ICE27C512
512kbit(64KX8) OTP EPROM

Description

The ICE27C512 is a low-power, high-performance 512k(524288) bit one-time programmable read only memory (OTP EPROM) organized as 64K by 8 bits. It is single 5V power supply in normal read mode operation. Any byte can be accessed in less than 70ns. The ICE27C512 typically consumes 10mA , standby mode supply current typically less than 10μA. Two lines control ($\overline{CE}$, $\overline{OE}$) to give designers the flexibility to prevent bus contention. Programming time is typically only 100 μs/byte. The Integrated Product Identification Code electronically identifies the device and manufacturer. This feature is used by industry standard programming equipment to select the proper programming algorithms and voltages.

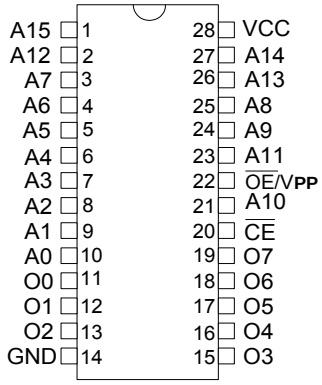
Features

- Fast Read Access Time : 70ns
- Low-Power consumption
  - 1 μA Typ. Standby
  - 10 mA max. Active at 5MHz
- JEDEC Standard Packages
  - 28-Lead 600-mil PDIP
  - 32-Lead PLCC
  - 28-Lead TSOP
- Operating voltage : 5V ±10%
- High Reliability CMOS Technology
  - 2000V ESD Protection
  - 200 mA Latchup Immunity
- Programming time : 100 μs/byte (typical)
- CMOS and TTL Compatible Inputs and Outputs
- Integrated Product Identification Code

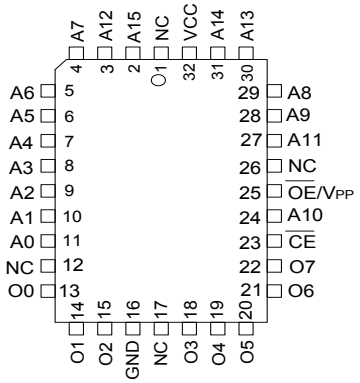
Pin Configurations

Pin Name	Function
A0 – A15	Addresses
O0 – O7	Outputs
$\overline{CE}$	Chip Enable
$\overline{OE}$ /VPP	Output Enable
NC	No Connect

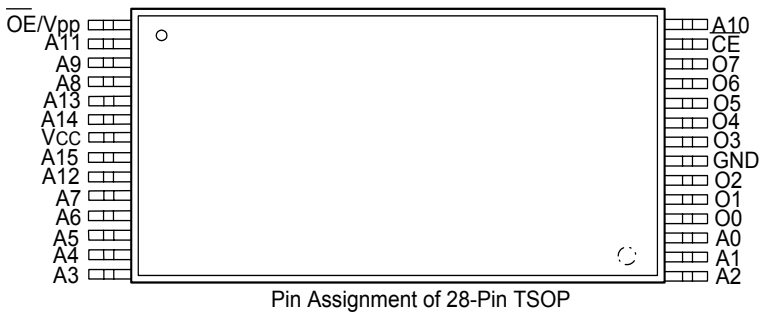
PDIP, SOP, SOLT Top View



PLCC Top View

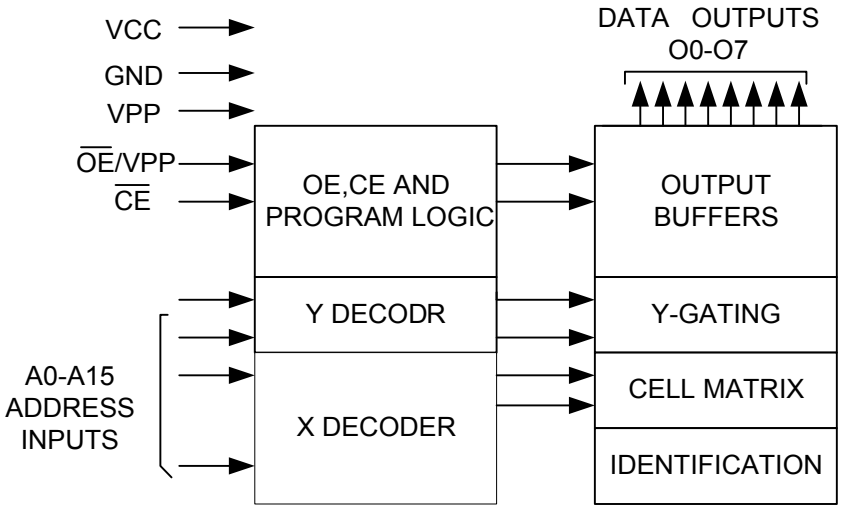


TSOP Top View



Pin Assignment of 28-Pin TSOP

Block Diagram



Absolute Maximum Rating

Operation Temperature Commercial	0℃ to +70℃
Storage Temperature	-65℃ to +125℃
Voltage on Any Pin with Respect to Ground	-0.6V to +7.0V(1)
Vpp Supply Voltage with Respect to Ground	-0.6V to +13.5V(1)

