ALPHA SEMICONDUCTOR
Excellence in Analog Power Products

AS426/AS427/AS428

Dual High-Speed Power MOSFET Drivers

FEATURES

- Latch Up Protected > 1.5A
- Logic Input Swing Negative 5V
- ESD 4kv
- Matched Rise and Fall Times 20ns
- Pin-to-Pin Compatible with TC426/427/428

APPLICATIONS

- Motor Controls
- Switch-Mode Power Supplies
- Pulse Transformer Driver
- Class D Switching Amplifiers

PRODUCT DESCRIPTION

The AS426/AS427/AS428 are dual CMOS high-speed drivers. A TTL/CMOS input voltage level is translated into an output voltage level swing equaling the supply. The CMOS output will be within 25 mV of ground or positive supply. Bipolar designs are capable of swinging only within 1V of the supply.

The low impedance, high-current driver outputs will swing a 1000 pF load 18V in 30 ns. The unique current and voltage drive qualities make the AS426/AS427/AS428 ideal power MOSFET drivers, line drivers, and DC-to-DC converter building blocks.

The inverting AS426 driver is pin-compatible with the bipolar DS0026 and MMH0026 devices. The AS427 is non-inverting; the AS428 contains an inverting and non-inverting driver.

Other pin compatible driver families are the TC1426/27/28, TC4426/27/28, and TC4426A/27A/28A.

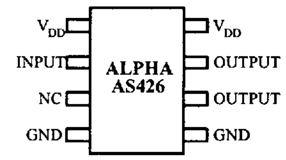
ORDERING INFORMATION

PART NUMBER	PACKAGE TYPE	TEMPERATURE RANGE
AS429XP	8-Pin PDIP	0°C to +70°C
AS429XP	8-Pin PDIP	-40°C to +85°C
AS429XP	8-Pin PDIP	-55°C to +125°C
AS429XS	SOIC-8	0°C to +70°C
AS429XS	SOIC-8	-40°C to +85°C
AS429XS	SOIC-8	-55°C to +125°C

X= I Industrial; C Commercial; M Military

PIN CONNECTIONS

8-Pin Surface Mount/PDIP



Top View

ABSOLUTE MAXIMUM RATINGS

Supply Voltage .... +20V
Input Voltage, Any Terminal......... V_{DD} +0.3V to GND -0.3V
Power dissipation
Plastic... 1000 mW
CERDIP ....800 mW
SOIC ....500 mW
Derating Factors
Plastic.. 8 mW/°C
CERDIP .... 6.4 mW/°C
SOIC .... 4 mW/°C

Operating Temperature Range
C Version .... 0°C to +70°C
I Version.. -40°C to +85°C
M Version... -55°C to +125°C
Maximum Chip Temperature.................................. +150°C

Storage Temperature Range .... -65°C to 150°C
Lead Temperature (Soldering, 10 sec)..................... +300°C

ELECTRICAL CHARACTERISTICS

T_A = +25°C with 4.5V ≤ V_{DD} ≤ 18V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Input						
Logic 1, High Input Voltage	V_{IH}		2.4	-	-	V
Logic 0, Low Input Voltage	V_{IL}		-	-	0.8	V
Input Current	I_{IN}	0V ≤ V_{IN} ≤ V_{DD}	-1	-	1	µA
Output						
High Output Voltage	V_{OH}		V_{DD} - 0.025	-	-	V
Low Output Voltage	V_{OL}		-	-	0.025	V
High Output Resistance	R_{OH}	I_{OUT} = 10 mA, v_{DD} = 18V	-	10	15	Ω
Low Output Resistance	R_{OL}	I_{OUT} = 10 mA, v_{DD} = 18V	-	6	10	Ω
Peak Output Current	I_{PK}		-	1.5	-	A
Switching Time (Note 1)						
Rise Time	t_R	Test Figure 1/2	-	-	30	ns
Fall Time	t_F	Test Figure 1/2	-	-	30	ns
Delay Time	t_{D1}	Test Figure 1/2	-	-	50	ns
Delay Time	t_{D2}	Test Figure 1/2	-	-	75	ns
Power Supply						
Power Supply Current	I_S	V_{IN} = 3V (Both Inputs)	-	-	8	mA
		V_{IN} = 0V (Both Inputs)	-	-	0.4	mA

