FUJITSU SEMICONDUCTOR
DATA SHEET

DS04–21215–4E

ASSP

IF Band
PLL Frequency Synthesizer

MB15C101

■ DESCRIPTION

The Fujitsu Semiconductor MB15C101 is an exclusive Intermediate Frequency (IF) band Phase Locked Loop (PLL) frequency synthesizer with pulse swallow operation. The reference divider and comparison divider have fixed divide ratios, so that it is not required to set the divide ratios by a microcontroller externally.

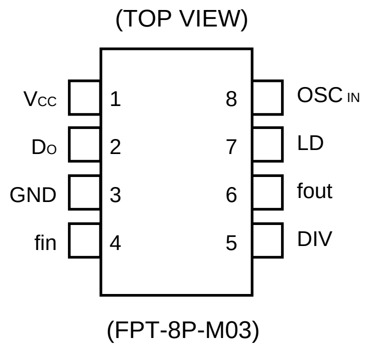
It operates with a supply voltage of 3.0 V Typ and dissipates 1.0 mA Typ (270MHz) of current realized through the use of Fujitsu Semiconductor’s CMOS technology.

■ FEATURES

- Low power supply current: I_{CC} = 1.0 mA Typ (V_{CC} = 3 V, 270 MHz)
- Pulse swallow function; Prescaler: 16/17
- Setting frequency (Selectable by DIV input.)
  - fosc = 19.2 MHz, fIF = 233.15 MHz (DIV = “H”)
  - fosc = 19.2 MHz, fIF = 259.20 MHz (DIV = “L”)
- Lock detector
- Low power supply voltage: V_{CC} = 2.4 V Min
- Wide operating temperature: Ta = –40 to +85°C

2012.11

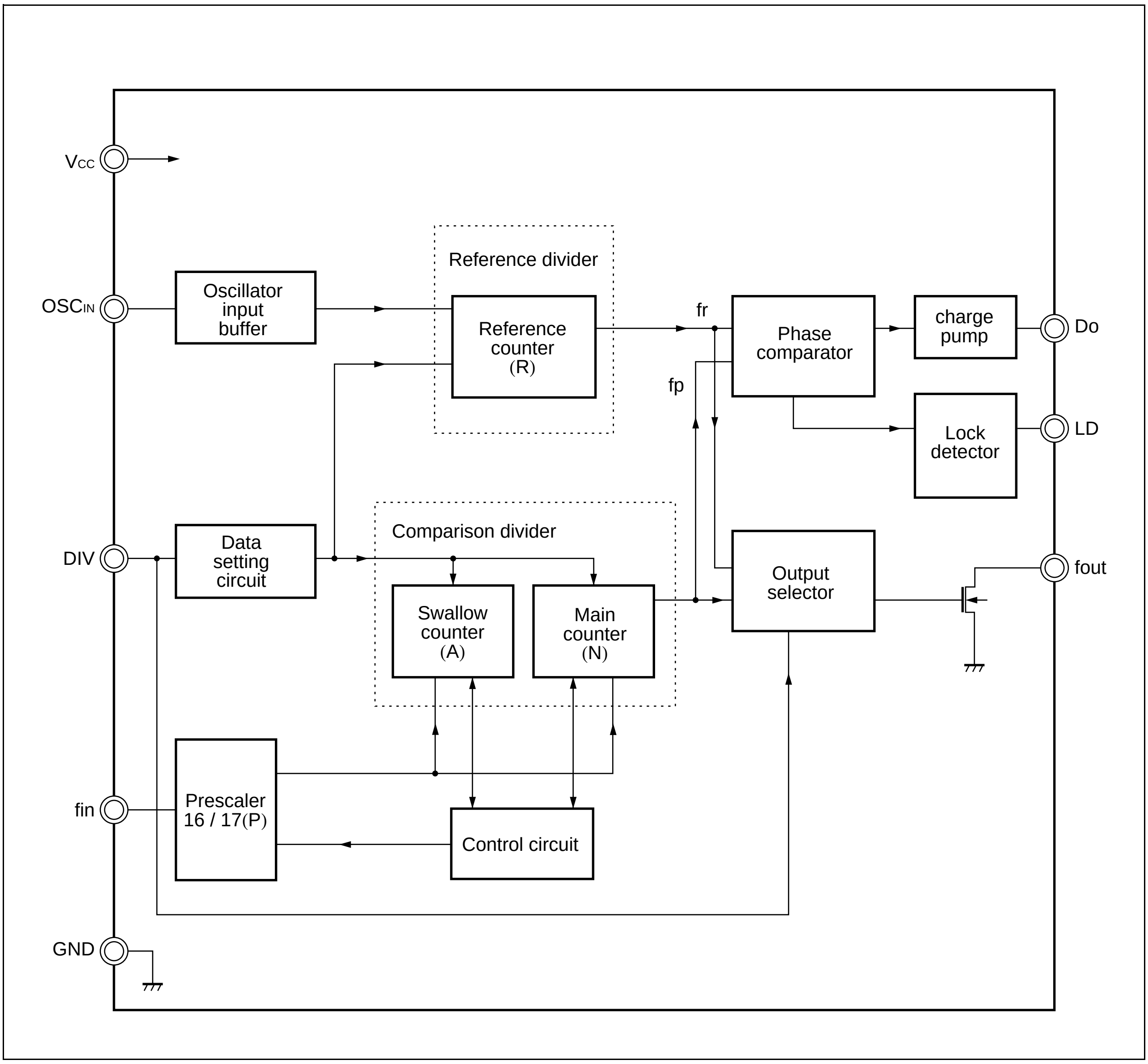
■ PIN ASSIGNMENT



■ PIN DESCRIPTIONS

Pin No.	Pin name	I/O	Descriptions
SSOP-8			
1	V_{CC}	–	Power supply voltage input pin (2.4 V to 3.6 V).
2	D_O	O	Charge pump output
3	GND	–	Ground
4	fin	I	Prescaler input. Connection should be with AC coupling.
5	DIV	I	Divide ratio switching input. Two kinds of divide ratios are selectable by DIV input "H" or "L".
6	fout	O	Test purpose output. This pin is an open drain output so that should be left open usually.
7	LD	O	Lock detector output. LD = H ; Lock LD = L ; Unlock
8	OSC_{IN}	I	Reference counter input. Connection should be with AC coupling.

