



LC7152, 7152M, 7152NM, 7152KM

Universal Dual-PLL Frequency Synthesizers



Overview

The LC7152, 7152M, 7152NM, 7152KM are universal dual-PLL frequency synthesizers for use in weak signal type cordless telephone applications in the USA, South Korea, and Japan, and broadcast satellite (BS) tuners in the USA and Europe.

Features

- Dual charge pump built in for fast channel switching
- Digital lock detector enables PLL lock status check with crystal oscillator precision
- Programmable reference frequency divider supports various applications
- The LC7152NM is a built-in power-on reset circuit version of the LC7152M
- The LC7152KM is an enhanced frequency characteristics version of the LC7152M

Functions

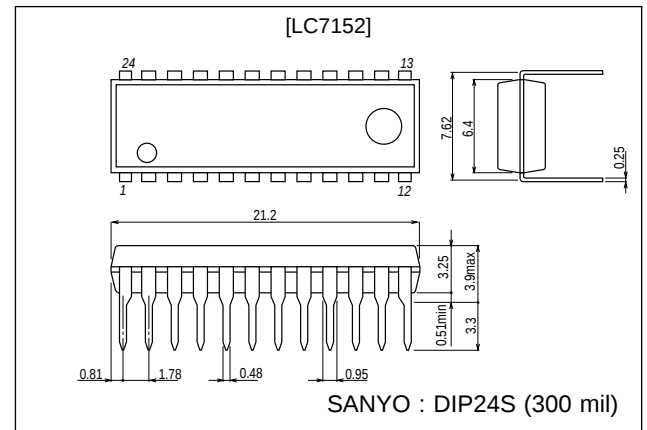
- 2-system PLL built-in (dual PLL)
- 16-bit programmable local-oscillator divider 1.5 to 55 MHz ($V_{DD} = 2.0$ to 3.3 V), LC7152KM: 55 to 80 MHz ($V_{DD} = 2.7$ to 3.3 V)
- 14-bit programmable reference-frequency divider 320 Hz to 640 kHz reference frequency using a 10.24 MHz crystal oscillator
- Digital lock detector
- Dual charge pump
- Amplifier built-in for an active LPF
- Serial transmission data input (CCB format)
- LC7152NM with power-on reset circuit (pins $\overline{OUTA}$ and $\overline{OUTB}$ become open at power-on)
- 2.0 to 3.3 V supply voltage
- DIP24S and MFP24S packages

• CCB is a trademark of SANYO ELECTRIC CO., LTD.
• CCB is SANYO's original bus format and all the bus addresses are controlled by SANYO.

Package Dimensions

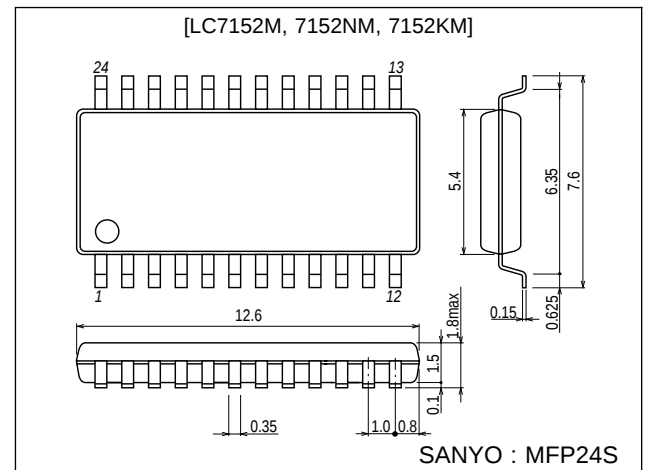
unit : mm

3067-DIP24S



unit : mm

3112-MFP24S



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SANYO Electric Co., Ltd. Semiconductor Company

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

61199RM (II)/41495TH(ID) No.3889-1/13

Specifications

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$, $V_{SS} = 0\text{ V}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{DD\text{max}}$	V_{DD}	-0.3 to +7.0	V
Maximum input voltage	$V_{IN\text{max}}(1)$	CE, CL, DI, AIA, AIB	-0.3 to +7.0	V
	$V_{IN\text{max}}(2)$	XIN, PIA, PIB, TEST	-0.3 to $V_{DD}+0.3$	V
Maximum output voltage	$V_{O\text{max}}(1)$	$\overline{\text{LDI}}$, $\overline{\text{LDB}}$	-0.3 to +7.0	V
	$V_{O\text{max}}(2)$	AOA, AOB, $\overline{\text{OUTA}}$, $\overline{\text{OUTB}}$	-0.3 to +15	V
	$V_{O\text{max}}(3)$	PDA1, PDA2, PDB1, PDB2, XOUT	-0.3 to $V_{DD}+0.3$	V
Maximum output current	$I_{O\text{max}}(1)$	$\overline{\text{LDA}}$, $\overline{\text{LDB}}$, $\overline{\text{OUTA}}$, $\overline{\text{OUTB}}$	0 to 3	mA
	$I_{O\text{max}}(2)$	AOA, AOB	0 to 6	mA
Allowable power dissipation	$P_d\text{ max}$	$T_a \leq 85^\circ\text{C}$, LC7152	350	mW
		$T_a \leq 85^\circ\text{C}$, LC7152M, 7152NM, 7152KM	160	mW
Operating temperature	T_{opr}		-40 to +85	$^\circ\text{C}$
Storage temperature	T_{stg}		-55 to +125	$^\circ\text{C}$

