Customer:

ALPS ELECTRIC EUROPA GmbH

Attention:

Your ref. No.:

Your Part No.: TDQB3-002A

No.D060027 (1/19)

Date:Apr. 11. 2006

SPECIFICATIONS

ALPS
MODEL : TDQB3-002A

Spec. No. :

Sample No.:

RECEIPT STATUS
RECEIVED
By. Date
Signature
Name
Title

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DSG'D A. Matsushita

APP'D

Sales

ALPS PRODUCT SPECIFICATION

SPECIFICATION

DIGITAL FRONT-END MODULE

MODEL NUMBER: TDQB3-002A

■With DC/DC ■With Loop Through
□Without DC/DC □Without Loop Through

CONFIDENTIAL

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ALPS ELECTRIC CO., LTD. Communication Devices Division

TDQB3-002A	TDQB3-002A
CUST. MODEL NO.	ALPS MODEL NO.

					DSGD. S. Matsuhata	
					CHKD.	TITLE TDQB3—002A PRODUCT SPECIFICATION
					APPD. Apr. 11. '01	Version1.0 (1/ 16)
SYMB.	DATE OR NO.	APPD.	CHKD.	DSGD.	ALPS ELECTRIC CO., LTD.	

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1. TECHNICAL SPECIFICATION

ITEM No.	ITEM	Condition
1-1	**Input**	
	· Input Frequency Range	UHF : 470MHz to 862MHz
	· Channel Bandwidth	8MHz
	· Channel Assignment	CCIR
	· Input Signal Level	-80dBm to -20dBm (typical)
	· Input Impedance	75 ohms nominal
	· Modulation Modes	DVB-T
1-2	**Output**	
	· Output Format	Digital ch. :Balance IF output
	· Output Frequency	Center : 36.166MHz
1-3	**Control format**	IIC Compatible Interface Refer to the Appendix. The reference frequency step of the Tuner section PLL is 166.666kHz. Xtal: 4MHz, Reference divider: 24, IF center frequency: 36.166MHz
1-4	**Power Supply Voltages (ripple : 5mVp-p)**	Pin Number / Operating Supply Voltages 2 / B1(+5V) : +5.0V±0.25V DC 18 / IF AGC(+3.3V) : +0V to +3.3V DC
1-5	**Current Consumption**	
	Operation Mode	Pin Number / Typ. / Max. 2 / B1 (+5V) 180 mA 210 mA 11 / Tuning (+32V) 1 mA 1.5 mA (without DCDC)*NOTE 18 / IF AGC (+3.3V) – 1mA
	Power save mode	2 / B1 (+5V) 70 mA 90 mA 11/Tuning (-32V) 0 mA 0 mA (without DCDC) *NOTE 18 / IF AGC (+3.3V) – 1mA
1-6	**Environmental Specifications**	
1-6-1	Temperature	Operating 0 to +60℃ Storage -10 to +70℃
1-6-2	Humidity	Operating Less than 80 % RH(at40℃) Storage Less than 95 % RH(at40℃)

*NOTE : Models with DCDC do not need TU voltage. Leave it open.

2. Standard Test Conditions

Test for electrical specification shall be performed on ALPS evaluation board,
at following condition unless otherwise specified.

ITEM No.	ITEM	CONDITION
2-1	**Ambient Conditions**	Temperature 25±2 deg C Humidity 65±5% RH
2-2	**Power Supply**	Pin Number — Operating Supply Voltages 2 / B1 (+5V) — +5.0V ±0.1V DC 11/ Tuning (+32V) — +32.0V ± 1V DC (without DCDC)*NOTE 18 / IF AGC (+3.3V) — +0V to +3.3V DC

*NOTE : Models with DCDC do not need TU voltage. Leave it open.

3. Absolute Maximum Voltage

ITEM No.	ITEM	CONDITION
3	**Absolute Maximum Voltage**	Pin Number — Maximum Voltages 1 / B1 (+5V) — +5.5V DC 11/Tuning (+32V) — +34V DC (without DCDC)*NOTE 18/ IF AGC (+3.3V) — +0V to +3.3V DC

*NOTE : Models with DCDC do not need TU voltage. Leave it open.

