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# FAN7380 Half-Bridge Gate Driver

## Features

- Floating Channel Designed for Bootstrapping Operation to +600 V
- Typically 90 mA / 180 mA Sourcing/Sinking Current Driving Capability for Both Channels
- Common-Mode dv/dt Noise Cancelling Circuit
- Extended Allowable Negative  $V_S$  Swing to -9.8 V for Signal Propagation at  $V_{CC}=V_{BS}=15$  V
- $V_{CC}$  &  $V_{BS}$  Supply Range from 10 V to 20 V
- UVLO Functions for Both Channels
- TTL-Compatible Input Logic Threshold Levels
- Matched Propagation Delay Below 50 ns
- Built-in 100 ns Dead-Time Control Function
- Output In-Phase with Input Signal

## Typical Applications

- Fluorescent Lamp Ballast
- Compact Fluorescent Lamp Ballast

## Related Resources

- [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

The FAN7380 is a monolithic half-bridge gate-drive IC for MOSFETs and IGBTs that operate up to +600 V. Fairchild's high-voltage process and common-mode noise cancelling technique provide stable operation of high-side driver under high-dv/dt noise circumstances. An advanced level-shift circuit allows high-side gate driver operation up to  $V_S=-9.8$  V (typical) for  $V_{BS}=15$  V. The input logic level is compatible with standard TTL-series logic gates. The internal shoot-through protection circuit provides 100 ns dead-time to prevent output switching devices from both conducting during transition periods. UVLO circuits for both channels prevent malfunction when  $V_{CC}$  and  $V_{BS}$  are lower than the specified threshold voltage. Output drivers typically source / sink at 90 mA / 180 mA, respectively, which is suitable for fluorescent / compact fluorescent lamp ballast applications and systems requiring low di/dt noise.

8-SOP



## Ordering Information

Device	Package	Pb-Free	Operating Temperature	Packing	Description
FAN7380MX <sup>(1)</sup>	8-SOP	Yes	-40°C ~ +125°C	Tape & Reel	Lighting Application

