STARPOWER

SEMICONDUCTOR **IGBT**

GD35PJA120L3S

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.

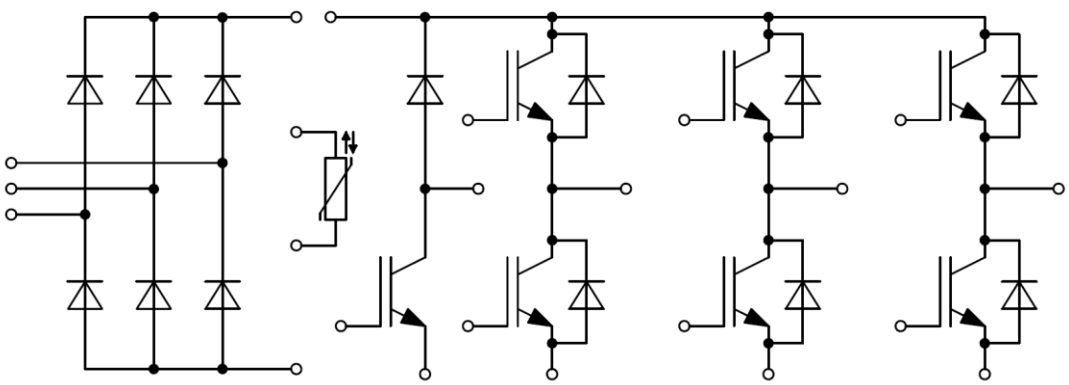
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 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=75°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=10ms @ T_{vj}=125°C @ T_{vj}=150°C	158 152	A
I^2t	I^2t-value,t_p=10ms @ T_{vj}=125°C @ T_{vj}=150°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°C	45	A
I_{RMSM}	Maximum RMS Current at Rectifier Output @ T_H=100°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=75°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=10ms @ T_{vj}=125°C @ T_{vj}=150°C	54 54	A
I^2t	I^2t-value,t_p=10ms @ T_{vj}=125°C @ T_{vj}=150°C	15 15	A^2s

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 +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 Terminal to Terminal	11.5 6.30	mm
d_{Clear}	Terminal to Heatsink Terminal to Terminal	10.0 5.00	mm
CTI	Comperative Tracking Index	> 175	
Internal Isolation	Basic Insulation (class 1,IEC 61140)	Al_2O_3	

Note: T_{vjop} > 150°C is allowed for operation at overload conditions.

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=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=18Ω, L_S=35nH, V_{GE}=±15V,T_{vj}=25°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}=600V,I_C=35A, R_G=18Ω, L_S=35nH, V_{GE}=±15V,T_{vj}=125°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}=600V,I_C=35A, R_G=18Ω, L_S=35nH, V_{GE}=±15V,T_{vj}=150°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≤8μs,V_{GE}=15V, T_{vj}=150°C,V_{CC}=600V, V_{CEM}≤1200V		105		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=35A,V_{GE}=0V,T_{vj}=25°C		1.60	2.05	V
		I_F=35A,V_{GE}=0V,T_{vj}=125°C		1.65		
		I_F=35A,V_{GE}=0V,T_{vj}=150°C		1.65		
Q_r	Recovered Charge	V_R=600V,I_F=35A, -di/dt=986A/μs, L_S=35nH, V_{GE}=-15V,T_{vj}=25°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=600V,I_F=35A, -di/dt=892A/μs, L_S=35nH, V_{GE}=-15V,T_{vj}=125°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=600V,I_F=35A, -di/dt=866A/μs, L_S=35nH, V_{GE}=-15V,T_{vj}=150°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°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=35A,V_{GE}=0V,T_{vj}=150°C		0.90		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=18Ω, L_S=35nH, V_{GE}=±15V,T_{vj}=25°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}=600V,I_C=35A, R_G=18Ω, L_S=35nH, V_{GE}=±15V,T_{vj}=125°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}=600V,I_C=35A, R_G=18Ω, L_S=35nH, V_{GE}=±15V,T_{vj}=150°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≤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=10A,V_{GE}=0V,T_{vj}=25°C		1.60	2.05	V
		I_F=10A,V_{GE}=0V,T_{vj}=125°C		1.65		
		I_F=10A,V_{GE}=0V,T_{vj}=150°C		1.65		
Q_r	Recovered Charge	V_R=600V,I_F=10A, -di/dt=842A/μs, L_S=35nH, V_{GE}=-15V,T_{vj}=25°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=600V,I_F=10A, -di/dt=731A/μs, L_S=35nH, V_{GE}=-15V,T_{vj}=125°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=600V,I_F=10A, -di/dt=715A/μs, L_S=35nH, V_{GE}=-15V,T_{vj}=150°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°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)		1.200 1.650 1.360 1.200 2.440		K/W
F	Mounting Force Per Clamp	40		80	N
G	Weight of Module		39		g

