MS8503H1
A Caller ID Integrated System

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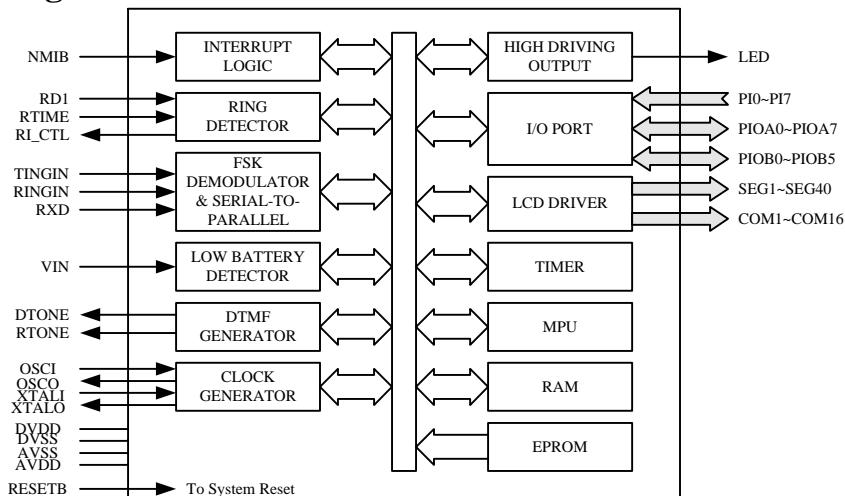
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Features

- 8-bit micro-processor built in
- 32K bytes ROM
- 2.5K bytes general-purposed RAM
- LCD contrast tunable by software
- Dual oscillators
  - 3.58MHz for system clock
  - 32.768KHz for system clock and real time clock
- Ring detector with line reversal detected
- FSK demodulator & carrier detector
- DTMF generator
- Ringer tone generator
- Low voltage detector [VIN=2.55V±0.15]
- Interrupts with three priorities and NMI
- Two general-purposed 8-bit timers
- Watchdog Timer
- Two serial-to-parallel ports

- I/O ports with internal pull-up resistors built in
  - Input port : 8 pins
  - I/O port A: 8 pins with/without open-drain option
  - I/O port B: 6 pins
- Other output pins
  - RI_CTL pin, LED pin
- One LCD driver with three options by masking
  - 40 segments × 16 commons
  - 40 segments × 8 commons
  - 40 segments × 4 commons
- Two power saving mode
  - Standby mode
  - Stop mode
- Operating voltage range: 2.8V~5.5V

Block Diagram

Applications

- Calling number delivery (CND) and calling name delivery (CNAM) features
- Phone set adjunct boxes

- Feature phones
- Other communication systems

Package

- 100-pin QFP or 128-pin QFP packaged

General Description

The MS8503H1 is a micro-controller with an 8-bit micro-processor (6502) embedded and it provides a complete solution for the service of caller identification. The features and functions offered by the MS8503H1 include FSK demodulation, DTMF generation, Ring detection, LCD driver, Power Management and Low battery indication. The

