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September 2015

FAN73611

Single-Channel High-Side Gate Drive IC

Features

- Floating Channel for Bootstrap Operation to +600V
- 250 mA/500 mA 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_{DD} and V_{BS}
- 8-Lead Small Outline Package (SOP)

The FAN73611 is a monolithic high-side gate drive IC that can drive MOSFETs and IGBTs operating up to +600 V. 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 circuits prevents malfunction when V_{DD} or V_{BS} is lower than the specified threshold voltage. The output drivers typically source/sink 250 mA/500 mA; respectively, which is suitable for Plasma Display Panel (PDP) application, motor drive inverter, and switching mode power supply applications.

Applications

- Electronic Ballast
- Switching-Mode Power Supply (SMPS)

8-SOP



Related Application Notes

- [AN-6076 — Design and Application Guide of Bootstrap Circuit for High-Voltage Gate-Drive IC](#)
- [AN-9052 — Design Guide for Selection of Bootstrap Components](#)
- [AN-8102 — Recommendations to Avoid Short Pulse Width Issues in HVIC Gate Driver Applications](#)

Description

Ordering Information

Part Number	Package	Operating Temperature	Packing Method	Description
FAN73611MX ⁽¹⁾	8 SOP	-40°C ~ 125°C	Tape & Reel	Lighting Application

Note:

