SCT3604 Datasheet

Broadband High Efficient RF Power Amplifier

V1.1

Nov, 2012

PRODUCT INTRODUCTION

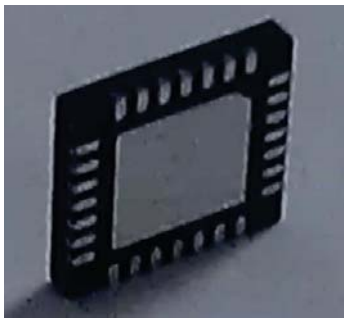
SCT3604 is a high-gain and high-efficiency power amplifier chip offering high performance and wideband in CW or FM signal amplifications, especially for VHF, UHF Walkie-Talkie, RFID and other FM, FSK, ASK applications in a frequency range from 130MHz to 1GHz. The chip is fabricated on silicon process. Its input and output matches are implemented on printed circuit board and can be easily adjusted to obtain optimum power and efficiency. The chip is assembled in a low thermal resistance 5x5 mm^2 QFN28 package.

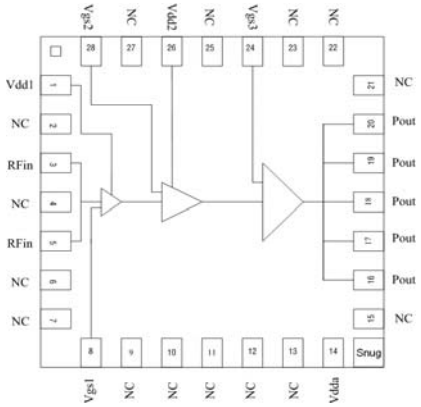
FEATURES

- Single supply voltage from 2.5 to 6 V
- Wide operation frequency range from 130 MHz to 1 GHz
- High power gain up to 35 dB
- High output power up to 34.5 dBm at 4.2 V
- High power added efficiency of 55%
- 5x5 mm^2 plastic QFN28 in 0.5mm pitch

TYPICAL APPLICATIONS

- Analog walkie-talkies, like Family Radio Service (FRS), General Mobile Radio Service (GMRS)
- Digital FDMA two way radio and trunking systems (DPMR, P25, DCR, NXDN, NDR)
- Digital TDMA two way radio and trunking systems (DMR, P25, PDT)
- Wireless data communication (FSK, AFSK, OOK, GFSK, MSK)
- RFID reader/writers
- Wireless sensor network and AdHoc application
- Remote control and sensing systems
- Commercial and consumer electronics





PIN DESCRIPTION

Pin out and their functions in the table below are defined for the chip SCT3604.

Pin No.	Pin Name	Pin Type	Description
1	Vdd1	Power supply	Power supply for first stage
2	NC	-	No connection
3	RFin	RF input	RF signal input and off chip DC blocking capacitor is required
4	NC	-	No connection
5	RFin	RF input	Same as Pin 2
6	NC	-	No connection
7	NC	-	Grounding
8	Vgs1	Analog input	Bias input for first stage, (Ref. to application schematic for details)
9	Vdec	-	Detection voltage for PA gain
10	PC	-	Power control input
11	NC	-	No connection
12	NC	-	No connection
13	NC	-	No connection
14	Vdda	Power supply	Power supply for analogy circuits
15	NC		No connection
16	RFout	RF power output	Power supply and RF output for the output stage. External matching is required to get maximum output power and PAE.
17	RFout		
18	RFout		
19	RFout		

20	RFout		(Ref. to application schematic for details.)
21	NC	-	No connection
22	NC	-	No connection
23	NC	-	No connection
24	Vgs3	Analog input	Bias input for output stage, (Ref. to application schematic for details.)
25	NC	-	No connection
26	Vdd2	Power supply	Power supply for second stage.
27	NC	-	No connection
28	Vgs2	Analog input	Bias input for second stage. (Ref. to application schematic for details.)
Snug	GND	Ground	Grounding and thermal radiation

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ABSOLUTE MAXIMUM RATINGS

The absolute maximum ratings given in table must not be violated under any circumstances. Stress exceeding one or more of the limiting values may cause permanent damage to the device.

