STARPOWER

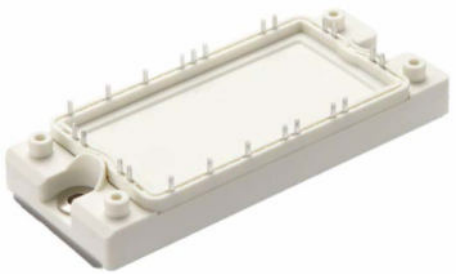
SEMICONDUCTOR **IGBT**

GD35PIY120C5SN

1200V/35A 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.



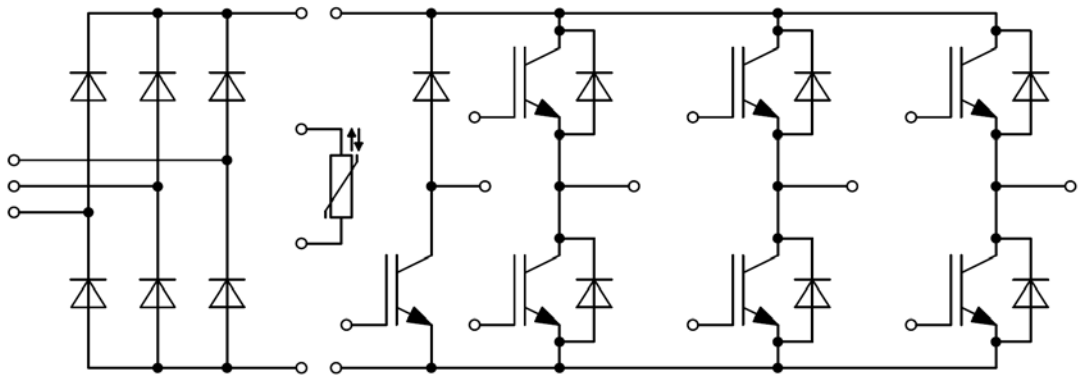
Features

- 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	69 35	A
I_{CM}	Pulsed Collector Current t_p=1ms	70	A
P_D	Maximum Power Dissipation @ T_j=175°C	263	W

Diode-inverter

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

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	35	A
I_{FSM}	Surge Forward Current V_R=0V,t_p=10ms,T_j=45°C	600	A
I^2t	I^2t-value,V_R=0V,t_p=10ms,T_j=45°C	1800	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	50 25	A
I_{CM}	Pulsed Collector Current t_p=1ms	50	A
P_D	Maximum Power Dissipation @ T_j=175°C	202	W

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	15	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	30	A

