STARPOWER

SEMICONDUCTOR **IGBT**

GD300TLY120C2S

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 UPS.

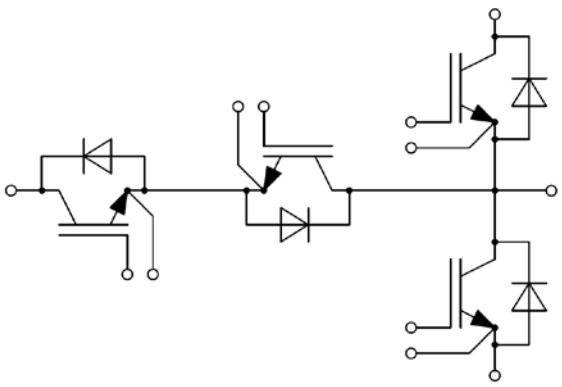
Features

- 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,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°C @ T_C=100°C	483 300	A
I_{CM}	Pulsed Collector Current t_p=1ms	600	A
P_D	Maximum Power Dissipation @ T_j=175°C	1612	W

D1,D2 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	300	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	600	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°C @ T_C=60°C	372 300	A
I_{CM}	Pulsed Collector Current t_p=1ms	600	A
P_D	Maximum Power Dissipation @ T_j=175°C	920	W

D3,D4 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	300	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	600	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,T2 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=300A,V_{GE}=15V, T_j=25°C		1.70	2.15	V
		I_C=300A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=300A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=7.50mA,V_{CE}=V_{GE}, T_j=25°C	5.2	6.0	6.8	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			2.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		21.0		nF
C_{res}	Reverse Transfer Capacitance			1.20		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		2.60		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=300A, R_G=1.3Ω,V_{GE}=±15V, T_j=25°C		182		ns
t_r	Rise Time			54		ns
$t_{d(off)}$	Turn-Off Delay Time			464		ns
t_f	Fall Time			72		ns
E_{on}	Turn-On Switching Loss			10.6		mJ
E_{off}	Turn-Off Switching Loss			25.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=300A, R_G=1.3Ω,V_{GE}=±15V, T_j=125°C		193		ns
t_r	Rise Time			54		ns
$t_{d(off)}$	Turn-Off Delay Time			577		ns
t_f	Fall Time			113		ns
E_{on}	Turn-On Switching Loss			16.8		mJ
E_{off}	Turn-Off Switching Loss			38.6		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=300A, R_G=1.3Ω,V_{GE}=±15V, T_j=150°C		203		ns
t_r	Rise Time			54		ns
$t_{d(off)}$	Turn-Off Delay Time			618		ns
t_f	Fall Time			124		ns
E_{on}	Turn-On Switching Loss			18.5		mJ
E_{off}	Turn-Off Switching Loss			43.3		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		1200		A

D1,D2 Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_C=300A,V_{GE}=0V,T_j=25°C		1.65	2.10	V
		I_C=300A,V_{GE}=0V,T_j=125°C		1.65		
		I_C=300A,V_{GE}=0V,T_j=150°C		1.65		
Q_r	Recovered Charge	V_{CC}=600V,I_F=300A, -di/dt=6050A/μs,V_{GE}=-15V, T_j=25°C		29		μC
I_{RM}	Peak Reverse Recovery Current			318		A
E_{rec}	Reverse Recovery Energy			18.1		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=300A, -di/dt=6050A/μs,V_{GE}=-15V, T_j=125°C		55		μC
I_{RM}	Peak Reverse Recovery Current			371		A
E_{rec}	Reverse Recovery Energy			28.0		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=300A, -di/dt=6050A/μs,V_{GE}=-15V, T_j=150°C		64		μC
I_{RM}	Peak Reverse Recovery Current			390		A
E_{rec}	Reverse Recovery Energy			32.8		mJ

T3,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=300A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=300A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=300A,V_{GE}=15V, T_j=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=4.8mA,V_{CE}=V_{GE}, T_j=25°C	5.1	5.8	6.5	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			1.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		17.1		nF
C_{res}	Reverse Transfer Capacitance			0.51		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		2.88		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=300A, R_G=2.4Ω,V_{GE}=±15V, T_j=25°C		88		ns
t_r	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			294		ns
t_f	Fall Time			43		ns
E_{on}	Turn-On Switching Loss			1.34		mJ
E_{off}	Turn-Off Switching Loss			8.60		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=300A, R_G=2.4Ω,V_{GE}=±15V, T_j=125°C		96		ns
t_r	Rise Time			48		ns
$t_{d(off)}$	Turn-Off Delay Time			312		ns
t_f	Fall Time			60		ns
E_{on}	Turn-On Switching Loss			1.86		mJ
E_{off}	Turn-Off Switching Loss			10.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=300A, R_G=2.4Ω,V_{GE}=±15V, T_j=150°C		104		ns
t_r	Rise Time			48		ns
$t_{d(off)}$	Turn-Off Delay Time			318		ns
t_f	Fall Time			60		ns
E_{on}	Turn-On Switching Loss			1.98		mJ
E_{off}	Turn-Off Switching Loss			11.3		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤650V		1500		A

D3,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=300A,V_{GE}=0V,T_i=25°C		1.55	1.95	V
		I_F=300A,V_{GE}=0V,T_j=125°C		1.50		
		I_F=300A,V_{GE}=0V,T_j=150°C		1.45		
Q_r	Recovered Charge	V_R=300V,I_F=300A, -di/dt=7150A/μs,V_{GE}=-15V T_j=25°C		14.3		μC
I_{RM}	Peak Reverse Recovery Current			209		A
E_{rec}	Reverse Recovery Energy			3.74		mJ
Q_r	Recovered Charge	V_R=300V,I_F=300A, -di/dt=7150A/μs,V_{GE}=-15V T_j=125°C		26.4		μC
I_{RM}	Peak Reverse Recovery Current			259		A
E_{rec}	Reverse Recovery Energy			6.82		mJ
Q_r	Recovered Charge	V_R=300V,I_F=300A, -di/dt=7150A/μs,V_{GE}=-15V T_j=150°C		30.8		μC
I_{RM}	Peak Reverse Recovery Current			275		A
E_{rec}	Reverse Recovery Energy			7.70		mJ

