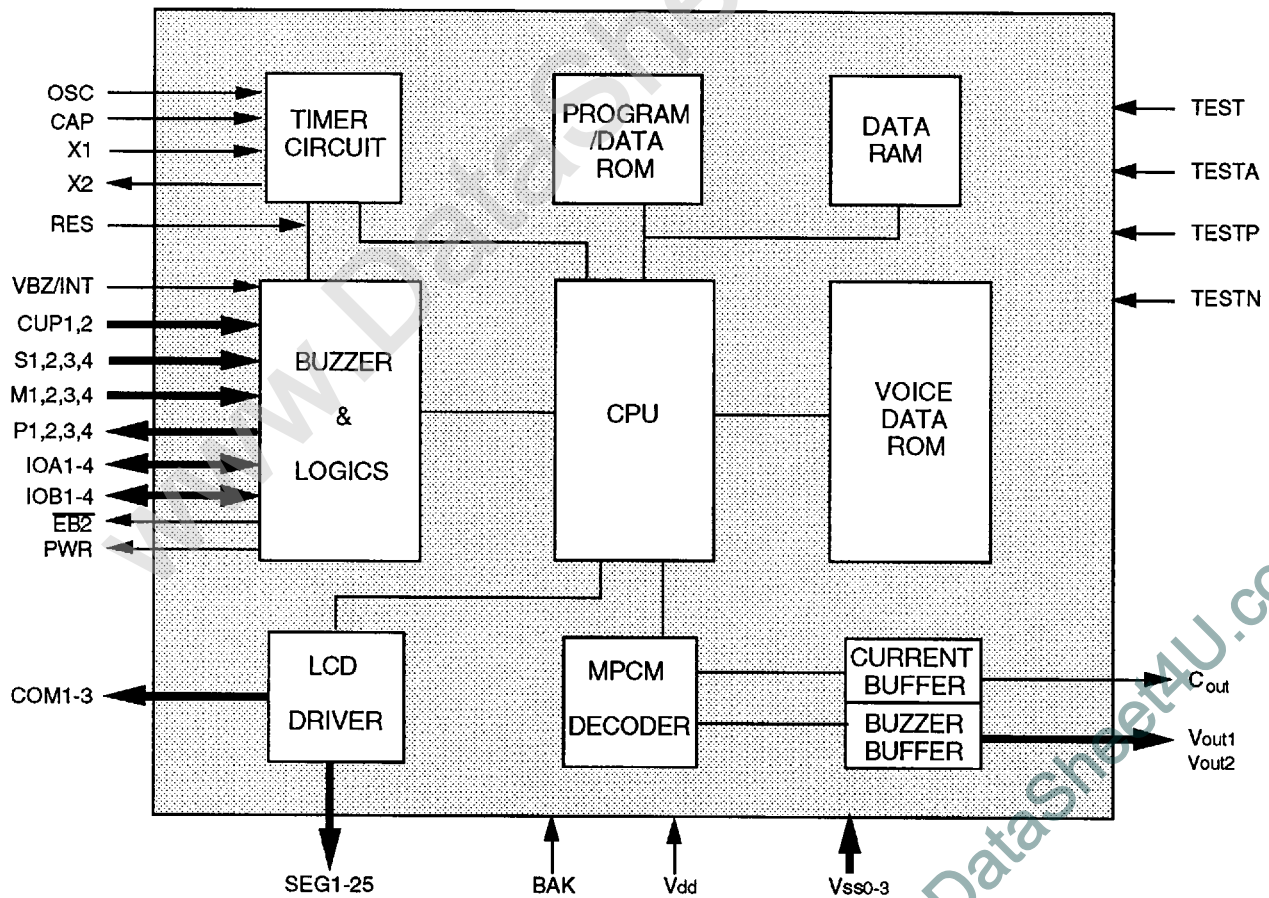


General Description

The MSU3031/U3041 is a monolithic talking microcomputer that can memorize voice up to 90/120 seconds using MOSEL qualified coding method(MPCM). It's an integration of traditional 4-bit microcomputer and voice chip with minimal external components. LCD driver and miscellaneous interface are provided for versatile applications. With more than 10K ROM/RAM inside, this chip meets every intelligent novelty. Customer requested function and voice data will be built in by changing masks during fabrication.

