

# FOR APPROVAL

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COMMODITY : MINI DIGITAL TERRESTRIAL NIM MODULE

MODEL NUMBER: DTN-356HEU/DTN-356ATW(U+VH BAND)DTN-356ATWT1(6M)

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T-NIM VERSION: V1.0

APPROVED DATE: \_\_\_\_\_

APPROVED SIGNATURES		
APPROVED	REVIEWED BY	CHECKED BY

## 1. GENERAL DESCRIPTION

This Specification covers DVB-T Tuner intended for application of Digital Terrestrial Broadcasting system

The Tuner compliant with ETSI 300 744 and included PLL ,COFDM Demodulator ,  
Built in 30v tuning voltage generator.

## 2. GENERAL SPECIFICATIONS

2 - 1	Receiving frequency range	UHF 470MHz ~ 862MHz VHF 174MHz ~ 230MHz
2 - 2	RF Input level	- 78dBm ~ -20dBm
2 - 3	RF Input connector	IEC type Female(EU)/F Terminal(TW)
2 - 4	Nominal input impedance	75 ohm
2 - 5	Channel selection system	Electronic tuning , PLL synthesizer (TDA6651TT, Clock 4.0 MHz)
2 - 6	Step frequency	166.67kHz
2 - 7	Voltage Gain	35dB min.(1 <sup>st</sup> IF)
2 - 8	IF frequency	36.167MHz
2 - 9	IF band width	8 MHz(for EU 7/8 MHz)/6MHz(TWT1)
2 - 10	COFDM-Demod. IC	ZL10353 (ZARLINK)
2 - 11	Operating voltage and current	
	Supply voltage & current	5.0V ± 0.25V DC (+5V) +5v=165mA max. 3V3 ± 0.15V DC (A3.3V/D3.3V) D3.3=5mA(pin 5) A3.3V=175mA(pin 6)
2--12	Temperature	Operation -10 °C ~ 50°C Storage -20 °C ~ 70°C
2 - 13	Humidity	Operating Less than 85% Storage Less than 95%
2--14	TESTING CONDITION	
	Supply voltage	5.0V ± 0.1V 3V3 ± 0.1V
	Ambient temperature	25 °C ± 5 °C
	Ambient humidity	65% ± 10%

### 3.ELECTRICAL CHARACTERISTICS

NO	Item	Specification				Condition
		Min	TYP	MAX	Unit	
3-1	ANT Input Return Loss	6	8		dB	170 ~ 230, 470 ~ 862MHz
3-2	ANT leakage at input terminal			46	dBuV	150 ~ 950MHz
				54	dBuV	950 ~ 1750MHz
3-2						
3-3						
3-4						
3-5	Image Rejection	-46	-50		dBc	Input : -50dBm
3-6	IF Rejection	-60			dBc	Input : -50dBm
3-7	RF Sensitivity (Min. Input level) Max. Input Level			-78	dBm	8k, 64QAM, 2/3 Code Rate 1/32 Guard Interval C/N OFF.
				-20		
3-8	Active White Gaussian Noise condition			18	dB	BER $2 \times 10^{-4}$ , -50dBm Input 8k, 64QAM, 2/3 Code Rate 1/32 GI .
3-9	Image PAL-BG Interference Protection Ratio	-36			dB	8k mode, Input : -50dBm,
	Adjacent PAL- BG Interference Protection Ratio(N+1)	-35			dB	8k mode, Input : -50dBm,
3-10	Adjacent PAL-BG Interference Protection Ratio(N-1)	-35			dB	8k mode, Input : -50dBm,
3-11	Co-Channel PAL-I Interference Ratio (C/I)	<+3			dB	64QAM, 8k, 2/3, 1/4

## 4. PLL FUNCTIONAL DESCRIPTION

### 4-1. I<sup>2</sup>C DATA FORMATS

Write data format (MSB is transmitted first)

<Table 1>

	BYTE	MSB	bit6	bit5	bit4	bit3	bit2	bit1	LSB	ACK
Address Byte	1	1	1	0	0	0	MA1= 0	MA0= 1	R/W= 0	A
Prog. Divider Byte1	2	0	N <sup>14</sup>	N <sup>13</sup>	N <sup>12</sup>	N <sup>11</sup>	N <sup>10</sup>	N <sup>9</sup>	N <sup>8</sup>	A
Prog. Divider Byte2	3	N <sup>7</sup>	N <sup>6</sup>	N <sup>5</sup>	N <sup>4</sup>	N <sup>3</sup>	N <sup>2</sup>	N <sup>1</sup>	N <sup>0</sup>	A
Control info Byte 1	4	1 1	D/A=1 D/A=0	0 0	0 0	1 ATC	R2=0 AL2	R1=1 AL1	R0=0 AL0	A
Control info Byte 2	5	CP2	CP1	CP0	BS5= 0	BS4= 0	BS3= 0/1	BS2= 1/0	BS1= 0	A