■ BLOCK DIAGRAM



■ FUNCTIONAL DESCRIPTIONS

Two different frequencies can be selected by Div input “H” or “L”.
The divide ratios are calculated using the following equation:

$f_{VCO} = \{(P \times N) + A\} \times f_{OSC} \div R \quad (A < N)$

Symbol	Description	DIV = “H”	DIV = “L”
fvco	Output frequency of external VCO	233.15 MHz	259.20 MHz
fosc	Reference oscillation frequency	19.2 MHz	19.2 MHz
N	Divide ratio of the main counter	291	33
A	Divide ratio of the swallow counter	7	12
P	Preset divide ratio of dual modulus prescaler	16/17	16/17
R	Divide ratio of the reference counter	384 (fr = 50 kHz)	40 (fr = 480 kHz)

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Unit
		Min	Max	
Power supply voltage	V_{CC}	–0.5	+4.0	V
Input voltage	V_I	–0.5	V_{CC} +0.5	V
Output voltage	V_O	–0.5	V_{CC} +0.5	V
Output current	I_O	0	+5	mA
Storage temperature	T_{stg}	–55	+125	°C

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Power supply voltage	V_{CC}	2.4	3.0	3.6	V
Input voltage	V_{IN}	GND	–	V_{CC}	V
Operating temperature	Ta	–40	–	+85	°C

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

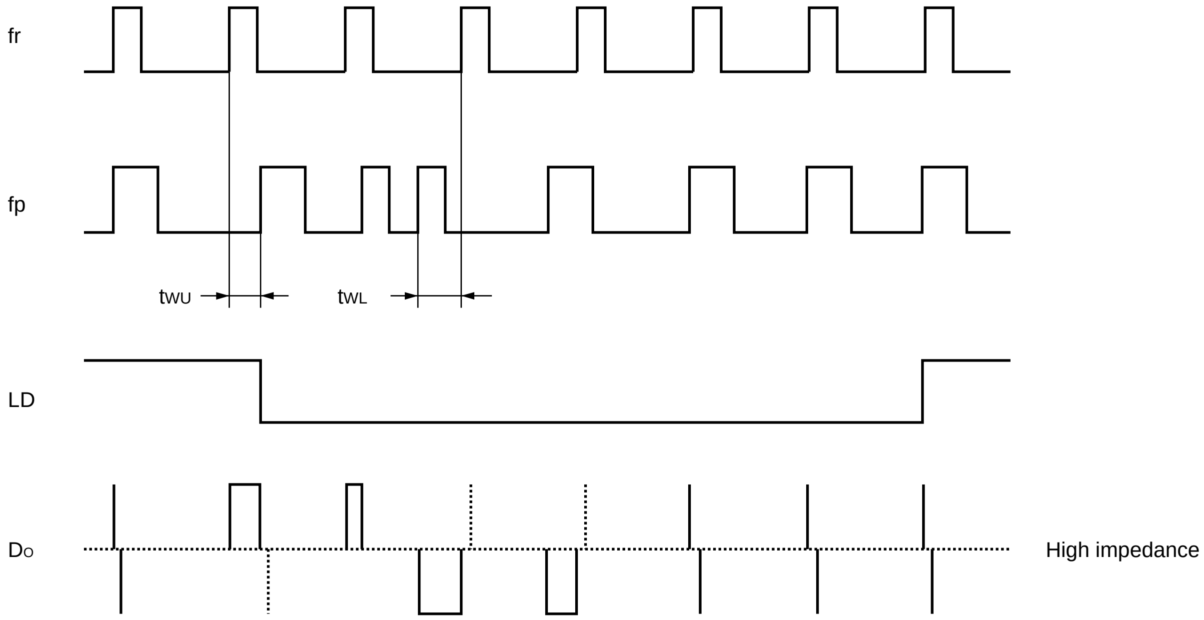
No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their representatives beforehand.

■ ELECTRICAL CHARACTERISTICS

Recommended operating conditions unless otherwise noted.

Parameter		Symbol	Condition	Value			Unit
				Min	Typ	Max	
Power supply current		I_{CC}	PLL is locked.(270 MHz) Ta = +25°C, V_{CC} = 3.0 V	0.1	1.0	2.0	mA
Operating frequency	fin	fin	AC coupling by 1000 pF capacitor	50	–	270	MHz
	OSC_{IN}	fosc	AC coupling by 1000 pF capacitor	3	–	26	MHz
Input sensitivity	fin	Pfin	AC coupling by 1000 pF capacitor	–10	–	2	dBm
	OSC_{IN}	Vosc	AC coupling by 1000 pF capacitor	0.5	–	–	Vpp
Input voltage	DIV	V_{IH}	–	$0.7\times V_{CC}$	–	–	V
		V_{IL}	–	–	–	$0.3\times V_{CC}$	V
Input current	DIV	I_{IH}	–	–	–	1.0	μA
		I_{IL}	–	–1.0	–	–	μA
Input current	OSC_{IN}	I_{OSC}	–	–100	–	+100	μA
Output voltage	Do	V_{OH}	V_{CC} = 3.0 V, I_{OH}=–0.3 mA	2.6	–	–	V
		V_{OL}	V_{CC} = 3.0 V, I_{OL}= 0.3 mA	–	–	0.4	V
Output current	Do	I_{OH}	V_{CC} = 3.0 V, V_{OH} = 2 V, Ta = +25°C	–	–6.0	–	mA
		I_{OL}	V_{CC} = 3.0 V, V_{OL} = 1 V, Ta = +25°C	–	6.0	–	mA
High impedance cut off current	Do	I_{OFF}	$0 \leq V_{DO} \leq V_{CC}$	–	–	3.0	nA

