3S/3HQ SPEECH+MELODY PROCESSOR (BandDirector™ Series)

1. GENERAL DESCRIPTION

The W566Bxxx is a powerful embedded microcontroller (µC) dedicated for speech and melody synthesis application. This series IC is tailored for plush toy, educational toy or music instrument. With the help of 16 bits microprocessor (µP) W566-16, the W566Bxxx can synthesize multi-channel speech and melody. 3-track of synthesized speech can be in different kinds of format, for example ADPCM and MDPCM. Regarding synthesized melody, W566Bxxx can provide 2-track of Tone melody (T-melody) plus 2-track percussion sound (2T+2Per), or 3-track of High-Quality melody (HQ-melody) that can emulate the characteristics of musical instruments. These signals can be mixed flexibly through 4-input Mixer to produce colorful effect. The result of Mixer is converted to analog signal to drive speaker output.

W566Bxxx has two kinds of power saving modes: one is HOLD mode and the other is STOP mode. In HOLD mode, the specific peripherals can be inactivated and IC can operate at the sub-clock. Consequently, the W566Bxxx can perform some special tasks periodically. In STOP mode, all the IC's peripherals are disable which is designated specially for try-me application. Besides, W566Bxxx can sink 8mA at most for high-current application.

Following table depicts the W566Bxxx series.

PART#	W566B025	W566B030	W566B040	W566B060	W566B080	W566B100	W566B120
ROM (Byte)	94K	108K	126K	200K	254K	328K	382K
RAM (Byte)	256	256	256	256	256	256	256
Operating Speed	8/4 MHz	8/4 MHz	8/4 MHz	8/4 MHz	8/4 MHz	4 MHz	4 MHz
Duration1 (sec) [1]	25"	30"	36"	61"	80"	105"	124"
Duration2 (sec) [2]	19”	23”	27”	46”	60”	79”	93”
In : Bid[3]	4 : 16	4 : 16	4 : 16	4 : 16	4 : 16	0 : 16	0 : 16
Speaker	DAC	DAC	DAC	DAC	DAC	DAC	DAC
Mixer Inputs	4	4	4	4	4	4	4
Speech Tracks[4]	3	3	3	3	3	3	3
Speech Algorithms	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM
Melody Tracks	3	3	3	3	3	3	3
Instrument Types	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice
IR-Carrier	✓	✓	✓	✓	✓	✓	✓
Number of System Clocks	2	2	2	2	2	2	2
Power Management	HOLD STOP	HOLD STOP	HOLD STOP	HOLD STOP	HOLD STOP	HOLD STOP	HOLD STOP

Following table depicts the W566Bxxx series, continued.

PART#	W566B150	W566B170	W566B210	W566B260	W566B300	W566B340
ROM (Byte)	460K	510K	640K	766K	912K	1022K
RAM (Byte)	256	256	256	256	256	256
Operating Speed	4 MHz	4 MHz	8/4 MHz	8/4 MHz	8/4 MHz	8/4 MHz
Duration1 (sec) [1]	150"	167"	212"	255"	304"	342"
Duration2 (sec) [2]	113”	125”	159”	191”	228”	257”
In : Bid[3]	0 : 16	0 : 16	4 : 16	4 : 16	4 : 16	4 : 16
Speaker Driver	DAC	DAC	DAC	DAC	DAC	DAC
Mixer Inputs	4	4	4	4	4	4
Speech Tracks[4]	3	3	3	3	3	3
Speech Algorithms	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM
Melody Tracks	3	3	3	3	3	3
Instrument Types	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice
IR-Carrier	✓	✓	✓	✓	✓	✓
Numbers of System Clock	2	2	2	2	2	2
Power Management	HOLD STOP	HOLD STOP	HOLD STOP	HOLD STOP	HOLD STOP	HOLD STOP

Notes:

1. The Duration1 is calculated based on 6000Hz*4-bits = 24 Kbps, 24 Kbps on the assumption that all the ROM space is used to store speech data.
2. The Duration2 is calculated based on 8000Hz*4-bits = 32 Kbps, 32 Kbps on the assumption that all the ROM space is used to store speech data.
3. "In" is the number of input pins; "Bid" is the number of I/O pins.
4. Synthesized speech in ADPCM/MDPCM format.

Following table depicts the W566Bxxx series, continued.

PART#	W566B101	W566B121	W566B151	W566B171
ROM (Byte)	328K	382K	460K	510K
RAM (Byte)	256	256	256	256
Operating Speed	8/4 MHz	8/4 MHz	8/4 MHz	8/4 MHz
Duration1 (sec) [1]	105"	124"	150"	167"
Duration2 (sec) [2]	79”	93”	113”	125”
In : Bid[3]	4 : 16	4 : 16	4 : 16	4 : 16
Speaker Driver	DAC	DAC	DAC	DAC
Mixer Inputs	4	4	4	4
Speech Tracks[4]	3	3	3	3
Speech Algorithms	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM	ADPCM MDPCM PCM
Melody Tracks	3	3	3	3
Instrument Types	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice	HQ Tone Voice
IR-Carrier	✓	✓	✓	✓
Numbers of System Clock	2	2	2	2
Power Management	HOLD STOP	HOLD STOP	HOLD STOP	HOLD STOP

Notes:

1. The Duration1 is calculated based on 6000Hz*4-bits = 24 Kbps, 24 Kbps on the assumption that all the ROM space is used to store speech data.
2. The Duration2 is calculated based on 8000Hz*4-bits = 32 Kbps, 32 Kbps on the assumption that all the ROM space is used to store speech data.
3. "In" is the number of input pins; "Bid" is the number of I/O pins.
4. Synthesized speech in ADPCM/MDPCM format.