Block Diagram



Hardware Features

- Low current consumption
- Maximal function with minimal cost
- Current output could drive 8 ohm speaker with a transistor, Vout could drive buzzer directly.
- The voice content is stored up to 120 seconds at 6 KHz (B0000h) and 90 seconds (81000h) and can be separated to 256 sections.
- Duration of each section can be different and is multiples of 100h.
- Duration of section with appended memory-less mute is up to 40 seconds (10000h).
- Each trigger can access a sentence, up to 256 sentences could be access. 1024 entry count are provided.
- Auto ramp up and ramp down.
- Halt mode is provided.
- LCD driver provided, can drive up to 75 segments
- Built-In clock generator
- Built-In doubler, halver, tripler
- Internal program ROM : 1024 x 15 bits;
Internal program RAM : 64 x 4 bits
- Two 4-bit input ports
- Two 4-bit input/output ports
- One 4-bit output port

Software Features

- 73 instructions, in 42 categories
- 4-level subroutine nesting (also used for interrupt)
- Two external factors (INT, S&M) for interrupt
- Two internal factors (timer, divider) for interrupt

Sample Applications

- handy game with LCD
- versatile timepiece with LCD
- talking timer with LCD
- intelligent calculator with LCD
- smart stationery with LCD
- talking home electronics with LCD
- talking education kit with LCD

Development Supports

- Development tools are provided
- Software / Hardware programming guide is provided
- Engineering sample could be provided

MSM9068 Developing Card
MSM9088 Program code emulation board
MSM9018 120" Sound emulation board

Mask Options

- mask option for either open or hold transistor on S port & M port
- mask option for either pull down or put up on Interrupt switch
- mask option for either leading edge or trailing edge on Interrupt edge
- mask option for either power back-up activated or not when power on
- mask option for either with reset or not when power on
- mask option for either 8 ms or 2 ms chattering removal time on S port & M port
- mask option for either slow (by 15.625 ms) or fast (by 224.14 us) set time timer
- mask option for either fast system clock (F_{osc}) or slow system clock ($F_{osc} / 2$)
- LCD display frequency : (1) 128 Hz /170.7 Hz (2) 64Hz /85.3 Hz (3) 32Hz /42.7Hz
- LCD driver : (1) static (2) 1/2 bias 1/2 duty (3) 1/2 bias 1/3 duty

Signal Summary

Pad #	PLCC #	Signal		I/O	Functions
		Vdd1	1	Power	Positive power supply for CPU function block
		Vreg	1	O	Voltage regulator
		CUP1,2	2	I	Voltage doubler capacitor
		X1	1	I	Crystal Oscillator input, 32768 Hz
		X2	1	O	Crystal Oscillator Output, 32768 Hz
		COM1	1	O	Common plate for LCD panel
		SEG1-25	25	O	25 segment outputs for LCD panel
		COM3,2	2	O	Common plate for LCD panel
		BAK	1	Power	Negative power supply
		Vss1,2	2	Power	BackUp negative power supply
		S4,S3	2	I	One-way input port; note 1
		ALM	1	O	Output port
		LGT	1	O	Output port
		IOA1-4	4	I/O	Bidirectional Input / output port
		RES	1	I	System reset
		Vdd2	1	Power	Positive supply for voice function block, internally connected to pad Vdd1
		Rosc	1	I	Oscillator Resistor for voice function block
		Vss3	1	Power	Negative power supply for voice signal
		Cout	1	O	Audio signal current output
		Vout1,2	2	O	Audio signal voltage output
		IOB1,2,3	3	I/O	Bidirectional Input / Output port
		TG6	1		
		IOB4	1	I/O	Bidirectional Input / Output port
		TG7	1		
		VBZ/INT	1	I/O	Busy status output; internally connected to INT (interrupt request) pin of CPU
		P1,2,3,4	4	O	One-way output port, 4 bits
		M1,2,3,4	4	I	One-way input port; note 1
		NC	1	NC	No connection
		S2,1	2	I	One-way input port, note 1

Note 1. with chatter removal time for either 8 ms (ph8) or 2 ms (ph6)

Signals

Cout

Cout is tristate during standby.

