High-performance Video Signal Switchers

Video･Audio Signal Switchers for Car Navigation Car DVD Player

BH7649KS2

No.11066EAT05

●Description

BH7649KS2 is built-in video switch, audio switch and isolation amplifier in a single chip.

●Features

1) Video inputs selector: 7-inputs composite, Video outputs: 2-outputs 75Ω video driver, 2-outputs AMP
2) Built in Video gain switch (-6dB / -3dB / 0dB / 3dB)
3) Built in Video LPF switch (6.75MHz / Through)
4) Built in sag compensation circuit
5) Enables two load drivers
6) Video driver: Able to be used without load
7) Video driver : Able to be used without output coupling capacitor(one load)
8) Audio inputs selector: 5-inputs(Lch, Rch), Audio outputs : 2-outputs(Lch, Rch)
9) Built in Audio gain switch (0dB / -6dB)
10) Built in Audio LPF switch (24kHz / Through)
11) Built in MUTE function
12) Audio/Video all inputs: Built in isolator function
13) Selectable isolator function for different Audio/Video input channels
14) Serial control with I^2C-BUS (I^2C-BUS is compatible with fast mode of Version2.0)
15) Optional Slave address modifications (90H / 92H)

●Applications

Car navigation, Car DVD

●Absolute maximum ratings (Ta=+25℃)

Parameter	Symbol	Ratings	Unit
Supply voltage VVcc	VVccmax	10	V
Supply voltage AVcc	AVccmax	10	V
Power dissipation	Pd	1900 *1	mW
Input voltage range I^2C-BUS input (SCL, SDA)	V_{I2CIN}	-0.2 ～ 7.0	V
Input voltage range Video selector, LOGIC (VIN1, VRET1, VIN2, VRET2, VIN3, VRET3, VIN4, VRET4, VIN5, VRET5, VIN6, VRET6, VIN7, VRET7, ADR)	V_{IN1}	-0.2 ～ 5.1	V
Input voltage range Video driver (VDIN1, VDIN2)	V_{DIN1}	-0.2 ～ VVcc+0.2	V
Input voltage range Audio seletor (LIN1, ARET1, RIN1, LIN2, ARET2, RIN2, LIN3, ARET3, RIN3, LIN4, ARET4, RIN4, LIN5, ARET5, RIN5)	V_{AIN1}	-0.2 ～ AVcc+0.2	V
Storage temperature range	Tstg	-55～+125	℃

*1 When mounting on a 70mm×70mm×1.6mm 4-layer glass epoxy board
Reduced by 19mW/℃ at Ta = +25℃ or higher

●Operating conditions

Parameter	Symbol	Ratings	Unit
Supply voltage VVcc	VVcc	+7.5 ～ +9.5	V
Supply voltage AVcc	AVcc	+7.5 ～ +9.5	V
Operating temperature range	Topr	-40 ～ +85	℃

* This product is not designed for protection against radioactive rays.

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●**Electric characteristic** (Unless otherwise specified, Ta=+25℃, VVcc=8.5V, AVcc=8.5V)

Parameter			Symbol	Limits			Unit	Conditions
				Min.	Typ.	Max.		
CHIP	Circuit current1		ICC1	-	34	48	mA	No signal(VIDEO)
	Circuit current2		ICC2	-	23	32	mA	No signal(AUDIO)
VIDEO	Voltage gain	-6dB	$GVM6_V$	-6.4	-6.0	-5.6	dB	Vin=1.0Vpp, f=100kHz
		-3dB	$GVM3_V$	-3.4	-3.0	-2.6	dB	Vin=1.0Vpp, f=100kHz
		0dB	$GV0_V$	-0.4	0.0	0.4	dB	Vin=1.0Vpp, f=100kHz
		3dB	$GV3_V$	2.6	3.0	3.4	dB	Vin=1.0Vpp, f=100kHz
		6dB	$GV6_V$	5.6	6.0	6.4	dB	Vin=1.0Vpp, f=100kHz
	Frequency characteristics1 [f=6.75MHz LPF MODE]		$GF11_V$	-1.5	0.0	1.0	dB	Vin=1.0Vpp, f=6.75MHz/100kHz
			$GF12_V$	-	-30	-20	dB	Vin=1.0Vpp, f=27MHz/100kHz
	Frequency characteristics 2_1 [THROUGH MODE_-6dB]		$GF2_V$	-0.6	0.9	1.9	dB	Vin=1.0Vpp, f=10MHz/100kHz Gain=-6dB
	Frequency characteristics 2_2 [THROUGH MODE_-3dB]		$GF2_V$	-0.7	0.8	1.8	dB	Vin=1.0Vpp, f=10MHz/100kHz Gain=-3dB
	Frequency characteristics 2_3 [THROUGH MODE_0dB]		$GF2_V$	-0.7	0.8	1.8	dB	Vin=1.0Vpp, f=10MHz/100kHz Gain=0dB
	Frequency characteristics 2_4 [THROUGH MODE_3dB]		$GF2_V$	-1.0	0.5	1.5	dB	Vin=1.0Vpp, f=10MHz/100kHz Gain=3dB
	Frequency characteristics 3 [VDOUT1, VDOUT2]		$GF3_V$	-3.0	-0.5	1.0	dB	Vin=1.0Vpp, f=15MHz
	Maximum output level		VOM_V	2.6	-	-	Vp-p	f=10kHz, THD=1.0%
	Cross talk		CT_V	-	-60	-50	dB	Vin=1.0Vpp, f=4.43MHz
	MUTE attenuation		MT_V	-	-60	-50	dB	Vin=1.0Vpp, f=4.43MHz
	Common mode rejection ratio		CMRR	-	-60	-40	dB	Vin=1Vpp, f=20kHz
AUDIO	Voltage gain	0dB	$GV0_A$	-0.4	0.0	0.4	dB	Vin=1Vrms, f=1kHz
		-6dB	$GV6_A$	-6.4	-6.0	-5.6	dB	Vin=1Vrms, f=1kHz
	Frequency characteristics 1 [f=24kHz LPF MODE]		$GF11_A$	-2.0	-0.5	1.0	dB	Vin=1Vrms, f=24kHz/1kHz
			$GF12_A$	-	-26	-15	dB	Vin=1Vrms, f=96kHz/1kHz
	Frequency characteristics 2 [THROUGH MODE]		$GF2_A$	-1.0	0.0	1.0	dB	Vin=1Vrms, f=50kHz/1kHz
	Total harmonic distortion		THD+N	-	0.002	0.1	%	Vin=1Vrms, f=1kHz ※1
	Maximum output level		VOM_A	2.0	2.4	-	Vrms	f=1kHz, THD<0.3% ※1
	Cross talk		CT_A	-	-100	-85	dB	Vin=2Vrms, f=1kHz ※1
	MUTE attenuation		MT_A	-	-100	-85	dB	Vin=2Vrms, f=1kHz ※1
	Residual noise1 [THROUGH MODE]		N_A	-	10	-	uVrms	(THROUGH MODE select) ※2
	Residual noise2 [f=24kHz LPF MODE]		N_{A_LPF}	-	20	-	uVrms	LOUT1, ROUT1(LPF select) ※2
	Common mode rejection ratio		CMRR	-	-70	-40	dB	Vin=1Vrms, f=1kHz
	PSRR		$PSRR_A$	-	-50	-	dB	※3
I^2C	[SCL,SDA]							
	VIL ※4		Vin1L	0	-	1.0	V	Low Level input voltage
	VIH ※4		Vin1H	2.0	-	5.5	V	High Level input voltage
	Input bias current		IINI2C	-10	0	10	uA	
	SDA output voltage		VoL	0	-	0.4	V	at 3.0mA sink current
	[ADR]							
	VIL		Vin2L	0	-	1.0	V	Low Level input voltage
	VIH		Vin2H	2.0	-	5.1	V	High Level input voltage ※5
	Input impedance		ZIN_{ADR}	70	100	130	kΩ	Pull-Down Resister

