STARPOWER

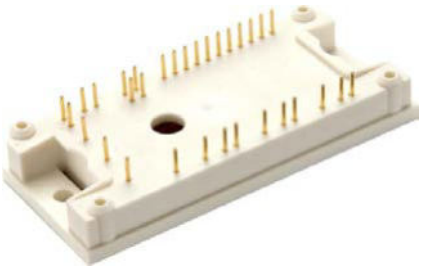
SEMICONDUCTOR **IGBT**

GD35PJY120F2S

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.



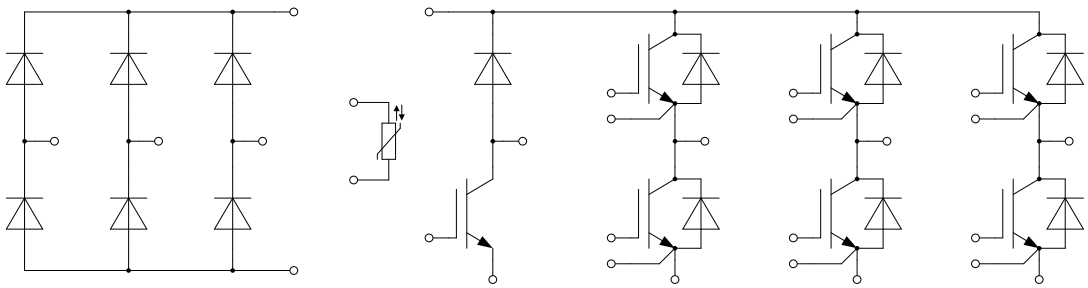
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Fast & soft reverse recovery anti-parallel FWD

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	63 35	A
I_{CM}	Pulsed Collector Current t_p=1ms	70	A
P_D	Maximum Power Dissipation @ T_j=175°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=1ms	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=0V,t_p=10ms,T_j=45°C	320	A
I^2t	I^2t-value,V_R=0V,t_p=10ms,T_j=45°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°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=175°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=1ms	30	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature(inverter,brake) Maximum Junction Temperature (rectifier)	175 150	°C
T_{jop}	Operating Junction Temperature	-40 to +150	°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=35A,V_{GE}=15V, T_j=25°C		1.70	2.15	V
		I_C=35A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=35A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=0.88mA,V_{CE}=V_{GE}, T_j=25°C	5.2	6.0	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		2.45		nF
C_{res}	Reverse Transfer Capacitance			0.14		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.33		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=35A, R_G=13Ω,V_{GE}=±15V, T_j=25°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}=600V,I_C=35A, R_G=13Ω,V_{GE}=±15V, T_j=125°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}=600V,I_C=35A, R_G=13Ω,V_{GE}=±15V, T_j=150°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≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		140		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=35A,V_{GE}=0V,T_i=25°C		2.00	2.45	V
		I_F=35A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=35A,V_{GE}=0V,T_i=150°C		1.88		
Q_r	Recovered Charge	V_R=600V,I_F=35A, -di/dt=1050A/μs,V_{GE}=-15V T_j=25°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=600V,I_F=35A, -di/dt=1050A/μs,V_{GE}=-15V T_j=125°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=600V,I_F=35A, -di/dt=1050A/μs,V_{GE}=-15V T_j=150°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°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=35A,T_j=150°C		1.12		V
I_R	Reverse Current	T_i=150°C,V_R=1600V			2.0	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=15A,V_{GE}=15V, T_j=25°C		1.70	2.15	V
		I_C=15A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=15A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=0.38mA,V_{CE}=V_{GE}, T_j=25°C	5.2	6.0	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		1.05		nF
C_{res}	Reverse Transfer Capacitance			0.06		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		0.15		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=15A, R_G=39Ω,V_{GE}=±15V, T_j=25°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}=600V,I_C=15A, R_G=39Ω,V_{GE}=±15V, T_j=125°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}=600V,I_C=15A, R_G=39Ω,V_{GE}=±15V, T_j=150°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≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		60		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=15A,V_{GE}=0V,T_j=25°C		2.05	2.50	V
		I_F=15A,V_{GE}=0V,T_j=125°C		2.20		
		I_F=15A,V_{GE}=0V,T_j=150°C		2.25		
Q_r	Recovered Charge	V_R=600V,I_F=15A, -di/dt=450A/μs,V_{GE}=-15V T_j=25°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=600V,I_F=15A, -di/dt=450A/μs,V_{GE}=-15V T_j=125°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=600V,I_F=15A, -di/dt=450A/μs,V_{GE}=-15V T_j=150°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°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			22		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)		0.605	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)		0.408		K/W
	Case-to-Heatsink (per Diode-inverter)		0.689		
	Case-to-Heatsink (per Diode-rectifier)		0.687		
	Case-to-Heatsink (per IGBT-brake)		0.709		
	Case-to-Heatsink (per Diode-brake)		1.085		
	Case-to-Heatsink (per Module)		0.029		
M	Mounting Torque, Screw M4	2.0		2.2	N.m
G	Weight of Module		42		g

