

TO

DATE : 2007.03.21

SPECIFICATION

**for Digital VSB (QAM) NIM
With Analog Demodulator**

Samsung name : DNV S263QV261A

THIS TUNER IS NOT INCLUDED ENVIRONMENTAL-RELATED CHEMICAL SUBSTANCES.
--

CUSTOMER

DRAWING	CHECKED	APPROVED

SUPPLIER

WRITTEN	CHECKED	APPROVED

Address : Digital tuner R&D group, Digital Module Division,
SAMSUNG ELECTRO-MECHANICS CO., LTD.
314,maetan-dong,yeong-tonggu,suwon-city,kyungki-do, KOREA
TEL. : 82-31-210-6607 FAX : 82-31-210-6380

Revision History

Rev.	Description	Page	Date
0.0			2007.03.21

INDEX

1. Description.

- 1-1 Receiving System**
- 1-2 VSB/QAM & Analog demodulator**
- 1-3 Receiving Channel.**
- 1-4 Intermediate Frequency.**
- 1-5 Input Impedance.**
- 1-6 Band Change-Over System .**
- 1-7 Tuning System.**
- 1-8 Internal RF AGC function.**
- 1-9 Built in the additional IF amplifier with AGC circuit.**
- 1-10 Control Data Bus.**
- 1-11 Control Data Format.**
- 1-12 Pin No. and Function.**

2. General Characteristics.

- 2-1 Temperature Range.**
- 2-2 Test conditions.**
- 2-3 Current Consumption.**
- 2-4 Absolute Maximum Ratings.**

3. Electrical Characteristics. (RF block & Digital Demodulation)

4. Programming for the tuner's PLL IC.

5. Safety and Reliability.

6. Mechanical Characteristics.

7. Frequency Table.

8. Label Format.

9. Block Diagram

10. Drawing

1. Description

- 1-1 Receiving System : Designed to cover all bands in VHF and UHF including digital Cable(Annex B)terrestrial(ATSC) and NTSC system.
- 1-2 It built in VSB/QAM Demod IC & Analog demodulator
- 1-3 Receiving Channel : 54MHz ~ 865MHz
- 1-4 Intermediate Frequency : Digital(center) 44 MHz, Analog(picture) 45.75MHz
- 1-5 Input Impedance : 75 Ω , Unbalanced.
Loop through output : 75 Ω , Unbalanced.
- 1-6 Band Change-Over System : PLL system.
- 1-7 Tuning System : PLL system.
- 1-8 Internal RF AGC function :
Built in wide band AGC detector with 6 programmable take-over points
- 1-9 Built in the additional IF amplifier with AGC circuit.
- 1-10 Control Data Bus : I²C (**BUS VOLTAGE : 3.3V**)
- 1-11 Control Data Format : Refer to 4 Section.
- 1-12 Pin No. and Function

Pin No	Connection	Remark	Pin No	Connection	Remark
1	5V	RF AMP B+	16	SYNC	Sync output
2	RF AGC	RF AGC Monitoring Pin	17	ENABLE	Data valid
3	5V	B+ VOLT.	18	MD7	MPEG data output 7
4	AFT OUT		19	MD6	MPEG data output 6
5	33V		20	MD5	MPEG data output 5
6	GND	Ground Pin	21	MD4	MPEG data output 4
7	POWER RESET		22	MD3	MPEG data output 3
8	ERROR		23	MD2	MPEG data output 2
9	VIDEO OUT		24	MD1	MPEG data output 1
10	-		25	MDO	MPEG data output 0
11	SIF OUT		26	MPEG CLK	
12	3.3V	Digital Core Power	27	SDA	Serial Data For Demod IC
13	GND	Ground Pin	28	SCL	Serial Clock For Demod IC
14	N. C				
15	1.2V	Digital Core Power			

2. General Characteristics

2-1 Temperature Range

Storage Temperature : -20℃ ~ +80℃

Operation Temperature : 0℃ ~ +65℃

2-2 Test conditions : All data hold under following conditions

T(amb.) : +25±2℃ / Humidity : 45 ~ 65 % RH

Supply voltage(BM 5V) : +5V ±2%

Supply voltage(BT 33V) : +33V ±2%

Supply voltage(B1.2V) : +1.2V ±2%

Supply voltage(B3.3V) : +3.3V ±2%

2-3 Current Consumption(In 8VSB mode)

Supply Voltage (BM 5V) : 200mA typ. 250mA max.

