
MSM7557

Single Chip MSK Modem with Compandor for Cordless Telephone

GENERAL DESCRIPTION

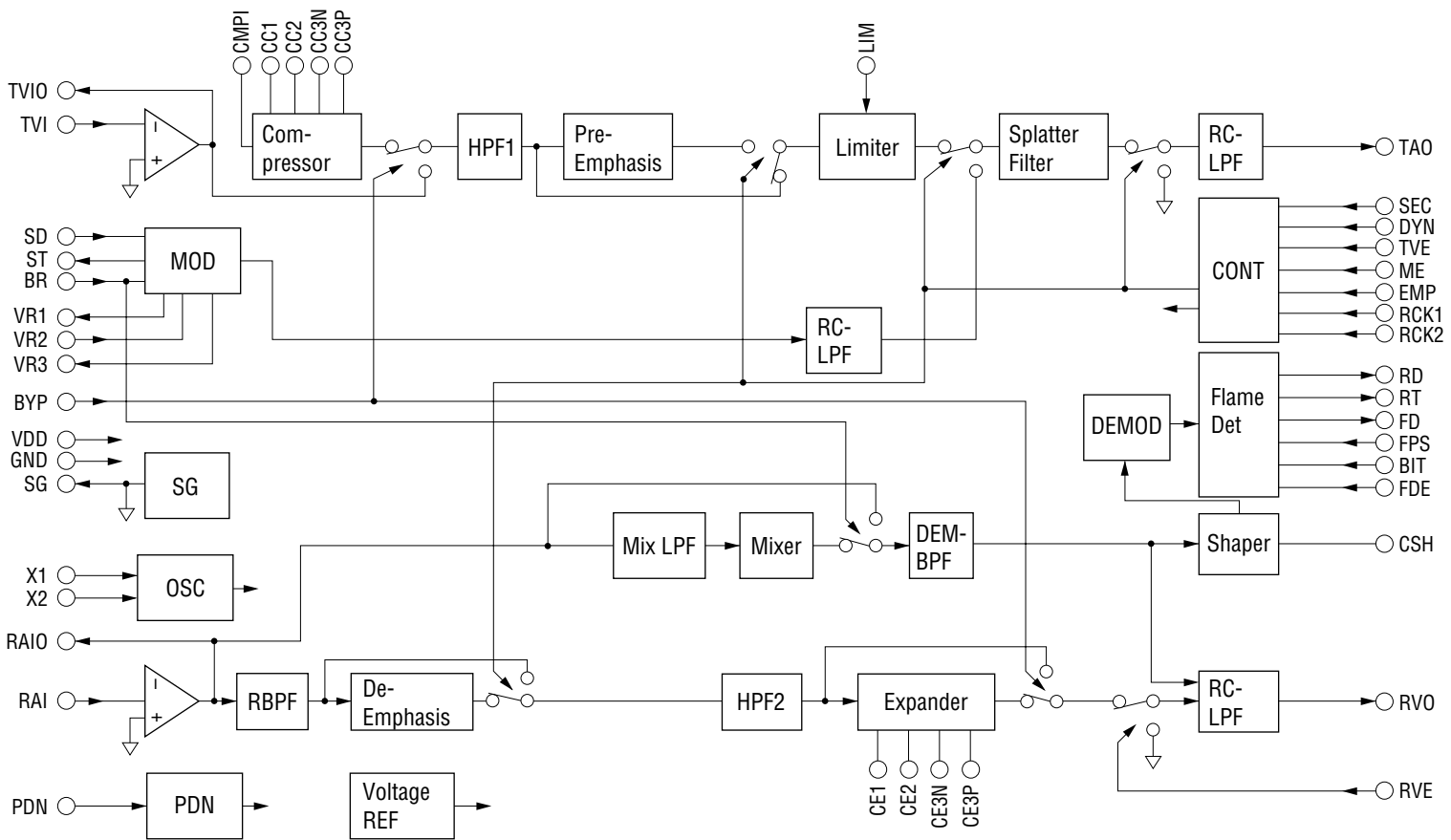
The MSM7557 is a single chip MSK modem with base band voice processor for cordless telephone. The MSM7557 voice transmit block consists of high pass filter, compressor, pre-emphasis, limiter and splatter filter.

Voice receive block consists of Band pass filter, De-emphasis and Expander.

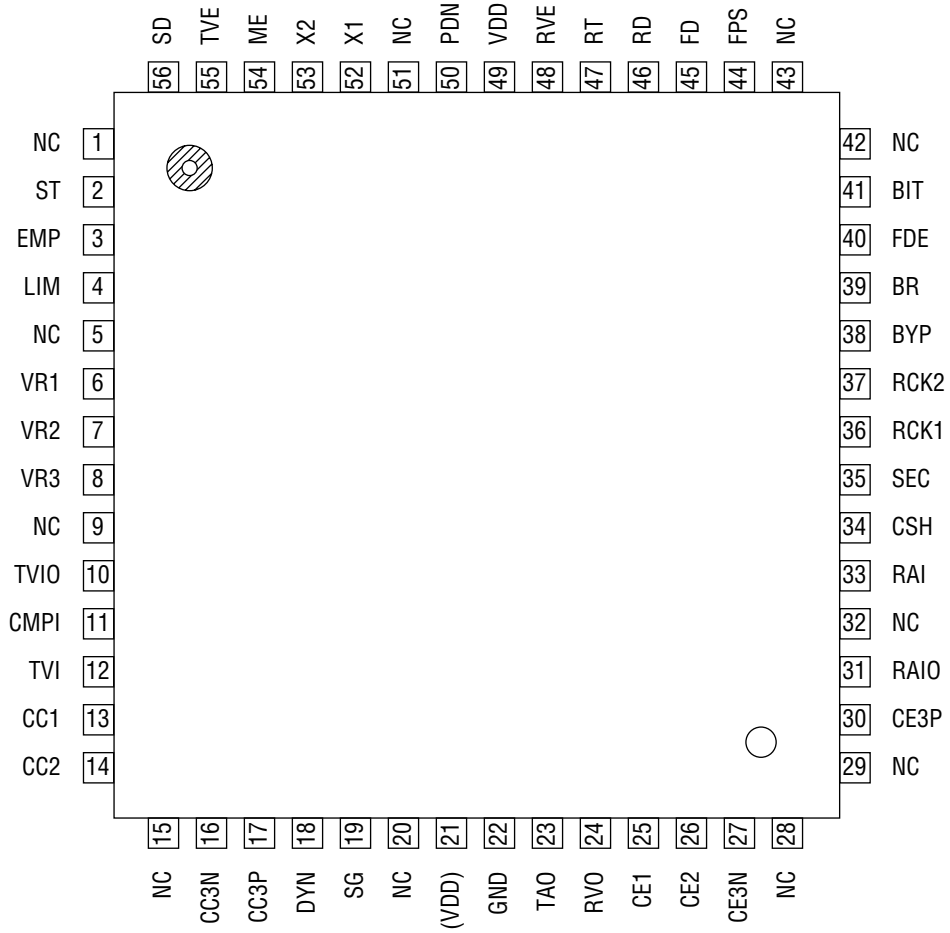
FEATURES

- Available to transmit modem signal and also transmit base band voice signal through wireless transmission path (0.3 kHz to 3.4 kHz)
- Built-in compandor circuit
- Upper limit of voice band (3306 Hz/3400 Hz/3500 Hz) is selectable
- Modem bit rate (2400/1200 bps) is selectable
- Transmit function and receive function operate separately
- Emphasis mode selectable
- Built-in bit synchronous detector and frame synchronous detector
- Built-in limiter level generator and external limit voltage input
- Dynamic range selectable
- Built-in crystal oscillator circuit
- Wide range power supply voltage (2.7V ~ 5.5V)
- Package :
56-pin plastic QFP (QFP56-P-910-0.65-2K) (Product name : MSM7557GS-2K)

BLOCK DIAGRAM

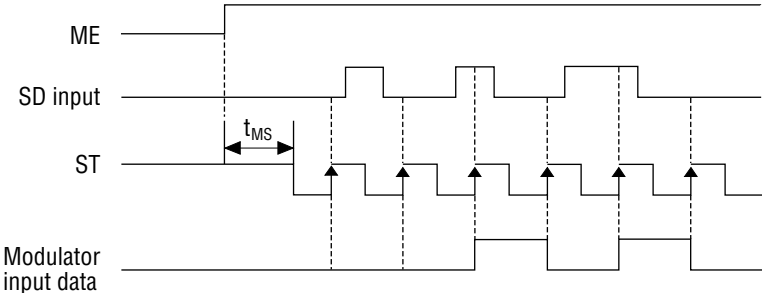


PIN CONFIGURATION (TOP VIEW)

