STARPOWER

SEMICONDUCTOR **IGBT**

GD900TLY120P2S

1200V/900A 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 UPS.

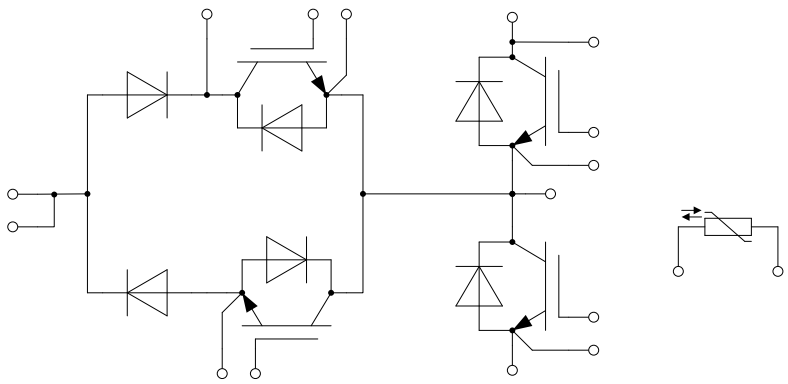
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low switching loss
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

Typical Applications

- Inverter for motor drive
- Uninterruptible power supply
- Solar power

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

T1,T4 IGBT

Symbol	Description	Values	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=80°C	1223 900	A
I_{CM}	Pulsed Collector Current t_p=1ms	1800	A
P_D	Maximum Power Dissipation @ T_j=175°C	3658	W

D1,D4 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	900	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1800	A

T2,T3 IGBT

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25°C @ T_C=40°C	986 900	A
I_{CM}	Pulsed Collector Current t_p=1ms	1800	A
P_D	Maximum Power Dissipation @ T_j=175°C	2307	W

D2,D3 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	90	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	180	A

D5,D6 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	900	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1800	A

Module

Symbol	Description	Values	Unit
T_{jmax}	Maximum Junction Temperature	175	°C
T_{jop}	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	4000	V

T1,T4 IGBT 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=900A,V_{GE}=15V, T_j=25°C		1.70	2.15	V
		I_C=900A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=900A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=36.0mA,V_{CE}=V_{GE}, T_j=25°C	5.3	5.8	6.3	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			0.83		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		93.2		nF
C_{res}	Reverse Transfer Capacitance			2.61		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		6.99		μC
$t_{d(on)}$	Turn-On Delay Time	Vcc=600V,Ic=900A, R_G=1.5Ω, Ls=68nH, V_{GE}=±15V, T_j=25°C		399		ns
t_r	Rise Time			155		ns
$t_{d(off)}$	Turn-Off Delay Time			514		ns
t_f	Fall Time			144		ns
E_{on}	Turn-On Switching Loss			70.9		mJ
E_{off}	Turn-Off Switching Loss			99.4		mJ
$t_{d(on)}$	Turn-On Delay Time	Vcc=600V,Ic=900A, R_G=1.5Ω, Ls=68nH, V_{GE}=±15V, T_j=125°C		412		ns
t_r	Rise Time			157		ns
$t_{d(off)}$	Turn-Off Delay Time			546		ns
t_f	Fall Time			159		ns
E_{on}	Turn-On Switching Loss			101		mJ
E_{off}	Turn-Off Switching Loss			116		mJ
$t_{d(on)}$	Turn-On Delay Time	Vcc=600V,Ic=900A, R_G=1.5Ω, Ls=68nH, V_{GE}=±15V, T_j=150°C		414		ns
t_r	Rise Time			164		ns
$t_{d(off)}$	Turn-Off Delay Time			586		ns
t_f	Fall Time			187		ns
E_{on}	Turn-On Switching Loss			107		mJ
E_{off}	Turn-Off Switching Loss			118		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=800V, V_{CEM}≤1200V		3600		A

D1,D4 Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=900A,V_{GE}=0V,T_i=25°C		1.85	2.3	V
		I_F=900A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=900A,V_{GE}=0V,T_j=150°C		1.95		
Q_r	Recovered Charge	V_R=600V,I_F=900A, -di/dt=4500A/μs,V_{GE}=-15V Ls=68nH,T_j=25°C		57.1		μC
I_{RM}	Peak Reverse Recovery Current			357		A
E_{rec}	Reverse Recovery Energy			28.9		mJ
Q_r	Recovered Charge	V_R=600V,I_F=900A, -di/dt=4240A/μs,V_{GE}=-15V Ls=68nH,T_j=125°C		105		μC
I_{RM}	Peak Reverse Recovery Current			409		A
E_{rec}	Reverse Recovery Energy			45.2		mJ
Q_r	Recovered Charge	V_R=600V,I_F=900A, -di/dt=4100A/μs,V_{GE}=-15V Ls=68nH,T_j=150°C		110		μC
I_{RM}	Peak Reverse Recovery Current			433		A
E_{rec}	Reverse Recovery Energy			46.7		mJ

T2,T3 IGBT 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=900A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=900A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=900A,V_{GE}=15V, T_j=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=14.4mA,V_{CE}=V_{GE}, T_j=25°C	5.1	5.8	6.4	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			0.33		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		104		nF
C_{res}	Reverse Transfer Capacitance			2.06		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		6.24		μC
$t_{d(on)}$	Turn-On Delay Time	Vcc=300V,Ic=900A, R_G=1.5Ω, Ls=68nH, V_{GE}=±15V, T_j=25°C		385		ns
t_r	Rise Time			177		ns
$t_{d(off)}$	Turn-Off Delay Time			364		ns
t_f	Fall Time			105		ns
E_{on}	Turn-On Switching Loss			4.23		mJ
E_{off}	Turn-Off Switching Loss			44.5		mJ
$t_{d(on)}$	Turn-On Delay Time	Vcc=300V,Ic=900A, R_G=1.5Ω, Ls=68nH, V_{GE}=±15V, T_j=125°C		391		ns
t_r	Rise Time			178		ns
$t_{d(off)}$	Turn-Off Delay Time			376		ns
t_f	Fall Time			109		ns
E_{on}	Turn-On Switching Loss			4.95		mJ
E_{off}	Turn-Off Switching Loss			45.5		mJ
$t_{d(on)}$	Turn-On Delay Time	Vcc=300V,Ic=900A, R_G=1.5Ω, Ls=68nH, V_{GE}=±15V, T_j=150°C		395		ns
t_r	Rise Time			179		ns
$t_{d(off)}$	Turn-Off Delay Time			386		ns
t_f	Fall Time			156		ns
E_{on}	Turn-On Switching Loss			5.35		mJ
E_{off}	Turn-Off Switching Loss			47.0		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤650V		4500		A

D2,D3 Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=90A,V_{GE}=0V,T_j=25°C		1.50	2.05	V
		I_F=90A,V_{GE}=0V,T_j=125°C		1.45		
		I_F=90A,V_{GE}=0V,T_j=150°C		1.40		

