STARPOWER

SEMICONDUCTOR **IGBT**

GD300MLT60B3ST

Molding Type Module

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-application.

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-application

IGBT T1 T4 T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD300MLT60B3ST	Unit
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℃	400 300	A
I_{CM}	Pulsed Collector Current t_p=1ms	600	A
P_{tot}	Total Power Dissipation @ T_j=175℃	857	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	T_j=25℃	650			V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=4.8mA,V_{CE}=V_{GE}, T_j=25℃	5.1	5.8	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=300A,V_{GE}=15V, T_j=25℃		1.45	1.90	V
		I_C=300A,V_{GE}=15V, T_j=125℃		1.60		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=300A, R_G=1.65Ω,V_{GE}=±15V, T_j=25℃		86		ns
t_r	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			302		ns
t_f	Fall Time			89		ns
E_{on}	Turn-On Switching Loss			2.40		mJ
E_{off}	Turn-Off Switching Loss			8.30		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=300A, R_G=1.65Ω,V_{GE}=±15V, T_j=125℃		102		ns
t_r	Rise Time			46		ns
$t_{d(off)}$	Turn-Off Delay Time			335		ns
t_f	Fall Time			135		ns
E_{on}	Turn-On Switching Loss			3.50		mJ
E_{off}	Turn-Off Switching Loss			10.2		mJ
C_{ies}	Input Capacitance	V_{CE}=25V,f=1Mhz, V_{GE}=0V		18.5		nF
C_{res}	Reverse Transfer Capacitance			0.55		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		3.20		μC
R_{Gint}	Internal Gate Resister			1.0		Ω
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150℃,V_{CC}=360V, V_{CEM}≤650V		1500		A

Diode D1 D4 T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD300MLT60B3ST	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	650	V
I_F	DC Forward Current	200	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	400	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=200A V_{GE}=0V	T_j=25℃		1.55	1.95	V
			T_j=125℃		1.50		
Q_r	Recovered Charge	I_F=200A, V_R=300V, -di/dt=6400A/μs, V_{GE}=-15V	T_j=25℃		8.4		μC
			T_j=125℃		15.6		
I_{RM}	Peak Reverse Recovery Current		T_j=25℃		180		A
			T_j=125℃		220		
E_{rec}	Reverse Recovery Energy		T_j=25℃		2.40		mJ
			T_j=125℃		4.30		

IGBT T2 T3 T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD300MLT60B3ST	Unit
V_{CES}	Collector-Emitter Voltage @ T_j=25℃	600	V
V_{GES}	Gate-Emitter Voltage @ T_j=25℃	±20	V
I_C	Collector Current @ T_C=25℃ @ T_C=70℃	400 300	A
I_{CM}	Pulsed Collector Current t_p=1ms	600	A
P_{tot}	Total Power Dissipation @ T_j=175℃	847	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	T_j=25℃	600			V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=4.8mA,V_{CE}=V_{GE}, T_j=25℃	5.1	5.8	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=300A,V_{GE}=15V, T_j=25℃		1.45	1.90	V
		I_C=300A,V_{GE}=15V, T_j=125℃		1.60		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=300A, R_G=2.4Ω,V_{GE}=±15V, T_j=25℃		108		ns
t_r	Rise Time			49		ns
$t_{d(off)}$	Turn-Off Delay Time			492		ns
t_f	Fall Time			49		ns
E_{on}	Turn-On Switching Loss			2.13		mJ
E_{off}	Turn-Off Switching Loss			9.83		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=300V,I_C=300A, R_G=2.4Ω,V_{GE}=±15V, T_j=125℃		121		ns
t_r	Rise Time			59		ns
$t_{d(off)}$	Turn-Off Delay Time			520		ns
t_f	Fall Time			71		ns
E_{on}	Turn-On Switching Loss			3.08		mJ
E_{off}	Turn-Off Switching Loss			12.1		mJ
C_{ies}	Input Capacitance	V_{CE}=25V,f=1Mhz, V_{GE}=0V		18.5		nF
C_{res}	Reverse Transfer Capacitance			0.55		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		3.22		μC
R_{Gint}	Internal Gate Resister			1.0		Ω
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150℃,V_{CC}=360V, V_{CEM}≤600V		1500		A

Diode D2 D3 T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD300MLT60B3ST	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	600	V
I_F	DC Forward Current	200	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	400	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=200A V_{GE}=0V	T_j=25℃		1.55	1.95	V
			T_j=125℃		1.50		
Q_r	Recovered Charge	I_F=200A, V_R=300V, -di/dt=6000A/μs, V_{GE}=-15V	T_j=25℃		9.0		μC
			T_j=125℃		16.0		
I_{RM}	Peak Reverse Recovery Current		T_j=25℃		130		A
			T_j=125℃		160		
E_{rec}	Reverse Recovery Energy		T_j=25℃		2.30		mJ
			T_j=125℃		4.10		

Diode D5 D6 T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD300MLT60B3ST	Unit
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	600	V
I_F	DC Forward Current	300	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	600	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=300A V_{GE}=0V	T_j=25℃		1.55	1.95	V
			T_j=125℃		1.50		
Q_r	Recovered Charge	I_F=300A, V_R=300V, -di/dt=6500A/μs, V_{GE}=-15V	T_j=25℃		13.2		μC
			T_j=125℃		23.8		
I_{RM}	Peak Reverse Recovery Current		T_j=25℃		192		A
			T_j=125℃		240		
E_{rec}	Reverse Recovery Energy		T_j=25℃		3.42		mJ
			T_j=125℃		6.18		

IGBT Module

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500			V
$R_{\theta JC}$	Junction-to-Case (per IGBT T1 T4) Junction-to-Case (per Diode D1 D4) Junction-to-Case (per IGBT T2 T3) Junction-to-Case (per Diode D2 D3) Junction-to-Case (per Diode D5 D6)			0.175 0.367 0.177 0.368 0.299	K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.035		K/W
T_{jmax}	Maximum Junction Temperature			175	℃
T_{jop}	Operating Junction Temperature	-40		150	℃
T_{STG}	Storage Temperature Range	-40		125	℃
Mounting Torque	Power Terminal Screw:M6 Mounting Screw:M6	2.5 3.0		5.0 5.0	N.m
Weight	Weight of Module		340		g

