FAIRCHILD
SEMICONDUCTOR®

September 2006

FAN7380
Half-Bridge Gate Driver

Features

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

Typical Applications

- Fluorescent Lamp Ballast
- Compact Fluorescent Lamp Ballast

Description

The FAN7380 is a monolithic half-bridge gate driver IC for MOSFETs and IGBTs, which operate up to +600V. Fairchild's high-voltage process and common-mode noise canceling technique give stable operation of high-side driver under high dv/dt noise circumstances. Advanced level shift circuit allows high-side gate driver operation up to V_S=-9.8V (typical) for V_{BS}=15V. The input logic level is compatible with standard TTL series logic gates. The internal shoot-through protection circuit provides 100nsec dead-time to prevent output switching devices from both conduction 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 90mA/180mA, respectively, which is suitable for the applications such as fluorescent/compact fluorescent lamp ballast applications and the systems that require low di/dt noise.

8-SOP

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Ordering Information

Device	Package	Operating Temperature	Packing
FAN7380M	8-SOP	-40°C ~ +125°C	Tube
FAN7380MX			Tape & Reel

Internal Block Diagram

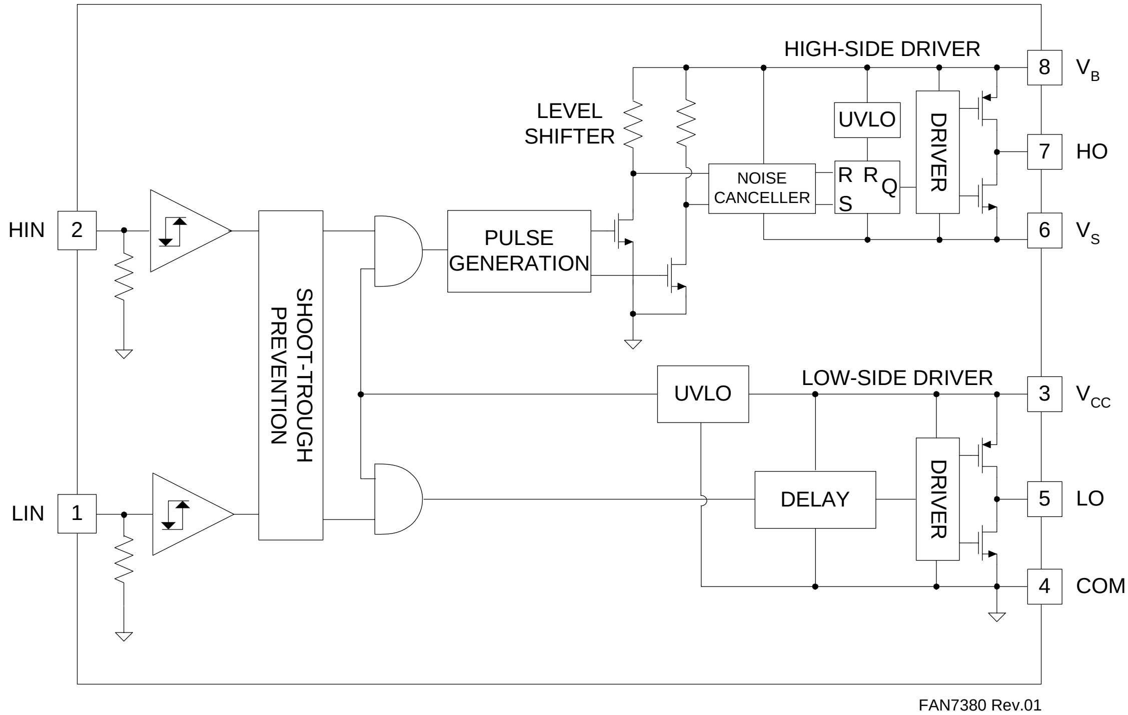

Figure 1. Functional Block Diagram of FAN7380

Pin Configuration

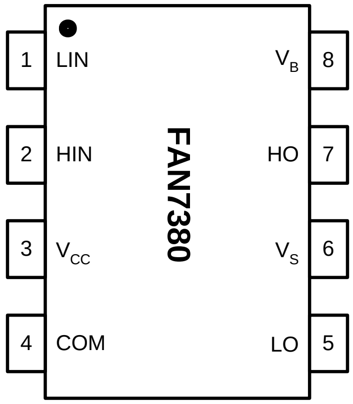

Figure 2. Pin Configuration (Top View)

Pin Definitions

Pin No.	Name	I/O	Function/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

The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table defines the conditions for actual device operation.

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	
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	
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	Power Dissipation	-	0.625	W
Rthja	Thermal resistance, junction to ambient	-	200	°C/W
T_J	Junction Temperature		150	°C
T_S	Storage Temperature	-50	150	°C

Note:
Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltage referenced to COM, all currents are defined positive into any lead.

