

IGBT

GD75PIT120C6S

Molding Type Module

1200V/75A PIM in one-package



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 $^{\circ}$ C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

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	GD75PIT120C6S	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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	120 75	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	150	A
P_{tot}	Total Power Dissipation @ $T_j=175^{\circ}\text{C}$	441	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	$V_{CE}=V_{CES}, V_{GE}=0\text{V},$ $T_j=25^{\circ}\text{C}$			5.0	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	$I_C=3.5\text{mA}, V_{CE}=V_{GE},$ $T_j=25^{\circ}\text{C}$	5.0	6.0	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=75\text{A}, V_{GE}=15\text{V},$ $T_j=25^{\circ}\text{C}$		2.00	2.45	V
		$I_C=75\text{A}, V_{GE}=15\text{V},$ $T_j=125^{\circ}\text{C}$		2.40		
		$I_C=75\text{A}, V_{GE}=15\text{V},$ $T_j=150^{\circ}\text{C}$		2.50		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=75A,$ $R_G=4.7\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		531		ns
t_r	Rise Time			96		ns
$t_{d(off)}$	Turn-Off Delay Time			381		ns
t_f	Fall Time			260		ns
E_{on}	Turn-On Switching Loss			8.95		mJ
E_{off}	Turn-Off Switching Loss			3.52		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=75A,$ $R_G=4.7\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		522		ns
t_r	Rise Time			97		ns
$t_{d(off)}$	Turn-Off Delay Time			425		ns
t_f	Fall Time			269		ns
E_{on}	Turn-On Switching Loss			10.4		mJ
E_{off}	Turn-Off Switching Loss			5.58		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=75A,$ $R_G=4.7\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		525		ns
t_r	Rise Time			103		ns
$t_{d(off)}$	Turn-Off Delay Time			426		ns
t_f	Fall Time			320		ns
E_{on}	Turn-On Switching Loss			13.0		mJ
E_{off}	Turn-Off Switching Loss			6.63		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		9.45		nF
C_{oes}	Output Capacitance			0.34		nF
C_{res}	Reverse Transfer Capacitance			0.23		nF
Q_G	Gate Charge	$V_{CC}=600V, I_C=75A,$ $V_{GE}=15V$		360		nC
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		720		A

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

Symbol	Description	GD75PIT120C6S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^{\circ}\text{C}$	1200	V
I_F	DC Forward Current	75	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	150	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	I _F =75A, V _{GE} =0V	T _j =25℃		1.65	2.05	V
			T _j =125℃		1.65		
			T _j =150℃		1.65		
Q _r	Recovered Charge	I _F =75A, V _R =600V, R _G =4.7Ω, V _{GE} =-15V	T _j =25℃		6.9		μC
			T _j =125℃		13.1		
			T _j =150℃		15.9		
I _{RM}	Peak Reverse Recovery Current		T _j =25℃		30		A
			T _j =125℃		40		
			T _j =150℃		45		
E _{rec}	Reverse Recovery Energy		T _j =25℃		2.30		mJ
			T _j =125℃		4.73		
			T _j =150℃		5.97		

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

Symbol	Description	GD75PIT120C6S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_j=25^{\circ}\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=100^{\circ}\text{C}$	78	A
I_{RMSM}	Maximum RMS Current At Rectifier Output @ $T_C=80^{\circ}\text{C}$	120	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	1100	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	6050	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=75\text{A}$	$T_j=150^{\circ}\text{C}$		1.10		V
I_R	Reverse Current	$T_j=150^{\circ}\text{C}, V_R=1600\text{V}$				3.0	mA

