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STARPOWER

SEMICONDUCTOR **IGBT**

GD75PIY120C6S

1200V/75A 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.

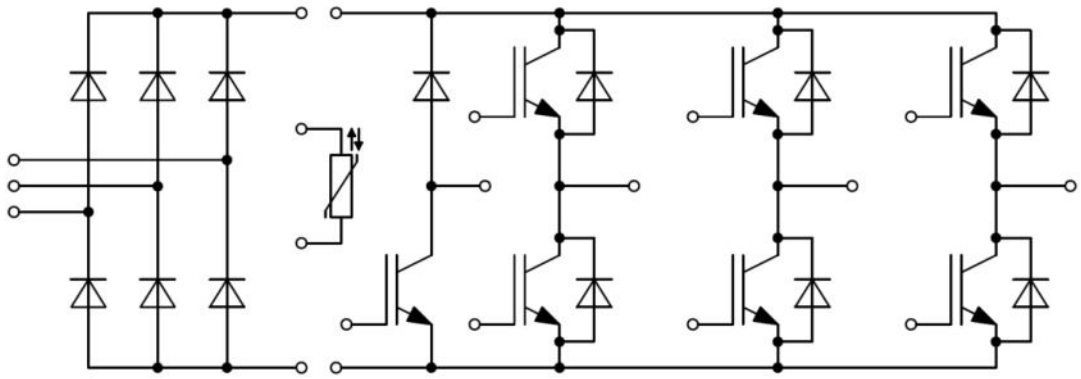
Features

- 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

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	117 75	A
I_{CM}	Pulsed Collector Current t_p=1ms	150	A
P_D	Maximum Power Dissipation @ T_j=175°C	380	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	75	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	150	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	75	A
I_{FSM}	Surge Forward Current t_p=10ms @ T_j=25°C @ T_j=150°C	600 470	A
I^2t	I^2t-value,t_p=10ms @ T_j=25°C @ T_j=150°C	1800 1100	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	62 35	A
I_{CM}	Pulsed Collector Current t_p=1ms	70	A
P_D	Maximum Power Dissipation @ T_j=175°C	218	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=1ms	50	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

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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=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=3.00mA,V_{CE}=V_{GE}, T_j=25°C	5.6	6.2	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			400	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		171		ns
t_r	Rise Time			32		ns
$t_{d(off)}$	Turn-Off Delay Time			350		ns
t_f	Fall Time			82		ns
E_{on}	Turn-On Switching Loss			3.64		mJ
E_{off}	Turn-Off Switching Loss			4.33		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		182		ns
t_r	Rise Time			43		ns
$t_{d(off)}$	Turn-Off Delay Time			443		ns
t_f	Fall Time			155		ns
E_{on}	Turn-On Switching Loss			7.81		mJ
E_{off}	Turn-Off Switching Loss			6.59		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		182		ns
t_r	Rise Time			43		ns
$t_{d(off)}$	Turn-Off Delay Time			464		ns
t_f	Fall Time			175		ns
E_{on}	Turn-On Switching Loss			9.10		mJ
E_{off}	Turn-Off Switching Loss			7.42		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=800V, 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=75A,V_{GE}=0V,T_j=25°C		1.85	2.30	V
		I_F=75A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=75A,V_{GE}=0V,T_j=150°C		1.95		
Q_r	Recovered Charge	V_R=600V,I_F=75A, -di/dt=1900A/μs,V_{GE}=-15V T_j=25°C		8.4		μC
I_{RM}	Peak Reverse Recovery Current			101		A
E_{rec}	Reverse Recovery Energy			2.55		mJ
Q_r	Recovered Charge	V_R=600V,I_F=75A, -di/dt=1900A/μs,V_{GE}=-15V T_j=125°C		15.0		μC
I_{RM}	Peak Reverse Recovery Current			102		A
E_{rec}	Reverse Recovery Energy			4.41		mJ
Q_r	Recovered Charge	V_R=600V,I_F=75A, -di/dt=1900A/μs,V_{GE}=-15V T_j=150°C		16.7		μC
I_{RM}	Peak Reverse Recovery Current			104		A
E_{rec}	Reverse Recovery Energy			5.39		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=75A,T_j=150°C		1.10		V
I_R	Reverse Current	T_j=150°C,V_R=1600V			3.0	mA

