



IC8205A

UNIVERSAL LEARNING REMOTE CONTROL INTEGRATED CIRCUIT

FEATURES

- Combines Innotech's extensive remote control Infrared code library with a powerful IR learning capability.
- Single chip solution provided in die form for lowest cost.
- Available in OTP form for prototyping.
- 6 device slots
- 64 Button Keypad
- Total learning capacity 112 buttons dynamically distributed over the 6 device slots.
- Broad coverage of all popular entertainment models.
- Two battery operation.
- Low operating power and Sleep Mode for long battery life.
- Flexible learner. Understands codes with toggle bits.
- Retains learned codes even with battery removed via external EEPROM.

DESCRIPTION

The IC8205A Universal Learning Remote Integrated Circuit is a fully integrated solution for any system that requires IR transmission and learning capability. The chip can be configured for keypad or serial control. The IC8205A includes a comprehensive IR library of entertainment remote control codes. The IC8205A is provided in die form for the lowest manufacturing costs using chip-on-board assembly and is also available in a One-Time-Programmable daughterboard for prototyping.

The IC8205A is a complete "six-in-one" remote control IC capable of controlling any combination of TV, VCR, CBL, DSS, DVD, Audio and Aux.

Based on the advanced Innotech IR learning technology, the IC8205A can "capture" remote control codes for the vast majority of home entertainment and automation equipment including TV, VCR, Cable Box, Satellite (DSS) Receiver, Audio equipment and DVD players.

**DESCRIPTION OF PIN FUNCTIONS**

Die Pad #	COB/ OTP Pin# daughterboard	Symbol	Input/ Output	Description
12-19	45-48,1, 5-7	Sense0- Sense7	Input	8x8 Keypad Sense lines (X0-X7)
3-10	37-44	Scan0- Scan7	Output	8x8 Keypad Scan lines (Y0-Y7)
39	30	~WAKE	Input	Keypad wakeup
38	29	~IRLED	Output	IR LED for transmitting IR codes
32	12	LED	Output	Visible LED indicator for visual feedback to user.
21	15	~Reset	Input	Power On Reset
30	10	SCL	Output	Clock output to serial EEPROM used for non-volatile storage of learned codes
29	9	SDA	I/O	Data signal to serial EEPROM used for non-volatile storage of learned codes
24	18	GND	Ground	Ground
1	34	IR_INP1	Input	Learner IR input 1
37, 2	28, 35	IR_INPx	Input	Learner IR inputs 2 & 3
31	11	ENABLE	Output	Enables the IR detector during learning
25, 26	19, 20	FXI, FXO	I/O	4 MHz ceramic resonator connection
22, 23	16, 17	SX1, SXO	I/O	Control resistor for internal secondary clock.
20	24	TSTPT	Input	Test point input. Should be tied low.
27, 28	21, 22	Vcc	Power	Positive battery connection
35, 36	26, 27	CFG1, CFG2	Input	Configuration Straps (0,1 for keyboard)
34	25	HOST_CLK _OUT	Input	Serial Clock to Host Processor
40	31	HOST_SYN C_DATA	I/O	Serial Data to/from Host Processor
42	33	HOST_CLK _IN	Output	Serial Clock from Host Processor

**BUTTON MAPPING**

Button Page 13	Function	Type	Learn Page 6	Class Page 5
1	Volume down	IR	yes	volume
2	Volume up	IR	yes	volume
3	Mute	IR	yes	volume
4	Search	Setup	no	
5	Program	Setup	no	
6	Learn	Setup	no	
7	Power off	IR	yes	power
8	Power	IR	yes	power
9	Enter	IR	yes	channel
10	9	IR	yes	channel
11	6	IR	yes	channel
12	3	IR	yes	channel
13	F3 macro	Macro	no	
14	AUX	Slot	no	
15	VCR	Slot	no	
16	Xir51	IR	yes	none
17	0	IR	yes	channel
18	8	IR	yes	channel
19	5	IR	yes	channel
20	2	IR	yes	channel
21	F2	Macro	no	
22	Audio	Slot	no	
23	CBL/SAT	Slot	no	
24	10+	IR	yes	channel
25	Previous	IR	yes	channel
26	7	IR	yes	channel
27	4	IR	yes	channel
28	1	IR	yes	channel
29	F1	Macro	no	
30	DVD	Slot	no	
31	TV	Slot	no	
32	Sleep	IR	yes	power
33	PIP swap	IR	yes	PIP
34	PIP move	IR	yes	PIP
35	PIP Ch+	IR	yes	PIP
36	PIP CH-	IR	yes	PIP

