

IGBT

GD50PIL120C6S

Preliminary

Molding Type Module

1200V/50A PIM in one-package



Features

- High short circuit capability, self limiting to $6 \cdot I_C$
- $10\mu s$ short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- 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	GD50PIL120C6S	Units
V_{CES}	Collector-Emitter Voltage @ $T_J=25^{\circ}\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=80^{\circ}\text{C}$	100 50	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	100	A
P_{tot}	Total Power Dissipation @ $T_J=150^{\circ}\text{C}$	403	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
BV_{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	$I_C=2.0\text{mA}, V_{CE}=V_{GE},$ $T_J=25^{\circ}\text{C}$	5.0	6.2	7.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=50\text{A}, V_{GE}=15\text{V},$ $T_J=25^{\circ}\text{C}$		1.77	2.20	V
		$I_C=50\text{A}, V_{GE}=15\text{V},$ $T_J=125^{\circ}\text{C}$		1.99		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	$V_{CC}=600\text{V}, I_C=50\text{A},$ $R_G=15\Omega, V_{GE}=\pm 15\text{V},$ $T_J=25^{\circ}\text{C}$		5.6		mJ
E_{off}	Turn-Off Switching Loss			2.9		mJ
E_{tot}	Total Switching Loss			8.5		mJ
E_{on}	Turn-On Switching Loss	$V_{CC}=600\text{V}, I_C=50\text{A},$ $R_G=15\Omega, V_{GE}=\pm 15\text{V},$ $T_J=125^{\circ}\text{C}$		6.9		mJ
E_{off}	Turn-Off Switching Loss			4.4		mJ
E_{tot}	Total Switching Loss			11.3		mJ

$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=50A,$ $R_G=15\Omega, V_{GE} = \pm 15V,$ $T_J=25^\circ C$		392		ns
t_r	Rise Time			74		ns
$t_{d(off)}$	Turn-Off Delay Time			379		ns
t_f	Fall Time			380		ns
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=50A,$ $R_G=15\Omega, V_{GE} = \pm 15V,$ $T_J=125^\circ C$		403		ns
t_r	Rise Time			69		ns
$t_{d(off)}$	Turn-Off Delay Time			408		ns
t_f	Fall Time			381		ns
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1Mhz,$ $V_{GE}=0V$		4.29		nF
C_{oes}	Output Capacitance			0.30		nF
C_{res}	Reverse Transfer Capacitance			0.20		nF
Q_G	Gate charge	$V_{CC}=600V, I_C=57A,$ $V_{GE}=-15\dots+15V$		611		nC
R_{Gint}	Internal Gate Resistance			10		Ω
I_{SC}	SC Data	$T_P \leq 10\mu s, V_{GE}=15V,$ $T_J=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		270		A

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

Maximum Rated Values

Symbol	Description	GD50PIL120C6S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_J=25^\circ C$	1200	V
I_F	DC Forward Current @ $T_C=80^\circ C$	50	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1ms$	100	A
I^2t	I^2t -value, $V_R=0V, t_p=10ms, T_J=125^\circ C$	690	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	I _F =50A,V _{GE} =0V	T _j =25°C		1.78	2.20	V
			T _j =125°C		1.90		
Q _{rr}	Recovered Charge	I _F =50A, V _R =600V, di/dt=-830A/μs, V _{GE} =-15V	T _j =25°C		3.3		μC
			T _j =125°C		6.5		
I _{RM}	Peak Reverse Recovery Current		T _j =25°C		34		A
			T _j =125°C		47		
E _{rec}	Reverse Recovery Energy		T _j =25°C		0.76		mJ
			T _j =125°C		1.81		

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

Symbol	Description	GD50PIL120C6S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_j=25^{\circ}\text{C}$	1600	V
$I_{F(AV)}$	Average On-state Current @ $T_C=100^{\circ}\text{C}$	59	A
I_{RMSM}	Maximum RMS Current at Rectifier Output @ $T_C=80^{\circ}\text{C}$	120	A
I_{FSM}	Surge Forward Current $V_R=0\text{V}, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	850	A
I^2t	I^2t -value, $V_R=0\text{V}, t_p=10\text{ms}, T_j=150^{\circ}\text{C}$	850	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=80\text{A}$	$T_j=25^{\circ}\text{C}$		1.23	V
			$T_j=150^{\circ}\text{C}$		1.17	
I_R	Reverse Current	$T_j=150^{\circ}\text{C}, V_R=1600\text{V}$			1.5	mA

