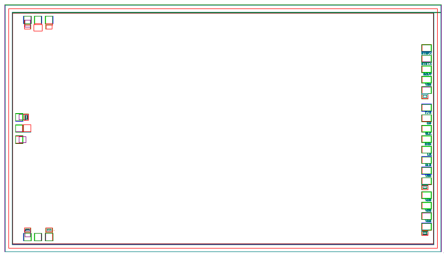
AMT1304
6 - 20GHz Multi-Function Chip



Key Features :

- Frequency range : 6 – 20GHz
- Receiver gain : 7dB
- Transmitter gain : 7dB
- Receiving, Transmitting P-1 : 13/14dBm
- Phase shift bit : 6 bits
- Phase shift step : 5.625°
- Phase shift RMS : 6°, phase shift additive attenuation ±2dB
- Attenuation bit : 6 bits
- Attenuation step : 0.5dB
- Attenuation RMS : 0.8dB, attenuation additive phase shift ±15°
- Input/output standing wave : 1.4
- Operating voltage VD1/VD2/VD3/VDN : +5V
- Operation voltage VSN/VSS : -5V
- Control method : TTL, serial control
- Chip dimensions : 3.4mm x 6.15mm x 0.1mm
- Applications : wireless communication, transceiver module, radio telecommunication etc.

Description :

AMT1304 is a multi-function chip incorporating with amplifier, switch, 6-digit attenuator, 6-digit phase shifter, control driver etc. super wideband multi-function MMIC, it is designed by Gallium Arsenide (GaAs) pHEMT process. The chip uses dual voltage operation, control level is TTL, with phase shift attenuation serial control. This chip is designed with ground through metal vias on the back technology. All chip products p are 100% RF tested.

Absolute Maximum Ratings (Ta = 25°C)

Symbol	Parameter	Value	Remark
$V_{CLK}/V_{CS}/V_{LE}/V_{T/R}/V_{DIN}$	Control voltage	+6V	
VD1/VD2/VD3/VDN	Operation voltage	+7V	
VSN/VSS	Operation voltage	-6V	
Pin	Max. Input Signal Power	+20dBm	
Tch	Operation Temperature	150℃	
Tm	Sintering Temperature	310℃	30s, N_2 protection
Tstg	Storage Temperature	-65 ~ +150℃	

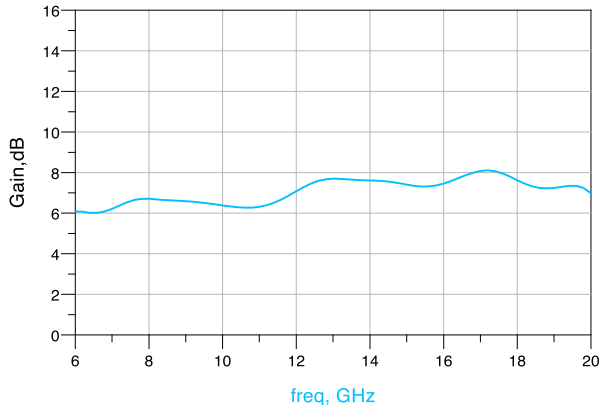
[1] Operation outside any of the Absolute Maximum Ratings may cause permanent device damage.

Electrical Characteristics (Ta = 25°C)

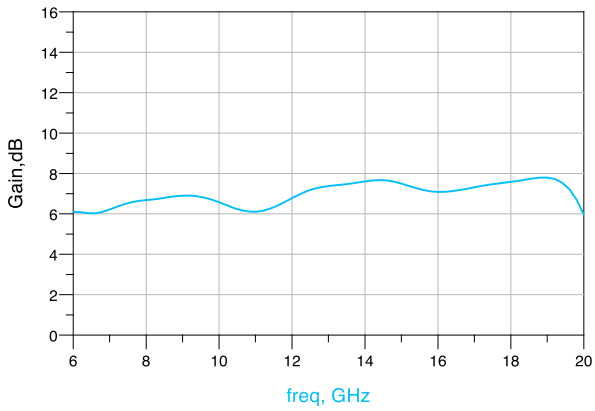
Symbol	Parameter	Value			Unit	Remark
		Min	Typical	Max		
F	Frequency		6 ~ 20		GHz	
G_R	Receiver gain	6	7	8	dB	
P_{-1R}	Receiver output at P-1 point	11	13	15	dBm	
NF	Noise figure	-	12	15	dB	
G_T	Transmitter gain	6	7	8.5	dB	
P_{-1T}	Transmitter output at P-1 point	12	14	16	dBm	
PS	Phase shift range	5.625 – 354.375 (6 bits phase shift)			°	
Δat	Phase shift additive attenuation variation	-3	-	+2	dB	
RMS_P	Phase shift RMS	-	4	5	°	6~18GHz
RMS_P	Phase shift RMS	-	5	8	°	18~20GHz
ATT	Attenuation range	0.5 – 31.5 (6 bits attenuation)			dB	
Δps	Attenuation additive phase shift variation	-17	-	+17	°	
RMS_A	Attenuation RMS	-	0.8	1.2	dB	
VSWR	COM Port Standing Wave	-	1.4	1.6	-	
VSWR	T/R Port Standing Wave	-	1.3	1.4	-	
Id	Operating Current Id	68	72	77	mA	
Is	Operating current Is	-	15	20	mA	

