WM7121, WM7121E

Top Port Analogue Silicon Microphone

DESCRIPTION

The WM7121 is a low-profile silicon analogue microphone. It offers high Signal to Noise Ratio (SNR) and low power consumption and is suited to a wide variety of consumer applications.

The WM7121 incorporates Wolfson's proprietary CMOS/MEMS membrane technology, offering high reliability and high performance in a miniature, low-profile package. The WM7121 is designed to withstand the high temperatures associated with automated flow solder assembly processes. (Note that conventional microphones can be damaged by this process.)

The WM7121E variant offers a tighter tolerance on the microphone sensitivity, giving reduced variation between parts. This removes the need for in-line production calibration of part-to-part microphone variations.

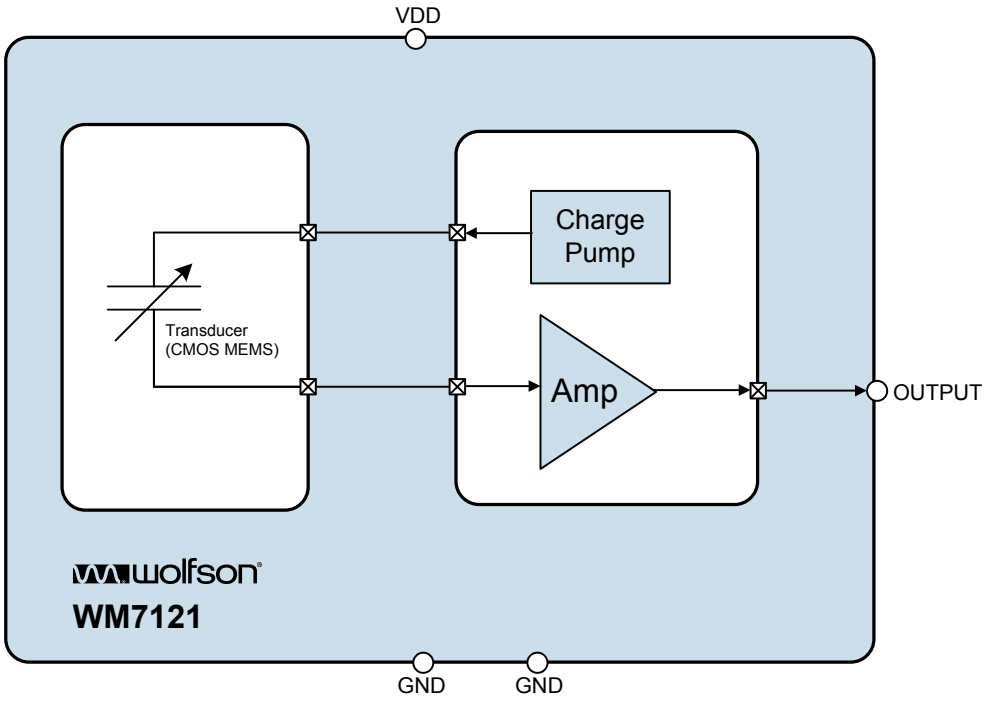
FEATURES

- High SNR; selectable sensitivity tolerance options
  - WM7121 - SNR 65dB, Sensitivity +/-3dB
  - WM7121E - SNR 65dB, Sensitivity +/-1dB
- Matched performance to bottom port microphone WM7132
  - Matched sensitivity performance
  - Matched frequency response
  - Matched phase response
- Low supply current 200µA
- Low profile packaging
- Support for automated flow solder assembly
- Analogue output
- Top Port Package
- 1.5V to 3.7V supply
- 3.76mm x 2.95mm x 1.10mm Package

APPLICATIONS

- Mobile phone handsets
- Portable media players
- Digital still cameras
- Digital video cameras
- Bluetooth headsets
- Portable navigation devices
- Portable games consoles

BLOCK DIAGRAM



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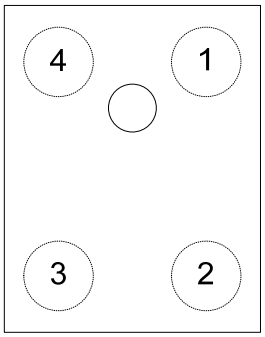
PIN CONFIGURATION



