

## 4-BIT SINGLE CHIP MICRO CONTROLLER WITH FL DRIVER

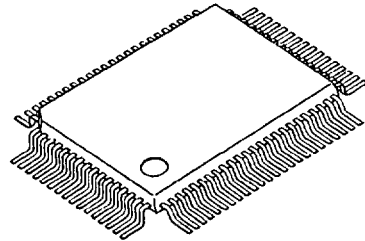
### ■ GENERAL DESCRIPTION

The NJU3401 is a 4-bit Single Chip Micro controller consisted of 4-bit CPU Core, ROM, RAM, I/O PORT, A/D CONVERTER, OSCILLATOR, FL DRIVER, and SERIAL OUTPUT.

It realizes Software Controlled Key Scanning operation with the FL common signal output terminals(8 terminals). The contained A/D converter can operate as 4-bit resolution(14 steps) and its minimum conversion time is 1  $\mu$ s.

Therefore the NJU3401 is suitable for the operation panel with FL display of Car Audio, Home Audio, and the other home appliances.

### ■ PACKAGE OUTLINE

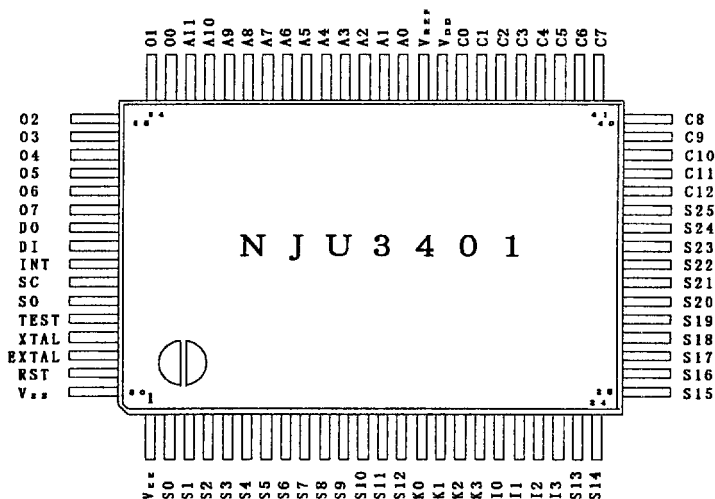


NJU3401F

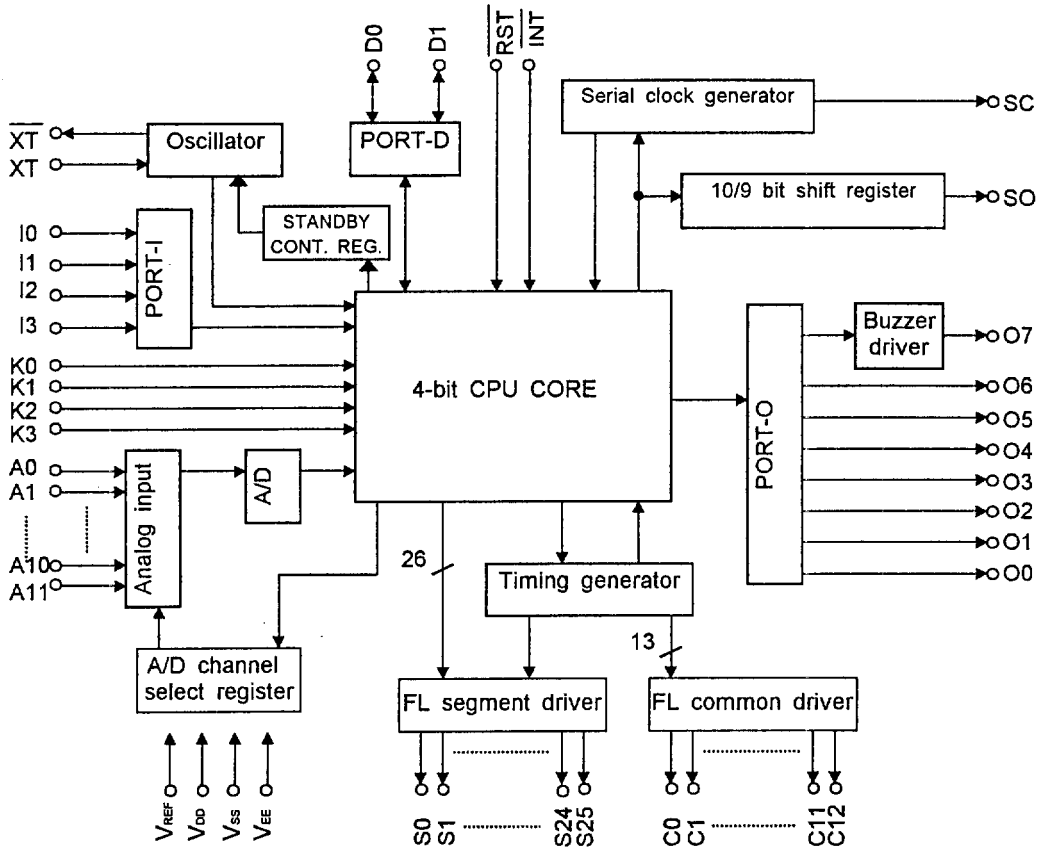
### ■ FEATURES

- FL Driver On-chip 26-segment X 13-common
- 4-bit A/D converter 14-step, 12-channel input
- Internal Program ROM 6,144 X 8 bits
- Internal Data RAM 576 X 4 bits
- Input/Output Port 2 lines
- Input Port 8 lines
- Output Port 8 lines
- Hardware STACK 8 registers
- Instruction executing time 6/fosc
- Oscillator circuit On-chip (X'tal or Ceramic oscillation, or External Clock)
- STANDBY function
- Interrupt factor 4
- C-MOS technology
- Package outline QFP 80

### ■ PIN CONFIGURATION



■ BLOCK DIAGRAM




**■ TERMINAL DESCRIPTION**

No.	SYMBOL	INPUT/OUTPUT	F U N C T I O N
