STARPOWER

SEMICONDUCTOR **IGBT**

GD100TLQ120L3S

1200V/100A 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.

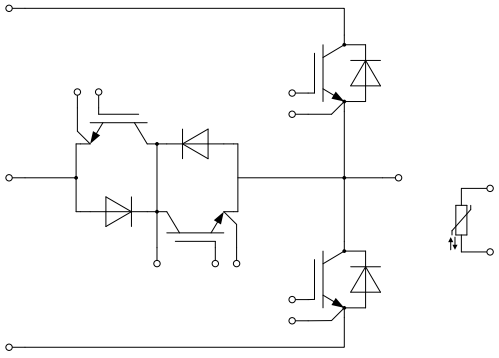
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching loss
- 10μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Fast & soft reverse recovery anti-parallel FWD
- Low inductance case
- Isolated heatsink using DBC technology

Typical Applications

- Solar power
- UPS
- 3-level-application

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

T1,T4 IGBT

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=100°C	100	A
I_{CM}	Pulsed Collector Current t_p=1ms	200	A
P_D	Maximum Power Dissipation @ T_j=175°C	765	W

D1,D4 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	35	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	150	A

T2,T3 IGBT

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=100°C	50	A
I_{CM}	Pulsed Collector Current t_p=1ms	100	A
P_D	Maximum Power Dissipation @ T_j=175°C	271	W

D2,D3 Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	100	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	200	A

Module

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

T1,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=50A,V_{GE}=15V, T_j=25°C		1.40	1.95	V
		I_C=50A,V_{GE}=15V, T_j=125°C		1.65		
		I_C=50A,V_{GE}=15V, T_j=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=2.50mA,V_{CE}=V_{GE}, T_j=25°C	5.2	6.0	6.8	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			100	nA
R_{Gint}	Internal Gate Resistance			7.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		10.4		nF
C_{res}	Reverse Transfer Capacitance			0.29		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.78		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=50A, R_G=1.1Ω,V_{GE}=±15V, T_j=25°C		132		ns
t_r	Rise Time			20		ns
$t_{d(off)}$	Turn-Off Delay Time			330		ns
t_f	Fall Time			33		ns
E_{on}	Turn-On Switching Loss			1.06		mJ
E_{off}	Turn-Off Switching Loss			1.78		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=50A, R_G=1.1Ω,V_{GE}=±15V, T_j=125°C		140		ns
t_r	Rise Time			29		ns
$t_{d(off)}$	Turn-Off Delay Time			418		ns
t_f	Fall Time			67		ns
E_{on}	Turn-On Switching Loss			1.67		mJ
E_{off}	Turn-Off Switching Loss			2.86		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=50A, R_G=1.1Ω,V_{GE}=±15V, T_j=150°C		146		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			440		ns
t_f	Fall Time			72		ns
E_{on}	Turn-On Switching Loss			1.79		mJ
E_{off}	Turn-Off Switching Loss			3.25		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=800V, V_{CEM}≤1200V		400		A

D1,D4 Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=35A,V_{GE}=0V,T_j=25°C		2.00	2.45	V
		I_F=35A,V_{GE}=0V,T_j=125°C		1.70		
		I_F=35A,V_{GE}=0V,T_j=150°C		1.65		
Q_r	Recovered Charge	V_R=400V,I_F=35A, -di/dt=2400A/μs,V_{GE}=-15V T_j=25°C		2.4		μC
I_{RM}	Peak Reverse Recovery Current			70		A
E_{rec}	Reverse Recovery Energy			0.70		mJ
Q_r	Recovered Charge	V_R=400V,I_F=35A, -di/dt=2400A/μs,V_{GE}=-15V T_j=125°C		5.7		μC
I_{RM}	Peak Reverse Recovery Current			85		A
E_{rec}	Reverse Recovery Energy			1.75		mJ
Q_r	Recovered Charge	V_R=400V,I_F=35A, -di/dt=2400A/μs,V_{GE}=-15V T_j=150°C		7.0		μC
I_{RM}	Peak Reverse Recovery Current			90		A
E_{rec}	Reverse Recovery Energy			2.15		mJ

T2,T3 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=50A,V_{GE}=15V, T_j=25°C		1.45	1.90	V
		I_C=50A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=50A,V_{GE}=15V, T_j=150°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=0.80mA,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			1.0	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			0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		5.80		nF
C_{res}	Reverse Transfer Capacitance			0.11		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.35		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=50A, R_G=8.2Ω,V_{GE}=±15V, T_j=25°C		20		ns
t_r	Rise Time			14		ns
$t_{d(off)}$	Turn-Off Delay Time			152		ns
t_f	Fall Time			26		ns
E_{on}	Turn-On Switching Loss			0.88		mJ
E_{off}	Turn-Off Switching Loss			1.20		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=50A, R_G=8.2Ω,V_{GE}=±15V, T_j=125°C		20		ns
t_r	Rise Time			17		ns
$t_{d(off)}$	Turn-Off Delay Time			176		ns
t_f	Fall Time			40		ns
E_{on}	Turn-On Switching Loss			1.40		mJ
E_{off}	Turn-Off Switching Loss			1.64		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=50A, R_G=8.2Ω,V_{GE}=±15V, T_j=150°C		20		ns
t_r	Rise Time			18		ns
$t_{d(off)}$	Turn-Off Delay Time			200		ns
t_f	Fall Time			44		ns
E_{on}	Turn-On Switching Loss			1.52		mJ
E_{off}	Turn-Off Switching Loss			1.76		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=360V, V_{CEM}≤1200V		250		A

D2,D3 Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=50A,V_{GE}=0V,T_i=25°C		1.35	1.80	V
		I_F=50A,V_{GE}=0V,T_j=125°C		1.30		
		I_F=50A,V_{GE}=0V,T_i=150°C		1.25		
Q_r	Recovered Charge	V_R=400V,I_F=50A, -di/dt=2200A/μs,V_{GE}=-15V T_j=25°C		2.09		μC
I_{RM}	Peak Reverse Recovery Current			57		A
E_{rec}	Reverse Recovery Energy			0.50		mJ
Q_r	Recovered Charge	V_R=400V,I_F=50A, -di/dt=2200A/μs,V_{GE}=-15V T_j=125°C		3.96		μC
I_{RM}	Peak Reverse Recovery Current			63		A
E_{rec}	Reverse Recovery Energy			0.83		mJ
Q_r	Recovered Charge	V_R=400V,I_F=50A, -di/dt=2200A/μs,V_{GE}=-15V T_j=150°C		4.51		μC
I_{RM}	Peak Reverse Recovery Current			65		A
E_{rec}	Reverse Recovery Energy			0.94		mJ

NTC Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100 °C,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
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$		3433		K

