W55RFS27T1B Data Sheet

Winbond
Electronics Corp.

SUPER-REGENERATION RF TRANSMITTER

Table of Contents-

1. GENERAL DESCRIPTION

The Winbond W55RFS27T1B is a fully integrated, S-R (Super-regeneration) RF transmitter with full-function baseband command encoder for R/C vehicles, toys, or wireless data communication applications.

The W55RFS27T1B provides two input modes: *uC-mode*, for general-purpose, micro-controller interfaces to the RF transmitter; and *manual-mode*, for a 6-function, baseband command encoder and RF transmitter that works conveniently with the W55RFS27R1B to provide a simple remote control capability with low cost and high performance.

The S-R RF transmitter meets FCC/ETSI regulations for 27 MHz, 35 MHz, 40 MHz, and 49 MHz S-R (Super-regeneration) modulation, and it is compliant with 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.

In addition, the W55RFS27T1B accommodates a wide range of operating voltages (2.2 V to 5.5 V), supports 2-battery or 3-battery R/C applications, and transmits very efficiently.

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) 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)

- Highly-efficient transmissions with minimum current consumption

- Power-down current consumption less than 1uA

- Fewer external components required

- Compliant with FCC part 15 class B and 15.227 / ETSI 300 220-1 low-power and short-range device requirements

- 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, 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

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

(ID1,ID0)	FUNCTION	ENCODER TIME BASE
(0,0)	Data Rate = 2.5 KBPS	T = 200 us
(0,1)	Data Rate = 1.25 KBPS	T = 400 us
(1,0)	Data Rate = 0.625 KBPS	T = 800 us
(1,1)	uC-Mode	Externally-controlled

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

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 functions)

2. SYSTEM DESCRIPTION

2.1 W55RFS27T1B System Block Diagram
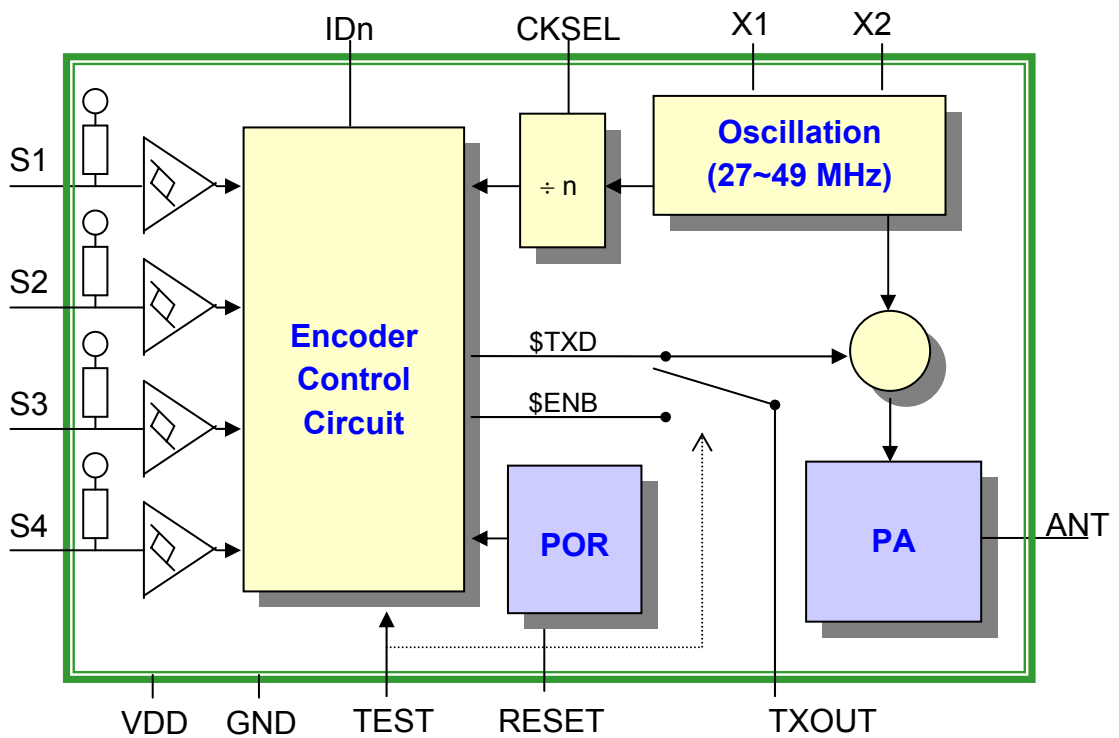
2.2 W55RFS27T1B Functional Description

The W55RFS27T1B provides two operating modes, *Manual-mode* and *uC-mode*, for remote-control product development.

