

STARPOWER

SEMICONDUCTOR

IGBT

GD300MLY65C2S

650V/300A 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.



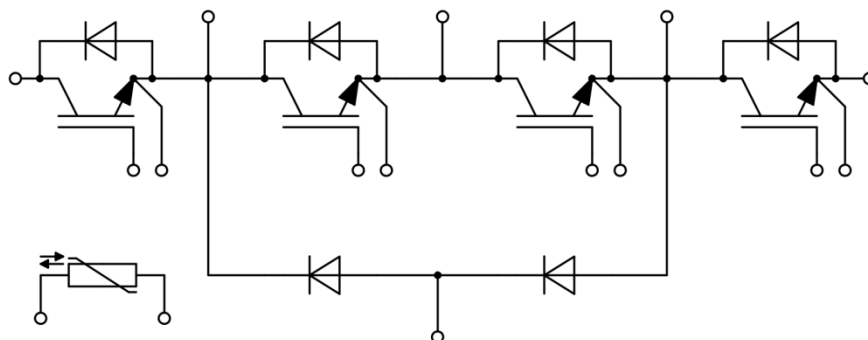
Features

- Low $V_{CE(sat)}$ trench IGBT technology
- 6 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

Typical Applications

- Solar power
- UPS
- 3-Level-Applications

Equivalent Circuit Schematic



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

Symbol	Description	Value	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^{\circ}\text{C}$	650	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^{\circ}\text{C}$	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	400	A
	@ $T_C=70^{\circ}\text{C}$	300	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	600	A
P_{tot}	Total Power Dissipation @ $T_j=175^{\circ}\text{C}$	847	W

D1,D2,D3,D4 Diode

Symbol	Description	Value	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^{\circ}\text{C}$	650	V
I_F	DC Forward Current	300	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	600	A

D5,D6 Diode

Symbol	Description	Value	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^{\circ}\text{C}$	650	V
I_F	DC Forward Current	300	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	600	A

Module

Symbol	Parameter	Value	Units
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,T2,T3,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	$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.45	1.90	V	
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.60			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=4.8\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.1	5.8	6.4	V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			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	
R_{Gint}	Internal Gate Resistance			1.0		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{Mhz}, V_{GE}=0\text{V}$		19.2		nF	
C_{res}	Reverse Transfer Capacitance				0.58		nF
Q_G	Gate Charge	$V_{CC}=300\text{V}, I_C=400\text{A}, V_{GE}=15\text{V}$		3.45		nC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		86		ns	
t_r	Rise Time			39		ns	
$t_{d(off)}$	Turn-Off Delay Time			394		ns	
t_f	Fall Time			39		ns	
E_{on}	Turn-On Switching Loss				1.71		mJ
E_{off}	Turn-Off Switching Loss				7.86		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=300\text{A}, R_G=2.4\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		97		ns	
t_r	Rise Time			47		ns	
$t_{d(off)}$	Turn-Off Delay Time			416		ns	
t_f	Fall Time			57		ns	
E_{on}	Turn-On Switching Loss				2.46		mJ
E_{off}	Turn-Off Switching Loss				9.68		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		1500		A	

D1,D2,D3,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	$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.55	1.95	V
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.50		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $-di/dt=7000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		11.9		μC
I_{RM}	Peak Reverse Recovery Current			172		A
E_{rec}	Reverse Recovery Energy			3.08		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $R_G=2.4\Omega, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		21.4		μC
I_{RM}	Peak Reverse Recovery Current			216		A
E_{rec}	Reverse Recovery Energy			5.56		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	$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.55	1.95	V
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.50		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $-di/dt=7000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		11.9		μC
I_{RM}	Peak Reverse Recovery Current			172		A
E_{rec}	Reverse Recovery Energy			3.08		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=300\text{A},$ $R_G=2.4\Omega, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		21.4		μC
I_{RM}	Peak Reverse Recovery Current			216		A
E_{rec}	Reverse Recovery Energy			5.56		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		$\text{k}\Omega$
$\Delta R/R$	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

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

Symbol	Parameter	Min.	Typ.	Max.	Units
R_{thJC}	Junction-to-Case (per T1,T2,T3,T4 IGBT)			0.177	K/W
	Junction-to-Case (per D1,D2,D3,D4 Diode)			0.288	
	Junction-to-Case (per D5,D6 Diode)			0.299	
R_{thCH}	Case-to-Heatsink (per Module)		0.010		K/W
M	Terminal Connection Torque, Screw M6	2.5		5.0	N.m
	Mounting Torque, Screw M6	3.0		5.0	
G	Weight of Module		340		g

