

STARPOWER

SEMICONDUCTOR

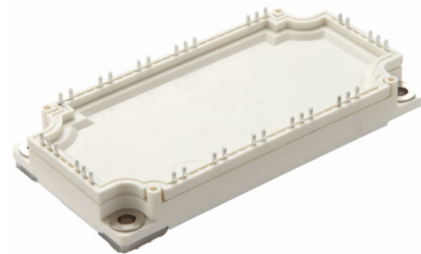
IGBT

GD100PIL120C6SN

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.



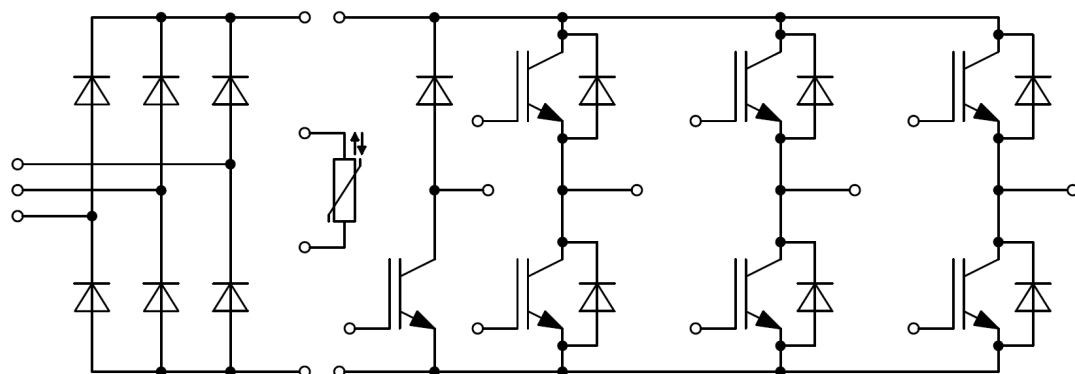
Features

- Low $V_{CE(sat)}$ SPT+ IGBT technology
- 10 μ s 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

Typical Applications

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

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_C=25^{\circ}\text{C}$ 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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	180 100	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	200	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	669	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 $t_p=1\text{ms}$	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 $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	1800	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	16200	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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	100 50	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	100	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	452	W

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	25	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	50	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature(inverter,brake) Maximum Junction Temperature (rectifier)	175 150	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	4000	V

IGBT-inverter Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.90	2.35	V
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.10		
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.20		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=4.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.0	6.5	7.0	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^{\circ}\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			2.0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		7.43		nF
C_{res}	Reverse Transfer Capacitance			0.34		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		1.12		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=100\text{A}, R_G=5.6\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		279		ns
t_r	Rise Time			61		ns
$t_{d(off)}$	Turn-Off Delay Time			308		ns
t_f	Fall Time			205		ns
E_{on}	Turn-On Switching Loss			5.56		mJ
E_{off}	Turn-Off Switching Loss			6.95		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=100\text{A}, R_G=5.6\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		287		ns
t_r	Rise Time			63		ns
$t_{d(off)}$	Turn-Off Delay Time			328		ns
t_f	Fall Time			360		ns
E_{on}	Turn-On Switching Loss			7.85		mJ
E_{off}	Turn-Off Switching Loss			10.6		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=100\text{A}, R_G=5.6\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		295		ns
t_r	Rise Time			65		ns
$t_{d(off)}$	Turn-Off Delay Time			350		ns
t_f	Fall Time			380		ns
E_{on}	Turn-On Switching Loss			8.65		mJ
E_{off}	Turn-Off Switching Loss			12.0		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		470		A

Diode-inverter Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_C=100\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.80	2.25	V
		$I_C=100\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.85		
		$I_C=100\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.85		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=100\text{A},$ $-di/dt=2000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		6.2		μC
I_{RM}	Peak Reverse Recovery Current			92		A
E_{rec}	Reverse Recovery Energy			3.74		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=100\text{A},$ $-di/dt=2000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		11.8		μC
I_{RM}	Peak Reverse Recovery Current			124		A
E_{rec}	Reverse Recovery Energy			6.45		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=100\text{A},$ $-di/dt=2000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		14.2		μC
I_{RM}	Peak Reverse Recovery Current			130		A
E_{rec}	Reverse Recovery Energy			8.05		mJ

Diode-rectifier Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_C=100\text{A}, T_j=150^{\circ}\text{C}$		1.03		V
I_R	Reverse Current	$T_j=150^{\circ}\text{C}, V_R=1600\text{V}$			2.0	mA