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

Symbol	Description	GD75PIT120C6S	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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	80 40	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	80	A
P_{tot}	Total Power Dissipation @ $T_j=175^{\circ}\text{C}$	325	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	$V_{CE}=V_{CES}, V_{GE}=0\text{V},$ $T_j=25^{\circ}\text{C}$			5.0	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	$I_C=2.4\text{mA}, V_{CE}=V_{GE},$ $T_j=25^{\circ}\text{C}$	5.0	6.1	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=40\text{A}, V_{GE}=15\text{V},$ $T_j=25^{\circ}\text{C}$		1.80	2.25	V
		$I_C=40\text{A}, V_{GE}=15\text{V},$ $T_j=125^{\circ}\text{C}$		2.00		
		$I_C=40\text{A}, V_{GE}=15\text{V},$ $T_j=150^{\circ}\text{C}$		2.05		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=40A,$ $R_G=24\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		370		ns
t_r	Rise Time			84		ns
$t_{d(off)}$	Turn-Off Delay Time			334		ns
t_f	Fall Time			276		ns
E_{on}	Turn-On Switching Loss			5.45		mJ
E_{off}	Turn-Off Switching Loss			2.21		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=40A,$ $R_G=24\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		375		ns
t_r	Rise Time			87		ns
$t_{d(off)}$	Turn-Off Delay Time			350		ns
t_f	Fall Time			328		ns
E_{on}	Turn-On Switching Loss			6.05		mJ
E_{off}	Turn-Off Switching Loss			3.45		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=40A,$ $R_G=24\Omega, V_{GE}=\pm 15V,$ $T_j=150^\circ C$		376		ns
t_r	Rise Time			92		ns
$t_{d(off)}$	Turn-Off Delay Time			350		ns
t_f	Fall Time			338		ns
E_{on}	Turn-On Switching Loss			6.30		mJ
E_{off}	Turn-Off Switching Loss			3.70		mJ
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz,$ $V_{GE}=0V$		6.24		nF
C_{oes}	Output Capacitance			0.23		nF
C_{res}	Reverse Transfer Capacitance			0.15		nF
Q_G	Gate Charge	$V_{CC}=600V, I_C=40A,$ $V_{GE}=15V$		232		nC
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		500		A

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

Symbol	Description	GD75PIT120C6S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_J=25^{\circ}\text{C}$	1200	V
I_F	DC Forward Current	40	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	80	A

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	I _F =40A, V _{GE} =0V	T _J =25℃		2.10	2.50	V
			T _J =125℃		2.00		
			T _J =150℃		1.97		
Q _r	Recovered Charge	I _F =40A, V _R =600V, R _G =24Ω, V _{GE} =-15V	T _J =25℃		2.5		μC
			T _J =125℃		4.8		
			T _J =150℃		5.0		
I _{RM}	Peak Reverse Recovery Current		T _J =25℃		22		A
			T _J =125℃		26		
			T _J =150℃		28		
E _{rec}	Reverse Recovery Energy		T _J =25℃		1.28		mJ
			T _J =125℃		2.40		
			T _J =150℃		2.50		

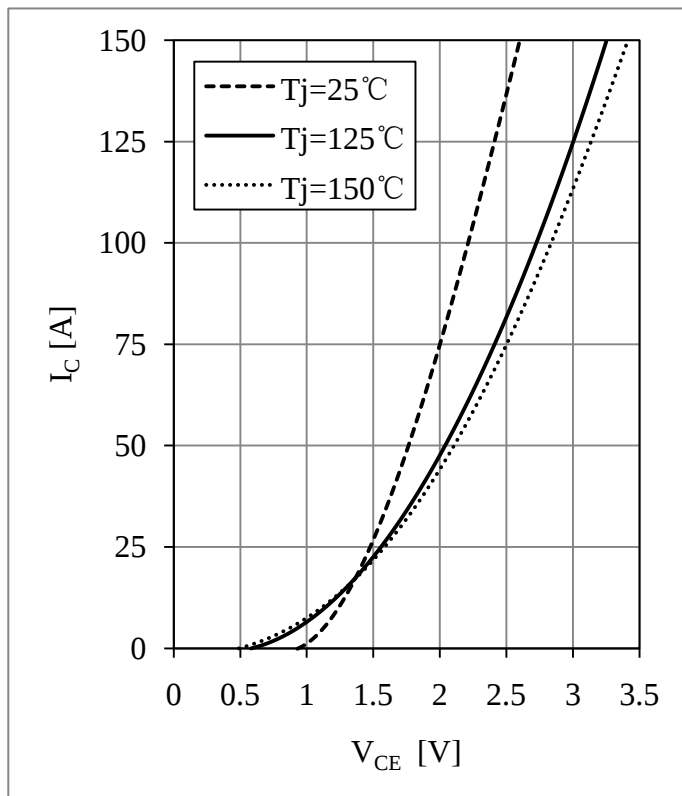
Electrical Characteristics of NTC $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K