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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=35A,V_{GE}=15V, T_j=25°C		1.70	2.15	V
		I_C=35A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=35A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.40mA,V_{CE}=V_{GE}, T_j=25°C	5.6	6.2	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			400	nA
R_{Gint}	Internal Gate Resistance			0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		3.62		nF
C_{res}	Reverse Transfer Capacitance			0.10		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.27		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=12Ω,V_{GE}=±15V, T_j=25°C		27		ns
t_r	Rise Time			14		ns
$t_{d(off)}$	Turn-Off Delay Time			247		ns
t_f	Fall Time			118		ns
E_{on}	Turn-On Switching Loss			2.03		mJ
E_{off}	Turn-Off Switching Loss			2.06		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=12Ω,V_{GE}=±15V, T_j=125°C		27		ns
t_r	Rise Time			17		ns
$t_{d(off)}$	Turn-Off Delay Time			304		ns
t_f	Fall Time			175		ns
E_{on}	Turn-On Switching Loss			3.10		mJ
E_{off}	Turn-Off Switching Loss			2.99		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=12Ω,V_{GE}=±15V, T_j=150°C		27		ns
t_r	Rise Time			19		ns
$t_{d(off)}$	Turn-Off Delay Time			319		ns
t_f	Fall Time			206		ns
E_{on}	Turn-On Switching Loss			3.37		mJ
E_{off}	Turn-Off Switching Loss			3.30		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		140		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=25A,V_{GE}=0V,T_i=25°C		1.85	2.30	V
		I_F=25A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=25A,V_{GE}=0V,T_j=150°C		1.95		
Q_r	Recovered Charge	V_R=600V,I_F=25A, -di/dt=900A/μs,V_{GE}=-15V T_j=25°C		2.9		μC
I_{RM}	Peak Reverse Recovery Current			55		A
E_{rec}	Reverse Recovery Energy			0.93		mJ
Q_r	Recovered Charge	V_R=600V,I_F=25A, -di/dt=900A/μs,V_{GE}=-15V T_j=125°C		5.1		μC
I_{RM}	Peak Reverse Recovery Current			58		A
E_{rec}	Reverse Recovery Energy			1.72		mJ
Q_r	Recovered Charge	V_R=600V,I_F=25A, -di/dt=900A/μs,V_{GE}=-15V T_j=150°C		5.6		μC
I_{RM}	Peak Reverse Recovery Current			60		A
E_{rec}	Reverse Recovery Energy			2.01		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

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Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		60		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance,Terminal to Chip		4.00 2.00		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)			0.394 0.602 0.618 0.685 1.233	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) Case-to-Heatsink (per Diode-brake) Case-to-Heatsink (per Module)		0.132 0.201 0.207 0.229 0.413 0.009		K/W
M	Mounting Torque, Screw:M5	3.0		6.0	N.m
G	Weight of Module		300		g

