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## GENERAL DESCRIPTION

The TM8704 is an embedded high-performance 4-bit microcomputer with LCD driver. It contains all the necessary functions, such as 4-bit parallel processing ALU, ROM, RAM, I/O ports, timer, clock generator, dual clock operation, LCD driver and look-up table in a signal chip.

## FEATURE

1. 1.5V operation only and with low power dissipation.
2. Powerful instruction set (129 instructions).
  - 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.
3. Memory capacity.

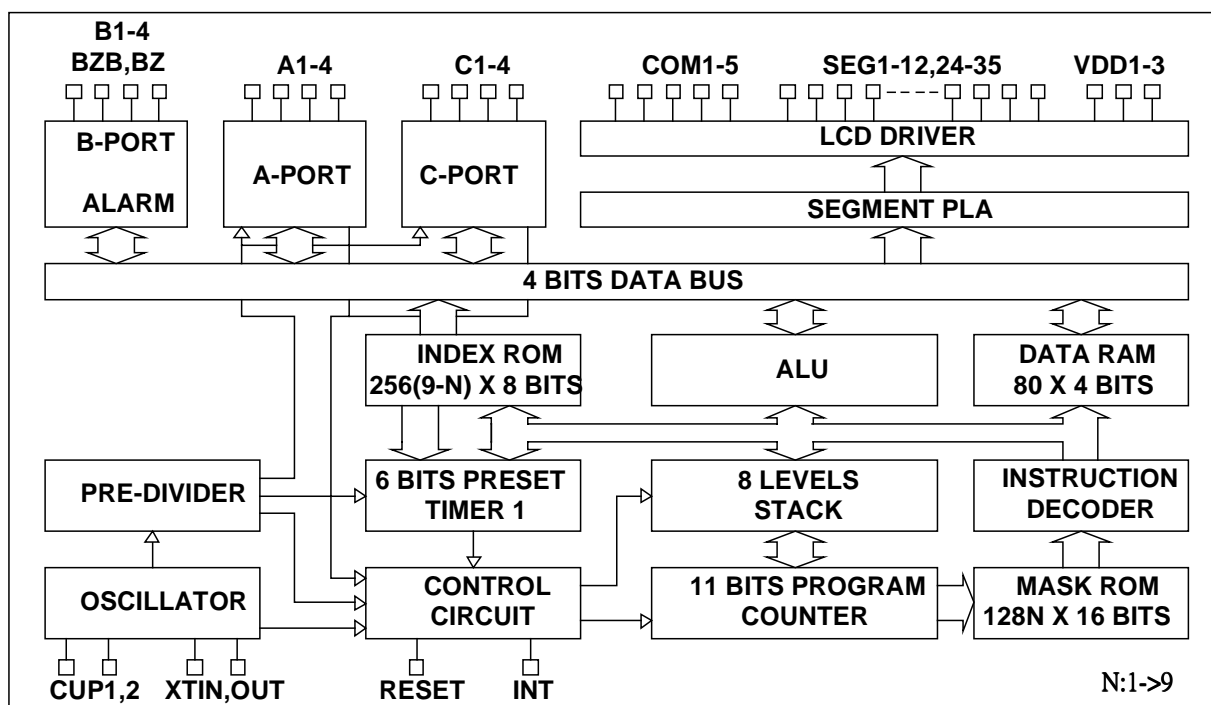
● ROM capacity	1152	x 16 bits.
● RAM capacity	80	x 4 bits.
4. LCD driver output.
  - 5 common outputs and 24 segment outputs (up to drive 120 LCD segments).
  - 1/2 Duty, 1/3 Duty, 1/4 Duty or 1/5 Duty is selected by MASK option.
  - 1/2 Bias or 1/3 Bias is selected by MASK option.
  - Single instruction to turn off all segments.
  - Segment output pins (SEG1~12) could be defined as CMOS or P\_open drain output type by mask option.
5. Input/output ports.
  - Port IOA 4 pins, muxed with SEG24~SEG27.
  - Port IOB 4 pins(with internal pull-low), muxed with SEG28~SEG31.
  - Port IOC 4 pins(with internal pull-low), muxed with SEG32~SEG35.  
IOC port had built in the input signal chattering prevention circuitry.
6. 8 level subroutine nesting.
7. Interrupt function.
  - External factor 2 (INT pin, Port IOC).
  - Internal factors 2 (Pre-Divider, Timer1).
8. Built-in Diode for Solar Cell power regulation.
9. Built in Alarm generator.

- BZB, BZ (Muxed with SEG30,SEG31).
10. One 6-bit programmable timer with programmable clock source.
  11. Built-in Voltage doubler, tripler charge pump circuit.
  12. Dual clock operation.
  13. HALT function.
  14. STOP function.

