STARPOWER

SEMICONDUCTOR **IGBT**

GD10PIK120C5S

1200V/10A PIM 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 general inverters and UPS.

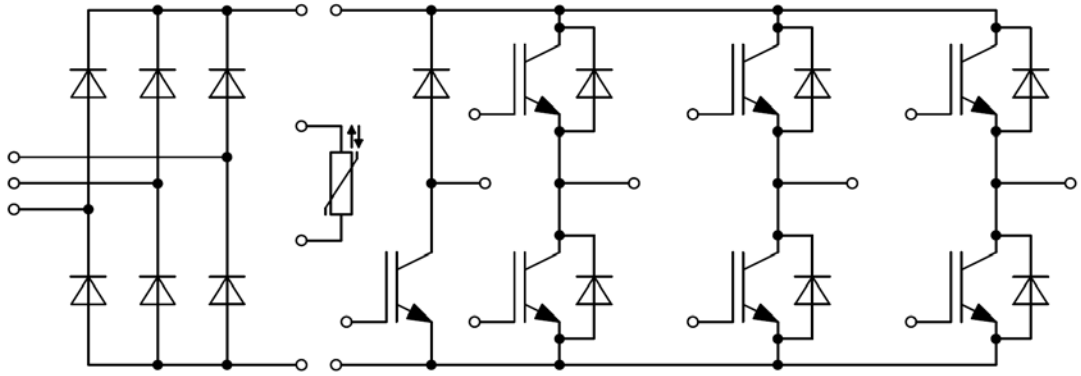
Features

- NPT IGBT technology
- 10μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 150°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

IGBT-inverter

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25°C @ T_C=100°C	20 10	A
I_{CM}	Pulsed Collector Current t_p=1ms	20	A
P_D	Maximum Power Dissipation @ T_j=150°C	116	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	10	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	20	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	10	A
I_{FSM}	Surge Forward Current V_R=0V,t_p=10ms,T_j=45°C	150	A
I^2t	I^2t-value,V_R=0V,t_p=10ms,T_j=45°C	110	A^2s

IGBT-brake

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25°C @ T_C=100°C	20 10	A
I_{CM}	Pulsed Collector Current t_p=1ms	20	A
P_D	Maximum Power Dissipation @ T_j=150°C	116	W

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	10	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	20	A

Module

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

IGBT-inverter 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=10A,V_{GE}=15V, T_j=25°C		2.15	2.60	V
		I_C=10A,V_{GE}=15V, T_j=125°C		2.65		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.0mA,V_{CE}=V_{GE}, T_j=25°C	5.4	6.1	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			400	nA
R_{Gint}	Internal Gate Resistance			/		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		0.65		nF
C_{res}	Reverse Transfer Capacitance			0.04		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.11		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=10A, R_G=82Ω,V_{GE}=±15V, T_j=25°C		164		ns
t_r	Rise Time			54		ns
$t_{d(off)}$	Turn-Off Delay Time			238		ns
t_f	Fall Time			352		ns
E_{on}	Turn-On Switching Loss			2.18		mJ
E_{off}	Turn-Off Switching Loss			0.72		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=10A, R_G=82Ω,V_{GE}=±15V, T_j=125°C		168		ns
t_r	Rise Time			55		ns
$t_{d(off)}$	Turn-Off Delay Time			247		ns
t_f	Fall Time			438		ns
E_{on}	Turn-On Switching Loss			2.48		mJ
E_{off}	Turn-Off Switching Loss			0.97		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=125°C,V_{CC}=900V, V_{CEM}≤1200V		80		A

Diode-inverter Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=10A,V_{GE}=0V,T_j=25°C		1.85	2.30	V
		I_F=10A,V_{GE}=0V,T_j=125°C		2.05		
Q_r	Recovered Charge	V_R=600V,I_F=10A, -di/dt=210A/μs,V_{GE}=-15V T_j=25°C		0.7		μC
I_{RM}	Peak Reverse Recovery Current			7		A
E_{rec}	Reverse Recovery Energy			0.31		mJ
Q_r	Recovered Charge	V_R=600V,I_F=10A, -di/dt=210A/μs,V_{GE}=-15V T_j=125°C		1.4		μC
I_{RM}	Peak Reverse Recovery Current			9		A
E_{rec}	Reverse Recovery Energy			0.51		mJ

Diode-rectifier Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=10A,T_j=150°C		1.00		V
I_R	Reverse Current	T_j=150°C,V_R=1600V			1.0	mA