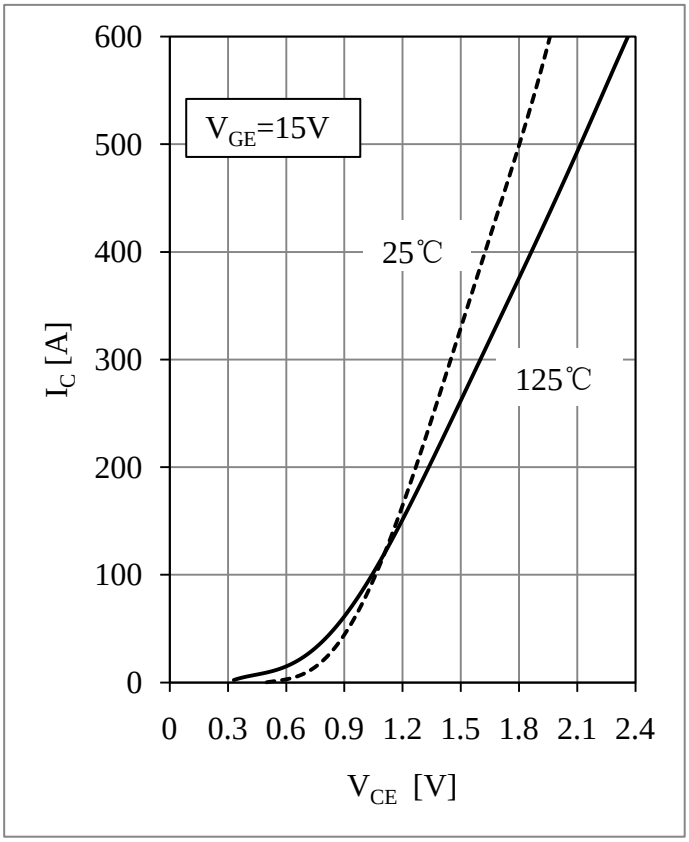


Fig 1. IGBT T1 T4 Output Characteristic

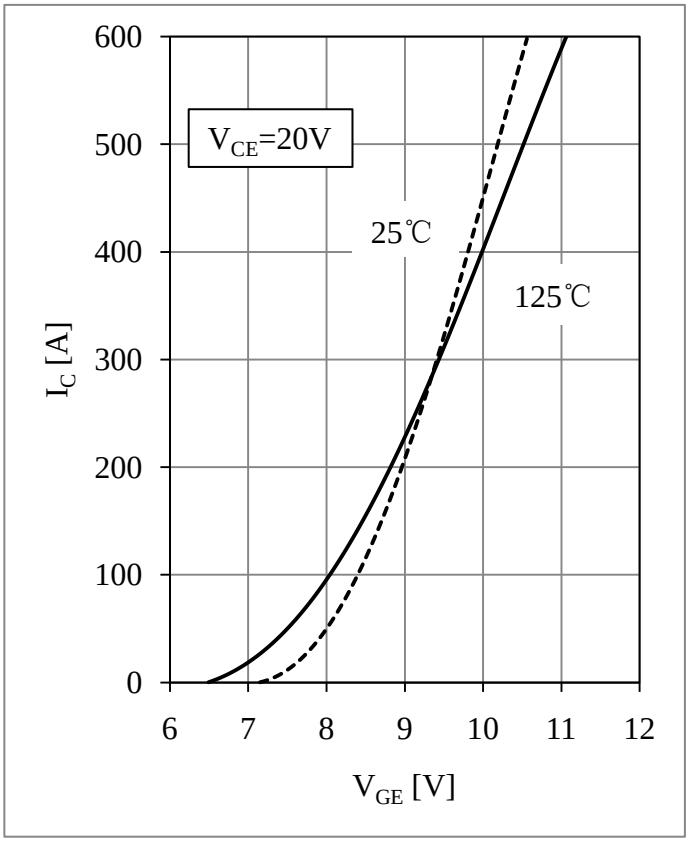


Fig 2. IGBT T1 T4 Transfer Characteristic

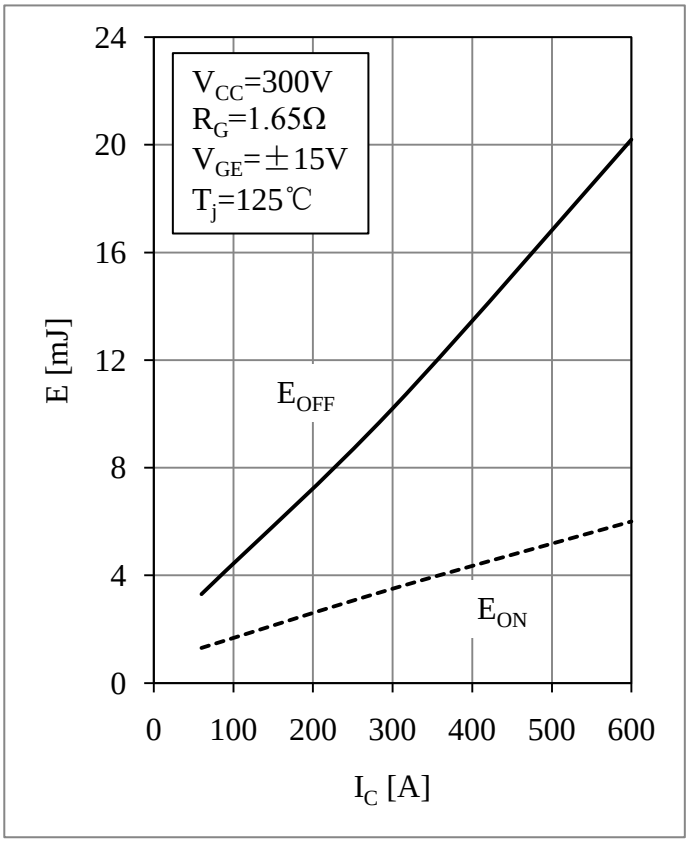


Fig 3. IGBT T1 T4 Switching Loss vs. I_C

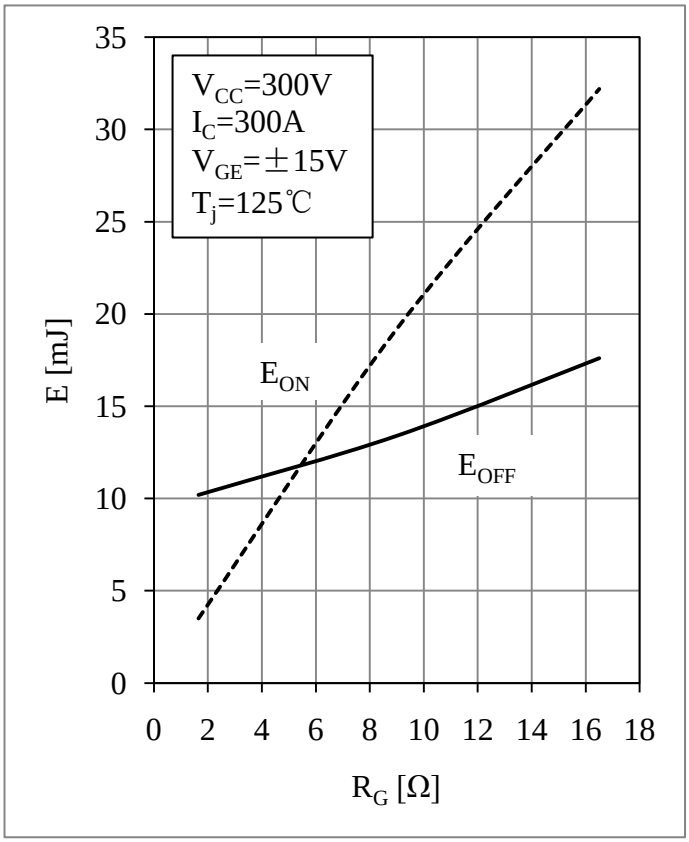


Fig 4. IGBT T1 T4 Switching Loss vs. R_G

