Data Sheet

RTC6659E

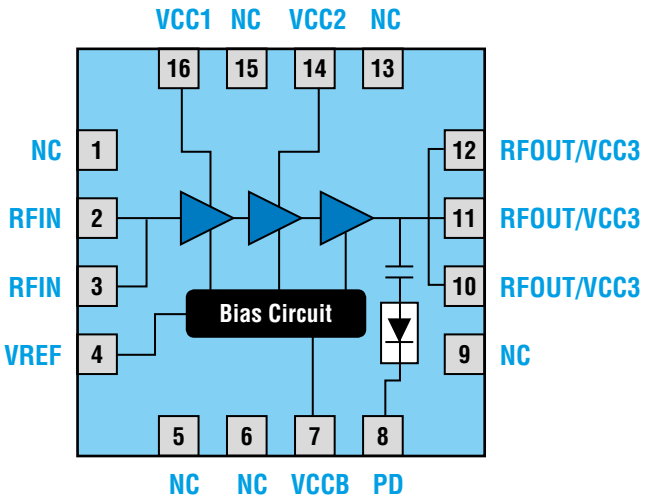
Power Amplifier for 802.11a

MAY 2018 - Ver. 1.2

Description

The RTC6659E is a power amplifier (PA) designed for 4.9 ~ 5.9 GHz frequency range, compatible with 802.11a wireless LAN system. The device is manufactured based on advanced InGaP/GaAs HBT (Heterojunction Bipolar Transistor) process. The amplifier consists of 3 gain stages with inter-stage matching, built-in input matching network, and a power detector for close loop power control operation. With single supply voltage 5V, it provides a low EVM (Error Vector magnitude) of 3% at +22 dBm linear output power In 802.11a mode (OFDM 64QAM, 54Mbps). The RTC6659E is packaged in a tiny industry-standard 16-lead surface mount package QFN 3mm x 3mm x 1mm (max) with lead-free RoHS compliant.

Functional Block Diagram



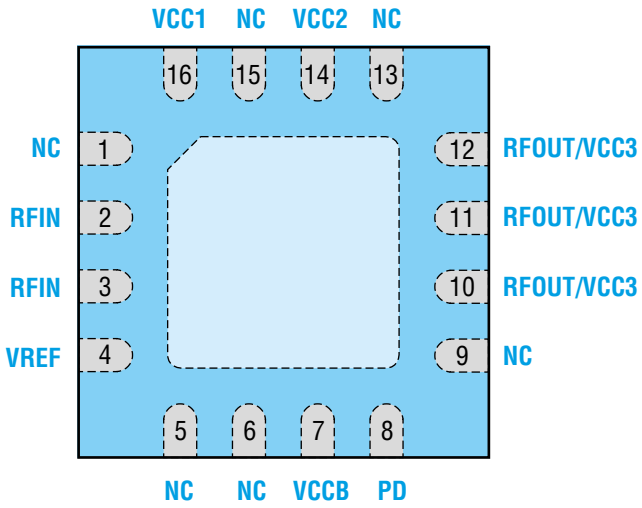
Features

- 4.9 ~ 5.9 GHz Frequency Range
- 5V Single Supply Voltage
- RTC6659 pin Compatible
- +22 dBm Linear Output Power for 3% EVM, 802.11a, 54Mbps 64 QAM
- Small Signal Gain : 32 dB
- On-chip Input Matching
- Packaged in 16L QFN-3mm x 3mm x 1mm (max)
- RoHS Compliant, Pb-free, Halogen Free
- Moisture Sensitivity Level : MSL 3

Applications

- High Power WLAN Applications
- IEEE 802.11a Wireless LAN System
- 5 GHz ISM Band Applications
- 5 GHz Cordless Phones

Pin Assignments



Top View Through Package

Pin No.	Pin Name	Description
2	RFIN	RF input. Input matching network is built on chip
3	RFIN	Same as pin 2
4	VREF	Bias Control voltage of power stage-1,2,3. This pin can be used to control PA on/off
7	VCCB	Power supply for bias circuit, typically 3.3 V
8	PD	Detector output voltage for output power index
10,11,12	RFOUT/VCC3	RF output and power supply for power stage-3
14	VCC2	Power supply for power stage-2
16	VCC1	Power supply for power stage-1
1, 5, 6, 9, 13, 15	NC	Not connected inside the package
Exposed Paddle		It must be connected to a ground through PCB via for best performance

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Supply Voltage	VCC	5.5	V
Reference Voltage	VREF	3.0	V
Input RF Level	RF_{IN}	+5	dBm
Operating Ambient Temperature	T_A	-40 to +85	°C
Storage Temperature	T_{STG}	-40 to +150	°C

NOTE: Stresses above those conditions listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only. Functional operation of the device above those conditions indicated in the Absolute Maximum Ratings is not implied. The functional operation of the device at the conditions in between Recommended Operating Ranges and Absolute Maximum Ratings for extended periods may affect device reliability.

