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September 2015

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

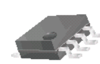
Related Resources

- 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(1)	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

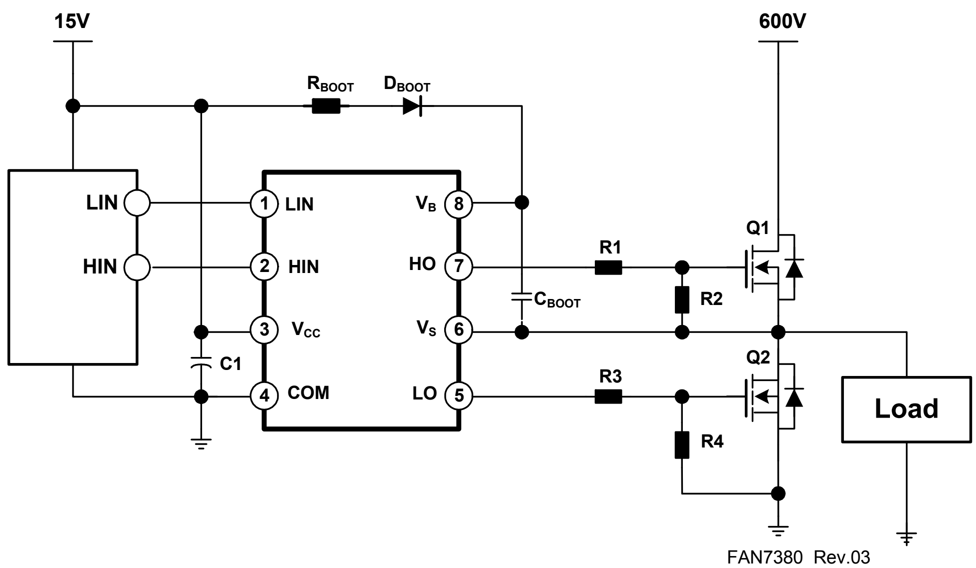


Figure 1. Application Circuit for Fluorescent Lamp Ballast

Internal Block Diagram

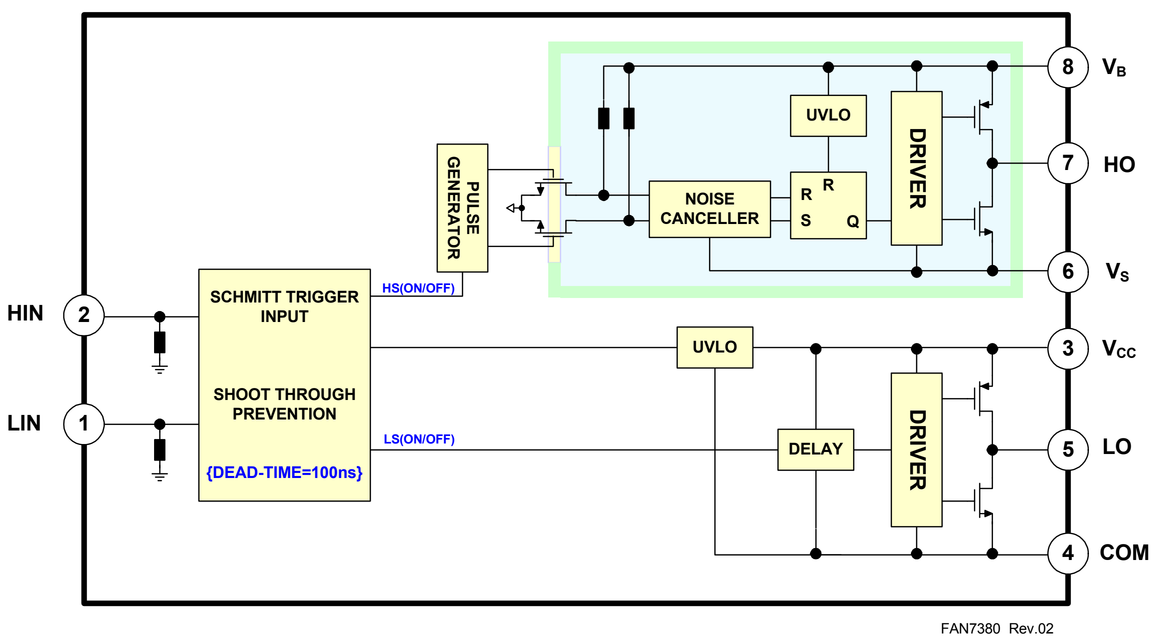


Figure 2. Functional Block Diagram

Pin Configuration

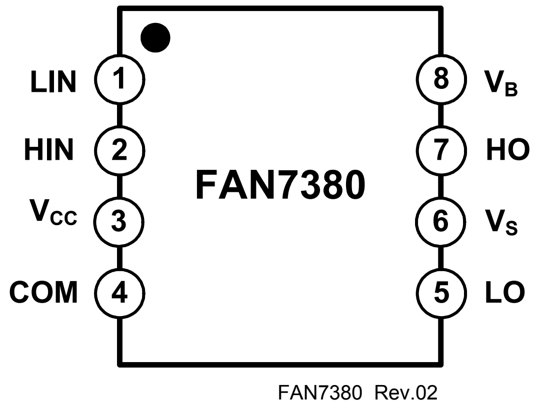


Figure 3. Pin Configuration (Top View)