Button Page 13	Function	Type	Learn Page 6	Class Page 5
37	PIP	IR	yes	PIP
38	Channel down	IR	yes	channel
39	Channel up	IR	yes	channel
40	Xir52	IR	yes	none
41	Input	IR	yes	PIP
42	Fast Forward	IR	yes	transport
43	Page down	IR	yes	channel
44	Page up	IR	yes	channel
45	Exit	IR	yes	setup
46	Navigate Right	IR	yes	setup
47	Menu	IR	yes	setup
48	Yellow	IR	yes	channel
49	Pause	IR	yes	transport
50	Stop	IR	yes	transport
51	Play	IR	yes	transport
52	Xir48	IR	yes	None
53	Navigate down	IR	yes	Setup
54	Select	IR	yes	Setup
55	Navigate up	IR	yes	Setup
56	Red	IR	yes	Channel
57	Smart Source	Setup	no	
58	Rewind	IR	yes	transport
59	F4 macro	Macro	no	
60	Record	IR	yes	transport
61	Guide	IR	yes	setup
62	Navigate left	IR	yes	setup
63	Display	IR	yes	setup
64	Blue	IR	yes	channel



REMOTE CONTROL OPERATION

General

The IC8205A implements a fully functional universal remote control. It supports up to 64 buttons, but not all buttons need to be implemented. The remote supports 6 source slots and contains an IR learner. All user preferences, programmed codes, and learned codes are stored in an external serial EPROM.

Programming the IC8205A

Many of the IC8205A parameters can be setup using the following model..

- Press one of the 6 Slot buttons (TV, DVD CBL/SAT, AUDIO, VCR, AUX) (1 LED flash)
Set the selected slot as the currently active slot until changed.
- Press PROGRAM (2 flashes)
 - Press 1 digit to set some user preference. (see text)
 - Press 2 digits to prepare to do a brand auto-search.
 - Press 3 digits to program a device from the library.
- Press PROGRAM (or SEARCH) to complete to operation.

Slots

Before the IC8205A can transmit an IR signal, one or more devices must be programmed from the library database or one or more buttons must be learned. The IC8205A is a 6-in-1 remote control meaning that 6 independent slots can be setup. These 6 slots can be programmed for any combination of device category. The 6 default categories are AUX, TV, VCR, DVD, AUD, and CBL/SAT, however there is no restriction on what device category gets programmed into what slot. For example all 6 slots can be programmed to be a different TV.

Programming a slot from the library

Slots are programmed either by directly entering a 3 digit device code for a selected slot or by using one of the auto-search modes.

Direct Device Code Programming

Like any universal remote control, the IC8205A can be programmed by directly entering a 3 digit device code from the device list. The button sequence to program a slot from the device list is as follows....

- Press one of the 6 source slots (TV, DVD CBL/SAT, AUDIO, VCR, AUX) (1 flash)
- Press PROGRAM (2 flashes)
- Press #0 - #9 representing the hundreds digit of the device code (1 flash)
- Press #0 - #9 representing the tens digit of the device code (1 flash)
- Press #0 - #9 representing the ones digit of the device code (1 flash)
- Press PROGRAM (3 flashes if the code is accepted)

See the device code list. Customized IR libraries are available to fit any application.

Transmitting IR codes from the library

Once a slot is programmed, the appropriate IR code is transmitted by pressing any button that is implemented for the device that was programmed. The IR code will be transmitted a minimum of 3 times however this default repeat count can be adjusted with a program user preference button sequence. The IR code will also repeat as long as the button is held unless the code is designated as a non-repeat type.



