

STARPOWER

SEMICONDUCTOR

IGBT

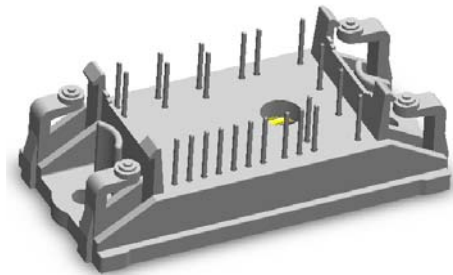
GD10PJK120F3S

Molding Type Module

1200V/10A PIM in one-package

General Description

STARPOWER IGBT Power Module provides ultra low conduction and switching loss as well as short circuit ruggedness. They are designed for the applications such as general inverters and UPS.



Features

- Low $V_{CE(sat)}$ NPT IGBT technology
- 10 μ s short circuit capability
- Square RBSOA
- $V_{CE(sat)}$ with positive temperature coefficient
- Fast & soft reverse recovery anti-parallel FWD

Typical Applications

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

IGBT-inverter $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD10PJK120F3S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	± 20	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=80^\circ\text{C}$	20 10	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	20	A
P_{tot}	Total Power Dissipation @ $T_j=150^\circ\text{C}$	94	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^\circ\text{C}$	1200			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

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=125\mu\text{A}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	4.4	5.0	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=10\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		2.45	2.90	V
		$I_C=10\text{A}, V_{GE}=15\text{V},$ $T_j=125^\circ\text{C}$		2.75		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=10A,$ $R_G=100\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		172		ns
t_r	Rise Time			55		ns
$t_{d(off)}$	Turn-Off Delay Time			189		ns
t_f	Fall Time			312		ns
E_{on}	Turn-On Switching Loss			2.34		mJ
E_{off}	Turn-Off Switching Loss			0.74		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=10A,$ $R_G=100\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		176		ns
t_r	Rise Time			58		ns
$t_{d(off)}$	Turn-Off Delay Time			199		ns
t_f	Fall Time			443		ns
E_{on}	Turn-On Switching Loss			2.71		mJ
E_{off}	Turn-Off Switching Loss			0.98		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		795		pF
C_{oes}	Output Capacitance			64		pF
C_{res}	Reverse Transfer Capacitance			25		pF
Q_G	Gate Charge	$V_{CC}=600V, I_C=10A,$ $V_{GE}=15V$		48		nC
R_{Gint}	Internal Gate Resister			/		Ω
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		72		A

Diode-inverter $T_C=25^\circ C$ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD10PJK120F3S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ C$	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	Diode Forward Voltage	$I_F=10A, V_{GE}=0V$	$T_j=25^\circ C$	1.85	2.30	V
			$T_j=125^\circ C$	2.05		
Q_r	Recovered Charge	$I_F=10A,$	$T_j=25^\circ C$	0.98		μC
			$T_j=125^\circ C$	1.51		
I_{RM}	Peak Reverse Recovery Current	$V_R=600V,$ $R_G=100\Omega,$	$T_j=25^\circ C$	6.6		A
			$T_j=125^\circ C$	8.0		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$	0.36		mJ
			$T_j=125^\circ C$	0.53		

Diode-rectifier $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD10PJK120F3S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=100^\circ\text{C}$	20	A
I_{RMSM}	Maximum RMS Current At Rectifier Output @ $T_C=80^\circ\text{C}$	40	A
I_{FSM}	Surge Forward Current $V_R=0V, t_p=10\text{ms}, T_j=45^\circ\text{C}$	270	A
I^2t	I^2t -value, $V_R=0V, t_p=10\text{ms}, T_j=45^\circ\text{C}$	360	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=20\text{A}$ $T_j=150^\circ\text{C}$		1.11		V
I_R	Reverse Current	$T_j=150^\circ\text{C}, V_R=1600\text{V}$			1.0	mA

IGBT-brake-chopper $T_C=25^\circ\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD10PJK120F3S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^\circ\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage @ $T_j=25^\circ\text{C}$	± 30	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=80^\circ\text{C}$	20 10	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	20	A
P_{tot}	Total Power Dissipation @ $T_j=175^\circ\text{C}$	94	W

Off Characteristics

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

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=400\mu\text{A}, V_{CE}=V_{GE},$ $T_j=25^\circ\text{C}$	5.0	6.0	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=10\text{A}, V_{GE}=15\text{V},$ $T_j=25^\circ\text{C}$		2.10	2.55	V
		$I_C=10\text{A}, V_{GE}=15\text{V},$ $T_j=175^\circ\text{C}$		2.70		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=10A,$ $R_G=22\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		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	$V_{CC}=600V, I_C=10A,$ $R_G=22\Omega, V_{GE}=\pm 15V,$ $T_j=175^\circ C$		15		ns
t_r	Rise Time			25		ns
$t_{d(off)}$	Turn-Off Delay Time			130		ns
t_f	Fall Time			270		ns
E_{on}	Turn-On Switching Loss			0.85		mJ
E_{off}	Turn-Off Switching Loss			0.75		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		1070		pF
C_{oes}	Output Capacitance			63		pF
C_{res}	Reverse Transfer Capacitance			26		pF
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	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		90		A

