

STARPOWER

SEMICONDUCTOR

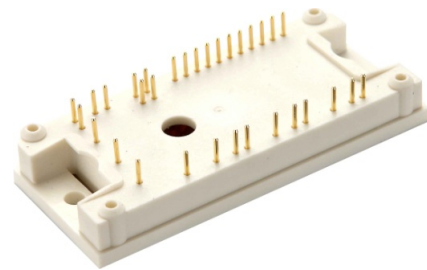
IGBT

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.



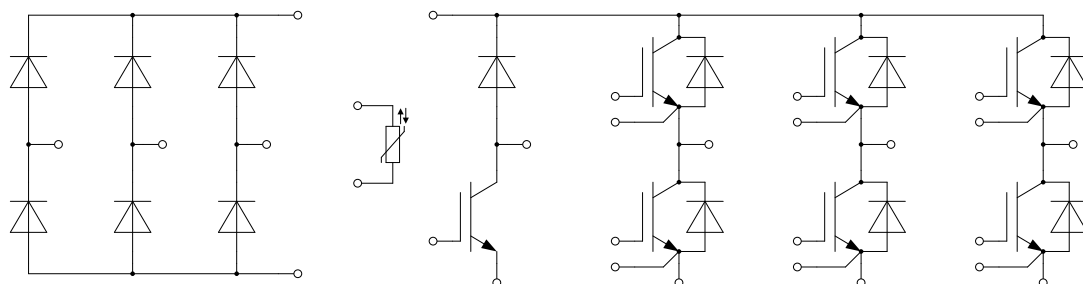
Features

- NPT IGBT technology
- 10 μ s 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 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 $T_C=25^{\circ}\text{C}$ 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 @ $T_C=25^{\circ}\text{C}$	30	A
	@ $T_C=100^{\circ}\text{C}$	15	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	30	A
P_D	Maximum Power Dissipation @ $T_j=150^{\circ}\text{C}$	213	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 $t_p=1\text{ms}$	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 $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	270	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	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 @ $T_C=25^{\circ}\text{C}$	20	A
	@ $T_C=100^{\circ}\text{C}$	10	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	20	A
P_D	Maximum Power Dissipation @ $T_j=150^{\circ}\text{C}$	96	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 $t_p=1\text{ms}$	20	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	150	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +125	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	4000	V

IGBT-inverter Characteristics $T_c=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=15\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.70	2.15	V	
		$I_C=15\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.95			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.0	5.6	6.2	V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			1.0	mA	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			400	nA	
R_{Gint}	Internal Gate Resistance			/		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		1.65		nF	
C_{res}	Reverse Transfer Capacitance				0.11		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.16		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=15\text{A}, R_G=33\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		184		ns	
t_r	Rise Time			44		ns	
$t_{d(off)}$	Turn-Off Delay Time			230		ns	
t_f	Fall Time			400		ns	
E_{on}	Turn-On Switching Loss				1.78		mJ
E_{off}	Turn-Off Switching Loss				1.10		mJ
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=600\text{V}, I_C=15\text{A}, R_G=33\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		222		ns
t_r	Rise Time				55		ns
$t_{d(off)}$	Turn-Off Delay Time			213		ns	
t_f	Fall Time			418		ns	
E_{on}	Turn-On Switching Loss				2.46		mJ
E_{off}	Turn-Off Switching Loss				1.20		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$			200		A

Diode-inverter Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=15\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		2.05	2.45	V
		$I_F=15\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		2.20		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=15\text{A},$ $-di/dt=500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		0.9		μC
I_{RM}	Peak Reverse Recovery Current			10		A
E_{rec}	Reverse Recovery Energy			0.41		mJ
Q_r	Recovered Charge			1.8		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=15\text{A},$ $-di/dt=500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		12		A
E_{rec}	Reverse Recovery Energy			0.74		mJ

Diode-rectifier Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=15\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		0.96		V
I_R	Reverse Current	$T_j=150^{\circ}\text{C}, V_R=1600\text{V}$			1.0	mA

IGBT-brake Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=10\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.15	2.60	V	
		$I_C=10\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.65			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.4	6.1	6.8	V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			1.0	mA	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			400	nA	
R_{Gint}	Internal Gate Resistance			/		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		0.65		nF	
C_{res}	Reverse Transfer Capacitance				0.04		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.11		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=10\text{A}, R_G=82\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		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		$V_{CC}=600\text{V}, I_C=10\text{A}, R_G=82\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		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	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$			80		A

