STARPOWER

SEMICONDUCTOR **IGBT**

GD275MJS120L6S

1200V/275A 3-level in one-package

General Description

STARPOWER IGBT Power Module provides ultra low conduction loss.They are designed for the applications such as 3-level-application.

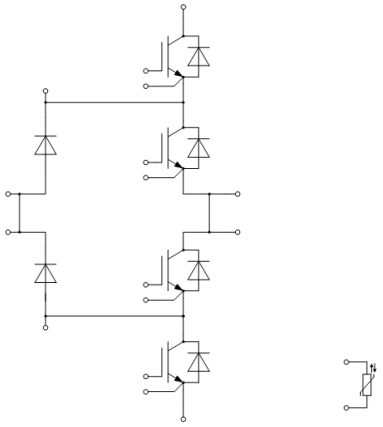
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175 °C
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using Si_3N_4 AMB technology

Typical Applications

- Solar power
- 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	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_{CN}	Implemented Collector Current	275	A
I_C	Collector Current @ T_C=100°C	110	A
I_{CM}	Pulsed Collector Current t_p=1ms	450	A

D1/D4 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_{FN}	Implemented Forward Current	275	A
I_F	Diode Continuous Forward Current	300	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	450	A

D2/D3 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_{FN}	Implemented Forward Current	275	A
I_F	Diode Continuous Forward Current	225	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	450	A

D5/D6 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_{FN}	Implemented Forward Current	275	A
I_F	Diode Continuous Forward Current	300	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	450	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	3200	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=225A,V_{GE}=15V, T_j=25°C		2.00	2.45	V
		I_C=225A,V_{GE}=15V, T_j=125°C		2.70		
		I_C=225A,V_{GE}=15V, T_j=150°C		2.90		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=9.00mA,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			1.7		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		38.1		nF
C_{res}	Reverse Transfer Capacitance			0.66		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		2.52		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=225A, R_G=2Ω,V_{GE}=-8/+15V, L_S=36nH ,T_j=25°C		154		ns
t_r	Rise Time			45		ns
$t_{d(off)}$	Turn-Off Delay Time			340		ns
t_f	Fall Time			76		ns
E_{on}	Turn-On Switching Loss			13.4		mJ
E_{off}	Turn-Off Switching Loss			8.08		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=225A, R_G=2Ω,V_{GE}=-8/+15V, L_S=36nH ,T_j=125°C		160		ns
t_r	Rise Time			49		ns
$t_{d(off)}$	Turn-Off Delay Time			388		ns
t_f	Fall Time			112		ns
E_{on}	Turn-On Switching Loss			17.6		mJ
E_{off}	Turn-Off Switching Loss			11.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=225A, R_G=2Ω,V_{GE}=-8/+15V, L_S=36nH ,T_j=150°C		163		ns
t_r	Rise Time			51		ns
$t_{d(off)}$	Turn-Off Delay Time			397		ns
t_f	Fall Time			114		ns
E_{on}	Turn-On Switching Loss			18.7		mJ
E_{off}	Turn-Off Switching Loss			12.0		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=225A,V_{GE}=15V, T_j=25°C			2.45	V
		I_C=225A,V_{GE}=15V, T_j=125°C				
		I_C=225A,V_{GE}=15V, T_j=150°C				
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=9.00mA,V_{CE}=V_{GE}, T_j=25°C	5.6		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					Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V				nF
C_{res}	Reverse Transfer Capacitance					nF
Q_G	Gate Charge	V_{GE}=-15…+15V				μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=225A, R_G=2Ω,V_{GE}=-8/+15V, L_S=36nH ,T_j=25°C		153		ns
t_r	Rise Time			46		ns
$t_{d(off)}$	Turn-Off Delay Time			280		ns
t_f	Fall Time			145		ns
E_{on}	Turn-On Switching Loss			13.5		mJ
E_{off}	Turn-Off Switching Loss			6.35		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=225A, R_G=2Ω,V_{GE}=-8/+15V, L_S=36nH ,T_j=125°C		157		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			349		ns
t_f	Fall Time			123		ns
E_{on}	Turn-On Switching Loss			16.9		mJ
E_{off}	Turn-Off Switching Loss			8.85		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=225A, R_G=2Ω,V_{GE}=-8/+15V, L_S=36nH ,T_j=150°C		159		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			363		ns
t_f	Fall Time			196		ns
E_{on}	Turn-On Switching Loss			18.1		mJ
E_{off}	Turn-Off Switching Loss			9.52		mJ

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=300A,V_{GE}=0V,T_j=25°C		1.60	2.05	V
		I_F=300A,V_{GE}=0V,T_j=125°C		1.60		
		I_F=300A,V_{GE}=0V,T_j=150°C		1.60		
Q_r	Recovered Charge	V_R=600V,I_F=225A, -di/dt=5350A/μs,V_{GE}=-8V L_S=36nH,T_j=25°C		20.1		μC
I_{RM}	Peak Reverse Recovery Current			250		A
E_{rec}	Reverse Recovery Energy			6.84		mJ
Q_r	Recovered Charge	V_R=600V,I_F=225A, -di/dt=5080A/μs,V_{GE}=-8V L_S=36nH,T_j=125°C		32.5		μC
I_{RM}	Peak Reverse Recovery Current			277		A
E_{rec}	Reverse Recovery Energy			11.5		mJ
Q_r	Recovered Charge	V_R=600V,I_F=225A, -di/dt=4930A/μs,V_{GE}=-8V L_S=36nH,T_j=150°C		39.0		μC
I_{RM}	Peak Reverse Recovery Current			288		A
E_{rec}	Reverse Recovery Energy			14.0		mJ

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=225A,V_{GE}=0V,T_j=25°C		1.60	2.05	V
		I_F=225A,V_{GE}=0V,T_j=125°C		1.60		
		I_F=225A,V_{GE}=0V,T_j=150°C		1.60		

D5/D6 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		1.60	2.05	V
		I_F=300A,V_{GE}=0V,T_j=125°C		1.60		
		I_F=300A,V_{GE}=0V,T_j=150°C		1.60		
Q_r	Recovered Charge	V_R=600V,I_F=225A, -di/dt=5050A/μs,V_{GE}=-8V L_S=30nH,T_j=25°C		18.6		μC
I_{RM}	Peak Reverse Recovery Current			189		A
E_{rec}	Reverse Recovery Energy			5.62		mJ
Q_r	Recovered Charge	V_R=600V,I_F=225A, -di/dt=4720A/μs,V_{GE}=-8V L_S=30nH,T_j=125°C		34.1		μC
I_{RM}	Peak Reverse Recovery Current			250		A
E_{rec}	Reverse Recovery Energy			11.4		mJ
Q_r	Recovered Charge	V_R=600V,I_F=225A, -di/dt=4720A/μs,V_{GE}=-8V L_S=30nH,T_j=150°C		38.9		μC
I_{RM}	Peak Reverse Recovery Current			265		A
E_{rec}	Reverse Recovery Energy			13.2		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
L_{CE}	Stray Inductance		15		nH
R_{thJC}	Junction-to-Case (per T1-T4 IGBT) Junction-to-Case (per D1/D4 Diode) Junction-to-Case (per D2/D3 Diode) Junction-to-Case (per D5/D6 Diode)			0.070 0.122 0.156 0.122	K/W
R_{thCH}	Case-to-Heatsink (per T1-T4 IGBT) Case-to-Heatsink (per D1/D4 Diode) Case-to-Heatsink (per D2/D3 Diode) Case-to-Heatsink (per D5/D6 Diode)		0.043 0.053 0.069 0.053		K/W
M	Mounting Torque, Screw:M5	3.0		5.0	N.m
G	Weight of Module		250		g