Parameter	Specification			Unit	Condition
	Min	Typ.	Max		
Drain to source voltage	-0.5		12.0	V	@Transient work
Drain to source current			2.2	A	@DC or Transient
Gate to source voltgae	-5		5	V	@DC
RF Power put pin			15	dBm	@Transient work
Output load VSWR			10.6:1		@UHF
ESD protection voltage	1.0			kV	
Thermal resistance		10		°C /W	@Working
Lead temperature			260	°C	
Storage temperature	-50		150	°C	

ELECTRICAL CHARACTERISTICS

Parameter	Specification			Unit	Condition
	Min	Typ.	Max		
Supply voltage (VDD)	2.5		6	V	@ In AC condition
Bias control voltage	0.0		2.0	V	@ In AC condition
AC supply current		1.26		A	@Pout =2.6W @VDD = 4V
Operation temperature	-40		85	°C	
Operating frequency range	100		1000	MHz	
Maximum output power Pmax		2.8		W	@Pin = 0 dBm @VDD = 4.2 V @UHF
Power added efficiency (PAE)		48	50	%	@ Pout = 2.6W @ VDD = 4V @UHF and LP
Input power for Pmax		0		dBm	@Pout=2.8W @VDD=4.2V
ACPR			-70	dBc	@1.0kHz narrow band FM signal
Reverse isolation		-60		dB	@ Pmax UHF
Second harmonic		-30		dBc	@ Pmax UHF
Third harmonic		-45		dBc	@ Pmax UHF
Fourth harmonic		-60		dBc	@ Pmax UHF
Other non-harmonic spurious			-60	dBc	@ Pmax UHF
Input VSWR		6.2: 1.0			External connected to 50 Ω source
Output load VSWR		10.6: 1.0			External connected to 50 Ω load