※1 400HzHPF + 30kHzLPF ON
※2 IHF-A Filter ON
※3 Vin=0.3Vpp, f=100Hz at VCC, 30kHzLPF ON
※4 <I^2C-BUS(SCL,SDA) SPEC> VIL:-0.5[V]～0.3V_{DD}[V], VIH:0.7 V_{DD}[V]～V_{DD}+0.5 or 5.5[V] (V_{DD}:I2C-BUS Supply voltage)
<BH7649KS2> Be sure to use as VIL:0.0[V]～1.0[V], VIH:2.0[V]～5.5[V]
※5 We recommend that it is connect ADR Pin to 38Pin(VREG Pin) when ADR Pin is used as “H”.

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●Block Diagram (Audio block)

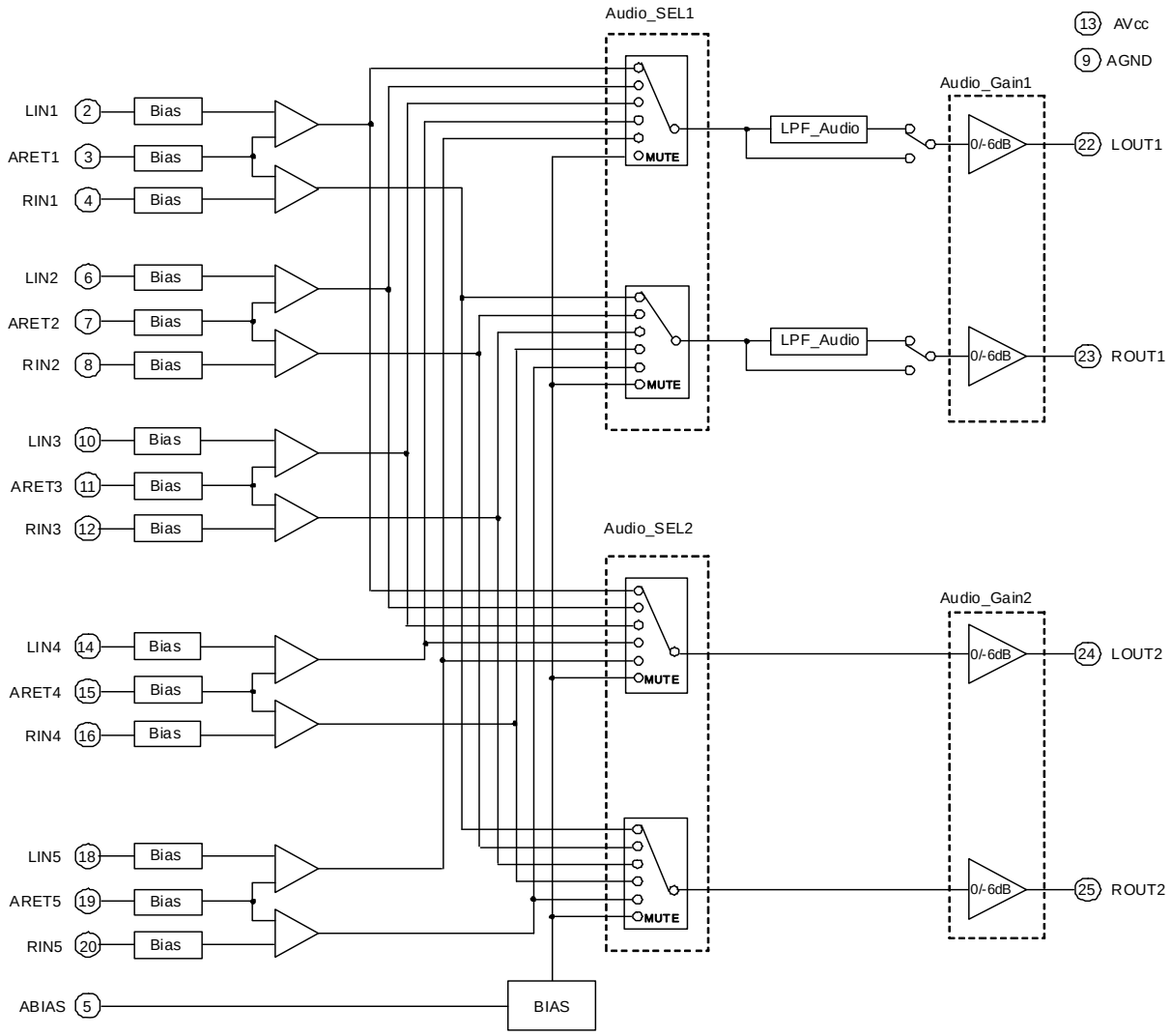


Fig.1 Block Diagram

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●Block Diagram (Video block)

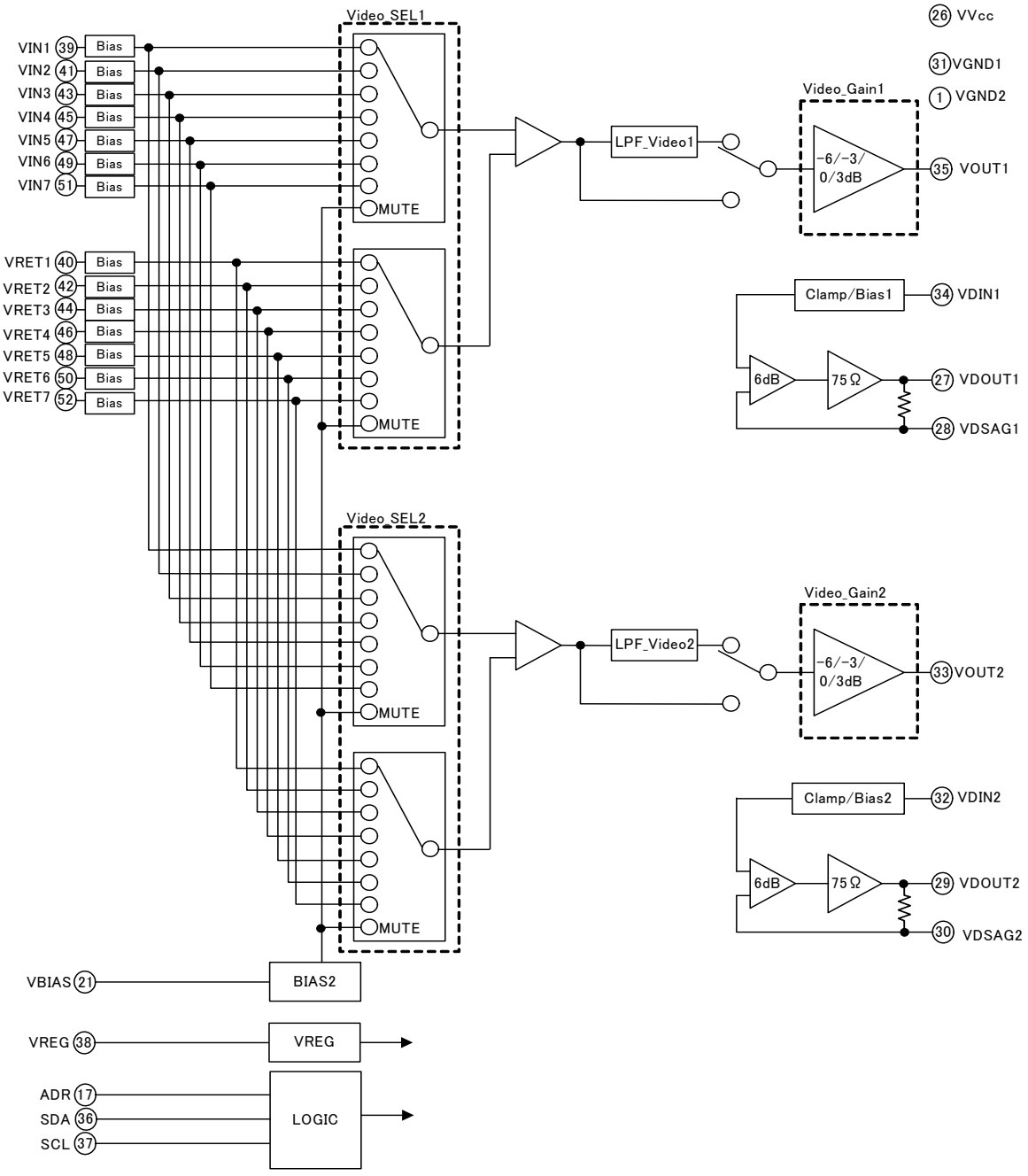
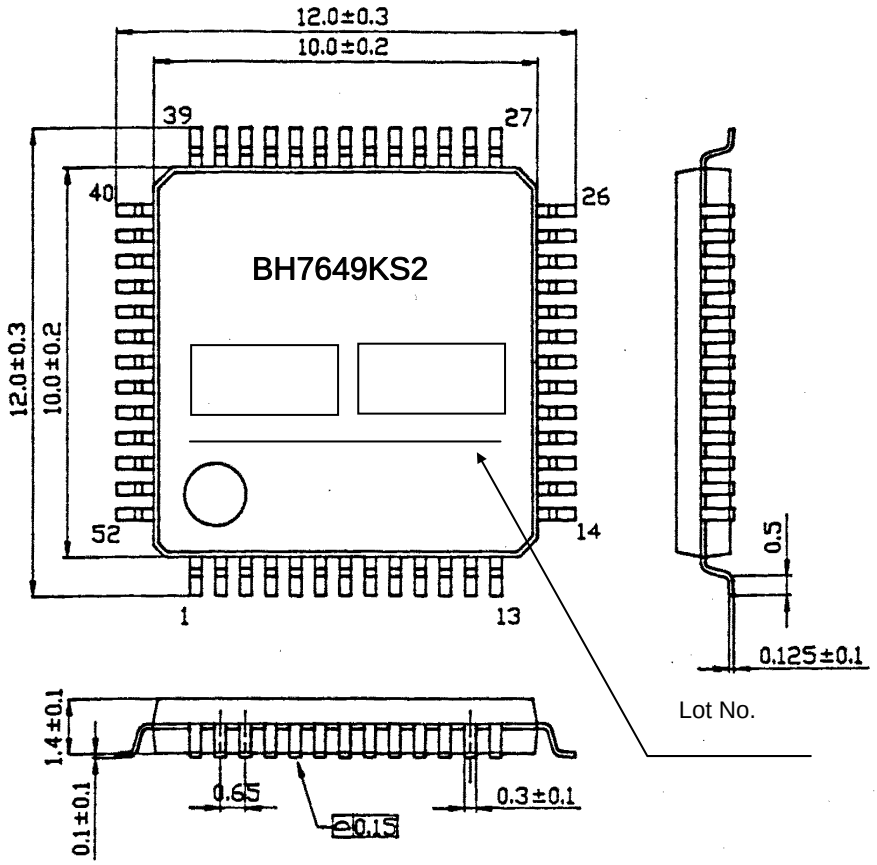


