NEC

MOS INTEGRATED CIRCUIT

μPD9903

μPD9903 ANALOG SUBSCRIBER LINE LSI (DIGITAL CODEC)

The μPD9903 is a digital CODEC that can be used in analog subscriber circuits such as private branch exchangers (PBXs) and switching equipment for central offices. It features three of the functions required for analog subscriber circuits: 2W/4W conversion, CODEC supervision, and subscriber line supervision.

Use of the μPD9903 in combination with a BS-SLIC (μPC7073) can reduce the number of components required in analog subscriber circuits.

FEATURES

- Single-chip monolithic LSI (CMOS)
- PCM CODEC → oversampling-type A/D and D/A converters
- Programmable functions
  - Termination impedance
  - Hybrid balance network
  - Feed resistance
  - Feed current
  - PAD control
  - A-law and μ-law
- Digital gain set function
- Ring-Trip function
- Single power supply (+5 V)
- Low power consumption during standby mode: 20 mW (TYP.)

ORDERING INFORMATION

Part Number	Package
μPD9903GT	48-pin plastic shrink SOP (375 mil)

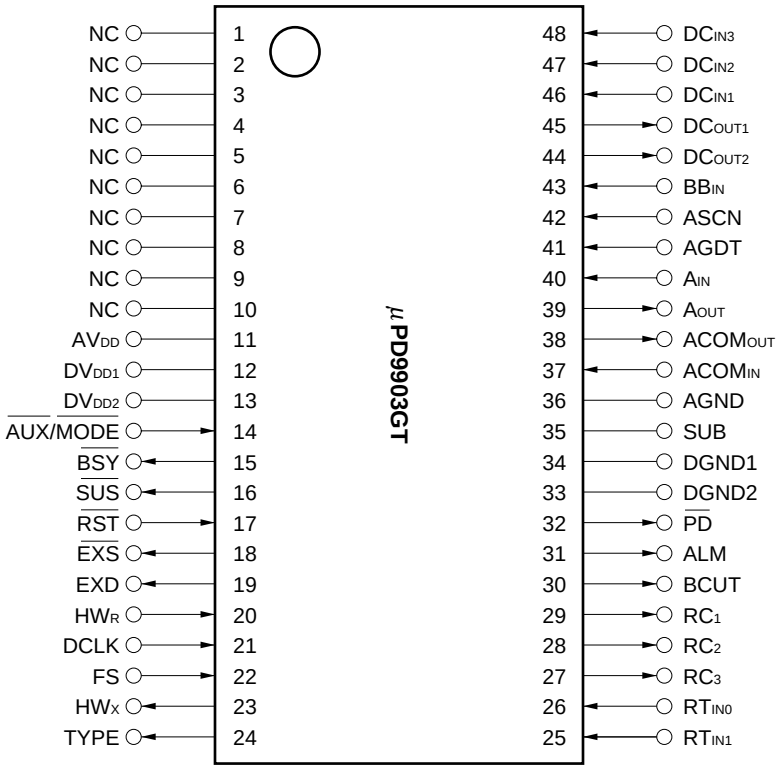
The information in this document is subject to change without notice.

Document No. S10897EJ3V0DS00 (3rd edition)
Date Published June 1997 N
Printed in Japan

The mark ★ shows major revised points.

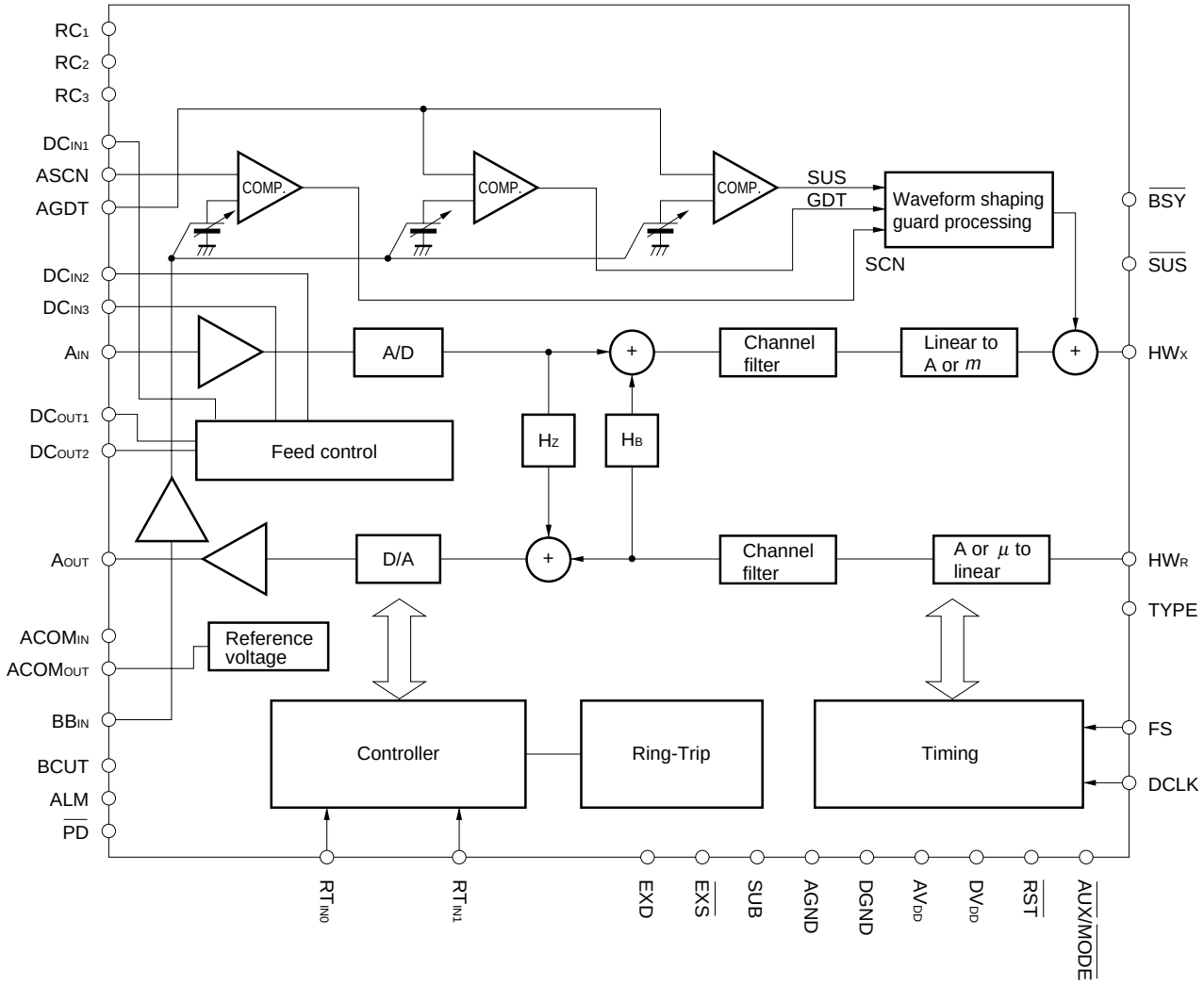
PIN CONFIGURATION (Top View)

