

# OKI Semiconductor

**FEDR27C1602B-01-03**

Issue Date: Jun. 17, 2003

## MR27C1602B

**1,048,576-Word × 16-Bit or 2,097,152-Word × 8-Bit One Time PROM**

### GENERAL DESCRIPTION

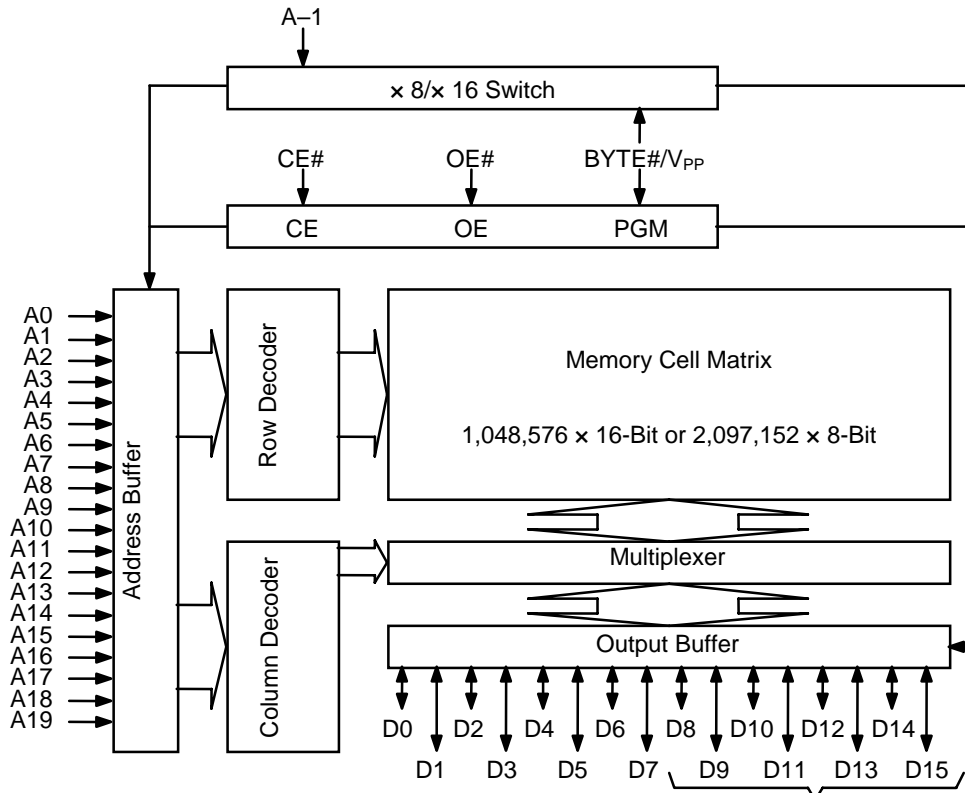
The MR27C1602B is a 16 Mbit electrically One Time Programmable Read-Only Memory that can be electrically switched between 1,048,576-word × 16-bit and 2,097,152-word × 8-bit by the state of the BYTE# pin. The MR27C1602B supports high speed asynchronous read operation using a single 5.0V power supply.

### FEATURES

- 1,048,576-word × 16-bit/2,097,152-word × 8-bit electrically switchable configuration
- +5.0 V power supply
- Access time                      90 nS MAX
- Operating current                70 mA MAX
- Standby current                 50 μA MAX
- Input/Output TTL compatible
- Tri-state output
- Packages:
  - 42-pin plastic DIP (DIP42-P-600-2.54) (MR27C1602BRA)
  - 44-pin plastic SOP (SOP44-P-600-1.27-K) (MR27C1602BMA)



**BLOCK DIAGRAM**



In 8-bit output mode, these pins are placed in a high-Z state and pin D15 functions as the A-1 address pin.

