

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.



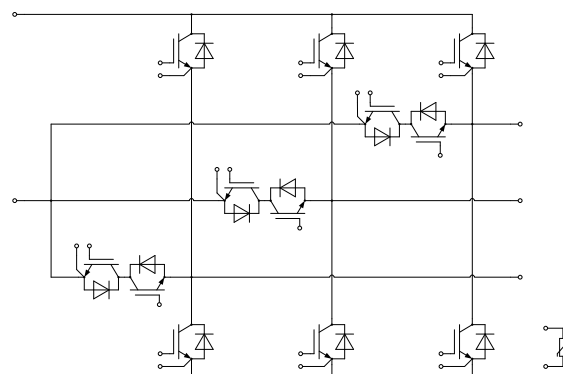
Features

- 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 $T_C=25^{\circ}\text{C}$ 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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	155 100	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	200	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	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 $t_p=1\text{ms}$	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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=75^{\circ}\text{C}$	135 100	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	200	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	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 $t_p=1\text{ms}$	200	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500	V

T1~T6 IGBT Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.70	2.15	V
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.95		
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=2.5\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.2	6.0	6.8	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^{\circ}\text{C}$			100	nA
R_{Gint}	Internal Gate Resistance			7.5		Ω
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=100\text{A}, R_G=1.6\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		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	$V_{CC}=600\text{V}, I_C=100\text{A}, R_G=1.6\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		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	$V_{CC}=600\text{V}, I_C=100\text{A}, R_G=1.6\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		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	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		400		A

D1~D6 Diode Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=100\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.70	2.15	V
		$I_F=100\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.65		
		$I_F=100\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.65		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=100\text{A},$ $-di/dt=2800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		9.0		μC
I_{RM}	Peak Reverse Recovery Current			110		A
E_{rec}	Reverse Recovery Energy			3.32		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=100\text{A},$ $-di/dt=2800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		16.2		μC
I_{RM}	Peak Reverse Recovery Current			120		A
E_{rec}	Reverse Recovery Energy			5.70		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=100\text{A},$ $-di/dt=2800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		19.5		μC
I_{RM}	Peak Reverse Recovery Current			123		A
E_{rec}	Reverse Recovery Energy			7.13		mJ

T7~T12 IGBT Characteristics $T_c=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.45	1.90	V
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.60		
		$I_C=100\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.6\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.1	5.8	6.4	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			2.0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		6.16		nF
C_{res}	Reverse Transfer Capacitance			0.18		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		1.10		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=100\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		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	$V_{CC}=300\text{V}, I_C=100\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		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	$V_{CC}=300\text{V}, I_C=100\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$		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	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		500		A

D7~D12 Diode Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=100\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.55	1.95	V
		$I_F=100\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.50		
		$I_F=100\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.45		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=100\text{A},$ $-di/dt=3200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		4.1		μC
I_{RM}	Peak Reverse Recovery Current			91		A
E_{rec}	Reverse Recovery Energy			1.22		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=100\text{A},$ $-di/dt=3200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		7.9		μC
I_{RM}	Peak Reverse Recovery Current			110		A
E_{rec}	Reverse Recovery Energy			2.16		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=100\text{A},$ $-di/dt=3200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		9.0		μC
I_{RM}	Peak Reverse Recovery Current			116		A
E_{rec}	Reverse Recovery Energy			2.40		mJ

NTC Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		k Ω
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		3433		K

Module Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per T1~T6 IGBT)			0.293	K/W
	Junction-to-Case (per D1~D6 Diode)			0.505	
	Junction-to-Case (per T7~T12 IGBT)			0.433	
	Junction-to-Case (per D7~D12 Diode)			0.714	
R_{thCH}	Case-to-Heatsink (per T1~T6 IGBT)		0.144		K/W
	Case-to-Heatsink (per D1~D6 Diode)		0.248		
	Case-to-Heatsink (per T7~T12 IGBT)		0.213		
	Case-to-Heatsink (per D7~D12 Diode)		0.351		
	Case-to-Heatsink (per Module)		0.009		
M	Mounting Torque, Screw M5	3.0		6.0	N.m
G	Weight of Module		300		g

