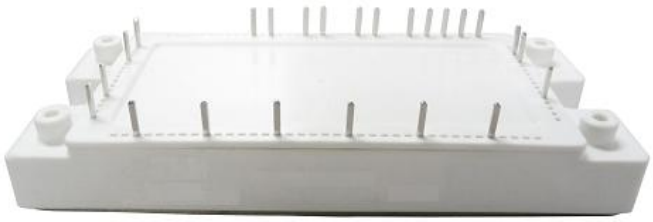
KDG40R12KT3

IGBT Module

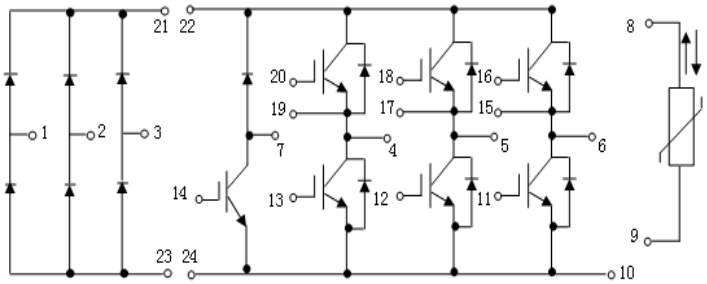


Features：

- IGBT Inverter Short Circuit Rated 10μs
- IGBT Inverter Low Saturation Voltage
- Low Switching Loss
- Low Stray Inductance
- Lead Free, Compliant With RoHS Requirement

Applications：

- Industrial Inverters
- Servo Applications



Internal Circuit Diagram

IGBT-Inverter

Absolute Maximum Ratings (T_C = 25℃ unless otherwise specified)

Symbol	Description		Value	Units
V_{CES}	Collector-Emitter Blocking Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		±20	V
I_C	Continuous Collector Current	T_C = 80℃	40	A
		T_C = 25℃	80	A
$I_{CM(1)}$	Peak Collector Current Repetitive	T_J = 150℃	80	A
t_{SC}	Short Circuit Withstand Time	T_J = 150℃	>10	μs
P_D	Maximum Power Dissipation (IGBT)	T_C = 25℃ T_{Jmax}=150℃	255	W

Characteristic Values (T_J = 25℃ unless otherwise specified)

Symbol	Description	Test Conditions		Min.	Typ.	Max.	Units
I_{CES}	Collector-Emitter Leakage Current	V_{GE} = 0V, V_{CE} = V_{CES}	T_J = 25℃			1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0V	T_J = 25℃			200	nA
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C = 1 mA, V_{CE} = V_{GE}		4.5	5.2	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 40A , V_{GE} = 15V	T_J = 25℃		1.90	2.10	V
			T_J = 125℃		2.20	2.40	V
C_{ies}	Input Capacitance	V_{CE} = 25V, V_{GE} = 0V , f ＝1MHz			2.2		nF
C_{oes}	Output Capacitance				0.21		nF

$t_{d(on)}$	Turn-on Delay Time	V_{CC} = 600V, I_C = 40A, R_G = 33Ω, V_{GE} =±15V , Inductive Load, T_J = 25℃		115		ns
t_r	Rise Time			70		ns
$t_{d(off)}$	Turn-off Delay Time			475		ns
t_f	Fall Time			285		ns
E_{on}	Turn-on Switching Loss			6.2		mJ
E_{off}	Turn-off Switching Loss			2.4		mJ
E_{ts}	Total Switching Loss			8.6		mJ
$t_{d(on)}$	Turn-on Delay Time	V_{CC} = 600V, I_C = 40A, R_G = 20Ω, V_{GE} =±15V, Inductive Load, T_J= 125℃		105		ns
t_r	Rise Time			75		ns
$t_{d(off)}$	Turn-off Delay Time			505		ns
t_f	Fall Time			445		ns
E_{on}	Turn-on Switching Loss			8.1		mJ
E_{off}	Turn-off Switching Loss			3.9		mJ
E_{ts}	Total Switching Loss			12.0		mJ
Q_g	Internal Gate Resistor	V_{CE} = 600V, I_C = 40A, V_{GE} = -15V ~ +15V		445		nC
RBSOA	Reverse Bias Safe Operating Area	I_C = 80A ,V_{CC} = 960V, Vp =1200V, Rg = 15Ω, V_{GE}=+15V to 0V, T_J =150°C	Trapezoid			
SCSOA	Short Circuit Safe Operating Area	V_{CC} = 600V, V_{GE} = 15V, T_J = 150℃	10			μs

