

CD4066B CMOS Quad Bilateral Switch

1 Features

- 15-V Digital or ± 7.5 -V Peak-to-Peak Switching
- 125- Ω Typical On-State Resistance for 15-V Operation
- Switch On-State Resistance Matched to Within 5 Ω Over 15-V Signal-Input Range
- On-State Resistance Flat Over Full Peak-to-Peak Signal Range
- High On or Off Output-Voltage Ratio: 80 dB Typical at $f_{is} = 10$ kHz, $R_L = 1$ k Ω
- High Degree of Linearity: <0.5% Distortion Typical at $f_{is} = 1$ kHz, $V_{is} = 5$ -V_{p-p}, $V_{DD} - V_{SS} \geq 10$ -V, $R_L = 10$ k Ω
- Extremely Low Off-State Switch Leakage, Resulting in Very Low Offset Current and High Effective Off-State Resistance: 10 pA Typical at $V_{DD} - V_{SS} = 10$ -V, $T_A = 25^\circ\text{C}$
- Extremely High Control Input Impedance (Control Circuit Isolated From Signal Circuit): 10^{12} Ω Typical
- Low Crosstalk Between Switches: -50 dB Typical at $f_{is} = 8$ MHz, $R_L = 1$ k Ω
- Matched Control-Input to Signal-Output Capacitance: Reduces Output Signal Transients
- Frequency Response, Switch On = 40 MHz Typical
- 100% Tested for Quiescent Current at 20-V
- 5-V, 10-V, and 15-V Parametric Ratings

2 Applications

- Analog Signal Switching and Multiplexing: Signal Gating, Modulators, Squelch Controls, Demodulators, Choppers, Commutating Switches
- Digital Signal Switching and Multiplexing
- Transmission-Gate Logic Implementation
- Analog-to-Digital and Digital-to-Analog Conversions
- Digital Control of Frequency, Impedance, Phase, and Analog-Signal Gain
- **Building Automation**

3 Description

The CD4066B device is a quad bilateral switch intended for the transmission or multiplexing of analog or digital signals. It is pin-for-pin compatible with the CD4016B device, but exhibits a much lower on-state resistance. In addition, the on-state resistance is relatively constant over the full signal-input range.

The CD4066B device consists of four bilateral switches, each with independent controls. Both the p and the n devices in a given switch are biased on or off simultaneously by the control signal. As shown in [Figure 17](#), the well of the n-channel device on each switch is tied to either the input (when the switch is on) or to V_{SS} (when the switch is off). This configuration eliminates the variation of the switch-transistor threshold voltage with input signal and, thus, keeps the on-state resistance low over the full operating-signal range.

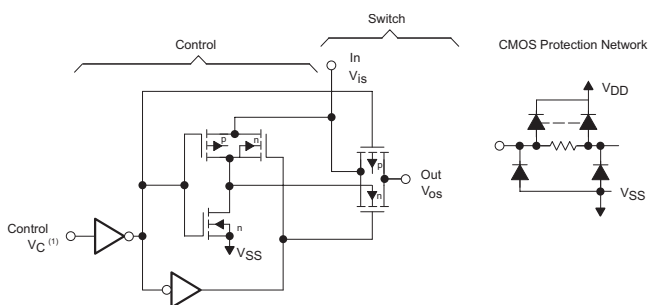
The advantages over single-channel switches include peak input-signal voltage swings equal to the full supply voltage and more constant on-state impedance over the input-signal range. However, for sample-and-hold applications, the CD4016B device is recommended.

Device Information⁽¹⁾

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|-------------|------------|--------------------|
| CD4066B | PDIP (14) | 19.30 mm x 6.35 mm |
| | CDIP (14) | 19.50 mm x 6.92 mm |
| | SOIC (14) | 8.65 mm x 3.91 mm |
| | SOP (14) | 10.30 mm x 5.30 mm |
| | TSSOP (14) | 5.00 mm x 4.40 mm |

(1) For all available packages, see the orderable addendum at the end of the datasheet.

Bidirectional Signal Transmission Via Digital Control Logic



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Table of Contents

| | | | |
|--|-----------|--|-----------|
| 1 Features | 1 | 8.3 Feature Description | 14 |
| 2 Applications | 1 | 8.4 Device Functional Modes | 14 |
| 3 Description | 1 | 9 Application and Implementation | 15 |
| 4 Revision History | 2 | 9.1 Application Information | 15 |
| 5 Pin Configuration and Functions | 3 | 9.2 Typical Application | 15 |
| 6 Specifications | 4 | 10 Power Supply Recommendations | 17 |
| 6.1 Absolute Maximum Ratings | 4 | 11 Layout | 17 |
| 6.2 ESD Ratings | 4 | 11.1 Layout Guidelines | 17 |
| 6.3 Recommended Operating Conditions | 4 | 11.2 Layout Example | 17 |
| 6.4 Thermal Information | 4 | 12 Device and Documentation Support | 18 |
| 6.5 Electrical Characteristics | 5 | 12.1 Receiving Notification of Documentation Updates | 18 |
| 6.6 Switching Characteristics | 8 | 12.2 Community Resources | 18 |
| 6.7 Typical Characteristics | 9 | 12.3 Trademarks | 18 |
| 7 Parameter Measurement Information | 10 | 12.4 Electrostatic Discharge Caution | 18 |
| 8 Detailed Description | 14 | 12.5 Glossary | 18 |
| 8.1 Overview | 14 | 13 Mechanical, Packaging, and Orderable Information | 18 |
| 8.2 Functional Block Diagram | 14 | | |

4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision G (June 2017) to Revision H | Page |
|---|-------------|
| • Added Junction Temperature details to the <i>Absolute Maximum Ratings</i> table | 4 |

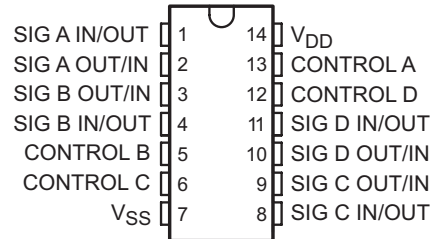
| Changes from Revision F (March 2017) to Revision G | Page |
|---|-------------|
| • Changed From: V_{SS} To: Hi-Z in the SIG OUT/IN column of | 14 |

| Changes from Revision E (September 2016) to Revision F | Page |
|--|-------------|
| • Corrected the $r_{on} V_{DD} = 10$ V values in the <i>Electrical Characteristics</i> table. | 7 |
| • Corrected the y axis scale in Figure 6 | 9 |

| Changes from Revision D (September 2003) to Revision E | Page |
|--|-------------|
| • Added <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section | 1 |
| • Deleted <i>Ordering Information</i> table, see POA at the end of the data sheet | 1 |
| • Changed values in the <i>Thermal Information</i> table to align with JEDEC standards | 4 |

5 Pin Configuration and Functions

**N, J, D, NS, or PW Packages
14-Pin PDIP, CDIP, SOIC, SO, or TSSOP
Top View**



Pin Functions

| PIN | | I/O | DESCRIPTION |
|-----|-----------------|-----|---------------------------|
| NO. | NAME | | |
| 1 | SIG A IN/OUT | I/O | Input/Output for Switch A |
| 2 | SIG A OUT/IN | I/O | Output/Input for Switch A |
| 3 | SIG B OUT/IN | I/O | Output/Input for Switch B |
| 4 | SIG B IN/OUT | I/O | Input/Output for Switch B |
| 5 | CONTROL B | I | Control pin for Switch B |
| 6 | CONTROL C | I | Control pin for Switch C |
| 7 | V _{SS} | — | Low Voltage Power Pin |
| 8 | SIG C IN/OUT | I/O | Input/Output for Switch C |
| 9 | SIG C OUT/IN | I/O | Output/Input for Switch C |
| 10 | SIG D OUT/IN | I/O | Output/Input for Switch D |
| 11 | SIG D IN/OUT | I/O | Input/Output for Switch D |
| 12 | CONTROL D | I | Control Pin for D |
| 13 | CONTROL A | I | Control Pin for A |
| 14 | V _{DD} | — | Power Pin |

