MSM9554/MSM9555

LSI Devices for FM Multiplex Data Demodulation

GENERAL DESCRIPTION

The MSM9554 and MSM9555 are LSI devices which demodulate FM character multiplex signals in the DARC (DAta Radio Channel)*1 format to acquire digital data. The MSM9554 and MSM9555 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 MSM9554 and MSM9555 has a bandpass filter consisting of SCF, frame synchronization circuit, and error correction circuit, 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 MSM9554 and MSM9555 have a simple configuration, and are equipped with only necessary functions. By making changes to software for the external microcontroller, the MSM9554 and MSM9555 can meet the various requirements of FM multiplex broadcasting services which will be offered in future.

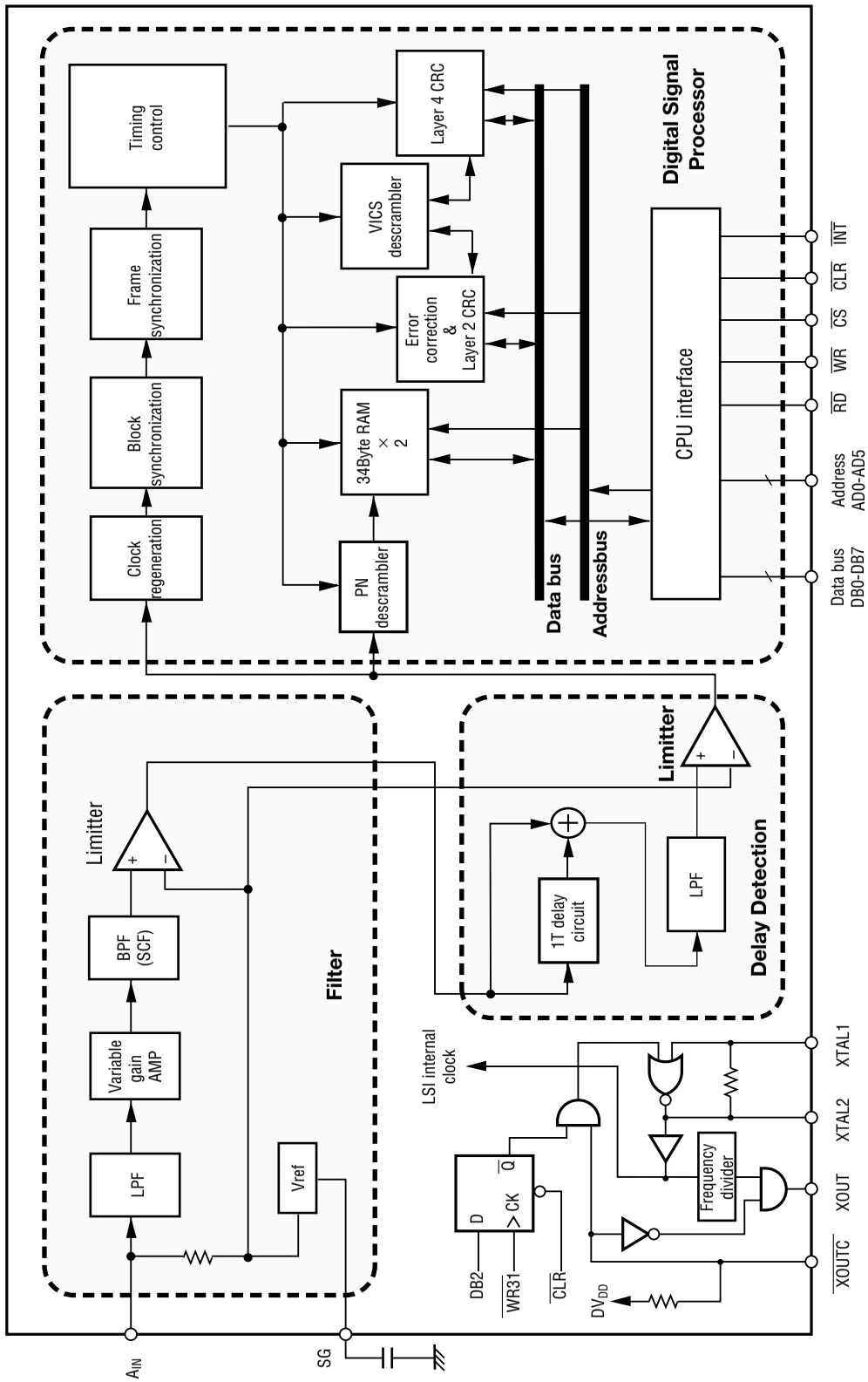
These devices are best suited to the car radios and car navigation systems supporting VICSs (Vehicle Information and Communication System)*2 that have been serviced since Aprit, 1996.

