STARPOWER

SEMICONDUCTOR **IGBT**

GD400TUX65C2S

650V/400A 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-applications.

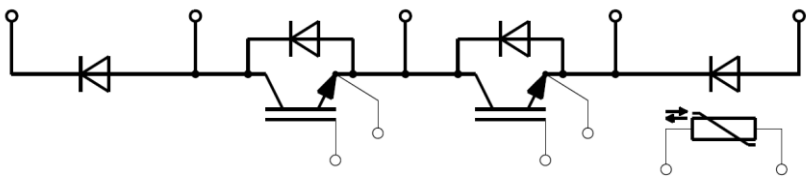
Features

- Low $V_{CE(sat)}$ trench IGBT technology
- 6μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175℃
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

Typical Applications

- Solar power
- UPS
- 3-level-applications

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25℃ unless otherwise noted

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℃ @ T_C=65℃	505 400	A
I_{CM}	Pulsed Collector Current t_p=1ms	800	A
P_D	Maximum Power Dissipation @ T_j=175℃	1261	W

D2 D3 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

D1 D4 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	400	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	800	A

Module

Symbol	Description	Value	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	2500	V

T2 T3 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=400A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=400A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=400A,V_{GE}=15V, T_j=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=6.40mA,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		46.4		nF
C_{res}	Reverse Transfer Capacitance			0.91		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		2.77		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=400A, R_G=1.8Ω,V_{GE}=±15V, T_j=25°C		80		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			368		ns
t_f	Fall Time			40		ns
E_{on}	Turn-On Switching Loss			2.3		mJ
E_{off}	Turn-Off Switching Loss			10.4		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=400A, R_G=1.8Ω,V_{GE}=±15V, T_j=125°C		88		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			400		ns
t_f	Fall Time			56		ns
E_{on}	Turn-On Switching Loss			3.4		mJ
E_{off}	Turn-Off Switching Loss			12.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=400A, R_G=1.8Ω,V_{GE}=±15V, T_j=150°C		96		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			400		ns
t_f	Fall Time			64		ns
E_{on}	Turn-On Switching Loss			3.6		mJ
E_{off}	Turn-Off Switching Loss			13.6		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤650V		2000		A

D2 D3 Diode Characteristics T_C=25℃ 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		1.55	2.05	V
		I_F=50A,V_{GE}=0V,T_j=125°C		1.50		
		I_F=50A,V_{GE}=0V,T_j=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

D1 D4 Diode Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=400A,V_{GE}=0V,T_j=25°C		1.65	2.10	V
		I_F=400A,V_{GE}=0V,T_j=125°C		1.65		
		I_F=400A,V_{GE}=0V,T_j=150°C		1.65		
Q_r	Recovered Charge	V_R=400V,I_F=400A, -di/dt=4700A/μs,V_{GE}=-15V T_j=25°C		10.5		μC
I_{RM}	Peak Reverse Recovery Current			216		A
E_{rec}	Reverse Recovery Energy			3.52		mJ
Q_r	Recovered Charge	V_R=400V,I_F=400A, -di/dt=4300A/μs,V_{GE}=-15V T_j=125°C		18		μC
I_{RM}	Peak Reverse Recovery Current			250		A
E_{rec}	Reverse Recovery Energy			7.10		mJ
Q_r	Recovered Charge	V_R=400V,I_F=400A, -di/dt=4200A/μs,V_{GE}=-15V T_j=150°C		21		μC
I_{RM}	Peak Reverse Recovery Current			276		A
E_{rec}	Reverse Recovery Energy			7.80		mJ

NTC Characteristics T_C=25℃ 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℃ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per T2 T3 IGBT) Junction-to-Case (per D2 D3 Diode) Junction-to-Case (per D1 D4 Diode)			0.119 1.066 0.218	K/W
R_{thCH}	Case-to-Sink (per T2 T3 IGBT) Case-to-Sink (per D2 D3 Diode) Case-to-Sink (per D1 D4 Diode) Case-to-Heatsink (per Module)		0.033 0.297 0.061 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		300		g