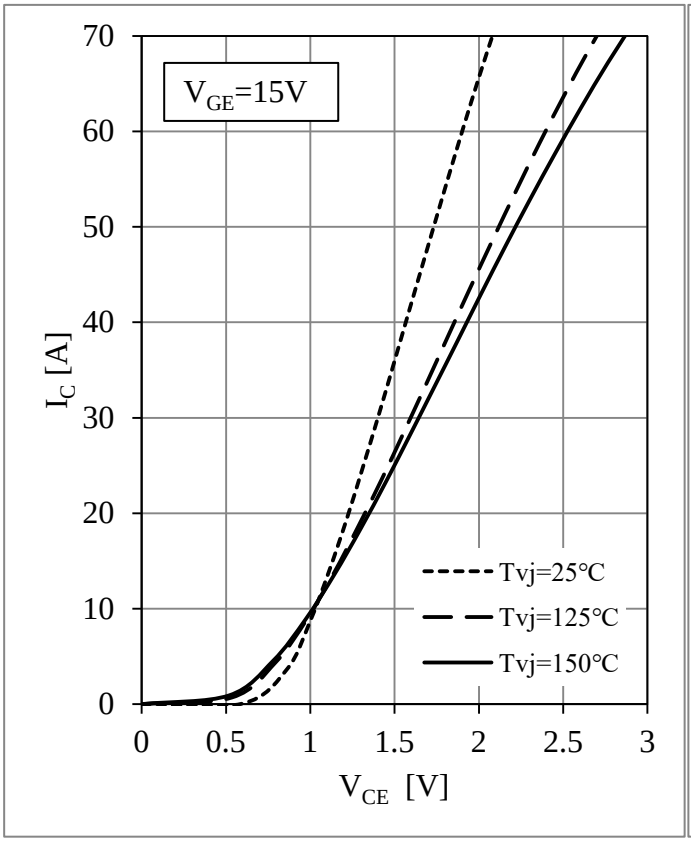


Fig 1. IGBT-inverter Output Characteristics

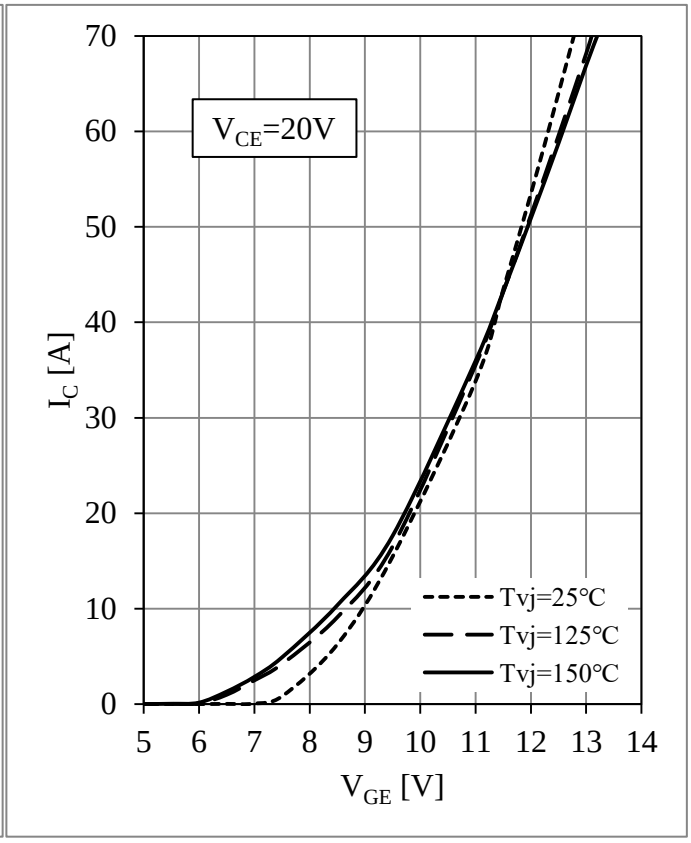


Fig 2. IGBT-inverter Transfer Characteristics

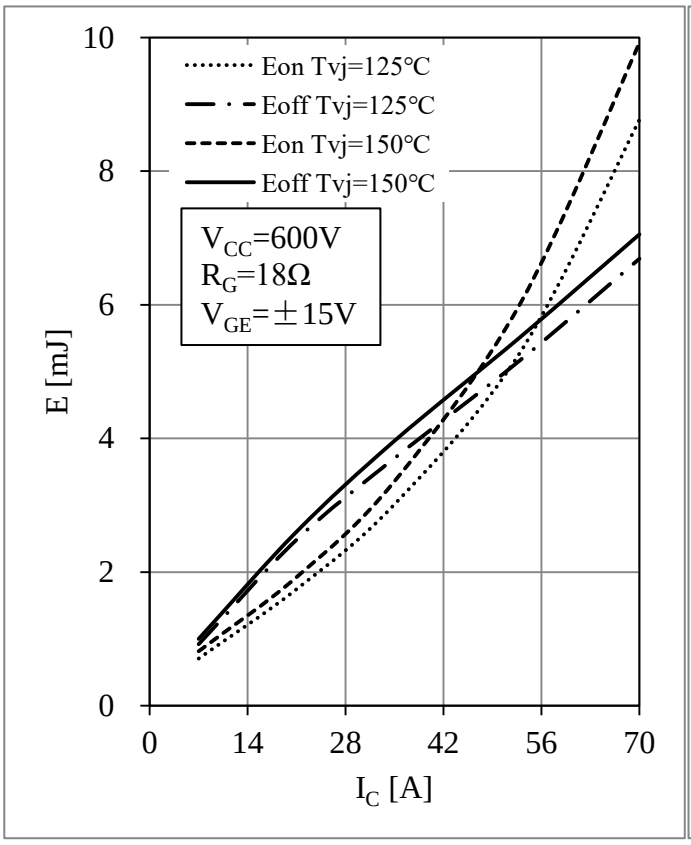