Module

Symbol	Description	Values	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=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=0.88mA,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			0		Ω
Q_G	Gate Charge	V_{GE}=-15…+15V		0.33		μC
C_{ies}	Input Capacitance	V_{CE}=30V,f=1MHz, V_{GE}=0V		3.20		nF
C_{res}	Reverse Transfer Capacitance			0.10		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.33		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=13Ω,V_{GE}=±15V, T_j=25°C		157		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			210		ns
t_f	Fall Time			320		ns
E_{on}	Turn-On Switching Loss			2.05		mJ
E_{off}	Turn-Off Switching Loss			2.50		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=13Ω,V_{GE}=±15V, T_j=125°C		158		ns
t_r	Rise Time			33		ns
$t_{d(off)}$	Turn-Off Delay Time			225		ns
t_f	Fall Time			505		ns
E_{on}	Turn-On Switching Loss			2.50		mJ
E_{off}	Turn-Off Switching Loss			3.80		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=13Ω,V_{GE}=±15V, T_j=150°C		160		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			230		ns
t_f	Fall Time			520		ns
E_{on}	Turn-On Switching Loss			2.65		mJ
E_{off}	Turn-Off Switching Loss			4.00		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		140		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=35A,V_{GE}=0V,T_i=25°C		2.00	2.45	V
		I_F=35A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=35A,V_{GE}=0V,T_i=150°C		1.88		
Q_r	Recovered Charge	V_R=600V,I_F=35A, R_G=13Ω,V_{GE}=-15V T_j=25°C		1.9		μC
I_{RM}	Peak Reverse Recovery Current			43		A
E_{rec}	Reverse Recovery Energy			1.01		mJ
Q_r	Recovered Charge	V_R=600V,I_F=35A, R_G=13Ω,V_{GE}=-15V T_j=125°C		3.1		μC
I_{RM}	Peak Reverse Recovery Current			51		A
E_{rec}	Reverse Recovery Energy			2.37		mJ
Q_r	Recovered Charge	V_R=600V,I_F=35A, R_G=13Ω,V_{GE}=-15V T_j=150°C		3.5		μC
I_{RM}	Peak Reverse Recovery Current			53		A
E_{rec}	Reverse Recovery Energy			2.77		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=35A,V_{GE}=0V,T_j=150°C		1.02		V
I_R	Reverse Current	T_i=150°C,V_R=1600V			3.0	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=25A,V_{GE}=15V, T_j=25°C		1.70	2.15	V
		I_C=25A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=25A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=0.63mA,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			400	nA
R_{Gint}	Internal Gate Resistance			0		Ω
Q_G	Gate Charge	V_{GE}=-15…+15V		0.24		μC
C_{ies}	Input Capacitance	V_{CE}=30V,f=1MHz, V_{GE}=0V		2.40		nF
C_{res}	Reverse Transfer Capacitance			0.08		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.24		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=25A, R_G=18Ω,V_{GE}=±15V, T_j=25°C		148		ns
t_r	Rise Time			27		ns
$t_{d(off)}$	Turn-Off Delay Time			200		ns
t_f	Fall Time			338		ns
E_{on}	Turn-On Switching Loss			1.66		mJ
E_{off}	Turn-Off Switching Loss			1.64		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=25A, R_G=18Ω,V_{GE}=±15V, T_j=125°C		144		ns
t_r	Rise Time			27		ns
$t_{d(off)}$	Turn-Off Delay Time			217		ns
t_f	Fall Time			401		ns
E_{on}	Turn-On Switching Loss			1.92		mJ
E_{off}	Turn-Off Switching Loss			2.36		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=25A, R_G=18Ω,V_{GE}=±15V, T_j=150°C		142		ns
t_r	Rise Time			29		ns
$t_{d(off)}$	Turn-Off Delay Time			219		ns
t_f	Fall Time			523		ns
E_{on}	Turn-On Switching Loss			2.23		mJ
E_{off}	Turn-Off Switching Loss			2.69		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		100		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=15A,V_{GE}=0V,T_i=25°C		2.05	2.50	V
		I_F=15A,V_{GE}=0V,T_j=125°C		2.20		
		I_F=15A,V_{GE}=0V,T_i=150°C		2.25		
Q_r	Recovered Charge	V_R=600V,I_F=15A, R_G=39Ω,V_{GE}=-15V T_j=25°C		0.7		μC
I_{RM}	Peak Reverse Recovery Current			11		A
E_{rec}	Reverse Recovery Energy			0.54		mJ
Q_r	Recovered Charge	V_R=600V,I_F=15A, R_G=39Ω,V_{GE}=-15V T_j=125°C		2.4		μC
I_{RM}	Peak Reverse Recovery Current			13		A
E_{rec}	Reverse Recovery Energy			1.00		mJ
Q_r	Recovered Charge	V_R=600V,I_F=15A, R_G=39Ω,V_{GE}=-15V T_j=150°C		2.6		μC
I_{RM}	Peak Reverse Recovery Current			13		A
E_{rec}	Reverse Recovery Energy			1.12		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		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)			0.569 1.068 0.995 0.742 1.760	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) Case-to-Sink (per per Module)		0.274 0.515 0.480 0.358 0.849 0.020		K/W
M	Mounting Torque, Screw:M5	3.0		6.0	N.m
G	Weight of Module		200		g

