# CD22M3494

16 x 8 x 1 BiMOS-E Crosspoint Switch

FN2793
Rev 8.00
May 29, 2014

The Intersil CD22M3494 is an array of 128 analog switches capable of handling signals from DC to video. Because of the switch structure, input signals may swing through the total supply voltage range, $V_{DD}$ to $V_{EE}$. Each of the 128 switches may be addressed via the ADDRESS input to the 7 to 128 line decoder. The state of the addressed switch is established by the signal to the DATA input. A low or zero input will open the switch, while a high logic level or a one will result in closure of the addressed switch when the STROBE input goes high from its normally low state. Any number or combination of connections may be active at one time. Each connection, however, must be made or broken individually in the manner previously described. All switches may be reset by taking the RESET input from a zero state to a one state and then returning it to its normal low state.

CS allows crosspoint array to be cascaded for matrix expansion.

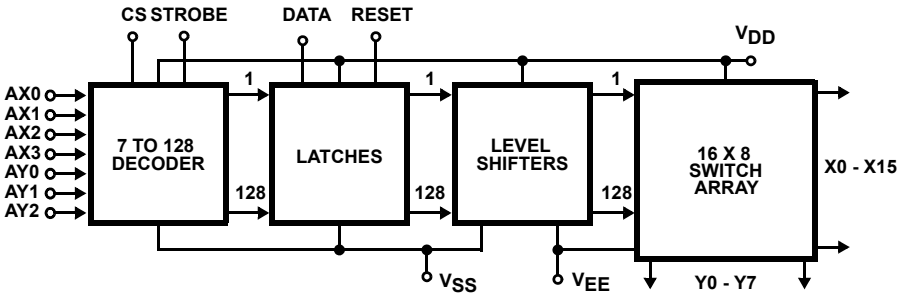
## Features

- 128 Analog Switches
- Low $r_{ON}$
- Guaranteed $r_{ON}$ Matching
- Analog Signal Input Voltage Equal to the Supply Voltage
- Wide Operating Voltage . . . . . 4V to 15V
- Parallel Input Addressing
- High Latch-Up Current . . . . . 50mA (Min)
- Very Low Crosstalk
- Pin and Functionally Compatible with the Following Types: SGS M3494 and Mitel MT8816
- Pb-Free (RoHS Compliant)

## Applications

- PBX Systems
- Instrumentation
- Analog and Digital Multiplexers
- Video Switching Networks

## Block Diagram



## Ordering Information

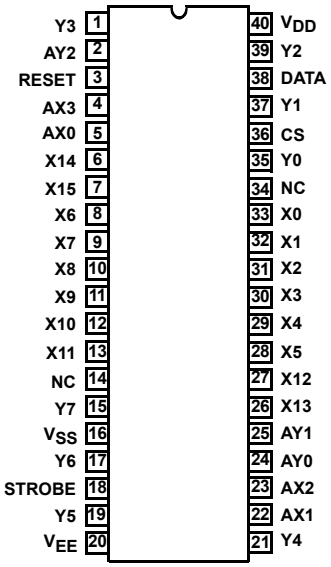
| PART NUMBER (Note 3) | PART MARKING | TEMP. RANGE (°C) | PACKAGE (Pb-Free) | PKG. DWG. # |
|---|---|---|---|---|
| CD22M3494EZ | CD22M3494EZ | -40 to 85 | 40 Ld PDIP (Note 2) | E40.6 |
| CD22M3494MQZ (Note 1) | CD22M3494MQZ | -40 to 85 | 44 Ld PLCC (Mitel Ld Compatible) | N44.65 |
| CD22M3494MQAZ (Note 1) | CD22M3494MQAZ | -40 to 85 | 44 Ld PLCC (Mitel Ld Compatible) | N44.65 |
| CD22M3494SQZ (Note 1) | CD22M3494SQZ | -40 to 85 | 44 Ld PLCC (SGS Ld Compatible) | N44.65 |

NOTES:

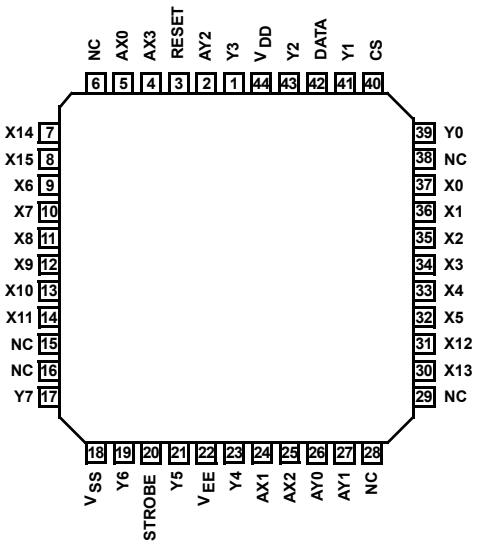
1. Add “96” suffix for tape and reel. At one time the "QZ" and "QAZ" were different products, but since 1994 these parts have been **exactly** the same.
2. Pb-free PDIPs can be used for through-hole wave solder processing only. They are not intended for use in Reflow solder processing applications.
3. Intersil Pb-free plus anneal products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

## Pinouts

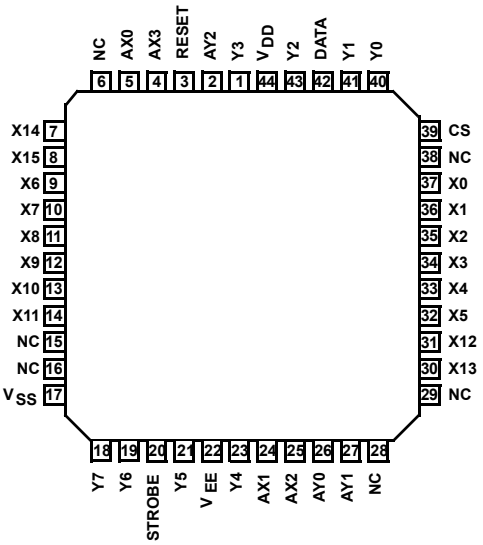
**CD22M3494E**
**(PDIP)**
TOP VIEW




**CD22M3494MQ**
**(PLCC) (MITEL LEAD COMPATIBLE)**
TOP VIEW




**CD22M3494SQ**
**(PLCC) (SGS LEAD COMPATIBLE)**
TOP VIEW



## Pin Descriptions

| SYMBOL | 40 LD PDIP PIN NO. | 44 LD PLCC PIN NO. | | DESCRIPTION |
|---|---|---|---|---|
| | | MQ | SQ | |
| **POWER SUPPLIES** | | | | |
| $V_{DD}$ | 40 | 44 | 44 | Positive Supply. |
| $V_{SS}$ | 16 | 18 | 17 | Negative Supply (Digital). |
| $V_{EE}$ | 20 | 22 | 22 | Negative Supply (Analog). |
| **ADDRESS** | | | | |
| AX0 - AX3 | 5, 22, 23 and 4 | 5, 24, 25 and 4 | | X Address Lines. These pins select one of the 16 rows of switches. See the Truth Table on page 7 for the valid addresses. |
| AY0 - AY2 | 24, 25 and 2 | 26, 27 and 2 | | Y Address Lines. These pins select one of the 8 columns of switches. See the Truth Table on page 7 for the valid addresses. |
| **CONTROL** | | | | |
| DATA | 38 | 42 | | DATA Input determines the state of the addressed switch. A high or one will close the switch. A low or zero will open the switch. |
| STROBE | 18 | 20 | | STROBE Input enables the action defined by the DATA and ADDRESS Inputs. A low or zero results in no action. The ADDRESS Input must be stable before the STROBE Input goes to the active high level. The DATA Input must be stable on the failing edge of the STROBE. |
| RESET | 3 | 3 | | MASTER RESET. A high or one on this line opens all switches. |
| CS | 36 | 40 | 39 | CHIP SELECT. Device is selected when CS is at a high level, allows the crosspoint array to be cascaded for matrix expansion. |
| **INPUTS/OUTPUTS** | | | | |
| X0 - X5<br>X6 - X11<br>X12 - X15 | 33-28, 8-13, 27, 26, 6, 7 | 37-32, 9-14, 31, 30, 7, 8 | | Analog or Digital Inputs/Outputs. These pins are the rows X0 - X15. |
| Y0 - Y7<br>I/O | 35, 37, 39, 1, 21, 19, 17, 15 | 39, 41, 43, 1, 23, 21, 19, 17 | 40, 41, 43, 1, 23, 21, 19, 18 | Analog or Digital Inputs/Outputs. These pins are the columns Y0 - Y7. |

