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FAN7390A

High-Current, High & Low-Side, Gate-Drive IC

Features

- Floating Channels for Bootstrap Operation to +600 V
- Typically 4.5 A / 4.5 A Sourcing / Sinking Current Driving Capability
- Common-Mode dv/dt Noise-Canceling Circuit
- Built-in Under-Voltage Lockout for Both Channels
- Matched Propagation Delay for Both Channels
- Logic (V_{SS}) and Power (COM) Ground $\pm 5V$ Offset
- 3.3 V and 5 V Input Logic Compatible
- Output In-phase with Input

Applications

- Plasma Display Panel (PDP) Sustain Driver
- High Intensity Discharge (HID) Lamp Ballast
- SMPS
- Motor Driver

Description

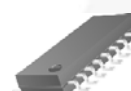
The FAN7390A is a monolithic high- and low-side gate drive IC, which can drive high-speed MOSFETs and IGBTs that operate to 600 V. It has a buffered output stage with all MOS transistors designed for high pulse current driving capability and minimum cross-conduction.

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 $V_G = 9.8 V$ (typical) for $V_{BS} = 15 V$.

The UVLO circuit prevents malfunction when V_{DD} and V_{BS} are lower than the specified threshold voltage.

The high-current and low-output voltage-drop feature make this device suitable for the PDP sustain pulse driver, motor driver, switching power supply, and high-power DC-DC converter applications.

14-SOP



Ordering Information

Part Number	Package	Operating Temperature Range	Packing Method
FAN7390AMX1	14-SOP	-40°C ~ 125°C	Tape & Reel

Typical Application Circuit

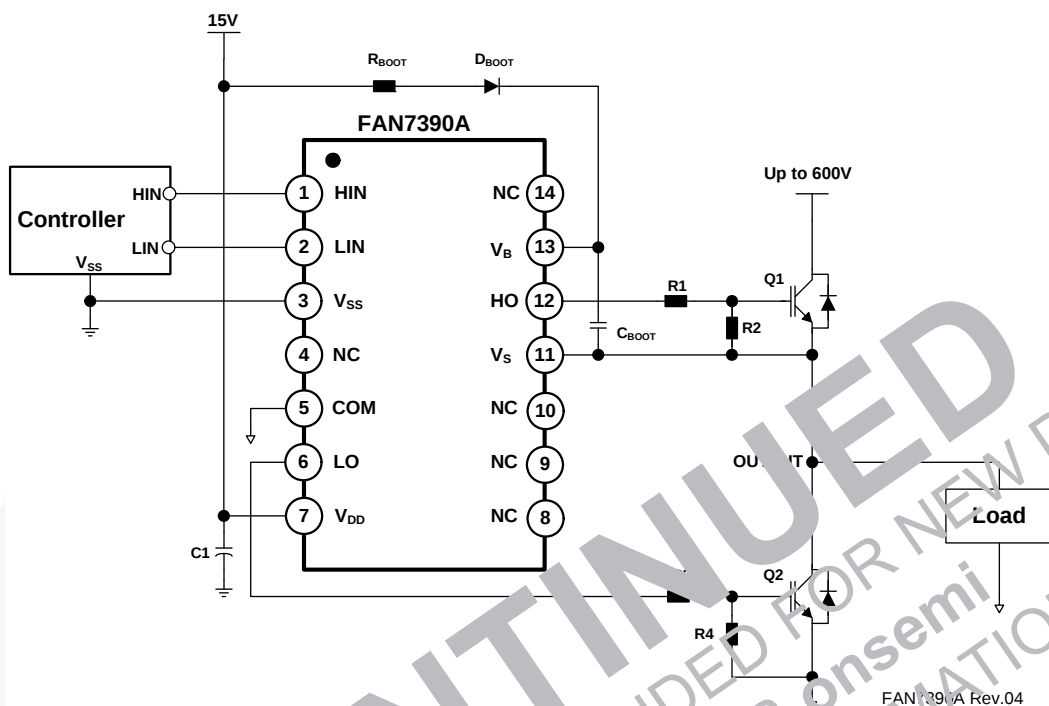


Figure 1. Application Circuit for Half-Bridge (Referenced 14-SOP)