A : Acknowledge Bit

MA1, MA0 : Address selection bits (See Table 3)

N<sup>0</sup>~N<sup>14</sup> : Programmable Divider bits = (RF + IF) / step-size ;

IF = 36.167 MHz , RF is the center frequency of a channel

$N = 2^{14} \times N14 + 2^{13} \times N13 + \dots + 2^3 \times N3 + 2^2 \times N2 + 2^1 \times N1 + N0$

CP0~CP2 : Charge pump current bit (See Table 4)

D/A:D/A=1 following 6 bits contain test and reference divider ratio data

D/A=0 following 6 bits contain AGC setting data

R0~R2 : Reference divider bits(See Table 6)

BS1-BS5 : Switch ports control bits(see band select table 5)

Bit = 0 : port V out is off

Bit = 1 : port V out is on

ATC : AGC Time constant bit; Only valid with internal AGC loop active

Bit = 0 :enables fast tuning speed during channel search mode

Bit = 1 :recommended after channel acquisition ;normal mode

AL2-AL0: AGC take over point bits (see table 7)

### 4.2 Read data format

<Table 2>

Name		MSB	bit6	bit5	bit4	bit3	bit2	bit1	LSB	ACK	
Address	ADB	1	1	0	0	0	MA1=0	MA0=1	R/W=1	A	Byte1
Status Byte	SB	POR	FL	0	1	AGC	A2=1	A1=0	A0=0	A	Byte2

MA1/MA0:Chip address

POR : Power - on reset flag; POR = 1 at Power – on reset. POR=0,normal operation

FL : PLL Lock flag (If bit = 1, Loop is Locked) fl=0,not locked

AGC : Internal AGC flag. AGC =1 when internal AGC is active

A2, A1, A0 : Digital output of the 5 – level ADC

**\*\*\*Timing of program sequences:**

Because of the Tuner-PLL frequency divider setting time of min, 60usec, the occurrence of any Other IIC traffic start condition present within that periods on the bus will disturb the divider and result in a not properly tuned tuner VCO.

Each time the Tuner-PLL frequency divider has been programmed ,a 60usec wait becomes necessary before continuing the IIC bus traffic.

START	Tuner PLL-chip address	Divider Byte1	Divider Byte2	Data Byte1	Data Byte2	STOP
60u sec						
START	any other IIC device	data	data	data	data	STOP
START	Tuner PLL-chip address	Data Byte 1		Data Byte 2		STOP
START	Modulator- PLL address	Divider Byte1	Divider Byte2	Data Byte1	Data Byte2	STOP
START	Tuner PLL-chip address	Divider Byte 1		Divider Byte 2		STOP
60u sec						

**NOTE:**

When you switched band from UHF to VHF-H, the PLL may not lock properly.  
 We recommend to set the band selection as UHF → VHF-LOW → VHF-HIGH.

#### 4-3. ADDRESS SELECTION(VCC = 5V)

<Table 3>

Voltage at AS	MA1	MA0
$(0 \sim 0.1) \times VCC$	0	0
$(0.2 \sim 0.3) \times VCC$ or open circuit	0	1
$(0.4 \sim 0.6) \times VCC$	1	0
$(0.9 \sim 1.0) \times VCC$	1	1

Tuner Default MA1=0,MA0=1

#### 4-4. CHARGE PUMP CURRENT

<Table 4>

LO FREQUENCY	CH FREQUENCY	CP CURRENT	BAND	CP2	CP1	CP0
		83uA	VHF-HI	0	1	0
196 to 296 MHz	160-260	122uA		0	1	1
		163uA		1	0	0
		254uA		1	0	1
		400uA		1	1	0
		580uA		1	1	1
484 to 604 MHz	448-568	122uA	UHF	0	1	1
604 to 676 MHz	568-640	163uA		1	0	0
676 to 752 MHz	640-716	254uA		1	0	1
752 to 868 MHz	716-832	400uA		1	1	0
868 to 904 MHz	832-868	580uA		1	1	1

The above values are recommended. It need readjust to get best performance.