48-pin plastic shrink SOP (375 mil)



ACOMIN : ANALOG COMMON VOLTAGE IN
ACOMOUT : ANALOG COMMON VOLTAGE OUT
AGDT : ANALOG GROUND DETECTION SIGNAL IN
AGND : ANALOG GROUND
AIN : ANALOG SIGNAL IN
ALM : ALARM OUT
AOUT : ANALOG SIGNAL OUT
ASCN : ANALOG LOOP DETECTION SIGNAL IN
AUX/MODE : EXTERNAL SIGNAL IN/MODE CONTROL SET
AVDD : ANALOG POSITIVE POWER SUPPLY
BBIN : VBB VOLTAGE INFORMATION IN
BCUT : BATTERY FEED CUT SIGNAL OUT
BSY : BUSY SIGNAL OUT
DCIN1 - DCIN3 : DC FEEDBACK CONTROL IN
DCLK : DATA CLOCK IN
DCOUT1, DCOUT2 : DC FEEDBACK CONTROL OUT
DGND1, DGND2 : DIGITAL GROUND
DVDD1, DVDD2 : DIGITAL POSITIVE POWER SUPPLY
EXD : EXPANSION PORT DATA
EXS : EXPANSION PORT SYNCHRONIZATION
FS : FRAME SYNCHRONOUS CLOCK IN
HWR : RECEIVE HIGHWAY DATA IN
HWX : TRANSMIT HIGHWAY DATA OUT
NC : NO CONNECTION
PD : POWER DOWN CONTROL OUT
RC1 - RC3 : RELAY CONTROL OUT
RST : RESET IN
RTIN0, RTIN1 : RING TRIP SIGNAL IN
SUB : SUB GROUND
SUS : SUSPEND SIGNAL OUT
TYPE : TYPE SIGNAL OUT

BLOCK DIAGRAM



CONTENTS

1. PIN FUNCTIONS

Number	Pin Name	I/O	Function
1-10	NC	–	Leave this pin open.
11	AV_{DD}	–	+5 V power supply (analog)
12	DV_{DD1}	–	+5 V power supply (digital)
13	DV_{DD2}	–	+5 V power supply (digital)
14	$\overline{AUX}/\overline{MODE}$	I	External signaling input
15	$\overline{BSY}$	O	BUSY LED driver output
16	$\overline{SUS}$	O	SUS LED driver output
17	$\overline{RST}$	I	Pin for reset input and power-on reset H: HW_X valid, L: HW_X output's internal F/F clear status
18	$\overline{EXS}$	O	SIPO sync signal output for expansion port **Note 1**
19	EXD	O	SIPO serial data output for expansion port **Note 1**
20	HW_R	I	Reception highway input [PCM data (8-bit) + CTL data (8-bit)]
21	DCLK	I	Clock input (2.048 MHz)
22	FS	I	8-kHz sync input Rising: HW_R PCM data input start Rising: HW_X PCM data output start Falling: HW_R CTL data input start Falling: HW_X SCN data output start
23	HW_X	O	Transmission highway output [PCM data (8-bit) + SCN data (8-bit)]
24	TYPE	O	HW_X data enable
25	RT_{IN1}	I	Ring-Trip signal input 2
26	RT_{IN0}	I	Ring-Trip signal input 1
27	RC_3	O	Relay control for network testing [to the μPC7073's pin 22]
28	RC_2	O	Relay control for line testing [to the μPC7073's pin 21]
29	RC_1	O	Relay control for ringer transmit [to the μPC7073's pin 20]
30	BCUT	O	High and wet control output [to the μPC7073's pin 19]
31	ALM	O	Control output for ground-fault/power line contact protection mode [to the μPC7073's pin 18]
32	$\overline{PD}$	O	Power-down control output [to the μPC7073's pin 17]
33	DGND2	–	Digital ground 2 **Note 2**
34	DGND1	–	Digital ground 1 **Note 2**
35	SUB	–	Substrate ground **Note 2**
36	AGND	–	Analog ground **Note 2**
37	$ACOM_{IN}$	I	Signal ground input **Note 3** [to the μPC7073's pin 11]
38	$ACOM_{OUT}$	O	Signal ground output **Note 3** [to the μPC7073's pin 11]
39	A_{OUT}	O	Analog signal output for receive side [to the μPC7073's pin 10]
40	A_{IN}	I	Analog signal input for transmit side [to the μPC7073's pin 9]
41	AGDT	I	Tip-Ring sum current detection input [to the μPC7073's pin 8]
42	ASCN	I	Tip-Ring difference current detection input [to the μPC7073's pin 7]
43	BB_{IN}	I	V_{BB} voltage information input [to the μPC7073's pin 6]

Notes 1. SIPO: Serial In Parallel Out

2. Short AGND, DGND1, DGND2, and SUB directly under the IC and connect them to an analog ground.

3. Short $ACOM_{IN}$ and $ACOM_{OUT}$ directly under the IC.

Number	Pin Name	I/O	Function
44	DC_{OUT2}	O	DC feedback bias voltage output [to the μPC7073's pin 5]
45	DC_{OUT1}	O	DC feedback control output [to the μPC7073's pin 4]
46	DC_{IN1}	I	DC feedback control input 1 [to the μPC7073's pin 3]
47	DC_{IN2}	I	DC feedback control input 2 [to the μPC7073's pin 2]
48	DC_{IN3}	I	DC feedback control input 3 [to the μPC7073's pin 1]

2. USE CAUTIONS

(1) Combined characteristics of the μPC9903 and μPD7073

- The μPD9903 is designed to be used in combination with the μPC7073. Therefore, the first half of the electrical specifications described below are ratings for the μPD9903 as a discrete unit while the second half are combined ratings with the μPC7073.

- Subscriber circuit constants that are determined by factors such as termination impedance are configured to enable setting by external order parameters. Consequently, input of an order that is not suitable for the target impedance may result in failure to obtain the required characteristics.

(2) Absolute maximum ratings

Application of voltage or current in excess of the absolute maximum ratings may result in damage. Be especially cautious about surges, etc.

(3) Load of by-pass capacitor

Because the μPC7073 and μPD9903 use several internal high-frequency operational amplifiers, high power supply impedance can cause instability in these internal operational amplifiers (such as oscillation). To suppress such instability and eliminate power supply noise, connect by-pass capacitors (C_{ACOM} = approximate 0.1 μF) having superior high frequency characteristics as close as possible to the μPC7073's power supply pins (V_{BB} and V_{CC}) and the μPD9903's power supply pins (AV_{DD} and DV_{DD}).

