查询"LA7209V"供应商

Monolithic Linear IC

LA7209V — ISO/IEC-14443 (proximity) RF amplifier for contact-less IC card and tag

Overview

The LA7209V is a ISO/IEC-14443 (proximity) RF amplifier for contact-less IC card and tag.

Features

- Driver amplifier for ASK modulation (under 500mW) :
  Modulation and output level be able to changing by out side constant.
- Diode detector (bridge connecting) : Abstract the data by envelope detector.
- Band pass filter (10kHz to 1MHz) : Data frequency bandwidth pass filter.
- Variable gain amplifier + fixed gain amplifier :
  Choosing the wide range output level by additional fixed gain amplifier.
- Comparator (10mVp-p to 2Vp-p) : Converting to the pulse signal of 0/5 volts from small signal.
- Regulator (2V) : Can be use the V_{CC} = 2.7V to 6.0V (recommend V_{CC} : 3V ±10% or 5V ±10%)
- Type changeover switch (card type A/B, C) : All smart card and RF-tag can be read and write by TYPE_CTL.
- Power save (mute) changeover switch : Power save (= 650μA) and output mute can be setting by PWR_CTL.

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		9.0	V
Allowable power dissipation	Pd max	Ta ≤ 75°C *	600	mW
Operating temperature	Topr		-20 to +75	°C
Storage temperature	Tstg		-40 to +125	°C

* When mounted on a 114.3mm×76.1mm×1.6mm, glass epoxy board.

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SANYO Semiconductor Co., Ltd.
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Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended operating voltage	V_{CC}		5.0	V
Allowable operating voltage range	V_{CC} op		2.7 to 6.0	V

Electrical Characteristics at Ta = 25°C, V_{CC} = 5V

Parameter	Symbol	IN	OUT	Conditions	Ratings			Unit
					min	typ	max	
Consumption current 1	$I_{CC}1$	T2A T3A		V_{IN} = 3.0Vp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure the flowing current at pin 20. T7 : 3.0V, SW1 : 2, SW2 : Open, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	15	20	25	mA
Consumption current 2	$I_{CC}2$	T2A T3A		V_{IN} = 3.0Vp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure the flowing current at pin 22 & 23. T7 : 3.0V, SW1 : 2, SW2 : Open, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	7	9.5	12	mA
Consumption current 1 in power save	$I_{CC}1S$	T2A T3A		V_{IN} = 3.0Vp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure the flowing current at pin 20 in P.S. T7 : 3.0V, SW1 : 2, SW2 : Open, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	0.5	0.65	0.8	mA
Consumption current 2 in power save	$I_{CC}2S$	T2A T3A		V_{IN} = 3.0Vp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure the flowing current at pin 22 & 23 in P.S. T7 : 3.0V, SW1 : 2, SW2 : Open, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	0	0.1	0.2	mA
MOD output level 1	VMOD1	T2A T3A	T22 T23	V_{IN} = 3.0Vp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure the amplitude of output waveform. T7 : 3.0V, SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	9	12	15	Vp-p
MOD output level 2	VMOD2	T2A T3A	T22 T23	V_{IN} = 750mVp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure the amplitude of output waveform. T7 : 3.0V, SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	1.2	2.5	3.8	Vp-p
MOD output level 3	VMOD3	T2A T3A	T22 T23	V_{IN} = 750mVp-p, 13.2MHz, Square wave (T2A/T3A : Opposite) The ratio of VMOD2. T7 : 3.0V, SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	70	85	100	%
MOD output level 4	VMOD4	T2A T3A	T22 T23	V_{IN} = 750mVp-p, 13.8MHz, Square wave (T2A/T3A : Opposite) The ratio of VMOD2. T7 : 3.0V, SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	70	85	100	%
MOD 2nd harmonic distortion	THD2	T2A T3A	T22 T23	V_{IN} = 750mVp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure 2nd harmonic distortion of output waveform. T7 : 3.0V, SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	-60	-40	-34	dB
Modulation type A	MODA	T2A T3A T7	T22 T23	V_{IN} = 3.0Vp-p, 106kHz, Square wave (T7) V_{IN} = 750mVp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure modulation of output waveform. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	90	100	110	%
Modulation type B	MODB	T2A T3A T7	T22 T23	V_{IN} = 3.0Vp-p, 106kHz, Square wave (T7) V_{IN} = 750mVp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure modulation of output waveform. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2	25	30	35	%
Modulator output noise level	NMOD	T7	T22 T23	DC_3V are impressed to T7 and an output noise is measured. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 2, SW5 : 2, SW6 : 2		-43	-39	dBV
MOD DATA input voltage "High"	VDATH	T7	T6	DC voltage that T6 sinks. SW1 : 2, SW2 : 2, SW3 : 3, SW4 : 2, SW5 : 2, SW6 : 2	1.7		5.0	V
MOD DATA input voltage "Low"	VDATL	T7	T6	DC voltage that T6 opens. SW1 : 2, SW2 : 2, SW3 : 3, SW4 : 2, SW5 : 2, SW6 : 2	0.0		1.3	V

