

STARPOWER

SEMICONDUCTOR

IGBT

GD150MLL120C2S

1200V/150A 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

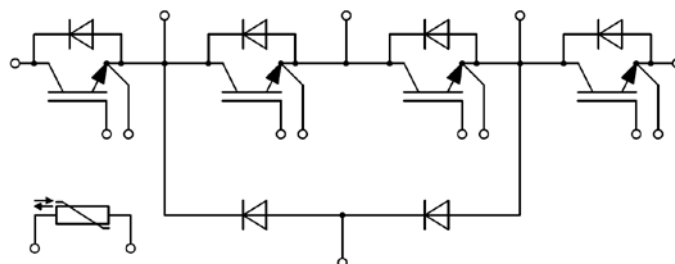
- Low $V_{CE(sat)}$ SPT+ IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low switching loss
- Maximum junction temperature 175 °C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



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-T4 IGBT**

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	245	A
	@ $T_C=100^{\circ}\text{C}$	150	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	300	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	938	W

D1-D4 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	300	A

D5,D6 Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	300	A

Module

Symbol	Description	Values	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, $f=50\text{Hz}$, $t=1\text{min}$	4000	V
M	Terminal Connection Torque, Screw M6	2.5 to 5.0	N.m
	Mounting Torque, Screw M6	3.0 to 5.0	

T1-T4 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	$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.00	2.45	V
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.20		
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.30		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=6.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.3	5.8	6.3	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	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		10.6		nF
C_{res}	Reverse Transfer Capacitance			0.47		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		1.53		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=150\text{A}, R_G=5.1\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		340		ns
t_r	Rise Time			70		ns
$t_{d(off)}$	Turn-Off Delay Time			442		ns
t_f	Fall Time			165		ns
E_{on}	Turn-On Switching Loss			8.00		mJ
E_{off}	Turn-Off Switching Loss			9.95		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=150\text{A}, R_G=5.1\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		355		ns
t_r	Rise Time			70		ns
$t_{d(off)}$	Turn-Off Delay Time			481		ns
t_f	Fall Time			311		ns
E_{on}	Turn-On Switching Loss			12.5		mJ
E_{off}	Turn-Off Switching Loss			15.3		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=150\text{A}, R_G=5.1\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$		370		ns
t_r	Rise Time			75		ns
$t_{d(off)}$	Turn-Off Delay Time			500		ns
t_f	Fall Time			330		ns
E_{on}	Turn-On Switching Loss			13.4		mJ
E_{off}	Turn-Off Switching Loss			16.4		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		650		A

D1-D4 Diode Characteristics $T_c=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_C=150\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.80	2.25	V
		$I_C=150\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.85		
		$I_C=150\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.85		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A}, R_G=5.1\Omega, V_{GE}=-15\text{V}, T_j=25^\circ\text{C}$		13.4		μC
I_{RM}	Peak Reverse Recovery Current			143		A
E_{rec}	Reverse Recovery Energy			9.11		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A}, R_G=5.1\Omega, V_{GE}=-15\text{V}, T_j=125^\circ\text{C}$		26.1		μC
I_{RM}	Peak Reverse Recovery Current			178		A
E_{rec}	Reverse Recovery Energy			15.4		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A}, R_G=5.1\Omega, V_{GE}=-15\text{V}, T_j=150^\circ\text{C}$		30.0		μC
I_{RM}	Peak Reverse Recovery Current			190		A
E_{rec}	Reverse Recovery Energy			18.2		mJ

D5,D6 Diode Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_C=150\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.80	2.25	V
		$I_C=150\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.85		
		$I_C=150\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.85		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A}, R_G=5.1\Omega, V_{GE}=-15\text{V}, T_j=25^\circ\text{C}$		13.4		μC
I_{RM}	Peak Reverse Recovery Current			143		A
E_{rec}	Reverse Recovery Energy			9.11		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A}, R_G=5.1\Omega, V_{GE}=-15\text{V}, T_j=125^\circ\text{C}$		26.1		μC
I_{RM}	Peak Reverse Recovery Current			178		A
E_{rec}	Reverse Recovery Energy			15.4		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=150\text{A}, R_G=5.1\Omega, V_{GE}=-15\text{V}, T_j=150^\circ\text{C}$		30.0		μC
I_{RM}	Peak Reverse Recovery Current			190		A
E_{rec}	Reverse Recovery Energy			18.2		mJ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JC}$	Junction-to-Case (per T1-T4 IGBT)			0.160	K/W
	Junction-to-Case (per D1-D4 Diode)			0.276	
	Junction-to-Case (per D5,D6 Diode)			0.276	
$R_{\theta CS}$	Case-to-Sink (per T1-T4 IGBT)		0.262		K/W
	Case-to-Sink (per D1-D4 Diode)		0.452		
	Case-to-Sink (per D5,D6 Diode)		0.452		
$R_{\theta CS}$	Case-to-Sink		0.035		K/W
G	Weight of Module		340		g

