

STARPOWER

SEMICONDUCTOR

IGBT

GD150TLT120B3S

1200V/150A 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.

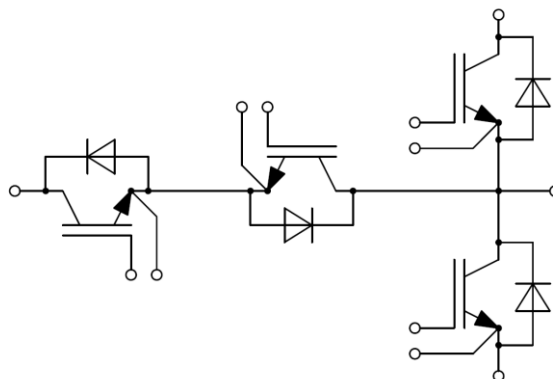
Features

- 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,T2 IGBT**

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	240	A
	@ $T_C=100^{\circ}\text{C}$	150	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	300	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	806	W

D1,D2 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	300	A

T3,T4 IGBT

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	750	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	185	A
	@ $T_C=65^{\circ}\text{C}$	150	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	300	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	459	W

D3,D4 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	750	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	300	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,T2 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	$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.70	2.15	V
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.00		
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.10		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=6.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.0	5.8	6.5	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			5.0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		10.8		nF
C_{res}	Reverse Transfer Capacitance				0.49	
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		1.40		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=150\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		258		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			425		ns
t_f	Fall Time			68		ns
E_{on}	Turn-On Switching Loss			10.0		mJ
E_{off}	Turn-Off Switching Loss			10.6		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=150\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		292		ns
t_r	Rise Time			49		ns
$t_{d(off)}$	Turn-Off Delay Time			530		ns
t_f	Fall Time			90		ns
E_{on}	Turn-On Switching Loss			16.1		mJ
E_{off}	Turn-Off Switching Loss			16.9		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=150\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$		295		ns
t_r	Rise Time			52		ns
$t_{d(off)}$	Turn-Off Delay Time			550		ns
t_f	Fall Time			96		ns
E_{on}	Turn-On Switching Loss			17.8		mJ
E_{off}	Turn-Off Switching Loss			18.8		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		600		A

D1,D2 Diode Characteristics $T_c=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.65	2.15	V
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.65		
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.65		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A}, R_G=2.4\Omega, V_{GE}=-15\text{V}, T_j=25^\circ\text{C}$		16.8		μC
I_{RM}	Peak Reverse Recovery Current			188		A
E_{rec}	Reverse Recovery Energy			7.10		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A}, R_G=2.4\Omega, V_{GE}=-15\text{V}, T_j=125^\circ\text{C}$		30.0		μC
I_{RM}	Peak Reverse Recovery Current			213		A
E_{rec}	Reverse Recovery Energy			12.9		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A}, R_G=2.4\Omega, V_{GE}=-15\text{V}, T_j=150^\circ\text{C}$		33.5		μC
I_{RM}	Peak Reverse Recovery Current			220		A
E_{rec}	Reverse Recovery Energy			15.3		mJ

T3,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	$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.45	1.90	V
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.60		
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=2.4\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	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			2.0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		9.24		nF
C_{res}	Reverse Transfer Capacitance				0.27	
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		1.10		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=150\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		84		ns
t_r	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			300		ns
t_f	Fall Time			88		ns
E_{on}	Turn-On Switching Loss			1.21		mJ
E_{off}	Turn-Off Switching Loss			4.14		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=150\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		102		ns
t_r	Rise Time			44		ns
$t_{d(off)}$	Turn-Off Delay Time			328		ns
t_f	Fall Time			130		ns
E_{on}	Turn-On Switching Loss			1.76		mJ
E_{off}	Turn-Off Switching Loss			5.09		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=150\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$		110		ns
t_r	Rise Time			45		ns
$t_{d(off)}$	Turn-Off Delay Time			342		ns
t_f	Fall Time			139		ns
E_{on}	Turn-On Switching Loss			1.95		mJ
E_{off}	Turn-Off Switching Loss			5.40		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 750\text{V}$		750		A

D3,D4 Diode Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.55	2.00	V
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.50		
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.45		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=150\text{A}, R_G=3.3\Omega, V_{GE}=-15\text{V}, T_j=25^\circ\text{C}$		6.9		μC
I_{RM}	Peak Reverse Recovery Current			78		A
E_{rec}	Reverse Recovery Energy			1.41		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=150\text{A}, R_G=3.3\Omega, V_{GE}=-15\text{V}, T_j=125^\circ\text{C}$		11.4		μC
I_{RM}	Peak Reverse Recovery Current			106		A
E_{rec}	Reverse Recovery Energy			2.49		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=150\text{A}, R_G=3.3\Omega, V_{GE}=-15\text{V}, T_j=150^\circ\text{C}$		13.6		μC
I_{RM}	Peak Reverse Recovery Current			111		A
E_{rec}	Reverse Recovery Energy			3.00		mJ

Module Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JC}$	Junction-to-Case (per T1,T2 IGBT)			0.186	K/W
	Junction-to-Case (per D1,D2 Diode)			0.322	
	Junction-to-Case (per T3,T4 IGBT)			0.327	
	Junction-to-Case (per D3,D4 Diode)			0.542	
$R_{\theta CS}$	Case-to-Sink (per T1,T2 IGBT)		0.174		K/W
	Case-to-Sink (per D1,D2 Diode)		0.302		
	Case-to-Sink (per T3,T4 IGBT)		0.306		
	Case-to-Sink (per D3,D4 Diode)		0.508		
$R_{\theta CS}$	Case-to-Sink		0.035		K/W
M	Terminal Connection Torque, Screw M6	2.5		5.0	N.m
	Mounting Torque, Screw M6	3.0		5.0	
G	Weight of Module		300		g

