

STARPOWER

SEMICONDUCTOR

IGBT

GD35PJX120L3SF

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.

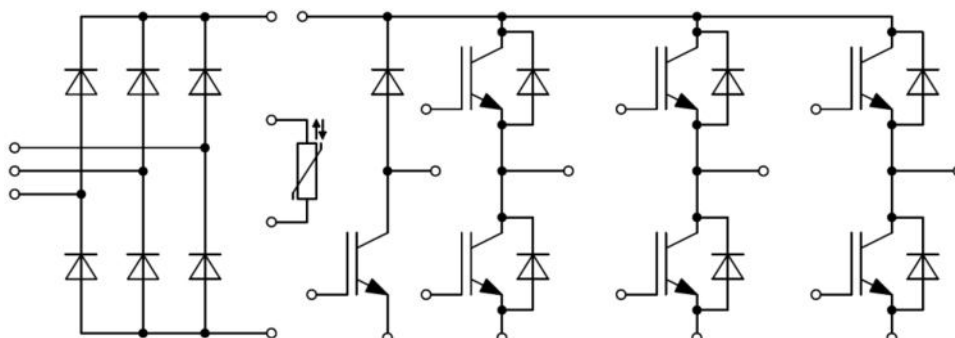
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 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 heatsink using DBC technology
- PressFIT contact 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 @ $T_C=25^{\circ}\text{C}$	70	A
	@ $T_C=100^{\circ}\text{C}$	35	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	70	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	319	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 $t_p=1\text{ms}$	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 $t_p=10\text{ms}$ @ $T_j=25^{\circ}\text{C}$	450	A
	@ $T_j=150^{\circ}\text{C}$	370	
I^2t	I^2t -value, $t_p=10\text{ms}$ @ $T_j=25^{\circ}\text{C}$ @ $T_j=150^{\circ}\text{C}$	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 @ $T_C=25^{\circ}\text{C}$	70	A
	@ $T_C=100^{\circ}\text{C}$	35	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	70	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	309	W

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_{jmax}	Maximum Junction Temperature(inverter,brake)	175	$^{\circ}\text{C}$
	Maximum Junction Temperature (rectifier)	150	
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, $f=50\text{Hz}$, $t=1\text{min}$	2500	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	$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.75	2.20	V
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.00		
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.05		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.40\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.6	6.2	6.8	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			0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		3.62		nF
C_{res}	Reverse Transfer Capacitance			0.10		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.27		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		22		ns
t_r	Rise Time			11		ns
$t_{d(off)}$	Turn-Off Delay Time			235		ns
t_f	Fall Time			112		ns
E_{on}	Turn-On Switching Loss			1.62		mJ
E_{off}	Turn-Off Switching Loss			1.96		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		22		ns
t_r	Rise Time			14		ns
$t_{d(off)}$	Turn-Off Delay Time			289		ns
t_f	Fall Time			166		ns
E_{on}	Turn-On Switching Loss			2.48		mJ
E_{off}	Turn-Off Switching Loss			2.84		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		22		ns
t_r	Rise Time			15		ns
$t_{d(off)}$	Turn-Off Delay Time			303		ns
t_f	Fall Time			196		ns
E_{on}	Turn-On Switching Loss			2.70		mJ
E_{off}	Turn-Off Switching Loss			3.14		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		140		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	$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.85	2.30	V
		$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.90		
		$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.95		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=2500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		4.5		μC
I_{RM}	Peak Reverse Recovery Current			93		A
E_{rec}	Reverse Recovery Energy			1.47		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=2500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		7.8		μC
I_{RM}	Peak Reverse Recovery Current			98		A
E_{rec}	Reverse Recovery Energy			2.65		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=2500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		8.6		μC
I_{RM}	Peak Reverse Recovery Current			101		A
E_{rec}	Reverse Recovery Energy			2.89		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	$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		0.90		V
I_R	Reverse Current	$T_j=150^{\circ}\text{C}, V_R=1600\text{V}$			3.0	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	$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.75	2.20	V
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.00		
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.05		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.40\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.6	6.2	6.8	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			0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		3.62		nF
C_{res}	Reverse Transfer Capacitance			0.10		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.27		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		22		ns
t_r	Rise Time			11		ns
$t_{d(off)}$	Turn-Off Delay Time			235		ns
t_f	Fall Time			112		ns
E_{on}	Turn-On Switching Loss			1.62		mJ
E_{off}	Turn-Off Switching Loss			1.96		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		22		ns
t_r	Rise Time			14		ns
$t_{d(off)}$	Turn-Off Delay Time			289		ns
t_f	Fall Time			166		ns
E_{on}	Turn-On Switching Loss			2.48		mJ
E_{off}	Turn-Off Switching Loss			2.84		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		22		ns
t_r	Rise Time			15		ns
$t_{d(off)}$	Turn-Off Delay Time			303		ns
t_f	Fall Time			196		ns
E_{on}	Turn-On Switching Loss			2.70		mJ
E_{off}	Turn-Off Switching Loss			3.14		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		140		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	$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.85	2.30	V
		$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.90		
		$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.95		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=10\text{A},$ $-di/dt=490\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		1.0		μC
I_{RM}	Peak Reverse Recovery Current			14		A
E_{rec}	Reverse Recovery Energy			0.24		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=10\text{A},$ $-di/dt=490\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		2.0		μC
I_{RM}	Peak Reverse Recovery Current			12		A
E_{rec}	Reverse Recovery Energy			0.51		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=10\text{A},$ $-di/dt=490\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		2.2		μC
I_{RM}	Peak Reverse Recovery Current			9		A
E_{rec}	Reverse Recovery Energy			0.58		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		$\text{k}\Omega$
$\Delta R/R$	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 $T_C=25^{\circ}\text{C}$ 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		5.00 6.00		m Ω
R_{thJC}	Junction-to-Case (per IGBT-inverter)		0.427	0.470	K/W
	Junction-to-Case (per Diode-inverter)		0.685	0.753	
	Junction-to-Case (per Diode-rectifier)		0.624	0.686	
	Junction-to-Case (per IGBT-brake)		0.440	0.484	
	Junction-to-Case (per Diode-brake)		1.494	1.643	
R_{thCH}	Case-to-Heatsink (per IGBT-inverter)		0.559		K/W
	Case-to-Heatsink (per Diode-inverter)		0.896		
	Case-to-Heatsink (per Diode-rectifier)		0.816		
	Case-to-Heatsink (per IGBT-brake)		0.576		
	Case-to-Heatsink (per Diode-brake)		1.955		
	Case-to-Heatsink (per Module)		0.037		
F	Mounting Force Per Clamp	40		80	N
G	Weight of Module		39		g

