



SANYO Semiconductors

## DATA SHEET



LV25400W

Bi-CMOS LSI

For Automotive Applications  
DSP Tuner Front End

## Overview

The LV25400W is a tuner front end IC that supports the Sanyo SDRS400 car radio DSP.

The LV25400W supports worldwide radio standards including the FM bands used in US, Europe, and Japan as well as the LW, MW, SW, and FM weather bands. It adopts an image canceling mixer for the FM mixer and incorporates a fast PLL locking function to support RDS. The LV25400W also supports automatic alignment using CCB bus control. It requires external EEPROM.

The LV25400W can implement a DSP tuner at low cost with a minimal number of external components.

## Functions

- AM, FM, FE, IF, and PLL circuits

## Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> 8V	OSC_V <sub>CC</sub> (2), FE_V <sub>CC</sub> (58)	9.0	V
	V <sub>CC</sub> 5V	XTAL_V <sub>CC</sub> (13), V <sub>CC</sub> D (22), V <sub>CC</sub> A (40)	6.0	V
CCB bus maximum input voltage	V <sub>IN</sub> max	Pin 18, 19, 20	-0.3 to +5.0	V
CCB bus maximum output voltage	V <sub>O</sub>	Pin 21	-0.3 to +6.5	V
Allowable power dissipation	P <sub>d</sub> max	Ta ≤ 85°C *1	840	mW
Operating temperature	T <sub>opr</sub>		-40 to +85	°C
Storage temperature	T <sub>stg</sub>		-50 to +125	°C

\*1 : Ratings vary with characteristics of the circuit board (materials, size, etc.) on which the device is to be mounted.

- CCB is a registered trademark of SANYO Electric Co., Ltd.
- CCB is SANYO Semiconductor's original bus format. All bus addresses are managed by SANYO Semiconductor for this format.

■ Any and all SANYO Semiconductor Co.,Ltd. products described or contained herein are, with regard to "standard application", intended for the use as general electronics equipment (home appliances, AV equipment, communication device, office equipment, industrial equipment etc.). The products mentioned herein shall not be intended for use for any "special application" (medical equipment whose purpose is to sustain life, aerospace instrument, nuclear control device, burning appliances, transportation machine, traffic signal system, safety equipment etc.) that shall require extremely high level of reliability and can directly threaten human lives in case of failure or malfunction of the product or may cause harm to human bodies, nor shall they grant any guarantee thereof. If you should intend to use our products for applications outside the standard applications of our customer who is considering such use and/or outside the scope of our intended standard applications, please consult with us prior to the intended use. If there is no consultation or inquiry before the intended use, our customer shall be solely responsible for the use.

■ Specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

**SANYO Semiconductor Co., Ltd.**

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

# LV25400W

## Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V <sub>CC</sub> 8V	OSC_V <sub>CC</sub> (2), FE_V <sub>CC</sub> (58)	8.0	V
	V <sub>CC</sub> 5V	XTAL_V <sub>CC</sub> (13), V <sub>CCD</sub> (22), V <sub>CCA</sub> (40)	5	V
Operating supply voltage range	V <sub>CC</sub> 8Vop		7.5 to 8.5	V
	V <sub>CC</sub> 5Vop		4.5 to 5.5	V
CCB bus high-level input voltage	V <sub>IH</sub>	CE, DI, CL	2.5 to 5.0	V
CCB bus low-level input voltage	V <sub>IL</sub>	CE, DI, CL	0 to 0.8	V
CCB bus high-level input current	I <sub>IH</sub>	CE, DI, CL ; VI5.5V	10 or less	μA
CCB bus low-level input current	I <sub>IL</sub>	CE, DI, CL ; VI0V	10 or less	μA
DO low-level output voltage	V <sub>OL</sub>		0.38 or less	V
DO high-level output voltage	V <sub>OH</sub>	Connected to an LC75040.	2.1 or more	V

## Reception Frequencies

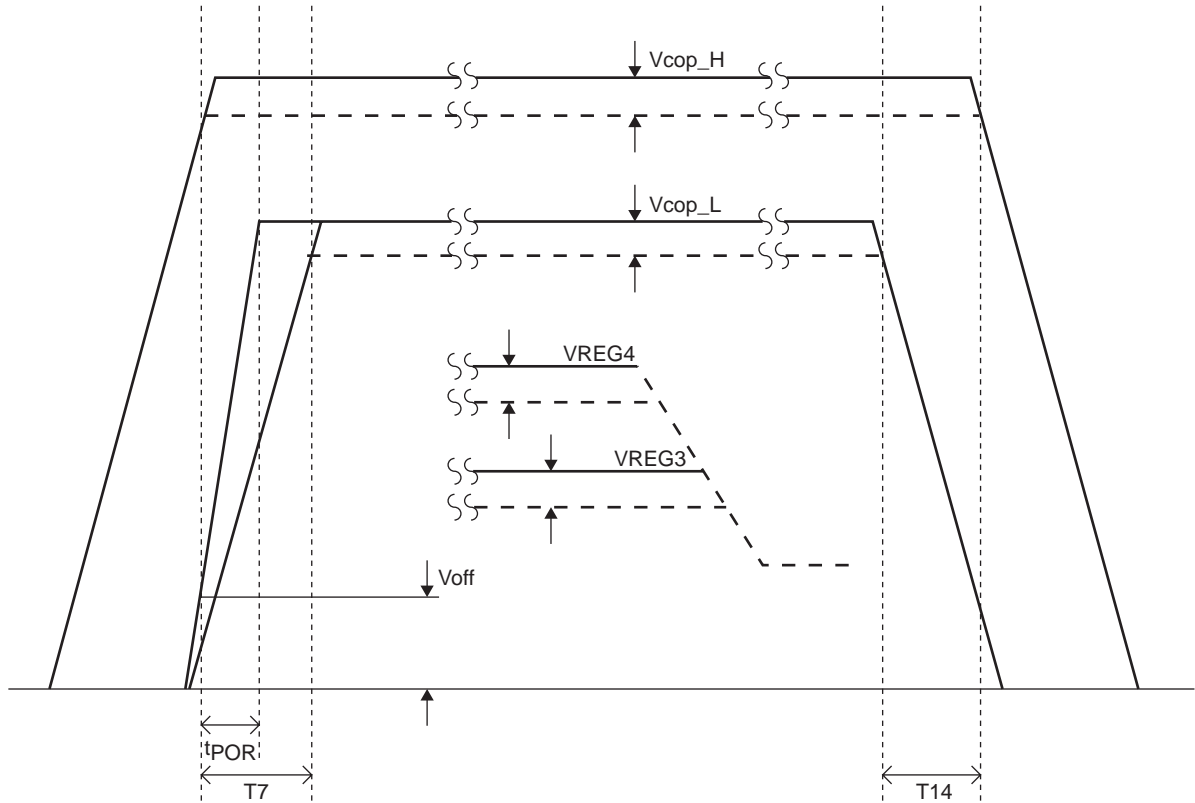
Parameter	Symbol	Conditions	Frequency ratings	Unit
FM reception frequencies	f <sub>FM</sub>	JPN, US, EUR	76 to 108.1	MHz
FM weather band reception frequencies	f <sub>FM-WB</sub>		162.4 to 162.55	MHz
AM reception frequencies	f <sub>AMLW</sub>	LW	144 to 288	kHz
	f <sub>AMMW</sub>	MW	520 to 1710	kHz
	f <sub>AMSW</sub>	SW	2.94 to 22.0	MHz

# LV25400W

## Power on/Power off Timing and the Power on Reset

Recommended Operating Ratings at  $T_a = 25^\circ\text{C}$ ,  $\text{GND} = 0\text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Operating supply voltage	Vcop H	Pin 2, 54, 55, 58	7.5		8.5	V
	Vcop L	Pin 13, 22, 40	4.5		5.5	V
Internal logic voltage	VREG3	Pin 23	2.7		3.3	V
	VREG4	Pin 24	3.7		4.3	V
Power application time (8.0 V $\rightarrow$ 5.0 V)	T7		10		100	msec
Internal register retention voltage	Vhmin3	Pin 23 : Design reference value	2.2			V
	Vhmin4	Pin 24 : Design reference value	2.2			V
Internal register reset voltage	Voff	Pin 13, 22, 40 : Design reference value	0		0.2	V
Internal register reset power supply rise time	tPOR	Pin 13, 22, 40 : Design reference value	0.05		3	msec
Power application time (5.0 V $\rightarrow$ 8.0 V)	T14		10		100	msec



# LV25400W

## AC Characteristics

**Operating Characteristics** at Ta = 25°C, VCC = 8.0V, VDD = 5.0V, unless otherwise specified. Ratings for publications

\* : These measurements are made using the Yamaichi Electronics IC51-0644-807 IC socket. An IHF bandpass filter is used as the audio filter.

### FM Characteristics - FM Front End Mixer Input (No dummy)

Parameter	Symbol	Conditions	Applied voltage				CCB Command				min	typ	max	unit
			Pin 25/26	Pin 32	Pin 50	Pin 64	IN1	IN2	IN3-1	IN3-2				
<b>DC Characteristics</b>														
Current drain-8V FM	I <sub>CCO</sub> -8V FM	No input, FM mode I2+I54+I55+I58	3				15	13	25	25	38	48	56	mA
Current drain-5V FM	I <sub>CCO</sub> -5V FM	No input, FM mode I13+I22+I40	3				15	13	25	25	31	40	46	mA
Current drain-8V FM	I <sub>CCO</sub> -8V FM2	No input, FM mode, IFAGC-Wide = OFF I2+I54+I55+I58	3				15	13	27	25	36	46	51	mA
Current drain-5V FM	I <sub>CCO</sub> -5V FM2	No input, FM mode I13+I22+I40	3				15	13	27	25	23	32	37	mA
Regulator bias 3V	VREG3V	The pin 23 voltage	3				15	13	25	25	2.7	3	3.3	V
Regulator bias 4V	VREG4V	The pin 24 voltage	3				15	13	25	25	3.6	4	4.4	V
FM antenna dump output current	IANTD-F	With 6.0V applied to pin 64 The pin 63 output current	0	0		6	15	13	25	25	5	8	12	mA
Crystal oscillator frequency	FXTAL	D2-5, 6, 7 = [110]	3				62	48	25	25		4.5		MHz
Crystal oscillator level	VXTAL	D2-5, 6, 7 = [110] (reference value)	3				62	48	25	25	15		30	mVrms
Crystal oscillator buffer level	VXTAL OSC OUT2	D2-5, 6, 7 = [110]	3				62	48	25	25	115	165		mVrms
S-meter DC output * : Adjust the shifter bits with a 50dBμV input.	VSMFM-1	10dBμV, the pin 38 DC output, no modulation	3				62	50	38	25B	0.65	0.95	1.25	V
	VSMFM-2	30dBμV, the pin 38 DC output, no modulation	3				62	50	38	25B	0.95	1.25	1.55	V
	VSMFM-3	50dBμV, the pin 38 DC output, no modulation	3				62	50	38	25B	2.10	2.15	2.20	V
	VSMFM-4	70dBμV, the pin 38 DC output, no modulation	3				62	50	38	25B	3.1	3.4	3.7	V
	VSMFM-5	90dBμV, the pin 38 DC output, no modulation	3				62	50	38	25B	3.7	4	4.3	V
Total gain from mixer to DIV IF amplifier	GMXDIV	FM_MIX_IN, DIV_OUT_IF (pin 31) Ratio of the input to output signal levels 98.1MHz mod = off, 70dBμV-Input	1.5				62	50	38	25	18.5	21.5	24.5	dB
DIV IF amplifier gain	GDIVIF	IF_N_IN1 (pin 45), DIV_OUT_IF (pin 31) Ratio of the input to output signal levels 10.7MHz mod = off, 88dBμV-Input	3				62	50	38	25	4.5	7.5	10.5	dB
1dB compression point driver IF	1DB POINT DIF	IF_N_IN1 (pin 45), DIV_OUT_IF (pin 31) Ratio of the input to output signal levels 10.7MHz mod = off	3				62	50	38	25		111		dB
Narrow IF AGC grain (FM)	GIFAGCNF1	FM_ANALOG_IN (pin 45), 10.7OUTN (pin 29) Ratio of the input to output signal levels 10.7MHz mod = off 100dBμV-Input [D32-28 to 25] = 1011, With 0V applied to pin 26	0				62	50	38	25	-3.1	-0.6	1.9	dB
Narrow IF AGC grain (FM)	GIFAGCNF2	FM_ANALOG_IN (pin 45), 10.7OUTN (pin 29) Ratio of the input to output signal levels 10.7MHz mod = off 80dBμV-Input [D32-28 to 25] = 1011, With 3V applied to pin 26	3				62	50	38	25	16.9	21.4	25.9	dB

Continued on next page.

# LV25400W

Continued from preceding page.