Fig.2 Block Diagram

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●Package outlines



SQFP-T52(UNIT：mm)

Fig.3 Package outlines

●Pin assignment table

No.	I/O	Pin Name	No.	I/O	Pin Name	No.	I/O	Pin Name	No.	I/O	Pin Name
1	-	VGND2	14	I	LIN4	27	O	VDOUT1	40	I	VRET1
2	I	LIN1	15	I	ARET4	28	O	VDSAG1	41	I	VIN2
3	I	ARET1	16	I	RIN4	29	O	VDOUT2	42	I	VRET2
4	I	RIN1	17	I	ADR	30	O	VDSAG2	43	I	VIN3
5	-	ABIAS	18	I	LIN5	31	-	VGND1	44	I	VRET3
6	I	LIN2	19	I	ARET5	32	I	VDIN2	45	I	VIN4
7	I	ARET2	20	I	RIN5	33	O	VOUT2	46	I	VRET4
8	I	RIN2	21	-	VBIAS	34	I	VDIN1	47	I	VIN5
9	-	AGND	22	O	LOUT1	35	O	VOUT1	48	I	VRET5
10	I	LIN3	23	O	ROUT1	36	I/O	SDA	49	I	VIN6
11	I	ARET3	24	O	LOUT2	37	I	SCL	50	I	VRET6
12	I	RIN3	25	O	ROUT2	38	O	VREG	51	I	VIN7
13	-	AVcc	26	-	VVcc	39	I	VIN1	52	I	VRET7

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●I²C−BUS Control specification I²C-BUS Format (WRITE MODE)

S	SLAVE ADDRESS	A	DATA1	A	DATA2	A	DATA3	A	DATA4	A	DATA5	A	DATA6	A	P

S : Start Condition
A : Acknowledge
P : Stop Condition

	b7	b6	b5	b4	b3	b2	b1	b0
SLAVE ADDRESS	1	0	0	1	0	0	ADR	0
DATA1	Video_SEL1			Video_SEL2			LPF_Video1	LPF_Video2
DATA2	Video_Gain1		Video_Gain2		Clamp/Bias1	Clamp/Bias2	Video_power-off1	Video_power-off2
DATA3	Audio_SEL1			Audio_SEL2			0	LPF_Audio
DATA4	0	0	Audio_Gain1	Audio_Gain2	0	0	0	0
DATA5	Isolation_V1	Isolation_V2	Isolation_V3	Isolation_V4	Isolation_V5	Isolation_V6	Isolation_V7	0
DATA6	Isolation_A1	Isolation_A2	Isolation_A3	Isolation_A4	Isolation_A5	0	0	0

When power is turned on, all parts start from LOW condition.
[Prohibited matter] The terminal inputs of ADR do not change from start to stop condition. Operation error might happen.