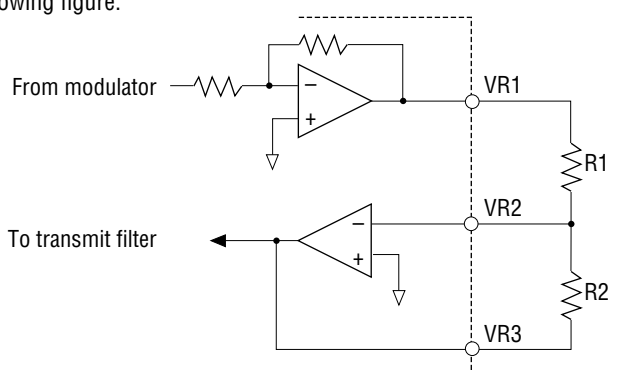
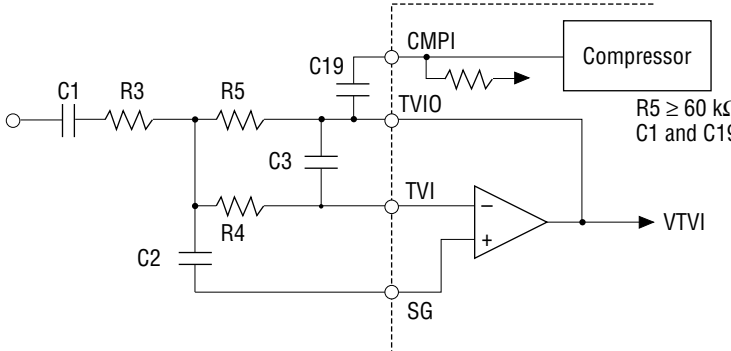


Notes: The pin 49 should be used for V_{DD}.
 The pin 21 should be connected to V_{DD} or opened.
 NC : No connect pin

PIN DESCRIPTION

Name	Description									
SD	<p>Transmit data input. The data on SD pin are took into MSK modulator and the data are available on the positive edge of ST.</p>  <p>In order to synchronize a receive modem, more than 18bits bit-synchronous signal should be transmitted before data transmission. If S/N ratio of the receive signal is always good, more than 11bits bit-synchronous signal synchronizes the receiver.</p>									
ST	<p>Transmit data timing clock output. When digital "0" is put on ME pin, ST is fixed to digital "1" level.</p>									
EMP	<p>Emphasis path selection.</p> <table border="1" data-bbox="264 1016 1199 1201"> <thead> <tr> <th data-bbox="264 1016 367 1047">EMP</th> <th data-bbox="374 1016 793 1047">Transmit side</th> <th data-bbox="799 1016 1199 1047">Receive side</th> </tr> </thead> <tbody> <tr> <td data-bbox="264 1056 367 1124">0</td> <td data-bbox="374 1056 793 1124">Pre-emphasis circuit is bypassed to the path</td> <td data-bbox="799 1056 1199 1124">De-emphasis circuit is bypassed to the path</td> </tr> <tr> <td data-bbox="264 1134 367 1201">1</td> <td data-bbox="374 1134 793 1201">Pre-emphasis circuit is connected to the path</td> <td data-bbox="799 1134 1199 1201">De-emphasis circuit is connected to the path</td> </tr> </tbody> </table>	EMP	Transmit side	Receive side	0	Pre-emphasis circuit is bypassed to the path	De-emphasis circuit is bypassed to the path	1	Pre-emphasis circuit is connected to the path	De-emphasis circuit is connected to the path
EMP	Transmit side	Receive side								
0	Pre-emphasis circuit is bypassed to the path	De-emphasis circuit is bypassed to the path								
1	Pre-emphasis circuit is connected to the path	De-emphasis circuit is connected to the path								
LIM	<p>Deviation limiter control. Voice signal maximum Rf modulation level is controlled by connecting external reference voltage to this pin. Input impedance of this pin is about 200 kΩ. When this pin is left open, internal reference voltage is used as the clamp level. Internal clamp level is as follows.</p> <table border="1" data-bbox="264 1479 1199 1595"> <thead> <tr> <th data-bbox="264 1479 367 1510">DYN</th> <th data-bbox="374 1479 793 1510">Internal clamp level</th> <th data-bbox="799 1479 1199 1510">Limiter level</th> </tr> </thead> <tbody> <tr> <td data-bbox="264 1520 367 1551">0</td> <td data-bbox="374 1520 793 1551">0.50 V</td> <td data-bbox="799 1520 1199 1551">-9 dBV</td> </tr> <tr> <td data-bbox="264 1561 367 1591">1</td> <td data-bbox="374 1561 793 1591">1.26 V</td> <td data-bbox="799 1561 1199 1591">-1 dBV</td> </tr> </tbody> </table> <p>This internal clamp level is made by internal reference voltage which is unrelated with V_{DD}. Negative clamp level is made by internal operational amplifier and the voltage is reversed at VSG.</p>	DYN	Internal clamp level	Limiter level	0	0.50 V	-9 dBV	1	1.26 V	-1 dBV
DYN	Internal clamp level	Limiter level								
0	0.50 V	-9 dBV								
1	1.26 V	-1 dBV								

(Continued)

Name	Description
VR1 VR2 VR3	<p>Modulator output level control. Refer to the following figure.</p>  <p style="text-align: right;"> $R1 \geq 40 \text{ k}\Omega$ $R2 \geq 40 \text{ k}\Omega$ $R1 \geq R2$ </p> <p> $V_{TA0} = 20 \times \log (R2/R1) - 9 \text{ dBV (DYN = "0")}$ $V_{TA0} = 20 \times \log (R2/R1) - 1 \text{ dBV (DYN = "1")}$ This level is made from internal voltage reference, so this level doesn't depend on power supply voltage. </p>
TVIO TVI	<p>Transmit side RC active filter input (TVI) and output (TVIO). If over 50 kHz frequency element is in the input signal, folding noise is generated from internal SCF circuit, so second order RC-active filter is needed. ($f_c = 10 \text{ kHz}$)</p>  <p style="text-align: right;"> $R5 \geq 60 \text{ k}\Omega$ C1 and C19 are used for DC cut. </p> <p style="text-align: center;"> (Example of $f_c = 10 \text{ kHz}$ and 0 dB gain $R3 = R4 = R5 = 68 \text{ k}\Omega$ $C1 = 0.22 \text{ }\mu\text{F}$, $C2 = 510 \text{ pF}$, $C3 = 110 \text{ pF}$) </p> <p>When digital "1" is applied to TVE pin, transmit voice signal comes out to TA0.</p>
CC1	Capacitor connection pins to remove for DC offset of the compressor.
CC2	A 1 μF capacitor between SG pin and each pin should be connected.
CC3N CC3P	Capacitor connection pins for the compressor attack and recovery time. When DYN is digital "0" level, a 0.22 μF capacitor should be connected between CC3N and CC3P. And when DYN is digital "1" level, a 0.47 μF capacitor should be connected between them.