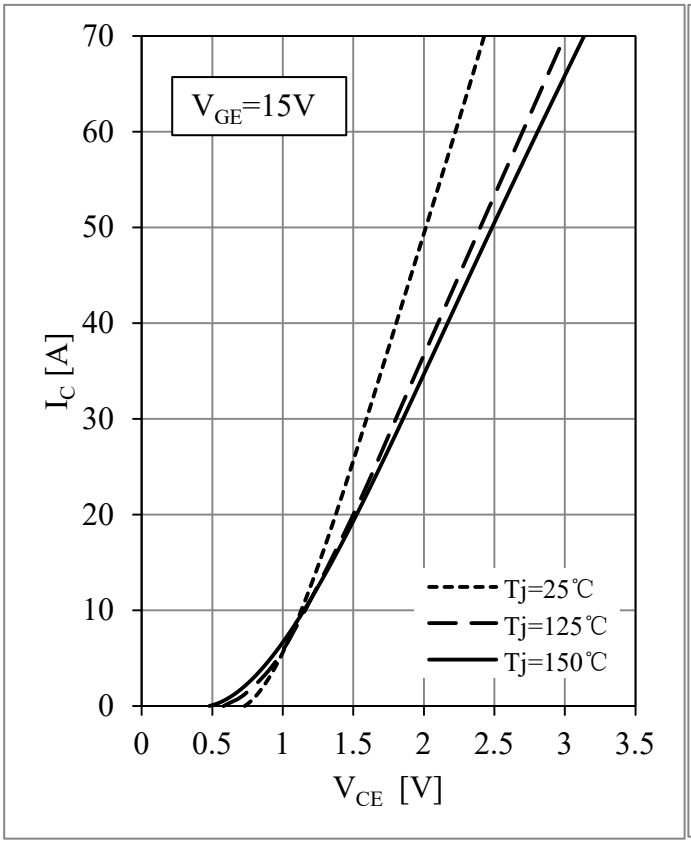


Fig 1. IGBT-inverter Output Characteristics

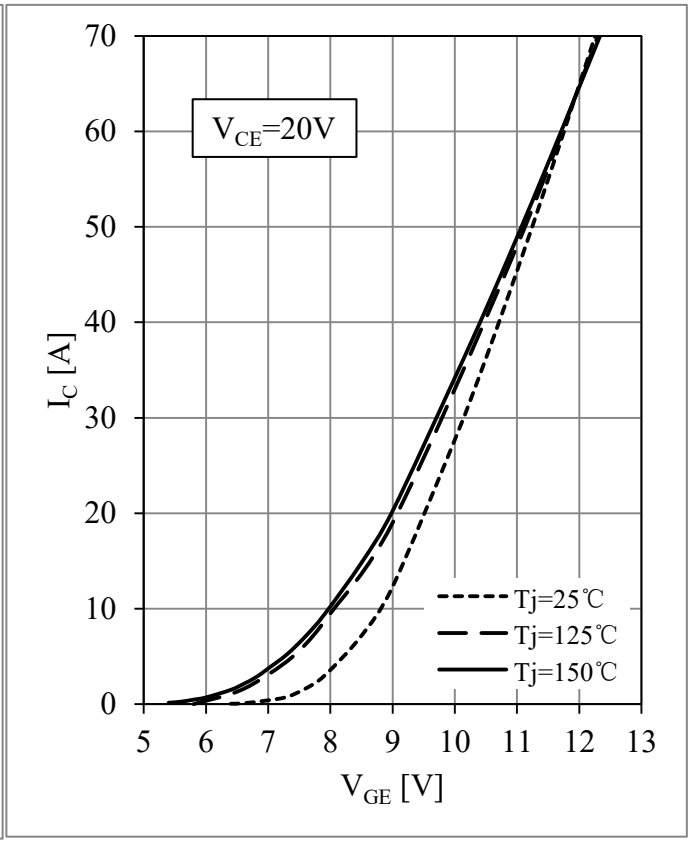


Fig 2. IGBT-inverter Transfer Characteristics

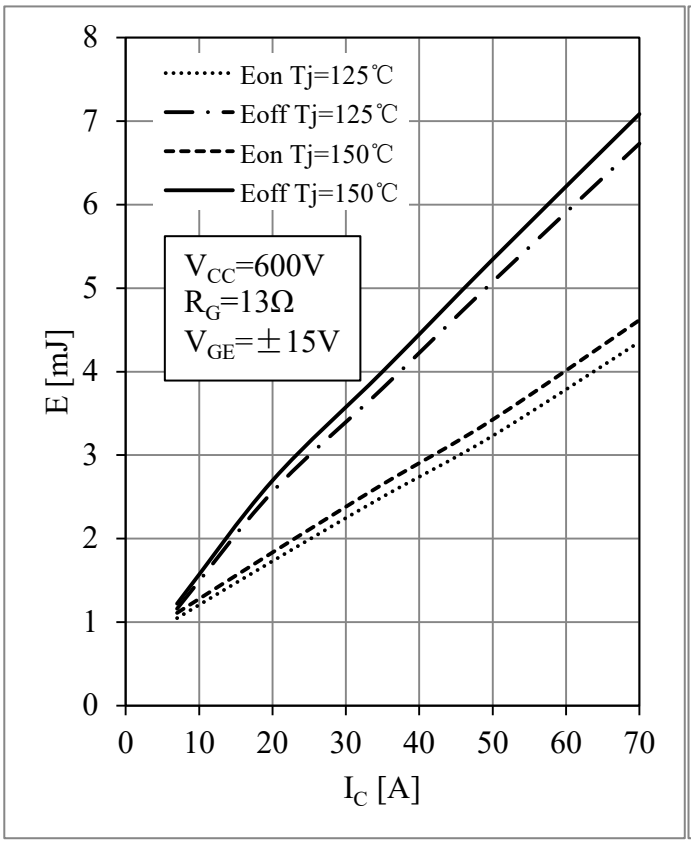


Fig 3. IGBT-inverter Switching Loss vs. I_C