ELECTRICAL CHARACTERISTICS Over Operating Temperature Range with $4.5V \leq V_{DD} \leq 18V$, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Units
Input						
Logic 1, High Input Voltage	V_{IH}		2.4	-	-	V
Logic 0, Low Input Voltage	V_{IL}		-	-	0.8	V
Input Current	I_{IN}	$0V \leq V_{IN} \leq V_{DD}$	-10	-	10	μA
Output						
High Output Voltage	V_{OH}		V_{DD} - 0.025	-	-	V
Low Output Voltage	V_{OL}		-	-	0.025	V
High Output Resistance	R_{OH}	I_{OUT} = 10 mA, v_{DD} = 18V	-	13	20	Ω
Low Output Resistance	R_{OL}	I_{OUT} = 10 mA, v_{DD} = 18V	-	8	15	Ω
Switching Time (Note 1)						
Rise Time	t_R	Test Figure 1/2	-	-	60	ns
Fall Time	t_F	Test Figure 1/2	-	-	30	ns
Delay Time	t_{D1}	Test Figure 1/2	-	-	75	ns
Delay Time	t_{D2}	Test Figure 1/2	-	-	120	ns
Power Supply						
Power Supply Current	I_S	V_{IN} = 3V (Both Inputs) V_{IN} = 0V (Both Inputs)	- -	- -	12 0.6	mA mA

*Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may effect device reliability.

SUPPLY BYPASSING

Charging and discharging large capacitive loads quickly requires large currents. For example, charging a 1000-pF load to 18V in 25 ns requires an 0.72A current from the device power supply.

To guarantee low supply impedance over a wide frequency range, a parallel capacitor combination is recommended for supply bypassing. Low-inductance ceramic disk capacitors with short lead lengths (<0.5 in.) should be used. A 1 μF film capacitor in parallel with one or two 0.1 μF ceramic disk capacitors normally provides adequate bypassing.

GROUNDING

THE AS426 and AS428 contain inverting drivers. Ground potential drops developed in common ground impedance's from input to output will appear as negative feedback and degrade switching speed characteristics.

Individual ground returns for the input and output circuits or a ground plane should be used.

INPUT STAGE

The input voltage level changes the no-load or quiescent supply current. The N-channel MOSFET input stage transistor drives a 2.5 mA current source load. With a logic "1" input, the maximum quiescent supply current is 8mA. Logic "0" input level signals reduce quiescent current to 0.4 mA maximum. Minimum power dissipation occurs for logic "0" inputs for the AS426/427/428. **Unused driver inputs must be connected to V_{DD} or GND.**

The drivers are designed with 100mV of hysteresis. This provides clean transitions and minimizes output stage olds are approximately 1.5V, making the device TTL compatible over the 4.5V to 18V supply operating range. Input current is less than 1μA over this range.

The AS426/427/428 may be directly driven by the TL494, SG1526/1527, SG1524, SE5560, and similar switch-mode power supply integrated circuits.

POWER DISSIPATION

The supply current vs. frequency and supply current vs. capacitive load characteristic curves will aid in determining power dissipation calculations.

The AS426/427/428 CMOS drivers have greatly reduced quiescent DC power consumption. Maximum quiescent current is 8mA compared to the DS0026 40mA specification. For a 15 supply, power dissipation is typically 40 mW.

Two other power dissipation components are:

- Output stage AC and CD load power.
- Transition state power.