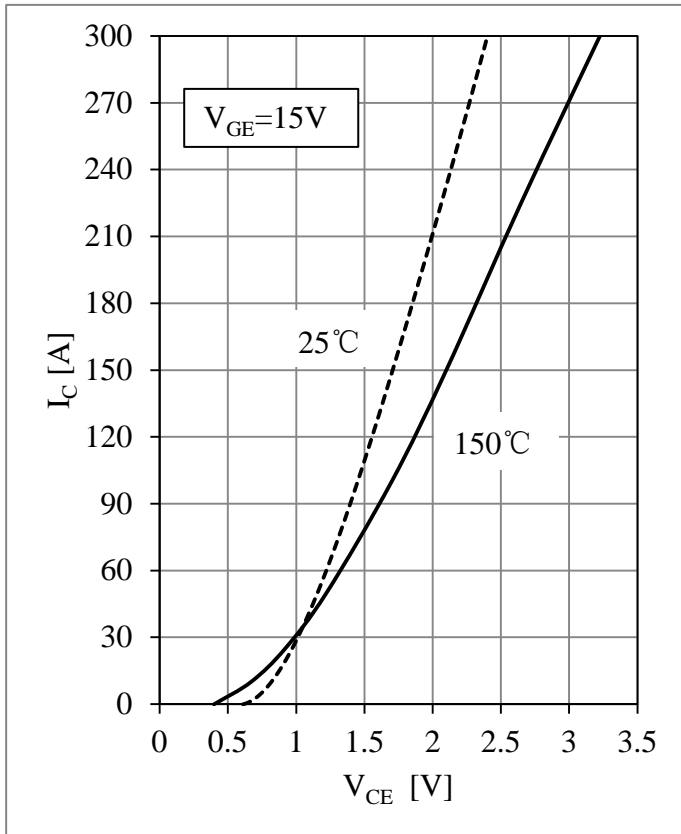


Fig 1. T1,T2 IGBT Output Characteristics

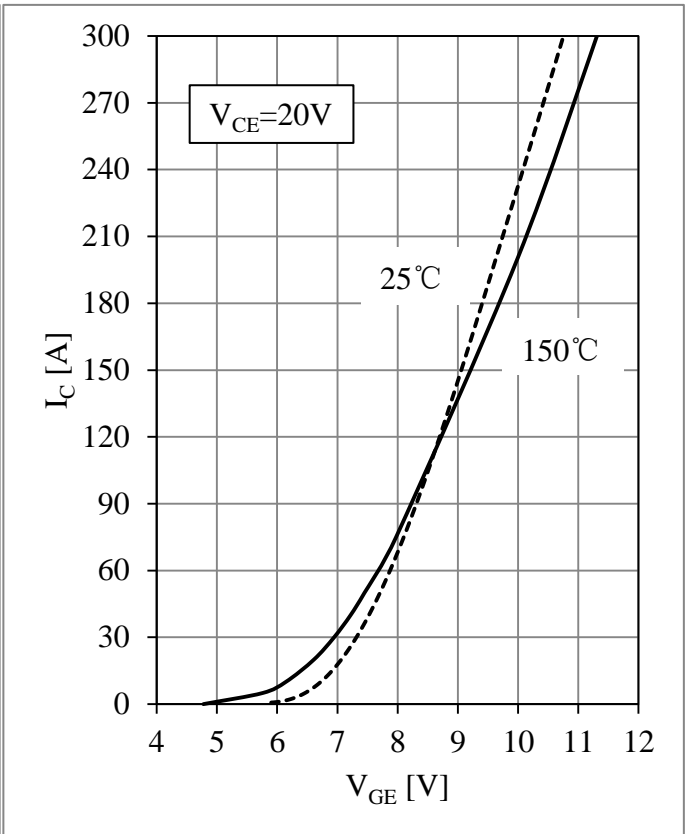


Fig 2. T1,T2 IGBT Transfer Characteristics

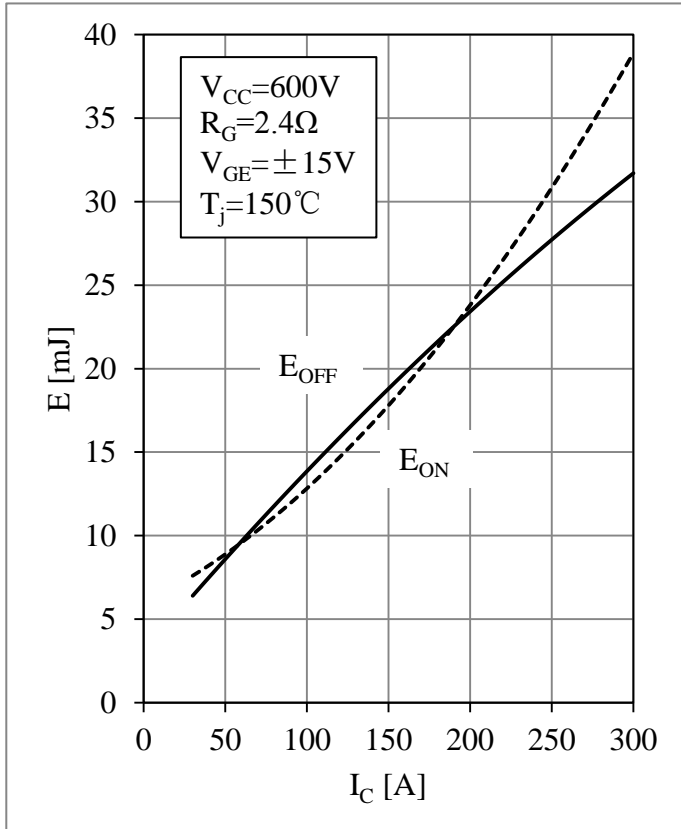


Fig 3. T1,T2 IGBT Switching Loss vs. I_C

