DATA SHEET

OKI TELECOMMUNICATION PRODUCTS

ML7074-001GA
Speech CODEC for VoIP

December 2002

Oki Semiconductor

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Oki Semiconductor

ML7074-001GA

Speech CODEC for VoIP

DESCRIPTION

Oki Semiconductor's ML7074-001GA is a speech CODEC designed for VoIP applications. This CODEC allows conformance selection for various VoIP standard environments including G.729.A (8 kbps), G.726 (32 kbps), G.711 (64 kbps) μ-law, and A-law, and a mutual conversion function between G.729.A and G.726.

The ML7074-001GA is optimized for adding VoIP functions to terminal adapters, routers, and IP-phones with a rich feature set that includes an echo canceller for 32 msec delay, DTMF detection, two tone detection functions, and tone generation, built-in FIFOs, I/P and O/P amplifiers. This CODEC uses a single 3.3-V power supply and has a 64-pin plastic QFP (QFP64-P-1414-0.80-BK) package.

FEATURES

- Single 3.3-V power supply operation (DV_{DD}0, 1, 2, AV_{DD}: 3.0 to 3.6 V)
- Speech CODEC:
  - Selectable among G.729.A (8 kbps), G.726 (32 kbps), G.711 (64 kbps) μ-law, and A-law
  - Mutual conversion function between G.729.A (8 kbps) and G.726 (32 kbps).
- Echo canceller for 32 ms delay
- DTMF detection function
- Tone detection function: 2 systems (1650 Hz, 2100 Hz: Detect frequency can be changed.)
- Tone generation function
- FSK generation function
- Dial pulse detection function
- Dial pulse transmit function
- Internal 1-channel 16-bit timer
- Built-in FIFO buffers (640 bytes) for transferring transmit and receive data:
  - Frame/DMA (slave) interface selectable.
- Master clock frequency: 4.096 MHz (crystal oscillation or external input)
- Hardware or software power-down operation option
- Analog input/output type:
  - Two built-in input amplifiers, 10 kΩ driving
  - Two built-in output amplifiers, 10 kΩ driving
- Package:
  - 64-pin plastic QFP (QFP64)

APPLICATIONS

- VoIP applications - G.729.A, G.726, G.711 μ-law, and A-law
- Terminal adapters
- Routers and gateways
- I/P-phones

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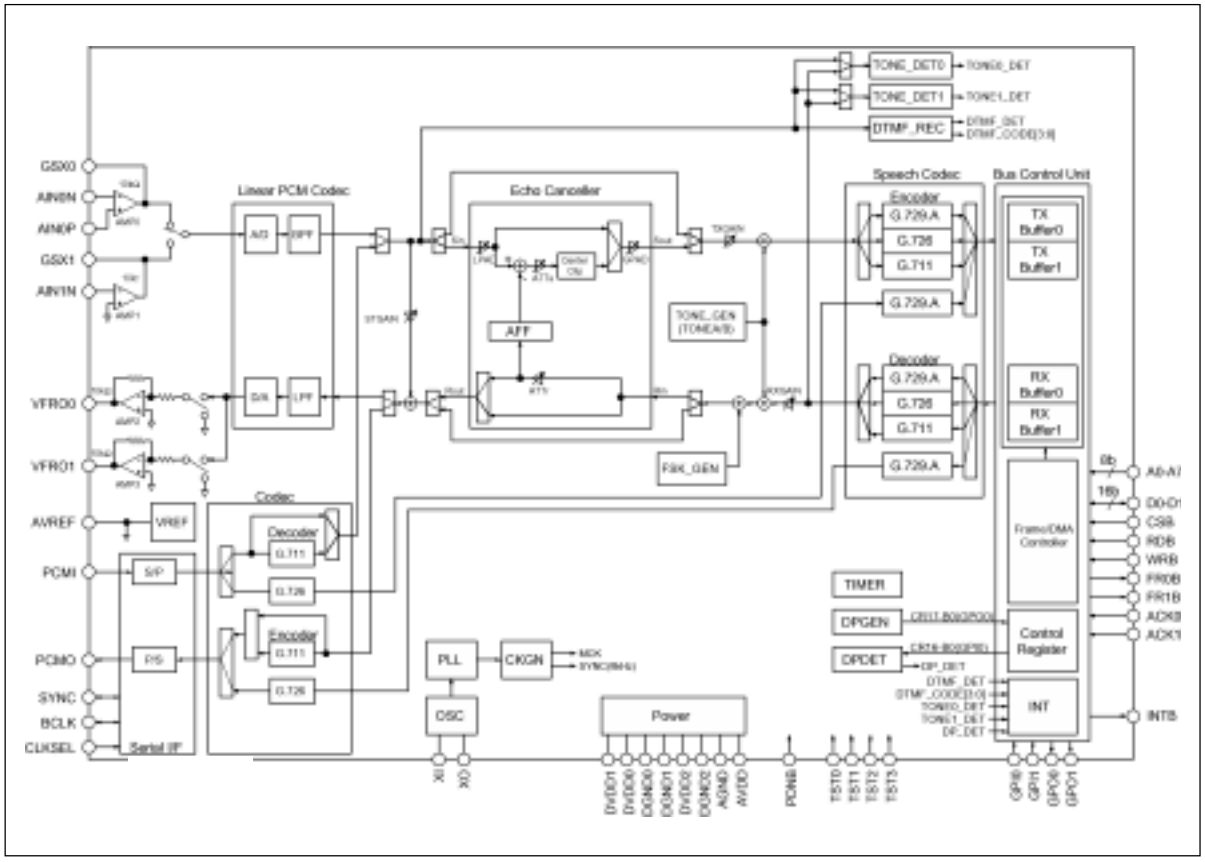
BLOCK DIAGRAM



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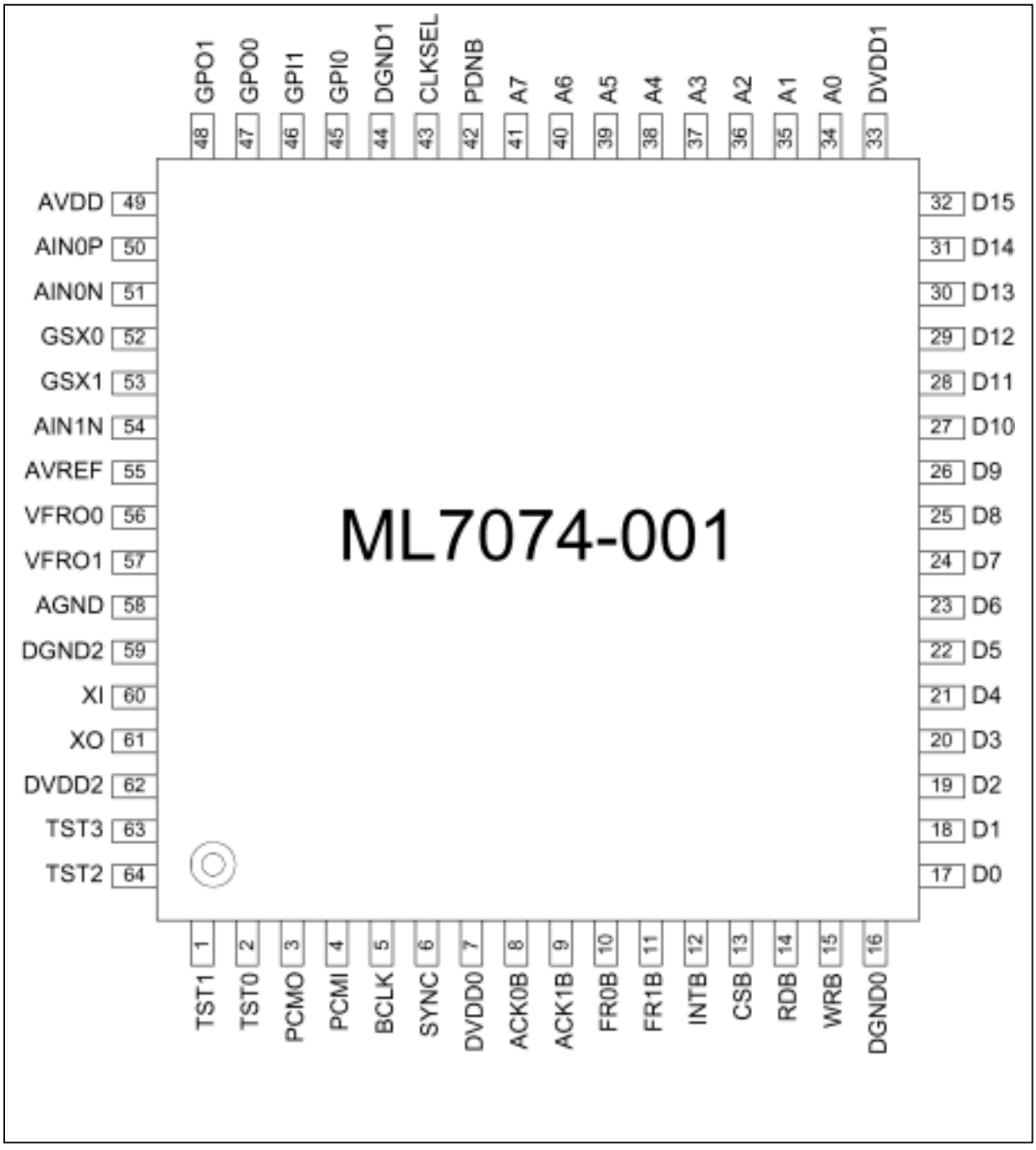
PIN ASSIGNMENT (TOP VIEW)