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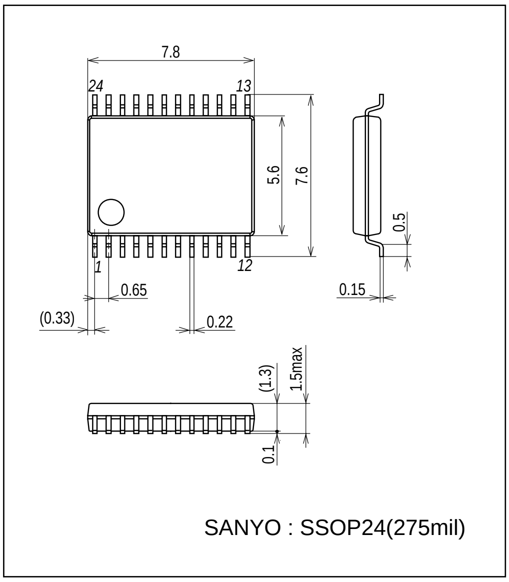
Parameter	Symbol	IN	OUT	Conditions	Ratings			Unit
					min	typ	max	
DET demodulation sensitivity type A	DETA	T22 T23	T18	V_{IN} = 5.0Vp-p (13.5MHz)+28mVp-p (847kHz) Measure the C/N ratio of the 847kHz component. SW1 : 1, SW2 : 2, SW3 : 2, SW4 : 1, SW5 : 1, SW6 : 2	42	45	48	dB
DET demodulation sensitivity type C	DETC	T22 T23	T18	V_{IN} = 5.0Vp-p (13.5MHz)+28mVp-p (106kHz) Measure the C/N ratio of the 106kHz component. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 1, SW5 : 1, SW6 : 2	47	50	53	dB
DET demodulation sensitivity 423k	DT423	T22 T23	T18	V_{IN} = 5.0Vp-p (13.5MHz)+28mVp-p (423kHz) Measure the C/N ratio of the 423kHz component. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 1, SW5 : 1, SW6 : 2	45	48	51	dB
Comparator sensitivity	SCMP	T16A	T15	V_{IN} = 10mVp-p, 106kHz, Square wave Measure the amplitude of output waveform. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 1, SW5 : 2, SW6 : 2	2.5	3.0	3.1	Vp-p
Comparator output "Low"	VCMPL	T2A T3A T7	T15	V_{IN} = 3.0Vp-p, 106kHz, Square wave (T7) VIN = 3.0Vp-p, 13.5MHz, Square wave (T2A/T3A : Opposite) Measure the bottom of DC of output waveform. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 1, SW5 : 2, SW6 : 2	0	0.2	0.4	V
EVR characteristics 1	GEVR1	T22 T23	T18	V_{IN} = 5.0Vp-p (13.5MHz)+28mVp-p (847kHz) Measure the output level at Pin 18, Calculate output/input ratio. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 1, SW5 : 1, SW6 : 2	24	30		dB
EVR characteristics 2	GEVR2	T22 T23	T18	V_{IN} = 5.0Vp-p (13.5MHz)+28mVp-p (847kHz) Measure the output level at Pin 18, Calculate GEVR1 minus output level. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 1, SW5 : 2, SW6 : 2	14	16	18	dB
TAG DET output	VTAG	T22 T23	T10	V_{IN} = 5.0Vp-p (13.5MHz)+28mVp-p (847kHz) Measure the output level at Pin 18. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 1, SW5 : 1, SW6 : 2	2.5	3.0	3.1	Vp-p
TAG DET output "Low"	VTAGL	T22 T23	T10	V_{IN} = 5.0Vp-p (13.5MHz)+28mVp-p (847kHz) Measure the DC bottom level of output wave at Pin 18. SW1 : 2, SW2 : 2, SW3 : 2, SW4 : 1, SW5 : 1, SW6 : 2	0	0.2	0.4	V
Type Switch ON voltage	TYPON	T11	T4	DC voltage that T4 sinks. SW1 : Open, SW2 : 2, SW3 : 3, SW4 : 2, SW5 : 2, SW6 : 2	0.0		1.3	V
Type Switch OFF voltage	TYPOF	T11	T4	DC voltage that T4 opens. SW1 : Open, SW2 : 2, SW3 : 3, SW4 : 2, SW5 : 2, SW6 : 2	1.7		5.0	V
Power save ON voltage	PSON	T12	T20	DC voltage that DC current 1mA or less flows into T20. SW1 : 2, SW2 : Open, SW3 : 3, SW4 : 2, SW5 : 2, SW6 : 2	1.7		5.0	V
Power save OFF voltage	PSOFF	T12	T20	DC voltage that DC current 10mA or more flows into T20. SW1 : 2, SW2 : Open, SW3 : 3, SW4 : 2, SW5 : 2, SW6 : 2	0.0		1.3	V