49	V <sub>DD</sub>	—	Power source. ( + 5V )
80	V <sub>SS</sub>	—	Power source. ( 0V )
1	V <sub>EE</sub>	—	FL Driver Power source.
50	V <sub>REF</sub>	—	A/D converter Reference Voltage Input Terminal.
2~14 23~35	S0~S12 S13~S25	OUTPUT OUTPUT	FL Segment Driving Signal Output Terminals. ( 26segments )
36~48	C12~C0	OUTPUT	FL Common Driving Signal Output Terminals. ( 13commons )
51~62	A0~A11	INPUT	Analog Signal Input Terminals to A/D converter .
63~69 70	O0~O6 O7	OUTPUT OUTPUT	7-bit Output PORT-O . Buzzer Driver Terminal.
19~22	I0~I3	INPUT	4-bit input PORT-I with pull-down resistance .
71,72	D0, D1	INPUT/OUTPUT	2-bit Programmable input / output PORT-D.
15~18	K0~K3	INPUT	4-bit Input PORT-K with pull-down resistance .
73	$\overline{\text{INT}}$	INPUT	External interrupt input Terminal.
74	SC	OUTPUT	Serial clock output Terminal.
75	SO	OUTPUT	Serial data output Terminal.
77 78	$\overline{\text{XT}}$ XT	(OUTPUT) INPUT	Internal Oscillator Terminals . Connect Crystal or Ceramic resonator to these terminals . In case of the external clock operation, $\overline{\text{XT}}$ is clock input terminal and XT is normally open.
79	$\overline{\text{RST}}$	INPUT	Reset Terminal. The low level input-signal initializes the system .
76	TEST	INPUT	Test Terminal ( Connect to V <sub>SS</sub> Terminal )



