

STARPOWER

SEMICONDUCTOR

IGBT

GD35PJA120L3S_B20

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.

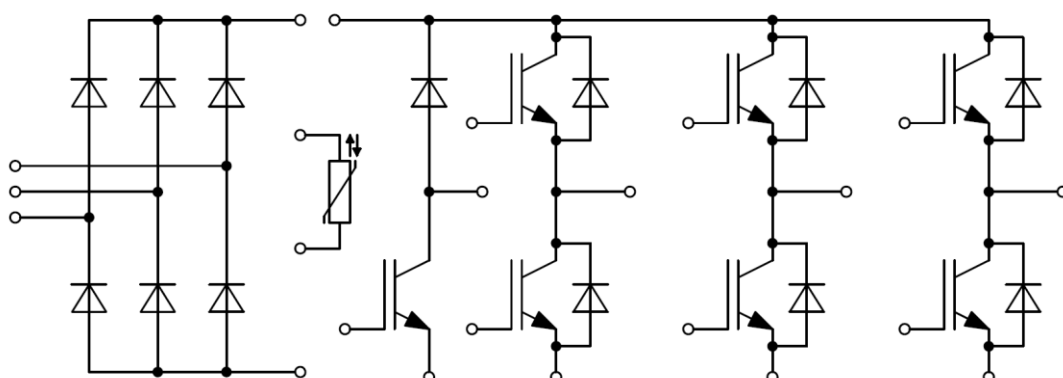
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 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 @ $T_H=75^{\circ}\text{C}$	35	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	70	A

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	35	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	70	A
I_{FSM}	Surge Forward Current $t_p=10\text{ms}$ @ $T_{vj}=125^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	158 152	A
I^2t	$I^2t\text{-value}, t_p=10\text{ms}$ @ $T_{vj}=125^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	125 116	A^2s

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_{FRMSM}	Maximum RMS Forward Current per Chip @ $T_H=100^{\circ}\text{C}$	45	A
I_{RMSM}	Maximum RMS Current at Rectifier Output @ $T_H=100^{\circ}\text{C}$	50	A
I_{FSM}	Surge Forward Current $t_p=10\text{ms}$ @ $T_{vj}=25^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	450 370	A
I^2t	$I^2t\text{-value}, t_p=10\text{ms}$ @ $T_{vj}=25^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	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 @ $T_H=75^{\circ}\text{C}$	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	10	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	20	A
I_{FSM}	Surge Forward Current $t_p=10\text{ms}$ @ $T_{vj}=125^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	54 54	A
I^2t	$I^2t\text{-value}, t_p=10\text{ms}$ @ $T_{vj}=125^{\circ}\text{C}$ @ $T_{vj}=150^{\circ}\text{C}$	15 15	A^2s

Module

Symbol	Description	Value	Unit
T _{vjmax}	Maximum Junction Temperature(inverter,brake)	175	°C
	Maximum Junction Temperature (rectifier)	150	
T _{vjop}	Operating Junction Temperature	-40 to +175	°C
T _{STG}	Storage Temperature Range	-40 to +125	°C
V _{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V
d _{Creep}	Terminal to Heatsink	11.5	mm
	Terminal to Terminal	6.30	
d _{Clear}	Terminal to Heatsink	10.0	mm
	Terminal to Terminal	5.00	
CTI	Comperative Tracking Index	> 175	
Internal Isolation	Basic Insulation (class 1,IEC 61140)	Al ₂ O ₃	