Punch-Through

Library devices generally implement some subset of the 64 possible buttons that exist on the keypad. For example it is unlikely that a TV in the library will implement the PLAY button (unless it's a combo). If a button is not implemented, the IC8205A will check the other slots for programmed devices that do have the requested button implemented. Punch-Through can be handy for most remote control operation however there may be applications where punch-through is not desired. Punch-Through mode can be toggled on or off with the following key sequence.

- o Press any Slot # (TV, DVD CBL/SAT, AUDIO, VCR, AUX) (1 flash)
- o Press PROGRAM (2 flashes)
- o Press 7 (1 flash)
- o Press PROGRAM (1 flash indicates punch through turned off.)
(2 flashes indicates punch through turned on)

Smart Source

The IC8205A can be programmed to pre-select specific slots when certain *classes* of buttons are pressed. Button classes are defined in the following table.

Class	Buttons
POWER	POWER, PWR_OFF, SLEEP
VOLUME	VOL+, VOL-, MUTE
CHANNEL	0-9, Enter, CH+, CH-, PREVIOUS
TRANSPORT	PLAY, STOP, FF, REW, PAUSE, RECORD
SETUP	UP, DOWN, LEFT, RIGHT, MENU, EXIT, GUIDE, DISPLAY
PIP	INPUT, PIP, PIP swap PIP Ch+ PIP Ch- PIP move

To program smart source press the following button sequence for each class that you want to setup.

- o Press a Slot # (TV, DVD CBL/SAT, AUDIO, VCR, AUX) (1 flash)
- o Press PROGRAM (2 flashes)
- o Press any button from the desired class. (3 flashes)

NOTE: To program the channel class you can not use the numbers (0-9 because they are used for device setup. Instead use another button from the channel class such as CH+. Programming a class automatically enables smart-source mode. Smart source can be temporarily disabled by pressing the SMART button.

An example best explains the power of Smart-Source.

- If you want the TV to turn on and off whenever the POWER button is pressed independent of what source button was pressed last you press; TV PROG POWER.
- In addition you want to select the TV whenever you adjust the volume. Press TV PROG VOL+
- You also want to select your cable box whenever you change the channel. Press CBL PROG CH+
- Finally to automatically select the VCR slot whenever you press a transport button, press VCR PROG PLAY.

With smart source you may never need to press a source (slot) button.



Auto-Search

Auto-Search mode causes the IC8205A to transmit a button from each device in the library, wait 3 seconds, and then move to the next device until told to stop. There are 2 auto-search modes in the IC8205A.

Category auto-search will search through an entire category (TV, DVD, VCR, etc) of device from the database. The category of the search is determined by the currently active slot. For example, selecting the TV slot will only search for TVs. Selecting the AUX slot will search through the entire library without regard to category. The button sequence to start a category auto-search is...

- Press a Slot button (TV, DVD CBL/SAT, AUDIO, VCR, AUX) (1 flash)
- Press PROGRAM (2 flashes)
- Press SEARCH (start searching. LED flashes every 3 seconds when IR is sent)

The IC8205A will start its search from the currently programmed device code in the currently active slot. It will transmit the POWER button, and then pause 3 seconds to give the user time to respond. The IC8205A will stop searching when one of the following happens.

- User presses the PROGRAM button. (Code will be saved in the current active slot)
- User presses a SLOT button (code will be save in that slot)
- User presses any other button (Abort search. Code will not be saved.)
- The IC8205A has tried every device of that category in the library

Brand Auto-Search

The IC8205A can filter its auto-search by category and brand. In other words, it can be told to search only for Sony TVs. This reduces the time it takes to find the desired code. 100 popular brands are supported.

To start s brand search the following button sequence is sent...

