STARPOWER

SEMICONDUCTOR **IGBT**

GD150TLT120C2S_T4

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.

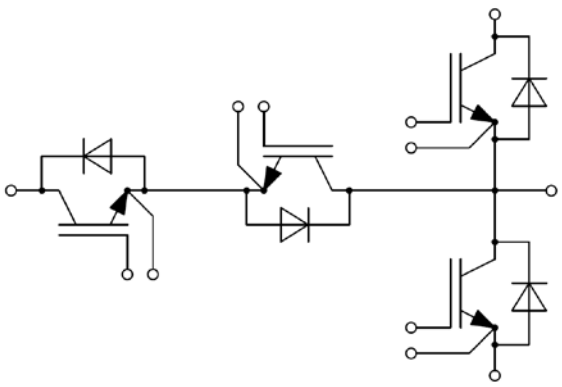
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low switching loss
- Maximum junction temperature 175℃
- 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℃ 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℃ @ T_C=95℃	215 150	A
I_{CM}	Pulsed Collector Current t_p=1ms	300	A
P_D	Maximum Power Dissipation @ T_j=175℃	761	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=1ms	300	A

T3,T4 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℃ @ T_C=65℃	185 150	A
I_{CM}	Pulsed Collector Current t_p=1ms	300	A
P_D	Maximum Power Dissipation @ T_j=175℃	459	W

D3,D4 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	300	A

Module

Symbol	Description	Values	Unit
T_{jmax}	Maximum Junction Temperature	175	℃
T_{jop}	Operating Junction Temperature	-40 to +150	℃
T_{STG}	Storage Temperature Range	-40 to +125	℃
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	4000	V
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M6	2.5 to 5.0 3.0 to 5.0	N.m

T1,T2 IGBT Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=150A,V_{GE}=15V, T_j=25℃		1.75	2.20	V
		I_C=150A,V_{GE}=15V, T_j=125℃		2.05		
		I_C=150A,V_{GE}=15V, T_j=150℃		2.10		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=5.7mA,V_{CE}=V_{GE}, T_j=25℃	5.3	5.8	6.3	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA
R_{Gint}	Internal Gate Resistance			5.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		9.35		nF
C_{res}	Reverse Transfer Capacitance			0.35		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		1.25		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=150A, R_G=1.1Ω,V_{GE}=±15V, T_j=25℃		116		ns
t_r	Rise Time			24		ns
$t_{d(off)}$	Turn-Off Delay Time			368		ns
t_f	Fall Time			60		ns
E_{on}	Turn-On Switching Loss			4.90		mJ
E_{off}	Turn-Off Switching Loss			10.1		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=150A, R_G=1.1Ω,V_{GE}=±15V, T_j=125℃		129		ns
t_r	Rise Time			29		ns
$t_{d(off)}$	Turn-Off Delay Time			450		ns
t_f	Fall Time			106		ns
E_{on}	Turn-On Switching Loss			9.10		mJ
E_{off}	Turn-Off Switching Loss			14.9		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=150A, R_G=1.1Ω,V_{GE}=±15V, T_j=150℃		135		ns
t_r	Rise Time			31		ns
$t_{d(off)}$	Turn-Off Delay Time			475		ns
t_f	Fall Time			125		ns
E_{on}	Turn-On Switching Loss			10.0		mJ
E_{off}	Turn-Off Switching Loss			16.0		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150℃,V_{CC}=900V, V_{CEM}≤1200V		540		A

D1,D2 Diode Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_C=150A,V_{GE}=0V,T_j=25℃		1.70	2.15	V
		I_C=150A,V_{GE}=0V,T_j=125℃		1.65		
		I_C=150A,V_{GE}=0V,T_j=150℃		1.65		
Q_r	Recovered Charge	V_R=600V,I_F=150A, R_G=1.1Ω,V_{GE}=-15V T_j=25℃		14.0		μC
I_{RM}	Peak Reverse Recovery Current			222		A
E_{rec}	Reverse Recovery Energy			7.02		mJ
Q_r	Recovered Charge	V_R=600V,I_F=150A, R_G=1.1Ω,V_{GE}=-15V T_j=125℃		25.1		μC
I_{RM}	Peak Reverse Recovery Current			238		A
E_{rec}	Reverse Recovery Energy			11.4		mJ
Q_r	Recovered Charge	V_R=600V,I_F=150A, R_G=1.1Ω,V_{GE}=-15V T_j=150℃		27.8		μC
I_{RM}	Peak Reverse Recovery Current			251		A
E_{rec}	Reverse Recovery Energy			13.5		mJ

T3,T4 IGBT Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=150A,V_{GE}=15V, T_j=25℃		1.45	1.90	V
		I_C=150A,V_{GE}=15V, T_j=125℃		1.60		
		I_C=150A,V_{GE}=15V, T_j=150℃		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=2.4mA,V_{CE}=V_{GE}, T_j=25℃	5.1	5.8	6.4	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA
R_{Gint}	Internal Gate Resistance			2.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		9.24		nF
C_{res}	Reverse Transfer Capacitance			0.27		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		1.10		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=100A, R_G=3.3Ω,V_{GE}=±15V, T_j=25℃		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}=300V,I_C=100A, R_G=3.3Ω,V_{GE}=±15V, T_j=125℃		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}=300V,I_C=100A, R_G=3.3Ω,V_{GE}=±15V, T_j=150℃		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≤6μs,V_{GE}=15V, T_j=150℃,V_{CC}=360V, V_{CEM}≤650V		750		A

D3,D4 Diode Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_C=150A,V_{GE}=0V,T_j=25℃		1.55	2.00	V
		I_C=150A,V_{GE}=0V,T_j=125℃		1.50		
		I_C=150A,V_{GE}=0V,T_j=150℃		1.45		
Q_r	Recovered Charge	V_R=300V,I_F=150A, R_G=3.3Ω,V_{GE}=-15V T_j=25℃		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=300V,I_F=150A, R_G=3.3Ω,V_{GE}=-15V T_j=125℃		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=300V,I_F=150A, R_G=3.3Ω,V_{GE}=-15V T_j=150℃		13.6		μC
I_{RM}	Peak Reverse Recovery Current			111		A
E_{rec}	Reverse Recovery Energy			3.00		mJ