Parameter	Symbol	Conditions	Applied voltage				CCB Command				min	typ	max	unit	
			25/26 pin	32 pin	50 pin	64 pin	IN1	IN2	IN3-1	IN3-2					
1dB compression point FM-Narrow	1DB POINT NF	FM_ANALOG_IN (pin 45), 10.7OUTN (pin 29) 10.7MHz mod = off [D32-28 to 25] = 1011, With 0V applied to pin 26	0				62	50	38	25	105				dB $\mu$ V
Wide IF AGC grain (FM)	GIFAGCWF1	FM_HD_IN (pin 48), HD_OUTN (pin 27) Ratio of the input to output signal levels 10.7MHz mod = off 100dB $\mu$ V-Input [D2-15 to 12] = 1011, With 0V applied to pin 25	0				62	50	38	25	-3.5	-1	1.5		dB
Wide IF AGC grain (FM)	GIFAGCWF2	FM_HD_IN (pin 48), HD_OUTN (pin 27) Ratio of the input to output signal levels 10.7MHz mod = off 80dB $\mu$ V-Input [D2-15 to 12] = 1011, With 3V applied to pin 25	3				62	50	38	25	16.5	21	25.5		dB
1dB compression point FM - wide	1DB POINT WF	FM_HD_IN (pin 48), HD_OUTP (pin 27) 10.7MHz mod = off [D2-15 to 12] = 1011	0				62	50	38	25	104				dB $\mu$ V
Image cancellation ratio (US)	IR US	98.1MHz reference, the amount rejected at +21.4MHz	1.5				62	50	38	25	17				dB
Image cancellation ratio (JPN)	IR JPN	83MHz reference, the amount rejected at -21.4MHz [D1-26, 27] = 01	1.5				69	50	38	25	15				dB
FM wide AGC on sensitivity F1	WAGC ON-F1	fr = 102.1MHz FM-Wide AGC-Bit [D32-3 to 0] = 0000 : minimum keyed-AGC-Bit [D32-11 to 8] = 0000 : minimum	0	0			62	50	38	13	78	85	92		dB $\mu$ V
FM wide AGC on sensitivity F2	WAGC ON-F2	fr = 102.1MHz FM-Wide AGC-Bit [D32-3 to 0] = 1111 : maximum keyed-AGC-Bit [D32-11 to 8] = 0000 : minimum	0	0			62	50	38	15	92	99	106		dB $\mu$ V
FM narrow AGC on sensitivity F1	NAGC ON-F1	fr = 98.1MHz FM-Narrow AGC-Bit [D32-7 to 4] = 0000 : minimum	0	3			62	50	38	16	66.5	73.5	80.5		dB $\mu$ V
FM narrow AGC on sensitivity F2	NAGC ON-F2	fr = 98.1MHz FM-Narrow AGC-Bit [D32-7 to 4] = 1111 : maximum	0	3			62	50	38	18	82.5	89.5	96.5		dB $\mu$ V
Practical sensitivity	S/N-31	Connected to an LA1787 (MPX, left channel output) *HCC OFF 98.1MHz, 31dB $\mu$ V, fm = 1kHz, 22.5kHz-mod 61/62pin input	3				62	50	38	25	30				dB
Signal-to-noise ratio	S/N-90	Connected to an LA1787 (MPX, left channel output) 98.1MHz, 90dB $\mu$ V, fm = 1kHz, 22.5kHz-mod 61/62pin input	0				62	50	38	25	54	57			dB

# LV25400W

## AM Characteristics : AM, AMANT inputs

Parameter	Symbol	Conditions	Applied voltage				CCB Command				min	typ	max	unit
			Pin 25/26	Pin 32	Pin 50	Pin 64	IN1	IN2	IN3-1	IN3-2				
<b>DC Characteristics</b>														
Current drain-8V AM	I <sub>CCO-8V AM</sub>	No input, AM mode I2+I54+I55+I58	3				33	15	26	26	32	44	54	mA
Current drain-5V AM	I <sub>CCO-5V AM</sub>	No input, AM mode I13+I22+I40	3				33	15	26	26	21	28	34	mA
AM antenna dump output current	I <sub>ANTD-A</sub>	When pin 50 is connected to ground The ANT-D (pin 52) output current	3				33	15	26	26	3.5	6	9	mA
<b>AC Characteristics</b>														
First AM amplifier gain	GAMP1	FM_N_IN1 (pin 45) IF_OUT (pin 43), after CF matching, 10.7MHz mod = off 74dB $\mu$ V = Input	0				33	44	26	26	5.2	6.2	7.2	dB
Narrow IF AGC gain (AM)	GIFAGCNA1	AM_ANALOG_IN (pin 37), 10.7OUTN (pin 29) Ratio of the input to output signal levels 10.7MHz mod = off 100dB $\mu$ V-Input [D32-28 to 25] = 1011, With 0V applied to pin 26	0				33	44	26	26	-1.6	0.9	3.4	dB
Narrow IF AGC gain (AM)	GIFAGCNA2	AM_ANALOG_IN (pin 37), 10.7OUTN (pin 29) Ratio of the input to output signal levels 10.7MHz mod = off 80dB $\mu$ V-Input [D32-28 to 25] = 1011, With 3V applied to pin 26	3				33	44	26	26	18	22.9	27	dB
1dB compression point AM - narrow	1DB POINT NA	AM_ANALOG_IN (pin 37), 10.7OUTN (pin29) 10.7MHz mod = off [D32-28 to 25] = 1011, With 0V applied to pin 26	0				33	44	26	26	105			dB $\mu$ V
Wide IF AGC gain (AM)	GIFAGCWA1	AM_HD_IN (pin 39), HD_OUTN (pin 27) Ratio of the input to output signal levels 10.7MHz mod = off 100dB $\mu$ V-Input [D2-15 to 12] = 1011, With 0V applied to pin 25	0				33	44	26	26	-2.5	0	2.5	dB
Wide IF AGC gain (AM)	GIFAGCWA2	AM_HD_IN (pin 39), HD_OUTN (pin 27) Ratio of the input to output signal levels 10.7MHz mod = off 80dB $\mu$ V-Input [D2-15 to 12] = 1011, With 3V applied to pin 25	3				33	44	26	26	17.5	22	26.5	dB
1dB compression point AM - wide	1DB POINT WA	AM_HD_IN (pin 39), HD_OUTP (pin 27) 10.7MHz mod = off [D2-15 to 12] = 1011, With 0V applied to pin 25	0				33	44	26	26	104			dB $\mu$ V
AM wide AGC on sensitivity A1	WAGC ON-A1	AM-ANT-IN = 1.4MHz, mod = off The input level such that the ANT_D (pin 52) level becomes 0.5V. AM wide AGC sensitivity control setting (D32-3 to D32-0) : 0000 (the minimum value)	3				33	44	26	27	78.5	83.5	88.5	dB $\mu$ V
AM wide AGC on sensitivity A2	WAGC ON-A2	AM-ANT-IN = 1.4MHz, mod = off The input level such that the ANT_D (pin 52) level becomes 0.5V. AM wide AGC sensitivity control setting (D32-3 to D32-0) : 1101	3				33	44	26	29	92	97	102	dB $\mu$ V

Continued on next page.

# LV25400W

Continued from preceding page.

Parameter	Symbol	Conditions	Applied voltage				CCB Command				min	typ	max	unit
			Pin 25/26	Pin 32	Pin 50	Pin 64	IN1	IN2	IN3-1	IN3-2				
AM narrow AGC on sensitivity A1	NAGC ON-A1	AM-ANT-IN = 1MHz, mod = off The input level such that the ANT_D (pin 52) level becomes 0.5V. AM narrow AGC sensitivity control setting (D32-7 to D32-4) : 0000 (the minimum value)	3				33	44	26	30	60	65	70	dB $\mu$ V
AM narrow AGC on sensitivity A2	NAGC ON-A2	AM-ANT-IN = 1MHz, mod = off The input level such that the ANT_D (pin 52) level becomes 0.5V. AM narrow AGC sensitivity control setting (D32-7 to D32-4) : 1111 (the maxim value)	3				33	44	26	32	75	80	85	dB $\mu$ V
Total AM gain	AMGAIN	1MHz, 60dB $\mu$ V, mod = off, the ration of the AM_ANT input and the 10.7OUTN (pin 29) output levels	3				33	44	26	32	33.5	39	44.5	dB
Practical sensitivity	S/N-33	With an LA1787 connected With a 1MHz, 33dB $\mu$ V, fm = 1kHz, 30% modulation ANT input and the IF AGC voltage = 3V add.	3				33	44	26	32	20			dB
THD_1	THD-74	With an LA1787 connected With a 1MHz, 74dB $\mu$ V, fm = 1kHz, 80% modulation ANT input and the IF AGC voltage adjusted so that the IFAGCOUT level is 100dB $\mu$ V.	Adjusted				33	44	26	32		0.7	1.2	%
THD_2	THD-77	With an LA1787 connected With a 1MHz, 77dB $\mu$ V, fm = 1kHz, 80% modulation ANT input and the IF AGC voltage adjusted so that the IFAGCOUT level is 100dB $\mu$ V.	Adjusted				33	44	26	32		0.7	1.2	%
Signal-to-noise ratio	S/N-74	With an LA1787 connected With a 1MHz, 74dB $\mu$ V, fm = 1kHz, 80% modulation ANT input and the IF AGC voltage adjusted so that the IFAGCOUT level is 100dB $\mu$ V.	Adjusted				33	44	26	32	52.5	56		dB

# LV25400W

## DC Characteristics

**Operating Characteristics** at Ta = 25°C, VCC = 8.0V, VDD = 5.0, GND = 0, VSS = 0, unless otherwise specified.

Ratings for publications

\* : These measurements are made using the Yamaichi Electronics IC51-0644-807 IC socket.

\*: Undefined

FM: No input

Pin No.	Parameter	Symbol	Conditions	CCB Command				min	typ	max	unit
				IN1	IN2	IN3-1	IN3-2				
1	FE_GND	V1FM		15	13	25	25	0			V
2	OSC_VCC	V2FM		15	13	25	25			8	V
3	OSC_B	V3FM		15	13	25	25		2.65		V
4	OSC_C	V4FM		15	13	25	25		7.45		V
5	VT	V5FM		15	13	25	25	0		8	V
6	FET_GND	V6FM		15	13	25	25	0			V
7	PLL-LPF	V7FM		15	13	25	25		*		V
8	FM FET	V8FM		15	13	25	25		*		V
9	AM FET	V9FM		15	13	25	25		*		V
10	CPAM	V10FM		15	13	25	25		*		V
11	CPFM	V11FM		15	13	25	25		*		V
12	GND (Digital)	V12FM		15	13	25	25	0			V
13	VCC (X'TAL)	V13FM		15	13	25	25			5	V
14	X'tal IN	V14FM		15	13	25	25		2.7		V
15	X'tal OUT	V15FM		15	13	25	25		4.1		V
16	GND (X'TAL)	V16FM		15	13	25	25	0			V
17	X'tal-Buffer-OUT	V17FM		15	13	25	25		3.45		V
18	CE	V18FM		15	13	25	25		BUS		V
19	DI	V19FM		15	13	25	25		BUS		V
20	CL	V20FM		15	13	25	25		BUS		V
21	DO	V21FM		15	13	25	25	0		Note 1	V
22	VCC 5V (Digital)	V22FM		15	13	25	25			5	V
23	PLL VDD (3V REG)	V23FM		15	13	25	25		3.1		V
24	PLL VDD (4V REG)	V24FM		15	13	25	25		4.15		V
25	AGC-Control-IN (HD)	V25FM		15	13	25	25		Input		V
26	AGC-Control-IN (Analog)	V26FM		15	13	25	25		Input		V
27	IFAGC-OUTN (HD)	V27FM		15	13	25	25		2.75		V
28	IFAGC-OUTP (HD)	V28FM		15	13	25	25		2.75		V
29	IFAGC-OUTN (Analog)	V29FM		15	13	25	25		2.75		V
30	IFAGC-OUTP (Analog)	V30FM		15	13	25	25		2.75		V
31	DIV-IF-OUT	V31FM		15	13	25	25		1.95		V
32	VSM-DC	V32FM		15	13	25	25	0		5	V
33	2.7V REG	V33FM		15	13	25	25		2.7		V
34	IFAGC-IN (Analog-Bypass)	V34FM		15	13	25	25		2.45		V
35	IFAGC-IN (HD-Bypass)	V35FM		15	13	25	25		2.45		V
36	GND (Analog)	V36FM		15	13	25	25		0		V
37	IFAGC-IN (Analog)	V37FM		15	13	25	25		2.45		V
38	VSM-AC	V38FM		15	13	25	25	0		5	V
39	IFAGC-IN (HD)	V39FM		15	13	25	25		2.45		V
40	VCC 5V (Analog)	V40FM		15	13	25	25		5		V
41	AM-Narrow-AGC-IN	V41FM		15	13	25	25		*		V
42	Address SW/DAC-Monitor	V42FM		15	13	25	25		3.1		V
43	AM-1st-IF-OUT	V43FM		15	13	25	25		7.5		V
44	4.9V REG	V44FM		15	13	25	25		4.7		V
45	IF-Narrow-IN	V45FM		15	13	25	25		2.6		V
46	IF-Narrow-IN(Bypass)	V46FM		15	13	25	25		2.6		V
47	AM-Wide-AGC (Bypass)	V47FM		15	13	25	25			1.5	V

Continued on next page.

# LV25400W

Continued from preceding page.

Pin No.	Parameter	Symbol	Conditions	CCB Command				min	typ	max	unit
				IN1	IN2	IN3-1	IN3-2				
48	IF-Wide-IN	V48FM		15	13	25	25		2.05		V
49	IF-Wide-IN (Bypass)	V49FM		15	13	25	25		2.05		V
50	AM-RF-AGC	V50FM		15	13	25	25			1	V
51	AM-RF-AGC (Bypass)	V51FM		15	13	25	25			1	V
52	AM-ANT-D	V52FM		15	13	25	25	0		0.3	V
53	FM-Narrow-AGC-IN	V53FM		15	13	25	25			0.3	V
54	FM/AM-MIX-OUT	V54FM		15	13	25	25			8	V
55	FM/AM-MIX-OUT	V55FM		15	13	25	25			8	V
56	ANT-DAC	V56FM		15	13	25	25	0		8	V
57	RF-DAC	V57FM		15	13	25	25	0		8	V
58	V <sub>CC</sub> (8V)	V58FM		15	13	25	25			8	V
59	AM-MIX-IN	V59FM		15	13	25	25			0.2	V
60	AM-MIX-IN	V60FM		15	13	25	25			0.2	V
61	FM-MIX-IN	V61FM		15	13	25	25		3		V
62	FM-MIX-IN	V62FM		15	13	25	25		3		V
63	FM-RF-AGC	V63FM		15	13	25	25		0.2		V
64	FM-ANT-D	V64FM		15	13	25	25		8		V

Note 1 : Pull-up voltage

## AM: No input

Pin No.	Parameter	Symbol	Conditions	CCB Command				min	typ	max	unit
				IN1	IN2	IN3-1	IN3-2				
1	FE_GND	V1AM		33	15	26	26	0			V
2	OSC_V <sub>CC</sub>	V2AM		33	15	26	26			8	V
3	OSC_B	V3AM		33	15	26	26		2.65		V
4	OSC_C	V4AM		33	15	26	26		7.45		V
5	VT	V5AM		33	15	26	26	0		8	V
6	FET_GND	V6AM		33	15	26	26	0			V
7	PLL-LPF	V7AM		33	15	26	26		*		V
8	FM FET	V8AM		33	15	26	26		*		V
9	AM FET	V9AM		33	15	26	26		*		V
10	CPAM	V10AM		33	15	26	26		*		V
11	CPFM	V11AM		33	15	26	26		*		V
12	GND (Digital)	V12AM		33	15	26	26	0			V
13	V <sub>CC</sub> (X'TAL)	V13AM		33	15	26	26			5	V
14	X'tal IN	V14AM		33	15	26	26		2.7		V
15	X'tal OUT	V15AM		33	15	26	26		4.1		V
16	GND (X'TAL)	V16AM		33	15	26	26	0			V
17	X'tal-Buffer-OUT	V17AM		33	15	26	26		3.45		V
18	CE	V18AM		33	15	26	26		BUS		V
19	DI	V19AM		33	15	26	26		BUS		V
20	CL	V20AM		33	15	26	26		BUS		V
21	DO	V21AM		33	15	26	26	0		Note 1	V
22	V <sub>CC</sub> 5V (Digital)	V22AM		33	15	26	26			5	V
23	PLL V <sub>DD</sub> (3V REG)	V23AM		33	15	26	26		3.1		V
24	PLL V <sub>DD</sub> (4V REG)	V24AM		33	15	26	26		4.15		V
25	AGC-Control-IN (HD)	V25AM		33	15	26	26		Input		V
26	AGC-Control-IN (Analog)	V26AM		33	15	26	26		Input		V
27	IFAGC-OUTN (HD)	V27AM		33	15	26	26		2.75		V

Continued on next page.