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per T1,T4 IGBT)		0.178	0.196	K/W
	Junction-to-Case (per D1,D4 Diode)		0.496	0.546	
	Junction-to-Case (per T2,T3 IGBT)		0.503	0.553	
	Junction-to-Case (per D2,D3 Diode)		0.486	0.535	
R_{thCH}	Case-to-Heatsink (per T1,T4 IGBT)		0.154		K/W
	Case-to-Heatsink (per D1,D4 Diode)		0.429		
	Case-to-Heatsink (per T2,T3 IGBT)		0.434		
	Case-to-Heatsink (per D2,D3 Diode)		0.420		
	Case-to-Heatsink (per Module)		0.037		
F	Mounting Force Per Clamp	40		80	K/W
G	Weight of Module		39		g

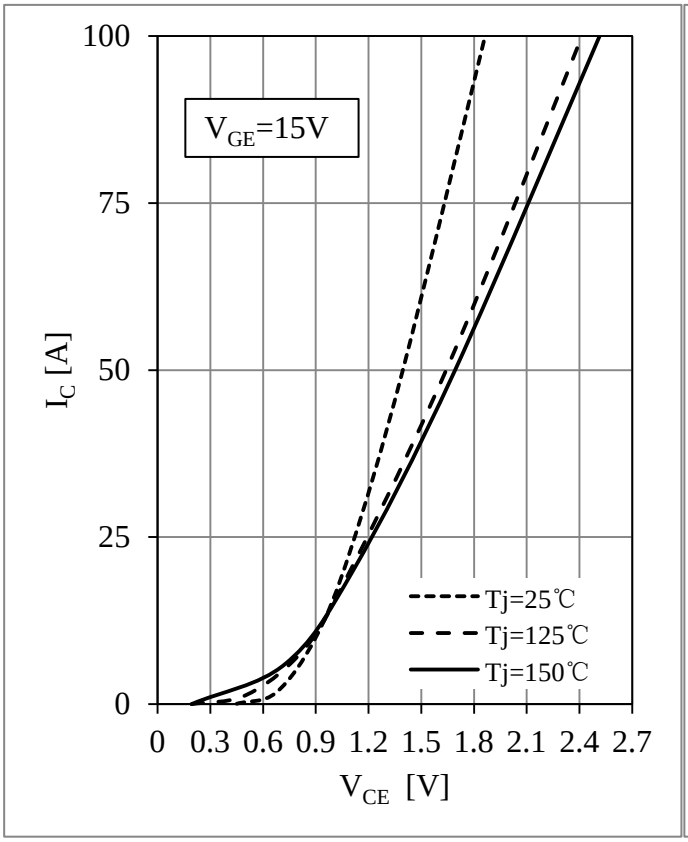


Fig 1. T1,T4 IGBT Output Characteristics

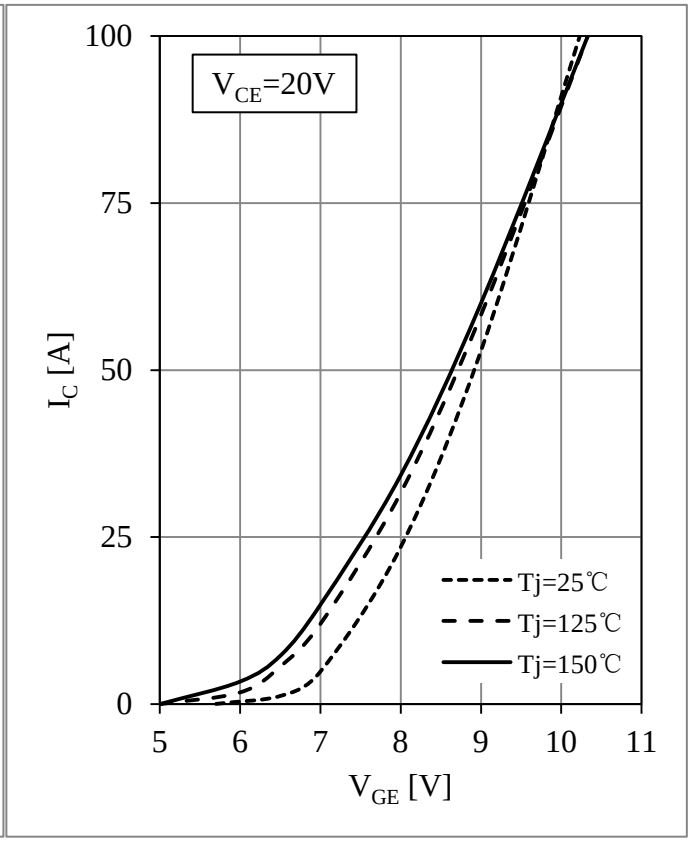


Fig 2. T1,T4 IGBT Transfer Characteristics

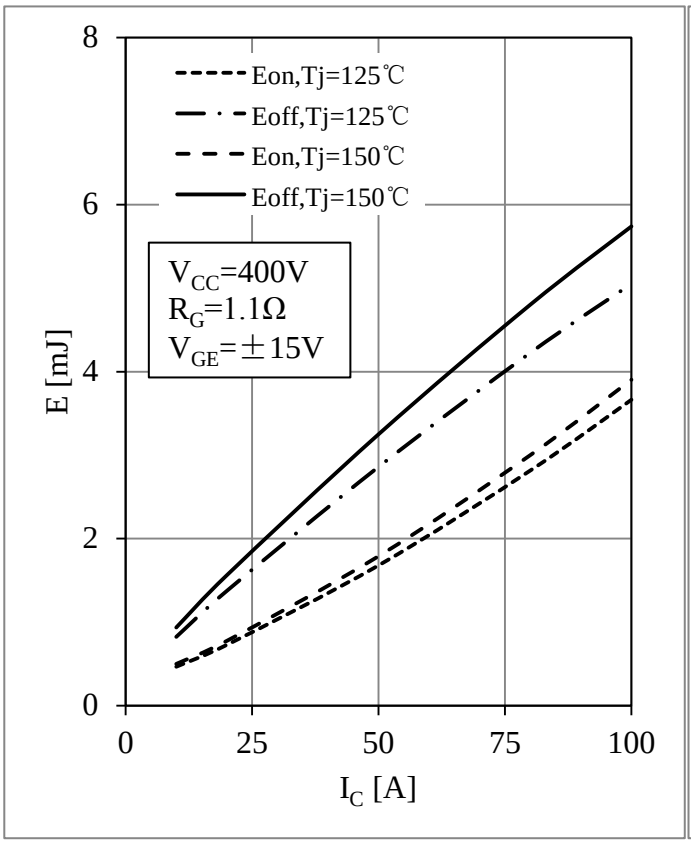


Fig 3. T1,T4 IGBT Switching Loss vs. I_C

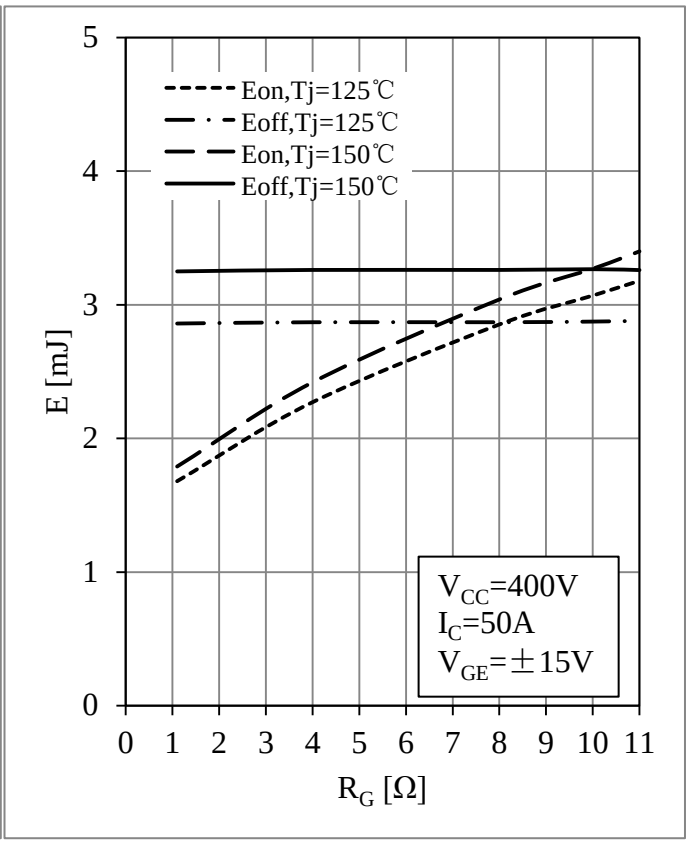


Fig 4. T1,T4 IGBT Switching Loss vs. R_G

