STARPOWER

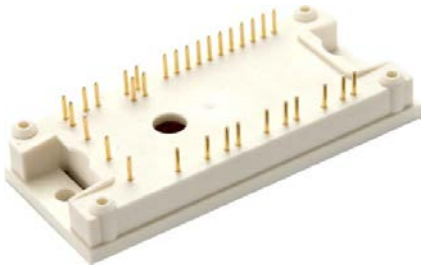
SEMICONDUCTOR **IGBT**

GD15PJK120F2S

1200V/15A 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.



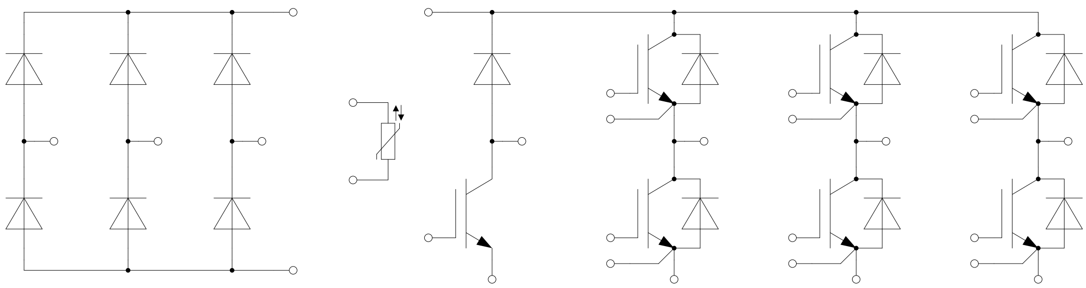
Features

- NPT IGBT technology
- 10μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 150^{o}C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated heatsink 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	30 15	A
I_{CM}	Pulsed Collector Current t_p=1ms	30	A
P_D	Maximum Power Dissipation @ T_j=150°C	159	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	15	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	30	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	15	A
I_{FSM}	Surge Forward Current V_R=0V,t_p=10ms,T_j=45°C	270	A
I^2t	I^2t-value,V_R=0V,t_p=10ms,T_j=45°C	360	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	94	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	4000	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=15A,V_{GE}=15V, T_j=25°C		2.05	2.50	V
		I_C=15A,V_{GE}=15V, T_j=125°C		2.40		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.0mA,V_{CE}=V_{GE}, T_j=25°C	5.0	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		0.99		nF
C_{res}	Reverse Transfer Capacitance			0.07		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.16		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=15A, R_G=68Ω,V_{GE}=±15V, T_j=25°C		182		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			306		ns
t_f	Fall Time			335		ns
E_{on}	Turn-On Switching Loss			2.98		mJ
E_{off}	Turn-Off Switching Loss			1.17		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=15A, R_G=68Ω,V_{GE}=±15V, T_j=125°C		186		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			321		ns
t_f	Fall Time			383		ns
E_{on}	Turn-On Switching Loss			3.32		mJ
E_{off}	Turn-Off Switching Loss			1.65		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=125°C,V_{CC}=900V, V_{CEM}≤1200V		150		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=15A,V_{GE}=0V,T_j=25°C		2.05	2.45	V
		I_F=15A,V_{GE}=0V,T_j=125°C		2.20		
Q_r	Recovered Charge	V_R=600V,I_F=15A, -di/dt=500A/μs,V_{GE}=-15V T_j=25°C		0.9		μC
I_{RM}	Peak Reverse Recovery Current			10		A
E_{rec}	Reverse Recovery Energy			0.41		mJ
Q_r	Recovered Charge	V_R=600V,I_F=15A, -di/dt=500A/μs,V_{GE}=-15V T_j=125°C		1.8		μC
I_{RM}	Peak Reverse Recovery Current			12		A
E_{rec}	Reverse Recovery Energy			0.74		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=15A,T_j=150°C		0.96		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			0		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			22.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100°C,R_{100}=1486.1Ω	-5		5	%
P_{25}	Power Dissipation				200	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		4000		K

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per IGBT-inverter)		0.713	0.784	K/W
	Junction-to-Case (per Diode-inverter)		1.465	1.612	
	Junction-to-Case (per Diode-rectifier)		1.324	1.456	
	Junction-to-Case (per IGBT-brake)		1.196	1.316	
	Junction-to-Case (per Diode-brake)		1.852	2.037	
R_{thCH}	Case-to-Heatsink (per IGBT-inverter)		0.381		K/W
	Case-to-Heatsink (per Diode-inverter)		0.783		
	Case-to-Heatsink (per Diode-rectifier)		0.707		
	Case-to-Heatsink (per IGBT-brake)		0.639		
	Case-to-Heatsink (per Diode-brake)		0.989		
	Case-to-Heatsink (per Module)		0.029		
M	Mounting Torque, Screw M4	2.0		2.2	N.m
G	Weight of Module		40		g