64-pin plastic QFP

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PIN DESCRIPTIONS

Pin No.	Symbol	I/O	PDNB = "0"	Description
1	TST1	I	"0"	Test control input 1: Normally input "0".
2	TST0	I	"0"	Test control input 0: Normally input "0".
3	PCMO	O	"Hi-z"	PCM data output
4	PCMI	I	I	PCM data input
5	BCLK	I/O	I	CLKSEL = "0" PCM shift clock input
			"L"	CLKSEL = "1" PCM shift clock output
6	SYNC	I/O	I	CLKSEL = "0" PCM sync signal 8 kHz input
			"L"	CLKSEL = "1" PCM sync signal 8 kHz output
7	$DV_{DD}0$	—	—	Digital power supply
8	ACK0B	I	I	Transmit buffer DMA access acknowledge signal input
9	ACK1B	I	I	Receive buffer DMA access acknowledge signal input
10	FR0B (DMARQ0B)	O	"H"	FR0B: (CR11-B7 = "0") Transmit buffer frame signal output DMARQ0B: (CR11-B7 = "1") Transmit buffer DMA access request signal output
11	FR1B (DMARQ1B)	O	"H"	FR1B: (CR11-B7 = "0") Receive buffer frame signal output DMARQ1B: (CR11-B7 = "1") Receive buffer DMA access request signal output
12	INTB	O	"H"	Interrupt request output "L" level is output for about 1.0 μsec when an interrupt is generated.
13	CSB	I	I	Chip select control input
14	RDB	I	I	Read control input
15	WRB	I	I	Write control input
16	DGND0	—	I	Digital ground (0.0 V)
17	D0	I/O	I	Data input/output
18	D1	I/O	I	Data input/output
19	D2	I/O	I	Data input/output
20	D3	I/O	I	Data input/output
21	D4	I/O	I	Data input/output
22	D5	I/O	I	Data input/output
23	D6	I/O	I	Data input/output
24	D7	I/O	I	Data input/output
25	D8	I/O	I	Data input/output Fix to input state when using in 8-bit bus access (CR11-B5 = "1").
26	D9	I/O	I	Data input/output Fix to input state when using in 8-bit bus access (CR11-B5 = "1").
27	D10	I/O	I	Data input/output Fix to input state when using in 8-bit bus access (CR11-B5 = "1").
28	D11	I/O	I	Data input/output Fix to input state when using in 8-bit bus access (CR11-B5 = "1").
29	D12	I/O	I	Data input/output Fix to input state when using in 8-bit bus access (CR11-B5 = "1").

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30	D13	I/O	I	Data input/output Fix to input state when using in 8-bit bus access (CR11-B5 = “1”).
31	D14	I/O	I	Data input/output Fix to input state when using in 8-bit bus access (CR11-B5 = “1”).
32	D15	I/O	I	Data input/output Fix to input state when using in 8-bit bus access (CR11-B5 = “1”).
33	$DV_{DD}1$	—	—	Digital power supply
34	A0	I	I	Address input
35	A1	I	I	Address input
36	A2	I	I	Address input
37	A3	I	I	Address input
38	A4	I	I	Address input
39	A5	I	I	Address input
40	A6	I	I	Address input
41	A7	I	I	Address input
42	PDNB	I	“0”	Power-down input “0”: Power-down reset “1”: Normal operation
43	CLKSEL	I	I	SYNC and BCLK I/O control input “0”: SYNC and BCLK become inputs “1”: SYNC and BCLK become outputs
44	DGND1	—	—	Digital ground (0.0 V)
45	GPI0	I	I	General-purpose input pin 0 (5 V tolerant input) /Secondary function: Dial pulse detect input pin
46	GPI1	I	I	General-purpose input pin 1 (5 V tolerant input)
47	GPO0	O	“L”	General-purpose output pin 0 (5 V tolerant output, can be pulled up externally) /Secondary function: Dial pulse transmit pin
48	GPO1	O	“L”	General-purpose output pin 1 (5 V tolerant output, can be pulled up externally)
49	AV_{DD}	—	—	Analog power supply
50	AIN0P	I	I	AMP0 non-inverted input
51	AIN0N	I	I	AMP0 inverted input
52	GSX0	O	“Hi-z”	AMP0 output (10 kΩ driving)
53	GSX1	O	“Hi-z”	AMP1 output (10 kΩ driving)
54	AIN1N	I	I	AMP1 inverted input
55	AVREF	O	“L”	Analog signal ground (1.4 V)
56	VFRO0	O	“Hi-z”	AMP2 Output (10 kΩ driving)
57	VFRO1	O	“Hi-z”	AMP3 Output (10 kΩ driving)
58	AGND	—		Analog ground (0.0 V)
59	DGND2	—		Digital ground (0.0 V)
60	XI	I	I	4.096 MHz crystal oscillator I/F, 4.096 MHz clock input
61	XO	O	“H”	4.096 MHz crystal oscillator I/F
62	$DV_{DD}2$	—		Digital power supply
63	TST3	I	“0”	Test control input 3: Normally input “0”.
64	TST2	I	“0”	Test control input 2: Normally input “0”.

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ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Rating	Unit
Analog power supply voltage	VDA	—	–0.3 to 5.0	V
Digital power supply voltage	V_{DD}	—	–0.3 to 5.0	V
Analog input voltage	VAIN	Analog pins	–0.3 to V_{DD} + 0.3	V
Digital input voltage	VDIN1	Normal digital pins	–0.3 to V_{DD} + 0.3	V
	VDIN2	5 V tolerant pins	–0.3 to 6.0	V
Storage temperature range	Tstg	—	–55 to +150	°C

RECOMMENDED OPERATING CONDITIONS

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Analog power supply voltage	VDA	—	3.0	3.3	3.6	V
Digital power supply voltage	V_{DD}	—	3.0	3.3	3.6	V
Operating temperature range	Ta	—	–20	—	60	°C
Digital high level input voltage	VIH1	Digital input pins	2.0	—	V_{DD}+ 0.3	V
	VIH2	GPI0 and GPI1 pins	2.0	—	5.5	V
Digital low level input voltage	VIL	Digital pins	–0.3	—	0.8	V
Digital input rise time	tIR	Digital pins	—	2	20	ns
Digital input fall time	tIF	Digital pins	—	2	20	ns
Digital output load capacitance	CDL	Digital pins	—	—	50	pF
Capacitance of bypass capacitor for AVREF	Cvref	Between AVREF and AGND	2.2+0.1	—	4.7+0.1	mF
Master clock frequency	Fmck	MCK	–0.01%	4.096	+0.01%	MHz
PCM shift clock frequency	Fbclk	BCLK (at input)	64	—	2048	kHz
PCM sync signal frequency	Fsync	SYNC (at input)	—	8.0	—	kHz
Clock duty ratio	DRCLK	MCK, BCLK (at input)	40	50	60	%
PCM sync timing	tBS	BCLK to SYNC (at input)	100	—	—	ns
	tSB	SYNC to BCLK (at input)	100	—	—	ns
PCM sync signal width	tWS	SYNC (at input)	1BCLK	—	100	ms

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ELECTRICAL CHARACTERISTICS

DC Characteristics

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply current	ISS	Standby state (PDNB = ”0”, V_{DD} = 3.3 V, Ta = 25°C)	—	5.0	20.0	mA
	$I_{DD}1$	Operating state 1 In the PCM/IF mode (SC_EN = “1”, PCMIF_EN = “1”, AFE_EN = “1”, TRANS_EN = “1”) Connect a 4.096 MHz crystal oscillator between XI and XO.	—	45.0	55.0	mA
	$I_{DD}2$	Operating state 2 When operating the whole system (SC_EN = “1”, PCMIF_EN = “0”, TRANS_EN = “0”, AFE_EN = “0”) Connect a 4.096 MHz crystal oscillator between XI and XO.	—	50.0	65.0	mA
Digital input pin input leakage current	IIH	Vin = DV_{DD}	—	0.01	1.0	mA
	IIL	Vin = DGND	–1.0	–0.01	—	mA
Digital I/O pin output leakage current	IOZH	Vout = DV_{DD}	—	0.01	1.0	mA
	IOZL	Vout = DGND	–1.0	–0.01	—	mA
High level output voltage	VOH	Digital output pins, I/O pins IOH = 4.0 mA IOH = 1.0 mA (XO pin)	2.2	—	—	V
Low level output voltage	VOL	Digital output pins, I/O pins IOL = –4.0 mA IOL = –1.0 mA (XO pin)	—	—	0.4	V
Input capacitance [1]	CIN	Input pins	—	8	12	pF

Note: 1 Guaranteed design value

Analog Interface

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input resistance [1]	RIN	AIN0N, AIN0P, AIN1N	10	—	—	MΩ
Output load resistance	RL	GSX0, GSX1, VFRO0, VFRO1	10	—	—	kΩ
Output load capacitance	CL	Analog output pins	—	—	50	pF
Offset voltage	VOF	VFRO0, VFRO1	–40	—	40	mV
Output voltage level [2]	VO	GSX0, GSX1, VFRO0, VFRO1 RL = 10 kΩ	—	—	1.3	Vpp

Notes:
1 Guaranteed design value
2 –7.7 dBm (600Ω) = 0 dBm0, +3.17 dBm0 = 1.3 Vpp

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AC Characteristics

CODEC (Speech CODEC in G.711 (μ-law) Mode)

