STARPOWER

SEMICONDUCTOR **IGBT**

GD50MLX65F1S

650V/50A 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.

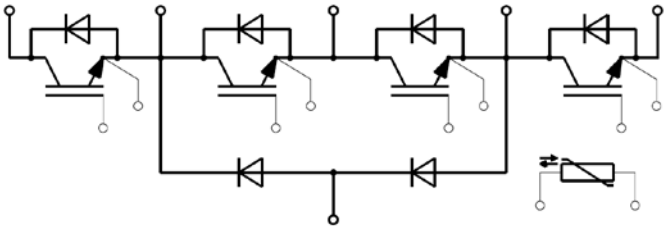
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 6μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- 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-T4 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=85°C	74 50	A
I_{CM}	Pulsed Collector Current t_p=1ms	100	A
P_D	Maximum Power Dissipation @ T_j=175°C	197	W

D1-D4 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	50	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	100	A

D5,D6 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	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-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=50A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=50A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=50A,V_{GE}=15V, T_j=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=0.80mA,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			0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		5.80		nF
C_{res}	Reverse Transfer Capacitance			0.11		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.35		uC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=50A, R_G=6.8Ω,V_{GE}=±15V, T_j=25°C		18		ns
t_r	Rise Time			15		ns
$t_{d(off)}$	Turn-Off Delay Time			136		ns
t_f	Fall Time			24		ns
E_{on}	Turn-On Switching Loss			0.32		mJ
E_{off}	Turn-Off Switching Loss			0.96		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=50A, R_G=6.8Ω,V_{GE}=±15V, T_j=125°C		18		ns
t_r	Rise Time			18		ns
$t_{d(off)}$	Turn-Off Delay Time			152		ns
t_f	Fall Time			32		ns
E_{on}	Turn-On Switching Loss			0.46		mJ
E_{off}	Turn-Off Switching Loss			1.28		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=50A, R_G=6.8Ω,V_{GE}=±15V, T_j=150°C		18		ns
t_r	Rise Time			18		ns
$t_{d(off)}$	Turn-Off Delay Time			160		ns
t_f	Fall Time			40		ns
E_{on}	Turn-On Switching Loss			0.51		mJ
E_{off}	Turn-Off Switching Loss			1.36		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150 °C,V_{CC}=300V, V_{CEM}≤600V		250		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=50A,V_{GE}=0V,T_i=25°C		1.55	2.05	V
		I_F=50A,V_{GE}=0V,T_j=125°C		1.50		
		I_F=50A,V_{GE}=0V,T_i=150°C		1.45		
Q_r	Recovered Charge	V_R=300V,I_F=50A, -di/dt=2420A/μs,V_{GE}=-15V T_j=25°C		2.2		μC
I_{RM}	Peak Reverse Recovery Current			55		A
E_{rec}	Reverse Recovery Energy			0.55		mJ
Q_r	Recovered Charge	V_R=300V,I_F=50A, -di/dt=2420A/μs,V_{GE}=-15V T_j=125°C		4.3		μC
I_{RM}	Peak Reverse Recovery Current			66		A
E_{rec}	Reverse Recovery Energy			1.10		mJ
Q_r	Recovered Charge	V_R=300V,I_F=50A, -di/dt=2420A/μs,V_{GE}=-15V T_j=150°C		4.8		μC
I_{RM}	Peak Reverse Recovery Current			72		A
E_{rec}	Reverse Recovery Energy			1.27		mJ

D5,D6 Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_C=60A,V_{GE}=0V,T_i=25°C		1.60	2.05	V
		I_C=60A,V_{GE}=0V,T_j=125°C		1.55		
		I_C=60A,V_{GE}=0V,T_i=150°C		1.50		
Q_r	Recovered Charge	V_R=300V,I_F=60A, -di/dt=4200A/μs,V_{GE}=-15V T_j=25°C		2.6		μC
I_{RM}	Peak Reverse Recovery Current			88		A
E_{rec}	Reverse Recovery Energy			0.7		mJ
Q_r	Recovered Charge	V_R=300V,I_F=60A, -di/dt=4200A/μs,V_{GE}=-15V T_j=125°C		4.6		μC
I_{RM}	Peak Reverse Recovery Current			96		A
E_{rec}	Reverse Recovery Energy			1.1		mJ
Q_r	Recovered Charge	V_R=300V,I_F=60A, -di/dt=4200A/μs,V_{GE}=-15V T_j=150°C		5.4		μC
I_{RM}	Peak Reverse Recovery Current			98		A
E_{rec}	Reverse Recovery Energy			1.3		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-T4 IGBT) Junction-to-Case (per D1-D4 Diode) Junction-to-Case (per D5,D6 Diode)		0.691 1.175 0.995	0.760 1.293 1.094	K/W
R_{thCH}	Case-to-Heatsink (per T1-T4 IGBT) Case-to-Heatsink (per D1-D4 Diode) Case-to-Heatsink (per D5,D6 Diode) Case-to-Heatsink (per Module)		0.271 0.461 0.390 0.035		K/W
M	Mounting Torque, Screw M4	2.0		2.2	N.m
G	Weight of Module		26		g