4. Electrical Specifications

ITEM	SPECIFICATION				CONDITION
	MIN.	TYP.	MAX.	UNIT	
4-1 RF Input Specification					
4-1-1 ANT Input Return Loss		8		dB	47 to 862MHz
4-1-2 L/T Output Return Loss		12		dB	47 to 862MHz
4-1-3 L/T Gain	-2	2	4	dB	47 to 862MHz Power Supply ON (Pin2)
4-1-4 L/T Noise Figure		6		dB	47 to 862MHz Power Supply ON (Pin2)
4-1-5 Spurious Signal at ANT Input			46 54	dBuV dBuV	Other terminal should be Termination (75ohms) 30 - 950MHz 950 - 1750MHz
4-1-6 L/T 3rd Order Inter modulation	55	70		dB	2f1-f2 f1 : 50-850MHz f2 : f1+10MHz

4. Electrical Specifications

ITEM	SPECIFICATION				CONDITION
	MIN.	TYP.	MAX.	UNIT	
4-2 Tuner Specification					
4-2-1 Noise Figure		6		dB	Full Gain 470MHz to 862MHz
4-2-2 Image rejection		60 55		dB	Full Gain 470MHz to 790MHz 791MHz to 862MHz
4-2-3 AGC1 control range		60		dB	
4-2-4 AGC1 start point		-50		dBm	AGC1 start point is –47dBm RF input level(RF=858MHz). AGST = (100)
4-2-5 1st Local Oscillation(LO)	-50 -50		50 50	ppm ppm	@Initial frequency accuracy (standard temperature:25℃) @Temperature drift(-10℃ to +60℃ :This value is against the initial value)
4-2-6 1st LO phase noise		-70 -85		dBc/Hz dBc/Hz	1KHz offset 10KHz offset
4-2-7 1st reference side band		-60		dBc	
4-2-8 1st LO Lock-up time			50	ms	Lock to f0±30KHz
4-2-9 X-tal output level		1.0		Vp-p	