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
		Frequency (Hz)	Level (dBm0)				
Transmit frequency characteristics	LT1	0 to 60	0	25	—	—	dB
	LT2	300 to 3000		–0.15	—	0.20	dB
	LT3	1020		Reference value			—
	LT4	3300		–0.15	—	0.80	dB
	LT5	3400		0	—	0.80	dB
	LT6	3968.75		13	—	—	dB
Receive frequency characteristics	LR2	0 to 3000	0	–0.15	—	0.20	dB
	LR3	1020		Reference value			—
	LR4	3300		–0.15	—	0.80	dB
	LR5	3400		0	—	0.80	dB
	LR6	3968.75		13	—	—	dB
Transmit signal to noise ratio [1]	SDT1	1020	3	35	—	—	dBp
	SDT2		0	35	—	—	dBp
	SDT3		–30	35	—	—	dBp
	SDT4		–40	28	—	—	dBp
	SDT5		–45	23	—	—	dBp
Receive signal to noise ratio [1]	SDR1	1020	3	35	—	—	dBp
	SDR2		0	35	—	—	dBp
	SDR3		–30	35	—	—	dBp
	SDR4		–40	28	—	—	dBp
	SDR5		–45	23	—	—	dBp
Transmit inter-level loss error	GTT1	1020	3	–0.2	—	0.2	dB
	GTT2		–10	Reference value			—
	GTT3		–40	–0.2	—	0.2	dB
	GTT4		–50	–0.6	—	0.6	dB
	GTT5		–55	–1.2	—	1.2	dB
Receive inter-level loss error	GTR1	1020	3	–0.2	—	0.2	dB
	GTR2		–10	Reference value			—
	GTR3		–40	–0.2	—	0.2	dB
	GTR4		–50	–0.6	—	0.6	dB
	GTR5		–55	–1.2	—	1.2	dB
Idle channel noise [1]	NIDLT	—	Analog input = AVREF	—	—	–68	dBm0p
	NIDLR	—	PCMI = ”1”	—	—	–72	dBm0p
Transmit absolute level [2]	AVT	1020	0	0.285	0.320	0.359	Vrms
Receive absolute level [2]	AVR	1020	0	0.285	0.320	0.359	Vrms
Power supply noise reject ratio	PSRRT	Noise frequency range: 0 to 50 kHz Noise level: 50mVpp	—	30	—	—	dB
	PSRRR		—	30	—	—	dB

Notes: 1 Using P-message filter
2 0.320 Vrms = 0 dBm0 = –7.7 dBm (600Ω)

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Gain Setting (Speech CODEC in G.711 (μ-law) Mode)

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Transmit and receive gain setting accuracy	GAC	—	–1.0	—	1.0	dB

Tone Output (Speech CODEC in G.711 (μ-law) Mode)

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Frequency deviation	fDFT	Relative to set frequency	–1.5	—	1.5	%
Output level	oLEV	Relative to set gain	–2.0	—	2.0	dB

DTMF Detector, Other Detectors (Speech CODEC in G.711 (μ-law) Mode)

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

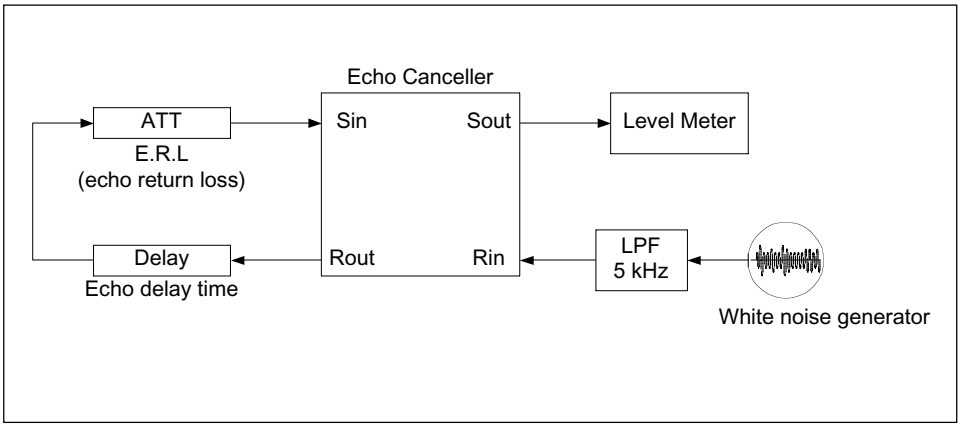
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Detect level accuracy	dLAC	Relative to set detect level	–2.5	—	2.5	dB

Echo Canceller

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Echo attenuation	eRES	In the analog I/F mode In the PCM I/F (16-bit linear) mode	—	35	—	dB
		In the PCM I/F (G.711) mode		30		
Erasable echo delay time	tECT	—	—	—	32	ms

Measurement Method



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PDNB, XO, AVREF Timings

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power-down signal pulse width	tPDNB	PDNB pin	1	—	—	ms
Oscillation start-up time	txtal	—	—	2+a [1]	100	ms
AVREF rise time	tAVREF	AVREF = 1.4 (90%) C5 = 4.7 mF, C6 = 0.1 mF (See figure 9.)	—	—	600	ms
Initialization mode start-up time	tINIT	—	—	1	—	sec

Note: 1. “a” is a value that depends on the oscillation stabilizing time when using a crystal oscillator.

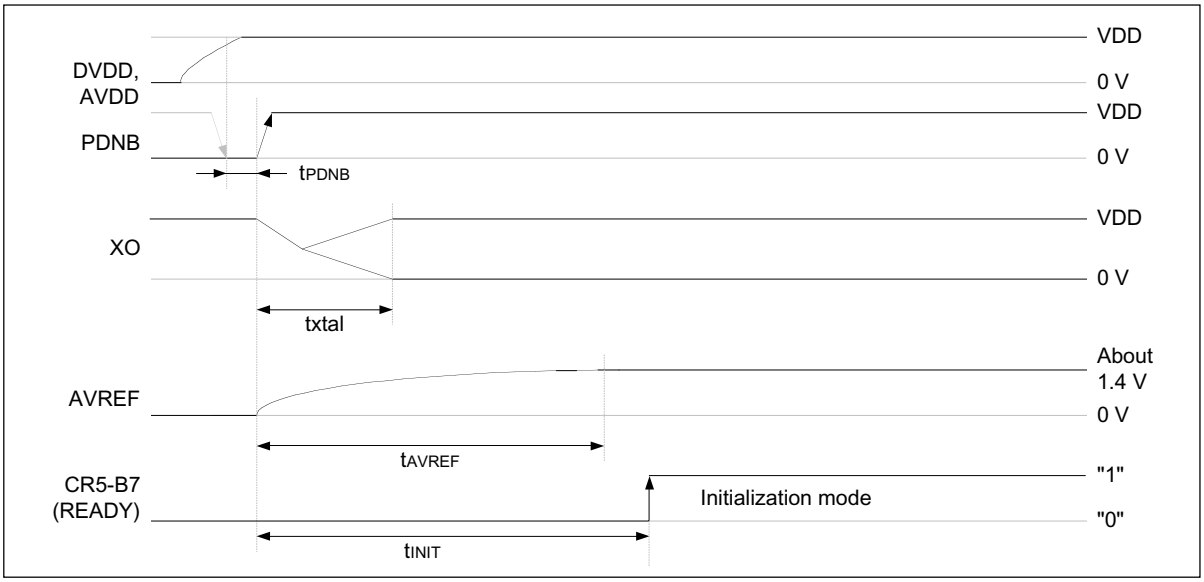

Figure 1 PDNB, XO, and AVREF timings

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PCM I/F Mode

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Bit clock frequency	fBCLK	CDL = 20pF(at output)	–0.1%	64	+0.1%	kHz
Bit clock duty ratio	dBCLK	CDL = 20pF(at output)	45	50	55	%
Sync signal frequency	fSYNC	CDL = 20pF(at output)	–0.1%	8	+0.1%	kHz
Sync signal duty ratio	dSYNC1	CDL = 20pF(at output) At 64 kHz output	12.4	12.5	12.6	%
	dSYNC2	CDL = 20pF(at output) At 128 kHz output	6.24	6.25	6.26	%
Transmit/receive signal sync timing	tBS	BCLK to SYNC (at output)	100	—	—	ns
	tSB	SYNC to BCLK (at output)	100	—	—	ns
Input setup time	tDS	—	100	—	—	ns
Input hold time	tDH	—	100	—	—	ns
Digital output delay time	tSDX	PCMO pin Pull-up, pull-down resistors RDL = 1 kΩ, CDL = 50 pF	—	—	100	ns
	tXD1		—	—	100	ns
Digital output hold time	tXD2		—	—	100	ns
	tXD3		—	—	100	ns

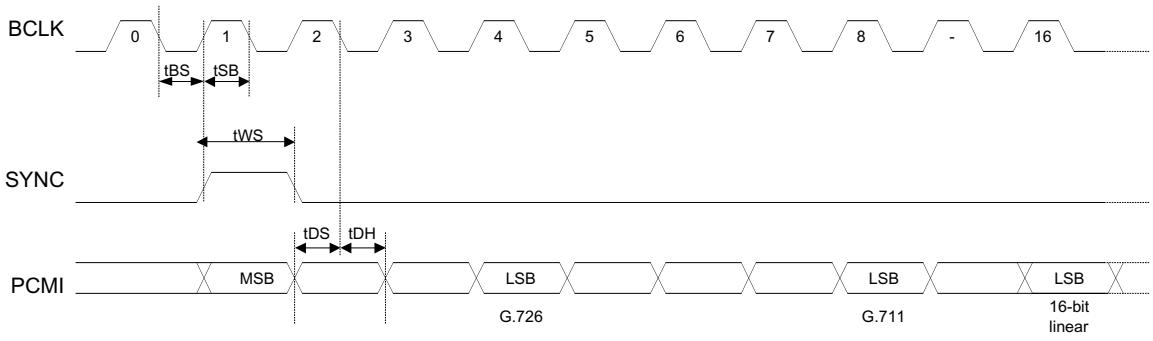

Figure 2 PCM I/F mode input timing (long frame)