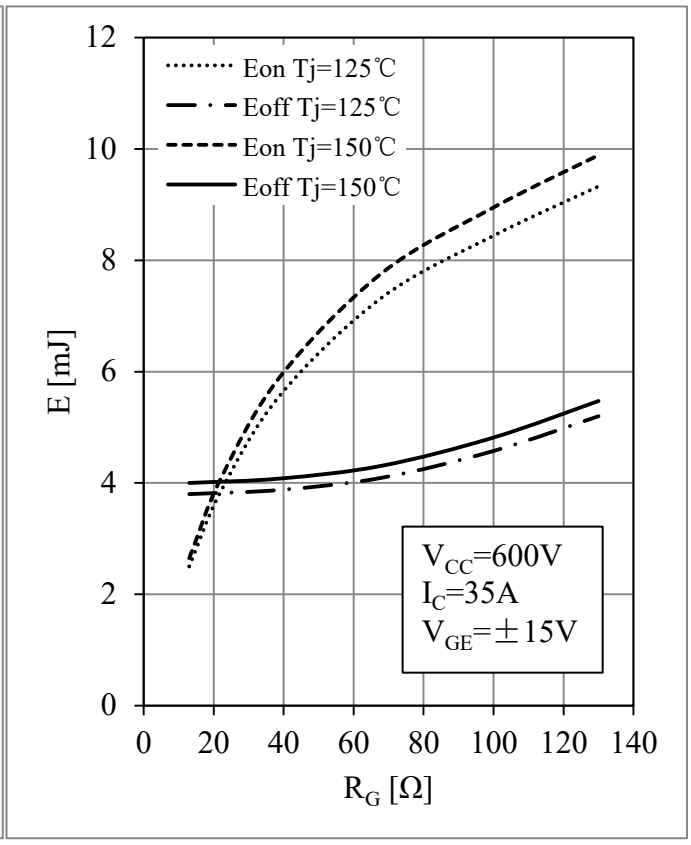


Fig 4. IGBT-inverter Switching Loss vs. R_G

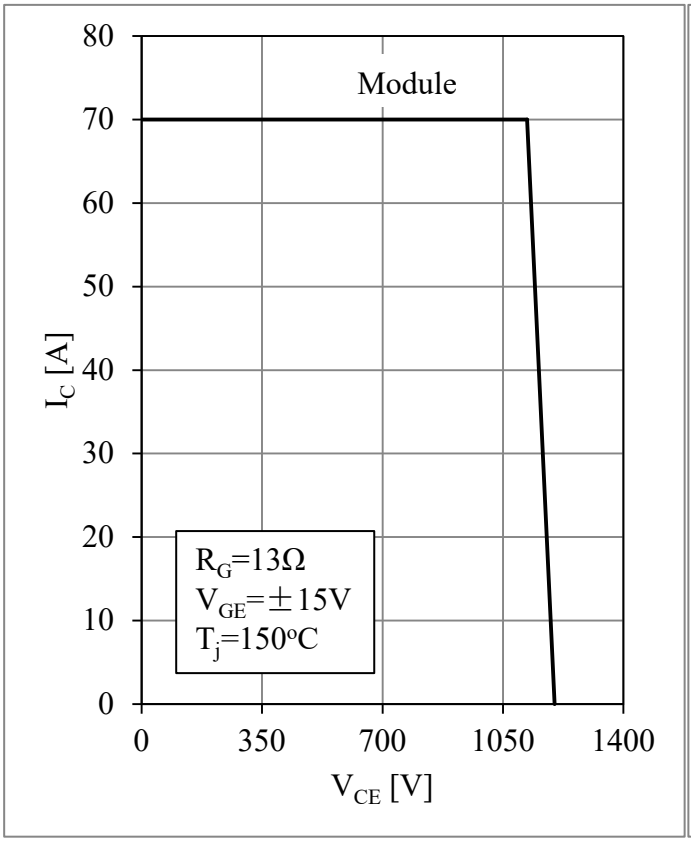


Fig 5. IGBT-inverter RBSOA

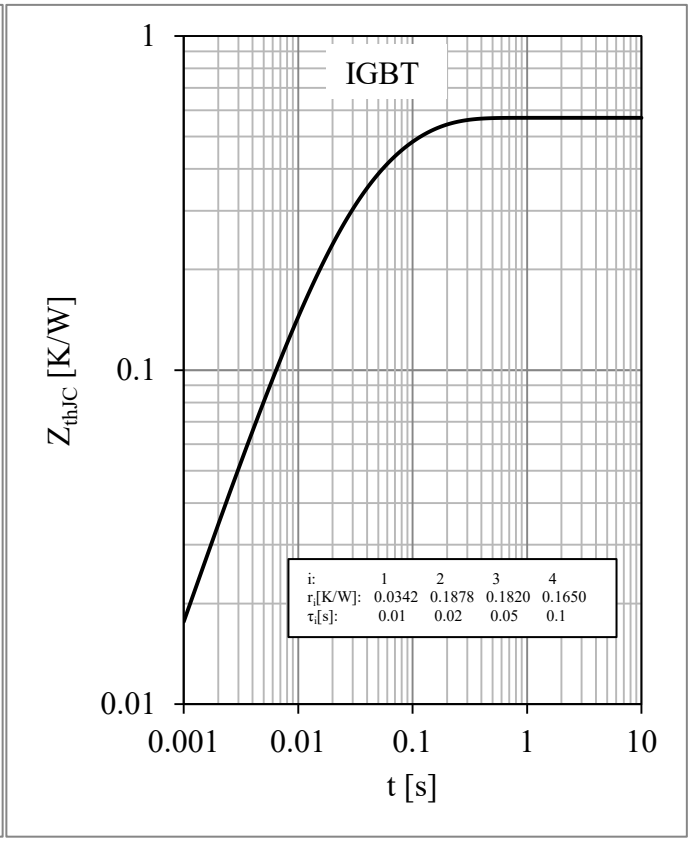


Fig 6. IGBT-inverter Transient Thermal Impedance