- Press a Slot button (TV, DVD CBL/SAT, AUDIO, VCR, AUX) (1 flash)
- Press PROGRAM (2 flashes)
- Press tens digit of the brand code (#0 - #9)
- Press ones digit of the brand code (#0 - #9)
- Press SEARCH or PROGRAM to start searching
LED flashes every 3 seconds when IR is sent

See the brand code list. Customized IR libraries are available to fit any application.

Brand auto-search is stopped the same was as the category auto-search. Press the PROGRAM button or one of the 6 source slot buttons.

Learning from another remote

The IC8205A can learn IR codes from other remote controls. These learned codes can be programmed on top of library codes or they can be learned onto unused buttons. If a learned code is programmed on top of an existing library code, the learned code has precedence. Up to 112 learned codes can be programmed into the IC8205A distributed in any way amongst the 6 source slots. Note that re-programming a device from the library will erase all learned codes for that device slot. The button sequence to learn an IR code is..

- Press a Slot button (TV, DVD CBL/SAT, AUDIO, VCR, AUX) (1 flash)
- Press LEARN (2 flashes)
- Press any learnable button (see page 3) onto which you want to learn. (the LED will come on)
- Aim the teaching remote at the IR detector (IR1) about 1-3 inches away.



- While holding the two remotes nose to nose, press the button on the teaching remote for about 2 seconds or until the LED goes out.
 - If the code is successfully learned, the LED will flash twice.
 - The LED will flash 3 or more times if the attempt to learn was unsuccessful.

You can only learn IR codes onto the 50 buttons that send IR. You cannot learn IR codes onto the following buttons that are used for device programming purposes.

- The 6 slot buttons. (TV, DVD CBL/SAT, AUDIO, VCR, AUX)
- PROGRAM
- LEARN
- F1 – F4 (macro buttons)
- SMART-SOURCE
- SEARCH

Programming a macro

There are 4 macro buttons in the IC8205A (F1 – F4). These buttons can be programmed to transmit a series of up to 25 button codes each. The macro buttons can be setup to send a series of favorite channels or to turn all your equipment on or off. To program a macro press the following buttons...

- Press a Slot button (TV, DVD CBL/SAT, AUDIO, VCR, AUX) (1 flash)
- Press LEARN (2 flashes)
- Press the Macro (F1-F4) button that you want to program (2 flashes)
- Press the sequence of buttons that you want to send when this macro is played.
- Press PROGRAM (3 flashes)

Multi String Macros.

You can program a macro button to send out a sequence of buttons that is different each time the macro button is pressed. For example, if you want to program macro 1 to go to each of your favorite sports channels.

- Press CBL (1 flash)
- Press LEARN (2 flashes)
- Press the F1 (2 flashes)
- Press #1
- Press #9
- Press LEARN (end of 1st macro string for channel 19) (2 flashes)
- Press #2
- Press #8
- Press LEARN (end of 2nd macro string for channel 28) (2 flashes)
- Press #4
- Press #5
- Press PROGRAM (end of 3rd macro string for channel 45 and end of the macro) (3 flashes)

The first time you press F1 the TV will go to channel 19, the 2nd press will show channel 28 and the 3rd will go to channel 45. After that the sequence begins at channel 19 again. Another macro button can be programmed to go to you favorite movie channels.



Reading back the programmed device code

To read back the 3 digit library device codes enter the following button sequence...

- Press one of the 6 Slot buttons for the slot you want to read back (1 flash)
- Press PROGRAM (2 flashes)
- Press 1 (1 flash)
- Press PROGRAM Count 0-9 flashes representing the 100s digit of the device code.

- Press the Slot button (1 flash)
- Press PROGRAM (2 flashes)
- Press 2 (1 flash)
- Press PROGRAM Count 0-9 flashes representing the 10s digit of the device code.

- Press the Slot button (1 flash)
- Press PROGRAM (2 flashes)
- Press 3 (1 flash)
- Press PROGRAM Count 0-9 flashes representing the 1s digit of the device code.