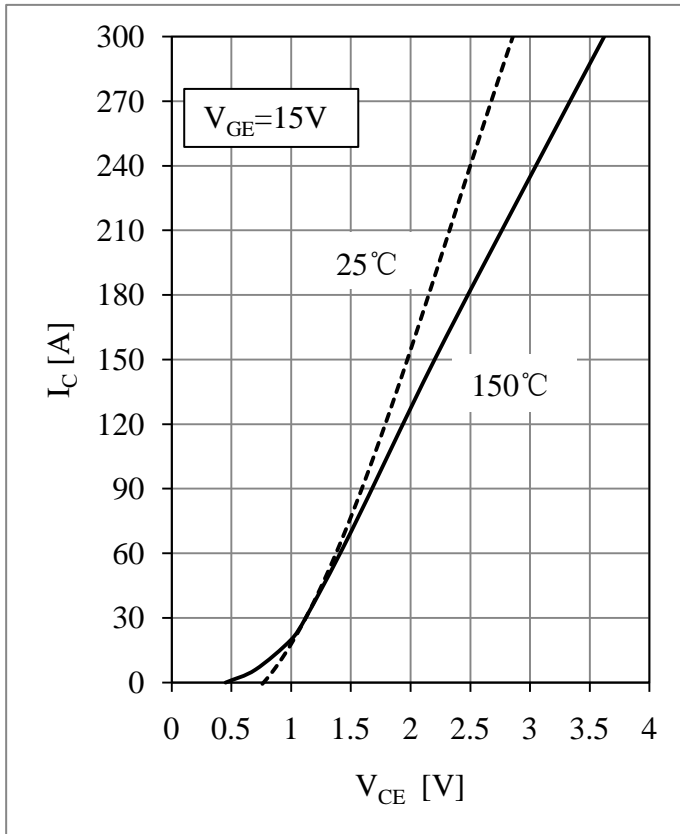


Fig 1. T1-T4 IGBT Output Characteristics

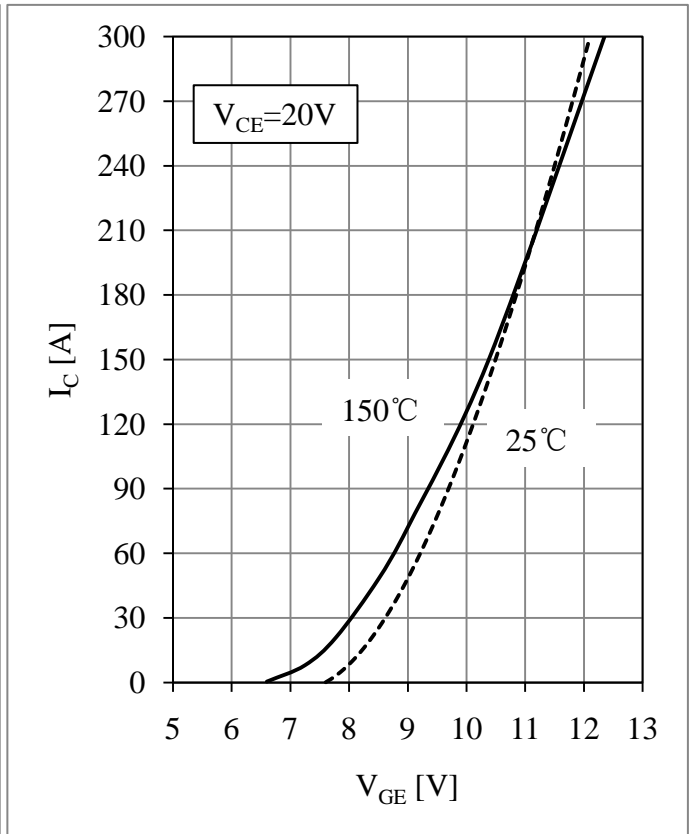


Fig 2. T1-T4 IGBT Transfer Characteristics

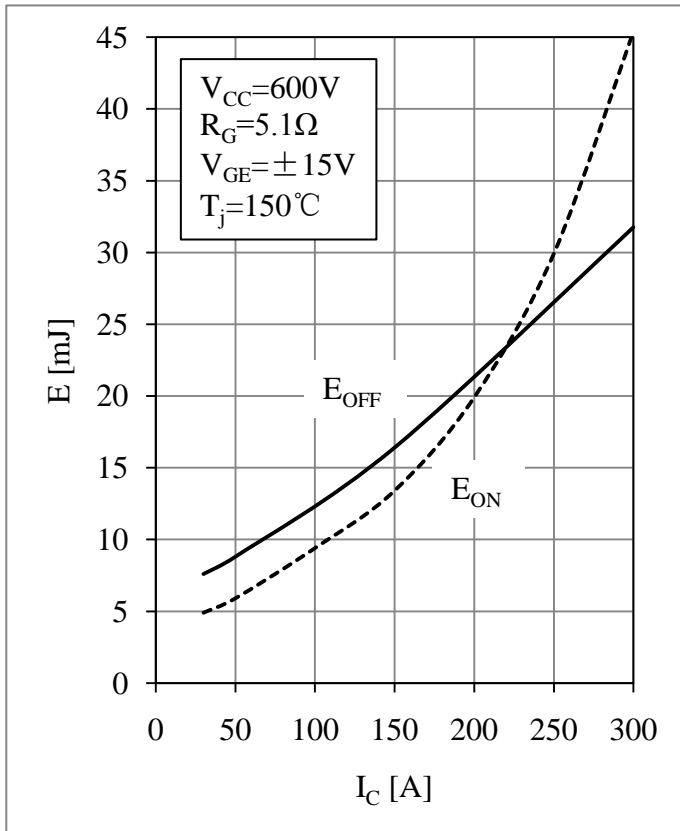