In *Manual-mode*, the W55RFS27T1B encodes one of up to six functions, modulates it with the on-chip RF power amplifier, and transmits it to the receiver (e.g., W55RFS27R1B). This mode supports up to six functions: Forward, Backward, Left-turn, Right-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. The micro-controller only uses two pins: *TXD* (S1), to send data; and *ENB* (S2), to tell the W55RFS27T1B to enter and exit power-down mode, as needed.

The transmitter meets FCC/ETSI regulations for 27 MHz, 35 MHz, 40 MHz, and 49 MHz S-R (Super-regeneration) modulation, and it is compliant with 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.

In addition, the W55RFS27T1B accommodates a wide range of operating voltages (2.2 V to 5.5 V), supports 2-battery or 3-battery R/C applications, and transmits at 15 dBm very efficiently.

3. 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, 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	-	-	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}	VOH=0.7 * V_{DD}	6	-	-	mA
TXOUT Output Low Sink Current	I_{OL}	VOL=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.

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3.3 W55RFS27T1B Ordering Information

The W55RFS27T1B is available in two forms: 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

==

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

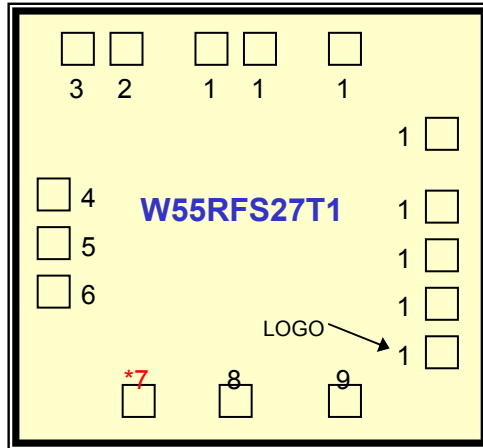==

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

3.4.2 Bonding Pad Diagram
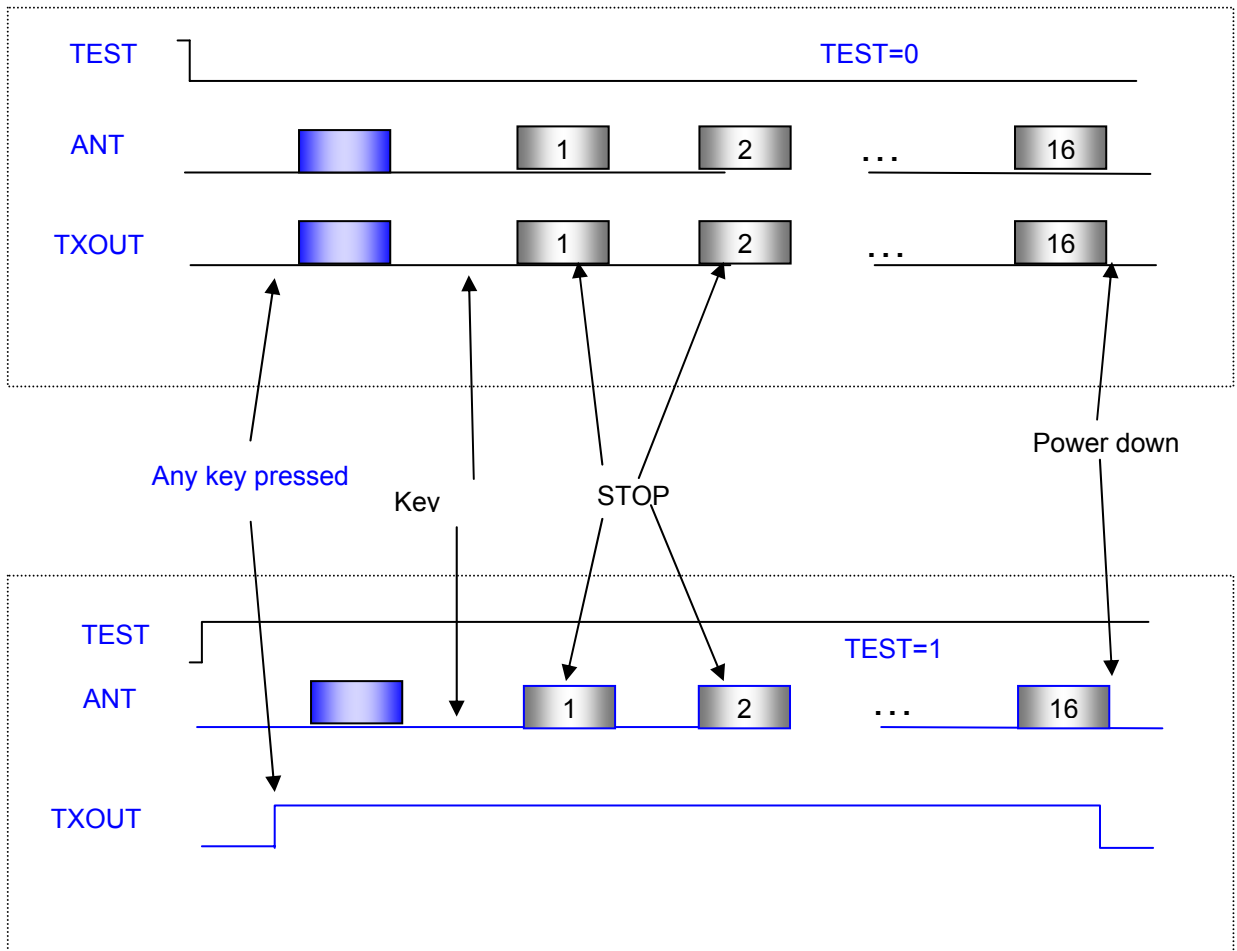
4. DESIGN INFORMATION