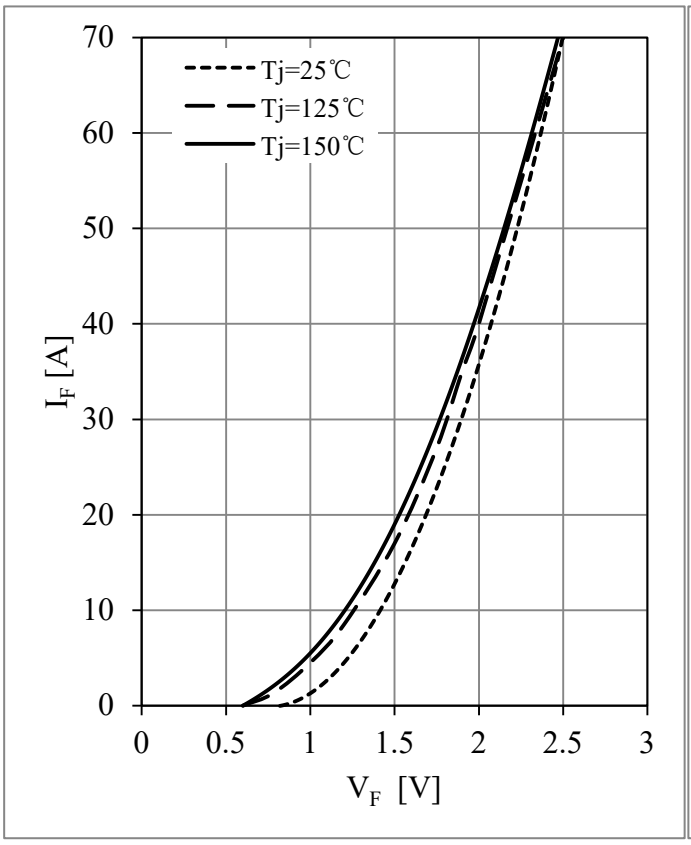


Fig 7. Diode-inverter Forward Characteristics

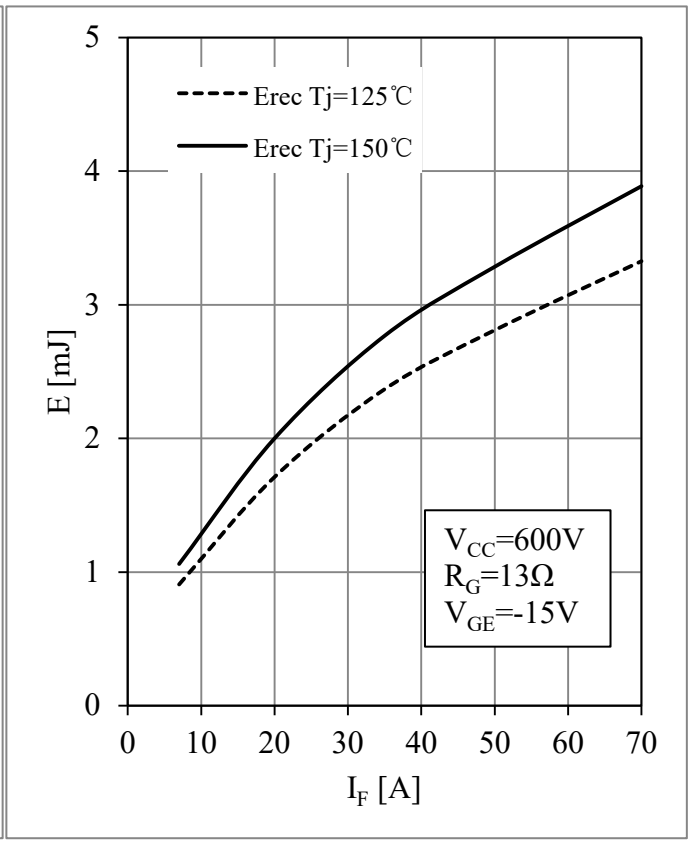


Fig 8. Diode-inverter Switching Loss vs. I_F

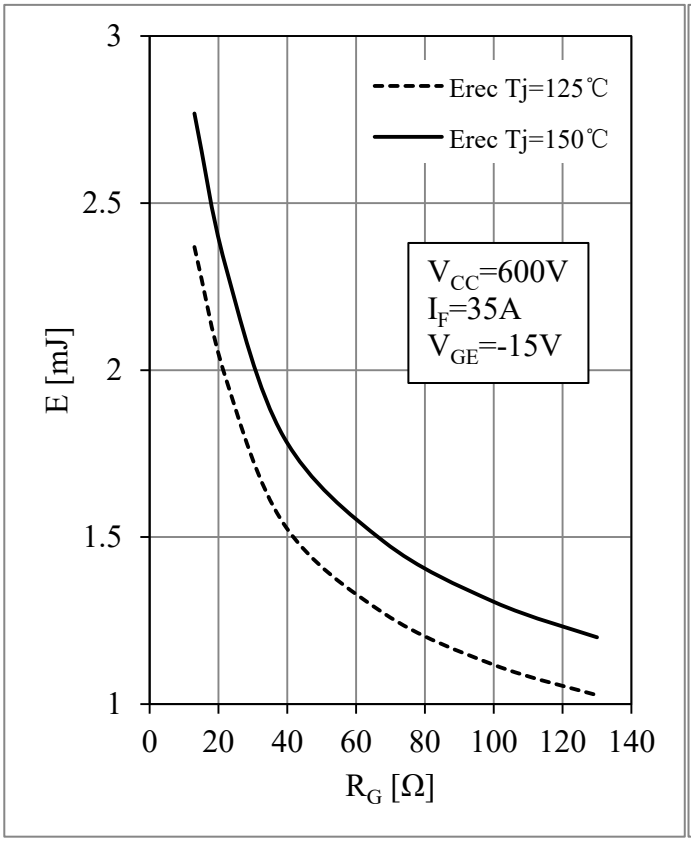