6 Specifications

6.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)⁽¹⁾

| | | | MIN | MAX | UNIT |
|--------------------|---|--|------|-----------------------|------|
| V _{DD} | DC supply-voltage | Voltages referenced to V _{SS} pin | -0.5 | 20 | V |
| V _{is} | Input voltage | All inputs | -0.5 | V _{DD} + 0.5 | V |
| I _{IN} | DC input current | Any one input | | ±10 | mA |
| T _{JMAX1} | Maximum junction temperature, ceramic package | | | 175 | °C |
| T _{JMAX2} | Maximum junction temperature, plastic package | | | 150 | °C |
| T _{stg} | Storage temperature | | -65 | 150 | °C |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* 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.

6.2 ESD Ratings

| | | | VALUE | UNIT |
|--------------------|-------------------------|--|-------|------|
| V _(ESD) | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins ⁽¹⁾ | ±500 | V |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins ⁽²⁾ | ±1500 | |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
 (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

| | | | MIN | MAX | UNIT |
|-----------------|--------------------------------|--|-----|-----|------|
| V _{DD} | Supply voltage | | 3 | 18 | V |
| T _A | Operating free-air temperature | | -55 | 125 | °C |

6.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | CD4066B | | | | UNIT | |
|-------------------------------|--|-------------|------------|---------------|-------|------|
| | N (PDIP) | D (SOIC) | NS (SO) | PW (TSSOP) | | |
| | 14 PINS | 14 PINS | 14 PINS | 14 PINS | | |
| R _{θJA} | Junction-to-ambient thermal resistance | 53.7 | 89.5 | 88.2 | 119.5 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 41.0 | 49.7 | 46.1 | 48.2 | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 33.6 | 43.8 | 47.0 | 61.2 | °C/W |
| ψ _{JT} | Junction-to-top characterization parameter | 25.8 | 17.4 | 16.3 | 5.5 | °C/W |
| ψ _{JB} | Junction-to-board characterization parameter | 33.5 | 43.5 | 46.6 | 60.6 | °C/W |

- (1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report.

6.5 Electrical Characteristics

Over operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------------|---|---|------------------------|------|------|-----|------|
| V _{os} | Switch output voltage | V _{DD} = 5 V V _{is} = 0 V | | | | 0.4 | V |
| | | V _{DD} = 5 V V _{is} = 5 V | | 4.6 | | | V |
| | | V _{DD} = 10 V V _{is} = 0 V | | | | 0.5 | V |
| | | V _{DD} = 10 V V _{is} = 10 V | | 9.5 | | | V |
| | | V _{DD} = 15 V V _{is} = 0 V | | | | 1.5 | V |
| | | V _{DD} = 15 V V _{is} = 15 V | | 13.5 | | | V |
| Δr _{on} | On-state resistance difference between any two switches | R _L = 10 kΩ, V _C = V _{DD} | V _{DD} = 5 V | | 15 | | Ω |
| | | | V _{DD} = 10 V | | 10 | | |
| | | | V _{DD} = 15 V | | 5 | | |
| THD | Total harmonic distortion | V _C = V _{DD} = 5 V, V _{SS} = -5 V, V _{is(p-p)} = 5 V (sine wave centered on 0 V), R _L = 10 kΩ, f _{is} = 1-kHz sine wave | | | 0.4% | | |
| | -3-dB cutoff frequency (switch on) | V _C = V _{DD} = 5 V, V _{SS} = -5 V, V _{is(p-p)} = 5 V (sine wave centered on 0 V), R _L = 1 kΩ | | | 40 | | MHz |
| | -50-dB feedthrough frequency (switch off) | V _C = V _{SS} = -5 V, V _{is(p-p)} = 5 V (sine wave centered on 0 V), R _L = 1 kΩ | | | 1 | | MHz |
| | -50-dB crosstalk frequency | V _{C(A)} = V _{DD} = 5 V, V _{C(B)} = V _{SS} = -5 V, V _{is(A)} = 5 V _{p-p} , 50-Ω source, R _L = 1 kΩ | | | 8 | | MHz |
| C _{is} | Input capacitance | V _{DD} = 5 V, V _C = V _{SS} = -5 V | | | 8 | | pF |
| C _{os} | Output capacitance | V _{DD} = 5 V, V _C = V _{SS} = -5 V | | | 8 | | pF |
| C _{ios} | Feedthrough | V _{DD} = 5 V, V _C = V _{SS} = -5 V | | | 0.5 | | pF |
| V _{IHC} | Control input, high voltage | See Figure 7 | V _{DD} = 5 V | | 3.5 | | V |
| | | | V _{DD} = 10 V | | 7 | | |
| | | | V _{DD} = 15 V | | 11 | | |
| | Crosstalk (control input to signal output) | V _C = 10 V (square wave), t _r , t _f = 20 ns, R _L = 10 kΩ V _{DD} = 10 V | | | 50 | | mV |
| | Turnon and turnoff propagation delay | V _{IN} = V _{DD} , t _r , t _f = 20 ns, C _L = 50 pF, R _L = 1 kΩ | V _{DD} = 5 V | | 35 | 70 | ns |
| | | | V _{DD} = 10 V | | 20 | 40 | |
| | | | V _{DD} = 15 V | | 15 | 30 | |
| | Maximum control input repetition rate | V _{is} = V _{DD} , V _{SS} = GND, R _L = 1 kΩ to GND, C _L = 50 pF, V _C = 10 V (square wave centered on 5 V), t _r , t _f = 20 ns, V _{os} = 1/2 V _{os} at 1 kHz | V _{DD} = 5 V | | 6 | | MHz |
| | | | V _{DD} = 10 V | | 9 | | |
| | | | V _{DD} = 15 V | | 9.5 | | |
| C _I | Input capacitance | | | | 5 | 7.5 | pF |

Electrical Characteristics (continued)