IGBT-brake 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=10A,V_{GE}=15V, T_j=25°C		2.15	2.60	V
		I_C=10A,V_{GE}=15V, T_j=125°C		2.65		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.0mA,V_{CE}=V_{GE}, T_j=25°C	5.4	6.1	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			400	nA
R_{Gint}	Internal Gate Resistance			/		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		0.65		nF
C_{res}	Reverse Transfer Capacitance			0.04		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.11		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=10A, R_G=82Ω,V_{GE}=±15V, T_j=25°C		164		ns
t_r	Rise Time			54		ns
$t_{d(off)}$	Turn-Off Delay Time			238		ns
t_f	Fall Time			352		ns
E_{on}	Turn-On Switching Loss			2.18		mJ
E_{off}	Turn-Off Switching Loss			0.72		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=10A, R_G=82Ω,V_{GE}=±15V, T_j=125°C		168		ns
t_r	Rise Time			55		ns
$t_{d(off)}$	Turn-Off Delay Time			247		ns
t_f	Fall Time			438		ns
E_{on}	Turn-On Switching Loss			2.48		mJ
E_{off}	Turn-Off Switching Loss			0.97		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=125°C,V_{CC}=900V, V_{CEM}≤1200V		80		A

Diode-brake Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=10A,V_{GE}=0V,T_j=25°C		1.85	2.30	V
		I_F=10A,V_{GE}=0V,T_j=125°C		2.05		
Q_r	Recovered Charge	V_R=600V,I_F=10A, -di/dt=210A/μs,V_{GE}=-15V T_j=25°C		0.7		μC
I_{RM}	Peak Reverse Recovery Current			7		A
E_{rec}	Reverse Recovery Energy			0.31		mJ
Q_r	Recovered Charge	V_R=600V,I_F=10A, -di/dt=210A/μs,V_{GE}=-15V T_j=125°C		1.4		μC
I_{RM}	Peak Reverse Recovery Current			9		A
E_{rec}	Reverse Recovery Energy			0.51		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
L_{CE}	Stray Inductance		60		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance,Terminal to Chip		4.00 3.00		mΩ
R_{thJC}	Junction-to-Case (per IGBT-inverter) Junction-to-Case (per Diode-inverter) Junction-to-Case (per Diode-rectifier) Junction-to-Case (per IGBT-brake) Junction-to-Case (per Diode-brake)			1.076 1.713 1.767 1.076 1.713	K/W
R_{thCH}	Case-to-Heatsink (per IGBT-inverter) Case-to-Heatsink (per Diode-inverter) Case-to-Heatsink (per Diode-rectifier) Case-to-Heatsink (per IGBT-brake) Case-to-Heatsink (per Diode-brake) Case-to-Heatsink (per Module)		0.301 0.479 0.494 0.301 0.479 0.020		K/W
M	Mounting Screw:M5	3.0		6.0	N.m
G	Weight of Module		200		g

