STARPOWER

SEMICONDUCTOR **IGBT**

GD400MLX65C2S

650V/400A 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.

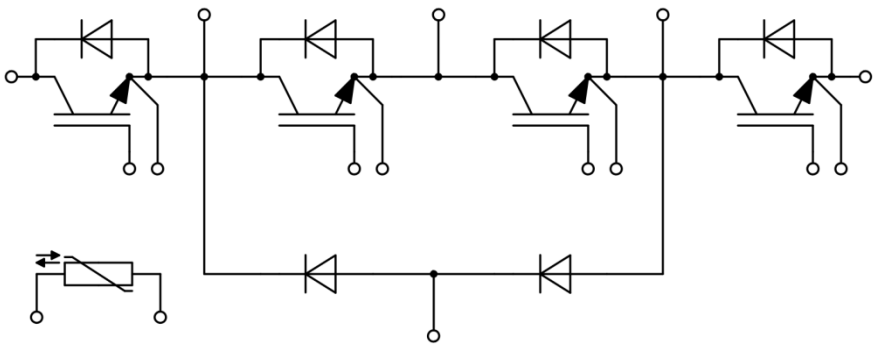
Features

- Low $V_{CE(sat)}$ trench IGBT technology
- 6μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175℃
- 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℃ unless otherwise noted

T1,T2,T3,T4 IGBT

Symbol	Description	Value	Units
V_{CES}	Collector-Emitter Voltage @ T_j=25℃	650	V
V_{GES}	Gate-Emitter Voltage @ T_j=25℃	±20	V
I_C	Collector Current @ T_C=25℃ @ T_C=70℃	500 400	A
I_{CM}	Pulsed Collector Current t_p=1ms	800	A
P_{tot}	Total Power Dissipation @ T_j=175℃	1027	W

D1,D2,D3,D4 Diode

Symbol	Description	Value	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	650	V
I_F	DC Forward Current	400	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	800	A

D5,D6 Diode

Symbol	Description	Value	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	650	V
I_F	DC Forward Current	400	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	800	A

Module

Symbol	Parameter	Value	Units
T_{jmax}	Maximum Junction Temperature	175	℃
T_{jop}	Operating Junction Temperature	-40 to +150	℃
T_{STG}	Storage Temperature Range	-40 to +125	℃
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V

T1,T2,T3,T4 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=400A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=400A,V_{GE}=15V, T_j=125°C		1.60		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=6.40mA,V_{CE}=V_{GE}, T_j=25°C	5.1	5.8	6.5	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			5.0	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			1.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1Mhz, V_{GE}=0V		24.7		nF
C_{oes}	Output Capacitance			1.54		nF
C_{res}	Reverse Transfer Capacitance			0.73		nF
Q_G	Gate Charge	V_{CC}=300V,I_C=400A, V_{GE}=15V		4.30		nC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=400A, R_G=1.8Ω,V_{GE}=±15V, T_j=25℃		81		ns
t_r	Rise Time			63		ns
$t_{d(off)}$	Turn-Off Delay Time			366		ns
t_f	Fall Time			39		ns
E_{on}	Turn-On Switching Loss			2.30		mJ
E_{off}	Turn-Off Switching Loss			10.3		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=400A, R_G=1.8Ω,V_{GE}=±15V, T_j=125℃		88		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			404		ns
t_f	Fall Time			56		ns
E_{on}	Turn-On Switching Loss			3.36		mJ
E_{off}	Turn-Off Switching Loss			12.8		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=125°C,V_{CC}=360V, V_{CEM}≤650V		2000		A

D1,D2,D3,D4 Diode Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=400A,V_{GE}=0V,T_j=25°C		1.55	1.95	V
		I_F=400A,V_{GE}=0V,T_j=125°C		1.50		
Q_r	Recovered Charge	V_R=300V,I_F=400A, R_G=1.8Ω,V_{GE}=-15V T_j=25°C		20.0		μC
I_{RM}	Peak Reverse Recovery Current			236		A
E_{rec}	Reverse Recovery Energy			3.93		mJ
Q_r	Recovered Charge	V_R=300V,I_F=400A, R_G=1.8Ω,V_{GE}=-15V T_j=125°C		32.7		μC
I_{RM}	Peak Reverse Recovery Current			308		A
E_{rec}	Reverse Recovery Energy			7.98		mJ

D5,D6 Diode Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=400A,V_{GE}=0V,T_j=25°C		1.55	1.95	V
		I_F=400A,V_{GE}=0V,T_j=125°C		1.50		
Q_r	Recovered Charge	V_R=300V,I_F=400A, R_G=1.8Ω,V_{GE}=-15V T_j=25°C		20.0		μC
I_{RM}	Peak Reverse Recovery Current			236		A
E_{rec}	Reverse Recovery Energy			3.93		mJ
Q_r	Recovered Charge	V_R=300V,I_F=400A, R_G=1.8Ω,V_{GE}=-15V T_j=125°C		32.7		μC
I_{RM}	Peak Reverse Recovery Current			308		A
E_{rec}	Reverse Recovery Energy			7.98		mJ

