STARPOWER

SEMICONDUCTOR **IGBT**

GD200TLQ120L3S

1200V/200A 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 3-level-application.

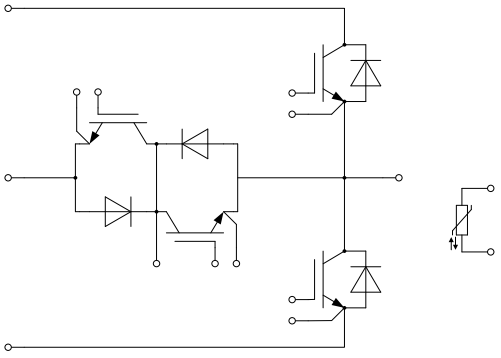
Features

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

Typical Applications

- Solar power
- UPS
- 3-level-application

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=100°C	200 100	A
I_{CM}	Pulsed Collector Current t_p=1ms	400	A
P_D	Maximum Power Dissipation @ T_j=175°C	666	W

D1,D4 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	75	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	150	A

T2,T3 IGBT

Symbol	Description	Value	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	119 100	A
I_{CM}	Pulsed Collector Current t_p=1ms	200	A
P_D	Maximum Power Dissipation @ T_j=175°C	290	W

D2,D3 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	100	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	200	A

Module

Symbol	Description	Value	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	2500	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=100A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=100A,V_{GE}=15V, T_j=125°C		1.70		
		I_C=100A,V_{GE}=15V, T_j=150°C		1.75		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=8.0mA,V_{CE}=V_{GE}, T_j=25°C	5.6	6.2	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			1.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		21.3		nF
C_{res}	Reverse Transfer Capacitance			0.60		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		1.65		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=100A, R_G=1.0Ω, V_{GE}=-8/+15V, T_j=25°C		90		ns
t_r	Rise Time			19		ns
$t_{d(off)}$	Turn-Off Delay Time			254		ns
t_f	Fall Time			44		ns
E_{on}	Turn-On Switching Loss			0.65		mJ
E_{off}	Turn-Off Switching Loss			2.44		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=100A, R_G=1.0Ω, V_{GE}=-8/+15V, T_j=125°C		91		ns
t_r	Rise Time			21		ns
$t_{d(off)}$	Turn-Off Delay Time			299		ns
t_f	Fall Time			68		ns
E_{on}	Turn-On Switching Loss			1.18		mJ
E_{off}	Turn-Off Switching Loss			3.46		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=100A, R_G=1.0Ω, V_{GE}=-8/+15V, T_j=150°C		93		ns
t_r	Rise Time			21		ns
$t_{d(off)}$	Turn-Off Delay Time			314		ns
t_f	Fall Time			77		ns
E_{on}	Turn-On Switching Loss			1.33		mJ
E_{off}	Turn-Off Switching Loss			3.72		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=800V, V_{CEM}≤1200V		800		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=75A,V_{GE}=0V,T_j=25°C		1.85	2.30	V
		I_F=75A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=75A,V_{GE}=0V,T_j=150°C		1.95		
Q_r	Recovered Charge	V_R=400V,I_F=100A, -di/dt=4700A/μs,V_{GE}=-8V T_j=25°C		5.70		μC
I_{RM}	Peak Reverse Recovery Current			120		A
E_{rec}	Reverse Recovery Energy			1.26		mJ
Q_r	Recovered Charge	V_R=400V,I_F=100A, -di/dt=3900A/μs,V_{GE}=-8V T_j=125°C		11.1		μC
I_{RM}	Peak Reverse Recovery Current			125		A
E_{rec}	Reverse Recovery Energy			2.66		mJ
Q_r	Recovered Charge	V_R=400V,I_F=100A, -di/dt=3600A/μs,V_{GE}=-8V T_j=150°C		13.3		μC
I_{RM}	Peak Reverse Recovery Current			130		A
E_{rec}	Reverse Recovery Energy			2.90		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=100A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=100A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=100A,V_{GE}=15V, T_j=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.60mA,V_{CE}=V_{GE}, T_j=25°C	5.4	6.0	6.6	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			2.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		11.9		nF
C_{res}	Reverse Transfer Capacitance			0.30		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.72		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=100A, R_G=3.0Ω,V V_{GE}=-8/+15V, T_j=25°C		82		ns
t_r	Rise Time			22		ns
$t_{d(off)}$	Turn-Off Delay Time			184		ns
t_f	Fall Time			35		ns
E_{on}	Turn-On Switching Loss			2.64		mJ
E_{off}	Turn-Off Switching Loss			1.93		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=100A, R_G=3.0Ω, V_{GE}=-8/+15V, T_j=125°C		84		ns
t_r	Rise Time			25		ns
$t_{d(off)}$	Turn-Off Delay Time			200		ns
t_f	Fall Time			45		ns
E_{on}	Turn-On Switching Loss			3.92		mJ
E_{off}	Turn-Off Switching Loss			2.61		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=100A, R_G=3.0Ω, V_{GE}=-8/+15V, T_j=150°C		84		ns
t_r	Rise Time			27		ns
$t_{d(off)}$	Turn-Off Delay Time			205		ns
t_f	Fall Time			51		ns
E_{on}	Turn-On Switching Loss			4.45		mJ
E_{off}	Turn-Off Switching Loss			2.73		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤650V		500		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=100A,V_{GE}=0V,T_i=25°C		1.65	2.10	V
		I_F=100A,V_{GE}=0V,T_j=125°C		1.65		
		I_F=100A,V_{GE}=0V,T_i=150°C		1.65		
Q_r	Recovered Charge	V_R=400V,I_F=100A, -di/dt=6500A/μs,V_{GE}=-8V T_j=25°C		2.09		μC
I_{RM}	Peak Reverse Recovery Current			96		A
E_{rec}	Reverse Recovery Energy			0.76		mJ
Q_r	Recovered Charge	V_R=400V,I_F=100A, -di/dt=6300A/μs,V_{GE}=-8V T_j=125°C		3.69		μC
I_{RM}	Peak Reverse Recovery Current			124		A
E_{rec}	Reverse Recovery Energy			2.00		mJ
Q_r	Recovered Charge	V_R=400V,I_F=100A, -di/dt=6000A/μs,V_{GE}=-8V T_j=150°C		4.34		μC
I_{RM}	Peak Reverse Recovery Current			132		A
E_{rec}	Reverse Recovery Energy			2.35		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
R_{thJC}	Junction-to-Case (per T1,T4 IGBT)		0.205	0.225	K/W
	Junction-to-Case (per D1,D4 Diode)		0.579	0.637	
	Junction-to-Case (per T2,T3 IGBT)		0.469	0.516	
	Junction-to-Case (per D2,D3 Diode)		0.505	0.556	
R_{thCH}	Case-to-Heatsink (per T1,T4 IGBT)		0.162		K/W
	Case-to-Heatsink (per D1,D4 Diode)		0.460		
	Case-to-Heatsink (per T2,T3 IGBT)		0.372		
	Case-to-Heatsink (per D2,D3 Diode)		0.401		
	Case-to-Heatsink (per Module)		0.037		
F	Mounting Force Per Clamp	40		80	N
G	Weight of Module		39		g