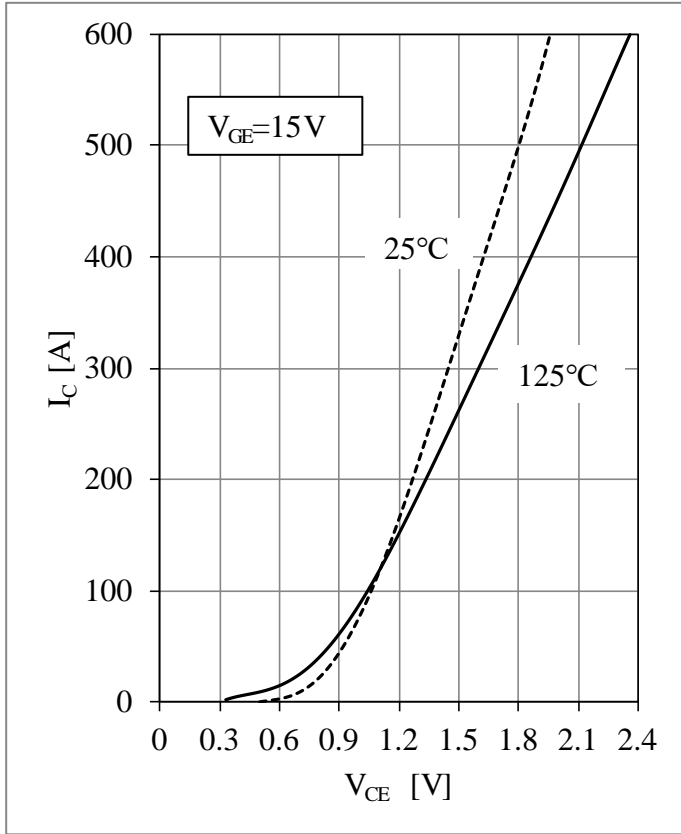


Fig 1. IGBT T1-T4 Output Characteristic

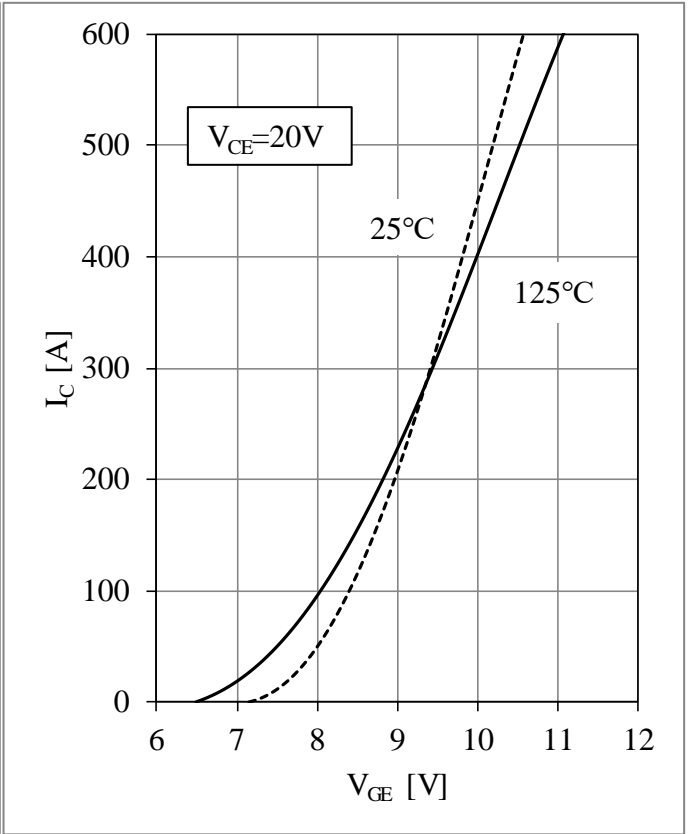


Fig 2. IGBT T1-T4 Transfer Characteristic

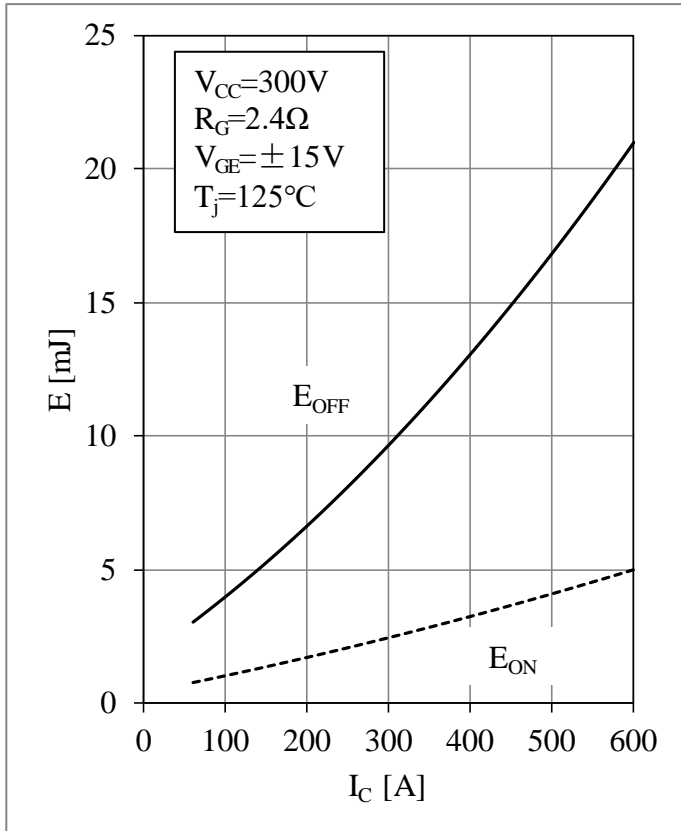


