M64898GP

PLL Frequency Synthesizer with DC/DC Converter For PC

REJ03F0168-0200
Rev.2.00
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Description

The M64898GP is a semiconductor integrated circuit consisting of PLL frequency synthesizer for TV/VCR /PC.

It contains the prescaler with operating up to 1.3 GHz, 4 band drivers and DC/DC converter for Tuning voltage.

Features

- Built-in DC/DC converter for Tuning voltage
- 4 integrated PNP band drivers (I_O = 30 mA, Vsat = 0.2 V Typ.@V_{CC1} to 10 V)
- Built-in prescaler with input amplifier (max = 1.3 GHz)
- PLL lock/unlock status display out put (Built-in pull up resistor)
- X'tal 4 MHz is used to realize 3 type of tuning steps (Divider ratio 1/512, 1/640, 1/1024)
- Software compatible with M64892/M64893
- Automatic switching of tuning step according to the number of data bits (62.5 kHz at 18 bits, 32.25 kHz at 19 bits)
- Built-in Power on reset system
- Small package (SSOP)

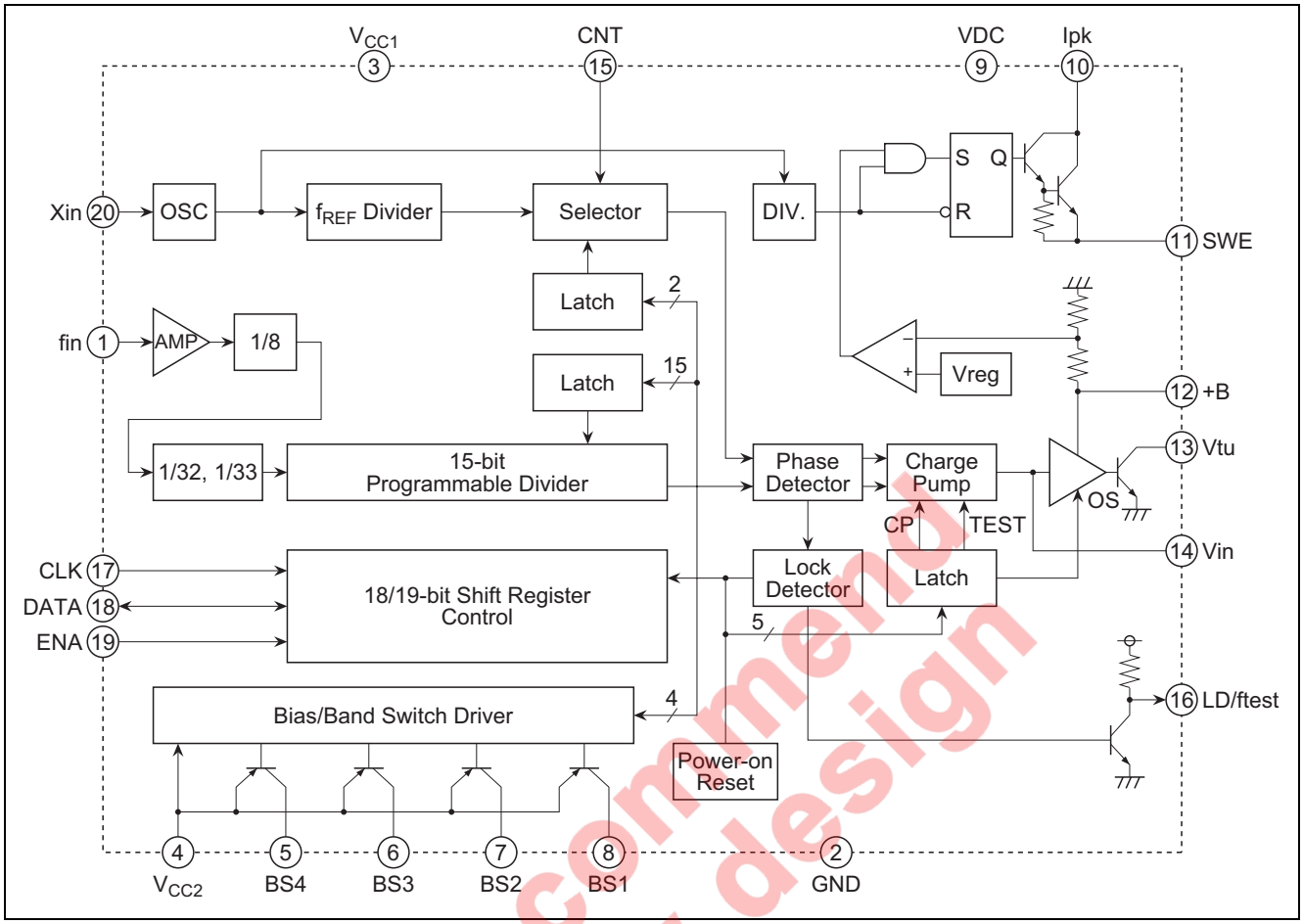
Application

PC, TV, VCR tuners

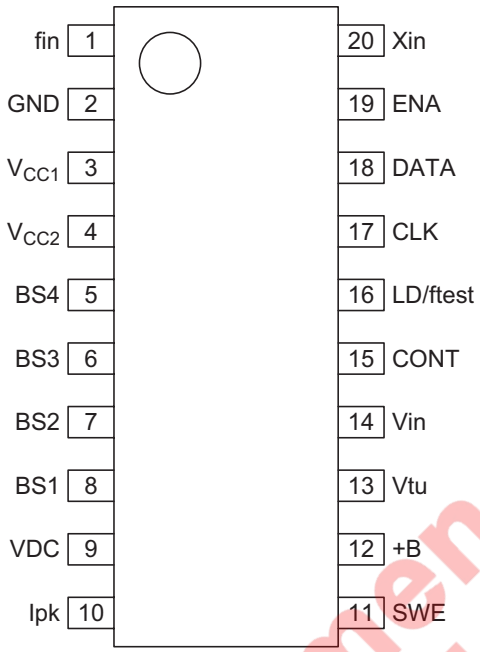
Recommended Operating Condition

- Supply voltage range
  - V_{CC1} = 4.5 to 5.5 V
  - V_{CC2} = V_{CC1} to 10 V
- Rated supply voltage
  - V_{CC1} = 5 V
  - V_{CC2} = V_{CC1}

Block Diagram



Pin Arrangement



(Top view)

Outline: PLSP0020JA-A (20P2E-A)

Pin Description

Pin No.	Symbol	Pin Name	Function
1	fin	Prescaler input	Input for the VCO frequency.
2	GND	GND	Ground to 0 V.
3	V_{CC1}	Power supply voltage 1	Power supply voltage terminal. 5.0 V ± 0.5 V
4	V_{CC2}	Power supply voltage 2	Power supply for band switching, V_{CC1} to 10 V
