

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.

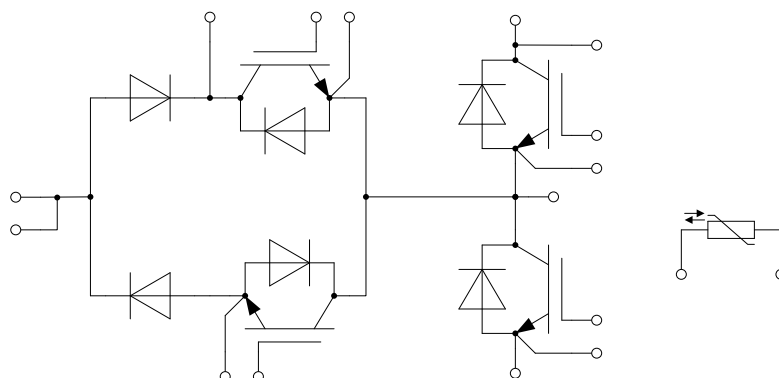
Features

- 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 $T_C=25^{\circ}\text{C}$ 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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=80^{\circ}\text{C}$	1223 900	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	1800	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	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 $t_p=1\text{ms}$	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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=40^{\circ}\text{C}$	986 900	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	1800	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	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 $t_p=1\text{ms}$	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 $t_p=1\text{ms}$	1800	A

Module

Symbol	Description	Values	Unit
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
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, $f=50\text{Hz}$, $t=1\text{min}$	4000	V

T1,T4 IGBT 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	$I_C=900\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.70	2.15	V
		$I_C=900\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.95		
		$I_C=900\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=36.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.3	5.8	6.3	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			0.83		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		93.2		nF
C_{res}	Reverse Transfer Capacitance			2.61		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		6.99		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=900\text{A}, R_G=1.5\Omega, L_S=68\text{nH}, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		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	$V_{CC}=600\text{V}, I_C=900\text{A}, R_G=1.5\Omega, L_S=68\text{nH}, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		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	$V_{CC}=600\text{V}, I_C=900\text{A}, R_G=1.5\Omega, L_S=68\text{nH}, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		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	$t_P \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$		3600		A

D1,D4 Diode Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

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

T2,T3 IGBT Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=900\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.45	1.90	V
		$I_C=900\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.60		
		$I_C=900\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=14.4\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.1	5.8	6.4	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			0.33		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		104		nF
C_{res}	Reverse Transfer Capacitance			2.06		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		6.24		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=900\text{A}, R_G=1.5\Omega, L_S=68\text{nH}, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		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	$V_{CC}=300\text{V}, I_C=900\text{A}, R_G=1.5\Omega, L_S=68\text{nH}, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		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	$V_{CC}=300\text{V}, I_C=900\text{A}, R_G=1.5\Omega, L_S=68\text{nH}, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		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	$t_P \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		4500		A

D2,D3 Diode Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

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

D5,D6 Diode Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=900\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.55	2.00	V
		$I_F=900\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.50		
		$I_F=900\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.45		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=900\text{A},$ $-di/dt=7400\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_s=68\text{nH}, T_j=25^{\circ}\text{C}$		19.0		μC
I_{RM}	Peak Reverse Recovery Current			258		A
E_{rec}	Reverse Recovery Energy			2.95		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=900\text{A},$ $-di/dt=6200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_s=68\text{nH}, T_j=125^{\circ}\text{C}$		35.0		μC
I_{RM}	Peak Reverse Recovery Current			294		A
E_{rec}	Reverse Recovery Energy			5.37		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=900\text{A},$ $-di/dt=6000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $L_s=68\text{nH}, T_j=150^{\circ}\text{C}$		36.7		μC
I_{RM}	Peak Reverse Recovery Current			313		A
E_{rec}	Reverse Recovery Energy			5.98		mJ

NTC Characteristics $T_C=25^{\circ}\text{C}$ 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		10		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.20		m Ω
R_{thJC}	Junction-to-Case (per T1,T4 IGBT)			41.00	K/kW
	Junction-to-Case (per D1,D4 Diode)			63.00	
	Junction-to-Case (per T2,T3 IGBT)			65.00	
	Junction-to-Case (per D2,D3 Diode)			382.25	
	Junction-to-Case (per D5,D6 Diode)			123.00	
R_{thCH}	Case-to-Heatsink (per T1,T4 IGBT)		16.33		K/kW
	Case-to-Heatsink (per D1,D4 Diode)		25.10		
	Case-to-Heatsink (per T2,T3 IGBT)		25.89		
	Case-to-Heatsink (per D2,D3 Diode)		152.28		
	Case-to-Heatsink (per D5,D6 Diode)		49.00		
	Case-to-Heatsink (per Module)		3.00		
M	Terminal Connection Torque, Screw M4	1.8		2.1	N.m
	Terminal Connection Torque, Screw M8	8.0		10	
	Mounting Torque, Screw M5	3.0		6.0	
G	Weight of Module		1210		g