Module Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JC}$	Junction-to-Case (per T1,T2 IGBT) Junction-to-Case (per D1,D2 Diode) Junction-to-Case (per T3,T4 IGBT) Junction-to-Case (per D3,D4 Diode)			0.197 0.340 0.327 0.542	K/W
$R_{\theta CS}$	Case-to-Sink (per T1,T2 IGBT) Case-to-Sink (per D1,D2 Diode) Case-to-Sink (per T3,T4 IGBT) Case-to-Sink (per D3,D4 Diode)		0.178 0.308 0.296 0.490		K/W
$R_{\theta CS}$	Case-to-Sink		0.035		K/W
G	Weight of Module		340		g

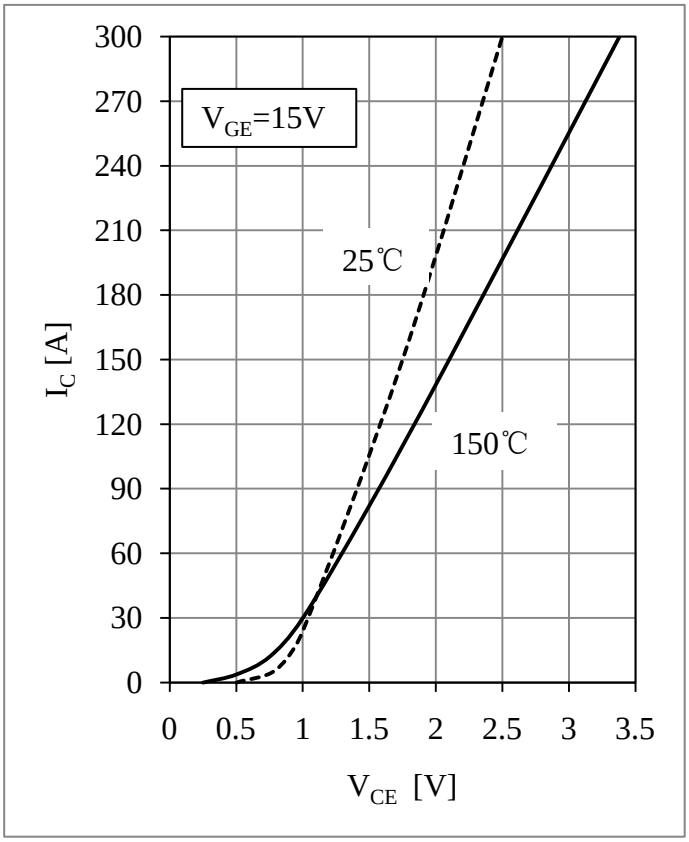


Fig 1. T1,T2 IGBT Output Characteristics

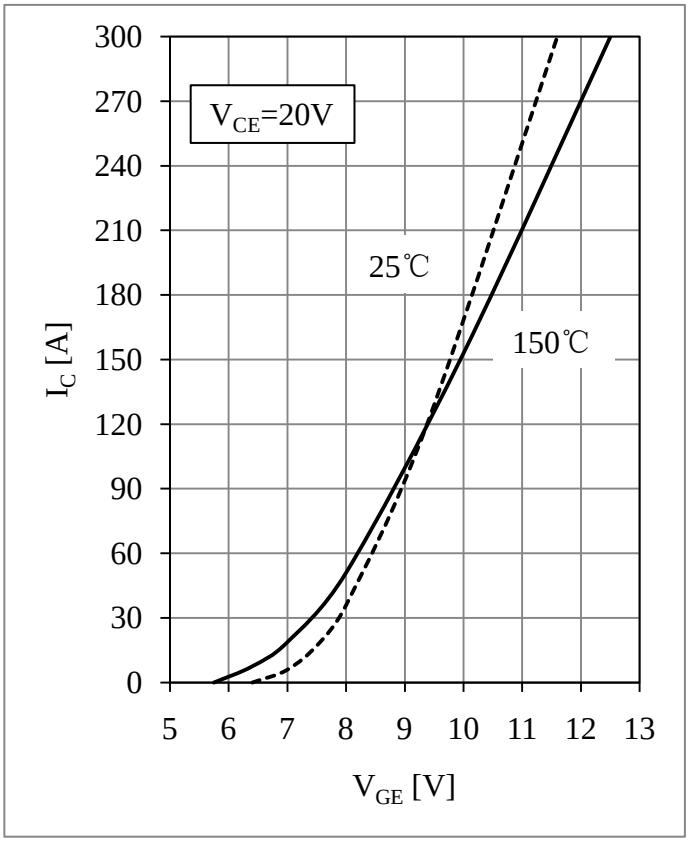


Fig 2. T1,T2 IGBT Transfer Characteristics

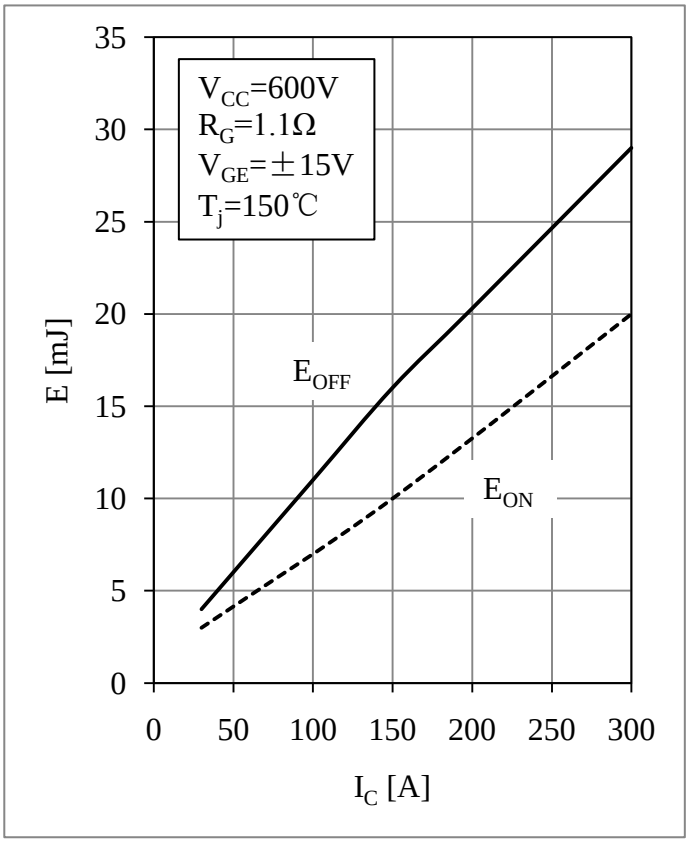