Allowable Operating Ranges at $T_a = -40$ to $+85^\circ\text{C}$, $V_{SS} = 0\text{ V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply voltage	$V_{DD}(1)$	V_{DD}	2.0		3.3	V
	$V_{DD}(2)$	V_{DD} : Serial data retention voltage, see Figure1, *1	1.5			V
	$V_{DD}(3)$	V_{DD} : Power-on reset voltage, $t_{PR} \geq 20\text{ ms}$, see Figure1, *1			0.05	V
Input high-level voltage	$V_{IH}(1)$	CE, CL, DI: $V_{DD} = 2.0\text{ V}$	1.5		5.5	V
	$V_{IH}(2)$	CE, CL, DI: $V_{DD} = 3.3\text{ V}$	1.7		5.5	V
Input low-level voltage	$V_{IL}(1)$	CE, CL, DI: $V_{DD} = 2.0\text{ V}$	0		0.4	V
	$V_{IL}(2)$	CE, CL, DI: $V_{DD} = 3.3\text{ V}$	0		0.6	V
Output voltage	$V_O(1)$	$\overline{\text{LDA}}$, $\overline{\text{LDB}}$	0		5.5	V
	$V_O(2)$	AOA, AOB, $\overline{\text{OUTA}}$, $\overline{\text{OUTB}}$	0		13	V
Input frequency	$f_{IN}(1)$	XIN: Sine wave, capacitively coupled	1.0		13	MHz
	$f_{IN}(2)$	PIA, PIB: Sine wave, capacitively coupled *2	1.5		55	MHz
	$f_{IN}(3)$	PIA, PIB: Sine wave, capacitively coupled *3	55		80	MHz
Input amplitude	$V_{IN}(1)$	XIN: Sine wave, capacitively coupled	200		600	mVrms
	$V_{IN}(2)$	PIA, PIB: Sine wave, capacitively coupled *2,3	100		600	mVrms
Crystal oscillator frequency	f_{Xtal}	XIN, XOUT: $CL \leq 50\ \Omega$, $CL \leq 16\text{ pF}$ *4	4	10.24	11	MHz

Note *1 LC7152NM

		FA/FB (serial data input frequency select bits)		V_{DD}	Device
		[0]	[1]		
*2	$f_{IN}(2)$	1.5 to 23 MHz	20 to 55 MHz	2.0 to 3.3 V	LC7152, 7152M, LC7152NM, 7152KM
*3	$f_{IN}(3)$	—	55 to 80 MHz	2.7 to 3.3 V	LC7152KM

*4 CL is the crystal impedance and CL is the load capacitance.

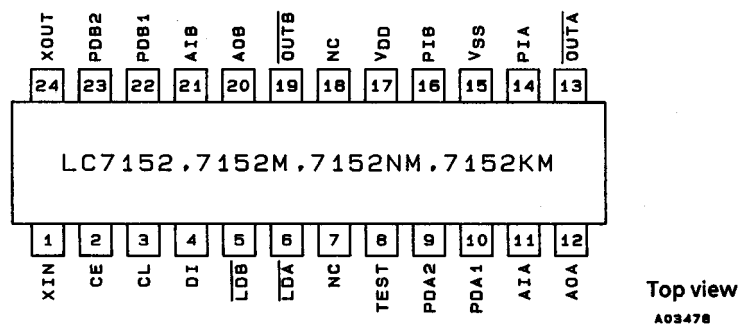
Electrical Characteristics in the allowable operating ranges

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output high-level voltage	V _{OH} (1)	PDA1, PDB1: I _O = 1 mA	V _{DD} - 1.0			V
	V _{OH} (2)	PDA2, PDB2: I _O = 2 mA	V _{DD} - 1.0			V
Output low-level voltage	V _{OL} (1)	PDA1, PDB1: I _O = 1 mA			1.0	V
	V _{OL} (2)	PDA2, PDB2: I _O = 2 mA			1.0	V
	V _{OL} (3)	OUTA, OUTB: I _O = 1 mA			1.0	V
	V _{OL} (4)	LDA, LDB: I _O = 2 mA			1.0	V
	V _{OL} (5)	AOA, AOB: I _O = 0.5 mA, AIA = AIB = 1.2 V			0.5	V
	V _{OL} (6)	AOA, AOB: I _O = 1 mA, AIA = AIB = 1.3 V			0.5	V
	V _{OL} (7)	AOA, AOB: I _O = 2 mA, AIA = AIB = 1.3 V			0.5	V
Output off-leakage current	I _{OFF} (1)	LDA, LDB: V _O = 5.5 V			5.0	μA
	I _{OFF} (2)	PDA1, PDB1, PDA2, PDB2: V _O = 0/3.3 V		0.01	10.0	nA
	I _{OFF} (3)	AOA, AOB, OUTA, OUTB: V _O = 13 V			5.0	μA
Input high-level current	I _{IH} (1)	CE, CL, DI: V _I = 5.5 V			5.0	μA
	I _{IH} (2)	XIN: V _I = 3.3 V, V _{DD} = 3.3 V	2.0		6.5	μA
	I _{IH} (3)	PIA, PIB: V _I = 3.3 V, V _{DD} = 3.3 V	3.5		10.0	μA
	I _{IH} (4)	AIA, AIB: V _I = 3.3 V		0.01	10.0	nA
	I _{IH} (5)	TEST: V _I = 3.3 V, V _{DD} = 3.3 V		120		μA
Input low-level current	I _{IL} (1)	CE, CL, DI: V _I = 0 V			5.0	μA
	I _{IL} (2)	XIN: V _I = 0 V, V _{DD} = 3.3 V	2.0		6.5	μA
	I _{IL} (3)	PIA, PIB: V _I = 0 V, V _{DD} = 3.3 V	3.5		10.0	μA
	I _{IL} (4)	AIA, AIB: V _I = 0 V		0.01	10.0	nA
	I _{IL} (5)	TEST: V _I = 0 V, V _{DD} = 3.3 V			5.0	μA
Internal feedback resistance	R _f (1)	XIN: V _{DD} = 3.3 V		1.0		MΩ
	R _f (2)	PIA, PIB: V _{DD} = 3.3 V		600		kΩ
Internal pull-down resistance	R _d	TEST: V _{DD} = 3.3 V		30		kΩ
Input capacitance	C _{IN}	XIN, PIA, PIB		2.5		pF
Supply current*1	I _{DD} (1)	V _{DD} (= 2.0 V): f _{IN} = 55 MHz		3.0	8.0	mA
	I _{DD} (2)	V _{DD} (= 3.3 V): f _{IN} = 55 MHz		7.0	14.0	mA
Supply current*2	I _{DD} (4)	V _{DD} (= 2.0 V): f _{IN} = 55 MHz		1.5	4.5	mA
	I _{DD} (5)	V _{DD} (= 3.3 V): f _{IN} = 55 MHz		3.9	8.0	mA