5	BS4	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.
6	BS3		
7	BS2		
8	BS1		
9	VDC	DC/DC power supply voltage	DC/DC power supply voltage terminal. 5.0 V ± 0.5V
10	Ipk	Peak current detect	When potential difference with VDC terminal becomes more than 0.33 V by current limiting detector of DC/DC converter, the listing rises with off.
11	SWE	Switching output	DC/DC converter oscillator output.
12	+B	Power supply voltage	Power supply voltage for tuning voltage.
13	Vtu	Tuning output	This supplies the tuning voltage.
14	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 (f 1/N) is ahead compared to the reference frequency (f_{REF}), 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.
15	LD/ftest	Lock detect/Test port	Lock detector output. When loop of phase locked loop locked it, it rise with “H” level in “L” level or unlock. In control byte data input, the programmable freq. divider output and reference freq. output is selected by the test mode.
16	CONT	f_{REF} Switch	Set up reference frequency divider ratio. In “L” level, set it up in 1/640 (19 Bit) in setting “opening” in 1/1024 (19 Bit) or 1/512 (18 Bit).
17	CLOCK	Clock input	Data is read into the shift register when the clock signal falls.
18	DATA	Data input	Input for band SW and programmable freq. divider set up.
19	ENABLE	Enable input	This normally at a “L”. When this is at “H”, data and clock signals are received. Data is read into the latch when the enable signal after the 18th signal of the clock signal falls or when the 19th pulse of the clock signal falls.
20	Xin	This is connected to the crystal oscillator.	4.0 MHz crystal oscillator connected.