1. This device passed wave soldering test by JESD22A-111.

Typical Application Diagrams

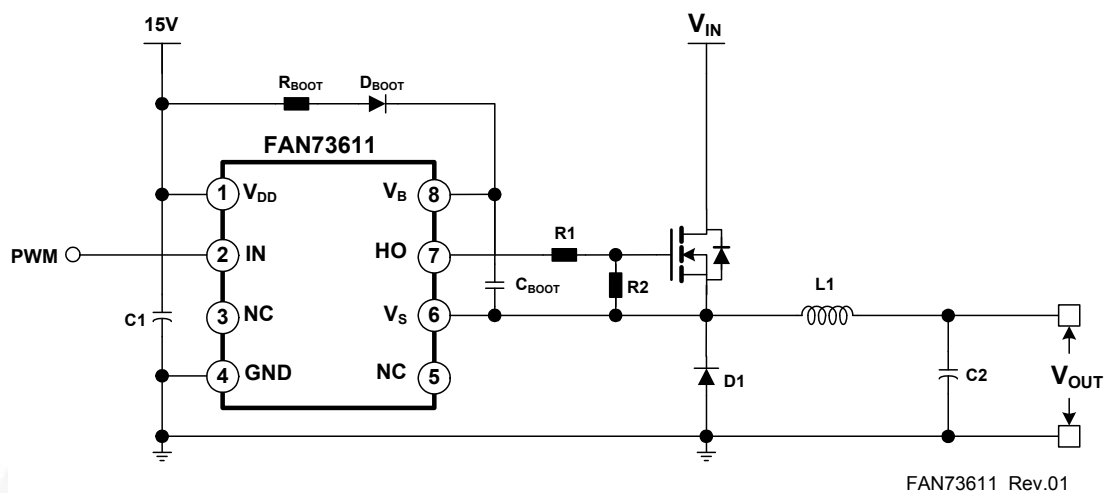


Figure 1. Step-Down (Buck) DC-DC Converter Application

Internal Block Diagram

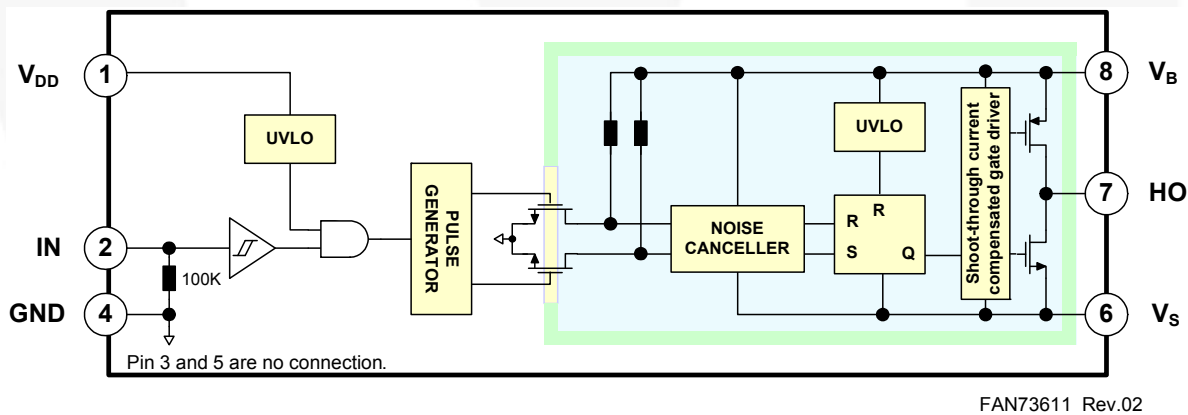


Figure 2. Functional Block Diagram

Pin Configuration

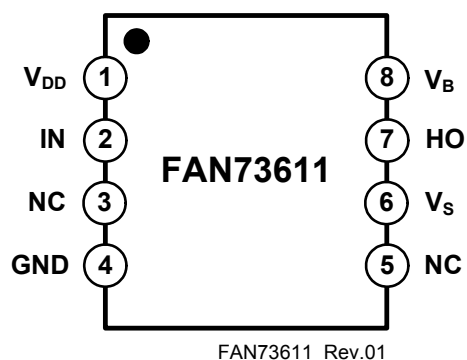


Figure 3. Pin Configuration (Top View)

Pin Definitions

Pin #	Name	Description
1	V _{DD}	Supply Voltage
2	IN	Logic Input for High-Side Gate Driver Output
3	NC	No Connection
4	GND	Ground
5	NC	No Connection
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 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	$V_S-0.3$	$V_B+0.3$	V
V_{DD}	Low-Side and Logic Supply Voltage	-0.3	25.0	V
V_{IN}	Logic Input Voltage	-0.3	$V_{DD}+0.3$	V
dV_S/dt	Allowable Offset Voltage Slew Rate		± 50	V/ns
P_D	Power Dissipation ^(2, 3, 4)		0.625	W
θ_{JA}	Thermal Resistance		200	$^{\circ}\text{C}/\text{W}$
T_J	Junction Temperature	-55	+150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature	-55	+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: Integrated circuits thermal test method environmental conditions, natural convection, and
JESD51-3: Low effective thermal conductivity test board for leaded surface mount packages.
- 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

$V_{BIAS}(V_{DD}, V_{BS}) = 15.0\text{ V}$ and $T_A = 25^\circ\text{C}$ 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
Power Supply Section						
I_{QDD}	Quiescent V_{DD} Supply Current	$V_{IN}=0\text{ V}$ or 5 V , $C_{LOAD}=1000\text{ pF}$		80	140	μA
I_{PDD}	Operating V_{DD} Supply Current	$C_{LOAD}=1000\text{ pF}$, $f_{IN}=20\text{ KHz}$, RMS value		80	160	μA
V_{DDUV+} V_{BSUV+}	V_{DD} and V_{BS} Supply Under-Voltage Positive Going Threshold Voltage	$V_{DD}=\text{Sweep}$, $V_{BS}=\text{Sweep}$	7.8	8.8	9.8	V
V_{DDUV-} V_{BSUV-}	V_{DD} and V_{BS} Supply Under-Voltage Negative Going Threshold Voltage	$V_{DD}=\text{Sweep}$, $V_{BS}=\text{Sweep}$	7.3	8.3	9.3	V
V_{DDHYS} V_{BSHYS}	V_{DD} and V_{BS} Supply Under-Voltage Lockout Hysteresis Voltage	$V_{DD}=\text{Sweep}$, $V_{BS}=\text{Sweep}$		0.5		V
I_{LK}	Offset Supply Leakage Current	$V_B=V_S=600\text{ V}$			10	μA
I_{QBS}	Quiescent V_{BS} Supply Current	$V_{IN}=0\text{ V}$ or 5 V , $C_{LOAD}=1000\text{ pF}$		60	100	μA
I_{PBS}	Operating V_{BS} Supply Current	$C_{LOAD}=1000\text{ pF}$, $f_{IN}=20\text{ KHz}$, RMS Value		420	600	μA
Input Logic Section						
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	$V_{IN}=5\text{ V}$		50	75	μA
I_{IN-}	Logic Input Low Bias Current	$V_{IN}=0\text{ V}$			2	μA
R_{IN}	Input Pull-Down Resistance		60	100		$\text{K}\Omega$
Gate Driver Output Section						
V_{OH}	High Level Output Voltage ($V_{BIAS} - V_O$)	No Load			0.1	V
V_{OL}	Low Level Output Voltage	No Load			0.1	V
I_{O+}	Output High, Short-Circuit Pulsed Current	$V_{HO}=0\text{ V}$, $V_{IN}=5\text{ V}$, $PW \leq 10\text{ }\mu\text{s}$	200	250		mA
I_{O-}	Output Low, Short-Circuit Pulsed Current	$V_{HO}=15\text{ V}$, $V_{IN}=0\text{ V}$, $PW \leq 10\text{ }\mu\text{s}$	400	500		mA
V_S	Allowable Negative V_S Pin Voltage for IN Signal Propagation to HO	$V_{BS}=15\text{ V}$		-9.8	-7.0	V

