

STARPOWER

SEMICONDUCTOR

IGBT

GD150MLT170C2S

Molding Type Module

1700V/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 3-level-applications.



Features

- Low $V_{CE(sat)}$ trench IGBT technology
- Low switching loss
- 10 μ s short circuit capability
- Low inductance case
- $V_{CE(sat)}$ with positive temperature coefficient
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

Typical Applications

- Solar power
- UPS
- 3-level-applications

IGBT T1 T2 T3 T4 $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD150MLT170C2S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1700	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	± 20	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$	260	A
	@ $T_C=80^\circ\text{C}$	150	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	300	A
P_{tot}	Total Power Dissipation @ $T_j=175^\circ\text{C}$	932	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^\circ\text{C}$	1700			V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V},$ $T_j=25^\circ\text{C}$			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V},$ $T_j=25^\circ\text{C}$			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=6.0\text{mA}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	5.2	5.8	6.4	V
$V_{CE(sat)}$	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
		$I_C=150\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.40		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=150A,$ $R_G=9.1\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		282		ns
t_r	Rise Time			48		ns
$t_{d(off)}$	Turn-Off Delay Time			800		ns
t_f	Fall Time			178		ns
E_{on}	Turn-On Switching Loss			33.1		mJ
E_{off}	Turn-Off Switching Loss			32.2		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=150A,$ $R_G=9.1\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		301		ns
t_r	Rise Time			65		ns
$t_{d(off)}$	Turn-Off Delay Time			1000		ns
t_f	Fall Time			302		ns
E_{on}	Turn-On Switching Loss			47.8		mJ
E_{off}	Turn-Off Switching Loss			47.1		mJ
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1MHz,$ $V_{GE}=0V$		13.3		nF
C_{oes}	Output Capacitance			0.55		nF
C_{res}	Reverse Transfer Capacitance			0.44		nF
Q_G	Gate Charge	$V_{CC}=900V, I_C=150A,$ $V_{GE}=-15 \dots +15V$		1.70		μC
R_{Gint}	Internal Gate Resister			5.0		Ω
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=1000V,$ $V_{CEM} \leq 1700V$		600		A

Diode D1 D2 D3 D4 $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD150MLT170C2S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1700	V
I_F	DC Forward Current $T_C=80^\circ\text{C}$	150	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	300	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=150\text{A}$, $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$		1.80	2.25	V
			$T_j=125^\circ\text{C}$		1.90		
Q_r	Recovered Charge	$I_F=150\text{A}$, $V_R=900\text{V}$, $R_G=9.1\Omega$, $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		39.1		μC
			$T_j=125^\circ\text{C}$		65.8		
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}$, $R_G=9.1\Omega$, $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		178		A
			$T_j=125^\circ\text{C}$		191		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		20.0		mJ
			$T_j=125^\circ\text{C}$		36.1		

Diode D5 D6 $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD150MLT170C2S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1700	V
I_F	DC Forward Current $T_C=80^\circ\text{C}$	150	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	300	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=150\text{A}$, $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$		1.80	2.25	V
			$T_j=125^\circ\text{C}$		1.90		
Q_r	Recovered Charge	$I_F=150\text{A}$, $V_R=900\text{V}$, $R_G=9.1\Omega$, $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		39.1		μC
			$T_j=125^\circ\text{C}$		65.8		
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}$, $R_G=9.1\Omega$, $V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		178		A
			$T_j=125^\circ\text{C}$		191		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15\text{V}$	$T_j=25^\circ\text{C}$		20.0		mJ
			$T_j=125^\circ\text{C}$		36.1		

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	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

IGBT Module

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	4000			V
$R_{\theta\text{JC}}$	Junction-to-Case (per IGBT T1 T2 T3 T4)			0.161	K/W
	Junction-to-Case (per Diode D1 D2 D3 D4)			0.337	
	Junction-to-Case (per Diode D5 D6)			0.346	
$R_{\theta\text{CS}}$	Case-to-Sink (Conductive grease applied)		0.035		K/W
T_{jmax}	Maximum Junction Temperature			175	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40		150	
T_{stg}	Storage Temperature Range	-40		125	$^{\circ}\text{C}$
Mounting Torque	Power Terminal Screw:M6	2.5		5.0	N.m
	Mounting Screw:M6	3.0		5.0	
Weight	Weight of Module		340		g