**FUNCTION TABLE**

Mode	CE#	OE#	BYTE#/V <sub>PP</sub>	V <sub>CC</sub>	D0 to D7	D8 to D14	D15/A-1	
Read (16-Bit)	L	L	H	5.0 V	D <sub>OUT</sub>			
Read (8-Bit)	L	L	L		D <sub>OUT</sub>	Hi-Z	L/H	
Output disable	L	H	H		Hi-Z			*
			L		Hi-Z			*
Standby	H	*	H	Hi-Z			*	
			L	Hi-Z			*	
Program	L	H	9.75 V	4.0 V	D <sub>IN</sub>			
Program inhibit	H	H			Hi-Z			
Program verify	H	L			D <sub>OUT</sub>			

\*: Don't Care (H or L)

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Condition	Value	Unit
Operating temperature under bias	T <sub>a</sub>	—	0 to 70	°C
Storage temperature	T <sub>stg</sub>		-55 to 125	°C
Input voltage	V <sub>I</sub>	relative to V <sub>SS</sub>	-0.5 to V <sub>CC</sub> +0.5	V
Output voltage	V <sub>O</sub>		-0.5 to V <sub>CC</sub> +0.5	V
Power supply voltage	V <sub>CC</sub>		-0.5 to 7	V
Program power supply voltage	V <sub>PP</sub>		-0.5 to 11.5	V
Power dissipation per package	P <sub>D</sub>	—	1.0	W

**RECOMMENDED OPERATING CONDITIONS**(T<sub>a</sub> = 0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
V <sub>CC</sub> power supply voltage	V <sub>CC</sub>	V <sub>CC</sub> = 4.5 to 5.5 V	4.5	—	5.5	V
V <sub>PP</sub> power supply voltage	V <sub>PP</sub>		-0.5	—	V <sub>CC</sub> +0.5	V
Input "H" level	V <sub>IH</sub>		2.2	—	V <sub>CC</sub> +0.5*	V
Input "L" level	V <sub>IL</sub>		-0.5**	—	0.8	V

Voltage is relative to V<sub>SS</sub>.\* : V<sub>CC</sub>+1.5V(Max.) when pulse width of overshoot is less than 10ns.

\*\* : -1.5V(Min.) when pulse width of undershoot is less than 10ns.

## ELECTRICAL CHARACTERISTICS

### DC Characteristics

(V<sub>CC</sub> = 5.0 V ± 0.5 V, T<sub>a</sub> = 0 to 70°C)

parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I <sub>LI</sub>	V <sub>I</sub> = 0 to V <sub>CC</sub>	—	—	10	μA
Output leakage current	I <sub>LO</sub>	V <sub>O</sub> = 0 to V <sub>CC</sub>	—	—	10	μA
V <sub>CC</sub> power supply current (Standby)	I <sub>CCSC</sub>	CE# = V <sub>CC</sub>	—	—	50	μA
	I <sub>CCST</sub>	CE# = V <sub>IH</sub>	—	—	1	mA
V <sub>CC</sub> power supply current (Read)	I <sub>CCA</sub>	CE# = V <sub>IL</sub> , OE# = V <sub>IH</sub> tc = 90 ns	—	—	70	mA
V <sub>PP</sub> power supply current	I <sub>PP</sub>	V <sub>PP</sub> = V <sub>CC</sub>	—	—	10	μA
Input "H" level	V <sub>IH</sub>	—	2.2	—	V <sub>CC</sub> +0.5*	V
Input "L" level	V <sub>IL</sub>	—	-0.5**	—	0.8	V
Output "H" level	V <sub>OH</sub>	I <sub>OH</sub> = -400 μA	2.4	—	—	V
Output "L" level	V <sub>OL</sub>	I <sub>OL</sub> = 2.1 mA	—	—	0.4	V

Voltage is relative to V<sub>SS</sub>.\* : V<sub>CC</sub>+1.5V(Max.) when pulse width of overshoot is less than 10ns.

\*\* : -1.5V(Min.) when pulse width of undershoot is less than 10ns.

