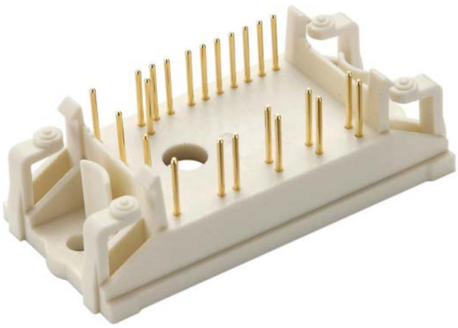
STARPOWER

SEMICONDUCTOR IGBT

GD15PJT120F3S_T4

Molding Type Module

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

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

Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

IGBT-inverter T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD15PJT120F3S_T4	Units
V_{CES}	Collector-Emitter Voltage @ T_j=25℃	1200	V
V_{GES}	Gate-Emitter Voltage @ T_j=25℃	±20	V
I_C	Collector Current @ T_C=25℃ @ T_C=100℃	28 15	A
I_{CM}	Pulsed Collector Current t_p=1ms	30	A
P_{tot}	Total Power Dissipation @ T_j=175℃	120	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	T_j=25℃	1200			V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}$,V_{GE}=0V, T_j=25℃			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}$,V_{CE}=0V, T_j=25℃			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=0.48mA,$V_{CE}=V_{GE}$, T_j=25℃	5.2	5.8	6.4	V
$V_{CE(sat)}$ (chip)	Collector to Emitter Saturation Voltage	I_C=15A,V_{GE}=15V, T_j=25℃		1.85	2.30	V
		I_C=15A,V_{GE}=15V, T_j=125℃		2.15		
		I_C=15A,V_{GE}=15V, T_j=150℃		2.25		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=15A, R_G=39Ω,V_{GE}=±15V, T_j=25℃		55		ns
t_r	Rise Time			59		ns
$t_{d(off)}$	Turn-Off Delay Time			195		ns
t_f	Fall Time			145		ns
E_{on}	Turn-On Switching Loss			1.29		mJ
E_{off}	Turn-Off Switching Loss			0.84		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=15A, R_G=39Ω,V_{GE}=±15V, T_j=125℃		55		ns
t_r	Rise Time			65		ns
$t_{d(off)}$	Turn-Off Delay Time			275		ns
t_f	Fall Time			190		ns
E_{on}	Turn-On Switching Loss			1.76		mJ
E_{off}	Turn-Off Switching Loss			1.19		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=15A, R_G=39Ω,V_{GE}=±15V, T_j=150℃		55		ns
t_r	Rise Time			65		ns
$t_{d(off)}$	Turn-Off Delay Time			280		ns
t_f	Fall Time			215		ns
E_{on}	Turn-On Switching Loss			1.96		mJ
E_{off}	Turn-Off Switching Loss			1.34		mJ
C_{ies}	Input Capacitance	V_{CE}=25V,f=1Mhz, V_{GE}=0V		0.89		nF
C_{oes}	Output Capacitance			0.08		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
Q_G	Gate Charge	V_{CC}=600V,I_C=15A, V_{GE}=-15…+15V		120		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150℃,V_{CC}=900V, V_{CEM}≤1200V		55		A

Diode-inverter T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD15PJT120F3S_T4	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	1200	V
I_F	DC Forward Current	15	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	30	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F (chip)	Diode Forward Voltage	I_F=15A, V_{GE}=0V	T_j=25℃		2.05	2.50	V
			T_j=125℃		2.00		
			T_j=150℃		2.00		
Q_r	Recovered Charge	I_F=15A, V_R=600V, R_G=39Ω, V_{GE}=-15V	T_j=25℃		1.3		μC
			T_j=125℃		2.2		
			T_j=150℃		2.4		
I_{RM}	Peak Reverse Recovery Current		T_j=25℃		13		A
			T_j=125℃		15		
			T_j=150℃		15		
E_{rec}	Reverse Recovery Energy		T_j=25℃		0.60		mJ
			T_j=125℃		1.10		
			T_j=150℃		1.22		

Diode-rectifier T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD15PJT120F3S_T4	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	1600	V
$I_{F(AV)}$	Average On-state Current @ T_C=100℃	20	A
I_{RMSM}	Maximum RMS Current At Rectifier Output @ T_C=80℃	40	A
I_{FSM}	Surge Forward Current V_R=0V,t_p=10ms,T_j=45℃	270	A
I^2t	I^2t-value,V_R=0V,t_p=10ms,T_j=45℃	360	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F (chip)	Diode Forward Voltage	I_F=20A	T_j=150℃		1.05		V
I_R	Reverse Current	T_j=150℃,V_R=1600V				1.0	mA

