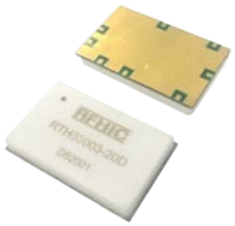
GaN Doherty Hybrid Amplifier RTH35003-20D

Product Features

- GaN on SiC Chip on Board
- Surface Mount Hybrid Type
- 2-Stage Doherty Amplifier
- High Efficiency
- No Matching circuit needed

Applications

- RF Sub-Systems
- Base Station
- RRH
- 4G/ LTE system
- Small cell



Package Type : SP-1E

Description

Accommodating the future of 4G/LTE small cells, RFHIC introduces RTH35003-20D amplifier fabricated using an advanced high power density Gallium Nitride (GaN) semiconductor process.

Electrical Specifications @ Vds=30V, Ta=25℃

PARAMETER	UNIT	MIN	TYP	MAX	CONDITION
Frequency Range	MHz	3520	3540	3560	ZS = ZL = 50 ohm
Power Gain	dB	21	24	-	-
Gain Flatness		-1.5	-	+1.5	
Input Return Loss		-	-14	-9	
Pout @ Average	dBm	-	35.1	-	3.236W
Pout @ Saturation	dBm	42.6	43.5	-	Pulse Width=20us, Duty cycle 10%
ACLR @ BW 20MHz 2FA LTE (PAPR 7.5dB)	dBc	-	-29	-25	Non DPD
		-	-53	-	With DPD
Doherty Efficiency	%	-	46	-	Tc=25℃
Total Efficiency		35	38	-	
Drive Amp. Idq	mA	-	40	-	-
Carrier Amp. Idq		-	110	-	-
Peaking Amp. Idq		-	0	-	
Supply Voltage	V	-4.9	-2.8	-2.0	Vgd
		-4.9	-2.8	-2.0	Vgc
		-4.9	-4.8	-3.0	Vgp
		-	30	-	Vds

Caution

The drain voltage must be supplied to the device after the gate voltage is supplied

Turn on ➔ Turn on the Gate voltage supply and last turn on the Drain voltage supplies

Turn off ➔ Turn off the Drain voltage and last turn off the Gate voltage

Note

1. ACLR Measured Pout=35.1dBm @ fc± 40MHz / 38.06MHz
   LTE 20MHz 2FA PAPR=7.5dB @ 0.01% probability on CCDF

Mechanical Specifications

PARAMETER	UNIT	TYPICAL	RATING
Mass	g	6.0	±1.0
Dimension	㎜	32 x 20 x 4.2	±0.15

Absolute Maximum Ratings

PARAMETER	UNIT	RATING	SYMBOL	CONDITION
Gate-Source Voltage	V	-10 ~ 0	Vgd Vgc Vgp	Tc=25°C
Drain-Source Voltage	V	50	Vds	Tc=25°C
Gate Current	mA	1.2 2.1 4	Drive Carrier Peaking	Tc=25°C
Power Dissipation	W	6.1	P_D	Tc=85°C
Operating Junction Temperature	°C	225	T_J	-
Operating Case Temperature	°C	-30 ~ 85	T_C	-
Storage Temperature	°C	-40 ~ 100	T_{STG}	-
Soldering Temperature[*1]	°C	260	Ts	30s Max.
RF Input Level (Pulse)	dBm	35	Pin	Tc=25°C

*1 Reflow cycle limit : 1time

Operating Voltages & Input level

PARAMETER	UNIT	MIN	TYP	MAX	SYMBOL
Drain Voltage 1	V	29.5	30	30.5	Vds1
Drain Voltage 2		29.5	30	30.5	Vds2
Gate Voltage (on-stage)	V	-4.9	Vgd[*2]	-2.0	Vgd
Gate Voltage (on-stage)	V	-4.9	Vgc[*3]	-2.0	Vgc
Gate Voltage (on-stage)	V	-4.9	Vgp[*4]	-3.0	Vgp
Gate Voltage (off-stage)	V	-	-8	-	Vgd
Gate Voltage (off-stage)	V	-	-8	-	Vgc
Gate Voltage (off-stage)	V	-	-8	-	Vgp
RF Input Level (Pulse)	dBm	-	-	30	Pin

