

STARPOWER

SEMICONDUCTOR

IGBT

GD50PJY65F5S

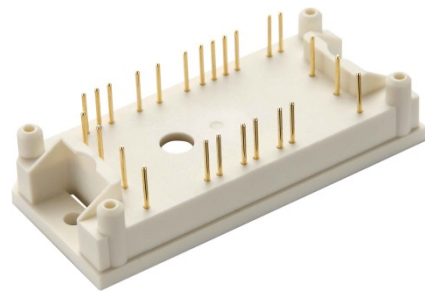
650V/50A PIM in one-package

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

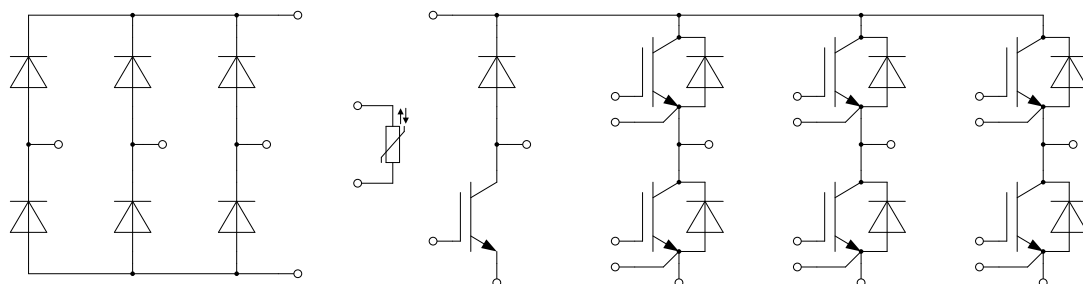
- Low $V_{CE(sat)}$ Trench IGBT technology
- 6 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated heatsink using DBC technology



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	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	71	A
	@ $T_C=80^{\circ}\text{C}$	50	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	100	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	195	W

Diode-inverter

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	50	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	100	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	50	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	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	46	A
	@ $T_C=90^{\circ}\text{C}$	30	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	60	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	131	W

Diode-brake

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	V
I_F	Diode Continuous Forward Current	50	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	100	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature(inverter,brake)	175	$^{\circ}\text{C}$
	Maximum Junction Temperature(rectifier)	150	
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
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	$I_C=50\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.45	1.90	V	
		$I_C=50\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.60			
		$I_C=50\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		1.70			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.80\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.1	5.8	6.5	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			0		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		2.80		nF	
C_{res}	Reverse Transfer Capacitance				0.09		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.45		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=50\text{A}, R_G=8.2\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		20		ns	
t_r	Rise Time			12		ns	
$t_{d(off)}$	Turn-Off Delay Time			114		ns	
t_f	Fall Time			85		ns	
E_{on}	Turn-On Switching Loss			0.33		mJ	
E_{off}	Turn-Off Switching Loss			1.08		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=300\text{V}, I_C=50\text{A}, R_G=8.2\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		20		ns
t_r	Rise Time				14		ns
$t_{d(off)}$	Turn-Off Delay Time			126		ns	
t_f	Fall Time			115		ns	
E_{on}	Turn-On Switching Loss			0.45		mJ	
E_{off}	Turn-Off Switching Loss			1.35		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=50\text{A}, R_G=8.2\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			20		ns
t_r	Rise Time				16		ns
$t_{d(off)}$	Turn-Off Delay Time			129		ns	
t_f	Fall Time			119		ns	
E_{on}	Turn-On Switching Loss			0.51		mJ	
E_{off}	Turn-Off Switching Loss			1.44		mJ	
I_{SC}	SC Data		$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		250		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	$I_F=50\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.55	2.00	V
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.50		
		$I_F=50\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.45		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=50\text{A},$ $-di/dt=3080\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		2.5		μC
I_{RM}	Peak Reverse Recovery Current			86		A
E_{rec}	Reverse Recovery Energy			0.64		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=50\text{A},$ $-di/dt=3080\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		4.4		μC
I_{RM}	Peak Reverse Recovery Current			90		A
E_{rec}	Reverse Recovery Energy			1.10		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=50\text{A},$ $-di/dt=3080\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		4.8		μC
I_{RM}	Peak Reverse Recovery Current			92		A
E_{rec}	Reverse Recovery Energy			1.21		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	$I_F=50\text{A}, T_j=150^{\circ}\text{C}$		1.26		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	$I_C=30\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.55	2.00	V	
		$I_C=30\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.70			
		$I_C=30\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		1.80			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.48\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.1	5.8	6.5	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			0		Ω	
C_{ies}	Input Capacitance	$V_{CE}=30\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		1.49		nF	
C_{res}	Reverse Transfer Capacitance				0.05		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.27		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=30\text{A}, R_G=15\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		16		ns	
t_r	Rise Time			13		ns	
$t_{d(off)}$	Turn-Off Delay Time			84		ns	
t_f	Fall Time			35		ns	
E_{on}	Turn-On Switching Loss			0.30		mJ	
E_{off}	Turn-Off Switching Loss			0.54		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=300\text{V}, I_C=30\text{A}, R_G=15\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		16		ns
t_r	Rise Time				17		ns
$t_{d(off)}$	Turn-Off Delay Time			128		ns	
t_f	Fall Time			51		ns	
E_{on}	Turn-On Switching Loss			0.39		mJ	
E_{off}	Turn-Off Switching Loss			0.68		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=30\text{A}, R_G=15\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			16		ns
t_r	Rise Time				18		ns
$t_{d(off)}$	Turn-Off Delay Time			144		ns	
t_f	Fall Time			55		ns	
E_{on}	Turn-On Switching Loss			0.45		mJ	
E_{off}	Turn-Off Switching Loss			0.72		mJ	
I_{SC}	SC Data		$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=360\text{V}, V_{CEM} \leq 650\text{V}$		150		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	$I_F=30\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.60	2.05	V
		$I_F=30\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.55		
		$I_F=30\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.50		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=30\text{A},$ $-di/dt=2310\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		1.4		μC
I_{RM}	Peak Reverse Recovery Current			48		A
E_{rec}	Reverse Recovery Energy			0.39		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=30\text{A},$ $-di/dt=2310\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		2.52		μC
I_{RM}	Peak Reverse Recovery Current			53		A
E_{rec}	Reverse Recovery Energy			0.61		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=30\text{A},$ $-di/dt=2310\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		3.0		μC
I_{RM}	Peak Reverse Recovery Current			54		A
E_{rec}	Reverse Recovery Energy			0.72		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)		0.699	0.769	K/W
	Junction-to-Case (per Diode-inverter)		1.111	1.222	
	Junction-to-Case (per Diode-rectifier)		1.005	1.106	
	Junction-to-Case (per IGBT-brake)		1.041	1.145	
	Junction-to-Case (per Diode-brake)		1.560	1.716	
R_{thCH}	Case-to-Heatsink (per IGBT-inverter)		0.452		K/W
	Case-to-Heatsink (per Diode-inverter)		0.718		
	Case-to-Heatsink (per Diode-rectifier)		0.650		
	Case-to-Heatsink (per IGBT-brake)		0.673		
	Case-to-Heatsink (per Diode-brake)		1.009		
	Case-to-Heatsink (per Module)		0.030		
M	Mounting Torque, Screw M4	2.0		2.2	N.m
G	Weight of Module		42		g