Fig 9. Diode-inverter Switching Loss vs. R_G

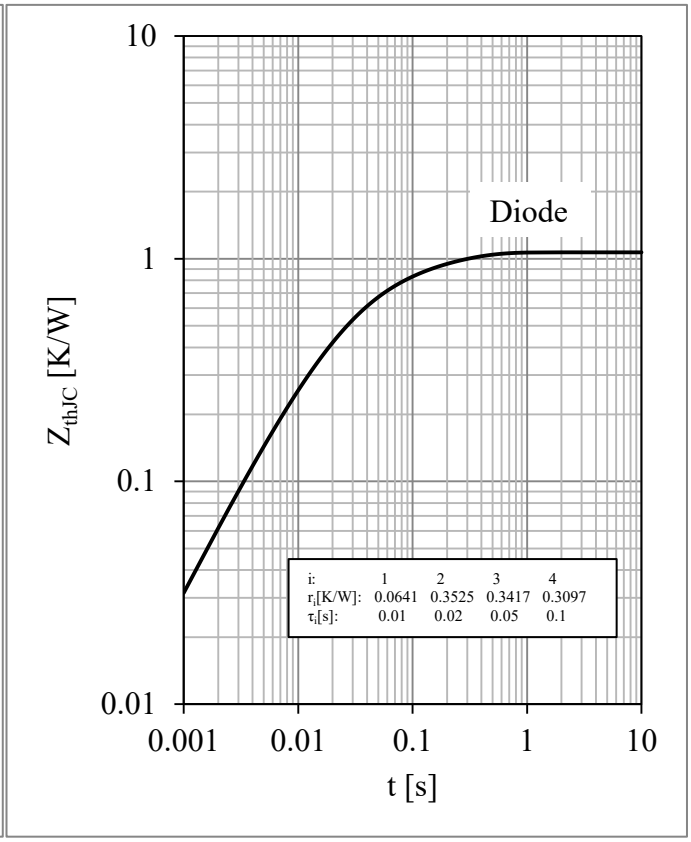


Fig 10. Diode-inverter Transient Thermal Impedance

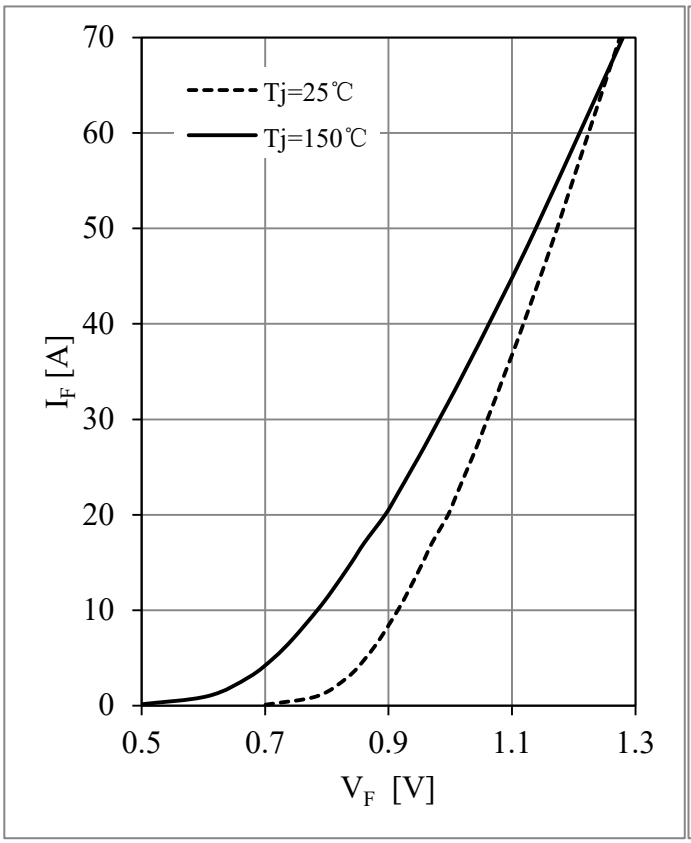


Fig 11. Diode-rectifier Forward Characteristics

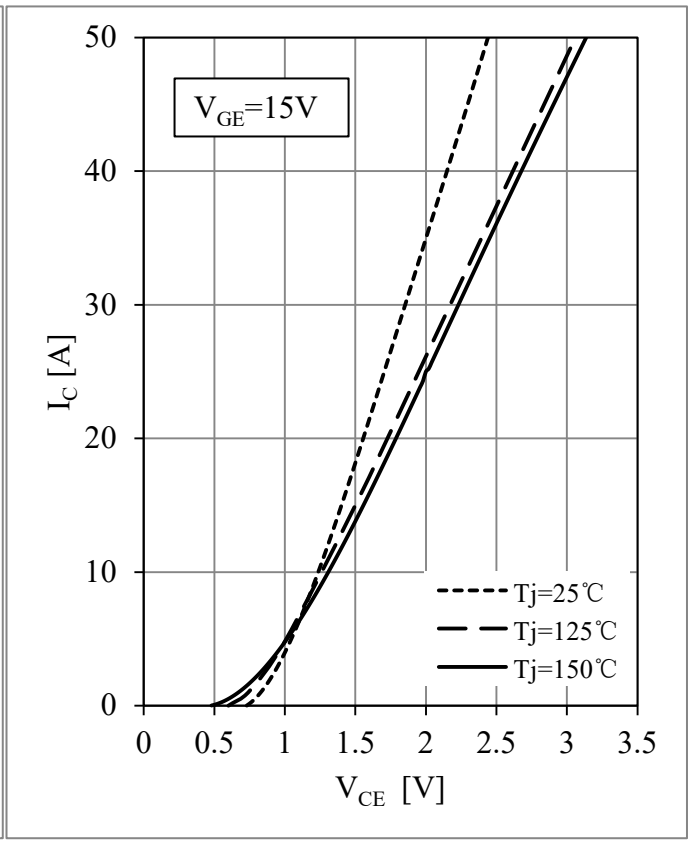