Diode-Inverter

Absolute Maximum Ratings (T_C = 25℃ unless otherwise specified)

Symbol	Description	Value	Units
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	DC Forward Current	40	A
I_{FRM}	Repetitive Peak Forward Current	80	A

Characteristic Values

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_F	Forward Voltage	I_F=40A, V_{GE} = 0V	T_J = 25℃		2.1		V
			T_J = 150℃		2.1		
I_{rr}	Peak Reverse Recovery Current	I_F=40A, di/dt = 835A/μs, V_{rr} = 600V, V_{GE} = -15V	T_J = 25℃		35		A
			T_J = 125℃		45		
Q_{rr}	Recovered Charge		T_J = 25℃		3.9		μC
			T_J = 125℃		6.0		
E_{rec}	Reverse Recovery Energy		T_J = 25℃		0.7		mJ
			T_J = 125℃		1.3		

Diode-Rectifier

Absolute Maximum Ratings (T_C = 25℃ unless otherwise specified)

Symbol	Description		Value	Units
V_{RRM}	Repetitive Peak Reverse Voltage	T_J =25℃	1800	V
I_{FRMSM}	Forward Current RMS Maximum Per Diode	T_J =80℃	50	A
I_{RMSM}	Maximum RMS Current At Rectifier Output	T_C = 80℃	60	A
I_{FSM}	Surge Current @t_p=10 ms	T_J =25℃	315	A
		T_J =150℃	270	
I^2t	t_p=10 ms	T_J =25℃	500	A^2s
		T_J =150℃	370	

Characteristic Value

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_F	Forward Voltage	I_F=40A (tested on top of terminals)	T_J = 25℃		1.10	1.30	V
			T_J = 125℃		1.05		

IGBT-Brake-Chopper

Absolute Maximum Ratings (T_C = 25℃ unless otherwise specified)

Symbol	Description		Value	Units
V_{CES}	Collector-Emitter Blocking Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		±20	V
I_C	Continuous Collector Current	T_C = 80℃	15	A
		T_C = 25℃	30	A
$I_{CM(1)}$	Peak Collector Current Repetitive	T_J = 150℃	30	A
P_D	Maximum Power Dissipation Per Leg	T_C = 25℃ T_{Jmax}=150℃	180	W

Characteristic Values

Symbol	Description	Test Conditions		Min.	Typ.	Max.	Units
I_{CES}	Collector-Emitter Leakage Current	V_{GE} = 0V, V_{CE} = V_{CES}	T_J = 25℃			1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0V	T_J = 25℃			200	nA
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C = 1 mA, V_{CE} = V_{GE}		4.5	5.2	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 15A , V_{GE} = 15V	T_J = 25℃		1.90	2.10	V
			T_J = 125℃		2.20		V
C_{ies}	Input Capacitance	V_{CE} = 25V, V_{GE} = 0V , f =1MHz			1.5		nF
C_{oes}	Output Capacitance				0.13		nF

$t_{d(on)}$	Turn-on Delay Time	V_{CC} = 600V, I_C = 15A, R_G =68Ω, V_{GE} =±15V , Inductive Load, T_J = 25℃		105		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-off Delay Time			260		ns
t_f	Fall Time			240		ns
E_{on}	Turn-on Switching Loss			1.67		mJ
E_{off}	Turn-off Switching Loss			0.62		mJ
E_{ts}	Total Switching Loss			2.29		mJ
$t_{d(on)}$	Turn-on Delay Time	V_{CC} = 600V, I_C = 15A, R_G = 68Ω, V_{GE} =±15V, Inductive Load, T_J= 125℃		90		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-off Delay Time			275		ns
t_f	Fall Time			360		ns
E_{on}	Turn-on Switching Loss			2.08		mJ
E_{off}	Turn-off Switching Loss			1.13		mJ
E_{ts}	Total Switching Loss			3.21		mJ
Q_g	Internal Gate Resistor	V_{CE} = 600V, I_C = 15A, V_{GE} = -15V ~ +15V		145		nC
RBSOA	Reverse Bias Safe Operating Area	I_C = 30A ,V_{CC} = 960V, Vp =1200V, Rg = 68Ω, V_{GE}=+15V to 0V, T_J =125°C	Trapezoid			
SCSOA	Short Circuit Safe Operating Area	V_{CC} = 600V, V_{GE} = 15V, T_J = 125℃	10			μs