Absolute Maximum Ratings

(Ta = –20°C to +75°C, unless otherwise noted)

Item	Symbol	Ratings	Unit	Condition
Supply voltage 1	V_{CC1}	6.0	V	Pin 3
Supply voltage 2	V_{CC2}	10.8	V	Pin 4
Input voltage	V_I	6.0	V	Not to exceed V_{CC1}
Output voltage	V_O	6.0	V	f_{REF} output
Voltage applied when the band output is OFF	V_{BSOFF}	10.8	V	
Band output current	I_{BSON}	40.0	mA	per 1 band output circuit
ON the time when the band output is ON	t_{BSON}	10	s	40mA per 1 band output circuit 3 circuits are pn at same time.
Power dissipation	Pd	255	mW	Ta=75°C
Operating temperature	Topr	–20 to +75	°C	
Storage temperature	Tstg	–40 to +125	°C	

Recommended Operation Conditions

(Ta = –20°C to +75°C, unless otherwise noted)

Item	Symbol	Ratings	Unit	Conditions
Supply voltage 1	V_{CC1}	4.5 to 5.5	V	Pin 3
Supply voltage 2	V_{CC2}	V_{CC1} to 10.0	V	Pin 4
Operating frequency (1)	f_{opr1}	4.0	V	Crystal oscillation circuit
Operating frequency (2)	f_{opr2}	80 to 1300	MHz	
Band output current 5 to 8	I_{BDL}	0 to 30	mA	Normally 1 circuit is on. 2 circuit on at the same time is max. It is prohibited to have 3 or more circuits turned on at the same time.

Electrical Characteristics

(Ta = –20°C to +75°C, unless otherwise noted, V_{CC1} = 5.0 V, V_{CC2} = 9.0 V)

Item		Symbol	Test Pin	Limits			Unit	Test Conditions
				Min.	Typ.	Max.		
Input terminals	"H" input voltage	V_{IH}	17 to 19	3.0	—	V_{CC1} + 0.3	V	
	"L" input voltage	V_{IL1}	15	—	—	0.4	V	
	"L" input voltage	V_{IL2}	17 to 19	—	—	1.5	V	
	"H" input current	I_{IH}	17 to 19	—	—	10	µA	V_{CC1} = 5.5V, Vi = 4.0V
	"L" input current	I_{IL1}	15	—	–50	–80	µA	V_{CC1} = 5.5V, Vi = 0V
	"L" input current	I_{IL2}	17, 19	—	–6	–10	µA	V_{CC1} = 5.5V, Vi = 0.5V
	"L" input current	I_{IL3}	18	—	–18	–30	µA	V_{CC1} = 5.5V, Vi = 0.5V
Lock output	"H" input current	V_{OH}	16	5.0	—	—	V	V_{CC1} = 5.5V
	"L" input current	V_{OL}	16		0.3	0.5	V	V_{CC1} = 5.5V
Band SW	Output voltage	V_{BS}	5 to 8	11.6	11.8	—	V	V_{CC2} = 9V, I_O = –30mA
	Leak current	I_{Olk1}	5 to 8	—	—	–10	µA	V_{CC2} = 9V, Band SW is OFF V_O = 0V
Tuning output	Output voltage "H"	V_{toH}	13	30.5	—	—	V	+B = 31V
	Output voltage "L"	V_{toL}	13	—	0.2	0.4	V	+B = 31V
Charge pump	"H" output current	I_{cpo}	14	—	270	370	µA	V_{CC1} = 5.0V, V_O = 2.5V
	Leak current	I_{cpLK}	14	—	—	50	nA	V_{CC1} = 5.0V, V_O = 2.5V
Supply current 1		I_{CC1}	3	—	20	30	mA	V_{CC1} = 5.5V
Supply current 2	4 circus OFF	I_{CC2A}	4	—	—	0.3	mA	V_{CC2} = 9V
	1 circus ON, Output open	I_{CC2B}	4	—	4.0	6.0	mA	V_{CC2} = 9V
	Output current 30 mA	I_{CC2C}	4	—	34.0	36.0	mA	V_{CC2} = 9V, I_O = –30mA
DC/DC Converter								
Supply current (action)		I_{CCdc}	9	—	1.3	3.0	mA	V_{CC1} = 5.5V
Output voltage		Vdo	12	28	31	35	V	V_{CC1} = 5.5V
OSC frequency		f_{OSC}	11	—	571	—	kHz	V_{CC1} = 5.5V
Current limit detect voltage		Vipk	10	—	330	—	mV	V_{CC1} = 5.5V

Note: The typical values are at V_{CC1} = 5.0 V, V_{CC2} = 9.0 V, Ta = +25°C.