Typical Performance

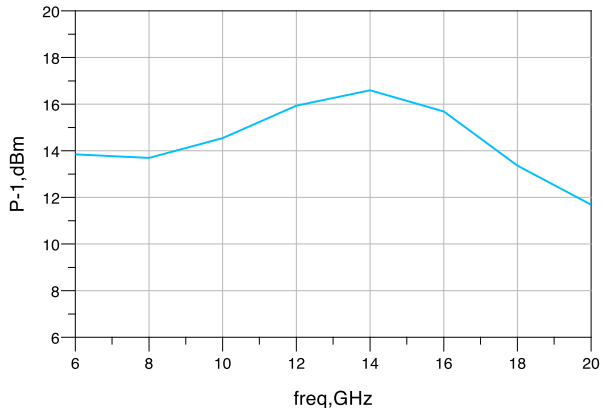
Receiver Gain Curve



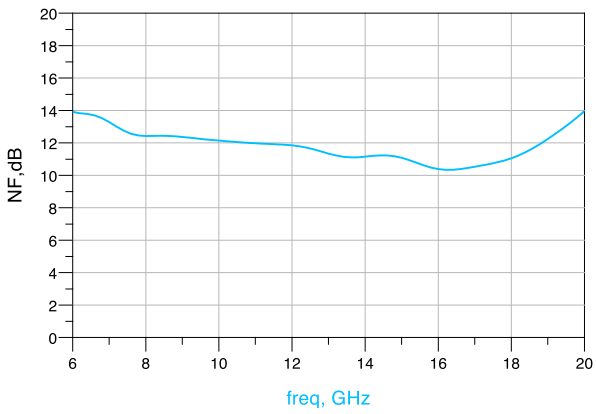
Transmitter Gain Curve



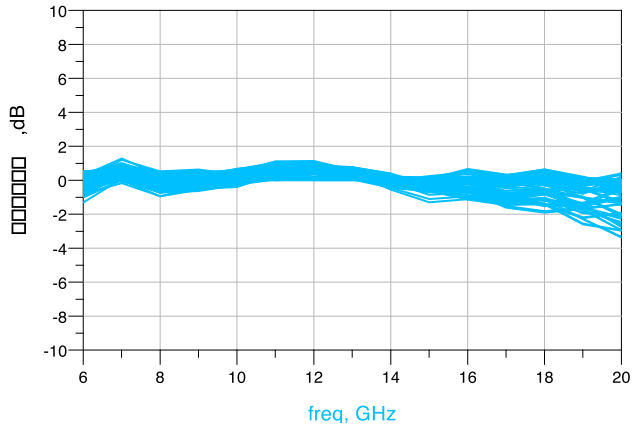
Transmitter P-1 Curve



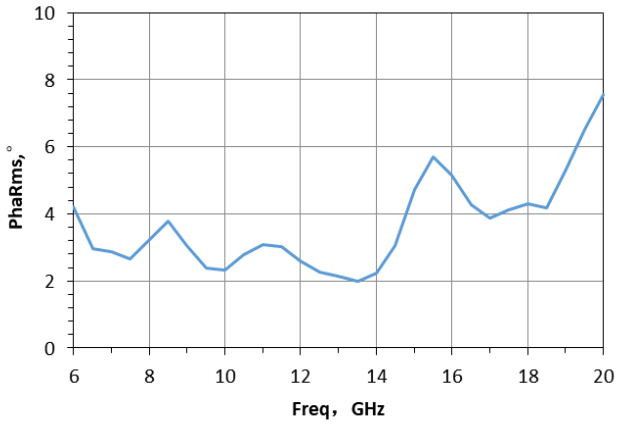
Reciver Noise Figure Curve



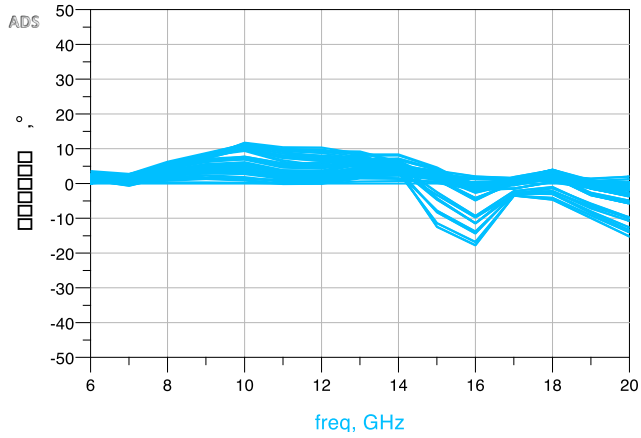
Phase Shift Additive Attenuation Curve



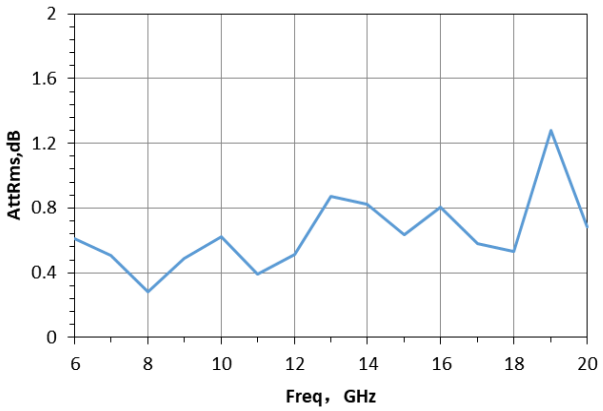