*2 Vgd(Pin#1) set : Lower Vgd of Δ-0.15V at Drive amp. Idq 80mA±5%

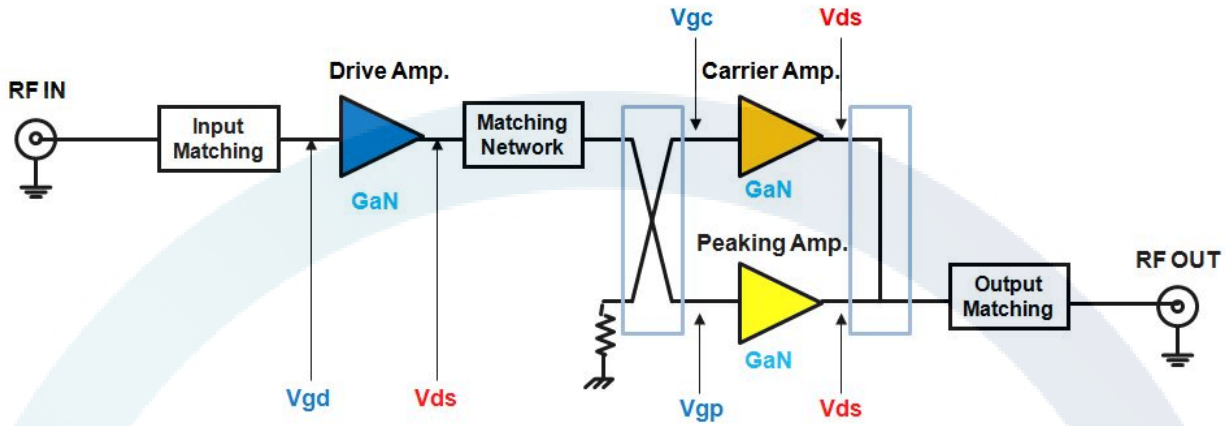
*3 Vgc(Pin#13) set: Carrier Idq 110mA±5%

*4 Vgp(Pin#5) set: Lower Vgp of Δ-1.7V at Peaking Idq 100mA±5%

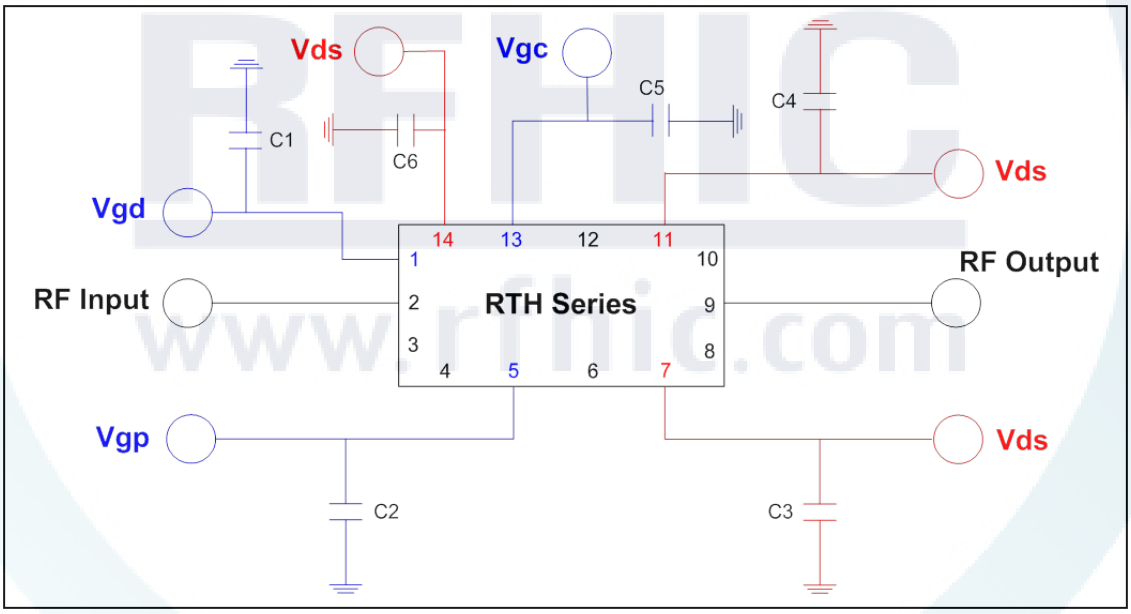
ESD Level

PARAMETER	STANDARD	RESULT
HBM	JESD22-A114E	Class 1A/ passed Voltage 500V
MM	JESD22-A115C	Class A/ passed Voltage 100V

