STARPOWER

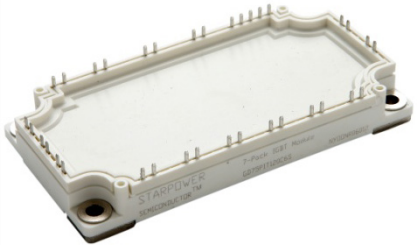
SEMICONDUCTOR **IGBT**

GD100FTY120C6S

1200V/100A 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 UPS.



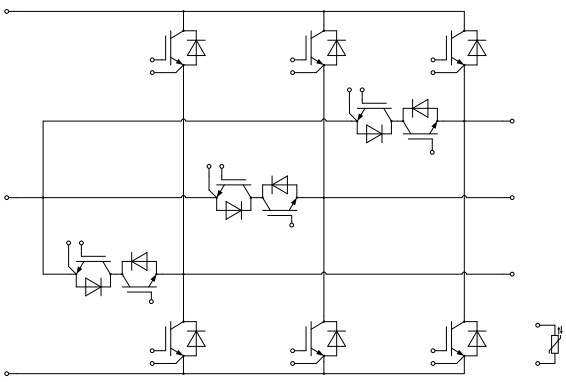
Features

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

Typical Applications

- Inverter for motor drive
- Uninterruptible power supply
- Solar power

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

T1~T6 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=100°C	155 100	A
I_{CM}	Pulsed Collector Current t_p=1ms	200	A
P_D	Maximum Power Dissipation @ T_j=175°C	511	W

D1~D6 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	100	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	200	A

T7~T12 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=75°C	135 100	A
I_{CM}	Pulsed Collector Current t_p=1ms	200	A
P_D	Maximum Power Dissipation @ T_j=175°C	346	W

D7~D12 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~T6 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		1.70	2.15	V
		I_C=100A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=100A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=2.5mA,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			100	nA
R_{Gint}	Internal Gate Resistance			7.5		Ω
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=100A, R_G=1.6Ω,V_{GE}=±15V, T_j=25°C		170		ns
t_r	Rise Time			32		ns
$t_{d(off)}$	Turn-Off Delay Time			360		ns
t_f	Fall Time			86		ns
E_{on}	Turn-On Switching Loss			5.90		mJ
E_{off}	Turn-Off Switching Loss			6.05		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=100A, R_G=1.6Ω,V_{GE}=±15V, T_j=125°C		180		ns
t_r	Rise Time			42		ns
$t_{d(off)}$	Turn-Off Delay Time			470		ns
t_f	Fall Time			165		ns
E_{on}	Turn-On Switching Loss			9.10		mJ
E_{off}	Turn-Off Switching Loss			9.35		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=100A, R_G=1.6Ω,V_{GE}=±15V, T_j=150°C		181		ns
t_r	Rise Time			43		ns
$t_{d(off)}$	Turn-Off Delay Time			480		ns
t_f	Fall Time			186		ns
E_{on}	Turn-On Switching Loss			10.0		mJ
E_{off}	Turn-Off Switching Loss			10.5		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		400		A

D1~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=100A,V_{GE}=0V,T_j=25°C		1.70	2.15	V
		I_F=100A,V_{GE}=0V,T_j=125°C		1.65		
		I_F=100A,V_{GE}=0V,T_j=150°C		1.65		
Q_r	Recovered Charge	V_R=600V,I_F=100A, -di/dt=2800A/μs,V_{GE}=-15V T_j=25°C		9.0		μC
I_{RM}	Peak Reverse Recovery Current			110		A
E_{rec}	Reverse Recovery Energy			3.32		mJ
Q_r	Recovered Charge	V_R=600V,I_F=100A, -di/dt=2800A/μs,V_{GE}=-15V T_j=125°C		16.2		μC
I_{RM}	Peak Reverse Recovery Current			120		A
E_{rec}	Reverse Recovery Energy			5.70		mJ
Q_r	Recovered Charge	V_R=600V,I_F=100A, -di/dt=2800A/μs,V_{GE}=-15V T_j=150°C		19.5		μC
I_{RM}	Peak Reverse Recovery Current			123		A
E_{rec}	Reverse Recovery Energy			7.13		mJ

T7~T12 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=1.6mA,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			2.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		6.16		nF
C_{res}	Reverse Transfer Capacitance			0.18		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		1.10		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=100A, R_G=3.3Ω,V_{GE}=±15V, T_j=25°C		51		ns
t_r	Rise Time			25		ns
$t_{d(off)}$	Turn-Off Delay Time			240		ns
t_f	Fall Time			48		ns
E_{on}	Turn-On Switching Loss			0.54		mJ
E_{off}	Turn-Off Switching Loss			2.52		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=100A, R_G=3.3Ω,V_{GE}=±15V, T_j=125°C		60		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			258		ns
t_f	Fall Time			65		ns
E_{on}	Turn-On Switching Loss			0.86		mJ
E_{off}	Turn-Off Switching Loss			3.34		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=100A, R_G=3.3Ω,V_{GE}=±15V, T_j=150°C		64		ns
t_r	Rise Time			31		ns
$t_{d(off)}$	Turn-Off Delay Time			269		ns
t_f	Fall Time			76		ns
E_{on}	Turn-On Switching Loss			0.95		mJ
E_{off}	Turn-Off Switching Loss			3.50		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤650V		500		A

D7~D12 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_j=25°C		1.55	1.95	V
		I_F=100A,V_{GE}=0V,T_j=125°C		1.50		
		I_F=100A,V_{GE}=0V,T_j=150°C		1.45		
Q_r	Recovered Charge	V_R=300V,I_F=100A, -di/dt=3200A/μs,V_{GE}=-15V T_j=25°C		4.1		μC
I_{RM}	Peak Reverse Recovery Current			91		A
E_{rec}	Reverse Recovery Energy			1.22		mJ
Q_r	Recovered Charge	V_R=300V,I_F=100A, -di/dt=3200A/μs,V_{GE}=-15V T_j=125°C		7.9		μC
I_{RM}	Peak Reverse Recovery Current			110		A
E_{rec}	Reverse Recovery Energy			2.16		mJ
Q_r	Recovered Charge	V_R=300V,I_F=100A, -di/dt=3200A/μs,V_{GE}=-15V T_j=150°C		9.0		μC
I_{RM}	Peak Reverse Recovery Current			116		A
E_{rec}	Reverse Recovery Energy			2.40		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~T6 IGBT) Junction-to-Case (per D1~D6 Diode) Junction-to-Case (per T7~T12 IGBT) Junction-to-Case (per D7~D12 Diode)			0.293 0.505 0.433 0.714	K/W
R_{thCH}	Case-to-Heatsink (per T1~T6 IGBT) Case-to-Heatsink (per D1~D6 Diode) Case-to-Heatsink (per T7~T12 IGBT) Case-to-Heatsink (per D7~D12 Diode) Case-to-Heatsink (per Module)		0.144 0.248 0.213 0.351 0.009		K/W
M	Mounting Torque, Screw M5	3.0		6.0	N.m
G	Weight of Module		300		g