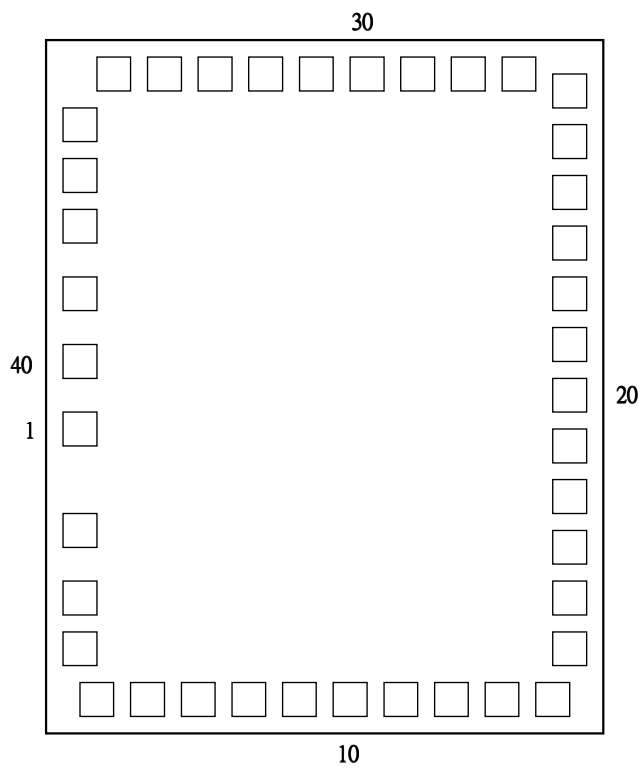
**APPLICATION**

- Timer / Calendar / Calculator

**BLOCK DIAGRAM**



**PAD DIAGRAM**



The substrate of chip should be connected to GND.

## PAD COORDINATE

No	Name	X	Y	No	Name	X	Y
1	XIN	72.50	712.85	21	SEG8	1176.85	919.50
2	XOUT	72.50	451.35	22	SEG9	1176.85	1041.50
3	GND	75.00	314.05	23	SEG10	1176.85	1163.50
4	VDD1	75.00	199.05	24	SEG11	1176.85	1285.50
5	VDD2	94.95	72.50	25	SEG12	1176.85	1407.50
6	VDD3	209.95	72.50	26	SEG24/IOA1	1176.85	1534.20
7	CUP1	324.95	72.50	27	SEG25/IOA2	1056.10	1571.30
8	CUP2	439.95	72.50	28	SEG26/IOA3	936.10	1571.30
9	COM1	554.95	72.50	29	SEG27/IOA4	816.10	1571.30
10	COM2	669.95	72.50	30	SEG28/IOB1	696.10	1571.30
11	COM3	784.95	72.50	31	SEG29/IOB2	576.10	1571.30
12	COM4	899.95	72.50	32	SEG30/IOB3/BZB	456.10	1571.30
13	COM5	1014.95	72.50	33	SEG31/IOB4/BZ	336.10	1571.30
14	SEG1	1129.95	72.50	34	SEG32/IOC1	216.10	1571.30
15	SEG2	1176.85	187.50	35	SEG33/IOC2	96.10	1571.30
16	SEG3	1176.85	309.50	36	SEG34/IOC3	72.50	1440.65
17	SEG4	1176.85	431.50	37	SEG35/IOC4	72.50	1325.65
18	SEG5	1176.85	553.50	38	RESET	72.50	1188.65
19	SEG6	1176.85	675.50	39	INT	72.50	1029.85
20	SEG7	1176.85	797.50	40	TEST	72.50	871.65

## PIN DESCRIPTION

Name	I/O	Description
VDD1,2,3	P	LCD supply voltage, and positive supply voltage.
RESET	I	Input pin for external reset request signal, built-in internal pull-down resistor.
INT	I	Input pin for external interrupt request signal. . Falling edge or rising edge triggered is defined by mask option. . Internal pull-down or pull-up resistor is defined by mask option.
TEST		Test signal input pin.
CUP1,2	O	Switching pins for supply the LCD driving voltage to the VDD1,2,3 pins. . Connect the CUP1 and CUP2 pins with non-polarized electrolytic capacitor when chip operated in 1/2 or 1/3 bias mode. . In no BIAS mode, leave these pins opened.
XIN XOUT	I O	Time base counter frequency (clock specified. LCD alternating frequency. Alarm signal frequency) or system clock oscillation. . 32KHz Crystal oscillator or External RC for SLOW ONLY or DUAL by mask option. . In FAST ONLY mode option, connect an external resistor could compose a RC oscillator.
COM1~5	O	Output pins for driving the common pins of the LCD panel.
SEG1-12,24-35	O	Output pins for driving the LCD panel segment.
IOA1-4	I/O	Input / Output port A.(muxed with SEG24~27)
IOB1-4	I/O	Input / Output port B.(muxed with SEG28~30)
IOC1-4	I/O	Input / Output port C. (muxed with SEG32~35)
BZB/BZ	O	Output port for alarm generator
GND	P	Negative supply voltage.

