



# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## General Description

The MAX4717/MAX4718 low-voltage, low on-resistance ( $R_{ON}$ ), dual single-pole/double throw (SPDT) analog switches operate from a single +1.8V to +5.5V supply. These devices are designed for USB 1.1 and audio switching applications.

The MAX4717 features two 4.5Ω  $R_{ON}$  (max) SPDT switches with 1.2Ω flatness and 0.3Ω matching between channels. The MAX4718 features one 4.5Ω  $R_{ON}$  (max) SPDT switch and one 20Ω  $R_{ON}$  (max) SPDT switch. The 20Ω switch has a guaranteed matching and flatness of 0.4Ω and 1.2Ω, respectively. These switches offer break-before-make switching (1ns) with  $t_{ON} < 80ns$  and  $t_{OFF} < 40ns$  at +2.7V. The digital logic inputs are +1.8V logic compatible with a +2.7V to +3.6V supply.

These switches are packaged in a chip-scale package (UCSP™), significantly reducing the required PC board area. The chip occupies only a 2.0mm × 1.50mm area and has a 4 × 3 bump array with a bump pitch of 0.5mm. These switches are also available in 10-pin μMAX® and 10-pin TDFN packages.

## Applications

USB 1.1 Signal Switching Circuits  
Battery-Operated Equipment  
Audio/Video-Signal Routing  
Headphone Switching  
Low-Voltage Data-Acquisition Systems  
Sample-and-Hold Circuits  
Cell Phones  
PDAs

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## Features

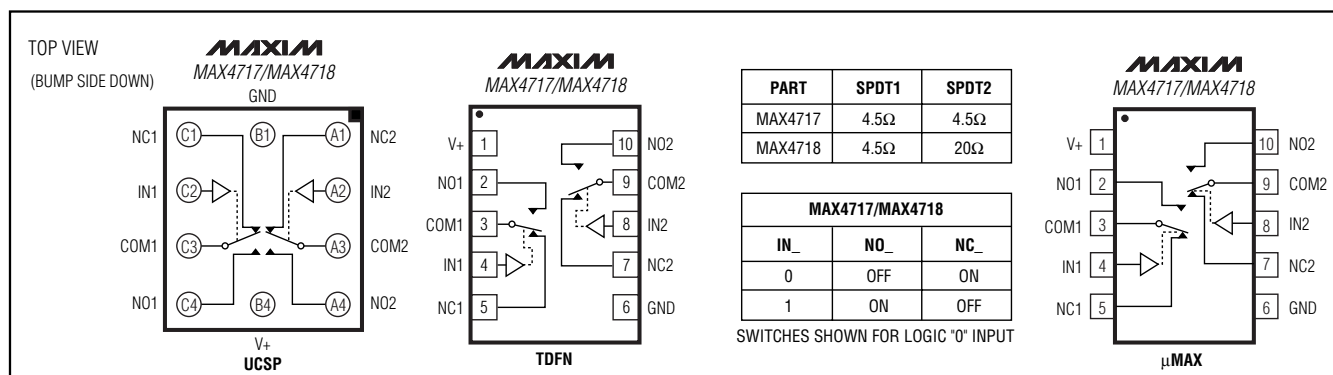
- ◆ USB 1.1 Signal Switching Compliant (TID = 4000231)
- ◆ 2ns (max) Differential Skew
- ◆ -3dB Bandwidth: > 300MHz
- ◆ Low 15pF On-Channel Capacitance
- ◆ Single-Supply Operation from +1.8V to +5.5V
- ◆ 4.5Ω  $R_{ON}$  (max) Switches (MAX4717/MAX4718)  
0.3Ω (max)  $R_{ON}$  Match (+3.0V Supply)  
1.2Ω (max) Flatness (+3.0V Supply)
- ◆ 20Ω  $R_{ON}$  (max) Switch (MAX4718)  
0.4Ω (max)  $R_{ON}$  Match (+3.0V Supply)  
1.2Ω (max) Flatness (+3.0V Supply)
- ◆ Rail-to-Rail Signal Handling
- ◆ High Off-Isolation: -55dB (10MHz)
- ◆ Low Crosstalk: -80dB (10MHz)
- ◆ Low Distortion: 0.03%
- ◆ +1.8V CMOS-Logic Compatible
- ◆ < 0.5nA Leakage Current at +25°C

## Ordering Information

| PART         | TEMP RANGE     | PIN/BUMP-PACKAGE | TOP MARK |
|--------------|----------------|------------------|----------|
| MAX4717EUB   | -40°C to +85°C | 10 μMAX          | —        |
| MAX4717ETB   | -40°C to +85°C | 10 TDFN-EP*      | ACV      |
| MAX4717EBC-T | -40°C to +85°C | 12 UCSP-12       | ABH      |
| MAX4718EUB   | -40°C to +85°C | 10 μMAX          | —        |
| MAX4718ETB   | -40°C to +85°C | 10 TDFN-EP*      | ACW      |
| MAX4718EBC-T | -40°C to +85°C | 12 UCSP-12       | ABI      |

\*EP = Exposed paddle.

## Pin Configurations/Functional Diagrams/Truth Tables



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## ABSOLUTE MAXIMUM RATINGS

(All voltages are referenced to GND.)

|                                                             |                      |
|-------------------------------------------------------------|----------------------|
| V+, IN_                                                     | -0.3V to +6.0V       |
| COM_, NO_, NC_ (Note 1)                                     | -0.3V to (V+ + 0.3V) |
| Continuous Current COM_, NO_, NC_                           | ±100mA               |
| Peak Current COM_, NO_, NC_ (pulsed at 1ms, 10% duty cycle) | ±200mA               |
| Continuous Power Dissipation (T <sub>A</sub> = +70°C)       |                      |
| 10-Pin μMAX (derate 5.6mW/°C above +70°C)                   | 444mW                |
| 10-Pin TDFN (derate 24.4mW/°C above +70°C)                  | 1951mW               |
| 12-Bump UCSP (derate 11.4mW/°C above +70°C)                 | 909mW                |

|                                   |                 |
|-----------------------------------|-----------------|
| ESD Method 3015.7                 | >2kV            |
| Operating Temperature Range       | -40°C to +85°C  |
| Junction Temperature              | +150°C          |
| Storage Temperature Range         | -65°C to +150°C |
| Lead Temperature (soldering, 10s) | +300°C          |
| Bump Temperature (soldering)      |                 |
| Infrared (15s)                    | +220°C          |
| Vapor Phase (60s)                 | +215°C          |

**Note 1:** Signals on COM\_, NO\_, or NC\_ exceeding V+ or GND are clamped by internal diodes. Limit forward-diode current to maximum current rating.

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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ELECTRICAL CHARACTERISTICS—Single +3V Supply

(V+ = +2.7V to +3.6V, V<sub>IH</sub> = +1.4V, V<sub>IL</sub> = +0.5V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at V+ = +3.0V, T<sub>A</sub> = +25°C, unless otherwise noted.) (Notes 2, 3)

| PARAMETER                                                         | SYMBOL                                                     | CONDITIONS                                                                                                      | T <sub>A</sub>                          | MIN  | TYP   | MAX  | UNITS |
|-------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------|------|-------|------|-------|
| Analog Signal Range                                               | V <sub>COM_</sub> ,<br>V <sub>NO_</sub> , V <sub>NC_</sub> |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> | 0    |       | V+   | V     |
| ANALOG SWITCH (Low R <sub>ON</sub> —MAX4717/MAX4718 SPDT 1)       |                                                            |                                                                                                                 |                                         |      |       |      |       |
| On-Resistance<br>(Note 4)                                         | R <sub>ON</sub>                                            | V+ = 2.7V, I <sub>COM_</sub> = 10mA;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 1.5V                             | +25°C                                   |      | 3.0   | 4.5  | Ω     |
|                                                                   |                                                            |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      |       | 5    |       |
| On-Resistance Match Between<br>Channels (Notes 4, 5)              | ΔR <sub>ON</sub>                                           | V+ = 2.7V, I <sub>COM_</sub> = 10mA;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 1.5V                             | +25°C                                   |      | 0.1   | 0.3  | Ω     |
|                                                                   |                                                            |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      |       | 0.4  |       |
| On-Resistance Flatness<br>(Note 6)                                | R <sub>FLAT(ON)</sub>                                      | V+ = 2.7V, I <sub>COM_</sub> = 10mA;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 1.0V, 1.5V, 2.0V                 | +25°C                                   |      | 0.6   | 1.2  | Ω     |
|                                                                   |                                                            |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      |       | 1.5  |       |
| NO <sub>_</sub> , NC <sub>_</sub> Off-Leakage Current<br>(Note 7) | I <sub>NO_(OFF)</sub> ,<br>I <sub>NC_(OFF)</sub>           | V+ = 3.6V, V <sub>COM_</sub> = 0.3V, 3.3V;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 3.3V, 0.3V                 | +25°C                                   | -0.5 | +0.01 | +0.5 | nA    |
|                                                                   |                                                            |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> | -1   |       | +1   |       |
| COM <sub>_</sub> On-Leakage Current<br>(Note 7)                   | I <sub>COM_(ON)</sub>                                      | V+ = 3.6V, V <sub>COM_</sub> = 0.3V, 3.3V;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 0.3V, 3.3V, or<br>floating | +25°C                                   | -1   | +0.01 | +1   | nA    |
|                                                                   |                                                            |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> | -2   |       | +2   |       |
| ANALOG SWITCH (High R <sub>ON</sub> —MAX4718 SPDT 2)              |                                                            |                                                                                                                 |                                         |      |       |      |       |
| On-Resistance (Note 4)                                            | R <sub>ON</sub>                                            | V+ = 2.7V, I <sub>COM_</sub> = 10mA;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 1.5V                             | +25°C                                   |      | 15    | 20   | Ω     |
|                                                                   |                                                            |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      |       | 25   |       |

# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

MAX4717/MAX4718

## ELECTRICAL CHARACTERISTICS—Single +3V Supply (continued)

(V+ = +2.7V to +3.6V, V<sub>IH</sub> = +1.4V, V<sub>IL</sub> = +0.5V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at V+ = +3.0V, T<sub>A</sub> = +25°C, unless otherwise noted.) (Notes 2, 3)

| PARAMETER                                         | SYMBOL                  | CONDITIONS                                                                    | T <sub>A</sub> | MIN  | TYP   | MAX  | UNITS |
|---------------------------------------------------|-------------------------|-------------------------------------------------------------------------------|----------------|------|-------|------|-------|
| On-Resistance Match Between Channels (Notes 4, 5) | ΔRON                    | V+ = 2.7V, ICOM_ = 10mA;<br>VNO_ or VNC_ = 1.5V                               | +25°C          | 0.15 | 0.4   | Ω    |       |
|                                                   |                         |                                                                               | TMIN to TMAX   |      | 0.5   |      |       |
| On-Resistance Flatness (Note 6)                   | RFLAT(ON)               | V+ = 2.7V, ICOM_ = 10mA;<br>VNO_ or VNC_ = 1.0V, 1.5V, 2.0V                   | +25°C          | 0.6  | 1.2   | Ω    |       |
|                                                   |                         |                                                                               | TMIN to TMAX   |      | 1.5   |      |       |
| NO_, NC_ Off-Leakage Current (Note 7)             | INO_(OFF),<br>INC_(OFF) | V+ = 3.6V, VCOM_ = 0.3V, 3.3V;<br>VNO_ or VNC_ = 3.3V, 0.3V                   | +25°C          | -0.5 | +0.01 | +0.5 | nA    |
|                                                   |                         |                                                                               | TMIN to TMAX   | -1   |       | +1   |       |
| COM_ On-Leakage Current (Note 7)                  | ICOM_(ON)               | V+ = 3.6V, VCOM_ = 0.3V, 3.3V;<br>VNO_ or VNC_ = 0.3V, 3.3V, or floating      | +25°C          | -1   | +0.01 | +1   | nA    |
|                                                   |                         |                                                                               | TMIN to TMAX   | -2   |       | +2   |       |
| DYNAMIC CHARACTERISTICS                           |                         |                                                                               |                |      |       |      |       |
| Turn-On Time                                      | tON                     | VNO_, VNC_ = 1.5V;<br>RL = 300Ω, CL = 35pF, Figure 1;<br>VIH = 1.5V, VIL = 0V | +25°C          | 40   | 80    | ns   |       |
|                                                   |                         |                                                                               | TMIN to TMAX   |      | 100   |      |       |
| Turn-Off Time                                     | tOFF                    | VNO_, VNC_ = 1.5V;<br>RL = 300Ω, CL = 35pF, Figure 1;<br>VIH = 1.5V, VIL = 0V | +25°C          | 20   | 40    | ns   |       |
|                                                   |                         |                                                                               | TMIN to TMAX   |      | 50    |      |       |
| Break-Before-Make Time Delay (Note 7)             | tBBM                    | VNO_, VNC_ = 1.5V;<br>RL = 300Ω, CL = 35pF, Figure 2                          | +25°C          | 8    |       | ns   |       |
|                                                   |                         |                                                                               | TMIN to TMAX   | 1    |       |      |       |
| Skew (Note 7)                                     | tsKEW                   | RS = 39Ω, CL = 50pF, Figure 3                                                 | TMIN to TMAX   | 0.15 | 2     | ns   |       |
| Charge Injection                                  | Q                       | VGEN = 1.5V, RGEN = 0Ω,<br>CL = 1.0nF, Figure 4                               | +25°C          | 5    |       | pC   |       |
| Off-Isolation                                     | VISO                    | f = 10MHz; VNO_, VNC_ = 1VP-P;<br>RL = 50Ω, CL = 5pF, Figure 5                | +25°C          | -55  |       | dB   |       |
|                                                   |                         | f = 1MHz; VNO_, VNC_ = 1VP-P;<br>RL = 50Ω, CL = 5pF, Figure 5                 |                | -80  |       |      |       |
| Crosstalk (Note 8)                                | VCT                     | f = 10MHz; VNO_, VNC_ = 1VP-P;<br>RL = 50Ω, CL = 5pF, Figure 5                | +25°C          | -80  |       | dB   |       |
|                                                   |                         | f = 1MHz; VNO_, VNC_ = 1VP-P;<br>RL = 50Ω, CL = 5pF, Figure 5                 |                | -110 |       |      |       |
| On-Channel -3dB Bandwidth                         | BW                      | Signal = 0dBm, RL = 50Ω,<br>CL = 5pF, Figure 5                                | +25°C          | >300 |       | MHz  |       |
| Total Harmonic Distortion                         | THD                     | VCOM_ = 2VP-P, RL = 600Ω                                                      | +25°C          | 0.03 |       | %    |       |
| NO_, NC_ Off-Capacitance                          | CNO_(OFF),<br>CNC_(OFF) | f = 1MHz, Figure 6                                                            | +25°C          | 9    |       | pF   |       |

## 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

### ELECTRICAL CHARACTERISTICS—Single +3V Supply (continued)

(V+ = +2.7V to +3.6V, V<sub>IH</sub> = +1.4V, V<sub>IL</sub> = +0.5V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at V+ = +3.0V, T<sub>A</sub> = +25°C, unless otherwise noted.) (Notes 2, 3)

| PARAMETER                | SYMBOL            | CONDITIONS                              | T <sub>A</sub>                       | MIN  | TYP | MAX  | UNITS |
|--------------------------|-------------------|-----------------------------------------|--------------------------------------|------|-----|------|-------|
| Switch On-Capacitance    | C <sub>(ON)</sub> | f = 1MHz, Figure 6                      | +25°C                                |      | 15  |      | pF    |
| <b>DIGITAL I/O</b>       |                   |                                         |                                      |      |     |      |       |
| Input Logic High Voltage | V <sub>IH</sub>   |                                         | T <sub>MIN</sub> to T <sub>MAX</sub> | 1.4  |     |      | V     |
| Input Logic Low Voltage  | V <sub>IL</sub>   |                                         | T <sub>MIN</sub> to T <sub>MAX</sub> |      |     | 0.5  | V     |
| Input Leakage Current    | I <sub>IN</sub>   | V+ = +3.6V, V <sub>IN</sub> = 0 or 5.5V | T <sub>MIN</sub> to T <sub>MAX</sub> | -100 |     | +100 | nA    |
| <b>POWER SUPPLY</b>      |                   |                                         |                                      |      |     |      |       |
| Power-Supply Range       | V+                |                                         | T <sub>MIN</sub> to T <sub>MAX</sub> | 1.8  |     | 5.5  | V     |
| Supply Current           | I+                | V+ = +5.5V, V <sub>IN</sub> = 0V or V+  | T <sub>MIN</sub> to T <sub>MAX</sub> |      |     | 1    | μA    |

### ELECTRICAL CHARACTERISTICS—Single +5V Supply

(V+ = +4.2V to +5.5V, V<sub>IH</sub> = +2.0V, V<sub>IL</sub> = +0.8V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at V+ = +5.0V, T<sub>A</sub> = +25°C, unless otherwise noted.) (Notes 2, 3)