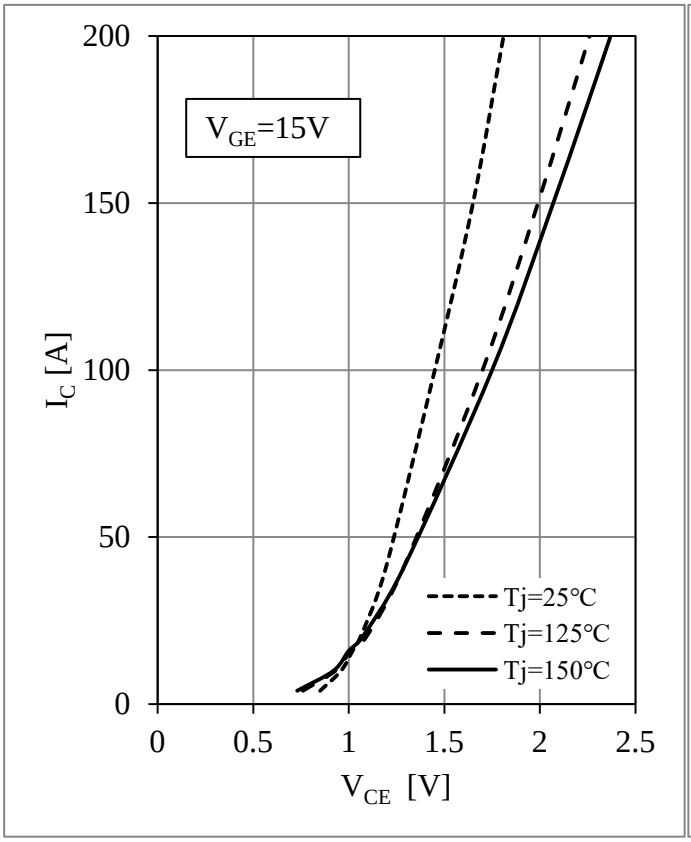


Fig 1. T1,T4 IGBT Output Characteristics

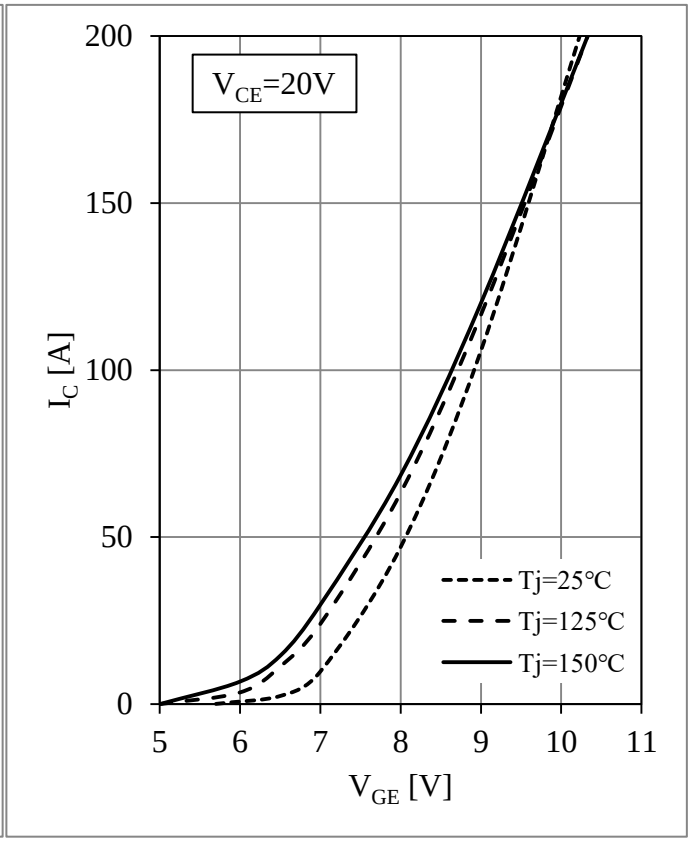


Fig 2. T1,T4 IGBT Transfer Characteristics

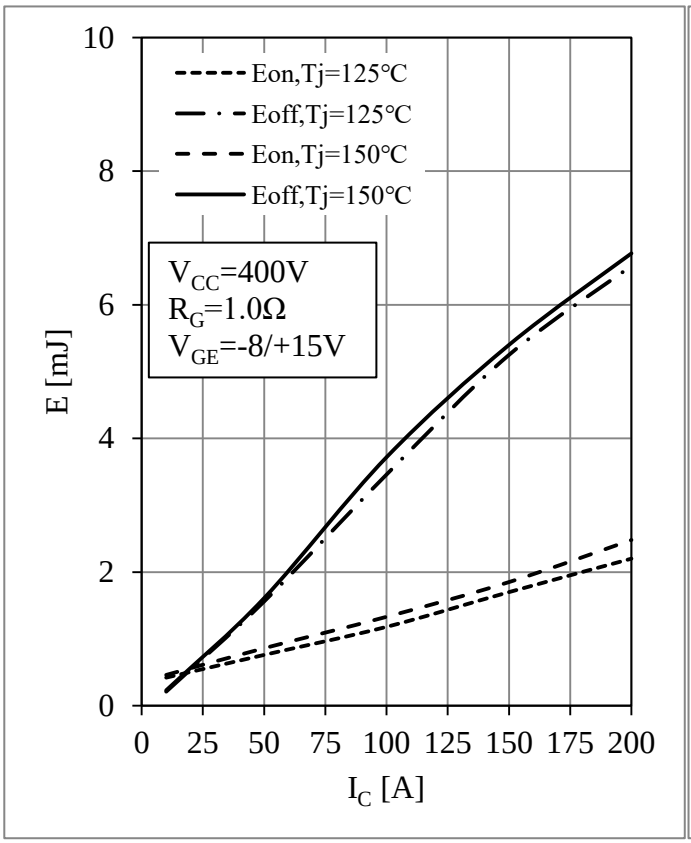


Fig 3. T1,T4 IGBT Switching Loss vs. I_C