(4) Addition of ACOM pin connection capacitor

The voltage of the ACOM pin between the μPC7073 and μPD9903 is the reference voltage of the signal source between the μPC9903 and μPC7073. Superposing of noise on this pin may have adverse effects on transmission characteristics. Therefore, make the wires between the ACOM pins of the two LSIs as short as possible, and connect capacitors (C_{ACOM} = approximate 0.1 μF) having superior high frequency characteristics as close as possible to the pins.

3. ELECTRICAL SPECIFICATIONS

3.1 Discrete unit Ratings

Absolute maximum ratings (T_A = +25 °C)

Parameter	Symbol	Conditions	Rating	Units
Power supply voltage	V_{DD}	AV_{DD}, DV_{DD1}, DV_{DD2}	–0.3 to +7.0	V
Analog input voltage	V_{AIN}	A_{IN}, ASCN, AGDT, $ACOM_{IN}$, BB_{IN}, DC_{IN1}, DC_{IN2}, and DC_{IN3} pins	–0.3 to V_{DD} + 0.3	
Digital input voltage	V_{DIN}	HW_R, DCLK, FS, RST, $\overline{AUX}$/$\overline{MODE}$, RT_{IN0}, and RT_{IN1} pins	–0.3 to V_{DD} + 0.3	
Applied voltage to analog output pin	V_{AOUT}	A_{OUT}, DC_{OUT1}, DC_{OUT2}, and $ACOM_{OUT}$ pins	–0.3 to V_{DD} + 0.3	
Applied voltage to digital output pin	V_{DOUT}	HW_X, $\overline{BSY}$, $\overline{SUS}$, RC_1, RC_2, RC_3, $\overline{EXS}$, EXD, BCUT, ALM, $\overline{PD}$, and TYPE pins	–0.3 to V_{DD} + 0.3	
Power dissipation	P_T		500	mW
Ambient operating temperature	T_A		0 to +70	°C
Storage temperature	T_{stg}		–65 to +150	

Caution If the absolute maximum rating for any of the above parameters is exceeded even momentarily, it may adversely affect the quality of this product. In other words, these absolute maximum ratings have been set to prevent physical damage to the product. Do not use the product in such a way as to exceed any of these ratings.

Recommended operating conditions (T_A = 0 to 70 °C, V_{DD} = 5 V ± 5 %, GND = 0 V)

(1) DC conditions

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Ambient operating temperature	T_A		0	25	70	°C
Power supply voltage	V_{DD}		4.75	5.0	5.25	V
Analog input voltage	V_{AI}	ASCN, and AGDT pins	0		V_{DD}	
Analog input driving resistance	R_{LA1}	ASCN, and AGDT pins			20	kΩ
Analog output load resistance	R_{LOAD}	A_{OUT} pin	100			
Analog output load capacitance	C_{LOAD}				100	pF
Low level input voltage	V_{IL1}	FS, DCLK, HW_R, and $\overline{AUX}$/$\overline{MODE}$ pins	0		0.8	V
	V_{IL2}	$\overline{RST}$, RT_{IN0}, and RT_{IN1} pins	0		0.2 × V_{DD}	
High level input voltage	V_{IH1}	FS, DCLK, HW_R, and $\overline{AUX}$/$\overline{MODE}$ pins	2.0		V_{DD}	
	V_{IH2}	$\overline{RST}$, RT_{IN0}, and RT_{IN1} pins	0.8 × V_{DD}		V_{DD}	

(2) AC conditions

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Data clock frequency	f_{DCLK}	(= $1/t_{CY}$) ± 50 ppm		2048		kHz
Data clock pulse width	t_{DCLK}		200			ns
Frame sync clock frequency	f_S	± 50 ppm		8.0		kHz
High level frame sync pulse width	t_{WHS}		$t_{CY} \times 8$			ns
Low level frame sync pulse width	t_{WLS}		$t_{CY} \times 8$			ns
Clock rise time	t_R				30	ns
Clock fall time	t_F				30	ns
Float in sync timing	t_{CSD1}				100	ns
	t_{CSD2}		40			ns
High level width of frame sync clock and data clock	t_{WHSC}		100			ns
HW_R set-up time	t_{DSR}	**Note 1**	65			ns
HW_R hold time	t_{DHR}	**Note 1**	120			ns
Minimum width of reset pulse	PW_{RST}	$\overline{RST}$ pin **Note 2**	10			μs

Notes 1. During timing measurement, use 5 ns as the rise time and fall time for the digital input wave form and clock signal.

2. The μPD9903 is initialized when high level input is applied to the $\overline{RST}$ pin after applying low level input for several clock widths. (However, use of the $\overline{RST}$ pin is not guaranteed during low level input. Also, low level input alone does not initialize the μPD9903.)

DC Characteristics (T_A = 0 to 70 °C, V_{DD} = 5 V ± 0.25 V, V_{DG} = V_{AG} = 0 V, f_{DCLK} = 2048 kHz, all output pins are unloaded)

(1) Current consumption

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Circuit current	I_{DD}	During normal mode		15	21	mA
Power-down circuit current	I_{DDPD}	During power-down mode		46	6	

(2) Digital interface

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Digital input current	I_{ID}	0 ≤ V_{DIN} ≤ V_{DD} for FS, DCLK, HW_R, RT_{IN0}, RT_{IN1}, and $\overline{RST}$ pins	–10		+10	μA
Digital input pull-up current	I_{IL}	V_{DIN} = 0 V for $\overline{AUX}$/$\overline{MODE}$ pin	–50	–7	–0.5	
3-state leakage current	I_L	0 ≤ V_{DIN} ≤ V_{DD} for HW_X pin	–10		+10	
Low level output voltage	V_{OL1}	I_{OL} = 3.4 mA for HW_X pin			0.4	V
	V_{OL2}	I_{OL} = 0.2 mA for RC_1, RC_2, RC_3, BCUT, ALM, $\overline{PD}$, $\overline{EXS}$, and EXD pins			0.4	
	V_{OL3}	I_{OL} = 5 mA for $\overline{BSY}$ and $\overline{SUS}$ pins			1.1	
High level output voltage	V_{OH1}	I_{OH} = –0.6 mA for HW_X and TYPE pins	2.4			
	V_{OH2}	I_{OH} = –2.0 mA for RC_1, RC_2, RC_3, BCUT, ALM, $\overline{PD}$, $\overline{EXS}$, and EXD pins	2.4			
	V_{OH3}	I_{OH} = 0 mA for $\overline{BSY}$ and $\overline{SUS}$ pins	V_{DD} – 0.5			
Output capacitance of digital output pin	C_{OD}	f = 1 MHz, unmeasured pins returned to 0 V			15	pF
Input capacitance of digital input pin	C_{ID}	f = 1 MHz, unmeasured pins returned to 0 V			10	