| PARAMETER                                                        | SYMBOL                                                      | CONDITIONS                                                                                                      | T <sub>A</sub>                       | MIN  | TYP   | MAX  | UNITS |
|------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------|------|-------|------|-------|
| Analog Signal Range                                              | V <sub>COM</sub> _,<br>V <sub>NO</sub> _, V <sub>NC</sub> _ |                                                                                                                 | T <sub>MIN</sub> to T <sub>MAX</sub> | 0    |       | V+   | V     |
| <b>ANALOG SWITCH (Low R<sub>ON</sub>—MAX4717/MAX4718 SPDT 1)</b> |                                                             |                                                                                                                 |                                      |      |       |      |       |
| On-Resistance (Note 4)                                           | R <sub>ON</sub>                                             | V+ = 4.2V, I <sub>COM</sub> _ = 10mA;<br>V <sub>NO</sub> _ or V <sub>NC</sub> _ = 3.5V                          | +25°C                                |      | 1.7   | 3    | Ω     |
|                                                                  |                                                             |                                                                                                                 | T <sub>MIN</sub> to T <sub>MAX</sub> |      |       | 3.5  |       |
| On-Resistance Match Between Channels (Notes 4, 5)                | ΔR <sub>ON</sub>                                            | V+ = 4.2V, I <sub>COM</sub> _ = 10mA;<br>V <sub>NO</sub> _ or V <sub>NC</sub> _ = 3.5V                          | +25°C                                |      | 0.1   | 0.3  | Ω     |
|                                                                  |                                                             |                                                                                                                 | T <sub>MIN</sub> to T <sub>MAX</sub> |      |       | 0.4  |       |
| On-Resistance Flatness (Note 6)                                  | R <sub>FLAT(ON)</sub>                                       | V+ = 4.2V, I <sub>COM</sub> _ = 10mA;<br>V <sub>NO</sub> _ or V <sub>NC</sub> _ = 1.0V, 2.0V, 3.5V              | +25°C                                |      | 0.4   | 1.2  | Ω     |
|                                                                  |                                                             |                                                                                                                 | T <sub>MIN</sub> to T <sub>MAX</sub> |      |       | 1.5  |       |
| NO_, NC_ Off-Leakage Current (Note 7)                            | I <sub>NO</sub> _(OFF),<br>I <sub>NC</sub> _(OFF)           | V+ = 5.5V; V <sub>COM</sub> _ = 1.0V, 4.5V;<br>V <sub>NO</sub> _ or V <sub>NC</sub> _ = 1.0V, 4.5V              | +25°C                                | -0.5 | +0.01 | +0.5 | nA    |
|                                                                  |                                                             |                                                                                                                 | T <sub>MIN</sub> to T <sub>MAX</sub> | -1   |       | +1   |       |
| COM_ On-Leakage Current (Note 7)                                 | I <sub>COM</sub> _(ON)                                      | V+ = 5.5V; V <sub>COM</sub> _ = 1.0V, 4.5V;<br>V <sub>NO</sub> _ or V <sub>NC</sub> _ = 1.0V, 4.5V, or floating | +25°C                                | -1   | +0.01 | +1   | nA    |
|                                                                  |                                                             |                                                                                                                 | T <sub>MIN</sub> to T <sub>MAX</sub> | -2   |       | +2   |       |

# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

MAX4717/MAX4718

## ELECTRICAL CHARACTERISTICS—Single +5V Supply (continued)

(V+ = +4.2V to +5.5V, V<sub>IH</sub> = +2.0V, V<sub>IL</sub> = +0.8V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at V+ = +5.0V, T<sub>A</sub> = +25°C, unless otherwise noted.) (Notes 2, 3)

| PARAMETER                                            | SYMBOL                                           | CONDITIONS                                                                                                      | T <sub>A</sub>                          | MIN  | TYP   | MAX  | UNITS |
|------------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------|------|-------|------|-------|
| ANALOG SWITCH (High R <sub>ON</sub> —MAX4718 SPDT 2) |                                                  |                                                                                                                 |                                         |      |       |      |       |
| On-Resistance (Note 4)                               | R <sub>ON</sub>                                  | V+ = 4.2V, I <sub>COM_</sub> = 10mA;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 3.5V                             | +25°C                                   | 12   | 20    | Ω    |       |
|                                                      |                                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      | 25    |      |       |
| On-Resistance Match Between<br>Channels (Notes 4, 5) | ΔR <sub>ON</sub>                                 | V+ = 4.2V, I <sub>COM_</sub> = 10mA;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 3.5V                             | +25°C                                   | 0.15 | 0.4   | Ω    |       |
|                                                      |                                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      | 0.5   |      |       |
| On-Resistance Flatness<br>(Note 6)                   | R <sub>FLAT(ON)</sub>                            | V+ = 4.2V, I <sub>COM_</sub> = 10mA;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 1.0V, 2.0V, 4.5V                 | +25°C                                   | 0.4  | 1.2   | Ω    |       |
|                                                      |                                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      | 1.5   |      |       |
| NO_, NC_ Off-Leakage Current<br>(Note 7)             | I <sub>NO_(OFF)</sub> ,<br>I <sub>NC_(OFF)</sub> | V+ = 5.5V; V <sub>COM_</sub> = 1.0V, 4.5V;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 1.0V, 4.5V                 | +25°C                                   | -0.5 | +0.01 | +0.5 | nA    |
|                                                      |                                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> | -1   |       | +1   |       |
| COM_ On-Leakage Current<br>(Note 7)                  | I <sub>COM_(ON)</sub>                            | V+ = 5.5V, V <sub>COM_</sub> = 1.0V, 4.5V;<br>V <sub>NO_</sub> or V <sub>NC_</sub> = 1.0V, 4.5V, or<br>floating | +25°C                                   | -1   | +0.01 | +1   | nA    |
|                                                      |                                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> | -2   |       | +2   |       |
| DYNAMIC CHARACTERISTICS                              |                                                  |                                                                                                                 |                                         |      |       |      |       |
| Turn-On Time                                         | t <sub>ON</sub>                                  | V <sub>NO_</sub> , V <sub>NC_</sub> = 3.0V;<br>R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Figure 1           | +25°C                                   | 30   | 80    | ns   |       |
|                                                      |                                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      | 100   |      |       |
| Turn-Off Time                                        | t <sub>OFF</sub>                                 | V <sub>NO_</sub> , V <sub>NC_</sub> = 3.0V;<br>R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Figure 1           | +25°C                                   | 20   | 40    | ns   |       |
|                                                      |                                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      | 50    |      |       |
| Break-Before-Make Time Delay<br>(Note 7)             | t <sub>BBM</sub>                                 | V <sub>NO_</sub> , V <sub>NC_</sub> = 3.0V;<br>R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Figure 2           | +25°C                                   | 8    |       | ns   |       |
|                                                      |                                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> | 1    |       |      |       |
| Skew (Note 7)                                        | t <sub>SKEW</sub>                                | R <sub>S</sub> = 39Ω, C <sub>L</sub> = 50pF, Figure 3                                                           | T <sub>MIN</sub> to<br>T <sub>MAX</sub> | 0.15 | 2     | ns   |       |
| DIGITAL I/O                                          |                                                  |                                                                                                                 |                                         |      |       |      |       |
| Input Logic High Voltage                             | V <sub>IH</sub>                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> | 2.0  |       | V    |       |
| Input Logic Low Voltage                              | V <sub>IL</sub>                                  |                                                                                                                 | T <sub>MIN</sub> to<br>T <sub>MAX</sub> |      | 0.8   | V    |       |
| Input Leakage Current                                | I <sub>IN</sub>                                  | V+ = 5.5V, V <sub>IN_</sub> = 0V or V+                                                                          | T <sub>MIN</sub> to<br>T <sub>MAX</sub> | -100 | +100  | nA   |       |

# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## ELECTRICAL CHARACTERISTICS—Single +5V Supply (continued)

( $V_+ = +4.2\text{V}$  to  $+5.5\text{V}$ ,  $V_{IH} = +2.0\text{V}$ ,  $V_{IL} = +0.8\text{V}$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted. Typical values are at  $V_+ = +5.0\text{V}$ ,  $T_A = +25^\circ\text{C}$ , unless otherwise noted.) (Notes 2, 3)

| PARAMETER           | SYMBOL | CONDITIONS                                            | $T_A$                  | MIN | TYP | MAX | UNITS         |
|---------------------|--------|-------------------------------------------------------|------------------------|-----|-----|-----|---------------|
| <b>POWER SUPPLY</b> |        |                                                       |                        |     |     |     |               |
| Power-Supply Range  | $V_+$  |                                                       | $T_{MIN}$ to $T_{MAX}$ | 1.8 |     | 5.5 | V             |
| Supply Current      | $I_+$  | $V_+ = 5.5\text{V}$ , $V_{IN_-} = 0\text{V}$ or $V_+$ | $T_{MIN}$ to $T_{MAX}$ |     |     | 1   | $\mu\text{A}$ |

**Note 2:** UCSP and TDFN parts are 100% tested at  $+25^\circ\text{C}$  only, and guaranteed by design over the specified temperature range.  $\mu\text{MAX}$  parts are 100% tested at  $T_{MAX}$  and guaranteed by design over the specified temperature range.

**Note 3:** The algebraic convention used in this data sheet is where the most negative value is a minimum and the most positive value is a maximum.