Fig 3. IGBT T1-T4 Switching Loss vs. I_C

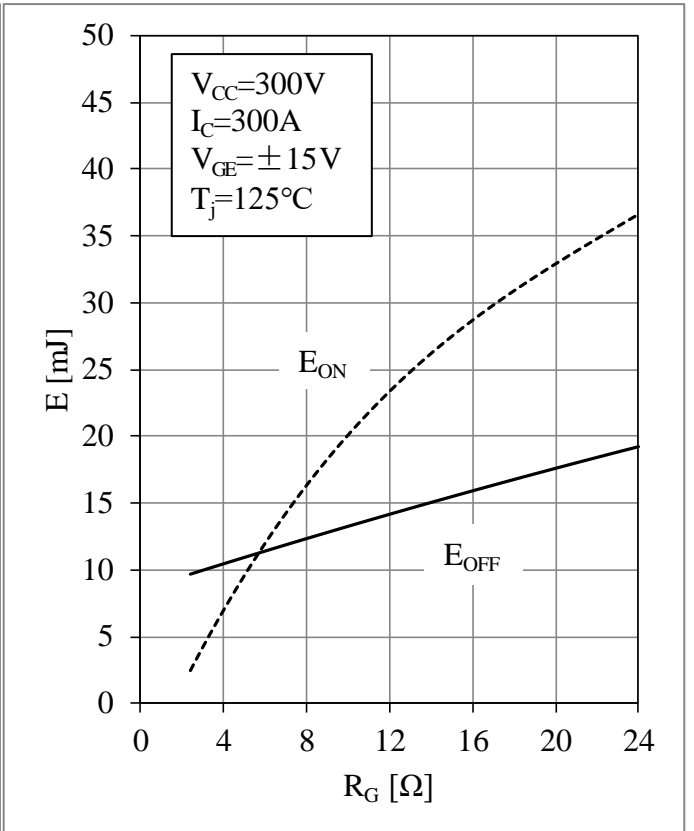


Fig 4. IGBT T1-T4 Switching Loss vs. R_G

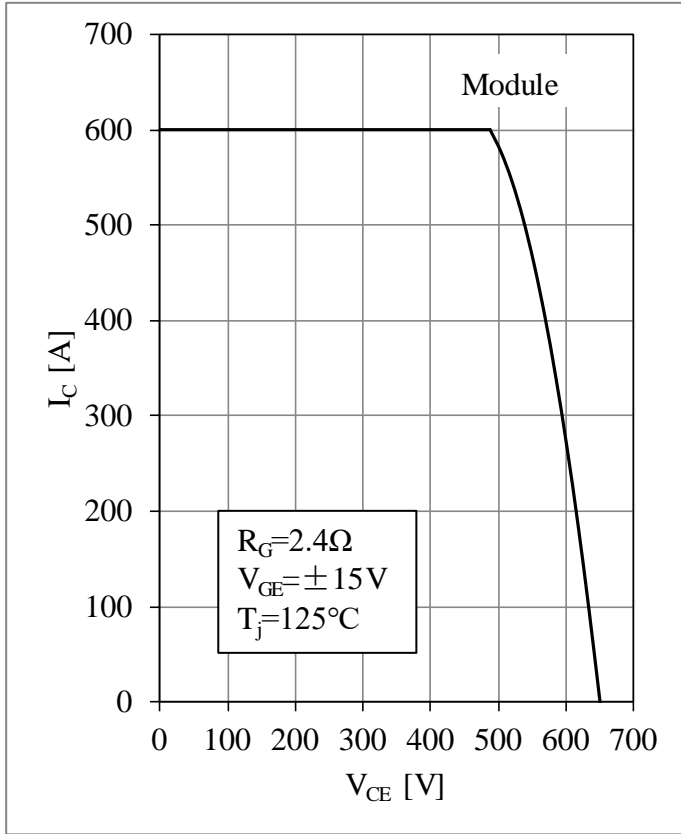


Fig 5. IGBT T1-T4 RBSOA