(3) A_{IN} pin

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Input bias current	I_B	Input voltage:	–10		+10	μA
Input resistance	R_{IN}		1			MΩ
Input capacitance	C_{IN}				10	pF

(4) A_{OUT} pin

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Output offset voltage	V_{OA}	HW_R PCM data: zero PCM code, referenced to V_{ACOM}	–100		+100	mV
Output resistance	R_{OUT}	I/O current: –100 to +100 μA			50	Ω

(5) ASCN and AGDT output pins

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Input bias current	I_B	Input voltage: 0 to V_{DD}	–10		+10	μA
Input resistance	R_{IN}		1			MΩ

(6) ACOMOUT pin

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Output voltage	V_{ACOM}	I/O current: –0.1 to +0.1 mA	2380		2420	mV

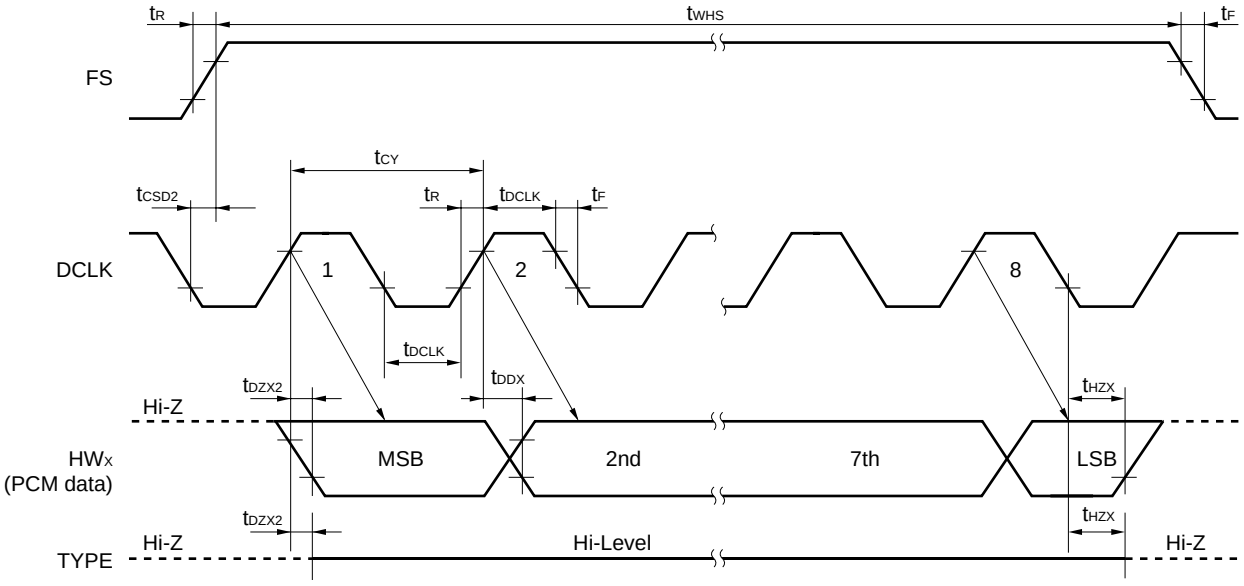
AC characteristics (T_A = 0 to 70 °C, V_{DD} = 5 V ± 0.25 V, V_{DG} = V_{AG} = 0, f_{DCLK} = 2048 kHz)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Data enable delay time	t_{DZX1}	HW_X and TYPE pins, when FS is delayed longer than DCLK			170	ns
	t_{DZX2}	HW_X and TYPE pins, when DCLK is delayed longer than FS			170	ns
Data delay time	t_{DDX}	HW_X pin			180	ns
Data hold time	t_{HZX}	HW_X and TYPE pins	30		200	ns
Delay time to $\overline{EXS}$ falling edge	t_{DEXSf}	$\overline{EXS}$ pin			120	ns
Delay time to $\overline{EXS}$ rising edge	t_{DEXSr}	$\overline{EXS}$ pin			120	ns
EXD data delay time	t_{DEXD}	EXD pin			120	ns
Signaling bit set-up delay time	t_{DSIG}				2	μs
Status bit set-up delay time	t_{DST}				2	μs
LED driver set-up delay time	t_{DLED}	$\overline{BSY}$ and $\overline{SUS}$ pins			2	μs
Delay time to rising edge	t_{THL}				100	ns
Delay time to falling edge	t_{TLH}				100	ns
Transmit delay time to external bit	t_{DAUX}	$\overline{AUX}$ pin			125	μs

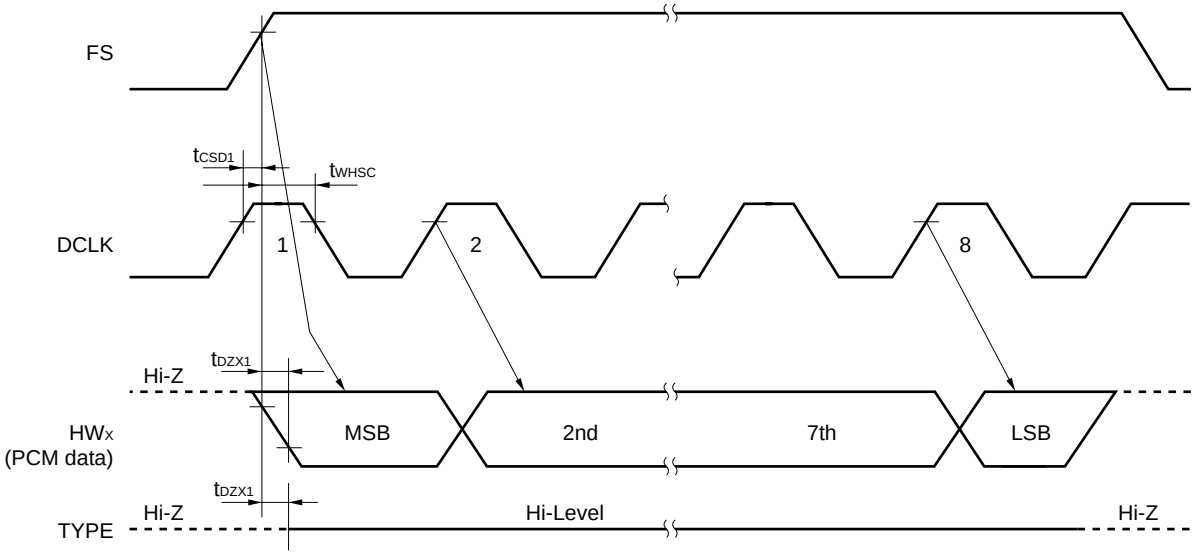
Timing charts

(1) PCM data transmission timing (HWx pin)