Operating Modes

Mode\Pin	$\overline{CE}$	$\overline{OE}$ /VPP	Ai	Outputs
Read	V_{IL}	V_{IL}	Ai	D_{OUT}
Output Disable	X	V_{IH}	X	High Z
Standby	V_{IH}	X	X	High Z
Rapid Program(2)	V_{IL}	V_{PP}	Ai	D_{IN}
PGM Inhibit	V_{IH}	X	X	High Z
Product Identification(4)	V_{IL}	V_{IL}	A9 = V_H (3) A0,A1 = V_{IH} or V_{IL} A2 – A15 = V_{IL}	Identification Code

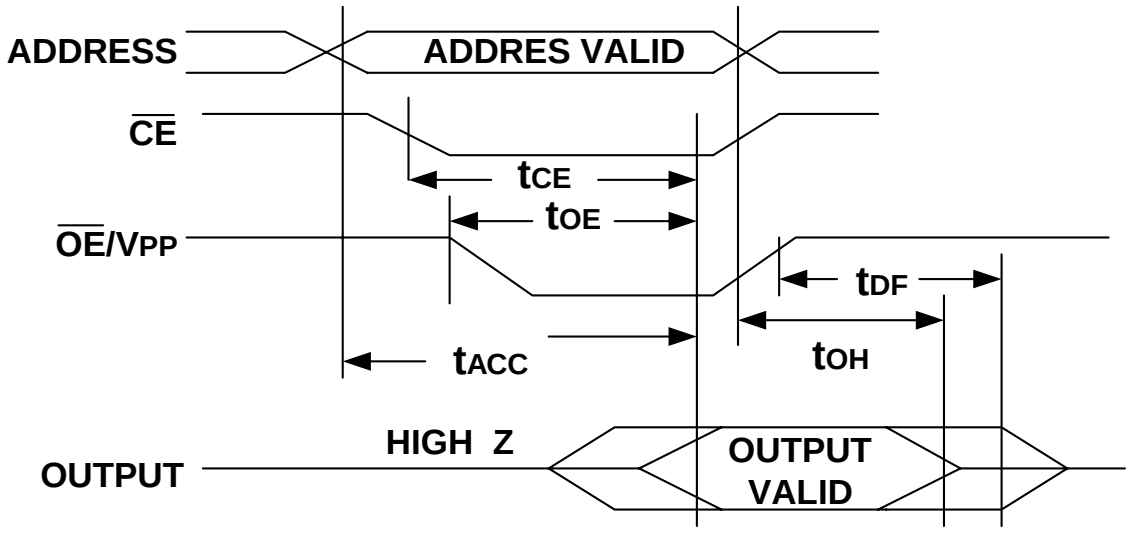
Notes: 1. X can be V_{IL} or V_{IH}.
2. Refer to Programming Characteristics.
3. V_H = 12 ± 0.5V.
4. See Product Identification Code item.

DC and Operating Characteristics for Read Operation

Symbol	Parameter	Condition		Min	Max	Units
I_{LI}	Input Load Current	V_{IN} = 0V to Vcc	Com.		± 1	µA
I_{LO}	Output Leakage Current	V_{OUT} = 0V to Vcc	Com.		± 5	µA
I_{SB}	Vcc[1] Standby Current	I_{SB1}(CMOS), $\overline{CE}$ = Vcc ± 0.3V			3	µA
		I_{SB2}(TTL), $\overline{CE}$ = 2.0 to Vcc + 0.5V			500	µA
I_{CC}	Vcc Active Current	f = 5MHz, I_{OUT} = 0mA, $\overline{CE}$ = V_{IL}			10	mA
V_{IL}	Input Low Voltage			-0.6	0.8	V
V_{IH}	Input High Voltage			2.0	Vcc + 0.5	V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA			0.4	V
V_{OH}	Output High Voltage	I_{OH} = -400 µA		2.4		V

Notes: 1.Vcc must be applied simultaneously or before Vpp and removed simultaneously or after Vpp.
2.Vpp may be connected directly to Vcc except during programming. The supply current would then be the sum of I_{CC} and I_{PP}.

