

STARPOWER

SEMICONDUCTOR

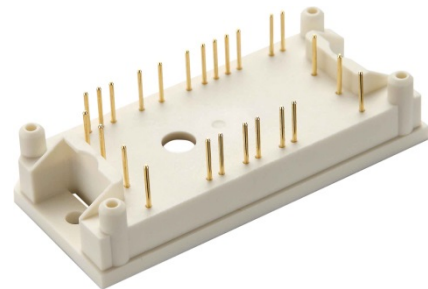
IGBT

GD35PJY120F5S

1200V/35A 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.



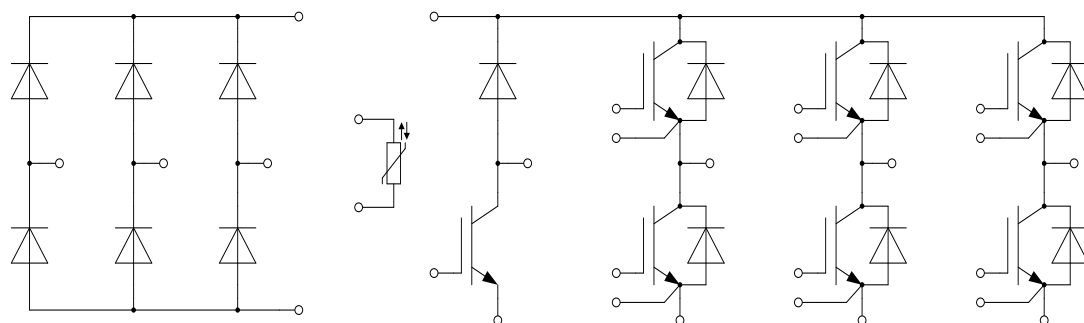
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 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	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	63	A
	@ $T_C=100^{\circ}\text{C}$	35	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	70	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	225	W

Diode-inverter

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 $t_p=1\text{ms}$	70	A

Diode-rectifier

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1600	V
I_O	Average Output Current 50Hz/60Hz,sine wave	35	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	320	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	510	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 @ $T_C=25^{\circ}\text{C}$	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 @ $T_j=175^{\circ}\text{C}$	129	W

Diode-brake

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

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature(inverter,brake)	175	$^{\circ}\text{C}$
	Maximum Junction Temperature (rectifier)	150	$^{\circ}\text{C}$
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, $f=50\text{Hz}, t=1\text{min}$	2500	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	$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.70	2.15	V
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.95		
		$I_C=35\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.88\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.2	6.0	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			0		Ω
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=13\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		156		ns
t_r	Rise Time			28		ns
$t_{d(off)}$	Turn-Off Delay Time			215		ns
t_f	Fall Time			323		ns
E_{on}	Turn-On Switching Loss			1.94		mJ
E_{off}	Turn-Off Switching Loss			2.55		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=13\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		156		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			229		ns
t_f	Fall Time			507		ns
E_{on}	Turn-On Switching Loss			2.38		mJ
E_{off}	Turn-Off Switching Loss			3.83		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=35\text{A}, R_G=13\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		153		ns
t_r	Rise Time			32		ns
$t_{d(off)}$	Turn-Off Delay Time			234		ns
t_f	Fall Time			522		ns
E_{on}	Turn-On Switching Loss			2.60		mJ
E_{off}	Turn-Off Switching Loss			4.02		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		140		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	$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		2.00	2.45	V
		$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.90		
		$I_F=35\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.88		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=1050\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		1.9		μC
I_{RM}	Peak Reverse Recovery Current			43		A
E_{rec}	Reverse Recovery Energy			1.01		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=1050\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		3.1		μC
I_{RM}	Peak Reverse Recovery Current			51		A
E_{rec}	Reverse Recovery Energy			2.37		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=35\text{A},$ $-di/dt=1050\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		3.5		μC
I_{RM}	Peak Reverse Recovery Current			53		A
E_{rec}	Reverse Recovery Energy			2.77		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	$I_F=35\text{A}, T_j=150^{\circ}\text{C}$		1.12		V
I_R	Reverse Current	$T_j=150^{\circ}\text{C}, V_R=1600\text{V}$			2.0	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	$I_C=15\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.70	2.15	V
		$I_C=15\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		1.95		
		$I_C=15\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.38\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.2	6.0	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			0		Ω
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=15\text{A}, R_G=39\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		59		ns
t_r	Rise Time			63		ns
$t_{d(off)}$	Turn-Off Delay Time			201		ns
t_f	Fall Time			149		ns
E_{on}	Turn-On Switching Loss			1.39		mJ
E_{off}	Turn-Off Switching Loss			0.85		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=15\text{A}, R_G=39\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		59		ns
t_r	Rise Time			70		ns
$t_{d(off)}$	Turn-Off Delay Time			283		ns
t_f	Fall Time			196		ns
E_{on}	Turn-On Switching Loss			1.87		mJ
E_{off}	Turn-Off Switching Loss			1.24		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=15\text{A}, R_G=39\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		59		ns
t_r	Rise Time			70		ns
$t_{d(off)}$	Turn-Off Delay Time			288		ns
t_f	Fall Time			221		ns
E_{on}	Turn-On Switching Loss			2.09		mJ
E_{off}	Turn-Off Switching Loss			1.39		mJ
I_{SC}	SC Data	$t_P \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		60		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	$I_F=15\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		2.05	2.50	V
		$I_F=15\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		2.20		
		$I_F=15\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		2.25		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=15\text{A},$ $-di/dt=450\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		0.5		μC
I_{RM}	Peak Reverse Recovery Current			15		A
E_{rec}	Reverse Recovery Energy			0.29		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=15\text{A},$ $-di/dt=450\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		1.0		μC
I_{RM}	Peak Reverse Recovery Current			16		A
E_{rec}	Reverse Recovery Energy			0.64		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=15\text{A},$ $-di/dt=450\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		1.1		μC
I_{RM}	Peak Reverse Recovery Current			17		A
E_{rec}	Reverse Recovery Energy			0.80		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		$\text{k}\Omega$
$\Delta R/R$	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)		0.605	0.666	K/W
	Junction-to-Case (per Diode-inverter)		1.023	1.125	
	Junction-to-Case (per Diode-rectifier)		1.019	1.121	
	Junction-to-Case (per IGBT-brake)		1.053	1.158	
	Junction-to-Case (per Diode-brake)		1.610	1.771	
R_{thCH}	Case-to-Heatsink (per IGBT-inverter)		0.422		K/W
	Case-to-Heatsink (per Diode-inverter)		0.713		
	Case-to-Heatsink (per Diode-rectifier)		0.710		
	Case-to-Heatsink (per IGBT-brake)		0.734		
	Case-to-Heatsink (per Diode-brake)		1.122		
	Case-to-Heatsink (per Module)		0.030		
M	Mounting Torque, Screw M4	2.0		2.2	N.m
G	Weight of Module		42		g

