

IGBT

GD40PIT120C5S

Preliminary

Molding Type Module

1200V/40A 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°C
- Square RBSOA
- 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	GD40PIT120C5S	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 @ $T_C=25^{\circ}\text{C}$	80	A
	@ $T_C=80^{\circ}\text{C}$	40	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	80	A
P_{tot}	Total Power Dissipation @ $T_J=175^{\circ}\text{C}$	333	W
T_{SC}	Short Circuit Withstand Time @ $T_J=150^{\circ}\text{C}$	10	μs

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		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	2.20	V
		$I_C=40\text{A}, V_{GE}=15\text{V},$ $T_J=125^{\circ}\text{C}$		2.00		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	$V_{CC}=600\text{V}, I_C=40\text{A},$ $R_G=33\Omega, V_{GE}=\pm 15\text{V},$ $T_J=25^{\circ}\text{C}$		7.50		mJ
E_{off}	Turn-Off Switching Loss			5.40		mJ
E_{tot}	Total Switching Loss			12.90		mJ
E_{on}	Turn-On Switching Loss	$V_{CC}=600\text{V}, I_C=40\text{A},$ $R_G=33\Omega, V_{GE}=\pm 15\text{V},$ $T_J=125^{\circ}\text{C}$		8.50		mJ
E_{off}	Turn-Off Switching Loss			6.90		mJ
E_{tot}	Total Switching Loss			15.40		mJ

GD40PIT120C5S**IGBT Module**

$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=40A,$ $R_G=33\Omega, V_{GE}=\pm 15V,$ $T_J=125^\circ C$		495		ns
t_r	Rise Time			110		ns
$t_{d(off)}$	Turn-Off Delay Time			550		ns
t_f	Fall Time			400		ns
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	$V_{CC}=600V, I_C=50A,$ $V_{GE}=15V$		290		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-inverter $T_C=25^\circ C$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD40PIT120C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_J=25^\circ C$	1200	V
I_F	DC Forward Current	40	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1ms$	80	A
I^2t	I^2t -value, $V_R=0V, t_p=10ms, T_J=125^\circ C$	330	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	I _F =40A, V _{GE} =0V	T _j =25°C		2.10	2.45	V
			T _j =125°C		2.00		
Q _r	Recovered Charge	I _F =40A, V _R =600V, di/dt=-410A/μs, V _{GE} =-15V	T _j =25°C		4.0		μC
			T _j =125°C		8.0		
I _{RM}	Peak Reverse Recovery Current		T _j =25°C		19.5		A
			T _j =125°C		20.0		
E _{rec}	Reverse Recovery Energy		T _j =25°C		1.49		mJ
			T _j =125°C		3.00		

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

Symbol	Description	GD40PIT120C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_J=25^{\circ}\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=100^{\circ}\text{C}$	42	A
I_{RMSM}	Maximum RMS Current At Rectifier Output @ $T_C=80^{\circ}\text{C}$	60	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_J=45^{\circ}\text{C}$	600	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_J=45^{\circ}\text{C}$	1800	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=40\text{A}$	$T_J=150^{\circ}\text{C}$		1.20		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	GD40PIT120C5S	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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=80^{\circ}\text{C}$	30 15	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	50	A
P_{tot}	Total Power Dissipation @ $T_J=150^{\circ}\text{C}$	187	W
T_{SC}	Short Circuit Withstand Time @ $T_J=150^{\circ}\text{C}$	10	μs