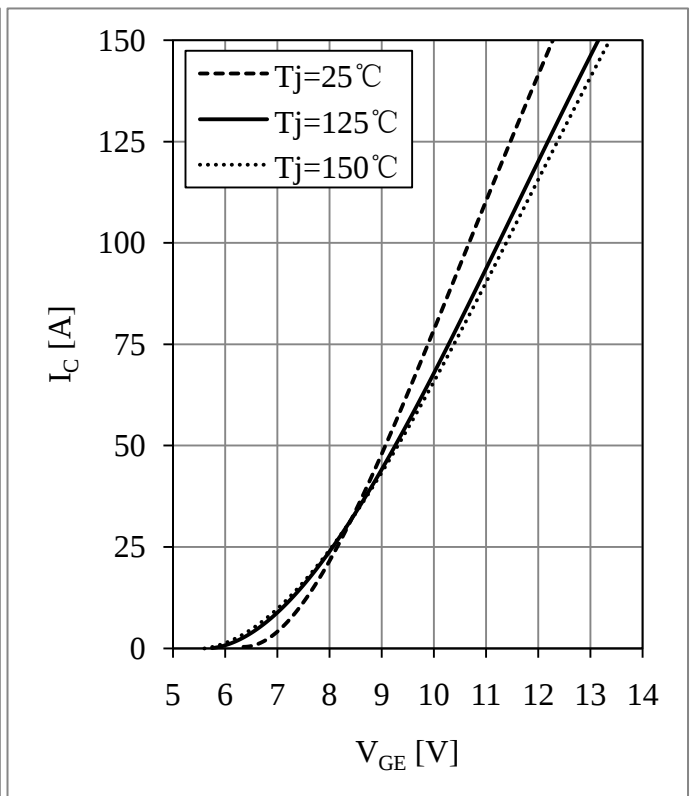
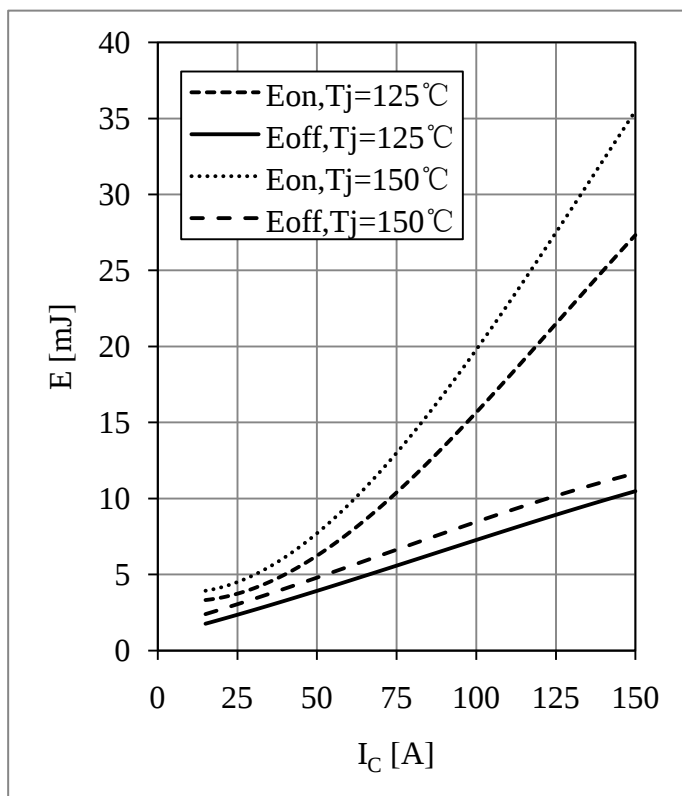
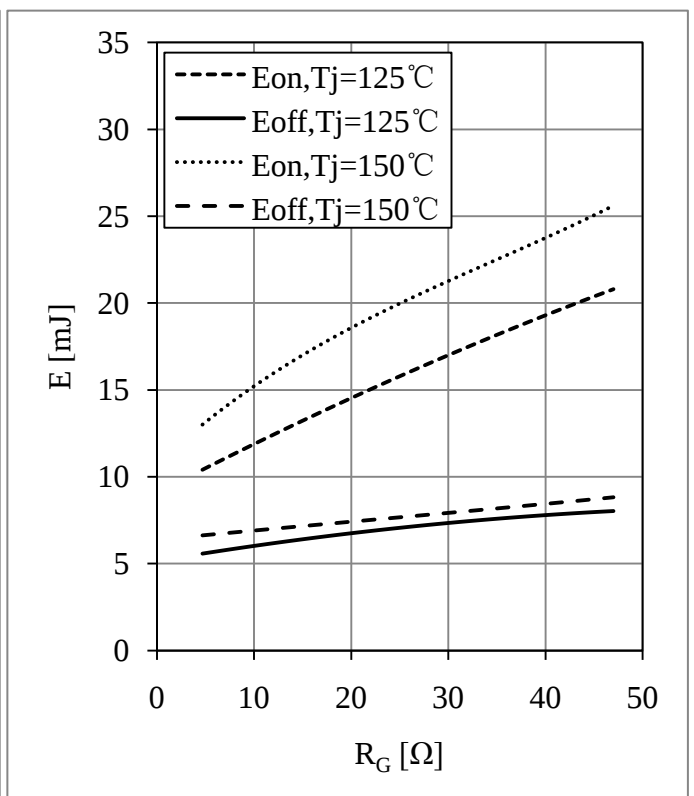
IGBT Module

