TM8795

4-Bit Microcontroller

Data Sheet

AMENDMENT HISTORY

Version	Date	Description
V1.0	April, 2003	New release
V1.1	May, 2003	Add Typical Application Circuit.
V1.2	April, 2004	Add Allowable Operating Frequency.
V1.3	Dec, 2011	Add Ordering Information table

CONTENTS

GENERAL DESCRIPTION

The TM8795 is an One Time PROM embedded high-performance 4-bit microcomputer with LCD/LED driver. It contains all the functions in TM87-series for 3V/5V appication.

FEATURE (define by Project)

1. Powerful instruction set.
   - Binary addition, subtraction, BCD adjust, logical operation in direct and index addressing mode.
   - Single-bit manipulation (set, reset, decision for branch).
   - Various conditional branch.
   - 16 working registers and manipulation.
   - Table look-up.
   - LCD driver data transfer.
2. Memory capacity.
   - Max. Program ROM capacity 4096 x 16 bits
   - Max. Index ROM capacity 4096 x 8 bits
   - Max. Data RAM capacity 1024 x 4 bits.
3. Input/output ports.
   - Port IOA 4 pins (with internal pull-low, chattering prevention clock).
   - Port IOB 4 pins (with internal pull-low).
   - Port IOC 4 pins (with internal pull-low, low-level-hold, chattering prevention clock).
   - Port IOD 4 pins (with internal pull-low, chattering prevention clock).
4. 8 level subroutine nesting.
5. Interrupt function.
   - External factor 5 (INT pin, Port IOA,C,D & KI input).
   - Internal factor 4 (Pre-Divider, Timer1,Timer2 & RFC).
6. Built-in EL-light driver.
   - ELC, ELP (Mux with IOB1 IOB2).
7. Built in Alarm, Frequency or Melody generator.
8. BZB, BZ (Mux with IOB3 IOB4).
9. Built-in R to F Converter circuit.
   - CX, RR, RT, RH (Mux with IOA1~IOA4).
10. Built in KEY_BOARD scanning function.
    - K1~K16 (Share with SEG1~SEG16).

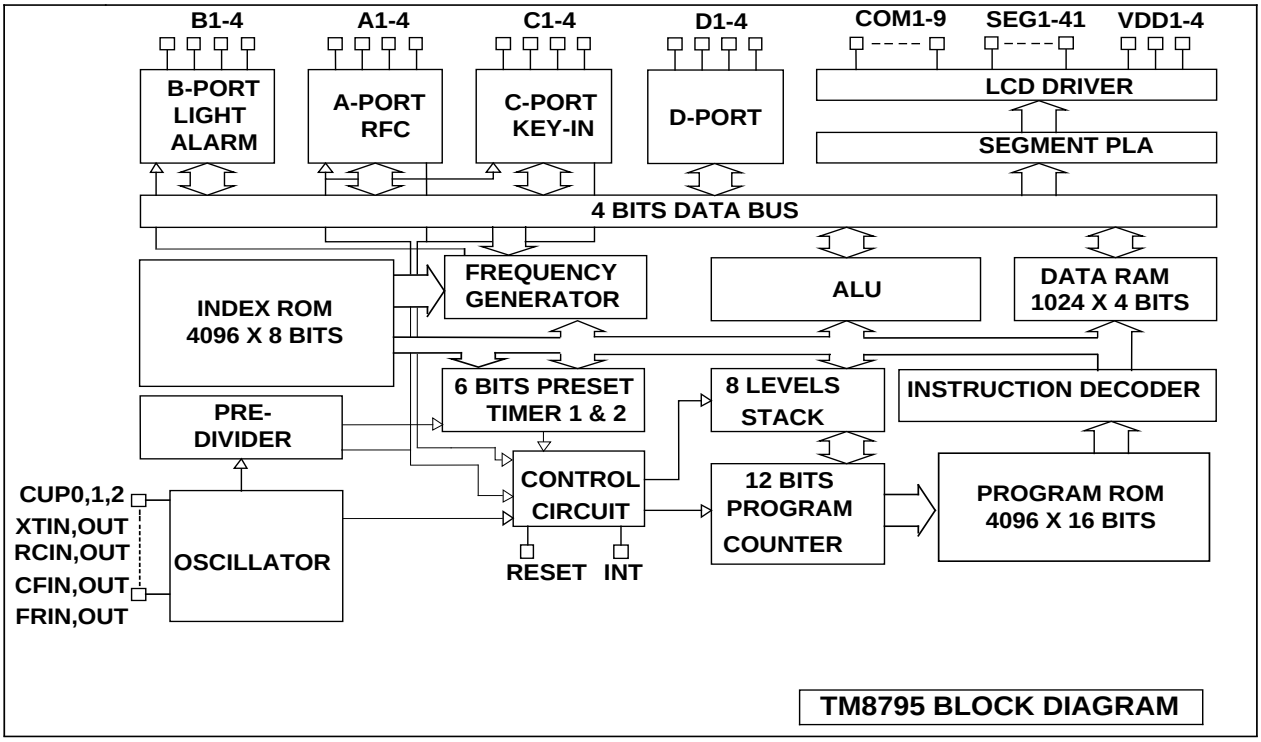
- KI1~KI4 (Mux with IOC1~IOC4).