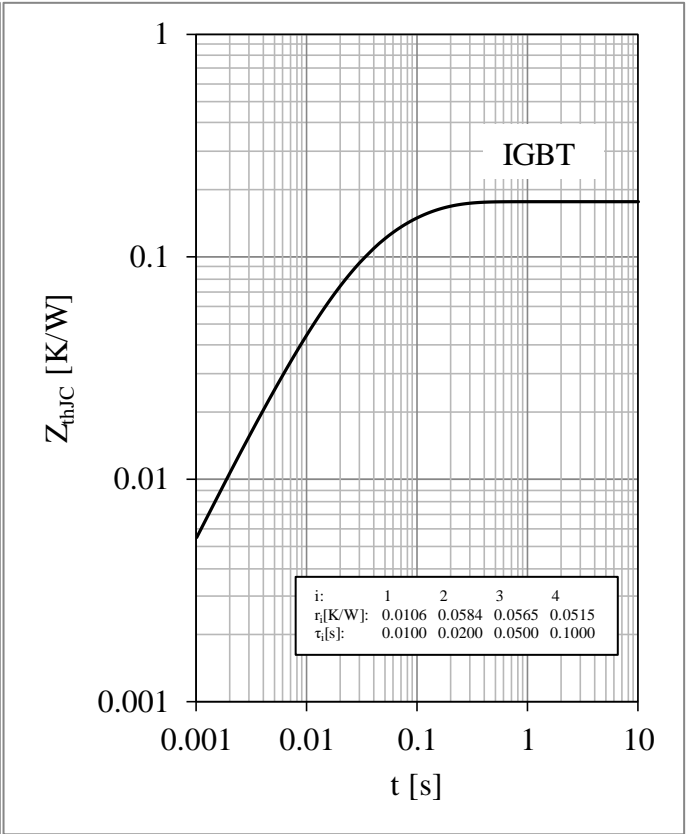


Fig 6. IGBT T1-T4 Transient Thermal Impedance

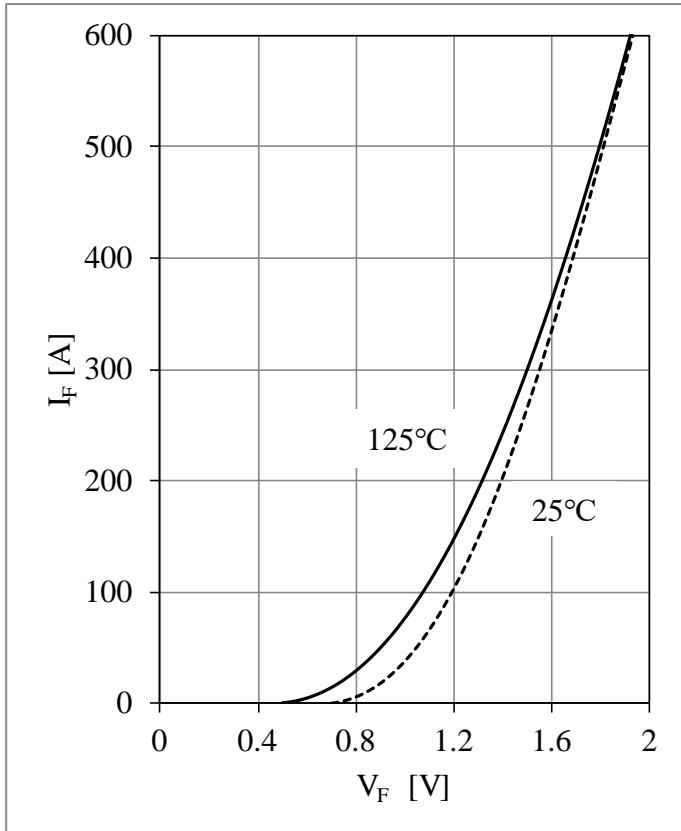


Fig 7. Diode D1-D4 Forward Characteristic

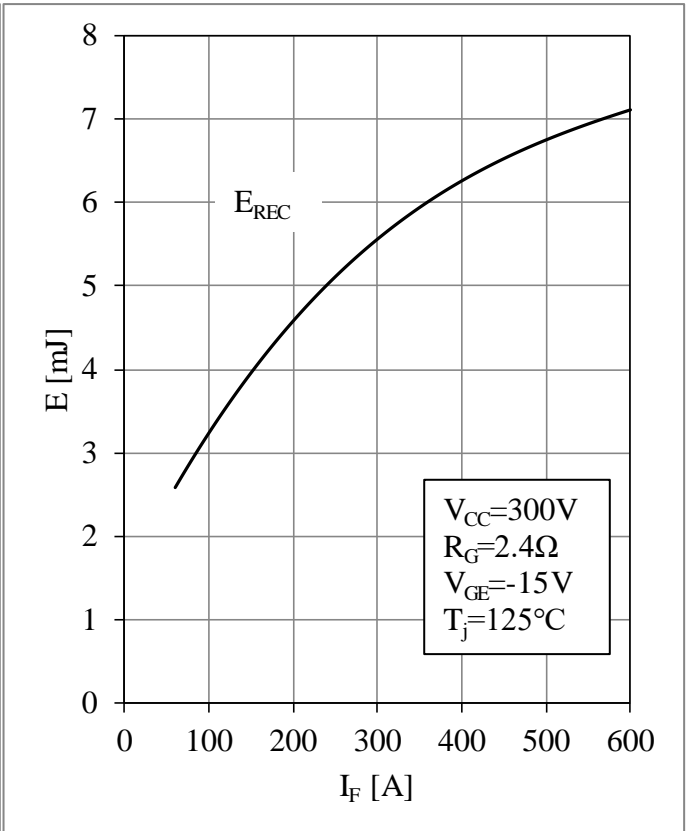