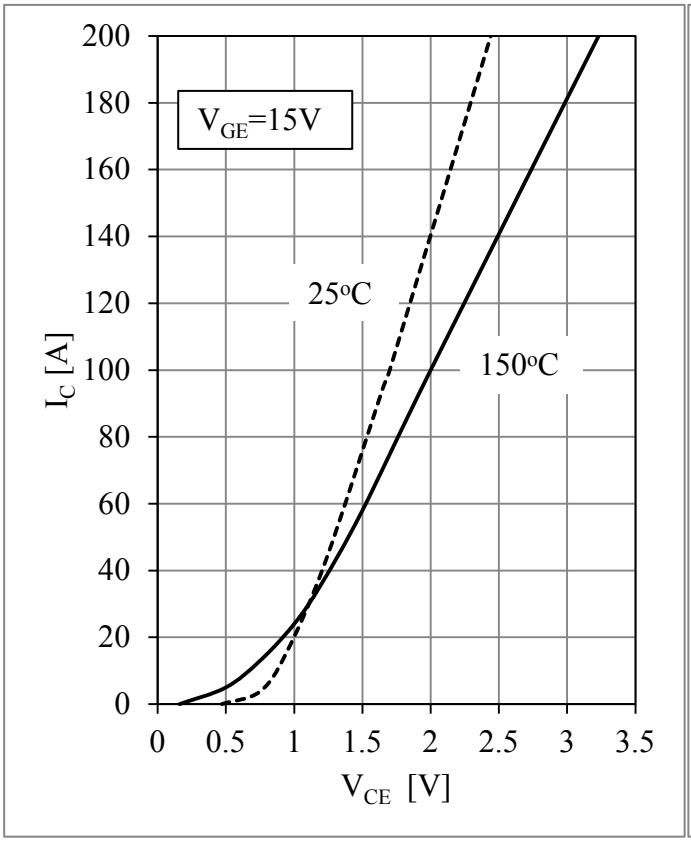


Fig 1. T1~T6 IGBT Output Characteristics

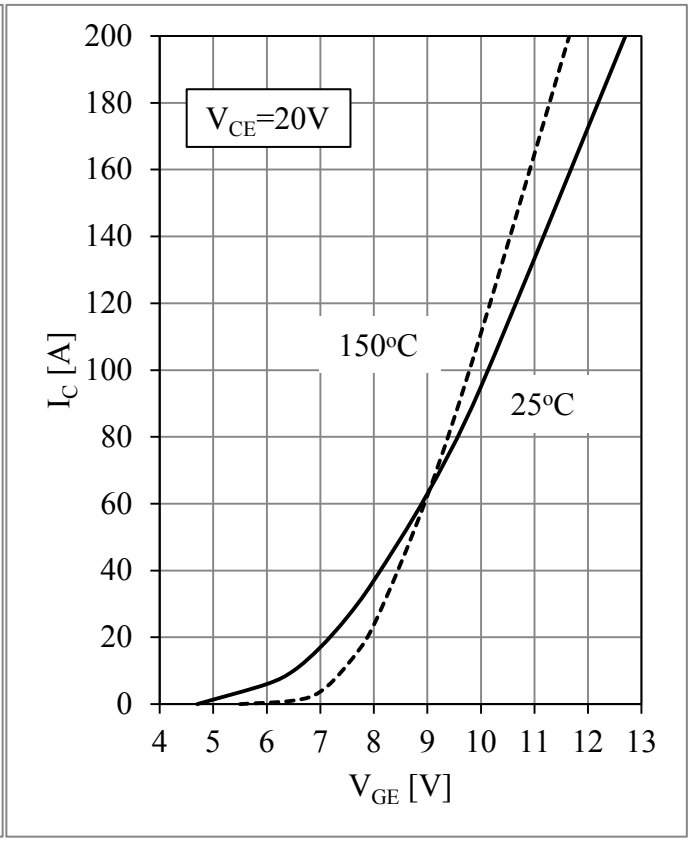


Fig 2. T1~T6 IGBT Transfer Characteristics

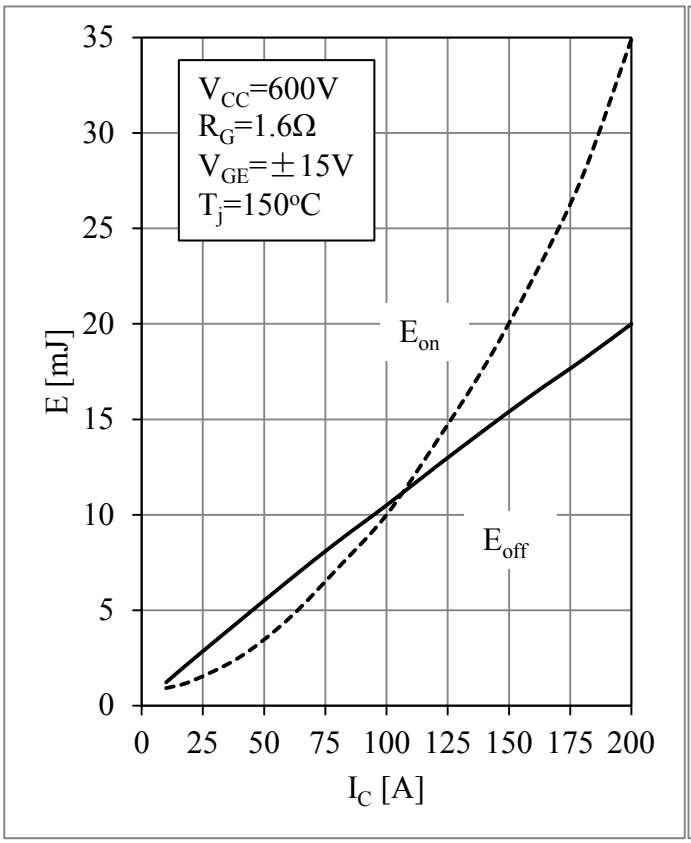


Fig 3. T1~T6 IGBT Switching Loss vs. I_C