11. Two 6-bit programmable timer with programmable clock source.
12. Watch dog timer.
13. LCD driver output.
    - 41 LCD/LED driver outputs (up to 369 LCD segment drivable).
    - 1/2 Duty~1/9 Duty for both LCD selected by option.
    - 1/2 Bias ~1/4 Bias for LCD selected by option.
    - Single instruction to turn off all segments.
    - Option is used to select COM5~9,SEG1~41 as DC outputs/P_open drain.
14. Built-in Voltage doubler, halver charge pump circuit.
15. Dual clock operation, and slow oscillation can set X'tal or external R&C by switch option, and fast oscillation can set 3.58MHz ceramic resonator or external R by switch option.
16. HALT function.
17. STOP function.
18. ROM code protect fuse.

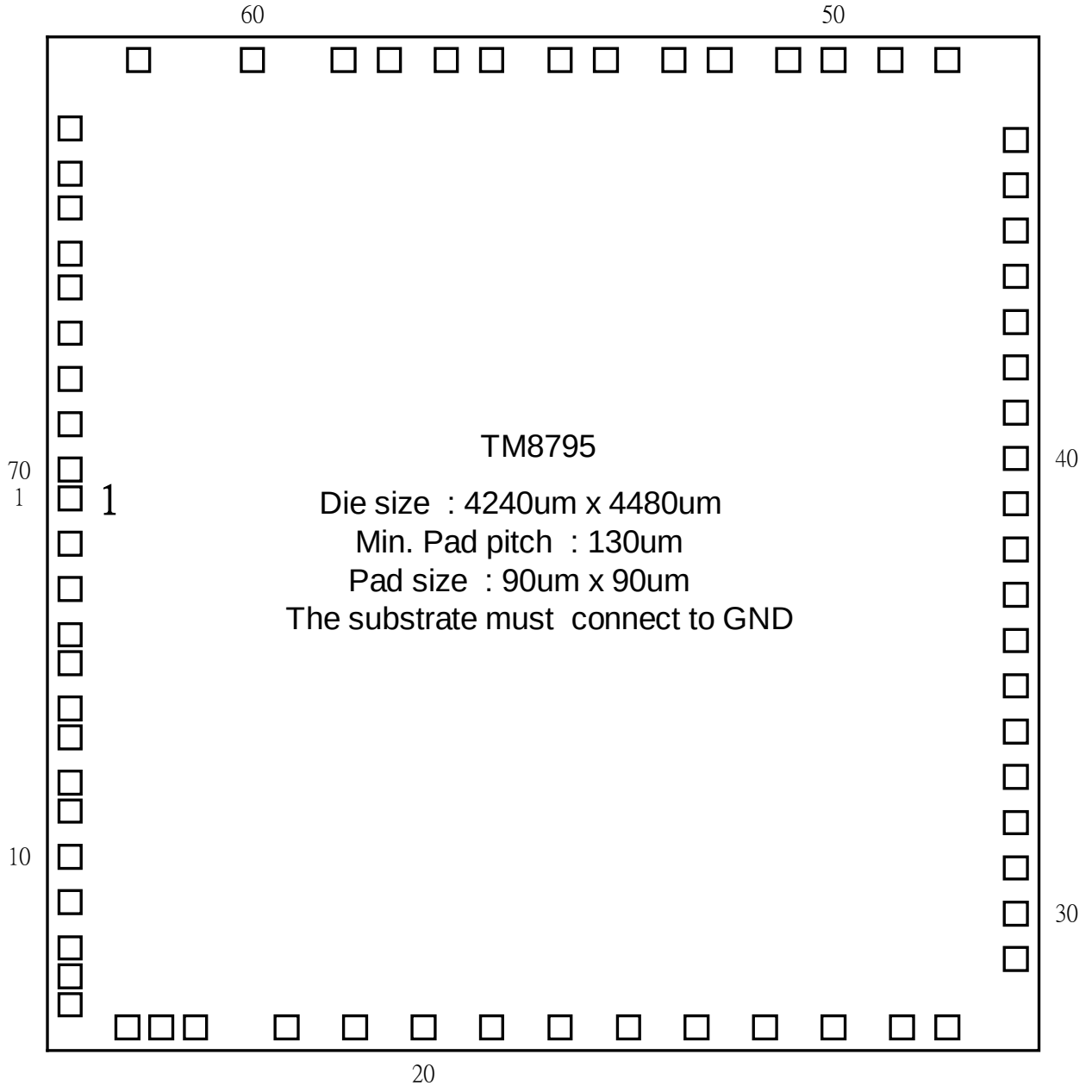
APPLICATION

■ Timer / Calendar / Calculator / Thermometer

BLOCK DIAGRAM



PAD DIAGRAM


60
50
70
1
1
40
10
30
20
TM8795
Die size : 4240um x 4480um
Min. Pad pitch : 130um
Pad size : 90um x 90um
The substrate must connect to GND

PIN ASSIGNMENT

No	Name	X	Y	No	Name	X	Y
1	XIN	93.00	2429.10	36	SEG10(K10)	4147.00	1796.30
2	XOUT	93.00	2261.60	37	SEG11(K11)	4147.00	2001.90
3	RCIN	93.00	2094.10	38	SEG12(K12)	4147.00	2206.10
4	RCOUT	93.00	1908.45	39	SEG13(K13)	4147.00	2411.70
5	FRIN	93.00	1764.10	40	SEG14(K14)	4147.00	2615.90
6	FROUT	93.00	1565.30	41	SEG15(K15)	4147.00	2821.50
7	CFIN	93.00	1429.10	42	SEG16(K16)	4147.00	3025.70
8	CFOUT	93.00	1230.30	43	SEG17	4147.00	3231.30
