# DATA SHEET

## 74LV4052

Dual 4-channel analog multiplexer/demultiplexer

Product specification
Supersedes data of 1997 Jul 15
IC24 Data Handbook

1998 Jun 23

Philips Semiconductors


PHILIPS

# Dual 4-channel analog multiplexer/demultiplexer 74LV4052

## FEATURES

- Optimized for low voltage applications: 1.0 to 6.0 V
- Accepts TTL input levels between $V_{CC}$ = 2.7 V and $V_{CC}$ = 3.6 V
- Low typ "ON" resistance:
  60 Ω at $V_{cc} - V_{EE}$ = 4.5 V
  90 Ω at $V_{cc} - V_{EE}$ = 3.0 V
  145 Ω at $V_{cc} - V_{EE}$ = 2.0 V
- Logic level translation: to enable 3 V logic to communicate with ± 3 V analog signals
- Typical "break before make" built in
- Analog/Digital multiplexing and demultiplexing
- Signal gating
- Output capability: non-standard
- $I_{CC}$ category: MSI

## DESCRIPTION

The 74LV4052 is a low-voltage CMOS device and is pin and function compatible with the 74HC/HCT4052.

The 74LV4052 is a dual 4-channel analog multiplexer/demultiplexer with a common select logic. Each multiplexer has four independent inputs/outputs ($nY_0$ to $nY_3$) and a common input/output (nZ). The common channel select logics include two digital select inputs ($S_0$ and $S_1$) and an active LOW enable input ($\overline{E}$).

With $\overline{E}$ LOW, one of the four switches is selected (low impedance ON-state) by $S_0$ and $S_1$. With $\overline{E}$ HIGH, all switches are in the high impedance OFF-state, independent of $S_0$ and $S_1$. $V_{CC}$ and GND are the supply voltage pins for the digital control inputs ($S_0$, $S_1$ and $\overline{E}$). The $V_{CC}$ to GND ranges are 1.0 to 6.0 V. The analog inputs/outputs ($nY_0$, to $nY_3$, and nZ) can swing between $V_{CC}$ as a positive limit and $V_{EE}$ as a negative limit. $V_{CC}$ - $V_{EE}$ may not exceed 6.0 V. For operation as a digital multiplexer/demultiplexer, $V_{EE}$ is connected to GND (typically ground).

## QUICK REFERENCE DATA

GND = 0 V; $T_{amb}$ = 25°C; $t_r = t_f \leq$ 2.5 ns

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | UNIT |
|---|---|---|---|---|
| $t_{PZH}/t_{PZL}$ | Turn "ON" time $\overline{E}$ or $V_{OS}$ $S_n$ | $C_L$ = 15 pF<br>$R_L$ = 1KΩ<br>$V_{CC}$ = 3.3 V | 30 | ns |
| $t_{PHZ}/t_{PLZ}$ | Turn "OFF" time $\overline{E}$ or $V_{OS}$ $S_n$ | | 22 | |
| $C_I$ | Input capacitance | | 3.5 | pF |
| $C_{PD}$ | Power dissipation capacitance per switch | See Notes 1 and 2 | 57 | |
| $C_S$ | Maximum switch capacitance<br>independent (Y) common (Z) | | 5<br>12 | |

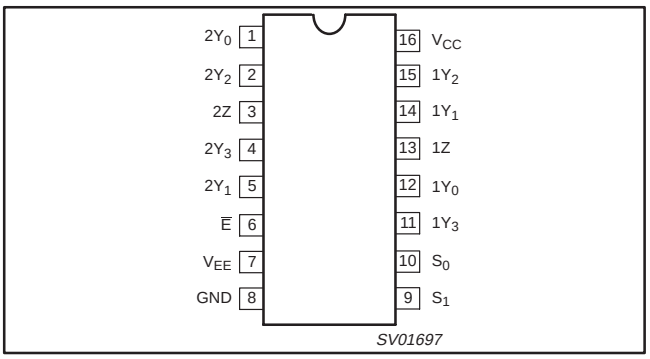
**NOTES:**

1. $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in µW)
   $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum ((C_L + C_S) \times V_{CC}^2 \times f_o)$ where:
   $f_i$ = input frequency in MHz; $C_L$ = output load capacity in pF;
   $f_o$ = output frequency in MHz; $C_S$ = maximum switch capacitance in pF;
   $V_{CC}$ = supply voltage in V;
   $\sum ((C_L + C_S) \times V_{CC}^2 \times f_o)$ = sum of the outputs.
2. The condition is $V_I$ = GND to $V_{CC}$.

## ORDERING INFORMATION

| PACKAGES | TEMPERATURE RANGE | OUTSIDE NORTH AMERICA | NORTH AMERICA | Code |
|---|---|---|---|---|
| 16-Pin Plastic DIL | –40°C to +125°C | 74LV4052 N | 74LV4052 N | SOT38-4 |
| 16-Pin Plastic SO | –40°C to +125°C | 74LV4052 D | 74LV4052 D | SOT109-1 |
| 16-Pin Plastic SSOP Type II | –40°C to +125°C | 74LV4052 DB | 74LV4052 DB | SOT338-1 |
| 16-Pin Plastic TSSOP Type I | –40°C to +125°C | 74LV4052 PW | 74LV4052PW DH | SOT403-1 |

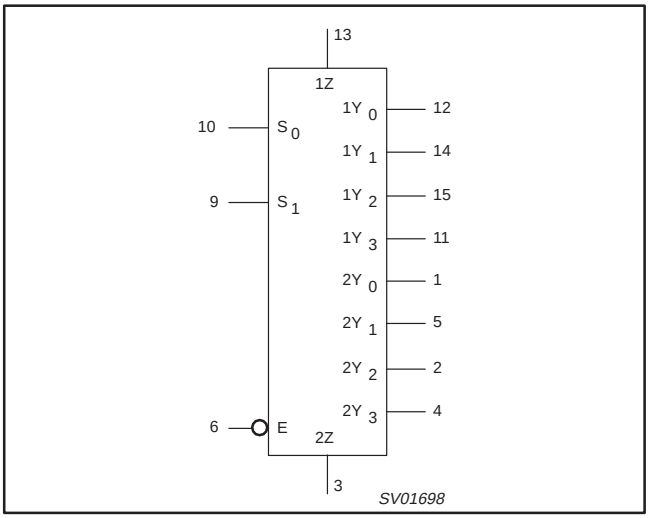
## PIN CONFIGURATION



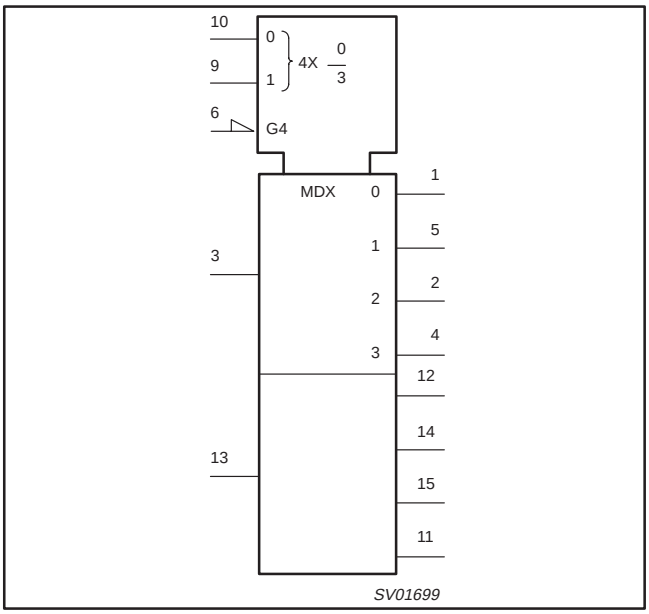

## PIN DESCRIPTION

| PIN NUMBER | SYMBOL | FUNCTION |
|---|---|---|
| 1, 5, 2, 4 | $2Y_0$, $2Y_3$ | Independent inputs/outputs |
| 6 | $\overline{E}$ | Enable input (active LOW) |
| 7 | $V_{EE}$ | Negative supply voltage |
| 8 | GND | Ground (0 V) |
| 10, 9 | $S_0$, $S_1$ | Select inputs |
| 12, 14, 15, 11 | $1Y_0$ to $1Y_3$ | Independent inputs/outputs |
| 13, 3 | 1Z, 2Z | Common inputs/outputs |
| 16 | $V_{CC}$ | Positive supply voltage |

