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# MSM9560

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## IC for FM Multiplex Data Demodulation

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### GENERAL DESCRIPTION

The MSM9560 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. 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 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 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.

\*1 DARC is a registered trademark of NHK Engineering Services.

Any manufacturer licensed by NHK Engineering Service can manufacture and sell products that utilize the DARC technology.

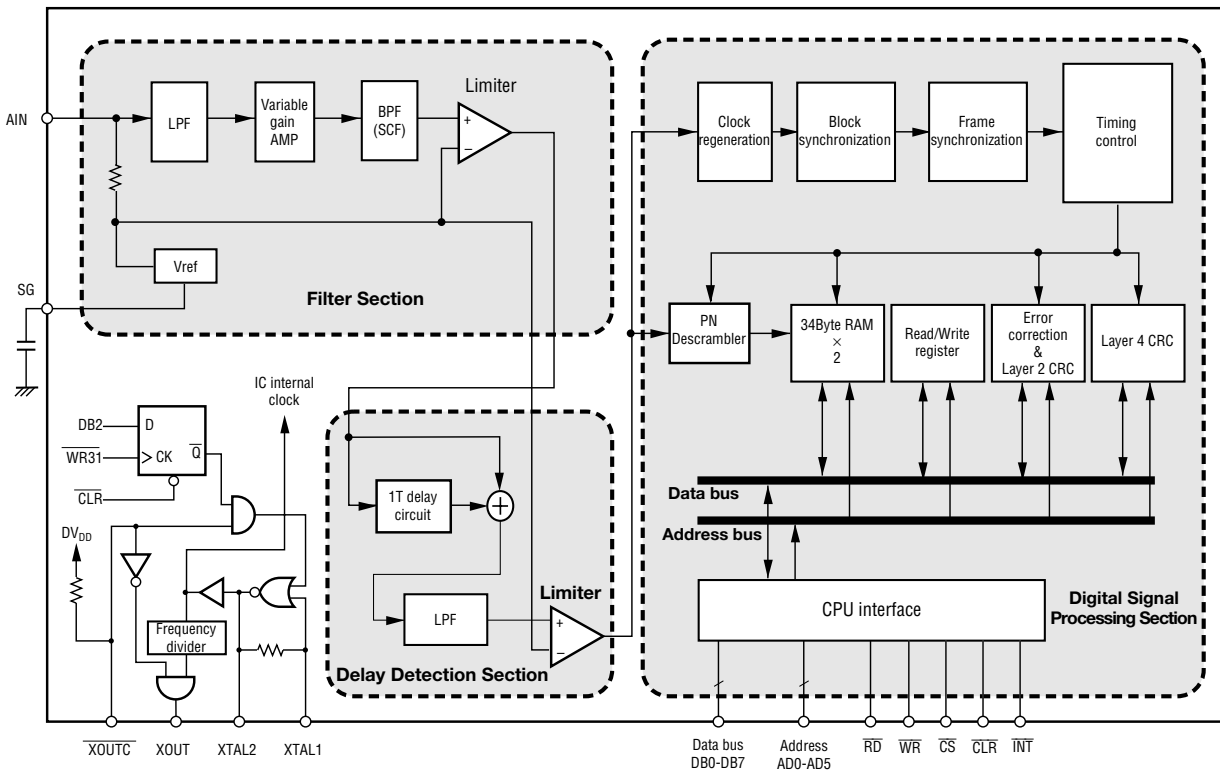
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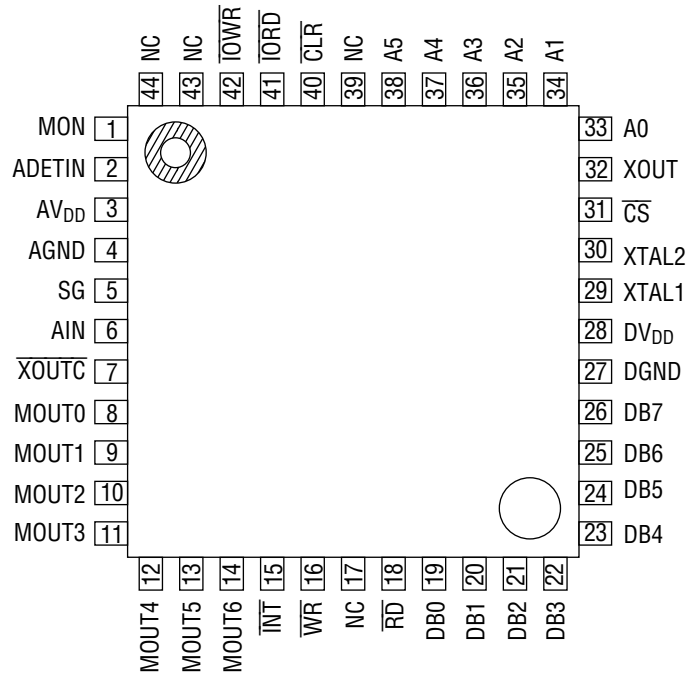
### FEATURES