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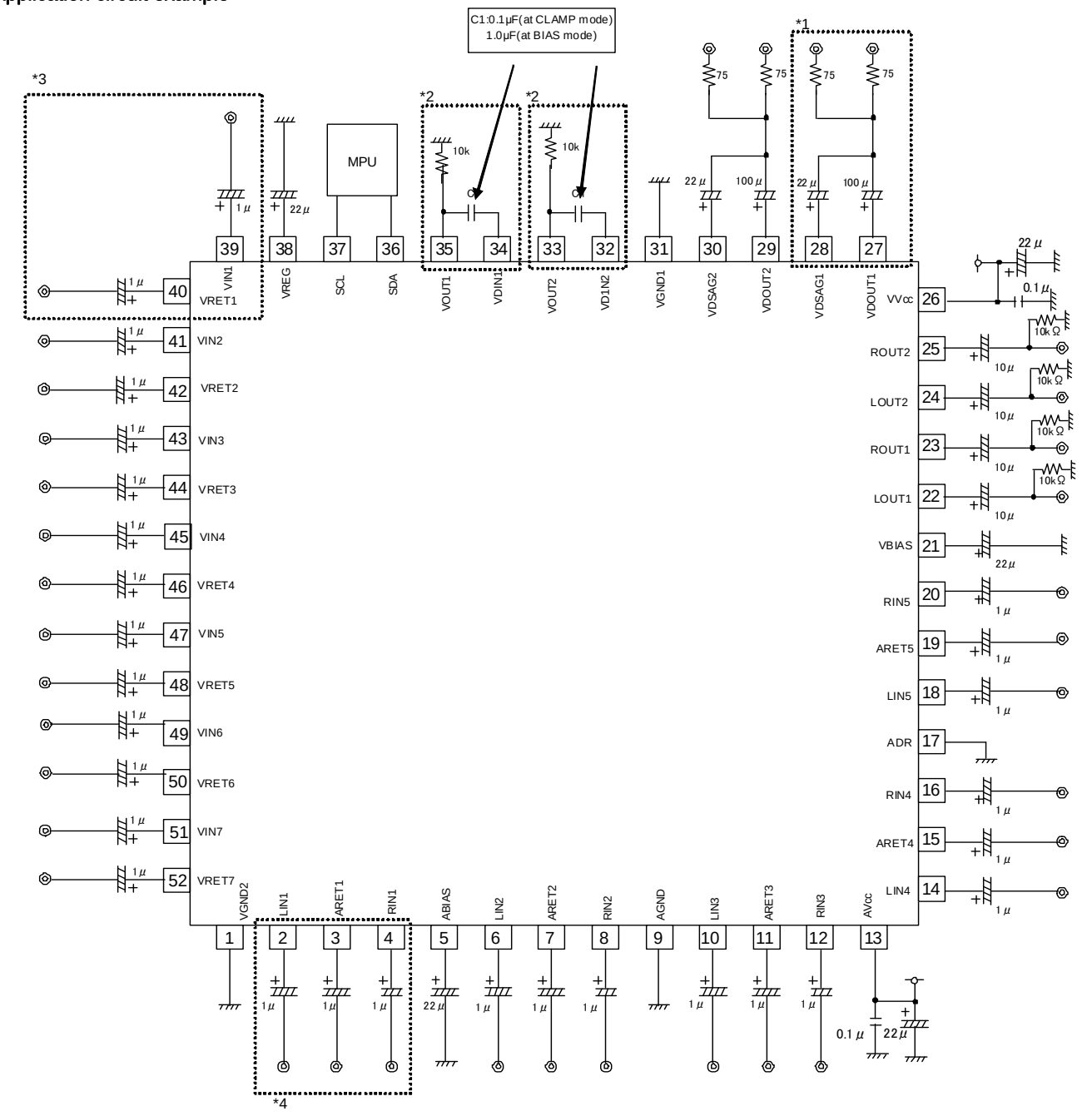
●Selecting input switch / Setting mode

Data name	Status	Data name	Status	Data name	Status
ADR	Sets the slave address by ADR pin	Clamp/Bias1	Input mode selectors (Clamp/Bias1 : VDIN1)	Isolation_V1	Isolator function selectors (VIN1)
	0 : 90H ADR pin = “ L ”		0 : Clamp input mode (VDOUT1:direct drive)		0 : On
	1 : 92H ADR pin =” H ”		1 : Bias input mode (VDOUT1:output coupling “C”)		1 : Off
Video_SEL1	Signal input selectors (Video_SEL1)	Clamp/Bias2	Input mode selectors (Clamp/Bias2 : VDIN2)	Isolation_V2	Isolator function selectors (VIN2)
	000 : VIN1		0 : Clamp input mode (VDOUT2 direct drive)		0 : On
	001 : VIN2		1 : Bias input mode (VDOUT2:output coupling “C”)		1 : Off
	010 : VIN3	Video_power-off1	Power-off function selectors (VDIN1 - VDOUT1)	Isolation_V3	Isolator function selectors (VIN3)
	011 : VIN4		0 : On		0 : On
	100 : VIN5		1 : Off		1 : Off
	101 : VIN6	Video_power-off2	Power-off function selectors (VDIN2 - VDOUT2)	Isolation_V4	Isolator function selectors (VIN4)
	110 : VIN7		0 : On		0 : On
	111 : MUTE		1 : Off		1 : Off
Video_SEL2	Signal input selectors (Video_SEL2)	Audio_ SEL1	Signal input selectors (Audio_ SEL1)	Isolation_V5	Isolator function selectors (VIN5)
	000 : VIN1		000 : LIN1, RIN1		0 : On
	001 : VIN2		001 : LIN2, RIN2		1 : Off
	010 : VIN3		010 : LIN3, RIN3	Isolation_V6	Isolator function selectors (VIN6)
	011 : VIN4		011 : LIN4, RIN4		0 : On
	100 : VIN5		100 : LIN5, RIN5		1 : Off
	101 : VIN6		101 : MUTE	Isolation_V7	Isolator function selectors (VIN7)
	110 : VIN7		110 : MUTE		0 : On
	111 : MUTE		111 : MUTE		1 : Off
LPF_Video1	LPF function selectors of VOUT1	Audio_ SEL2	Signal input selectors (Audio_ SEL2)	Isolation_A1	Isolator function selectors (LIN1, RIN1)
	0 : 6.75MHz		000 : LIN1, RIN1		0 : On
	1 : Through		001 : LIN2, RIN2		1 : Off
LPF_Video2	LPF function selectors of VOUT2		010 : LIN3, RIN3	Isolation_A2	Isolator function selectors (LIN2, RIN2)
	0 : 6.75MHz		011 : LIN4, RIN4		0 : On
	1 : Through		100 : LIN5, RIN5		1 : Off
Video_Gain1	Output gain selectors (Video_Gain1)		101 : MUTE	Isolation_A3	Isolator function selectors (LIN3, RIN3)
	00 : -6dB		110 : MUTE		0 : On
	01 : -3dB		111 : MUTE		1 : Off
	10 : 0dB	LPF_Audio	LPF function selectors of LOUT1 and ROUT1	Isolation_A4	Isolator function selectors (LIN4, RIN4)
	11 : 3dB		0 : Through		0 : On
Video_Gain2	Output gain selectors (Video_Gain2)		1 : 24kHz		1 : Off
	00 : -6dB	Audio_ Gain1	Output gain selectors (Audio_Gain1)	Isolation_A5	Isolator function selectors (LIN5, RIN5)
	01 : -3dB		0 : 0dB		0 : On
	10 : 0dB		1 : -6dB		1 : Off
	11 : 3dB	Audio_ Gain2	Output gain selectors (Audio_Gain2)		
			0 : 0dB		
			1 : -6dB		