## Absolute Maximum Ratings

DC Supply Voltage ($V_{DD}$)
Voltages Referenced to $V_{EE}$ . . . . . -0.5V to 16V
DC Supply Voltage ($V_{DD}$)
Voltages Referenced to $V_{SS}$ . . . . . -0.5V to 16V
DC Input Diode Current, $I_{IN}$
For $V_I$, Digital < $V_{SS}$ -0.5V or $V_I$,
Analog < $V_{EE}$ -0.5V or $V_I$ > $V_{DD}$ 0.5V . . . . . ±20mA
DC Output Diode Current, $I_{OK}$
For $V_O$, Digital < $V_{SS}$ -0.5V or $V_O$,
Analog < $V_{EE}$ -0.5V or $V_O$ > $V_{DD}$ 0.5V. . . . . ±20mA
DC Transmission Gate Current . . . . . ±25mA
Power Dissipation Per Package (Po)
For $T_A$ = -40°C to +85°C (PDIP). . . . . .500mW
For $T_A$ = -40°C to +85°C (PLCC) . . . . . .600mW

## Thermal Information

Thermal Resistance (Typical, Note 4) $\theta_{JA}$ (°C/W)
PDIP Package* . . . . . 55
PLCC Package. . . . . 43
Maximum Junction Temperature Plastic Package . . . . . .+150°C
Maximum Storage Temperature Range ($T_{STG}$). . . . -65°C to +150°C
Pb-Free Reflow Profile. . . . . see TB493
*Pb-free PDIPs can be used for through hole wave solder processing only. They are not intended for use in Reflow solder processing. applications.

## Operating Conditions

Operating Temperature Range ($T_A$)
Package Type E and Q . . . . . -40°C to +85°C
Supply Voltage Range
For $T_A$ = Full Package Temperature Range
$V_{SS}$ = 0V, $V_{EE}$ = 0V, $V_{DD}$ . . . . . 4V to 15V
DC Input or Output Voltage $V_I$ or $V_O$ . . . . . $V_{EE}$ to $V_{DD}$
Digital Input Voltage. . . . . $V_{SS}$ to $V_{DD}$

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

NOTE:

4. $\theta_{JA}$ is measured with the component mounted on an evaluation PC board in free air.

## Electrical Specifications

$T_A$ = -40°C to +85°C, $V_{DD}$ = 5V, $V_{SS}$ = 0V, $V_{EE}$ = 0V, Unless Otherwise Specified

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **STATIC CONTROLS** | | | | | | |
| Supply Current | $I_{DD}$ | $V_{DD}$ = 5V, Logic Inputs = $V_{DD}$ | - | - | 2 | mA |
| | | $V_{DD}$ = 15V, Logic Inputs = $V_{DD}$ | - | - | 5 | mA |
| High-Level Input Voltage | $V_{IH}$ | $V_{DD}$ = 5V | 2.4 (Note 5) | - | - | V |
| Low-Level Input Voltage | $V_{IL}$ | | - | - | 0.8 (Note 5) | V |
| Input Leakage Current, Digital | $I_{IN}$ | Reset = Low (Note 6) | - | - | ±10 (Note 7) | µA |

## Electrical Specifications

$T_A$ = -40°C to +85°C, $V_{DD}$ = 12V, $V_{SS}$ = 0V, $V_{EE}$ = 0V, Unless Otherwise Specified.