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

Symbol	Description	GD50PIL120C6S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^{\circ}\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=80^{\circ}\text{C}$	50	A
		25	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	50	A
P_{tot}	Total Power Dissipation @ $T_j=150^{\circ}\text{C}$	227	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
BV_{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	$I_C=250\mu A, V_{CE}=V_{GE}, T_J=25^\circ C$	4.0	5.0	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=25A, V_{GE}=15V, T_J=25^\circ C$		2.35	2.75	V
		$I_C=25A, V_{GE}=15V, T_J=125^\circ C$		2.60		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	$V_{CC}=600V, I_C=25A, R_G=10\Omega, V_{GE}=\pm 15V, T_J=25^\circ C$		2.5		mJ
E_{off}	Turn-Off Switching Loss			2.1		mJ
E_{tot}	Total Switching Loss			4.6		mJ
E_{on}	Turn-On Switching Loss	$V_{CC}=600V, I_C=25A, R_G=10\Omega, V_{GE}=\pm 15V, T_J=125^\circ C$		3.4		mJ
E_{off}	Turn-Off Switching Loss			2.9		mJ
E_{tot}	Total Switching Loss			6.3		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=25A, R_G=10\Omega, V_{GE}=\pm 15V, T_J=125^\circ C$		80		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			510		ns
t_f	Fall Time			230		ns
C_{ies}	Input Capacitance	$V_{CE}=30V, f=1Mhz, V_{GE}=0V$		2.37		nF
C_{oes}	Output Capacitance			0.46		nF
C_{res}	Reverse Transfer Capacitance			0.06		nF
Q_G	Gate charge	$V_{CC}=400V, I_C=25A, V_{GE}=-15\dots+15V$		175		nC
R_{Gint}	Internal Gate Resistance			/		Ω
I_{SC}	SC Data	$T_P \leq 10\mu s, V_{GE}=15V, T_J=125^\circ C, V_{CC}=900V, V_{CEM} \leq 1200V$		TBD		A

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

Symbol	Description	GD50PIL120C6S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_J=25^{\circ}\text{C}$	1200	V
I_F	DC Forward Current @ $T_C=80^{\circ}\text{C}$	25	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	50	A
I^2t	I^2t -value, $V_R=0\text{V}$, $t_p=10\text{ms}$, $T_J=125^{\circ}\text{C}$	170	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	I _F =25A,V _{GE} =0V	T _j =25℃		1.78	2.20	V
			T _j =125℃		1.90		
Q _r	Diode Forward Voltage	I _F =25A, V _R =600V, di/dt=-700A/μs, V _{GE} =-15V	T _j =25℃		2.1		μC
			T _j =125℃		4.5		
I _{RM}	Recovered Charge		T _j =25℃		26		A
			T _j =125℃		24		
E _{rec}	Peak Reverse Recovery Current		T _j =25℃		0.66		mJ
			T _j =125℃		1.55		

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)			0.31	K/W
	Junction-to-Case (per DIODE-inverter)			0.59	
	Junction-to-Case (per DIODE-rectifier)			0.62	
	Junction-to-Case (per IGBT-brake-chopper)			0.55	
	Junction-to-Case (per DIODE-brake-chopper)			0.70	
R _{θCS}	Case-to-Sink (Conductive grease applied)		0.009		K/W
T _j	Maximum Junction Temperature			150	℃
T _{STG}	Storage Temperature Range	-40		125	℃
Mounting Torque	Mounting Screw:M5	3.0		6.0	N.m
G	Weight of Module		300		g