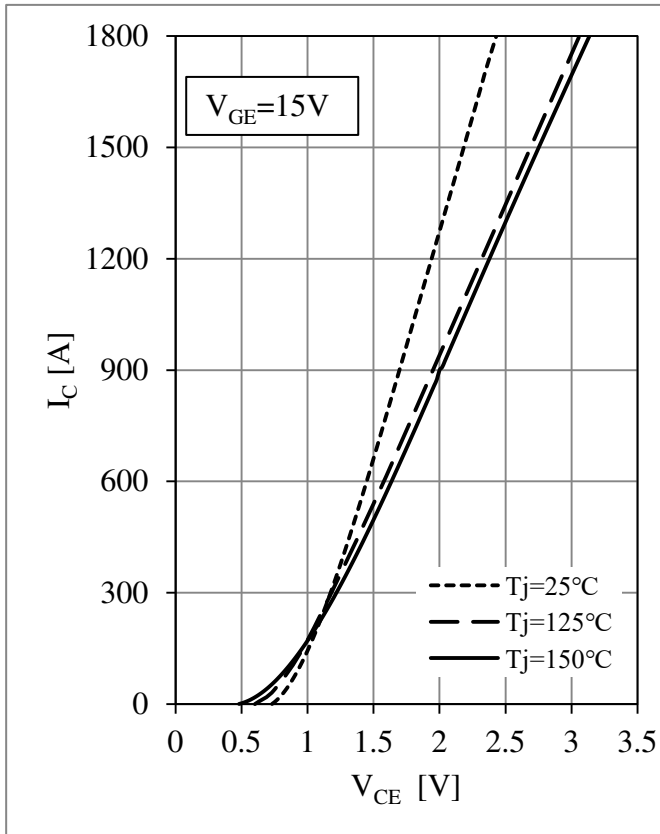


Fig 1. T1,T4 IGBT Output Characteristics

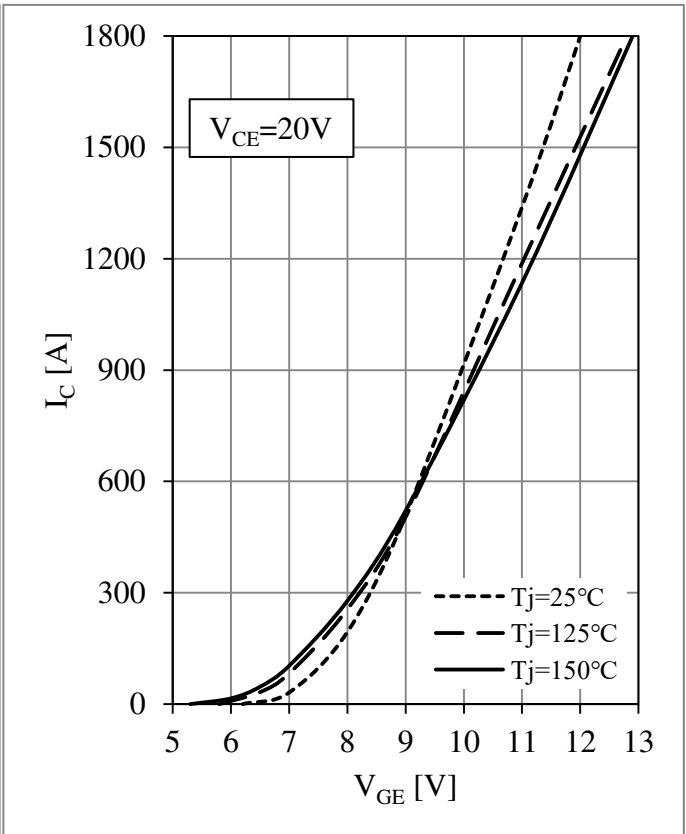
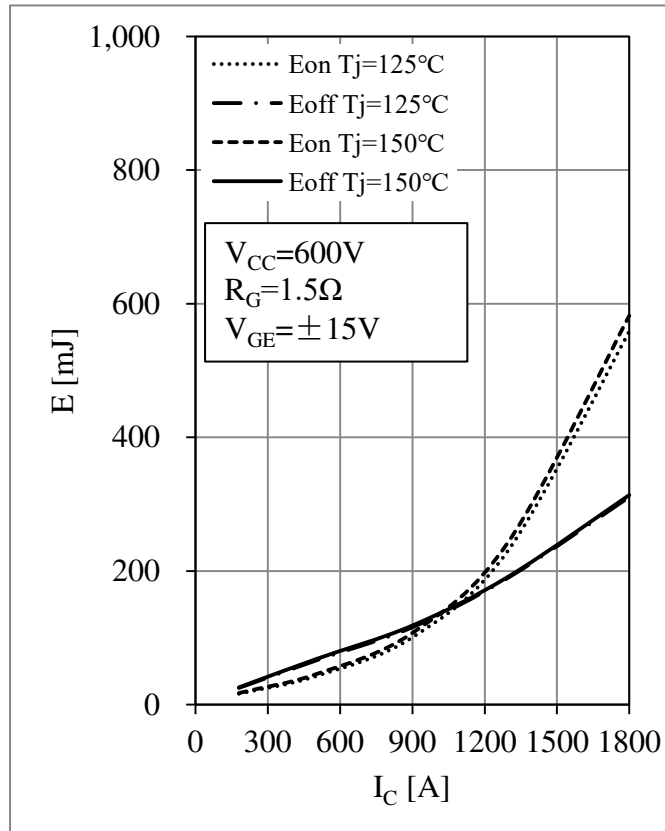
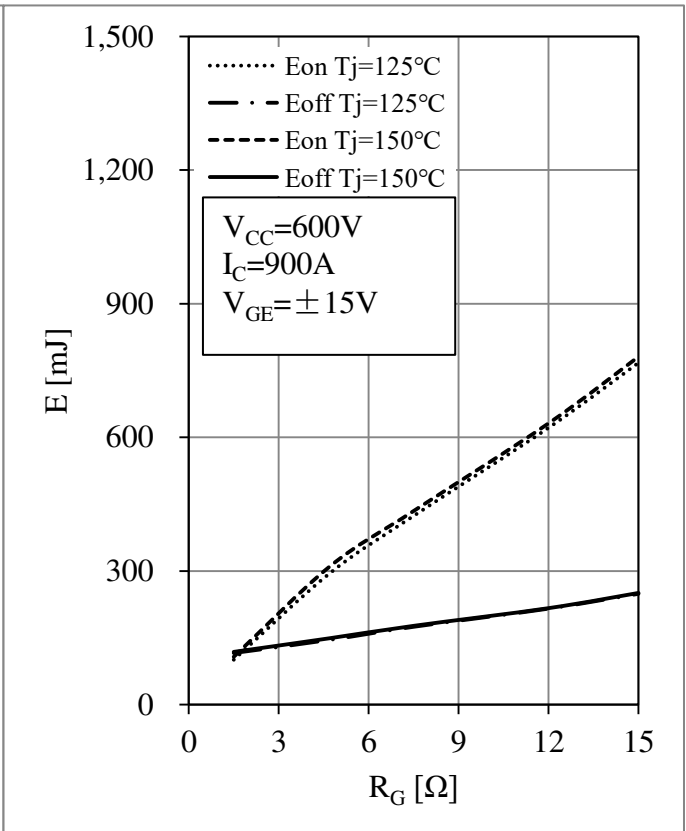


Fig 2. T1,T4 IGBT Transfer Characteristics

Fig 3. T1,T4 IGBT Switching Loss vs. I_C Fig 4. T1,T4 IGBT Switching Loss vs. R_G