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	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)			0.093 0.158 0.163 0.299	K/W
R_{thCH}	Case-to-Heatsink (per T1,T2 IGBT) Case-to-Heatsink (per D1,D2 Diode) Case-to-Heatsink (per T3,T4 IGBT) Case-to-Heatsink (per D3,D4 Diode) Case-to-Heatsink (per Module)		0.050 0.083 0.087 0.160 0.010		K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M6	2.5 3.0		5.0 5.0	N.m
G	Weight of Module		340		g

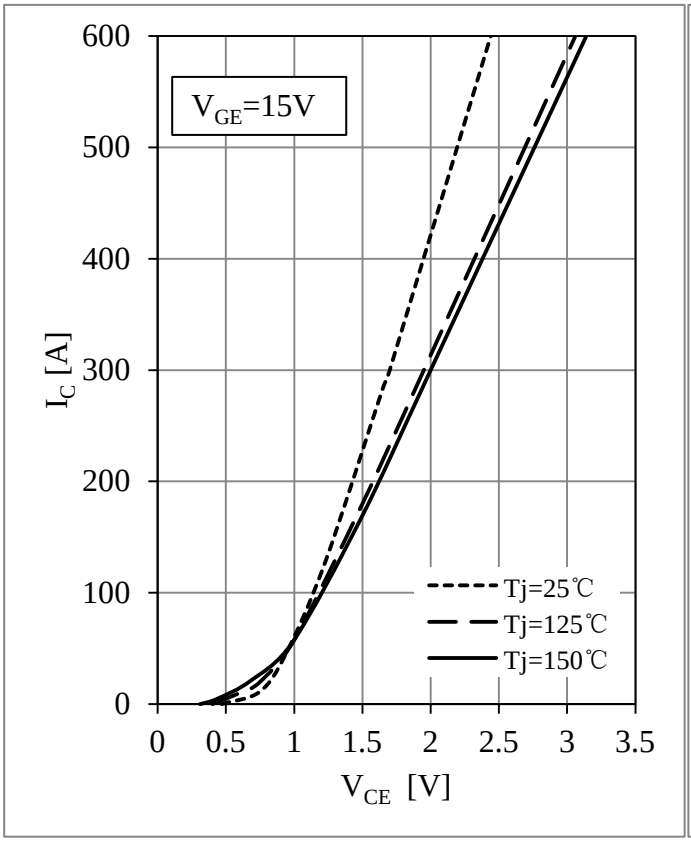


Fig 1. T1,T2 IGBT Output Characteristics

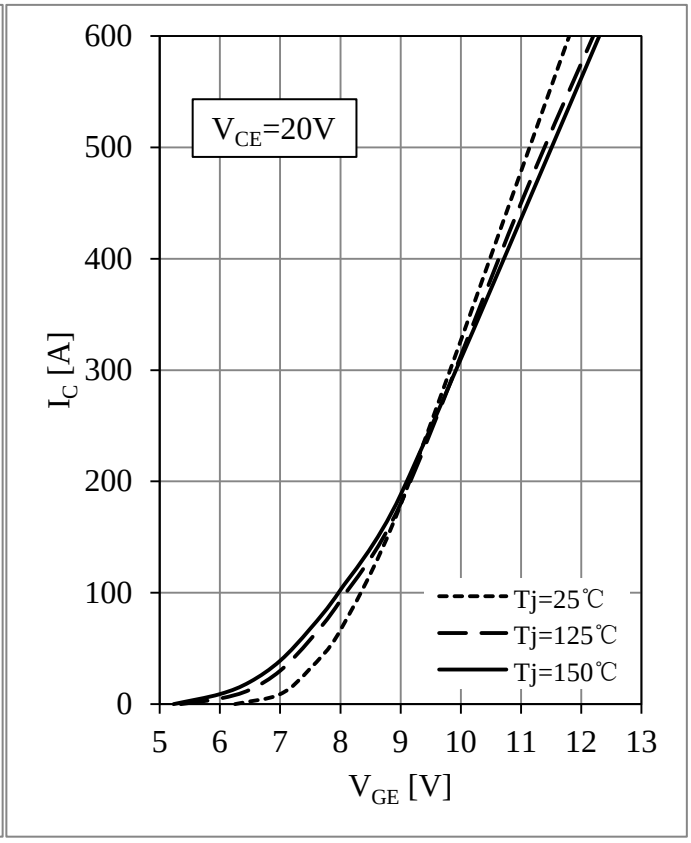


Fig 2. T1,T2 IGBT Transfer Characteristics

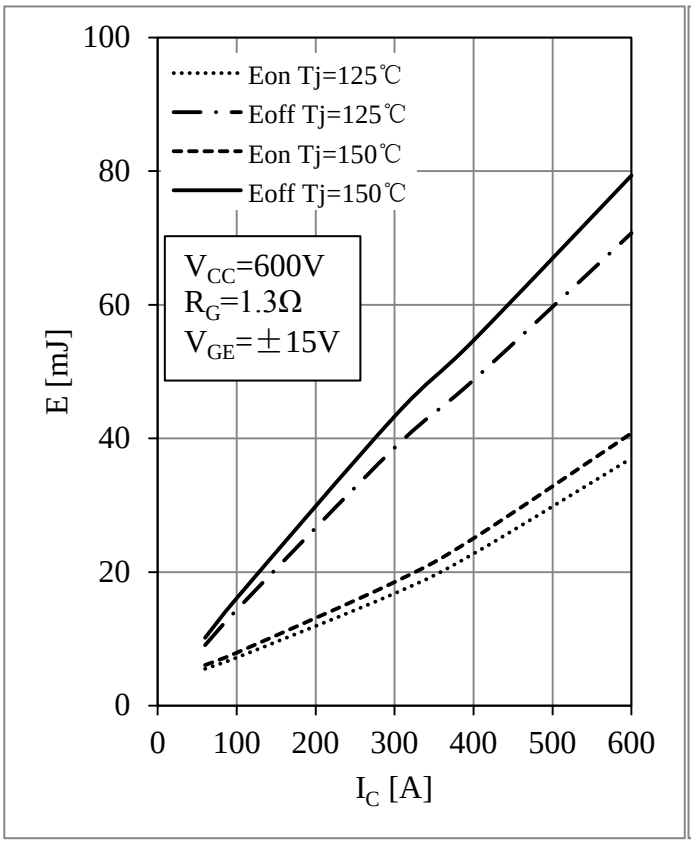