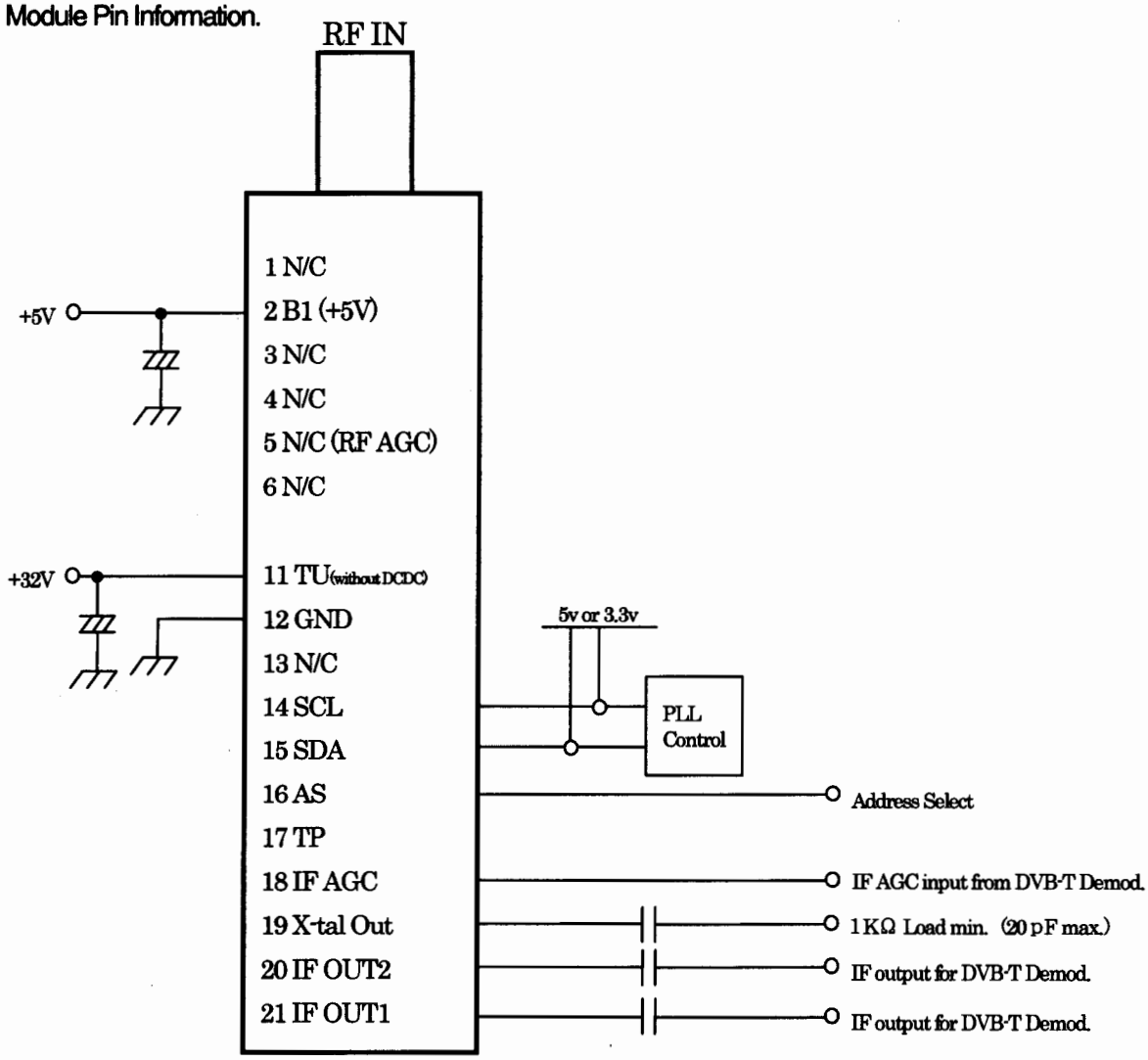
4. Electrical Specifications

ITEM	SPECIFICATION				CONDITION
	MIN.	TYP.	MAX.	UNIT	
4-3 **IF AMP Specification**					
4-3-1 IF AGC control range		60		dB	
4-3-2 IF Output level		0		dBm	Unbalance 1kΩ load. The condition is as follows RF Input level : -90dBm IF AGC Voltage : 3.3V Input RF frequency : 858MHz

NOTE : Case of unbalance output : other terminal should be termination(2KΩ).

5. Mechanical Information

5-1. Module Pin Information.



1	No connection (Leave this terminal open)	13	No connection (Leave this terminal open)
2	+5.00V +/- 0.25V for LNA and Tuner	14	I2C clock
3	No connection (Leave this terminal open)	15	I2C data
4	No connection (Leave this terminal open)	16	I2C address select terminal
5	0 to 4V for RF AGC (Leave this terminal open)	17	Test Pin (Leave this terminal open)
6	No connection (Leave this terminal open)	18	0V to 3.3V for IF AGC
		19	NC or X-tal Output
11	+32V for tuning (without DCDC)*NOTE	20	Digital IF signal output 2
12	GND	21	Digital IF signal output 1

*NOTE : Models with DCDC do not need TU voltage. Leave it open.

ITEM No	ITEM	Specification
5-2	Appearance Structure	Dimensions as mechanical drawing
5-3	RF Input Connector Form	IEC Female Connector
5-4	Weight	31g Typ.

