



# PRELIMINARY

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# M64895FP/GP

## I<sup>2</sup>C BUS FREQUENCY SYNTHESIZER FOR TV/VCR

### DESCRIPTION OF PIN

Pin No.	Symbol	Pin name	Function
1	f in	Prescaler input	Input for the VCO frequency.
2	GND	GND	Ground to 0V.
3	Vcc1	Power supply voltage 1	Power supply voltage terminal. 5.0V±0.5V
4	Vcc2	Power supply voltage 2	Power supply for band switching, Vcc1 to 13.2V
5 6 7 8	BS4 BS3 BS2 BS1	Band switching outputs	PNP open collector method is used. When the band switching data is "H", the output is ON. When it is "L", the output is OFF.
9	Vin	Filter input (Charge pump output)	This is the output terminal for the LPF input and charge pump output. When the phase of the programmable divider output (f1/N) is ahead compared to the reference frequency (fREF), the "source" current state becomes active. If it is behind, the "sink" current becomes active. If the phases are the same, the high impedance state becomes active.
10	Vtu	Tuning output	This supplies the tuning voltage.
11	Vcc3	Power supply voltage 3	Power supply voltage for tuning voltage 28 to 35V
12	LD/ftest	Lock detect/ Test port	Lock detector is output. Programmable freq. Divider output and reference freq. output is selected by the test mode.
13	SCL	Clock input	Data is read into the shift register when the clock signal falls
14	SDA	Data input	Input for band SW and programmable freq. divider set up.
15	ADS	Address switching input	Chip address sets it up with the input condition of terminal.
16	Xin	This is connected to the crystal oscillator.	4.0MHz crystal oscillator is connected.

### ABSOLUTE MAXIMUM RATINGS (Ta=-20°C to +75°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
Vcc1	Super voltage 1	Pin3	6.0	V
Vcc2	Super voltage 2	Pin4	14.4	V
Vcc3	Super voltage 3	Pin11	36.0	V
Vi	Input voltage	Not to exceed Vcc1	6.0	V
Vo	Output voltage	Pin16	6.0	V
VBSOFF	Voltage applied when the band output is OFF	per 1 band output circuit 50mA per 1 band output	14.4	V
IBSON	Band output current	circuit	50.0	mA
tBSON	ON the time when the band output is ON	3circuits are pn at same time	10	sec
Pd	Power dissipation	Ta=75°C	470	mW
Topr	Operating temperature		-20 to +75	°C
Tstg	Storage temperature		-40 to +125	°C

### RECOMMENDED OPERATING CONDITIONS (Ta=-20°C to +75°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
Vcc1	Super voltage 1	Pin3	4.5 to 5.5	V
Vcc2	Super voltage 2	Pin4	Vcc1 to 13.2	V
Vcc3	Super voltage 3	Pin11	28 to 35	V
fopr1	Operating frequency (1)	Crystal oscillation circuit	4.0	MHz
fopr2	Operating frequency (2)		80 to 1300	MHz
IBDL	Band output current 5 to 8	Normally 1 circuit is on. 2 circuits on at the same time is max. It is prohibited to have 3 or more circuits turned on at the same time.	0 to 40	mA

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**M64895FP/GP****I<sup>2</sup>C BUS FREQUENCY SYNTHESIZER FOR TV/VCR****ELECTRICAL CHARACTERISTICS** (Ta=-20°C to +75°C, unless otherwise noted, Vcc1=5.0V, Vcc2=12V, Vcc3=33V)