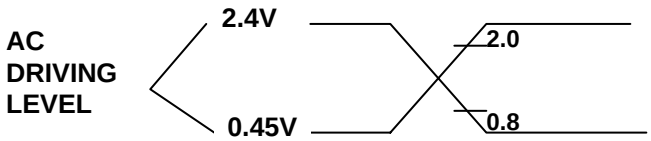
AC Waveforms for Read Operation [1]



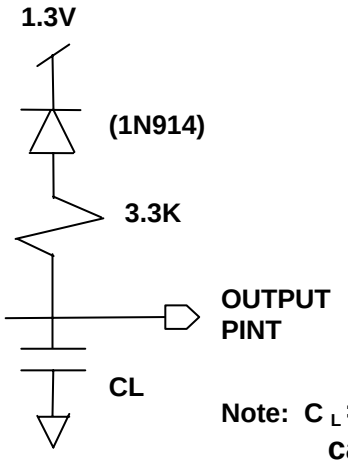
Notes:

1. $\overline{OE}$ /VPP may be delayed up to t_{CE} - t_{OE} after the falling edge of $\overline{CE}$ without impact on t_{CE}.
2. $\overline{OE}$ /VPP may be delayed up to t_{ACC} - t_{OE} after the address in valid without impact on t_{ACC}.
3. This parameter is only sampled and is not 100% tested.
4. Output float is defined as the point when data is no longer driven.

Input Test Waveforms and Measurement Levels

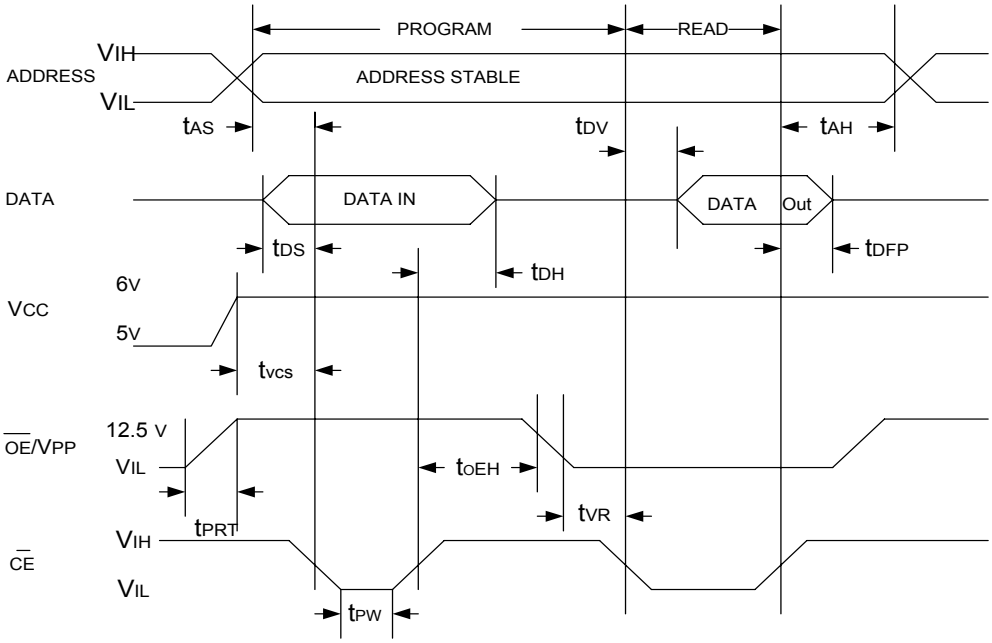


Output Test Load



Note: C_L = 100 pF including jig capacitance

Programming Waveforms



Notes:

1. The Input Timing Reference is 0.8V for V_{IL} and 2.0V V_{IH}.
2. t_{OE} and t_{DFP} are characteristics of the device but must be accommodated by the programmer.
3. When programming the ICE27C512 at 0.1μ F capacitor is required across V_{pp} and ground to suppress spurious voltage transients.