Fig 3. T1,T2 IGBT Switching Loss vs. I_C

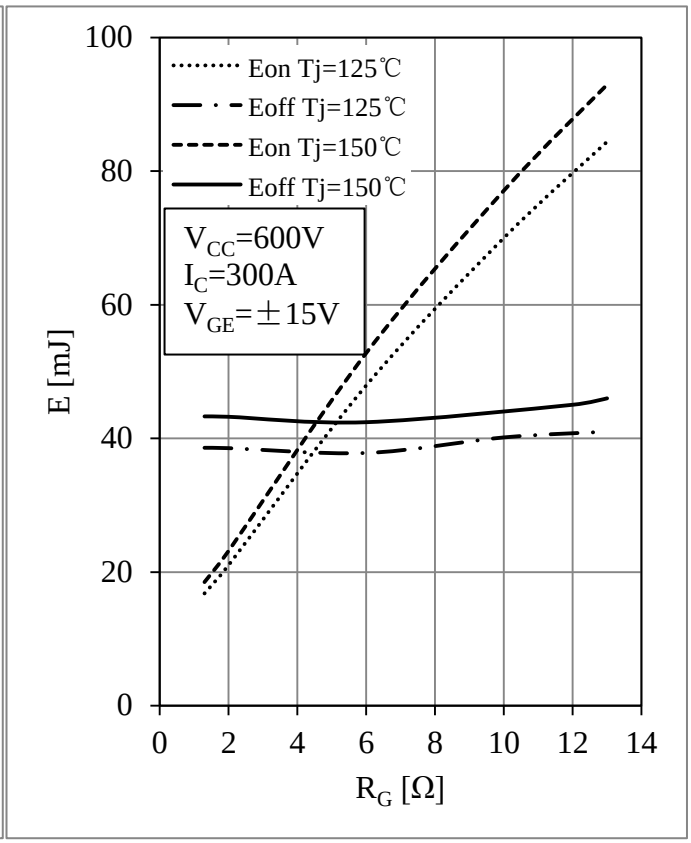


Fig 4. T1,T2 IGBT Switching Loss vs. R_G

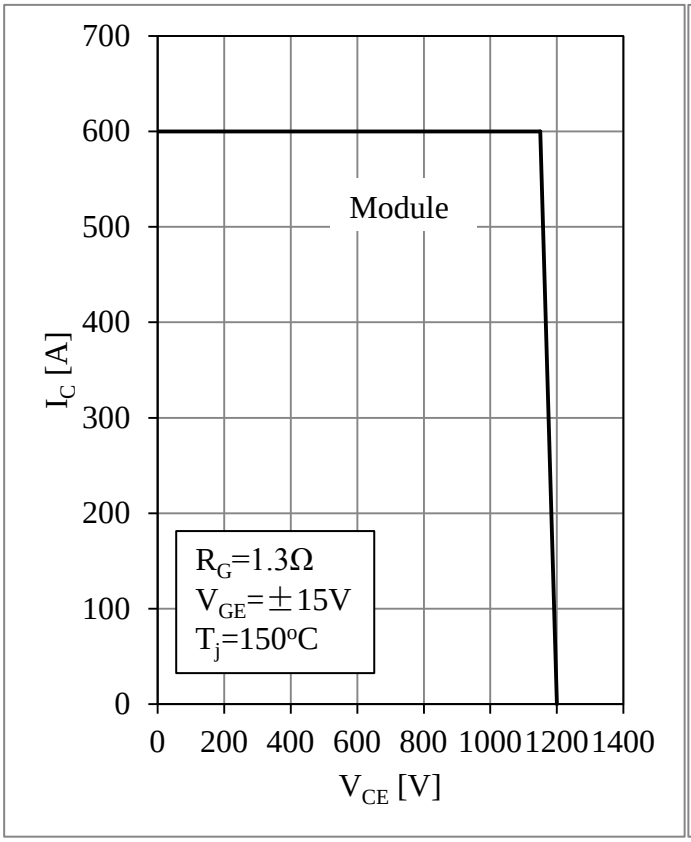


Fig 5. T1,T2 RBSOA

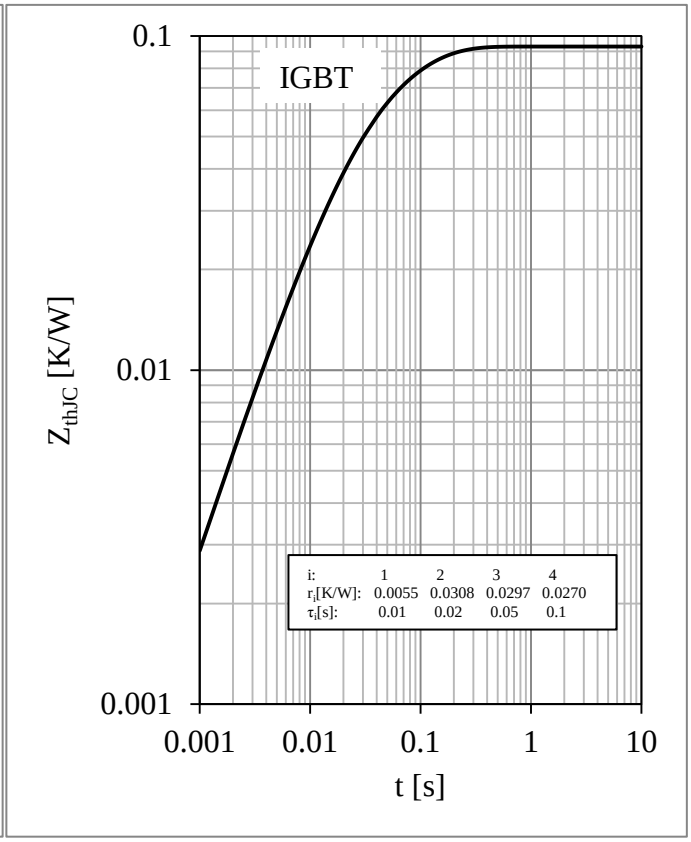


Fig 6. T1,T2 IGBT Transient Thermal Impedance

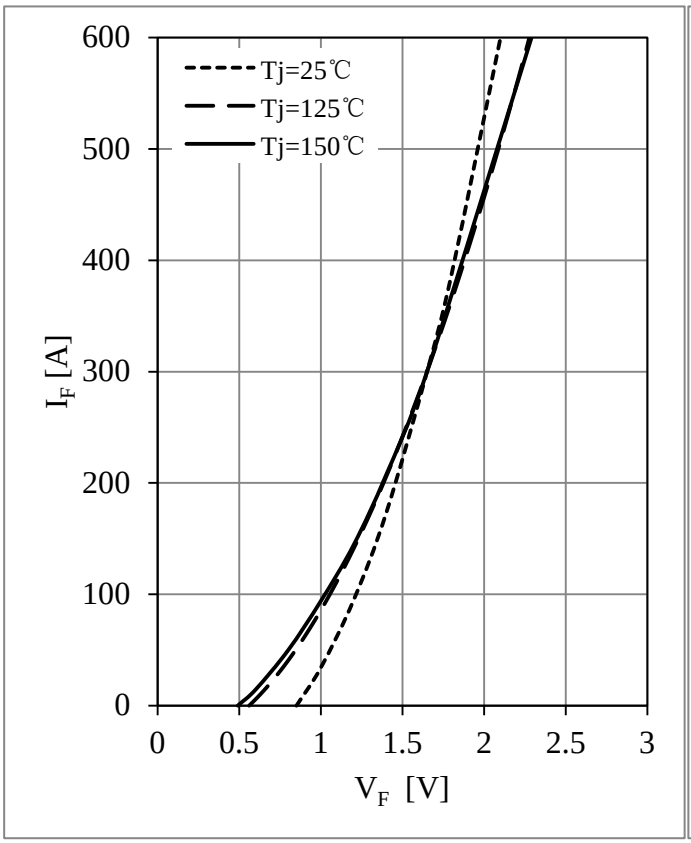