# LV25400W

Continued from preceding page.

Pin No.	Parameter	Symbol	Conditions	CCB Command				min	typ	max	unit
				IN1	IN2	IN3-1	IN3-2				
28	IFAGC-OUTP (HD)	V28AM		33	15	26	26		2.75		V
29	IFAGC-OUTN (Analog)	V29AM		33	15	26	26		2.75		V
30	IFAGC-OUTP (Analog)	V30AM		33	15	26	26		2.75		V
31	DIV-IF-OUT	V31AM		33	15	26	26		1.95		V
32	VSM-DC	V32AM		33	15	26	26	0		5	V
33	2.7V REG	V33AM		33	15	26	26		2.7		V
34	IFAGC-IN (Analog-Bypass)	V34AM		33	15	26	26		2.2		V
35	IFAGC-IN (HD-Bypass)	V35AM		33	15	26	26		2.1		V
36	GND (Analog)	V36AM		33	15	26	26		0		V
37	IFAGC-IN (Analog)	V37AM		33	15	26	26		2.2		V
38	VSM-AC	V38AM		33	15	26	26	0		5	V
39	IFAGC-IN (HD)	V39AM		33	15	26	26		2.1		V
40	V <sub>CC</sub> 5V (Analog)	V40AM		33	15	26	26		5		V
41	AM-Narrow-AGC-IN	V41AM		33	15	26	26		*		V
42	Address SW/DAC-Monitor	V42AM		33	15	26	26		3.1		V
43	AM-1st-IF-OUT	V43AM		33	15	26	26		4.8		V
44	4.9V REG	V44AM		33	15	26	26		4.7		V
45	IF-Narrow-IN	V45AM		33	15	26	26		2.65		V
46	IF-Narrow-IN (Bypass)	V46AM		33	15	26	26		2.65		V
47	AM-Wide-AGC (Bypass)	V47AM		33	15	26	26		2.25		V
48	IF-Wide-IN	V48AM		33	15	26	26		2.4		V
49	IF-Wide-IN (Bypass)	V49AM		33	15	26	26		2.4		V
50	AM-RF-AGC	V50AM		33	15	26	26		6.45		V
51	AM-RF-AGC (Bypass)	V51AM		33	15	26	26		0.8		V
52	AM-ANT-D	V52AM		33	15	26	26	0			V
53	FM-Narrow-AGC-IN	V53AM		33	15	26	26		0.4		V
54	FM/AM-MIX-OUT	V54AM		33	15	26	26			8	V
55	FM/AM-MIX-OUT	V55AM		33	15	26	26			8	V
56	ANT-DAC	V56AM		33	15	26	26	0		8	V
57	RF-DAC	V57AM		33	15	26	26	0		8	V
58	V <sub>CC</sub> (8V)	V58AM		33	15	26	26			8	V
59	AM-MIX-IN	V59AM		33	15	26	26		2.65		V
60	AM-MIX-IN	V60AM		33	15	26	26		2.65		V
61	FM-MIX-IN	V61AM		33	15	26	26			1.5	V
62	FM-MIX-IN	V62AM		33	15	26	26			1.5	V
63	FM-RF-AGC	V63AM		33	15	26	26		7		V
64	FM-ANT-D	V64AM		33	15	26	26	0			V

Parameter	Symbol	Conditions	CCB Command				min	typ	max	unit
			IN1	IN2	IN3-1	IN3-2				
TUNER OFF	V33		19	37	25	25		0.03		V

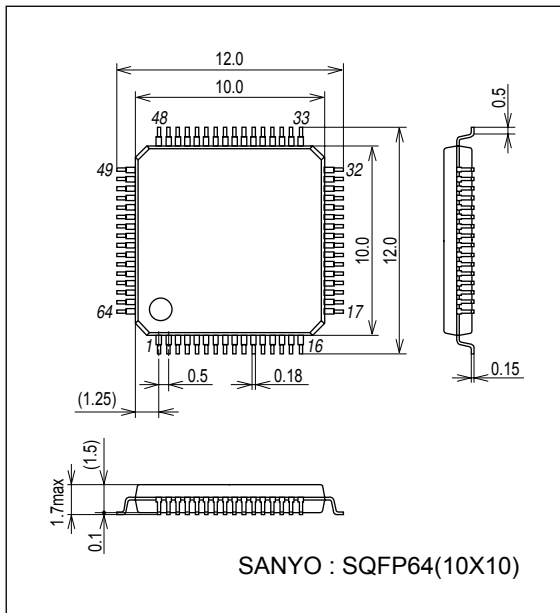
# LV25400W

Parameter	Symbol	Conditions	CCB Command				min	typ	max	unit
			IN1	IN2	IN3-1	IN3-2				
<b>ANT-DAC</b>										
ALL_OFF (000000000)	DAC560		15	13	1	25	105		285	mV
D10_SETP (100000000)	DAC561	(DAC56_1)-(DAC56_0)	15	13	2	25	3		20	mV
D11_SETP (010000000)	DAC562	(DAC56_2)-(DAC56_0)	15	13	3	25	5		35	mV
D12_SETP (001000000)	DAC563	(DAC56_3)-(DAC56_0)	15	13	5	25	15		65	mV
D13_SETP (000100000)	DAC564	(DAC56_4)-(DAC56_0)	15	13	7	25	35		125	mV
D14_SETP (000010000)	DAC565	(DAC56_5)-(DAC56_0)	15	13	9	25	120		250	mV
D15_SETP (000001000)	DAC566	(DAC56_6)-(DAC56_0)	15	13	11	25	310		490	mV
D16_SETP (000000100)	DAC567	(DAC56_7)-(DAC56_0)	15	13	13	25	730		960	mV
D17_SETP (000000010)	DAC568	(DAC56_8)-(DAC56_0)	15	13	15	25	1.5		1.9	V
D18_SETP (000000001)	DAC569	(DAC56_9)-(DAC56_0)	15	13	17	25	3.05		3.75	V
ALL_ON (111111111)	DAC56A		15	13	18	25	6.25		7.55	V
<b>RF-DAC</b>										
ALL_OFF (111111111)	DAC570		15	13	1	25	105		285	mV
D0_SETP (100000000)	DAC571	(DAC57_1)-(DAC57_0)	15	13	2	25	3		20	mV
D1_SETP (010000000)	DAC572	(DAC57_2)-(DAC57_0)	15	13	3	25	5		35	mV
D2_SETP (001000000)	DAC573	(DAC57_3)-(DAC57_0)	15	13	5	25	15		65	mV
D3_SETP (000100000)	DAC574	(DAC57_4)-(DAC57_0)	15	13	7	25	35		125	mV
D4_SETP (000010000)	DAC575	(DAC57_5)-(DAC57_0)	15	13	9	25	120		250	mV
D5_SETP (000001000)	DAC576	(DAC57_6)-(DAC57_0)	15	13	11	25	310		490	mV
D6_SETP (000000100)	DAC577	(DAC57_7)-(DAC57_0)	15	13	13	25	730		960	mV
D7_SETP (000000010)	DAC578	(DAC57_8)-(DAC57_0)	15	13	15	25	1.5		1.9	V
D8_SETP (000000001)	DAC579	(DAC57_9)-(DAC57_0)	15	13	17	25	3.05		3.75	V
ALL_ON (111111111)	DAC57A		15	13	18	25	6.25		7.55	V

## Package Dimensions

unit : mm (typ)

3190A



# LV25400W

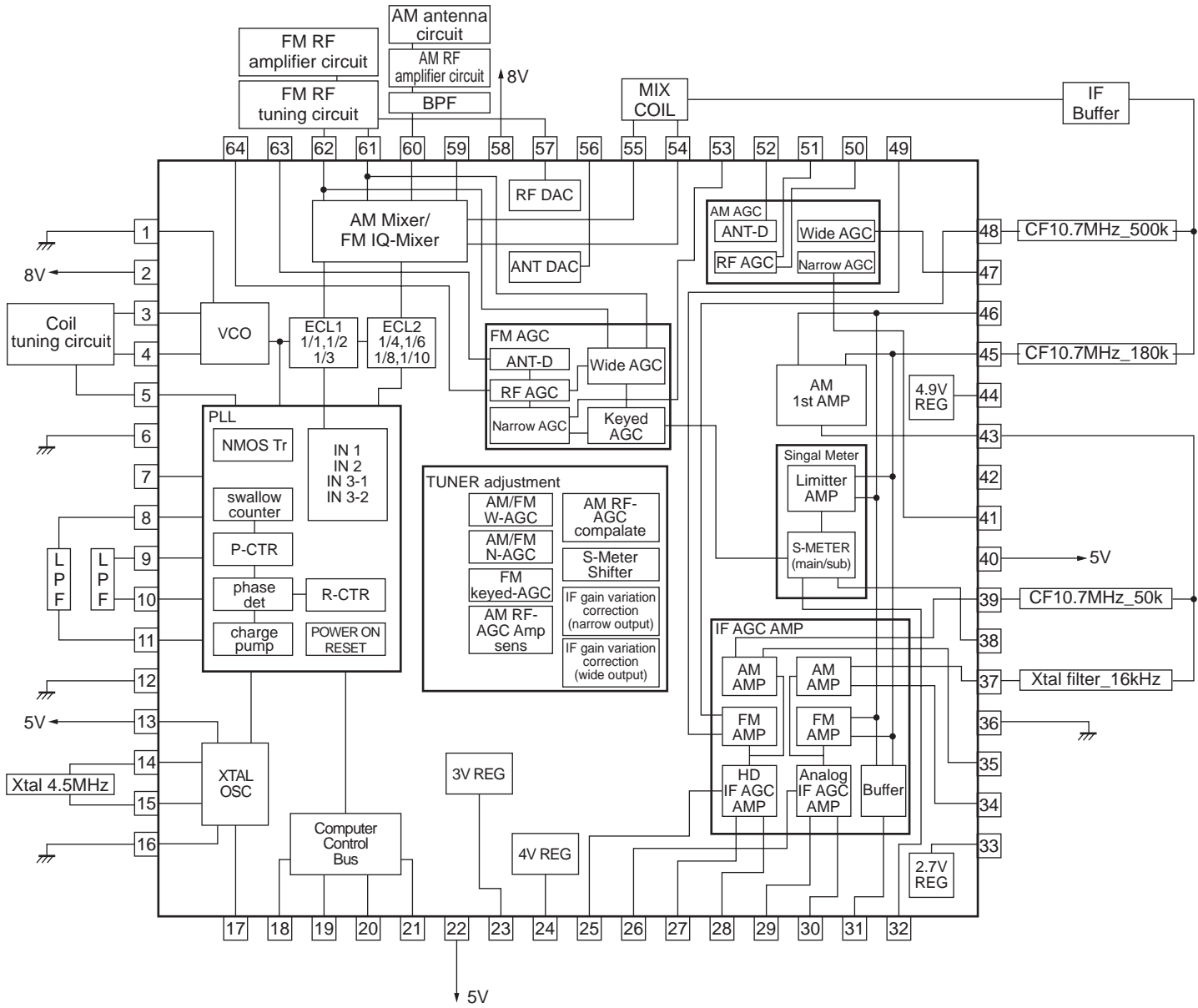
## Pin Functions

Pin No.	Pin	Pin No.	Pin
1	FE_GND	33	VREG2.7V
2	OSC_VCC	34	AM_ANALOG_IN Bypass
3	OSC_B	35	AM_HD_IN Bypass
4	OSC_C	36	AGND
5	PLL-VT	37	AM ANALOG IN
6	FET_GND	38	VSM_AC
7	PLL-LPF_AM	39	AM HD IN (35k CF)
8	FM_FET_OUT	40	V <sub>CC</sub> A5V
9	AM_FET_OUT	41	AM_N-AGC pick-up
10	AM_CP	42	Address-SW
11	FM_CP	43	IF_OUT
12	DGND	44	VREG4.9V
13	XTAL_VCC	45	IF-N_IN1 (CF = 180k)
14	XTAL-IN	46	IF-N_IN2 (180k_Bypass)
15	XTAL-OUT	47	AM-W-AGC
16	XTAL_GND	48	IF-W_IN1 (CF = 500k)
17	XTAL_OSC_OUT2	49	IF-W_IN2 (500k_Bypass)
18	CE	50	AM-RF-AGC
19	DI	51	AM RF-AGC (Bypass)
20	CL	52	AM-ANT-D
21	DO	53	FM N-AGC-IN
22	V <sub>CC</sub> D5V	54	MIX-OUT
23	VREG 3V	55	MIX-OUT
24	VREG 4V	56	ANT-DAC
25	AGC_DAC_I	57	RF-DAC
26	AGC_DAC_S	58	FE_V <sub>CC</sub> 8V
27	HD-Radio out N	59	AM-MIX-IN2 (Bypass)
28	HD-Radio out P	60	AM-MIX-IN1
29	10.7M OUT N	61	FM-MIX-IN1
30	10.7M OUT P	62	FM-MIX-IN2
31	DIV_OUT_IF	63	FM-ANT D
32	VSM_DC	64	FM-RF-AGC