IGBT-brake-chopper T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD15PJT120F3S_T4	Units
V_{CES}	Collector-Emitter Voltage @ T_j=25℃	1200	V
V_{GES}	Gate-Emitter Voltage @ T_j=25℃	±20	V
I_C	Collector Current @ T_C=25℃ @ T_C=100℃	20 10	A
I_{CM}	Pulsed Collector Current t_p=1ms	20	A
P_{tot}	Total Power Dissipation @ T_j=175℃	94	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	T_j=25℃	1200			V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=125μA,V_{CE}=V_{GE}, T_j=25℃	5.0	5.9	7.5	V
$V_{CE(sat)}$ (chip)	Collector to Emitter Saturation Voltage	I_C=10A,V_{GE}=15V, T_j=25℃		2.10	2.55	V
		I_C=10A,V_{GE}=15V, T_j=125℃		2.50		
		I_C=10A,V_{GE}=15V, T_j=150℃		2.60		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=10A, R_G=22Ω,V_{GE}=±15V, T_j=25℃		14		ns
t_r	Rise Time			24		ns
$t_{d(off)}$	Turn-Off Delay Time			110		ns
t_f	Fall Time			38		ns
E_{on}	Turn-On Switching Loss			0.53		mJ
E_{off}	Turn-Off Switching Loss			0.38		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=10A, R_G=22Ω,V_{GE}=±15V, T_j=125℃		15		ns
t_r	Rise Time			25		ns
$t_{d(off)}$	Turn-Off Delay Time			125		ns
t_f	Fall Time			220		ns
E_{on}	Turn-On Switching Loss			0.69		mJ
E_{off}	Turn-Off Switching Loss			0.58		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=10A, R_G=22Ω,V_{GE}=±15V, T_j=150℃		15		ns
t_r	Rise Time			25		ns
$t_{d(off)}$	Turn-Off Delay Time			128		ns
t_f	Fall Time			250		ns
E_{on}	Turn-On Switching Loss			0.76		mJ
E_{off}	Turn-Off Switching Loss			0.66		mJ
C_{ies}	Input Capacitance	V_{CE}=30V,f=1Mhz, V_{GE}=0V		1.07		nF
C_{oes}	Output Capacitance			0.06		nF
C_{res}	Reverse Transfer Capacitance			0.03		nF
Q_G	Gate Charge	V_{CC}=600V,I_C=10A, V_{GE}=15V		50		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150℃,V_{CC}=900V, V_{CEM}≤1200V		90		A

Diode-brake-chopper T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD15PJT120F3S_T4	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ T_j=25℃	1200	V
I_F	DC Forward Current	10	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	20	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F (chip)	Diode Forward Voltage	I_F=10A, V_{GE}=0V	T_j=25℃		1.85	2.30	V
			T_j=125℃		2.05		
			T_j=150℃		2.10		
Q_r	Recovered Charge	I_F=10A, V_R=600V, R_G=100Ω, V_{GE}=-15V	T_j=25℃		0.98		μC
			T_j=125℃		1.51		
			T_j=150℃		1.70		
I_{RM}	Peak Reverse Recovery Current		T_j=25℃		6.6		A
			T_j=125℃		8.0		
			T_j=150℃		8.1		
E_{rec}	Reverse Recovery Energy		T_j=25℃		0.36		mJ
			T_j=125℃		0.53		
			T_j=150℃		0.62		

NTC T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			22.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100℃,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

IGBT Module

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	4000			V
$R_{\theta JC}$	Junction-to-Case (per IGBT-inverter) Junction-to-Case (per Diode-inverter) Junction-to-Case (per Diode-rectifier) Junction-to-Case (per IGBT-brake-chopper) Junction-to-Case (per Diode-brake-chopper)			1.254 2.231 1.623 1.588 2.434	K/W
$R_{\theta CS}$	Case-to-Sink (per IGBT-inverter) Case-to-Sink (per Diode-inverter) Case-to-Sink (per Diode-rectifier) Case-to-Sink (per IGBT-brake-chopper) Case-to-Sink (per Diode-brake-chopper)		0.551 0.981 0.713 0.698 1.070		K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.036		K/W
T_{jmax}	Maximum Junction Temperature (inverter,brake) Maximum Junction Temperature(rectifier)			175 150	℃
T_{jop}	Operating Junction Temperature	-40		150	℃
T_{STG}	Storage Temperature Range	-40		125	℃