## LOGIC SYMBOL




## LOGIC SYMBOL (IEEE/IEC)

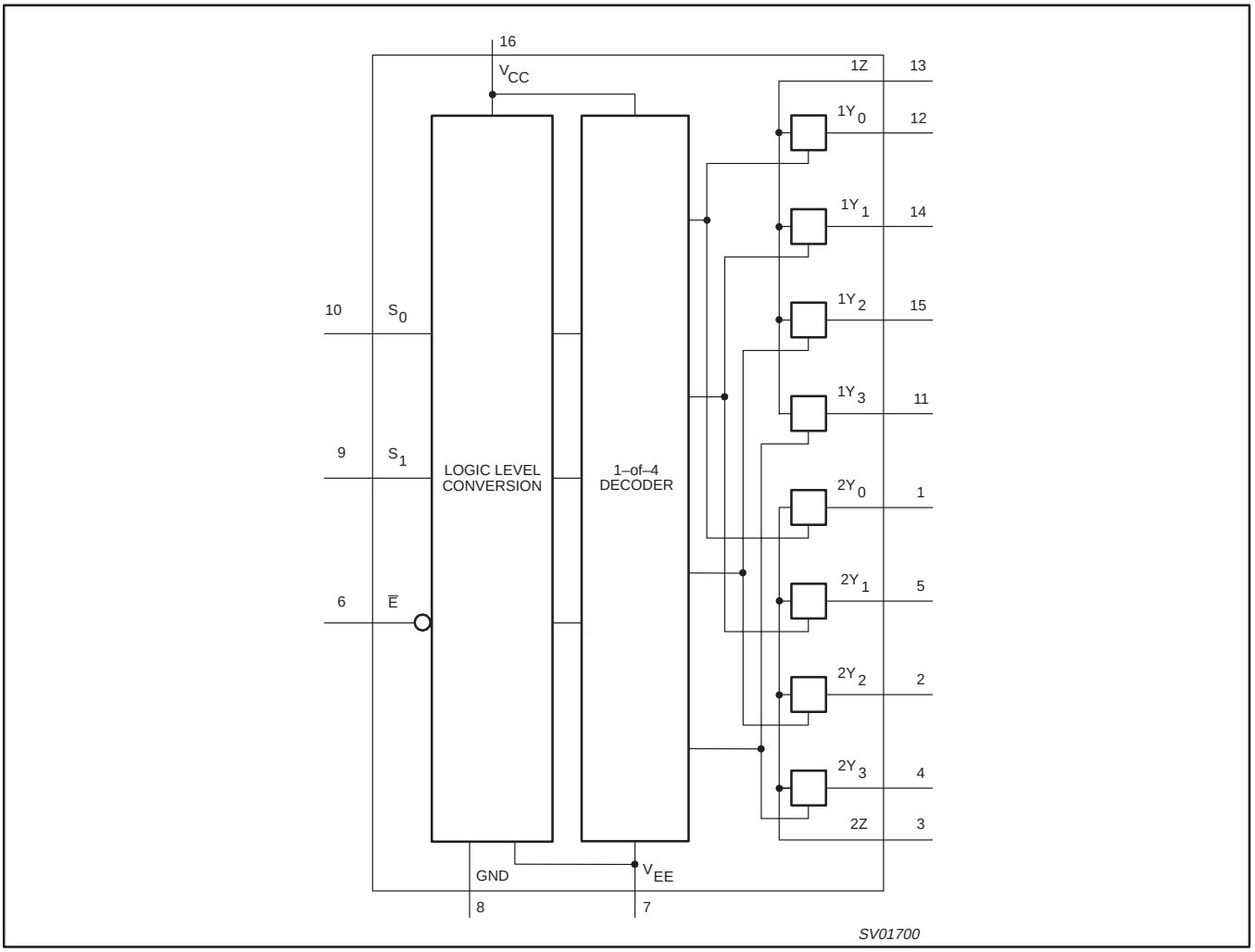



## FUNCTION TABLE

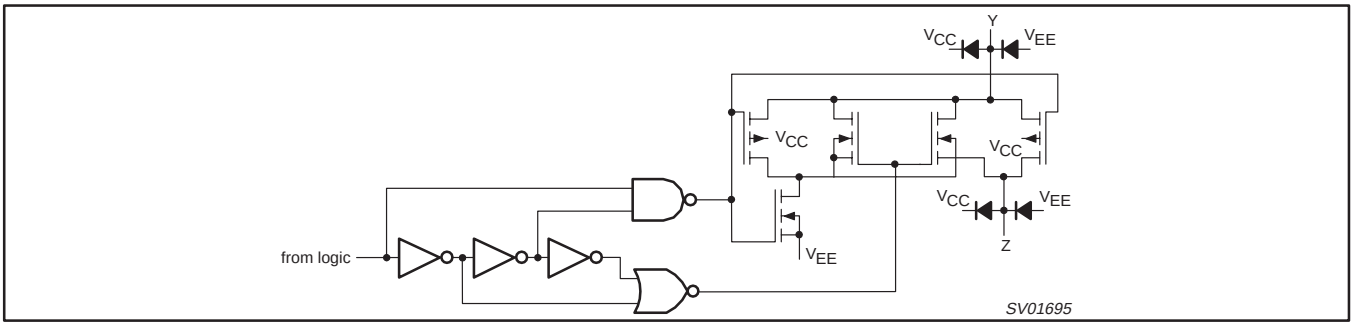
| INPUTS | | | CHANNEL ON |
|---|---|---|---|
| $\overline{E}$ | $S_1$ | $S_0$ | |
| L | L | L | $nY_0 – nZ$ |
| L | L | H | $nY_1 – nZ$ |
| L | H | L | $nY_2 – nZ$ |
| L | H | H | $nY_3 – nZ$ |
| H | X | X | None |

**NOTES:**
1. H = HIGH voltage level
2. L = LOW voltage level
3. X = don't care

## FUNCTIONAL DIAGRAM




## SCHEMATIC DIAGRAM (ONE SWITCH)



## ABSOLUTE MAXIMUM RATINGS[1, 2]

In accordance with the Absolute Maximum Rating System (IEC 134).
Voltages are referenced to GND (ground = 0 V).