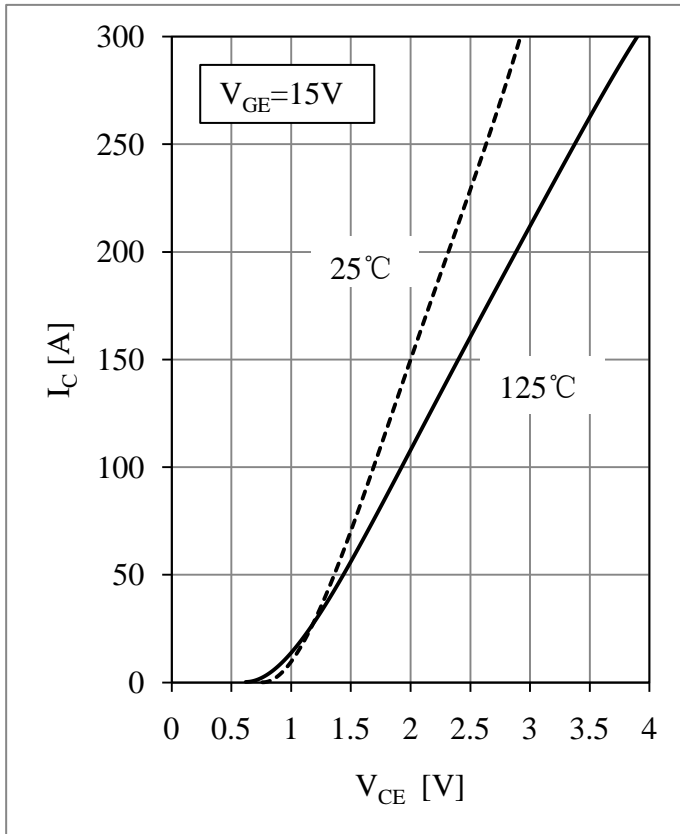


Fig 1. IGBT T1-T4 Output Characteristic

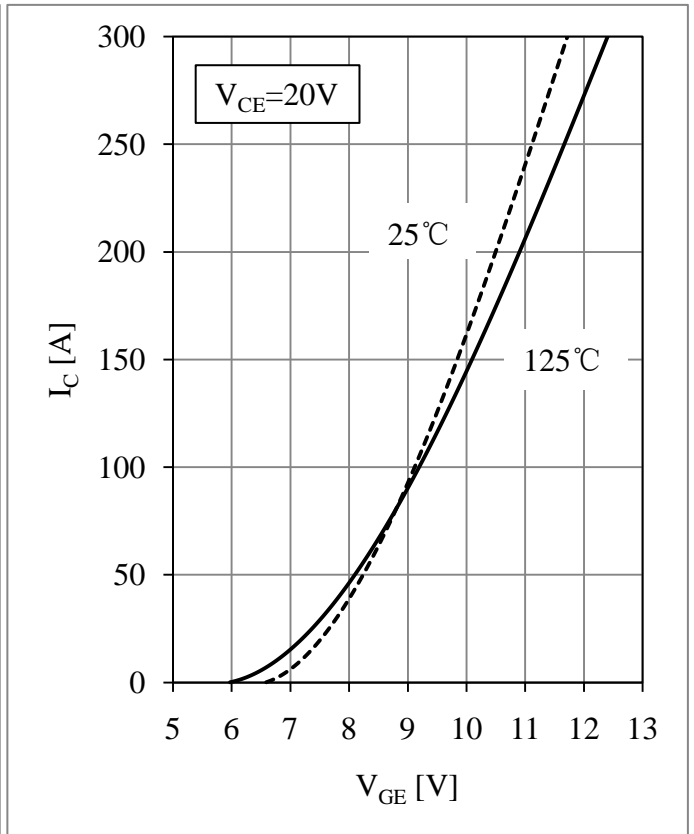


Fig 2. IGBT T1-T4 Transfer Characteristic

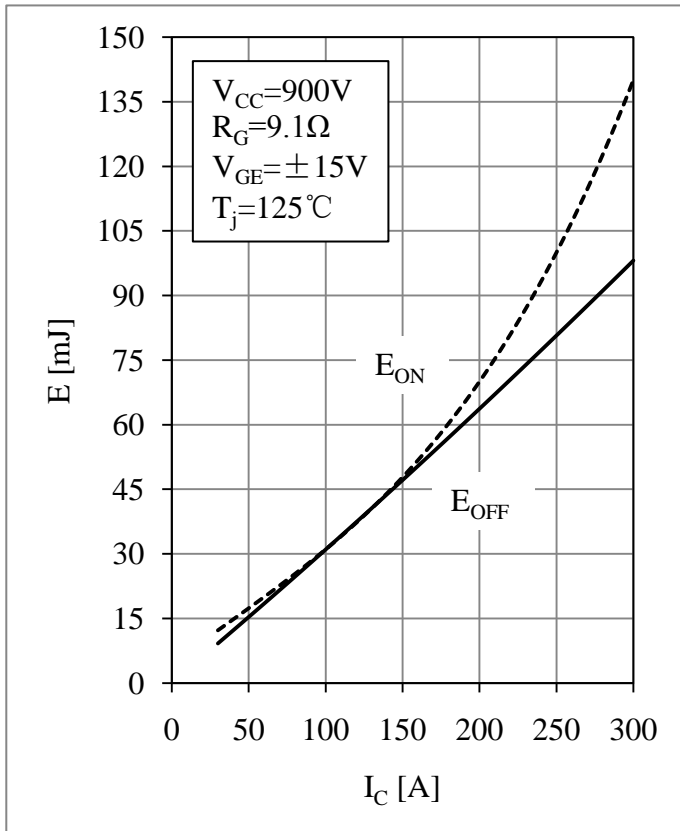