Dynamic Electrical Characteristics

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-On Propagation Delay Time	$V_S=0\text{ V}$	70	120	170	ns
t_{off}	Turn-Off Propagation Delay Time	$V_S=0\text{ V}$	70	120	170	ns
t_r	Turn-On Rise Time			70	140	ns
t_f	Turn-Off Fall Time			30	60	ns

Typical Characteristics

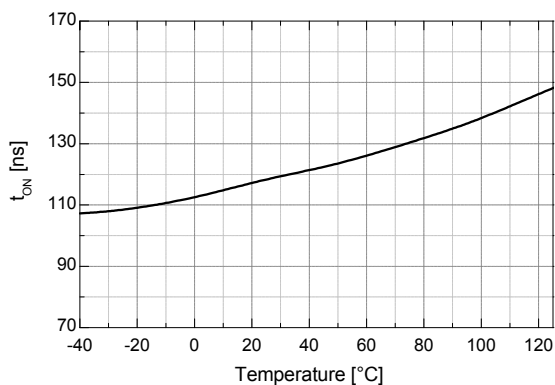


Figure 5. Turn-On Propagation Delay vs. Temperature

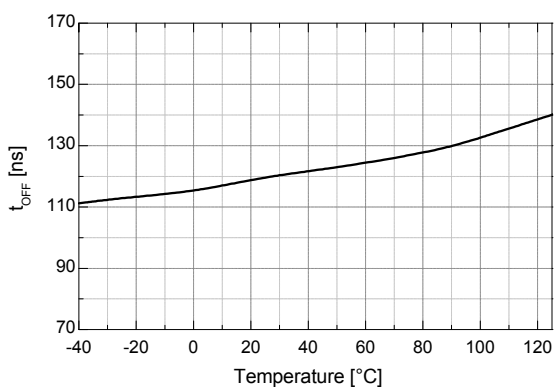


Figure 6. Turn-Off Propagation Delay vs. Temperature

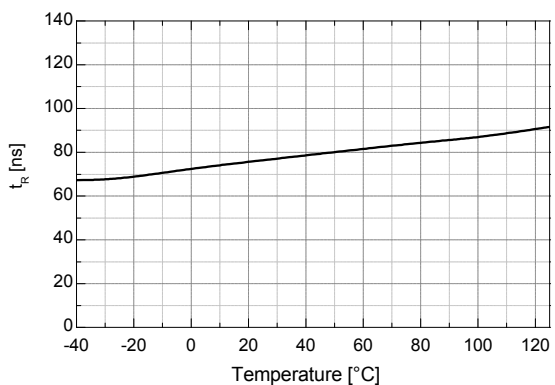


Figure 7. Turn-On Rise Time vs. Temperature

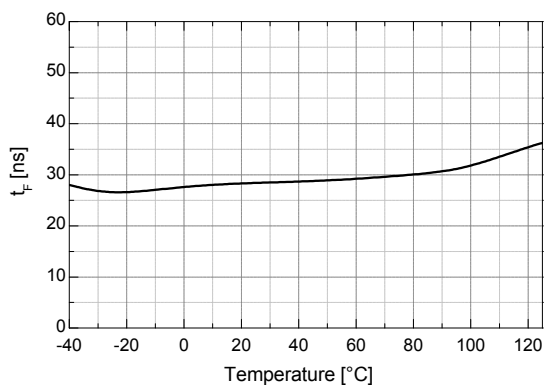


Figure 8. Turn-Off Fall Time vs. Temperature

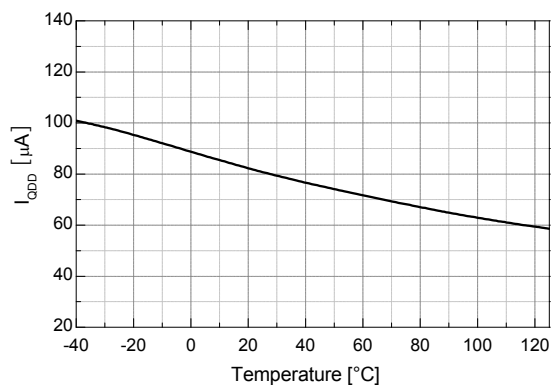


Figure 9. Quiescent V_{DD} Supply Current vs. Temperature

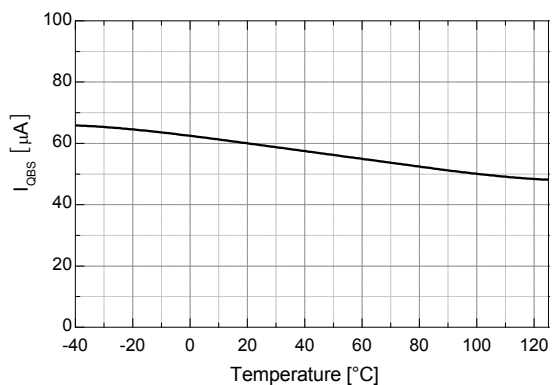


Figure 10. Quiescent V_{BS} Supply Current vs. Temperature

Typical Characteristics (Continued)