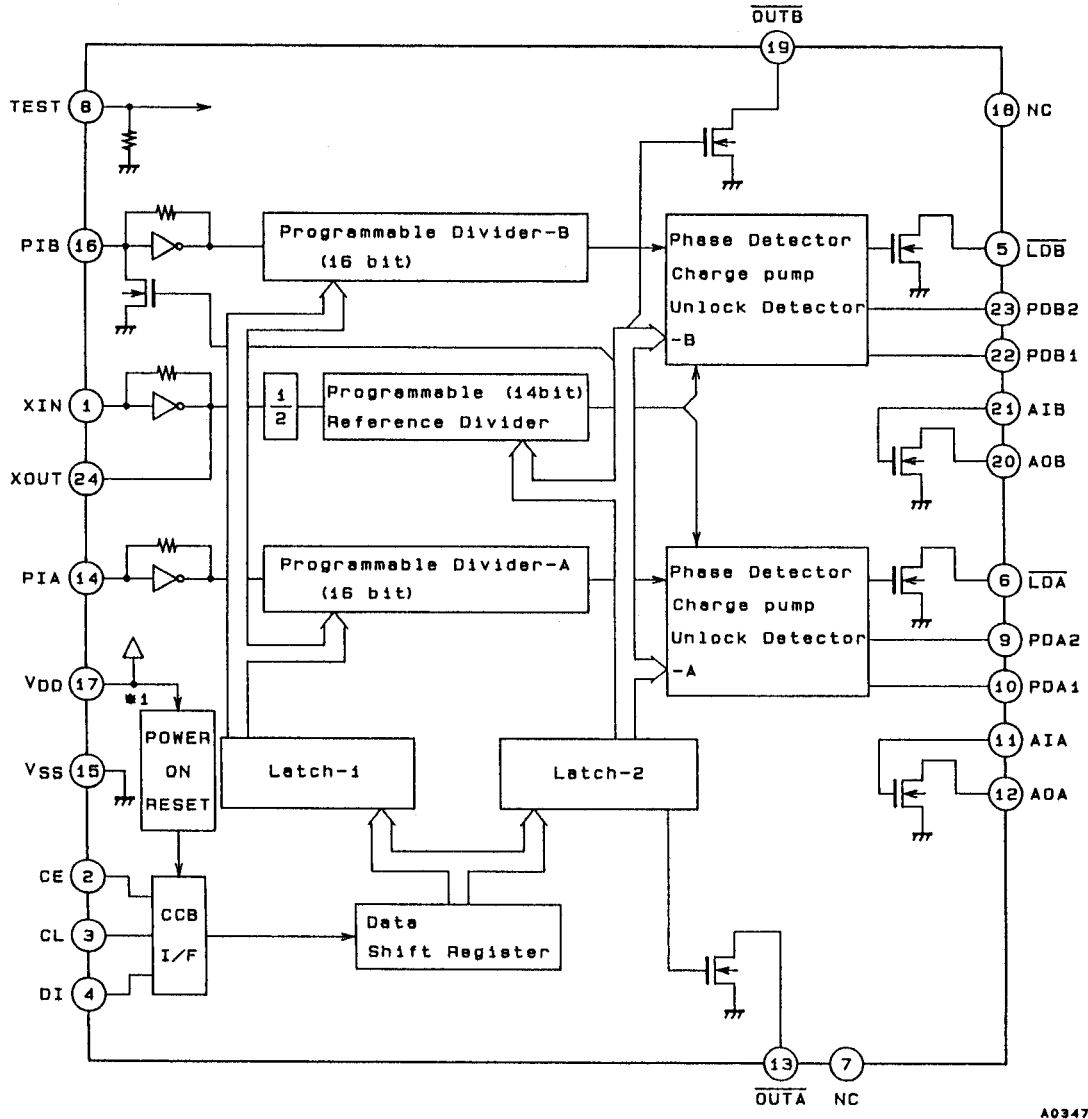
Note *1. Dual PLL operation (both PLL-A and PLL-B), SB = 0, XIN = 10.24 MHz (crystal), PIA and PIB input = 100mVrms at f_{IN}, all other inputs at V_{SS}, all other outputs open.