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_{CC}	I	Low-Side Supply Voltage
4	COM		Logic Ground and Low-Side Driver Return
5	LO	O	Low-Side Driver Output
6	V_S	I	High-Voltage Floating Supply Return
7	HO	O	High-Side Driver Output
8	V_B	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°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
θ_{JA}	Thermal resistance, junction-to-ambient		200	°C/W
T_J	Junction temperature		150	°C
T_S	Storage temperature	-50	150	°C

Notes:

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
   JESD51-3: Low effective thermal conductivity test board for leaded surface mount packages
4. 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	°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	µA
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	µA
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	µA
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≤10 µs	60	90		mA
I_{O-}	Output LOW short-circuit pulsed current	V_O=15 V,V_{IN}=0 V with PW≤10 µs	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(5)	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

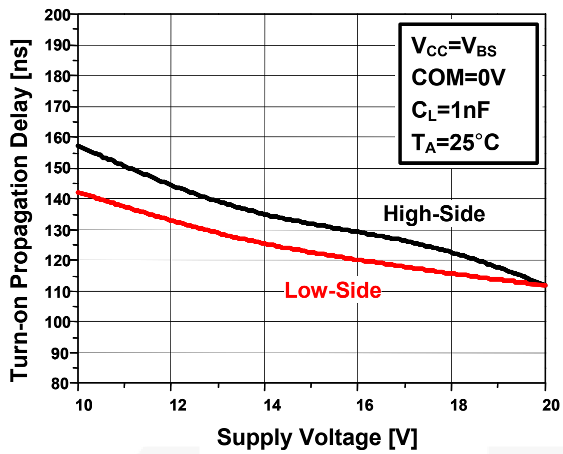


Figure 4. Turn-On Propagation Delay vs. Supply Voltage

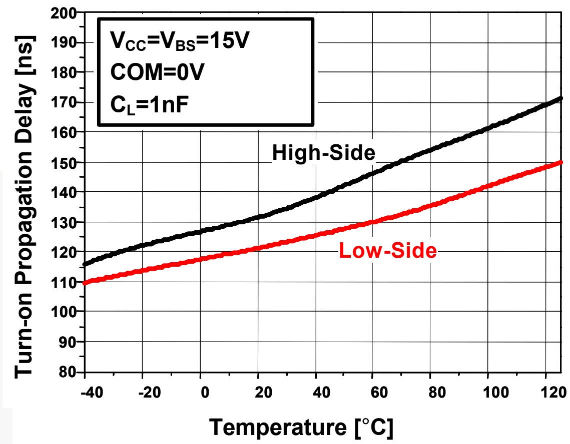


Figure 5. Turn-On Propagation Delay vs. Temp.

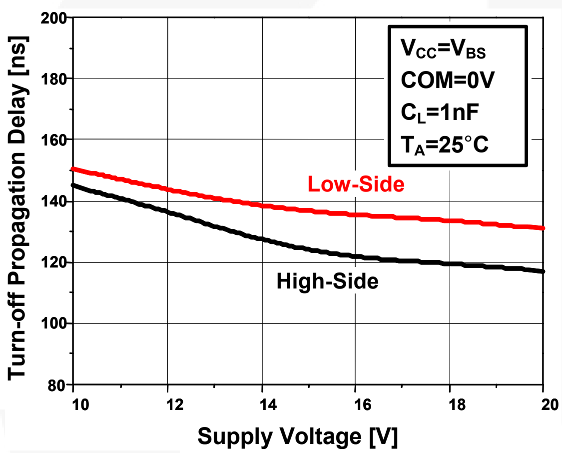


Figure 6. Turn-Off Propagation Delay vs. Supply Voltage

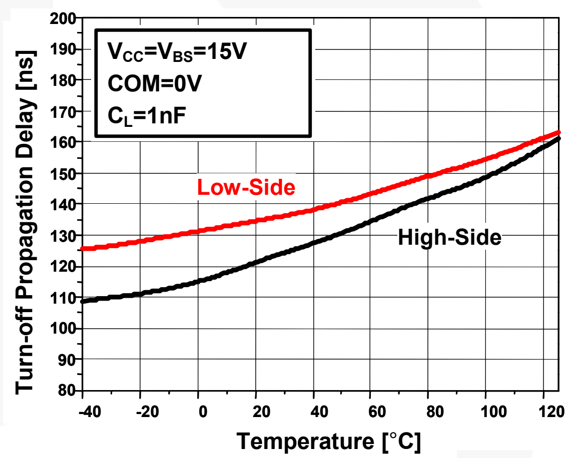


Figure 7. Turn-Off Propagation Delay vs. Temp.

