

OKI Semiconductor

MSM9560/MSM9561

IC for FM Multiplex Data Demodulation

GENERAL DESCRIPTION

The MSM9560/MSM9561 is an IC which demodulates FM character multiplex signals in the DARC (Data Radio Channel)*1 format to obtain digital data. The MSM9560 operates at 4.5 to 5.5 V and the MSM9561 at 1.8 to 3.3 V. In the DARC system, 16 kbps of digital data L-MSK modulated at 76 kHz is multiplexed on an ordinary FM broadcast base band signal.

The MSM9560/MSM9561 contains on one chip a band pass filter using a switched capacitor filter (SCF) and a group of circuits including a frame synchronization circuit and an error correction circuit.

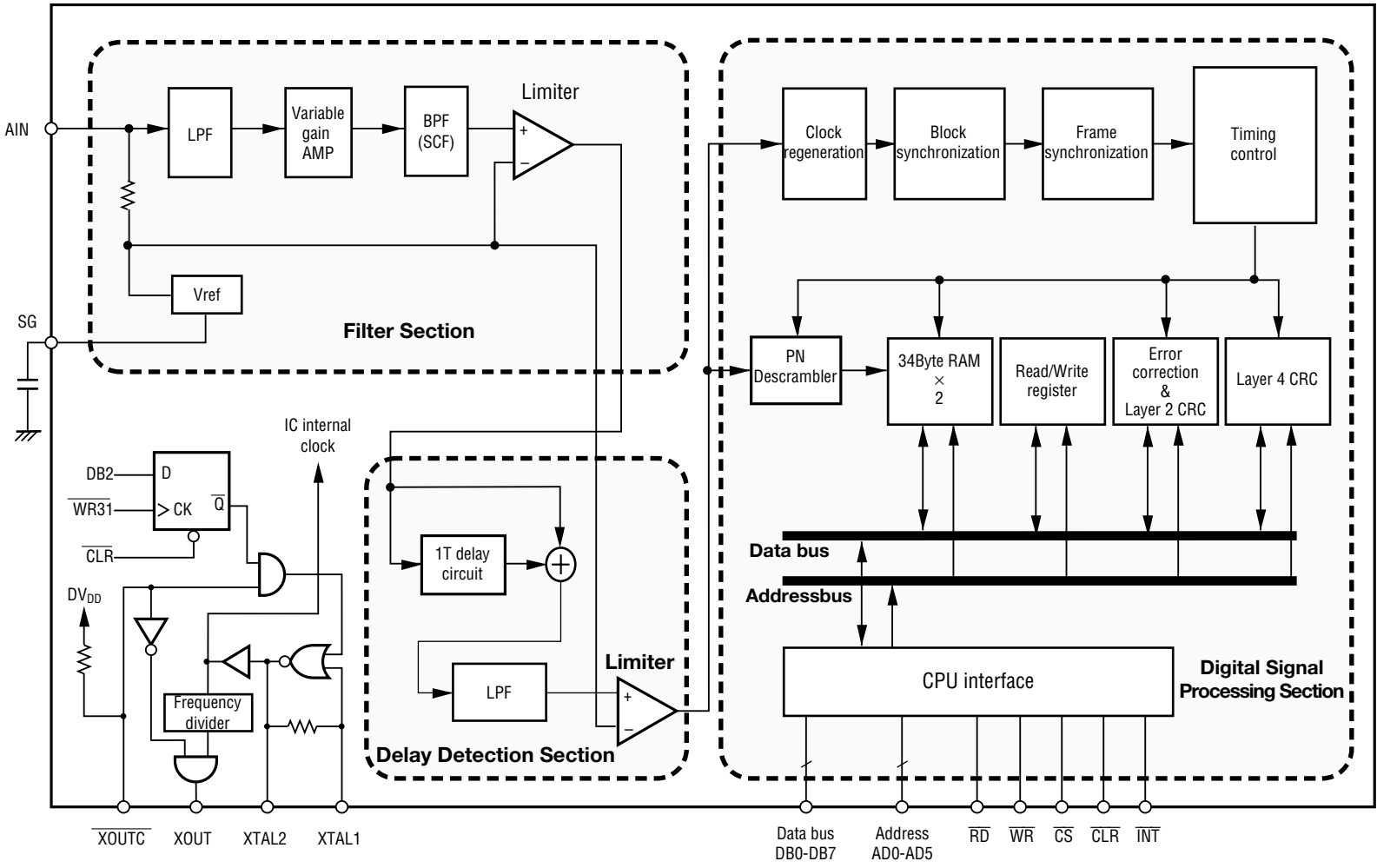
By connecting an external FM receiver and memory for temporary data storage and by controlling them by the CPU, a system for obtaining digital data can easily be constructed.