Note: T_{vjop} > 150°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	$I_C=35\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.50	1.95	V
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.70		
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.70\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	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	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		3.09		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.22		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		55		ns
t_r	Rise Time			32		ns
$t_{d(off)}$	Turn-Off Delay Time			245		ns
t_f	Fall Time			196		ns
E_{on}	Turn-On Switching Loss			2.25		mJ
E_{off}	Turn-Off Switching Loss			2.71		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^{\circ}\text{C}$		56		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			291		ns
t_f	Fall Time			296		ns
E_{on}	Turn-On Switching Loss			3.02		mJ
E_{off}	Turn-Off Switching Loss			3.71		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^{\circ}\text{C}$		57		ns
t_r	Rise Time			36		ns
$t_{d(off)}$	Turn-Off Delay Time			296		ns
t_f	Fall Time			321		ns
E_{on}	Turn-On Switching Loss			3.36		mJ
E_{off}	Turn-Off Switching Loss			3.97		mJ
I_{SC}	SC Data	$t_p \leq 8\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=600\text{V}, V_{CEM} \leq 1200\text{V}$		105		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	$I_F=35\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.60	2.05	V
		$I_F=35\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.65		
		$I_F=35\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		1.65		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=986\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=25^{\circ}\text{C}$		2.65		μC
I_{RM}	Peak Reverse Recovery Current			35		A
E_{rec}	Reverse Recovery Energy			0.88		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=892\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=125^{\circ}\text{C}$		4.70		μC
I_{RM}	Peak Reverse Recovery Current			38		A
E_{rec}	Reverse Recovery Energy			1.74		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=866\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=150^{\circ}\text{C}$		5.21		μC
I_{RM}	Peak Reverse Recovery Current			38		A
E_{rec}	Reverse Recovery Energy			1.93		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	$I_F=35\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		0.90		V
I_R	Reverse Current	$T_{vj}=150^{\circ}\text{C}, V_R=1600\text{V}$			2.0	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	$I_C=35\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.50	1.95	V
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.70		
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.70\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	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	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		3.09		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.22		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		55		ns
t_r	Rise Time			32		ns
$t_{d(off)}$	Turn-Off Delay Time			245		ns
t_f	Fall Time			196		ns
E_{on}	Turn-On Switching Loss			2.25		mJ
E_{off}	Turn-Off Switching Loss			2.71		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^{\circ}\text{C}$		56		ns
t_r	Rise Time			35		ns
$t_{d(off)}$	Turn-Off Delay Time			291		ns
t_f	Fall Time			296		ns
E_{on}	Turn-On Switching Loss			3.02		mJ
E_{off}	Turn-Off Switching Loss			3.71		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=18\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^{\circ}\text{C}$		57		ns
t_r	Rise Time			36		ns
$t_{d(off)}$	Turn-Off Delay Time			296		ns
t_f	Fall Time			321		ns
E_{on}	Turn-On Switching Loss			3.36		mJ
E_{off}	Turn-Off Switching Loss			3.97		mJ
I_{SC}	SC Data	$t_p \leq 8\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=600\text{V}, V_{CEM} \leq 1200\text{V}$		105		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		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=10\text{A},$ $-di/dt=842\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=25^{\circ}\text{C}$		0.86		μC
I_{RM}	Peak Reverse Recovery Current			15		A
E_{rec}	Reverse Recovery Energy			0.31		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=10\text{A},$ $-di/dt=731\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.57		μC
I_{RM}	Peak Reverse Recovery Current			16		A
E_{rec}	Reverse Recovery Energy			0.63		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=10\text{A},$ $-di/dt=715\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.76		μC
I_{RM}	Peak Reverse Recovery Current			16		A
E_{rec}	Reverse Recovery Energy			0.71		mJ

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		5.00 6.00		m Ω
R_{thJH}	Junction-to-Heatsink (per IGBT-inverter)		1.200		K/W
	Junction-to-Heatsink (per Diode-inverter)		1.650		
	Junction-to-Heatsink (per Diode-rectifier)		1.360		
	Junction-to-Heatsink (per IGBT-brake)		1.200		
	Junction-to-Heatsink (per Diode-brake)		2.440		
F	Mounting Force Per Clamp	40		80	N
G	Weight of Module		39		g