# LV25400W

## Functions

<b>AM/FM front-end AGC block</b>	
FM Image rejection Mixer (IQ-MIX)	Gain switching : 1 bit
FM IQ-MIX phase adjust (For the Japanese FM band)	2 bit DAC
AM Double balance Mixer	
Pin diode drive AGC output (AM/FM)	
Wide AGC sensitivity setting (AM/FM)	4 bit DAC
Narrow AGC sensitivity setting (AM/FM)	4 bit DAC
Keyed AGC adjust (FM)	4 bit DAC
AM RF AGC	4 bit DAC
Local oscillator	155MHz to 262MHz
Local osc divider (FM/AM)	Division by 1, 2, or 3
Local osc divider (AM)	Division by 10, 8, 6, or 4
ANT/RF DAC (FM)	9 bit DAC
<b>AM 1st IF AMP block</b>	
1st-IF amplifier 10.7M (Narrow)	
<b>FM IF block</b>	
S-meter shifter	5 bit DAC
IF Limiter Amplifier 6 stage	
S-meter (DC for keyed AGC) (FM)	
IF output Driver for DSP/iBoc (10.7MHz output)	
<b>IF-AGC block</b>	
IF AGC Amplifier (control Voltage from DSP)	
IF output Driver for DSP/iBoc	10.7MHz IF
IF Buffer Output for Diversity	10.7MHz IF
IF Gain Adjust	4 bit DAC
IF AGC Amp-OFF-Sw	For the analog system and the iBoc system ; 1 bit each
<b>PLL</b>	
Fast lock PLL	
Filter SW	1 bit SW
<b>other</b>	
Tuner off	1 bit SW
2.7V Regulator adjust	2 bit DAC



# LV25400W

## Equivalent Circuits

Pin No.	Pin	Description	Equivalent Circuit
1	FE.GND		8V GND (F.E.)
2	OSC V <sub>CC</sub>	Dedicated oscillator system power supply	8V V <sub>CC</sub> (VCO.)
3 4	FM/AM OSC_B FM/AM OSC_C	Oscillator connections	
5 6 7 8 9 10 11	Tuning voltage output Low-pass filter output FET ground AM filter FM mode FET AM mode FET AM charge pump FM charge pump	<p>FM mode :</p> <p>A PLL filter is formed on pins 8 through 11. (Pins 9 and 10 are left open.)</p> <p>AM mode :</p> <p>A PLL filter is formed on pins 7, 9, and 10. In this mode, a low-pass filter is formed by the internal impedance (10kΩ) and an external capacitor.</p>	
12	DIGITAL GND		
13	XTAL V <sub>CC</sub>	Dedicated crystal oscillator system power supply	5V V <sub>CC</sub> (XTAL)
14 15	X'tal-OSC-IN X'tal-OSC-OUT	<p>Connect a 4.5MHz crystal element between pins 14 and 15.</p> <p>Connect a 10pF capacitor between pin 14 and ground, and connect a 150pF capacitor between pin 15 and ground.</p>	

Continued on next page.

# LV25400W

Continued from preceding page.

Pin No.	Pin	Description	Equivalent Circuit
16	XTAL GND	Dedicated crystal oscillator system ground	
17	XTAL OSC2	Crystal oscillator output 2 for use by a 2-tuner clock	
18	CE	Used to enable serial data input (DI) to the LV25400W or force the output to the high level during serial data output.	
19	DI	Input for the serial data transferred to the LV25400W from the controller.	

Continued on next page.

# LV25400W

Continued from preceding page.

Pin No.	Pin	Description	Equivalent Circuit
20	CL	Clock used for synchronization when serial data is input to the LV25400W (DI) or when serial data is output (DO).	
21	DO	Output for serial data output to the controller by the LV25400W. Note : The pull-up resistor must be in the range 10kΩ to 50kΩ.	
22	V <sub>CCD</sub>	Digital system power supply	5V V <sub>CC</sub> (Digital)
23	PLL VREG (V <sub>DD</sub> ) - 3V	Regulator output for the PLL circuit - 3V	

Continued on next page.

# LV25400W

Continued from preceding page.

Pin No.	Pin	Description	Equivalent Circuit
24	Swallow counter VREG - 4V	Regulator output for the PLL swallow counter - 4V	
25	AGC_DAC_I	IF AGC control bias is supplied from the LC75040 (for iBoc).	
26	AGC_DAC_S	IF AGC control bias is supplied from the LC75040 (for the analog system).	
27 28	HD_OUTN HD_OUTP	Wideband IF (10.7MHz) signal differential output to the LC75040 for iBoc use.	

Continued on next page.

# LV25400W

Continued from preceding page.

Pin No.	Pin	Description	Equivalent Circuit
29 30	10.7OUTN 10.7OUTP	Narrowband IF (10.7MHz) signal differential output to the LC75040 for analog use.	
31	DIV_OUT_IF	Driver 10.7MHz signal buffer output	
32	S-meter (DC)	Current driver S-meter output AC components are removed with an external capacitor.	
33	Vref 2.7V	2.7V regulator	

Continued on next page.

# LV25400W

Continued from preceding page.

Pin No.	Pin	Description	Equivalent Circuit
34 37	AM ANALOG_IN Bypass AM ANALOG_IN	AM analog signal system related input (AM narrowband 10.7MHz IF signal)	
35 39	AM HD_IN Bypass AM HD_IN	iBoc and AM analog signal system related input (AM narrowband 10.7MHz IF signal)	
36	ANALOG GND		
38	S-meter AC output pin	FM mode: S-meter AC signal output	
40	V <sub>CCA</sub>	Analog system power supply	5V V <sub>CC</sub> (Analog)
41	AM Narrow-AGC Pick-Up	AM narrow AGC detection	
42	Address_SW	When two tuners are used, one of the two ICs' pin 42 is connected to ground, need changes the address.	

Continued on next page.

# LV25400W

Continued from preceding page.

Pin No.	Pin	Description	Equivalent Circuit
43	AM 1stIF_AMP_OUT	First AM IF amplifier output	
44	VREG4.9V	4.9V regulator	
45 46	IF-N_IN1 IF-N_IN2	First AM IF amplifier input Driver 10.7MHz signal buffer input FM limiter amplifier input	
47	AM W-AGC	Used for wide AGC pickup. There is a built-in amplifier.	

Continued on next page.

# LV25400W

Continued from preceding page.

Pin No.	Pin	Description	Equivalent Circuit
48 49	FM IF-W_IN1 FM IF-W_IN2	Wideband FM IF AGC clamp input	
50 51	AM RF-AGC AM RF-AGC-Bypass	RF AGC rectifying capacitor Determines the distortion for low-frequency modulation. Increasing the size of C50 and C 51 : Distortion → Improves Response → Becomes slower  Reducing the size of C50 and C 51 : Distortion → Degrades Response → Becomes faster	
52	AM ANT-D	Provides the PIN diode drive current. I52 = 6mA This is the antenna dumping current.	

Continued on next page.

# LV25400W

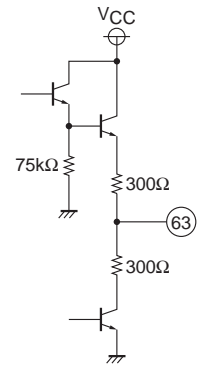
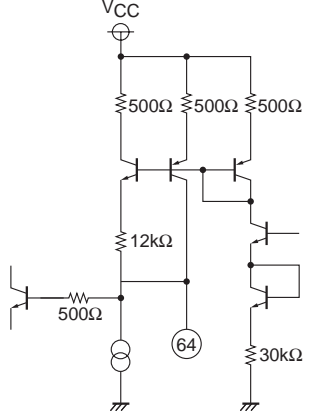
Continued from preceding page.

Pin No.	Pin	Description	Equivalent Circuit
53	FM Narrow AGC	Used for narrow AGC pickup. There is a built-in amplifier.	
54 55	AM/FM 1st-MIX OUT	FM/AM mixer output (common)	
56 57	ANT DAC RF DAC	9-bit D/A converter	
58	V <sub>CC</sub> A		V <sub>CC</sub> 8V FM FE/AM
59 60	AM MIX-IN2 (Bypass) AM MIX-IN1	AM mixer input Input impedance : 10kΩ	
61 62	FM MIX-IN1 FM MIX-IN2	FM mixer input FM wide AGC pickup Input impedance : 10kΩ	

Continued on next page.

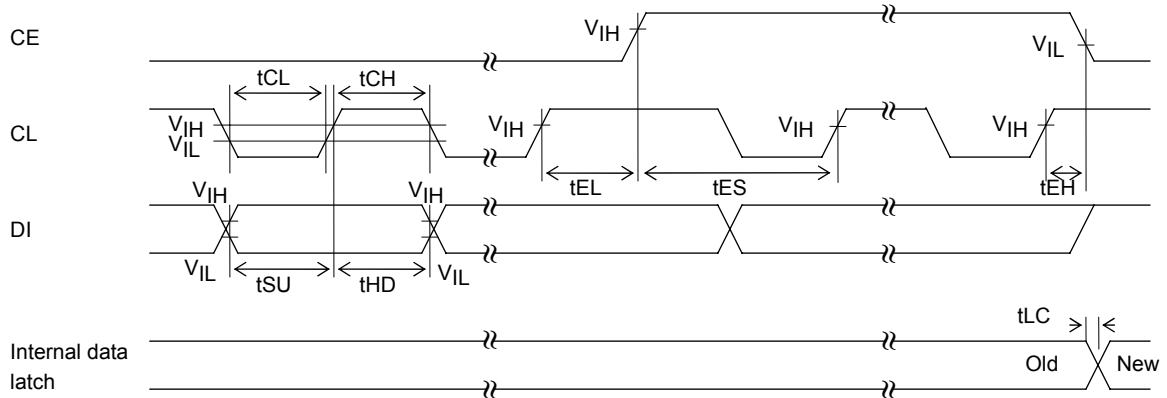
# LV25400W

Continued from preceding page.

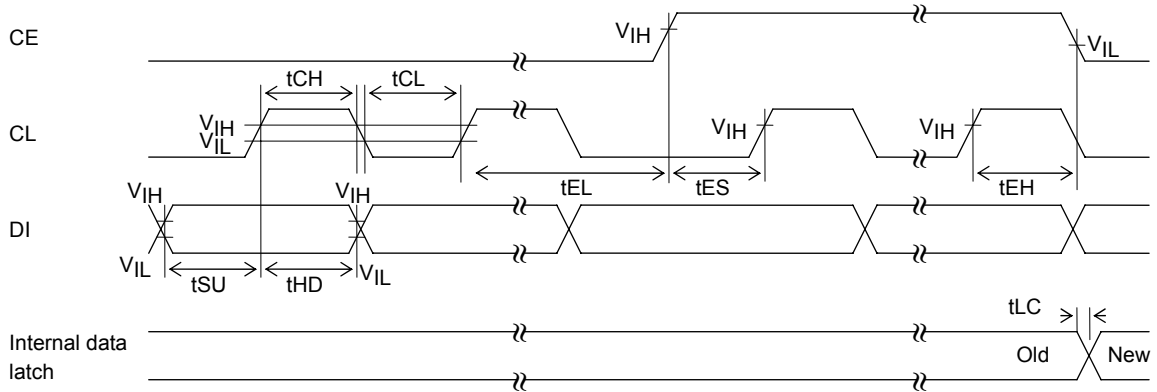
Pin No.	Pin	Description	Equivalent Circuit
63	FM ANT D	Pin 63 : The antenna driving current flows when the RF AGC voltage reaches $(V_{CC} - V_{be})$ .	
64	FM RF AGC	RF AGC voltage	

**SANYO Serial Bus Data Timing**

CE : Chip enable  
 CL : Clock  
 DI : Data input  
 DO : Data output (pin information only)



《《 When CL is stopped at the L level 》》



《《 When CL is stopped at the H level 》》

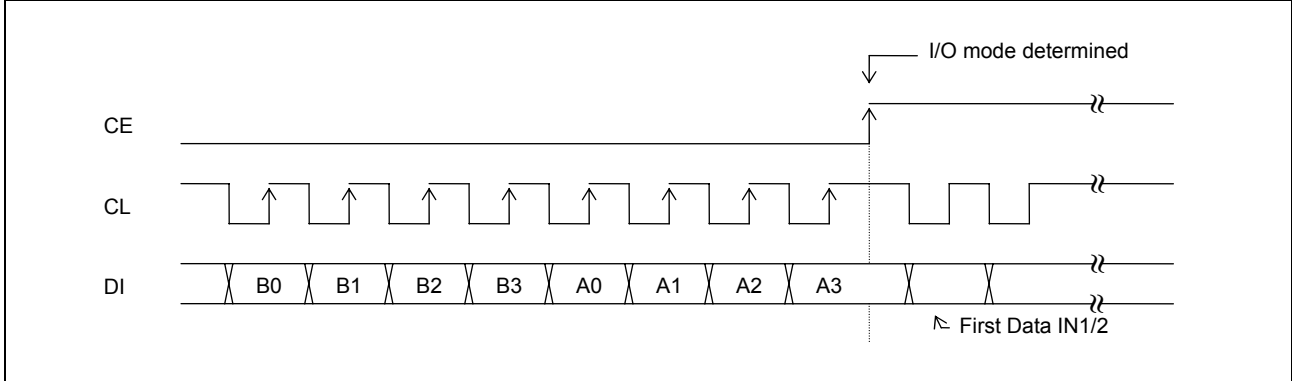
Parameter	Symbol	Pin	Conditions	min	typ	max	unit
Data setup time	tSU	DI, CL		0.45			μs
Data hold time	tHD	DI, CL		0.45			μs
Clock L-level time	tCL	CL		0.45			μs
Clock H-level time	tCH	CL		0.45			μs
CE wait time	tEL	CE, CL		0.45			μs
CE setup time	tES	CE, CL		0.45			μs
CE hold time	tEH	CE, CL		0.45			μs
Data latch change time	tLC					0.45	μs
Data input high-level voltage	V <sub>IH</sub>	CL, DI, CE		2.5		5.0	V
Data input low-level voltage	V <sub>IL</sub>	CL, DI, CE		-0.3		0.8	V