Fig 3. IGBT T1-T4 Switching Loss vs. I_C

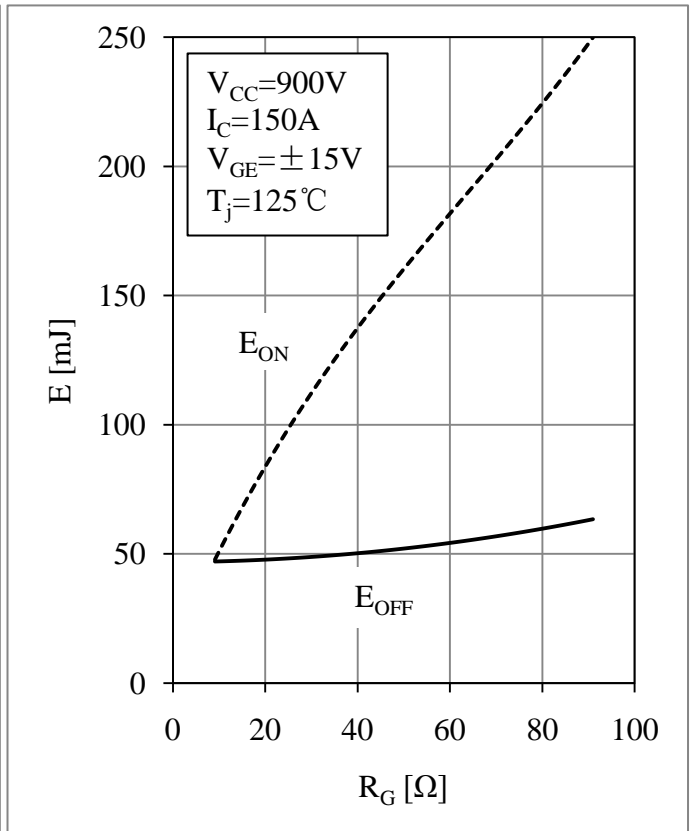


Fig 4. IGBT T1-T4 Switching Loss vs. R_G

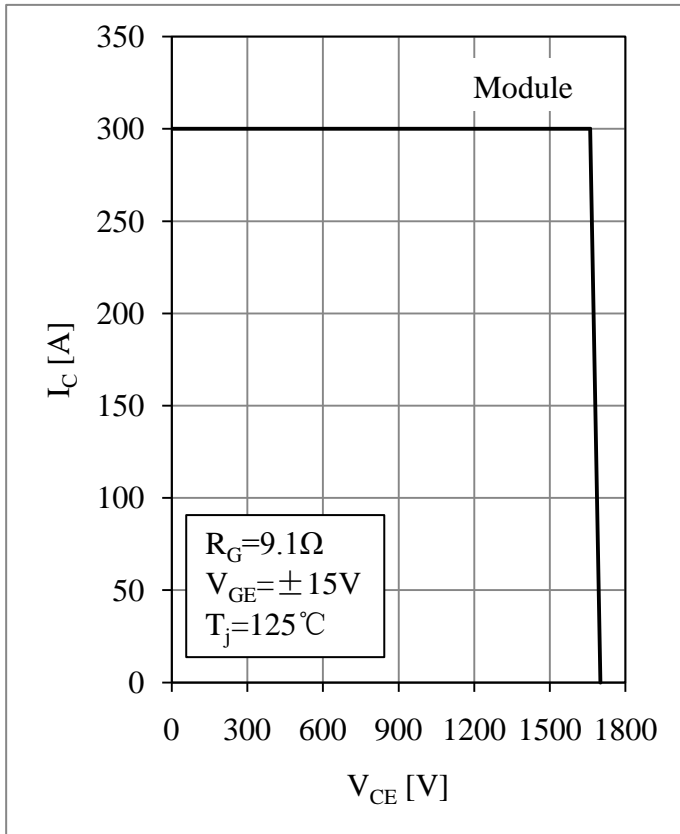


Fig 5. IGBT T1-T4 RBSOA

