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FAN73901

High- and Low-Side, Gate-Drive IC

Features

- Floating Channels for Bootstrap Operation to +600 V
- Typically 2.5 A / 2.5 A Sourcing/Sinking Current Driving Capability
- Common-Mode dv/dt Noise Canceling Circuit
- Built-in Under-Voltage Lockout for Both Channels
- Matched Propagation Delay for Both Channels
- 3.3 V and 5 V Input Logic Compatible
- Output In-Phase with Input

Applications

- Half-Bridge Driver
- HID Lamp Ballast
- SMPS
- Motor Driver

Description

The FAN73901 is a monolithic high- and low-side gate-drive IC, which can drive high-speed MOSFETs and IGBTs that operate up to +600 V. It has a buffered output stage with all NMOS transistors designed for high pulse current driving capability and minimum cross-conduction.

Fairchild's high-voltage process and common-mode noise canceling techniques provide stable operation of the high-side driver under high dv/dt noise circumstances. An advanced level-shift circuit offers high-side gate driver operation up to $V_S = -9.8$ V (typical) for $V_{BS} = 15$ V.

The UVLO circuit prevents malfunction when V_{DD} and V_{BS} are lower than the specified threshold voltage.

The high current and low output voltage drop features make sFAN73901 suitable for switching power supply, motor driver, and high-power DC-DC converter applications.

8-SOP



Ordering Information

| Part Number | Package | Operating Temperature Range | Packing Method |
|-------------|---------|-----------------------------|----------------|
| FAN73901M | 8-SOP | -40°C ~ 125°C | Tube |
| FAN73901MX | | | Tape & Reel |