# LV25400W

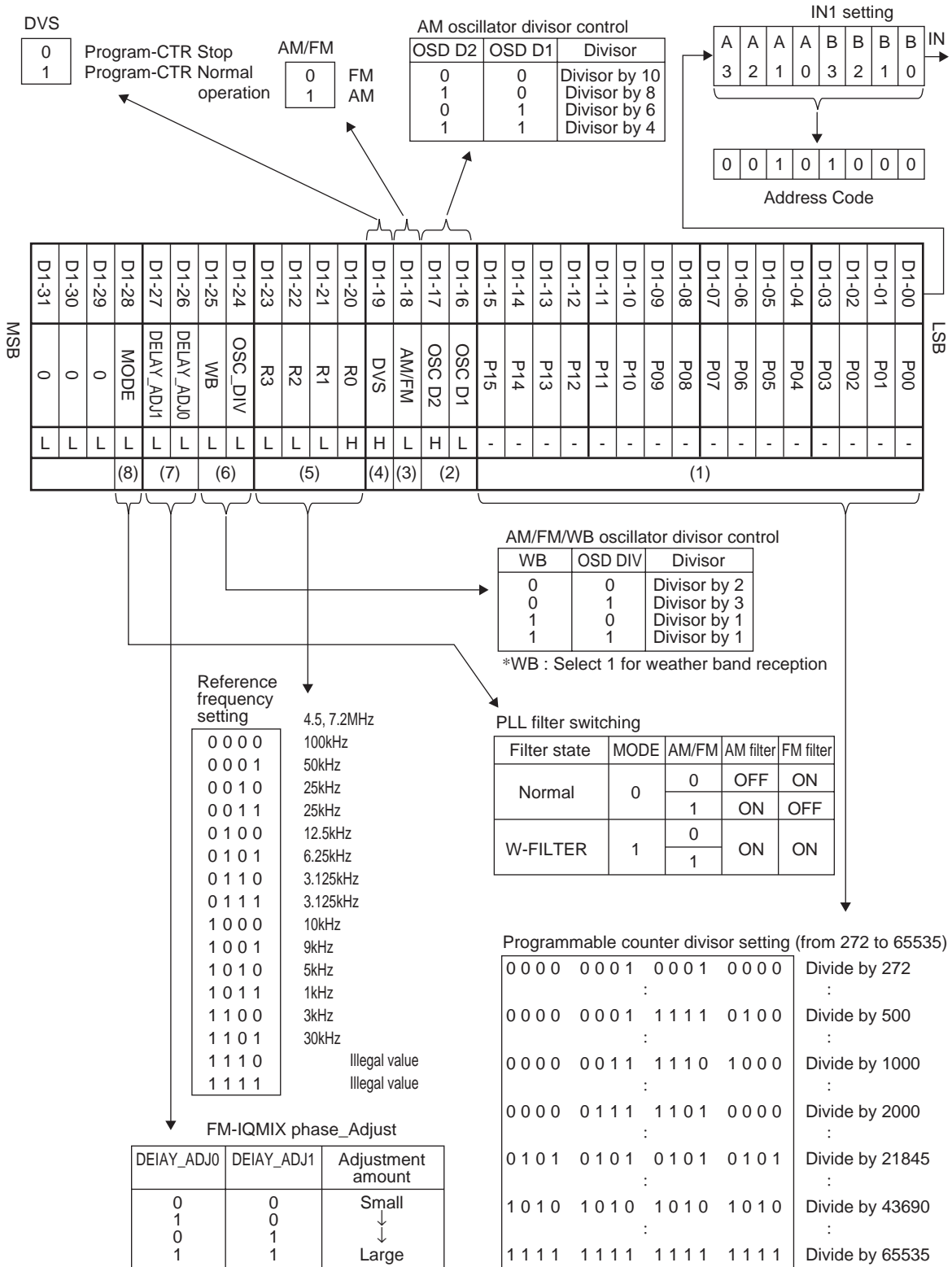
## Serial Data I/O Procedures

The LV25400W uses the SANYO audio IC serial bus format. Data is input and output using a CCB (Computer Control Bus). The LV25400W adopts an 8-bit address version of the CCB format.

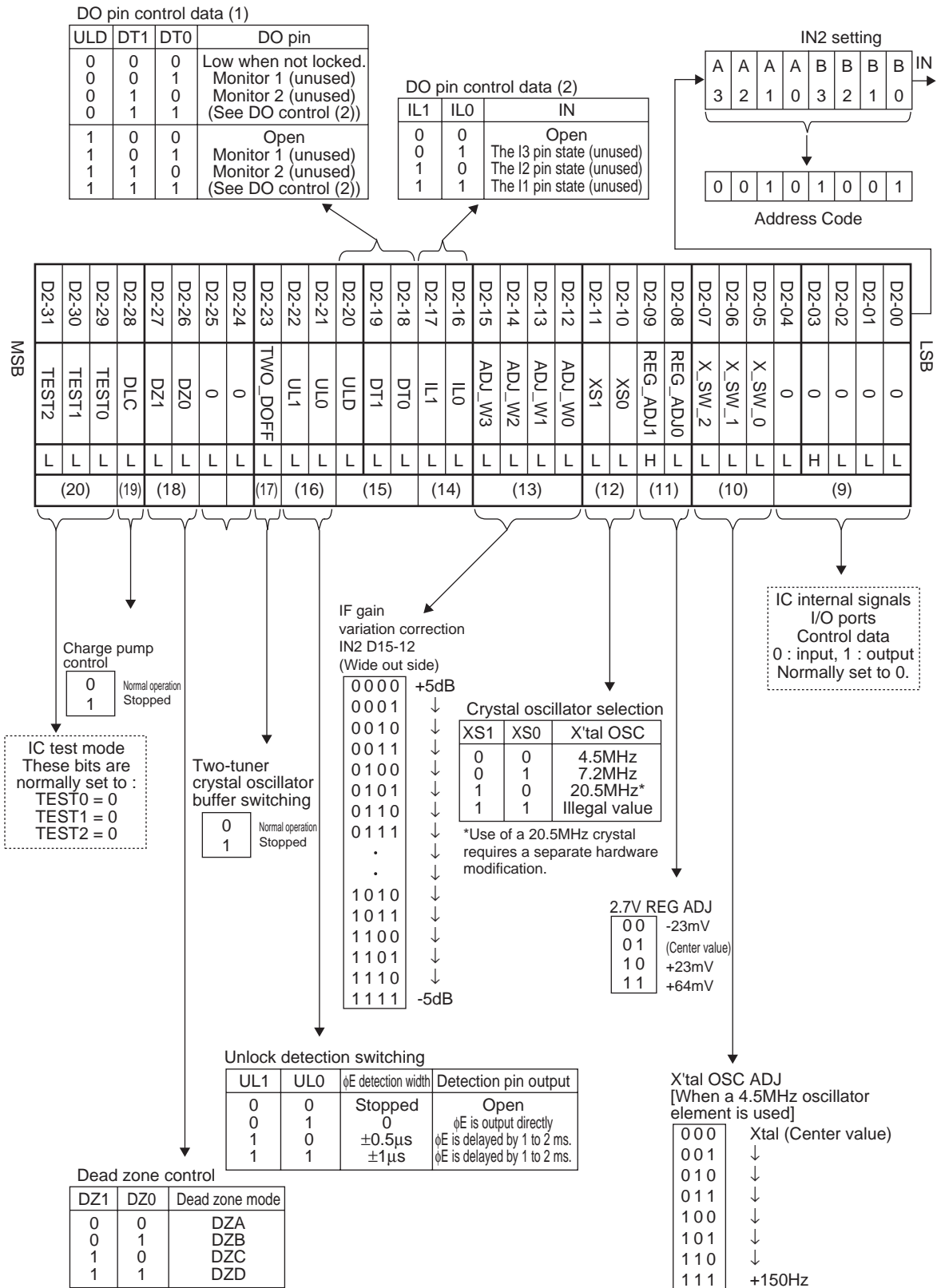
	I/O mode	Address								Contents
		B0	B1	B2	B3	A0	A1	A2	A3	
[1]	IN1	0	0	0	1	0	1	0	0	<ul style="list-style-type: none"> <li>Control data input mode. PLL setup</li> <li>32 bits of data are input</li> <li>IN1B is the 2-tuner mode address (when pin 42 is tied to ground)</li> </ul>
	IN1B	0	1	0	1	0	1	0	0	
[2]	IN2	1	0	0	1	0	1	0	0	<ul style="list-style-type: none"> <li>Control data input mode. PLL setup</li> <li>32 bits of data are input</li> <li>IN2B is the 2-tuner mode address (when pin 42 is tied to ground)</li> </ul>
	IN2B	1	1	0	1	0	1	0	0	
[3]	IN3	1	0	0	1	0	1	1	0	<ul style="list-style-type: none"> <li>The tuner block is set up in control data input (serial data input) mode.</li> <li>32 bits of data are input - There is a sub-address</li> <li>IN3B is the 2-tuner mode address (when pin 42 is tied to ground)</li> </ul>
	IN3B	0	0	0	1	0	1	1	0	