Diode-brake-chopper $T_C=25^\circ C$ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD10PJK120F3S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^\circ C$	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	Diode Forward Voltage	$I_F=10A, V_{GE}=0V$	$T_j=25^\circ C$	1.85	2.30	V
			$T_j=125^\circ C$	2.05		
Q_r	Recovered Charge	$I_F=10A,$	$T_j=25^\circ C$	0.98		μC
			$T_j=125^\circ C$	1.51		
I_{RM}	Peak Reverse Recovery Current	$V_R=600V,$ $R_G=100\Omega,$	$T_j=25^\circ C$	6.6		A
			$T_j=125^\circ C$	8.0		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$	0.36		mJ
			$T_j=125^\circ C$	0.53		

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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

IGBT Module

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	4000			V
$R_{\theta\text{JC}}$	Junction-to-Case (per IGBT-inverter)			1.326	K/W
	Junction-to-Case (per Diode-inverter)			2.258	
	Junction-to-Case (per Diode-rectifier)			1.611	
	Junction-to-Case (per IGBT-brake-chopper)			1.588	
	Junction-to-Case (per Diode-brake-chopper)			2.434	
$R_{\theta\text{CS}}$	Case-to-Sink (Conductive grease applied)		0.036		K/W
T_{jmax}	Maximum Junction Temperature			150	$^\circ\text{C}$
T_{jop}	Operating Junction Temperature	-40		125	$^\circ\text{C}$
T_{STG}	Storage Temperature Range	-40		125	$^\circ\text{C}$