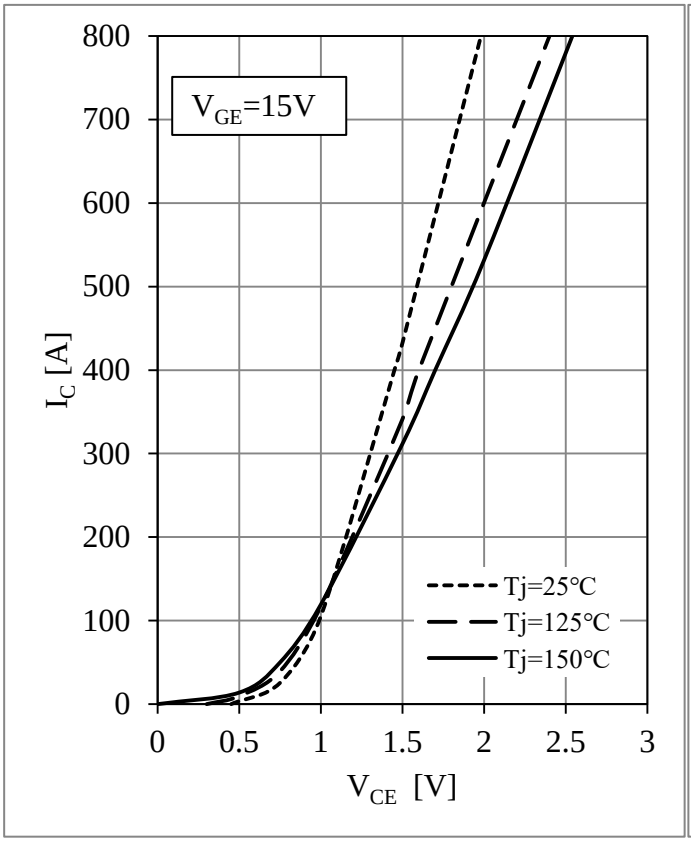


Fig 1. T2 T3 IGBT Output Characteristics

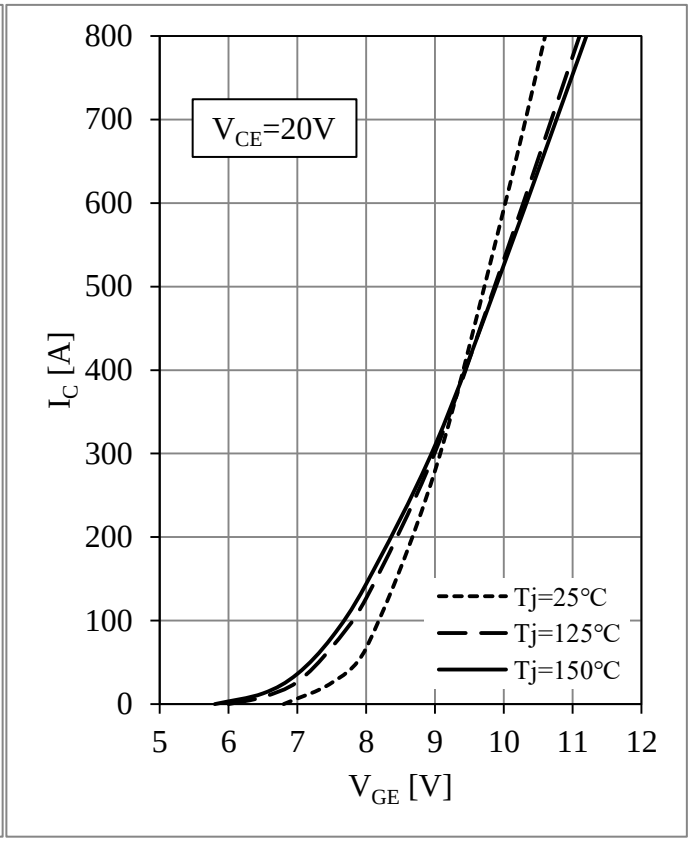


Fig 2. T2 T3 IGBT Transfer Characteristics

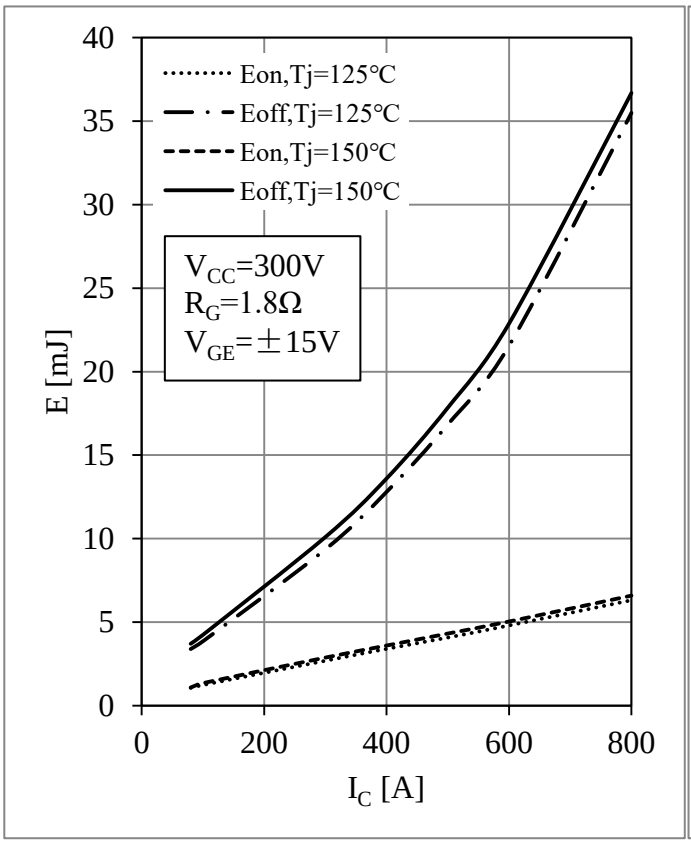