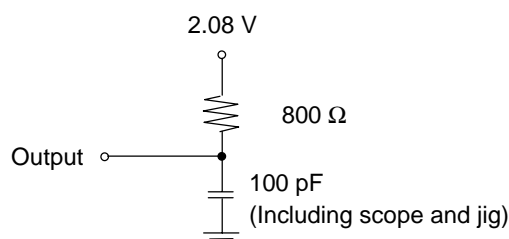
### AC Characteristics

(V<sub>CC</sub> = 5.0 V ± 0.5 V, T<sub>a</sub> = 0 to 70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Address cycle time	t <sub>C</sub>	—	90	—	ns
Address access time	t <sub>ACC</sub>	CE# = OE# = V <sub>IL</sub>	—	90	ns
CE access time	t <sub>CE</sub>	OE# = V <sub>IL</sub>	—	90	ns
OE access time	t <sub>OE</sub>	CE# = V <sub>IL</sub>	—	45	ns
Output disable time	t <sub>CHZ</sub>	OE# = V <sub>IL</sub>	0	30	ns
	t <sub>OHZ</sub>	CE# = V <sub>IL</sub>	0	25	ns
Output hold time	t <sub>OH</sub>	CE# = OE# = V <sub>IL</sub>	0	—	ns

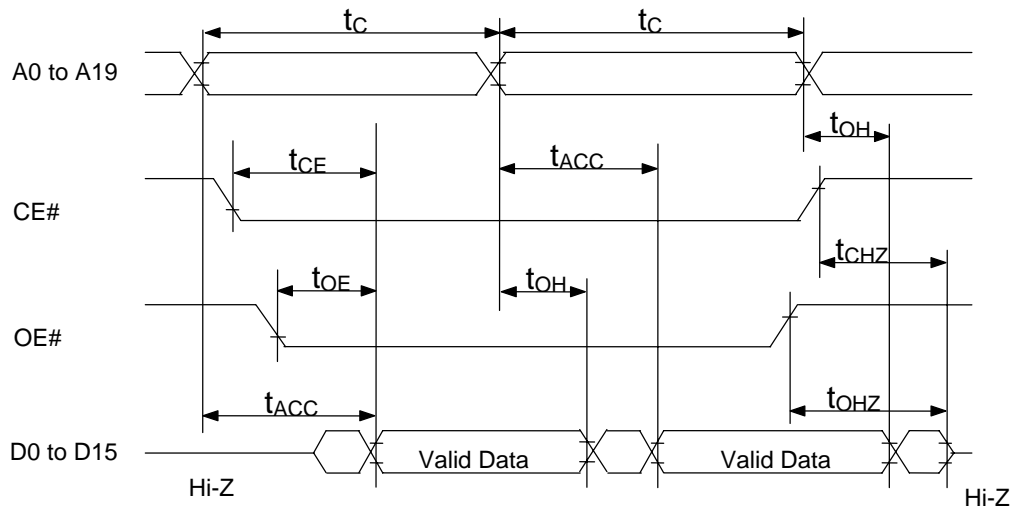
### Measurement conditions

Input signal level-----0 V/3 V  
 Input timing reference level -----0.8 V/2.0 V  
 Output load-----1TTL gate + 100 pF  
 Output timing reference level -----0.8 V/2.0 V