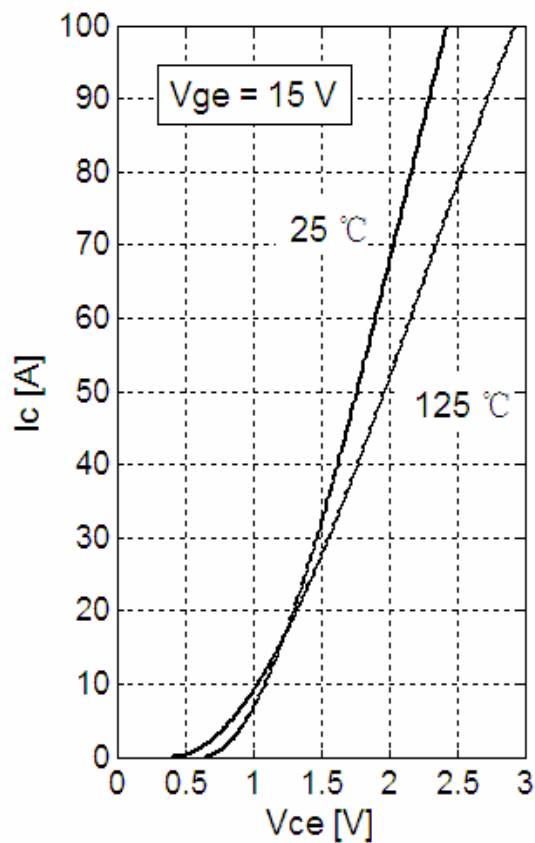


Fig 1. Typical IGBT Output Characteristics

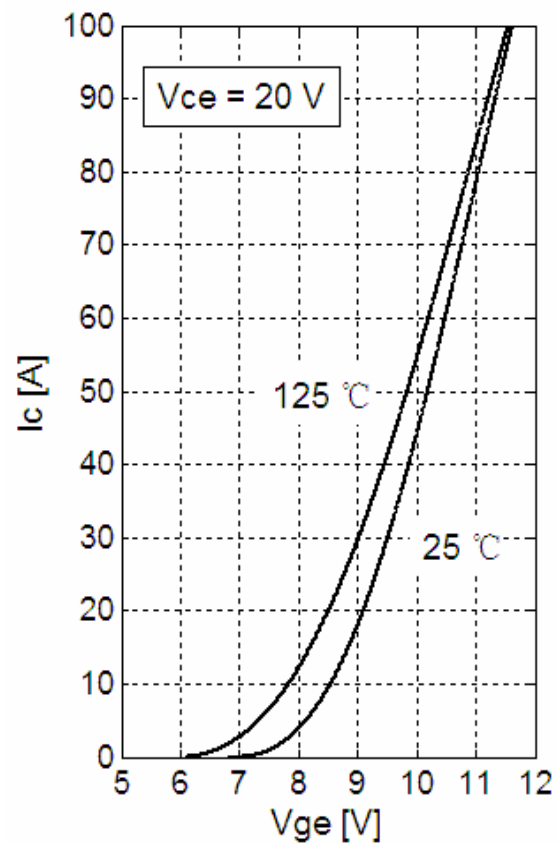
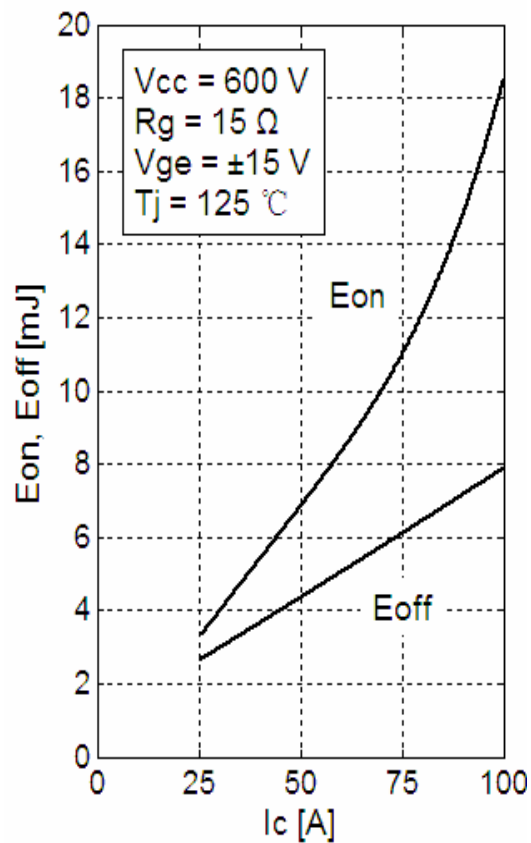
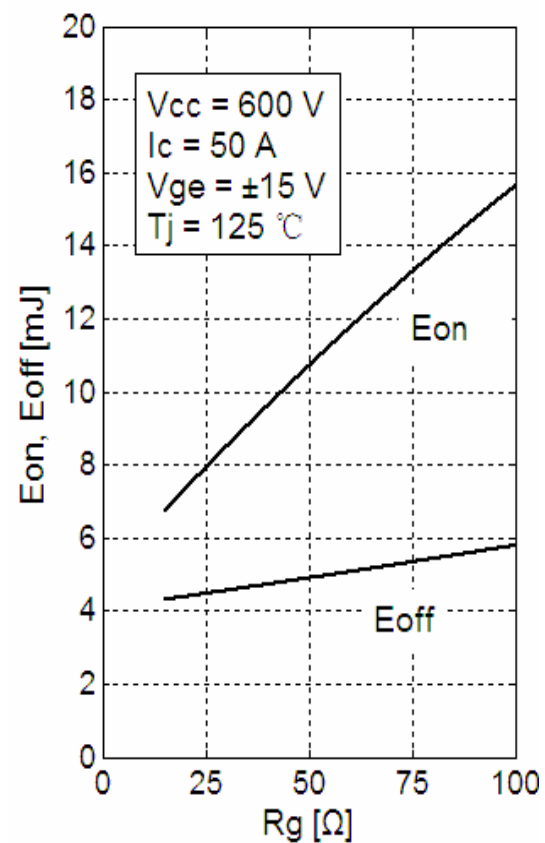