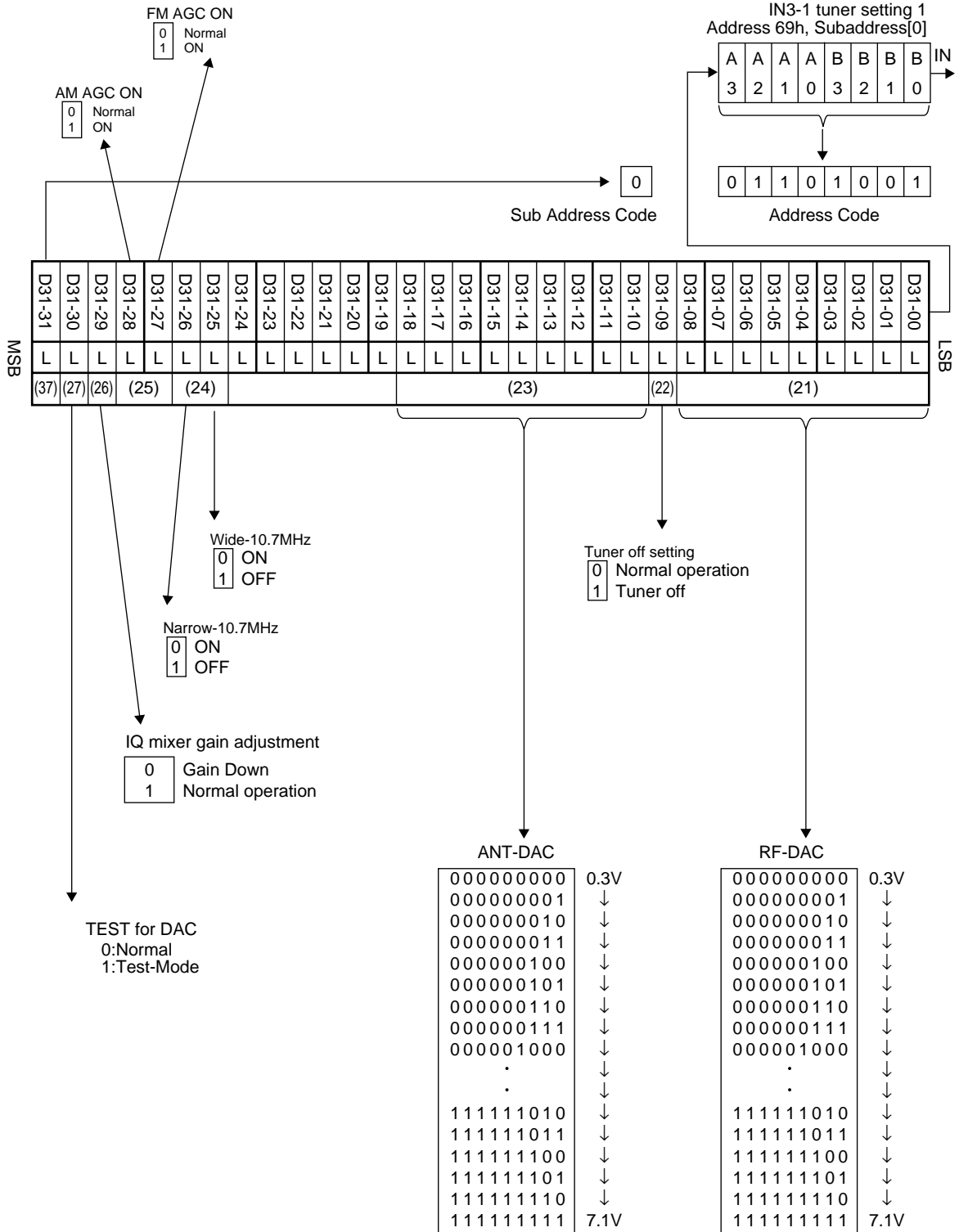
# LV25400W



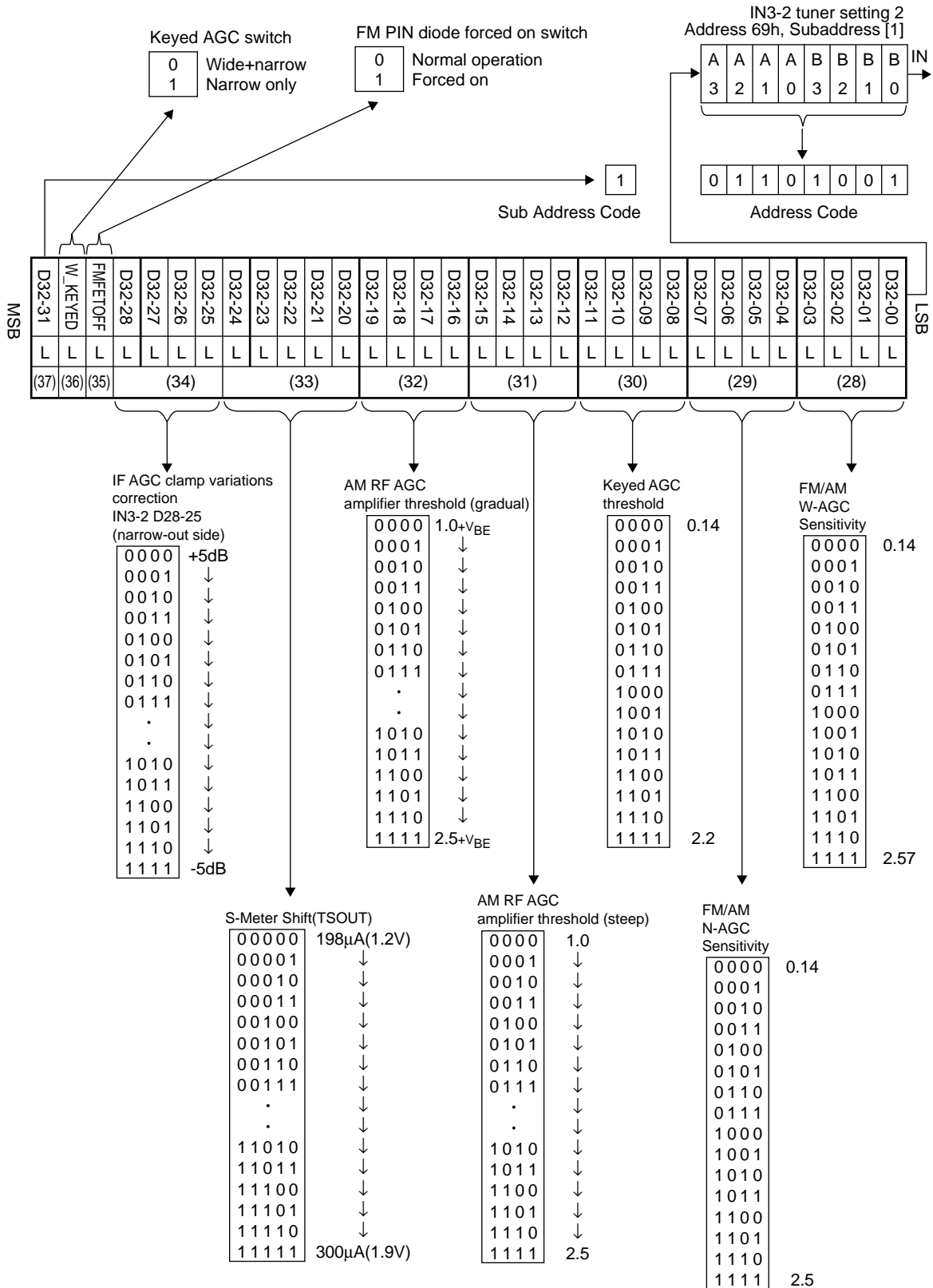
# LV25400W



# LV25400W



# LV25400W



# LV25400W

## Control Data Documentation

No.	Control block/data	Description	Related data																																																																																																												
(1)	Programmable divider data P0 to P15  DVS	<ul style="list-style-type: none"> <li>• Sets the programmable divider's divisor. This is a binary value in which P0 is the LSB, P15 the MSB. DVS = 0 : The IC internal FMIN pin is stopped (pulled down) DVS = 1 : The IC internal FMIN pin is selected Set divisor (N) : 272 to 65536 Input frequency range : 120 to 270 MHz</li> <li>* : See the "Programmable Divider Structure" section for more information.</li> </ul>	AM/FM OSC D1, D2 WB, OSC DIV																																																																																																												
(2)	AM oscillator divisor control  OSC D1, OSC D2	<ul style="list-style-type: none"> <li>• OSC D1, OSC D2-AM oscillator divisor control</li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>OSC D1</th> <th>OSC D2</th> <th>Divisor</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Divide by 10</td> </tr> <tr> <td>0</td> <td>1</td> <td>Divide by 8</td> </tr> <tr> <td>1</td> <td>0</td> <td>Divide by 6</td> </tr> <tr> <td>1</td> <td>1</td> <td>Divide by 4</td> </tr> </tbody> </table>	OSC D1	OSC D2	Divisor	0	0	Divide by 10	0	1	Divide by 8	1	0	Divide by 6	1	1	Divide by 4	AM/FM P0 to P15																																																																																													
OSC D1	OSC D2	Divisor																																																																																																													
0	0	Divide by 10																																																																																																													
0	1	Divide by 8																																																																																																													
1	0	Divide by 6																																																																																																													
1	1	Divide by 4																																																																																																													
(3)	Tuner mode switching  AM/FM	<ul style="list-style-type: none"> <li>• Tuner mode switching between AM and FM 1 = AM 0 = FM</li> </ul>	P0 to P15 OSC D1, D2																																																																																																												
(4)	Programmable divider stop  DVS	<ul style="list-style-type: none"> <li>• DVS = 0 : The IC internal PLL-IN pin is stopped (pulled down) DVS = 1 : The IC internal PLL-IN pin is selected Set divisor (N) : 272 to 65536 Input frequency range : 120 to 270 MHz</li> <li>* : See the "Programmable Divider Structure" section for more information.</li> </ul>	CTS GT0, GT1 CTP CTC																																																																																																												
(5)	Reference divider data  R0 to R3	<ul style="list-style-type: none"> <li>• Selects the reference frequency.</li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="4"></th> <th colspan="2">Reference frequency setting (kHz)</th> </tr> <tr> <th>R3</th> <th>R2</th> <th>R1</th> <th>R0</th> <th>Crystal : 20.5MHz</th> <th>Crystal : 4.5/7.2MHz</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>Illegal value</td><td>100</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>100</td><td>50</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>50</td><td>25</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td><td>25</td><td>25</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>0</td><td>12.5</td><td>12.5</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>1</td><td>6.25</td><td>6.25</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>0</td><td>3.125</td><td>3.125</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>1</td><td>3.125</td><td>3.125</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>10</td><td>10</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>1</td><td>Illegal value</td><td>9</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td><td>5</td><td>5</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>0</td><td>Illegal value</td><td>3</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>1</td><td>Illegal value</td><td>30</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td><td>Illegal value</td><td>Illegal value</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>Illegal value</td><td>Illegal value</td></tr> </tbody> </table>					Reference frequency setting (kHz)		R3	R2	R1	R0	Crystal : 20.5MHz	Crystal : 4.5/7.2MHz	0	0	0	0	Illegal value	100	0	0	0	1	100	50	0	0	1	0	50	25	0	0	1	1	25	25	0	1	0	0	12.5	12.5	0	1	0	1	6.25	6.25	0	1	1	0	3.125	3.125	0	1	1	1	3.125	3.125	1	0	0	0	10	10	1	0	0	1	Illegal value	9	1	0	1	0	5	5	1	0	1	1	1	1	1	1	0	0	Illegal value	3	1	1	0	1	Illegal value	30	1	1	1	0	Illegal value	Illegal value	1	1	1	1	Illegal value	Illegal value	
				Reference frequency setting (kHz)																																																																																																											
R3	R2	R1	R0	Crystal : 20.5MHz	Crystal : 4.5/7.2MHz																																																																																																										
0	0	0	0	Illegal value	100																																																																																																										
0	0	0	1	100	50																																																																																																										
0	0	1	0	50	25																																																																																																										
0	0	1	1	25	25																																																																																																										
0	1	0	0	12.5	12.5																																																																																																										
0	1	0	1	6.25	6.25																																																																																																										
0	1	1	0	3.125	3.125																																																																																																										
0	1	1	1	3.125	3.125																																																																																																										
1	0	0	0	10	10																																																																																																										
1	0	0	1	Illegal value	9																																																																																																										
1	0	1	0	5	5																																																																																																										
1	0	1	1	1	1																																																																																																										
1	1	0	0	Illegal value	3																																																																																																										
1	1	0	1	Illegal value	30																																																																																																										
1	1	1	0	Illegal value	Illegal value																																																																																																										
1	1	1	1	Illegal value	Illegal value																																																																																																										

Continued on next page.

# LV25400W

Continued from preceding page.

No.	Control block/data	Description	Related data																														
(6)	Tuner mode switching  AM/FM oscillator divisor  OSC_DIV WB	(1) AM/FM/WB oscillator divisor control <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 25%;">WB</th> <th style="width: 25%;">OSC DIV</th> <th style="width: 50%;">Divisor</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">Divide by 2</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">Divide by 3</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">Divide by 1</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">Divide by 1</td> </tr> </tbody> </table> *: WB: Select 1 for weather band reception  (2) AM oscillator divisor control <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 25%;">OSD D2</th> <th style="width: 25%;">OSC D1</th> <th style="width: 50%;">Divisor</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">Divide by 10</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">Divide by 8</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">Divide by 6</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">Divide by 4</td> </tr> </tbody> </table> In FM mode, only the WB and OSC DIV bits are valid. In AM mode, this function is set up by combination of the OSC D2, OSC (however, this is fixed at the divide-by-2 setting) D1, WB, and the OSC DIV bits. FM (Japan) : Fixed at the divide-by-3 setting FM (other regions) : Fixed at the divide-by-2 setting WB : Fixed at the divide-by-1 setting (OK if WB = 1)  In AM mode, set WB = 0, OSC DIV = 0 for the divide-by-2 setting. The OSC D2 and OSC D1 bits can be set according to end product needs.  Example : USA : (1) <divide by 2> × (2) <divide by 10> = divide by 20 SW2 : (1) <divide by 2> × (2) <divide by 4> = divide by 8	WB	OSC DIV	Divisor	0	0	Divide by 2	0	1	Divide by 3	1	0	Divide by 1	1	1	Divide by 1	OSD D2	OSC D1	Divisor	0	0	Divide by 10	1	0	Divide by 8	0	1	Divide by 6	1	1	Divide by 4	P0 to P15 DVS
WB	OSC DIV	Divisor																															
0	0	Divide by 2																															
0	1	Divide by 3																															
1	0	Divide by 1																															
1	1	Divide by 1																															
OSD D2	OSC D1	Divisor																															
0	0	Divide by 10																															
1	0	Divide by 8																															
0	1	Divide by 6																															
1	1	Divide by 4																															
(7)	FM IQ mixer phase adjustment  DELAY_ADJ0 DELAY_ADJ1	• FM IQ mixer phase adjustment FM-IQMIX phase_Adjust <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 25%;">DELAY_ADJ0</th> <th style="width: 25%;">DELAY_ADJ1</th> <th style="width: 50%;">Adjustment amount</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">Small</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">↓</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">↓</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">Large</td> </tr> </tbody> </table>	DELAY_ADJ0	DELAY_ADJ1	Adjustment amount	0	0	Small	0	1	↓	1	0	↓	1	1	Large	OSC_DIV															
DELAY_ADJ0	DELAY_ADJ1	Adjustment amount																															
0	0	Small																															
0	1	↓																															
1	0	↓																															
1	1	Large																															

Continued on next page.

# LV25400W

Continued from preceding page.

No.	Control block/data	Description	Related data																			
(8)	PLL filter switching mode  MODE	<ul style="list-style-type: none"> <li>Switches the PLL filter</li> </ul> <p>PLL filter switching</p> <table border="1" style="margin-left: 20px; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Filter state</th> <th>MODE</th> <th>AM/FM</th> <th>AM filter</th> <th>FM filter</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Normal</td> <td rowspan="2">0</td> <td>0</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>1</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td rowspan="2">W-FILTER</td> <td rowspan="2">1</td> <td>0</td> <td rowspan="2">ON</td> <td rowspan="2">ON</td> </tr> <tr> <td>1</td> </tr> </tbody> </table> <p>Normal mode (MODE = 0) The filter state is switched in conjunction with the AM/FM bit.</p> <p>FM mode (AM/FM = 0) A filter is formed on pins 8 and 11. Since this filter can be independent of the filter used in AM mode, PLL locking can be fast.</p> <p>AM mode (AM/FM = 1) A filter is formed on pins 9 and 10 and with the two internal switches SW1 and SW2. An additional filter is added using an internal resistor and an external capacitor.</p> <p>W-filter mode (MODE = 1) Both filters are enabled, regardless of the AM/FM bit. (All of pins 8, 9, 10, and 11, and switches SW1 and SW2 are used.)</p> <p>This is used when sidebands occur in AM mode, and in other cases. However, there are case where, depending on the particular filter component values, this mode cannot be used.</p>	Filter state	MODE	AM/FM	AM filter	FM filter	Normal	0	0	OFF	ON	1	ON	OFF	W-FILTER	1	0	ON	ON	1	AM/FM
Filter state	MODE	AM/FM	AM filter	FM filter																		
Normal	0	0	OFF	ON																		
		1	ON	OFF																		
W-FILTER	1	0	ON	ON																		
		1																				
		<p>The diagram shows the internal circuitry for PLL filter switching. It includes an FM oscillator (FM OSC) connected to pin 3, and an oscillator circuit with capacitors C3 (2pF) and C4 (3pF) connected to pins 3 and 4. Pin 5 is labeled VT. Pin 6 is FET_GND with a 0.033μF capacitor. Pin 7 is connected to a 30kΩ resistor (R7) and a 330pF capacitor (C4). Pin 8 is FM_FET_OUT. Pin 9 is AM_FET_OUT. Pin 10 is AM_CP with a 1μF capacitor (C10A) and a 1.3kΩ resistor (C11). Pin 11 is FM_CP with a 0.033μF capacitor (C11A) and a 2.2kΩ resistor (C12). The circuit is powered by +8V (PIN58) through a 3kΩ resistor and VDD (PIN23) through a 1kΩ resistor. A crystal (L5) and a diode (D5, SVC704) are also shown.</p>																				
(9)	IC internal signals I/O ports Control data	<ul style="list-style-type: none"> <li>Specifies the I/O direction for the I/O ports</li> </ul> <p>Data = 0 : Input port. The value 0 should be specified in normal operation. = 1 : Output port. A value of 1 is used for IC testing.</p> <p>* : This data must be set to 0 at all times other than IC evaluation. Normally set to 0.</p>																				
(10)	Crystal oscillator fine adjustment  X_SW_0 X_SW_1 X_SW_2	<ul style="list-style-type: none"> <li>Adjusts the crystal 4.5 MHz reference frequency if beating occurs</li> </ul> <p>X'tal OSC ADJ [When a 4.5MHz oscillator element is used]</p> <table border="1" style="margin-left: 20px; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td>0 0 0</td> <td>Xtal (Center value)</td> </tr> <tr> <td>0 0 1</td> <td>↓</td> </tr> <tr> <td>0 1 0</td> <td>↓</td> </tr> <tr> <td>0 1 1</td> <td>↓</td> </tr> <tr> <td>1 0 0</td> <td>↓</td> </tr> <tr> <td>1 0 1</td> <td>↓</td> </tr> <tr> <td>1 1 0</td> <td>↓</td> </tr> <tr> <td>1 1 1</td> <td>+150Hz</td> </tr> </tbody> </table>	0 0 0	Xtal (Center value)	0 0 1	↓	0 1 0	↓	0 1 1	↓	1 0 0	↓	1 0 1	↓	1 1 0	↓	1 1 1	+150Hz	XS0, XS1 R0 to R3			
0 0 0	Xtal (Center value)																					
0 0 1	↓																					
0 1 0	↓																					
0 1 1	↓																					
1 0 0	↓																					
1 0 1	↓																					
1 1 0	↓																					
1 1 1	+150Hz																					

Continued on next page.

