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# FAN73711

## High-Current, High-Side Gate Drive IC

### Features

- Floating Channel for Bootstrap Operation to +600 V
- 4 A / 4 A Sourcing/Sinking Current Driving Capability
- Common-Mode dv/dt Noise Canceling Circuit
- 3.3 V and 5 V Input Logic Compatible
- Output In-phase with Input Signal
- Under-Voltage Lockout for  $V_{BS}$
- Built-In Shunt Regulator on  $V_{DD}$  and  $V_{BS}$
- 8-Lead, Small Outline Package (SOP)

### Applications

- High-Speed Gate Driver
- Sustain Switch Driver in PDP Application
- Energy Recovery Circuit Switch Driver in PDP Application
- High-Power Buck Converter
- Motor Drive Inverter

### Description

The FAN73711 is a monolithic high-side gate-drive IC that can drive high-speed MOSFETs and IGBTs operating 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  $V_{BS}$  is lower than the specified threshold voltage.

The high-current and low-output voltage-drop feature makes this device suitable as a sustain and energy-recovery circuit switch driver in plasma display panel, motor drive inverter, switching power supply, and high-power DC-DC converter applications.

8-SOP



### Ordering Information

| Part Number | Operating Temperature Range | Package | Packing Method |
|-------------|-----------------------------|---------|----------------|
| FAN73711MX  | 40°C ~ 125°C                | 8-SOP   | Tape and Reel  |

