OKI Semiconductor

MSM9560

IC for FM Multiplex Data Demodulation

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.
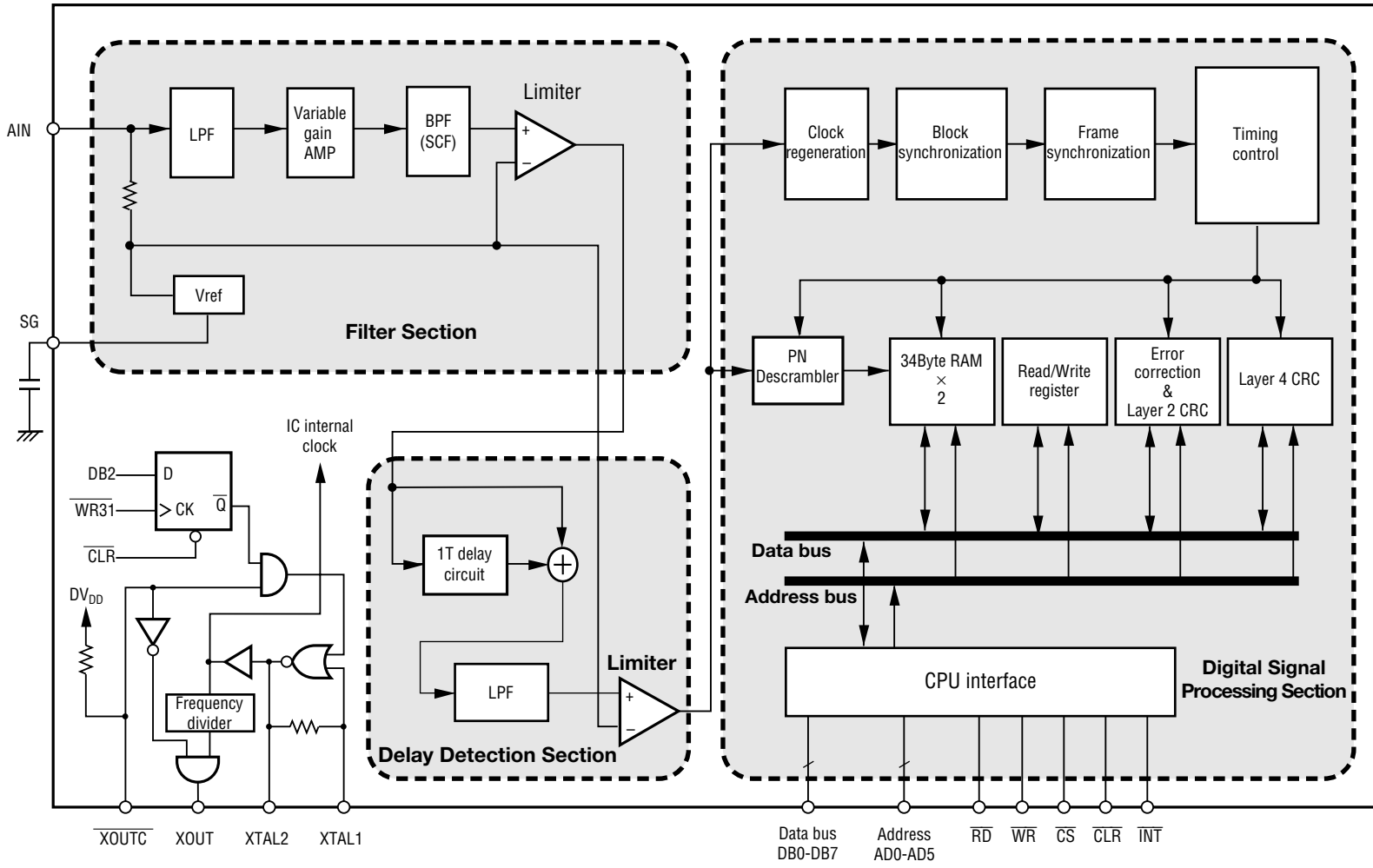
For detailed information on license, please contact:
NHK Engineering Service   Phone: 81-3481-2650
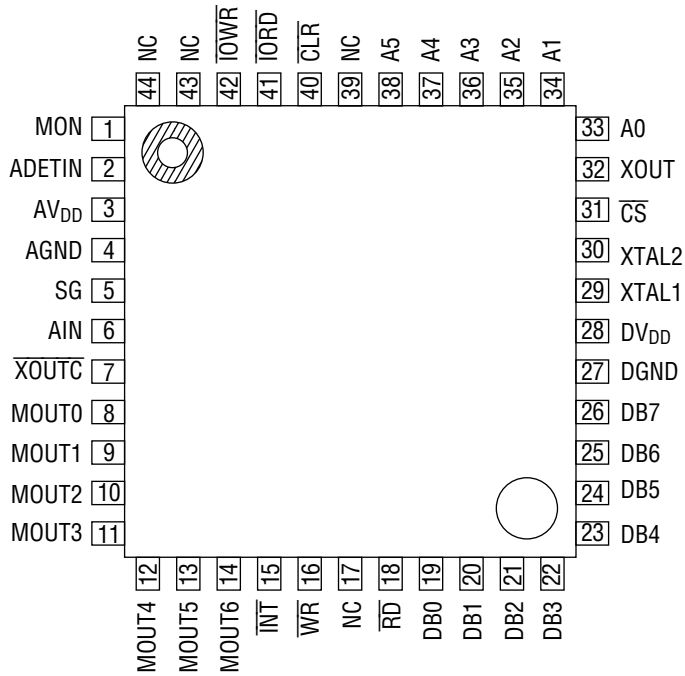
FEATURES