Internal Block Diagram

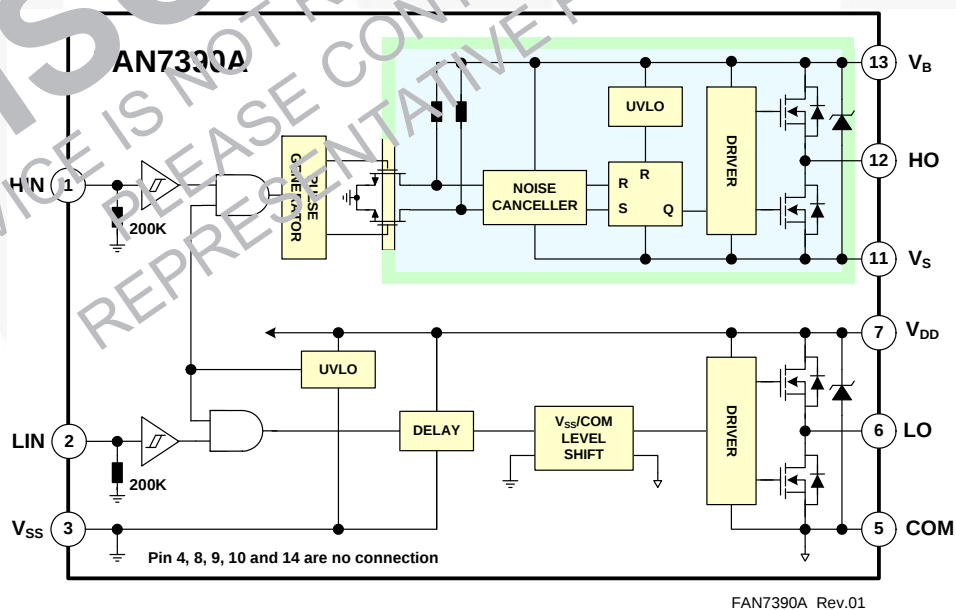


Figure 2. Functional Block Diagram (Referenced 14-SOP)

Pin Configurations

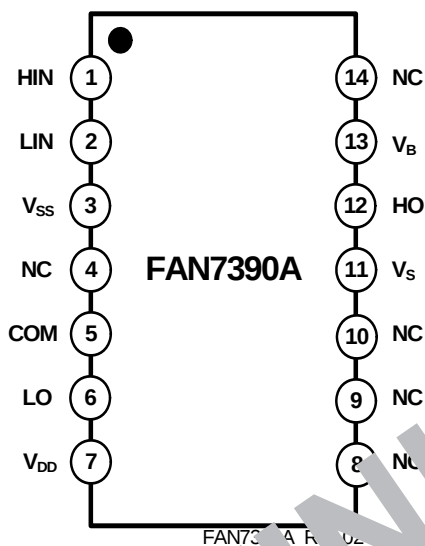


Figure 3. Pin Assignment (Top View)

Pin Definitions

14-Pin	Name	Description
1	HIN	Logic Input for High-Side Gate Driver Output
2	LIN	Logic Input for Low-Side Gate Driver Output
3	VSS	Logic Ground
5	COM	Low-Side Driver Return
6	LO	Low-Side Driver Output
7	VDD	Low-Side and Logic Part Supply Voltage
11	VS	High-Voltage Floating Supply Return
12	HO	High-Side Driver Output
13	VB	High-Side Floating Supply
4, 8, 9, 10, 14	NC	No Connect

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 Supply Offset Voltage	$V_B - V_{SHUNT}$	$V_B + 0.3$	V
V_B	High-Side Floating Supply Voltage	-0.3	625.0	V
V_{HO}	High-Side Floating Output Voltage, HO Pin	$V_S - 0.3$	$V_B + 0.3$	V
V_{DD}	Low-Side and Logic Fixed Supply Voltage	-0.3	V_{SHUNT}	V
V_{LO}	Low-Side Output Voltage, LO Pin	-0.3	$V_{DD} + 0.3$	V
V_{IN}	Logic Input Voltage (HIN and LIN)	$V_{SS} - 0.3$	$V_{DD} + 0.3$	V
V_{SS}	Logic Ground	$V_{DD} - 25$	$V_{DD} + 0.3$	V
dV_S/dt	Allowable Offset Voltage Slew Rate		50	V/ns
$P_D^{(1)(2)(3)}$	Power Dissipation		1.0	W
θ_{JA}	Thermal Resistance, Junction-to-Ambient		110	$^{\circ}\text{C/W}$
T_J	Junction Temperature		+150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature		+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; and
 JESD51-3: Low effective thermal conductivity test board for leaded surface mount packages.
- Do not exceed P_D maximum 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_{DD}	Low-Side and Logic Supply Voltage	10	20	V
V_{LO}	Low-Side Output Voltage	COM	V_{DD}	V
V_{IN}	Logic Input Voltage (HIN and LIN)	V_{SS}	V_{DD}	V
T_A	Operating Ambient Temperature	-40	+125	$^{\circ}\text{C}$