The FM multiplex demodulation ICs, the MSM9500-series devices, are configured with minimum functions; so they will, merely by making changes to the software of the external microcomputer, be able to respond flexibly to the many FM multiplex broadcast services that are going to come about in the future.

The MSM9560/MSM9561 is best suited to radios and information processing devices that support DARC FM multiplex broadcasting. It is also best suited to car radios and car navigation systems, and the MSM9561 is especially suited to portable equipment.

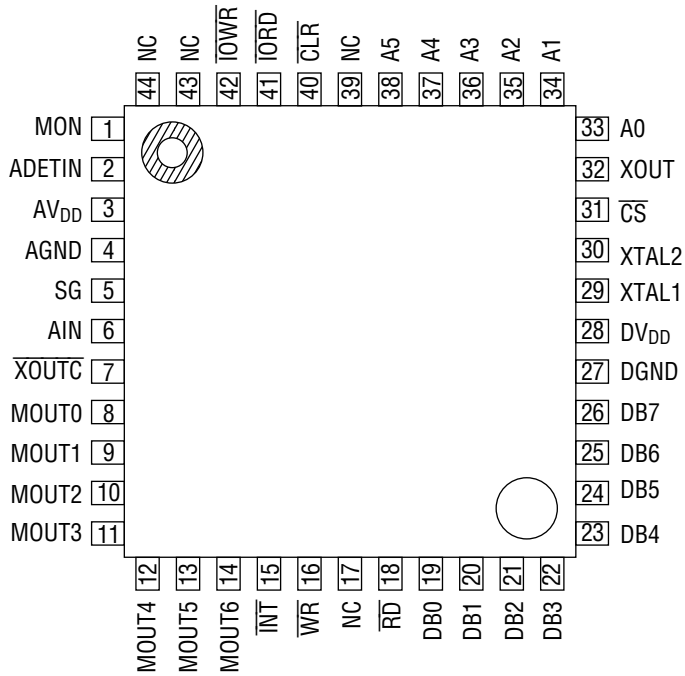
FEATURES

- Pin compatible with MSM9552/MSM9553
- Built-in bandpass filter (SCF)
- Built-in block synchronization circuit and frame synchronization circuit
- Setting of the number of synchronization protection steps can be changed
- Data clocks are regenerated by digital PLL
- 1T delay detection
- Built-in vertical and horizontal error correction circuits
- Built-in layer 4 and layer 2 CRC processing circuit
- Parallel interface with microcontroller
- Clock output for external devices (64 kHz to 8.192 MHz variable)
- Compatible with the international standard frame format (ITU-R Rec. BS1194)
- Power supply: 4.5 to 5.5 V (MSM9560), 1.8 to 3.3 V (MSM9561)
- Package:
44-pin plastic QFP (QFP44-P-910-0.80-2K) (Product name: MSM9560GS-2K/MSM9561GS-2K)



BLOCK DIAGRAM

PIN CONFIGURATION (TOP VIEW)



NC : No-connection pin

44-Pin Plastic QFP

PIN DESCRIPTIONS

Function	Pin	Symbol	Type	Description
Micro-computer interface	16	\overline{WR}	I	Write signal to internal register.
	18	\overline{RD}	I	Read signal to internal register.
	15	\overline{INT}	O	Interrupt signal to microcontroller. "L": An interrupt is generated.
	31	\overline{CS}	I	Chip select signal. "L": Read, write, and data bus signals become active.
	40	\overline{CLR}	I	"L" : the internal registers are initialized and the device enters power down mode.
	33-38	A0-A5	I	Address signal to internal register.
	19-26	DB0-DB7	I/O	Data bus signal to internal register.
Tuner interface	6	AIN	I	FM multiplex signal input.
	5	SG	O	Analog reference voltage output pin. Connect a capacitor between this pin and analog ground to prevent noise.
Analog section test	1	MON	O	Analog section waveform monitoring pin. The analog block mode setting is specified by the analog control register.
	2	ADETIN	I	Analog signal input pin for testing.
Digital section test	41 42	\overline{TORD} \overline{TOWR}	I	Digital section test signal input pins. Internally pulled up.
	8-14	MOUT0-MOUT6	O	Digital section test signal output and monitor output pins.
Clock	29	XTAL1	I	8.192 MHz crystal oscillator connection pin.
	30	XTAL2	O	8.192 MHz crystal oscillator connection pin.
	32	XOUT	O	Pin for supply of 64 kHz to 8.192 MHz clock to the outside.
	7	\overline{XOUTC}	I	XOUT output control pin. "L"=Clock output, "H"=Output disabled. Pulled up internally.
Power supply	3	AV _{DD}	—	Analog section power supply pin.
	4	AGND	—	Analog ground pin.
	28	DV _{DD}	—	Digital section power supply pin.
	27	DGND	—	Digital ground pin.