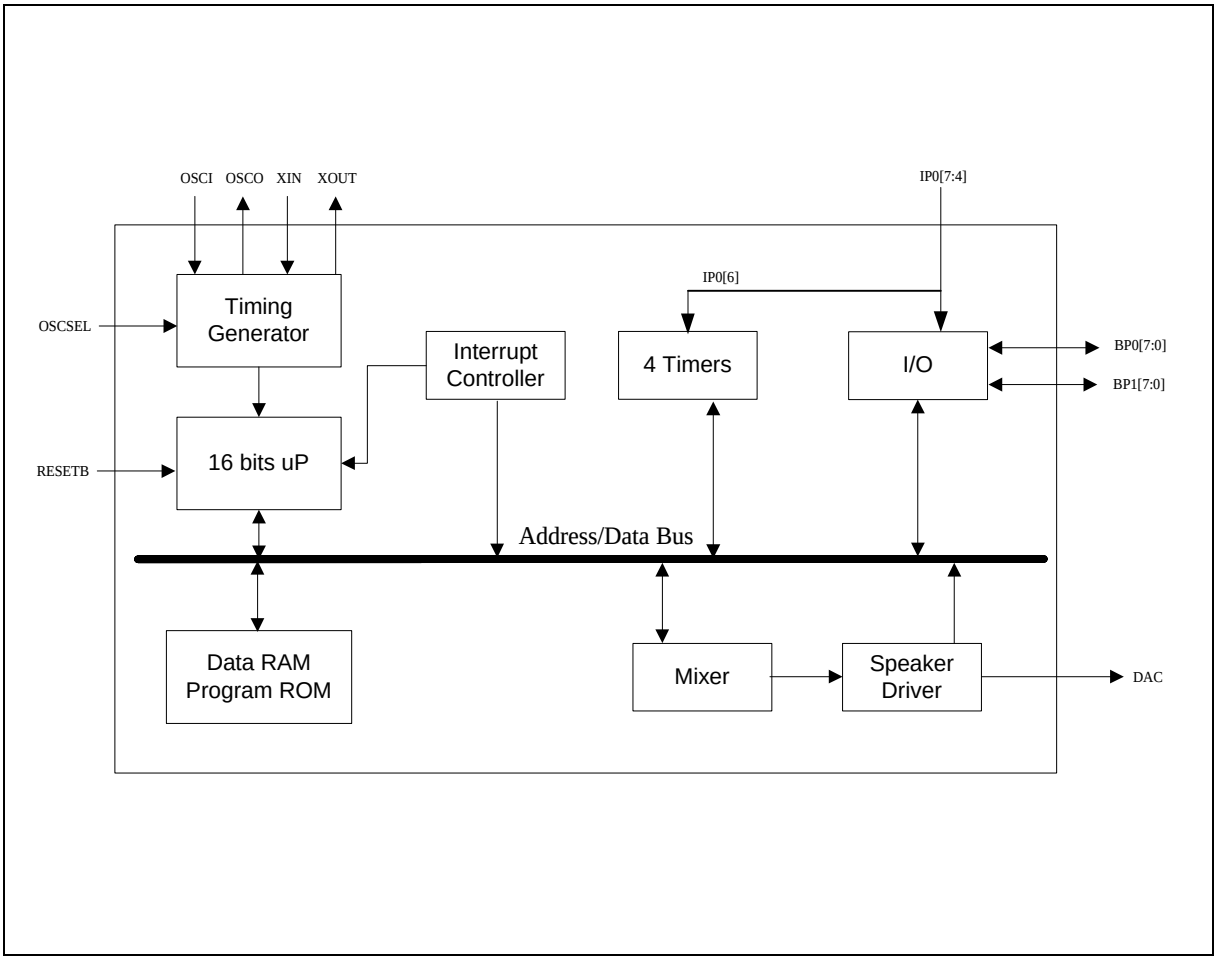
2. FEATURES

- Wide operating voltage:
  - 4MHz @ 2.4 volt to 5.5 volt
  - 8MHz @ 3.6 volt to 5.5 volt
- Sophisticated power managements:
  - Dual system clocks, one is 8 MHz and the other is 32768 Hz
  - HOLD mode for dealing with interrupt events only
  - STOP mode for stopping all IC operation
- 4 input pins
- 16 I/O pins and 8 of them can sink 8 mA in their output portion
- 10-bit Current type digital-to-analog converters (DAC) to drive speaker output
- Multiple synthesized speech formats: ADPCM/MDPCM/PCM
- 3 tracks synthesized ADPCM/MDPCM speech at programmable playback rate
- 2 tracks Tone melody which can emulate envelope of music instruments
- 3 tracks High-Quality melody that can emulate characteristic of musical instruments
- 4-input/10-bit-resolution Mixer can mix the speech and melody signals flexibly
- Built-in IR carrier generation circuit for simplification firmware IR application
- Built-in 4 timers for speech/melody synthesis and general purpose application
- Available package: COB

3. PIN DESCRIPTION

PIN NAME	I/O	FUNCTION
RESETB	In	IC reset input.
XIN	In	Sub-clock oscillation input. Only RC type is allowed.
XOUT	Out	Sub-clock oscillation output.
OSCI	In	Main-clock oscillation input.
OSCO	Out	Main-clock oscillation output.
OSCSEL	In	Pin selection of main-clock type. When OSCSEL is logic 1, Ring type is used. When OSCSEL is logic 0, crystal type is used.
IP0[7:4] (Expect W566B100, W566B120, W566B150, & W566B170)	In	General input port with pull-high selection. Each input pin can be programmed to generate interrupt request and used to release IC from HOLD/STOP mode. IP0.6 can be used as the external clock source of the general timer TimerG.
BP0[7:0]	I/O	General input/output pins. When used as output pin, it can be open–drain or CMOS type and it can sink 8mA for high-current application. When used as input pin, there may have a pull-high option and generate interrupt request to release IC from HOLD/STOP mode. When BP0[7] is used as output pin, it can be the IR transmission carrier for firmware IR application.
BP1[7:0]	I/O	General input/output pins. When used as output pin, it can be open–drain or CMOS type. When used as input pin, there may have a pull-high option and generate interrupt request to release IC from HOLD/STOP mode.
DAC	Out	Current type speaker output.
TEST	In	Test input. Do not connect during normal operation.
V_{DD}	Power	Positive power supply.
V_{SS}	Power	Negative power supply.