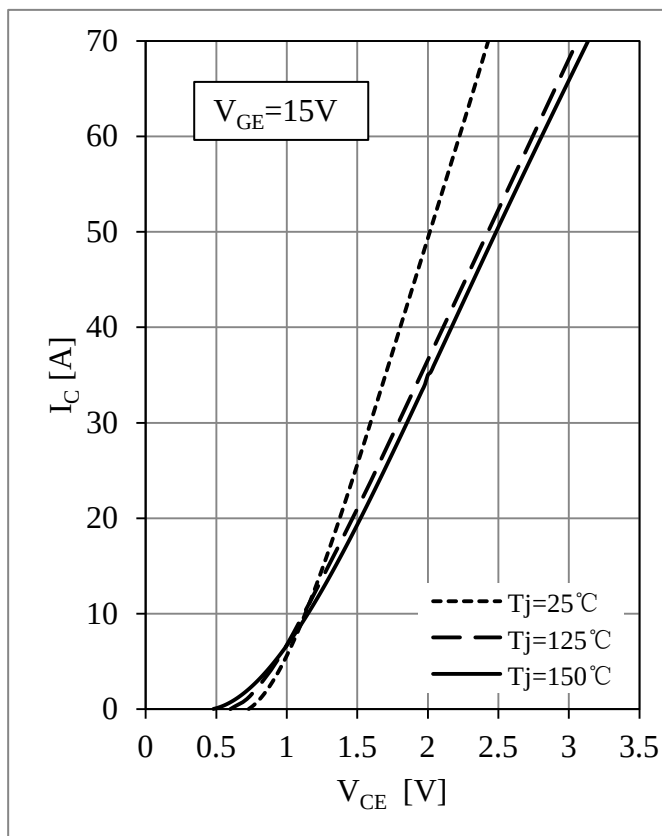


Fig 1. IGBT-inverter Output Characteristics