Top View

PIN DESCRIPTION

PIN	NAME	TYPE	DESCRIPTION
1	VDD	Supply	Analogue Supply
2	GND	Supply	Analogue ground
3	GND	Supply	Analogue ground
4	OUTPUT	Analogue Output	Microphone analogue output signal

ORDERING INFORMATION

DEVICE	DESCRIPTION	TEMPERATURE RANGE	MOISTURE SENSITIVITY LEVEL	PEAK SOLDERING TEMPERATURE
WM7121IMS/V	Standard	-40 to +100°C	MSL2A	+260°C
WM7121IMS/RV	Standard (tape and reel)	-40 to +100°C	MSL2A	+260°C
WM7121IMSE/V	Enhanced	-40 to +100°C	MSL2A	+260°C
WM7121IMSE/RV	Enhanced (tape and reel)	-40 to +100°C	MSL2A	+260°C

Note:

Reel quantity = 5000

All devices are Pb-free and Halogen free.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings are stress ratings only. Permanent damage to the device may be caused by continuously operating at or beyond these limits. Device functional operating limits and guaranteed performance specifications are given under Electrical Characteristics at the test conditions specified.

ESD Sensitive Device. This device is manufactured on a CMOS process. It is therefore generically susceptible to damage from excessive static voltages. Proper ESD precautions must be taken during handling and storage of this device.

Wolfson tests its package types according to IPC/JEDEC J-STD-020 for Moisture Sensitivity to determine acceptable storage conditions prior to surface mount assembly. These levels are:

MSL1 = unlimited floor life at <30°C / 85% Relative Humidity. Not normally stored in moisture barrier bag.
MSL2 = out of bag storage for 1 year at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.
MSL2A = out of bag storage for 4 weeks at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.
MSL3 = out of bag storage for 168 hours at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.
The Moisture Sensitivity Level for each package type is specified in Ordering Information.

CONDITION	MIN	MAX
Supply Voltage (VDD)	-0.3V	+4.2V
Operating temperature range, T_A	-40ºC	+100ºC
Storage temperature prior to soldering	30°C max / 60% RH max	
Storage temperature after soldering	-40ºC	+100ºC

IMPORTANT ASSEMBLY GUIDELINES

Do not put a vacuum over the port hole of the microphone. Placing a vacuum over the port hole can damage the device.

Do not board wash the microphone after a re-flow process. Board washing and the associated cleaning agents can damage the device. Do not expose to ultrasonic cleaning methods.

Do not use a vapour phase re-flow process. The vapour can damage the device.

Please refer to application note WAN0273 (MEMS MIC Assembly and Handling Guidelines) for further assembly and handling guidelines.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Analogue Supply Range	VDD	1.5		3.7	V
Ground	GND		0		V