ABSOLUTE MAXIMUM RATINGS (MSM9560)

Parameter	Symbol	Condition	Rating	Unit
Power supply voltage	AV_{DD} DV_{DD}	$AV_{DD}=DV_{DD}$ $T_a=25^{\circ}C$	-0.3 to +7.0	V
Input voltage Output voltage	V_I V_O		-0.3 to $AV_{DD}+0.3$ -0.3 to $DV_{DD}+0.3$	
Maximum power dissipation	P_D	$T_a=25^{\circ}C$, per package	400	mW
		$T_a=25^{\circ}C$, per output	50	
Storage temperature	T_{STG}	—	-55 to +150	$^{\circ}C$

RECOMMENDED OPERATING CONDITIONS (MSM9560)

Parameter	Symbol	Condition	Range	Unit	Applied Pin
Power supply voltage	AV_{DD} DV_{DD}	$AV_{DD}=DV_{DD}$	4.5 to 5.5	V	AV_{DD} DV_{DD}
Crystal oscillation frequency	f_{XTAL}	—	8.192 MHz \pm 100 ppm	—	XTAL1 XTAL2
FM multiplex signal input voltage	V_{AIN}	Composite signals including multiplex signals	0.5 to 2	V_{P-P}	AIN
Operating temperature	T_{op}	—	-40 to +85	$^{\circ}C$	—

ELECTRICAL CHARACTERISTICS (MSM9560)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Applied Pin
Supply current	I_{DD}	When operating, no load $f=8.192$ MHz	—	14	28	mA	AV_{DD} DV_{DD}
		When in power down mode, no load	—	—	20	μA	
BPF pass band attenuation	GAIN1	72 - 80 kHz Variable gain amplifier gain: 0 dB	—	—	3.0	dB	MON
BPF stop band attenuation	GAIN2	0 - 53 kHz Variable gain amplifier gain: 0 dB	50	—	—	dB	MON
BPF stop band attenuation	GAIN3	100 - 500 kHz Variable gain amplifier gain: 0 dB	50	—	—	dB	MON

ABSOLUTE MAXIMUM RATINGS (MSM9561)

Parameter	Symbol	Condition	Rating	Unit
Power supply voltage	AV_{DD} DV_{DD}	$AV_{DD}=DV_{DD}$ $T_a=25^{\circ}\text{C}$	-0.3 to +7.0	V
Input voltage Output voltage	V_I V_O		-0.3 to $AV_{DD}+0.3$ -0.3 to $DV_{DD}+0.3$	
Maximum power dissipation	P_D	$T_a=25^{\circ}\text{C}$, per package	400	mW
		$T_a=25^{\circ}\text{C}$, per output	50	
Storage temperature	T_{STG}	—	-55 to +150	$^{\circ}\text{C}$

RECOMMENDED OPERATING CONDITIONS (MSM9561)

Parameter	Symbol	Condition	Range	Unit	Applied Pin
Power supply voltage	AV_{DD} DV_{DD}	$AV_{DD}=DV_{DD}$	1.8 to 3.3	V	AV_{DD} DV_{DD}
Crystal oscillation frequency	f_{XTAL}	—	8.192 MHz \pm 100 ppm	—	XTAL1 XTAL2
FM multiplex signal input voltage	V_{AIN}	Composite signals including multiplex signals	0.2 to 0.9	V_{P-P}	AIN
Operating temperature	T_{OP}	—	-20 to +75	$^{\circ}\text{C}$	—

ELECTRICAL CHARACTERISTICS (MSM9561)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Applied Pin
Current consumption	I_{DD}	$AV_{DD}=DV_{DD}=1.8\text{ V}$ When operating, no load $f=8.192\text{ MHz}$	—	8	—	mA	AV_{DD} DV_{DD}
		$AV_{DD}=DV_{DD}=3.0\text{ V}$ When operating, no load $f=8.192\text{ MHz}$	—	10	—	mA	
		When operating, no load $f=8.192\text{ MHz}$	—	—	18	mA	
		When in power down mode, no load	—	—	10	μA	
BPF pass band attenuation	GAIN1	72 - 80kHz Variable gain amplifier gain: 0dB	—	—	3.0	dB	MON
BPF stop band attenuation (1)	GAIN2	0 - 53kHz Variable gain amplifier gain: 0dB	50	—	—	dB	MON
BPF stop band attenuation (2)	GAIN3	100 - 500kHz Variable gain amplifier gain: 0dB	50	—	—	dB	MON

APPLICATION CIRCUIT