**Note 4:** Guaranteed by design for UCSP and TDFN parts.

**Note 5:**  $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ .

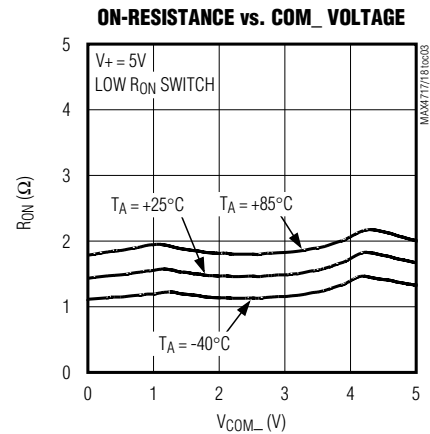
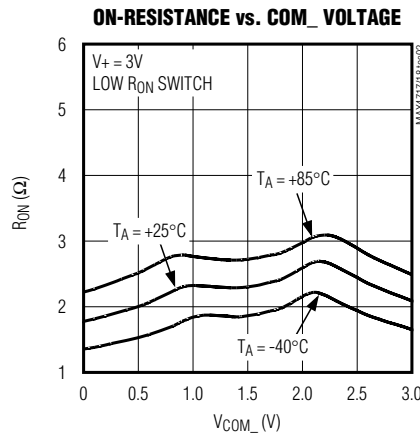
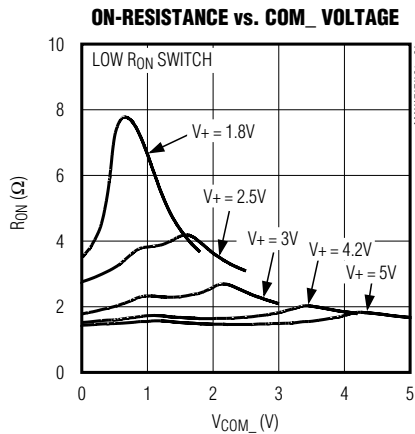
**Note 6:** Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

**Note 7:** Guaranteed by design.

**Note 8:** Between any two switches.

## Typical Operating Characteristics

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

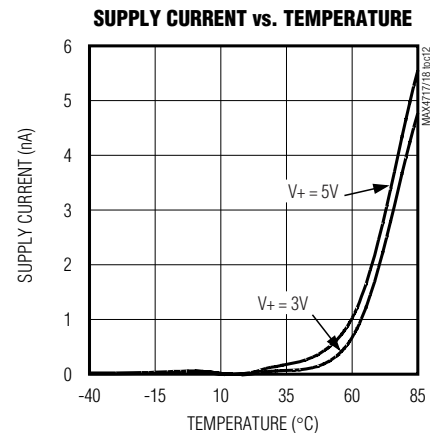
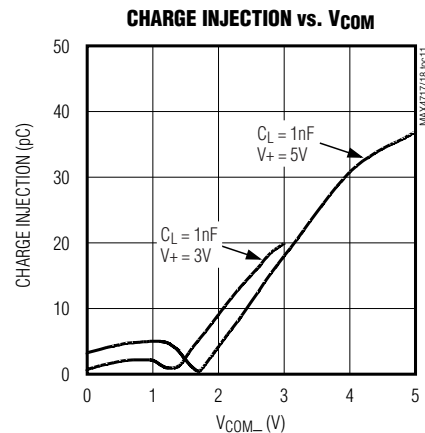
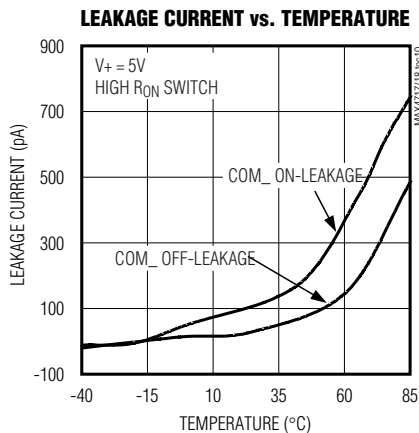
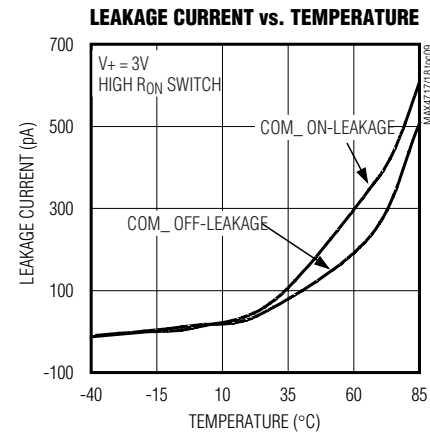
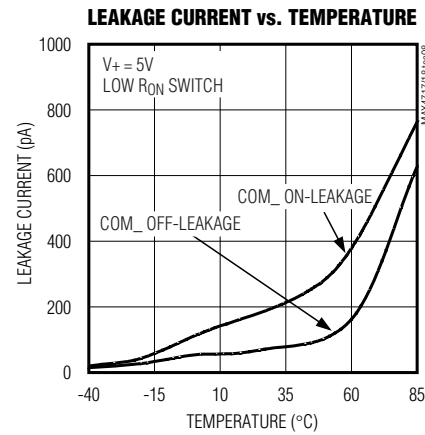
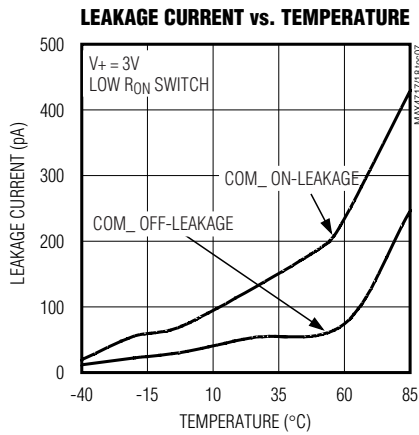
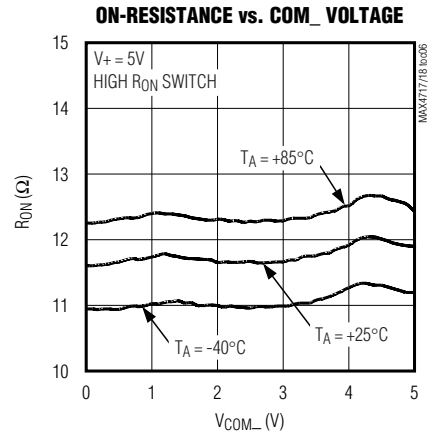
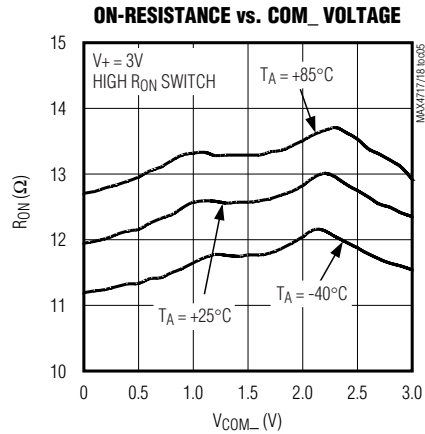
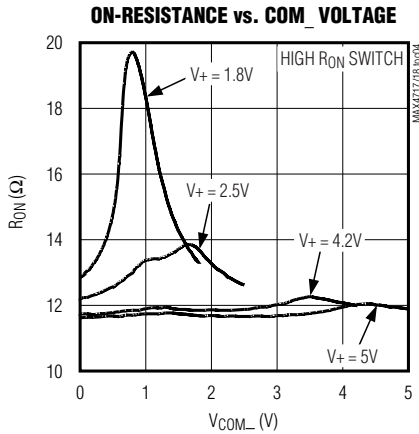


# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## Typical Operating Characteristics (continued)