Electrical Characteristics

V_{BIAS} (V_{DD} , V_{BS})=15.0 V, $V_S=V_{SS}=COM$, $T_A=25^\circ C$, unless otherwise specified. The V_{IL} , V_{IH} , and I_{IN} parameters are referenced to V_{SS}/COM and are applicable to the respective input signals HIN and LIN. The V_O and I_O parameters are referenced to COM and V_S is applicable to the respective output signals HO and LO.

Symbol	Characteristics	Condition	Min.	Typ.	Max.	Unit
POWER SUPPLY SECTION (V _{DD} AND V _{BS})						
V _{DDUV+} V _{BSUV+}	V _{DD} and V _{BS} Supply Under-Voltage Positive-Going Threshold		8.0	8.8	9.8	V
V _{DDUV-} V _{BSUV-}	V _{DD} and V _{BS} Supply Under-Voltage Negative-Going Threshold		7.4	8.3	9.0	
V _{DDUVH} V _{BSUVH}	V _{DD} and V _{BS} Supply Under-Voltage Lockout Hysteresis Voltage					
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		45	80	
I _{QDD}	Quiescent V _{DD} Supply Current	V _{IN} =0 V or 5 V		75	110	
I _{PBS}	Operating V _{BS} Supply Current	f _{IN} =20 kHz, rms value		530	640	
I _{PDD}	Operating V _{DD} Supply Current	f _{IN} =20 kHz, rms value		530	640	
SHUNT REGULATOR SECTION						
V _{SHUNT}	V _{DD} and V _{BS} Shunt Regulator Clamping Voltage	V _{DD} Sweep or V _{BS} Sweep, I _{SHUNT} =5 mA	21	23	25	V
LOGIC INPUT SECTION (H _{IN} , L _{IN})						
V _{IH}	Logic "1" Input Voltage		2.5			V
V _{IL}	Logic "0" Input Voltage				1.2	
I _{IN+}	Logic "1" Input Bias Current	V _{IN} =5 V		25	50	μA
I _{IN-}	Logic "0" Input Bias Current	V _{IN} =0 V		1.0	2.0	
R _{IN}	Input Pull-down Resistance		100	200		
GATE DRIVER OUTPUT SECTION (H _O , L _O)						
V _{OH}	High-Level Output Voltage, V _{BIAS} -V _O	No Load			1.0	V
V _{OL}	Low-Level Output Voltage, V _O	No Load			35	mV
I _{O+}	Output High, Short-Circuit Pulsed Current ⁽⁴⁾	V _O =0 V, V _{IN} =5 V, PW<10 μs	3.5	4.5		A
I _{O-}	Output Low, Short-Circuit Pulsed Current ⁽⁵⁾	V _O =15 V, V _{IN} =0 V, PW<10 μs	3.5	4.5		
V _{S-}	Allowable Negative V _S Pin Voltage for H _{IN} Signal Propagation to H _O			-9.8	-7.0	V
V _{SS-COM}	V _{SS} -COM/COM-V _{SS} Voltage Endurability		-5		5	V

Note:

4. This parameter guaranteed by design.

Dynamic Electrical Characteristics

V_{BIAS} (V_{DD} , V_{BS})=15.0 V, $V_S=V_{SS}=COM=0$ V, $C_L=1000$ pF and $T_A=25^\circ C$ unless otherwise specified.

