

STARPOWER

SEMICONDUCTOR

IGBT

GD25PJA120L2S

1200V/25A 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.

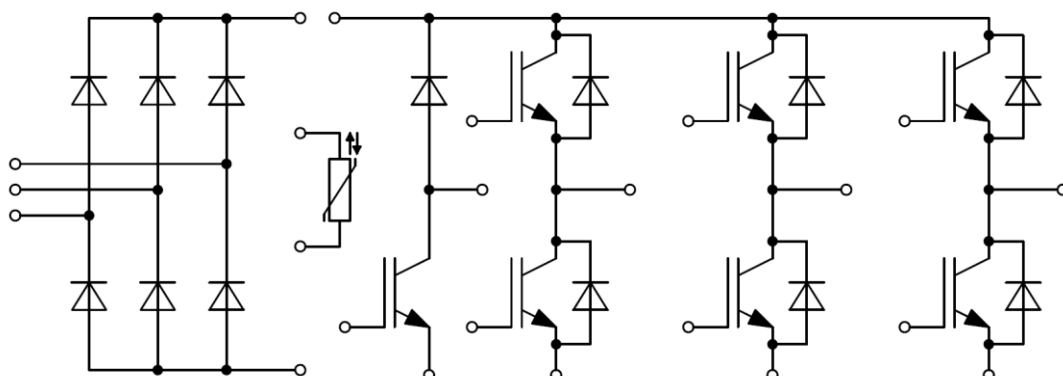
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 8 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 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 $T_H=25^{\circ}\text{C}$ 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 @ $T_H=85^{\circ}\text{C}$	25	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	50	A

Diode-inverter

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

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_{FRMSM}	Maximum RMS Forward Current per Chip @ $T_H=100^{\circ}\text{C}$	25	A
I_{RMSM}	Maximum RMS Current at Rectifier Output @ $T_H=100^{\circ}\text{C}$	25	A
I_{FSM}	Surge Forward Current $t_p=10\text{ms}$ @ $T_{vj}=25^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	300 245	A
I^2t	I^2t -value, $t_p=10\text{ms}$ @ $T_{vj}=25^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	450 300	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 @ $T_H=85^{\circ}\text{C}$	25	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	50	A

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	10	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	20	A

Module

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

Note: $T_{vjop} > 150^{\circ}\text{C}$ is allowed for operation at overload conditions.

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=25\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.50	1.95	V
		$I_C=25\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.70		
		$I_C=25\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.50\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.4	6.2	7.0	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			50	μA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			100	nA
R_{Gint}	Internal Gate Resistance			0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		2.21		nF
C_{res}	Reverse Transfer Capacitance			0.02		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.16		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=25\text{A}, R_G=20\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		27		ns
t_r	Rise Time			33		ns
$t_{d(off)}$	Turn-Off Delay Time			209		ns
t_f	Fall Time			203		ns
E_{on}	Turn-On Switching Loss			2.31		mJ
E_{off}	Turn-Off Switching Loss			1.77		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=25\text{A}, R_G=20\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^{\circ}\text{C}$		29		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			252		ns
t_f	Fall Time			295		ns
E_{on}	Turn-On Switching Loss			3.00		mJ
E_{off}	Turn-Off Switching Loss			2.46		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=25\text{A}, R_G=20\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^{\circ}\text{C}$		30		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			263		ns
t_f	Fall Time			323		ns
E_{on}	Turn-On Switching Loss			3.06		mJ
E_{off}	Turn-Off Switching Loss			2.59		mJ
I_{SC}	SC Data	$t_p \leq 8\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=600\text{V}, V_{CEM} \leq 1200\text{V}$		75		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=25\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.60	2.05	V
		$I_F=25\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.65		
		$I_F=25\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		1.65		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=25\text{A},$ $-di/dt=1232\text{A}/\mu\text{s}, L_S=50\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=25^{\circ}\text{C}$		2.38		μC
I_{RM}	Peak Reverse Recovery Current			22		A
E_{rec}	Reverse Recovery Energy			0.73		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=25\text{A},$ $-di/dt=1057\text{A}/\mu\text{s}, L_S=50\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=125^{\circ}\text{C}$		3.88		μC
I_{RM}	Peak Reverse Recovery Current			23		A
E_{rec}	Reverse Recovery Energy			1.34		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=25\text{A},$ $-di/dt=1000\text{A}/\mu\text{s}, L_S=50\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=150^{\circ}\text{C}$		4.31		μC
I_{RM}	Peak Reverse Recovery Current			23		A
E_{rec}	Reverse Recovery Energy			1.53		mJ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=25\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		0.90		V
I_R	Reverse Current	$T_{vj}=150^{\circ}\text{C}, V_R=1600\text{V}$			3.0	mA