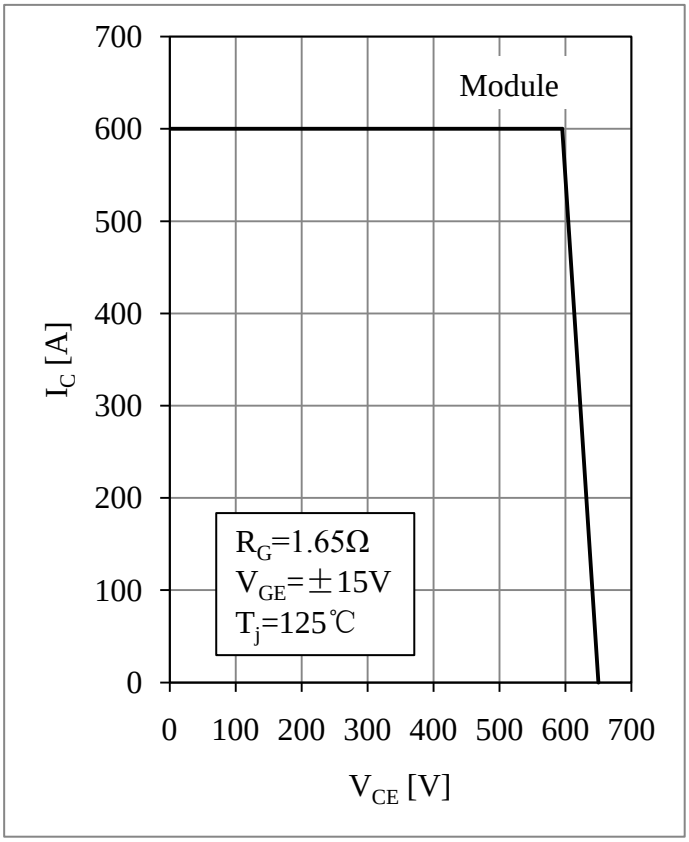


Fig 5. IGBT T1 T4 RBSOA

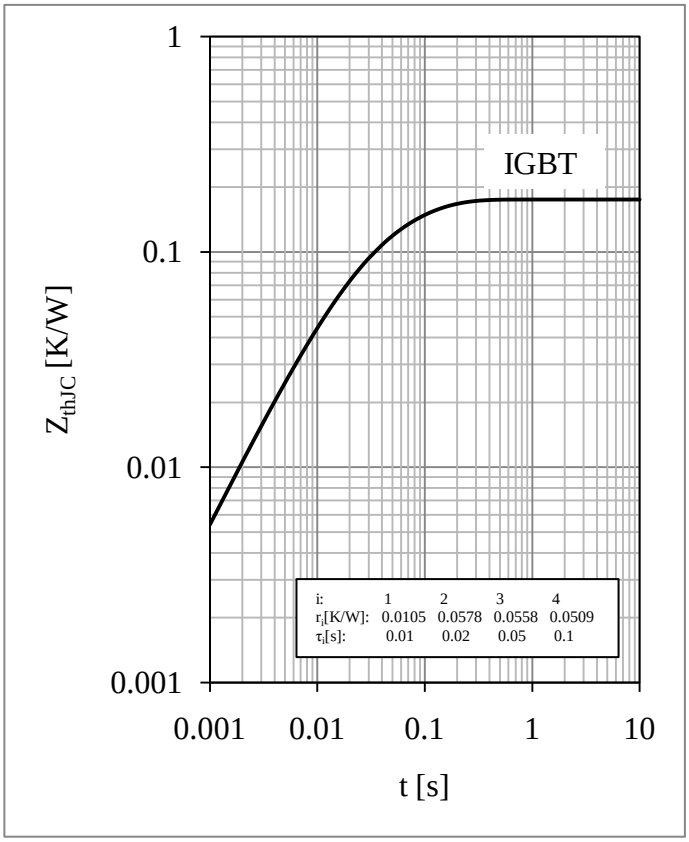


Fig 6. IGBT T1 T4 Transient Thermal Impedance

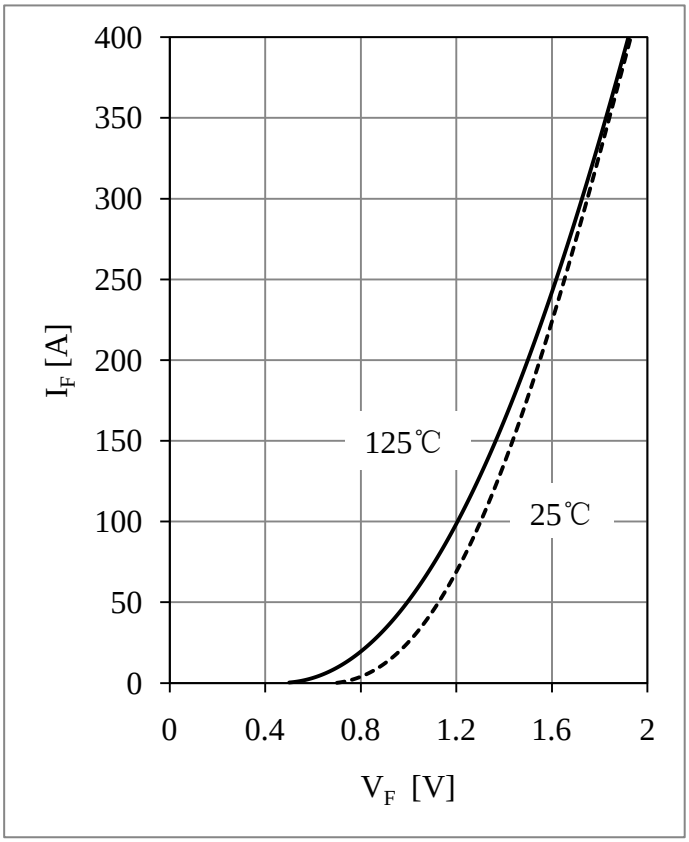


Fig 7. Diode D1 D4 Forward Characteristic

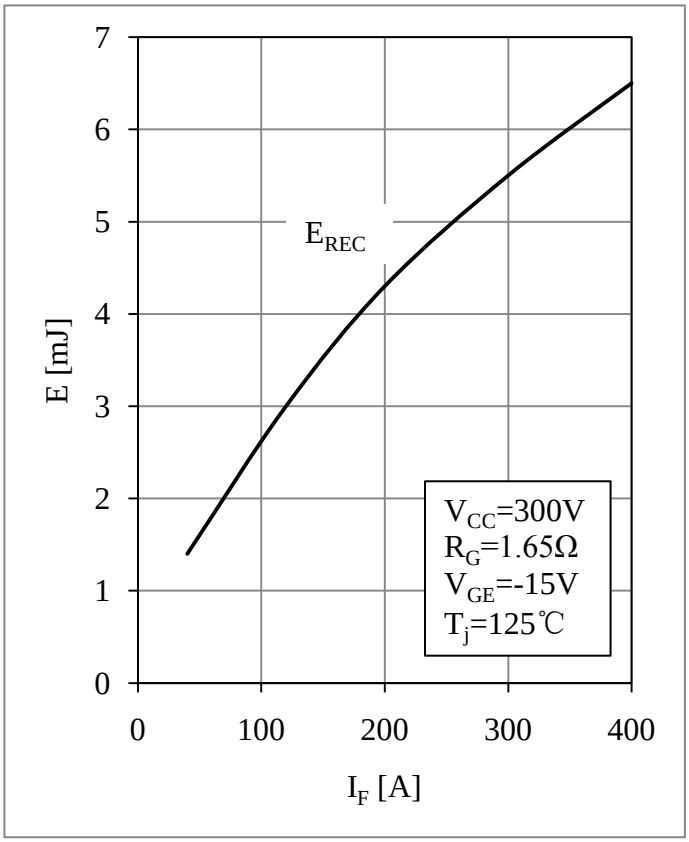