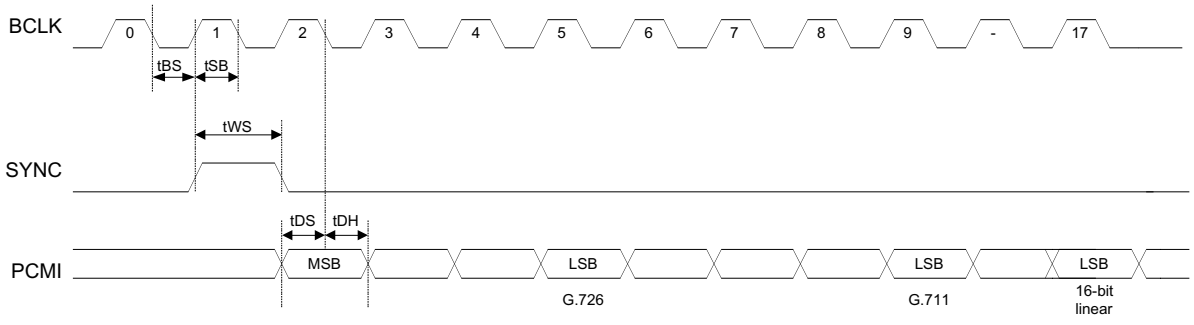

Figure 3 PCM I/F mode input timing (short frame)

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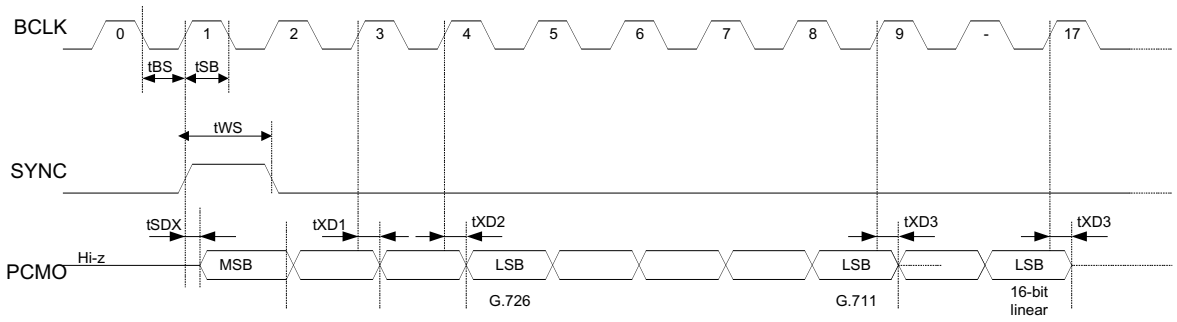

Figure 4 PCM I/F mode output timing (long frame)

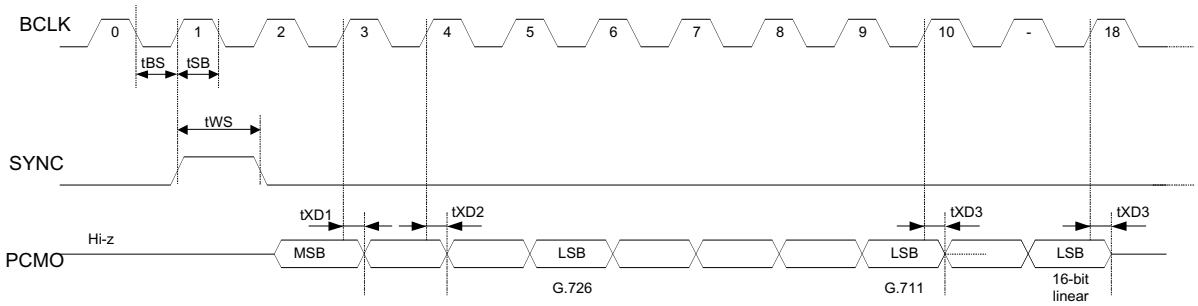

Figure 5 PCM I/F mode output timing (short frame)

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Control Register Interface

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Address setup time	tAS	CL = 50 pF	10	—	—	ns
Address hold time	tAH		10	—	—	ns
Write data setup time	tWDS		10	—	—	ns
Write data hold time	tWDH		10	—	—	ns
CSB setup time	tCS		10	—	—	ns
CSB hold time	tCH		10	—	—	ns
WRB pulse width	tWW		10	—	—	ns
Read data output delay time	tRDD		—	—	20	ns
Read data output hold time	tRDH		3	—	—	ns
RDB pulse width	tRW		25	—	—	ns
CSB disable time	tCD		10	—	—	ns

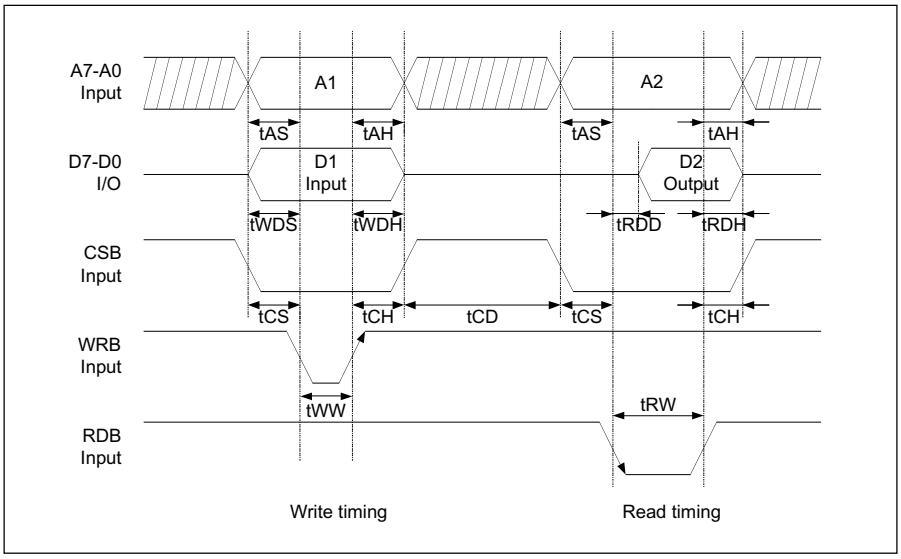

Figure 6 Control register interface

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Transmit and Receive Buffer Interface (in Frame Mode)

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
FR1B setup time	tF1S	CL = 50 pF	3	—	—	ns
FR1B output delay time	tF1D		—	—	20	ns
Address setup time	tAS		10	—	—	ns
Address hold time	tAH		10	—	—	ns
Write data setup time	tWDS		10	—	—	ns
Write data hold time	tWDH		10	—	—	ns
CSB setup time	tCS		10	—	—	ns
CSB hold time	tCH		10	—	—	ns
WRB pulse width	tWW		10	—	—	ns
FR0B setup time	tF0S		3	—	—	ns
FR0B output delay time	tF0D		—	—	20	ns
Read data output delay time	tRDD		—	—	30	ns
Read data output hold time	tRDH		3	—	—	ns
RDB pulse width	tRW		35	—	—	ns
CSB disable time	tCD		10	—	—	ns

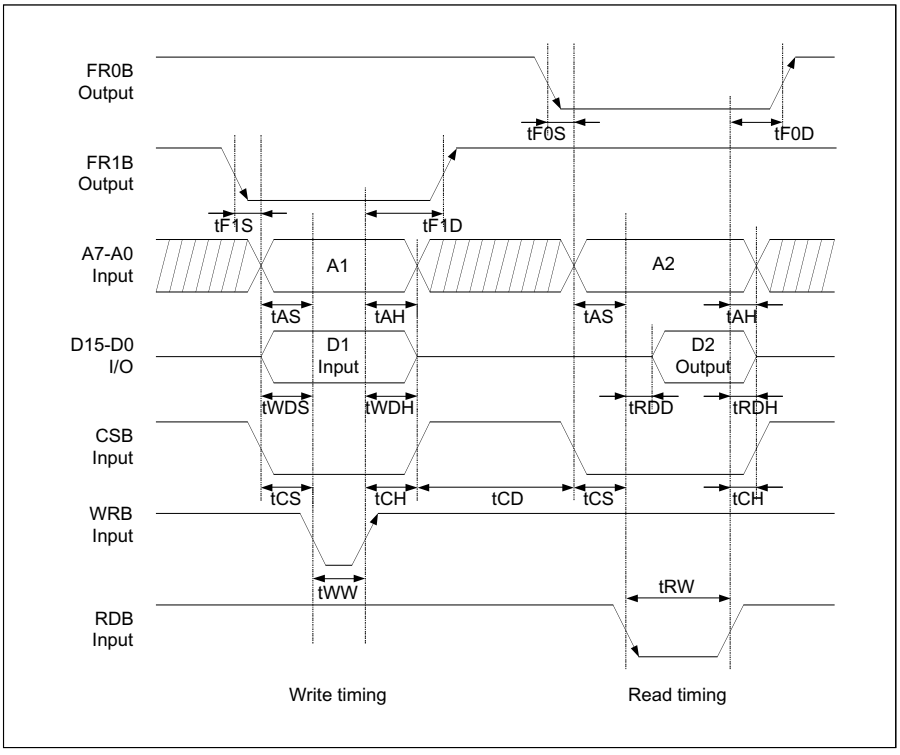

Figure 7 Transmit and receive buffer interface (in frame mode)

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Transmit and Receive Buffer Interface (in DMA Mode)

