

# DATA SHEET

## **OM5234/OM5284** CMOS single-chip 8-bit microcontrollers

Preliminary specification

1996 Nov 01

# CMOS single-chip 8-bit microcontrollers

# OM5234/OM5284

## DESCRIPTION

The OM5234 and OM5284 single-chip 8-bit microcontrollers are manufactured in an advanced CMOS process and are derivatives of the 80C51 microcontroller family. The OM5234 and OM5284 are pre-programmed devices for specific applications. Unless specifically stated otherwise, all references to OM5234 apply equally to OM5284.

The OM5234 contains a non-volatile 16k × 8 read-only program memory, a volatile 256 × 8 read/write data memory, four 8-bit I/O ports, two 16-bit timer/event counters (identical to the timers of the 80C51), a multi-source, two-priority-level, nested interrupt structure, UART and on-chip oscillator and timing circuits.

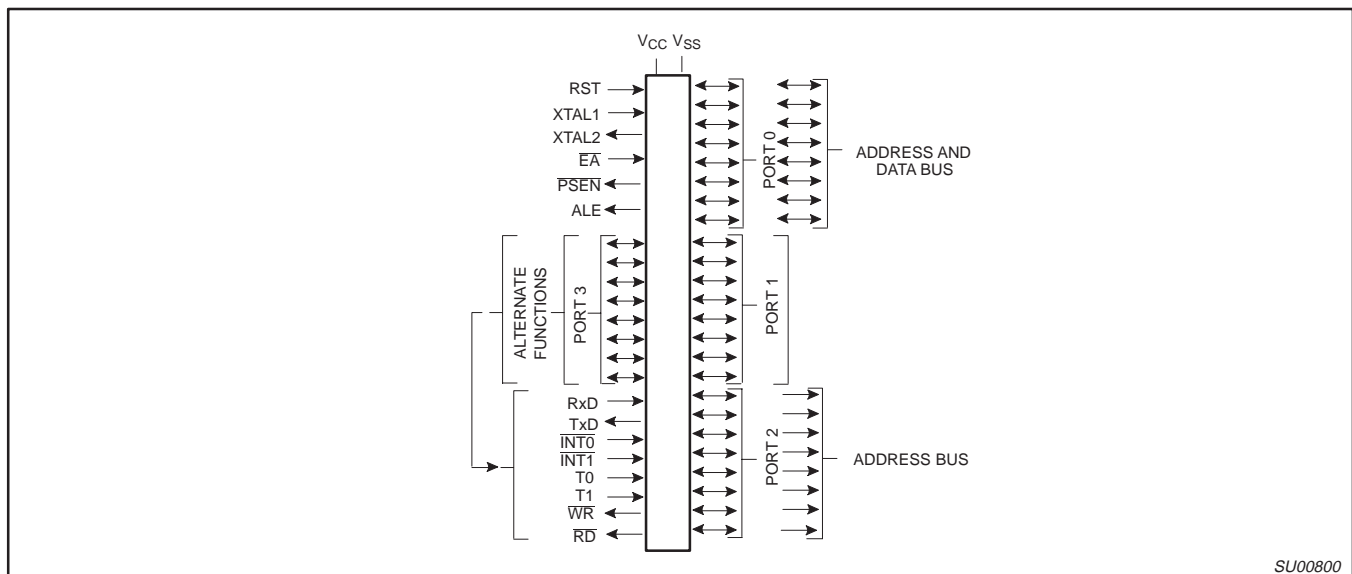
## FEATURES

- 80C51 central processing unit
- 6k × 8 ROM
- 256 × 8 RAM
- Two standard 16-bit timer/counters
- Four 8-bit I/O ports
- Full-duplex UART facilities
- Power control modes
  - Idle mode
  - Power-down mode
- ROM code protection

## ORDERING INFORMATION

PART NUMBER	TEMPERATURE RANGE °C AND PACKAGE	FREQUENCY (MHz)	DRAWING NUMBER
OM5234/FBB/YYY	0 to 70°C, Plastic Quad Flat Package	16	SOT307-2
OM5234/FBP/YYY	0 to 70°C, Plastic Dual In-Line Package	16	SOT129-1
OM5234/FBA/YYY	0 to 70°C, Plastic Leaded Chip Carrier	16	SOT187-2
OM5284EBYY	0 to 70°C, Plastic Quad Flat Package	16	SOT307-2
OM5284EAYY	0 to 70°C, Plastic Leaded Chip Carrier	16	SOT187-2
OM5284EPYY	0 to 70°C, Plastic Dual In-Line Package	16	SOT129-1

