W55RFS27T3B DATA SHEET

SUPER-REGENERATION RF RECEIVER

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1. GENERAL DESCRIPTION

The Winbond W55RFS27T3B is a fully-integrated, S-R (Super-regeneration) RF transmitter with full-function baseband command encoder and a Winbond-patented, channel-sharing algorithm that supports up to three players simultaneously. As such, the W55RFS27T3B is suitable for R/C vehicles, toys, or wireless data communication applications.

The W55RFS27T3B provides two input modes: ***uC-mode***, for general-purpose, micro-controller interfaces with the RF transmitter; and ***manual-mode***, for a 3-player, 6-function, baseband command encoder and RF transmitter. In ***manual-mode***, the W55RFS27T3B works conveniently with up to three W55RFS27R3C chips to provide a simple, multi-player remote control capability with low cost and high performance.

The S-R RF transmitter operates on 27 MHz, 35 MHz, 40 MHz, or 49 MHz with a default data rate of 2.5 KBPS, and it is compliant with FCC part 15 Subpart C 15.227(15.235) and ETSI 300 220-1, making it easier for wireless end products to get FCC and ETSI compliance approval.

In addition, the W55RFS27T3B accommodates a wide range of operating voltages (2.2 V to 5.5 V), supports 2- or 3-battery R/C toy applications, and generates highly-efficient transmissions.

1.1 Features

- Operating frequency: 27 MHz ~ 49 MHz
- Wide operating voltage: 2.2 V ~ 5.5 V
- Two input modes—uC-mode and manual-mode—for more flexibility
- (uC-mode) Transmission data rate up to 10 Kbps for 30%-70% duty cycle signals
- (manual-mode) Winbond-patented, channel-sharing algorithm that allows up to 3 players simultaneously on the same frequency band
- (manual-mode) R/C toy baseband control command encoder, supporting 4 or 6 functions: Forward, Backward, Left-turn, Right-turn, and 2 user-defined functions F1 and F2 (user-defined functions not available in 4-function mode)
- 15-dBm, high-efficiency transmissions (50 Ω) with minimum current consumption
- Power-down current consumption less than 1 uA
- Fewer external components required
- Compliant with FCC part 15 Subpart C 15.227(15.235) / ETSI 300 220-1 low-power and short-range device requirements
- Operating temperature: 0°C ~ 70°C

1.2 W55RFS27T3B Pad Definition

1.2.1 Pad Description

SYMBOL	PAD NO.	I/O	FUNCTIONAL DESCRIPTION
S3	1	I	***Manual-mode*** input, internal pull-high
S4	2	I	***Manual-mode*** input , internal pull-high
CKSEL0	3	I	Clock frequency select LSB (please see section 1.2.2 for setup)
TEST	4	I	TEST=0 for 6-function mode, TEST=1 for 4-function mode
CKSEL1	5	I	Clock frequency select MSB (please see section 1.2.2 for setup)
ANT	6	O	RF signal output. An external matching circuit is necessary for connecting with an antenna.
GND	7	Ground	Ground return path
VDD	8	Power	Power path
RESET	9	I	RESET=0 resets whole chip, internal pull-high
X1	10	I	Input of internal crystal oscillator to connect to an external crystal
X2	11	O	Output of internal crystal oscillator to connect to an external crystal
ID1	12	I	ID setting MSB (please see section 1.2.3 for setup)
ID0	13	I	ID setting LSB (please see section 1.2.3 for setup)
TXOUT	14	O	TXD Data output
S1/~TXD	15	I	***Manual-mode*** input or ***uC-mode***: ~TXD, internal pull-high
S2/~ENB	16	I	***Manual-mode*** input or ***uC-mode***: ~ENB, internal pull-high

