

Super-Regeneration RF Transmitter

W55RFS27T1B

Data Sheet

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General Description

nuvoTon W55RFS27T1B is a fully integrated S-R (Super-regeneration) RF transmitter with full-function of baseband command encoder for application of R/C vehicle, toy, or wireless data communication.

W55RFS27T1B provides both *uC-mode* for general purpose of micro-controller programming interface and *manual-mode* for RF transmitter as well as 6-function of baseband command encoder.

W55RFS27T1B cooperate with W55RFS27R1B is very easy and convenient to

provide simple remote control function with very low production cost in various application. The transmitter provides the FCC/ETSI regulation provisions for 27M, 35M, 40M, 49MHz S-R (Super-regeneration) modulation. Wide range of operation voltage from 2.2V to 5.5V is suitable for 2-battery or 3-battery R/C toy application, and high efficient transmission output power.

W55RFS27T1B is compliant to FCC part 15 class B and 15.227 / ETSI 300 220-1, making it easier for wireless end products to get FCC and ETSI compliance approval.

1.1 Features

- ❑ Operating frequency: 27MHz ~ 49MHz
- ❑ Wide operating voltage: 2.2V ~ 5.5V
- ❑ Transmission data rates up to 10K bps (uC-mode) for 30%-70% duty cycle
- ❑ High efficiency transmission output power.
- ❑ **Manual-mode** supports 6-function of R/C toy baseband control command encoder, i.e, Forward, Backward, Left-turn, right-turn, and 2 user defined function F1 and F2
- ❑ High efficient transmission power with minimum current consumption
- ❑ Power down current consumption less than 1uA
- ❑ Less manual adjustment needed in production
- ❑ Fewer external components required in production
- ❑ Lower manufacture production cost
- ❑ Compliant to FCC part 15 class B and 15.227 / ETSI 300 220-1 low-power & short-range device requirements
- ❑ Two input modes for flexibility of more control function and lower component cost
- ❑ Dice form available for PCB bonding
- ❑ Operating temperature: 0°C ~ 70°C

1.2 W55RFS27T1B Pad Definition

1.2.1 Pad Description

Symbol	Pad No.	I/O	Functional Description
S3	1	I	Manual-mode input, internally pull-high
S4	2	I	Manual-mode input , internally pull-high
CKSEL0	3	I	Clock source 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 source 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, internally pull-high
X1	10	I	Input of internal crystal oscillator to connect with an external crystal
X2	11	O	Output of internal crystal oscillator to connect with 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, internally pull-high
S2/~ENB	16	I	Manual-mode input or uC-mode: ~ENB, internally pull-high

1.2.2 Clock Frequency Select (CKSEL) Setup

(CKSEL1,CKSEL0)	Clock Frequency
(0,0)	27.145MHz
(0,1)	35.48 MHz
(1,0)	40.68 MHz
(1,1)	49.86 MHz

1.2.3 uC-Mode & Manual Mode (Baseband Data Rate) Setup

(ID1,ID0)	Function	Encoder Time Base
(0,0)	Data Rate= 2.5KBPS	T=200us
(0,1)	Data Rate= 1.25KBPS	T=400us
(1,0)	Data Rate= 0.625KBPS	T=800us
(1,1)	uC- Mode	External controlled

(Note: W55RFS27R1B Data Rate=1.25KBPS; W55RFS27R1A Data Rate=2.5KBPS)