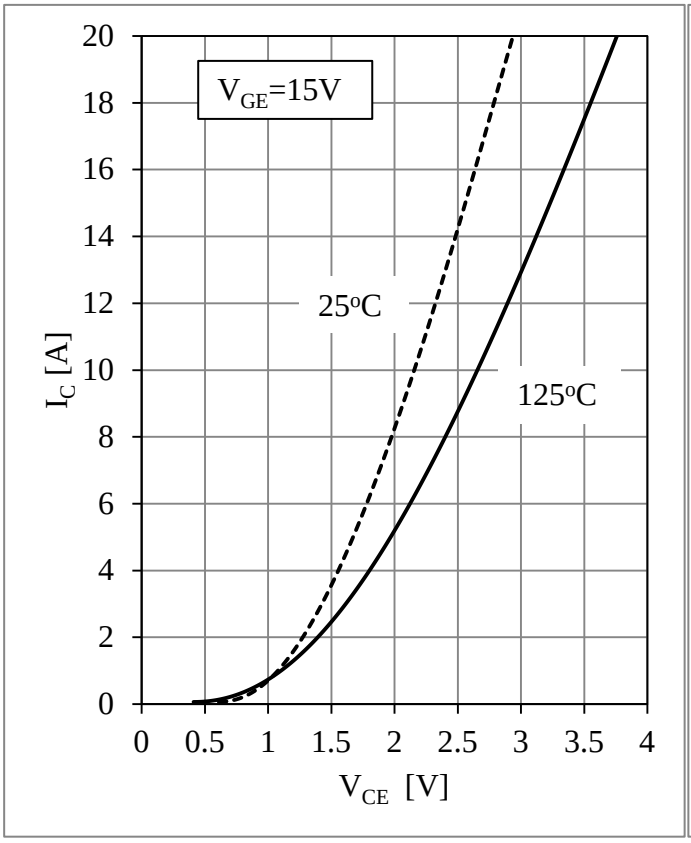


Fig 1. IGBT Output Characteristics

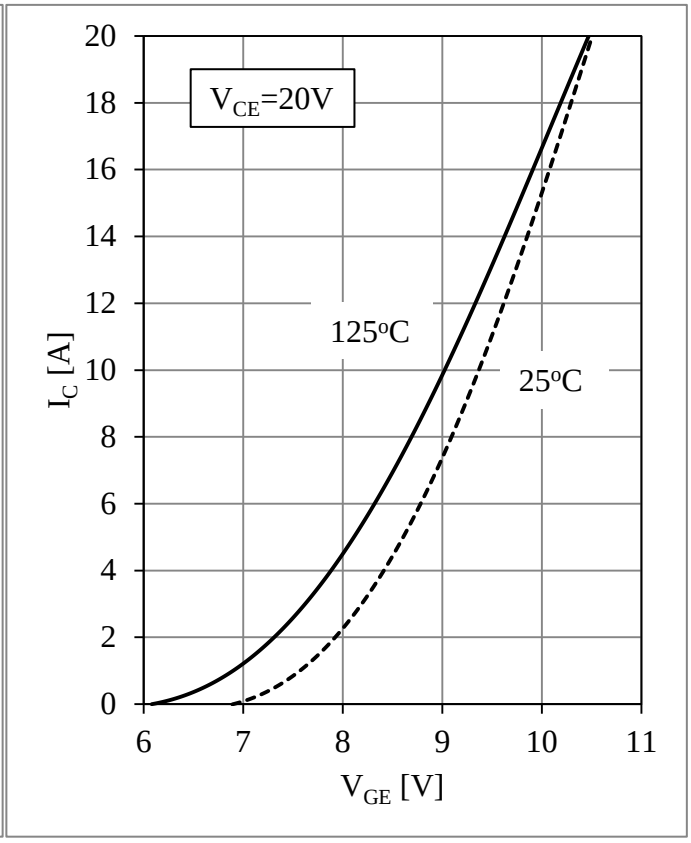


Fig 2. IGBT Transfer Characteristics

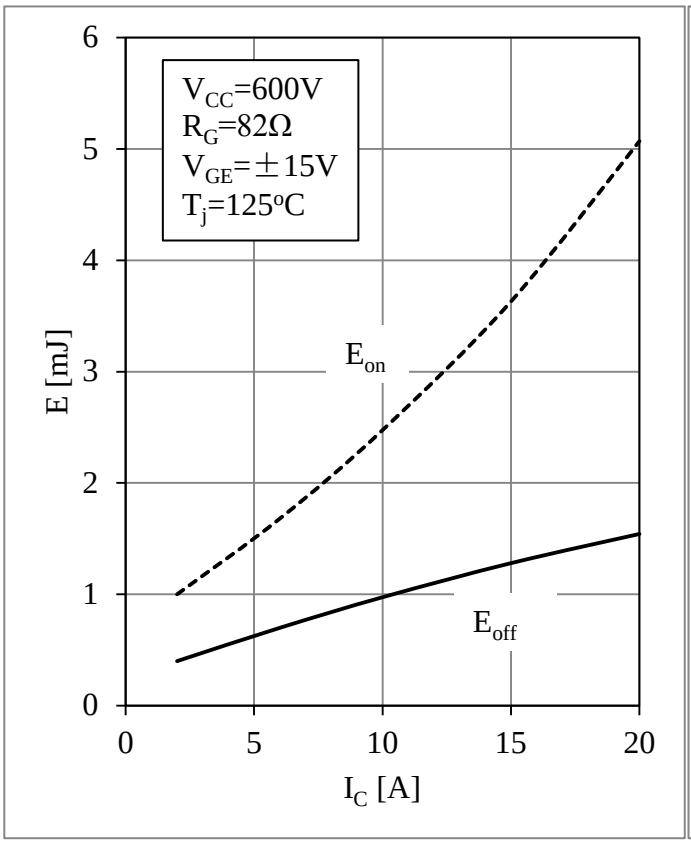


Fig 3. IGBT Switching Loss vs. I_C