Fig 8. Diode D1-D4 Switching Loss vs. I_F

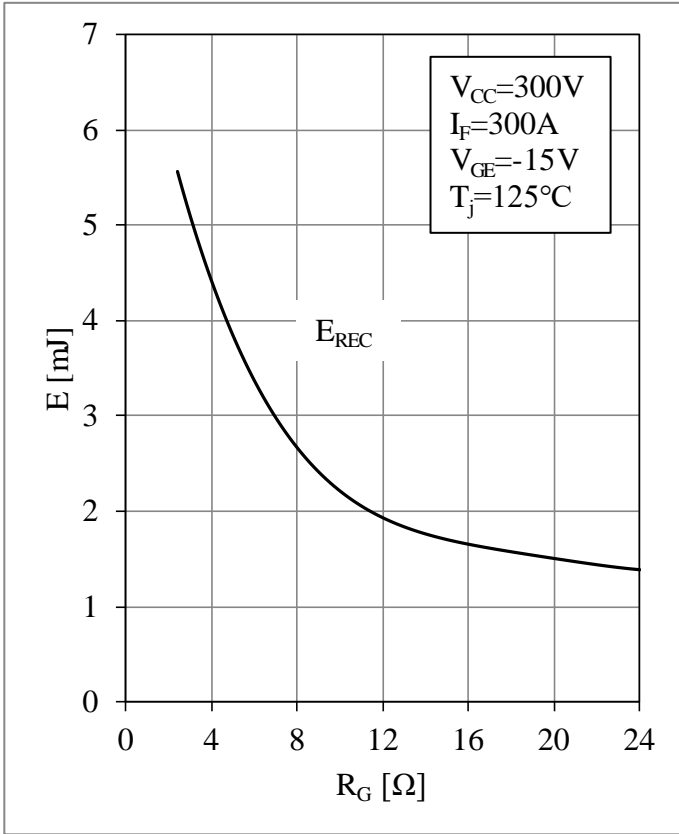


Fig 9. Diode D1-D4 Switching Loss vs. R_G

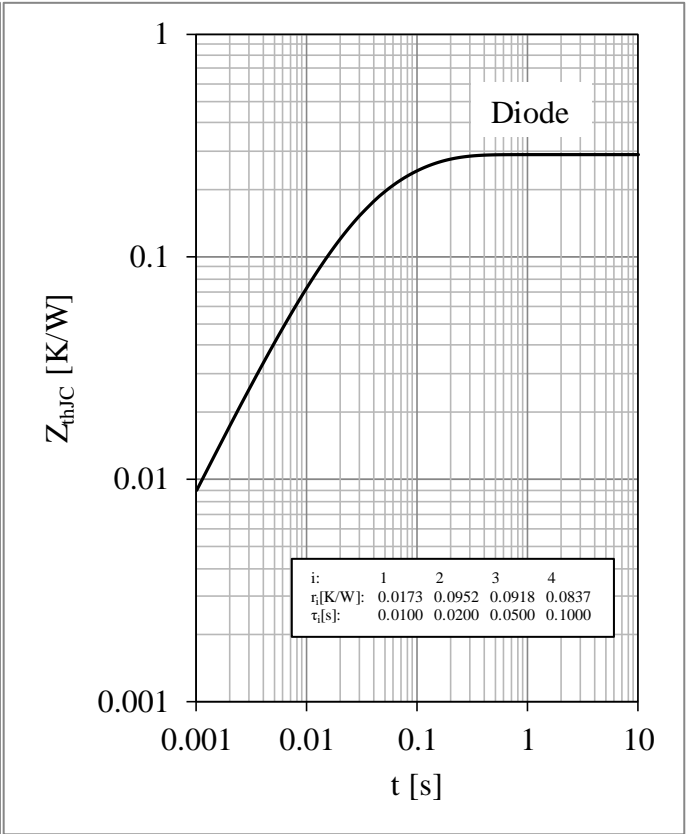


Fig 10. Diode D1-D4 Transient Thermal Impedance