# LV25400W

Continued from preceding page.

No.	Control block/data	Description	Related data																																				
(11)	2.7V REG ADJ  REG_ADJ0 REG_ADJ1	<ul style="list-style-type: none"> <li>Adjusts the 2.7 V regulator</li> </ul> <p>2.7V REG ADJ</p> <table border="1" style="margin-left: 20px;"> <tr> <td style="width: 30px;">0 0</td> <td>-23mV</td> </tr> <tr> <td>0 1</td> <td>(Center value)</td> </tr> <tr> <td>1 0</td> <td>+23mV</td> </tr> <tr> <td>1 1</td> <td>+64mV</td> </tr> </table>	0 0	-23mV	0 1	(Center value)	1 0	+23mV	1 1	+64mV																													
0 0	-23mV																																						
0 1	(Center value)																																						
1 0	+23mV																																						
1 1	+64mV																																						
(12)	Crystal oscillator selection  XS0, XS1	<ul style="list-style-type: none"> <li>Selects the crystal element.</li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>XS1</th> <th>XS0</th> <th>X'tal OSC</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>4.5MHz</td> </tr> <tr> <td>0</td> <td>1</td> <td>Illegal value</td> </tr> <tr> <td>1</td> <td>0</td> <td>Illegal value</td> </tr> <tr> <td>1</td> <td>1</td> <td>Illegal value</td> </tr> </tbody> </table>	XS1	XS0	X'tal OSC	0	0	4.5MHz	0	1	Illegal value	1	0	Illegal value	1	1	Illegal value																						
XS1	XS0	X'tal OSC																																					
0	0	4.5MHz																																					
0	1	Illegal value																																					
1	0	Illegal value																																					
1	1	Illegal value																																					
(13)	HD (wide) IF AGC amplifier variation correction bits  ADJ_W0 ADJ_W1 ADJ_W2 ADJ_W3	<ul style="list-style-type: none"> <li>Corrects for sample-to-sample variations in the IF AGC amplifier gain</li> </ul> <p style="text-align: center;">Amount of correction : ±5 dB</p> <p style="text-align: center;">4 bit</p>																																					
(14)	DO pin control data (2)  IL0, IL1	<ul style="list-style-type: none"> <li>Controls the DO pin output</li> </ul> <p>DO pin control data (2)</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>IL1</th> <th>IL0</th> <th>IN</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Open</td> </tr> <tr> <td>0</td> <td>1</td> <td>The I3 pin state (unused)</td> </tr> <tr> <td>1</td> <td>0</td> <td>The I2 pin state (unused)</td> </tr> <tr> <td>1</td> <td>1</td> <td>The I1 pin state (unused)</td> </tr> </tbody> </table> <p>Since there are no connected pins in the current product, the open setting must be used.</p>	IL1	IL0	IN	0	0	Open	0	1	The I3 pin state (unused)	1	0	The I2 pin state (unused)	1	1	The I1 pin state (unused)																						
IL1	IL0	IN																																					
0	0	Open																																					
0	1	The I3 pin state (unused)																																					
1	0	The I2 pin state (unused)																																					
1	1	The I1 pin state (unused)																																					
(15)	DO pin control data (1)  ULD DT0, DT1	<ul style="list-style-type: none"> <li>Determines the DO pin output.</li> </ul> <p>DO pin control data (1)</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>ULD</th> <th>IL0</th> <th>DT0</th> <th>DO pin</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Low when not locked.</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Monitor 1 (unused)</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Monitor 2 (unused)</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>(See DO control (2))</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Open</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Monitor 1 (unused)</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Monitor 2 (unused)</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>(See DO control (2))</td> </tr> </tbody> </table> <p>The following item (5) must also be set when monitoring the unlock detection signal.</p>	ULD	IL0	DT0	DO pin	0	0	0	Low when not locked.	0	1	1	Monitor 1 (unused)	1	0	0	Monitor 2 (unused)	1	1	1	(See DO control (2))	1	0	0	Open	1	0	1	Monitor 1 (unused)	1	1	0	Monitor 2 (unused)	1	1	1	(See DO control (2))	UL0, UL1
ULD	IL0	DT0	DO pin																																				
0	0	0	Low when not locked.																																				
0	1	1	Monitor 1 (unused)																																				
1	0	0	Monitor 2 (unused)																																				
1	1	1	(See DO control (2))																																				
1	0	0	Open																																				
1	0	1	Monitor 1 (unused)																																				
1	1	0	Monitor 2 (unused)																																				
1	1	1	(See DO control (2))																																				
(16)	Unlock state detection data  UL0, UL1	<ul style="list-style-type: none"> <li>Selects the phase error (<math>\phi E</math>) detection width used to judge the PLL locked state.</li> </ul> <p>If a phase error in excess of the <math>\phi E</math> detection width from the table below occurs, the PLL is seen as being in the unlocked state.</p> <p>When the PLL is seen as being unlocked, the detection pin (DO) is set low.</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>UL1</th> <th>UL0</th> <th><math>\phi E</math> detection width</th> <th>Detection pin output</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Stopped</td> <td>Open</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td><math>\phi E</math> is output directly</td> </tr> <tr> <td>1</td> <td>0</td> <td>±0.5<math>\mu</math>s</td> <td><math>\phi E</math> is delayed by 1 to 2 ms.</td> </tr> <tr> <td>1</td> <td>1</td> <td>±1<math>\mu</math>s</td> <td><math>\phi E</math> is delayed by 1 to 2 ms.</td> </tr> </tbody> </table> <div style="margin-left: 20px;"> </div>	UL1	UL0	$\phi E$ detection width	Detection pin output	0	0	Stopped	Open	0	1	0	$\phi E$ is output directly	1	0	±0.5 $\mu$ s	$\phi E$ is delayed by 1 to 2 ms.	1	1	±1 $\mu$ s	$\phi E$ is delayed by 1 to 2 ms.	ULD DT0, DT1																
UL1	UL0	$\phi E$ detection width	Detection pin output																																				
0	0	Stopped	Open																																				
0	1	0	$\phi E$ is output directly																																				
1	0	±0.5 $\mu$ s	$\phi E$ is delayed by 1 to 2 ms.																																				
1	1	±1 $\mu$ s	$\phi E$ is delayed by 1 to 2 ms.																																				

Continued on next page.

# LV25400W

Continued from preceding page.

No.	Control block/data	Description	Related data															
(17)	Crystal oscillator buffer output stop switching  TWO_DOFF	<ul style="list-style-type: none"> <li>Stops the crystal oscillator buffer output.</li> </ul> 1 bit      Two-tuner crystal oscillator buffer switching <table border="1" style="margin-left: 40px;"> <tr> <td style="text-align: center;">0</td> <td>Normal operation</td> </tr> <tr> <td style="text-align: center;">1</td> <td>Stopped</td> </tr> </table>	0	Normal operation	1	Stopped												
0	Normal operation																	
1	Stopped																	
(18)	Phase comparator control data  DZ0, DZ1	<ul style="list-style-type: none"> <li>Controls the phase comparator's dead zone.</li> </ul> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>DZ1</th> <th>DZ0</th> <th>Dead zone mode</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td>DZA</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td>DZB</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td>DZC</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td>DZD</td> </tr> </tbody> </table> <p style="margin-left: 40px;">The DZA setting is selected after the power-on reset.</p>	DZ1	DZ0	Dead zone mode	0	0	DZA	0	1	DZB	1	0	DZC	1	1	DZD	
DZ1	DZ0	Dead zone mode																
0	0	DZA																
0	1	DZB																
1	0	DZC																
1	1	DZD																
(19)	Charge pump control data  DLC	<ul style="list-style-type: none"> <li>Forcibly sets the charge pump output to the low level (<math>V_{SS}</math> level).</li> </ul> DLC = 1 : Low level DLC = 0 : Normal operation  * : If the IC deadlocks with VCO oscillator stopped with the VCO control voltage ( $V_{tune}$ ) at 0 V, the deadlock can be resolved by setting the charge pump output to the low level and setting $V_{tune}$ to $V_{CC}$ . This item is set to the normal operation state after the power-on reset.																
(20)	IC internal signal I/O port control data	<ul style="list-style-type: none"> <li>Specifies the I/O direction for the I/O ports</li> </ul> <p style="margin-left: 40px;">Data = 0 : Input port. The value 0 should be specified in normal operation.            = 1 : Output port. A value of 1 is used for IC testing.</p> <p style="margin-left: 40px;">* : This data must be set to 0 at all times other than IC evaluation.</p>																
(21)	RF tuning D/A converter output D31-00 to D31-08	<ul style="list-style-type: none"> <li>Applies a control voltage to the RF tuning circuit (varactor).</li> </ul> 9 bit																
(22)	Tuner off setting  D31-09	<ul style="list-style-type: none"> <li>Set the IC to tuner off mode.</li> </ul> 1 bit      Tuner OFF mord <table border="1" style="margin-left: 40px;"> <tr> <td style="text-align: center;">0</td> <td>Normal operation</td> </tr> <tr> <td style="text-align: center;">1</td> <td>Tuner-OFF</td> </tr> </table>	0	Normal operation	1	Tuner-OFF												
0	Normal operation																	
1	Tuner-OFF																	
(23)	Antenna tuning D/A converter output  D31-10 to D31-18	<ul style="list-style-type: none"> <li>Applies a control voltage to the antenna tuning circuit (varactor).</li> </ul> 9 bit																
(24)	IF AGC amplifier (narrow/wide) on/off switching  D31-25 D31-26	<ul style="list-style-type: none"> <li>Operates the IF AGC amplifier circuit (narrow/wide).</li> </ul> D31-25 : wide-10.7MHz [0] = ON, [1] = OFF D31-26 : narrow-10.7MHz [0] = ON, [1] = OFF  Each 1 bit																
(25)	Forced AGC (AM/FM) switching  D31-27 D31-28	<ul style="list-style-type: none"> <li>Operates the forced AGC circuit (narrow/wide).</li> </ul> D31-27:FM AGC [0] = NORMAL, [1] = ON D31-28:AM AGC [0] = NORMAL, [1] = ON  Each 1 bit																
(26)	IQ mixer gain adjustment  D31-29	<ul style="list-style-type: none"> <li>Switches the FM IQ mixer gain.</li> </ul> 1 bit      IQ mixer gain adjustment <table border="1" style="margin-left: 40px;"> <tr> <td style="text-align: center;">0</td> <td>Gain Down</td> </tr> <tr> <td style="text-align: center;">1</td> <td>Normal operation</td> </tr> </table>	0	Gain Down	1	Normal operation												
0	Gain Down																	
1	Normal operation																	
(27)																		
(28)	AM/FM wide AGC setting  D32-0 to D32-3	<ul style="list-style-type: none"> <li>Sets the AM/FM wide AGC sensitivity.</li> </ul> 4 bit																

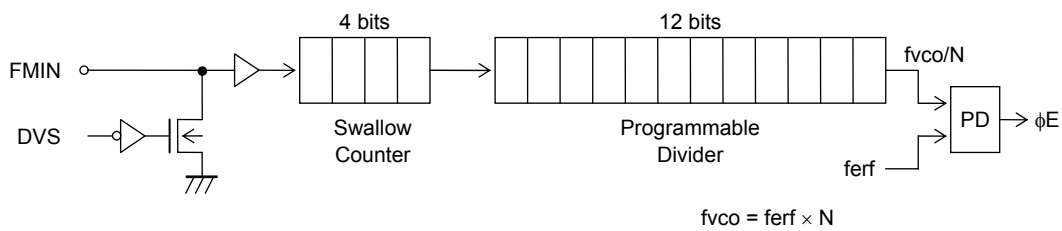
Continued on next page.

# LV25400W

Continued from preceding page.

No.	Control block/data	Description	Related data				
(29)	AM/FM narrow AGC setting D33-4 to D33-7	• Sets the AM/FM narrow AGC sensitivity. 4 bit					
(30)	Keyed AGC setting D32-8 to D32-11	• Controls the FM keyed AGC sensitivity. 4 bit					
(31)	AM RF AGC amplifier threshold (steep) setting D32-12 to D32-15	• Sets the AM RF AGC amplifier circuit threshold (steep). 4 bit					
(32)	AM RF AGC amplifier threshold (gradual) setting D32-16 to D32-19	• Sets the AM RF AGC amplifier circuit threshold (gradual). 4 bit					
(33)	S-meter shifter control D32-20 to D32-24	• Controls the FM S-meter shifter circuit output value. 5 bit					
(34)	Analog (narrow) IF AGC clamp variations correction D32-25 to D32-28	• Corrects the sample-to-sample variations in the IF AGC clamp circuit.  Amount of correction : ±5 dB  4 bit					
(35)	FM PIN diode forced on state bit FMFETOFF	• Forcibly sets the FM PIN diode to the on state. 1 bit					
(36)	Keyed AGC connection circuit selection W_KEYED	• Modifies the keyed AGC connection circuit. 1 bit  Keyed AGC switch <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">0</td> <td>Wide + narroww</td> </tr> <tr> <td style="text-align: center;">1</td> <td>Narrow only</td> </tr> </table>	0	Wide + narroww	1	Narrow only	
0	Wide + narroww						
1	Narrow only						
(37)	D31-31 D32-31	• Sub-code address  Each 1 bit					

## Programmable Divider Structure



DVS	Set divisor (N)	Input frequency range (f (MHz))	IC internal FMIN pin
1	272 to 65535	$120 \leq f \leq 270$	Selected
0	-	-	Stopped

\* : Since the IC is closed internally, the input sensitivity is not specified.

Phase Comparator and Charge Pump Circuits

(1) Phase comparator and charge pump operation

In the PLL circuit block shown in figure 1, the phase comparator compares the phases of the reference frequency ( $f_r$ ) and the comparison frequency ( $f_p$ ), and outputs the amount of the phase difference from the charge pump.