Cout has zero current output when sound data is zero. Cout has full current output when sound data is the highest. Cout has half of full current output when sound is silence at middle data value. Cout has half of full current output when playing sound at appended memory-less mute.

The bypass Cout Resistor is used to bypass the audio output current from Cout. This bypassing extra current to ground gives a way to prevent the saturation of audio waveform amplified by transistor. This Resistance is 470 ohm typically. It always is not very small. Or user can let it open if the transistor has a fair beta value.

A transistor with beta value 150 is sufficient for typical applications. Larger beta value get larger sound but may have the amplified waveform saturated.

Vout1, Vout2

They are tristate during standby state.

These two pins can drive buzzer directly. The piezo buzzer used should have its resonant frequency at the center of your sound frequency domain or you are unable to play you sound good by this buzzer.

For instance, you have your sound spans over frequency from 100 Hz through 1 KHz. A buzzer with resonant frequency at 300 Hz will play this sound good. A buzzer with resonant frequency at 1 KHz will distort the sound very much because that most of the energy of the playback sound is unable to be played by this buzzer.

Terms

To be available

AC Characteristics at 4.5 V & 6 KHz S.R.

Timing		Min.	Typ.	Max.	Remarks
T _W	Write Enable pulse width	300ns	—	—	SRD
T _H	Trigger address hold time	80ns	—	—	SRD
T _S	Trigger address setup time	220ns	—	—	SRD
T _{WB}	Write Enable to BUSY delay time	—	—	1 us	SRD
T _{WA}	Write Enable to Audio delay time	—	—	500us	SRD

SRD := Sample Rate Dependent

Absolute Maximum Rating (Vdd=3.0V, Vss=Vss2=0.0V, Vss3=0.0V/-1.5V)

Symbol	Rating	Unit
Vss1	1.2-1.8	V
BAK	0.0-0.6	V
Vreg	0.0-0.6	V
CAP	Vreg-Vd	V
X1	Vreg-Vdd	V
S1,2,3,4	Vss-Vdd	V
M1,2,3,4	Vss-Vdd	V
(IOA1,2,3,4)TG0,1,2,3	Vss-Vdd	V
IOB1,2,3,4	Vss-Vdd	V
VBZ/INT	Vss-Vdd	V
RESET	Vss-Vdd	V

Symbol	Rating	Unit
Rosc	Vss-Vdd	V
X2	Vreg-Vdd	V
PWR(ALM)	Vss-Vdd	V
#EB2	Vss-Vdd	V
P1,2,3,4	Vss3-Vdd	V
SEG1-25	Vss3-Vdd	V
COM1,2,3	Vss3-Vdd	V
CUP1,2	Vss3-Vdd	V
Vout1,2	Vss-Vdd	V
T(operating)	-60+60	Degree C
T(storage)	-55+125	Degree C

Common Plate Usage

	Static	1/2 duty	1/3 duty
COM1	V	V	V
COM2	-	V	V
COM2	-	-	V
Alternating Frequency	32 Hz	32 Hz	43 Hz

