

MC14015B

Dual 4-Bit Static Shift Register

The MC14015B dual 4-bit static shift register is constructed with MOS P-Channel and N-Channel enhancement mode devices in a single monolithic structure. It consists of two identical, independent 4-state serial-input/parallel-output registers. Each register has independent Clock and Reset inputs with a single serial Data input. The register states are type D master-slave flip-flops. Data is shifted from one stage to the next during the positive-going clock transition. Each register can be cleared when a high level is applied on the Reset line. These complementary MOS shift registers find primary use in buffer storage and serial-to-parallel conversion where low power dissipation and/or noise immunity is desired.

Features

- Diode Protection on All Inputs
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Logic Edge-Clocked Flip-Flop Design
- Logic State is Retained Indefinitely with Clock Level either High or Low; Information is Transferred to the Output only on the Positive-going Edge of the Clock Pulse
- Capable of Driving Two Low-power TTL Loads or One Low-power Schottky TTL Load Over the Rated Temperature Range
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- This Device is Pb-Free and is RoHS Compliant

MAXIMUM RATINGS (Voltages Referenced to V_{SS})

| Symbol | Parameter | Value | Unit |
|-------------------|---|------------------------|------|
| V_{DD} | DC Supply Voltage Range | -0.5 to +18.0 | V |
| V_{in}, V_{out} | Input or Output Voltage Range (DC or Transient) | -0.5 to $V_{DD} + 0.5$ | V |
| I_{in}, I_{out} | Input or Output Current (DC or Transient) per Pin | ± 10 | mA |
| P_D | Power Dissipation, per Package (Note 1) | 500 | mW |
| T_A | Ambient Temperature Range | -55 to +125 | °C |
| T_{stg} | Storage Temperature Range | -65 to +150 | °C |
| T_L | Lead Temperature (8-Second Soldering) | 260 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Temperature Derating: "D/DW" Package: -7.0 mW/°C From 65°C To 125°C

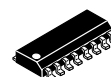
This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}). Unused outputs must be left open.



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SOIC-16
D SUFFIX
CASE 751B

MARKING DIAGRAM



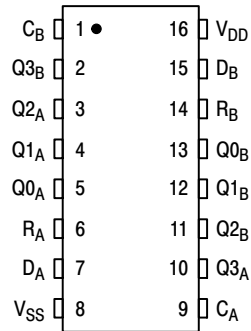
A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
G = Pb-Free Indicator

ORDERING INFORMATION

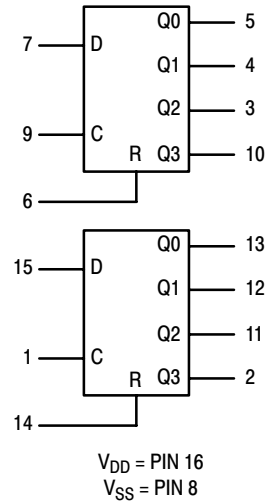
See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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PIN ASSIGNMENT



BLOCK DIAGRAM



TRUTH TABLE

| C | D | R | Q ₀ | Q _n |
|---|---|---|----------------|------------------|
| ↗ | 0 | 0 | 0 | Q _{n-1} |
| ↗ | 1 | 0 | 1 | Q _{n-1} |
| ↘ | X | 0 | No Change | No Change |
| X | X | 1 | 0 | 0 |

X = Don't Care

Q_n = Q0, Q1, Q2, or Q3, as applicable.

Q_{n-1} = Output of prior stage.

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|----------------|----------------------|--------------------------|
| MC14015BDG | SOIC-16 (Pb-Free) | 48 Units / Rail |
| MC14015BDR2G | SOIC-16 (Pb-Free) | 2500 Units / Tape & Reel |
| NLV14015BDR2G* | SOIC-16 (Pb-Free) | 2500 Units / Tape & Reel |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