Recommended Operating 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})=15.0V, T_A = 25°C, unless otherwise specified. The V_{IN}, V_{TH} and I_{IN} parameters are referenced to COM. The V_O and I_O parameters are referenced to COM and V_S is applicable to HO and LO.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
VCCUV+ VBSUV+	V_{CC} & V_{BS} supply under voltage positive going threshold		8.2	9.2	10.0	
VCCUV- VBSUV-	V_{CC} & V_{BS} supply under voltage negative going threshold		7.6	8.7	9.6	V
VCCUVH VBSUVH	V_{CC} supply under voltage lockout hysteresis		-	0.5	-	
I_{LK}	Offset supply leakage current	V_B=V_S=600V	-	-	50	
I_{QBS}	Quiescent V_{BS} supply current	V_{IN}=0V or 5V	-	44	100	µA
I_{QCC}	Quiescent V_{CC} supply current	V_{IN}=0V or 5V	-	70	180	
I_{PBS}	Operating V_{BS} supply current	fin=20kHz, rms value	-	-	600	µA
I_{PCC}	Operating V_{CC} supply current	fin=20kHz, 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=20mA	-	-	2.8	V
V_{OL}	Low-level output voltage, V_O		-	-	1.2	
I_{IN+}	Logic "1" input bias current	V_{IN}=5V	-	5	40	µA
I_{IN-}	Logic "0" input bias current	V_{IN}=0V	-	1.0	2.0	
I_{O+}	Output HIGH short circuit pulse current	V_O=0V,VIN=5V with PW≤10µs	60	90	-	mA
I_{O-}	Output LOW short circuit pulsed current	V_O=15V=VB,VIN=0V with PW≤10µs	130	180	-	
V_S	Allowable negative V_S pin voltage for HIN signal propagation to HO		-	-9.8	-7	V

Dynamic Electrical Characteristics

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on propagation delay	V_S=0V	70	135	200	
t_{off}	Turn-off propagation delay	V_S=0V or 600V	60	130	190	
t_r	Turn-on rise time		160	230	290	ns
t_f	Turn-off fall time		20	90	160	
DT	Dead-time		80	100	190	
MT	Delay matching, HS & LS turn-on/off		-	-	50	

Typical Performance Characteristics

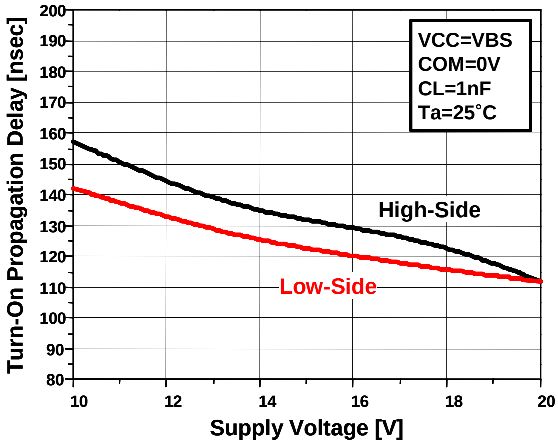

Figure 3. Turn-On Propagation Delay vs. Supply Voltage

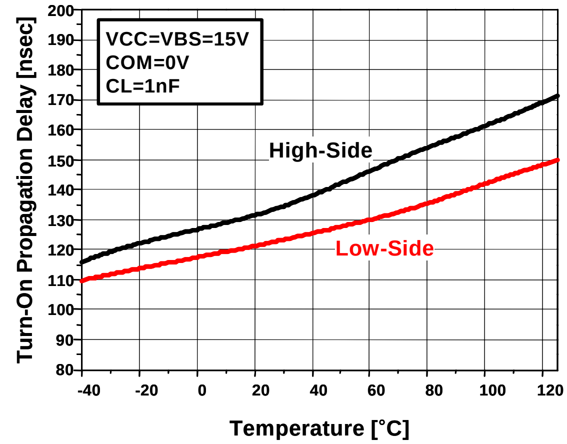

Figure 4. Turn-On Propagation Delay vs. Temp.

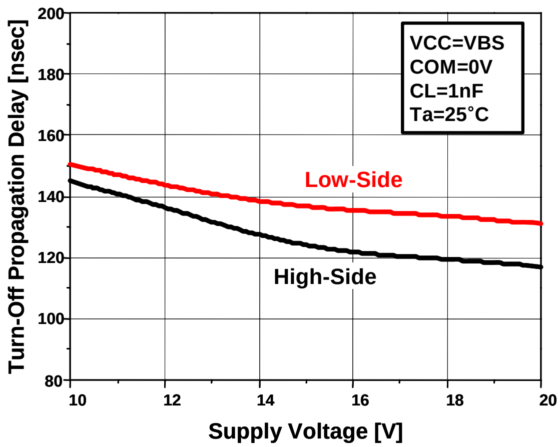

Figure 5. Turn-Off Propagation Delay vs. Supply Voltage

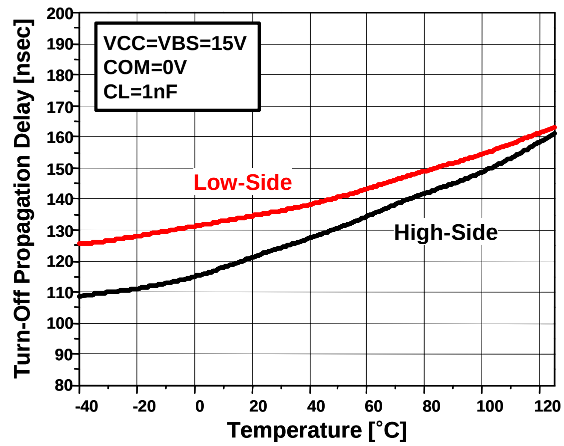

Figure 6. Turn-Off Propagation Delay vs. Temp.