Symbol	Parameter		Test pin	Test conditions	Limits			Unit
					Min.	Typ.	Max.	
V <sub>IH</sub>	Input terminals	"H" input voltage	13 to 14		3.0	-	V <sub>CC1</sub> +0.3	V
V <sub>IL</sub>		"L" input voltage	13 to 14		-	-	1.5	V
I <sub>IH</sub>		"H" input current	13 to 14	V <sub>CC1</sub> =5.5V, V <sub>i</sub> =4.0V	-	-	10	μA
I <sub>IL</sub>		"L" input current	13/14	V <sub>CC1</sub> =5.5V, V <sub>i</sub> =0.4V	-	-4/-14	-10/-30	μA
V <sub>OL</sub>	SDA output	"L" output voltage	14	V <sub>CC1</sub> =5.5V, I <sub>o</sub> =3mA	-	-	0.4	μA
I <sub>LO</sub>		Leak current	14	V <sub>CC1</sub> =5.5V, V <sub>o</sub> =5.5V	-	-	10	μA
V <sub>BS</sub>	Band SW	Output voltage	5 to 8	V <sub>CC2</sub> =12V, I <sub>o</sub> =-40mA	11.6	11.8	-	V
I <sub>OLK1</sub>		Leak current	5 to 8	V <sub>CC2</sub> =12V band SW is OFF V <sub>o</sub> =0V	-	-	-10	μA
V <sub>toH</sub>	Tuning output	Output voltage "H"	10	V <sub>CC3</sub> =33V	32.5	-	-	V
V <sub>toL</sub>		Output voltage "L"	10	V <sub>CC3</sub> =33V	-	0.2	0.4	V
I <sub>OH</sub>	Charge pump	"H" output current	9	V <sub>CC1</sub> =5.0V, V <sub>o</sub> =2.5V	-	±270	±370	μA
I <sub>OL</sub>		"L" output current	9	V <sub>CC1</sub> =5.0V, V <sub>o</sub> =2.5V	-	±70	±110	μA
I <sub>CPLK</sub>		Leak current	9	V <sub>CC1</sub> =5.0V, V <sub>o</sub> =2.5V	-	-	±50	nA
I <sub>CC1</sub>	Supply current 1		3	V <sub>CC1</sub> =5.5V	-	20	30	mA
I <sub>CC2A</sub>	Supply current 2	4 circuits: OFF	4	V <sub>CC2</sub> =12V	-	-	0.3	mA
I <sub>CC2B</sub>		1 circuit: ON, Output: OPEN	4	V <sub>CC2</sub> =12V	-	6.0	8.0	mA
I <sub>CC2C</sub>		Output current 40mA	4	V <sub>CC2</sub> =12V I <sub>o</sub> =-40mA	-	46.0	48.0	mA
I <sub>CC3</sub>	Supply current 3		11	V <sub>CC3</sub> =33V Output ON	-	3.0	4.0	mA

The typical values are at V<sub>CC1</sub>=5.0V V<sub>CC2</sub>=12V V<sub>CC3</sub>=33V, Ta=+25°C.

**SWITCHING CHARACTERISTICS** (Ta=-20°C to +75°C, unless otherwise noted, Vcc1=5.0V, Vcc2=12V, Vcc3=33V)

Symbol	Parameter		Test pin	Test conditions	Limits			Unit	
					Min.	Typ.	Max.		
f <sub>opr</sub>	Prescaler operating frequency		1	V <sub>CC1</sub> =4.5 to 5.5V V <sub>in</sub> =V <sub>inmin</sub> to V <sub>inmax</sub>	80	-	1300	MHz	
V <sub>in</sub>	Operating input voltage		1	V <sub>CC1</sub> =4.5 to 5.5V	80 to 100MHz	-24	-	4	dBm
					100 to 200MHz	-27	-	4	
					200 to 800MHz	-30	-	4	
					800 to 1000MHz	-27	-	4	
					1000 to 1300MHz	-18	-	4	
f <sub>SCL</sub>	Clock pulse frequency		13	V <sub>CC1</sub> =4.5 to 5.5V	0	-	100	kHz	
t <sub>BUF</sub>	Bus free time		14	V <sub>CC1</sub> =4.5 to 5.5V	4.7	-	-	μs	
t <sub>HD<sub>STA</sub></sub>	Data hold time		13	V <sub>CC1</sub> =4.5 to 5.5V	4	-	-	μs	
t <sub>LOW</sub>	SCL low hold time		13	V <sub>CC1</sub> =4.5 to 5.5V	4.7	-	-	μs	
t <sub>HIGH</sub>	SCL high hold time		13	V <sub>CC1</sub> =4.5 to 5.5V	4	-	-	μs	
t <sub>SU<sub>STA</sub></sub>	Set up time		13, 14	V <sub>CC1</sub> =4.5 to 5.5V	4.7	-	-	μs	
t <sub>HD<sub>DAT</sub></sub>	Data hold time		13, 14	V <sub>CC1</sub> =4.5 to 5.5V	0	-	-	s	
t <sub>SU<sub>DAT</sub></sub>	Data set up time		13, 14	V <sub>CC1</sub> =4.5 to 5.5V	250	-	-	ns	
t <sub>r</sub>	Rise time		13, 14	V <sub>CC1</sub> =4.5 to 5.5V	-	-	1000	ns	
t <sub>f</sub>	Fall time		13, 14	V <sub>CC1</sub> =4.5 to 5.5V	-	-	300	ns	
t <sub>SU<sub>STO</sub></sub>	Set up time		13, 14	V <sub>CC1</sub> =4.5 to 5.5V	4	-	-	μs	