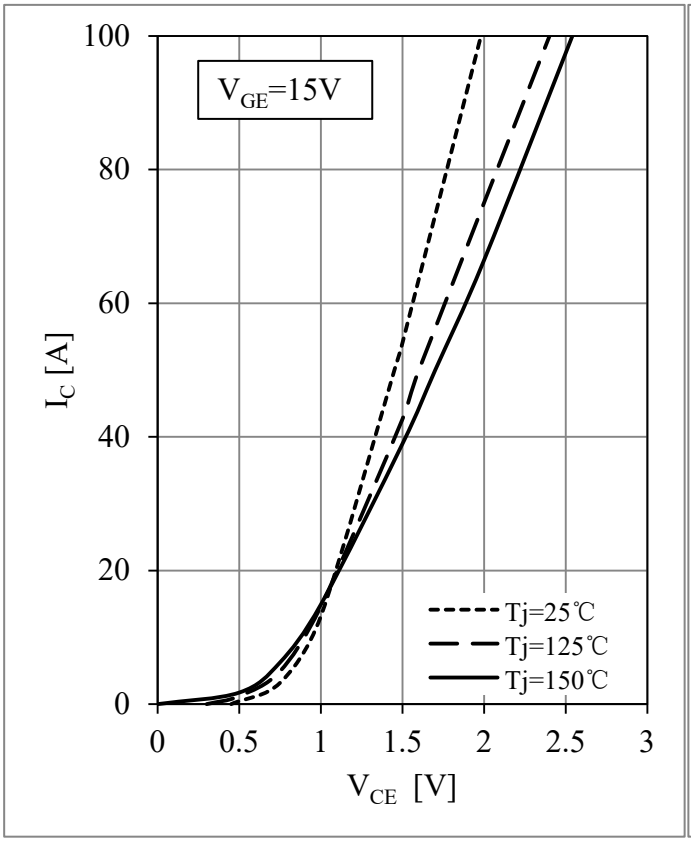


Fig 1. T1-T4 IGBT Output Characteristics

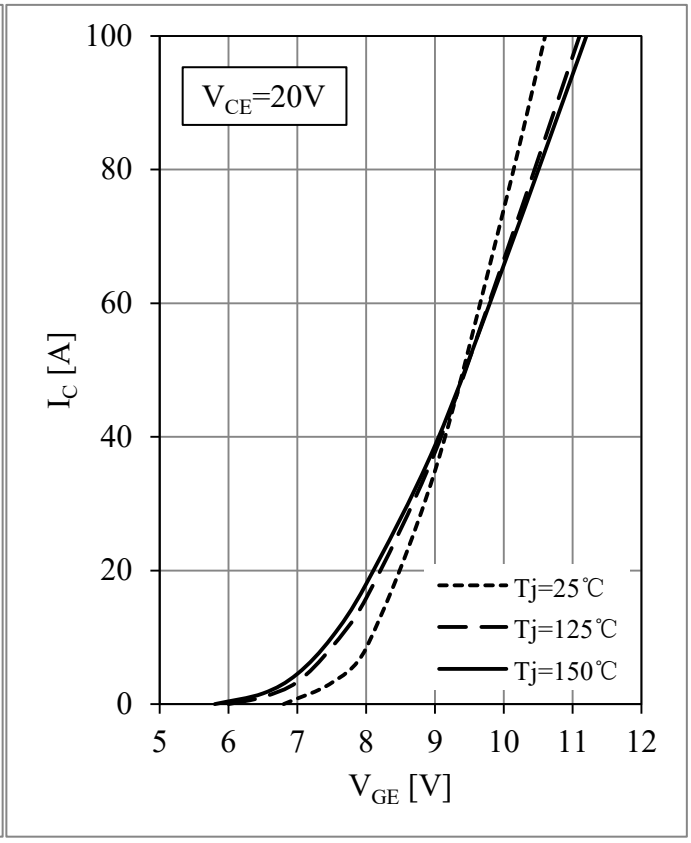


Fig 2. T1-T4 IGBT Transfer Characteristics

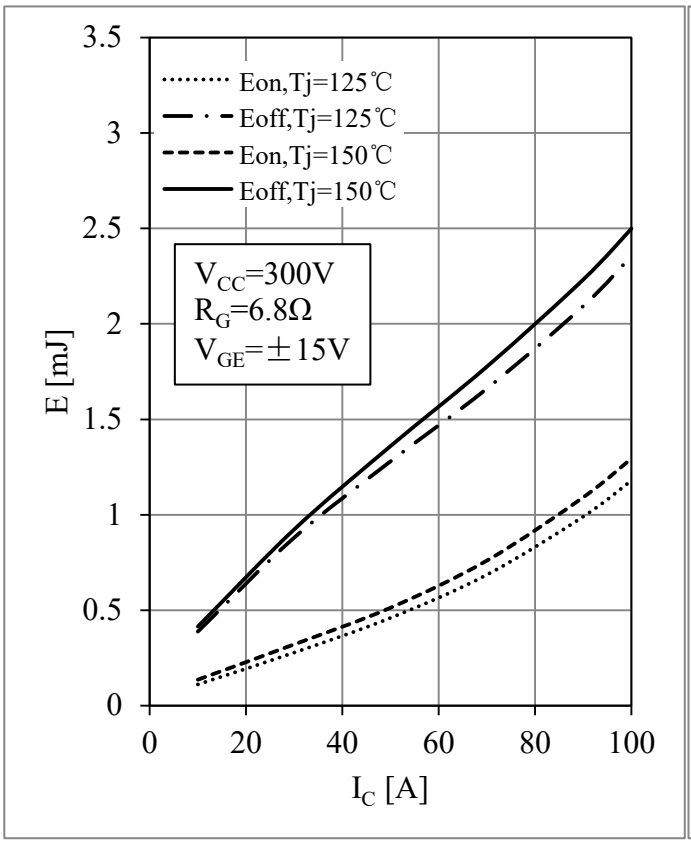