ACOUSTIC AND ELECTRICAL CHARACTERISTICS

Test Conditions: VDD=2.1V, 1kHz test signal, T_A = 25°C

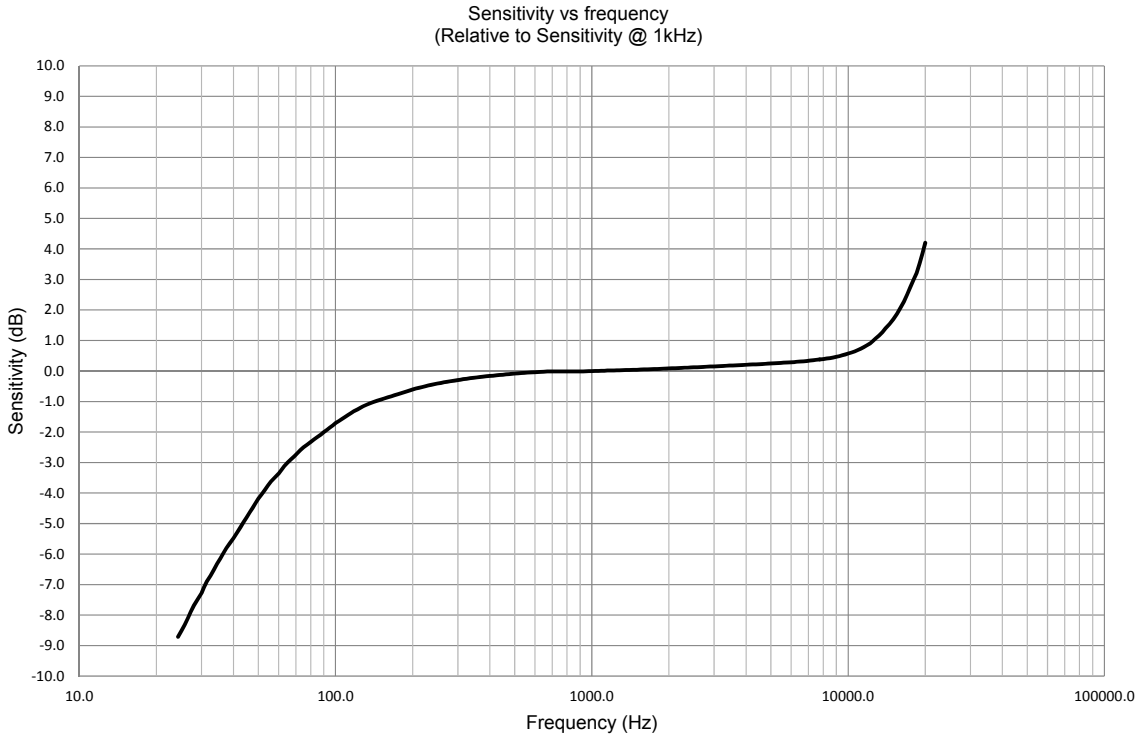
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Directivity				Omni-directional		
Sensitivity (WM7121)	S	94dB SPL	-41	-38	-35	dBV
Sensitivity (WM7121E)	S	94dB SPL	-39	-38	-37	dBV
Acoustic Overload		No Load THD < 10%		126		dB SPL
Signal to Noise Ratio	SNR	A-Weighted		65		dB
Total Harmonic Distortion	THD	104dB SPL		0.25		%
Dynamic Range	DR	A-Weighted, Noise floor to 1% THD		91		dB
Frequency Response		-3dB Low Frequency +3dB High Frequency		62 15000		Hz Hz
Acoustic Noise Floor		A-Weighted		29		dB SPL
Electrical Noise Floor		A-Weighted		-103		dBV
Power Supply Rejection Ratio	PSRR	100mV RMS, 217Hz		46		dB
Current Consumption	I_{VDD}			200		µA
Output DC Impedance	Z_{OUT}			100	250	Ω