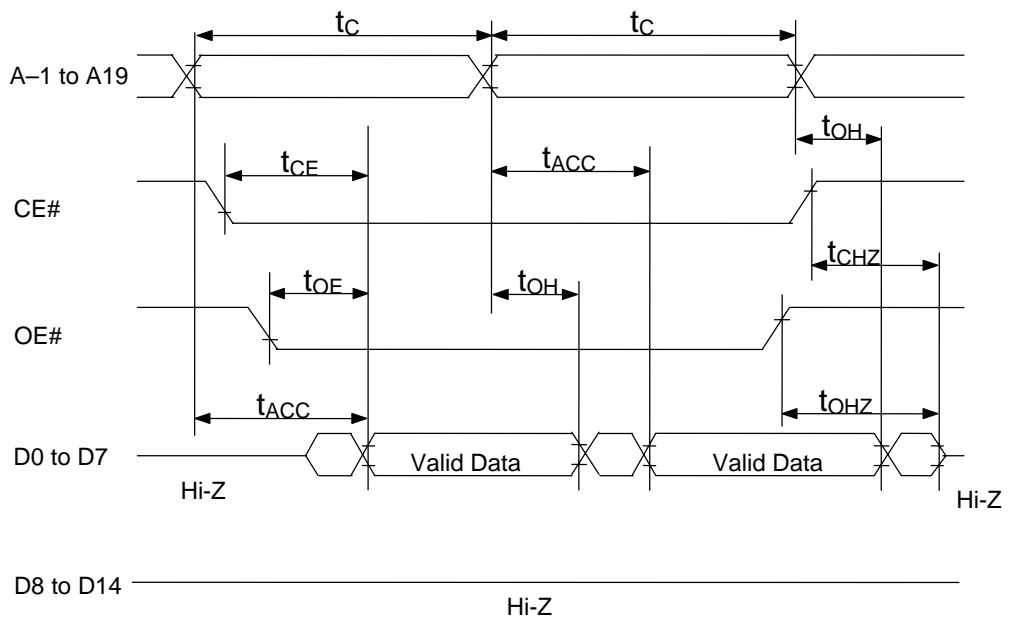


**TIMING CHART (READ CYCLE)**

**16-Bit Read Mode (BYTE# = V<sub>IH</sub>)**



**8-Bit Read Mode (BYTE# = V<sub>IL</sub>)**



**ELECTRICAL CHARACTERISTICS (PROGRAMMING OPERATION)****DC Characteristics**

(Ta = 25°C ± 5°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I <sub>LI</sub>	V <sub>I</sub> = V <sub>CC</sub> +0.5 V	—	—	10	μA
V <sub>PP</sub> power supply current (Program)	I <sub>PP2</sub>	CE# = V <sub>IL</sub>	—	—	50	mA
V <sub>CC</sub> power supply current	I <sub>CC</sub>	—	—	—	70	mA
Input "H" level	V <sub>IH</sub>	—	V <sub>CC</sub> +1.0	—	V <sub>CC</sub> +0.5	V
Input "L" level	V <sub>IL</sub>	—	-0.5	—	0.6	V
Output "H" level	V <sub>OH</sub>	I <sub>OH</sub> = -400 μA	2.4	—	—	V
Output "L" level	V <sub>OL</sub>	I <sub>OL</sub> = 2.1 mA	—	—	0.45	V
Program voltage	V <sub>PP</sub>	—	9.5	9.75	10.0	V
V <sub>CC</sub> power supply voltage (Program)	V <sub>CC</sub>	—	3.9	4.0	4.1	V
V <sub>CC</sub> power supply voltage (Verify-1)	V <sub>CV1</sub>	—	5.9	6.0	6.1	V
V <sub>CC</sub> power supply voltage (Verify-2)	V <sub>CV2</sub>	—	4.4	4.5	4.6	V
V <sub>CC</sub> power supply voltage (Verify-3)	V <sub>CV3</sub>	—	5.4	5.5	5.6	V

Voltage is relative to V<sub>SS</sub>.**AC Characteristics**(V<sub>CC</sub> = 4.0 V ± 0.1 V, BYTE#/V<sub>PP</sub> = 9.75 V ± 0.25 V, Ta = 25°C ± 5°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Address set-up time	t <sub>AS</sub>	—	100	—	—	ns
OE set-up time	t <sub>OES</sub>	—	2	—	—	μs
Data set-up time	t <sub>DS</sub>	—	100	—	—	ns
Address hold time	t <sub>AH</sub>	—	2	—	—	μs
Data hold time	t <sub>DH</sub>	—	100	—	—	ns
Output float delay time from $\overline{\text{OE}}$	t <sub>OZH</sub>	—	0	—	25	ns
V <sub>PP</sub> voltage set-up time	t <sub>VS</sub>	—	2	—	—	μs
Program pulse width	t <sub>PW</sub>	—	9	10	11	μs
Data valid from $\overline{\text{OE}}$	t <sub>OE</sub>	—	—	—	50	ns
Address hold from $\overline{\text{OE}}$ high	t <sub>AOH</sub>	—	0	—	—	ns