4. BLOCK DIAGRAM



5. ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNIT
Supply Voltage to Ground Potential	-0.3 to +7.0	V
D.C. Voltage on Any Pin to Ground Potential	-0.3 to V_{DD} +0.3	V
Operating Temperature	0 to +70	°C
Storage Temperature	-55 to +150	°C

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

6. D.C. ELECTRICAL CHARACTERISTICS

(V_{DD} – V_{SS} = 4.5 V, F_M = 8 MHz, F_S = 32768 Hz, T_A = 25° C; No Load unless otherwise specified)

PARAMETER	SYM.	TEST CONDITIONS	SPEC.			UNIT
			Min.	Typ.	Max.	
Operating Voltage	V_{DD}	F_{SYS} = 4 MHz	2.4	--	5.5	V
		F_{SYS} = 8 MHz	3.6	--	5.5	V
Operating Current	I_{OP}	F_{SYS} = F_M, F_S active, normal operation	--	--	12	mA
Hold Current	I_{HD}	F_{SYS} = F_S, F_M inactive, HOLD mode	--	--	25	µA
Standby Current	I_{SB}	STOP mode	--	--	1	µA
Input Low Voltage	V_{IL}	All input pins except RESETB	V_{SS}	--	0.3 V_{DD}	V
		RESETB	V_{SS}	--	0.3 V_{DD}	V
Input High Voltage	V_{IH}	All input pins	0.7 V_{DD}	--	V_{DD}	V
Output Low Current	I_{OL}	Vout = 0.4V, all output pins expect BP0	--	--	4	mA
		Vout = 0.4V, BP0 only	--	--	8	mA
Output High Current	I_{OH}	Vout = 2.4V, all output pins	-4	--	--	mA
DAC Full Scale Current	I_{DAC}	V_{DD} = 4.5V, RL = 100Ω	-1.6 -2.4 -3.2 -4.0	-2.0 -3.0 -4.0 -5.0	-2.4 -3.6 -4.8 -6.0	mA
Pull High Resistance	R_{IN}	All input pins except RESETB	150		300	KΩ
		RESERB	100			KΩ

7. A.C. ELECTRICAL CHARACTERISTICS

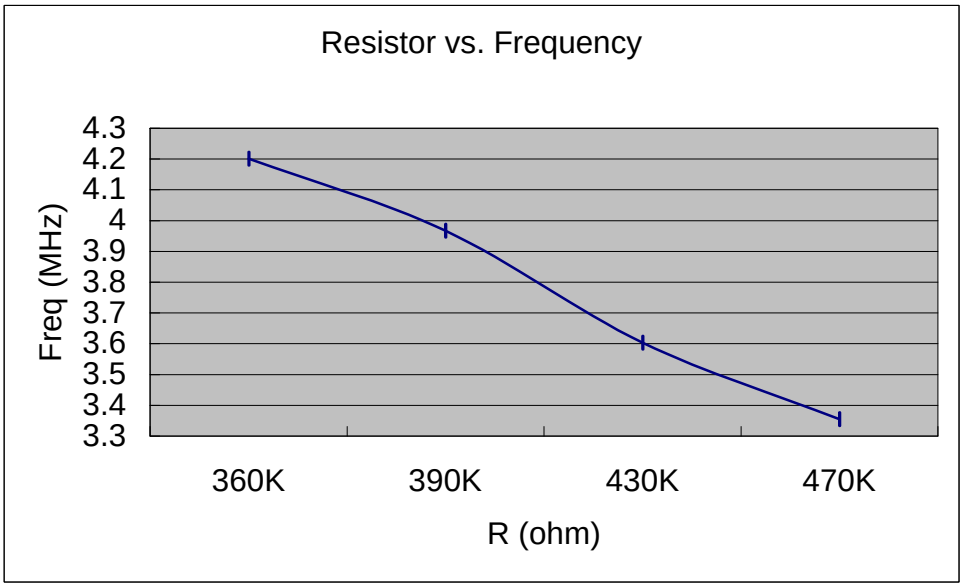
(V_{DD} – V_{SS} = 4.5 V, F_M = 8 MHz, F_S = 32768 Hz, T_A = 25° C; No Load unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	SPEC.			UNIT
			Min.	Typ.	Max.	
Main-Clock	F_M	Ring type, R = 181 KΩ	7.6	8	8.4	MHz
		Crystal type	--	8	--	MHz
Sub-Clock	F_S	RC type, R = 965 KΩ	26.214	32.768	39.322	KHz
Cycle Time	T_{CYC}	F_{SYS} = 8 MHz	125	--	DC	nS
Main-Clock Wake-up Stable Time	T_{WSM}	Ring type, R = 181 KΩ	--	3	5	mS
		Crystal type, F_M = 8 MHz	--	3	5	mS
Sub-Clock Wake-up Stable Time	T_{WSS}	RC type, R = 965 KΩ	--	1	2	S
Main-Clock Frequency Deviation	$\frac{\Delta F}{F}$	$* \frac{F_{MAX} - F_{MIN}}{F_{MIN}}$	--	--	5	%
RESETB Active Width	T_{RES}	After F_{SYS} stable	4	--	--	T_{CYC}

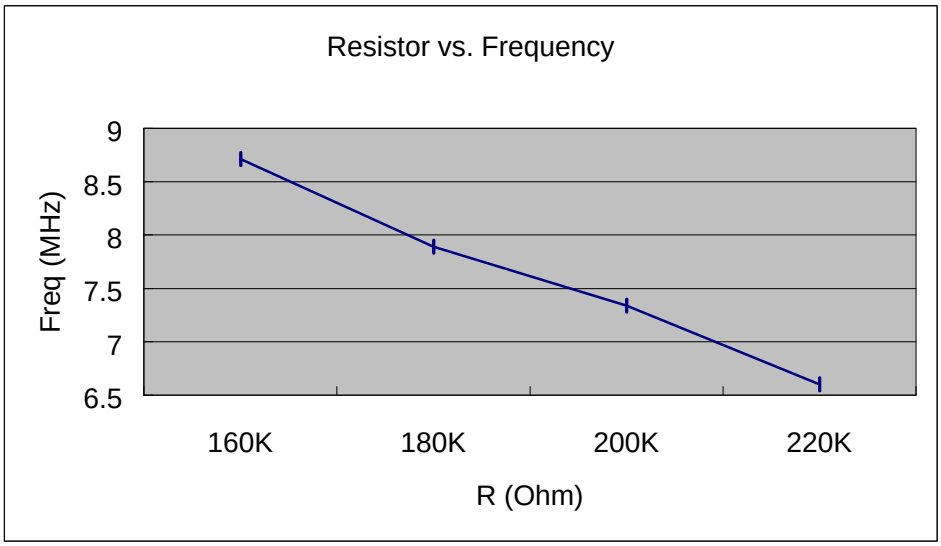
Note* : "F_{MAX}" is max. oscillation frequency for operating voltage V_{DD}, "F_{MIN}" is minimum oscillation frequency for operating voltage V_{DD}