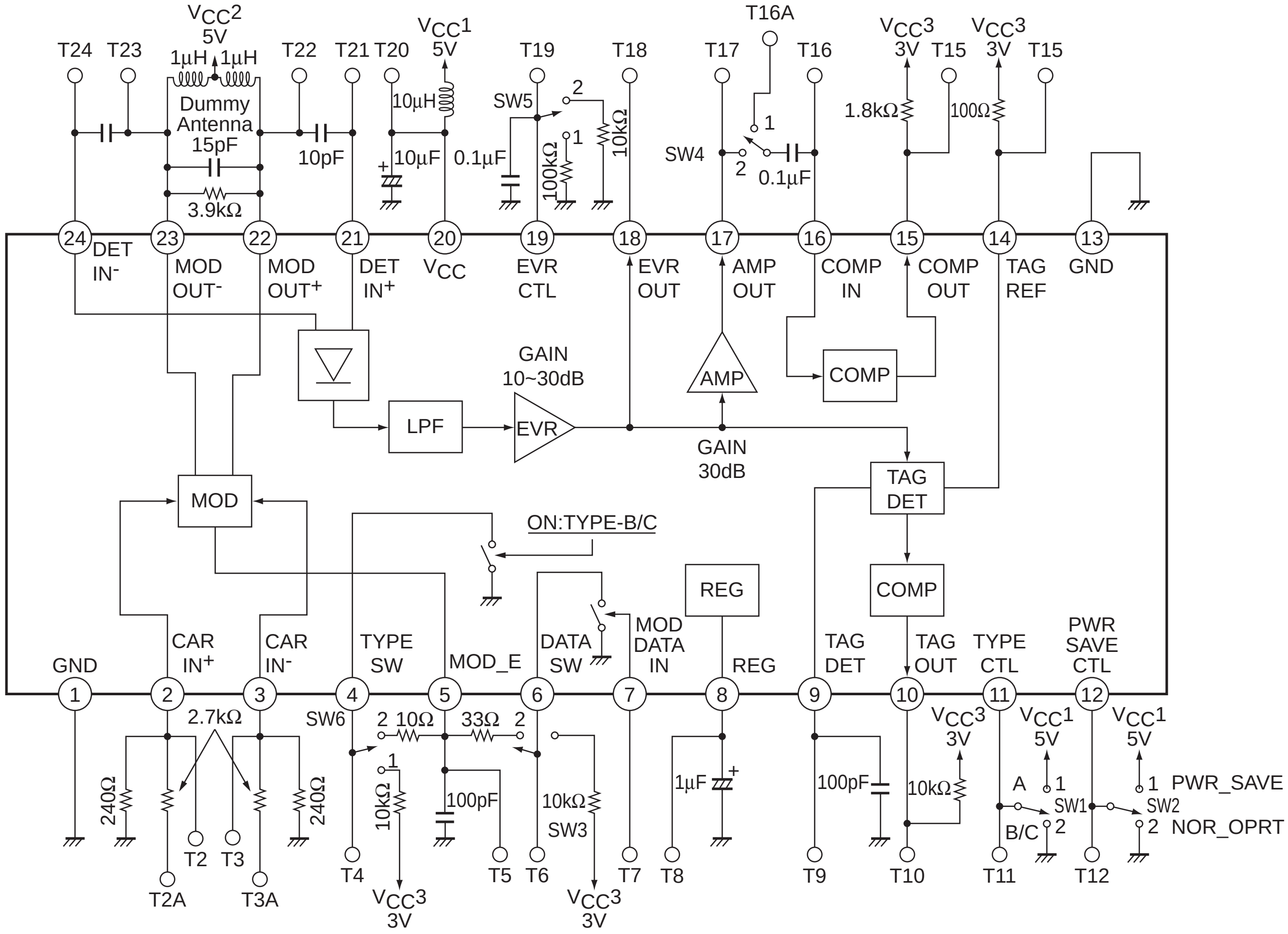
Package Dimensions

unit : mm (typ)

3175C

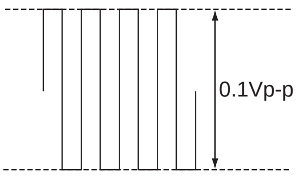
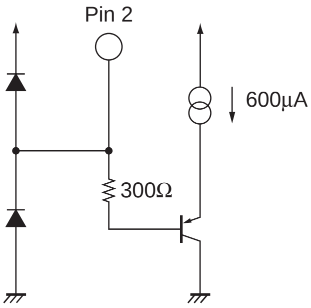
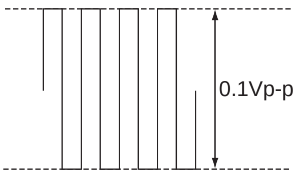
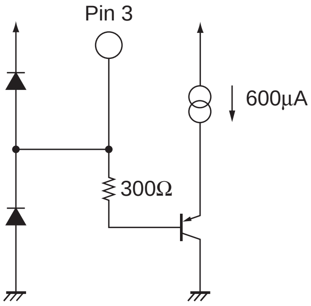
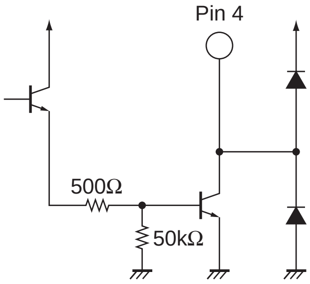
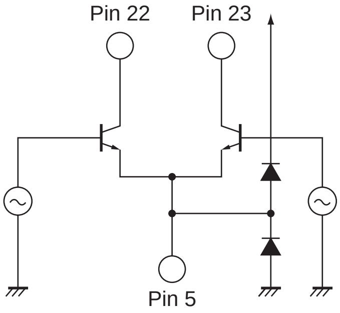
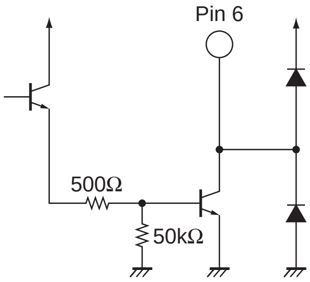


Block Diagram



* Dummy antenna : TDK inductor EL0405
Specifications : L = 1µH ±1%, Q = 50 (at f = 7.96MHz), DC resistance = 0.22Ω (maximum)

Pin Functions

Pin No.	Pin Name	DC voltage	Signal wave form	Equivalent Circuit
1	GND			
2	CAR_IN^{+}	0V	SQUARE-WAVE : 13.5MHz 	
3	CAR_IN^{-}	0V	SQUARE-WAVE : 13.5MHz 	
4	TYPE_SW	0V	DC	
5	MOD_E	1V	DC	
6	DATA_SW	0V	DC	