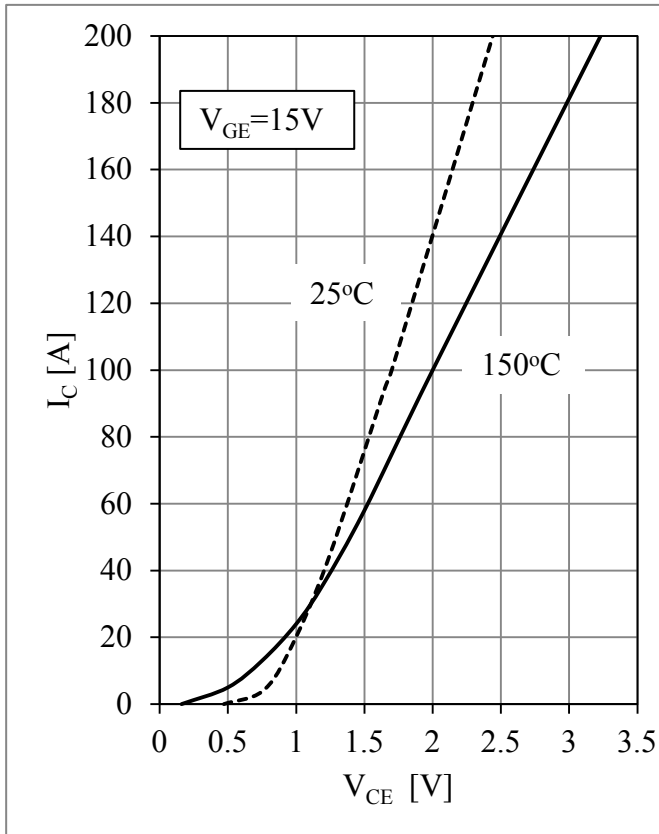


Fig 1. T1~T6 IGBT Output Characteristics

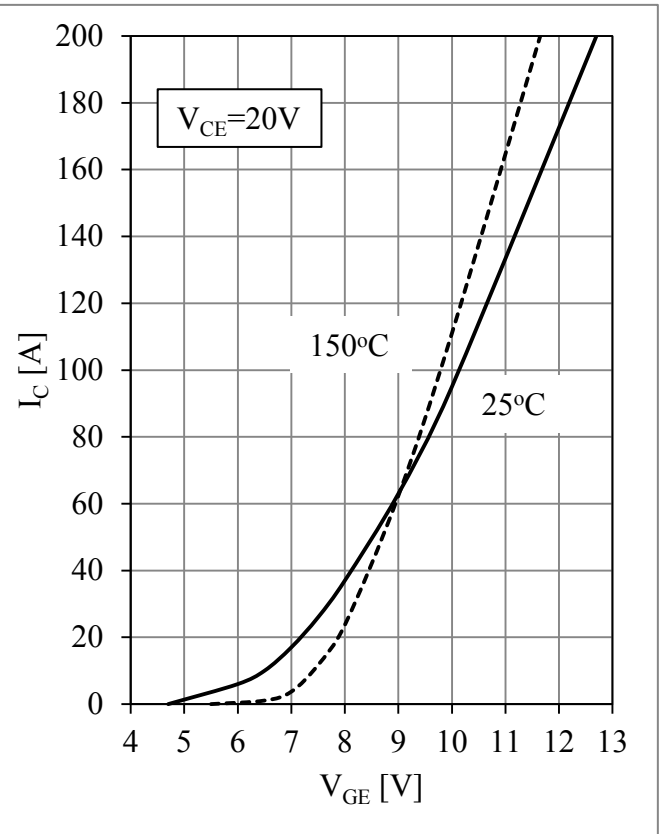
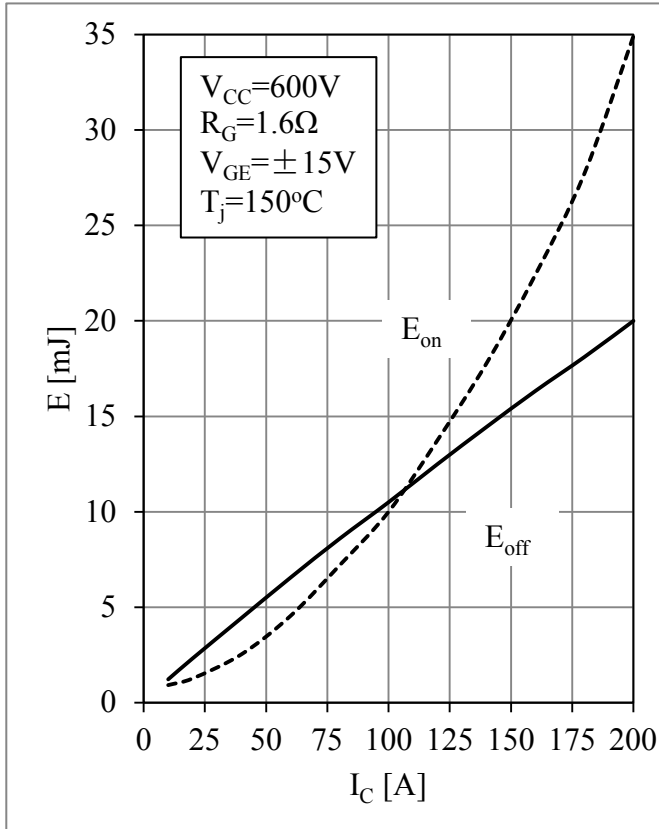
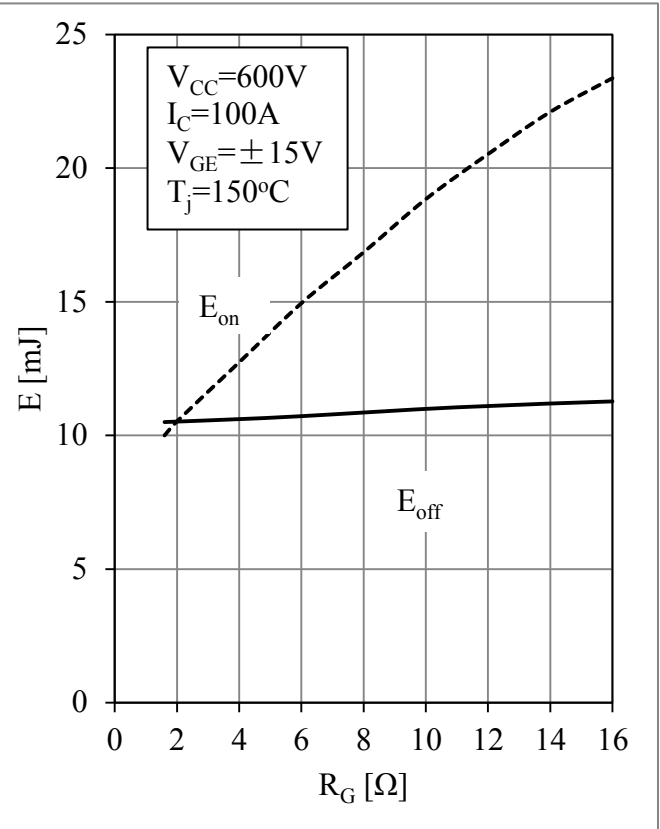


Fig 2. T1~T6 IGBT Transfer Characteristics

Fig 3. T1~T6 IGBT Switching Loss vs. I_C Fig 4. T1~T6 IGBT Switching Loss vs. R_G