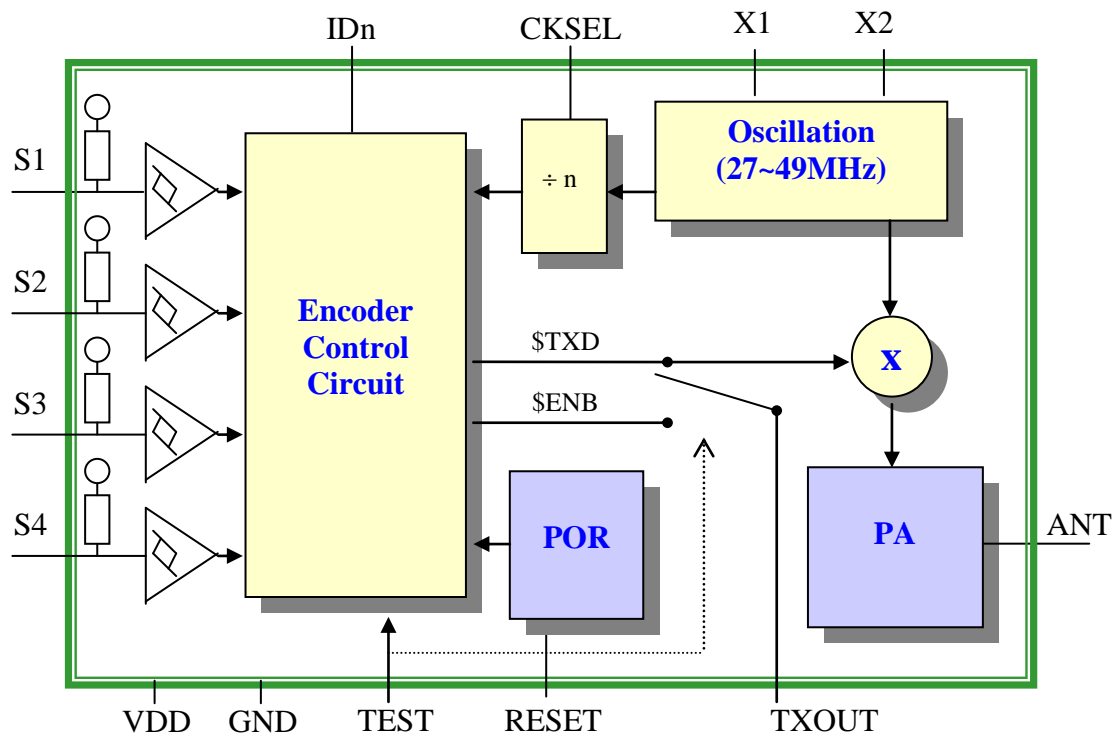
1.2.4 Baseband Encoder Control Function Description

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)	F = 0, B = 0	B = 0
	GND	F = 0, B = 1	B = 1
	TXOUT	F = 1, B = 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)

System Description

2.1 W55RFS27T1B System Block Diagram



2.2 W55RFS27T1B Functional Description

W55RFS27T1B provides two operation modes for convenient remote control product development, named *Manual-mode* and *uC-mode*. The *Manual-mode* provides a powerful baseband command encoder, which perform 6-function

binary data encode and, modulate with the on-chip RF power amplifier to transmit control command. The control function can be at most to 6 functions, **Forward**, **Backward**, **Left-turn**, **Right-turn** for

general R/C-vehicle control and 2 other user-defined functions **F1** and **F2**.

It is very suitable for remote control applications if W55RFS27T1B and its associated receiver/decoder W55RFS27R1B are adopted. The very pair provides extremely low-cost and high-performance function for design of various remote-control applications.

The **uC-mode** provides digital interface for external micro-controller to control the transmitter easily and efficiently. The micro-controller only need two pins, **TXD** (S1) to send data and **ENB** (S2) to enter power down mode, if needed.

The transmitter provides the FCC/ETSI regulation provisions for 27M, 40MHz and 49MHz S-R (Super-regeneration) modulation. Wide range of operation voltage from 2.2V to 5.5V is suitable for 2-battery or 3-battery R/C toy application, and 15dBm high efficient transmission output power.

W55RFS27T1B Super-regeneration RF transmitter is compliant to FCC part 15 class B and 15.227 / ETSI 300 220-1, making it easier for wireless end products to get FCC and ETSI compliance approval.