8. STABILITY DATA

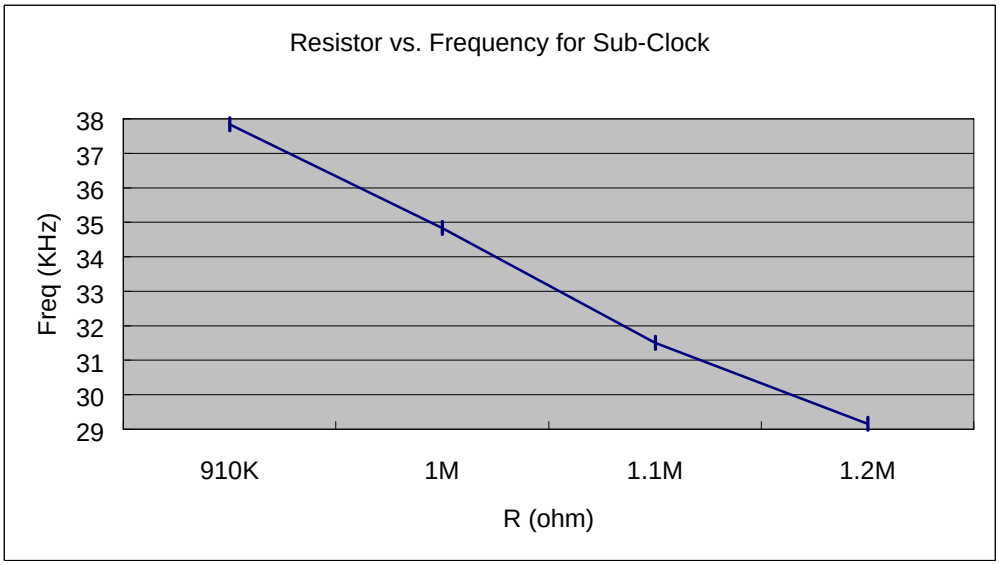
- Resistance vs. Frequency for W566B025/B030/B040 at V_{DD} = 3.0V, main-clock in Ring Type



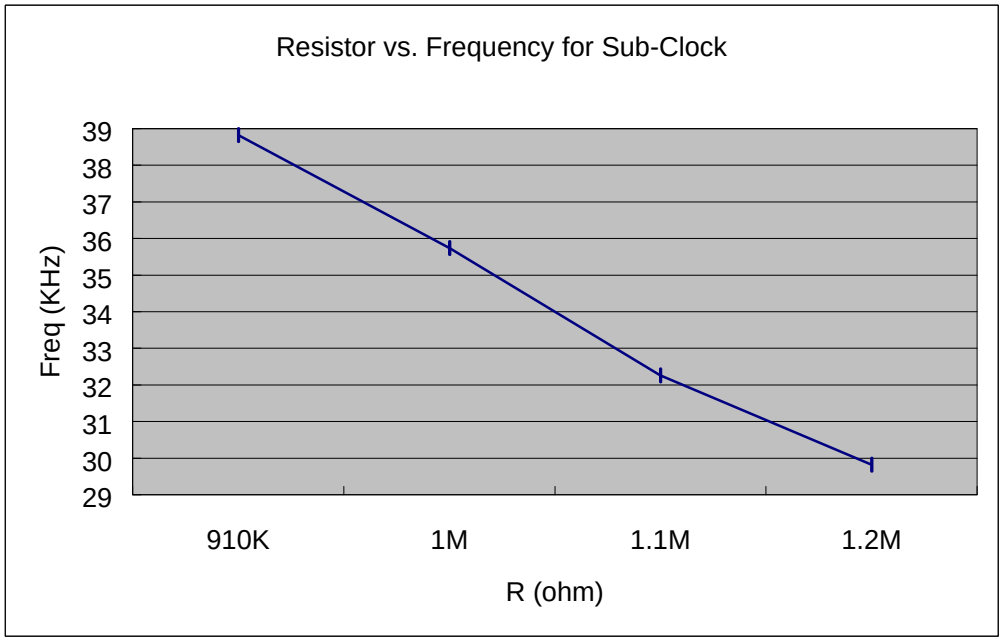
- Resistance vs. Frequency for W566B025/B030/B040 at V_{DD} = 4.5V, main-clock in Ring Type



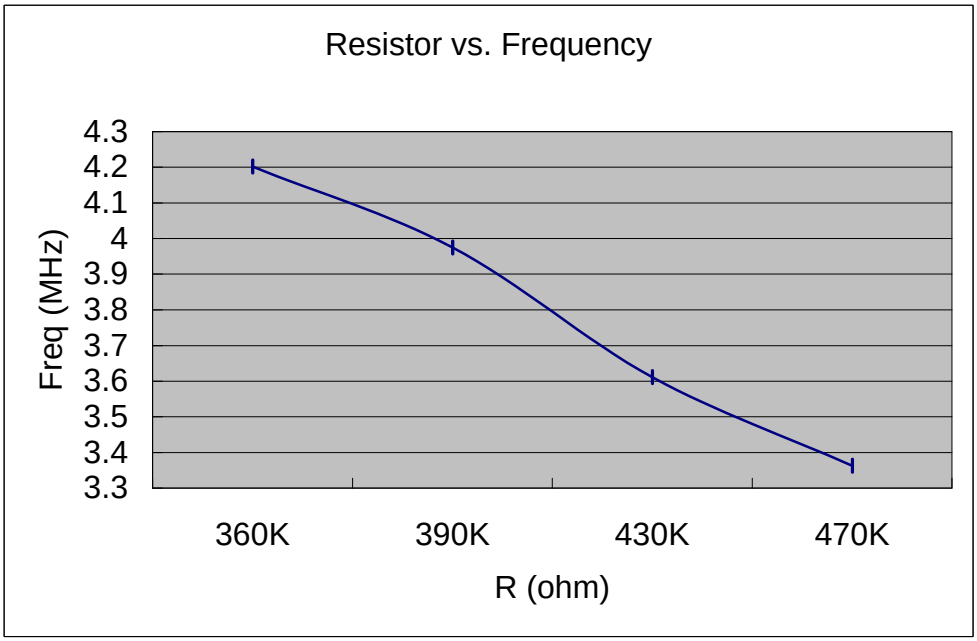
- Resistance vs. Frequency for W566B025/B030/B040 at V_{DD} = 3.0V, sub-clock in RC Type