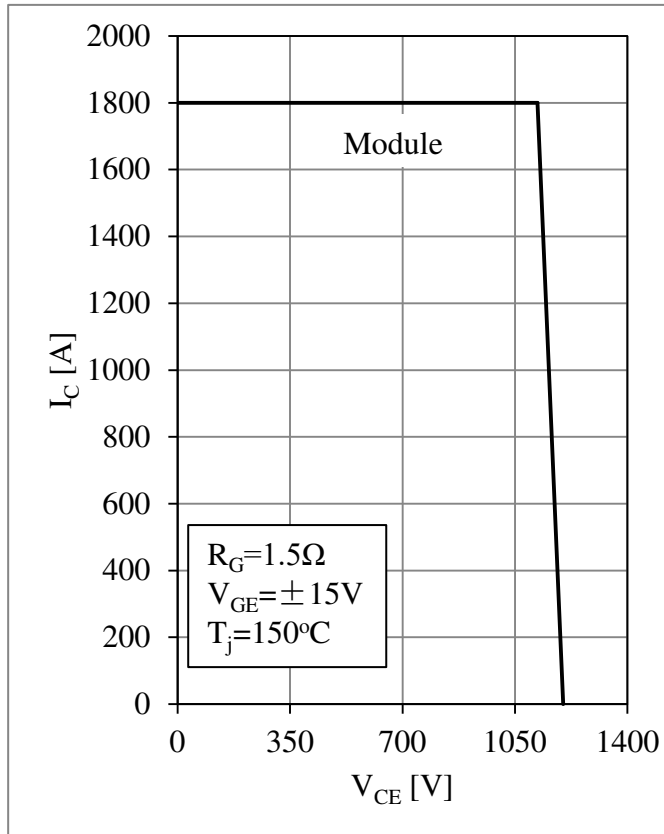


Fig 5. T1,T4 RBSOA

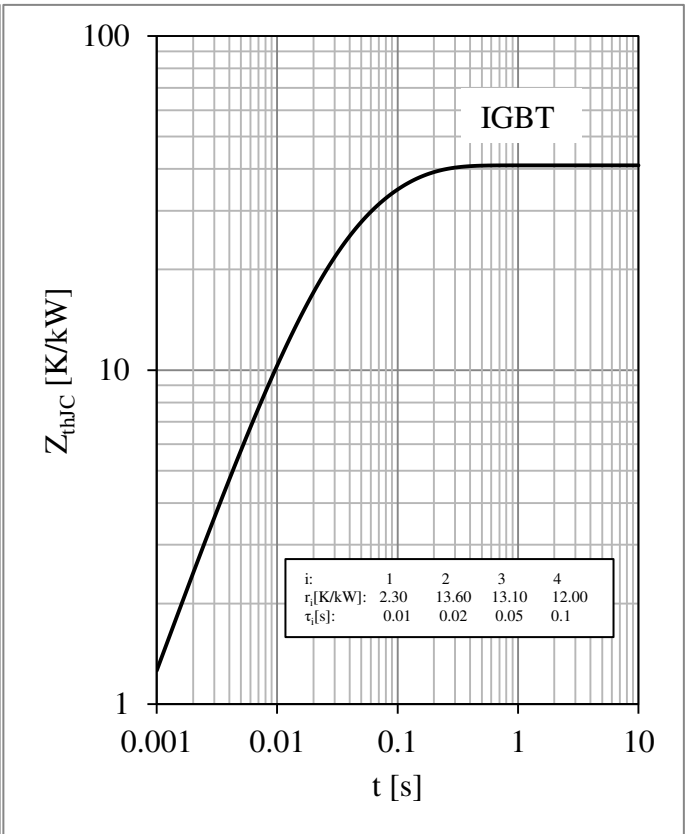


Fig 6. T1,T4 IGBT Transient Thermal Impedance

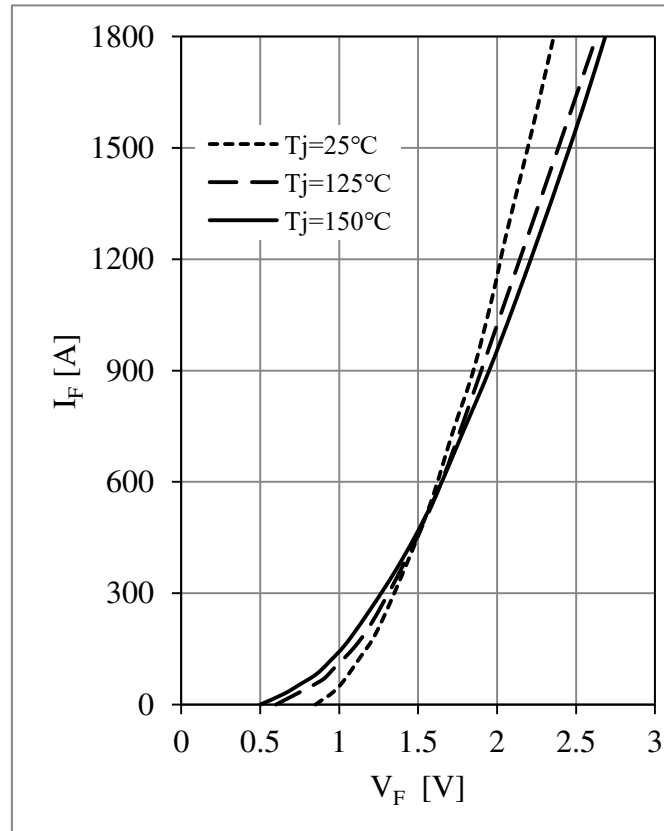