DC Programming Characteristics

T_A = 25 ± 5℃, Vcc = 5.5 ± 0.5V, Vpp = 12 ± 0.5V

Symbol	Parameter	Test Conditions	Limits		Units
			Min	Max	
I_{LI}	Input Load Current	$I_{IN} = V_{IL}, V_{IH}$		± 10	μA
V_{IL}	Input Low Level		-0.6	0.8	V
V_{IH}	Input High Level		2.0	Vcc + 1	V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA		0.4	V
V_{OH}	Output High Voltage	I_{OH} = -400 μA	2.4		V
I_{CC2}	Vcc Supply Current (Program and Verify)			40	mA
I_{PP2}	$\overline{OE}$ /VPP Current	$\overline{CE}$ = V_{IL}		20	mA
V_{ID}	A9 Product Identification Voltage		11.0	12.5	V

AC Characteristics for Read Operation

Symbol	Parameter	condition	ICE27C512 -70		Units
			Min	Max	
t_{ACC} (3)	Address to Output Delay	$\overline{CE}$ = $\overline{OE}$ /VPP=VIL		70	ns
t_{CE} (2)	$\overline{CE}$ to Output Delay	$\overline{OE}$ /VPP=VIL		70	ns
t_{OE} (2)(3)	$\overline{OE}$ /Vpp to Output Delay	$\overline{CE}$ =VIL		30	ns
t_{DF} (4)(5)	$\overline{OE}$ /VPP or $\overline{CE}$ Hight to Output Float,whichever occurred first			25	ns
t_{OH}	Output Hold from Address, $\overline{CE}$ or $\overline{OE}$ /VPP whichever occurred first		7		ns

Notes:2,3,4,5.-see AC Waveforms for Read Operation.

AC Programming Characteristics

T_A = 25 ± 5℃, Vcc = 5.5 ± 0.5V, Vpp = 12.0 ± 0.5V

Symbol	Parameter	Test Conditions	Limits		Units
			Min	Max	
t_{AS}	Address Setup Time	Input Rise and Fall Times (10% to 90%) 20ns Input Pulse Levels 0.45V to 2.4V Input Timing Reference Level 0.8V to 2.0V Output Timing Reference Level 0.8V to 2.0V	2		μs
t_{OEH}	$\overline{OE}$ /Vpp Hold Time		2		μs
t_{OES}	$\overline{OE}$ /Vpp Setup Time		2		μs
t_{DS}	Data Setup Time		2		μs
t_{AH}	Address Hold Time		0		μs
t_{DH}	Data Hold Time		2		μs
t_{DFP}	$\overline{OE}$ /Vpp High to Output Float Delay(2)		0	130	ns
t_{VCS}	Vcc Setup Time		2		μs
t_{PW}	$\overline{CE}$ Program Pulse Width(3)		95	105	μs
t_{DV}	Data Valid from $\overline{CE}$			150	ns
t_{PRT}	Vpp Pulse Rise Time During Programming		50		ns
t_{VR}	$\overline{OE}$ /VPP Recover time		2		μs

Notes: 1. Vcc must be applied simultaneously or before $\overline{OE}$ /VPP and removed simultaneously or after $\overline{OE}$ /VPP

2. This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven – see timing diagram.
3. Program Pulse width tolerance is 100 μsec ± 5%.