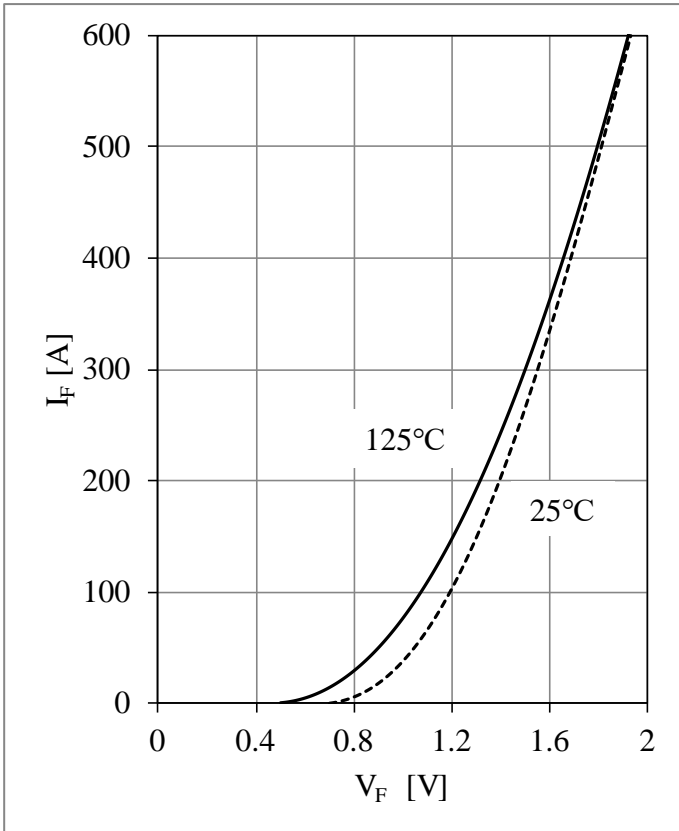


Fig 11. Diode D5-D6 Forward Characteristic

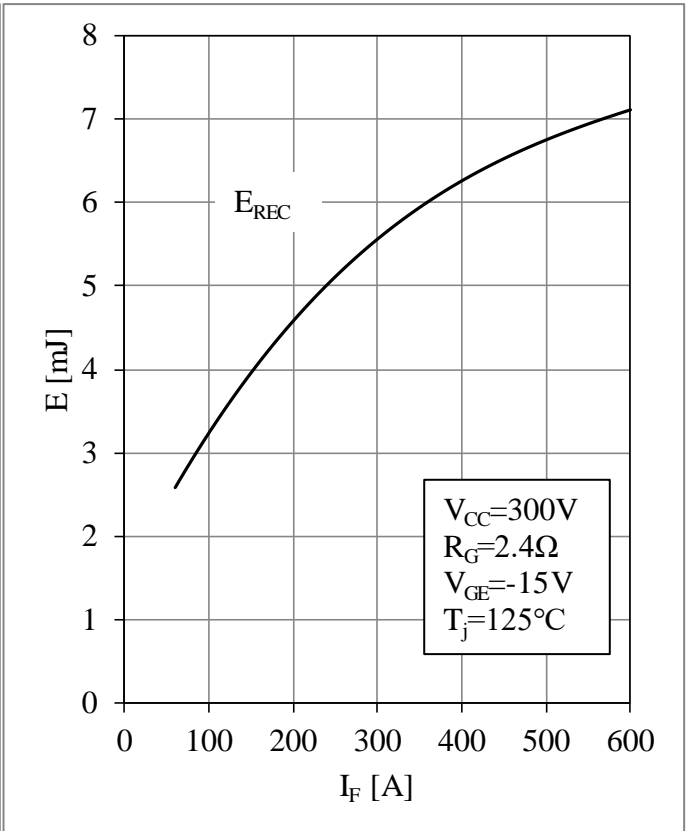


Fig 12. Diode D5-D6 Switching Loss vs. I_F

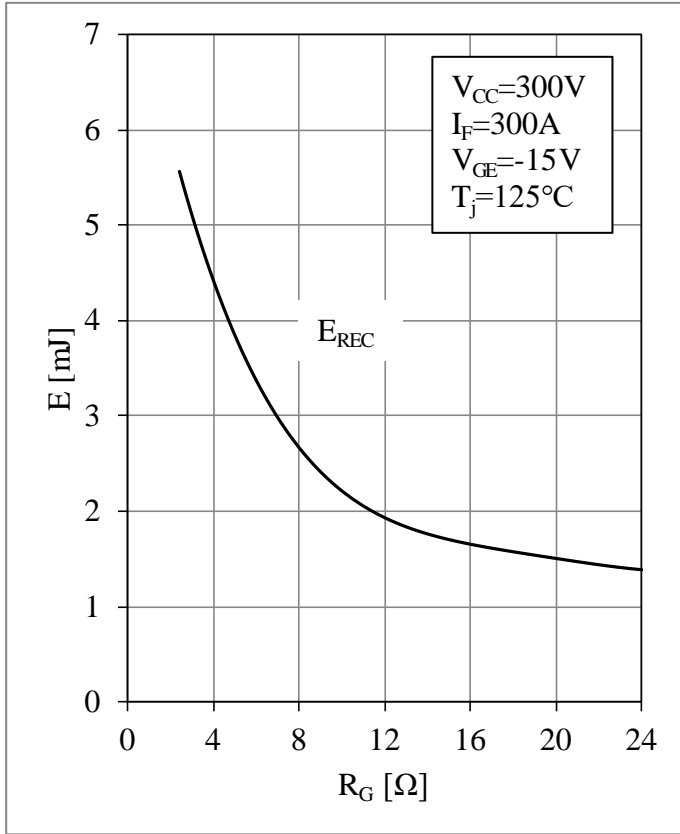