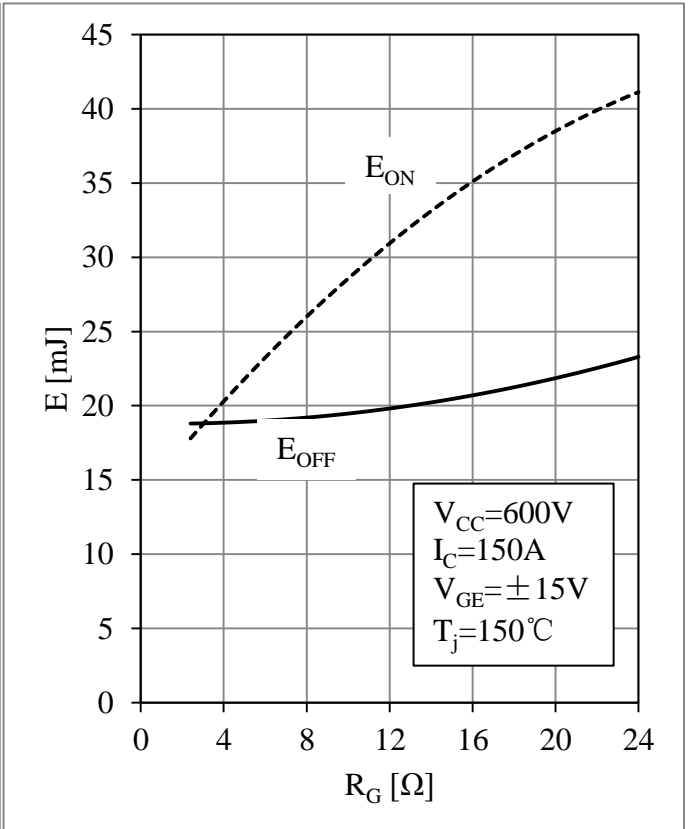


Fig 4. T1,T2 IGBT Switching Loss vs. R_G

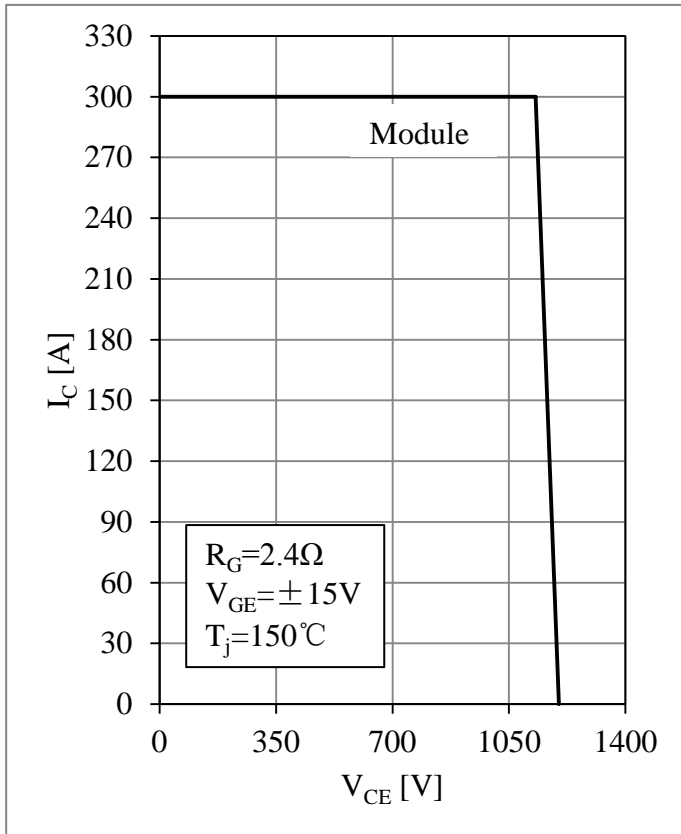


Fig 5. T1,T2 RBSOA

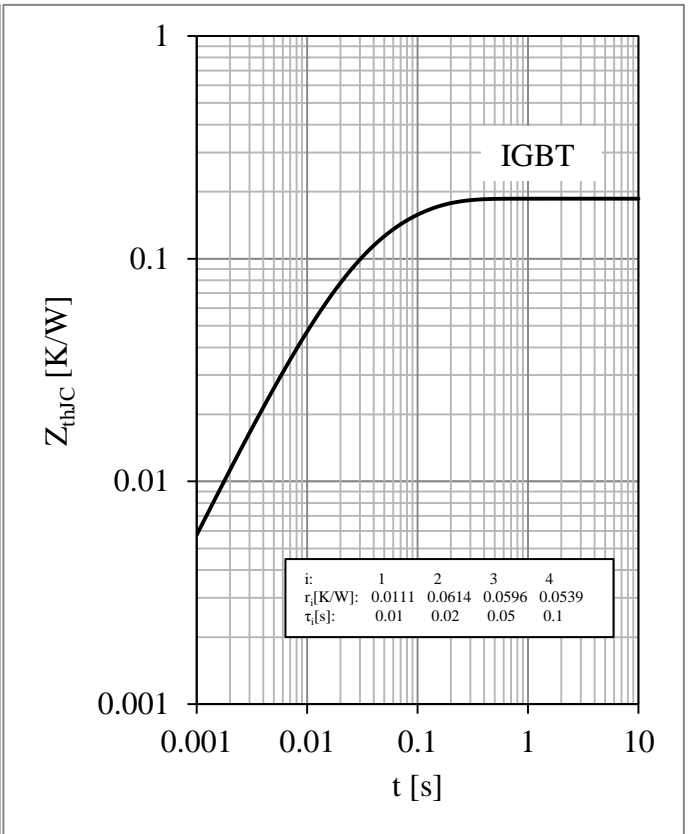


Fig 6. T1,T2 IGBT Transient Thermal Impedance

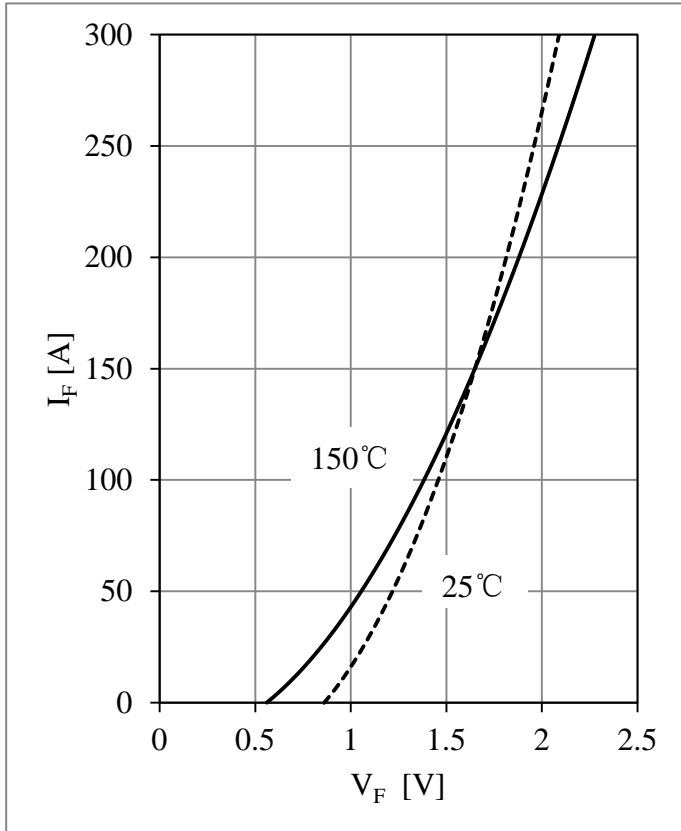