Supply voltage(BT 33V) : 1mA typ. 5mA max.

Supply Voltage(1.2V) : 320mA typ. 360mA max.

Supply Voltage(3.3V) : 70mA typ. 82mA max.

2-4 Absolute Maximum Ratings

Supply Voltage(BM 5V) : 5.0V (+0.5V -0.25V) max.

Supply voltage(BT 33V) : 33V (+2V -2V) max.

Supply Voltage(B1.2V) : 1.2V (+0.12V -0.05V) max.

Supply Voltage(B3.3V) : 3.3V (+0.33V -0.16V) max.

3. *Electrical Characteristics (RF block & Digital Demodulation)*

3-1 Input/Loopthrough Frequency Range

VHF-Low Band	:	54 MHz ~ 168 MHz
VHF-High Band	:	169 MHz ~ 467 MHz
UHF Band	:	471 MHz ~ 864 MHz
Front end Loopthrough	:	54 MHz ~ 864 MHz
Loop Loss -6dB Max		

3-2 Input Signal Level(Digital reception) : -75dBm ~ -7dBm (Average power)

3-3 VSB/QAM Demod IC : S5H1410(Samsung LSI Semiconductor)

3-4 Input Impedance : 75 Ω

3-5 IF Frequency

1) Digital center frequency	:	44 MHz
2) Analog center frequency	:	45.75 MHz

3-6 IF Response curve

1) Amplitude ripple in band (AGC Volt 4.0 ~ 0.8V) : ± 3dB max.
Center; 3MHz

3-7 Spurious Signals at Input Terminal

Local Oscillator Leakage : 45dBuV max.

3-8 Reference Frequency

The X-tal for the RF block's PLL : 4MHz

3-9 Phase Noise

@ 10kHz : -90dBc/Hz typ. -80dBc/Hz min.

3-10 Control Data Bus : I²C

3-11 Control Data Format : refer **4 section**

3-12 Adjacent NTSC Interference Protection Ratio. (N ; 1 channel)

: -40dB typ. -35dB min Note1.

3-13 Co-Channel NTSC Interference Ratio.

: 3dB typ. 6dB min Note1.

◆ Note1 :

Desire input signal condition

a : Modulation - 8VSB

b : Input Level -53dBm

Undesired input signal condition :

NTSC: Video 87.5% color bars

FM sound : 1kHz/± 25kHz deviation, freq. P/S : 7dB)

※ Adjacent & Image channel NTSC interference test procedure

- a : Use changeover switch to select power meter
- b : Turn 8VSB source off ; adjust NTSC level to -23dBm
- c : Turn NTSC off ; turn 8VSB on
- d : Adjust 8VSB to -53dBm
- e : Turn 8VSB on and increase NTSC level to see the pixelation on the screen
- f : Note protection ratio as the difference value between 8VSB and NTSC's level

※ Co-Channel NTSC interference test procedure

- a : Use changeover switch to select power meter
- b : Turn NTSC source off ; adjust 8VSB level to -48dBm
- c : Turn 8VSB off ; turn NTSC on
- d : Adjust NTSC to -53dBm
- e : Turn 8VSB on and increase step attenuator in NTSC channel

3-14 Additive White Gaussian Noise Condition. at QEF.

: 15.6dB typ. 16dB max.