IGBT-brake Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=50\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.85	2.30	V
		$I_C=50\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.05		
		$I_C=50\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.10		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=2.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.0	5.9	7.0	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^{\circ}\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			10		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		4.29		nF
C_{res}	Reverse Transfer Capacitance			0.20		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.54		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_G=15\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		392		ns
t_r	Rise Time			74		ns
$t_{d(off)}$	Turn-Off Delay Time			379		ns
t_f	Fall Time			380		ns
E_{on}	Turn-On Switching Loss			6.29		mJ
E_{off}	Turn-Off Switching Loss			3.22		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_G=15\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		403		ns
t_r	Rise Time			75		ns
$t_{d(off)}$	Turn-Off Delay Time			408		ns
t_f	Fall Time			381		ns
E_{on}	Turn-On Switching Loss			7.30		mJ
E_{off}	Turn-Off Switching Loss			5.22		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=50\text{A}, R_G=15\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		410		ns
t_r	Rise Time			76		ns
$t_{d(off)}$	Turn-Off Delay Time			420		ns
t_f	Fall Time			382		ns
E_{on}	Turn-On Switching Loss			7.75		mJ
E_{off}	Turn-Off Switching Loss			5.70		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		270		A

Diode-brake Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_C=25\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.78	2.18	V
		$I_C=25\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.88		
		$I_C=25\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.91		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=25\text{A},$ $-di/dt=425\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		1.1		μC
I_{RM}	Peak Reverse Recovery Current			17		A
E_{rec}	Reverse Recovery Energy			0.80		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=25\text{A},$ $-di/dt=425\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		3.2		μC
I_{RM}	Peak Reverse Recovery Current			21		A
E_{rec}	Reverse Recovery Energy			1.38		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=25\text{A},$ $-di/dt=425\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		4.5		μC
I_{RM}	Peak Reverse Recovery Current			28		A
E_{rec}	Reverse Recovery Energy			1.96		mJ

NTC Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		k Ω
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K

Module Characteristics $T_C=25^{\circ}\text{C}$ 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		m Ω
$R_{\theta JC}$	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)			0.224 0.406 0.387 0.332 0.936	K/W
$R_{\theta CS}$	Case-to-Sink (per IGBT-inverter) Case-to-Sink (per Diode-inverter) Case-to-Sink (per Diode-rectifier) Case-to-Sink (per IGBT-brake-chopper) Case-to-Sink (per Diode-brake-chopper)		0.123 0.223 0.213 0.183 0.515		K/W
$R_{\theta CS}$	Case-to-Sink		0.009		K/W
M	Mounting Torque, Screw:M5	3.0		6.0	N.m
G	Weight of Module		300		g