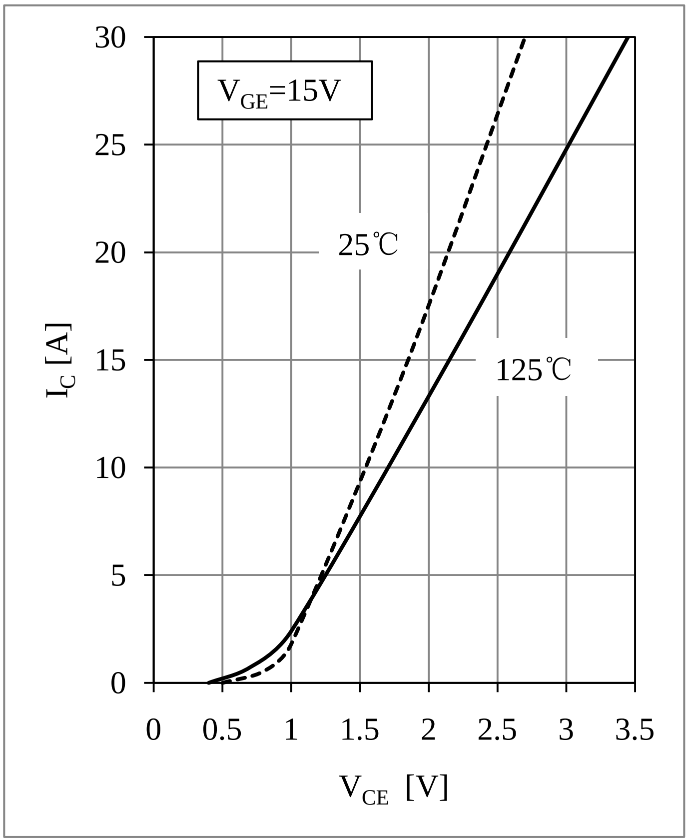


Fig 1. IGBT-inverter Output Characteristics

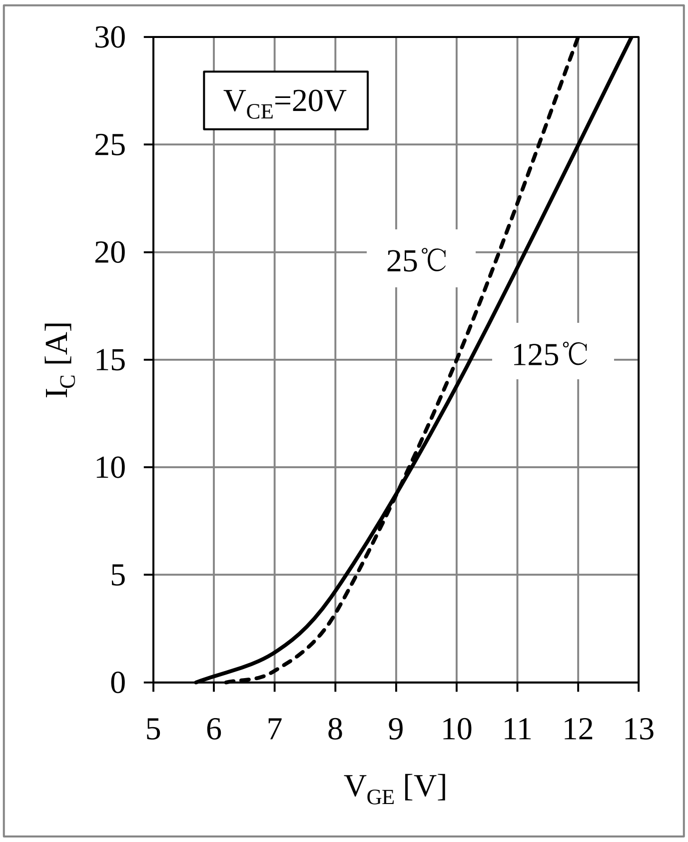


Fig 2. IGBT-inverter Transfer Characteristics

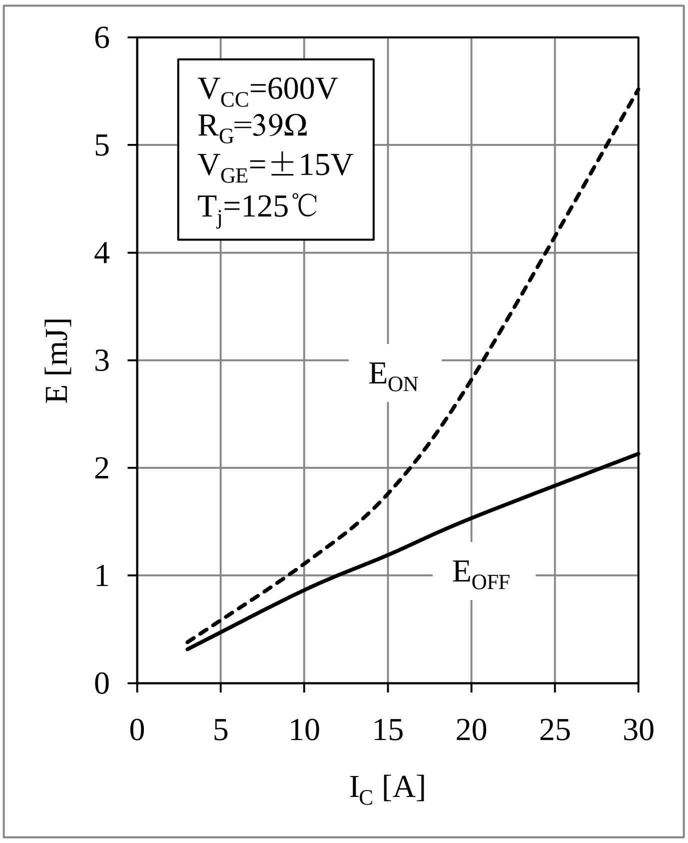