D5,D6 Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=900A,V_{GE}=0V,T_j=25°C		1.55	2.00	V
		I_F=900A,V_{GE}=0V,T_j=125°C		1.50		
		I_F=900A,V_{GE}=0V,T_j=150°C		1.45		
Q_r	Recovered Charge	V_R=300V,I_F=900A, -di/dt=7400A/μs,V_{GE}=-15V Ls=68nH,T_j=25°C		19.0		μC
I_{RM}	Peak Reverse Recovery Current			258		A
E_{rec}	Reverse Recovery Energy			2.95		mJ
Q_r	Recovered Charge	V_R=300V,I_F=900A, -di/dt=6200A/μs,V_{GE}=-15V Ls=68nH,T_j=125°C		35.0		μC
I_{RM}	Peak Reverse Recovery Current			294		A
E_{rec}	Reverse Recovery Energy			5.37		mJ
Q_r	Recovered Charge	V_R=300V,I_F=900A, -di/dt=6000A/μs,V_{GE}=-15V Ls=68nH,T_j=150°C		36.7		μC
I_{RM}	Peak Reverse Recovery Current			313		A
E_{rec}	Reverse Recovery Energy			5.98		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		10		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.20		mΩ
R_{thJC}	Junction-to-Case (per T1,T4 IGBT) Junction-to-Case (per D1,D4 Diode) Junction-to-Case (per T2,T3 IGBT) Junction-to-Case (per D2,D3 Diode) Junction-to-Case (per D5,D6 Diode)			41.00 63.00 65.00 382.25 123.00	K/kW
R_{thCH}	Case-to-Heatsink (per T1,T4 IGBT) Case-to-Heatsink (per D1,D4 Diode) Case-to-Heatsink (per T2,T3 IGBT) Case-to-Heatsink (per D2,D3 Diode) Case-to-Heatsink (per D5,D6 Diode) Case-to-Heatsink (per Module)		16.33 25.10 25.89 152.28 49.00 3.00		K/kW
M	Terminal Connection Torque, Screw M4 Terminal Connection Torque, Screw M8 Mounting Torque, Screw M5	1.8 8.0 3.0		2.1 10 6.0	N.m
G	Weight of Module		1210		g