*2. Standby mode: Single PLL operation (PLL-A operating and PLL-B stopped), SB = 1, XIN = 10.24 MHz (crystal), PIA input = 100mVrms at f_{IN}, all other inputs at V_{SS}, all other outputs open.

Pin Assignment



Equivalent Block Diagram



Pin Functions

Symbol	Pin No.	Function	Symbol	Pin No.	Function
PIB	16	Side-B oscillator signal input	PDB2	23	Sub charge pump
XIN	1	Crystal oscillator	PDB1	22	Main charge pump
XOUT	24		AIB	21	Low-pass filter transistors
PIA	14	Side-A oscillator signal output	AOB	20	
VDD	17	Power supply	OUTB	19	General-purpose output port
VSS	15	Ground	LDA	6	Side-A unlock detection
CE	2	Serial data input	PDA2	9	Sub charge pump
CL	3		PDA1	10	Main charge pump
DI	4		AIA	11	Low-pass filter transistors
TEST	8	IC Test	AOA	12	
NC	7, 18	No connections	OUTA	13	General-purpose output port
LDB	5	Side-B unlock detection			

LC7152, 7152M, 7152NM, 7152KM

Pin Description

Symbol	Pin No.	Function	Description of function												
PIA	14	Side-A local oscillator signal input	- Side-A programmable divider. The input frequency ranges are as follows. <table border="1"> <thead> <tr> <th>FA = [0]</th><th>FA = [1]</th><th>V_{DD}</th><th>Device</th></tr> </thead> <tbody> <tr> <td>1.5 to 23 MHz</td><td>20 to 55 MHz</td><td>2.0 to 3.3 V</td><td>LC7152, 7152M LC7152NM, 7152KM</td></tr> <tr> <td>—————</td><td>55 to 80 MHz</td><td>2.7 to 3.3 V</td><td>LC7152KM</td></tr> </tbody> </table> - FA: Serial data - Bits DA0 to DA15 determine the divider ratios Divider ratio N = 272 to 65535	FA = [0]	FA = [1]	V _{DD}	Device	1.5 to 23 MHz	20 to 55 MHz	2.0 to 3.3 V	LC7152, 7152M LC7152NM, 7152KM	—————	55 to 80 MHz	2.7 to 3.3 V	LC7152KM
FA = [0]	FA = [1]	V _{DD}	Device												
1.5 to 23 MHz	20 to 55 MHz	2.0 to 3.3 V	LC7152, 7152M LC7152NM, 7152KM												
—————	55 to 80 MHz	2.7 to 3.3 V	LC7152KM												
PIB	16	Side-B local-oscillator signal input	- Side-B programmable divider The input frequency ranges are the same as for PIA. FB(→ FA): Determined by the serial data - Bits DB0 to DB15 determine the divider ratios Divider ratio N= 272 to 65535 - Serial data: Bit SB is the standby mode control bit When SB = 1, standby mode is selected. In standby mode, side-B is stopped, PIB is pulled down to V_{SS}. When SB = 0, normal operation is selected.												
XIN XOUT	1 24	Crystal oscillator	- Crystal oscillator connections (C_I ≤ 50 Ω, C_L ≤ 16pF). - Note) When using a crystal other than as indicated above, its compatibility with the crystal oscillator must be thoroughly studied.												
PDA1 PDB1	10 22	Side-A main charge pump Side-B main charge pump	- These are PLL charge pump outputs that output the PLL phase error signals. When the frequency generated by dividing the local oscillator signal frequency by N is higher than the reference frequency, the charge pump outputs a high-level signal for the phase error; when lower, the charge pump outputs a low-level signal for the phase error. If the two values match, these pins go to high-impedance. - fosc/N > fref or leading → Positive Pulse - fosc/N < fref or lagging → Negative Pulse - fosc/N = fref and coincidence → High-Impedance (*SB = [1] : PDB1 → High-Impedance)												
PDA2 PDB2	9 23	Side-A sub charge pump Side-B sub charge pump	- PLL charge pump output; outputs PLL phase error signal only when the unlock condition is detected. - The unlock detection threshold is set by serial data bits UL0 and UL1. - When a phase error that is shorter than the detection threshold occurs, this signal goes to high impedance and the phase error signal for the main charge pump is output. - The output pulse of the phase error signal has the same polarity as the main charge pump.												
LDA	6	Side-A unlock detector output	- Outputs the PLL lock/unlock status. Locked: Open Unlocked: Low - The unlock detection threshold for lock/unlock discrimination is set by serial data bits UL0 and UL1. - The output phase error extension is set by serial data bits UE0 and UE1. - For details, refer to the description of the serial data. - SB = 1: LDB → Open												
LDB	5	Side-B unlock detector output													
AIA AOA AIB OAB	11 12 21 20	Side-A low-pass filter transistor Side-B low-pass filter transistor	- MOS N-channel transistor for the PLL filter - The AOA and AOB output withstand voltage is 13V.												
OUTA OUTB	13 19	Side-A general purpose output port Side-B general purpose output port	- These latch the serial data bits OA and OB that are sent from the controller, and then invert and output the data. (OUTA can also output XIN divided by two. - In the LC7152NM, OUTA and OUTB are open at the power-on reset.												