## LOGIC SYMBOL



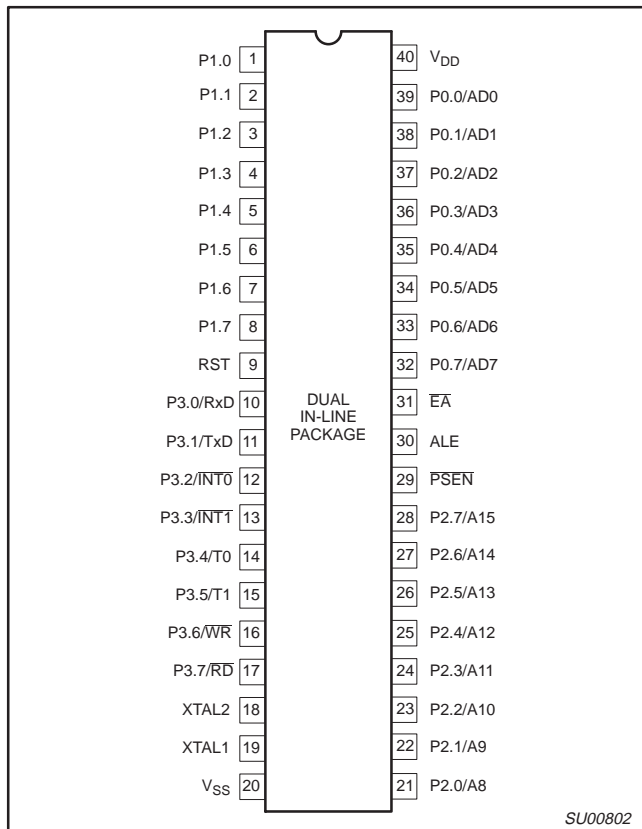
SU00800

# CMOS single-chip 8-bit microcontrollers

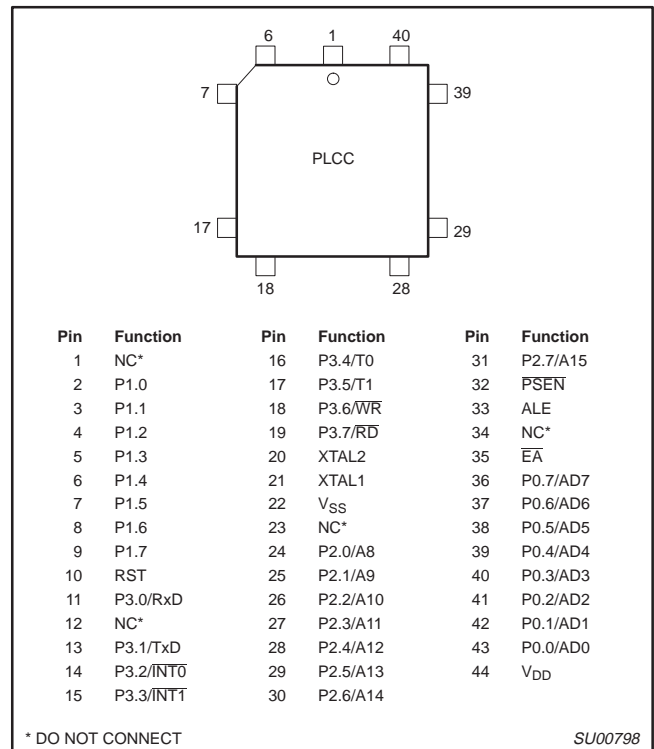
# OM5234/OM5284

## PIN CONFIGURATIONS

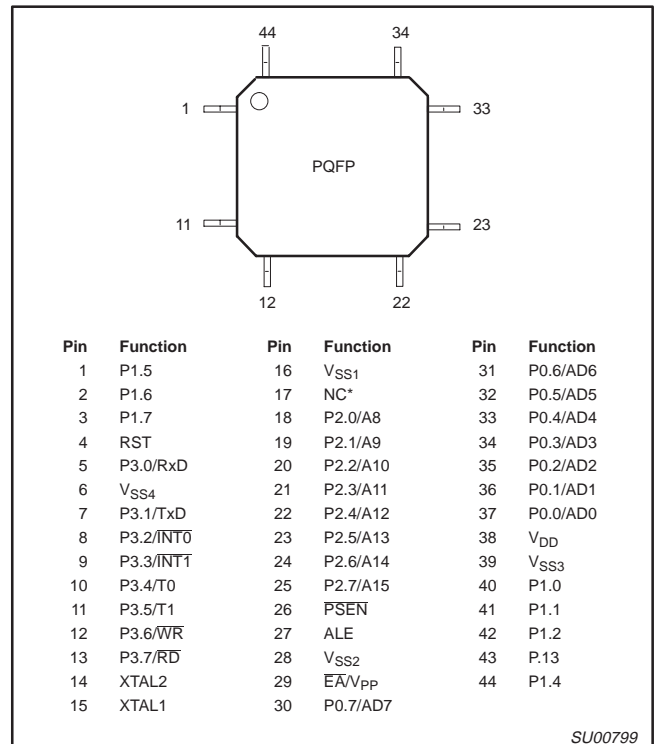
### DUAL IN-LINE PACKAGE PIN FUNCTIONS



### PLASTIC LEADED CHIP CARRIER PIN FUNCTIONS



### PLASTIC QUAD FLAT PACK PIN FUNCTIONS



## CMOS single-chip 8-bit microcontrollers

## OM5234/OM5284

## PIN DESCRIPTIONS

MNEMONIC	PIN NUMBER			TYPE	NAME AND FUNCTION
	PLCC	QFP	DIP		
V <sub>SS</sub>	22	6, 16, 28, 39	20	I	<b>Ground:</b> 0V reference. With the QFP package, all V <sub>SS</sub> pins (V <sub>SS1</sub> to V <sub>SS4</sub> ) must be connected.
V <sub>DD</sub>	44	38	40	I	<b>Power Supply:</b> This is the power supply voltage for normal, idle, and power-down operation.
P0.0–P0.7	43–36	37–30	39–32	I/O	<b>Port 0:</b> Port 0 is an open-drain, bidirectional I/O port. Port 0 pins that have 1s written to them float and can be used as high-impedance inputs. Port 0 is also the multiplexed low-order address and data bus during accesses to external program and data memory. In this application, it uses strong internal pull-ups when emitting 1s.
P1.0–P1.7	2–9	40–44, 1–3	1–8	I/O	<b>Port 1:</b> Port 1 is an 8-bit bidirectional I/O port with internal pull-ups, except P1.6 and P1.7, which are open drain for OM5234 (only). Port 1 pins that have 1s written to them are pulled high by the internal pull-ups and can be used as inputs. As inputs, port 1 pins that are externally pulled low will source current because of the internal pull-ups. (See DC Electrical Characteristics: I <sub>IL</sub> ). Alternate functions include:
P1.6	8	2	7	I/O	Bidirectional I/O with internal pull-ups (OM5284), and open drain for (OM5234).
P1.7	9	3	8	I/O	Bidirectional I/O with internal pull-ups (OM5284), and open drain for (OM5234).
P2.0–P2.7	24–31	18–25	21–28	I/O	<b>Port 2:</b> Port 2 is an 8-bit bidirectional I/O port with internal pull-ups. Port 2 pins that have 1s written to them are pulled high by the internal pull-ups and can be used as inputs. As inputs, port 2 pins that are externally being pulled low will source current because of the internal pull-ups. (See DC Electrical Characteristics: I <sub>IL</sub> ). Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that use 16-bit addresses (MOVX @DPTR). In this application, it uses strong internal pull-ups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOV @Ri), port 2 emits the contents of the P2 special function register.