Fig 3. T1-T4 IGBT Switching Loss vs. I_C

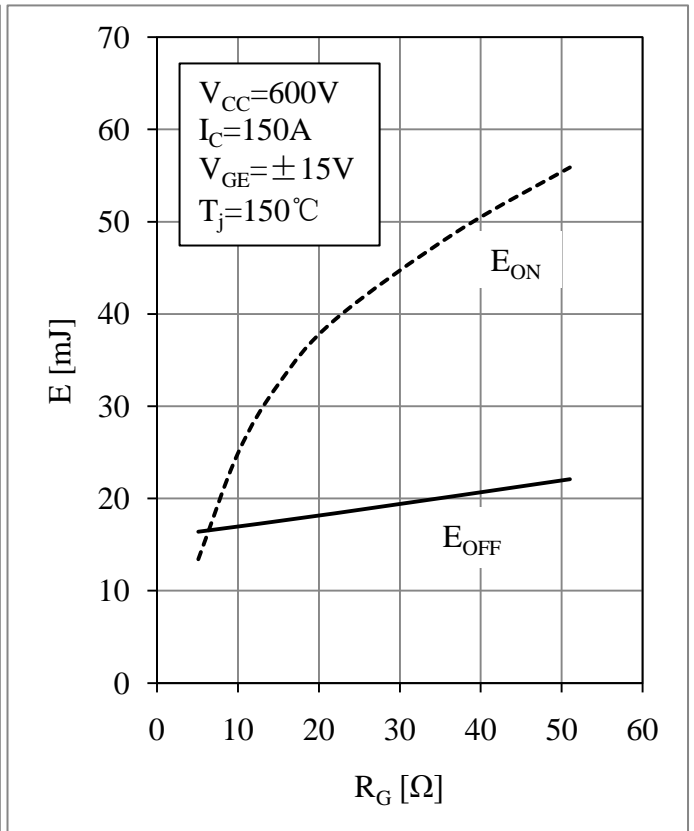


Fig 4. T1-T4 IGBT Switching Loss vs. R_G

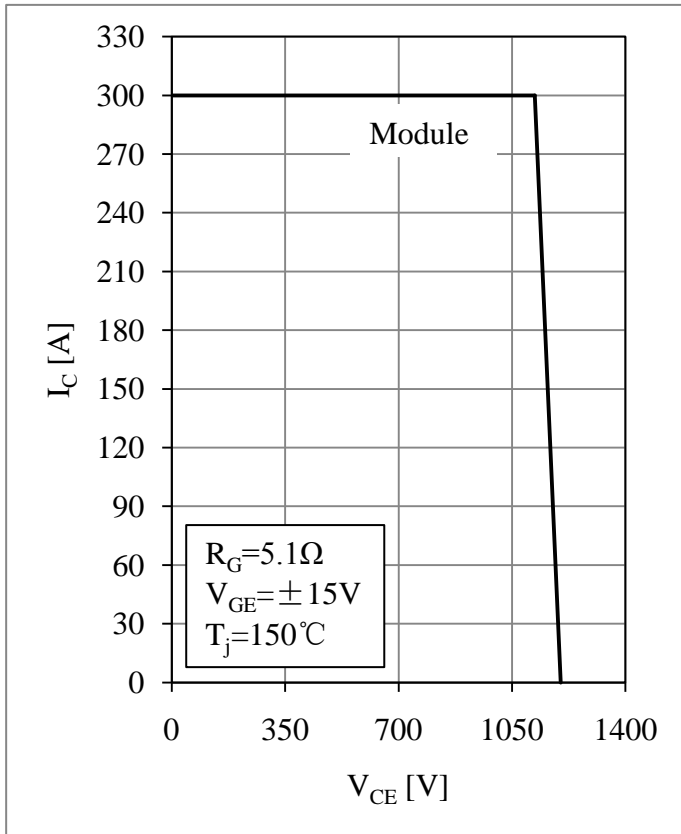


Fig 5. T1-T4 RBSOA

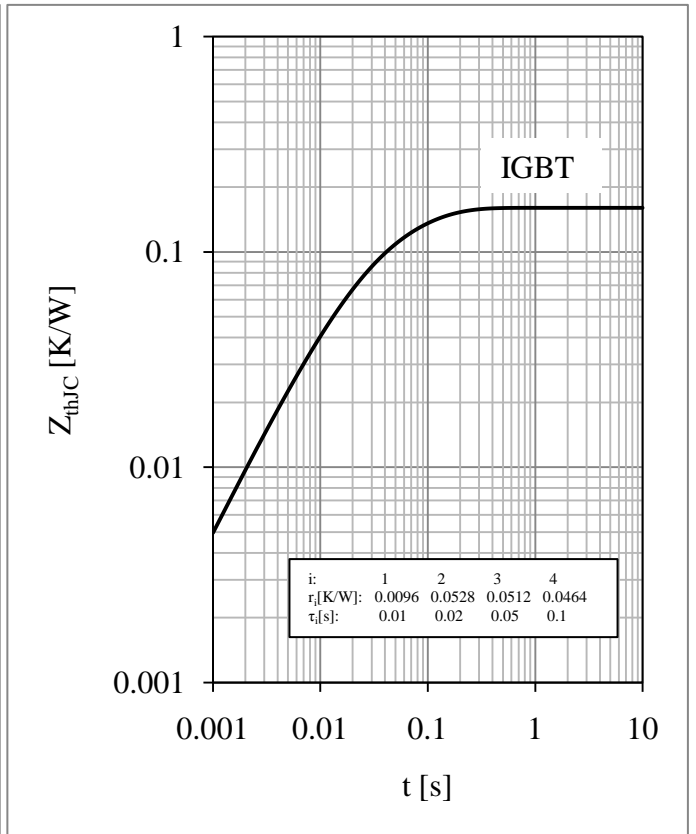