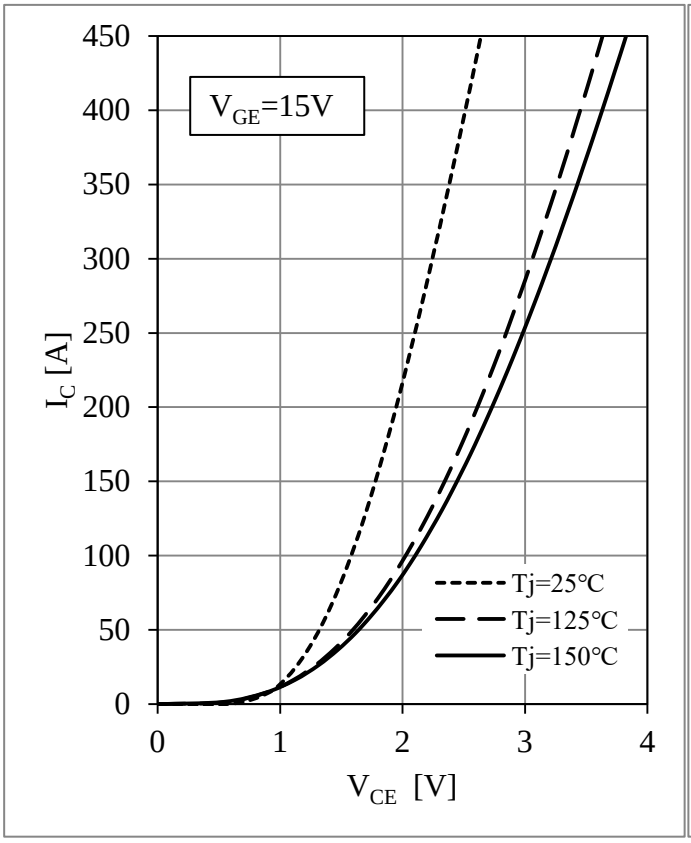


Fig 1. T1/T4 IGBT Output Characteristics

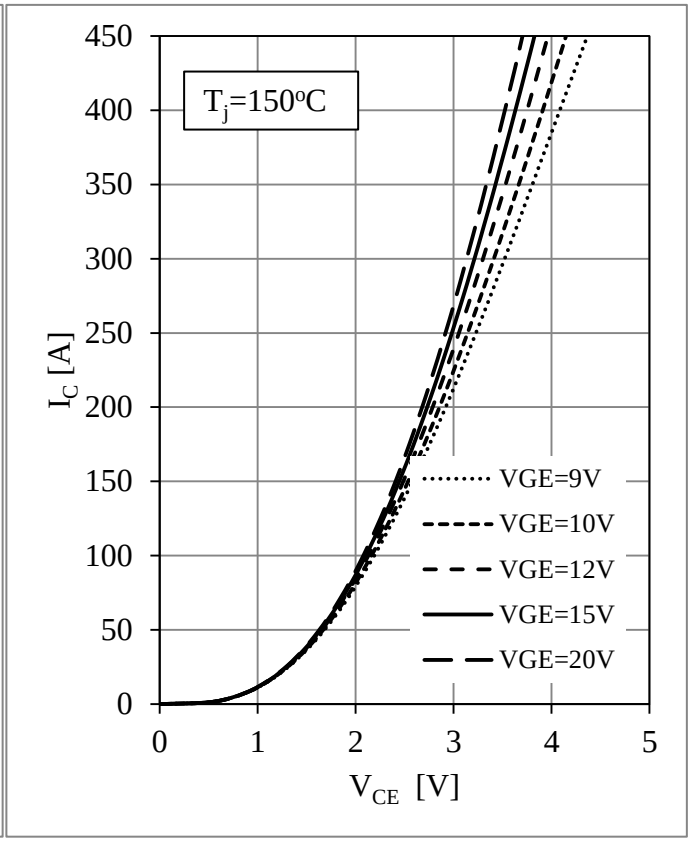


Fig 2. T1/T4 IGBT Output Characteristics

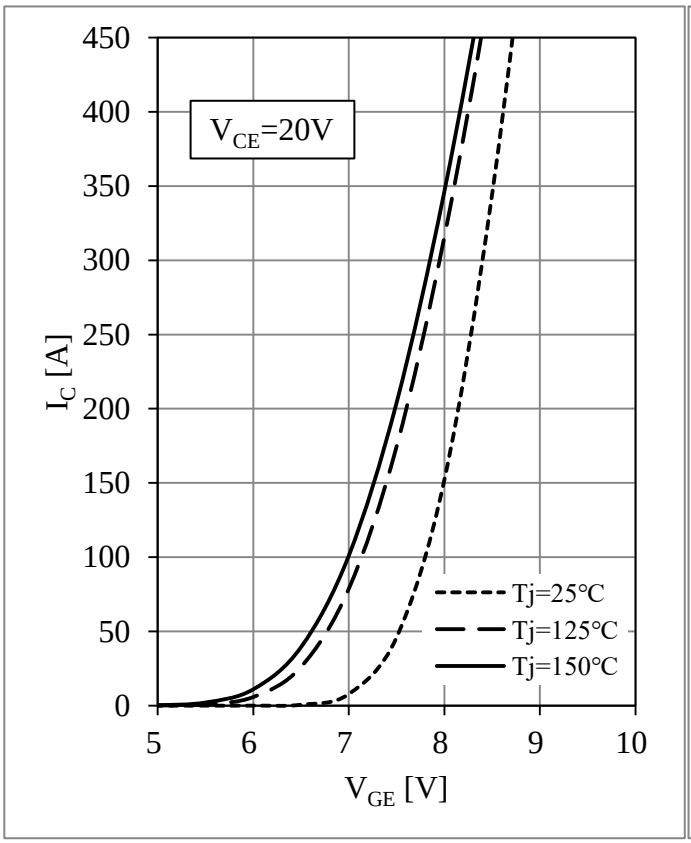


Fig 3. T1/T4 IGBT Transfer Characteristics

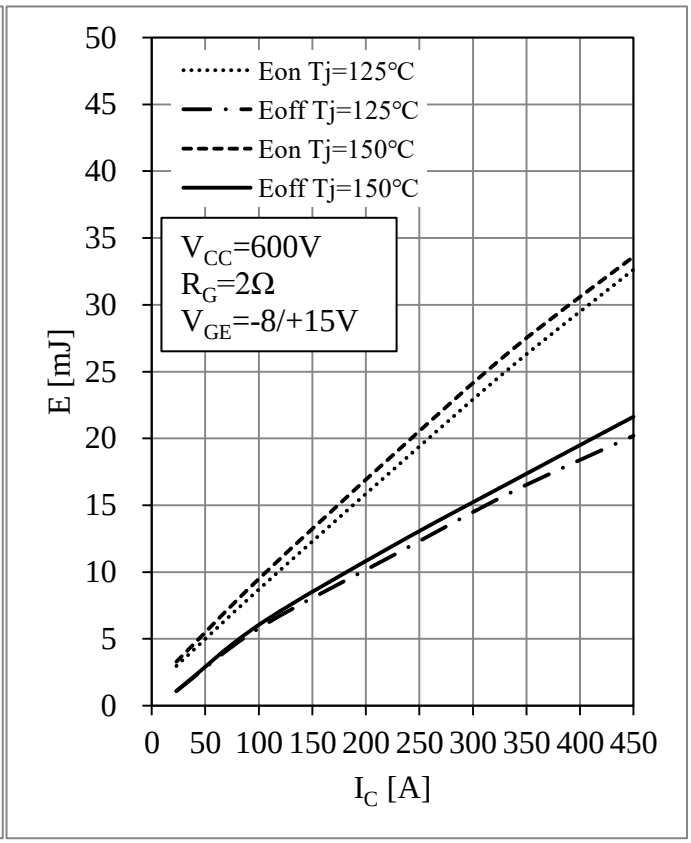