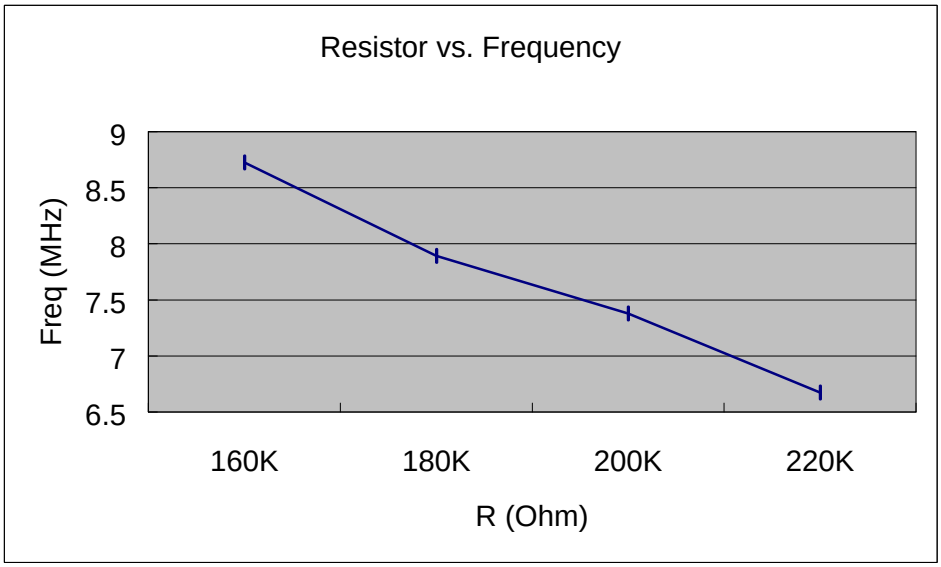
- Resistance vs. Frequency for W566B025/B030/B040 at V_{DD} = 4.5V, sub-clock in RC Type



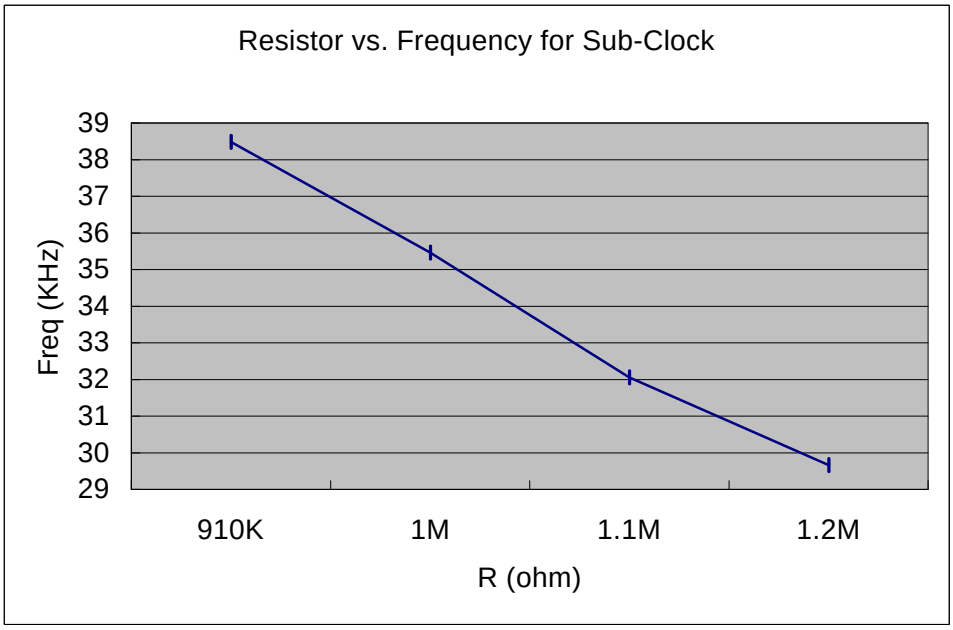
- Resistance vs. Frequency for W566B060/B080 at V_{DD} = 3.0V, main-clock in Ring Type



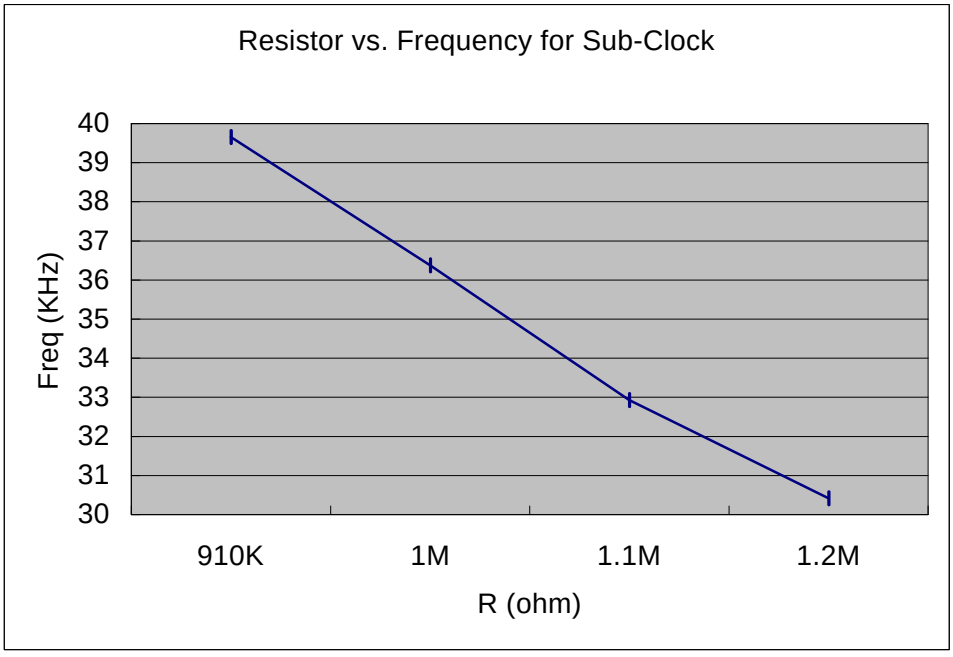
- Resistance vs. Frequency for W566B060/B080 at V_{DD} = 4.5V, main-clock in Ring Type