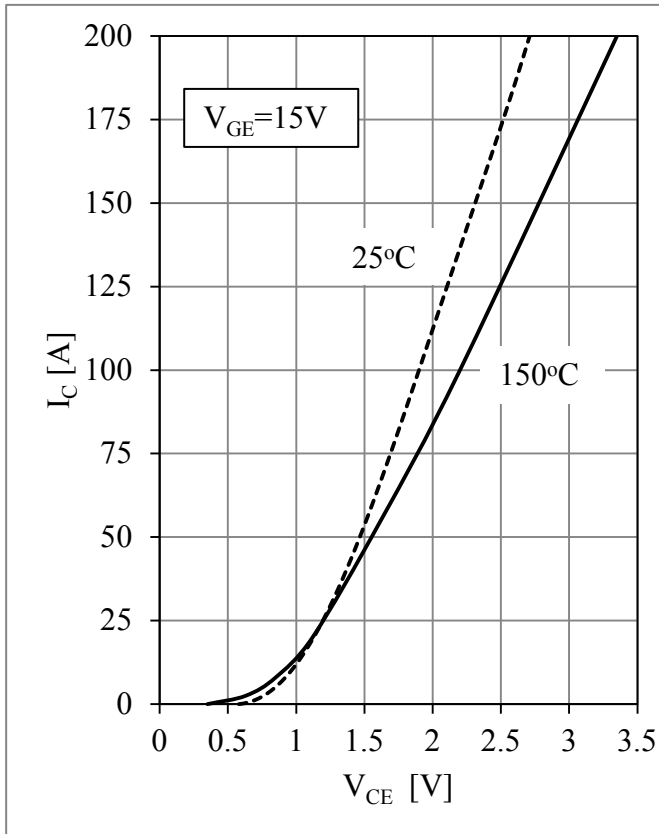


Fig 1. IGBT-inverter Output Characteristics

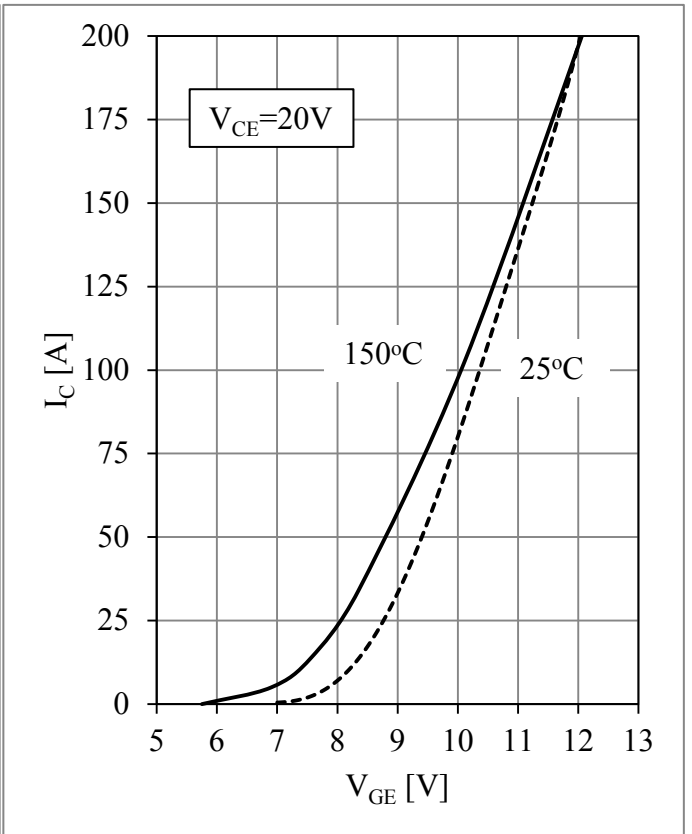
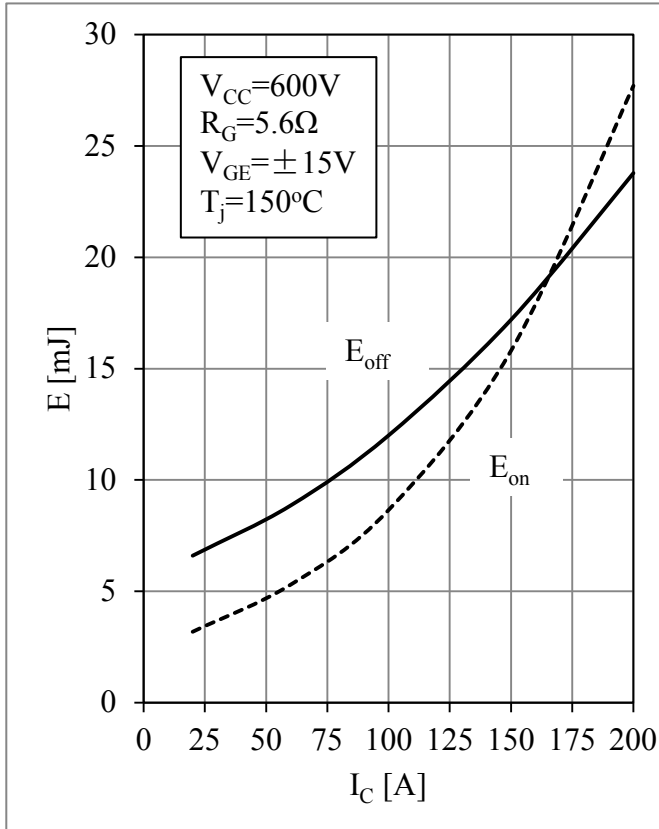
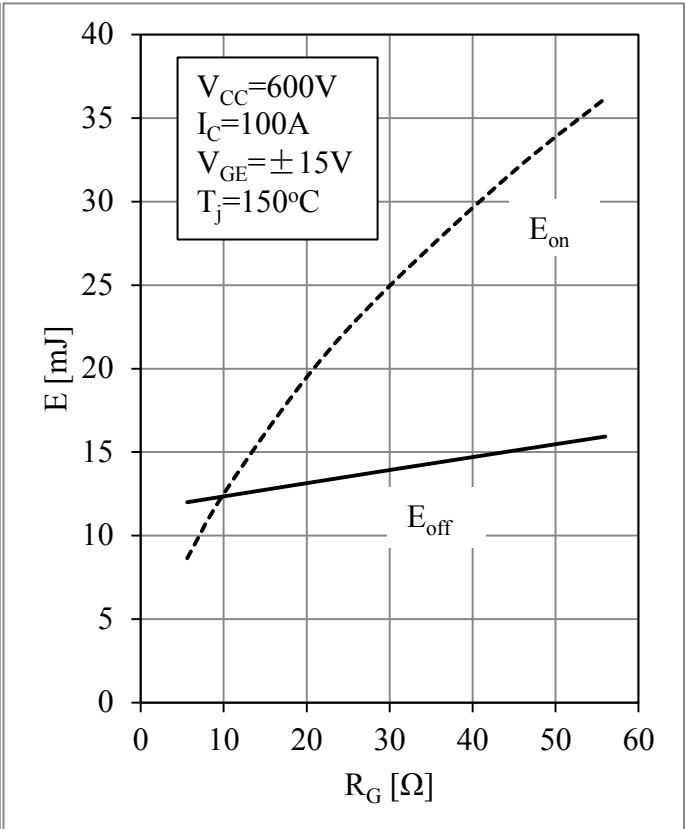