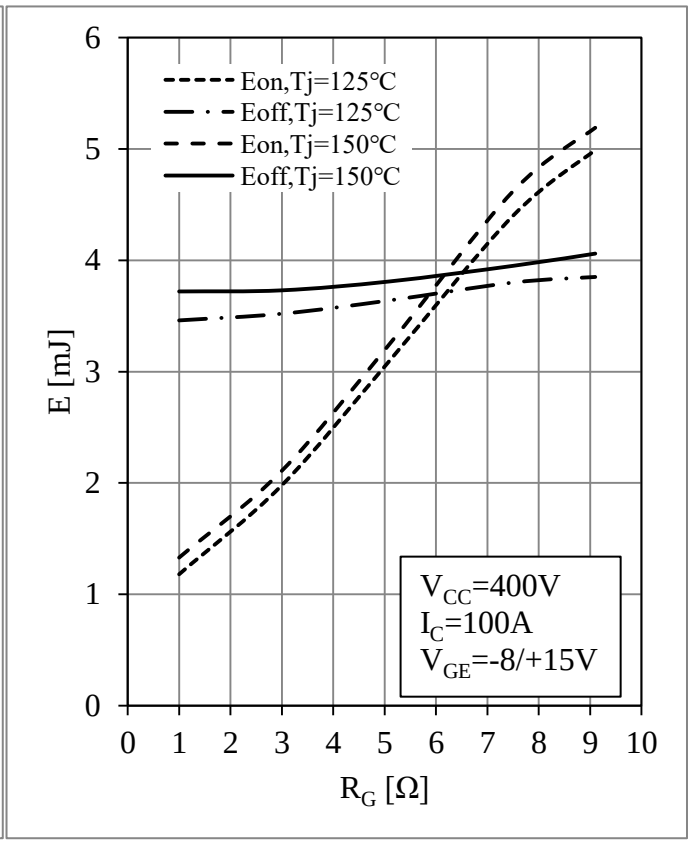


Fig 4. T1,T4 IGBT Switching Loss vs. R_G

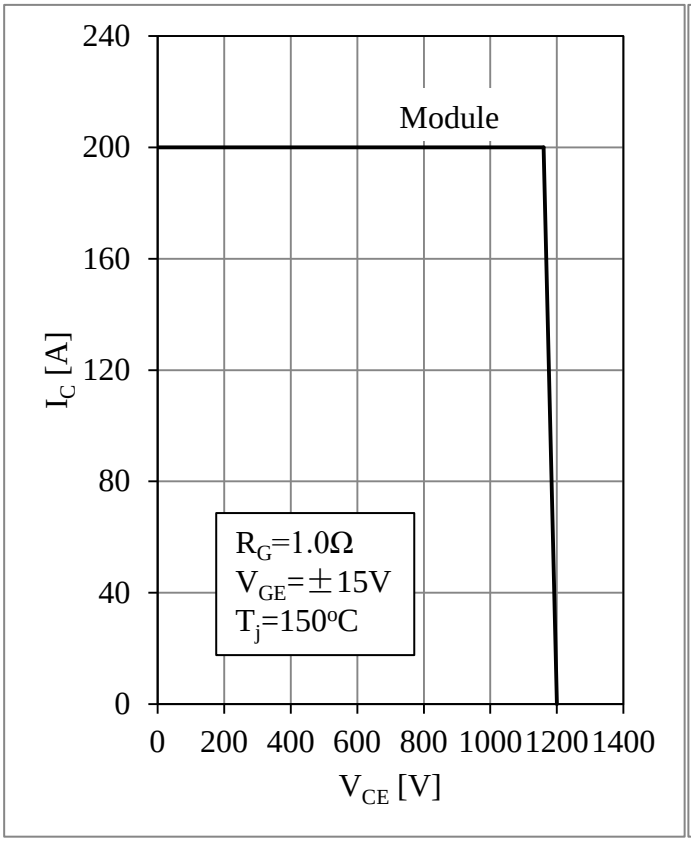


Fig 5. T1,T4 RBSOA

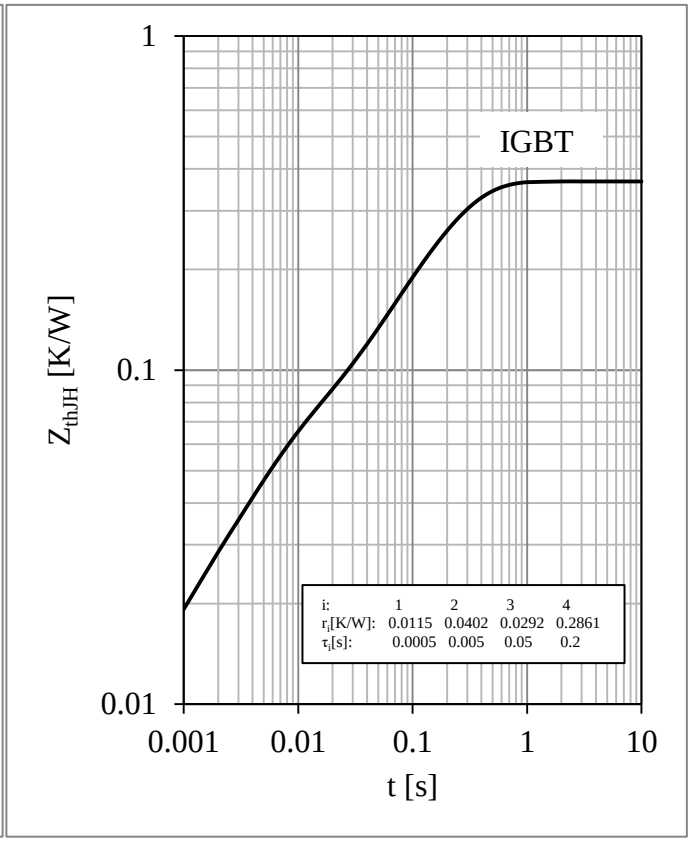


Fig 6. T1,T4 IGBT Transient Thermal Impedance

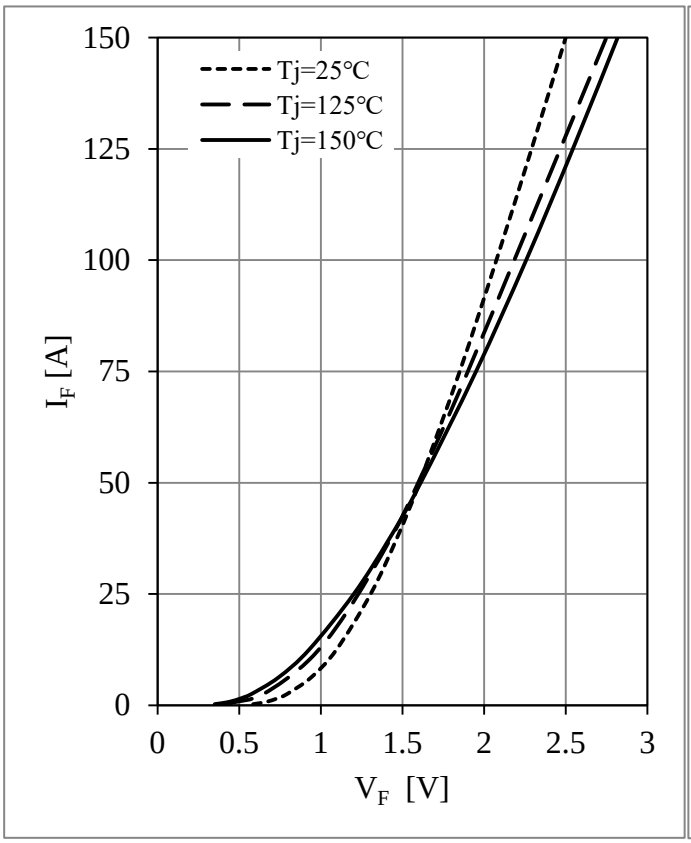