(Continued)

Name	Description												
CMPI	Compressor circuit input. A 0.47 μ F capacitor should be connected between CMPI and TVIO.												
DYN	Dynamic range control input. For an application of which V_{DD} is always higher than 4.5 V (Base station), by setting DYN = "1", modem transmit carrier level, typical input signal level, limiter clamp level and compandor standard input level are up about 8dB to improve S/N ratio. For an application of which V_{DD} is lower than 4.5 V (Hand-set) DYN shall be digital "0". To make easier interface with the RF part, one solution is to put digital "0" on DYN pin for both Base station and Handset.												
SG	Built-in analog signal ground. The DC voltage is half of V_{DD} . To make this voltage source impedance lower and to ensure the device performance, it is necessary to put a bypass capacitor of more than 1 μ F between SG and V_{DD} in close physical proximity to the device.												
GND	Ground pin, (0V).												
TAO	<p>Transmit analog signal output. According to control data on ME and TVE, TAO is set as follows.</p> <table border="1" data-bbox="364 904 1109 1062"> <thead> <tr> <th data-bbox="364 904 502 942">ME</th> <th data-bbox="502 904 655 942">TVE</th> <th data-bbox="655 904 1109 942">TAO</th> </tr> </thead> <tbody> <tr> <td data-bbox="364 942 502 981">0</td> <td data-bbox="502 942 655 981">0</td> <td data-bbox="655 942 1109 981">No signal output (potential = SG)</td> </tr> <tr> <td data-bbox="364 981 502 1020">0</td> <td data-bbox="502 981 655 1020">1</td> <td data-bbox="655 981 1109 1020">Voice signal output</td> </tr> <tr> <td data-bbox="364 1020 502 1058">1</td> <td data-bbox="502 1020 655 1058">X</td> <td data-bbox="655 1020 1109 1058">MSK modulator output</td> </tr> </tbody> </table> <p style="text-align: right; margin-right: 50px;">X : Don't care</p>	ME	TVE	TAO	0	0	No signal output (potential = SG)	0	1	Voice signal output	1	X	MSK modulator output
ME	TVE	TAO											
0	0	No signal output (potential = SG)											
0	1	Voice signal output											
1	X	MSK modulator output											
RVO	<p>Receive voice signal output. RVO pin state is defined by RVE control.</p> <table border="1" data-bbox="364 1213 875 1333"> <thead> <tr> <th data-bbox="364 1213 502 1251">RVE</th> <th data-bbox="502 1213 875 1251">RVO</th> </tr> </thead> <tbody> <tr> <td data-bbox="364 1251 502 1290">0</td> <td data-bbox="502 1251 875 1290">Output disable (potential = SG)</td> </tr> <tr> <td data-bbox="364 1290 502 1329">1</td> <td data-bbox="502 1290 875 1329">Output enable</td> </tr> </tbody> </table>	RVE	RVO	0	Output disable (potential = SG)	1	Output enable						
RVE	RVO												
0	Output disable (potential = SG)												
1	Output enable												
CE1 CE2	Capacitor connection pins to remove DC offset of the expander. A 1 μ F capacitor between SG pin and each pin should be connected.												
CE3N CE3P	Capacitor connection pins for the expander attack time and recovery time. When DYN is digital "0" level, a 0.22 μ F capacitor should be connected between CE3N and CE3P. And when DYN is digital "1" level, a 0.47 μ F capacitor should be connected between them.												
RAIO RAI	Receive side amplifier input (RAI) and output (RAIO). Second order RC-active filter is needed like TVIO and TVI. Refer to TVIO and TVI pin description.												
CSH	Capacitor connection pin to remove DC offset of the modem shaper circuit. A 1 μ F capacitor should be connected between GND pin and CSH.												

(Continued)

Name	Function														
SEC	Device test input. SEC shall be connected to GND.														
RCK1 RCK2	Voice band select. <table border="1" data-bbox="381 455 1074 610"> <thead> <tr> <th data-bbox="381 455 518 492">RCK1</th> <th data-bbox="522 455 677 492">RCK2</th> <th data-bbox="681 455 1074 492">Upper Limit of Voice Band</th> </tr> </thead> <tbody> <tr> <td data-bbox="381 498 518 535">0</td> <td data-bbox="522 498 677 535">1</td> <td data-bbox="681 498 1074 535">3306 Hz</td> </tr> <tr> <td data-bbox="381 540 518 577">X</td> <td data-bbox="522 540 677 577">0</td> <td data-bbox="681 540 1074 577">3400 Hz</td> </tr> <tr> <td data-bbox="381 583 518 620">1</td> <td data-bbox="522 583 677 620">1</td> <td data-bbox="681 583 1074 620">3500 Hz</td> </tr> </tbody> </table>			RCK1	RCK2	Upper Limit of Voice Band	0	1	3306 Hz	X	0	3400 Hz	1	1	3500 Hz
RCK1	RCK2	Upper Limit of Voice Band													
0	1	3306 Hz													
X	0	3400 Hz													
1	1	3500 Hz													
BYP	Compandor path selection. <table border="1" data-bbox="293 678 1192 799"> <thead> <tr> <th data-bbox="293 678 403 714">BYP</th> <th data-bbox="407 678 814 714">Transmit side</th> <th data-bbox="819 678 1192 714">Receive side</th> </tr> </thead> <tbody> <tr> <td data-bbox="293 720 403 757">0</td> <td data-bbox="407 720 814 757">Compressor is connected to the path.</td> <td data-bbox="819 720 1192 757">Expander is connected to the path.</td> </tr> <tr> <td data-bbox="293 763 403 799">1</td> <td data-bbox="407 763 814 799">Compressor is bypassed to the path.</td> <td data-bbox="819 763 1192 799">Expander is bypassed to the path.</td> </tr> </tbody> </table>			BYP	Transmit side	Receive side	0	Compressor is connected to the path.	Expander is connected to the path.	1	Compressor is bypassed to the path.	Expander is bypassed to the path.			
BYP	Transmit side	Receive side													
0	Compressor is connected to the path.	Expander is connected to the path.													
1	Compressor is bypassed to the path.	Expander is bypassed to the path.													
BR	Modem data signaling rate select pin. <table border="1" data-bbox="515 882 897 1004"> <thead> <tr> <th data-bbox="515 882 605 919">BR</th> <th data-bbox="609 882 897 919">Date signaling rate</th> </tr> </thead> <tbody> <tr> <td data-bbox="515 925 605 962">0</td> <td data-bbox="609 925 897 962">1200 bps</td> </tr> <tr> <td data-bbox="515 967 605 1004">1</td> <td data-bbox="609 967 897 1004">2400 bps</td> </tr> </tbody> </table>			BR	Date signaling rate	0	1200 bps	1	2400 bps						
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(Continued)

Name	Function																				
FDE	<p>Frame synchronous signal detector control.</p> <p>When digital "0" is applied to this pin, FD pin is fixed to "0" level. RT and RD always work.</p> <p>When digital "1" is applied to this pin, frame synchronous detector works, and RT and RD pins are fixed to "1" level until synchronous signal detector detects frame synchronous signal and FD becomes "1" level. Refer to Fig.3 (receive signal timing).</p>																				
BIT	<p>Bit synchronous signal detector control.</p> <p>When BIT and FDE pins are digital "1" level and when bit synchronous signal and frame synchronous signal are detected continuously, FD becomes digital "1".</p> <p>When BIT pin is digital "0" level and FDE pin is digital "1" level and when 16-bit frame synchronous signal is detected, FD pin becomes digital "1" level.</p> <p>Refer to FPS pin detection.</p>																				
FPS	<p>Frame synchronous pattern control.</p> <table border="1" data-bbox="266 780 1140 973"> <thead> <tr> <th data-bbox="266 788 316 815">BIT</th> <th data-bbox="326 788 377 815">FPS</th> <th data-bbox="605 788 769 815">Detect pattern</th> <th data-bbox="1007 788 1112 815">Receiver</th> </tr> </thead> <tbody> <tr> <td data-bbox="266 826 289 853">0</td> <td data-bbox="326 826 349 853">0</td> <td data-bbox="495 826 975 853">1 0 0 1 0 0 1 1 0 0 1 1 0 1 1 0 (=9336H)</td> <td data-bbox="993 826 1112 853">Handset side</td> </tr> <tr> <td data-bbox="266 865 289 892">0</td> <td data-bbox="326 865 349 892">1</td> <td data-bbox="495 865 975 892">1 1 0 0 0 1 0 0 1 1 0 1 0 1 1 0 (=C4D6H)</td> <td data-bbox="993 865 1112 892">Base station</td> </tr> <tr> <td data-bbox="266 904 289 931">1</td> <td data-bbox="326 904 349 931">0</td> <td data-bbox="403 904 975 931">1 0 1 0 1 0 0 1 0 0 1 1 0 0 1 1 0 1 1 0 (=A9336H)</td> <td data-bbox="993 904 1112 931">Handset side</td> </tr> <tr> <td data-bbox="266 942 289 969">1</td> <td data-bbox="326 942 349 969">1</td> <td data-bbox="403 942 975 969">1 0 1 0 1 1 0 0 0 1 0 0 1 1 0 1 0 1 1 0 (=AC4D6H)</td> <td data-bbox="993 942 1112 969">Base station</td> </tr> </tbody> </table> <p data-bbox="605 981 1140 1006">(Note : This pattern is for Japanese Cordless Telephone.)</p>	BIT	FPS	Detect pattern	Receiver	0	0	1 0 0 1 0 0 1 1 0 0 1 1 0 1 1 0 (=9336H)	Handset side	0	1	1 1 0 0 0 1 0 0 1 1 0 1 0 1 1 0 (=C4D6H)	Base station	1	0	1 0 1 0 1 0 0 1 0 0 1 1 0 0 1 1 0 1 1 0 (=A9336H)	Handset side	1	1	1 0 1 0 1 1 0 0 0 1 0 0 1 1 0 1 0 1 1 0 (=AC4D6H)	Base station
BIT	FPS	Detect pattern	Receiver																		
0	0	1 0 0 1 0 0 1 1 0 0 1 1 0 1 1 0 (=9336H)	Handset side																		
0	1	1 1 0 0 0 1 0 0 1 1 0 1 0 1 1 0 (=C4D6H)	Base station																		
1	0	1 0 1 0 1 0 0 1 0 0 1 1 0 0 1 1 0 1 1 0 (=A9336H)	Handset side																		
1	1	1 0 1 0 1 1 0 0 0 1 0 0 1 1 0 1 0 1 1 0 (=AC4D6H)	Base station																		
FD	<p>Frame synchronous detector output.</p> <p>When receive data correspond to detection pattern, FD pin is held to digital "1" level.</p> <p>When FDE is applied to digital "0" level, FD pin is reset to digital "0" level.</p> <p>And at the full power down state (PDN = "1", RVE = "0"), FD pin is reset to digital "0" level.</p>																				
RD	<p>Demodulator serial data output.</p> <p>The data are synchronized with the re-generated timing clock of RT.</p> <p>When FDE is digital "1" level and also FD is digital "0" level, RD is fixed to digital "1" level.</p>																				
RT	<p>Receive data timing clock output.</p> <p>This signal is re-generated by internal digital PLL. The falling edge of this clock output is coincident with the transitions of RD.</p> <p>The rising edge of RT can be used to latch the valid receive data.</p> <p>When FDE pin is applied to digital "1" level and also FD pin output digital "0" level, RT pin is fixed to digital "1" level. Refer to Fig.3.</p>																				
RVE	<p>Receive voice signal control.</p> <p>Refer to RVO pin description.</p>																				
V _{DD}	<p>Power supply.</p> <p>This device is sensitive to power supply noises as switched capacitor techniques are utilized.</p> <p>A bypass capacitor of more than 10 μF between V_{DD} and GND pin should be connected to ensure the performance.</p>																				