Over operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---------------------------|--|--|---------------------------|-------|-------|------|
| I_{is} | Switch input current | $V_{DD} = 5\text{ V}$ $V_{is} = 0\text{ V}$ | $T_A = -55^\circ\text{C}$ | | 0.64 | mA |
| | | | $T_A = -40^\circ\text{C}$ | | 0.61 | |
| | | | $T_A = 25^\circ\text{C}$ | 0.51 | | |
| | | | $T_A = 85^\circ\text{C}$ | | 0.42 | |
| | | | $T_A = 125^\circ\text{C}$ | | 0.36 | |
| | | $V_{DD} = 5\text{ V}$ $V_{is} = 5\text{ V}$ | $T_A = -55^\circ\text{C}$ | | -0.64 | mA |
| | | | $T_A = -40^\circ\text{C}$ | | -0.61 | |
| | | | $T_A = 25^\circ\text{C}$ | -0.51 | | |
| | | | $T_A = 85^\circ\text{C}$ | | -0.42 | |
| | | | $T_A = 125^\circ\text{C}$ | | -0.36 | |
| | | $V_{DD} = 10\text{ V}$ $V_{is} = 0\text{ V}$ | $T_A = -55^\circ\text{C}$ | | 1.6 | mA |
| | | | $T_A = -40^\circ\text{C}$ | | 1.5 | |
| | | | $T_A = 25^\circ\text{C}$ | 1.3 | | |
| | | | $T_A = 85^\circ\text{C}$ | | 1.1 | |
| | | | $T_A = 125^\circ\text{C}$ | | 0.9 | |
| | | $V_{DD} = 10\text{ V}$ $V_{is} = 10\text{ V}$ | $T_A = -55^\circ\text{C}$ | | -1.6 | mA |
| | | | $T_A = -40^\circ\text{C}$ | | -1.5 | |
| | | | $T_A = 25^\circ\text{C}$ | -1.3 | | |
| | | | $T_A = 85^\circ\text{C}$ | | -1.1 | |
| | | | $T_A = 125^\circ\text{C}$ | | -0.9 | |
| | | $V_{DD} = 15\text{ V}$ $V_{is} = 0\text{ V}$ | $T_A = -55^\circ\text{C}$ | | 4.2 | mA |
| | | | $T_A = -40^\circ\text{C}$ | | 4 | |
| | | | $T_A = 25^\circ\text{C}$ | 3.4 | | |
| | | | $T_A = 85^\circ\text{C}$ | | 2.8 | |
| $T_A = 125^\circ\text{C}$ | | | | 2.4 | | |
| | $V_{DD} = 15\text{ V}$ $V_{is} = 15\text{ V}$ | $T_A = -55^\circ\text{C}$ | | -4.2 | mA | |
| | | $T_A = -40^\circ\text{C}$ | | -4 | | |
| | | $T_A = 25^\circ\text{C}$ | -3.4 | | | |
| | | $T_A = 85^\circ\text{C}$ | | -2.8 | | |
| | | $T_A = 125^\circ\text{C}$ | | -2.4 | | |

Electrical Characteristics (continued)

Over operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT | |
|---------------------------|---------------------------|--|---------------------------|---------------------------|------|------|---------------|------|
| I_{DD} | Quiescent device current | $V_{IN} = 0$ to 5 V $V_{DD} = 5$ V | $T_A = -55^\circ\text{C}$ | | | 0.25 | μA | |
| | | | $T_A = -40^\circ\text{C}$ | | | 0.25 | | |
| | | | $T_A = 25^\circ\text{C}$ | | 0.01 | 0.25 | | |
| | | | $T_A = 85^\circ\text{C}$ | | | 7.5 | | |
| | | | $T_A = 125^\circ\text{C}$ | | | 7.5 | | |
| | | $V_{IN} = 0$ to 10 V $V_{DD} = 10$ V | $T_A = -55^\circ\text{C}$ | | | 0.5 | μA | |
| | | | $T_A = -40^\circ\text{C}$ | | | 0.5 | | |
| | | | $T_A = 25^\circ\text{C}$ | | 0.01 | 0.5 | | |
| | | | $T_A = 85^\circ\text{C}$ | | | 15 | | |
| | | | $T_A = 125^\circ\text{C}$ | | | 15 | | |
| | | $V_{IN} = 0$ to 15 V $V_{DD} = 15$ V | $T_A = -55^\circ\text{C}$ | | | 1 | μA | |
| | | | $T_A = -40^\circ\text{C}$ | | | 1 | | |
| | | | $T_A = 25^\circ\text{C}$ | | 0.01 | 1 | | |
| | | | $T_A = 85^\circ\text{C}$ | | | 30 | | |
| | | | $T_A = 125^\circ\text{C}$ | | | 30 | | |
| | | $V_{IN} = 0$ to 20 V $V_{DD} = 20$ V | $T_A = -55^\circ\text{C}$ | | | 5 | μA | |
| $T_A = -40^\circ\text{C}$ | | | | 5 | | | | |
| $T_A = 25^\circ\text{C}$ | | | 0.02 | 5 | | | | |
| $T_A = 85^\circ\text{C}$ | | | | 150 | | | | |
| $T_A = 125^\circ\text{C}$ | | | | 150 | | | | |
| r_{on} | On-state resistance (max) | to $\frac{(V_{DD} - V_{SS})}{V_C = V_{DD}^2}$, $R_L = 10\text{ k}\Omega$ returned $V_{is} = V_{SS}$ to V_{DD} | $V_{DD} = 5$ V | $T_A = -55^\circ\text{C}$ | | 800 | Ω | |
| | | | | $T_A = -40^\circ\text{C}$ | | 850 | | |
| | | | | $T_A = 25^\circ\text{C}$ | | 470 | | 1050 |
| | | | | $T_A = 85^\circ\text{C}$ | | | | 1200 |
| | | | | $T_A = 125^\circ\text{C}$ | | | | 1300 |
| | | | $V_{DD} = 10$ V | $T_A = -55^\circ\text{C}$ | | | | 310 |
| | | | | $T_A = -40^\circ\text{C}$ | | | | 330 |
| | | | | $T_A = 25^\circ\text{C}$ | | 180 | | 400 |
| | | | | $T_A = 85^\circ\text{C}$ | | | | 500 |
| | | | | $T_A = 125^\circ\text{C}$ | | | | 500 |
| | | | $V_{DD} = 15$ V | $T_A = -55^\circ\text{C}$ | | | | 200 |
| | | | | $T_A = -40^\circ\text{C}$ | | | | 210 |
| | | | | $T_A = 25^\circ\text{C}$ | | 125 | | 240 |
| | | | | $T_A = 85^\circ\text{C}$ | | | | 300 |
| | | | | $T_A = 125^\circ\text{C}$ | | | | 320 |

Electrical Characteristics (continued)

Over operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|-----------|----------------------------------|---|---------------------|-------------------------|-----|---------|------|
| V_{ILC} | Control input, low voltage (max) | $ I_{is} < 10 \mu A$, $V_{is} = V_{SS}$, $V_{OS} = V_{DD}$, and $V_{is} = V_{DD}$, $V_{OS} = V_{SS}$ | $V_{DD} = 5 V$ | $T_A = -55^\circ C$ | 1 | | V |
| | | | | $T_A = -40^\circ C$ | 1 | | |
| | | | | $T_A = 25^\circ C$ | 1 | | |
| | | | | $T_A = 85^\circ C$ | 1 | | |
| | | | | $T_A = 125^\circ C$ | 1 | | |
| | | | $V_{DD} = 10 V$ | $T_A = -55^\circ C$ | 2 | | |
| | | | | $T_A = -40^\circ C$ | 2 | | |
| | | | | $T_A = 25^\circ C$ | 2 | | |
| | | | | $T_A = 85^\circ C$ | 2 | | |
| | | | | $T_A = 125^\circ C$ | 2 | | |
| | | | $V_{DD} = 15 V$ | $T_A = -55^\circ C$ | 2 | | |
| | | | | $T_A = -40^\circ C$ | 2 | | |
| | | | | $T_A = 25^\circ C$ | 2 | | |
| | | | | $T_A = 85^\circ C$ | 2 | | |
| | | | | $T_A = 125^\circ C$ | 2 | | |
| I_{IN} | Input current (max) | $V_{is} \leq V_{DD}$, $V_{DD} - V_{SS} = 18 V$, $V_{CC} \leq V_{DD} - V_{SS}$ $V_{DD} = 18 V$ | $T_A = -55^\circ C$ | ± 0.1 | | μA | |
| | | | $T_A = -40^\circ C$ | ± 0.1 | | | |
| | | | $T_A = 25^\circ C$ | $\pm 10^{-5}$ ± 0.1 | | | |
| | | | $T_A = 85^\circ C$ | ± 1 | | | |
| | | | $T_A = 125^\circ C$ | ± 1 | | | |