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=25\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.50	1.95	V
		$I_C=25\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.70		
		$I_C=25\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.50\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.4	6.2	7.0	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			50	μA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			100	nA
R_{Gint}	Internal Gate Resistance			0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		2.21		nF
C_{res}	Reverse Transfer Capacitance			0.02		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.16		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=25\text{A}, R_G=20\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		27		ns
t_r	Rise Time			33		ns
$t_{d(off)}$	Turn-Off Delay Time			209		ns
t_f	Fall Time			203		ns
E_{on}	Turn-On Switching Loss			2.31		mJ
E_{off}	Turn-Off Switching Loss			1.77		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=25\text{A}, R_G=20\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^{\circ}\text{C}$		29		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			252		ns
t_f	Fall Time			295		ns
E_{on}	Turn-On Switching Loss			3.00		mJ
E_{off}	Turn-Off Switching Loss			2.46		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=25\text{A}, R_G=20\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^{\circ}\text{C}$		30		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			263		ns
t_f	Fall Time			323		ns
E_{on}	Turn-On Switching Loss			3.06		mJ
E_{off}	Turn-Off Switching Loss			2.59		mJ
I_{SC}	SC Data	$t_p \leq 8\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=600\text{V}, V_{CEM} \leq 1200\text{V}$		75		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=10\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.60	2.05	V
		$I_F=10\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.65		
		$I_F=10\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		1.65		

NTC Characteristics $T_H=25^{\circ}\text{C}$ 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
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		3433		K

Module Characteristics $T_H=25^{\circ}\text{C}$ 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		8.00 6.00		m Ω
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)		1.550 2.040 1.540 1.550 2.450		K/W
F	Mounting Force Per Clamp	20		50	N
G	Weight of Module		24		g