1.2.2 Clock Frequency Select (CKSEL) Setup

(CKSEL1,CKSEL0)	CLOCK FREQUENCY
(0,0)	27.145 MHz
(0,1)	35.48 MHz
(1,0)	40.68 MHz
(1,1)	49.86 MHz

1.2.3 ID Setup

(ID1,ID0)	ID
(0,0)	Player 1
(0,1)	Player 2
(1,0)	Player 3
(1,1)	***uC- Mode***

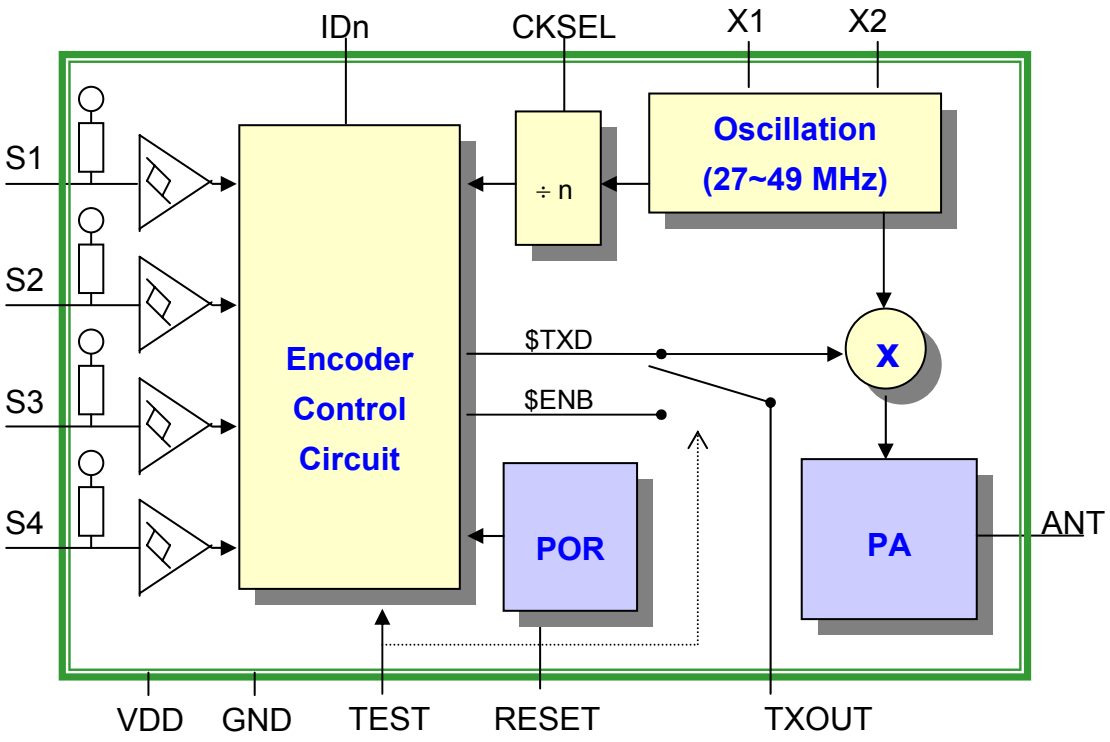
1.2.4 Baseband Encoder Control Function Description

INPUT PIN NAME	CONNECT TO	6-FUNCTION (TEST=0)	4-FUNCTION (TEST=1)
S1	Default (pull high)	**F** = 0, **B** = 0	**F** = 0
	GND	**F** = 0, **B** = 1	**F** = 1
	TXOUT	**F** = 1, **B** = 0	**-**
S2	Default (pull high)	**L** = 0, **R** = 0	**B** = 0
	GND	**L** = 0, **R** = 1	**B** = 1
	TXOUT	**L** = 1, **R** = 0	**-**
S3	Default (pull high)	**F1** = 0	**L** = 0
	GND	**F1** = 1	**L** = 1
S4	Default (pull high)	**F2** = 0	**R** = 0
	GND	**F2** = 1	**R** = 1