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| **STATIC CROSSPOINTS** | | | | | | | |
| ON Resistance | $r_{ON}$ | $V_{SS}$ = $V_{EE}$ = 0V, $T_A$ = +25°C, $V_{IN}$ = $V_{DD}$/2, VX - VY = 0.2V | $V_{DD}$ = 10V | - | 40 | 75 | Ω |
| | | | $V_{DD}$ = 12V | - | 36 | 65 | Ω |
| ON Resistance | $r_{ON}$ | $T_A$ = -40°C to +85°C, $V_{IN}$ = $V_{DD}$/2, VX -VY = 0.2V, $V_{SS}$ = $V_{EE}$ = 0V | $V_{DD}$ = 10V | - | 50 | 75 | Ω |
| | | | $V_{DD}$ = 12V | - | 45 | 65 | Ω |
| Difference in ON Resistance Between Any Two Switches | $\Delta r_{ON}$ | $T_A$ = +25°C, $V_{IN}$ = $V_{DD}$/2, VX - VY = 0.2V, $V_{SS}$ = $V_{EE}$ = 0V, $V_{DD}$ = 12V | | - | 6 | 10 | Ω |

**Electrical Specifications** $T_A$ = -40°C to +85°C, $V_{DD}$ = 12V, $V_{SS}$ = 0V, $V_{EE}$ = 0V, Unless Otherwise Specified. **(Continued)**

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Difference in ON Resistance Between Any Two Switches | $\Delta r_{ON}$ | $T_A$ = -40°C to +85°C, $V_{IN}$ = $V_{DD}$/2, VX - VY = 0.2V, $V_{DD}$ = 12V $V_{SS}$ = $V_{EE}$ = 0V, VDD = 12V | - | - | 10 | Ω |
| OFF-State Leakage Current | $I_L$ | \|VX - VY\| = 12V | - | - | ±10 (Note 7) | µA |

**Electrical Specifications** $T_A$ = +25°C, $V_{SS}$ = 0V, $V_{EE}$ = 0V, $V_{DD}$ = 14V, $C_L$ = 50pF, Unless Otherwise Specified.

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **DYNAMIC CROSSPOINTS** | | | | | | |
| Switch I/O Capacitance | | $V_{IN}$ = $V_{DD}$/2, f = 1MHz | - | - | 20 | pF |
| Switch Feedthrough Capacitance | | $V_{IN}$ = $V_{DD}$/2, f = 1MHz | - | 0.3 | - | pF |
| Propagation Delay Time (Switch ON) Signal Input to Output, $t_{PHL}$ or $t_{PLH}$ | | | - | 5 | 30 | ns |
| Frequency Response Channel ON f = 20log (VX/VY) = -3dB | | $C_L$ = 3pF, $R_L$ = 75Ω, $V_{IN}$ = $2V_{P-P}$ | - | 50 | - | MHz |
| Total Harmonic, THD | | $V_{IN}$ = $2V_{P-P}$, f = 1kHz | - | 0.01 | - | % |
| Feedthrough Channel OFF Feedthrough = 20log (VX/VY) = $F_{DT}$ | | $V_{IN}$ = $2V_{P-P}$, f = 1kHz | - | -95 | - | dB |
| Frequency for Signal Crosstalk, $f_{CT}$ Attenuation of: | 40dB | $V_{IN}$ = $2V_{P-P}$, $R_L$ = 75Ω | - | 10 | - | MHz |
| | 110dB | $V_{IN}$ = $2V_{P-P}$, $R_L$ = 1kΩ \|\| 10pF | - | 5 | - | kHz |
| Control Crosstalk DATA-Input, ADDRESS, or STROBE to Output | | Control Input = $3V_{P-P}$ Square Wave, $t_R$ = $t_F$ = 10ns $R_{IN}$ = 1K, $R_{OUT}$ = 10kΩ \|\| 10pF | - | 75 | - | $mV_{PEAK}$ |

**Electrical Specifications** $T_A$ = +25°C, $V_{SS}$ = 0V, $V_{EE}$ = 0V, $V_{DD}$ = 14V, $R_L$ = 1kΩ || 50pF, Unless Otherwise Specified.