Fig 3. T2 T3 IGBT Switching Loss vs. I_C

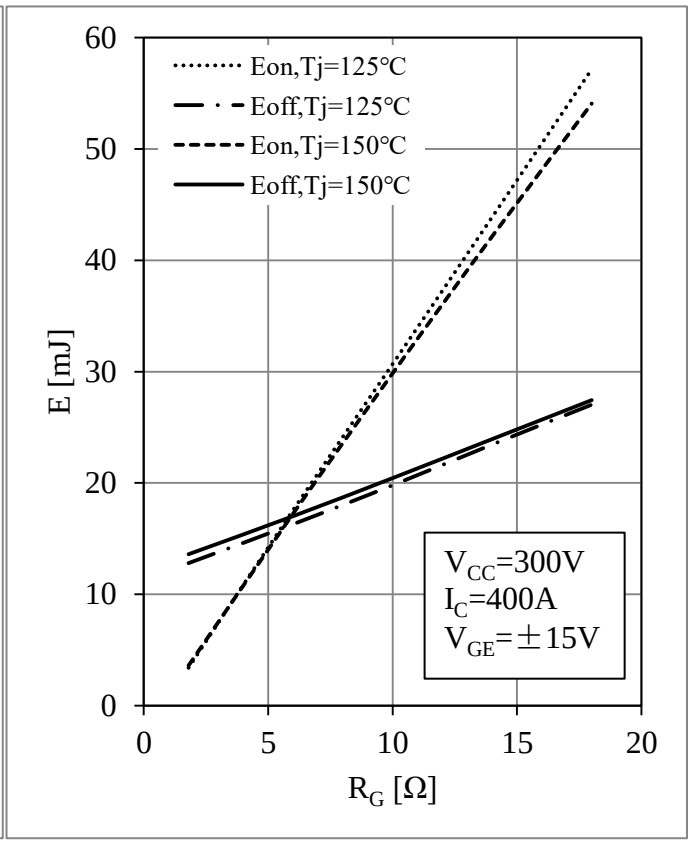


Fig 4. T2 T3 IGBT Switching Loss vs. R_G

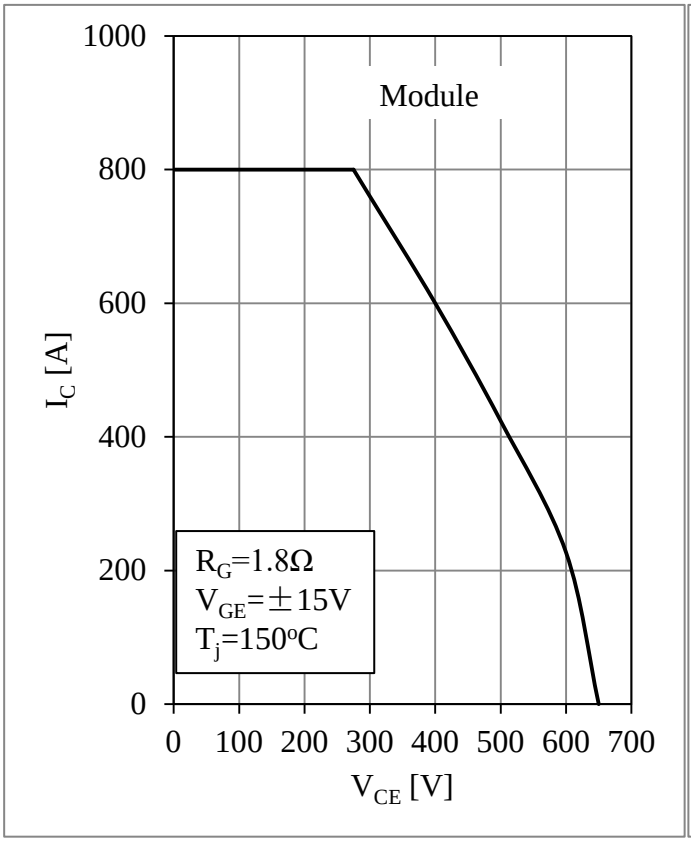


Fig 5. T2 T3 RBSOA

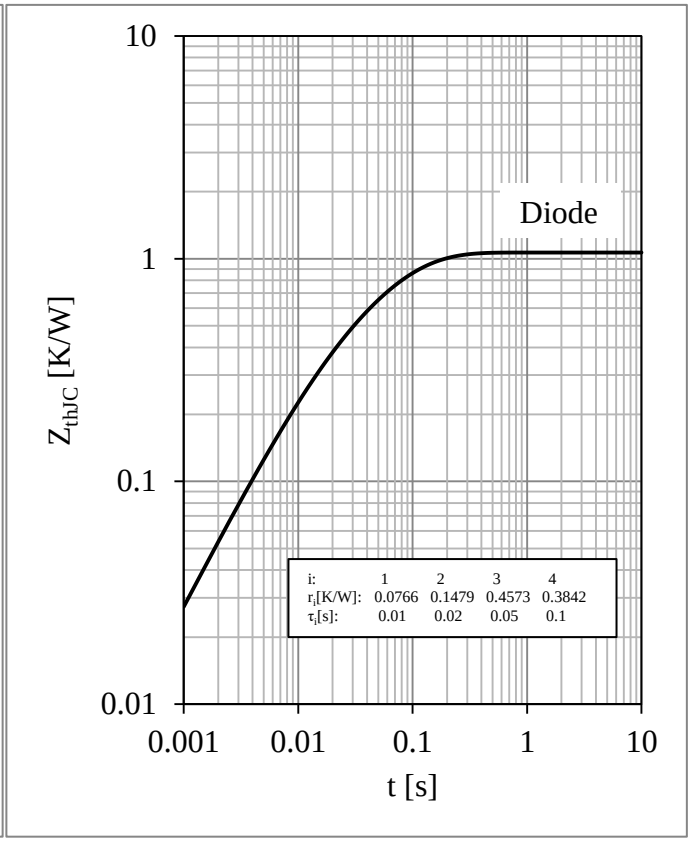