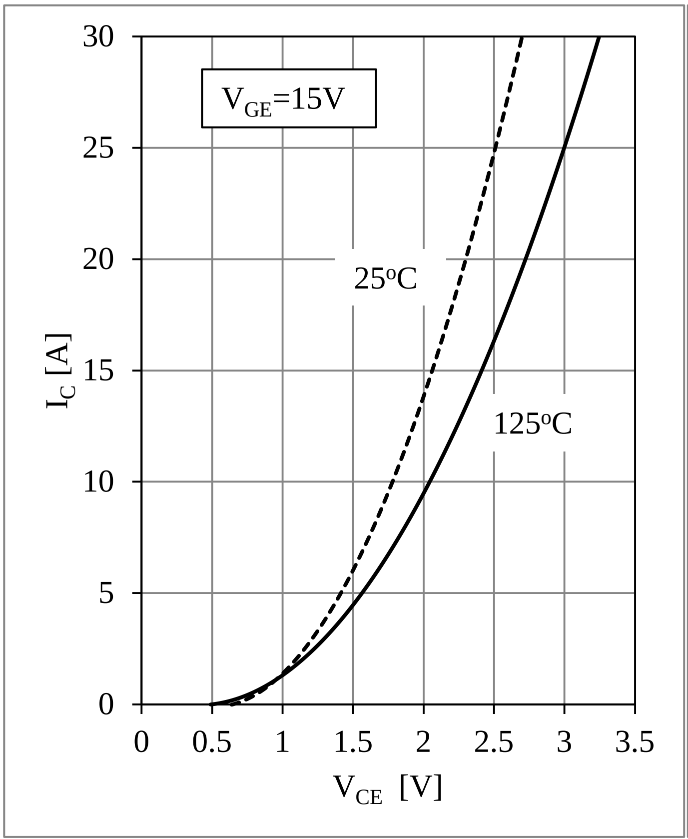


Fig 1. IGBT-inverter Output Characteristics

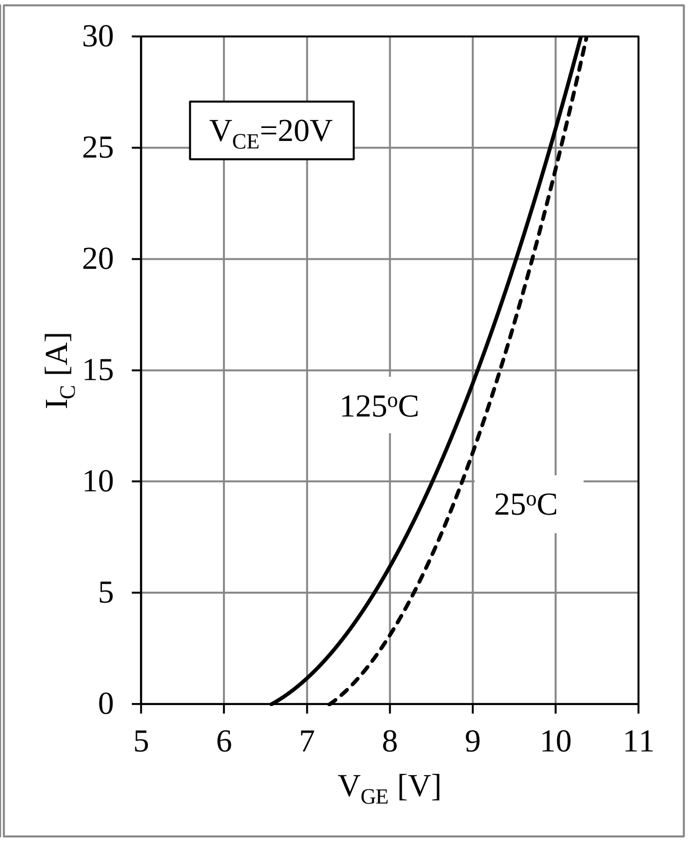


Fig 2. IGBT-inverter Transfer Characteristics