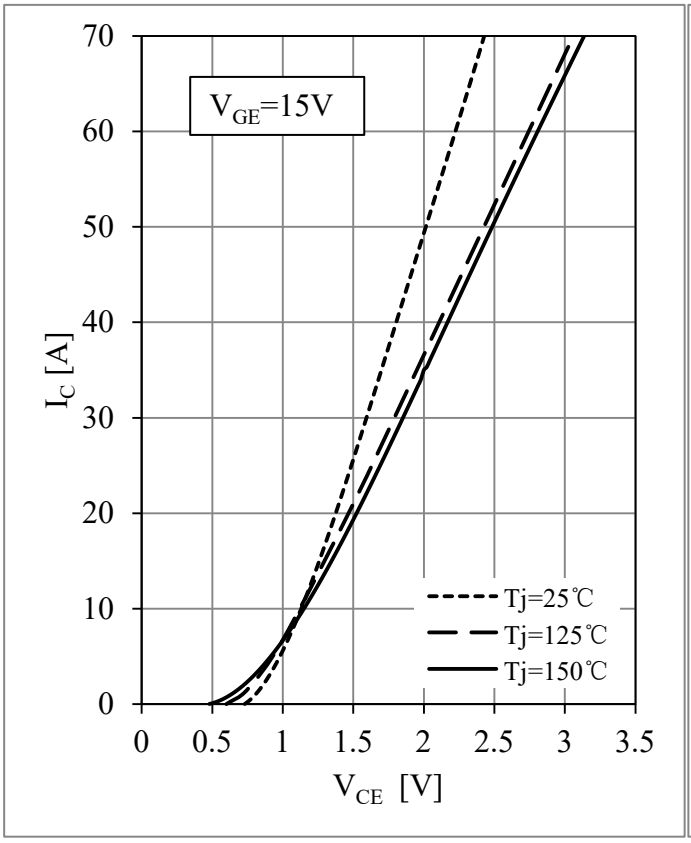


Fig 1. IGBT-inverter Output Characteristics

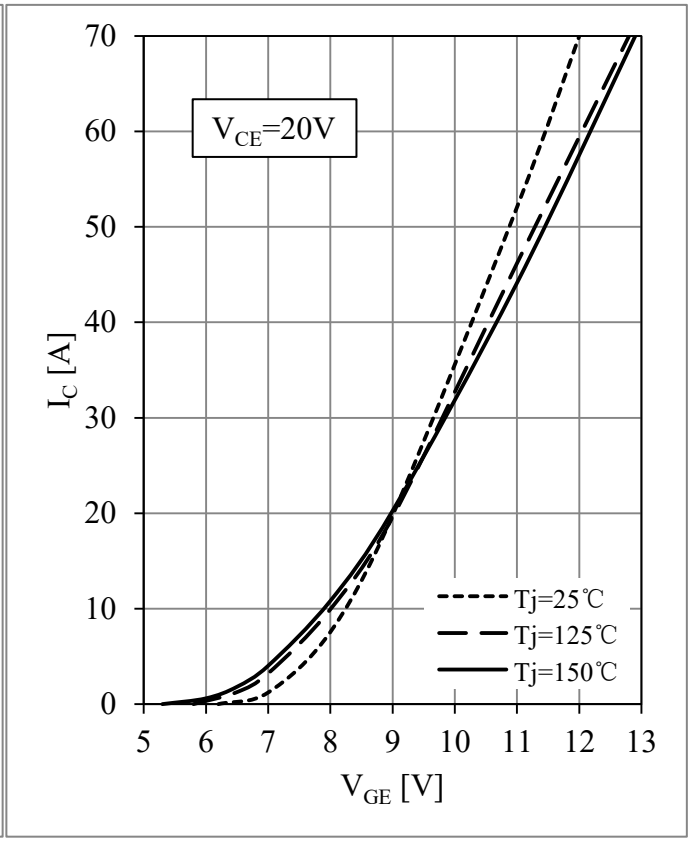


Fig 2. IGBT-inverter Transfer Characteristics