DC Characteristics at 3.0 Vdd

Symbol	Name	Valid	Min.	Typ.	Max.	Unit	Remarks
I _{sb}	stand by I	V _{dd}	-	1	-	uA	
I _{op}	operation I	V _{dd}	-	100	-	uA	
I _{ohv}	output high I	V _{outs}	-	-	-	mA	
I _{oLv}	output low I	V _{outs}	-	-	-	mA	
I _{co}	current output	C _{out}	-	2.5	-	mA	
		C _{out}	-	-	-	mA	
d F/F	frequency stability		-5	-	5	%	[Fosc(3.0V)-Fosc(2.7V)]/Fosc(3.0V)
d F/F	frequency variation		-10	-	10	%	6 KHz S.R., 680 kohm R _{osc}
R _{osc}	oscillation R	R _{osc}	-	680	-	kohm	S.R.=6000 Hz
		R _{osc}	-	620	-	kohm	S.R.=8000 Hz

DC Characteristics at 4.5 Vdd

Symbol	Name	Valid	Min.	Typ.	Max.	Unit	Remarks
I _{sb}	stand by I	V _{dd}	-	1	-	uA	
I _{op}	operation I	V _{dd}	-	500	-	uA	
I _{ohv}	output high I	V _{outs}	-	-	-	mA	
I _{oLv}	output low I	V _{outs}	-	-	-	mA	
I _{co}	current output	C _{out}	-	4	-	mA	
		C _{out}	-	-	-	mA	
V _{ohp}	o/p high V	P port	*-0.4V	-		V	I _{oh} = -400 uA
V _{oLp}	o/p low V	P port		-	*+0.4V	V	I _{oL} = 400 uA
V _{ohw}	o/p low V	PWR	*-0.4V	-		V	I _{oh} = -1 mA
V _{oLw}	o/p high V	PWR		-	*+0.4V	V	I _{oL} = 1 mA
V _{ohio}	o/p low V	i/o port	*-0.4V	-		V	I _{oh} = -100 uA
V _{oLio}	o/p high V	i/o port		-	*+0.4V	V	I _{oL} = 100 uA
V _{ohc}	o/p low V	Com	*-0.4V	-		V	I _{oh} = -4 uA
V _{oLc}	o/p high V	Com		-	*+0.4V	V	I _{oL} = 4 uA
V _{ohg}	o/p low V	Seg's	*-0.4V	-		V	I _{oh} = -0.4 uA
V _{oLg}	o/p high V	Seg's		-	*+0.4V	V	I _{oL} = 0.4 uA
d F/F	frequency stability		-5	-	5	%	[Fosc(4.5V)-Fosc(4.0V)]/Fosc(4.5V)
d F/F	frequency variation		-10	-	10	%	6 KHz S.R., 680 kohm R _{osc}
R _{isn}	input R when on	S port	-	330	-	kohm	pull-down X'tor=on & note 1
R _{isf}	input R when off	S port	-	30	-	kohm	pull-down X'tor=off, halt mode & note 1
R _{imn}	input R when on	M port	-	30	-	kohm	pull-down X'tor=on & note 1
R _{imf}	input R when off	M port	-	30	-	kohm	pull-down X'tor=off, halt mode & note 1
R _{inh}	input R	VBZ,INT	-	140	-	kohm	V _{ss2} =0V, V _i =V _{dd} , VBZ=high
R _{inL}	input R	VBZ,INT	-	3	-	kohm	V _{ss2} =0V, V _i =V _{dd} , VBZ=low
R _{ir}	input R	RESET	-	18	-	kohm	V _{ss2} =0V, V _i =V _{dd}
R _{osc}	oscillation R	R _{osc}	-	680	-	kohm	S.R.=6000 Hz
		R _{osc}	-	620	-	kohm	S.R.=8000 Hz

