STARPOWER

SEMICONDUCTOR **IGBT**

GD80TLQ120F1S

1200V/80A 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 solar power.

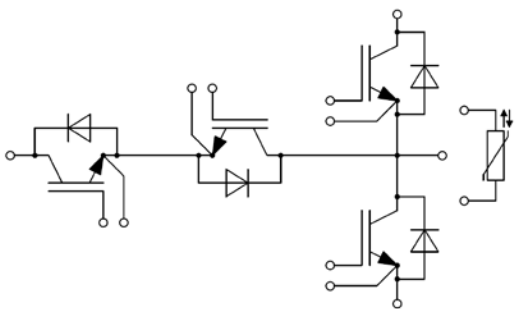
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching loss
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- Maximum junction temperature 175°C
- Fast & soft reverse recovery anti-parallel FWD
- 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,T2 IGBT

Symbol	Description	Value	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=90°C	110 80	A
I_{CM}	Pulsed Collector Current t_p=1ms	160	A
P_D	Maximum Power Dissipation @ T_j=175°C	450	W

D1,D2 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	50	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	100	A

T3,T4 IGBT

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25°C @ T_C=65°C	93 75	A
I_{CM}	Pulsed Collector Current t_p=1ms	150	A
P_D	Maximum Power Dissipation @ T_j=175°C	231	W

D3,D4 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	600	V
I_F	Diode Continuous Forward Current	60	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	120	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	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=80A,V_{GE}=15V, T_j=25°C		1.95	2.40	V
		I_C=80A,V_{GE}=15V, T_j=125°C		2.25		
		I_C=80A,V_{GE}=15V, T_j=150°C		2.30		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=2.0mA,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			TBD		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		TBD		nF
C_{res}	Reverse Transfer Capacitance			TBD		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		TBD		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=350V,I_C=56A, R_G=4.0Ω,V_{GE}=±15V, T_j=25°C		68		ns
t_r	Rise Time			11		ns
$t_{d(off)}$	Turn-Off Delay Time			181		ns
t_f	Fall Time			53		ns
E_{on}	Turn-On Switching Loss			0.41		mJ
E_{off}	Turn-Off Switching Loss			1.41		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=350V,I_C=56A, R_G=4.0Ω,V_{GE}=±15V, T_j=125°C		69		ns
t_r	Rise Time			14		ns
$t_{d(off)}$	Turn-Off Delay Time			226		ns
t_f	Fall Time			65		ns
E_{on}	Turn-On Switching Loss			0.72		mJ
E_{off}	Turn-Off Switching Loss			1.95		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=350V,I_C=56A, R_G=4.0Ω,V_{GE}=±15V, T_j=150°C		70		ns
t_r	Rise Time			14		ns
$t_{d(off)}$	Turn-Off Delay Time			236		ns
t_f	Fall Time			69		ns
E_{on}	Turn-On Switching Loss			0.86		mJ
E_{off}	Turn-Off Switching Loss			2.35		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤1200V		375		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=50A,V_{GE}=0V,T_j=25°C		1.75	2.20	V
		I_F=50A,V_{GE}=0V,T_j=125°C		1.65		
		I_F=50A,V_{GE}=0V,T_j=150°C		1.65		
Q_r	Recovered Charge	V_R=350V,I_F=56A, -di/dt=5000A/μs,V_{GE}=-15V T_j=25°C		5.2		μC
I_{RM}	Peak Reverse Recovery Current			105		A
E_{rec}	Reverse Recovery Energy			1.50		mJ
Q_r	Recovered Charge	V_R=350V,I_F=56A, -di/dt=5000A/μs,V_{GE}=-15V T_j=125°C		7.0		μC
I_{RM}	Peak Reverse Recovery Current			114		A
E_{rec}	Reverse Recovery Energy			2.10		mJ
Q_r	Recovered Charge	V_R=350V,I_F=56A, -di/dt=5000A/μs,V_{GE}=-15V T_j=150°C		8.1		μC
I_{RM}	Peak Reverse Recovery Current			118		A
E_{rec}	Reverse Recovery Energy			2.40		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=75A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=75A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=75A,V_{GE}=15V, T_j=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.2mA,V_{CE}=V_{GE}, T_j=25°C	5.1	5.8	6.4	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			/		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		4.62		nF
C_{res}	Reverse Transfer Capacitance			0.14		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.80		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=350V,I_C=56A, R_G=4.0Ω,V_{GE}=±15V, T_j=25°C		84		ns
t_r	Rise Time			10		ns
$t_{d(off)}$	Turn-Off Delay Time			180		ns
t_f	Fall Time			87		ns
E_{on}	Turn-On Switching Loss			0.53		mJ
E_{off}	Turn-Off Switching Loss			1.86		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=350V,I_C=56A, R_G=4.0Ω,V_{GE}=±15V, T_j=125°C		85		ns
t_r	Rise Time			11		ns
$t_{d(off)}$	Turn-Off Delay Time			200		ns
t_f	Fall Time			100		ns
E_{on}	Turn-On Switching Loss			0.66		mJ
E_{off}	Turn-Off Switching Loss			2.20		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=350V,I_C=56A, R_G=4.0Ω,V_{GE}=±15V, T_j=150°C		86		ns
t_r	Rise Time			12		ns
$t_{d(off)}$	Turn-Off Delay Time			208		ns
t_f	Fall Time			105		ns
E_{on}	Turn-On Switching Loss			0.75		mJ
E_{off}	Turn-Off Switching Loss			2.50		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=350V, V_{CEM}≤600V		380		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=60A,V_{GE}=0V,T_j=25°C		1.50	1.95	V
		I_F=60A,V_{GE}=0V,T_j=125°C		1.40		
		I_F=60A,V_{GE}=0V,T_j=150°C		1.40		
Q_r	Recovered Charge	V_R=350V,I_F=56A, -di/dt=4000A/μs,V_{GE}=-15V T_j=25°C		1.4		μC
I_{RM}	Peak Reverse Recovery Current			38		A
E_{rec}	Reverse Recovery Energy			0.20		mJ
Q_r	Recovered Charge	V_R=350V,I_F=56A, -di/dt=4000A/μs,V_{GE}=-15V T_j=125°C		2.7		μC
I_{RM}	Peak Reverse Recovery Current			45		A
E_{rec}	Reverse Recovery Energy			0.50		mJ
Q_r	Recovered Charge	V_R=350V,I_F=56A, -di/dt=4000A/μs,V_{GE}=-15V T_j=150°C		3.1		μC
I_{RM}	Peak Reverse Recovery Current			50		A
E_{rec}	Reverse Recovery Energy			0.60		mJ

NTC Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			22.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100°C,R_{100}=1486.1Ω	-5		5	%
P_{25}	Power Dissipation				200	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		4000		K