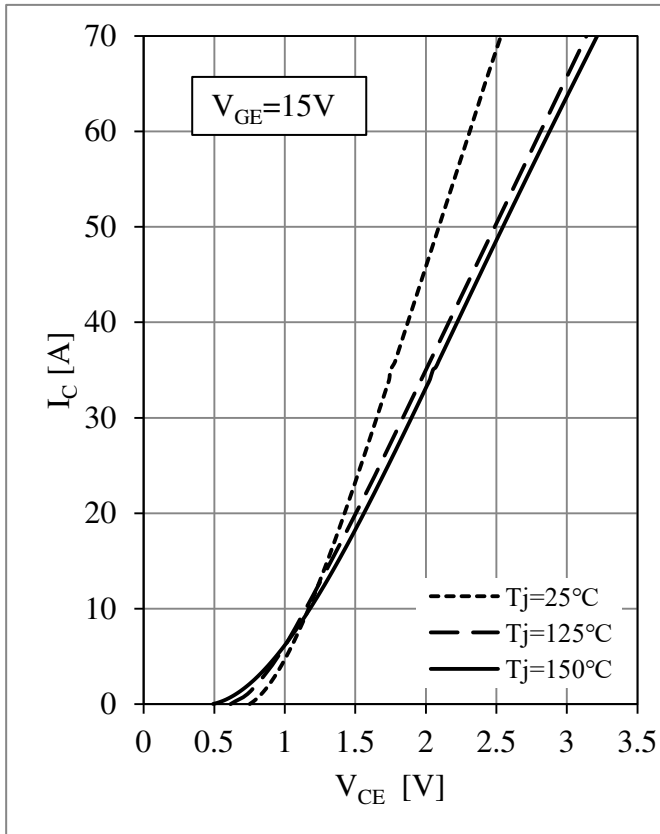


Fig 1. IGBT-inverter Output Characteristics