Output stage power is:

$$P_o = P_{DC} + PAC$$
$$= V_o (I_{DC}) + f\, C_L\, V_S$$

Where:

V_o = DC output voltage
I_{DC} = DC output load current
f = Switching frequency
V_s = Supply voltage

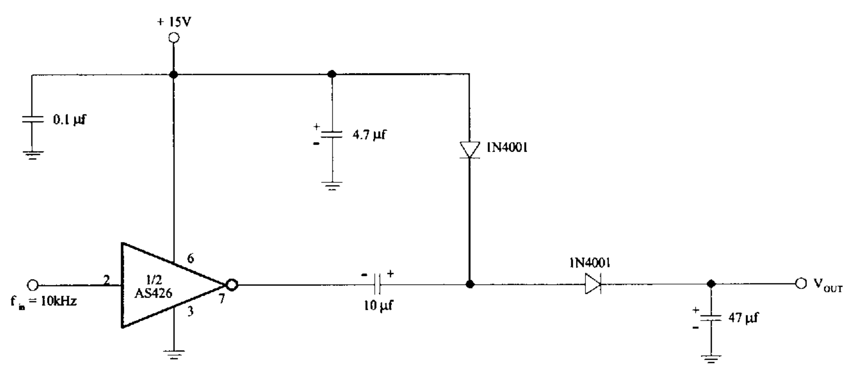
In power MOSFET drive applications the P_{DC} term is negligible. MOSFET power transistors are high impedance, capacitive input devices. In applications where resistive loads or relays are drive, the P_{DC} component will normally dominate.

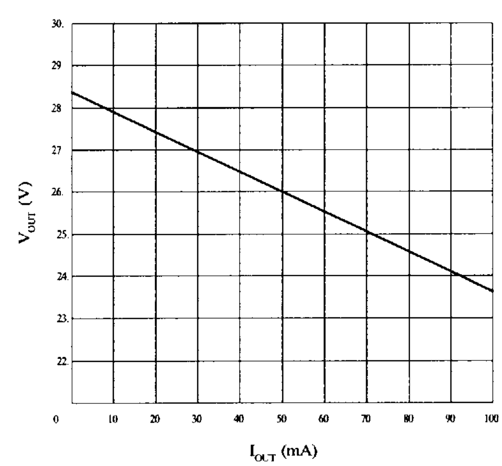
The magnitude of P_{AC} is readily estimated for several cases:

A.		B.	
1. f	= 20kHZ kHz	1. f	= 200
2. C_L	= 1000 pf pf	2. C_L	= 1000
3. Vs	= 18V	3. VS	= 15V
4. P_{AC}	= 65 mW mW	4. P_{AC}	= 45

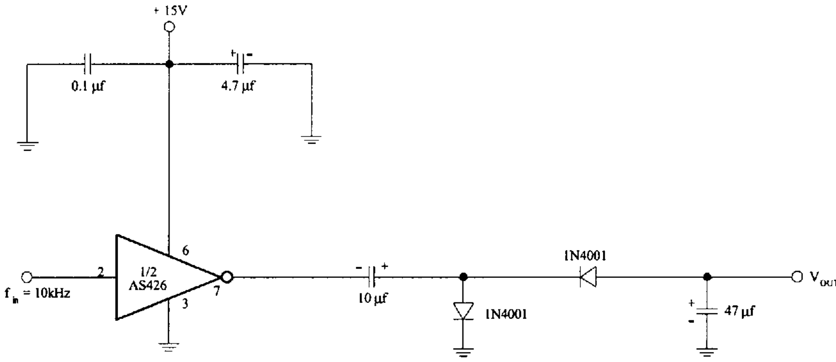
During output level state changes, a current surge will flow through the series connected N and P channel output MOSFETS as one device is turning "ON" while the other is turning "OFF". The current spike flows only during output transitions. The input levels should not be maintained between the logic "0" and logic "1" levels. **Unused driver inputs must be tied to ground and not be allowed to float.** Average power dissipation will be reduced by minimizing input rise times. As shown in the characteristic curves, average supply current is frequency dependent.