(Unless otherwise specified, AV_{DD} = 3.0 to 3.6 V, DV_{DD}0, 1, 2 = 3.0 to 3.6 V, AGND = DGND0, 1, 2 = 0.0 V, Ta = –20 to +60°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
DMARQ1B setup time	tDR1S	CL = 50 pF	3	—	—	ns
DMARQ1B output delay time	tDR1RD		—	—	25	ns
	tDR1FD		—	—	25	ns
Address setup time	tAS		10	—	—	ns
Address hold time	tAH		10	—	—	ns
Write data setup time	tWDS		10	—	—	ns
Write data hold time	tWDH		10	—	—	ns
ACK setup time	tAKS		10	—	—	ns
ACK hold time	tAKH		10	—	—	ns
WRB pulse width	tWW		10	—	—	ns
DMARQ0B setup time	tDR0S		3	—	—	ns
DMARQ0B output delay time	tDR0RD		—	—	20	ns
	tDR0FD		—	—	25	ns
Read data output delay time	tRDD		—	—	30	ns
Read data output hold time	tRDH		3	—	—	ns
RDB pulse width	tRW		35	—	—	ns
ACKB disable time	tAD		10	—	—	ns

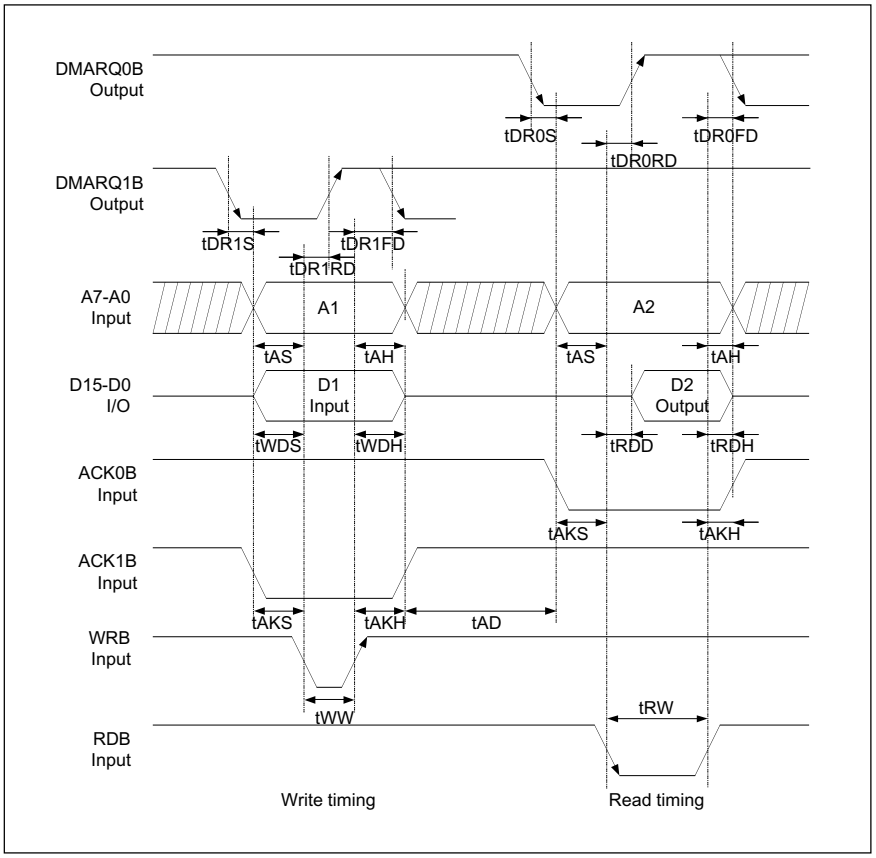

Figure 8 Transmit and receive buffer interface (in DMA mode)

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PIN FUNCTION DESCRIPTIONS

AIN0N, AIN0P, GSX0, AIN1N, GSX1

These are the analog transmit input and transmit level adjust pins. Each of AIN0N and AIN1N is connected to each of the inverting input pins of the built-in transmit amplifiers AMP0 and AMP1, and AIN0P is connected to the non-inverting input pin of AMP0. In addition, GSX0 and GSX1 are connected to the output pins of AMP0 and AMP1, respectively. The selection between AMP0 and AMP1 is made by CR10-B0. See figure 9 for the method of making level adjustment. During the power-down mode (when PDNB = "0" or CR0-B7 = "1"), the outputs of GSX0 and GSX1 go to the high impedance state. If AMP0 is not used in the specific application of this ML7074, short GSX0 with AIN0N and connect AIN0P with AVREF. When AMP1 is not used, short GSX1 with AIN1N.

Notice:

It is recommended that the amplifier to be used is selected before the conversation starts, since a small amount of noise will be generated if the amplifier selection is changed while the conversation is in progress.

VFRO0, VFRO1

These are analog receive output pins and are connected to the output pins of the built-in receive amplifiers AMP2 and AMP3, respectively. The output signals of VFRO0 and VFRO1 can be selected using CR10-B1 and CR10-B2, respectively. When selected ("1"), the received signal will be output, and when deselected ("0"), the AVREF signal (about 1.4 V) will be output. In power-down mode, these pins will be in the high impedance state. It is recommended to use these output signals via DC coupling capacitors.

Notice:

It is recommended that the amplifier to be used is selected before the conversation starts, since a small amount of noise will be generated if the amplifier selection is changed while the conversation is in progress.

At the time of resetting or releasing from the reset state, it is recommended to select the AVREF as outputs of VFRO0 and VFRO1.

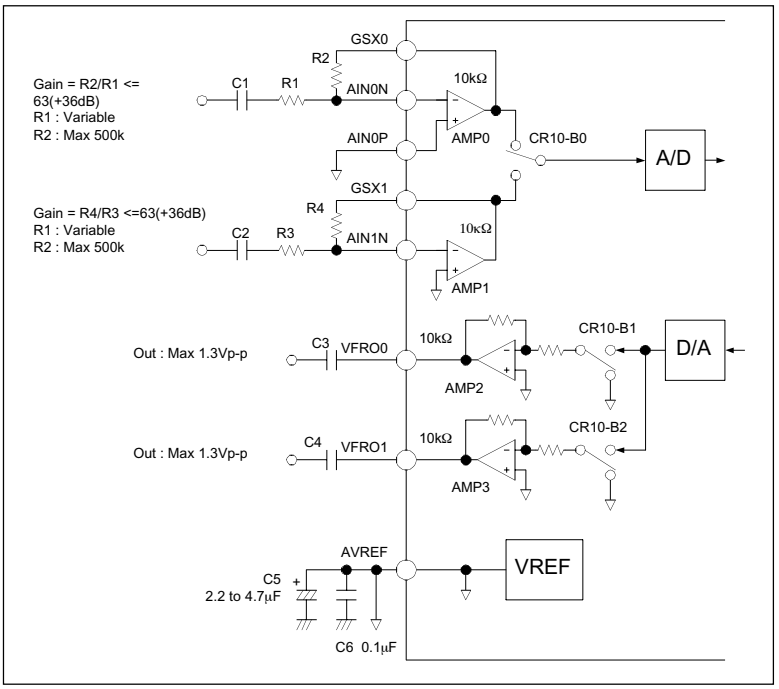

Figure 9 Analog interface

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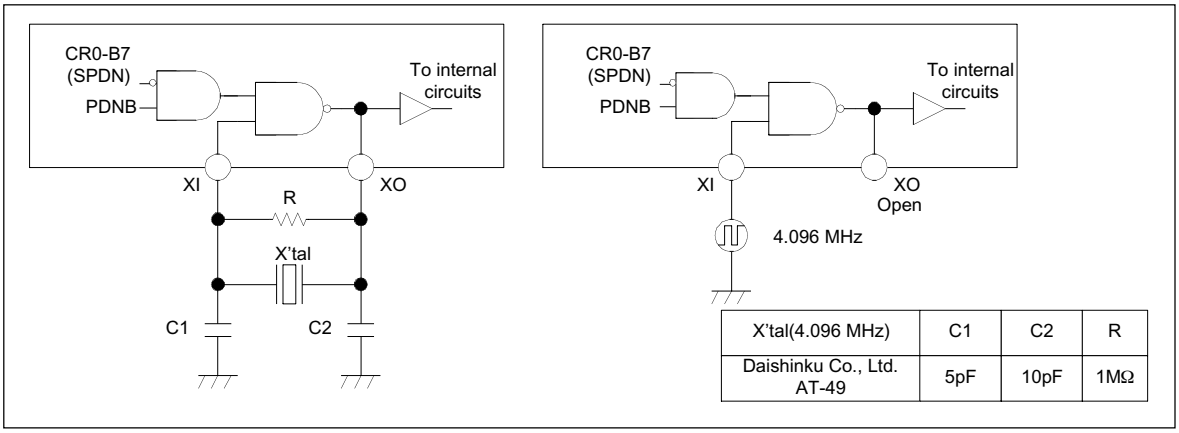
AVREF

This is the output pin for the analog signal ground potential. The output potential at this pin will be about 1.4 V. Connect a 2.2 to 4.7 μF (aluminum electrolytic type) capacitor and a 0.1 μF (ceramic type) capacitor in parallel between this pin and the GND pin as bypass capacitors. The output at the AVREF pin goes to 0.0 V in the power-down mode. The voltage starts rising after the power-down mode is released (PDNB = "1" and also CR0-B7 = "0"). The rise time is about 0.6 sec.

XI, XO

These are the pins for either connecting the crystal oscillator for the master clock or for inputting an external master clock signal.

The operation of the master clock oscillator will be stopped during a power-down due to the PDNB signal, or during a software power-down due to CR0-B7 (SPDN). The oscillator operation starts when the power-down condition is released, and the ML7074's internal clock will be started after counting up the oscillation stabilization period (of about 16 ms). Examples of crystal oscillator connection and external master clock input are shown in figure 10.