Diode-brake Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

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

NTC Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			22.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^\circ\text{C}, R_{100}=1486.1\Omega$	-5		5	%
P_{25}	Power Dissipation				200	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		4000		K

Module Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per IGBT-inverter)		0.533	0.586	K/W
	Junction-to-Case (per Diode-inverter)		1.509	1.660	
	Junction-to-Case (per Diode-rectifier)		1.320	1.452	
	Junction-to-Case (per IGBT-brake)		1.180	1.298	
	Junction-to-Case (per Diode-brake)		1.742	1.916	
R_{thCH}	Case-to-Heatsink (per IGBT-inverter)		0.328		K/W
	Case-to-Heatsink (per Diode-inverter)		0.928		
	Case-to-Heatsink (per Diode-rectifier)		0.812		
	Case-to-Heatsink (per IGBT-brake)		0.726		
	Case-to-Heatsink (per Diode-brake)		1.071		
	Case-to-Heatsink (per Module)		0.029		
M	Mounting Torque, Screw M4	2.0		2.2	N.m
G	Weight of Module		40		g

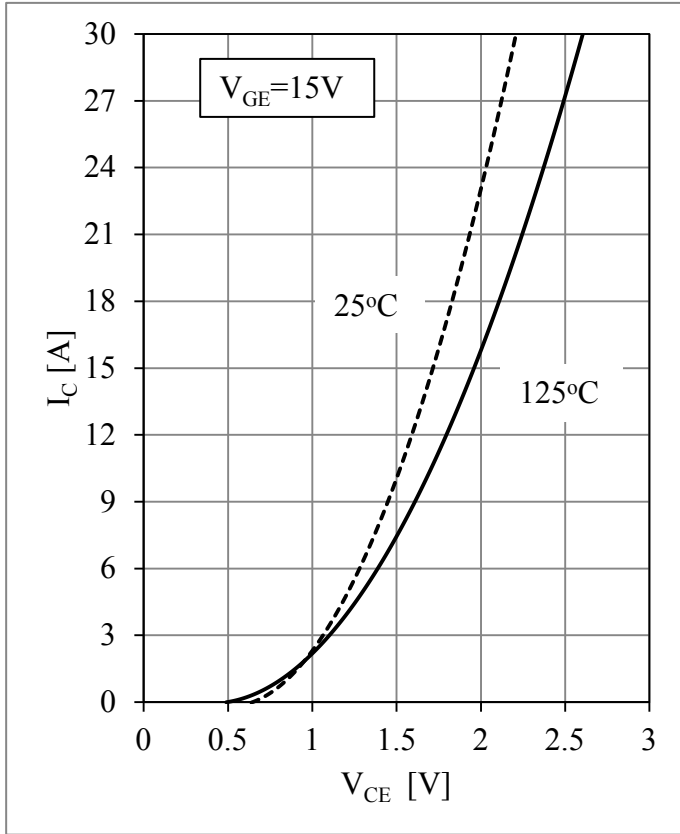


Fig 1. IGBT-inverter Output Characteristics

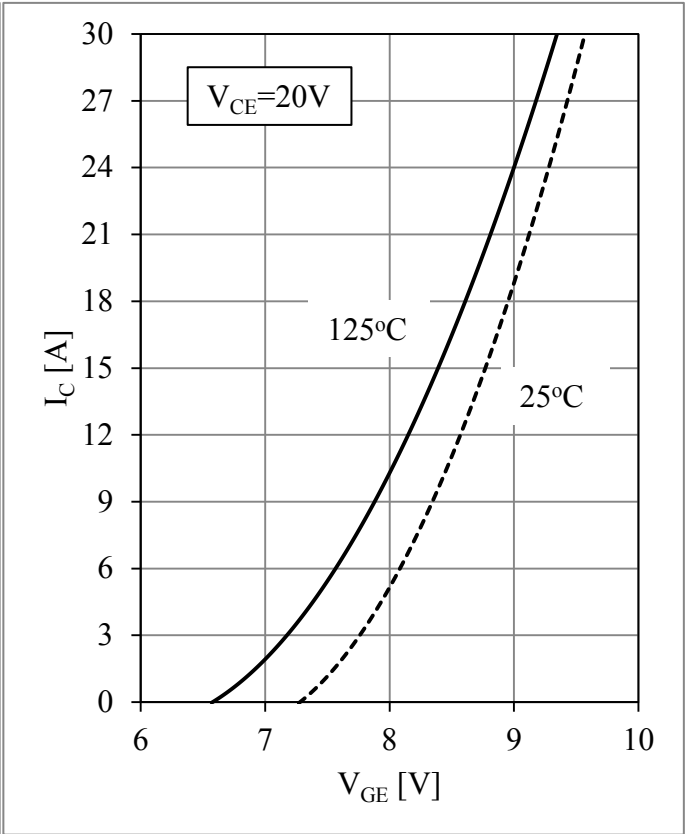


Fig 2. IGBT-inverter Transfer Characteristics

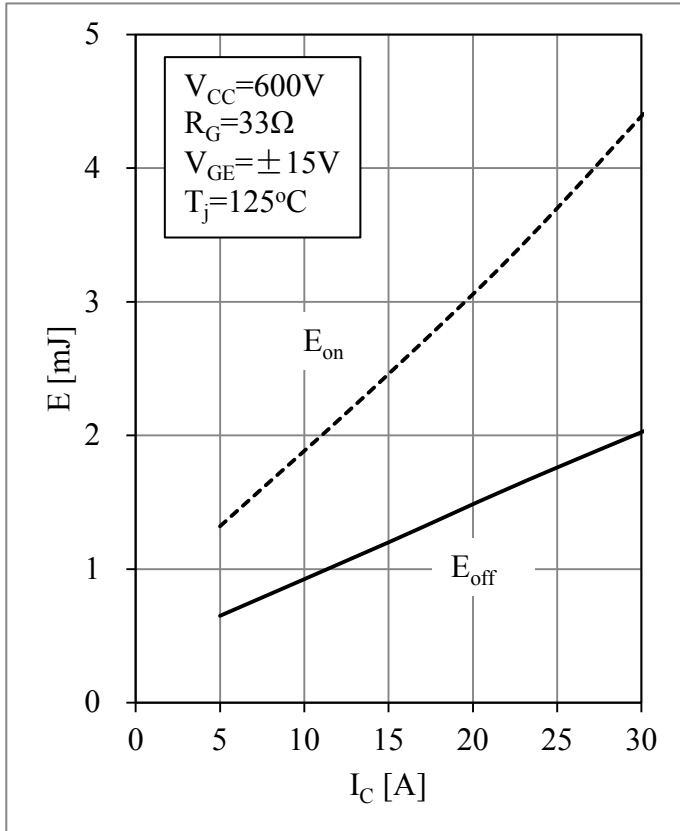


Fig 3. IGBT-inverter Switching Loss vs. I_C

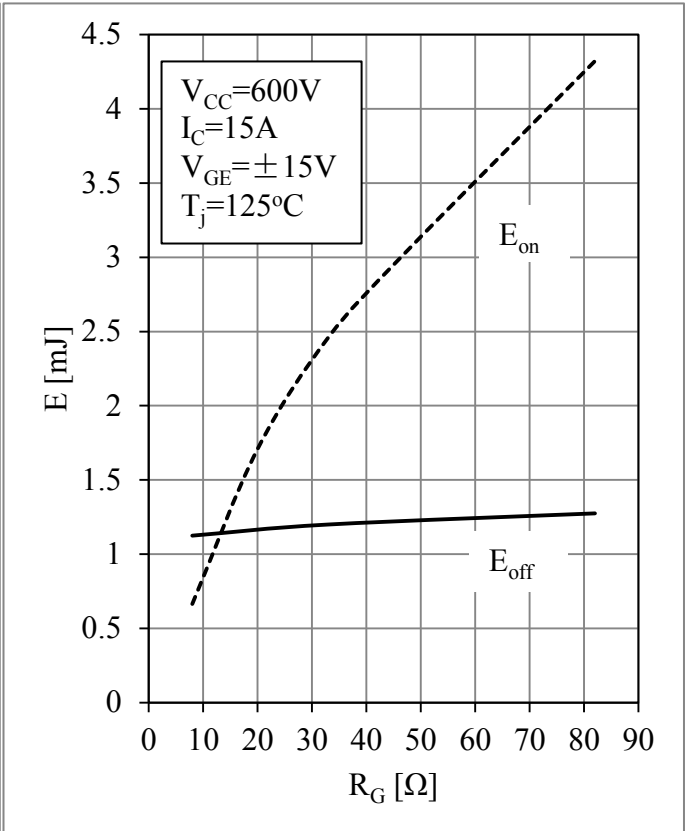


Fig 4. IGBT-inverter Switching Loss vs. R_G