MS8503H1_DATA_SHEET_V1.1
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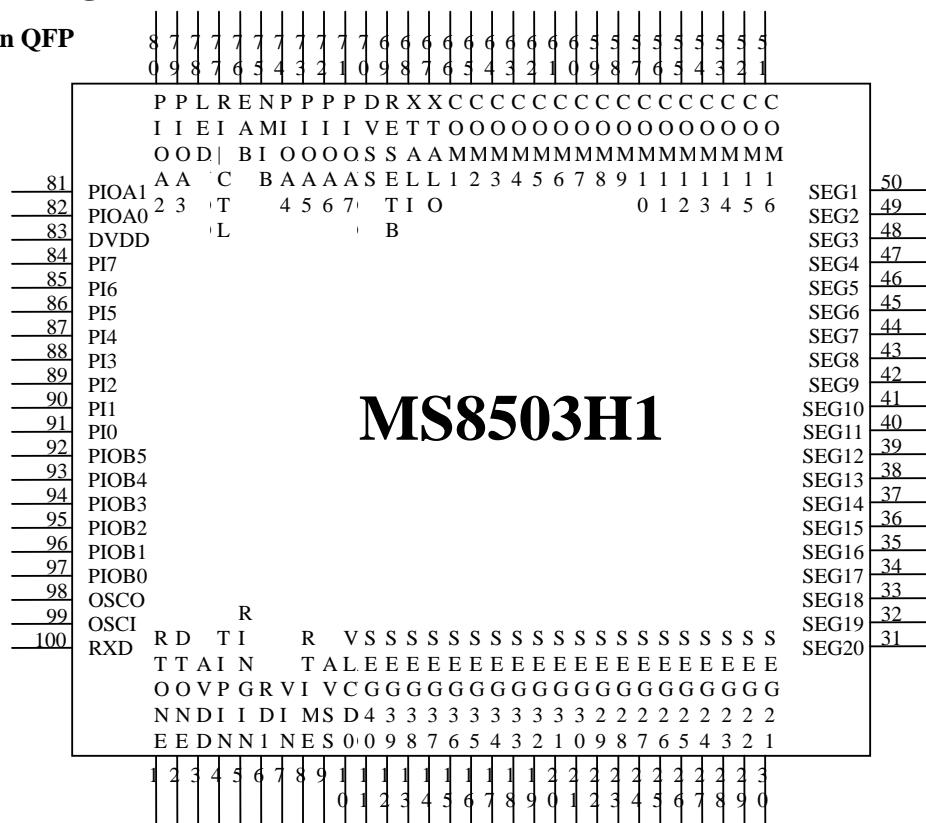
FSK demodulator is designed for the Bell 202 and CCITT V.23 1200-baud asynchronous data and its performance is compliant to the Bellcore GR-30-CORE. With 32K Bytes ROM embedded, it can help the designers easily and flexibly to achieve the desired features. For these applications, it provides a one-chip solution for the adjunct boxes, feature phones, and other communication systems.
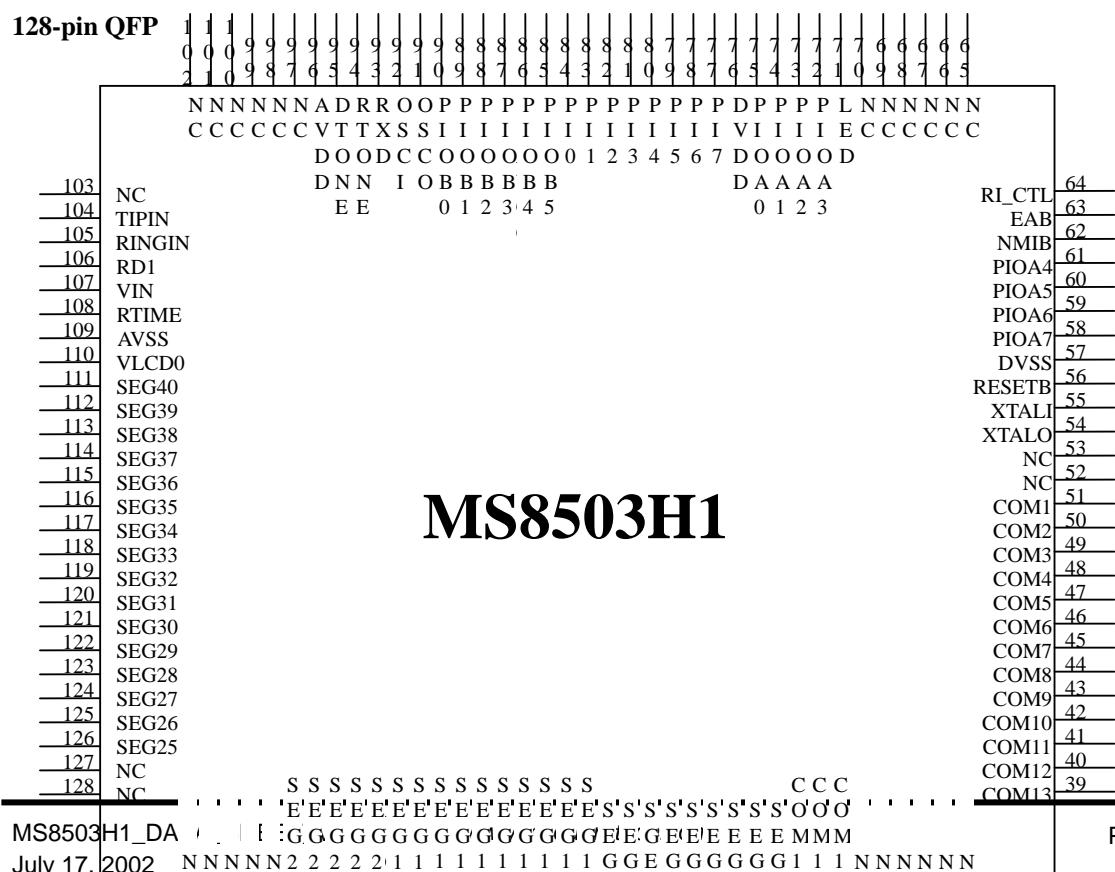
Pin Configuration

