STARPOWER

SEMICONDUCTOR **IGBT**

GD50PJA120L3S

1200V/50A 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.

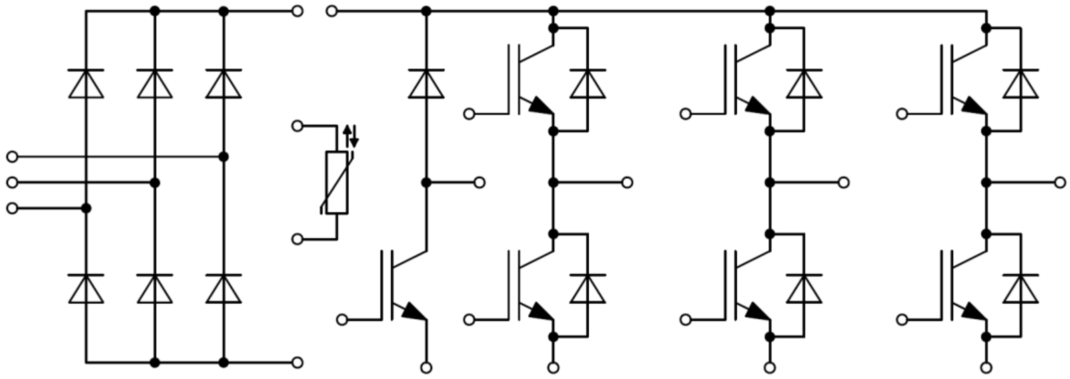
Features

- 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 heatsink 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_H=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_H=70°C	50	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	100	A

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	50	A
I_{FM}	Repetitive Peak Forward Current tp limited by T_{vjop}	100	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_{FRMSM}	Maximum RMS Forward Current per Chip @ T_H=90°C	50	A
I_{RMSM}	Maximum RMS Current at Rectifier Output @ T_H=90°C	50	A
I_{FSM}	Surge Forward Current t_p=10ms @ T_{vj}=25°C @ T_{vj}=150°C	450 370	A
I^2t	I^2t-value,t_p=10ms @ T_{vj}=25°C @ T_{vj}=150°C	1000 685	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_H=85°C	35	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	70	A

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	25	A
I_{FM}	Repetitive Peak Forward Current tp limited by T_{vjop}	50	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature(inverter,brake) Maximum Junction Temperature (rectifier)	175 150	°C
T_{vjop}	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_H=25°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°C		1.50	1.95	V
		I_C=50A,V_{GE}=15V, T_{vj}=125°C		1.70		
		I_C=50A,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		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°C		65		ns
t_r	Rise Time			46		ns
$t_{d(off)}$	Turn-Off Delay Time			304		ns
t_f	Fall Time			179		ns
E_{on}	Turn-On Switching Loss			5.27		mJ
E_{off}	Turn-Off Switching Loss			3.66		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°C		66		ns
t_r	Rise Time			49		ns
$t_{d(off)}$	Turn-Off Delay Time			361		ns
t_f	Fall Time			280		ns
E_{on}	Turn-On Switching Loss			6.46		mJ
E_{off}	Turn-Off Switching Loss			5.16		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°C		72		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			374		ns
t_f	Fall Time			303		ns
E_{on}	Turn-On Switching Loss			6.77		mJ
E_{off}	Turn-Off Switching Loss			5.45		mJ
I_{SC}	SC Data	t_P≤8μs,V_{GE}=15V, T_{vj}=150°C,V_{CC}=600V, V_{CEM}≤1200V		150		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=50A,V_{GE}=0V,T_{vj}=25°C		1.60	2.05	V
		I_F=50A,V_{GE}=0V,T_{vj}=125°C		1.65		
		I_F=50A,V_{GE}=0V,T_{vj}=150°C		1.65		
Q_r	Recovered Charge	V_R=600V,I_F=50A, -di/dt=1198A/μs,L_S=35nH, V_{GE}=-15V,T_{vj}=25°C		4.67		μC
I_{RM}	Peak Reverse Recovery Current			47		A
E_{rec}	Reverse Recovery Energy			1.39		mJ
Q_r	Recovered Charge	V_R=600V,I_F=50A, -di/dt=1076A/μs,L_S=35nH, V_{GE}=-15V,T_{vj}=125°C		7.80		μC
I_{RM}	Peak Reverse Recovery Current			49		A
E_{rec}	Reverse Recovery Energy			2.64		mJ
Q_r	Recovered Charge	V_R=600V,I_F=50A, -di/dt=1046A/μs,L_S=35nH, V_{GE}=-15V,T_{vj}=150°C		8.49		μC
I_{RM}	Peak Reverse Recovery Current			49		A
E_{rec}	Reverse Recovery Energy			2.90		mJ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=50A,V_{GE}=0V,T_{vj}=150°C		1.00		V
I_R	Reverse Current	T_{vj}=150°C,V_R=1600V			2.0	mA