(**Note: F** ⇨ Forward; **B** ⇨ Backward; **L** ⇨ Left-turn; **R** ⇨ Right-turn; **F1**, **F2** ⇨ Two User-defined function)

2. SYSTEM DESCRIPTION

2.1 W55RFS27T3B System Block Diagram



2.2 W55RFS27T3B Functional Description

The W55RFS27T3B provides two operating modes, ***Manual-mode*** and ***uC-mode,*** for remote control product development***.***

In ***Manual-mode***, the W55RFS27T3B encodes one of up to six functions for one of up to three players, modulates it with the on-chip RF power amplifier, and transmits it to the receiver(s) (e.g., W55RFS27R3C). This transmission occurs in the same frequency band for all players, as this frequency band is divided using a Winbond-patented, channel-sharing algorithm. ***Manual-mode*** supports up to six functions: **F**orward, **B**ackward, **L**eft-turn, **R**ight-turn (for general R/C-vehicle control) and two user-defined functions **F1** and **F2**.

uC-mode provides a digital interface for any external micro-controller to control the S-R RF transmitter easily and efficiently. This interface uses two W55RFS27T3B pins: ***TXD*** (S1), to send data; and ***ENB*** (S2), to tell the W55RFS27T3B to enter and exit power-down mode, as needed.

The transmitter meets FCC/ETSI regulations for 27 MHz, 40 MHz and 49 MHz S-R (Super-regeneration) modulation, and it is compliant with FCC part 15 Subpart C 15.227(15.235) and ETSI 300 220-1, making it easier for wireless end products to get FCC and ETSI compliance approval..

In addition, the W55RFS27T3B accommodates a wide range of operating voltages (2.2 V to 5.5 V), supports 2- or 3-battery R/C toy applications, and transmits at 15 dBm very efficiently.

3. ELECTRONIC CHARACTERISTICS

3.1 W55RFS27T3B 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 W55RFS27T3B 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 (uC-mode)	I_{TX}	Continuous emission, V_{DD}=5.5V	-	-	50	mA
Stand-by Current	I_{SBY}		-	-	1	μA
Digital Input/Output Pin (S1, S2, S3, S4, ID0, ID1, MODE,CKSEL0,CKSEL1)						
Input High Voltage	V_{IH}		0.8*V_{DD}	-	V_{DD}	V
Input Low Voltage	V_{IL}		V_{SS}	-	0.1*V_{DD}	V
Input Pin Pull-High Resistance	R_{PH}	S1~S4, RESET	-	150K	-	ohm
TXOUT Output High Source Current	I_{OH}	V_{OH}=0.7 * V_{DD}	6	-	-	mA
TXOUT Output Low Sink Current	I_{OL}	V_{OL}=0.3 * V_{DD}	6	-	-	mA
Crystal Oscillator						
Operation Frequency	F_{XTL}		27	-	49	MHz
Oscillator Turn-On Time	T_{OSC}	Fundamental type	-	-	1.0	mS
		Over-tone type	-	-	3.0	mS
Transmitter Section						
Modulation Duty Cycle	M_{DYT}		30	50	70	%
Transmission Data Rate	R_{DTT}	50% Duty-cycle RZ Code	-	2.5	10	Kbps
Transmission Power	P_{ANT}		-	15	-	dBm

Notes: (1). Crystal turn-on time depends on crystal type: fundamental or overtone type crystal.
(2). Transmitter settling time depends on crystal type: fundamental or overtone type crystal.