Fig 4. T1/T4 IGBT Switching Loss vs. I_C

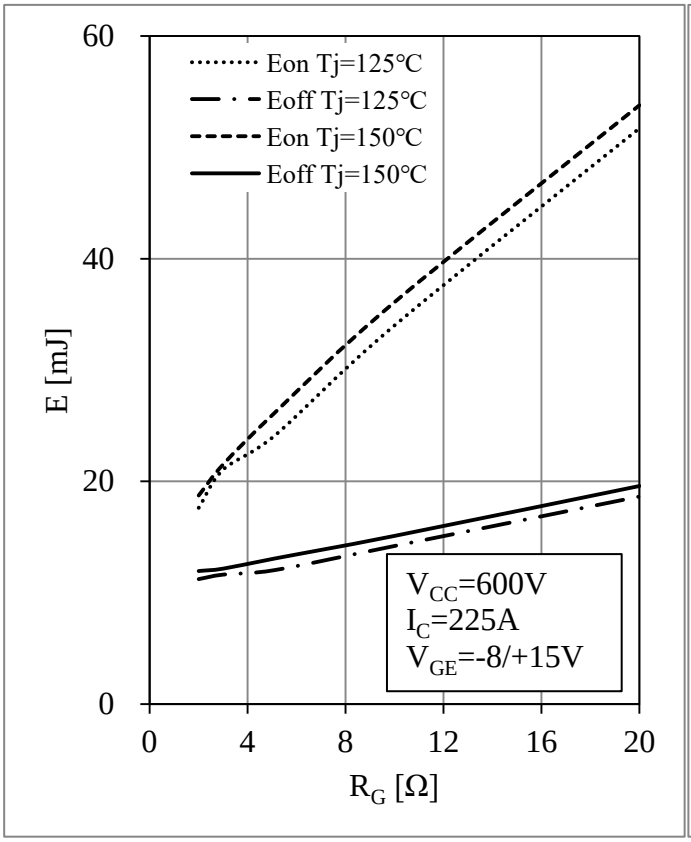


Fig 5. T1/T4 IGBT Switching Loss vs. R_G

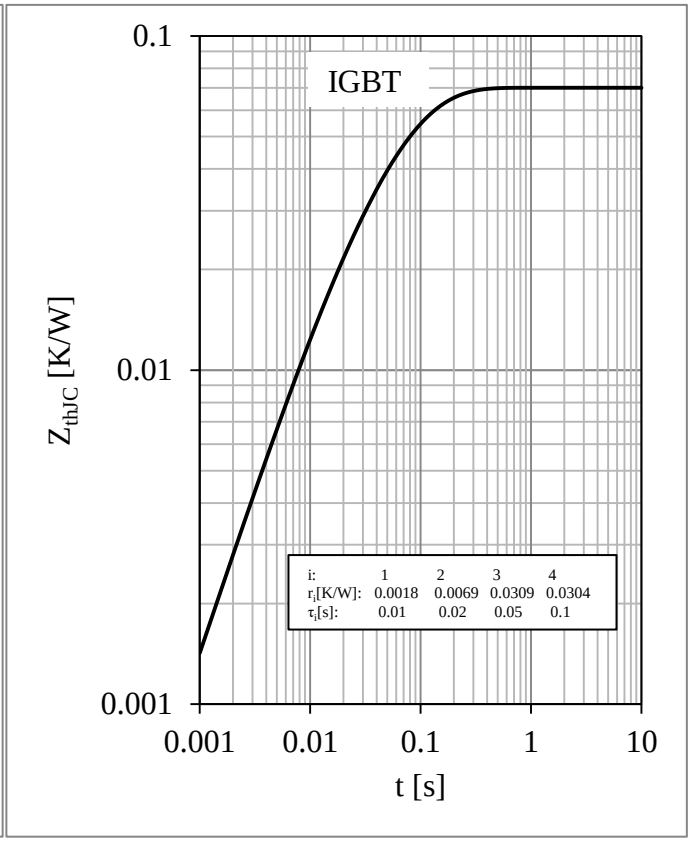


Fig 6. T1/T4 IGBT Transient Thermal Impedance

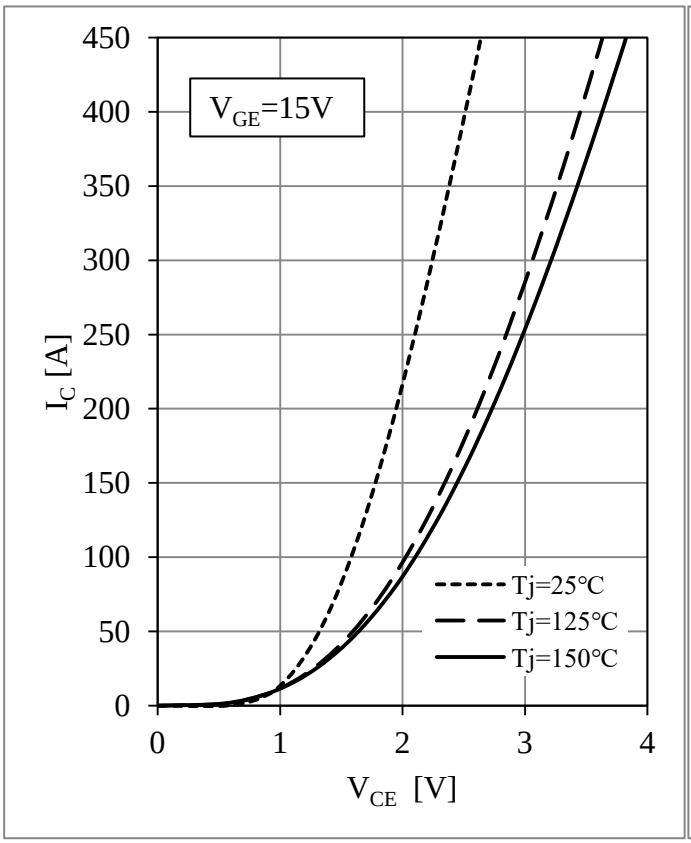


Fig 7. T2/T3 IGBT Output Characteristics