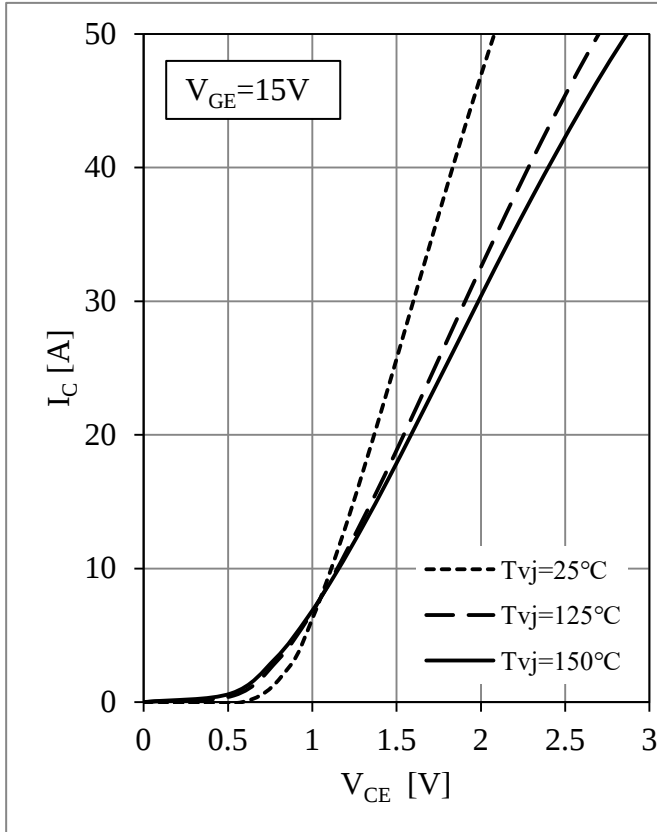


Fig 1. IGBT-inverter Output Characteristics

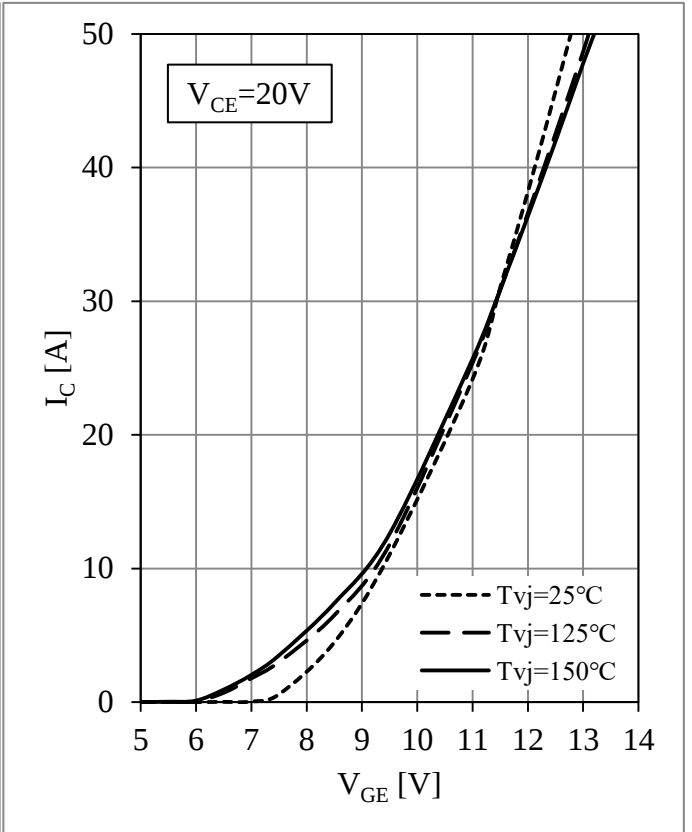
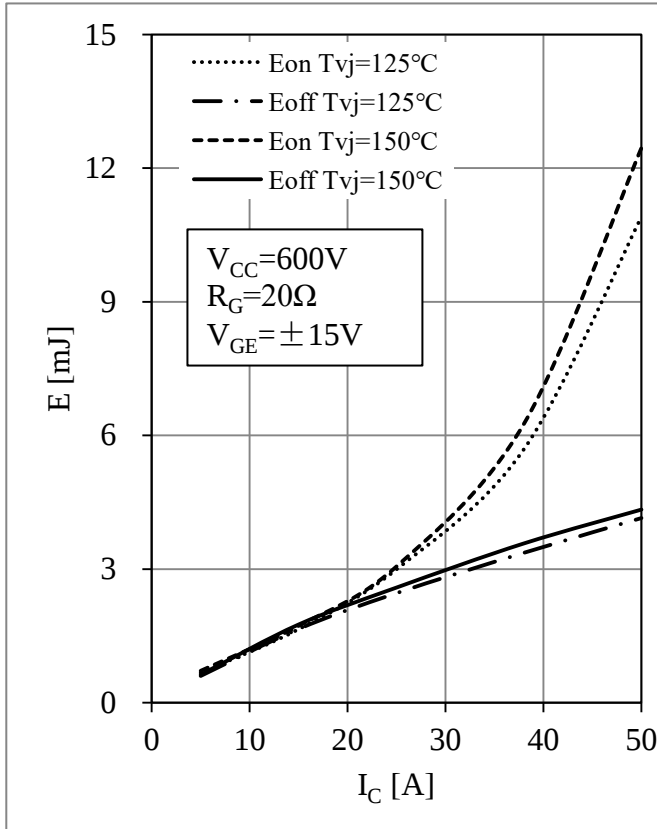
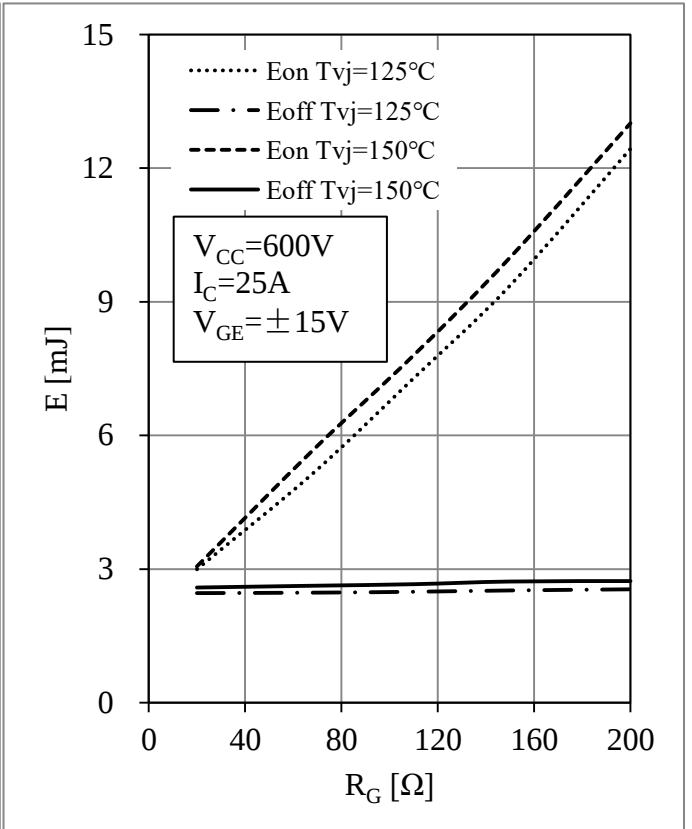