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	$I_C=125\mu A, V_{CE}=V_{GE}, T_j=25^\circ C$	4.4	5.1	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=15A, V_{GE}=15V, T_j=25^\circ C$		2.46	2.85	V
		$I_C=15A, V_{GE}=15V, T_j=125^\circ C$		2.85		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	$V_{CC}=600V, I_C=15A, R_G=22\Omega, V_{GE}=\pm 15V, T_j=25^\circ C$		1.10		mJ
E_{off}	Turn-Off Switching Loss			0.67		mJ
E_{tot}	Total Switching Loss			1.77		mJ
E_{on}	Turn-On Switching Loss	$V_{CC}=600V, I_C=15A, R_G=22\Omega, V_{GE}=\pm 15V, T_j=125^\circ C$		1.40		mJ
E_{off}	Turn-Off Switching Loss			1.10		mJ
E_{tot}	Total Switching Loss			2.50		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=15A, R_G=22\Omega, V_{GE}=\pm 15V, T_j=125^\circ C$		125		ns
t_r	Rise Time			24		ns
$t_{d(off)}$	Turn-Off Delay Time			150		ns
t_f	Fall Time			241		ns
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz, V_{GE}=0V$		1.11		nF
C_{oes}	Output Capacitance			0.10		nF
C_{res}	Reverse Transfer Capacitance			0.04		nF
Q_G	Gate charge	$V_{CC}=400V, I_C=15A, V_{GE}=15V$		95		nC
I_{SC}	SC Data	$T_P \leq 10\mu s, V_{GE}=15V, T_j=125^\circ C, V_{CC}=900V, V_{CEM} \leq 1200V$		120		A

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

Symbol	Description	GD40PIT120C5S	Units
V_{RRM}	Repetitive Peak Reverse Voltage @ $T_J=25^{\circ}\text{C}$	1200	V
I_F	DC Forward Current	15	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	30	A
I^2t	I^2t -value, $V_R=0\text{V}$, $t_p=10\text{ms}$, $T_J=125^{\circ}\text{C}$	60	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	I _F =15A,V _{GE} =0V	T _j =25℃		2.05	2.45	V
			T _j =125℃		2.15		
Q _r	Recovered Charge	I _F =15A, V _R =600V, di/dt=-400A/μs, V _{GE} =-15V	T _j =25℃		1.90		μC
			T _j =125℃		3.00		
I _{RM}	Peak Reverse Recovery Current		T _j =25℃		15.0		A
			T _j =125℃		16.0		
E _{rec}	Reverse Recovery Energy		T _j =25℃		0.55		mJ
			T _j =125℃		1.15		

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=50Hz,t=1min		2500		V
L _{CE}	Stray Inductance		60		nH
R _{CC'+EE'}	Module Lead Resistance,Terminal to Chip @ T _C =25℃		4.00		mΩ
R _{θJC}	Junction-to-Case (per IGBT-inverter)			0.45	K/W
	Junction-to-Case (per DIODE-inverter)			0.95	
	Junction-to-Case (per DIODE-rectifier)			0.84	
	Junction-to-Case (per IGBT-brake-chopper)			0.67	
	Junction-to-Case (per DIODE-brake-chopper)			1.24	
R _{θCS}	Case-to-Sink (Conductive grease applied)		0.02		K/W
T _j	Maximum Junction Temperature			175	℃
T _{STG}	Storage Temperature Range	-40		125	℃
Mounting Torque	Mounting Screw:M5	3.0		6.0	N.m
G	Weight of Module		180		g