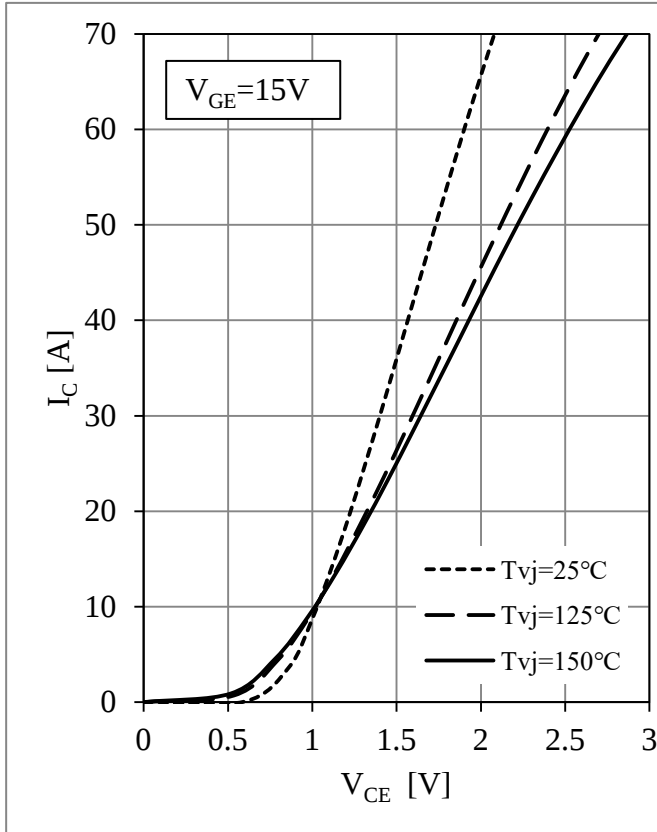


Fig 1. IGBT-inverter Output Characteristics

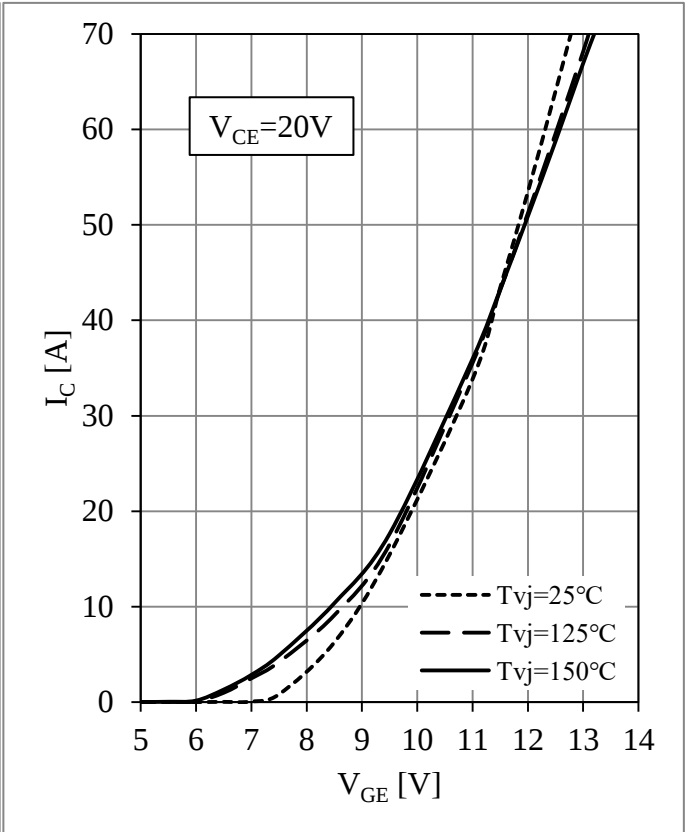
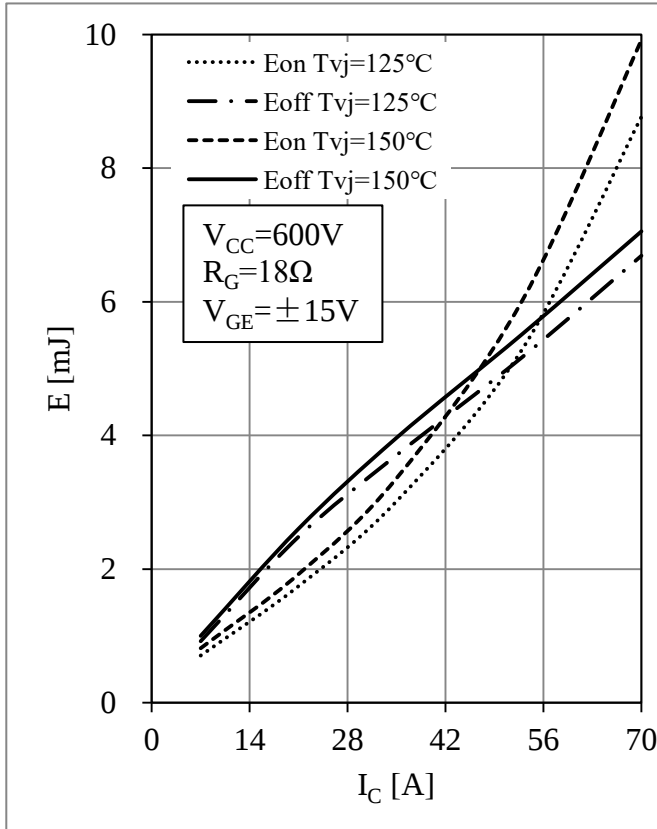
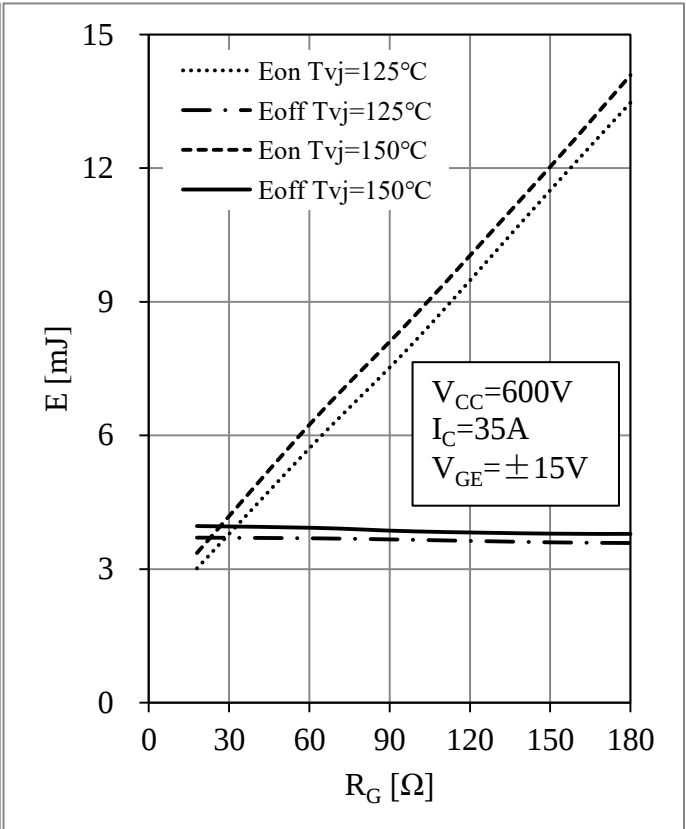