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

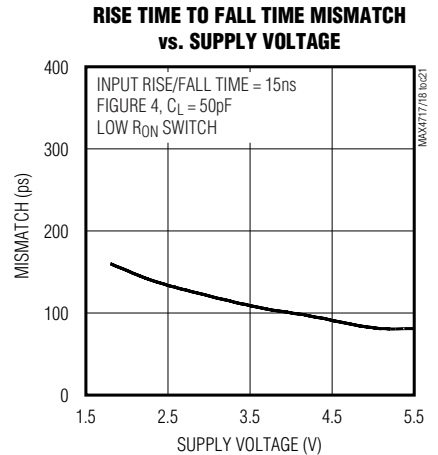
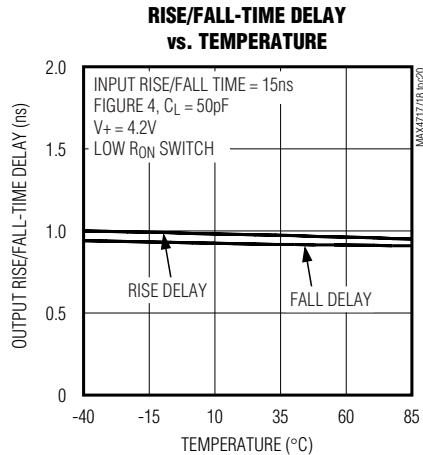
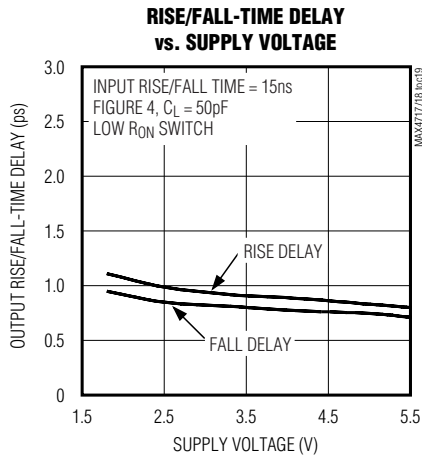
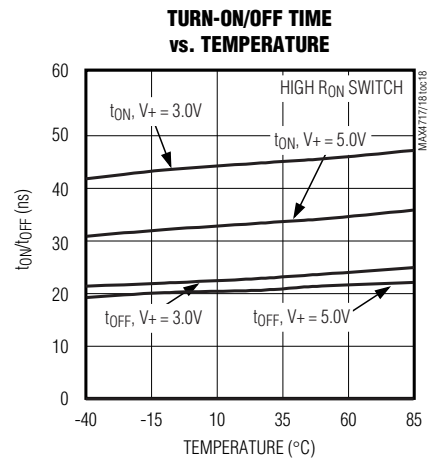
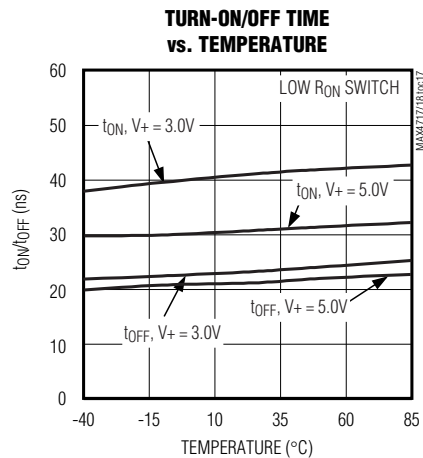
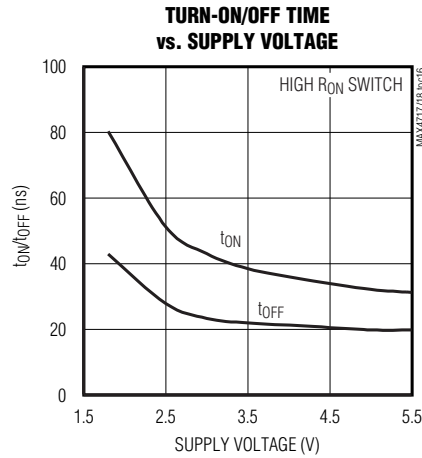
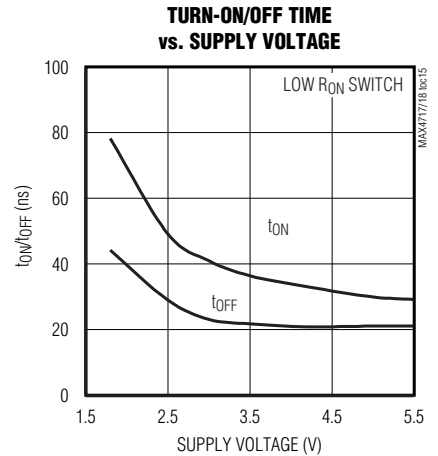
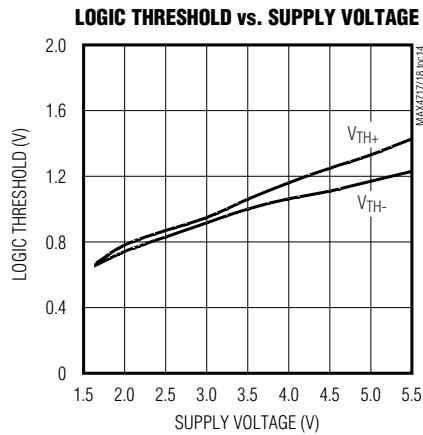
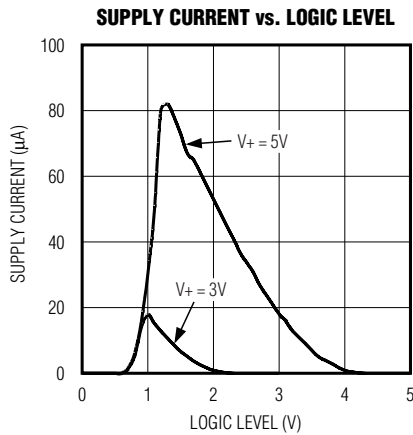
MAX4717/MAX4718



# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## Typical Operating Characteristics (continued)

(T<sub>A</sub> = +25°C, unless otherwise noted.)



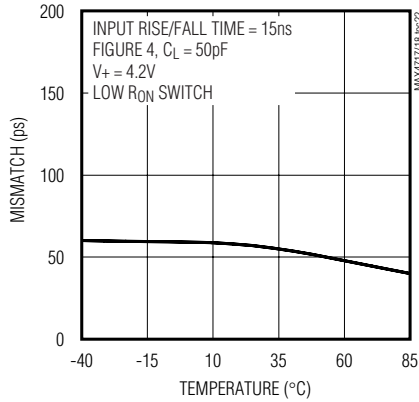
# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## Typical Operating Characteristics (continued)

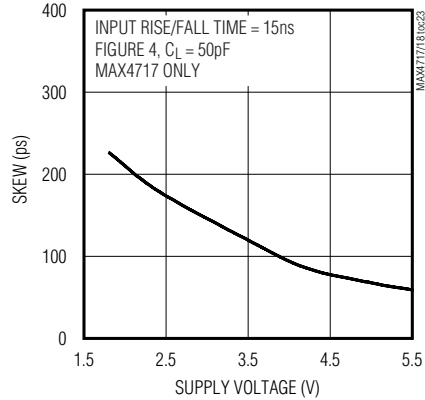
(T<sub>A</sub> = +25°C, unless otherwise noted.)

MAX4717/MAX4718

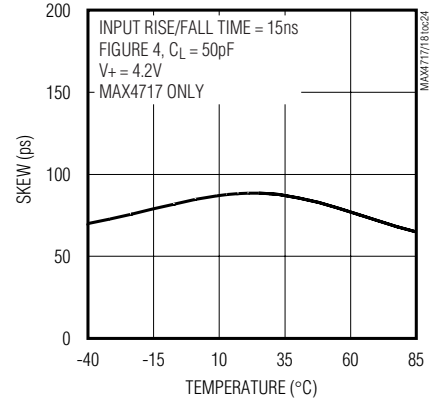
**RISE TIME TO FALL TIME MISMATCH  
vs. TEMPERATURE**



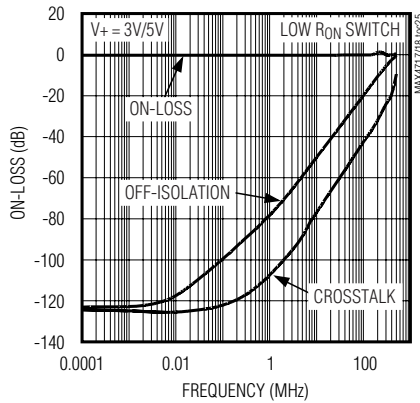
**SKEW vs. SUPPLY VOLTAGE**



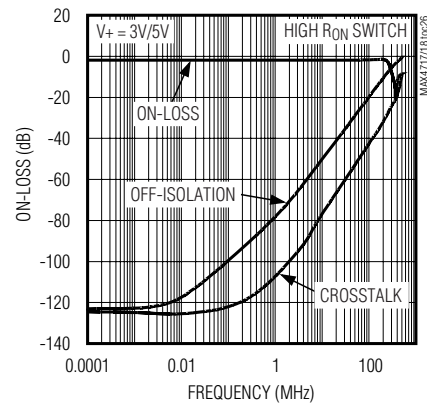
**SKEW vs. TEMPERATURE**



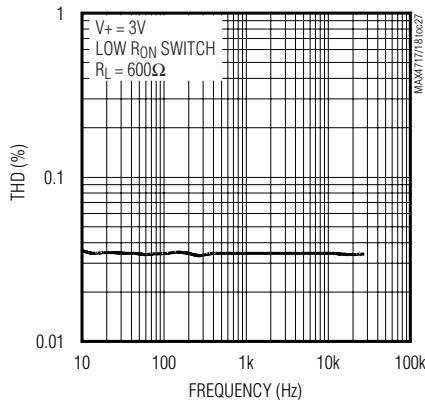
**FREQUENCY RESPONSE**



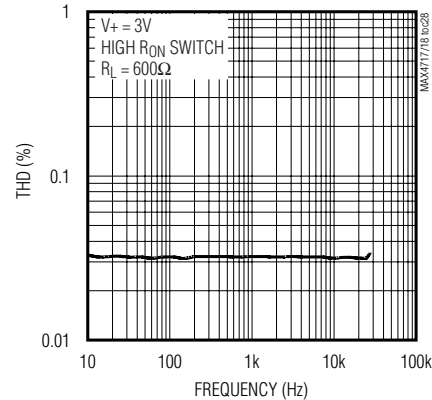
**FREQUENCY RESPONSE**



**TOTAL HARMONIC DISTORTION  
vs. FREQUENCY**



**TOTAL HARMONIC DISTORTION  
vs. FREQUENCY**



## 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

### Pin Description

| PIN  |           | NAME | FUNCTION                                                |
|------|-----------|------|---------------------------------------------------------|
| UCSP | μMAX/TDFN |      |                                                         |
| A1   | 7         | NC2  | Analog Switch 2—Normally Closed Terminal                |
| A2   | 8         | IN2  | Analog Switch 2—Digital Control Input                   |
| A3   | 9         | COM2 | Analog Switch 2—Common Terminal                         |
| A4   | 10        | NO2  | Analog Switch 2—Normally Open Terminal                  |
| B1   | 6         | GND  | Ground. Connection.                                     |
| B4   | 1         | V+   | Positive-Supply Voltage                                 |
| C1   | 5         | NC1  | Analog Switch 1—Normally Closed Terminal                |
| C2   | 4         | IN1  | Analog Switch 1—Digital Control Input                   |
| C3   | 3         | COM1 | Analog Switch 1—Common Terminal                         |
| C4   | 2         | NO1  | Analog Switch 1—Normally Open Terminal                  |
| —    | —         | EP   | Exposed Pad (for TDFN package only). Connect to ground. |

### Detailed Description

The MAX4717/MAX4718 high-speed, low-voltage, low on-resistance ( $R_{ON}$ ), dual SPDT analog switches operate from a single +1.8V to +5.5V supply. The switches feature break-before-make switching operation and fast switching speeds ( $t_{ON} = 80\text{ns}$  (max),  $t_{OFF} = 40\text{ns}$  (max)).

