



# Standard Test Method for Determining the Contact Bounce Time of a Membrane Switch<sup>1</sup>

This standard is issued under the fixed designation F1661; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers the determination of the contact bounce time of a membrane switch.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[D2240 Test Method for Rubber Property—Durometer Hardness](#)

[F2592 Test Method for Measuring the Force-Displacement of a Membrane Switch](#)

[F1680 Test Method for Determining Circuit Resistance of a Membrane Switch](#)

## 3. Terminology

3.1 *Definitions:*

3.1.1 *contact bounce*—intermittent contact opening and contact closure that may occur after switch operation.

3.1.2 *contact bounce time (break),  $T_{CBB}$* —the time period measured from the first instant  $V_M$  is equal to the SUTV until it constantly remains below the SLTV after the last instant it rises above the SUTV. If  $V_M$  does not rise above SUTV during the time interval,  $T_{CBB} = 0$ , (see [Fig. 1](#)).

3.1.3 *contact bounce time (make),  $T_{CBM}$* —the time period measured from the first instant  $V_M$  is equal to the SLTV until

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

it constantly remains above the SUTV after the last instant it falls below the SLTV. If  $V_M$  does not fall below SLTV during the time interval,  $T_{CBM} = 0$ , (see [Fig. 2](#)).

3.1.4 *lower transition voltage, LTV*—the voltage at which the switched logic device transitions to an “off” state.

3.1.5 *membrane switch*—a momentary switching device in which at least one contact is on, or made of, a flexible substrate.

3.1.6 *resistor, load,  $R_L$* —load resistance in series with switch under test.

3.1.7 *specified lower transition voltage, SLTV*— minimum allowable LTV.

3.1.8 *specified upper transition voltage, SUTV*— minimum allowable UTV.

3.1.9 *upper transition voltage, UTV*—the voltage at which the switched logic device transitions to an “on” state.

3.1.10 *voltage, measured,  $V_M$* —voltage measured across load Resistor ( $R_L$ ) by the oscilloscope and measured on it's screen or voltage measured across the switch under test when a contact bounce measuring device is used.

## 4. Significance and Use

4.1 Contact bounce time is essential to manufacturers and users when designing interface circuitry because it specifies the time delay necessary in the decoder circuitry to avoid any false signals caused by contact bounce. Allowing for time delay makes the switch operation considerably more reliable.

## 5. Interference

5.1 The following parameters may affect the results of this test:

5.1.1 Mechanical probe materials (hardness) and speed will affect results.

## 6. Apparatus

6.1 *Test Probe*, built to either of the configuration shown in [Fig. 3](#) and [Fig. 4](#) are acceptable but must be made of an inert elastomeric material with a hardness number equivalent to  $A/45 \pm 5$  as measured in accordance with Test Method [D2240](#). Test probes that do not meet the above criteria must be fully specified and recorded.