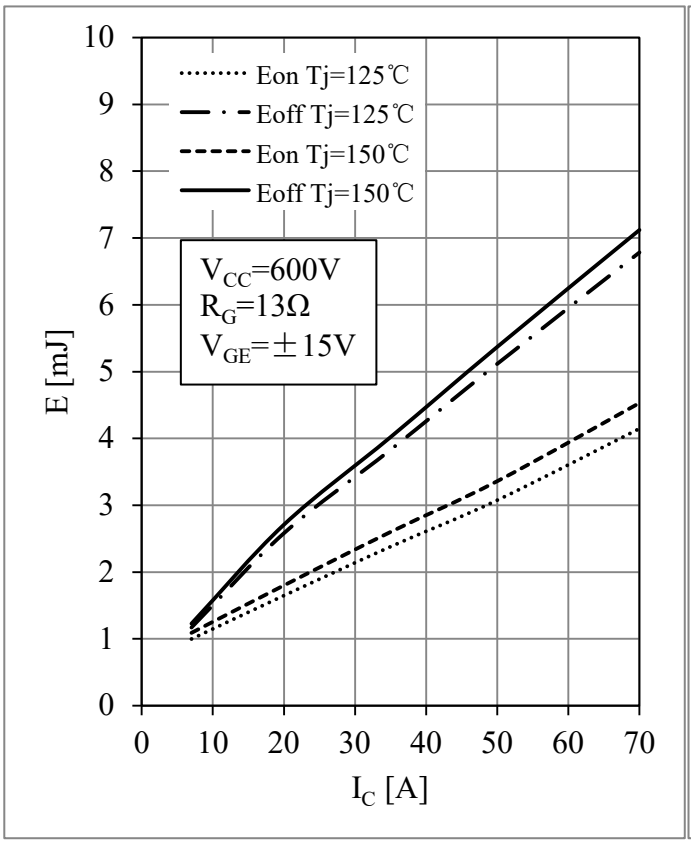


Fig 3. IGBT-inverter Switching Loss vs. I_C

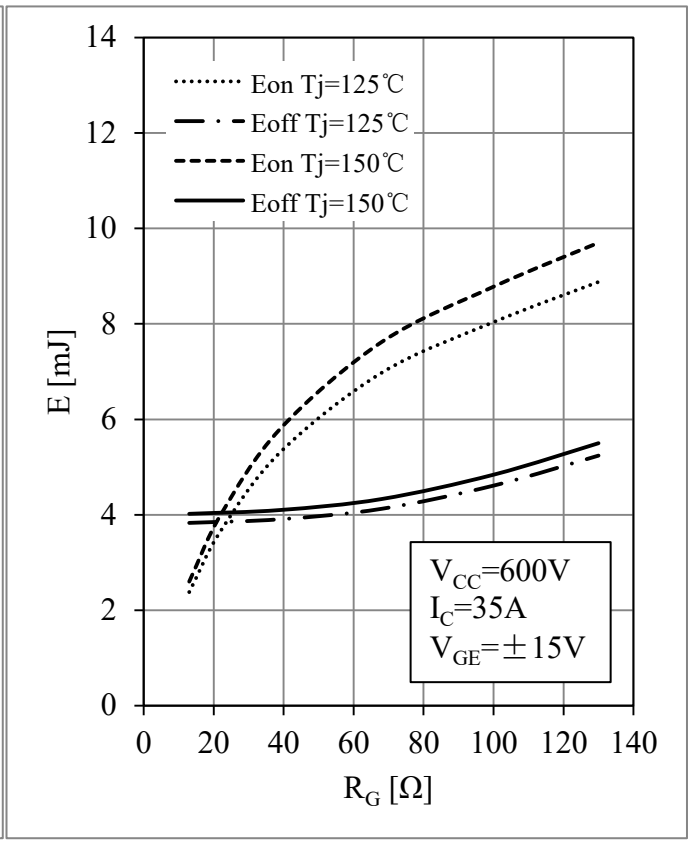


Fig 4. IGBT-inverter Switching Loss vs. R_G

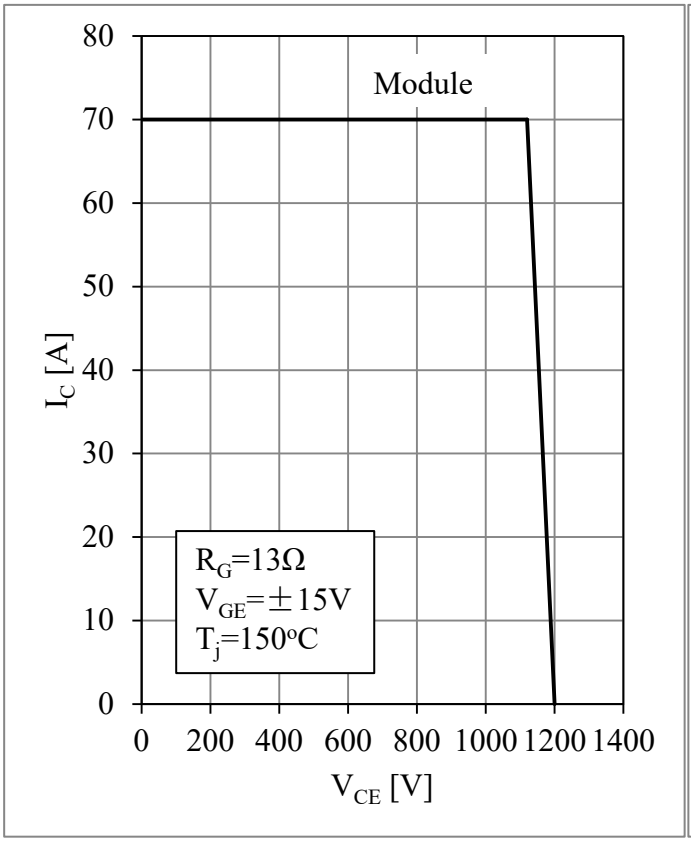