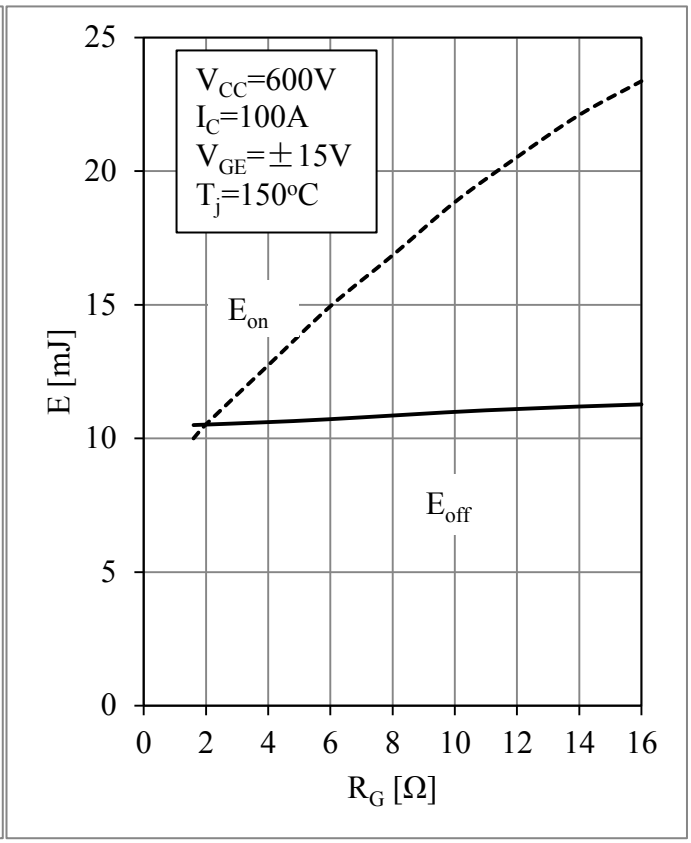


Fig 4. T1~T6 IGBT Switching Loss vs. R_G

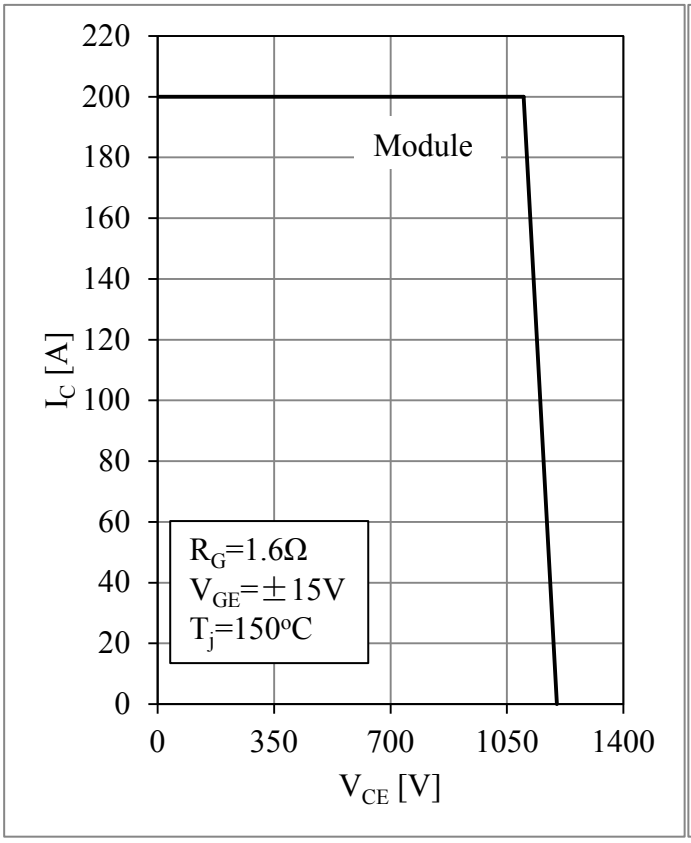


Fig 5. T1~T6 RBSOA

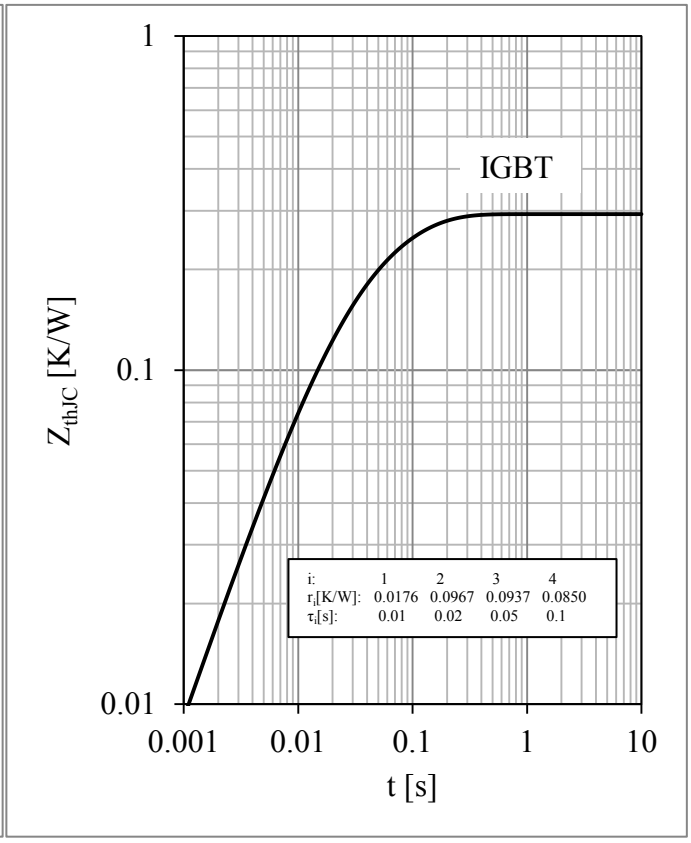


Fig 6. T1~T6 IGBT Transient Thermal Impedance

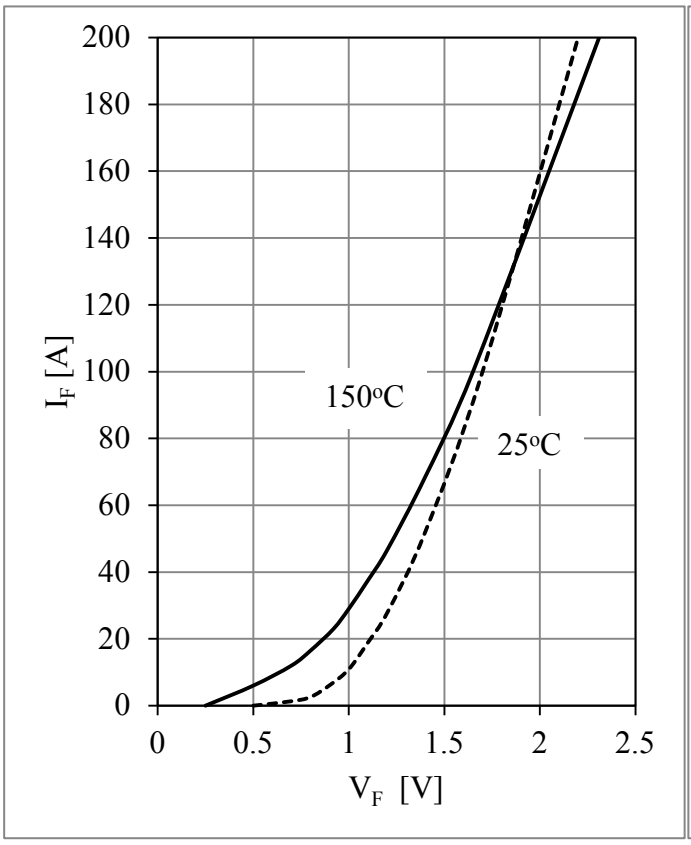