Fig 6. T2 T3 IGBT Transient Thermal Impedance

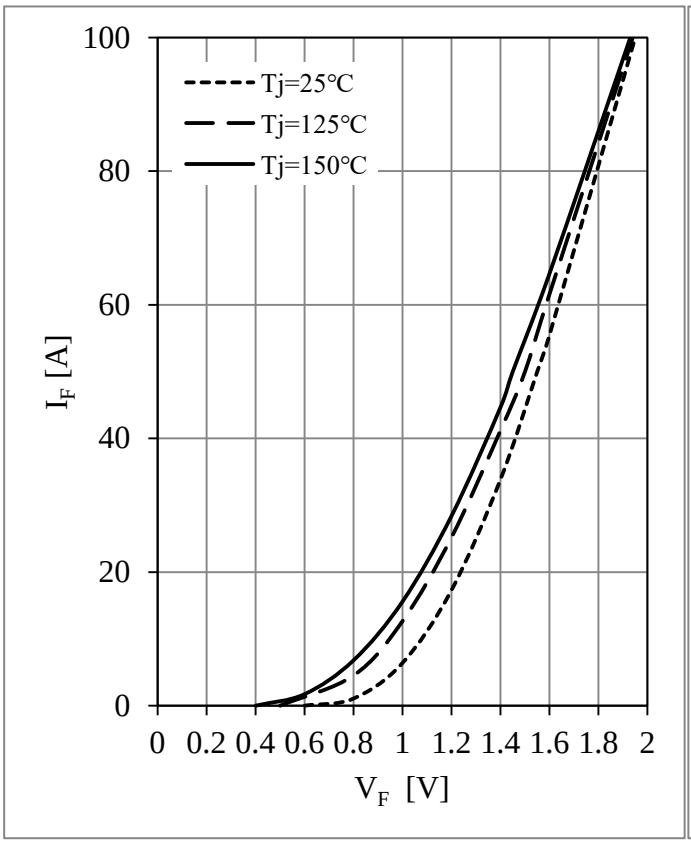


Fig 7. D2 D3 Diode Forward Characteristics

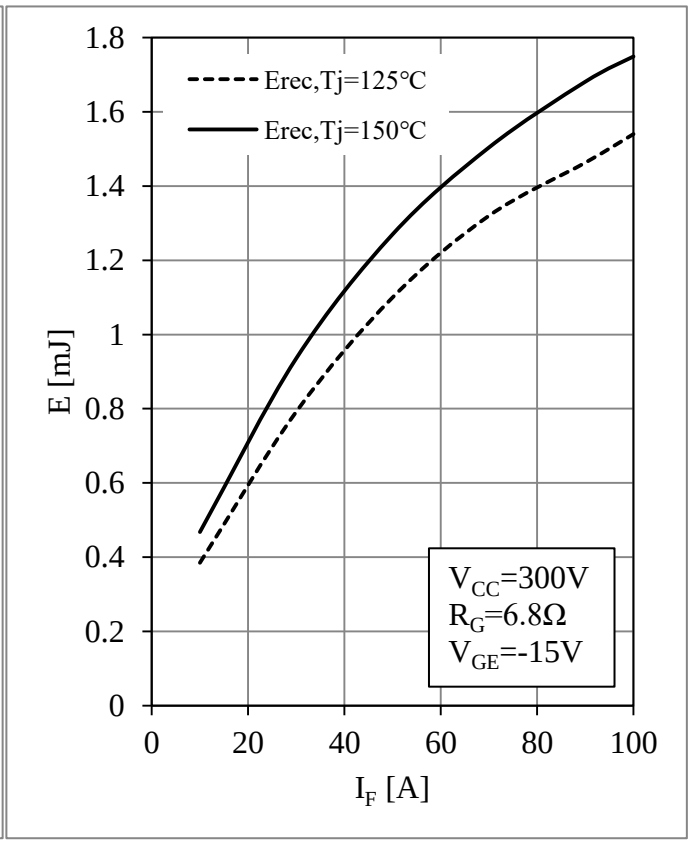