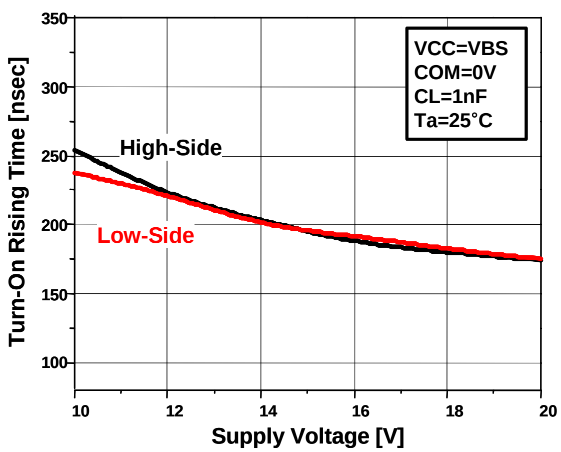

Figure 7. Turn-On Rising Time vs. Supply Voltage

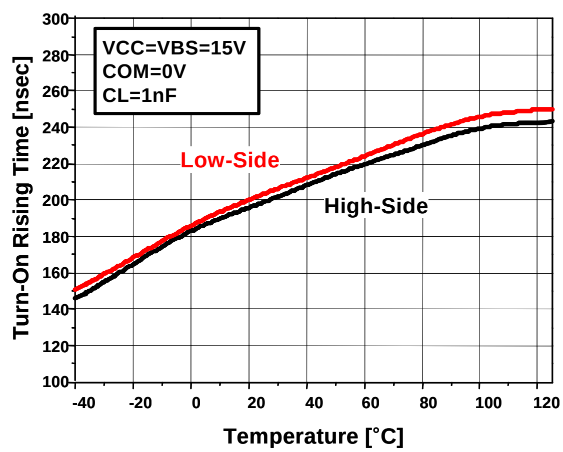

Figure 8. Turn-On Rising Time vs. Temp.

Typical Performance Characteristics (Continued)

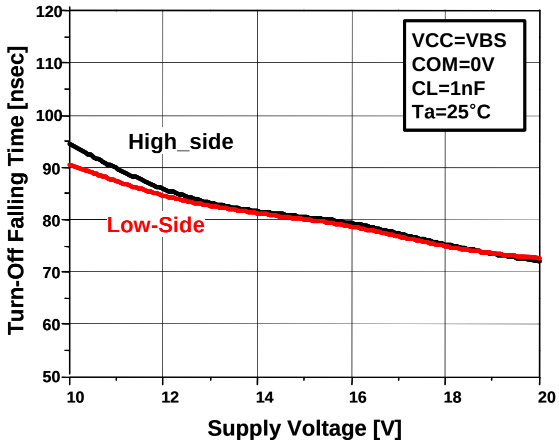

Figure 9. Turn-Off Falling Time vs. Supply Voltage

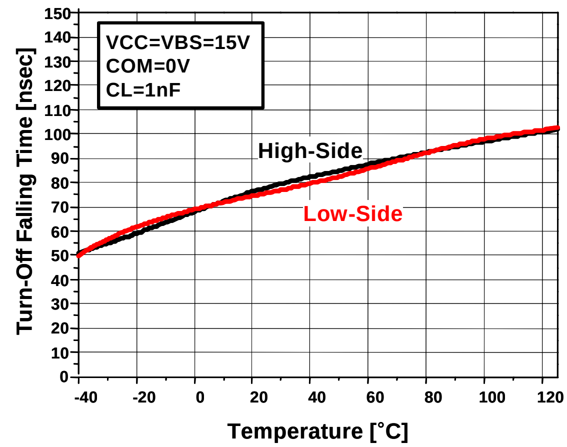

Figure 10. Turn-Off Falling Time vs. Temp.

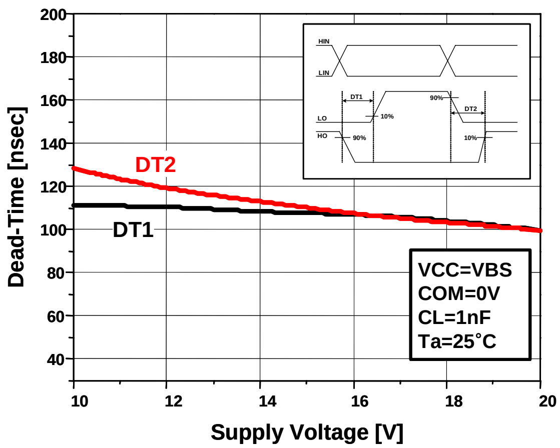

Figure 11. Dead-Time vs. Supply Voltage

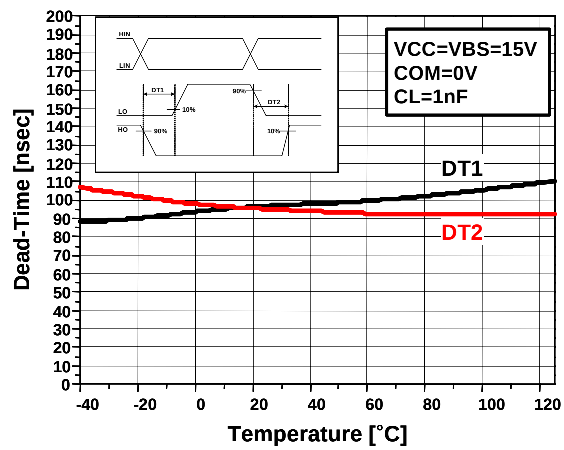

Figure 12. Dead-Time vs. Temp.