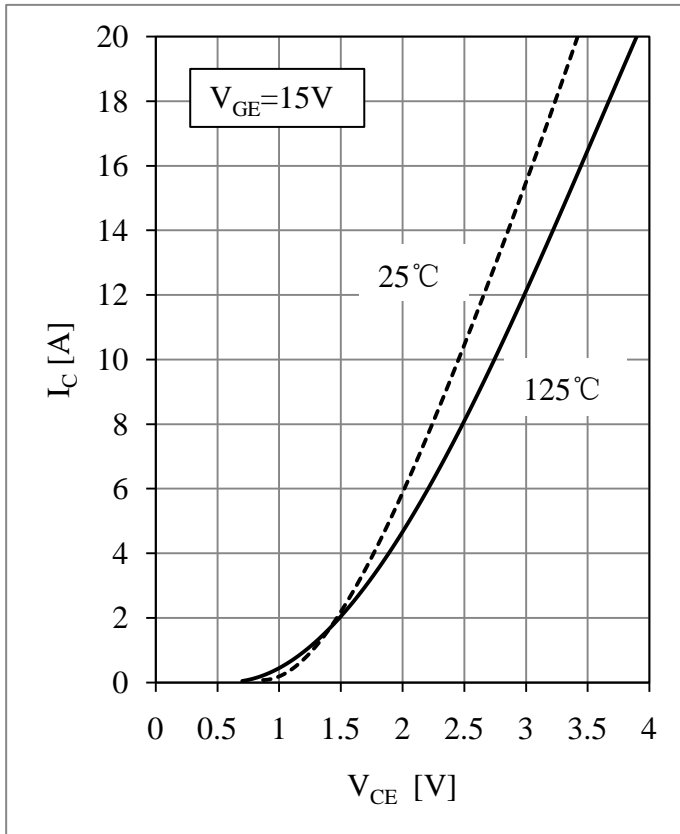


Fig 1. IGBT-inverter Output Characteristics

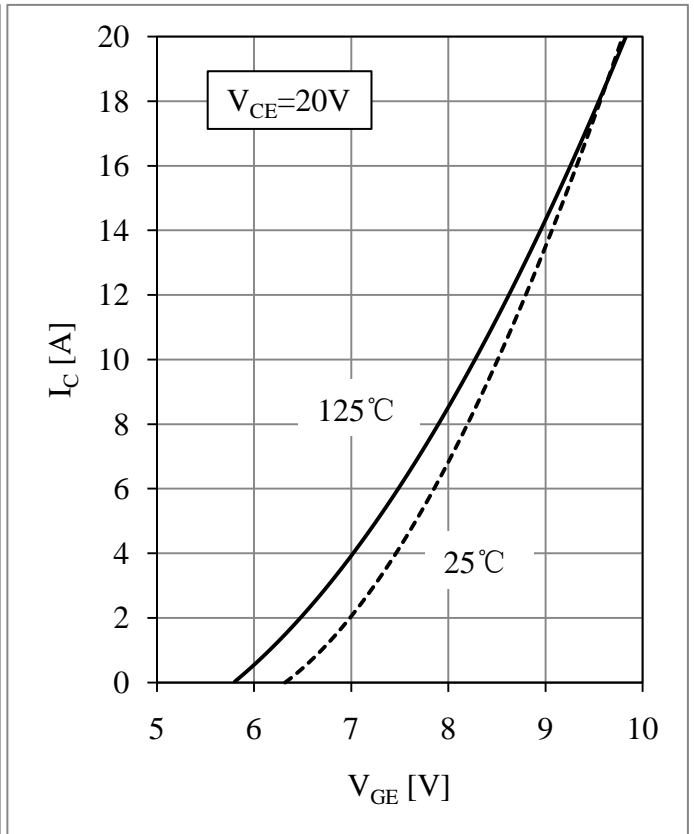


Fig 2. IGBT-inverter Transfer Characteristics

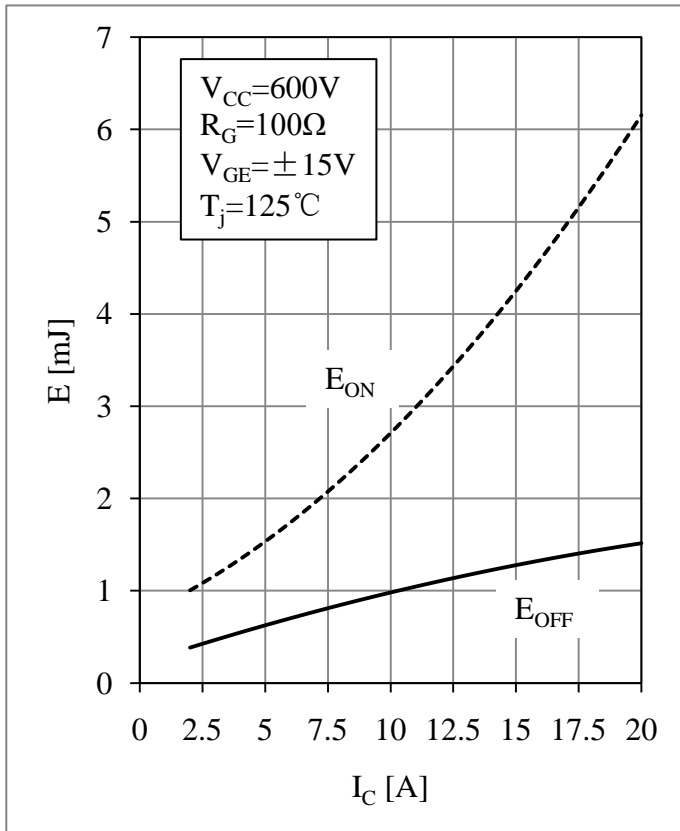