100-pin QFP

MS8503H1

Left side pins (top to bottom):
- 81 PIOA1
- 82 PIOA0
- 83 DVDD
- 84 PI7
- 85 PI6
- 86 PI5
- 87 PI4
- 88 PI3
- 89 PI2
- 90 PI1
- 91 PI0
- 92 PIOB5
- 93 PIOB4
- 94 PIOB3
- 95 PIOB2
- 96 PIOB1
- 97 PIOB0
- 98 OSCO
- 99 OSCI
- 100 RXD

Right side pins (top to bottom):
- 50 SEG1
- 49 SEG2
- 48 SEG3
- 47 SEG4
- 46 SEG5
- 45 SEG6
- 44 SEG7
- 43 SEG8
- 42 SEG9
- 41 SEG10
- 40 SEG11
- 39 SEG12
- 38 SEG13
- 37 SEG14
- 36 SEG15
- 35 SEG16
- 34 SEG17
- 33 SEG18
- 32 SEG19
- 31 SEG20

128-pin QFP

MS8503H1

Left side pins (top to bottom):
- 103 NC
- 104 TIPIN
- 105 RINGIN
- 106 RD1
- 107 VIN
- 108 RTIME
- 109 AVSS
- 110 VLCD0
- 111 SEG40
- 112 SEG39
- 113 SEG38
- 114 SEG37
- 115 SEG36
- 116 SEG35
- 117 SEG34
- 118 SEG33
- 119 SEG32
- 120 SEG31
- 121 SEG30
- 122 SEG29
- 123 SEG28
- 124 SEG27
- 125 SEG26
- 126 SEG25
- 127 NC
- 128 NC

Right side pins (top to bottom):
- 64 RI_CTL
- 63 EAB
- 62 NMIB
- 61 PIOA4
- 60 PIOA5
- 59 PIOA6
- 58 PIOA7
- 57 DVSS
- 56 RESETB
- 55 XTALI
- 54 XTALO
- 53 NC
- 52 NC
- 51 COM1
- 50 COM2
- 49 COM3
- 48 COM4
- 47 COM5
- 46 COM6
- 45 COM7
- 44 COM8
- 43 COM9
- 42 COM10
- 41 COM11
- 40 COM12
- 39 COM13

Pin Description

100-pin QFP

Pin No.	Notation	I/O	Description
1	RTONE	O	Ringer tone signal output.
2	DTONE	O	DTMF signal output.
3	AVDD	Power	Analog power supply Input.
4	TIPIN	I	Signal input of tip side of twisted pair line (*see note 1).
5	RINGIN	I	Signal input of ring side of twisted pair line (*see note 1).
6	RD1	I	Ring detection signal input (*see note 2).
7	VIN	I	Low-voltage detector input.
8	RTIME	I	Ring time signal input.
9	AVSS	Power	Analog ground input.
10	VLCD0	I	Voltage supply input for LCD driver.
11-50	SEG40 – SEG1	O	Segment output pins of LCD driver.
51-66	COM16 – COM1	O	Common output pins of LCD driver.
67	XTALO	O	32.768KHz oscillator output.
68	XTALI	I	32.768KHz oscillator input.
69	RESETB	I	Reset signal input (low active).
70	DVSS	Power	Digital ground input.
71-74	PIOA7 – PIOA4	I/O	General-purposed I/O pins with internal pull-up resistors Open-drain structure is optioned by masking.
75	NMIB	I	Non-maskable Interrupt input with schmitt trigger built in (low active).
76	EAB	I	This is a reserved pin with internal pull-up resistors. Don't connect this pin to any specified level.
77	RI_CTL	O	Ring control output or general-purposed output.
78	LED	O	General-purposed output with high driving capability. (Max. 10 - 15 mA).
79-82	PIOA3 – PIOA0	I/O	General-purposed I/O pins with internal pull-up resistors Open-drain structure is optioned by masking.
83	DVDD	Power	Digital power supply input.
84-91	PI7 – PI0	I	General-purposed input pins with internal pull-up resistors. It can be programmed as interrupt input (negative-edge trigger).
92-97	PIOB5 – PIOB0	I/O	General-purposed I/O pins with internal pull-up resistors.
98	OSCO	O	3.58MHz oscillator output.
99	OSCI	I	3.58MHz oscillator input.
100	RXD	I	This pin is used to receive the output data of external FSK demodulator. One internal serial-to-parallel port is connected to this pin.