Fig 3. T1,T2 IGBT Switching Loss vs. I_C

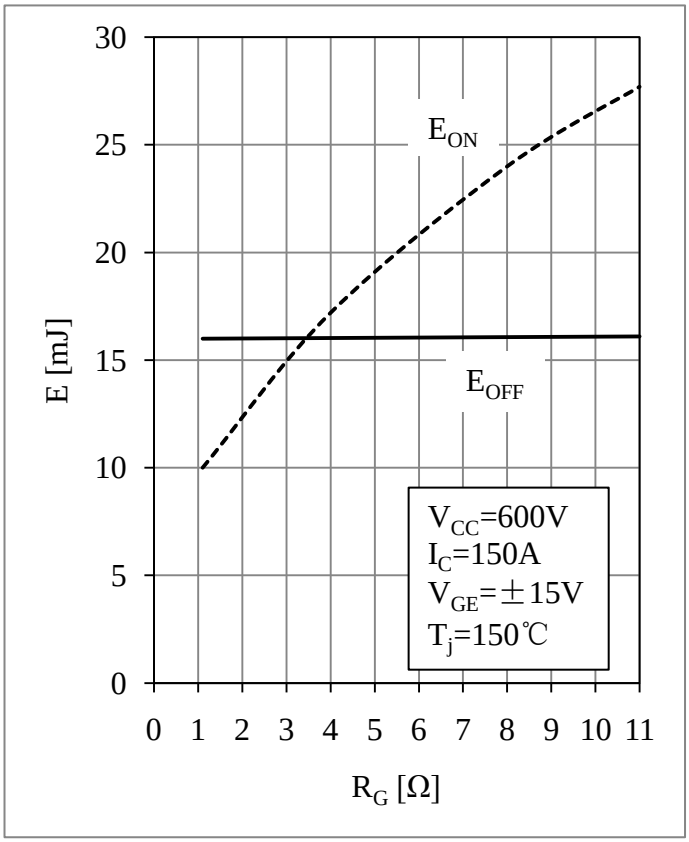


Fig 4. T1,T2 IGBT Switching Loss vs. R_G

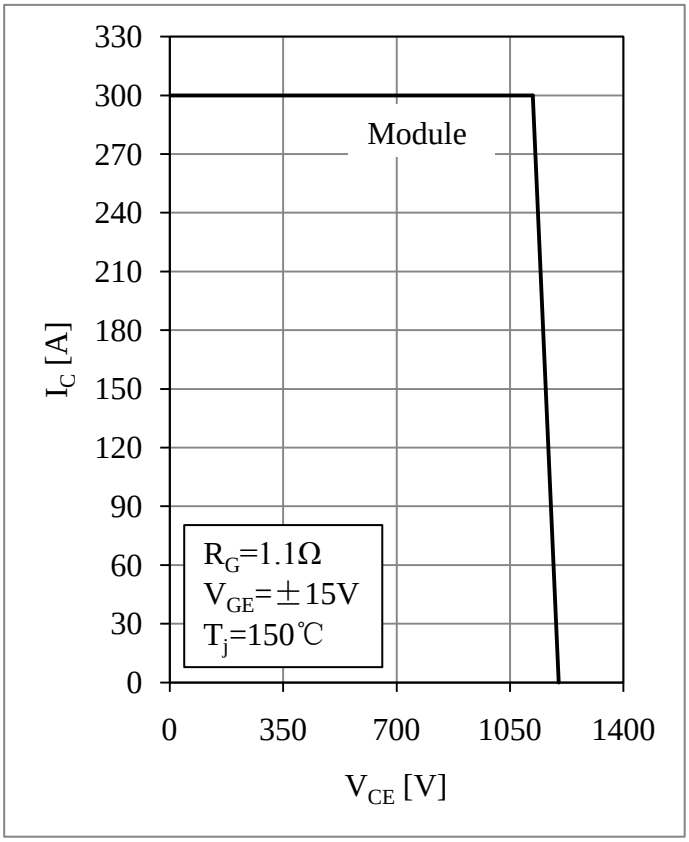


Fig 5. T1,T2 RBSOA

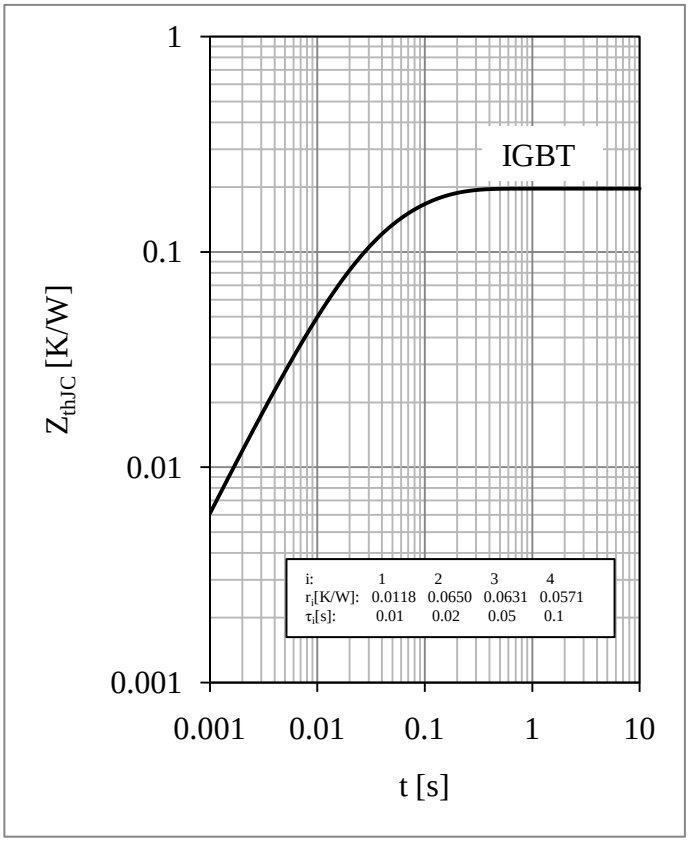


Fig 6. T1,T2 IGBT Transient Thermal Impedance

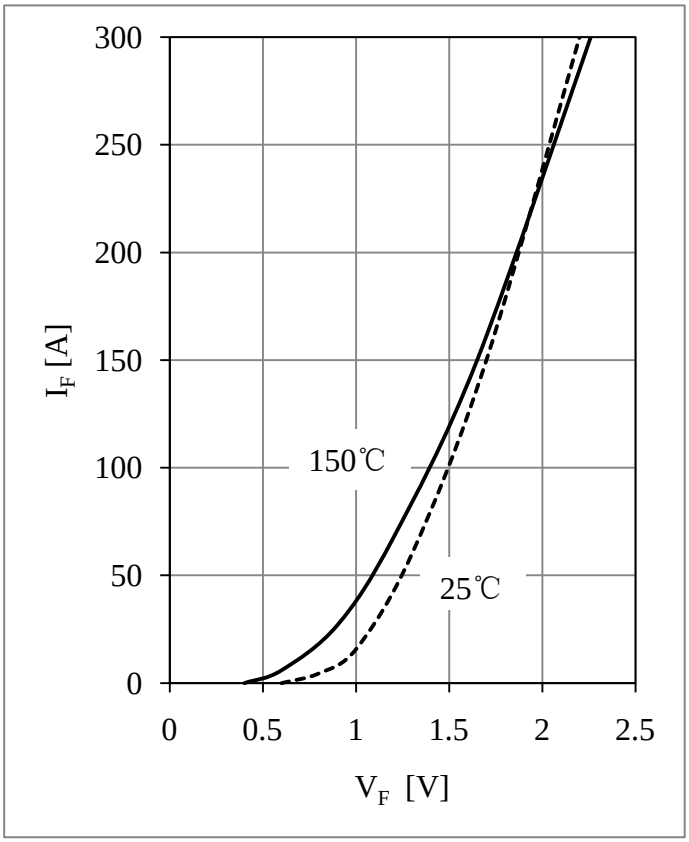