## Typical Application Diagrams

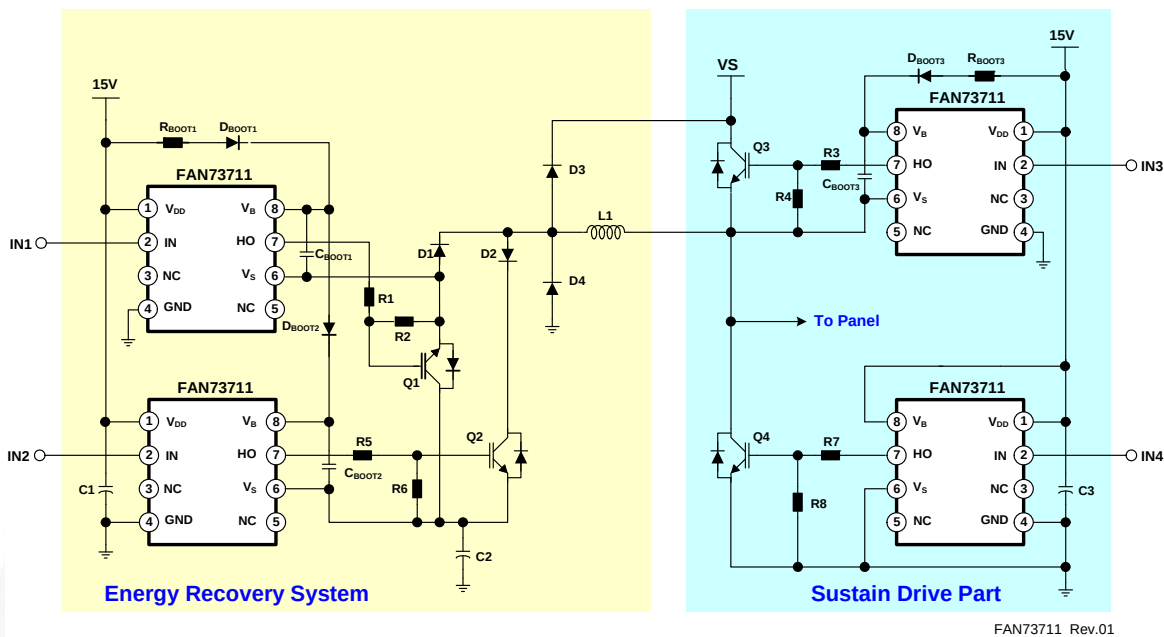


Figure 1. Floated Bi-Directional Switch and Half-Bridge Driver: PDP Application

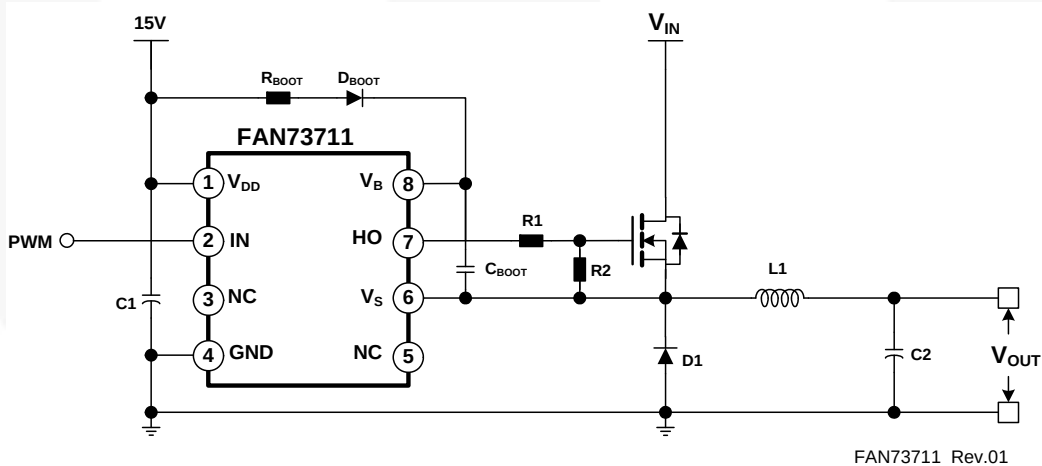


Figure 2. Step-Down (Buck) DC-DC Converter Application



## 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 Offset Voltage <sup>(1)</sup> | $V_B - V_{SHUNT}$ | $V_B + 0.3$    | V                    |
| $V_B$         | High-Side Floating Supply Voltage                | -0.3              | 625.0          | V                    |
| $V_{HO}$      | High-Side Floating Output Voltage                | $V_S - 0.3$       | $V_B + 0.3$    | V                    |
| $V_{DD}$      | Low-Side and Logic Supply Voltage <sup>(1)</sup> | -0.3              | $V_{SHUNT}$    | V                    |
| $V_{IN}$      | Logic Input Voltage                              | -0.3              | $V_{DD} + 0.3$ | V                    |
| $dV_S/dt$     | Allowable Offset Voltage Slew Rate               |                   | $\pm 50$       | V/ns                 |
| $P_D$         | Power Dissipation <sup>(2,3,4)</sup>             |                   | 0.625          | W                    |
| $\theta_{JA}$ | Thermal Resistance                               |                   | 200            | $^{\circ}\text{C/W}$ |
| $T_J$         | Junction Temperature                             | -55               | +150           | $^{\circ}\text{C}$   |
| $T_{STG}$     | Storage Temperature                              | -55               | +150           | $^{\circ}\text{C}$   |

### Notes:

1. This IC contains a shunt regulator on  $V_{DD}$  and  $V_{BS}$ . This supply pin should not be driven by a low-impedance voltage source greater than the  $V_{SHUNT}$  specified in the Electrical Characteristics section.
2. Mounted on 76.2 x 114.3 x 1.6 mm PCB (FR-4 glass epoxy material).
3. Refer to the following standards:  
JESD51-2: Integral circuits thermal test method environmental conditions, natural convection, and  
JESD51-3: Low effective thermal conductivity test board for leaded surface-mount packages.
4. Do not exceed power dissipation ( $P_D$ ) 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                  |
| $V_{IN}$ | Logic Input Voltage                      | GND          | $V_{DD}$   | V                  |
| $V_{DD}$ | Supply Voltage                           | 10           | 20         | V                  |
| $T_A$    | Operating Ambient Temperature            | -40          | +125       | $^{\circ}\text{C}$ |

## Electrical Characteristics

$V_{BIAS}(V_{DD}, V_{BS})=15.0\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise specified. The  $V_{IN}$  and  $I_{IN}$  parameters are referenced to GND. The  $V_O$  and  $I_O$  parameters are relative to  $V_S$  and are applicable to the respective output HO.

