OKI Semiconductor

MSM9552/MSM9553

LSI for FM Multiplex Data Demodulation

GENERAL DESCRIPTION

The MSM9552 and MSM9553 are LSI devices which demodulate FM character multiplex signals in the DARC (DAta Radio Channel)* format to acquire digital data. The MSM9552 and MSM9553 operate on 5V and 3V, respectively. In the DARC format, baseband signals at ordinary FM broadcasting frequencies are multiplexed with 16k-bps digital data which are L-MSK-modulated at 76kHz.

Each of the MSM9552 and MSM9553 has a bandpass filter consisting of SCF, frame synchronization circuit, error correction circuit, etc. on a single chip.

So, a system for acquisition of digital data can be easily constructed by externally mounting an FM receiver tuner, microcontroller for control, and memory for temporary storage of data.

The MSM9552 and MSM9553 have a simple configuration, and are equipped with only necessary functions. By making changes to software for the external microcontroller, the MSM9552 and MSM9553 can meet the various requirements of FM multiplex broadcasting services which will be offered in future.

These LSI devices are best suited to the radio sets and information devices for FM character multiplex broadcasting, which started in Japan in October 1994. Especially, the MSM9553 is suitable for portable units.

* DARC is a registered trademark of NHK ENGINEERING SERVICES, INC.
Note that a contract needs to be made with NHK Engineering Service if a manufacturer produces/ sells electronic equipment utilizing the DARC technology.