### Note:

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

Typical Application Circuit

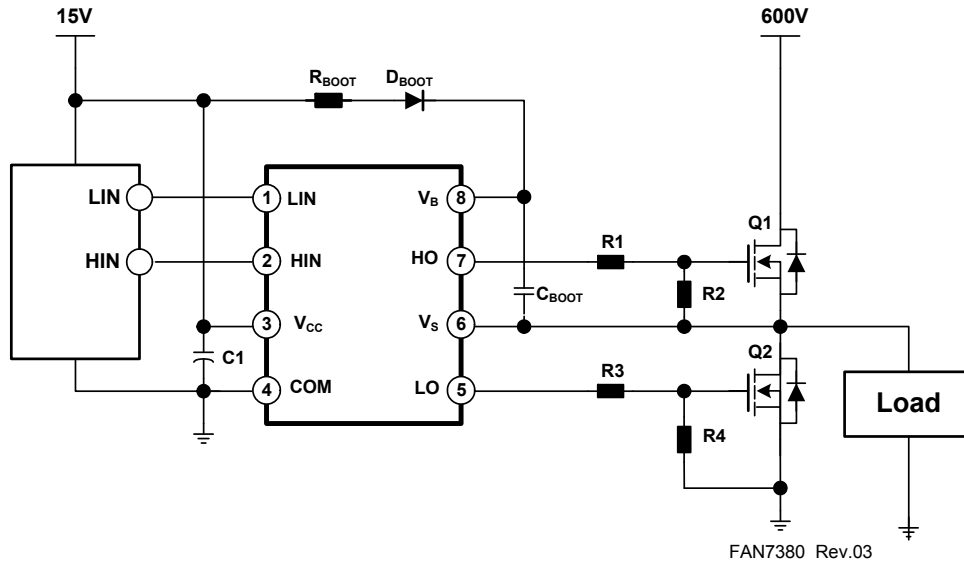


Figure 1. Application Circuit for Fluorescent Lamp Ballast

Internal Block Diagram

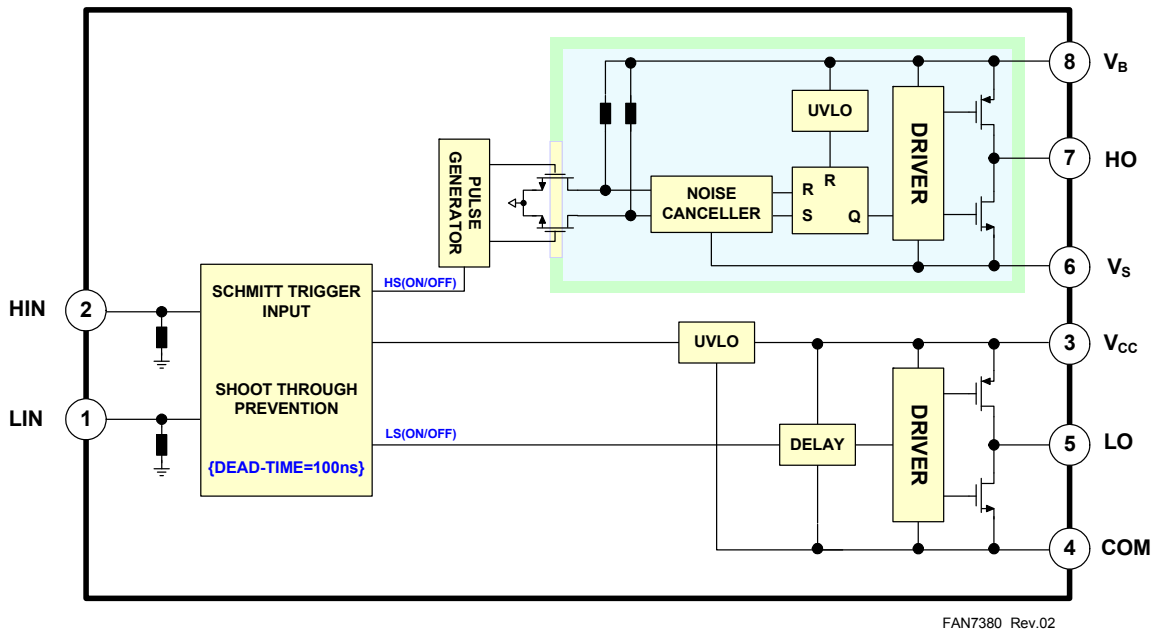


Figure 2. Functional Block Diagram

## Pin Configuration

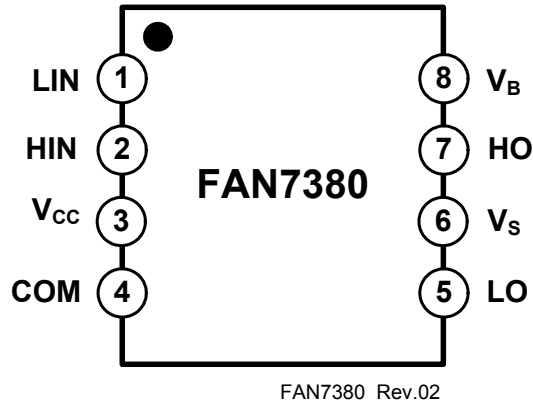


Figure 3. Pin Configuration (Top View)

## Pin Definitions

Pin #	Name	I/O	Description
1	LIN	I	Logic Input for Low-Side Gate Driver Output
2	HIN	I	Logic Input for High-Side Gate Driver Output
3	V <sub>CC</sub>	I	Low-Side Supply Voltage
4	COM		Logic Ground and Low-Side Driver Return
5	LO	O	Low-Side Driver Output
6	V <sub>S</sub>	I	High-Voltage Floating Supply Return
7	HO	O	High-Side Driver Output
8	V <sub>B</sub>	I	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	Parameter	Min.	Max.	Unit
$V_S$	High-side offset voltage	$V_B-25$	$V_B+0.3$	V
$V_B$	High-side floating supply voltage	-0.3	625.0	
$V_{HO}$	High-side floating output voltage HO	$V_S-0.3$	$V_B+0.3$	
$V_{CC}$	Low-side and logic-fixed supply voltage	-0.3	25.0	
$V_{LO}$	Low-side output voltage LO	-0.3	$V_{CC}+0.3$	
$V_{IN}$	Logic input voltage (HIN, LIN)	-0.3	$V_{CC}+0.3$	
COM	Logic ground	$V_{CC}-25$	$V_{CC}+0.3$	
$dV_S/dt$	Allowable offset voltage slew rate		50	V/ns
$P_D^{(2)(3)(4)}$	Power dissipation		0.625	W
$\theta_{JA}$	Thermal resistance, junction-to-ambient		200	$^{\circ}\text{C}/\text{W}$
$T_J$	Junction temperature		150	$^{\circ}\text{C}$
$T_S$	Storage temperature	-50	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 Ratings

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance. 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	$6-V_{CC}$	600	
$V_{HO}$	High-side (HO) output voltage	$V_S$	$V_B$	
$V_{LO}$	Low-side (LO) output voltage	COM	$V_{CC}$	
$V_{IN}$	Logic input voltage (HIN, LIN)	COM	$V_{CC}$	
$V_{CC}$	Low-side supply voltage	10	20	
$T_A$	Ambient temperature	-40	125	$^{\circ}\text{C}$

## Static Electrical Characteristics

$V_{BIAS}$  ( $V_{CC}$ ,  $V_{BS}$ ) = 15.0 V,  $T_A$  = 25°C, unless otherwise specified. The  $V_{IN}$  and  $I_{IN}$  parameters are referenced to COM. The  $V_O$  and  $I_O$  parameters are referenced to  $V_S$  and COM and are applicable to the respective outputs HO and LO.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{CCUV+}$ $V_{BSUV+}$	$V_{CC}$ & $V_{BS}$ supply under-voltage positive going threshold		8.2	9.2	10.0	V
$V_{CCUV-}$ $V_{BSUV-}$	$V_{CC}$ & $V_{BS}$ supply under-voltage negative going threshold		7.6	8.7	9.6	
$V_{CCUVH}$ $V_{BSUVH}$	$V_{CC}$ supply under-voltage lockout hysteresis			0.5		
$I_{LK}$	Offset supply leakage current	$V_B = V_S = 600$ V			50	$\mu$ A
$I_{QBS}$	Quiescent $V_{BS}$ supply current	$V_{IN} = 0$ V or 5 V		44	100	
$I_{QCC}$	Quiescent $V_{CC}$ supply current	$V_{IN} = 0$ V or 5 V		70	180	
$I_{PBS}$	Operating $V_{BS}$ supply current	$f_{IN} = 20$ kHz, rms value			600	$\mu$ A
$I_{PCC}$	Operating $V_{CC}$ supply current	$f_{IN} = 20$ kHz, rms value			610	
$V_{IH}$	Logic "1" input voltage		2.5			V
$V_{IL}$	Logic "0" input voltage				0.8	
$V_{OH}$	High-level output voltage, $V_{BIAS} - V_O$	$I_O = 20$ mA			2.8	V
$V_{OL}$	Low-level output voltage, $V_O$				1.2	
$I_{IN+}$	Logic "1" input bias current	$V_{IN} = 5$ V		5	40	$\mu$ A
$I_{IN-}$	Logic "0" input bias current	$V_{IN} = 0$ V		1.0	2.0	
$I_{O+}$	Output HIGH short-circuit pulse current	$V_O = 0$ V, $V_{IN} = 5$ V with $PW \leq 10$ $\mu$ s	60	90		mA
$I_{O-}$	Output LOW short-circuit pulsed current	$V_O = 15$ V, $V_{IN} = 0$ V with $PW \leq 10$ $\mu$ s	130	180		
$V_S$	Allowable negative $V_S$ pin voltage for HIN signal propagation to HO			-9.8	-7.0	V