6.6 Switching Characteristics
 $T_A = 25^\circ C$

| PARAMETER | FROM | TO | TEST CONDITIONS | V_{CC} | MIN | TYP | MAX | UNIT |
|-----------|--------------|---------------|---|----------|-----|-----|-----|------|
| t_{pd} | Signal input | Signal output | $V_{IN} = V_{DD}$, $t_r, t_f = 20 ns$, $C_L = 50 pF$, $R_L = 1 k\Omega$ | 5 V | 20 | | 40 | ns |
| | | | | 10 V | 10 | | 20 | |
| | | | | 15 V | 7 | | 15 | |
| t_{ph} | Signal input | Signal output | $V_{IN} = V_{DD}$, $t_r, t_f = 20 ns$, $C_L = 50 pF$, $R_L = 1 k\Omega$ | 5 V | 35 | | 70 | ns |
| | | | | 10 V | 20 | | 40 | |
| | | | | 15 V | 15 | | 30 | |
| t_{phl} | Signal input | Signal output | $V_{IN} = V_{DD}$, $t_r, t_f = 20 ns$, $C_L = 50 pF$, $R_L = 1 k\Omega$ | 5 V | 35 | | 70 | ns |
| | | | | 10 V | 20 | | 40 | |
| | | | | 15 V | 15 | | 30 | |

6.7 Typical Characteristics

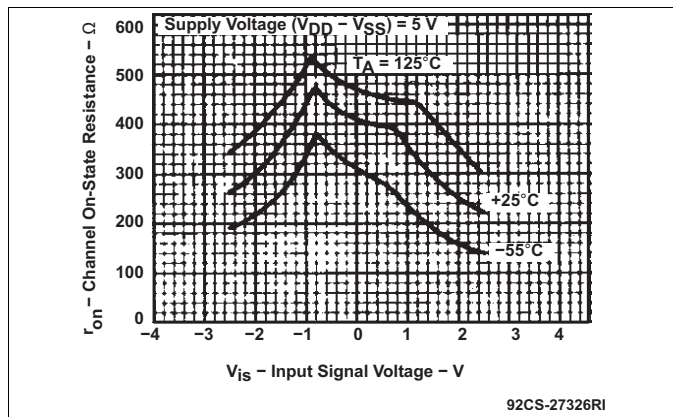


Figure 1. Typical ON-State Resistance vs Input Signal Voltage (All Types)

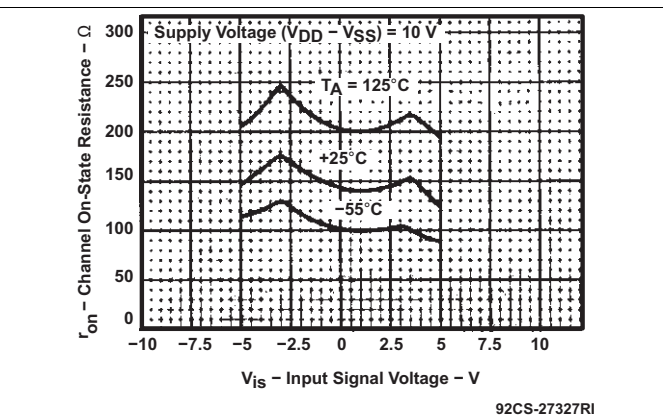


Figure 2. Typical ON-State Resistance vs Input Signal Voltage (All Types)

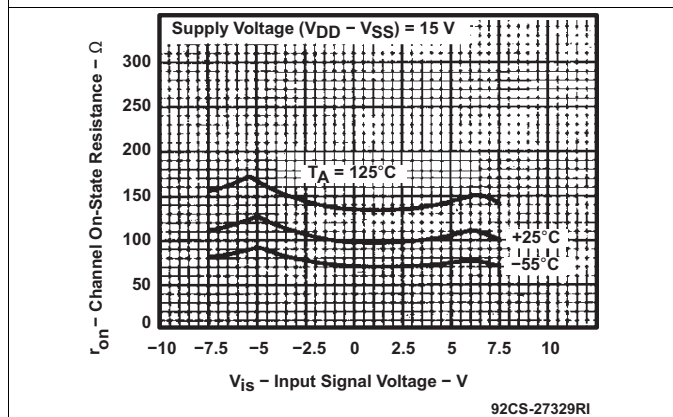


Figure 3. Typical ON-State Resistance vs Input Signal Voltage (All Types)

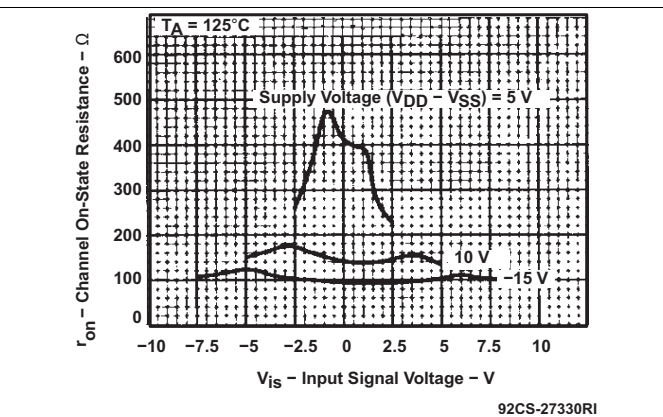


Figure 4. Typical ON-State Resistance vs Input Signal Voltage (All Types)

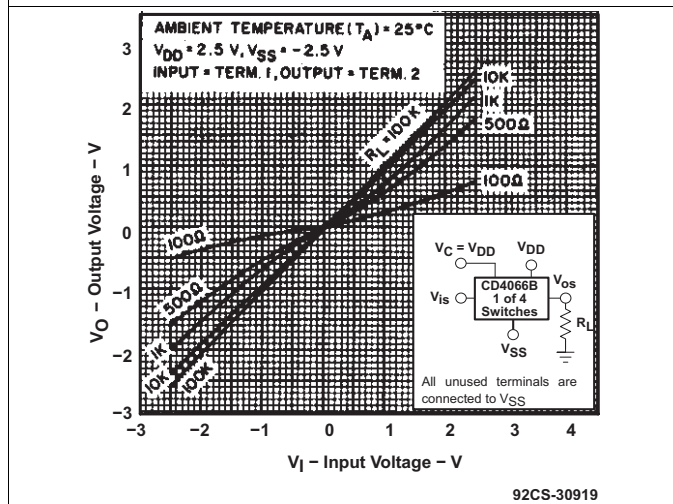


Figure 5. Typical ON Characteristics for 1 of 4 Channels

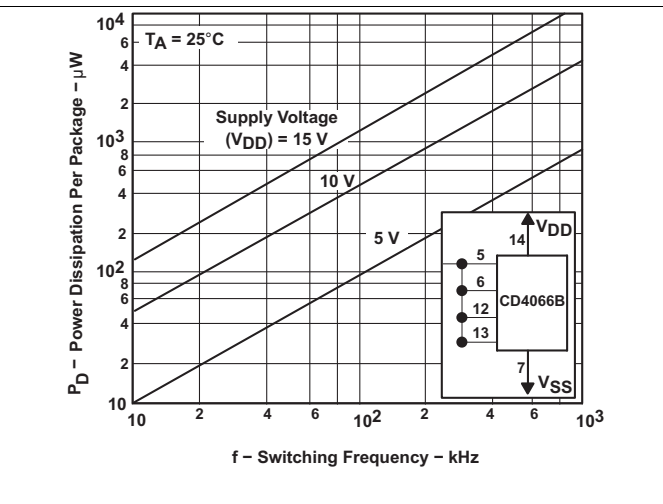
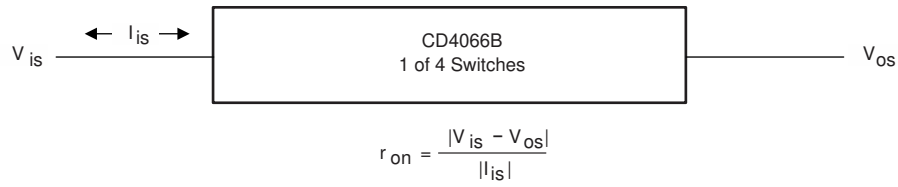