Fig 12. IGBT-brake-chopper Output Characteristics

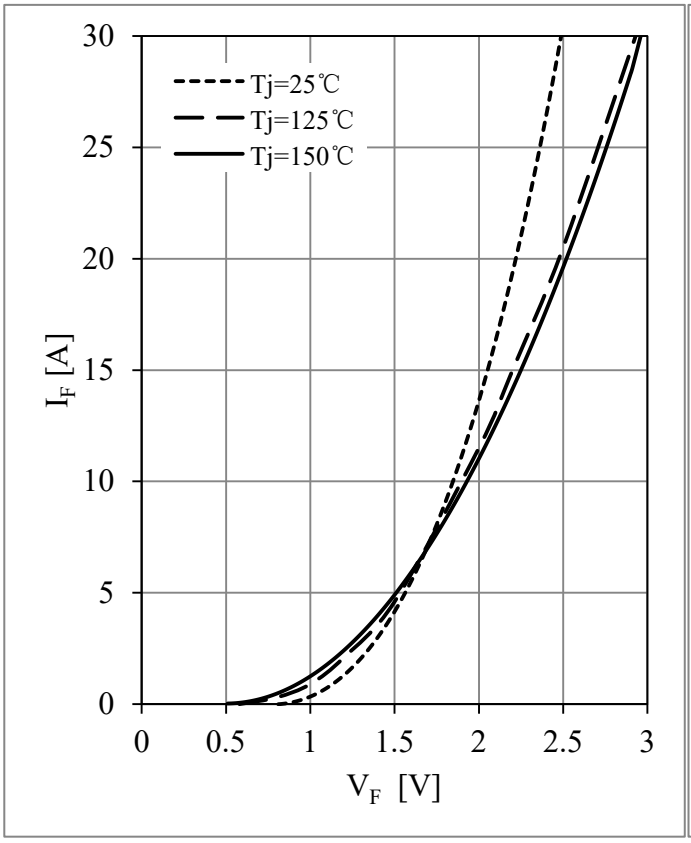


Fig 13. Diode-brake-chopper Forward Characteristics

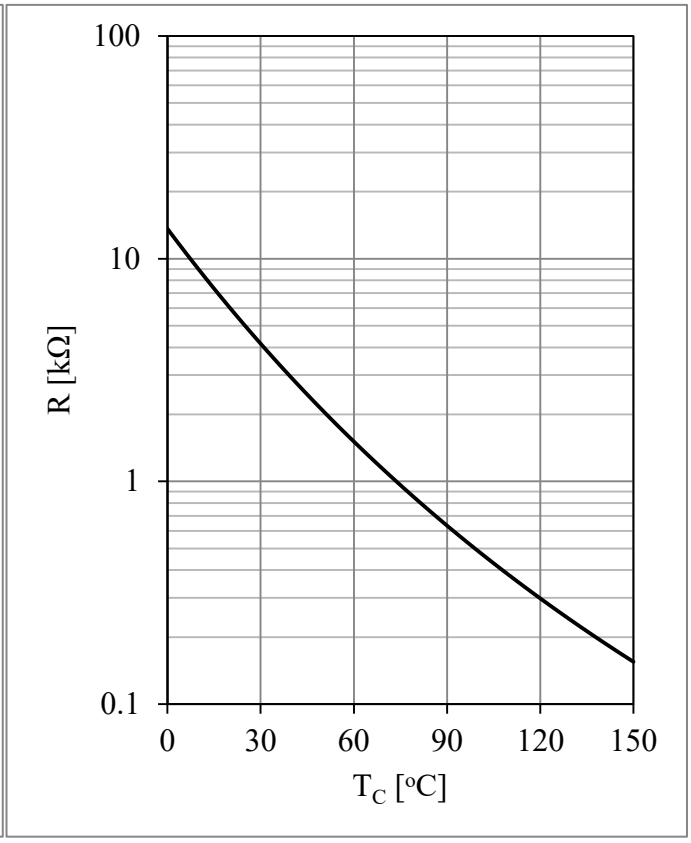
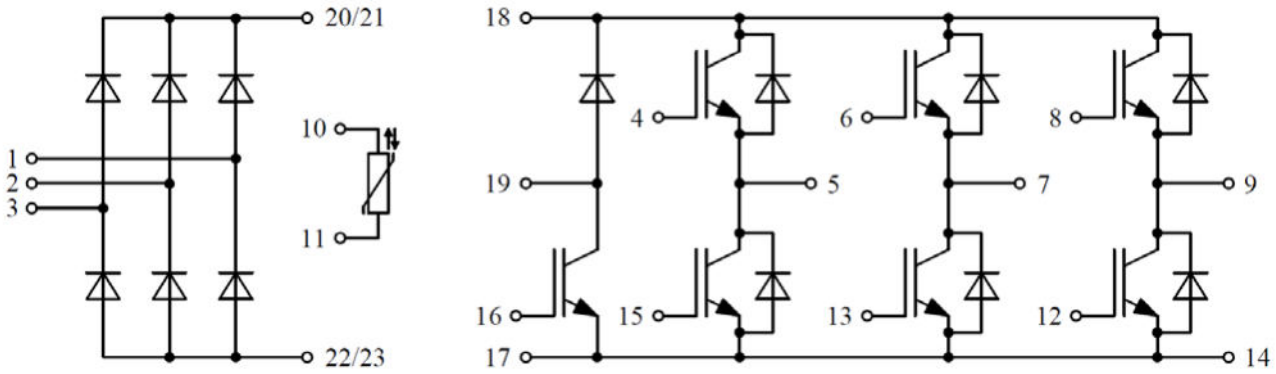