(a) DCLK is later than FS

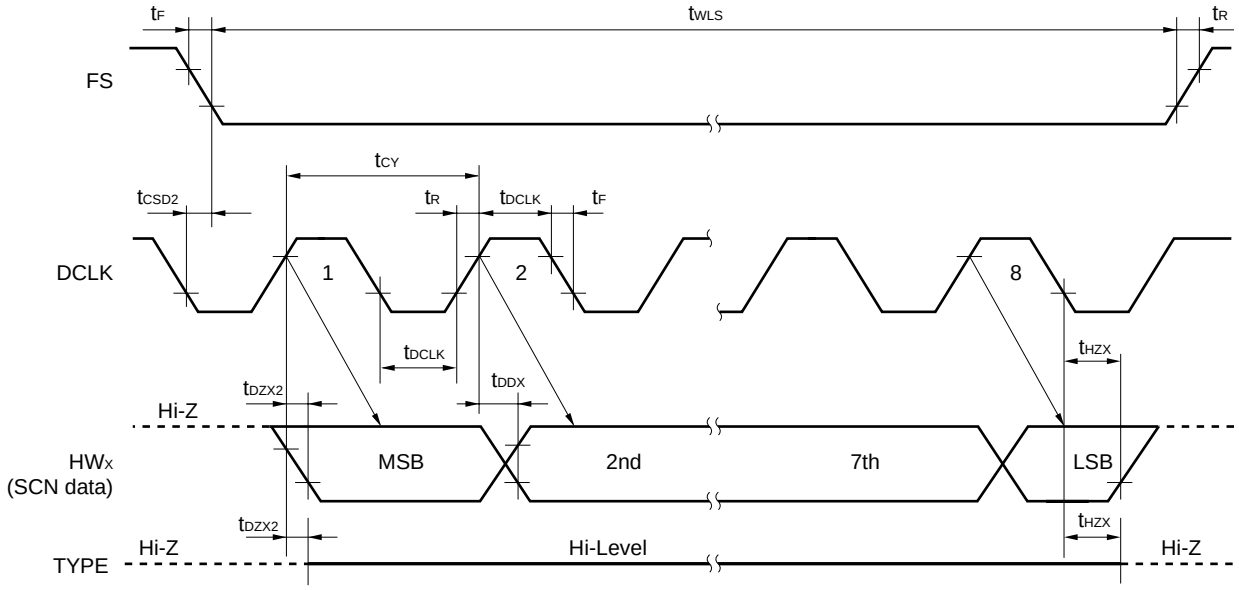


(b) FS is later than DCLK

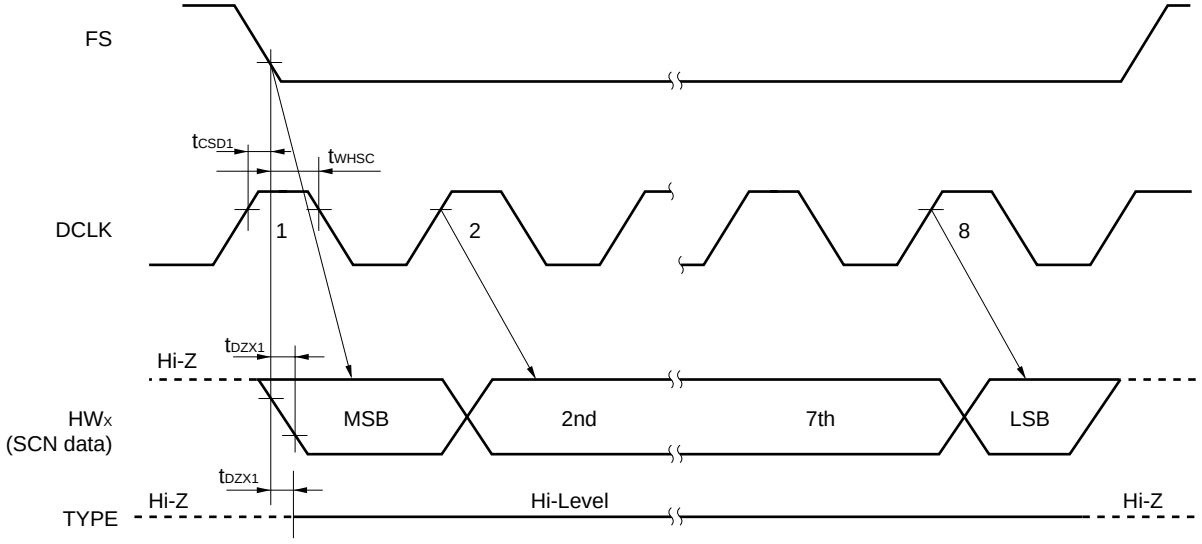


(2) SCN data transmission timing (HWx pin)