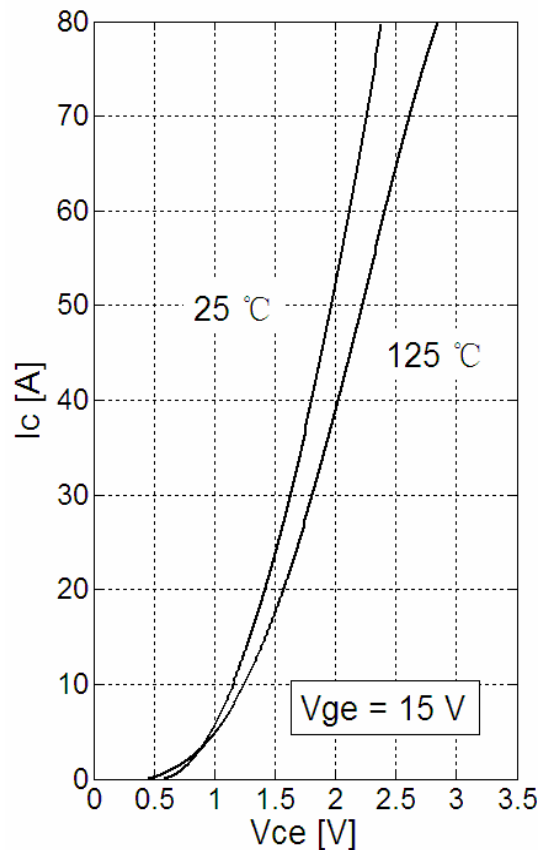


Fig 1. IGBT-inverter Output Characteristics