9	GND	93.00	1097.20	44	SEG18	4147.00	3435.50
10	VDD1	93.00	887.20	45	SEG19	4147.00	3641.10
11	VDD(2)	93.00	677.20	46	SEG20	4147.00	3845.30
12	VPP	93.00	465.20	47	SEG21	4147.00	4051.20
13	VDD3	93.00	335.20	48	SEG22	3858.30	4387.00
14	VDD4	93.00	201.00	49	SEG23	3604.10	4387.00
15	CUP0	357.25	93.00	50	SEG24/IOA1/CX	3348.30	4387.00
16	CUP1	533.25	93.00	51	SEG25/IOA2/RR	3170.30	4387.00
17	CUP2	709.25	93.05	52	SEG26/IOA3/RT	2861.30	4387.00
18	COM1	1053.70	93.00	53	SEG27/IOA4/RH	2683.30	4387.00
19	COM2	1342.80	93.00	54	SEG28/IOB1/ELC	2401.70	4387.00
20	COM3	1631.90	93.00	55	SEG29/IOB2/ELP	2199.10	4387.00
21	COM4	1921.00	93.00	56	SEG30/IOB3/BZB	1944.90	4387.00
22	COM5	2210.10	93.00	57	SEG31/IOB4/BZ	1742.30	4387.00
23	COM6	2499.20	93.00	58	SEG32/IOC1/KI1	1471.60	4387.00
24	COM7	2788.30	93.00	59	SEG33/IOC2/KI2	1254.40	4387.00
25	COM8	3077.40	93.00	60	SEG34/IOC3/KI3	922.20	4387.00
26	COM9	3366.50	93.00	61	SEG35/IOC4/KI4	483.00	4387.00
27	SEG1(K1)	3667.20	93.00	62	SEG36/IOD1	93.00	4074.10
28	SEG2(K2)	3871.40	93.00	63	SEG37/IOD2	93.00	3869.90
29	SEG3(K3)	4147.00	362.70	64	SEG38/IOD3	93.00	3717.30
30	SEG4(K4)	4147.00	566.90	65	SEG39/IOD4	93.00	3513.10
31	SEG5(K5)	4147.00	772.50	66	SEG40	93.00	3350.85
32	SEG6(K6)	4147.00	976.70	67	SEG41	93.00	3146.65
33	SEG7(K7)	4147.00	1182.30	68	RESET	93.00	2934.85
34	SEG8(K8)	4147.00	1386.50	69	INT	93.00	2759.10
35	SEG9(K9)	4147.00	1592.10	70	TEST	93.00	2565.30