Recommended Operating Ranges

Parameter	Symbol	Min	Typ	Max	Unit
Operating Frequency	f	4.9		5.9	GHz
Supply Voltage	VCC1, VCC2, VCC3, VCCB	3	5	5.25	V
Reference Voltage	VREF	2.85	2.9	2.95	V

NOTE: Recommended Operating Ranges indicate conditions for which the device is intended to be functional, but does not guarantee specific performance limits.

Electrical Specification

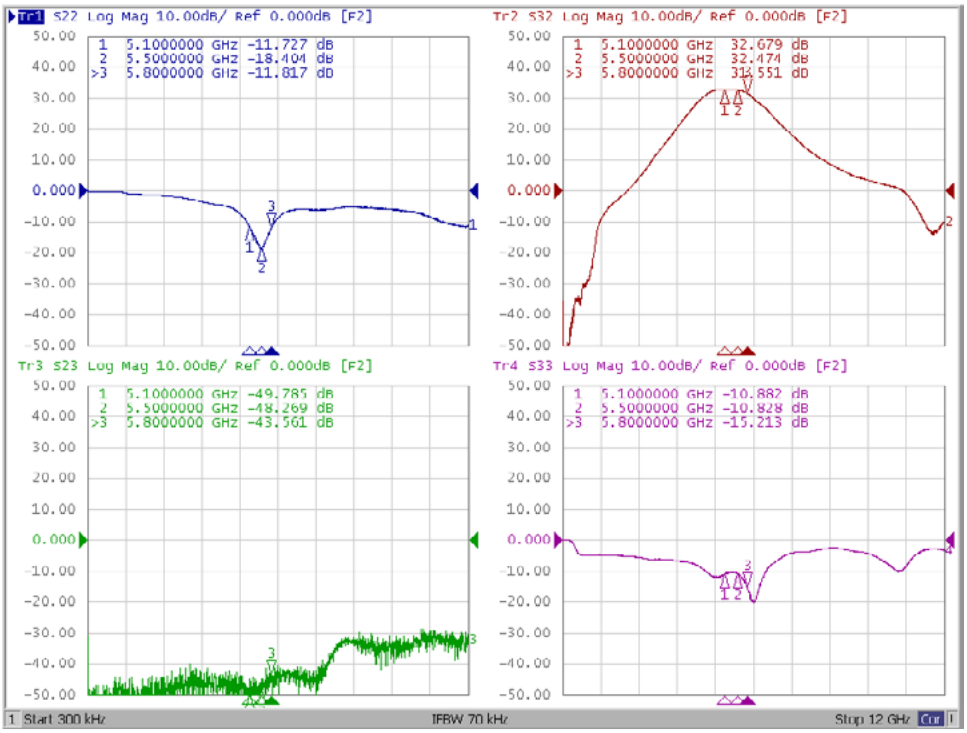
T_A = +25°C, VCC1/2/3 = VCCB = 5 V, Freq = 5.5 GHz, VREF = 2.9 V, unless otherwise noted

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Frequency	f		4.9		5.9	GHz
Output Power	Pout	802.11a, 64QAM/54Mbps, EVM = 3%	21.5	22	22.5	dBm
		802.11a mask compliant power, OFDM 6Mbps		26		dBm
Small Signal Gain		Pin=-30dBm	31.5	32	32.5	dB
Gain Flatness	ΔG	within band (4.9 – 5.9 GHz)		0.5		dB
1 dB Output Compression Point	P1dB	1dB Gain compression		27		dBm
Input Return Loss	|S11|				10	dB
Output Return Loss	|S22|				10	dB
2nd/3rd Harmonics	2fo, 3fo	CW signal, Pout = 22 dBm		-40		dBc
Supply Current	I_{CQ}	Quiescent (no RF)		265		mA
	I_{CC}	Pout = 22 dBm		300		mA
Reference Current	Iref	Quiescent (no RF)		4		μA
		Pout = 22 dBm		5		μA