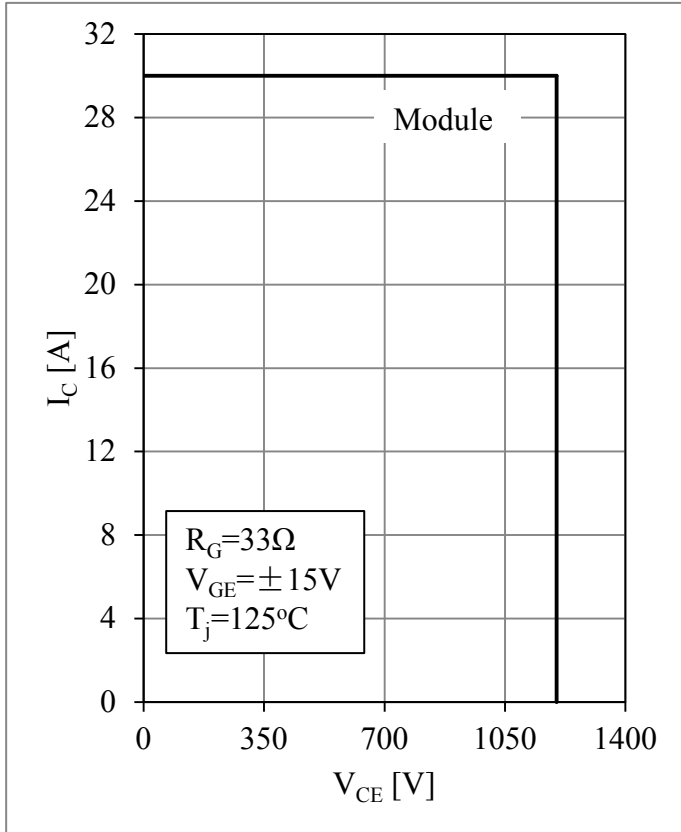


Fig 5. IGBT-inverter RBSOA

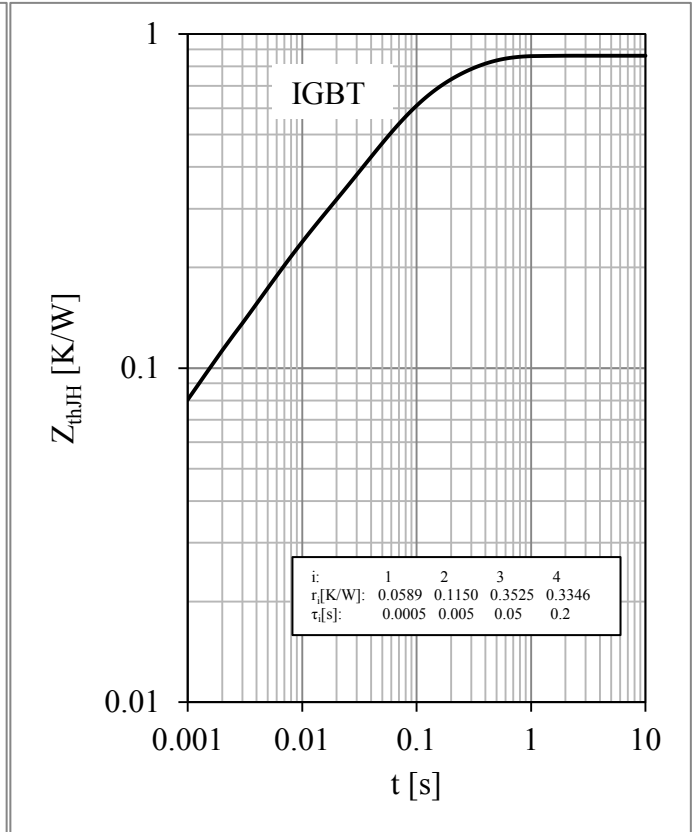


Fig 6. IGBT-inverter Transient Thermal Impedance

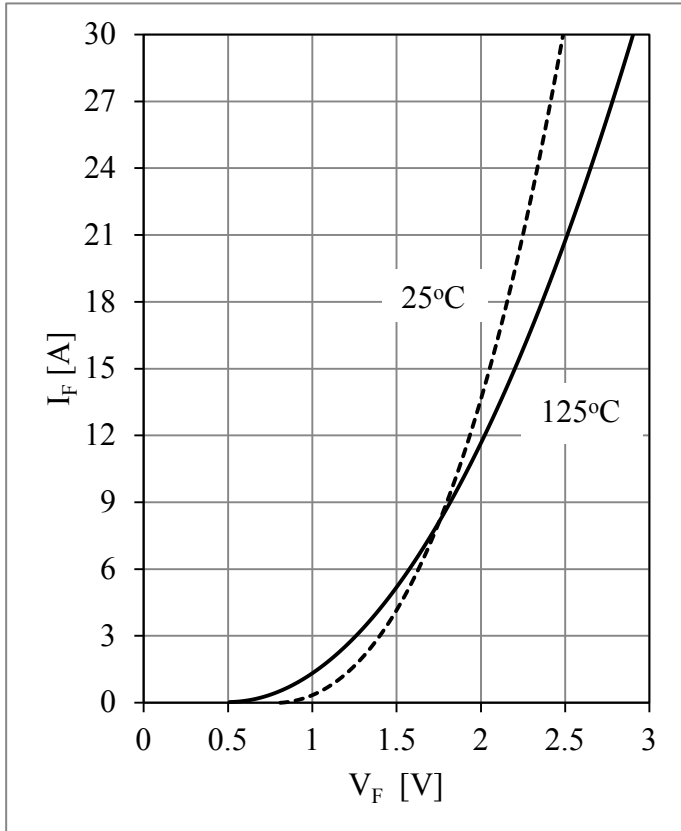


Fig 7. Diode-inverter Forward Characteristics

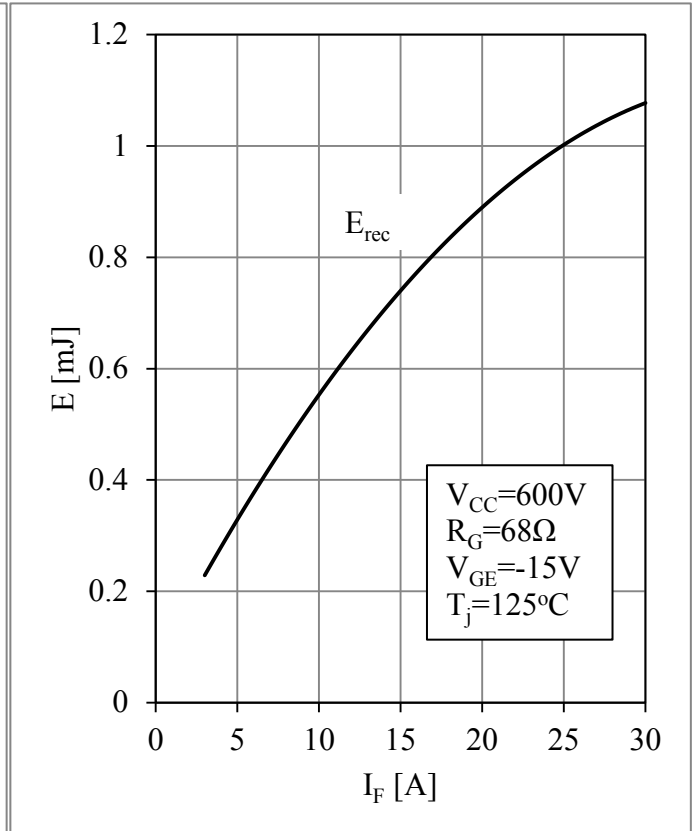


Fig 8. Diode-inverter Switching Loss vs. I_F