PHASE DETECTOR TIME CHART

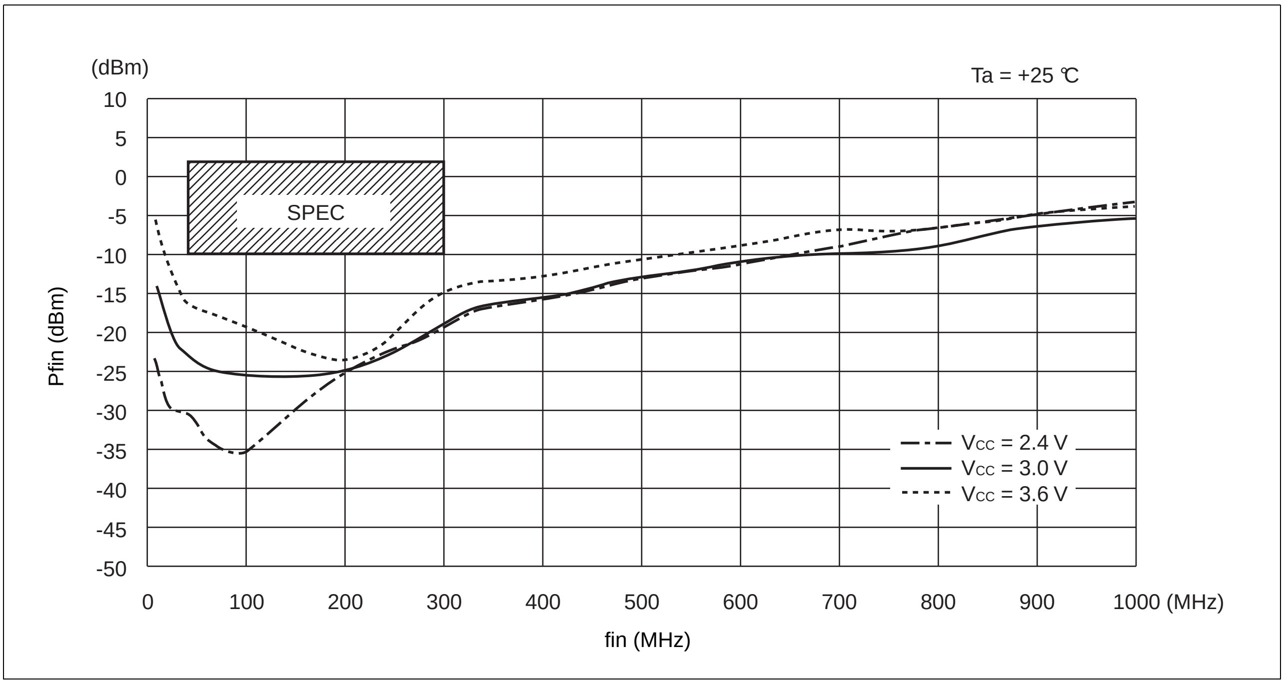


Notes
- .Phase error detection range: -2π to $+2\pi$
- LD output becomes low when phase is t_{WU} or more. LD output becomes high when phase error is t_{WL} or less and continues to be so for three cycles or more.
- Pulses on Do output signal during locked state are output to prevent dead zone.
- .t_{WU} and t_{WL} depend on OSC_{IN} input frequency.

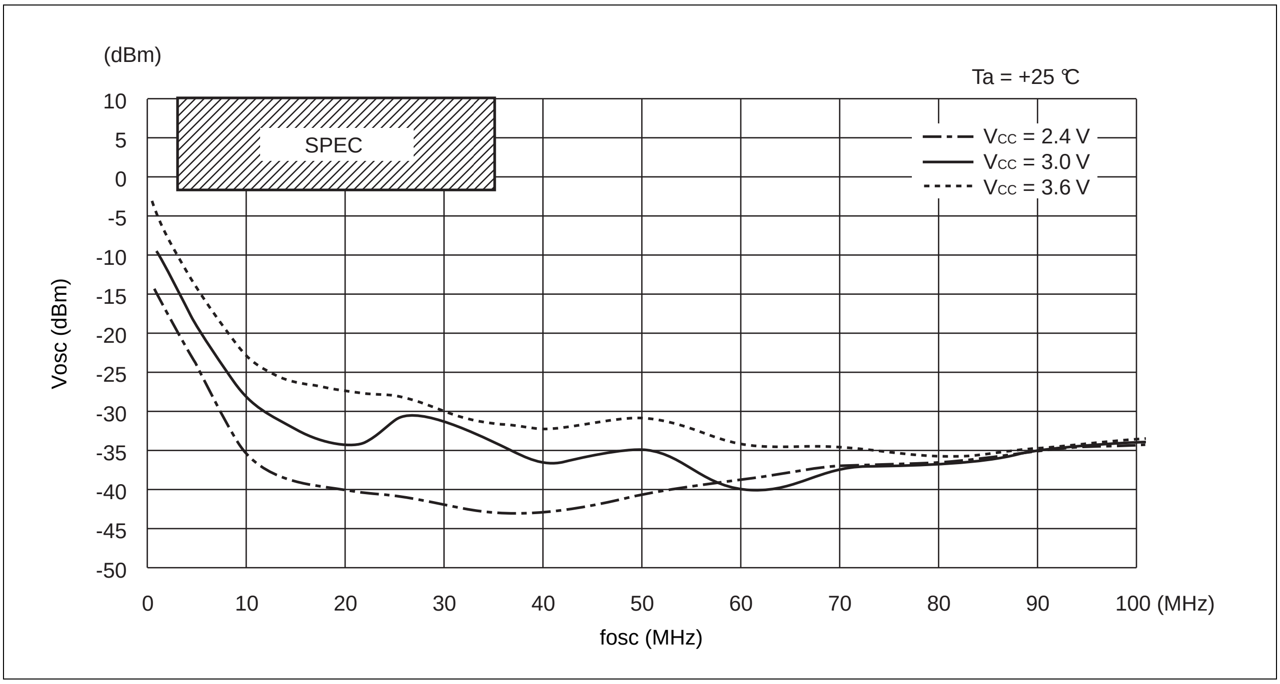
  $t_{WU} \geq$ 8/fosc (s) (e. g.t_{WU} $\geq$ 625.0ns, foscin = 12.8 MHz)
  $t_{WL} \leq$ 16/fosc (s) (e. g. $t_{WL} \leq$ 1250.0ns, foscin = 12.8 MHz)