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per T1,T2 IGBT)		0.303	0.333	K/W
	Junction-to-Case (per D1,D2 Diode)		0.764	0.840	
	Junction-to-Case (per T3,T4 IGBT)		0.590	0.649	
	Junction-to-Case (per D3,D4 Diode)		0.860	0.946	
R_{thCH}	Case-to-Heatsink (per T1,T2 IGBT)		0.158		K/W
	Case-to-Heatsink (per D1,D2 Diode)		0.399		
	Case-to-Heatsink (per T3,T4 IGBT)		0.309		
	Case-to-Heatsink (per D3,D4 Diode)		0.450		
	Case-to-Heatsink (per Module)		0.035		
M	Mounting Torque, Screw M4	2.0		2.2	N.m
G	Weight of Module		26		g

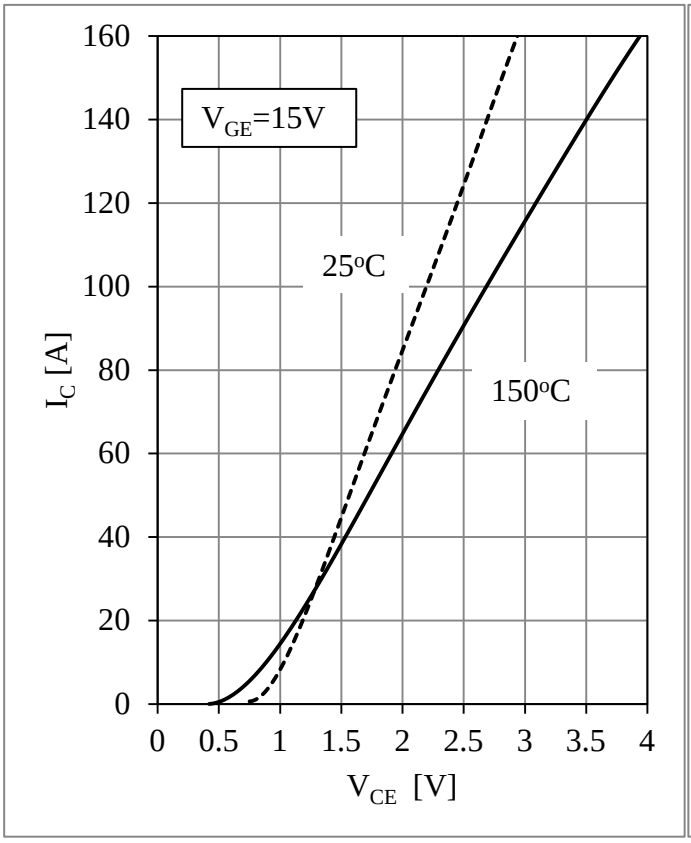


Fig 1. T1,T2 IGBT Output Characteristics

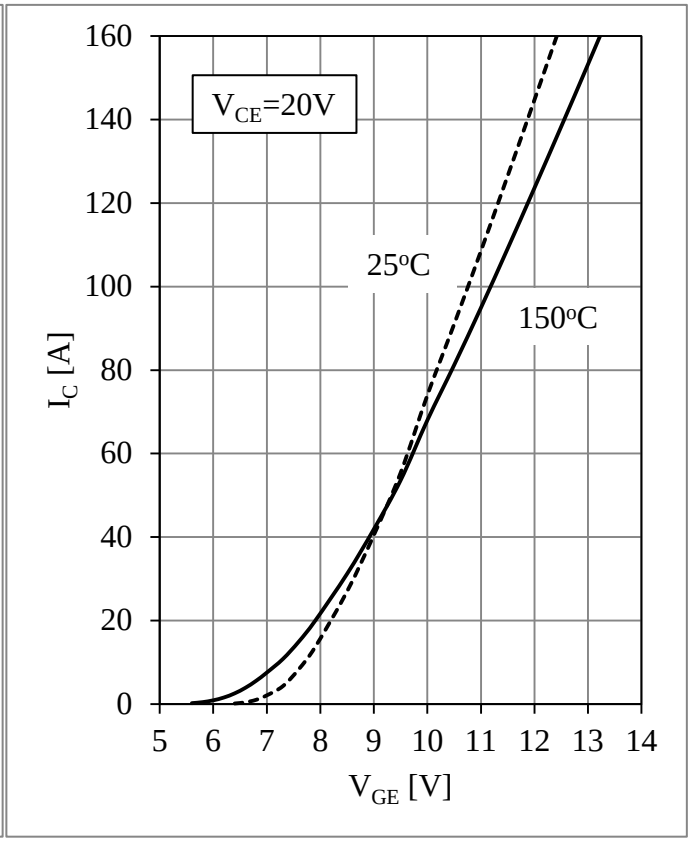


Fig 2. T1,T2 IGBT Transfer Characteristics