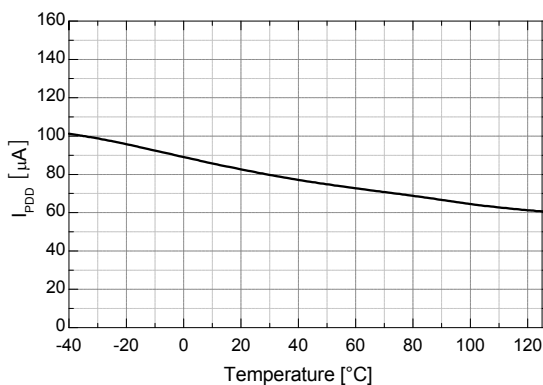


Figure 11. Operating V_{DD} Supply Current vs. Temperature

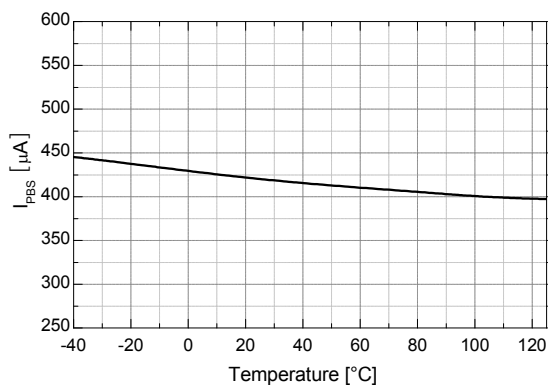


Figure 12. Operating V_{BS} Supply Current vs. Temperature

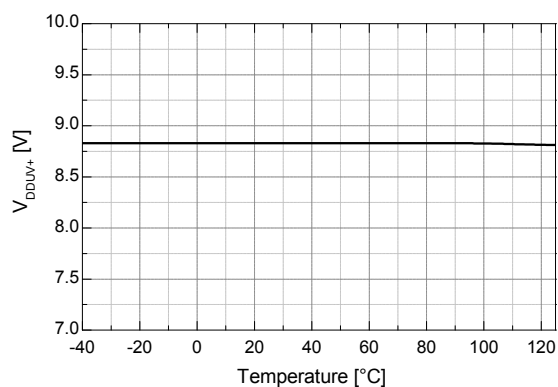


Figure 13. V_{DD} UVLO+ vs. Temperature

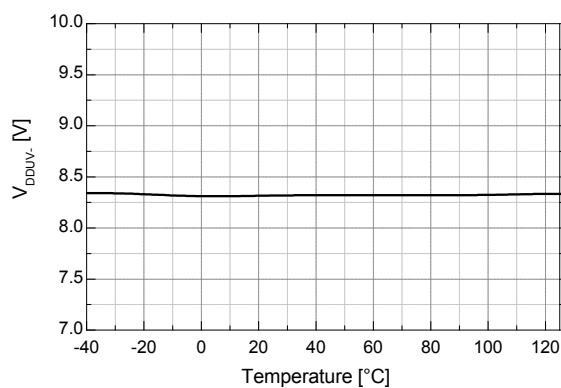


Figure 14. V_{DD} UVLO- vs. Temperature

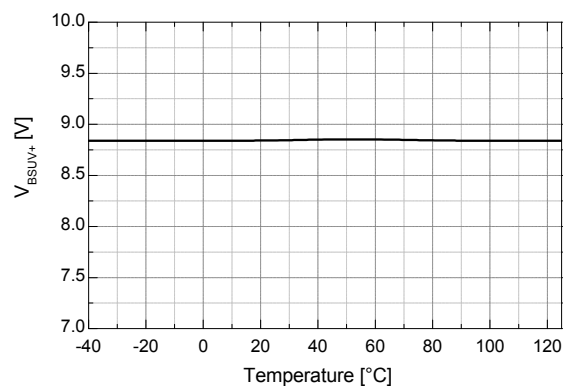


Figure 15. V_{BS} UVLO+ vs. Temperature

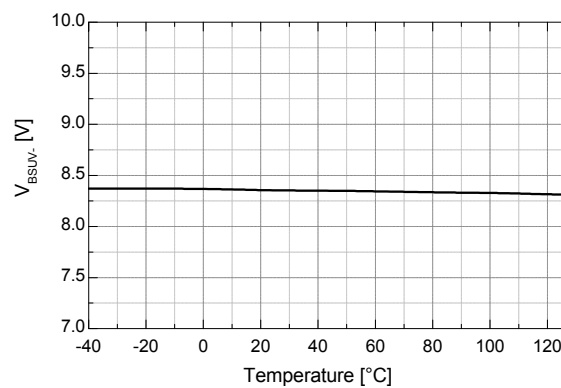


Figure 16. V_{BS} UVLO- vs. Temperature

Typical Characteristics (Continued)