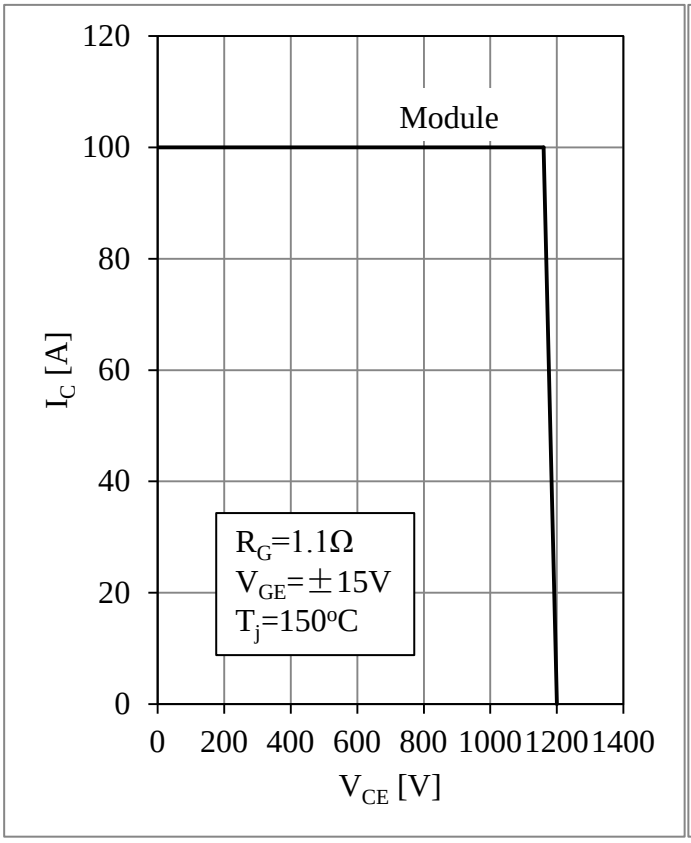


Fig 5. T1,T4 RBSOA

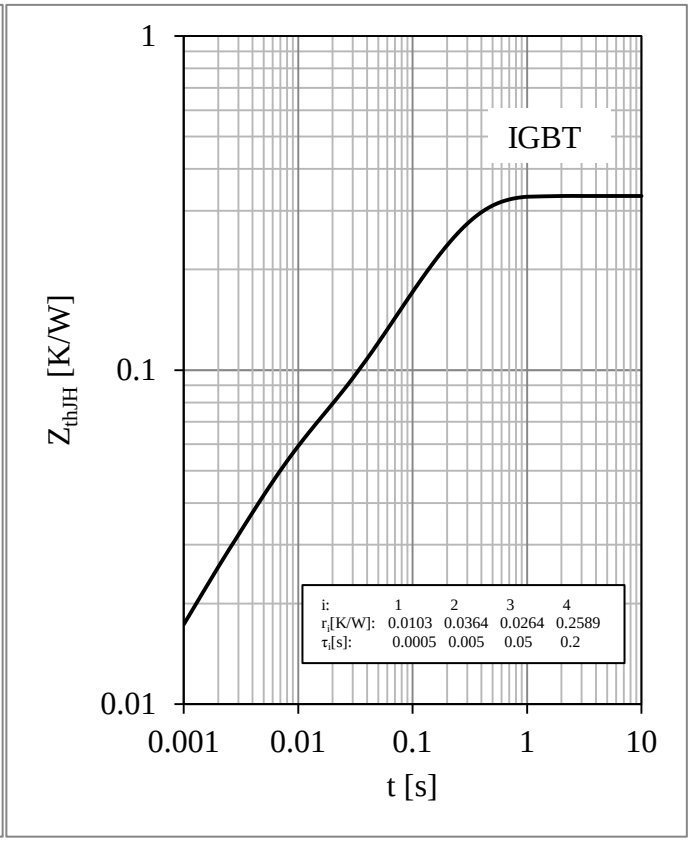


Fig 6. T1,T4 IGBT Transient Thermal Impedance

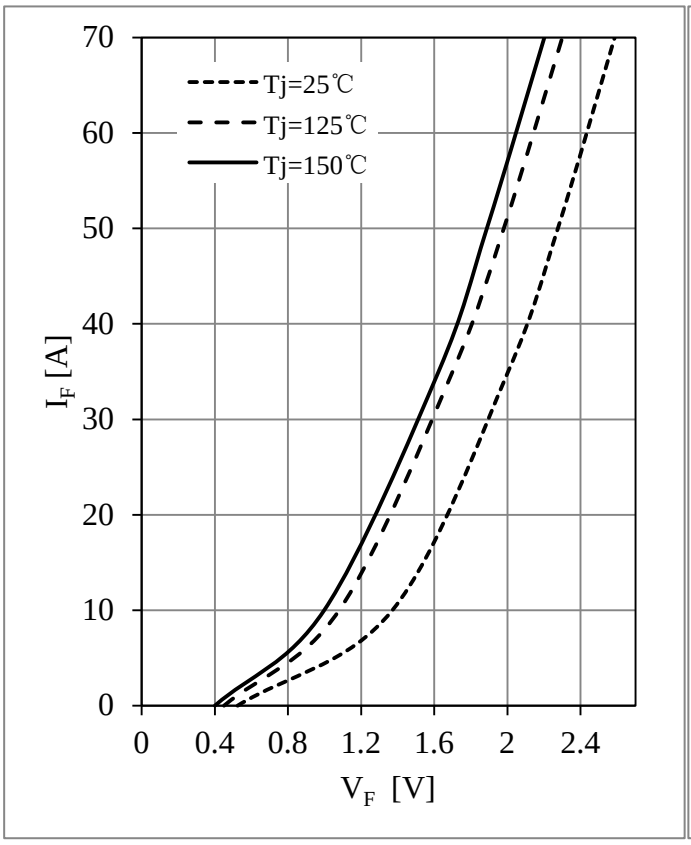


Fig 7. D1,D4 Diode Forward Characteristics

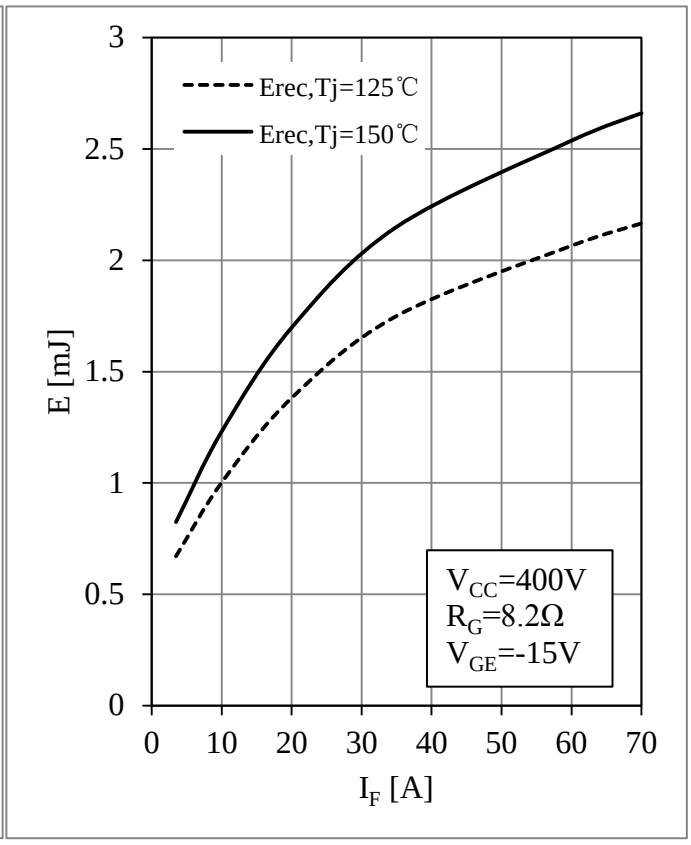


Fig 8. D1,D4 Diode Switching Loss vs. I_F

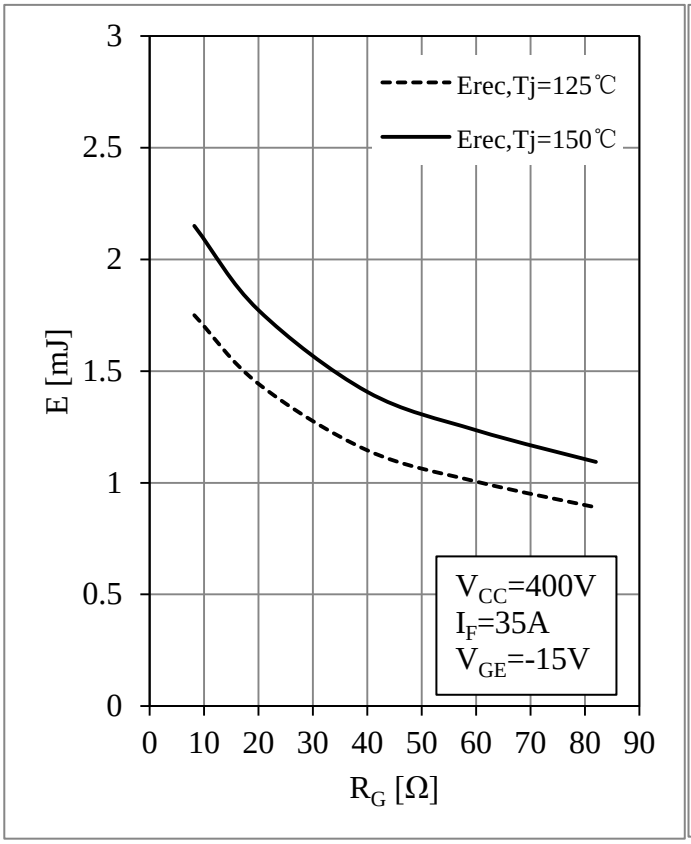


Fig 9. D1,D4 Diode Switching Loss vs. R_G

