

Super-Regeneration RF Receiver

W55RFS27R3C

Data Sheet

Table of Content-

1.	GENERAL DESCRIPTION	3
1.1	W55RFS27R3C Features.....	3
1.2	W55RFS27R3C Pad Definition.....	4
1.2.1	W55RFS27R3C Pad Description.....	4
1.2.2	Power-On Trapping Function Description.....	5
2.	SYSTEM DESCRIPTION.....	6
2.1	W55RFS27R3C System Block Diagram	6
2.2	W55RFS27R3C Functional Description	7
3.	ELECTRONIC CHARACTERISTICS	8
3.1	W55RFS27R3C Absolute Maximum Ratings	8
3.2	W55RFS27R3C DC Characteristics	8
3.3	W55RFS27R3C Ordering Information	9
3.4	W55RFS27R3C Package Information	9
3.4.1	W55RFS27R3C Bonding Pad List.....	9
3.4.2	W55RFS27R3C Bonding Pad Diagram.....	10
4.	DESIGN INFORMATION	11
4.1	W55RFS27R3C Reference Design	11
4.1.1	W55RFS27R3C Application Circuit	11
5.	REVISION HISTORY	13



1. GENERAL DESCRIPTION

The Winbond W55RFS27R3C is a fully integrated, S-R (Super-regeneration) RF receiver with full-function baseband command decoder for R/C vehicles, toys, or wireless data communication applications.

The W55RFS27R3C provides two input modes: **uC-mode**, for general-purpose, micro-controller interfaces to the RF transmitter (the decoder is disabled); and **manual-mode**, for a 6-function, baseband command decoder and RF receiver. **Manual-mode** is also designed with the Winbond-patented **ChannelShared^{WB}** protocol for multi-player applications, and up to three players are allowed simultaneously in the same frequency band. As a result, the W55RFS27T3B / W55RFS27R3C provide a simple remote control capability for multiple players with low cost and high performance.

In addition, the W55RFS27R3C accommodates a wide range of operating voltages (2.2 ~ 5.5 V) and supports 2- or 3-battery applications.

The associated transmitter W55RFS27T3B meets FCC/ETSI regulations for 27 MHz, 40 MHz, and 49 MHz S-R (Super-regeneration) demodulation.

1.1 W55RFS27R3C Features

- Winbond patented **ChannelShared^{WB}** protocol enables a maximum of three players simultaneously in one frequency band.
- On-chip LNA provides better isolation so that receivers can work together without interference.
- Enhanced receiver circuit provides higher sensitivity than traditional super-regenerative circuits.
- Operating frequencies: 27 MHz to 49 MHz (depending on the oscillator frequency)
- Operating voltages: 2.2 V ~ 5.5 V
- (uC-mode) Receiving data rates up to 2.5 Kbps for 50% duty cycle signals
- (manual-mode) R/C-toy baseband control command decoder, supporting 6 functions; Forward, Backward, Left-turn, Right-turn, and 2 user-defined functions F1 and F2
- (manual-mode) Frequency hopping increases receiver sensitivity
- Power-down current consumption less than 1 μ A
- Associated transmitter W55RFS27T3B is compliant with FCC part 15 Subpart C 15.227 / ETSI 300 220-1 low-power and 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 connection
RBIAS	3	I/O	A	Resistor to adjust internal ring-oscillator frequency
RSAB	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 connection
LNAING	10	I	A	LNA Gate input
LNAINS	11	I	A	LNA Source input
LNAOUT	12	O	A	LNA output(NC)
OSCI	13	O	A	Oscillator tank input
OSCO	14	O	A	Oscillator tank output
GNDA	15	O	A	Regulator ground return path
Resetr	16	I/O	D	Resetr =0 reset whole circuit, internal pull-high
Mode	17	I	D	Receiver mode selection; should be "0" for regular operation
ID0	18	I	D	ID setting(LSB) for Channel shared protocol ([ID1:ID0] = [1,1]) uC-mode
ID1	19	I	D	ID setting (MSB) for Channel shared protocol ([ID1:ID0] = [1,1]) uC-mode
TEST	20	I	D	TEST=1, reserved for chip testing, internal pull-low
F1	21	I/O	D	(manual-mode) Decoder F1 output (uC-mode) Set to "0".
F2	22	I/O	D	(manual-mode) Decoder F2 output (manual-mode) Power on trapping of Frequency Hopping (uC-mode) \$ENB ("0" to power down)



W55RFS27R3C Pad Description, continued.