TEST AND APPLICATION SCHEMATIC

The typical test and application circuit for UHF is shown in Fig.2 for SCT3604

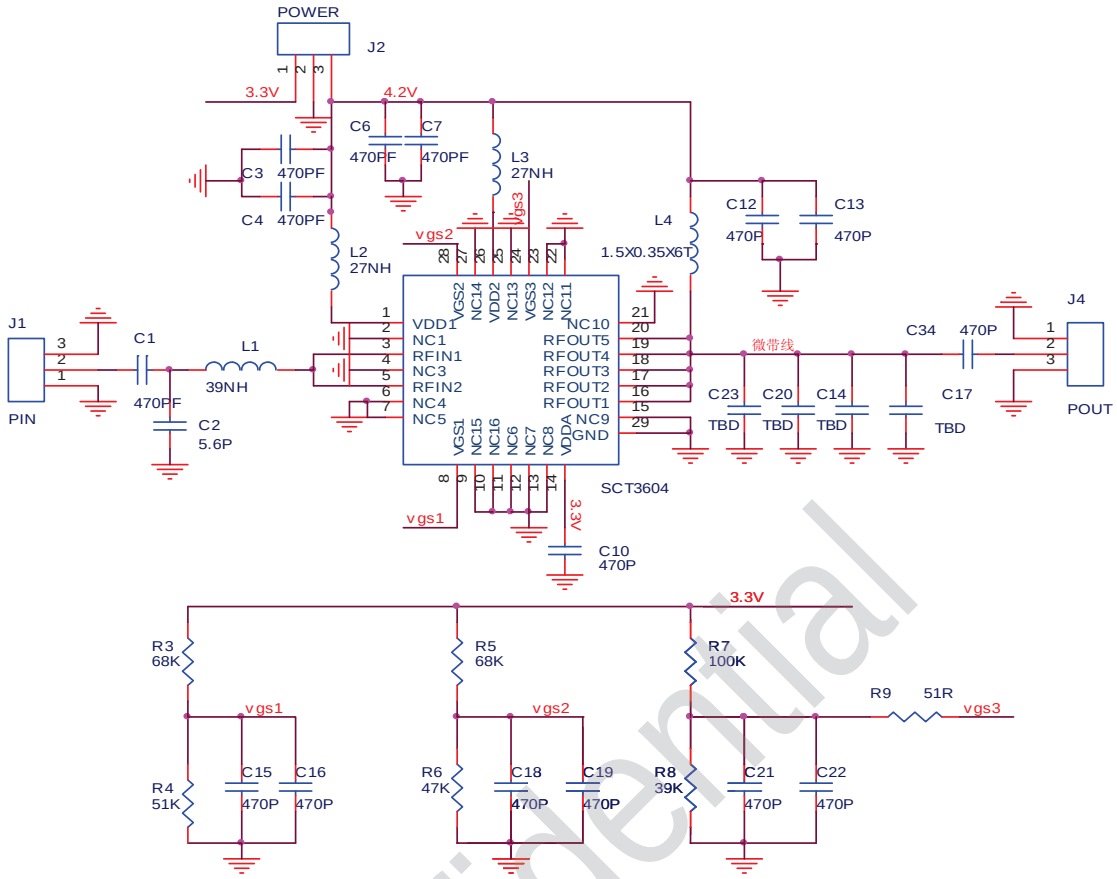
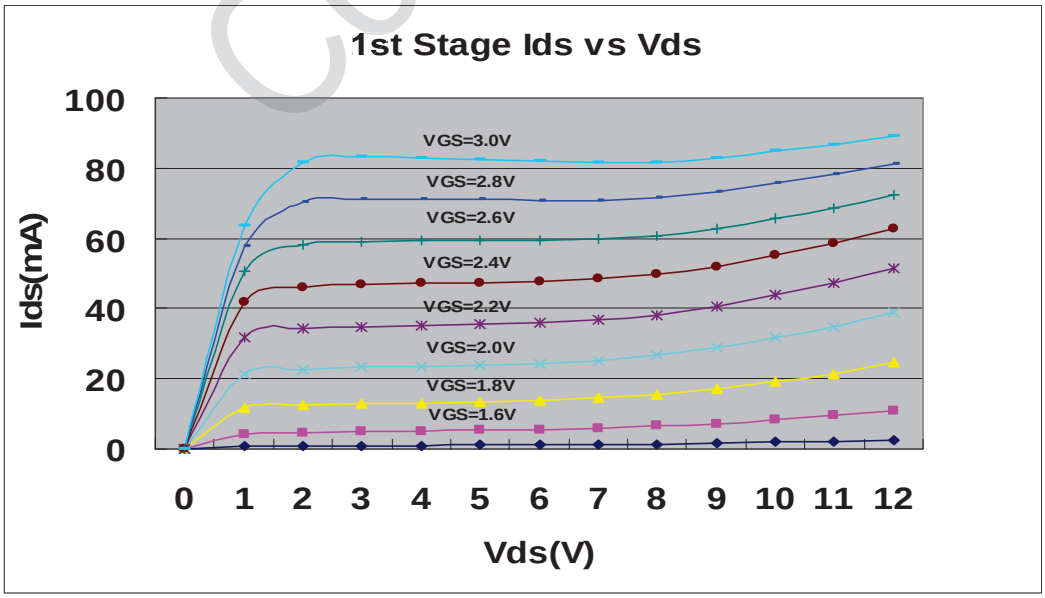
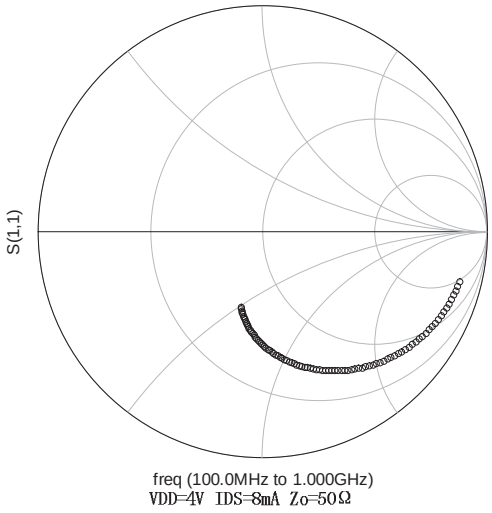
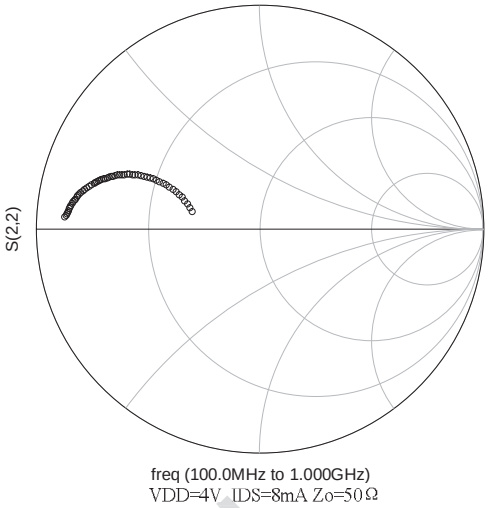