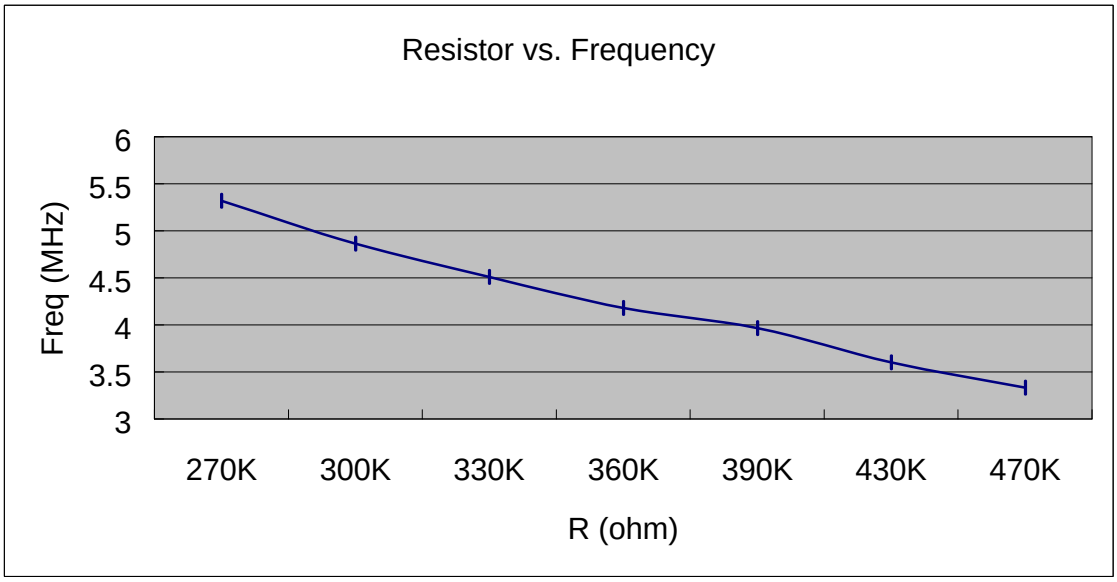
- Resistance vs. Frequency for W566B060/B080 at V_{DD} = 3.0V, sub-clock in RC Type



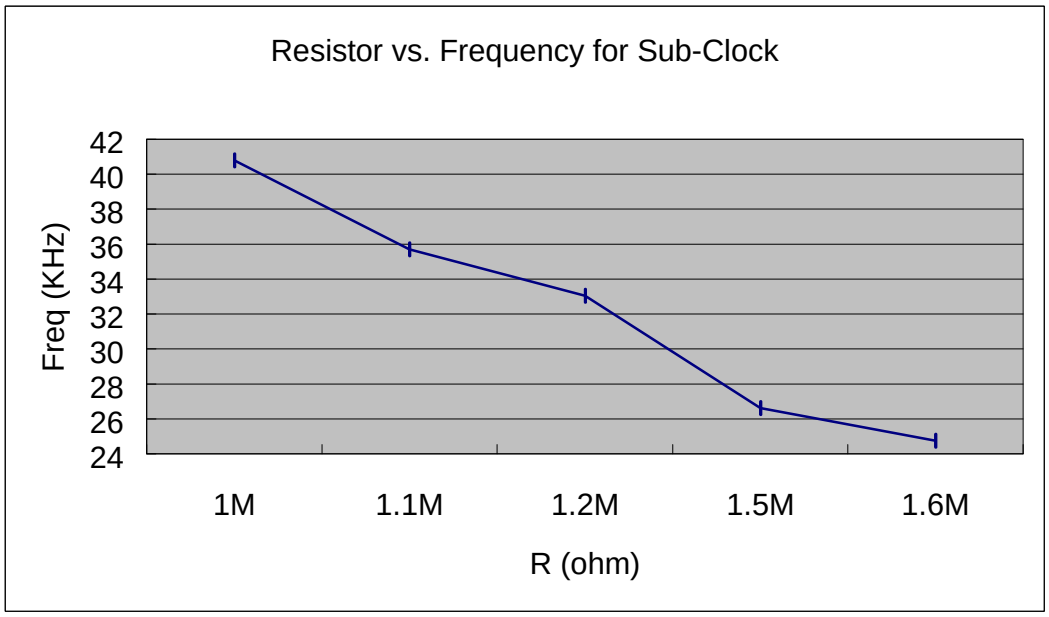
- Resistance vs. Frequency for W566B060/B080 at V_{DD} = 4.5V, sub-clock in RC Type



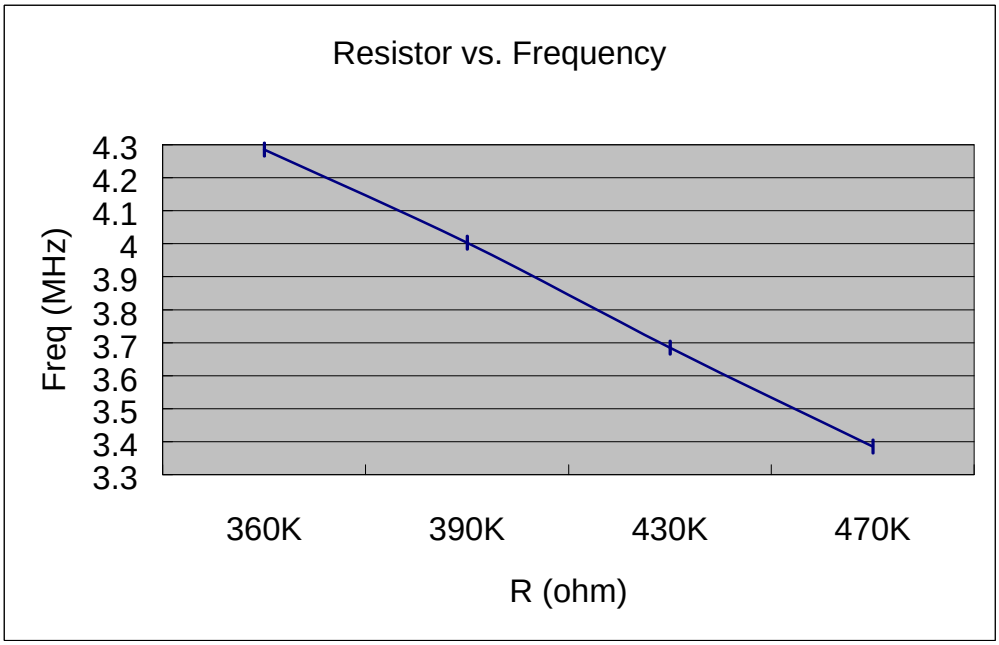
- Resistance vs. Frequency for W566B100/B120/B150/B170 at V_{DD} = 3.0V, main-clock in Ring Type