Note 1. V_{ss2}=0V, V_i=V_{ss2}+0.4V

Note 2. *:= V_{dd}

Instruction Set Summary

Syntax	Description
1 ADC A,Rm	Addition with Carry
2 ADC Wn,d	"
3 ADCS A,Rm	ADC and store
4 ADCS Wn,d	"
5 ADD A,Rm	addition
6 ADD Wn,d	"
7 ADDS A,Rm	ADD and store
8 ADDS Wn,d	"
9 ADL A,Rm	addition logical
10 ADL Wn,d	"
11 ADLS A,Rm	ADL and store
12 ADLS Wn,d	"
13 AND A,Rm	move the AND result to Accumulator
14 AND Wn,d	"
15 ANDS A,Rm	AND and store
16 ANDS Wn,d	"
17 CALL d10	call the subroutine at address d10
18 CLRM d7	turn the #EB2 and clear modes
19 CLRS d9	clear setting
20 HALT	halt the processor
21 IN Rm,PA	input to Rm from port A
22 IN Rm,PB	input to Rm from port B
23 IN Rm,PS	input to Rm from port S
24 IN Rm,PM	input to Rm from port M
25 INM Rm,PA	input to Rm and setting
26 INM Rm,PB	"
27 JC d10	jump if Carry set
28 JMP d10	jump absolute
29 JNC d10	jump if non-Carry
30 JNZ d10	jump if non-zero
31 JPK d10	jump on bit k value
32 JZ d10	jump if zero
33 MOV Hl,d8	move data to HIB
34 MOV PH,d5	move data to port halt interrupt release byte
35 MOV Rm,SR2	move ESR to register Rm
36 MOV Rm,SR1	"
37 MOV A,Rm	move data to Accumulator from Rm
38 MOV Rm,A	move data from Accumulator to Rm
39 MOV Wn,Rm	move Rm to Accumulator and Wn
40 MOV CF,Rm	move data from Rm3 to Carry flag

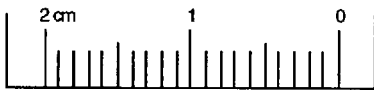
Instruction Set Summary (Continued)

Syntax	Description
41 MOV Rm,d	move data to Accumulator and Rm
42 MOV Rm,Wn	"
43 MOV ALM,00h	activate a sentence out of 256
44 MOV TM,d6	move data to timer and start
45 MOV Rm,CF	move data from Carry flag
46 MOV IC,d4	move data to interrupt control byte
47 NOP	no operation
48 OR A,Rm	move the OR result to Accumulator
49 OR Wn,d	"
50 ORS A,Rm	OR and store
51 ORS Wn,d	"
52 OUT PA,Rm	output from Rm and setting
53 OUT PB,Rm	"
54 OUT PP,Rm	output data to port P
55 OUTS Rm,d	output data to port P serially
56 RET	return from subroutine
57 SBC A,Rm	subtraction with Carry
58 SBC Wn,d	"
59 SBCS A,Rm	SBC and store
60 SBCS Wn,d	"
61 SETM d7	turn the #EB2 and set modes
62 SL0 Rm	shift register left and moving
63 SL1 Rm	"
64 SR0 Rm	shift register and moving
65 SR1 Rm	"
66 SUB A,Rm	subtraction
67 SUB Wn,d	"
68 SUBS A,Rm	SUB and store
69 SUBS Wn,d	"
70 XOR A,Rm	move the XOR result to Accumulator
71 XOR Wn,d	"
72 XORS A,Rm	XOR and store
73 XORS Wn,d	"