3.3 W55RFS27T3B Ordering Information

The W55RFS27T3B is available in two forms: Dice form and Wafer form

PART NUMBER	PACKAGE	REMARKS
W55RFS27T3B(H)	Dice form	-
W55RFS27T3B(W)	Wafer form	-

3.4 W55RFS27T3B Package Information

3.4.1 Bonding Pad List

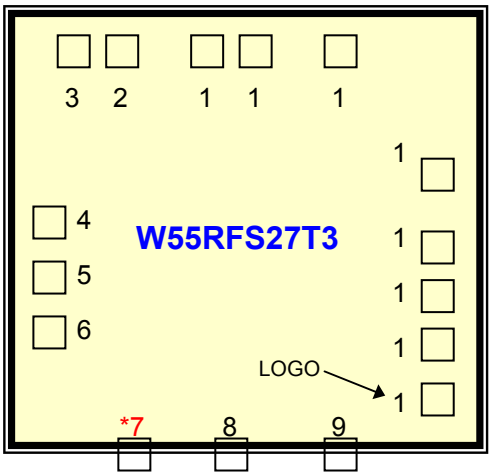
Window : (xl = -620.000, yl = -635.000),(xh = 620.000, yh = 635.000)

Windows size : Width = 1240.000, length = 1270.000

PAD NO	PAD NAME	PIN NAME	X	Y
1	S3	1	-535.000	-69.260
2	S4	2	-535.000	-360.520
3	CKSEL0	3	-535.000	-484.865
4	TEST	4	66.325	-550.000
5	CKSEL1	5	173.325	-550.000
6	ANT	6	282.725	-550.000
7	* VSS	* 7	535.000	-218.395
8	VDD	8	535.000	20.945
9	RESET	9	535.000	284.600
10	X1	10	245.005	550.000
11	X2	11	138.005	550.000
12	ID1	12	31.005	550.000
13	ID0	13	-75.995	550.000
14	TXOUT	14	-288.420	550.000
15	S1	15	-535.000	329.000
16	S2	16	-535.000	37.740

(*: Bonding Sequence start from VSS(Pin7))