## Dynamic Electrical Characteristics

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$t_{on}$	Turn-on propagation delay	$V_S = 0$ V	70	135	200	ns
$t_{off}$	Turn-off propagation delay	$V_S = 0$ V or 600 V <sup>(5)</sup>	60	130	190	
$t_r$	Turn-on rise time		160	230	290	
$t_f$	Turn-off fall time		20	90	160	
DT	Dead time		80	120	190	
MT	Delay matching, HS & LS turn-on/off				50	

### Note:

5. This parameter guaranteed by design.

Typical Performance Characteristics

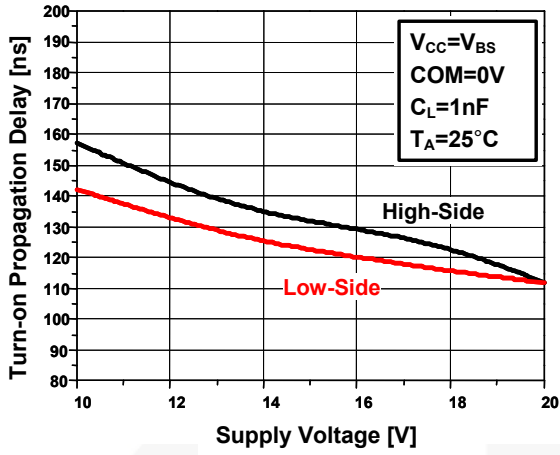


Figure 4. Turn-On Propagation Delay vs. Supply Voltage

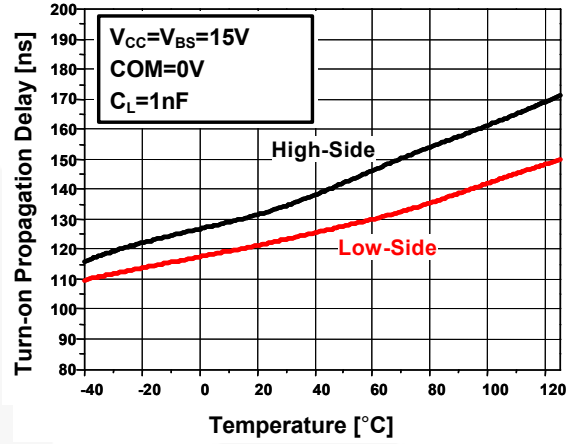


Figure 5. Turn-On Propagation Delay vs. Temp.

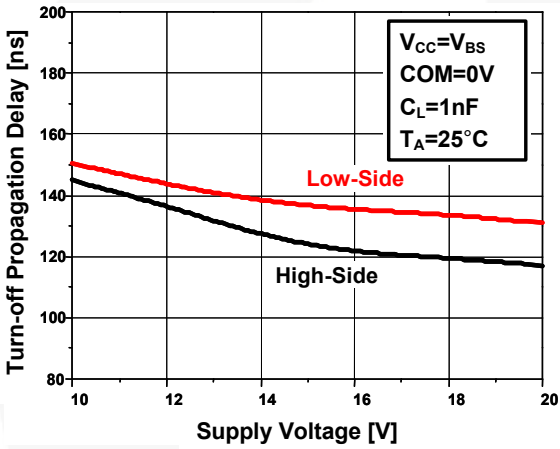


Figure 6. Turn-Off Propagation Delay vs. Supply Voltage

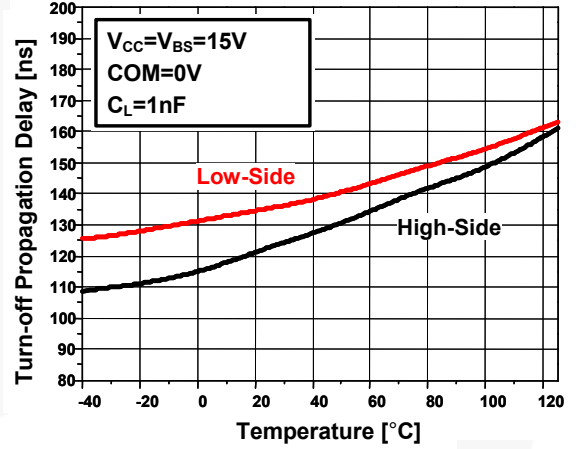


Figure 7. Turn-Off Propagation Delay vs. Temp.

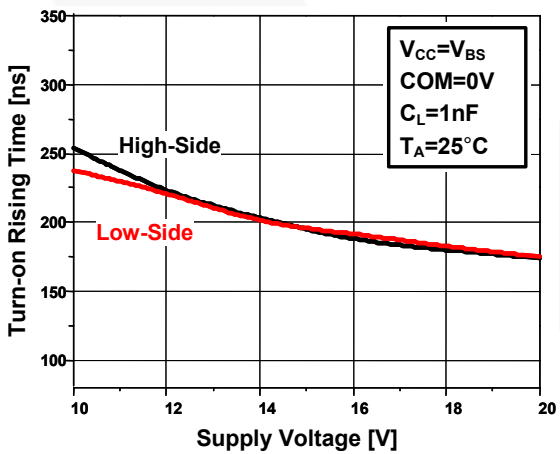


Figure 8. Turn-On Rising Time vs. Supply Voltage

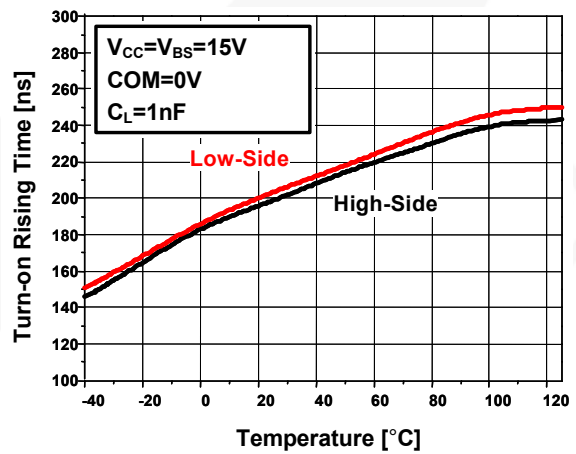


Figure 9. Turn-On Rising Time vs. Temp.