Fig 2. IGBT-inverter Transfer Characteristics

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

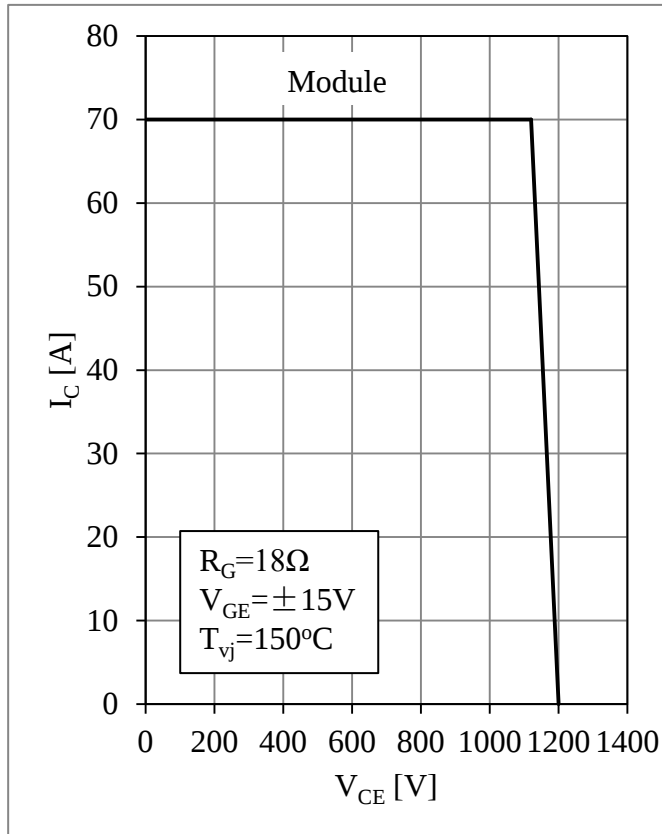


Fig 5. IGBT-inverter RBSOA