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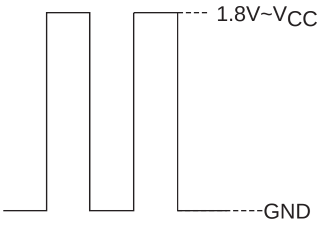
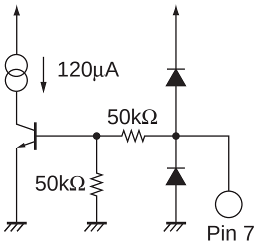
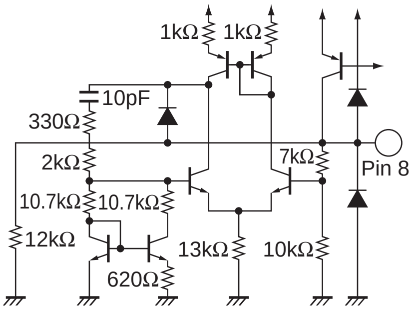
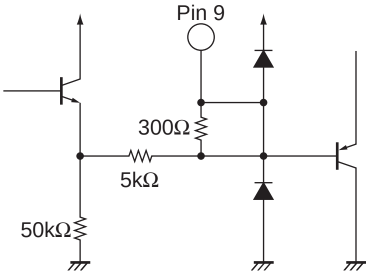
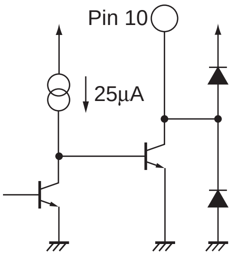
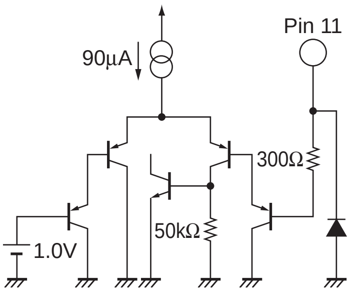
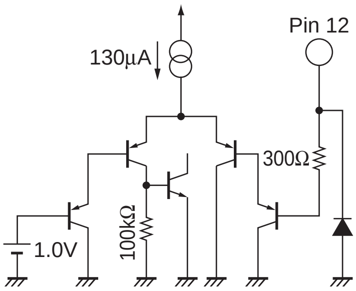
Pin No.	Pin Name	DC voltage	Signal wave form	Equivalent Circuit
7	MOD_DATA_IN	0V	SQUARE-WAVE  	
8	REG	2V	DC	
9	TAG_DET			
10	TAG_OUT	5V	DC	
11	TYPE_CTL		0V to 1.2V : TYPE_B/C 1.8V to V_{CC} : TYPE_A	
12	PWR_SAVE_ CTL		0V to 1.2V : Normal 1.8V to V_{CC} : Power_Save	
13	GND			

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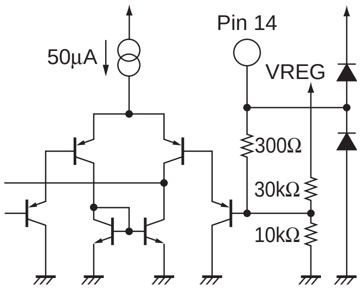
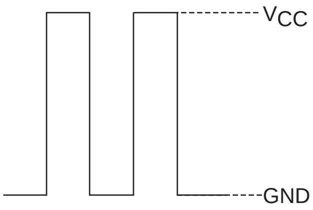
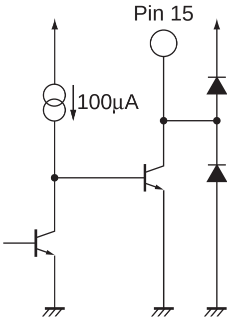
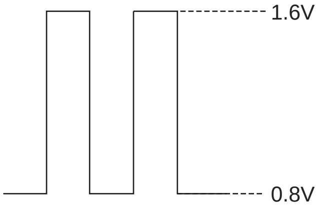
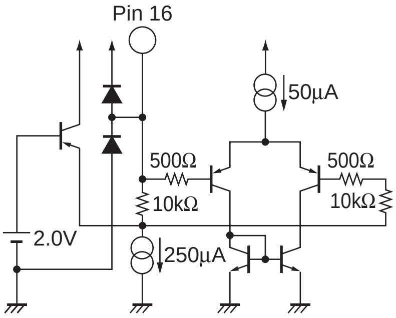
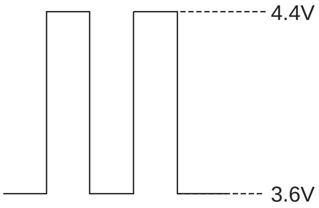
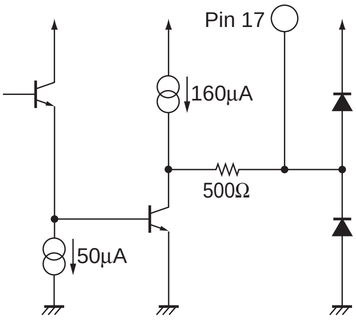
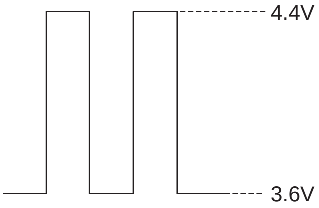
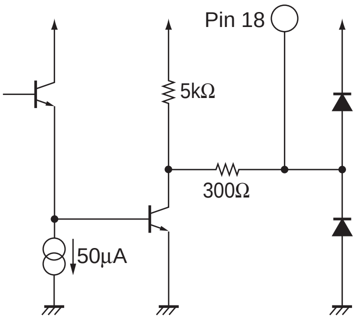
Pin No.	Pin Name	DC voltage	Signal wave form	Equivalent Circuit
14	TAG_REF	0.5V	DC	
15	COMP_OUT	1.6V	SQUARE-WAVE 	
16	COMP_IN	1.2V	SQUARE-WAVE 	
17	AMP_OUT	4V	SQUARE-WAVE 	
18	EVR_OUT	4V	SQUARE-WAVE 	