Fig 7. D1,D2 Diode Forward Characteristics

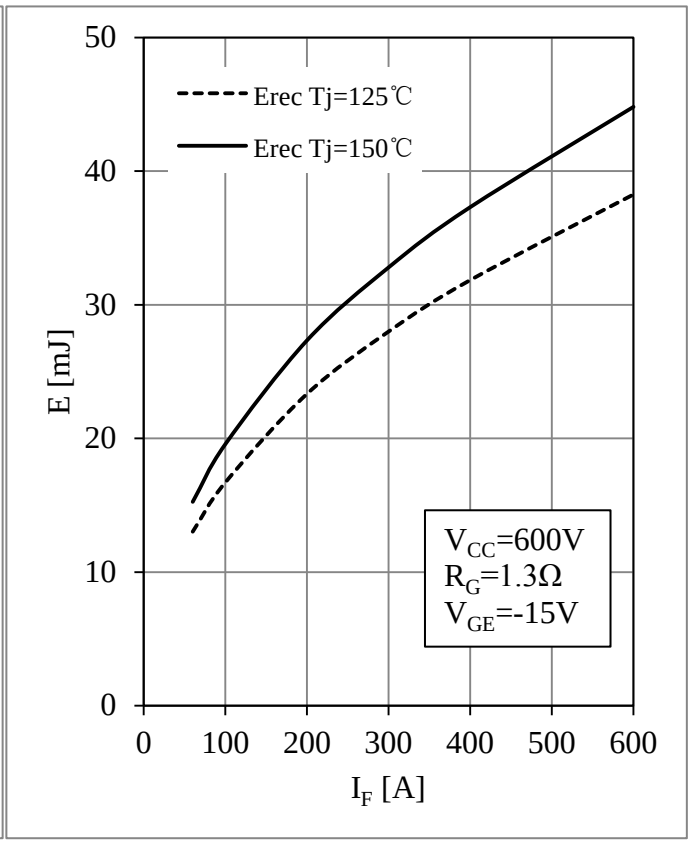


Fig 8. D1,D2 Diode Switching Loss vs. I_F

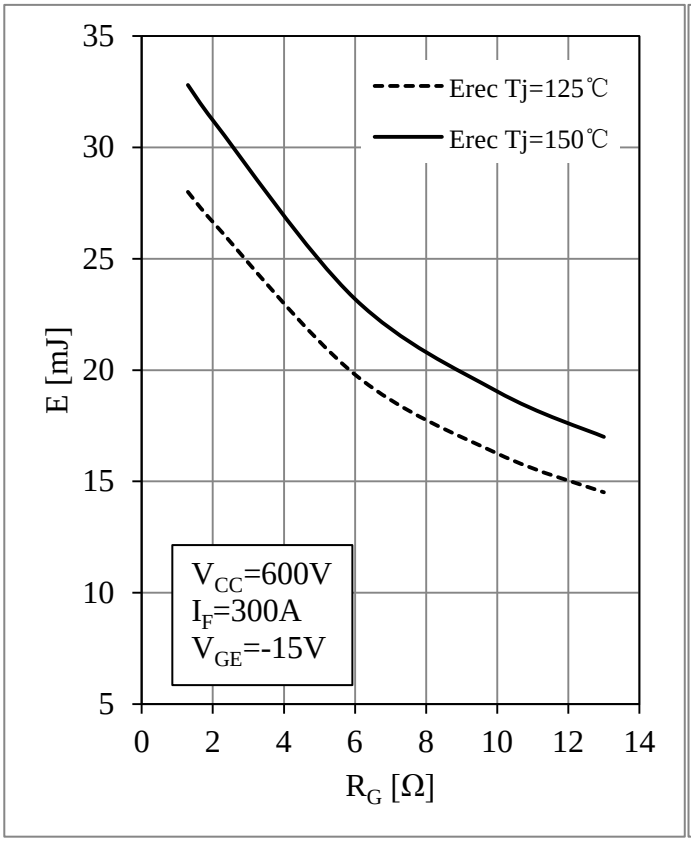


Fig 9. D1,D2 Diode Switching Loss vs. R_G

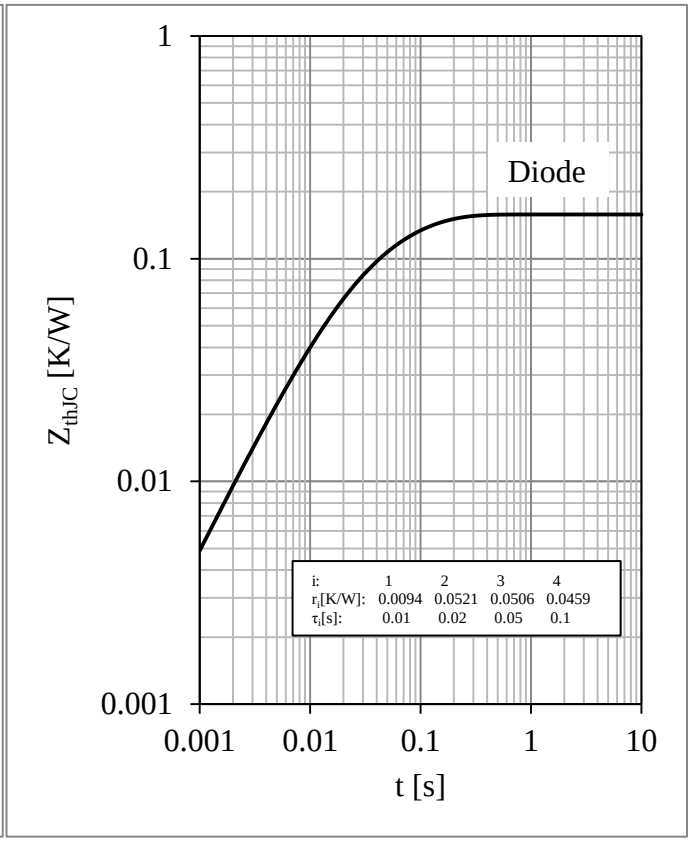


Fig 10. D1,D2 Diode Transient Thermal Impedance