COB Information I

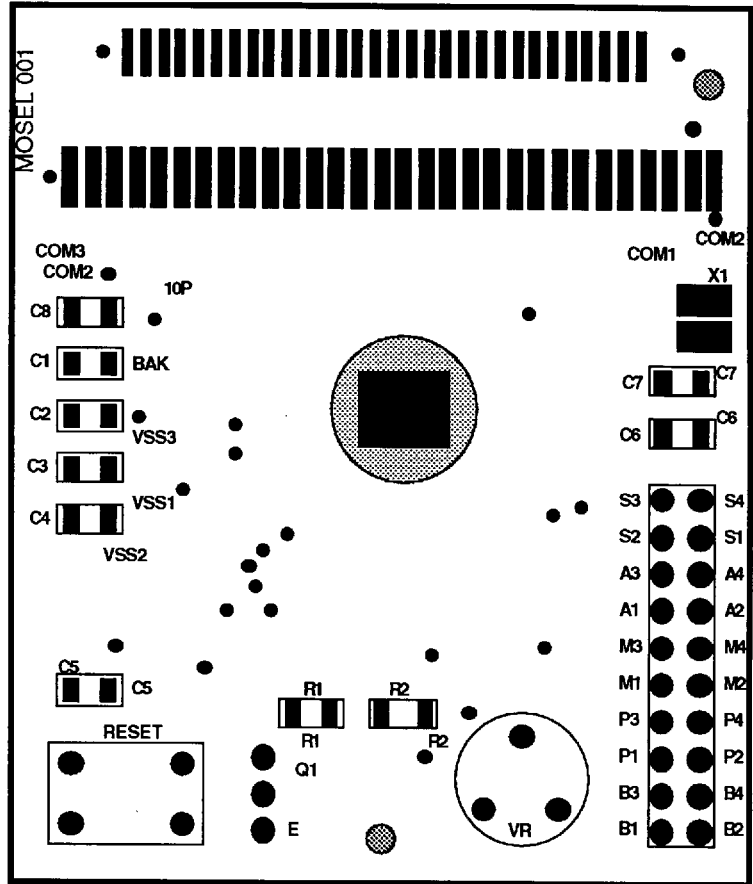
Silk screen & copper print

COB model number : MOSEL 001
 Chip bonded : either U3031 or U3041



Legend

- Copper pad for X'tal
- Copper pad for LCD
- Copper pad for LCD
- Copper pad
- Through hole
- Through hole
- Alignment hole for Jig