Fig 8. Diode D1 D4 Switching Loss vs. I_F

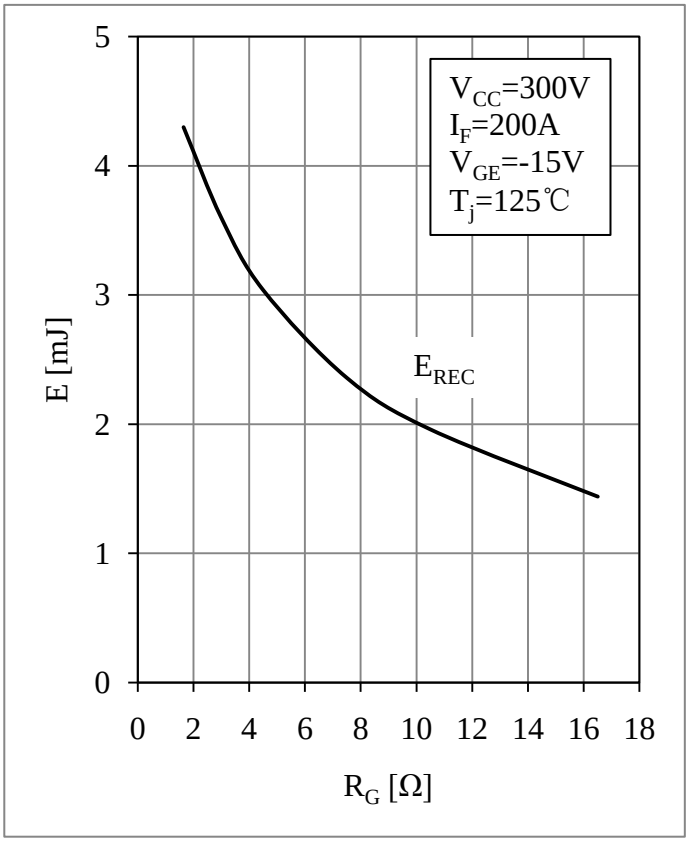


Fig 9. Diode D1 D4 Switching Loss vs. R_G

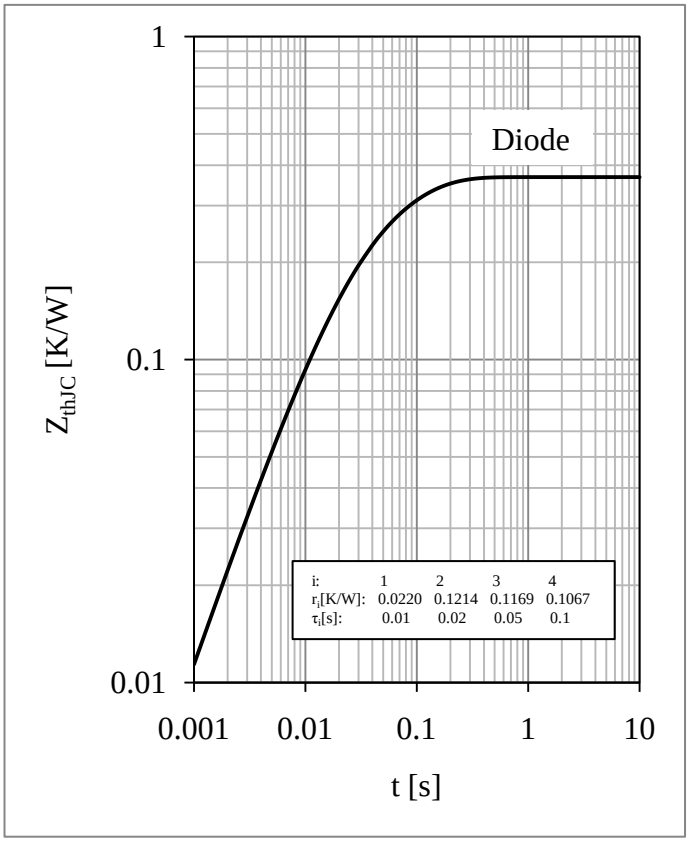


Fig 10. Diode D1 D4 Transient Thermal Impedance

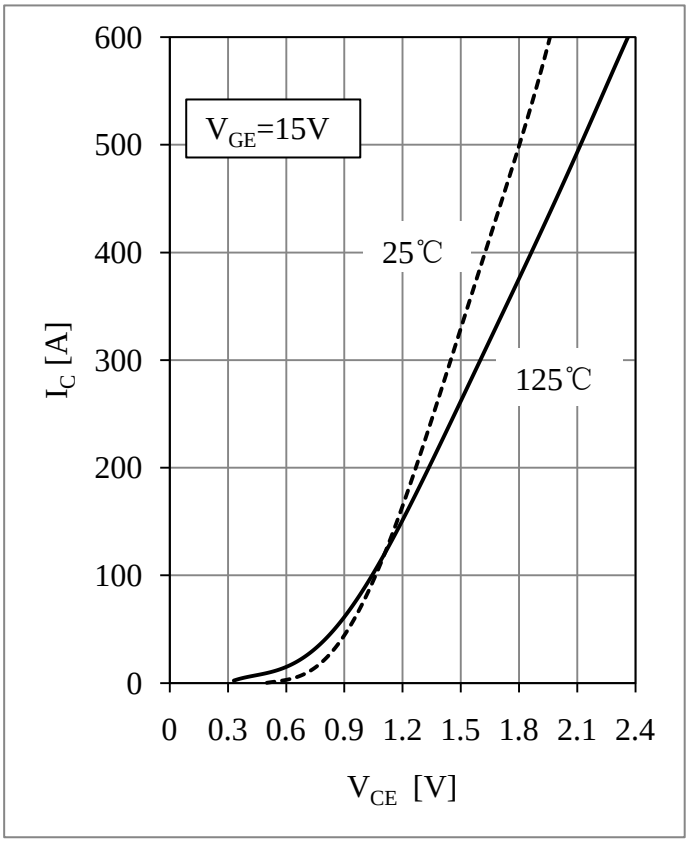


Fig 11. IGBT T2 T3 Output Characteristic

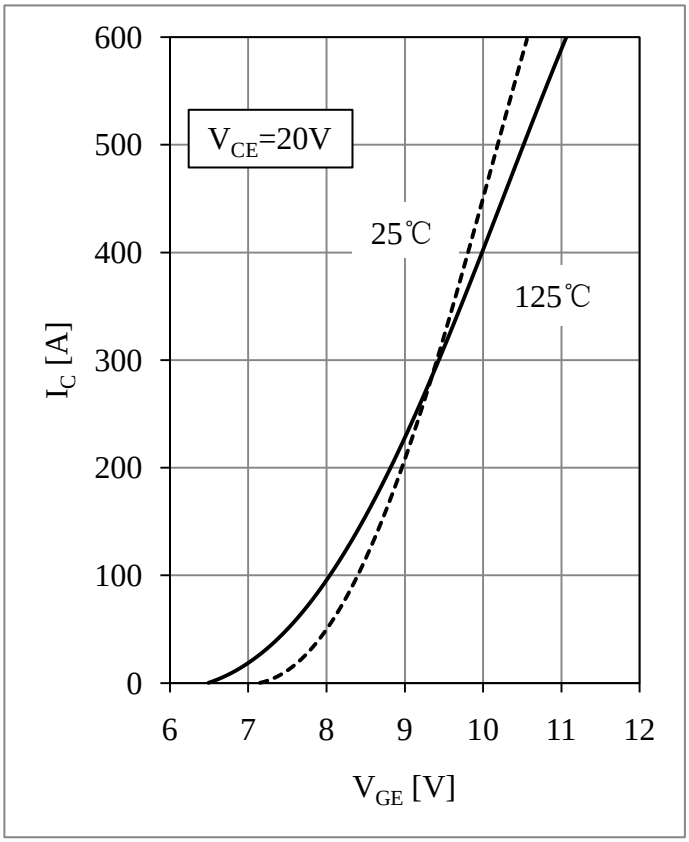