Fig 8. D2 D3 Diode Switching Loss vs. I_F

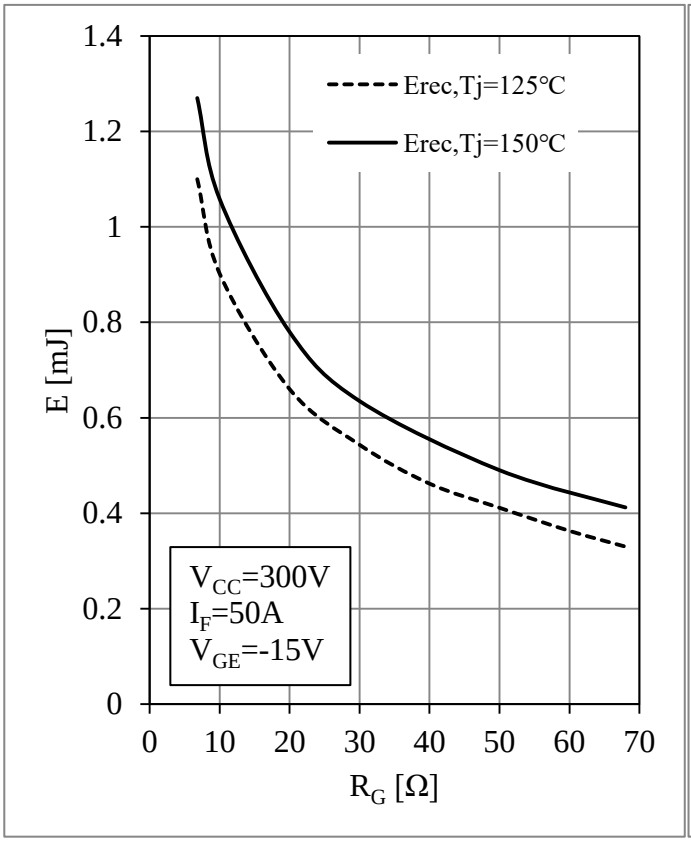


Fig 9. D2 D3 Diode Switching Loss vs. R_G

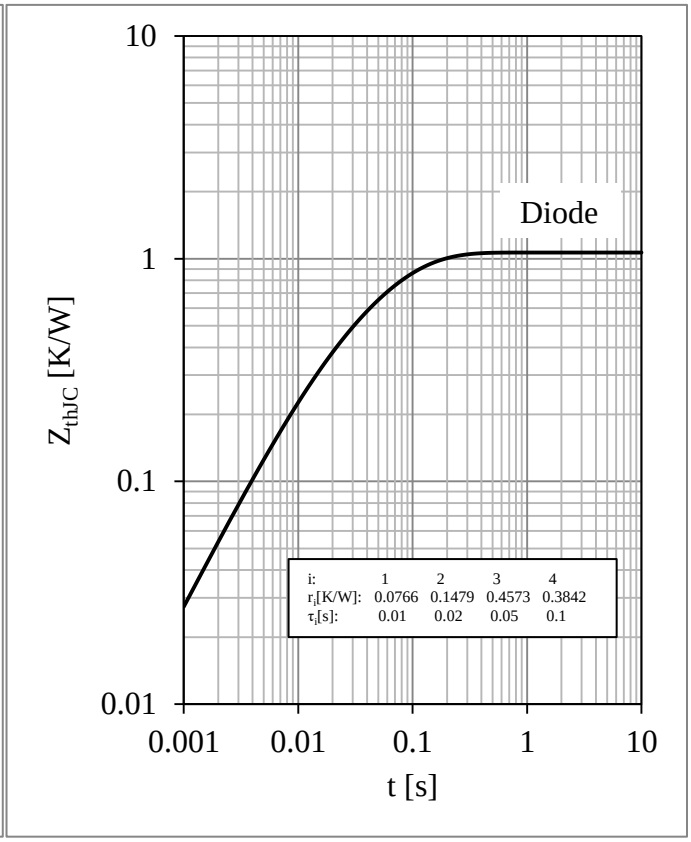


Fig 10. D2 D3 Diode Transient Thermal Impedance