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
t_{on}	Turn-On Propagation Delay	$V_S=0$ V		140	200	ns
t_{off}	Turn-Off Propagation Delay	$V_S=0$ V		140	200	
MT	Delay Matching, HS & LS Turn-On/Off			15	50	
t_r	Turn-on Rise Time			25	50	
t_f	Turn-off Fall Time			20	45	

Typical Characteristics

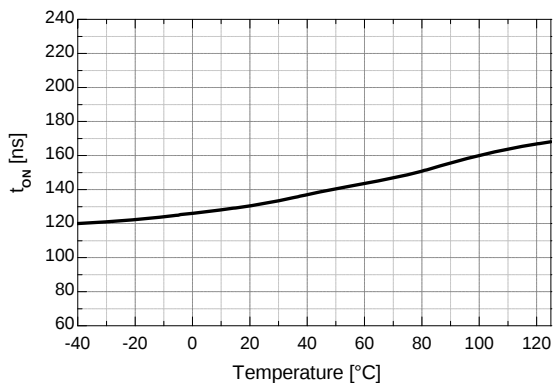


Figure 4. Turn-On Propagation Delay vs. Temperature

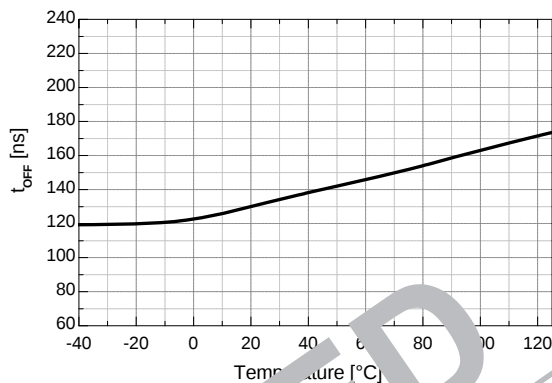


Figure 5. Turn-Off Propagation Delay vs. Temperature

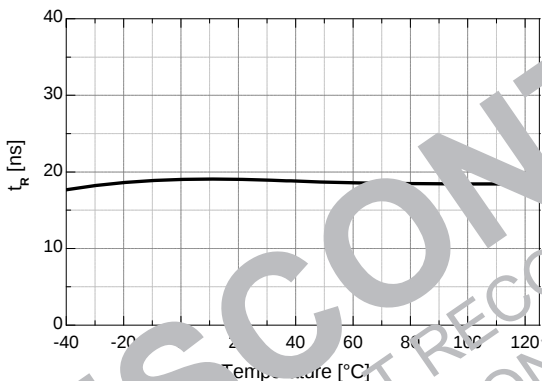