These switches have low 15pF on-channel capacitance, which allows for 12Mbps switching of the data signals for USB 1.0/1.1 applications. The MAX4717 is designed to switch D+ and D- USB signals with a guaranteed skew of less than 2ns (see Figure 4) as measured from 50% of the input signal to 50% of the output signal.

### Applications Information

#### Digital Control Inputs

The MAX4717/MAX4718 logic inputs accept up to +5.5V regardless of supply voltage. For example, with a +3.3V supply,  $IN_{\bar{}}$  can be driven low to GND and high to +5.5V allowing for mixing of logic levels in a system. Driving the control logic inputs rail-to-rail minimizes power consumption. For a +3V supply voltage, the logic thresholds are 0.5V (low) and 1.4V (high); for a +5V supply voltage, the logic thresholds are 0.8V (low) and 2.0V (high).

#### Analog Signal Levels

The on-resistance of the MAX4717/MAX4718 changes very little for analog input signals across the entire supply voltage range (see the *Typical Operating Characteristics*). The switches are bidirectional, so the  $NO_{\bar{}}$ ,  $NC_{\bar{}}$ , and  $COM_{\bar{}}$  pins can be either inputs or outputs.

#### Power-Supply Sequencing and Overvoltage Protection

**Caution:** Do not exceed the absolute maximum ratings because stresses beyond the listed ratings may cause permanent damage to the device.

Proper power-supply sequencing is recommended for all CMOS devices. Always apply  $V_{+}$  before applying analog signals, especially if the analog signal is not current-limited.

### UCSP Application Information

For the latest application details on UCSP construction, dimensions, tape carrier information, printed circuit board techniques, bump-pad layout, and recommended reflow temperature profile as well as the latest information on reliability testing results, go to the Maxim web site at [www.maxim-ic.com/ucsp](http://www.maxim-ic.com/ucsp) to find the Application Note: *USCP—A Wafer-Level Chip-Scale Package*.

### Chip Information

TRANSISTOR COUNT: 235

PROCESS: BiCMOS

# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## Test Circuits/Timing Diagrams

MAX4717/MAX4718

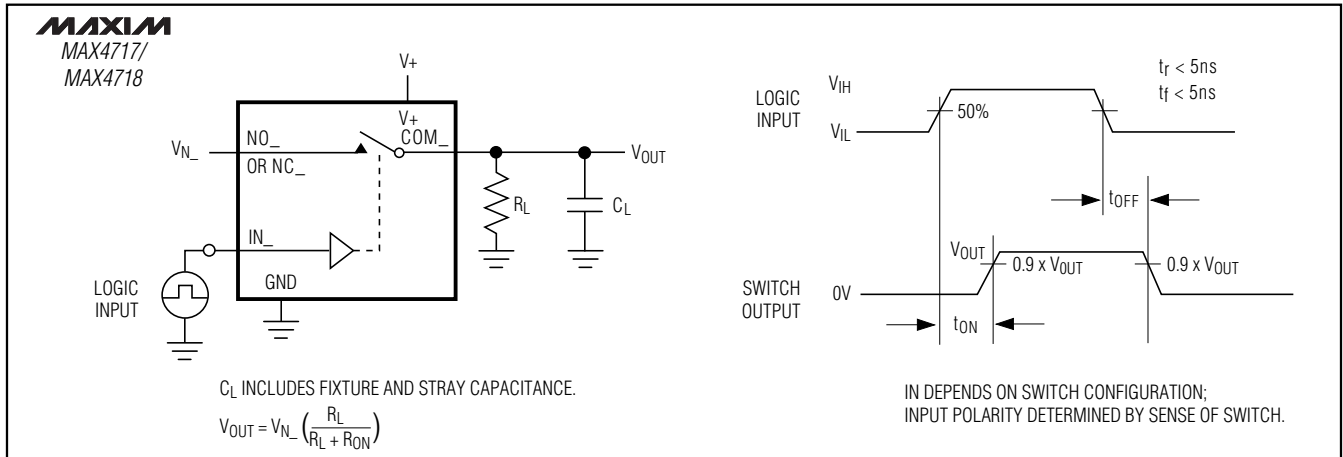


Figure 1. Switching Time

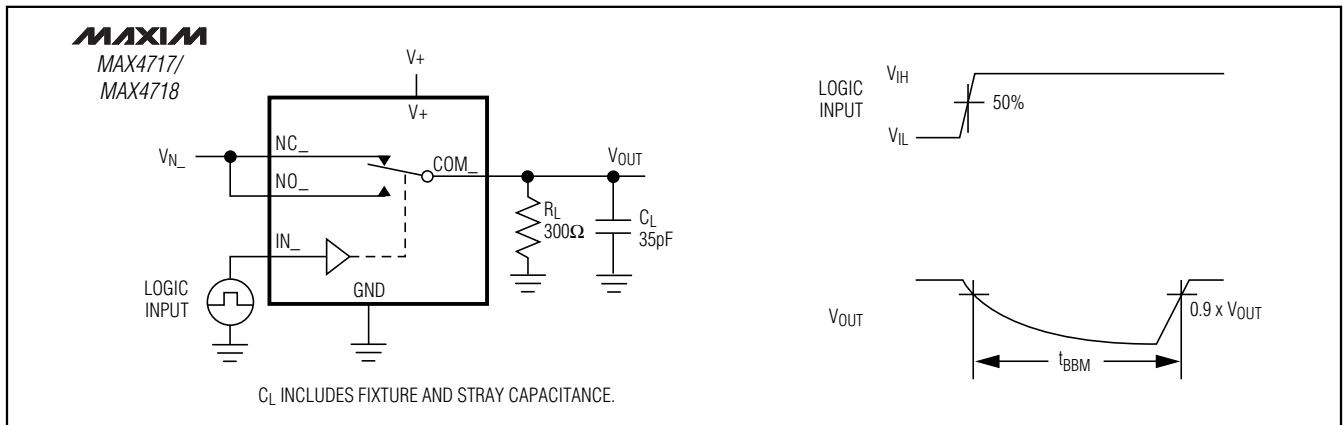


Figure 2. Break-Before-Make Interval

# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## Test Circuits/Timing Diagrams (continued)

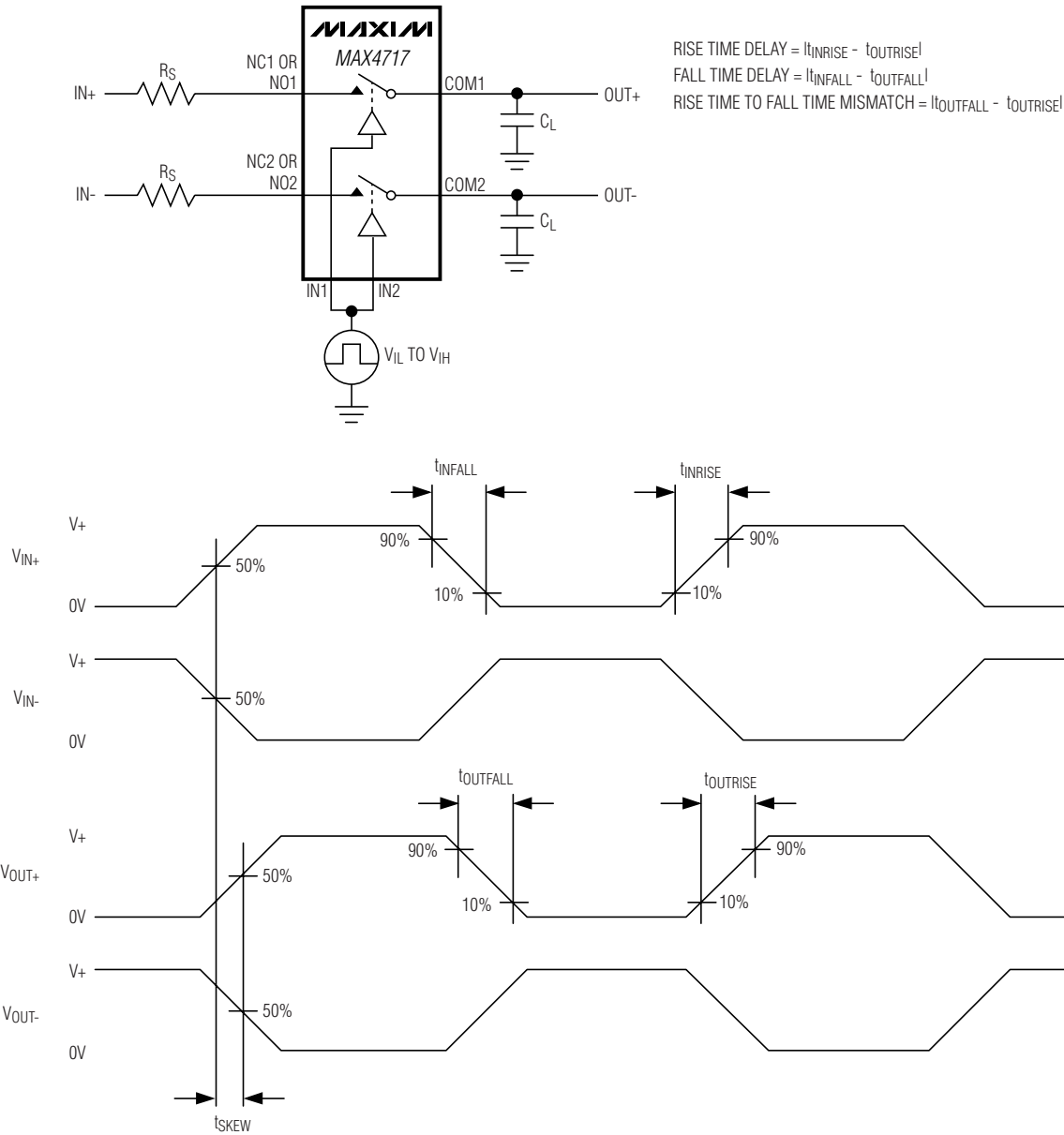


Figure 3. Output Signal Skew

# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## Test Circuits/Timing Diagrams (continued)