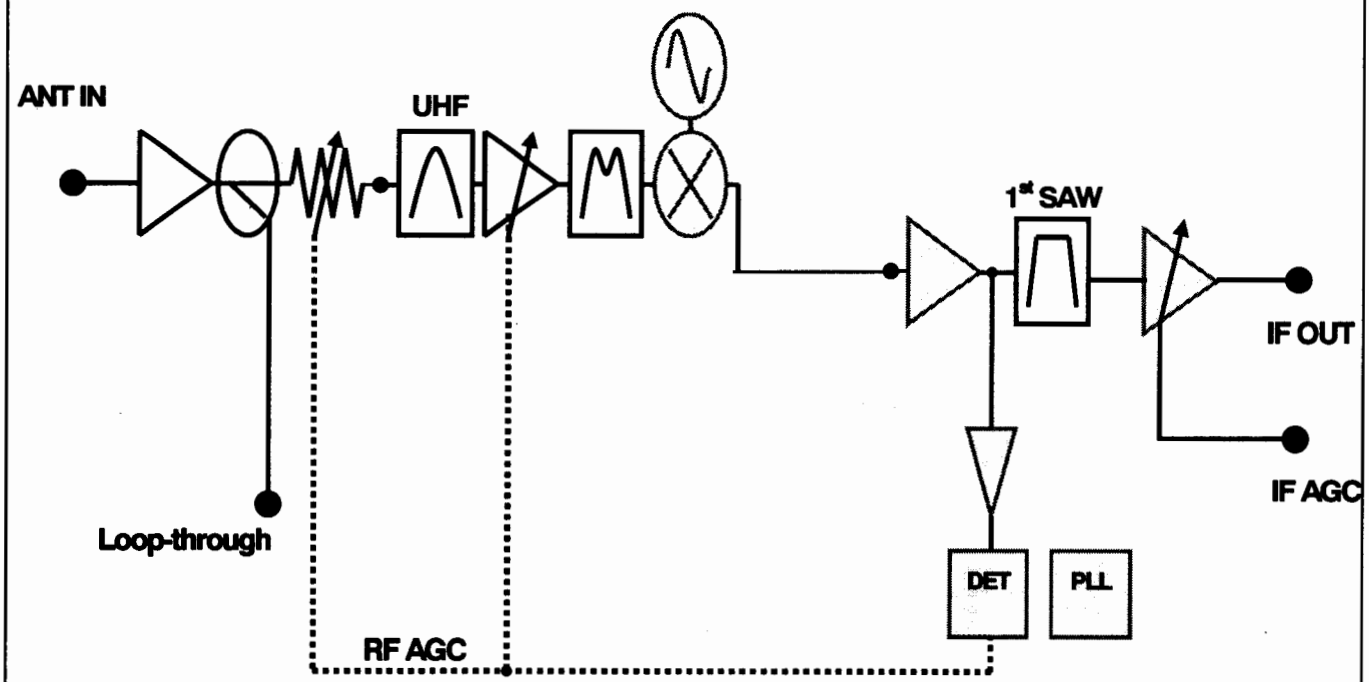
6. ENVIRONMENTAL TESTS

ITEM	CONDITION
6-1 TESTING CONDITIONS	
6-1-1 Heat load test	Measure initial value at standard testing conditions. Leave samples in 70±2 °C for 96±5 hours, and in standard testing conditions for 2 hours, then take measurements within 1 hour. Supply voltage cycle : 1.5 h ON / 0.5 h OFF
6-1-2 Humidity load test	Leave samples in 40±5 °C for 24±2 hours, and in standard testing conditions for 2 hours, then take measurements. Leave samples in 40±2 °C, 90 ~ 95 % RH, for 96±5 hours, and in standard testing conditions for 2 hours, then take measurements within 1 hour. Supply voltage cycle : 1.5 h ON / 0.5 h OFF
6-1-3 High Temperature Operating Life Test	To be test after loading samples for 96±8 hours at 50±2°C and with 1 hour In room temperature / no load. Supply voltage : Standard
6-1-4 Cold test	Measure initial value at standard testing conditions. Leave samples in -20±2 °C for 96±5 hours, and in standard testing conditions for 2 hours, then take measurements within 1 hour.
6-1-5 High Voltage Test ESD	ANT Input 1000pF,150Ω, ±15kV,10times Terminal 200pF, 0Ω, ±200V, 5times
6-1-6 Vibration Test	Vibration test fixture is used to vibrate the tuner with a total amplitude of 1mm and frequency ranging from 10 to 55Hz, once per minutes consecutively, for 40 minutes in each of three directions, X, Y and Z.
6-1-7 Impact Test	Impact acceleration : 50 m/s² Impact time : 11ms Impact time & direction : 3 times per each 6 sides
6-1-8 Packing Box Fall Test	Fall height : 40 cm Process : Drop directly to concrete flower. Concrete floor must be 20cm or thicker. Turn of the fall : 1 corner and 2 ridge, 5 face(except the top face) / each 1 time (total 8 times)
6-2 SPECIFICATION	Conversion Gain: ±3 dB Noise Figure: ±3 dB Output Level : ±4dB * Except for Vibration test, Impact test, Packing Box Fall test, High Voltage test, ESD.

