STARPOWER

SEMICONDUCTOR **IGBT**

GD300MNX120C6SA

1200V/300A 3-level 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 3-level-applications.

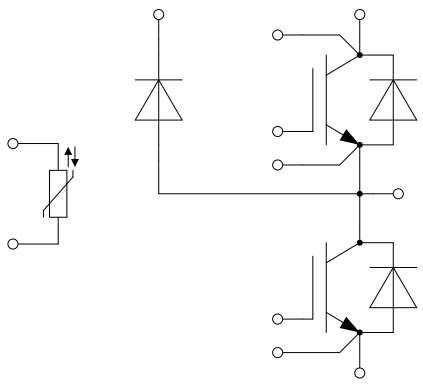
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10μs 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 copper baseplate using DBC technology

Typical Applications

- Solar power
- UPS
- 3-level-applications

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=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_C=25°C @ T_C=100°C	468 300	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	600	A
P_D	Maximum Power Dissipation @ T_{vj}=175°C	1530	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	300	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	600	A

Diode-3-level

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	300	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	600	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	°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_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=300A,V_{GE}=15V, T_{vj}=25°C		1.70	2.15	V
		I_C=300A,V_{GE}=15V, T_{vj}=125°C		1.95		
		I_C=300A,V_{GE}=15V, T_{vj}=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=12.0mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.6	6.2	6.8	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_{vj}=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_{vj}=25°C			400	nA
R_{Gint}	Internal Gate Resistance			2.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		31.1		nF
C_{res}	Reverse Transfer Capacitance			0.87		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		2.33		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=300A, R_G=2.4Ω,Ls=35nH, V_{GE}=±15V,T_{vj}=25°C		215		ns
t_r	Rise Time			53		ns
$t_{d(off)}$	Turn-Off Delay Time			334		ns
t_f	Fall Time			205		ns
E_{on}	Turn-On Switching Loss			21.5		mJ
E_{off}	Turn-Off Switching Loss			20.7		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=300A, R_G=2.4Ω,Ls=35nH, V_{GE}=±15V,T_{vj}=125°C		231		ns
t_r	Rise Time			59		ns
$t_{d(off)}$	Turn-Off Delay Time			361		ns
t_f	Fall Time			296		ns
E_{on}	Turn-On Switching Loss			30.1		mJ
E_{off}	Turn-Off Switching Loss			28.1		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=300A, R_G=2.4Ω,Ls=35nH, V_{GE}=±15V,T_{vj}=150°C		240		ns
t_r	Rise Time			62		ns
$t_{d(off)}$	Turn-Off Delay Time			376		ns
t_f	Fall Time			311		ns
E_{on}	Turn-On Switching Loss			32.9		mJ
E_{off}	Turn-Off Switching Loss			29.9		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_{vj}=150°C,V_{CC}=800V, V_{CEM}≤1200V		1200		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=300A,V_{GE}=0V,T_{vj}=25°C		1.85	2.30	V
		I_F=300A,V_{GE}=0V,T_{vj}=125°C		1.90		
		I_F=300A,V_{GE}=0V,T_{vj}=150°C		1.95		
Q_r	Recovered Charge	V_{CC}=600V,I_F=300A, -di/dt=2937A/μs, Ls=70nH, V_{GE}=-15V,T_{vj}=25°C		36.3		μC
I_{RM}	Peak Reverse Recovery Current			235		A
E_{rec}	Reverse Recovery Energy			15.7		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=300A, -di/dt=2720A/μs, Ls=70nH, V_{GE}=-15V,T_{vj}=125°C		61.3		μC
I_{RM}	Peak Reverse Recovery Current			257		A
E_{rec}	Reverse Recovery Energy			27.5		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=300A, -di/dt=2616A/μs, Ls=70nH, V_{GE}=-15V,T_{vj}=150°C		68.8		μC
I_{RM}	Peak Reverse Recovery Current			262		A
E_{rec}	Reverse Recovery Energy			30.8		mJ

Diode-3-level Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=300A,V_{GE}=0V,T_{vj}=25°C		1.85	2.30	V
		I_F=300A,V_{GE}=0V,T_{vj}=125°C		1.90		
		I_F=300A,V_{GE}=0V,T_{vj}=150°C		1.95		
Q_r	Recovered Charge	V_{CC}=600V,I_F=300A, -di/dt=5683A/μs,Ls=35nH, V_{GE}=-15V,T_{vj}=25°C		36.2		μC
I_{RM}	Peak Reverse Recovery Current			290		A
E_{rec}	Reverse Recovery Energy			13.4		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=300A, -di/dt=4958A/μs,Ls=35nH, V_{GE}=-15V,T_{vj}=125°C		56.6		μC
I_{RM}	Peak Reverse Recovery Current			301		A
E_{rec}	Reverse Recovery Energy			22.2		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=300A, -di/dt=4673A/μs,Ls=35nH, V_{GE}=-15V,T_{vj}=150°C		65.9		μC
I_{RM}	Peak Reverse Recovery Current			306		A
E_{rec}	Reverse Recovery Energy			26.3		mJ