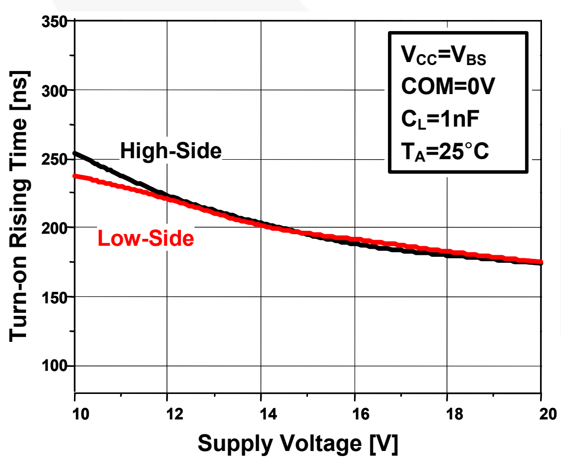


Figure 8. Turn-On Rising Time vs. Supply Voltage

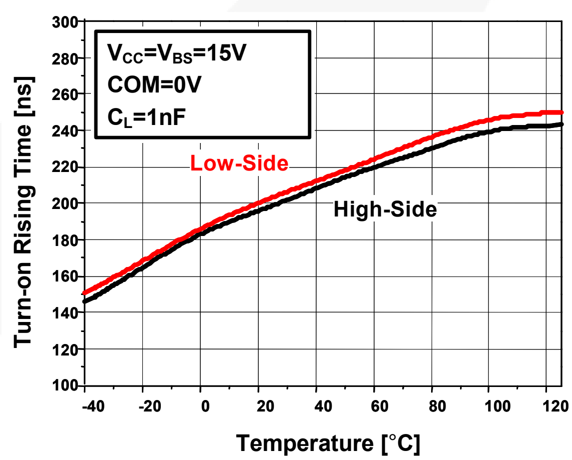


Figure 9. Turn-On Rising Time vs. Temp.

Typical Performance Characteristics (Continued)

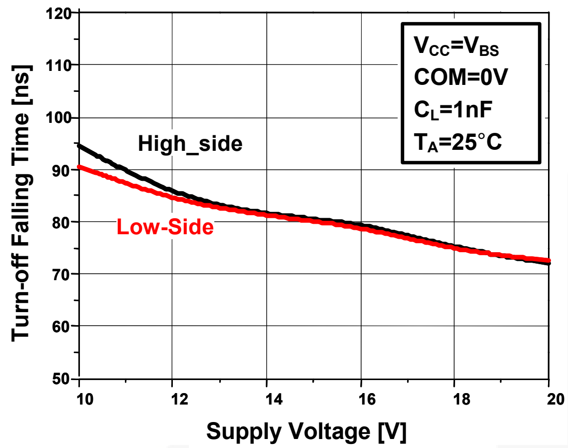


Figure 10. Turn-Off Falling Time vs. Supply Voltage

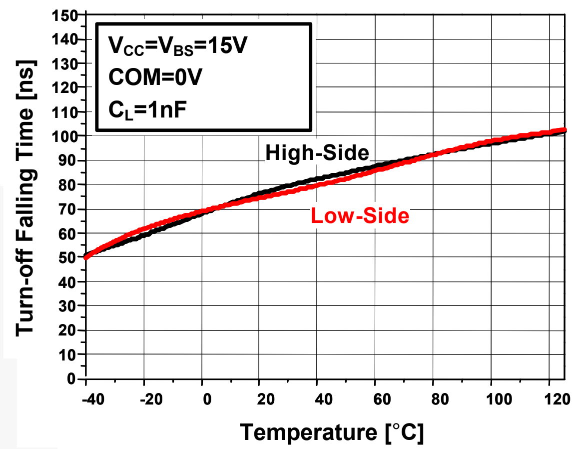


Figure 11. Turn-Off Falling Time vs. Temp.

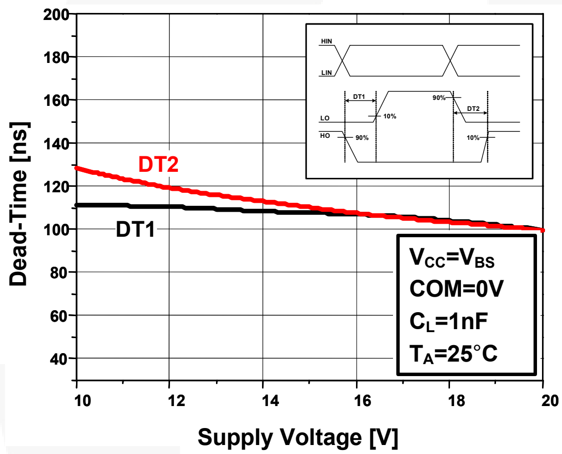


Figure 12. Dead-Time vs. Supply Voltage

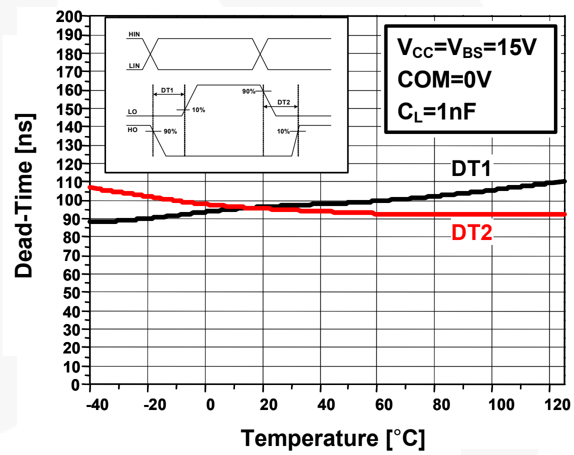


Figure 13. Dead-Time vs. Temp.