Fig 2. Typical IGBT Transfer Characteristics

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

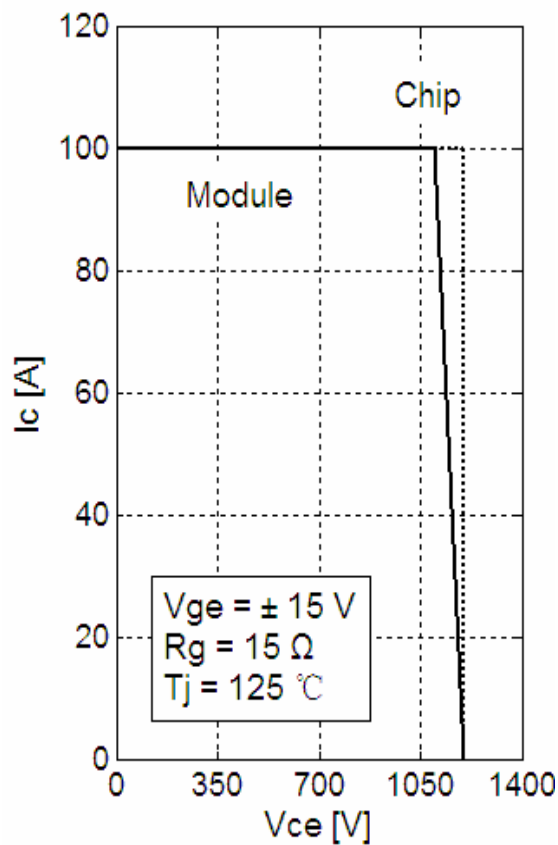


Fig 5. RBSOA