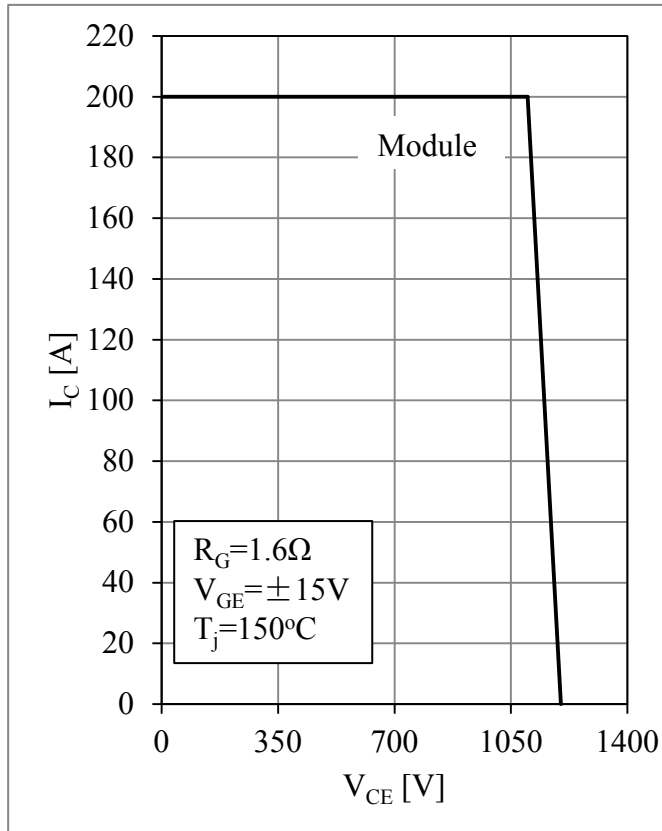


Fig 5. T1~T6 RBSOA

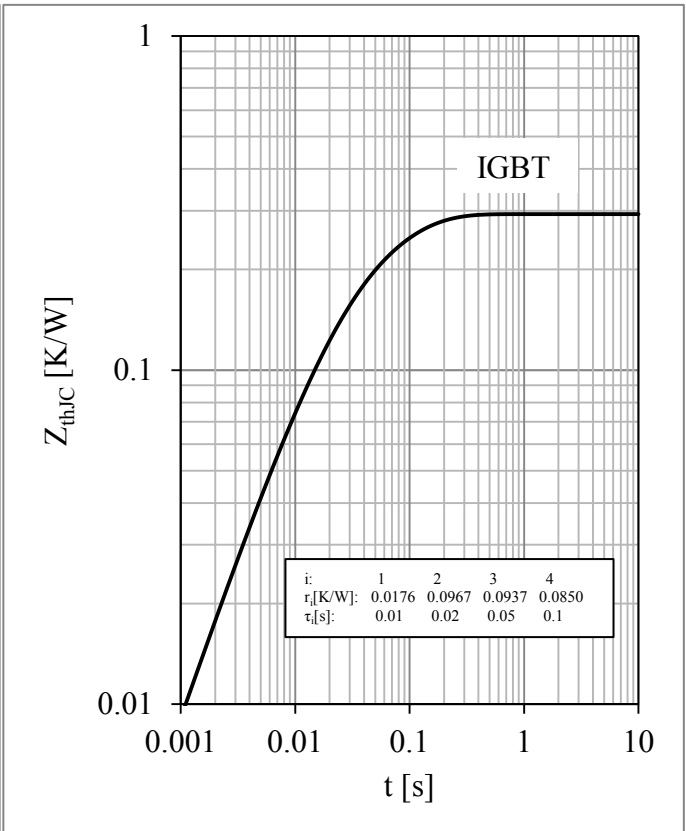


Fig 6. T1~T6 IGBT Transient Thermal Impedance

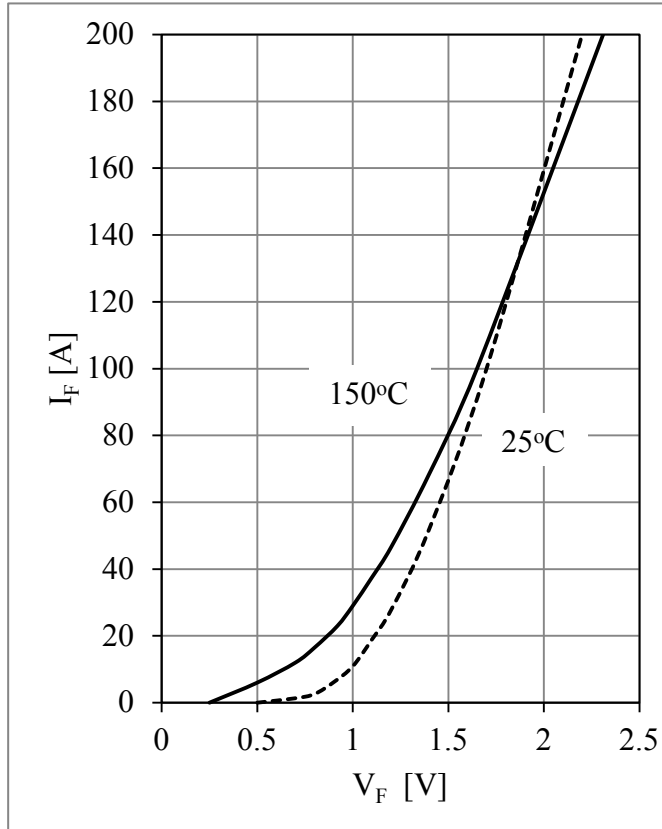