P3.0–P3.7	11, 13–19	5, 7–13	10–17	I/O	<b>Port 3:</b> Port 3 is an 8-bit bidirectional I/O port with internal pull-ups. Port 3 pins that have 1s written to them are pulled high by the internal pull-ups and can be used as inputs. As inputs, port 3 pins that are externally being pulled low will source current because of the pull-ups. (See DC Electrical Characteristics: I <sub>IL</sub> ). Port 3 also serves the special features of the 80C51 family, as listed below:
	11	5	10	I	<b>RxD (P3.0):</b> Serial input port
	13	7	11	O	<b>TxD (P3.1):</b> Serial output port
	14	8	12	I	<b>INT0 (P3.2):</b> External interrupt
	15	9	13	I	<b>INT1 (P3.3):</b> External interrupt
	16	10	14	I	<b>T0 (P3.4):</b> Timer 0 external input
	17	11	15	I	<b>T1 (P3.5):</b> Timer 1 external input
	18	12	16	O	<b>WR (P3.6):</b> External data memory write strobe
	19	13	17	O	<b>RD (P3.7):</b> External data memory read strobe
RST	10	4	9	I	<b>Reset:</b> A high on this pin for two machine cycles while the oscillator is running, resets the device. An internal diffused resistor to V <sub>SS</sub> permits a power-on reset using only an external capacitor to V <sub>CC</sub> .
ALE	33	27	30	I/O	<b>Address Latch Enable:</b> Output pulse for latching the low byte of the address during an access to external memory. In normal operation, ALE is emitted at a constant rate of 1/6 the oscillator frequency. Note that one ALE pulse is skipped during each access to external data memory.
PSEN	32	26	29	O	<b>Program Store Enable:</b> Read strobe to external program memory via Port 0 and Port 2. It is activated twice each machine cycle during fetches from the external program memory. When executing out of external program memory, two activations of PSEN are skipped during each access to external data memory. PSEN is not activated (remains HIGH) during fetches from external program memory. PSEN can sink/source 8 LSTTL inputs and can drive CMOS inputs without external pull-ups.
E <sub>A</sub>	35	29	31	I	<b>External Access:</b> If during a RESET, E <sub>A</sub> is held at TTL, level HIGH, the CPU executes out of the internal program memory ROM provided the Program Counter is less than 16384. If during a RESET, E <sub>A</sub> is held at TTL LOW level, the CPU executes out of external program memory. E <sub>A</sub> is not allowed to float.
XTAL1	21	15	19	I	<b>Crystal 1:</b> Input to the inverting oscillator amplifier and input to the internal clock generator circuits.
XTAL2	20	14	18	O	<b>Crystal 2:</b> Output from the inverting oscillator amplifier.

**NOTE:**

To avoid "latch-up" effect at power-on, the voltage on any pin at any time must not be higher than V<sub>DD</sub> + 0.5V or V<sub>SS</sub> – 0.5V, respectively.