Fig 7. D1~D6 Diode Forward Characteristics

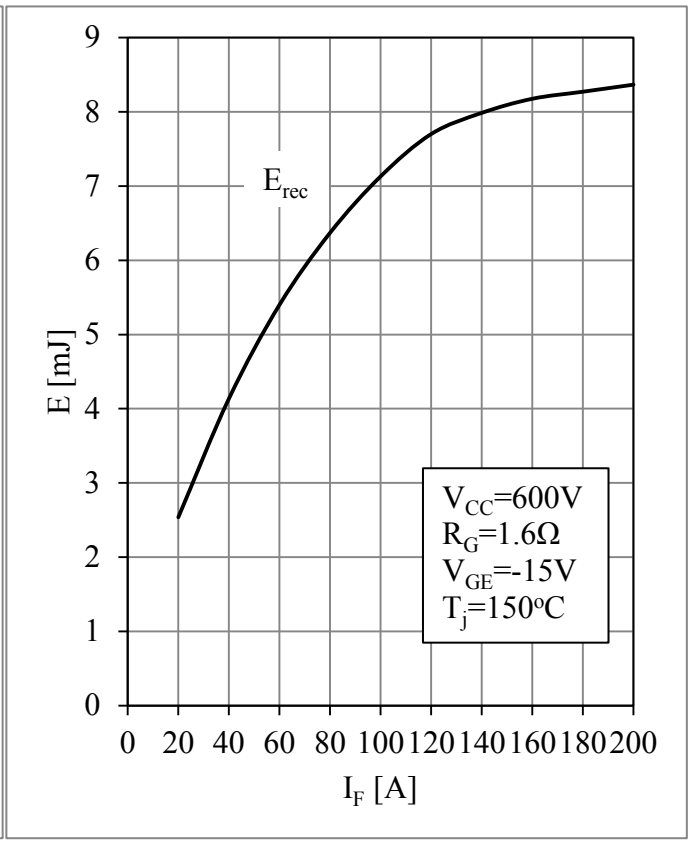


Fig 8. D1~D6 Diode Switching Loss vs. I_F

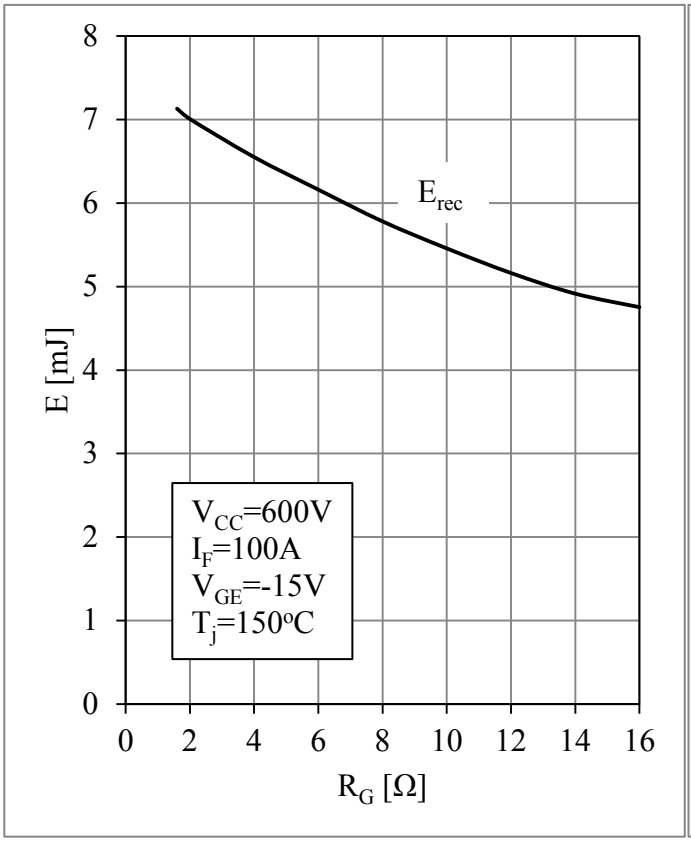


Fig 9. D1~D6 Diode Switching Loss vs. R_G

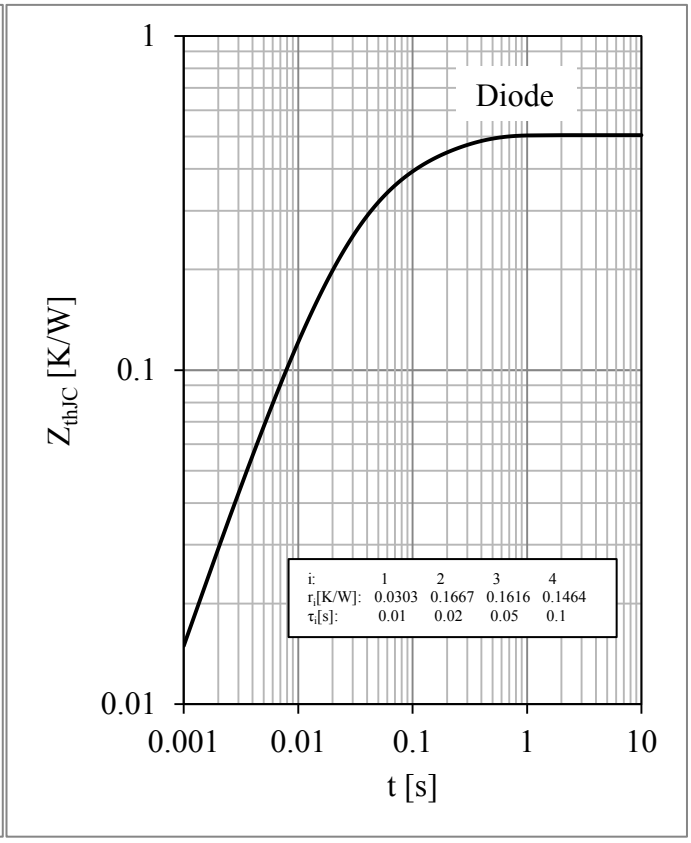


Fig 10. D1~D6 Diode Transient Thermal Impedance