During search tuning, recommended to use a fix value. For example cp2,cp1,cp0=010 or 011

#### 4-5. Band Selection(Via Band switching byte)

<Table 5>

Band	BS5	BS4	BS3	BS2	BS1
VHF high	0	0	0	1	0
UHF	0	0	1	0	0

Tuner Default VHF-H BS2=1, UHF BS3=1

#### 4-6. PLL Reference divider ratio(4MHz external reference)

<Table 6>

Reference divider ratio	F-ref		R2	R1	R0	
24	166.67KHz		0	1	0	default
64	62.5KHz		0	0	0	
80	50KHz		0	1	1	

Tuner Recommend=Default

4-7. AGC take-over point (Control Data Byte 1)

<Table 7>

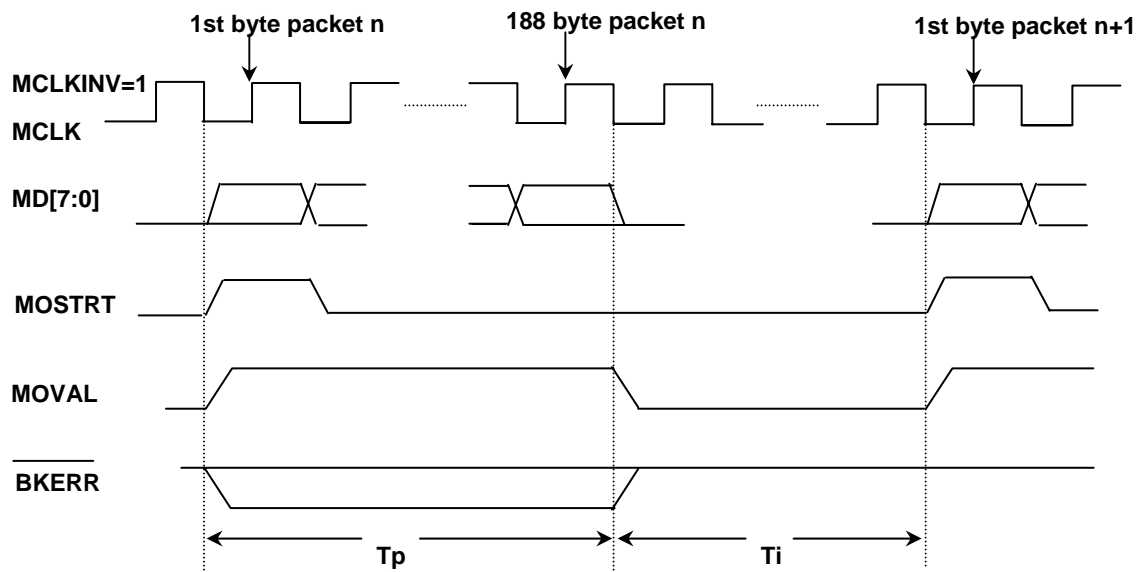
IF output level sym. mode	Remark	AL2	AL1	AL0
124dB $\mu$ V		0	0	0
121dB $\mu$ V		0	0	1
118dB $\mu$ V		0	1	0
115dB $\mu$ V		0	1	1
112dB $\mu$ V		1	0	0
109dB $\mu$ V		1	0	1
I <sub>AGC</sub> = 0	External AGC <sup>1)</sup>	1	1	0
V <sub>agc</sub> =3.6V	LOOP Disabled <sup>2)</sup>	1	1	1

1). The tuner internal AGC current sources are disabled (default mode after power on reset).

2). The tuner internal AGC detector is disabled. The RF gain is always set to maximum.