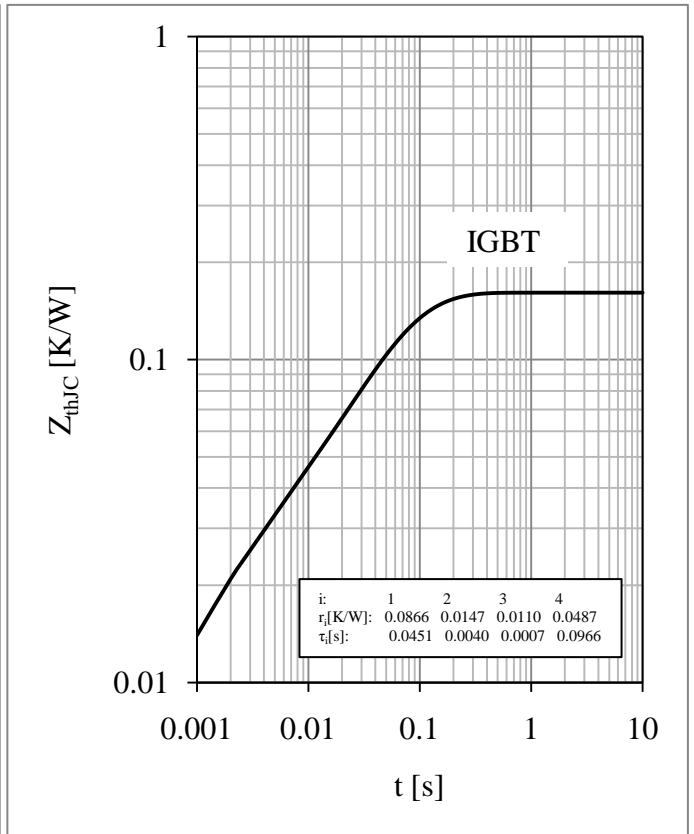


Fig 6. IGBT T1-T4 Transient Thermal Impedance

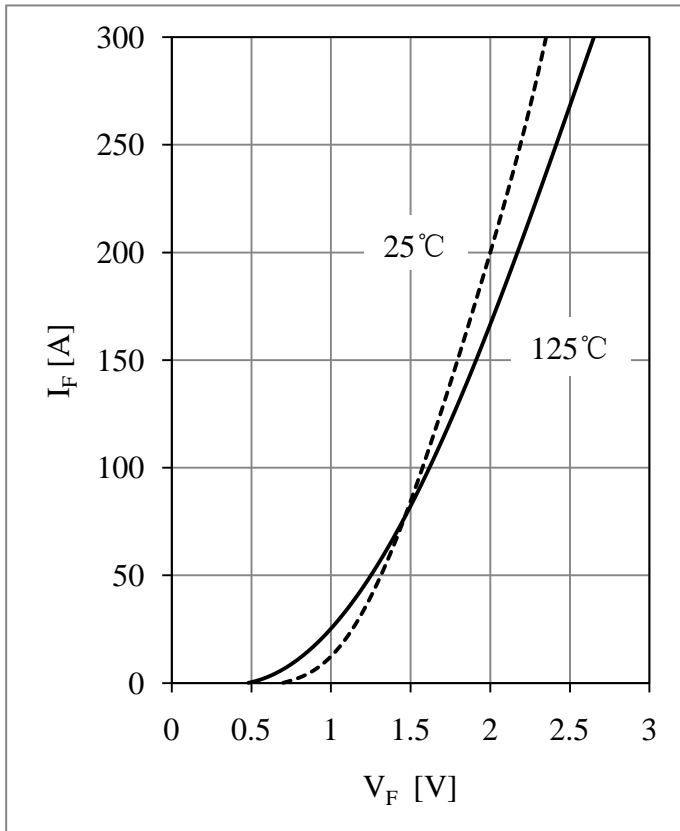


Fig 7. Diode D1-D4 Forward Characteristic

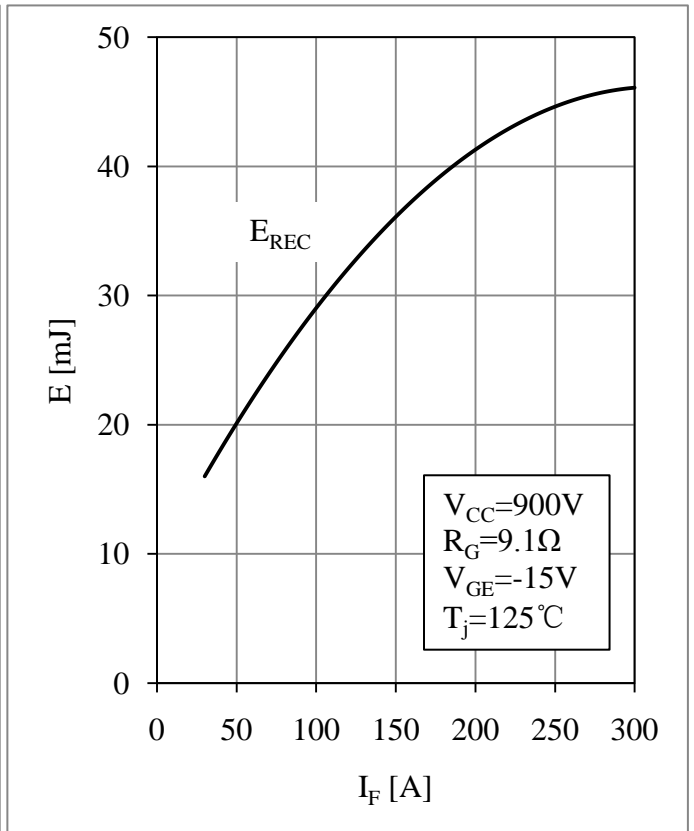