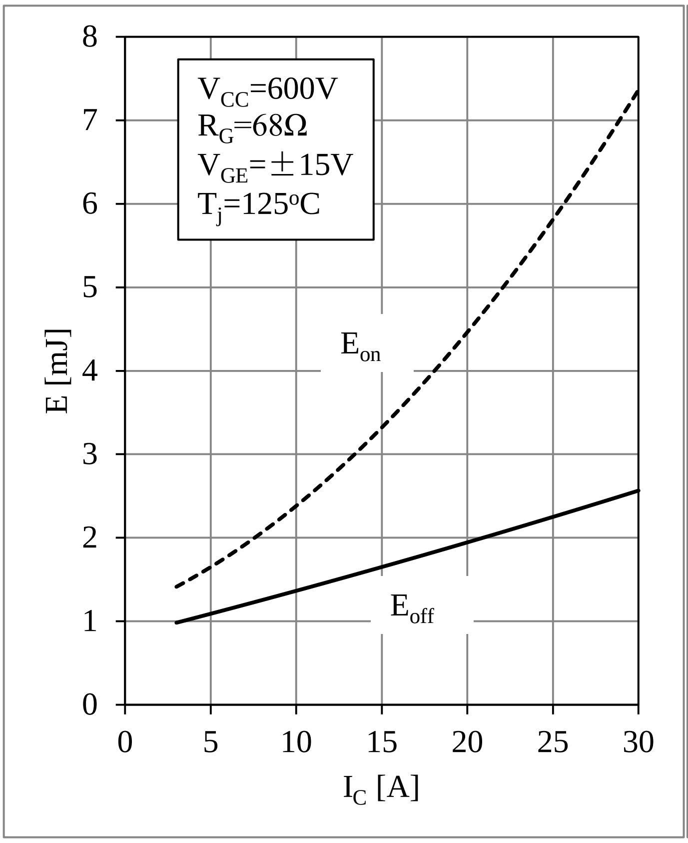


Fig 3. IGBT-inverter Switching Loss vs. I_C

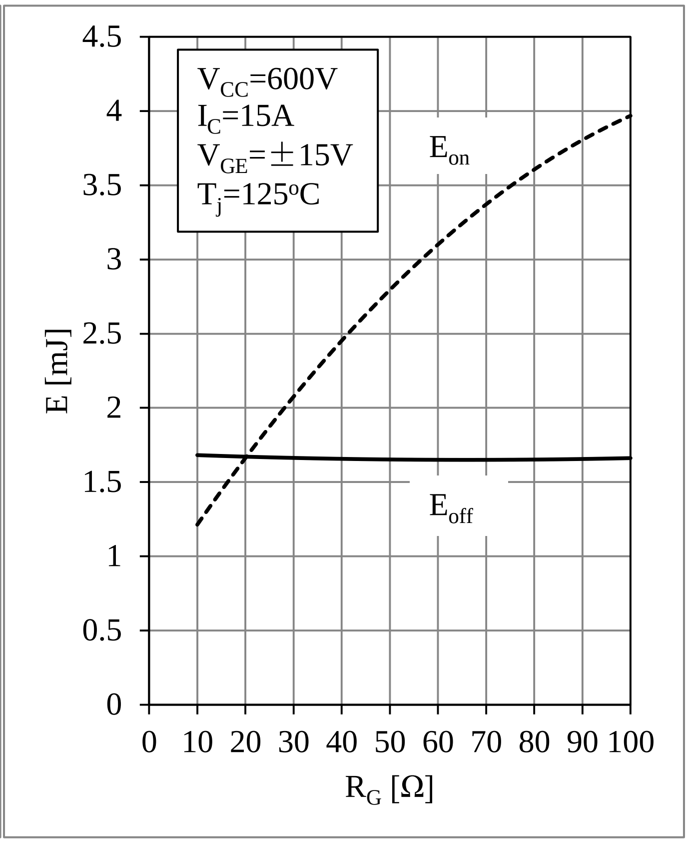


Fig 4. IGBT-inverter Switching Loss vs. R_G

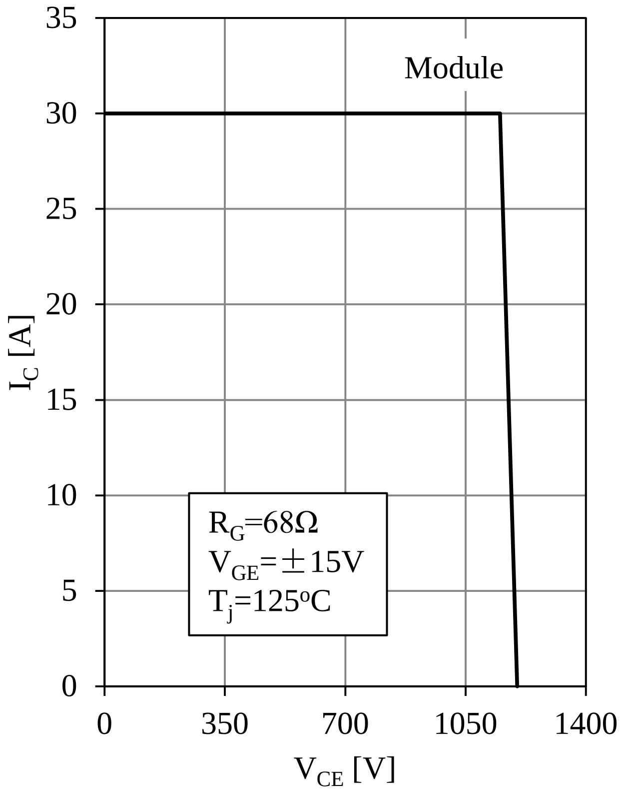