Note 1:   'TIPIN' and 'RINGIN' must be DC isolated from the phone line.
Note 2:   'RD1' input is normally coupled to the one of the twisted pair wires through an attenuating network. It detects energy and enables the 3.58MHz oscillator and precision ring detection.
Note 3:   It is suggested that the power AVDD and DVDD are blocked by coil for de-coupling the noise form analog circuit to digital circuit. (AVSS and DVSS, too)

Absolute Maximum Ratings

DC Supply Voltage.................-0.5V to + 6.0V
Input Voltage..............-0.5V to V_{DD} + 0.5V
Output Voltage...........-0.5V to V_{DD} + 0.5V
Operating Temperature….............0℃ to 70℃
Storage Temperature...........-40℃ to 150℃

Comments
Never allow a stress to exceed the values listed under "Absolute Maximum Ratings", otherwise the device would suffer from a permanent damage. Nor is a stress at the listed value be allowed to persist over a period, since an extended exposure to the absolute maximum rating condition may also affect the reliability of the device, if not causing a damage thereof.

AC & DC Electrical Characteristics

DC Electrical Characteristics

(Temperature=0℃ to 70℃, V_{DD}=4.5V, GND=0V)
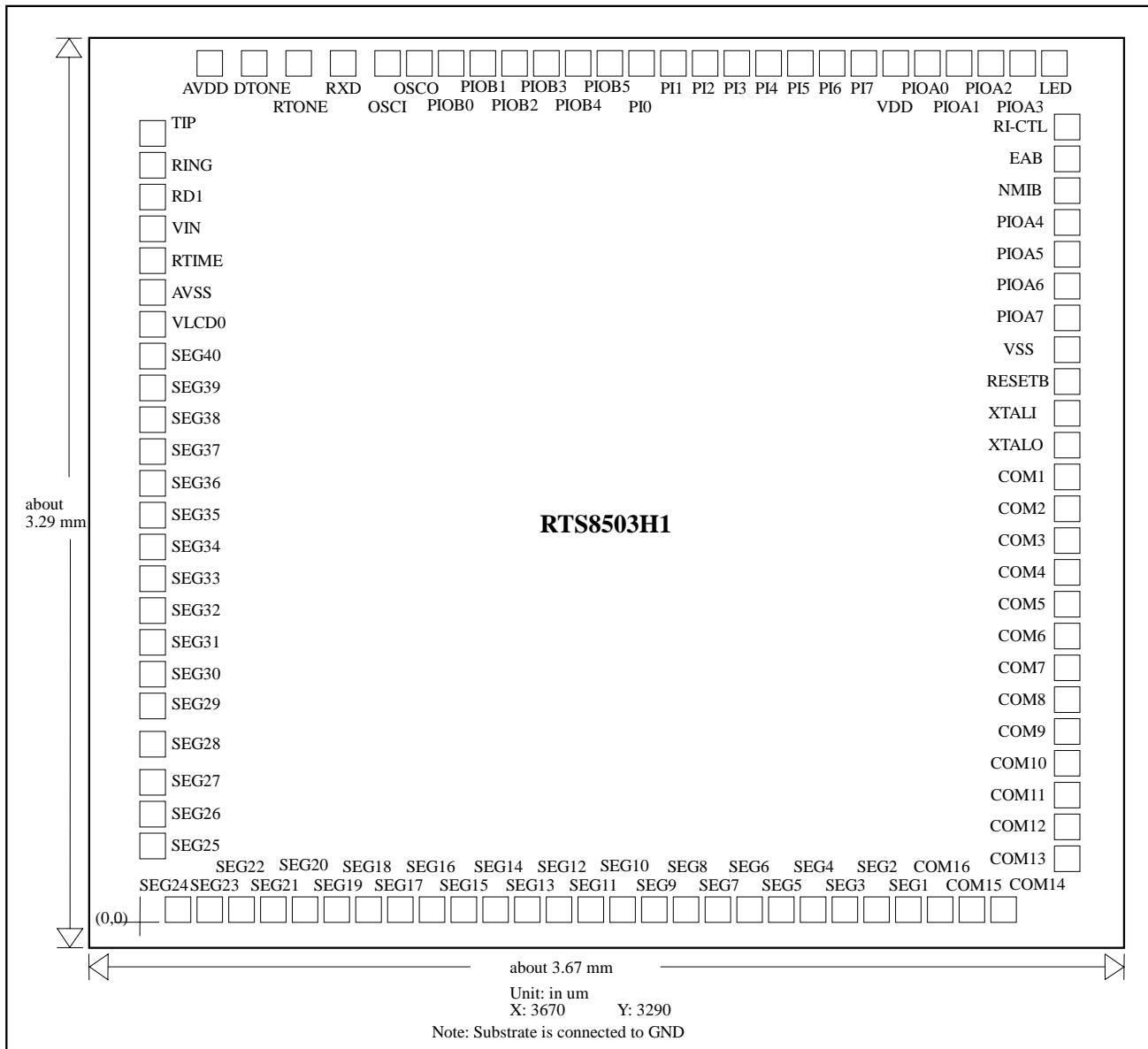
Parameters	Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	MPU operating voltage	V_{DD}	2.2	5.0	5.5	V
	FSK operating voltage	V_{DDF}	2.8	5.0	5.5	V
	RAM operating voltage	V_{RAM}	2.2	5.0	5.5	V