3-15 8VSB Input Sensitivity

Parameters	Unit	Min	Typ	Max	Remarks
Input Sensitivity (8VSB)	dBm	-75	-	-7	

3-16 Multipath channel Interference

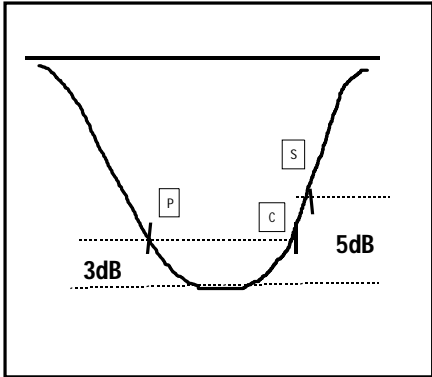
short echo : 5dB max

long echo : 10dB max

3-17 QAM Demodulator Stage

Parameters	Unit	Min	Typ	Max	Remarks
Input Sensitivity (256QAM)	dBmV	-12	-	15	For C/N=33dB , BERT=2E-04
Adjacent NTSC Interference @ -1dBmV (256QAM)	dB	16	26	-	DIGITAL Desired Level /NTSC Undesired Level at the Antenna.
Input Sensitivity (64QAM)	dBmV	-15	-	15	
Adjacent NTSC Interference @ -6dBmV (64QAM)	dB	21	33	-	DIGITAL Desired Level /NTSC Undesired Level at the Antenna

3-18. TUNER characteristics

Parameter		Specification			Unit	Remark
		Min.	Typ.	Max.		
Noise Figure		-	6	10	dB	At tuner IF output
Power Gain		35	40	-	dB	
Power Gain Deviation		-	4	6	dB	
VSWR		-	-	6	-	
Phase Noise	10KHz	80	90		dBc/Hz	
LO Voltage at the Antenna	54-803MHz	-	34	45	dBuV	Inband Leakage
	803-1700MHz	-	45	50	dBuV	harmonic
Image Rejection	FULL UHF VHF	57	63	-	dB	Gain Reduction=0dB
		60	65	-	dB	
	30dB UHF VHF	50	55	-	dB	Gain Reduction=30dB
IF Rejection	FULL UHF VHF	60	70	-	dB	Gain Reduction=0dB
	30dB UHF VHF	50	60	-	dB	Gain Reduction=30dB
IF Response						P: Peak -1dB C: $P \geq C(0 \sim -3\text{dB})$ S: Peak -5dB
1% Cross Modulation of 2nd side band CH.	UHF & VHF AIR CABLE	70 68	75 72		dBuV	Gain Reduction=0dB
	UHF & VHF AIR CABLE	75 75	85 85		dBuV	Gain Reduction=30dB

3-18. PIF characteristics

When it is no specific note,

Fp input level is 70dBuV, P/S ratio is -7dB, 25°C, after warm-up(20sec).

Parameter		Specification			Unit	Remark
		Min.	Typ.	Max.		
Video Output Level		0.8	1.0	1.2	Vp-p	Standard color bar : 87.5% mod.
Video S/N		45	48	-	dB	Input level : 70dBuV HPF:100KHz, LPF:4.2MHz, SC trap:ON 100% white signal, 87.5% mod. Ref. A bill of changed SPEC (2004.09.08 from SEC)
Sensitivity	VHF	-	42	50	dBuV	S/N = 30dB HPF:100KHz, LPF:4.2MHz, SC trap:ON 100% white signal, 87.5% mod. Ref. A bill of changed SPEC (2004.09.08 from SEC)
	UHF	-	42	50		
Over-Modulation		105	115		%	WHITE BAR
Chroma Distortion	DP	-10		+10	Deg	10 Step Linearity Signal 87.5% mod. Ref. I F I C SPEC
	DG	-10		+10	%	
Video Frequency Response		Min.	Typ.	Max.	dB	Video Signal : 87.5 % AM Mod. Multi - Burst Signal
1.0MHz		-1.5	0	+1.5		
2.0MHz		-2.5	0	+1.5		
3.0MHz		-3.0	0	+1.5		
3.58MHz		-4.0	0	+1.5		
AFT Alignment Accuracy		1.5	2.5	3.5	V	Standard color bar : 87.5% mod. Test condition : 25°C - after warm-up (20sec)
SIF OUT Level		70	85		dBuV	Standard color bar : 87.5% mod. FM mod : 1KHz, 25KHz dev. (100% mod) RF input = 70dBuV, P/S = -7dB Test point : SIF out of TUNER Test cable : IF cable