NTC Characteristics T_C=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_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		35		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		1.45		mΩ
R_{thJC}	Junction-to-Case (per IGBT-inverter) Junction-to-Case (per Diode-inverter) Junction-to-Case (per Diode-3-level)			0.098 0.176 0.176	K/W
R_{thCH}	Case-to-Sink (per IGBT-inverter) Case-to-Sink (per Diode-inverter) Case-to-Sink (per Diode-3-level) Case-to-Heatsink (per Module)		0.033 0.059 0.059 0.009		K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M5	3.0 3.0		6.0 6.0	N.m
G	Weight of Module		350		g

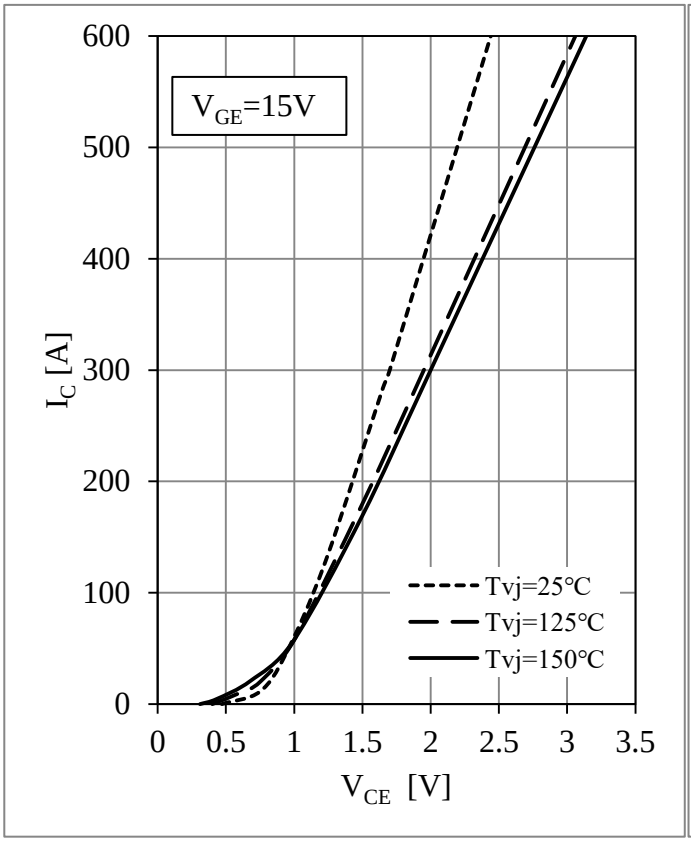