Supply current	current of FSK receiving data	I_{FSK}	-	2.5	-	mA
	current of DTMF dialing	I_{DTMF}	-	1.9	-	mA
	MPU on (running by 3.58MHz), 3.58MHz on, 32.768KHz on, FSK off, DTMF off, LCD on (voltage at pin 'VLCD0' is 3.95V)	I_{ACT1}	-	2.2	-	mA
	MPU on(running by 32.768KHz), 3.58MHz off, 32.768KHz on, FSK off, DTMF off, LCD on (voltage at pin 'VLCD0' is 3.95V)	I_{ACT2}	-	1.1	-	mA
	MPU off, 3.58MHz off, 32.768KHz on, FSK off, DTMF off, LCD on (voltage at pin 'VLCD0' is 3.95V)	I_{STDBY}		20		μA
	MPU off, 3.58MHz off, 32.768KHz off, FSK off, DTMF off, LCD off	I_{STOP}	-	2	10	μA
Output voltage	I_{OH}=1 mA , PIOA and PIOB pins	V_{OH1}	4.3	-	-	V
	I_{OL}=2 mA, PIOA and PIOB pins	V_{OL1}	0.2	-	-	V
	I_{OL}=2.2 mA, PIOA open-drained	V_{OL2}	0.2	-	-	V
Input voltage	PIOA and PIOB pins	V_{IH1}	0.8 V_{DD}	-	V_{DD}+0.3	V
	PIOA and PIOB pins	V_{IL1}	-0.3	-	0.2 V_{DD}	V
	PI pins	V_{IH2}	0.8 V_{DD}	-	V_{DD}+0.3	V
	PI pins	V_{IL2}	-0.3	-	0.1V_{DD}	V
Output current	V_{OH}=4.0V, PIOA and PIOB pins	I_{OH1}	-2.4	-2.6	-2.7	mA
	V_{OH}=3.6V		-4.0	-4.4	-4.6	
	V_{OH}=0.9V, PIOA and PIOB pins	I_{OL1}	6.3	7.00	7.4	mA
	V_{OH}=0.5V		3.9	4.4	4.6	
	V_{OH}=0.9V, PIOA open-drained	I_{OL2}	7.2	8.0	8.5	mA
	V_{OH}=0.5V		4.5	5.0	5.3	
Pull-up resistor	PI, PIOA and PIOB	R_{PULL}	-	100	-	KΩ
DTMF output distortion	R_{load}=10KΩ~40KΩ	DIS	-	-	0.8	%
Twist of DTMF power (high freq. power-low freq. power)	R_{load}=10KΩ~40KΩ	TW	1	2	3	dB
DTMF loading resistor	-	R_{load}	5	10	40	KΩ