Typical Application Circuit

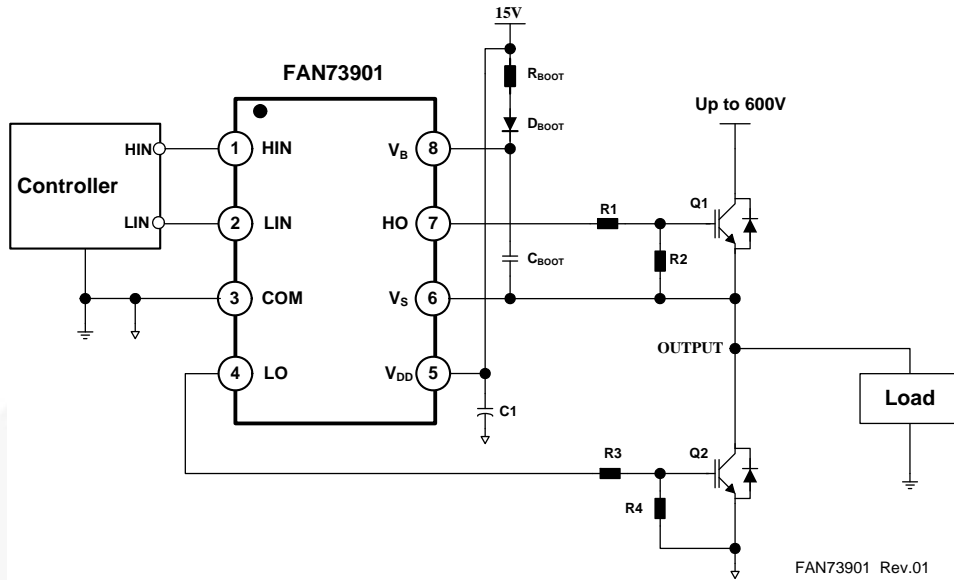


Figure 1. Application Circuit for Half-Bridge

Internal Block Diagram

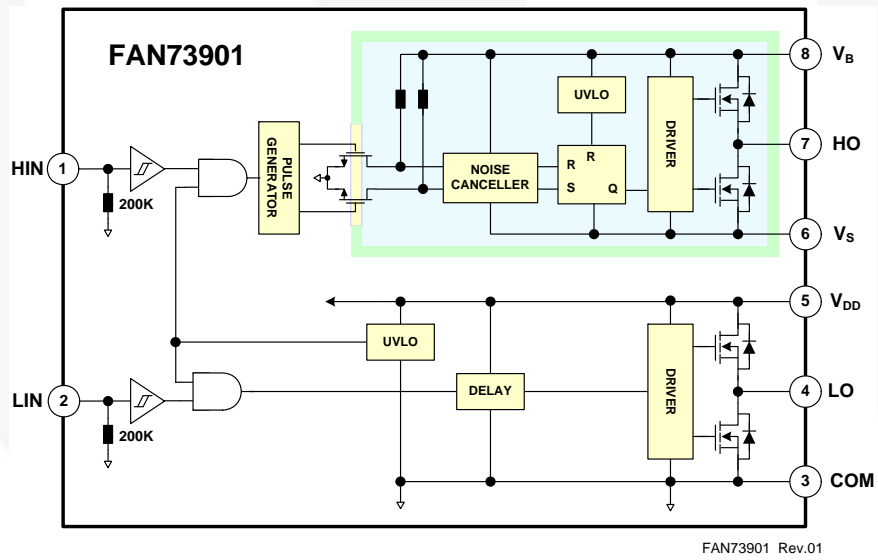
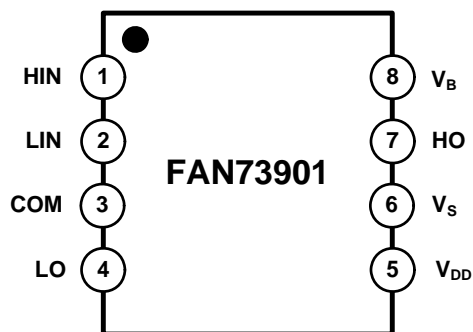


Figure 2. Functional Block Diagram

Pin Configuration



FAN73901 Rev.01

Figure 3. Pin Assignments (Top View)

Pin Definitions

| Pin # | Name | Description |
|-------|-----------------|--|
| 1 | HIN | Logic Input for High-Side Gate Driver Output |
| 2 | LIN | Logic Input for Low-Side Gate Driver Output |
| 3 | COM | Low-Side Driver Return |
| 4 | LO | Low-Side Driver Output |
| 5 | V _{DD} | Low-Side and Logic Part Supply Voltage |
| 6 | V _S | High-Voltage Floating Supply Return |
| 7 | HO | High-Side Driver Output |
| 8 | V _B | High-Side Floating Supply |

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. $T_A=25^{\circ}\text{C}$, unless otherwise specified.

| Symbol | Characteristics | Min. | Max. | Unit |
|---------------|--|-----------|--------------|-----------------------------|
| V_S | High-Side Floating Supply Offset Voltage | V_B-25 | $V_B+0.3$ | V |
| V_B | High-Side Floating Supply Voltage | -0.3 | 625.0 | V |
| V_{HO} | High-Side Floating Output Voltage HO | $V_S-0.3$ | $V_B+0.3$ | V |
| V_{DD} | Low-Side and Logic Fixed Supply Voltage | -0.3 | 25.0 | V |
| V_{LO} | Low-Side Output Voltage LO | -0.3 | $V_{DD}+0.3$ | V |
| V_{IN} | Logic Input Voltage (HIN and LIN) | -0.3 | $V_{DD}+0.3$ | V |
| dV_S/dt | Allowable Offset Voltage Slew Rate | | 50 | V/ns |
| P_D | Power Dissipation ⁽¹⁾⁽²⁾⁽³⁾ | | 0.625 | W |
| θ_{JA} | Thermal Resistance, Junction-to-Ambient | | 200 | $^{\circ}\text{C}/\text{W}$ |
| T_J | Junction Temperature | | +150 | $^{\circ}\text{C}$ |
| T_{STG} | Storage Temperature | | +150 | $^{\circ}\text{C}$ |

Notes:

- Mounted on 76.2 x 114.3 x 1.6 mm PCB (FR-4 glass epoxy material).
- Refer to the following standards:
 - JESD51-2: Integral circuits thermal test method environmental conditions - natural convection
 - JESD51-3: Low effective thermal conductivity test board for leaded surface mount packages.
- Do not exceed P_D under any circumstances.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

| Symbol | Parameter | Min. | Max. | Unit |
|----------|--|------------|----------|--------------------|
| V_B | High-Side Floating Supply Voltage | V_S+10 | V_S+20 | V |
| V_S | High-Side Floating Supply Offset Voltage | $6-V_{DD}$ | 600 | V |
| V_{HO} | High-Side Output Voltage | V_S | V_B | V |
| V_{DD} | Low-Side and Logic Supply Voltage | 10 | 20 | V |
| V_{LO} | Low-Side Output Voltage | COM | V_{DD} | V |
| V_{IN} | Logic Input Voltage (HIN and LIN) | COM | V_{DD} | V |
| T_A | Operating Ambient Temperature | -40 | +125 | $^{\circ}\text{C}$ |