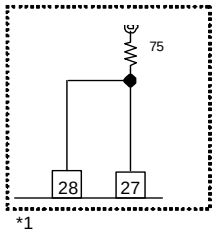
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●Application circuit example

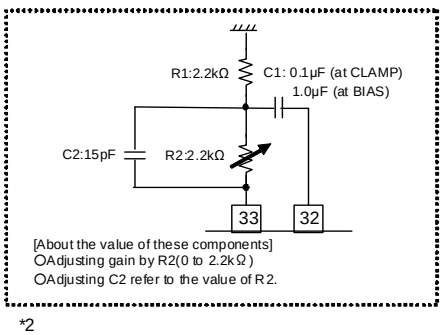


*1. 75 ohm Driver connection
At CLAMP mode: Connect directly
At BIAS mode: Connect via coupling capacitor
(Not only 27-28 pin, but also 29-30 pin)



*1

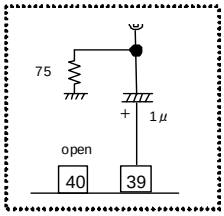
*2. When adjusting gain by external resistors.
(Not only 32-33 pin, but also 34-35pin)



[About the value of these components]
○Adjusting gain by R2(0 to 2.2kΩ)
○Adjusting C2 refer to the value of R2.

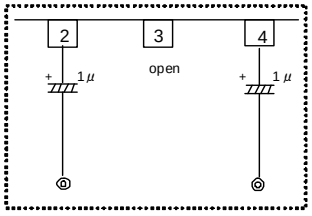
*2

*3. When video isolator is off
(Not only 39-40 pin, but also 41-52 pin)



*3

*4. When audio isolator is off
(Not only 6-8 pin, but also 10-12, 14-16, 18-20 pin)



*4

Fig.4

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●Evaluation board circuit diagram