Reading back the revision level

- Press one of the 6 Slot buttons for the revision information you want to read back (1 flash)
 - AUX returns the Product ID code
 - TV returns the Firmware major number
 - VCR returns the Firmware minor
 - CBL/SAT returns the Library Major number
 - DVD returns the Library Minor number
 - AUDIO returns the build number
- Press PROGRAM (2 flashes)
- Press 0 (1 flash)
- Press PROGRAM Count 0-9 flashes

Resetting the IC8205A to factory default settings.

- Press one of the 6 Slot buttons (1 flash)
- Press 9 (1 flash)
- Press PROGRAM

This key sequence will erase all user device codes, learned buttons, preference settings, smart-source programming, and macros.

**ABSOLUTE GUARANTEED RATINGS***

Operating Temperature Range 0°C to 70°C
 Storage Temperature Range -20°C to + 100°C
 Voltage from any pin to V_{SS} -0.3 to V_{CC} + 0.3
 Voltage from V_{CC} to V_{SS}..... -0.5 to +3.9

*Stresses above those listed could cause permanent damage to the device. This is a stress rating only and functional operation of the device at any other condition above those indicated in the operation sections of this specification is not implied.

DC ELECTRICAL CHARACTERISTICS (T_A = 0° to 70°C, V_{CC} = 2.2 to 3.6 V)

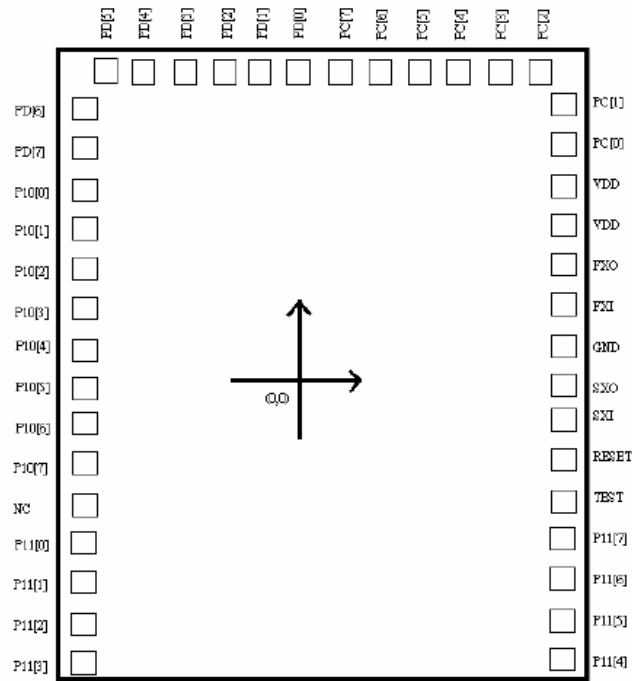
SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	COMMENT
V _{IL}	Input Voltage Low			0.2V _{CC}	V	
V _{IH}	Input Voltage High	0.8V _{CC}			V	Except XTAL
V _{HYS}	Reset Input Voltage Low			1/3V _{CC}	V	
V _{IHR}	Reset Input Voltage High	.67 V _{CC}			V	
I _{IL}	Logic 0 Sink Current	.8	1		mA	V _{OL} = .4 V _{CC}
I _{IL}	Logic 1 Source Current	-40	-50	-60	μA	V _{OH} = .9 V _{CC}
V _{OL}	Output Voltage Low			.45	V	I _{OL} = 1.0mA
V _{OH}	Output Voltage High	2.4			V	I _{OH} = -50μA
I _{CC}	Power Supply Current		0.75	2	mA	Active
I _{CC}	Power Supply Current			1	μA	Sleep

AC ELECTRICAL CHARACTERISTICS (T_A = 0° to 70°C, V_{CC} = +2.2 to 3.6 V)

SYMBOL	PARAMETER	MIN	MAX	UNIT	COMMENT
f _{in}	Clock frequency	3.98	4.02	MHz	
T _{IR}	Infrared Output Resolution		±500	ns	
T _{RD}	Reset Pulse Width	2		μs	
f _{cap}	IR Capture (Learn) Frequency	10	70	kHz	