For more information on crystal oscillator : Nihon Dempa Kogyo Co., Ltd.

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*1 The input “H” voltage and the input “L” voltage on the CE, CL, and DI pins are $V_{IH} = 1.5$ to $5.5V$ and $V_{IL} = 0$ to $0.4V$ when $V_{DD} = 2.0V$. When $V_{DD} = 3.3V$, then $V_{IH} = 1.7$ to $5.5V$ and $V_{IL} = 0$ to $0.6V$. (Voltage greater than V_{DD} may be applied to V_{IH} .)

Mode1: Latch-1 data (programmable divider data)



Description of Serial Data

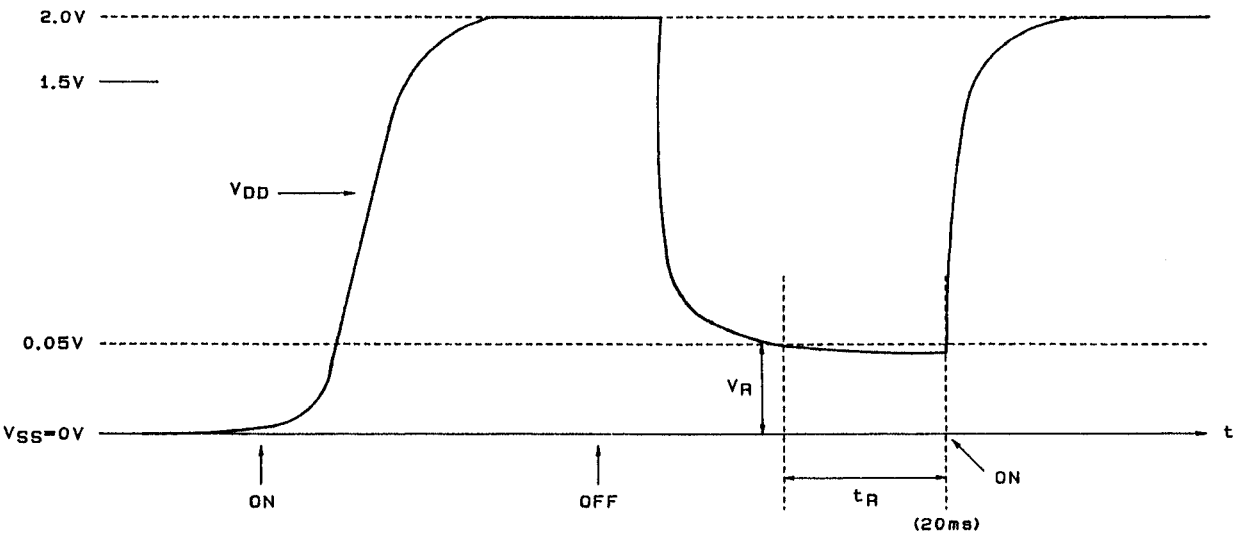
No.	Controller/Data	Description	Related Data																																																																														
(1)	Side-A programmable divider data: DA0 to DA15	This data sets the side-A programmable divider number. This data is a binary value in which DA0 is the LSB. The range of divider values that can be set is 272 to 65,535. $NA = fVCO-A/fref$	R0 to R13																																																																														
(2)	Side-B programmable divider data: DB0 to DB15	This data sets the side-B programmable divider number. This data is a binary value in which DB0 is the LSB. The range of divider values that can be set is 272 to 65,535. $NB = fVCO-B/fref$	R0 to R13																																																																														
(3)	Reference frequency data: R0 to R13	This data sets the reference divider number. This data is a binary value in which R0 is the LSB. The range of divider values that can be set is 8 to 16,383. (Actual divider number) = (setting) × 2 (reference frequency: fref) = (fX_{tal}: XIN)/(actual divider number)	UL0 UI1 UE0 UE1																																																																														
(4)	Output port data: OA, OB	- This data determines the output on the general-purpose output port. OA → OUTA OB → OUTB - Data 0: open; Data 1: low - During the power-on reset in the LC7152NM, OA and OB are both “0”.																																																																															
(5)	Input frequency range switching data: FA, FB	- This data switches the input frequency range for the PIA and PIB pins. (FA → PIA, FB → PIB) <table border="1"><thead><tr><th>Data</th><th>Supply voltage (V_{DD})</th></tr></thead><tbody><tr><td></td><td>2.0 to 3.3 V</td></tr><tr><td>[0]</td><td>1.5 to 23 MHz</td></tr><tr><td>[1]</td><td>20 to 55 MHz</td></tr></tbody></table> - In the case of the LC7152KM: Data 1: 55 to 80 MHz (V_{DD} = 2.7 V to 3.3 V)	Data	Supply voltage (V _{DD})		2.0 to 3.3 V	[0]	1.5 to 23 MHz	[1]	20 to 55 MHz	DA0 to DA15 DB0 to DB15																																																																						
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(6)	Standby mode data : SB	- This data puts the PLL in standby mode. - SB = 1: standby mode (LDB pin: open) → Single PLL operation: Side-A operating, side-B stopped - SB = 0: standby mode off → Dual PLL operation: Side-A operating, side-B operating - During the power-on reset in the LC7152NM, SB is “1”.																																																																															