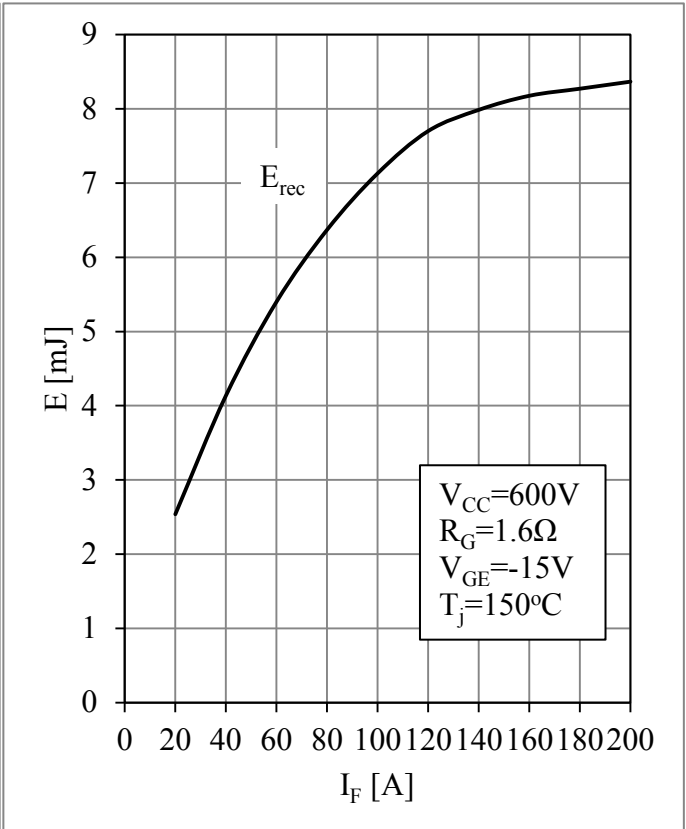
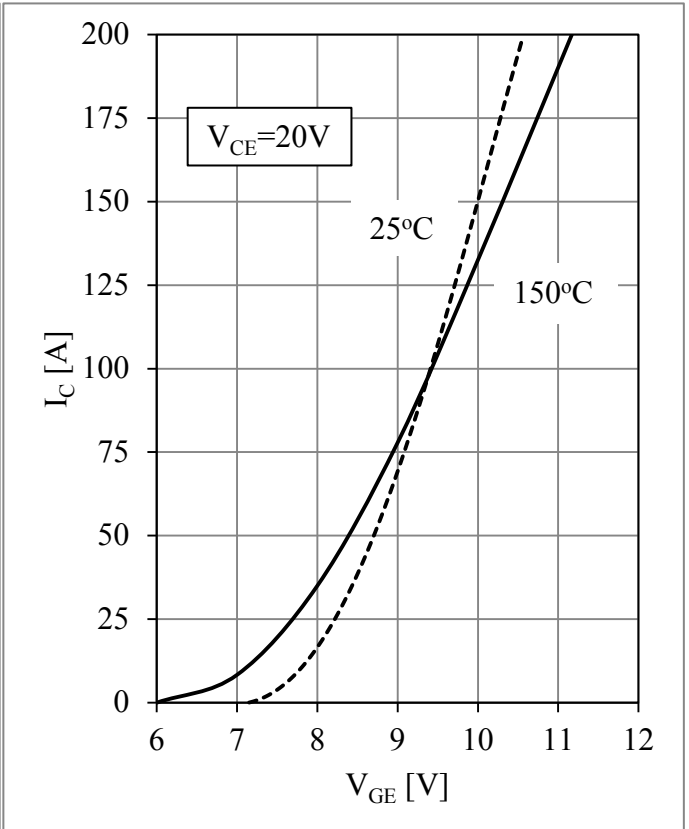
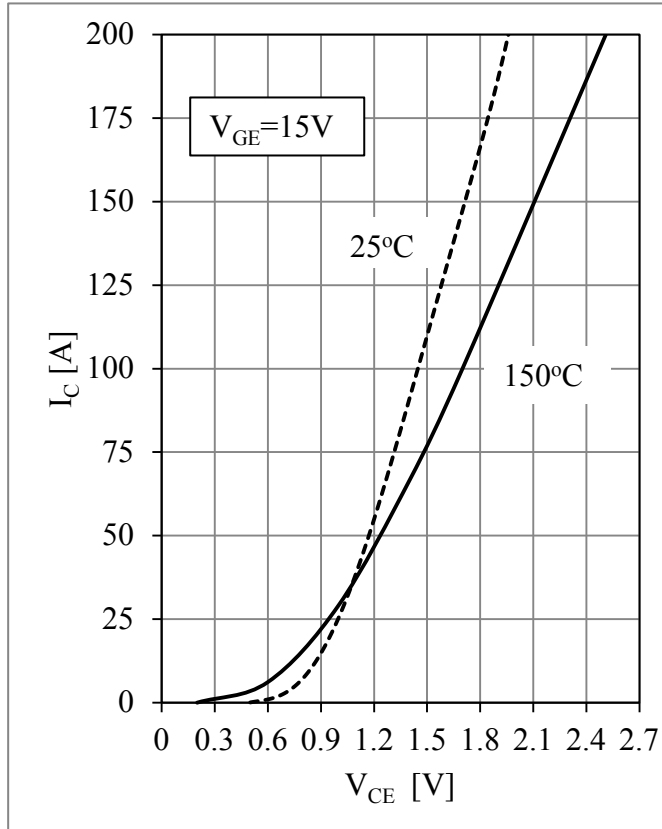
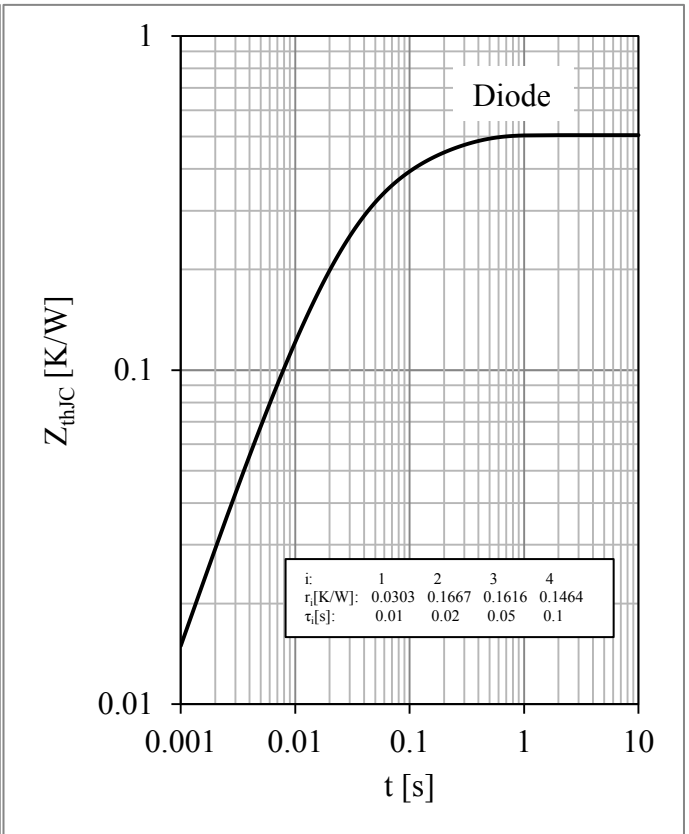
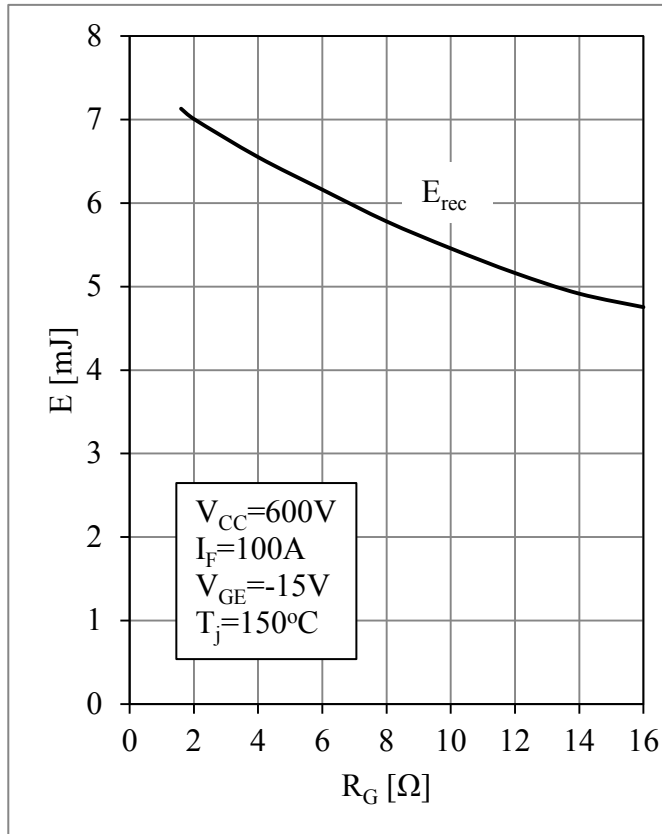