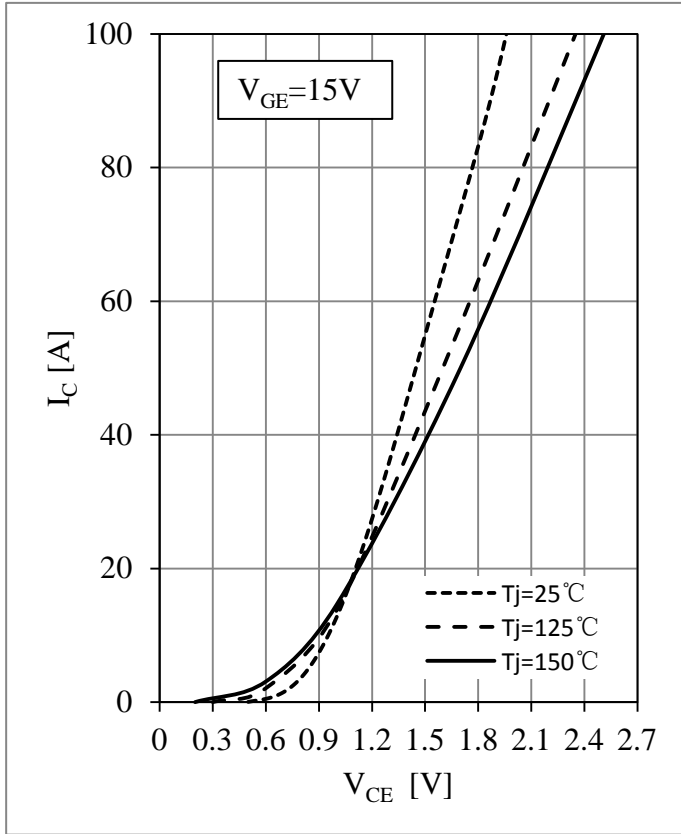


Fig 1. IGBT-inverter Output Characteristics

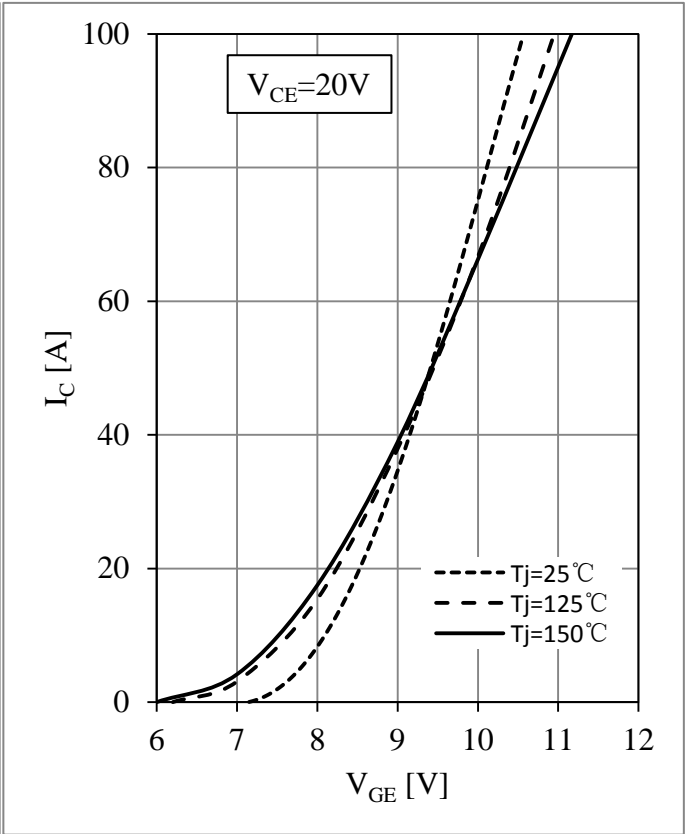


Fig 2. IGBT-inverter Transfer Characteristics

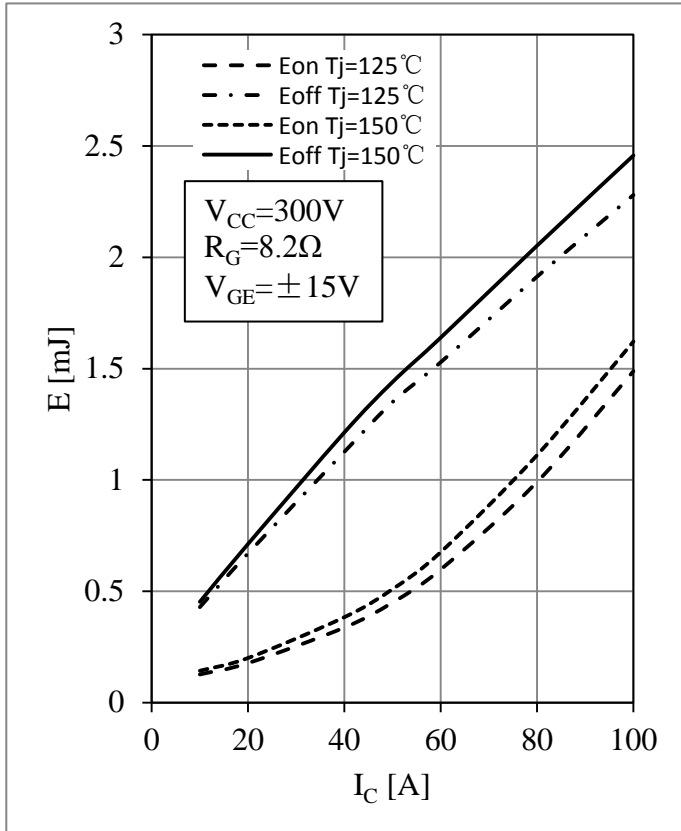


