

# E0C62M1

## 4-bit Single Chip Microcomputer



- Core CPU Architecture
- Dual Slope Type A/D Converter
- High Quality Display LCD Driver
- SVD Circuit

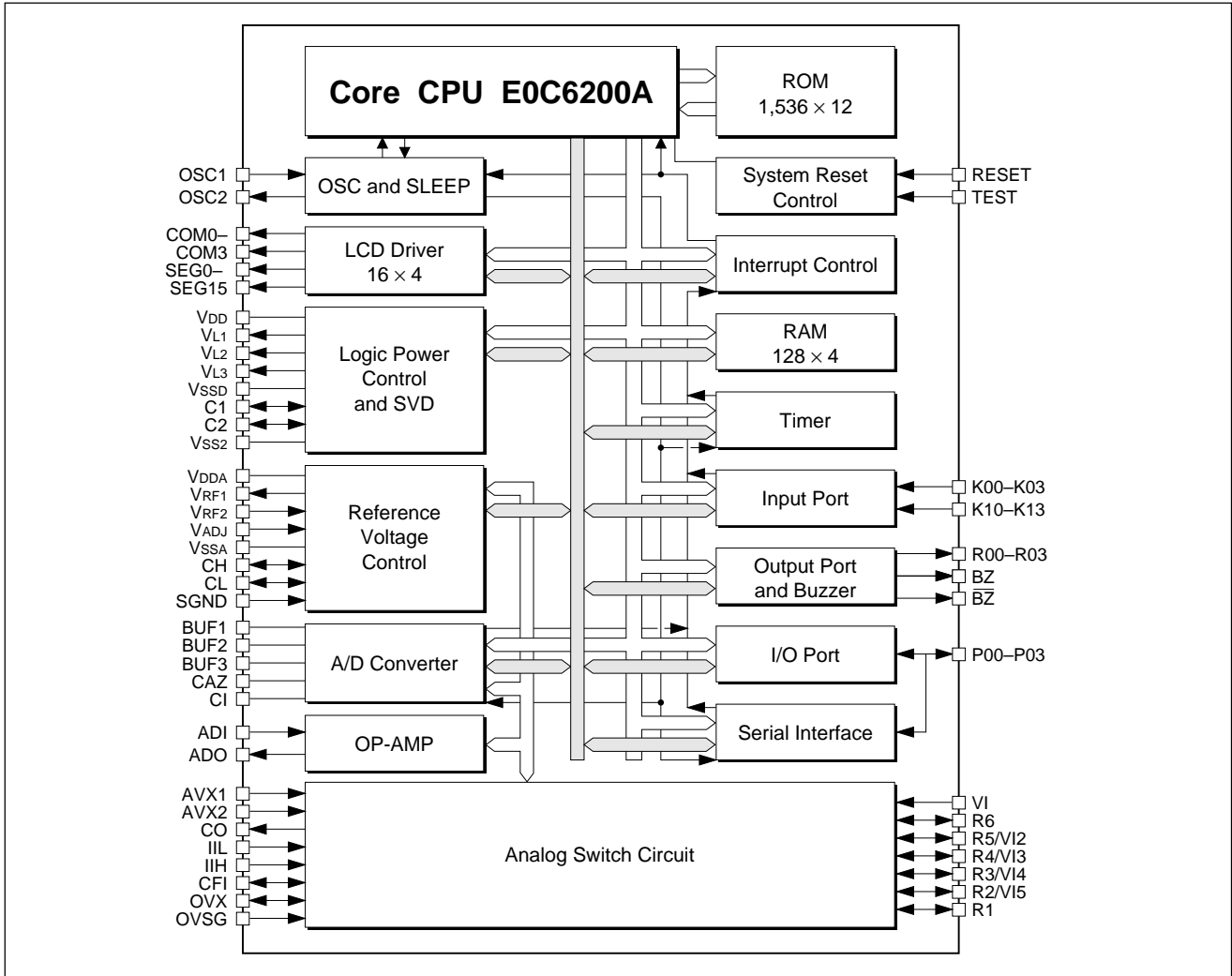
### DESCRIPTION

The E0C62M1 is a CMOS 4-bit single-chip microcomputer made up of the 4-bit core CPU E0C6200A, ROM, RAM, dual slope type A/D converter, attenuator circuit for various measurement modes, LCD driver, serial interface, and other circuits. It is especially suitable for measurement and LCD display systems such as a digital multimeter.