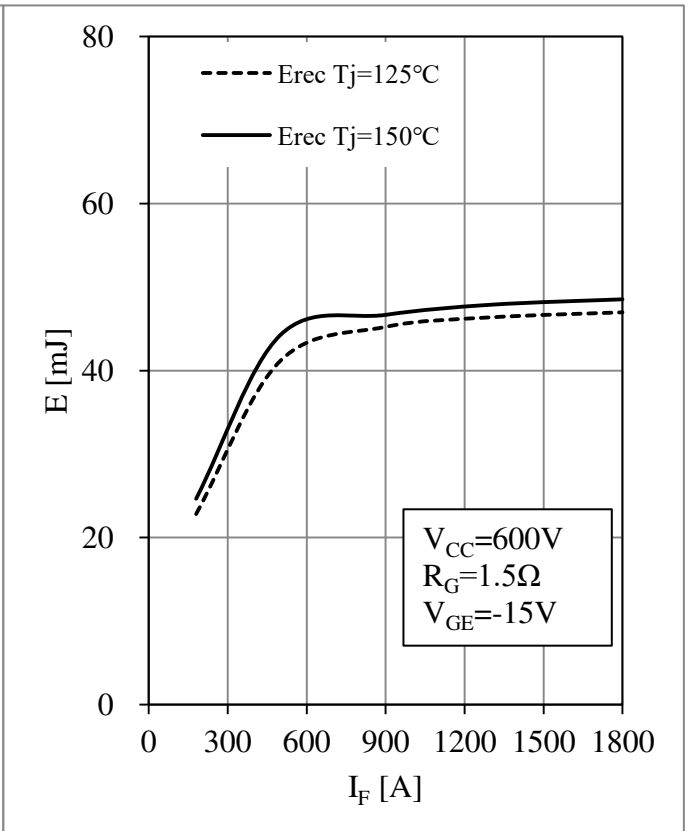
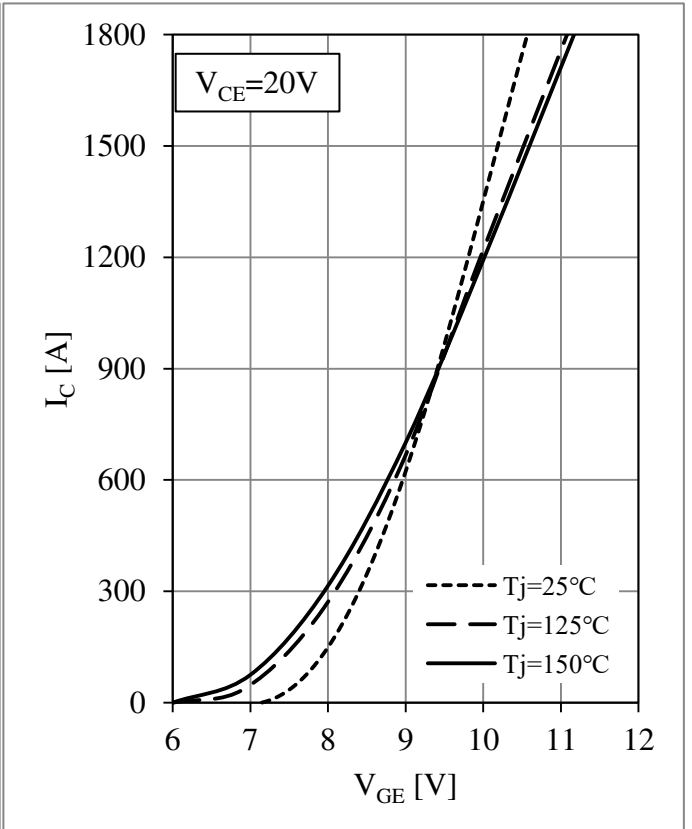
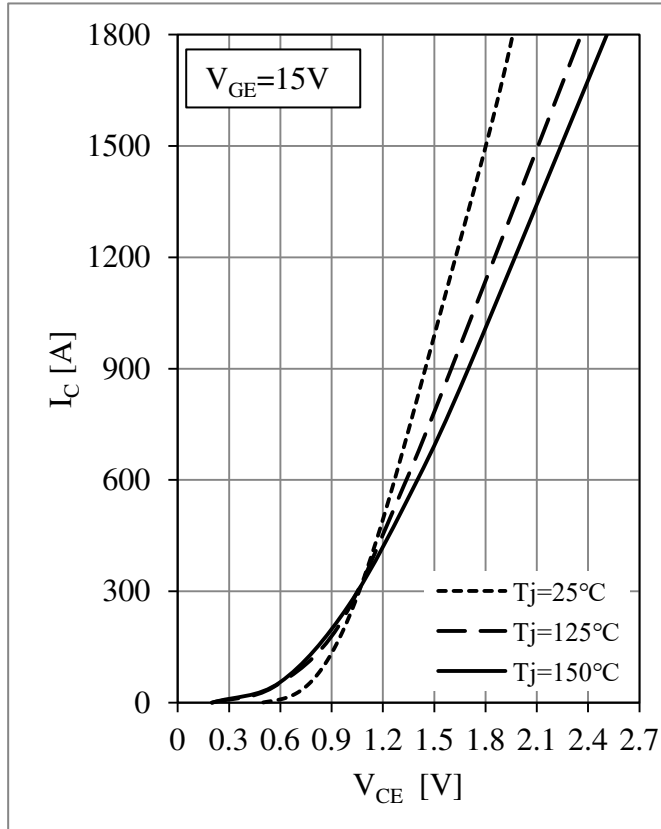
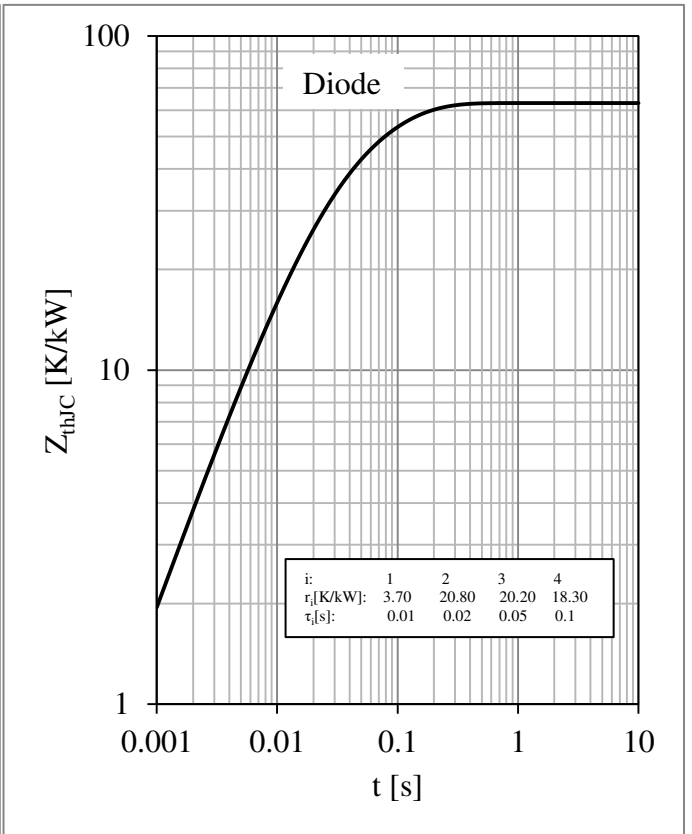