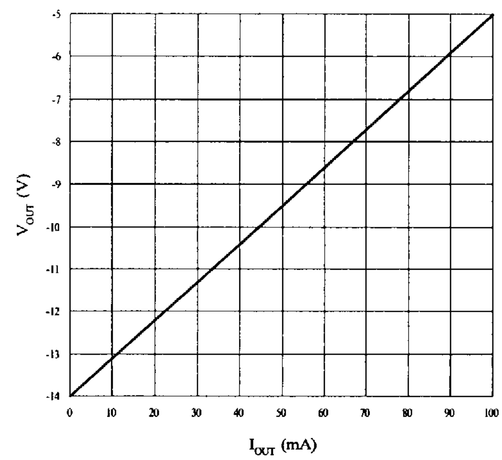
VOLTAGE DOUBLER

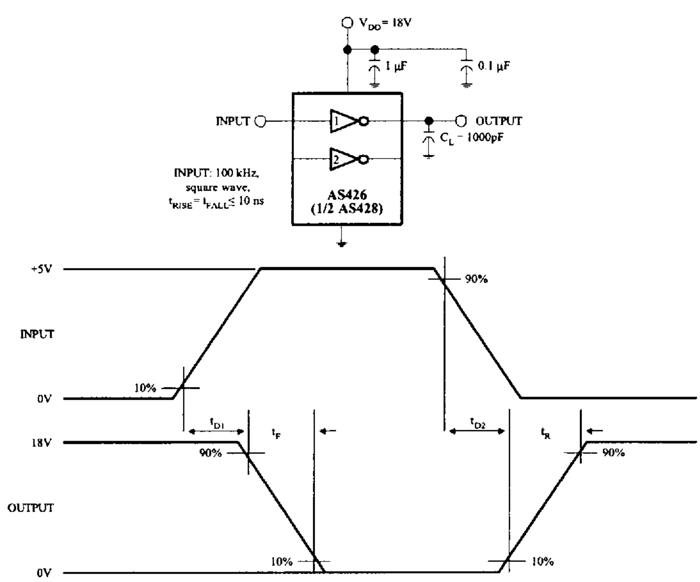




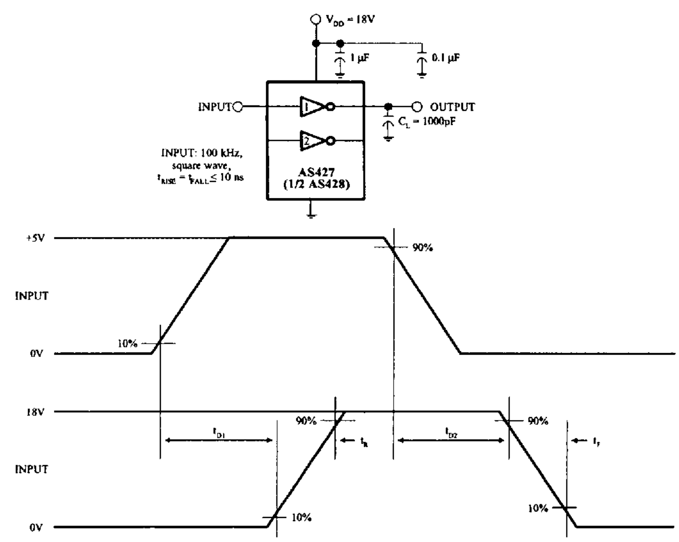
VOLTAGE INVERTER







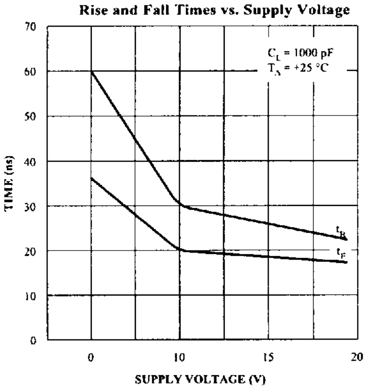
Test Figure 1. Inverting Driver Switching Time Test Circuit



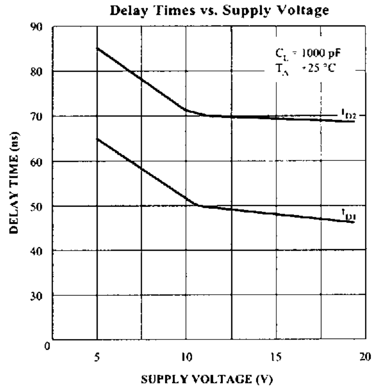
Test Figure 2. Non-Inverting Driver Switching Time Test Circuit