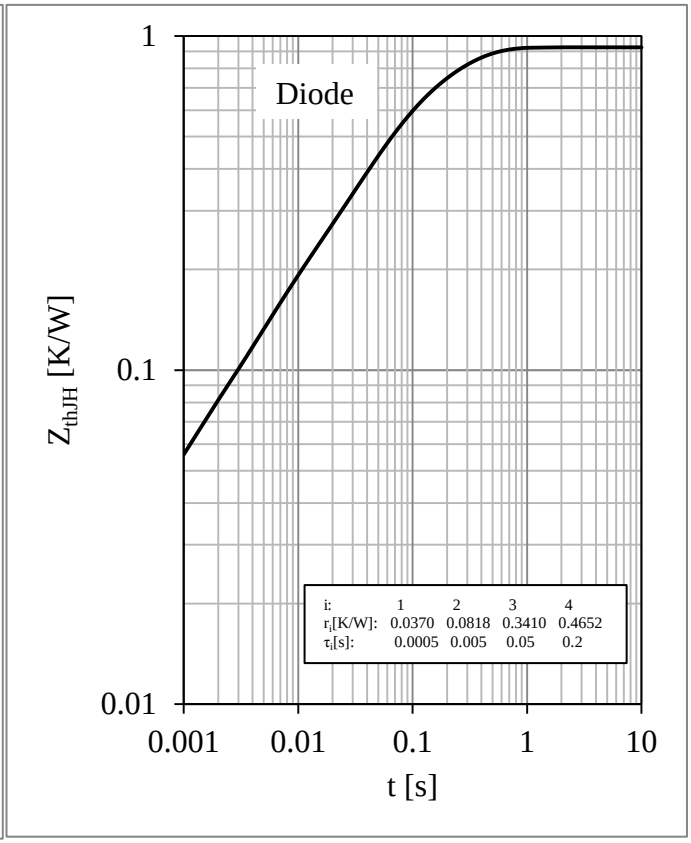


Fig 10. D1,D4 Diode Transient Thermal Impedance

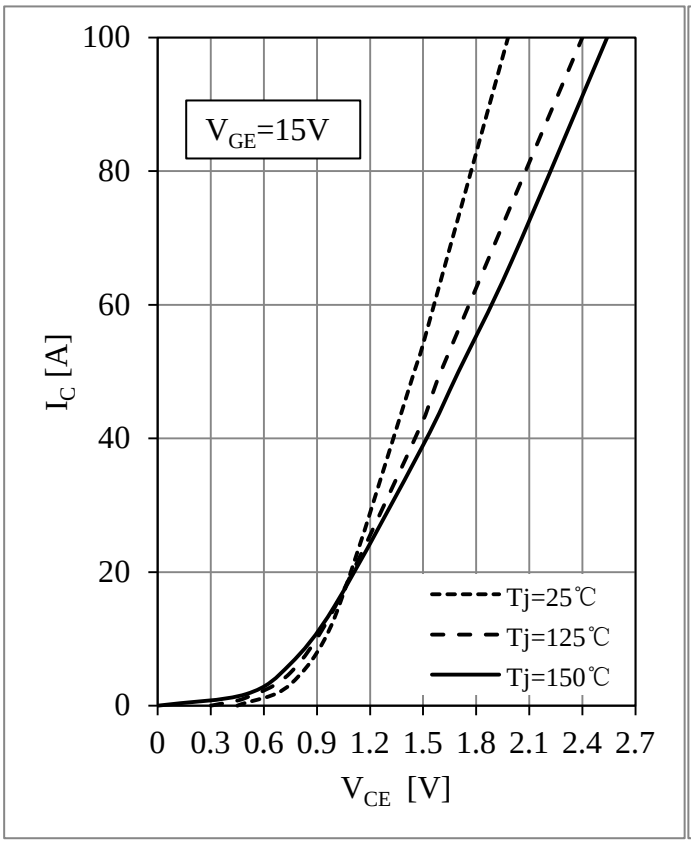


Fig 11. T2,T3 IGBT Output Characteristics

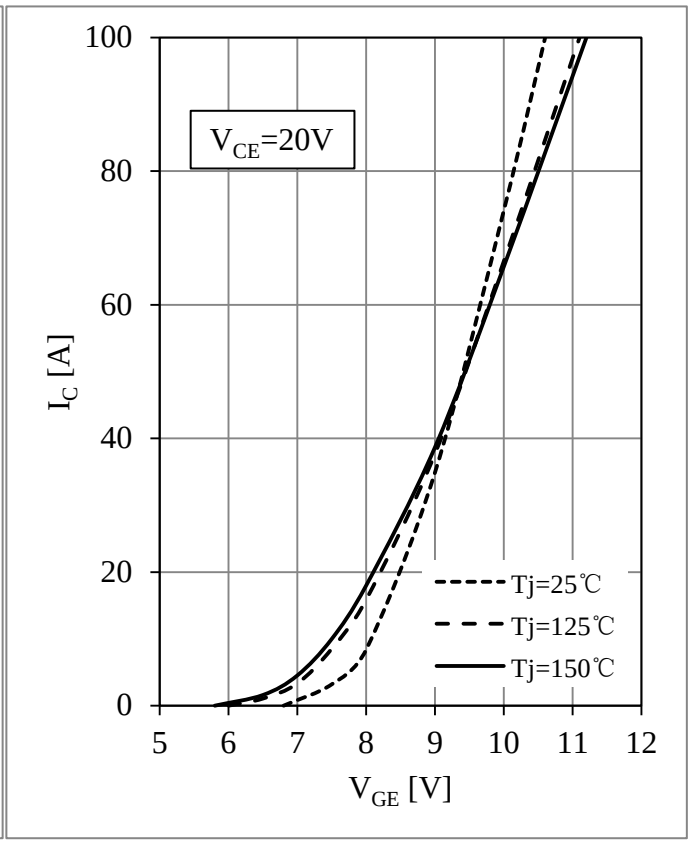


Fig 12. T2,T3 IGBT Transfer Characteristics

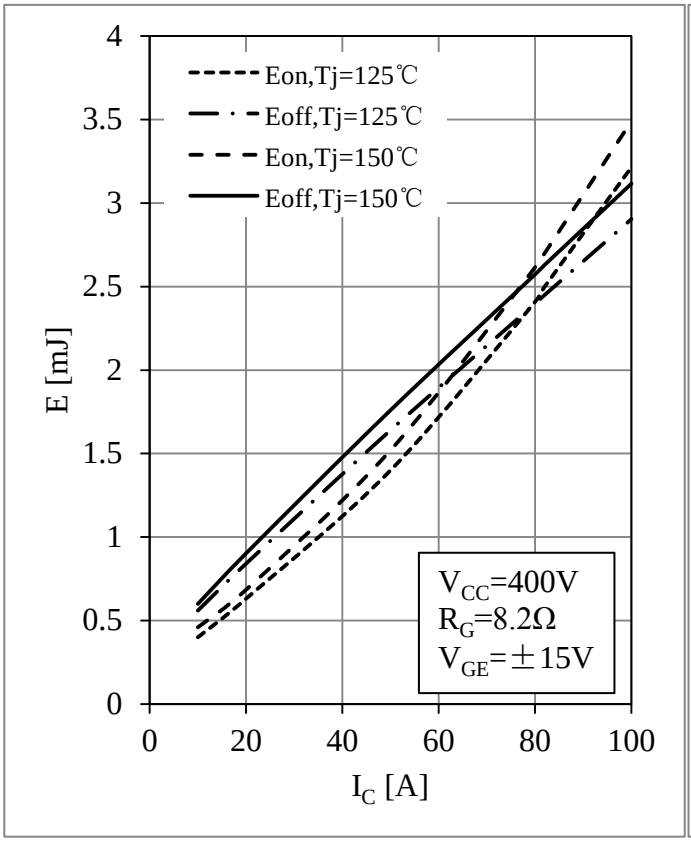


Fig 13. T2,T3 IGBT Switching Loss vs. I_C

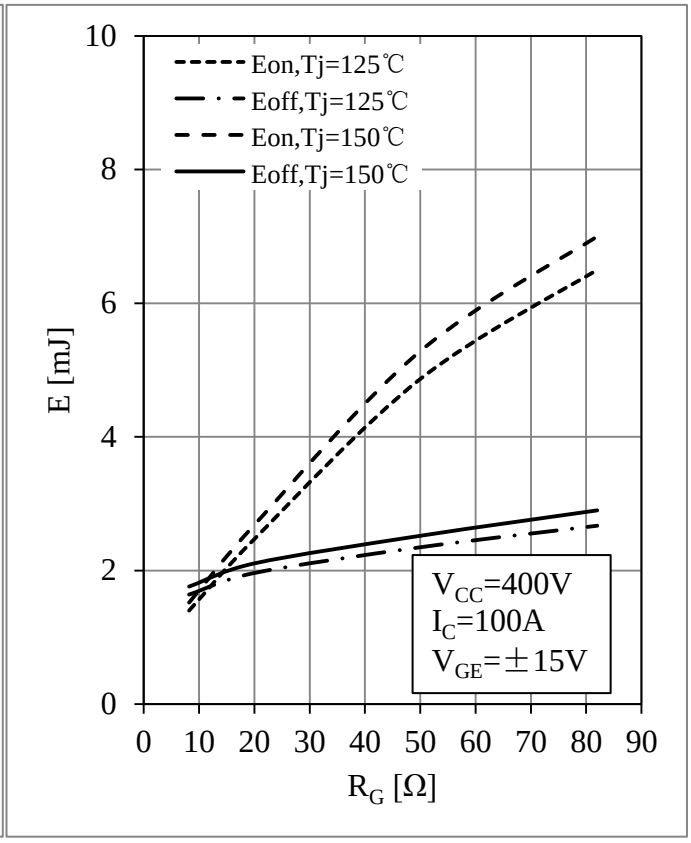


Fig 14. T2,T3 IGBT Switching Loss vs. R_G