Fig 2. IGBT-inverter Transfer Characteristics

Fig 3. IGBT-inverter Switching Loss vs. I_C Fig 4. IGBT-inverter Switching Loss vs. R_G

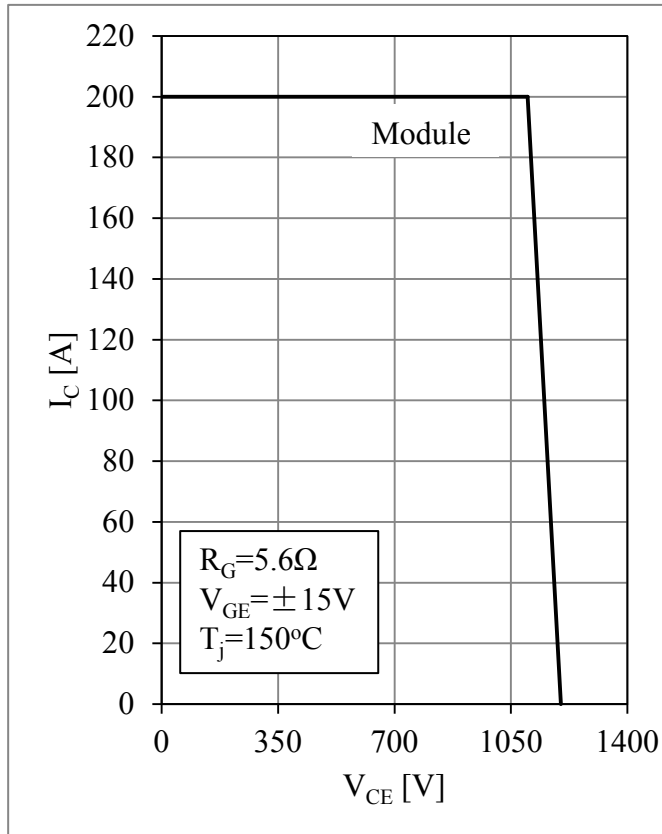


Fig 5. IGBT-inverter RBSOA

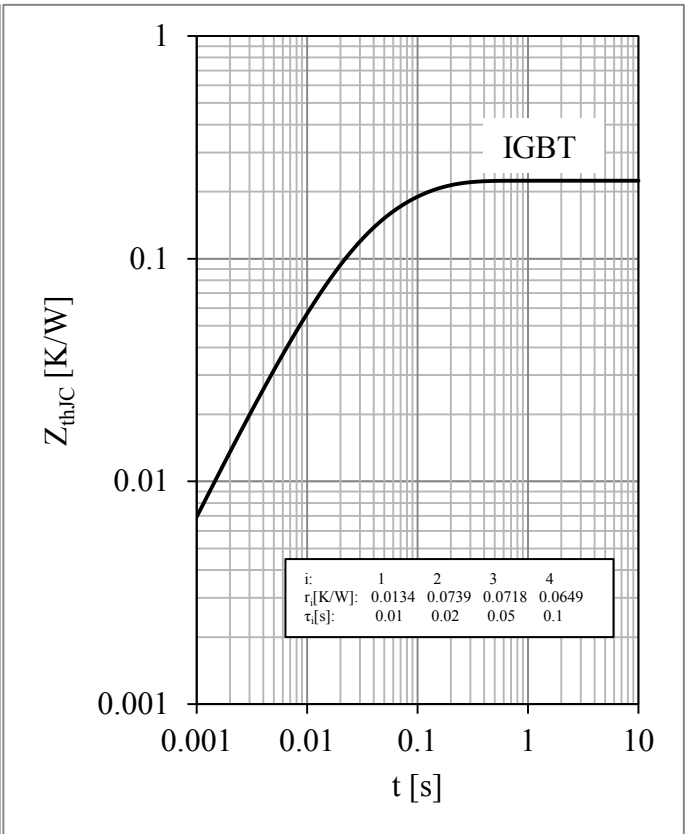


Fig 6. IGBT-inverter Transient Thermal Impedance