Fig 7. D1~D6 Diode Forward Characteristics

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



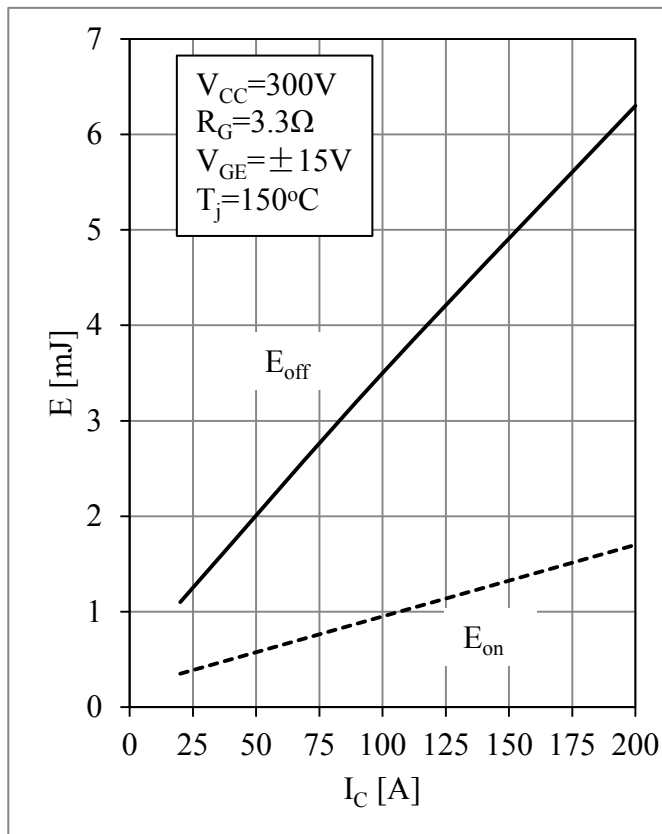
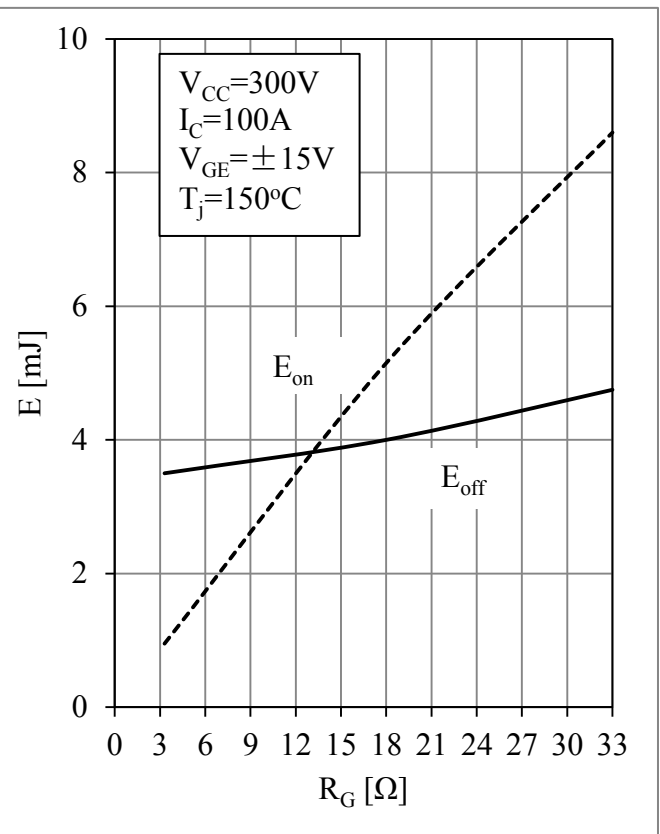
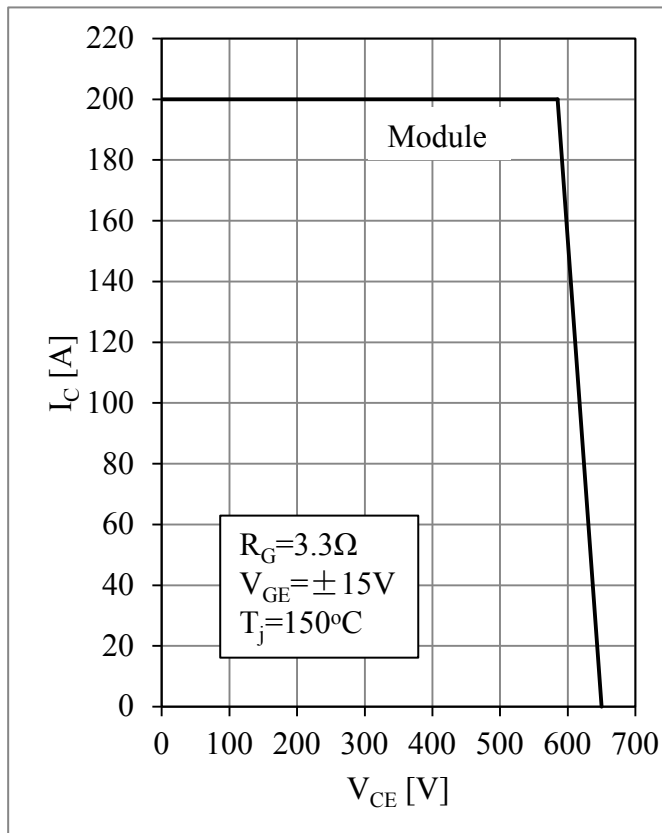
Fig 13. T7~T12 IGBT Switching Loss vs. I_C Fig 14. T7~T12 IGBT Switching Loss vs. R_G 