AC Electrical Characteristics

(Temperature=0℃ to 70℃, V_{DD}=4.5V, GND=0V)

| Parameters	Conditions	Min.	Typ.	Max.	Unit
Input sensitivity of Tip and Ring	S/N=25, Baud rate=1200 Bps Mark=1200Hz, Space=2200Hz	-	-45	-	dBm
SNR of input signal	Signal level = 0~-45dBm Baud rate=1200 Bps Mark=1200Hz, Space=2200Hz	-	12	-	dB
Baud Rate	Signal level = -45dBm, S/N=25 Mark=1200Hz, Space=2200Hz	1150	1200	1250	Bps
Positive twist (twist = mark power-space power) Negative twist	Signal level=-45dBm, S/N=25, Baud rate=1200Bps, Mark=1200Hz, Space=2200Hz	-	+10 -7	-	dB
Bell 202 FSK Mark frequency Space frequency	Signal level=-45dBm, S/N=25 Baud rate=1200Bps	1200-50 2200-50	1200 2200	1200+50 2200+50	Hz
CCITT V.23 Mark frequency Space frequency	Signal level=-45dBm, S/N=25 Baud rate=1200Bps	1300-50 2100-50	1300 2100	1300+50 1300+50	Hz

Bonding Diagram

about 3.29 mm

RTS8503H1

Top pins (left to right): AVDD, DTONE, RTONE, RXD, OSCO, OSCI, PIOB0, PIOB1, PIOB2, PIOB3, PIOB4, PIOB5, PI0, PI1, PI2, PI3, PI4, PI5, PI6, PI7, VDD, PIOA0, PIOA1, PIOA2, PIOA3, LED

Left pins (top to bottom): TIP, RING, RD1, VIN, RTIME, AVSS, VLCD0, SEG40, SEG39, SEG38, SEG37, SEG36, SEG35, SEG34, SEG33, SEG32, SEG31, SEG30, SEG29, SEG28, SEG27, SEG26, SEG25

Right pins (top to bottom): RI-CTL, EAB, NMIB, PIOA4, PIOA5, PIOA6, PIOA7, VSS, RESETB, XTALI, XTALO, COM1, COM2, COM3, COM4, COM5, COM6, COM7, COM8, COM9, COM10, COM11, COM12, COM13

Bottom pins (left to right): SEG24, SEG23, SEG22, SEG21, SEG20, SEG19, SEG18, SEG17, SEG16, SEG15, SEG14, SEG13, SEG12, SEG11, SEG10, SEG9, SEG8, SEG7, SEG6, SEG5, SEG4, SEG3, SEG2, SEG1, COM16, COM15, COM14

(0,0)