(Continued)

Name	Function							
PDN	Power down control. Power down state is controlled by PDN, ME, RVE, and TVE.							
		PDN	ME	RVE	TVE	Voice control path	Transmit side modem	Receive side modem
	Mode1	1	X	0	X	OFF	OFF	OFF
	Mode2	1	X	1	X	OFF	OFF	ON
	Mode3	0	1	0	0	OFF	ON	ON
Mode4	others				ON	ON	ON	
	X : Don't care							
	At the mode 4, all functions are powered on. At the full power down mode(PDN = "1" and RVE = "0"), the demodulator circuit and FD pin are reset. When V _{DD} is turned ON, the demodulator circuit and FD pin should be reset by setting Mode1.							
X1	Crystal connection.							
X2	3.6864 MHz crystal shall be connected.							
	When an external master clock is applied, the clock should be supplied to X2 pin via a 200 pF capacitor for AC coupling and X1 should be opened.							
ME	MSK modulator output. When digital "1" is applied to this pin, MSK modulator is connected to the splatter filter. Refer to TAO pin description.							
TVE	Transmit side voice signal control. Refer to TAO pin description.							

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Rating	Unit
Power Supply Voltage	V_{DD}	Ta = 25°C Refer to GND	-0.3 to +7.0	V
Analog Input Voltage *1	V_{IA}		-0.3 to $V_{DD} + 0.3$	
Digital Input Voltage *2	V_{ID}			
Storage Temperature	T_{STG}	—	-55 to +150	°C

*1 : LIM, VR2, TVI, RAI, CMPI

*2 : SD, EMP, DYN, SEC, RCK1, RCK2, BYP, BR, FDE, BIT, FPS, RVE, PDN, X2, ME, TVE

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Power Supply Voltage	V_{DD}	from GND level	DYN = "0"	2.7	3.6	5.5	V
			DYN = "1"	4.5	5.0	5.5	
Operating Temperature	T_{op}	$V_{DD} = 2.7\text{ V to }5.5\text{ V}$	-30	+25	+70	°C	
Crystal Oscillating Freq.	$f_{X'TAL}$	—	3.6860	3.6864	3.6868	MHz	
Data Signaling Rate	T_S	BR = "0"	—	1200	—	bit/sec	
		BR = "1"	—	2400	—		
C4, C5, C11, C12, C15	—	—	—	1.0	—	μF	
C6, C13	—	DYN = "0"	—	0.22	—		
		DYN = "1"	—	0.47	—		
C7, C8	—	—	—	1.0	—		
C9, C10	—	$RL \geq 40\text{k}\Omega$	—	0.22	—		
C14	—	—	—	10	—		
C19	—	—	—	0.47	—		
C20, C21	—	—	—	20	—	pF	

ELECTRICAL CHARACTERISTICS

DC Characteristics

(DYN = "0" : $V_{DD} = 2.7\text{ V to }5.5\text{ V}$, $T_a = -30^\circ\text{C to }70^\circ\text{C}$)
 (DYN = "1" : $V_{DD} = 4.5\text{ V to }5.5\text{ V}$, $T_a = -30^\circ\text{C to }70^\circ\text{C}$)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Power Supply Current *1	I _{DD}	Normal mode (mode 4)	3.6 V	—	9.0	18	mA
			5.5 V	—	14.0	24	
	I _{DDS1}	Power down mode 1	5.5 V	—	1.0	20	μA
	I _{DDS2}	Power down mode 2	3.6 V	—	3.8	7.0	mA
I _{DDS3}				Power down mode 3	—	4.6	
Input Leakage Current *2	I _{IL}	V _{IN} = 0 V	-10	—	+10	μA	
	I _{IH}	V _{IN} = V _{DD}					
Input Voltage *2	I _{IL}	—	0	—	0.2V _{DD}	V	
	I _{IH}		0.7V _{DD}	—	V _{DD}		
Output Voltage *3	V _{OL}	I _{OL} = -20 μA	0	—	0.1V _{DD}		
	V _{OH}	I _{OH} = 20 μA	0.8V _{DD}	—	V _{DD}		

*1 Refer to PDN pin description

*2 SD, EMP, DYN, SEC, RCK1, RCK2, BYP, BR, FDE, BIT, FPS, RVE, PDN, ME, TVE

*3 ST, FD, RD, RT

AC Characteristics

(DYN = "0" : V_{DD} = 2.7 V to 5.5 V, T_a = -30°C to 70°C)
 (DYN = "1" : V_{DD} = 4.5 V to 5.5 V, T_a = -30°C to 70°C)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	
Transmit Carrier Frequency		f _{M1}	SD = "1" BR = "0"	1199	1200	1201	Hz	
		f _{S1}	SD= "0" ME= "1"	1799	1800	1801		
		f _{M2}	SD = "1" BR = "1"	1199	1200	1201		
		f _{S2}	SD= "0" ME= "1"	2399	2400	2401		
Transmit Carrier Level		V _{OX}	R1 = R2	DYN = "0"	-11	-9	-7	dBV
Receive Carrier Input Level				DYN = "1"	-3	-1	+1	
Receive Carrier Input Level		V _{IR}		-32	—	-2		
Bit Error Rate	1200 bps	BER	Defined at RAIO	8 dB	—	1 × 10 ⁻³	—	—
	2400 bps			10 dB	—	5 × 10 ⁻⁵	—	
				11 dB	—	1 × 10 ⁻³	—	
				13 dB	—	5 × 10 ⁻⁵	—	
Number of PLL Lock-in Data Bits *1		V _{IR}	Number of data bits required for the PLL to be locked in within the phase difference of 22.5° or less	—	—	18	bit	
			Number of data bits required for the PLL to be locked in within the phase difference of 90° or less	—	—	11		

*1 Receive MSK signal is bit synchronous signal (modulated signal of alternating "0", "1" pattern).