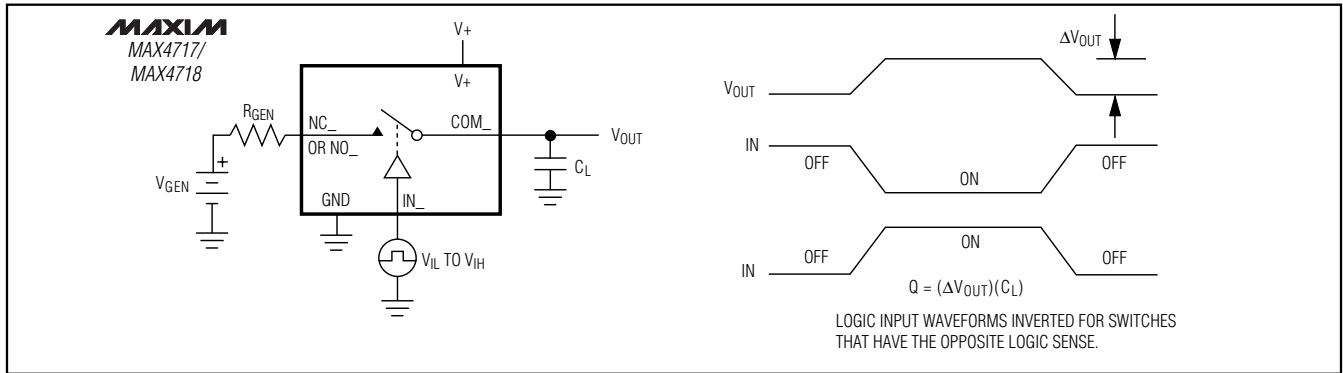


Figure 4. Charge Injection

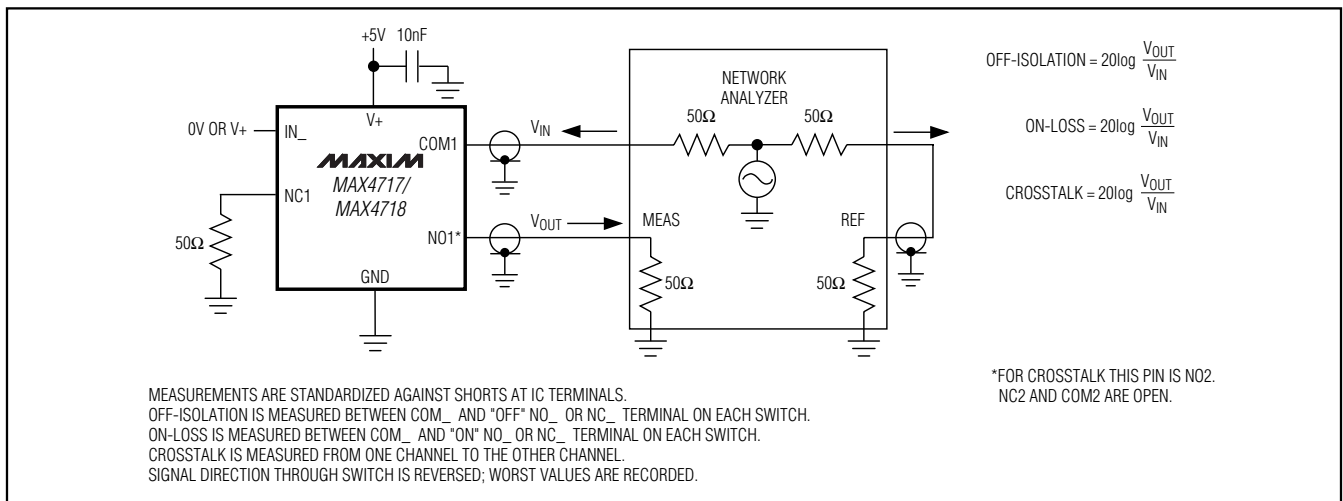


Figure 5. On-Loss, Off-Isolation, and Crosstalk

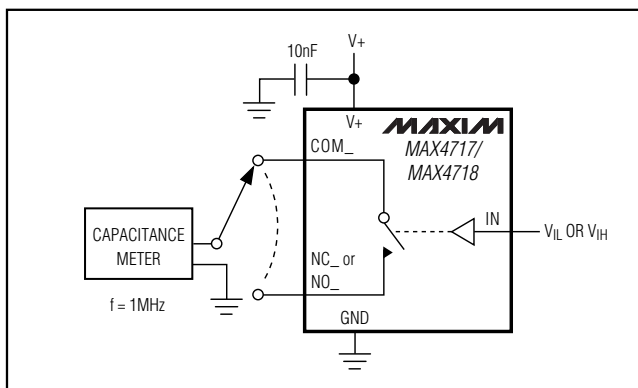
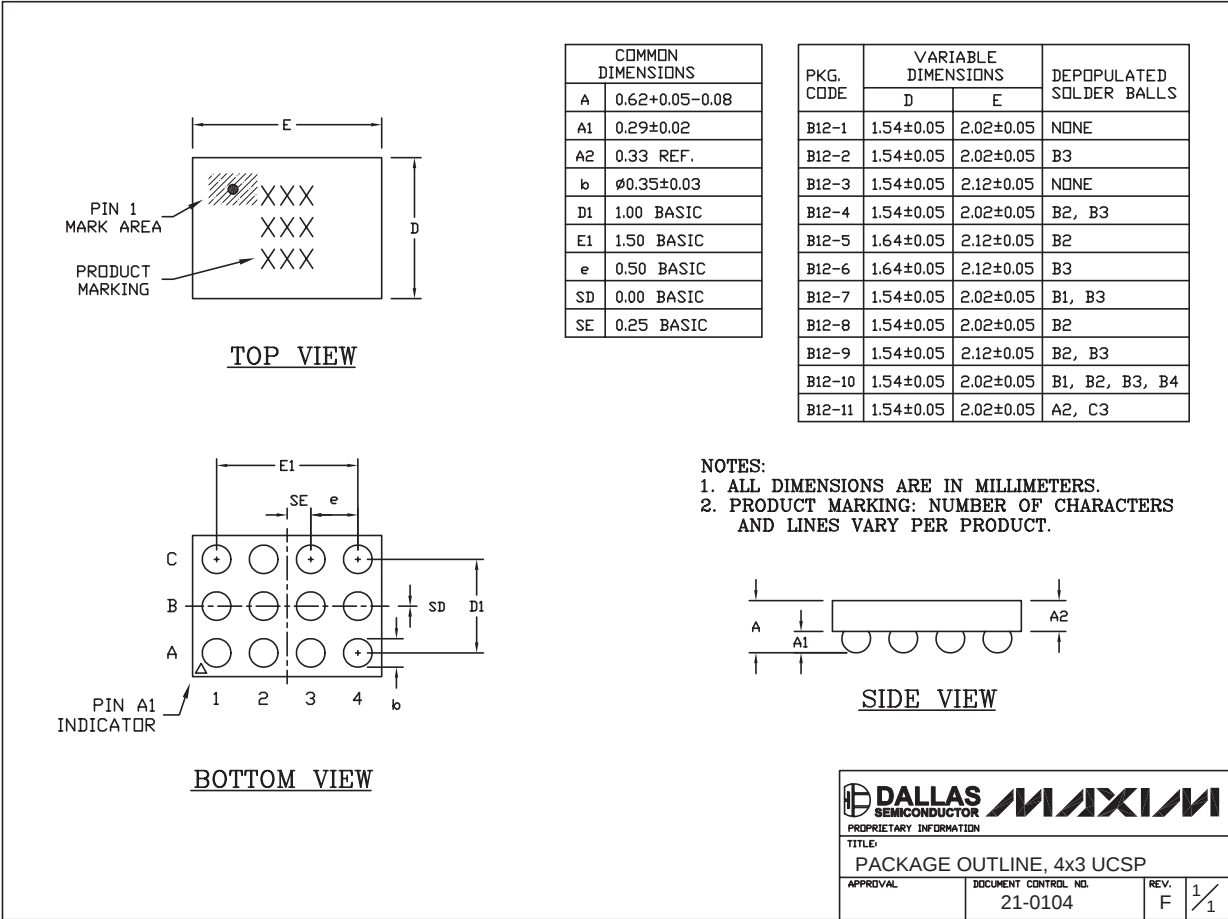