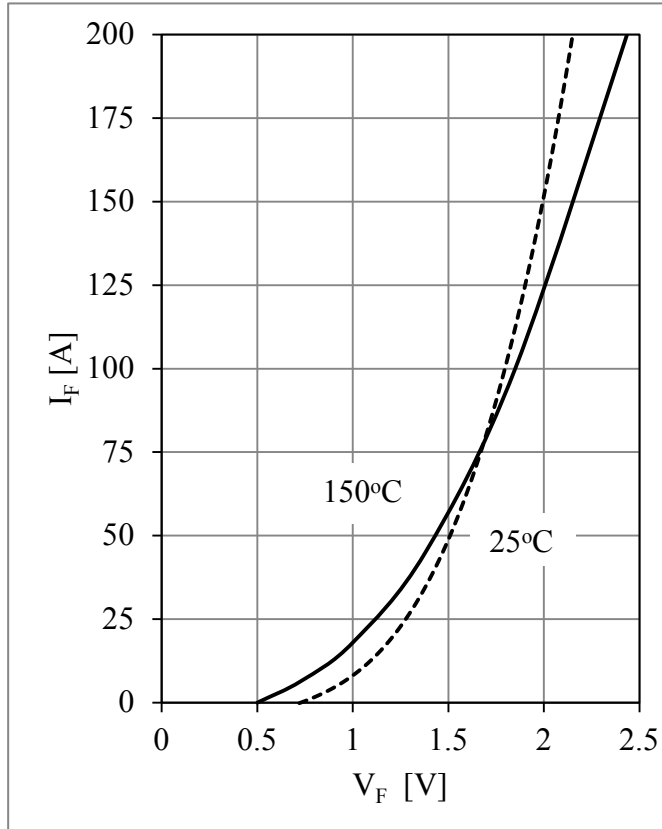
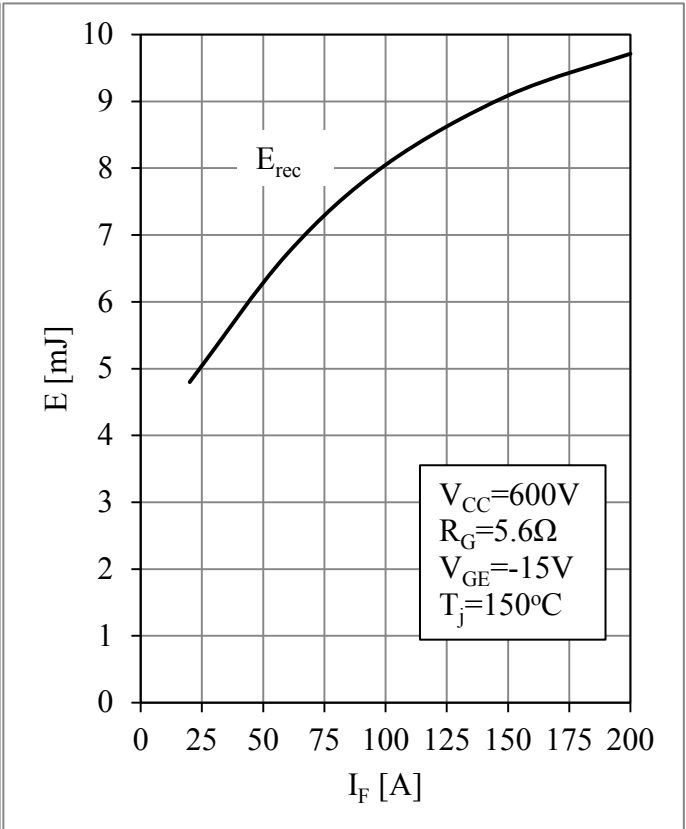


Fig 7. Diode-inverter Forward Characteristics

Fig 8. Diode-inverter Switching Loss vs. I_F

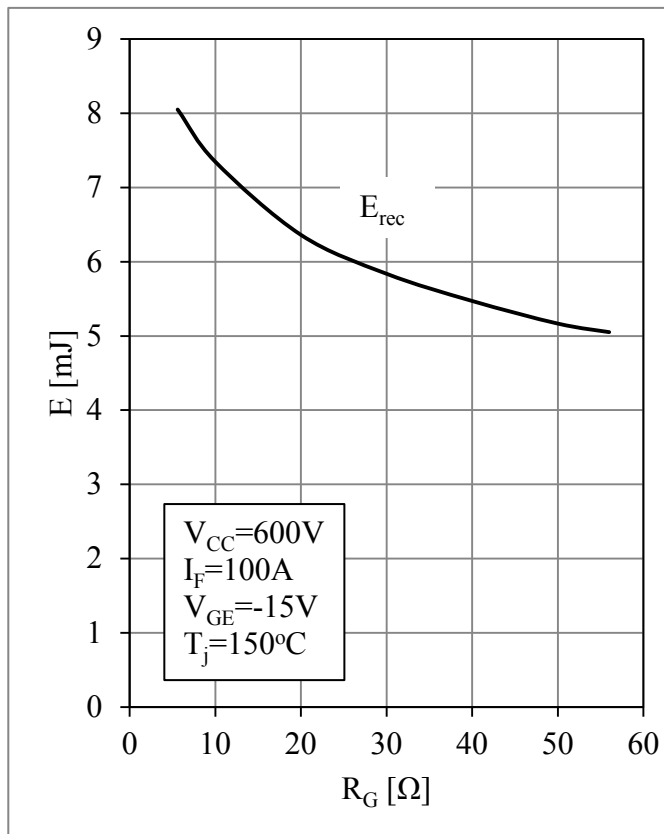
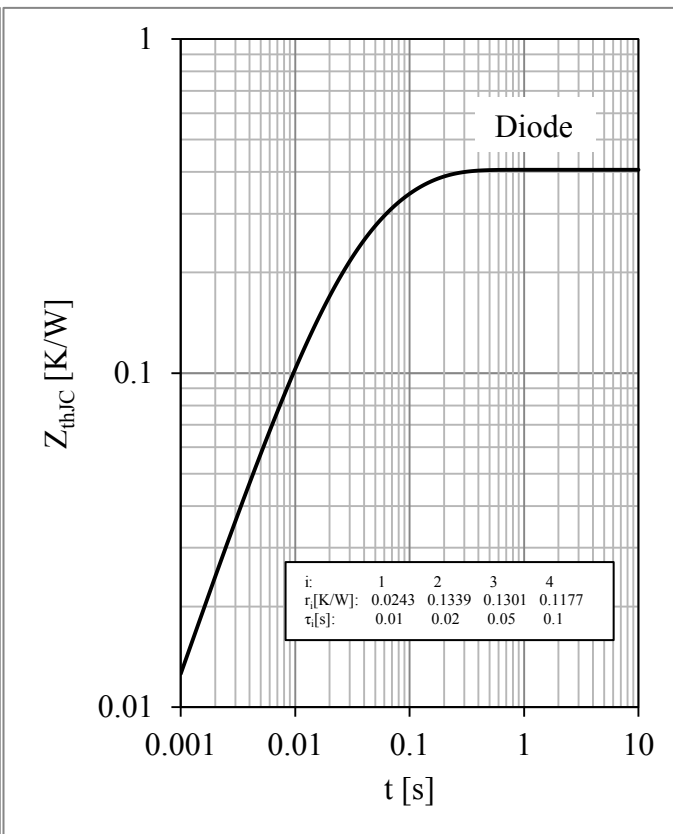
Fig 9. Diode-inverter Switching Loss vs. R_G 

