TC4421A/TC4422A

9A High-Speed MOSFET Drivers

Features

- High Peak Output Current: 10A (typ.)
- Low Shoot-Through/Cross-Conduction Current in Output Stage
- Wide Input Supply Voltage Operating Range:
  - 4.5V to 18V
- High Continuous Output Current: 2A (max.)
- Matched Fast Rise and Fall Times:
  - 15 ns with 4,700 pF Load
  - 135 ns with 47,000 pF Load
- Matched Short Propagation Delays: 42 ns (typ.)
- Low Supply Current:
  - With Logic '1' Input – 130 µA (typ.)
  - With Logic '0' Input – 33 µA (typ.)
- Low Output Impedance: 1.2Ω (typ.)
- Latch-Up Protected: Will Withstand 1.5A Output Reverse Current
- Input Will Withstand Negative Inputs Up To 5V
- Pin-Compatible with the TC4420/TC4429 and TC4421/TC4422 MOSFET Drivers
- Space-Saving, Thermally-Enhanced, 8-Pin DFN Package

Applications

- Line Drivers for Extra Heavily-Loaded Lines
- Pulse Generators
- Driving the Largest MOSFETs and IGBTs
- Local Power ON/OFF Switch
- Motor and Solenoid Driver
- LF Initiator

General Description

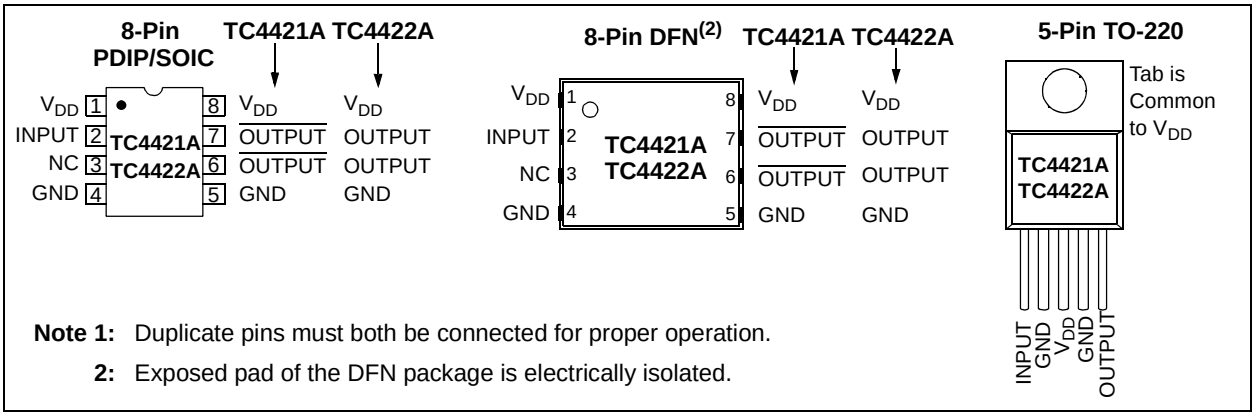
The TC4421A/TC4422A are improved versions of the earlier TC4421/TC4422 family of single-output MOSFET drivers. These devices are high-current buffer/drivers capable of driving large MOSFETs and Insulated Gate Bipolar Transistors (IGBTs). The TC4421A/TC4422A have matched output rise and fall times, as well as matched leading and falling-edge propagation delay times. The TC4421A/TC4422A devices also have very low cross-conduction current, reducing the overall power dissipation of the device.

These devices are essentially immune to any form of upset, except direct overvoltage or over-dissipation. They cannot be latched under any conditions within their power and voltage ratings. These parts are not subject to damage or improper operation when up to 5V of ground bounce is present on their ground terminals. They can accept, without damage or logic upset, more than 1A inductive current of either polarity being forced back into their outputs. In addition, all terminals are fully protected against up to 4 kV of electrostatic discharge.

The TC4421A/TC4422A inputs may be driven directly from either TTL or CMOS (3V to 18V). In addition, 300 mV of hysteresis is built into the input, providing noise immunity and allowing the device to be driven from slowly rising or falling waveforms.

With both surface-mount and pin-through-hole packages, in addition to a wide operating temperature range, the TC4421A/TC4422A family of 9A MOSFET drivers fit into most any application where high gate/line capacitance drive is required.