Fig 5. IGBT-inverter RBSOA

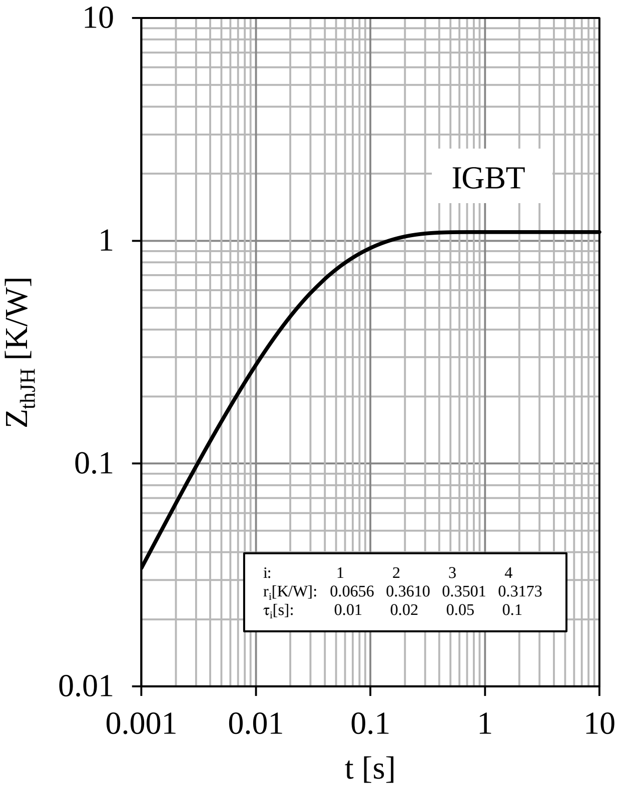


Fig 6. IGBT-inverter Transient Thermal Impedance

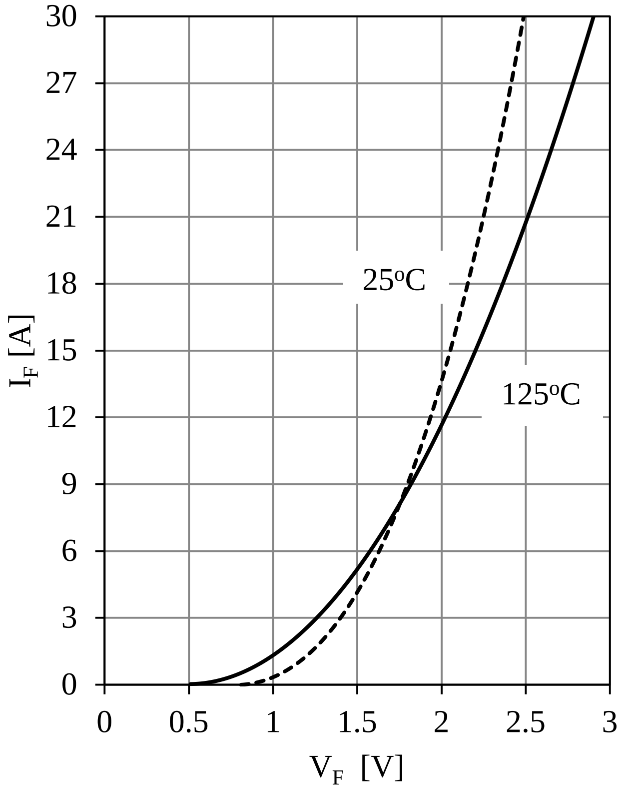


Fig 7. Diode-inverter Forward Characteristics

