Super-Regeneration RF Receiver

W55RFS27R3C

Data Sheet

Contents

General Description

nuvoton W55RFS27R3C is a fully integrated S-R (Super-regeneration) RF receiver with full-function of baseband control command decoder for application of R/C vehicle, toy, or wireless data communication. W55RFS27R3C provides both *uC-mode* for simple logic interface to general purpose of micro-controller and *manual-mode* for baseband control command decoder.

Manual-mode is designed with Winbond patented *ChannelShared^{WB}* protocol for multi-player application. Up to 3 players is allowed simultaneously playing in the same frequency band. There are 6 function available in *Manual-mode*, i.e.,
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Forward, Backward, Left-turn, Right-turn, and two other reserved function F1, F2 for light, horn or other control function.

uC-mode can be controlled by general purpose micro-controller to support R/C toy, or wireless data communication.

The associate transmitter W55RFS27T3B provides the FCC/ETSI regulation provisions for 27MHz, 40MHz, and 49MHz S-R (Super-regeneration) demodulation and wide range of operating voltage 2.1V ~ 5.5V for 2-battery or 3-battery R/C toy application.

1.1 W55RFS27R3C Features

- Winbond patented *ChannelShared^{WB}* protocol enables maximum 3 players simultaneously playing in one frequency band.

- On-chip LNA provides very good isolation so that receivers can work together without interference.

- Enhanced receiver circuit provides higher sensitivity than traditional super-regenerative circuits.

- Operating frequency: 27MHz to 49MHz (depend on oscillator frequency)

- Very low operating voltage: 2.2V ~ 5.5V

- Receiving data rates up to 2.5Kbps for 50% duty cycle

- Supports 6-function of R/C toy baseband control command decoder

- Power down current consumption less than 1uA

- Less manual adjustment needed in production

- Lower manufacture production cost

- Associate transmitter W55RFS27T3B compliant to FCC part 15 Subpart C 15.227 / ETSI 300 220-1 low-power & short-range device requirements