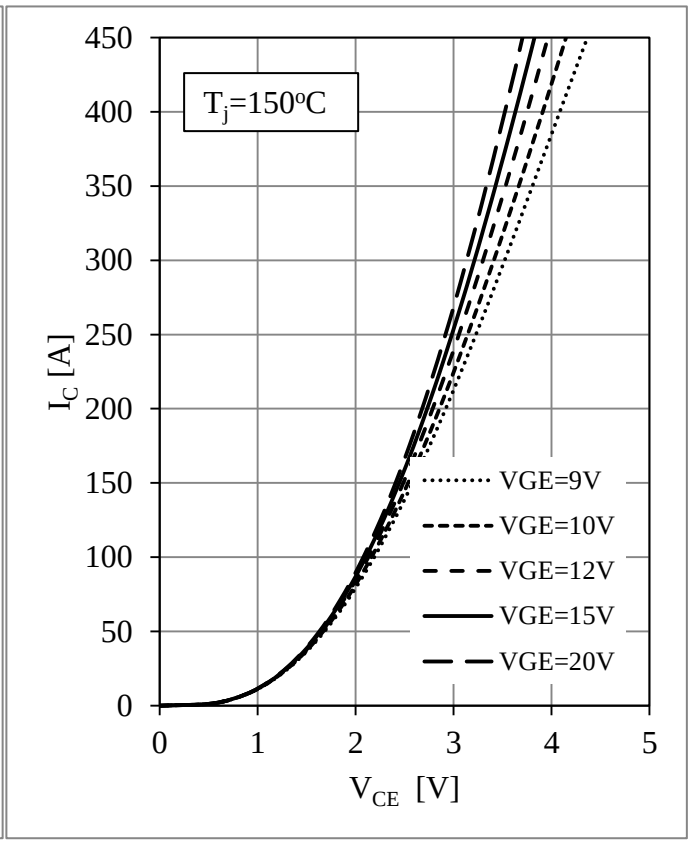


Fig 8. T2/T3 IGBT Output Characteristics

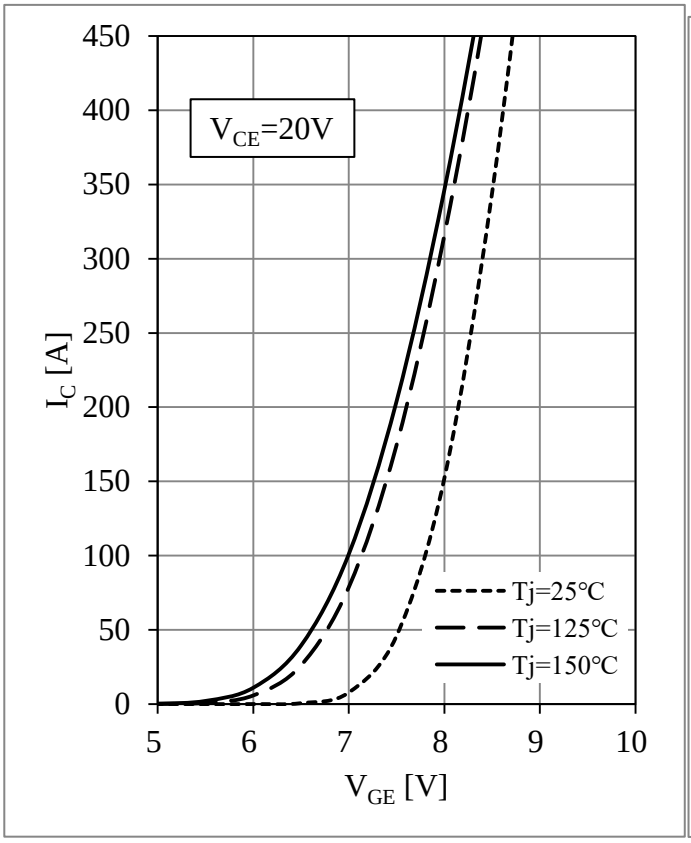


Fig 9. T2/T3 IGBT Transfer Characteristics

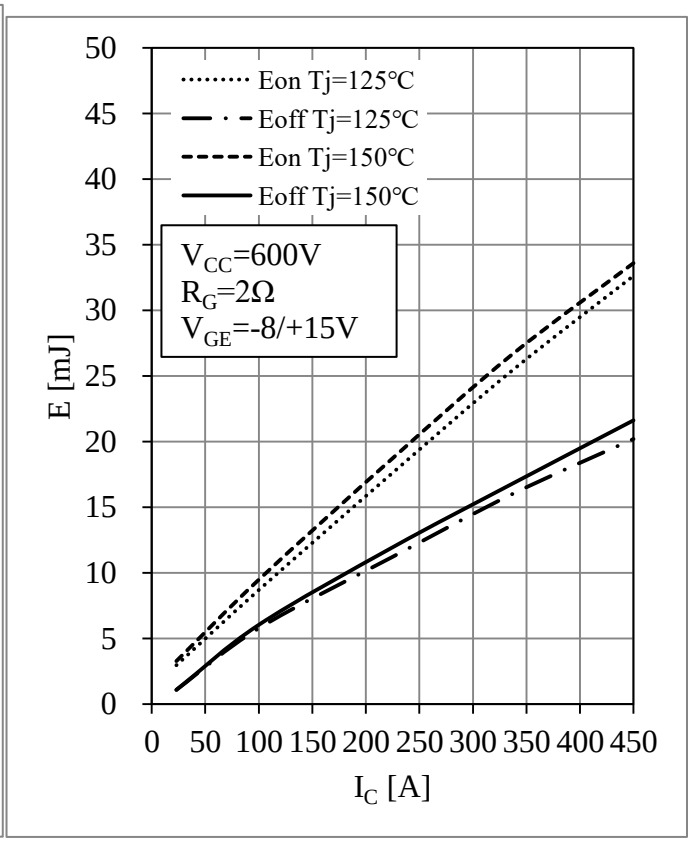


Fig 10. T2/T3 IGBT Switching Loss vs. I_C

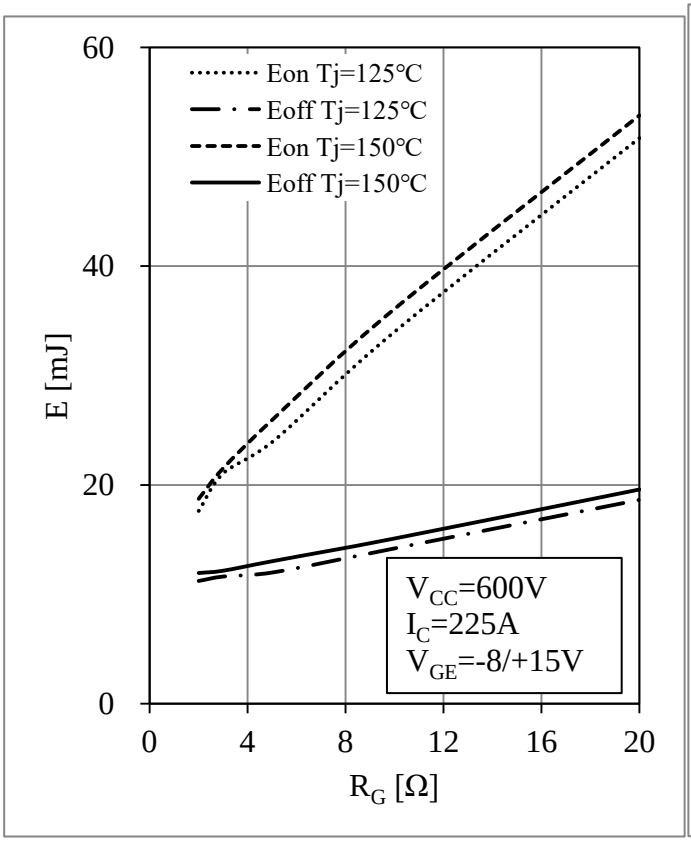


Fig 11. T2/T3 IGBT Switching Loss vs. R_G