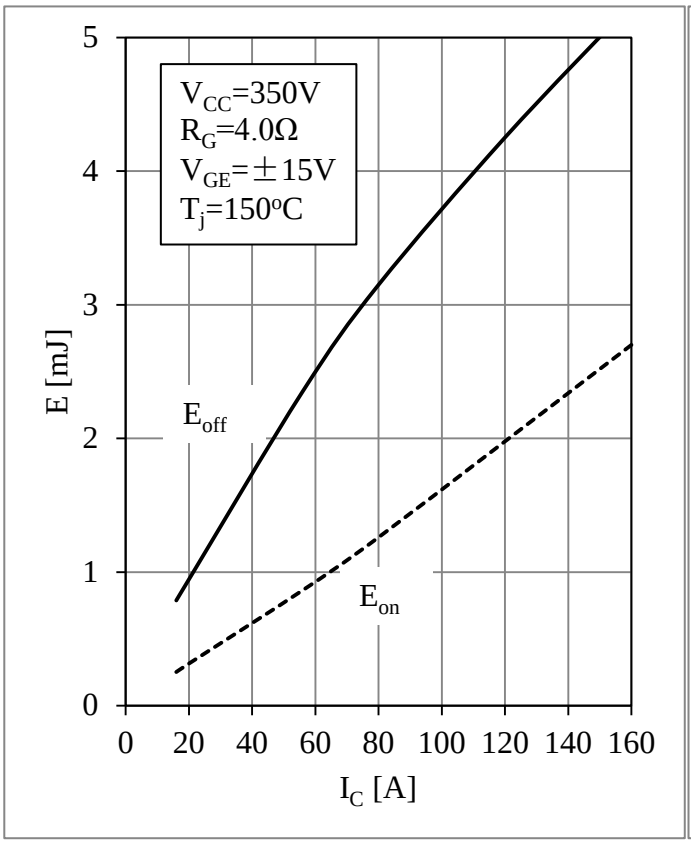


Fig 3. T1,T2 IGBT Switching Loss vs. I_C

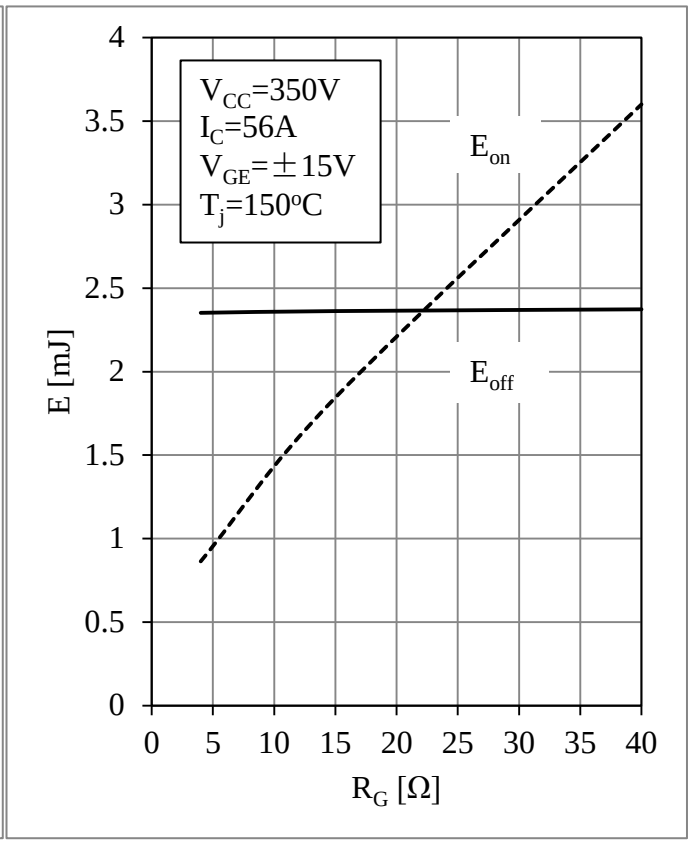


Fig 4. T1,T2 IGBT Switching Loss vs. R_G

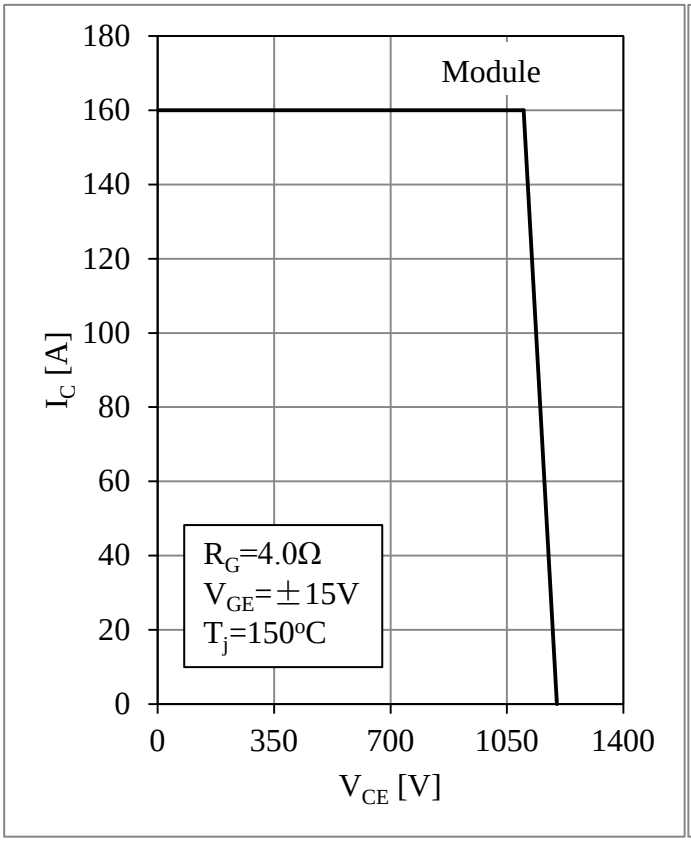


Fig 5. T1,T2 RBSOA

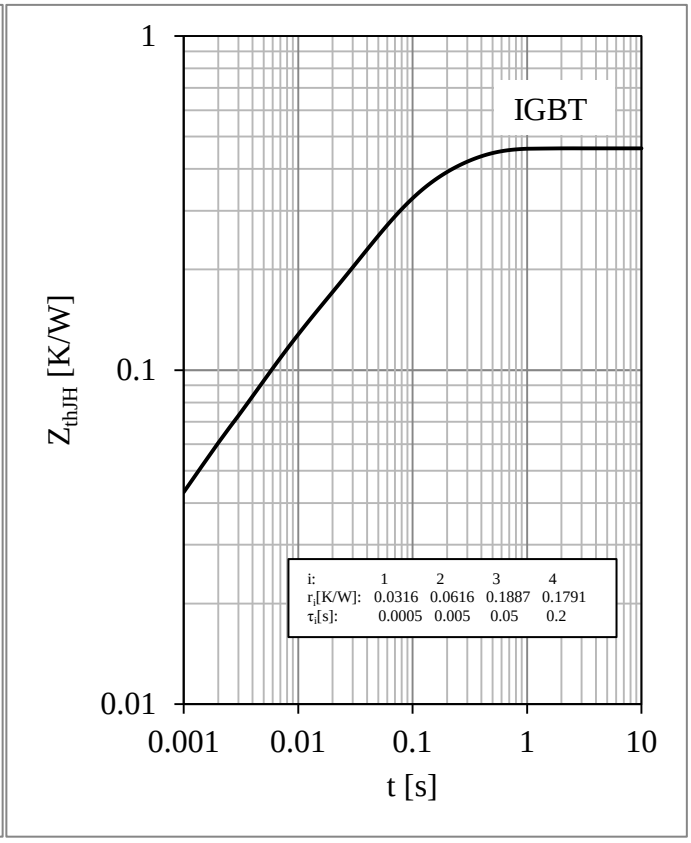


Fig 6. T1,T2 IGBT Transient Thermal Impedance

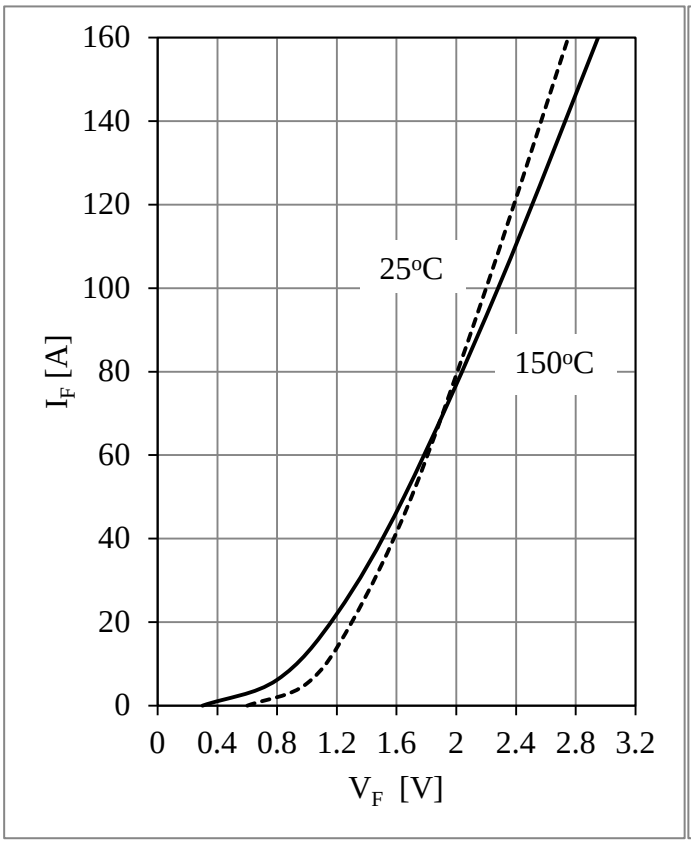