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **DYNAMIC CONTROLS** | | | | | | |
| Digital Input Capacitance | $C_{IN}$ | $V_{IN}$ = 5V, f = 1MHz | - | 5 | - | pF |
| Propagation Delay Time STROBE to Output | | | | | | |
| Switch Turn-ON | $t_{PSN}$ | | - | 50 | 100 | ns |
| Switch Turn-OFF | $t_{PSF}$ | | - | 50 | 100 | ns |
| DATA-IN to Output | | | | | | |
| Turn-ON to High Level | $t_{PZH}$ | | - | 60 | 100 | ns |
| Turn-ON to Low Level | $t_{PZL}$ | | - | 70 | 100 | ns |
| ADDRESS to Output | | | | | | |
| Turn-ON to High Level | $t_{PAN}$ | | - | 70 | - | ns |
| Turn-OFF to Low Level | $t_{PAF}$ | | - | 70 | - | ns |

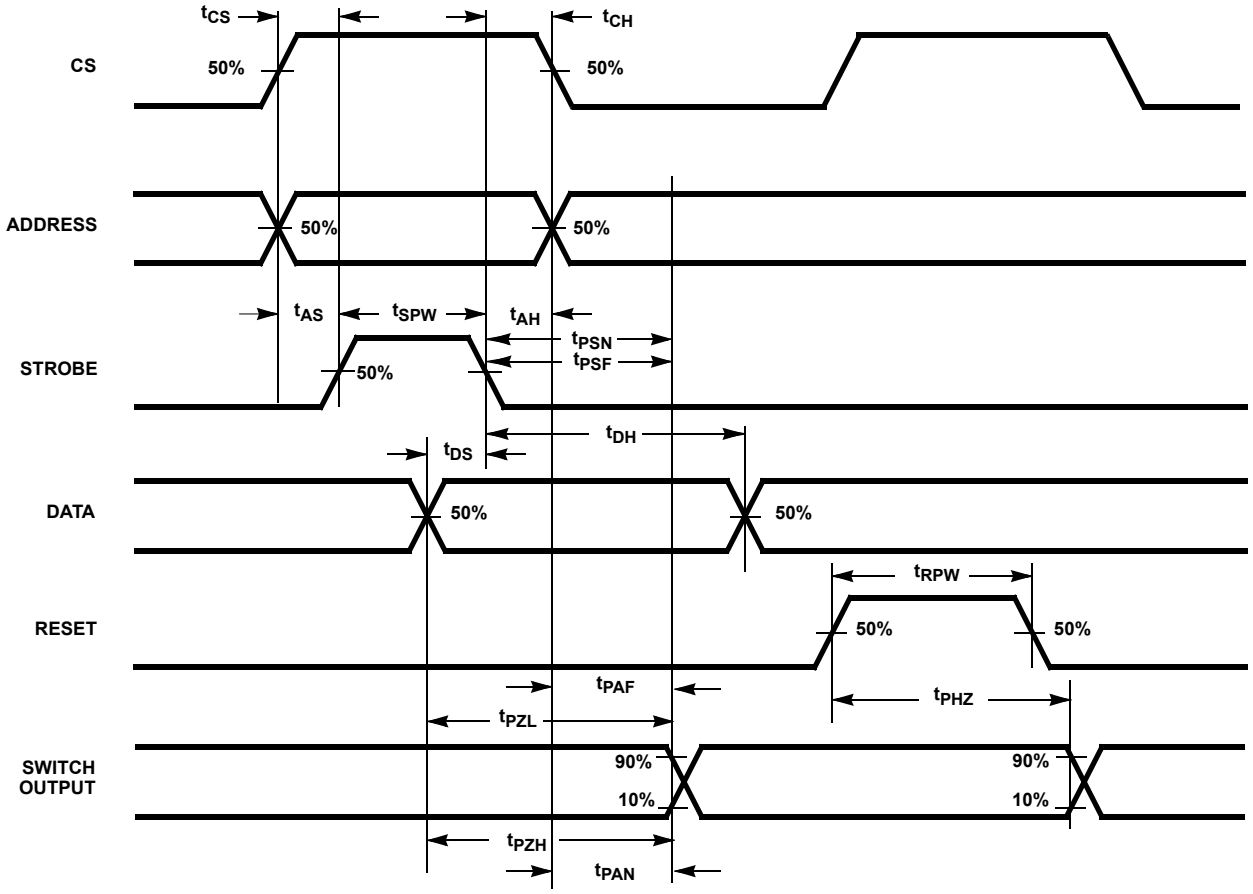
**Electrical Specifications** $T_A$ = +25°C, $V_{SS}$ = 0V, $V_{EE}$ = 0V, $V_{DD}$ = 14V, $R_L$ = 1kΩ || 50pF, Unless Otherwise Specified. **(Continued)**