Electrical Characteristics

V_{BIAS} (V_{DD} , V_{BS})=15.0 V, V_S =COM, T_A =25°C, unless otherwise specified. The V_{IL} , V_{IH} , and I_{IN} parameters are referred to COM and are applicable to the respective input signals HIN and LIN. The V_O and I_O parameters are referred to COM and V_S is applicable to the respective output signals HO and LO.

| Symbol | Characteristics | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|------|------|------|------------|
| POWER SUPPLY SECTION (V_{DD} AND V_{BS}) | | | | | | |
| V_{DDUV+} V_{BSUV+} | V_{DD} and V_{BS} Supply Under-Voltage Positive-Going Threshold | | 8.0 | 8.8 | 9.8 | V |
| V_{DDUV-} V_{BSUV-} | V_{DD} and V_{BS} Supply Under-Voltage Negative-Going Threshold | | 7.4 | 8.3 | 9.0 | V |
| V_{DDUVH} V_{BSUVH} | V_{DD} and V_{BS} Supply Under-Voltage Lockout Hysteresis Voltage | | | 0.5 | | V |
| I_{LK} | Offset Supply Leakage Current | $V_B=V_S=600$ V | | | 50 | μ A |
| I_{QBS} | Quiescent V_{BS} Supply Current | $V_{IN}=0$ V or 5 V | | 45 | 80 | μ A |
| I_{QDD} | Quiescent V_{DD} Supply Current | $V_{IN}=0$ V or 5 V | | 75 | 110 | μ A |
| I_{PBS} | Operating V_{BS} Supply Current | $f_{IN}=20$ kHz, rms value | | 530 | 640 | μ A |
| I_{PDD} | Operating V_{DD} Supply Current | $f_{IN}=20$ kHz, rms value | | 530 | 640 | μ A |
| LOGIC INPUT SECTION (HIN, LIN) | | | | | | |
| V_{IH} | Logic "1" Input Voltage | | 2.5 | | | V |
| V_{IL} | Logic "0" Input Voltage | | | | 1.2 | V |
| I_{IN+} | Logic "1" Input Bias Current | $V_{IN}=5$ V | | 25 | 50 | μ A |
| I_{IN-} | Logic "0" Input Bias Current | $V_{IN}=0$ V | | 1.0 | 2.0 | μ A |
| R_{IN} | Input Pull-Down Resistance | | 100 | 200 | | K Ω |
| GATE DRIVER OUTPUT SECTION (HO, LO) | | | | | | |
| V_{OH} | High-Level Output Voltage, $V_{BIAS}-V_O$ | No Load | | | 1.0 | V |
| V_{OL} | Low-Level Output Voltage, V_O | No Load | | | 35 | mV |
| I_{O+} | Output High, Short-Circuit Pulsed Current ⁽⁴⁾ | $V_O=0$ V, $V_{IN}=5$ V with $PW<10$ μ s | 1.8 | 2.5 | | A |
| I_{O-} | Output Low, Short-Circuit Pulsed Current ⁽⁴⁾ | $V_O=15$ V, $V_{IN}=0$ V with $PW<10$ μ s | 1.8 | 2.5 | | A |
| V_S | Allowable Negative V_S Pin Voltage for HIN Signal Propagation to HO | | | -9.8 | -7.0 | V |

Note:

4. This parameter guaranteed by design.

Dynamic Electrical Characteristics

V_{BIAS} (V_{DD} , V_{BS})=15.0 V, V_S =COM=0 V, C_L =1000 pF and T_A =25°C unless otherwise specified.

| Symbol | Characteristics | Test Condition | Min. | Typ. | Max. | Unit |
|-----------|-------------------------------------|----------------|------|------|------|------|
| t_{on} | Turn-on Propagation Delay | $V_S=0$ V | | 140 | 200 | ns |
| t_{off} | Turn-off Propagation Delay | $V_S=0$ V | | 140 | 200 | ns |
| MT | Delay Matching, HS & LS Turn-on/off | | | 0 | 50 | ns |
| t_r | Turn-on Rise Time | | | 25 | 50 | ns |
| t_f | Turn-off Fall Time | | | 20 | 45 | ns |