PIN DESCRIPTION

Name	I/O	Description
VDD1,2,3,4	P	LCD supply voltage, and positive supply voltage. Connect +3.0V battery positive pin to VDD2. Above 4.0V is need to VDD2,4 for Serial Program/Read Mode.
RESET	I	Input pin from LSI reset request signal, with internal pull-down resistor. Instruction Reset Time can select “PH15/2” or “PH12/2” by option. Reset Type can select “Level” or “Pulse” by option. Control Signal for Serial Program/Read Mode.
INT	I I/O	Input pin for external INT request signal. Falling edge or rising edge triggered by option. Internal pull-down or pull-up resistor be selected by option. Serial Data for Serial Program/Read Mode.
TEST	I	Test signal input pin.
CUP0,1,2	O	Switching pins for supply the LCD driving voltage to the VDD1,2,3,4 pins. Connect the CUP1 and CUP2 pins with non-polarized electrolytic capacitor if 1/2 or 1/3 bias mode has been selected, and also connect CUP0 and CUP1 pins with non-polarized electrolytic capacitor if 1/4 bias mode has been selected. In no BIAS mode, these pins should be open.
XIN XOUT	I O	32KHz Crystal oscillator for Slow Clock.
RCIN RCOUT	I O	External R&C oscillator for Slow Clock.
CFIN CFOUT	I O	3.58MHz ceramic resonator oscillator for Fast Clock .
FRIN FROUT	I O	External R oscillation or Fast Clock.
COM1~9	O	Output pins for driving the common pins of the LCD or LED panel. COM5~8 is muxed with DC/Open Drain, and set mask option
SEG1-41	O	Output pins for driving the LCD or LED panel segment.
IOA1-4	I/O	Input / Output port A, can use software to define internal pull-low Resistor, And Chattering clock to reduce input bounce. This port is muxed with SEG24~27 / CX,RR,RT,RH, and set by option.
IOB1-4	I/O	Input / Output port B, can use software to define internal pull-low Resistor. This port is muxed with SEG28~31 / ELC,ELP,BZB,BZ, and set by option.
IOC1-4	I/O	Input / Output port C, can use software to define internal pull-low / low-level-hold Resistor and Chattering clock to reduce input bounce. This port is muxed with SEG32~35 / KI1~4, and set by option.
IOD1-4	I/O	Input / Output port D, can use software to define internal pull-low Resistor, and Chattering clock to reduce input bounce. This port is muxed with SEG36~39 , and set by option.
(RFC) CX RR/RT/RH	 I O	1 input pin and 3 output pins for RFC application. This port is muxed with SEG24~27 / IOA1~4, and set by option.
(EL) ELC/ELP	 O	Output port for EL-light. This port is muxed with SEG28~29 / IOB1~2, and set by option.
(ALM) BZB/BZ	 O	Output port for alarm, frequency or melody generator This port is muxed with SEG30~31 / IOB3~4, and set by option.
KI1~4	I	Keyboard scanning input port. This port is muxed with SEG32~35 / IOC1~4, and set by option.
GND	P	Negative supply voltage. Connect for Serial Program/Read Mode.