Fig 3. IGBT-inverter Switching Loss vs. I_C

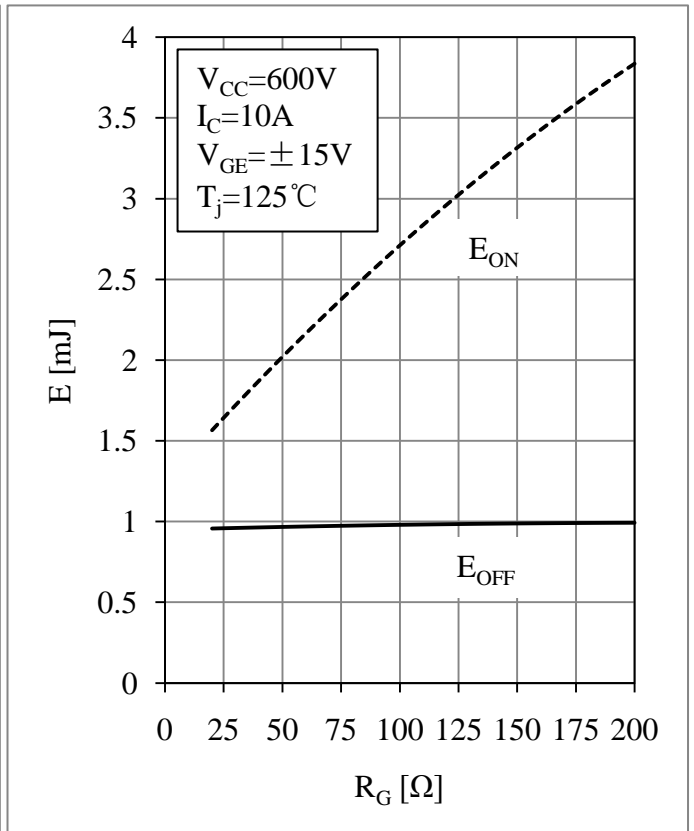


Fig 4. IGBT-inverter Switching Loss vs. R_G

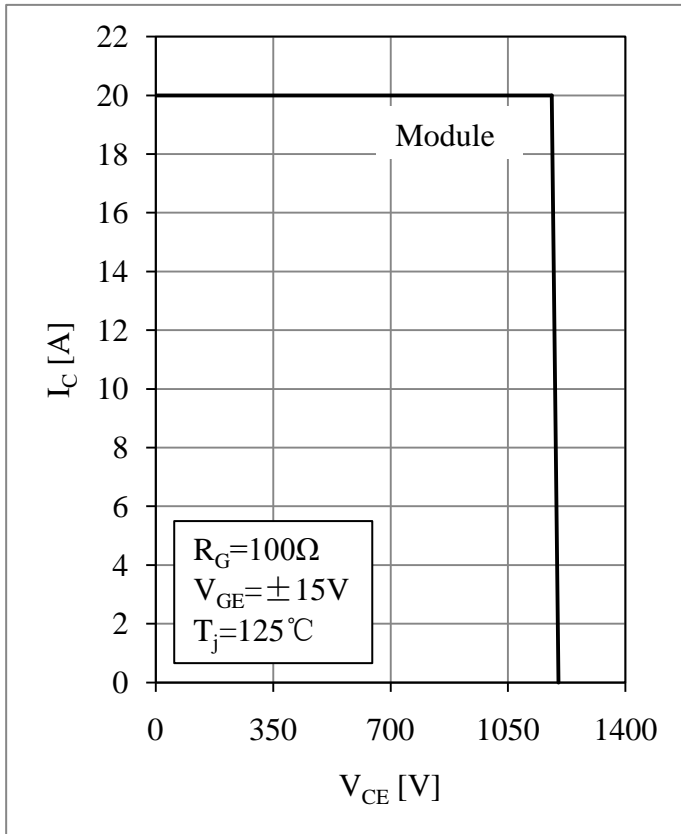


Fig 5. IGBT-inverter RBSOA

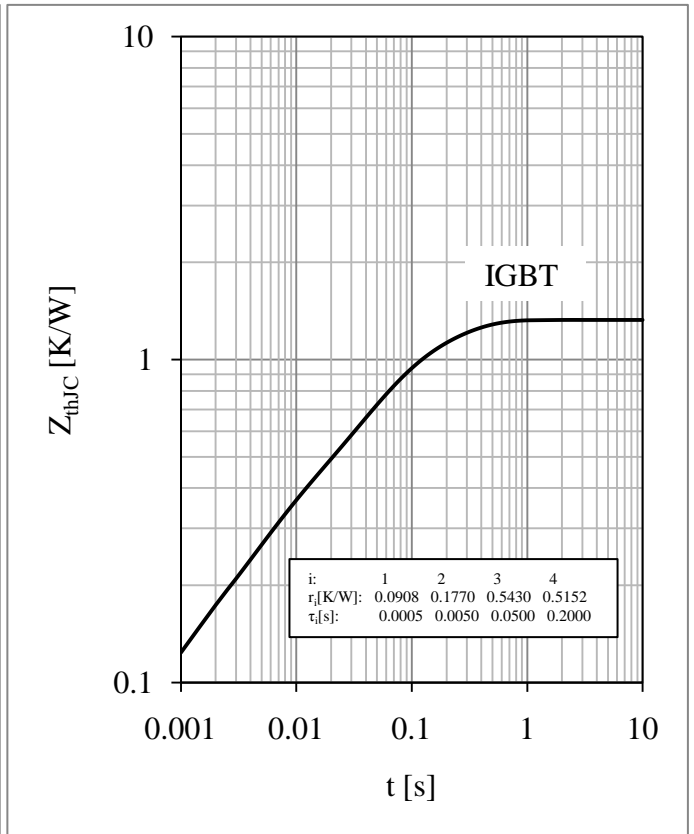