7. MECHANICAL SPECIFICATION

ITEM No.	ITEM	Condition
7-1	**Outline view** Assembly Appearance	 No defects of wiring, soldering and assembling. No dirt, corrosion or foreign material.
7-2	**Appearance Structure** Dimension Mounting Weight	 As assembly drawing. As assembly drawing. Approximately 31±5 [g]
7-3	**ANT connector strength** **(Type F connector)**	No function fault, no remove or no crack or on falling of Type F connector and no crack of PWB, when add force of 0.98 [Nm] to the connector point.
7-4	**Heatproof** **(Pb Free Solder)**	The tuner shall be tested resistance to soldering heat in following conditions. 1. Shall be satisfied with Electrical and mechanical specifications 2. Good appearance after testing. (1) Flow soldering: Temp. [℃] 260±5, Time [sec] 10+1/-0 (2) Iron soldering: Temp. [℃] 400±5, Time [sec] 3+1/-0 ・ After the tuner is heated, it leaves at the normal temperature for 1 hour. The board thickness for test is 1.6m,m.
7-5	**Solder ability** **(Pb-free Solder)**	Solder-ability is measured by Meniscus solder test in following conditions after heat treatment and PCT. 1. Solder-ability must be in 5[sec]. 2. Solder area must be 95% or more of dip area. Test conditions (1) Solder temperature : 240±5 [℃] (2) PCT conditions : 105 [℃], 100%RH, 1.22×10^5 [Pa] , 4 hour. (3) Solder : Sn/3.0Ag/0.5Cu (Weight %) M705 made of SMIC. Flux : ROSIN 25%/IPA 75% EC-19S-8 made of TAMURA

8. Block Diagram



Appendix

Program Tuner PLL

1. Write mode

	MSB						LSB				Hex
ADDRESS	1	1	0	0	0	MA1	MA0	0	A	Byte1	C2
EX)	1	1	0	0	0	0	1	0			
PROGRAMMABLE DIVIDER	0	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	A	Byte2	0B
EX)	0	0	0	0	1	0	1	1			
PROGRAMMABLE DIVIDER	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	A	Byte3	F5
EX)	1	1	1	1	0	1	0	1			
CONTROL DATA	1	0	AGST2	AGST1	AGST0	R2	R1	R0	A	Byte4	A0
EX)	1	0	1	0	0	0	0	0			
CONTROL DATA	CP1	CP0	TS3	TS2	BS4	BS3	BS2	BS1	A	Byte5	EC
EX)	1	1	1	0	1	1	0	0			
CONTROL DATA	1	1	IFBW2	IFBW1	CP2	XLO1/TS1	XLO0/TS0	POW	A	Byte6	C6
EX)	1	1	0	0	0	1	1	0			

EX)

Programmable data = (Desired channel center frequency) + 36.166M / (4M / 24)

= (474(CH21)+36.166) M / 166.666k

= 3061 (Dec.)

= 000 1011 1111 0101 (15 bits)

= 0BF5 (Hex.)

Charge pump current and port setting

CONTROL DATA	CP1	CP0	CP2		BS4	BS3	BS2	BS1
470MHz – 782MHz	1	1	0		1	1	0	0
782MHz – 862MHz	0	0	0		1	1	0	0

Address selection

MA1	MA0	Address Input voltage level
0	0	(0 to 0.1)*Vcc
0	1	Open circuit or (0.2 to 0.3)*Vcc
1	0	(0.4 to 0.6)*Vcc
1	1	(0.9 to 1.0)*Vcc(+5V)

AGST selection

AGST2	AGST1	AGST0	Start Point of RF input	note
0	0	0	RF AGC Disable	external control
0	0	1	-6dB	
0	1	0	-4dB	
0	1	1	-2dB	
1	0	0	0dB	normal operation
1	0	1	+2dB	
1	1	0	+4dB	
1	1	1	+6dB	

Charge pump selection

CP1	CP0	CP2	Charge pump current
X	X	1	70uA
0	1	0	150uA
1	0	0	300uA
1	1	0	700uA
0	0	0	1.2mA

Reference Counter selection

R2	R1	R0	Reference Counter	Reference Frequency
0	0	0	24	166.666kHz
0	0	1	28	142.857kHz
0	1	0	50	80.0kHz
0	1	1	64	62.5kHz
1	0	0	128	31.25kHz

IFBW1, IF BW2 switch (Not available for this model. Set to 0)

IFBWn=1 : ON , IFBWn=0 : OFF

X-tal Output

TS3	TS2	XLO1/TS1	XLO0/TS0	XTAL Output
1	0	1	1	OFF
0	0	0	0	4MHz Output

Power on/off switch

POW=1 : power save mode , POW=0 : operation mode

2. Read mode

	MSB							LSB			Hex.
ADDRESS	1	1	0	0	0	0	1	1	A	Byte1	C3
Status byte	POR	FL	1	1	1	A2	A1	A0	A		