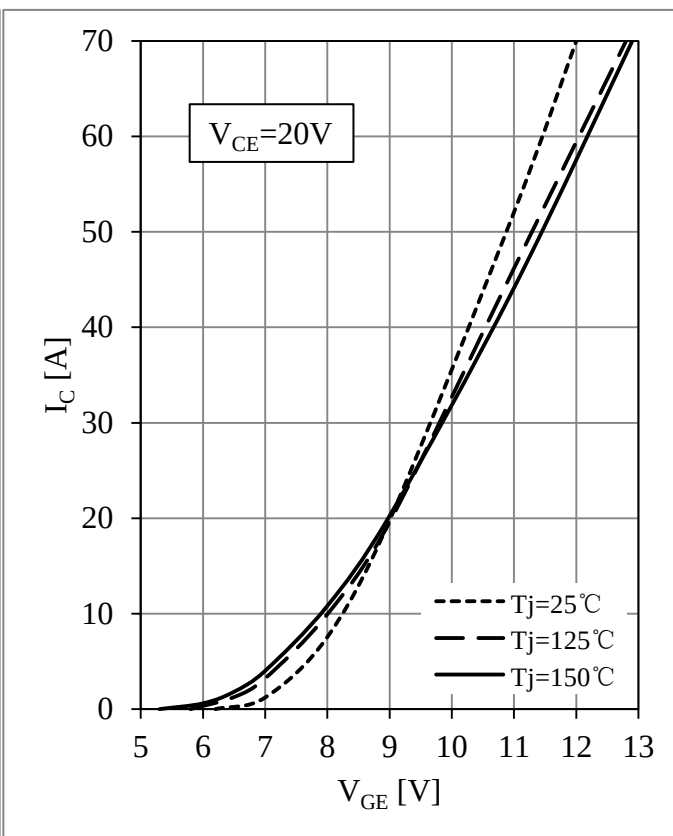
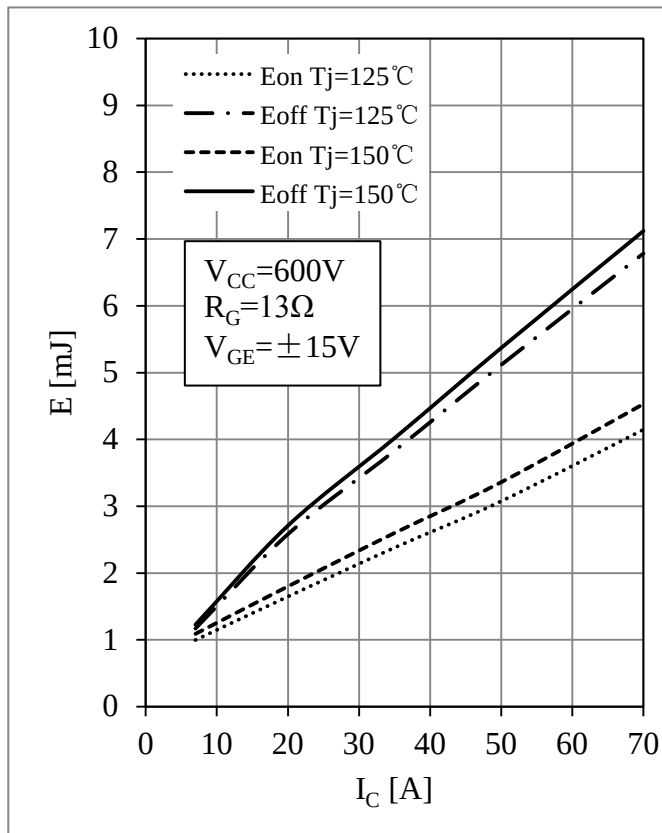
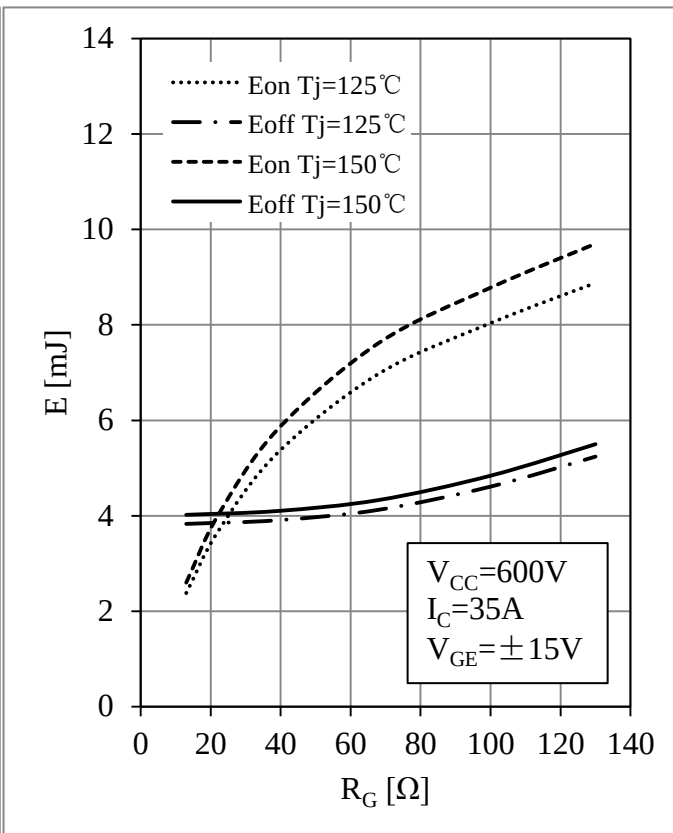