Typical Performance Characteristics (Continued)

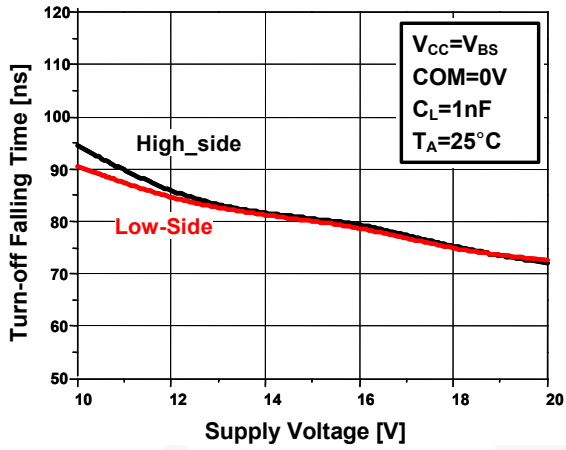


Figure 10. Turn-Off Falling Time vs. Supply Voltage

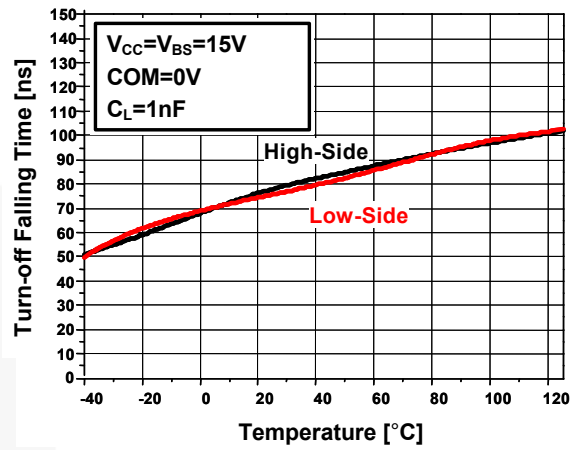


Figure 11. Turn-Off Falling Time vs. Temp.

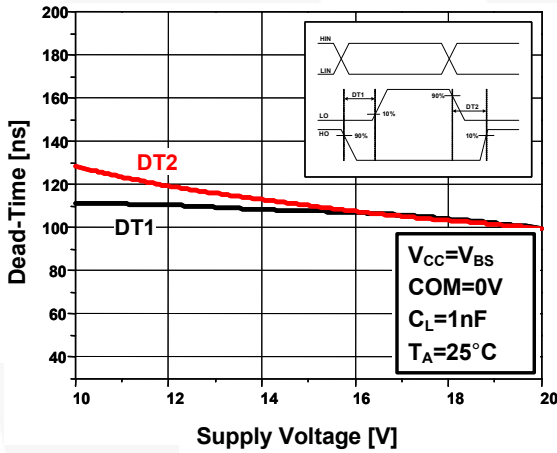


Figure 12. Dead-Time vs. Supply Voltage

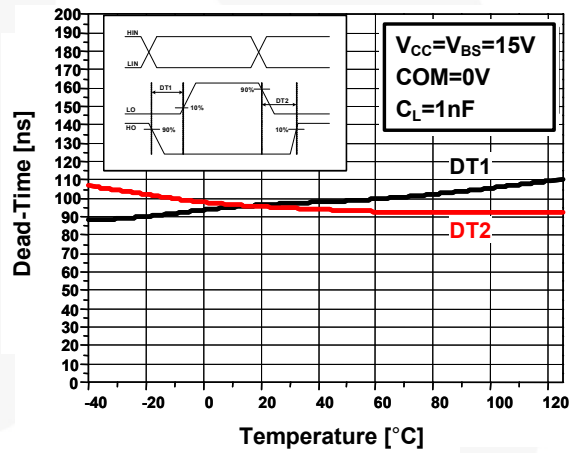


Figure 13. Dead-Time vs. Temp.

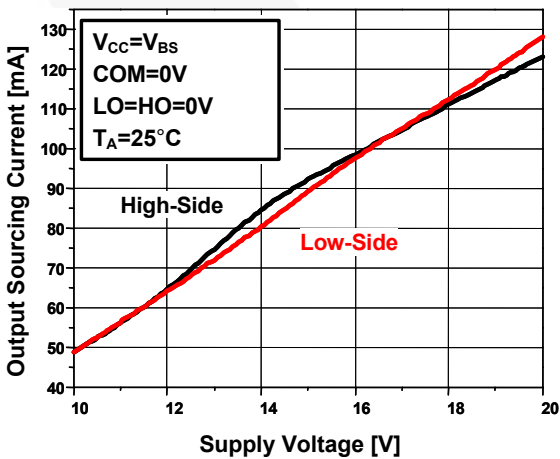


Figure 14. Output Sourcing Current vs. Supply Voltage

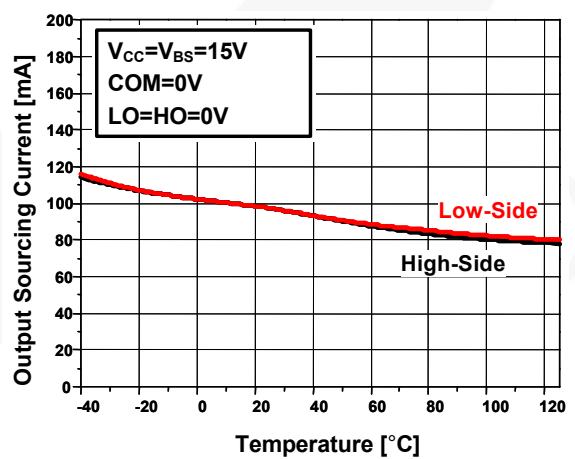


Figure 15. Output Sourcing Current vs. Temp.