Phase Shift RMS Curve



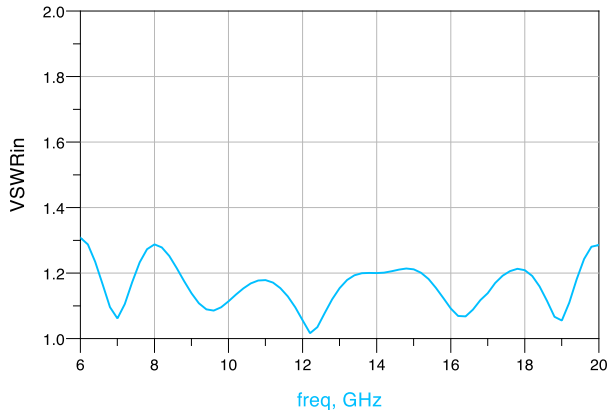
Attenuatoin Additive Phase Shift Curve



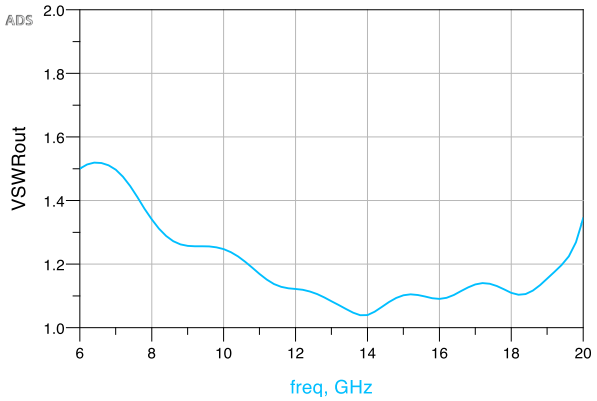
Attenuation RMS Curve



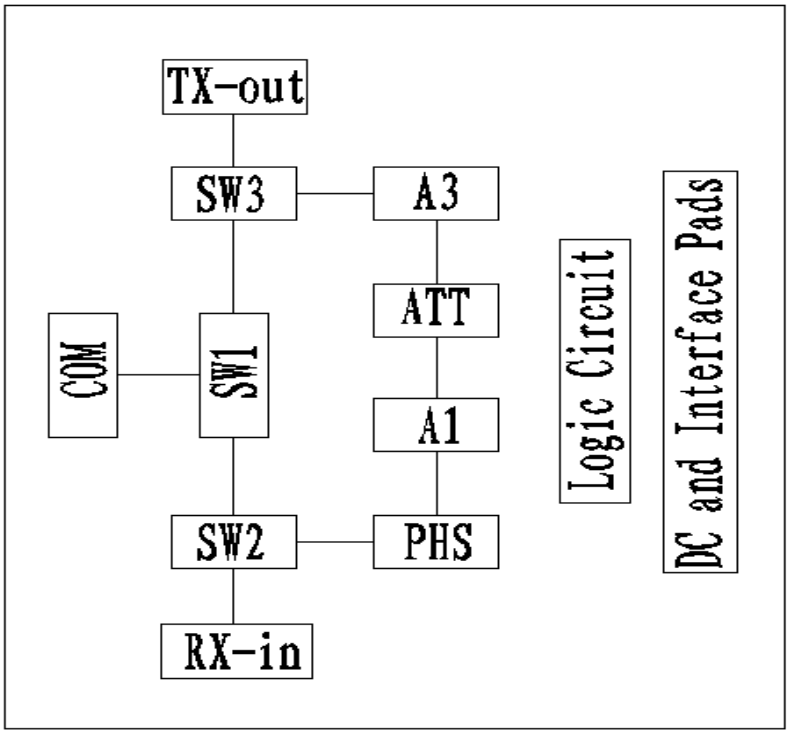
Receiver Input Standing Wave Curve



Receiver Output Standing Wave Curve



Internal Functional Block Diagram



Chip Dimensions (Unit : μm)

Solder Pad Definition

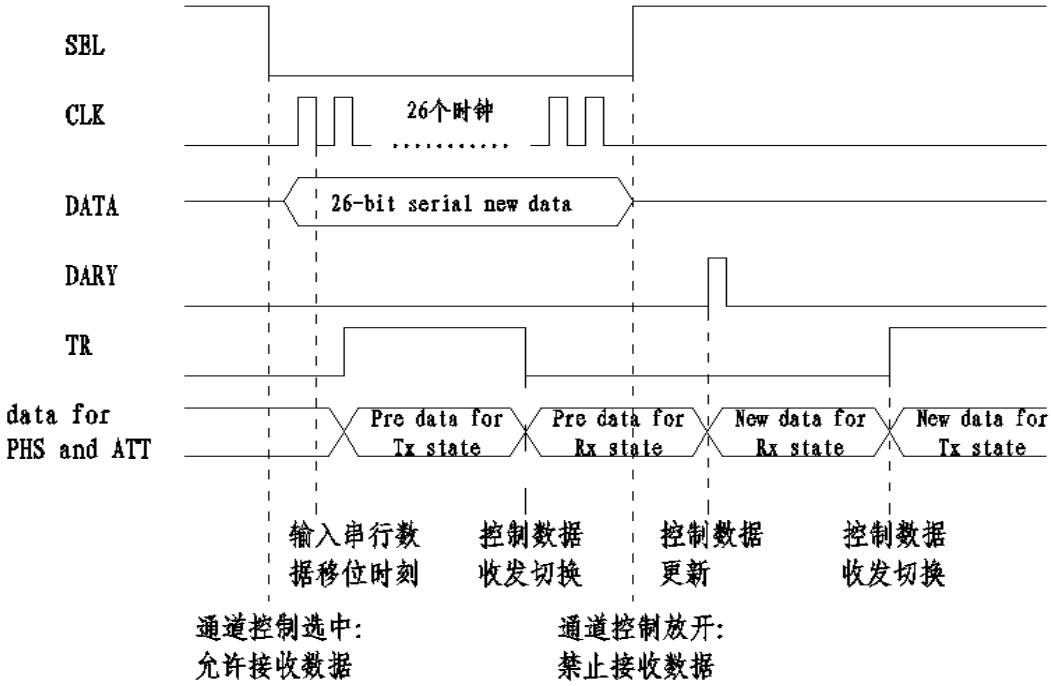
Name	Dimension	Remark
RX_in/TX_out	100μm x 100μm	Receiver Input/Transmitter Output
COM	100μm x 100μm	Receiver Output/Transmitter Input
STBRX/STBTX/DOUT	90μm x 130μm	TTL, Output : Receive Standby/Transmit Standby/Serial Control Data
VSN/VDN/VD1,2,3	90μm x 130μm	Power Supply Pad : -5V / +5V / +5V
CS/CLK/DIN/LE/TR	90μm x 130μm	TTL, Control Signal Input, rate 40MHz
CLR	90μm x 130μm	TTL, Reset Signal Input
GND	90μm x 130μm	Ground Pad