**Pin Check Function**

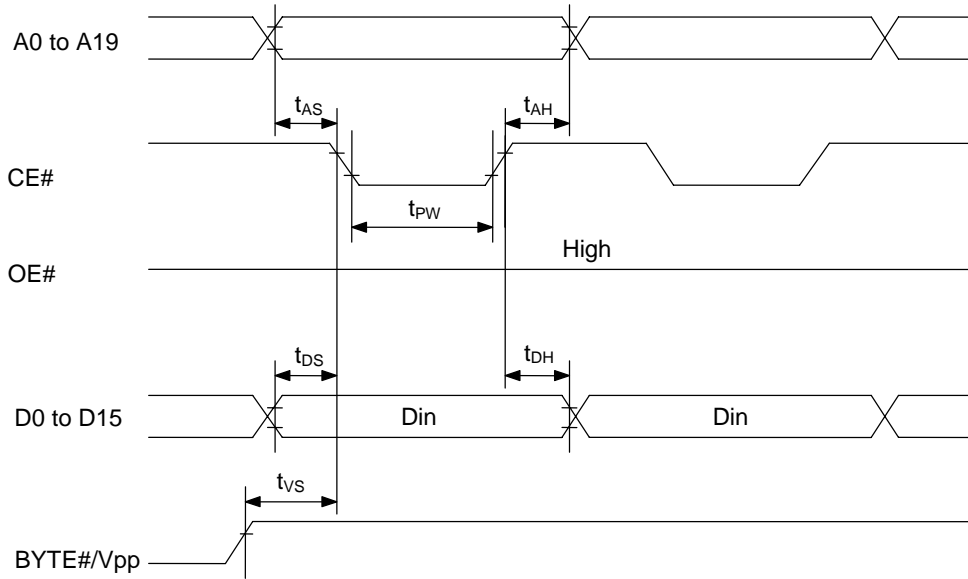
Pin Check Function is to check contact between each device-pin and each socket-lead with EPROM programmer. Setting up address as following condition call the preprogrammed codes on device outputs.

(V<sub>CC</sub> = 4.0 V ± 0.1 V, CE# = V<sub>IL</sub>, OE# = V<sub>IL</sub>, BYTE#/V<sub>PP</sub> = V<sub>IH</sub>, Ta = 25°C ± 5°C)

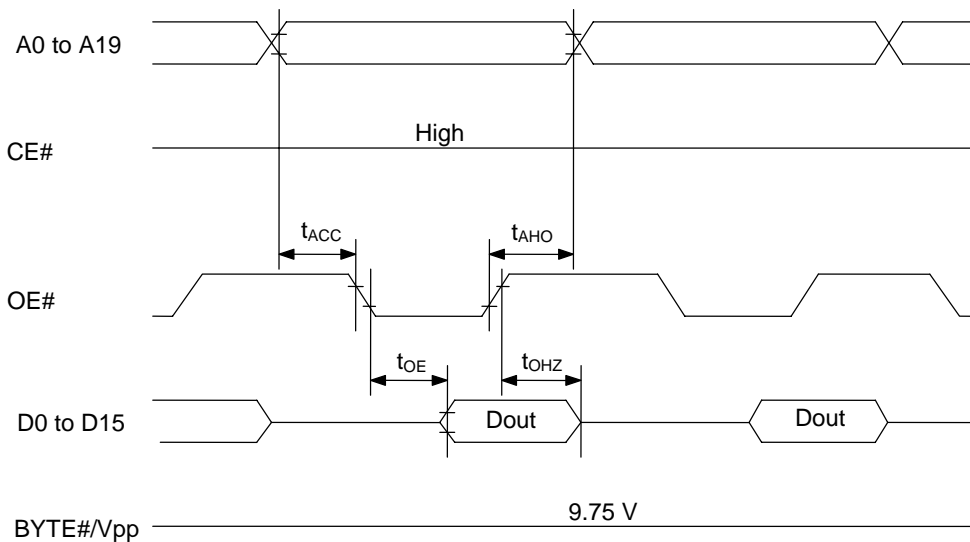
A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	DATA
1	0	1	0	1	0	1	0	1	VH*	1	0	1	0	1	0	1	1	0	0	FF00
0	1	0	1	0	1	0	1	0	VH*	0	1	0	1	0	1	0	0	1	1	00FF
Other conditions																				FFFF