Diode-Brake-chopper

Absolute Maximum Ratings (T_C = 25℃ unless otherwise specified)

Symbol	Description	Value	Units
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	DC Forward Current	15	A
I_{FRM}	Repetitive Peak Forward Current	30	A

Characteristic Values

Symbol	Description	Test conditions		Min.	Typ.	Max.	Units
V_{FM}	Forward Voltage	I_F＝15A (tested on top of terminals)	T_J = 25℃		1.9		V
			T_J = 125℃		2.3		
I_{rr}	Peak Reverse Recovery Current	I_F＝15A, di/dt =345A/μs, V_{rr} = 600V, V_{GE} = -15V	T_J = 25℃		10		A
			T_J = 125℃		15		
Q_{rr}	Reverse Recovery Charge		T_J = 25℃		0.8		μC
			T_J = 125℃		1.6		

NTC Thermistor

Characteristic values

Symbol	Condition	Typ.	Max.	Units
R_{25}	T_C =25℃	5		kΩ
△R/R	T_C =100℃，R_{100} =481Ω		±5	%
P_{25}	T_C =25℃	50		mW
$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$	3380		K
$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$	3440		K

Module

Absolute Maximum Ratings

Inverter& Brake& Rectifier	T_J	Maximum Junction Temperature		150	℃
	T_{JOP}	Maximum Operating Temperature		-40 +150	℃
	T_{stg}	Storage Temperature		-40 +125	℃
	V_{iso}	Isolation Voltage (All Terminals Shorted)	f = 50Hz, 1minute	2500	V

Thermal characteristics

	Symbol	Description	Typ.	Max.	Units
Inverter	$R_{\theta JC}$	Junction-To-Case (IGBT Part, Per Leg)		0.40	℃/W
	$R_{\theta JC}$	Junction-To-Case (Diode Part, Per Leg)		0.77	℃/W
Brake	$R_{\theta JC}$	Junction-To-Case, IGBT		0.73	℃/W
	$R_{\theta JC}$	Junction-To-Case, diode		1.42	℃/W
Rectifier	$R_{\theta JC}$	Junction-To-Case, diode		0.69	℃/W
Module	$R_{\theta CS}$	Case-To-Sink (Conductive Grease Applied)		0.10	℃/W
	Mounting torque	Mounting Screw:M5	3.0	5.0	N·m
Weight		Weight Of Module		200	g