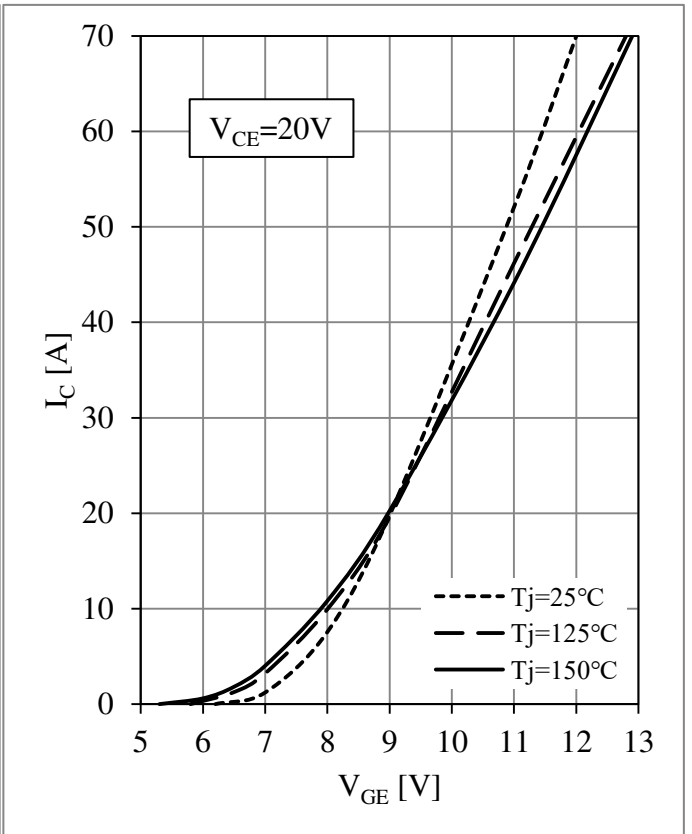
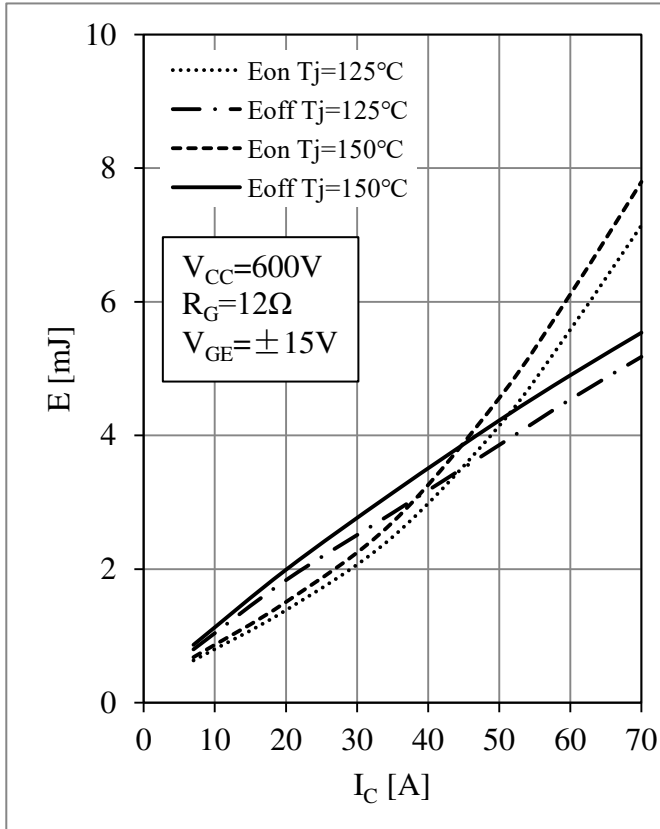
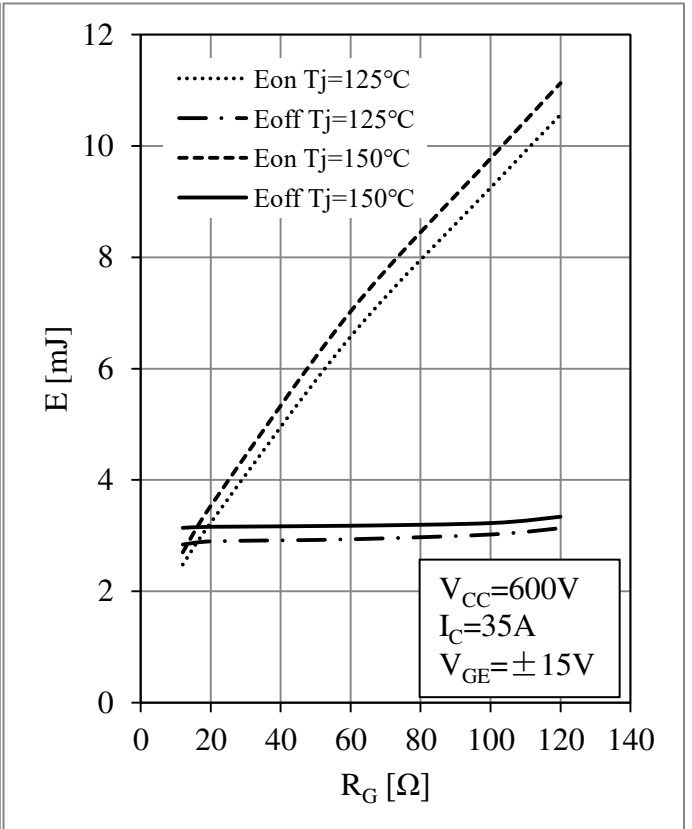