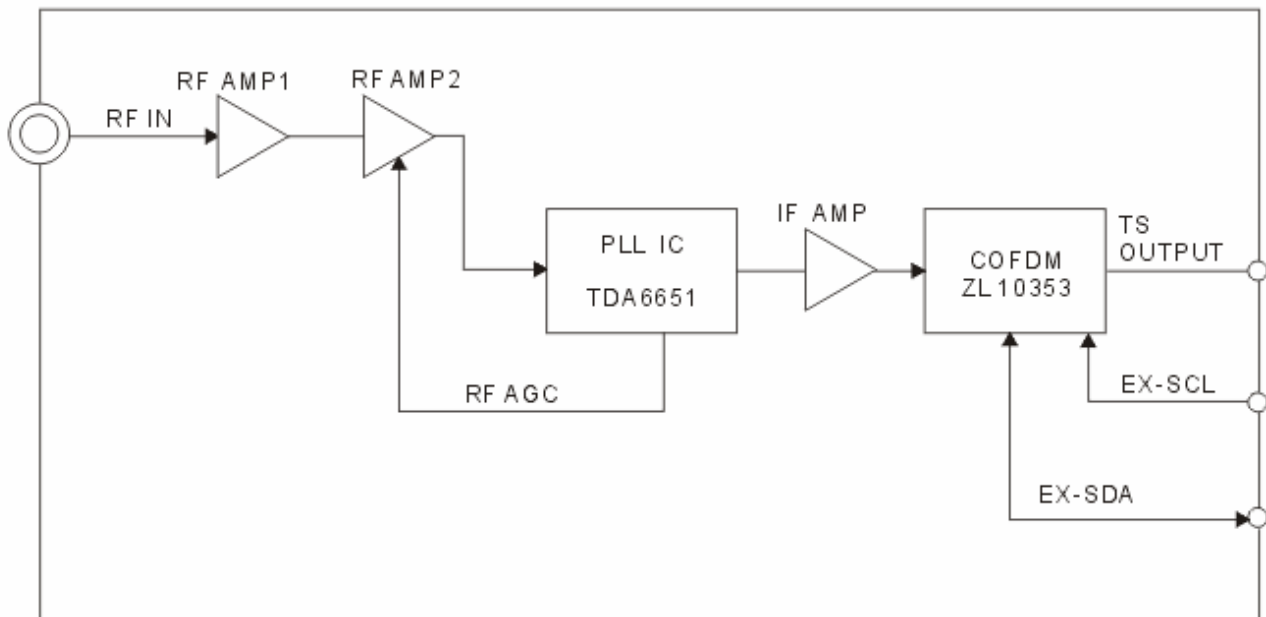
## 5. PARALLEL AND SERIAL OUTPUT INTERFACE