Figure 6. Channel Off/On-Capacitance

# **4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP**

## **Package Information**

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)

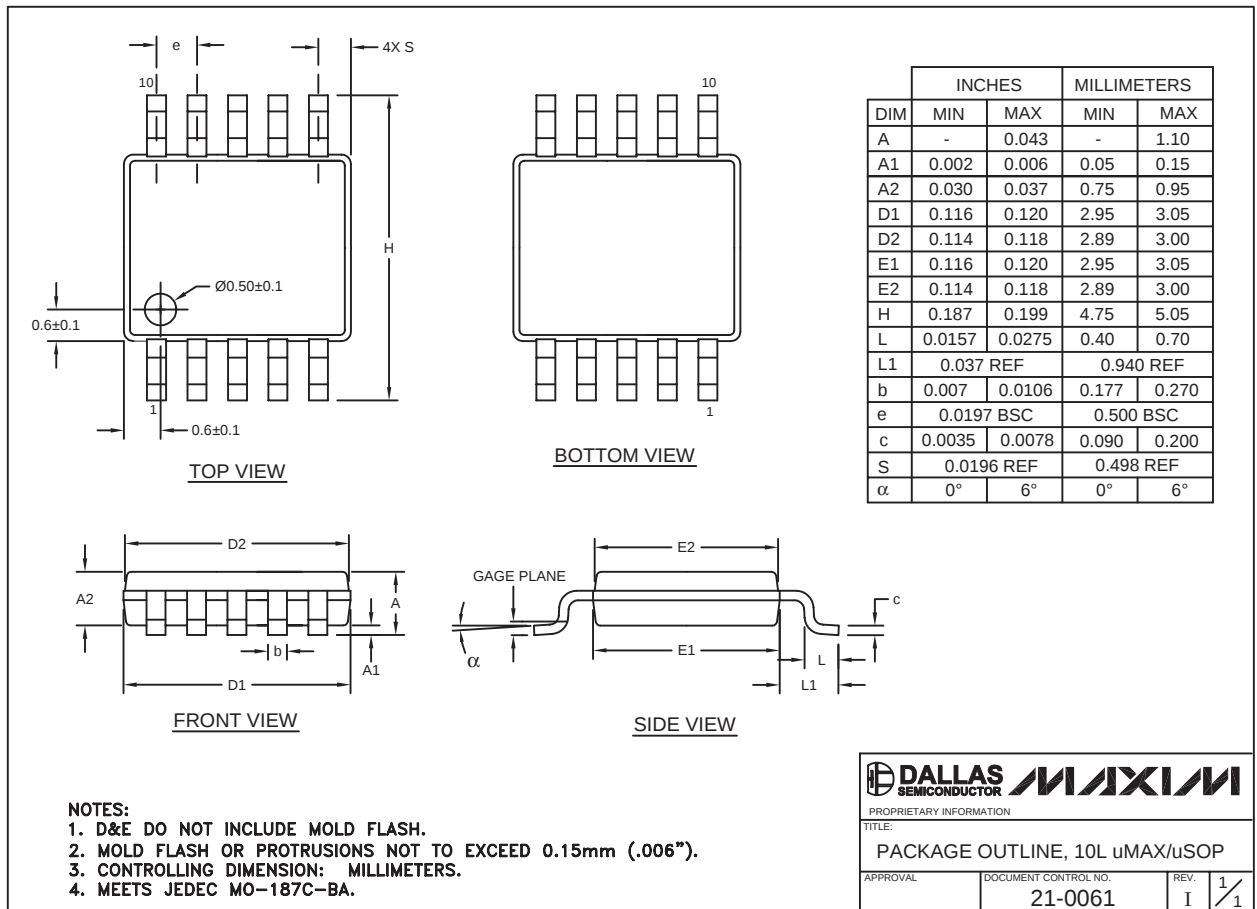


12L UCSP 4x3 EPS

# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)



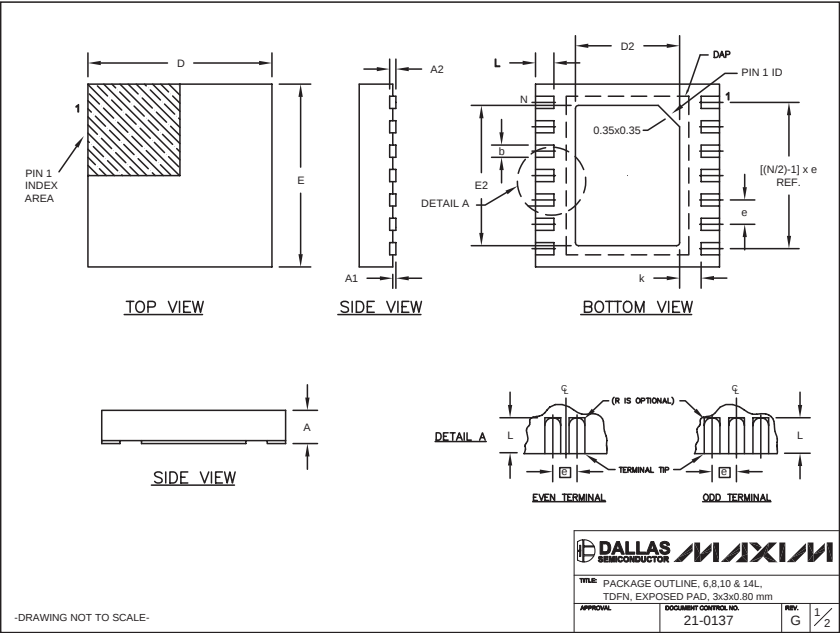
10L uMAX/EP

MAX4717/MAX4718

# 4.5Ω/20Ω, 300MHz Bandwidth, Dual SPDT Analog Switches in UCSP

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)



| COMMON DIMENSIONS |           |      |  |  |  |  |  |
|-------------------|-----------|------|--|--|--|--|--|
| SYMBOL            | MIN.      | MAX. |  |  |  |  |  |
| A                 | 0.70      | 0.80 |  |  |  |  |  |
| D                 | 2.90      | 3.10 |  |  |  |  |  |
| E                 | 2.90      | 3.10 |  |  |  |  |  |
| A1                | 0.00      | 0.05 |  |  |  |  |  |
| L                 | 0.20      | 0.40 |  |  |  |  |  |
| k                 | 0.25 MIN. |      |  |  |  |  |  |
| A2                | 0.20 REF. |      |  |  |  |  |  |

| PACKAGE VARIATIONS |    |           |           |          |                |           |               |
|--------------------|----|-----------|-----------|----------|----------------|-----------|---------------|
| PKG. CODE          | N  | D2        | E2        | e        | JEDEC SPEC     | b         | [(N/2)-1] x e |
| T633-1             | 6  | 1.50±0.10 | 2.30±0.10 | 0.95 BSC | MO229 / WEEA   | 0.40±0.05 | 1.90 REF      |
| T633-2             | 6  | 1.50±0.10 | 2.30±0.10 | 0.95 BSC | MO229 / WEEA   | 0.40±0.05 | 1.90 REF      |
| T833-1             | 8  | 1.50±0.10 | 2.30±0.10 | 0.65 BSC | MO229 / WEEC   | 0.30±0.05 | 1.95 REF      |
| T833-2             | 8  | 1.50±0.10 | 2.30±0.10 | 0.65 BSC | MO229 / WEEC   | 0.30±0.05 | 1.95 REF      |
| T833-3             | 8  | 1.50±0.10 | 2.30±0.10 | 0.65 BSC | MO229 / WEEC   | 0.30±0.05 | 1.95 REF      |
| T1033-1            | 10 | 1.50±0.10 | 2.30±0.10 | 0.50 BSC | MO229 / WEED-3 | 0.25±0.05 | 2.00 REF      |
| T1433-1            | 14 | 1.70±0.10 | 2.30±0.10 | 0.40 BSC | ----           | 0.20±0.05 | 2.40 REF      |
| T1433-2            | 14 | 1.70±0.10 | 2.30±0.10 | 0.40 BSC | ----           | 0.20±0.05 | 2.40 REF      |

NOTES:

1. ALL DIMENSIONS ARE IN mm, ANGLES IN DEGREES.
2. COPLANARITY SHALL NOT EXCEED 0.08 mm.
3. WARPAGE SHALL NOT EXCEED 0.10 mm.
4. PACKAGE LENGTH/PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S).
5. DRAWING CONFORMS TO JEDEC MO229, EXCEPT DIMENSIONS "D2" AND "E2", AND T1433-1 & T1433-2.
6. "N" IS THE TOTAL NUMBER OF LEADS.
7. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.

DALLAS SEMICONDUCTOR MAXIM

TITLE: PACKAGE OUTLINE, 6.8, 10 & 14L, TDFN, EXPOSED PAD, 3x3x0.80 mm

APPROVAL: 21-0137

REV: G 2/2

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- Специальные условия для постоянных клиентов.
- Подбор аналогов.
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- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
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- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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[www.lifeelectronics.ru](http://www.lifeelectronics.ru)