Serial Program/Read Connect Pins :

VPP, VDD2, GND, RESET, INT

ABSOLOUTE MAXIMUM RATINGS

(GND= 0V)

Name	Symbol	Range	Unit
Maximum Supply Voltage	VDD1	-0.3 to 5.5	V
	VDD2	-0.3 to 5.5	V
	VDD3	-0.3 to 8.5	V
Maximum Input Voltage	Vin	-0.3 to VDD1/2+0.3	V
Maximum output Voltage	Vout1	-0.3 to VDD1/2+0.3	V
	Vout2	-0.3 to VDD3+0.3	V
Maximum Operating Temperature	Topg	-20 to +70	℃
Maximum Storage Temperature	Tstg	-25 to +125	℃

POWER CONSUMPTION

at Ta=-20 ℃ to 70℃,GND= 0V

Name	Sym.	Condition	Min.	Typ.	Max.	Unit
HALT mode	IHALT	Only 32768 Crystal oscillator operating, without loading. VDD2=3.0V, BCF = 0		2	5	uA
STOP mode	ISTOP				1	uA

Note : When RC oscillator function is operating, the current consumption will depend on the frequency of oscillation.

ALLOWABLE OPERATING CONDITIONS

at Ta=-20 ℃ to 70℃,GND= 0V

Name	Symb.	Condition	Min.	Max.	Unit
Supply Voltage	VDD2		2.4	5.25	V
	VDD3		2.4	8.0	V
Oscillator Start-Up Voltage	VDDB	rystal Mode	1.3		V
Oscillator Sustain Voltage	VDDB	Crystal Mode	1.2		V
Supply Voltage	VDD2	EXT-V, Li Mode	2.4	5.25	V
Input “H” Voltage	Vih1	Li Battery Mode	VDD2-0.7	VDD2+0.7	V
Input “L” Voltage	Vil1		-0.7	0.7	V
Input “H” Voltage	Vih2	OSCIN at Li Battery Mode	0.8xVDD2	VDD2	V
Input “L” Voltage	Vil2		0	0.2xVDD2	V
Input “H” Voltage	Vih3	CFIN at Li Battery or EXT-V Mode	0.8xVDD2	VDD2	V
Input “L” Voltage	Vil3		0	0.2xVDD2	V
Input “H” Voltage	Vih4	RC Mode	0.8xVDDO	VDDO	V
Input “L” Voltage	Vil4		0	0.2xVDDO	V
Operating Freq	Fopg1	Crystal Mode	32		KHZ
	Fopg2	RC Mode	10	1000	KHZ

ALLOWABLE OPERATING FREQUENCY

at Ta=-20 ℃ to 70℃,GND= 0V

Condition	Max, Operating Frequency
BAK=3V	4MHz

INTERNAL RC FREQUENCY RANGE

VDD2=3.0V

Option Mode	Min.	Typ.	Max.
250KHz Mode	200KHz	250KHz	300KHz
500KHz Mode	400KHz	500KHz	600KHz

ELECTRICAL CHARACTERISTICS

at#1:VDD2=3.0V(Li):
at#2:VDD2=5.0V(Ext-V);