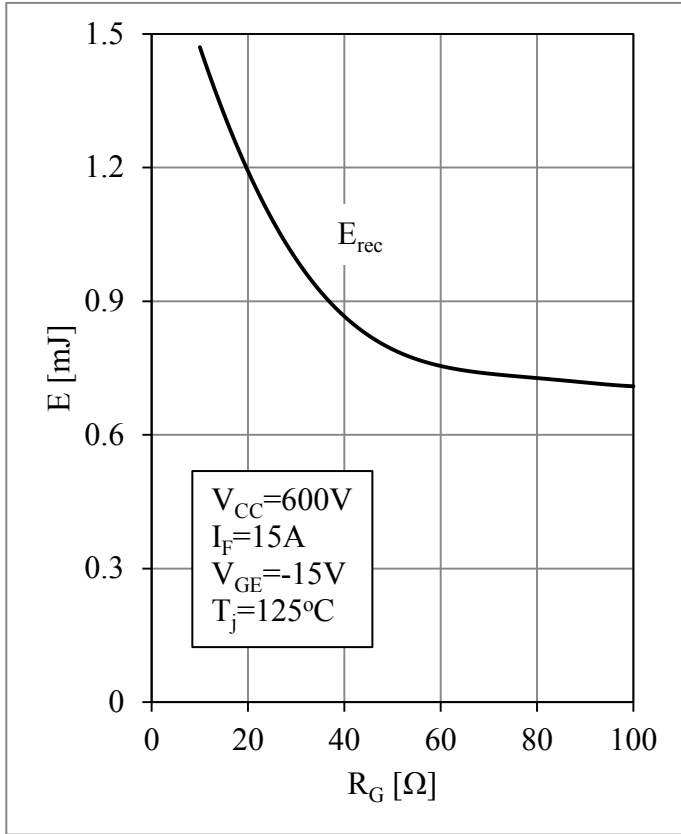


Fig 9. Diode-inverter Switching Loss vs. R_G

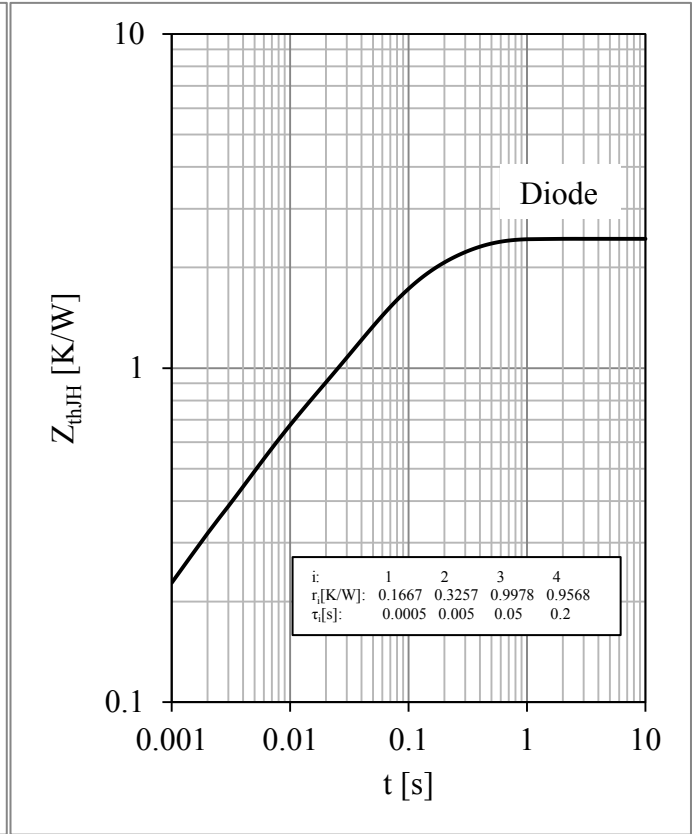


Fig 10. Diode-inverter Transient Thermal Impedance

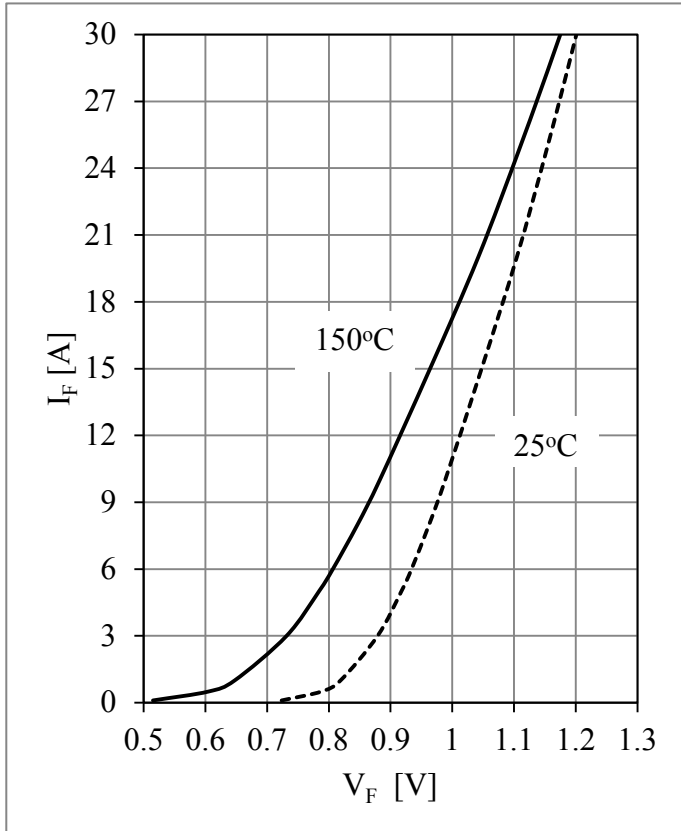


Fig 11. Diode-rectifier Forward Characteristics

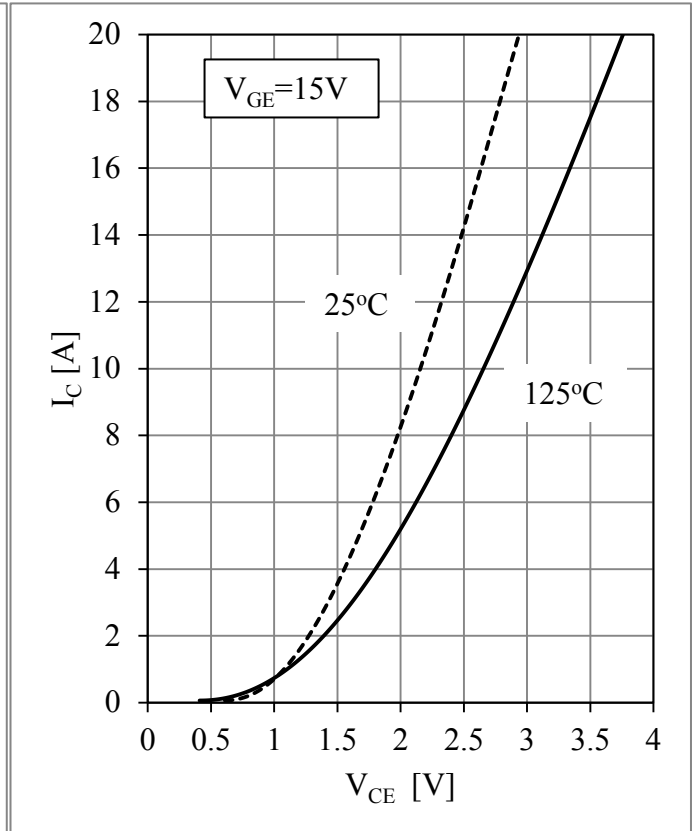