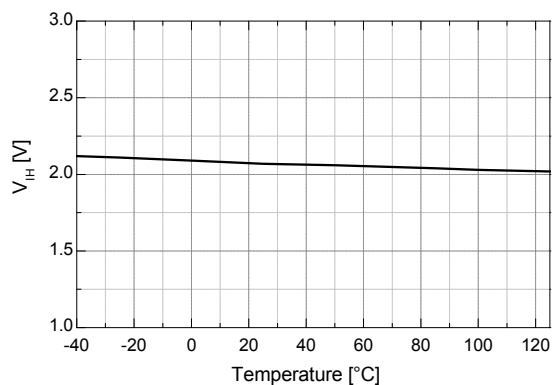


Figure 17. Logic HIGH Input Voltage vs. Temperature

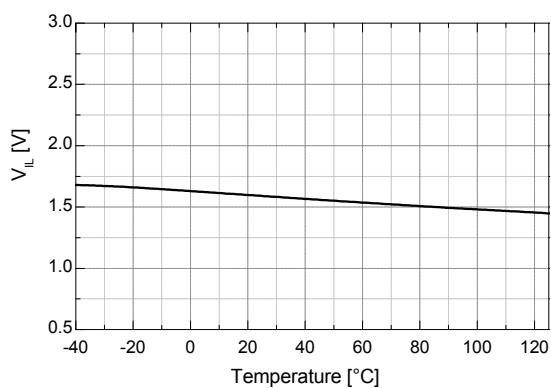


Figure 18. Logic LOW Input Voltage vs. Temperature

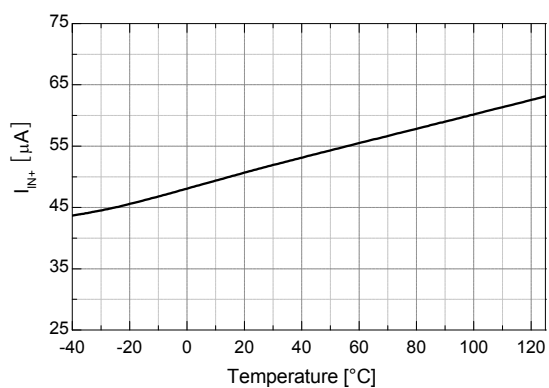


Figure 19. Logic HIGH Input Bias Current vs. Temperature

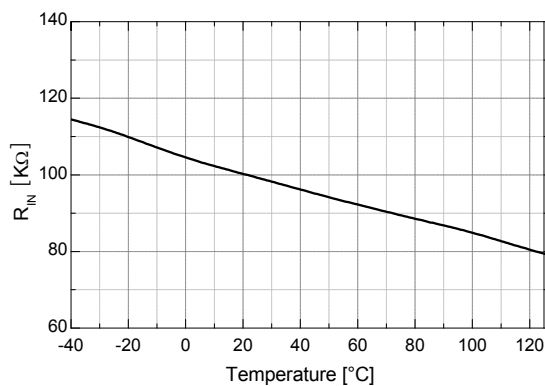


Figure 20. Input Pull-Down Resistance vs. Temperature

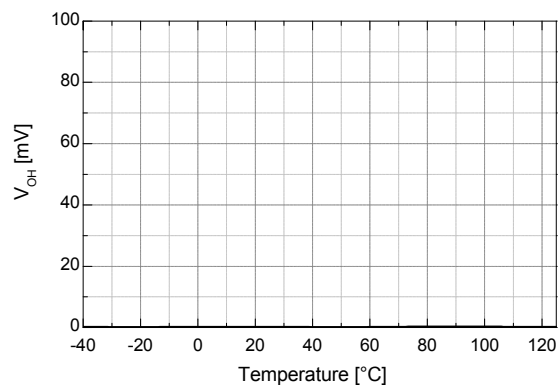


Figure 21. High-Level Output Voltage vs. Temperature

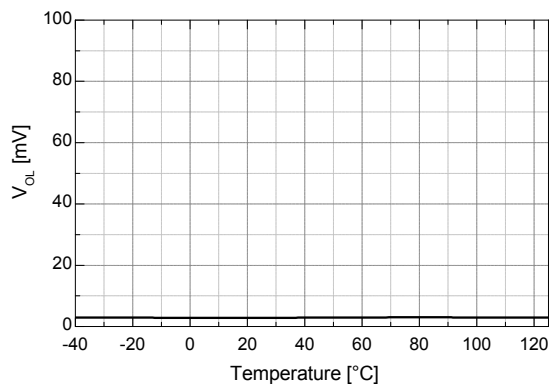


Figure 22. Low-Level Output Voltage vs. Temperature

Typical Characteristics (Continued)