Control Explanation

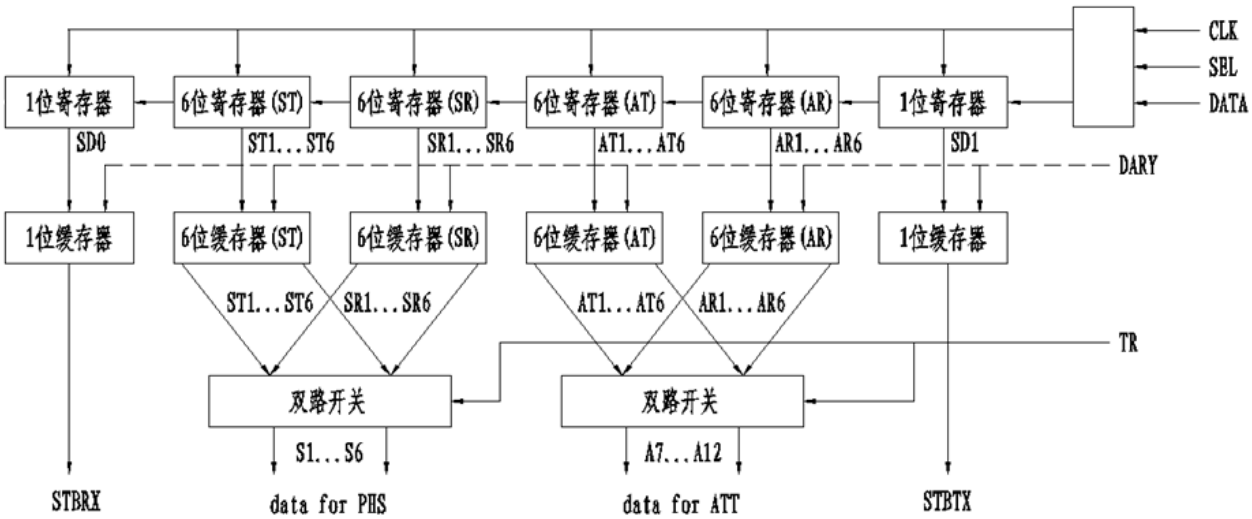
Signal Function Definition

No.	Signal		Level	Function		Remark
				"0"	"1"	
1	TR		Input (TTL Level)	Receive	Transmit	Transmit, receive control signal
2	CS		Input (TTL Level)	Load data	Hold data	Chip select signal, low active
3	CLK		Input (TTL Level)	-		Clock signal, falling edge active
4	LE		Input (TTL Level)	-		Data ready signal, rising edge active
5	DIN	Bit0	Input (TTL Level)	Operate	Standby	Receive standby signal : operate means normal receiving status
		Bit1 ~ Bit24	Input (TTL Level)	Off	On	Phase shift attenuation control signal : ON means phase shifter and attenuator enable
		Bit25	Input (TTL Level)	Operate	Standby	Transmit standby signal : operate means normal transmitting status
6	CLR		Input (TTL Level)	-		Reset signal : 100ms low level after power on, reset activates.
7	STBRX		Output (TTL Level)	-		Receive standby signal
8	STBTX		Output (TTL Level)	-		Transmit standby signal
9	DOUT		Output (TTL Level)	-		Output DIN control signal : when there is new serial control data sending to the shift register, the original control data in the register will be output in sequence from DOUT.

Timing



Serial Parallel Conversion Illustration



DIN Serial Control Word Definition

BIT	Description	
BIT0	Receive standby	STBRX output
BIT1	5.625 °	Transmit phase shift
BIT2	11.25 °	
BIT3	22.5 °	
BIT4	45 °	
BIT5	90 °	
BIT6	180 °	
BIT7	5.625 °	Receive phase shift
BIT8	11.25 °	
BIT9	22.5 °	
BIT10	45 °	
BIT11	90 °	
BIT12	180 °	
BIT13	0.5 dB	Transmit attenuation
BIT14	1 dB	
BIT15	2 dB	
BIT16	4 dB	
BIT17	8 dB	
BIT18	16 dB	
BIT19	0.5 dB	Receive attenuation
BIT20	1 dB	
BIT21	2 dB	
BIT22	4 dB	
BIT23	8 dB	
BIT24	16 dB	
BIT25	Transmit standby	STBTX output

Please see appendix A for details.