Fig 2. IGBT-inverter Transfer Characteristics

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

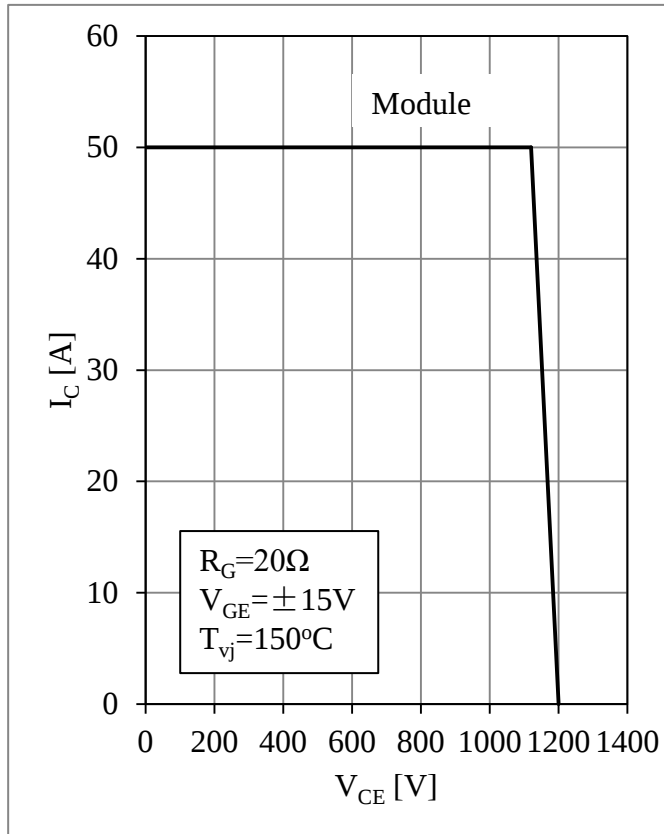


Fig 5. IGBT-inverter RBSOA