Fig 2. IGBT-inverter Transfer Characteristics

Fig 3. IGBT-inverter Switching Loss vs. I_C Fig 4. IGBT-inverter Switching Loss vs. R_G

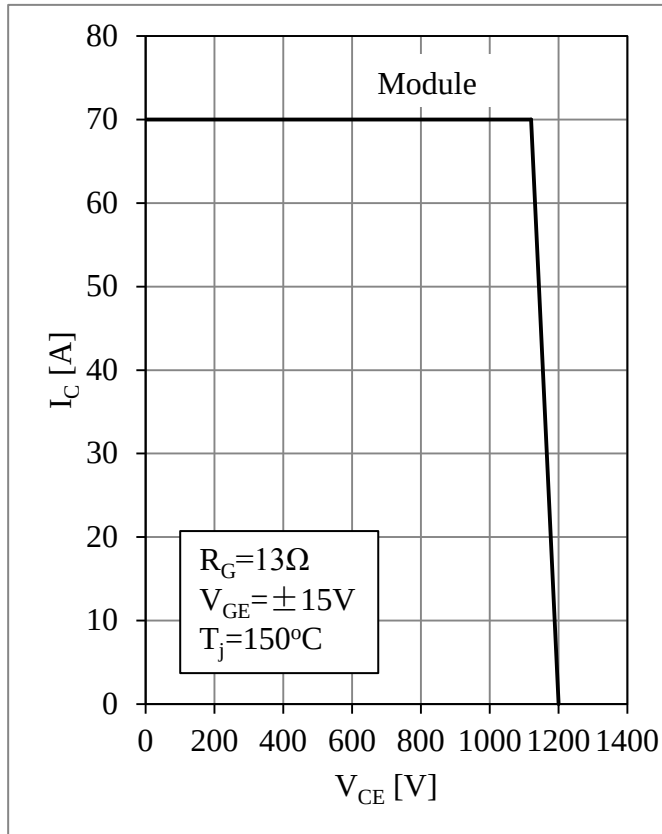