Block Diagram



Application Circuit



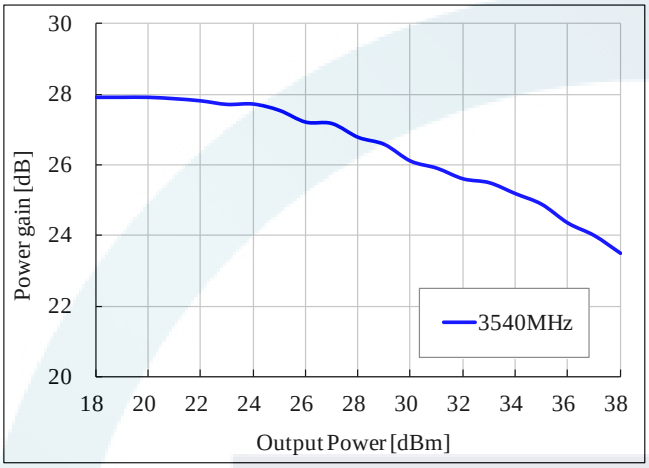
Bill of Material (Evaluation board)

LOCATION	Part Number	Value	Manufacturer
C3, C4, C6	1812B225K101CT	2.2uF / 100V	WALSIN
C1, C2, C5	GRM1885C1H101JA01D	100pF / 50V	MURATA
PCB	RO4350B	2Layer, 20mil, 1oz	ROGERS

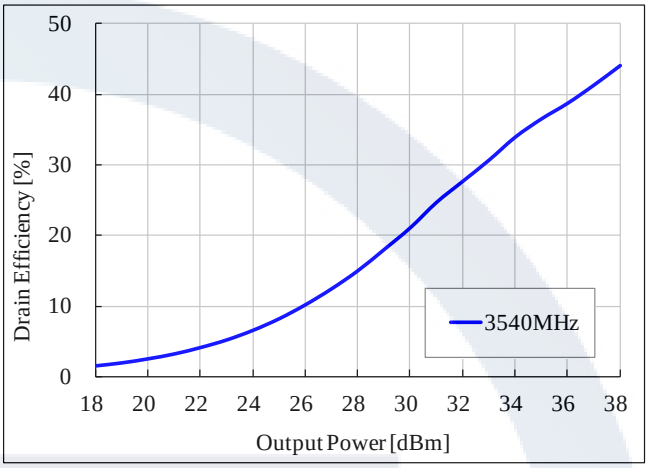
Performance Charts

* **Bias condition** @ Drive Idq=40mA, Carrier Idq=110mA, Peaking Idq=0mA, Ta=25℃