Fig 5. IGBT-inverter RBSOA

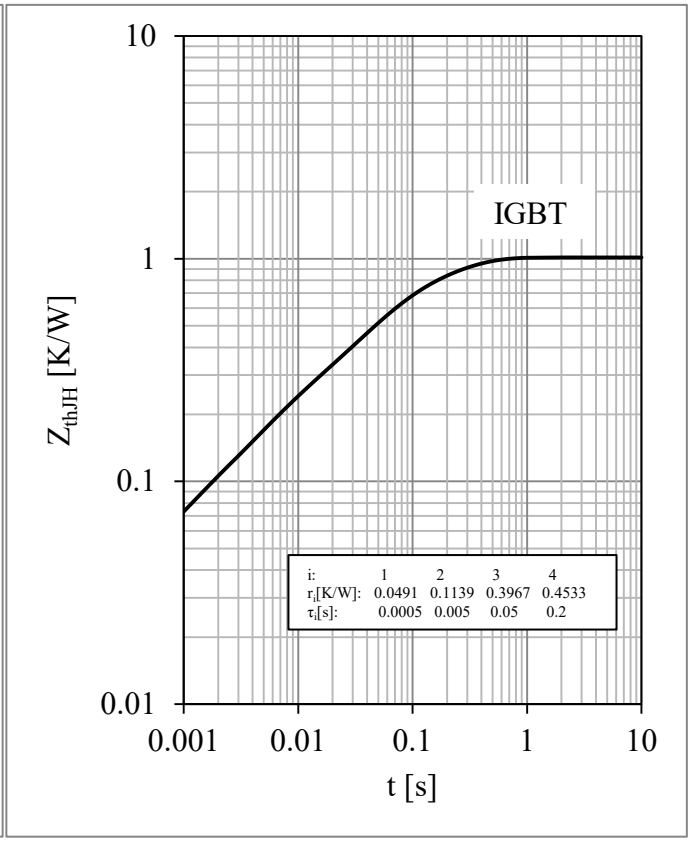


Fig 6. IGBT-inverter Transient Thermal Impedance

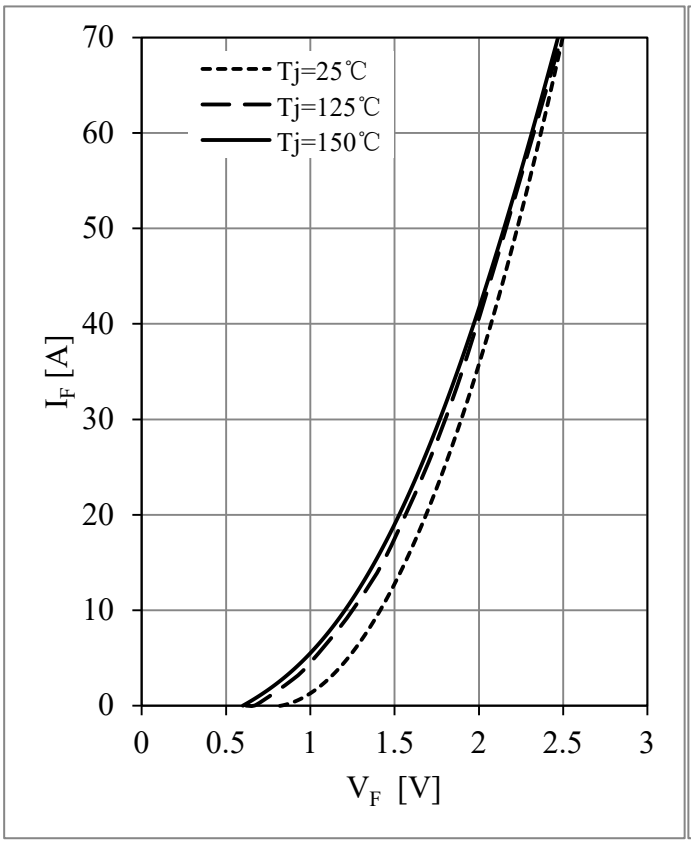


Fig 7. Diode-inverter Forward Characteristics