| SYMBOL | PARAMETER | CONDITIONS | RATING | UNIT |
|---|---|---|---|---|
| $V_{CC}$ | DC supply voltage | | –0.5 to +7.0 | V |
| $\pm I_{IK}$ | DC input diode current | $V_I < -0.5$ or $V_I > V_{CC} + 0.5$ V | 20 | mA |
| $\pm I_{SK}$ | DC switch diode current | $V_S < -0.5$ or $V_S > V_{CC} + 0.5$ V | 20 | mA |
| $\pm I_S$ | DC switch current | $-0.5$ V $< V_S < V_{CC} + 0.5$ V | 25 | mA |
| $T_{stg}$ | Storage temperature range | | –65 to +150 | °C |
| $P_{TOT}$ | Power dissipation per package<br>– plastic DIL<br>– plastic mini-pack (SO)<br>– plastic shrink mini-pack (SSOP and TSSOP) | for temperature range: –40 to +125°C<br>above +70°C derate linearly with 12 mW/K<br>above +70°C derate linearly with 8 mW/K<br>above +60°C derate linearly with 5.5 mW/K | <br>750<br>500<br>400 | mW |

**NOTES:**
1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{CC}$ | DC supply voltage | See Note 1 and Figure 5 | 1.0 | 3.3 | 6.0 | V |
| $V_I$ | Input voltage | | 0 | – | $V_{CC}$ | V |
| $V_O$ | Output voltage | | 0 | – | $V_{CC}$ | V |
| $T_{amb}$ | Operating ambient temperature range in free air | See DC and AC characteristics | –40<br>–40 | | +85<br>+125 | °C |
| $t_r$, $t_f$ | Input rise and fall times | $V_{CC}$ = 1.0 V to 2.0 V<br>$V_{CC}$ = 2.0 V to 2.7 V<br>$V_{CC}$ = 2.7 V to 6.0 V | –<br>–<br>– | –<br>–<br>– | 500<br>200<br>100 | ns/V |

**NOTE:**
1. The LV is guaranteed to function down to $V_{CC}$ = 1.0V (input levels GND or $V_{CC}$); DC characteristics are guaranteed from $V_{CC}$ = 1.2V to $V_{CC}$ = 6.0V.

## DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions, voltages are referenced to GND (ground = 0 V)

| SYMBOL | PARAMETER | TEST CONDITIONS | | LIMITS | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | -40°C to +85°C | | | -40°C to +125°C | | |
| | | | | MIN | TYP[1] | MAX | MIN | MAX | |
| $V_{IH}$ | HIGH level Input voltage | $V_{CC}$ = 1.2 V | | 0.9 | | | 0.9 | | V |
| | | $V_{CC}$ = 2.0 V | | 1.4 | | | 1.4 | | |
| | | $V_{CC}$ = 2.7 to 3.6 V | | 2.0 | | | 2.0 | | |
| | | $V_{CC}$ = 4.5 V | | 3.15 | | | 3.15 | | |
| | | $V_{CC}$ = 6.0 V | | 4.20 | | | 4.20 | | |
| $V_{IL}$ | LOW level Input voltage | $V_{CC}$ = 1.2 V | | | | 0.3 | | 0.3 | V |
| | | $V_{CC}$ = 2.0 V | | | | 0.6 | | 0.6 | |
| | | $V_{CC}$ = 2.7 to 3.6 V | | | | 0.8 | | 0.8 | |
| | | $V_{CC}$ = 4.5 V | | | | 1.35 | | 1.35 | |
| | | $V_{CC}$ = 6.0 V | | | | 1.80 | | 1.80 | |
| $\pm I_I$ | Input leakage current | $V_{CC}$ = 3.6 | $V_I$ = $V_{CC}$ or GND | | | 1.0 | | 1.0 | µA |
| | | $V_{CC}$ = 6.0 | | | | 2.0 | | 2.0 | |
| $\pm I_S$ | Analog switch OFF-state current per channel | $V_{CC}$ = 3.6 | $V_I$ = $V_{IH}$ or $V_{IL}$; $\lvert V_S \rvert$ = $V_{CC}$ - GND (See Figure 2) | | | 1.0 | | 1.0 | µA |
| | | $V_{CC}$ = 6.0 | | | | 2.0 | | 2.0 | |
| $\pm I_S$ | Analog switch ON-state current | $V_{CC}$ = 3.6 | $V_I$ = $V_{IH}$ or $V_{IL}$; $\lvert V_S \rvert$ = $V_{CC}$ - GND (See Figure 3) | | | 1.0 | | 1.0 | µA |
| | | $V_{CC}$ = 6.0 | | | | 2.0 | | 2.0 | |
| $I_{CC}$ | Quiescent supply current | $V_{CC}$ = 3.6 V | $V_I$ = $V_{CC}$ or GND; $V_{IS}$ = GND or $V_{CC}$; $V_{OS}$ = $V_{CC}$ or GND | | | 20.0 | | 40 | µA |
| | | $V_{CC}$ = 6.0 V | | | | 40.0 | | 80 | |
| $\Delta I_{CC}$ | Additional quiescent supply current per input | $V_{CC}$ = 2.7 to 3.6 V | $V_I$ = $V_{CC}$ – 0.6 V | | | 500 | | 850 | µA |
| $R_{ON}$ | ON-resistance (peak) | $V_{CC}$ = 1.2 V | $V_I$ = $V_{IH}$ or $V_{IL}$; $I_S$ = 100 µA; $V_{IS}$ = $V_{CC}$ to GND | | | | | | Ω |
| | | $V_{CC}$ = 2.0 V | $V_I$ = $V_{IH}$ or $V_{IL}$; $I_S$ = 1000 µA; $V_{IS}$ = $V_{CC}$ to GND | | 145 | 325 | | 375 | |
| | | $V_{CC}$ = 2.7 V | | | 90 | 200 | | 235 | |
| | | $V_{CC}$ = 3.0 to 3.6 V | | | 80 | 180 | | 210 | |
| | | $V_{CC}$ = 4.5 V | | | 60 | 135 | | 160 | |
| | | $V_{CC}$ = 6.0 V | | | 55 | 125 | | 145 | |
| $R_{ON}$ | ON-resistance (rail) | $V_{CC}$ = 1.2 V | $V_I$ = $V_{IH}$ or $V_{IL}$; $I_S$ = 100 µA; $V_{IS}$ = GND | | 225 | | | | Ω |
| | | $V_{CC}$ = 2.0 V | $V_I$ = $V_{IH}$ or $V_{IL}$; $I_S$ = 1000 µA; $V_{IS}$ = GND | | 110 | 235 | | 270 | |
| | | $V_{CC}$ = 2.7 V | | | 70 | 145 | | 165 | |
| | | $V_{CC}$ = 3.0 to 3.6 V | | | 60 | 130 | | 150 | |
| | | $V_{CC}$ = 4.5 V | | | 45 | 100 | | 115 | |
| | | $V_{CC}$ = 6.0 V | | | 40 | 85 | | 100 | |

**NOTES:**

1. All typical values are measured at $T_{amb}$ = 25°C.
2. At supply voltages approaching 1.2 V, the analog switch ON-resistance becomes extremely non-linear. Therefore, it is recommended that these devices be used to transmit digital signals only, when using these supply voltages.
3. $R_{ON}$ (MAX) data is preliminary.