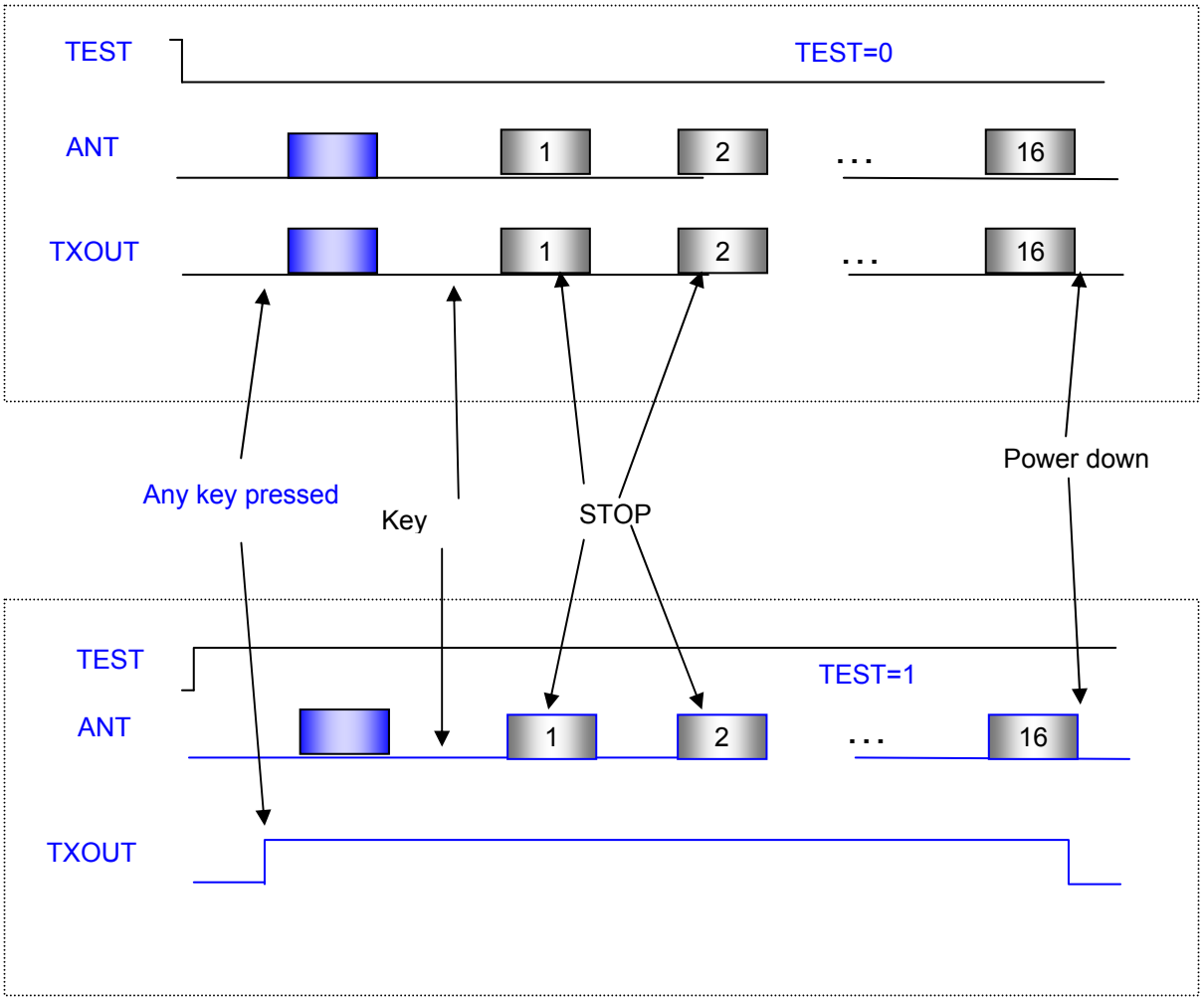
3.4.2 Bonding Pad Diagram



4. DESIGN INFORMATION

4.1 W55RFS27T3B Reference Design

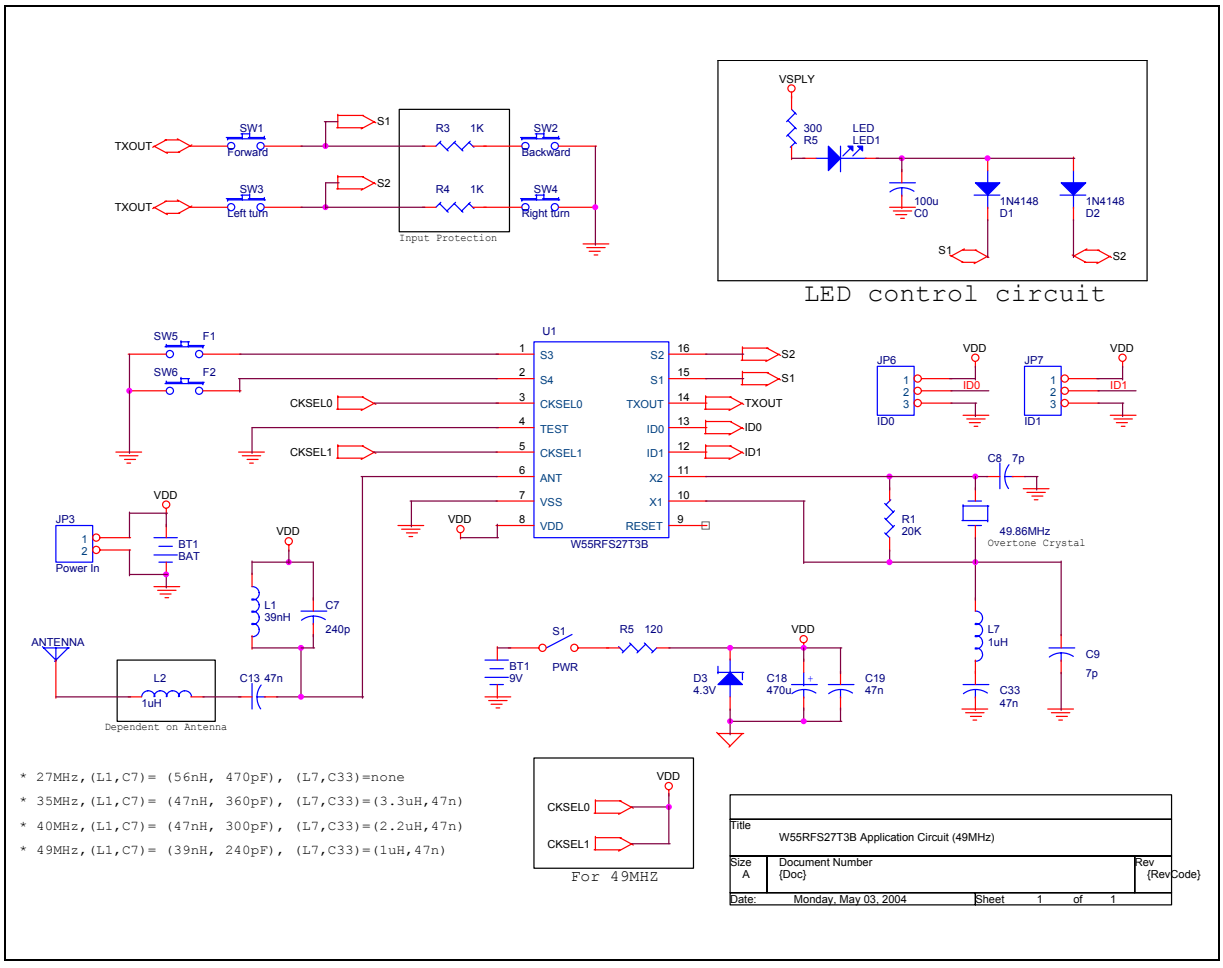
4.1.1 TXOUT waveform



4.1.2 Application Circuit for 6 Control Functions

Set TEST = 0.