| Symbol                             | Characteristics                                                      | Test Condition                                                          | Min. | Typ. | Max. | Unit             |
|------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------|------|------|------|------------------|
| <b>Power Supply Section</b>        |                                                                      |                                                                         |      |      |      |                  |
| $I_{QDD}$                          | Quiescent $V_{DD}$ Supply Current                                    | $V_{IN}=0\text{ V or }5\text{ V}$                                       |      | 25   | 70   | $\mu\text{A}$    |
| $I_{PDD}$                          | Operating $V_{DD}$ Supply Current                                    | $f_{IN}=20\text{ kHz, No Load}$                                         |      | 35   | 100  | $\mu\text{A}$    |
| <b>Bootstrapped Supply Section</b> |                                                                      |                                                                         |      |      |      |                  |
| $V_{BSUV+}$                        | $V_{BS}$ Supply Under-Voltage Positive-Going Threshold Voltage       | $V_{BS}=\text{Sweep}$                                                   | 8.0  | 9.0  | 10.0 | V                |
| $V_{BSUV-}$                        | $V_{BS}$ Supply Under-Voltage Negative-Going Threshold Voltage       | $V_{BS}=\text{Sweep}$                                                   | 7.3  | 8.3  | 9.3  | V                |
| $V_{BSHYS}$                        | $V_{BS}$ Supply Under-Voltage Lockout Hysteresis Voltage             | $V_{BS}=\text{Sweep}$                                                   |      | 0.7  |      | V                |
| $I_{LK}$                           | Offset Supply Leakage Current                                        | $V_B=V_S=625\text{ V}$                                                  |      |      | 10   | $\mu\text{A}$    |
| $I_{QBS}$                          | Quiescent $V_{BS}$ Supply Current                                    | $V_{IN}=0\text{V or }5\text{ V}$                                        |      | 60   | 120  | $\mu\text{A}$    |
| $I_{PBS}$                          | Operating $V_{BS}$ Supply Current                                    | $C_{LOAD}=1000\text{ pF, }f_{IN}=20\text{ kHz, rms Value}$              |      | 470  | 800  | $\mu\text{A}$    |
| <b>Shunt Regulator Section</b>     |                                                                      |                                                                         |      |      |      |                  |
| $V_{SHUNT}$                        | $V_{DD}$ and $V_{BS}$ Shunt Regulator Clamping Voltage               | $V_{DD}=\text{Sweep or }V_{BS}=\text{Sweep}$<br>$I_{SHUNT}=5\text{ mA}$ | 21   | 23   | 25   | V                |
| <b>Input Logic Section</b>         |                                                                      |                                                                         |      |      |      |                  |
| $V_{IH}$                           | Logic "1" Input Voltage                                              |                                                                         | 2.5  |      |      | V                |
| $V_{IL}$                           | Logic "0" Input Voltage                                              |                                                                         |      |      | 0.8  | V                |
| $I_{IN+}$                          | Logic Input High Bias Current                                        | $V_{IN}=5\text{ V}$                                                     |      | 40   | 65   | $\mu\text{A}$    |
| $I_{IN-}$                          | Logic Input Low Bias Current                                         | $V_{IN}=0\text{ V}$                                                     |      |      | 2    | $\mu\text{A}$    |
| $R_{IN}$                           | Input Pull-Down Resistance                                           |                                                                         | 90   | 110  |      | $\text{k}\Omega$ |
| <b>Gate Driver Output Section</b>  |                                                                      |                                                                         |      |      |      |                  |
| $V_{OH}$                           | High Level Output Voltage ( $V_{BIAS} - V_O$ )                       | No Load                                                                 |      |      | 1.2  | V                |
| $V_{OL}$                           | Low Level Output Voltage                                             | No Load                                                                 |      |      | 30   | mV               |
| $I_{O+}$                           | Output High, Short-Circuit Pulsed Current <sup>(5)</sup>             | $V_{HO}=0\text{ V, }V_{IN}=5\text{ V, }PW \leq 10\text{ }\mu\text{s}$   | 3    | 4    |      | A                |
| $I_{O-}$                           | Output Low, Short-Circuit Pulsed Current <sup>(5)</sup>              | $V_{HO}=15\text{ V, }V_{IN}=0\text{ V, }PW \leq 10\text{ }\mu\text{s}$  | 3    | 4    |      | A                |
| $V_S$                              | Allowable Negative $V_S$ Pin Voltage for IN Signal Propagation to HO |                                                                         |      | -9.8 | -7.0 | V                |

### Note:

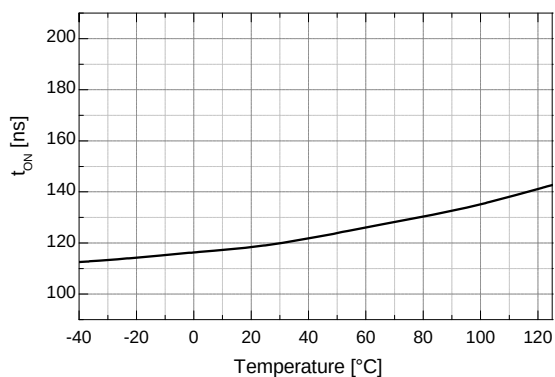
5. These parameters guaranteed by design.