Electronic Characteristics

3.1 W55RFS27T1B 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 W55RFS27T1B DC Characteristics

(VDD-VSS = 3 V, T_a = 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	-	-	50	mA
Stand-by Current	I_{SBY}		-	-	1	μ A
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 Manchester Code	-	1.25	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 W55RFS27T1B Ordering Information

W55RFS27T1B provides two forms in shipment: Dice form, and wafer form

Part Number	Package	Remarks
W55RFS27T1B(H)	Dice form	-
W55RFS27T1B(W)	Wafer form	-

3.4 W55RFS27T1B 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

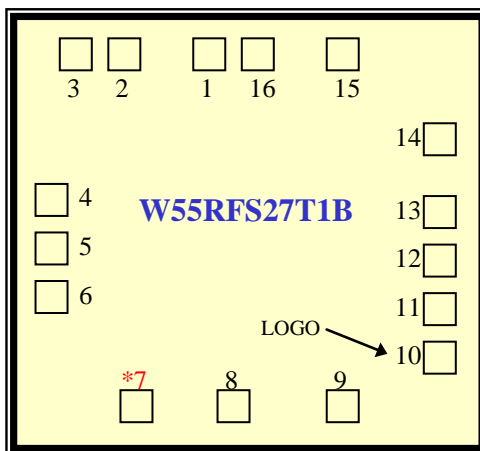
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PAD NO	PAD NAME	PIN NAME	X	Y
1	S3	1	-535.000	-69.260
2	S4	2	-535.000	-360.520
3	CKSEL0	3	-535.000	-484.865
4	TEST	4	66.325	-550.000
5	CKSEL1	5	173.325	-550.000
6	ANT	6	282.725	-550.000
7	* VSS	* 7	535.000	-218.395
8	VDD	8	535.000	20.945
9	RESET	9	535.000	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