about 3.67 mm

Unit: in um
X: 3670   Y: 3290
Note: Substrate is connected to GND

Pad No.	Name	X	Y	Pad No.	Name	X	Y
1	TIP	86.11	2955.86	51	COM13	3467.50	163.01
2	RING	86.11	2830.29	52	COM12	3467.50	290.66
3	RD1	86.11	2710.23	53	COM11	3467.50	416.22
4	VIN	86.11	2590.17	54	COM10	3467.50	538.36
5	RTIME	86.11	2470.09	55	COM9	3465.00	658.44
6	AVSS	86.11	2350.04	56	COM8	3465.00	778.50
7	VLCD0	86.11	2227.21	57	COM7	3465.00	898.56
8	SEG40	86.11	2107.16	58	COM6	3465.00	1018.62
9	SEG39	86.11	1987.10	59	COM5	3465.00	1138.68
10	SEG38	86.11	1867.04	60	COM4	3465.00	1258.74
11	SEG37	86.11	1746.98	61	COM3	3465.00	1378.80
12	SEG36	86.11	1626.92	62	COM2	3465.00	1498.86
13	SEG35	86.11	1506.86	63	COM1	3465.00	1618.92
14	SEG34	86.11	1386.80	64	XTALO	3465.01	1738.99
15	SEG33	86.10	1266.73	65	XTALI	3465.01	1859.04
16	SEG32	86.10	1145.29	66	RESETB	3465.01	1979.10
17	SEG31	86.10	1023.85	67	VSS	3465.01	2099.16
18	SEG30	86.10	902.41	68	PIOA7	3465.00	2219.20
19	SEG29	86.10	780.97	69	PIOA6	3465.00	2339.27
20	SEG28	86.10	659.53	70	PIOA5	3465.00	2457.57
21	SEG27	86.10	538.09	71	PIOA4	3465.00	2579.40
22	SEG26	86.10	400.10	72	NMIB	3465.01	2699.45
23	SEG25	86.10	262.10	73	EAB	3465.01	2825.03
24	SEG24	131.07	86.10	74	RI-CTL	3464.73	2950.65
25	SEG23	269.07	86.10	75	LED	3404.72	3089.07
26	SEG22	407.07	86.10	76	PIOA3	3279.16	3093.22
27	SEG21	536.23	86.10	77	PIOA2	3153.21	3093.22
28	SEG20	657.67	86.10	78	PIOA1	3033.13	3093.22
29	SEG19	779.11	86.10	79	PIOA0	2913.08	3093.22
30	SEG18	900.55	86.10	80	VDD	2793.05	3093.17
31	SEG17	1021.99	86.10	81	PI7	2672.97	3093.17
32	SEG16	1143.43	86.10	82	PI6	2552.90	3093.17
33	SEG15	1264.87	86.10	83	PI5	2432.85	3093.17
34	SEG14	1386.31	86.10	84	PI4	2309.90	3093.17
35	SEG13	1507.75	86.10	85	PI3	2189.84	3093.17
36	SEG12	1629.19	86.10	86	PI2	2069.78	3093.17
37	SEG11	1750.63	86.10	87	PI1	1949.72	3093.17
38	SEG10	1872.07	86.10	88	PI0	1829.66	3093.17
39	SEG9	1993.51	86.10	89	PIOB5	1712.47	3093.17
40	SEG8	2113.57	86.10	90	PIOB4	1592.41	3093.17
41	SEG7	2233.63	86.10	91	PIOB3	1472.35	3093.17
42	SEG6	2353.69	86.10	92	PIOB2	1352.29	3093.17
43	SEG5	2473.75	86.10	93	PIOB1	1232.23	3093.17
44	SEG4	2593.81	86.10	94	PIOB0	1112.17	3093.17
45	SEG3	2713.87	86.10	95	OSCO	992.10	3093.17
46	SEG2	2833.92	86.10	96	OSCI	872.05	3093.17
47	SEG1	2954.00	86.10	97	RXD	731.29	3093.17

48	COM16	3074.05	86.09	98	RTONE	576.73	3093.17
49	COM15	3199.62	86.09	99	DTONE	416.65	3093.17
50	COM14	3325.20	86.09	100	AVDD	258.81	3093.19

Package Diagram

Symbol	Dimension(inch)			Dimension(mm)		
	Min	Typ	Max	Min	Typ	Max
A	0.106	0.118	0.130	2.70	3.00	3.30
A1	0.004	0.020	0.036	0.11	0.51	0.91
A2	0.102	0.112	0.122	2.60	2.85	3.10
b	0.007	0.012	0.017	0.18	0.30	0.42
c	0.002	0.006	0.010	0.04	0.15	0.26
D	0.541	0.551	0.561	13.75	14.00	14.25
E	0.778	0.787	0.797	19.75	20.00	20.25
e	0.020	0.026	0.031	0.50	0.65	0.80
HD	0.726	0.740	0.754	18.45	18.80	19.15
HE	0.963	0.976	0.990	24.45	24.80	25.15
L	0.039	0.047	0.055	1.00	1.20	1.40
L1	0.089	0.094	0.104	2.25	2.40	2.65
y	—	—	0.04	—	—	0.10
θ	0°	—	12°	0°	—	12°

NOTE:

1. Dimension D & E do not include interlead flash.
2. Dimension b does not include dambar protrusion /intrusion.
3. Controlling dimension: Millimeter on final visual inspection spec.
4. General appearance spec. should be based on final visual inspection spec.

TITLE :

100L QFP (14x20 mm**2)   FOOTPRINT 4.8 mm