Fig 2. IGBT-inverter Transfer Characteristics

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

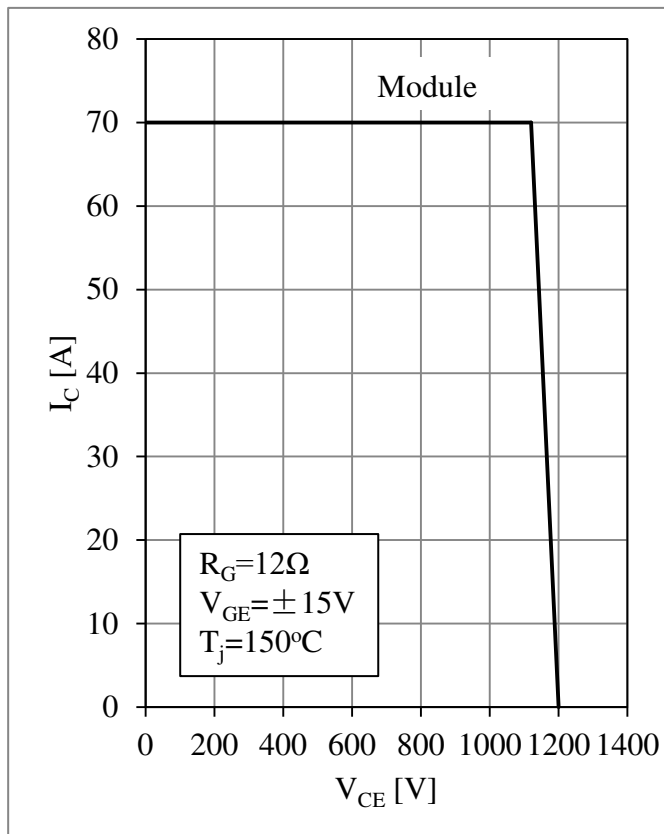


Fig 5. IGBT-inverter RBSOA