4.1 W55RFS27T1B Reference Design

4.1.1 TXOUT waveform

TEST
TEST=0
ANT
1   2   ...   16
TXOUT
1   2   ...   16

Power down
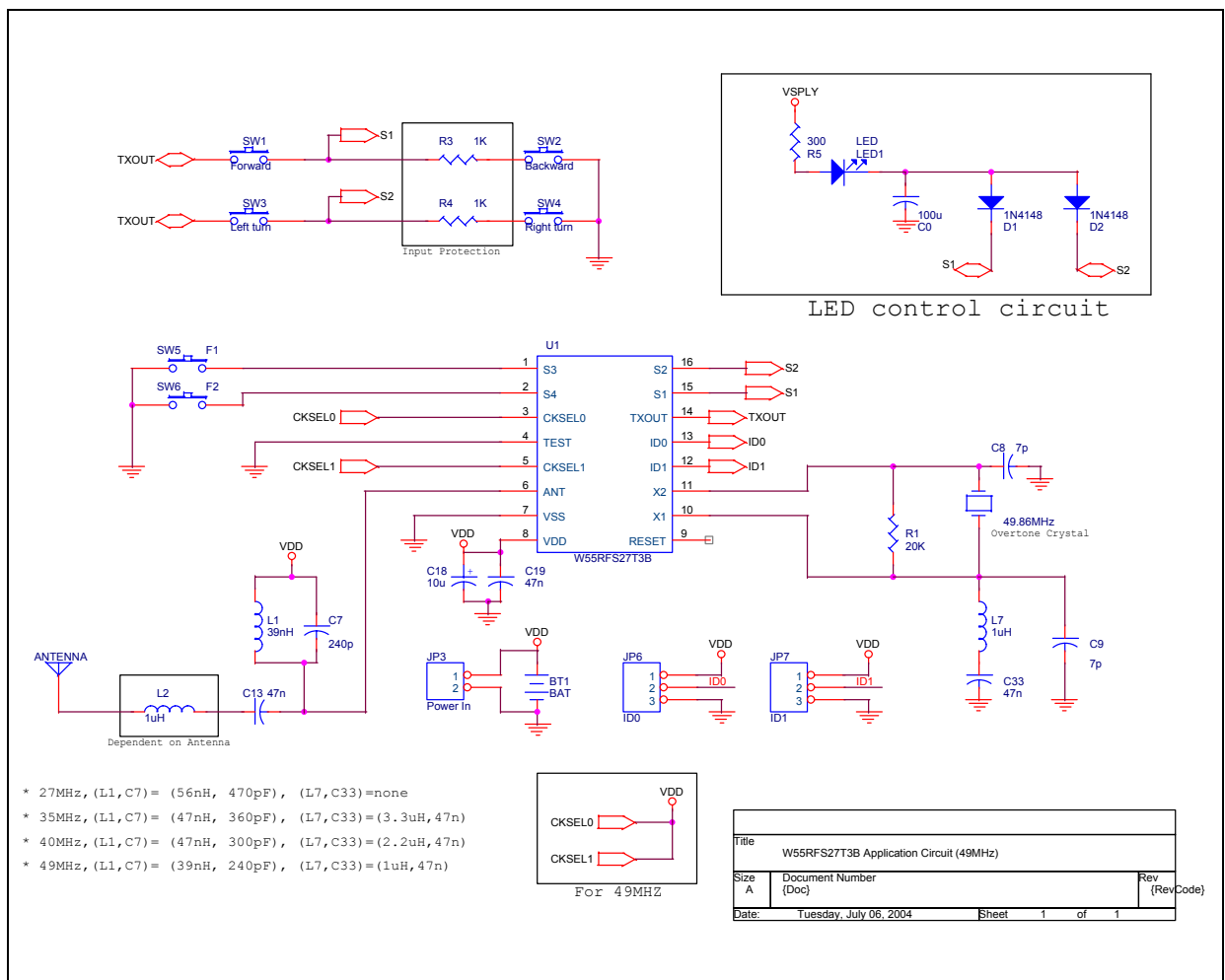
Any key pressed
Kev
STOP

TEST
TEST=1
ANT
1   2   ...   16
TXOUT

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.

* 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)
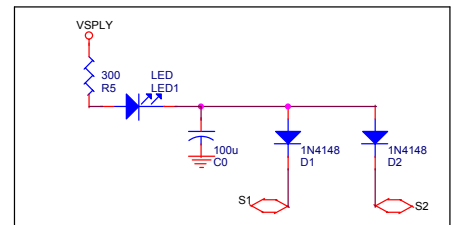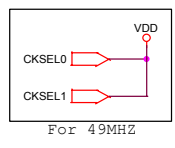
Title	W55RFS27T3B Application Circuit (49MHz)		
Size A	Document Number {Doc}		Rev {RevCode}
Date:	Tuesday, July 06, 2004	Sheet 1 of 1	

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 functions are provided.

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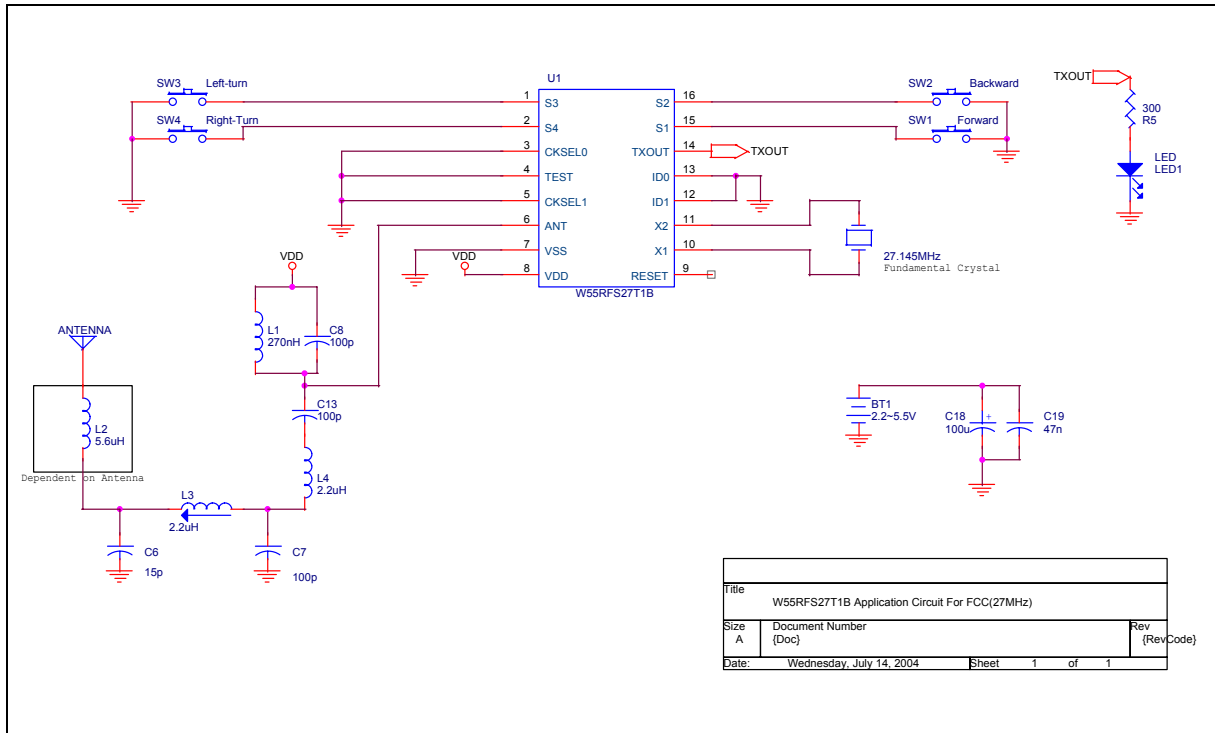
3. LEDs can be directly driven by TXOUT.