Fig 7. D1,D2 Diode Forward Characteristics

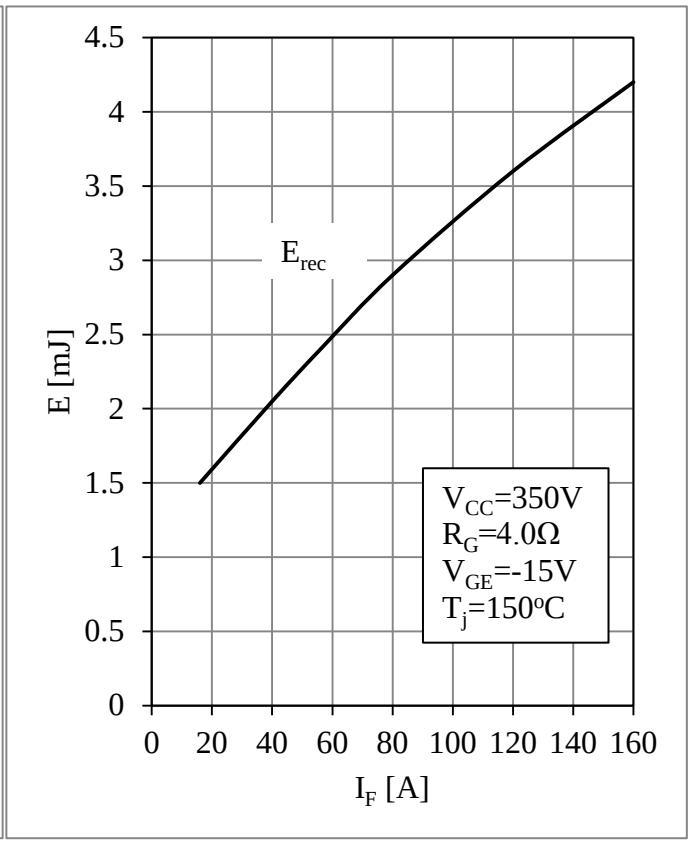


Fig 8. D1,D2 Diode Switching Loss vs. I_F

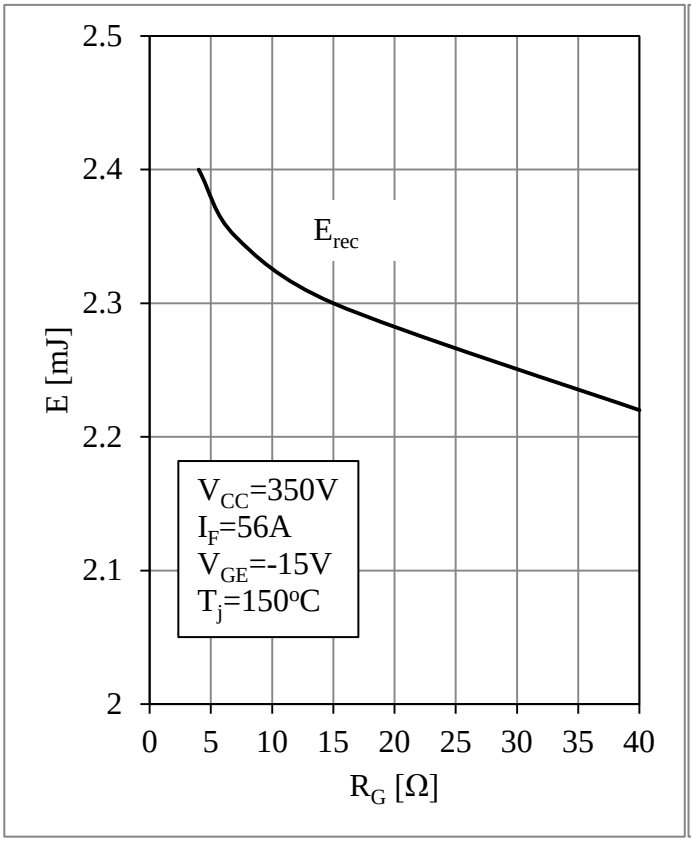


Fig 9. D1,D2 Diode Switching Loss vs. R_G

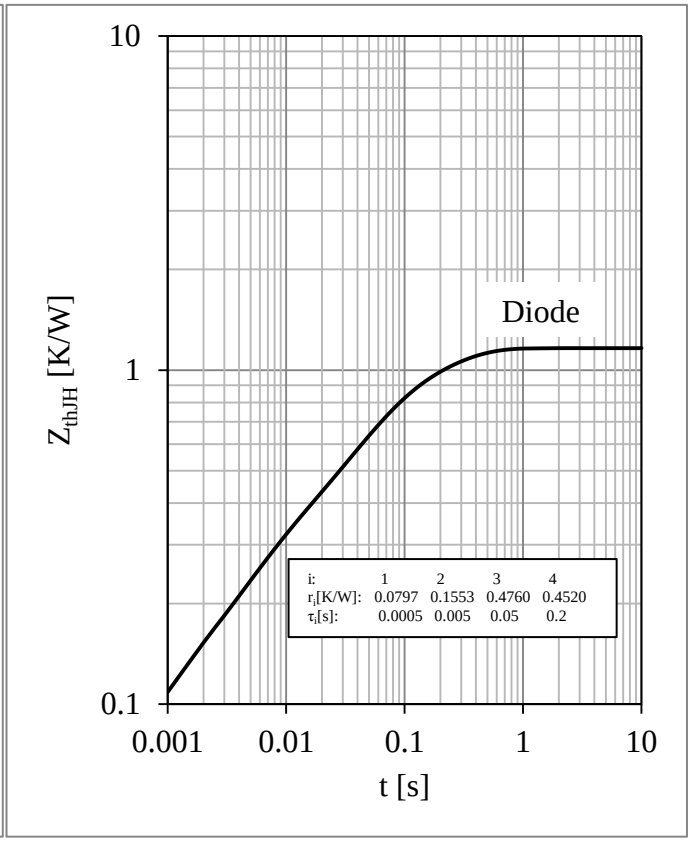


Fig 10. D1,D2 Diode Transient Thermal Impedance

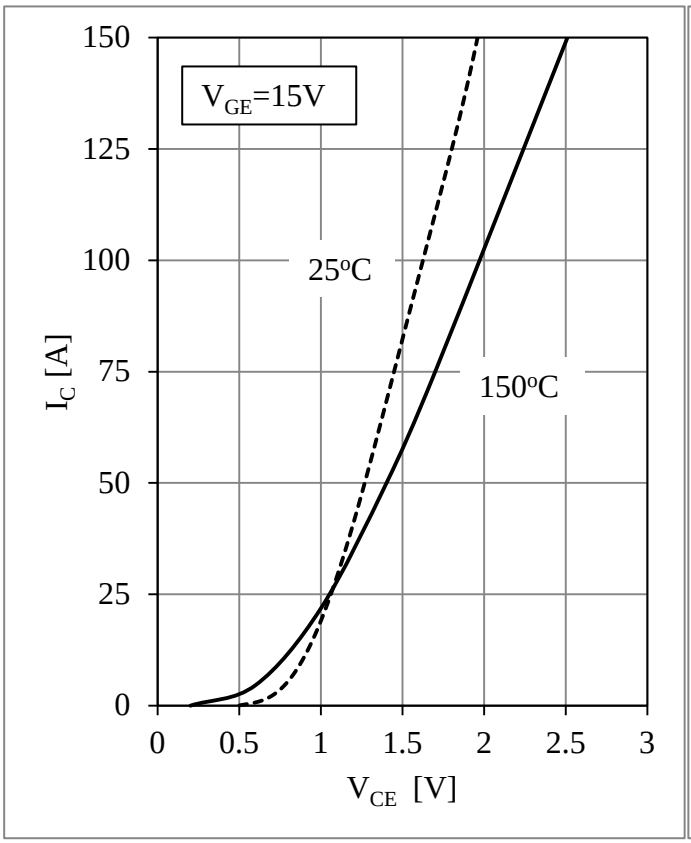