Fig 6. IGBT-inverter Transient Thermal Impedance

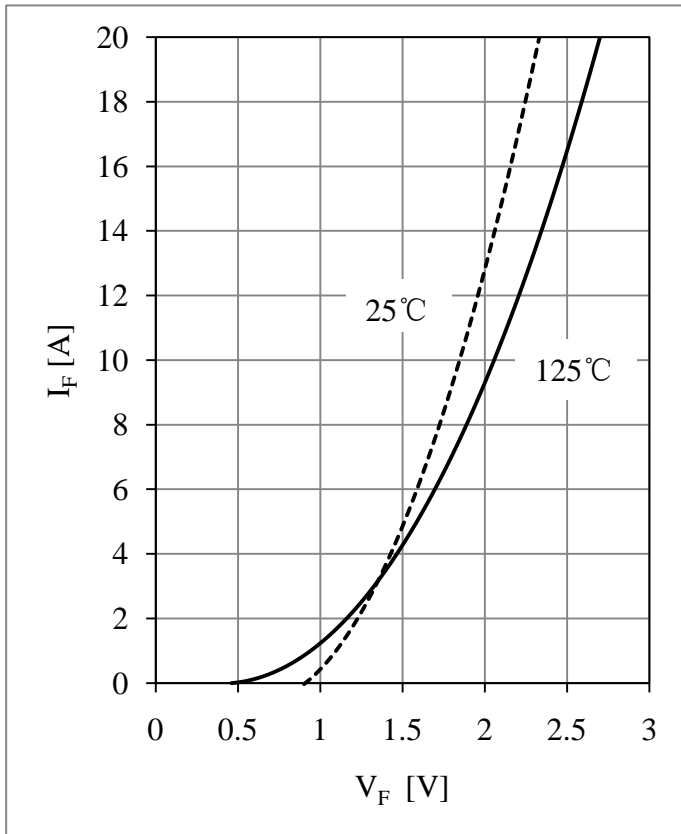


Fig 7. Diode-inverter Forward Characteristics

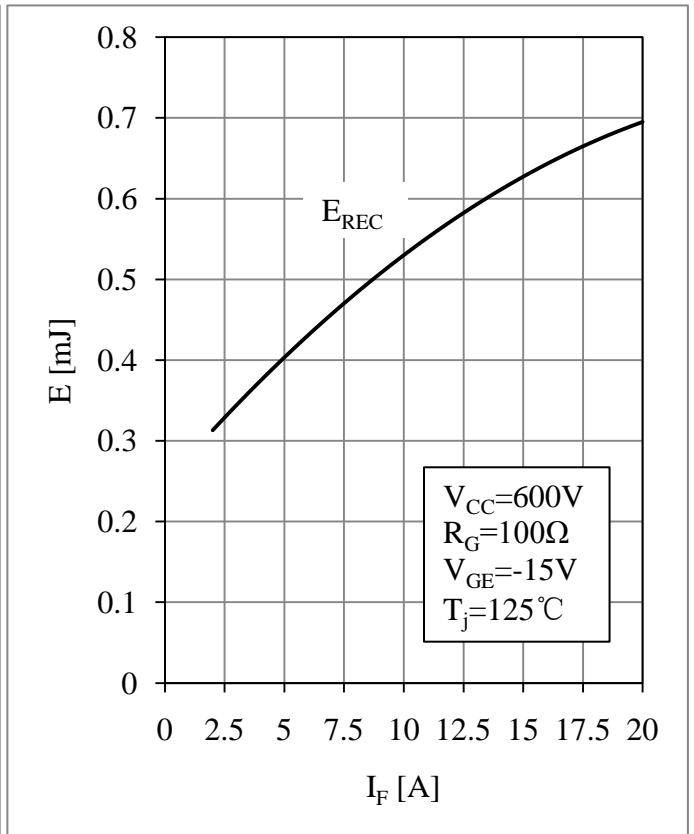


Fig 8. Diode-inverter Switching Loss vs. I_F