Figure 6. Power Dissipation per Package vs Switching Frequency

7 Parameter Measurement Information



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Figure 7. Determination of r_{on} as a Test Condition for Control-Input High-Voltage (V_{IHC}) Specification

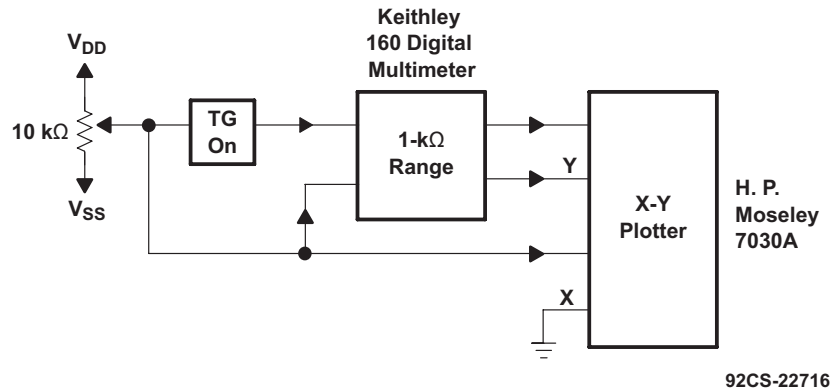
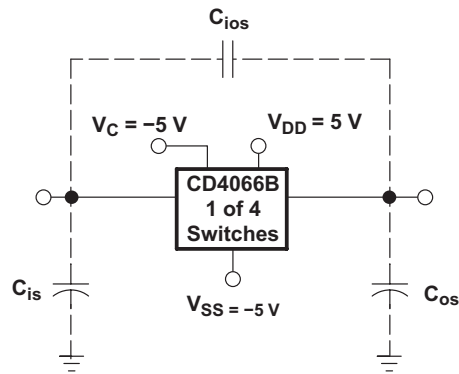


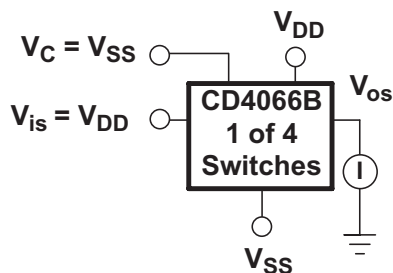
Figure 8. Channel On-State Resistance Measurement Circuit



Measured on Boonton capacitance bridge, model 75a (1 MHz);
test-fixture capacitance nulled out.

Figure 9. Typical On Characteristics for One of Four Channels

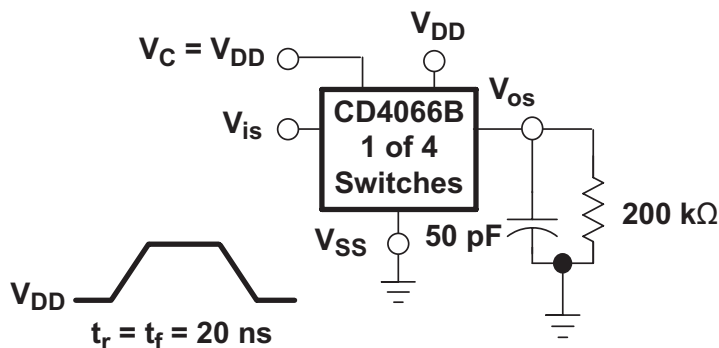
Parameter Measurement Information (continued)



92CS-30922

All unused terminals are connected to V_{SS} .

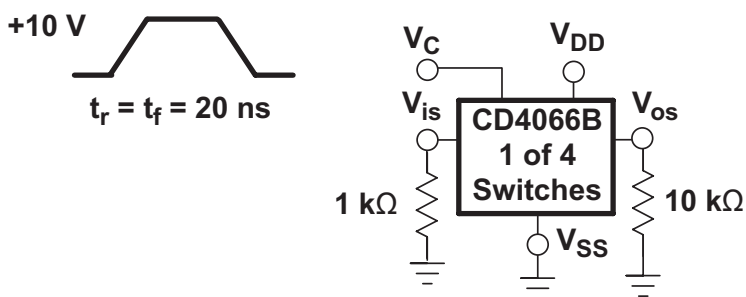
Figure 10. Off-Switch Input or Output Leakage



92CS-30923

All unused terminals are connected to V_{SS} .

Figure 11. Propagation Delay Time Signal Input (V_{is}) to Signal Output (V_{os})

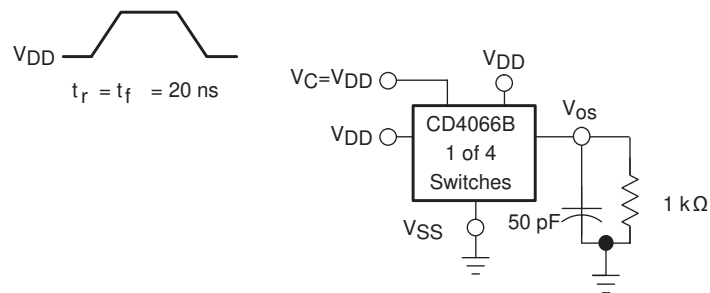


92CS-30924

All unused terminals are connected to V_{SS} .

Figure 12. Crosstalk-Control Input to Signal Output

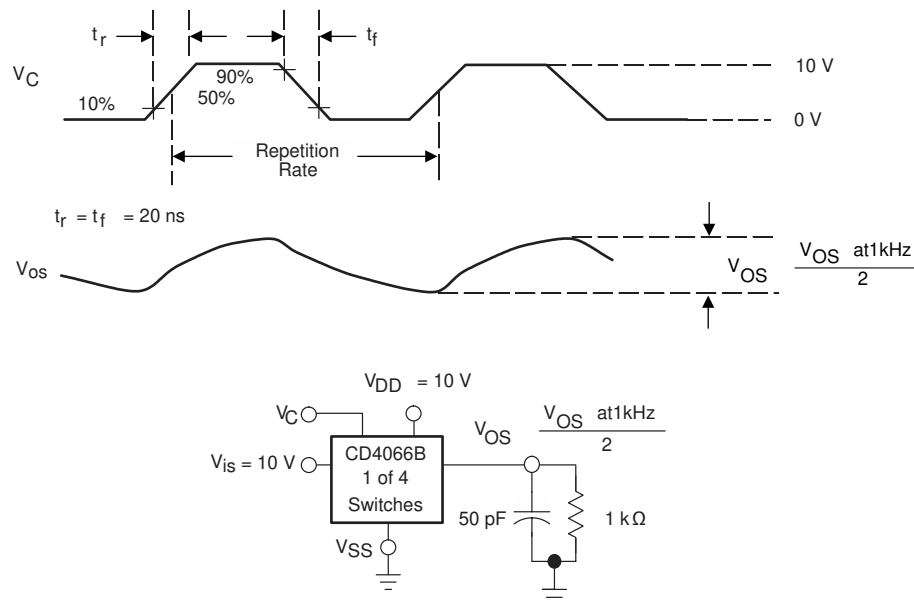
Parameter Measurement Information (continued)



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 All unused pins are connected to V_{SS} .

 Delay is measured at V_{OS} level of +10% from ground (turn-on) or on-state output level (turn-off).