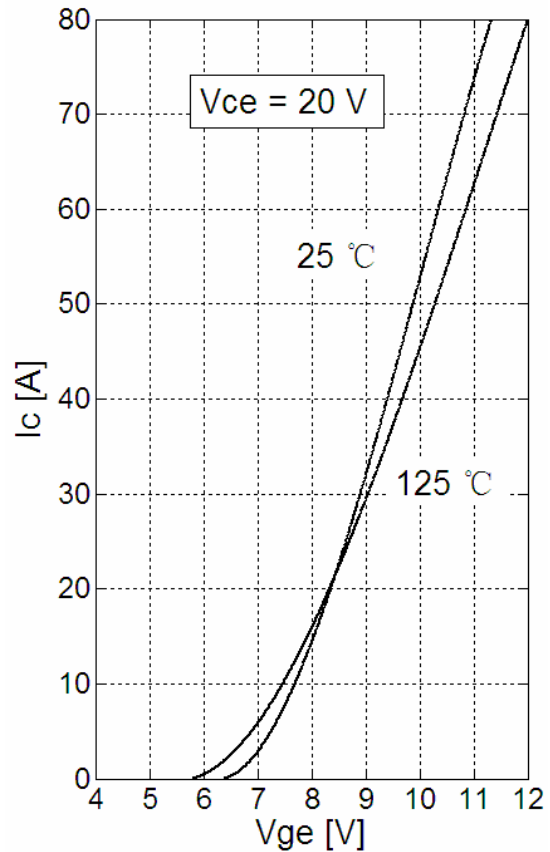
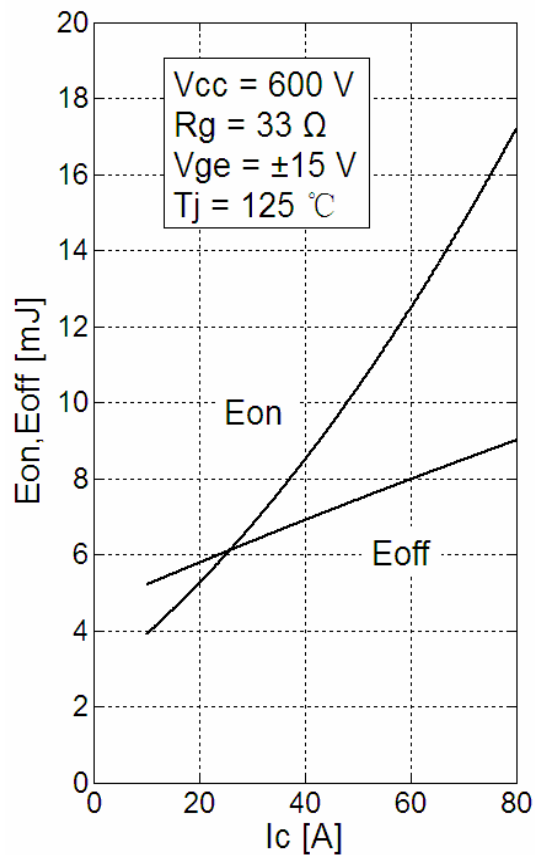
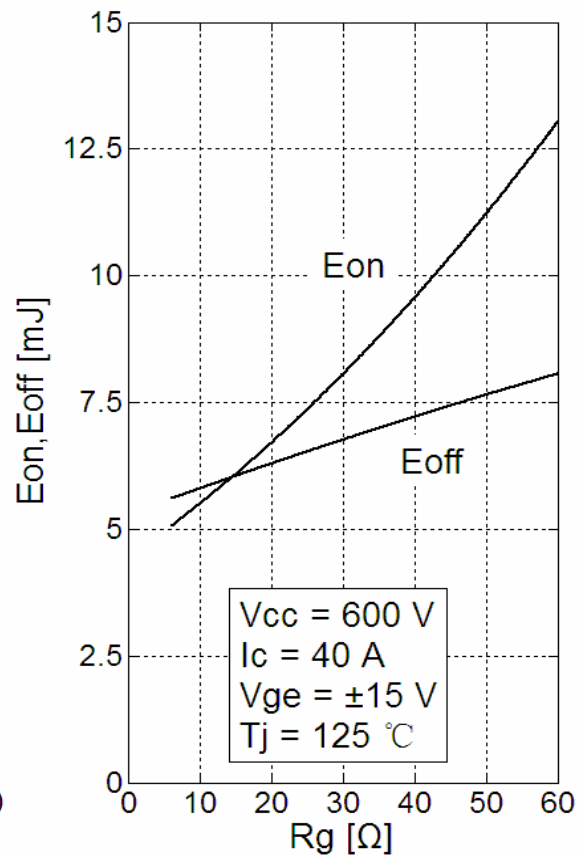