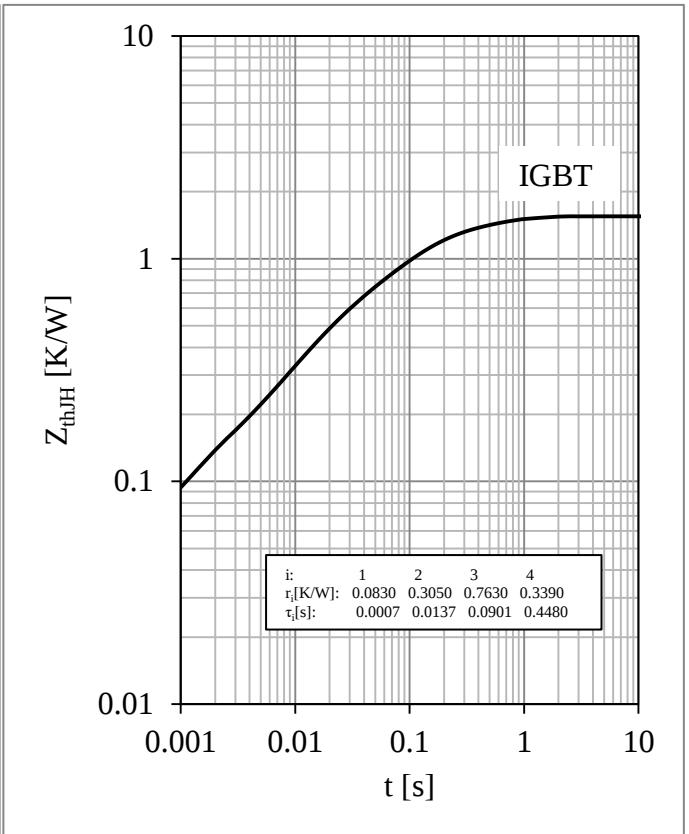


Fig 6. IGBT-inverter Transient Thermal Impedance

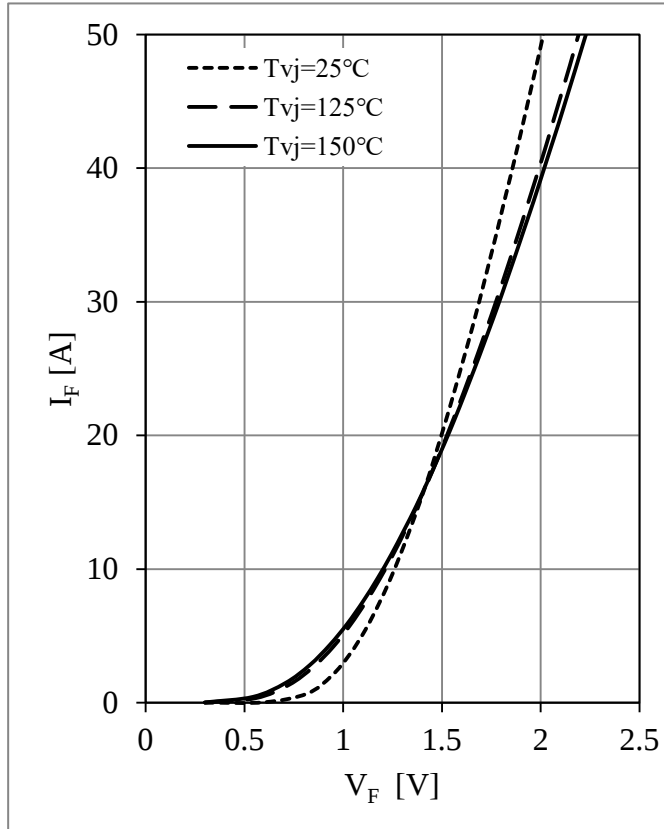
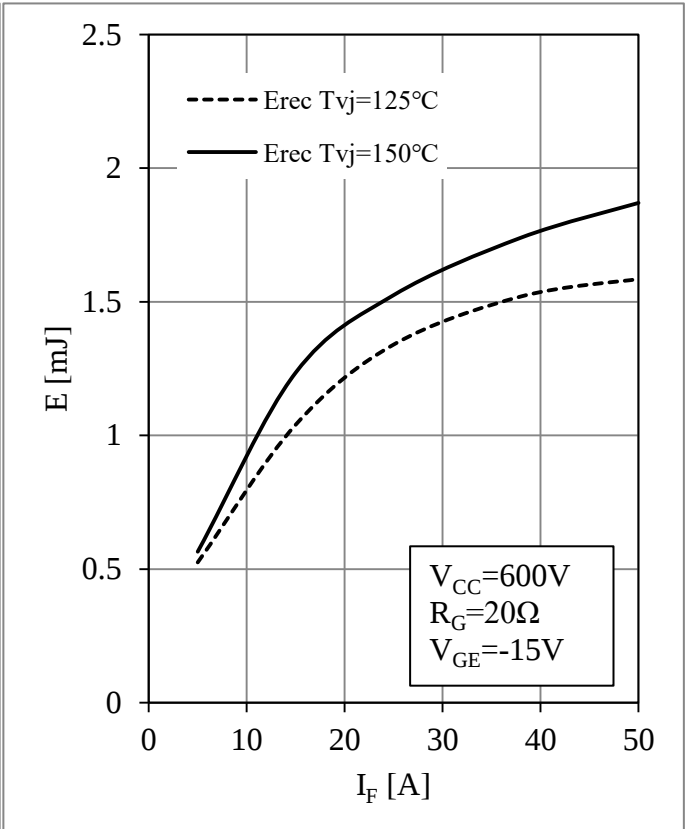