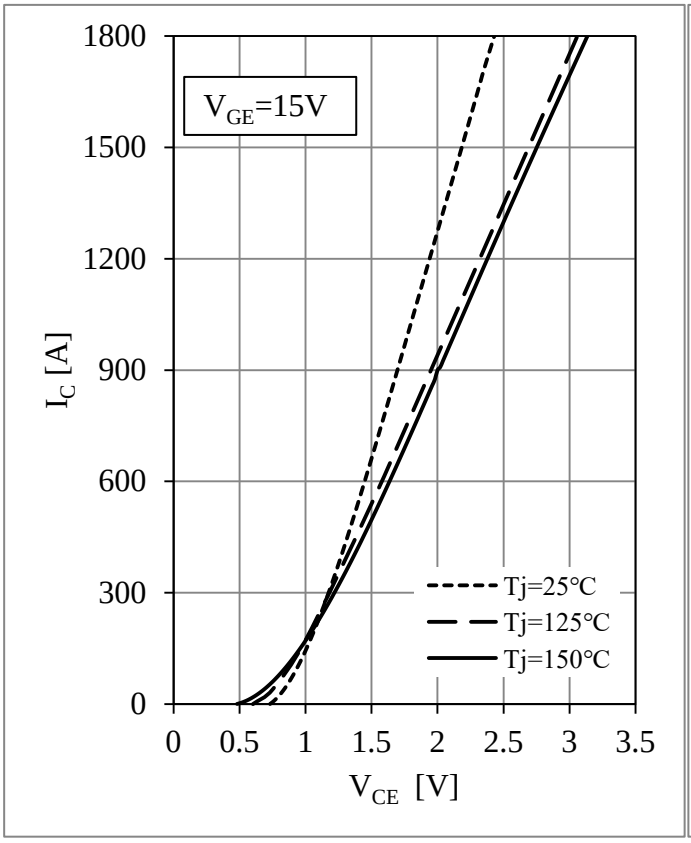


Fig 1. T1,T4 IGBT Output Characteristics

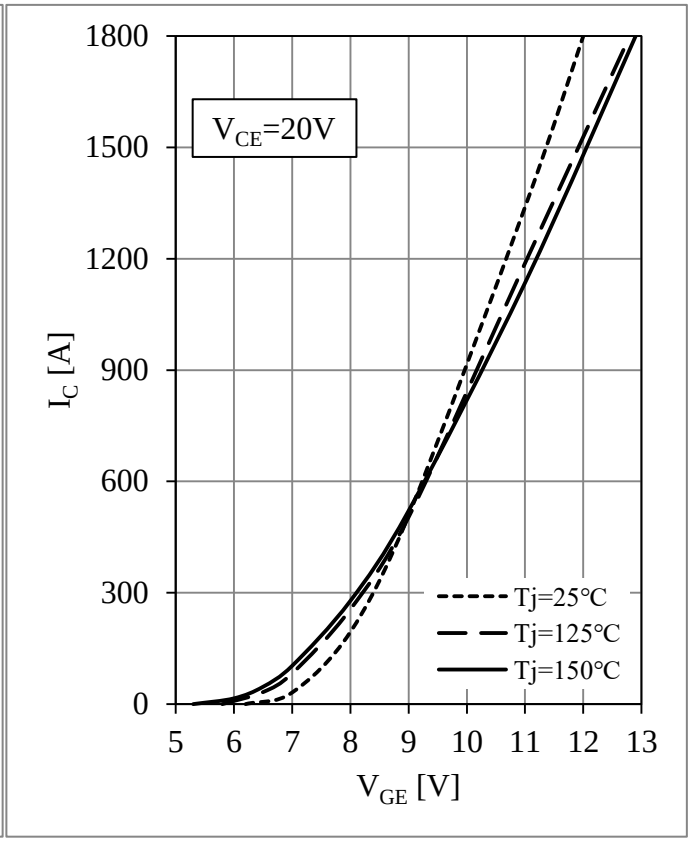


Fig 2. T1,T4 IGBT Transfer Characteristics

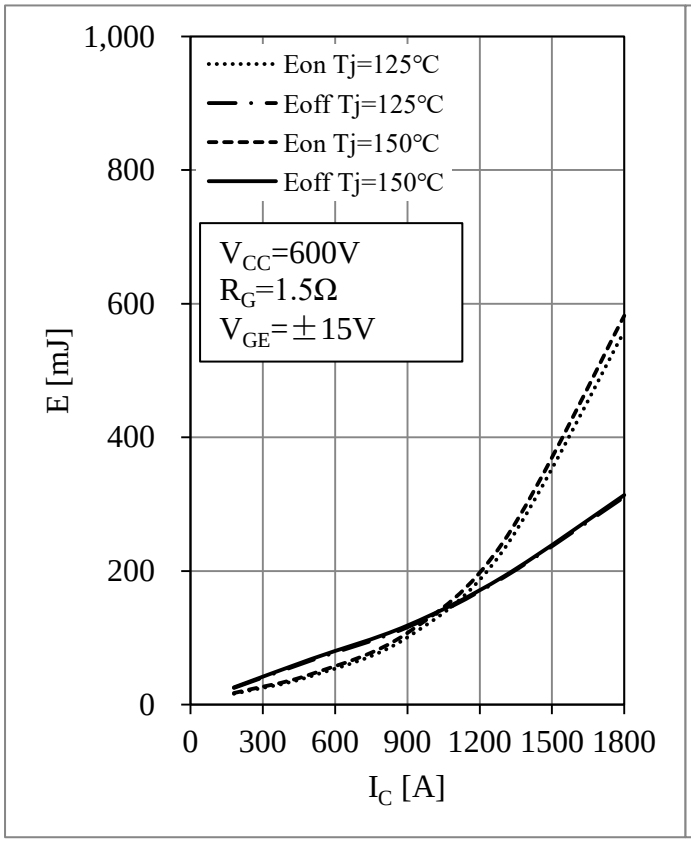


Fig 3. T1,T4 IGBT Switching Loss vs. I_C

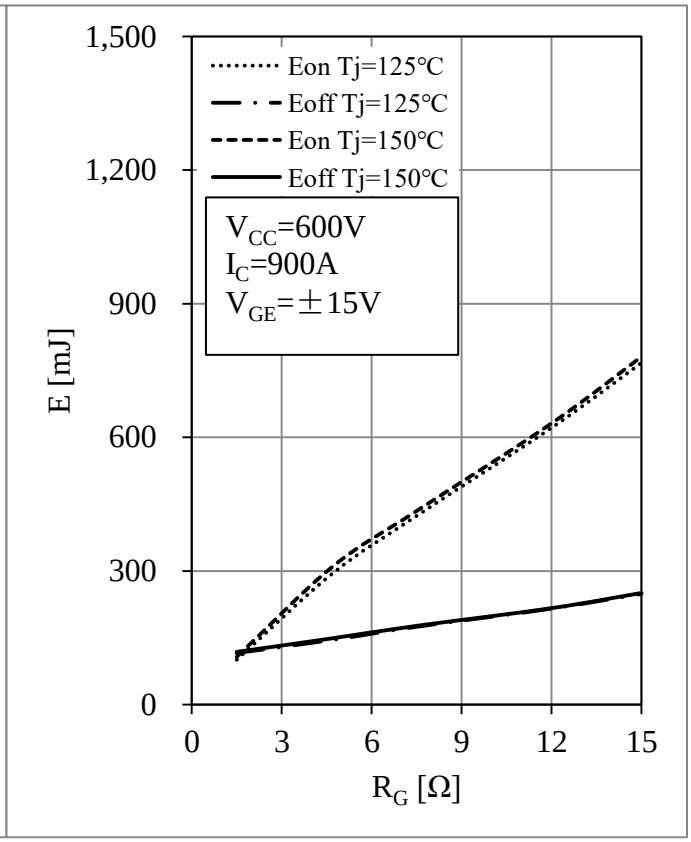


Fig 4. T1,T4 IGBT Switching Loss vs. R_G

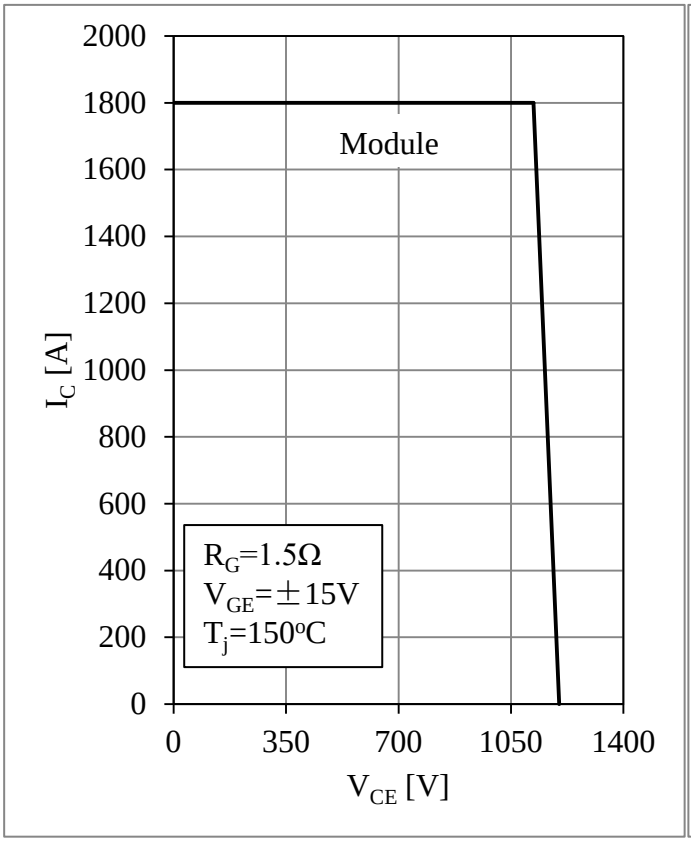