Fig 3. T1-T4 IGBT Switching Loss vs. I_C

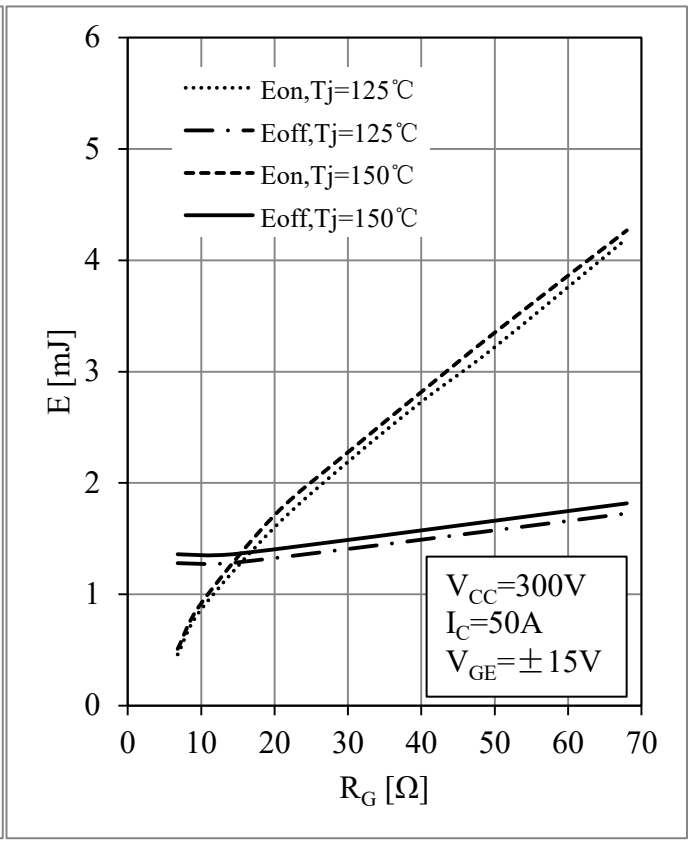


Fig 4. T1-T4 IGBT Switching Loss vs. R_G

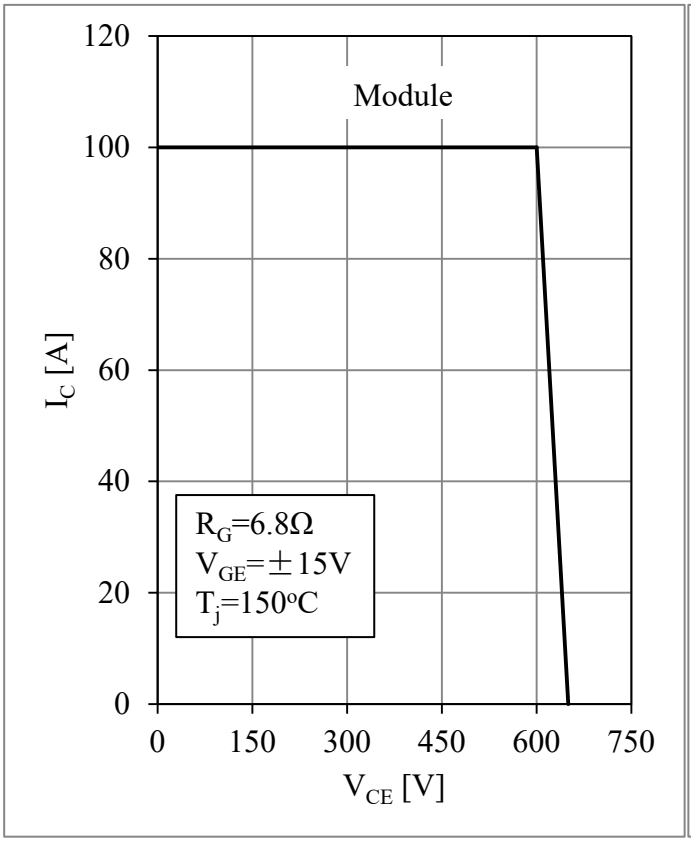


Fig 5. T1-T4 RBSOA

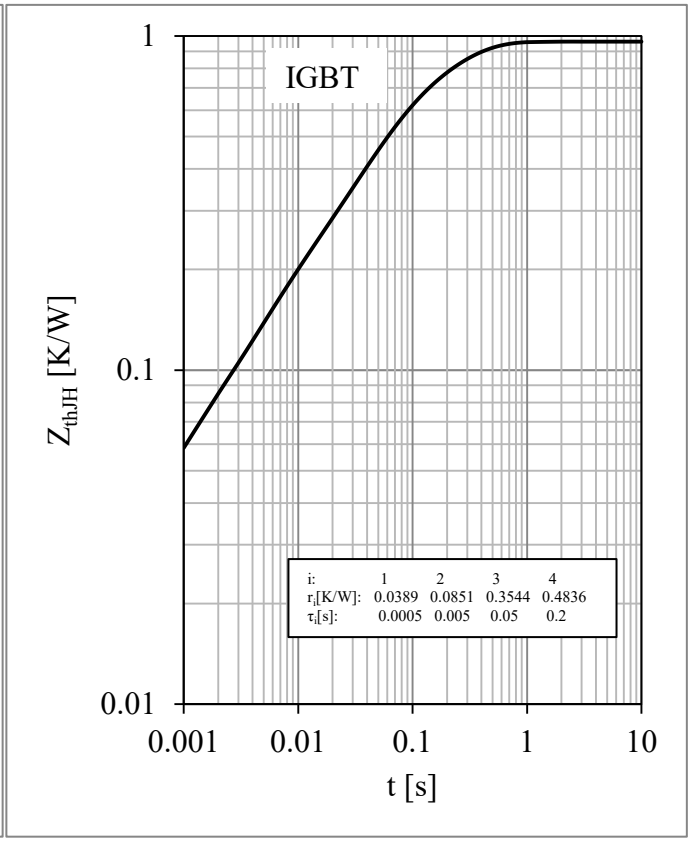