FEATURES

- Built-in bandpass filter (SCF)
- Built-in block synchronization circuit and frame synchronization circuit
- Setting of the number of synchronization protecting stages
- Regeneration of data clocks by digital PLL
- 1T delay detection
- Built-in error correction circuit
- Built-in layer 4 and layer 2 CRC check circuit
- Microcontroller parallel interface
- Clock output for external devices (64kHz to 8.192MHz selectable)
- International standard frame format
- Power source: 5V (MSM9552), 3V (MSM9553)
- Package
  44-pin plastic QFP (QFP44-P-910-0.80-2K)
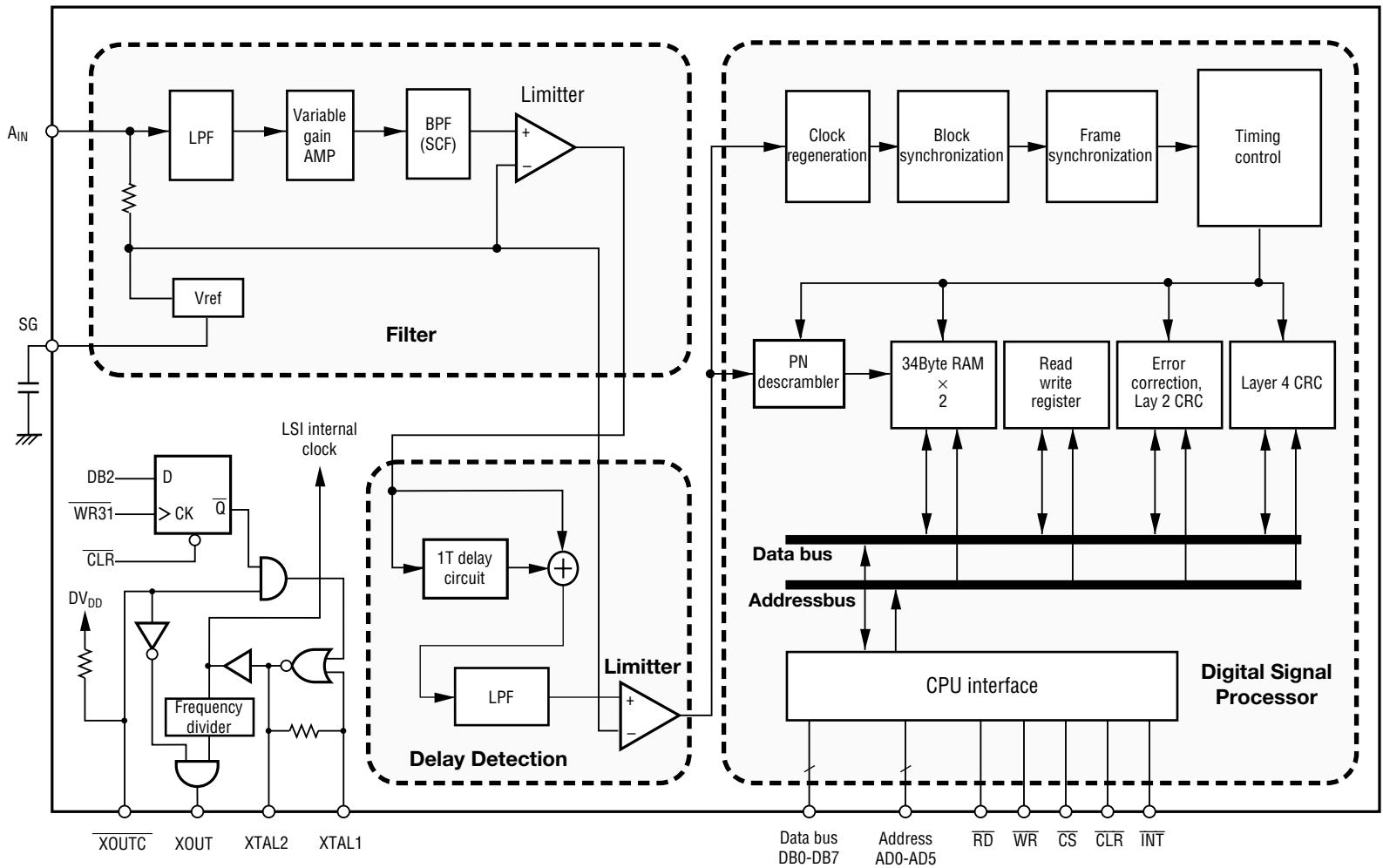
PIN CONFIGURATION (TOP VIEW)
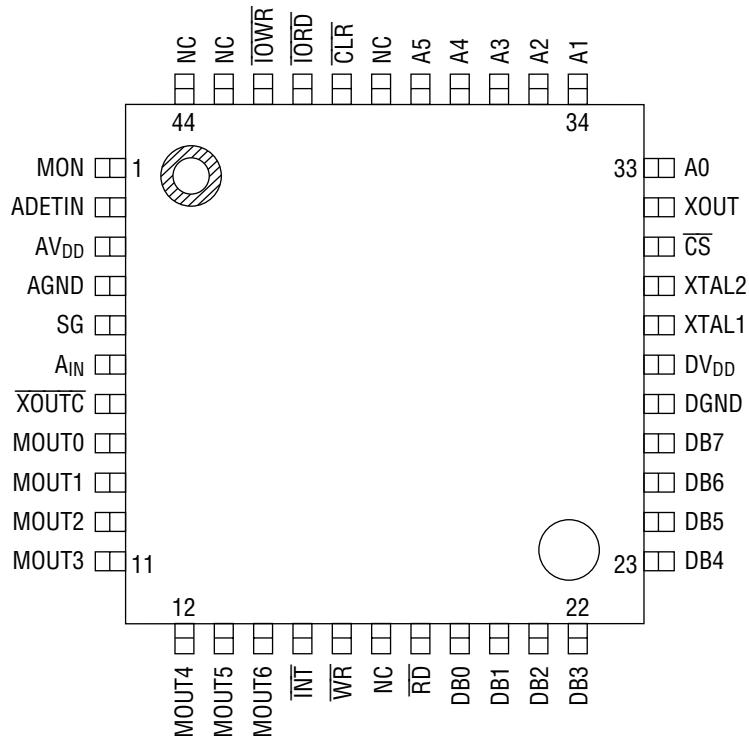
44-Pin Plastic QFP

Note: Leave the NC pins open.

PIN DESCRIPTION

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

ABSOLUTE MAXIMUM RATINGS (MSM9552)

Parameter	Symbol	Condition	Rating	Unit
Power supply voltage	AV_{DD} DV_{DD}	$AV_{DD}=DV_{DD}$ Ta=25°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	Ta=25°C per package	400	mW
		Ta=25°C per output	50	
Storage temperature	T_{STG}	—	−55 to +150	°C

RECOMMENDED OPERATING CONDITIONS (MSM9552)

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 frequency	f_{XTAL}	—	8.192MHz ±100ppm	—	XTAL1 XTAL2
FM multiplex signal input voltage	V_{AIN}	Composite signals, including multiplex signals	0.5 to 2	V_{P-P}	A_{IN}
Operating temperature	T_{OP}	—	−40 to +85	°C	—