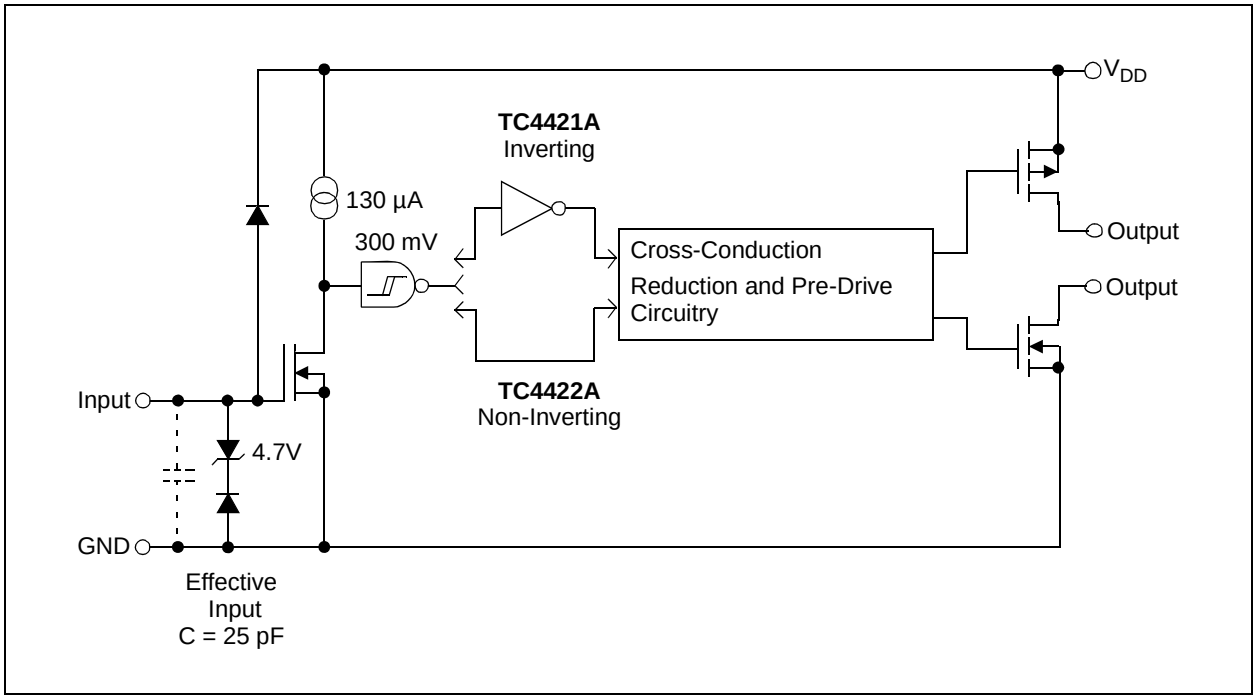
Package Types(1)



Note 1: Duplicate pins must both be connected for proper operation.

2: Exposed pad of the DFN package is electrically isolated.

Functional Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage ..... +20V
Input Voltage ..... (V_{DD} + 0.3V) to (GND – 5V)
Input Current (V_{IN} > V_{DD}) ..... 50 mA

† 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 operation sections of the specifications is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

DC CHARACTERISTICS

Electrical Specifications: Unless otherwise noted, T_A = +25°C with 4.5V ≤ V_{DD} ≤ 18V.						
Parameters	**Sym**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
Input						
Logic ‘1’, High Input Voltage	V_{IH}	2.4	1.8	—	V	
Logic ‘0’, Low Input Voltage	V_{IL}	—	1.3	0.8	V	
Input Current	I_{IN}	–10	—	+10	µA	0V ≤ V_{IN} ≤ V_{DD}
Input Voltage	V_{IN}	–5	—	V_{DD} – 0.3	V	
Output						
High Output Voltage	V_{OH}	V_{DD} – 0.025	—	—	V	DC Test
Low Output Voltage	V_{OL}	—	—	0.025	V	DC Test
Output Resistance, High	R_{OH}	—	1.25	1.5	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Output Resistance, Low	R_{OL}	—	0.8	1.1	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Peak Output Current	I_{PK}	—	10.0	—	A	V_{DD} = 18V
Continuous Output Current	I_{DC}	2	—	—	A	10V ≤ V_{DD} ≤ 18V, T_A = +25°C (**TC4421A/TC4422A** CAT only) **(Note 2)**
Latch-Up Protection Withstand Reverse Current	I_{REV}	—	>1.5	—	A	Duty cycle ≤ 2%, t ≤ 300 µsec
Switching Time (Note 1)						
Rise Time	t_R	—	28	34	ns	**Figure 4-1**, C_L = 10,000 pF
Fall Time	t_F	—	26	32	ns	**Figure 4-1**, C_L = 10,000 pF
Propagation Delay Time	t_{D1}	—	38	45	ns	**Figure 4-1**, C_L = 10,000 pF
Propagation Delay Time	t_{D2}	—	42	49	ns	**Figure 4-1**, C_L = 10,000 pF
Power Supply						
Power Supply Current	I_S	—	130	250	µA	V_{IN} = 3V
		—	35	100	µA	V_{IN} = 0V
Operating Input Voltage	V_{DD}	4.5	—	18	V	

Note 1: Switching times ensured by design.
2: Tested during characterization, not production tested.