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ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

| Characteristic | Symbol | V _{DD} Vdc | -55°C | | 25°C | | | 125°C | | Unit |
|---|------------------------------|------------------------|--|------|-------|-----------------|------|-------|------|------|
| | | | Min | Max | Min | Typ (Note 2) | Max | Min | Max | |
| Output Voltage V _{in} = V _{DD} or 0 | "0" Level V _{OL} | 5.0 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | Vdc |
| | | 10 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | |
| 15 | | - | 0.05 | - | 0 | 0.05 | - | 0.05 | | |
| V _{in} = 0 or V _{DD} | "1" Level V _{OH} | 5.0 | 4.95 | - | 4.95 | 5.0 | - | 4.95 | - | Vdc |
| | | 10 | 9.95 | - | 9.95 | 10 | - | 9.95 | - | |
| | | 15 | 14.95 | - | 14.95 | 15 | - | 14.95 | - | |
| Input Voltage (V _O = 4.5 or .05 Vdc) (V _O = 9.0 or 1.0 Vdc) (V _O = 13.5 or 1.5 Vdc) | "0" Level V _{IL} | 5.0 | - | 1.5 | - | 2.25 | 1.5 | - | 1.5 | Vdc |
| | | 10 | - | 3.0 | - | 4.50 | 3.0 | - | 3.0 | |
| 15 | | - | 4.0 | - | 6.75 | 4.0 | - | 4.0 | | |
| (V _O = 0.5 or 4.5 Vdc) (V _O = 1.0 or 9.0 Vdc) (V _O = 1.5 or 13.5 Vdc) | "1" Level V _{IH} | 5.0 | 3.5 | - | 3.5 | 2.75 | - | 3.5 | - | Vdc |
| | | 10 | 7.0 | - | 7.0 | 5.50 | - | 7.0 | - | |
| | | 15 | 11 | - | 11 | 8.25 | - | 11 | - | |
| Output Drive Current (V _{OH} = 2.5 Vdc) (V _{OH} = 4.6 Vdc) (V _{OH} = 9.5 Vdc) (V _{OH} = 13.5 Vdc) | Source I _{OH} | 5.0 | -3.0 | - | -2.4 | -4.2 | - | -1.7 | - | mAdc |
| | | 5.0 | -0.64 | - | -0.51 | -0.88 | - | -0.36 | - | |
| 10 | | -1.6 | - | -1.3 | -2.25 | - | -0.9 | - | | |
| 15 | | -4.2 | - | -3.4 | -8.8 | - | -2.4 | - | | |
| (V _{OL} = 0.4 Vdc) (V _{OL} = 0.5 Vdc) (V _{OL} = 1.5 Vdc) | Sink I _{OL} | 5.0 | 0.64 | - | 0.51 | 0.88 | - | 0.36 | - | mAdc |
| | | 10 | 1.6 | - | 1.3 | 2.25 | - | 0.9 | - | |
| | | 15 | 4.2 | - | 3.4 | 8.8 | - | 2.4 | - | |
| Input Current | I _{in} | 15 | - | ±0.1 | - | ±0.00001 | ±0.1 | - | ±1.0 | μAdc |
| Input Capacitance (V _{in} = 0) | C _{in} | - | - | - | - | 5.0 | 7.5 | - | - | pF |
| Quiescent Current (Per Package) | I _{DD} | 5.0 | - | 5.0 | - | 0.005 | 5.0 | - | 150 | μAdc |
| | | 10 | - | 10 | - | 0.010 | 10 | - | 300 | |
| | | 15 | - | 20 | - | 0.015 | 20 | - | 600 | |
| Total Supply Current (Notes 3 & 4) (Dynamic plus Quiescent, Per Package) (C _L = 50 pF on all outputs, all buffers switching) | I _T | 5.0 | I _T = (1.2 μA/kHz)f + I _{DD} I _T = (2.4 μA/kHz)f + I _{DD} I _T = (3.6 μA/kHz)f + I _{DD} | | | | | | | μAdc |
| | | 10 | | | | | | | | |
| | | 15 | | | | | | | | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

3. The formulas given are for the typical characteristics only at 25°C.

4. To calculate total supply current at loads other than 50 pF:

$$I_T(C_L) = I_T(50 \text{ pF}) + (C_L - 50) Vfk$$

where: I_T is in μA (per package), C_L in pF, V = (V_{DD} - V_{SS}) in volts, f in kHz is input frequency, and k = 0.002.