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<tr><th>Pin No.</th><th>Pin Name</th><th>DC voltage</th><th>Signal wave form</th><th>Equivalent Circuit</th></tr>
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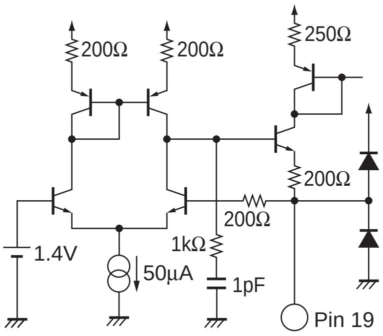

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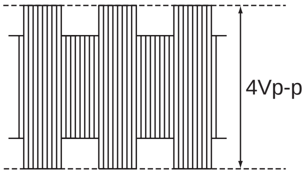
<tr><td>20</td><td>V_{CC}</td><td>5V</td><td>DC</td><td></td></tr>
<tr><td>21
24</td><td>DET_IN$^+$
DET_IN$^-$</td><td>2V</td><td>ASK-WAVE : 13.5MHz


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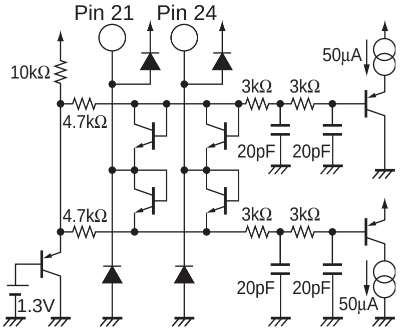

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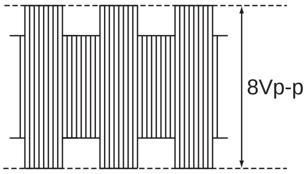
<tr><td>22
23</td><td>MOD_OUT$^+$
MOD_OUT$^-$</td><td>5V</td><td>ASK-WAVE : 13.5MHz


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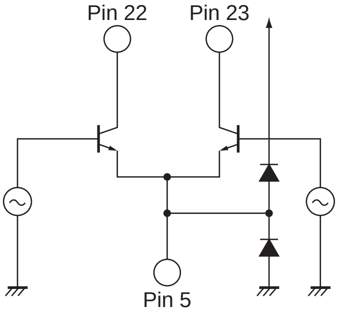

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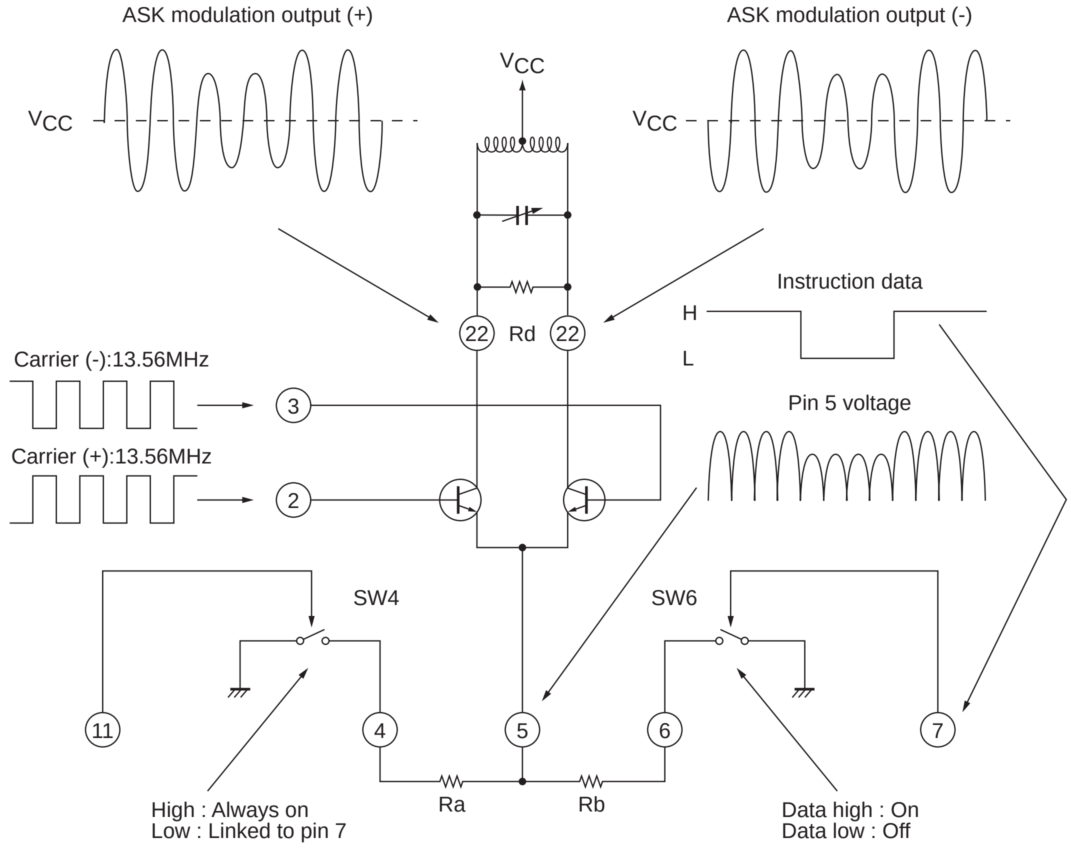
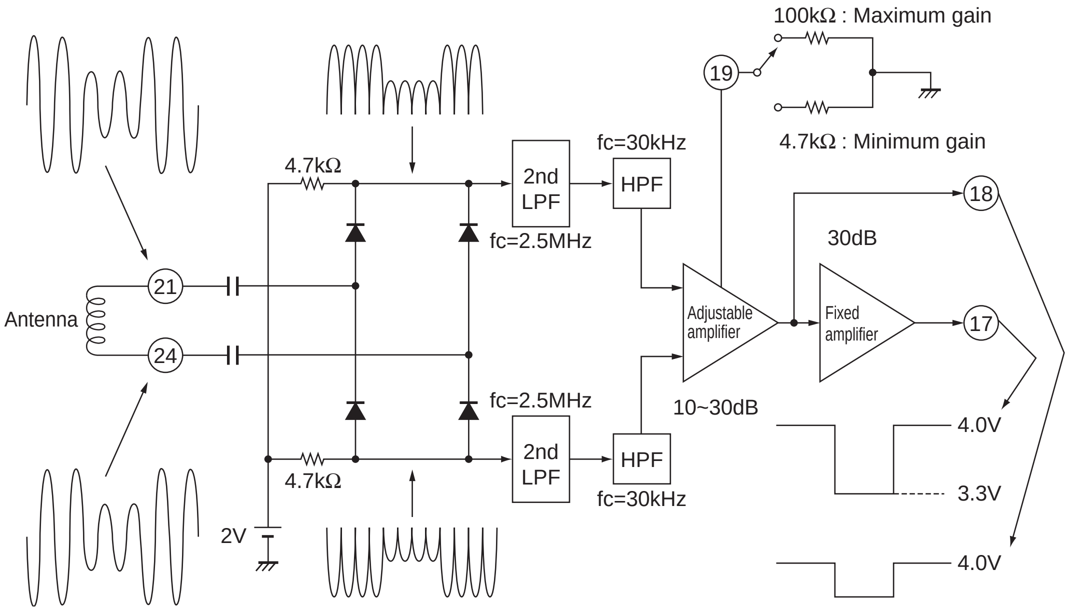
ASK Modulation Driver Amplifier Signal Flow