Fig 1. IGBT-inverter Output Characteristics

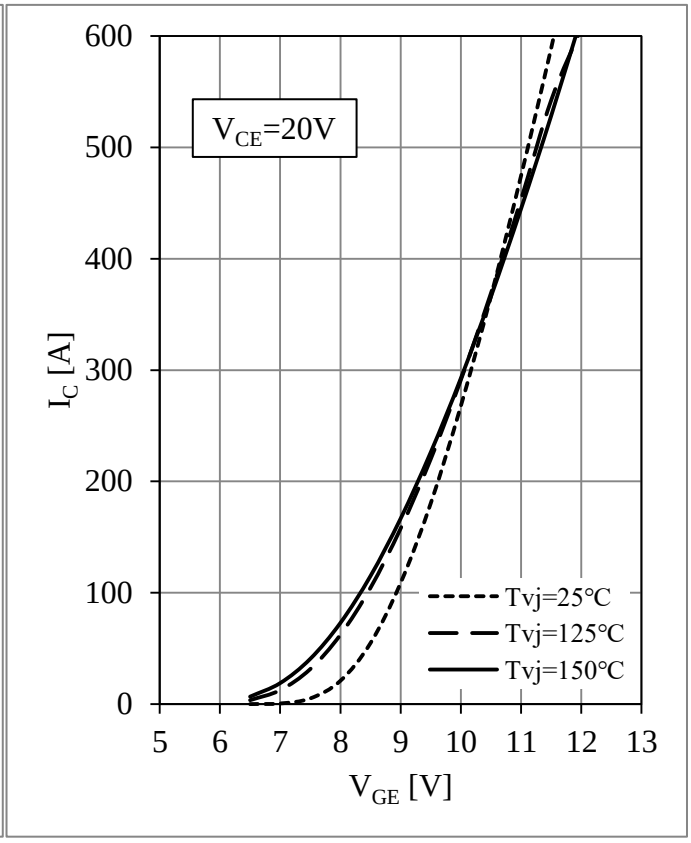


Fig 2. IGBT-inverter Transfer Characteristics

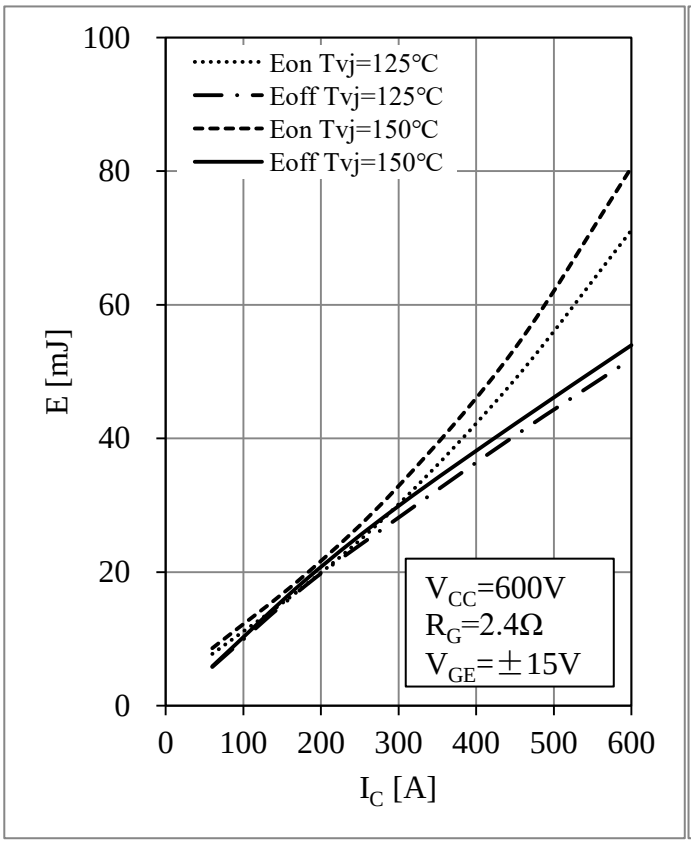


Fig 3. IGBT-inverter Switching Loss vs. I_C

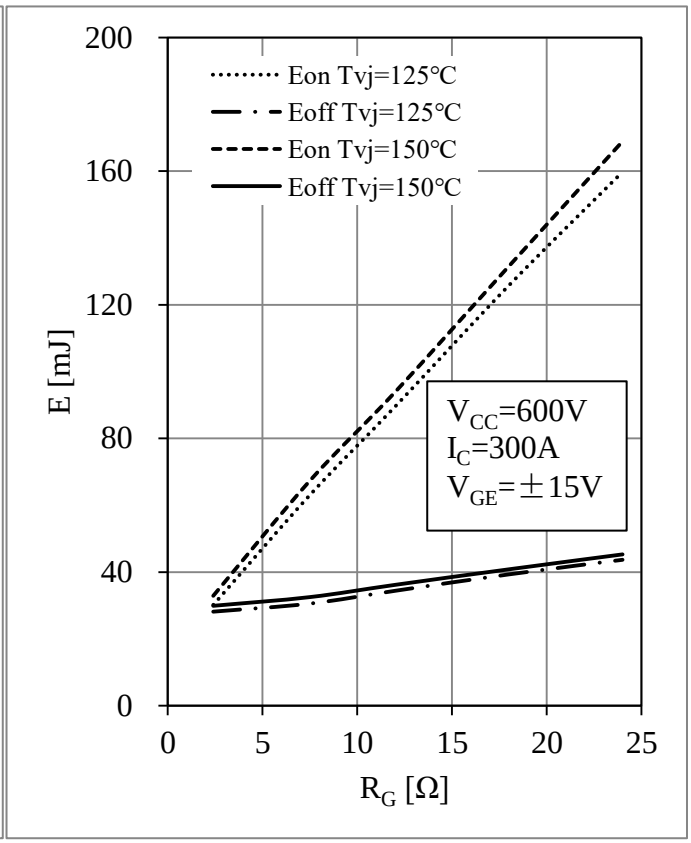


Fig 4. IGBT-inverter Switching Loss vs. R_G