Typical Performance Characteristics (Continued)

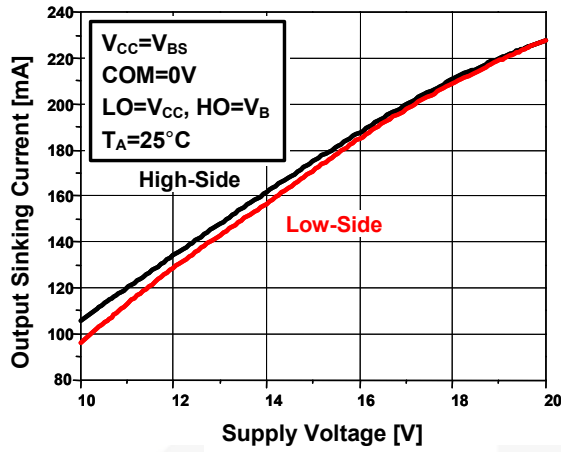


Figure 16. Output Sinking Current vs. Supply Voltage

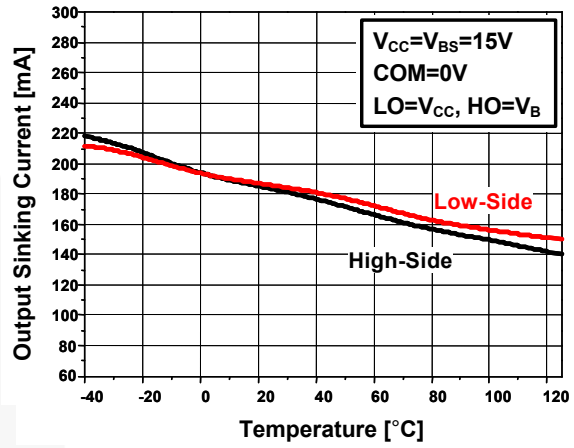


Figure 17. Output Sinking Current vs. Temp.

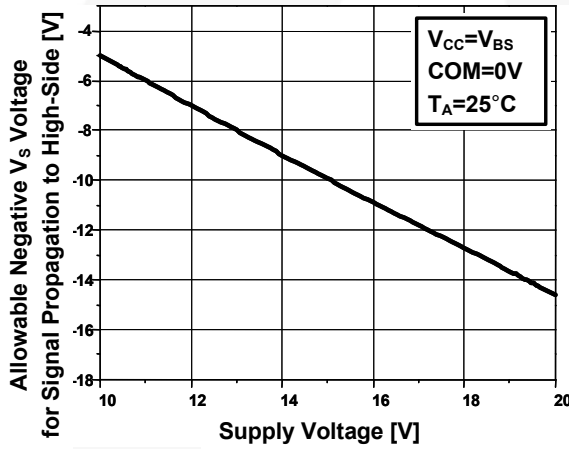


Figure 18. Allowable Negative  $V_S$  Voltage for Signal Propagation to High-Side vs. Supply Voltage

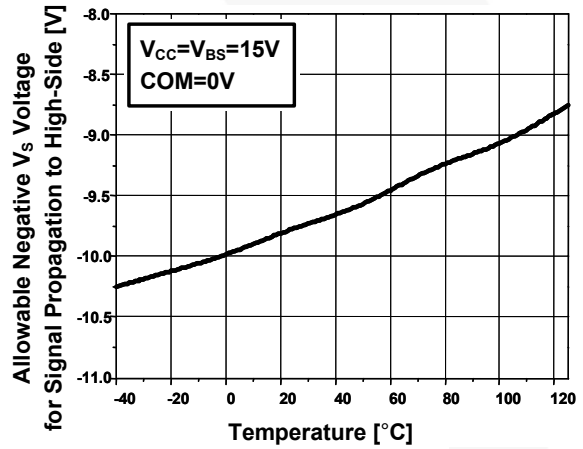


Figure 19. Allowable Negative  $V_S$  Voltage for Signal Propagation to High-Side vs. Temperature

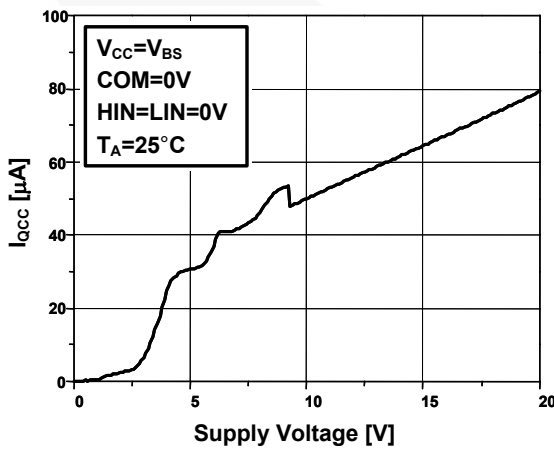


Figure 20.  $I_{QCC}$  vs. Supply Voltage

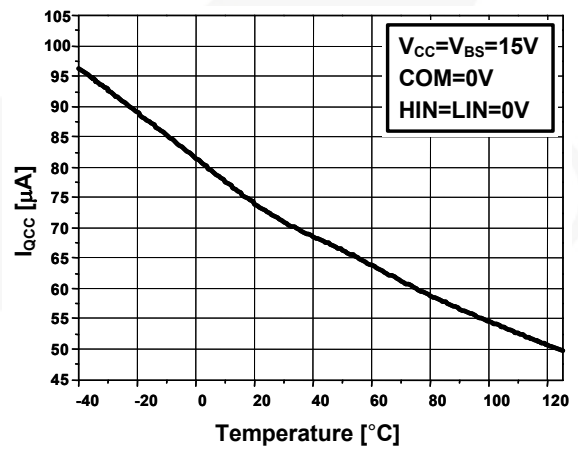


Figure 21.  $I_{QCC}$  vs. Temperature

Typical Performance Characteristics (Continued)