Fig 8. Diode D1-D4 Switching Loss vs. I_F

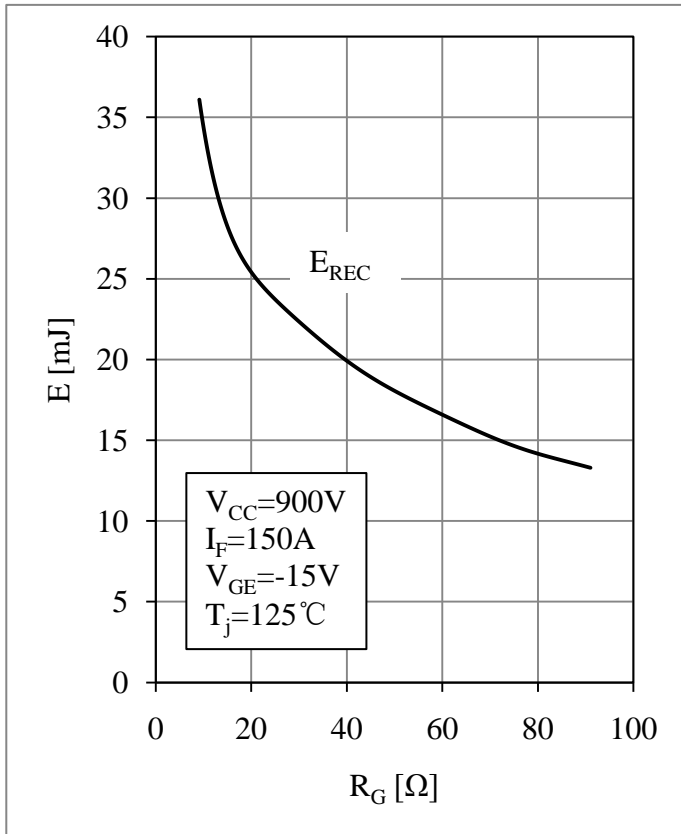


Fig 9. Diode D1-D4 Switching Loss vs. R_G

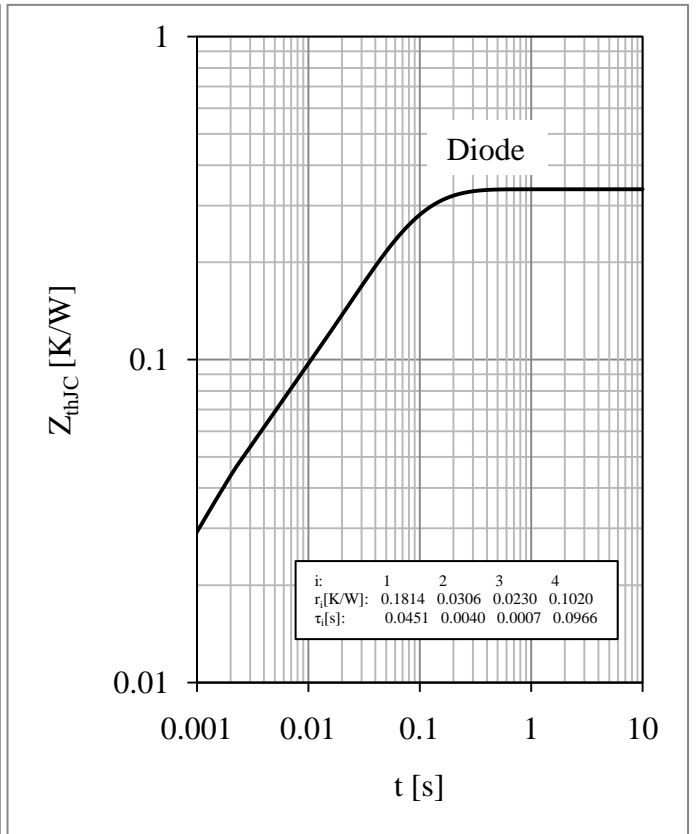


Fig 10. Diode D1-D4 Transient Thermal Impedance