(a) DCLK is later than FS

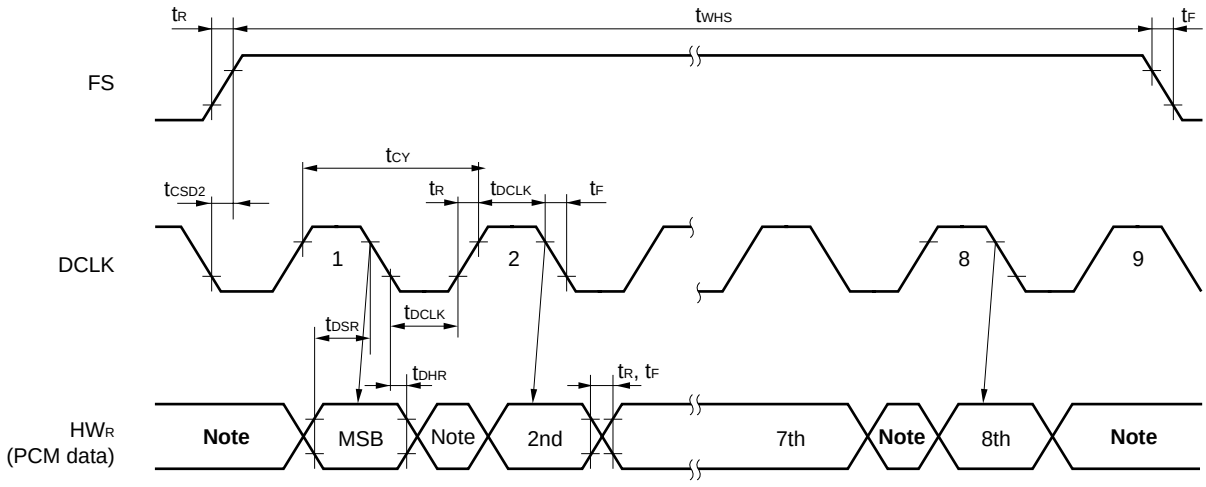


(b) FS is later than DCLK



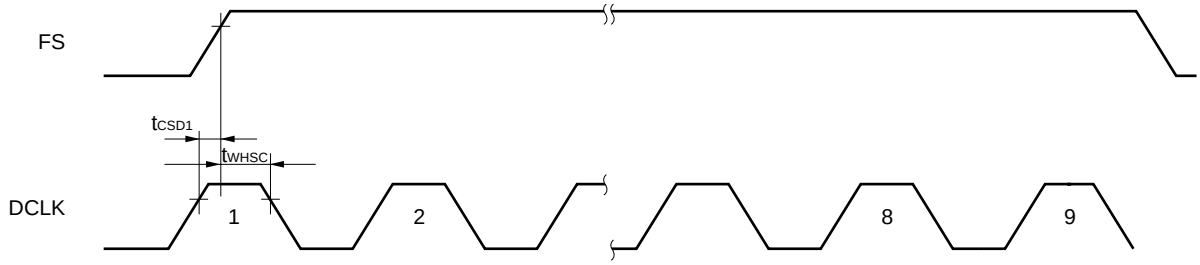
(3) PCM data reception timing (HW_R pin)

(a) DCLK is later than FS



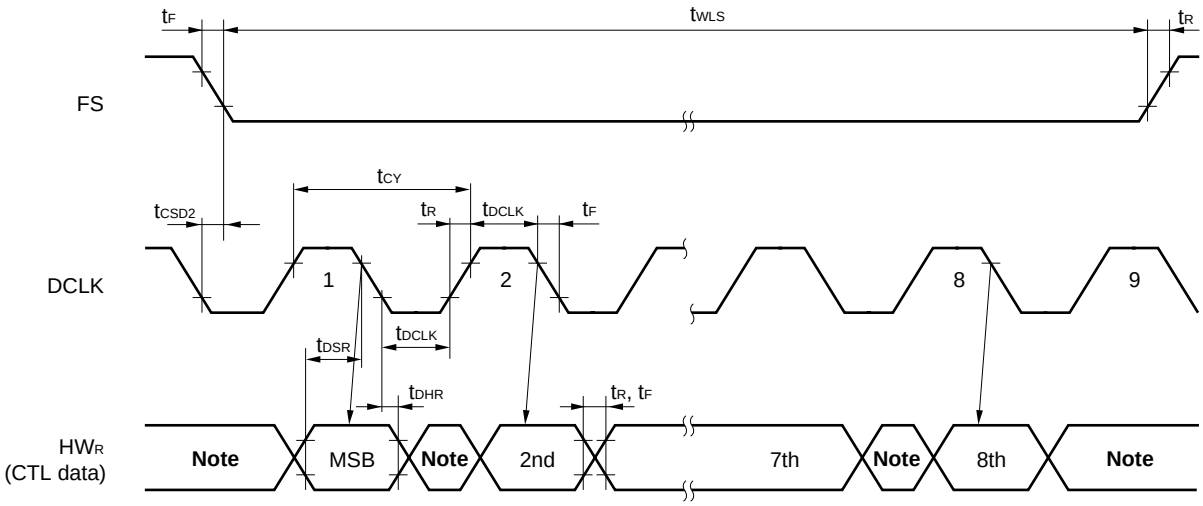
Note Don't care

(b) FS is later than DCLK



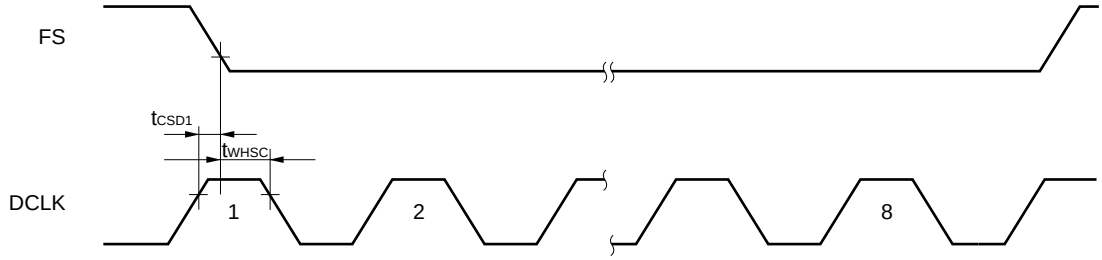
(4) CTL data reception timing (HW_R pin)

(a) DCLK is later than FS



Note Don't care

(b) FS is later than DCLK



3.2 Combined Specifications with the μPC7073

DC characteristics

μPC7073 (V_{BB} = –42 to –58 V, V_{CC} = 5 V ± 0.25 V, T_A = 0 to 70 °C, 18 ≤ I_L ≤ I_{LMAX} (mA))

μPD9903 (T_A = 0 to 70 °C, V_{DD} = 5 V ± 0.25 V, V_{DG} = V_{AG} = 0 V, f_{DCLK} = 2048 kHz)

Parameter	Symbol	Conditions		MIN.	TYP.	MAX.	Units
DC feed resistance	R_{BF}	200 Ω feed		180	200	220	Ω
		400 Ω feed		360	400	440	
Minimum loop current	I_{LMIN}	V_{BB} = –51 V	200 Ω feed	21.7	22.2	22.6	mA
		R_L = 1900 Ω	400 Ω feed	18.2	18.8	19.3	
Maximum current setting value	I_{LMAX}	I_{LMAX} = 76 mA setting	200 Ω feed	70	76	82	mA
			400 Ω feed	50	55	60	
		I_{LMAX} = 45 mA setting		40	45	50	
		I_{LMAX} = 35 mA setting		31	35	39	
Pin voltage during on-hook	V_{TS}	Normal on-hook, between Tip and GND, V_{BB} = –48 V		2.25	2.55	2.85	V
	V_{RS}	Normal on-hook, between Ring and V_{BB}, V_{BB} = –48 V		3.05	3.35	3.65	
	V_{TS}	On-hook transmission, between Tip and GND, V_{BB} = –48 V		2.25	2.55	2.85	
	V_{RS}	On-hook transmission, between Ring and V_{BB}, V_{BB} = –48 V		3.05	3.35	3.65	
Voltage between lines during on-hook	V_{TS}	V_{BB} = –48 V		V_{BB} – 7.0	V_{BB} – 5.9	V_{BB} – 5.0	V
Supervisory control – V_{BB} abnormal voltage	V_{BBF}			32	35	38	V