Fig 12. IGBT-brake Output Characteristics

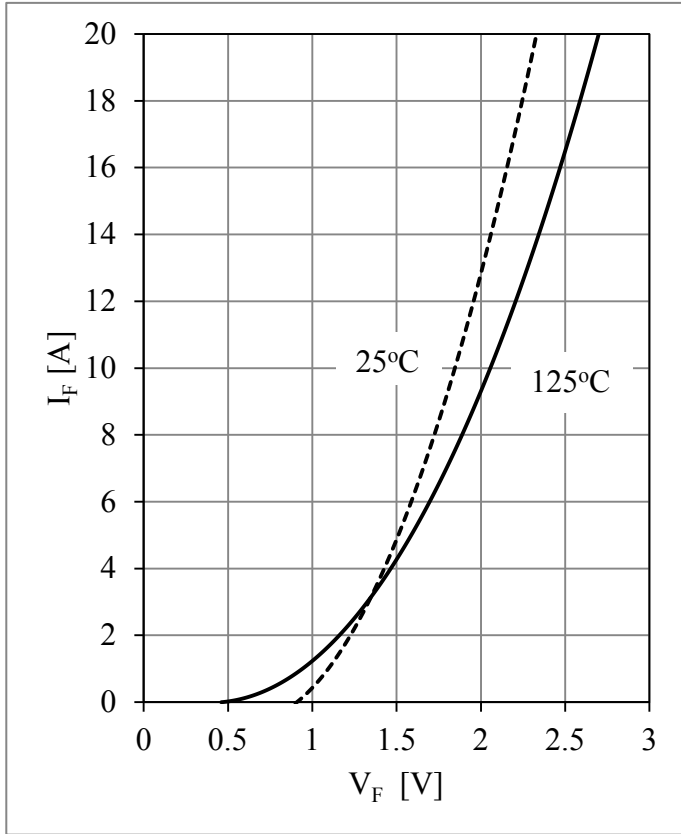


Fig 13. Diode-brake Forward Characteristics

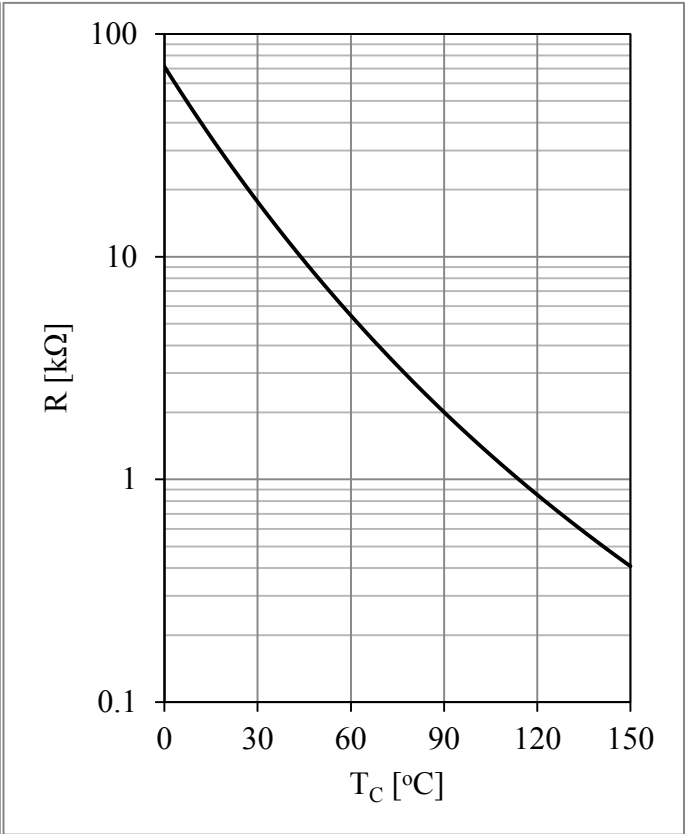
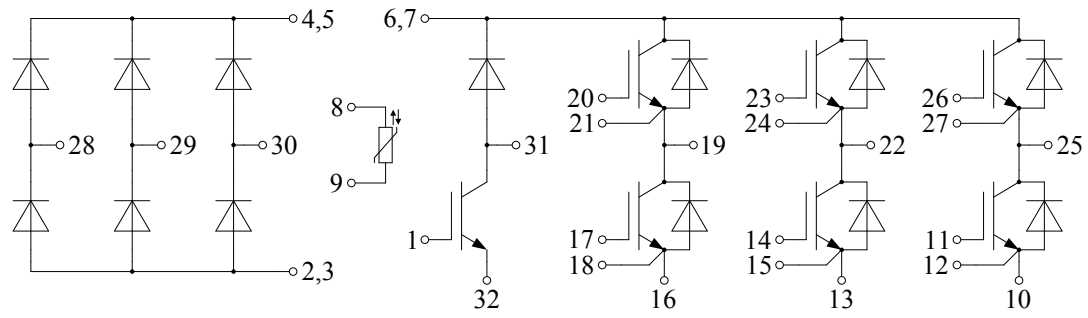


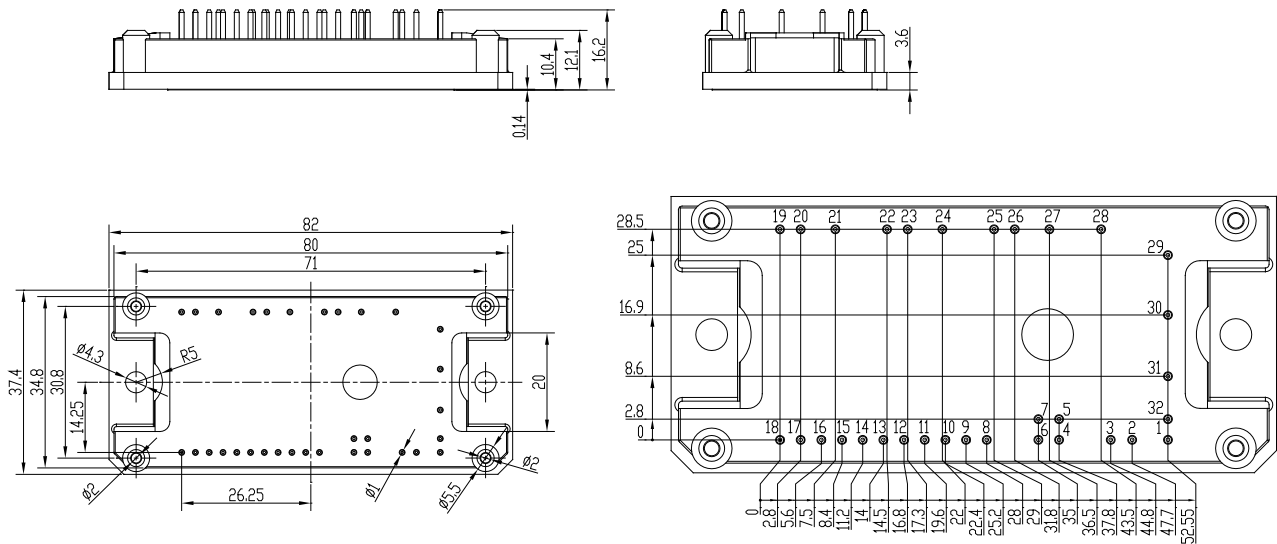
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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