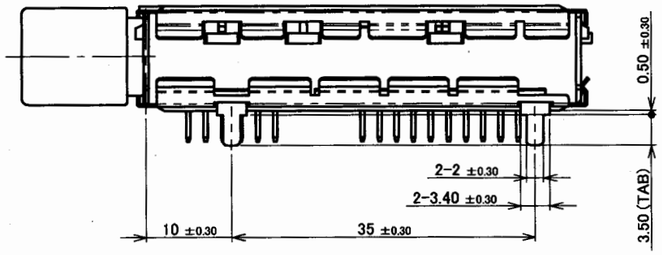
Description of data symbol

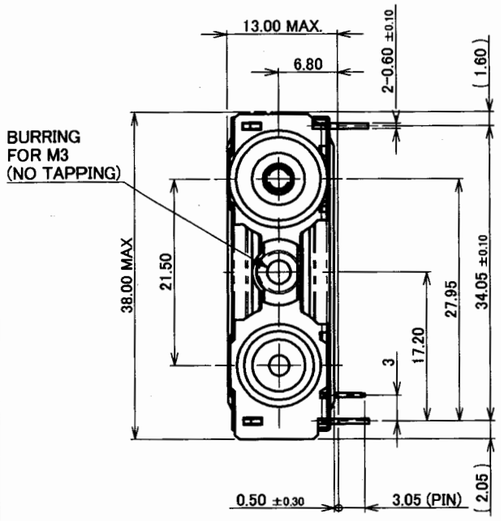
SYMBOL	DESCRIPTION	DEFAULT
POR	power-on reset flag POR set : Power-on POR reset : End-of-data at transmission procedure	POR=1
FL	In-lock flag PLL lock(FL=1) Unlock(FL=0)	
A2...A0	ADC data(See ADC convert level)	

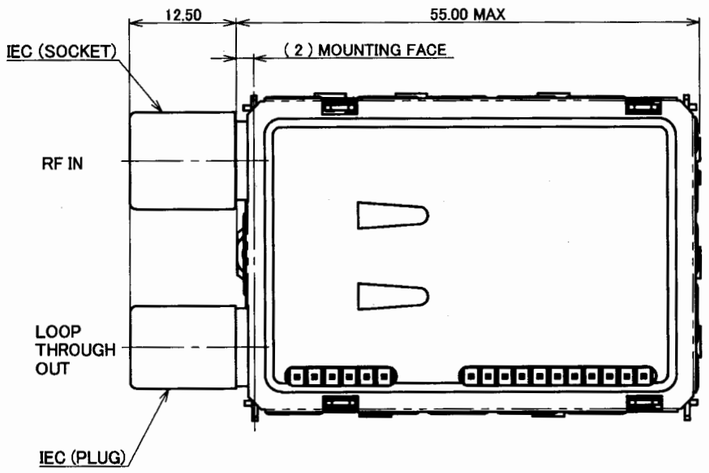
ADC convert level

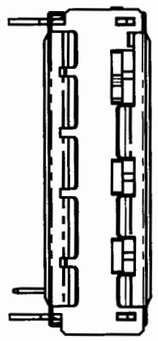
Voltage applied on ADC input	A2	A1	A0
0.6Vcc to Vcc	1	0	0
0.45Vcc to 0.6Vcc	0	1	1
0.3Vcc to 0.45Vcc	0	1	0
0.15Vcc to 0.3Vcc	0	0	1
0 to 0.15Vcc	0	0	0

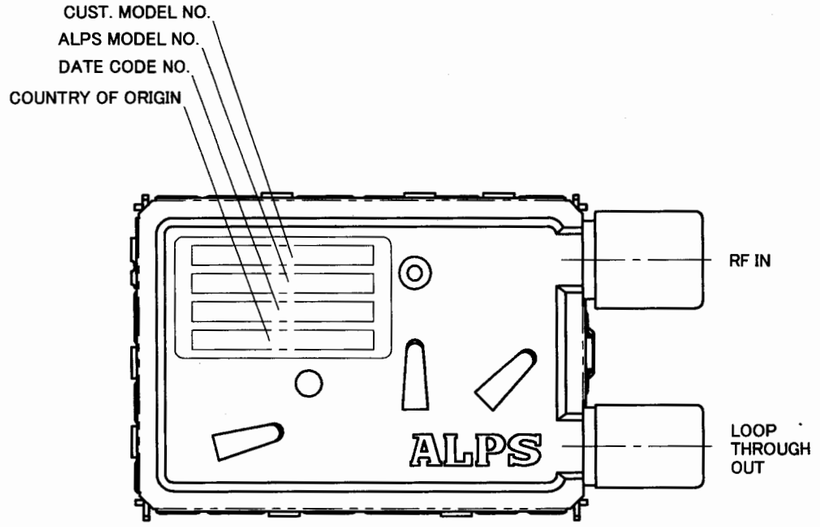
*Vcc=B1(+5V)