IGBT-brake Characteristics T_H=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_{vj}=25°C		1.50	1.95	V
		I_C=35A,V_{GE}=15V, T_{vj}=125°C		1.70		
		I_C=35A,V_{GE}=15V, T_{vj}=150°C		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=0.70mA,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		3.09		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.22		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=22Ω,L_S=35nH, V_{GE}=±15V,T_{vj}=25°C		55		ns
t_r	Rise Time			33		ns
$t_{d(off)}$	Turn-Off Delay Time			240		ns
t_f	Fall Time			190		ns
E_{on}	Turn-On Switching Loss			3.01		mJ
E_{off}	Turn-Off Switching Loss			2.43		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=22Ω,L_S=35nH, V_{GE}=±15V,T_{vj}=125°C		56		ns
t_r	Rise Time			36		ns
$t_{d(off)}$	Turn-Off Delay Time			281		ns
t_f	Fall Time			282		ns
E_{on}	Turn-On Switching Loss			3.79		mJ
E_{off}	Turn-Off Switching Loss			3.31		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=22Ω,L_S=35nH, V_{GE}=±15V,T_{vj}=150°C		57		ns
t_r	Rise Time			38		ns
$t_{d(off)}$	Turn-Off Delay Time			292		ns
t_f	Fall Time			300		ns
E_{on}	Turn-On Switching Loss			4.10		mJ
E_{off}	Turn-Off Switching Loss			3.54		mJ
I_{SC}	SC Data	t_P≤8μs,V_{GE}=15V, T_{vj}=150°C,V_{CC}=600V, V_{CEM}≤1200V		105		A

Diode-brake Characteristics T_H=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_{vj}=25°C		1.60	2.05	V
		I_F=25A,V_{GE}=0V,T_{vj}=125°C		1.65		
		I_F=25A,V_{GE}=0V,T_{vj}=150°C		1.65		

NTC Characteristics T_H=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_H=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		30		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance,Terminal to Chip		5.00 6.00		mΩ
R_{thJH}	Junction-to-Heatsink (per IGBT-inverter) Junction-to-Heatsink (per Diode-inverter) Junction-to-Heatsink (per Diode-rectifier) Junction-to-Heatsink (per IGBT-brake) Junction-to-Heatsink (per Diode-brake)		0.910 1.200 1.240 1.090 2.020		K/W
F	Mounting Force Per Clamp	40		80	N
G	Weight of Module		39		g