Fig 7. D1,D2 Diode Forward Characteristics

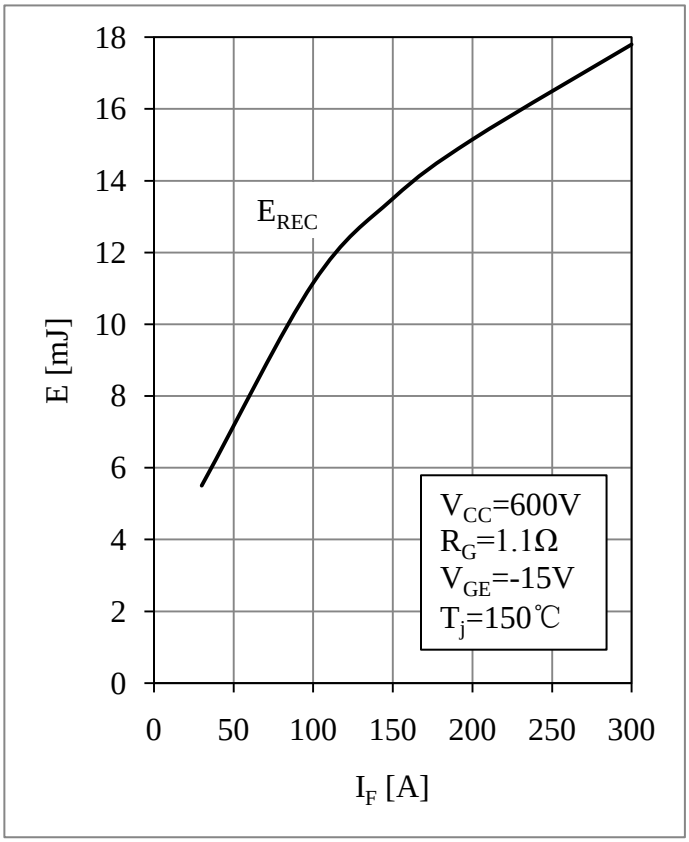


Fig 8. D1,D2 Diode Switching Loss vs. I_F

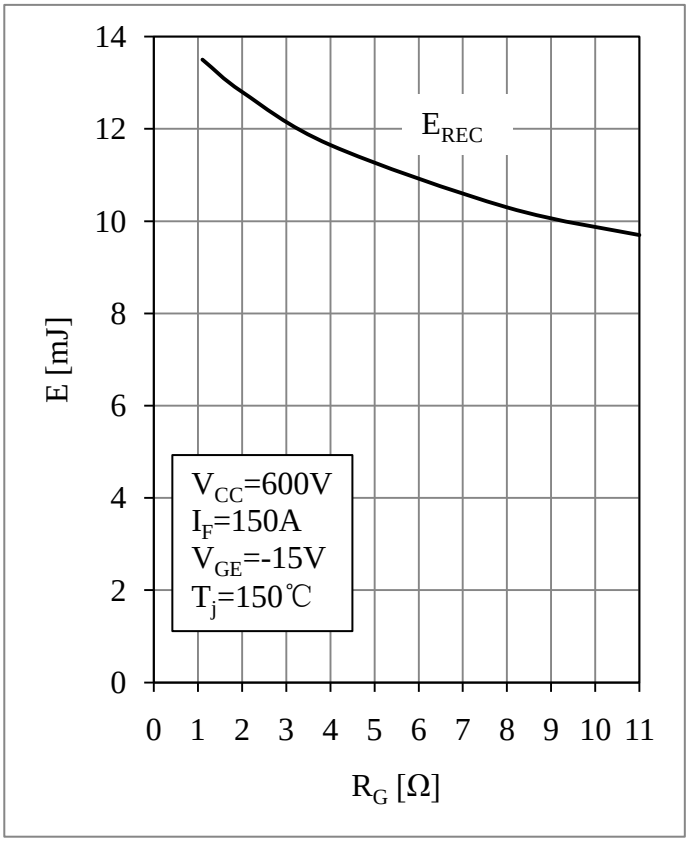


Fig 9. D1,D2 Diode Switching Loss vs. R_G

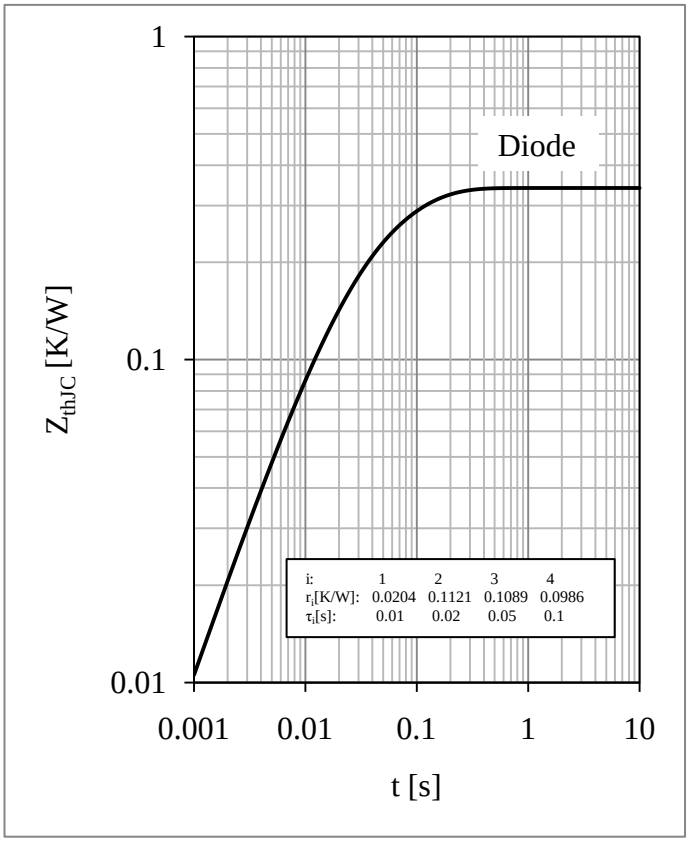


Fig 10. D1,D2 Diode Transient Thermal Impedance