Fig 2. IGBT-inverter Transfer Characteristics

Fig 3. IGBT-inverter Switching Loss vs. I_c Fig 4. IGBT-inverter Switching Loss vs. R_g

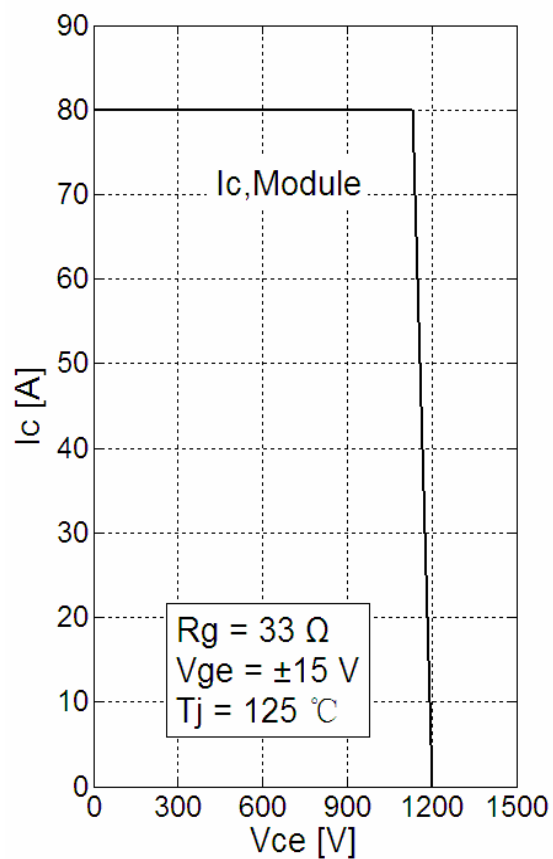