- 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
- Package:  
44-pin plastic QFP (QFP44-P-910-0.80-2K) (Product name: MSM9560GS-2K)

BLOCK DIAGRAM



**PIN CONFIGURATION (TOP VIEW)**



NC : No-connection pin

**44-Pin Plastic QFP**

## PIN DESCRIPTIONS

Function	Pin	Symbol	Type	Description
Microcontroller 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 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	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	$\overline{TORD}$	I	Digital section test signal input pins. Internally pulled up.
	42	$\overline{TOWR}$		
	8 to 14	MOUT0 to MOUT6	O	Digital section test signal output and monitor output pins.
Clock	29	XTAL1	I	8.192 MHz crystal connection pin.
	30	XTAL2	O	8.192 MHz crystal connection pin.
	32	XOUT	O	Pin for supply of 64 kHz to 8.192 MHz variable 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 <sub>DD</sub>	—	Analog section power supply pin.
	4	AGND	—	Analog ground pin.
	28	DV <sub>DD</sub>	—	Digital section power supply pin.
	27	DGND	—	Digital ground pin.

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Condition	Rating	Unit
Power Supply Voltage	$AV_{DD}$	$AV_{DD} = DV_{DD}$ $T_a = 25^\circ\text{C}$	-0.3 to +7.0	V
	$DV_{DD}$			
Input Voltage	$V_I$		-0.3 to $AV_{DD} + 0.3$	
Output Voltage	$V_O$	-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	$^\circ\text{C}$

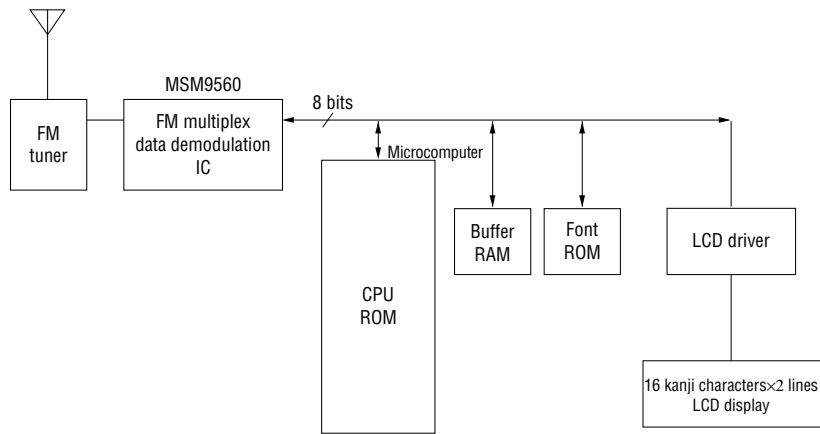
**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Condition	Range	Unit	Applied Pin
Power Supply Voltage	$AV_{DD}$	$AV_{DD} = DV_{DD}$	4.5 to 5.5	V	$AV_{DD}$
	$DV_{DD}$				$DV_{DD}$
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	$^\circ\text{C}$	—