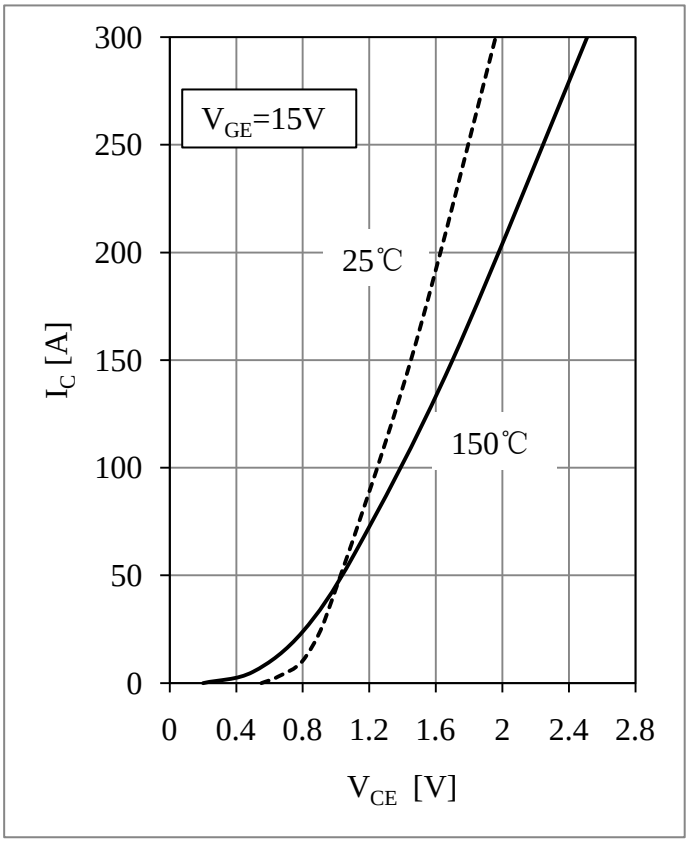


Fig 11. T3,T4 IGBT Output Characteristics

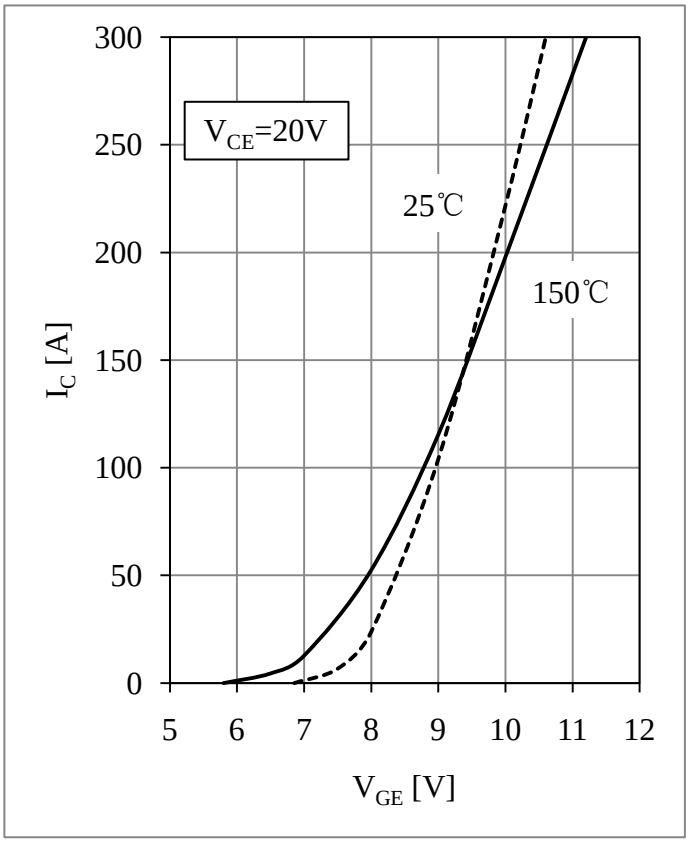


Fig 12. T3,T4 IGBT Transfer Characteristics

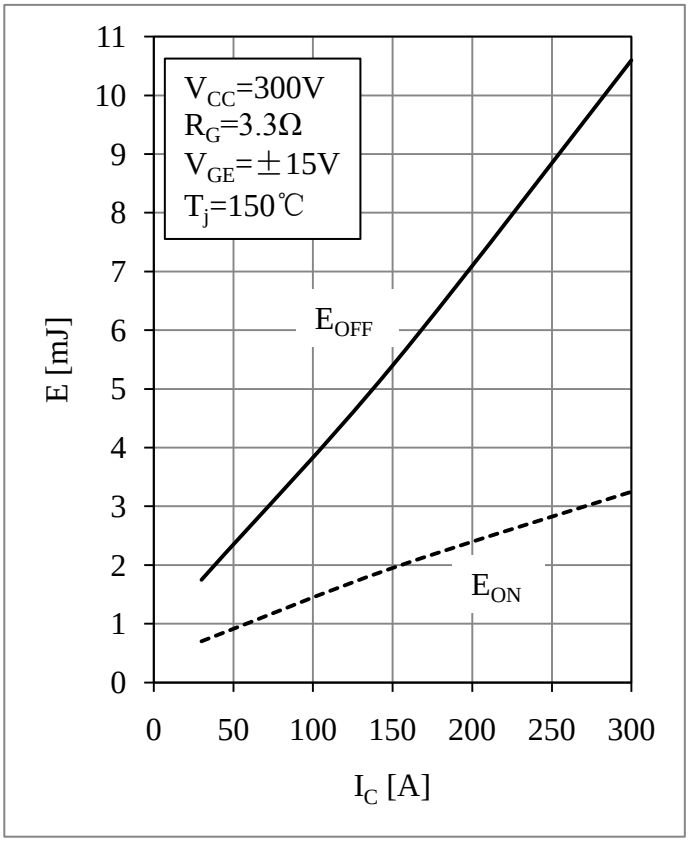


Fig 13. T3,T4 IGBT Switching Loss vs. I_C

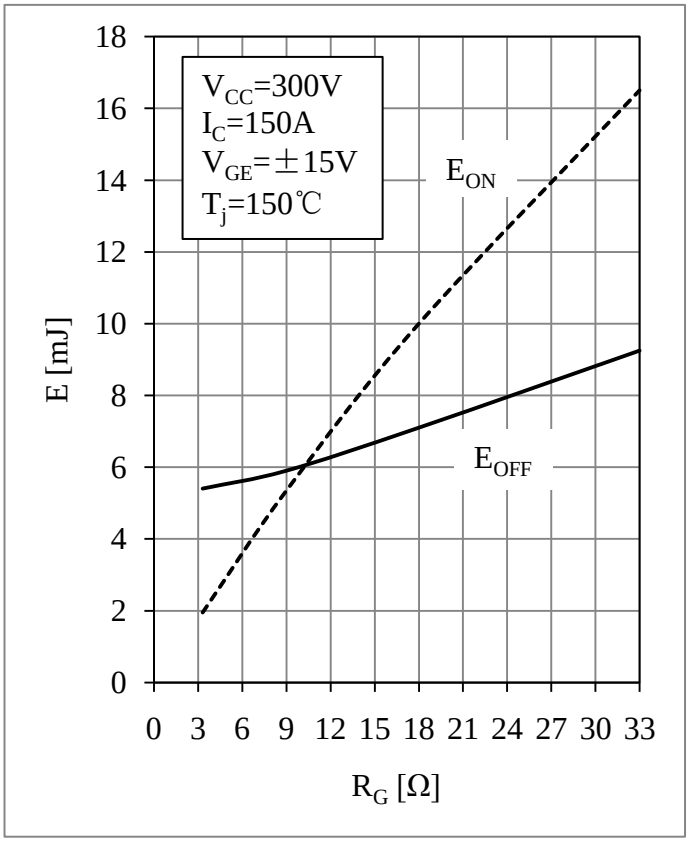


Fig 14. T3,T4 IGBT Switching Loss vs. R_G