DC CHARACTERISTICS (OVER OPERATING TEMPERATURE RANGE)

Electrical Specifications: Unless otherwise noted, over operating temperature range with 4.5V ≤ V_{DD} ≤ 18V.

Parameters	Sym	Min	Typ	Max	Units	Conditions
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}	–10	—	+10	µA	0V ≤ V_{IN} ≤ V_{DD}
Output						
High Output Voltage	V_{OH}	V_{DD} – 0.025	—	—	V	DC Test
Low Output Voltage	V_{OL}	—	—	0.025	V	DC Test
Output Resistance, High	R_{OH}	—	—	2.0	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Output Resistance, Low	R_{OL}	—	—	1.6	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Switching Time (Note 1)						
Rise Time	t_R	—	38	45	ns	**Figure 4-1**, C_L = 10,000 pF
Fall Time	t_F	—	33	40	ns	**Figure 4-1**, C_L = 10,000 pF
Propagation Delay Time	t_{D1}	—	50.4	60	ns	**Figure 4-1**, C_L = 10,000 pF
Propagation Delay Time	t_{D2}	—	53	60	ns	**Figure 4-1**, C_L = 10,000 pF
Power Supply						
Power Supply Current	I_S	—	200	500	µA	V_{IN} = 3V
		—	50	150	µA	V_{IN} = 0V
Operating Input Voltage	V_{DD}	4.5	—	18	V	

Note 1: Switching times ensured by design.

TEMPERATURE CHARACTERISTICS

Electrical Specifications: Unless otherwise noted, all parameters apply with 4.5V ≤ V_{DD} ≤ 18V.

Parameters	Sym	Min	Typ	Max	Units	Conditions
Temperature Ranges						
Specified Temperature Range (V)	T_A	–40	—	+125	℃	
Maximum Junction Temperature	T_J	—	—	+150	℃	
Storage Temperature Range	T_A	–65	—	+150	℃	
Package Thermal Resistances						
Thermal Resistance, 5L-TO-220	θ_{JA}	—	71	—	℃/W	Without heat sink
Thermal Resistance, 8L-6x5 DFN	θ_{JA}	—	33.2	—	℃/W	Typical 4-layer board with vias to ground plane
Thermal Resistance, 8L-PDIP	θ_{JA}	—	125	—	°C/W	
Thermal Resistance, 8L-SOIC	θ_{JA}	—	155	—	°C/W	

2.0 TYPICAL PERFORMANCE CURVES

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

Note: Unless otherwise indicated, T_A = +25°C with 4.5V ≤ V_{DD} ≤ 18V.