## DC ELECTRICAL CHARACTERISTICS (*Continued*)

| SYMBOL | PARAMETER | TEST CONDITIONS | | LIMITS | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | -40°C to +85°C | | | -40°C to +125°C | | |
| | | | | MIN | TYP[1] | MAX | MIN | MAX | |
| $R_{ON}$ | ON-resistance (rail) | $V_{CC}$ = 1.2 V | $V_I$ = $V_{IH}$ or $V_{IL}$; $I_S$ = 100 μA; $V_{IS}$ = $V_{CC}$ | | 250 | | | | Ω |
| | | $V_{CC}$ = 2.0 V | $V_I$ = $V_{IH}$ or $V_{IL}$; $I_S$ = 1000 μA; $V_{IS}$ = $V_{CC}$ | | 120 | 320 | | 370 | Ω |
| | | $V_{CC}$ = 2.7 V | | | 75 | 195 | | 225 | |
| | | $V_{CC}$ = 3.0 to 3.6 V | | | 70 | 175 | | 205 | |
| | | $V_{CC}$ = 4.5 V | | | 50 | 130 | | 150 | |
| | | $V_{CC}$ = 6.0 V | | | 45 | 120 | | 135 | |
| $\Delta R_{ON}$ | Maximum variation of ON-resistance between any two channels | $V_{CC}$ = 1.2 V | $V_I$ = $V_{IH}$ or $V_{IL}$; $V_{IS}$ = $V_{CC}$ to GND | | | | | | Ω |
| | | $V_{CC}$ = 2.0 V | | | 5 | | | | |
| | | $V_{CC}$ = 2.7 V | | | 4 | | | | |
| | | $V_{CC}$ = 3.0 to 3.6 V | | | 4 | | | | |
| | | $V_{CC}$ = 4.5 V | | | 3 | | | | |
| | | $V_{CC}$ = 6.0 V | | | 2 | | | | |

**NOTES:**
1. All typical values are measured at $T_{amb}$ = 25°C.
2. At supply voltages approaching 1.2 V, the analog switch ON-resistance becomes extremely non-linear. Therefore, it is recommended that these devices be used to transmit digital signals only, when using these supply voltages.
3. $R_{ON}$ (MAX) data is preliminary.

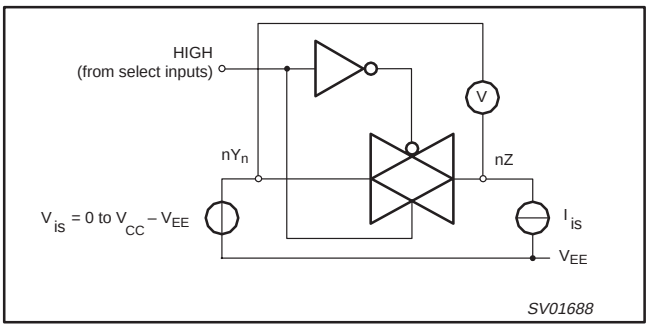



**Figure 1. Test circuit for measuring ON-resistance ($R_{ON}$).**

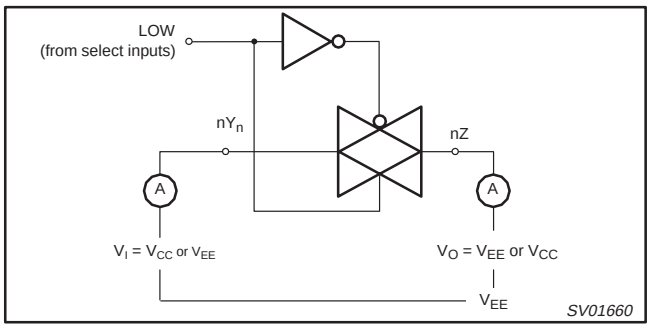



**Figure 2. Test circuit for measuring OFF-state current.**

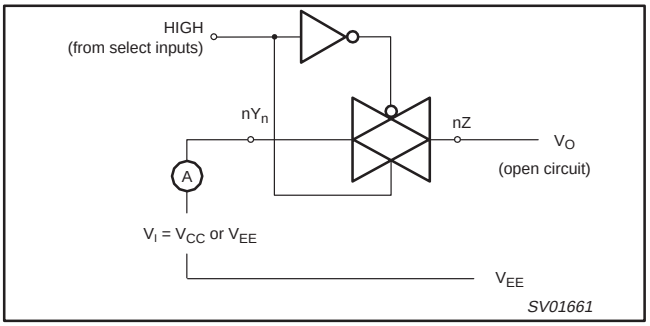



**Figure 3. Test circuit for measuring ON-state current.**

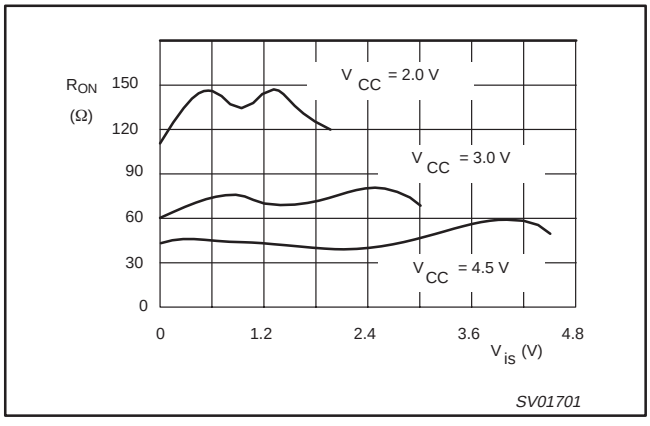



**Figure 4. Typical ON-resistance ($R_{on}$) as a function of input voltage ($V_{is}$) for $V_{is}$ = 0 to $V_{CC}$ – $V_{EE}$.**

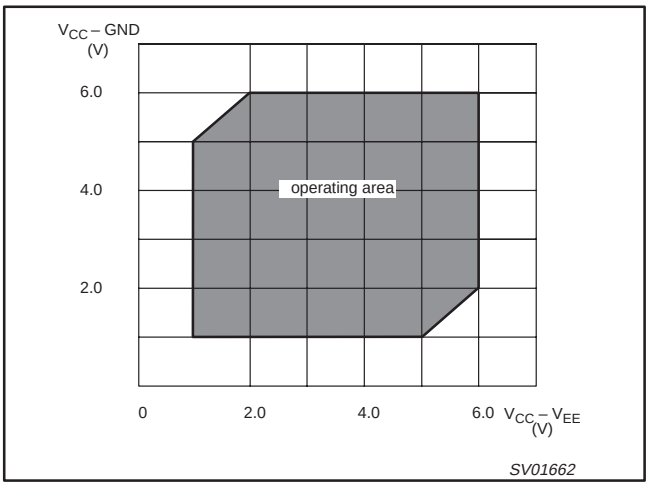



**Figure 5. Guaranteed operating area as a function of the supply voltages.**

## AC CHARACTERISTICS

GND = 0 V; $t_r = t_f \leq 2.5$ns; $C_L$ = 50pF

| SYMBOL | PARAMETER | CONDITION | | LIMITS | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | –40 to +85 °C | | | –40 to +125 °C | | |
| | | $V_{CC}$ (V) | OTHER | MIN | TYP[1] | MAX | MIN | MAX | |
| $t_{PHL}/t_{PLH}$ | Propagation delay $V_{is}$ to $V_{os}$ | 1.2 | $R_L$ = ∞; $C_L$ = 50 pF Figure 12 | | 25 | | | | ns |
| | | 2.0 | | | 9 | 17 | | 20 | |
| | | 2.7 | | | 6 | 13 | | 15 | |
| | | 3.0 to 3.6 | | | 5[2] | 10 | | 12 | |
| | | 4.5 | | | 4 | 9 | | 10 | |
| | | 6.0 | | | 3 | 7 | | 8 | |
| $t_{PZH}/t_{PZL}$ | Turn-on time $\overline{E}$, $S_n$ to $V_{OS}$ | 1.2 | $R_L$ = 1kΩ; $C_L$ = 50 pF Figures 13 and 1 | | 190 | | | | ns |
| | | 2.0 | | | 65 | 121 | | 146 | |
| | | 2.7 | | | 48 | 89 | | 108 | |
| | | 3.0 to 3.6 | | | 36[2] | 71 | | 86 | |
| | | 4.5 | | | 32 | 60 | | 73 | |
| | | 6.0 | | | 25 | 46 | | 56 | |
| $t_{PHZ}/t_{PLZ}$ | Turn-off time $\overline{E}$, Sn to $V_{OS}$ | 1.2 | $R_L$ = 1kΩ: $C_L$ = 50 pF Figures 13 and 1 | | 125 | | | | ns |
| | | 2.0 | | | 43 | 80 | | 95 | |
| | | 2.7 | | | 33 | 59 | | 71 | |
| | | 3.0 to 3.6 | | | 26[2] | 48 | | 57 | |
| | | 4.5 | | | 23 | 41 | | 49 | |
| | | 6.0 | | | 18 | 32 | | 38 | |

**NOTES:**
1. Unless otherwise stated, all typical values are measured at $T_{amb}$ = 25°C
2. Typical values are measured at $V_{CC}$ = 3.3 V.