Fig 6. T1-T4 IGBT Transient Thermal Impedance

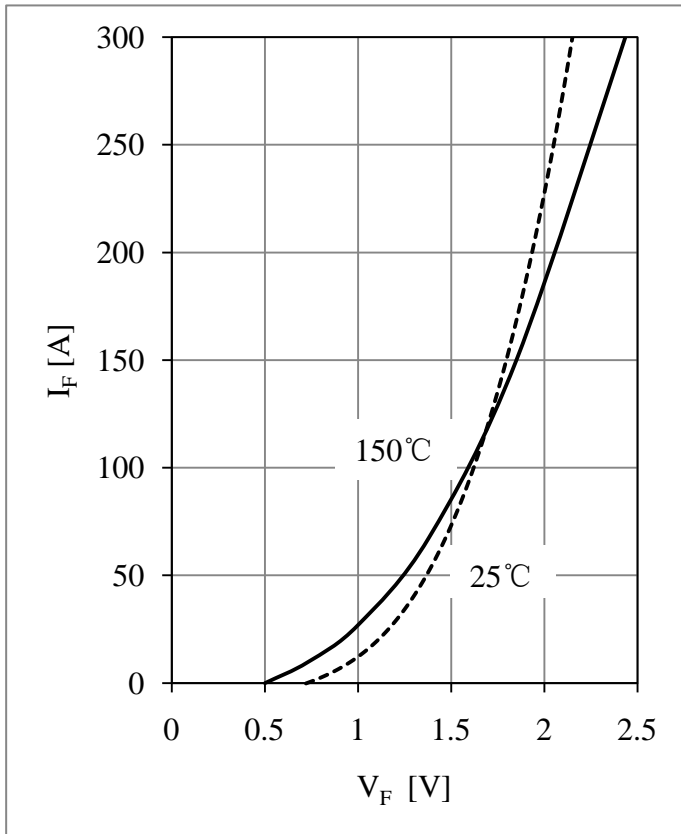


Fig 7. D1-D4 Diode Forward Characteristics

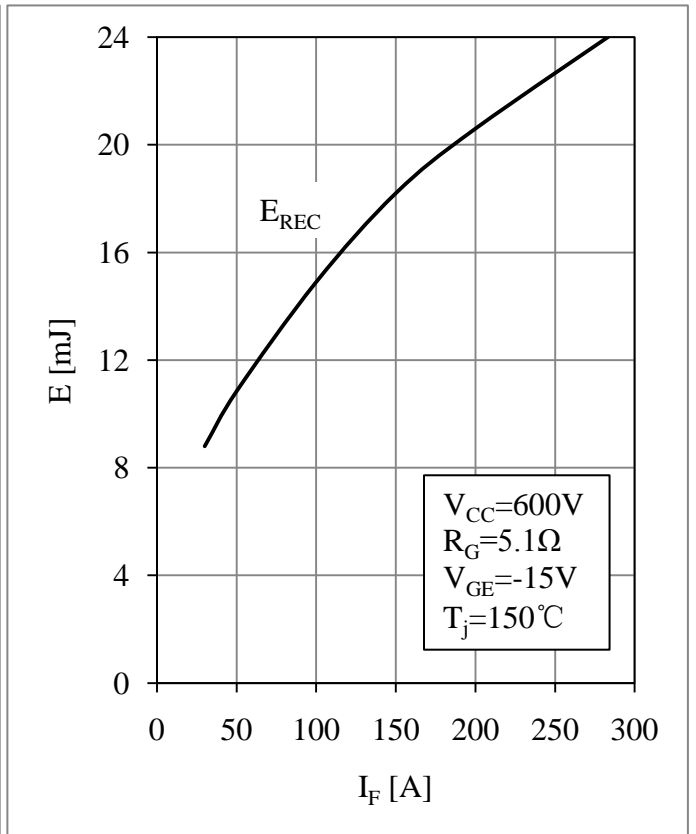