Typical Characteristics

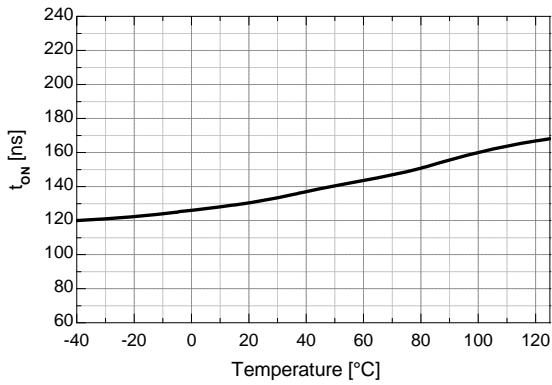


Figure 4. Turn-on Propagation Delay vs. Temperature

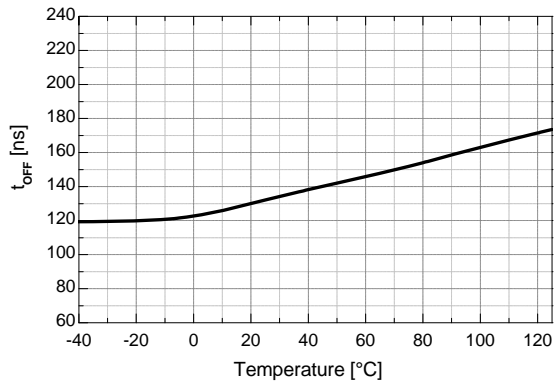


Figure 5. Turn-off Propagation Delay vs. Temperature

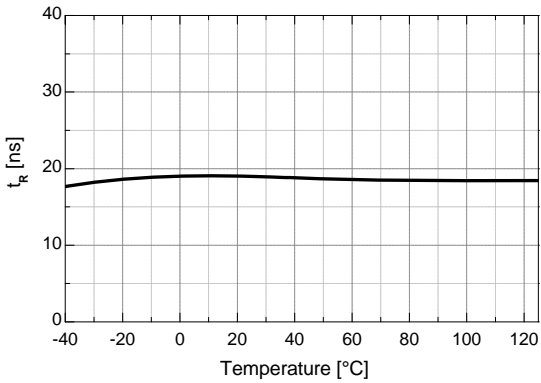


Figure 6. Turn-on Rise Time vs. Temperature

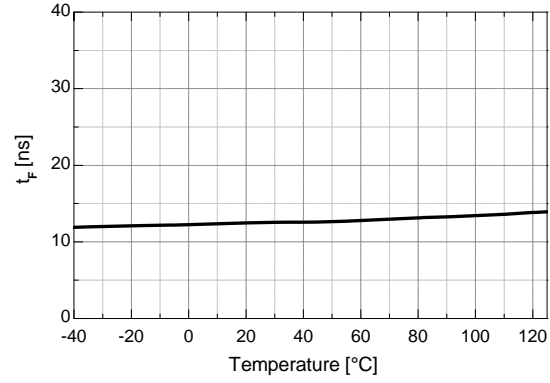


Figure 7. Turn-off Fall Time vs. Temperature

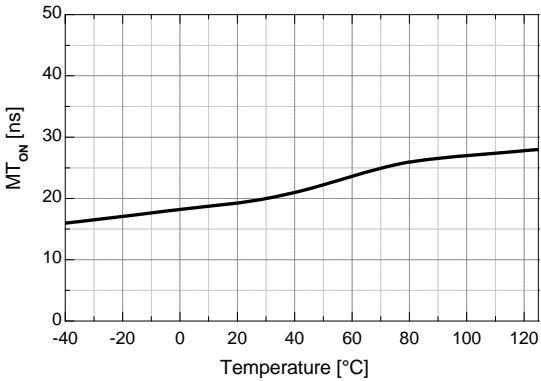


Figure 8. Turn-on Delay Matching vs. Temperature

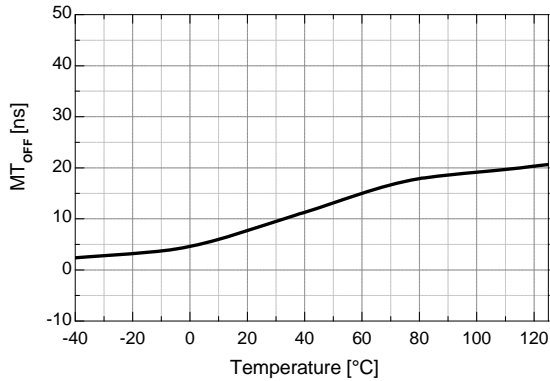


Figure 9. Turn-off Delay Matching vs. Temperature

Typical Characteristics (Continued)