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## MITSUBISHI ICs (TV) M64895FP/GP

### I<sup>2</sup>C BUS FREQUENCY SYNTHESIZER FOR TV/VCR

#### METHOD OF SETTING DATA

The input information to consist of 2 or data of 4 bytes to lead to Chip Address is received in I<sup>2</sup>Cbus receiver. It shows a definition of bus protocol admitted in the following.

```

1_STA CA CB BB STO
2_STA CA D1 D2 STO
3_STA CA CB BB D1 D2 STO
4_STA CA D1 D2 CB BB STO
    
```

STA : Start condition

STO : Stop condition

CA : Chip address

CB : Control data byte

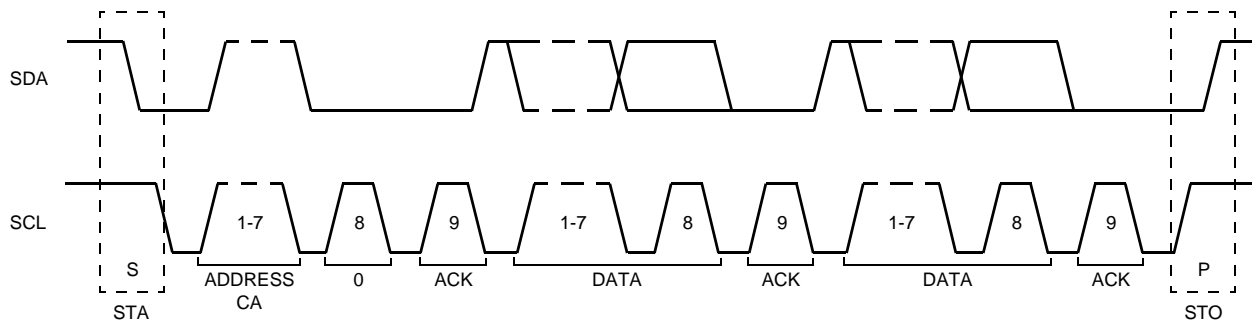
BB : BandS.W. data byte

D1 : Divider data byte

D2 : Divider data byte

The information of 5 bytes necessary for circuit operation is chip address and control data, bandS.W. data of 2 bytes and divider byte of 2 bytes. After the chip address input, 2 or data of 4 bytes are received.

Function bit is contained the first and the third data byte to distinguish between divider data and control data, band data, and "0" goes ahead of divider data, and "1" goes ahead of control data, bandS.W. data.