Fig 12. IGBT T2 T3 Transfer Characteristic

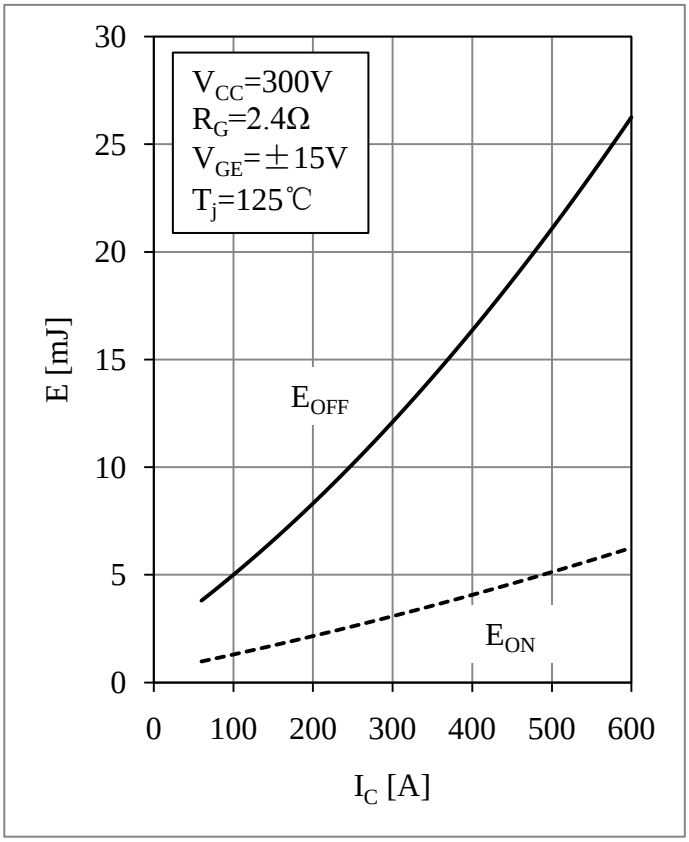


Fig 13. IGBT T2 T3 Switching Loss vs. I_C

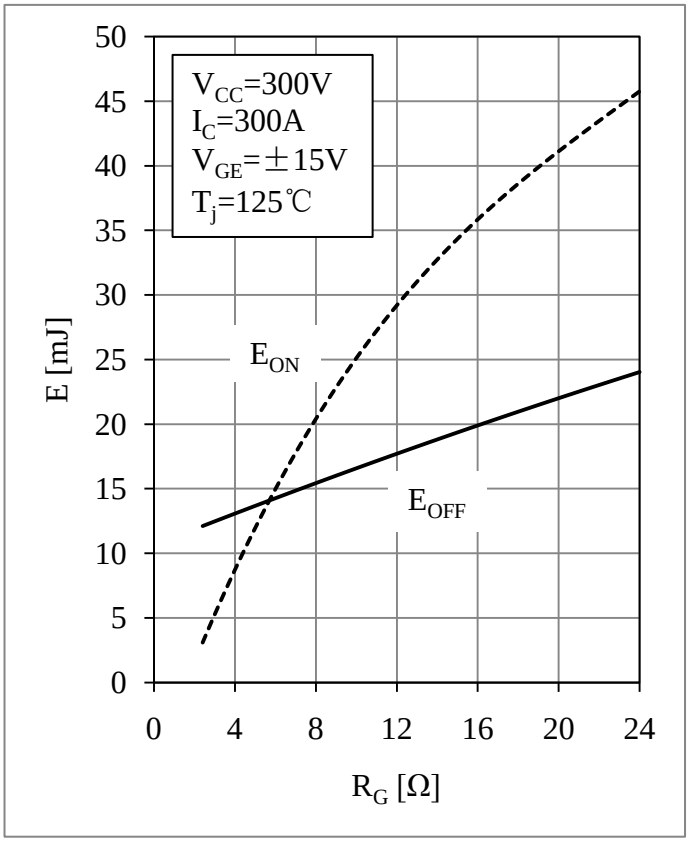


Fig 14. IGBT T2 T3 Switching Loss vs. R_G

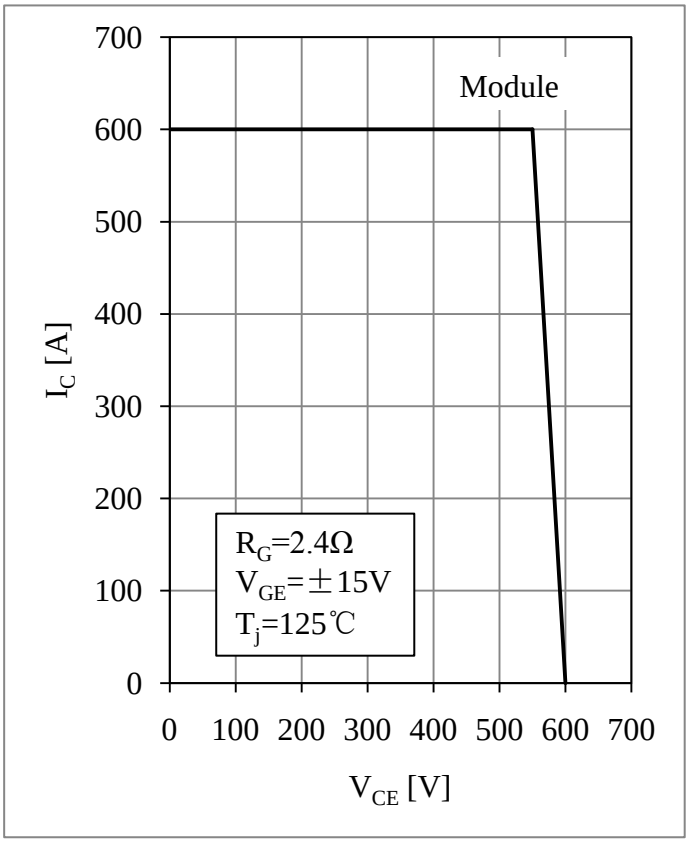


Fig 15. IGBT T2 T3 RBSOA

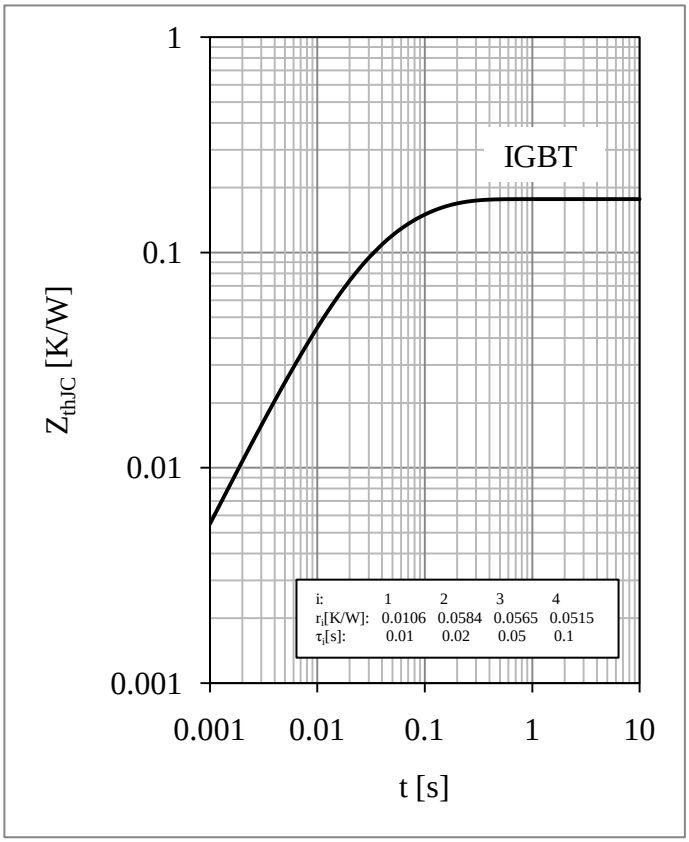