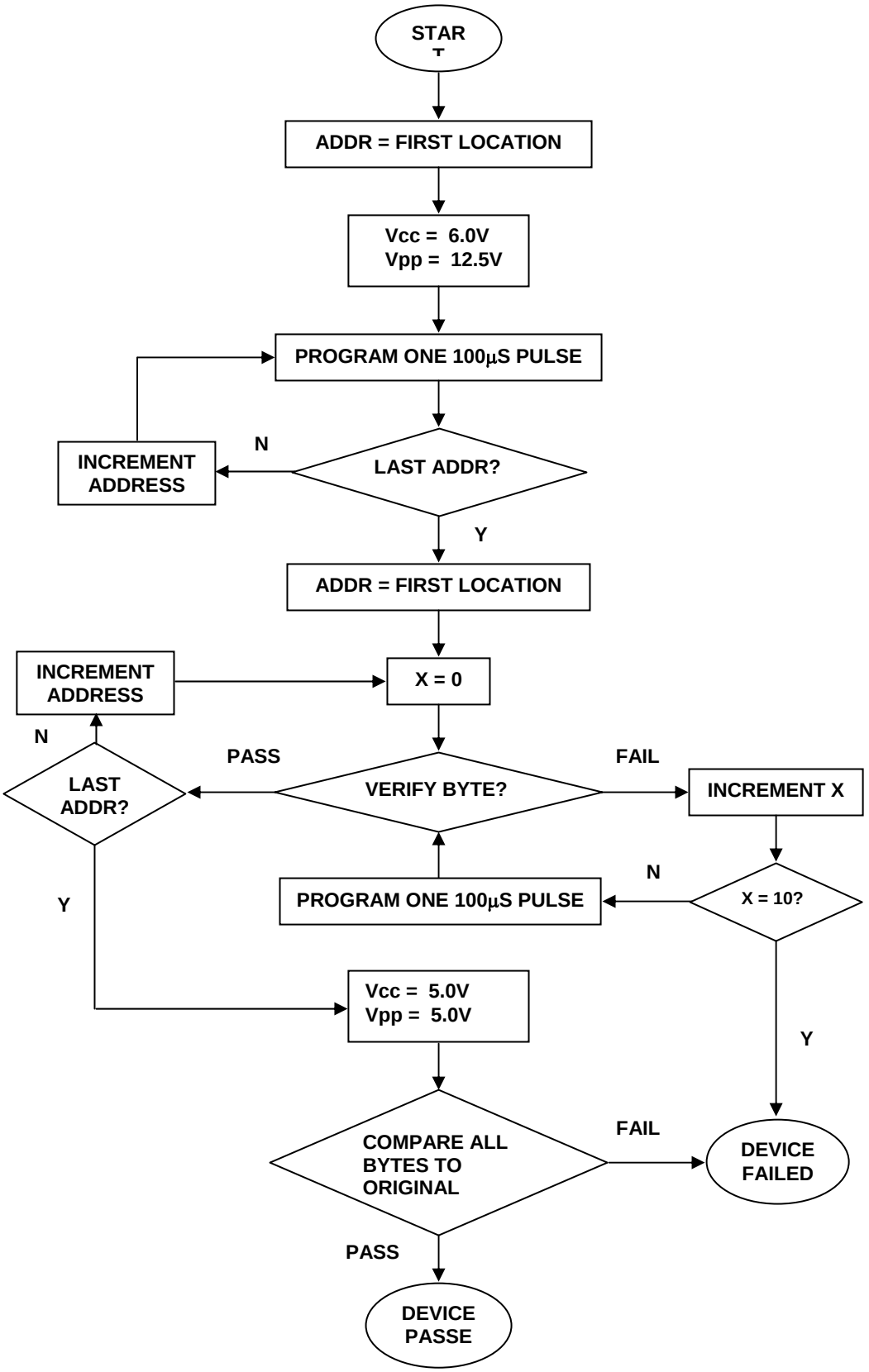
Product Identification Code

Codes	Pins										Hex Data
	A1	A0	O7	O6	O5	O4	O3	O2	O1	O0	
Continue Code 1	0	0	0	1	1	1	1	1	1	1	7F
Continue Code 2	0	1	0	1	1	1	1	1	1	1	7F
Manufacturer	1	0	0	1	0	1	1	1	1	0	5E
Device Type	1	1	1	1	0	0	0	0	0	0	C0