NTC Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			5.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100℃,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

Module Characteristics T_C=25℃ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Units
R_{thJC}	Junction-to-Case (per T1,T2,T3,T4 IGBT) Junction-to-Case (per D1,D2,D3,D4 Diode) Junction-to-Case (per D5,D6 Diode)			0.146 0.243 0.251	K/W
R_{thCH}	Case-to-Heatsink (per Module)		0.010		K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M6	2.5 3.0		5.0 5.0	N.m
G	Weight of Module		340		g

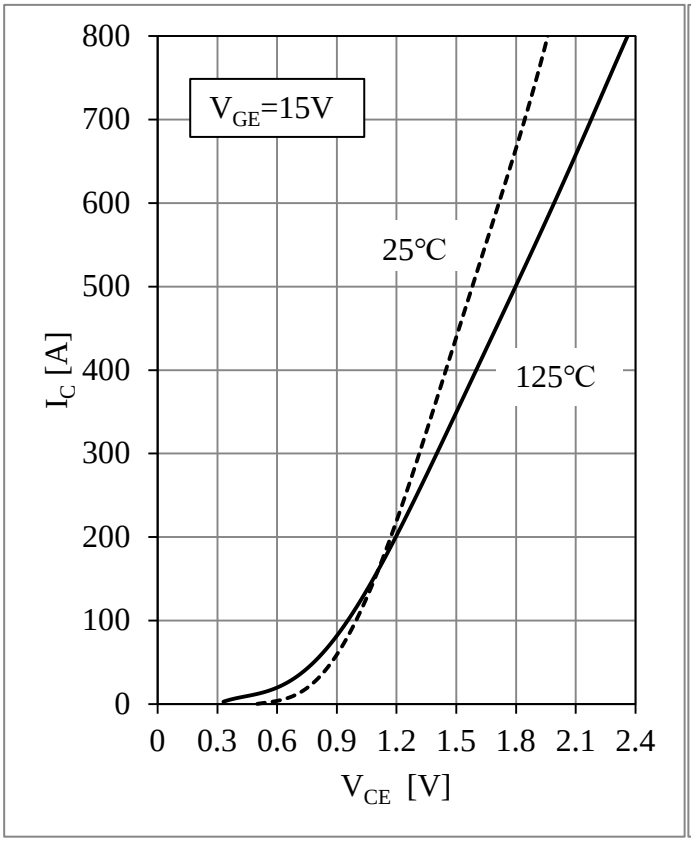