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V_{DD}$	-0.3~+7.0	V
	$V_{EE}$	$V_{DD}-40\sim V_{DD}+0.3$	
Input Voltage	$V_{IN}$	-0.3~ $V_{DD}+0.3$	V
Output Voltage	$V_{OUT}$	-0.3~ $V_{DD}+0.3$	V
	$V_{OD}$	$V_{DD}-40\sim V_{DD}+0.3$	
Power Dissipation	$P_D$	500	mW
Operating Temperature	$T_{opr}$	-20~+75	°C
Storage Temperature	$T_{stg}$	-55~+125	°C

■ ELECTRICAL CHARACTERISTICS

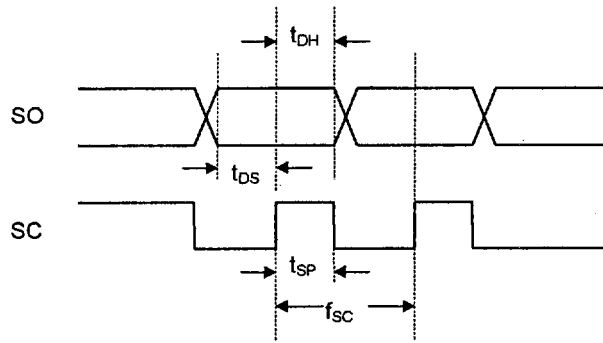
DC CHARACTERISTICS

( $V_{DD}=+5V\pm 10\%$ ,  $V_{SS}=0V$ ,  $V_{EE}=V_{DD}-40\sim V_{DD}$ ,  $T_a=-20\sim 75^\circ C$ )

PARAMETER	SYMBOL	RATING	MIN	TYP	MAX	UNIT
Operating Current	$I_{DD}$	$V_{DD}=5V, f_{osc}=3.58MHz$ , IN RESET $V_{DD}$	—	5	10	mA
	$I_{DDs}$	$V_{DD}=5V$ , STANDBY Mode $V_{DD}$	—	—	10	$\mu A$
STANDBY Mode Keeping Voltage	$V_{STB}$	$V_{DD}$	2.0	—	—	V
High-Level Input Voltage	$V_{IH}$	K0~K3, I0~I3, D0, D1, RST, INT	$0.7V_{DD}$	—	—	V
		XT	$V_{DD}-0.5$	—	—	
Low-Level Input Voltage	$V_{IL}$	K0~K3, I0~I3, D0, D1, RST, INT	—	—	$0.2V_{DD}$	V
		XT	—	—	0.5	
Input Current	$I_{IL}$	$V_{DD}=V_{IN}=5.5V$ D0, D1, RST, INT	—	—	10	$\mu A$
		$V_{DD}=5.5V, V_{IN}=0V$ , D0, D1, RST, INT	—	—	-10	
		$V_{DD}=V_{IN}=5.5V$ K0~K3, I0~I3	—	—	60	
		$V_{DD}=5.5V, V_{IN}=0V$ K0~K3, I0~I3	—	—	-60	
High-Level Output Voltage	$V_{OH}$	$I_{OH}=-1.0mA$ O0~O7, D0, D1, SC, SO	$V_{DD}-1.0$	—	—	V
Low-Level Output Voltage	$V_{OL}$	$I_{OL}=1.0mA$ O0~O7, D0, D1, SC, SO	—	—	0.4	V
Input Capacitance	$C_{IN}$	$f_{osc}=1MHz$ , Except $V_{DD}, V_{SS}, V_{EE}, O0\sim O7$ , $S0\sim S25, C0\sim C12$ terminals =0V	—	10	20	pF


**ELECTRICAL CHARACTERISTICS**
**AC CHARACTERISTICS**
 $(V_{DD}=+5V \pm 10\%, V_{SS}=0V, V_{EE}=V_{DD}-40 \sim V_{DD}, T_a=-20 \sim 75^\circ C)$ 