- Operating temperature: 0°C ~ 70°C

1.2 W55RFS27R3C Pad Definition
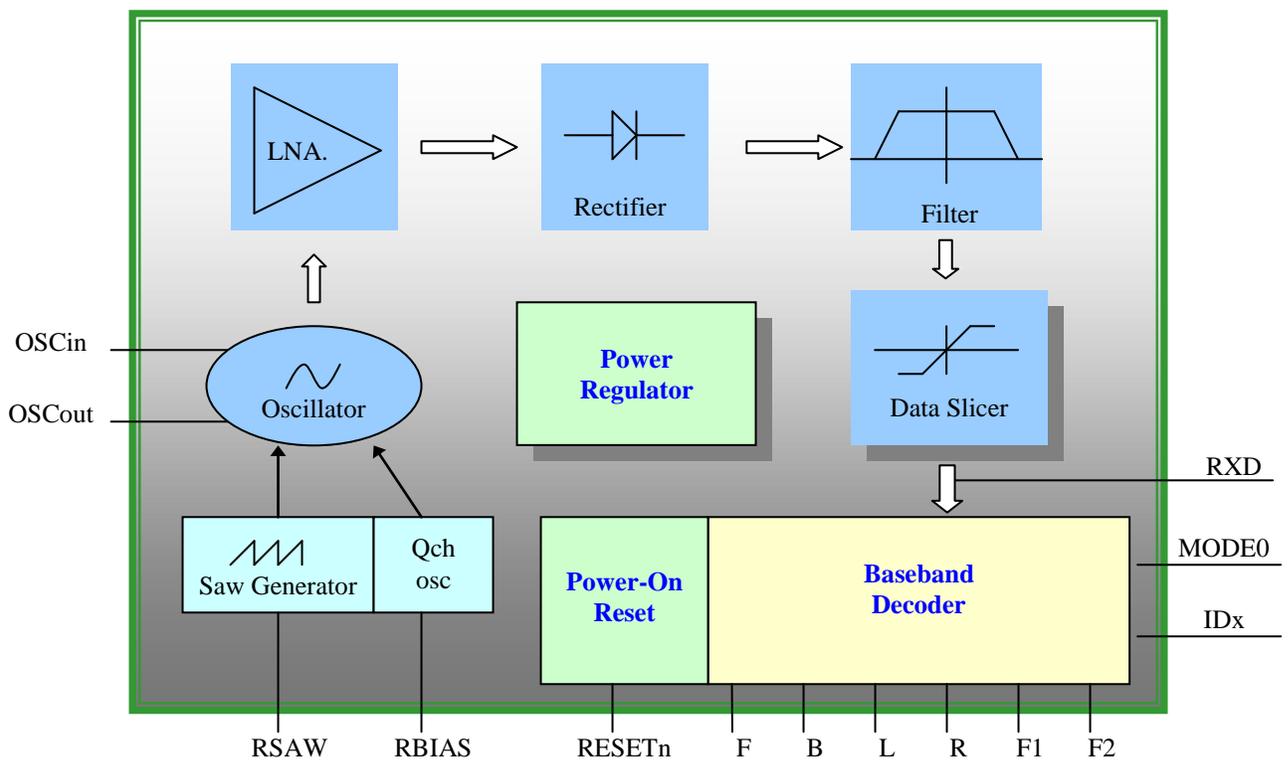
1.2.1 W55RFS27R3C Pad Description

Symbol	Pad No.	I/O	A/D	Functional Description
GND	1.	Ground	A	Ground return path
CMFB	2.	I/O	A	Common-mode feedback capacitor connect
RBIAS	3.	I/O	A	Resistor to adjust internal ring-oscillator frequency
RSAW	4.	I/O	A	Resistor to control internal saw generator
VDDA	5.	Power	A	Regulated voltage output
VDDA	6.	Power	A	Regulated voltage output
GND_LNA	7.	Ground	A	LNA Ground return path
VDD_LNA	8.	Power	A	LNA power input
SDINGD	9.	Ground	A	Filter capacitor connect
LNAING	10.	I	A	LNA Gate input
LNAINS	11.	I	A	LNA Source input
LNAOUT	12.	O	A	LNA output(NC)
OSCin	13.	O	A	Oscillator tank input
OSCout	14.	O	A	Oscillator tank output
GNDA	15.	O	A	Regulator ground return path
Resetn	16.	I/O	D	Resetn =0 reset whole circuit, internal pull-high
Mode	17.	I	D	Receiver mode selection, should be "0" when operating
ID0	18.	I	D	ID setting(LSB) for Channel shared , ID0=ID1 = 1⇨ enter *uC-mode*
ID1	19.	I	D	ID setting (MSB) for Channel shared , ID0=ID1 = 1⇨ enter *uC-mode*
TEST	20.	I	D	TEST=1 reserved for chip testing, internal pull-low
F1	21.	I/O	D	Decoder F1 output / power on trapping of OAGC (Set "0")
F2	22.	I/O	D	Decoder F2 output / Power on trapping of HOPQ(Set "1") / CPU mode= $ENB ("0" power down)
R	23.	I/O	D	Decoder Right-turn output / CPU mode=HOP_CLK
L	24.	I/O	D	Decoder Left-turn output / CPU mode=OAGC2Q
B	25.	I/O	D	Decoder Backward output / CPU mode=OAGC1Q
F	26.	I/O	D	Decoder Forward output / CPU mode=OAGC0Q
RXD	27.	I/O	D	Receiver data output / power on trapping of LENB (set "1")
VSPLY	28.	Power	A	Power input

1.2.2 Power-On Trapping Function Description

Power-Trapping Pin Name	Trapping State	Function Description	Recommend Usage
RXD	1	Enable LNA	Enable LNA
	0	Disable LNA	
F1	1	Enable OAGC	Disable OAGC
	0	Disable OAGC	
F2	1	Enable Frequency Hopping	Enable Frequency Hopping
	0	Disable Frequency Hopping	

System Description

2.1 W55RFS27R3C System Block Diagram

2.2 W55RFS27R3C Functional Description

ChannelShared Protocol Engine
W55RFS27R3C+W55RFS27T3B built-in *ChannelShared^{WB}* protocol enables maximum 3 players in a frequency band. Switch channel is simply switch an input state, instead of change crystal such a high cost channel switching.

Power Regulator
W55RFS27R3C build-in on-chip power regulator provides a stable operating performance under operating voltage from 2.2V ~ 5.5V, the very wide range of operating voltage is specially designed for mini R/C toy or R/C vehicle by 2-battery or 3-battery operation.

RF Receiver
W55RFS27R3C RF receiver has been enhanced from "Super-Regeneration" architecture for R/C toy application. The high sensitivity and high noise immunity property is very suitable for getting higher RF receiving performance in very high noise level environment.
On-chip LNA provides isolation from receivers and is very useful for multi-player application

Baseband Control Function Decoder
W55RFS27R3C build-in 6-function of general baseband control function for R/C toy "**F**orward"; "**B**ackward"; "**L**eft-turn"; "**R**ight-turn", and 2 more reserved control functions of "**F1**"; "**F2**".

Electronic Characteristics

3.1 W55RFS27R3C Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage to Ground Potential	- 0.3 to 6.5	V
Applied Input/Output Voltage	- 0.3 to 6.5	V
Power Dissipation ($T_a = 70°C$)	150	mW
Ambient Operating Temperature	0 to 70	°C
Storage Temperature	-40 to 85	°C

Note: Exposure to conditions beyond those listed under Absolute Maximum Ratings may adversely affect the life and reliability of the device.