Voice Signal Interfaces

(DYN = "0" : V_{DD} = 2.7 V to 5.5 V, T_a = -30°C to 70°C)
 (DYN = "1" : V_{DD} = 4.5 V to 5.5 V, T_a = -30°C to 70°C)

Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit
RVO Maximum Output Signal Level	V _{OUT}	f _{IN} = 1 kHz	DYN = "0"	—	—	-6	dBV
		BYP = "0" *1	DYN = "1"	—	—	+2	
Limiter Clamp Level	V _{LIM}	f _{IN} = 1 kHz	DYN = "0"	-10	-9	-8	dB
		LIM = open	DYN = "1"	-2	-1	0	
Transmit Output Distortion	H _{DT}	f _{IN} = 1 kHz, -12 dBV		—	-40	—	dB
Receive Output Distortion	H _{DR}	BYP = "0", EMP = "1"		—	-40	—	
Transmit Gain	G _T	f _{IN} = 1 kHz, BYP = EMP = "1"		-1.5	-0.2	+1	dB
Receive Gain	G _R	f _{IN} = 1 kHz, BYP = EMP = "1"		-1.5	-0.2	+1	
Transmit Idle Noise	H _{IT}	BYP = "0"		—	-51	—	dBV
Receive Idle Noise	H _{IR}	EMP = "1"		—	-85	—	
Cross Talk	R _{CV.} →T _{ran.}	C _{TT}	RAIO = -2 dBV	*2	—	-75	-60
	T _{ran.} →R _{CV.}	C _{TR}	TVIO = -2 dBV		—	-80	-60
Transmit Filter Response	FT1	EMP = "1" BYP = "1" RCK2 = "0" Ref. = 1 kHz	100 Hz	—	-28	-23	dB
	FT3		300 Hz	-12.5	-10.5	-8.5	
	FT25		2.5 kHz	+6.5	+8.0	+9.5	
	FT34		3.4 kHz	+8.5	+10.5	+12.5	
	FT60		6 kHz	—	-40	-30	
Receive Filter Response	FR1	EMP = "1" BYP = "1" RCK2 = "0" Ref. = 1 kHz	100 Hz	+1.5	+3.0	+4.5	dB
	FR3		300 Hz	+8.0	+9.5	+11.0	
	FR25		2.5 kHz	-9.5	-8.0	-6.5	
	FR34		3.4 kHz	-12.5	-10.5	-8.5	
	FR60		6 kHz	—	-40	-30	

*1 S/D ≥ 20 dB

*2 f_{IN} = 1 kHz, BYP = EMP = "1"

(Continued)

(DYN = "0" : V_{DD} = 2.7 V to 5.5 V, T_a = -30°C to 70°C)
 (DYN = "1" : V_{DD} = 4.5 V to 5.5 V, T_a = -30°C to 70°C)

	Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Compressor	Standard Input Level	V _{ICS}	f _{IN} = 1 kHz	DYN = "0"	-16.1	-13.7	-11.3	dBV
				DYN = "1"	-7.1	-5.5	-3.9	
	Maximum Input Level	V _{ICM}		DYN = "0"	—	—	-7	
				DYN = "1"	—	—	+1.0	
	Output Level *3	GC2	f _{IN} = 1 kHz	-20 dB	-10.6	-9.9	-9.2	dB
		GC4		-40 dB	-21.0	-19.8	-18.6	
GC5		-60 dB		—	-29.5	—		
Attack Time	T _{AT1}	DYN = "0", C6 = 0.22 μF		—	3.4	—	ms	
	T _{AT2}	DYN = "1", C6 = 0.47 μF		—	3.5	—		
Recovery Time	T _{RE1}	DYN = "0", C6 = 0.22 μF		—	17	—		
	T _{RE2}	DYN = "1", C6 = 0.47 μF		—	16	—		
Expander	Standard Input Level	V _{IES}	f _{IN} = 1 kHz	*4	-12.9	-10.8	-8.7	dBV
				*5	-13.3	-11.2	-9.1	
				*6	-4.7	-3.1	-1.5	
	Maximum Output Level	V _{IEM}		DYN = "0"	—	—	-6	
				DYN = "1"	—	—	+2	
	Output Level	GE1		f _{IN} = 1 kHz *3	-10 dB	-21.5	-20	
		GE2	-20 dB		-42.2	-40	-37.5	
		GE3	-30 dB		—	-59	—	
Attack Time	T _{AT3}	DYN = "0", C13 = 0.22 μF		—	3.4	—	ms	
	T _{AT4}	DYN = "1", C13 = 0.47 μF		—	3.5	—		
Recovery Time	T _{RE3}	DYN = "0", C13 = 0.22 μF		—	17	—		
	T _{RE4}	DYN = "1", C13 = 0.47 μF		—	16	—		

*3 0 dB is defined as the input level and the output level when the standard input level is input.

*4 V_{DD} = 3.6 V, DYN = "0"

*5 V_{DD} = 5.0 V, DYN = "0"

*6 V_{DD} = 5.0 V, DYN = "1"

Common Characteristics

(DYN = "0" : $V_{DD} = 2.7\text{ V to }5.5\text{ V}$, $T_a = -30^\circ\text{C to }70^\circ\text{C}$)
 (DYN = "1" : $V_{DD} = 4.5\text{ V to }5.5\text{ V}$, $T_a = -30^\circ\text{C to }70^\circ\text{C}$)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input Resistance	R_{IA}	TVI, RAI, VR2	—	10	—	$M\Omega$
	R_{IC}	LIM	—	200	—	$k\Omega$
Output Resistance	R_{Ox1}	TAO	—	1750	—	Ω
	R_{Ox2}	VR1, VR3, RVO	—	600	—	
	R_{Ox3}	TVIO, RAIO	—	100	—	
Output Load Resistance	RXL1	S/D $\geq 20\text{ dB}$	*1	40	—	$k\Omega$
	RXL2		TVIO	60	—	
Output DC Voltage	V_{SG}	SG	$\frac{V_{DD}}{2} - 0.1$	$\frac{V_{DD}}{2}$	$\frac{V_{DD}}{2} + 0.1$	V
	V_{AO}	TAO, RVO	$\frac{V_{DD}}{2} - 0.15$	$\frac{V_{DD}}{2}$	$\frac{V_{DD}}{2} + 0.15$	

*1 VR1, VR3, TAO, RVO, RAIO

Digital Timing Characteristics

(DYN = "0" : $V_{DD} = 2.7\text{ V to }5.5\text{ V}$, $T_a = -30^\circ\text{C to }70^\circ\text{C}$)
 (DYN = "1" : $V_{DD} = 4.5\text{ V to }5.5\text{ V}$, $T_a = -30^\circ\text{C to }70^\circ\text{C}$)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Transmit Data Set-up Time	t_S	Refer to Fig. 1	1	—	—	μs
Transmit Data Hold Time	t_H		1	—	—	
Receive Data Output Delay	t_D	Refer to Fig. 1	-300	—	300	ns
Sync-signal Output Delay (ME→ST)	t_{MS}	Refer to Fig. 1	0	—	834	μs