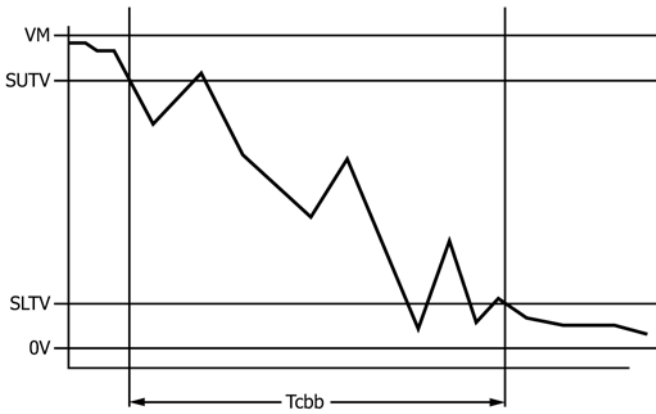


FIG. 1 Contact Bounce on Switch Break

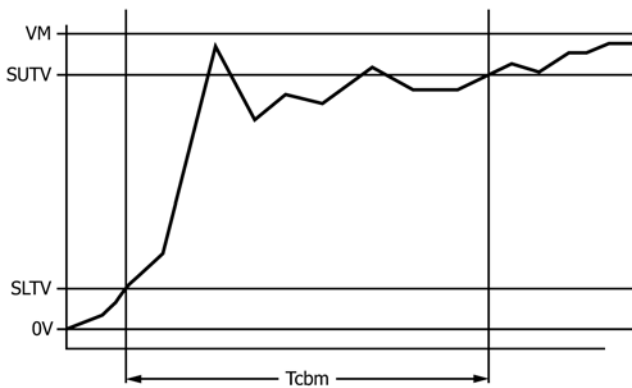


FIG. 2 Contact Bounce on Switch Make

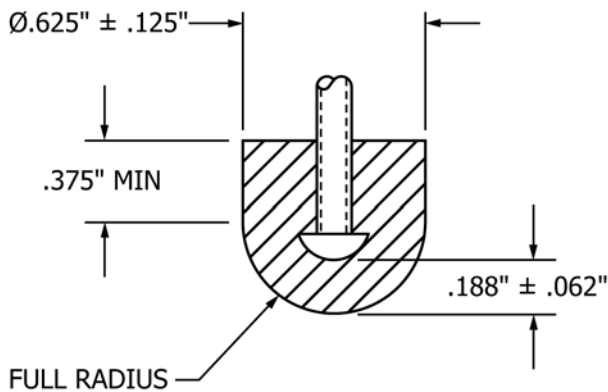


FIG. 3 Test Probe Option

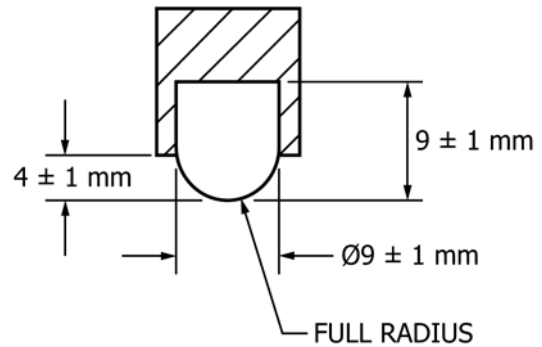


FIG. 4 Test Probe Option

7.1.1 Determine  $F_{max}$  or  $F_c$  (whichever is greater) per Test Method F2592.

7.1.2 Determine switch resistance ( $R_s$ ) per Test Method F1680.

7.1.3 Secure switch on test surface.

7.1.4 Connect switch terminals as shown in Fig. 5 so that:

$$R_L = 10 \text{ to } 100 \text{ times } R_s$$

7.1.5 Adjust oscilloscope to initial settings as follows:

7.1.5.1 One half to 1.0 V/cm vertical, and

7.1.5.2 Two to 3 ms/cm horizontal.

7.1.5.3 Set SUTV per Fig. 6 if known. If not known, default SUTV will be 2.0 VDC.

7.1.5.4 Set SLTV per Fig. 6 if known. If not known, default SLTV will be 0.9 VDC.

7.1.6 Adjust power supply to test voltage per Fig. 6 if known. If not known, default test voltage will be 5 VDC.

7.1.7 Adjust to rising waveform when measuring  $T_{CBM}$ .

7.1.8 Adjust to falling waveform when measuring  $T_{CBB}$ .

7.2 In Process Test ( $T_{CBM}$ ):

7.2.1 Activate and release switch with test probe at the predetermined force (7.1.6) at a cycling rate not to exceed 3 cycles per second.

7.2.2 Record  $T_{CBM}$  (see Fig. 2) from oscilloscope display.

7.2.3 Repeat 7.2.1 – 7.2.3 four more times.

7.3 In Process Test ( $T_{CBB}$ ):

7.3.1 Activate and release switch with test probe at the predetermined force (7.1.6) at a cycling rate not to exceed 3 cycles per second.