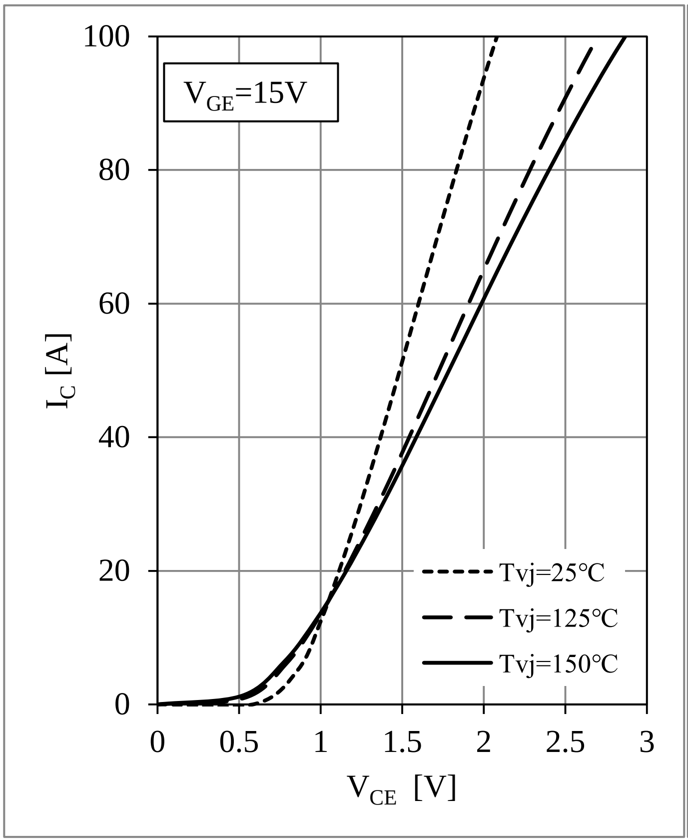


Fig 1. IGBT-inverter Output Characteristics

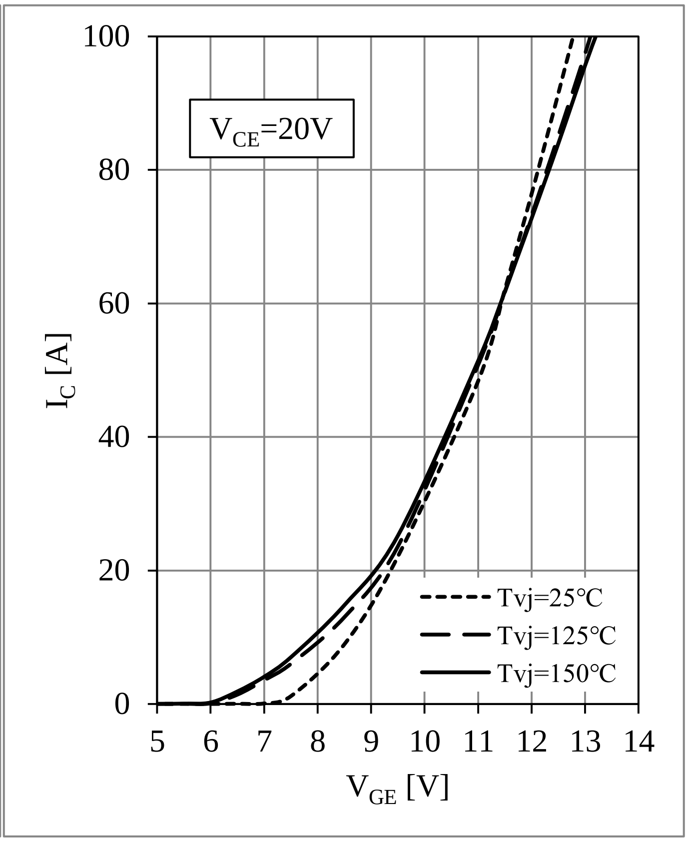


Fig 2. IGBT-inverter Transfer Characteristics

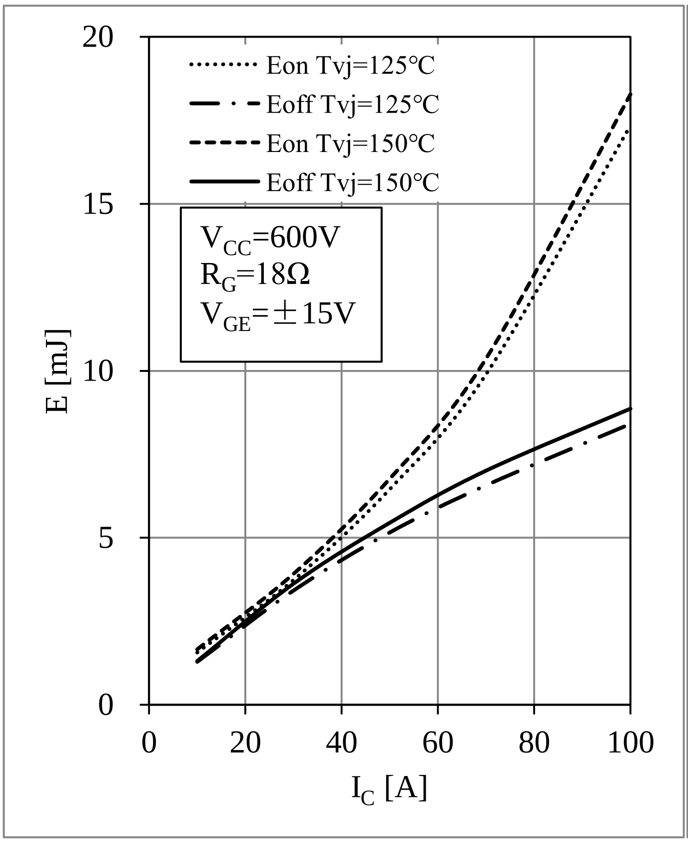