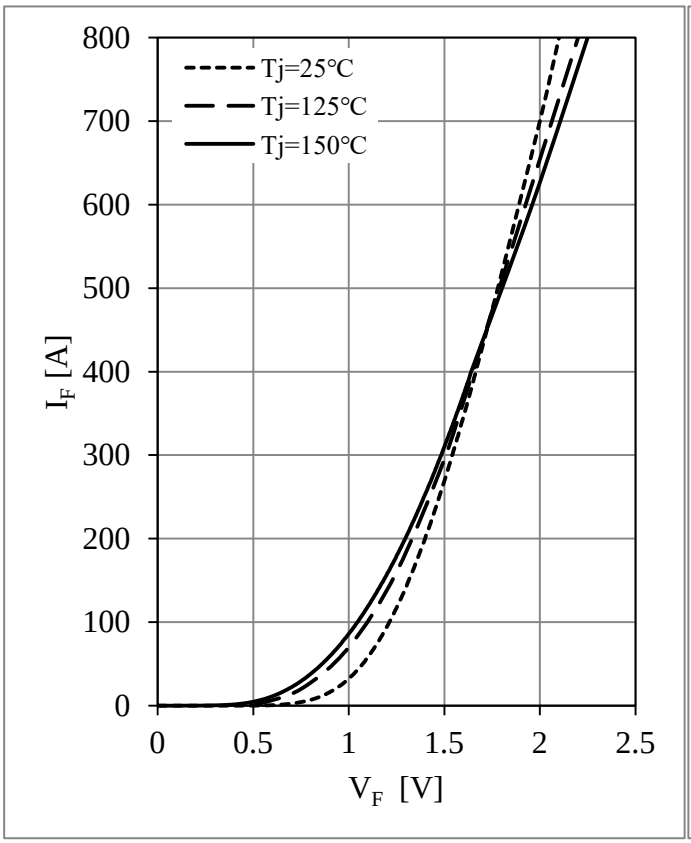


Fig 11. D1 D4 Diode Forward Characteristics

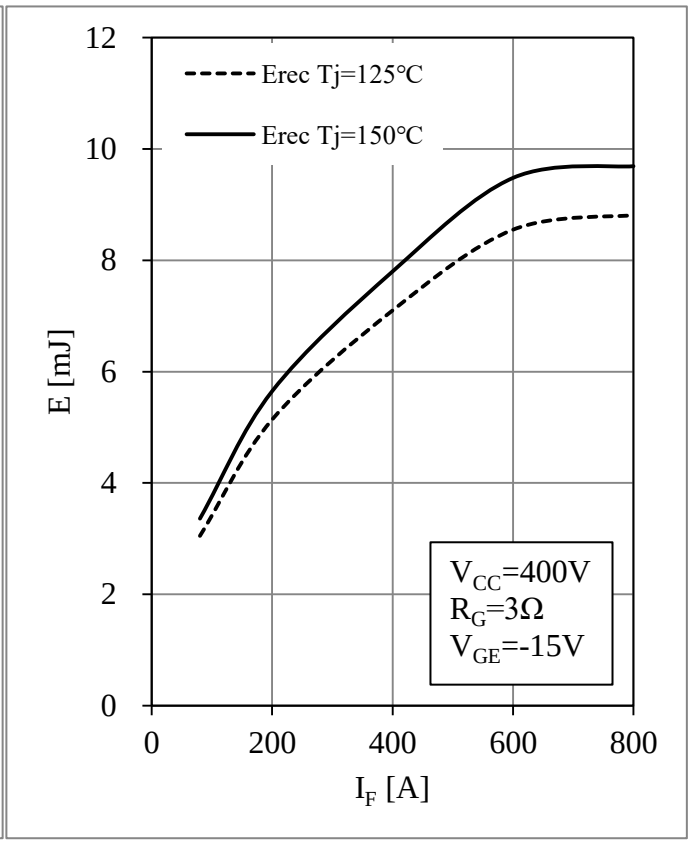


Fig 12. D1 D4 Diode Switching Loss vs. I_F

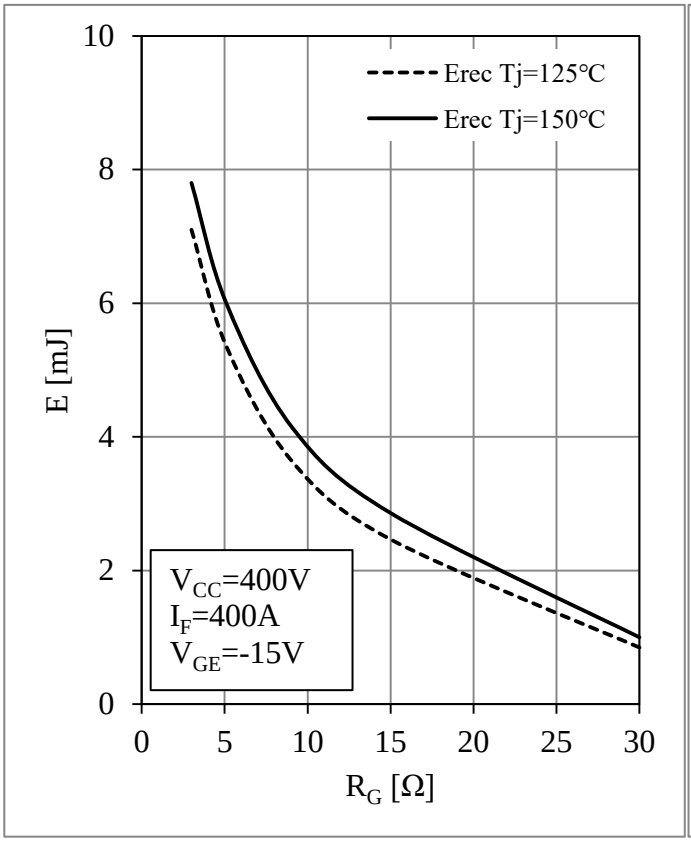