Switching Characteristics

(Ta = –20°C to +75°C, unless otherwise noted, V_{CC1} = 5.0 V, V_{CC2} = 9.0 V)

Item	Symbol	Test Pin	Limits			Unit	Test Conditions	
			Min.	Typ.	Max.			
Prescaler operating frequency	f_{opr}	1	80	—	1300	MHz	V_{CC1} = 4.5 to 5.5V Vin = Vinmin to Vinmax	
Operating input voltage	V_{in}	1	–24	—	4	dBm	V_{CC1} = 4.5 to 5.5V	80 to 100MHz
			–27	—	4			100 to 950MHz
			–15	—	4			950 to 1300MHz
Clock pulse width	t_{PWC}	17	1	—	—	µs	V_{CC1} = 4.5 to 5.5V	
Data setup time	$t_{SU\ (D)}$	18	2	—	—	µs	V_{CC1} = 4.5 to 5.5V	
Data hold time	$t_{H\ (D)}$	18	1	—	—	µs	V_{CC1} = 4.5 to 5.5V	
Enable setup time	$t_{SU\ (E)}$	18	3	—	—	µs	V_{CC1} = 4.5 to 5.5V	
Enable hold time	$t_{H\ (E)}$	18	3	—	—	µs	V_{CC1} = 4.5 to 5.5V	
Enable data interval time	t_{INT}	19, 18	1	—	—	µs	V_{CC1} = 4.5 to 5.5V	
Rise time	t_R	17, 18, 19	—	—	1	µs	V_{CC1} = 4.5 to 5.5V	
Fall time	t_F	17, 18, 19	—	—	1	µs	V_{CC1} = 4.5 to 5.5V	
Next enable prohibit time	t_{BT}	19	5	—	—	µs	V_{CC1} = 4.5 to 5.5V	
Next clock prohibit time	t_{BCL}	17, 19	5	—	—	µs	V_{CC1} = 4.5 to 5.5V	

Method of Setting Data

The programmable divider ratio uses 15 bits. Setting up the band switching output uses 4 bits.

The test mode data uses 8 bits. The total bits used are 27 bits. Data is read in when the enable signal is “H” and the clock signal falls.

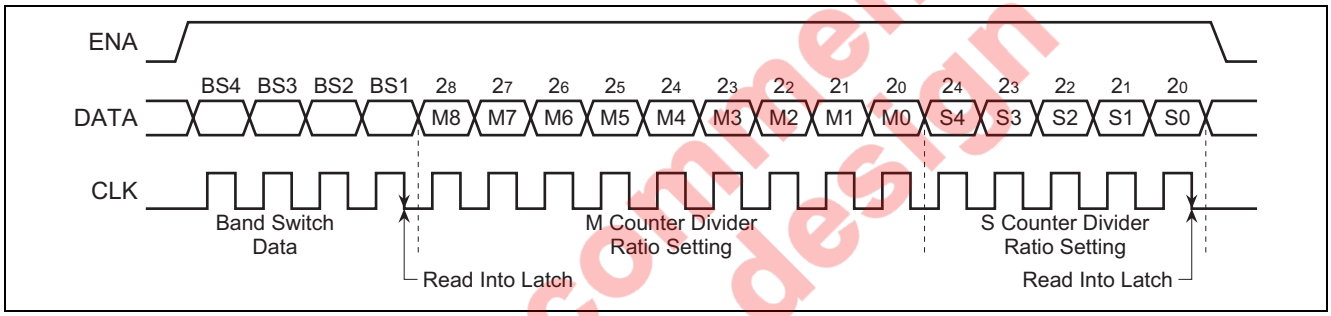
The band switching data is read in at the 4th pulse of the clock signal. The programmable counter data is read into the latch by the fall of the enable signal after the 18th pulse of the clock signal or the fall of the 19th pulse of the clock signal. When the enable signal goes to “L” before the 18th pulse of the enable signal, only the band SW data is updated and other data is ignored.