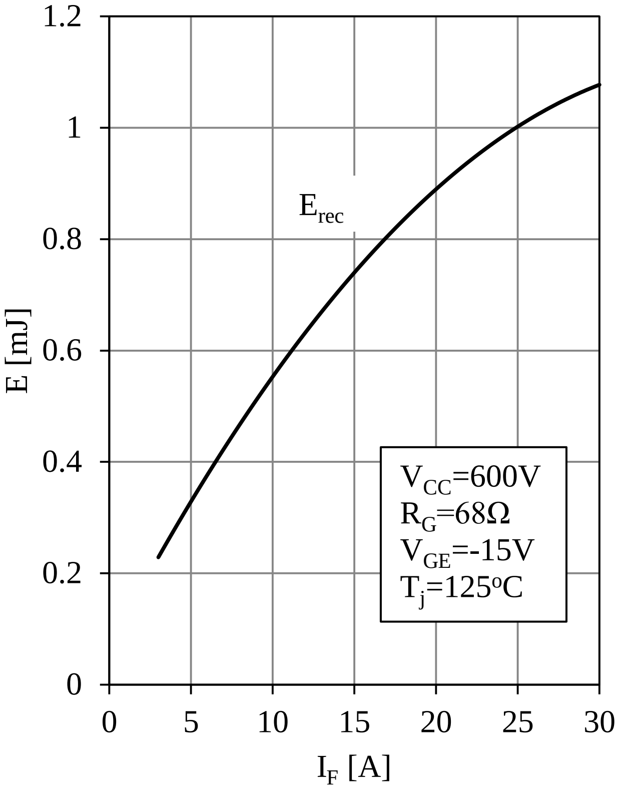


Fig 8. Diode-inverter Switching Loss vs. I_F

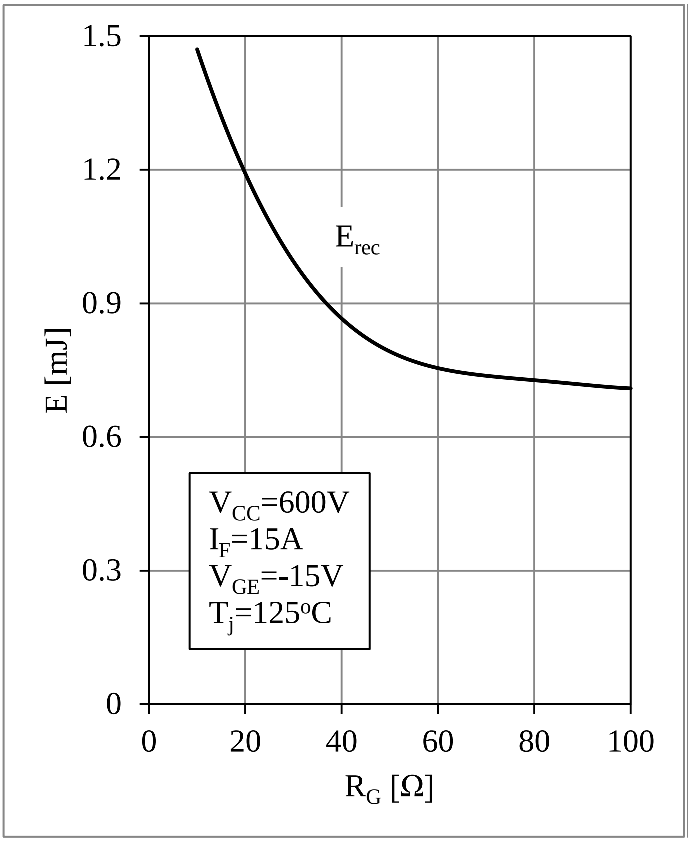


Fig 9. Diode-inverter Switching Loss vs. R_G