Read Amplifier Signal Flow



Description of Functional Settings

1. ASK modulation driver amplifier: ASK modulates the data and outputs it as an RD signal.

(1) Input settings

Pins 2 and 3 input a 13.56MHz carrier signal (pulse/sine wave) as an inverting/noninverting input pair.
The input dynamic range is 500mVp-p.

I/O Characteristics Sample Data

Input level [mVp-p]	Output level [Vp-p] Data : high/low	Ra [Ω]	Rb [Ω]	Rd [kΩ]	Antenna current [mA] Data : high/low	IC current [mA] Data : high/low
280	7.9/3.9	15	4.7	1	13.5/6.0	20.9/19.4
220	6.3/3.3	15	4.7	1	10.5/4.8	20.7/19.2
180	4.6/2.5	15	4.7	1	7.8/3.7	20.5/19.0
280	7.1/3.3	22	6.8	1	11.9/4.9	20.9/19.4
220	5.6/2.9	22	6.8	1	9.3/4.0	20.7/19.2
180	4.1/2.3	22	6.8	1	7.0/3.1	20.5/19.0
280	6.2/2.9	33	10	1	10.0/3.9	20.9/19.4
220	4.8/2.5	33	10	1	8.0/3.2	20.7/19.2
180	3.5/1.5	33	10	1	6.0/2.5	20.5/19.0

(2) Setting the degree of modulation

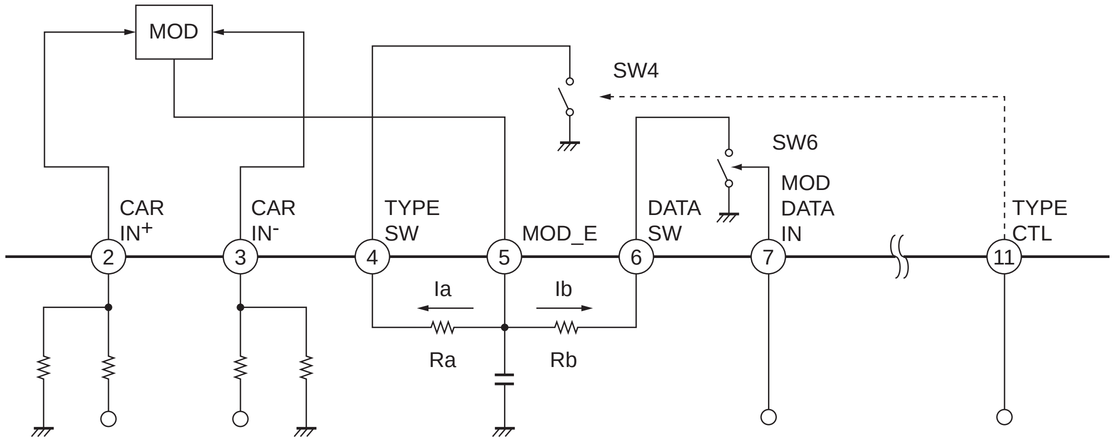
The degree of modulating is set by the ratio of the resistors connected between pins 4 and 5 (Ra) and pins 5 and 6 (Rb).
For types B and C, this is determined by the idling current (Ia) determined by Ra and parallel resistance of Ra + Rb.
The degree of modulation is determined by the idling current (Iab).
(Modulation is performed by switching pin 6 (DATA_SW) on and off.)
For type A, the 100% modulation point is determined by the idling current (Iab) determined by the parallel resistance of Ra + Rb.
(Modulation is performed by switching pin 4 (TYPE_SW) and pin 6 on and off at the same time.)