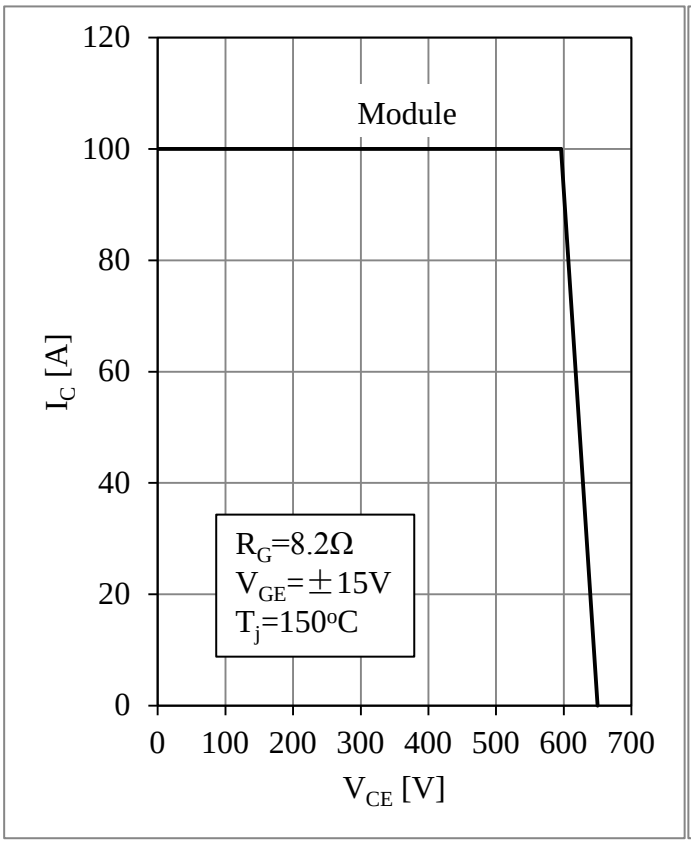


Fig 15. T2,T3 RBSOA

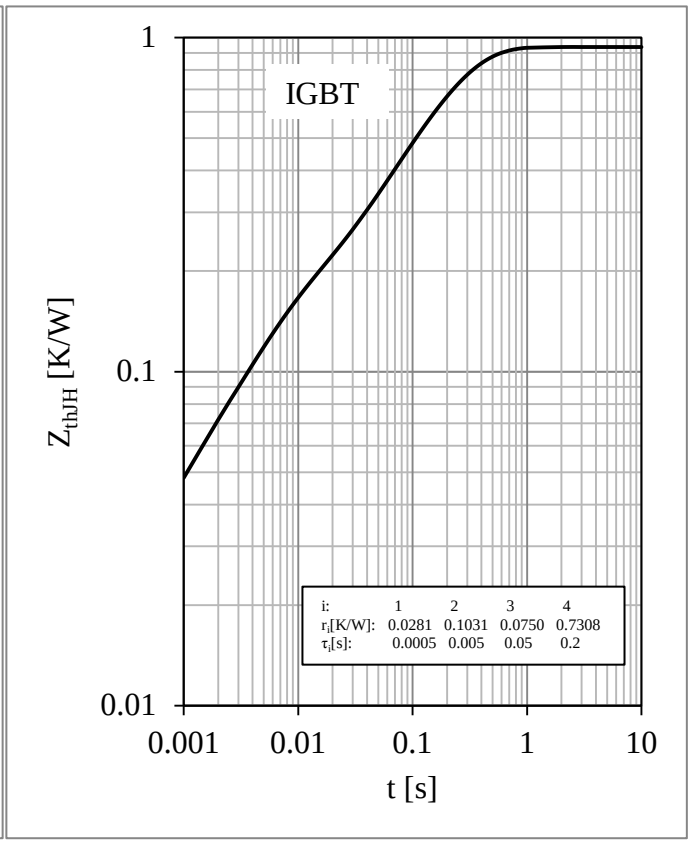


Fig 16. T2,T3 IGBT Transient Thermal Impedance

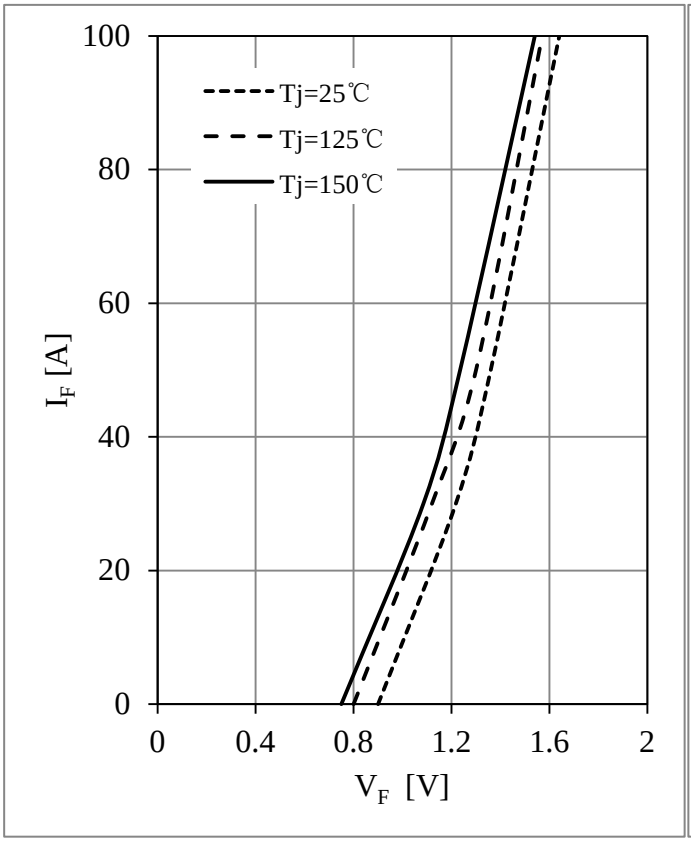


Fig 17. D2,D3 Diode Forward Characteristics

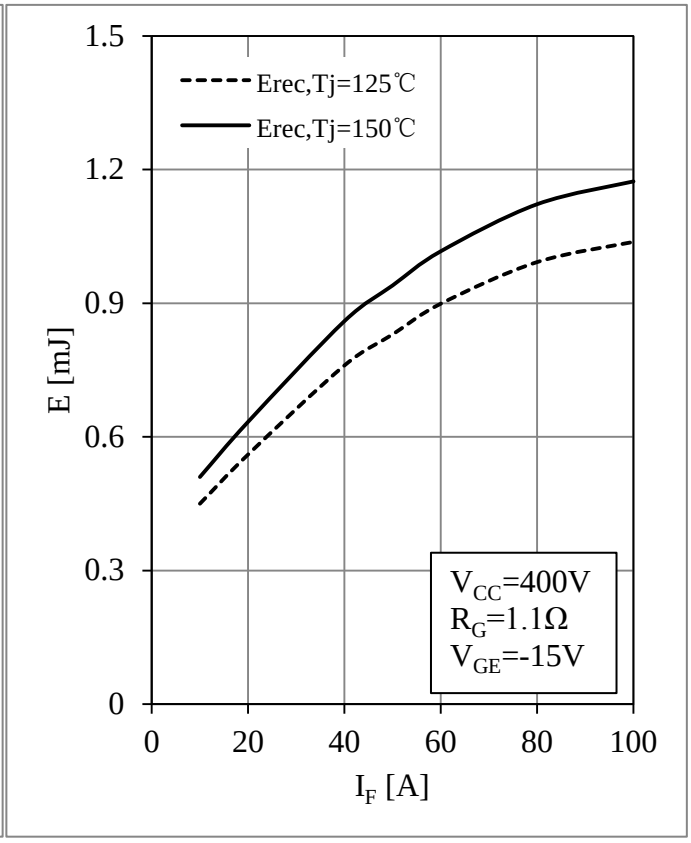


Fig 18. D2,D3 Diode Switching Loss vs. I_F

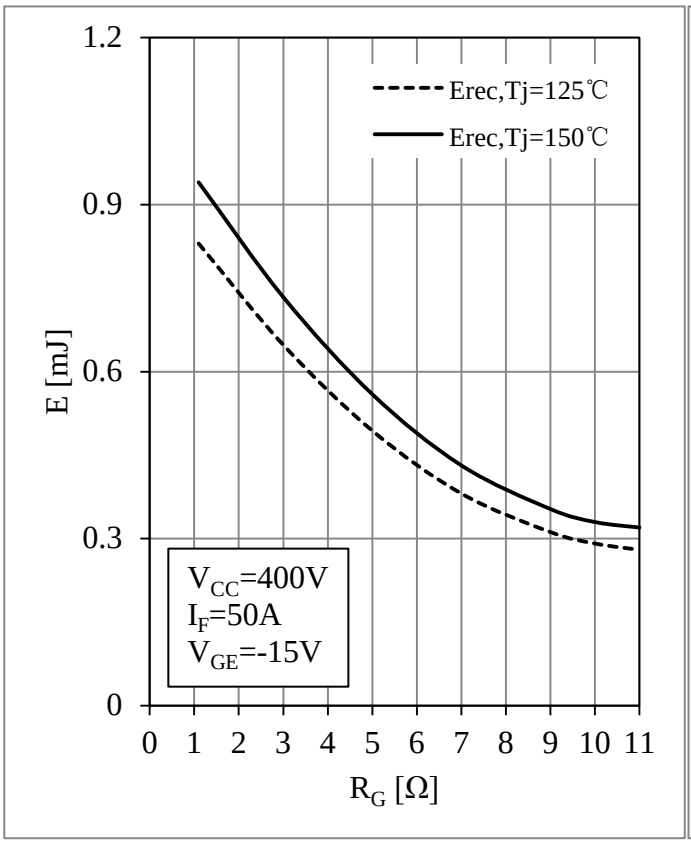


Fig 19. D2,D3 Diode Switching Loss vs. R_G

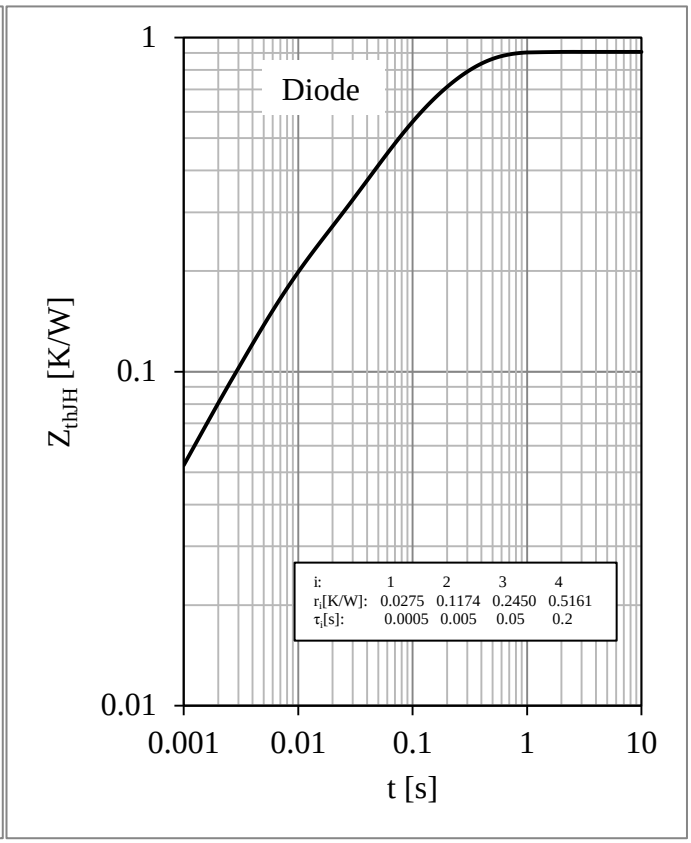