Fig 7. D1,D4 Diode Forward Characteristics

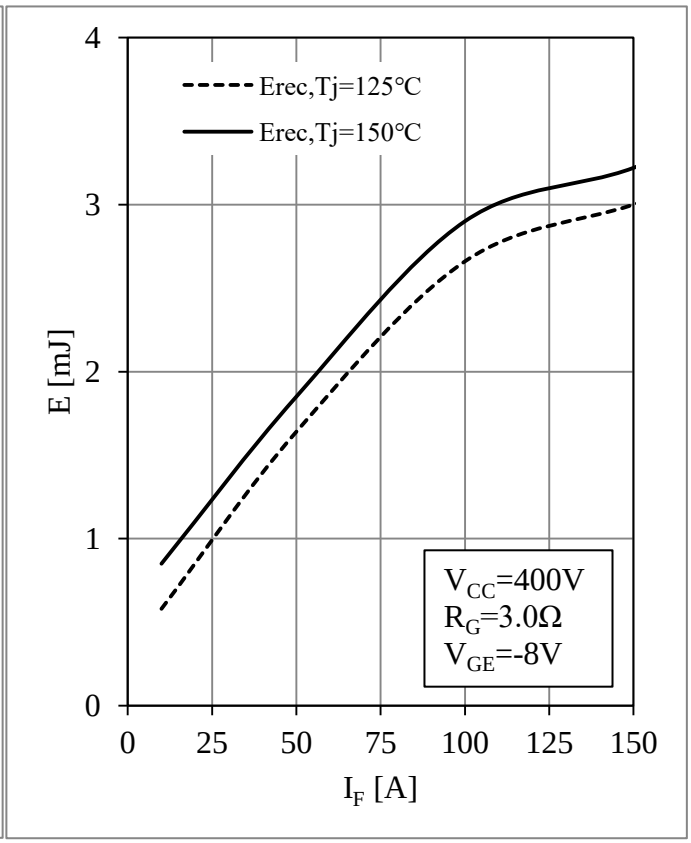


Fig 8. D1,D4 Diode Switching Loss vs. I_F

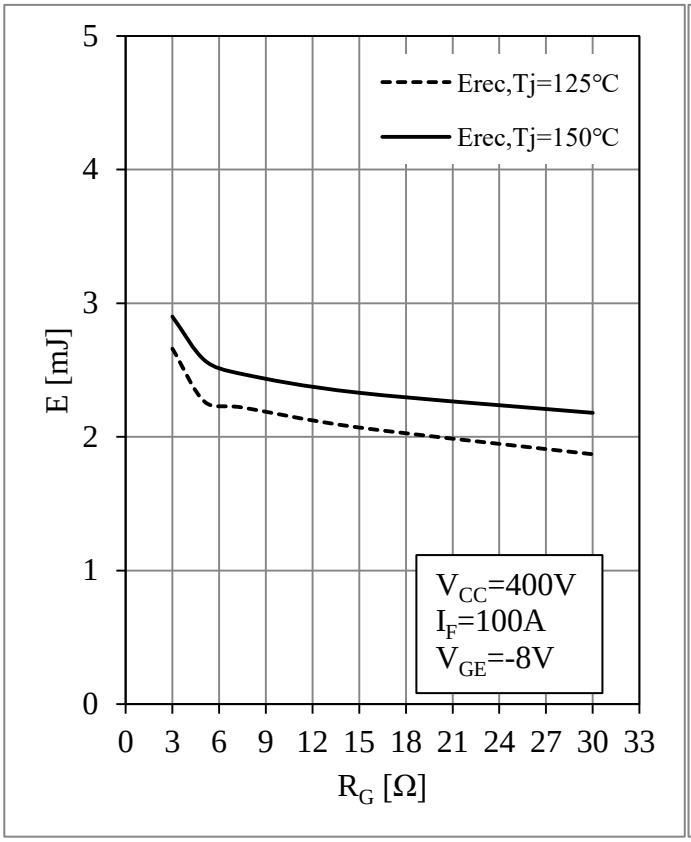


Fig 9. D1,D4 Diode Switching Loss vs. R_G

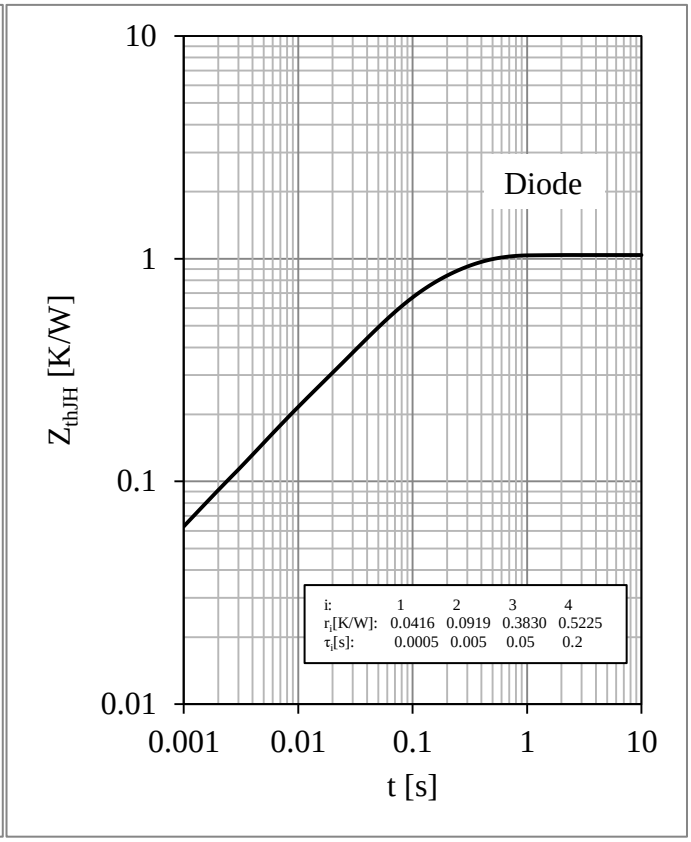


Fig 10. D1,D4 Diode Transient Thermal Impedance