Fig 3. IGBT-inverter Switching Loss vs. I_C

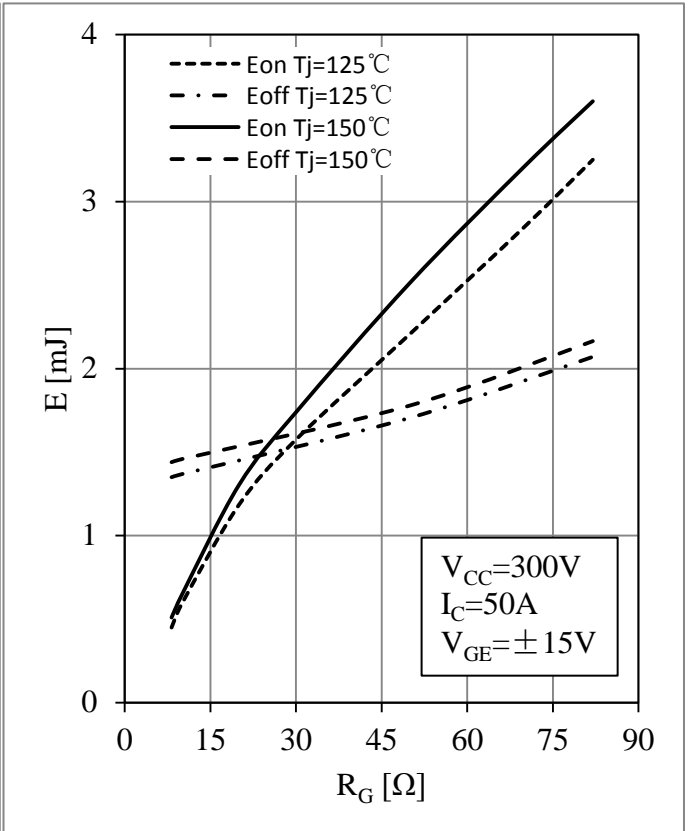


Fig 4. IGBT-inverter Switching Loss vs. R_G

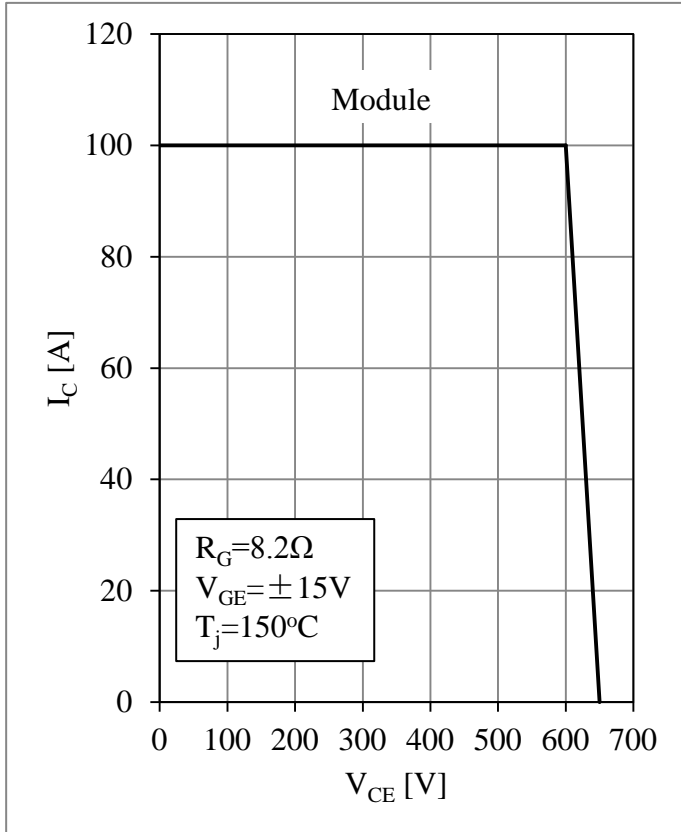


Fig 5. IGBT-inverter RBSOA