## ADDITIONAL AC CHARACTERISTICS

Recommended conditions and typical values
GND = 0 V; $t_r = t_f \leq 2.5$ns

| SYMBOL | PARAMETER | TYP. | UNIT | $V_{CC}$ (V) | $V_{is(p-p)}$ (V) | CONDITIONS |
|---|---|---|---|---|---|---|
| | Sine-wave distortion<br>f = 1 kHz | 0.80<br>0.40 | % | 3.0<br>6.0 | 2.75<br>5.50 | $R_L$ = 10 kΩ; $C_L$ = 50 pf<br>Figure 9 and 10 |
| | Sine-wave distortion<br>f = 10 kHz | 2.40<br>1.20 | % | 3.0<br>6.0 | 2.75<br>5.50 | $R_L$ = 10 kΩ; $C_L$ = 50 pf<br>Figure 9 and 10 |
| | Switch "OFF" signal feed through | –50<br>–50 | dB | 3.0<br>6.0 | Note 1 | $R_L$ = 600 Ω; $C_L$ = 50 pf; f= 1 MHz<br>Figures 5 and 11 |
| | Crosstalk between any two switches/multiplexers | –60<br>–60 | dB | 3.0<br>6.0 | Note 1 | $R_L$ = 600 Ω; $C_L$ = 50 pf; f= 1 MHz<br>Figure 8 |
| $V_{(p-p)}$ | Crosstalk voltage between enable or address input to any switch (peak-to-peak value) | 110<br>120 | mV | 3.0<br>6.0 | | $R_L$ = 600 Ω; $C_L$ = 50 pf; f= 1 MHz<br>($S_n$ or $\overline{E}$, square wave between $V_{CC}$ and GND $t_r = t_f$ = 6 ns) Figure 8 |
| $f_{max}$ | Minimum frequency response (–3 dB) | 180<br>200 | MHz | 3.0<br>6.0 | Note 2 | $R_L$ = 50 Ω; $C_L$ = 50 pF<br>Figures 6, 8 and 9 |
| $C_S$ | Maximum switch capacitance | 5 | pf | | | |

**GENERAL NOTES:**

1. $V_{is}$ is the input voltage at nY or nZ terminal, whichever is assigned as an input.
2. $V_{OS}$ is the output voltage at nY or nZ terminal, whichever is assigned as an output.

**NOTES:**

1. Adjust input voltage $V_{is}$ is 0 dBm level (0 dBm = 1 mW into 600 Ω).
2. Adjust input voltage $V_{is}$ is 0 dBm level at $V_{OS}$ for 1 MHz (0 dBm = 1 mW into 50 Ω).

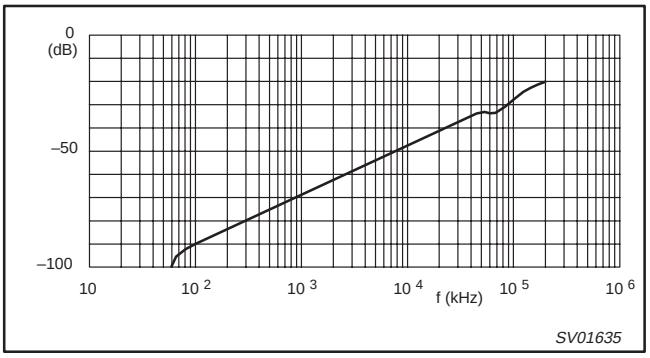



**Figure 6. Typical switch "OFF" signal feed-through as a function of frequency.**

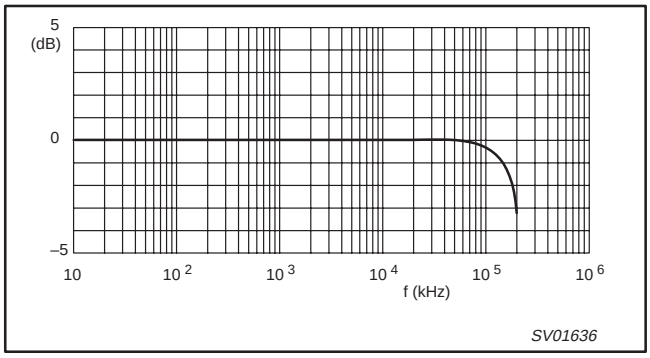



**Figure 7. Typical frequency response.**

**NOTES TO FIGURES 6 AND 7:**

Test conditions: $V_{CC}$ = 3.0 V; GND = 0 V; $V_{EE}$ = -3.0 V; $R_L$ = 50 Ω; $R_{SOURCE}$ = 1kΩ.

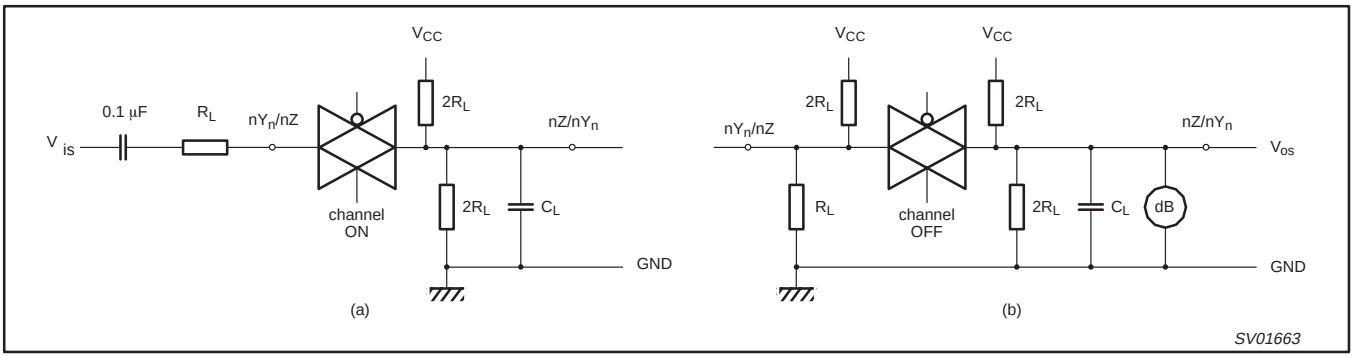
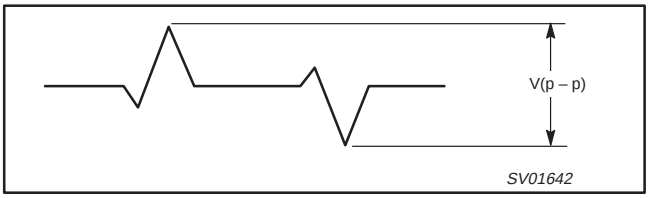