1. Use this circuit when F1 and F2 are required.(i.e., when more than 4 functions are required).
2. When a 9-V battery is used, an external power switch is required to save power
3. LEDs require extra components



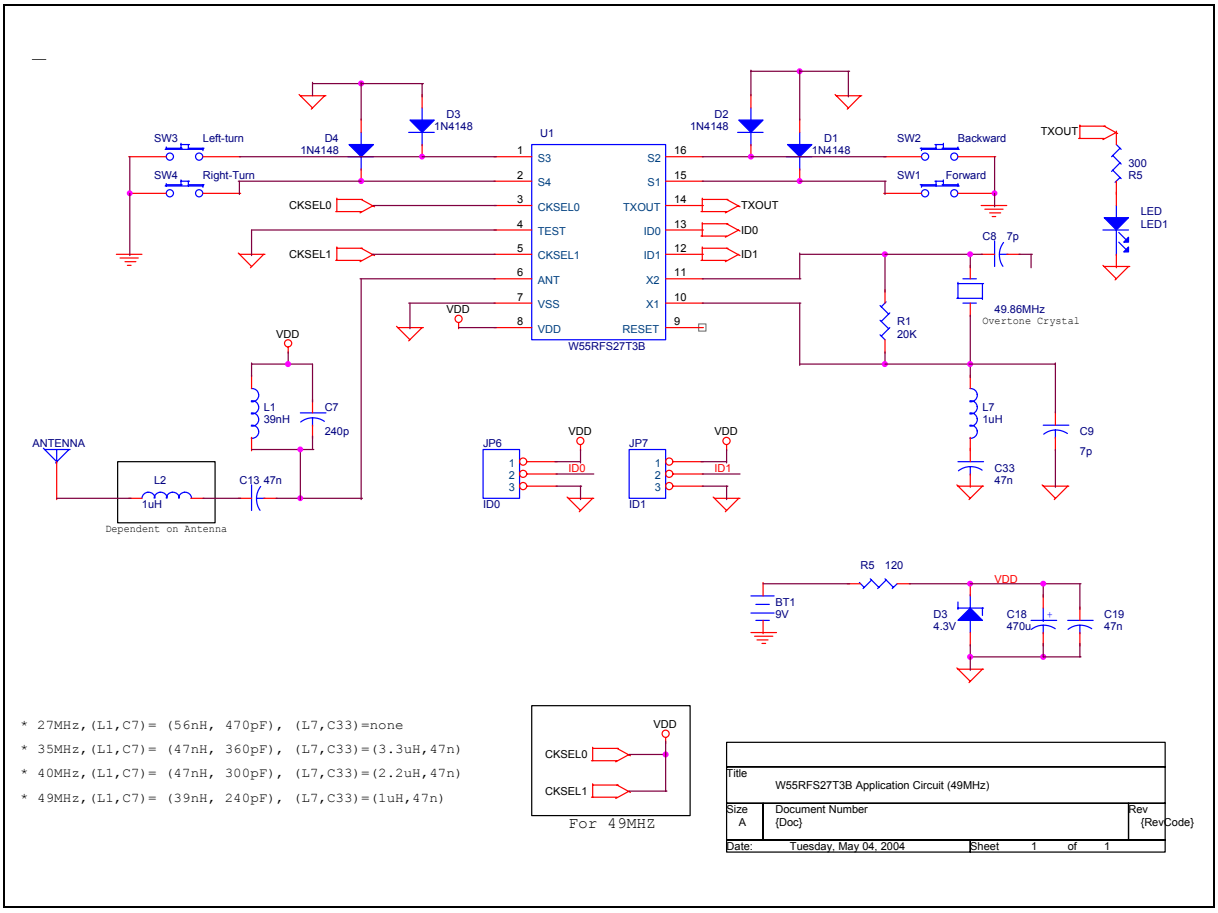
W55RFS27T3B Application Schematic BOM(6-function):