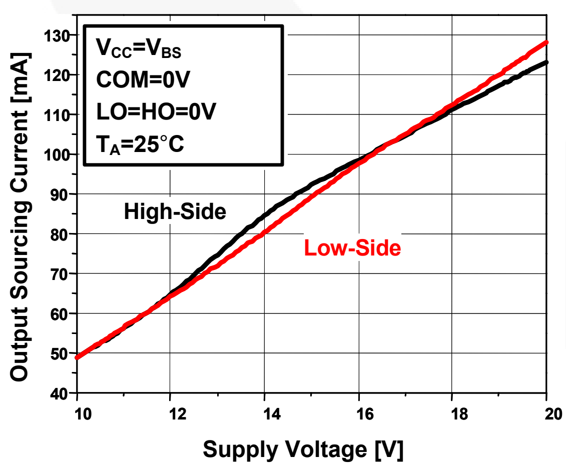


Figure 14. Output Sourcing Current vs. Supply Voltage

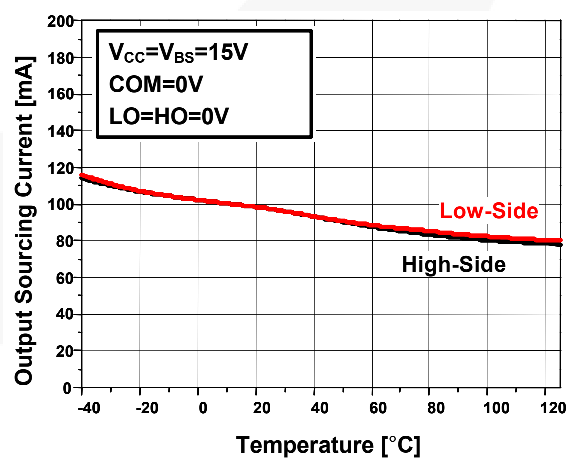


Figure 15. Output Sourcing Current vs. Temp.

Typical Performance Characteristics (Continued)

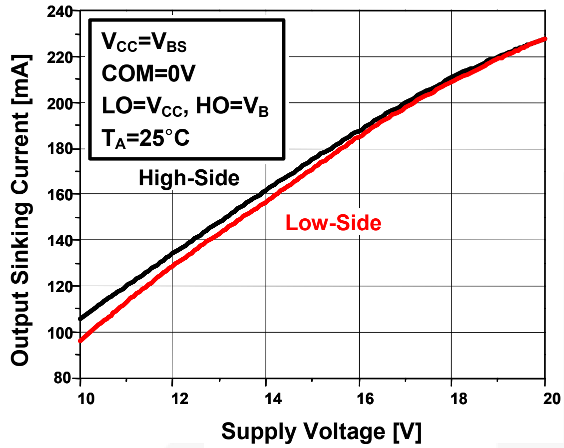


Figure 16. Output Sinking Current vs. Supply Voltage

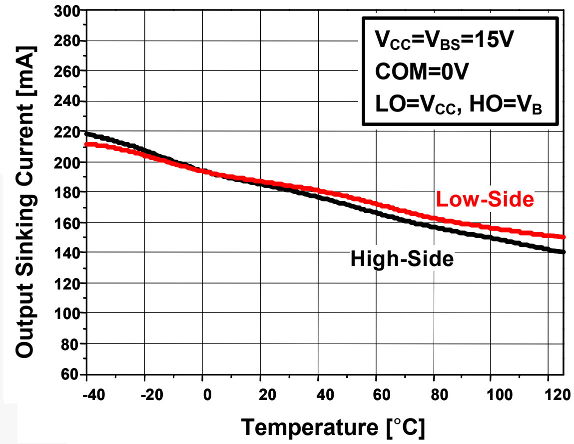


Figure 17. Output Sinking Current vs. Temp.

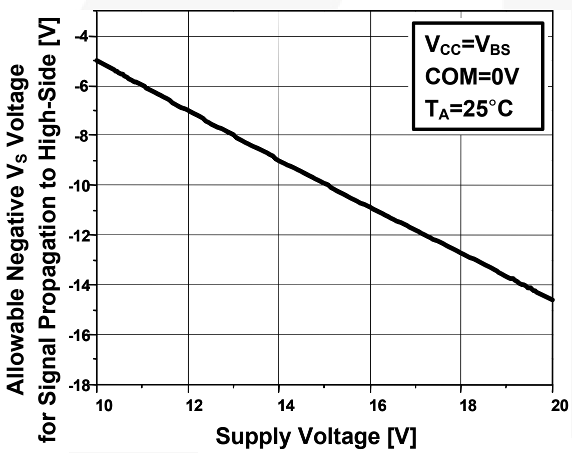


Figure 18. Allowable Negative V_S Voltage for Signal Propagation to High-Side vs. Supply Voltage