## CMOS single-chip 8-bit microcontrollers

## OM5234/OM5284

## DC ELECTRICAL CHARACTERISTICS

 $V_{SS} = 0V$ ,  $V_{DD} = 5V \pm 10\%$ ,  $T_{amb} = 0^{\circ}C$  to  $+70^{\circ}C$ 

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS		UNIT
			MIN.	MAX.	
$V_{IL}$	Input low voltage, except $\overline{EA}$ , P1.6, P1.7		-0.5	$0.2V_{DD}-0.1$	V
$V_{IL1}$	Input low voltage to $\overline{EA}$		-0.5	$0.2V_{DD}-0.3$	V
$V_{IL2}$	Input low voltage to P1.6, P1.7		-0.5	$0.3V_{DD}$	V
$V_{IH}$	Input high voltage, except XTAL1, RST, P1.6, P1.7		$0.2V_{DD}+0.9$	$V_{DD}+0.5$	V
$V_{IH1}$	Input high voltage, XTAL1, RST		$0.7V_{DD}$	$V_{DD}+0.5$	V
$V_{OL}$	Output low voltage, ports 1, 2, 3, except P1.6, P1.7	$I_{OL} = 1.6mA^{6,7}$		0.45	V
$V_{OL1}$	Output low voltage, port 0, ALE, $\overline{PSEN}$	$I_{OL} = 3.2mA^{6,7}$		0.45	V
$V_{OL2}$	Output low voltage, P1.6, P1.7	$I_{OL} = 3.0mA$		0.4	V
$V_{OH}$	Output high voltage, ports 1, 2, 3, ALE, $\overline{PSEN}^8$	$I_{OH} = -25\mu A$	$0.75V_{DD}$		V
$I_{IL}$	Logical 0 input current, ports 1, 2, 3, except P1.6, P1.7	$V_{IN} = 0.45V$		-50	$\mu A$
$I_{TL}$	Logical 1-to-0 transition current, ports 1, 2, 3, except P1.6, P1.7	See note 5		-650	$\mu A$
$I_{L1}$	Input leakage current, port 0, $\overline{EA}$ , P1.6, P1.7	$0.45V < V_I < 4.7V$		$\pm 10$	$\mu A$
$I_{DD}$	Power supply current: Active mode @ 16MHz <sup>1,9</sup> Idle mode @ 16MHz <sup>2,9</sup> Power down mode <sup>3,4</sup>	$V_{DD}=5.5V$		32.0 6 50	mA mA $\mu A$
$R_{RST}$	Internal reset pull-down resistor		40	225	k $\Omega$
$C_{IO}$	Pin capacitance			15	pF

## NOTES:

- The operating supply current is measured with all output pins disconnected; XTAL1 driven with  $t_r = t_f = 5ns$ ;  $V_{IL} = V_{SS} + 0.5V$ ;  $V_{IH} = V_{DD} - 0.5V$ ; XTAL2 not connected;  $\overline{EA} = RST = Port 0 = P1.6 = P1.7 = V_{DD}$ .
- The idle mode supply current is measured with all output pins disconnected; XTAL1 driven with  $t_r = t_f = 5ns$ ;  $V_{IL} = V_{SS} + 0.5V$ ;  $V_{IH} = V_{DD} - 0.5V$ ; XTAL2 not connected; Port 0 = P1.6 = P1.7 =  $V_{DD}$ ;  $\overline{EA} = RST = V_{SS}$ .
- The power-down current is measured with all output pins disconnected; XTAL2 not connected; Port 0 = P1.6 = P1.7 =  $V_{DD}$ ;  $\overline{EA} = RST = V_{SS}$ .
- $2V \leq V_{PD} \leq V_{DDmax}$ .
- Pins of ports 1, 2, and 3 source a transition current when they are being externally driven from 1 to 0. The transition current reaches its maximum value when  $V_{IN}$  is approximately 2V.
- Capacitive loading on ports 0 and 2 may cause spurious noise to be superimposed on the  $V_{OL}$ s of ALE and ports 1 and 3. The noise is due to external bus capacitance discharging into the port 0 and port 2 pins when these pins make 1-to-0 transitions during bus operations. In the worst cases (capacitive loading > 100pF), the noise pulse on the ALE pin may exceed 0.8V. In such cases, it may be desirable to qualify ALE with a Schmitt Trigger, or use an address latch with a Schmitt Trigger STROBE input.
- Under steady state (non-transient) conditions,  $I_{OL}$  must be externally limited as follows: Maximum  $I_{OL} = 10mA$  per port pin; Maximum  $I_{OL} = 26mA$  total for Port 0; Maximum  $I_{OL} = 15mA$  total for Ports 1, 2, and 3; Maximum  $I_{OL} = 71mA$  total for all output pins. If  $I_{OL}$  exceeds the test conditions,  $V_{OL}$  may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test conditions.
- Capacitive loading on ports 0 and 2 may cause the  $V_{OH}$  on ALE and  $\overline{PSEN}$  to momentarily fall below the  $0.9V_{DD}$  specification when the address bits are stabilizing.
- $I_{DDMAX}$  for other frequencies can be derived from Figure 1, where  $FREQ$  is the external oscillator frequency in MHz.  $I_{DDMAX}$  is given in mA.