**ELECTRICAL CHARACTERISTICS**

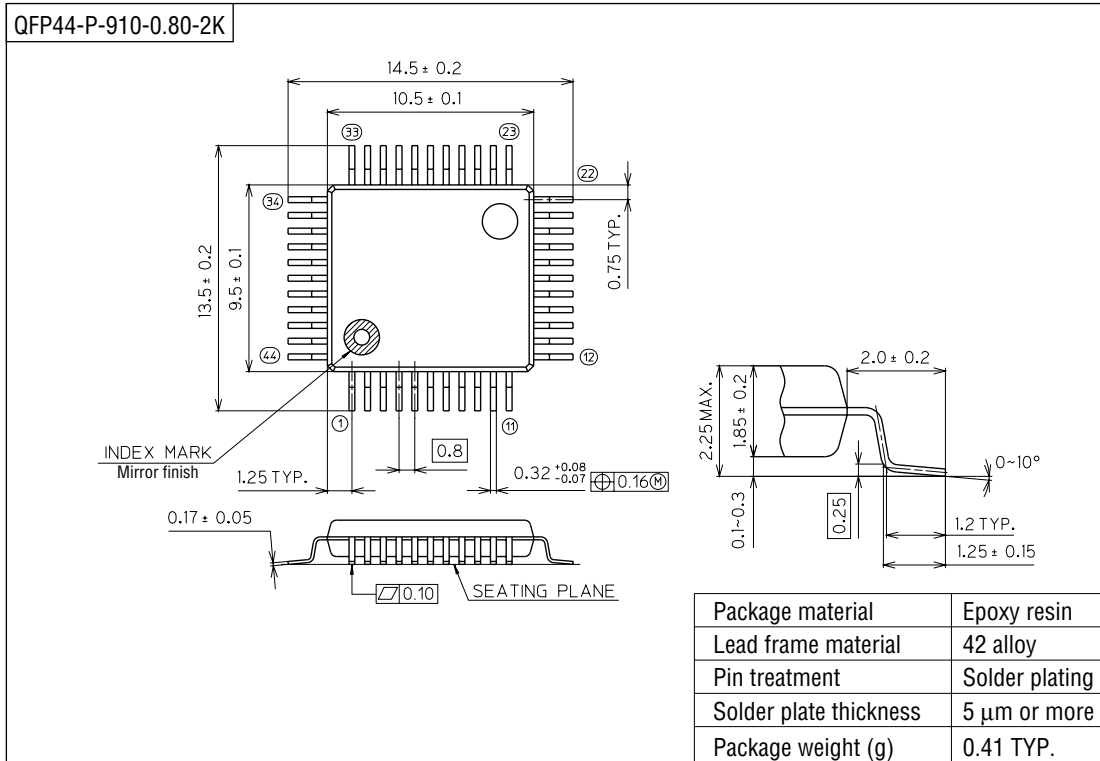
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Applied Pin
Supply Current	$I_{DD}$	When operating, no load $f = 8.192$ MHz	—	14	28	mA	$AV_{DD}$ , $DV_{DD}$
		When in power down mode, no load	—	—	20	$\mu\text{A}$	
BPF Pass Band Attenuation	GAIN1	72 to 80 kHz Variable gain amplifier gain: 0 dB	—	—	3.0	dB	MON
BPF Stop Band Attenuation	GAIN2	0 to 53 kHz Variable gain amplifier gain: 0 dB	50	—	—	dB	MON
BPF Stop Band Attenuation	GAIN3	100 to 500 kHz Variable gain amplifier gain: 0 dB	50	—	—	dB	MON

APPLICATION CIRCUIT



**PACKAGE DIMENSIONS**

(Unit : mm)



**Notes for Mounting the Surface Mount Type Package**

The SOP, QFP, TSOP, TQFP, LQFP, 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 on the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

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2. The outline of action and examples for application circuits described herein have been chosen as an explanation for the standard action and performance of the product. When planning to use the product, please ensure that the external conditions are reflected in the actual circuit, assembly, and program designs.
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