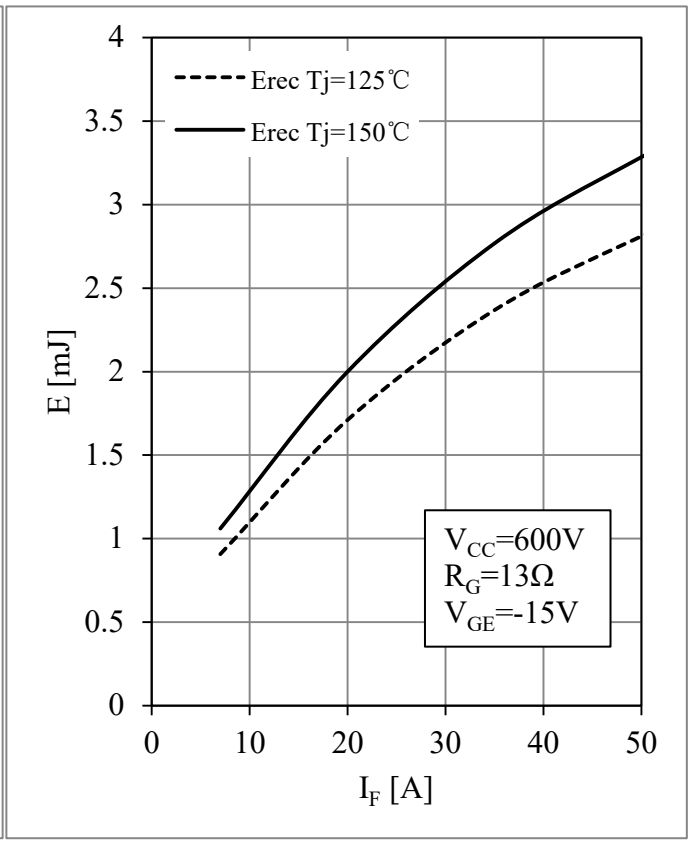


Fig 8. Diode-inverter Switching Loss vs. I_F

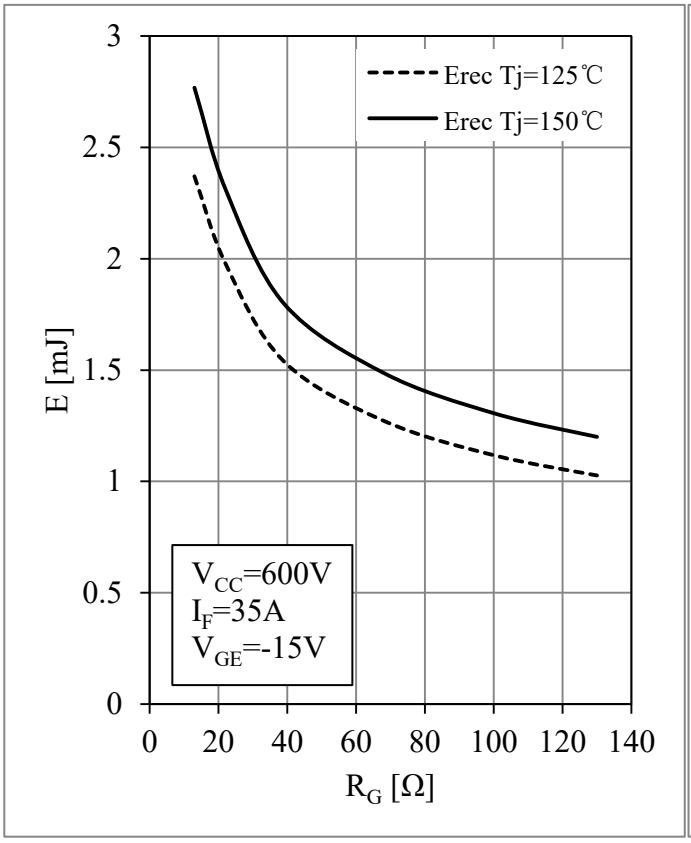


Fig 9. Diode-inverter Switching Loss vs. R_G