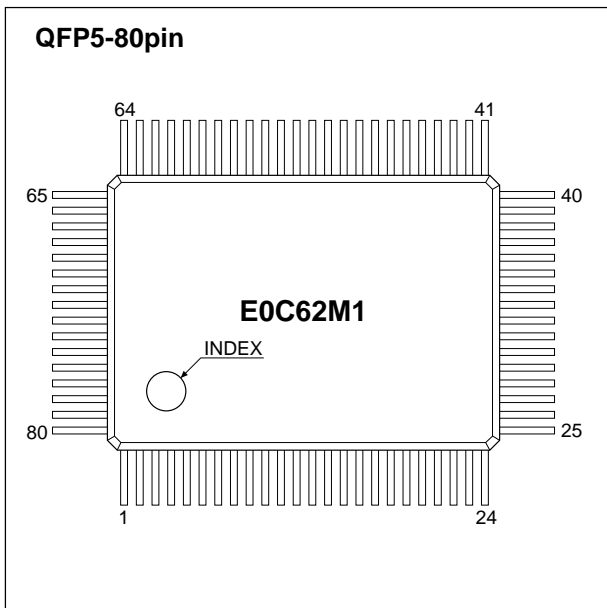
### FEATURES

- CMOS LSI 4-bit parallel processing
- Clock ..... 32.768kHz (Typ.)
- Instruction set ..... 100 instructions
- Instruction execution time ..... 153μsec, 214μsec, 366μsec
- ROM capacity ..... 1,536 words × 12 bits
- RAM capacity ..... 128 words × 4 bits
- A/D converter ..... Dual slope type
  - Resolution : Conversion time (2 stages)
  - 4,370 counts : 400 msec
  - A/D conversion precision: ±0.1%
  - (operating temperature range: 15°C to 35°C)
  - 441 counts : 100 msec (High speed mode)
  - 3 integral resistors can be connected
  - Current, voltage and resistance can be measured
  - AC voltage/AC current can be measured using an external rectifier circuit
  - Continuity check mode built-in (measurement value can be displayed)
  - Reference voltage generation circuit built-in
- Input port ..... 8 bits (pull down resistors can be supplemented by mask option)
- Output port ..... 4 bits
- Buzzer output ..... 2 ports (BZ,  $\overline{\text{BZ}}$ )
- I/O port ..... 4 bits
- Serial interface ..... 1 port for data input  
 1 port for data output  
 1 port for clock input/output
  - These ports can be switched to general I/O port
- LCD driver ..... 16 segments × 3 or 4 commons (can be switched using software)
- LCD drive voltage generation circuit built-in (VL1, VL2, VL3)
- Compatible with 3V LCD panel
- Timer ..... Built-in
- Watchdog timer ..... Built-in
- Supply voltage detection (SVD) circuit .. 2.3 ± 0.15V
- Interrupt ..... External : Input port interrupt                    2 systems  
 Internal : A/D interrupt    1 system  
 Timer interrupt    1 system  
 Serial interface interrupt    1 system
- Supply voltage ..... 3.0V (2.15V to 3.5V)
- Current consumption (Typ.) ..... HALT mode (32.768kHz/3.0V) : 3.0μA (Typ.)  
 A/D operating (32.768kHz/3.0V) : 0.9mA (in DC measurement)  
 A/D operating (32.768kHz/3.0V) : 1.1mA (in AC measurement)
- Package ..... QFP5-80pin (plastic)  
 Die form

■ BLOCK DIAGRAM



■ PIN CONFIGURATION



Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	SEG15	21	VRF1	41	OVSG	61	BZ
2	COM0	22	VRF2	42	R1	62	P00/SIN
3	COM1	23	CH	43	R2/VI5	63	P01/SOUT
4	COM2	24	CL	44	R3/VI4	64	P02/SCLK
5	COM3	25	ADI	45	R4/VI3	65	P03/SRDY
6	VL1	26	ADO	46	R5/VI2	66	SEG0
7	VL2	27	AVX1	47	R6	67	SEG1
8	VL3	28	AVX2	48	K00	68	SEG2
9	VDD	29	CO	49	K01	69	SEG3
10	OSC1	30	CAZ	50	K02	70	SEG4
11	OSC2	31	CI	51	K03	71	SEG5
12	RESET	32	BUF1	52	K10	72	SEG6
13	TEST	33	BUF2	53	K11	73	SEG7
14	VSSD	34	BUF3	54	K12	74	SEG8
15	C1	35	IIL	55	K13	75	SEG9
16	C2	36	IIH	56	R00	76	SEG10
17	VSS2	37	CFI	57	R01	77	SEG11
18	VDDA	38	SGND	58	R02	78	SEG12
19	VSSA	39	VI	59	R03	79	SEG13
20	VADJ	40	OVX	60	BZ	80	SEG14