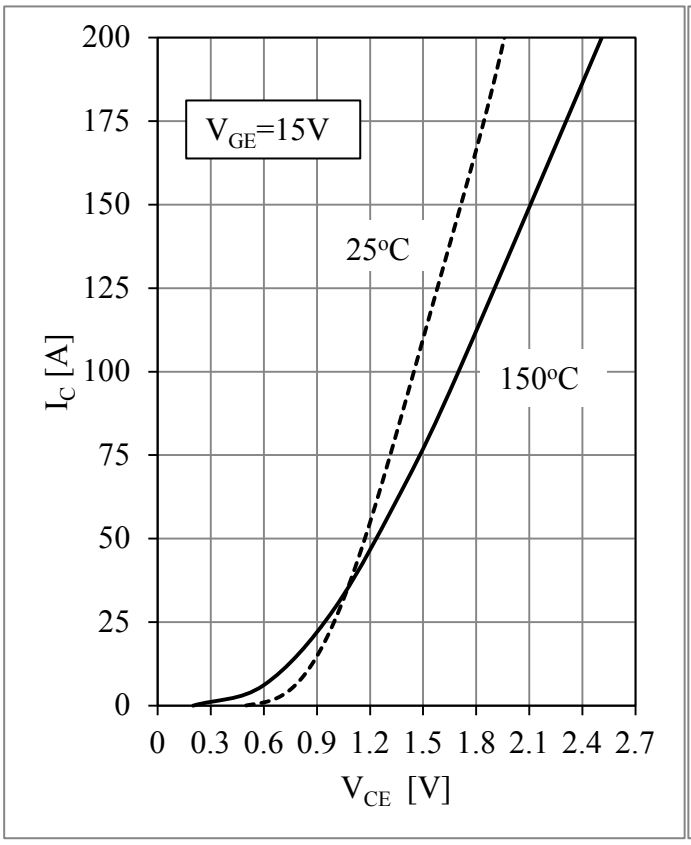


Fig 11. T7~T12 IGBT Output Characteristics

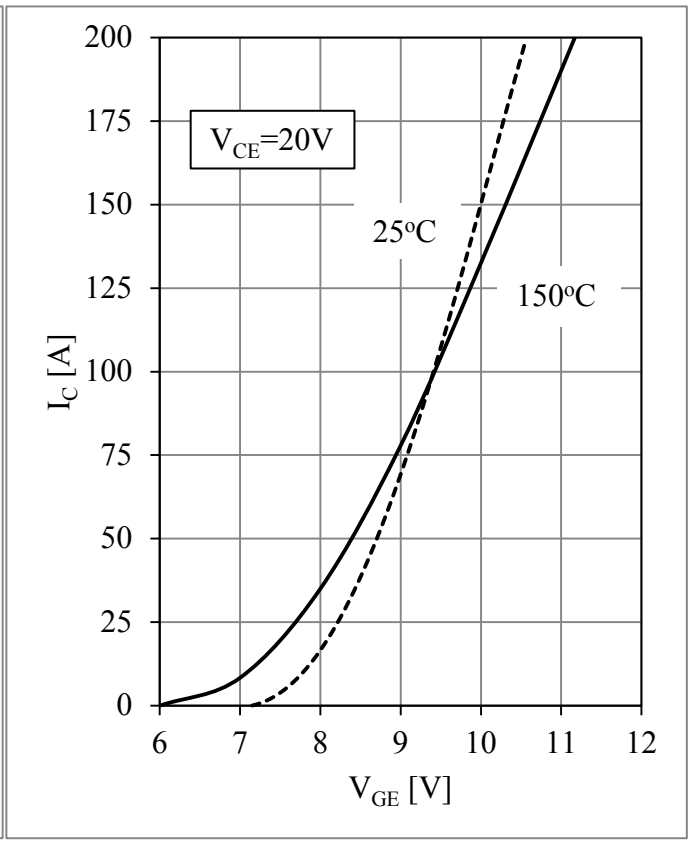


Fig 12. T7~T12 IGBT Transfer Characteristics

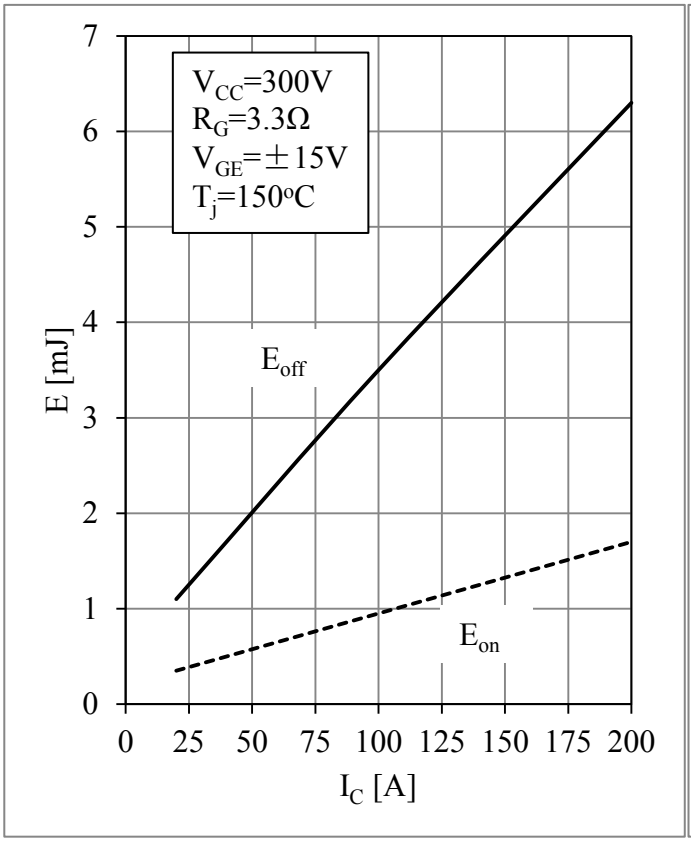


Fig 13. T7~T12 IGBT Switching Loss vs. I_C