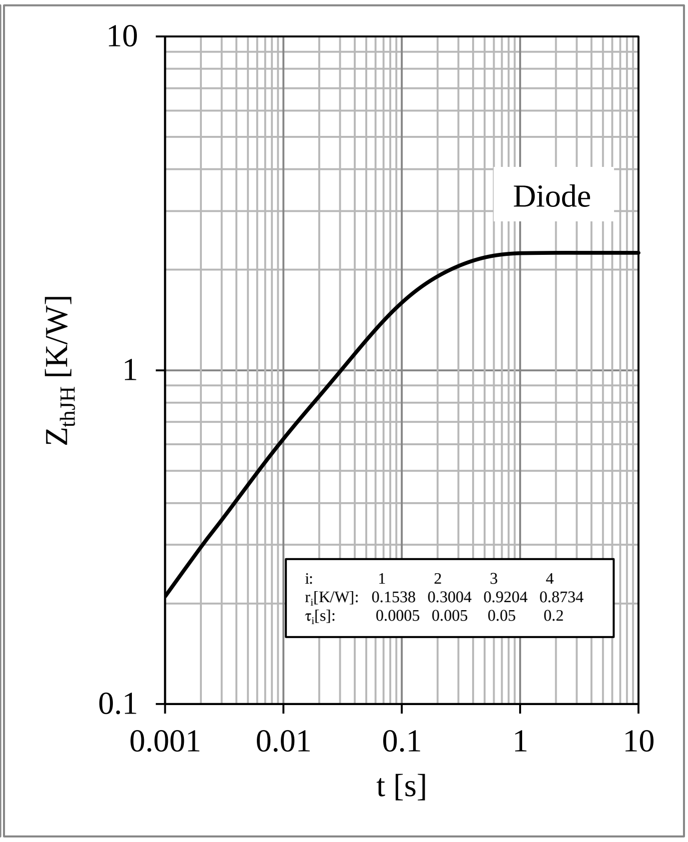


Fig 10. Diode-inverter Transient Thermal Impedance

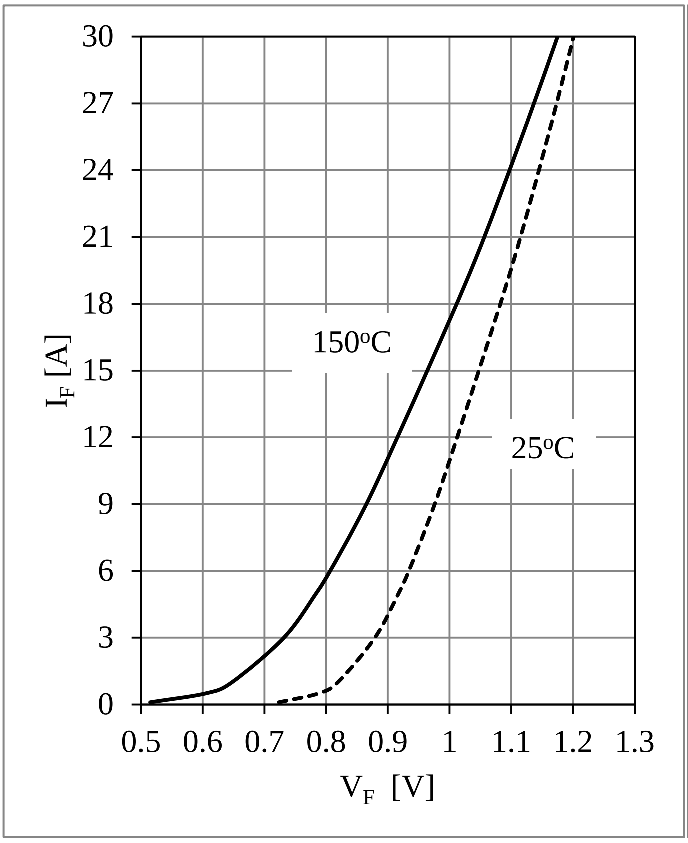


Fig 11. Diode-rectifier Forward Characteristics