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500			V
L_{CE}	Stray Inductance		60		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance, Terminal to Chip @ $T_C=25^\circ\text{C}$		4.00 2.00		m Ω
$R_{\theta JC}$	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)			0.340 0.569 0.545 0.462 1.061	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)		0.288 0.481 0.461 0.391 0.898		
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.009		K/W
T_{jmax}	Maximum Junction Temperature (inverter, brake) Maximum Junction Temperature(rectifier)			175 150	$^\circ\text{C}$
T_{jop}	Operating Junction Temperature (inverter, brake) Operating Junction Temperature(rectifier)	-40 -40		150 125	$^\circ\text{C}$
T_{STG}	Storage Temperature Range	-40		125	$^\circ\text{C}$
Mounting Torque	Mounting Screw:M5	3.0		6.0	N.m
G	Weight of Module		300		g

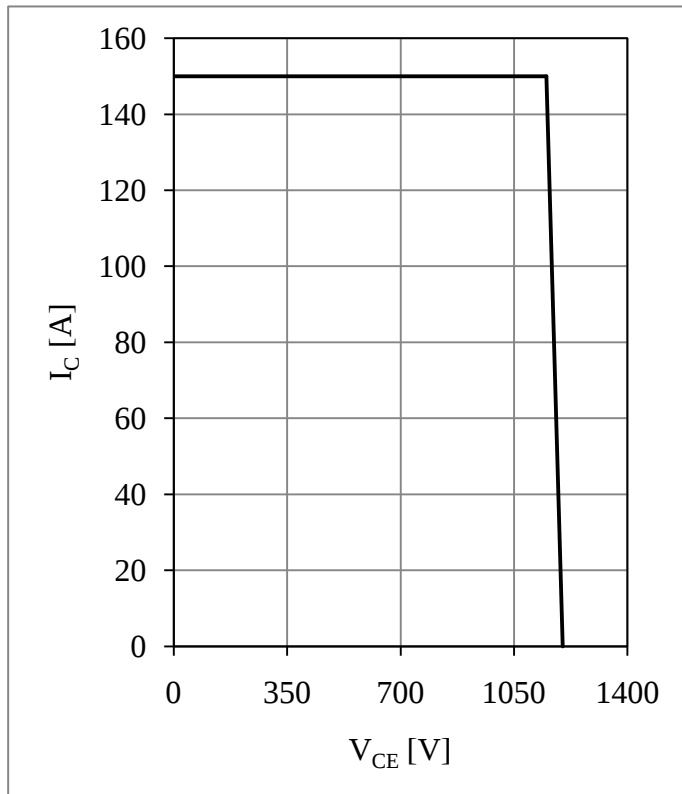
IGBT-inverter Output Characteristics

 $V_{GE}=15V$ 

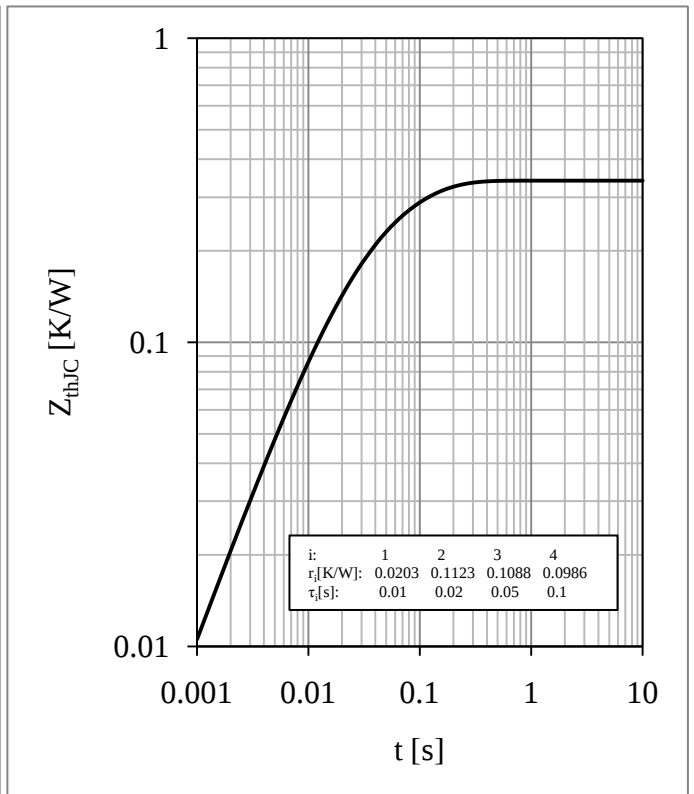
IGBT-inverter Transfer Characteristics

 $V_{CE}=20V$ IGBT-inverter Switching Loss vs. I_C $V_{CC}=600V, R_G=4.7\Omega, V_{GE}=\pm 15V$ IGBT-inverter Switching Loss vs. R_G $V_{CC}=600V, I_C=75A, V_{GE}=\pm 15V$ 

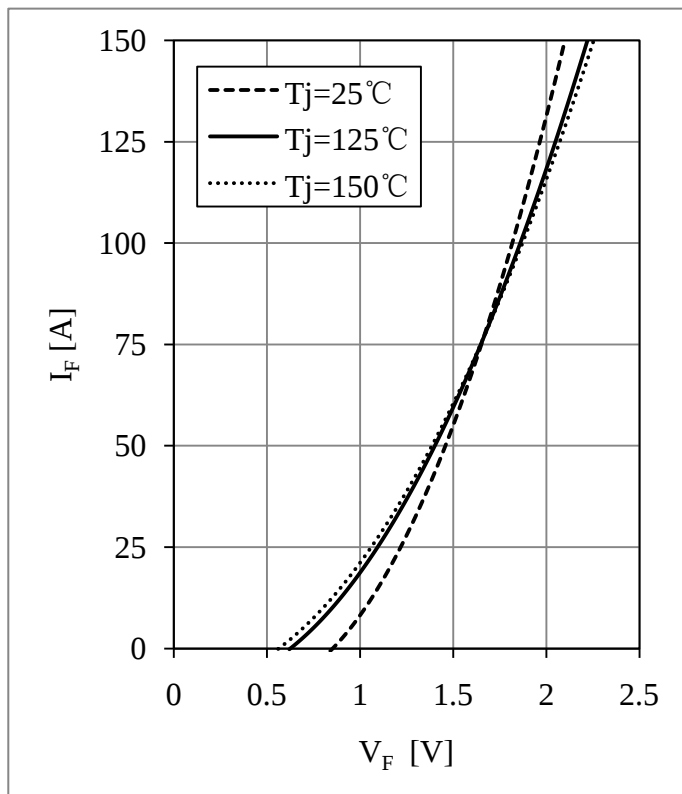
IGBT-inverter RBSOA
Module, $R_G=4.7\Omega$, $V_{GE}=\pm 15V$, $T_j=150^\circ C$



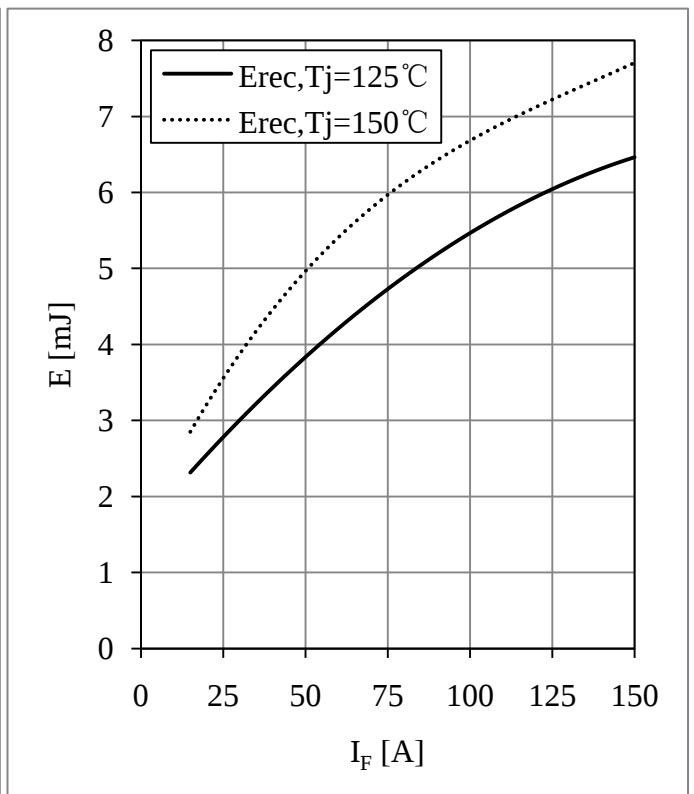
IGBT-inverter Transient Thermal Impedance