\*: VH = 8 V ± 0.25 V

**Consecutive Programming Waveforms**

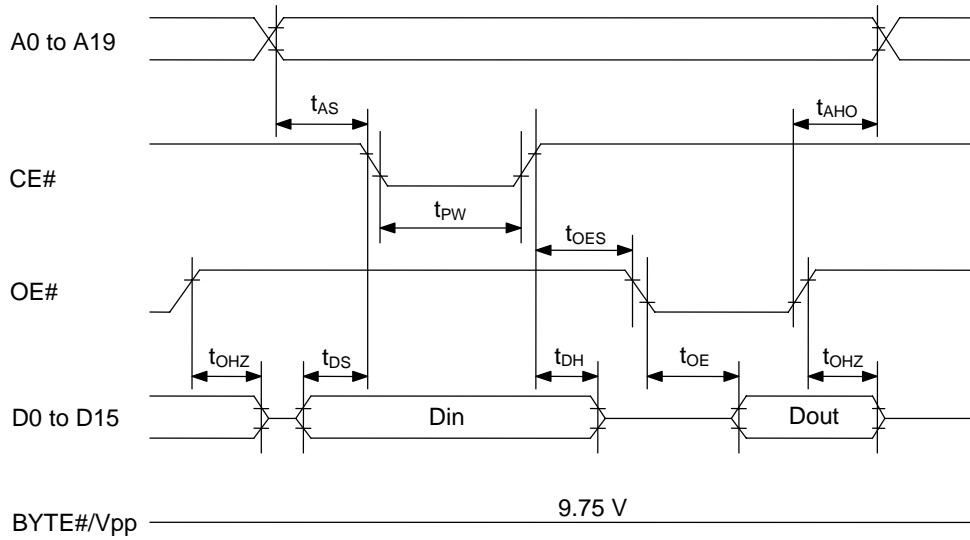


**Consecutive Program Verify Waveforms**





**Program and Program Verify Cycle Waveforms**



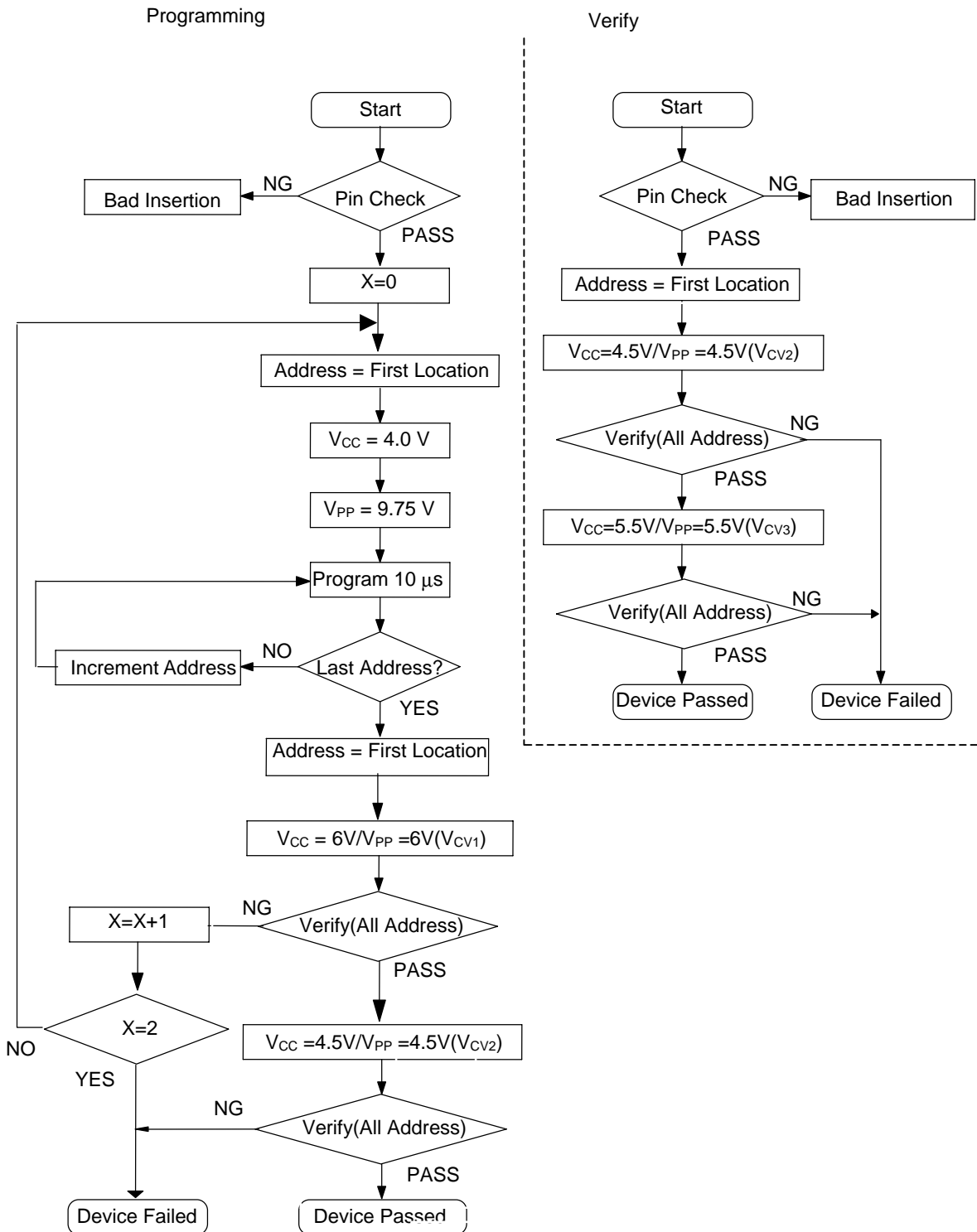
**Pin Capacitance**

( $V_{CC} = 5.0\text{ V}$ ,  $T_a = 25^\circ\text{C}$ ,  $f = 1\text{ MHz}$ )

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input	$C_{IN1}$	$V_I = 0\text{ V}$	—	—	8(10)	pF
BYTE#/V <sub>PP</sub>	$C_{IN2}$		—	—	120	
Output	$C_{OUT}$	$V_O = 0\text{ V}$	—	—	10(12)	