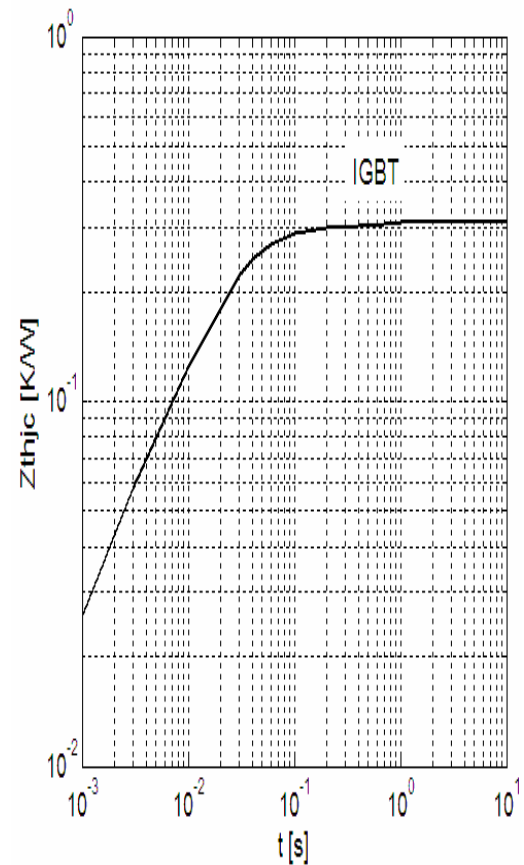


Fig 6. IGBT Transient Thermal Impedance

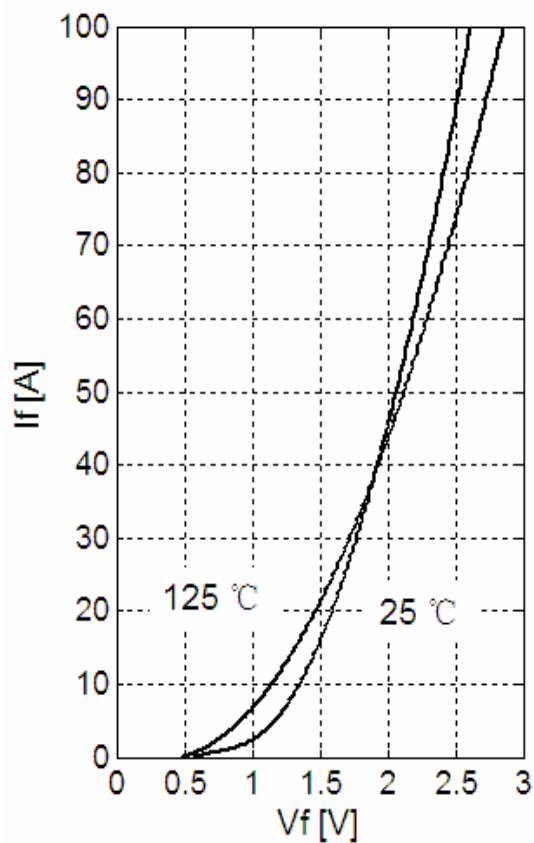
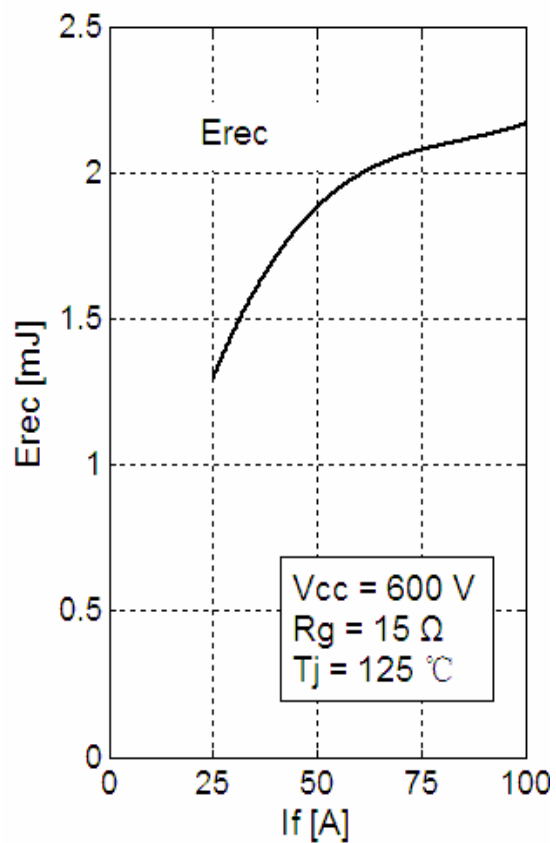