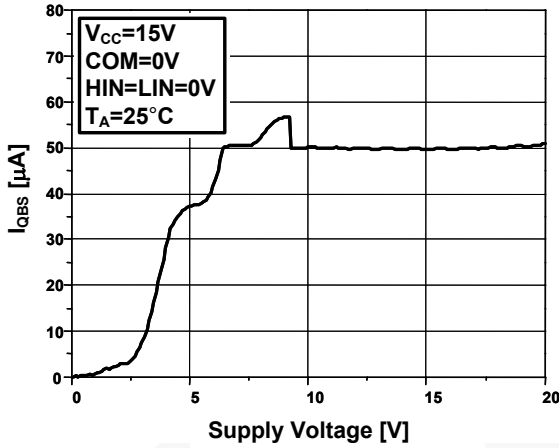


Figure 22.  $I_{QBS}$  vs. Supply Voltage

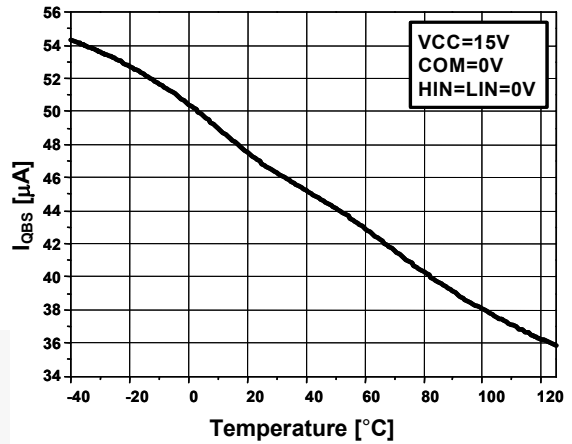


Figure 23.  $I_{QBS}$  vs. Temperature

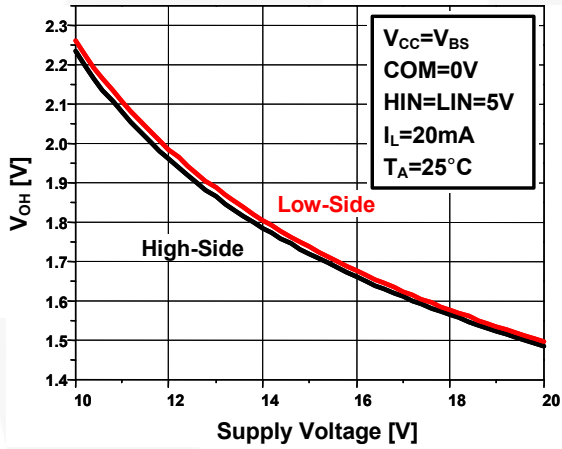


Figure 24. High-Level Output Voltage vs. Supply Voltage

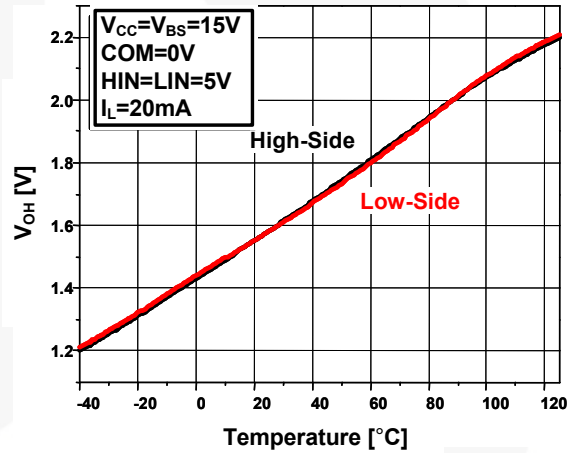


Figure 25. High-Level Output Voltage vs. Temp.

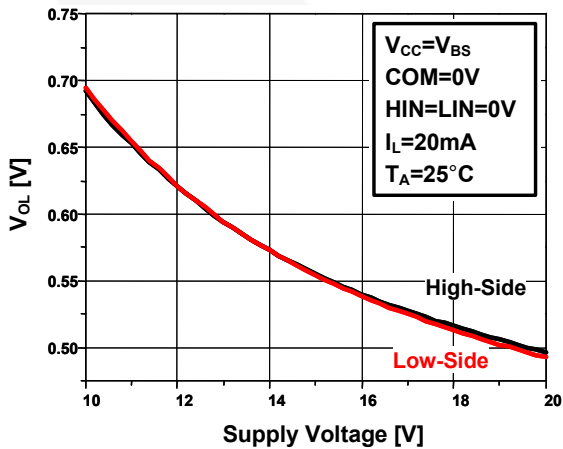


Figure 26. Low-Level Output Voltage vs. Supply Voltage

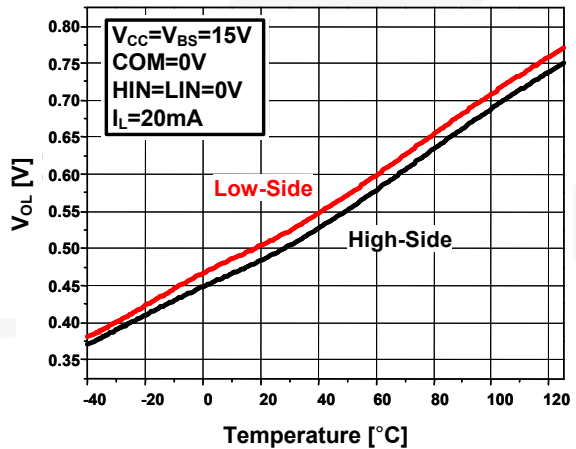


Figure 27. Low-Level Output Voltage vs. Temp.