W55RFS27T1B

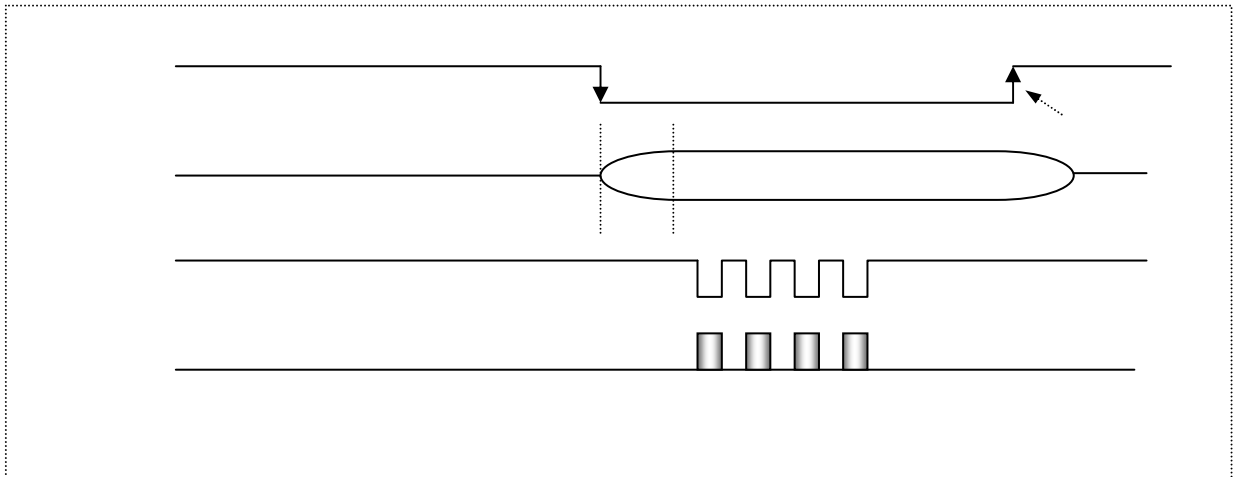* 27MHz,(L1,C7)= (56nH, 470pF), (L7,C33)=none
* 35MHz,(L1,C7)= (47nH, 360pF), (L7,C33)=(3.3uH,47n)
* 40MHz,(L1,C7)= (47nH, 300pF), (L7,C33)=(2.2uH,47n)
* 49MHz,(L1,C7)= (39nH, 240pF), (L7,C33)=(1uH,47n)

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4.1.4 Application Circuit for FCC

Title: W55RFS27T1B Application Circuit For FCC(27MHz)

