=100°C	155 100	A
I_{CM}	Pulsed Collector Current t_p=1ms	200	A
P_D	Maximum Power Dissipation @ T_j=175°C	511	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	100	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	200	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	100	A
I_{FSM}	Surge Forward Current t_p=10ms @ T_j=25°C @ T_j=150°C	1150 880	A
I^2t	I^2t-value,t_p=10ms @ T_j=25°C @ T_j=150°C	6600 3850	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=25°C @ T_C=100°C	125 75	A
I_{CM}	Pulsed Collector Current t_p=1ms	150	A
P_D	Maximum Power Dissipation @ T_j=175°C	432	W

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	35	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	70	A

Module

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

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_j=25°C		1.70	2.15	V
		I_C=100A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=100A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=2.50mA,V_{CE}=V_{GE}, T_j=25°C	5.2	6.0	6.8	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			100	nA
R_{Gint}	Internal Gate Resistance			7.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		10.35		nF
C_{res}	Reverse Transfer Capacitance			0.29		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.78		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=100A, R_G=1.6Ω,V_{GE}=±15V, T_j=25°C		170		ns
t_r	Rise Time			32		ns
$t_{d(off)}$	Turn-Off Delay Time			360		ns
t_f	Fall Time			86		ns
E_{on}	Turn-On Switching Loss			5.90		mJ
E_{off}	Turn-Off Switching Loss			6.05		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=100A, R_G=1.6Ω,V_{GE}=±15V, T_j=125°C		180		ns
t_r	Rise Time			42		ns
$t_{d(off)}$	Turn-Off Delay Time			470		ns
t_f	Fall Time			165		ns
E_{on}	Turn-On Switching Loss			9.10		mJ
E_{off}	Turn-Off Switching Loss			9.35		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=100A, R_G=1.6Ω,V_{GE}=±15V, T_j=150°C		181		ns
t_r	Rise Time			43		ns
$t_{d(off)}$	Turn-Off Delay Time			480		ns
t_f	Fall Time			186		ns
E_{on}	Turn-On Switching Loss			10.0		mJ
E_{off}	Turn-Off Switching Loss			10.5		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		400		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_j=25°C		1.85	2.30	V
		I_F=100A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=100A,V_{GE}=0V,T_j=150°C		1.95		
Q_r	Recovered Charge	V_R=600V,I_F=100A, -di/dt=3500A/μs,V_{GE}=-15V T_j=25°C		11.0		μC
I_{RM}	Peak Reverse Recovery Current			173		A
E_{rec}	Reverse Recovery Energy			4.02		mJ
Q_r	Recovered Charge	V_R=600V,I_F=100A, -di/dt=3500A/μs,V_{GE}=-15V T_j=125°C		19.6		μC
I_{RM}	Peak Reverse Recovery Current			184		A
E_{rec}	Reverse Recovery Energy			6.86		mJ
Q_r	Recovered Charge	V_R=600V,I_F=100A, -di/dt=3500A/μs,V_{GE}=-15V T_j=150°C		21.9		μC
I_{RM}	Peak Reverse Recovery Current			190		A
E_{rec}	Reverse Recovery Energy			7.84		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,T_j=150°C		0.95		V
I_R	Reverse Current	T_j=150°C,V_R=1600V			2.0	mA

IGBT-brake 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=75A,V_{GE}=15V, T_j=25°C		1.70	2.15	V
		I_C=75A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=75A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.88mA,V_{CE}=V_{GE}, T_j=25°C	5.2	6.0	6.8	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			100	nA
R_{Gint}	Internal Gate Resistance			5.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		7.76		nF
C_{res}	Reverse Transfer Capacitance			0.22		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.58		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=75A, R_G=2.2Ω,V_{GE}=±15V, T_j=25°C		170		ns
t_r	Rise Time			32		ns
$t_{d(off)}$	Turn-Off Delay Time			360		ns
t_f	Fall Time			86		ns
E_{on}	Turn-On Switching Loss			3.64		mJ
E_{off}	Turn-Off Switching Loss			4.60		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=75A, R_G=2.2Ω,V_{GE}=±15V, T_j=125°C		180		ns
t_r	Rise Time			42		ns
$t_{d(off)}$	Turn-Off Delay Time			470		ns
t_f	Fall Time			165		ns
E_{on}	Turn-On Switching Loss			7.80		mJ
E_{off}	Turn-Off Switching Loss			7.00		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=75A, R_G=2.2Ω,V_{GE}=±15V, T_j=150°C		181		ns
t_r	Rise Time			43		ns
$t_{d(off)}$	Turn-Off Delay Time			480		ns
t_f	Fall Time			186		ns
E_{on}	Turn-On Switching Loss			9.10		mJ
E_{off}	Turn-Off Switching Loss			7.90		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		300		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_j=25°C		1.85	2.30	V
		I_F=35A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=35A,V_{GE}=0V,T_j=150°C		1.95		
Q_r	Recovered Charge	V_R=600V,I_F=35A, -di/dt=2500A/μs,V_{GE}=-15V T_j=25°C		4.5		μC
I_{RM}	Peak Reverse Recovery Current			93		A
E_{rec}	Reverse Recovery Energy			1.47		mJ
Q_r	Recovered Charge	V_R=600V,I_F=35A, -di/dt=2500A/μs,V_{GE}=-15V T_j=125°C		7.8		μC
I_{RM}	Peak Reverse Recovery Current			98		A
E_{rec}	Reverse Recovery Energy			2.65		mJ
Q_r	Recovered Charge	V_R=600V,I_F=35A, -di/dt=2500A/μs,V_{GE}=-15V T_j=150°C		8.6		μC
I_{RM}	Peak Reverse Recovery Current			101		A
E_{rec}	Reverse Recovery Energy			2.89		mJ