### 7-1. Parallel Transport Stream Output



\*At power up, the RESET pin is held active(LOW) for at least 250msec

## 6. BLOCK DIAGRAM





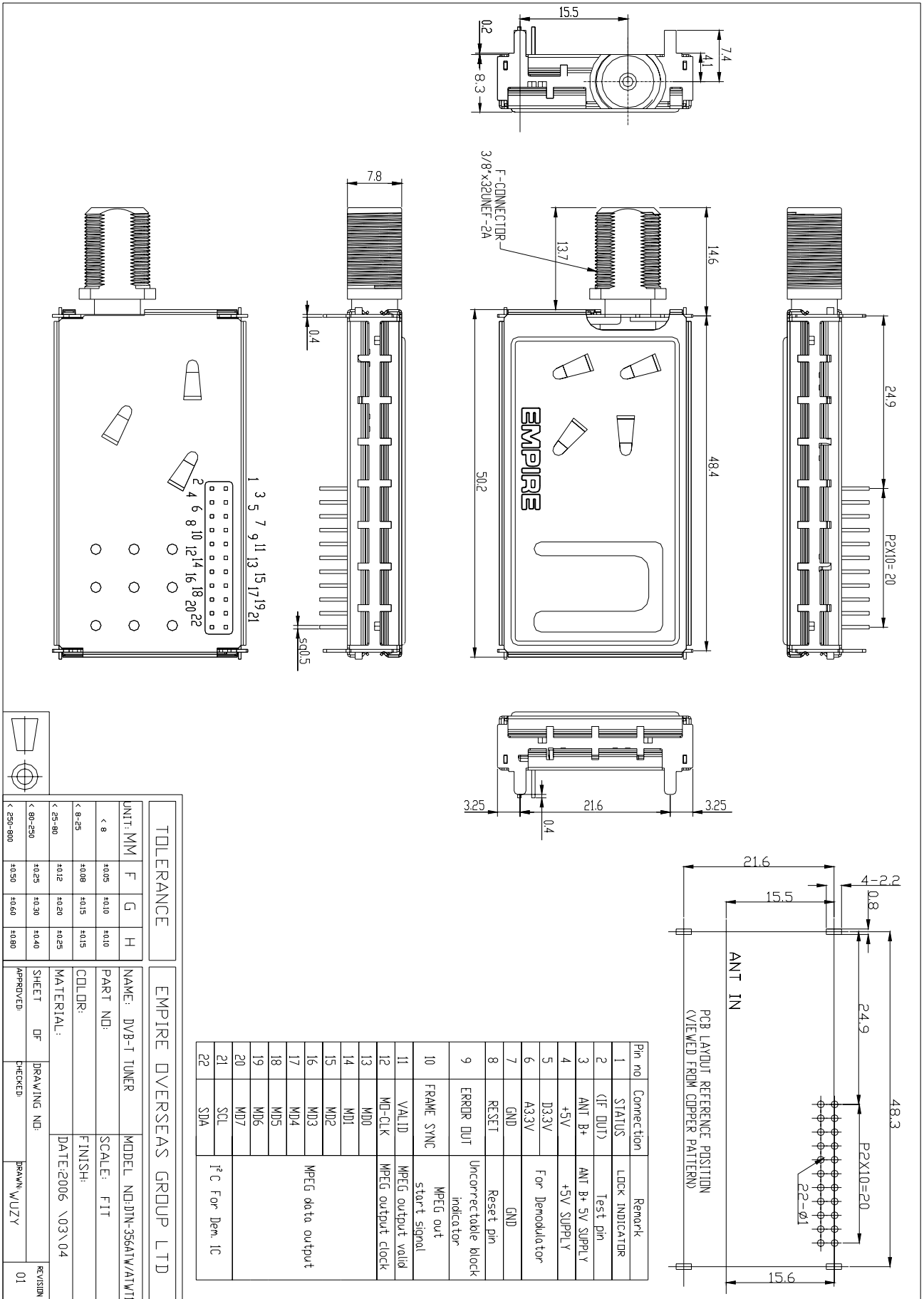
## 7. PIN DISCRPTION

PIN	CONNECTION	PIN DESCRIPTION
1	STATUS/NC	WHEN MPEG DESCRAMBLER LOCKED, THIS PIN WILL OUTPUT A HIGH LEVEL TO DRIVE DIRECTLY LED LAMP I=3.3mA Max.
2	IF OUT	TEST PIN (KEEP OPEN)
3	ANT B+	ANT 5V POWER SUPPLY FOR ACTIVE ANTENA
4	+5V	FOR RF, MOPLL , DC/DC & IF AMP
5	D3.3V	FOR DEMODULATOR
6	A3.3V	
7	GND	GND
8	RESET	RESET PIN
9	ERROR OUT	UNCORRECTABLE BLOCK INDICATOR
10	FRAME SYNC	MPEG OUT START SIGNAL
11	VALID	MPEG OUTPUT VALID
12	MO-CLK	MPEG OUTPUT CLOCK
13	MD0	MPEG DATA OUTPUT
14	MD1	
15	MD2	
16	MD3	
17	MD4	
18	MD5	
19	MD6	
20	MD7	
21	SCL	I2C CLOCK
22	SDA	I2C DATA

## 8. SAFETY AND RELIABILITY

No.	ITEM	TEST CONDITIONS	SPECIFICATIONS
1	COLD TEST	-20° C, 96 HR	<p>Gain Variation: &lt;math&gt;\pm 3\text{dB}&lt;/math&gt;</p> <p>Wave Variation : &lt;math&gt;\pm 30\%&lt;/math&gt;</p> <p>Local oscillator drift:  VHF HIGH : <math>\pm 45\text{KHz}</math>  UHF : <math>\pm 75\text{KHz}</math></p>
2	HIGH TEMPERATURE LOAD TEST	+60° C, 96 HR WITH STD POWER SUPPLY	
3	HUMIDITY TEST	+40° C ,95%RH, 96 HR	
4	HUMIDITY& TEMPERATURE LOAD TEST	+40° C ,95%RH, 96 HR , WITH STD POWER SUPPLY	
5	VIBRATION TEST	Frequency ranging from 5 to 55Hz, amplitude 2mm, 40 minutes in each direction of X,Y,Z.	
6	Life Test	<ol style="list-style-type: none"> <li>1) Take measurements in standard test condition.</li> <li>2) Leave samples for 1000 hours, in nominal ambient with standard power supply.</li> <li>3) Take measurements within 1 hour.</li> </ol>	
7	ESD protection	<ol style="list-style-type: none"> <li>1) The tuner contains components that can be damaged by static discharge.</li> <li>2) Observe these precautions.</li> <li>3) Ground yourself before handling the tuner.</li> <li>4) Do not touch the tuner connector pins without ESD protection</li> </ol>	

# 9. MECHANICAL DRAWING (FOR DTN-356ATW/ATWT1 HORIZONTAL TYPE)



## TOLERANCE

UNIT: MM	F	G	H
< 8	±0.05	±0.10	±0.10
< 8-25	±0.08	±0.15	±0.15
< 25-80	±0.12	±0.20	±0.25
< 80-250	±0.25	±0.30	±0.40
< 250-800	±0.50	±0.60	±0.80

## EMPIRE OVERSEAS GROUP LTD

NAME: DVB-T TUNER	MODEL: ND-DTN-356ATW/ATWT1
PART NO:	SCALE: FIT
COLOR:	FINISH:
MATERIAL:	DATE: 2006 \03\04
SHEET OF	DRAWING NO:
APPROVED:	CHECKED:
	DRAWN: WUZY
	REVISION
	01

10. MECHANICAL DRAWING (FOR DTN-356HEU/HEG HORIZONTAL TYPE)