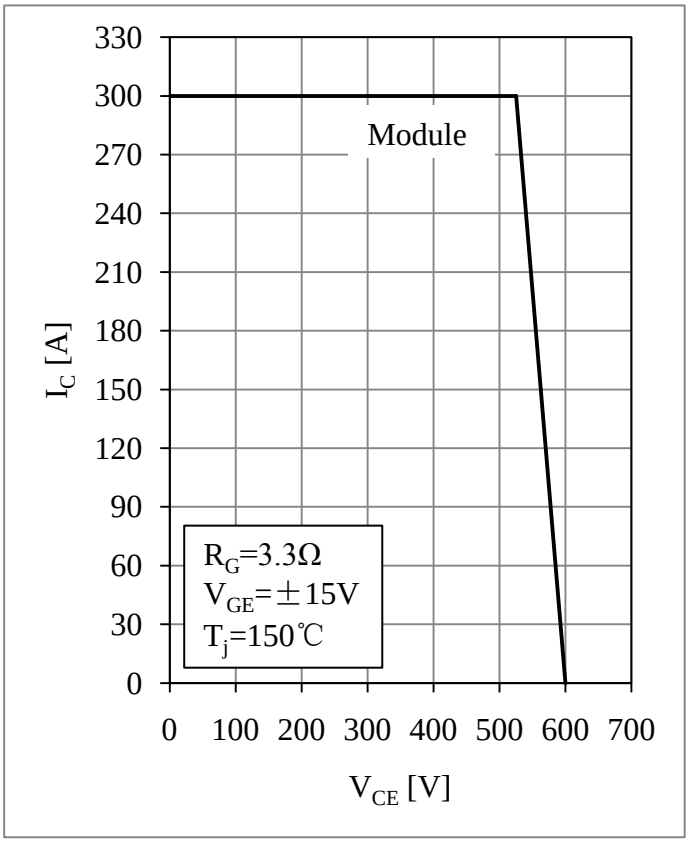


Fig 15. T3,T4 RBSOA

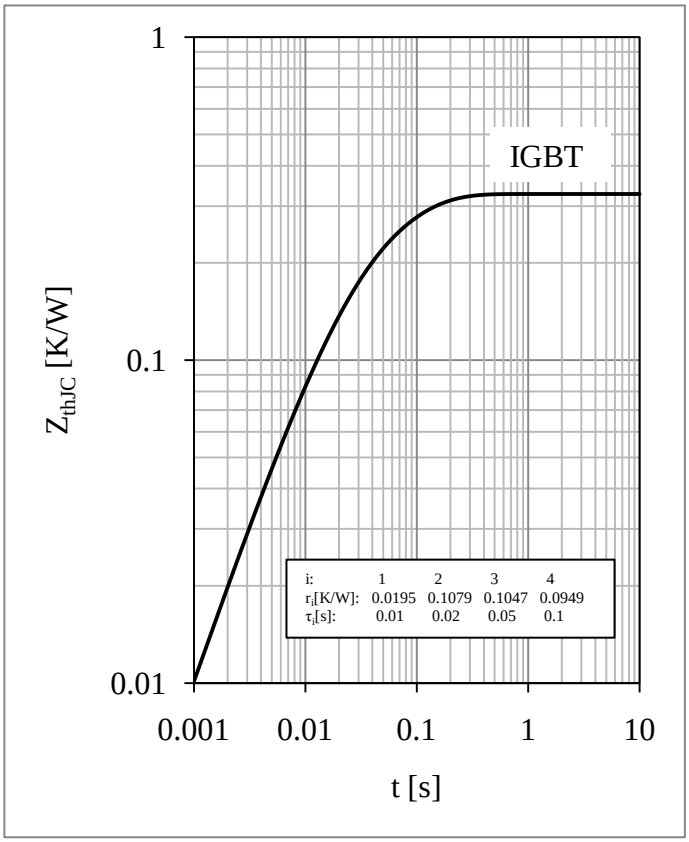


Fig 16. T3,T4 IGBT Transient Thermal Impedance

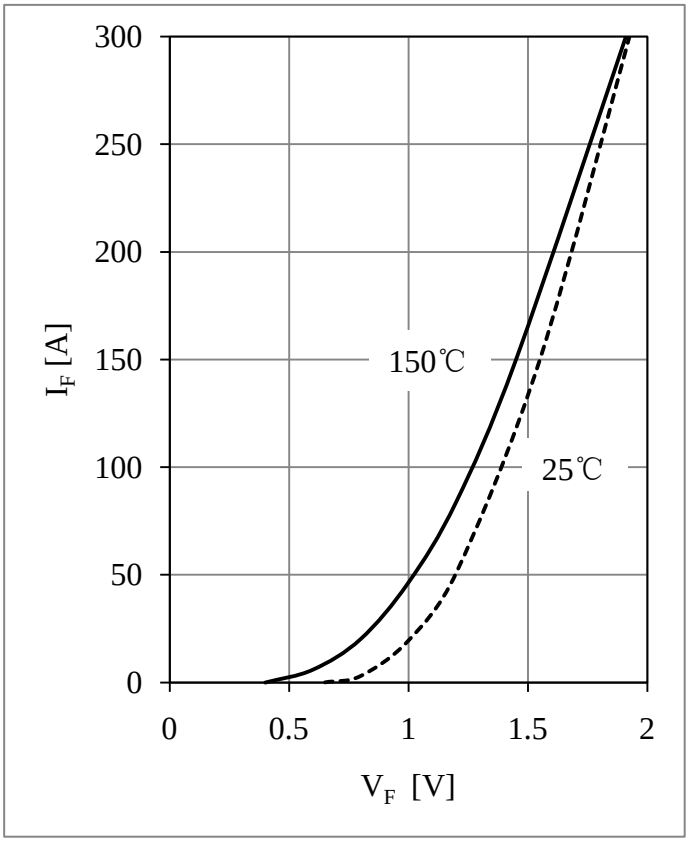


Fig 17. D3,D4 Diode Forward Characteristics

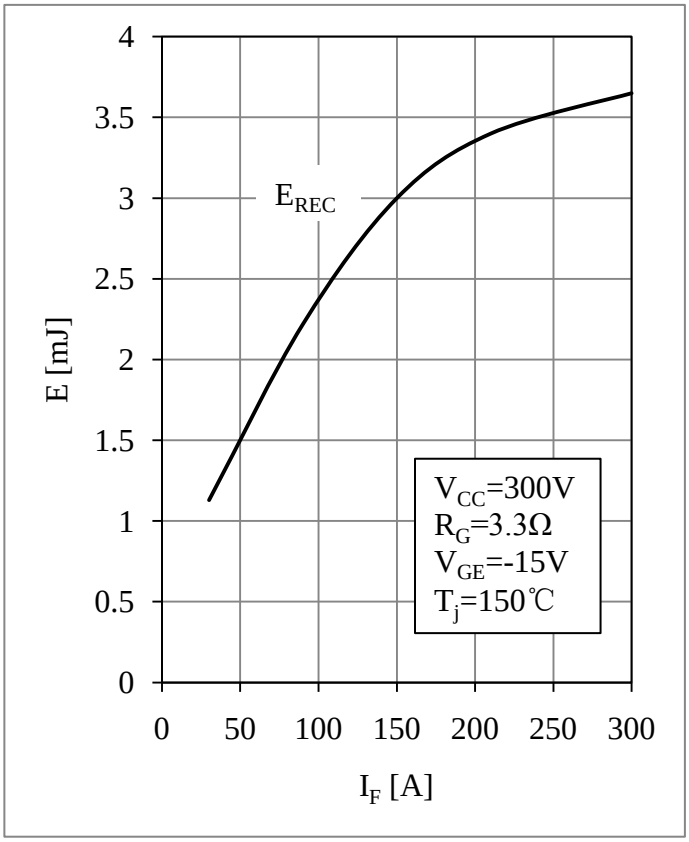


Fig 18. D3,D4 Diode Switching Loss vs. I_F