Fig 16. IGBT T2 T3 Transient Thermal Impedance

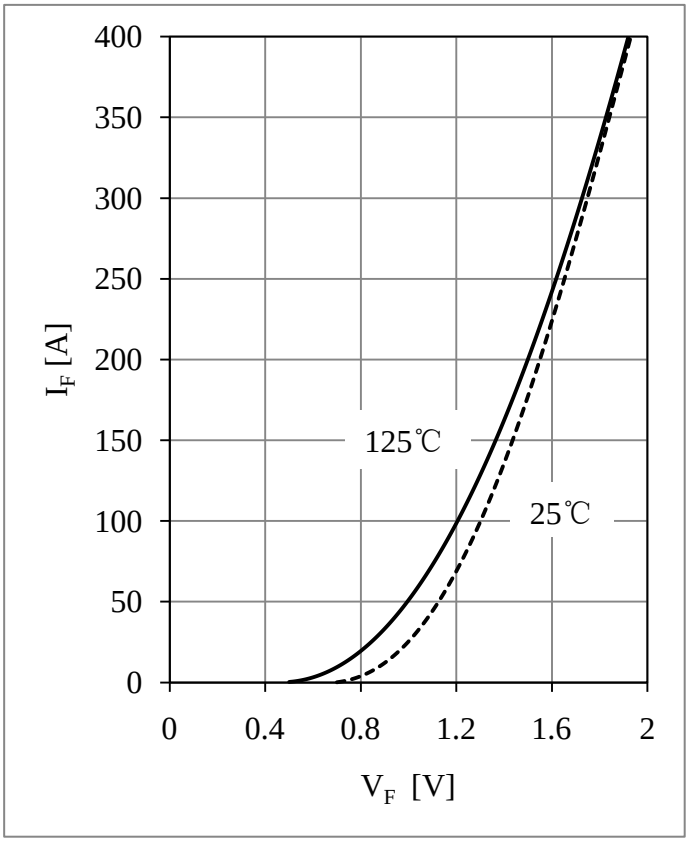


Fig 17. Diode D2 D3 Forward Characteristic

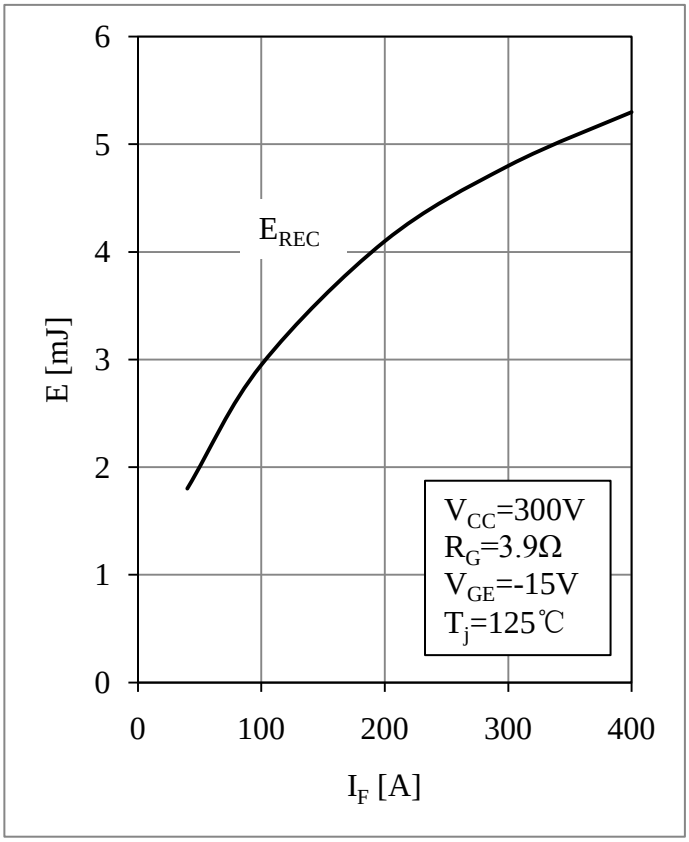


Fig 18. Diode D2 D3 Switching Loss vs. I_F

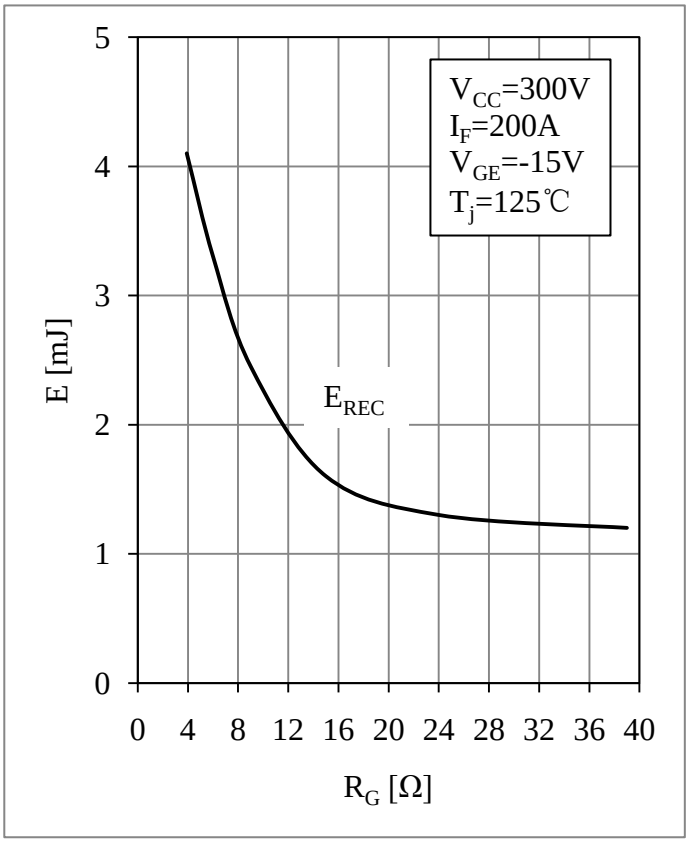


Fig 19. Diode D2 D3 Switching Loss vs. R_G