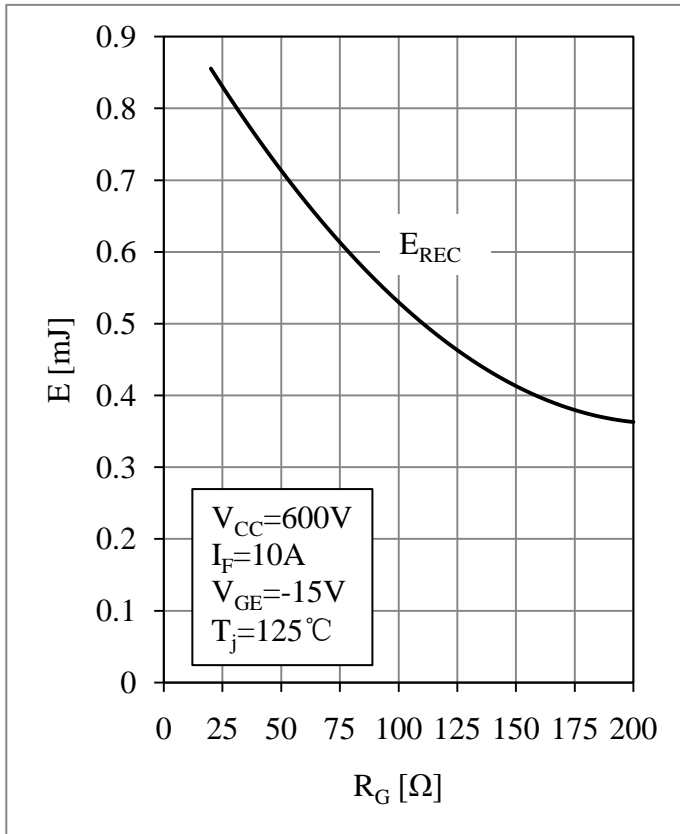


Fig 9. Diode-inverter Switching Loss vs. R_G

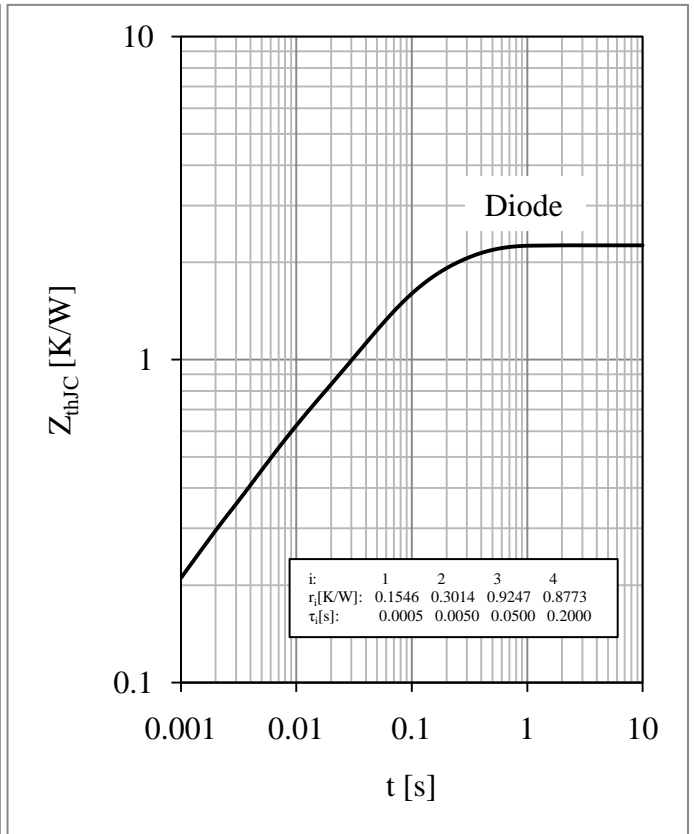


Fig 10. Diode-inverter Transient Thermal Impedance

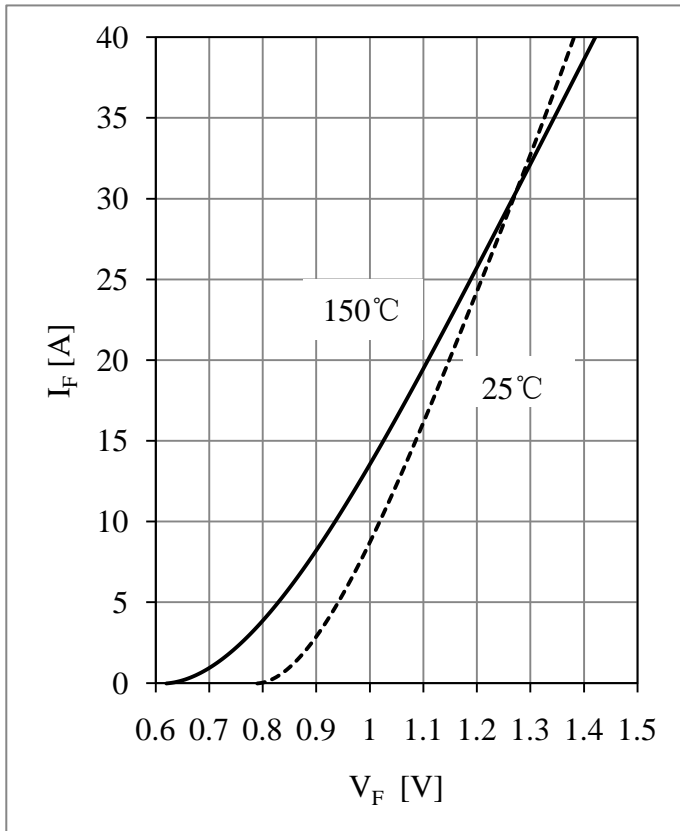


Fig 11. Diode-rectifier Forward Characteristics