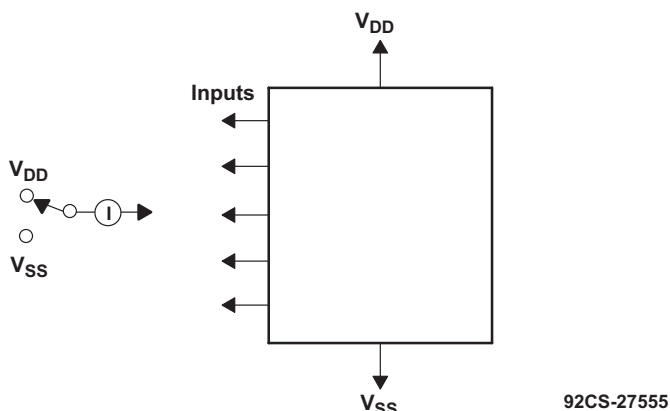
Figure 13. Propagation Delay, t_{PLH} , t_{PHL} Control-Signal Output


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 All unused pins are connected to V_{SS} .

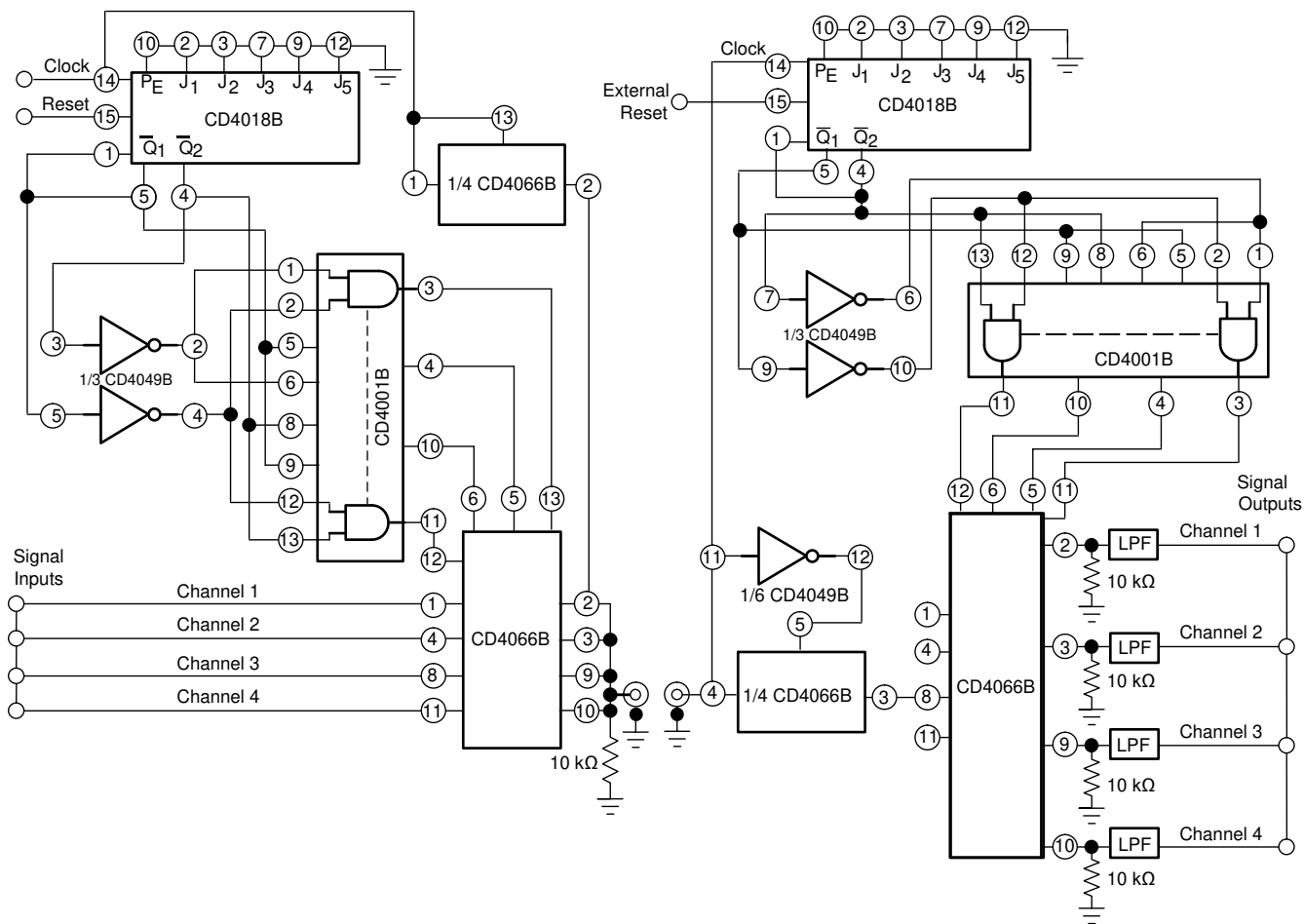
Figure 14. Maximum Allowable Control-Input Repetition Rate

Parameter Measurement Information (continued)



Measure inputs sequentially to both V_{DD} and V_{SS} . Connect all unused inputs to either V_{DD} or V_{SS} . Measure control inputs only.

Figure 15. Input Leakage-Current Test Circuit



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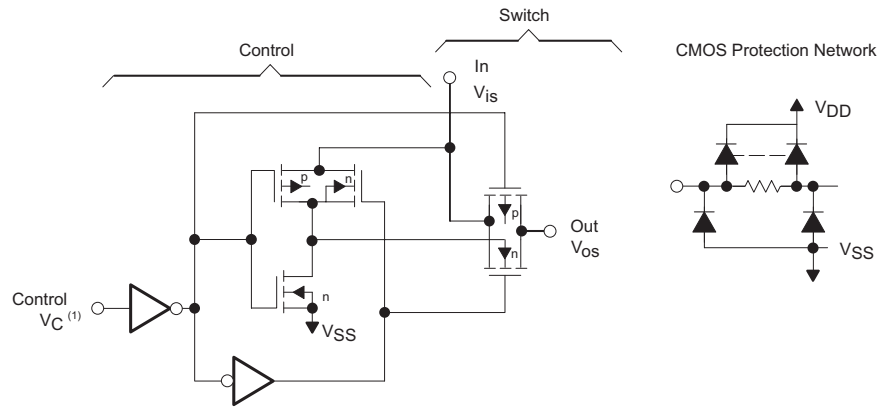
Figure 16. Four-Channel PAM Multiplex System Diagram

8 Detailed Description

8.1 Overview

CD4066B has four independent digitally controlled analog switches with a bias voltage of V_{SS} to allow for different voltage levels to be used for low output. Both the p and the n devices in a given switch are biased on or off simultaneously by the control signal. As shown in Figure 17, the well of the n-channel device on each switch is tied to either the input (when the switch is on) or to V_{SS} (when the switch is off). Thus, when the control of the device is low, the output of the switch goes to V_{SS} and when the control is high the output of the device goes to V_{DD} .

8.2 Functional Block Diagram



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- (1) All control inputs are protected by the CMOS protection network.
- (2) All p substrates are connected to V_{DD} .
- (3) Normal operation control-line biasing: switch on (logic 1), $V_C = V_{DD}$; switch off (logic 0), $V_C = V_{SS}$.
- (4) Signal-level range: $V_{SS} \leq V_{is} \leq V_{DD}$.

Figure 17. Schematic Diagram of One-of-Four Identical Switches and Associated Control Circuitry

8.3 Feature Description

Each switch has different control pins, which allows for more options for the outputs. Bias Voltage allows the device to output a voltage other than 0 V when the device control is low. The CD4066B has a large absolute maximum voltage for V_{DD} of 20 V.