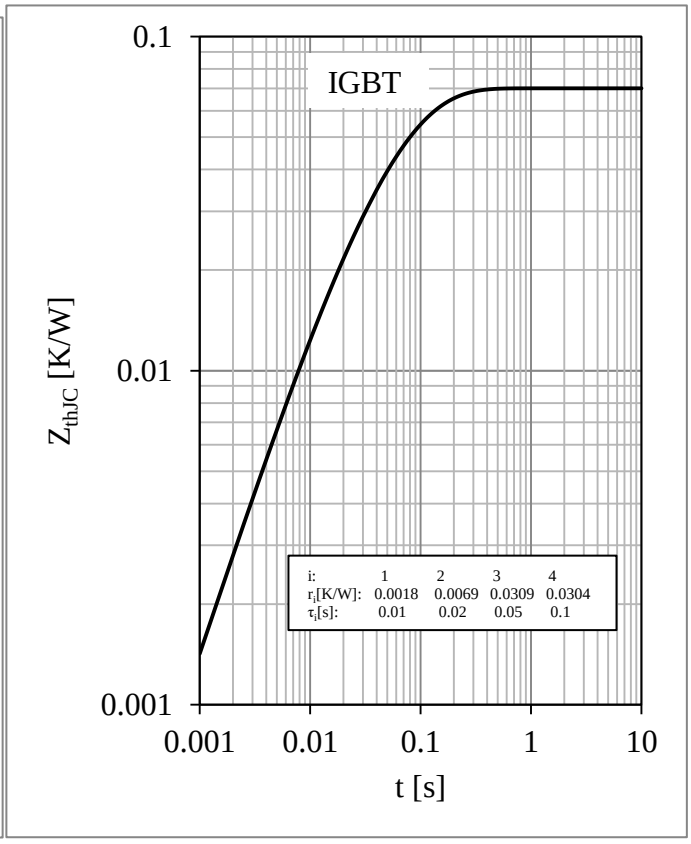


Fig 12. T2/T3 IGBT Transient Thermal Impedance

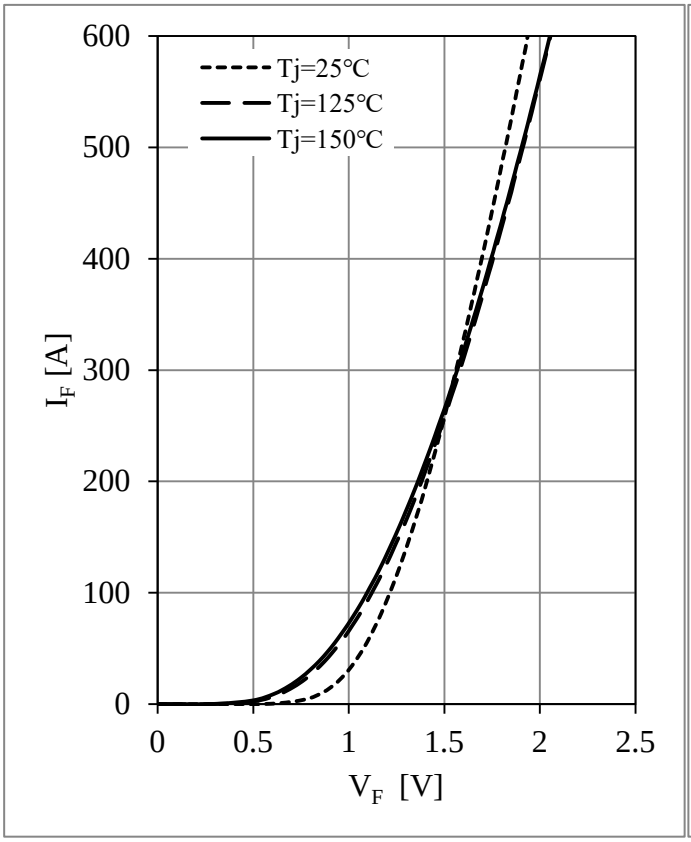


Fig 13. D1/D4 Diode Forward Characteristics

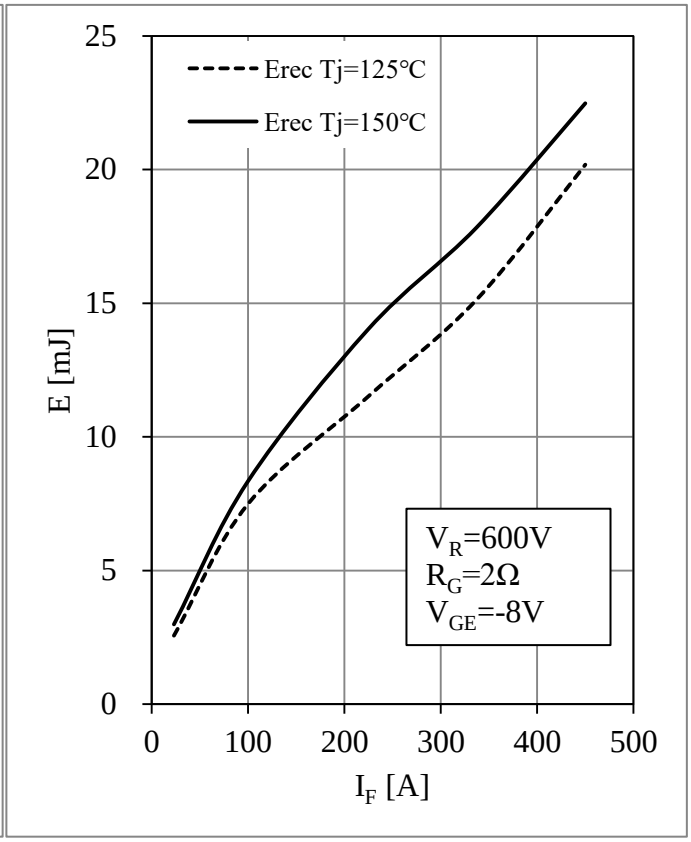


Fig 14. D1/D4 Diode Switching Loss vs. I_F

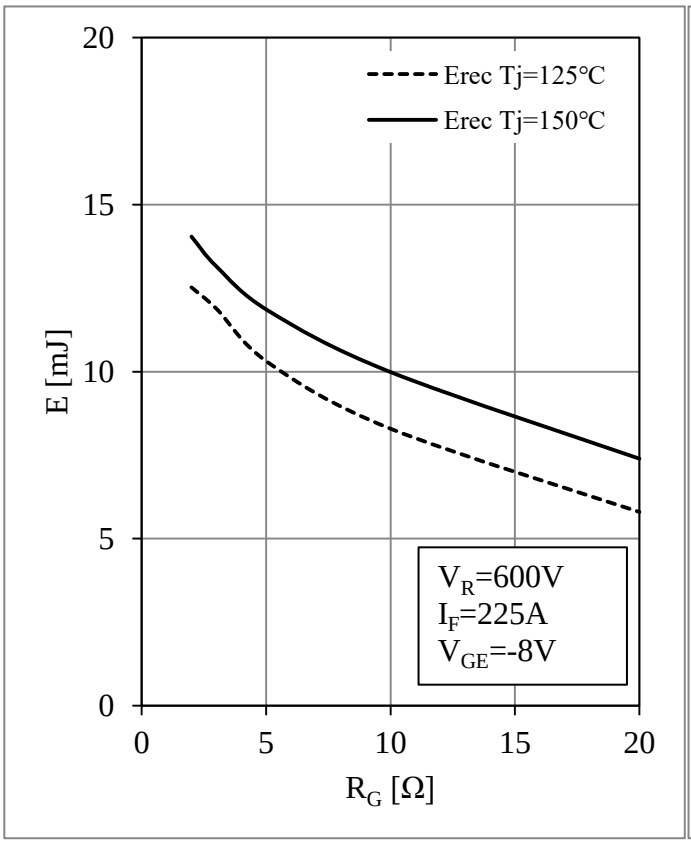