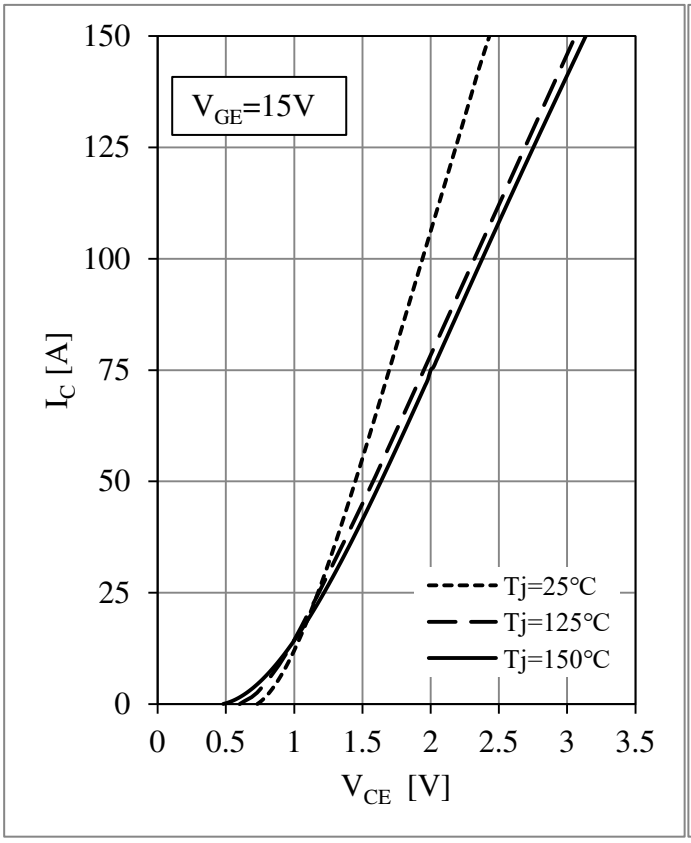

Fig 1. IGBT-inverter Output Characteristics

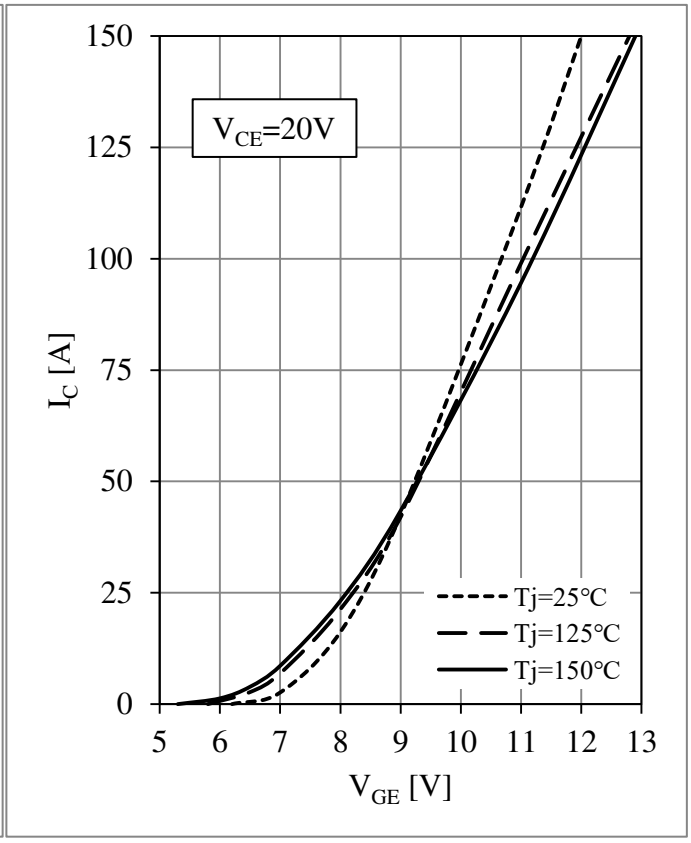

Fig 2. IGBT-inverter Transfer Characteristics

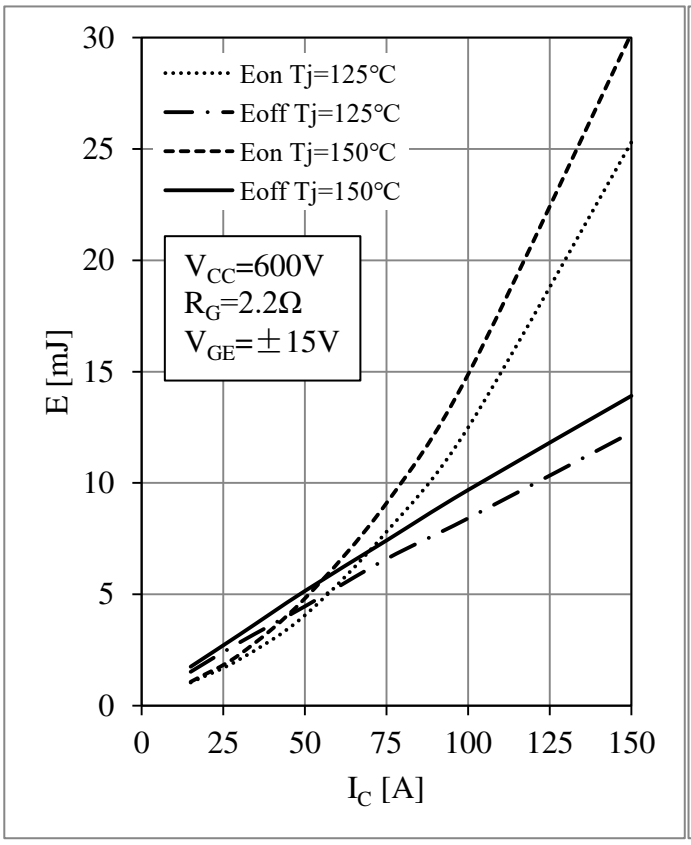