Fig 8. D1-D4 Diode Switching Loss vs. I_F

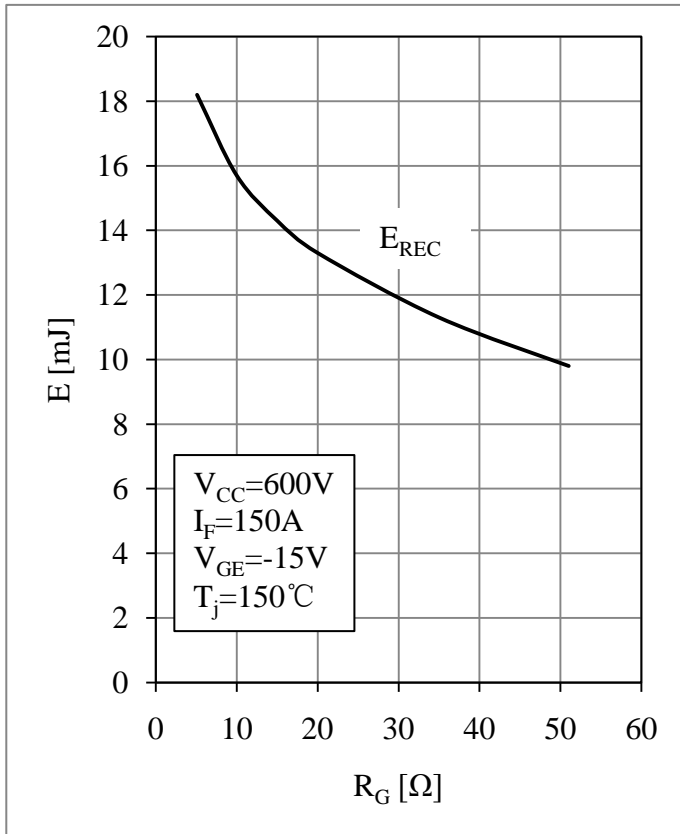


Fig 9. D1-D4 Diode Switching Loss vs. R_G

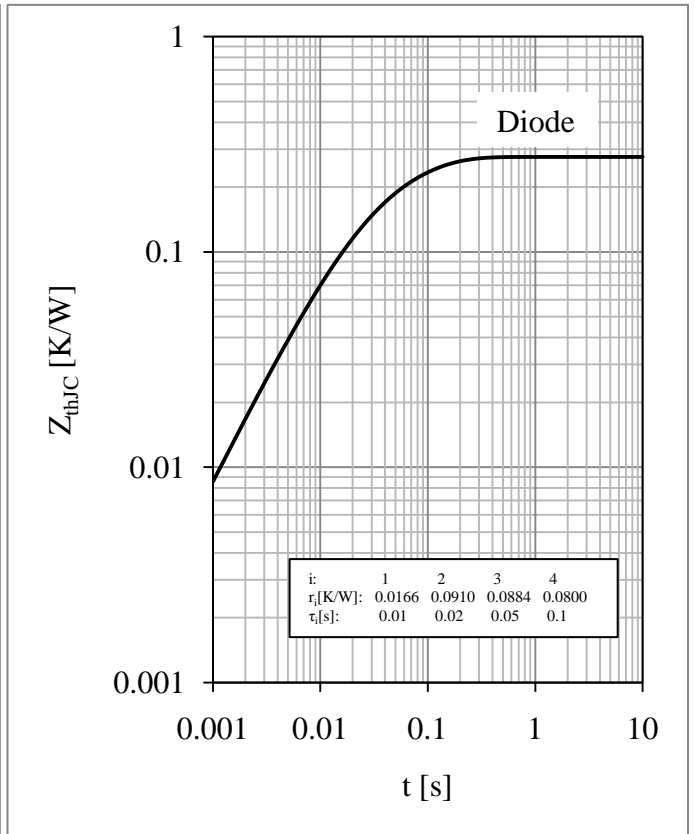


Fig 10. D1-D4 Diode Transient Thermal Impedance