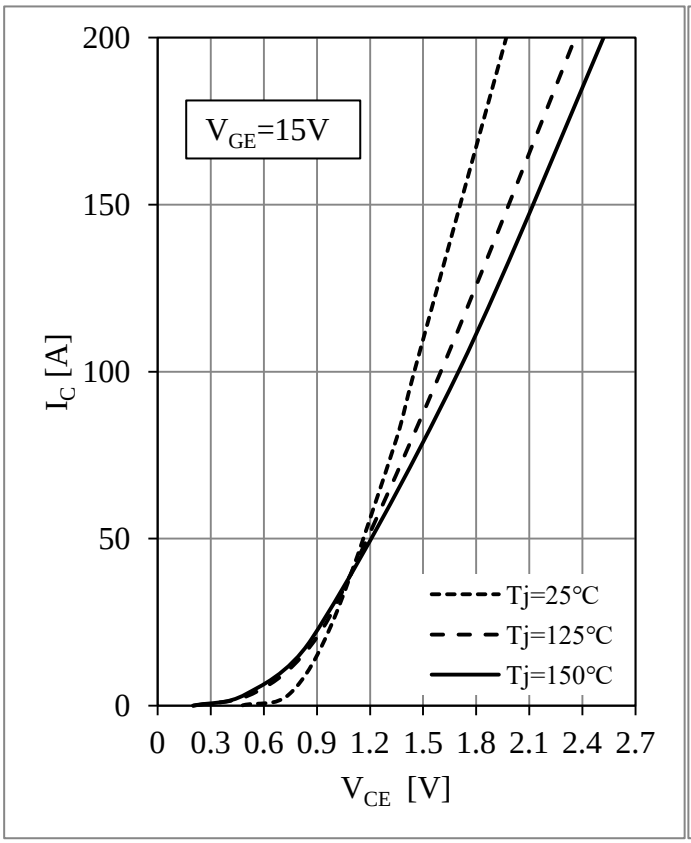


Fig 11. T2,T3 IGBT Output Characteristics

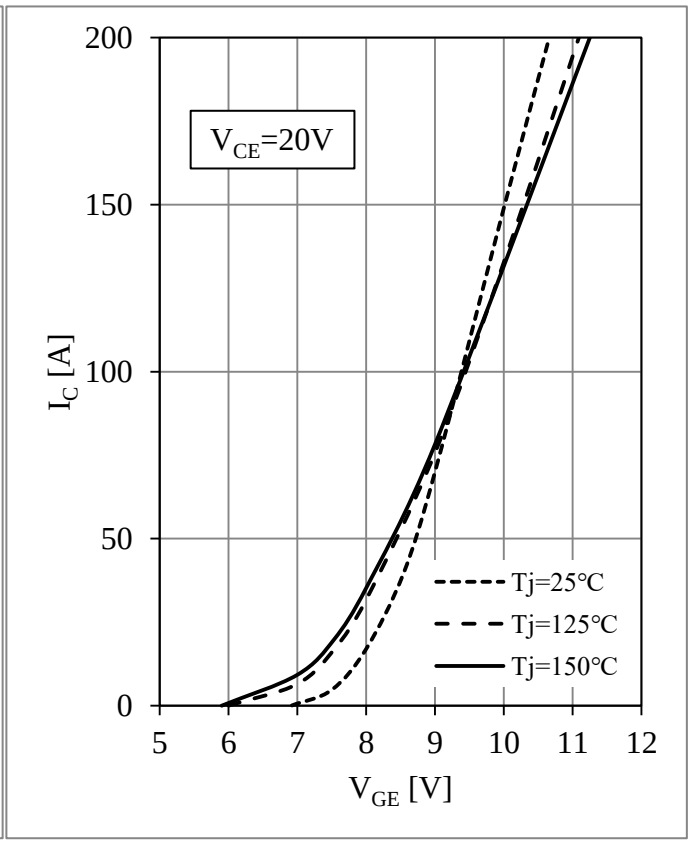


Fig 12. T2,T3 IGBT Transfer Characteristics

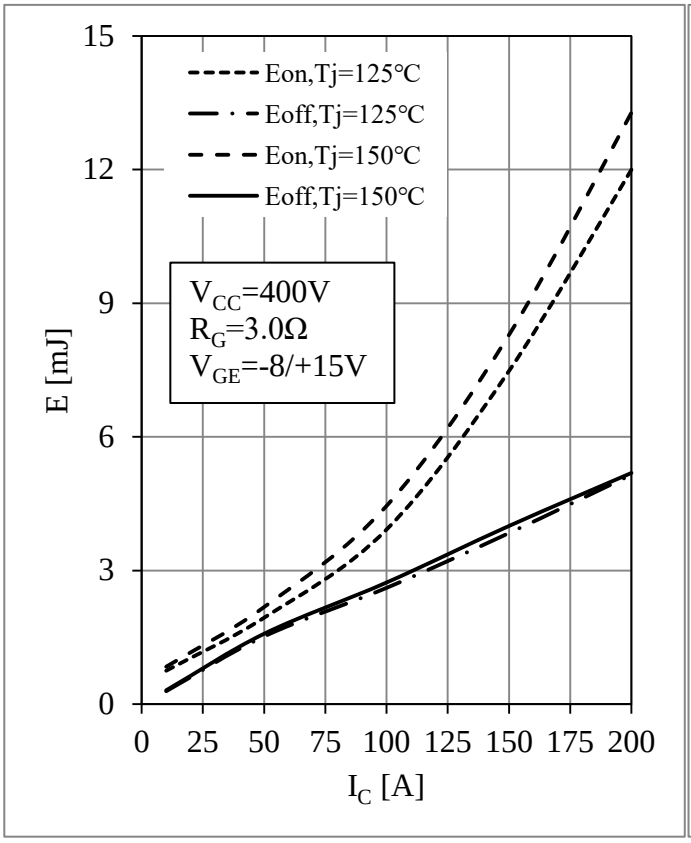


Fig 13. T2,T3 IGBT Switching Loss vs. I_C