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		40		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-chopper) Junction-to-Case (per Diode-brake-chopper)			0.293 0.505 0.571 0.347 1.068	K/W
R_{thCH}	Case-to-Heatsink (per IGBT-inverter) Case-to-Heatsink (per Diode-inverter) Case-to-Heatsink (per Diode-rectifier) Case-to-Heatsink (per IGBT-brake-chopper) Case-to-Heatsink (per Diode-brake-chopper) Case-to-Heatsink (per Module)		0.123 0.212 0.240 0.146 0.449 0.009		K/W
M	Mounting Torque, Screw:M5	3.0		6.0	N.m
G	Weight of Module		300		g

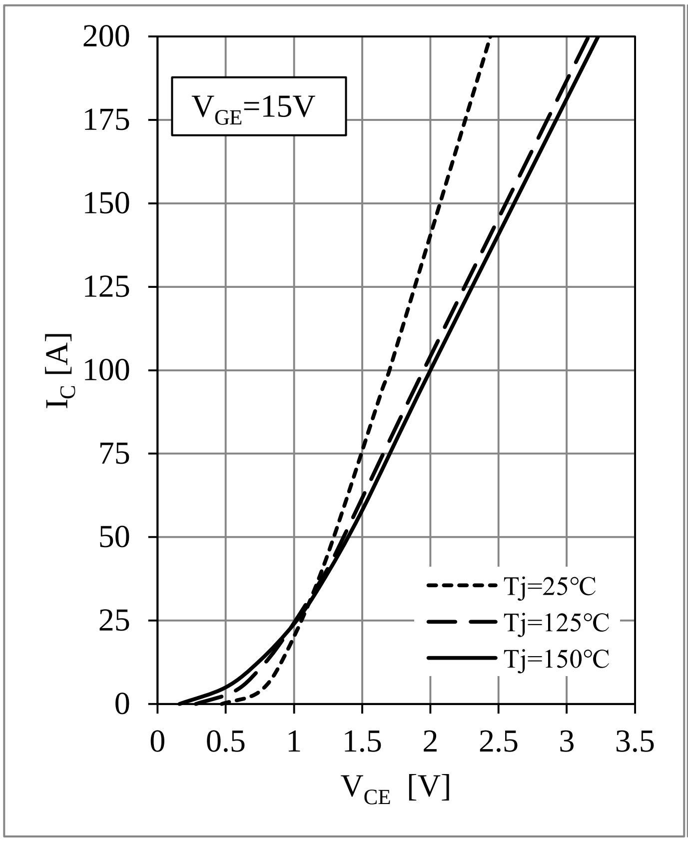