Fig 3. IGBT-inverter Switching Loss vs. I_C

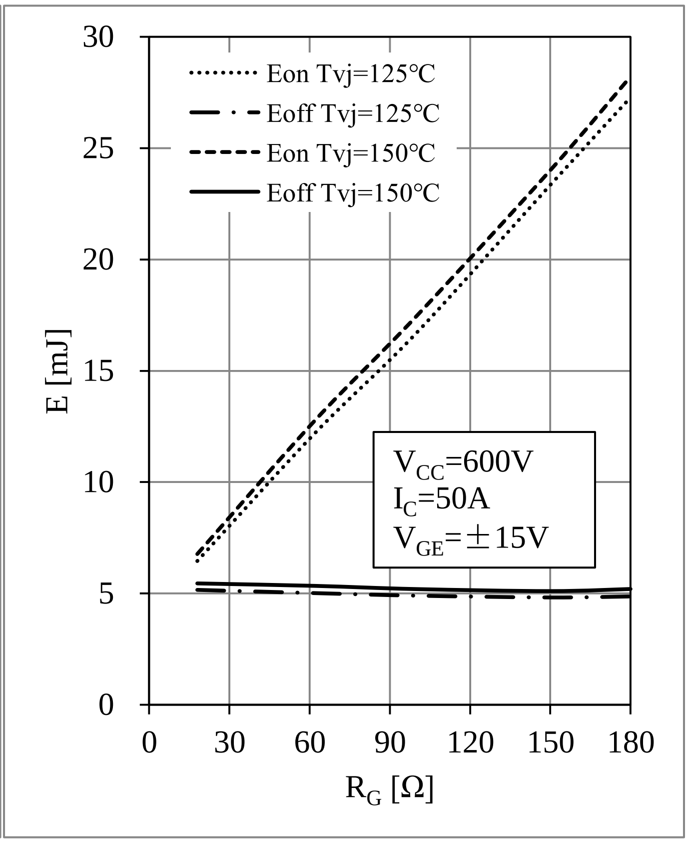


Fig 4. IGBT-inverter Switching Loss vs. R_G

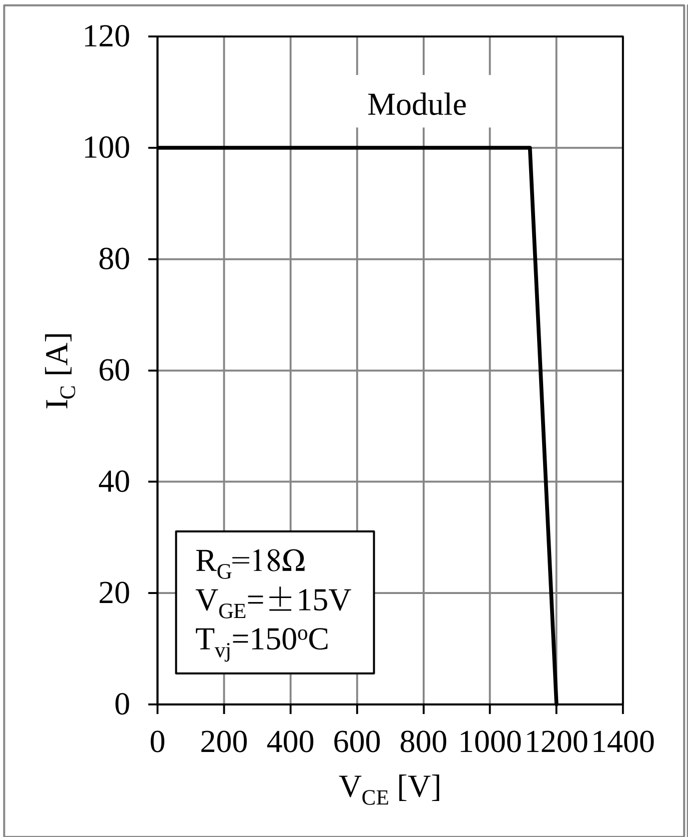


Fig 5. IGBT-inverter RBSOA

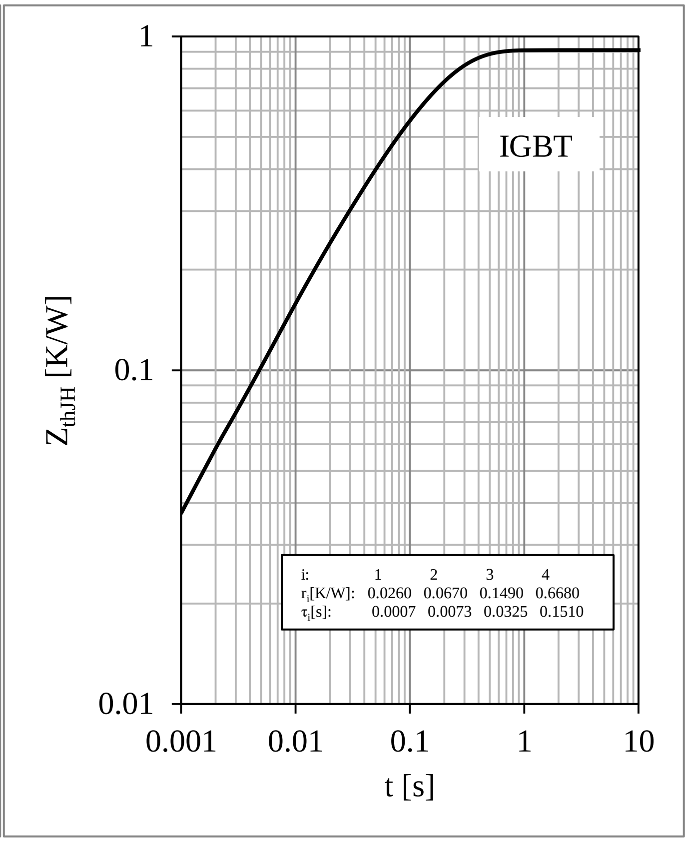