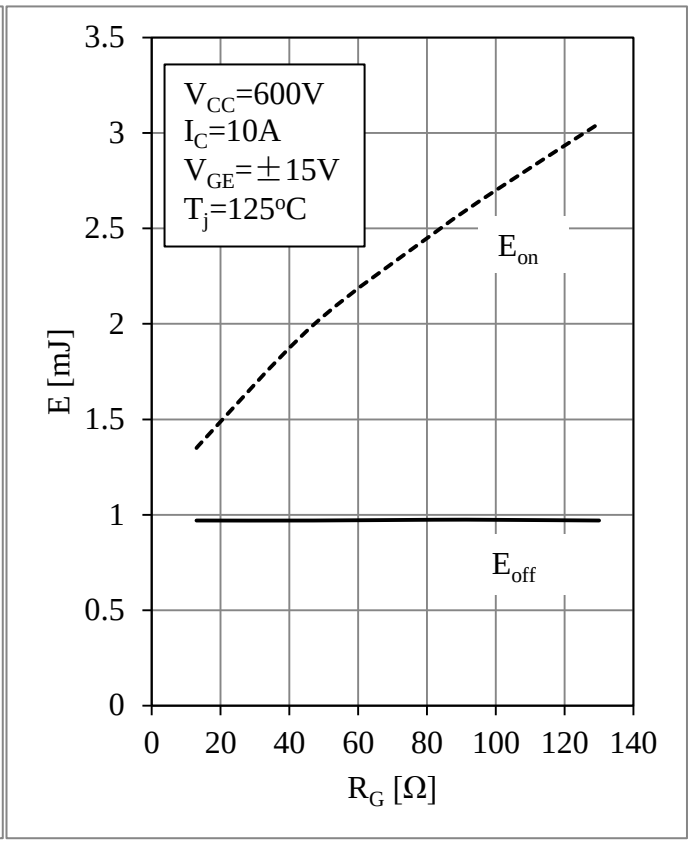


Fig 4. IGBT Switching Loss vs. R_G

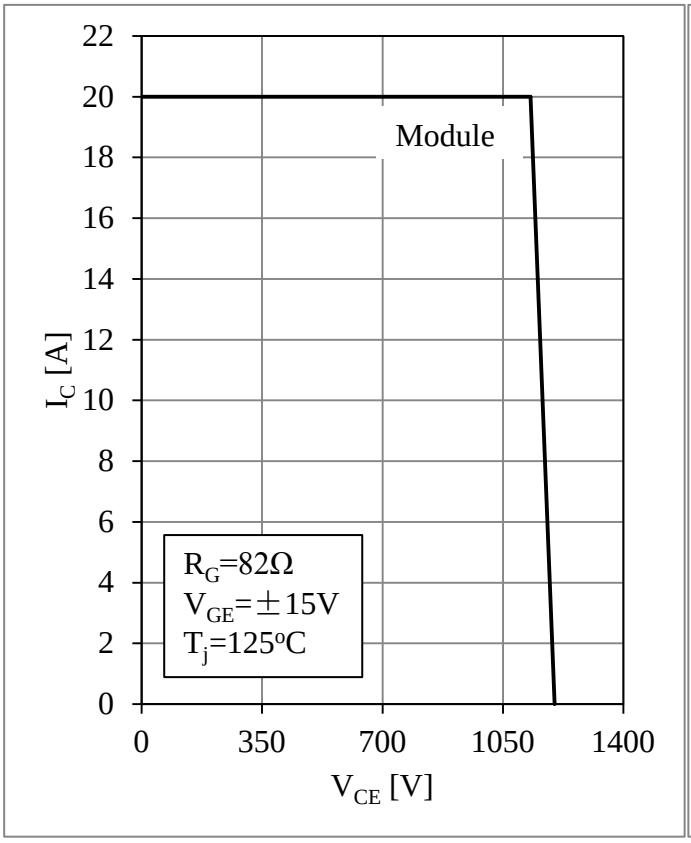


Fig 5. IGBT RBSOA

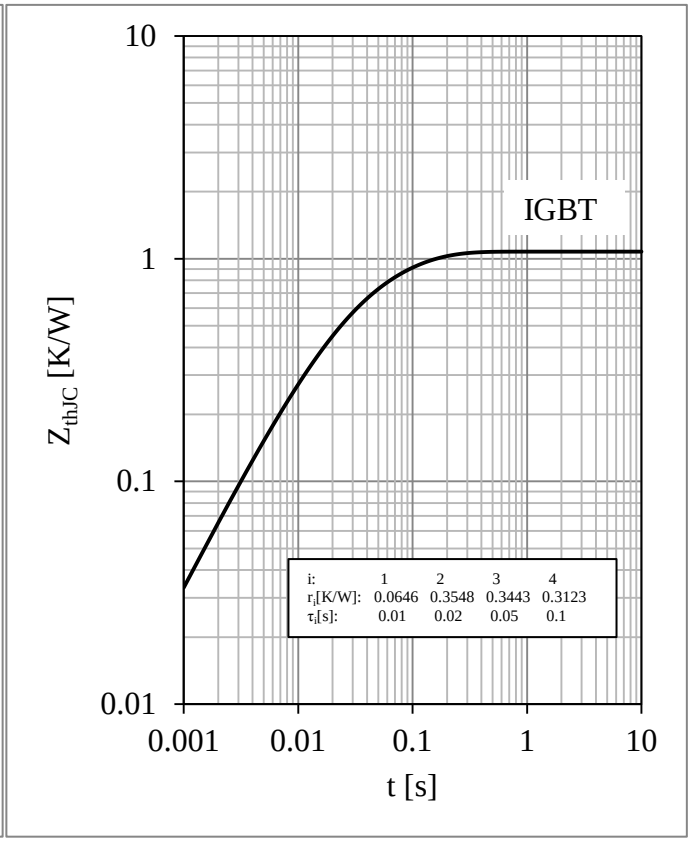


Fig 6. IGBT Transient Thermal Impedance