*1 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.
*2 If samples or detail documents are to be provided, contracts with VICS center are reqired beforehand.

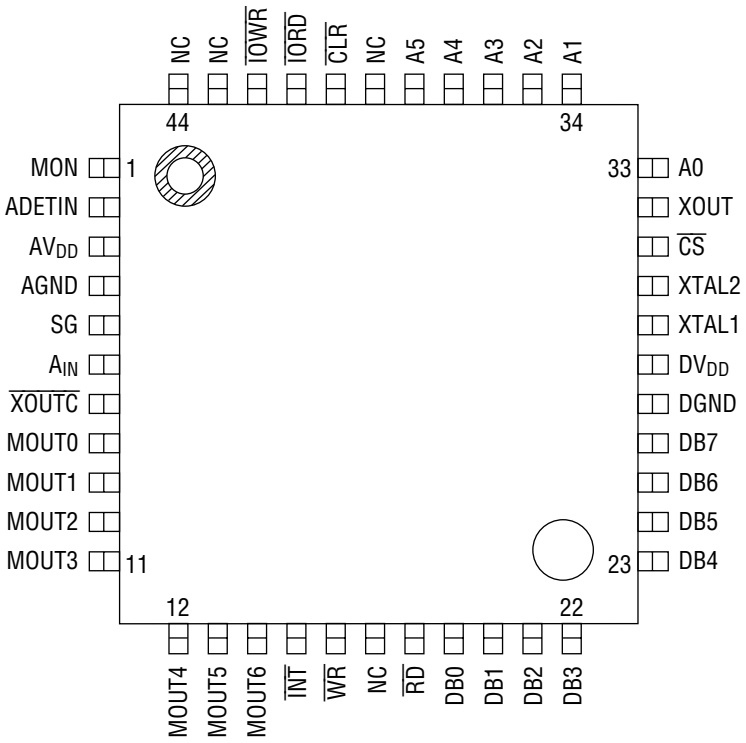
FEATURES

- Built-in discrambler supporting VICS
- Pin compatible with MSM9552/MSM9553
- Built-in bandpass filter (SCF)
- Built-in timer internal to block
- 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 (MSM9554), 3V (MSM9555)
- Package
  44-pin plastic QFP (QFP44-P-910-0.80-2K) (Product name: MSM9554GS-2K/MSM9555GS-2K)

BLOCK DIAGRAM



PIN CONFIGURATION (TOP VIEW)



Note: Leave the NC pins open.

44-Pin Plastic QFP

PIN DESCRIPTION

Function	Pin	Symbol	Type	Description
Micro-controller 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": Occurrence of an interrupt
	31	$\overline{CS}$	I	Chip select signal. "L": Read, write, and data bus signals valid
	40	$\overline{CLR}$	I	"L" initializes internal registers, and the device enters power down mode
	33 to 38	A0 to A5	I	Address signal to internal register
	19 to 26	DB0 to DB7	I/O	Data bus signal to internal register
Tuner interface	6	A_{IN}	I	FM multiplex signal input
	5	SG	O	Analog reference voltage output pin. To prevent noise, connect a capacitor between this pin and analog ground.
Analog section test	1	MON	O	Analog section waveform monitor pin. The analog block is specified by the analog control register.
	2	ADETIN	I	Analog signal input pin for testing
Digital section test	41 42	$\overline{IORD}$ $\overline{IOWR}$	I	Digital section test signal input pins. Internally pulled up.
	8 to 14	MOUT0 to MOUT6	O	Digital section test signal output and monitor output pins
Clock	29	XTAL1	I	8.192MHz crystal oscillator connection pin
	30	XTAL2	O	8.192MHz crystal oscillator connection pin
	32	XOUT	O	Pin for supply of 64kHz to 8.192MHz 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 (MSM9554)

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 (MSM9554)

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 (MSM9554)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Applied Pin
Current consumption	I_{DD}	During operation, No load f=8.192MHz	—	18	34	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 (MSM9555)

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 (MSM9555)

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 (MSM9555)

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit	Applied Pin
Current consumption	I_{DD}	During operation, No load f=8.192MHz	—	14	23	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

APPLICATION CIRCUIT