Fig 6. IGBT-inverter Transient Thermal Impedance

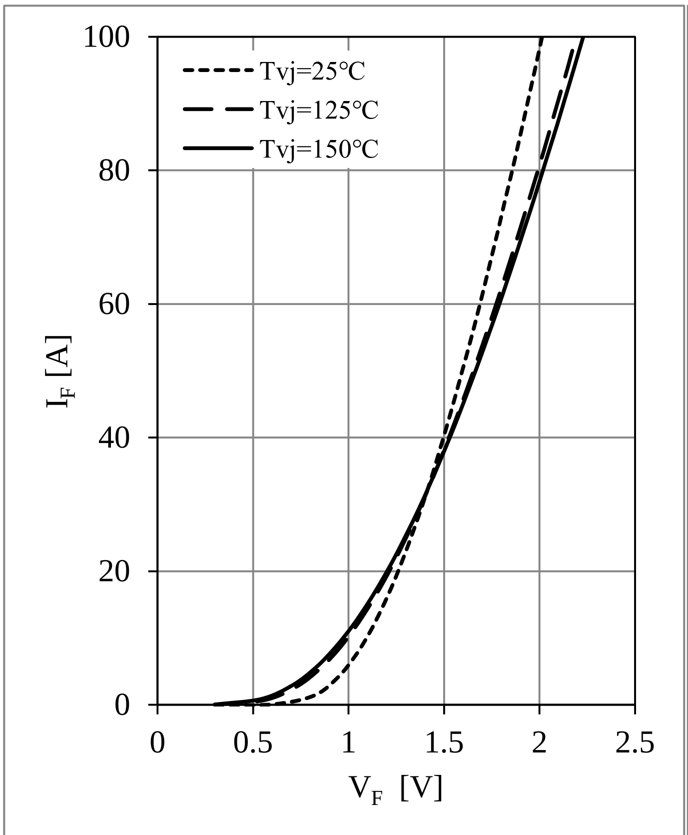


Fig 7. Diode-inverter Forward Characteristics

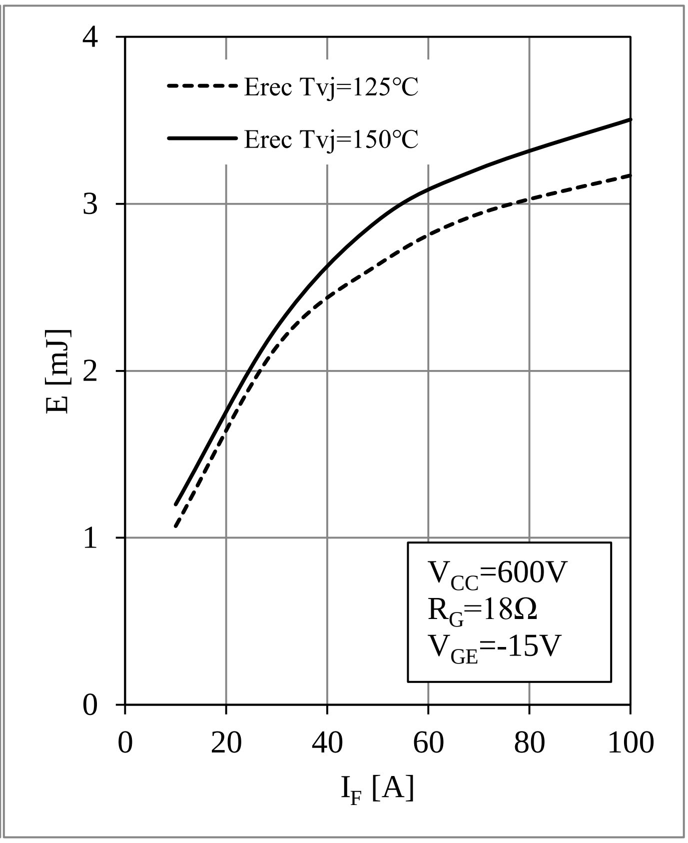


Fig 8. Diode-inverter Switching Loss vs. I_F