Setting the Degree of Modulation

	Pin 11	
	High (Type A)	Low (type B and C)
Pin 4	*1	On

	Pin 7	
	Data high	Data low
Pin 6	On	Off

*1 : When type A is selected by setting pin 11 high, SW4 and SW6 operate in a linked manner.



Degree of Modulation Sample Data

Input level [mVp-p]	Output level [Vp-p] Data : high/low	Ra [Ω]	Rb [Ω]	Rd [kΩ]	Antenna current [mA] Data : high/low	IC current [mA] Data : high/low	Degree of modulatio [%]
220	4.8/3.9	10	33	1	8.0/6.0	20.7/19.2	10
220	4.8/0.0	10	33	1	8.0/0.1	20.7/19.2	100

* : This IC can support out-of-standard modulation levels by settings using the resistors Ra and Rb described above.

(3) Output level setting

The output level is set by setting the two items (the input level and the idling current) described above and the damping resistor (Rd) between pins 22 and 23. Note that although an output amplitude (at pins 22 and 23) of about two times the V_{CC} voltage can be acquired, if the output voltage limit is exceeded, a collision with the pin 5 voltage occurs and abnormal oscillation due to V_{CE} saturation may occur. In such cases, changes to the antenna structure (V_{CC} midpoint supply) and/or damping of the output level will be required.

Output Damping Characteristics Sample Data

Rd [Ω]	Output level [Vp-p] Data : high/low	Ra [Ω]	Rb [Ω]	Input level [mVp-p]	Antenna current [mA] Data : high/low	IC current [mA] Data : high/low
3.9	8.5/4.6	15	4.7	180	7.8/3.7	20.5/19.0
2.2	6.9/3.5	15	4.7	180	7.8/3.7	20.5/19.0
1	4.6/2.5	15	4.7	180	7.8/3.7	20.5/19.0
3.9	8.1/4.3	22	6.8	180	7.0/3.1	20.5/19.0
2.2	6.5/3.3	22	6.8	180	7.0/3.1	20.5/19.0
1	4.1/2.3	22	6.8	180	7.0/3.1	20.5/19.0
3.9	7.5/3.5	33	10	180	6.0/2.5	20.5/19.0
2.2	5.8/2.9	33	10	180	6.0/2.5	20.5/19.0
1	3.5/1.9	33	10	180	6.0/2.5	20.5/19.0

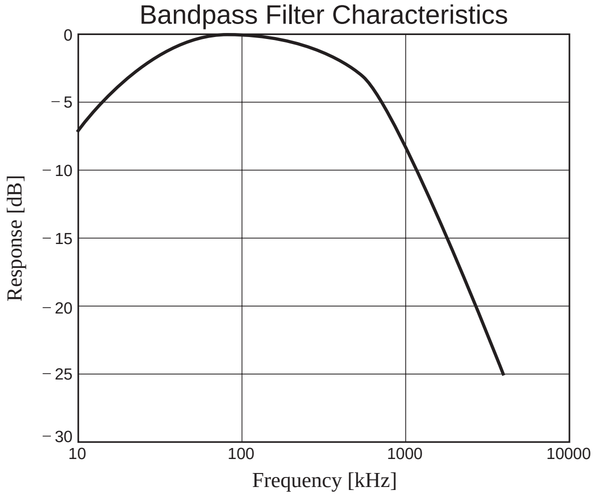
2. Read amplifier (diode detector, bandpass filter, variable amplifier + fixed amplifier) : Data modulation from the RF signal

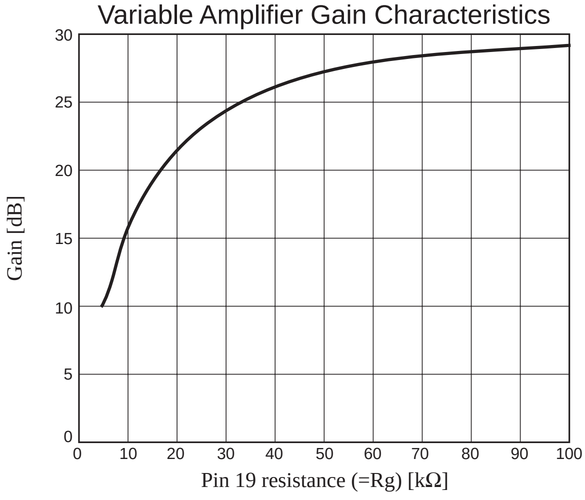
(1) Level setting

The input level is determined by voltage division by the capacitors connected between pins 21 and 22 and between pins 23 and 24 and the IC internal capacitance. However, note that the input dynamic range of pins 21 and 24 is the same as the V_{CC} voltage.

(2) Variable amplifier gain setting

The gain is determined by the value of the resistor (Rg) connected between pin 19 and ground.
Note that the range of values that may be used for Rg is from 4.7kΩ (minimum gain) to 100kΩ (maximum gain).