Fig 3. IGBT-inverter Switching Loss vs. I_C

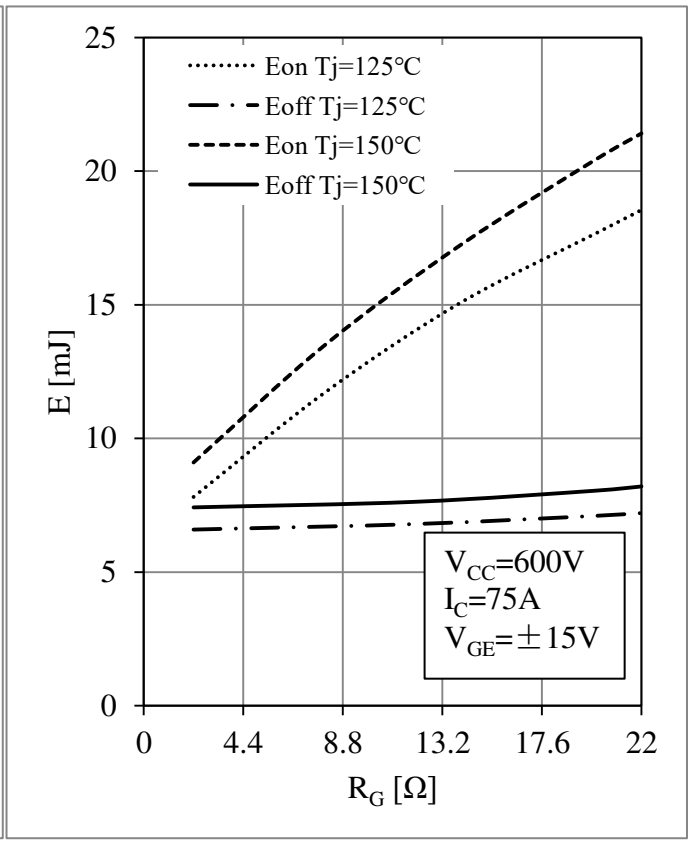

Fig 4. IGBT-inverter Switching Loss vs. R_G

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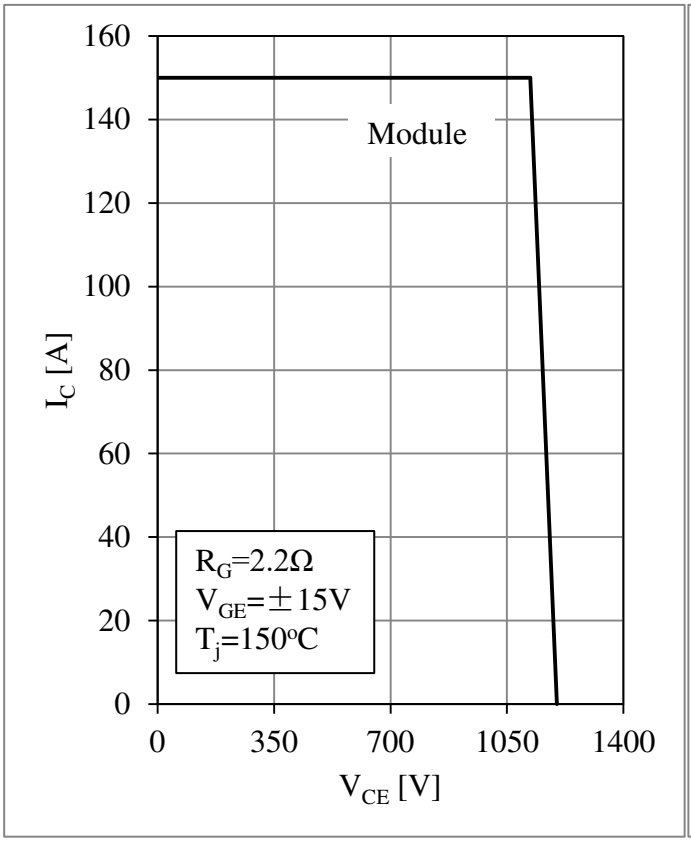