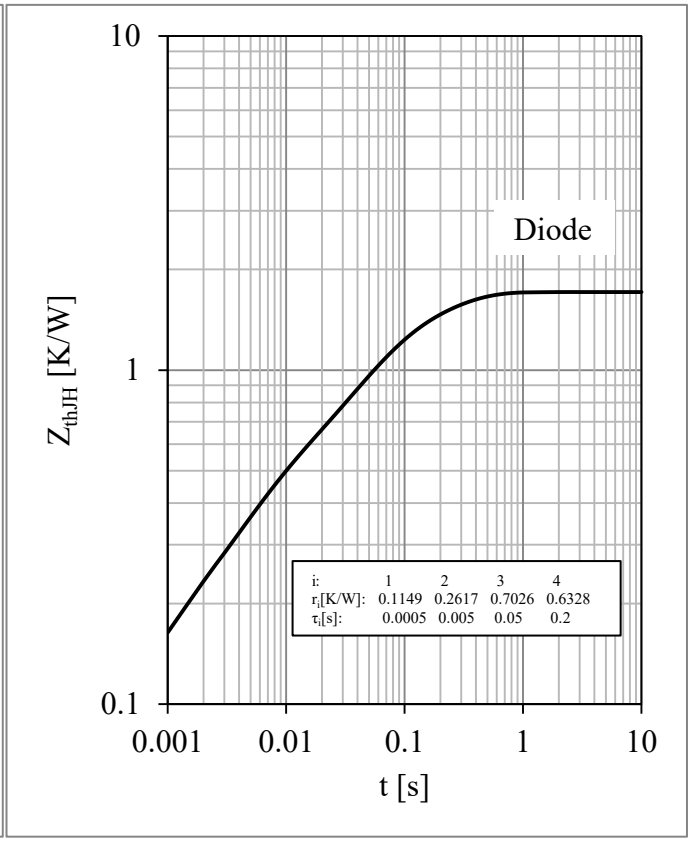


Fig 10. Diode-inverter Transient Thermal Impedance

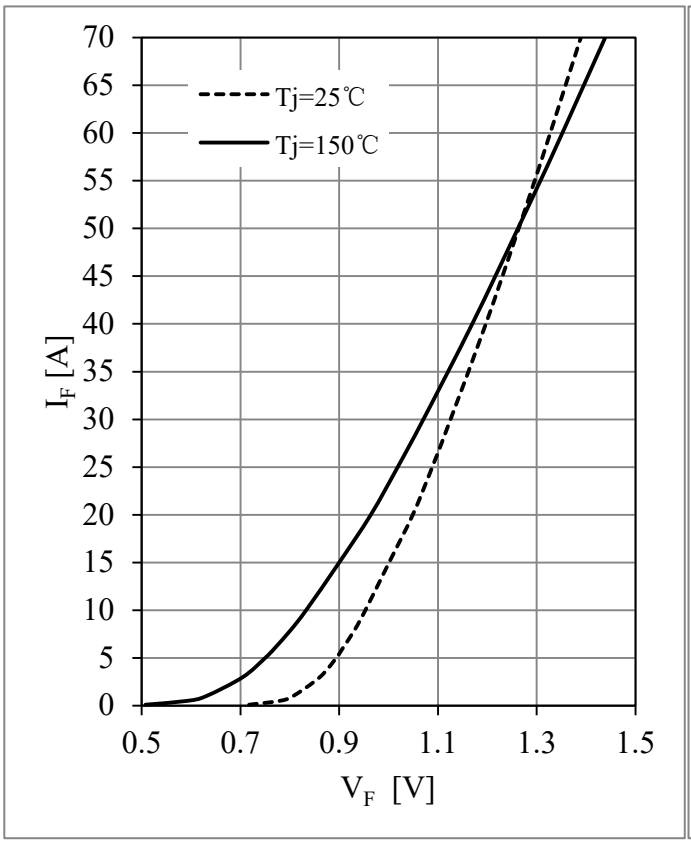


Fig 11. Diode-rectifier Forward Characteristics