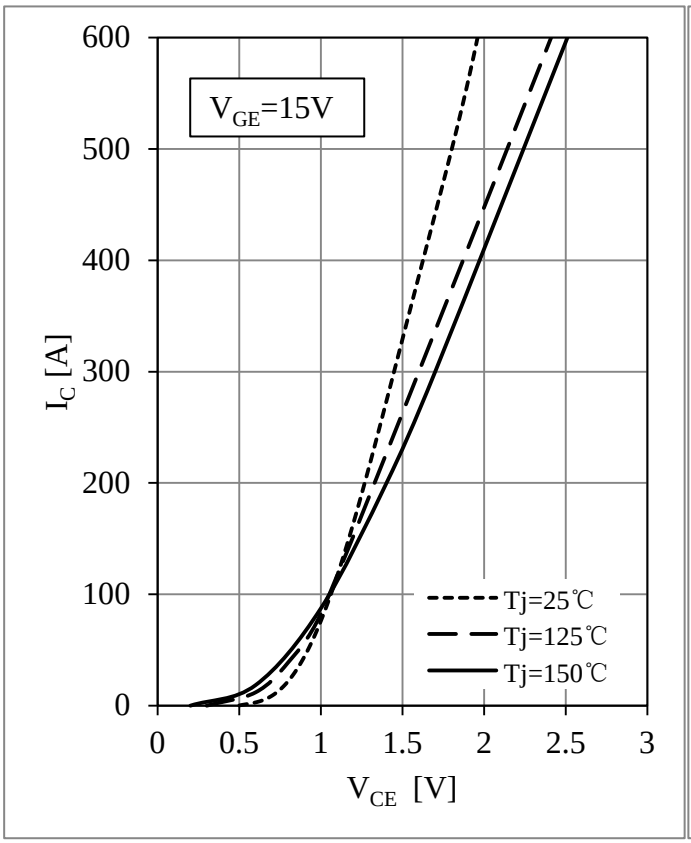


Fig 11. T3,T4 IGBT Output Characteristics

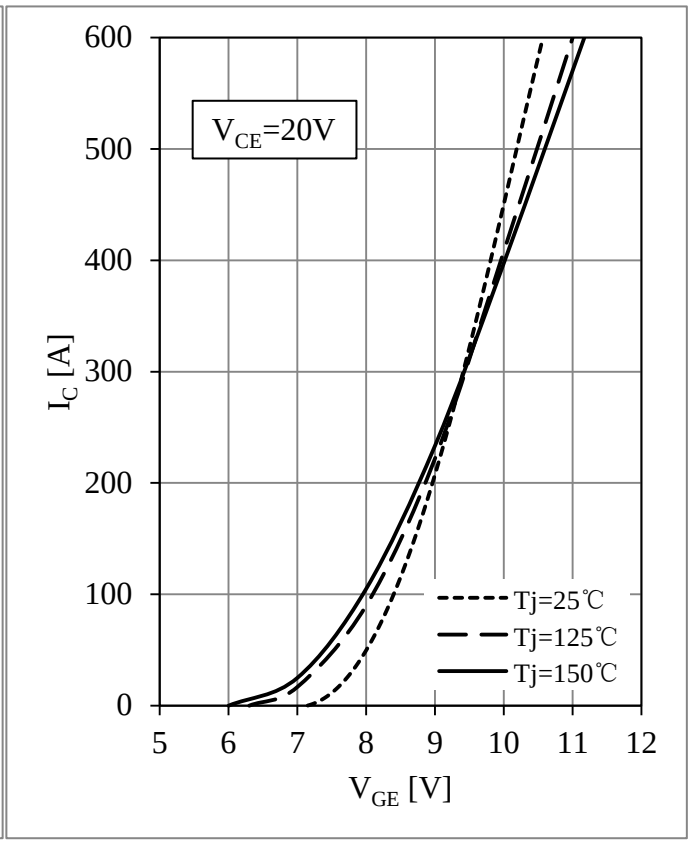


Fig 12. T3,T4 IGBT Transfer Characteristics

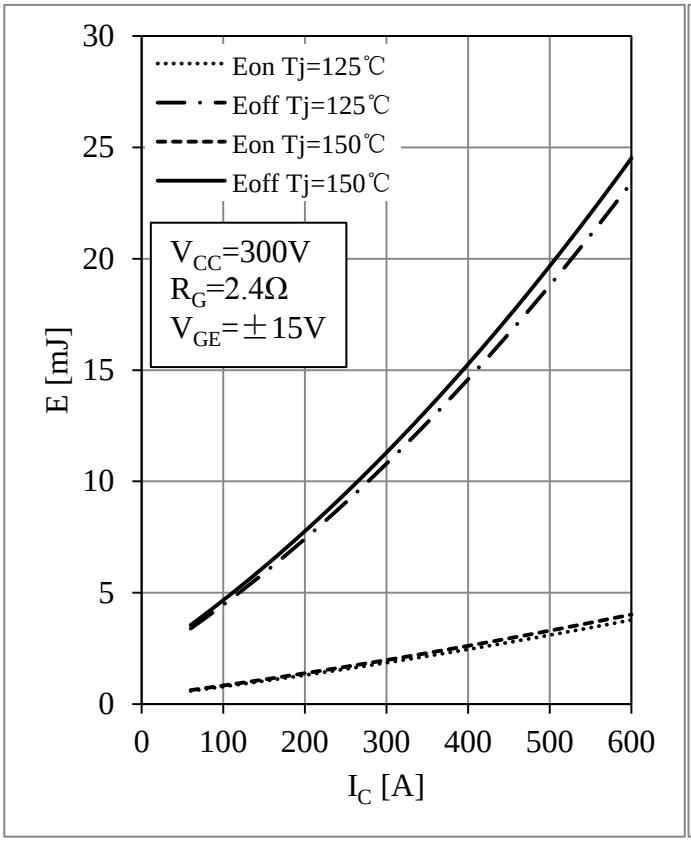


Fig 13. T3,T4 IGBT Switching Loss vs. I_C

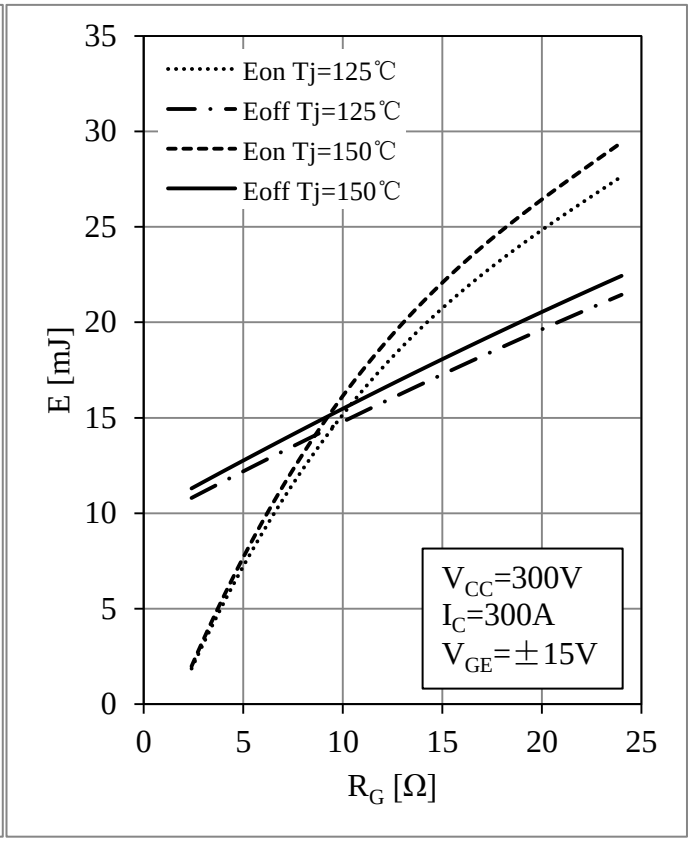


Fig 14. T3,T4 IGBT Switching Loss vs. R_G