Fig 5. IGBT-inverter RBSOA

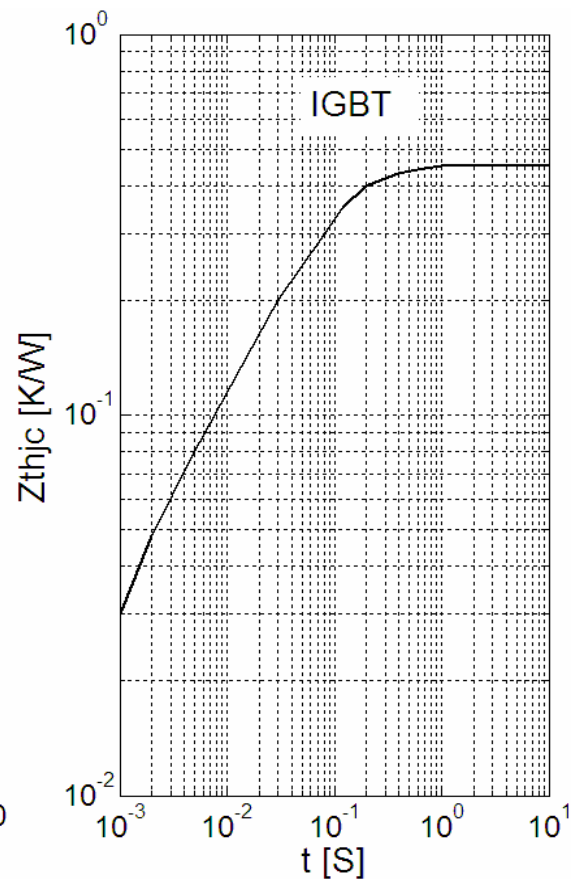


Fig 6. IGBT-inverter Transient Thermal Impedance

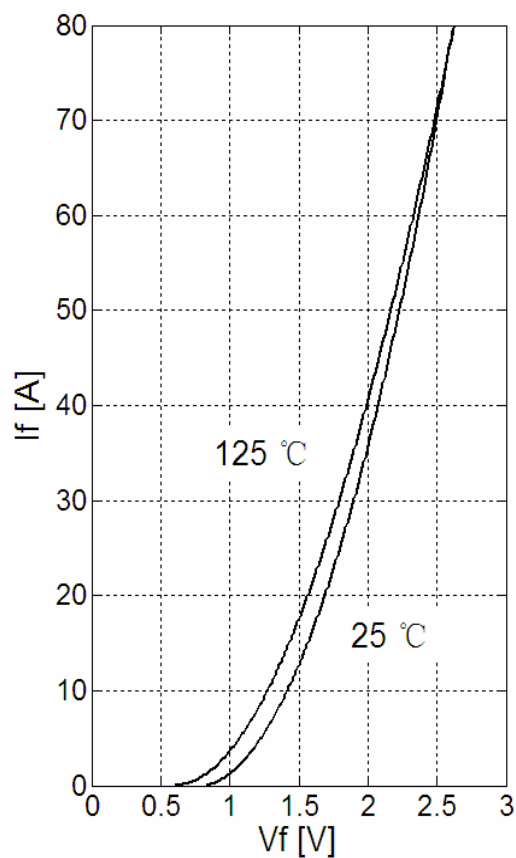
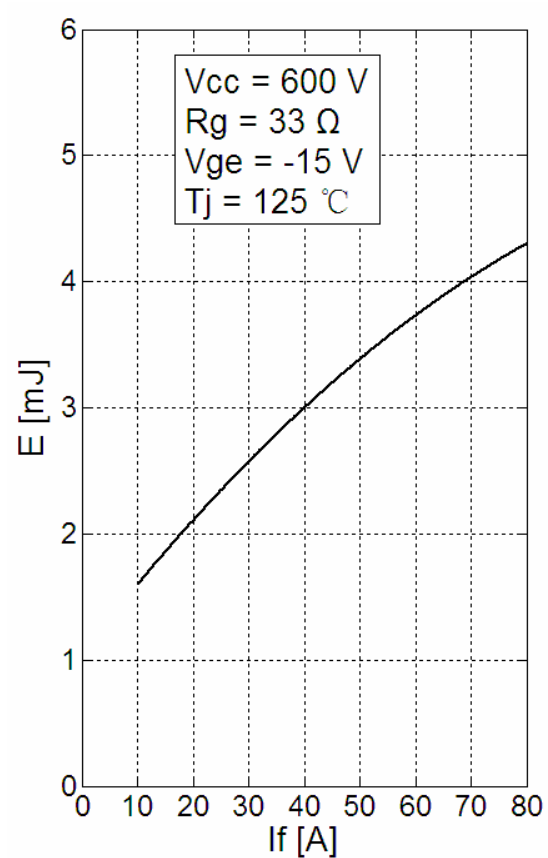