TIMING DIAGRAM

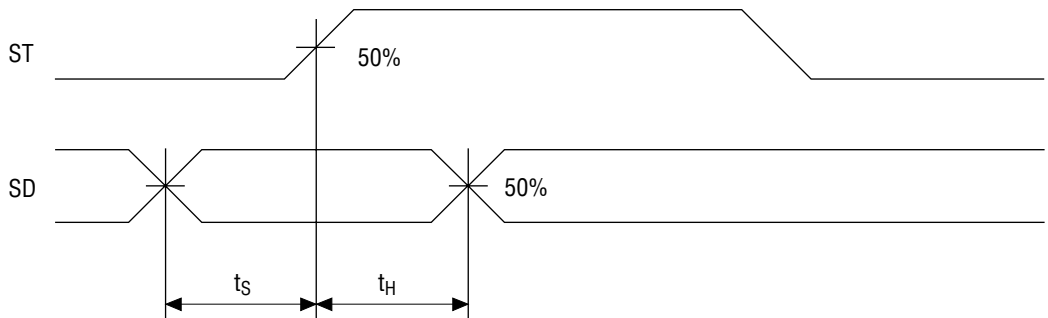


Figure 1 Input Data Timing

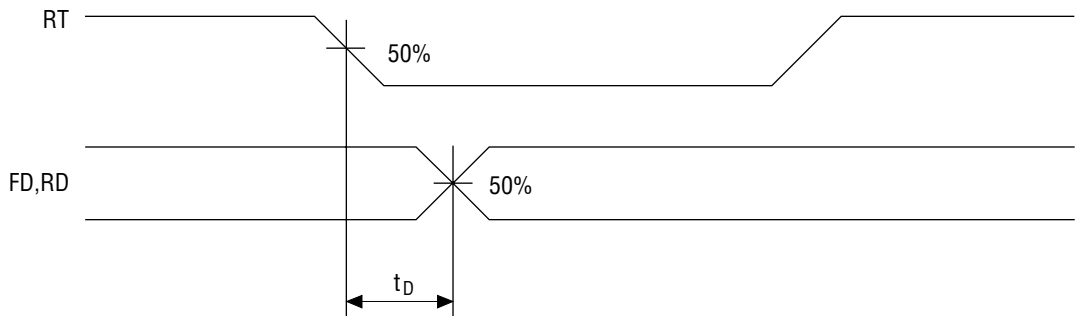
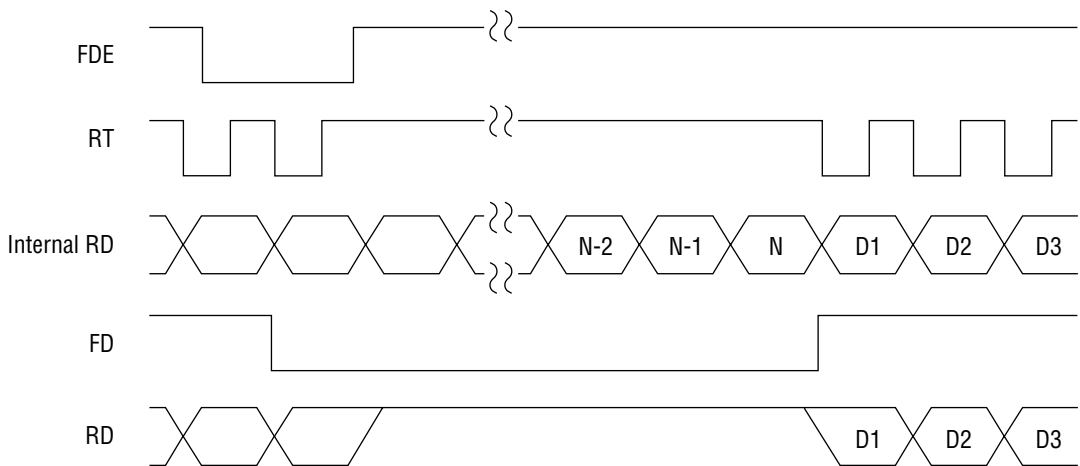


Figure 2 Output Data Timing

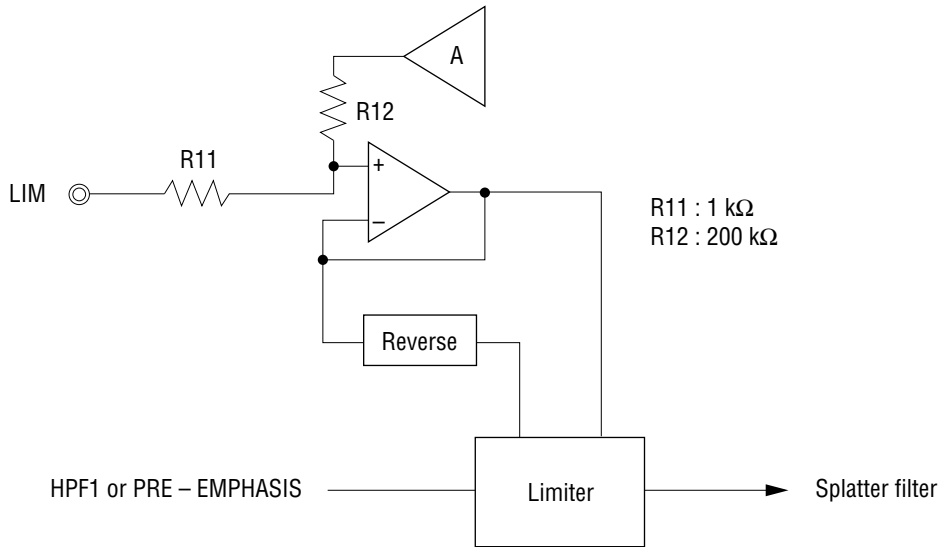


N-2, N-1, N : Frame synchronous signal

Figure 3 Receive Signal Timing

OPERATION DESCRIPTION

Limiter Circuit



- DYN = "0" : Clamp level = VSG ±0.50 V
- DYN = "1" : Clamp level = VSG ±1.26 V

2. In case of using external voltage reference

LIM pin shall be supplied over VSG voltage.

- Notes
- 1) R11 is protection resistor from external extra voltage.
 - 2) Resistor value of R11 and R12 changes 0.7 to 1.3 times from the typical value by lot variation and temperature variation.

Frame Detector

Frame detection pattern is defined by BIT and FPS.

BIT	FPS	Sync-pattern	Receiver	Note
0	0	9336H	S.H.	Frame synchronous
0	1	C4D6H	M.T.	Frame synchronous
1	0	A9336H	S.H.	Bit + Frame synchronous
1	1	AC4D6H	M.T.	Bit + Frame synchronous

M.T. = Master telephone
S.H. = Slave handset

Fig 3 shows detection timing

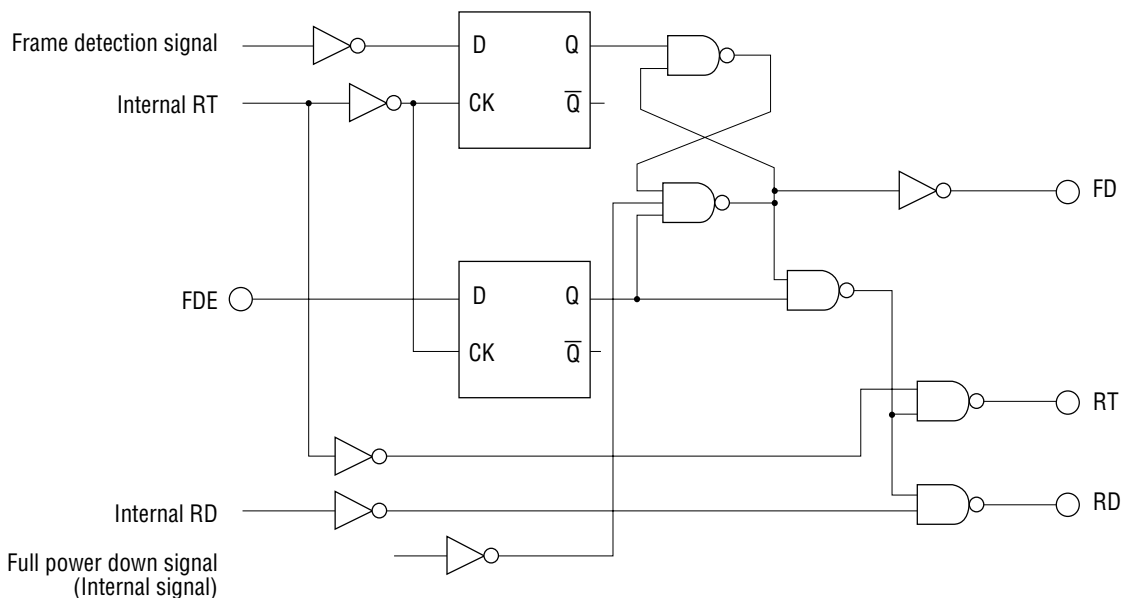
First, put digital "0" level to FDE pin more than 1 ms, then FD pin is reset to "0" level. Next, put digital "1" level to FDE pin, then RT and RD output digital "1" level until frame synchronous signal detected.

When synchronous pattern is detected, FD pin is held to digital "1" level.

At the full power down state (PDN = "1", RVE = "0"), FD pin becomes reset state.