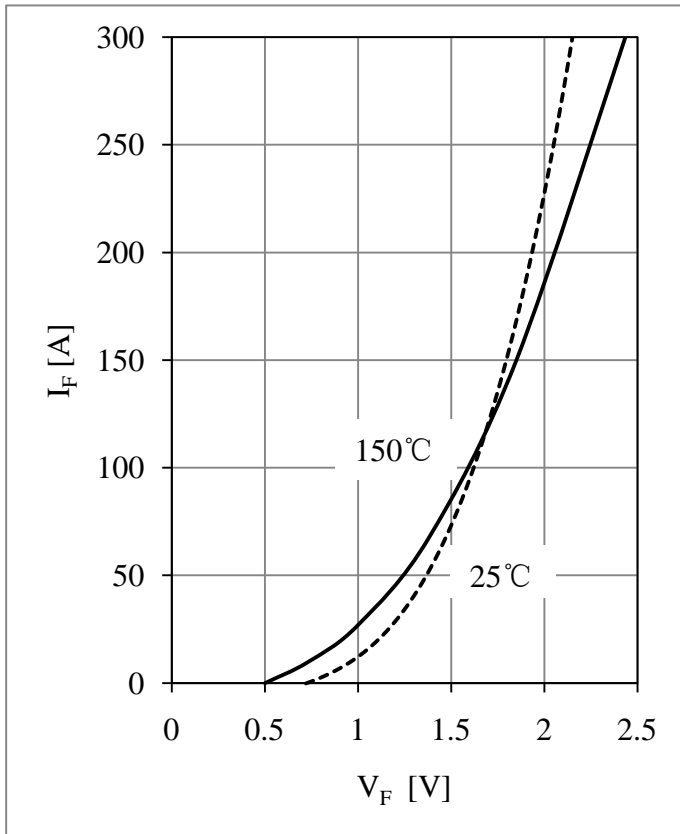


Fig 11. D5,D6 Diode Forward Characteristics

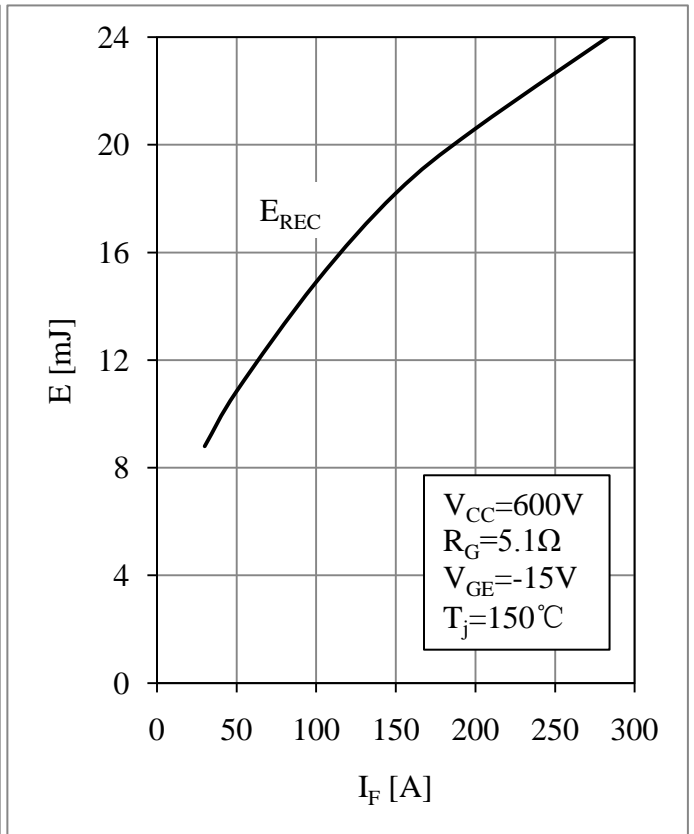


Fig 12. D5,D6 Diode Switching Loss vs. I_F

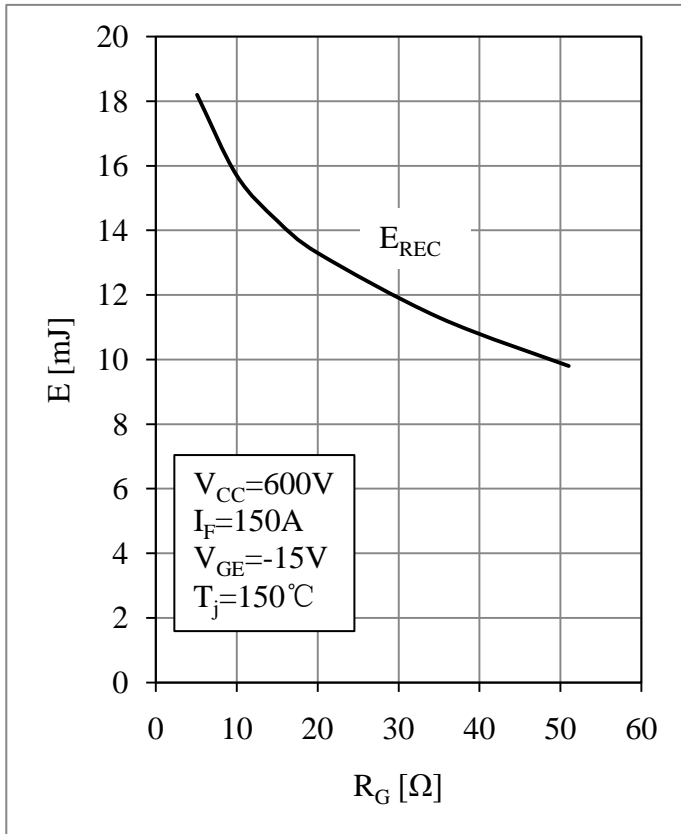