## ■ PIN DESCRIPTION

Pin name	Pin No.	In/Out	Function
VDD	9	(I)	Digital system power supply pin (+)
VDDA	18	(I)	Analog system power supply pin (+)
VSSD	14	(I)	Digital system power supply pin (-)
VSSA	19	(I)	Analog system GND pin (same voltage with VSSD)
VSS2	17	(O)	Analog system power supply pin (boosted voltage)
C1, C2	15, 16	O	Booster capacitor connecting pins for analog system power supply (VSS2)
OSC1	10	I	Crystal oscillation input pin: 32.768kHz
OSC2	11	O	Crystal oscillation output pin
K00-K13	48-55	I	Input pins
R00-R03	56-59	O	Output pins
BZ, BZ	60, 61	O	Buzzer signal output pins
P00-P03	62-65	I/O	I/O pins
VL1-VL3	6-8	O	LCD system voltage output pin
COM0-3	2-5	O	LCD common output pins (1/3, 1/4 duty, programmable)
SEG0-15	66-80, 1	O	LCD segment output pin (DC output may be selected by mask option)
VADJ	20	-	Reference voltage adjustment pin
VRF1	21	-	Reference voltage output pin
VRF2	22	-	Reference voltage output pin
ADI	25	I	OP-AMP inverted input pin for AC-DC conversion
ADO	26	O	OP-AMP output pin for AC-DC conversion
AVX1	27	-	AC-DC converted voltage input pin
AVX2	28	-	AC-DC converted voltage input pin
IIL, IIH	35, 36	-	Input pins for current measurement
VI	39	-	Input pin for voltage measurement
R1	42	-	Reference resistor connecting pin (100Ω)
R2/VI5	43	-	Reference resistor connecting pin (1kΩ)
R3/VI4	44	-	Reference resistor connecting pin (10kΩ)
R4/VI3	45	-	Reference resistor connecting pin (101kΩ)
R5/VI2	46	-	Reference resistor connecting pin (1.11MΩ)
R6	47	-	Reference resistor connecting pin (10MΩ)
OVX	40	-	Reference resistor voltage input pin for resistance measurement
OVSG	41	-	Reference resistor voltage input pin for resistance measurement
SGND	38	-	GND for measurement
CO	29	-	Comparator output pin
CAZ	30	-	Capacitor connecting pin for offset voltage zero adjustment
CI	31	-	Integral capacitor connecting pin
BUF1-3	32-34	-	Buffer AMP output, integral resistor connecting pin
CFI	37	-	Noise rejection filter connecting pin
CH	23	-	Capacitor connecting pin for reference voltage control
CL	24	-	Capacitor connecting pin for reference voltage control
TEST	13	I	Testing input pin
RESET	12	I	Initial reset input pin

■ ELECTRICAL CHARACTERISTICS

● Absolute Maximum Ratings

(VDD/VDDA=0V)

Rating	Symbol	Value	Unit
Supply voltage	VDD/VDDA	0	V
	VSSD/VSSA	-3.5	V
	VSS2	-7.0	V
Input voltage	VSSD system	V <sub>I1</sub>	(VSSD/VSSA - 0.3) to (VDD/VDDA + 0.3)
	VSS2 system	V <sub>I2</sub>	(VSS2 - 0.3) to (VDD/VDDA + 0.3)
Permissible total output current *1	ΣI	10	mA
Operating temperature (1)	Topr1	-20 to 70	°C
Operating temperature (2) *2	Topr2	0 to 40	°C
Storage temperature	Tstg	-65 to 150	°C
Soldering temperature / Time	Tsol	260°C, 10sec (lead section)	–
Permissible dissipation *3	P <sub>D</sub>	250	mW

\*1 The permissible total output current is the sum total of the current (average current) that simultaneously flows from the output pins (or is drawn in).

\*2 The A/D converter is ON status.

\*3 In case of plastic package (QFP5-80pin).