(7)	Unlock detection data : UL0, UL1 : UE0, UE1	- This is the phase error detection threshold data that is used for PLL lock/unlock discrimination. If the threshold shown in the table is exceeded, the unlocked state is detected. unit : μs <table border="1"><thead><tr><th rowspan="2">UL0</th><th rowspan="2">UL1</th><th rowspan="2">Phase error detector threshold</th><th colspan="5">XIN : fXIN [MHz] example</th></tr><tr><th>4.0</th><th>7.2</th><th>8.0</th><th>10.24</th><th>12.8</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td><td>←</td><td>←</td><td>←</td><td>←</td><td>←</td></tr><tr><td>1</td><td>0</td><td>±4/f_{X_{tal}}</td><td>±1.00</td><td>±0.55</td><td>±0.50</td><td>±0.39</td><td>±0.31</td></tr><tr><td>0</td><td>1</td><td>±16/f_{X_{tal}}</td><td>±4.00</td><td>±2.22</td><td>±2.00</td><td>±1.56</td><td>±1.20</td></tr><tr><td>1</td><td>1</td><td>±64/f_{X_{tal}}</td><td>±16.00</td><td>±8.88</td><td>±8.00</td><td>±6.25</td><td>±5.00</td></tr></tbody></table> (Note) Note that if the data changes in lock state, the PLL will be unlocked temporarily. - The detected phase error (øE) signal can be extended by a certain amount of time and output on the LDA and LDB pins. This data determines the length of this extension. However, when UL0 = UL1 = 0, the phase error is not extended, and is output directly. unit : ms <table border="1"><thead><tr><th rowspan="2">UE0</th><th rowspan="2">UE1</th><th rowspan="2">Reference frequency fref</th><th colspan="3">Reference frequency : fref [kHz] example</th></tr><tr><th>1 kHz</th><th>5 kHz</th><th>12.5 kHz</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>4 × (1/fref)</td><td>4.0*</td><td>0.8</td><td>0.32</td></tr><tr><td>1</td><td>0</td><td>8 × (1/fref)</td><td>8.0</td><td>1.6</td><td>0.64</td></tr><tr><td>0</td><td>1</td><td>32 × (1/fref)</td><td>32.0</td><td>6.4*</td><td>2.56</td></tr><tr><td>1</td><td>1</td><td>64 × (1/fref)</td><td>64.0</td><td>12.8</td><td>5.12*</td></tr></tbody></table> (*standard value)	UL0	UL1	Phase error detector threshold	XIN : fXIN [MHz] example					4.0	7.2	8.0	10.24	12.8	0	0	0	←	←	←	←	←	1	0	±4/f _{X_{tal}}	±1.00	±0.55	±0.50	±0.39	±0.31	0	1	±16/f _{X_{tal}}	±4.00	±2.22	±2.00	±1.56	±1.20	1	1	±64/f _{X_{tal}}	±16.00	±8.88	±8.00	±6.25	±5.00	UE0	UE1	Reference frequency fref	Reference frequency : fref [kHz] example			1 kHz	5 kHz	12.5 kHz	0	0	4 × (1/fref)	4.0*	0.8	0.32	1	0	8 × (1/fref)	8.0	1.6	0.64	0	1	32 × (1/fref)	32.0	6.4*	2.56	1	1	64 × (1/fref)	64.0	12.8	5.12*	
UL0	UL1	Phase error detector threshold				XIN : fXIN [MHz] example																																																																											
			4.0	7.2	8.0	10.24	12.8																																																																										
0	0	0	←	←	←	←	←																																																																										
1	0	±4/f _{X_{tal}}	±1.00	±0.55	±0.50	±0.39	±0.31																																																																										
0	1	±16/f _{X_{tal}}	±4.00	±2.22	±2.00	±1.56	±1.20																																																																										
1	1	±64/f _{X_{tal}}	±16.00	±8.88	±8.00	±6.25	±5.00																																																																										
UE0	UE1	Reference frequency fref	Reference frequency : fref [kHz] example																																																																														
			1 kHz	5 kHz	12.5 kHz																																																																												
0	0	4 × (1/fref)	4.0*	0.8	0.32																																																																												
1	0	8 × (1/fref)	8.0	1.6	0.64																																																																												
0	1	32 × (1/fref)	32.0	6.4*	2.56																																																																												
1	1	64 × (1/fref)	64.0	12.8	5.12*																																																																												