## Dynamic Electrical Characteristics

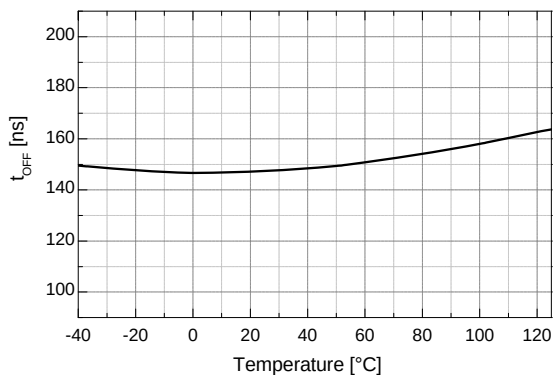
$V_{DD}=V_{BS}=15\text{ V}$ ,  $\text{GND}=0\text{ V}$ ,  $C_{LOAD}=1000\text{ pF}$ ,  $T_A=25^\circ\text{C}$ , unless otherwise specified.

| Symbol    | Parameter                  | Conditions       | Min. | Typ. | Max. | Unit |
|-----------|----------------------------|------------------|------|------|------|------|
| $t_{on}$  | Turn-On Propagation Delay  | $V_S=0\text{ V}$ |      | 150  | 210  | ns   |
| $t_{off}$ | Turn-Off Propagation Delay | $V_S=0\text{ V}$ |      | 150  | 210  | ns   |
| $t_r$     | Turn-On Rise Time          |                  |      | 25   | 50   | ns   |
| $t_f$     | Turn-Off Fall Time         |                  |      | 15   | 40   | ns   |

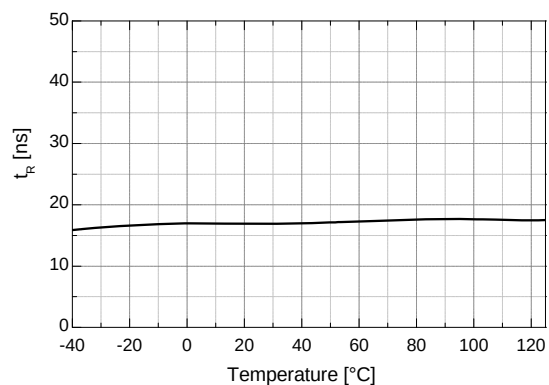
## Typical Characteristics



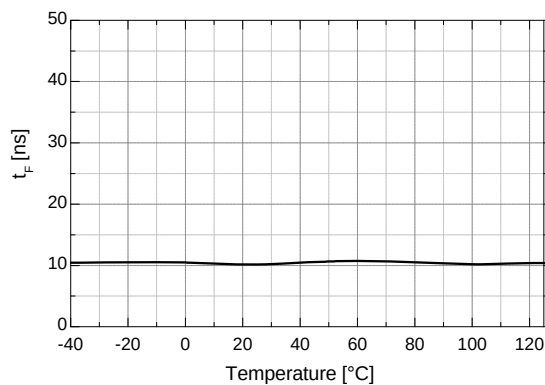
**Figure 5. Turn-On Propagation Delay vs. Temperature**



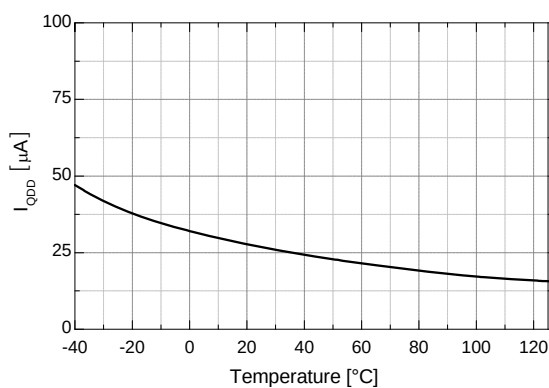
**Figure 6. Turn-Off Propagation Delay vs. Temperature**