TERMINOLOGY

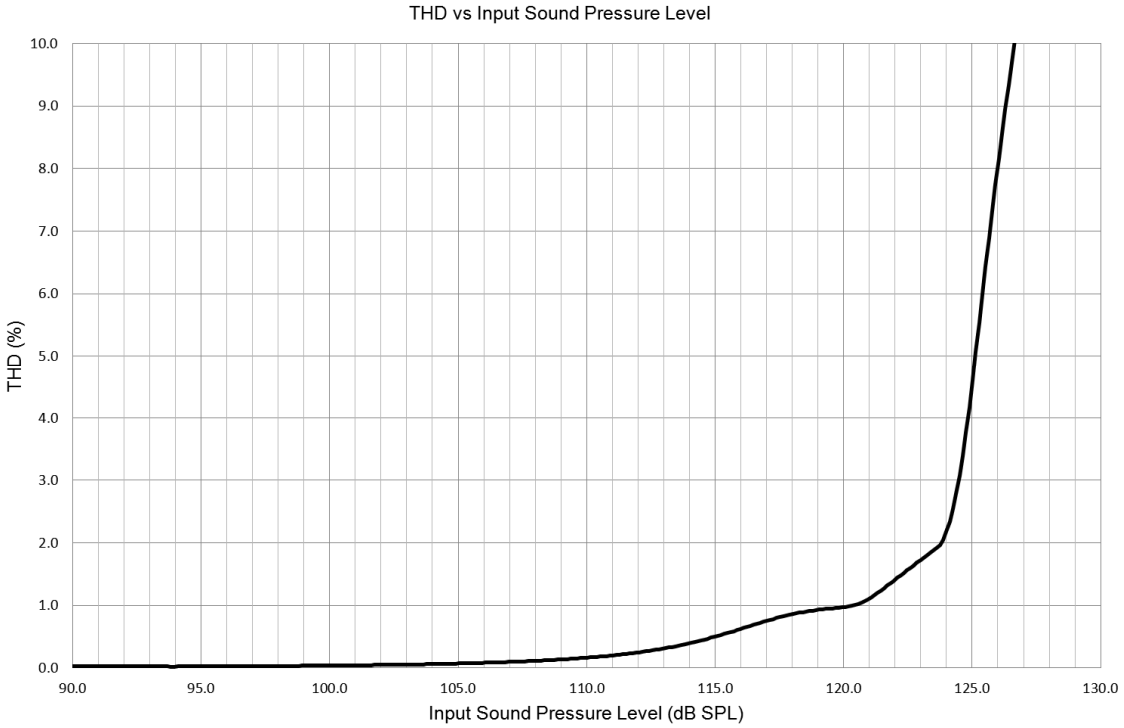
1. Sensitivity (dBV) – Sensitivity is a measure of the microphone output response to the acoustic pressure of a 1kHz 94dB SPL (1Pa RMS) sine wave.
2. Signal-to-Noise Ratio (dB) – SNR is a measure of the difference in level between the output response of a 1kHz 94dB SPL sine wave and the idle noise output.
3. Total Harmonic Distortion (dB) – THD is the ratio of the RMS sum of the harmonic distortion products in the specified bandwidth (see note below) relative to the amplitude of the fundamental (ie. Test frequency) output.
4. Dynamic Range (dB) – DR is the ratio of the 1% THD microphone output level (in response to a sine wave input) and the idle noise output level. Parameter validated in electroacoustic laboratory and not guaranteed.
5. All performance measurements are carried out with 20 kHz low pass 'brick wall' filter and, where noted, an A-weighted filter. Failure to use these filters will result in higher THD and lower SNR values than are found in the Acoustic and Electrical Characteristics. The low pass filter removes out of band noise.

TYPICAL PERFORMANCE

FREQUENCY RESPONSE



THD RATIO



APPLICATIONS INFORMATION

RECOMMENDED EXTERNAL COMPONENTS

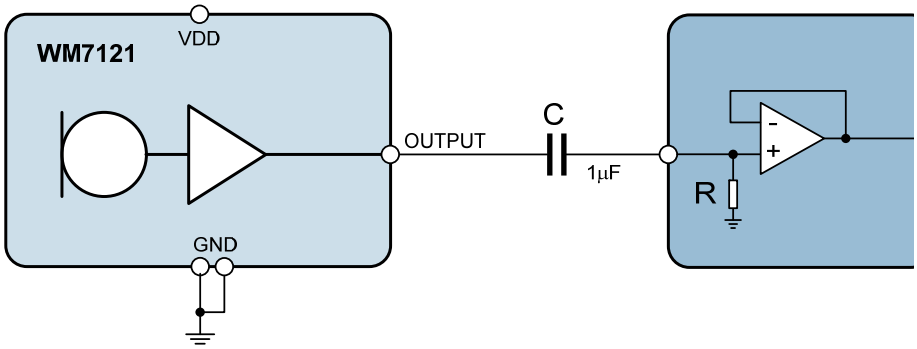


Figure 1 WM7121 Recommended External Components

A DC-blocking output capacitor is required on the OUTPUT pin, as illustrated in Figure 1. A single capacitor is required for a single-ended connection. The capacitor must be correctly selected as it affects the cut-off frequency of the output path. A low cut-off frequency is desirable as it means there is no significant filtering of the audio bandwidth.

The 3dB cut-off frequency of the output path is given by the equation below, where C is the output capacitance and R is the input resistance of the other circuit.

$$\text{3dB filter roll-off frequency} = \frac{1}{2\pi RC}$$

A typical recommended configuration, with 1uF DC-blocking capacitor and 20kΩ minimum input circuit impedance, gives a 3dB cut-off frequency of 10Hz or less. Tantalum electrolytic capacitors are particularly suitable for the DC-blocking components as they offer high stability in a small package size

OPTIMISED SYSTEM RF DESIGN

For optimised RF design please refer to document WAN0278 (Recommended PCB Layout for

Microphone RF Immunity in Mobile Cell Phone Applications) for further information.