ELECTRICAL CHARACTERISTICS (MSM9552)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Applied Pin
Current consumption	I_{DD}	During operation, No load f=8.192MHz	—	16	32	mA	AV_{DD} DV_{DD}
		During power down, No load	—	—	20	µA	
BPF pass band attenuation	GAIN1	72 - 80kHz Variable gain amplifier gain: 0dB	—	—	3.0	dB	MON
BPF reject band attenuation	GAIN2	0 - 53kHz Variable gain amplifier gain: 0dB	50	—	—	dB	MON
BPF reject band attenuation	GAIN3	100 - 500kHz Variable gain amplifier gain: 0dB	50	—	—	dB	MON

ABSOLUTE MAXIMUM RATINGS (MSM9553)

Parameter	Symbol	Condition	Rating	Unit
Power supply voltage	AV_{DD} DV_{DD}	$AV_{DD}=DV_{DD}$ Ta=25°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	Ta=25°C per package	400	mW
		Ta=25°C per output	50	
Storage temperature	T_{STG}	—	−55 to +150	°C

RECOMMENDED OPERATING CONDITIONS (MSM9553)

Parameter	Symbol	Condition	Range	Unit	Applied Pin
Power supply voltage	AV_{DD} DV_{DD}	$AV_{DD}=DV_{DD}$	2.7 to 3.3	V	AV_{DD} DV_{DD}
Crystal frequency	f_{XTAL}	—	8.192MHz ±100ppm	—	XTAL1 XTAL2
FM multiplex signal input voltage	V_{AIN}	Composite signals, including multiplex signals	0.2 to 0.9	V_{P-P}	A_{IN}
Operating temperature	T_{OP}	—	−20 to +75	°C	—

ELECTRICAL CHARACTERISTICS (MSM9553)

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit	Applied Pin
Current consumption	I_{DD}	During operation, No load f=8.192MHz	—	13	22	mA	AV_{DD} DV_{DD}
		During power down, No load	—	—	10	μA	
BPF pass band attenuation	GAIN1	72 - 80kHz Variable gain amplifier gain: 0dB	—	—	3.0	dB	MON
BPF reject band attenuation (1)	GAIN2	0 - 53kHz Variable gain amplifier gain: 0dB	50	—	—	dB	MON
BPF reject band attenuation (2)	GAIN3	100 - 500kHz Variable gain amplifier gain: 0dB	50	—	—	dB	MON

MSM9552

FM multiplex
data demodulation
LSI

8 bits

FM
tuner

MSM6794 x 2

LCD control
driver

MCU

CPU

ROM

Buffer
RAM

Font
ROM

16 Chinese
characters
x 2 lines
LCD display
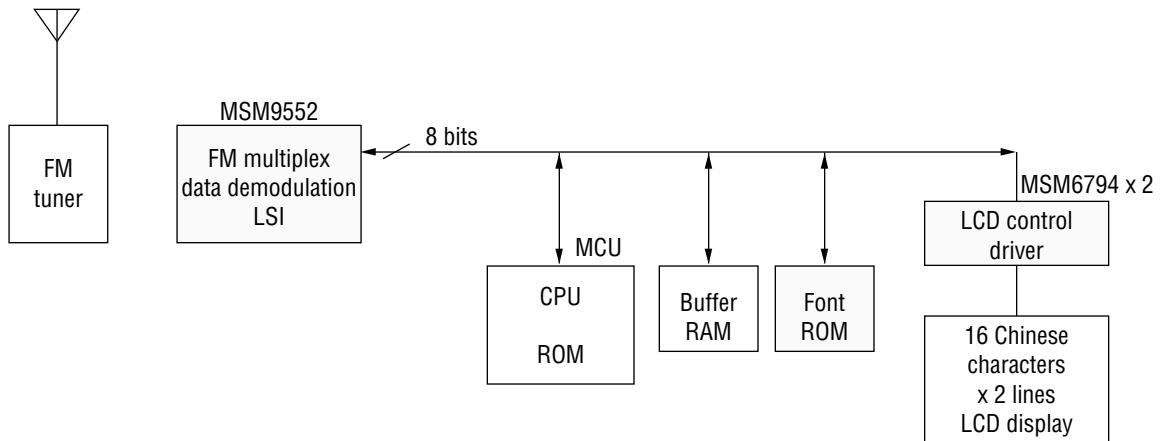
MSM6794: LCD driver with built-in 128-channel
RAM for liquid crystal dot matrix