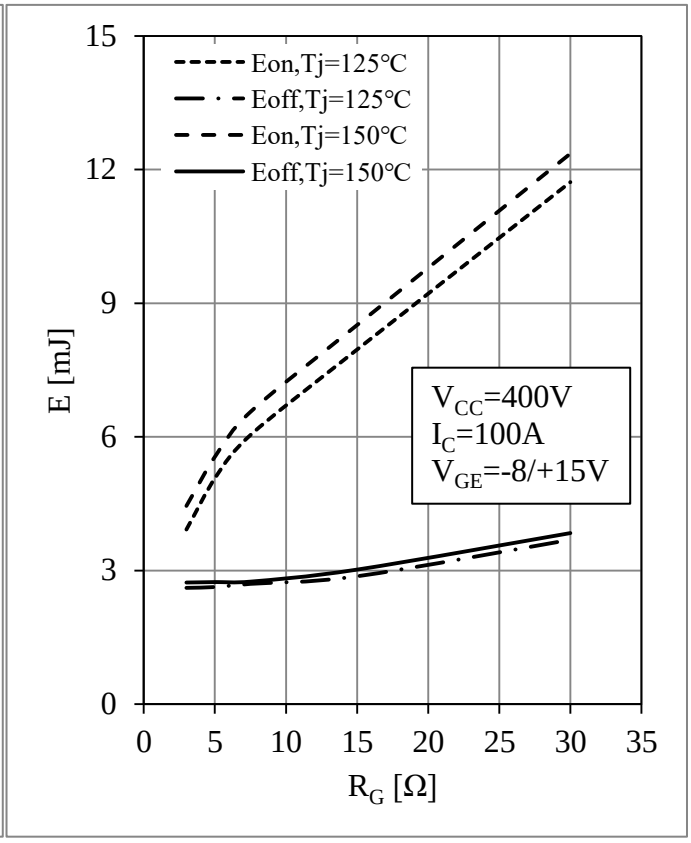


Fig 14. T2,T3 IGBT Switching Loss vs. R_G

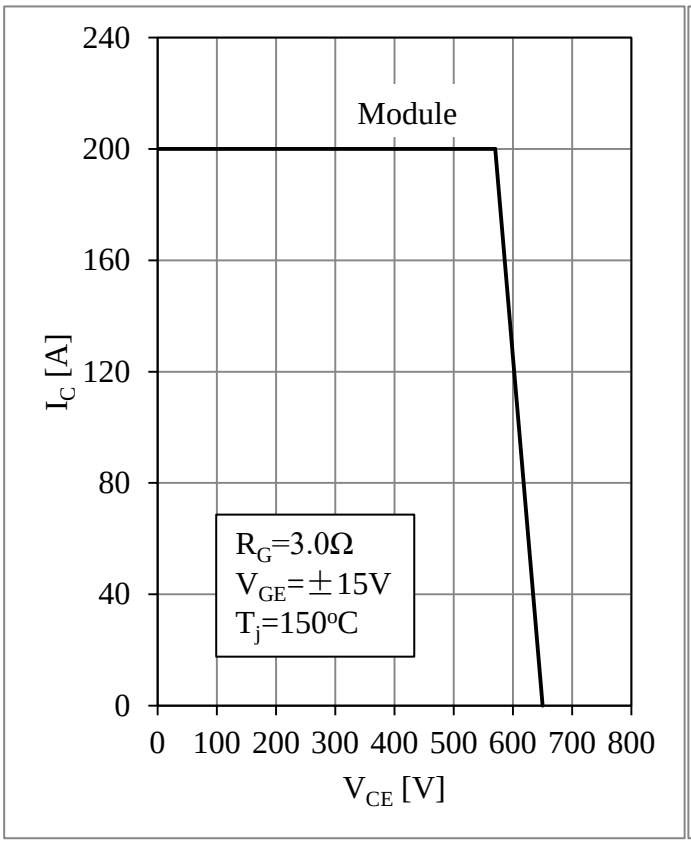


Fig 15. T2,T3 RBSOA

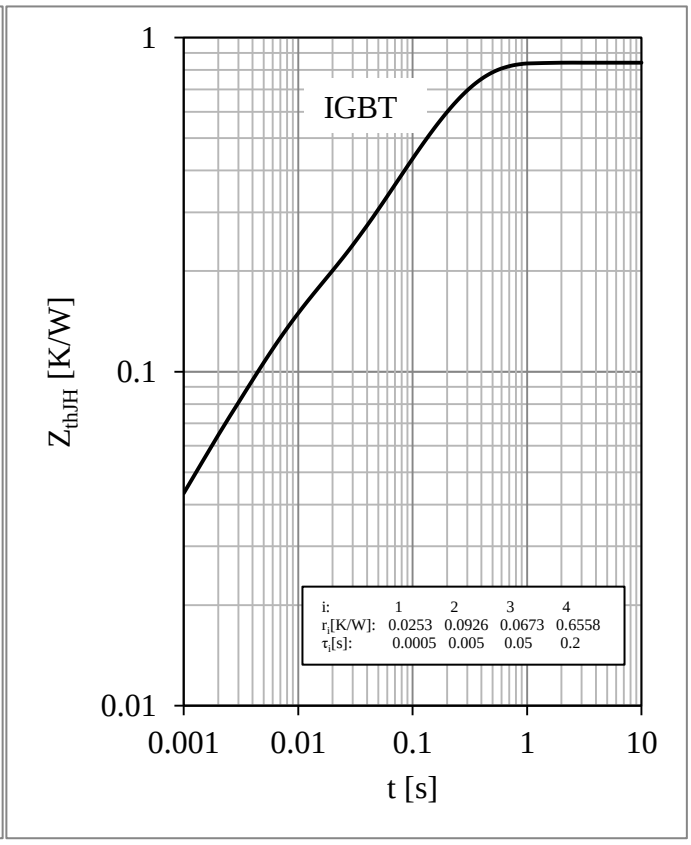


Fig 16. T2,T3 IGBT Transient Thermal Impedance

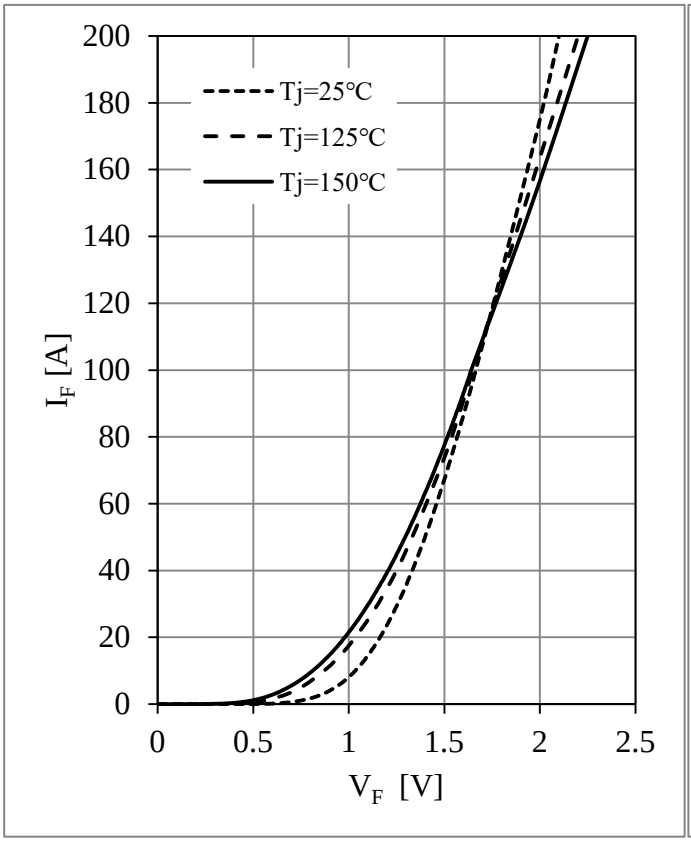