Fig 15. D1/D4 Diode Switching Loss vs. R_G

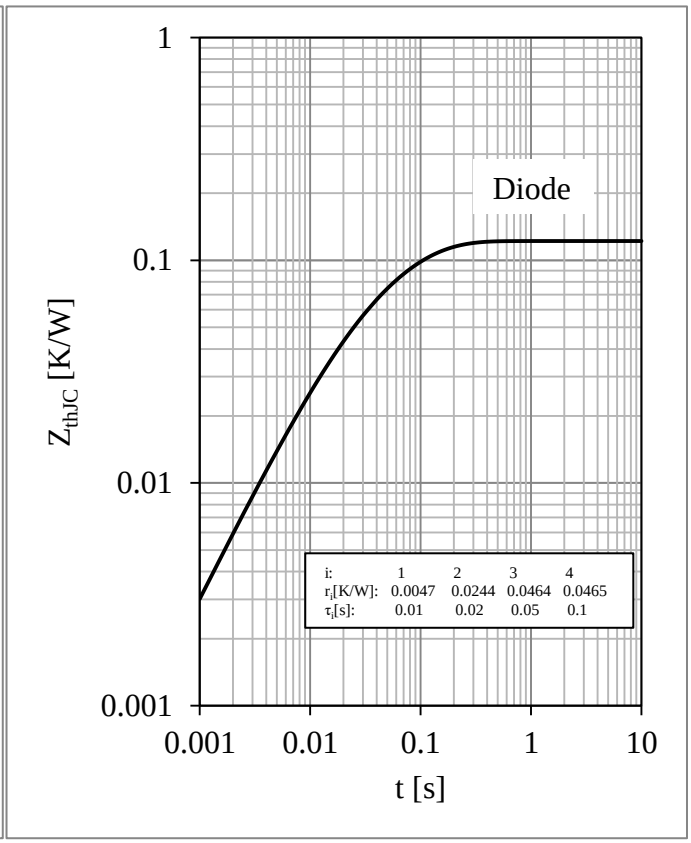


Fig 16. D1/D4 Diode Transient Thermal Impedance

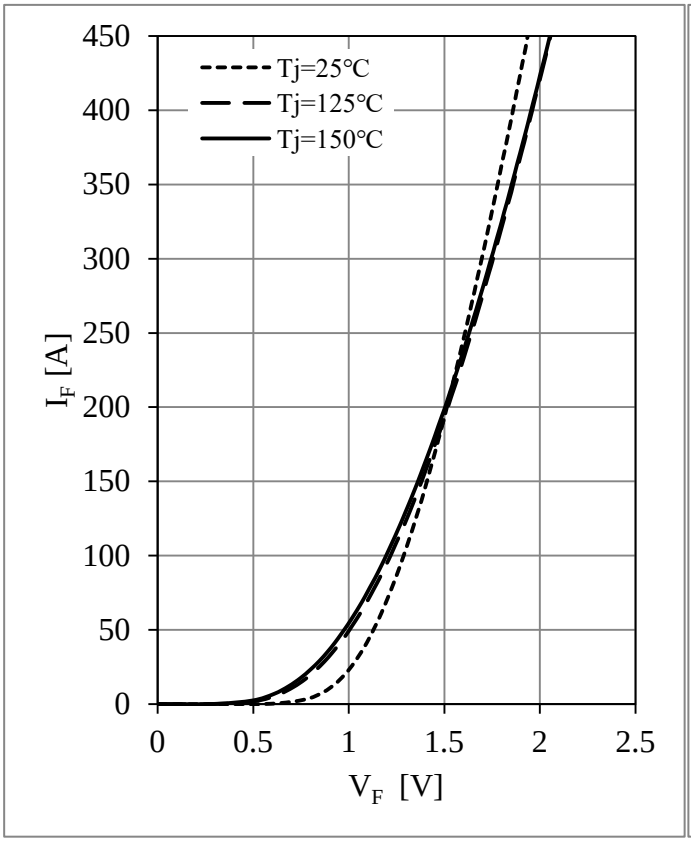


Fig 17. D2/D3 Diode Forward Characteristics

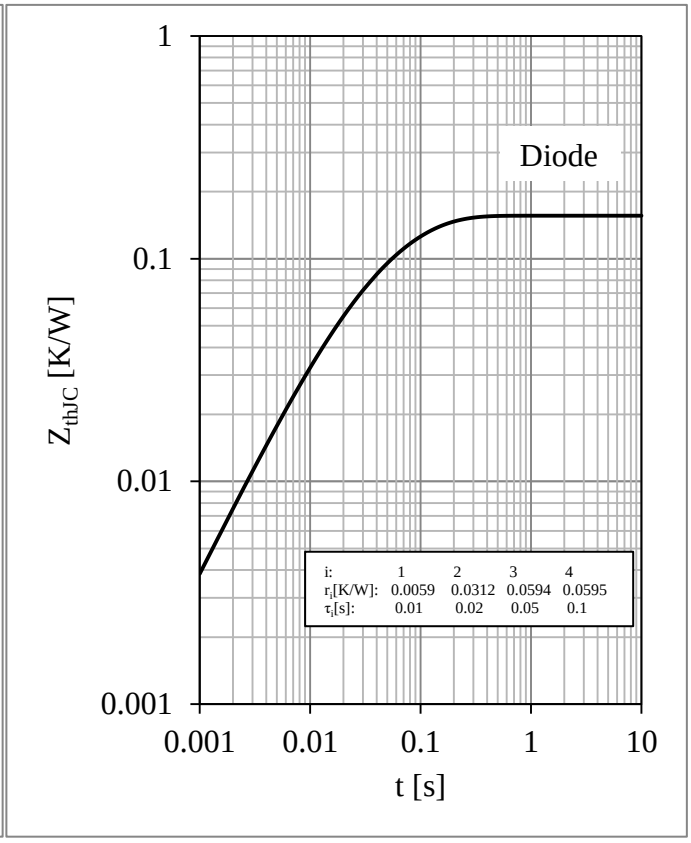