● Recommended Operating Conditions

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Supply voltage	VSSD/VSSA	VDD/VDDA=0V	-3.5	-3.0	-2.15	V
Oscillation frequency	fOSC1		–	32.768	–	kHz
Measurement system operating temperature	Tmes	During measurement by the A/D converter	15	25	35	°C

● DC Characteristics

(Unless otherwise specified: VDD/VDDA=0V, VSSD/VSSA=-3.0V, fOSC1=32.768kHz, Ta=25°C, VL1–VL3 are internal voltage)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
High level input voltage (1)	V <sub>IH1</sub>	K00–K03, K10–K13 RESET, TEST	0.1•V <sub>SSD</sub>		V <sub>DD</sub>	V
High level input voltage (2)	V <sub>IH2</sub>	P00–P03	0.1•V <sub>SSD</sub>		V <sub>DD</sub>	V
Low level input voltage (1)	V <sub>IL1</sub>	K00–K03, K10–K13 RESET, TEST	V <sub>SSD</sub>		0.9•V <sub>SSD</sub>	V
Low level input voltage (2)	V <sub>IL2</sub>	P00–P03	V <sub>SSD</sub>		0.9•V <sub>SSD</sub>	V
High level input current (1)	I <sub>IH1</sub>	V <sub>IH1</sub> =V <sub>DD</sub> , V <sub>SSD</sub> =-3.0V Without pull down resistor	0		0.5	μA
High level input current (2)	I <sub>IH2</sub>	V <sub>IH2</sub> =V <sub>DD</sub> , V <sub>SSD</sub> =-3.0V With pull down resistor	5	10	20	μA
Low level input current	I <sub>IL</sub>	V <sub>IL</sub> =V <sub>SSD</sub> =-3.0V	-0.5		0	μA
High level output current (1)	I <sub>OH1</sub>	V <sub>OH1</sub> =0.1•V <sub>SSD</sub> , V <sub>SSD</sub> =-3.0V			-0.9	mA
High level output current (2)	I <sub>OH2</sub>	V <sub>OH2</sub> =0.1•V <sub>SSD</sub> , V <sub>SSD</sub> =-3.0V			-1.2	mA
Low level output current (1)	I <sub>OL1</sub>	V <sub>OL1</sub> =0.9•V <sub>SSD</sub> , V <sub>SSD</sub> =-3.0V	3.0			mA
Low level output current (2)	I <sub>OL2</sub>	V <sub>OL2</sub> =0.9•V <sub>SSD</sub> , V <sub>SSD</sub> =-3.0V	3.5			mA
Common output current	I <sub>OH3</sub>	V <sub>OH3</sub> =V <sub>DD</sub> -0.05V			-3.0	μA
	I <sub>OL3</sub>	V <sub>OL3</sub> =V <sub>L3</sub> +0.05V	3.0			μA
Segment output current (during LCD output)	I <sub>OH4</sub>	V <sub>OH4</sub> =V <sub>DD</sub> -0.05V			-3.0	μA
	I <sub>OL4</sub>	V <sub>OL4</sub> =V <sub>L3</sub> +0.05V	3.0			μA
Segment output current (during DC output)	I <sub>OH5</sub>	V <sub>OH5</sub> =0.1•V <sub>SSD</sub>			-50	mA
	I <sub>OL5</sub>	V <sub>OL5</sub> =0.9•V <sub>SSD</sub>	70			mA

● Analog Circuit Characteristics and Current Consumption

(Unless otherwise specified: VDD/VDDA=0V, VSSD/VSSA=-3.0V, fOSC1=32.768kHz, Ta=25°C, VL1-VL3 are internal voltage)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD drive voltage	VL1	Connect 1MΩ load resistor between VDD and VL1, CL1=0.047μF	-1.15	-1.05	-0.95	V
	VL2	Connect 1MΩ load resistor between VDD and VL2, CL2=0.047μF	-2.20	-2.10	-2.00	V
	VL3	Connect 1MΩ load resistor between VDD and VL3, CL3=0.047μF	-3.25	-3.15	-3.05	V
SVD voltage	VSVD		-2.45	-2.30	-2.15	V
SVD circuit response time	tSVD				100	μS
Power current consumption	IOP	During SLEEP		1.5	4.0	μA
		During HALT	VSSD/VSSA=-3.0V	3.0	6.0	μA
		During A/D operation *1	VSSD/VSSA=-3.0V	0.9	2.0	mA
		During A/D operation *2	VSSD/VSSA=-3.0V	1.1	2.2	mA

\*1 DCV and DCA measurement mode

\*2 DCV and ACV measurement mode (The general AMP is ON status.)