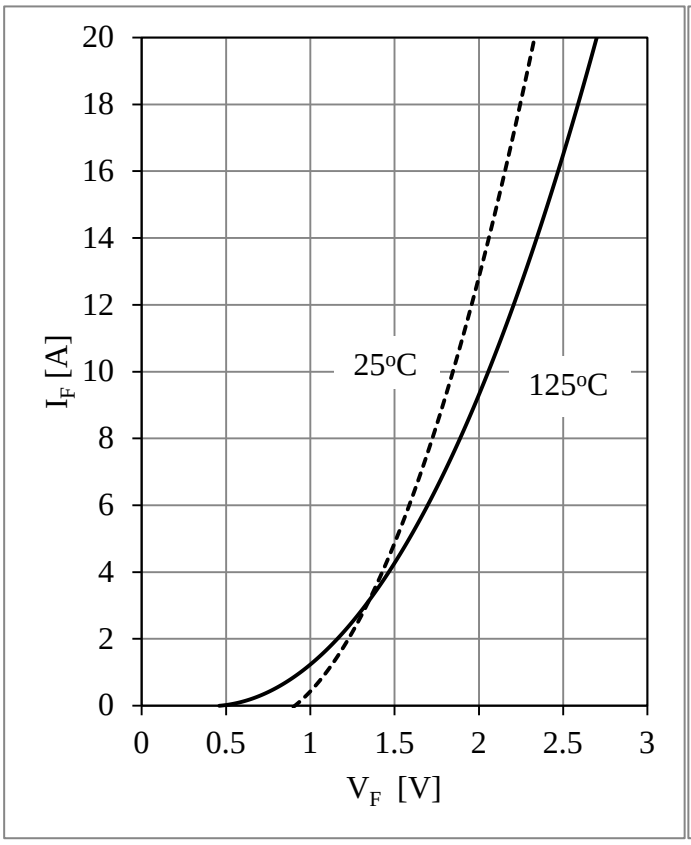


Fig 7. Diode Forward Characteristics

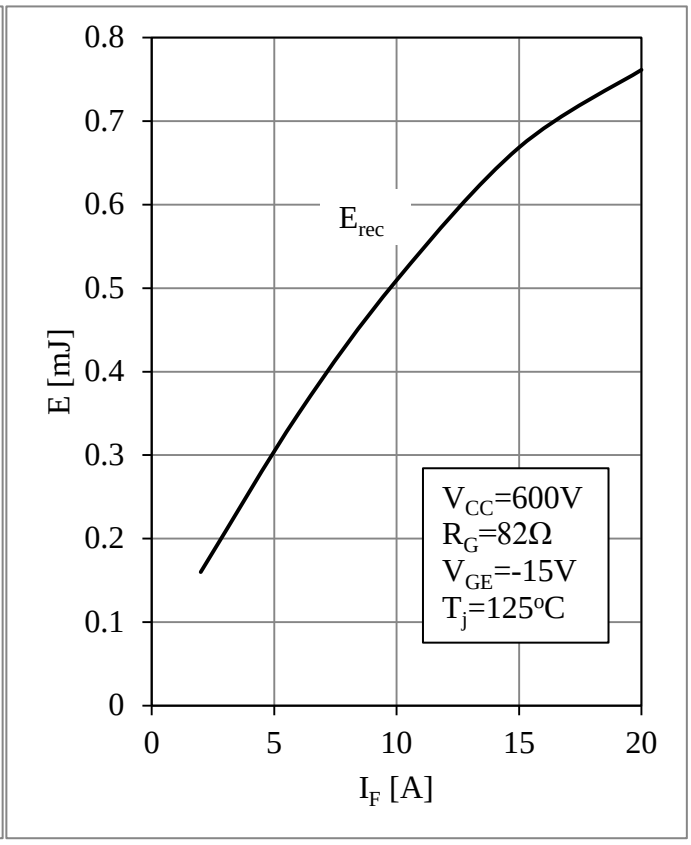


Fig 8. Diode Switching Loss vs. I_F

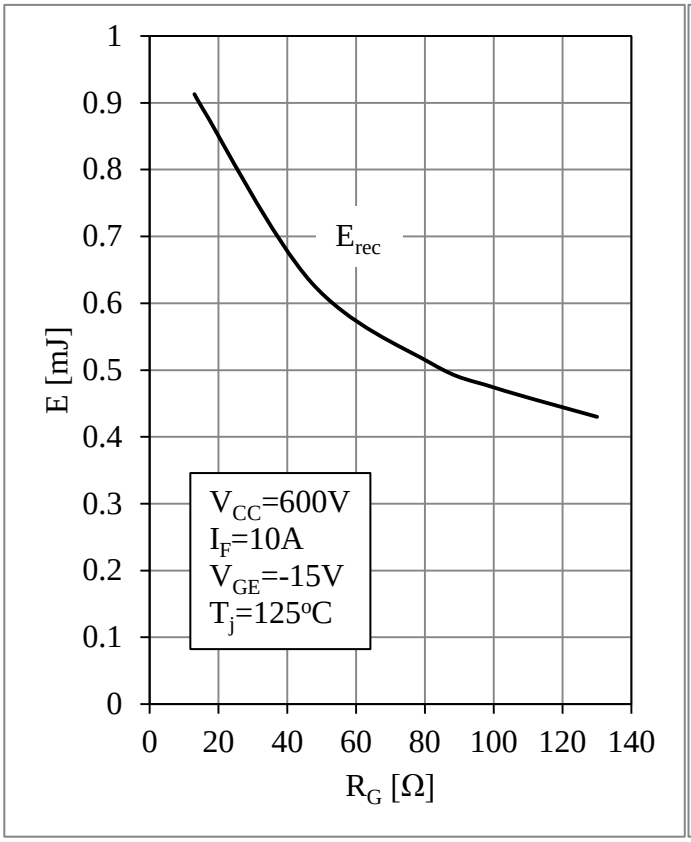


Fig 9. Diode Switching Loss vs. R_G