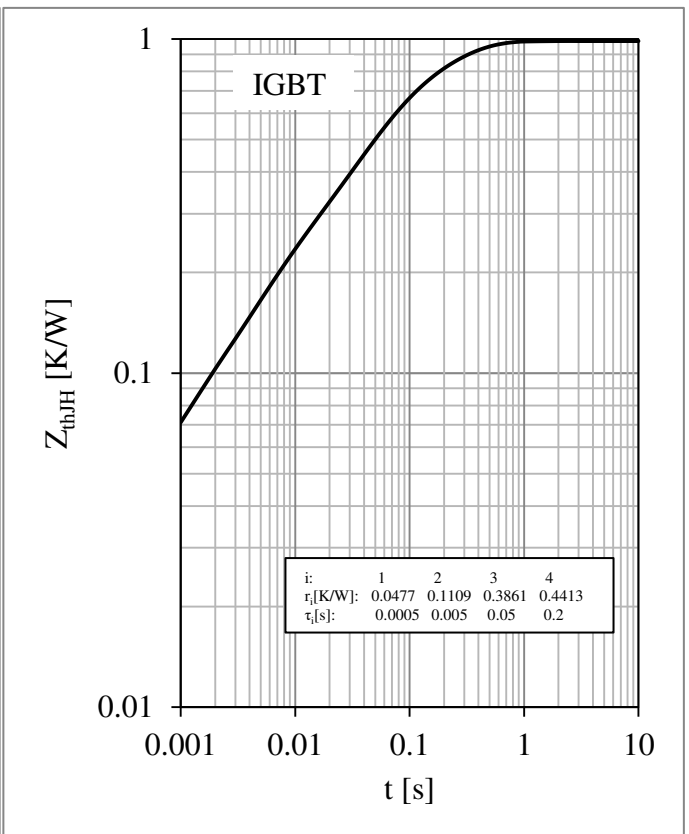


Fig 6. IGBT-inverter Transient Thermal Impedance

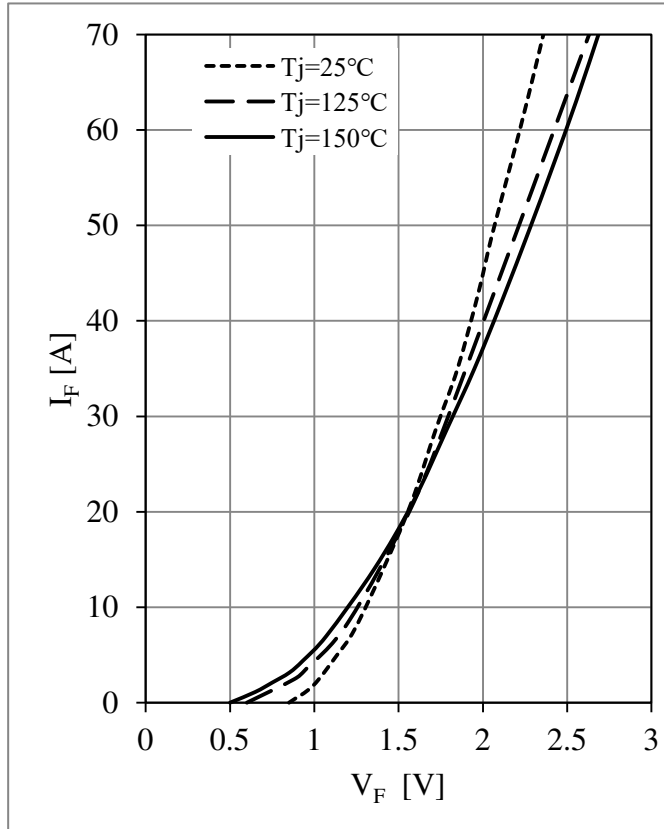
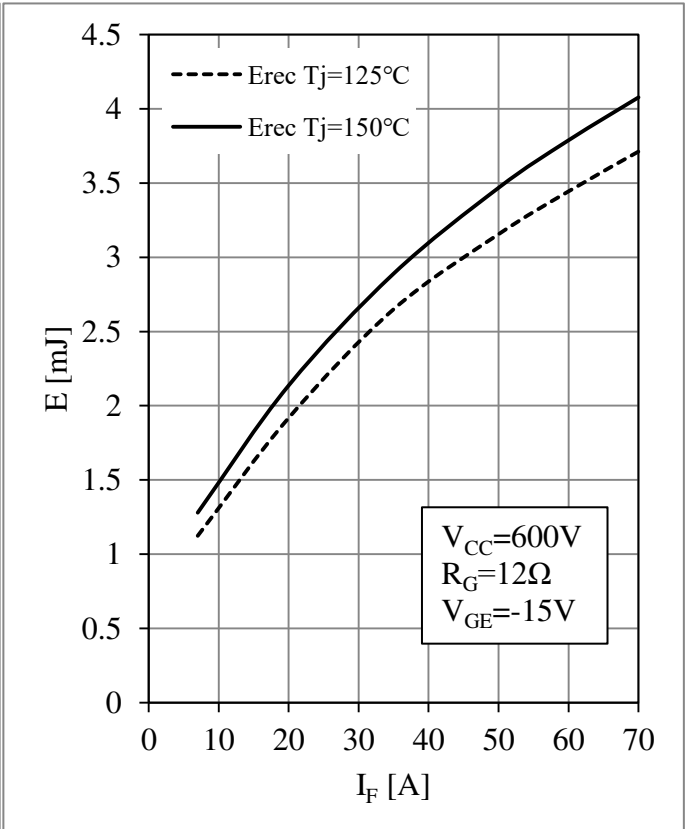