Fig 5. IGBT-inverter RBSOA

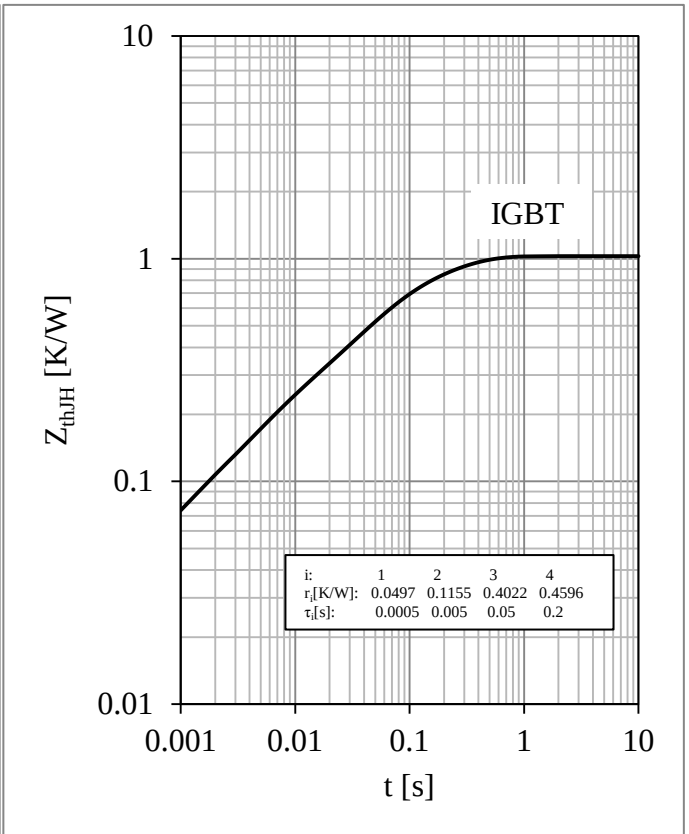


Fig 6. IGBT-inverter Transient Thermal Impedance

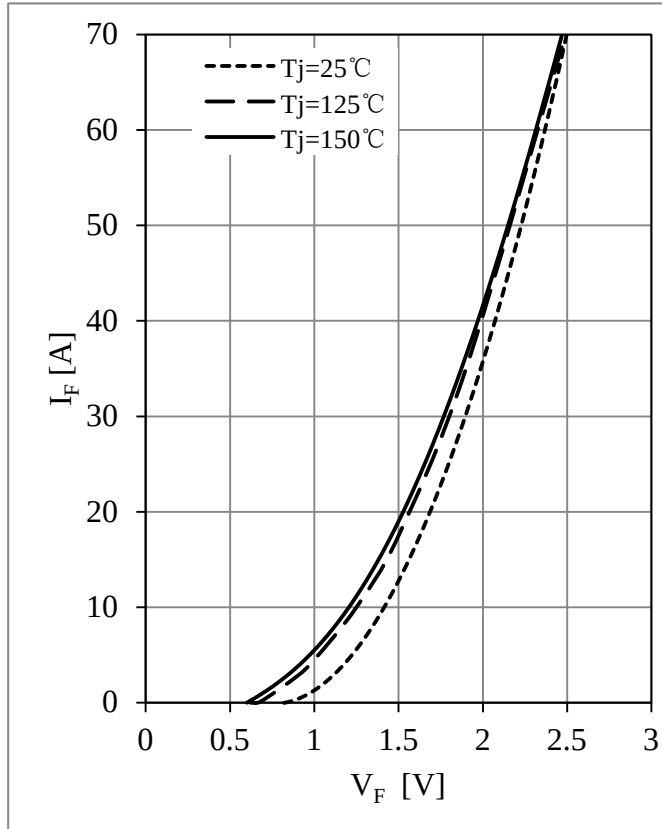
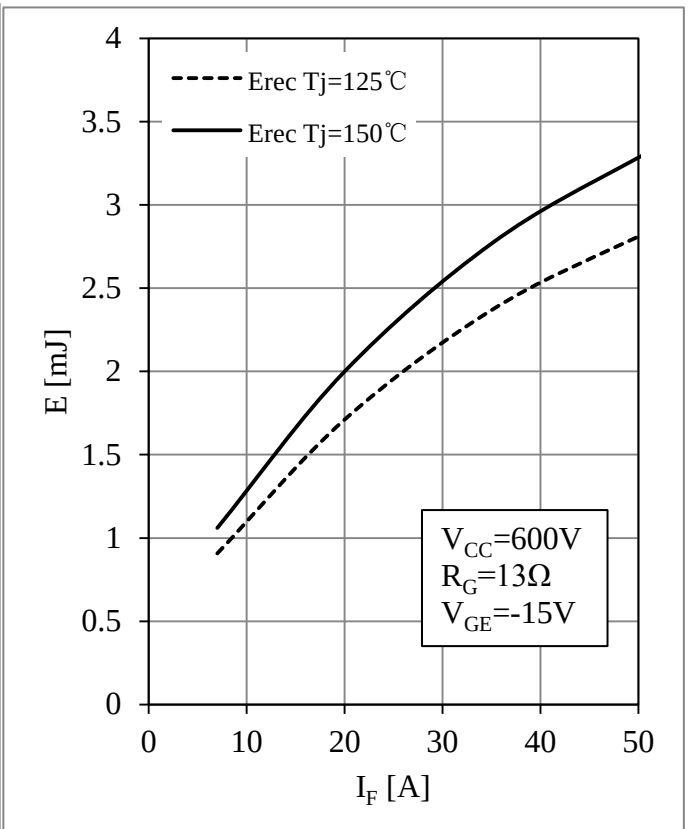