Fig 20. D2,D3 Diode Transient Thermal Impedance

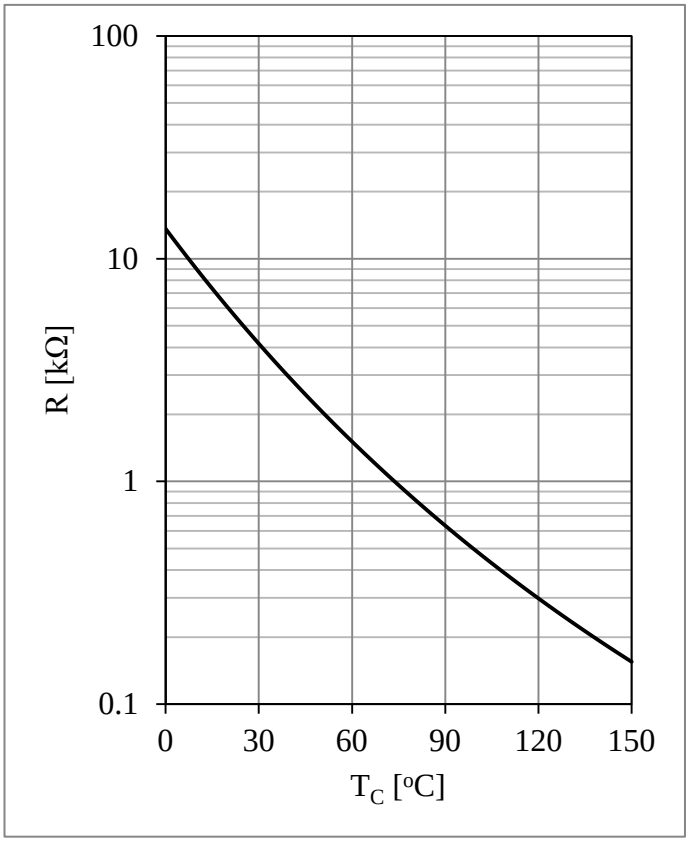
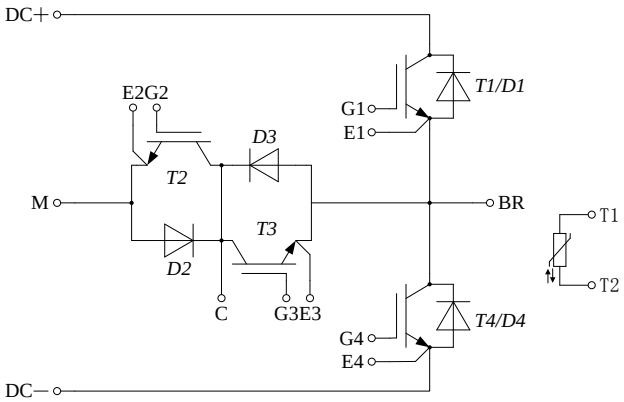


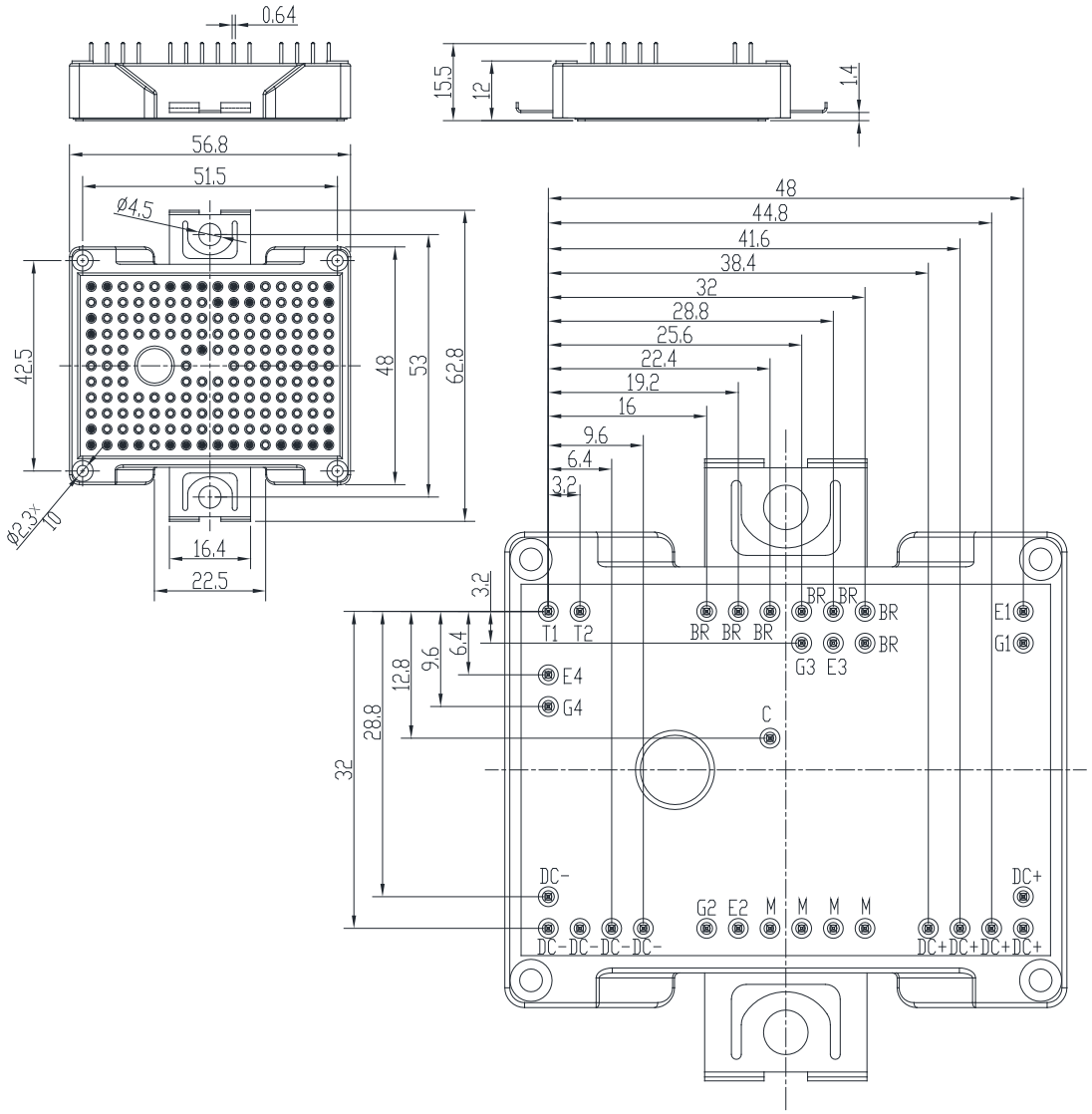
Fig 21. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



Terms and Conditions of Usage

The data contained in this product datasheet is exclusively intended for technically trained staff. you and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application.

This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.

Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see www.powersemi.cc), For those that are specifically interested we may provide application notes.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify.

If and to the extent necessary, please forward equivalent notices to your customers.
Changes of this product data sheet are reserved.