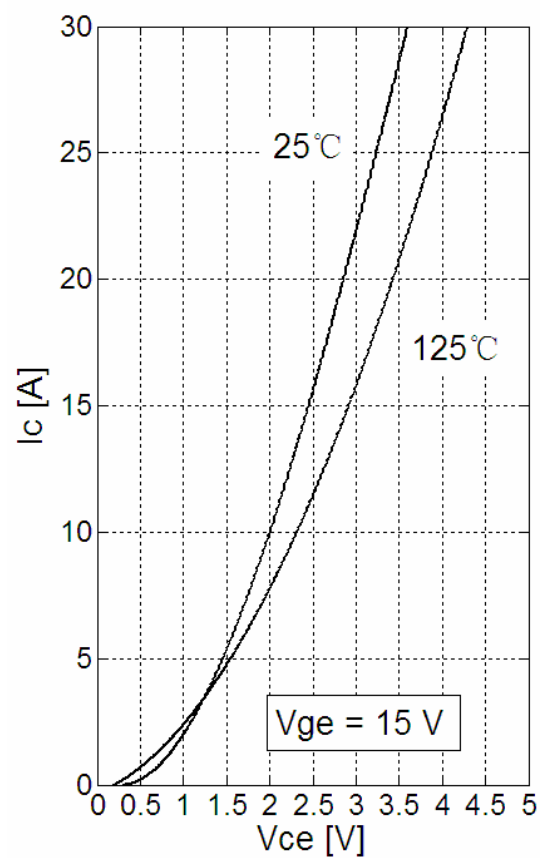
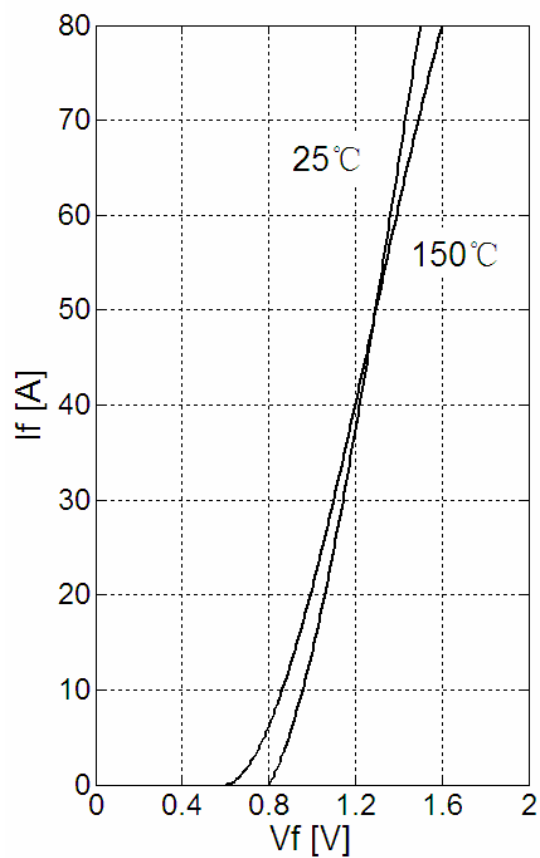
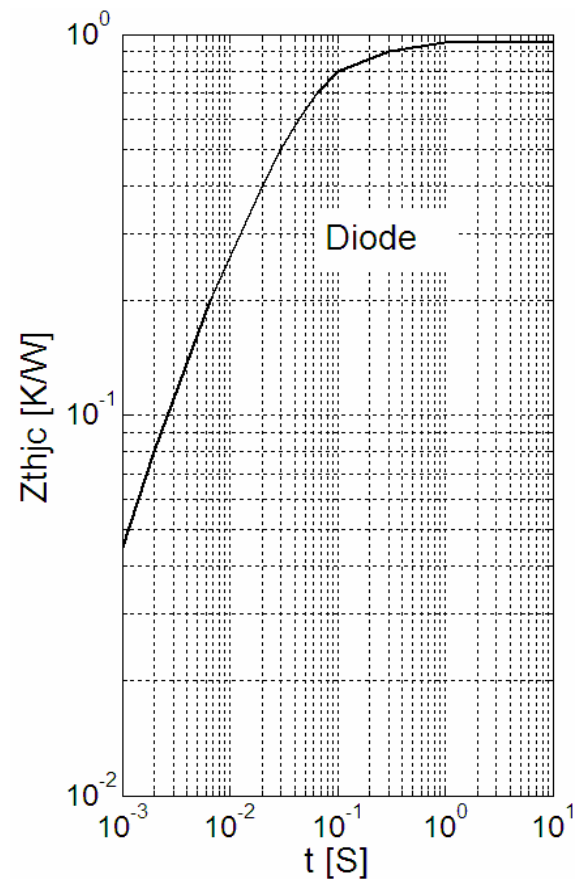
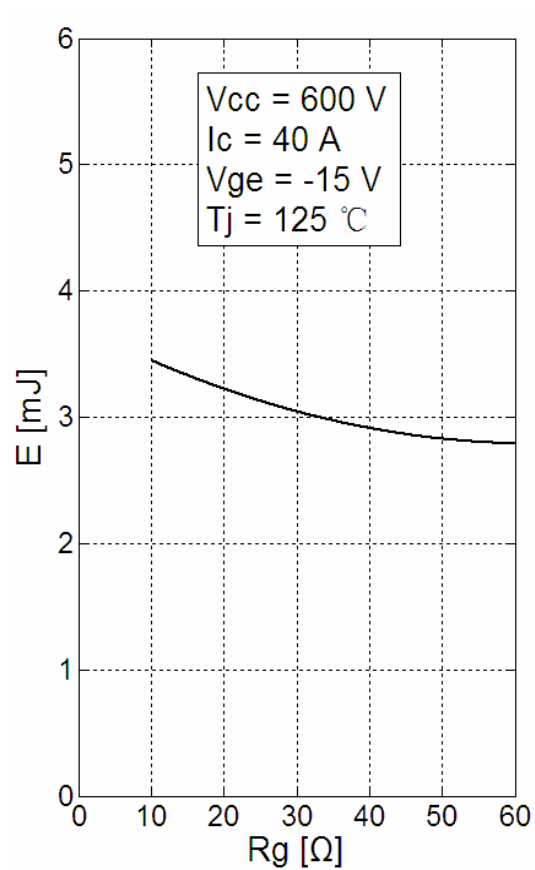