Fig 5. T1,T4 RBSOA

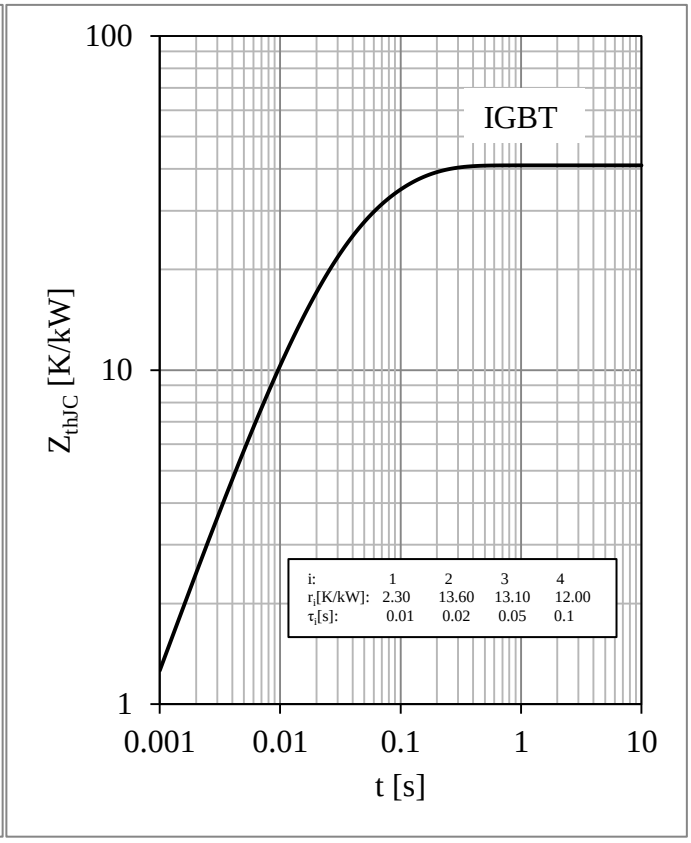


Fig 6. T1,T4 IGBT Transient Thermal Impedance

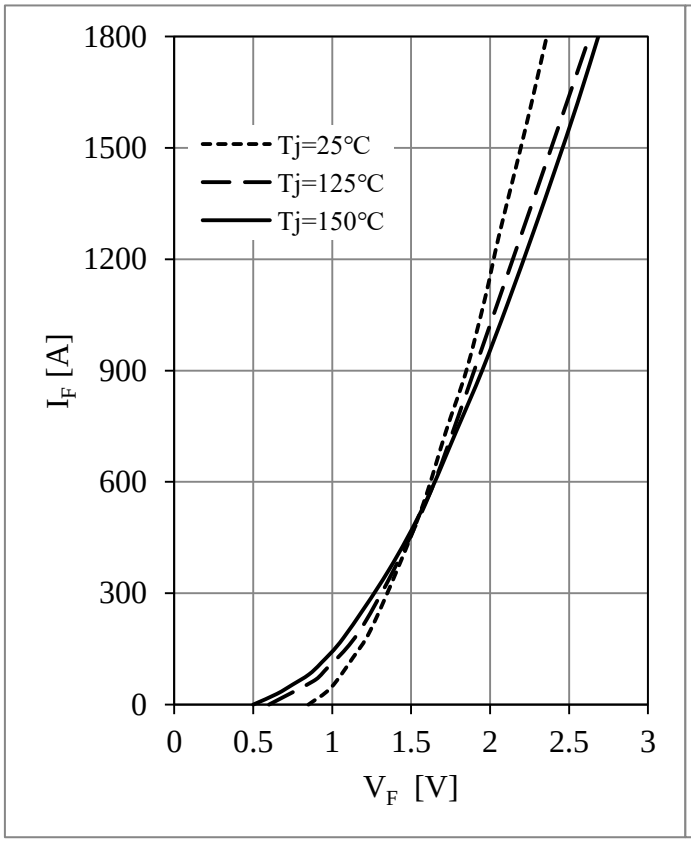


Fig 7. D1,D4 Diode Forward Characteristics

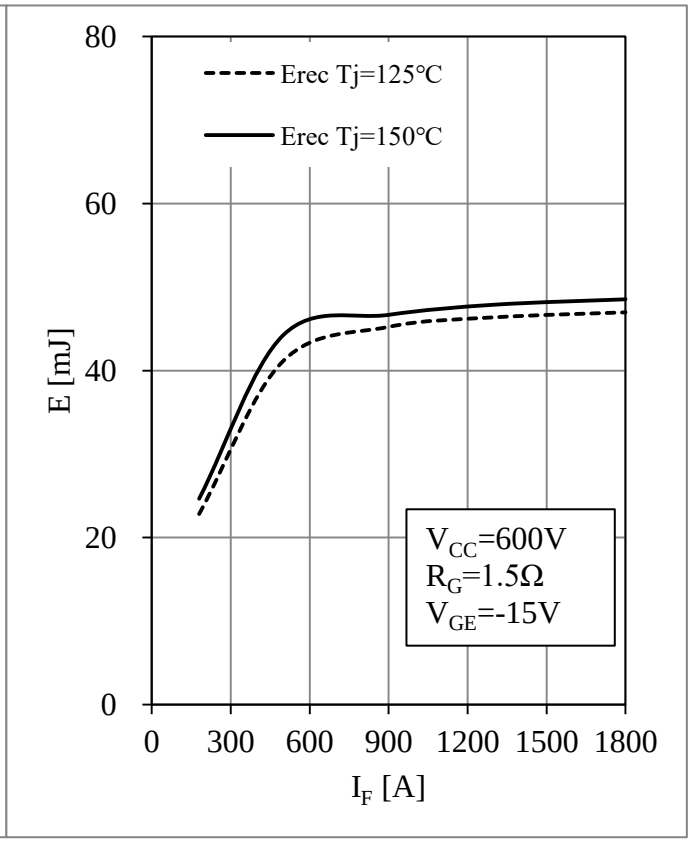


Fig 8. D1,D4 Diode Switching Loss vs. I_F

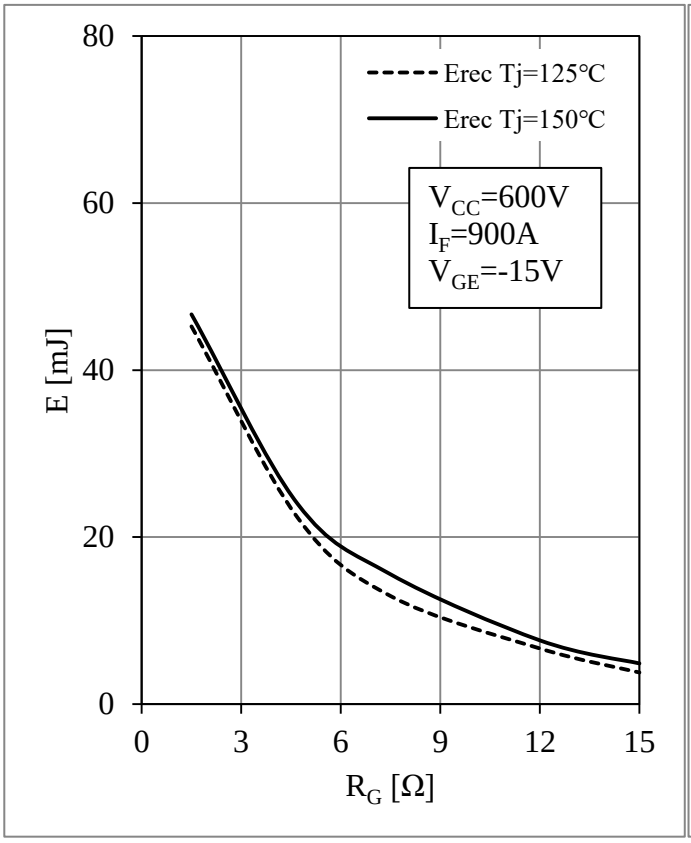


Fig 9. D1,D4 Diode Switching Loss vs. R_G