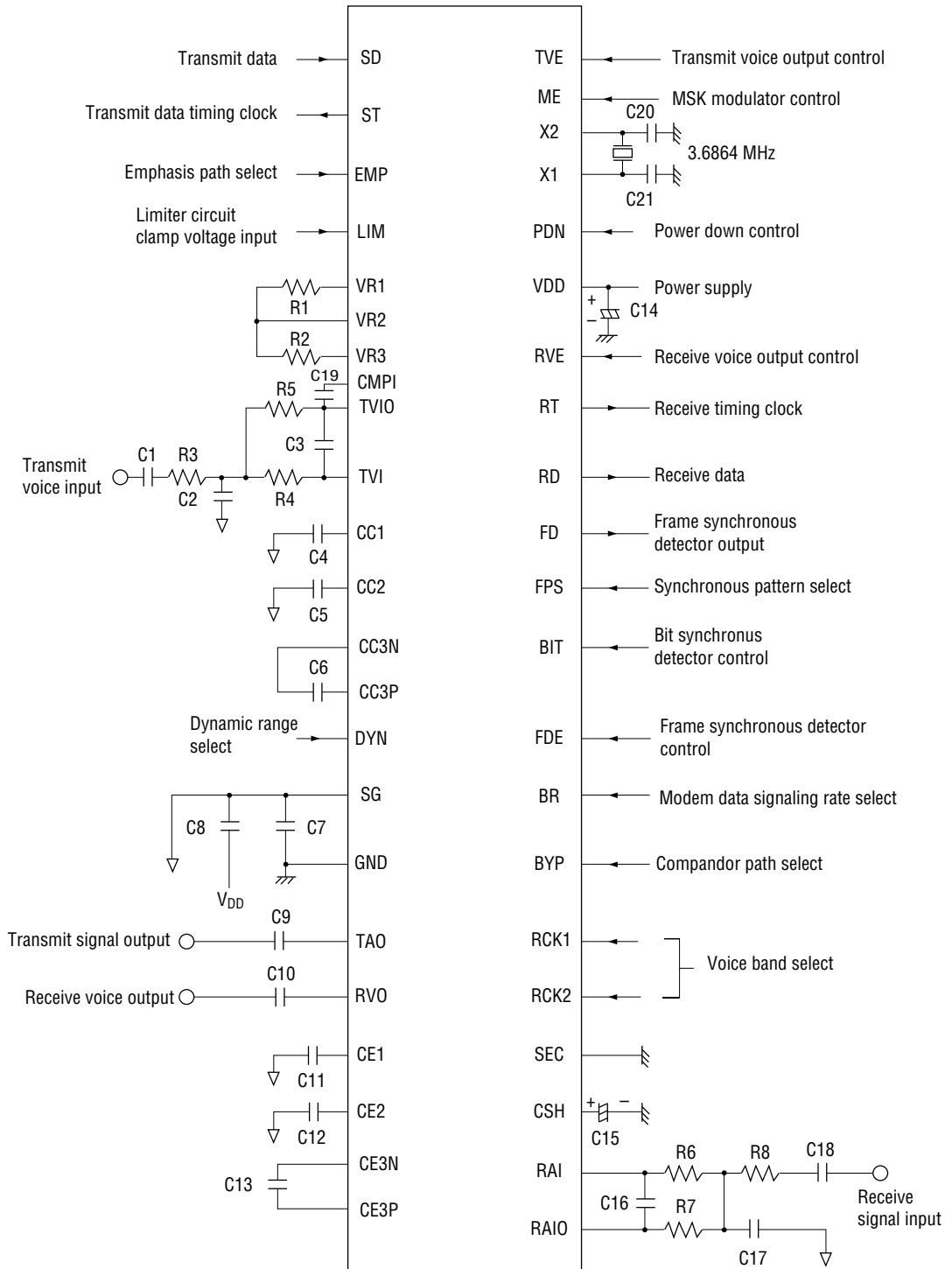
In order to detect frame synchronous signal certainly, receive side PLL should be locked in sufficiently.

When a modem starts data transmission, the bit-synchronous signal of more than 18 bits should be transmitted before frame pattern of the upper table.



Application Circuit

MSM7557GS-2K



Note : An arrow mark of (\downarrow) indicates connection to the SG pin.

MSM7557 Filter Characteristics

MSM7557 has wide band filters (0.3 kHz to 3.4 kHz) as follows.

Pre-Emphasis Fig. 4
 Splatter Filter Fig. 5
 RBPF Fig. 6
 De-Emphasis Fig. 7
 Transmit Total (HPF1 + Pre-Emphasis + Splatter) Fig. 8
 Receive Total (RBPF + De-Emphasis) Fig. 9
 Transmit and Receive Total Fig. 10

Fig. 4 to Fig. 10 show the filter characteristics when RCK2 is digital "0". When RCK1 is digital "0" and RCK2 is digital "1", the filter characteristics change 0.972 times on the frequency axis. (pass-band becomes narrow) When RCK1 is digital "1" and RCK2 is digital "1", the filter characteristics change 1.029 times on the frequency axis. (pass-band becomes wide)