Fig 7. Diode-inverter Forward Characteristics

Fig 8. Diode-inverter Switching Loss vs. I_F

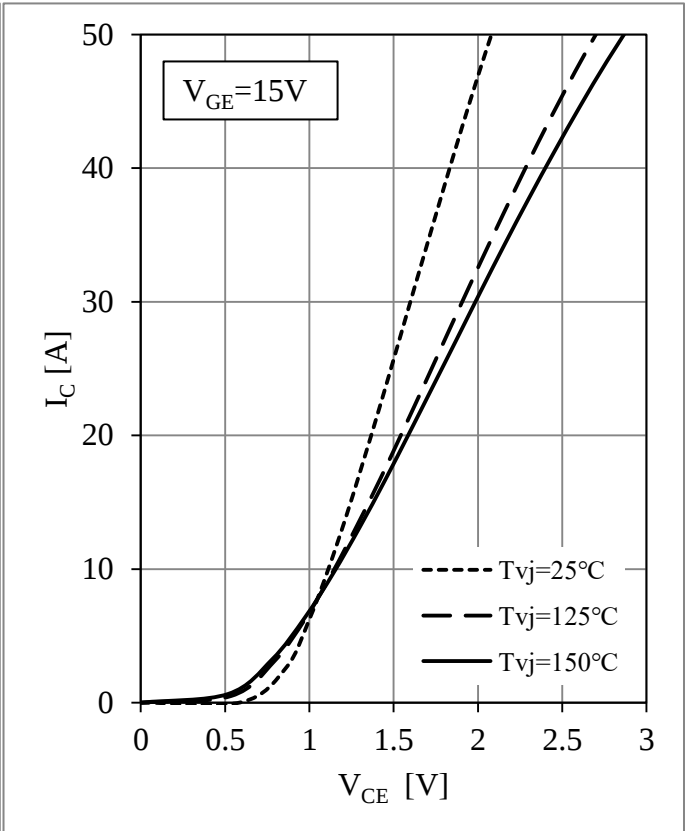
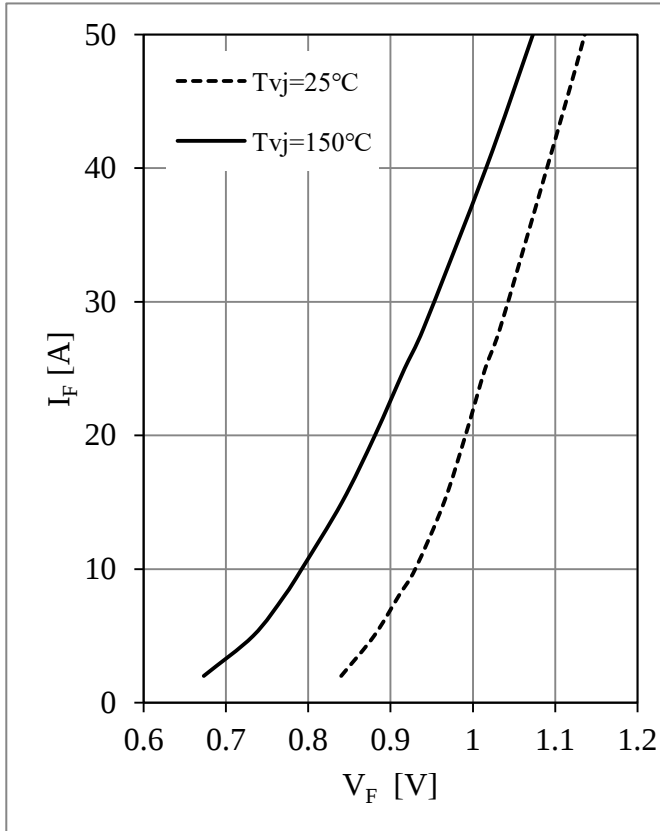
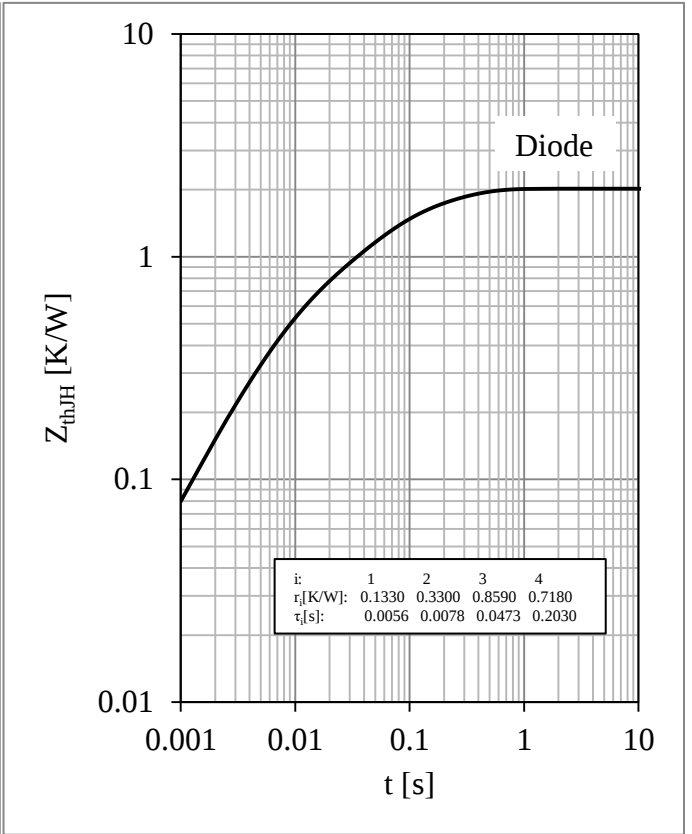
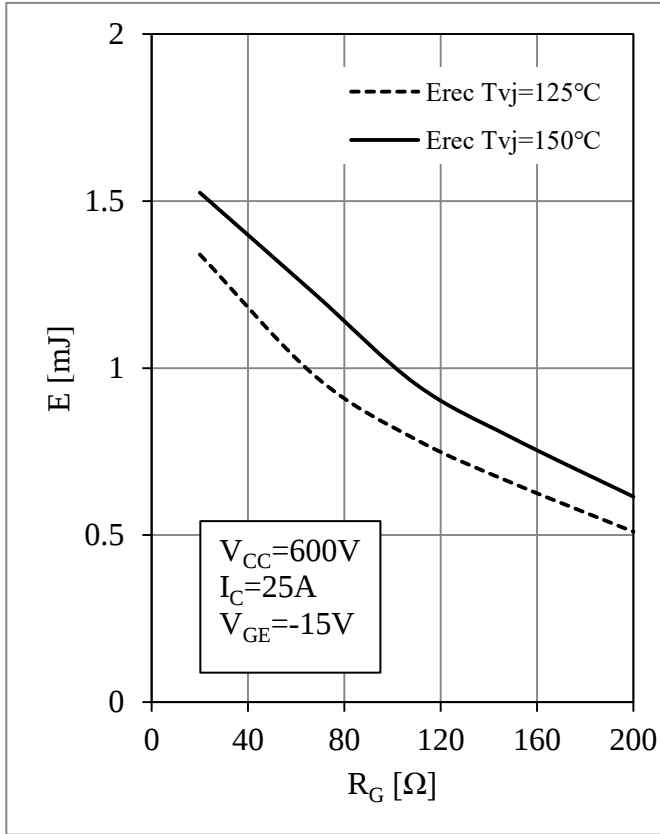