Fig 3. IGBT-inverter Switching Loss vs. I_C

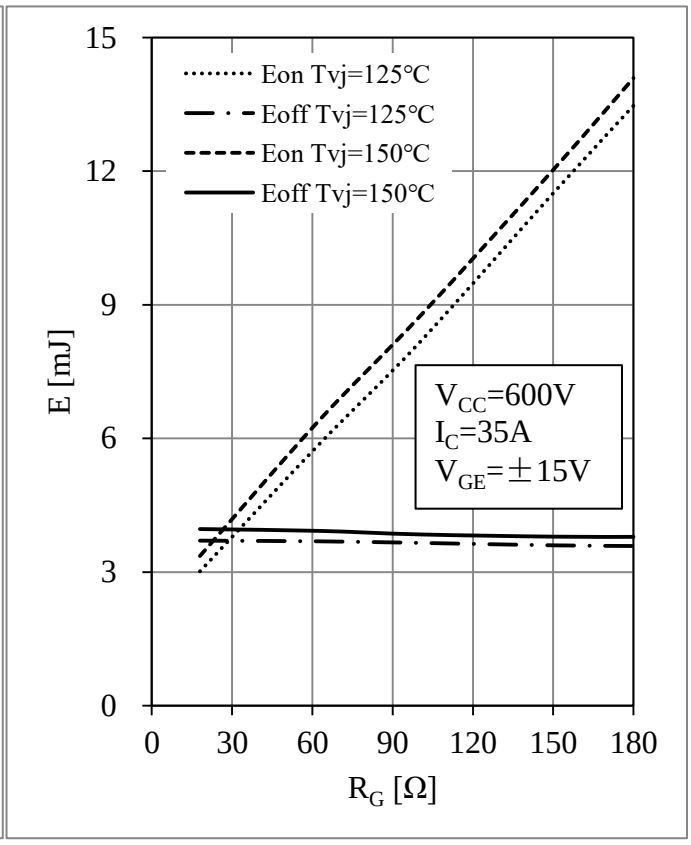


Fig 4. IGBT-inverter Switching Loss vs. R_G

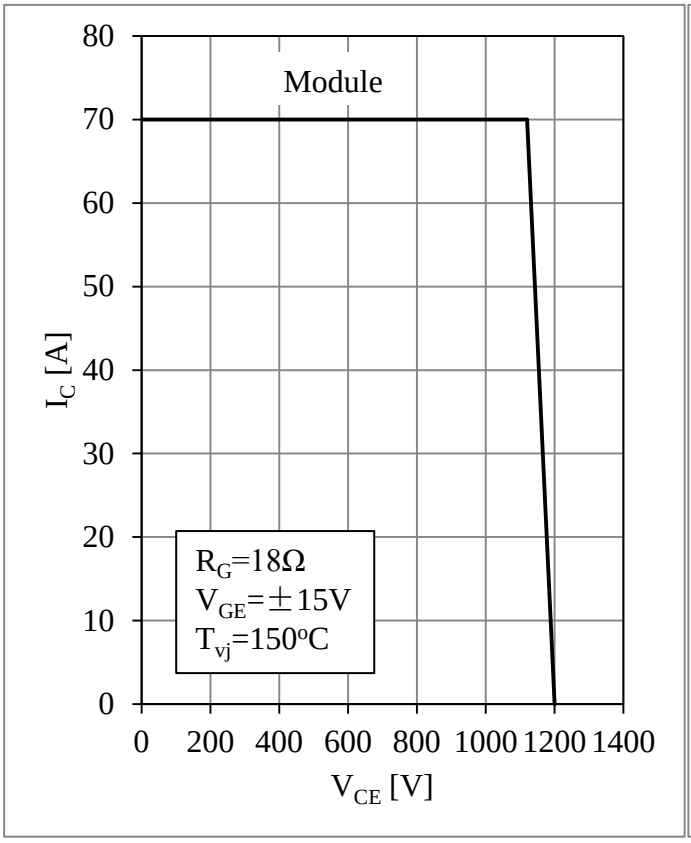


Fig 5. IGBT-inverter RBSOA