Fig 6. T1-T4 IGBT Transient Thermal Impedance

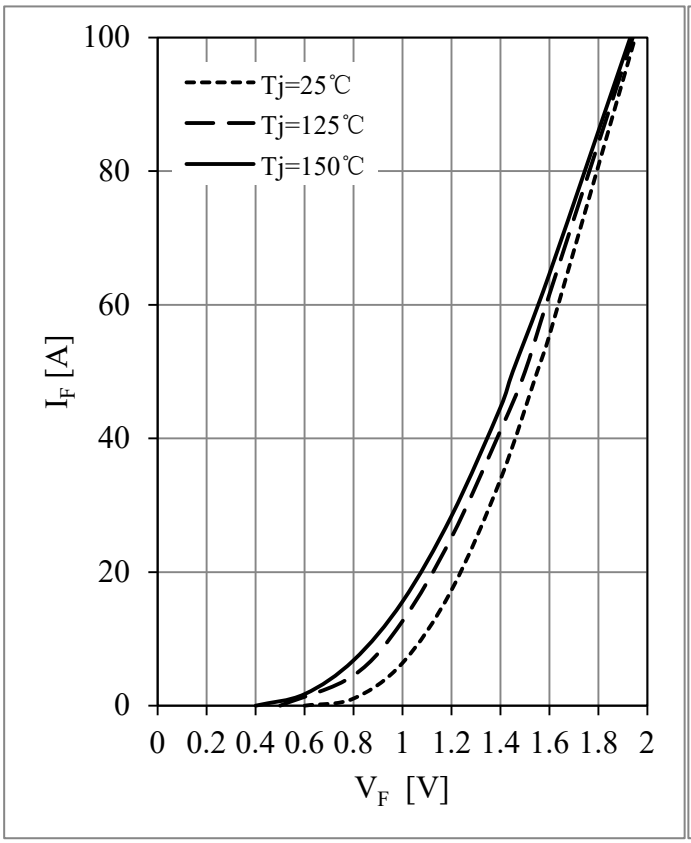


Fig 7. D1-D4 Diode Forward Characteristics

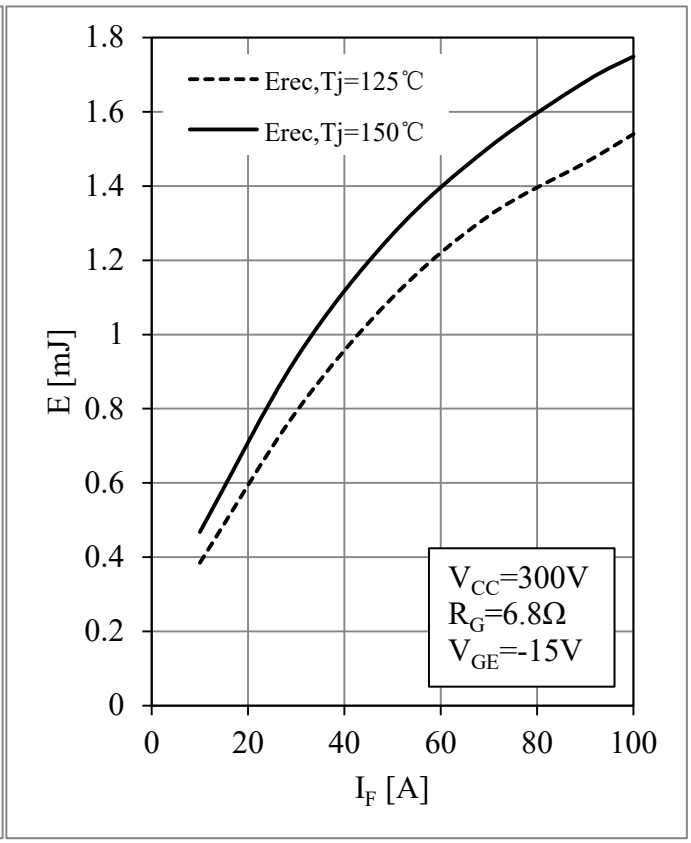