**Figure 8. Test circuit for measuring crosstalk between any two switches.
(a) channel ON condition; (b) channel OFF condition.**

**NOTE TO FIGURE 8:**
The crosstalk is defined as follows (oscilloscope output):



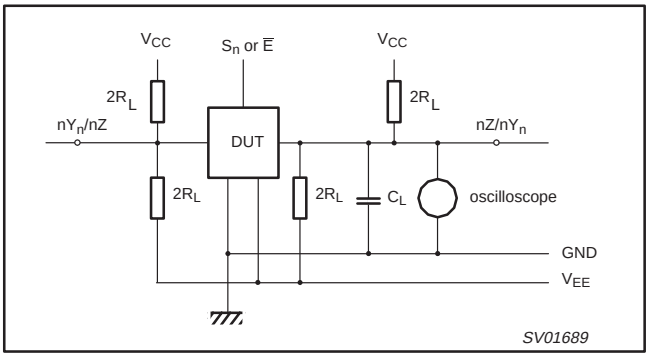




**Figure 9. Test circuit for measuring crosstalk between control and any switch.**

**NOTE TO FIGURE 9:**
Adjust input voltage to obtain 0 dBm at $V_{OS}$ when $F_{in}$ = 1 MHz. After set-up frequency of $f_{in}$ is increased to obtain a reading of –3 dB at $V_{OS}$.

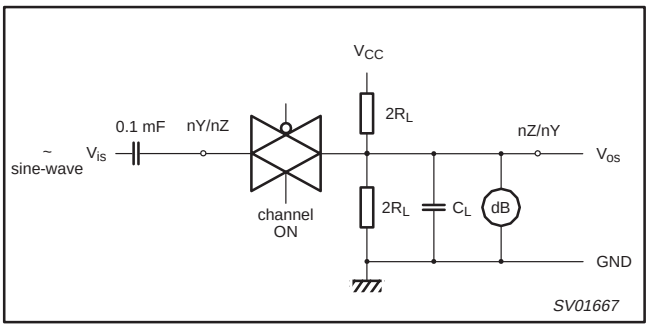



**Figure 10. Test circuit for measuring minimum frequency response.**

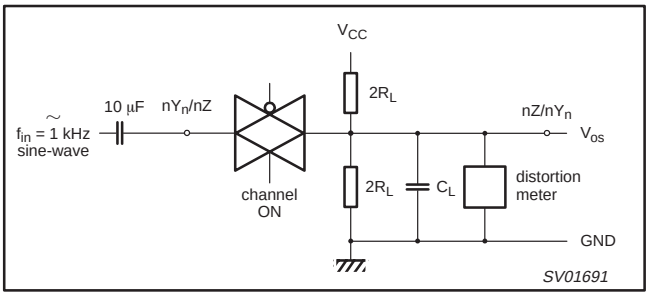



**Figure 11. Test circuit for measuring sine-wave distortion.**

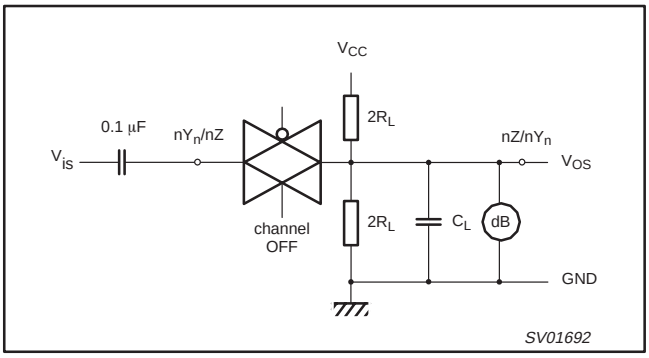



**Figure 12. Test circuit for measuring switch “OFF” signal feed-through.**

## WAVEFORMS

**NOTES:**

1. $V_M$ = 1.5 V at 2.7 V ≤ $V_{CC}$ ≤ 3.6 V
   $V_M$ = 0.5 × $V_{CC}$ at 2.7 V > $V_{CC}$ > 3.6 V
2. $V_{OL}$ and $V_{OH}$ are the typical output voltage drop that occur with the output load
3. $V_X$ = $V_{OL}$ + 0.3 V at 2.7 V ≤ $V_{CC}$ ≤ 3.6 V
   $V_X$ = $V_{OL}$ + 0.1 × $V_{CC}$ at 2.7 V >$V_{CC}$ > 3.6 V
   $V_Y$ = $V_{OH}$ – 0.3 V at 2.7 V ≤ $V_{CC}$ ≤ 3.6 V
   $V_Y$ = $V_{OH}$ – 0.1 × $V_{CC}$ at 2.7 V >$V_{CC}$ > 3.6 V

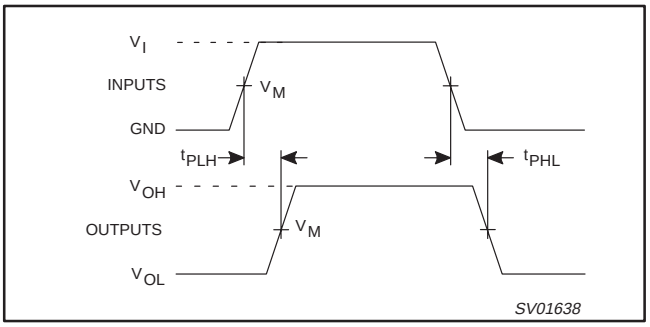



**Figure 13. Input ($V_{is}$) to output ($V_{os}$) propagation delays.**

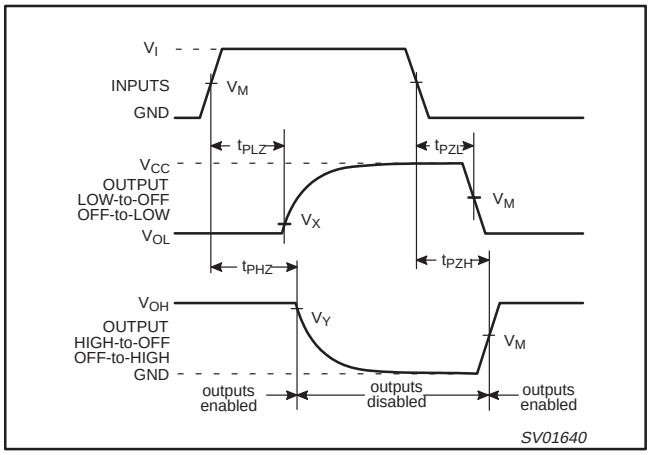
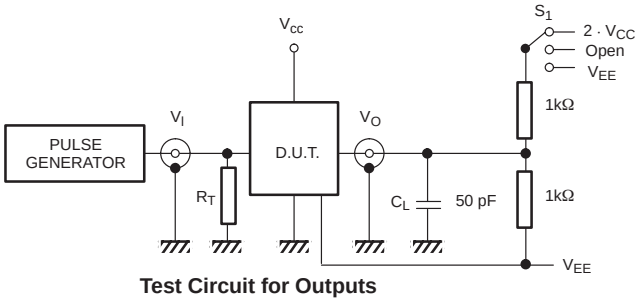
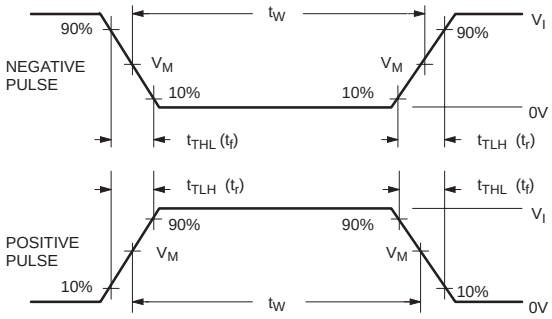