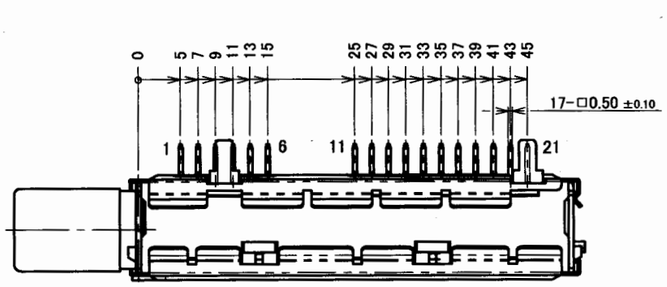




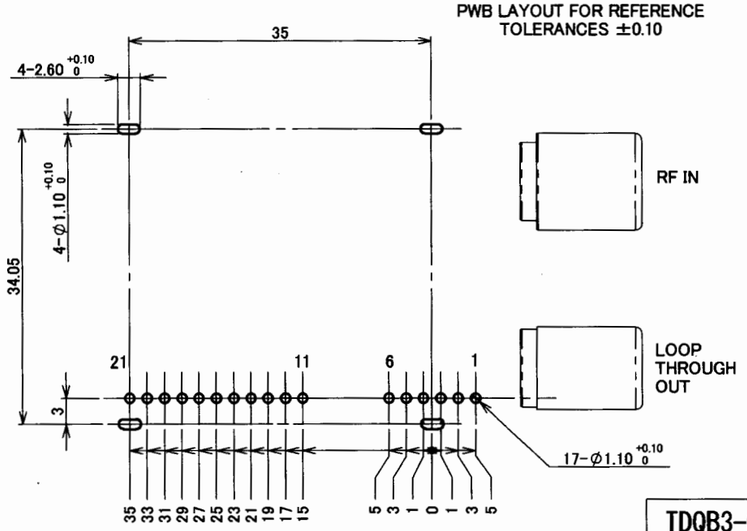








PWB LAYOUT FOR REFERENCE
TOLERANCES ±0.10



NOTES

1. TOLERANCES ARE ±0.5mm, UNLESS OTHERWISE SPECIFIED.
2. DIMENSION OF TERMINALS IS SPECIFIED AT THE ROOT.
3. ALPS CAN ALTER FRAME AND COVER DESIGN WITHOUT NOTICE IF NO ELECTRICAL DEGRADATION.
4. THE PRINTING ID IS ON LABEL.
5. DATE CODE NO. IS CONFORMED TO ALPS STANDARD SPECIFICATION.
6. MATERIALS
   FRAME : TINPLATE
   PIN : BRASS (Ni PLATING 1 μ MIN. Sn PLATING 2 μ MIN.)

TDQB3-002A	TDQB3-002A
CUST. MODEL NO.	ALPS MODEL NO.

PART NO.	NAME	MATERIAL	SPEC.	FINISH

ALPS ELECTRIC CO., LTD.

ZONE	SYMB.	DATE OR NO.	APPD.	CHKD.	DSGD.

DSGD. Apr. 11. '06 T. Saito
CHKD.
APPD. Apr. 11. '06 S. Motegi

SCALE 2:1
UNIT mm
KEY No.

TITLE TDQ ASSEMBLY DRAWING

RECORD OF REVISION

TDQB3-002A

DATE	PRESENT CONTENTS	NEW CONTENTS / REASON	DSGN BY
Apr. 11 '06 (D060027)	NEW		S.MATSUSHITA

CZECH	ALPS ELECTRIC CZECH,S.R.O.
KOREA	ALPS ELECTRIC KOREA CO.,LTD.
MALAYSIA	ALPS ELECTRIC (MALAYSIA) SDN.BHD
SHANGHAI	SHANGHAI ALPS ELECTRONICS CO.,LTD.
JAPAN	ALPS ELECTRIC CO.,LTD.

MANUFACTURER