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Setup Time | | | | | | |
| CS to STROBE | $t_{CS}$ | | 10 | - | - | ns |
| DATA-IN to STROBE | $t_{DS}$ | | 10 | - | - | ns |
| ADDRESS to STROBE | $t_{AS}$ | | 10 | - | - | ns |
| Hold Time | | | | | | |
| STROBE to CS | $t_{CH}$ | | 10 | - | - | ns |
| ADDRESS to CS | | | 10 | - | - | ns |
| STROBE to DATA-IN | $t_{DH}$ | | 20 | - | - | ns |
| STROBE to ADDRESS | $t_{AH}$ | | 10 | - | - | ns |
| DATA-IN to CS | | | 20 | - | - | ns |
| Pulse Width | | | | | | |
| STROBE | $t_{SPW}$ | | 20 | - | - | ns |
| RESET | $t_{RPW}$ | | 20 | - | - | ns |
| RESET Turn-OFF to Output Delay | $t_{PHZ}$ | | - | 70 | 100 | ns |

NOTES:

5. Operation of $V_{IH}$ at 2.4V or $V_{IL}$ at 0.8V will result in much higher supply current ($I_{DD}$) than for logic inputs equal to $V_{DD}$ or $V_{SS}$ respectively.
6. Reset $I_{IH}$ < 20µA, Reset = $V_{IH}$.
7. At +25°C Limit is ±100nA.

## *Timing Diagram*




**TRUTH TABLE X AXIS**

| X ADDRESS | | | | |
|---|---|---|---|---|
| **AX3** | **AX2** | **AX1** | **AX0** | **X SWITCH** |
| 0 | 0 | 0 | 0 | X0 |
| 0 | 0 | 0 | 1 | X1 |
| 0 | 0 | 1 | 0 | X2 |
| 0 | 0 | 1 | 1 | X3 |
| 0 | 1 | 0 | 0 | X4 |
| 0 | 1 | 0 | 1 | X5 |
| 0 | 1 | 1 | 0 | X12 |
| 0 | 1 | 1 | 1 | X13 |
| 1 | 0 | 0 | 0 | X6 |
| 1 | 0 | 0 | 1 | X7 |
| 1 | 0 | 1 | 0 | X8 |
| 1 | 0 | 1 | 1 | X9 |
| 1 | 1 | 0 | 0 | X10 |
| 1 | 1 | 0 | 1 | X11 |
| 1 | 1 | 1 | 0 | X14 |
| 1 | 1 | 1 | 1 | X15 |

**TRUTH TABLE Y AXIS**

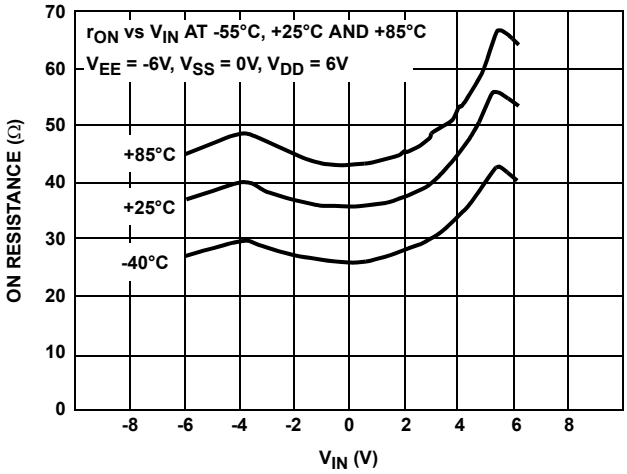
| Y ADDRESS | | | |
|---|---|---|---|
| **AY2** | **AY1** | **AY0** | **Y SWITCH** |
| 0 | 0 | 0 | Y0 |
| 0 | 0 | 1 | Y1 |
| 0 | 1 | 0 | Y2 |
| 0 | 1 | 1 | Y3 |
| 1 | 0 | 0 | Y4 |
| 1 | 0 | 1 | Y5 |
| 1 | 1 | 0 | Y6 |
| 1 | 1 | 1 | Y7 |

To make a connection (close switch) between any two points, specify an “X” address, a “Y” address, set “DATA” high, and switch “STROBE” from low to high. To break a connection, follow this same procedure with “DATA” low.