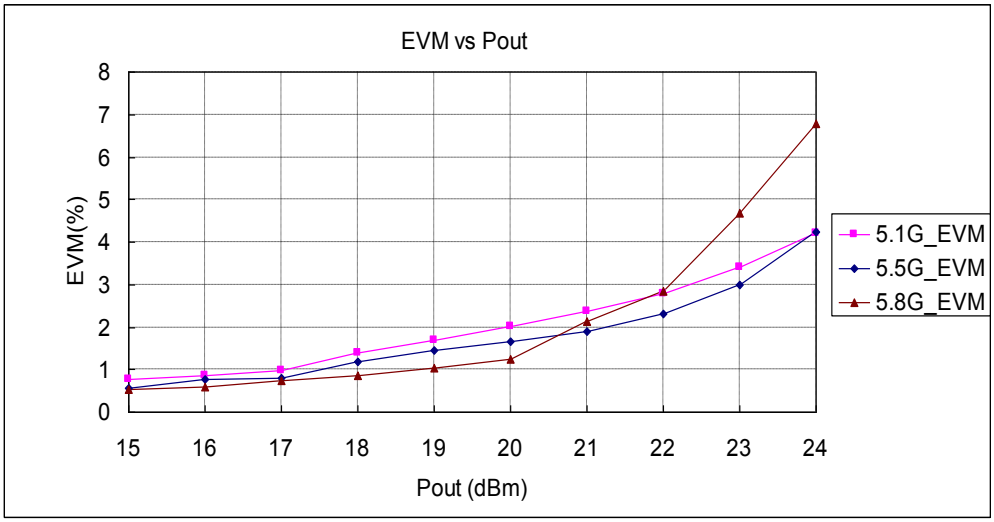
Typical Performance Characteristics

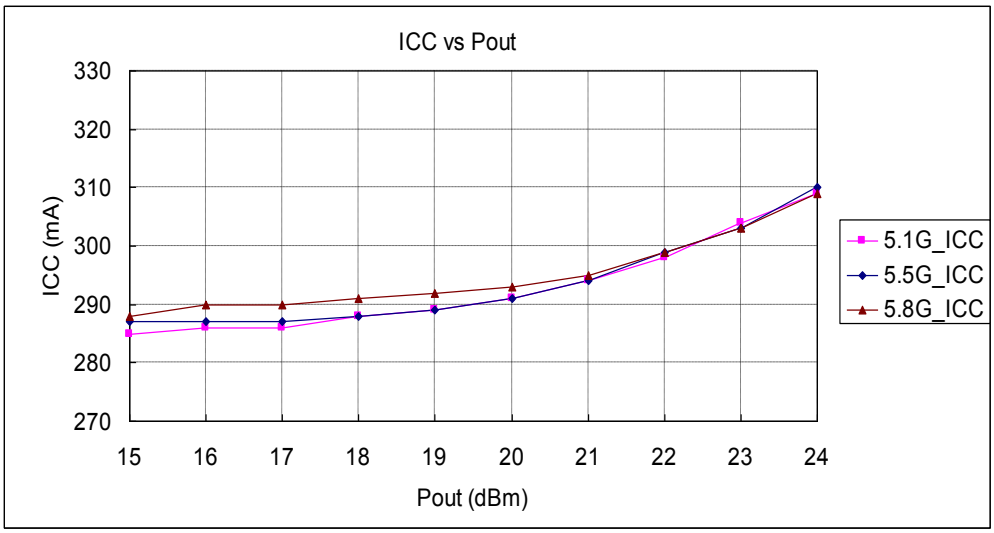
T_A = +25°C, VCC1/2/3 = VCCB = 5 V, VREF = 2.9 V