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SWITCHING CHARACTERISTICS (Note 5) ($C_L = 50 \text{ pF}$, $T_A = 25^\circ\text{C}$)

| Characteristic | Symbol | V_{DD} | Min | Typ (Note 6) | Max | Unit |
|---|-------------------------|--|--------------------------------|---|--|---------------|
| Output Rise and Fall Time $t_{TLH}, t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$ $t_{TLH}, t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$ $t_{TLH}, t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$ | $t_{TLH},$ t_{THL} | 5.0 10 15 | – – – | 100 50 40 | 200 100 80 | ns |
| Propagation Delay Time Clock, Data to Q $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 225 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 92 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 65 \text{ ns}$ Reset to Q $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 375 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 147 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 95 \text{ ns}$ | $t_{PLH},$ t_{PHL} | 5.0 10 15 5.0 10 15 | – – – – – – | 310 125 90 460 180 120 | 750 250 170 750 250 170 | ns |
| Clock Pulse Width | t_{WH} | 5.0 10 15 | 400 175 135 | 185 85 55 | – – – | ns |
| Clock Pulse Frequency | f_{cl} | 5.0 10 15 | – – – | 2.0 6.0 7.5 | 1.5 3.0 3.75 | MHz |
| Clock Pulse Rise and Fall Times | t_{TLH}, t_{THL} | 5.0 10 15 | – – – | – – – | 15 5 4 | μs |
| Reset Pulse Width | t_{WH} | 5.0 10 15 | 400 160 120 | 200 80 60 | – – – | ns |
| Setup Time | t_{su} | 5.0 10 15 | 350 100 75 | 100 50 40 | – – – | ns |

5. The formulas given are for typical characteristics only at 25°C .

6. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

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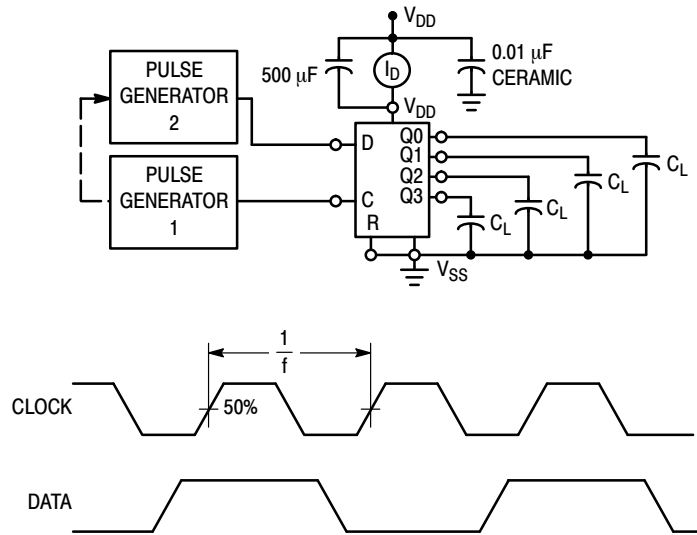