Fig 1. IGBT T1-T4 Output Characteristic

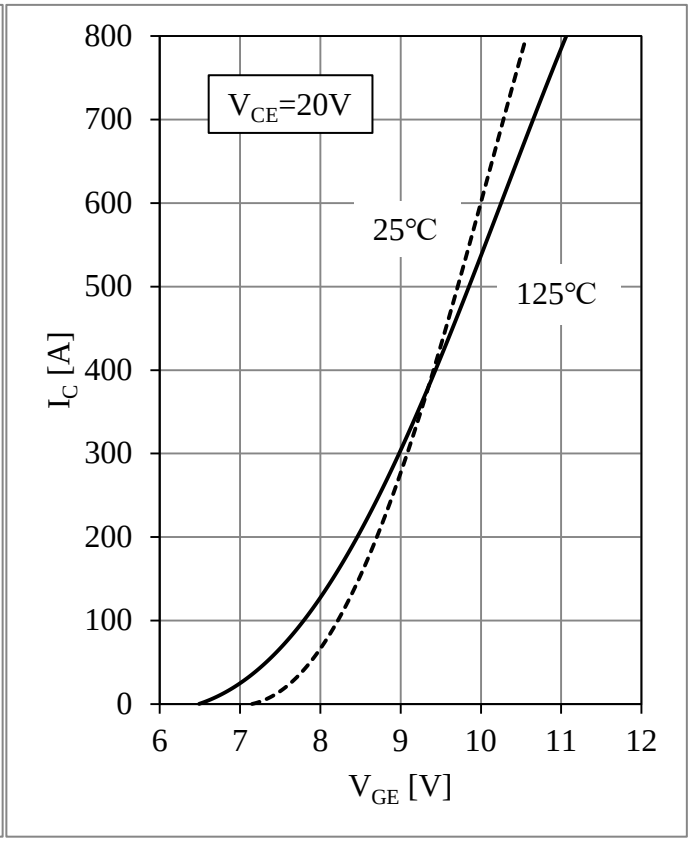


Fig 2. IGBT T1-T4 Transfer Characteristic

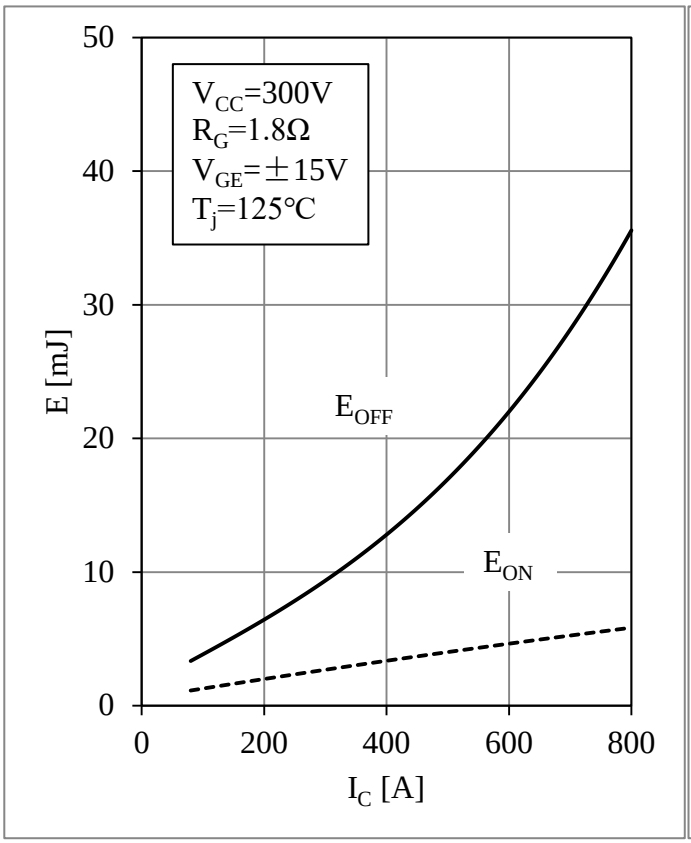


Fig 3. IGBT T1-T4 Switching Loss vs. I_C

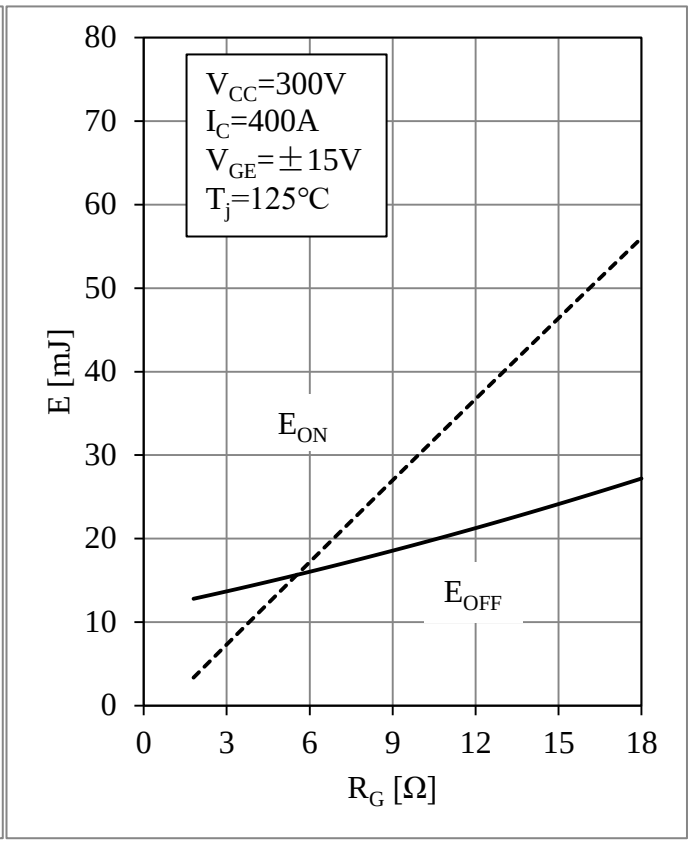


Fig 4. IGBT T1-T4 Switching Loss vs. R_G