3. Comparator: Used to provide 0V/5V pulse output of the demodulated data.

(1) Setting the input level

Signals from 10mVp-p to 2Vpp can be handled by using capacitor coupling to input the signal to pin 16.

(2) Setting the output load resistance

The load resistance is set so that the pin 15 current capacity is 2.2mA to 5mA.
Note that this will be the range 2.2 kΩ to 1 kΩ when V_{CC} = 5 V.

4. Variable threshold TAG detector: Detects tags in the communications area

(1) Setting the input level

The input level is determined by the resistor (Rg) connected between pin 19 and ground. Note however, that since the output level can also be modified at the same time by pins 17 and 18, the adjustment described in step (2) of the following item is required.

(2) Setting the detection threshold level

The built-in detector's threshold level can be changed by pin 14, and is set so that it can identify whether or not a TAG is present.
* : The level goes to 500mV if the pin is left open.

(3) Setting the detection (smoothing) capacitor

The built-in detector's sensitivity is adjusted with pin 9. (Minimum capacitance : 10pF)

(4) Setting the output load resistance

Set the load resistance so that the pin 10 pull-in current is in the range 0.2mA to 0.5mA.
Note that this will be the range 10kΩ to 24kΩ when V_{CC} = 5 V.

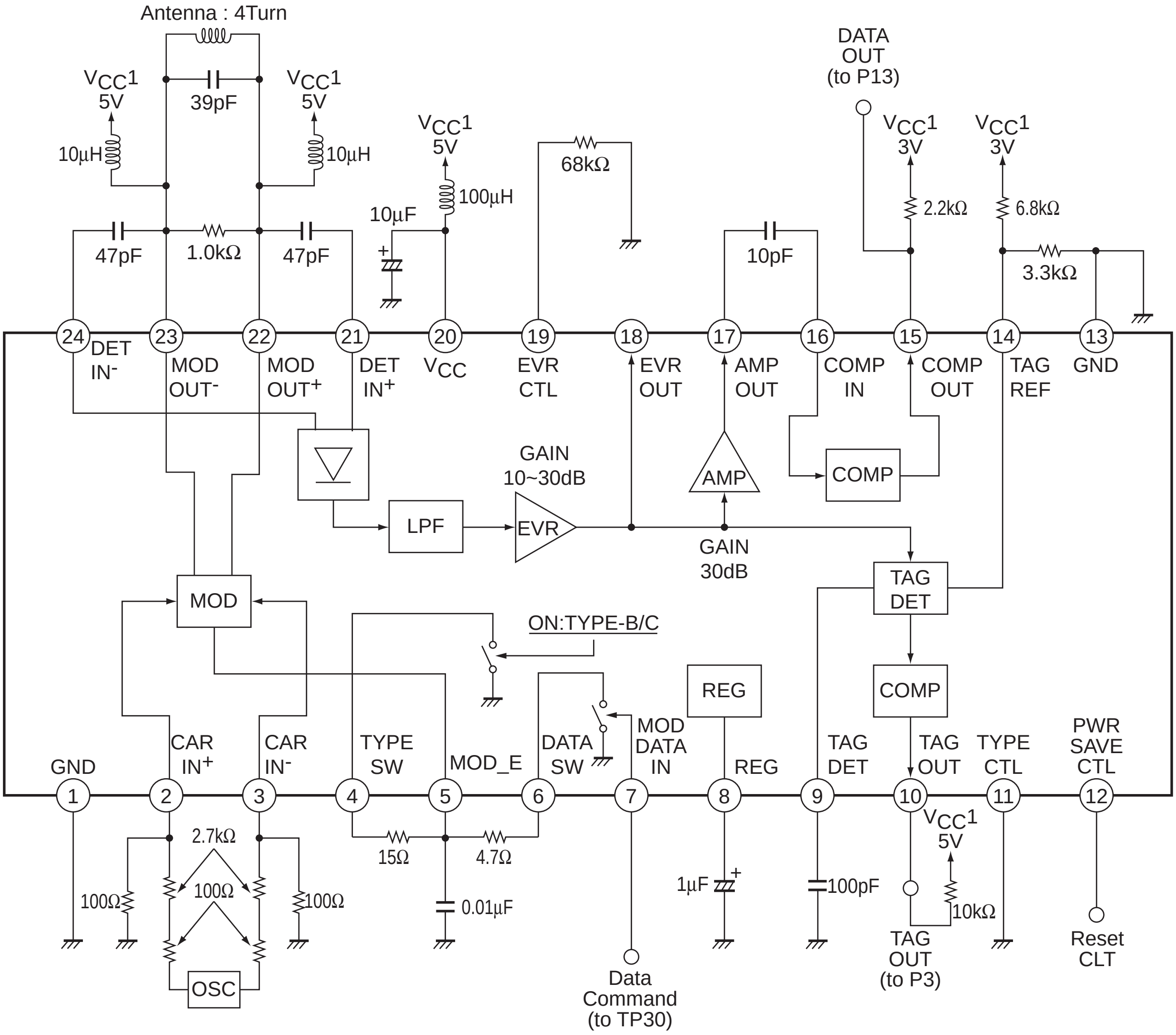
5. Type switching: For IC card type switching

- Low (0V to 1V) : Type B/C read/write communication is possible
- High (2V to V_{CC}) : Type A read/write communication is possible

6. Power save mode (muting) switching: Used for low-power mode control and driver amplifier output muting

- Low (0V to 1V) : Normal operation ⇒ Read/write communication is possible
- High (2V to V_{CC}) : Power saving mode ⇒ Read/write communication is not possible

Application Circuit Example



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