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

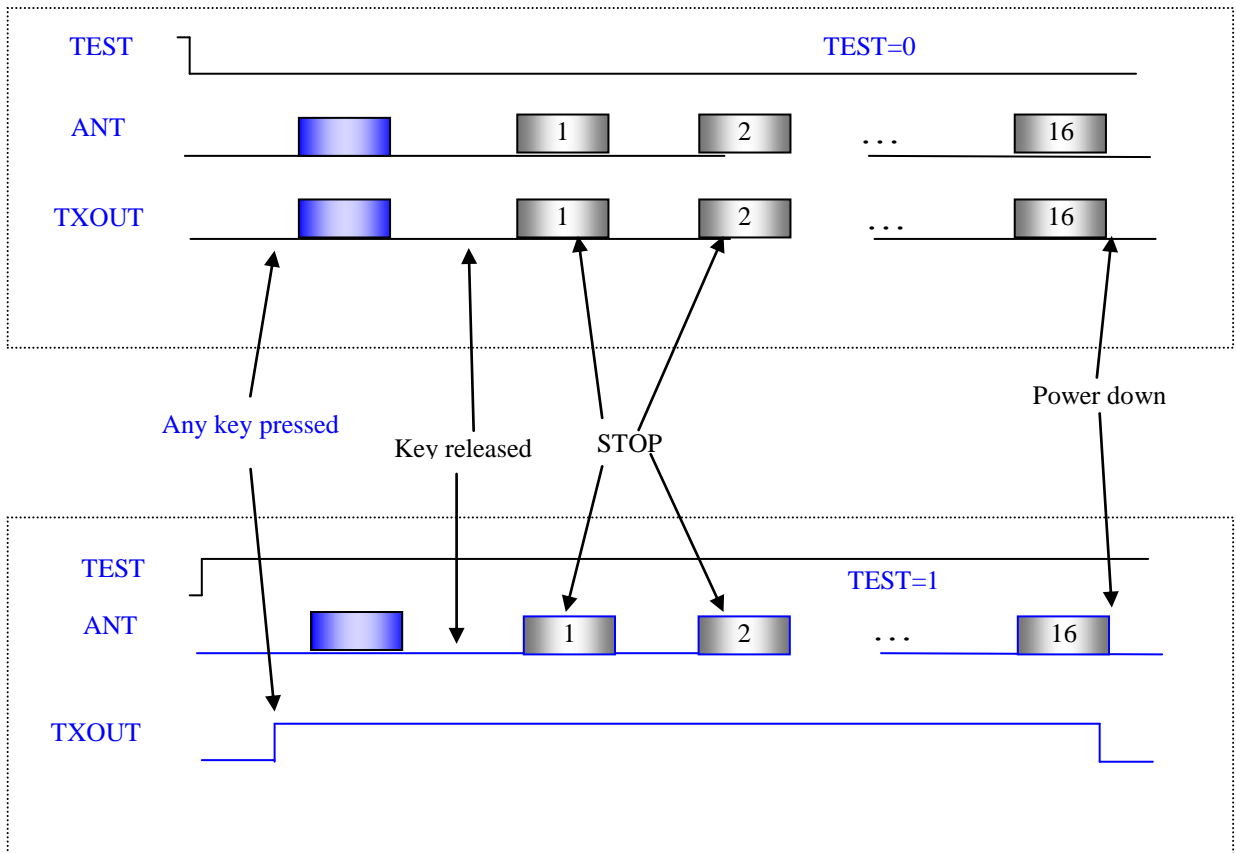
3.4.2 Bonding Pad Diagram



Design Information

4.1 W55RFS27T1B Reference Design

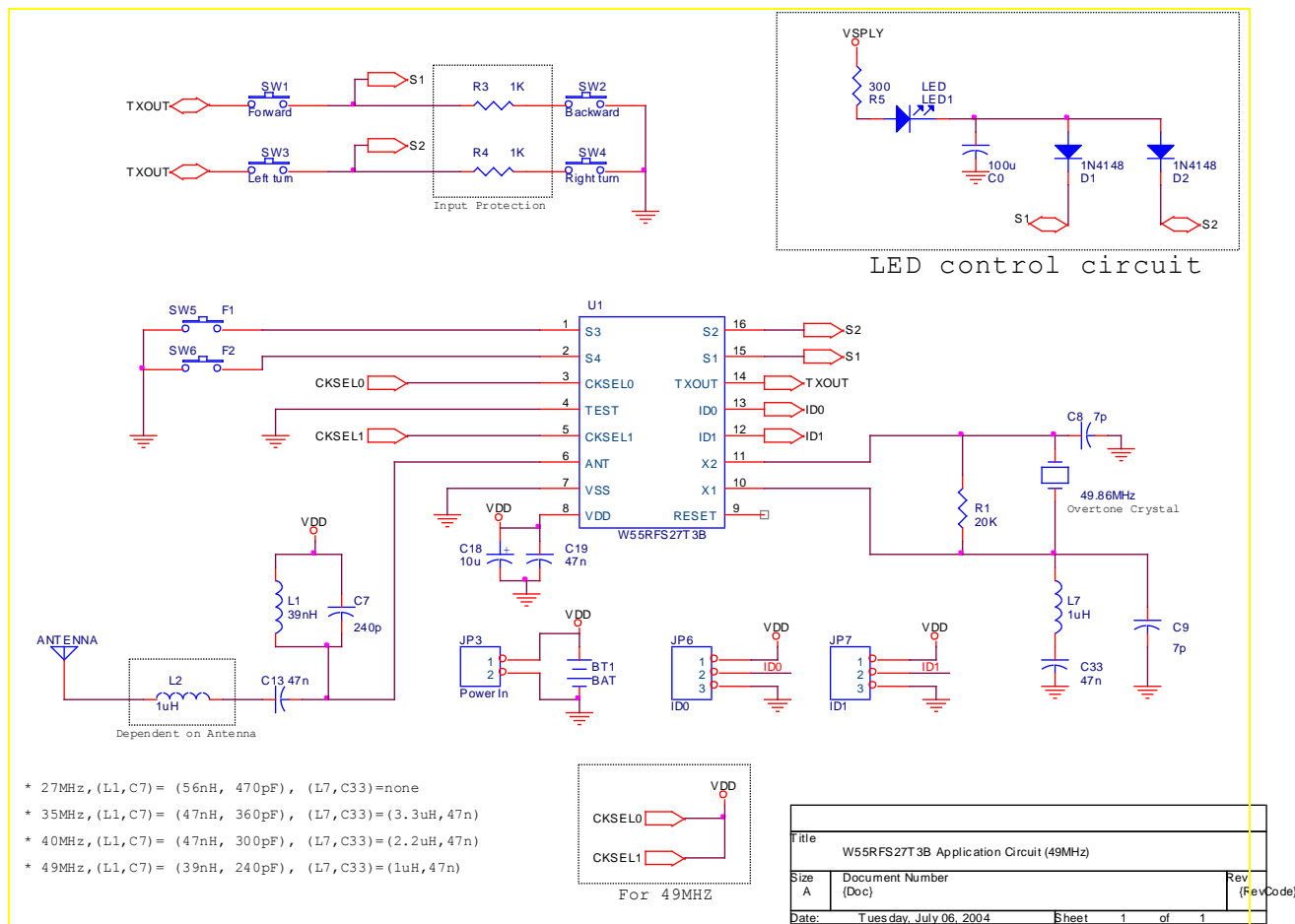
4.1.1 TXOUT waveform