Fig 7. D1,D2 Diode Forward Characteristics

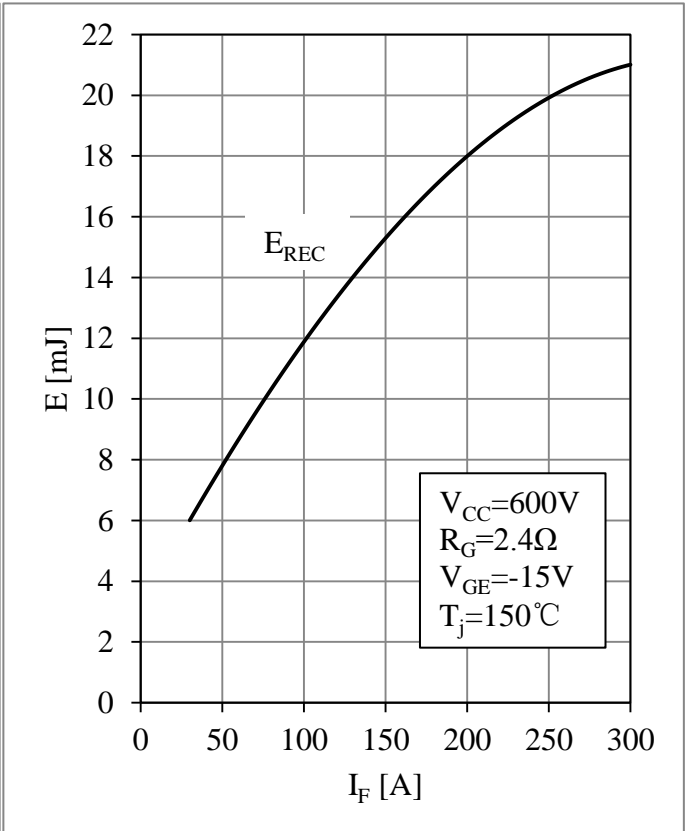


Fig 8. D1,D2 Diode Switching Loss vs. I_F

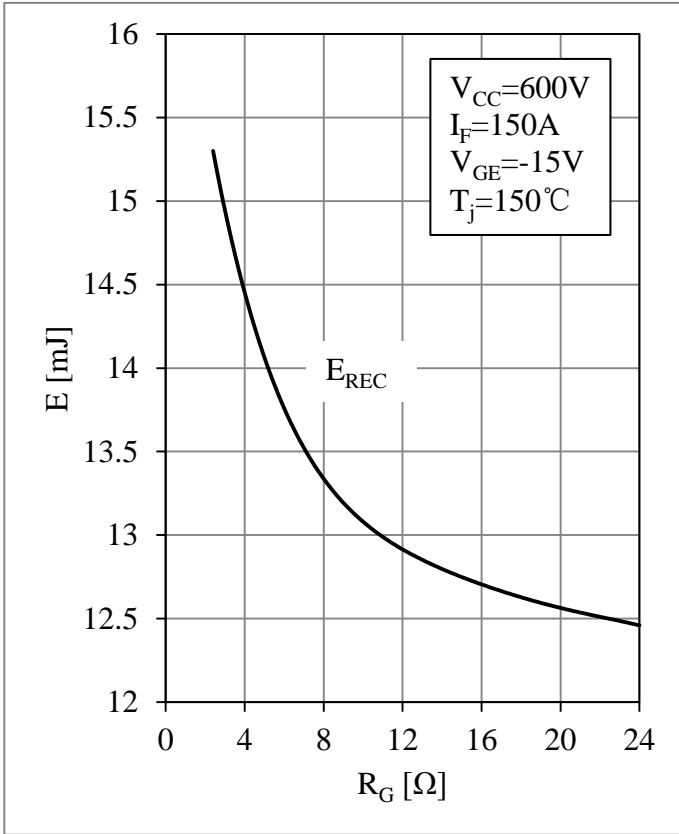


Fig 9. D1,D2 Diode Switching Loss vs. R_G

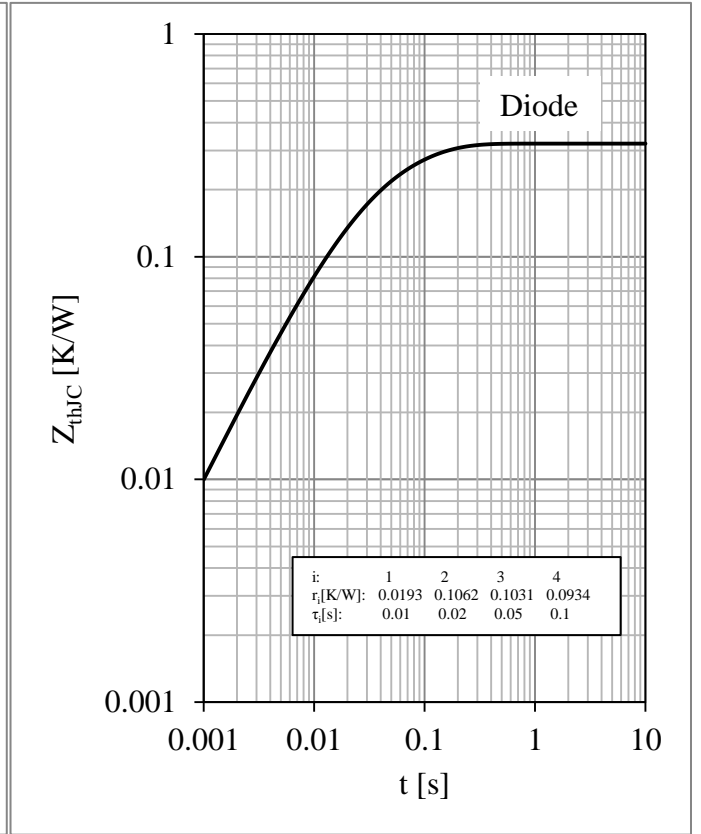