Fig 13. D1 D4 Diode Switching Loss vs. R_G

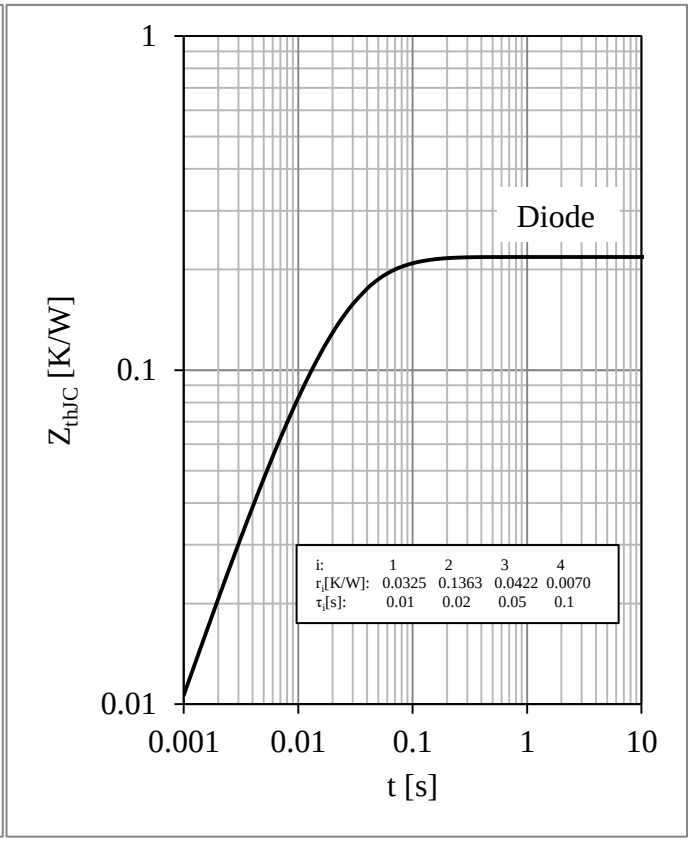


Fig 14. D1 D4 Diode Transient Thermal Impedance

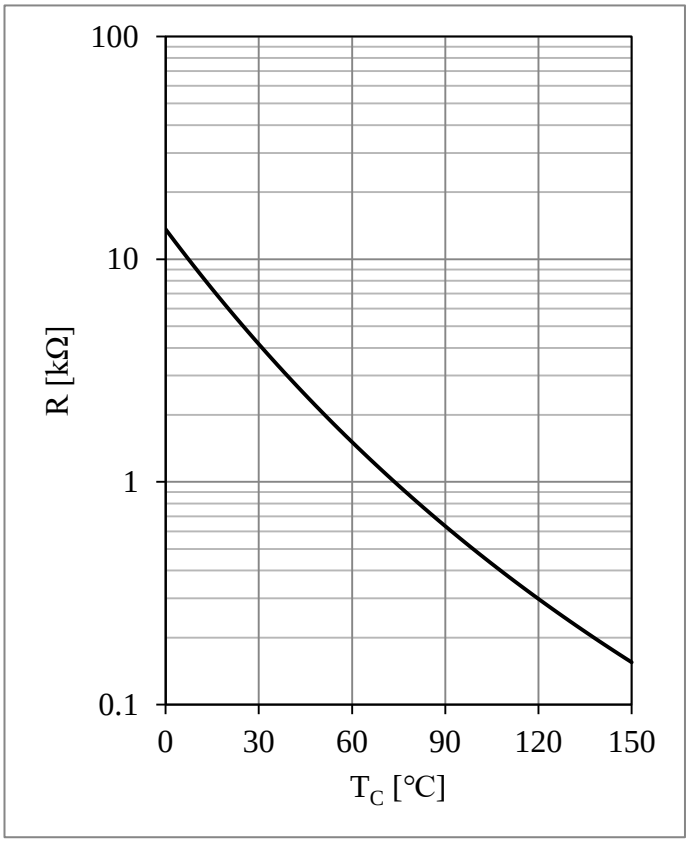
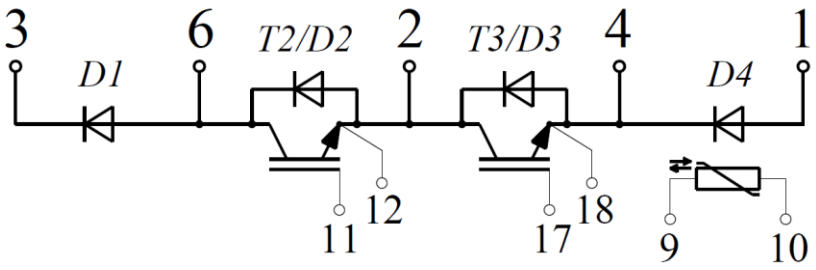