Automatic judgment facility comes being it, and, as for Shift resister, CONT terminal rises by 18/19 bits at the time of “L”. At the time of data of 18 bits, M9 bit of Programmable divider is done reset of, and it is established in reference frequency divider ratio is established 1/512.

At the time of 19 bits, reference frequency divider ratio is established in 1/1024.

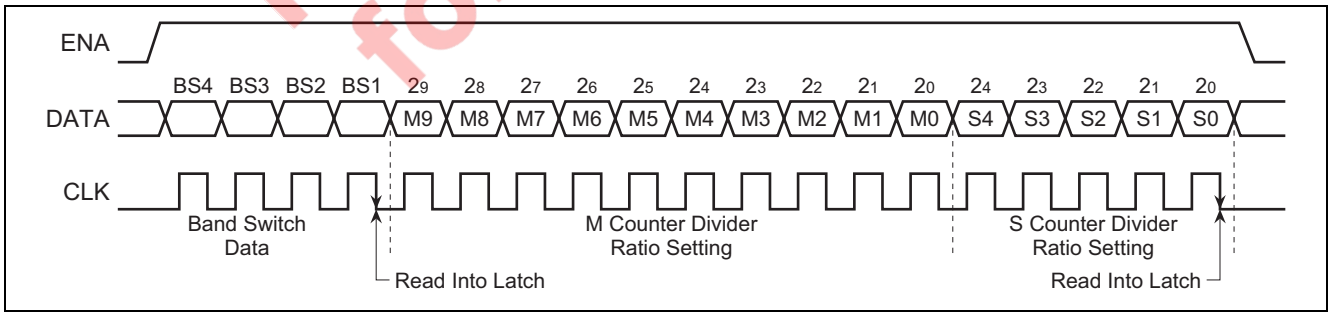
When reference frequency divider ratio was established in 1/640 by 19 bits at the time if “opening” CONT terminal, and it became “L” before 19 pulses enable signal, only band SW data are renewed, and other data are ignored.

1. Transfer of the 18th bit data (CONT terminal is “L”)
   Data is latched by the fall of the enable signal after the 18th clock signal. At this time, the divider of the 1/512 of the reference frequency is used.



2. Transfer of the 19th bit data (CONT terminal is “L” or “open”)
   The data is latched at the 19th pulse of the clock signal.
   Reference frequency divider ratio is established in 1/1024 in case of “L” CONT terminal at this time.
   Reference frequency divider ratio is established in 1/640 in case of “opening” CONT terminal.
   Invalid the clock signal after 19th pulse.

Note: When CONT terminal is “L”, to change reference frequency, set up as ENA in “L” after 19th pulse of clock signal by all means.



How to Set The Dividing Ratio of The Programmable Divider

1. Transfer of the 18th bit data (CONT terminal is “L”)
   Total divider N is given by the following formulas in addition to the prescaler used in the previous stage.
   $N = 8 \bullet (32\ M + S)$ M: 9 bit main counter divider
   S: 5 bit swallow counter divider

   The M and S counters are binary the possible ranges of divider are as follows.
   $32 \bullet M \bullet 511$

   $0 \bullet S \bullet 31$

   Therefore, the range of divider N is 8,192 to 131,064.
   The tuning frequency f_{VCO} is given in the following equations.
   $f_{VCO} = f_{REF} \bullet N$

   $= 7.8125 \bullet 8 \bullet (32\ M + S)$

   $= 62.5 \bullet (32\ M + S)$ (kHz)

   Therefore, the tuning frequency range is 64 MHz to 1023.9375 MHz.