Figure 6. Turn-On Rise Time vs. Temperature

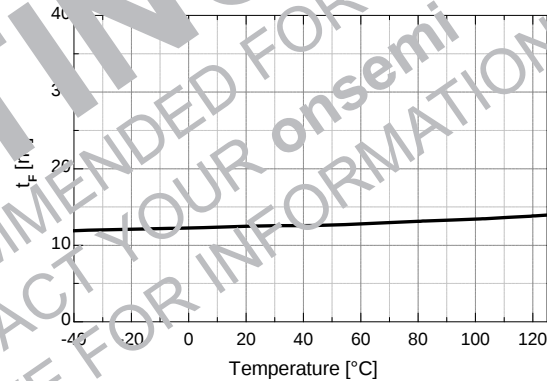


Figure 7. Turn-Off Fall Time vs. Temperature

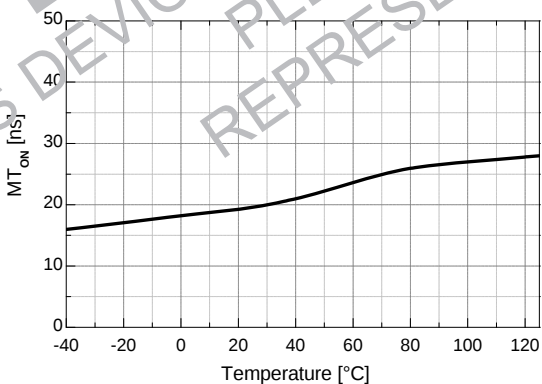


Figure 8. Turn-On Delay Matching vs. Temperature

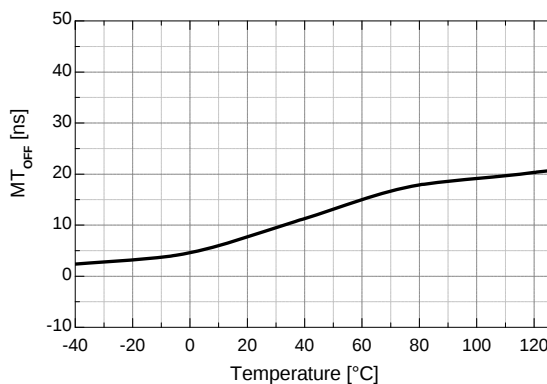
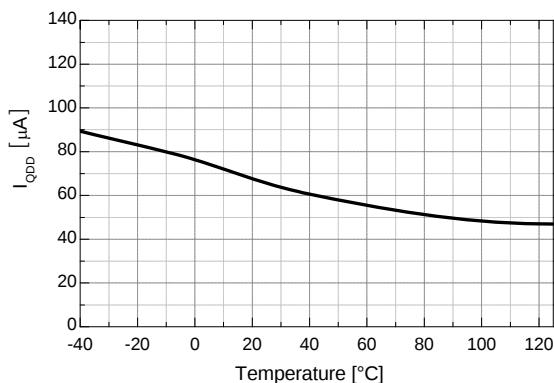
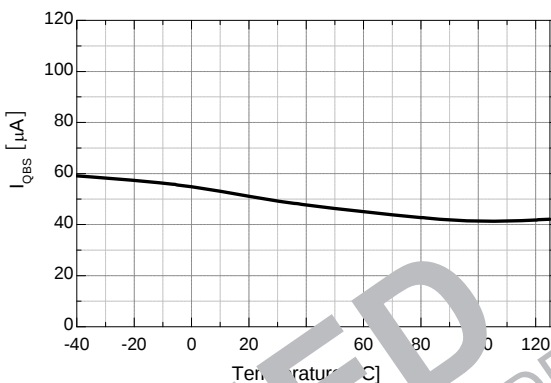
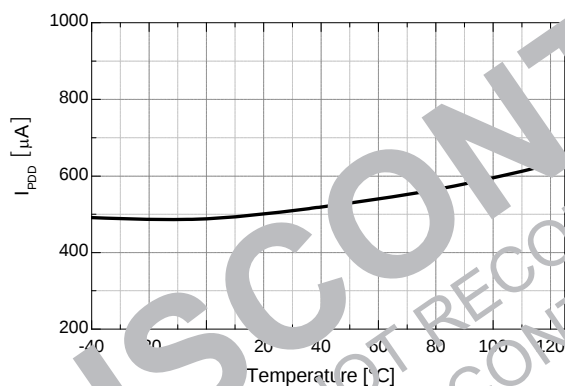
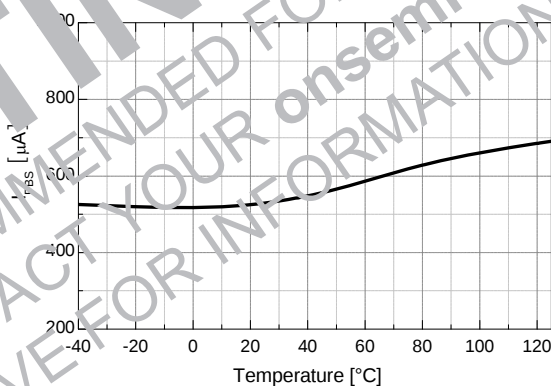
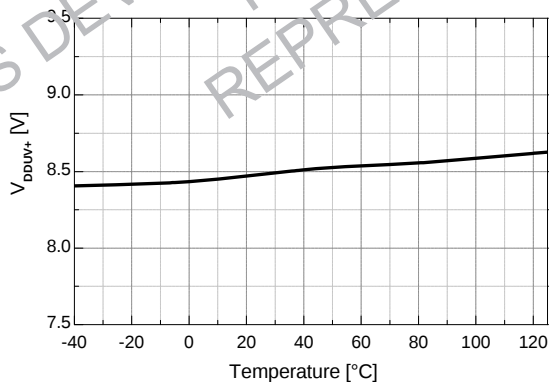
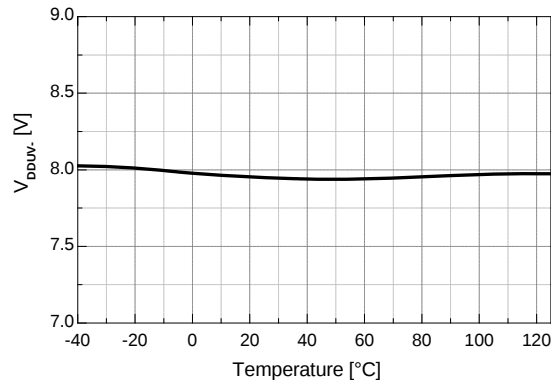