Notes:
(1) Repetitive Rating: Pulse width limited by max. Junction temperature

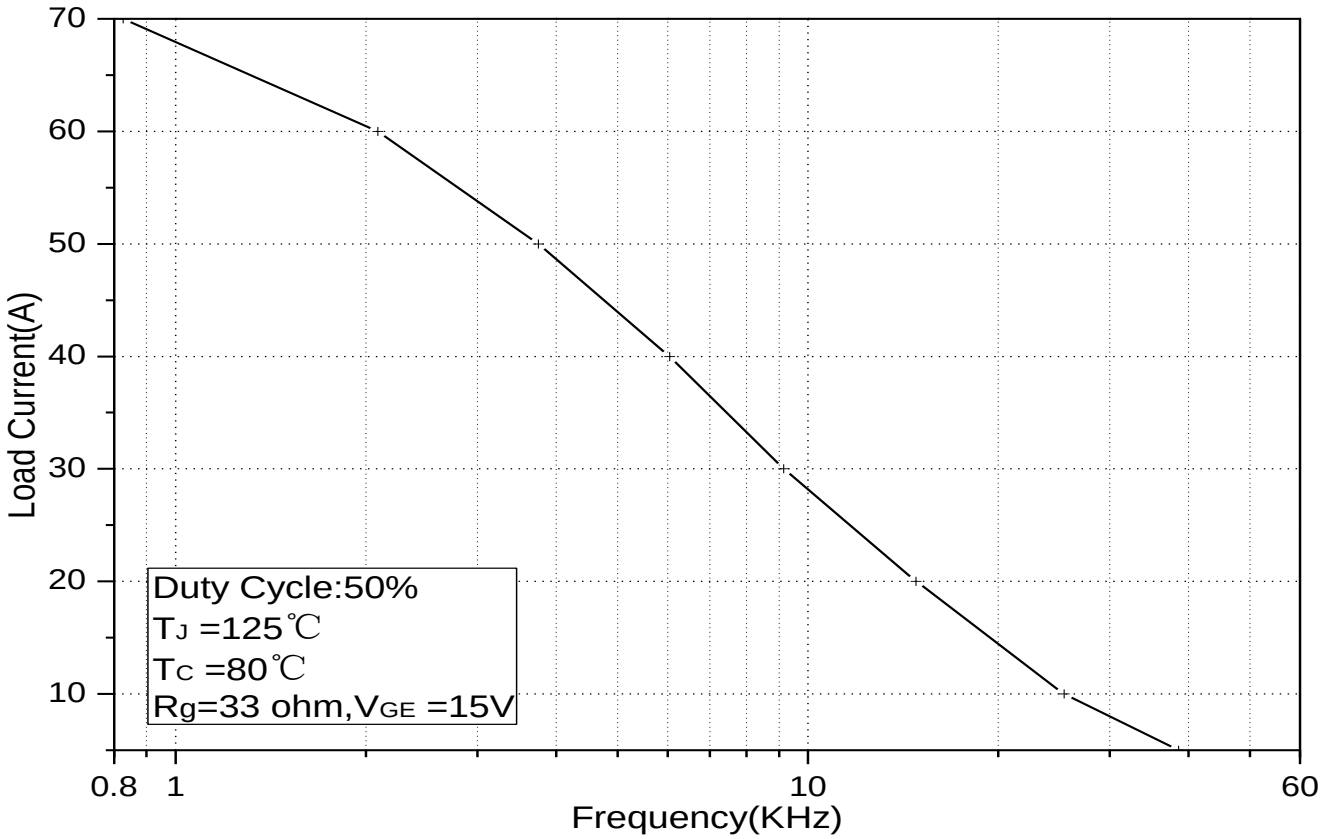


Fig.1 Typical Load Current vs. Frequency (Inverter)