4. Programming for the tuner's PLL IC

4-1 Bit allocation Write/Read

Byte	⁽³⁾ MSB	bit6	bit5	bit4	bit3	bit2	bit1	LSB	Ack	Remark
Write Data										
Address Byte	1	1	0	0	0	MA1	MA0	0	A	
Divider Byte1(DB1)	0	N14	N13	N12	N11	N10	N9	N8	A	
Divider Byte2(DB2)	N7	N6	N5	N4	N3	N2	N1	N0	A	
Control Byte1(CB1)	1	⁽¹⁾ T/A	T2	T1	T0	R2	R1	R0	A	
			0 ⁽²⁾	0 ⁽²⁾	ATC ⁽²⁾	AL2 ⁽²⁾	AL1 ⁽²⁾	AL0 ⁽²⁾	A	AGC
Control Byte2(CB2)	CP2	CP1	CP0	BS5	BS4	BS3	BS2	BS1	A	
Read Data										
Address Byte	1	1	0	0	0	MA1	MA0	1	A	
Status Byte	POR	FL	ALBC	1	AGC	A2	A1	A0	A	

Notes

1. The bit T/A selects whether the 6 following bits will be Test and reference divider ratio data(T/A = logic 1) or AGC settings data (T/A = logic 0).
2. The meaning of this bit depends on the bit T/A
3. MSB is transmitted first

4-2 Description of symbols

A : acknowledge

MA1, MA0 : programmable address bits (see 4-3)

N14 to N0 : programmable LO frequency

N: programmed division ratio

$$N = N14 \cdot 2^{14} + N13 \cdot 2^{13} + N12 \cdot 2^{12} + \dots + N1 \cdot 2^1 + N0$$

$$F_o = N \cdot (F_x / N_{ref}) \quad F_o : \text{local osc frequency}$$

$$N = F_o \cdot (N_{ref} / F_x) \quad F_x : \text{x-tal osc frequency}$$

Nref : reference osc divided ratio

T2, T1, T0 : test bits when T/A = 1, see 4-6

R2, R1, R0 : programmable frequency step when T/A = 1, see 4-4

ATC : AGC time constant when T/A = 0, see 4-8

AL2, AL1, AL0 : AGC take-over point bits when T/A = 0, see 4-9

CP2 to CP0 : charge pump current, see 4-5

BS5, BS4, BS3, BS2, BS1 : PMOS ports control bits, see 4-7

bit = 0; corresponding port is i OFF $_i$,

high impedance state (status at Power On Reset)

bit = 1; corresponding port is i ON $_i$; $V_{OUT} = V_{CC} - V_{DSSAT}$

POR : power-on-reset flag. (POR = 1 on power-on)

FL : in-lock flag. (FL = 1 when the loop is phase-locked)

AGC : internal AGC flag.