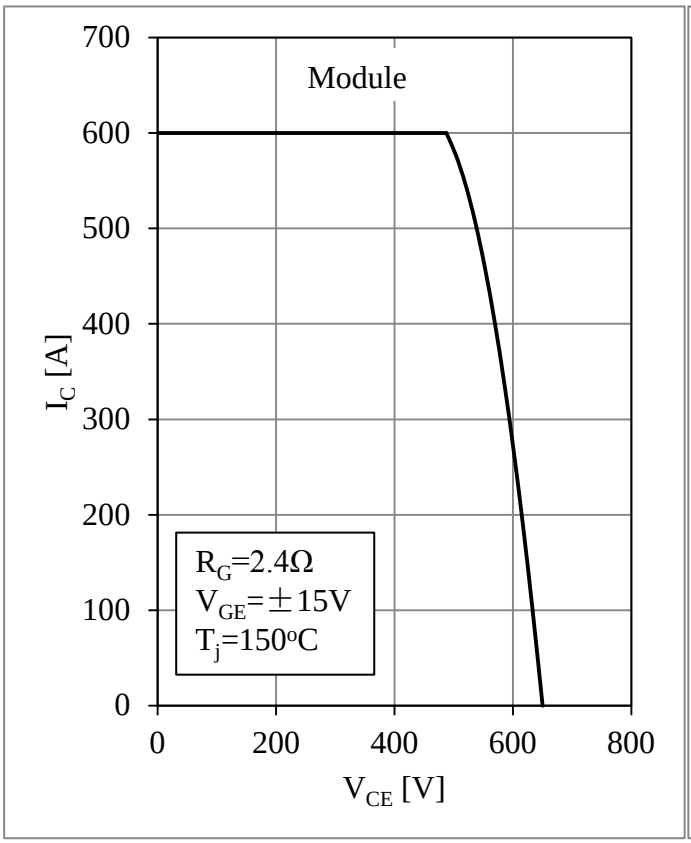


Fig 15. T3,T4 RBSOA

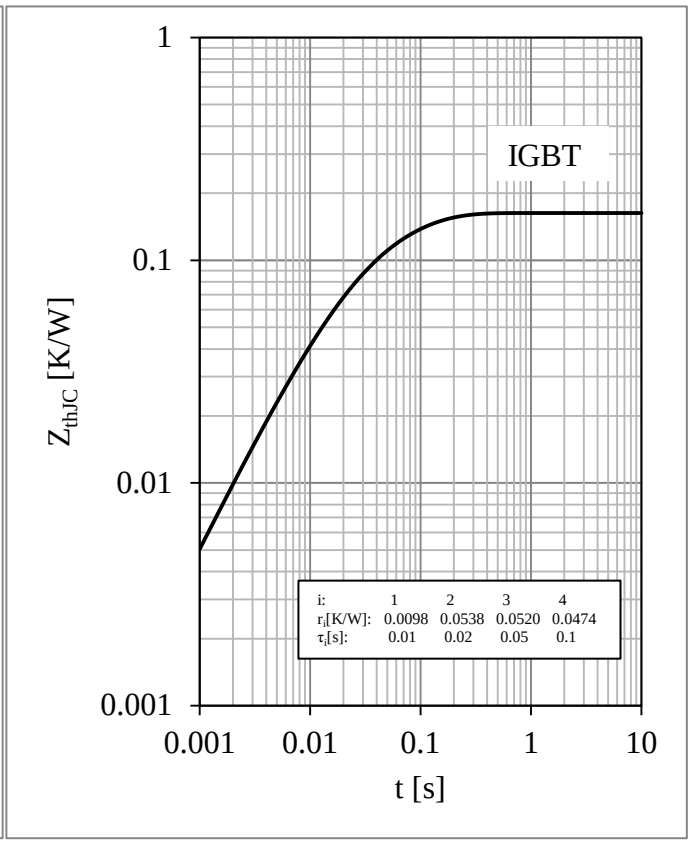


Fig 16. T3,T4 IGBT Transient Thermal Impedance

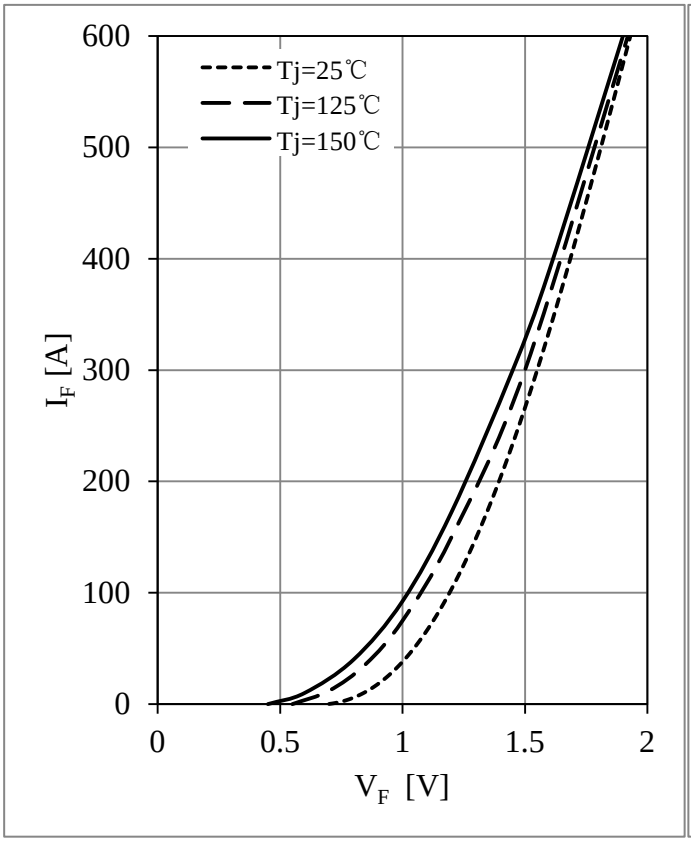


Fig 17. D3,D4 Diode Forward Characteristics

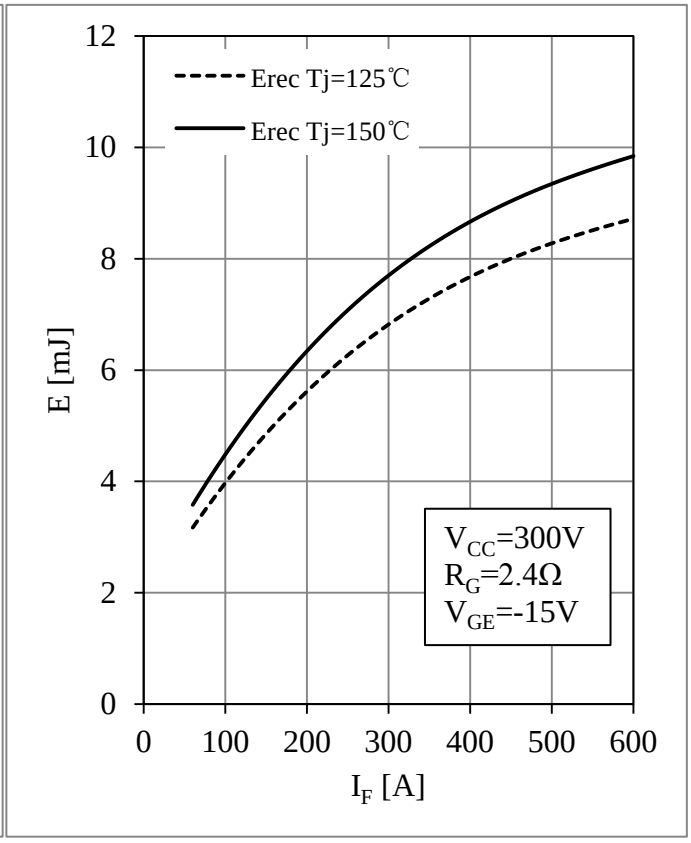


Fig 18. D3,D4 Diode Switching Loss vs. I_F