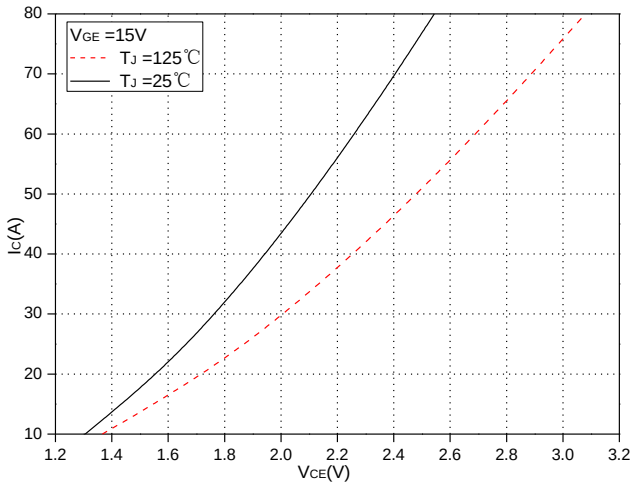


Fig.2 Typical Output Characteristics- Inverter

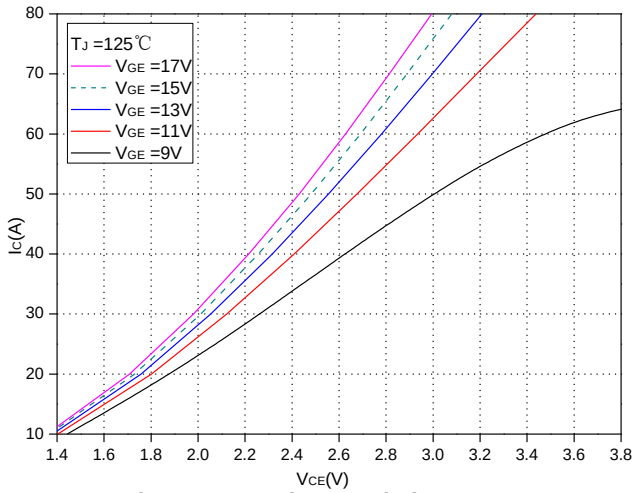


Fig.3 Output Characteristics- Inverter

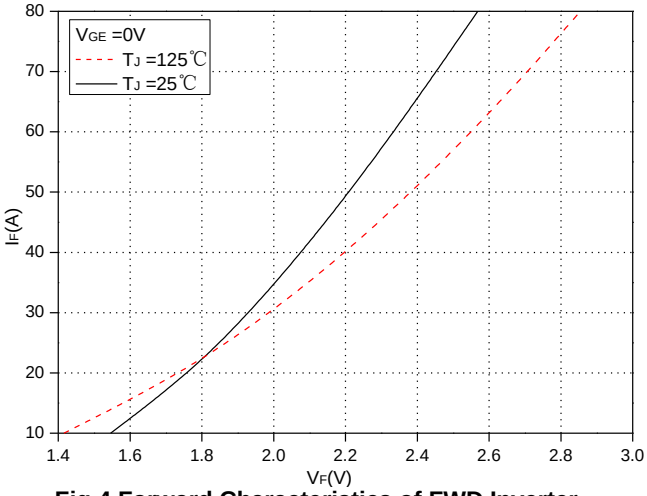


Fig.4 Forward Characteristics of FWD Inverter

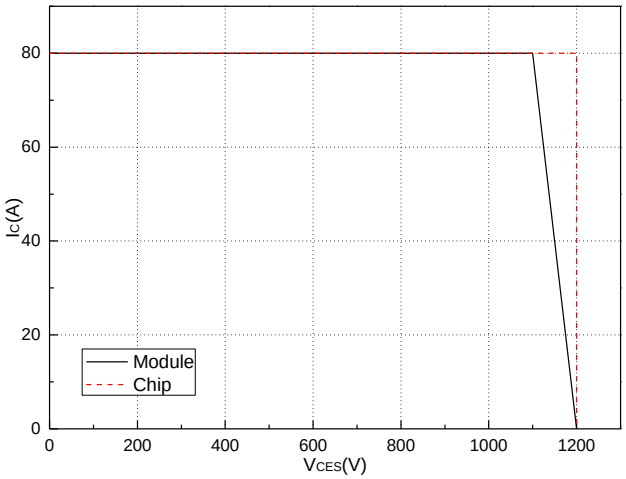


Fig.5 Reverse Bias Safe Operation Area (RBSOA)

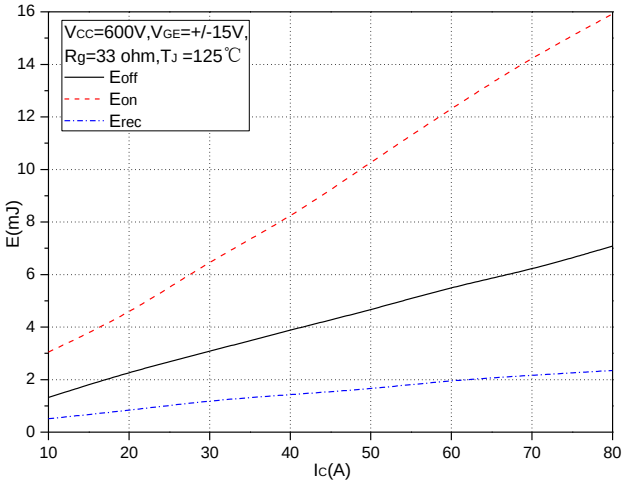


Fig.6 Typical Switching Loss vs. Collector Current (Inverter)