S-Parameters

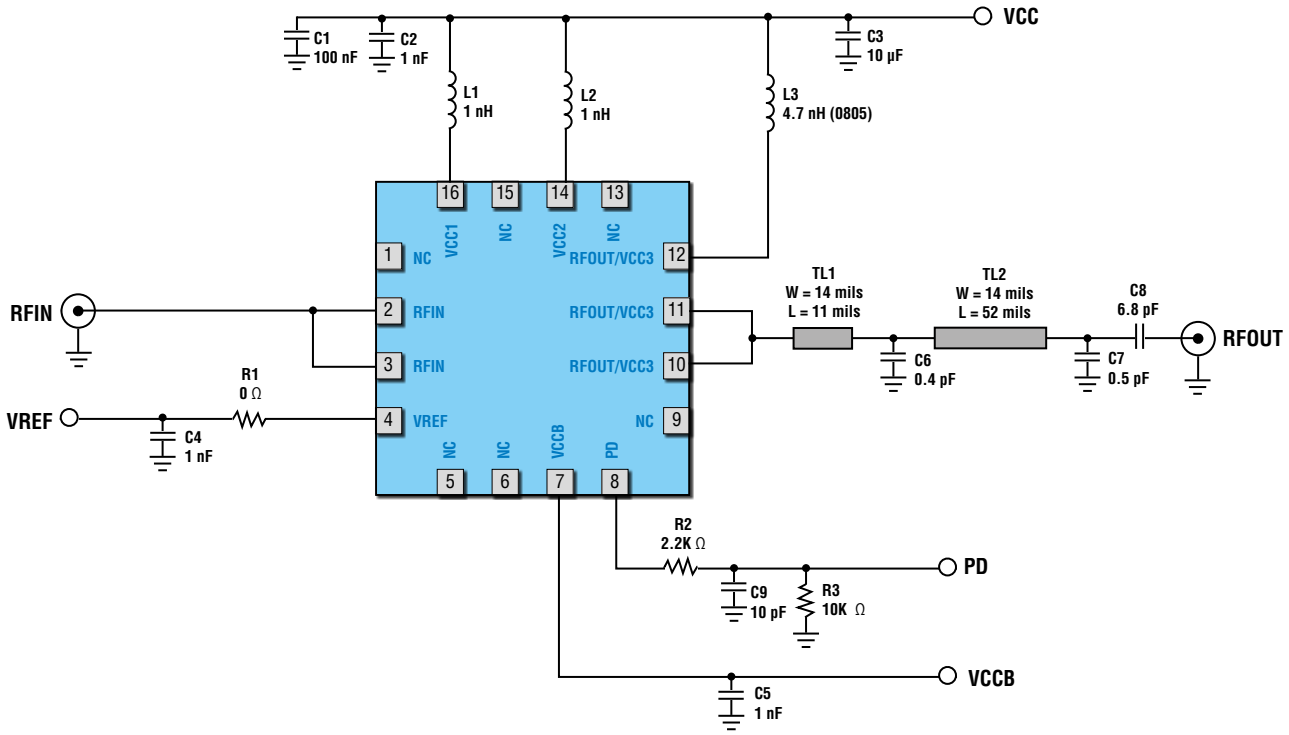


EVM and ICC at 802.11a 64QAM 54Mbps





Application Circuits

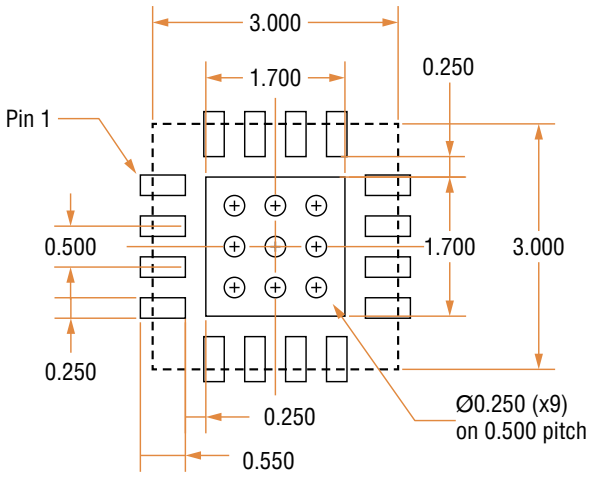


NOTE : Information in the above application is for reference only, and does not guarantee the mass production design of the device.

Evaluation Board Bill of Material

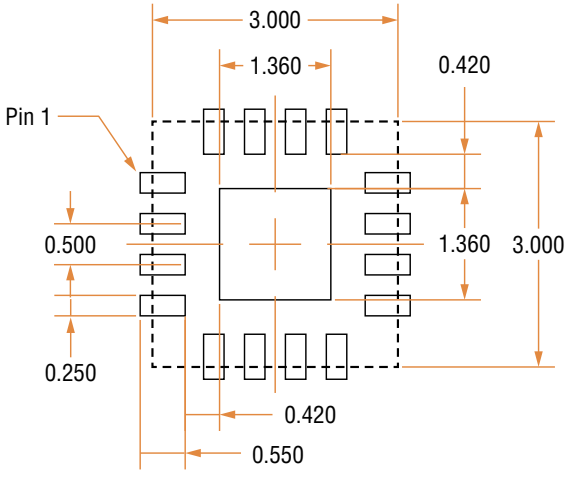
Component	Value	Description	Supplier	Part Number
IC		RTC6659E	RichWave	
C1	100 pF	De-coupling capacitor	Walsin	0402N101J500LT
C2, C4, C5	1nF	De-coupling capacitor	Walsin	0402B102K500CT
C9	10 pF	De-coupling capacitor	Walsin	0402N100J500LT
C6	0.4 pF	Matching capacitor	Walsin	RF15N0R4B500LT
C7	0.5 pF	Matching capacitor	Walsin	RF15N0R5C500LT
C8	6.8 pF	DC block capacitor	Walsin	0402N6R8D500LT
C3	10 µF	De-coupling capacitor	Walsin	0402X106K6R3CT
R1	0 Ω		Walsin	WR04X00R0PTL
R2	2.2 Ω		Walsin	WR04X02R2PTL
R3	10K Ω		Walsin	WR04X1002FTL
L1, L2	1 nH	RF choke inductor	ACX	HI1005-1C1N0SMT
L3	4.7 nH	RF choke inductor, 0805	ACX	HI2012-1_4N7_N_