X'tal(4.096 MHz)	C1	C2	R
Daishinku Co., Ltd. AT-49	5pF	10pF	1MΩ

Figure 10 Examples of oscillator circuit and clock input

PDNB

This is the power-down control input pin. Power-down mode is entered when this pin goes to "0". In addition, this pin also has the function of resetting the ML7074. In order to prevent wrong operation of the ML7074, carry out the initial power-down reset after switching on the power using this PDNB pin. Also, keep the PDNB pin at "0" level for 1 μs or more to initiate the power-down state.

Further, it is possible to carry out a power-down reset of the ML7074 when the power is being supplied, by performing control of CR0-B7 (SPDN) in the sequence "0" → "1" → "0".

The READY signal (CR5-B7) goes to "1" about 1.0 second after the power-down mode is released thereby entering the mode in which various functions are set (initialization mode). See figure 1 for the timing of PDNB and AVREF, XO, and the initialization mode.

Notice: At the time of switching on the power, start from the power-down mode using PDNB.

$DV_{DD}0$, $DV_{DD}1$, $DV_{DD}2$, AV_{DD}

These are power supply pins. $DV_{DD}0$, 1, 2 are the power supply pins for the digital circuits while AV_{DD} is the power supply pin for the analog circuits of the ML7074. Connect DGND and AGND together near the ML7074 with a 10 μF electrolytic capacitor and a 0.1 μF ceramic capacitor, as bypass capacitors, in parallel between these pins. See figure 12 circuit diagram.

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DGND0, DGND1, DGND2, AGND

These are ground pins. GDND0, 1, 2 are the ground pins for the digital circuits and AGND is the ground pin for the analog circuits of the ML7074. Connect these pins to ground near the ML7074.

TST0, TST1, TST2, TST3

These are input pins for testing purposes only. Keep the inputs to these pins at the "0" level during normal use conditions.

INTB

This is the interrupt request output pin. An "L" level is output for a duration of about 1.0 μsec at this pin when there is a change in state of an interrupt cause.

This output will be maintained at the "H" level when there is no change in state of any of the interrupt causes. The actual interrupt cause generating the interrupt can be verified by reading CR3 and CR4. The different interrupt causes are described below.

- Underflow error (CR3-B0)

  An interrupt is generated when an internal read from the receive buffer occurs before the write into the receive buffer from the ML7074 has been completed.

  An interrupt is generated when a normal write is made into the receive buffer by the ML7074 and the underflow error is released.

- Overrun error (CR3-B1)

  An interrupt is generated when an internal write of the next data into the transmit buffer occurs before the transmit buffer data read out from the ML7074 has been completed.

  An interrupt is generated when a normal read out is made from the transmit buffer by the ML7074 and the overrun error is released.

- When a dial pulse is detected (CR4-B6).
- When a DTMF signal is detected (CR4-B4).
- When DTMF_CODEC0, 1, 2, 3 are detected (CR4-B0, B1, B2, B3).

  An interrupt is generated when a DTMF signal is detected.

  An interrupt is generated when there is a change from the DTMF signal detected state to the not-detected state.

  An interrupt is generated when there is a change in the detected code (CR4-B0, B1, B2, B3) in the condition in which a DTMF signal is being detected.

- When TONE0 is detected (CR3-B3).

  An interrupt is generated when a 1650 Hz tone signal is detected.

  An interrupt is generated when there is a change to the non-detection condition in the tone signal detection condition.

- When TONE1 is detected (CR3-B4).

  An interrupt is generated when a 2100 Hz tone signal is detected.

  An interrupt is generated when there is a change to the non-detection condition in the tone signal detection condition.

- When FGEN_RQ is generated (CR3-B6).

  An interrupt is generated when the FSK generator makes a request for the next data to be transmitted.

  An interrupt is generated when there is a change from the condition in which the FSK generator is requesting for transmission data to the condition in which there is no request for internal fetch of the data to be transmitted next.

- When DSP_ERR is detected (CR3-B7).

  An interrupt is generated when any error occurs in the DSP inside the ML7074.

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A0 to A7

These are the address input pins for use during an access of the frame, DMA, or control registers. The addresses are shown below:

Transmit buffer (TX Buffer)

A7 to A0 = 10xxxxxxb (the lower 6 bits are not valid)

Receive buffer (RX Buffer)

A7 to A0 = 01xxxxxxb (the lower 6 bits are not valid)

Control register (CR)

A7 to A0 = 00xxxxxxb

D0 to D15

These are the data input/output pins for use during an access of the frame, DMA, or control registers. Connect pull-up resistors to these pins since they are I/O pins. When the 8-bit bus access method is selected by CR11-B5, only D0 to D7 become valid. Since the higher 8 bits D8 to D15 will always be in the input state when the 8-bit bus access method is selected (CR11-B5 = "1"), tie them to "0" or "1" inputs.

CSB

This is the chip select input pin for use during a frame or control register access.

RDB

This is the read enable input pin for use during a frame, DMA, or control register access.

WRB

This is the write enable input pin for use during a frame, DMA, or control register access.

FR0B (DMARQ0B)

- FR0B (In frame mode, CR11-B7 = "0")

  This is the transmit frame output pin which outputs the signal when the transmit buffer is full during frame access. This pin outputs an "L" level when the transmit buffer becomes full, and maintains that "L" level output until a specific number of words are read out from the ML7074.

- DMARQ0B (In DMA mode, CR11-B7 = "1")

  This is the DMA request output pin which outputs the signal when the transmit buffer is full during DMA access. This output becomes "L" when the transmit buffer becomes full, and returns to the "H" level automatically on the falling edge of the read enable signal (RDB = "1" → "0") when there is an acknowledgement signal (ACK0B = "0") from the ML7074. This relationship is repeated until a specific number of words are read out from the ML7074.

FR1B (DMARQ1B)

- FR1B (In frame mode, CR11-B7 = "0")

  This is the receive frame output pin which outputs the signal when the receive buffer is empty during frame access. This pin outputs an "L" level when the receive buffer becomes empty, and maintains that "L" level output until a specific number of words are written from the ML7074.

- DMARQ1B (In DMA mode, CR11-B7 = "1")

  This is the DMA request output pin which outputs the signal when the receive buffer is empty during DMA access. This output becomes "L" when the receive buffer becomes empty, and returns to the "H" level automatically on the falling edge of the write enable signal (WRB = "1" → "0") when there is an acknowledgement signal (ACK1B = "0") from the ML7074. This relationship is repeated until a specific number of words are written from the ML7074.

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ACK0B

This is the DMA acknowledgement input pin for the DMARQ0B signal during DMA access of the transmit buffer and becomes valid in the DMA mode (CR11-B7 = "1").

Tie this pin to "1" when using this ML7074 in the frame access mode (CR11-B7 = "0").

ACK1B

This is the DMA acknowledgement input pin for the DMARQ1B signal during DMA access of the receive buffer and becomes valid in the DMA mode (CR11-B7 = "1").

Tie this pin to "1" when using this ML7074 in the frame access mode (CR11-B7 = "0").

GPI0, GPI1

These are general-purpose input pins. The state ("1" or "0") of each of these GPI0 and GPI1 pins can be read out respectively from CR16-B0 and CR16-B1. Further, GPI0 becomes the input pin for the dial pulse detector (DPDET) in the secondary functions.

GPO0, GPO1

These are general-purpose output pins. The values set in CR17-B0 and CR17-B1 are output at these pins GPO0 and GPO1, respectively. Further, GPO0 becomes the output pin for the dial pulse generator (DPGEN) in the secondary functions.

CLKSEL

This is the input/output control input pin of SYNC and BCLK. The pin becomes input at "0" level and output at "1" level.

SYNC

This is the 8 kHz sync signal input/output pin of PCM signals. When CLKSEL is "0", input continuously an 8 kHz clock synchronous with BCLK. Further, when CLKSEL is "1", this pin outputs an 8 kHz clock synchronous with BCLK. Long frame synchronization is used when CR0-B1 (LONG/SHORT) is "0" and short frame synchronization is used when it is "1".

BCLK

This is the shift clock input/output pin for the PCM signal. When CLKSEL is "0", it is necessary to input to this pin a clock signal that is synchronous with SYNC. Input a 64 to 2048 kHz clock when the G.711 mode or the G.726 mode has been selected, and input a 128 to 2048 kHz clock when the 16-bit linear mode has been selected. When CLKSEL is "1", this pin outputs a clock that is synchronous with SYNC. This pin outputs a 64 kHz clock when the G.711 mode or the G.726 mode has been selected, and outputs an 128 kHz clock when the 16-bit linear mode or G.729.A mode has been selected.

Note: The input/output control and frequencies of the above SYNC and BLCK signals will be as shown in Table 1 below.

Table 1 Input/output control of SYNC and BCLK

CLKSEL	SYNC	BCLK	Remarks
"0"	Input (8 kHz)	Input (64 kHz to 2048 kHz)	Input a continuous clock after starting the power supply. Input a 64 to 2048 kHz clock when G.711 or G.726 is selected. Input a 128 to 2048 kHz clock when 16-bit linear mode is selected.
"1"	Output (8 kHz)	Output (64 kHz or 128 kHz)	An "L" level is output during the power-down mode. A 64 kHz clock is output when G.711 or G.726 is selected. A 128 kHz clock is output when G.729.A or 16-bit linear mode is selected.

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PCMO

This is the PCM signal output pin for the transmitting section. The PCM signal is output in synchronization with the rising edges of SYNC and BCLK. The PCMO outputs the data only during the valid data segment in the selected coding format and goes to the high impedance state during all other segments. The basic timing chart of the PCM I/F mode is shown in figure 11. The PCMO output will be in the high impedance state when the mutual conversion function is not used (CR11-B0 = "0") or when the PCM I/F mode is not used (CR12-B0 = "0").

PCMI

This is the PCM signal input pin for the receiving section. The data is entered starting from the MSB by shift on the falling edge of BCLK.