SYMBOL	PAD NO.	I/O	A/D	FUNCTIONAL DESCRIPTION
R	23	I/O	D	(manual-mode) Decoder Right-turn output (uC-mode) HOP_CLK (toggle every 20 ms for better performance or fix at "0" or "1")
L	24	I/O	D	(manual-mode) Decoder Left-turn output (uC-mode) Set to "0".
B	25	I/O	D	(manual-mode) Decoder Backward output (uC-mode) Set to "1".
F	26	I/O	D	(manual-mode) Decoder Forward output (uC-mode) Set to "0".
RXD	27	I/O	D	Receiver data output / Power on trapping of LNA
VSPPLY	28	Power	A	Power input

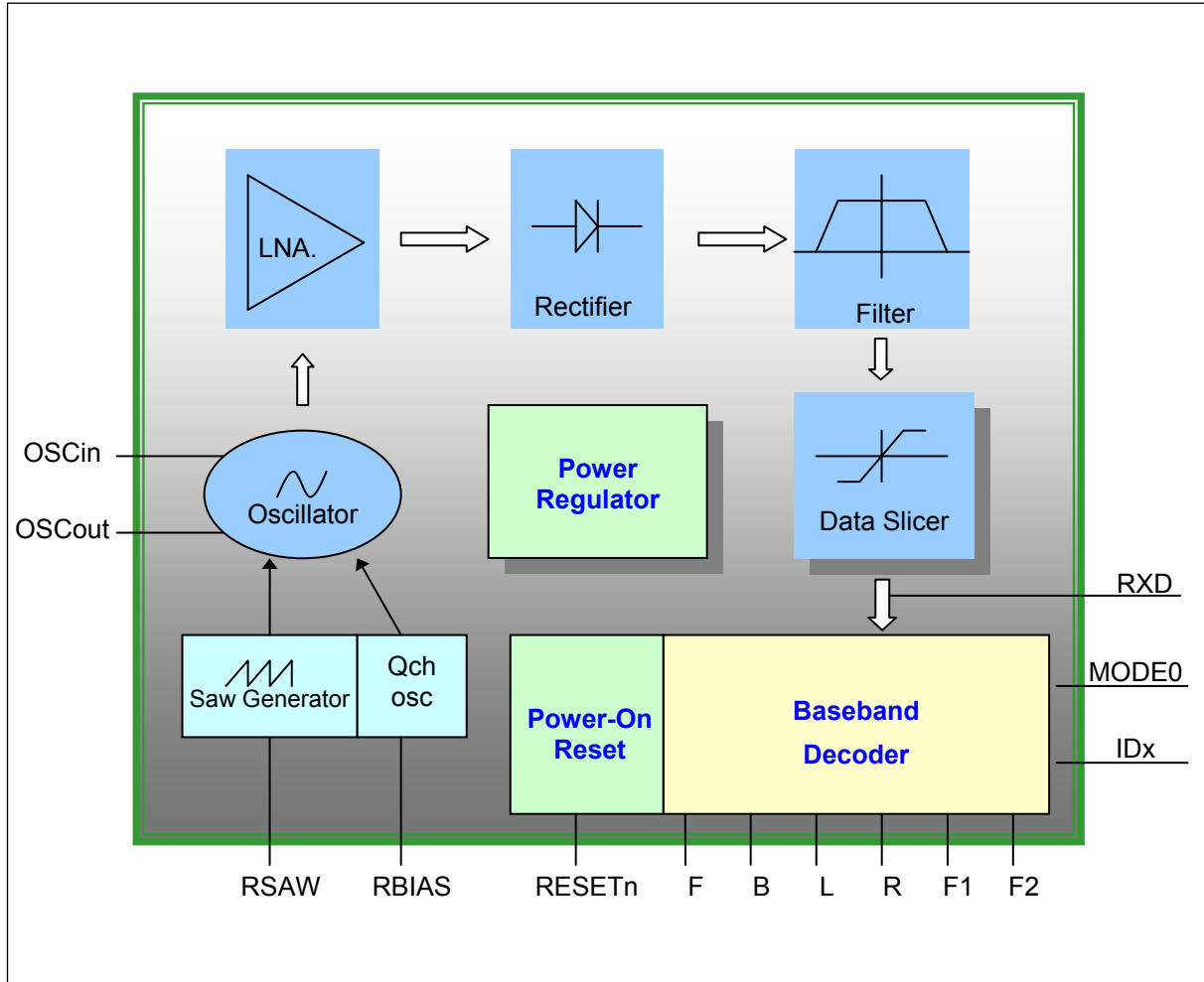
1.2.2 Power-On Trapping Function Description