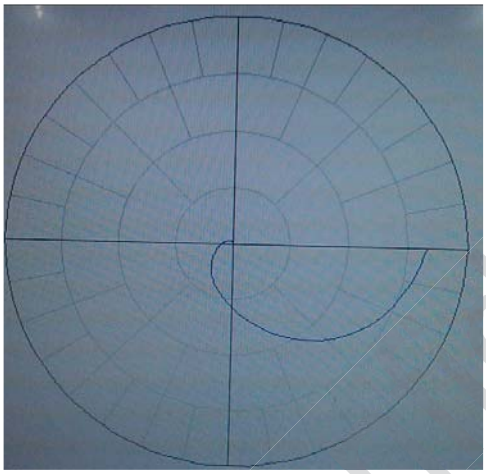
Fig.2. Test and application circuit

MAIN CHARACTERISTICS



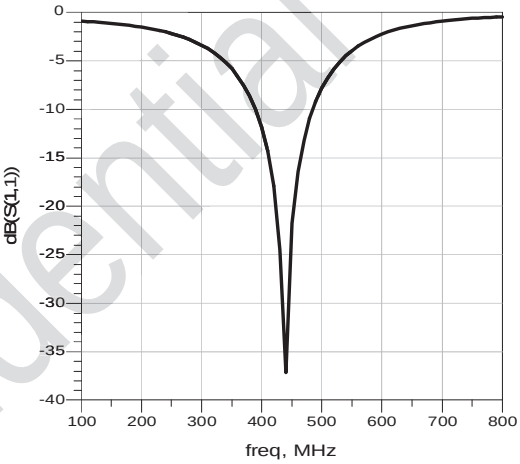






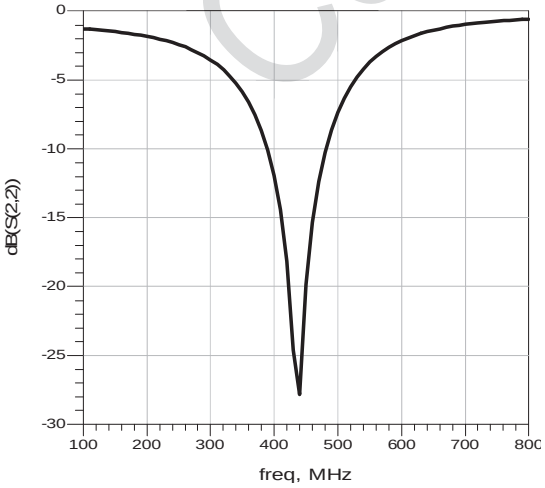
Freq (100.0MHz to 1.000GHz)

S21 UHF VDD=4V IDS=8Ma Zo=50Ω



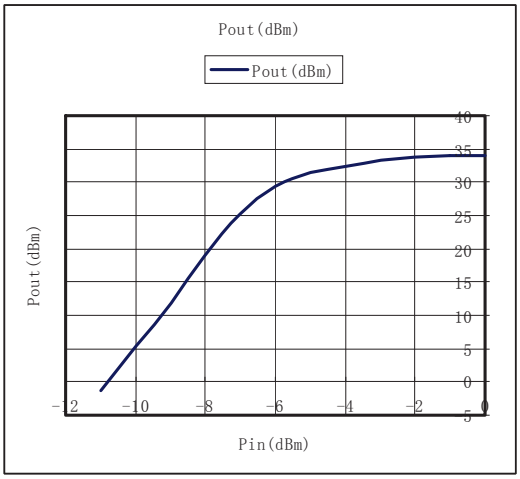
Freq (100.0MHz to 800MHz)

UHF input matched dB(S11)



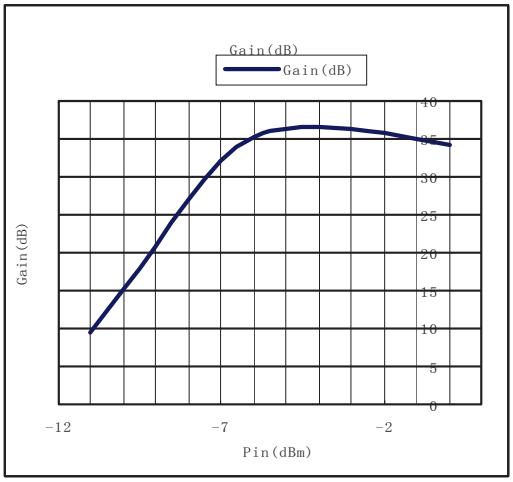
Freq (100.0MHz to 800MHz)