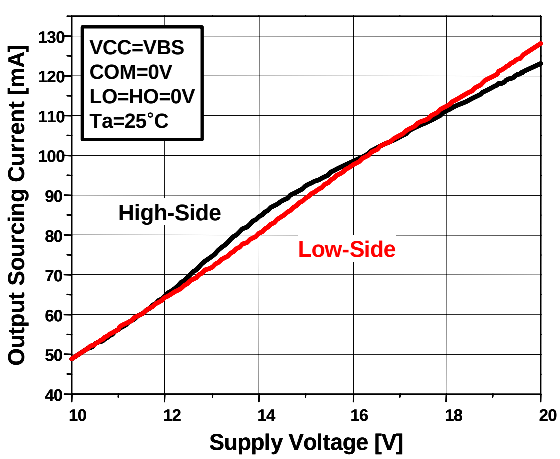

Figure 13. Output Sourcing Current vs. Supply Voltage

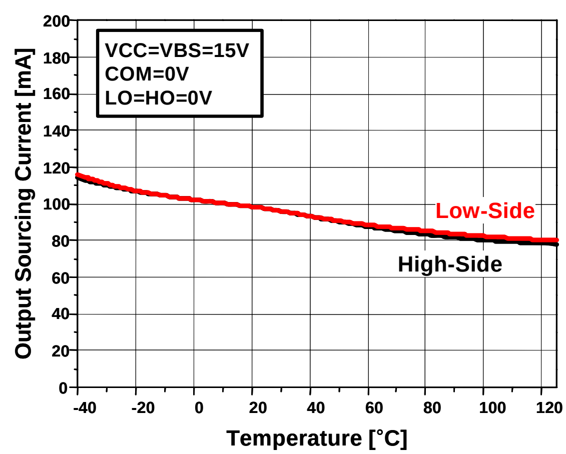

Figure 14. Output Sourcing Current vs. Temp.

Typical Performance Characteristics (Continued)

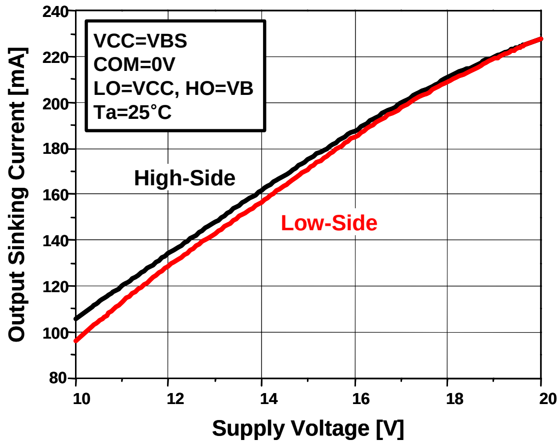

Figure 15. Output Sinking Current vs. Supply Voltage

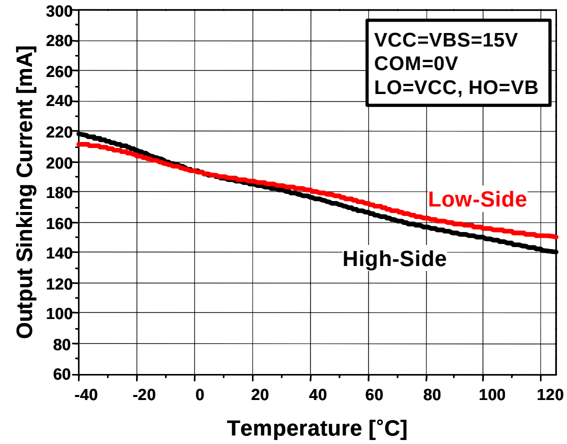

Figure 16. Output Sinking Current vs. Temp.

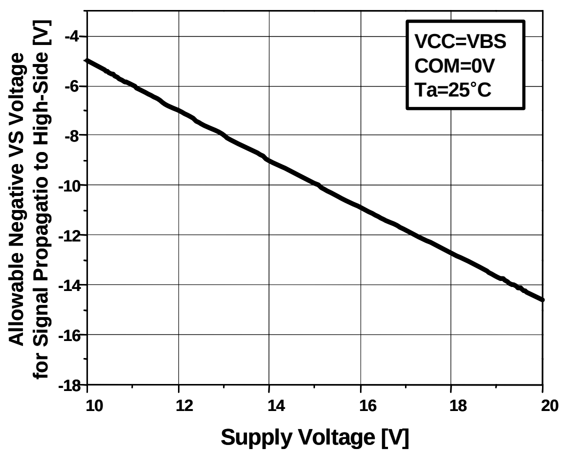

Figure 17. Allowable Negative V_S Voltage for Signal Propagation to High-Side vs. Supply Voltage

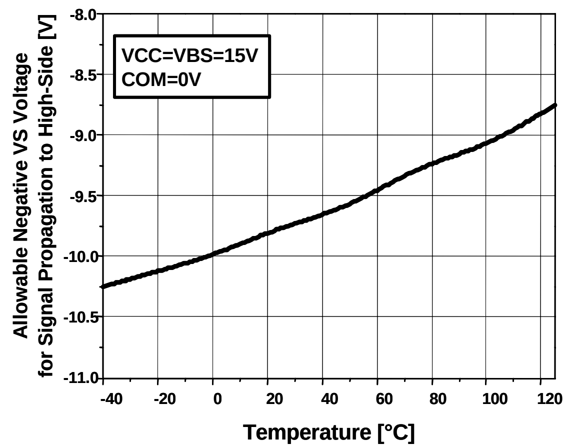

Figure 18. Allowable Negative V_S Voltage for Signal Propagation to High-Side vs. Temp.