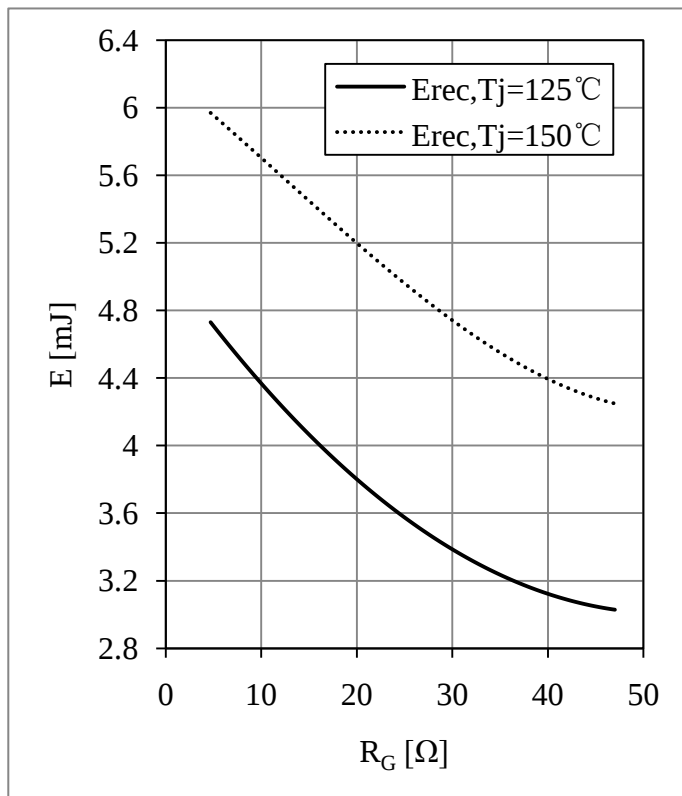
Diode-inverter Forward Characteristics



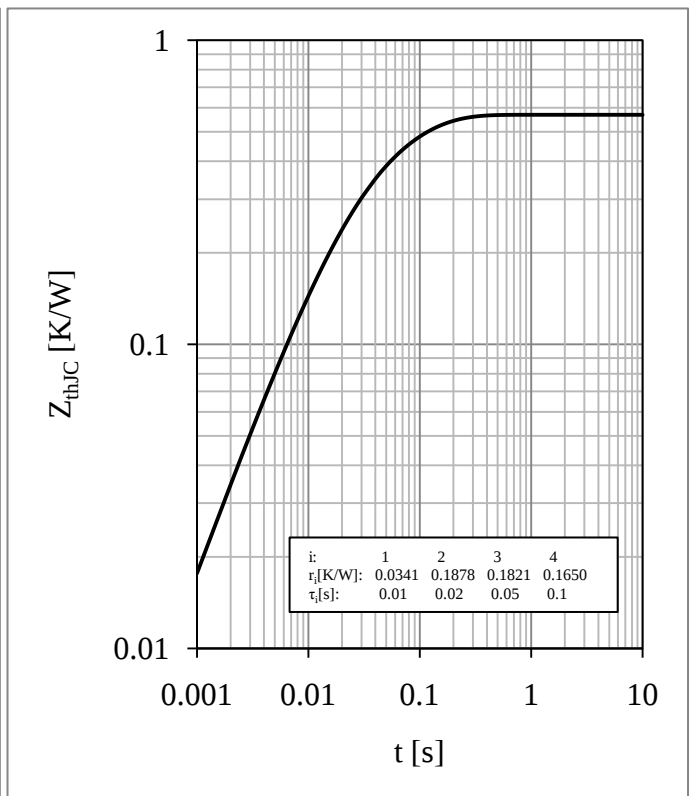
Diode-inverter Switching Loss vs. I_F
 $V_{CC}=600V$, $R_G=4.7\Omega$