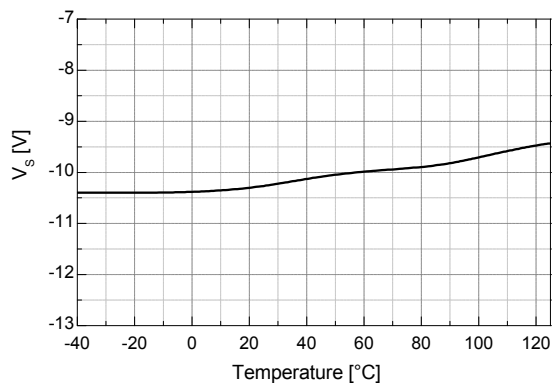


Figure 23. Allowable Negative V_S Voltage vs. Temperature

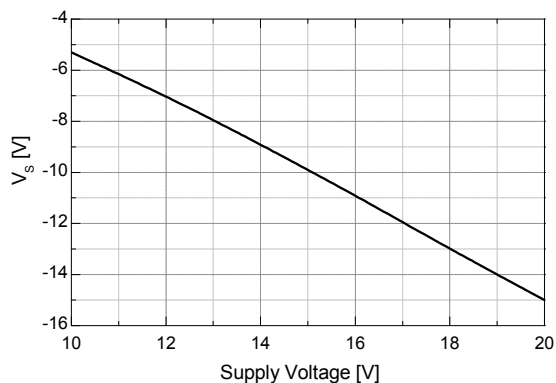


Figure 24. Allowable Negative V_S Voltage vs. Supply Voltage

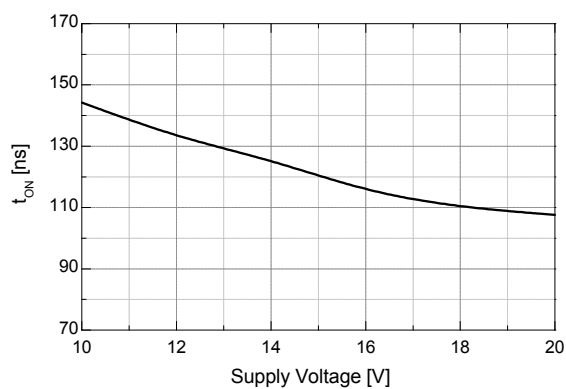


Figure 25. Turn-On Propagation Delay vs. Supply Voltage

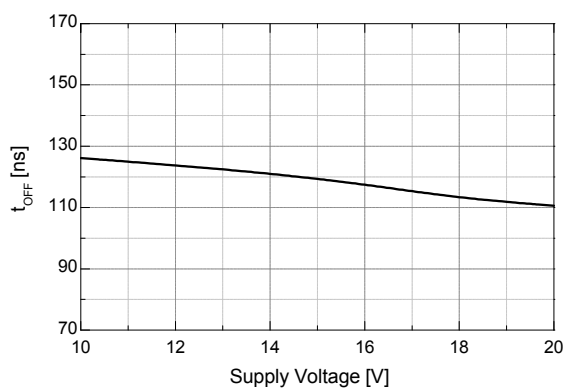


Figure 26. Turn-Off Propagation Delay vs. Supply Voltage

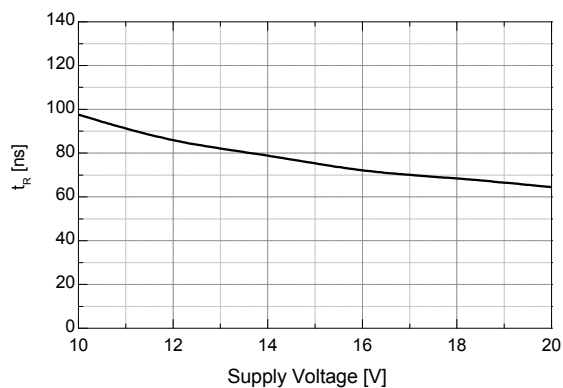


Figure 27. Turn-On Rise Time vs. Supply Voltage

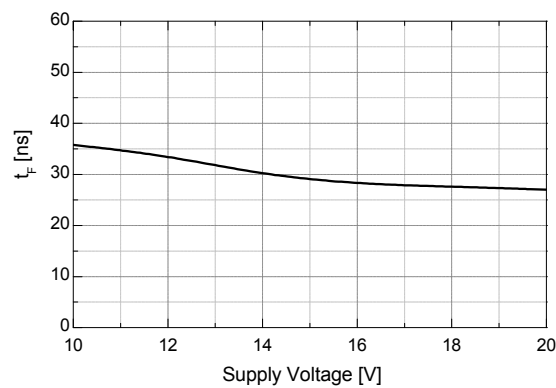


Figure 28. Turn-Off Fall Time vs. Supply Voltage

Typical Characteristics (Continued)