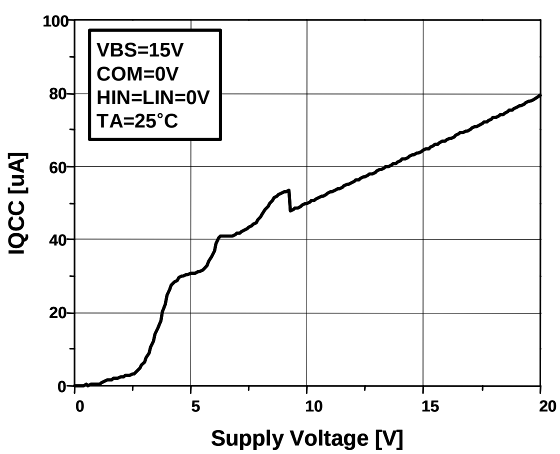

Figure 19. I_{QCC} vs. Supply Voltage

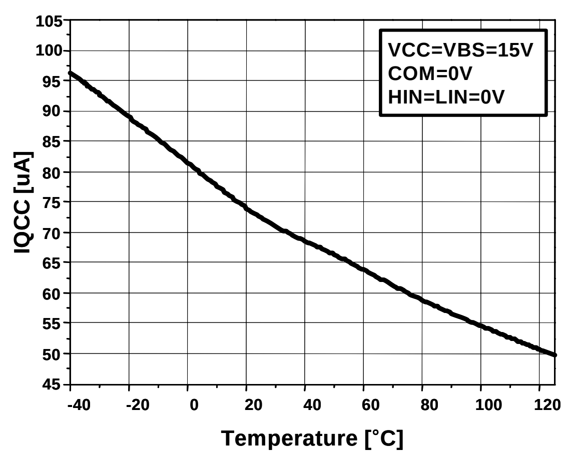

Figure 20. I_{QCC} vs. Temp.

Typical Performance Characteristics (Continued)

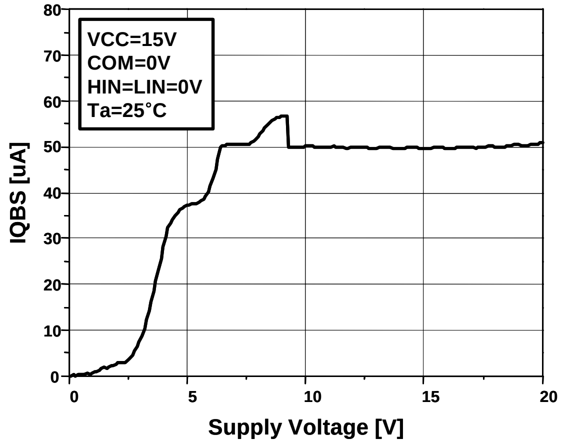

Figure 21. I_{QBS} vs. Supply Voltage

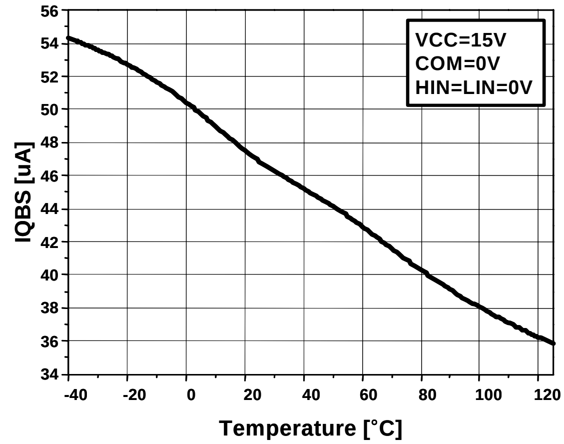

Figure 22. I_{QBS} vs. Temp.

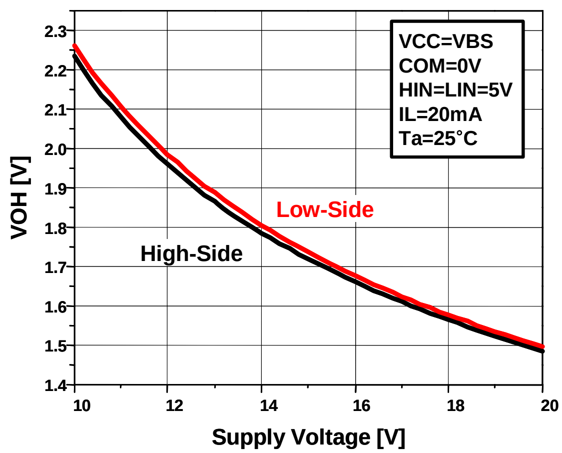

Figure 23. High-Level Output Voltage vs. Supply Voltage

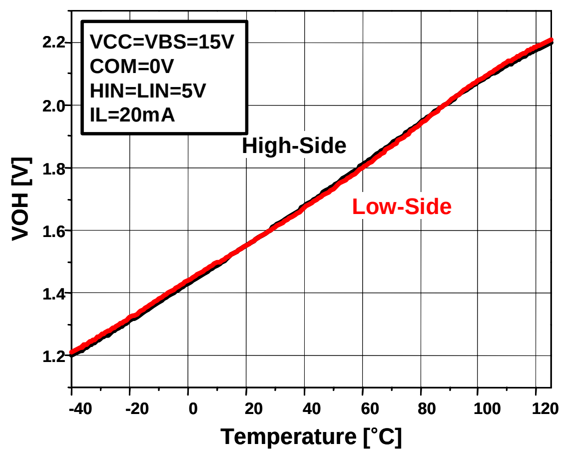

Figure 24. High-Level Output Voltage vs. Temp.