Fig 3. IGBT-inverter Switching Loss vs. I_C

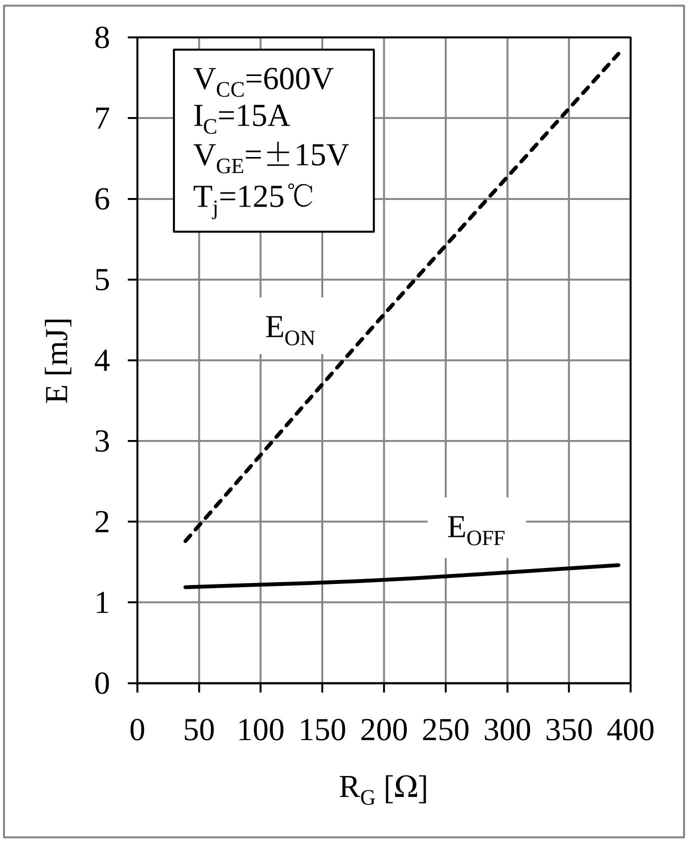
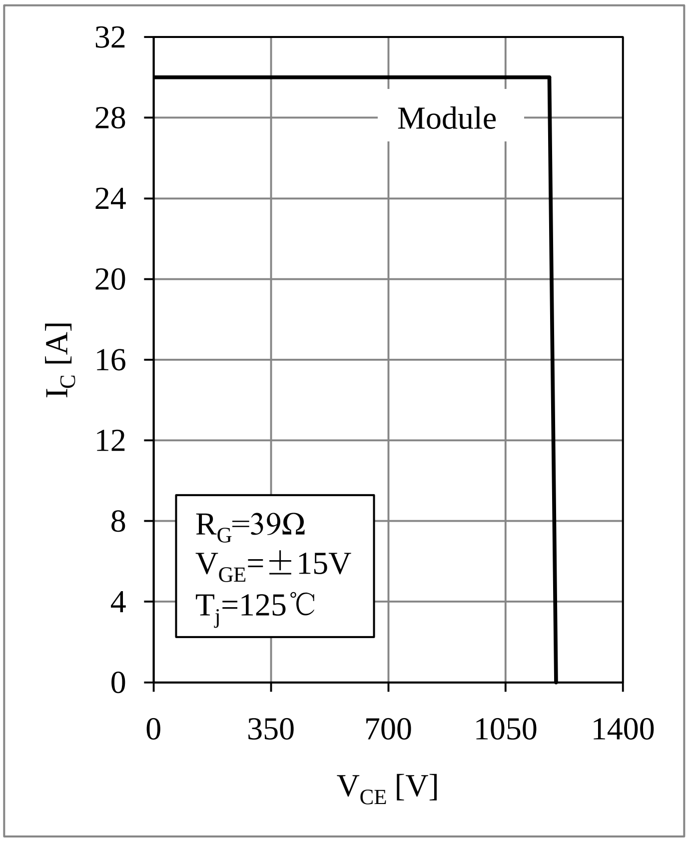


Fig 4. IGBT-inverter Switching Loss vs. R_G



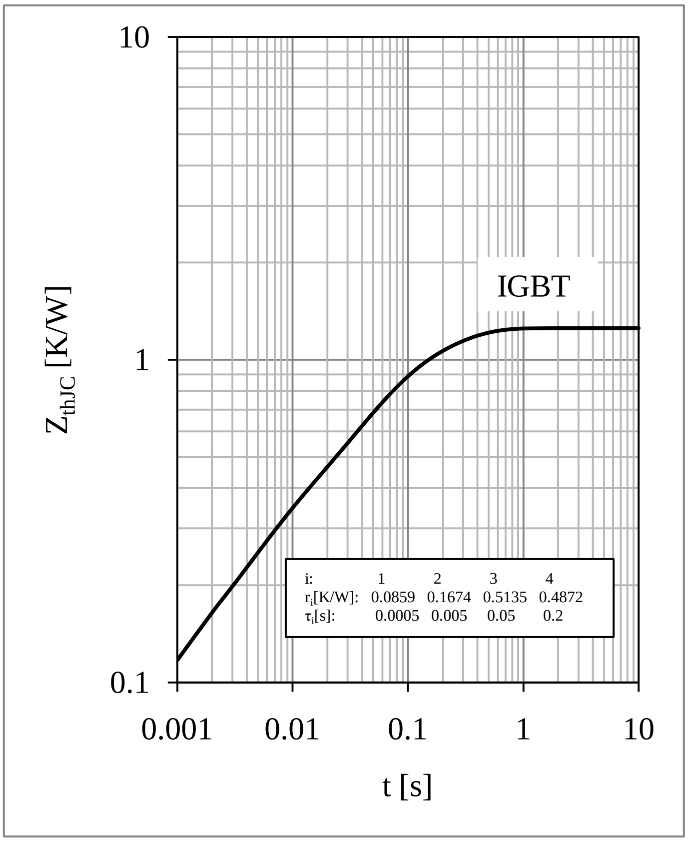
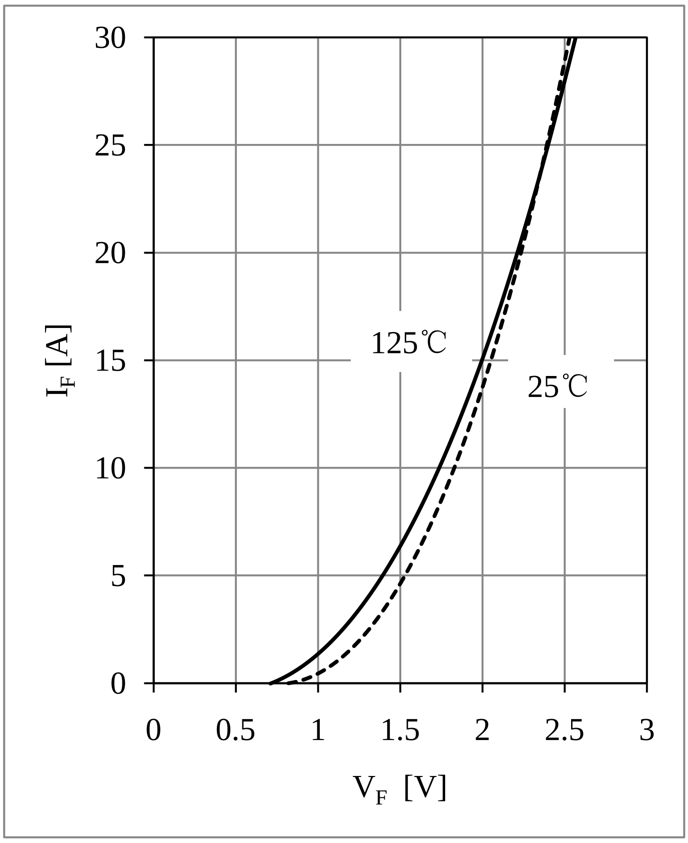