2. Transfer of the 19th bit data (CONT terminal is “L”)
   Total divider N is given by the following formulas in addition to the prescaler used in the previous stage.
   $N = 8 \bullet (32\ M + S)$ M: 10 bit main counter divider
   S: 5 bit swallow counter divider

   The M and S counters are binary the possible ranges of divider are as follows.
   $32 \bullet M \bullet 1023$

   $0 \bullet S \bullet 31$

   Therefore, the range of divider N is 8,192 to 262,136.
   The tuning frequency f_{VCO} is given in the following equations.
   $f_{VCO} = f_{REF} \bullet N$

   $= 3.90625 \bullet 8 \bullet (32\ M + S)$

   $= 31.25 \bullet (32\ M + S)$ (kHz)

   Therefore, the tuning frequency range is 32 MHz to 1023.96875 MHz.

3. Transfer of the 19th data (CONT terminal is “open”)
   Total divider N is given by the following formulas in addition to the prescaler used in the previous stage.
   $N = 8 \bullet (32M + S)$ M: 10 bit main counter divider
   S: 5 bit swallow counter divider

   The M and S counters are binary the possible ranges of divider are as follows.
   $32 \bullet M \bullet 1023$

   $0 \bullet S \bullet 31$

   Therefore, the range of divider N is 8,192 to 262,136.
   The tuning frequency f_{VCO} is given in the following equations.
   $f_{VCO} = f_{REF} \bullet N$

   $= 6.25 \bullet 8 \bullet (32\ M + S)$

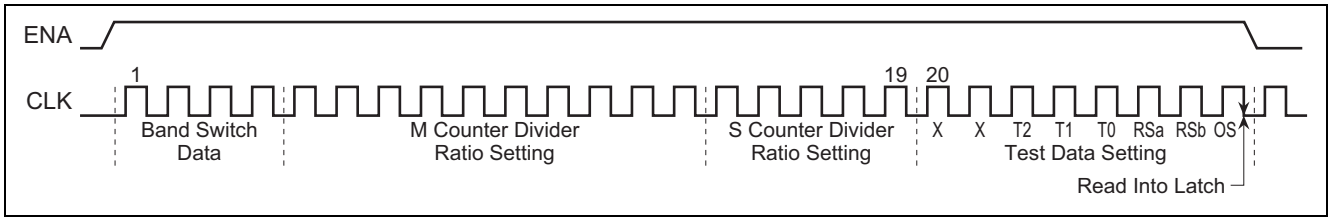
   $= 50.0 \bullet (32\ M + S)$ (kHz)

   But, the tuning frequency range is 51.2 MHz to 1300 MHz from the maximum prescaler operating frequency.

Test Mode Data Set Up Method

The data for the test mode uses 20 to 27 bits. Data is latched when the 27th clock signal falls.

1. When transferring 3-wire 27 bit data



2. Test Mode Bit Set Up

X : Random, 0 or 1 normal “0”
T0, T1 & T2 : Set up test modes
RSa, Rsa : Set the frequency divider of the reference frequency
OS : Set up the tuning amplifier

Setting Up for The Test mode

T2	T1	T0	Charge Pump	Pin 12 Condition	Mode
0	0	X	Normal operation	LD	Normal operation
0	1	X	High impedance	LD	Test mode
1	1	0	Sink	LD	Test mode
1	1	1	Source	LD	Test mode
1	0	0	High impedance	f_{REF}	Test mode
1	0	1	High impedance	f1/N	Test mode