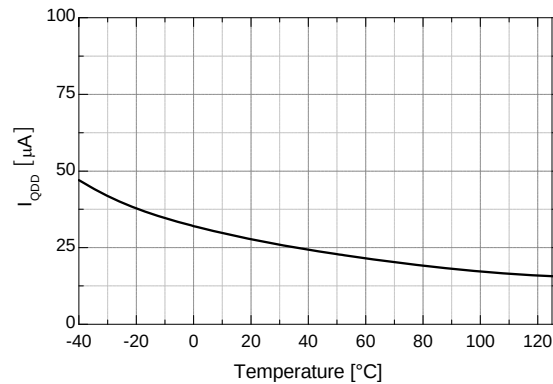
**Figure 7. Turn-On Rise Time vs. Temperature**



**Figure 8. Turn-Off Fall Time vs. Temperature**



**Figure 9. Quiescent  $V_{DD}$  Supply Current vs. Temperature**



**Figure 10. Quiescent  $V_{BS}$  Supply Current vs. Temperature**

## Typical Characteristics (Continued)

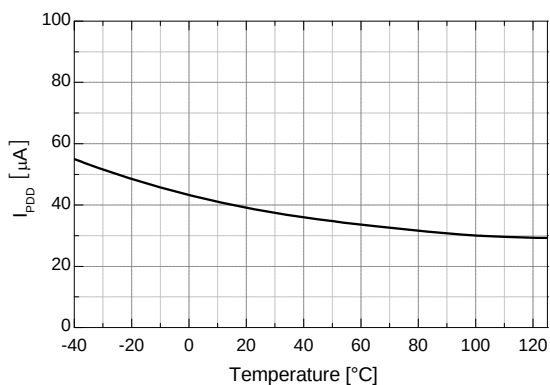
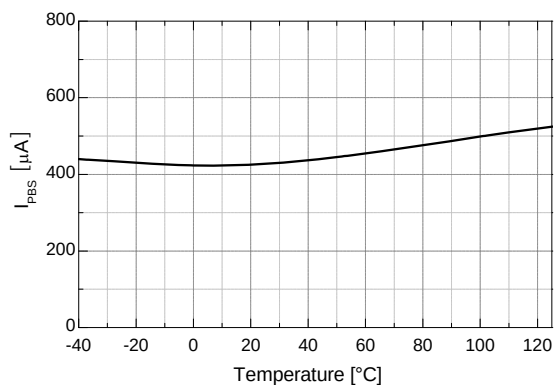
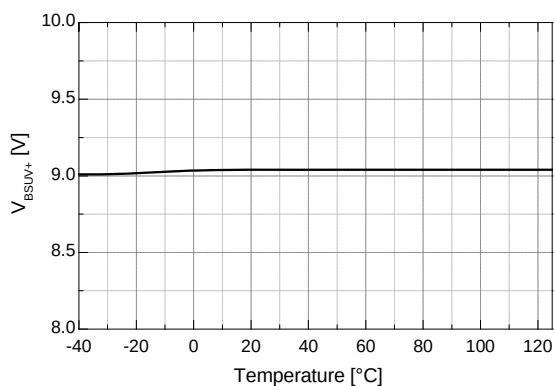
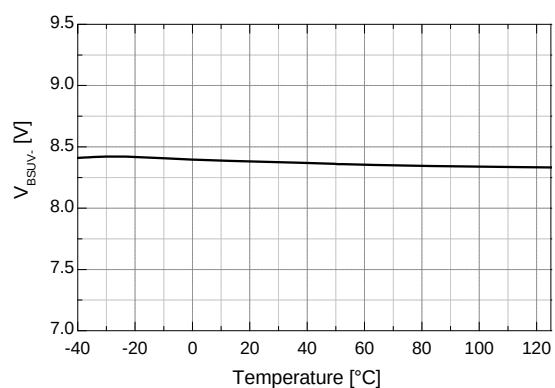
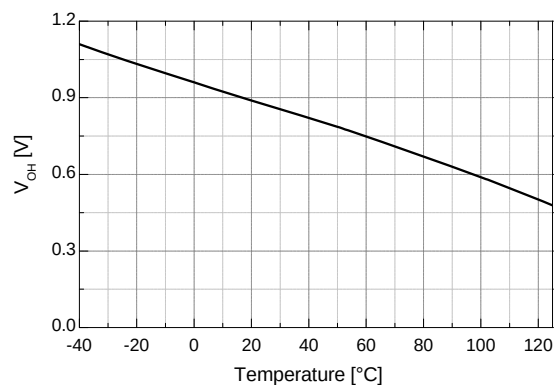
Figure 11. Operating  $V_{DD}$  Supply Current vs. TemperatureFigure 12. Operating  $V_{BS}$  Supply Current vs. TemperatureFigure 13.  $V_{BS}$  UVLO+ vs. TemperatureFigure 14.  $V_{BS}$  UVLO- vs. Temperature