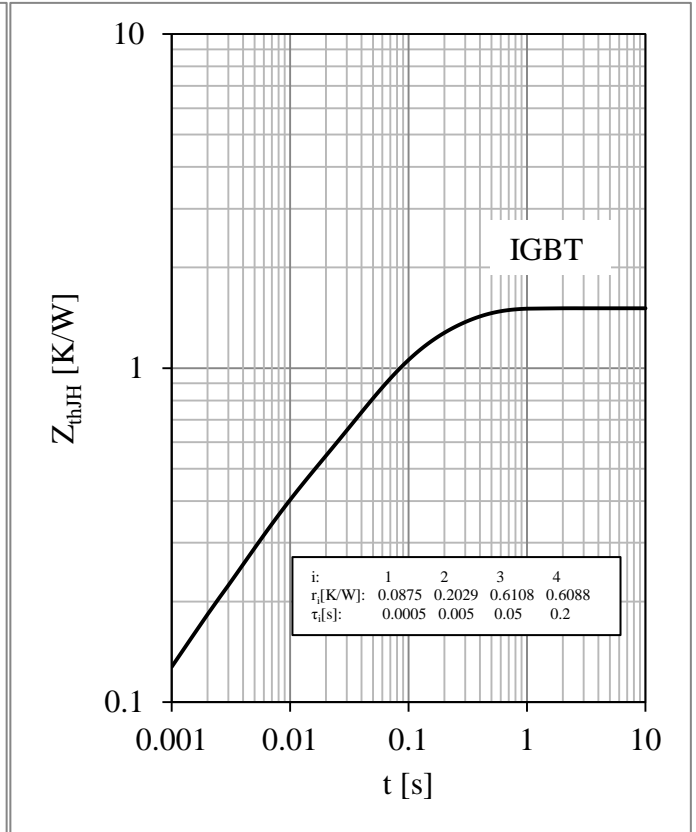


Fig 6. IGBT-inverter Transient Thermal Impedance

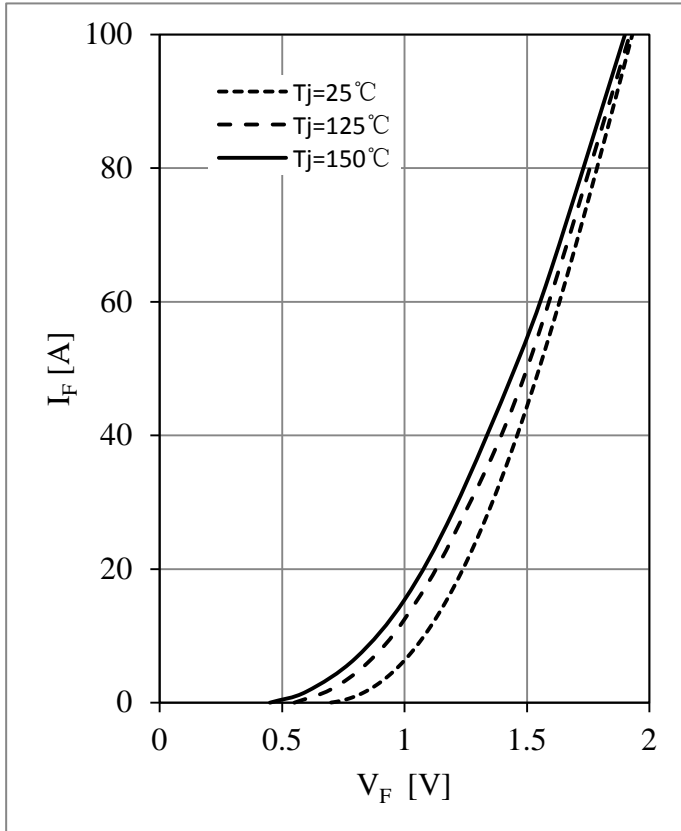


Fig 7. Diode-inverter Forward Characteristics