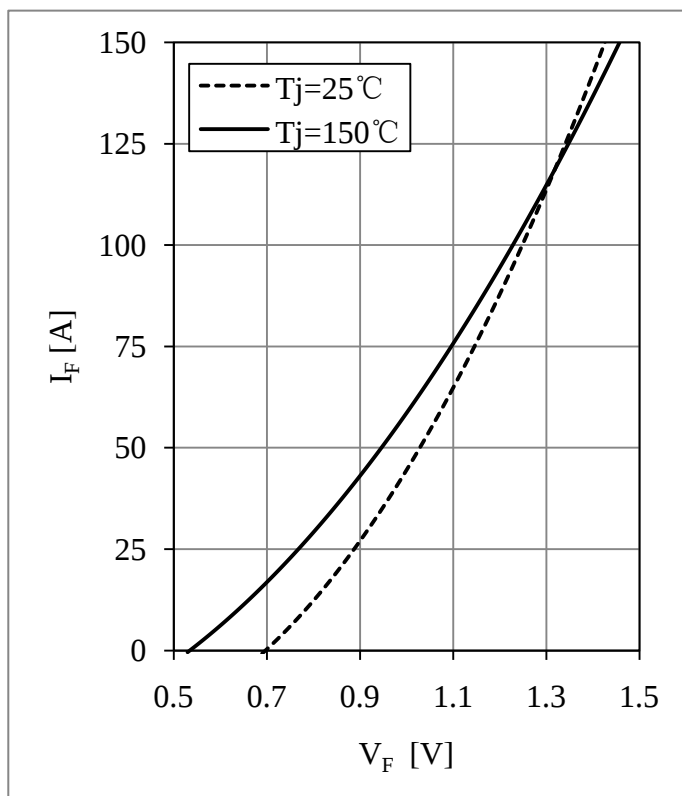
Diode-inverter Switching Loss vs. R_G
 $V_{CC}=600V, I_F=75A$



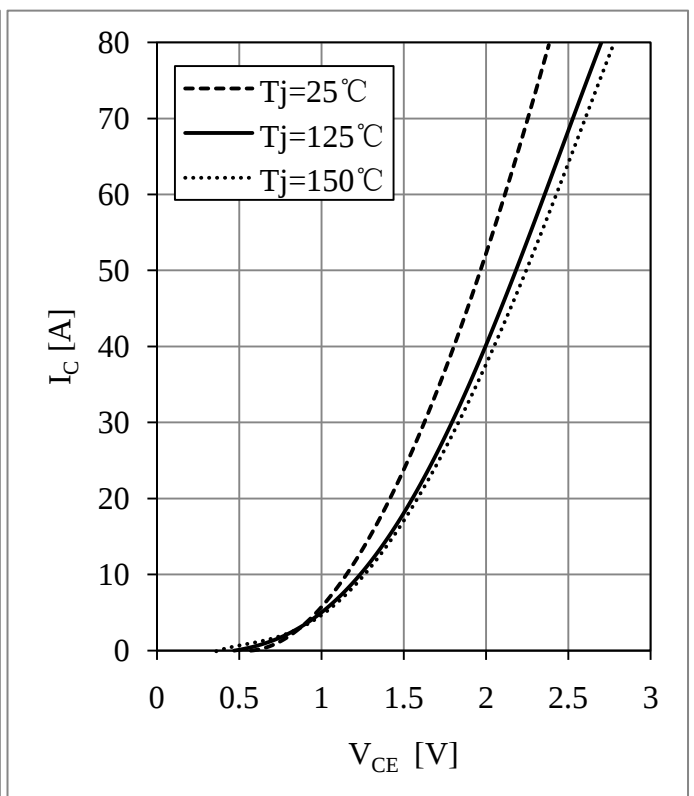
Diode-inverter Transient Thermal Impedance