Fig 10. D1,D2 Diode Transient Thermal Impedance

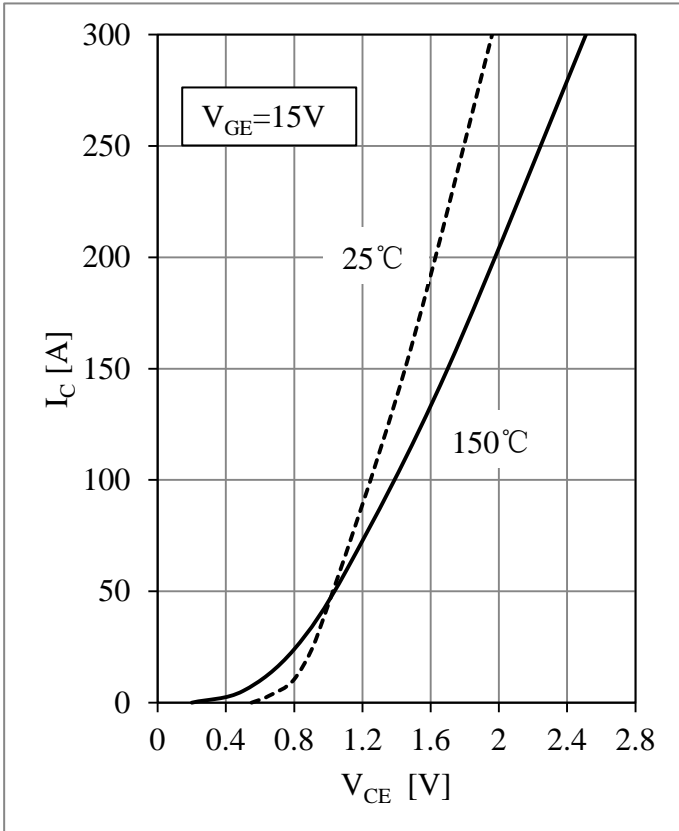


Fig 11. T3,T4 IGBT Output Characteristics

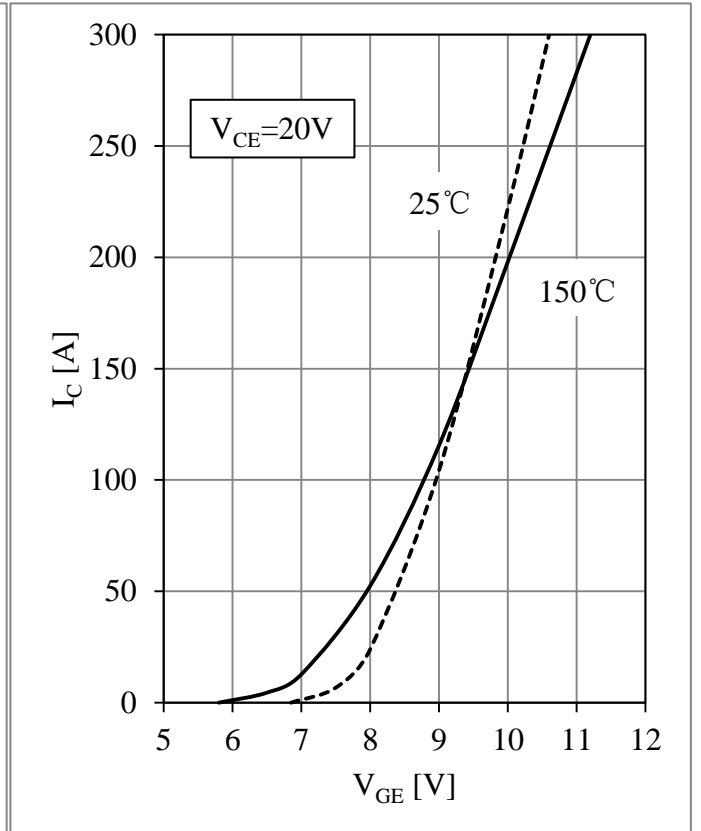


Fig 12. T3,T4 IGBT Transfer Characteristics

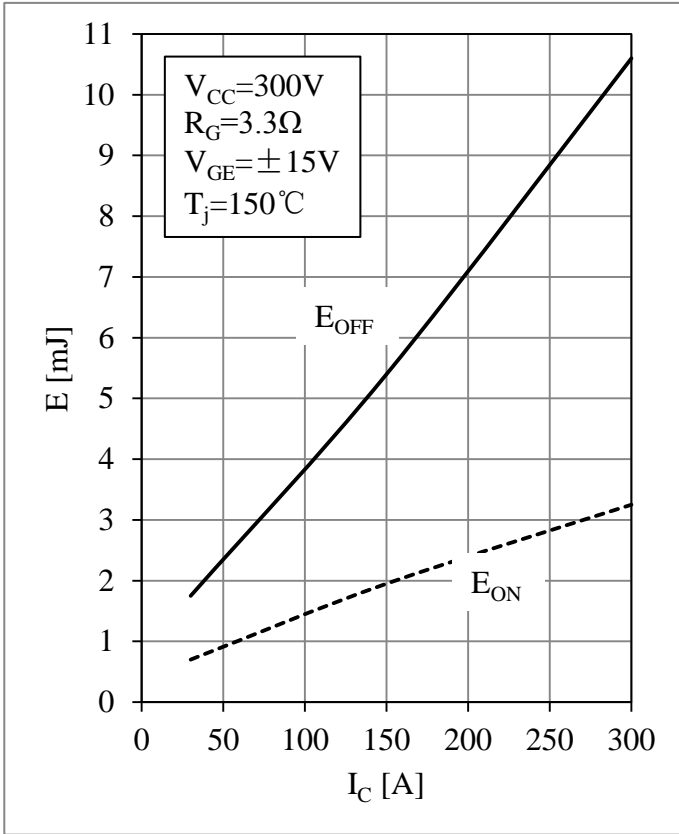