CMOS single-chip 8-bit microcontrollers

OM5234/OM5284

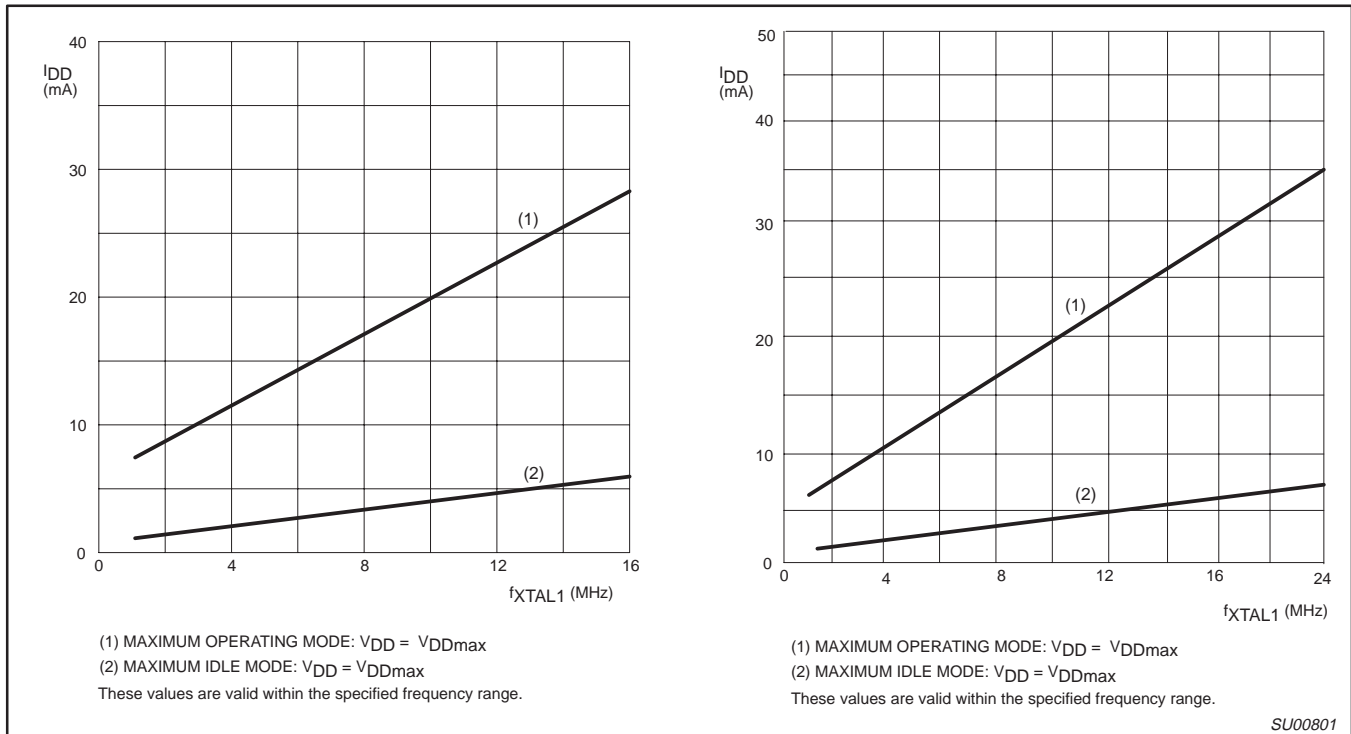


Figure 1.  $I_{DD}$  vs. Frequency

AC ELECTRICAL CHARACTERISTICS<sup>1, 2</sup>

SYMBOL	FIGURE	PARAMETER	16MHz CLOCK		VARIABLE CLOCK		UNIT
			MIN	MAX	MIN	MAX	
<b>External Clock</b>							
$t_{CHCX}$	2	High time <sup>3</sup>	20		20	$t_{CLCL} - t_{LOW}$	ns
$t_{CLCX}$	2	Low time <sup>3</sup>	20		20	$t_{CLCL} - t_{HIGH}$	ns
$t_{CLCH}$	2	Rise time <sup>3</sup>		20		20	ns
$t_{CHCL}$	2	Fall time <sup>3</sup>		20		20	ns

NOTES:

- Parameters are valid over operating temperature range unless otherwise specified.
- Load capacitance for port 0, ALE, and  $\overline{PSEN}$  = 100pF, load capacitance for all other outputs = 80pF.
- These values are characterized but not 100% production tested.