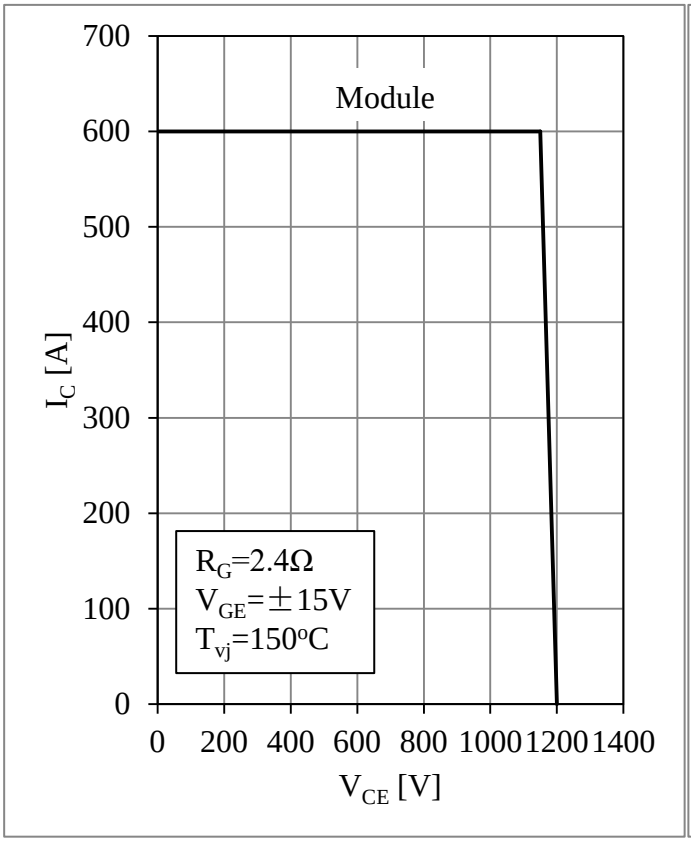


Fig 5. IGBT-inverter RBSOA

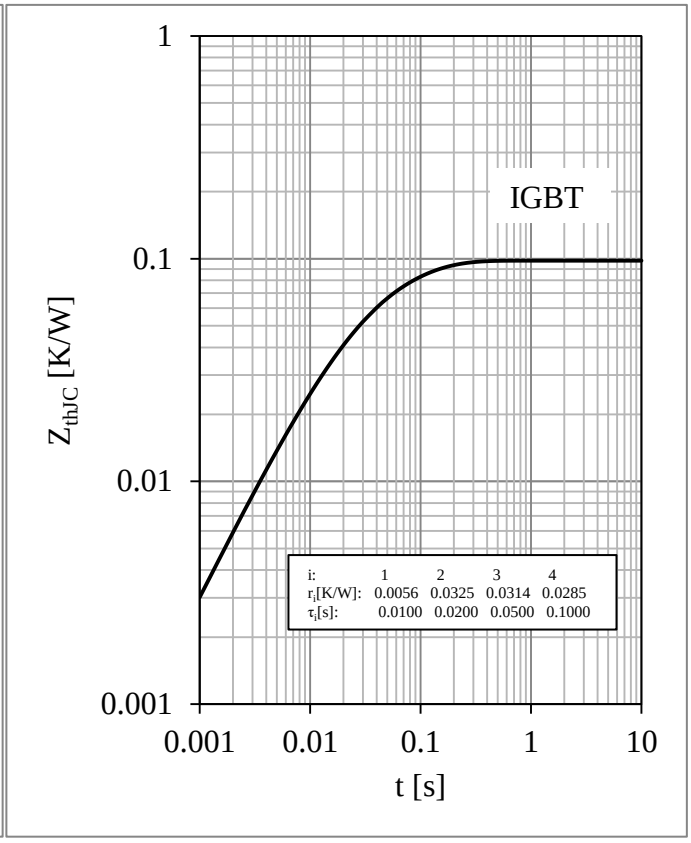


Fig 6. IGBT-inverter Transient Thermal Impedance

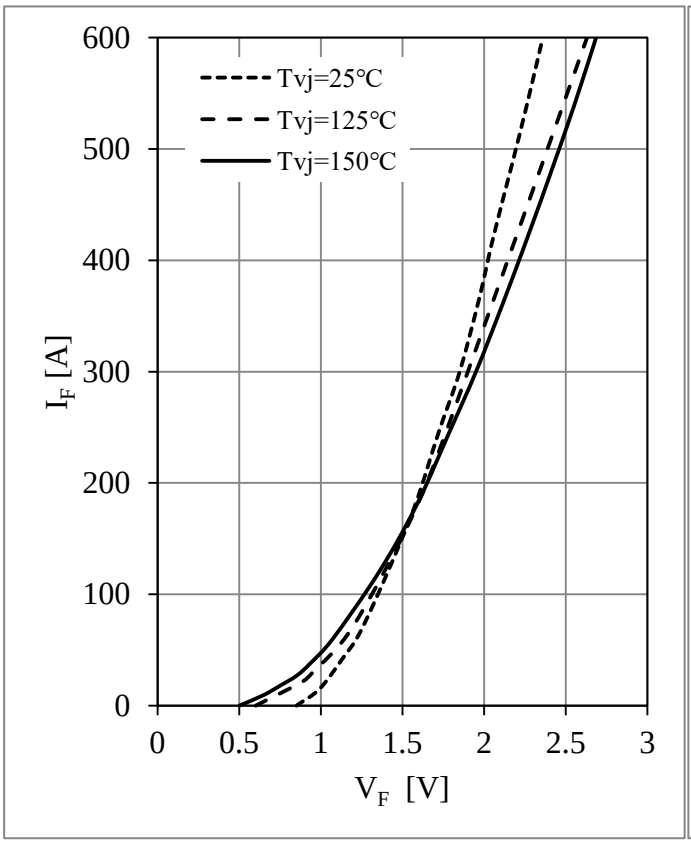


Fig 7. Diode-inverter Forward Characteristics

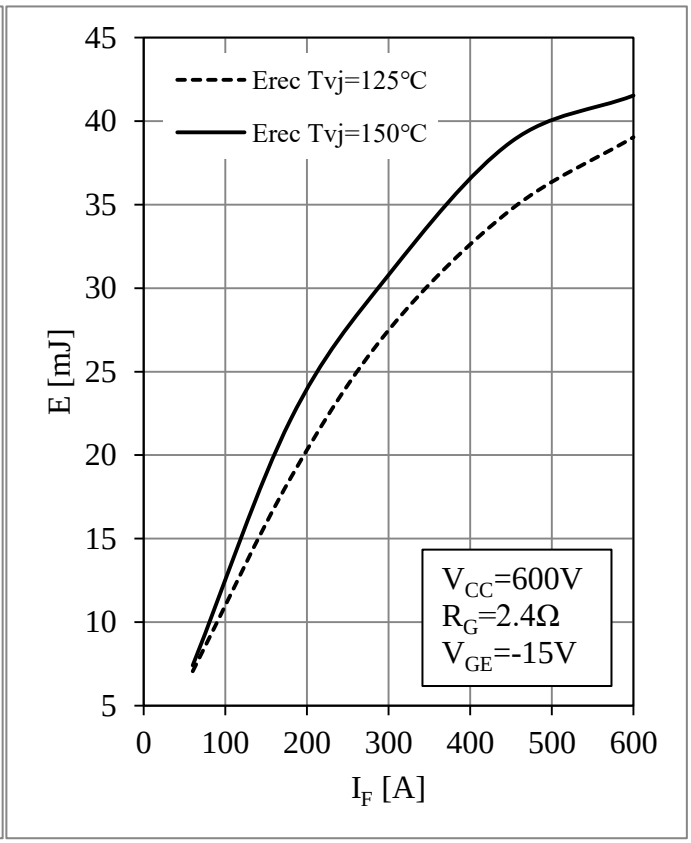


Fig 8. Diode-inverter Switching Loss vs. I_F