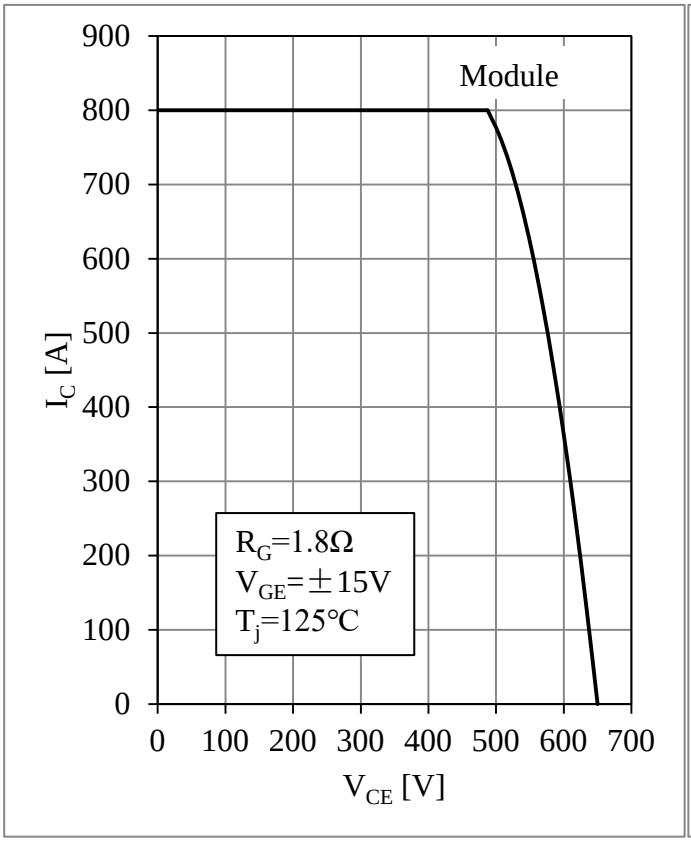


Fig 5. IGBT T1-T4 RBSOA

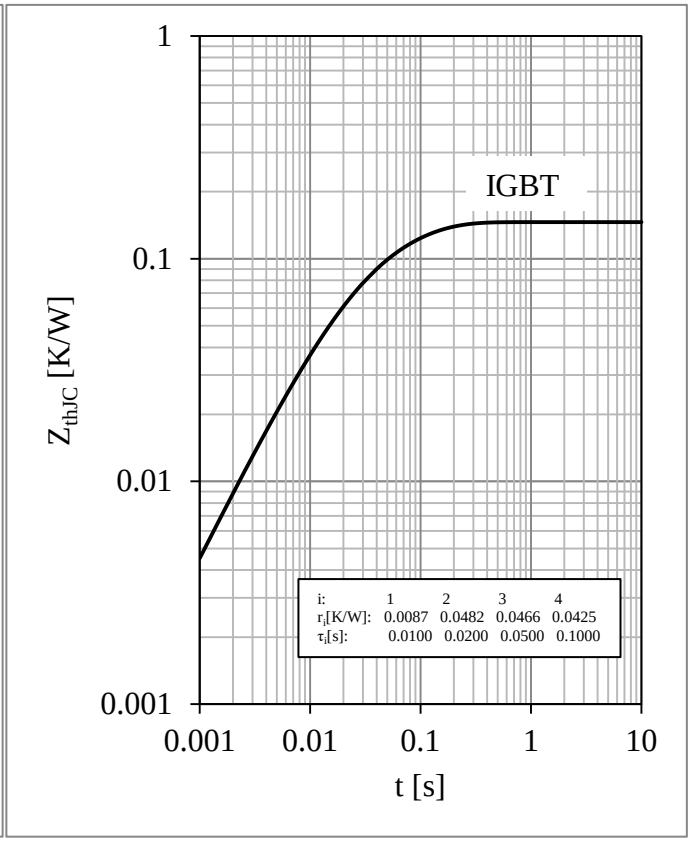


Fig 6. IGBT T1-T4 Transient Thermal Impedance

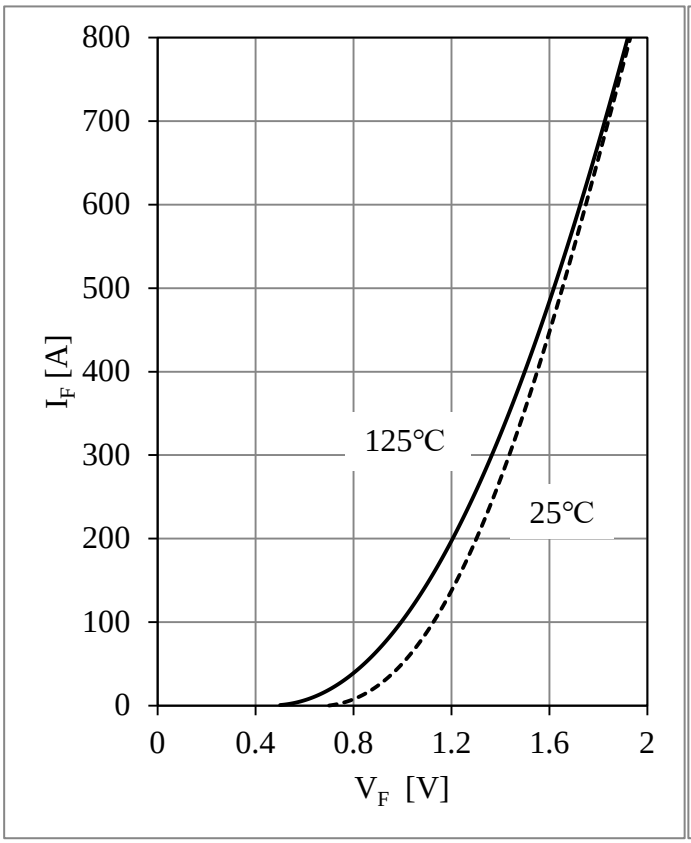


Fig 7. Diode D1-D4 Forward Characteristic

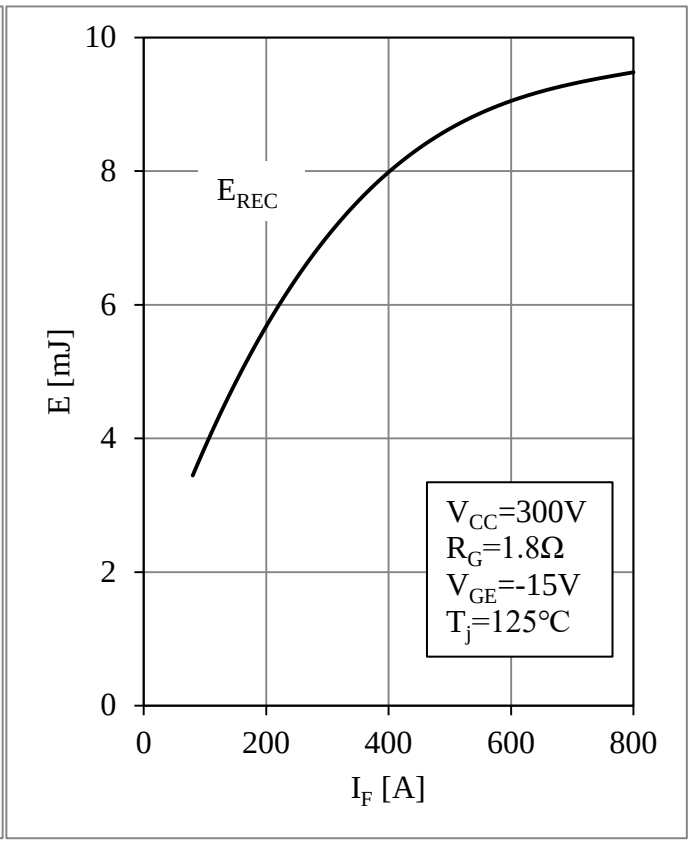


Fig 8. Diode D1-D4 Switching Loss vs. I_F