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No.	Controller/Data	Description	Related Data						
(8)	Dead zone control data: DZ	• This data controls the phase comparator dead zone. (DZA < DZB) <table><tr><td>DZ</td><td>Mode</td></tr><tr><td>0</td><td>DZA</td></tr><tr><td>1</td><td>DZB</td></tr></table>	DZ	Mode	0	DZA	1	DZB	
DZ	Mode								
0	DZA								
1	DZB								
(9)	IC test data: T0, T1, T2	• This is the IC test mode switching data. The user does not need to be concerned about this data. Assume that T0 = T1 = T2 = 0. Normally, the test pins must be either at V_{SS} or left open.							

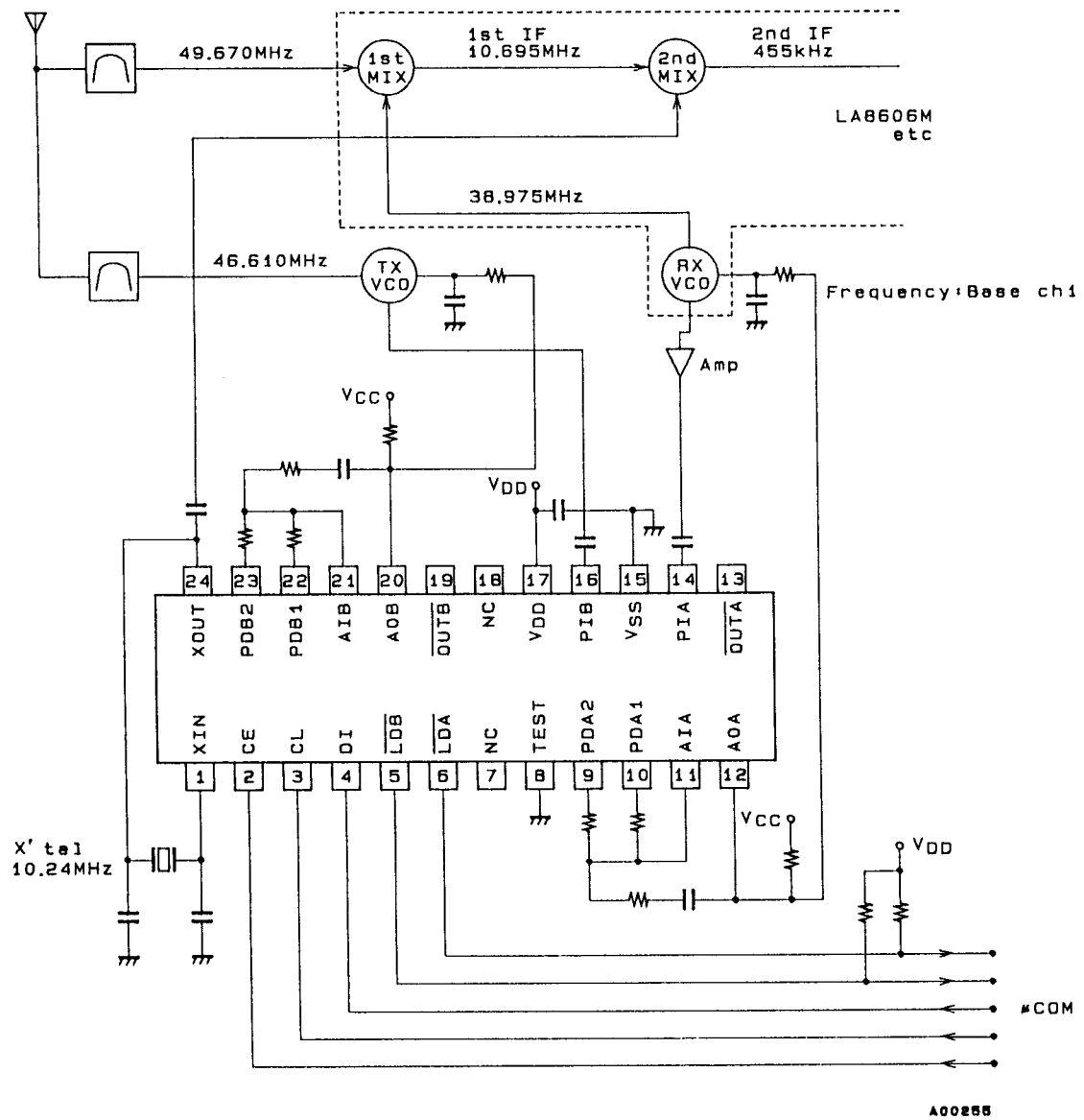
Power-on Reset supply voltage



- Power-on reset is performed when the supply voltage V_{DD} exceeds 2.0 V by power application after the V_{DD} has once fallen under 0.05 V and kept the level for at least 20ms.
- Latch data is retained when the V_{DD} is 1.5 V, where power-on reset is not performed.

LC7152, 7152M, 7152NM, 7152KM

Sample Application Circuit (FCC: 10 ch 46/49 MHz cordless telephone)



Example: FCC 1-channel 46/49 MHz cordless telephone base station (See diagram in the preceding page.)
for fref: 5 kHz, RX VCO: 38.975 MHz, TX VCO: 46.610 MHz

$$(1) \quad NA = \frac{f_{VCO} - A}{f_{ref}} = \frac{RX \text{ VCO}}{f_{ref}} = \frac{38.975 \text{ MHz}}{5 \text{ kHz}} = 7795 \text{ (DA0 to DA15)}$$

(1E73)Hex

$$(2) \quad \text{NB} = \frac{\text{fVCO} - \text{B}}{\text{fref}} = \frac{\text{TX VCO}}{\text{fref}} = \frac{46.610\text{MHz}}{5\text{kHz}} = 9322 \text{ (DB0 to DB15)}$$

(246A)Hex

$$NR = \left(\frac{f_{X' \text{ tal}}}{f_{\text{ref}}} \right) \div 2 = \frac{10.24\text{MHz}}{5\text{kHz}} \div 2 = 1024 \text{ (R0 to R13)}$$

(400)Hex

General-purpose output port: Open (OA = 0, OB = 0)

(7) Unlock detector output
 Extends the phase error signal by 6.4ms if a phase error of $\pm 6.25 \mu\text{s}$ or more is generated.
 : UL0 = UL1 = 1
 : UE0 = 0, UE1 = 1