Fig 8. D1-D4 Diode Switching Loss vs. I_F

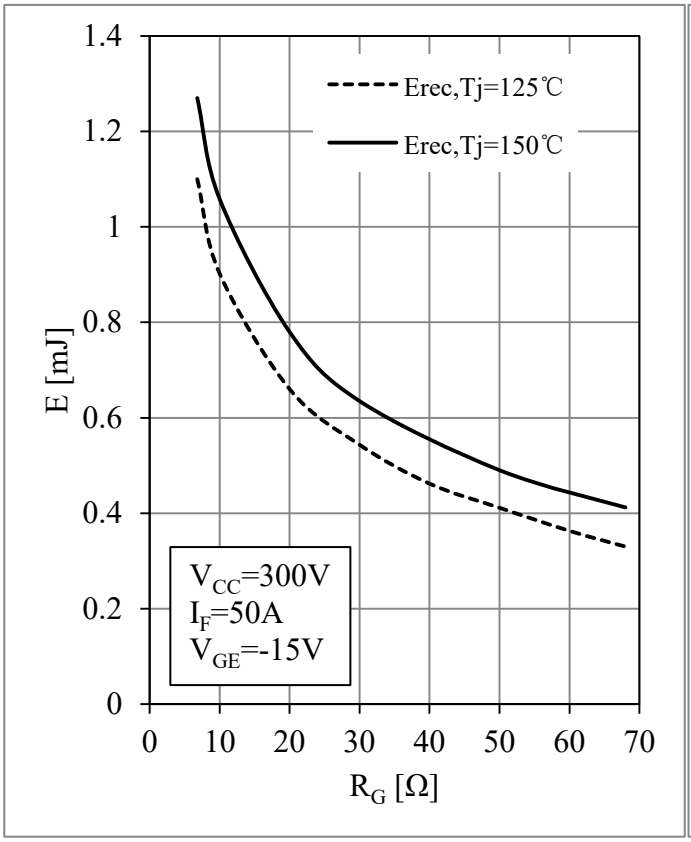


Fig 9. D1-D4 Diode Switching Loss vs. R_G

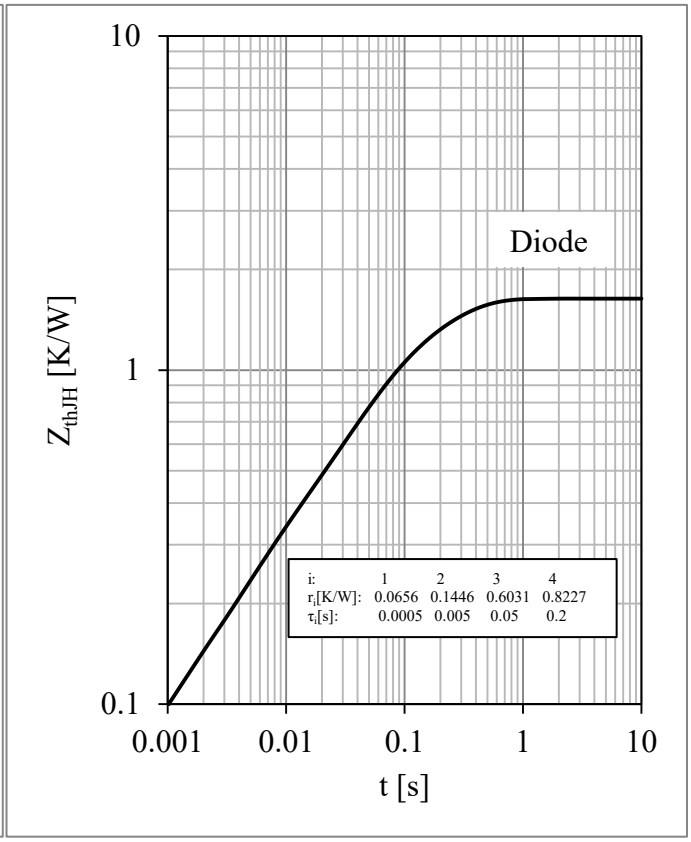


Fig 10. D1-D4 Diode Transient Thermal Impedance