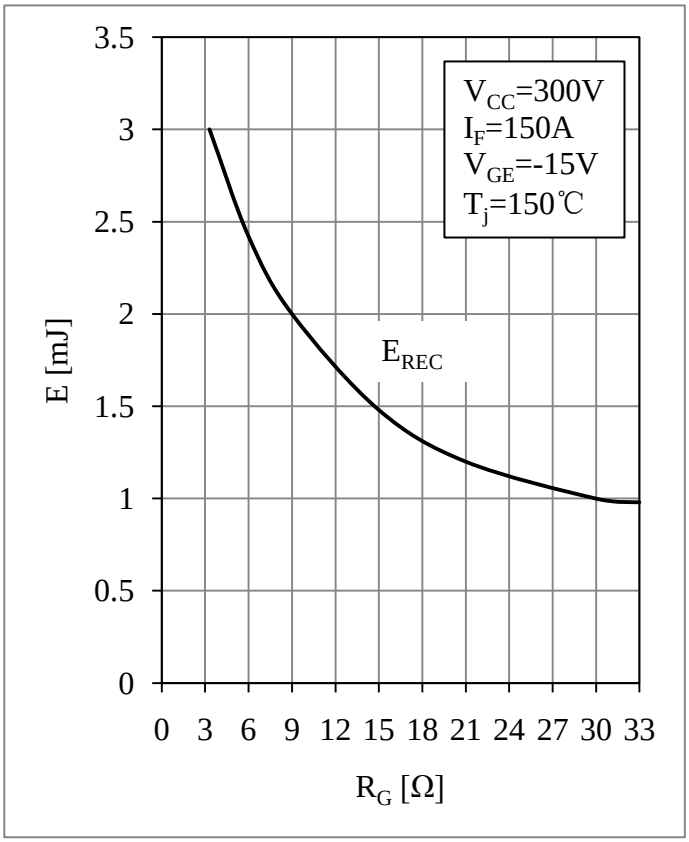


Fig 19. D3,D4 Diode Switching Loss vs. R_G

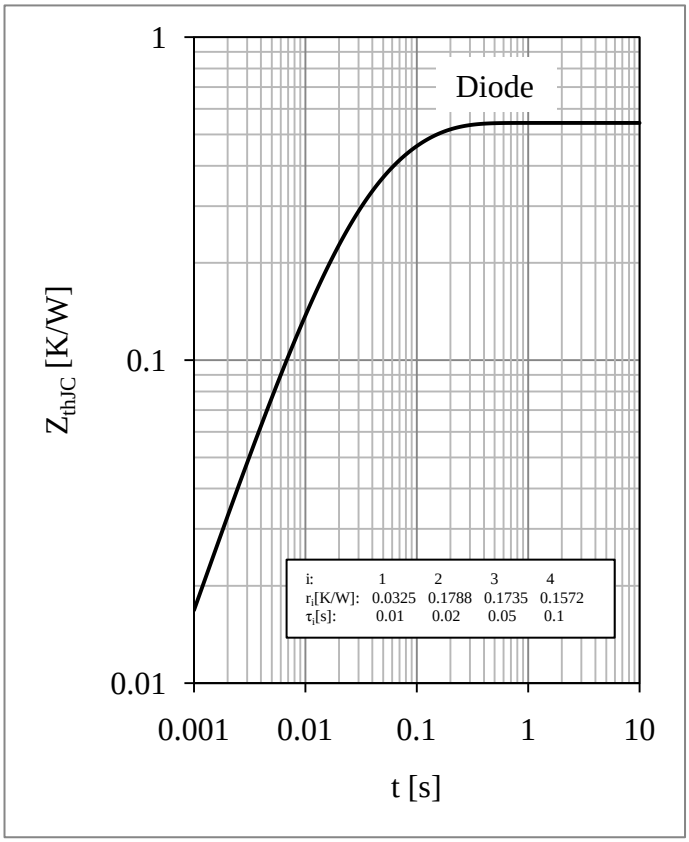
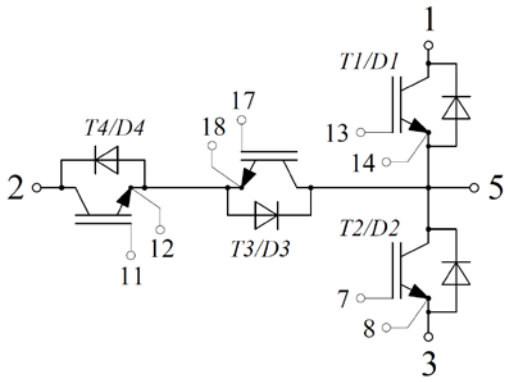


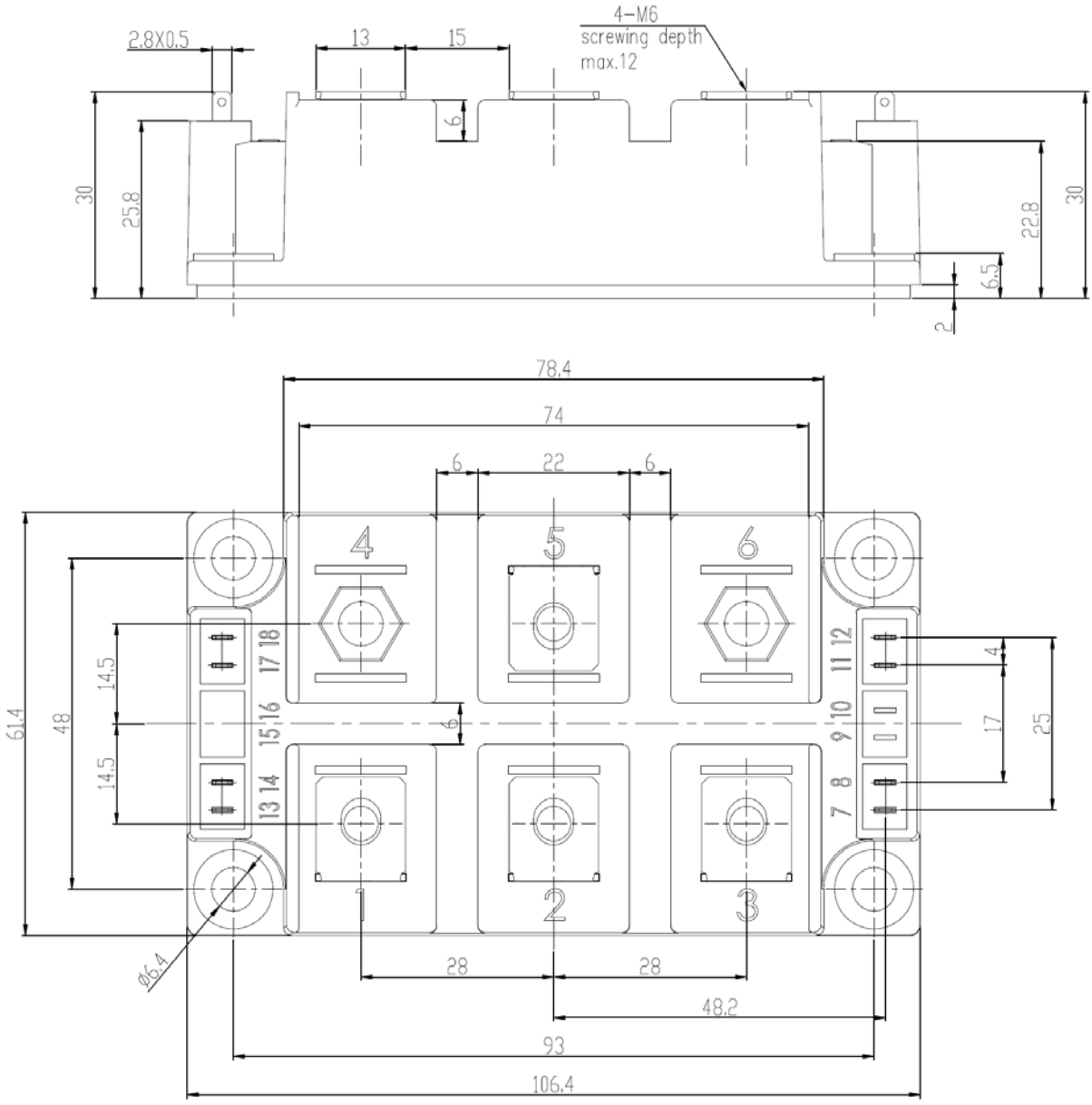
Fig 20. D3,D4 Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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