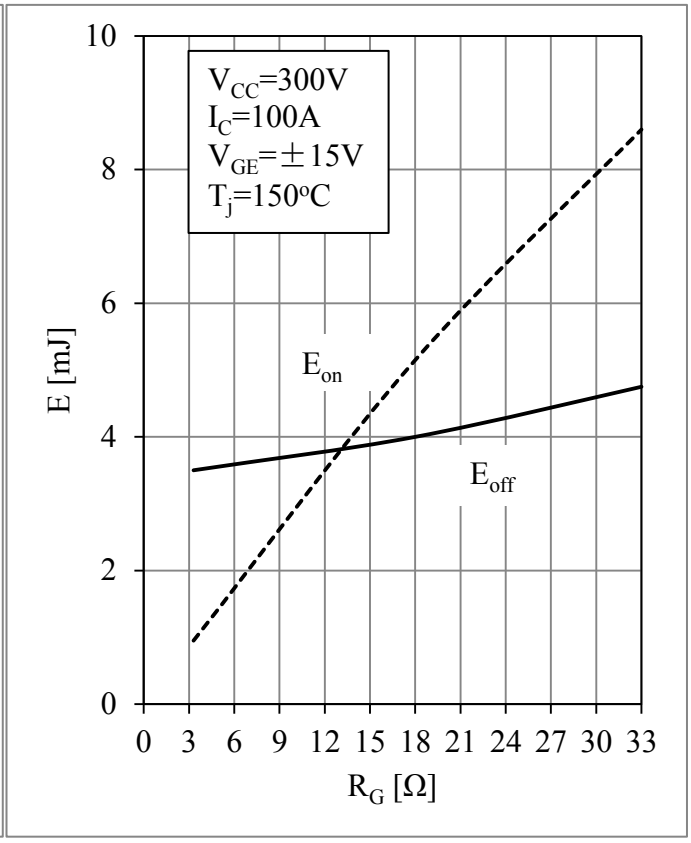


Fig 14. T7~T12 IGBT Switching Loss vs. R_G

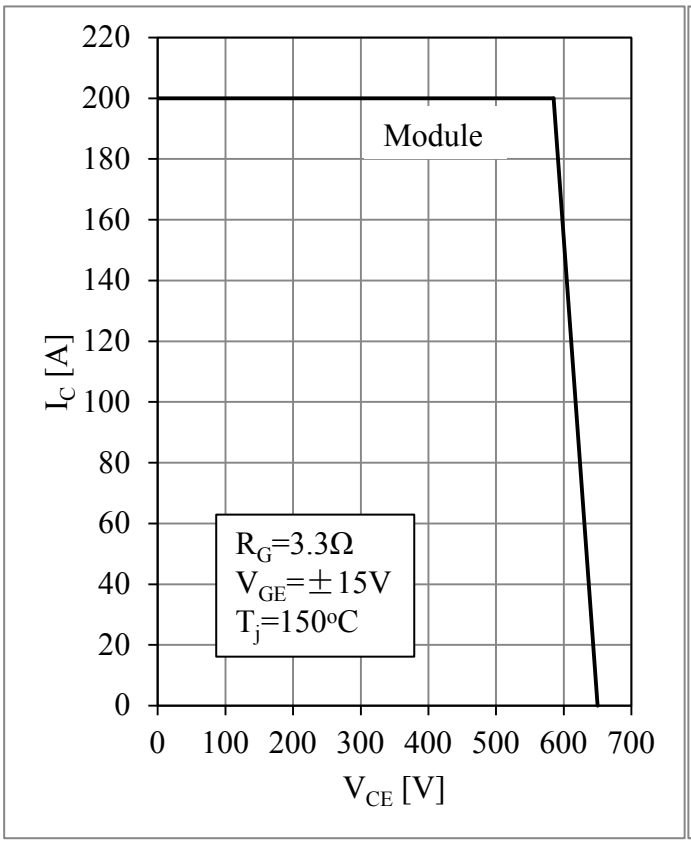


Fig 15. T7~T12 RBSOA

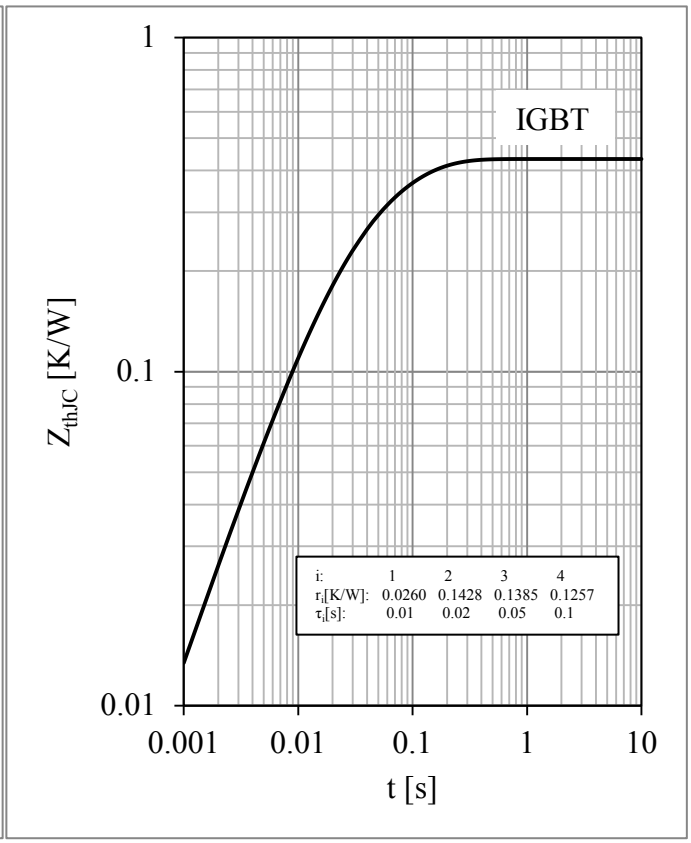


Fig 16. T7~T12 IGBT Transient Thermal Impedance

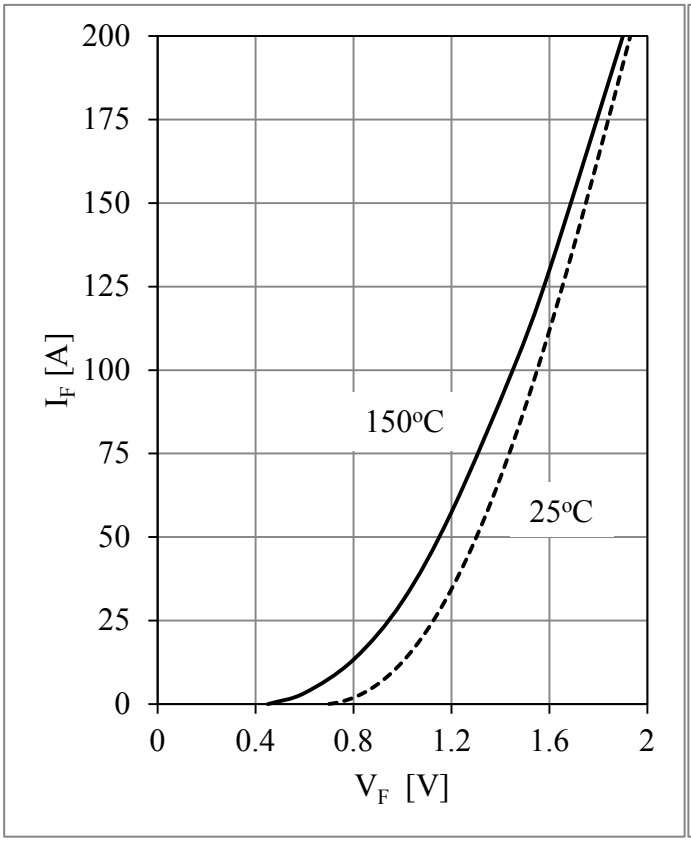