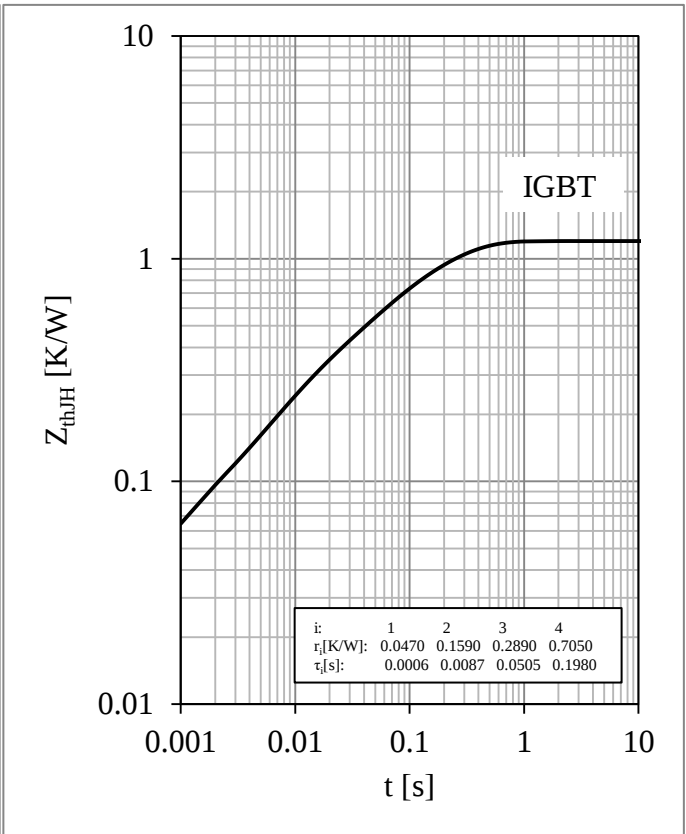


Fig 6. IGBT-inverter Transient Thermal Impedance

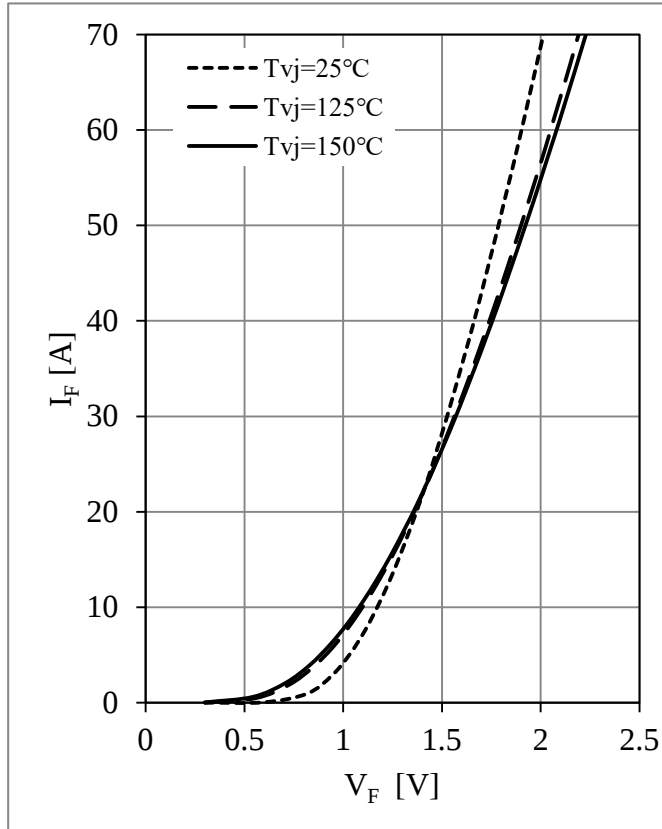
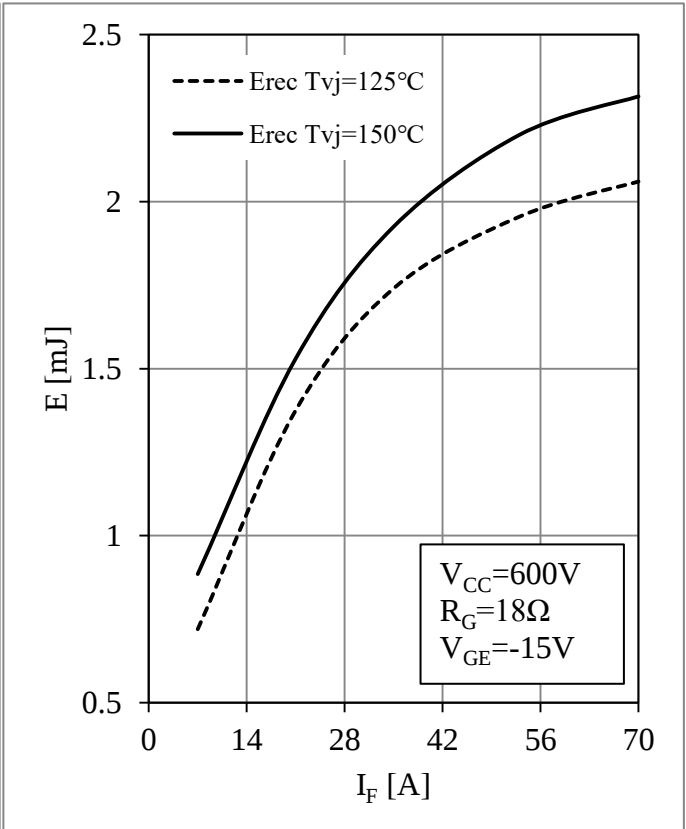