Item	Qty	Reference	Part	
1	1	C7	240p	
2	2	C8,C9	7p	
3	3	C13,C19,C33	47n	
4	1	C18	10u	
5	1	L1	39nH	
6	2	L2,L7	1uH	
7	1	R1	20K	
8	1	U1	W55RFS27T3B	
9	1	Y1	49.86MHz	
10	1	LED1	LED	(Optional)
11	1	C0	100u	(Optional)
12	2	D2,D1	1N4148	(Optional)
13	1	R5	300	(Optional)
14	2	R4,R3	1K	(Optional)

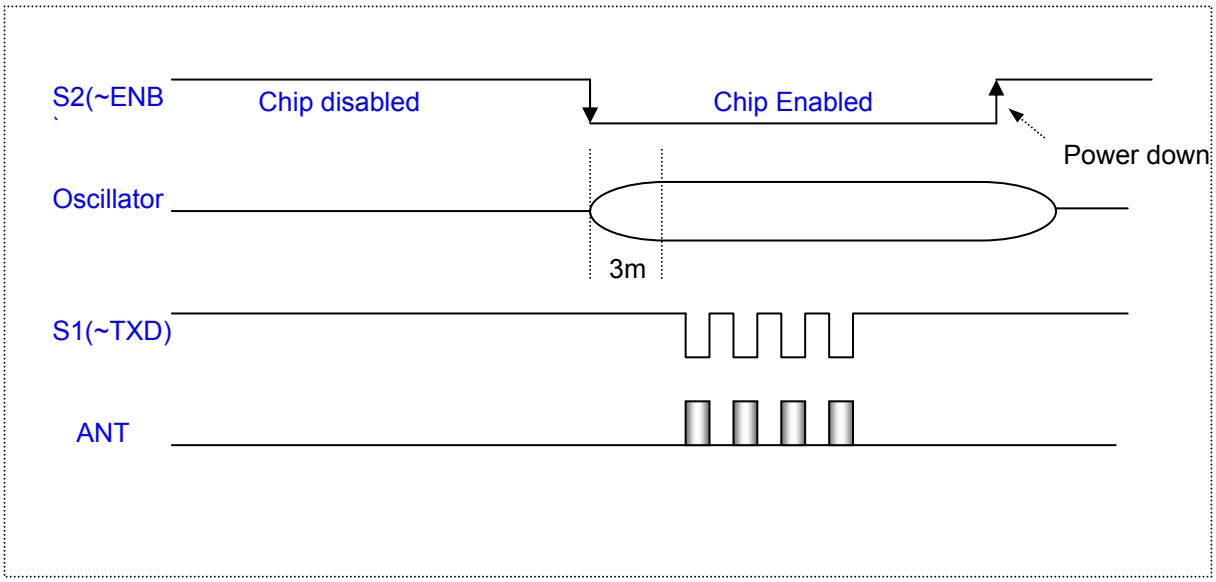
4.1.3 Application Circuit for 4 Control Functions