Fig 13. T3,T4 IGBT Switching Loss vs. I_C

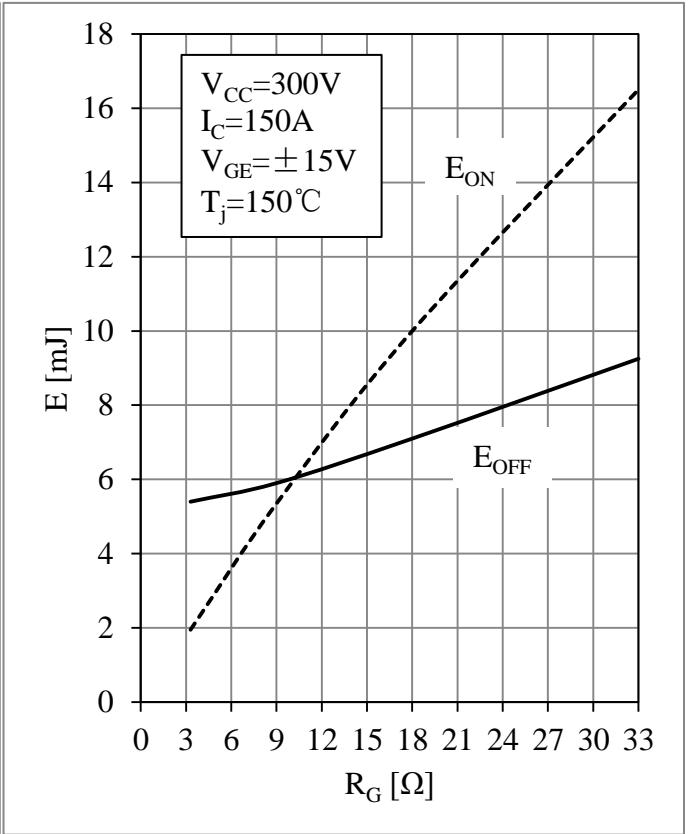


Fig 14. T3,T4 IGBT Switching Loss vs. R_G

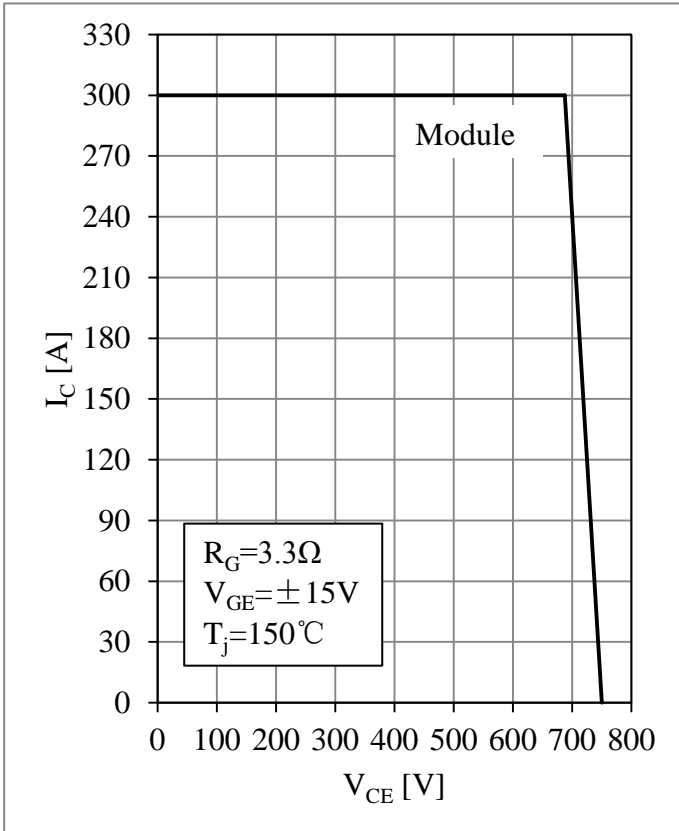


Fig 15. T3,T4 RBSOA

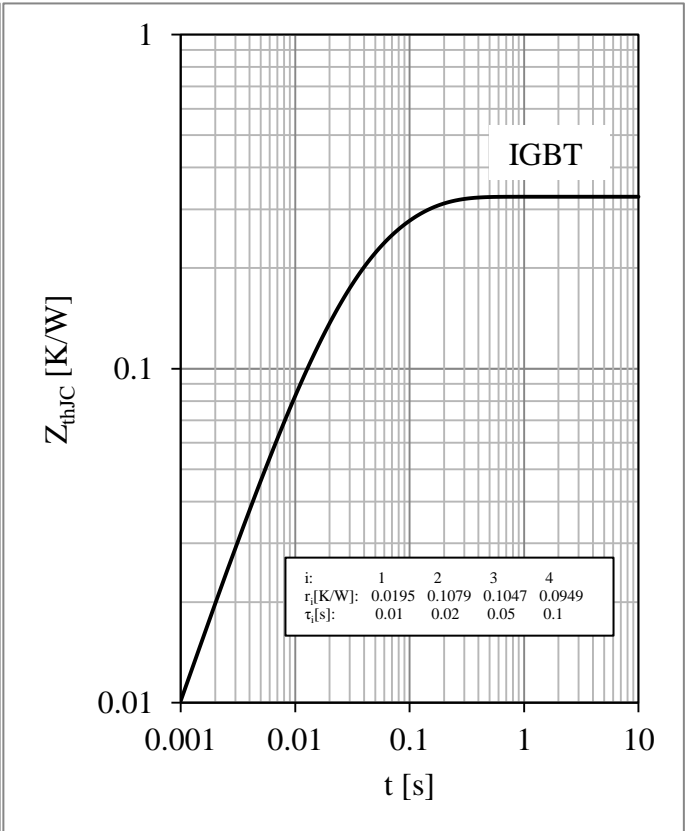


Fig 16. T3,T4 IGBT Transient Thermal Impedance