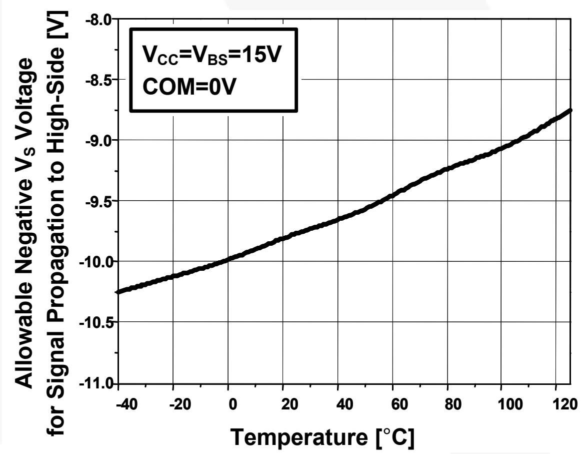


Figure 19. Allowable Negative V_S Voltage for Signal Propagation to High-Side vs. Temperature

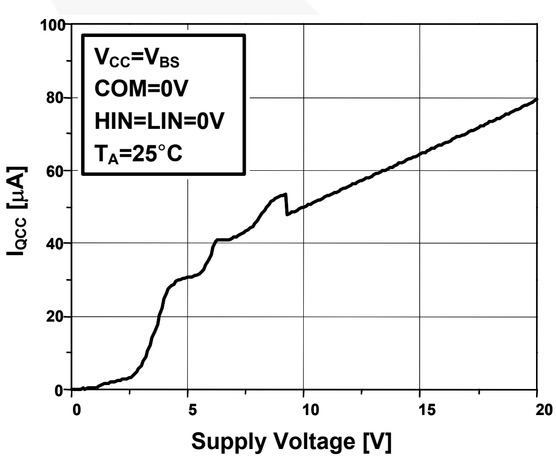


Figure 20. I_{QCC} vs. Supply Voltage

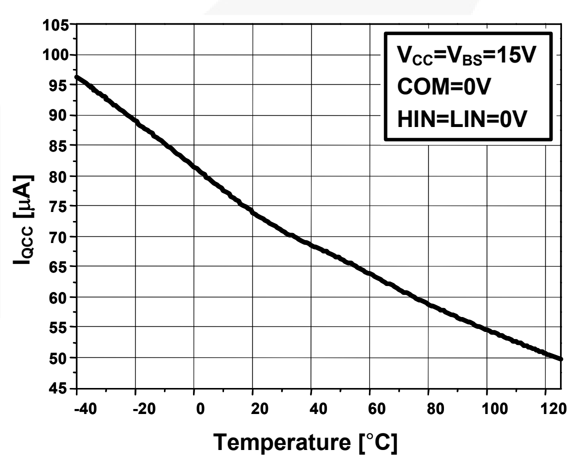


Figure 21. I_{QCC} vs. Temperature

Typical Performance Characteristics (Continued)