POWER-TRAPPING PIN NAME	TRAPPING STATE	FUNCTION DESCRIPTION	RECOMMENDED USAGE
RXD	1	Enable LNA	Enable LNA
	0	Disable LNA	
F1*	1	Not Used	Disable (Set to "0")
	0	Not Used	
F2	1	Enable Frequency Hopping	Enable Frequency Hopping
	0	Disable Frequency Hopping	

* **Note:** Currently, F1 does not support any functions, but it should be set to "0" when the W55RFS27R3C is powered on.

2. SYSTEM DESCRIPTION

2.1 W55RFS27R3C System Block Diagram



This block diagram is applicable in **manual-mode**. There are some differences in **uC-mode**.



2.2 W55RFS27R3C Functional Description

ChannelShared^{WB} Protocol Engine

The W55RFS27R3C / W55RFS27T3B built-in **ChannelShared^{WB}** protocol allows a maximum of three players simultaneously in the same frequency band. Each player is distinguished by the input states of ID1 and ID0, instead of different frequencies. This approach significantly reduces the cost and complexity of multi-player applications.

Frequency Hopping and HOP_CLK

In **manual-mode**, the W55RFS27R3C can automatically toggle the center frequency very slightly to increase the receiver sensitivity. The W55RFS27R3C stops toggling while data is being received and resumes again afterwards. This is called frequency hopping, and it is available in **manual-mode**. Frequency hopping is enabled and disabled by the F2 pin, whose value is trapped during power-on. In **uC-mode**, toggling is controlled manually using HOP_CLK (R pin, pin 23), and it is effectively disabled by fixing the value of HOP_CLK at either "0" or "1".

RF Receiver

The W55RFS27R3C has been implemented using an enhanced "Super-Regenerative" receiving architecture. The resulting high sensitivity and high noise immunity is suitable for getting higher RF receiving performance in very noisy environments. In addition, the on-chip LNA provides isolation from other receivers, which is important in multi-player applications.

Power Regulator

The W55RFS27R3C built-in power regulator provides stable operating performance for operating voltages from 2.2 to 5.5 V, a very wide range of voltages suitable for 2- or 3-battery R/C toys or R/C vehicles.

Baseband Control Function Decoder

The W55RFS27R3C has a built-in, 6-function baseband control function decoder for R/C toys. The six functions include **Forward**; **Backward**; **Left-turn**; **Right-turn**, and two user-defined functions **F1** and **F2**.