3.2 W55RFS27R3C DC Characteristics

(VDD-VSS = 3 V, Ta = 25°C; unless otherwise specified)

Parameter	Sym.	Conditions	Min.	Typ.	Max.	Unit
Power Supply						
Operating Voltage	V_{DD}		2.2	-	5.5	V
Operating Current	I_{OP}	V_{DD}=5.5V	-	-	4	mA
Stand-by Current	I_{SBY}	V_{DD}=5.5V , ENB= 0 (*uC-mode*)	-	-	2	μA
Digital Input/Output Pin						
Input High Voltage	V_{IH}		0.8*V_{DD}	-	V_{DD}	V
Input Low Voltage	V_{IL}		V_{SS}	-	0.1*V_{DD}	V
F,B,L,R,F1,F2 Output High Source	I_{OH}	V_{OH}=0.7 * V_{DD}	-	6	-	mA
F,B,L,R,F1,F2 Output Low Sink	I_{OL}	V_{OL}=0.3 * V_{DD}	-	6	-	mA
RXD Output High Source Current	I_{OH}	V_{OH}=0.7 * V_{DD}	-	2	-	mA
RXD Output Low Sink Current	I_{OL}	V_{OL}=0.3 * V_{DD}	-	2	-	mA
Oscillator						
Operation Frequency	F_{OSC}		27	-	49.8	MHz
Quench frequency	F_{QCH}		170	200	250	KHz
Baseband Decoder Section						
Modulation Duty Cycle	M_{DYT}		30	50	70	%
Received Data Rate	R_{DTT}	50% Duty-cycle Manchester Code	-	2.5	-	Kbps

3.3 W55RFS27R3C Ordering Information

W55RFS27R3C provides two types of package in shipment: Dice form and wafer form

Part Number	Package	Remarks
W55RFS27R3C(H)	Dice form	
W55RFS27R3C(W)	Wafer form	

3.4 W55RFS27R3C Package Information

3.4.1 W55RFS27R3C Bonding Pad List

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Window : (xl = -1228.000, yl = -625.000),(xh = 1228.000, yh = 625.000)
Windows size : Width = 2456.000, length = 1250.000
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PAD NO	PAD NAME	PIN NO(DIP28)	X	Y
1	* GND	* 1	-33.015	540.000
2	CMFB	2	-385.965	540.000
3	RBIAS	3	-492.965	540.000
4	RSAW	4	-599.965	540.000
5	VDDA:	5	-709.365	540.000
6	VDDA:	5	-821.165	540.000
7	GND_LNA	6	-1143.000	532.375
8	VDD_LNA	7	-1143.000	420.975
9	SDINGD	8	-1143.000	308.495
10	LNAING	9	-1143.000	174.685
11	LNAINS	10	-1143.000	-46.460
12	LNAOUT	11	-1143.000	-525.320
13	OSCin	12	-815.090	-540.000
14	OSCout	13	-685.215	-540.000
15	GNDA	14	-575.165	-540.000
16	resetn	15	-148.690	-540.000
17	MODE	16	-41.690	-540.000
18	ID0	17	65.310	-540.000
19	ID1	18	172.310	-540.000
20	TEST	19	279.310	-540.000
21	F1	20	389.910	-540.000
------------------------------21(GND)-------------------------------------
22	F2	22	770.310	540.000
23	R	23	655.860	540.000
24	L	24	541.410	540.000
25	B	25	426.960	540.000
26	F	26	312.510	540.000
27	RXD	27	196.535	540.000
28	VSPLY	28	78.385	540.000