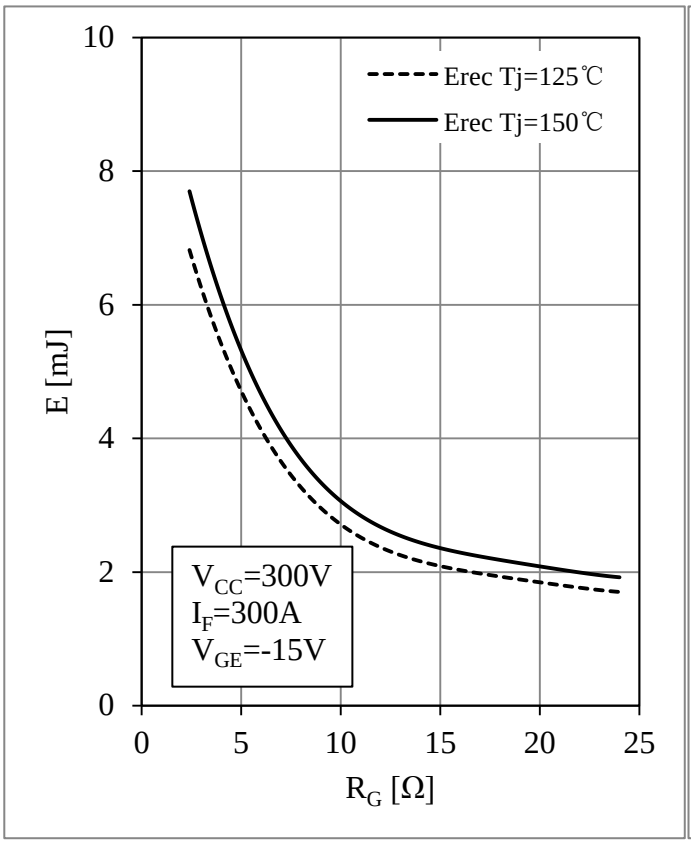


Fig 19. D3,D4 Diode Switching Loss vs. R_G

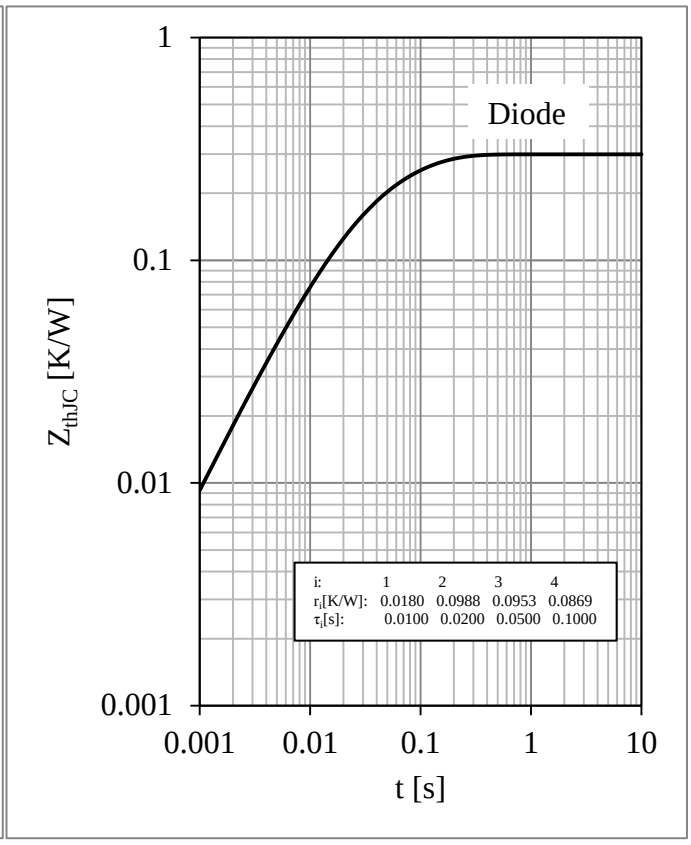
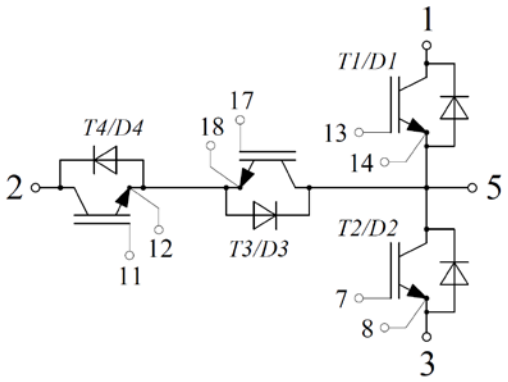


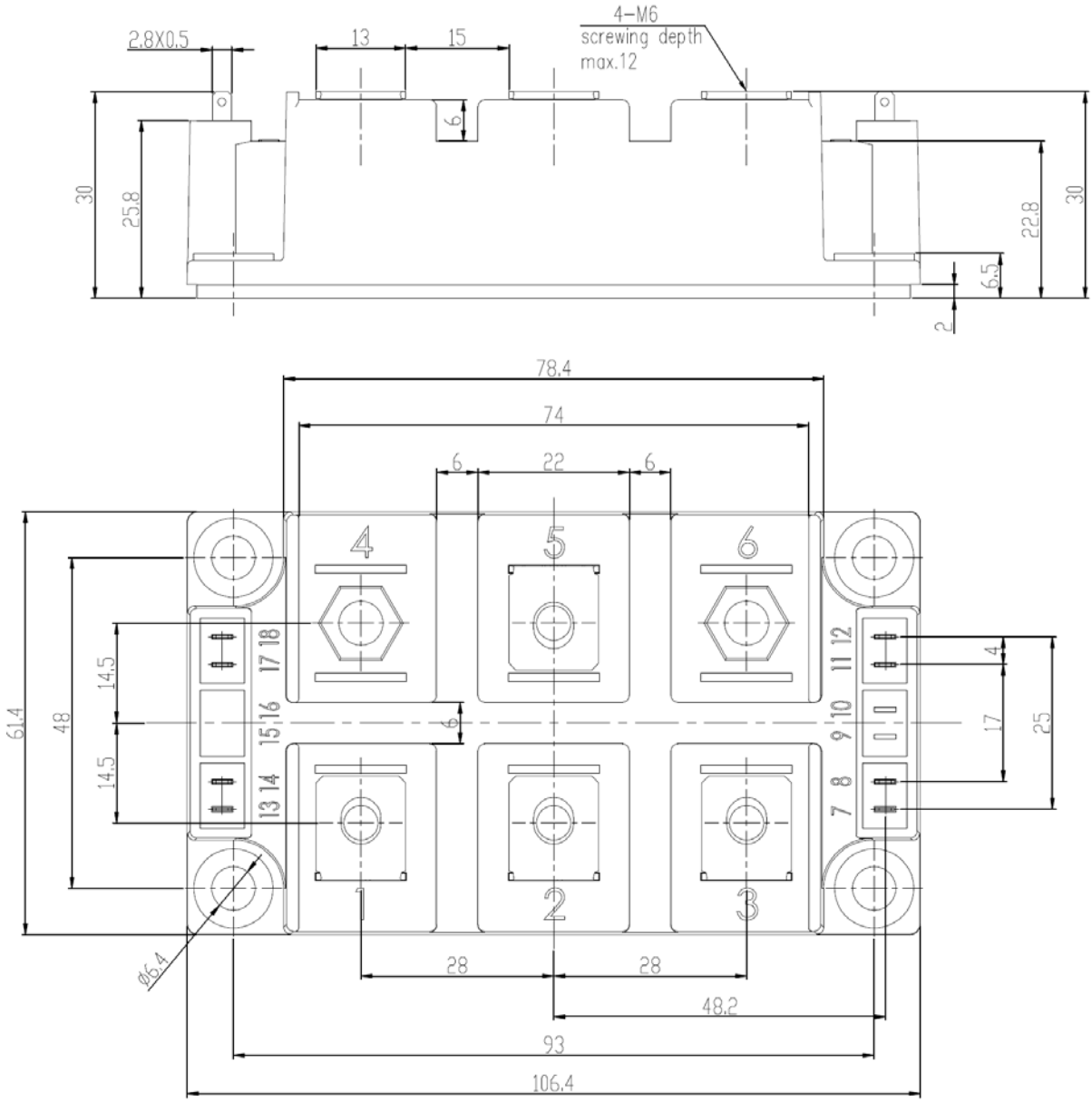
Fig 20. D3,D4 Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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