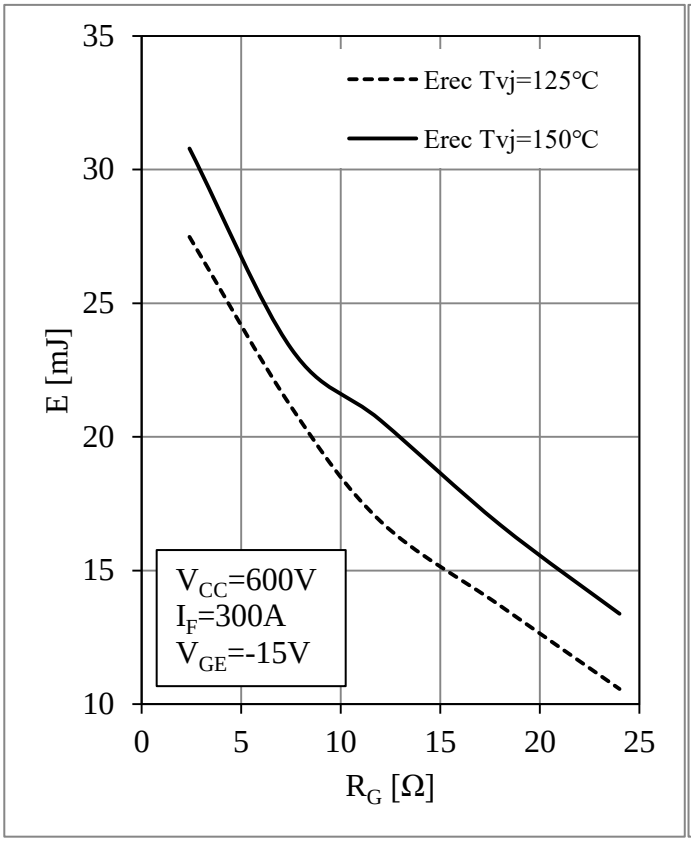


Fig 9. Diode-inverter Switching Loss vs. R_G

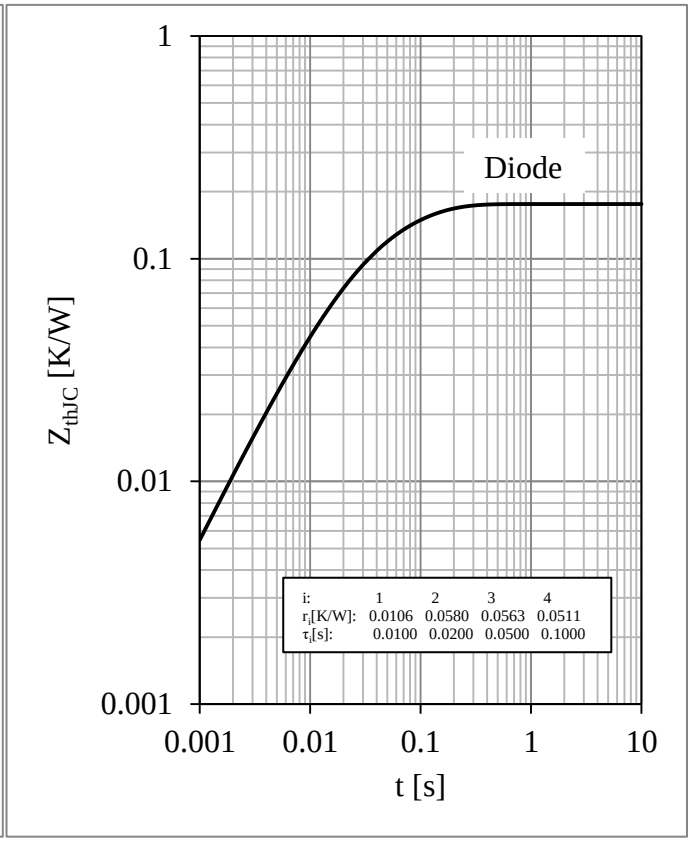


Fig 10. Diode-inverter Transient Thermal Impedance

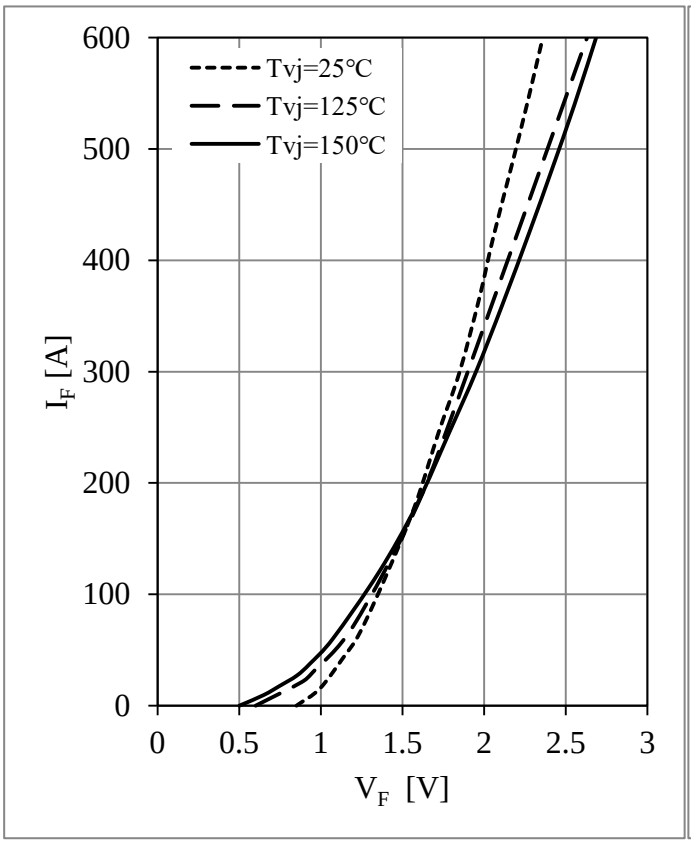


Fig 11. Diode-3-level Forward Characteristics

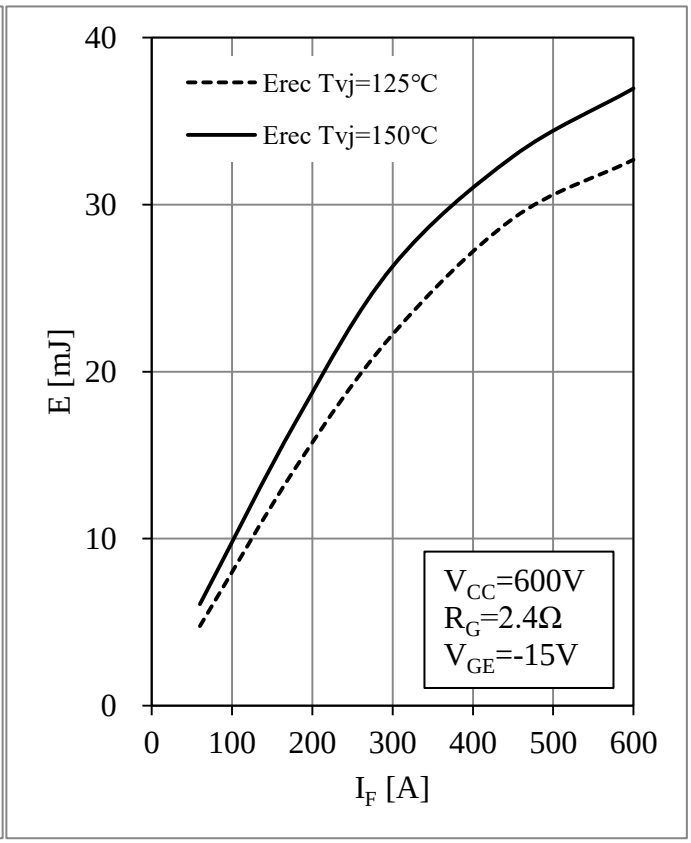