Parameter[Note]	Symbol	Conditions		MIN.	TYP.	MAX.	Units
Loop detection operating resistance (during normal transmission)	R_{ON1}	Includes termination resistance	200 Ω feed 400 Ω feed			2500 2100	Ω
Loop detection non-operating resistance (during normal transmission)			200 Ω feed 400 Ω feed	3900 3500			
Loop detection operating resistance (during on hook transmission)	R_{ON2}	Includes termination resistance	200 Ω feed 400 Ω feed			1900 1500	Ω
Loop detection non-operating resistance (during on hook transmission)			200 Ω feed 400 Ω feed	2840 2440			
Loop release non-operating resistance	R_{ON3}	Includes termination resistance	200 Ω feed 400 Ω feed			2960 2560	Ω
Loop release operating resistance			200 Ω feed 400 Ω feed	4540 4140			
Ground detection 1 (C/O) operating resistance	R_{ON4}	Includes termination resistance				5.2	kΩ
Ground detection 1 (C/O) non-operating resistance				20			
Ground-fault/power line contact detection operating resistance	R_{ON6}	Includes termination resistance Off-hook state	I_{LMAX} = 45/76 mA			340	Ω
			I_{LMAX} = 35 mA			480	
Ground-fault/power line contact detection non-operating resistance		Includes termination resistance	I_{LMAX} = 45/76 mA	870			Ω
			I_{LMAX} = 35 mA	1130			
Ground-fault/power line contact release non-operating resistance	R_{ON7}	Includes termination resistance				1.4	kΩ
Ground-fault/power line contact release operating resistance				10			

Note The above values are resistance-converted values.

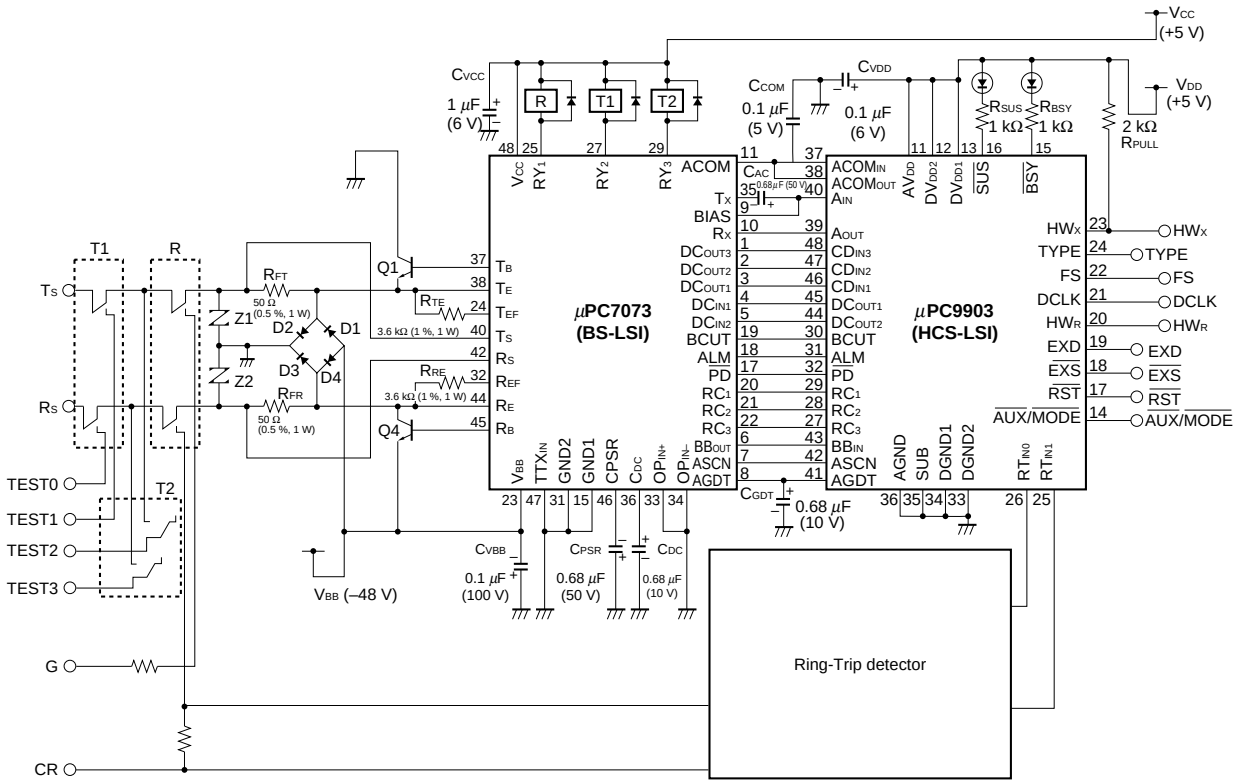
Transmission characteristics

μPC7073 (V_{BB} = –42 to –58 V, V_{CC} = 5 V ± 0.25 V, T_A = 0 to 70 °C, 18 ≤ I_L ≤ I_{LMAX} (mA))

μPD9903 (T_A = 0 to 70 °C, V_{DD} = 5 V ± 0.25 V, V_{DG}= V_{AG} = 0 V, f_{DCLK} = 2048 kHz)