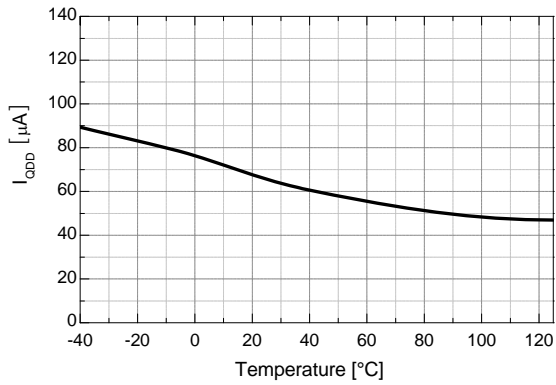


Figure 10. Quiescent V_{DD} Supply Current vs. Temperature

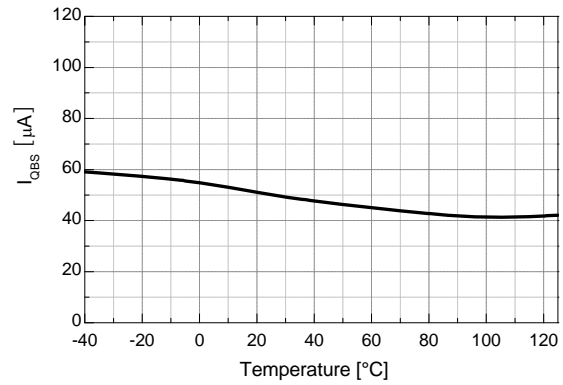


Figure 11. Quiescent V_{BS} Supply Current vs. Temperature

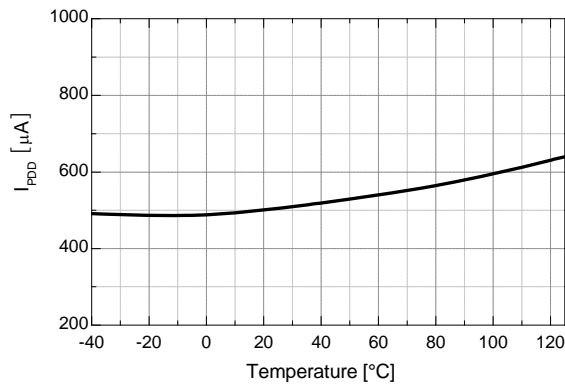


Figure 12. Operating V_{DD} Supply Current vs. Temperature

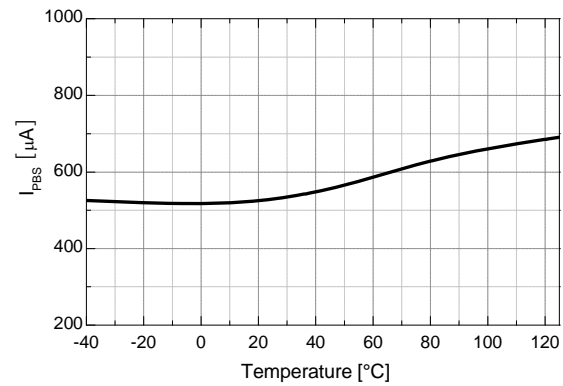


Figure 13. Operating V_{BS} Supply Current vs. Temperature

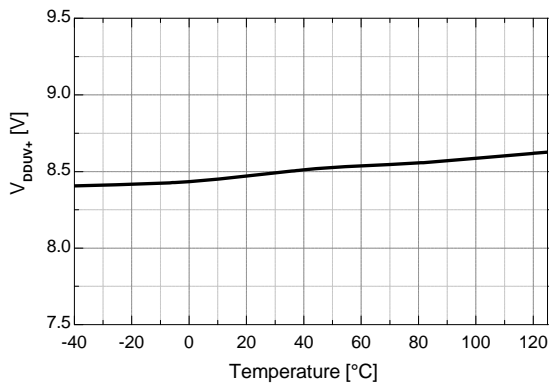


Figure 14. V_{DD} UVLO+ vs. Temperature

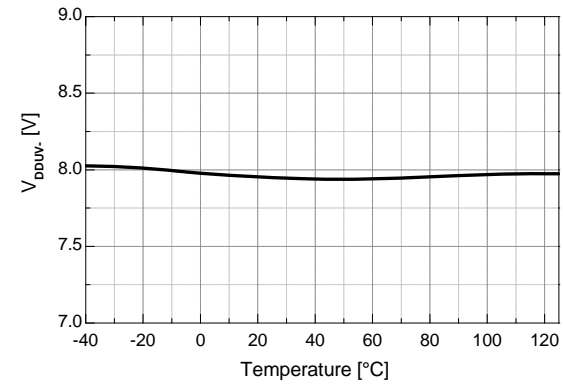


Figure 15. V_{DD} UVLO- vs. Temperature

Typical Characteristics (Continued)