Rapid Programming Algorithm

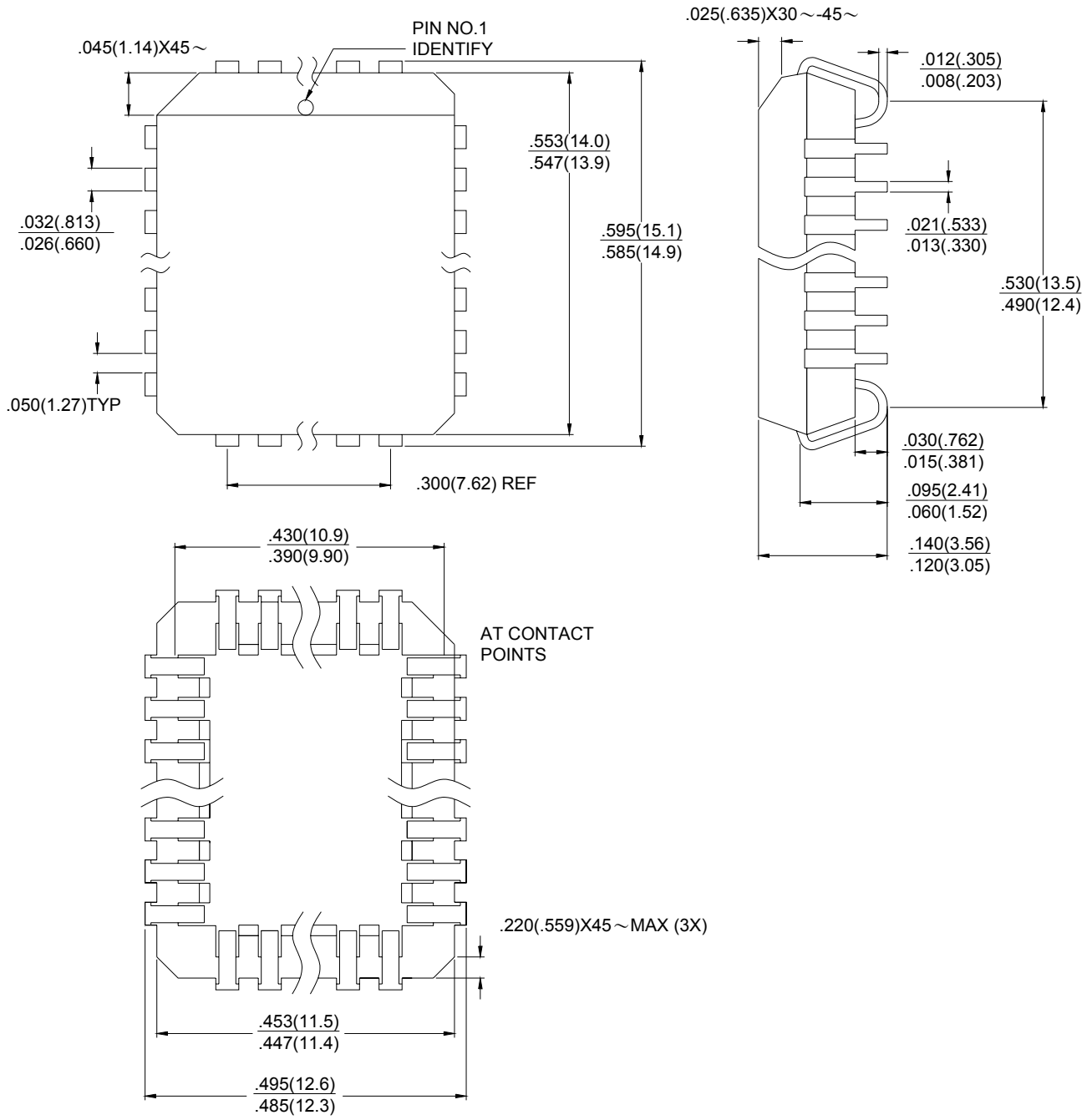
A 100 μs $\overline{CE}$ pulse width is used to program. The address is set to the first location. Vcc is raised to 6.0V and $\overline{OE}$ /VPP is raised to 12.5V. Each address is first programmed with one 100μs $\overline{CE}$ pulse without verification. Then a verification reprogramming loop is executed for each address. In the event a byte fails to pass verification, up to 10 successive 100 μs pulses are applied with a verification after each pulse. If the byte fails to verify after 10 pulses have been applied, the part is considered failed. After the byte verifies properly, the next address is selected until all have been checked. All bytes are read again and compared with the original data to determine if the device passes or fails.