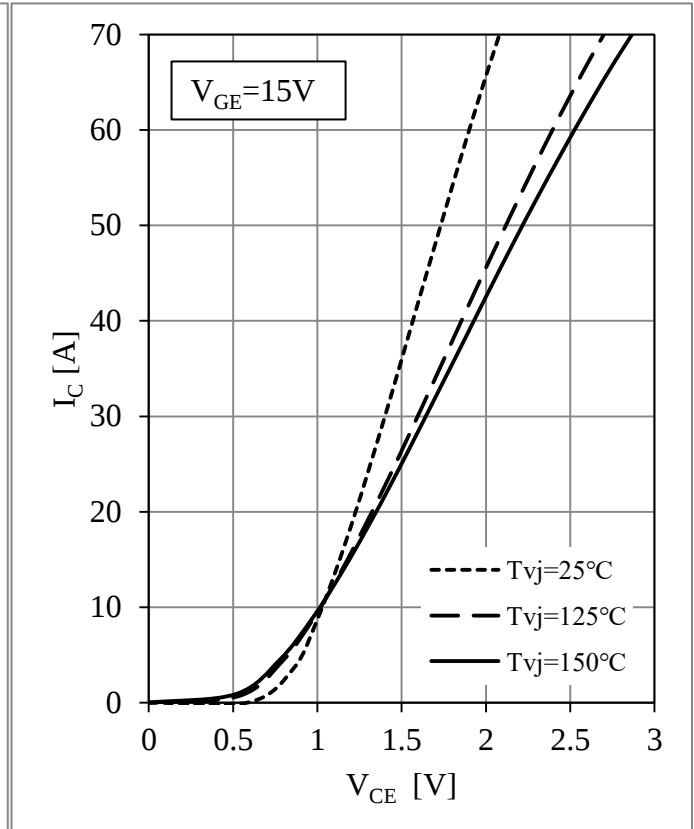
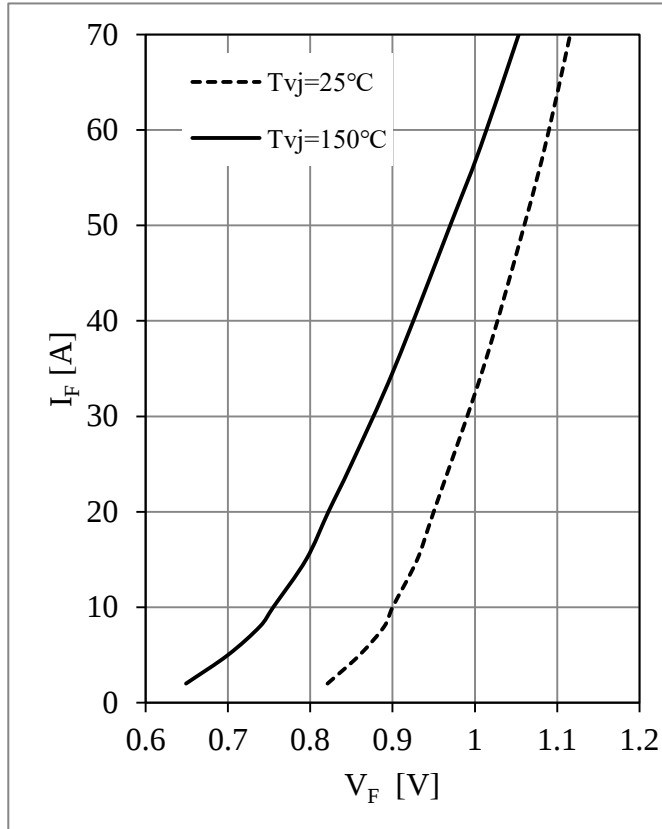
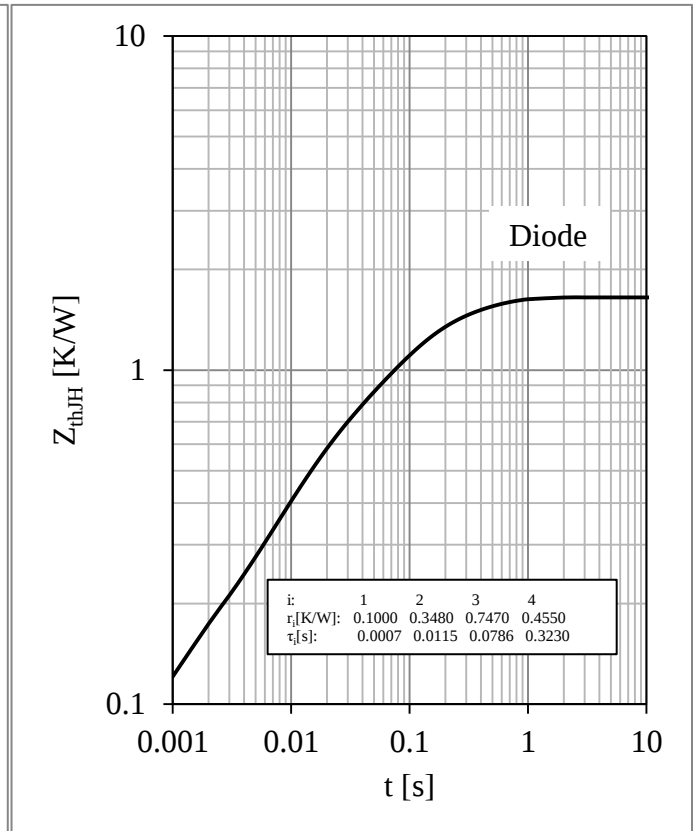
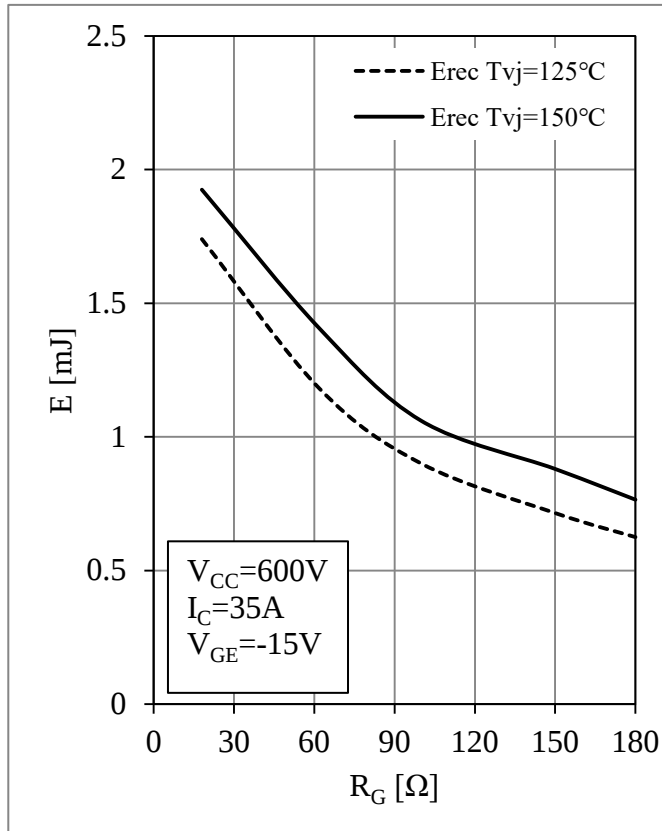