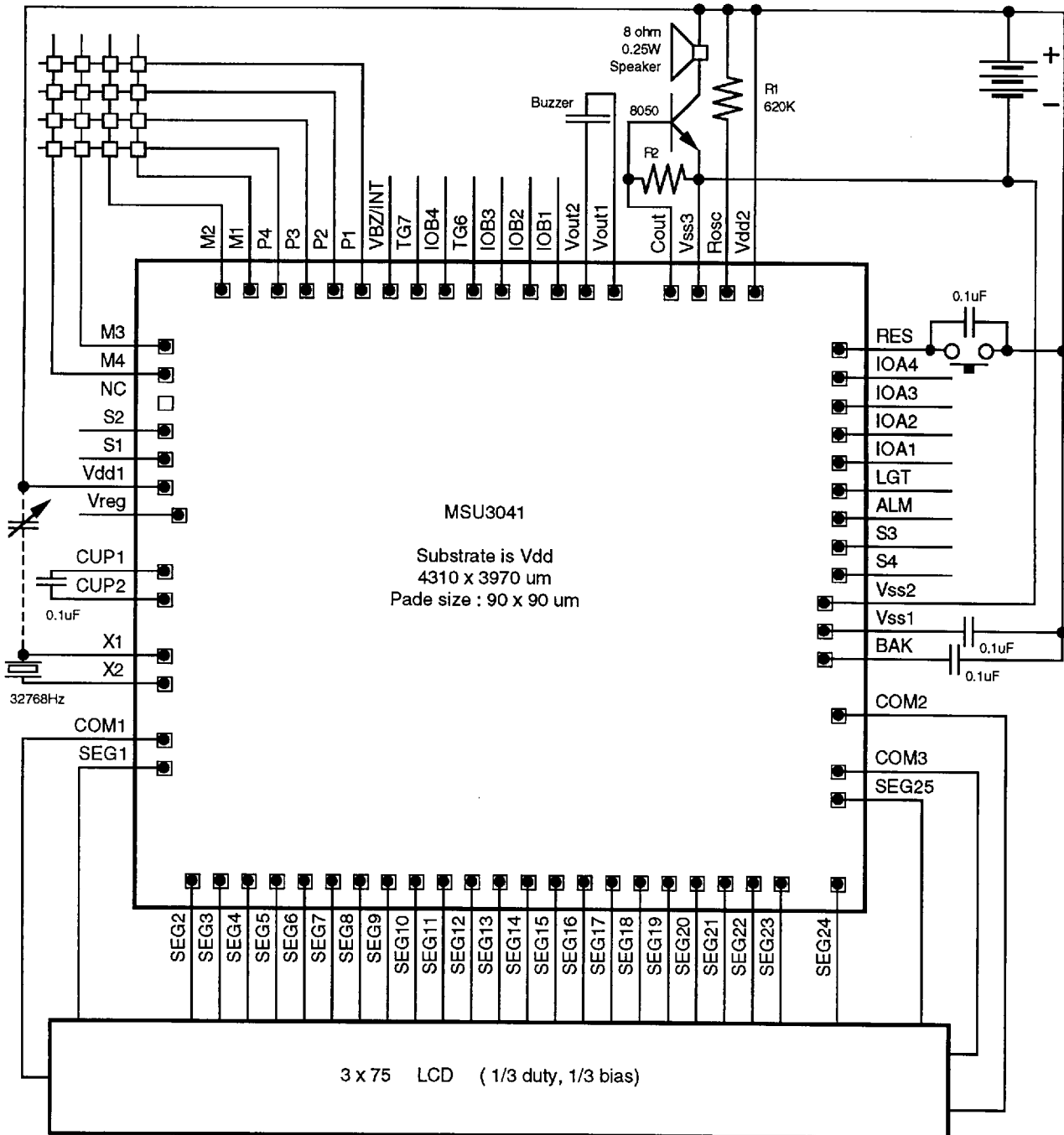


Timing Diagram

To be Available soon

Standard Code Line Up

To be Available soon



Note: All the above components need to adjust possibly case by case to meet required performance.

Bonding Pad Information

<u>Pad No.</u>	<u>Designation</u>	<u>X</u>	<u>Y</u>	<u>Pad No.</u>	<u>Designation</u>	<u>X</u>	<u>Y</u>
	Vdd1	-1995	629		LGT	1985	519
	VREG	-1962	467		IOA1	1985	700
	CUP1	-1994	56		IOA2	1985	846
	CUP2	-1994	-158		IOA3	1985	1011
	X1	-1995	-464		IOA4	1985	1156
	X2	-1995	-633		RES	1986	1349
	COM1	-1995	-955		Vdd2	1460	1827
	SEG1	-1995	-1138		ROSC	1300	1827
	SEG2	-1775	-1827		Vss3	1080	1827
	SEG3	-1618	-1827		COUT	920	1827
	SEG4	-1450	-1827		VOUT1	625	1826
	SEG5	-1294	-1827		VOUT2	408	1826
	SEG6	-1126	-1827		IOB1	254	1826
	SEG7	-970	-1827		IOB2	87	1826
	SEG8	-801	-1827		IOB3	-58	1826
	SEG9	-645	-1827		TG6	-229	1827
	SEG10	-477	-1827		IOB4	-387	1826
	SEG11	-321	-1827		TG7	-560	1827
	SEG12	-153	-1827		VBZ/INT	-720	1826
	SEG13	3	-1827		P1	-887	1826
	SEG14	171	-1827		P2	-1033	1826
	SEG15	327	-1827		P3	-1198	1826
	SEG16	495	-1827		P4	-1344	1826
	SEG17	651	-1827		M1	-1525	1827
	SEG18	820	-1827		M2	-1685	1827
	SEG19	976	-1827		M3	-1995	1479
	SEG20	1144	-1827		M4	-1995	1319
	SEG21	1300	-1827		NC	-1995	1146
	SEG22	1468	-1827		S2	-1995	949
	SEG23	1625	-1827		S1	-1995	789
	SEG24	1995	-1747				
	SEG25	1995	-1127				
	COM3	1995	-943				
	COM2	1995	-707				
	BAK	1908	-416				
	Vss1	1908	-275				
	Vss2	1932	-129				
	S4	1986	31				
	S3	1986	191				
	ALM	1985	373				

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