UHF output matched dB(S22)

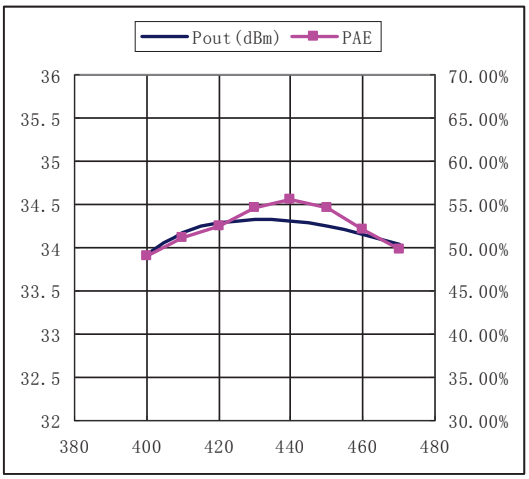


Freq 440MHz

UHF Output power vs input power



Freq 440MHz
Power Gain



Power and PAE vs freq
400~470MHz

VDD=4V IDS=8mA Zo=50Ω

freq	S(1,1)	S(2,2)
100.0 MHz	0.906 / -14.082	0.876 / 176.454
150.0 MHz	0.890 / -20.979	0.870 / 175.958
200.0 MHz	0.870 / -27.711	0.866 / 175.192
250.0 MHz	0.845 / -34.244	0.861 / 174.282
300.0 MHz	0.817 / -40.554	0.855 / 173.264
350.0 MHz	0.787 / -46.627	0.848 / 172.150
400.0 MHz	0.755 / -52.460	0.839 / 170.936
450.0 MHz	0.722 / -58.057	0.828 / 169.612
500.0 MHz	0.689 / -63.427	0.814 / 168.167
550.0 MHz	0.655 / -68.583	0.797 / 166.587
600.0 MHz	0.621 / -73.537	0.775 / 164.860
650.0 MHz	0.588 / -78.301	0.748 / 162.980
700.0 MHz	0.554 / -82.884	0.715 / 160.960
750.0 MHz	0.521 / -87.290	0.673 / 158.854
800.0 MHz	0.487 / -91.514	0.621 / 156.800
850.0 MHz	0.453 / -95.539	0.557 / 155.127
900.0 MHz	0.419 / -99.327	0.481 / 154.577
950.0 MHz	0.384 / -102.809	0.395 / 156.809
1.000 GHz	0.348 / -105.870	0.312 / 165.286

VDD=4V IDS=8mA Zo=50Ω

freq	VSWR1	VSWR2
100.0 MHz	20.261	15.072
150.0 MHz	17.260	14.442
200.0 MHz	14.376	13.948
250.0 MHz	11.920	13.424
300.0 MHz	9.943	12.831
350.0 MHz	8.385	12.162
400.0 MHz	7.163	11.419
450.0 MHz	6.196	10.608
500.0 MHz	5.424	9.740
550.0 MHz	4.799	8.830
600.0 MHz	4.284	7.894
650.0 MHz	3.854	6.949
700.0 MHz	3.489	6.018
750.0 MHz	3.175	5.120
800.0 MHz	2.901	4.279
850.0 MHz	2.659	3.516
900.0 MHz	2.442	2.850
950.0 MHz	2.245	2.304
1.000 GHz	2.067	1.906