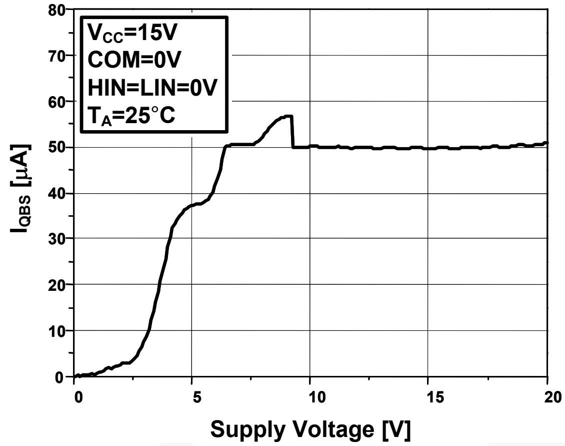


Figure 22. I_{QBS} vs. Supply Voltage

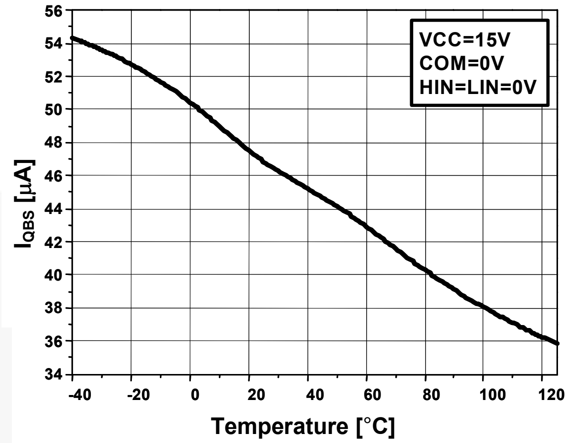


Figure 23. I_{QBS} vs. Temperature

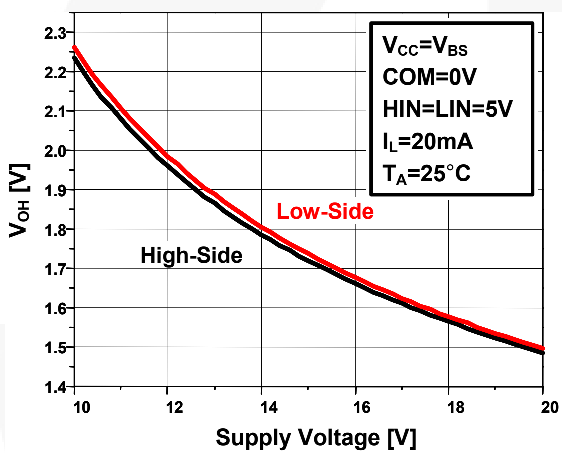


Figure 24. High-Level Output Voltage vs. Supply Voltage

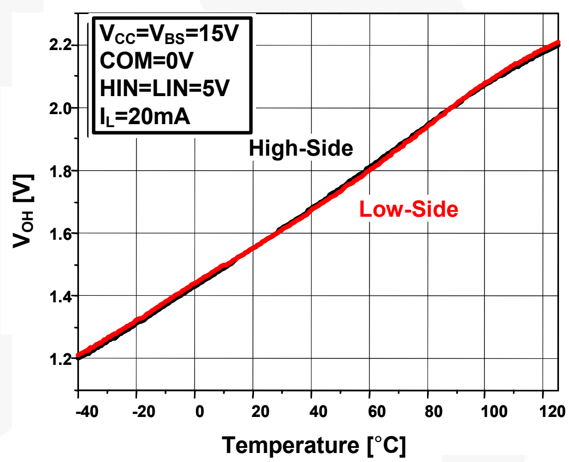


Figure 25. High-Level Output Voltage vs. Temp.

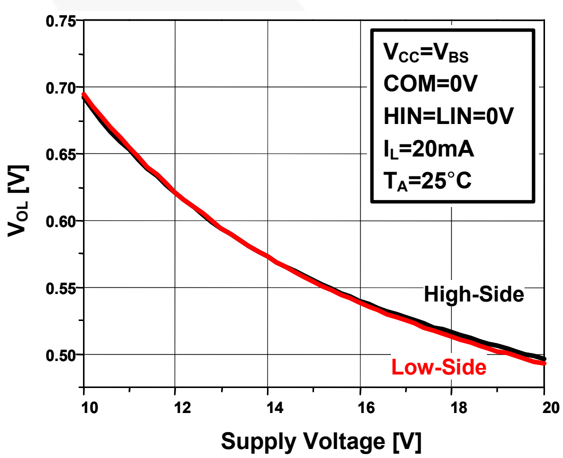


Figure 26. Low-Level Output Voltage vs. Supply Voltage

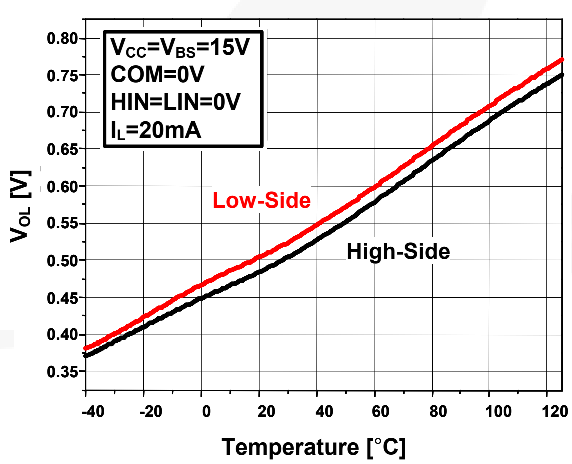


Figure 27. Low-Level Output Voltage vs. Temp.

Typical Performance Characteristics (Continued)