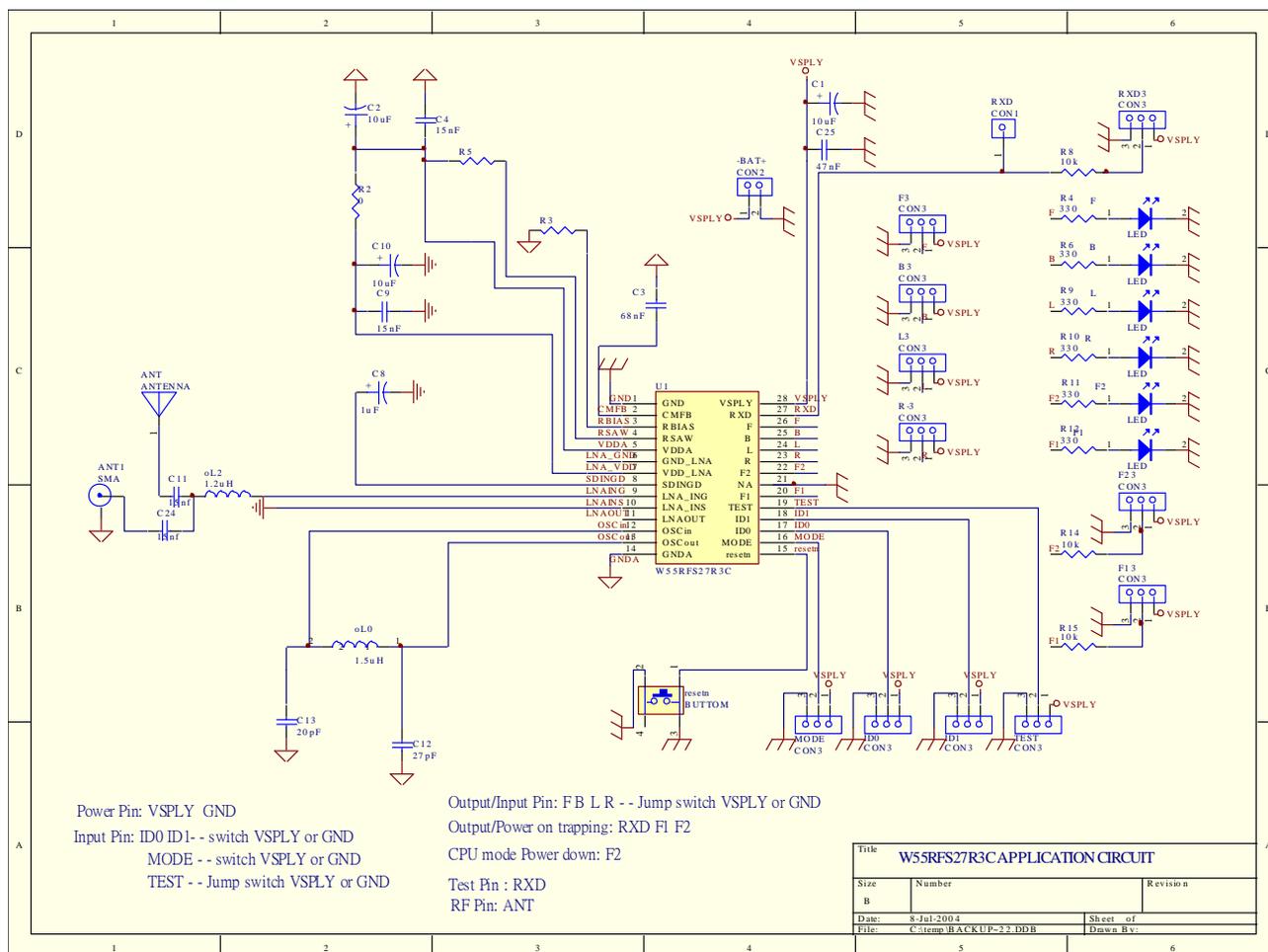**(*: Bonding Sequence start from GND(Pin1))**

3.4.2 W55RFS27R3C Bonding Pad Diagram
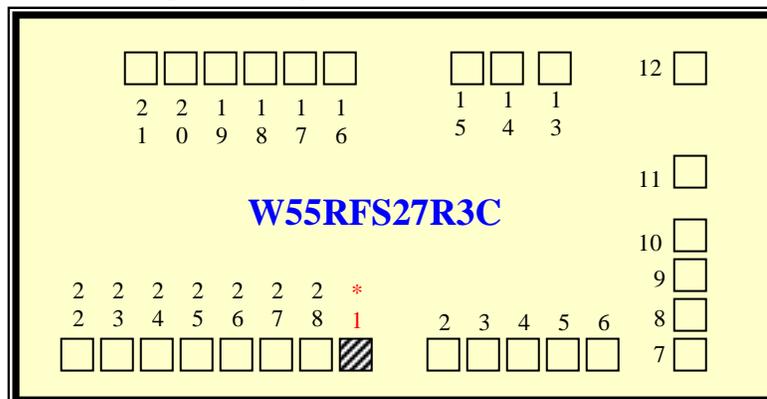
Design Information

4.1 W55RFS27R3C Reference Design
4.1.1 W55RFS27R3C Application Circuit

W55RFS27R3C Application Schematic BOM:

Item	Qty	Reference	Part
1.	1	0	R2
2.	1	1.2uH	oL2
3.	1	1.5uH	oL0
4.	1	1uF	C8
5.	2	10k	R8 R14
6.	1	10k	R15
7.	3	10uF	C1 C2 C10
8.	4	15nF	C4 C9 C11 C24
9.	1	20pF	C13
10.	1	27pF	C12
11.	1	47nF	C25
12.	1	68nF	C3
13.	5	330	R4 R6 R9 10 R11
14.	1	330	R12
15.	1	ANTENNA	ANT
16.	1	W55RFS27R3C	U1

4.2 W55RFS27R3C Data Sheet Document History

Revision	Date	Description
A0	Jul. 2004	Preliminary version A0
A1.0	Feb. 2010	Logo Changed

Important Notice

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