The basic timing chart of the PCM I/F mode is shown in figure 11.

Fix input with "0" or "1" when the mutual conversion function is not used (CR11-B0 = "0") or when the PCM I/F mode (CR12-B0 = "0") is not used.

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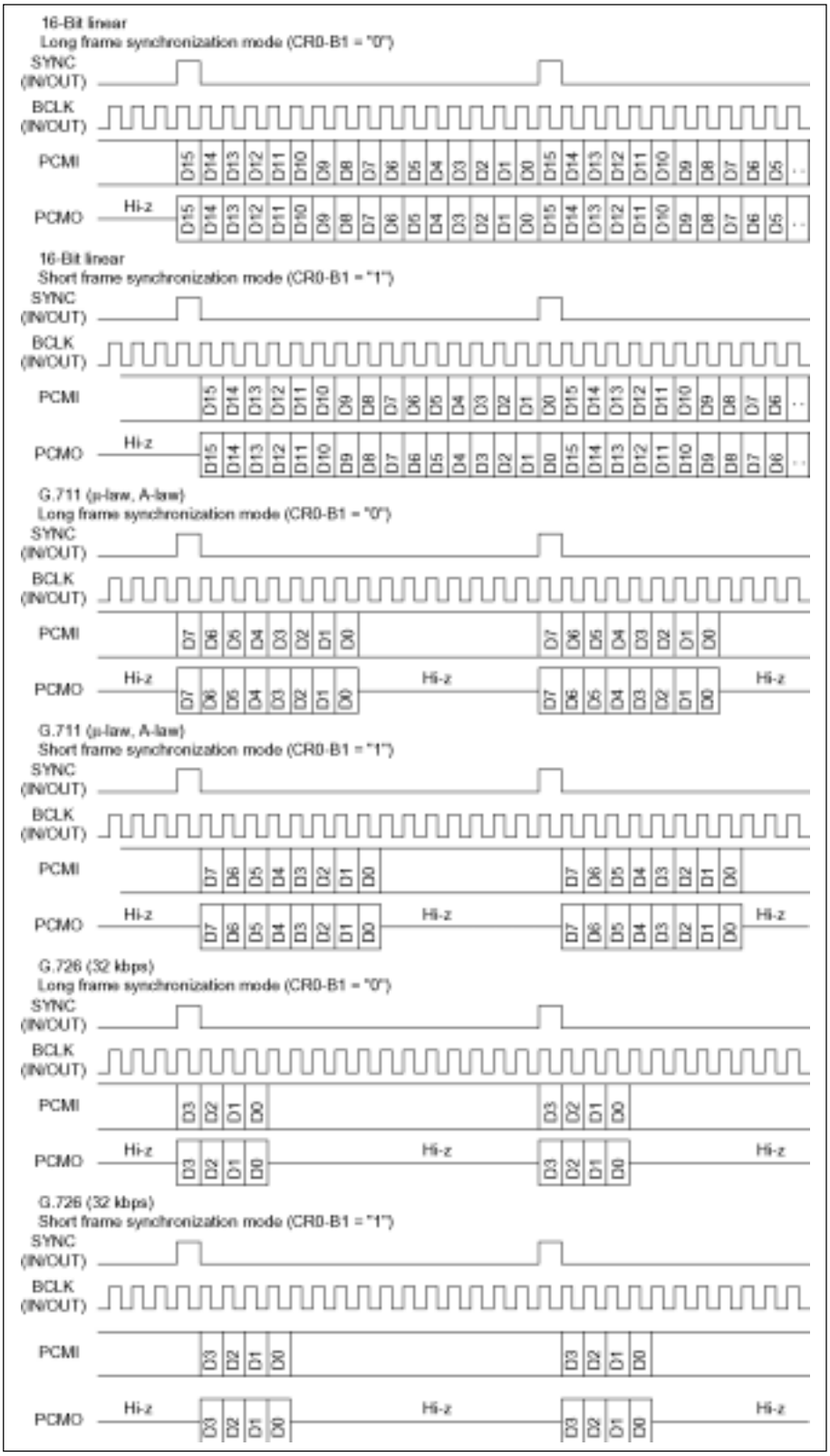

Figure 11 PCM I/F mode timing diagram

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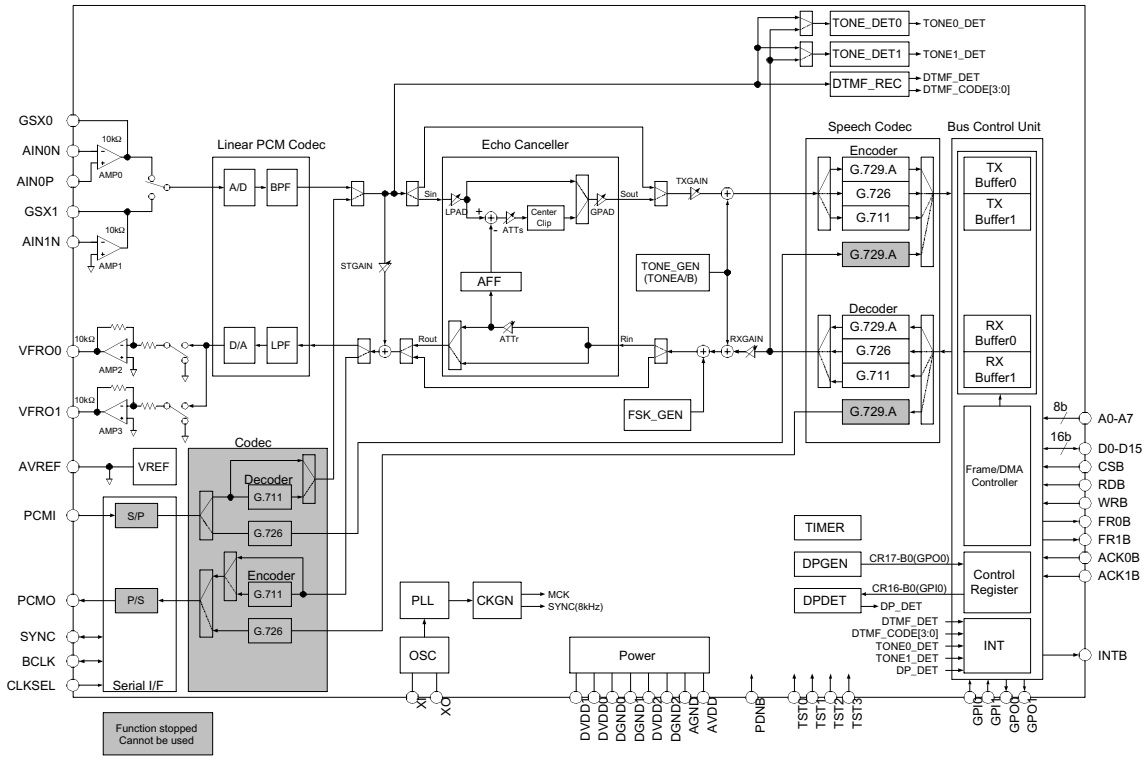
SELECTABLE VOIP ENVIRONMENT CONFIGURATION EXAMPLES

Analog I/F Mode



Example of settings in the initialization mode

· CR15 = 40

· CR11 = 00h (Frame/10 ms/16B/Speech CODEC = G.729.A)

· Various settings

· CR0 = 09h (OPE_STAT = “1”)

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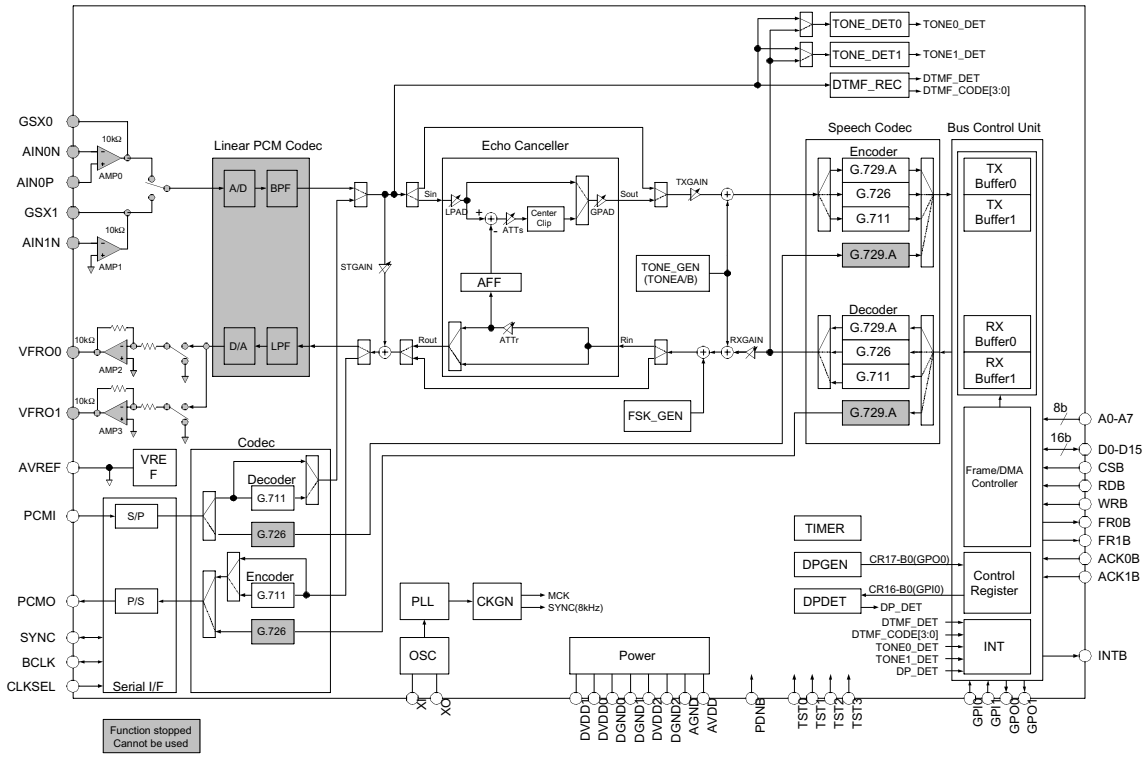
PCM I/F Mode