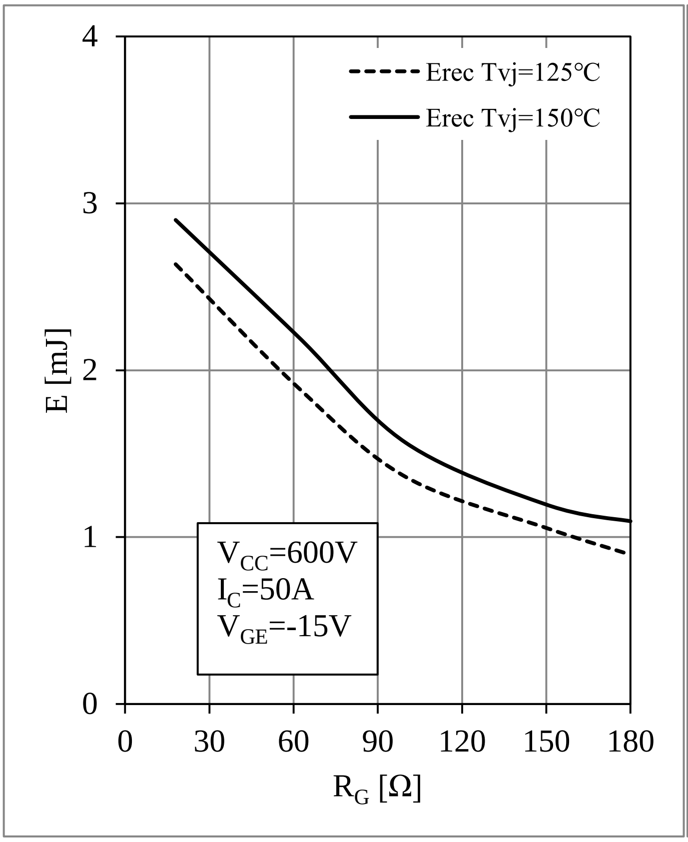


Fig 9. Diode-inverter Switching Loss vs. R_G

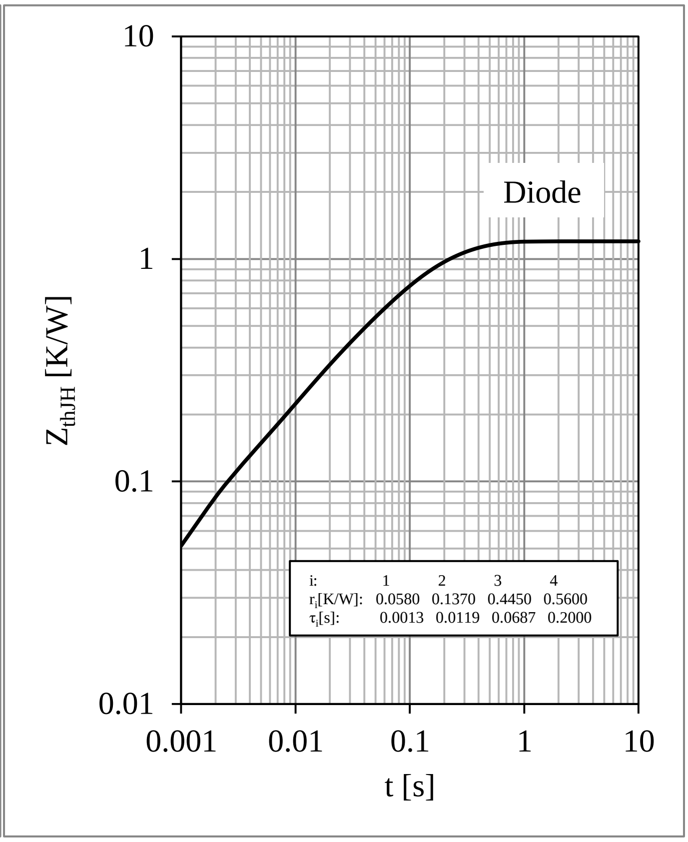


Fig 10. Diode-inverter Transient Thermal Impedance

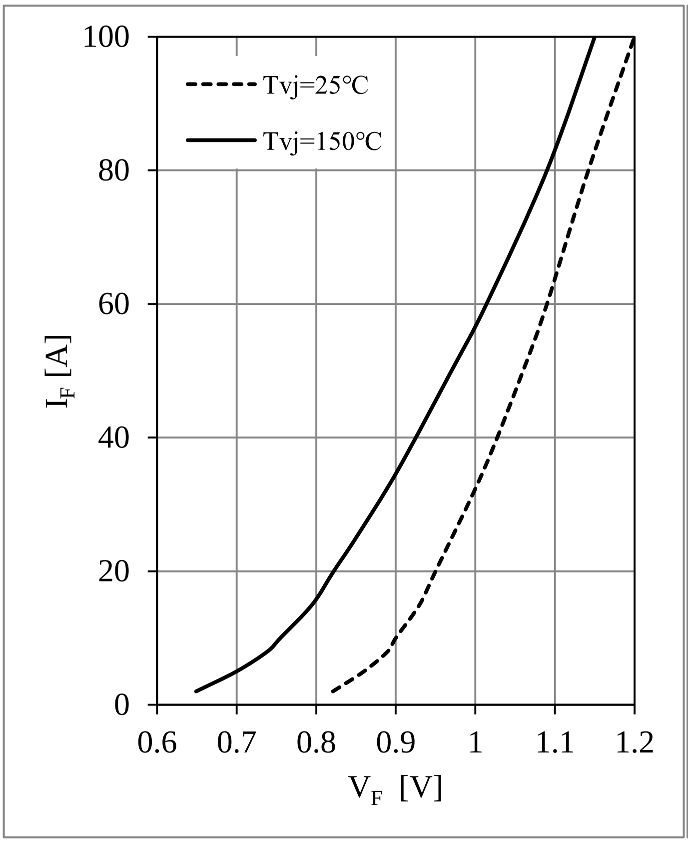


Fig 11. Diode-rectifier Forward Characteristics