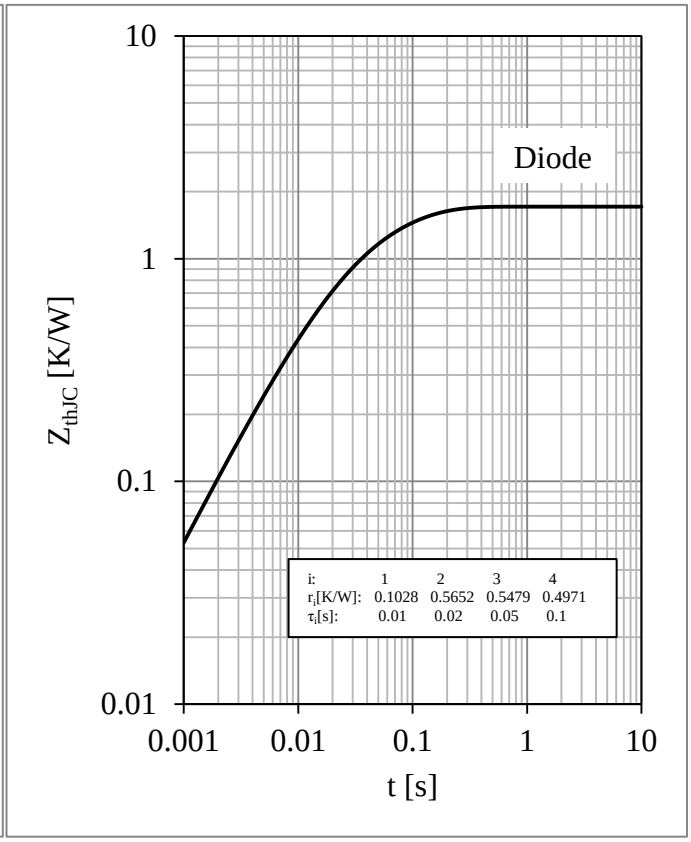


Fig 10. Diode Transient Thermal Impedance

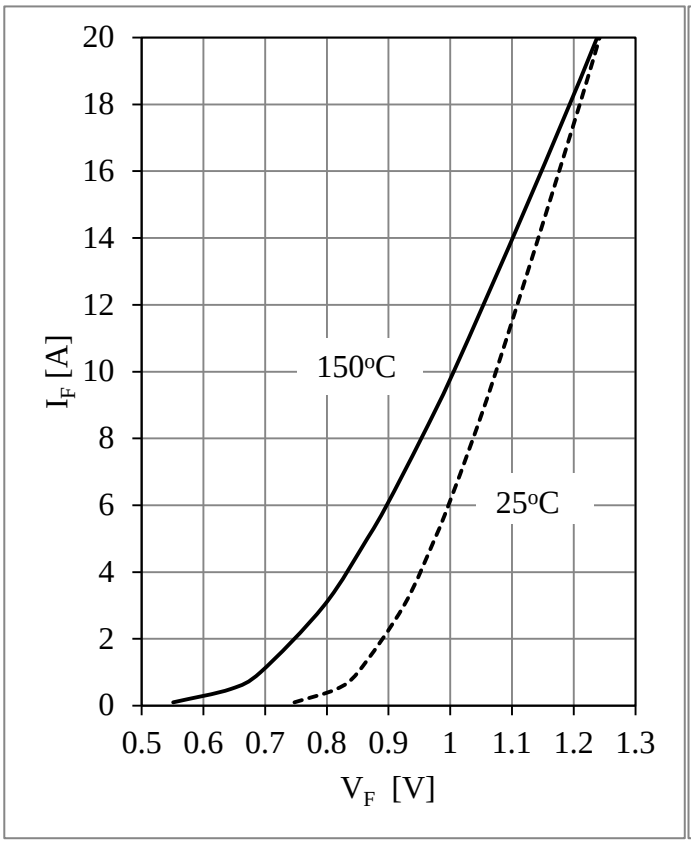


Fig 11. Diode-rectifier Forward Characteristics

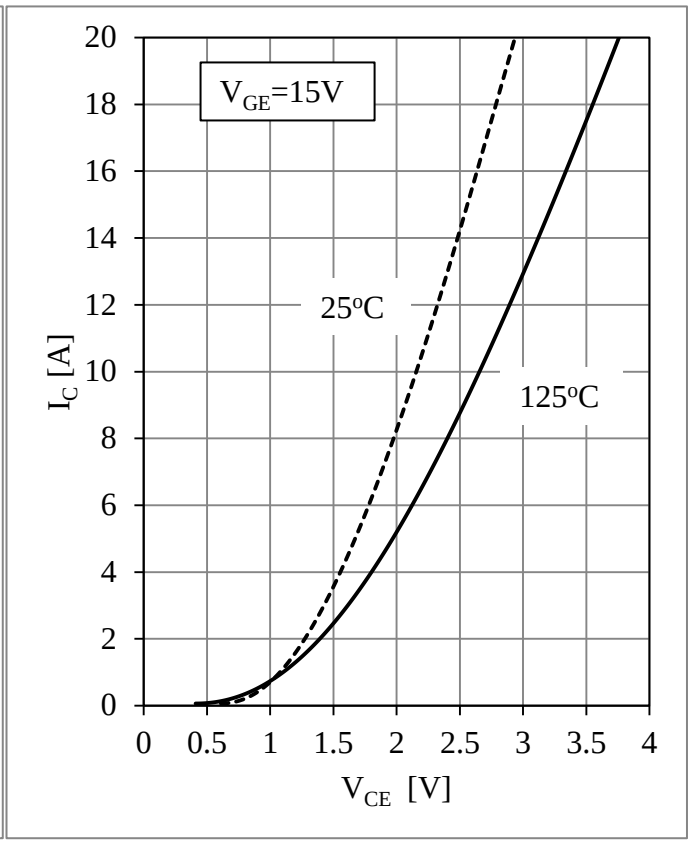