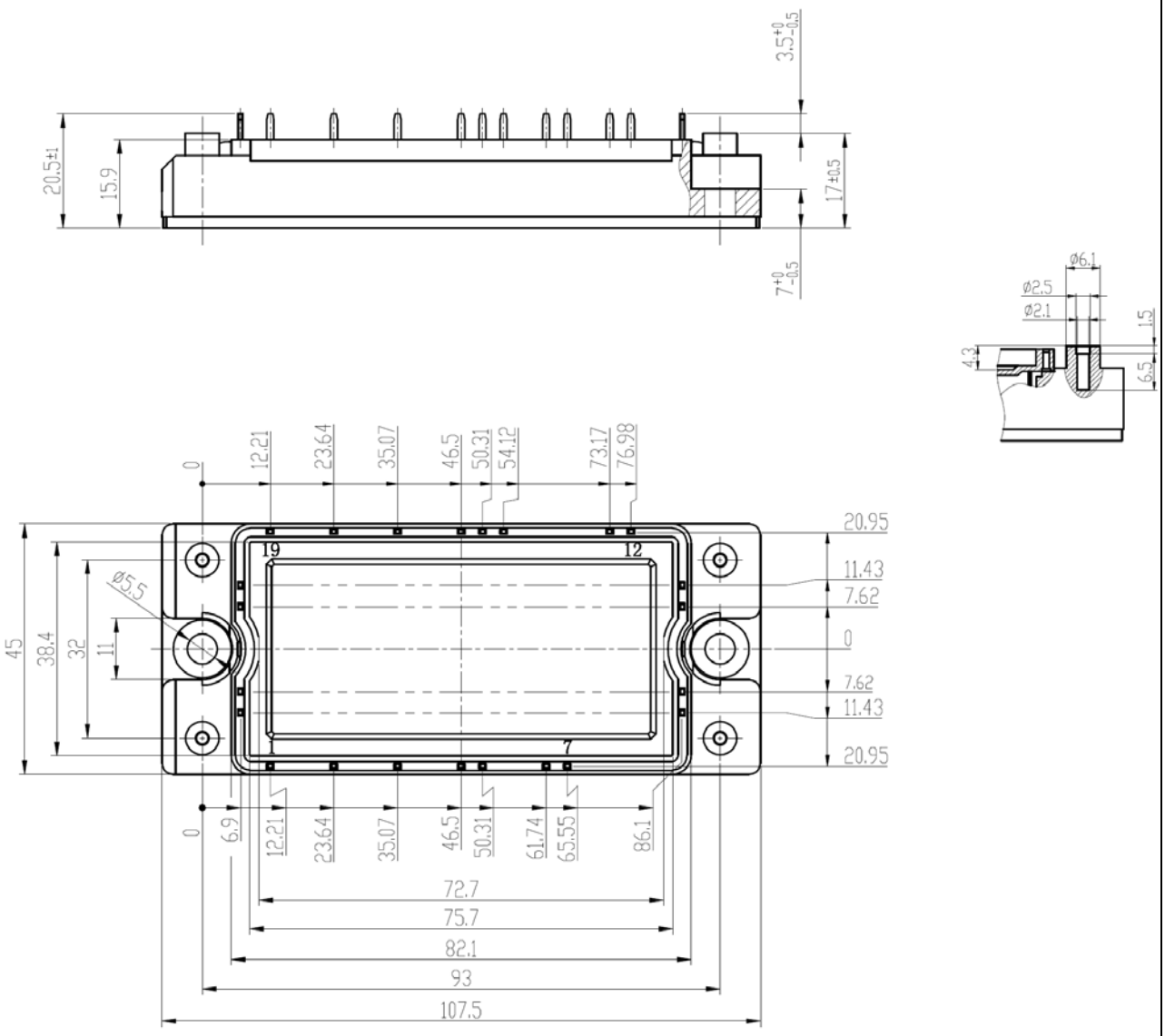
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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