Fig 17. D2,D3 Diode Forward Characteristics

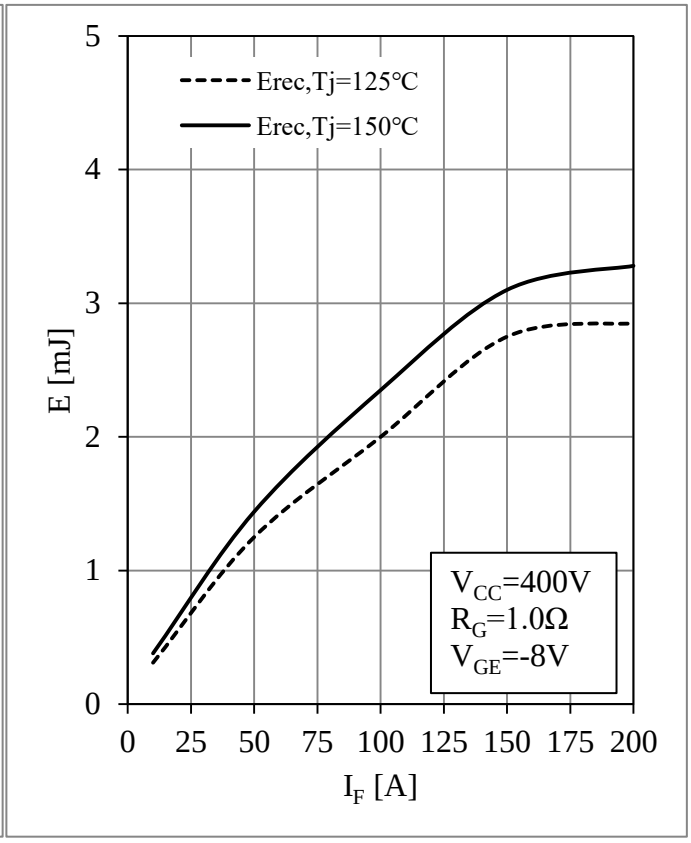


Fig 18. D2,D3 Diode Switching Loss vs. I_F

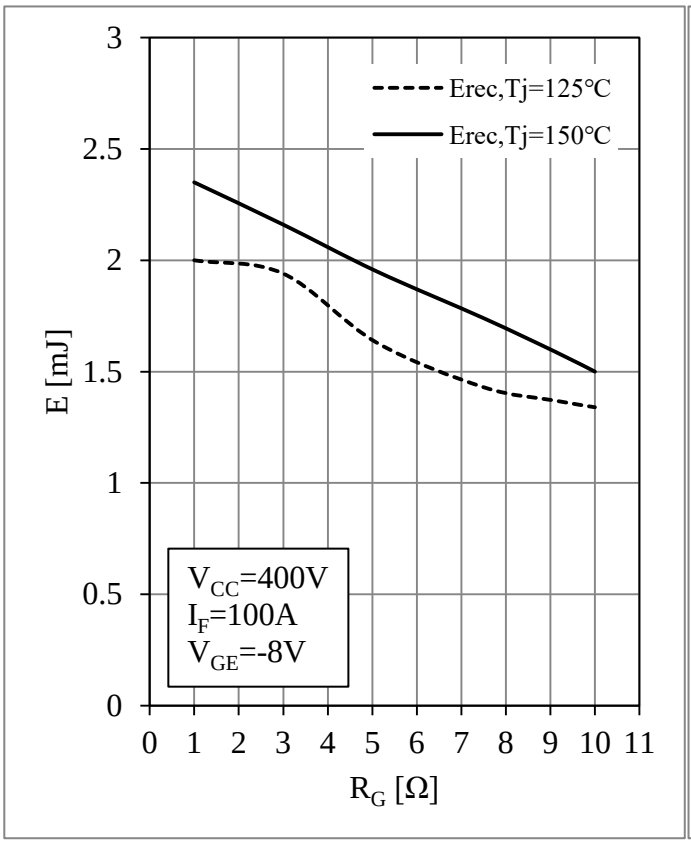


Fig 19. D2,D3 Diode Switching Loss vs. R_G

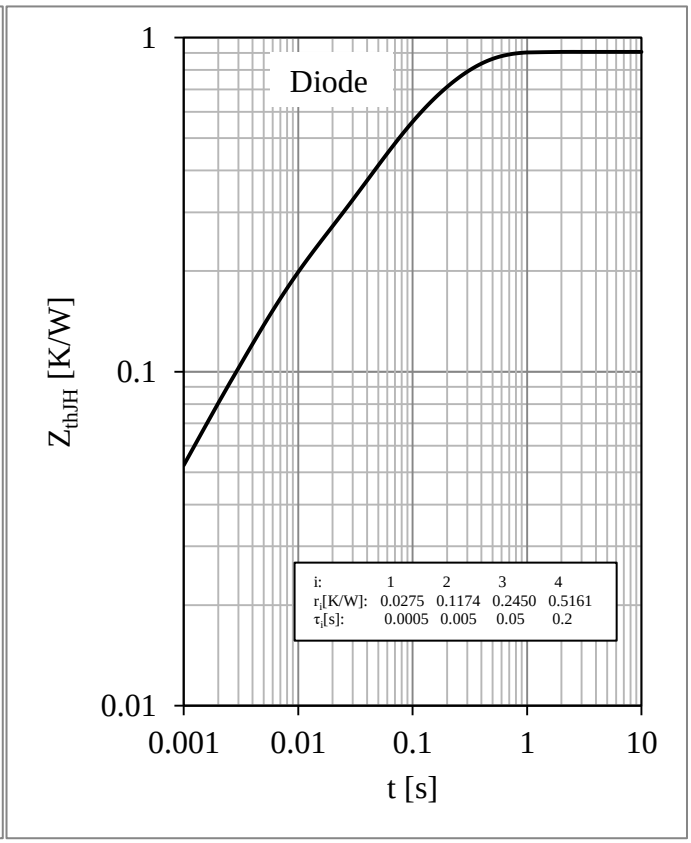