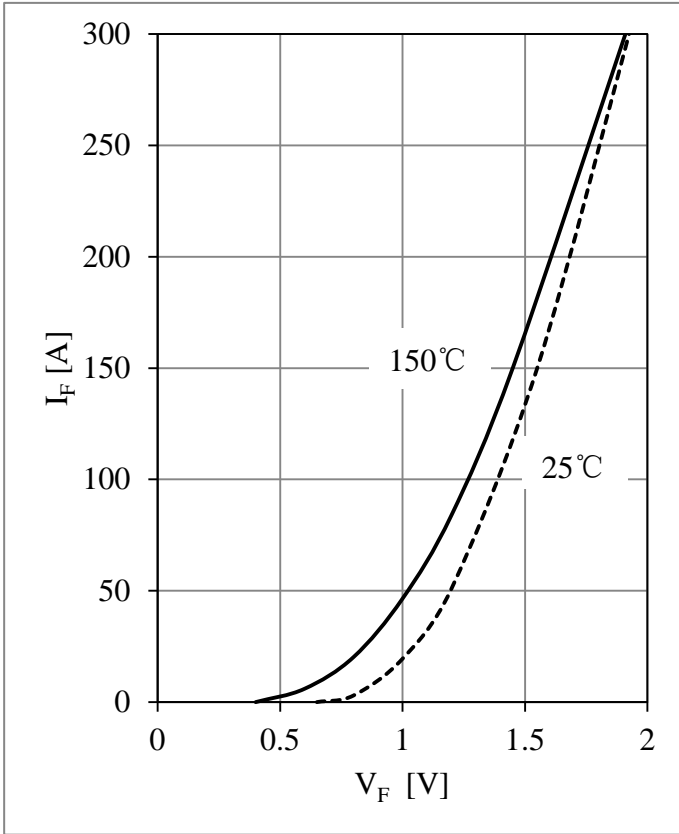


Fig 17. D3,D4 Diode Forward Characteristics

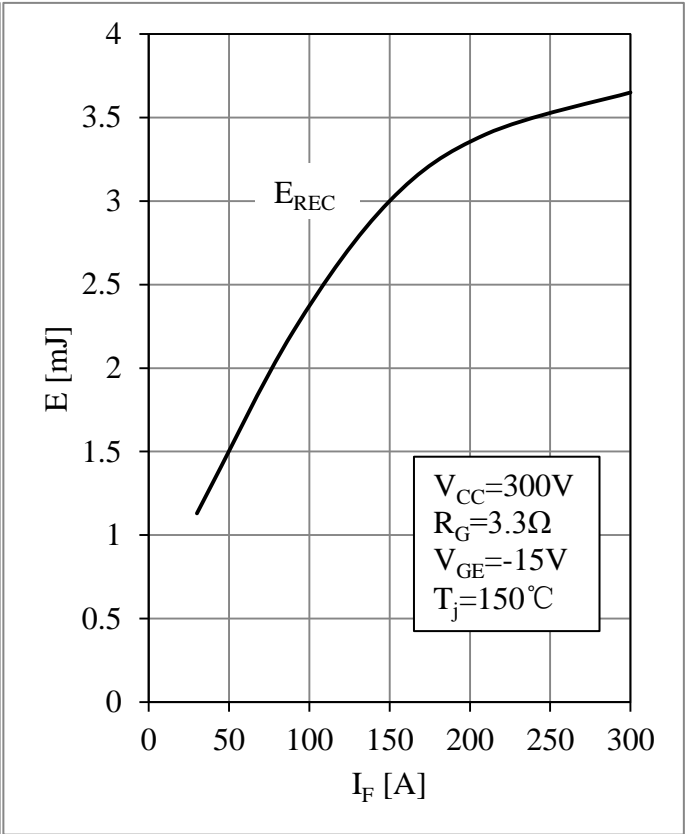


Fig 18. D3,D4 Diode Switching Loss vs. I_F

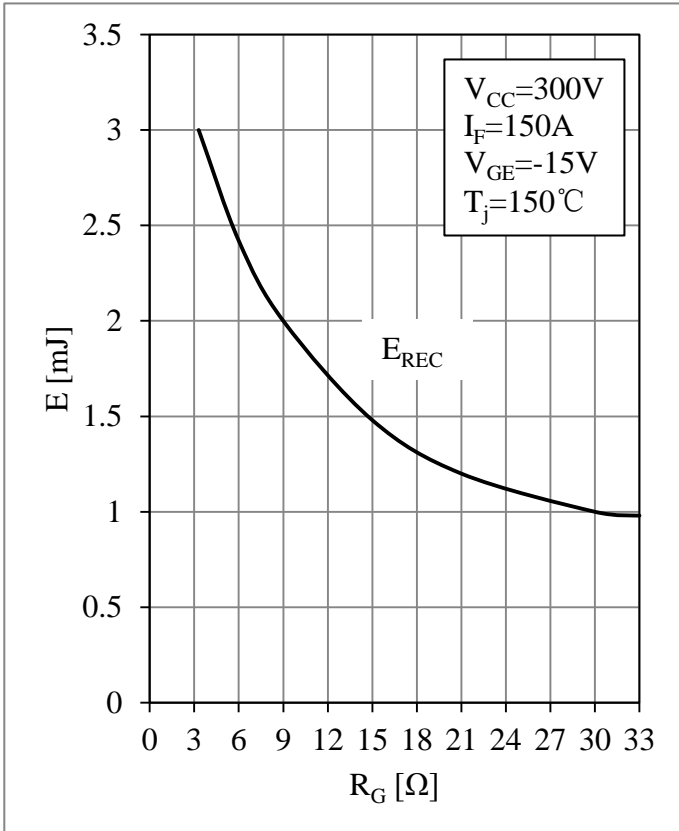


Fig 19. D3,D4 Diode Switching Loss vs. R_G