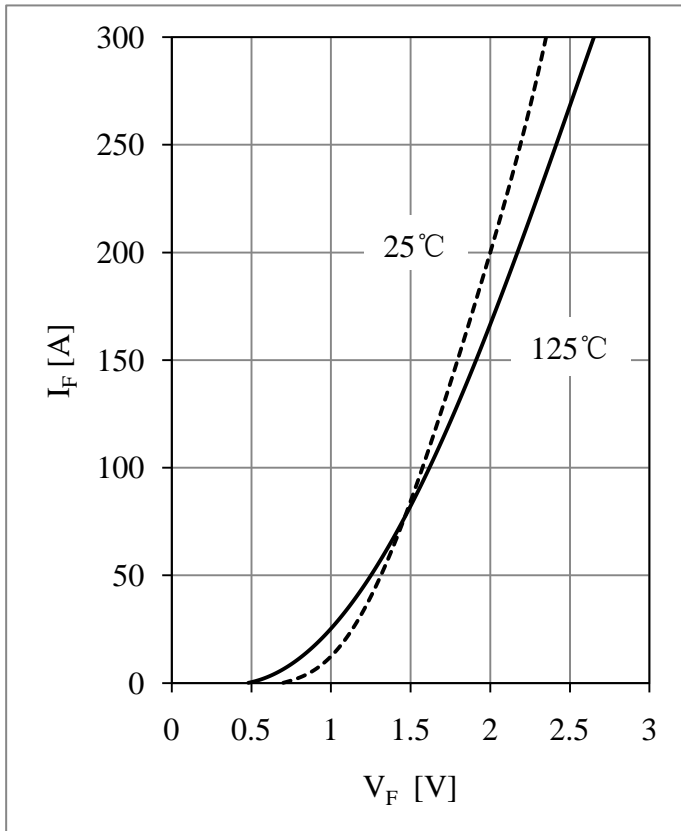


Fig 11. Diode D5-D6 Forward Characteristic

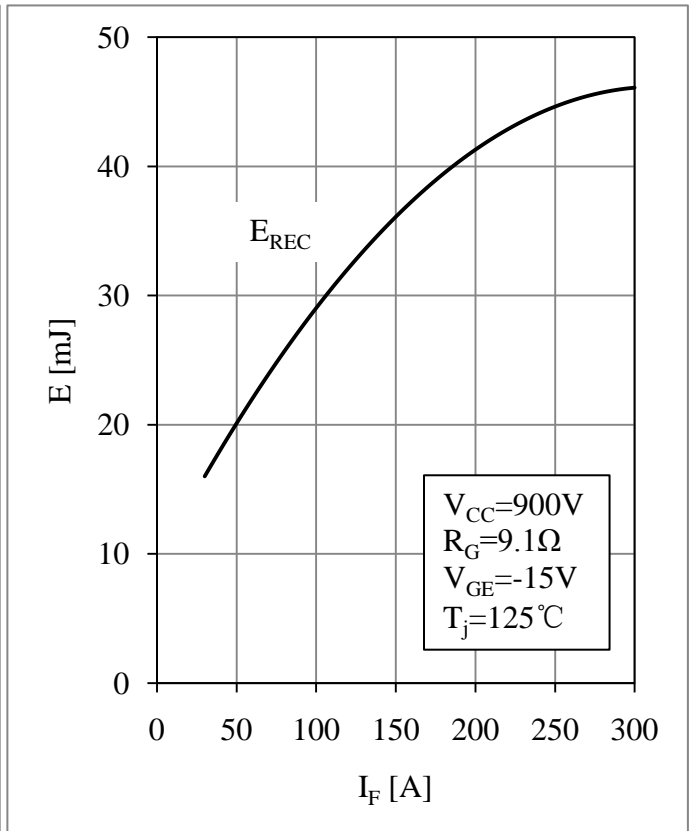


Fig 12. Diode D5-D6 Switching Loss vs. I_F

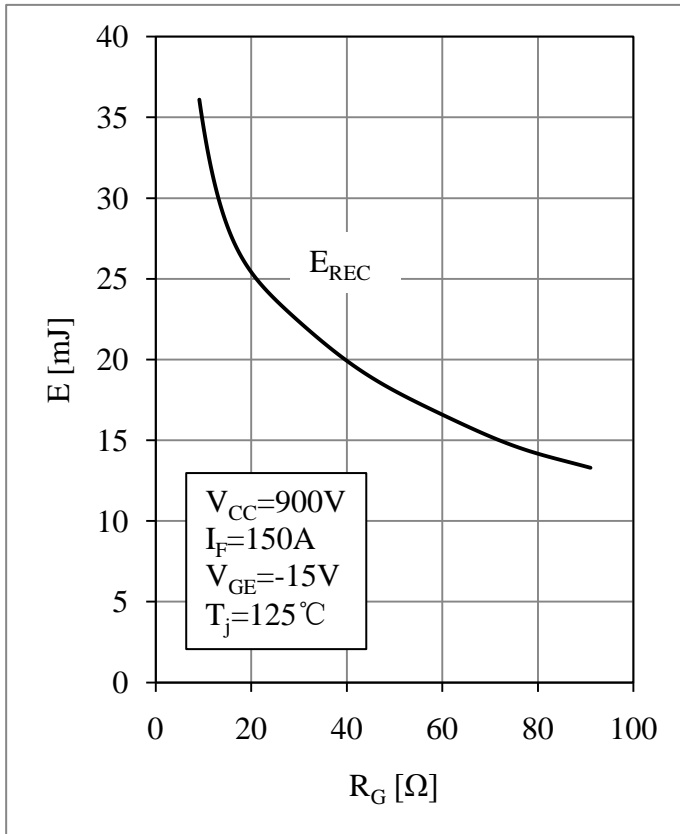