CONNECTION TO A WOLFSON AUDIO CODEC

Wolfson provides a range of audio CODECs incorporating an analogue microphone input interface; these support connection to silicon microphones such as the WM7121.

The recommended connection of a WM7121 silicon microphone to the WM8994 is illustrated in Figure 2 (for single-ended mode) and Figure 3 (for pseudo-differential mode).

A DC blocking capacitor is required, as described in the previous section. A 1µF decoupling capacitor is also recommended; this should be positioned close to the VDD pin of the WM7121.

Further information on the WM8994 is provided in the product datasheet, which is available from the Wolfson website. The equivalent connections can be made to other Wolfson devices in a similar manner.

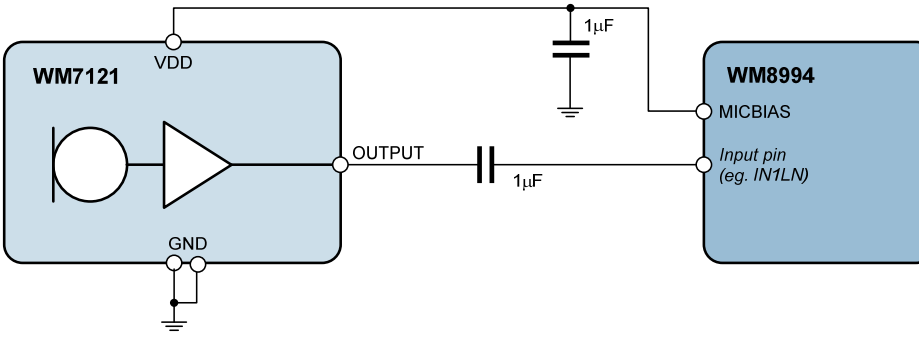


Figure 2 WM7121 Silicon Microphone Single-ended Connection to WM8994

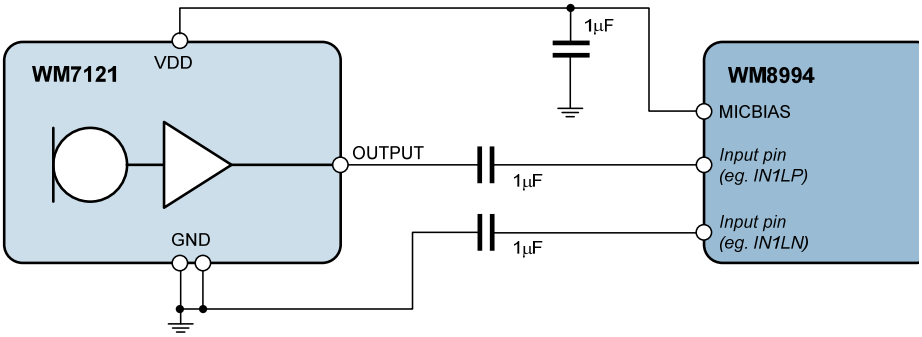


Figure 3 WM7121 Silicon Microphone Pseudo-differential Connection to WM8994

MATCHED MICROPHONE PAIRS

WM7121 and WM7132 are sensitivity matched microphone pairs. The enhanced versions, WM7121E and WM7132E have tight tolerance of ±1dB and compatible output performance. These microphones are ideal for accurate sound pickup from opposite directions in slim profile applications.

WM7132E should be positioned close to WM7121E on the same side of the PCB to maximise acoustic matching for effective DSP application.

The WM7121 and WM7132 also have matched frequency response at both high and low frequencies, allowing simplified system design.