#### Write mode format

Byte	MSB								LSB
Address Byte	1	1	0	0	0	MA1	MA0	0	A
Divider Byte1	0	N14	N13	N12	N11	N10	N9	N8	A
Divider Byte2	N7	N6	N5	N4	N3	N2	N1	N0	A
Control Byte1	1	CP	T2	T1	T0	RSa	RSb	OS	A
Band SW Byte	X	X	X	X	BS4	BS3	BS2	BS1	A

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**TEST MODE DATA SET UP METHOD**

**Test Mode Bit Set Up**

X : Random, 0 or 1. normal "0"

MA1, MA0 : Programmable Address Bit

Address input voltage	MA1	MA0
0 to 0.1 V <sub>CC1</sub>	0	0
Always valid	0	1
0.4 V <sub>CC1</sub> to 0.6*V <sub>CC1</sub>	1	0
0.9 V <sub>CC1</sub> to V <sub>CC1</sub>	1	1

N14 to N0 : How to set dividing ratio of the programmable the divider

$$\text{Dividing ratio} = N14(2^{14} = 16384) + N0(2^0 = 1)$$

Therefore, the range of division N is 1,024 to 32,768

Example)  $f_{vco} = f_{REF} \times 8 \times N$

$$= 3.90625 \times 8 \times N$$

$$= 31.25 \times N \text{ (kHz)}$$

**CP: Setting up the charge pump current of the phase**

**comparator**

CP	Charge pump current	Mode
0	70μA	Test
1	270μA	Normal

**T2,T1,T0 : Setting up for the test mode**

T2 T1 T0	Charge pump	Pin 12 condition	Mode
0 0 X	Normal operation	Lock output	Normal operation
0 1 X	High impedance	Lock output	Test mode
1 1 0	Sink	Lock output	Test mode
1 1 1	Source	Lock output	Test mode
1 0 0	High impedance	f <sub>REF</sub> output	Test mode
1 0 1	High impedance	f <sub>1/N</sub> output	Test mode

**RSa, RSb : Set up for the reference frequency division ratio**

RSa	RSb	Division ratio
1	1	1/512
0	1	1/1024
X	0	1/640

**OS : Set up the tuning amplifier**

OS	Tuning voltage output	Mode
0	ON	Normal
1	OFF	Test

Power on reset operation (Initial state the power is turned ON)