Input Resistance

Name	Symb.	Condition	Min.	Typ.	Max.	Unit
"L" Level Hold Tr(IOC)	Rllh1	Vi=0.2VDD2,#1	10	40	100	Kohm
	Rllh2	Vi=0.2VDD2,#2	5	20	50	Kohm
IOA,B,C Pull-Down Tr	Rmad1	Vi=VDD2,#1	200	500	1000	Kohm
	Rmad2	Vi=VDD2,#2	100	250	500	Kohm
INT Pull-up Tr	Rintu1	Vi=VDD2,#1	200	500	1000	Kohm
	Rintu2	Vi=VDD2,#2	100	250	500	Kohm
INT Pull-Down Tr	Rintd1	Vi=GND,#1	200	500	1000	Kohm
	Rintd2	Vi=GND,#2	100	250	500	Kohm
RES Pull-Down R	Rres1	Vi=GND or VDD2,#1	50	80	100	Kohm
	Rres2	Vi=GND or VDD2,#2	5	20	50	Kohm

at#3:VDD2=2.4V(Li):
at#4:VDD2=4.0V(Ext-V);

DC Output Characteristics

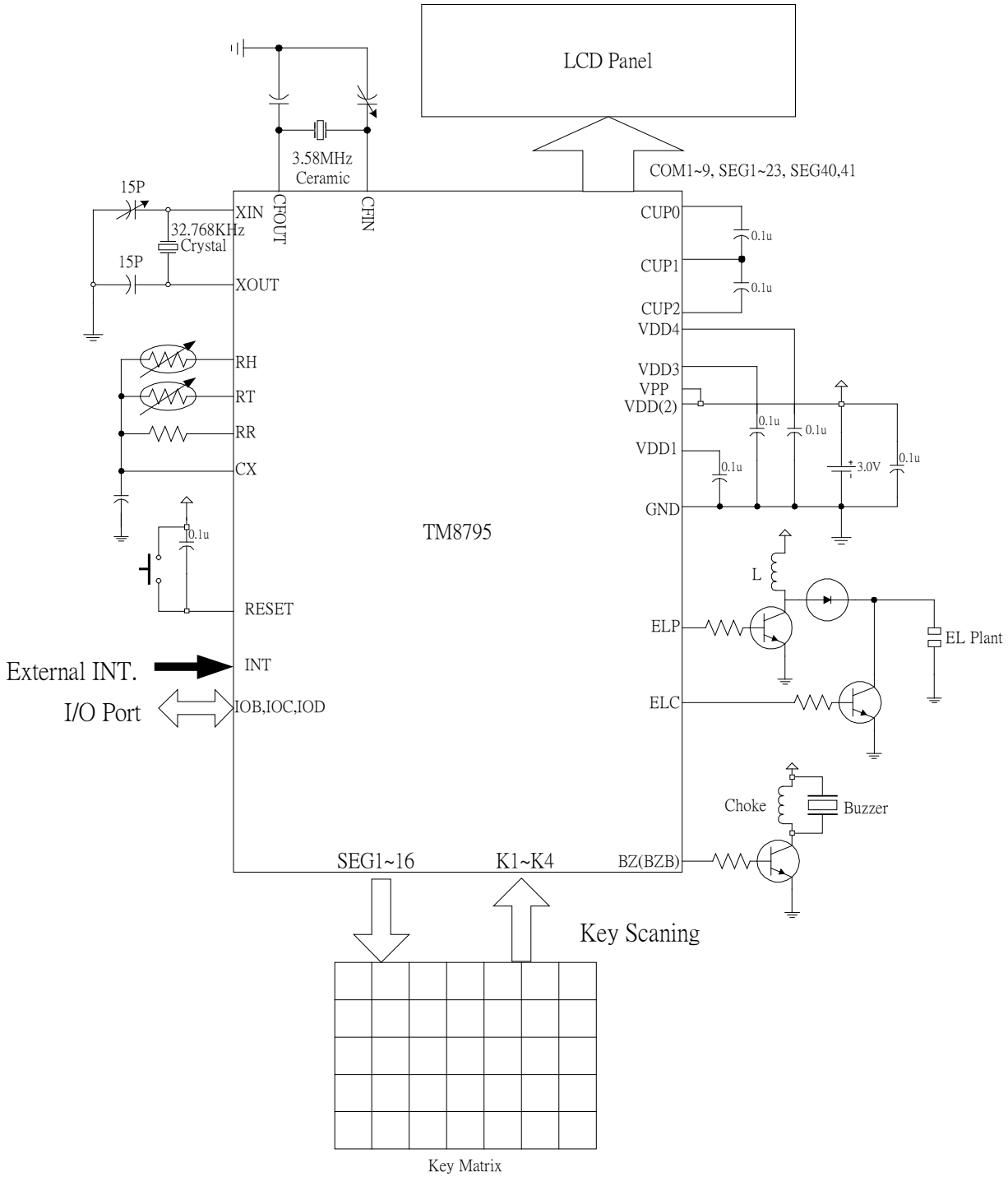
Name	Symb.	Condition	Port	Min.	Typ.	Max.	Unit
Output "H" Voltage	Voh3c	Ioh=-1mA,#3	COM5~9 SEG1~41	1.5	1.8		V
	Voh4c	Ioh=-3mA,#4		2.5	3.0		V
Output "L" Voltage	Vol3c	Iol=2mA,#3			0.6	0.9	V
	Vol4c	Iol=6mA,#4			1.0	1.5	V