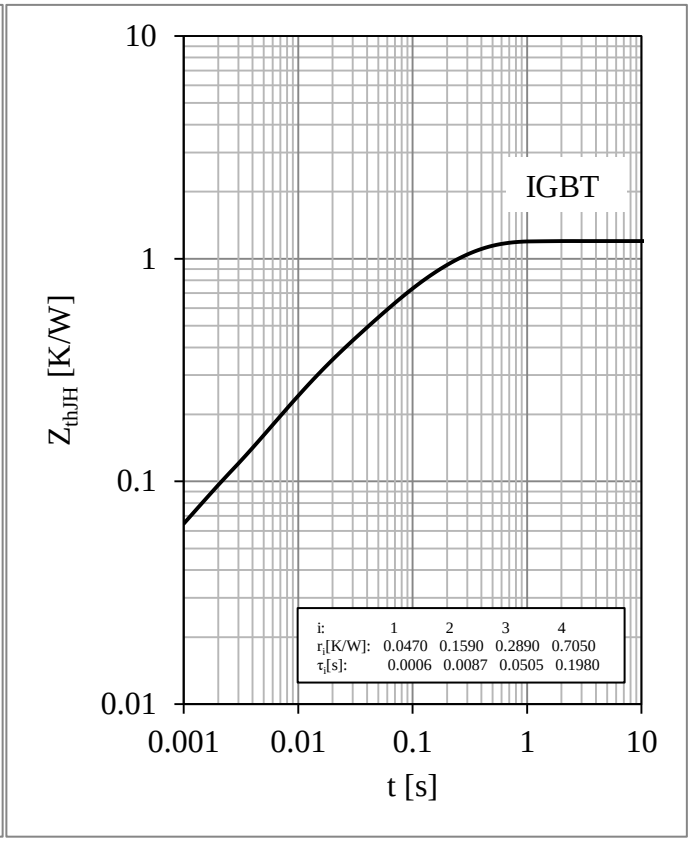


Fig 6. IGBT-inverter Transient Thermal Impedance

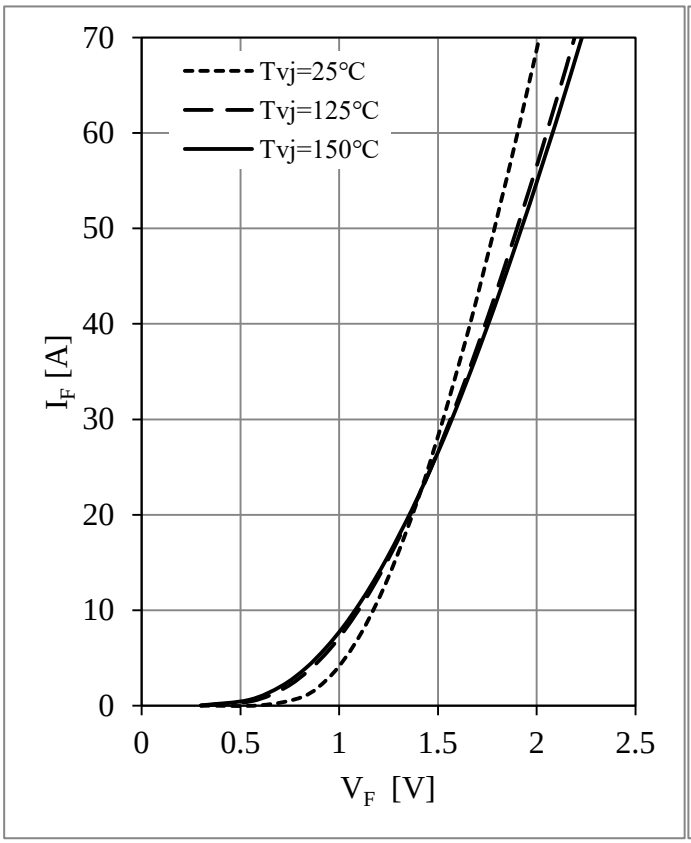


Fig 7. Diode-inverter Forward Characteristics