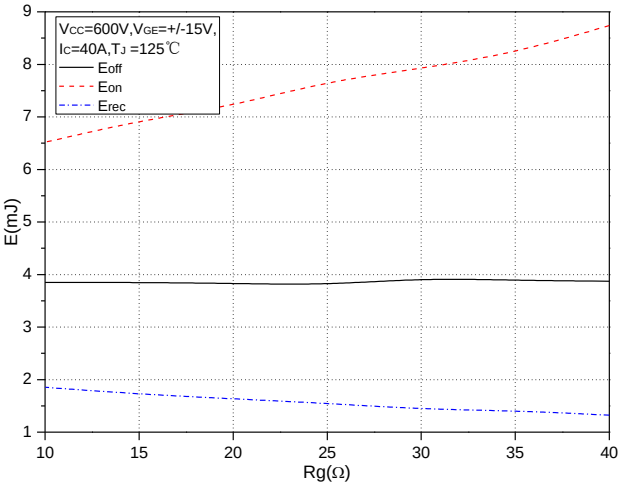


Fig.7 Typical Switching Loss vs. Gate Resistance (Inverter)

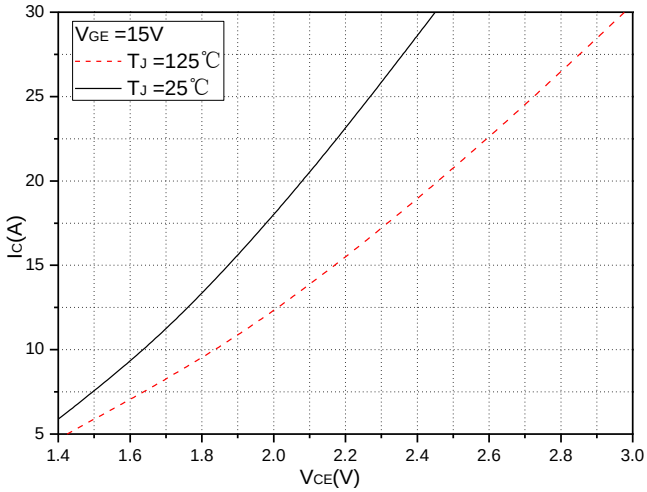


Fig.8 Typical Saturation Voltage Characteristics

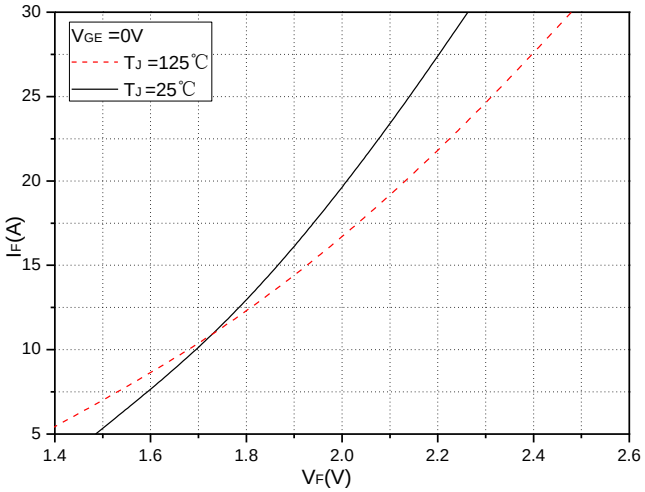


Fig.9 Forward Characteristics of Diode

(Brake-Chopper- IGBT)

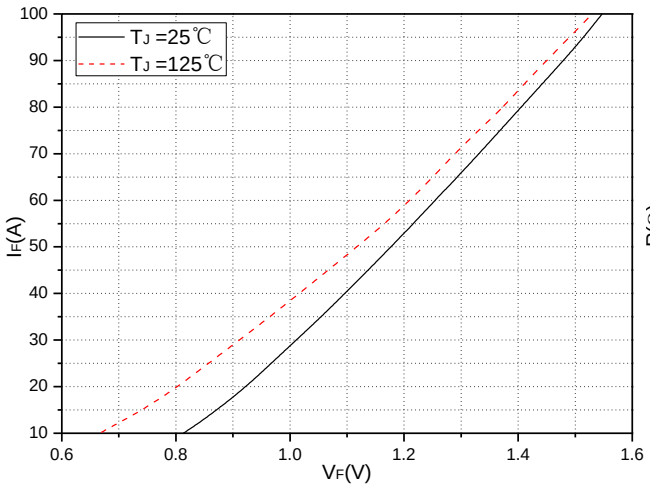


Fig.10 Forward Characteristics of Rectifier Diode

(Brake-Chopper- FWD)