Fig 5. IGBT-inverter RBSOA

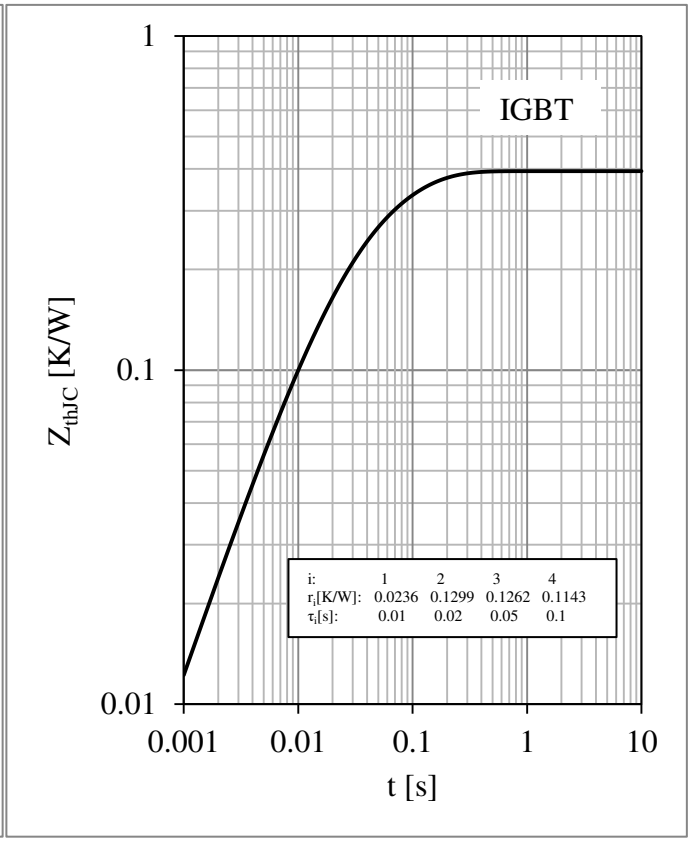

Fig 6. IGBT-inverter Transient Thermal Impedance

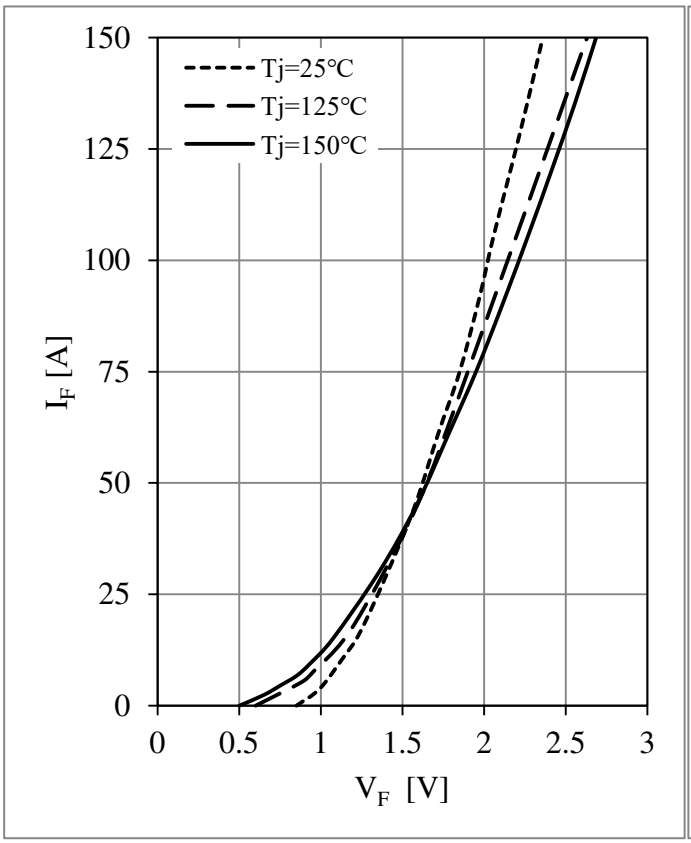

Fig 7. Diode-inverter Forward Characteristics

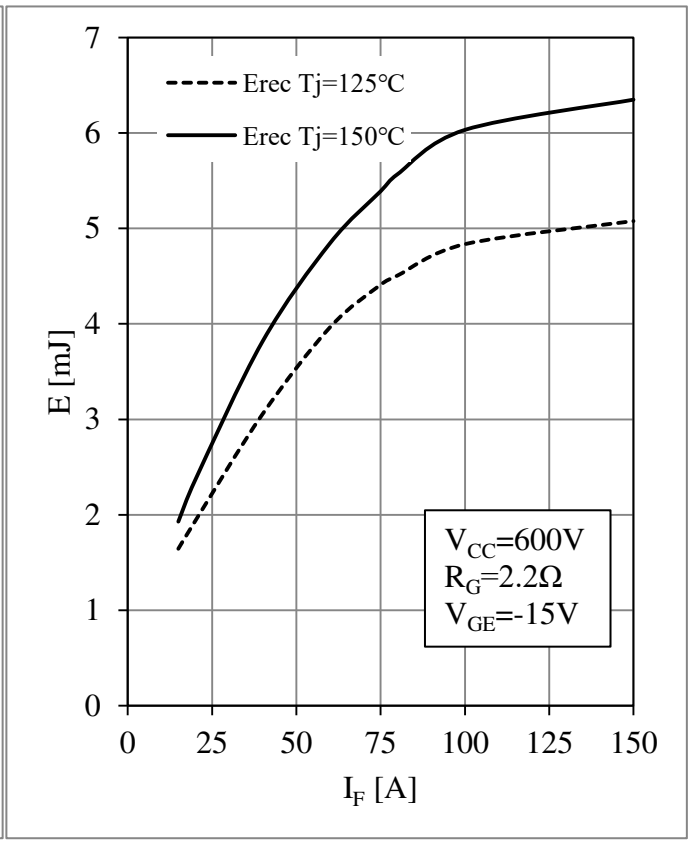

Fig 8. Diode-inverter Switching Loss vs. I_F