RECOMMENDED PCB LAND PATTERNS

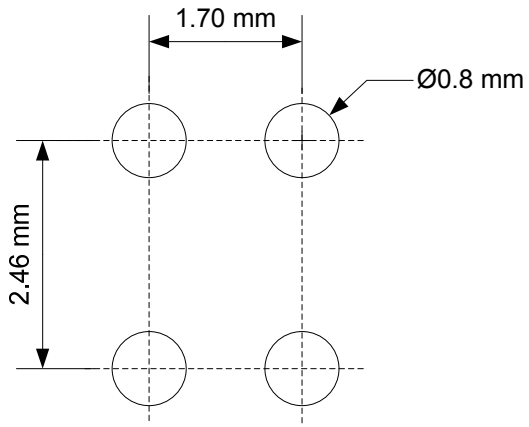
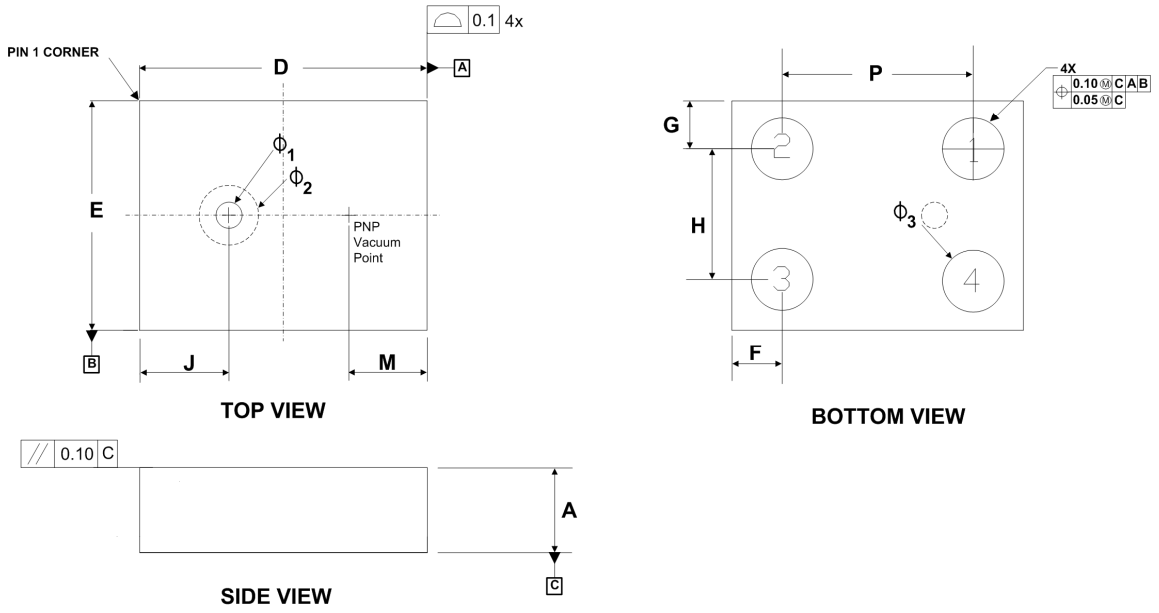


Figure 4 Recommended Customer PCB Land Pattern

(Note that all other dimensions can be obtained from the package dimensions)

PACKAGE DIMENSIONS (LGA)

MS4: PACKAGE 3.76 x 2.95 x 1.10 mm BODY **DM124.B**



Symbols	Dimensions (mm)			
	MIN	NOM	MAX	NOTE
A	1.00	1.10	1.20	
D	3.66	3.76	3.86	
E	2.85	2.95	3.05	
F	0.60	0.65	0.70	
G	0.575	0.625	0.675	
H	1.60	1.70	1.80	
J		1.18		
M		1.16		
P	2.36	2.46	2.56	
ϕ_1	0.15	0.25	0.35	
ϕ_2		0.60		Gasket Diameter
ϕ_3		0.80		

NOTES:
1. THE SEATING PLANE IS REPRESENTED BY PRIMARY DATUM -C-
2. THE DEVIATION FROM THE SEATING PLANE DUE TO WARPAGE OR TWIST IS SPECIFIED AS MAX 50μm (FLATNESS).
3. LID SHOULD BE PARALLEL TO THE SEATING PLANE ±100μm.
4. INTERPRET DIM AND TOL PER ASME Y14.5M - 1994

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REVISION HISTORY

DATE	REV	ORIGINATOR	CHANGES
26/09/12	2.0	JMacD	First Release
28/01/13	2.1	MR/JMacD	Package Dimensions updated: Top View diagram: Pin 1 identifier added Bottom View diagram: Port hold added
26/03/13	3.0	MR/JMacD	PSSR updated from 53 to 46.