Fig 1. IGBT-inverter Output Characteristics

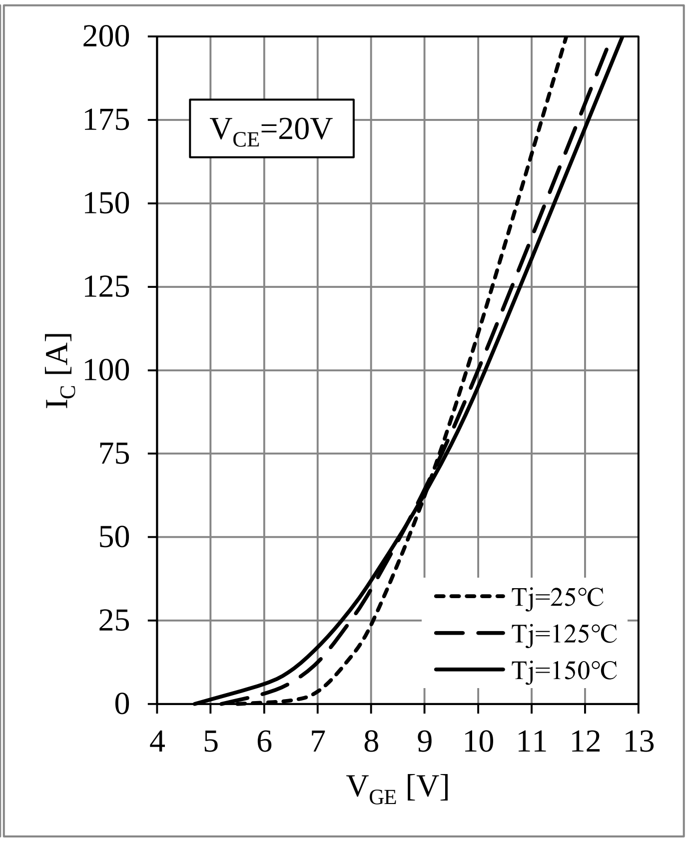


Fig 2. IGBT-inverter Transfer Characteristics

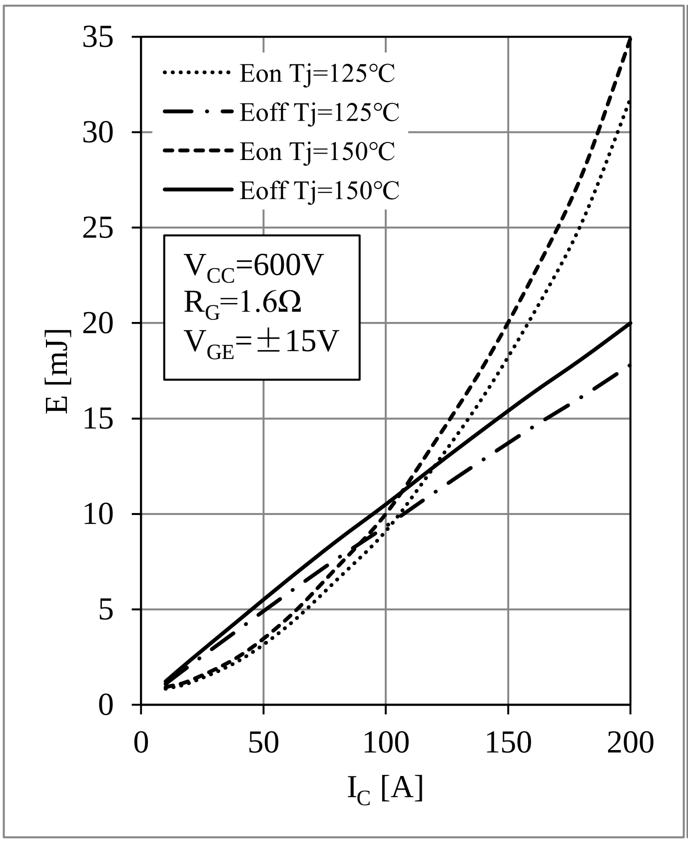


Fig 3. IGBT-inverter Switching Loss vs. I_C

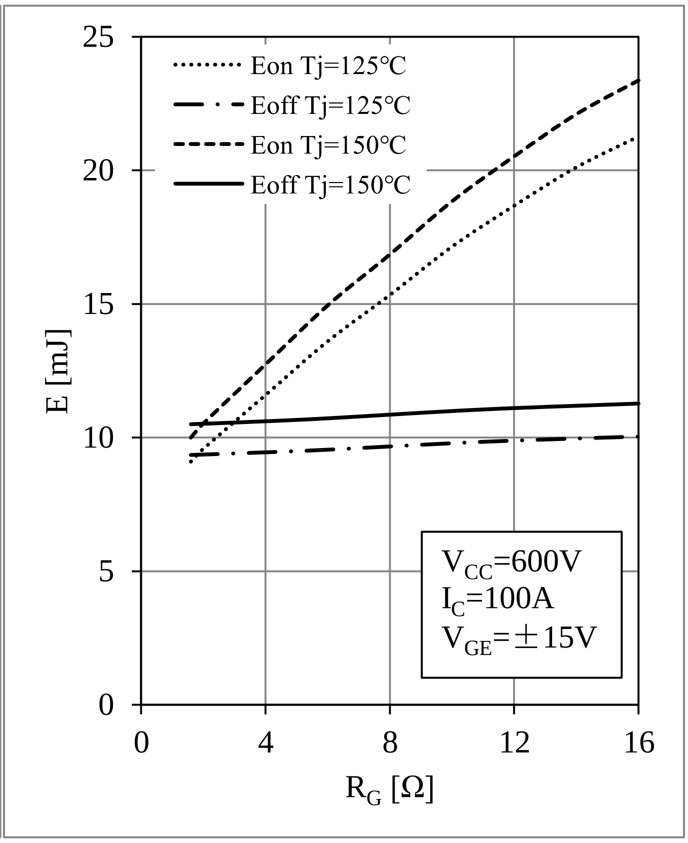


Fig 4. IGBT-inverter Switching Loss vs. R_G