■ TYPICAL CHARACTERISTICS

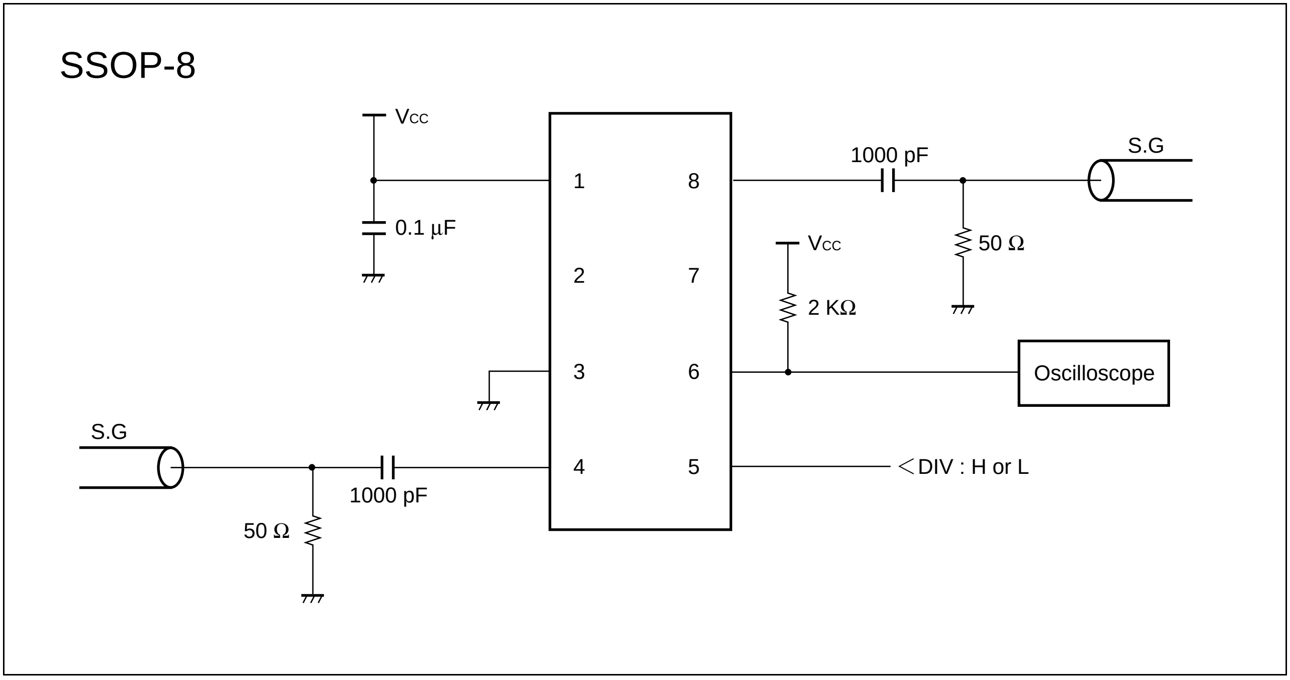
1. fin Input Sensitivity



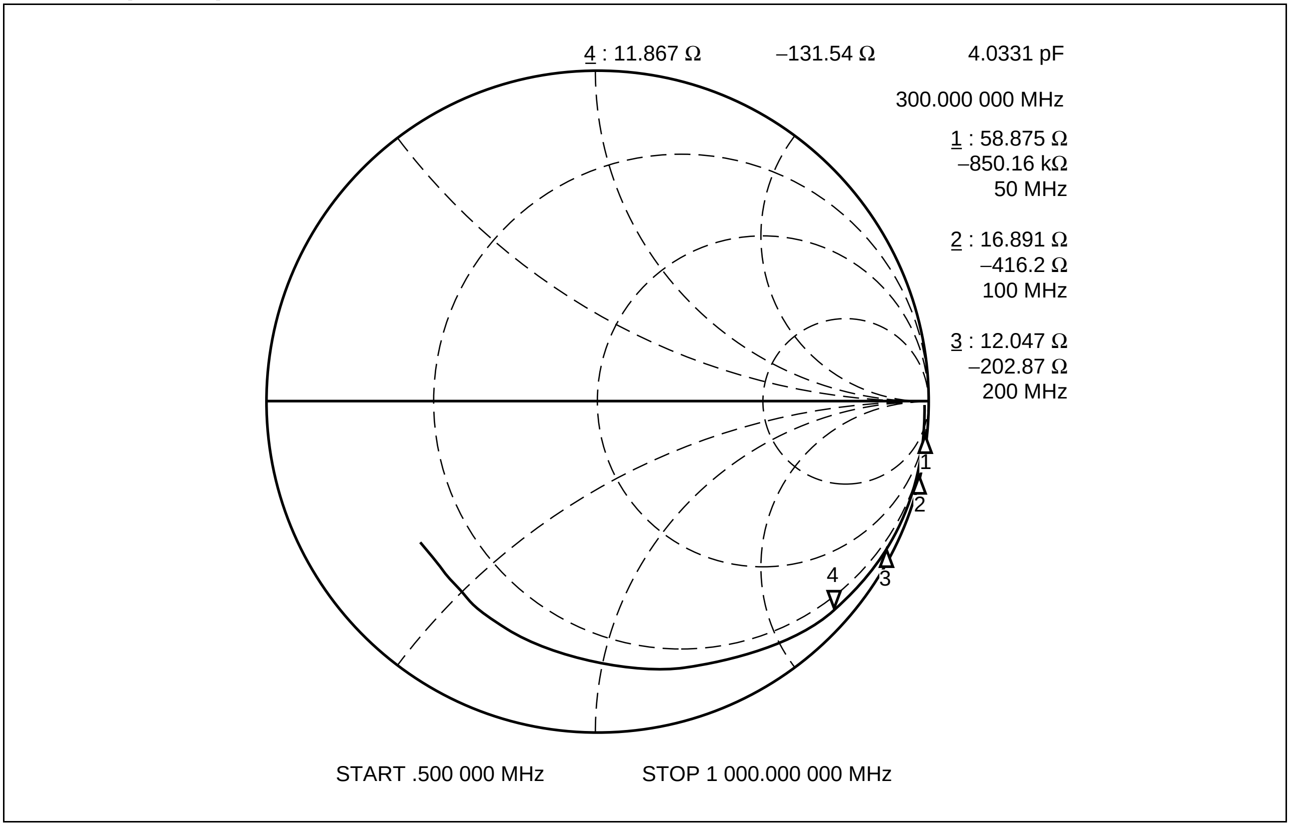