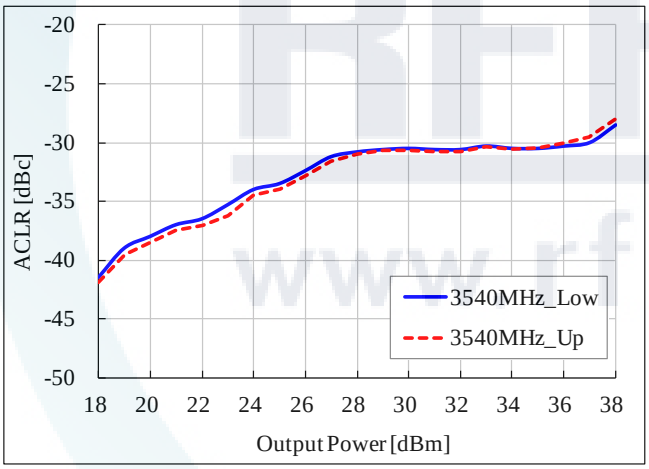
Power Gain vs. Output Power



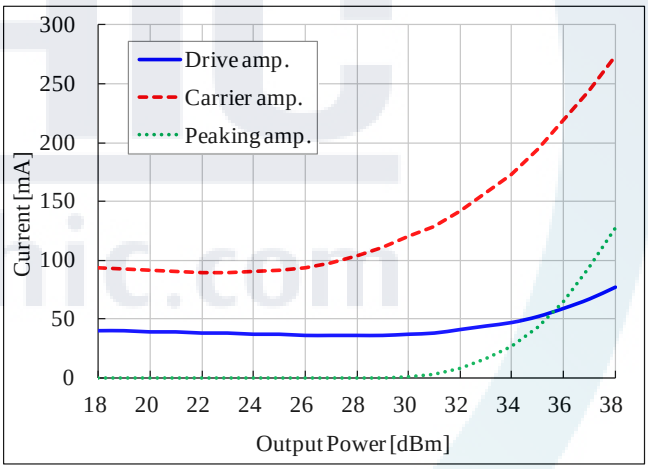
Drain Efficiency vs. Output Power



ACLR vs. Output Power

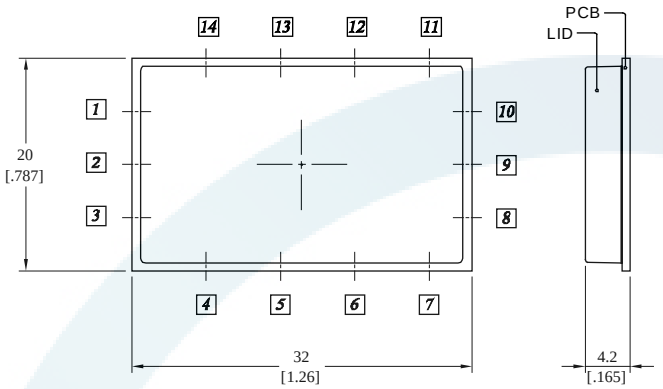


Current vs. Output Power



Package Dimensions (Type: SP-1E)

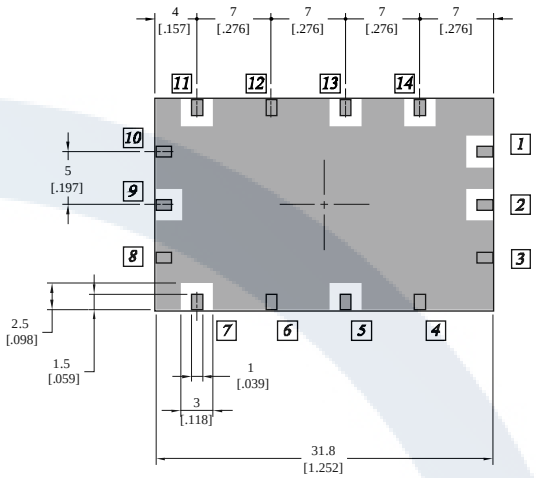
* Unit: mm[inch] | Tolerance: ±0.15[.006]



▲ Top View

▲ Side View

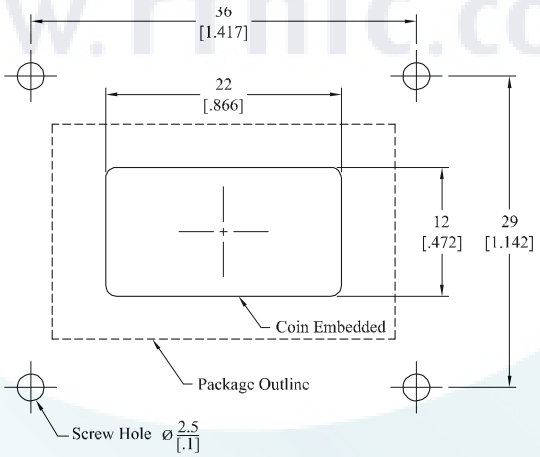
* Unit: mm[inch] | Tolerance: ±0.15[.006]



▲ Bottom View

Pin Description (RTH35003-20D)							
Pin No	**Function**	**Pin No**	**Function**	**Pin No**	**Function**	**Pin No**	**Function**
1	Vgd	4	GND	8	GND	11	Vds
2	RF In	5	Vgp	9	RF Out	12	GND
3	GND	6	GND	10	GND	13	Vgc
		7	Vds			14	Vds

Recommended Mounting Configuration



*** Mounting Configuration Notes**

1. For the proper performance of the device, Ground / Thermal via holes must be designed to remove heat.
2. To properly use heatsink, ensure the ground/thermal via hole region to contact the heatsink. We recommend the mounting screws be added near the heatsink to mount the board
3. In designing the necessary RF trace, width will depend upon the PCB material and construction.
4. Use 1 oz. Copper minimum thickness for the heatsink.
5. Do not put solder mask on the backside of the PCB in the region where the board contacts the heatsink
6. We recommend adding as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
7. We recommend that the PCB with the RF device in a hybrid package(RTH Series) is not washed to remove the flux.

Ordering Information

Part Number	Package Design
RTH35003-20D	-R (Reel)
	-B (Bulk)
	-EVB (Evaluation Board)

Revision History

Part Number	Release Date	Version	Modification	Data Sheet Status
RTH35003-20D	2016.04.20	3.0	Electrical Specification (1p) Performance Charts (3p)	-
RTH35003-20D	2015.10.20	1.1	Electrical Specification Absolute Maximum Ratings	-
RTH35003-20D	2015.08.28	1.0	Operating voltages & Input level	-