Fast Programming Flowchart

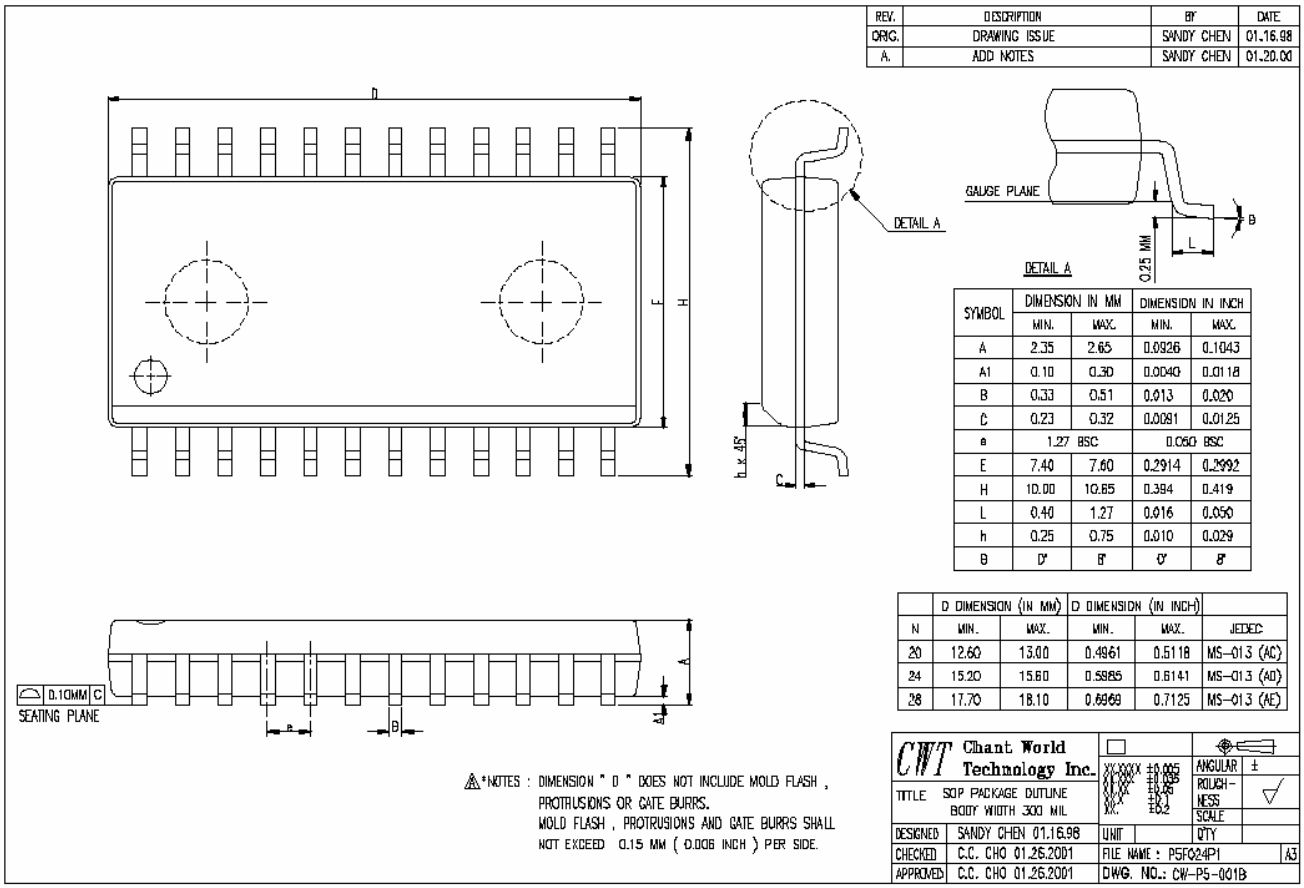


Packaging Information

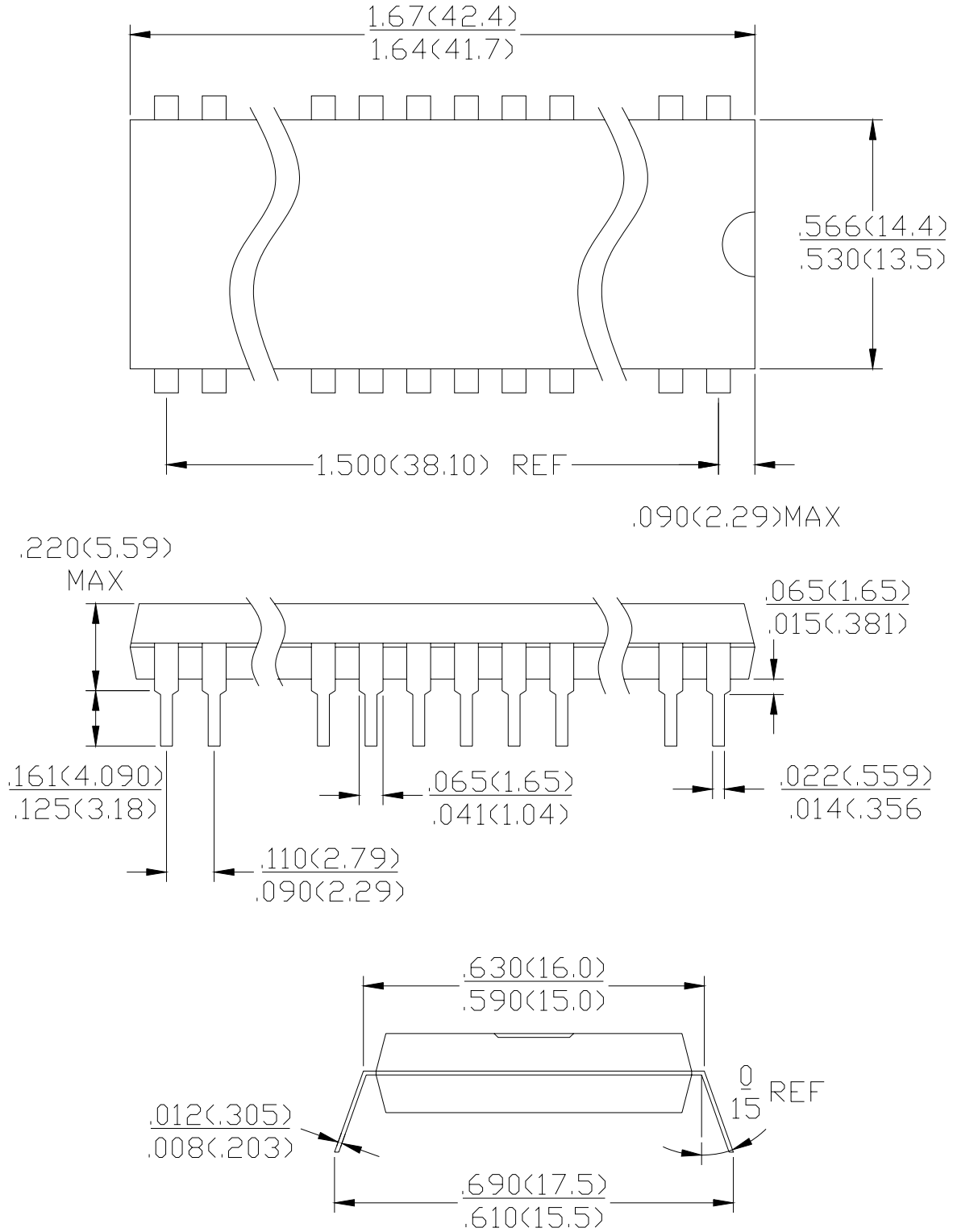
32P, 32-Lead, Plastic J-Leaded Chip Carrier (PLCC)
Dimensions in Inches and (Millimeters)
JEDEC STANDARD MS-016 AE