Fig 13. Diode D5-D6 Switching Loss vs. R_G

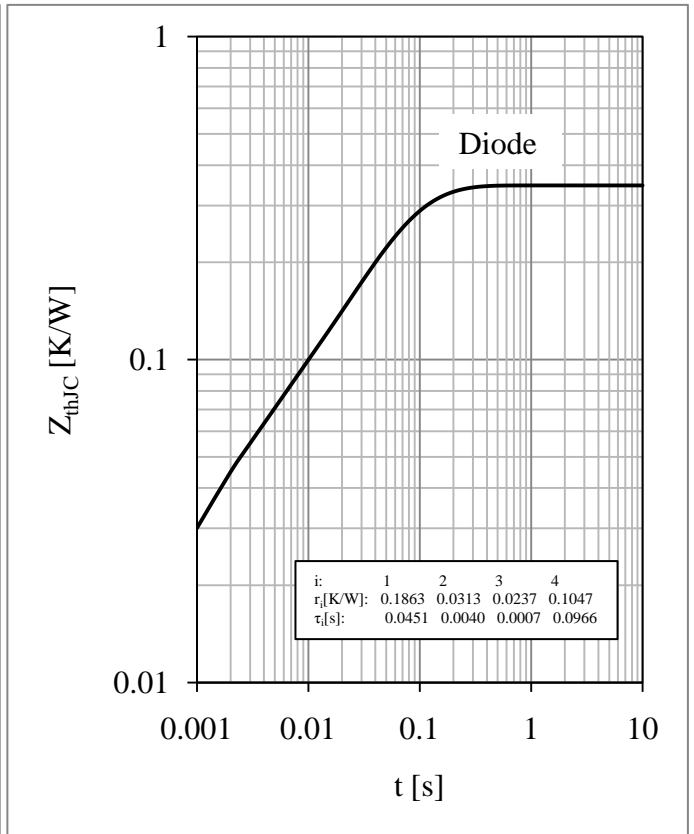


Fig 14. Diode D5-D6 Transient Thermal Impedance

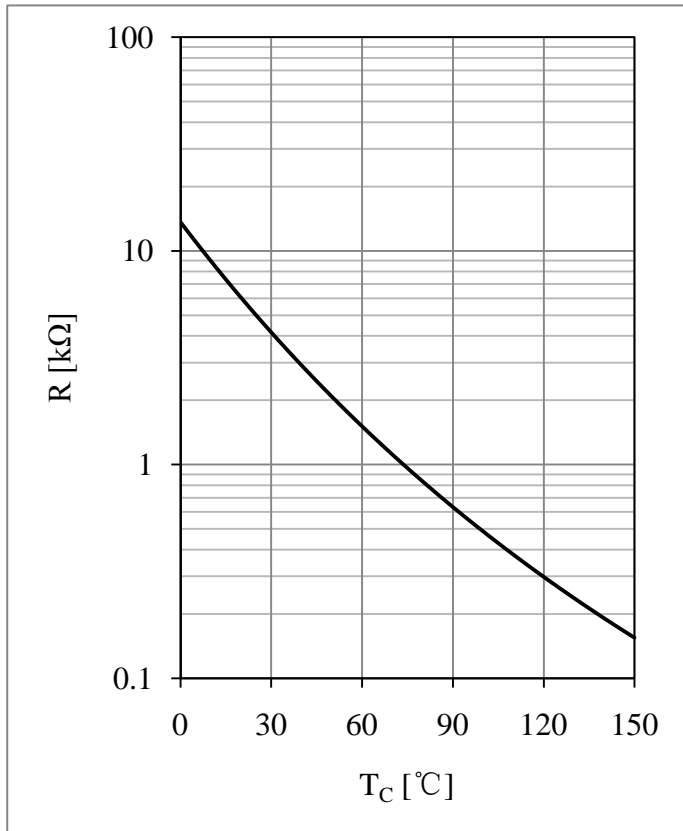
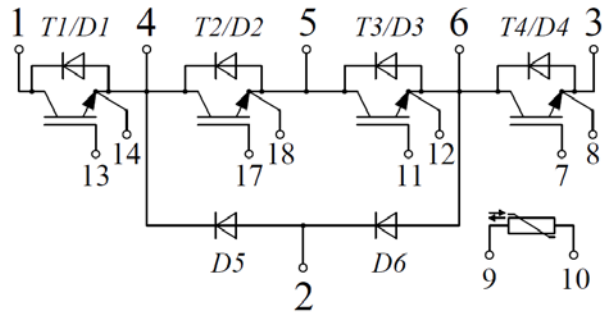