Example:

| | DATA | X ADDRESS | | | | Y ADDRESS | | |
|---|---|---|---|---|---|---|---|---|
| | | AX3 | AX2 | AX1 | AX0 | AY2 | AY1 | AY0 |
| To connect switch X3 to switch Y4: | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| To connect switch X6 to switch Y7: | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| To break connection from X3 to Y4: | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |

## *Typical Performance Curve*

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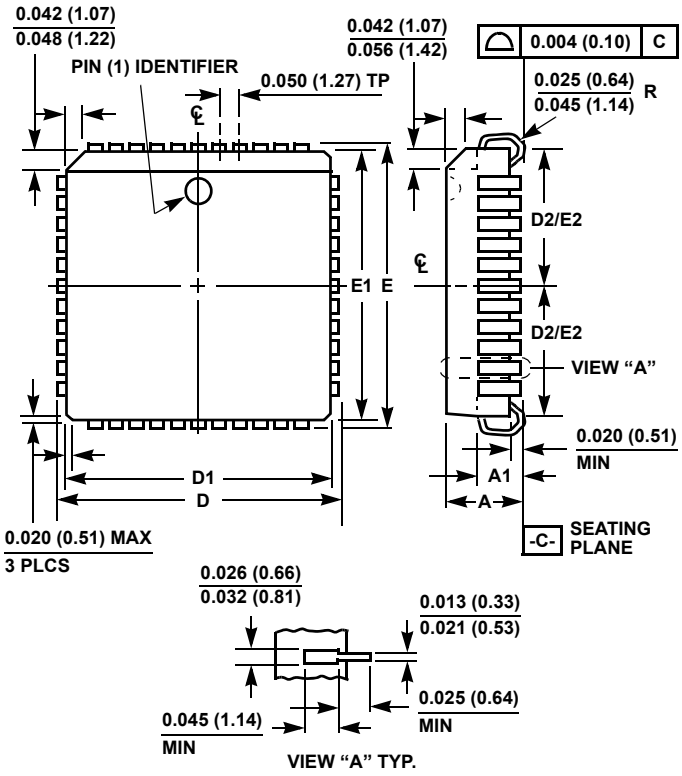
## *Plastic Leaded Chip Carrier Packages (PLCC)*




**N44.65** (JEDEC MS-018AC ISSUE A)
**44 LEAD PLASTIC LEADED CHIP CARRIER PACKAGE**

| SYMBOL | INCHES | | MILLIMETERS | | NOTES |
|---|---|---|---|---|---|
| | MIN | MAX | MIN | MAX | |
| A | 0.165 | 0.180 | 4.20 | 4.57 | - |
| A1 | 0.090 | 0.120 | 2.29 | 3.04 | - |
| D | 0.685 | 0.695 | 17.40 | 17.65 | - |
| D1 | 0.650 | 0.656 | 16.51 | 16.66 | 3 |
| D2 | 0.291 | 0.319 | 7.40 | 8.10 | 4, 5 |
| E | 0.685 | 0.695 | 17.40 | 17.65 | - |
| E1 | 0.650 | 0.656 | 16.51 | 16.66 | 3 |
| E2 | 0.291 | 0.319 | 7.40 | 8.10 | 4, 5 |
| N | 44 | | 44 | | 6 |

Rev. 2 11/97

NOTES:

1. Controlling dimension: INCH. Converted millimeter dimensions are not necessarily exact.
2. Dimensions and tolerancing per ANSI Y14.5M-1982.
3. Dimensions D1 and E1 do not include mold protrusions. Allowable mold protrusion is 0.010 inch (0.25mm) per side. Dimensions D1 and E1 include mold mismatch and are measured at the extreme material condition at the body parting line.
4. To be measured at seating plane -C- contact point.
5. Centerline to be determined where center leads exit plastic body.
6. "N" is the number of terminal positions.