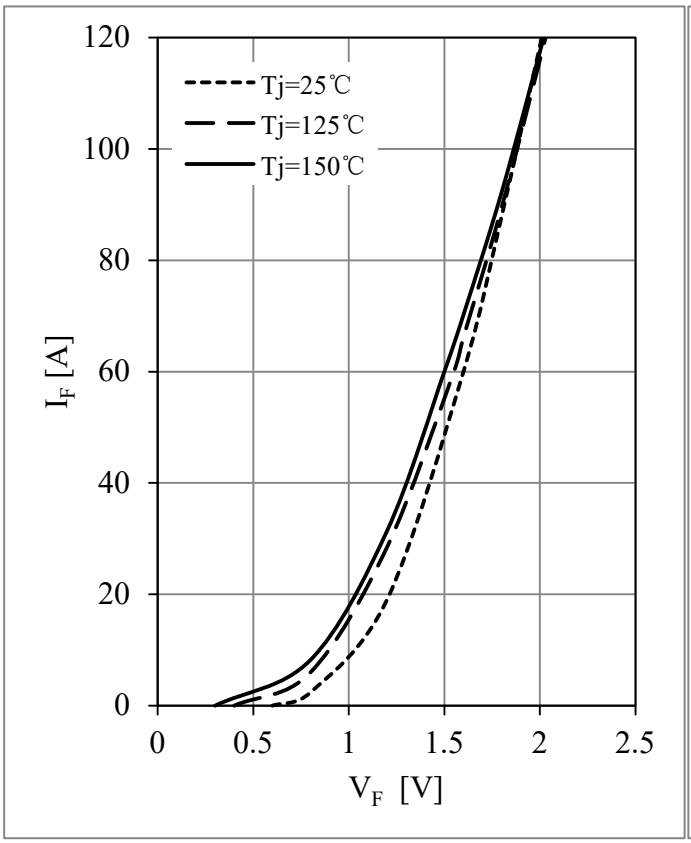


Fig 11. D5,D6 Diode Forward Characteristics

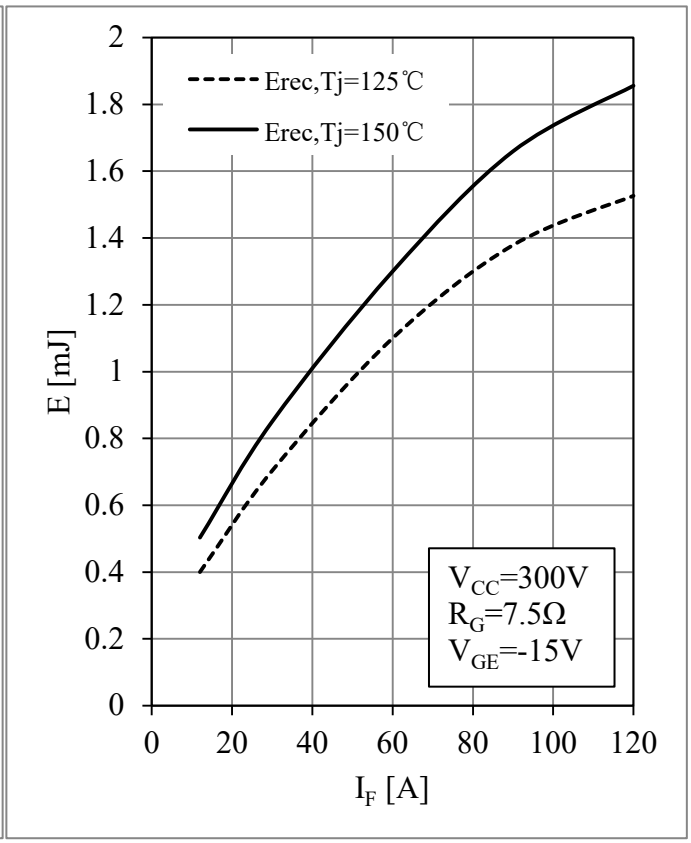


Fig 12. D5,D6 Diode Switching Loss vs. I_F

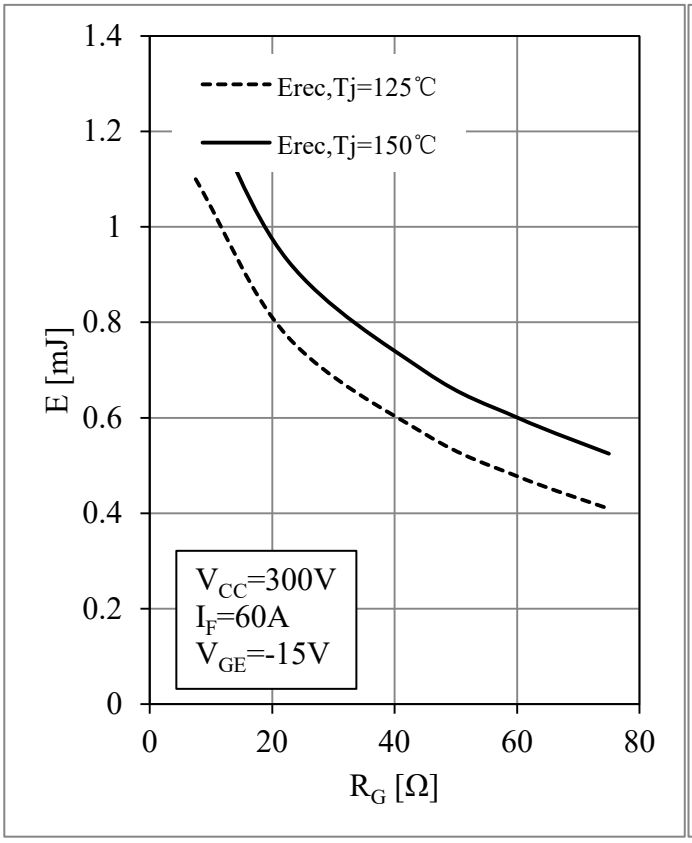