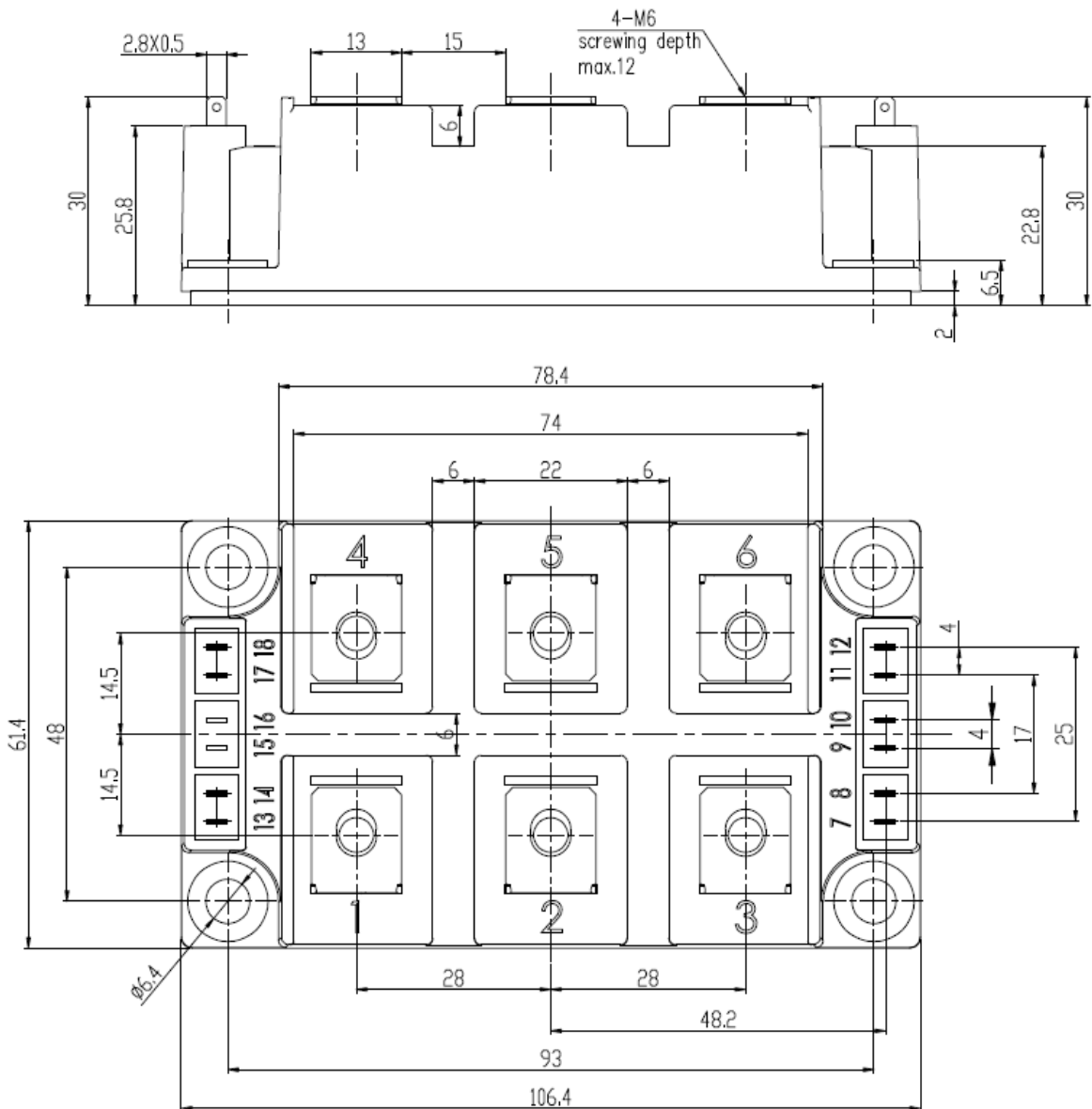
Fig 15. NTC Temperature Characteristic

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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