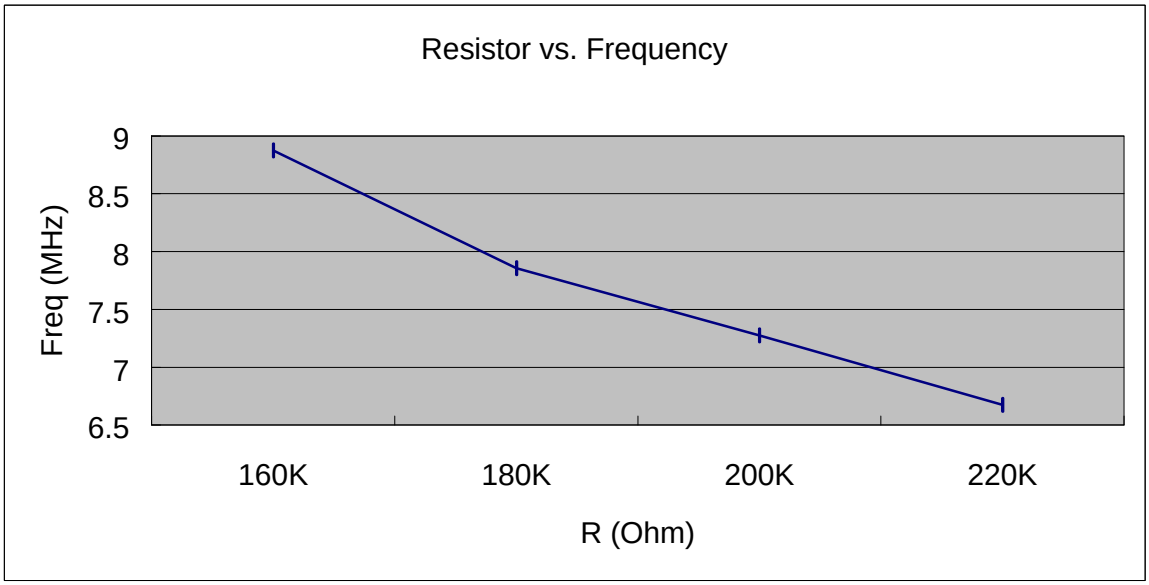
- Resistance vs. Frequency for W566B100/B120/B150/B170 at V_{DD} = 3.0V, sub-clock in RC Type



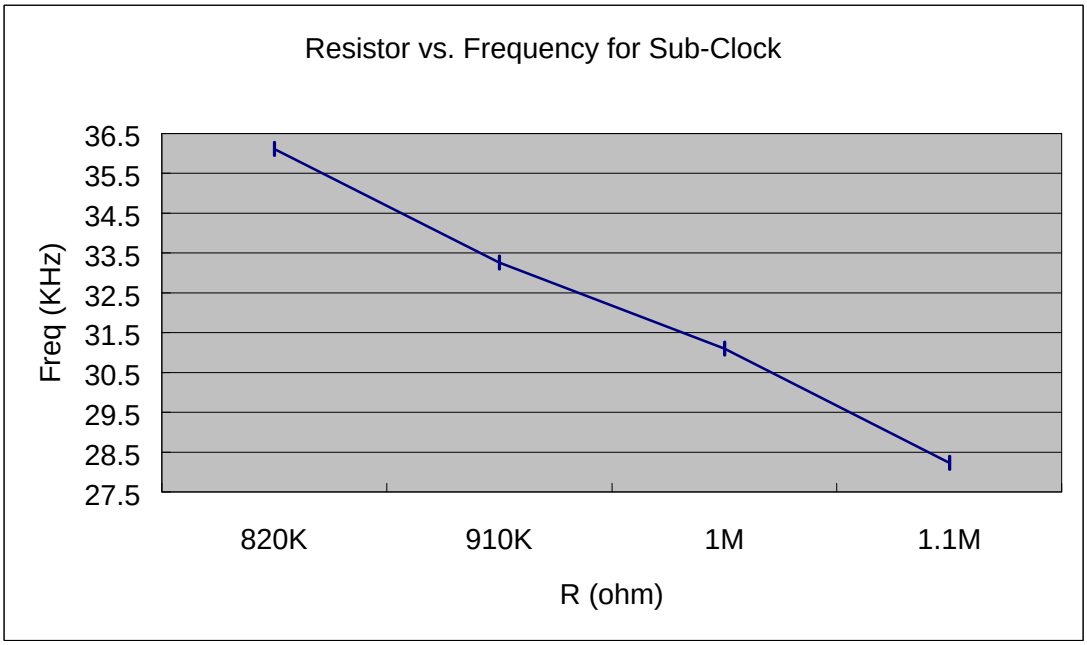
- Resistance vs. Frequency for W566B210/B260/B300/B340 at V_{DD} = 3.0V, main-clock in Ring Type



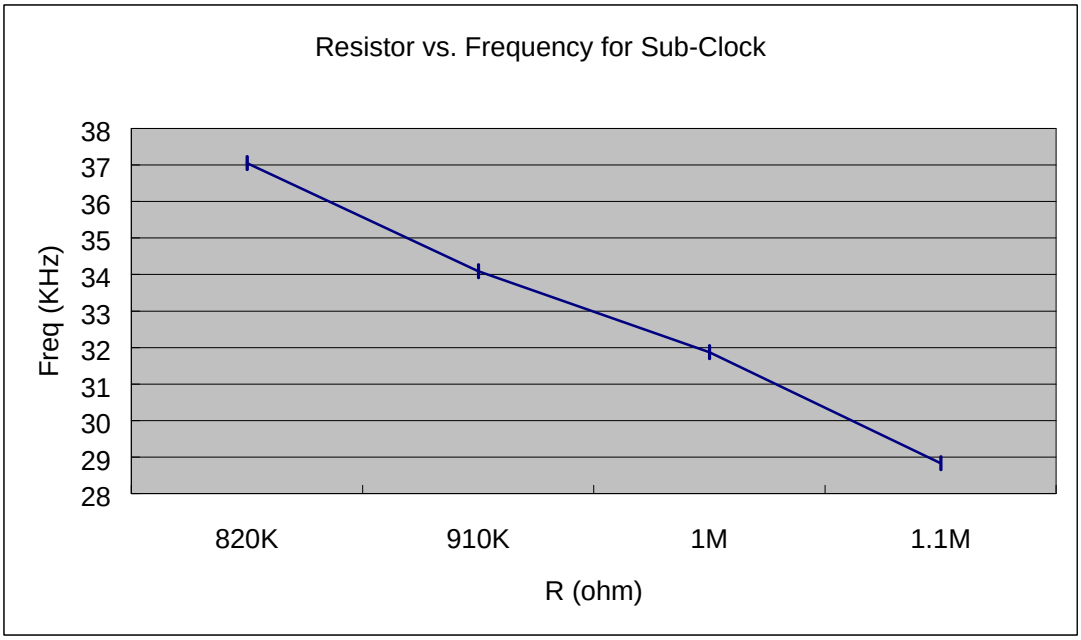
- Resistance vs. Frequency for W566B210/B260/B300/B340 at V_{DD} = 4.5V, main-clock in Ring Type