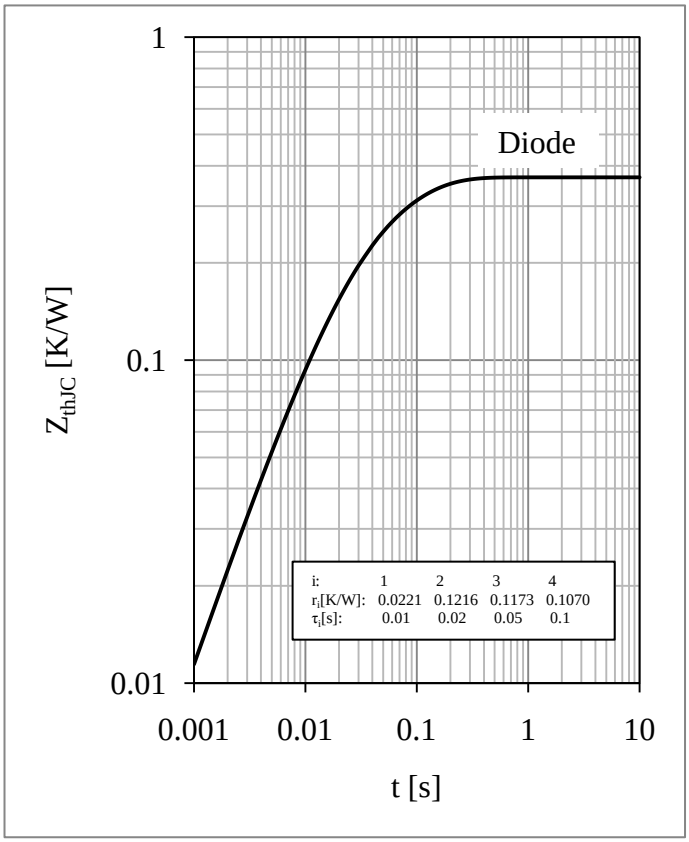


Fig 20. Diode D2 D3 Transient Thermal Impedance

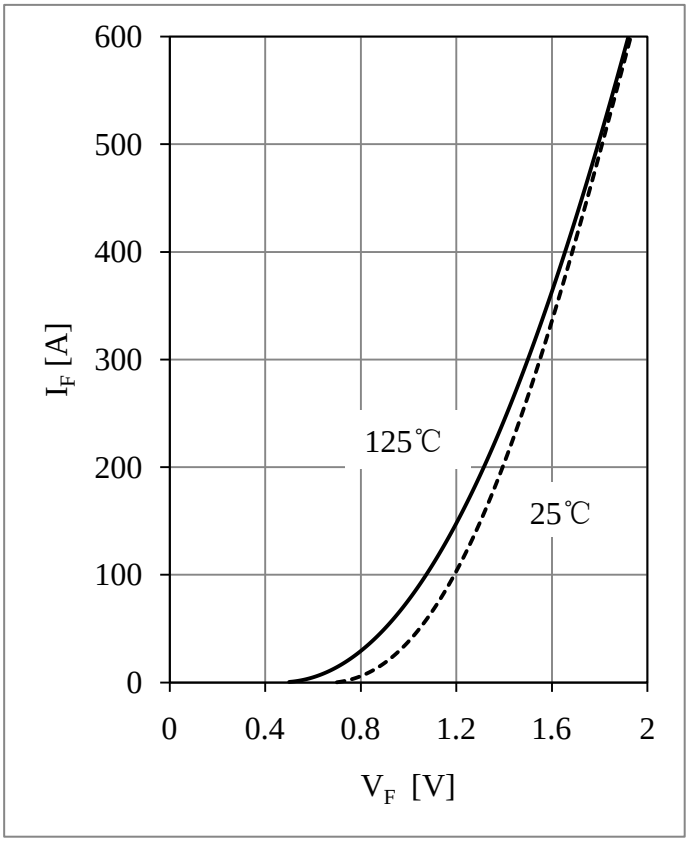


Fig 21. Diode D5 D6 Forward Characteristic

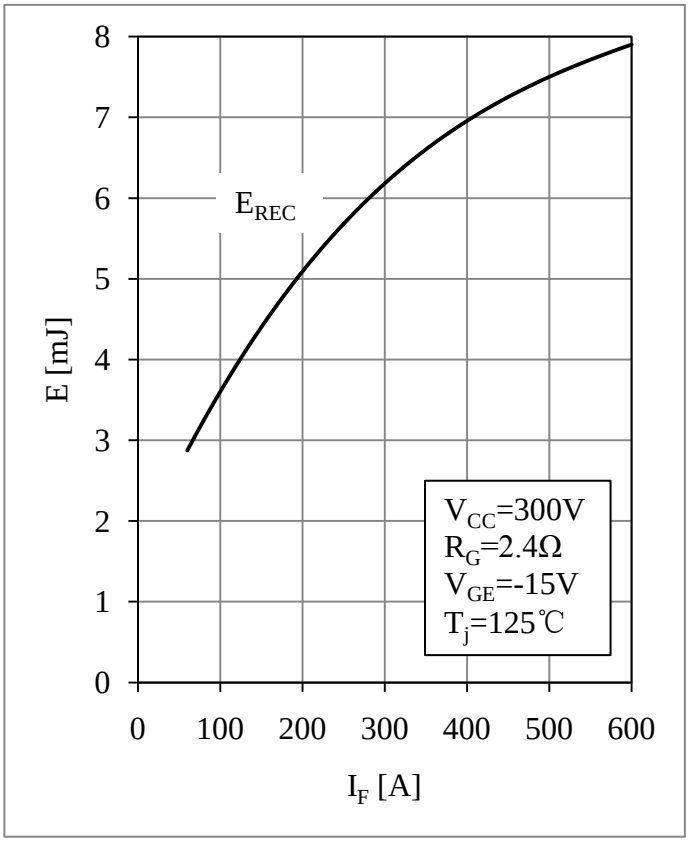


Fig 22. Diode D5 D6 Switching Loss vs. I_F

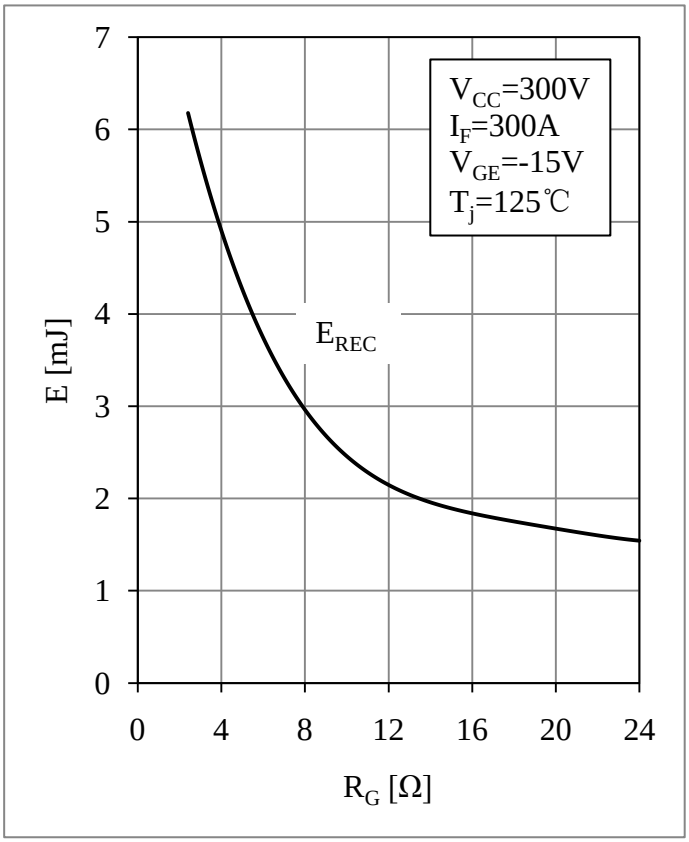