Fig 18. D2/D3 Diode Transient Thermal Impedance

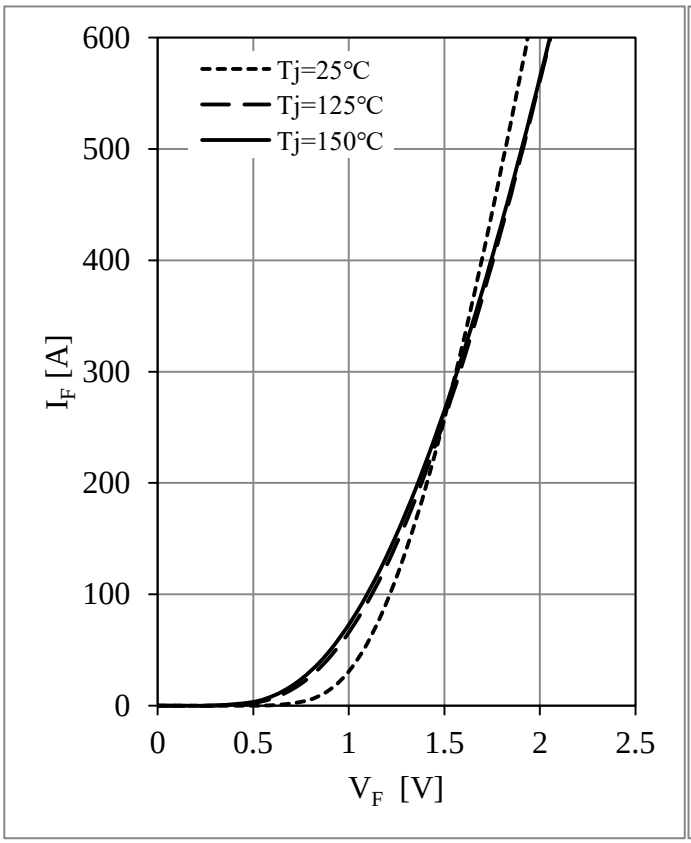


Fig 19. D5/D6 Diode Forward Characteristics

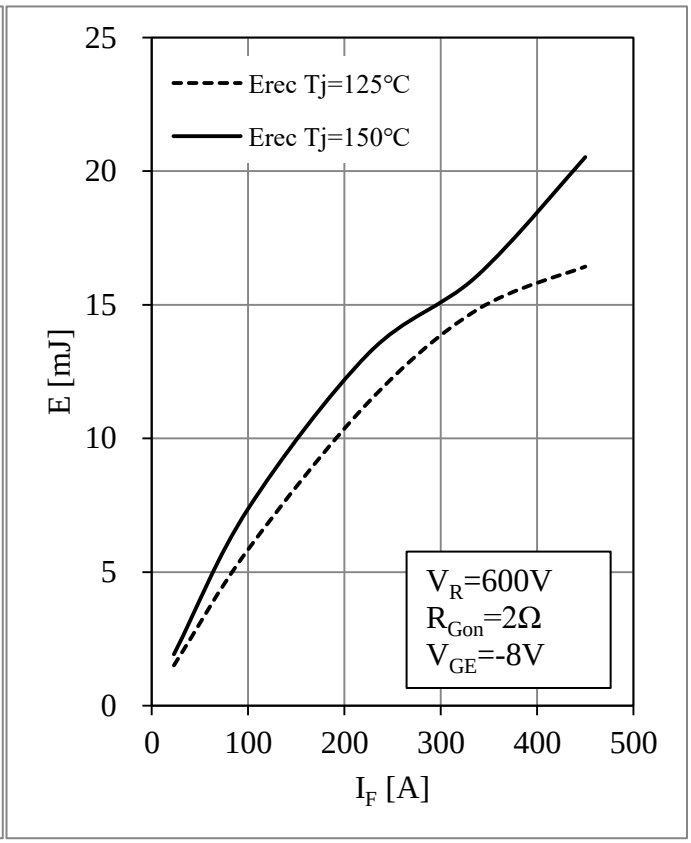


Fig 20. D5/D6 Diode Switching Loss vs. I_F

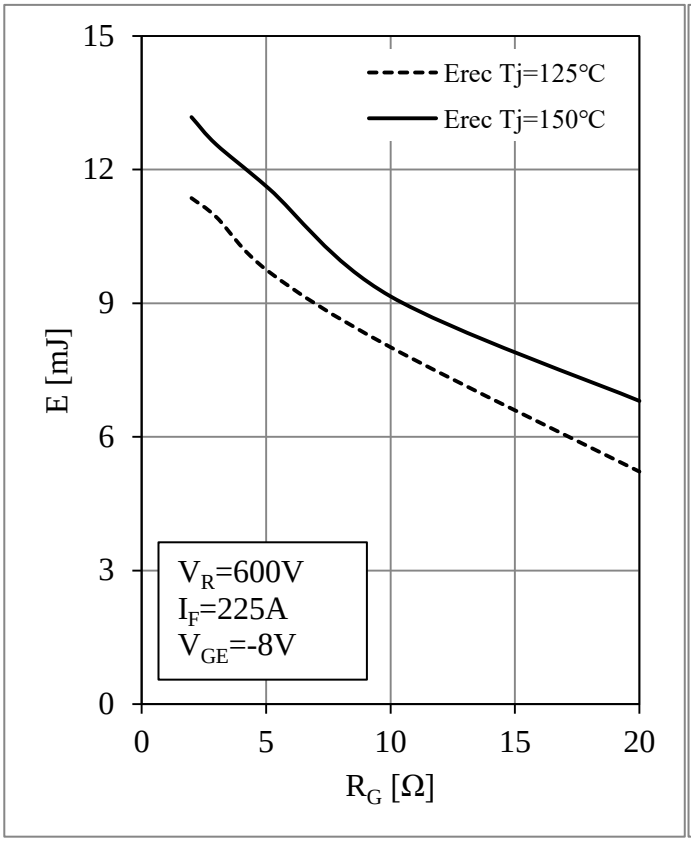


Fig 21. D5/D6 Diode Switching Loss vs. R_G