Fig 11. Diode-rectifier Forward Characteristics

Fig 12. IGBT-brake-chopper Output Characteristics

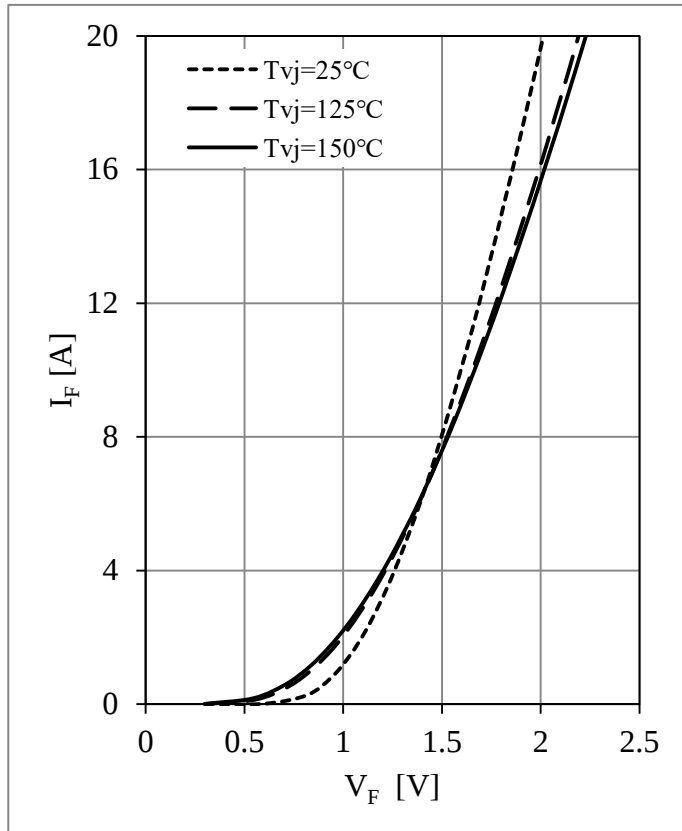


Fig 13. Diode-brake-chopper Forward Characteristics

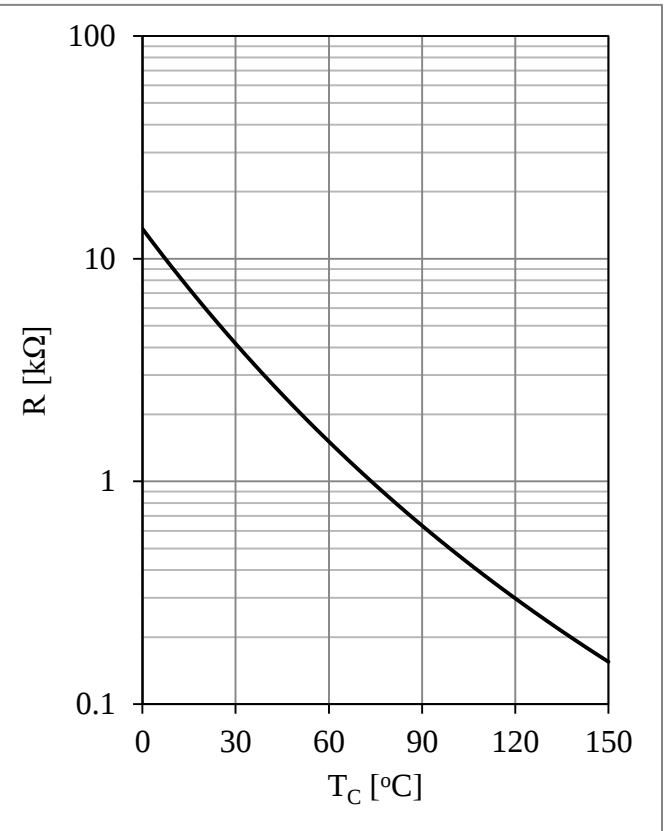
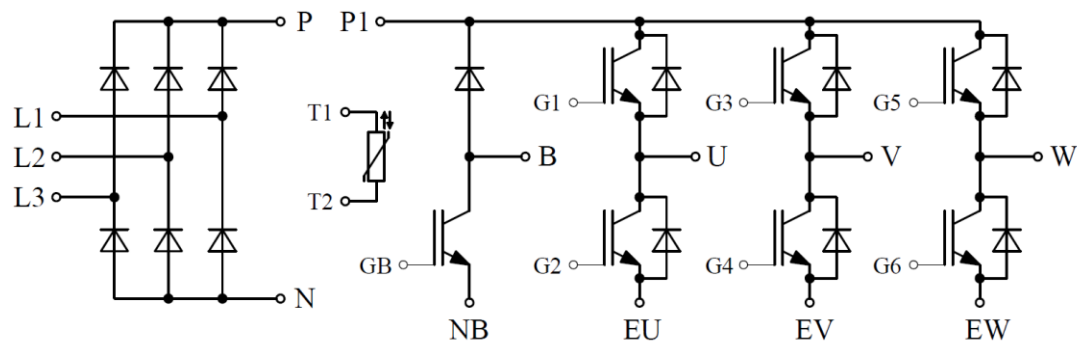