Figure 15. High-Level Output Voltage vs. Temperature

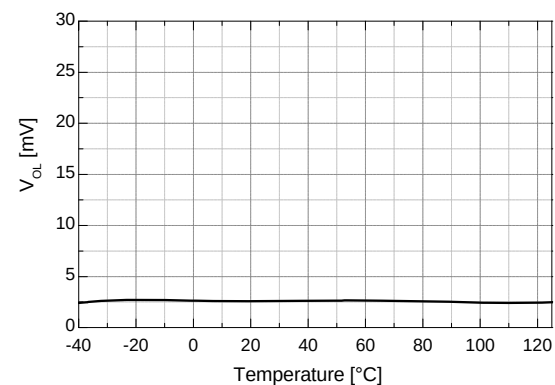
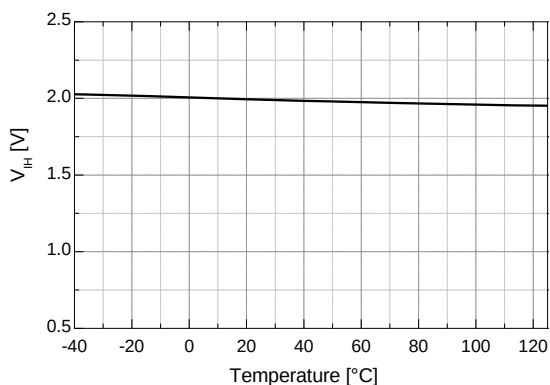


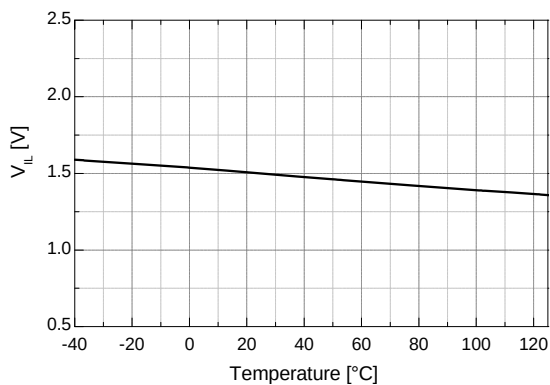
Figure 16. Low-Level Output Voltage vs. Temperature



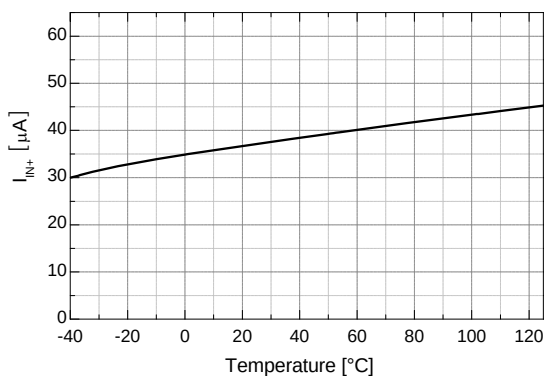
## Typical Characteristics (Continued)



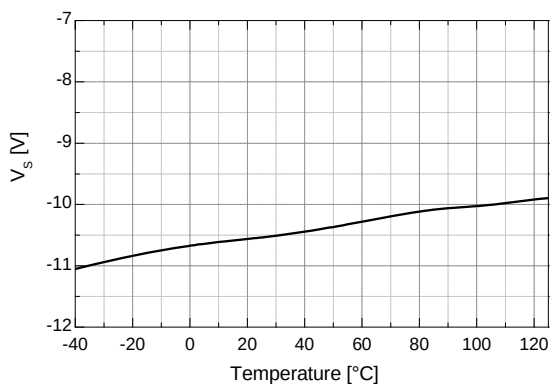
**Figure 17. Logic High Input Voltage vs. Temperature**



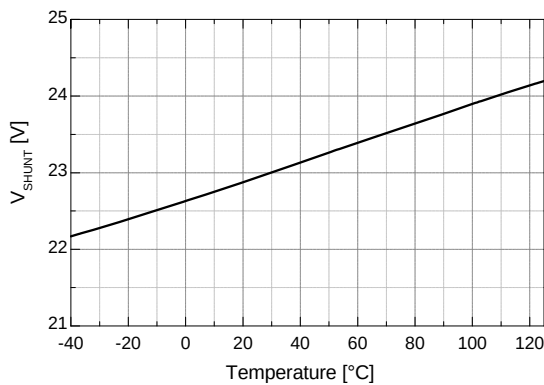
**Figure 18. Logic Low Input Voltage vs. Temperature**