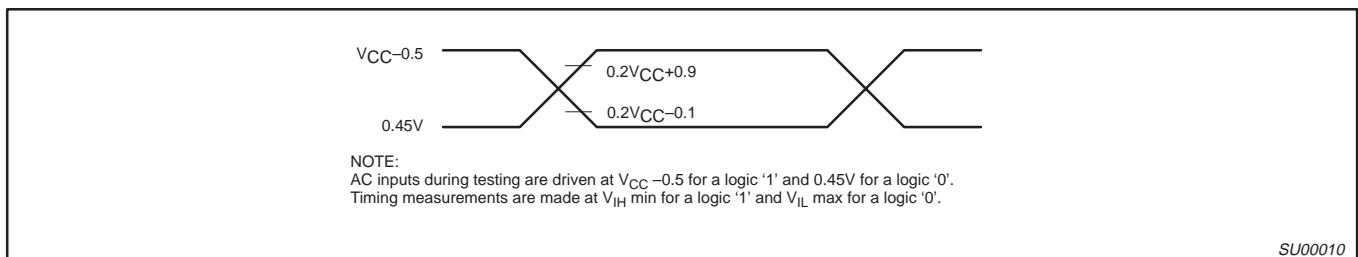


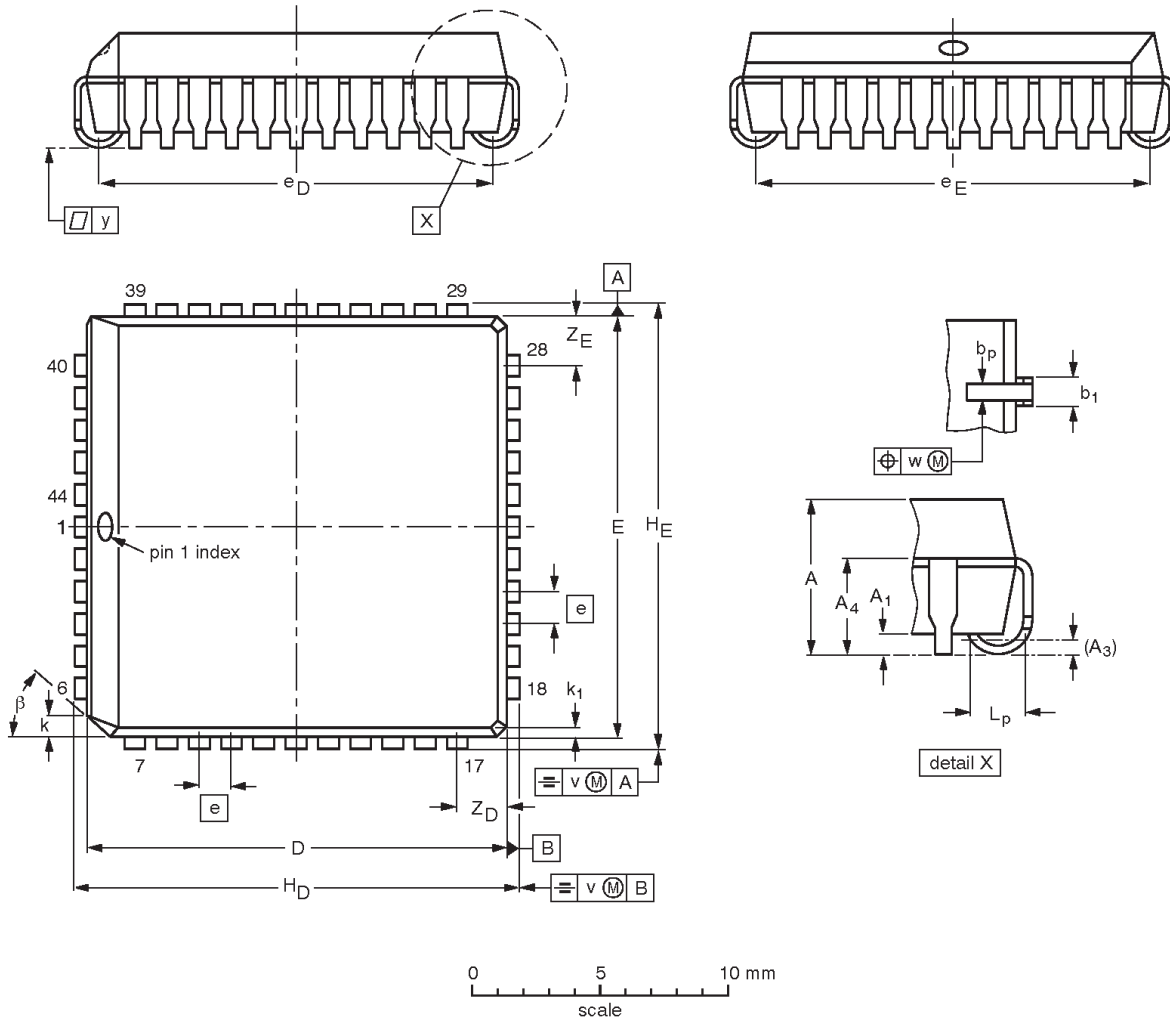
Figure 2. AC Testing Input/Output

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OM5234/OM5284

PLCC44: plastic leaded chip carrier; 44 leads

SOT187-2



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	A <sub>1</sub> min.	A <sub>3</sub>	A <sub>4</sub> max.	b <sub>p</sub>	b <sub>1</sub>	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>D</sub>	e <sub>E</sub>	H <sub>D</sub>	H <sub>E</sub>	k	k <sub>1</sub> max.	L <sub>p</sub>	v	w	y	Z <sub>D</sub> <sup>(1)</sup> max.	Z <sub>E</sub> <sup>(1)</sup> max.	$\beta$
mm	4.57 4.19	0.51	0.25	3.05	0.53 0.33	0.81 0.66	16.66 16.51	16.66 16.51	1.27	16.00 14.99	16.00 14.99	17.65 17.40	17.65 17.40	1.22 1.07	0.51	1.44 1.02	0.18	0.18	0.10	2.16	2.16	45°