Figure 1 PLL Circuit Block

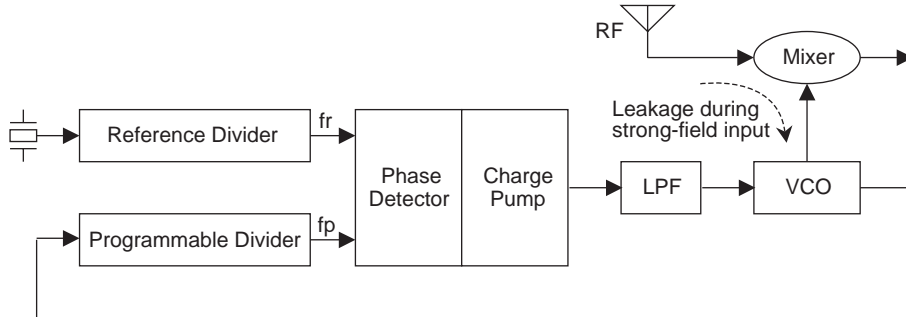
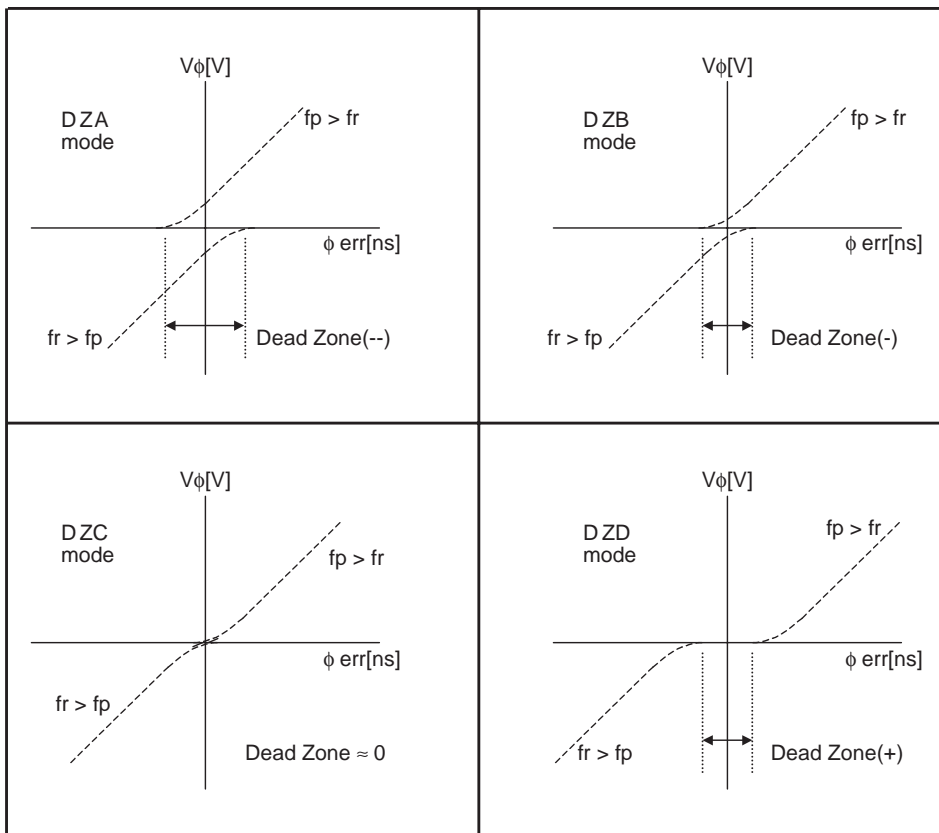


Figure 2 shows the phase comparator/charge pump output characteristics. The phase comparator outputs a voltage  $V_\phi$  that is proportional to the phase difference  $\phi$  between  $f_r$  and  $f_p$ . The phase comparator's characteristics can be switched by changing the phase comparator dead zone mode setting. The phase comparator can be set to modes (DZA, DZB) in which both the charge pump p-channel and n-channel sides are turned on when the phase difference is small, or can be set to a mode (DZD) that does not output the phase difference when the phase difference is small.

Figure 2 Phase Comparator/Charge Pump Characteristics



## (2) Dead zone mode characteristics

The table below presents an overview of the characteristics in each of the dead zone modes.

Setting		Dead zone mode	Charge pump (p/n-channel) state at 0 phase difference	Dead zone width (for reference purposes)	Notes
DZ1	DZ0				
0	0	DZA	On/on	--(-15[ns])	
0	1	DZB	On/on	- (-8[ns])	
1	0	DZC	On or off	Close to 0 (0[ns])	Illegal setting
1	1	DZD	Off/off	+ (+8[ns])	

## (3) Dead zone mode characteristics and selection criteria

This section describes the characteristics of each dead zone mode and the criteria for selecting that mode.

### (1) DZA mode

In DZA mode, the correction signal is output from the charge pump even if the reference frequency (fr) and comparison frequency (fp) match. This results in excellent signal-to-noise ratio characteristics. However, due to the generation of reference frequency component sidebands, beating may occur in the presence of a strong input signal. This is because the PLL loop responds sensitively to leakage components from the RF stage through the mixer and this modulates the VCO.

### (2) DZB mode

Like DZA mode, in DZB mode the correction signal is output from the charge pump even if the reference frequency (fr) and comparison frequency (fp) match. However, the correction signal voltage is lower in DZB mode than in DZA mode. The feature of this mode is that it provides a better signal-to-noise ratio than DZC or DZD mode yet is less susceptible to beating than DZA mode.

### (3) DZC mode

In DZC mode, a correction signal proportional to the phase difference between the reference frequency (fr) and comparison frequency (fp) is output from the charge pump. A small amount of noise may occur when the phase difference is close to 0 ns. Since the signal-to-noise ratio may degrade significantly at low temperatures (under -30°C), this mode should not be used.

### (4) DZD mode

In DZD mode, a correction signal proportional to the phase difference between the reference frequency (fr) and comparison frequency (fp) is output from the charge pump. The correction signal is not output when the phase difference is in the vicinity of  $\pm$  <a few ns>. As a result the signal-to-noise ratio is worse than the other modes, but the occurrence of beating is suppressed.

# LV25400W

## LV25400W bit control specification: reference values

### 1. FM S-Meter shifter

LSB		MSB			Functions
D32-20	D32-21	D32-22	D32-23	D32-24	
0	0	0	0	0	Vsm (DC) = 1.87V : +5.6dB
					↑
0	0	0	0	1	Vsm (DC) = 2.15V : 0dB
					↓
1	1	1	1	1	Vsm (DC) = 2.45V : -6.0dB

### 2-1. FM IFAGC (HD)

LSB		MSB		Functions
D2-12	D2-13	D2-14	D2-15	
0	0	0	0	IFAGC (HD) -Amp-Gain : +4dB
				↑
1	1	0	1	IFAGC (HD) -Amp-Gain : 0dB
				↓
1	1	1	1	IFAGC (HD) -Amp-Gain : -4dB

### 2-2. AM IFAGC (HD)

LSB		MSB		Functions
D2-12	D2-13	D2-14	D2-15	
0	0	0	0	IFAGC (HD) -Amp-Gain : +4dB
				↑
1	1	0	1	IFAGC (HD) -Amp-Gain : 0dB
				↓
1	1	1	1	IFAGC (HD) -Amp-Gain : -4dB

### 3-1. FM IFAGC (Analog)

LSB		MSB		Functions
D32-25	D32-26	D32-27	D32-28	
0	0	0	0	IFAGC (Analog) -Amp-Gain : +4dB
				↑
1	1	0	1	IFAGC (Analog) -Amp-Gain : 0dB
				↓
1	1	1	1	IFAGC (Analog) -Amp-Gain : -4dB

### 3-2. AM IFAGC (Analog)

LSB		MSB		Functions
D32-25	D32-26	D32-27	D32-28	
0	0	0	0	IFAGC (Analog) -Amp-Gain : +4dB
				↑
1	1	0	1	IFAGC (Analog) -Amp-Gain : 0dB
				↓
1	1	1	1	IFAGC (Analog) -Amp-Gain : -4dB

### 4-1. FM Wide-AGC-ON-Level

LSB		MSB		Functions
D32-00	D32-01	D32-02	D32-03	
0	0	0	0	Wide-AGC-ON-Level : -8.5dB
				↑
1	1	1	0	Wide-AGC-ON-Level : 0dB
				↓
1	1	1	1	Wide-AGC-ON-Level : +5.5dB

### 4-2. AM Wide-AGC-ON-Level

LSB		MSB		Functions
D32-00	D32-01	D32-02	D32-03	
0	0	0	0	Wide-AGC-ON-Level : -8.5dB
				↑
1	1	1	0	Wide-AGC-ON-Level : 0dB
				↓
1	1	1	1	Wide-AGC-ON-Level : +7.0dB

### 5-1. FM Narrow-AGC-ON-Level

LSB		MSB		Functions
D32-04	D32-05	D32-06	D32-07	
0	0	0	0	Narrow-AGC-ON-Level : -9.5dB
				↑
1	1	1	0	Narrow-AGC-ON-Level : 0dB
				↓
1	1	1	1	Narrow-AGC-ON-Level : +6.5dB

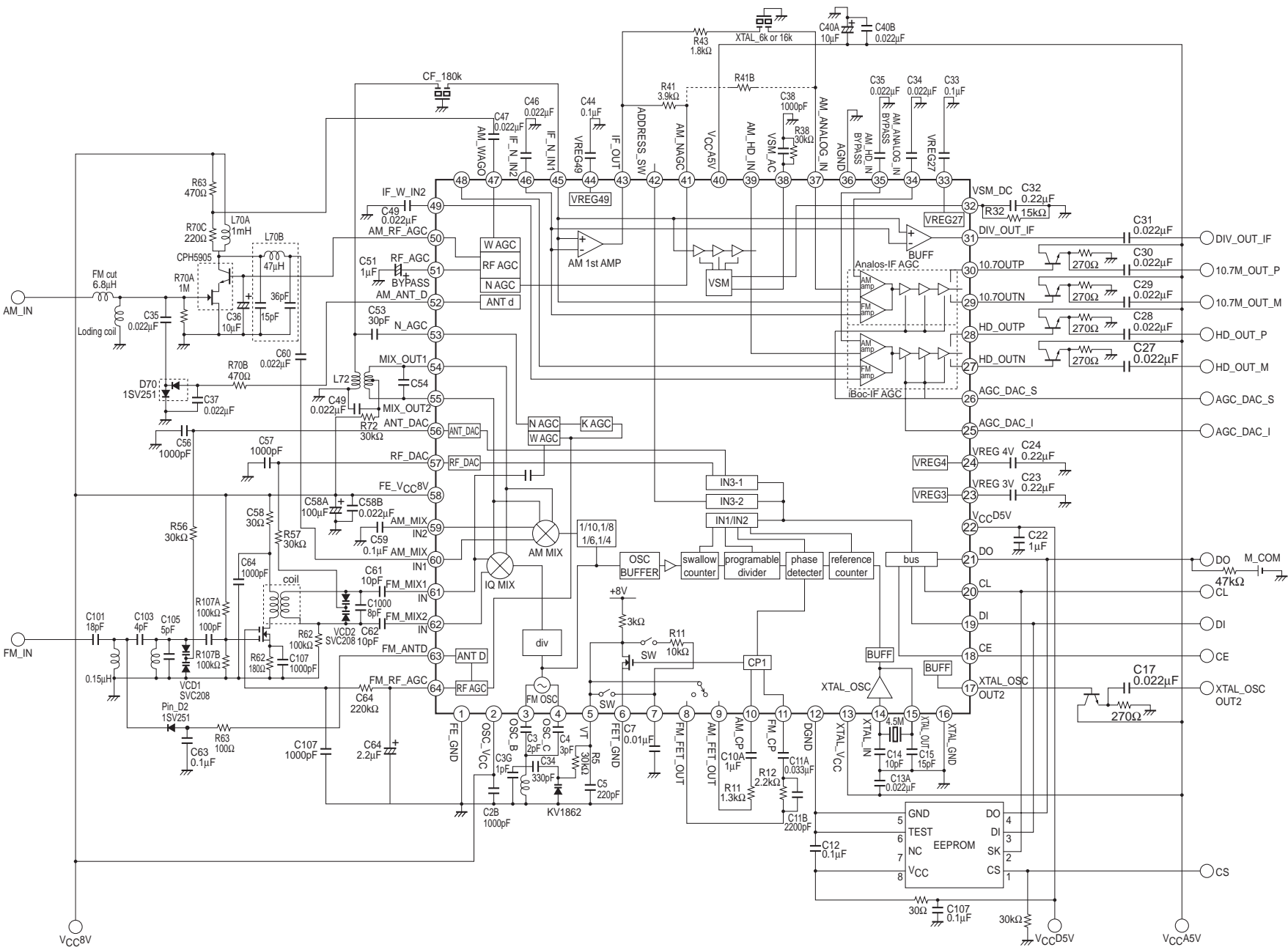
### 5-2. AM Narrow-AGC-ON-Level

LSB		MSB		Functions
D32-04	D32-05	D32-06	D32-07	
0	0	0	0	Narrow-AGC-ON-Level : -9.0dB
				↑
1	1	1	0	Narrow-AGC-ON-Level : 0dB
				↓
1	1	1	1	Narrow-AGC-ON-Level : +5.0dB

### 6-1. Keyed-AGC-ON-Level

LSB		MSB		Functions
D32-08	D32-09	D32-10	D32-11	
0	0	0	0	Keyed-AGC-ON V32 : 0.27V
				↑
1	1	1	0	Keyed-AGC-ON V32 : 1.20V
				↓
1	1	1	1	Keyed-AGC-ON V32 : 2.25V





- SANYO Semiconductor Co.,Ltd. assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein.
- SANYO Semiconductor Co.,Ltd. strives to supply high-quality high-reliability products, however, any and all semiconductor products fail or malfunction with some probability. It is possible that these probabilistic failures or malfunction could give rise to accidents or events that could endanger human lives, trouble that could give rise to smoke or fire, or accidents that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO Semiconductor Co.,Ltd. products described or contained herein are controlled under any of applicable local export control laws and regulations, such products may require the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written consent of SANYO Semiconductor Co.,Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO Semiconductor Co.,Ltd. product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production.
- Upon using the technical information or products described herein, neither warranty nor license shall be granted with regard to intellectual property rights or any other rights of SANYO Semiconductor Co.,Ltd. or any third party. SANYO Semiconductor Co.,Ltd. shall not be liable for any claim or suits with regard to a third party's intellectual property rights which has resulted from the use of the technical information and products mentioned above.

This catalog provides information as of December, 2007. Specifications and information herein are subject to change without notice.