A/D Converter

(Unless otherwise specified: VDD/VDDA=0V, VSSD/VSSA=-3.0V, fOSC1=32.768kHz, Ta=25°C, VL1-VL3 are internal voltage)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Sampling time	St1	A/D conversion in normal mode		100		mS
	St2	A/D conversion in high speed mode		10		mS
Sampling rate	Sr1	A/D conversion in normal mode		2.5		/S
	Sr2	A/D conversion in high speed mode		10		/S
Linearity error	LIN	A/D conversion in normal mode	-0.2		0.2	%FS
Porality error	EP	A/D conversion in normal mode	-2		+2	dgt
Zero point error	ZOFF	A/D conversion in normal mode	-2		+2	dgt

Reference Voltage Generator

(Unless otherwise specified: VDD/VDDA=0V, VSSD/VSSA=-3.0V, fOSC1=32.768kHz, Ta=25°C, VL1-VL3 are internal voltage)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature characteristics	VrefT	0 to 40°C	-300	0	300	ppm/deg
Supply voltage characteristics	VrefV	VSSA (VSSD)=2.15 to 3.5V	-0.1		0.1	%
Reference voltage output	Vref1	Short-circuit between VRF1 and VADJ terminals	400		780	mV
	Vref2	Short-circuit between VRF2 and VADJ terminals	400		780	mV
Output voltage during resistance measurement	Vrmes	VRF1=1.0V	400Ω range		VDDA	V
			4kΩ range		0.7	V
			40kΩ range		0.47	V
			400kΩ range		0.47	V
			4MΩ range		0.47	V
			40MΩ range		0.47	V