Recommended Footprint Patterns



PCB Board Metal & Via Pattern

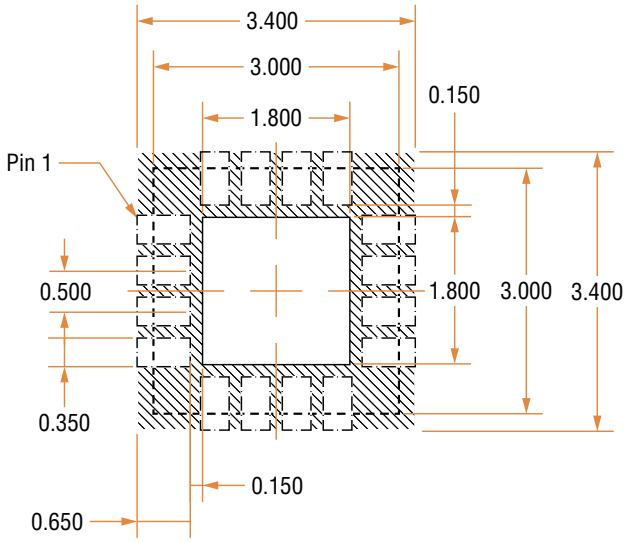
Top View



PCB Stencil Pattern

Top View

64% Solder Coverage on Pad



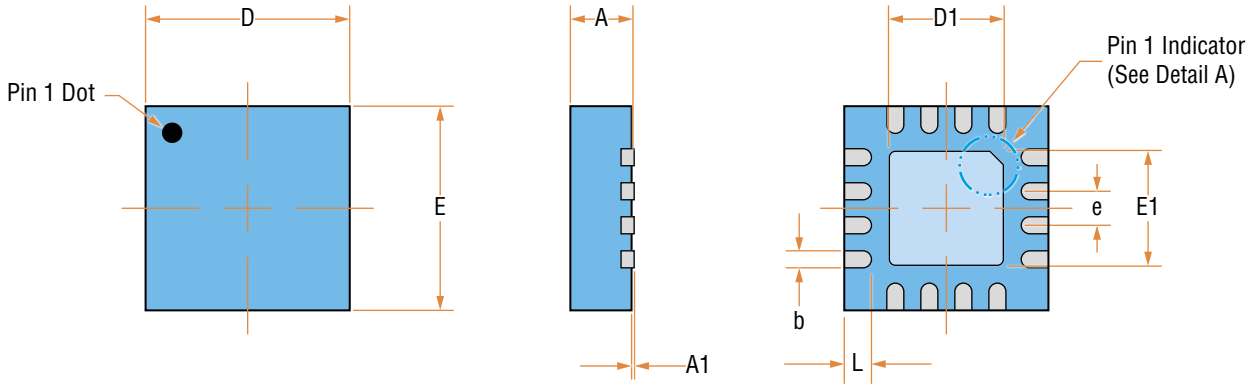
PCB Solder Mask Pattern

Top View

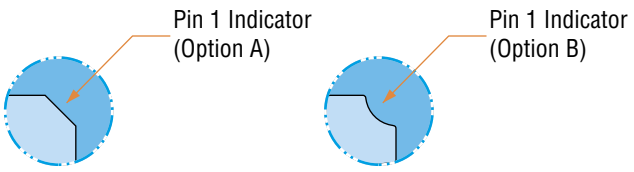
NOTE :

1. All dimensions are measured in millimeters.
2. Drawing is not to scale.

Package Dimensions



Top View **Side View** **Bottom View**



Detail A

16L QFN 3 X 3 X 1 - C		
SYMBOL	**MIN**	**MAX**
A	0.800	1.000
A1	0.000	0.050
b	0.180	0.320
D	2.900	3.100
D1	1.550	1.850
e	0.500 BSC	
E	2.900	3.100
E1	1.550	1.850
L	0.300	0.500

NOTE :

1. All dimensions are measured in millimeters.
2. Drawing is not to scale.
3. The shape of the Pin 1 Indicator can be either Option A or Option B, but it must be located within the zone indicated.

Customer Service

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