Fig 11. T3,T4 IGBT Output Characteristics

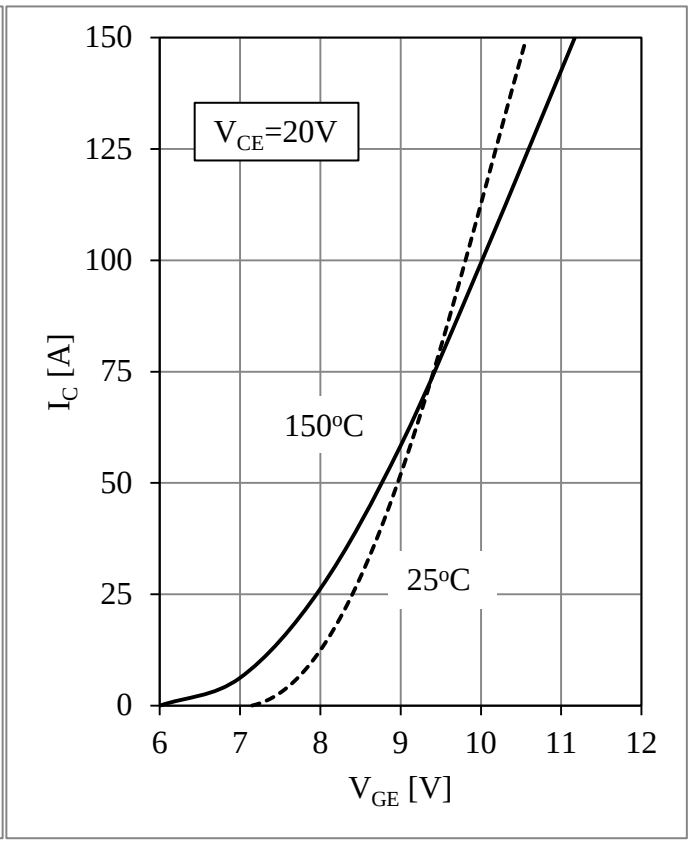


Fig 12. T3,T4 IGBT Transfer Characteristics

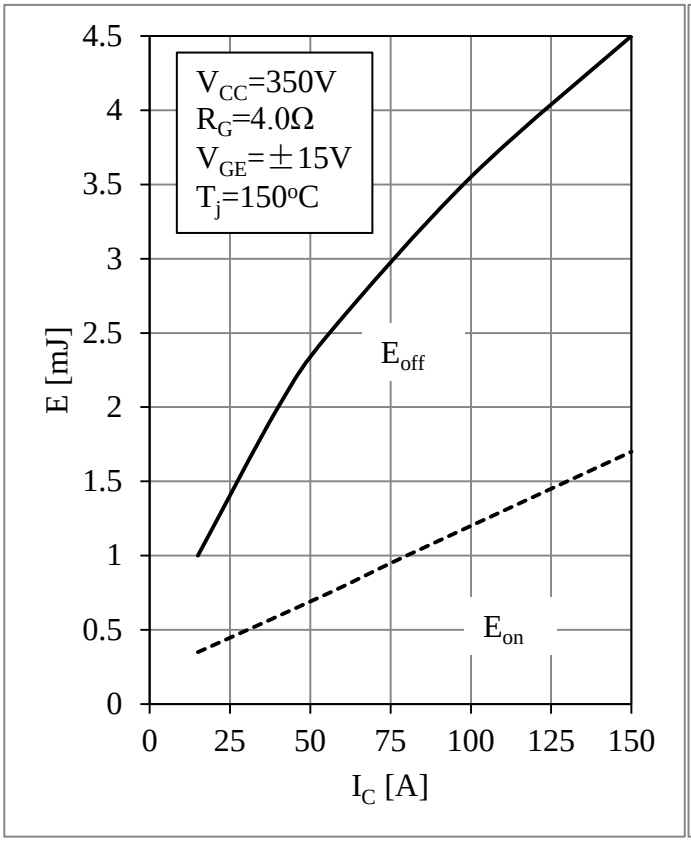


Fig 13. T3,T4 IGBT Switching Loss vs. I_C

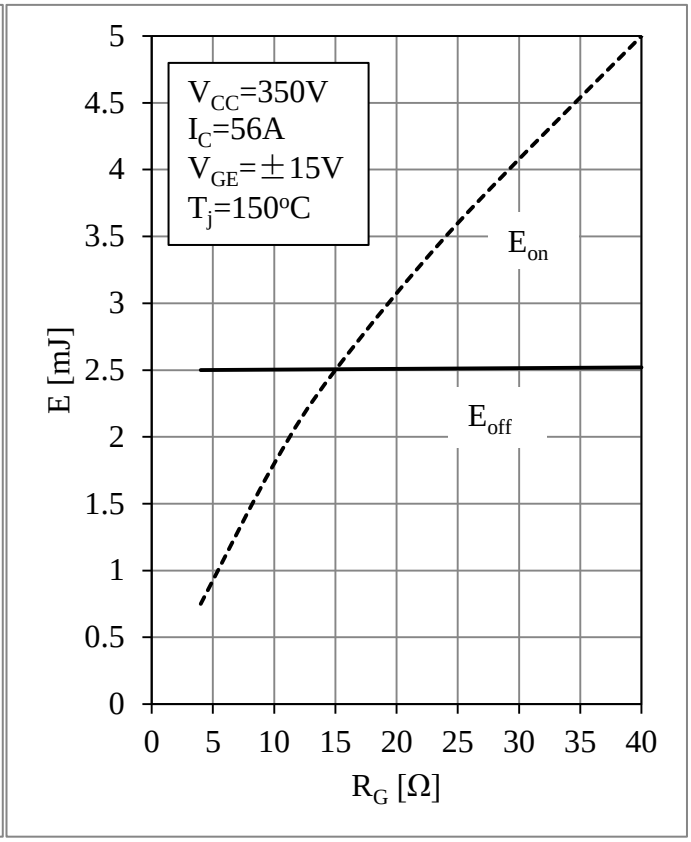


Fig 14. T3,T4 IGBT Switching Loss vs. R_G

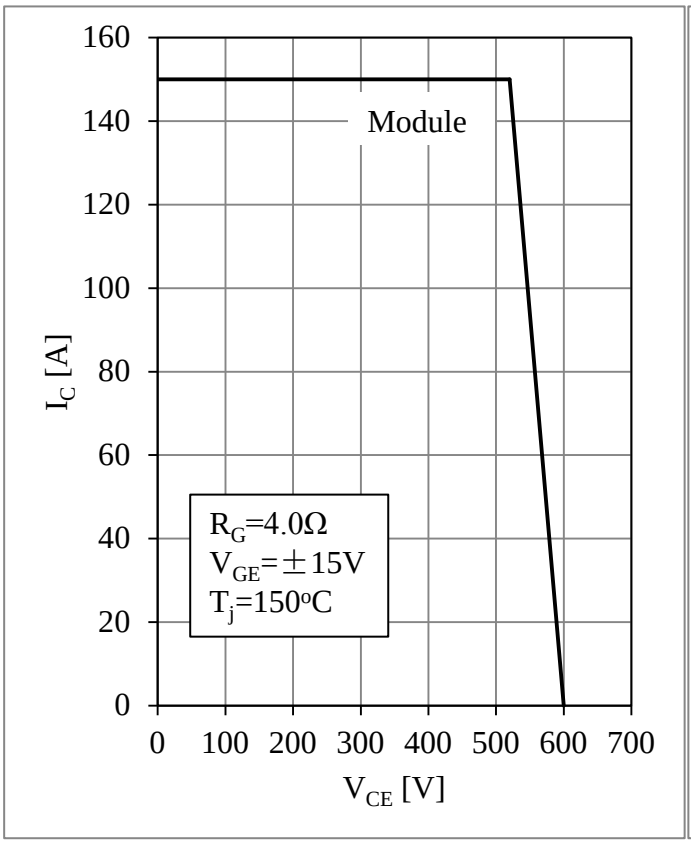