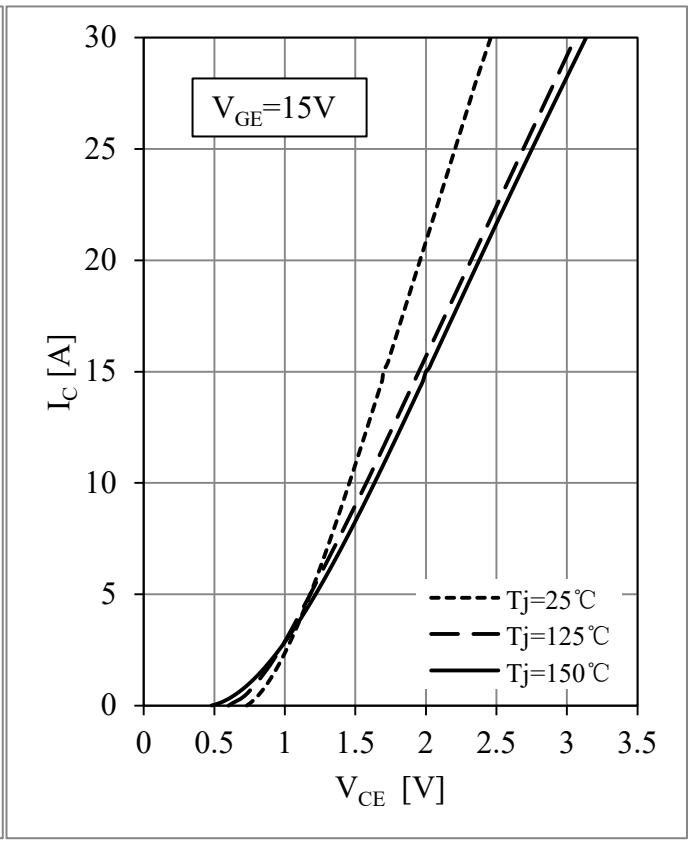


Fig 12. IGBT-brake Output Characteristics

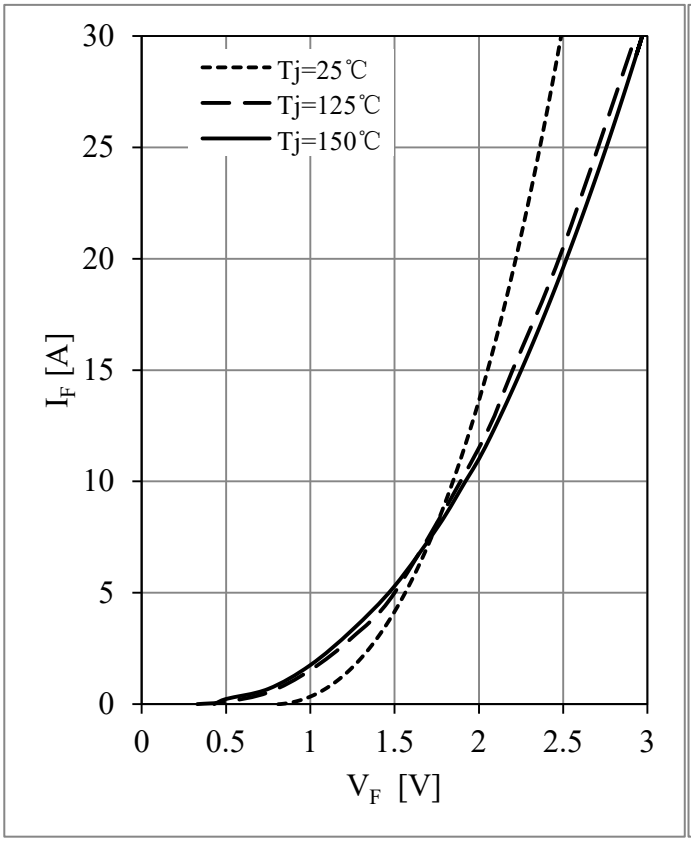


Fig 13. Diode-brake Forward Characteristics

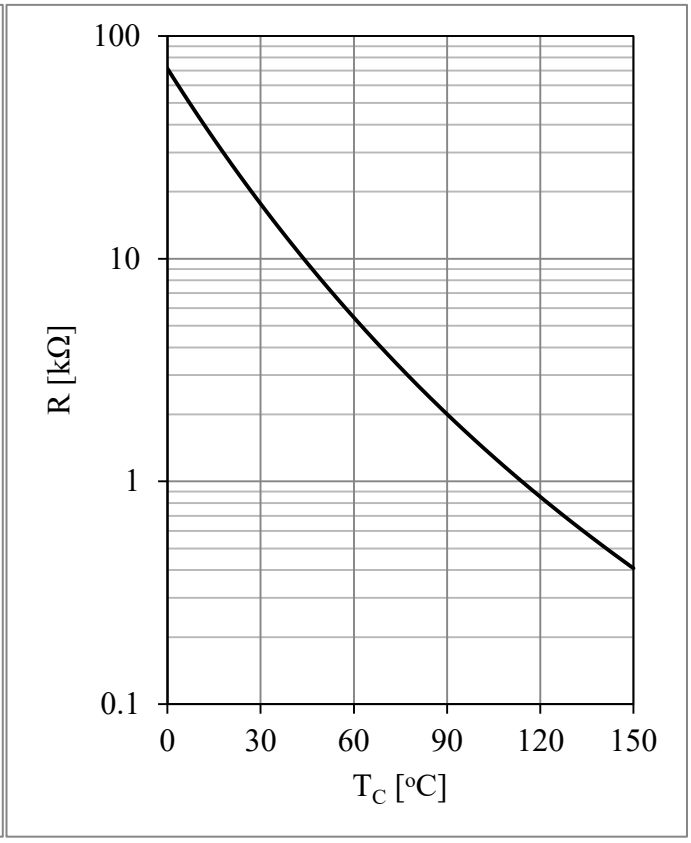