Fig 7. Diode-inverter Forward Characteristics

Fig 8. Diode-inverter Switching Loss vs. I_f



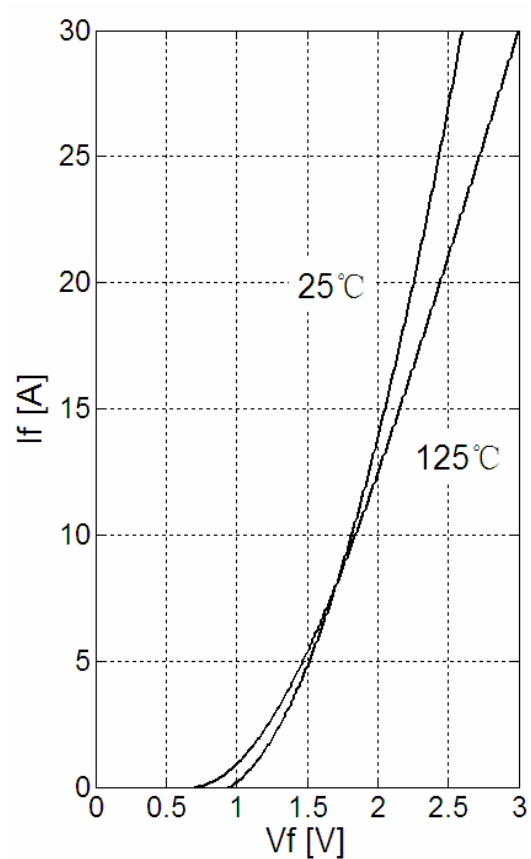


Fig 13. Diode-brake Forward Characteristics

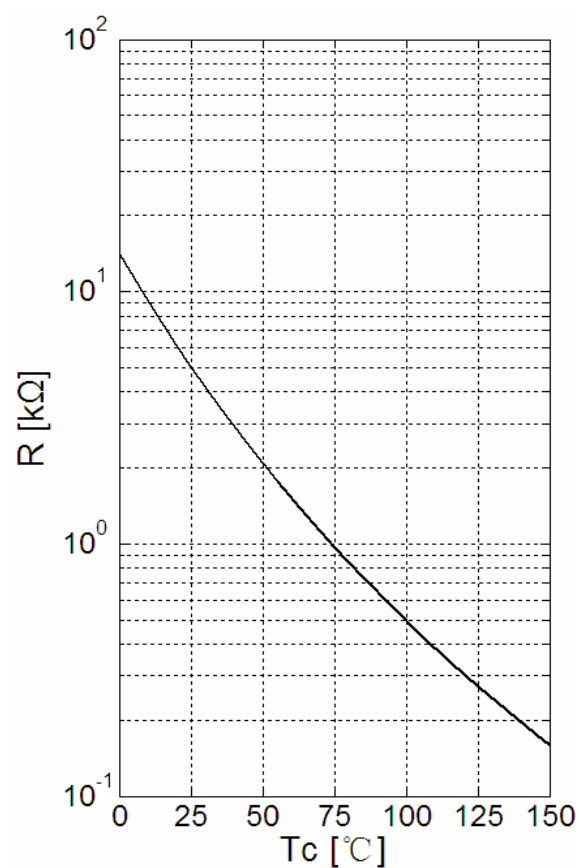
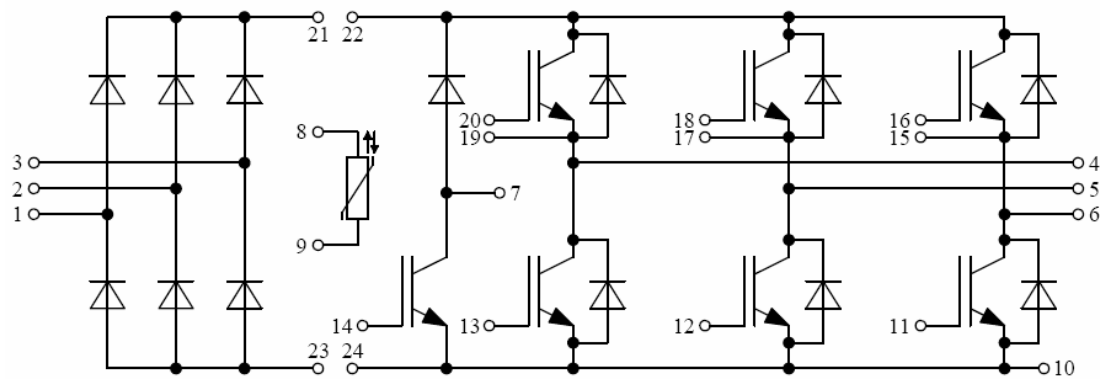


Fig 14. NTC-Temperature Characteristic

Equivalent Circuit Schematic



Package Dimension

Dimensions in Millimeters