**Figure 19. Logic Input High Bias Current vs. Temperature**



**Figure 20. Allowable Negative V<sub>S</sub> Voltage vs. Temperature**



**Figure 21. Shunt Regulator Clamping Voltage vs. Temperature**

## Switching Time Definitions

### Timing Diagram

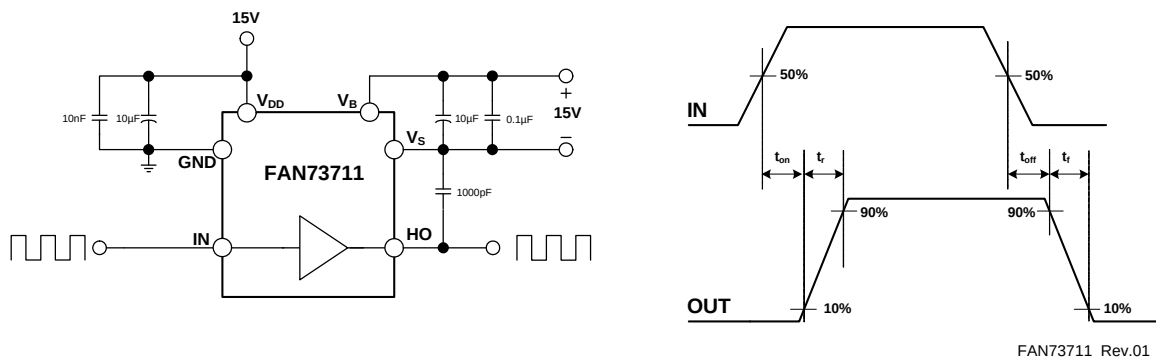
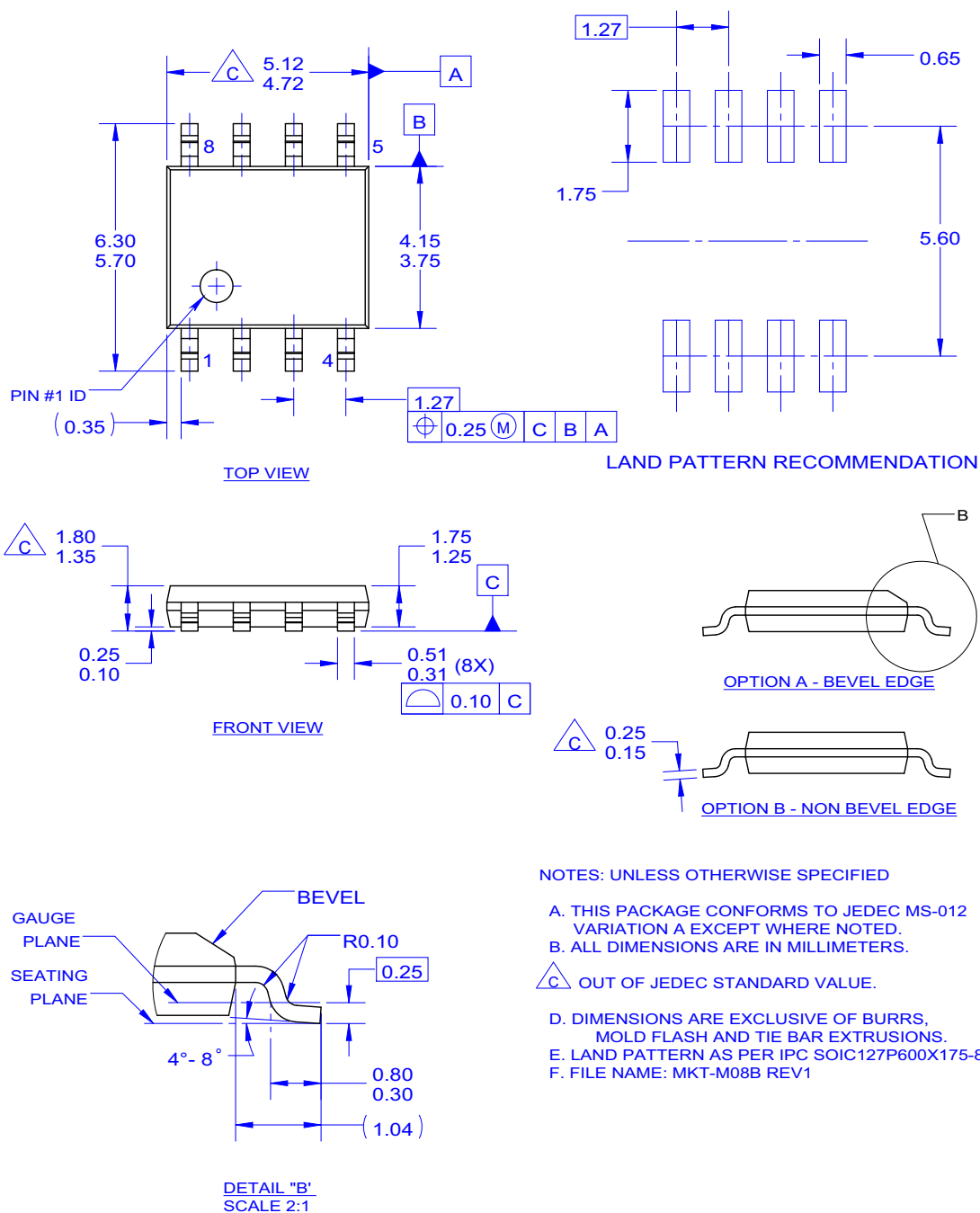