Examples of settings in the initialization mode

· CR15 = 40

· CR10 = 00h (VFRO1 = AVREF/VFRO0 = AVREF)

· CR11 = 00h (Frame/10 ms/16B/PCMIF = 16-bit linear)

· CR12 = 01h (Speech CODEC = G.729.A/PCMIF_EN = “1”)

· Various settings

· CR0 = 29h (AFE_EN = Power-down/LONG/OPE_STAT = “1”)

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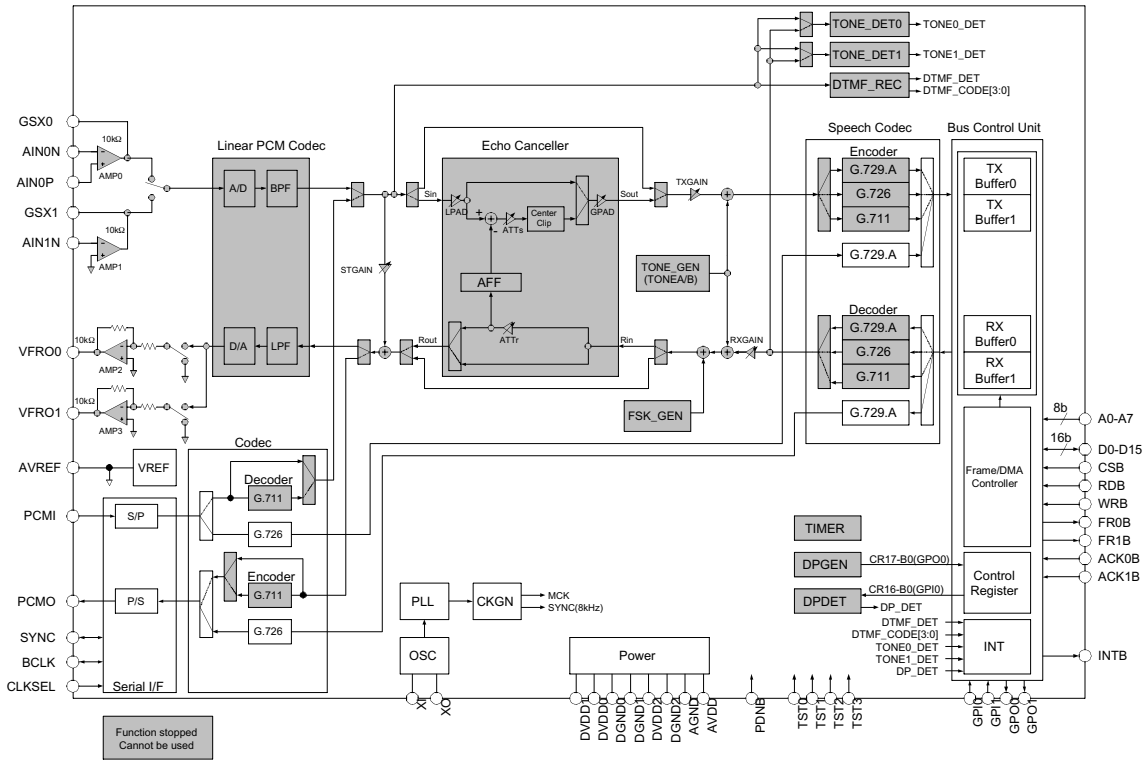
Mutual Conversion of G.729.A to G.726 and Vice-Versa



Examples of settings in the initialization mode

· CR15 = 40

· CR11 = 05h (Frame/10 ms/16B/G.726/TRANS_EN= “1”)

· CR10 = 00h (VFRO1 = AVREF/VFRO0 = AVREF)

· Various settings

· CR0 = 29h (AFE_EN = Power-down/LONG/OPE_STAT = “1”)

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APPLICATION CIRCUIT EXAMPLE

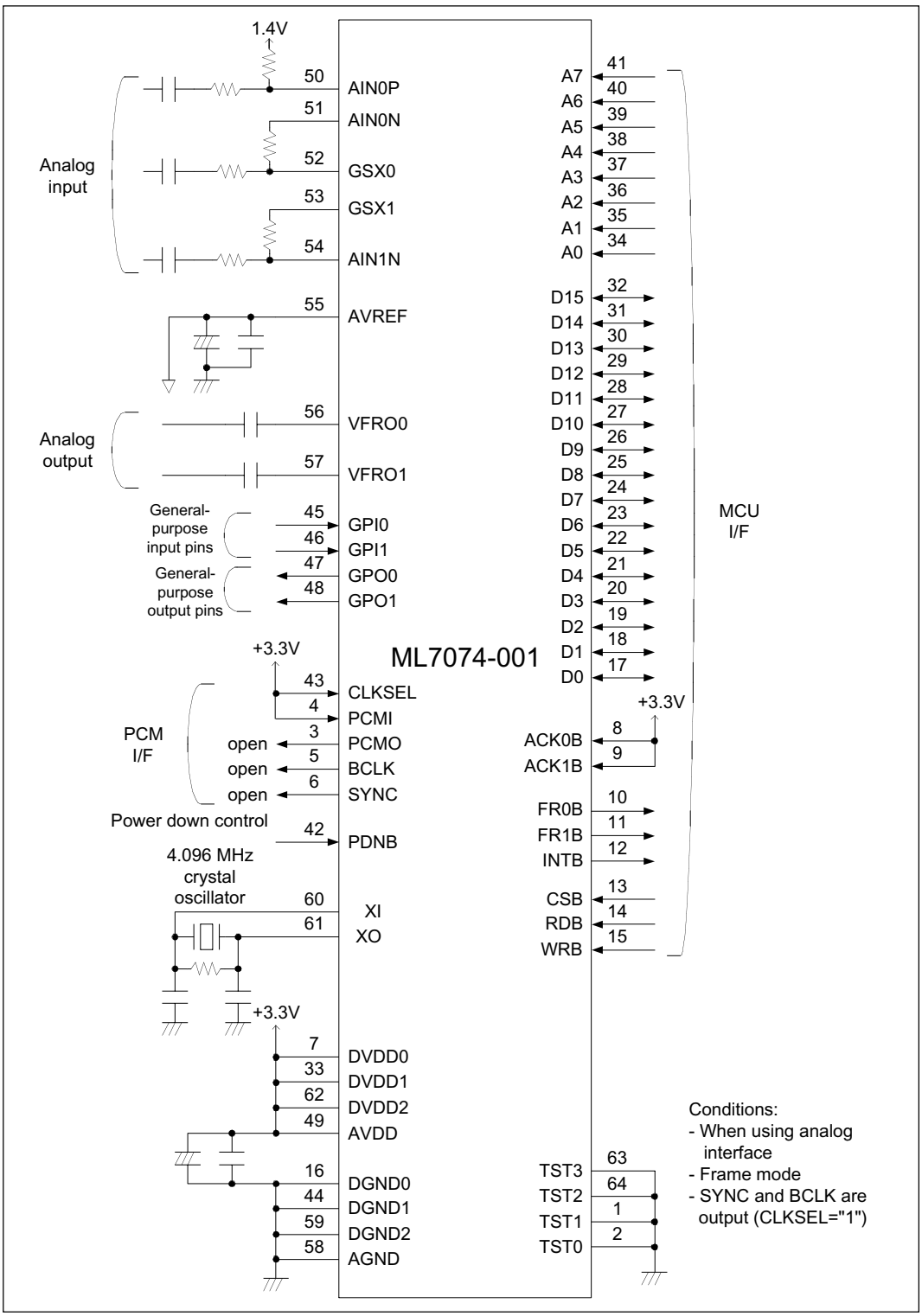

Figure 12 Application Circuit Example

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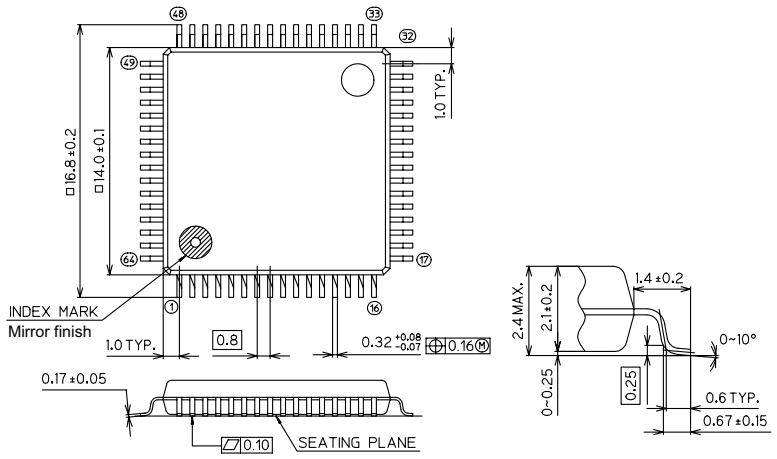
PACKAGE DIMENSIONS

(Unit: mm)

QFP64-P-1414-0.80-BK



Oki Electric Industry Co., Ltd

Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating (≥5µm)
Package weight (g)	0.87 TYP.
Rev. No./Last Revised	6/Feb. 23, 2001

Notes for Mounting the Surface Mount Type Package

The surface mount type packages are very susceptible to heat in reflow mounting and humidity absorbed in storage.
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