Fig 10. Diode-inverter Transient Thermal Impedance

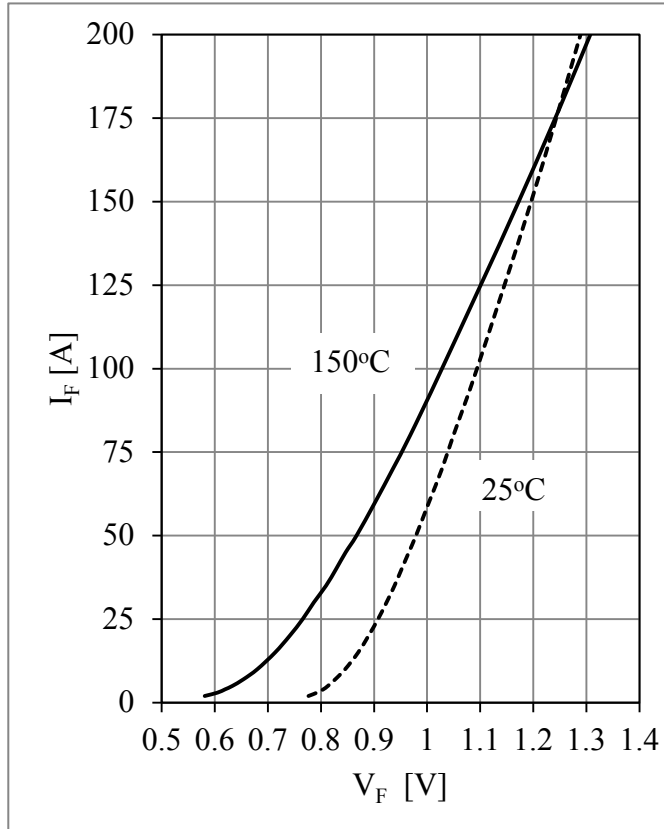


Fig 11. Diode-rectifier Forward Characteristics

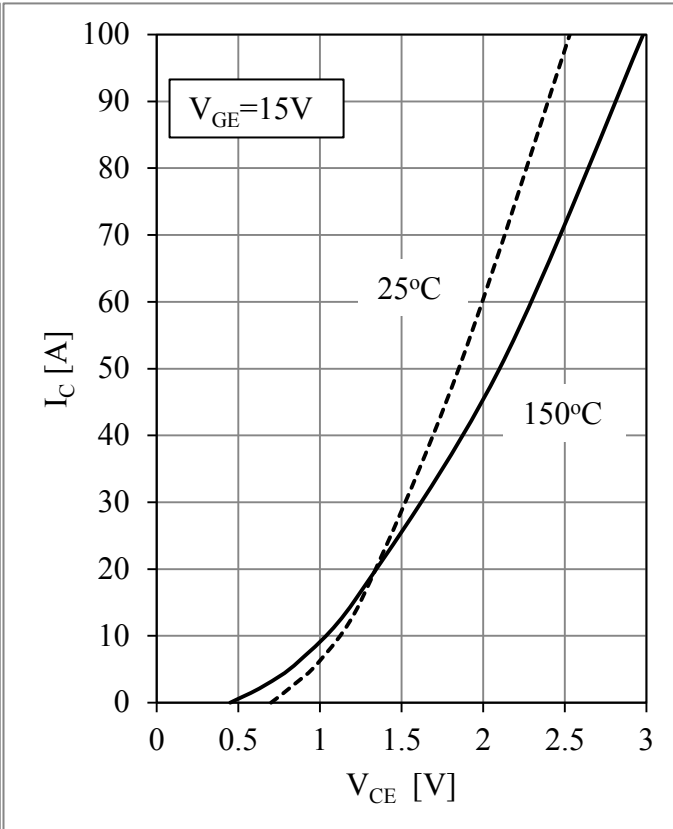