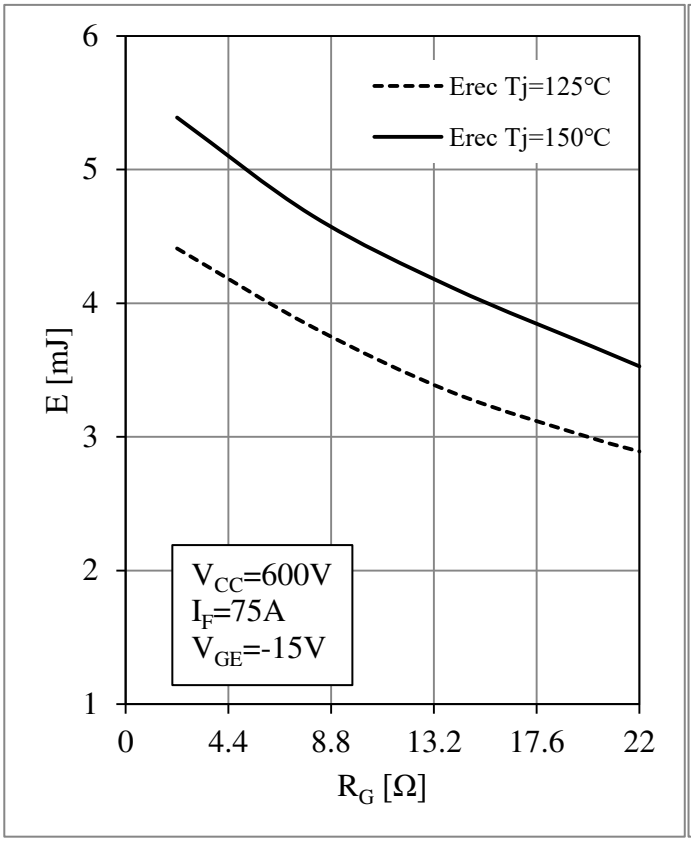

Fig 9. Diode-inverter Switching Loss vs. R_G

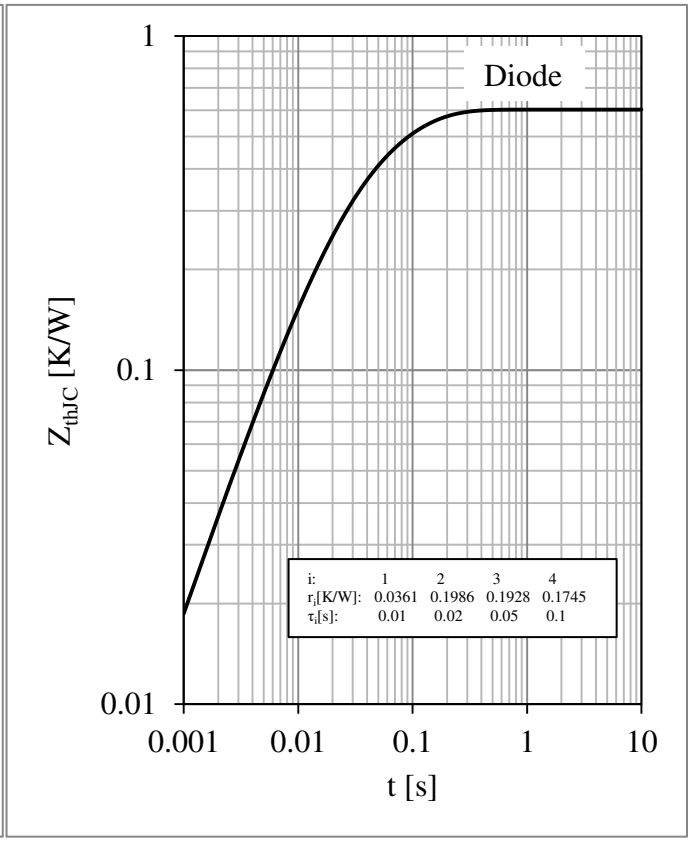

Fig 10. Diode-inverter Transient Thermal Impedance

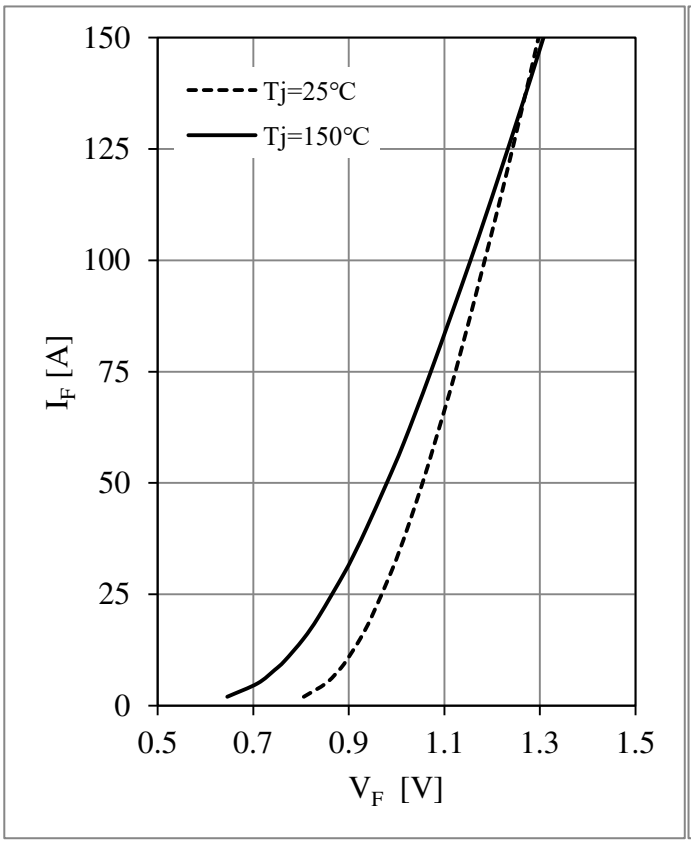

Fig 11. Diode-rectifier Forward Characteristics

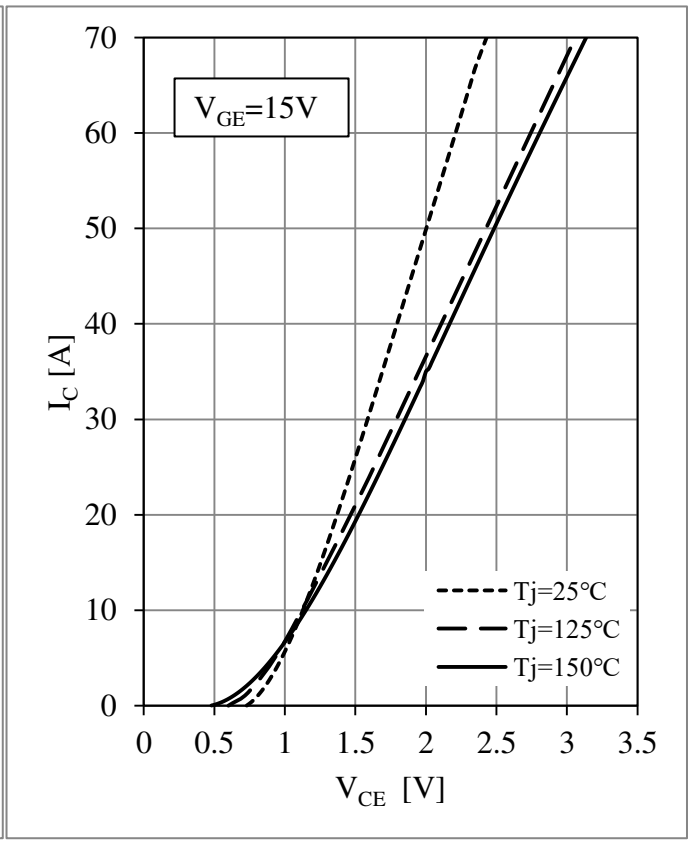