Segment Driver Output Characteristics

Name	Symb.	Condition	For	Min.	Typ.	Max.	Unit.
1/2 Bias Display Mode							
Output ”H” Voltage	Voh3f	Ioh=-1uA,#3	SEG-n	2.2			V
	Voh4f	Ioh=-1uA,#4		3.8			V
Output ”L” Voltage	Vol3f	Iol=1uA,#3				0.2	V
	Vol4f	Iol=1uA,#4				0.2	V
Output ”H” Voltage	Voh3g	Ioh=-10uA,#3		2.2			V
	Voh4g	Ioh=-10uA,#4	COM-n	3.8			V
Output ”M” Voltage	Vom3g	Iol/h=+/-10uA,#3	COM-n	1.0		1.4	V
	Vom4g	Iol/h=+/-10uA,#4		1.8		2.2	V
Output ”L” Voltage	Vol3g	Iol=10uA,#3				0.2	V
	Vol4g	Iol=10uA,#4				0.2	V
1/3 Bias display Mode							
Output ”H” Voltage	Voh3i	Ioh=-1uA,#3	SEG-n	3.4			V
	Voh4i	Ioh=-1uA,#4		5.8			V
Output ”M1” Voltage	Vom13i	Iol/h=+/-10uA,#3		1.0		1.4	V
	Vom14i	Iol/h=+/-10uA,#4		1.8		2.2	V
Output ”M2” Voltage	Vom23i	Iol/h=+/-10uA,#3		2.2		2.6	V
	Vom24i	Iol/h=+/-10uA,#4		3.8		4.2	V
Output ”L” Voltage	Vol3i	Iol=1uA,#3				0.2	V
	Vol4i	Iol=1uA,#4				0.2	V
Output ”H” Voltage	Voh3j	Ioh=-10uA,#3	COM-n	3.4			V
	Voh4j	Ioh=-10uA,#4		5.8			V
Output ”M1” Voltage	Vom13j	Iol/h=+/-10uA,#3		1.0		1.4	V
	Vom14j	Iol/h=+/-10uA,#4		1.8		2.2	V
Output ”M2” Voltage	Vom23j	Iol/h=+/-10uA,#3		2.2		2.6	V
	Vom24j	Iol/h=+/-10uA,#4		3.8		4.2	V
Output ”L” Voltage	Vol3j	Iol=10uA,#3				0.2	V
	Vol4j	Iol=10uA,#4				0.2	V

TYPICAL APPLICATION CIRCUIT

This application circuit is simply an example, and is not guaranteed to work.



1/4 Bias, 1/9Duty

ORDERING INFORMATION

The ordering information:

Ordering number	Package
TM8795-COD	Wafer / Dice with code