Fig 12. IGBT-brake-chopper Output Characteristics

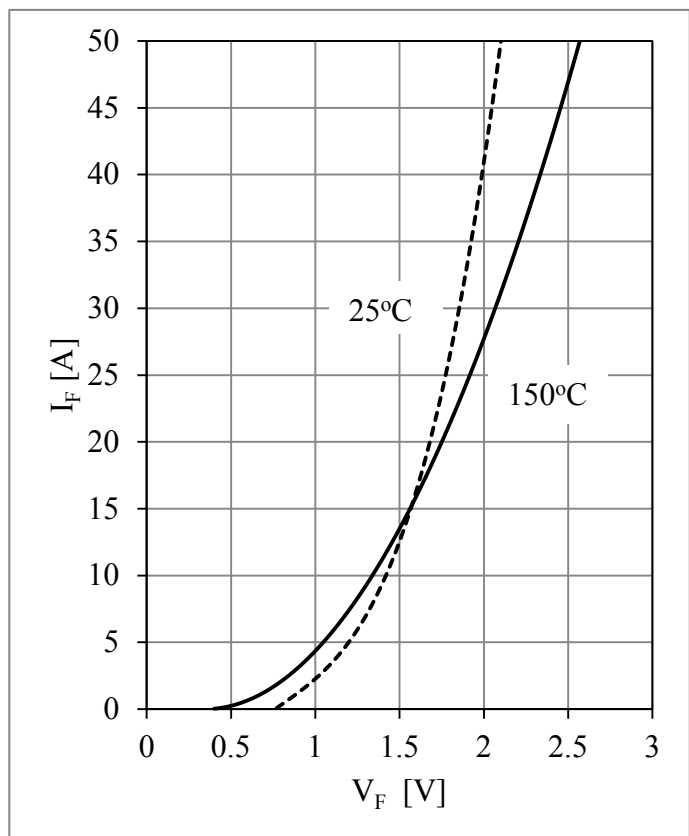


Fig 13. Diode-brake-chopper Forward Characteristics

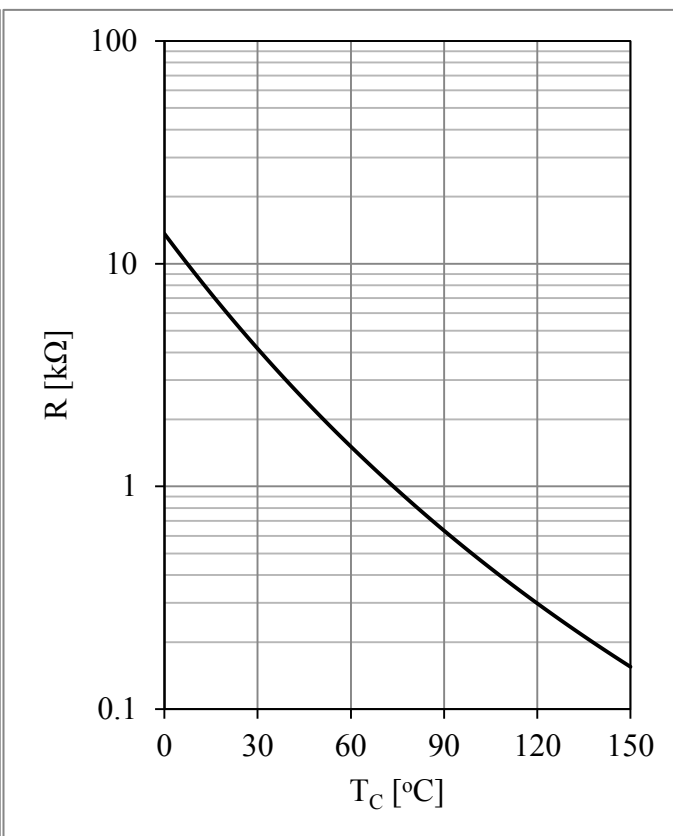
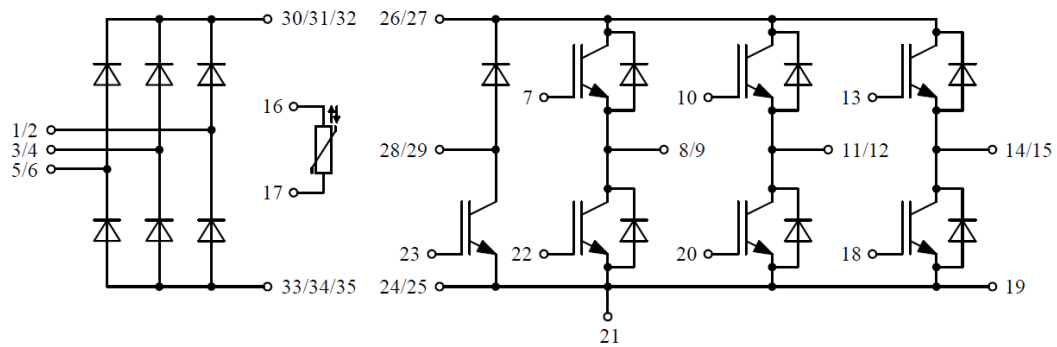