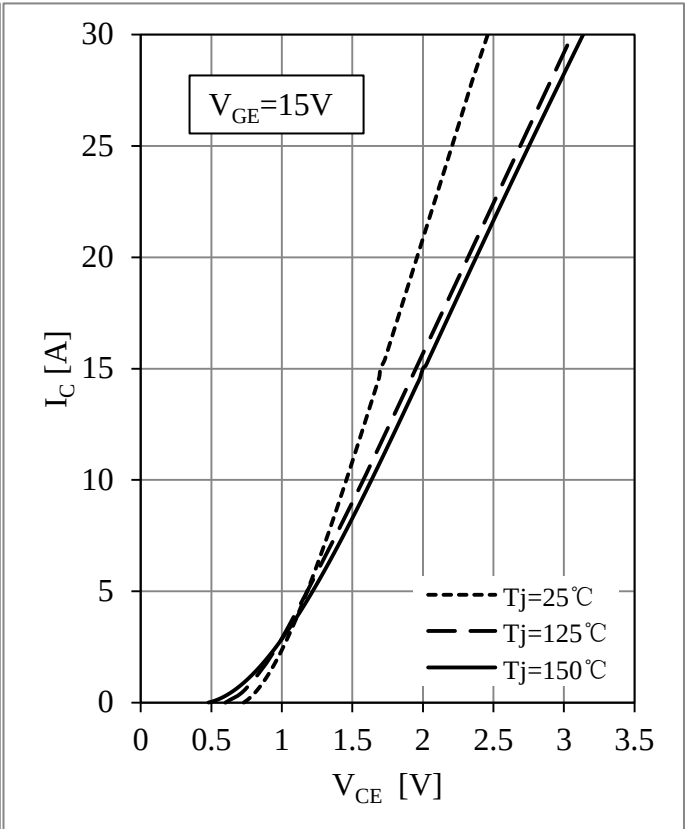
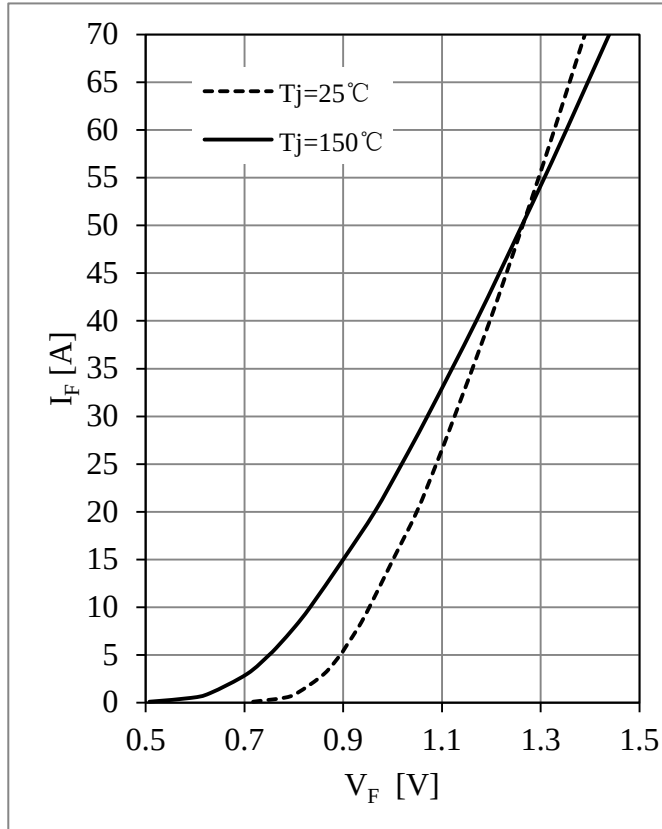
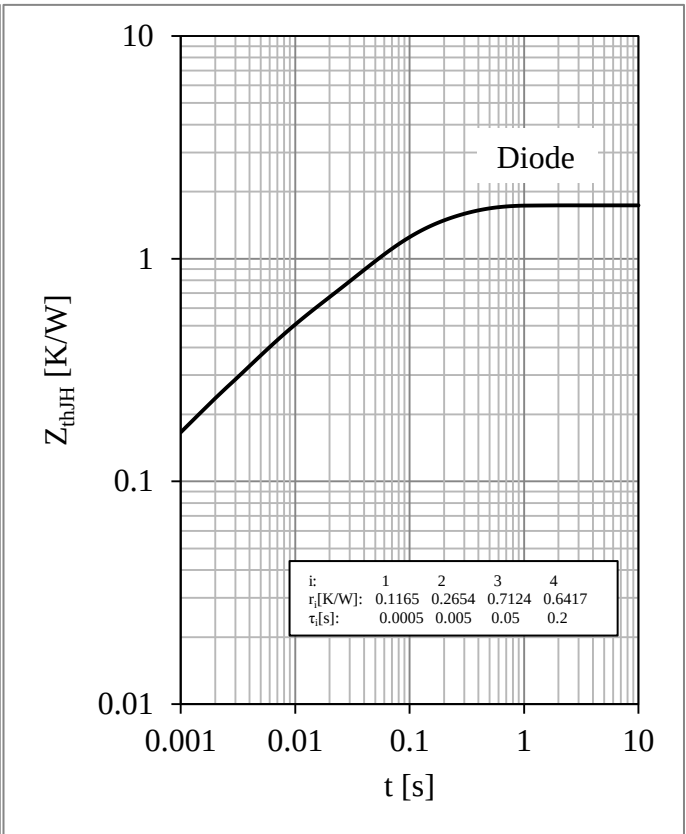
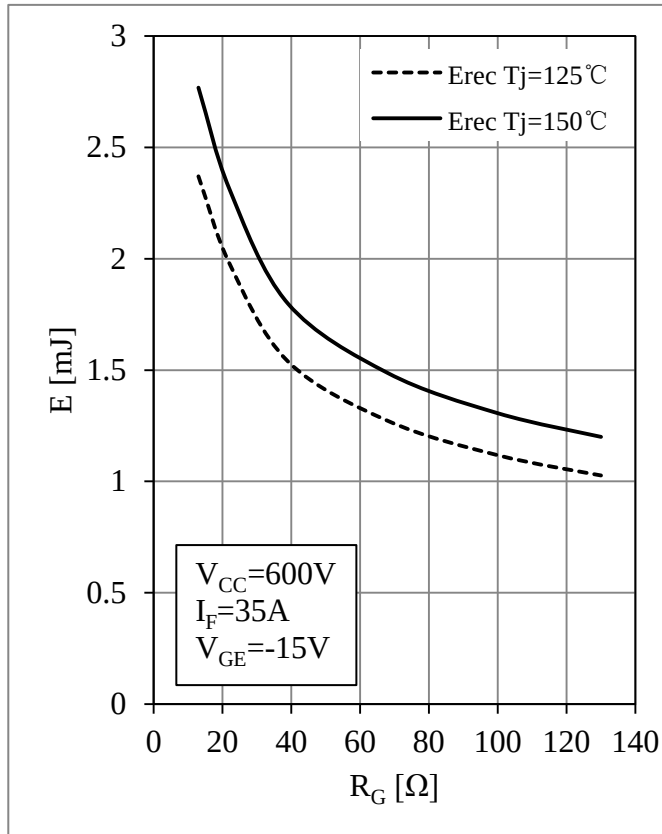