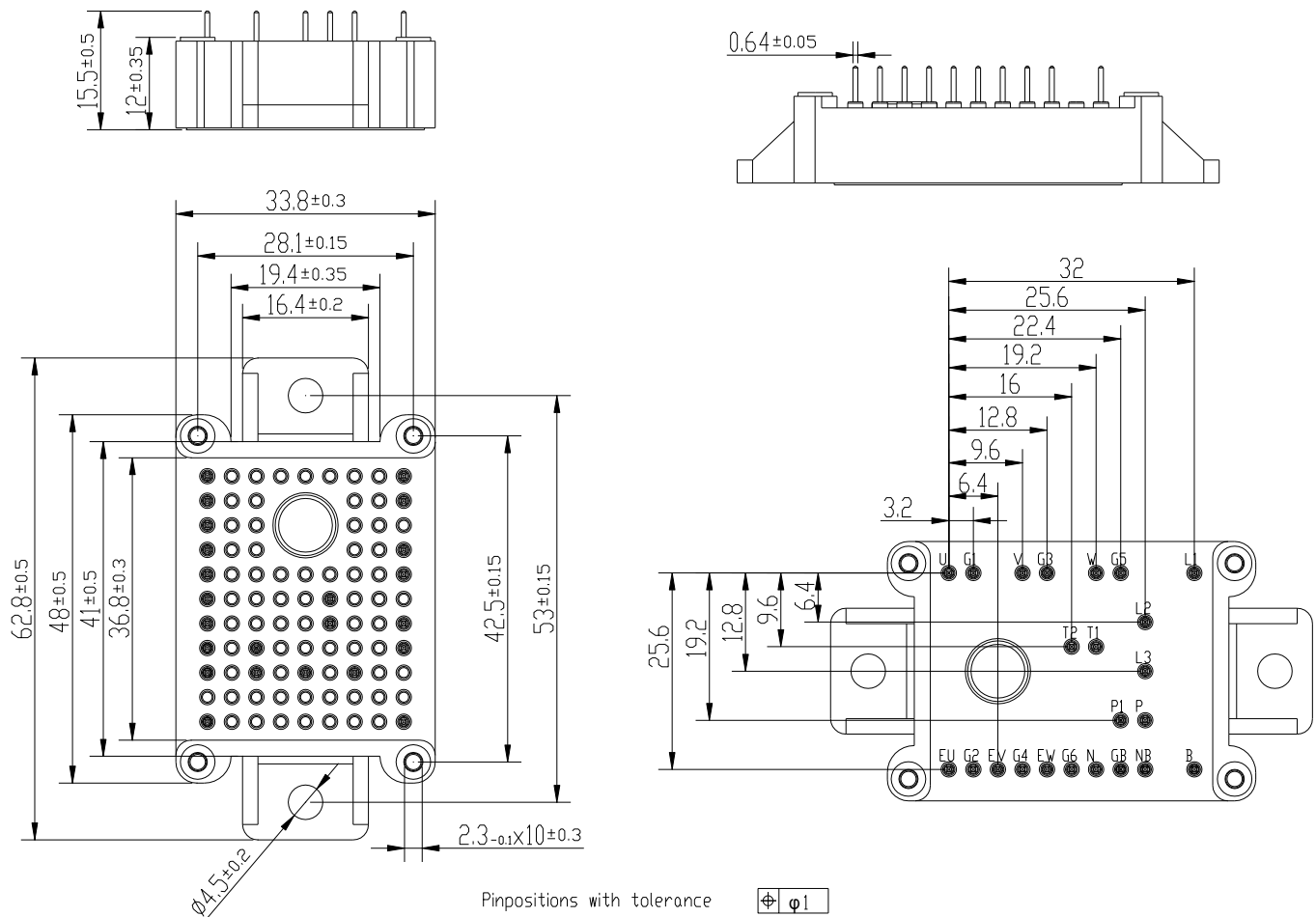
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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