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_f

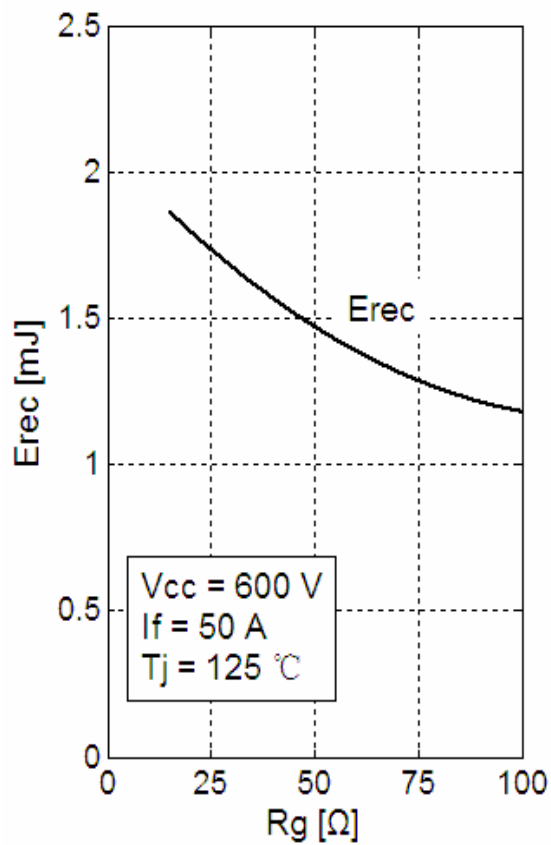
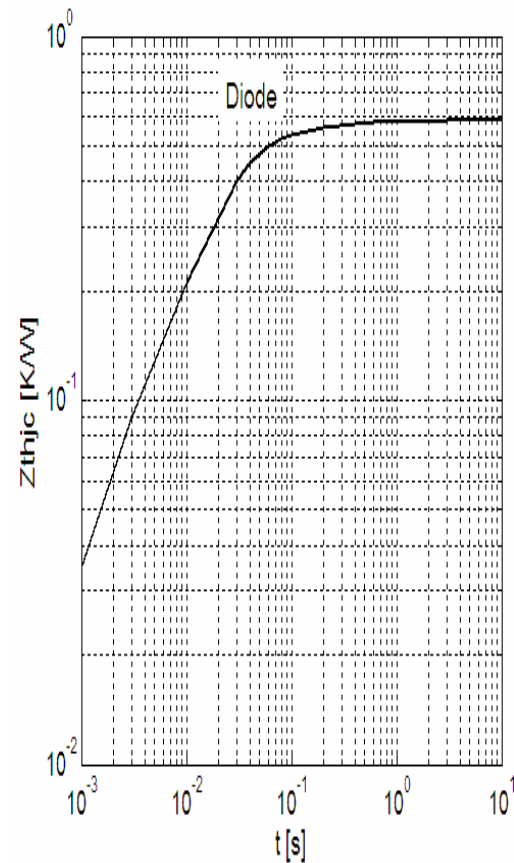
Fig9. Diode Switching Loss vs. R_G 