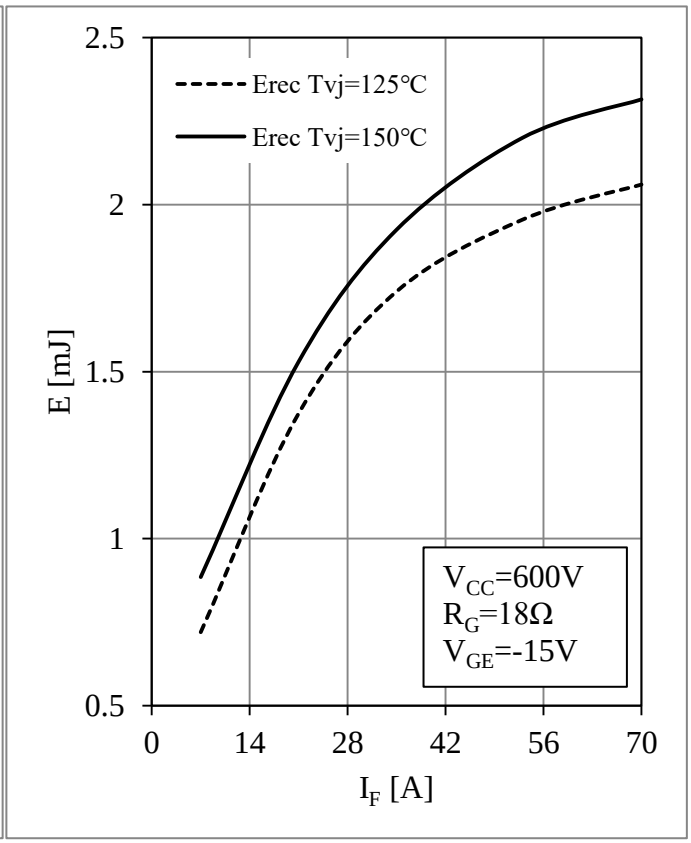


Fig 8. Diode-inverter Switching Loss vs. I_F

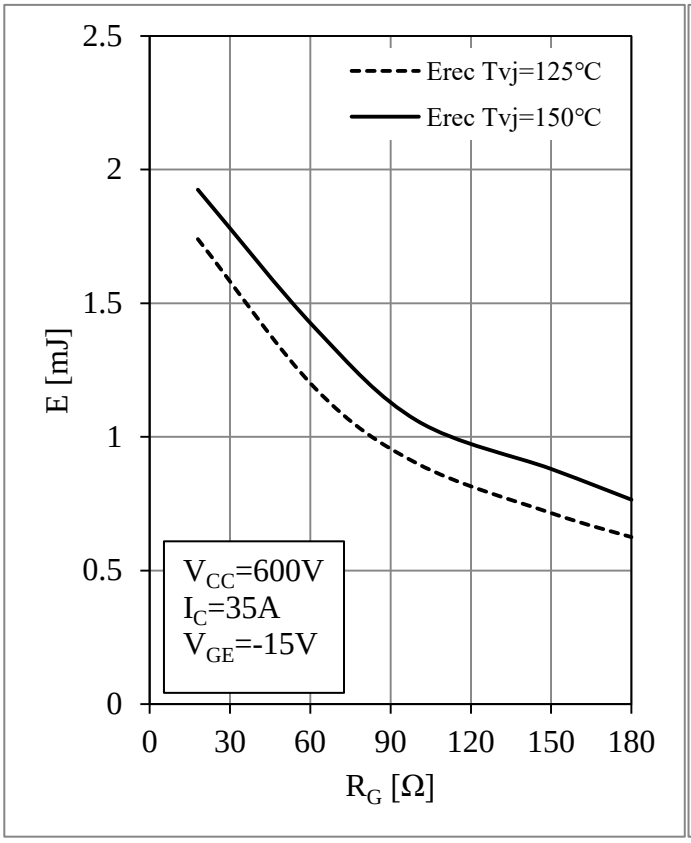


Fig 9. Diode-inverter Switching Loss vs. R_G

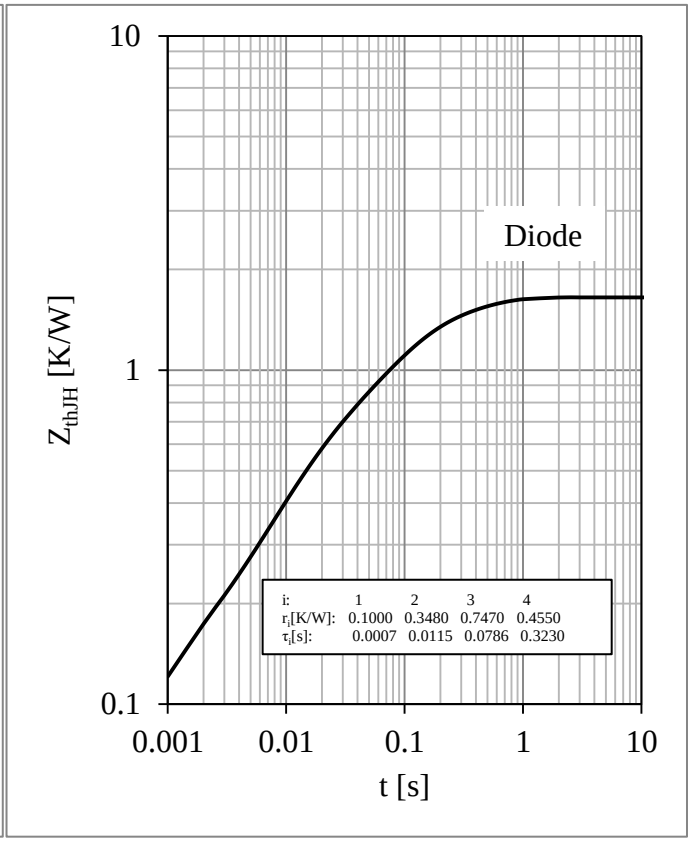