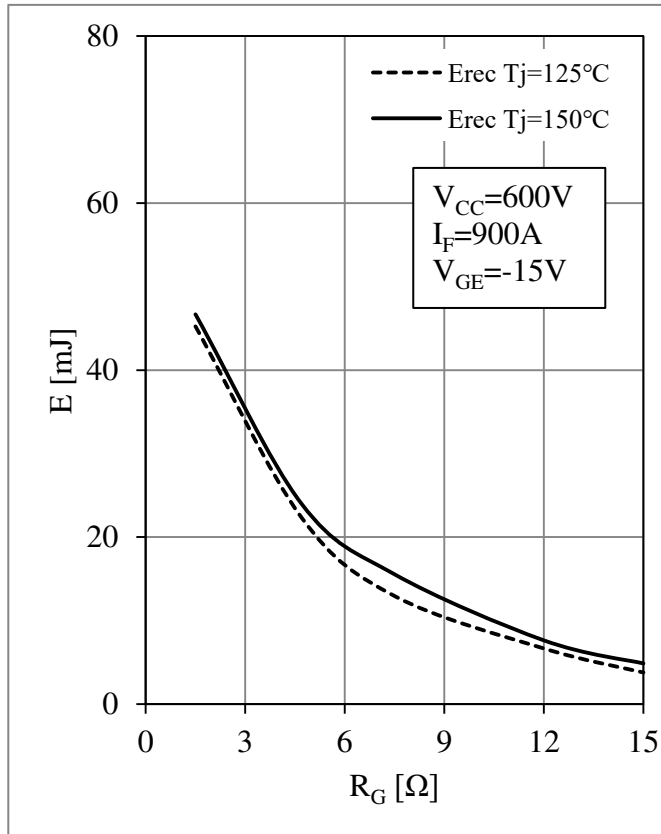
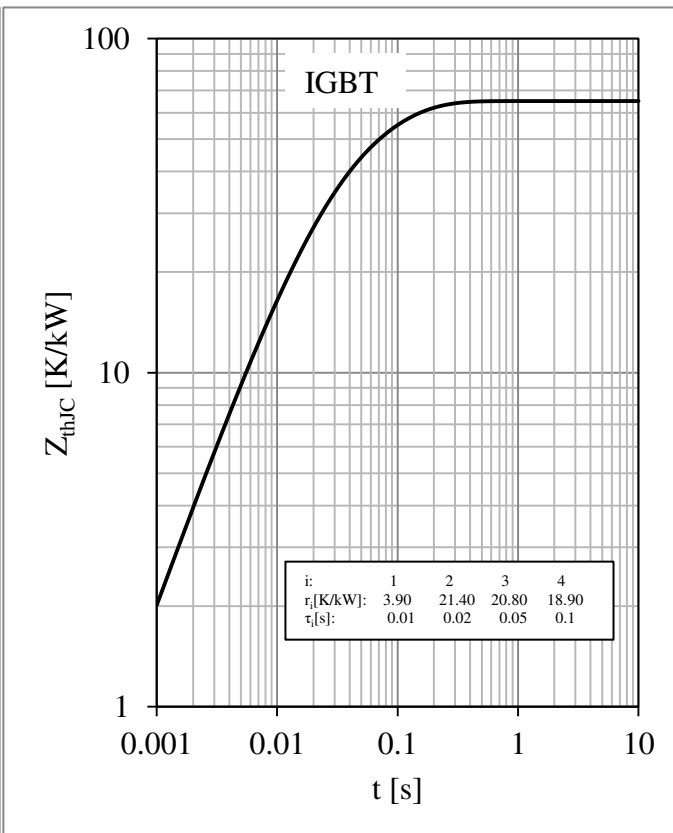
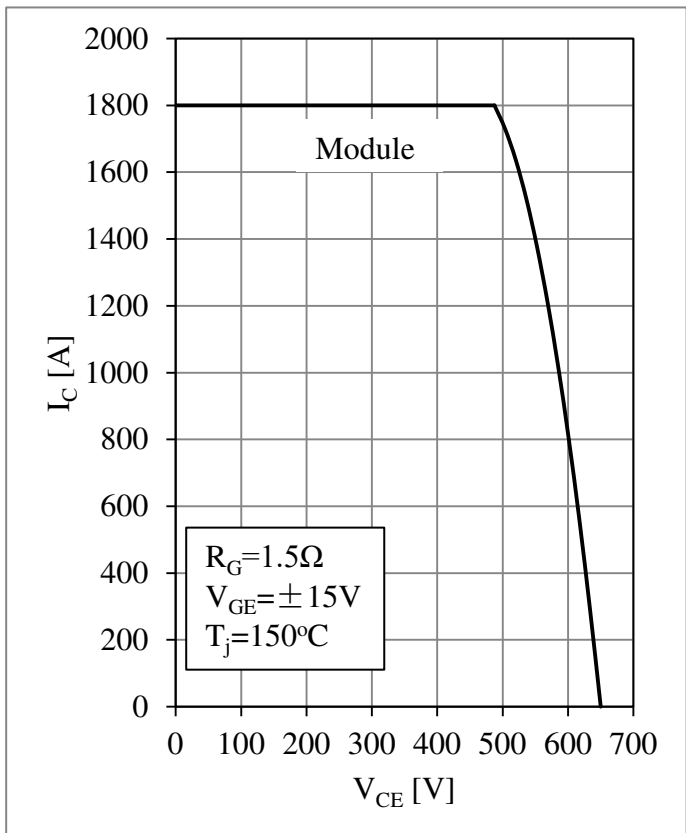
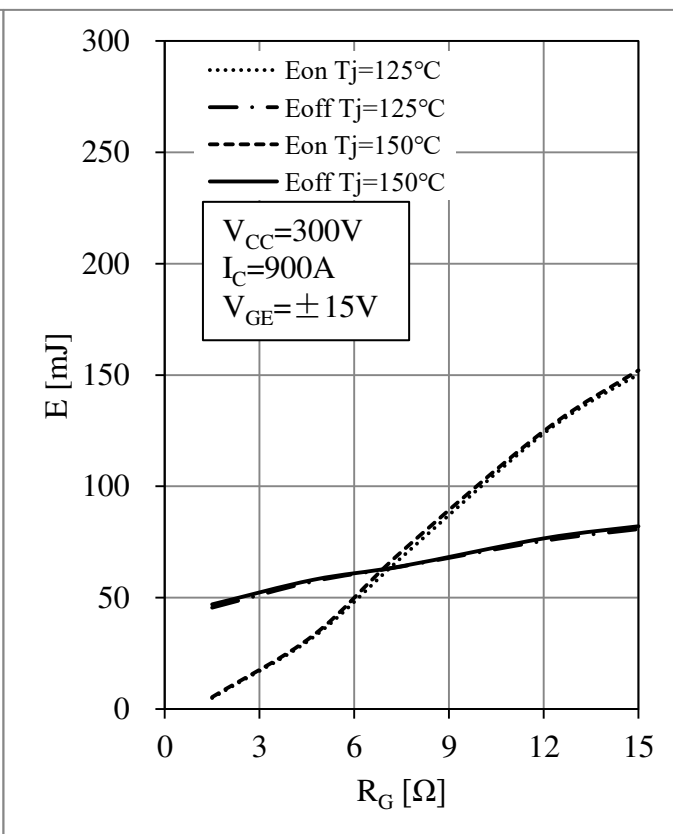
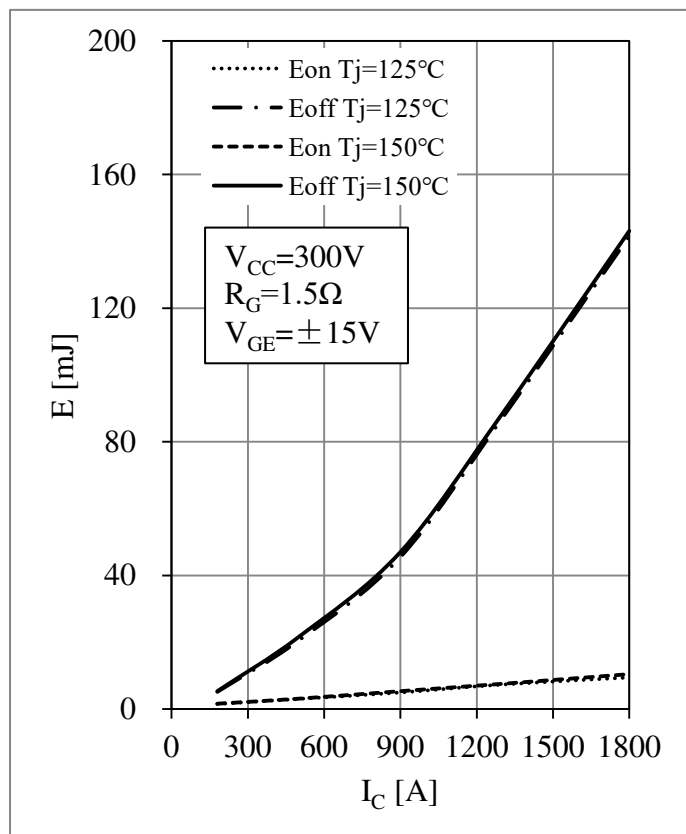