Figure 1. Power Dissipation Test Circuit and Waveform

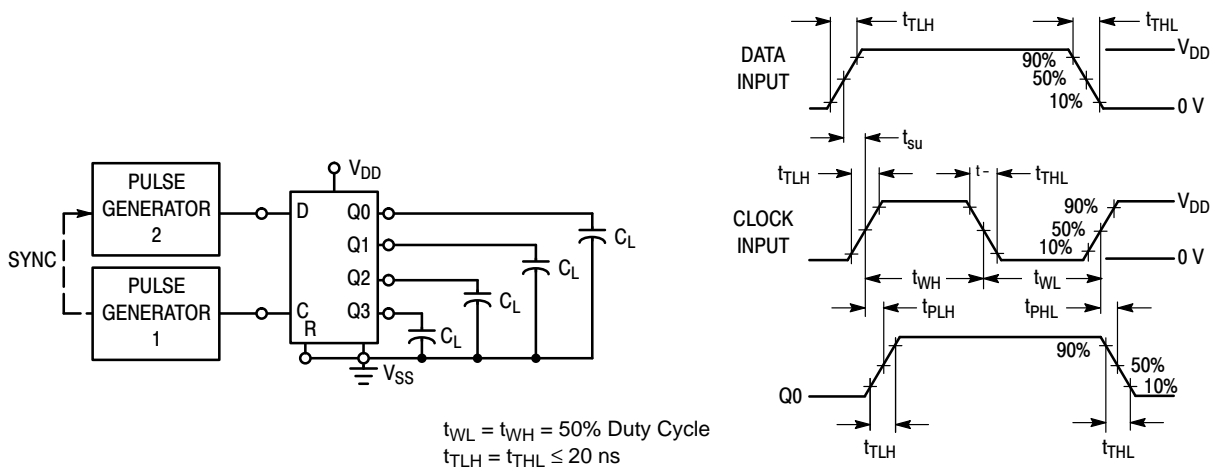


Figure 2. Switching Test Circuit and Waveforms

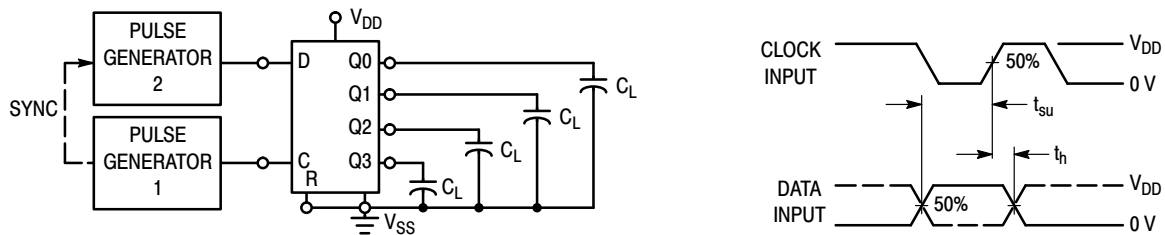
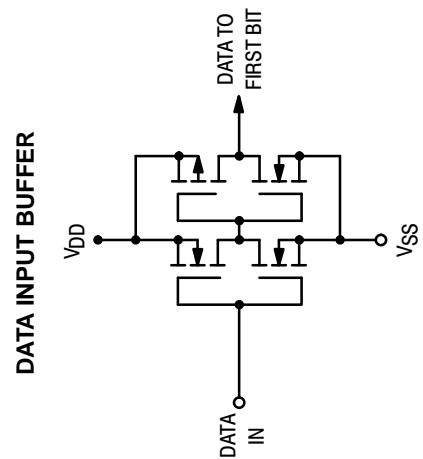
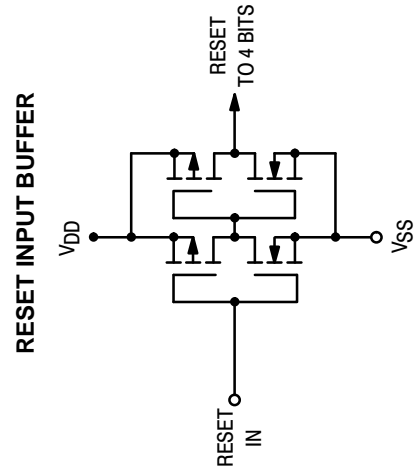
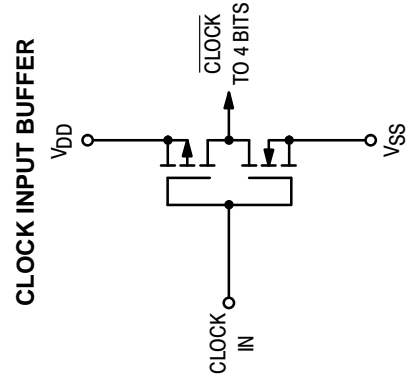
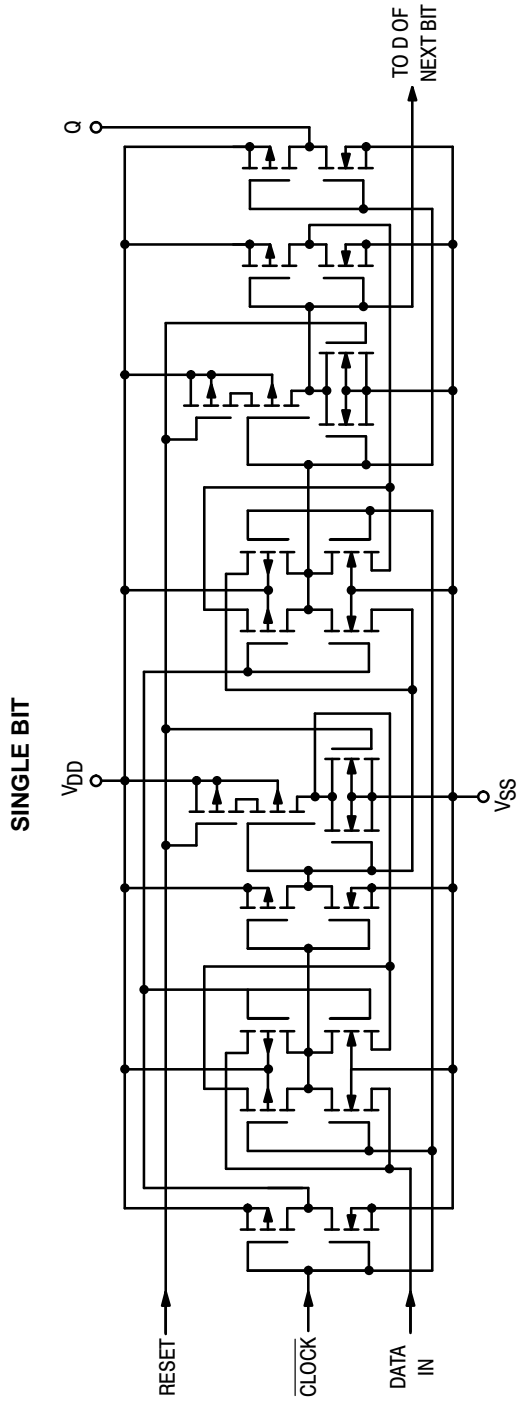