- 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)

PIN CONFIGURATION (TOP VIEW)

Pin	Signal
1	MON
2	ADETIN
3	AV$_{DD}$
4	AGND
5	SG
6	AIN
7	$\overline{XOUTC}$
8	MOUT0
9	MOUT1
10	MOUT2
11	MOUT3
12	MOUT4
13	MOUT5
14	MOUT6
15	$\overline{INT}$
16	$\overline{WR}$
17	NC
18	$\overline{RD}$
19	DB0
20	DB1
21	DB2
22	DB3
23	DB4
24	DB5
25	DB6
26	DB7
27	DGND
28	DV$_{DD}$
29	XTAL1
30	XTAL2
31	$\overline{CS}$
32	XOUT
33	A0
34	A1
35	A2
36	A3
37	A4
38	A5
39	NC
40	$\overline{CLR}$
41	$\overline{IORD}$
42	$\overline{IOWR}$
43	NC
44	NC

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	$\overline{IORD}$	I	Digital section test signal input pins. Internally pulled up.
	42	$\overline{IOWR}$		
	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_{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

Parameter	Symbol	Condition	Rating	Unit
Power Supply Voltage	AV_{DD}	$AV_{DD} = DV_{DD}$ Ta = 25°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	Ta = 25°C, per package	400	mW
		Ta = 25°C, per output	50	
Storage Temperature	T_{STG}	—	−55 to +150	°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 ±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	°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	μA	
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

MSM9560

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         ▽
         |
      +--------+        FM multiplex        8 bits
      |   FM   |------| data demodulation |----/----+--------+--------+-----------------+
      | tuner  |      |        IC         |         |        |        |                 |
      +--------+      +-------------------+    Microcomputer |        |                 |
                                               |        |        |                 |
                                          +--------+ +--------+ +--------+ +-------------+
                                          |        | | Buffer | |  Font  | |             |
                                          |        | |  RAM   | |  ROM   | | LCD driver  |
                                          |  CPU   | +--------+ +--------+ +-------------+
                                          |  ROM   |                            |
                                          |        |                    +-------------------+
                                          |        |                    | 16 kanji characters×2 lines |
                                          +--------+                    |    LCD display    |
                                                                        +-------------------+
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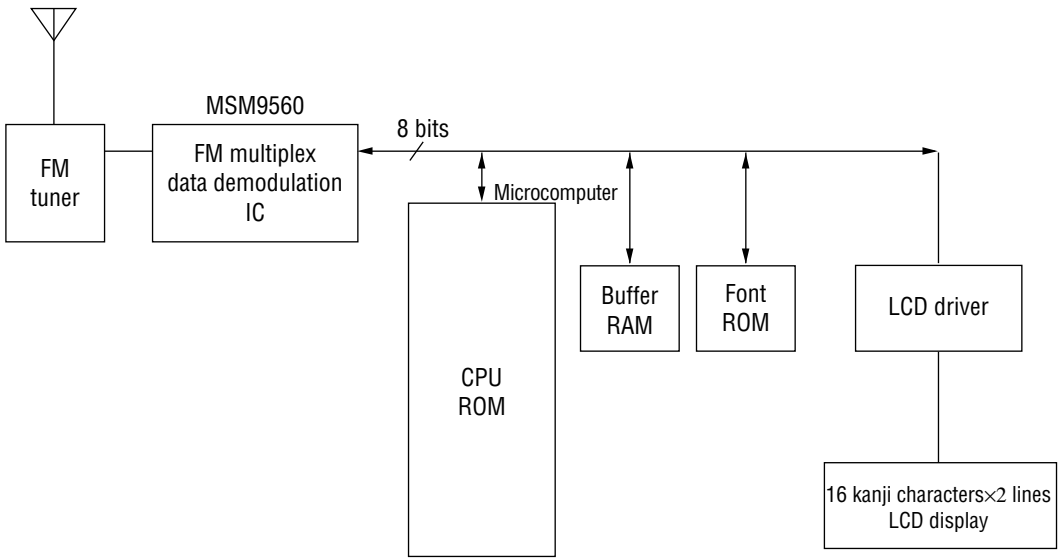
PACKAGE DIMENSIONS