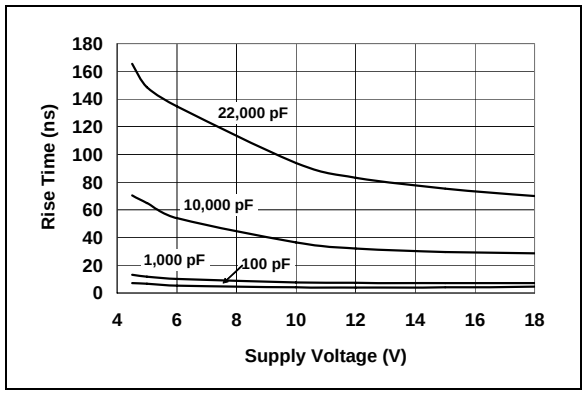


FIGURE 2-1: *Rise Time vs. Supply Voltage.*

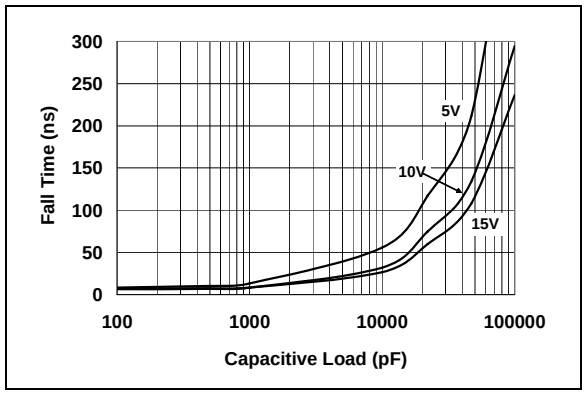


FIGURE 2-4: *Fall Time vs. Capacitive Load.*

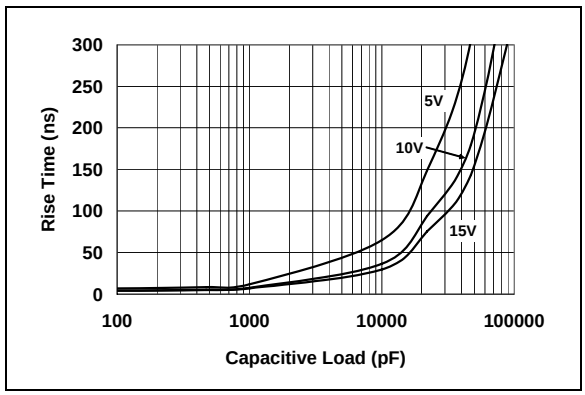


FIGURE 2-2: *Rise Time vs. Capacitive Load.*

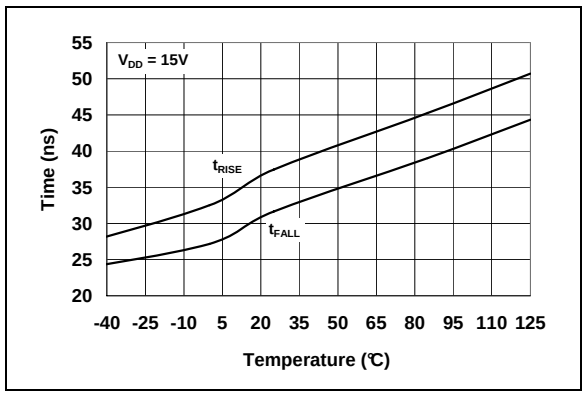


FIGURE 2-5: *Rise and Fall Times vs. Temperature.*

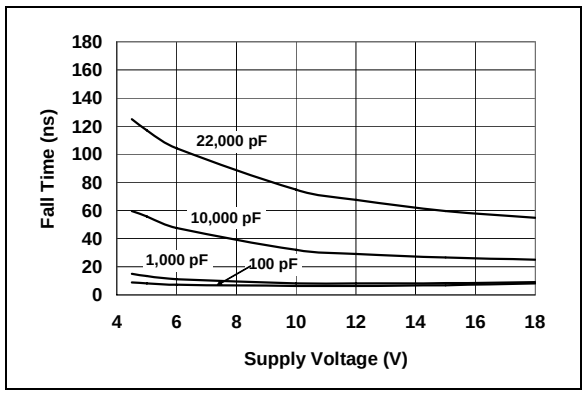


FIGURE 2-3: *Fall Time vs. Supply Voltage.*

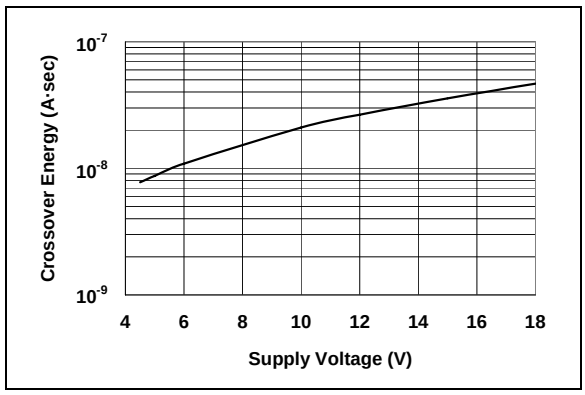


FIGURE 2-6: *Crossover Energy vs Supply Voltage.*

Note: Unless otherwise indicated, T_A = +25°C with 4.5V ≤ V_{DD} ≤ 18V.