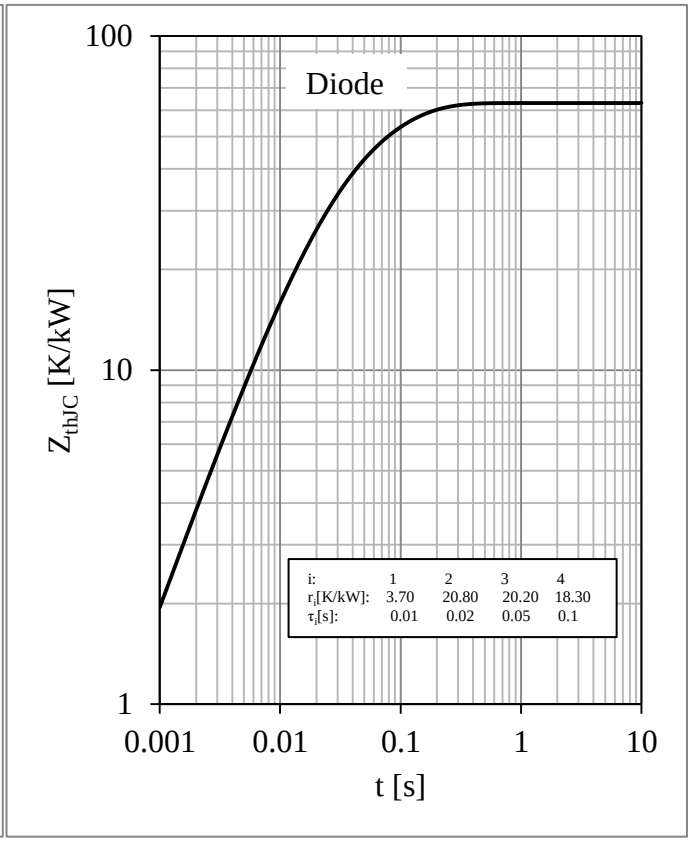


Fig 10. D1,D4 Diode Transient Thermal Impedance

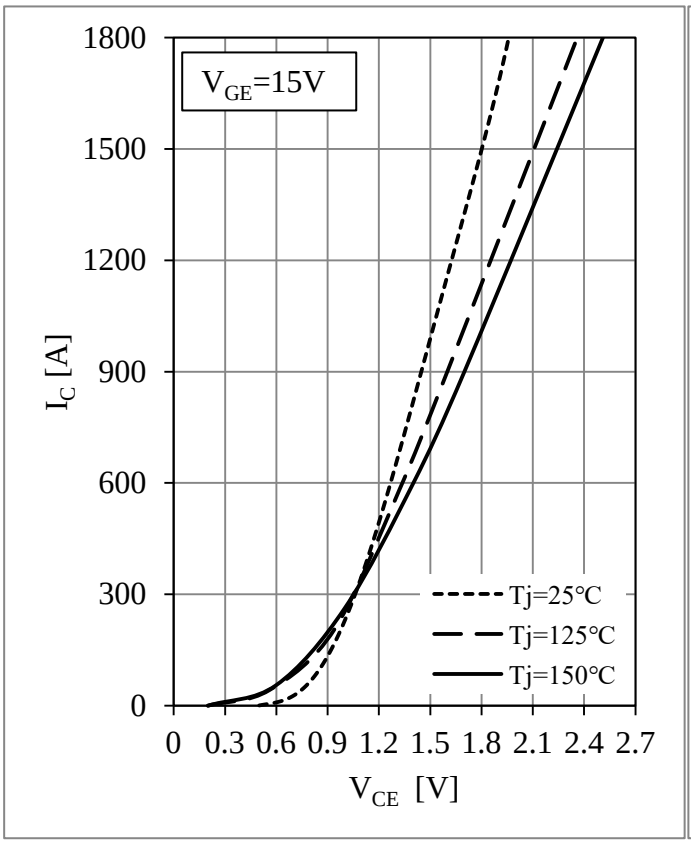


Fig 11. T2,T3 IGBT Output Characteristics

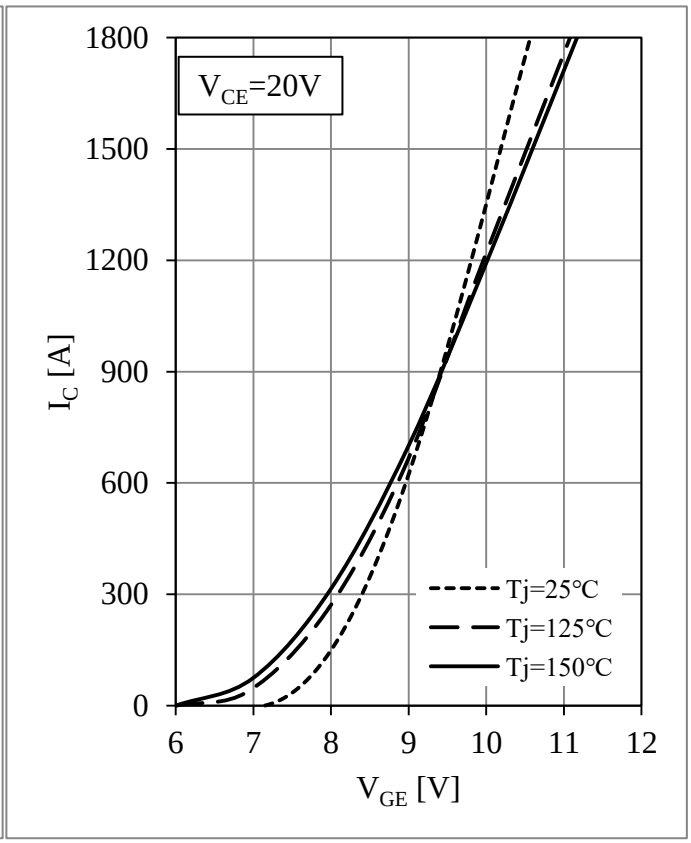


Fig 12. T2,T3 IGBT Transfer Characteristics

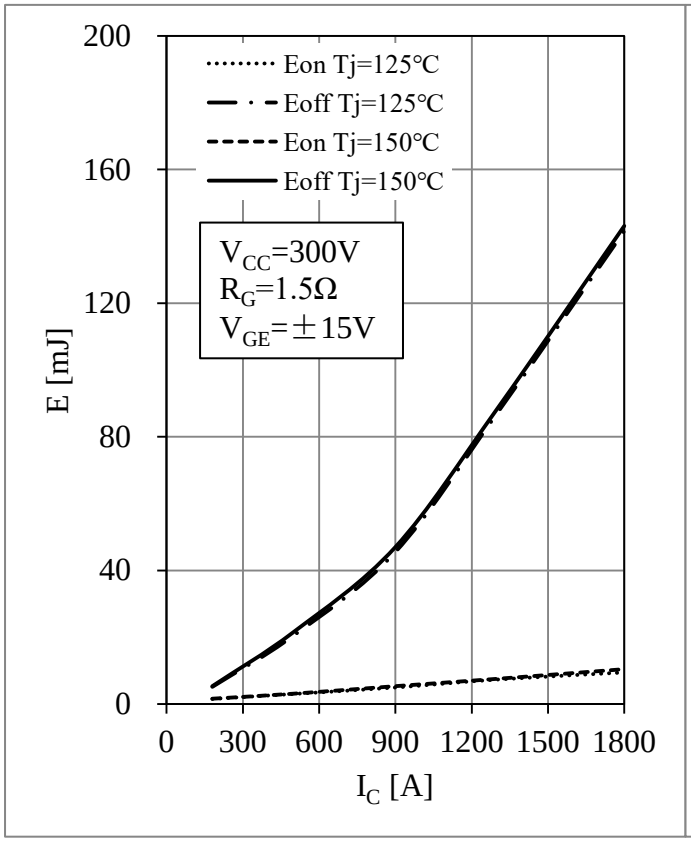


Fig 13. T2,T3 IGBT Switching Loss vs. I_C

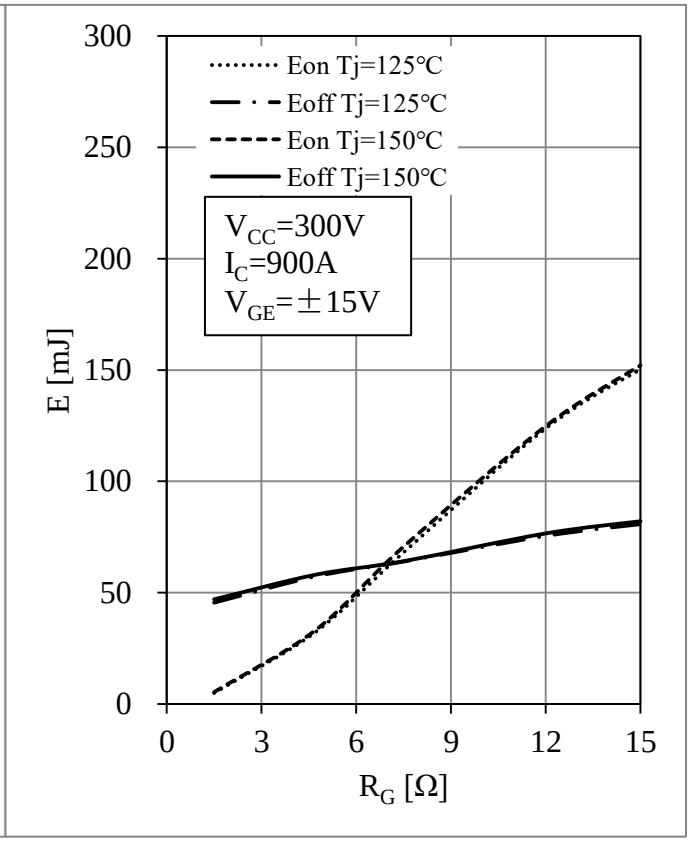