Fig 7. Diode-inverter Forward Characteristics

Fig 8. Diode-inverter Switching Loss vs. I_F



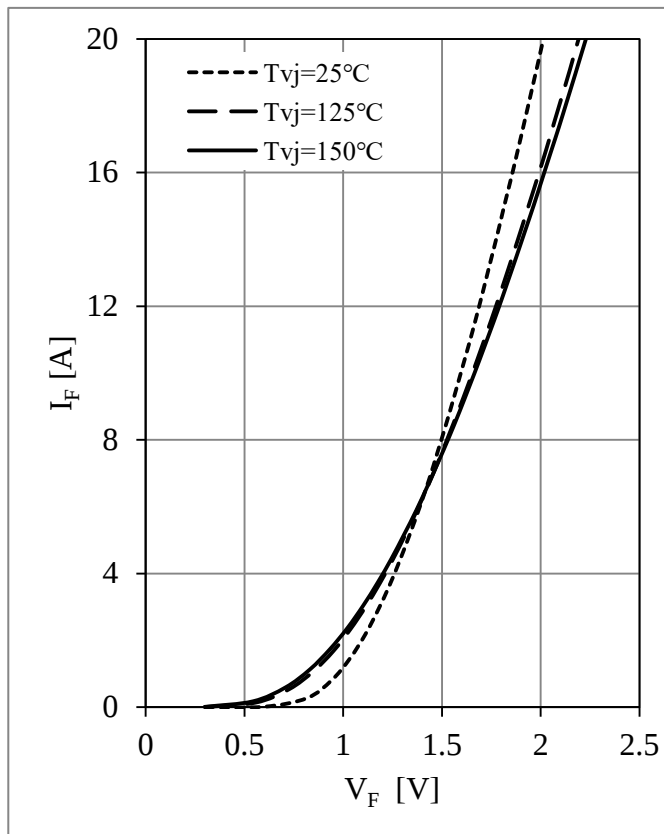


Fig 13. Diode-brake-chopper Forward Characteristics

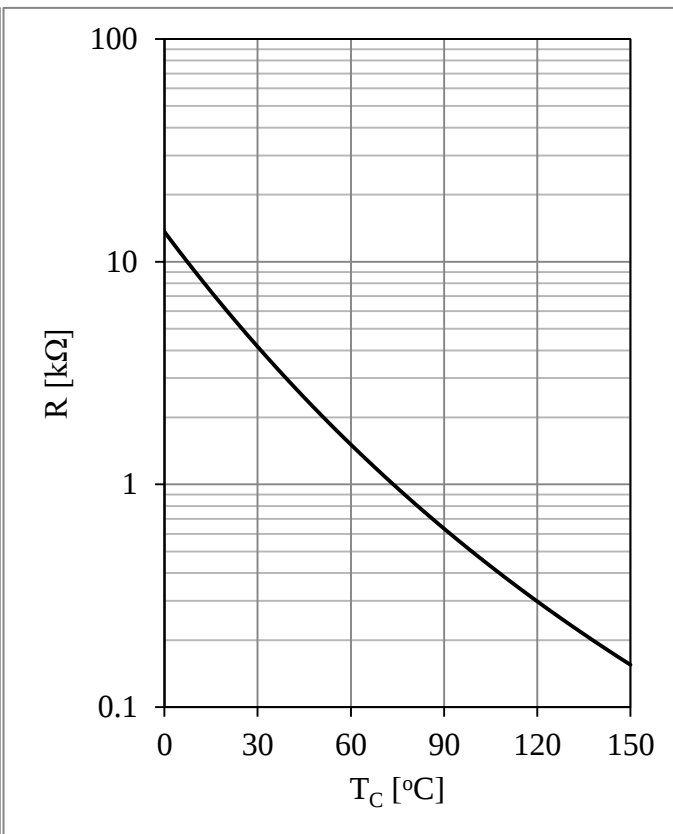
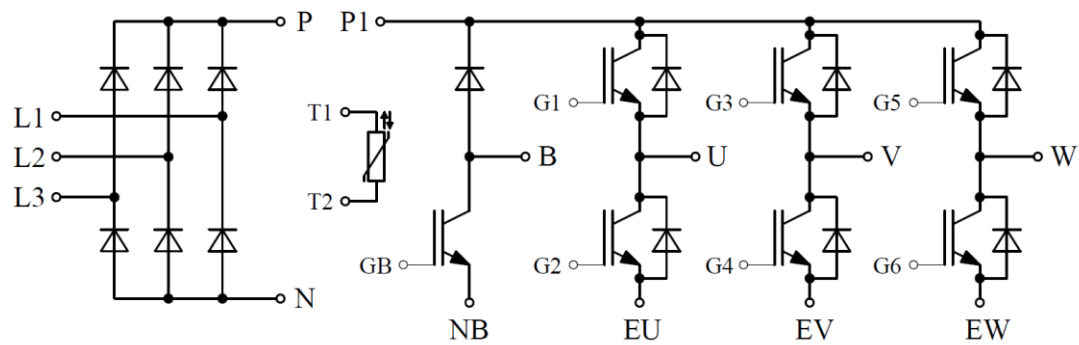