Figure 3. Setup and Hold Time Test Circuit and Waveforms

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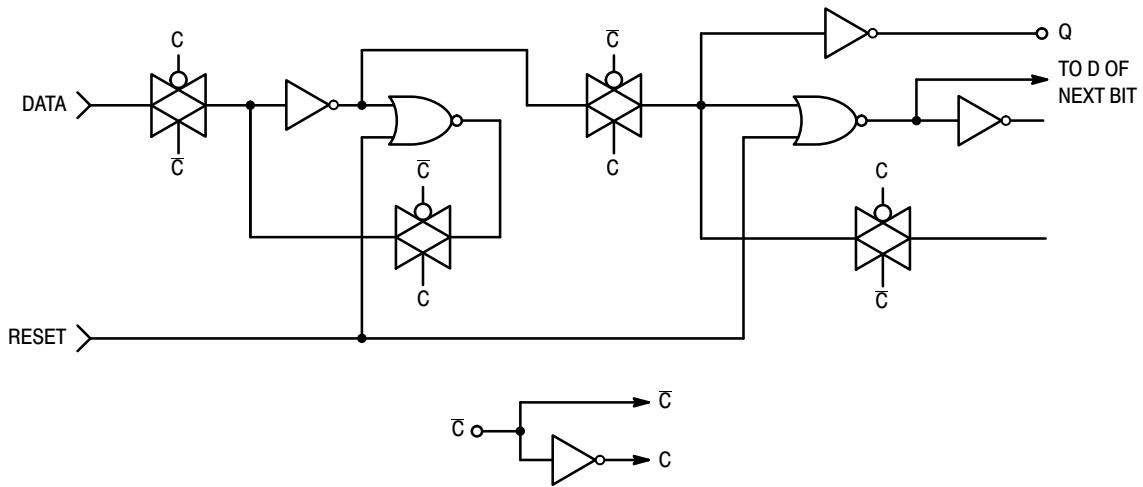
CIRCUIT SCHEMATICS



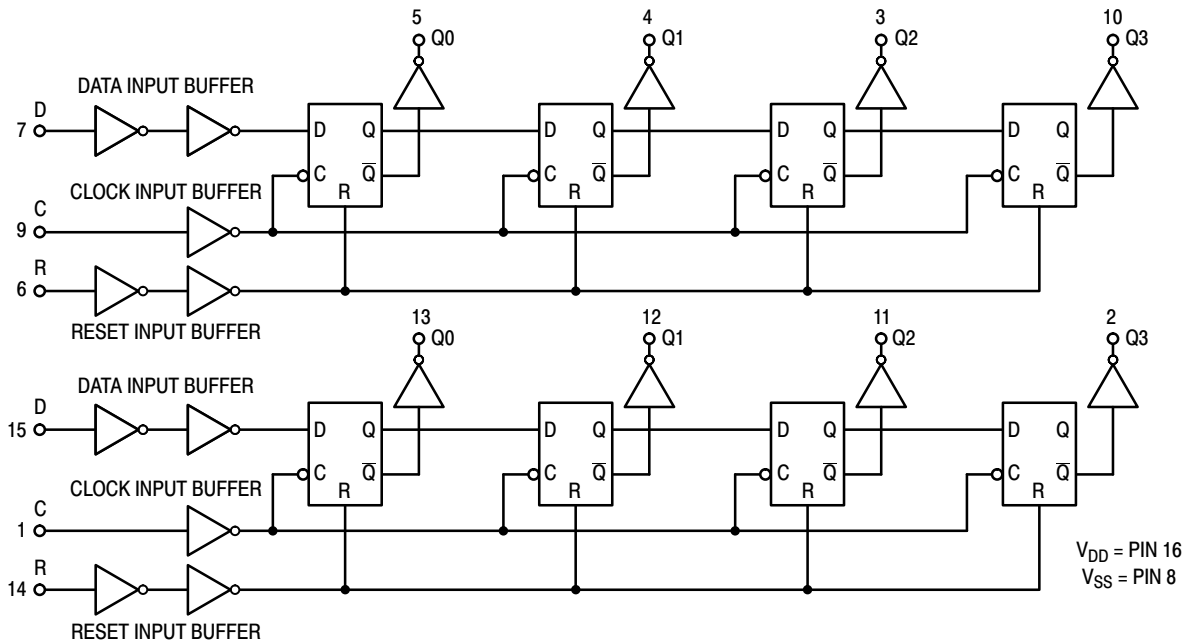
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LOGIC DIAGRAMS