2. OSC$_{IN}$ Input Sensitivity



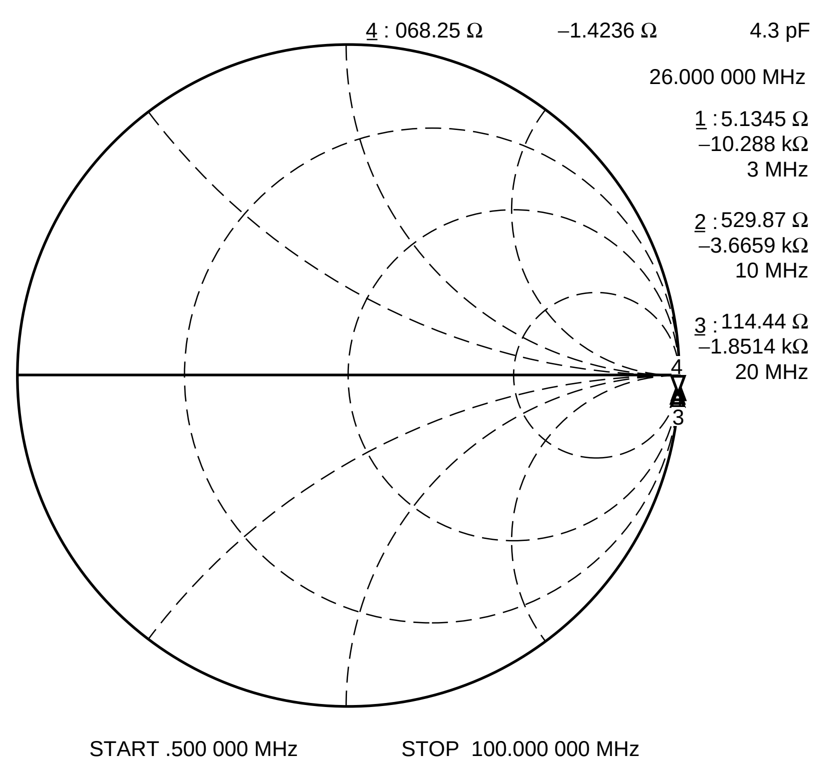
- Measurment Circuit (for measuring input sensitivity fin/OSC$_{IN}$)