Fig 14. T2,T3 IGBT Switching Loss vs. R_G

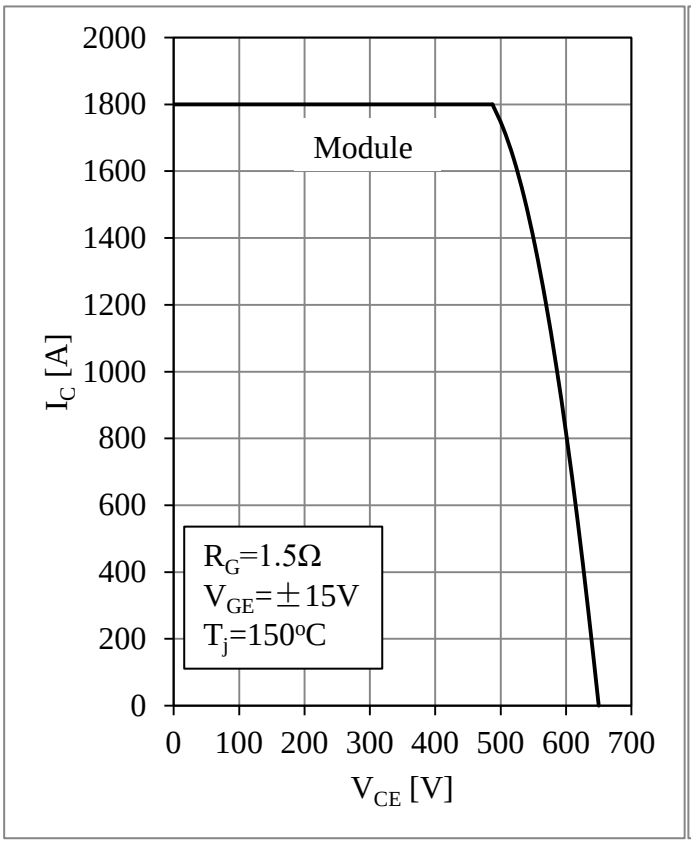


Fig 15. T2,T3 RBSOA

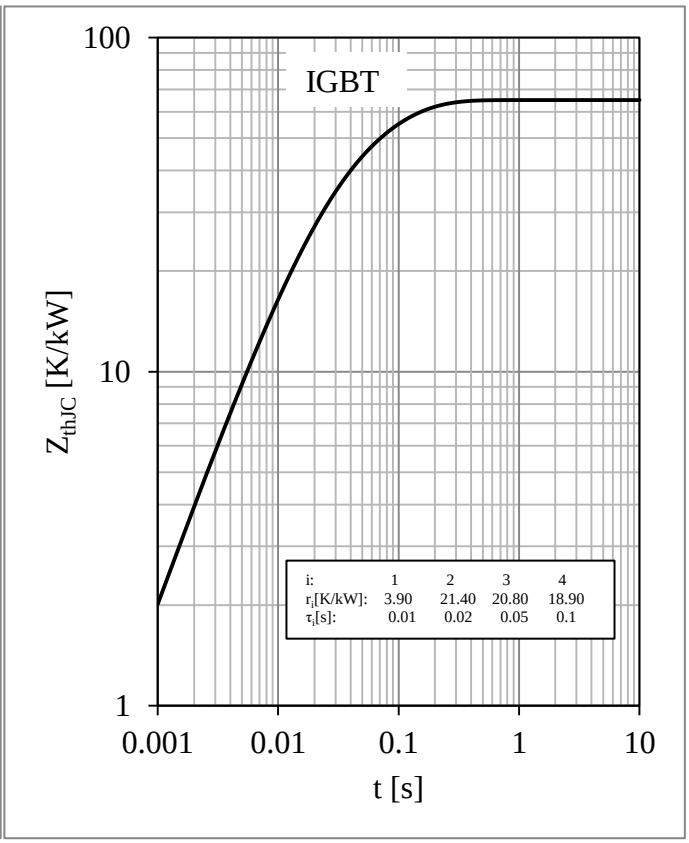


Fig 16. T2,T3 IGBT Transient Thermal Impedance

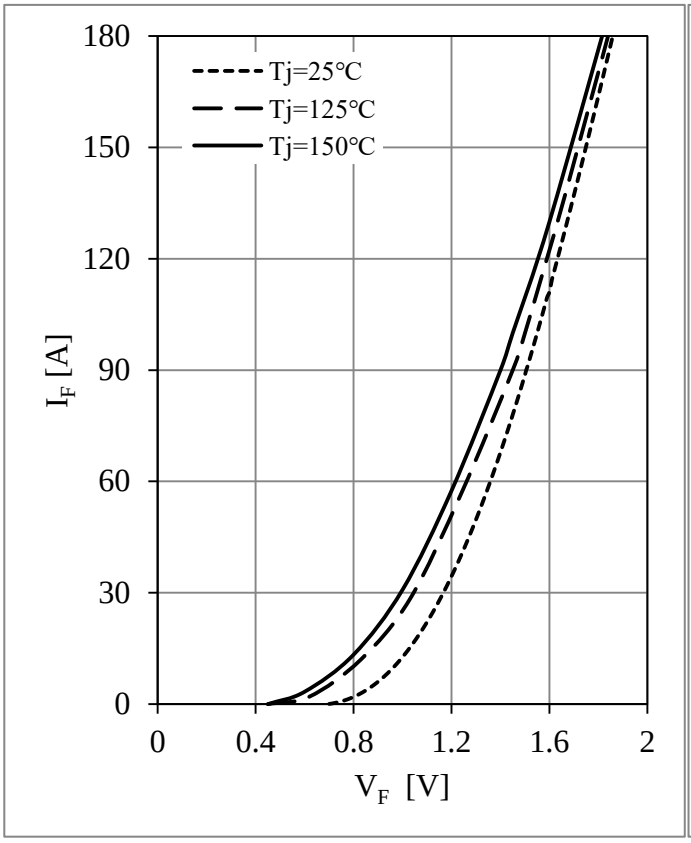


Fig 17. D2,D3Diode Switching Loss vs. R_G

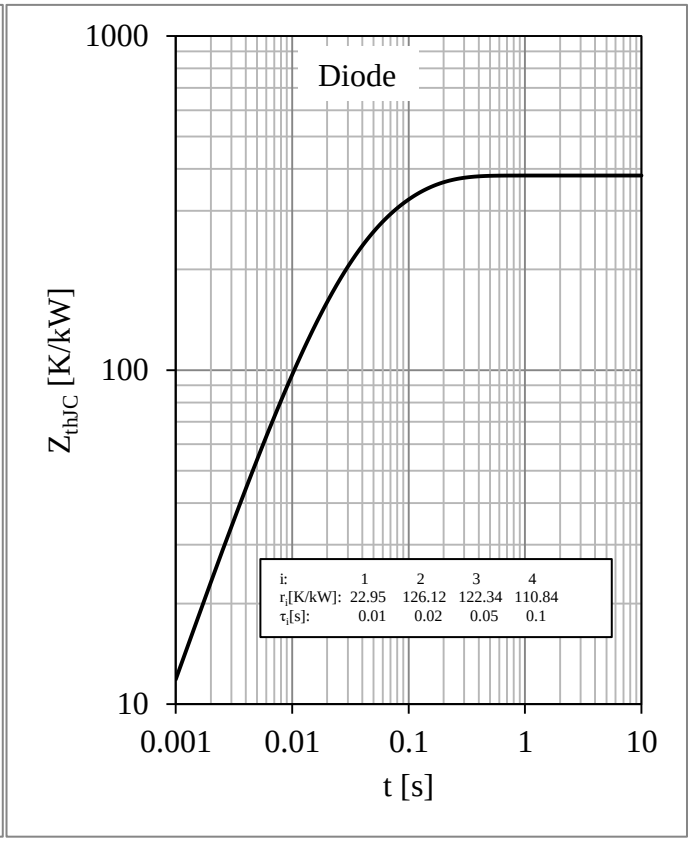


Fig 18. D2,D3 Diode Transient Thermal Impedance