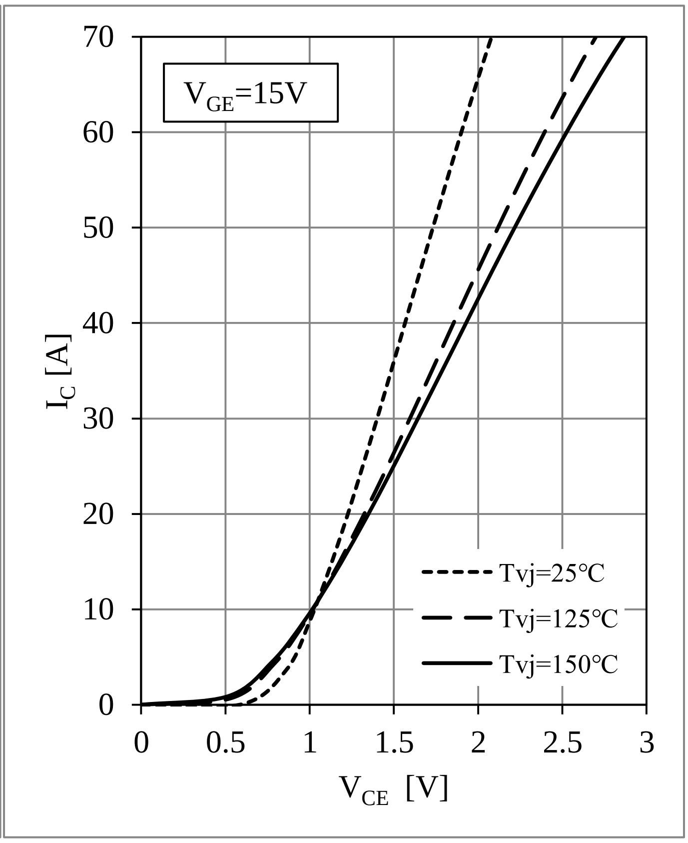
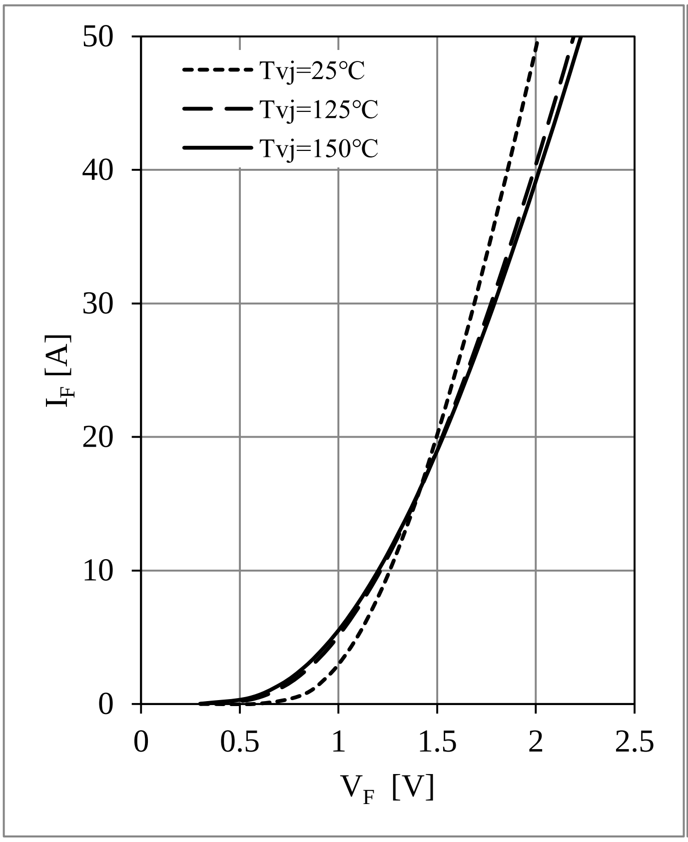


Fig 12. IGBT-brake-chopper Output Characteristics



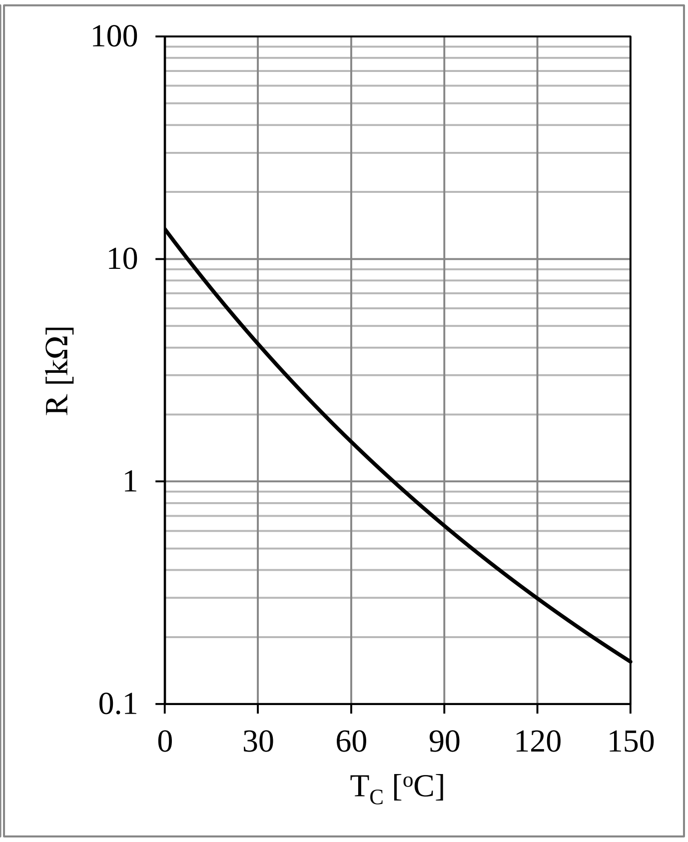
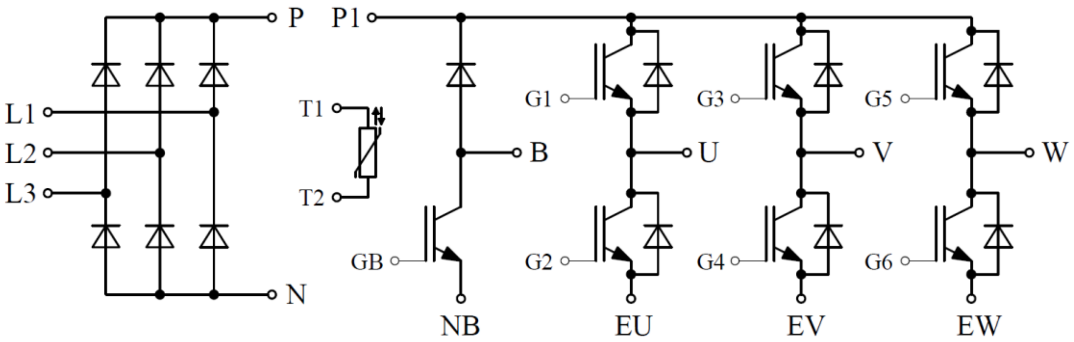