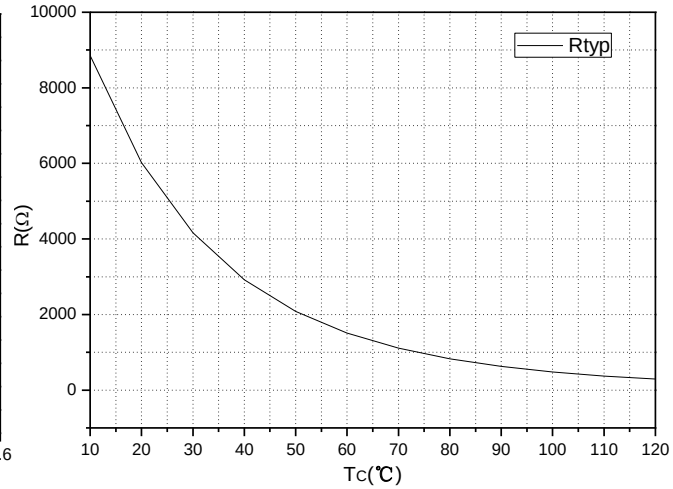


Fig.11 NTC Temperature characteristics

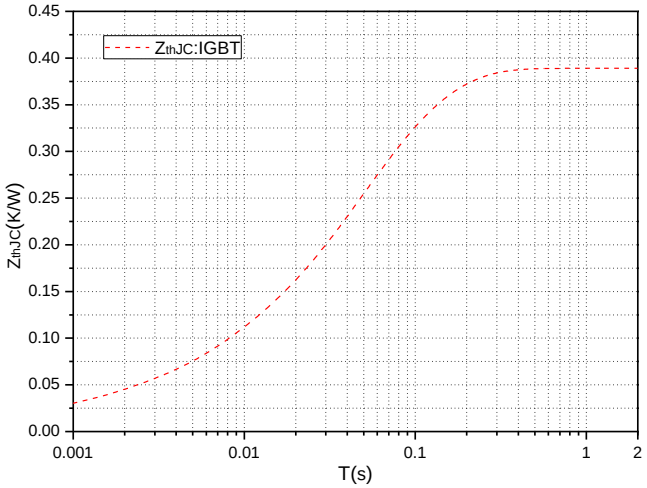


Fig.12 Transient thermal impedance (IGBT -Inverter)