Fig 7. Diode-inverter Forward Characteristics

Fig 8. Diode-inverter Switching Loss vs. I_F



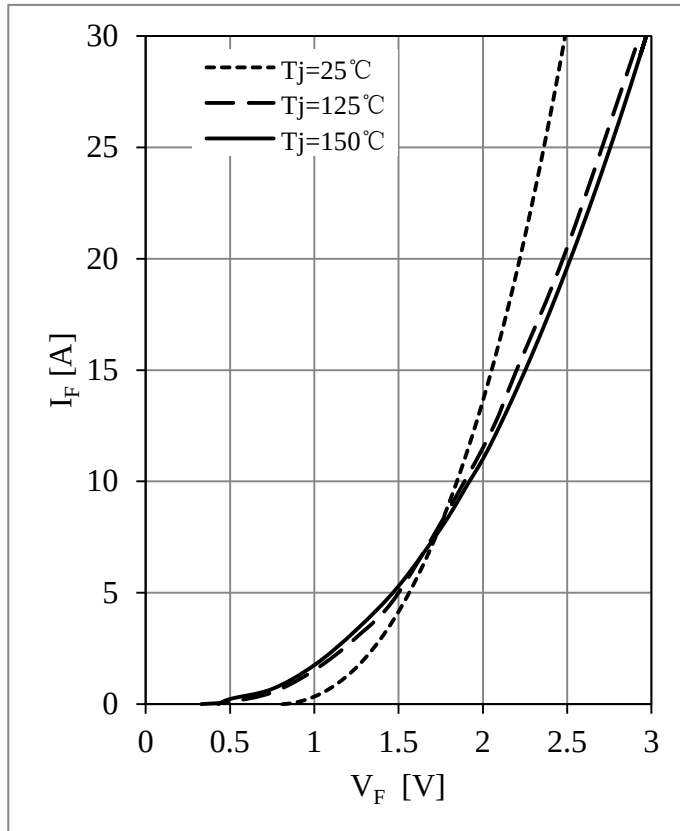


Fig 13. Diode-brake-chopper Forward Characteristics