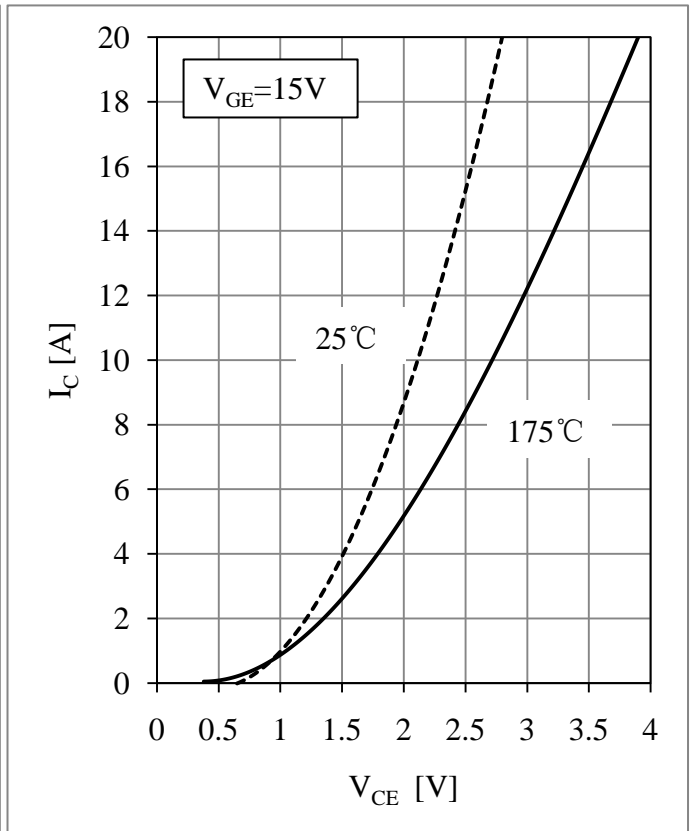


Fig 12. IGBT-brake-chopper Output Characteristics

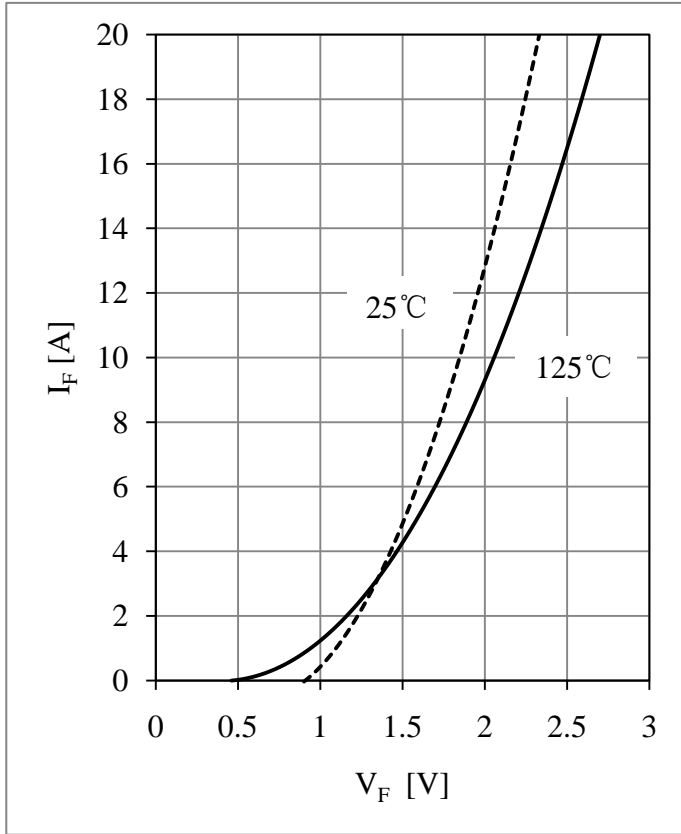


Fig 13. Diode-brake-chopper Forward Characteristics

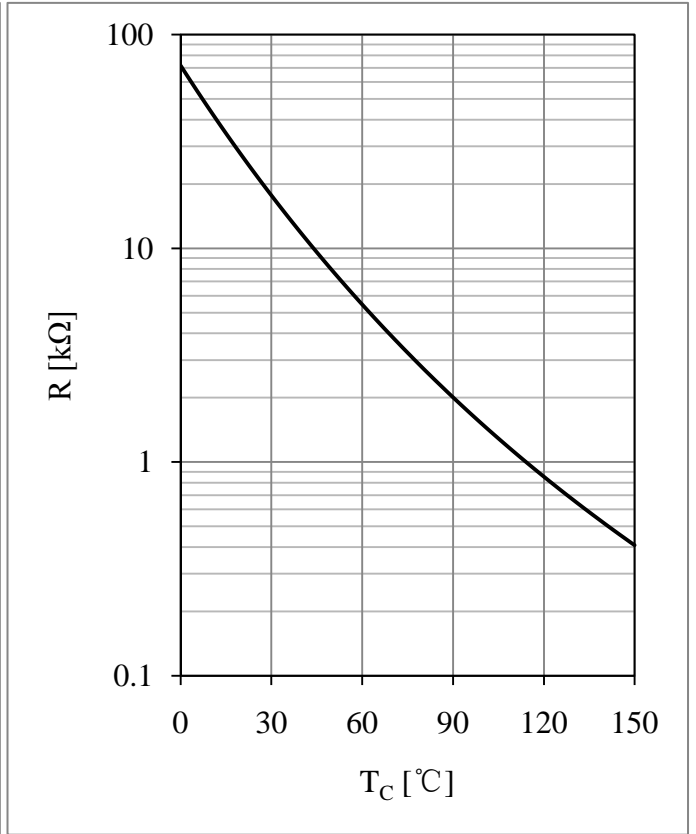