Size	Document Number		Rev
A	{Doc}		{RevCode}
Date:	Wednesday, July 14, 2004	Sheet 1 of 1	
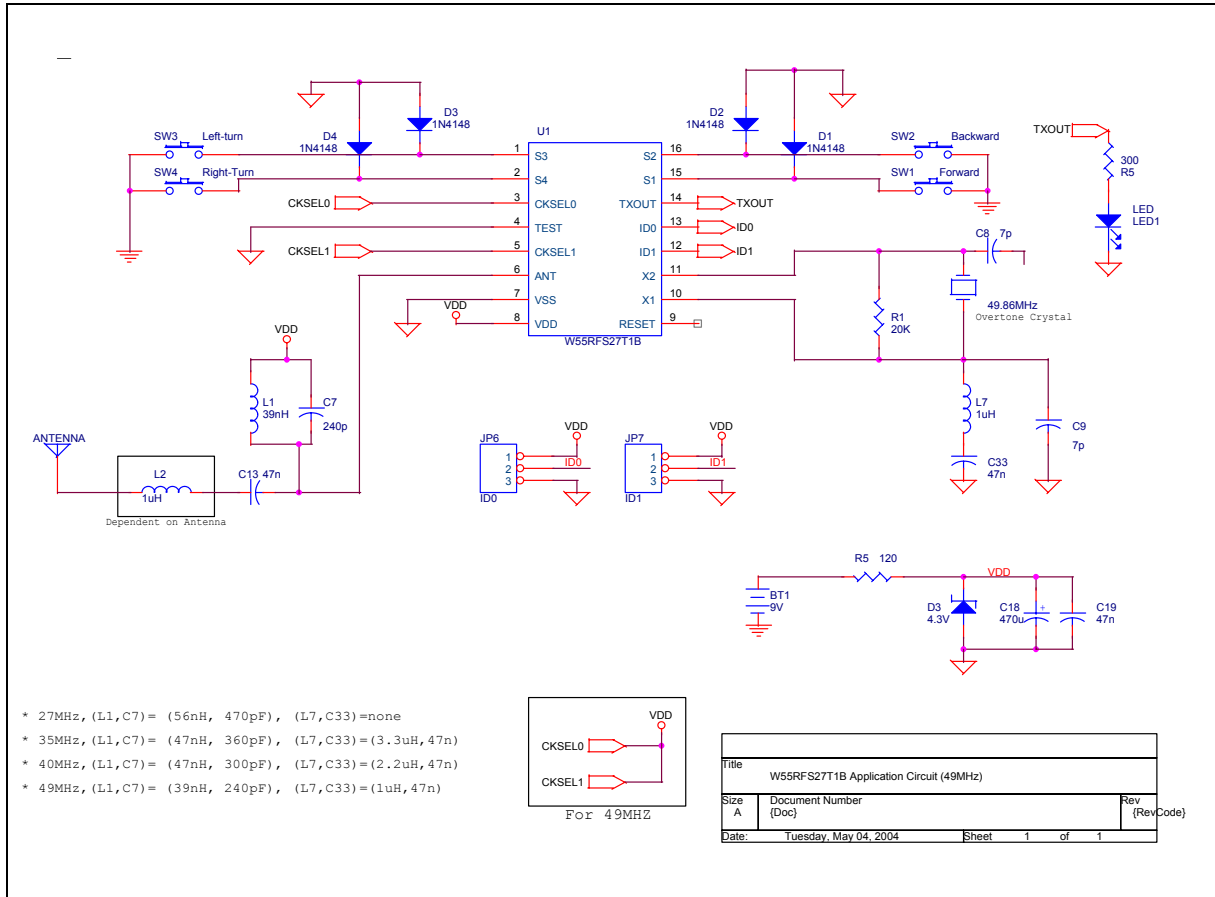
4.2 uC-Mode Control Signal

4.3 W55RFS27T Family FCC Certification

QTK QuieTek   Report No. 034H059FI

Test Report Certification

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

QTK 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
NVLAP Lab Code : 200347-0

The Test Results relate only to the samples tested.
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Documented By   :   _____
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Tested By   :   _____
                          (K e n n y J w o)

Approved By   :   _____
                          (K e v i n W a n g)

5. REVISION HISTORY

VERSION	DATE	PAGE	DESCRIPTION
A1	2004/5/27	-	Preliminary version
A2	2004/715	-	Released version A2
A3	2005/5/10	-	Revised by Brand AND ADD IMPORTANT INTOCE

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