Fig 12. Diode-3-level Switching Loss vs. I_F

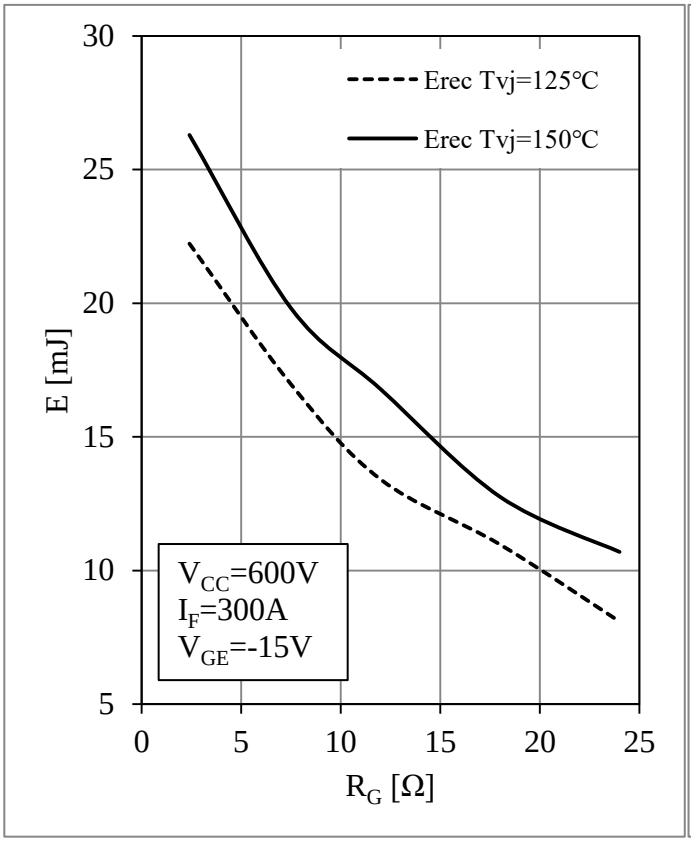


Fig 13. Diode-3-level Switching Loss vs. R_G

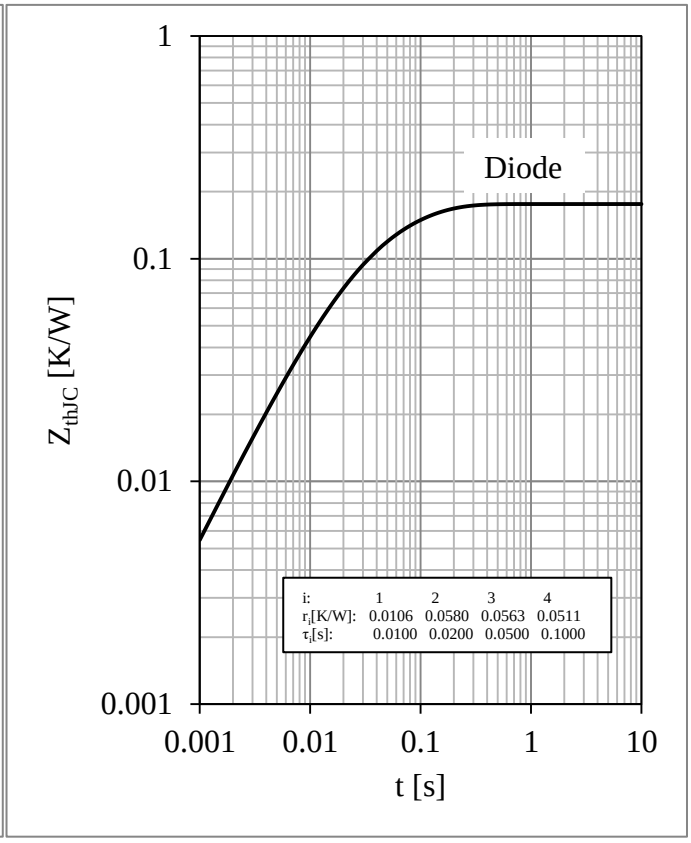


Fig 14. Diode-3-level Transient Thermal Impedance

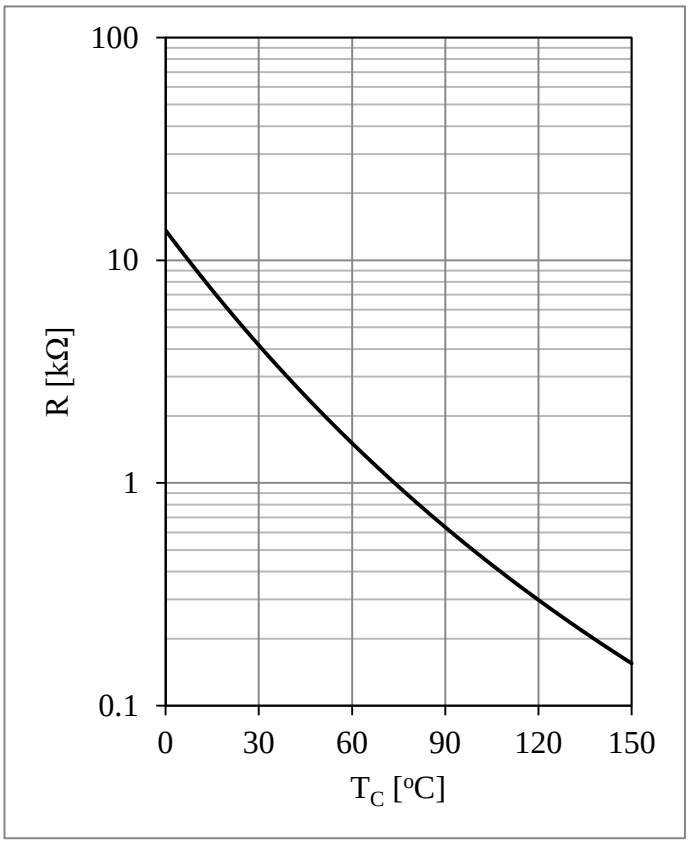
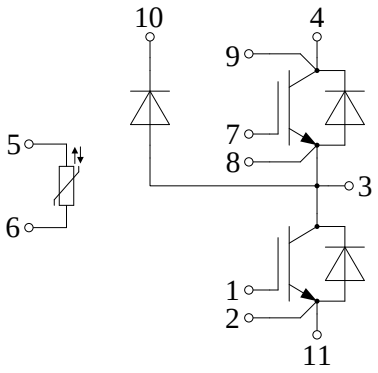