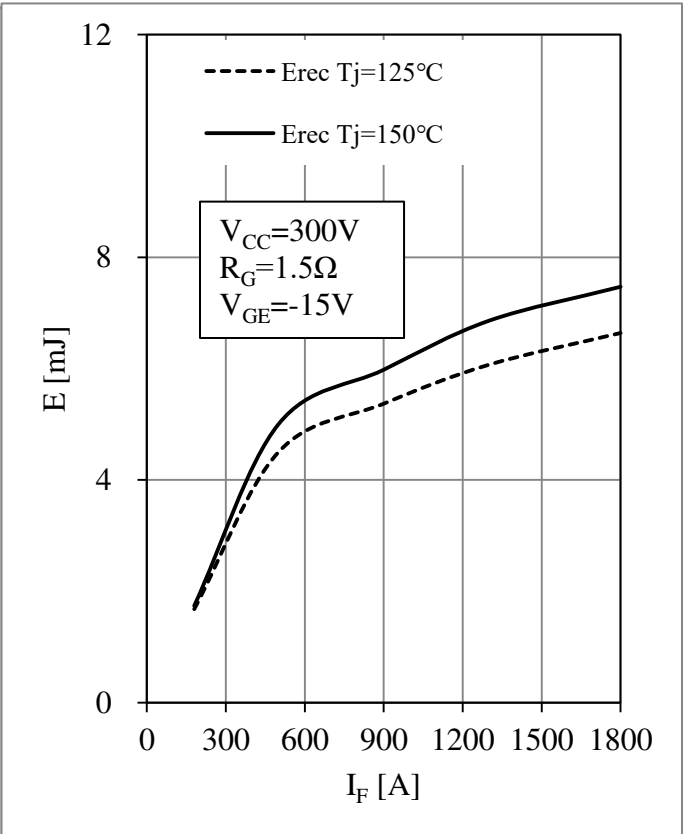
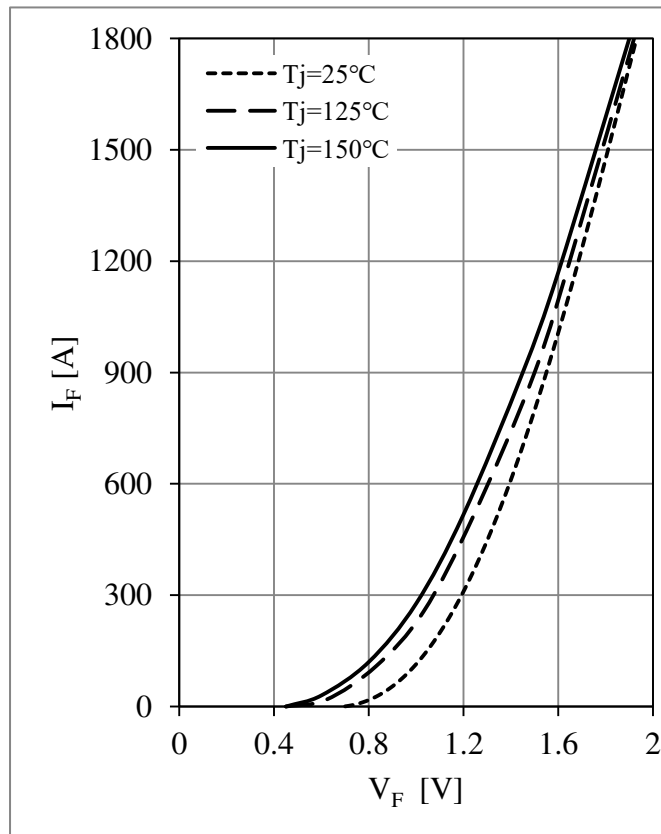
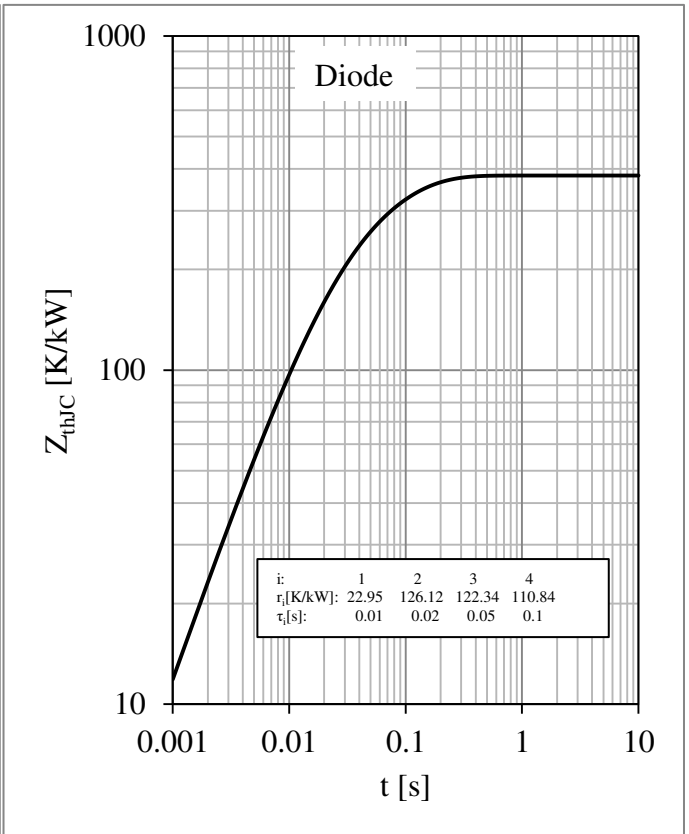
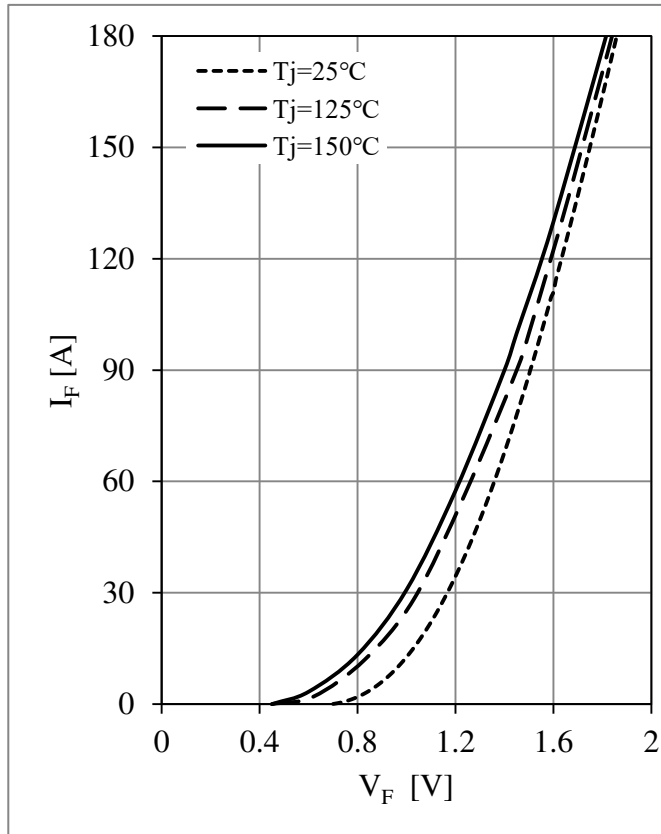