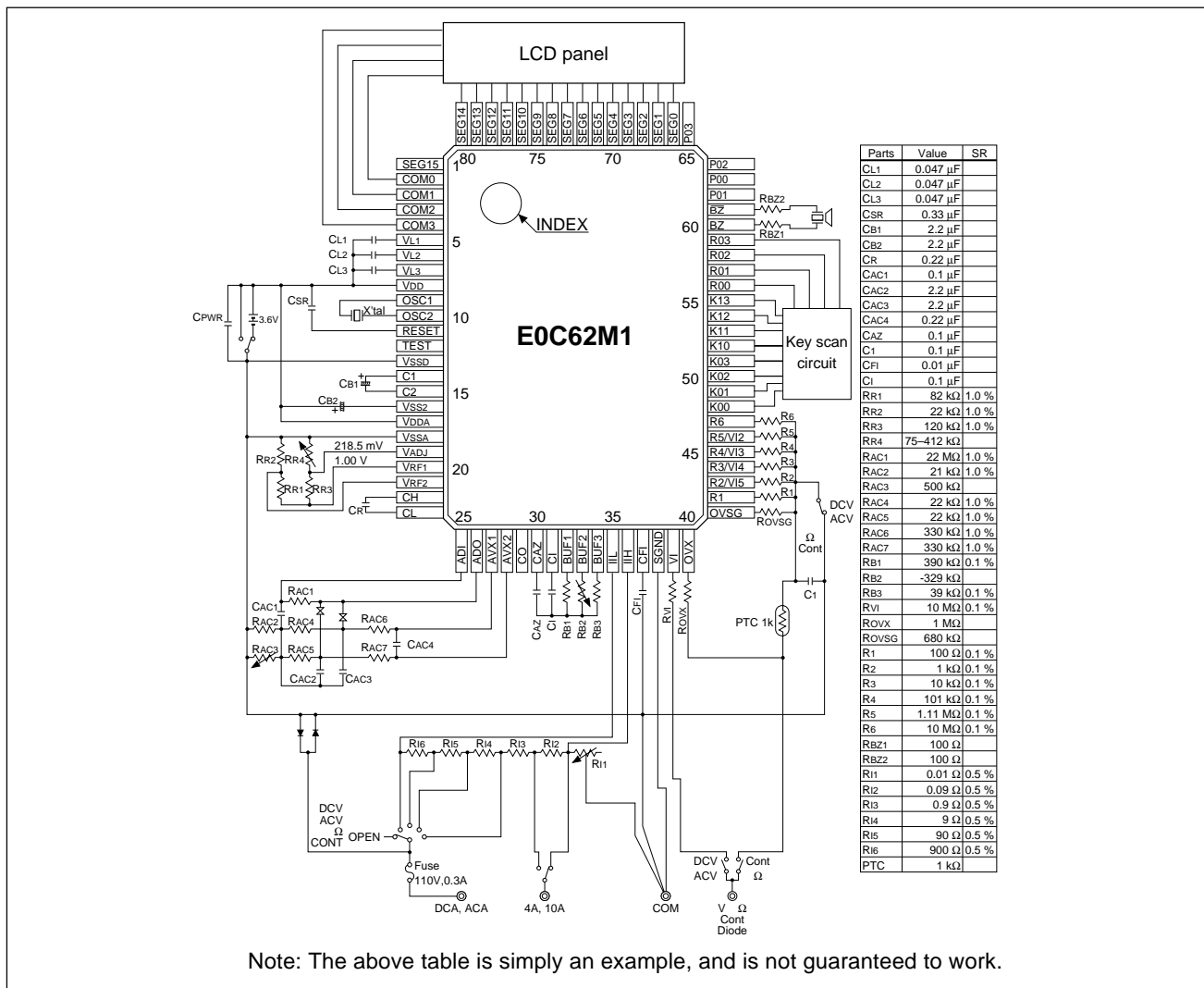
● Oscillation Characteristics

The oscillation characteristics change depending on the conditions (components used, board pattern, etc.). Use the following characteristics as reference values.

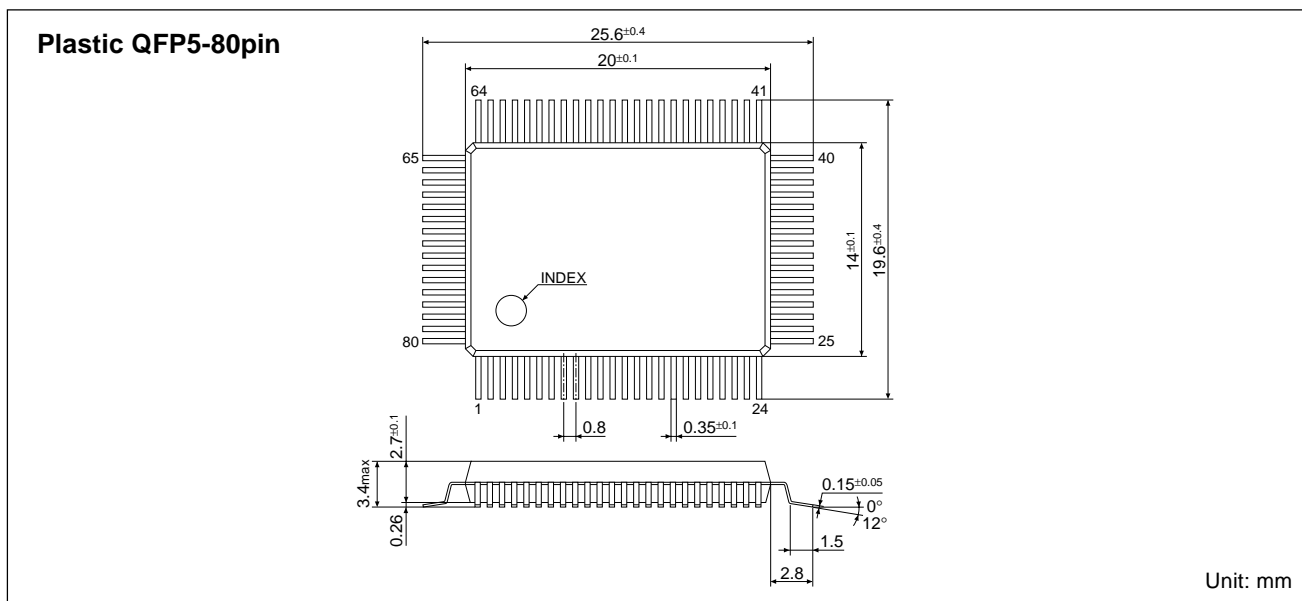
(Unless otherwise specified: VDD/VDDA=0V, VSSD/VSSA=-3.0V, Crystal: C-002R (CI=35kΩ), CG=CD=built-in, fOSC1=32.768kHz, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta	tsta ≤ 3sec			-2.15	V
Oscillation stop voltage	Vstp	tstp ≤ 10sec			-1.8	V
Built-in capacitance (gate)	CG			20		pF
Built-in capacitance (drain)	CD			15		pF
Harmonic oscillation start voltage	Vhho				-3.5	V
Permitted leak resistance	Rleak		200			MΩ

■ BASIC EXTERNAL CONNECTION DIAGRAM



■ PACKAGE DIMENSIONS



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