inches	0.180 0.165	0.020	0.01	0.12	0.021 0.013	0.032 0.026	0.656 0.650	0.656 0.650	0.05	0.630 0.590	0.630 0.590	0.695 0.685	0.695 0.685	0.048 0.042	0.020	0.057 0.040	0.007	0.007	0.004	0.085	0.085	

Note

1. Plastic or metal protrusions of 0.01 inches maximum per side are not included.

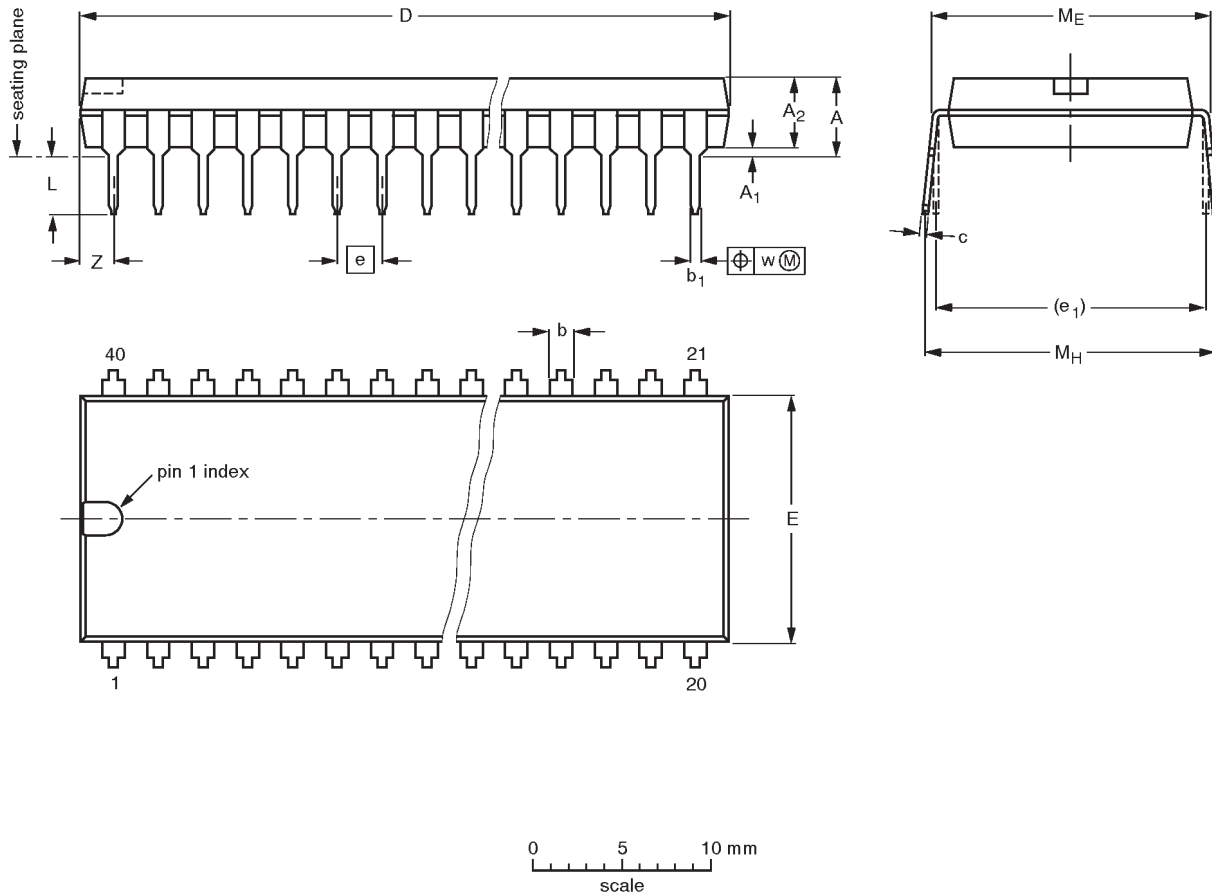
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT187-2	112E10	MO-047AC				92-11-17 95-02-25

# CMOS single-chip 8-bit microcontrollers

# OM5234/OM5284

**DIP40: plastic dual in-line package; 40 leads (600 mil)**

**SOT129-1**



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.7	0.51	4.0	1.70 1.14	0.53 0.38	0.36 0.23	52.50 51.50	14.1 13.7	2.54	15.24	3.60 3.05	15.80 15.24	17.42 15.90	0.254	2.25
inches	0.19	0.020	0.16	0.067 0.045	0.021 0.015	0.014 0.009	2.067 2.028	0.56 0.54	0.10	0.60	0.14 0.12	0.62 0.60	0.69 0.63	0.01	0.089