Fig 13. D5,D6 Diode Switching Loss vs. R_G

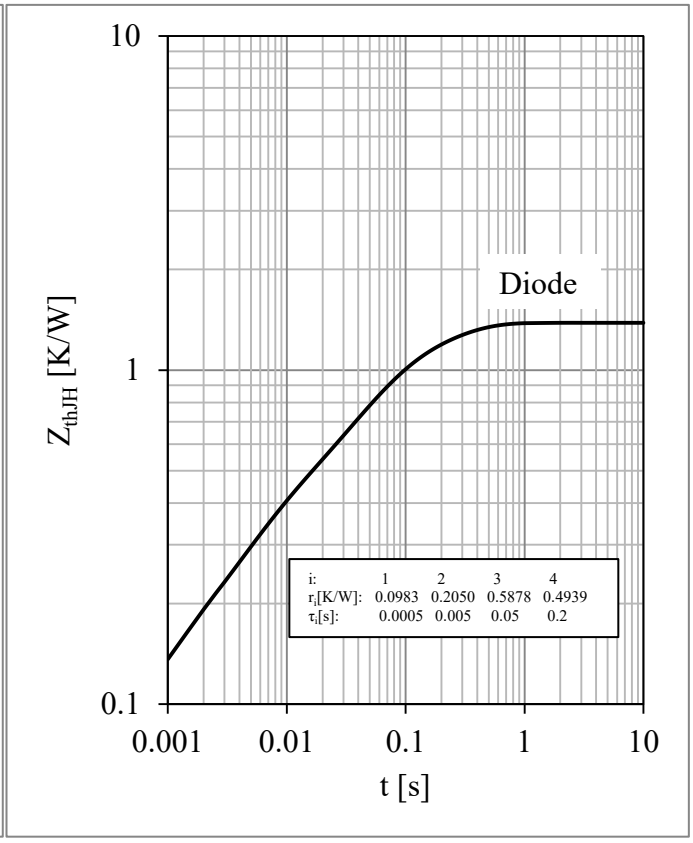


Fig 14. D5,D6 Diode Transient Thermal Impedance

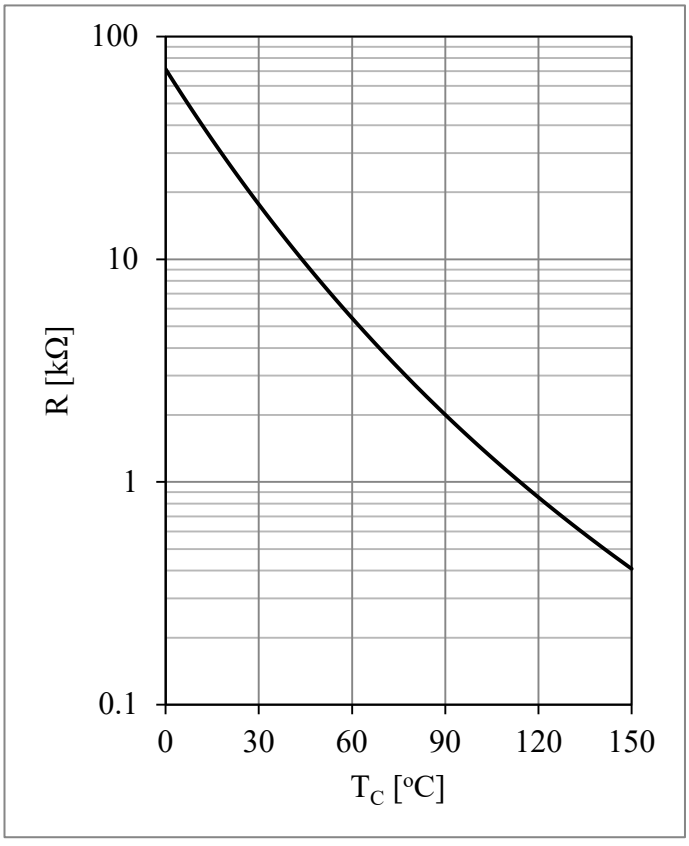
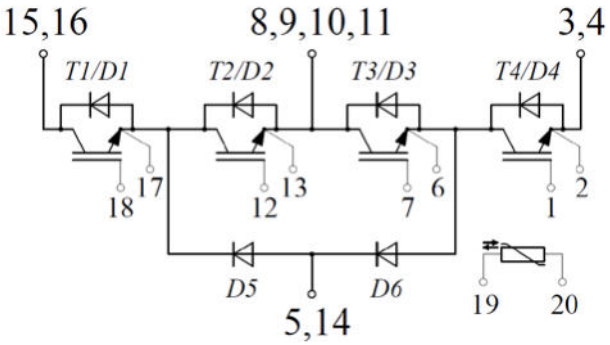