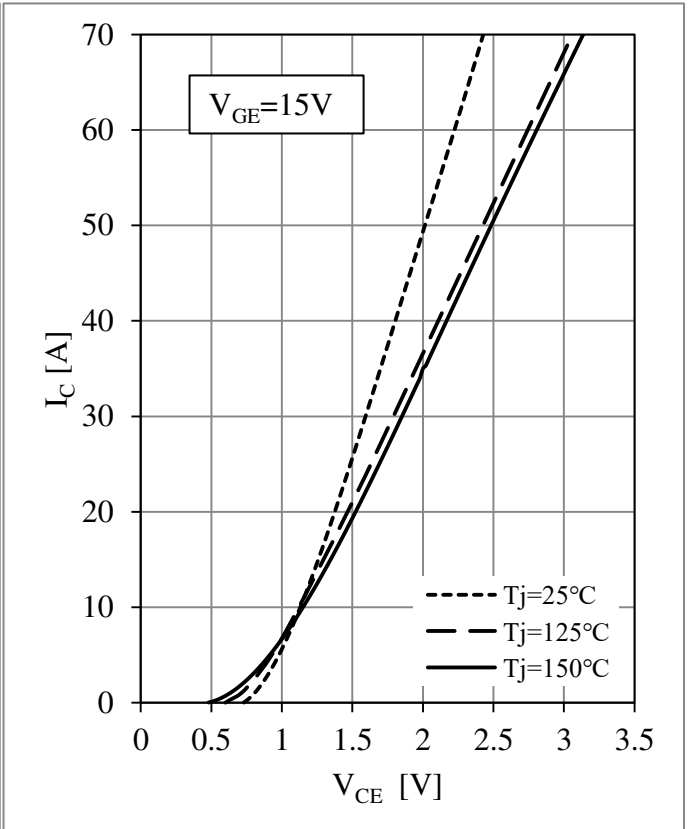
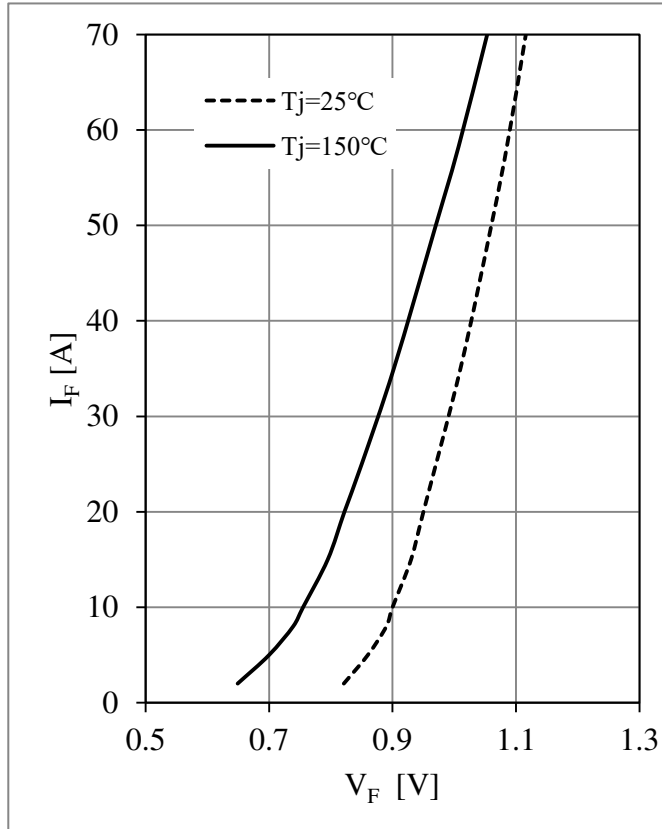
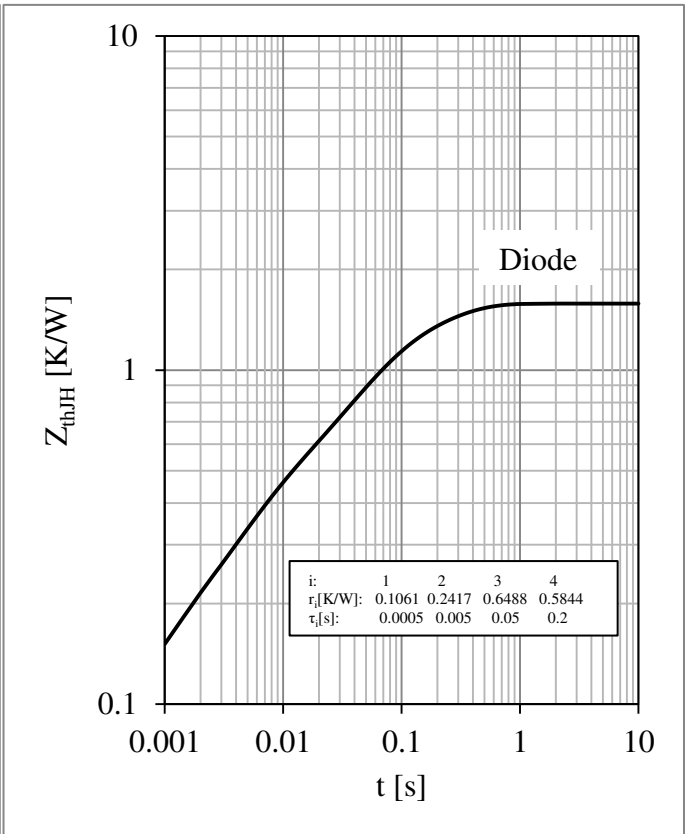
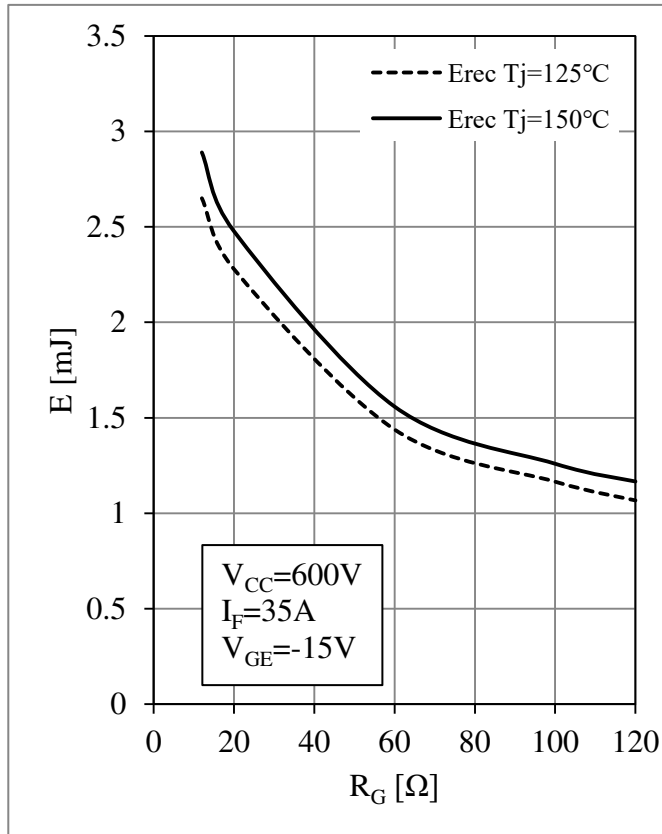