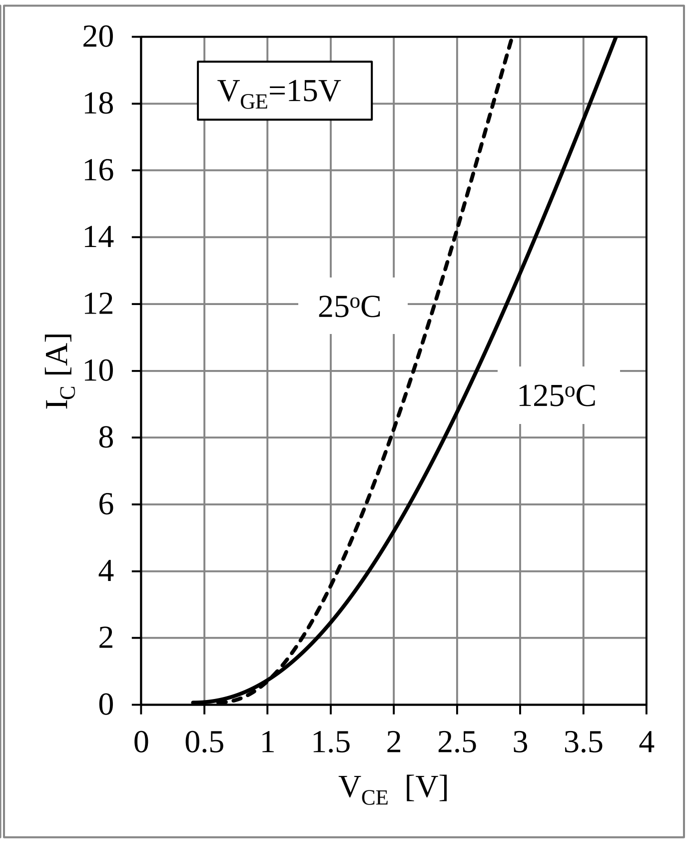


Fig 12. IGBT-brake Output Characteristics

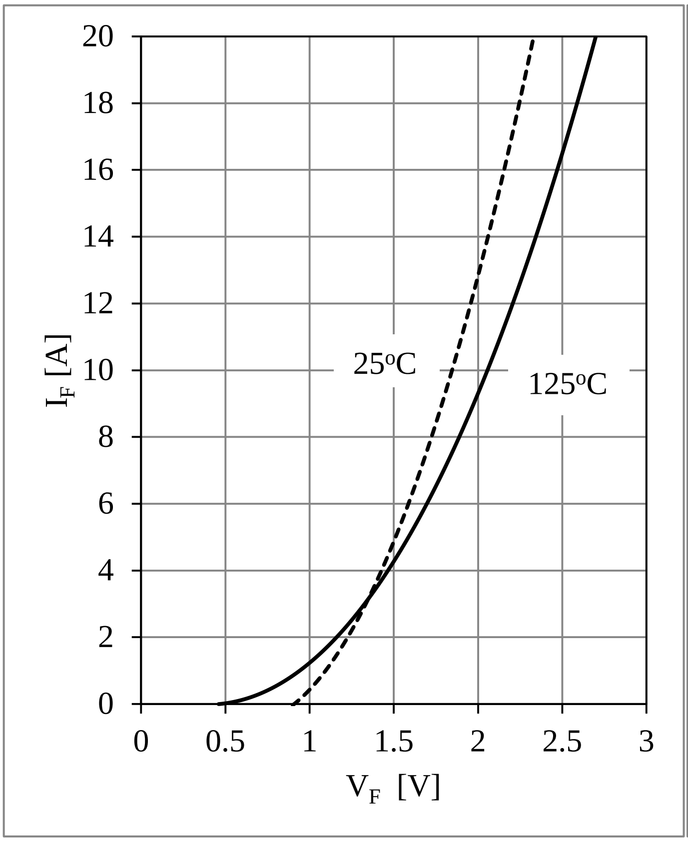


Fig 13. Diode-brake Forward Characteristics

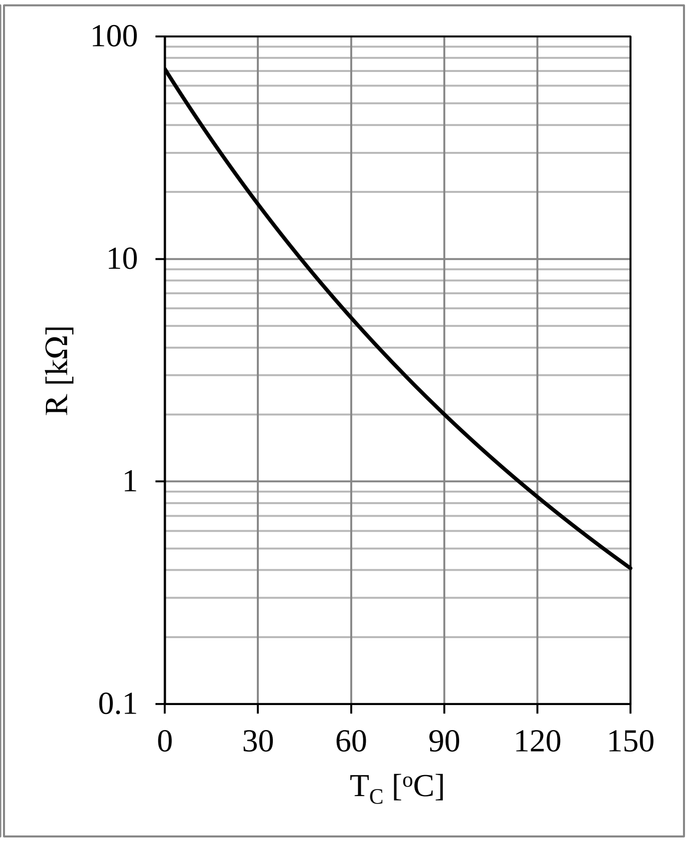