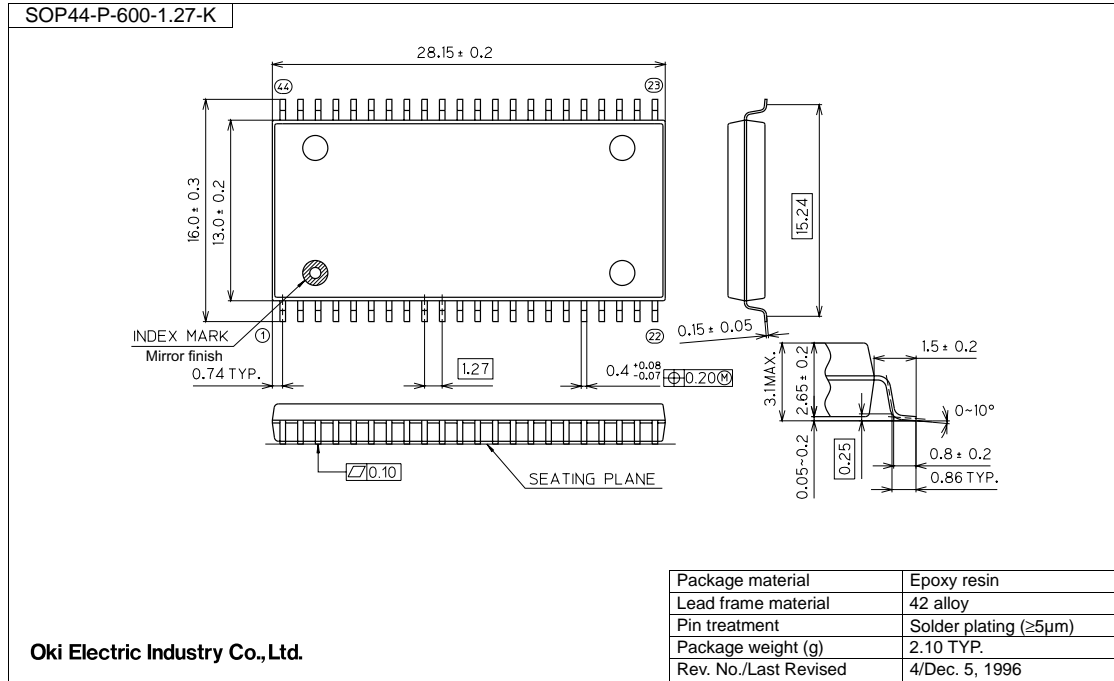
( ) : DIP only

Programming/Verify Flow Chart



**PACKAGE DIMENSIONS**

(Unit: mm)

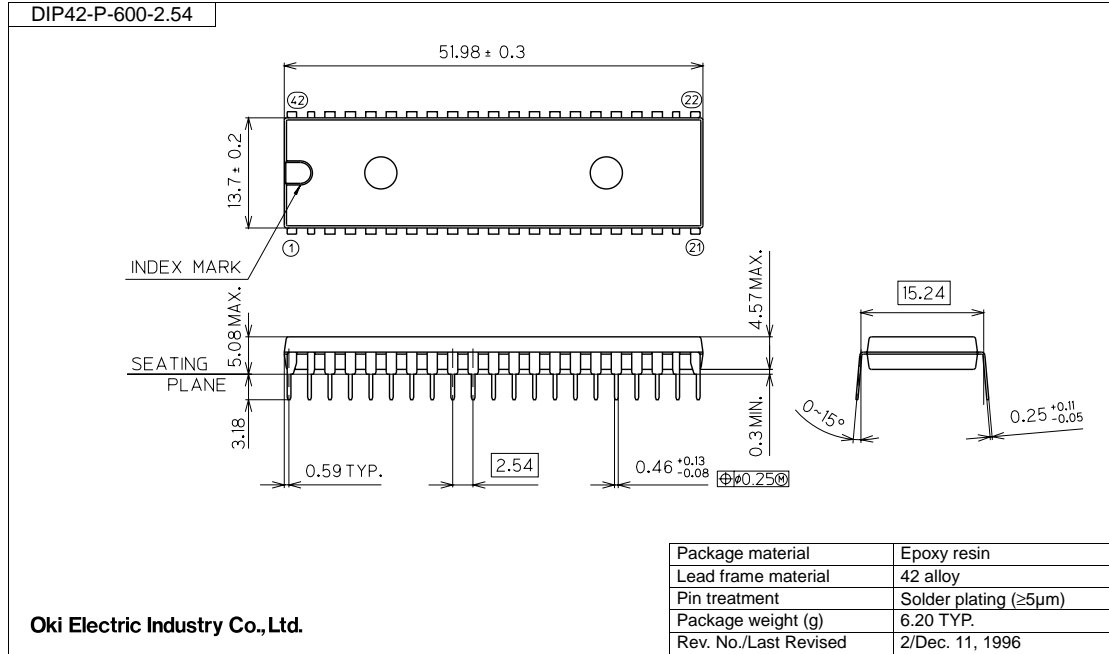


**Notes for Mounting the Surface Mount Type Package**

The surface mount type packages are very susceptible to heat in reflow mounting and humidity absorbed in storage.

Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

(Unit: mm)



**REVISION HISTORY**

Document No.	Date	Page		Description
		Previous Edition	Current Edition	
FEDR27V1602B-01-01	Dec, 2001	–	–	Final edition 1
FEDR27V1602B-01-03	Jun. 17, 2003	–	–	Change over-bar fonts.

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