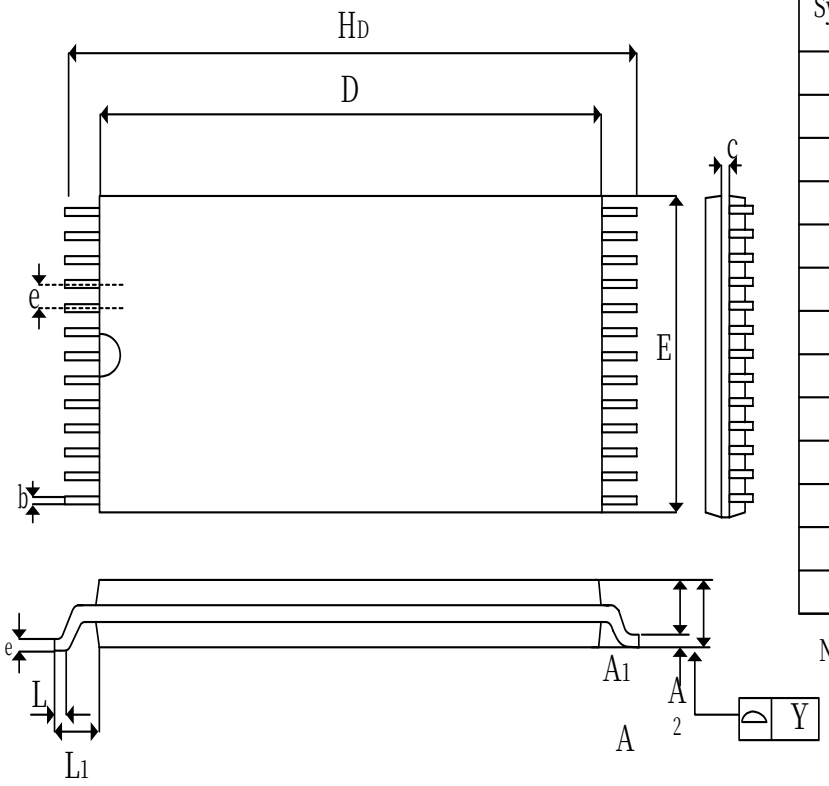
28Pin, 28-Lead, Small Outline Package (SOP)
Dimensions in Inches and (Millimeters)



28Pin, 28-Lead, 0.600” wide, Plastic Dual Inline Package (PDIP)
Dimensions in Inches and (Millimeters)



28Pin, 28-Lead, Plastic Thin Small Outline Package (TSOP)
Dimensions in Millimeters and (Inches)*
JEDEC OUTLINE MO- 141 BD



Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	0.047	—	—	1.20
A1	0.002	—	0.006	0.05	—	0.15
A2	0.035	0.040	0.041	0.95	1.00	1.05
b	0.007	0.008	0.011	0.17	0.20	0.27
c	0.004	0.006	0.008	0.10	0.15	0.21
D	0.461	0.465	0.469	11.70	11.80	11.90
E	0.311	0.315	0.319	7.90	8.00	8.10
HD	0.520	0.528	0.536	13.20	13.40	13.60
e	—	0.022	—	—	0.55	—
L	0.020	0.024	0.028	0.50	0.60	0.70
L1	—	0.010	—	—	0.25	—
Y	0.000	—	0.004	0.00	—	0.10
	0	3	5	0	3	5

Note:Controlling dimension:Millimeters

PRODUCTION ORDERING INFORMATION

Example

ICE27C512 - XX XX

Operating Temperature
C = Commercial = 0° to 70°C

Package Type
D = PDIP
P = PLCC
T0 = TSOP (8*13.4)
S = SOP

Read Access Speed
70 = 70 ns