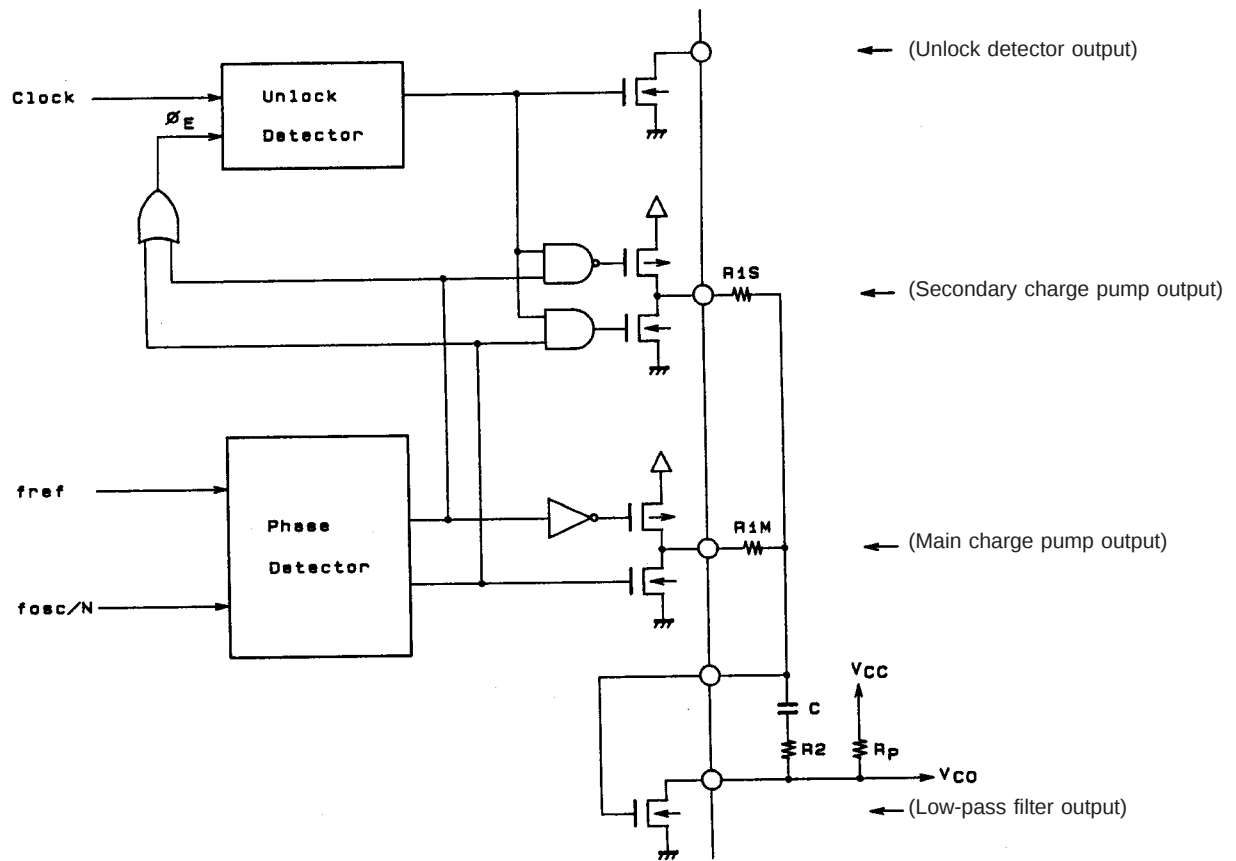
(9) LSI test data: $T_0 = T_1 = T_2 = 0$

D A 0	D A 1	D A 2	D A 3	D A 4	D A 5	D A 6	D A 7	D A 8	D A 9	D A 10	D A 11	D A 12	D A 13	D A 14	D A 15	D 8 0	D 8 1	D 8 2	D 8 3	D 8 4	D 8 5	D 8 6	D 8 7	D 8 8	D 8 9	D 8 10	D 8 11	D 8 12	D 8 13	D 8 14	D 8 15		
1	1	0	0	1	1	1	0	0	1	1	1	1	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	1	0	0	1	0	0

R	R	R	R	R	R	R	R	R	R	R	R	R	R	R			D	D	F	F				S	U	U	U	U	D	T	T	T
0	1	2	3	4	5	6	7	8	9	10	11	12	13			A	B	A	B				B	L	L	E	E	Z	0	1	2	
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	0	0	0	0	
																								1								

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Dual Charge Pump Descriptions



If an unlock state is detected at channel switch, the sub-charge pump operates, R1M/R1S becomes R1, low-pass filter's time constant is reduced, and the lockup accelerates.

When the circuit is locked, side-band characteristics and modulation characteristics are improved by making the sub-charge pump off, i.e., floating, R1M to be R1, and increasing low-pass filter's time constant.

Device Comparison

Device	Operating frequency			Power-on reset circuit	Package
	FA/FB = 0	FA/FB = 1			
	1.5 to 23 MHz	20 to 55 MHz	55 to 80 MHz		
LC7152	Yes	Yes	No	No	DIP24S
LC7152M	Yes	Yes	No	No	MFP24S
LC7152NM	Yes	Yes	No	Yes	MFP24S
LC7152KM	Yes	Yes	Yes (V _{DD} = 2.7 to 3.3 V)	No	MFP24S

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