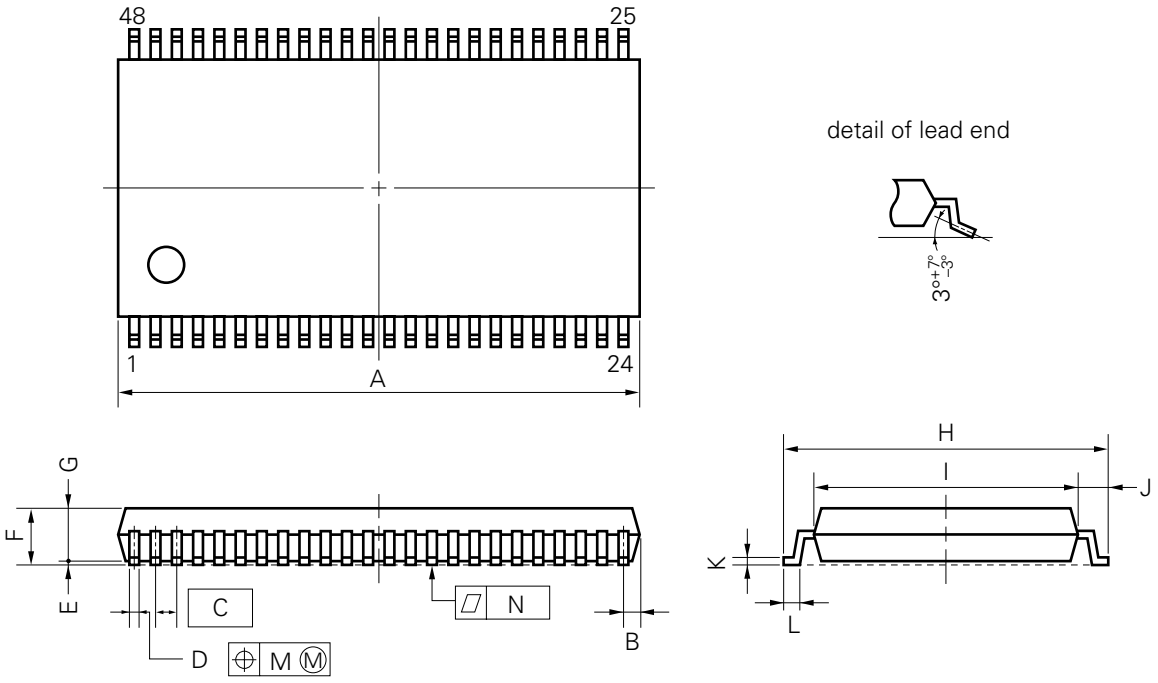
Parameter	Symbol	Conditions		MIN.	TYP.	MAX.	Units
Insertion loss	IL	A-D input signal 0 dBm0 1 kHz		–0.45	0.0	+0.45	dB
		D-A input signal 0 dBm0 1 kHz		–0.45	0.0	+0.45	
Transfer loss frequency characteristics	F_{RX}	A-D Reference input signal 1015 Hz 0 dBm0	60 Hz 200 Hz 300 Hz 400 to 3000 Hz 3200 Hz 3400 Hz	24.0 0.6 –0.15 –0.15 –0.15 0.2		– 2.0 +0.21 +0.15 +0.65 0.8	dB
	F_{RR}	D-A Reference input signal 1015 Hz 0 dBm0	60 Hz 200 Hz 300 Hz 400 to 3000 Hz 3200 Hz 3400 Hz	0.2 0.1 –0.15 –0.15 –0.15 0.2		4.0 1.0 +0.25 +0.15 +0.65 0.8	
Gain tracking (tone method)	GT_X	A-D Reference input signal –10 dBm0 f = 700 to 1100 Hz	+3 to –40 dBm0 –50 dBm0 –55 dBm0	–0.2 –0.5 –1.0		+0.2 +0.5 +1.0	dB
	GT_R	D-A Reference input signal –10 dBm0 f = 700 to 1100 Hz	+3 to –40 dBm0 –50 dBm0 –55 dBm0	–0.2 –0.4 –0.8		+0.2 +0.4 +0.8	
Return loss	RL	Input signal 0 dBm0 Z_T = 600 Ω + 2.16 μF	300 Hz 500 to 2000 Hz 2000 to 3400 Hz	16 20 16			dB
Echo attenuation	TBRL	Input signal 0 dBm0 Z_T = 600 Ω + 2.16 μF	300 Hz 500 to 2500 Hz 3400 Hz	18 22 18			dB
Transmit channel total power distortion factor (tone method)	SD_X	A-D Input signal f = 700 to 1100 Hz	+3 to –30 dBm0 –40 dBm0 –45 dBm0	36 30 25			dB
	SD_R	D-A Input signal f = 700 to 1100 Hz	+3 to –30 dBm0 –40 dBm0 –45 dBm0	36 30 25			

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Units
Absolute delay characteristics	D_A	A-A Input signal 0 dBm0			540	μs
Absolute delay distortion frequency characteristics	D_O	A-A 500 Hz 600 HZ 1000 to 2600 Hz 2800 Hz			1400 700 200 1400	
Intermodulation (2 Tone)	IMD	A-D Input signal f1, f2: 300 to 3400 Hz –4 to –21 dBm0 Measurement signal: 2 × f1 – f2 level (2 × f1 – f2) vs level (f1, f2)	44.0			dB
		D-A Input signal f1, f2: 300 to 3400 Hz –4 to –21 dBm0 Measurement signal: 2 × f1 – f2 level (2 × f1 – f2) vs level (f1, f2)	44.0			
Single frequency noise	N_{SF}	D-A PAD level set at 0 dB Measurement signal up to f = 256 kHz			–54	dBm0
Deviation in gain setting for transmission channel	ΔDGS_X	A-D Difference from reference set value Setting value: +7.5 to +3.0 dB +3.0 to –3.5 dB	 –0.2 –0.1		 +0.2 +0.1	dB
Deviation in gain setting for reception chanel	ΔDGS_R	D-A Difference from reference set value Setting value: 0.0 to –5.0 dB –5.0 to –8.5 dB	 –0.1 –0.2		 +0.1 +0.2	
Idle circuit noise	IDN_{24}	2W-4W A-law Psophometric weighted			–67	dBm0p
		2W-4W μ-law C message weighted			23	dBrnc0
	IDN_{42}	4W-2W A-law Psophometric weighted			–76	dBm0p
		4W-2W μ-law C message weighted			14	dBrnc0
Line to ground balance attenuation	LCL	R_F = 50 Ω f = 300 to 600 Hz Relative accuracy = 0.5 % f = 600 to 3400 Hz	42 48			dB
AC induction noise resistance	LFI	I_L = 0 mA V_{IN} = 6 V_{rms}			43	dBrnc
		I_L = 20 mA V_{IN} = 15 V_{rms}			20	



5. PACKAGE DRAWING

48 PIN PLASTIC SHRINK SOP (375 mil)



P48GT-65-375B-1

NOTE

Each lead centerline is located within 0.10 mm (0.004 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	16.21 MAX.	0.639 MAX.
B	0.63 MAX.	0.025 MAX.
C	0.65 (T.P.)	0.026 (T.P.)
D	0.30±0.10	$0.012^{+0.004}_{-0.005}$
E	0.125±0.075	0.005±0.003
F	2.0 MAX.	0.079 MAX.
G	1.7±0.1	0.067±0.004
H	10.0±0.3	$0.394^{+0.012}_{-0.013}$
I	8.0±0.2	0.315±0.008
J	1.0±0.2	$0.039^{+0.009}_{-0.008}$
K	$0.15^{+0.10}_{-0.05}$	$0.006^{+0.004}_{-0.002}$
L	0.5±0.2	$0.020^{+0.008}_{-0.009}$
M	0.10	0.004
N	0.10	0.004

6. RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the conditions recommended below.

For details of recommended soldering conditions, refer to the information document **Semiconductor Device Mounting Technology Manual (C10535E)**.

For soldering methods and conditions other than those recommended, please contact your NEC sales representative.

SURFACE MOUNT TYPE

μPC9903GT: 48-pin plastic shrink SOP (375 mil)

Soldering Method	Soldering Conditions	Recommended Condition Symbol
★ Infrared ray reflow	Package peak temperature: 235 ˚C Reflow time: 30 sec. max. (210 ˚C or above) Number of times: 1 time	IR35-00-1
Partial heating method	Pin temperature: 300 ˚C max. Heat time: 3 sec. max. (per each side of the device)	–

[MEMO]

[MEMO]

[MEMO]

NOTES FOR CMOS DEVICES

① PRECAUTION AGAINST ESD FOR SEMICONDUCTORS

Note: Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

② HANDLING OF UNUSED INPUT PINS FOR CMOS

Note: No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

③ STATUS BEFORE INITIALIZATION OF MOS DEVICES

Note: Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.

[MEMO]

The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

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