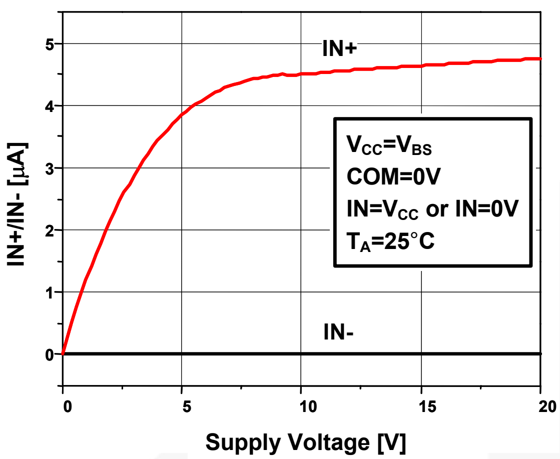


Figure 28. Input Bias Current vs. Supply Voltage

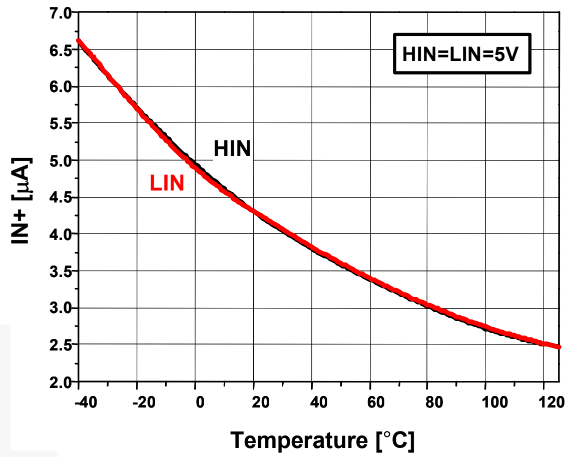


Figure 29. Input Bias Current vs. Temperature

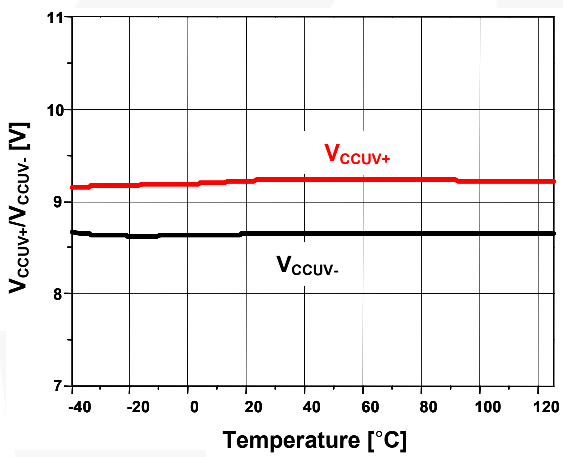


Figure 30. V_{CC} UVLO Threshold Voltage vs. Temp.

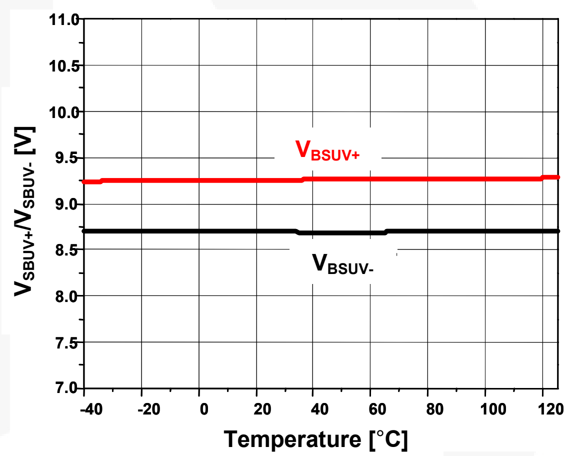


Figure 31. V_{BS} UVLO Threshold Voltage vs. Temp.

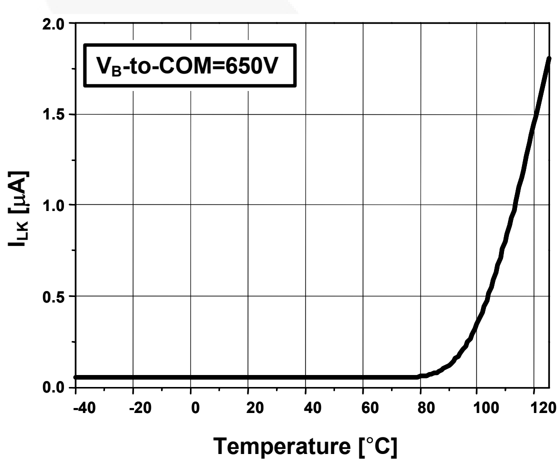


Figure 32. VB to COM Leakage Current vs. Temp.

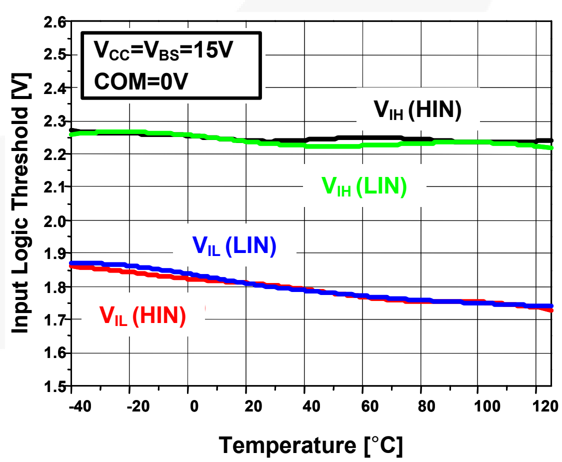


Figure 33. Input Logic Threshold vs. Temp.