BS4 to BS1 : OFF

Charge pump : High impedance

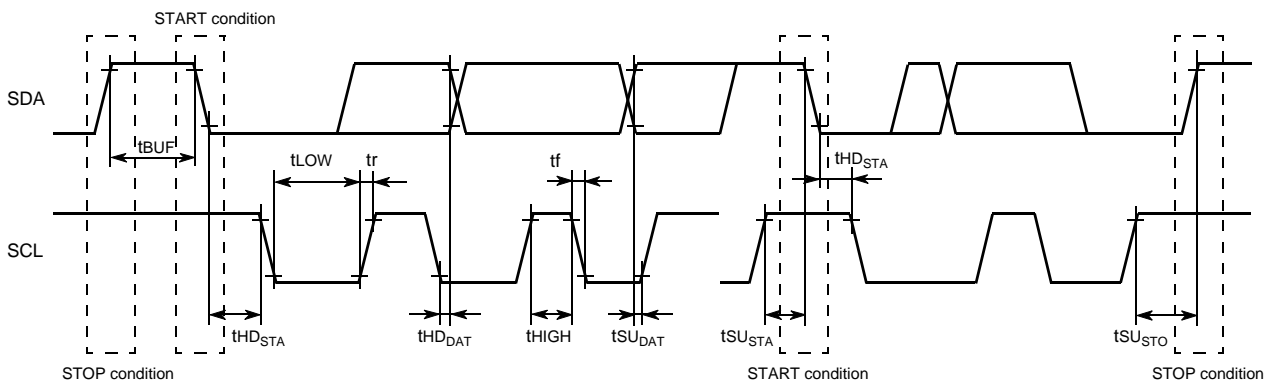
Tuning amplifier : OFF

Charge pump current : 270μA

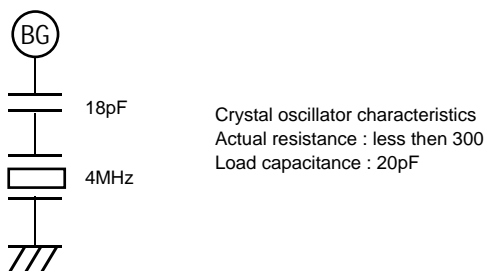
Frequency division ratio : 1/1024

Lock detector : High

**TIMING DIAGRAM**



**CRYSTAL OSCILLATOR CONNECTION DIAGRAM**

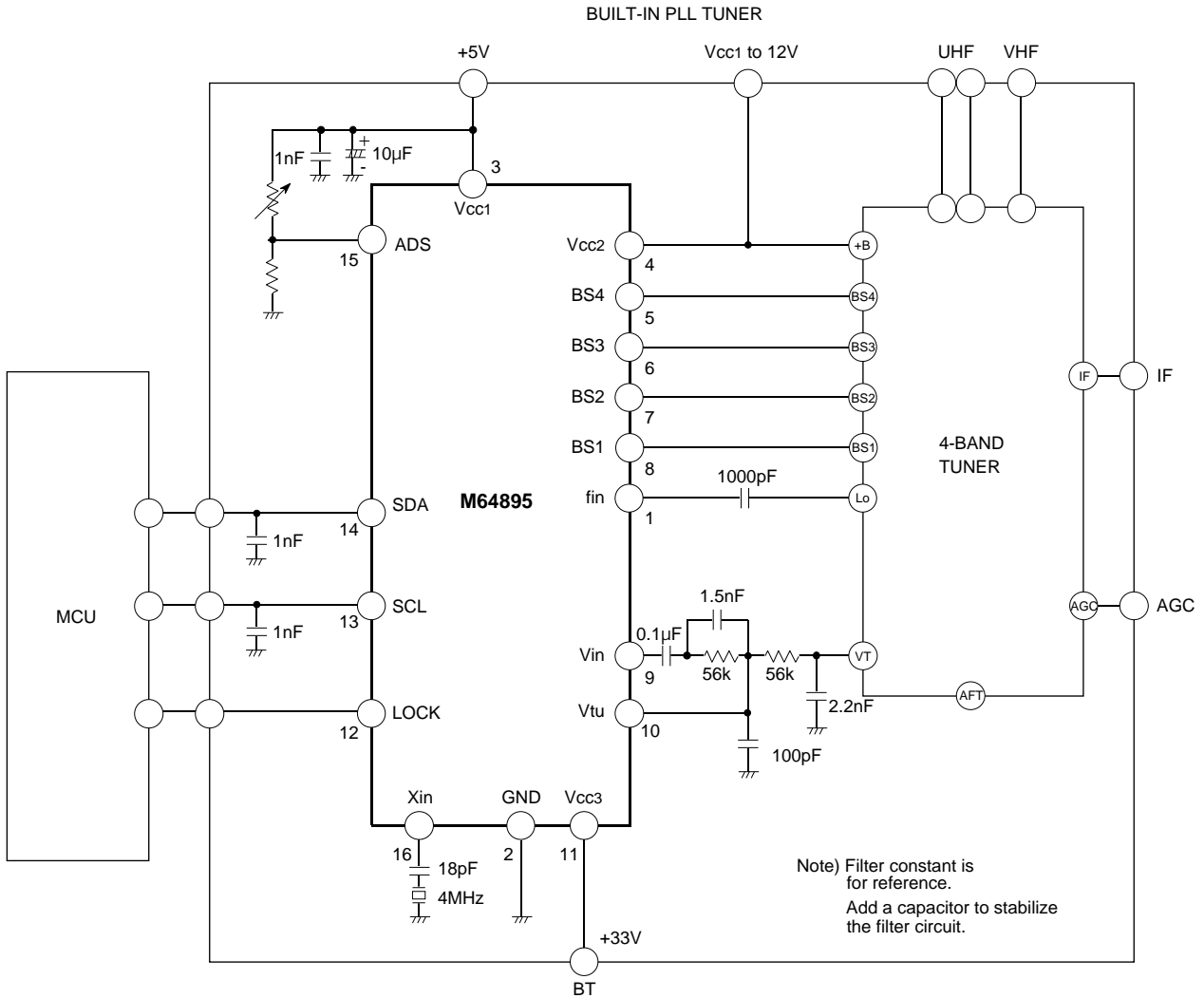


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APPLICATION EXAMPLE



Units Resistance :  
Capacitance : F