Fig 17. D7~D12 Diode Forward Characteristics

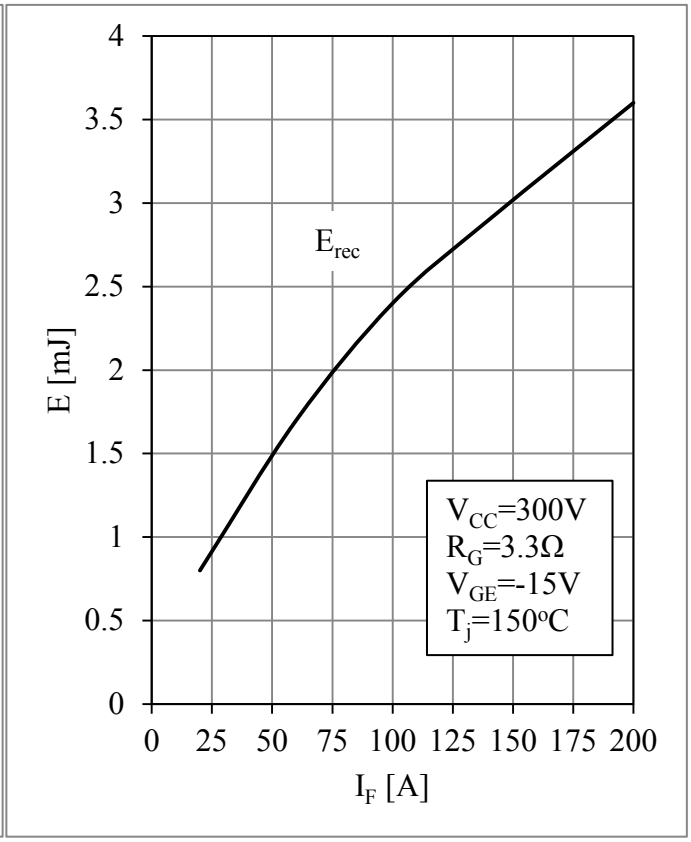


Fig 18. D7~D12 Diode Switching Loss vs. I_F

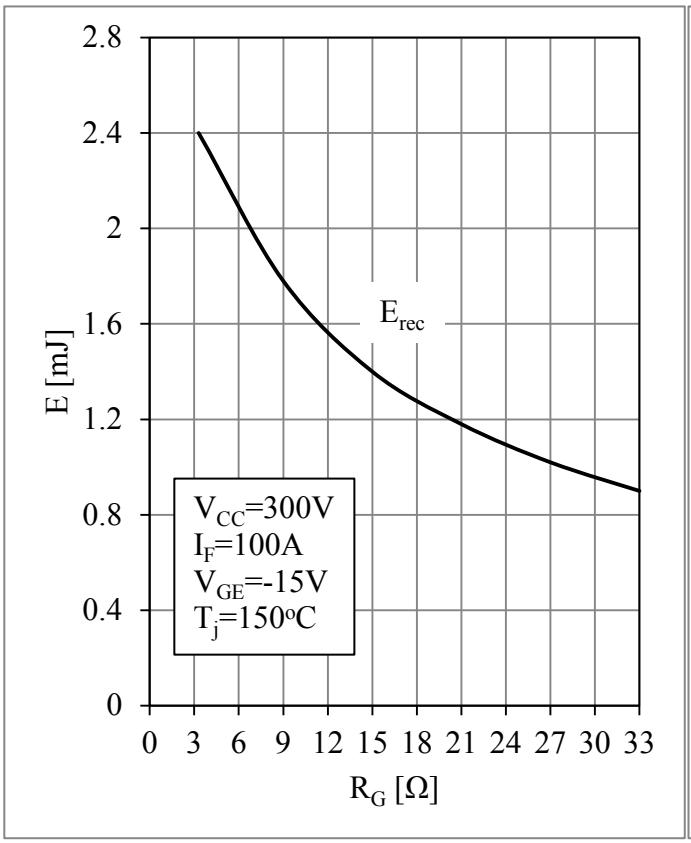


Fig 19. D7~D12 Diode Switching Loss vs. R_G

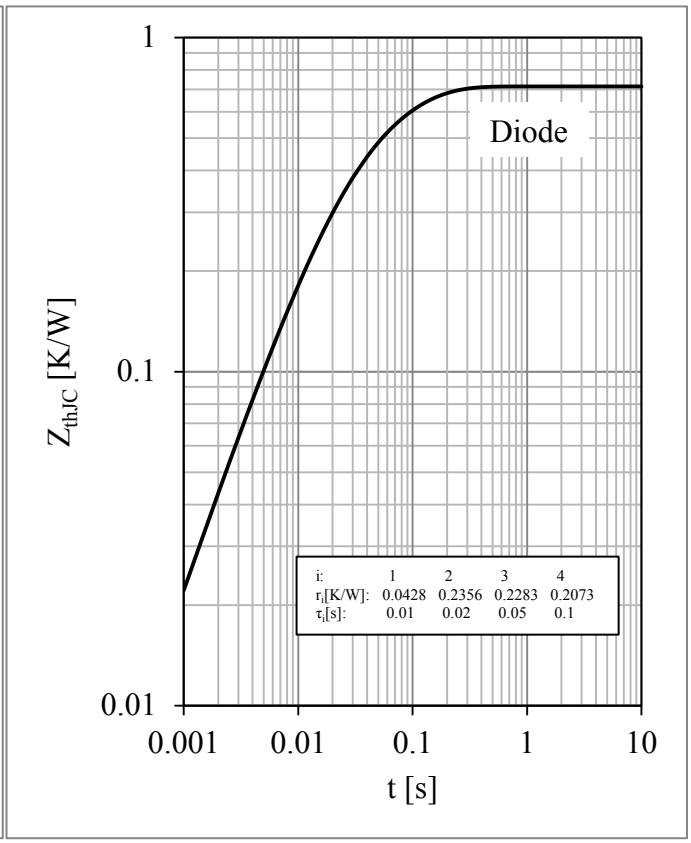