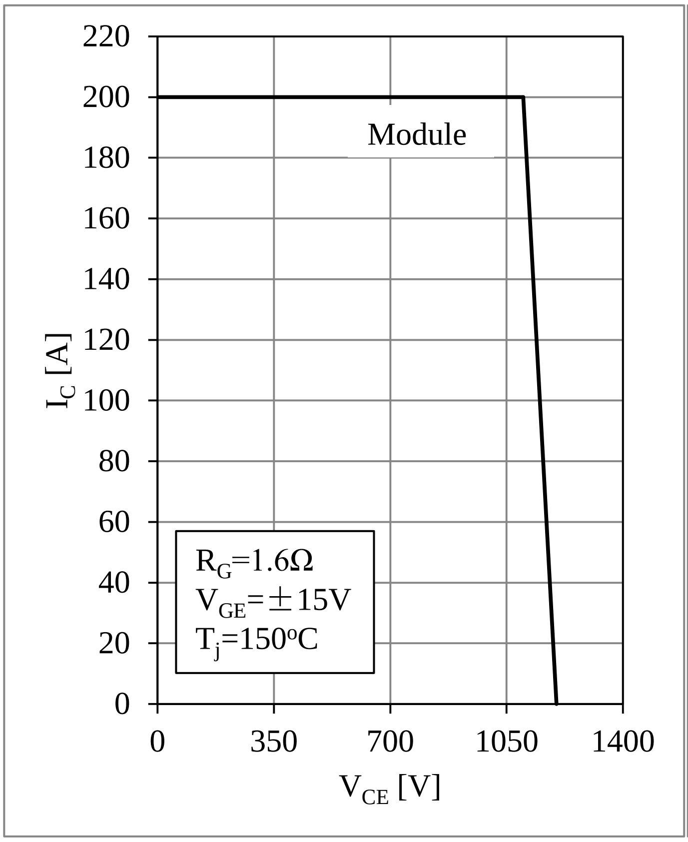


Fig 5. IGBT-inverter RBSOA

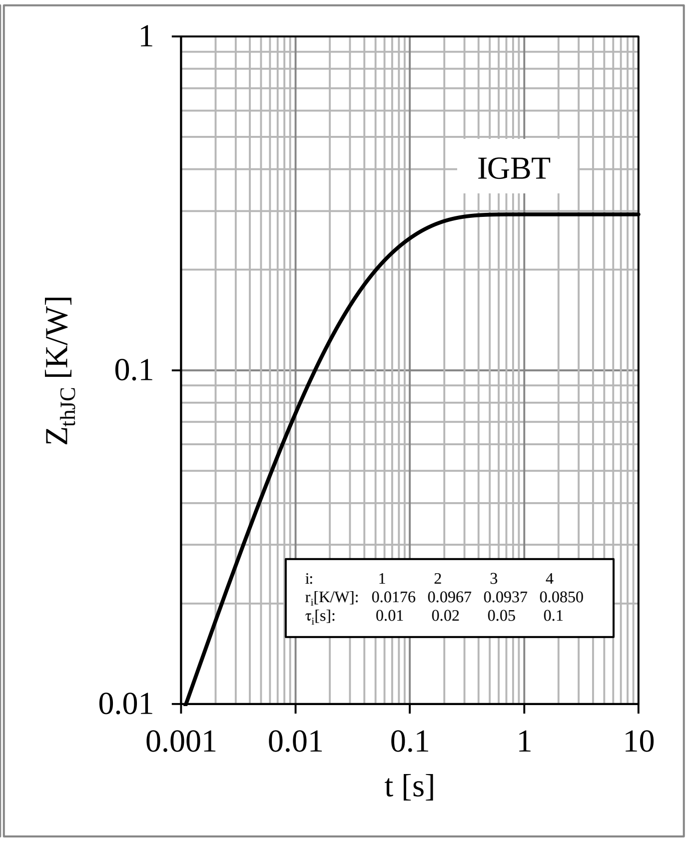


Fig 6. IGBT-inverter Transient Thermal Impedance

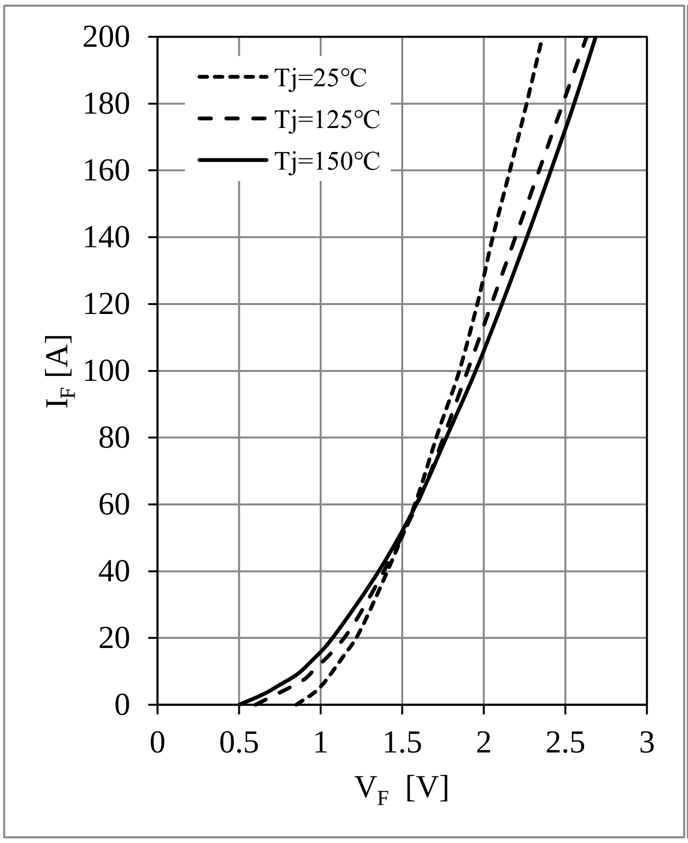


Fig 7. Diode-inverter Forward Characteristics

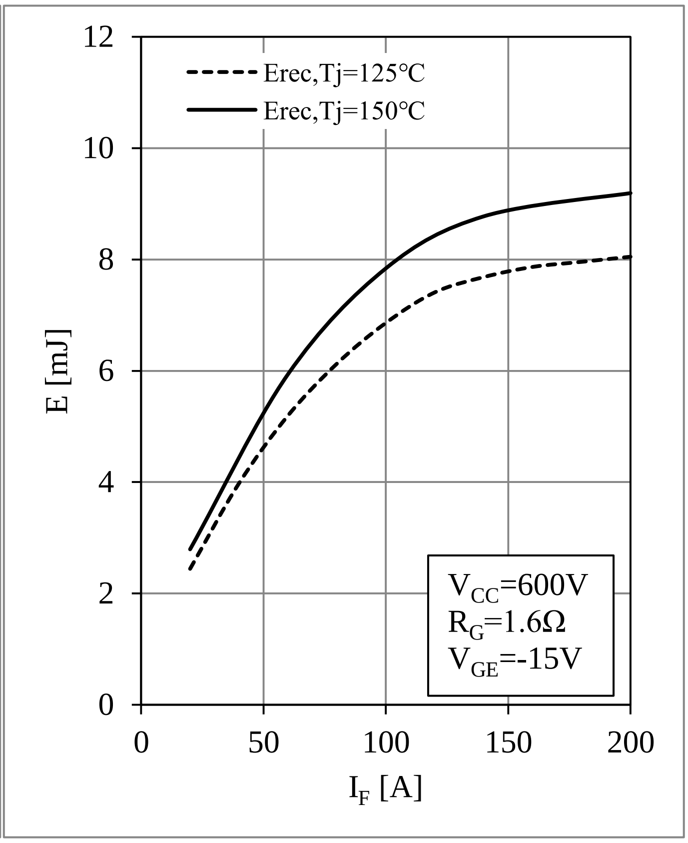