Fig 10. Diode-inverter Transient Thermal Impedance

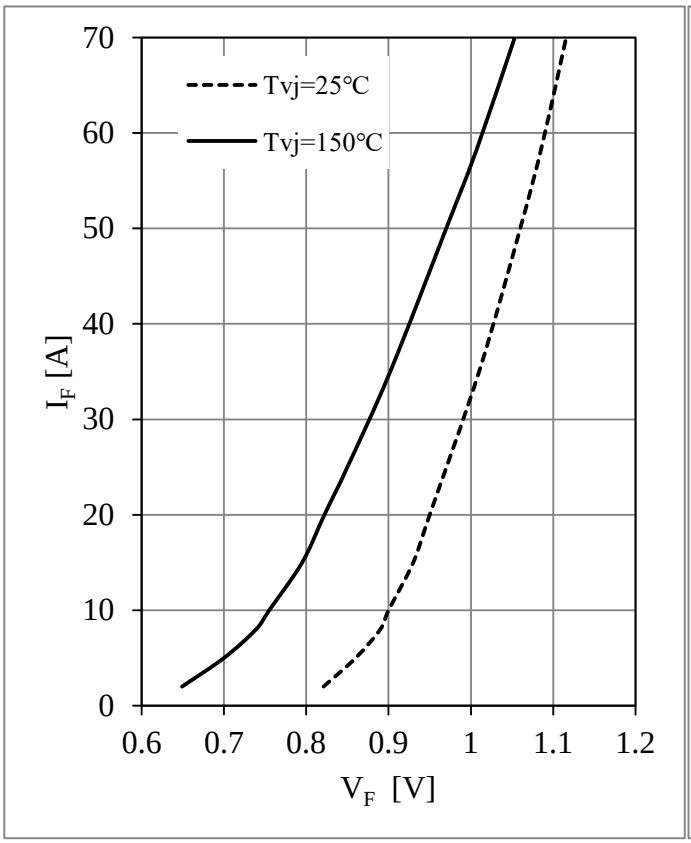


Fig 11. Diode-rectifier Forward Characteristics

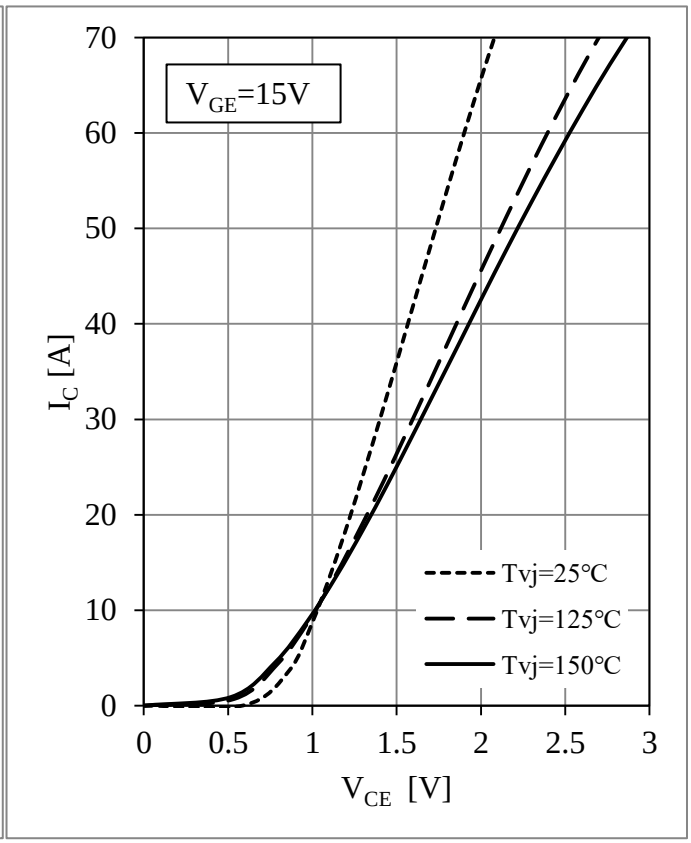