8.4 Device Functional Modes

Added Junction Temperature details to the *Absolute Maximum Ratings* table lists the functions of this device.

Table 1. Function Table

| INPUTS | | OUTPUT |
|------------|---------|------------|
| SIG IN/OUT | CONTROL | SIG OUT/IN |
| H | H | H |
| L | H | L |
| X | L | Hi-Z |

9 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

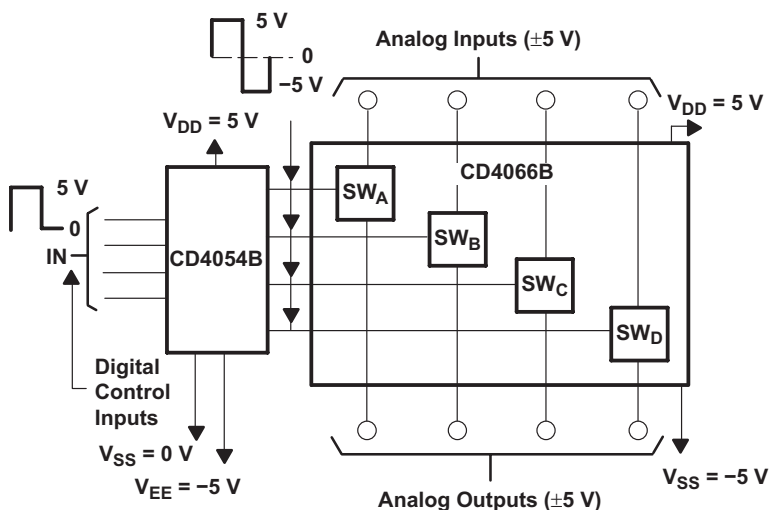
9.1 Application Information

In applications that employ separate power sources to drive V_{DD} and the signal inputs, the V_{DD} current capability should exceed V_{DD}/R_L (R_L = effective external load of the four CD4066B device bilateral switches). This provision avoids any permanent current flow or clamp action on the V_{DD} supply when power is applied or removed from the CD4066B device.

In certain applications, the external load-resistor current can include both V_{DD} and signal-line components. To avoid drawing V_{DD} current when switch current flows into pins 1, 4, 8, or 11, the voltage drop across the bidirectional switch must not exceed 0.8 V (calculated from r_{on} values shown).

No V_{DD} current flows through R_L if the switch current flows into pins 2, 3, 9, or 10.

9.2 Typical Application



92CS-30927

Figure 18. Bidirectional Signal Transmission Through Digital Control Logic

9.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Avoid bus contention because it can drive currents in excess of maximum limits. The high drive also creates fast edges into light loads, so consider routing and load conditions to prevent ringing.

9.2.2 Detailed Design Procedure

- Recommended Input Conditions:
 - For rise time and fall time specifications, see $\Delta t/\Delta v$ in [Recommended Operating Conditions](#).
 - For specified high and low levels, see V_{IH} and V_{IL} in [Recommended Operating Conditions](#).
- Recommended Output Conditions:
 - Load currents should not exceed ± 10 mA.

Typical Application (continued)

9.2.3 Application Curve

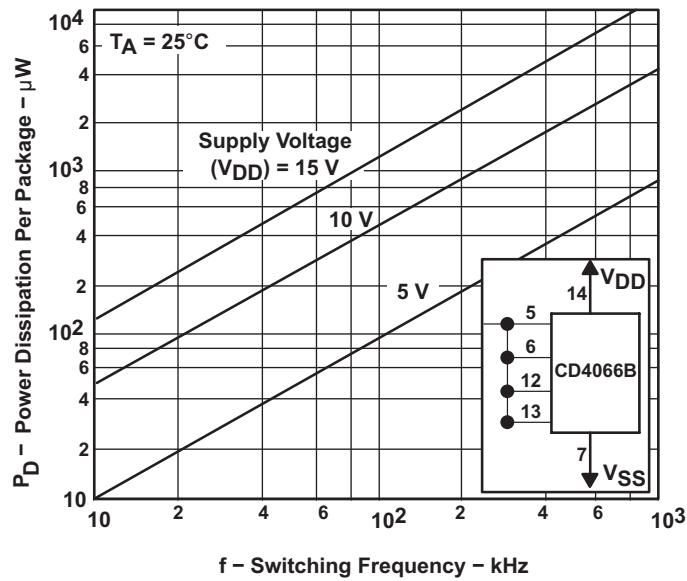


Figure 19. Power Dissipation vs. Switching Frequency

10 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in [Recommended Operating Conditions](#).

Each VCC pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1- μF is recommended; if there are multiple VCC pins, then 0.01- μF or 0.022- μF is recommended for each power pin. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. A 0.1- μF and a 1- μF are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

11 Layout

11.1 Layout Guidelines

When using multiple bit logic devices inputs must never float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input *and* gate are used or only 3 of the 4 buffer gates are used. Such input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they are tied to GND or VCC, whichever makes more sense or is more convenient. It is generally acceptable to float outputs, unless the part is a transceiver. If the transceiver has an output enable pin, it disables the output section of the part when asserted. This does not disable the input section of the I/Os, so they cannot float when disabled.

11.2 Layout Example

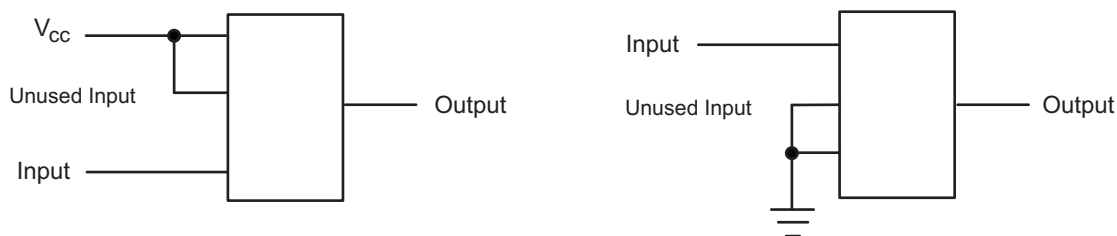


Figure 20. Diagram for Unused Inputs

12 Device and Documentation Support

12.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

12.2 Community Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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12.3 Trademarks

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12.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

12.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| CD4066BE | ACTIVE | PDIP | N | 14 | 25 | Green (RoHS & no Sb/Br) | NIPDAU SN | N / A for Pkg Type | -55 to 125 | CD4066BE | Samples |
| CD4066BEE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | NIPDAU | N / A for Pkg Type | -55 to 125 | CD4066BE | Samples |
| CD4066BF | ACTIVE | CDIP | J | 14 | 1 | TBD | SNPB | N / A for Pkg Type | -55 to 125 | CD4066BF | Samples |
| CD4066BF3A | ACTIVE | CDIP | J | 14 | 1 | TBD | SNPB | N / A for Pkg Type | -55 to 125 | CD4066BF3A | Samples |
| CD4066BM | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4066BM | Samples |
| CD4066BM96 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | NIPDAU SN | Level-1-260C-UNLIM | -55 to 125 | CD4066BM | Samples |
| CD4066BM96E4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4066BM | Samples |
| CD4066BM96G4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4066BM | Samples |
| CD4066BMT | ACTIVE | SOIC | D | 14 | 250 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4066BM | Samples |
| CD4066BNS | ACTIVE | SO | NS | 14 | 50 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | | CD4066B | Samples |
| CD4066BNSR | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4066B | Samples |
| CD4066BPW | ACTIVE | TSSOP | PW | 14 | 90 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM066B | Samples |
| CD4066BPWG4 | ACTIVE | TSSOP | PW | 14 | 90 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM066B | Samples |
| CD4066BPWR | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | NIPDAU SN | Level-1-260C-UNLIM | -55 to 125 | CM066B | Samples |
| CD4066BPWRG4 | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM066B | Samples |
| JM38510/05852BCA | ACTIVE | CDIP | J | 14 | 1 | TBD | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 05852BCA | Samples |
| M38510/05852BCA | ACTIVE | CDIP | J | 14 | 1 | TBD | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 05852BCA | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of ≤ 1000 ppm threshold. Antimony trioxide based flame retardants must also meet the ≤ 1000 ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF CD4066B, CD4066B-MIL :