Set TEST = 1.

1. Only 4 functions are provided.
2. The external power switch is not required when using a 9-V battery.
3. LEDs can be directly driven by TXOUT.


U1
W55RFS27T3B
S3
S4
CKSEL0
TEST
CKSEL1
ANT
VSS
VDD
S2
S1
TXOUT
ID0
ID1
X2
X1
RESET
SW3 Left-turn
SW4 Right-Turn
SW2 Backward
SW1 Forward
D3 1N4148
D4 1N4148
D2 1N4148
D1 1N4148
TXOUT
300 R5
LED LED1
C8 7p
49.86MHz
Overtone Crystal
R1 20K
L7 1uH
C9 7p
C33 47n
L1 39nH
C7 240p
ANTENNA
L2 1uH
C13 47n
Dependent on Antenna
JP6
JP7
ID0
ID1
R5 120
BT1 9V
D3 4.3V
C18 470u
C19 47n
* 27MHz,(L1,C7)= (56nH, 470pF), (L7,C33)=none
* 35MHz,(L1,C7)= (47nH, 360pF), (L7,C33)=(3.3uH,47n)
* 40MHz,(L1,C7)= (47nH, 300pF), (L7,C33)=(2.2uH,47n)
* 49MHz,(L1,C7)= (39nH, 240pF), (L7,C33)=(1uH,47n)
For 49MHZ
Title
W55RFS27T3B Application Circuit (49MHz)
Size A
Document Number {Doc}
Rev {RevCode}
Date: Tuesday, May 04, 2004
Sheet 1 of 1

4.2 uC-Mode Control Signal



4.3 W55RFS27T Family FCC Certification

QuieTek Report No. 034H059FI

Test Report Certification

Test Date : Apr. 22, 2003
Report No. : 034H059FI

QuieTek Corporation
Accredited by NIST (NVLAP)
NVLAP Lab Code: 200347-0

Product Name	:	27/49 MHz Radio Transmitter
Applicant	:	Winbond Electronics Corp.
Address	:	No.4, Creation Rd. III Science-Based Industrial Park Hsinchu, Taiwan, R.O.C.
Manufacturer	:	Winbond Electronics Corp.
Model No.	:	W55RFS27T
FCC ID.	:	ID2-W55RFS27T
Rated Voltage	:	DC 4.5V(Power by Battery)
Trade Name	:	Winbond
Measurement Standard	:	FCC Part 15 Intentional Radiators for Subpart C Paragraph 15.227
Measurement Procedure	:	ANSI C63.4:1992
Test Result	:	Complied

NVLAP Lab Code : 200347-0

The Test Results relate only to the samples tested.
The test report shall not be reproduced except in full without the written approval of QuieTek Corporation.
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Documented By : (Zoe Lee)

Tested By : (Kenny Jwo)

Approved By : (Kevin Wang)

5. REVISION HISTORY

VERSION	DATE	PAGE	DESCRIPTION
A0	2004/7/6	-	Preliminary version A0
A1	2005/5/30	-	Released version A1 (Revised by Brand) and important notice

Important Notice

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