**Figure 14. Turn-on and turn-off times for the inputs ($S_n$, $\overline{E}$) to the output ($V_{os}$).**

## TEST CIRCUIT




**Test Circuit for Outputs**




| $V_{CC}$ | $V_I$ |
|---|---|
| < 2.7V | $V_{CC}$ |
| 2.7 - 3.6V | 2.7V |
| > 3.6 V | $V_{CC}$ |

| Test | $S_1$ | $V_{IS}$ |
|---|---|---|
| $t_{PLH}/t_{PHL}$ | Open | Pulse |
| $t_{PLZ}/t_{PZL}$ | 2 · $V_{CC}$ | $V_{EE}$ |
| $t_{PHZ}/t_{PZH}$ | $V_{EE}$ | $V_I$ |

### DEFINITIONS

$R_L$ = Load resistor

$C_L$ = Load capacitance includes jig and probe capacitance

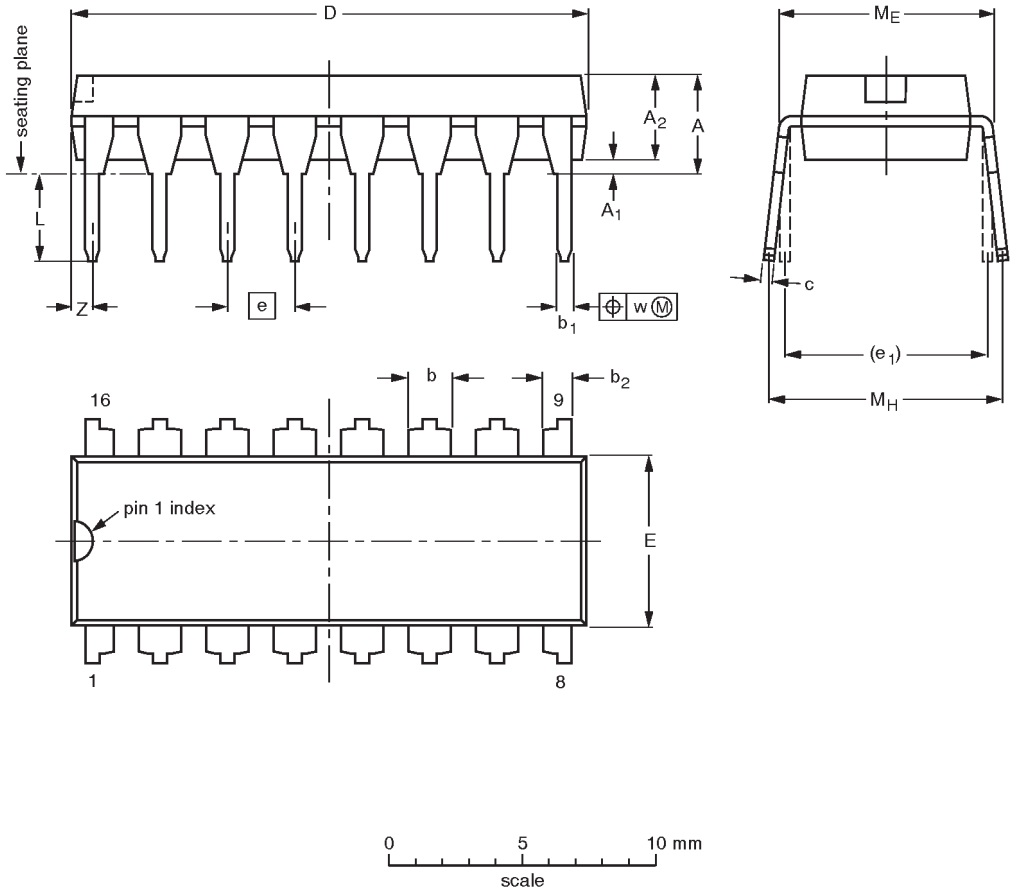
$R_T$ = Termination resistance should be equal to $Z_{OUT}$ of pulse generators.

$t_r$ = $t_f$ =6ns, when measuring $f_{max,}$ there is no constraint on $t_r$, $t_f$ with 50% duty factor.

SY01738

**Figure 15. Load circuitry for switching times.**

**DIP16: plastic dual in-line package; 16 leads (300 mil)** **SOT38-4**




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

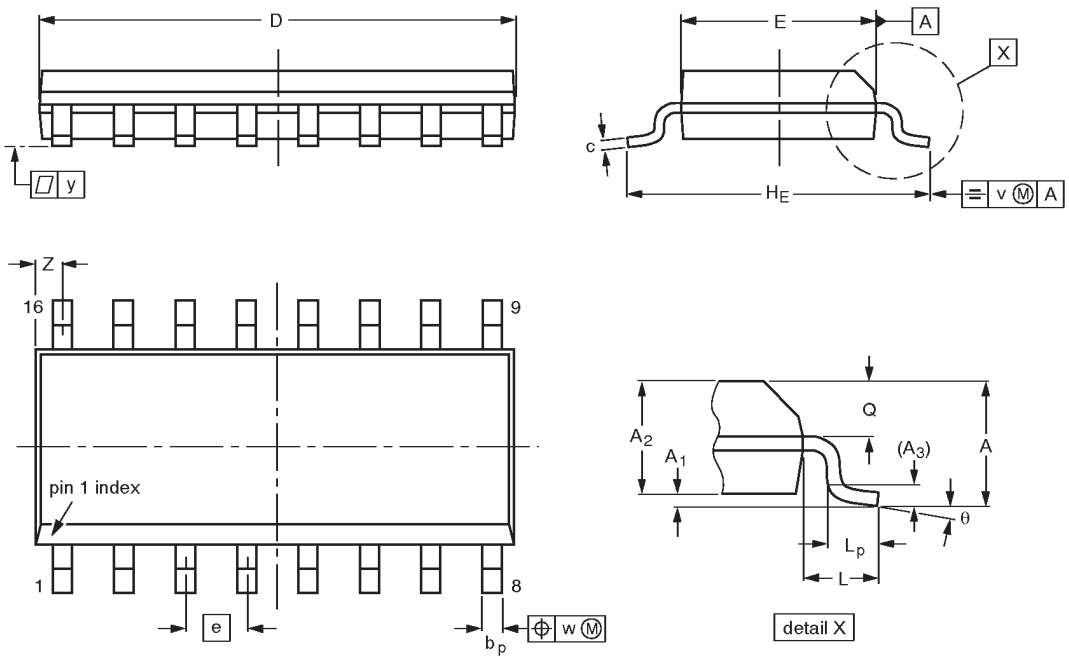
| UNIT | A max. | $A_1$ min. | $A_2$ max. | b | $b_1$ | $b_2$ | c | D (1) | E (1) | e | $e_1$ | L | $M_E$ | $M_H$ | w | Z (1) max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.2 | 0.51 | 3.2 | 1.73<br>1.30 | 0.53<br>0.38 | 1.25<br>0.85 | 0.36<br>0.23 | 19.50<br>18.55 | 6.48<br>6.20 | 2.54 | 7.62 | 3.60<br>3.05 | 8.25<br>7.80 | 10.0<br>8.3 | 0.254 | 0.76 |
| inches | 0.17 | 0.020 | 0.13 | 0.068<br>0.051 | 0.021<br>0.015 | 0.049<br>0.033 | 0.014<br>0.009 | 0.77<br>0.73 | 0.26<br>0.24 | 0.10 | 0.30 | 0.14<br>0.12 | 0.32<br>0.31 | 0.39<br>0.33 | 0.01 | 0.030 |