Fig 13. D5,D6 Diode Switching Loss vs. R_G

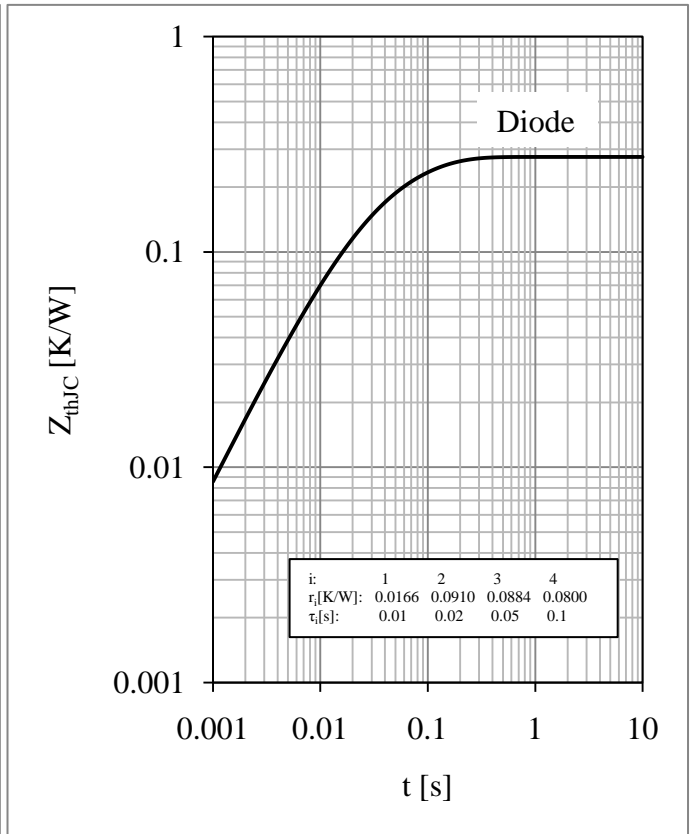


Fig 14. D5,D6 Diode Transient Thermal Impedance

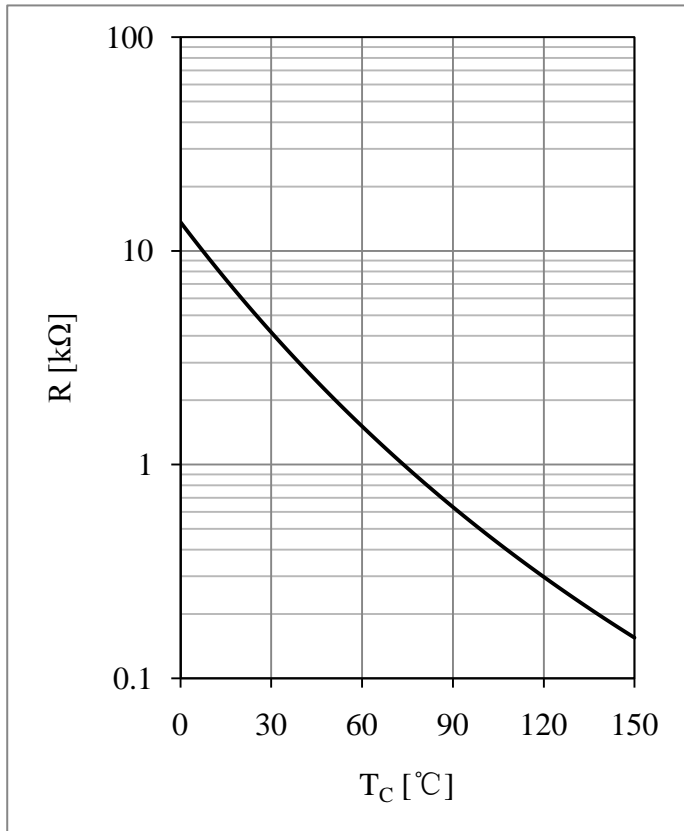
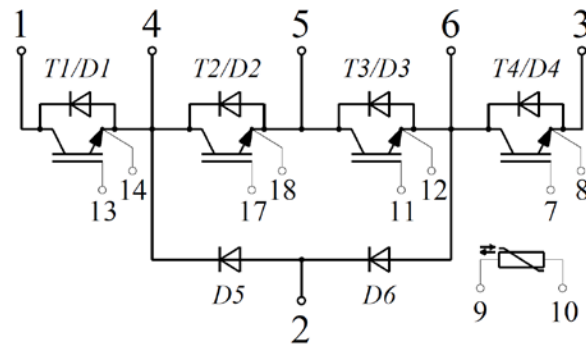