Fig 7. D1,D4 Diode Forward Characteristics

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







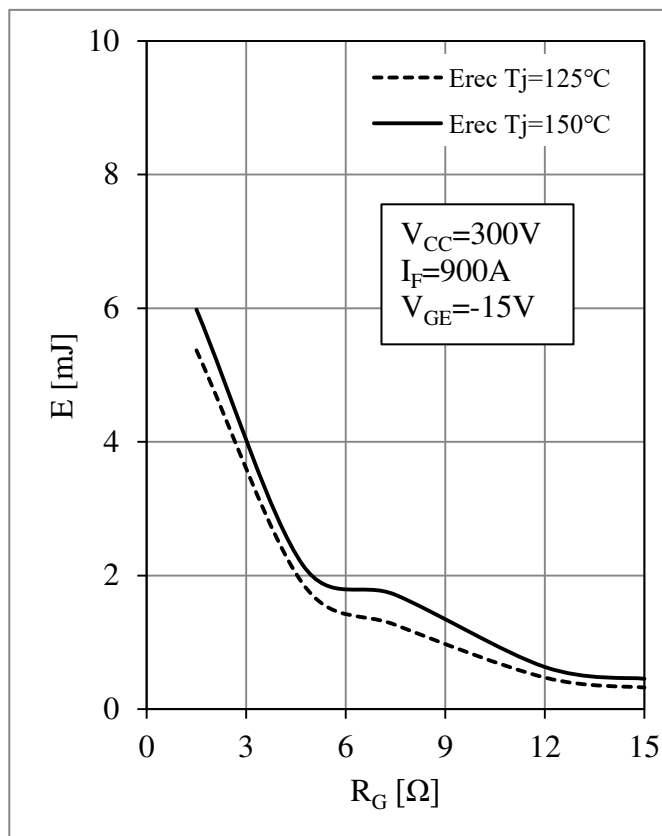
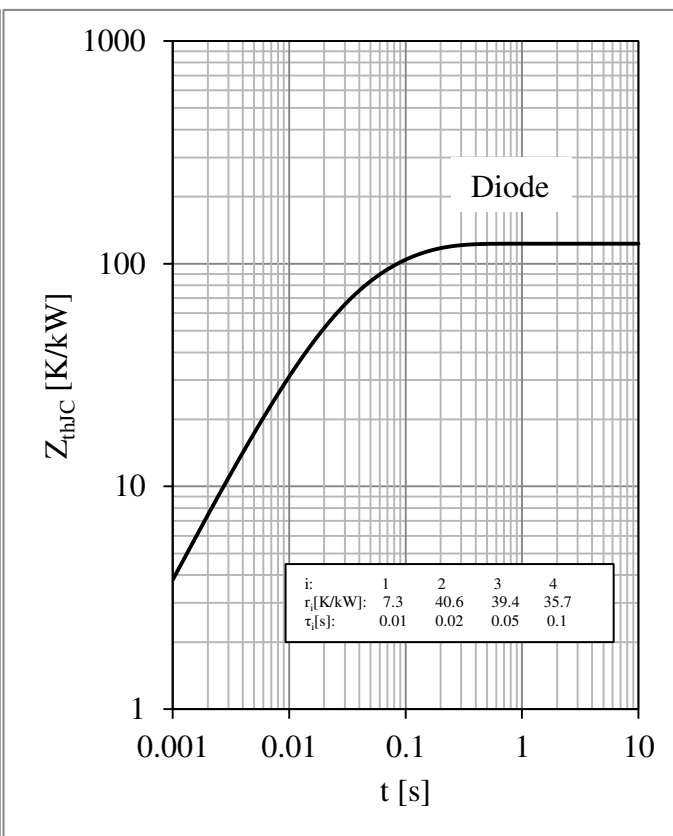
Fig 21. D5,D6 Diode Switching Loss vs. R_G 