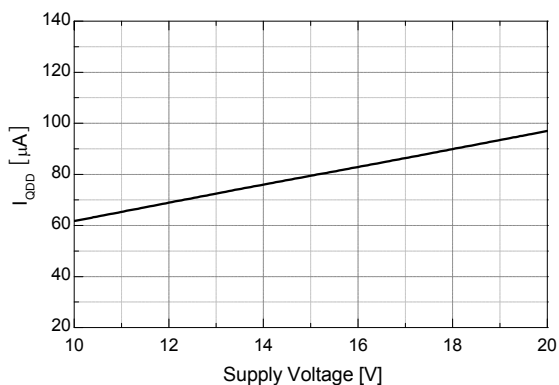


Figure 29. Quiescent V_{DD} Supply Current vs. Supply Voltage

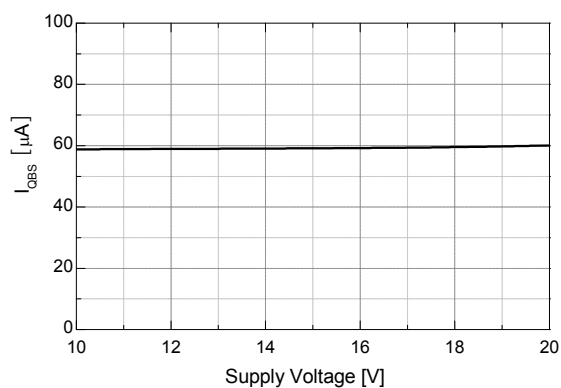


Figure 30. Quiescent V_{BS} Supply Current vs. Supply Voltage

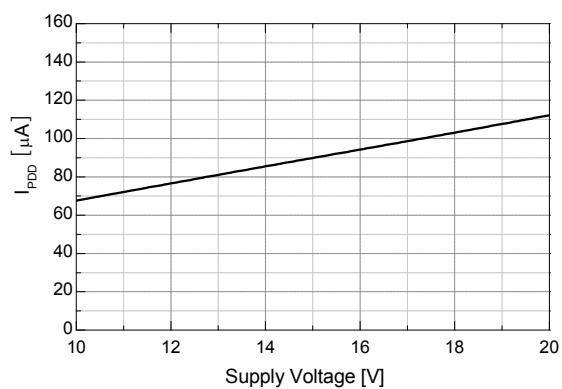


Figure 31. Operating V_{DD} Supply Current vs. Supply Voltage

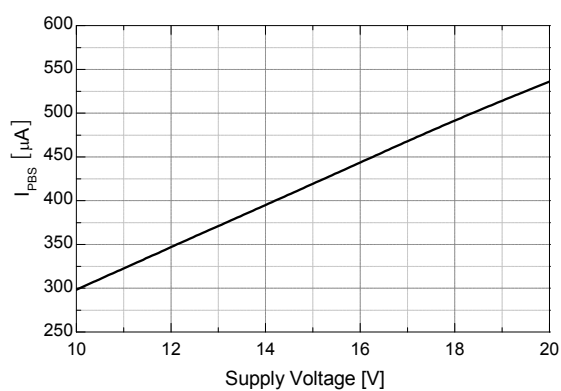
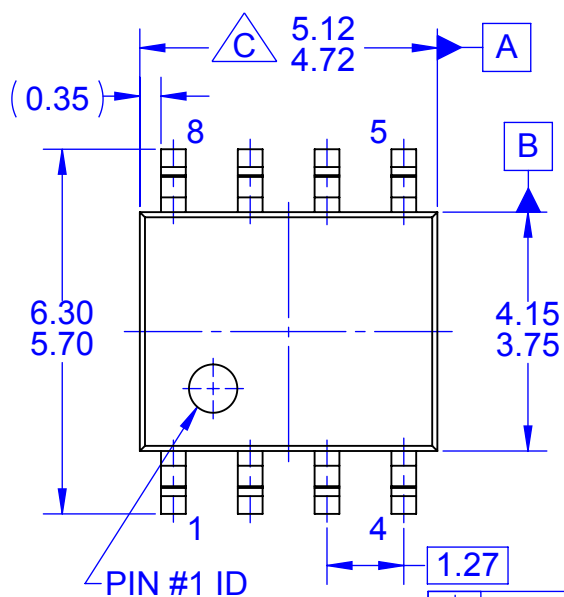