Fig 20. D2,D3 Diode Transient Thermal Impedance

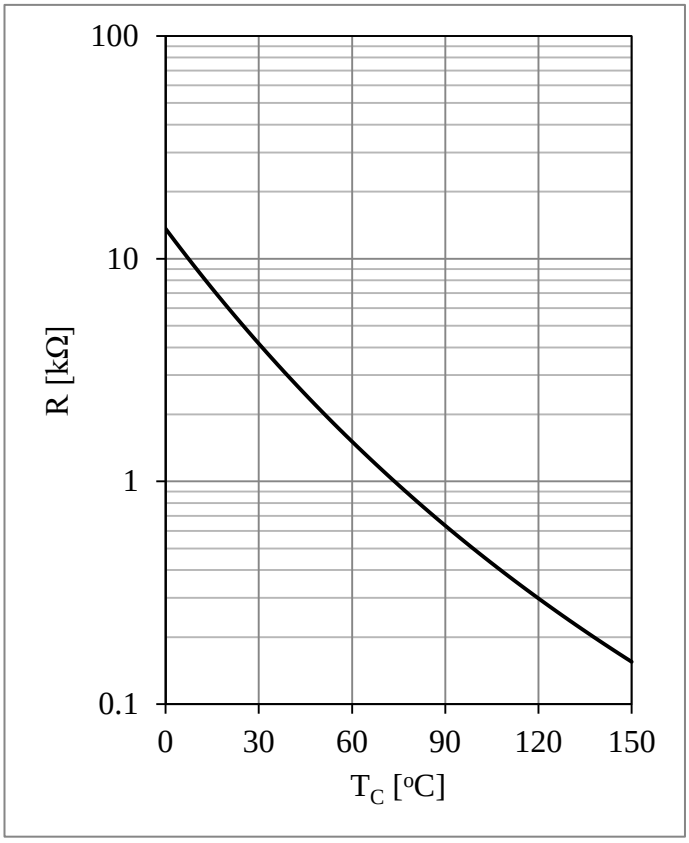
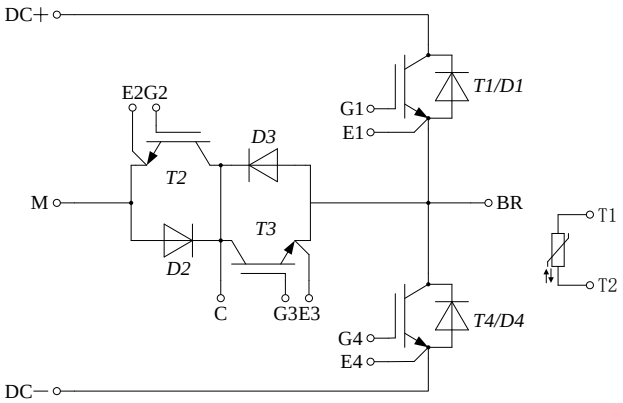


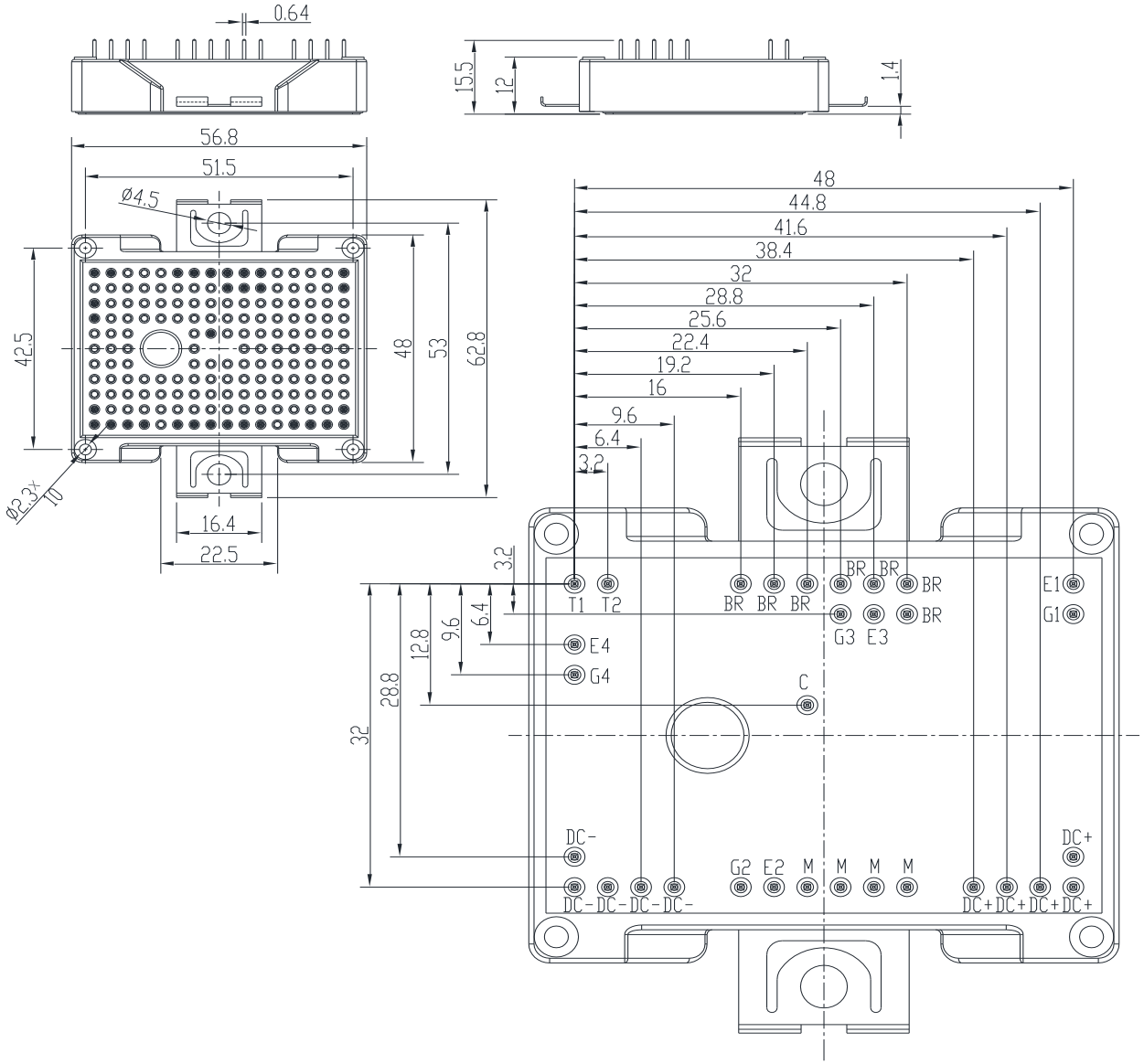
Fig 21. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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