RSa, RSb: Set Up for The Reference Frequency Divider Ratio

RSa	RSb	Divider 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

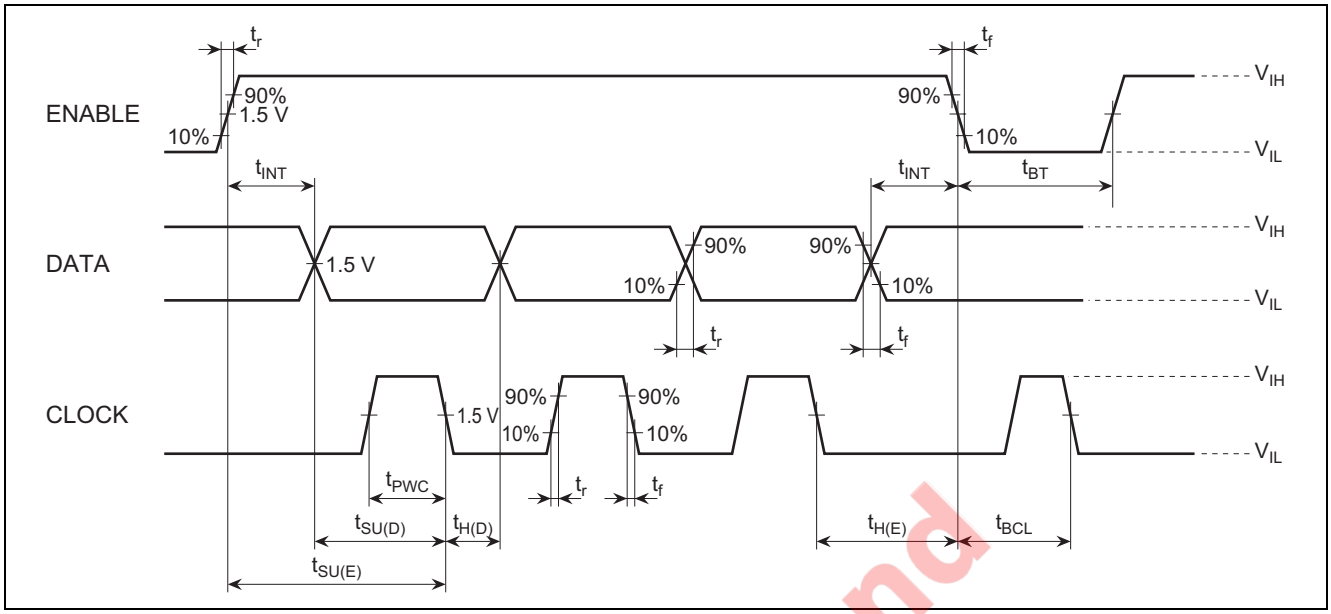
Power On Reset Operation

(Initial state the power is turned ON)

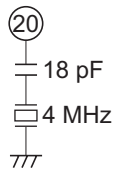
BS4 to BS1 : OFF
Charge pump : High impedance
Tuning amplifier : OFF
Charge pump current : 270 µA
Frequency divider ratio : 1/1024
Lock detect : H

Charge pump current is replaced by 70 µA when locks it by automatic change facility.