Fig 5. IGBT-inverter RBSOA

Fig 6. IGBT-inverter Transient Thermal Impedance



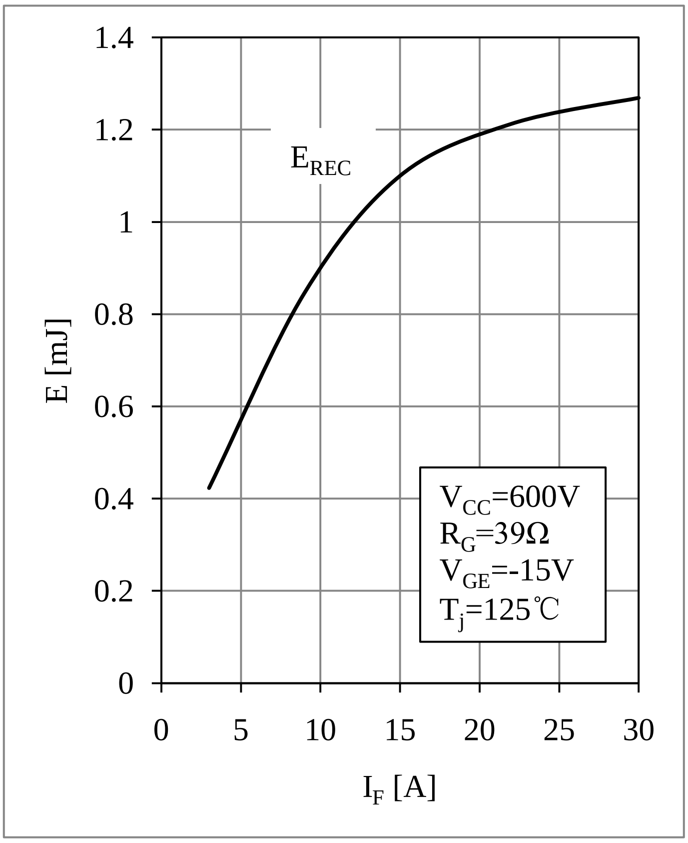


Fig 7. Diode-inverter Forward Characteristics

Fig 8. Diode-inverter Switching Loss vs. I_F

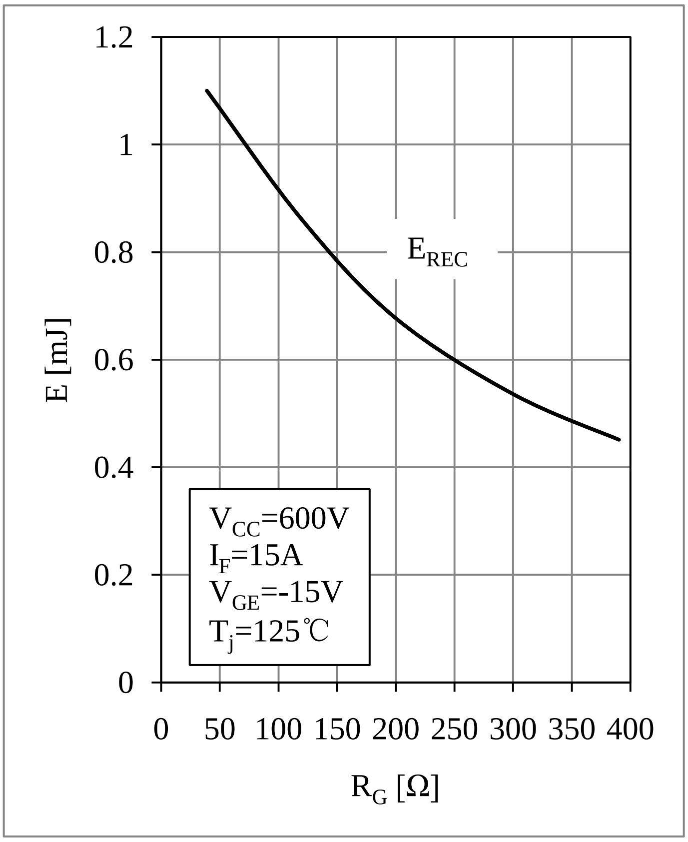