4.1.2 Application Circuit for 6 Control Functions

Set TEST = 0,

1. Used when need F1 and F2.(more than 4 control functions)
2. When use 9V battery, an external power switch is required for power-saving
3. Need extra components to light LED



W55RFS27T1B Application Schematic BOM(6-function):

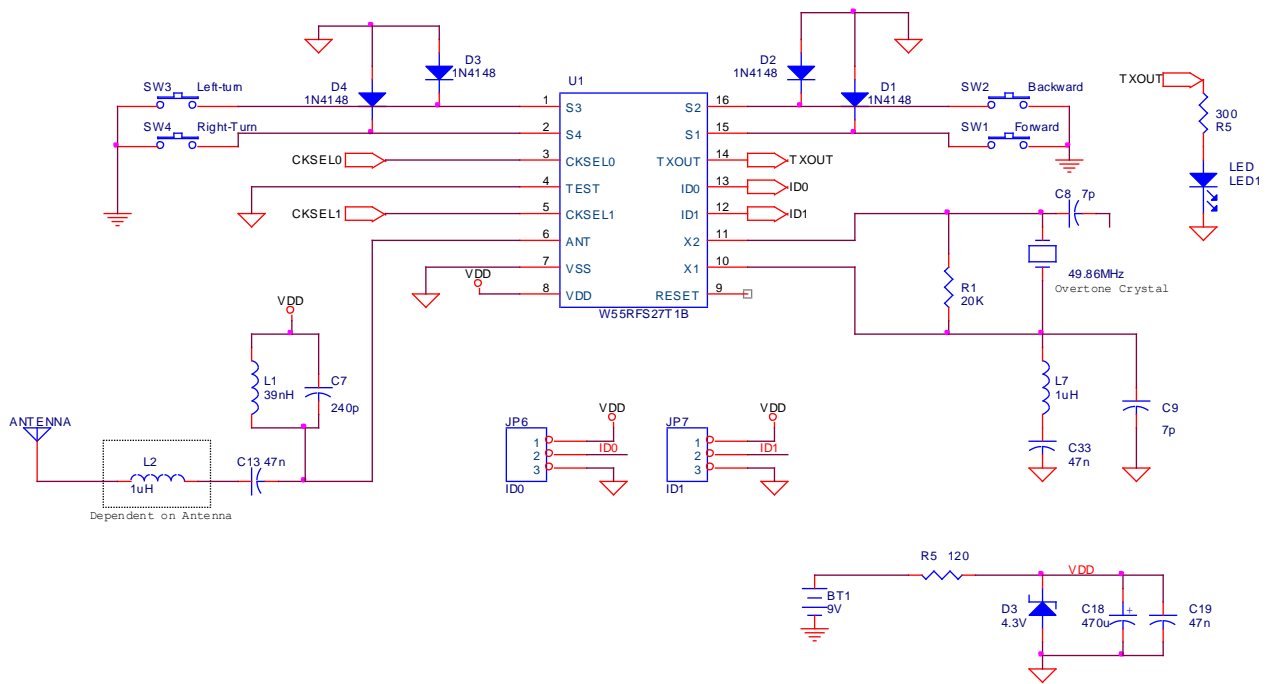
Item	Qty	Reference	Part
1	1	C7	240p
2	2	C8,C9	7p
3	3	C13,C19,C33	47n
4	1	C18	10u
5	1	L1	39nH
6	2	L2,L7	1uH
7	1	R1	20K
8	1	U1	W55RFS27T1B
9	1	Y1	49.86MHz