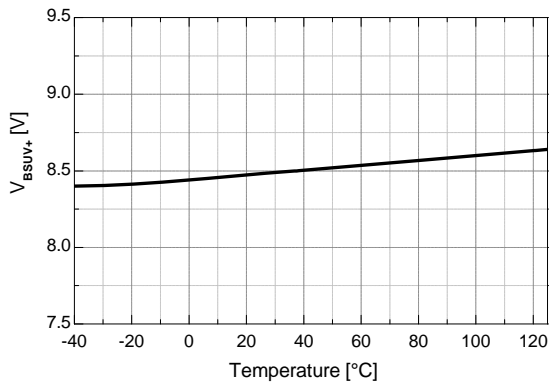


Figure 16. V_{BS} UVLO+ vs. Temperature

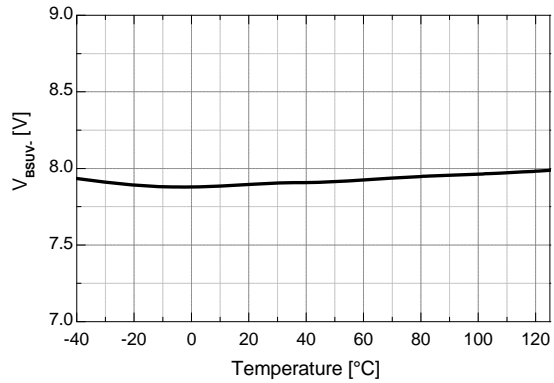


Figure 17. V_{BS} UVLO- vs. Temperature

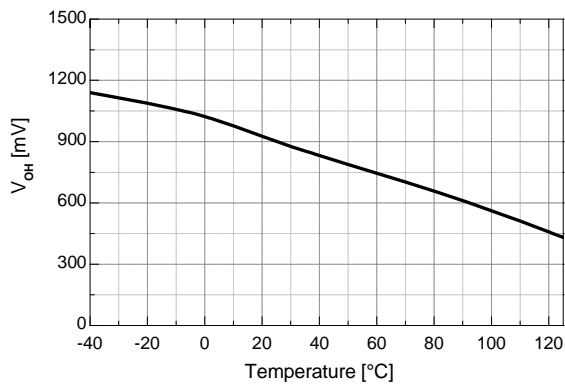


Figure 18. High-Level Output Voltage vs. Temperature

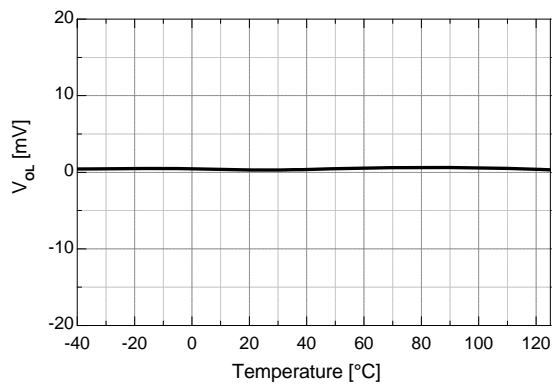


Figure 19. Low-Level Output Voltage vs. Temperature

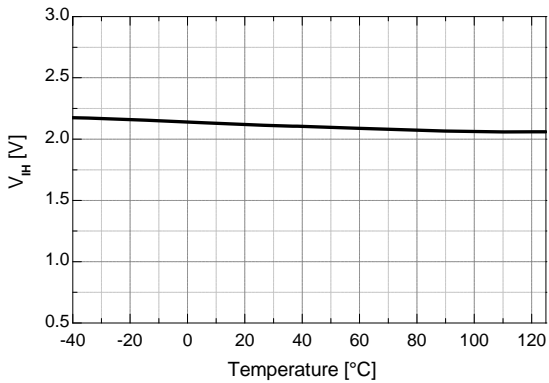


Figure 20. Logic High Input Voltage vs. Temperature

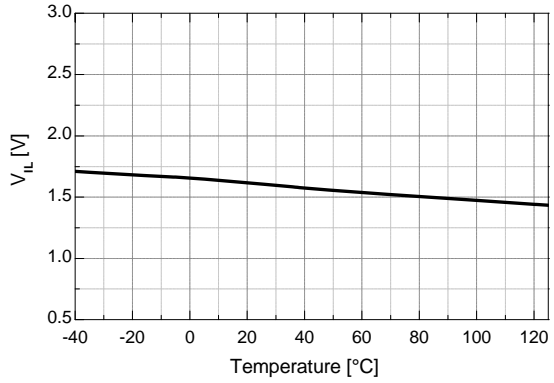


Figure 21. Logic Low Input Voltage vs. Temperature

Typical Characteristics (Continued)