3. 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 ($T_a = 70^\circ\text{C}$)	150	mW
Ambient Operating Temperature	0 to 70	$^\circ\text{C}$
Storage Temperature	-40 to 85	$^\circ\text{C}$

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, $T_a = 25^\circ\text{C}$; 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}	$V_{DD}=5.5\text{V}$	-	-	4	mA
Stand-by Current	I_{SBY}	$V_{DD}=5.5\text{V}$, ENB= 0 (uC-mode)	-	-	2	μA
Digital Input/Output Pin						
Input High Voltage	V_{IH}		$0.8 \cdot V_{DD}$	-	V_{DD}	V
Input Low Voltage	V_{IL}		V_{SS}	-	$0.1 \cdot V_{DD}$	V
F,B,L,R,F1,F2 Output High Source Current	I_{OH}	$VOH=0.7 \cdot V_{DD}$	-	6	-	mA
F,B,L,R,F1,F2 Output Low Sink Current	I_{OL}	$VOL=0.3 \cdot V_{DD}$	-	6	-	mA
RXD Output High Source Current	I_{OH}	$VOH=0.7 \cdot V_{DD}$	-	2	-	mA
RXD Output Low Sink Current	I_{OL}	$VOL=0.3 \cdot V_{DD}$	-	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

The W55RFS27R3C is available in two types of packages: 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

Window : (xl = -1228.000, yl = -625.000), (xh = 1228.000, yh = 625.000)

Windows size : Width = 2456.000, length = 1250.000

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	RS AW	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	OS Cout	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) -----				

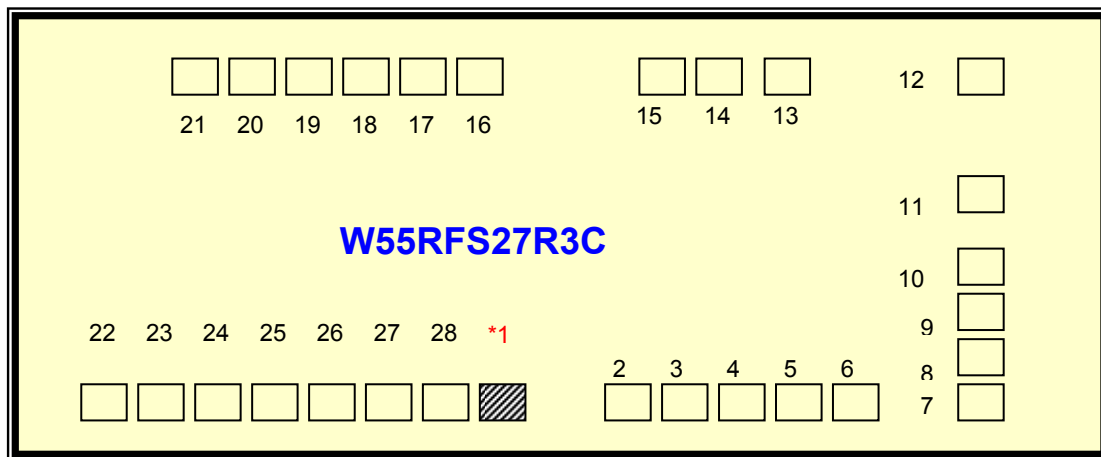
W55RFS27R3C



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))