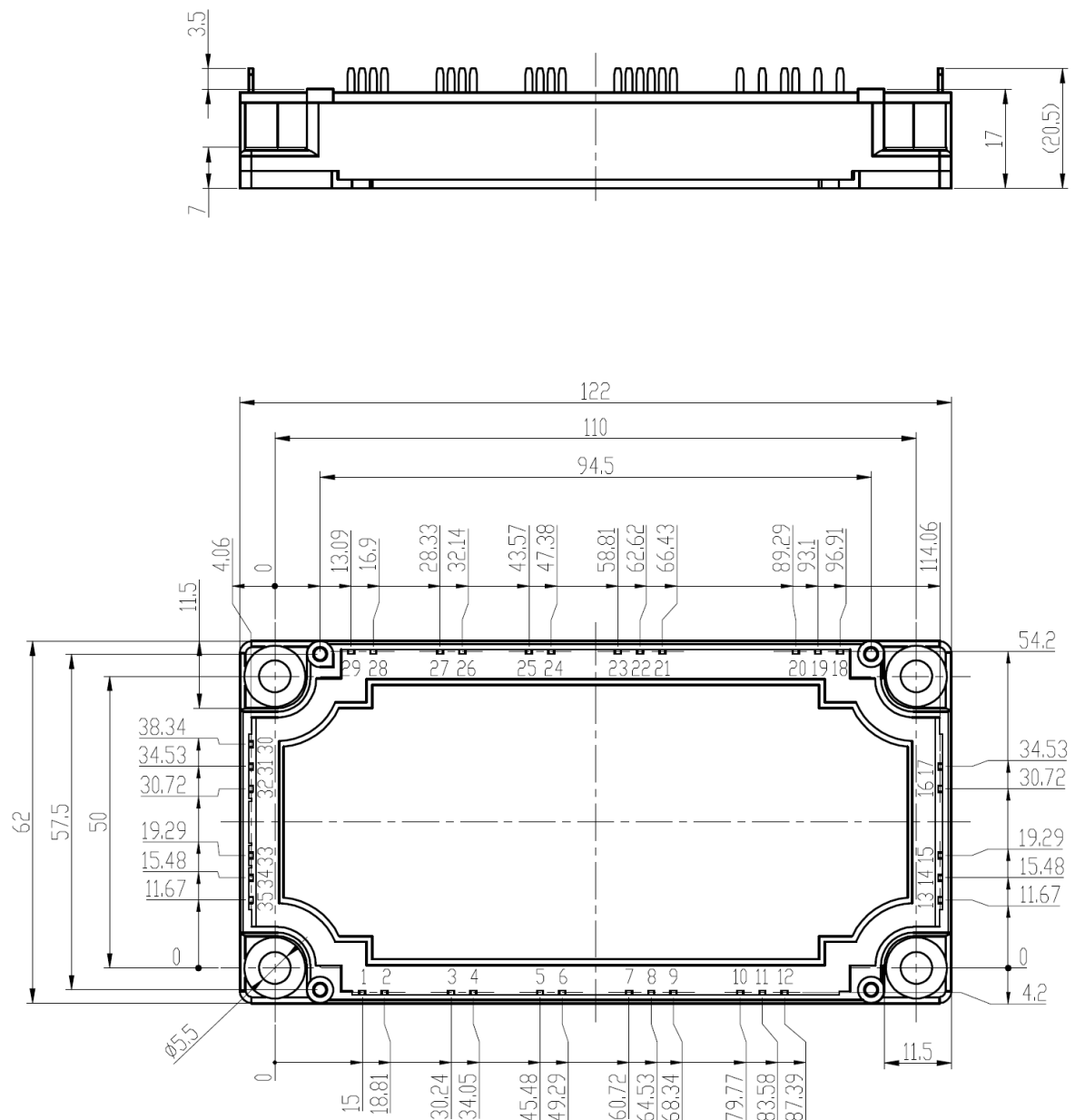
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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