TYPICAL CHARACTERISTICS CURVES

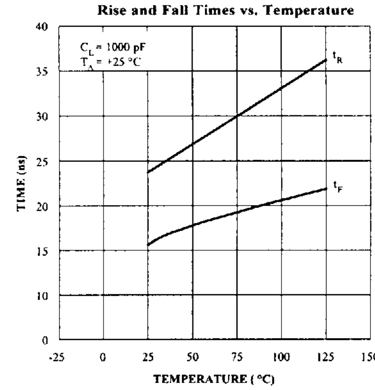
Rise and Fall Times vs. Supply Voltage



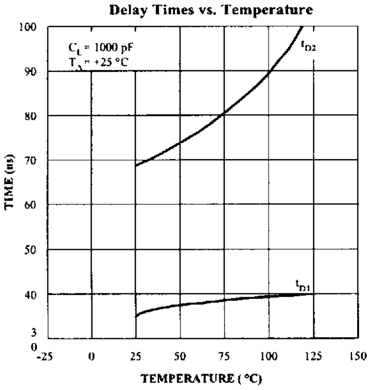
Delay Times vs. Supply Voltage



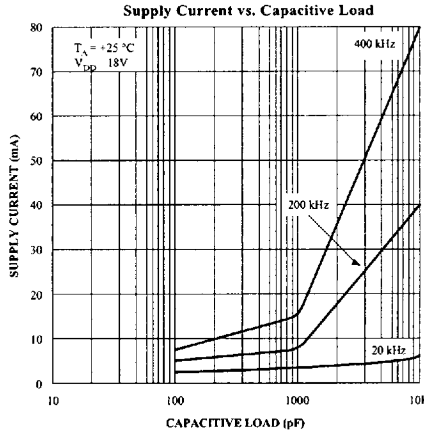
Rise and Fall Times vs. Temperature



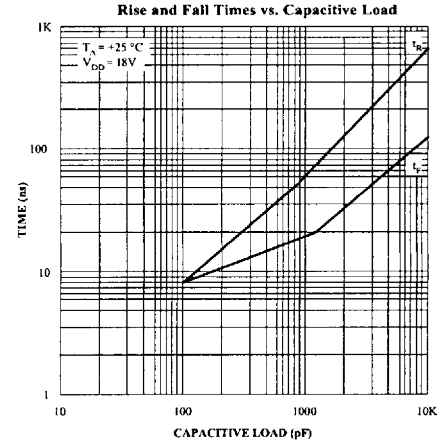
Delay Times vs. Temperature



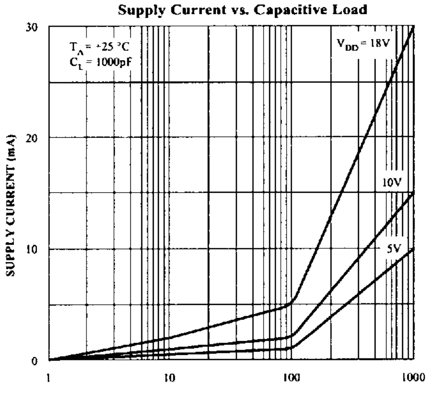
Supply Current vs. Capacitive Load



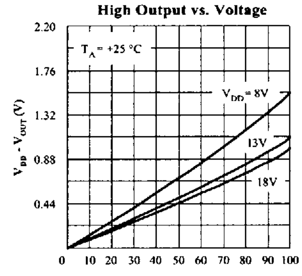
Rise and Fall Times vs. Capacitive Load



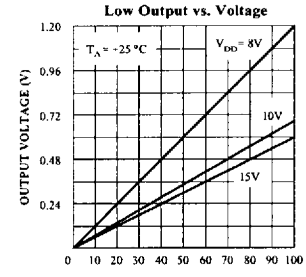
Supply Current vs. Capacitive Load



High Output vs. Voltage



Low Output vs. Voltage



TYPICAL CHARACTERISTICS CURVES (Continued)