- Resistance vs. Frequency for W566B210/B260/B300/B340 at V_{DD} = 3.0V, sub-clock in RC Type

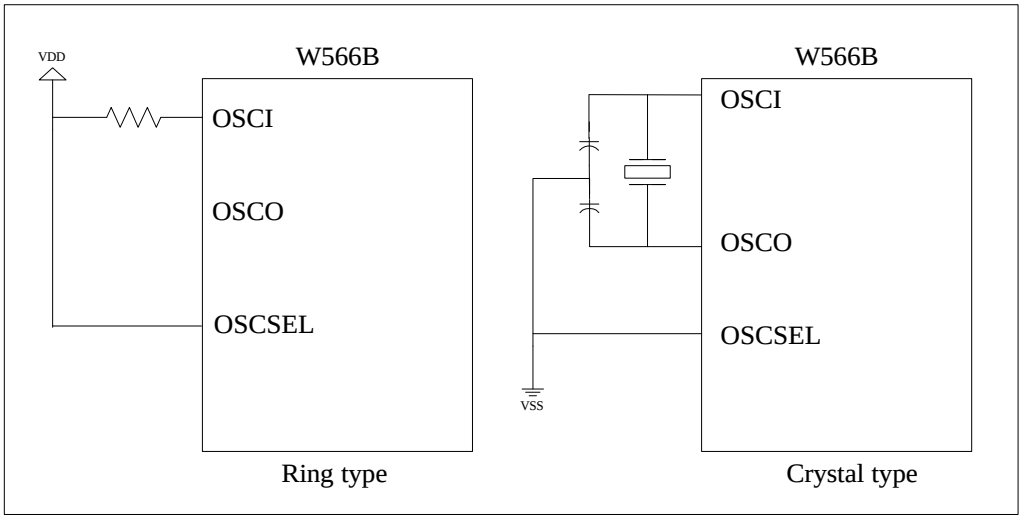


- Resistance vs. Frequency for W566B210/B260/B300/B340 at V_{DD} = 4.5V, sub-clock in RC Type

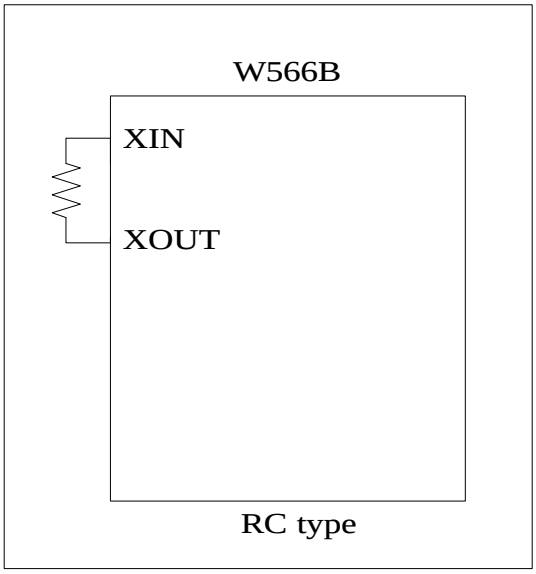


9. APPLICATION CIRCUITS

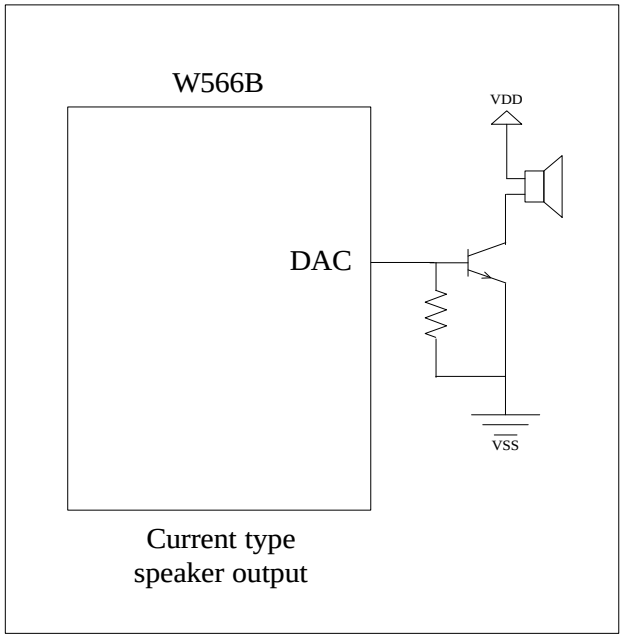
- **FM Connection**



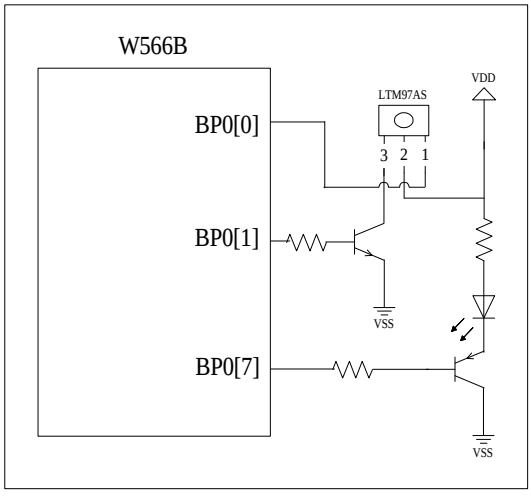
- **FS Connection**



- **Speaker Output Connection**



- **IR Tx/Rx Connection**



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