Fig 13. Diode-brake-chopper Forward Characteristics

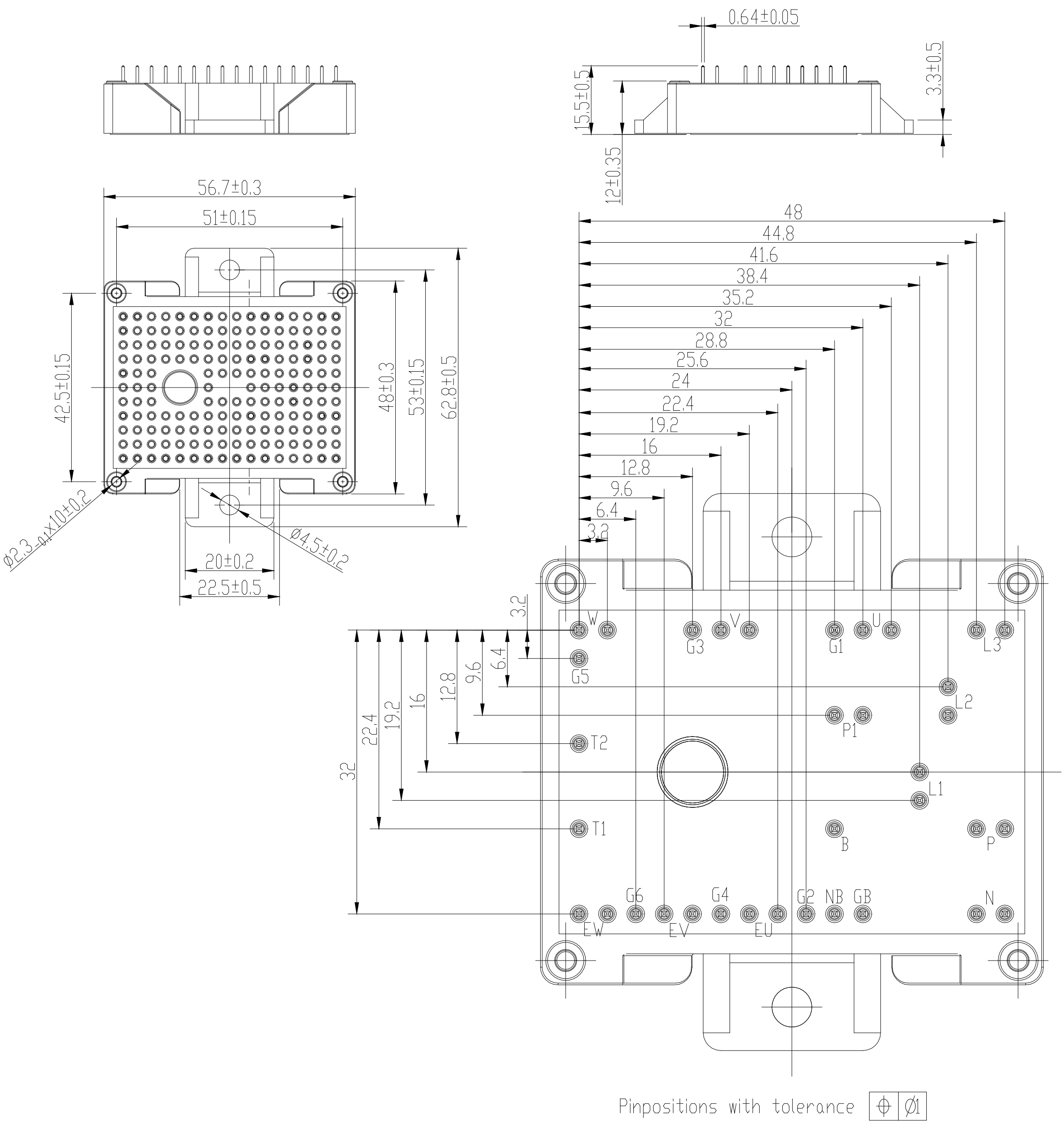
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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