Fig 9. Diode-inverter Switching Loss vs. R_G

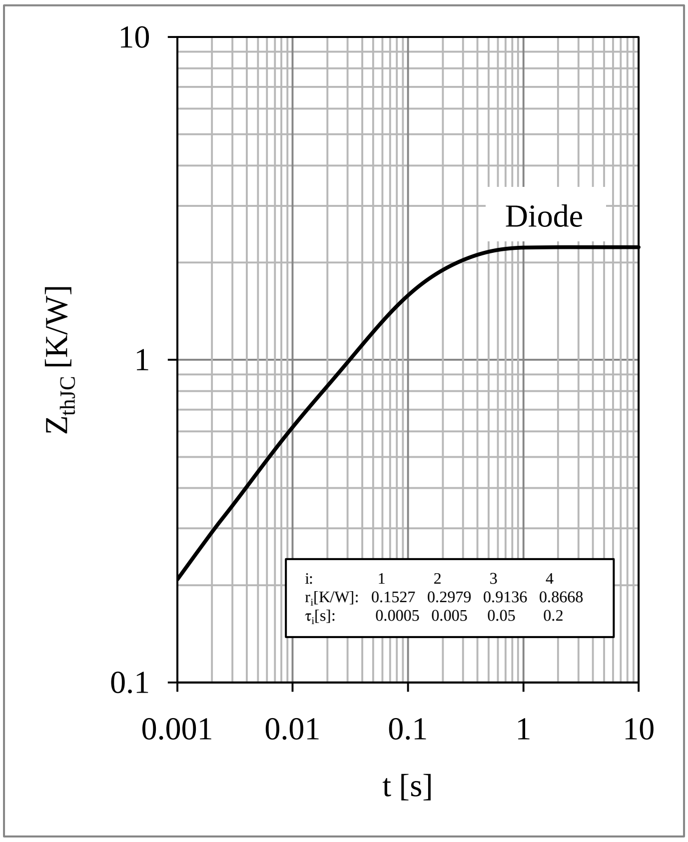


Fig 10. Diode-inverter Transient Thermal Impedance

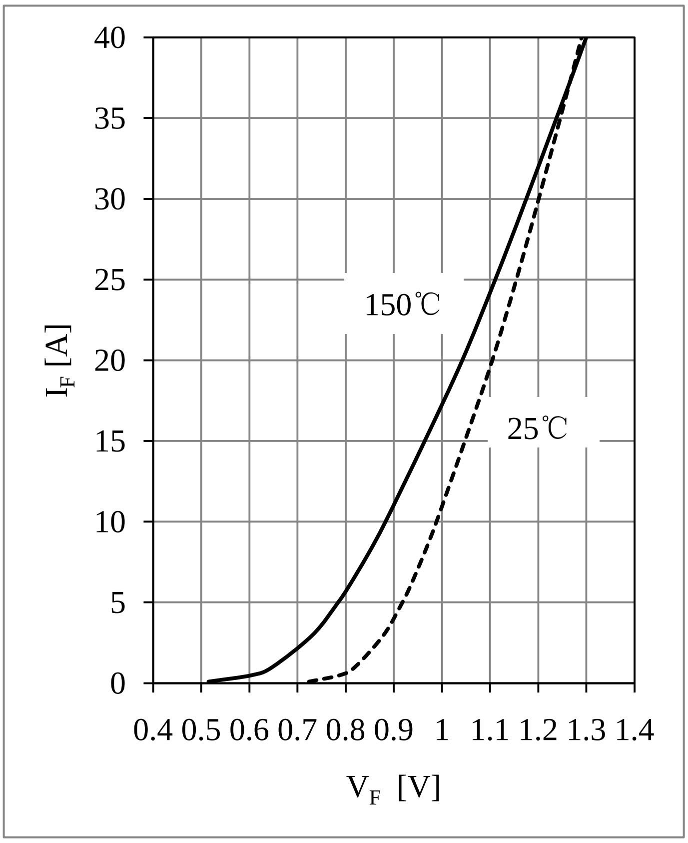


Fig 11. Diode-rectifier Forward Characteristics