A2, A1, A0 : digital outputs of the 5-level A/D converter

ALBC : ALBC(automatic loop bandwidth control) flag.
(ALBC=1 when ALBC is selected)

4-3 Address selection

MA1	MA0	AS input voltage level
0	0	$(0 \sim 0.1) * V_{VCC}$
0	1	Open Circuit or $(0.2 \sim 0.3) * V_{VCC}$
1	0	$(0.4 \sim 0.6) * V_{VCC}$
1	1	$(0.9 \sim 1) * V_{VCC}$

4-4 Reference divider ratios (4MHz X-Tal external reference)

R2	R1	R0	Frequency step	Remark
0	1	1	50kHz	Only use this

4-5 Charge pump current

No.	CP2	CP1	CP0	Current in uA
1	0	0	0	38
2	0	0	1	54
3	0	1	0	83
4	0	1	1	122
5	1	0	0	163
6	1	0	1	254
7	1	1	0	400
8	1	1	1	580

4-6 X-Tal output buffer

T2	T1	T0	Device operation	Remark
0	0	0	Normal operation with XTout buffer off	

4-7 Band selection port

Band	BS4	BS3	BS2	BS1
VHF low	0	0	0	1
VHF high	0	0	1	0
UHF	1	0	0	0

4-8 AGC current and time constant

ATC	AGC current	AGC time constant	Remarks
0	220nA	2s	Normal mode (MUST)
1	9uA	50ms	search mode

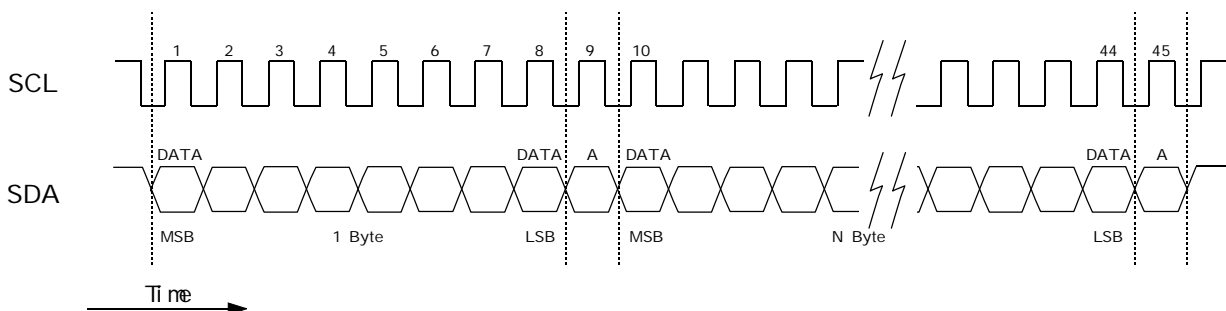
4-9 AGC take-over points

AL2	AL1	AL0	Take-over point level	Remarks
0	0	0	124dBuVpp	
0	0	1	121dBuVpp	
0	1	0	118dBuVpp	MUST
0	1	1	115dBuVpp	
1	0	0	112dBuVpp	
1	0	1	109dBuVpp	
1	1	0	I _{agc} =0	external AGC
1	1	1	V _{agc} =3.5V	AGC detector is disabled

4-10 Example for the I2C data stream to PLL(digital mode)

Frequency	100MHz	200MHz	800MHz
Write register (PLL)	DATA(Hex)	DATA(Hex)	DATA(Hex)
Address Byte	C2	C2	C2
Divider Byte1(DB1)	0B	13	41
Divider Byte2(DB2)	40	10	F0
Control Byte1(CB1), T/A=1	C3	C3	C3
Control Byte2(CB2)	C1	C2	C8
Control Byte1(CB1) T/A=0	81	81	81

ex) start C2 A 0B A 40 A C3 A C1 A 81 stop

4-11 I²C bus data format

5. Safety and Reliability

NO	ITEM	TEST CONDITIONS	SPECIFICATIONS
5-1	Cold Test	-40℃ , 96 HR	* 1st IF Gain Variation : < 3dB * Tu Local oscillator drift VHF Low : 15kHz VHF High : 45kHz UHF : 75kHz * Video S/N : 6dB * Video Output Level : 0.2Vp-p * Noise Limit Sensitivity : 6dB * Audio Output Level : 30% Max.
5-2	High Temperature Load Test	+80℃ , 96 HR , B+	
5-3	Humidity Test	+60℃ , 95%RH , 96 HR	
5-4	Humidity & Temperature Load Test	+60℃ , 95%RH , 96 HR , B+	
5-5	Thermal Shock test	-40℃ ↔ 110℃ , 30min, 100cycle	
5-6	Vibration Test	Frequency ranging from 10 to 55Hz, amplitude 1.5mm, 0.5 HR in each direction of X,Y,Z.	
5-7	Static Electricity Test	Apply 10kV standard pulse 5 times at ANT.	