Timing Diagram

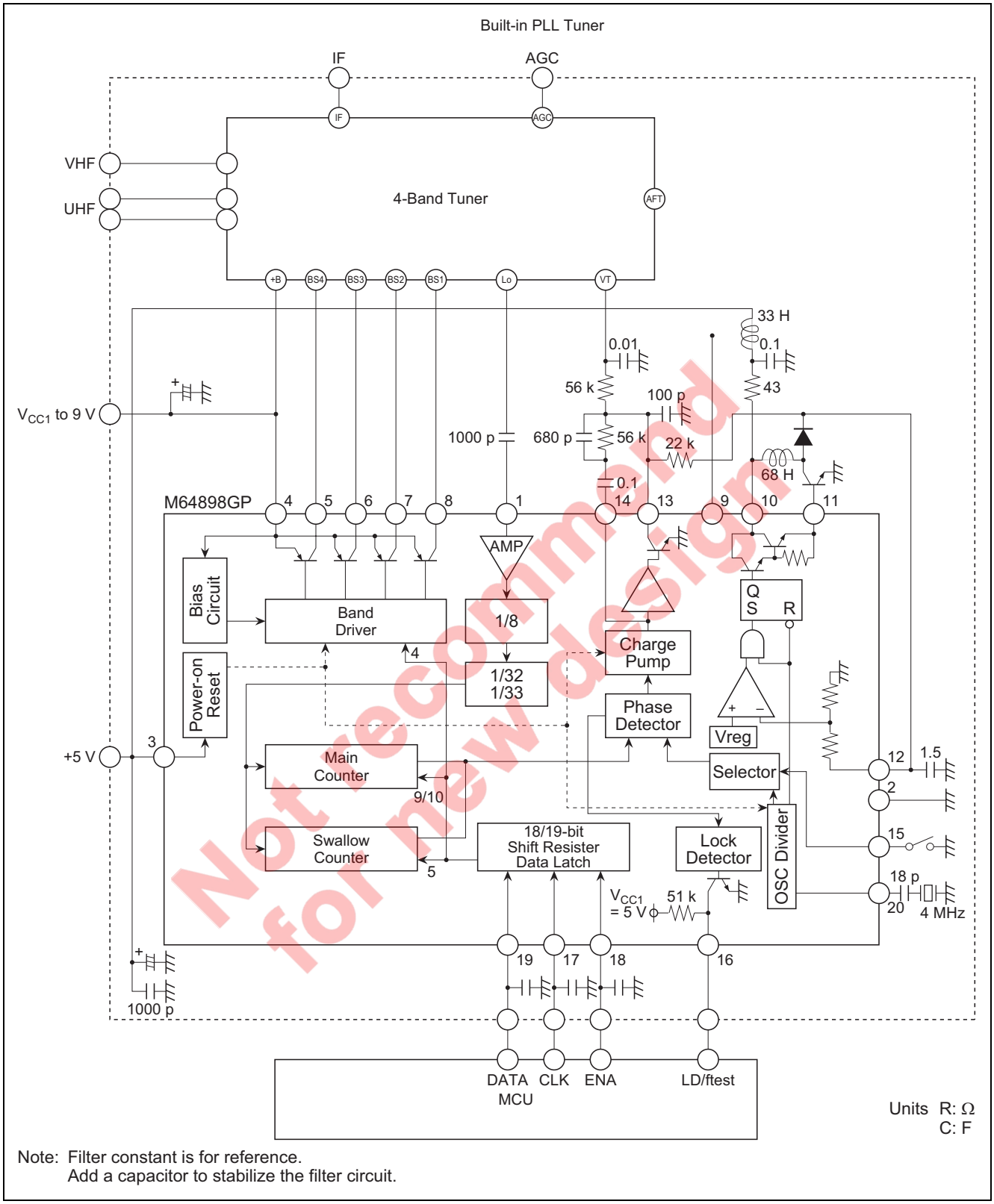


Crystal Oscillator Connection Diagram



Crystal oscillator characteristics
Actual resistance: less than 300 Ω
Load capacitance: 20 pF

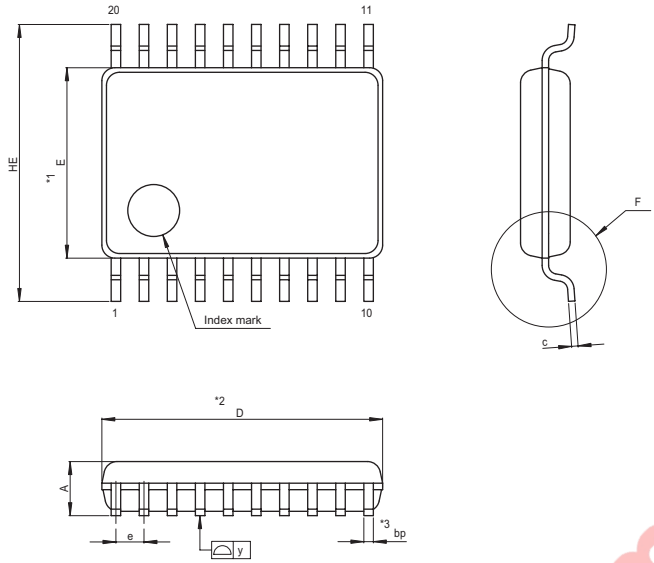
Application Example



Note: Filter constant is for reference.
Add a capacitor to stabilize the filter circuit.

Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-LSSOP20-4.4x6.5-0.65	PLSP0020JA-A	20P2E-A	0.08g



NOTE)
1. DIMENSIONS "*1" AND "*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION "*3" DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	6.4	6.5	6.6
E	4.3	4.4	4.5
A_2	—	1.15	—
A	—	—	1.45
A_1	0	0.1	0.2
b_p	0.17	0.22	0.32
c	0.13	0.15	0.2
θ	0°	—	10°
H_E	6.2	6.4	6.6
e	0.53	0.65	0.77
y	—	—	0.10
L	0.3	0.5	0.7

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

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Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.
Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2730-6071

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510

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