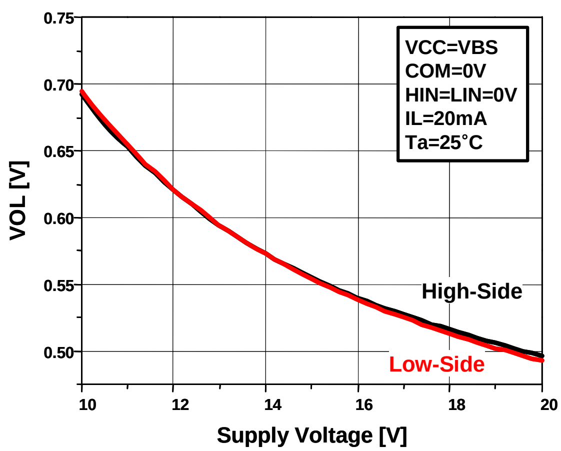

Figure 25. Low-Level Output Voltage vs. Supply Voltage

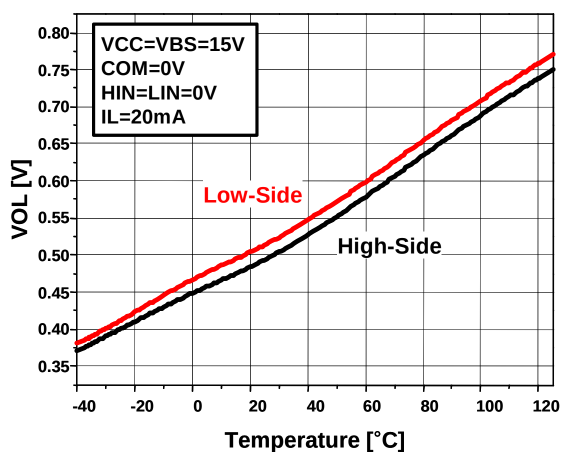

Figure 26. Low-Level Output Voltage vs. Temp.

Typical Performance Characteristics (Continued)

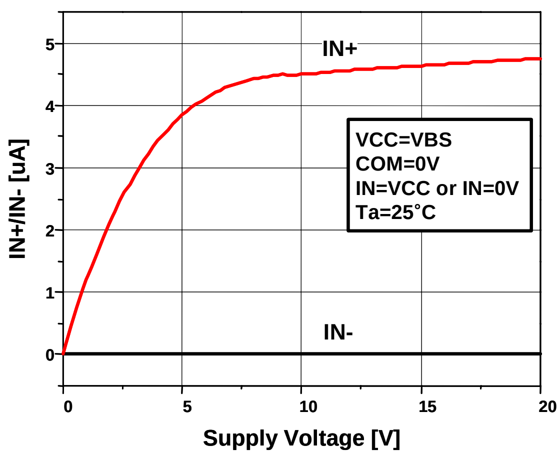

Figure 27. Input Bias Current vs. Supply Voltage

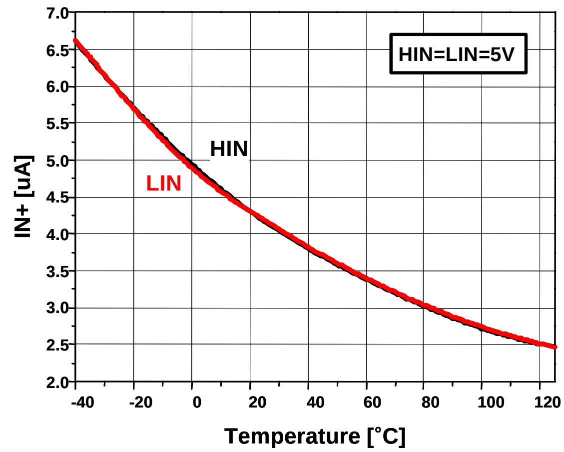

Figure 28. Input Bias Current vs. Temp.

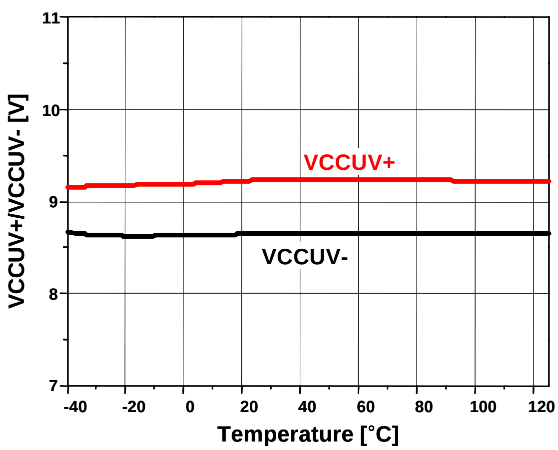

Figure 29. V_{CC} UVLO Threshold Voltage vs. Temp

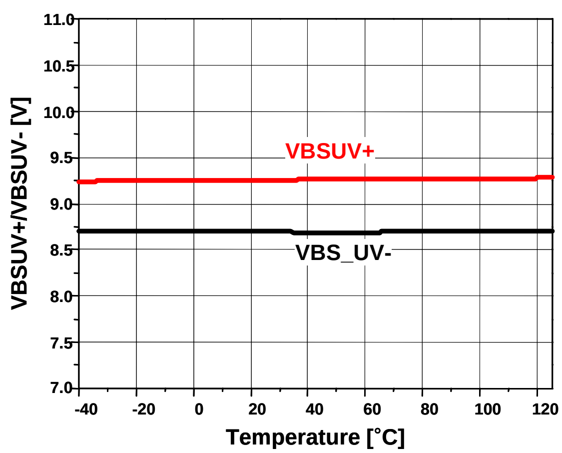

Figure 30. V_{BS} UVLO Threshold Voltage vs. Temp.