Fig 8. Diode-inverter Switching Loss vs. I_F

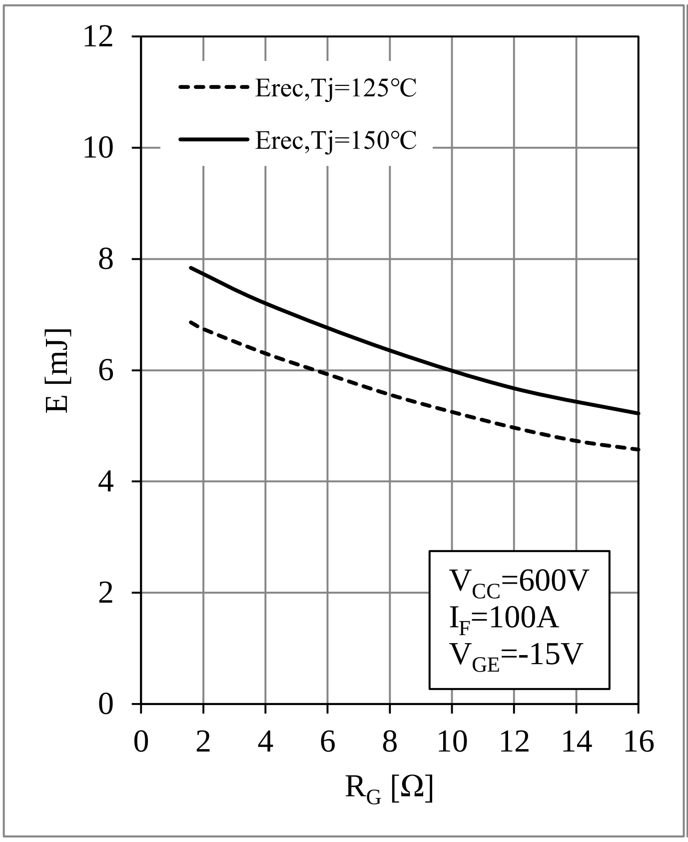


Fig 9. Diode-inverter Switching Loss vs. R_G

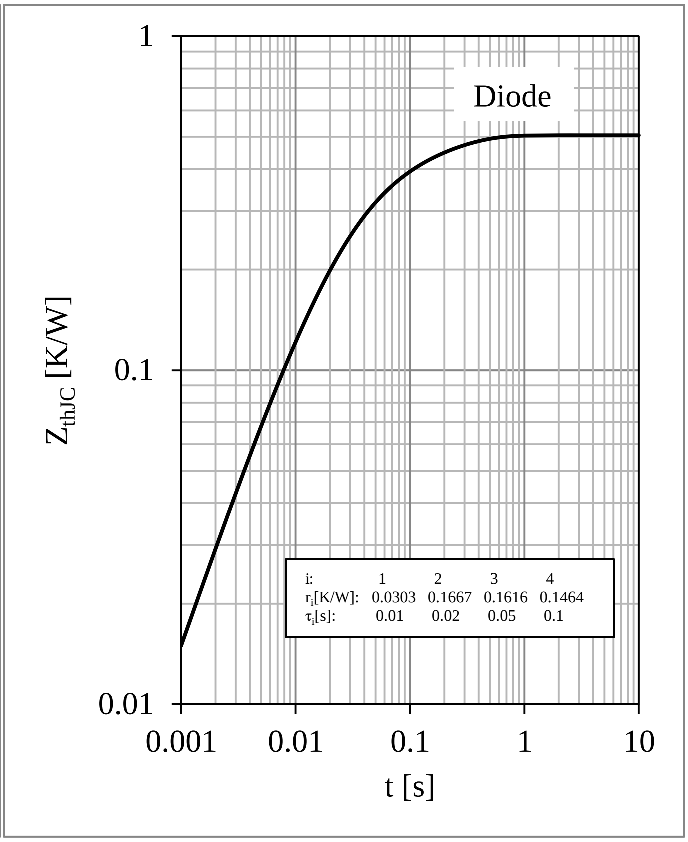


Fig 10. Diode-inverter Transient Thermal Impedance

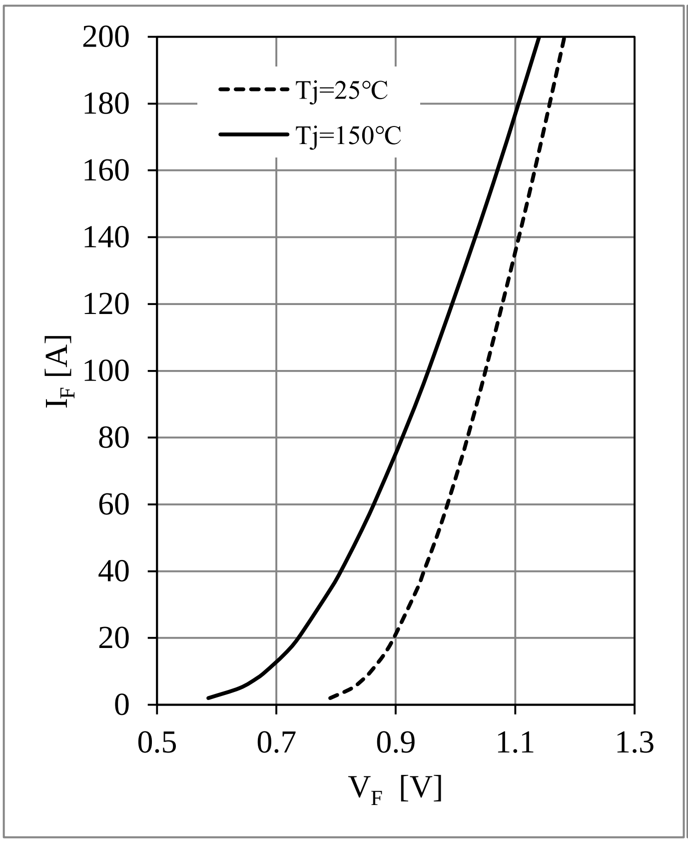