Fig 7. Diode-inverter Forward Characteristics

Fig 8. Diode-inverter Switching Loss vs. I_F



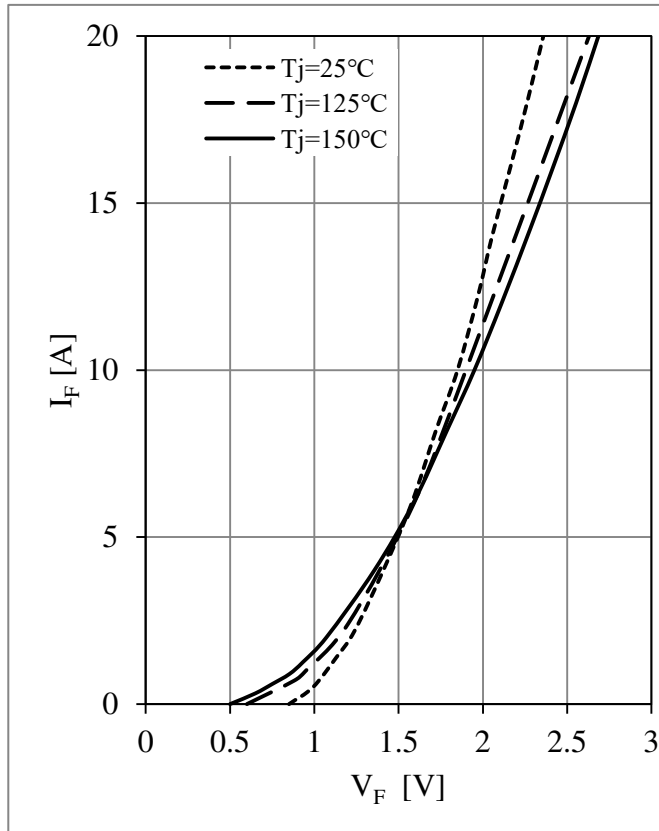


Fig 13. Diode-brake-chopper Forward Characteristics

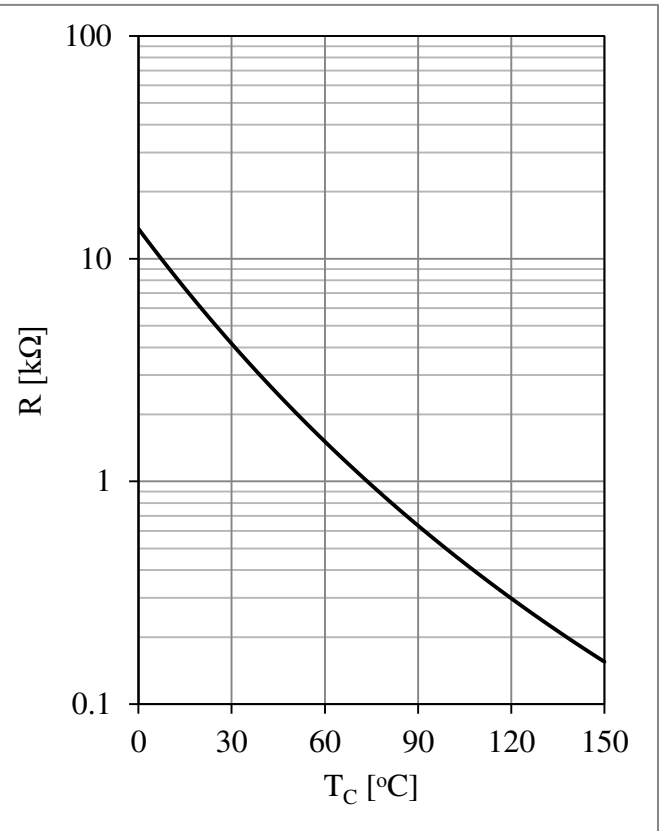
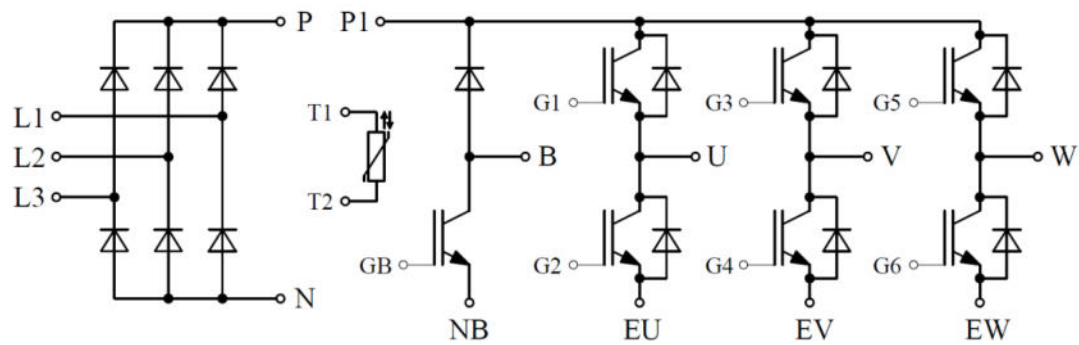