PARAMETER	SYMBOL	RATING	MIN	TYP	MAX	UNIT
Clock Frequency	$f_{osc}$		—	3.58	5.0	MHz
Instruction Cycle Time	$t_c$		1.2	1.68	—	$\mu s$
Serial Operating Frequency	$f_{sc}$		—	$f_{osc}/16$	—	Hz
Serial Clock Pulse Width	$t_{sp}$		—	$8/f_{osc}$	—	s
Serial Data Set Time	$t_{ds}$		—	$8/f_{osc}$	—	s
Serial Data Hold Time	$t_{dh}$		—	$8/f_{osc}$	—	s
Output Buzz Frequency	$f_{bz}$		—	$f_{osc}/1536$	—	Hz

**AC CHARACTERISTICS SERIAL INTERFACE TIMING CHART**

**FL DRIVER CHARACTERISTICS**
 $(V_{DD}=+5V \pm 10\%, V_{SS}=0V, V_{EE}=V_{DD}-40 \sim V_{DD}, T_a=-20 \sim 75^\circ C)$ 

PARAMETER	SYMBOL	RATING	MIN	TYP	MAX	UNIT
FL Output Current	$I_{OD}$	$V_{DD}=4.5V, V_{OH}=2.5V$ C0~C12	-18	—	—	mA
		$V_{DD}=4.5V, V_{OH}=2.5V$ S0~S25	-12	—	—	mA
Open Drain Leakage Current	$I_{OL}$	$V_{DD}=5.5V,$ $V_{OL}=V_{DD}-40V$ (Pch Tr off) C0~C12, S0~S25	—	—	-20	$\mu A$
FL Output Pull-down Resistance	$R_{PD}$	$V_{DD}=5.0V, V_{EE}=V_{DD}-40V$ C0~C12, S0~S25	100	—	—	k $\Omega$