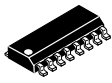
SINGLE BIT



COMPLETE DEVICE



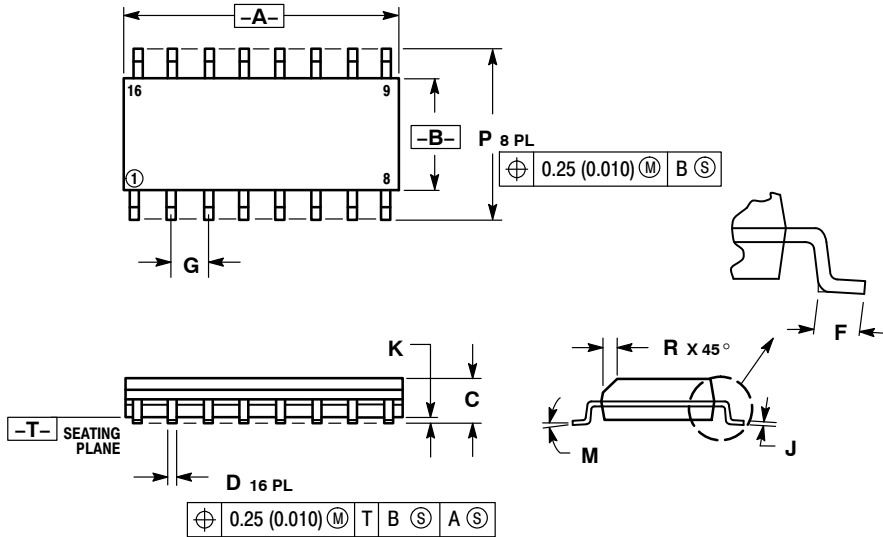
MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-16
CASE 751B-05
ISSUE K

DATE 29 DEC 2006



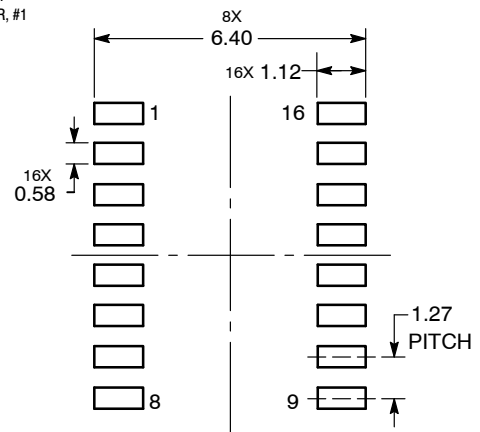
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 9.80 | 10.00 | 0.386 | 0.393 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0° | 7° | 0° | 7° |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