Fig 12. IGBT-brake-chopper Output Characteristics

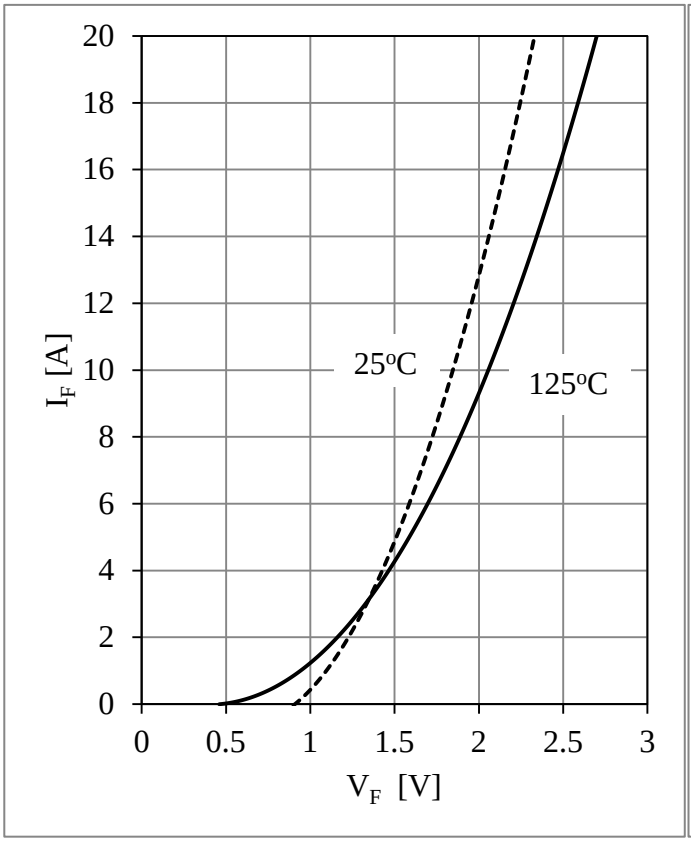


Fig 13. Diode-brake-chopper Forward Characteristics

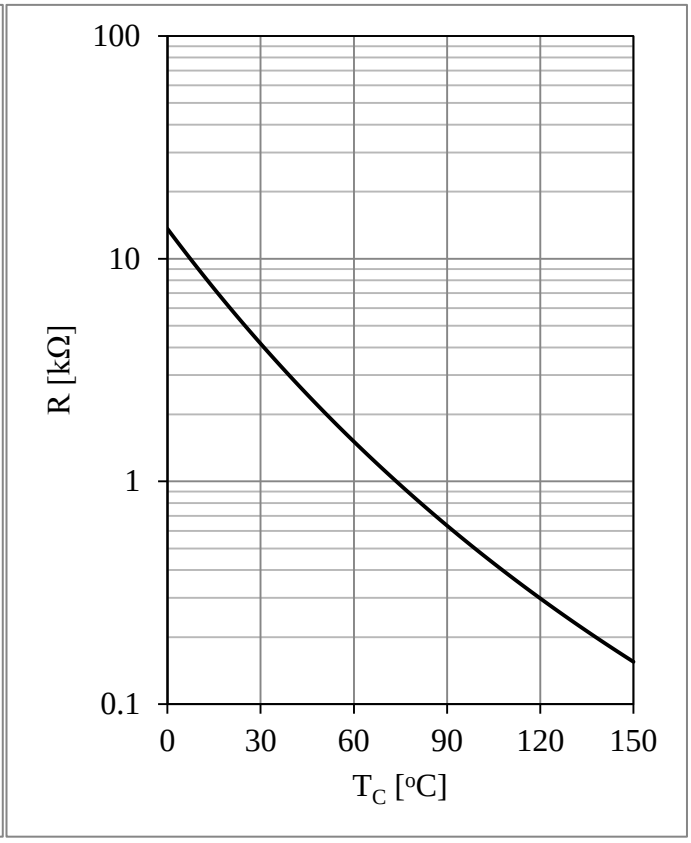
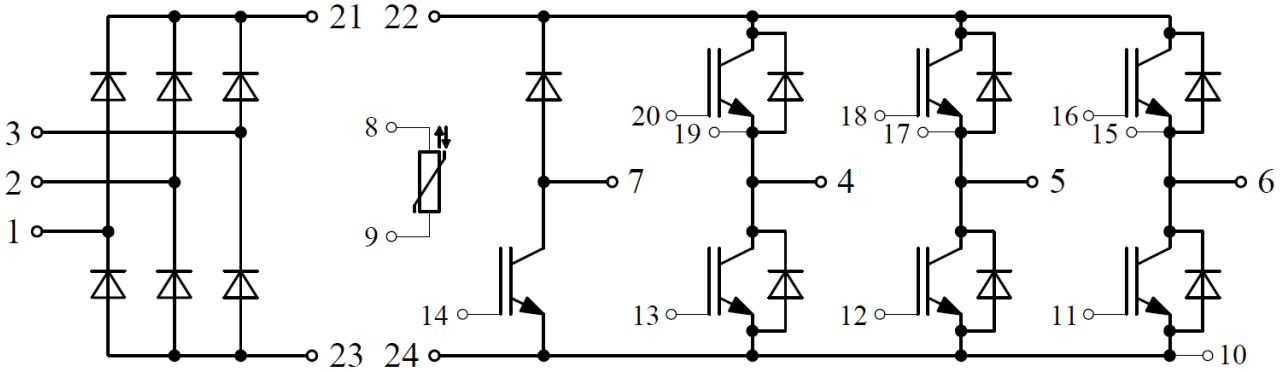