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)

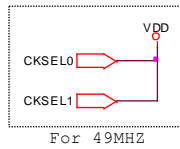
4.1.3 Application Circuit for 4 Control Functions

Set TEST = 1,

1. Only 4 control functions provided
2. No need to add external power switch when use 9V battery.
3. LED can be directly driven by TXOUT

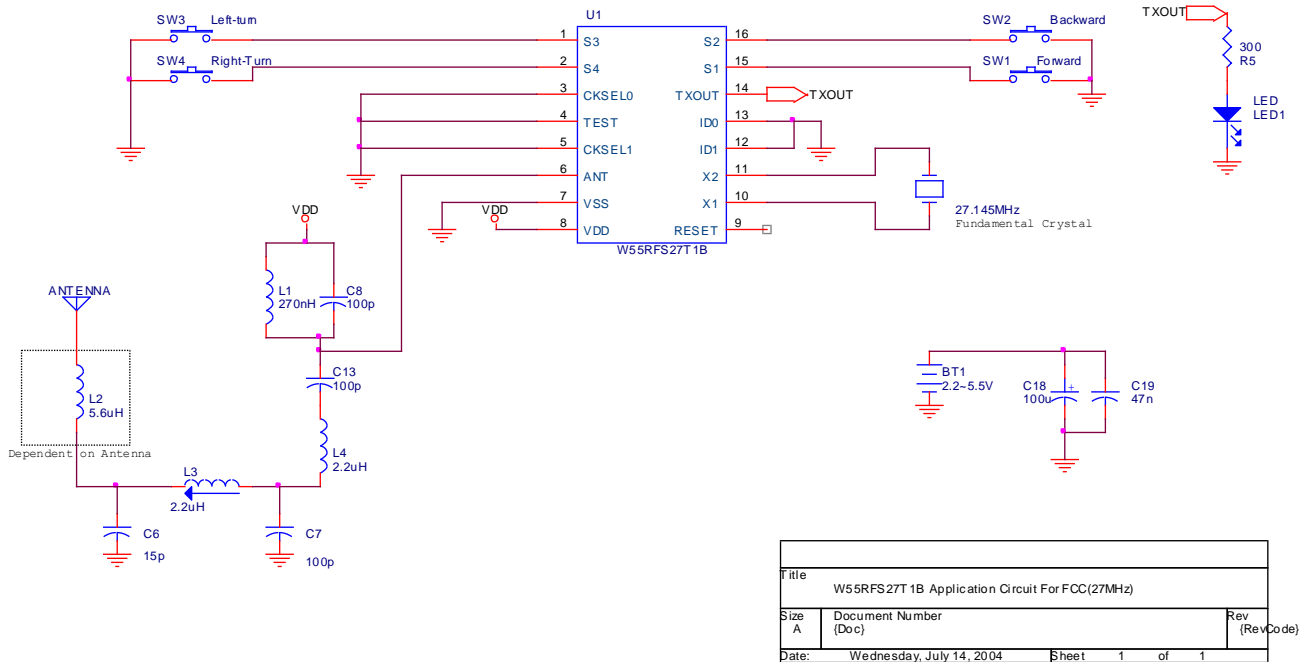


- * 27MHz, (L1, C7) = (56nH, 470pF), (L7, C33) = none
- * 35MHz, (L1, C7) = (47nH, 360pF), (L7, C33) = (3.3uH, 47n)
- * 40MHz, (L1, C7) = (47nH, 300pF), (L7, C33) = (2.2uH, 47n)
- * 49MHz, (L1, C7) = (39nH, 240pF), (L7, C33) = (1uH, 47n)

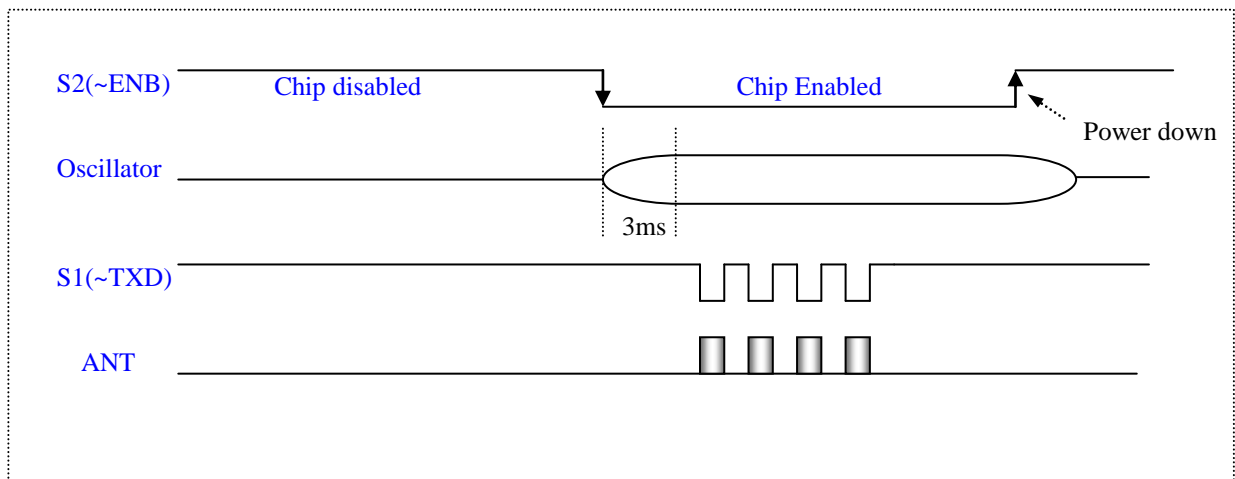


Title		
W55RFS27T1B Application Circuit (49MHz)		
Size	Document Number	Rev
A	(Doc)	(RevCode)
Date:	Tuesday, May 04, 2004	Sheet 1 of 1

4.1.4 Application Circuit for FCC



4.2 uC-Mode Control Signal



4.3 W55RFS27T Family FCC Certification



Report No. 034H059FI

Test Report Certification

Test Date : Apr. 22, 2003

Report No. : 034H059FI



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



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.

This report must not be used to claim product endorsement by NVLAP any agency of the U.S. Government

Documented By : Zoe Lee
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Tested By : Kenny Jwo
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Approved By : Kevin Wang
(Kevin Wang)

4.4 W55RFS27T1B Data Sheet Document History

Revision	Date	Description
A1.0	May 2004	Preliminary version
A2.0	Jul. 2004	Formal released version
A3.0	Feb. 2010	Logo Changed

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