Fig 12. IGBT-brake-chopper Output Characteristics

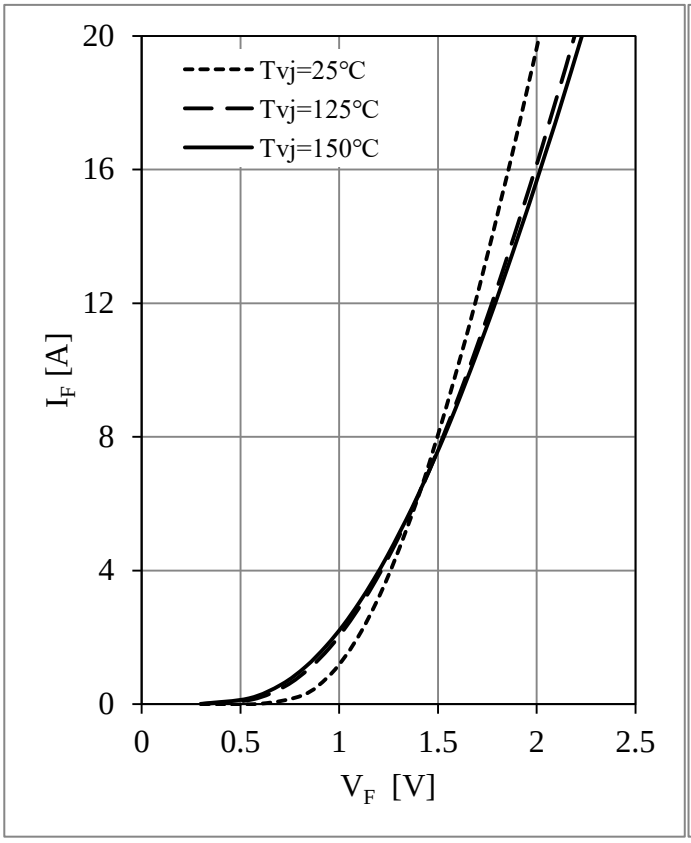


Fig 13. Diode-brake-chopper Forward Characteristics

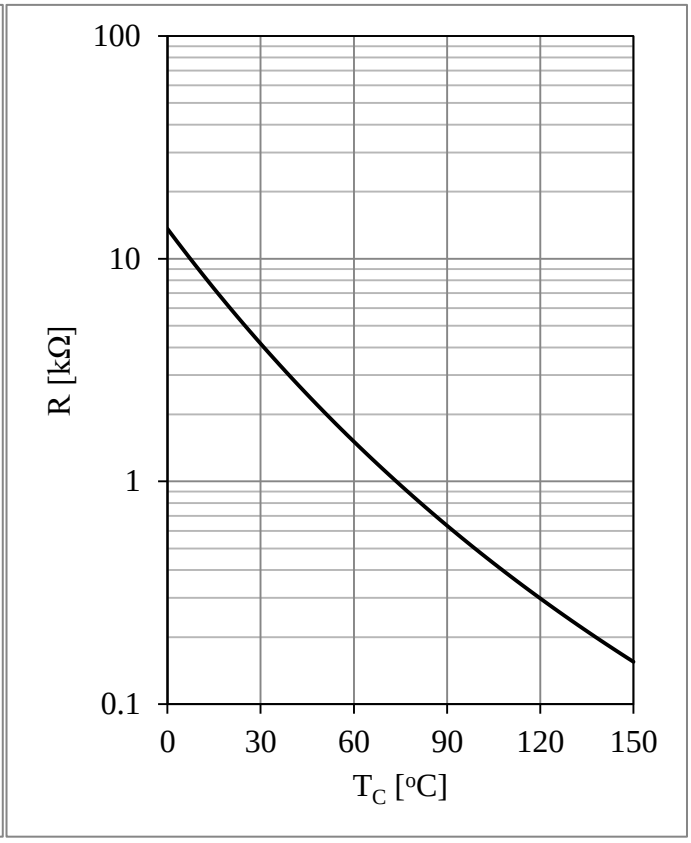
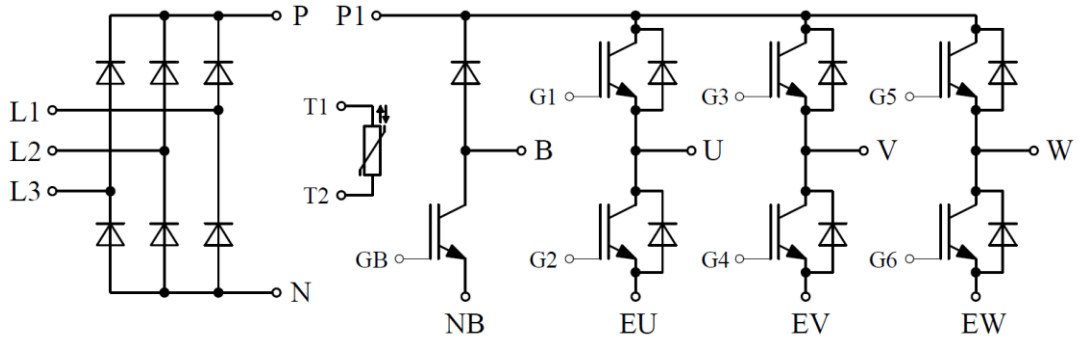