Fig 15. T7~T12 RBSOA

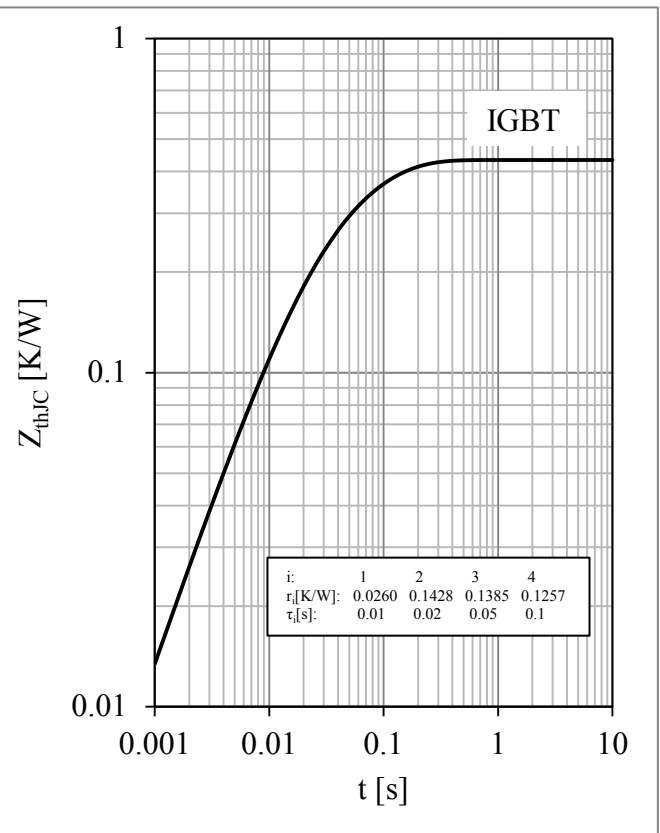


Fig 16. T7~T12 IGBT Transient Thermal Impedance

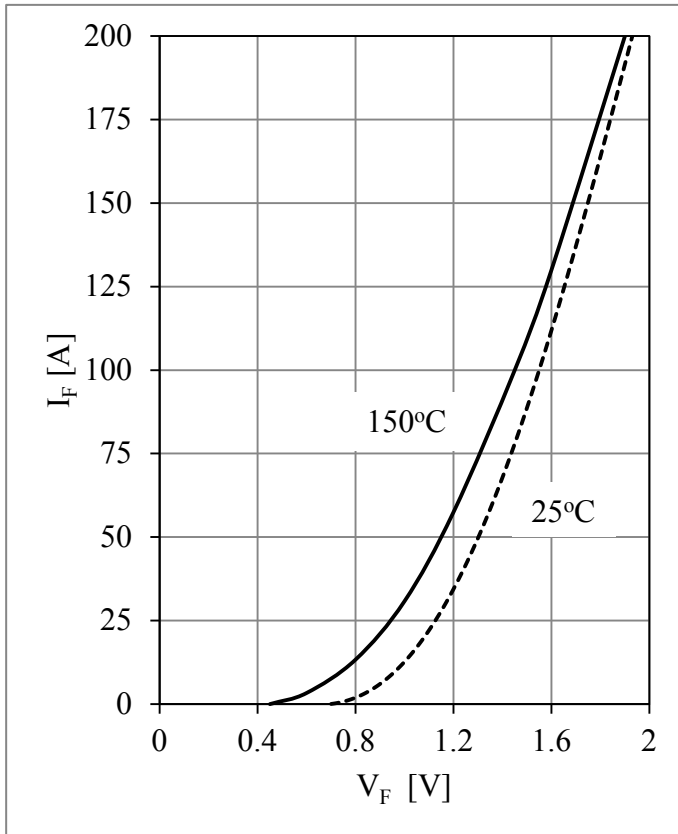


Fig 17. D7~D12 Diode Forward Characteristics