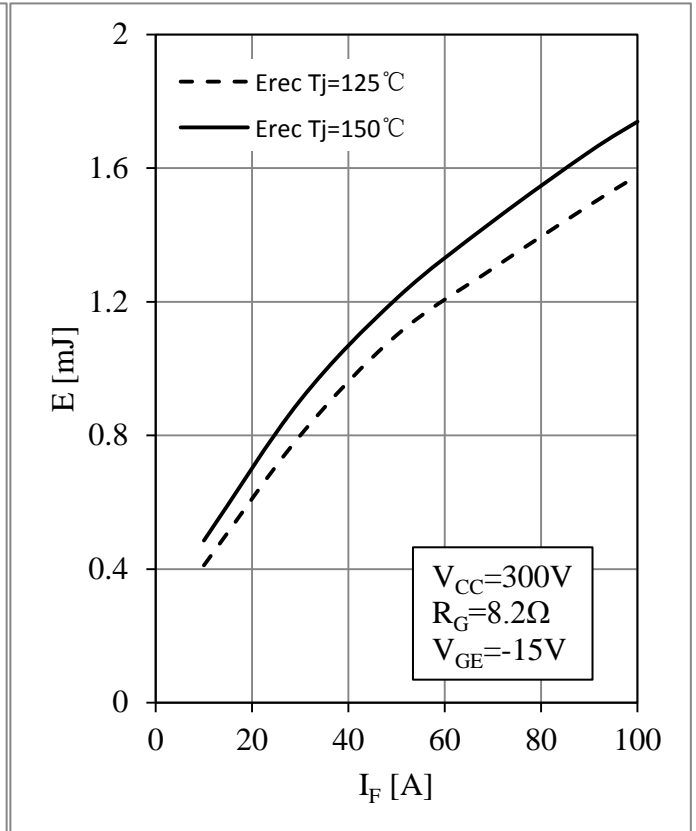


Fig 8. Diode-inverter Switching Loss vs. I_F

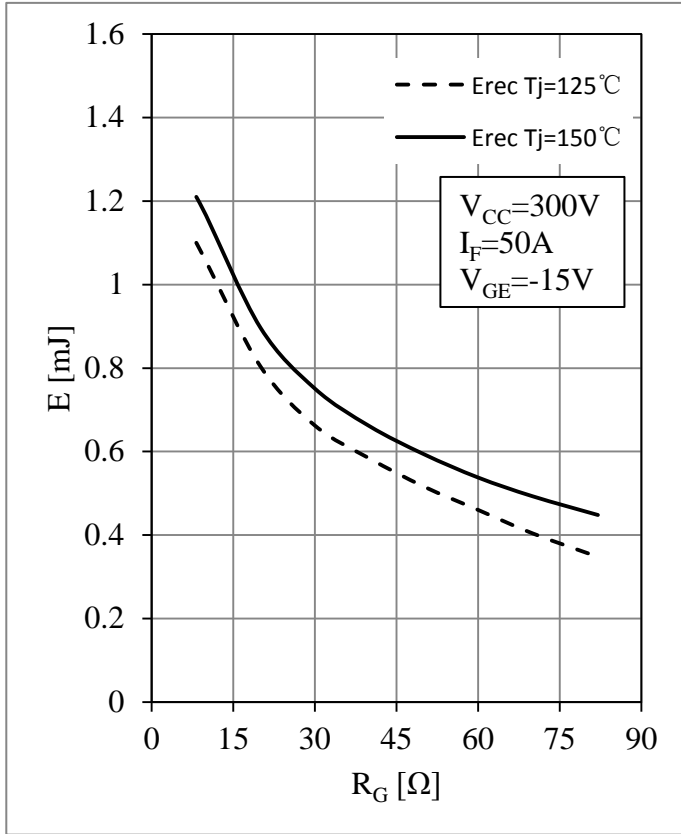


Fig 9. Diode-inverter Switching Loss vs. R_G

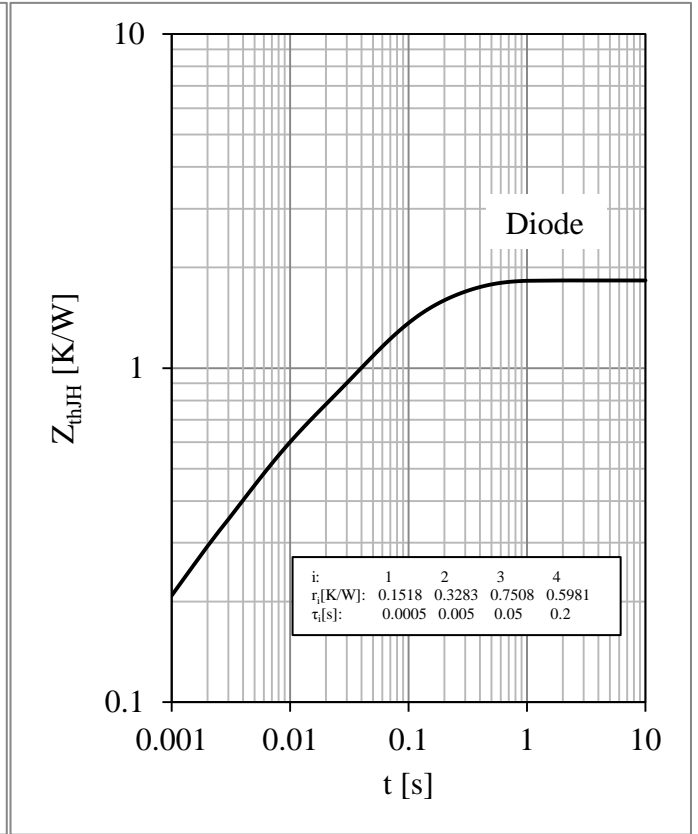