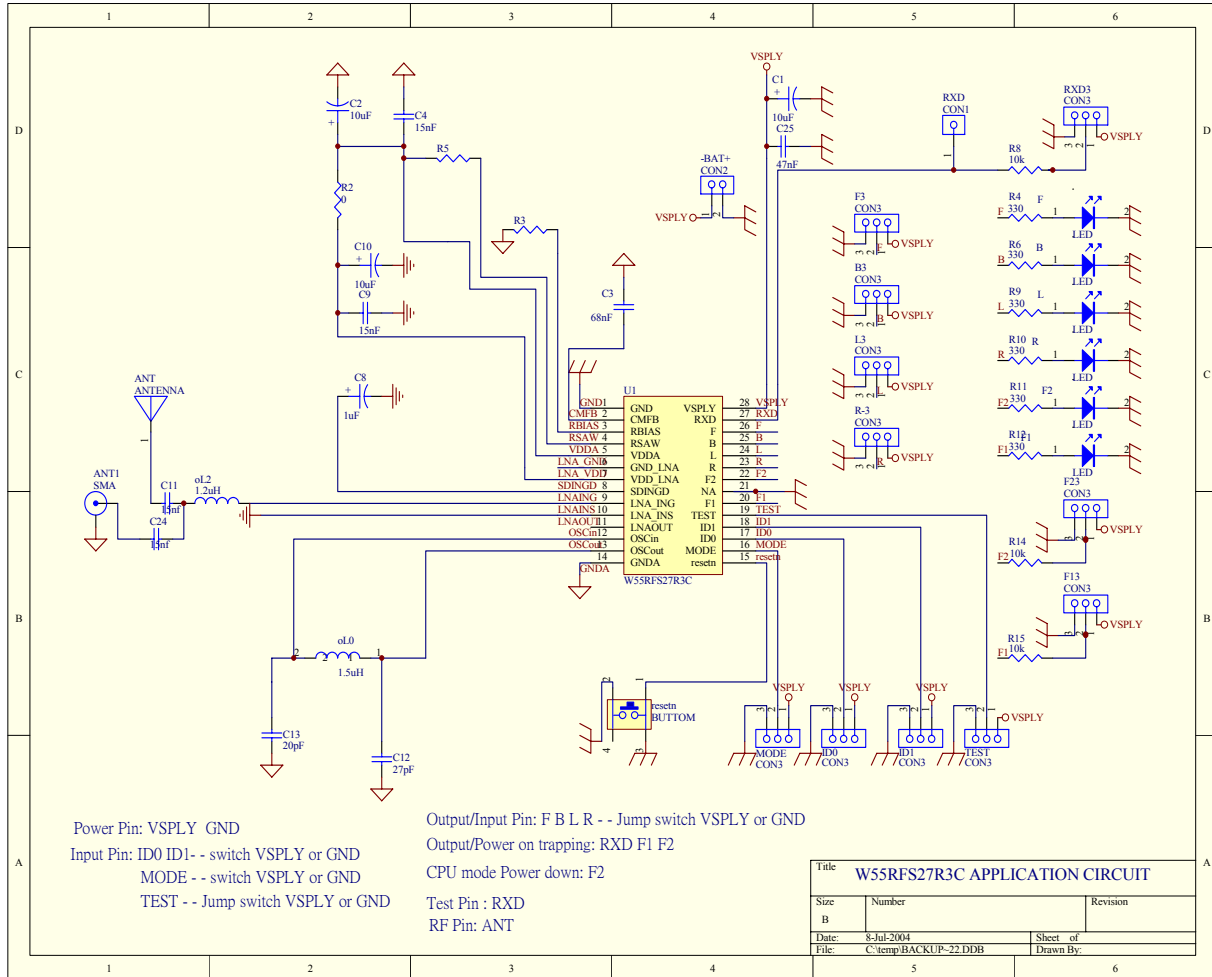
3.4.2 W55RFS27R3C Bonding Pad Diagram



4. DESIGN INFORMATION

4.1 W55RFS27R3C Reference Design

4.1.1 W55RFS27R3C Application Circuit



W55RFS27R3C



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

**5. REVISION HISTORY**

VERSION	DATE	PAGE	DESCRIPTION
A0	2004/7/8	-	Preliminary version A0
A1	2005/5/31	-	Released version A1(Revised by Brand) and Important Notice

Important Notice

Winbond products are not designed, intended, authorized or warranted for use as components in systems or equipment intended for surgical implantation, atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, or for other applications intended to support or sustain life. Further more, Winbond products are not intended for applications wherein failure of Winbond products could result or lead to a situation wherein personal injury, death or severe property or environmental damage could occur.

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