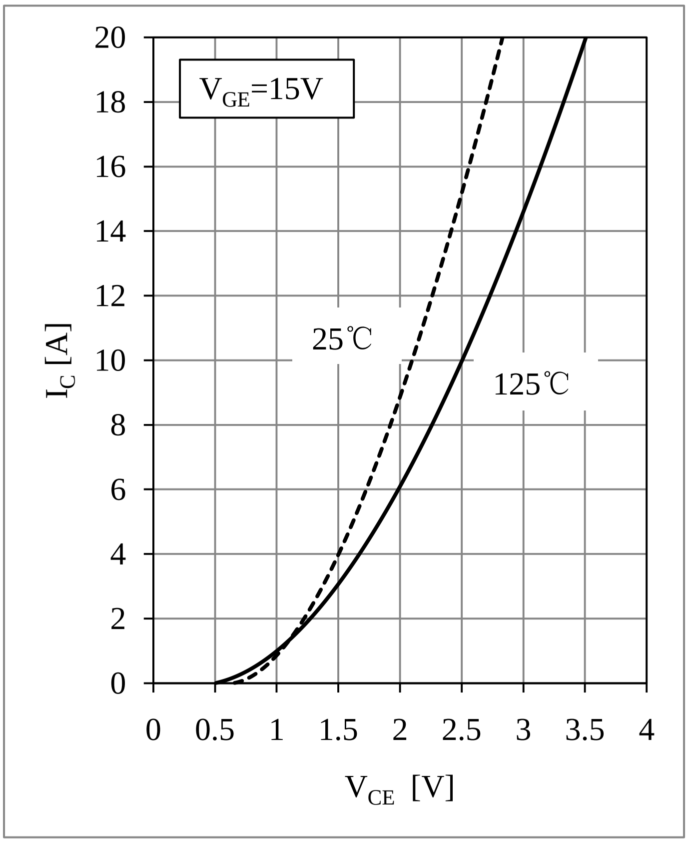


Fig 12. IGBT-brake-chopper Output Characteristics

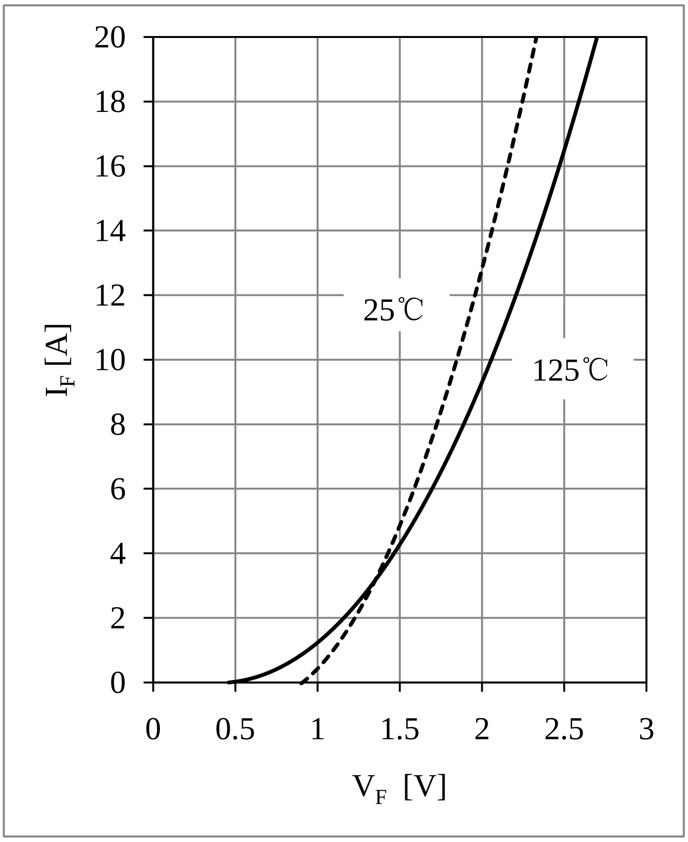


Fig 13. Diode-brake-chopper Forward Characteristics

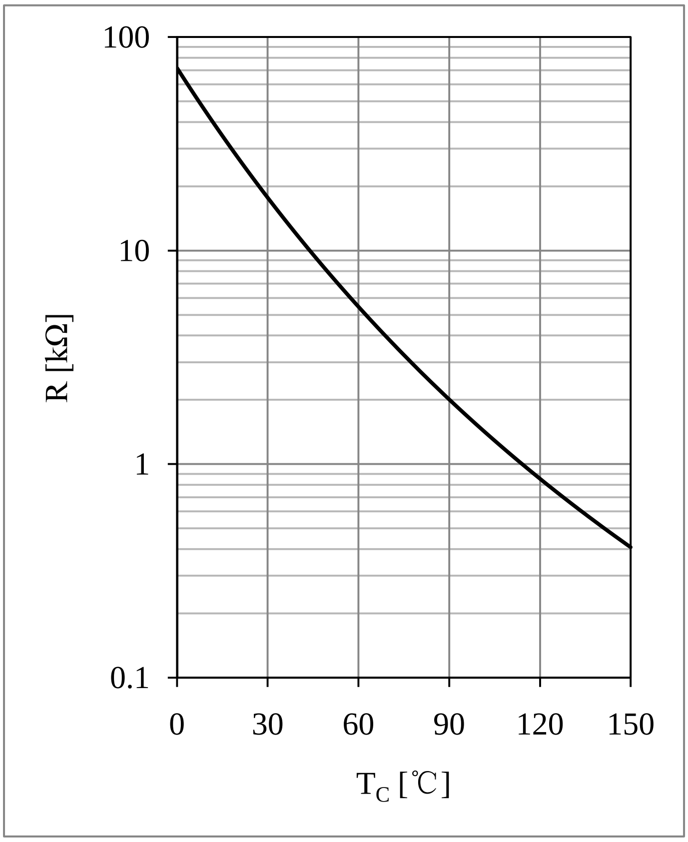
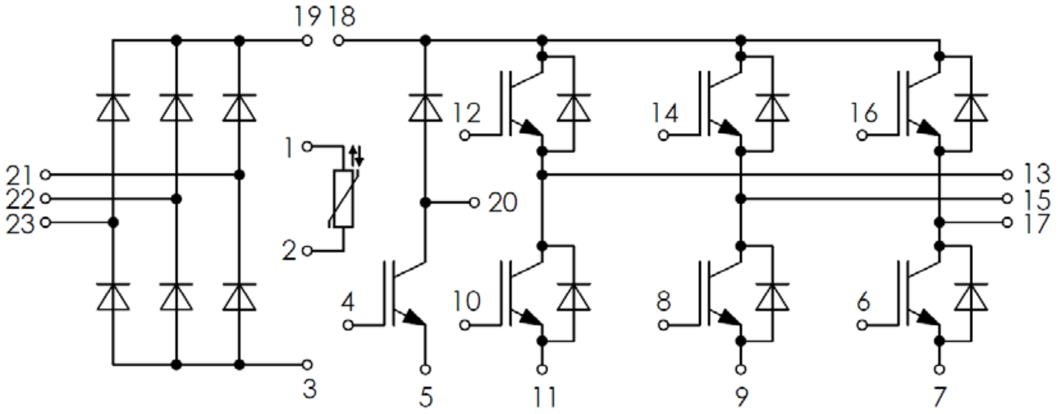