## ABSOLUTE MAXIMUM RATINGS

GND= 0V

Name	Symbol	Range	Unit
Maximum Supply Voltage	VDD1	-0.3 to 2.0	V
	VDD2	-0.3 to 4.0	V
	VDD3	-0.3 to 6.0	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	°C
Maximum Storage Temperature	Tstg	-25 to +125	°C

## POWER CONSUMPTION

at Ta=-20°C to 70°C, GND= 0V

Name	Sym.	Condition	Min.	Typ.	Max.	Unit
HALT mode	IHALT1	Only 32.768KHz Crystal oscillator operating, without loading. (BCF = 0)		2		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=0 to 70°C, GND= 0V

Name	Symb.	Condition	Min.	Max.	Unit
Supply Voltage	VDD1		1.2	1.8	V
	VDD2		2.4	3.6	V
	VDD3		2.4	5.4	V
Oscillator Start-Up Voltage	VDD1	Crystal Mode	1.3		V
Oscillator Sustain Voltage	VDD1	Crystal Mode	1.2		V
Input "H" Voltage	Vih1		VDD1-0.7	VDD1+0.7	V
Input "L" Voltage	Vil1		-0.7	0.7	V
Input "H" Voltage	Vih3	OSCIN	0.8xVDD1	VDD1	V
Input "L" Voltage	Vil3		0	0.2xVDD1	V
Operating Freq	Fopg1	Crystal Mode	32		KHZ
	Fopg2	RC/CF Mode	10	1000	KHZ

**INTERNAL RC FREQUENCY RANGE**

Option Mode	BAK	Min.	Typ.	Max.
250KHz	1.2V~1.5V	300KHz	350KHz	400KHz
	2.4V~5.0V	200KHz	250KHz	300KHz
500KHz	1.2V~1.5V	550KHz	650KHz	750KHz
	2.4V~5.0V	400KHz	500KHz	600KHz

**ELECTRICAL CHARACTERISTICS**

VDD1=1.2V;

**Input Resistance**

Name	Symb.	Condition	Min.	Typ.	Max.	Unit
IOB,C Pull-Down Tr	Rmad1	Vi=VDD1	200	500	1000	Kohm
INT Pull-up Tr	Rintu1	Vi=GND	200	500	1000	Kohm
INT Pull-Down Tr	Rintd1	Vi=VDD1	200	500	1000	Kohm
RES Pull-Down Tr	Rres1	Vi=VDD1	100	300	500	Kohm

**DC Output Characteristics**

Name	Symb.	Condition	Port	Min.	Typ.	Max.	Unit
Output "H" Voltage	Voha	Ioh=-200uA	SEG1~12 SEG24~35	0.8	0.9	1.0	V
Output "L" Voltage	Vola	Iol=400uA	SEG1~12 SEG24~35	0.2	0.3	0.4	V

**Segment Driver Output Characteristics**

Name	Symb.	Condition	For	Min.	Typ.	Max.	Unit.
Static Display Mode							
Output "H" Voltage	Vohb	Ioh=-1uA	SEG-n	1.0			V
Output "L" Voltage	Volb	Iol=1uA	SEG-n			0.2	V
Output "H" Voltage	Vohc	Ioh=-10uA	COM-n	1.0			V
Output "L" Voltage	Volc	Iol=10uA	COM-n			0.2	V
1/2 Bias Display Mode							
Output "H" Voltage	Vohd	Ioh=-1uA	SEG-n	2.2			V
Output "L" Voltage	Vold	Iol=1uA	SEG-n			0.2	V
Output "H" Voltage	Vohe	Ioh=-10uA	COM-n	2.2			V
Output "M" Voltage	Vom1e	Iol/h=+/-10uA	COM-n	1.0		1.4	V
Output "L" Voltage	Vole	Iol=10uA	COM-n			0.2	V
1/3 Bias display Mode							
Output "H" Voltage	Vohf	Ioh=-1uA	SEG-n	3.4			V

Output "M1" Voltage	Vom1f	Iol/h=+/-10uA		1.0		1.4	V
Output "M2" Voltage	Vom2f	Iol/h=+/-10uA		2.2		2.6	V
Output "L" Voltage	Volf	Iol=1uA				0.2	V
Output "H" Voltage	Vohg	Ioh=-10uA	COM-n	3.4			V
Output "M1" Voltage	Vom1g	Iol/h=+/-10uA		1.0		1.4	V
Output "M2" Voltage	Vom2g	Iol/h=+/-10uA		2.2		2.6	V
Output "L" Voltage	Volg	Iol=10uA				0.2	V

### Typical Application Circuit

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