Fig 10. Diode-inverter Transient Thermal Impedance

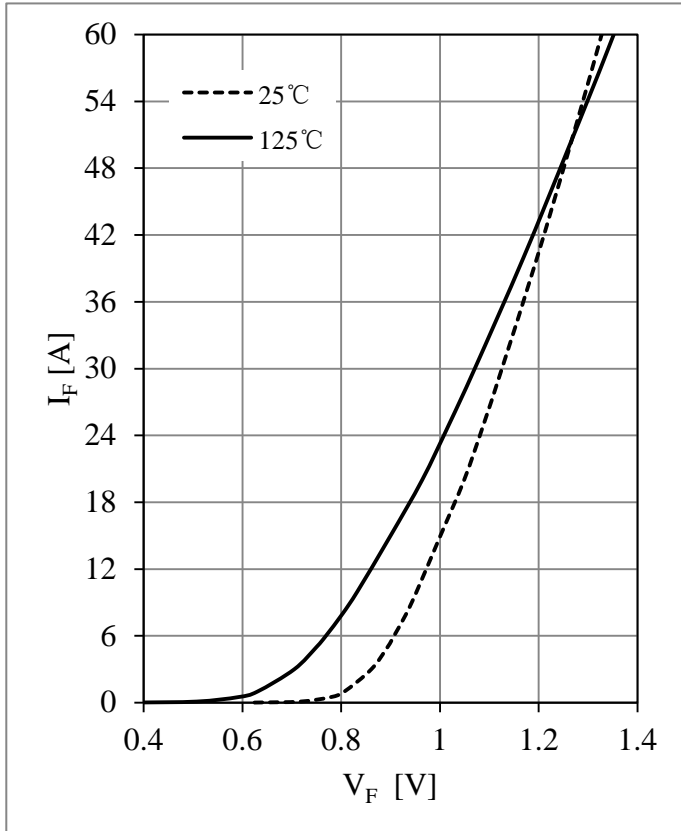


Fig 11. Diode-rectifier Forward Characteristics

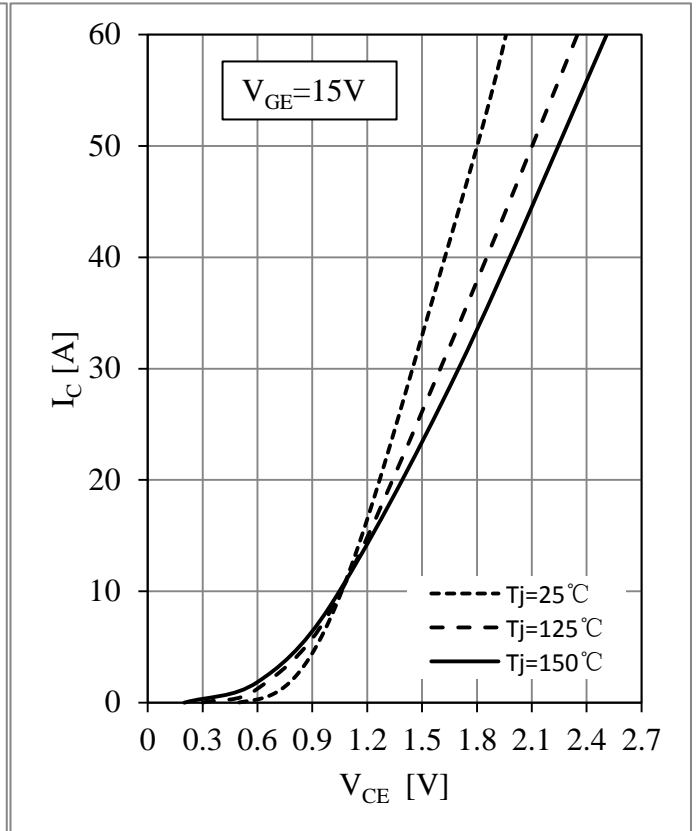