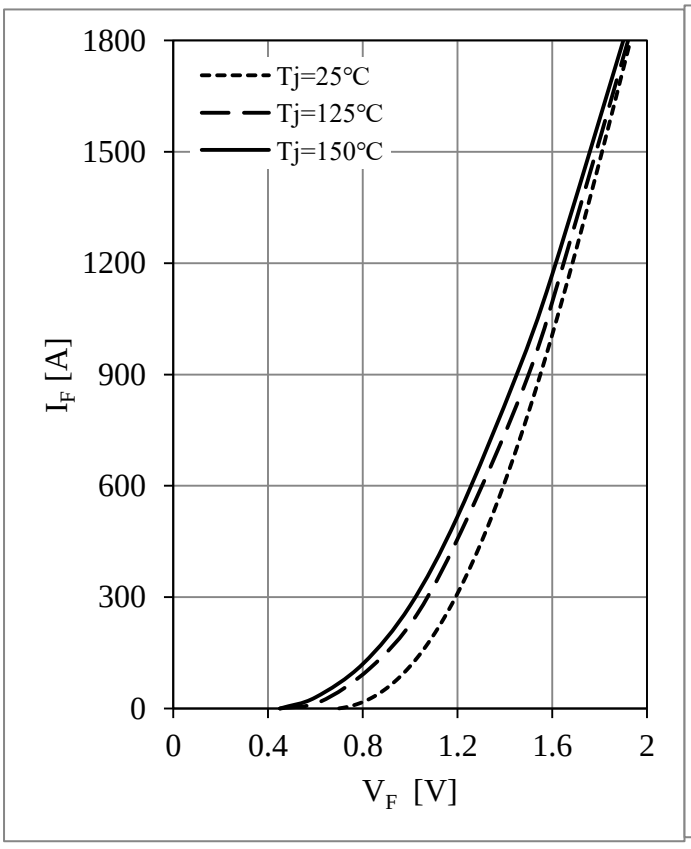


Fig 19. D5,D6 Diode Forward Characteristics

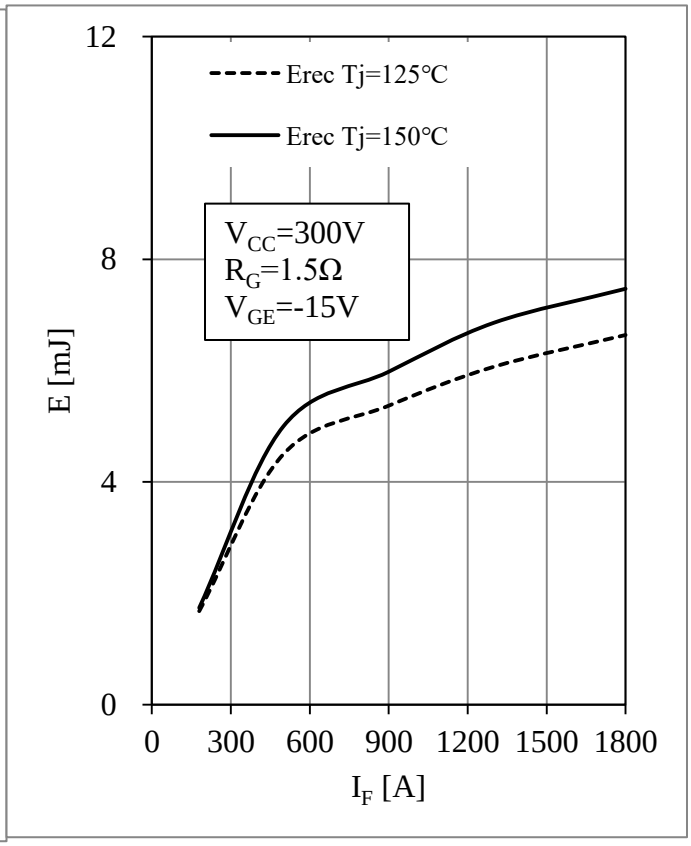


Fig 20. D5,D6 Diode Switching Loss vs. I_F

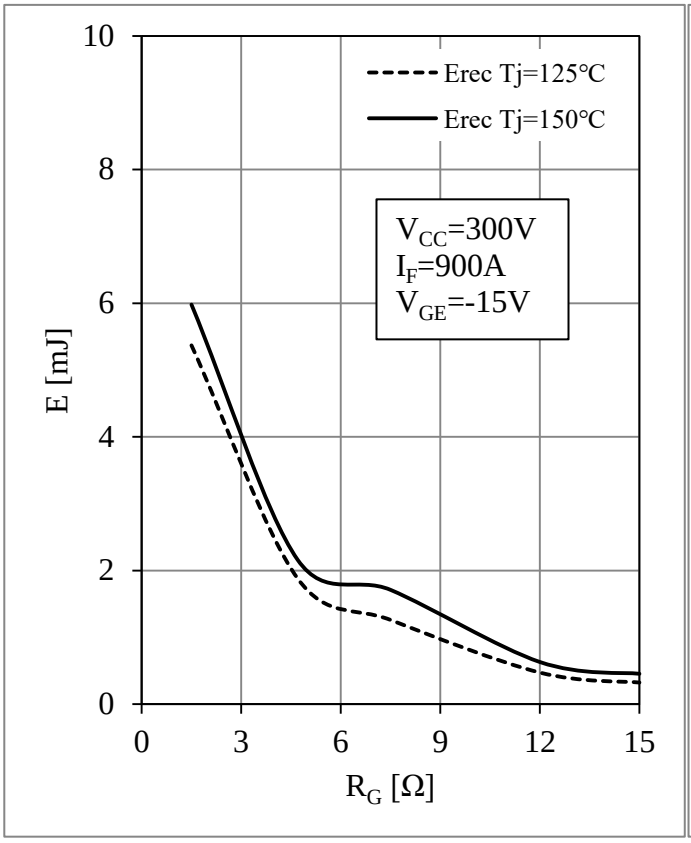


Fig 21. D5,D6 Diode Switching Loss vs. R_G

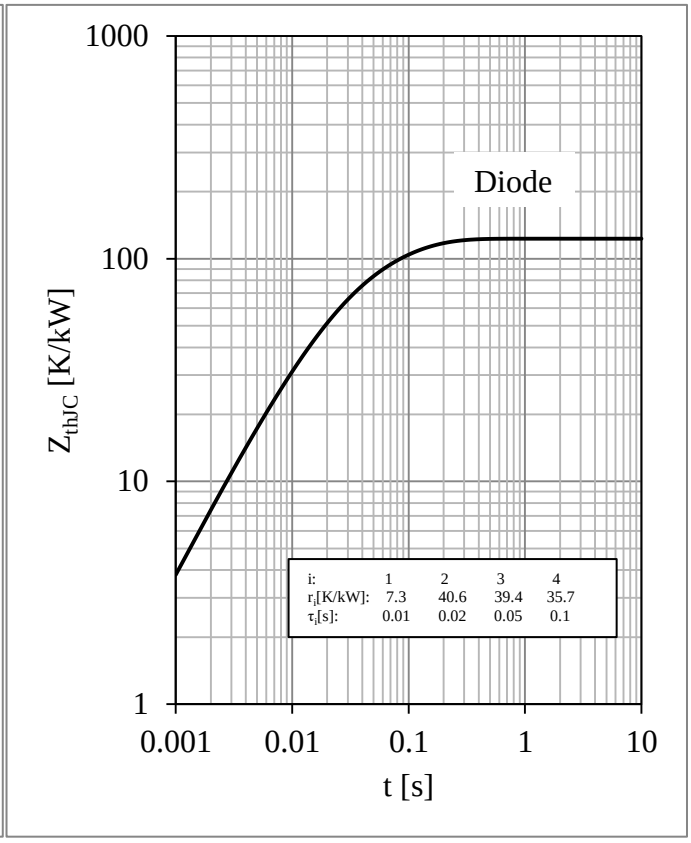


Fig 22. D5,D6 Diode Transient Thermal Impedance

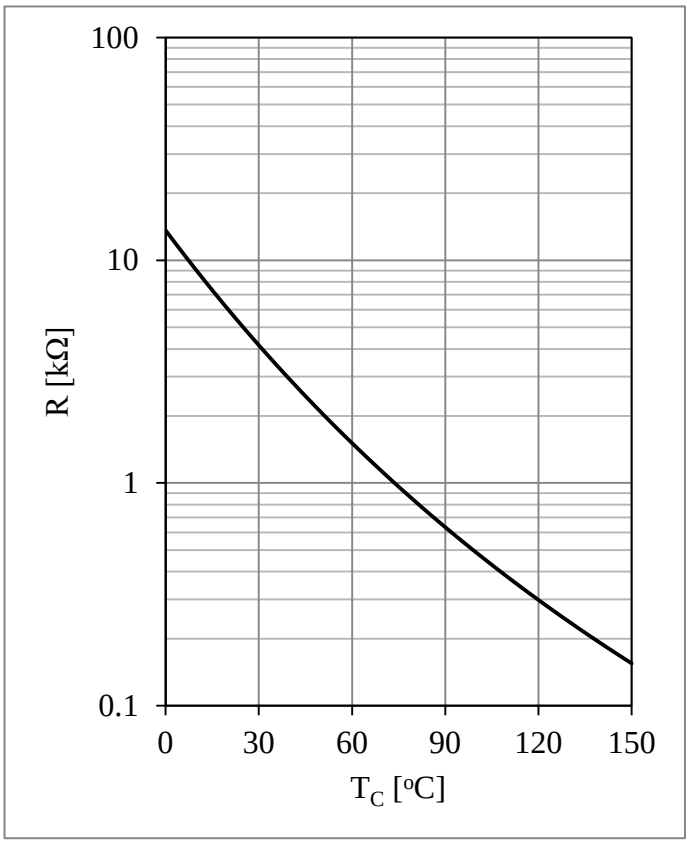