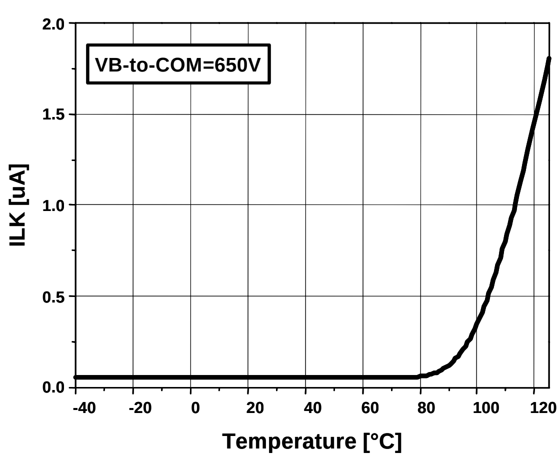

Figure 31. VB to COM Leakage Current vs. Temp.

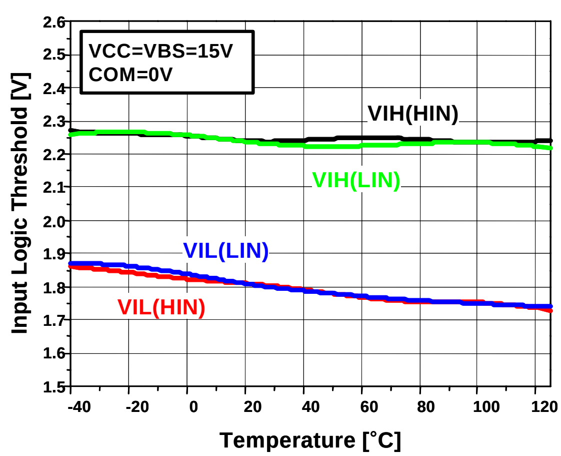

Figure 32. Input Logic Threshold vs. Temp.