5-8 ESD protection

The tuner contains components that can be damaged by static discharge.

Observe these precautions

; Ground yourself before handling the tuner.

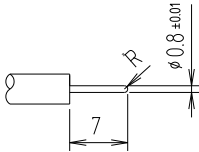
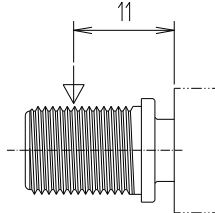
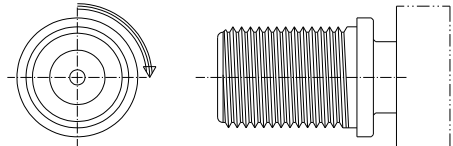
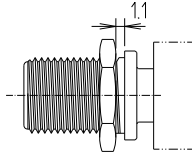
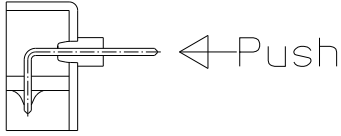
; Do not touch the tuner connector pins without ESD protection.

6. Mechanical Characteristics

6-1 Dimensions : refer to below

6-2 RF input : F-Connector

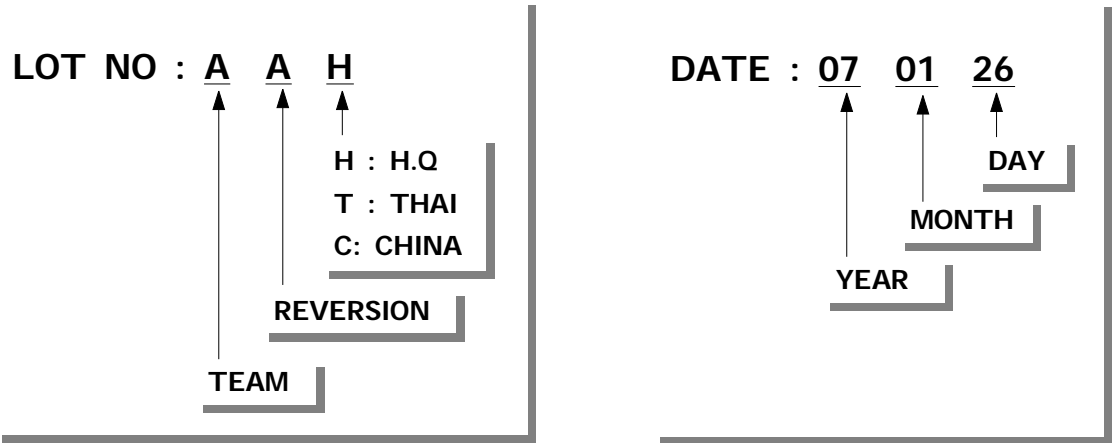
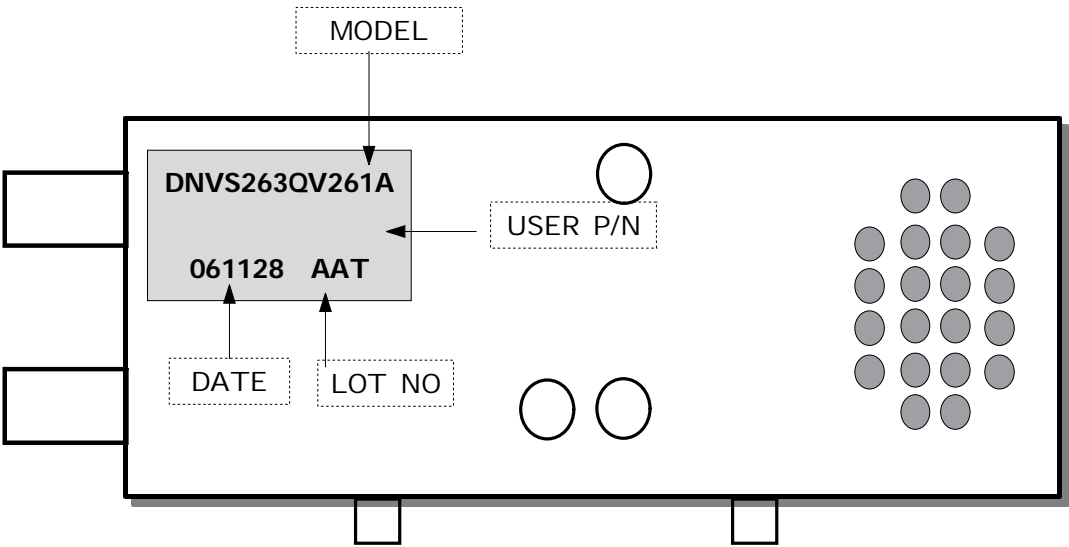
6-3 RF Loop through : F-Connector