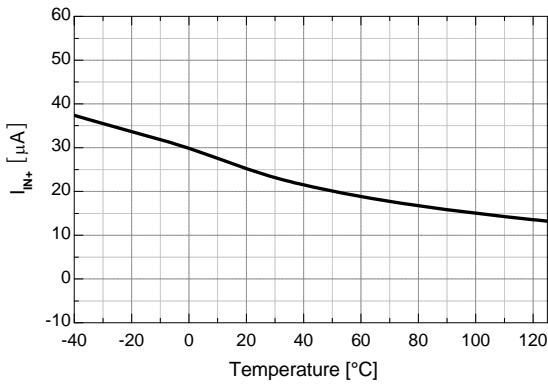


Figure 22. Logic Input High Bias Current vs. Temperature

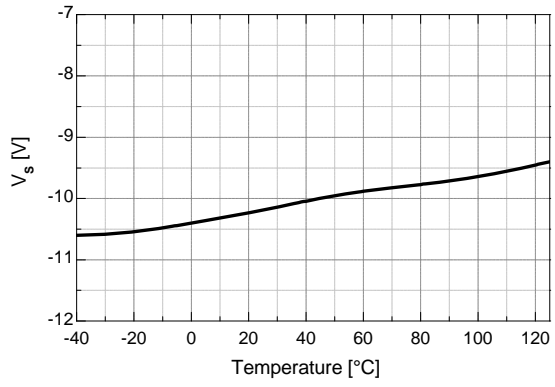


Figure 23. Allowable Negative V_S Voltage vs. Temperature

Switching Time Definitions

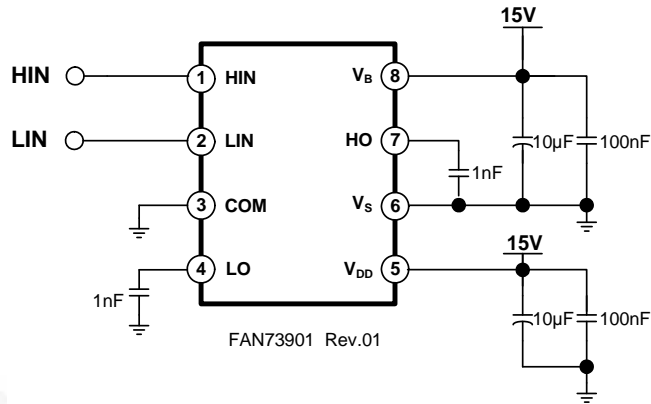


Figure 24. Switching Time Test Circuit

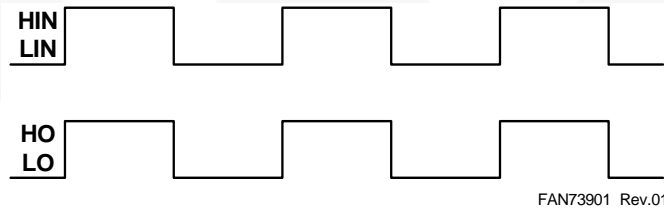


Figure 25. Input / Output Timing Diagram

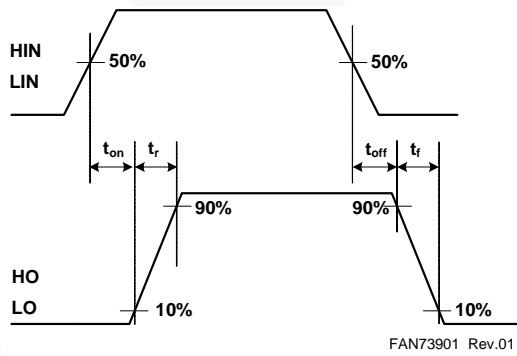


Figure 26. Switching Time Waveform Definitions

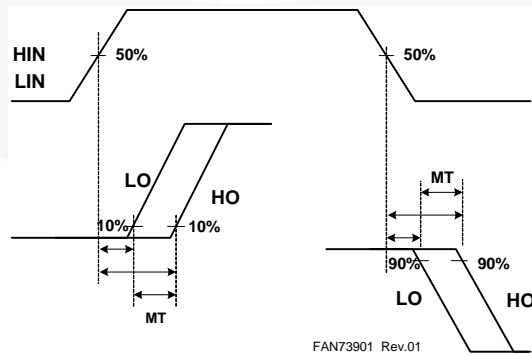