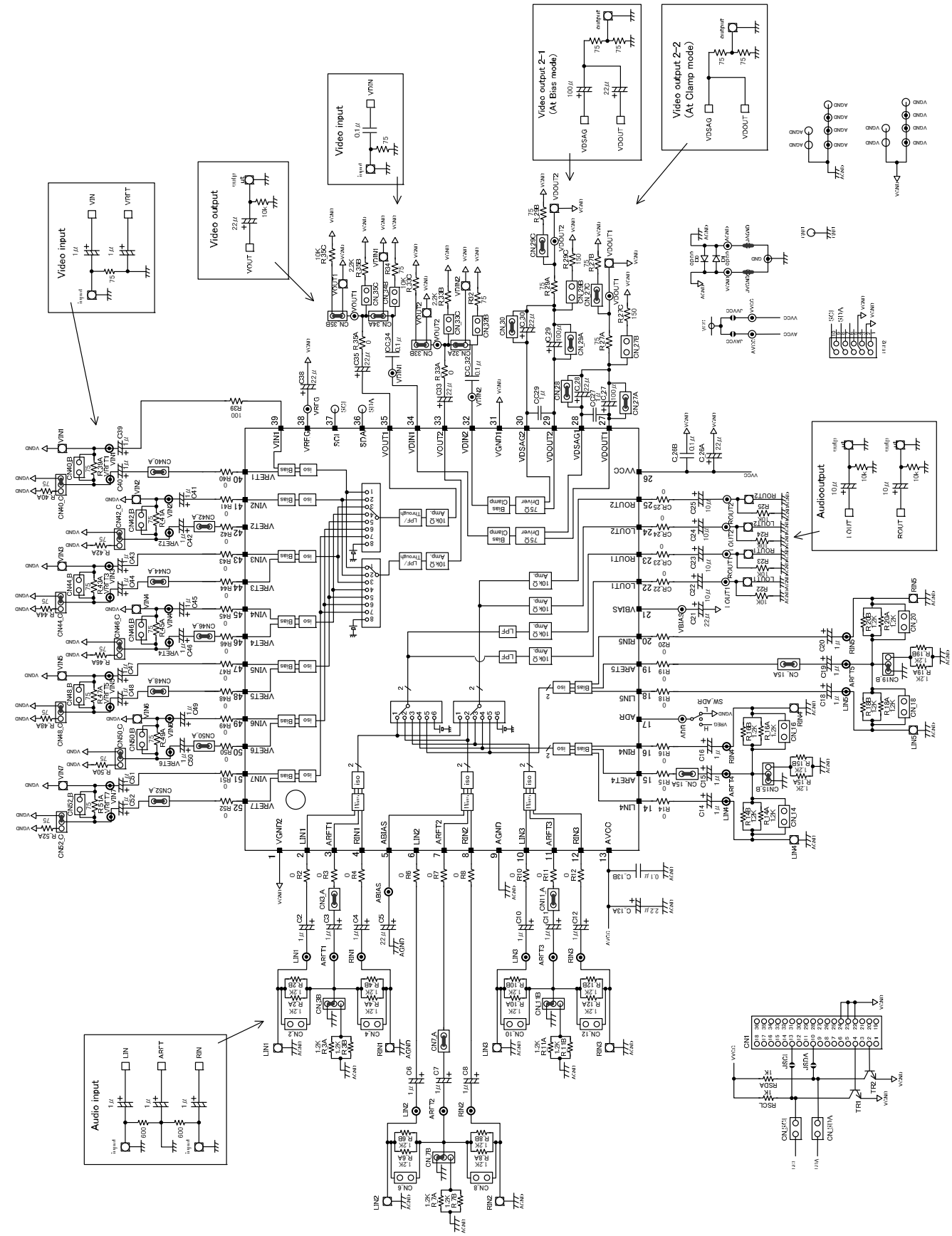
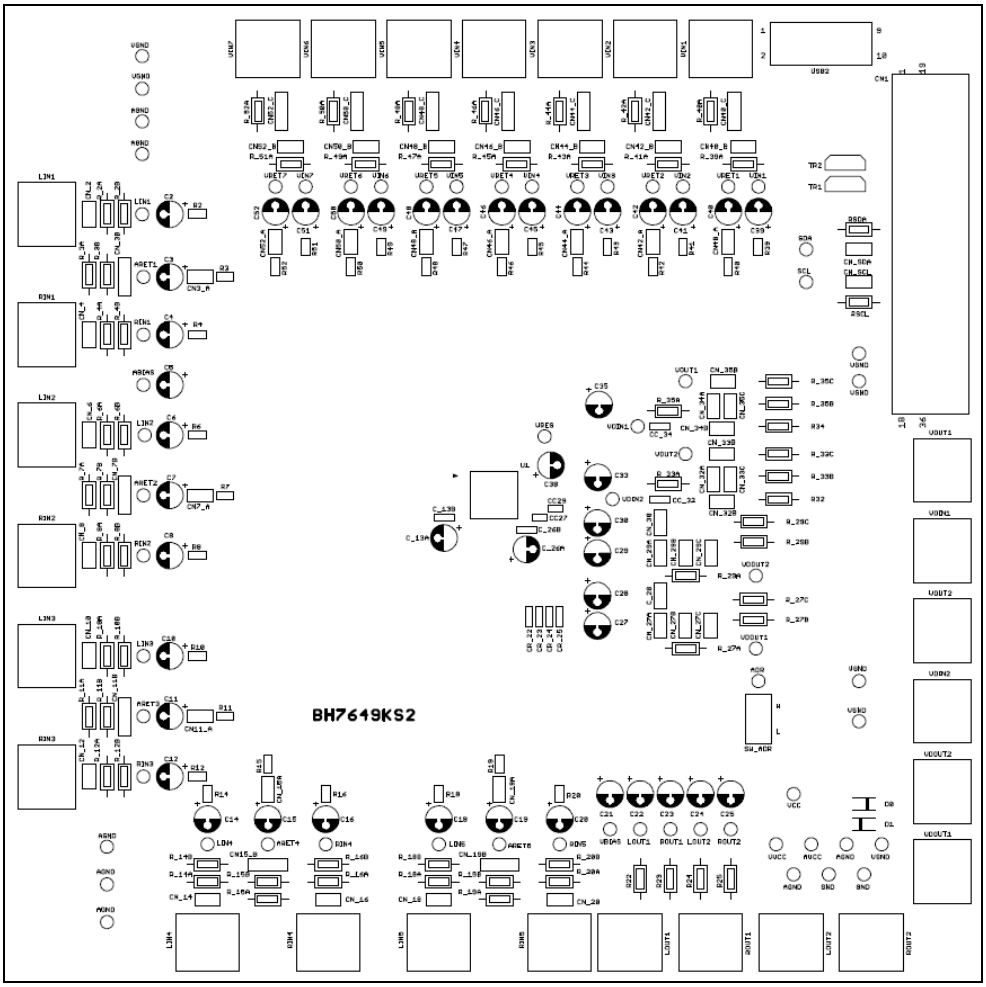