7.3.2 Record  $T_{CBB}$  (see Fig. 1) from oscilloscope display.

7.3.3 Repeat 7.3.1 – 7.3.3 four more times.

6.2 Test Surface— flat, smooth, unyielding, and larger than switch under test.

6.3 Oscilloscope, with recording capabilities and power supply, or suitable contact bounce time measuring instrument.

6.4 Device, which will consistently move probe into and away from the switch at a controlled speed. Also capable of applying a specified force.

## 7. Procedure

7.1 Pretest Setup:

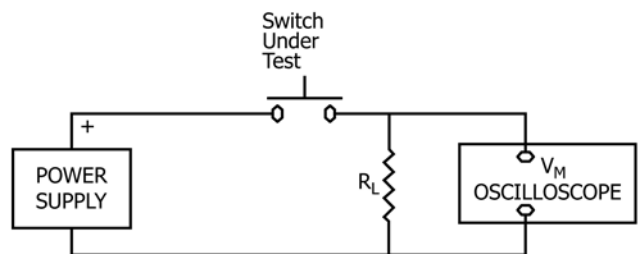


FIG. 5 Test Setup Option

Voltage	Logical Family						
	CMOS	TTL/CMOS	TTL	ETL	LOW V	BTL	GTL
5	Logic Level High (1)				N/A		
4.9							
4.8							
4.7							
4.6							
4.5							
4.4							
4.3							
4.2							
4.1							
4							
3.9	Gray Zone logic level floats randomly (1 or 0)	Logic Level High (1)	Logic Level High (1)	Logic Level High (1)	Logic Level High (1)	N/A	N/A
3.8							
3.7							
3.6							
3.5							
3.4							
3.3							
3.2							
3.1							
3							
2.9							
2.8							
2.7							
2.6							
2.5							
2.4							
2.3							
2.2							
2.1							
2							
1.9	Logic Level Low (0)	Gray Zone logic level floats randomly (1 or 0)	Gray Zone logic level floats randomly (1 or 0)	(1 or 0)	Gray Zone logic level floats randomly (1 or 0)	Logic Level High (1)	Logic Level High (1)
1.8							
1.7							
1.6							
1.5							
1.4							
1.3							
1.2							
1.1							
1							
0.9							
0.8							
0.7							
0.6							
0.5							
0.4							
0.3							
0.2							
0.1							
0							

FIG. 6 Table 1

## 8. Report

- 8.1 Report the following information:
- 8.1.1 Temperature,
  - 8.1.2 Humidity,
  - 8.1.3 Barometric pressure,
  - 8.1.4 Specified resistance ( $R_S$ ),
  - 8.1.5 Load resistance ( $R_L$ ) (if using oscilloscope method),
  - 8.1.6  $T_{CBM}$  (min),  $T_{CBM}$  (max),
  - 8.1.7  $T_{CBB}$  (min),  $T_{CBB}$  (max),
  - 8.1.8 Part number or description of switch under test, or both,
  - 8.1.9 Date of test,
  - 8.1.10 Description of oscilloscope or contact bounce time measuring instrument,
  - 8.1.11 SUTV for oscilloscope method, UTV for contact bounce time measuring instrument method,
  - 8.1.12 SLTV for oscilloscope method, LTV for contact bounce time measuring instrument method,
  - 8.1.13 Completely describe means of activating switch, include details such as:

- 8.1.13.1 Size, shape and durometer of probe,
- 8.1.13.2 Actuation force,
- 8.1.13.3 Velocity of probe, and
- 8.1.13.4 Any other relevant information needed to duplicate test.

## 9. Precision and Bias

9.1 *Precision*—It is not possible to specify the precision of the procedure in Test Method F1661 for measuring contact bounce time because interlaboratory studies have proven inconclusive due to insufficient participating laboratories with the appropriate equipment.

9.2 *Bias*—No information can be presented on the bias of the procedure in Test Method F1661 for measuring contact bounce time because no standard sample is available for this industry.

## 10. Keywords

- 10.1 contact bounce; membrane switch

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