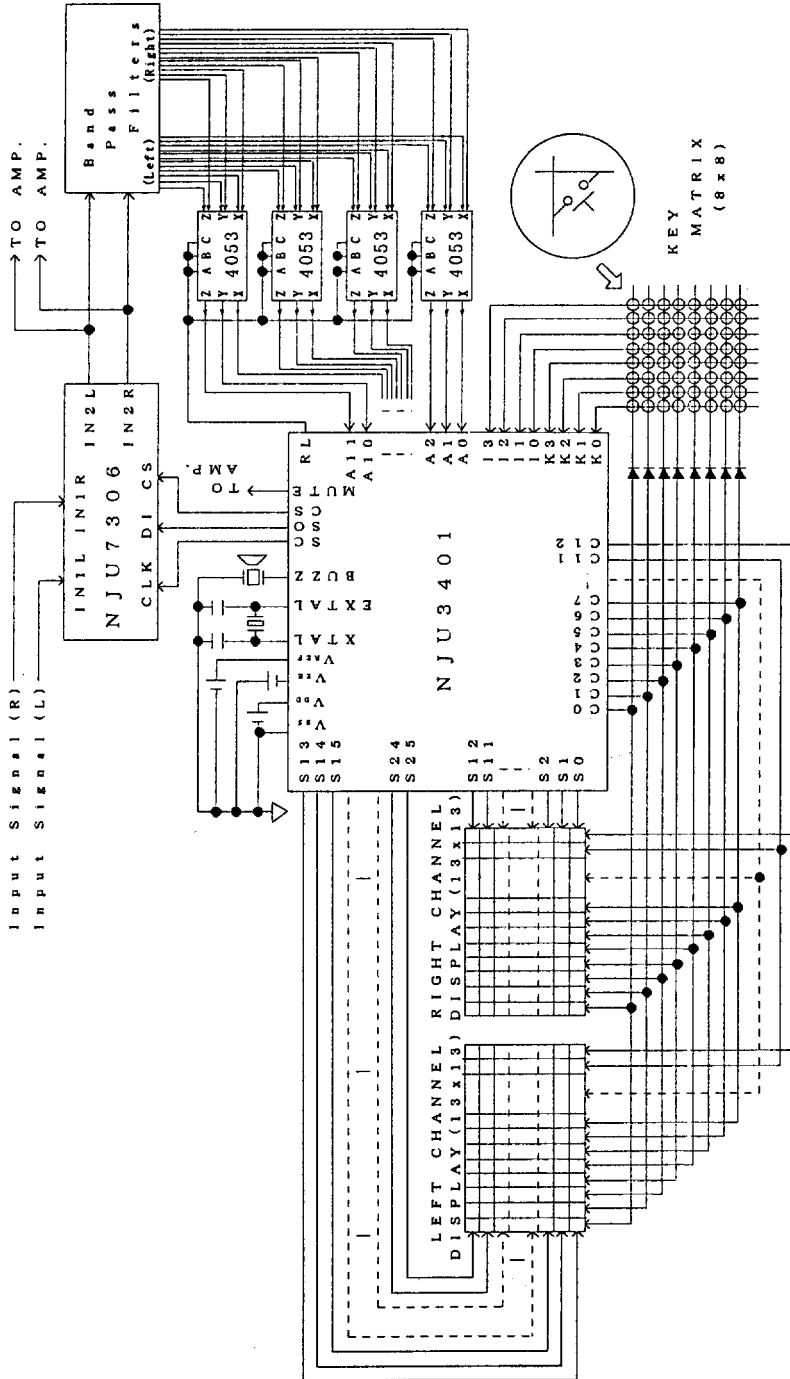

**■ A/D CONVERTER CHARACTERISTICS**
 $(V_{DD}=+5V \pm 10\%, V_{SS}=0V, V_{EE}=V_{DD}-40 \sim V_{DD}, T_a=-20 \sim 75^\circ C)$ 

PARAMETER	SYMBOL	RATING	A/D Output Code	MIN	TYP	MAX	UNIT
Analog Input Voltage	$AV_{IN}$	A0~A11 terminals	—	$V_{SS}$	—	$V_{DD}$	V
Input Sensitivity (dB)	$V_i$	$V_{DD}=5V$ $V_{SS}=0V$ $V_{REF}=5V$ $f_{OSC}=3.58MHz$ $0dB=267mV$ A0~A11 terminals	0000	—	—	—	dB
			0001	-1	0	1	
			0010	1	2	3	
			0011	3	4	5	
			0100	5	6	7	
			0101	7	8	9	
			0110	9	10	11	
			0111	11	12	13	
			1000	13	14	15	
			1001	15	16	17	
			1010	17	18	19	
			1011	19	20	21	
			1100	21	22	23	
			1101	23	24	25	
Input Sensitivity (Voltage)	$V_i$	$V_{DD}=5V$ $V_{SS}=0V$ $V_{REF}=5V$ $f_{OSC}=3.58MHz$ A0~A11 terminals	0000	—	0	—	V
			0001	0.24	0.27	0.30	
			0010	0.30	0.34	0.38	
			0011	0.38	0.42	0.47	
			0100	0.47	0.53	0.60	
			0101	0.60	0.67	0.75	
			0110	0.75	0.84	0.95	
			0111	0.95	1.06	1.19	
			1000	1.19	1.34	1.50	
			1001	1.50	1.68	1.89	
			1010	1.89	2.12	2.38	
			1011	2.38	2.67	3.00	
			1100	3.00	3.36	3.77	
			1101	3.77	4.23	4.75	

NOTE) A/D output Code is the read data from A/D data register in the application program.



## APPLICATION CIRCUITS



Note1) The application software assigned four parts in the output port, "00" to "07", as "CS", "RL", "MUTE" and "BUZZ". The special port "07" can out 2kHz at  $f_{osc} = 3.58\text{Mhz}$  clock signal to drive the external buzzer.

Note2) All diodes connected to the key-matrix example require to endure against voltage over than 45 volt. The diode connection in this application example requires to ignore the roll over key operation by the application software.



## [ FL DRIVER APPLICATION CIRCUIT ]