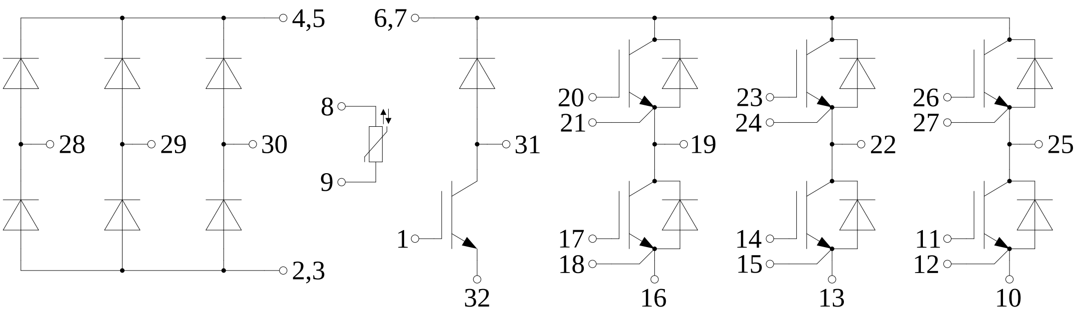


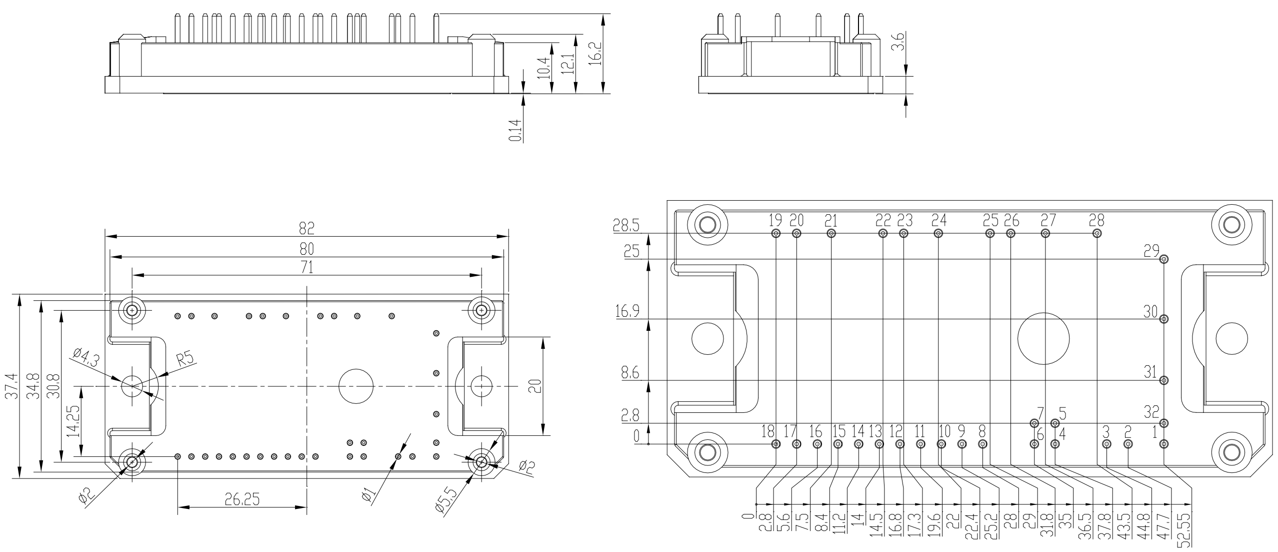
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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