Typical Performance Characteristics (Continued)

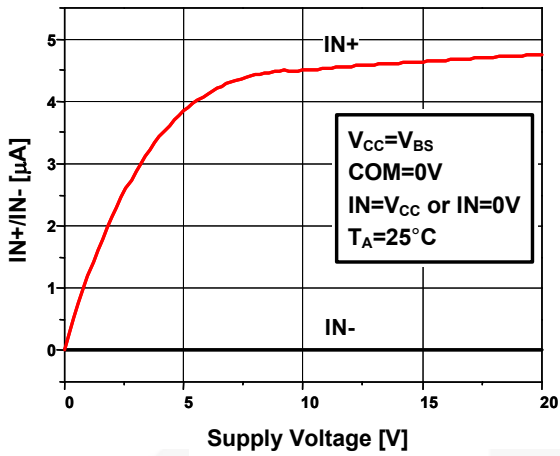


Figure 28. Input Bias Current vs. Supply Voltage

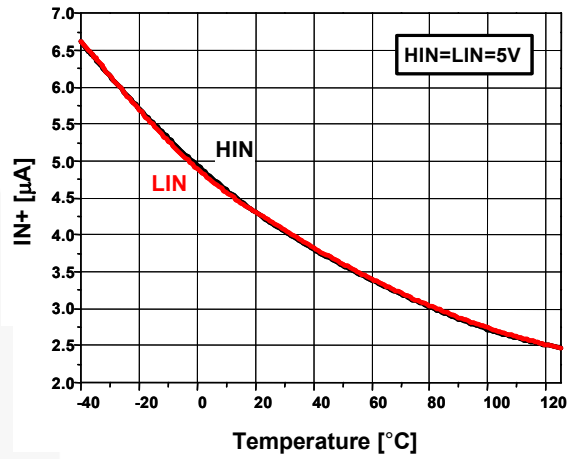


Figure 29. Input Bias Current vs. Temperature

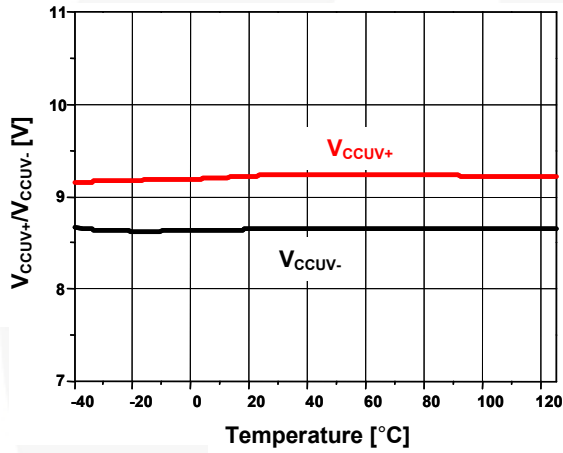


Figure 30.  $V_{CC}$  UVLO Threshold Voltage vs. Temp.

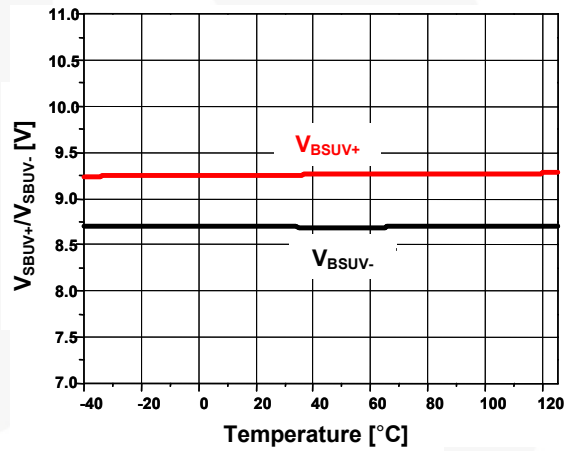


Figure 31.  $V_{BS}$  UVLO Threshold Voltage vs. Temp.

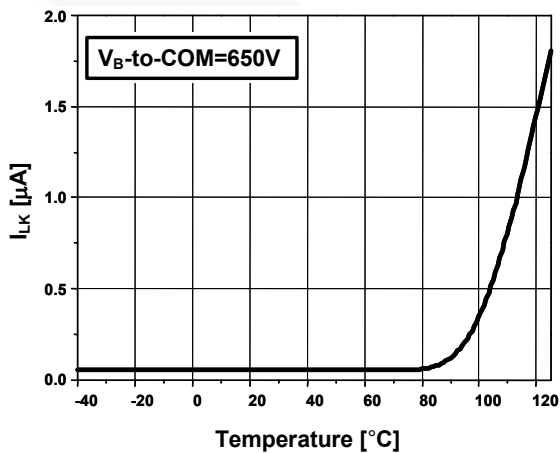


Figure 32. VB to COM Leakage Current vs. Temp.

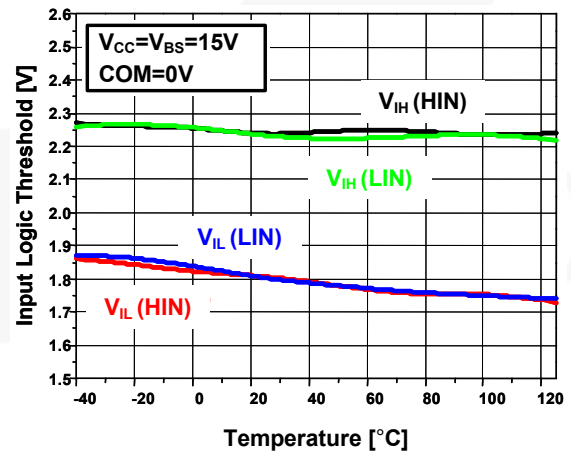


Figure 33. Input Logic Threshold vs. Temp.