Fig 13. Diode D5-D6 Switching Loss vs. R_G

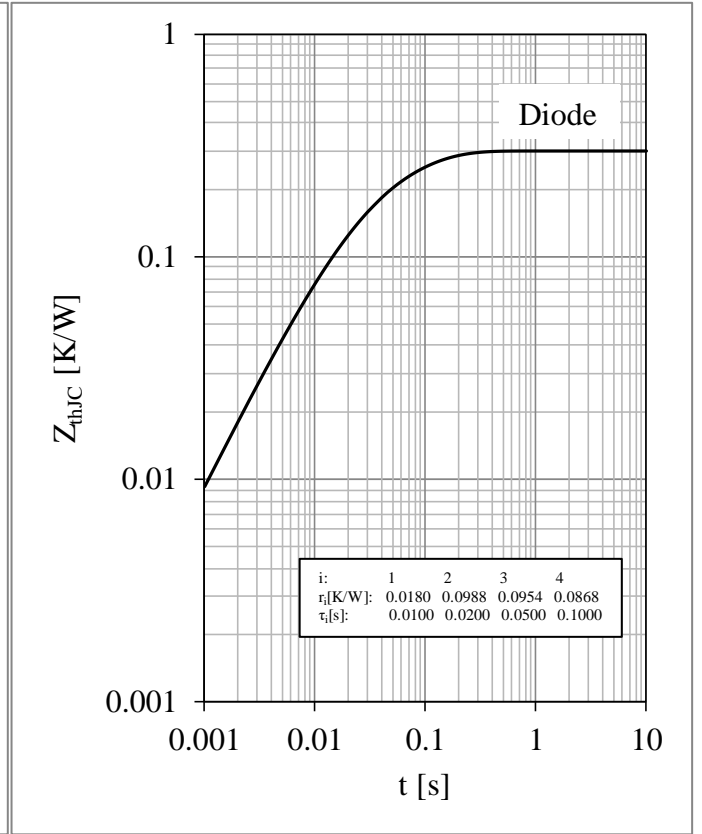


Fig 14. Diode D5-D6 Transient Thermal Impedance

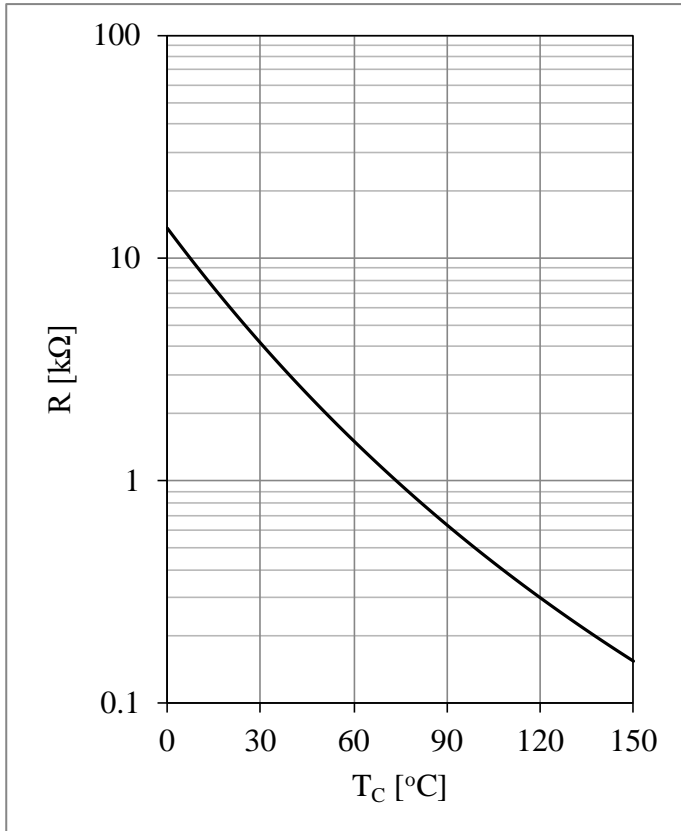
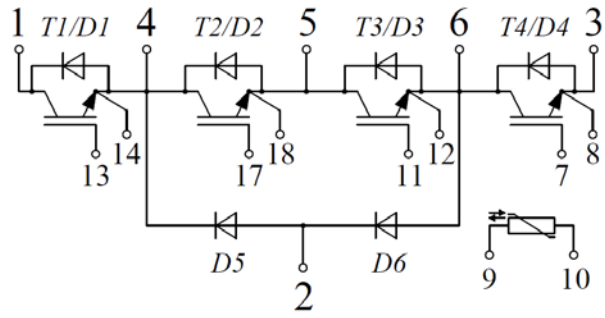