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT129-1	051G08	MO-015AJ				92-11-17 95-01-14

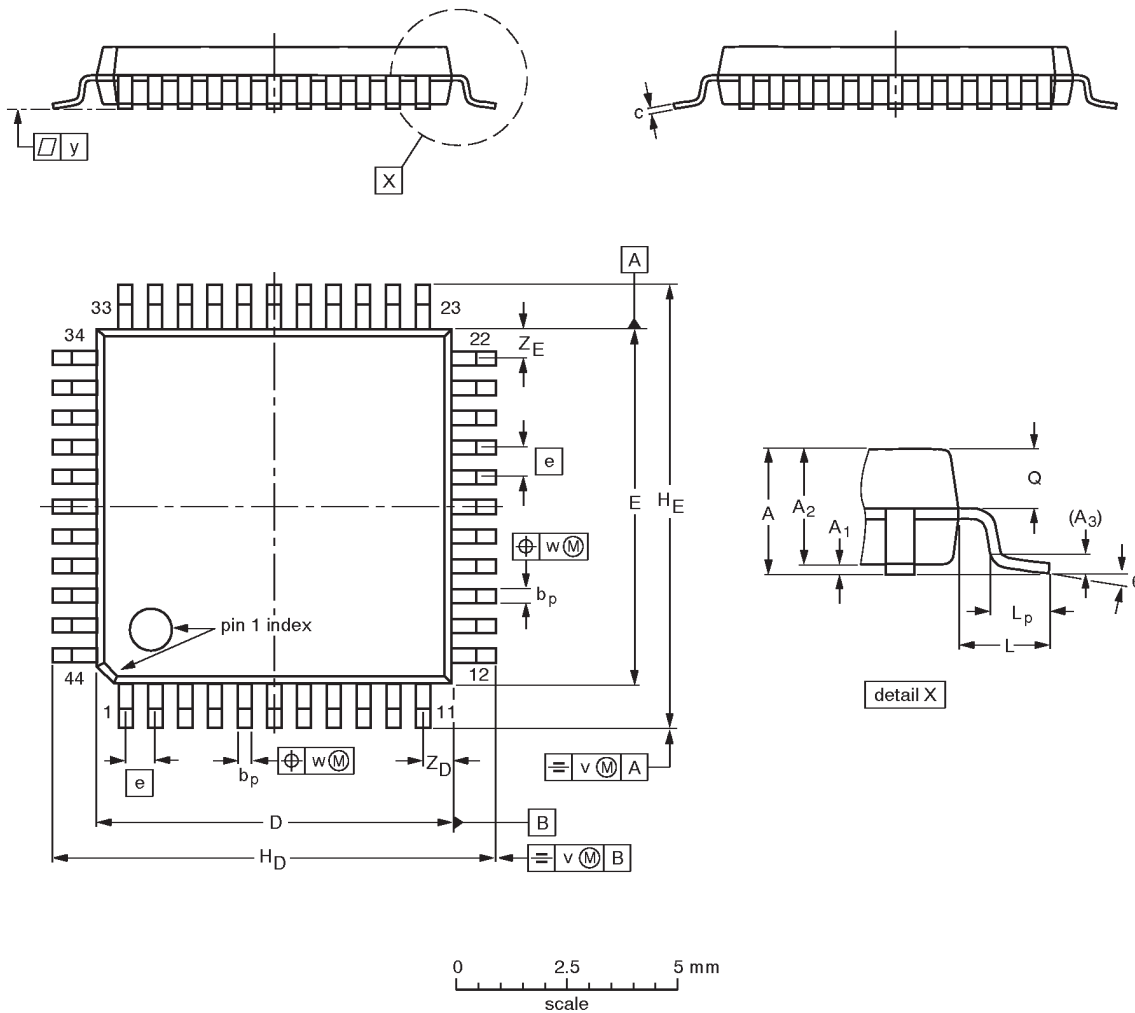


CMOS single-chip 8-bit microcontrollers

OM5234/OM5284

**QFP44:** plastic quad flat package; 44 leads (lead length 1.3 mm); body 10 x 10 x 1.75 mm

**SOT307-2**



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>D</sub>	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sub>D</sub> <sup>(1)</sup>	Z <sub>E</sub> <sup>(1)</sup>	θ
mm	2.10	0.25 0.05	1.85 1.65	0.25	0.40 0.20	0.25 0.14	10.1 9.9	10.1 9.9	0.8	12.9 12.3	12.9 12.3	1.3	0.95 0.55	0.85 0.75	0.15	0.15	0.1	1.2 0.8	1.2 0.8	10° 0°

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT307-2						92-11-17 95-02-04

CMOS single-chip 8-bit microcontrollers

OM5234/OM5284

**DEFINITIONS**

<b>Data Sheet Identification</b>	<b>Product Status</b>	<b>Definition</b>
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