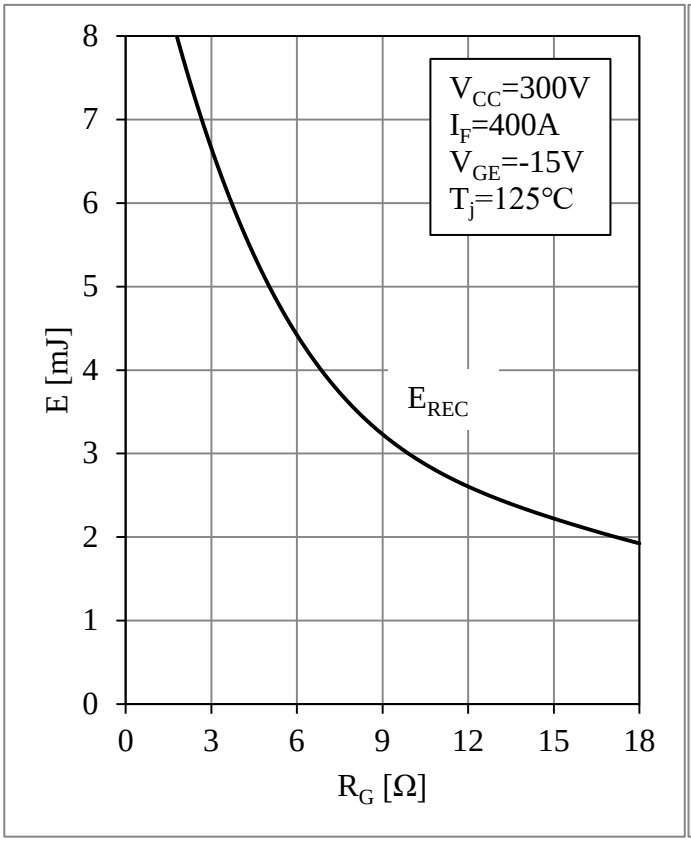


Fig 9. Diode D1-D4 Switching Loss vs. R_G

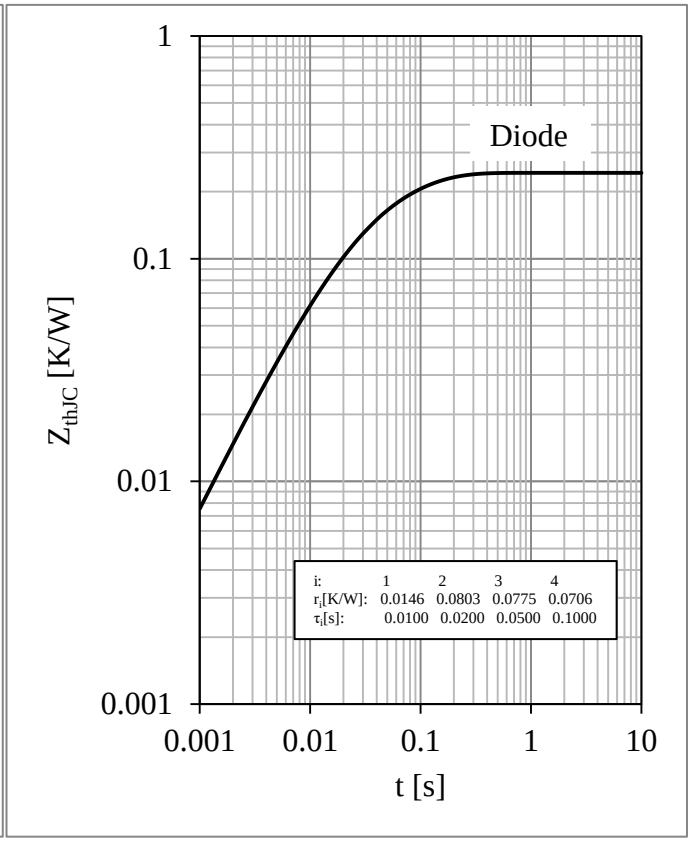


Fig 10. Diode D1-D4 Transient Thermal Impedance

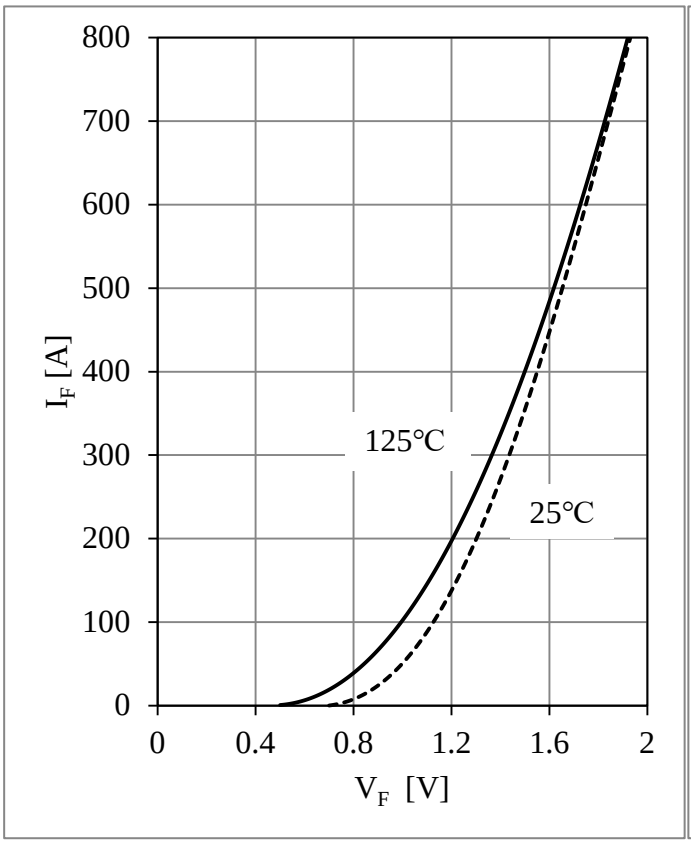


Fig 11. Diode D5-D6 Forward Characteristic

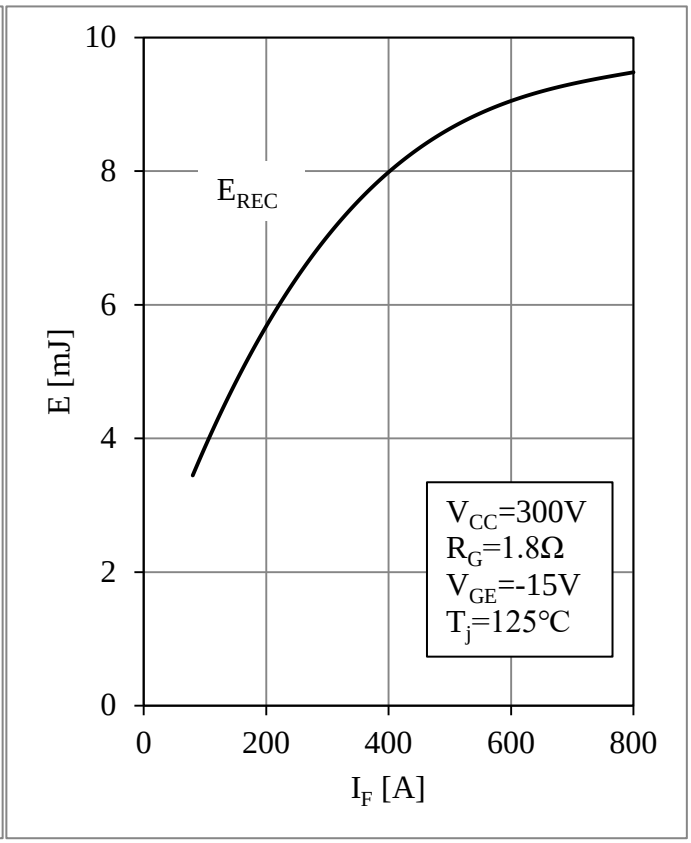