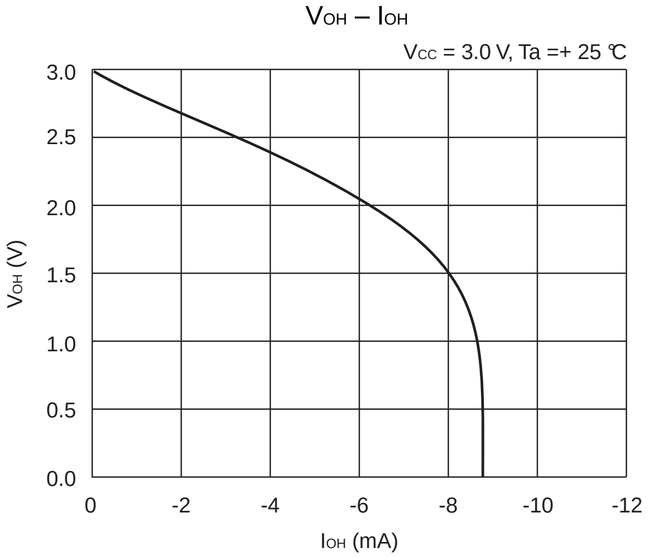
3. fin Input Impedance

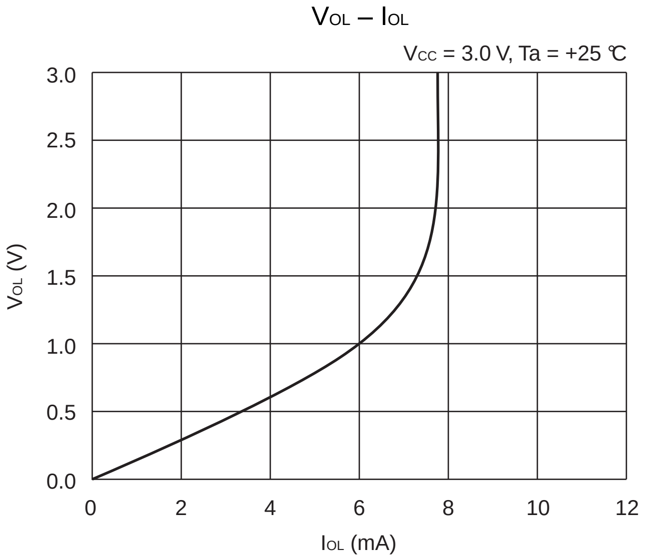


4. OSC$_{IN}$ Input Impedance

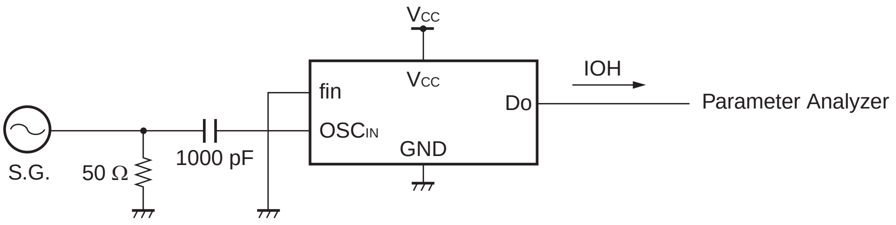


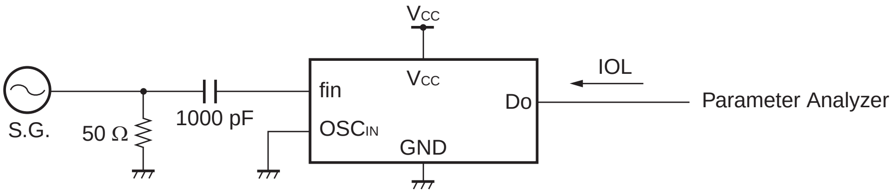
5. Do Outut Current





Measurement Circuit





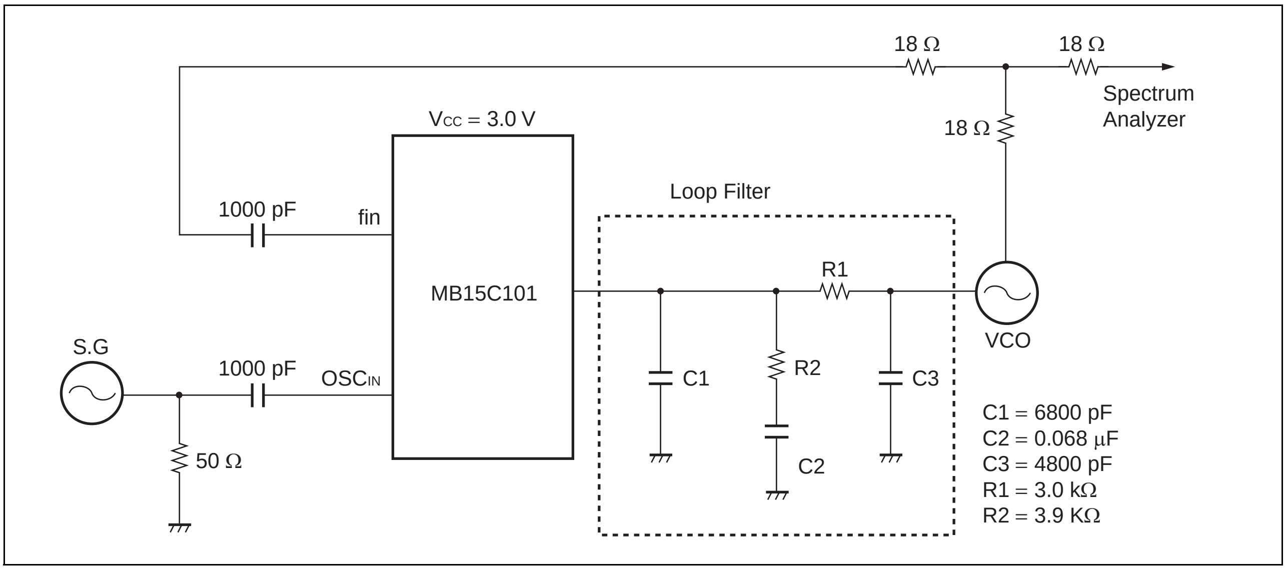
■ REFERENCE INFORMATION

1. Application Measurement

- Test Results

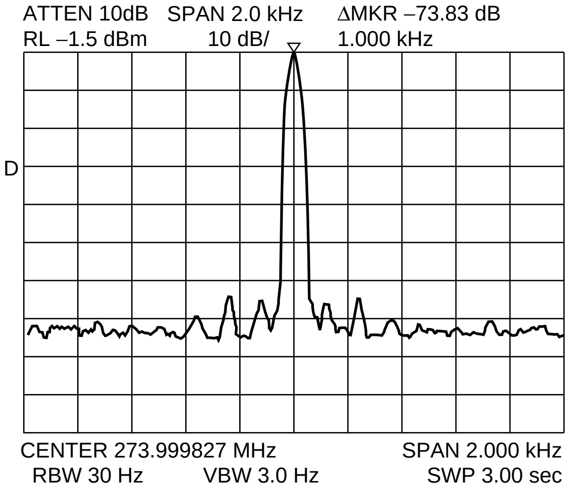
		Results
Lockup time ±1 kHz Un lock → Lock Power on → Lock		 2.3 ms 3.4 ms
Reference leakage (Δf = 58 kHz)		–88.5 dBc
Phase noise	(Δf = 1 kHz) (Δf = 10 kHz) (Δf = 100 kHz) (Δf = 1 MHz)	–88.0 dBc/Hz –111.0 dBc/Hz –118.0 dBc/Hz –134.0 dBc/Hz
V_{CC} (V)		3.0 V
VCO		Discrete VCO (Kv = 3.5 MHz/V) Lock Frequency = 274.0 MHz (fr = 58 kHz)