Figure 9. Turn-Off Delay Matching vs. Temperature

Typical Characteristics (Continued)

Figure 10. Quiescent V_{DD} Supply Current vs. TemperatureFigure 11. Quiescent V_{BS} Supply Current vs. TemperatureFigure 12. Operating V_{DD} Supply Current vs. TemperatureFigure 13. Operating V_{BS} Supply Current vs. TemperatureFigure 14. V_{DD} UVLO+ vs. TemperatureFigure 15. V_{DD} UVLO- vs. Temperature

Typical Characteristics (Continued)

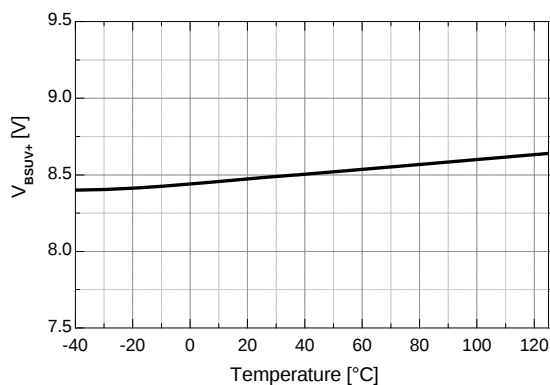
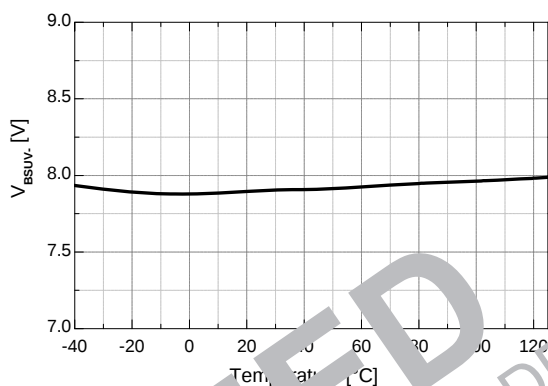
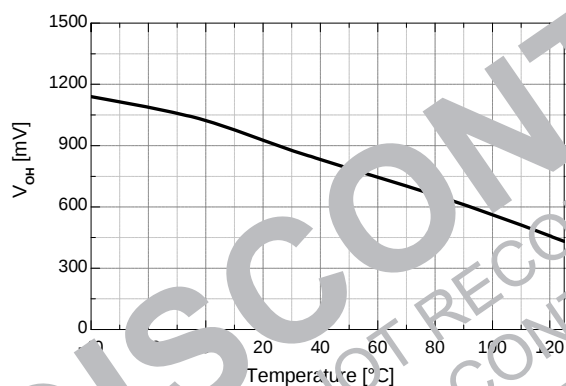
Figure 16. V_{BS} UVLO+ vs. TemperatureFigure 17. V_{BS} UVLO- vs. Temperature