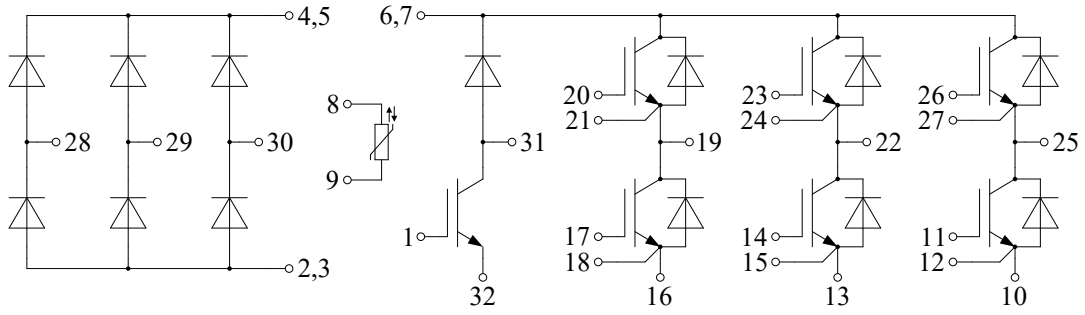


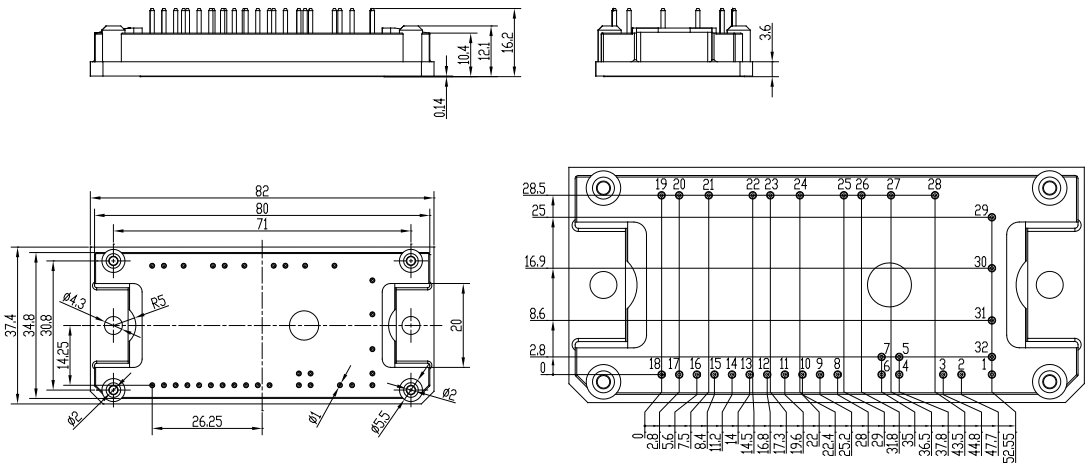
Fig 14. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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