Fig 12. IGBT-brake-chopper Output Characteristics

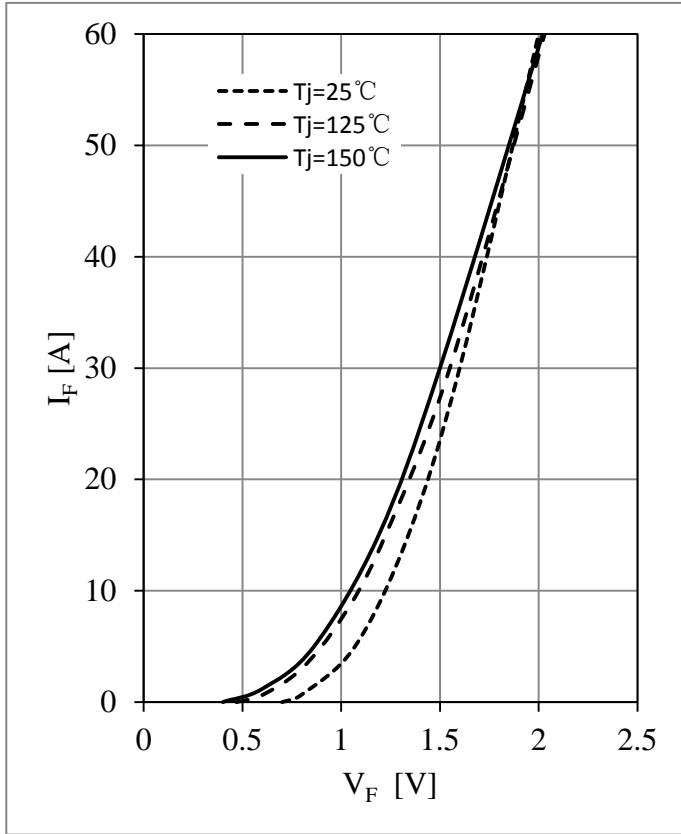


Fig 13. Diode-brake-chopper Forward Characteristics

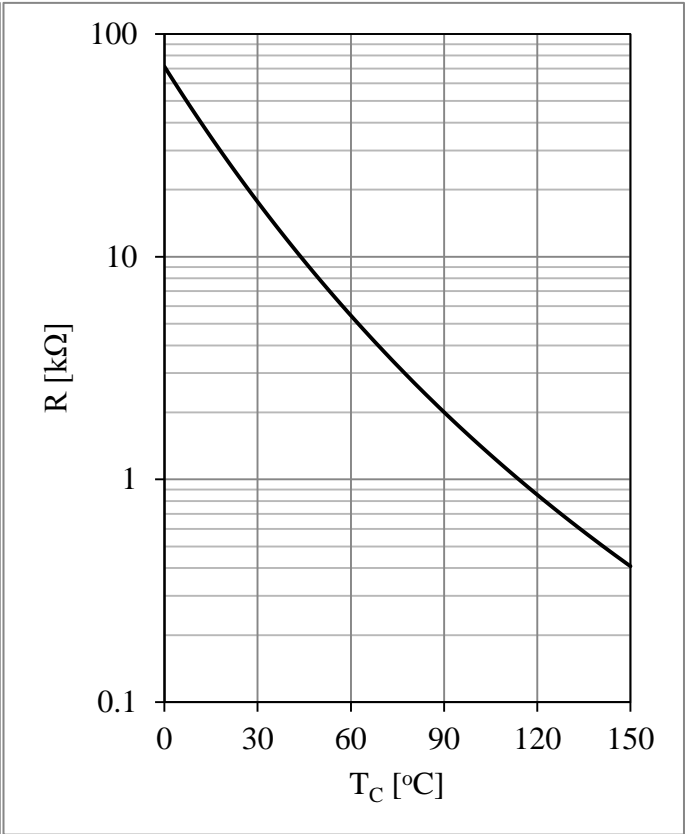
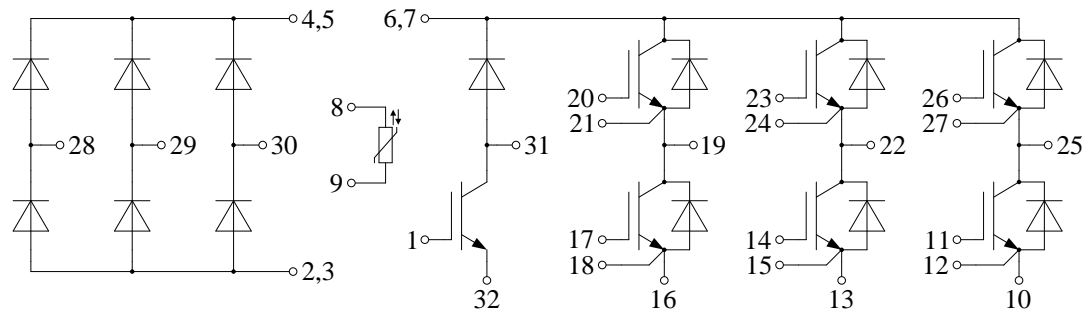