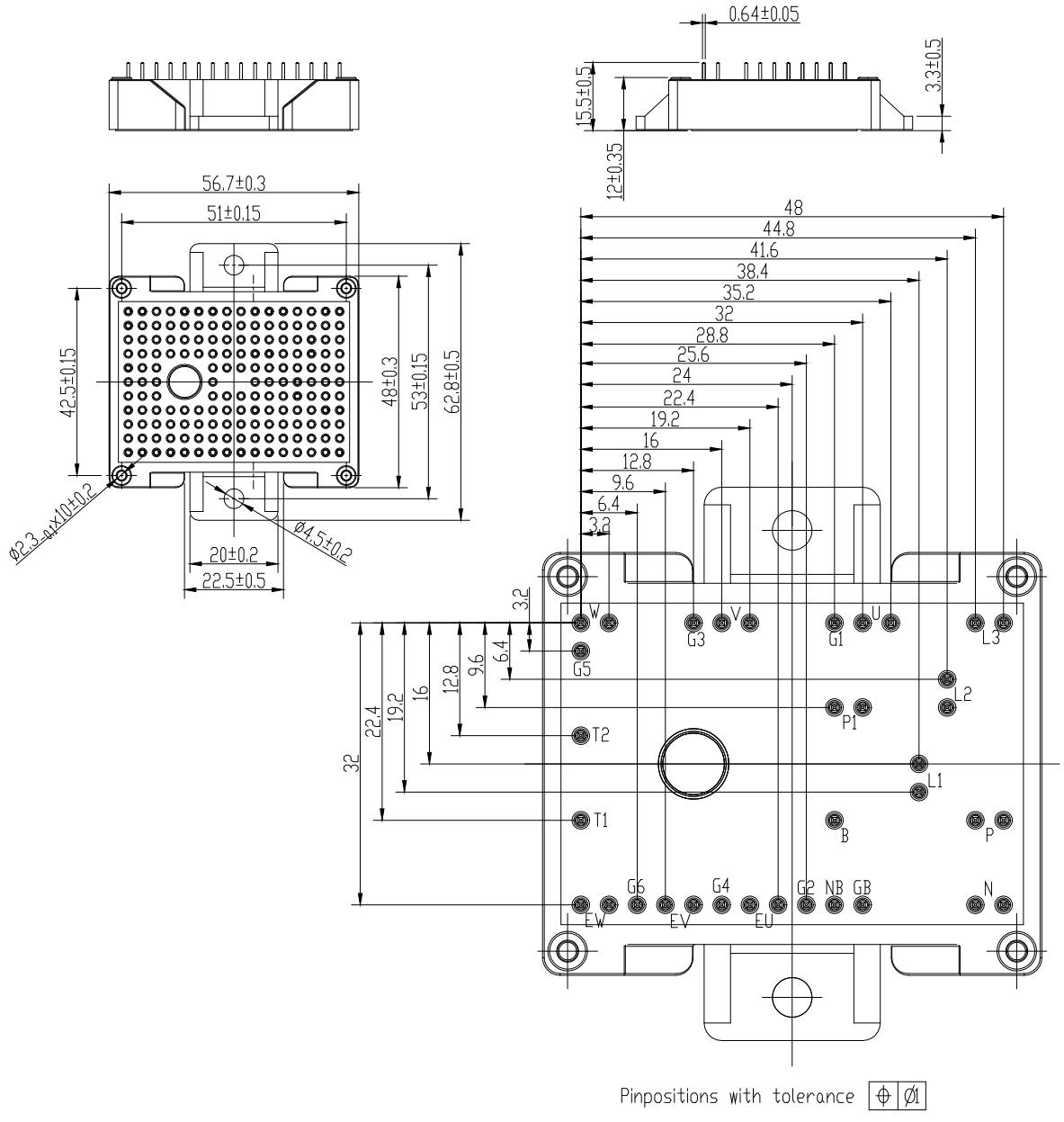
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



Terms and Conditions of Usage

The data contained in this product datasheet is exclusively intended for technically trained staff. you and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application.

This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.

Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see www.powersemi.cc), For those that are specifically interested we may provide application notes.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify.

If and to the extent necessary, please forward equivalent notices to your customers.
Changes of this product data sheet are reserved.