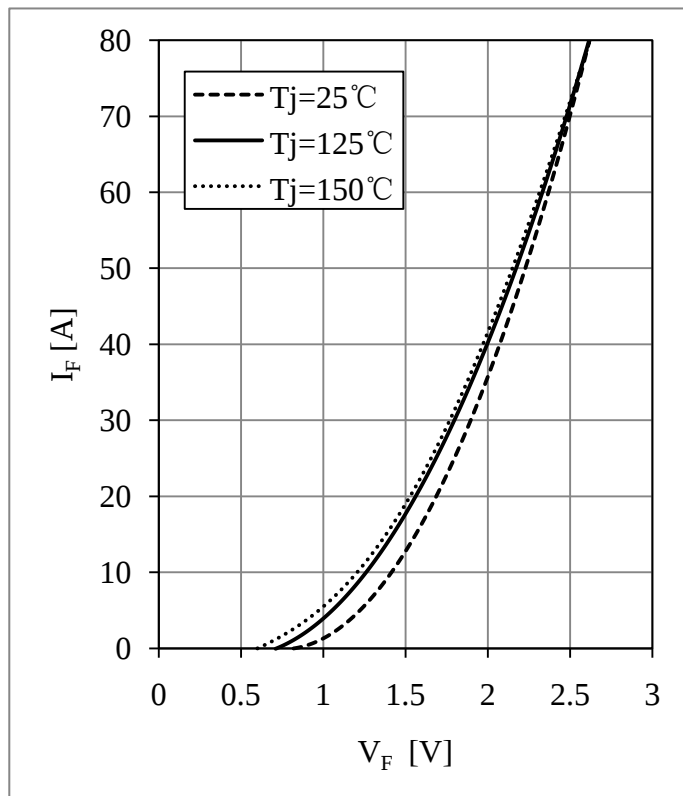
Diode-rectifier Forward Characteristics



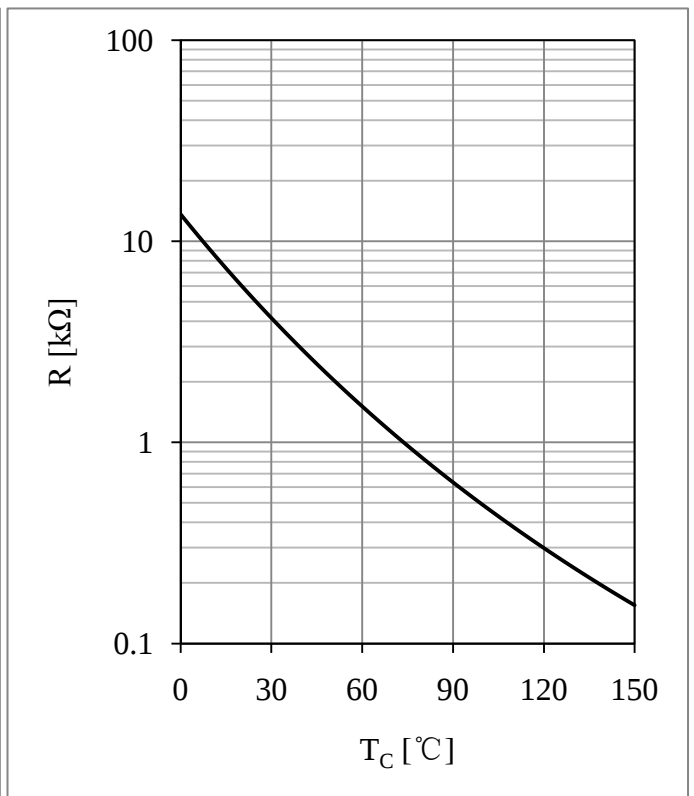
IGBT-brake-chopper Output Characteristics
 $V_{GE}=15V$



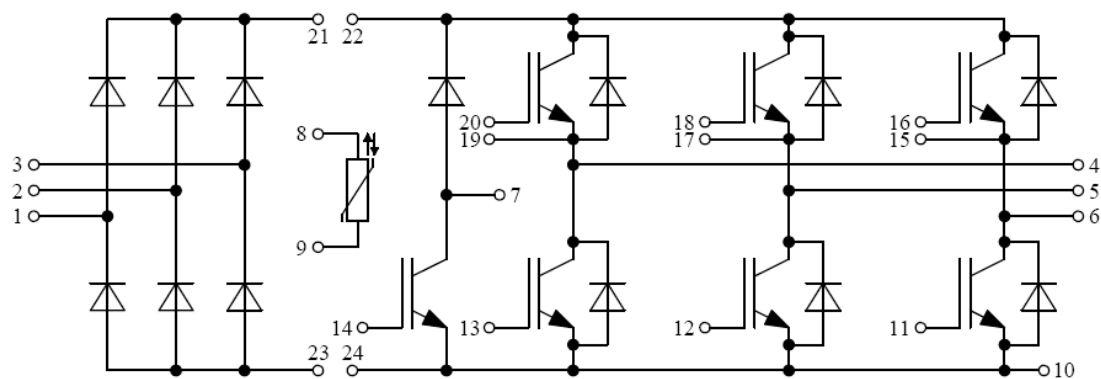
Diode-brake-chopper Forward Characteristics



NTC Temperature Characteristic



Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters