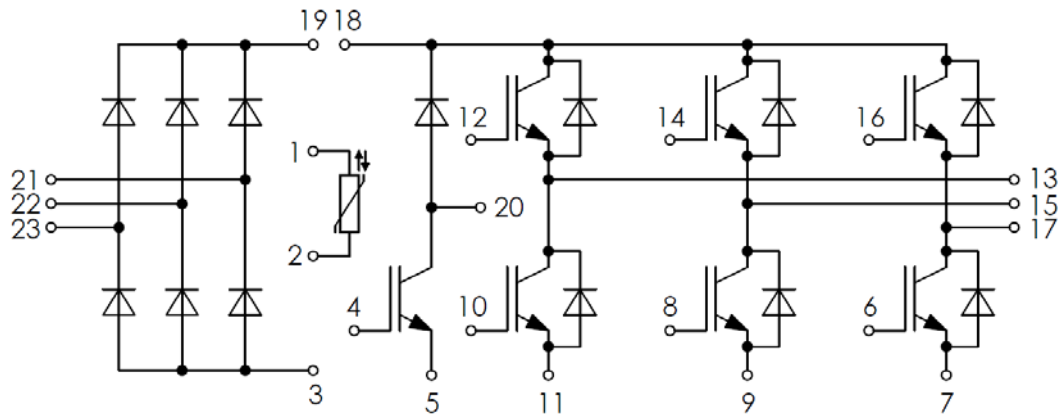


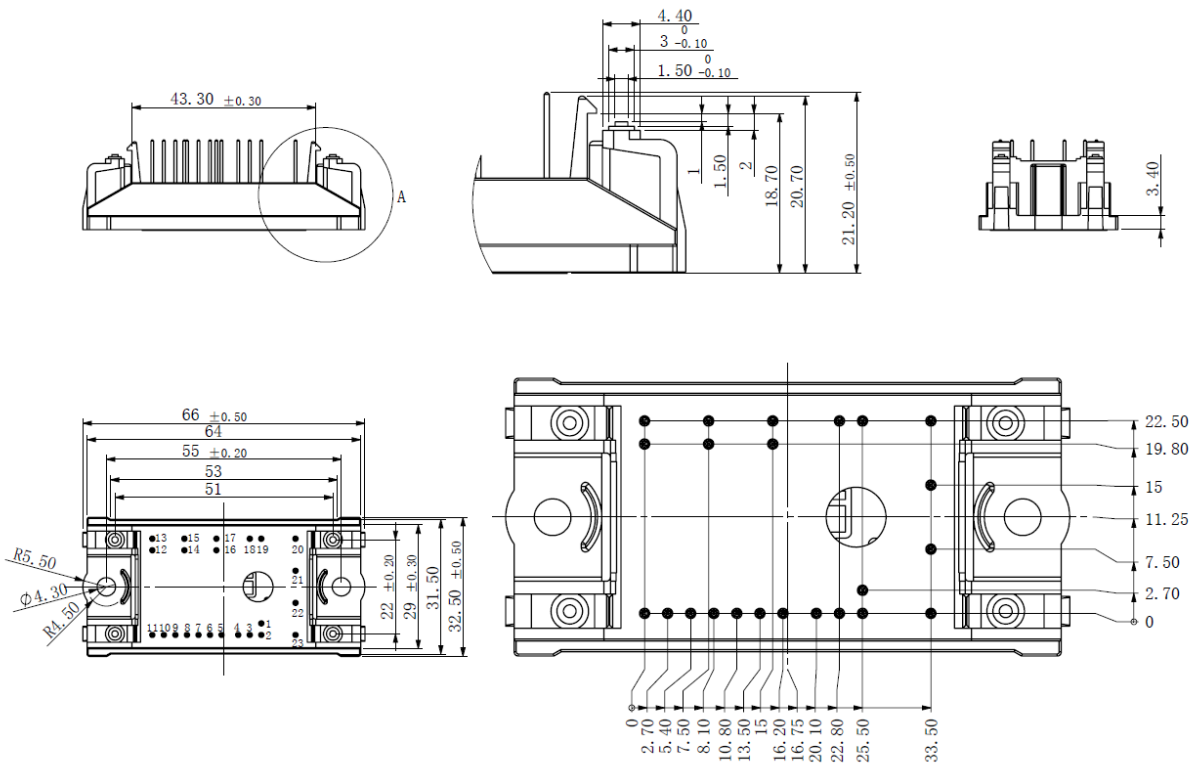
Fig 14. NTC Temperature Characteristic

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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