(Unit : mm)

QFP44-P-910-0.80-2K

Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating
Solder plate thickness	5 μm or more
Package weight (g)	0.41 TYP.
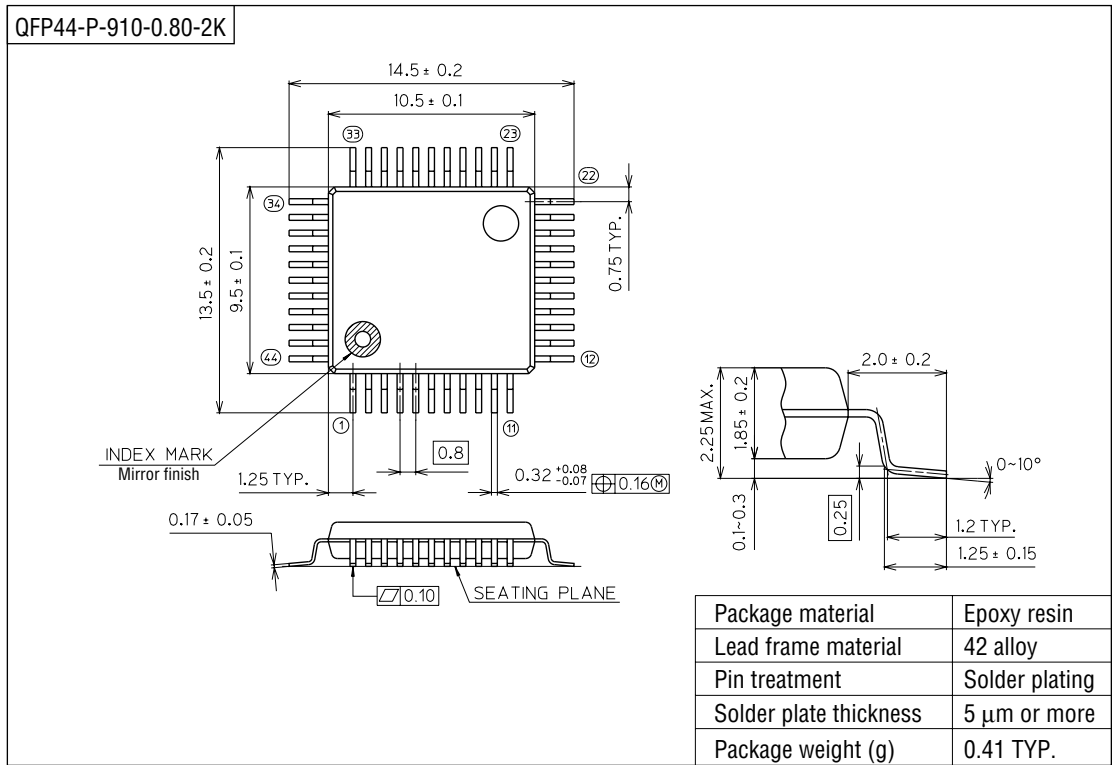
Notes for Mounting the Surface Mount Type Package

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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