Fig 20. D7~D12 Diode Transient Thermal Impedance

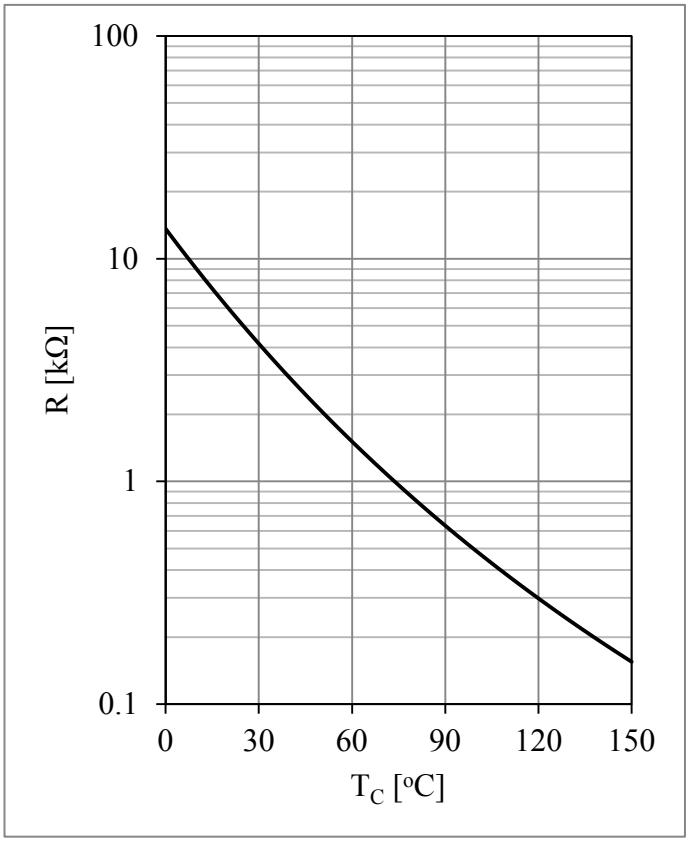
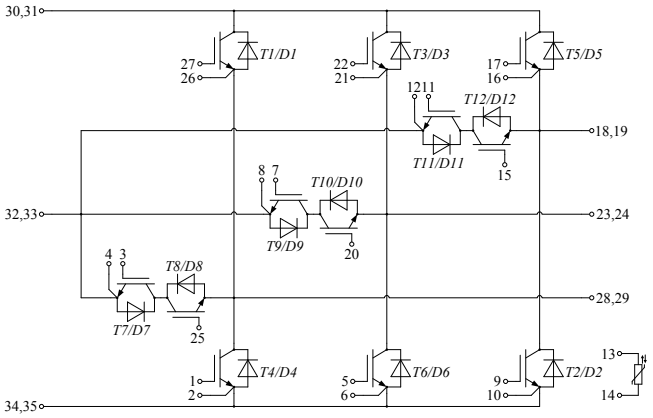


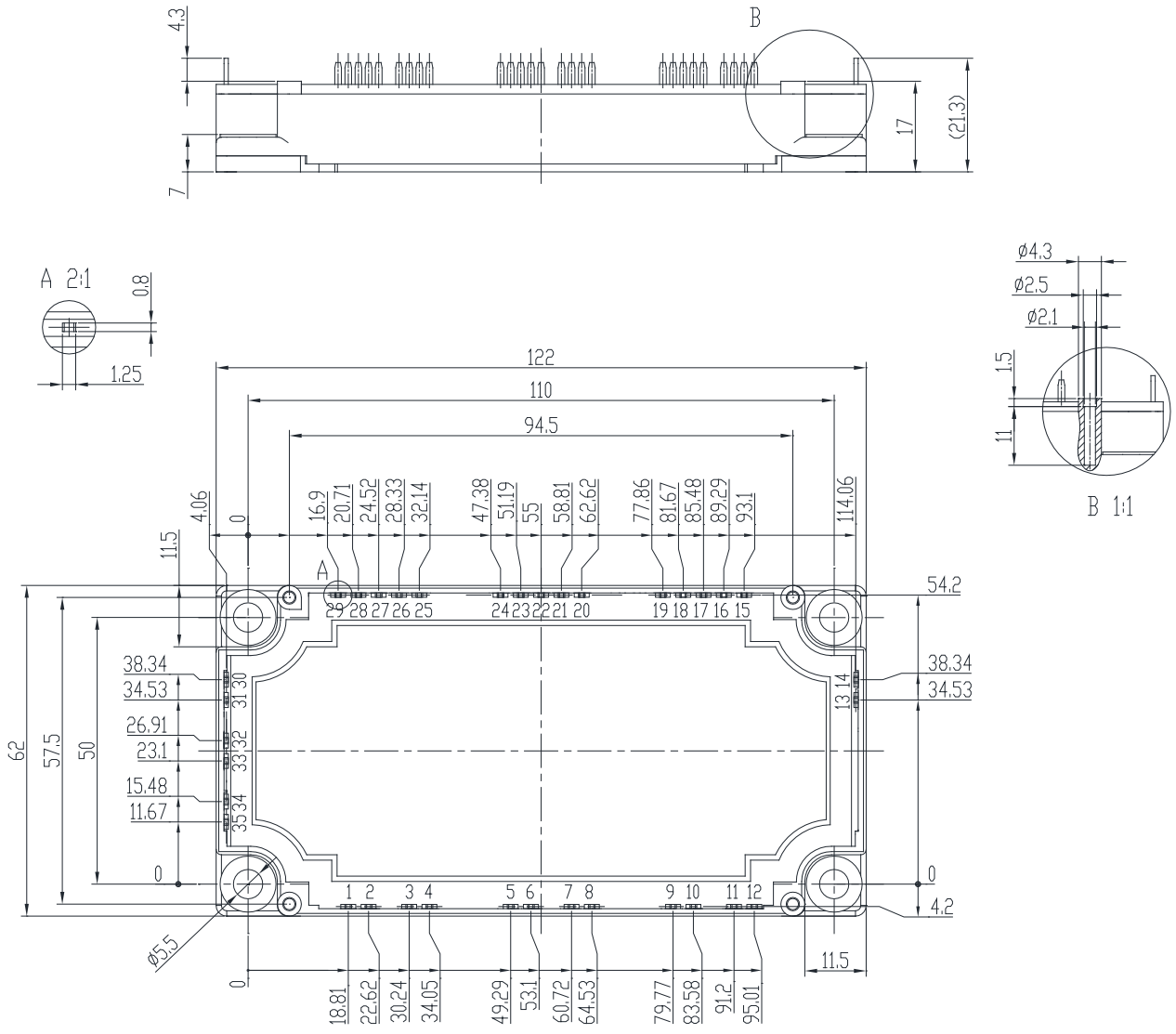
Fig 21. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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