Fig 12. Diode D5-D6 Switching Loss vs. I_F

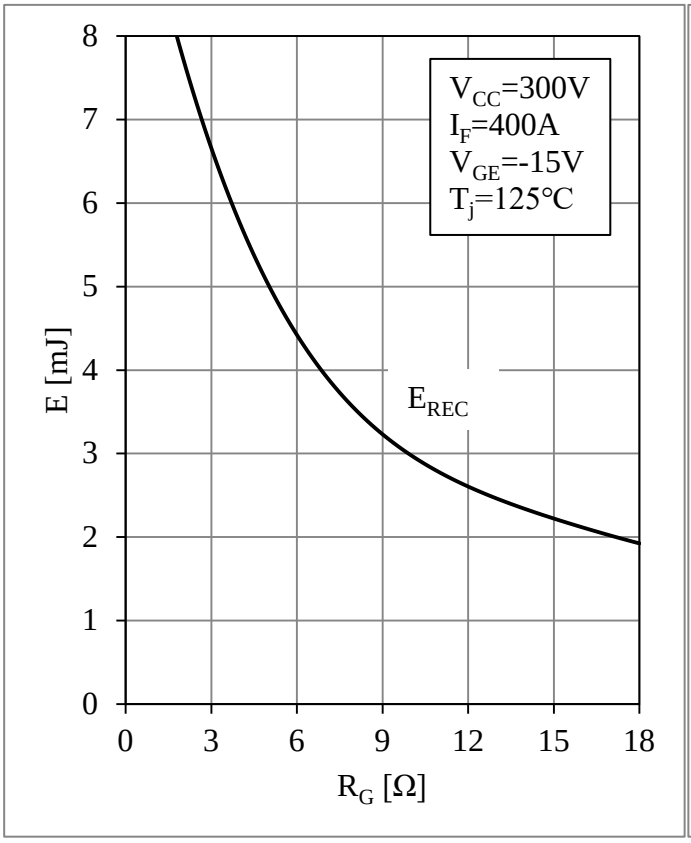


Fig 13. Diode D5-D6 Switching Loss vs. R_G

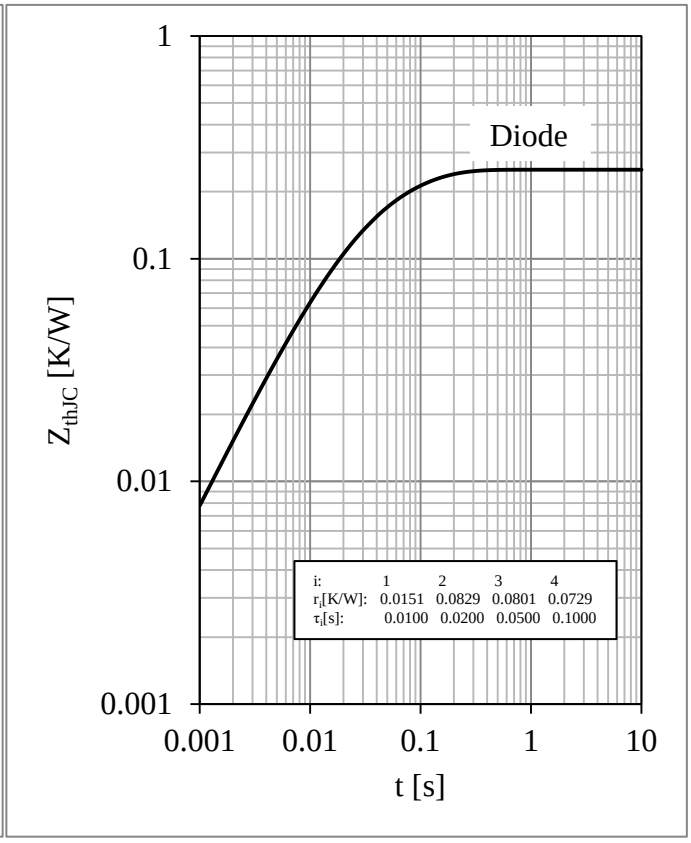


Fig 14. Diode D5-D6 Transient Thermal Impedance

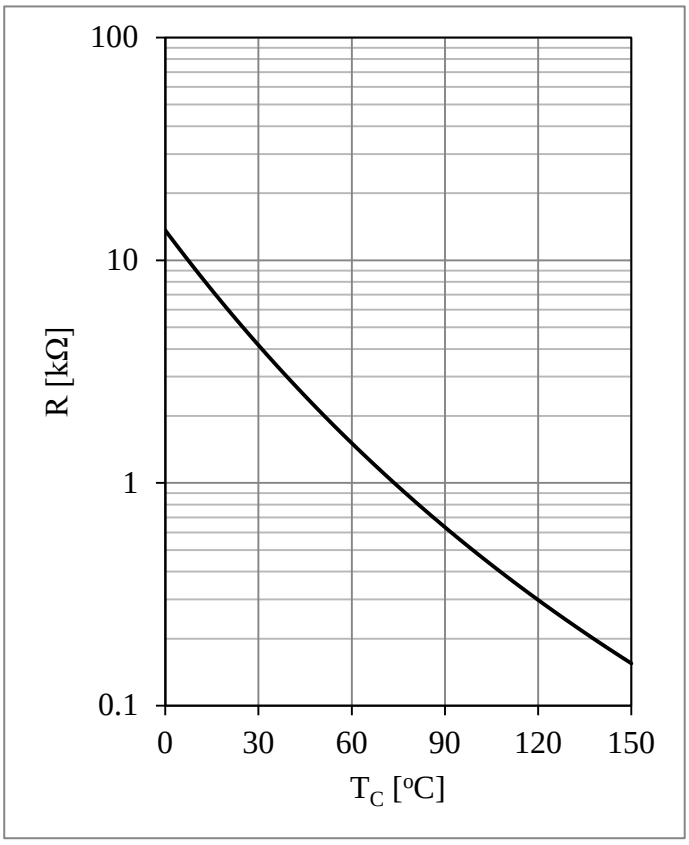
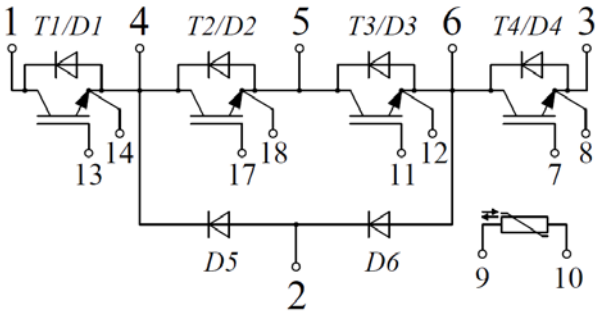