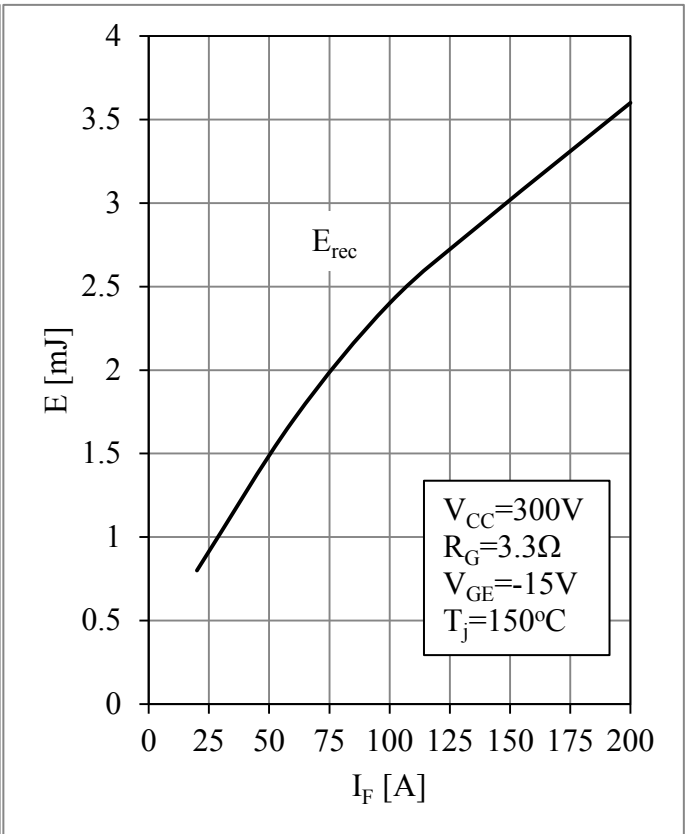
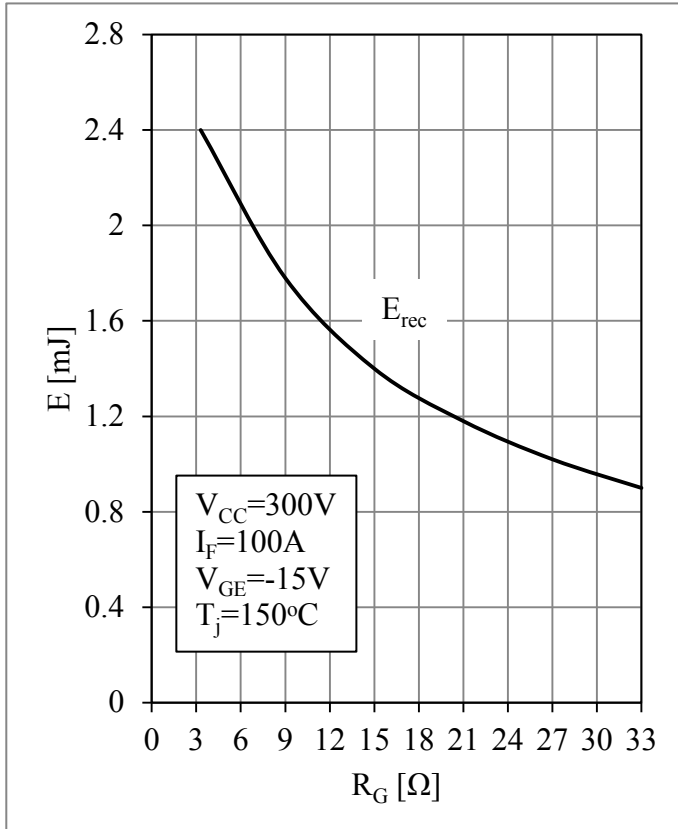
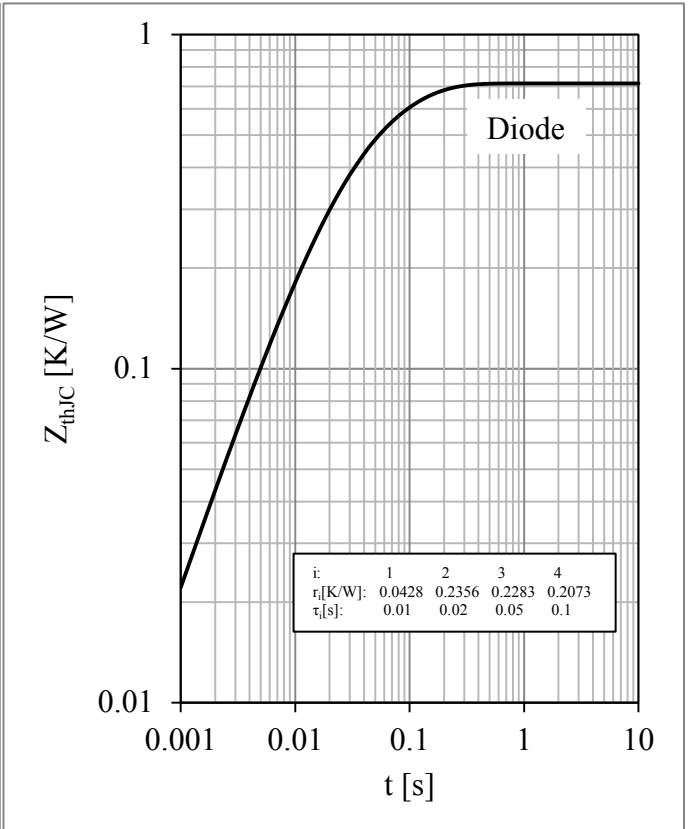
Fig 18. D7~D12 Diode Switching Loss vs. I_F Fig 19. D7~D12 Diode Switching Loss vs. R_G 