Switching Time Definitions

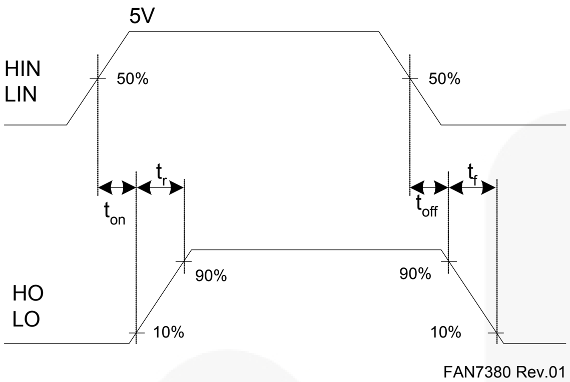


Figure 34. Switching Time Waveforms

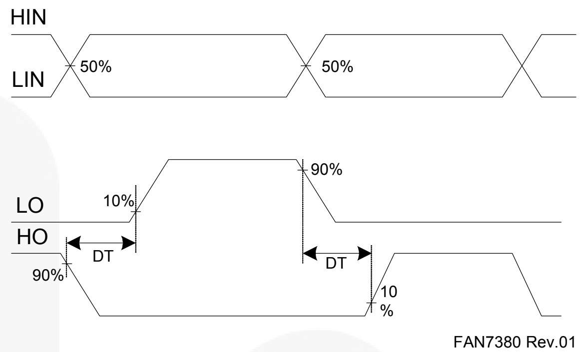
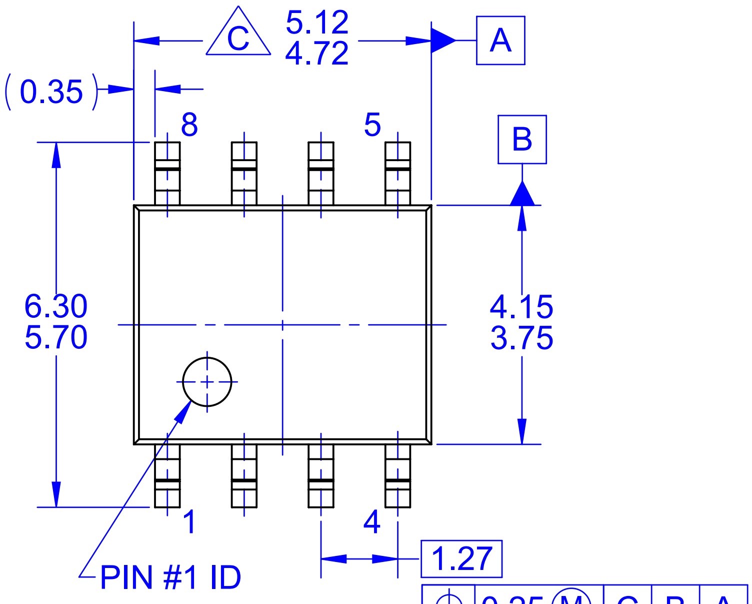
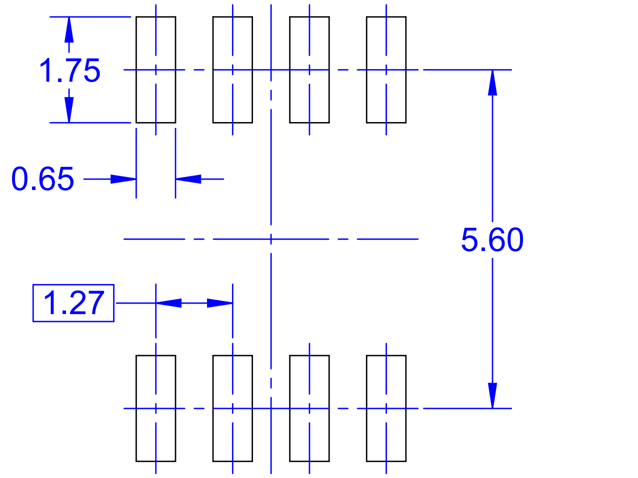


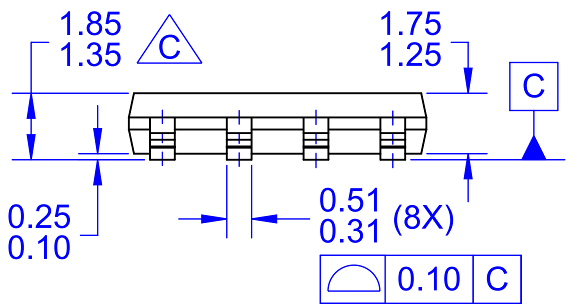
Figure 35. Internal Dead-Time Timing



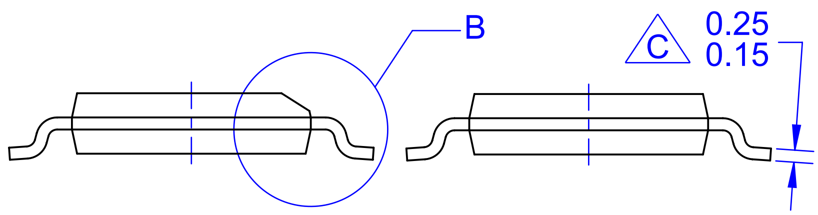
TOP VIEW



LAND PATTERN RECOMMENDATION



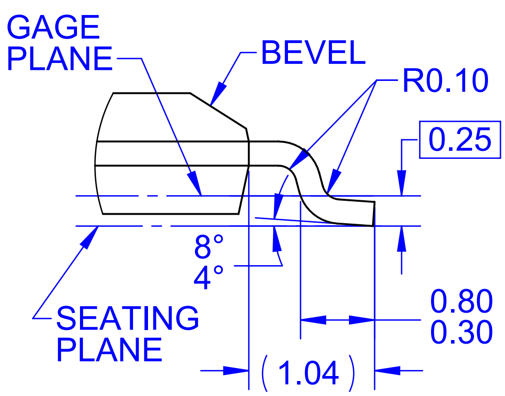
FRONT VIEW



OPTION A
BEVEL EDGE

OPTION B
NON-BEVEL EDGE

SIDE VIEW



DETAIL "B"
SCALE 2:1

NOTES: UNLESS OTHERWISED 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. DRAWING FILENAME: MKT-M08Brev2

FAIRCHILD ™

PUBLICATION ORDERING INFORMATION

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