Fig 12. IGBT-brake-chopper Output Characteristics

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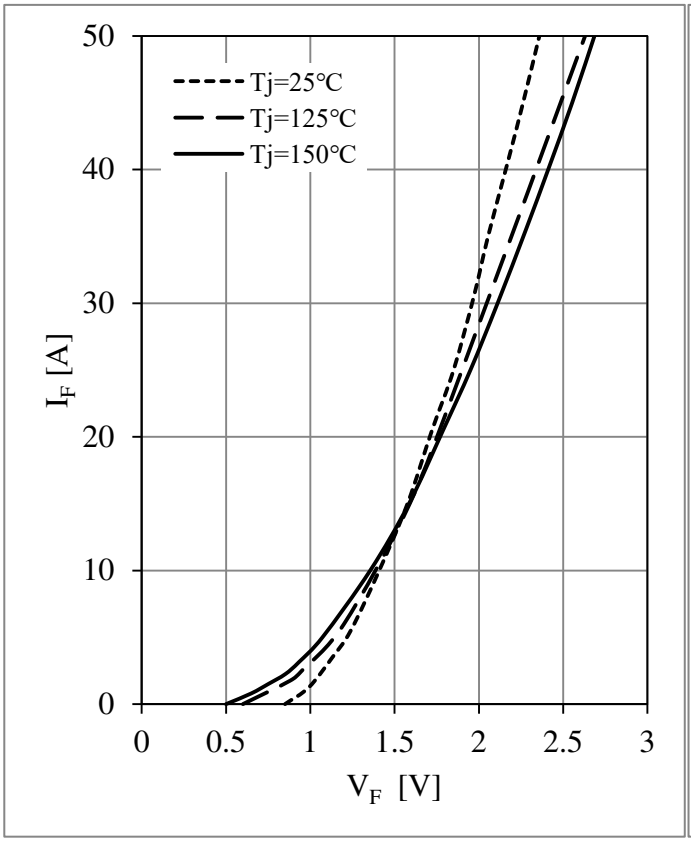


Fig 13. Diode-brake-chopper Forward Characteristics

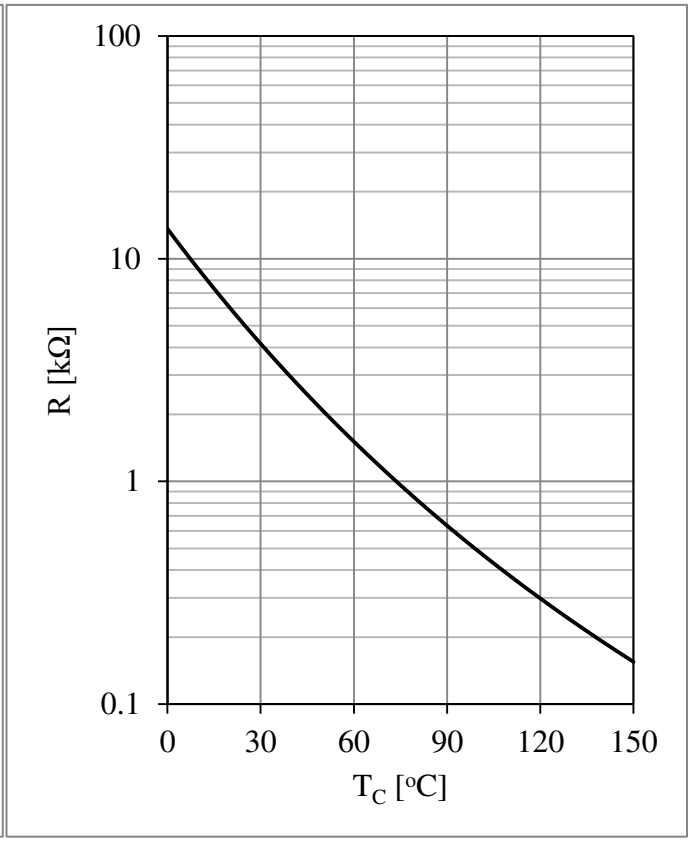
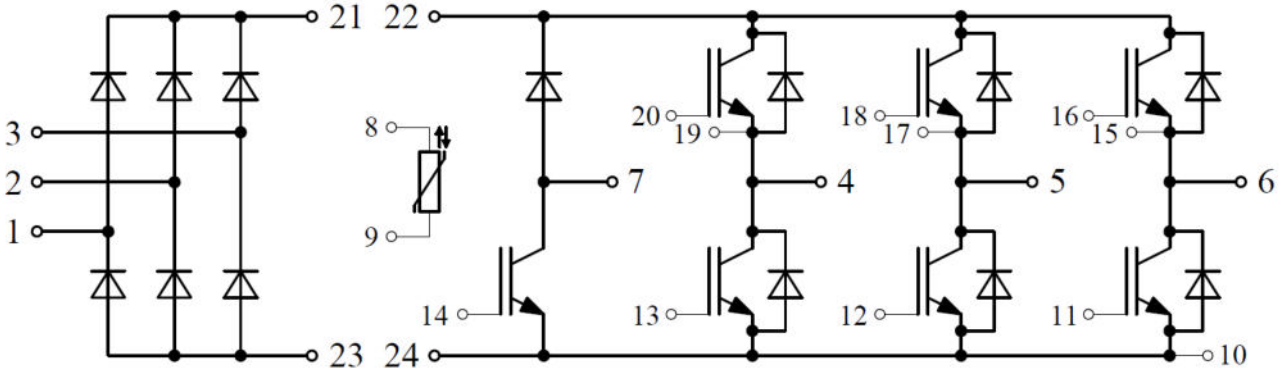