Pad Diagram



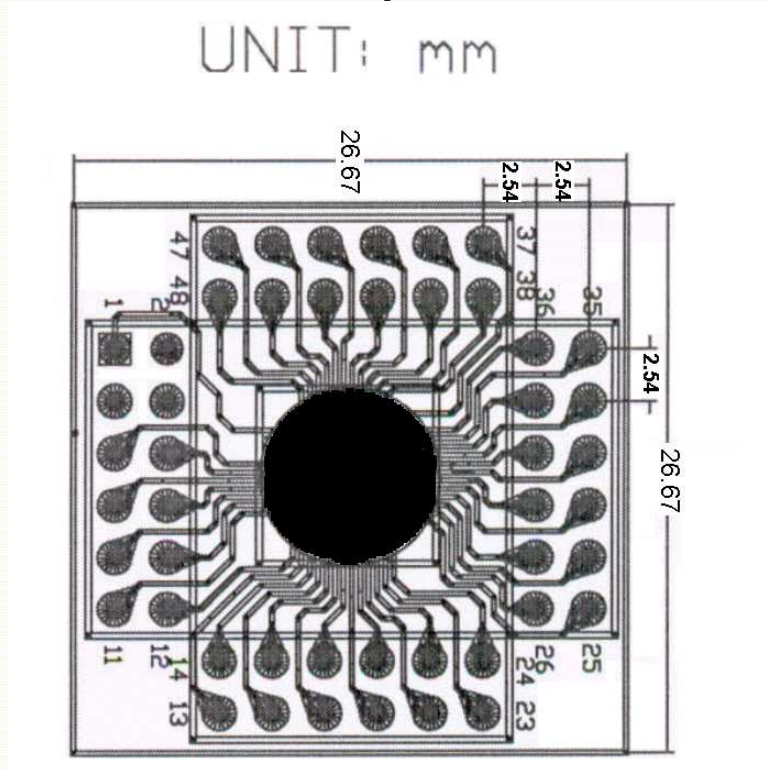
Chip Size : 1640um X 2160um
 IC 's substrate is connected to GND

Pad Coordination

Pin Number	Pin Name	X Coordinate	Y Coordinate	Pin Number	Pin Name	X Coordinate	Y Coordinate
1	PD.6	-747.400	485.250	22	SXI	747.400	-368.800
2	PD.7	-747.400	380.250	23	SXO	747.400	-263.800
3	P10.0	-747.400	275.250	24	GND	747.400	-158.800
4	P10.1	-747.400	170.250	25	FXI	747.400	-53.800
5	P10.2	-747.400	65.250	26	FXO	747.400	51.200
6	P10.3	-747.400	-39.750	27	VDD	747.400	156.800
7	P10.4	-747.400	-144.750	28	VDD	747.400	262.400
8	P10.5	-747.400	-249.750	29	PC.0	747.400	367.400
9	P10.6	-747.400	-354.750	30	PC.1	747.400	472.400
10	P10.7	-747.400	-459.750	31	PC.2	598.700	1006.300
11	NC	-747.400	-572.650	32	PC.3	493.700	1006.300
12	P11.0	-747.400	-682.400	33	PC.4	388.700	1006.300
13	P11.1	-747.400	-787.400	34	PC.5	283.700	1006.300
14	P11.2	-747.400	-892.400	35	PC.6	178.700	1006.300
15	P11.3	-747.400	-997.400	36	PC.7	73.700	1006.300
16	P11.4	747.400	-998.800	37	PD.0	-31.300	1006.300
17	P11.5	747.400	-893.800	38	PD.1	-136.300	1006.300
18	P11.6	747.400	-788.800	39	PD.2	-241.300	1006.300
19	P11.7	747.400	-683.800	40	PD.3	-346.300	1006.300
20	TEST	747.400	-578.800	41	PD.4	-451.300	1006.300
21	RESET	747.400	-473.800	42	PD.5	-556.300	1006.300



IC8205A OTP and COB daughter board Footprints



See page 2



Keypad matrix