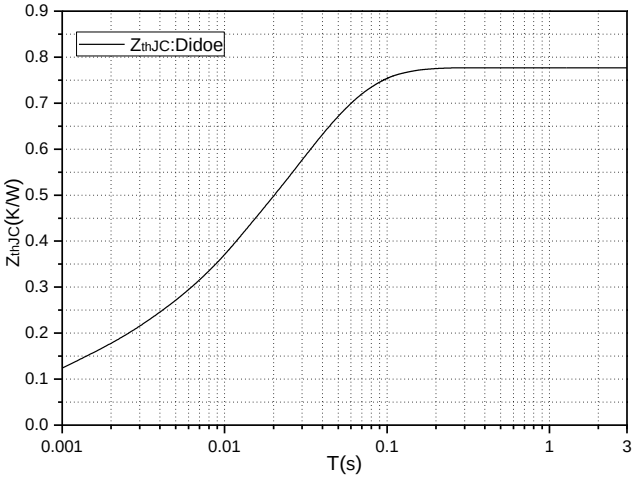
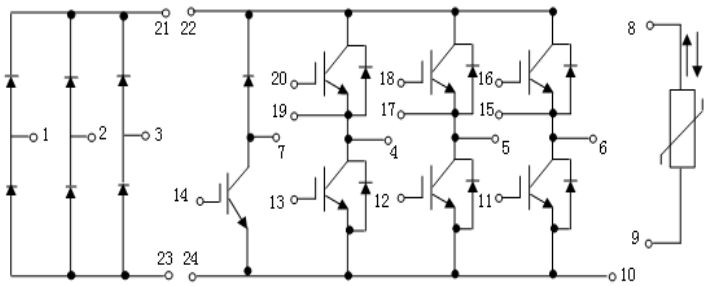
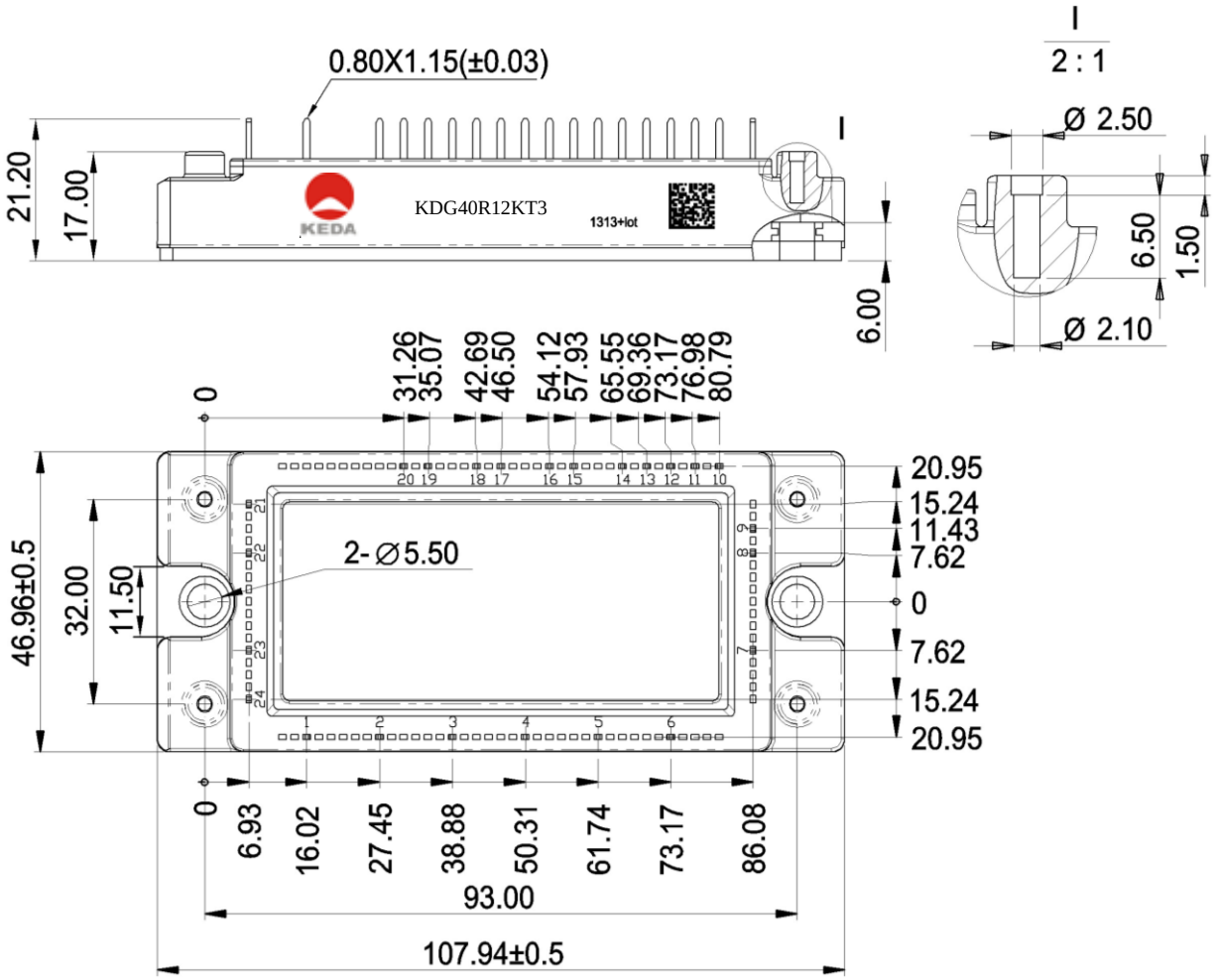


Fig.13 Transient thermal impedance (Diode -Inverter)

Internal Circuit Diagram:



Package Outline (Unit: mm):



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