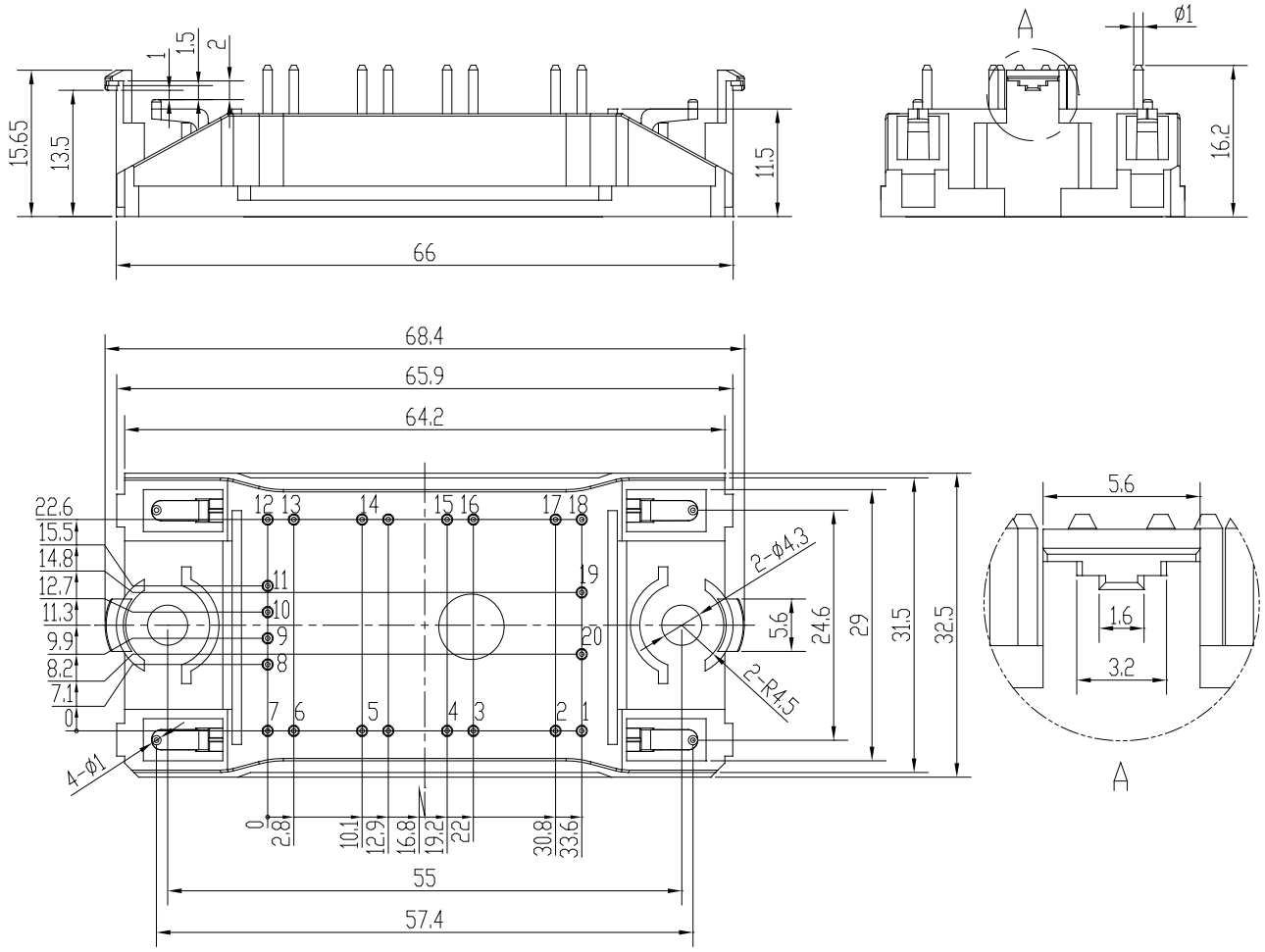
Fig 15. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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