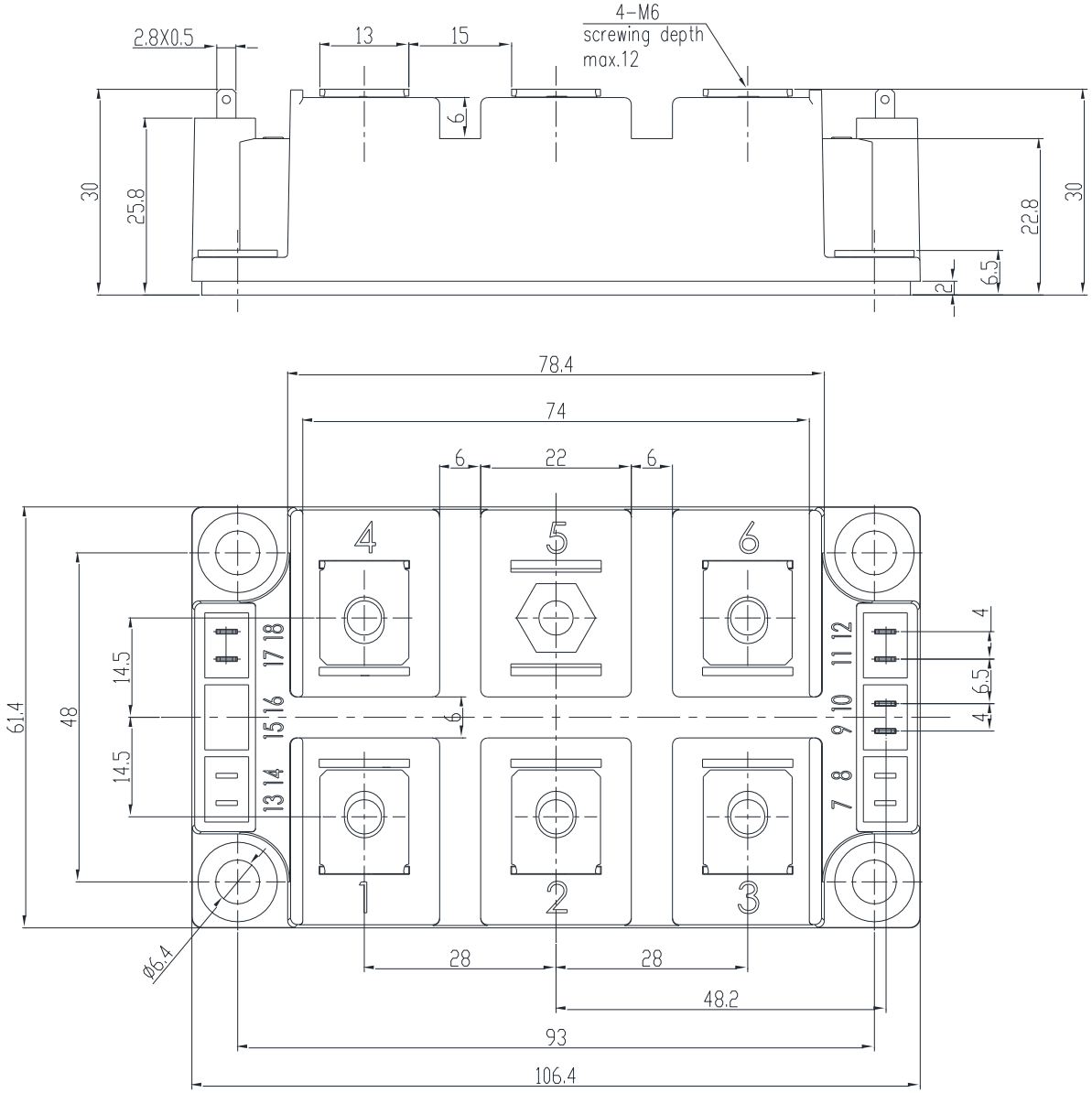
Fig 15. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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