Figure 22. Switching Time Test Circuit and Waveform Definitions

## Package Dimensions



**Figure 23. 8-Lead Small Outline Package (SOP)**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

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|-----------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 2Cool™                                                                            | FPS™                                           |  | Sync-Lock™                                                                          |
| AccuPower™                                                                        | F-PFS™                                         | PowerTrench®                                                                      | SYSTEM GENERAL®                                                                     |
| AX-CAP®*                                                                          | FRFET®                                         | PowerXS™                                                                          | TinyBoost™                                                                          |
| BitSiC™                                                                           | Global Power Resource™                         | Programmable Active Droop™                                                        | TinyBuck™                                                                           |
| Build it Now™                                                                     | GreenBridge™                                   | QFET®                                                                             | TinyCalc™                                                                           |
| CorePLUS™                                                                         | Green FPS™                                     | QS™                                                                               | TinyLogic®                                                                          |
| CorePOWER™                                                                        | Green FPS™ e-Series™                           | Quiet Series™                                                                     | TINYOPTO™                                                                           |
| CROSSVOLT™                                                                        | Gmax™                                          | RapidConfigure™                                                                   | TinyPower™                                                                          |
| CTL™                                                                              | GTO™                                           |  | TinyPWM™                                                                            |
| Current Transfer Logic™                                                           | IntelliMAX™                                    | Saving our world, 1mW/W/kW at a time™                                             | TinyWire™                                                                           |
| DEUXPEED®                                                                         | ISOPLANAR™                                     | SignalWise™                                                                       | TranSiC™                                                                            |
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| EcoSPARK®                                                                         | MegaBuck™                                      | SMART START™                                                                      | TRUECURRENT®*                                                                       |
| EfficientMax™                                                                     | MICROCOUPLER™                                  | Solutions for Your Success™                                                       | µSerDes™                                                                            |
| ESBC™                                                                             | MicroFET™                                      | SPM®                                                                              |  |
|  | MicroPak™                                      | STEALTH™                                                                          | UHC®                                                                                |
| Fairchild®                                                                        | MicroPak2™                                     | SuperFET®                                                                         | Ultra FRFET™                                                                        |
| Fairchild Semiconductor®                                                          | MillerDrive™                                   | SuperSOT™-3                                                                       | UniFET™                                                                             |
| FACT Quiet Series™                                                                | MotionMax™                                     | SuperSOT™-6                                                                       | VCX™                                                                                |
| FACT®                                                                             | mWSaver™                                       | SuperSOT™-8                                                                       | VisualMax™                                                                          |
| FAST®                                                                             | OptoHiT™                                       | SupreMOS®                                                                         | VoltagePlus™                                                                        |
| FastvCore™                                                                        | OPTOLOGIC®                                     | SyncFET™                                                                          | XS™                                                                                 |
| FETBench™                                                                         | OPTOPLANAR®                                    |                                                                                   |                                                                                     |

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| Datasheet Identification | Product Status        | Definition                                                                                                                                                                                          |
|--------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                       |
| Preliminary              | First Production      | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production       | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.                                               |
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