Fig 10. Diode Transient Thermal Impedance

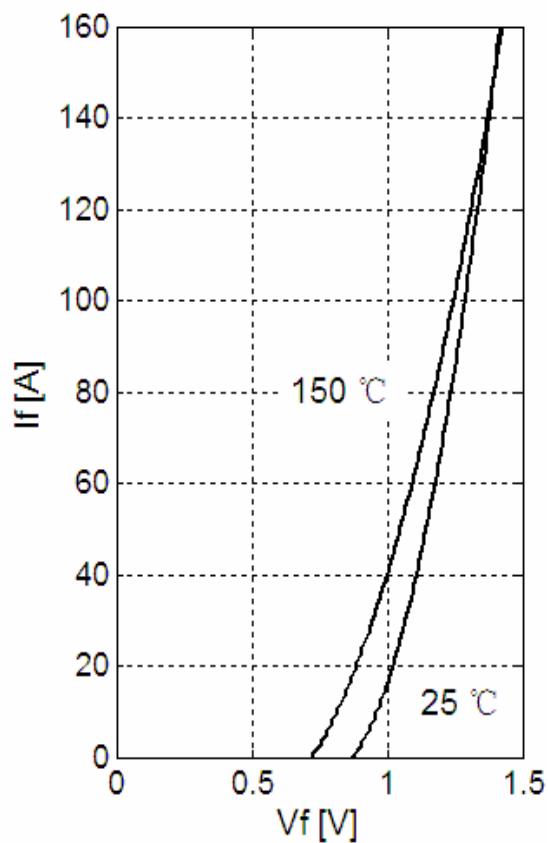


Fig 11. Rectifier Forward Characteristics

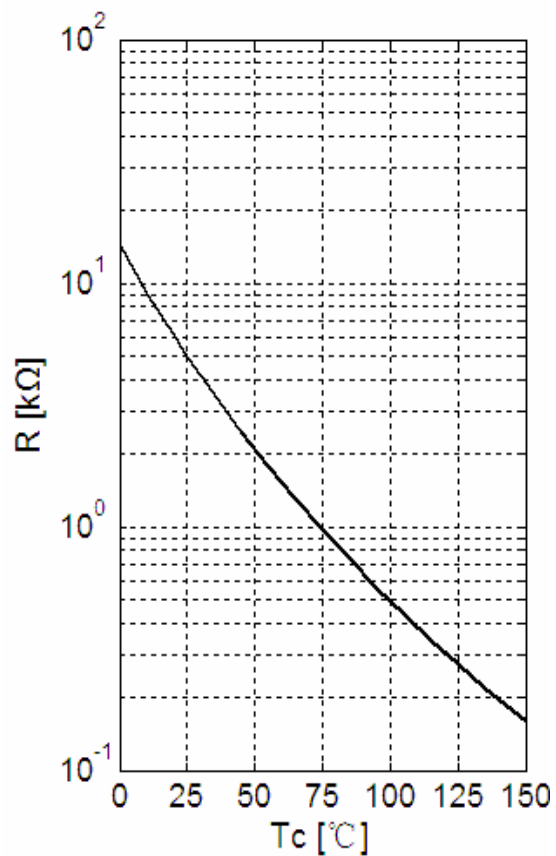
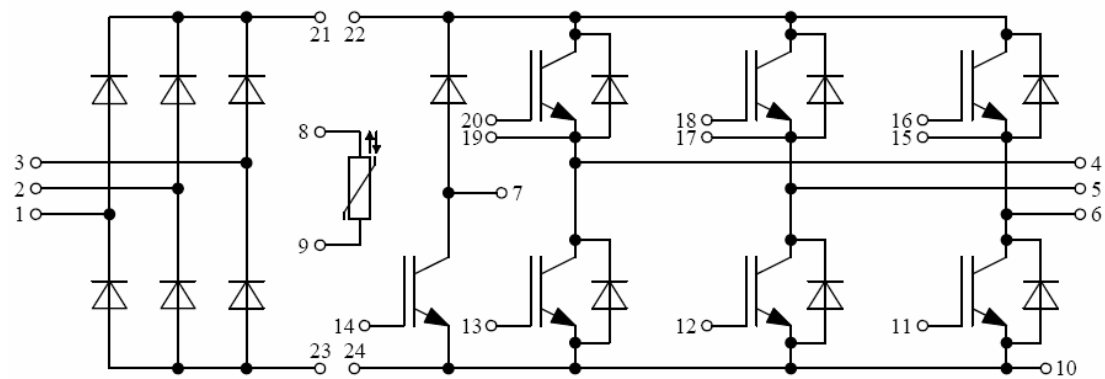


Fig 12. NTC-Temperature Characteristic

Equivalent Circuit Schematic



Package Dimension

Dimensions in Millimeters