Fig 15. T3,T4 RBSOA

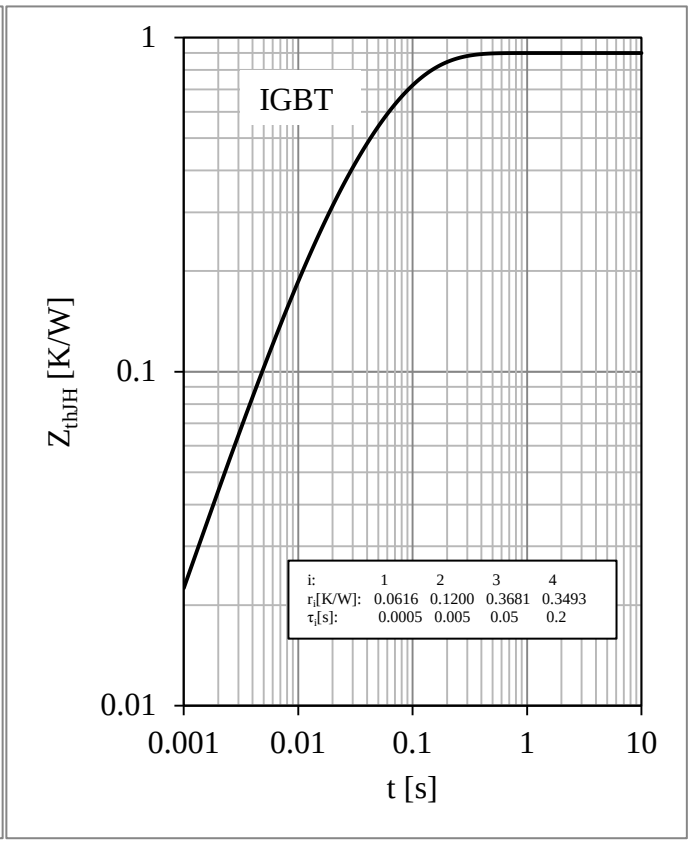


Fig 16. T3,T4 IGBT Transient Thermal Impedance

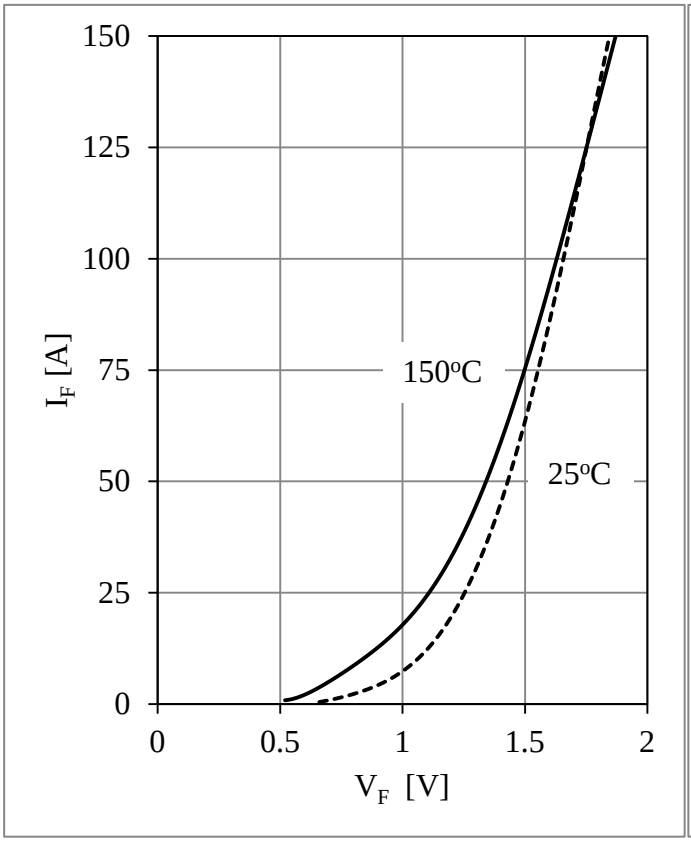


Fig 17. D3,D4 Diode Forward Characteristics

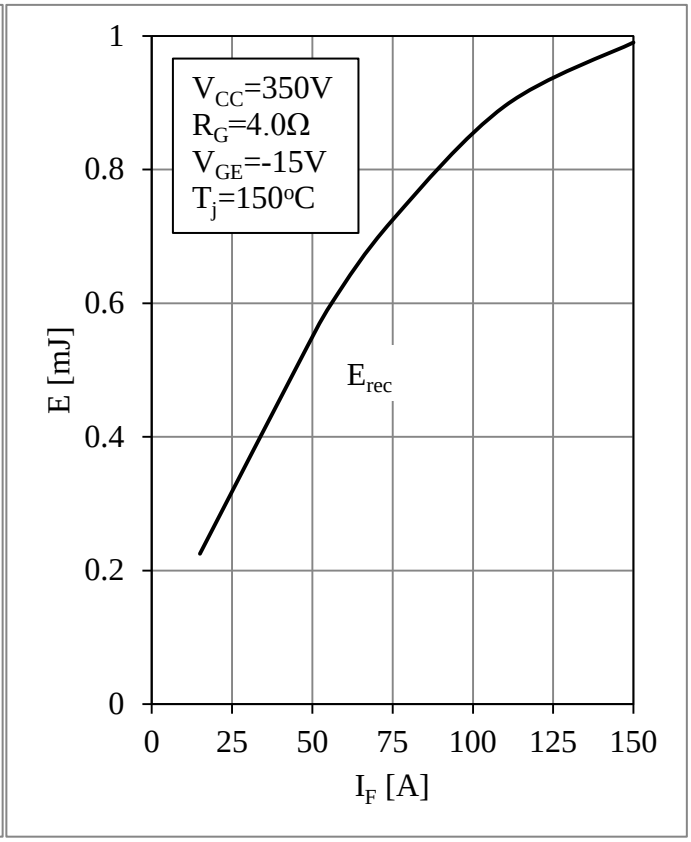


Fig 18. D3,D4 Diode Switching Loss vs. I_F

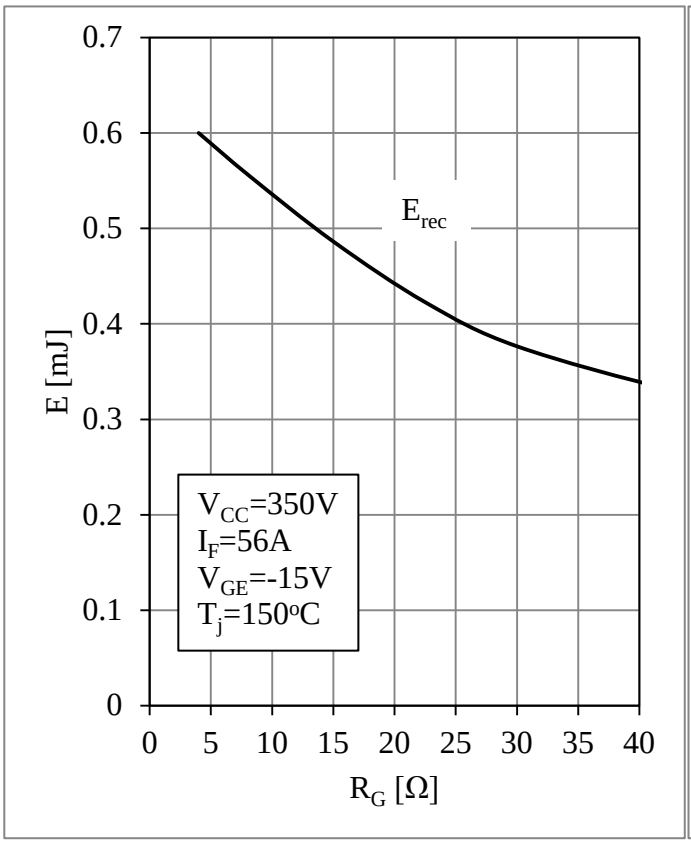