### Switching Time Definitions

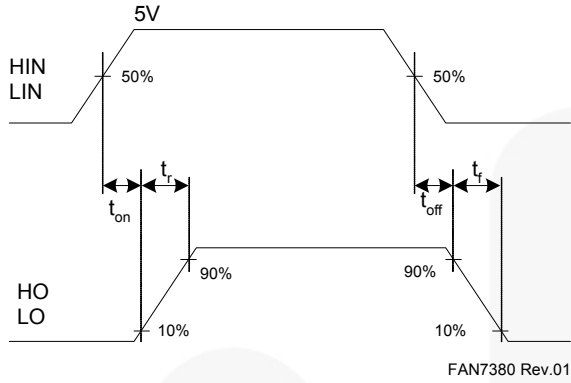


Figure 34. Switching Time Waveforms

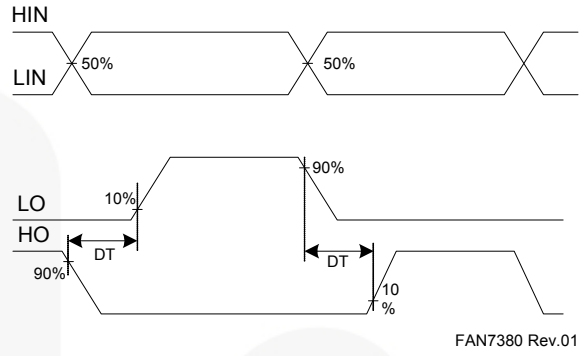
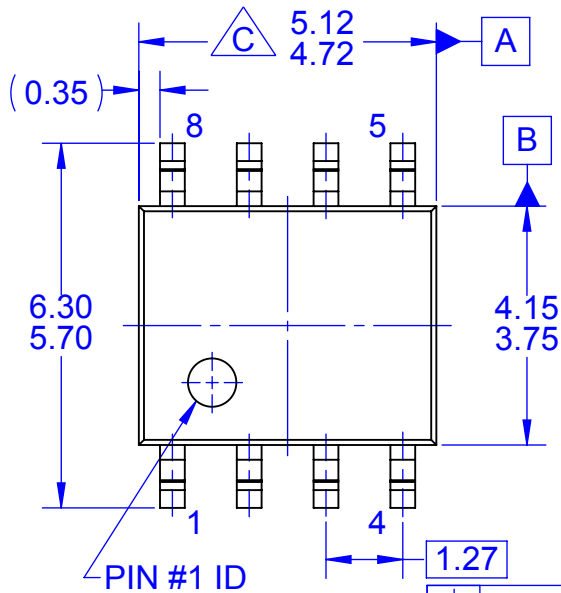
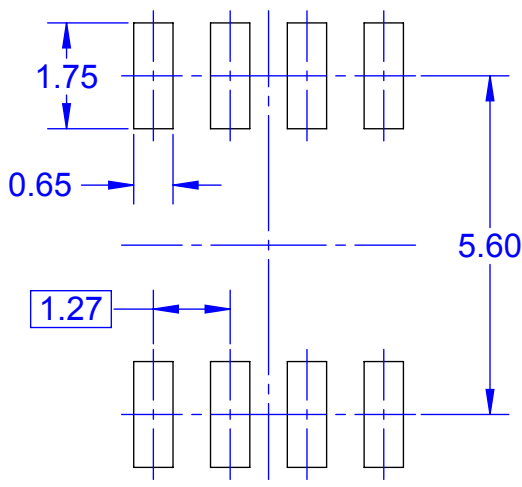


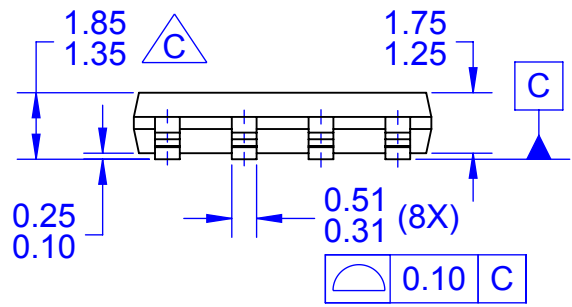
Figure 35. Internal Dead-Time Timing



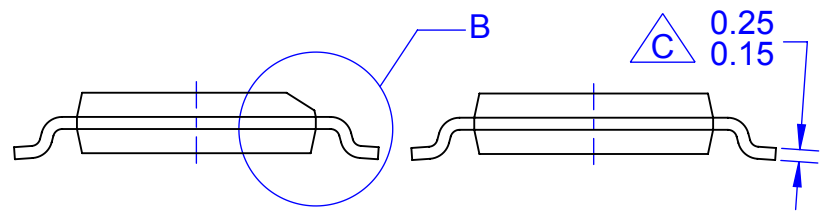
TOP VIEW



LAND PATTERN RECOMMENDATION



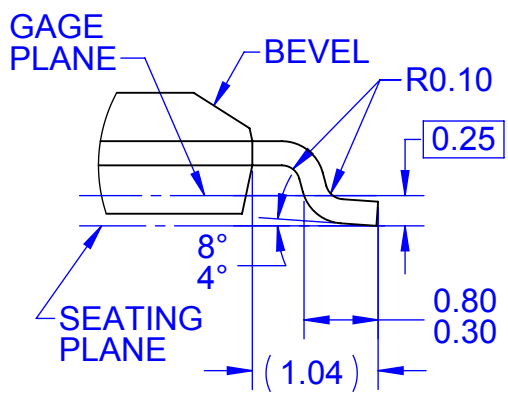
FRONT VIEW



OPTION A  
BEVEL EDGE

OPTION B  
NON-BEVEL EDGE

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
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