APPLICATION INFORMATION

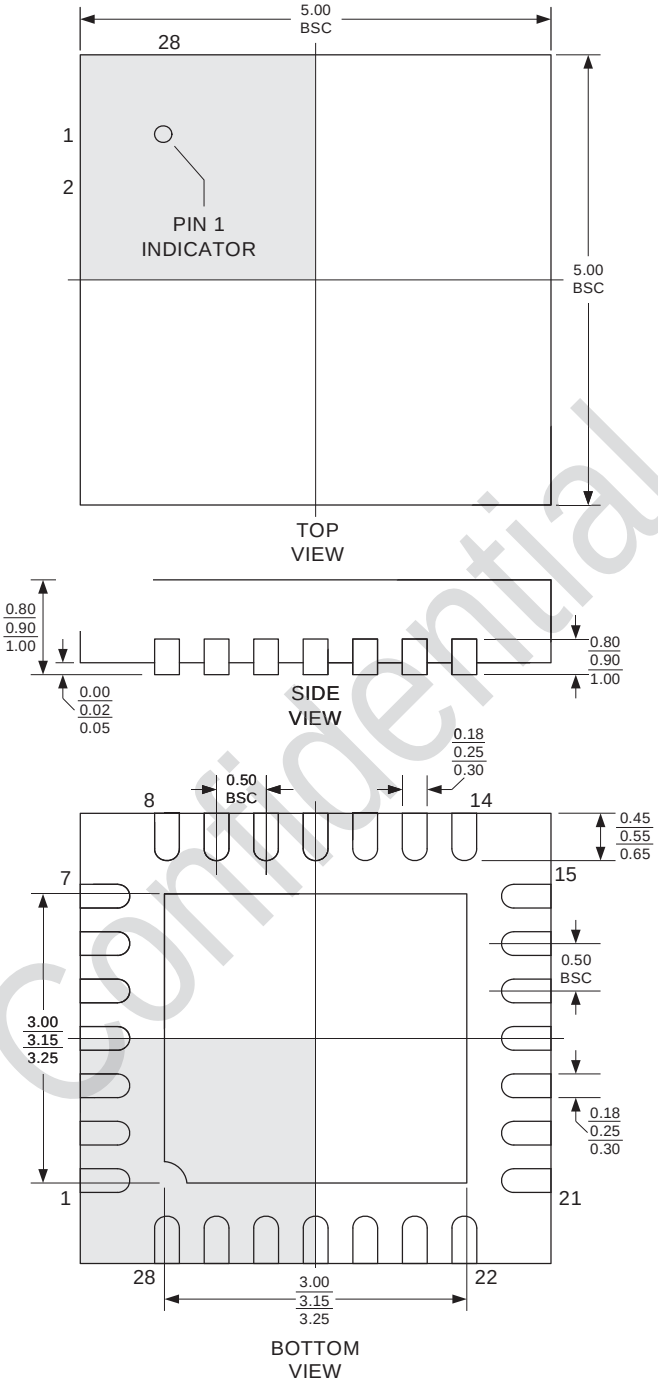
SCT3604 is a three-stage power amplifier device with high gain at full output power. An input power of -5 dBm is required to achieve its fully saturate output power. The chip requires only a single positive power supply. The amplifier's main ground is the big and exposed pad in the middle of the package at the bottom (the snug as indicated on the chip symbol), and the pad should be connected to PCB ground plate with 20-25 vias for good thermal conductivity and grounding.

A special care must be taken care for the multi via layout of the PCB. The 10 mil hole size is recommended and the via must be from top layer to bottom layer. At the same time, an excellent thermal radiator or excellent thermal connection between the chip and the alloy frame of the system.

In normal application for signal with constant envelope, the first and second stages of the amplifier are in class-A and class-AB mode, respectively. The third stage of the amplifier operates in class-C mode. Its DC current will be increased with RF input signal. The optimum load for maximum output power and efficiency is approximately 5 Ω. An external output matching network is required to match this impedance to 50 Ω load, referring to the test and application schematic for more details. The chip inputs (pin 3 and 4) are DC biased, thus a blocking capacitor must be inserted in series between signal source and the chip inputs.

Vdd1 and Vdd2 provide DC power supply to the first and second stages, respectively. RF chock inductor is need for each pin. Vgs1, Vgs2 and Vgs3 should be set to different bias voltages for maximum output power and efficiency. Even though the max DC voltage to the chip power supply is 12 V, in AC condition, do not provide over 6 V power supply to the chip.