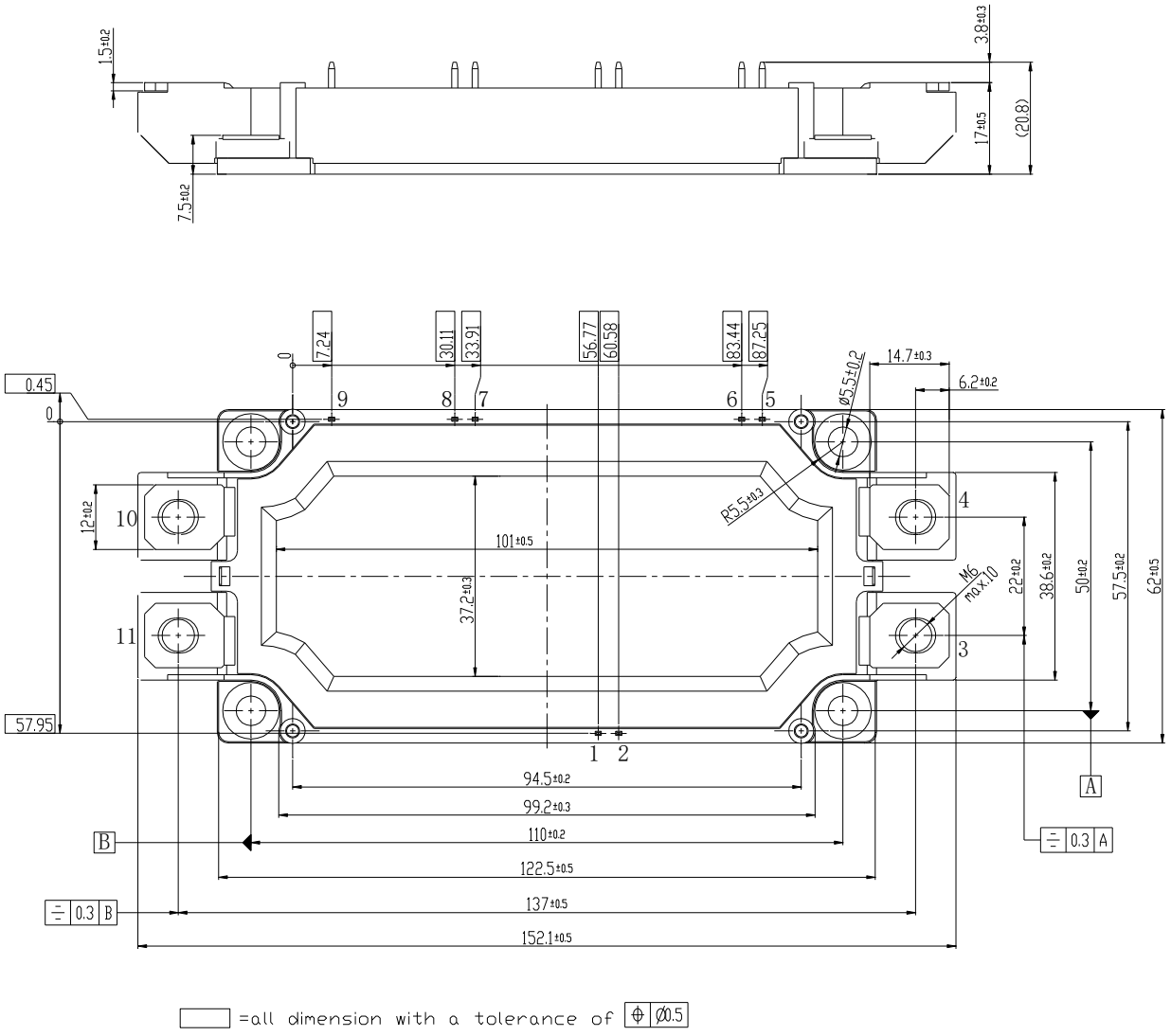
Fig 15. NTC Temperature Characteristic

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.