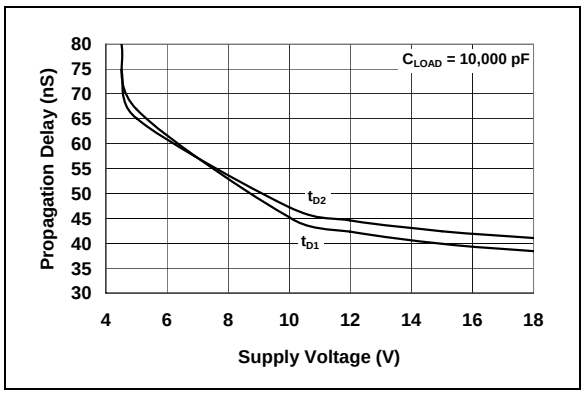


FIGURE 2-7: *Propagation Delay vs. Supply Voltage.*

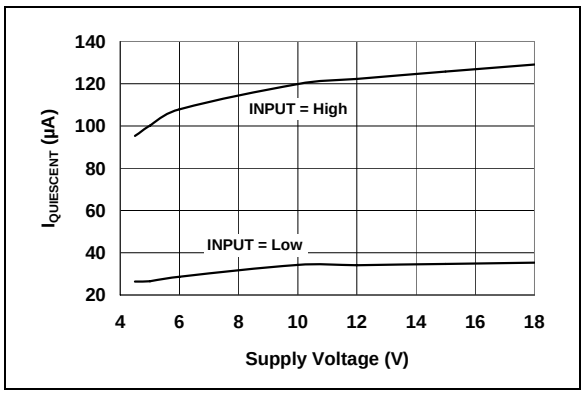


FIGURE 2-10: *Quiescent Supply Current vs. Supply Voltage.*

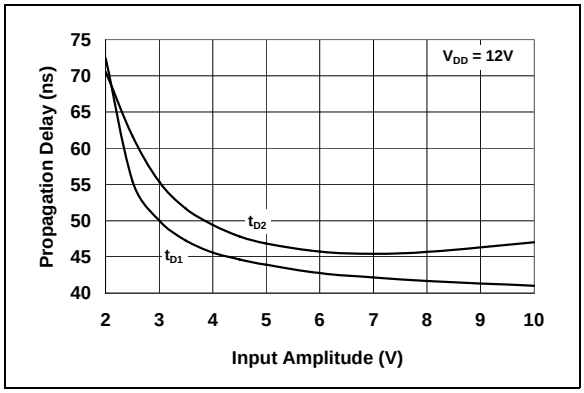


FIGURE 2-8: *Propagation Delay vs. Input Amplitude.*

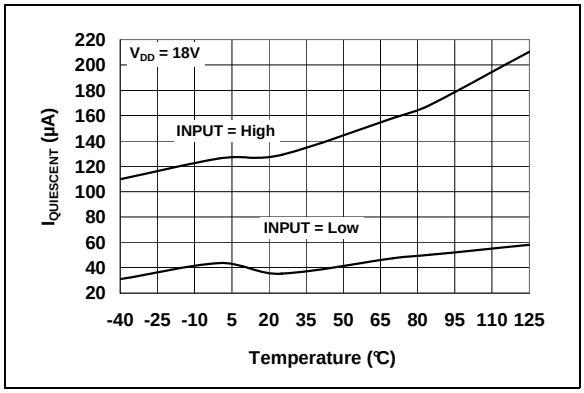


FIGURE 2-11: *Quiescent Supply Current vs. Temperature.*

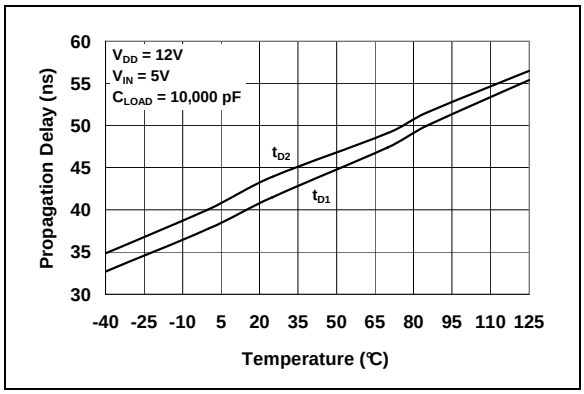


FIGURE 2-9: *Propagation Delay vs. Temperature.*

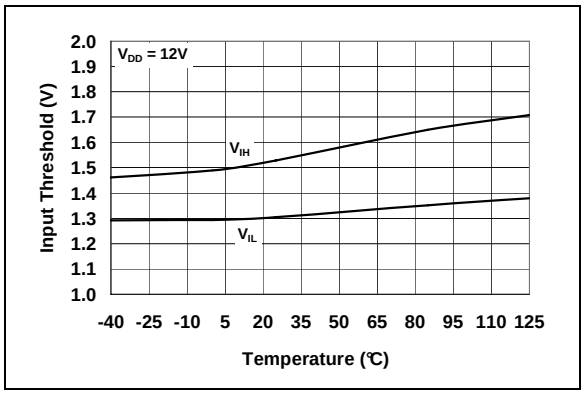


FIGURE 2-12: *Input Threshold vs. Temperature.*