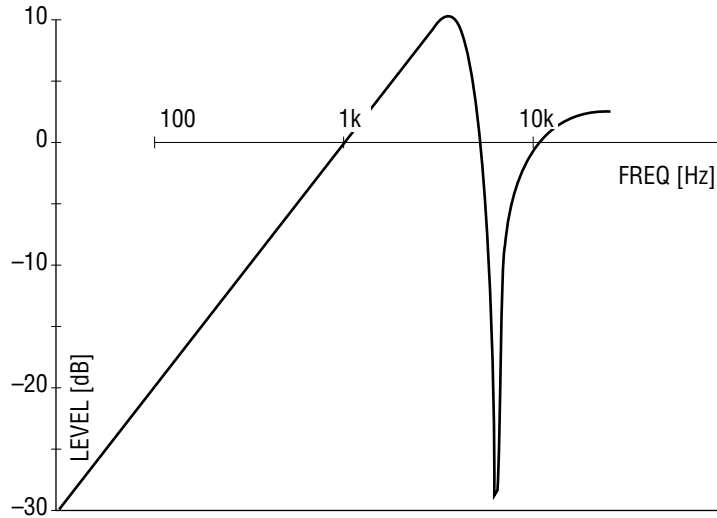


Figure 4 MSM7557 Pre-Emphasis

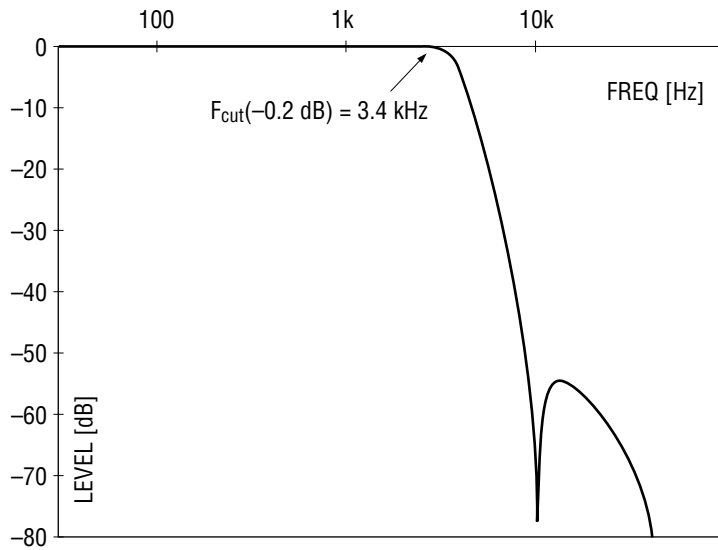


Figure 5 MSM7557 Splatter Filter

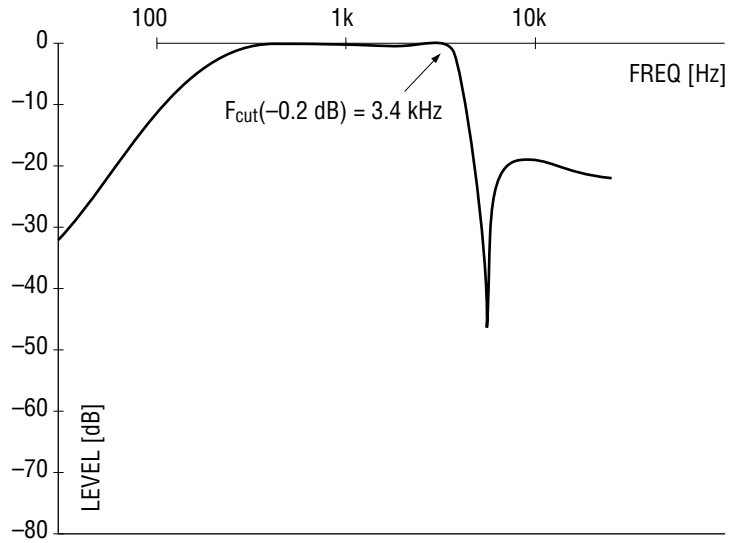


Figure 6 MSM7557 RBPF

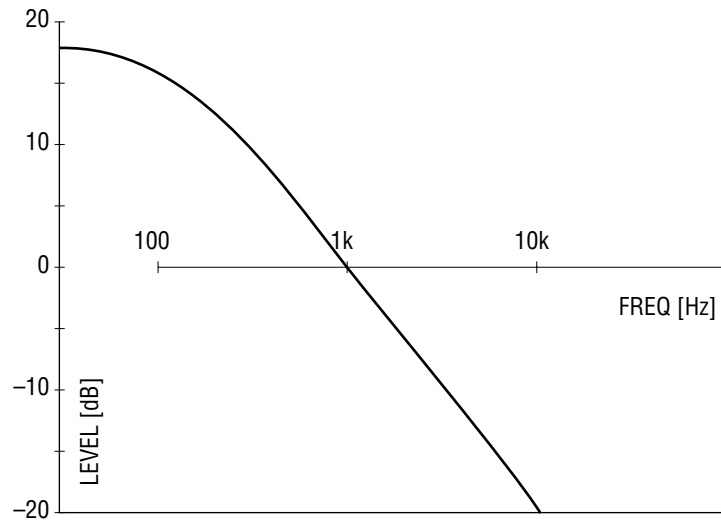


Figure 7 MSM7557 De-Emphasis

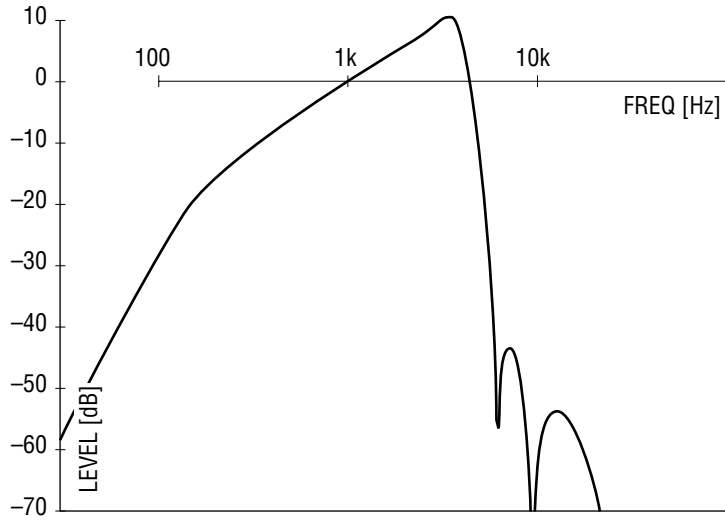


Figure 8 MSM7557 Transmit Total (HPF1 + Pre-Emphasis+Splatter)

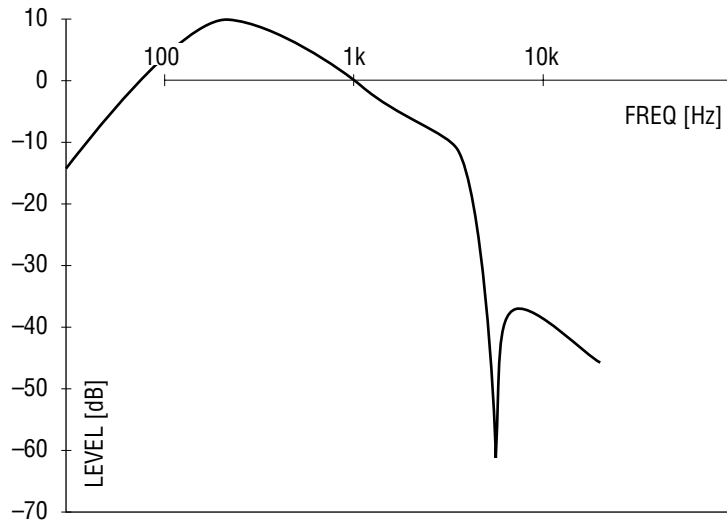


Figure 9 MSM7557 Receive Total (RBPF + De-Emphasis)

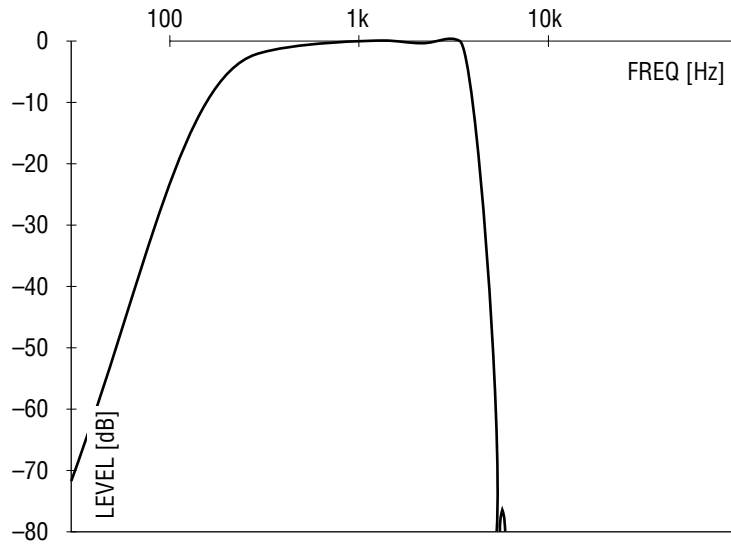
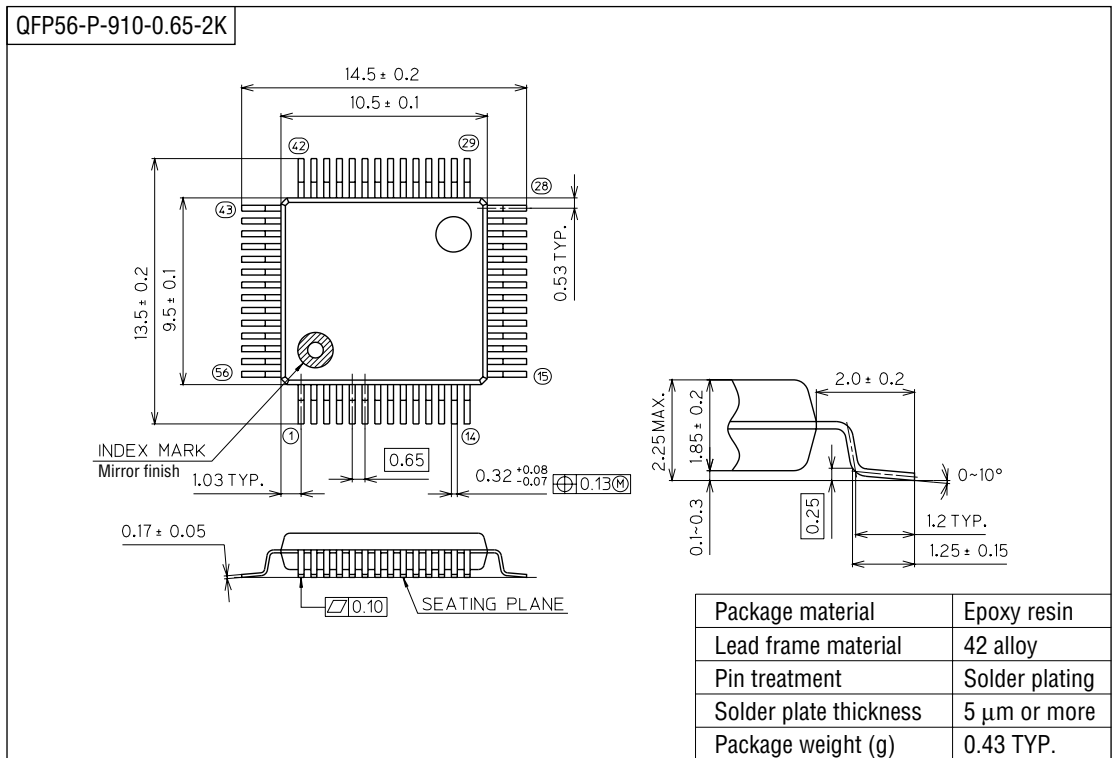


Figure 10 MSM7557 Transmit and Receive Total

PACKAGE DIMENSIONS

(Unit : mm)



Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, SOJ, QFJ (PLCC), SHP and BGA are surface mount type packages, which are very susceptible to heat in reflow mounting and humidity absorbed in storage. Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).