● Catalog: [CD4066B](#)

● Automotive: [CD4066B-Q1](#), [CD4066B-Q1](#)

● Military: [CD4066B-MIL](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD4066BM96 | SOIC | D | 14 | 2500 | 330.0 | 16.8 | 6.5 | 9.5 | 2.1 | 8.0 | 16.0 | Q1 |
| CD4066BM96 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| CD4066BM96 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| CD4066BM96G4 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| CD4066BM96G4 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| CD4066BMT | SOIC | D | 14 | 250 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| CD4066BNSR | SO | NS | 14 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| CD4066BPWR | TSSOP | PW | 14 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| CD4066BPWR | TSSOP | PW | 14 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| CD4066BPWRG4 | TSSOP | PW | 14 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD4066BM96 | SOIC | D | 14 | 2500 | 364.0 | 364.0 | 27.0 |
| CD4066BM96 | SOIC | D | 14 | 2500 | 333.2 | 345.9 | 28.6 |
| CD4066BM96 | SOIC | D | 14 | 2500 | 367.0 | 367.0 | 38.0 |
| CD4066BM96G4 | SOIC | D | 14 | 2500 | 367.0 | 367.0 | 38.0 |
| CD4066BM96G4 | SOIC | D | 14 | 2500 | 333.2 | 345.9 | 28.6 |
| CD4066BMT | SOIC | D | 14 | 250 | 210.0 | 185.0 | 35.0 |
| CD4066BNSR | SO | NS | 14 | 2000 | 367.0 | 367.0 | 38.0 |
| CD4066BPWR | TSSOP | PW | 14 | 2000 | 364.0 | 364.0 | 27.0 |
| CD4066BPWR | TSSOP | PW | 14 | 2000 | 367.0 | 367.0 | 35.0 |
| CD4066BPWRG4 | TSSOP | PW | 14 | 2000 | 367.0 | 367.0 | 35.0 |

J 14

GENERIC PACKAGE VIEW
CDIP - 5.08 mm max height
CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4040083-5/G

J0014A



PACKAGE OUTLINE

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.

EXAMPLE BOARD LAYOUT

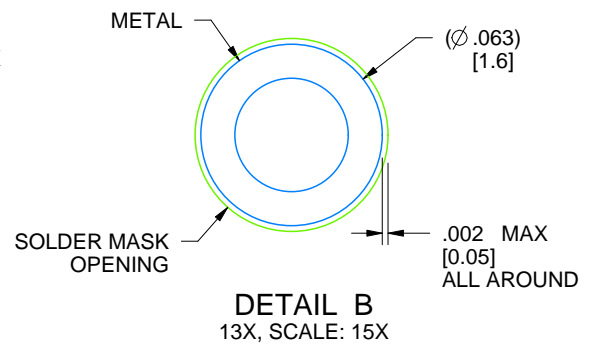
J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE: 5X



4214771/A 05/2017

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

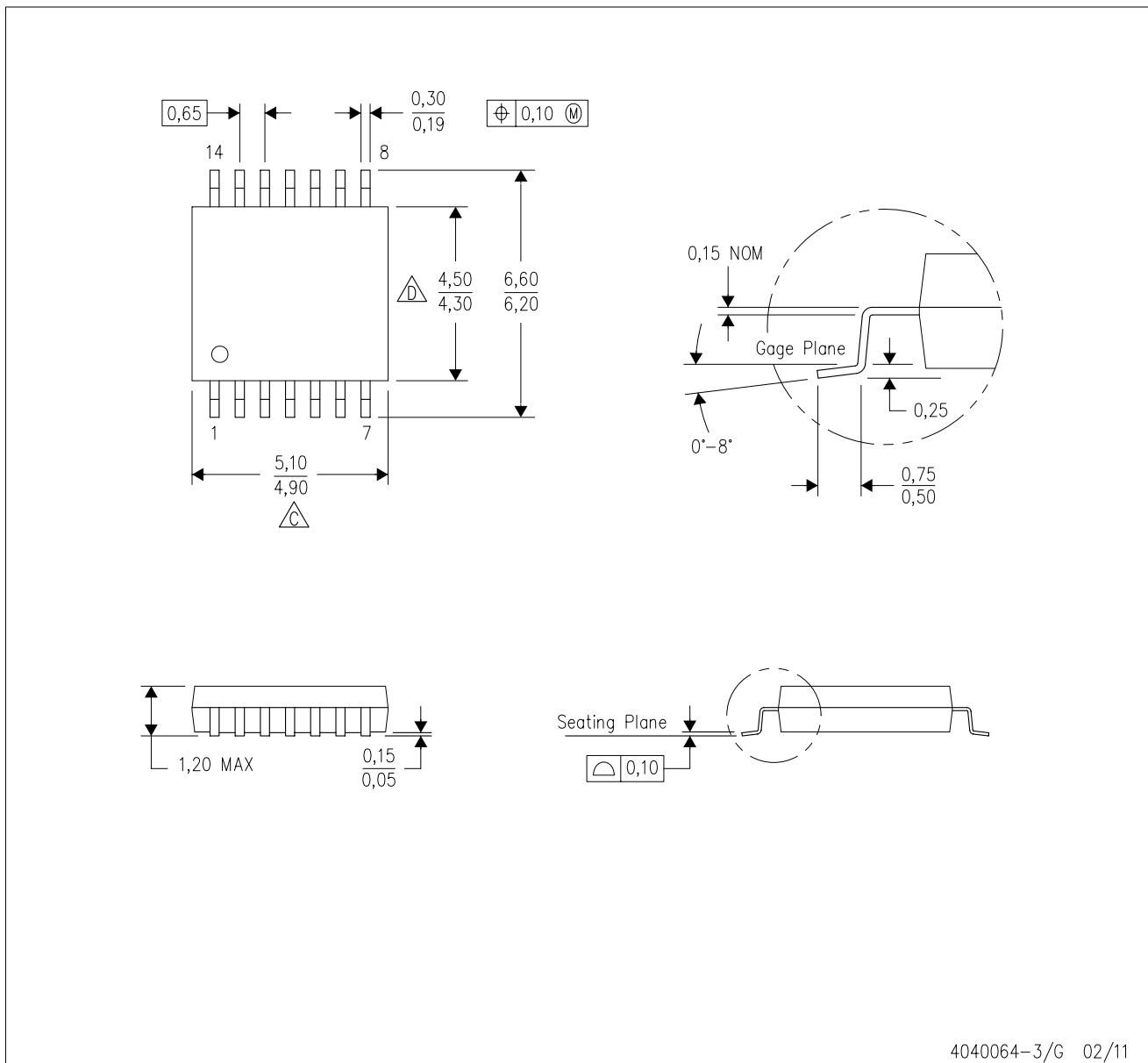
PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040064-3/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
 - E. Falls within JEDEC MO-153

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4211284-2/G 08/15

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - D The 20 pin end lead shoulder width is a vendor option, either half or full width.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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