- | | | | |
|--|--|--|--|
| <p>STYLE 1:</p> <p>PIN 1. COLLECTOR</p> <p>2. BASE</p> <p>3. EMITTER</p> <p>4. NO CONNECTION</p> <p>5. EMITTER</p> <p>6. BASE</p> <p>7. COLLECTOR</p> <p>8. COLLECTOR</p> <p>9. BASE</p> <p>10. EMITTER</p> <p>11. NO CONNECTION</p> <p>12. EMITTER</p> <p>13. BASE</p> <p>14. COLLECTOR</p> <p>15. EMITTER</p> <p>16. COLLECTOR</p> | <p>STYLE 2:</p> <p>PIN 1. CATHODE</p> <p>2. ANODE</p> <p>3. NO CONNECTION</p> <p>4. CATHODE</p> <p>5. CATHODE</p> <p>6. NO CONNECTION</p> <p>7. ANODE</p> <p>8. CATHODE</p> <p>9. CATHODE</p> <p>10. ANODE</p> <p>11. NO CONNECTION</p> <p>12. CATHODE</p> <p>13. CATHODE</p> <p>14. NO CONNECTION</p> <p>15. ANODE</p> <p>16. CATHODE</p> | <p>STYLE 3:</p> <p>PIN 1. COLLECTOR, DYE #1</p> <p>2. BASE, #1</p> <p>3. EMITTER, #1</p> <p>4. COLLECTOR, #1</p> <p>5. COLLECTOR, #2</p> <p>6. BASE, #2</p> <p>7. EMITTER, #2</p> <p>8. COLLECTOR, #2</p> <p>9. COLLECTOR, #3</p> <p>10. BASE, #3</p> <p>11. EMITTER, #3</p> <p>12. COLLECTOR, #3</p> <p>13. COLLECTOR, #4</p> <p>14. BASE, #4</p> <p>15. EMITTER, #4</p> <p>16. COLLECTOR, #4</p> | <p>STYLE 4:</p> <p>PIN 1. COLLECTOR, DYE #1</p> <p>2. COLLECTOR, #1</p> <p>3. COLLECTOR, #2</p> <p>4. COLLECTOR, #2</p> <p>5. COLLECTOR, #3</p> <p>6. COLLECTOR, #3</p> <p>7. COLLECTOR, #4</p> <p>8. COLLECTOR, #4</p> <p>9. BASE, #4</p> <p>10. EMITTER, #4</p> <p>11. BASE, #3</p> <p>12. EMITTER, #3</p> <p>13. BASE, #2</p> <p>14. EMITTER, #2</p> <p>15. BASE, #1</p> <p>16. EMITTER, #1</p> |
| <p>STYLE 5:</p> <p>PIN 1. DRAIN, DYE #1</p> <p>2. DRAIN, #1</p> <p>3. DRAIN, #2</p> <p>4. DRAIN, #2</p> <p>5. DRAIN, #3</p> <p>6. DRAIN, #3</p> <p>7. DRAIN, #4</p> <p>8. DRAIN, #4</p> <p>9. GATE, #4</p> <p>10. SOURCE, #4</p> <p>11. GATE, #3</p> <p>12. SOURCE, #3</p> <p>13. GATE, #2</p> <p>14. SOURCE, #2</p> <p>15. GATE, #1</p> <p>16. SOURCE, #1</p> | <p>STYLE 6:</p> <p>PIN 1. CATHODE</p> <p>2. CATHODE</p> <p>3. CATHODE</p> <p>4. CATHODE</p> <p>5. CATHODE</p> <p>6. CATHODE</p> <p>7. CATHODE</p> <p>8. CATHODE</p> <p>9. ANODE</p> <p>10. ANODE</p> <p>11. ANODE</p> <p>12. ANODE</p> <p>13. ANODE</p> <p>14. ANODE</p> <p>15. ANODE</p> <p>16. ANODE</p> | <p>STYLE 7:</p> <p>PIN 1. SOURCE N-CH</p> <p>2. COMMON DRAIN (OUTPUT)</p> <p>3. COMMON DRAIN (OUTPUT)</p> <p>4. GATE P-CH</p> <p>5. COMMON DRAIN (OUTPUT)</p> <p>6. COMMON DRAIN (OUTPUT)</p> <p>7. COMMON DRAIN (OUTPUT)</p> <p>8. SOURCE P-CH</p> <p>9. SOURCE P-CH</p> <p>10. COMMON DRAIN (OUTPUT)</p> <p>11. COMMON DRAIN (OUTPUT)</p> <p>12. COMMON DRAIN (OUTPUT)</p> <p>13. GATE N-CH</p> <p>14. COMMON DRAIN (OUTPUT)</p> <p>15. COMMON DRAIN (OUTPUT)</p> <p>16. SOURCE N-CH</p> | |

RECOMMENDED
SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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