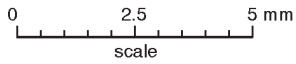
**Note**

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 | | | |
| SOT38-4 | | | | | | ~~92-11-17~~<br>95-01-14 |

**SO16: plastic small outline package; 16 leads; body width 3.9 mm** **SOT109-1**




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

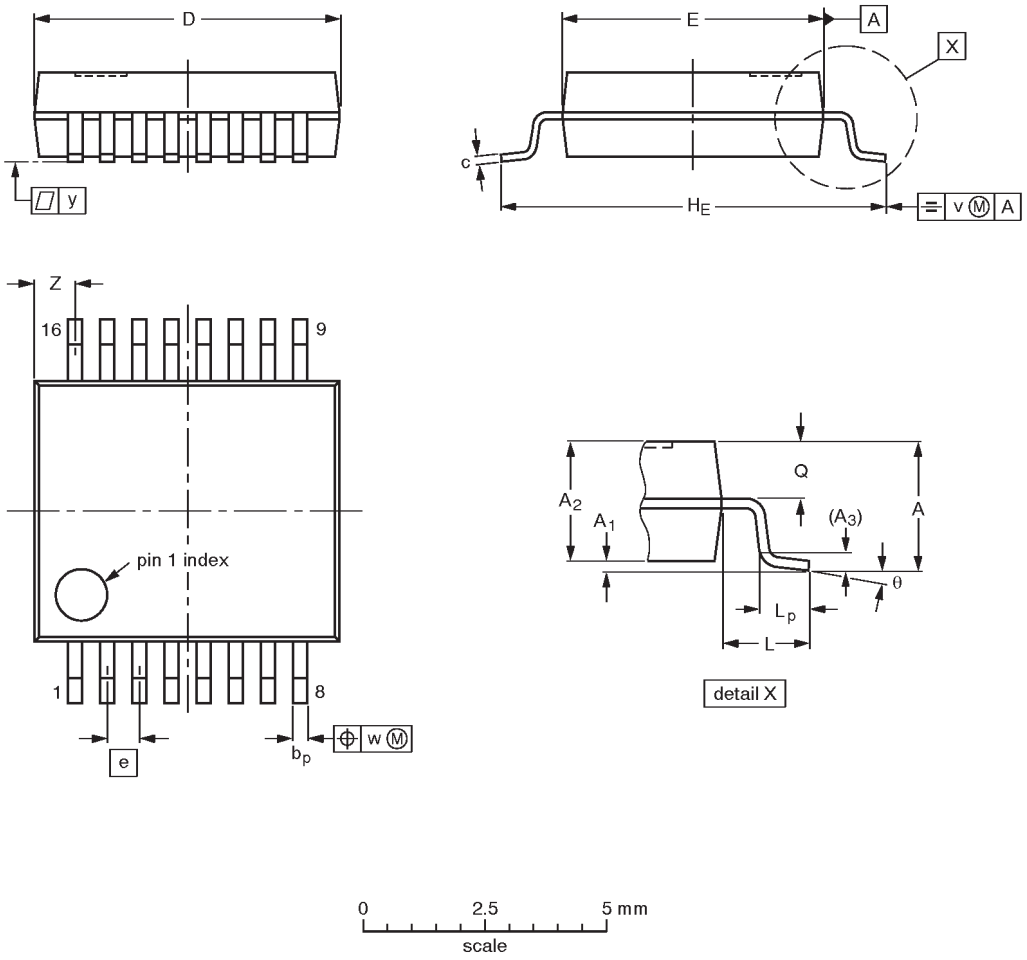
| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 10.0<br>9.8 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | 8°<br>0° |
| inches | 0.069 | 0.0098<br>0.0039 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0098<br>0.0075 | 0.39<br>0.38 | 0.16<br>0.15 | 0.050 | 0.24<br>0.23 | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT109-1 | 076E07S | MS-012AC | | | | ~~91-08-13~~<br>95-01-23 |

**SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm** **SOT338-1**




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

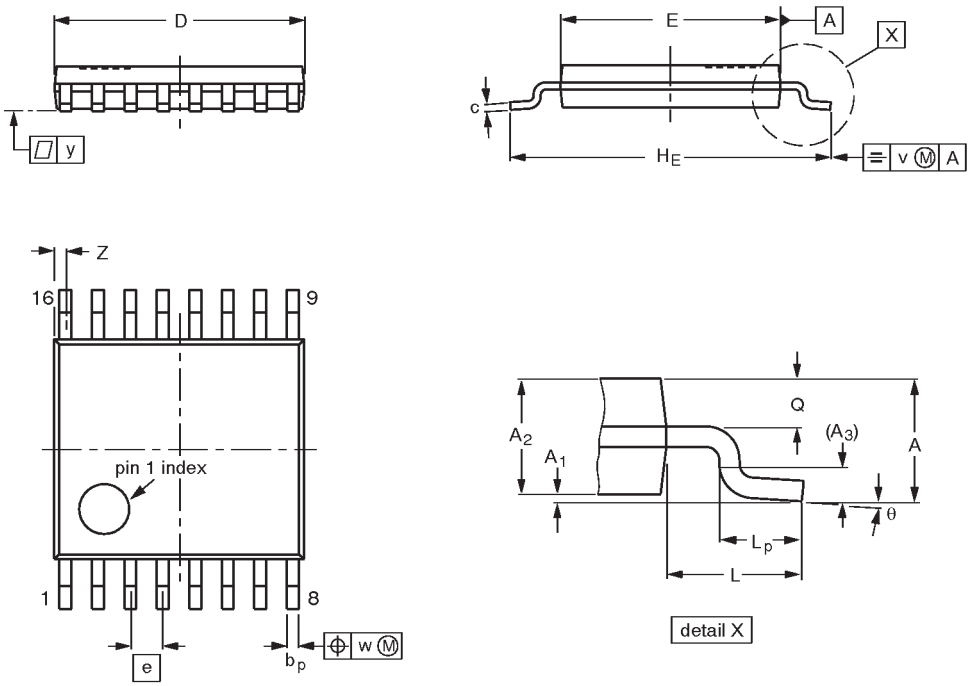
| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (1) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.0 | 0.21<br>0.05 | 1.80<br>1.65 | 0.25 | 0.38<br>0.25 | 0.20<br>0.09 | 6.4<br>6.0 | 5.4<br>5.2 | 0.65 | 7.9<br>7.6 | 1.25 | 1.03<br>0.63 | 0.9<br>0.7 | 0.2 | 0.13 | 0.1 | 1.00<br>0.55 | 8°<br>0° |

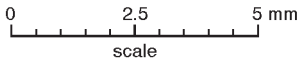
**Note**

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 | | | |
| SOT338-1 | | MO-150AC | | | | ~~94-01-14~~<br>95-02-04 |

**TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm** **SOT403-1**




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

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (2) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.10 | 0.15<br>0.05 | 0.95<br>0.80 | 0.25 | 0.30<br>0.19 | 0.2<br>0.1 | 5.1<br>4.9 | 4.5<br>4.3 | 0.65 | 6.6<br>6.2 | 1.0 | 0.75<br>0.50 | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.40<br>0.06 | 8°<br>0° |

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT403-1 | | MO-153 | | | | ~~94-07-12~~<br>95-04-04 |

## DEFINITIONS

| Data Sheet Identification | Product Status | Definition |
|---|---|---|
| *Objective Specification* | Formative or in Design | This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice. |
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