Switching Time Definitions

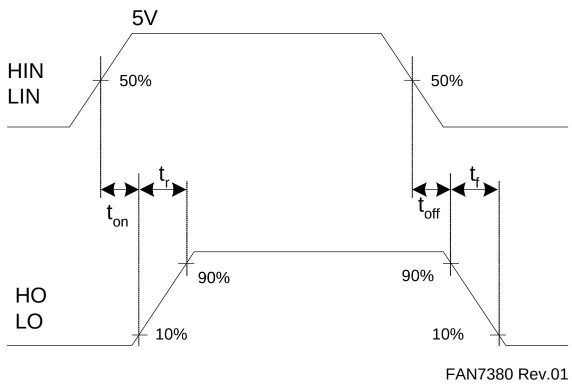

Figure 33. Switching Time Waveforms

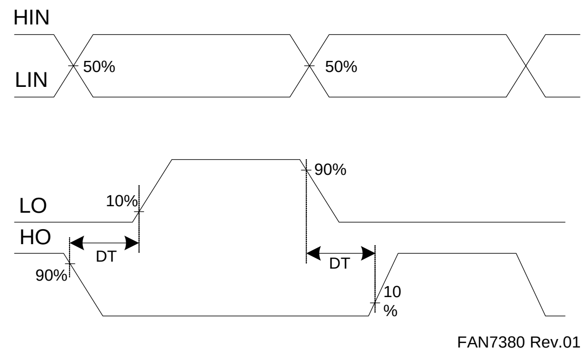

Figure 34. Internal Dead-Time Timing

Typical Application Circuit

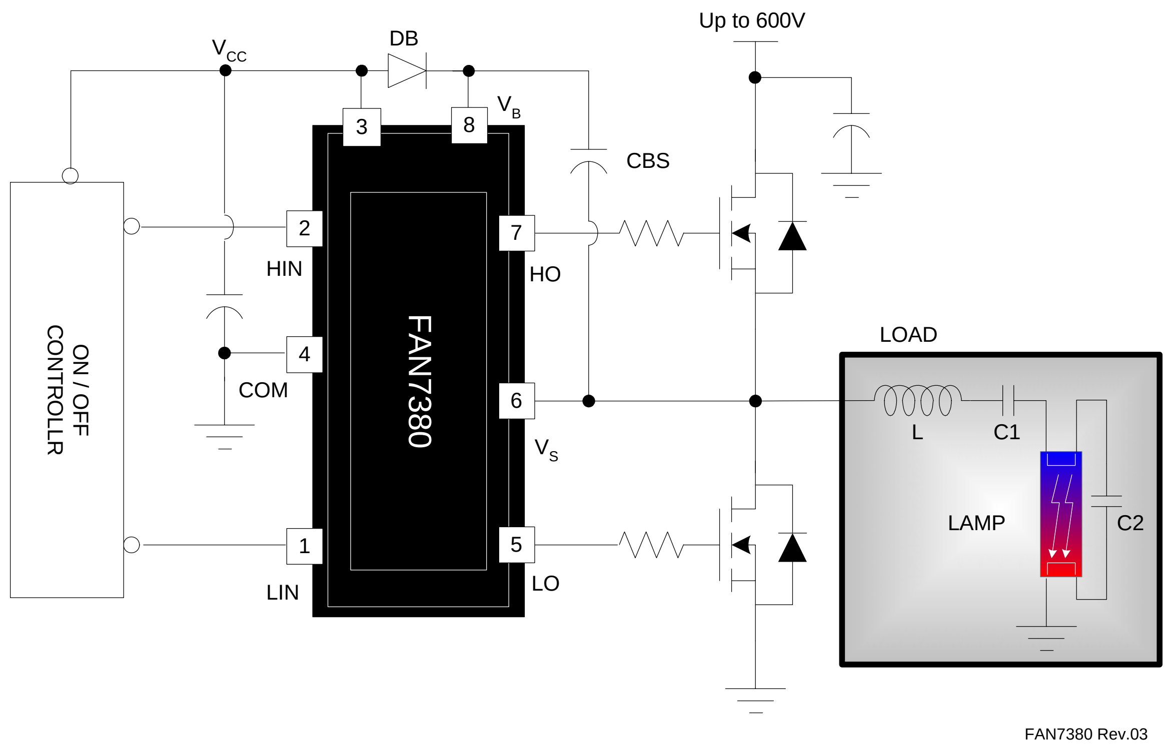

Figure 35. Application Circuit for Fluorescent Lamp Ballast

Mechanical Dimensions

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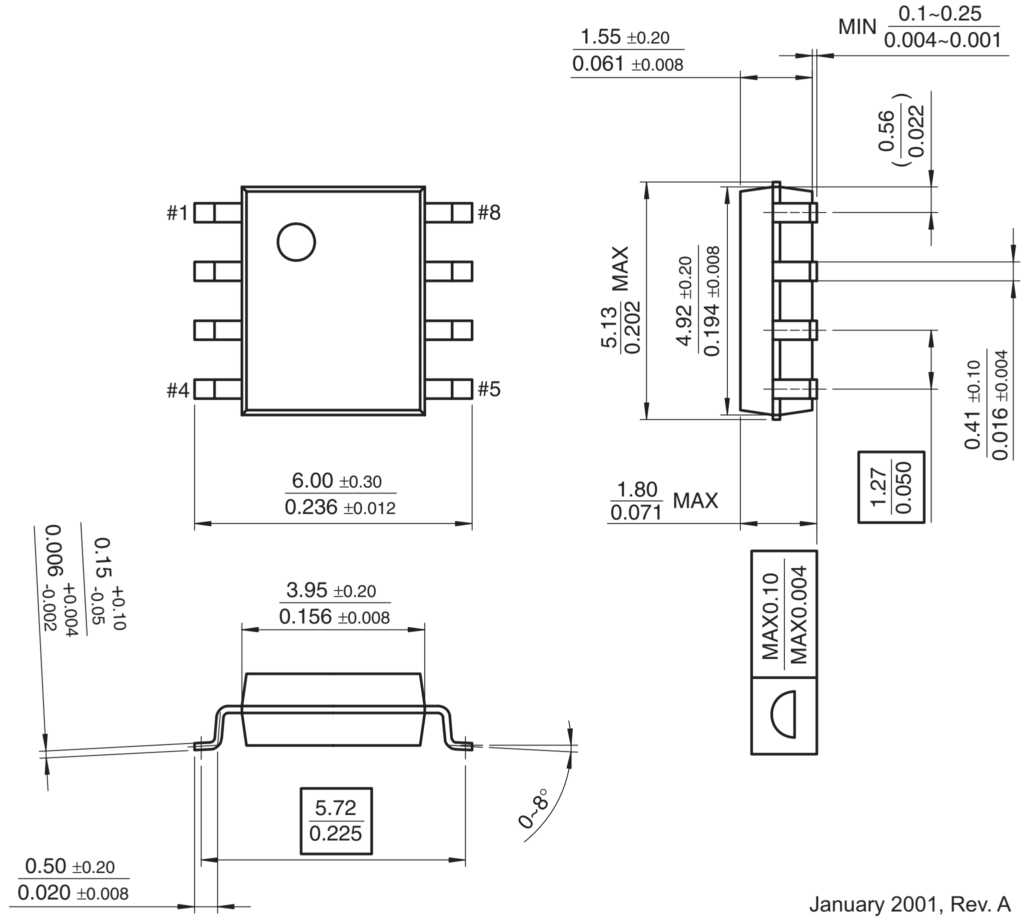
Dimensions are in millimeters (inches) unless otherwise noted.



January 2001, Rev. A

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CoolFET™	*i-Lo*™	POP™	Stealth™	TinyPWM™
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DOME™	IntelliMAX™	PowerEdge™	SuperSOT™-3	UHC™
EcoSPARK™	ISOPLANAR™	PowerSaver™	SuperSOT™-6	UltraFET®
E^2CMOS™	LittleFET™	PowerTrench®	SuperSOT™-8	UniFET™
EnSigna™	MICROCOUPLER™	QFET®	SyncFET™	VCX™
FACT™	MicroFET™	QS™	TCM™	Wire™
FACT Quiet Series™	MicroPak™	QT Optoelectronics™	TinyBoost™	
FAST®	MICROWIRE™	Quiet Series™		
FASTr™	MSX™	RapidConfigure™	Across the board. Around the world.™	
FPS™	MSXPro™	RapidConnect™	Programmable Active Droop™	
FRFET™	OCX™	ScalarPump™	The Power Franchise®	

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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This 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	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.

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