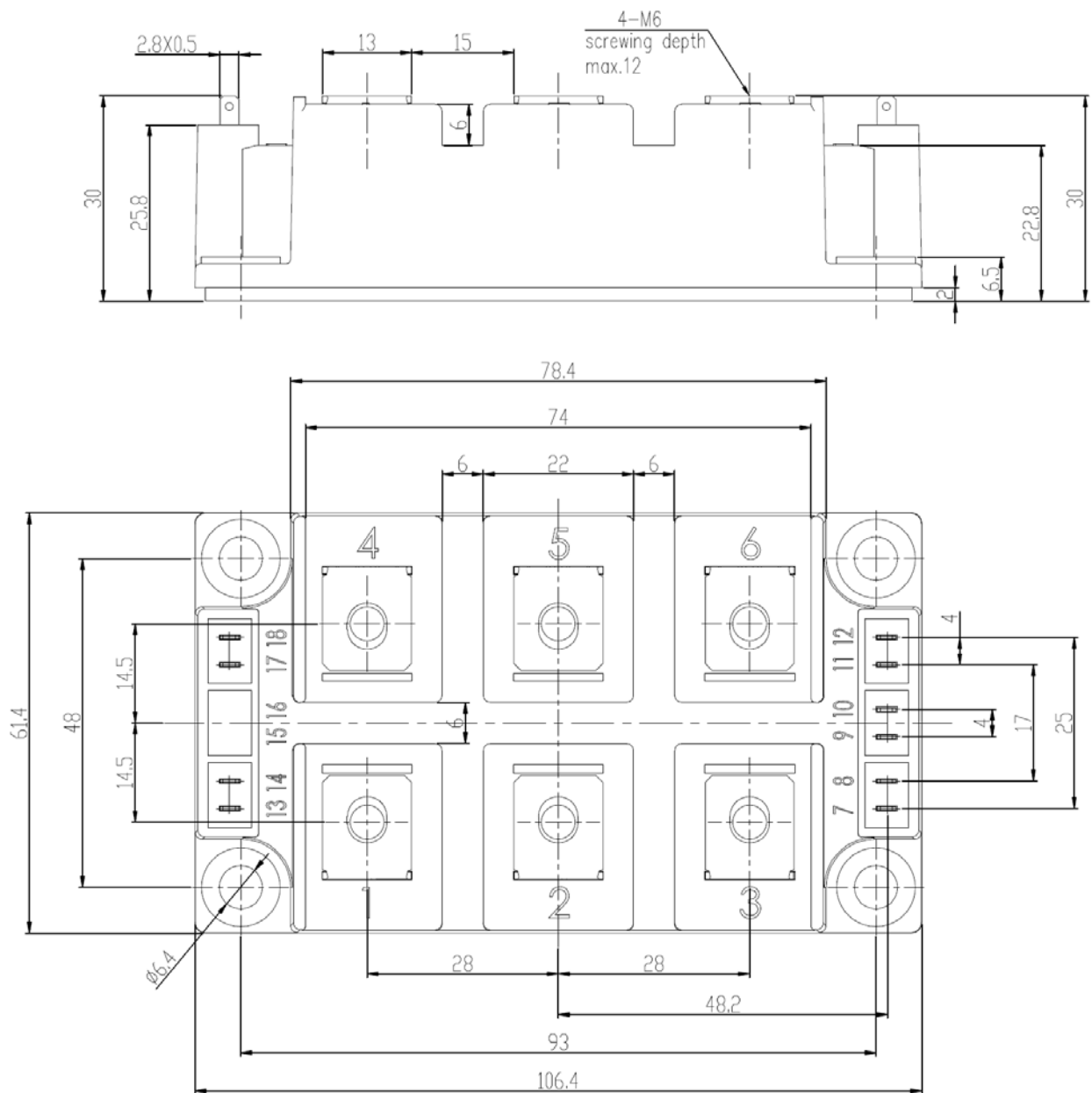
Fig 15. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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