- Measurement Circuit

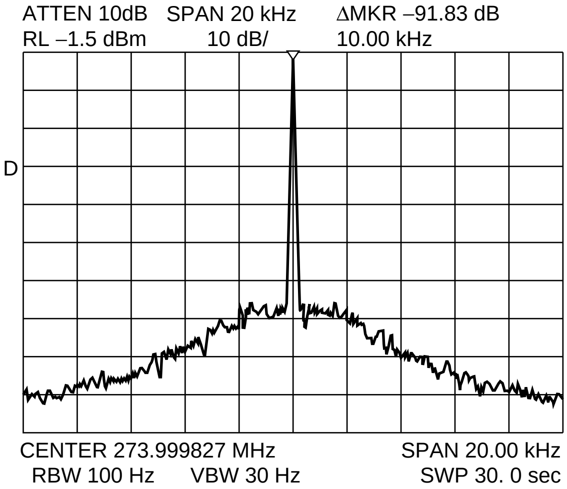


2. Spectrum Characteristic

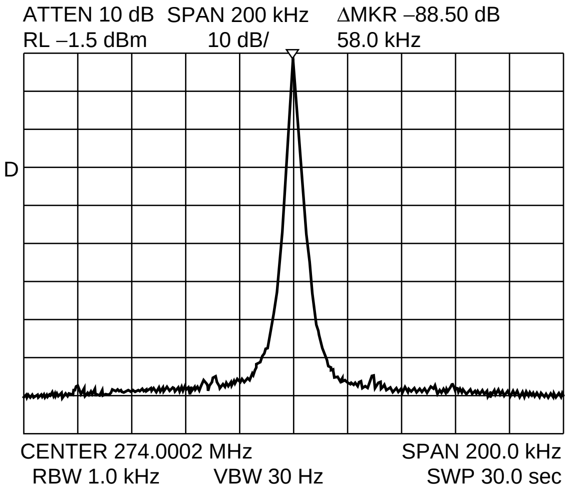
Δ f = 1 kHz



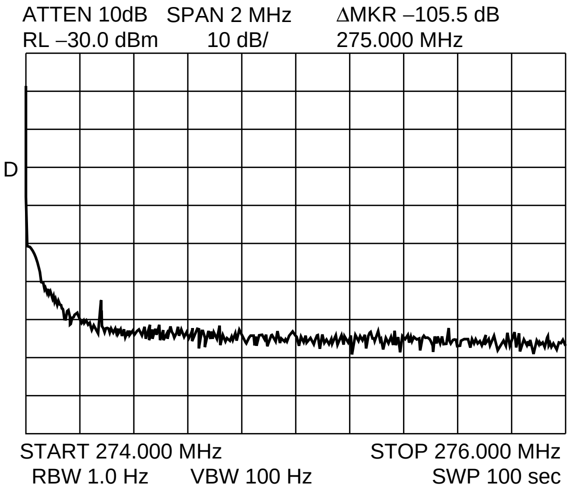
Δ f = 10 kHz



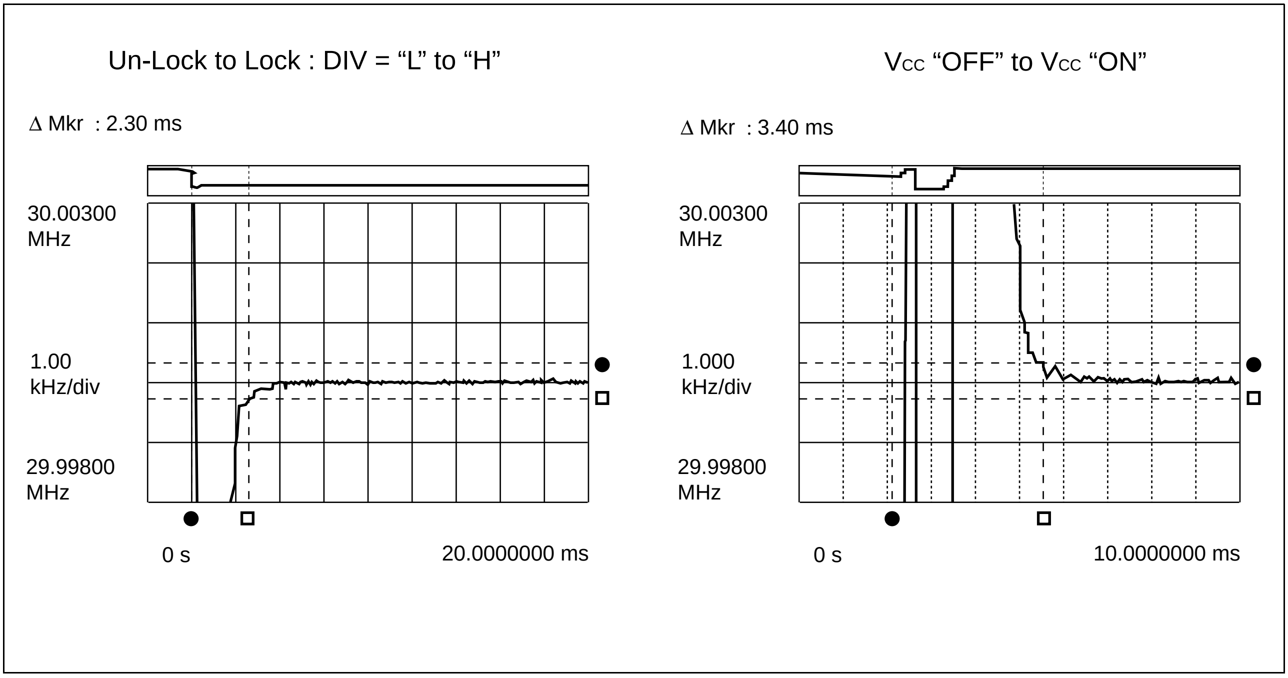
Δ f = 100 kHz



Δ f = 1 MHz



3. Lockup Time: Un-Lock to Lock



■ HANDLING PRECAUTIONS

Take appropriate measures against static electricity.

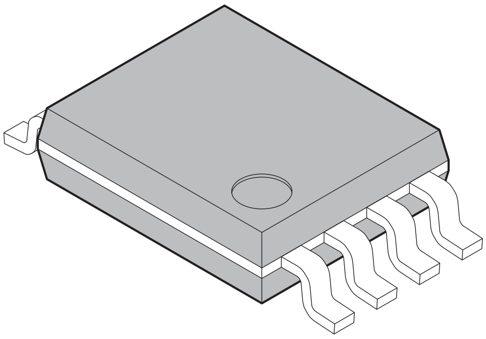
- This device should be transported and stored in anti-static containers.
- This is a static-sensitive device; take proper anti-ESD precautions. Ensure that personnel and equipment are properly grounded. Cover workbenches with grounded conductive mats.
- Always turn the power supply off before inserting or removing the device from its socket.
- Protect leads with a conductive sheet when handling or transporting PC boards with devices.

■ ORDERING INFORMATION

Part number	Package	Remarks
MB15C101PFV	8-pin, Plastic SSOP (FPT-8P-M03)	

■ PACKAGE DIMENSIONS

8-pin plastic SSOP

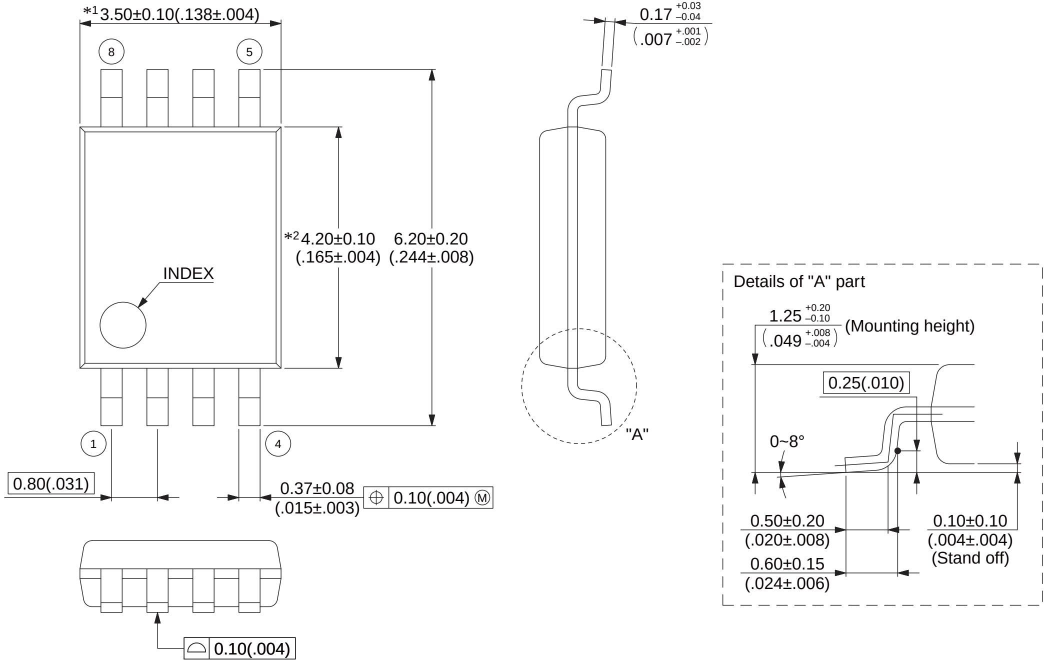


(FPT-8P-M03)

Lead pitch	0.80 mm
Package width × package length	4.2 × 3.5 mm
Lead shape	Gullwing
Sealing method	Plastic mold
Mounting height	1.45 mm MAX
Weight	0.04 g
Code (Reference)	P-SSOP8-4.2×3.5-0.80

8-pin plastic SSOP
(FPT-8P-M03)

Note 1) *1 : Resin protrusion. (Each side : +0.15 (.006) Max).
Note 2) *2 : These dimensions do not include resin protrusion.
Note 3) Pins width and pins thickness include plating thickness.
Note 4) Pins width do not include tie bar cutting remainder.



Dimensions in mm (inches).
Note: The values in parentheses are reference values.

■ MAJOR CHANGES IN THIS EDITION

A change on a page is indicated by a vertical line drawn on the left side of that page.

Page	Section	Change Results
2	■ PIN ASSIGNMENT	Deleted the description of BCC package “LCC-16P-M06”.
	■ PIN DESCRIPTIONS	
8	■ TYPICAL CHARACTERISTICS • Measurment Circuit (for measuring input sensitivity fin/$\mathrm{OSC_{IN}}$)	
14	■ ORDERING INFORMATION	
15	■ PACKAGE DIMENSIONS	

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