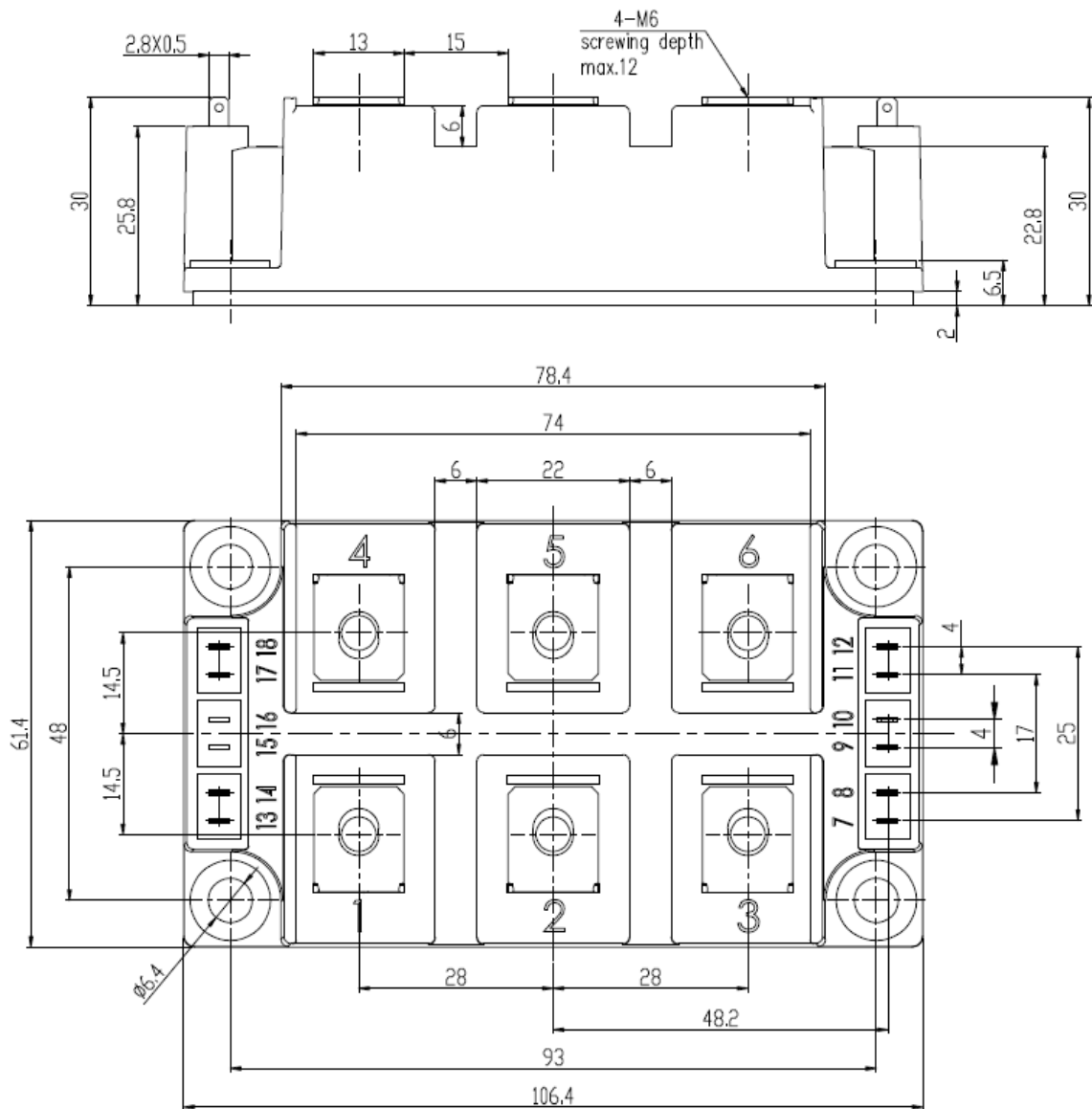
Fig 15. NTC Temperature Characteristic

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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