Fig 22. D5,D6 Diode Transient Thermal Impedance

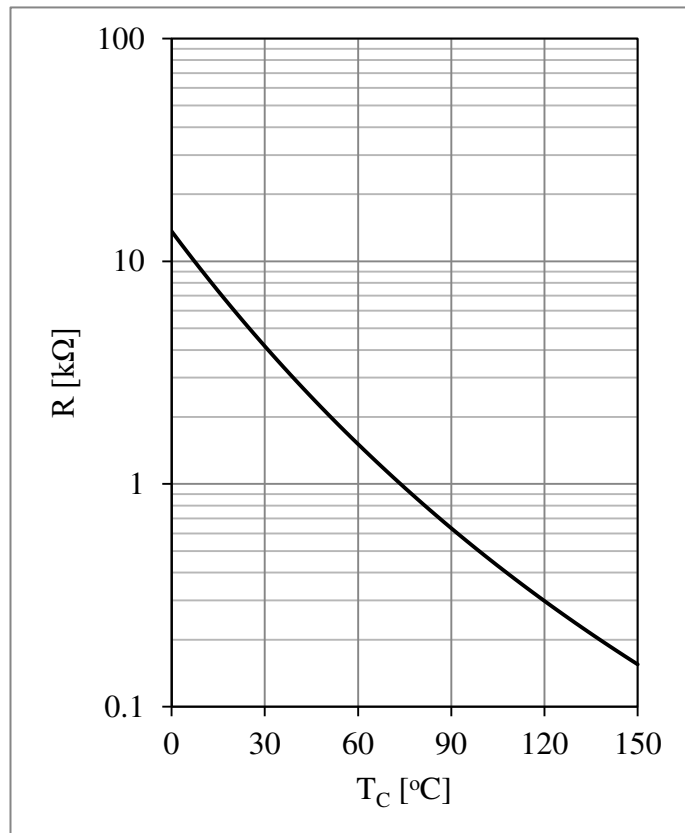
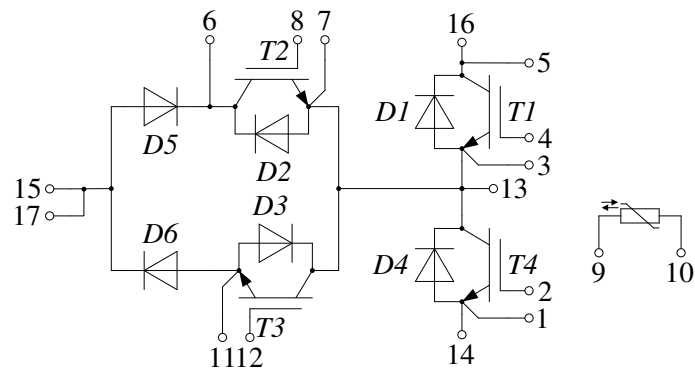


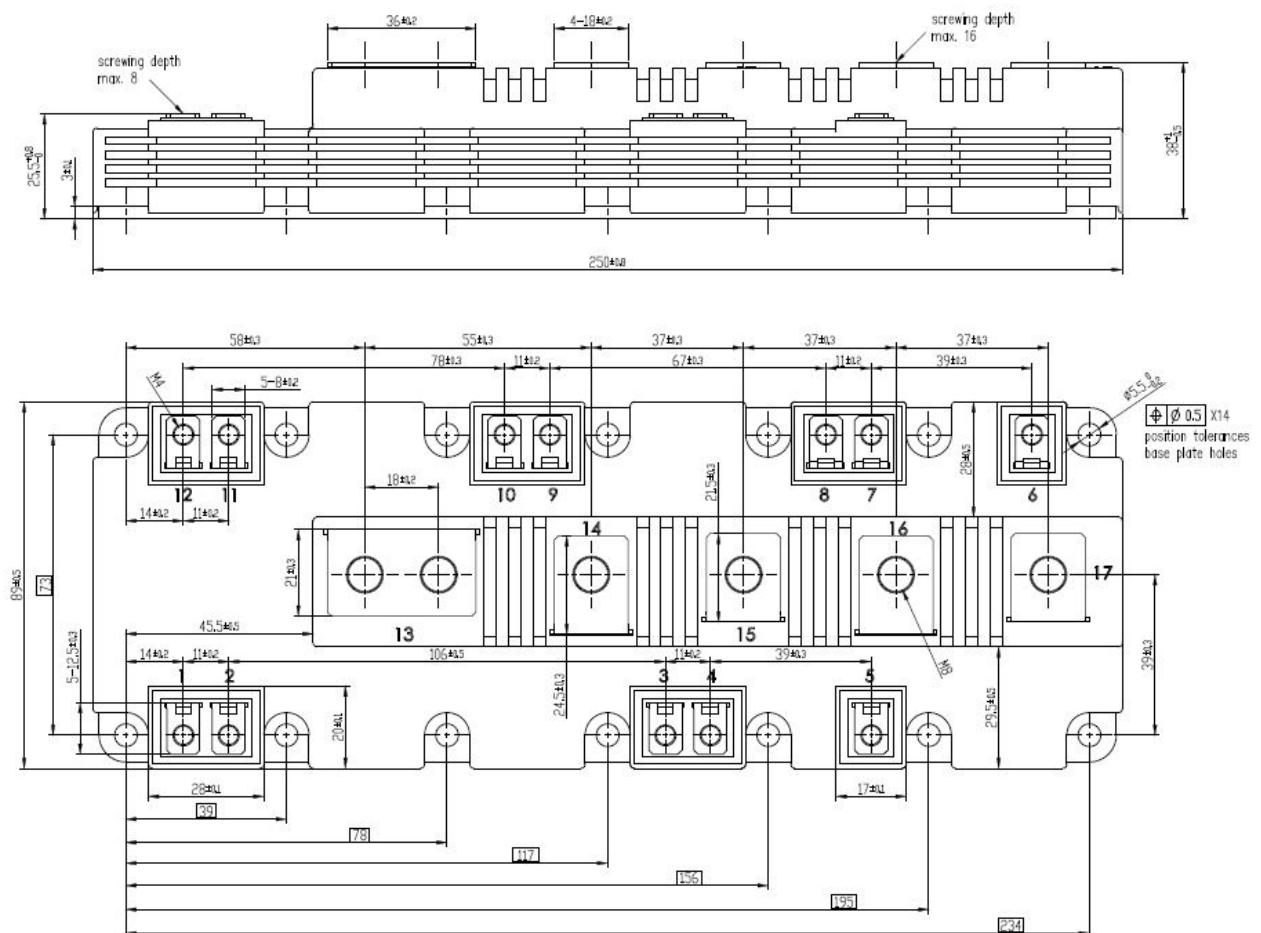
Fig 23. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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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.

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