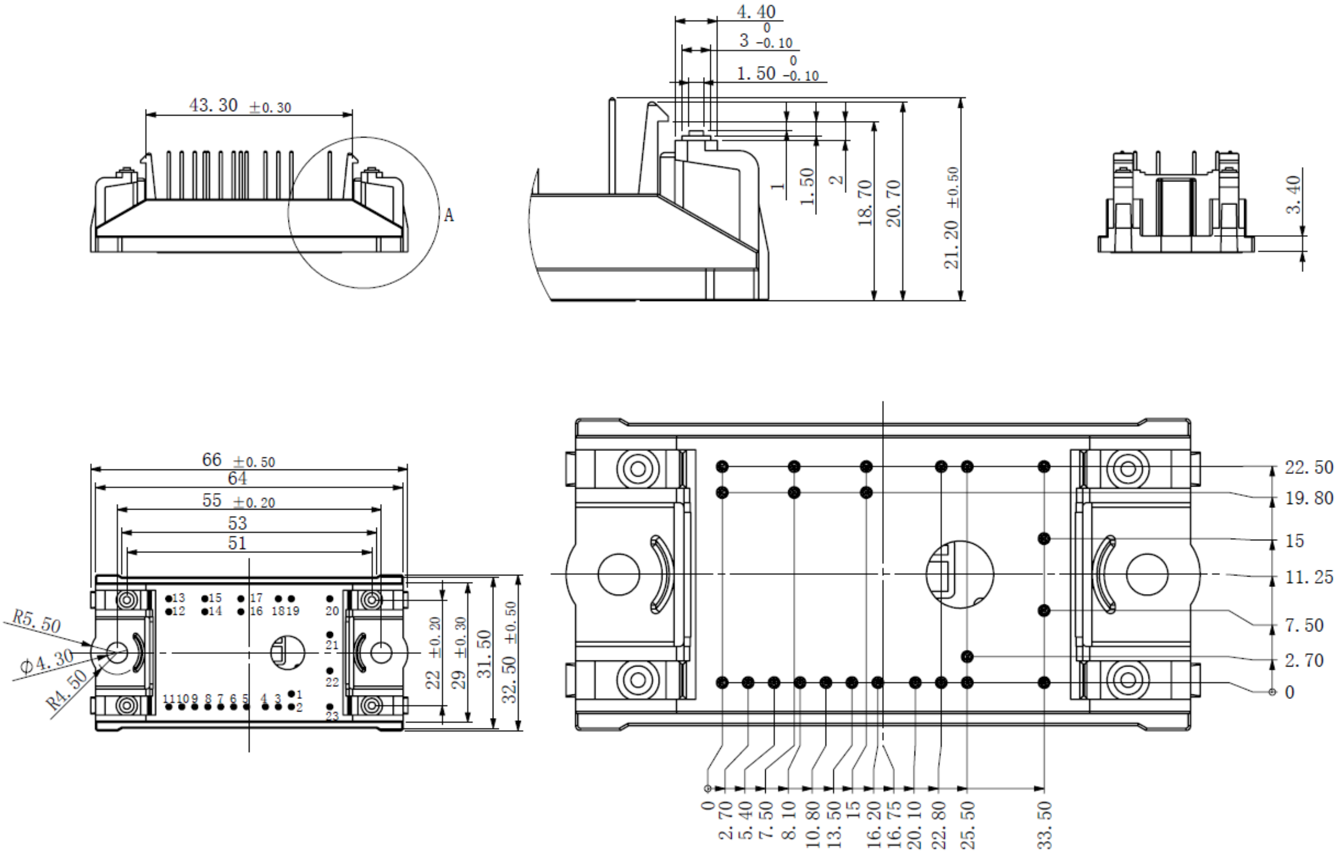
Fig 14. NTC Temperature Characteristic

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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