Fig.5

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●Evaluation board PCB layer



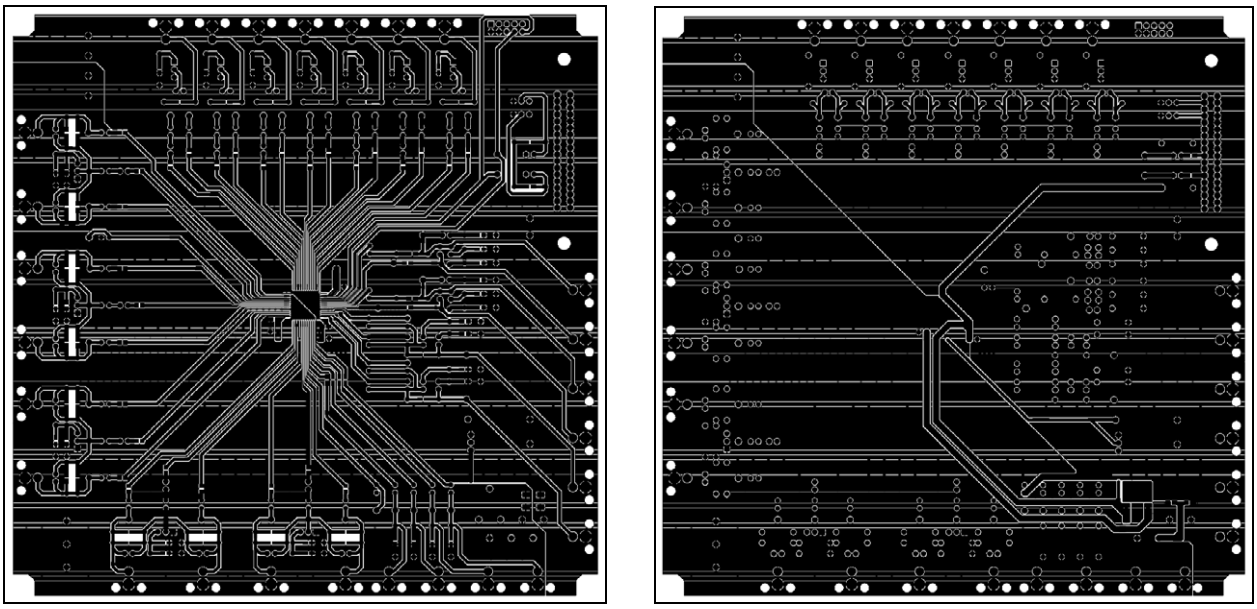


Fig.6

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●Notes for use

(1) Absolute maximum ratings
If the absolute maximum ratings for applied voltage and/or operation temperature are exceeded, LSI damage may result. Therefore, do not apply voltage or use in a temperature that exceeds these absolute maximum ratings. If it is possible that absolute maximum ratings will be exceeded, use a physical safety device such as a fuse and make sure that no conditions that might exceed the absolute maximum ratings will be applied to the LSI IC.

(2) GND potential
Regardless of the operation mode, the voltage of the GND pin should be at least the minimum voltage. Actually check whether or not the voltage at each pin, including transient phenomena, is less than the
GND pin voltage.

(3) Thermal design
The thermal design should be done using an ample margin that takes into consideration the allowable dissipation under actual use conditions. Perform thermal design in which there are adequate margins by taking into account the allowable power dissipation in actual states of use.

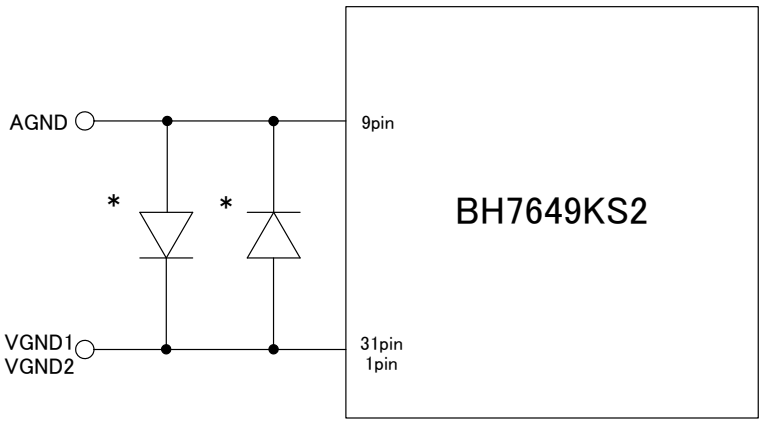
(4) Shorts between pins and mounting errors
When mounting LSI ICs onto the circuit board, make sure each LSI's orientation and position is correct. The ICs may become damaged if they are not mounted correctly when the power is turned on. Similarly, damage may also result if a short occurs, such as when a foreign object is positioned between pins in an IC, or between a pin and power supply or GND connection.

(5) Operation in strong electromagnetic field
When used within a strong electromagnetic field, evaluate carefully to avoid the risk of operation faults.

(6) When not using a sag compensation circuit
Connect the sag compensation pin and output pin as closely as possible. There is a danger of high frequency oscillation. Also make the distance from the output pin (OUT pin, SAG pin) to the 75Ω resistance as short as possible.

(7) When using a sag compensation circuit
Make the length of the output pin (OUT pin, SAG pin) and capacitor as short as possible. There is a danger of high frequency oscillation. Also make the distance from the output pin (OUT pin, SAG pin) to the 75Ω resistance as short as possible. If these cautions is not observed in board layout, connect a capacitor (0.01μF～0.1μF) as short as possible

(8) VGND1(31pin), VGND2(1pin) and AGND(9pin) connection
When to float any one of GND pins(VGND1, VGND2 and AGND) during operation, the internal ESD protection diode Between VGND1, VGND2 and AGND may be damaged by large current surge. If the abnormal design like floating any one of GND pins is required, it is advisable to connect external diodes between GND pins. The connection detail of external diodes is illustrated in Fig.7.



＊ :1SR154-400(ROHM） etc.

Fig.7 External diodes

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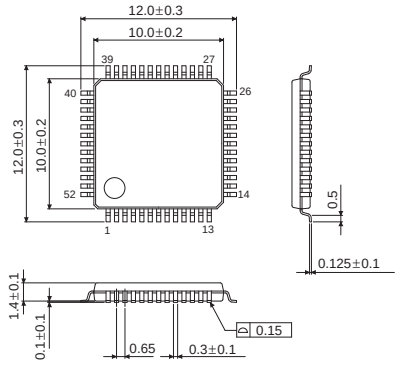
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●Ordering part number

B	D	7	6	4	9	K	S	2		

Part No. Part No. Package KS2 : SQFP-T52 Packaging and forming specification None: Tray

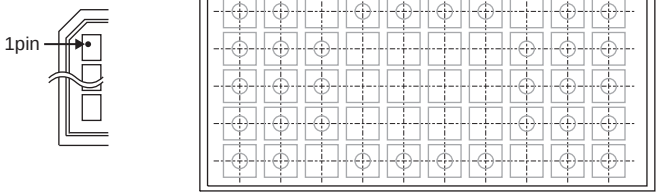
SQFP-T52



(Unit : mm)

<Tape and Reel information>

Container	Tray (with dry pack)
Quantity	1000pcs
Direction of feed	Direction of product is fixed in a tray



∗Order quantity needs to be multiple of the minimum quantity.

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Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   - [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   - [b] the temperature or humidity exceeds those recommended by ROHM
   - [c] the Products are exposed to direct sunshine or condensation
   - [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

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