Figure 18. High Level Output Voltage vs. Temperature

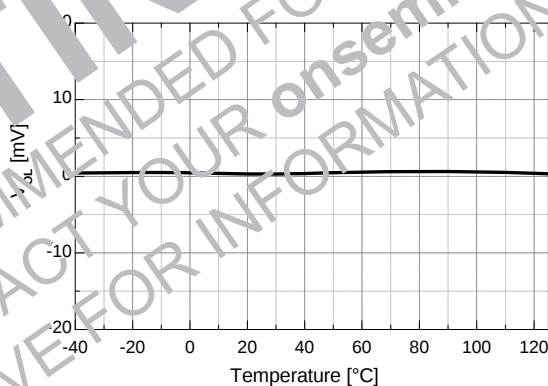


Figure 19. Low-Level Output Voltage vs. Temperature

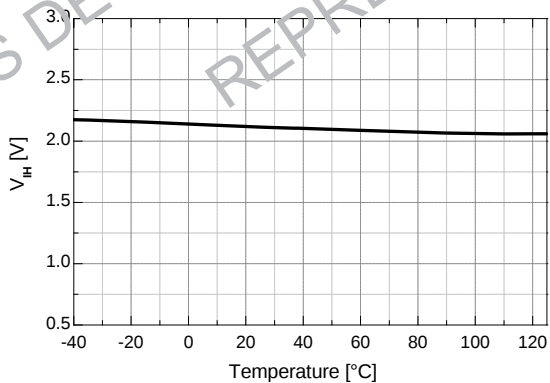


Figure 20. Logic HIGH Input Voltage vs. Temperature

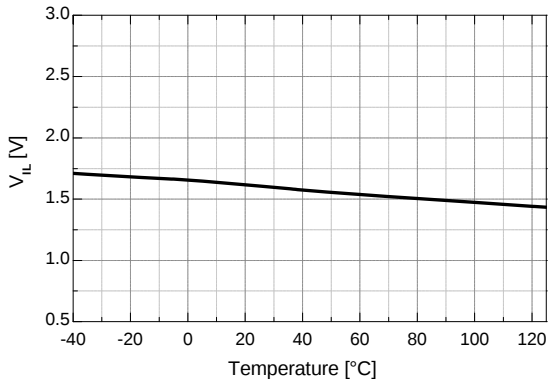


Figure 21. Logic LOW Input Voltage vs. Temperature

Typical Characteristics (Continued)

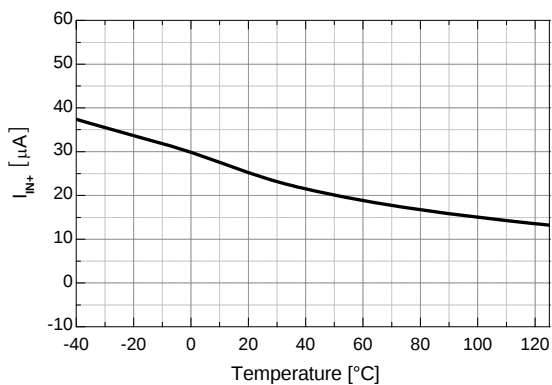


Figure 22. Logic Input High Bias Current vs. Temperature

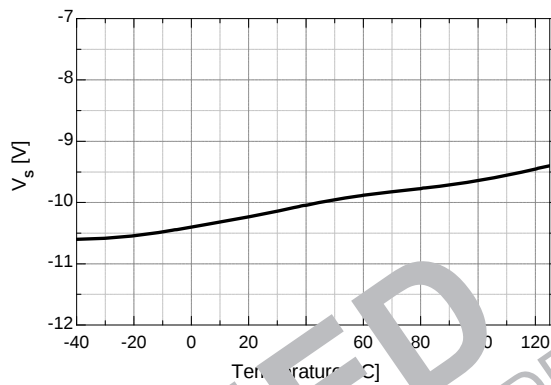


Figure 23. Allowable Negative V_S Voltage vs. Temperature

Switching Time Definitions

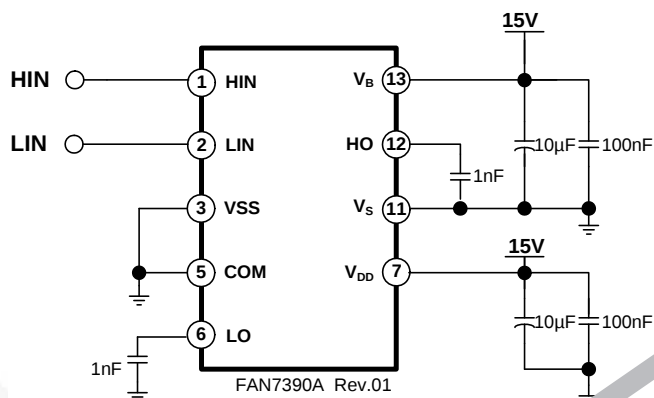


Figure 24. Switching Time Test Circuit (Reference 8-S)