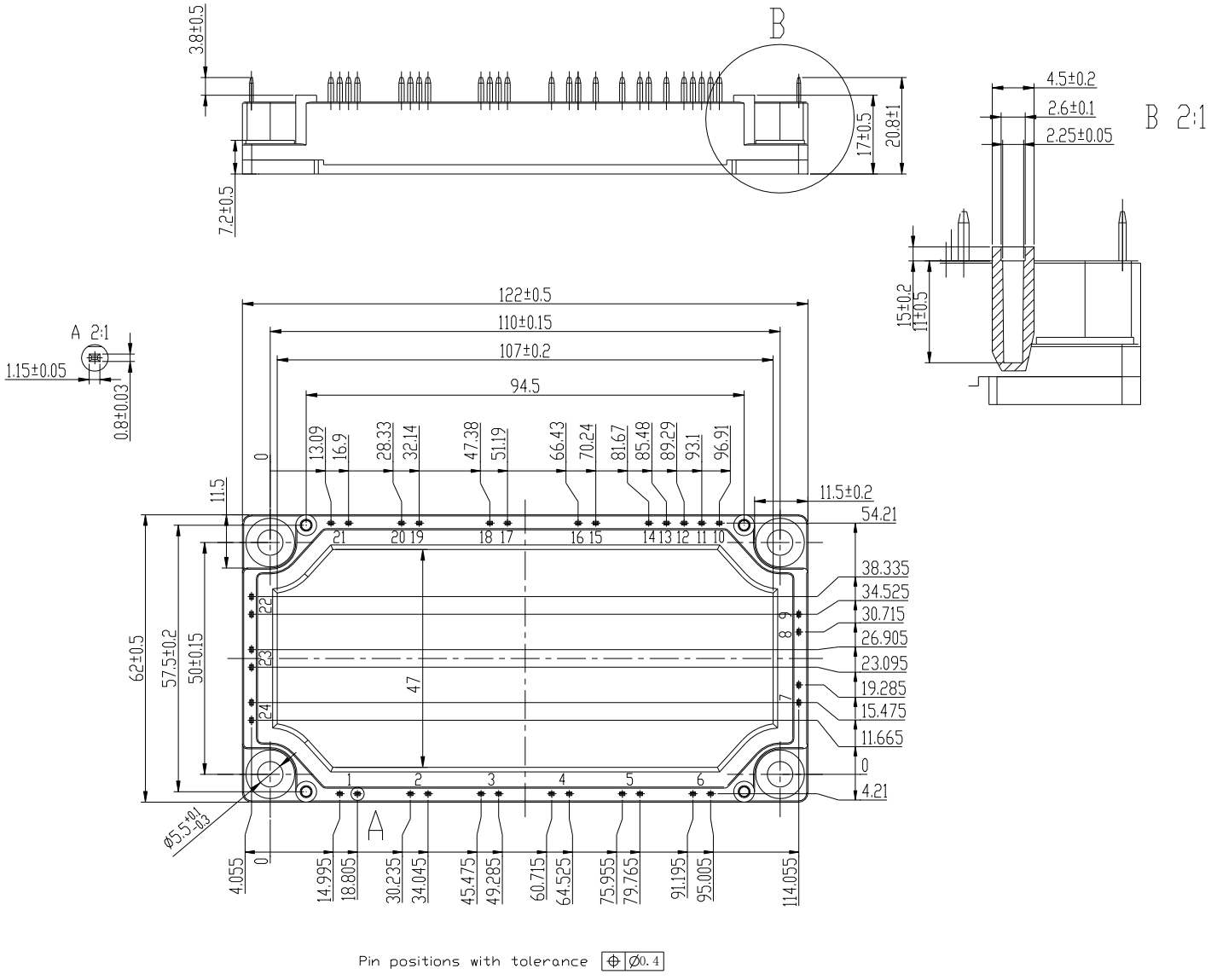
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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