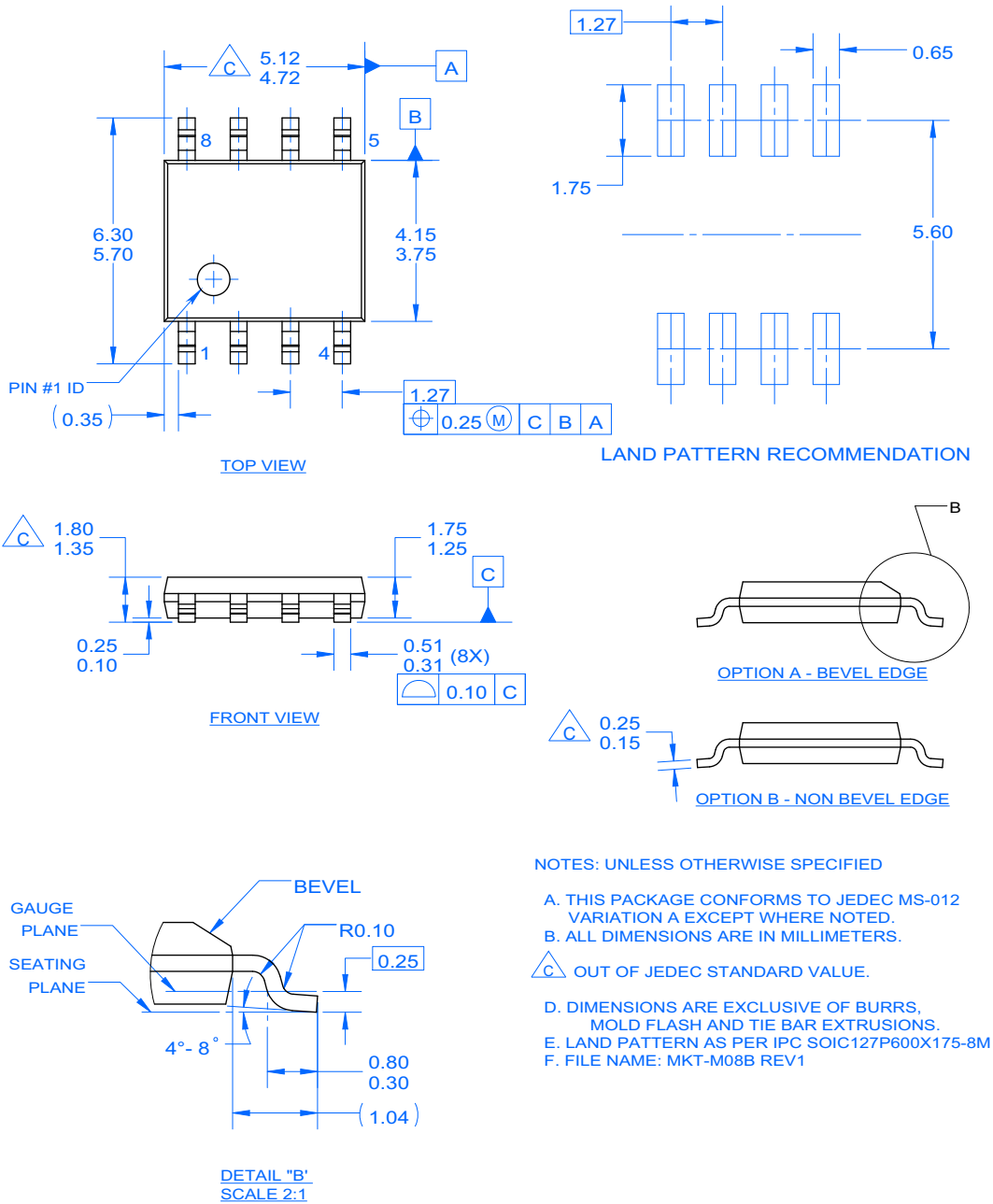


Figure 27. Delay Matching Waveform Definitions

Mechanical Dimensions



- NOTES: UNLESS OTHERWISE SPECIFIED
- A. THIS PACKAGE CONFORMS TO JEDEC MS-012 VARIATION A EXCEPT WHERE NOTED.
 - B. ALL DIMENSIONS ARE IN MILLIMETERS.
 - C. OUT OF JEDEC STANDARD VALUE.
 - D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
 - E. LAND PATTERN AS PER IPC SOIC127P600X175-8M
 - F. FILE NAME: MKT-M08B REV1

Figure 28. 8-Lead Small Outline Package (SOP)

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