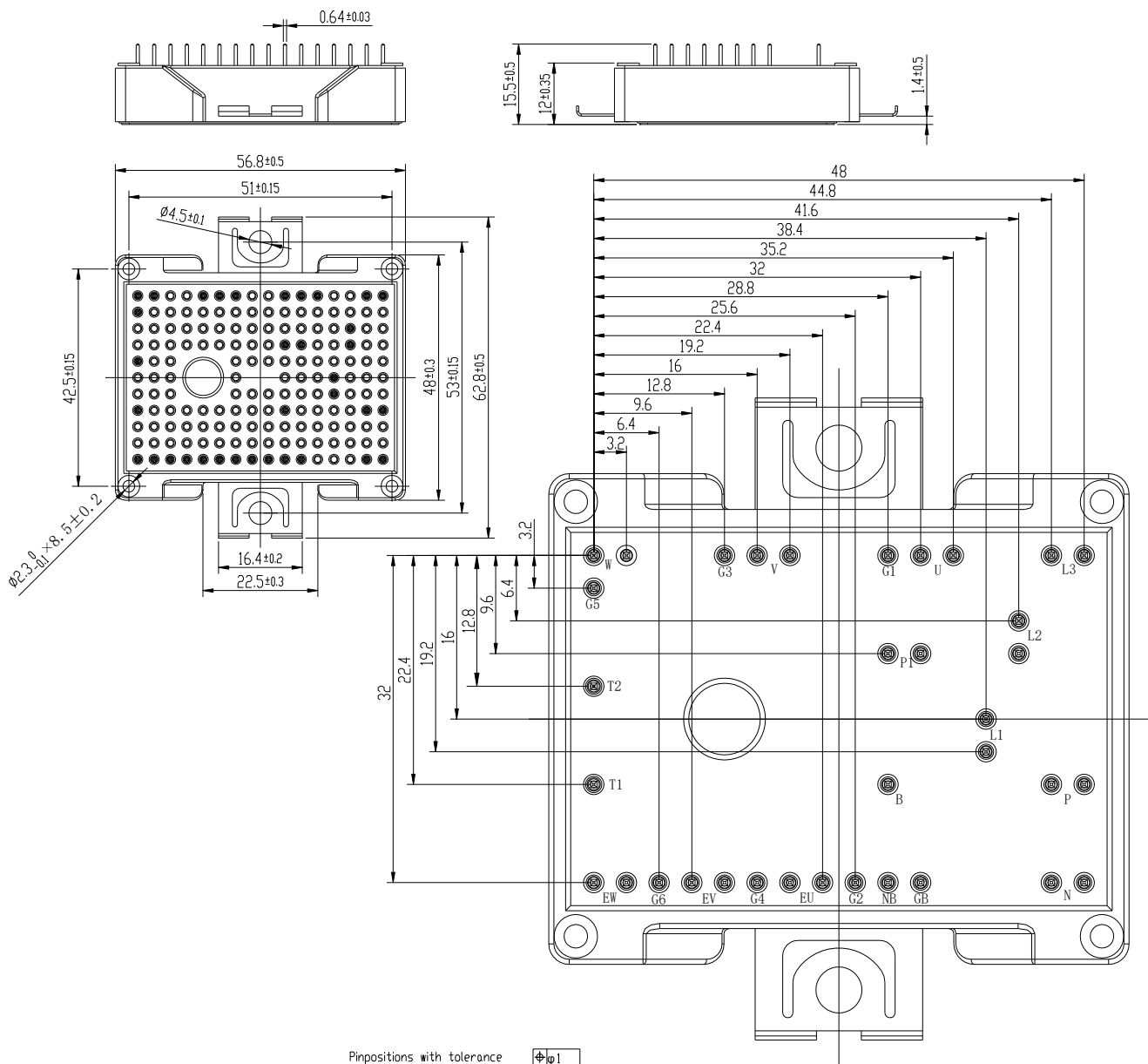
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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