Fig 11. Diode-rectifier Forward Characteristics

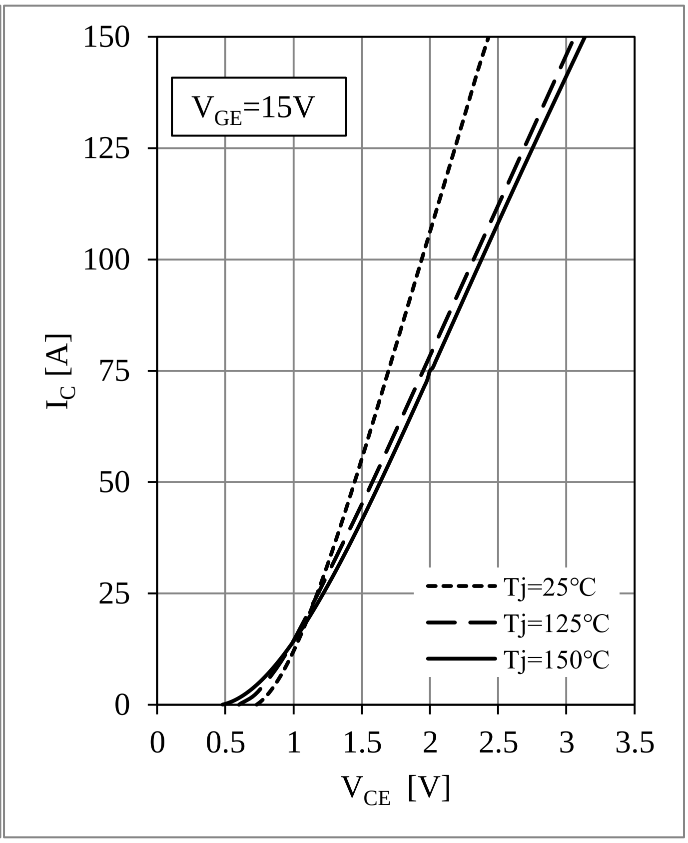


Fig 12. IGBT-brake-chopper Output Characteristics

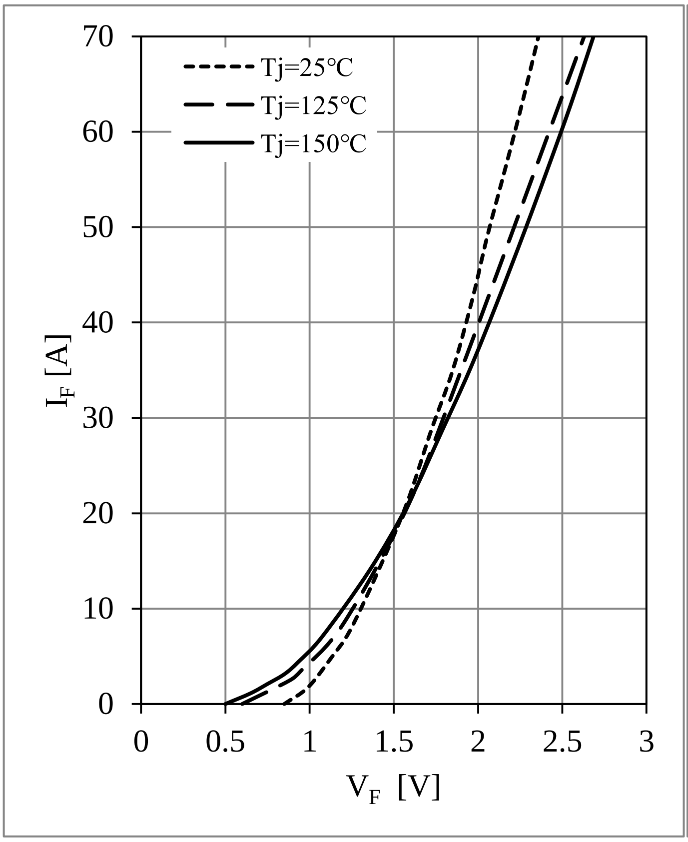


Fig 13. Diode-brake-chopper Forward Characteristics

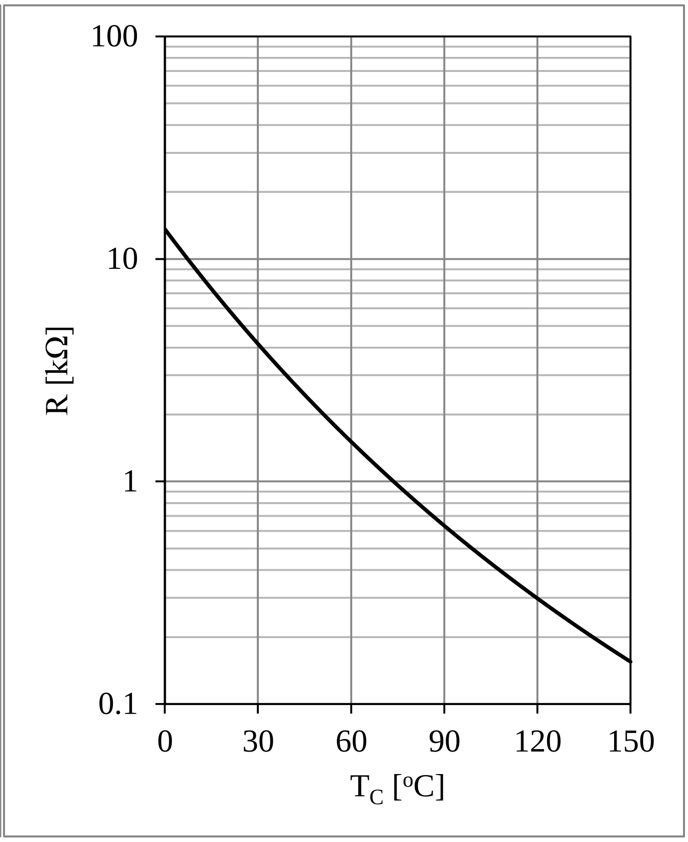
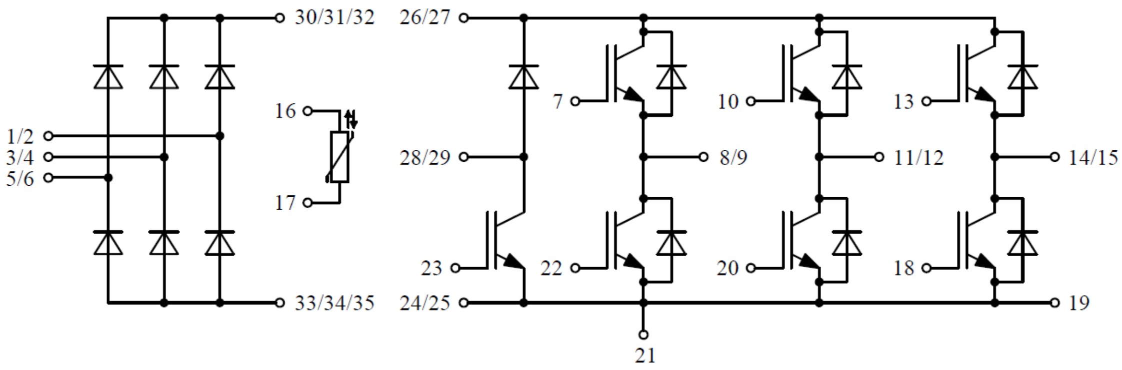