Fig 19. D3,D4 Diode Switching Loss vs. R_G

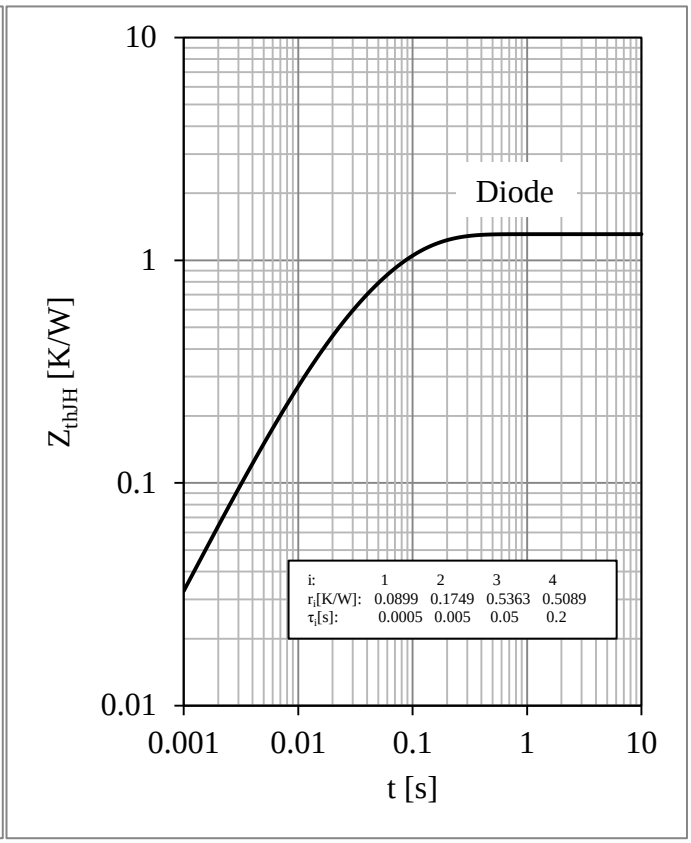


Fig 20. D3,D4 Diode Transient Thermal Impedance

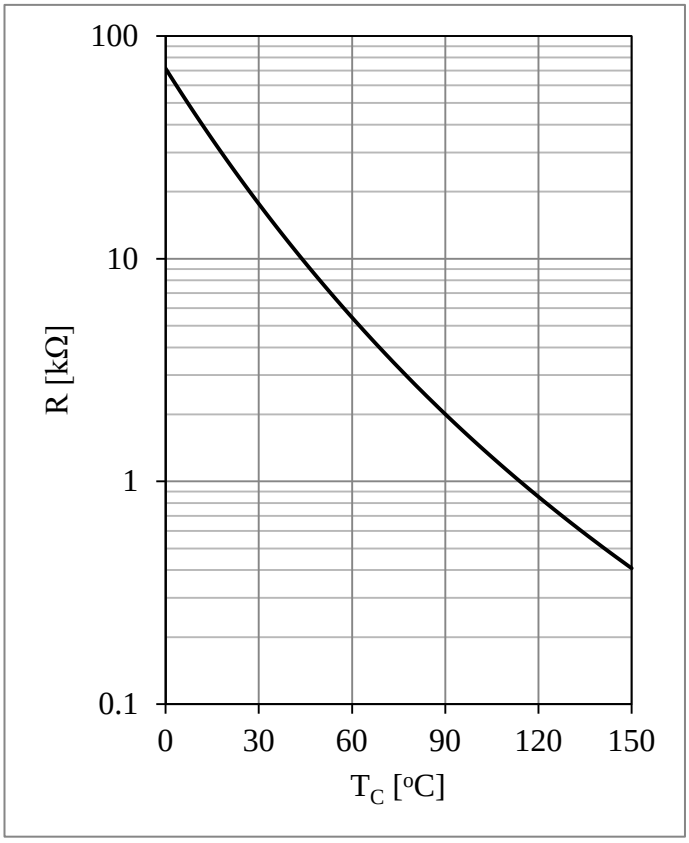
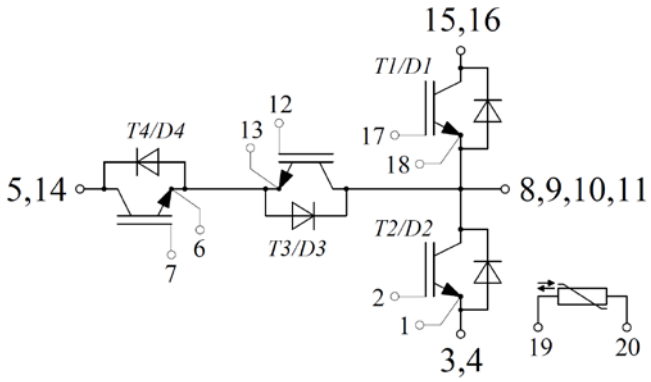


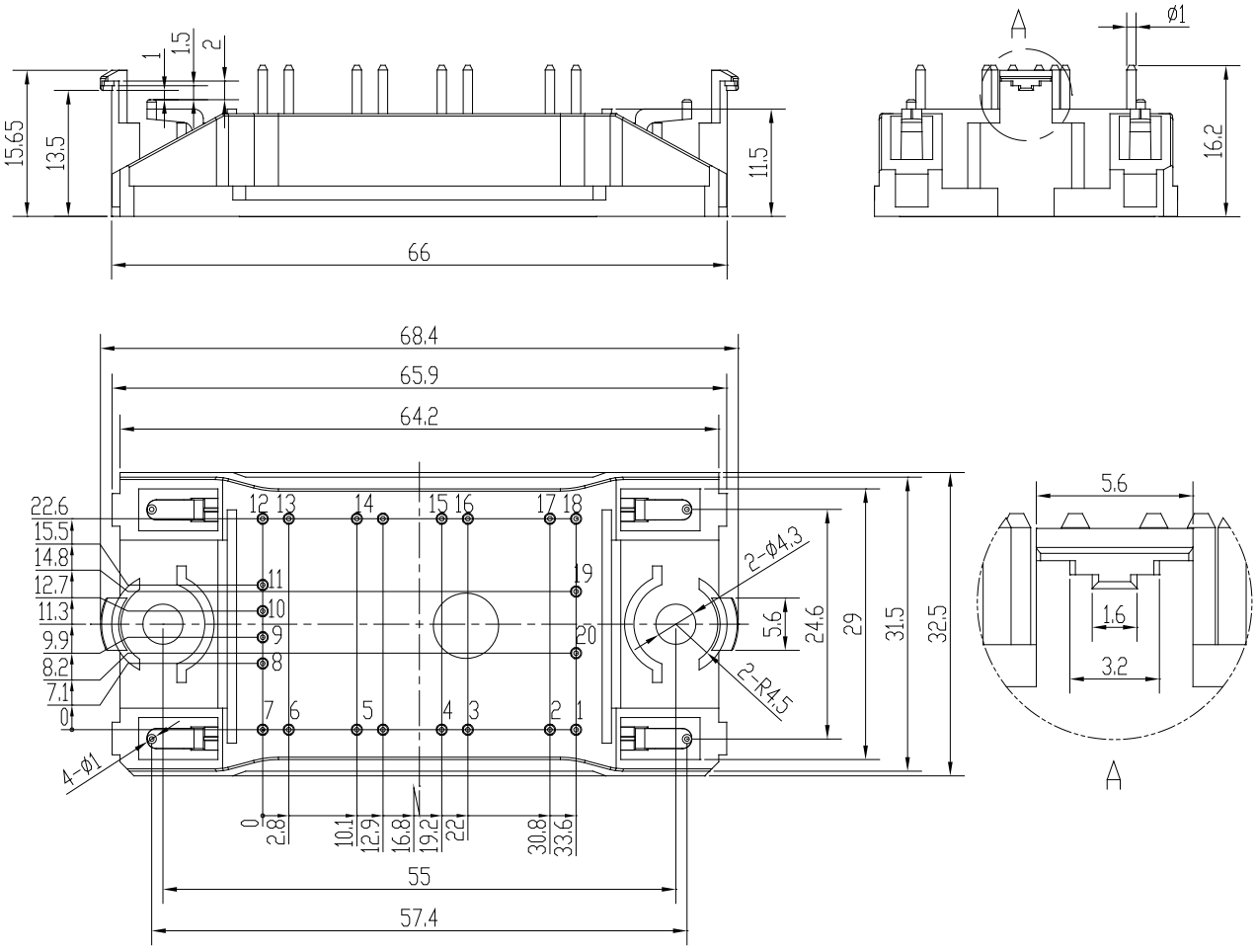
Fig 21. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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