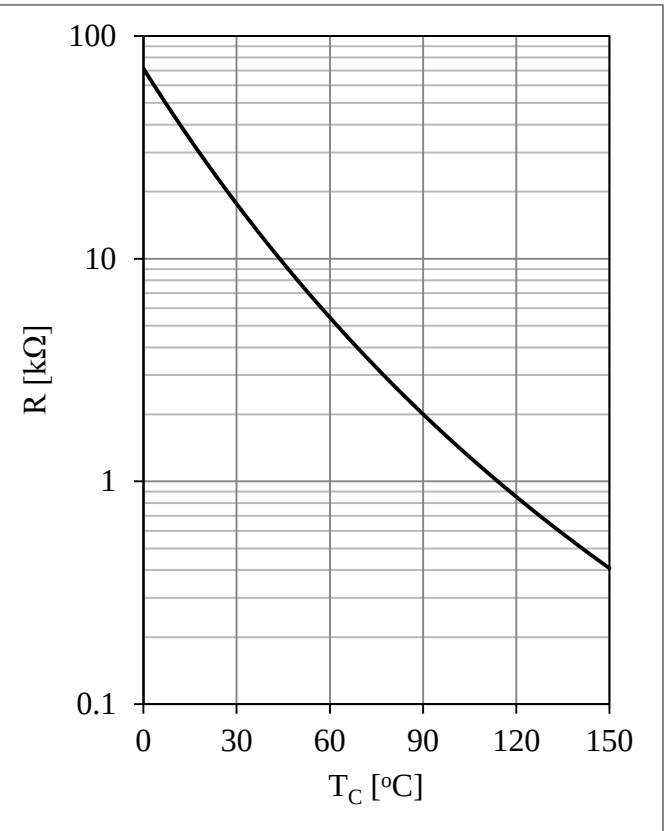
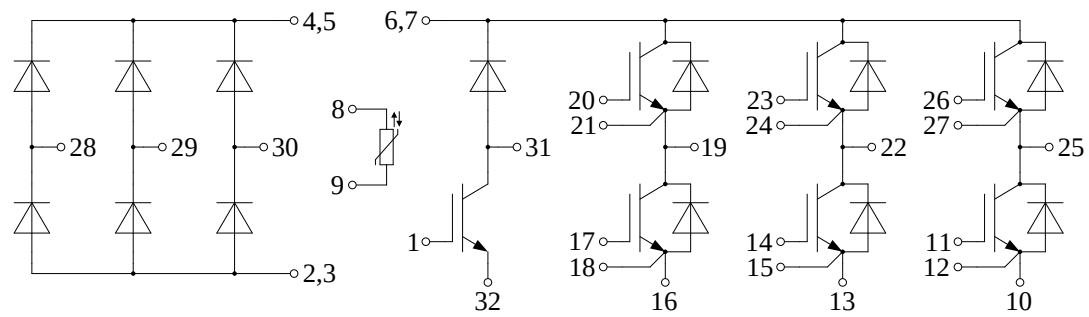


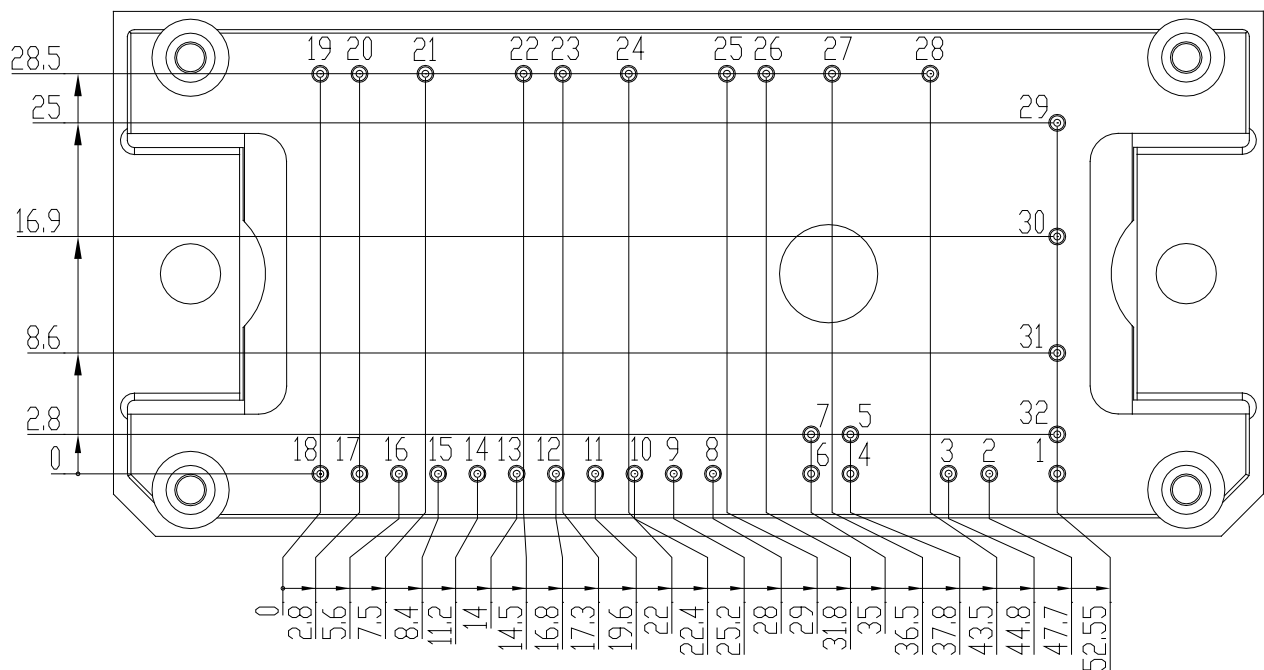
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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