Figure 32. Operating V_{BS} Supply Current vs. Supply Voltage

FAN73611 Rev.02

The diagram shows a 15V to -15V level shifter circuit. A 15V supply is connected to the V_{DD} pin of the FAN73611. A UF4007 diode is connected between the 15V supply and the V_S pin. A 0.1µF capacitor is connected between the 15V supply and ground. A 10µF capacitor is connected between the V_{DD} pin and ground. The V_S pin is connected to the V_S pin of the FAN73611. The V_S pin is also connected to the output of the FAN73611, which is connected to an output monitor. The output monitor shows a square wave signal with a peak-to-peak voltage of -V_S. The output is also connected to a 1000pF capacitor to ground. The input of the FAN73611 is connected to a square wave signal. The output of the FAN73611 is connected to the output monitor.

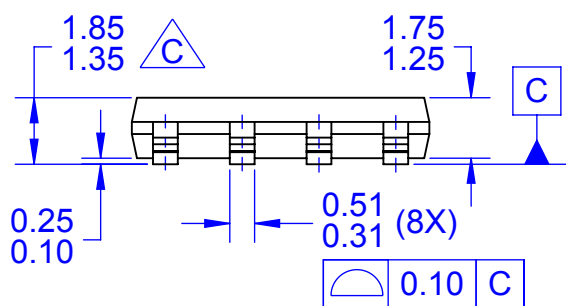
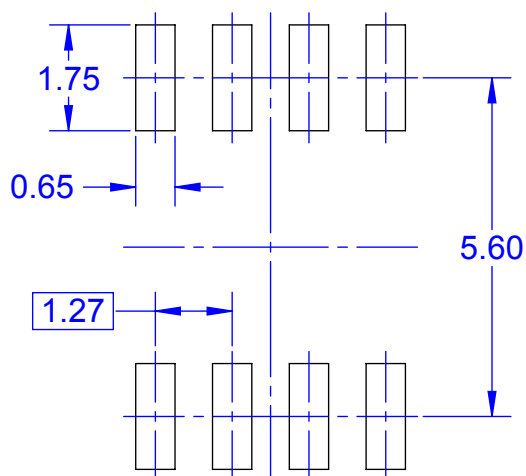
Figure 34. Floating Supply Voltage Transient Test



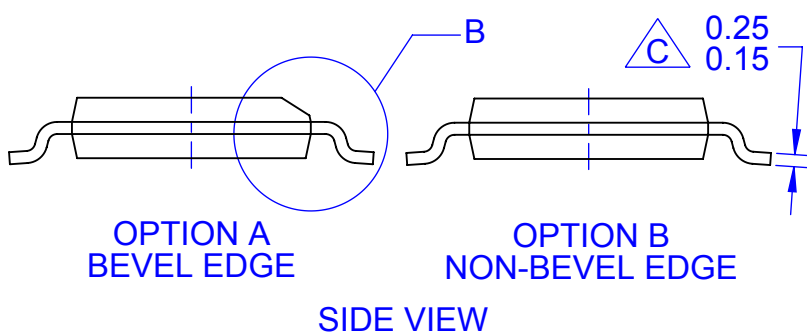
TOP VIEW

$\oplus$	0.25	(M)	C	B	A
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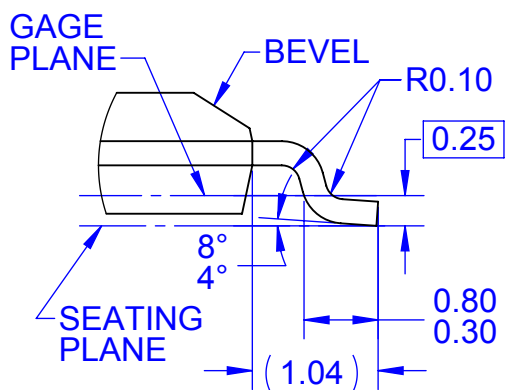
LAND PATTERN RECOMMENDATION



FRONT VIEW



SIDE VIEW



DETAIL "B"
SCALE 2:1

NOTES: UNLESS OTHERWISE SPECIFIED

- A. THIS PACKAGE CONFORMS TO JEDEC MS-012 VARIATION A EXCEPT WHERE NOTED.
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- $\triangle C$ OUT OF JEDEC STANDARD VALUE
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
- E. LAND PATTERN AS PER IPC
- F. SOIC127P600X175-8M
- F. DRAWING FILENAME: MKT-M08Brev2



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