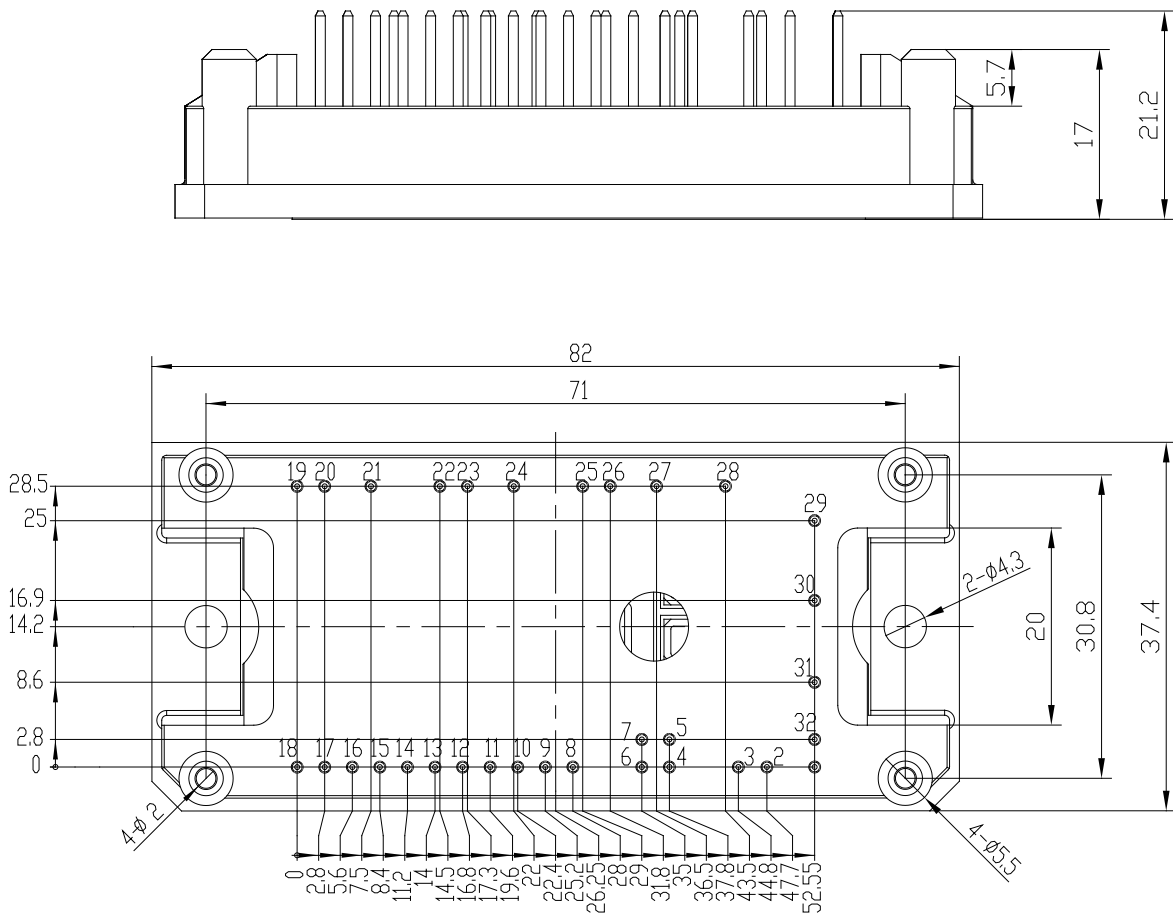
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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