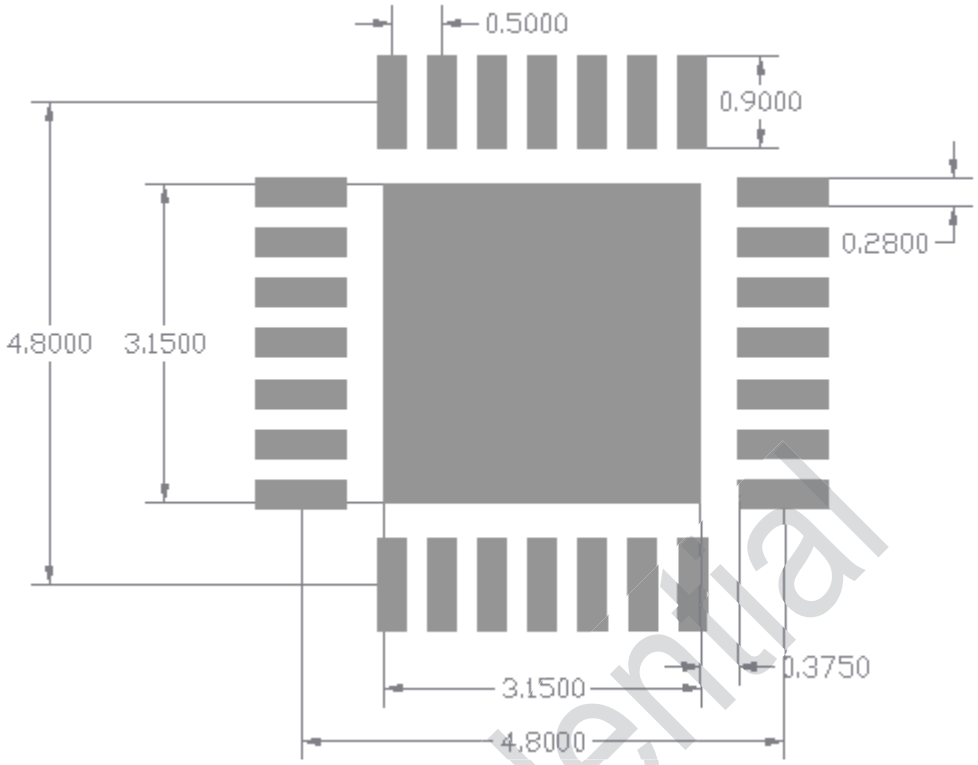
PACKAGING INFORMATION

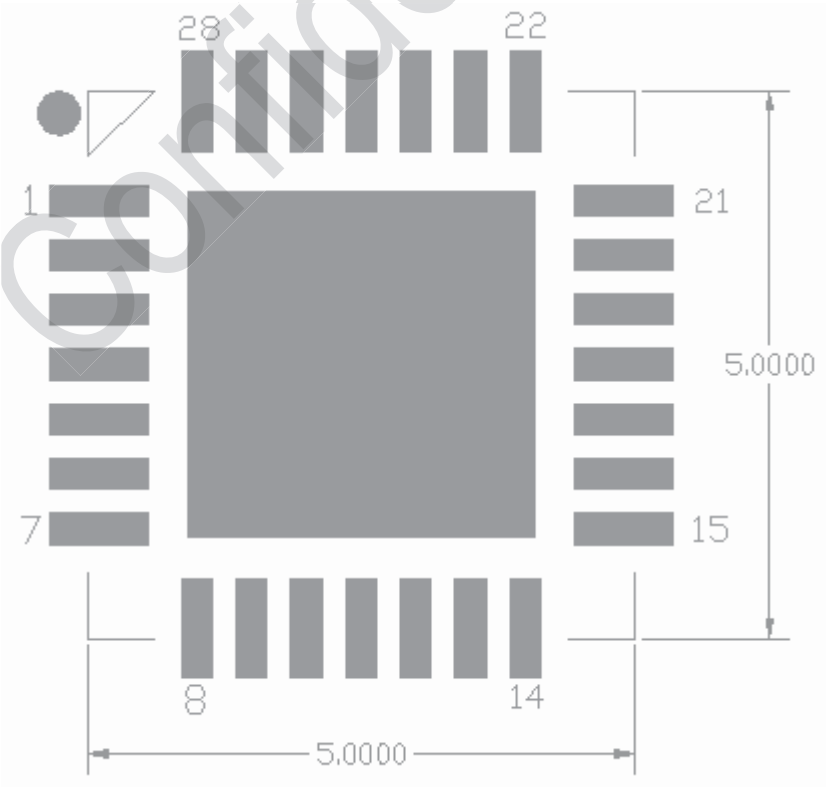


Dimensions shown in millimeters

Fig.4: 5x5mm QFN 28-pin package

PCB LAYOUT





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