Fig 20. D7~D12 Diode Transient Thermal Impedance

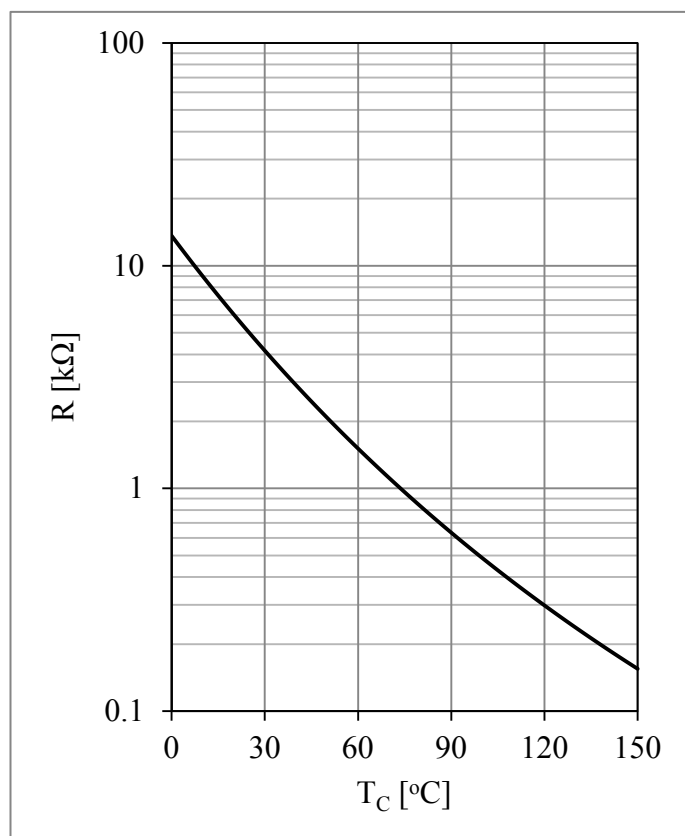
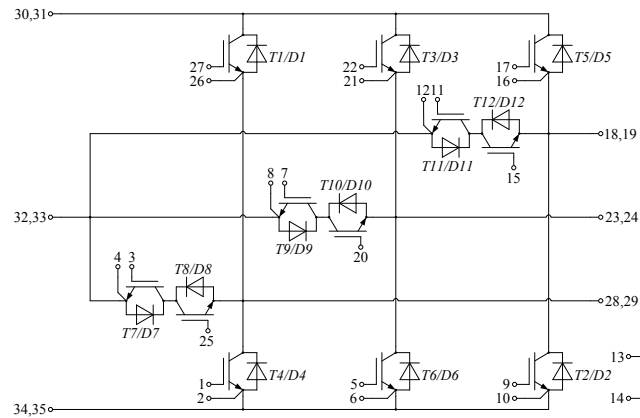


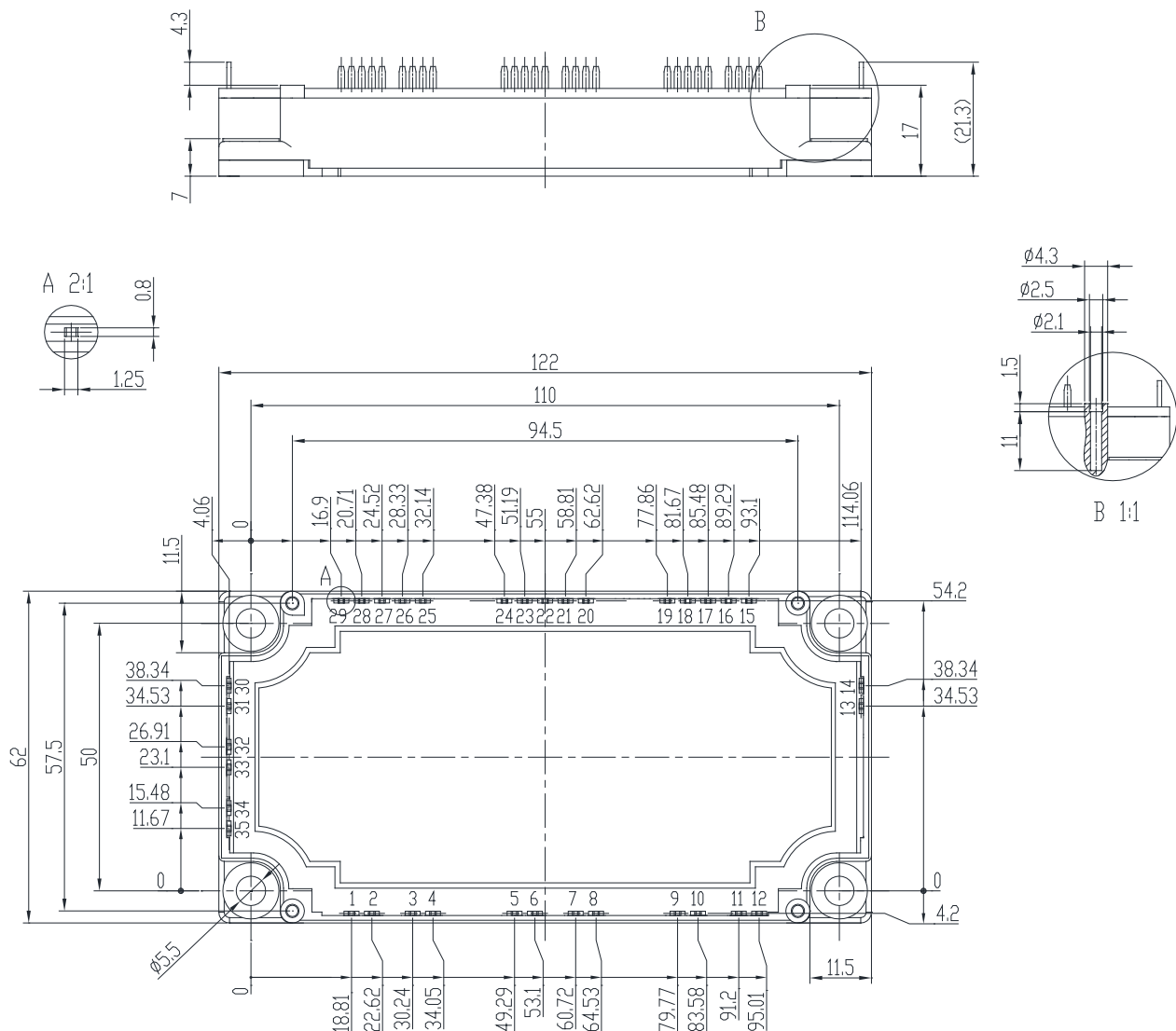
Fig 21. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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