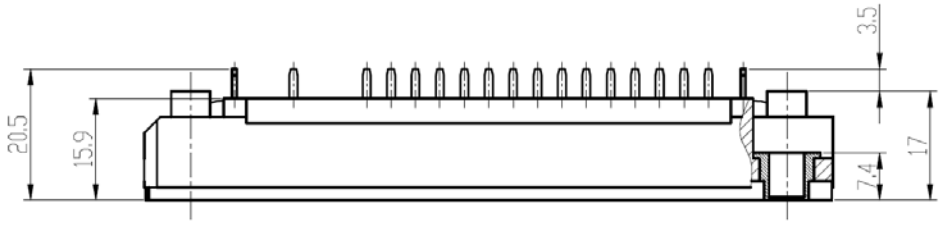
Fig 14. NTC Temperature Characteristic

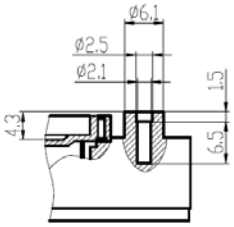
Circuit Schematic

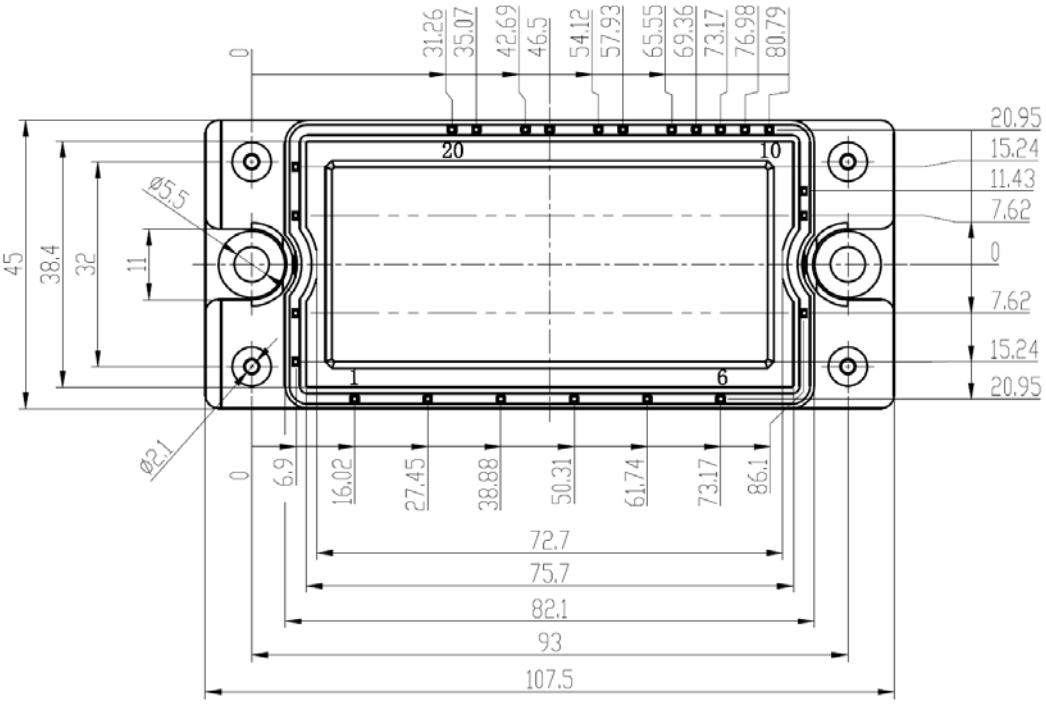


Package Dimensions

Dimensions in Millimeters







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