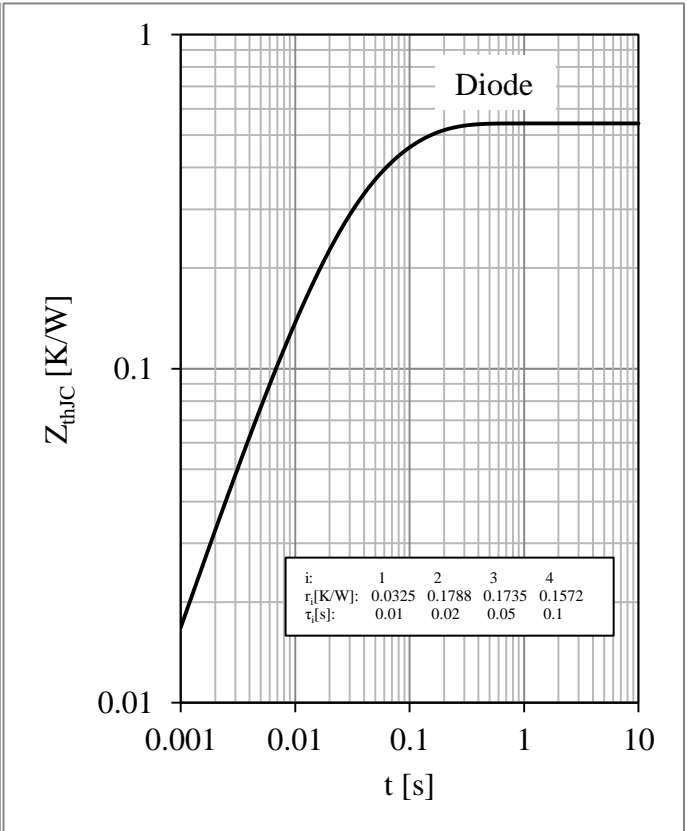
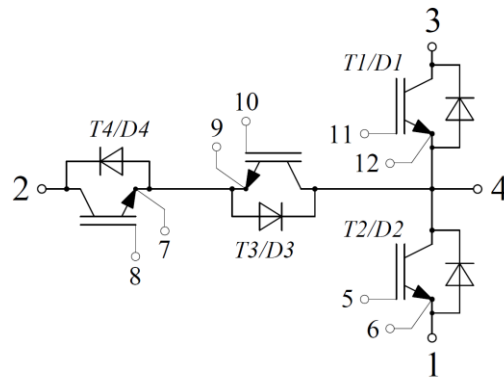


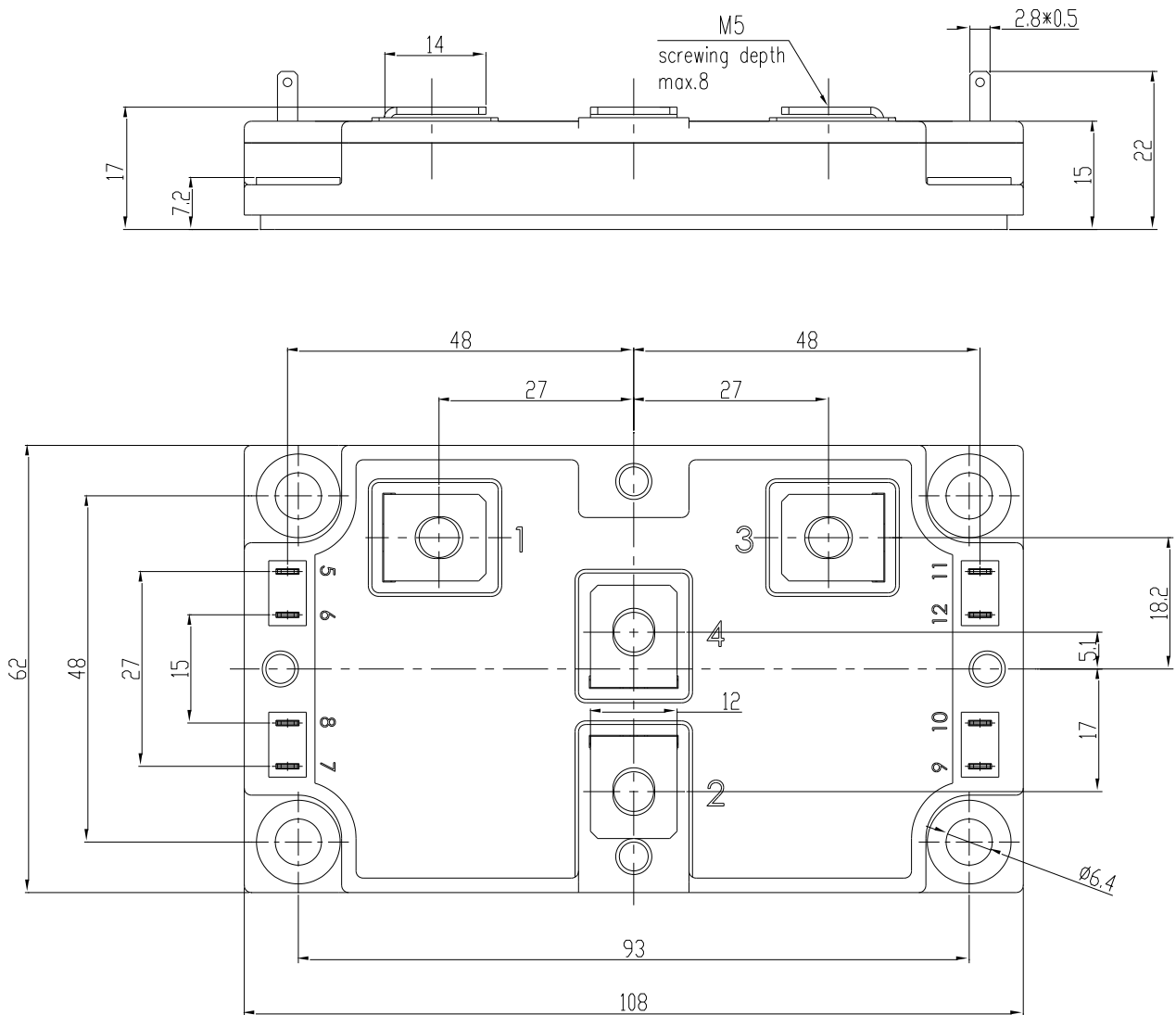
Fig 20. D3,D4 Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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