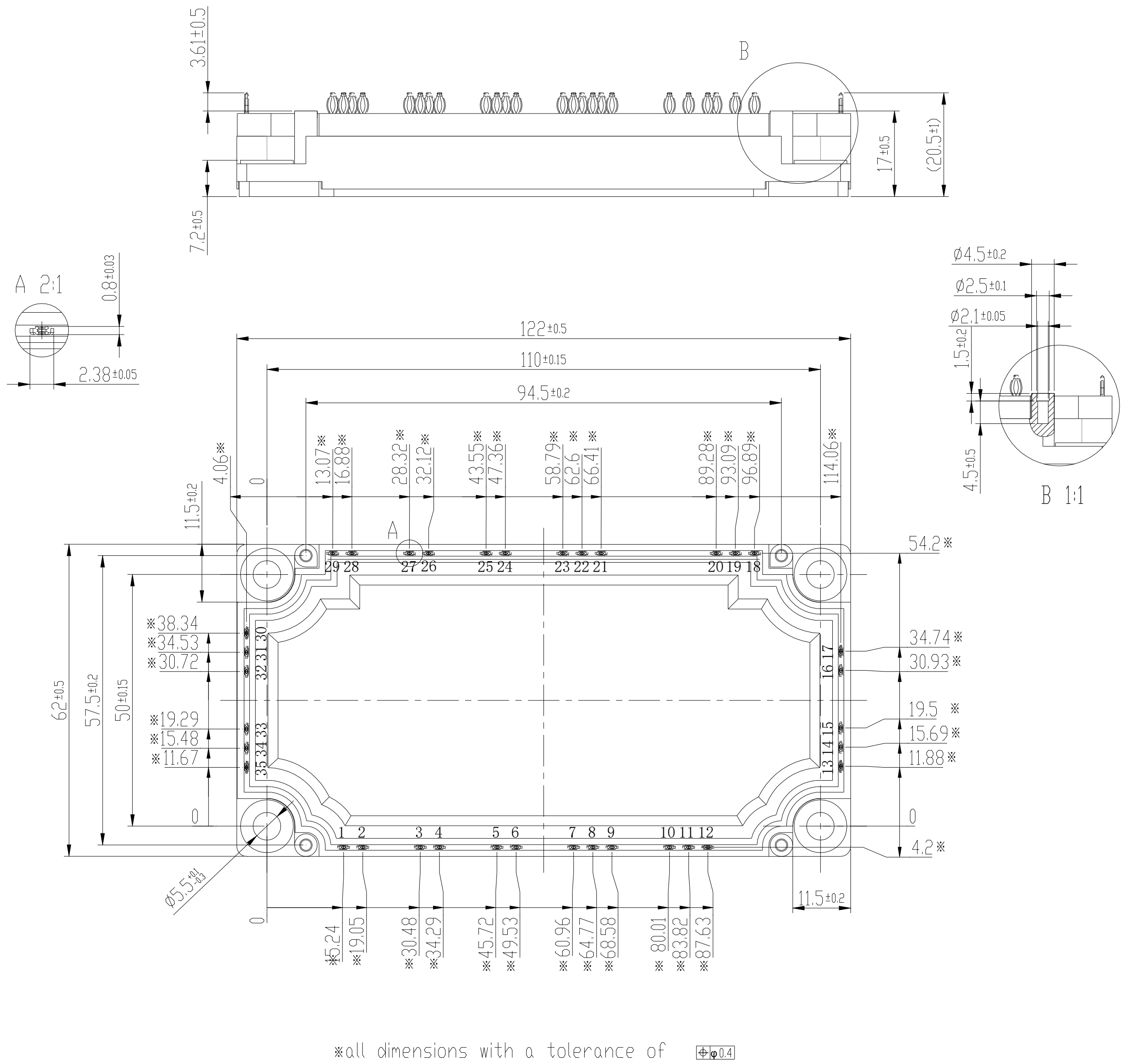
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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