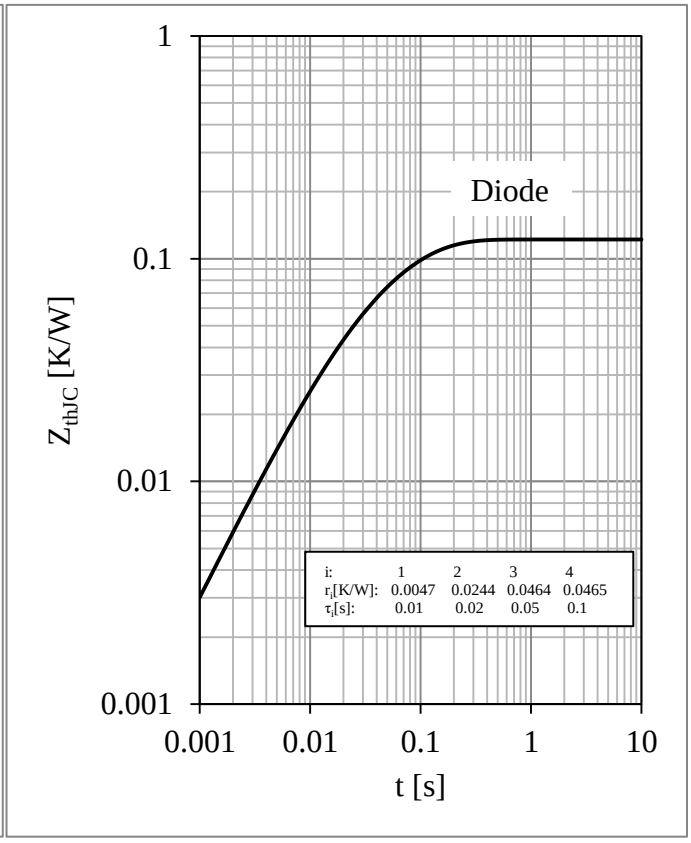


Fig 22. D5/D6 Diode Transient Thermal Impedance

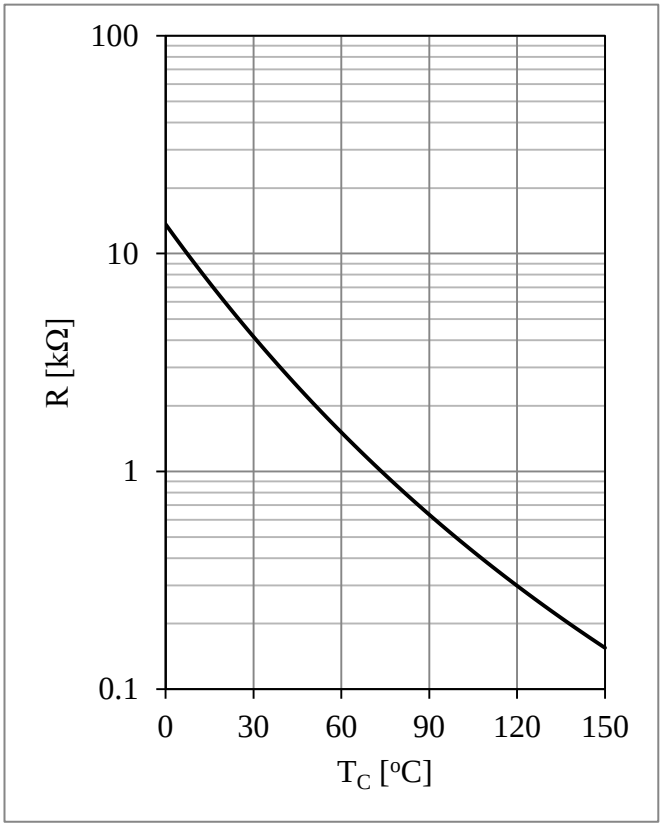
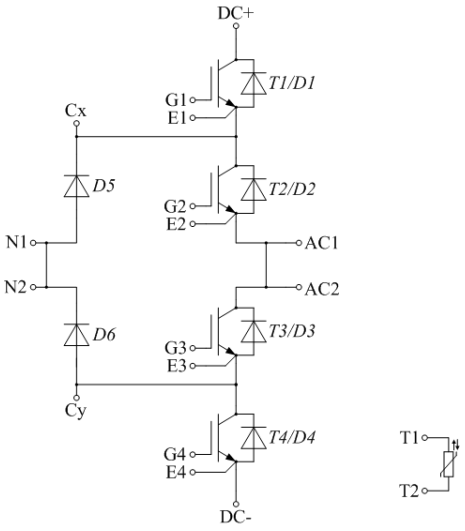


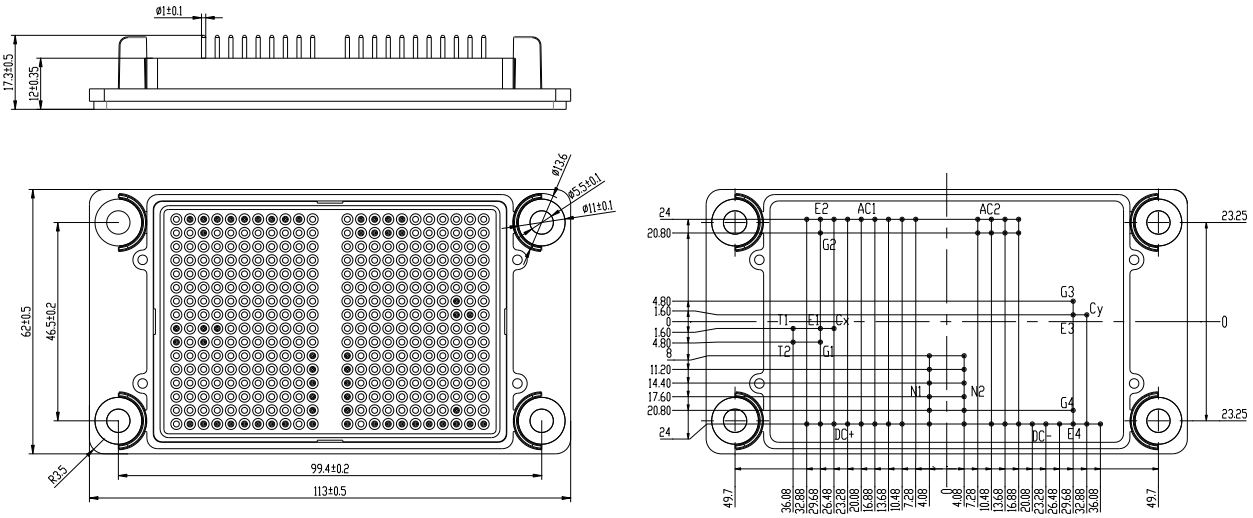
Fig 23. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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