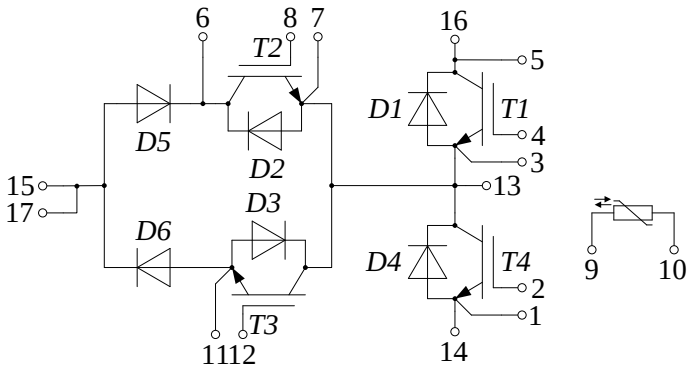


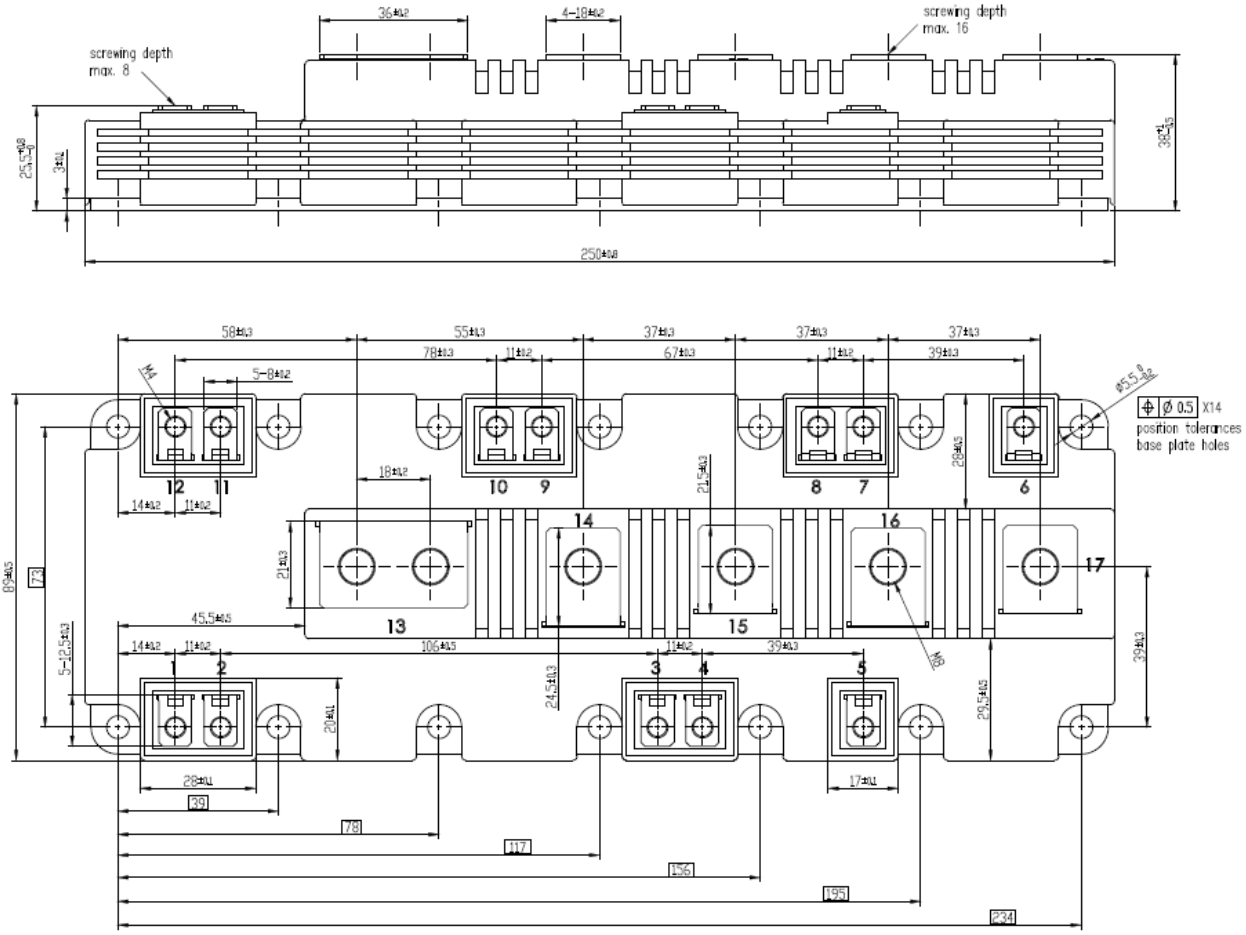
Fig 23. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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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.

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

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