No.	Test Item	Test Conditions	Specifications
1	Holding strength of Center contact for Coaxial Connector	 <p>Unit : mm IEC 600169-24</p>	<p>Insertion and extraction measure force after perform 10 cycles.</p> <p>Insertion force : 300g(2.94N) ≤ Extraction force : 50g(0.5N) ≤</p>
2	Destructive power of Coaxial Connector	<p>► UTM (Universal Tensile Machine)</p> <p>► Test speed : 100 mm/min</p>	<p>Destructive power of Coaxial connector shall stand the force up to 5kgf(49N) applied to the point of 11mm.</p>  <p>Unit : mm</p> <p>We recommend to fix to the back panel by using a Nut</p>
3	Rotating Torque of Coaxial Connector	<p>► Torque gage</p> <p>► Test speed: 12 rad/sec</p>	<p>Rotating Torque of Coaxial connector shall stand the torque up to 6kgf*cm(58.8N*cm)</p> 
4	Incomplete thread zone		<p>Distance of Coaxial connector's incomplete thread zone must be less than 1.1mm</p>
5	Strength of Terminals	<p>► Push-pull gage</p>	<p>The terminal shall not withdraw to the inside when a force of 1.0Kgf(9.8N) is applied to the end.</p> 

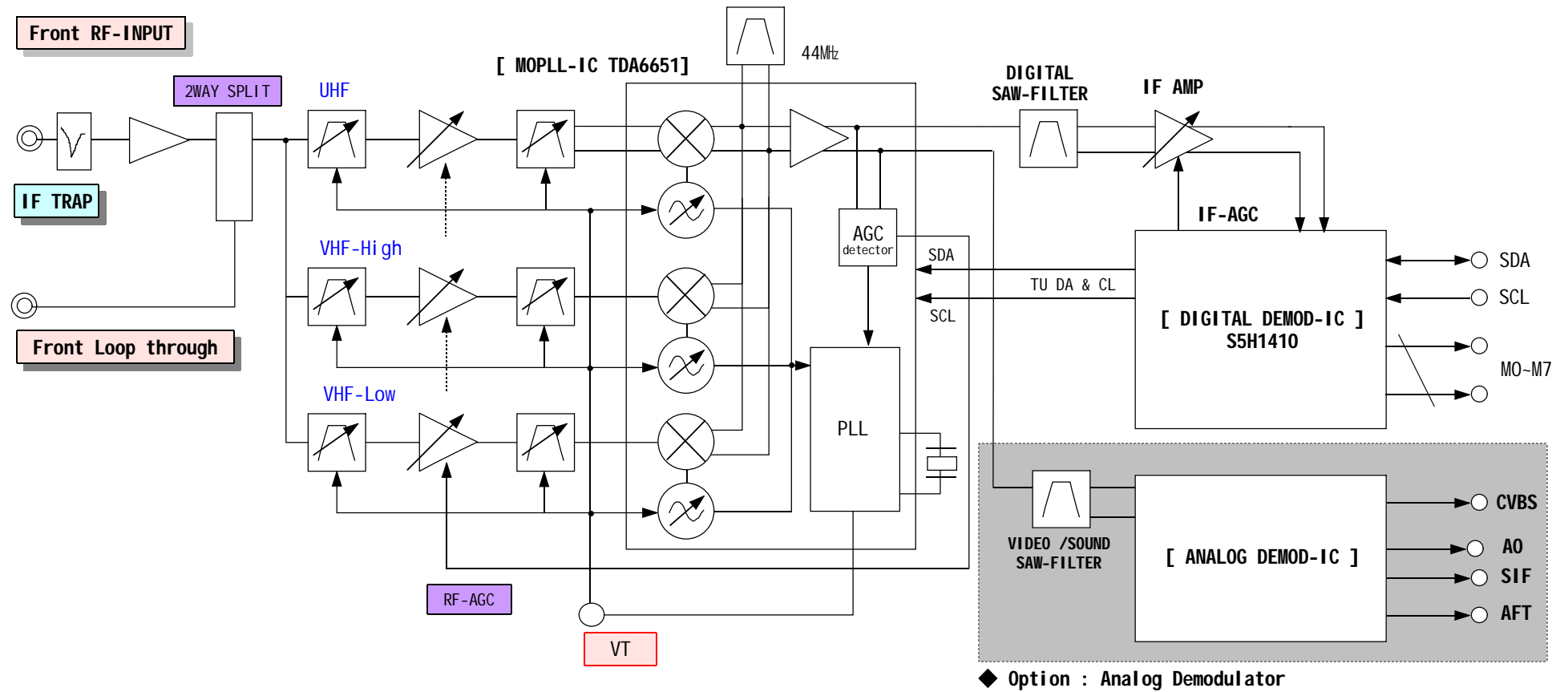
58	735,250	781,000	U	C2	3D04	C3	C8	82
59	741,250	787,000	U	C2	3D7C	C3	C8	82
60	747,250	793,000	U	C2	3DF4	C3	C8	82
61	753,250	799,000	U	C2	3E6C	C3	C8	82
62	759,250	805,000	U	C2	3EE4	C3	C8	82
63	765,250	811,000	U	C2	3F5C	C3	C8	82
64	771,250	817,000	U	C2	3FD4	C3	C8	82
65	777,250	823,000	U	C2	404C	C3	C8	82
66	783,250	829,000	U	C2	40C4	C3	C8	82
67	789,250	835,000	U	C2	413C	C3	C8	82
68	795,250	841,000	U	C2	41B4	C3	C8	82
69	801,250	847,000	U	C2	422C	C3	C8	82
70	807.250	853,000	U	C2	42A4	C3	C8	82
71	813.250	859,000	U	C2	431C	C3	C8	82
72	819.250	865,000	U	C2	4394	C3	C8	82
73	825.250	871,000	U	C2	440C	C3	C8	82
74	831.250	877,000	U	C2	4484	C3	E8	82
75	837.250	883,000	U	C2	44FC	C3	E8	82
76	843.250	889,000	U	C2	4574	C3	E8	82
77	849.250	895,000	U	C2	45EC	C3	E8	82
78	855.250	901,000	U	C2	4664	C3	E8	82
79	861.250	907,000	U	C2	46DC	C3	E8	82

→
→
→

8. Label Format



9. Block Diagram



10. Drawing