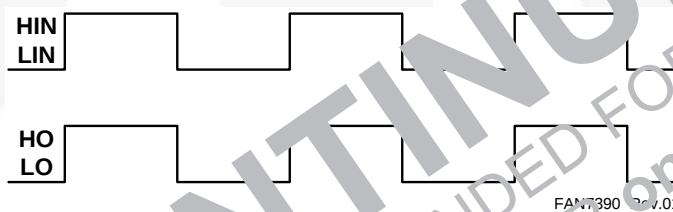


Figure 25. Input/Output Timing Diagram

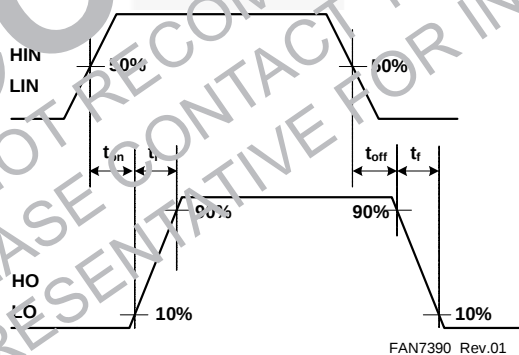


Figure 26. Switching Time Waveform Definitions

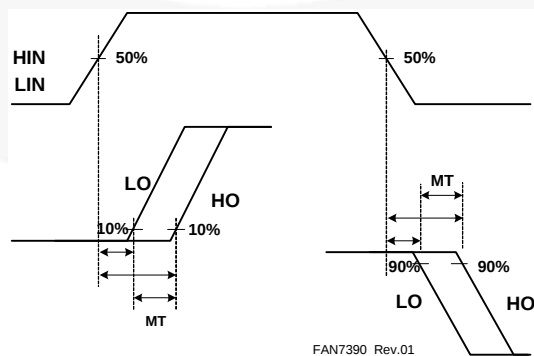


Figure 27. Delay Matching Waveform Definitions

Package Dimensions

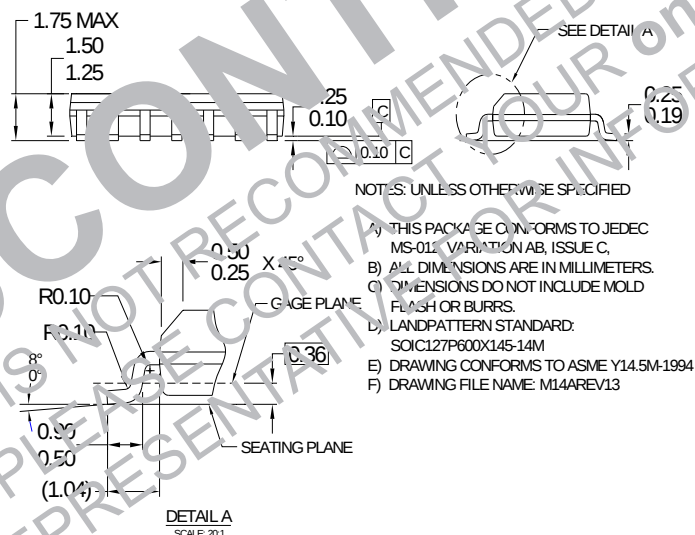
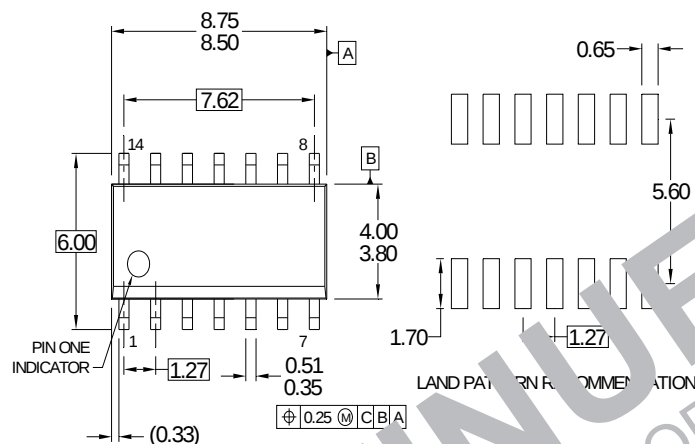


Figure 28. 14-Lead, Small Outline Package (SOP)

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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.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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