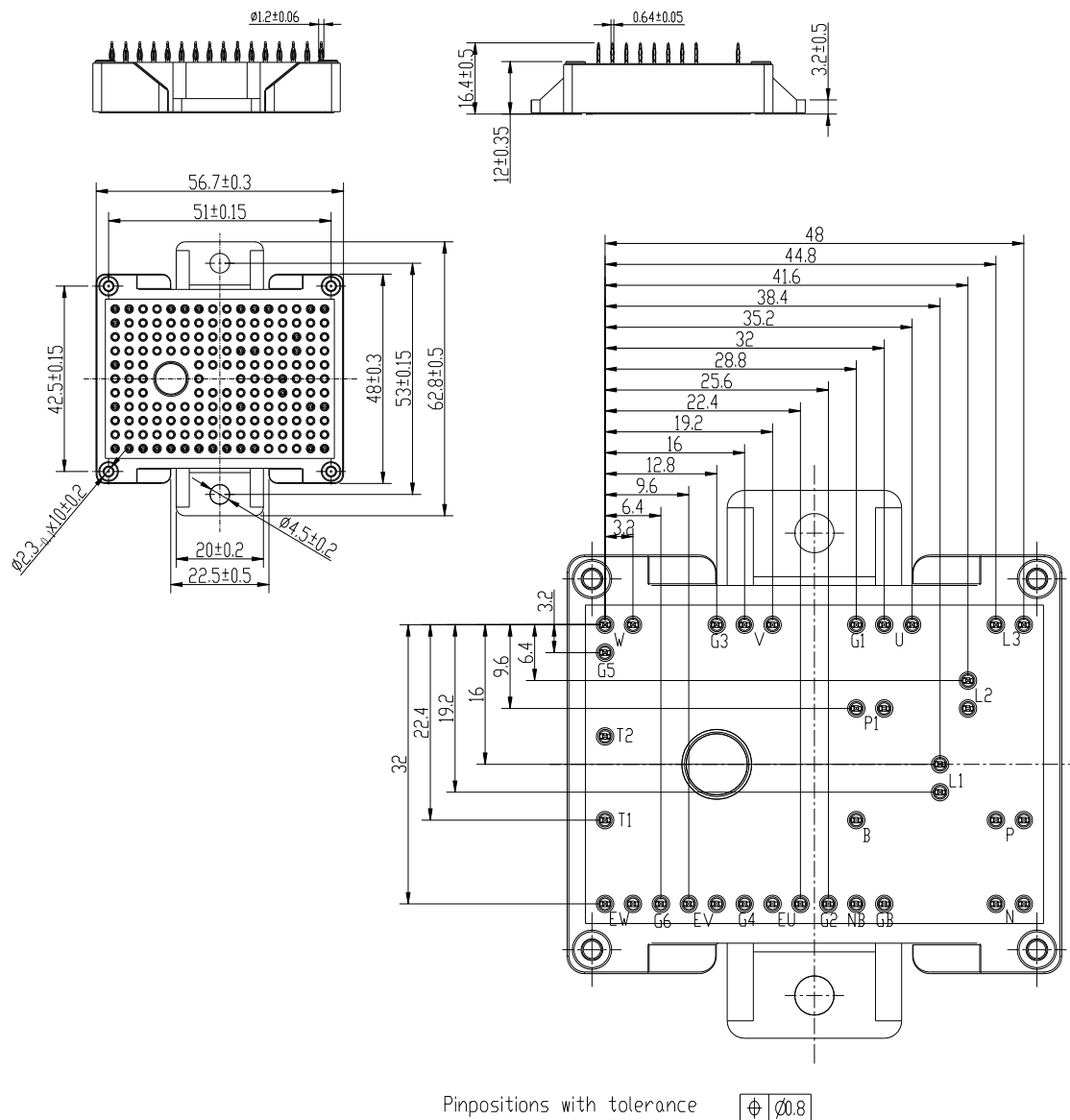
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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