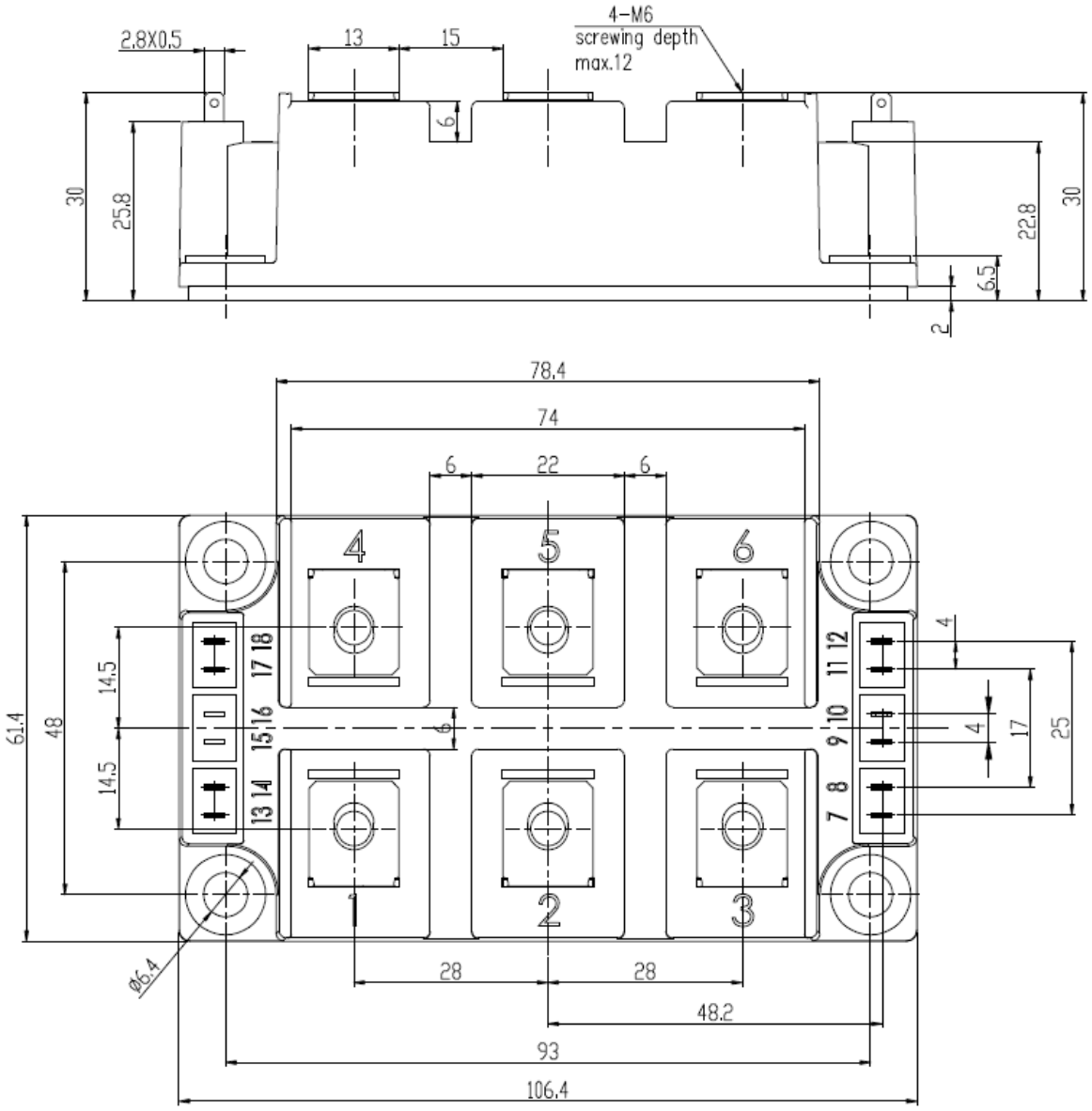
Fig 15. NTC Temperature Characteristic

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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