Fig 23. Diode D5 D6 Switching Loss vs. R_G

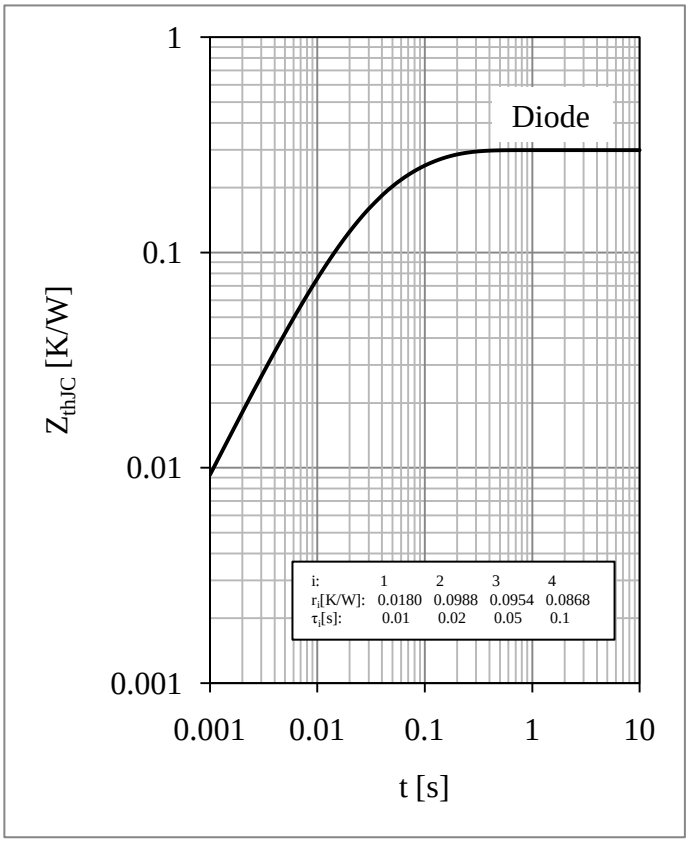
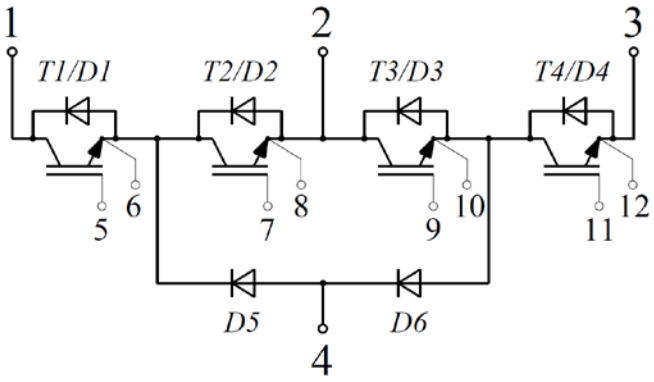


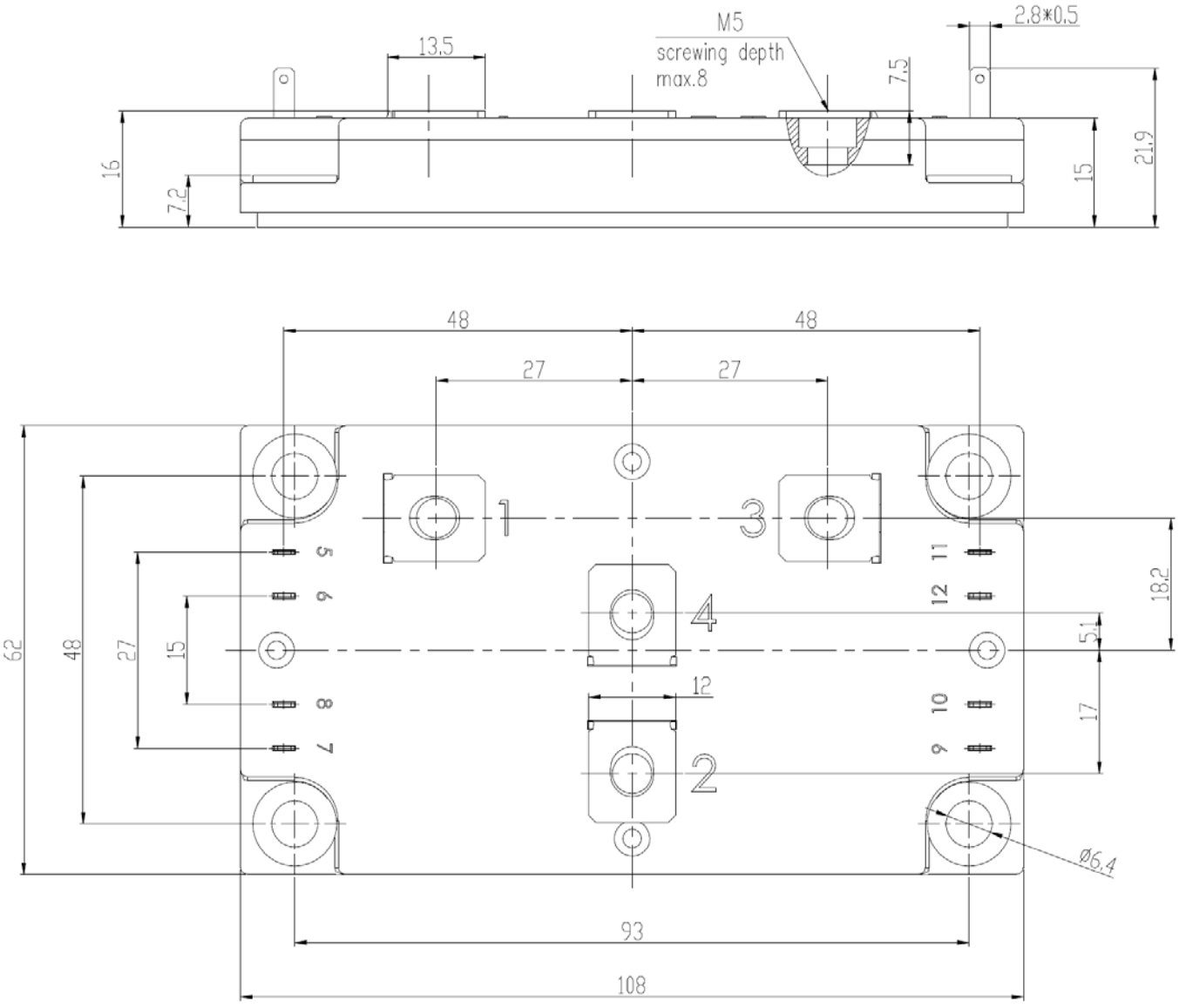
Fig 24. Diode D5 D6 Transient Thermal Impedance

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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