9.0 A High-Speed MOSFET Drivers

The NCP4421/4422 are high current buffer/drivers capable of driving large MOSFETs and IGBTs.

They 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; they are not subject to damage or improper operation when up to 5.0 V of ground bounce is present on their ground terminals; they can accept, without either damage or logic upset, more than 1.0 A inductive current of either polarity being forced back into their outputs. In addition, all terminals are fully protected against up to 4.0 kV of electrostatic discharge.

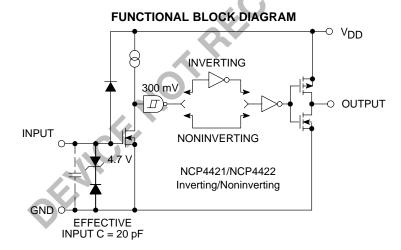
The inputs may be driven directly from either TTL or CMOS (3.0 V to 18 V). In addition, 300 mV of hysteresis is built into the input, providing noise immunity and allowing the device to be driven from slowly rising or falling waveforms.

Features

- Tough CMOS™ Construction
- High Peak Output Current (9.0 A)
- High Continuous Output Current (2.0 A Max)
- Fast Rise and Fall Times:
 - 30 ns with 4,700 pF Load
 - 180 ns with 47,000 pF Load
- Short Internal Delays (30 nsec Typ)
- Low Output Impedance (1.4 Ω Typ)

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





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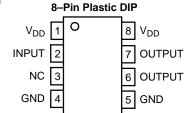


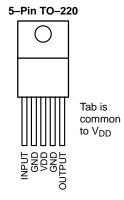
PDIP-8 P SUFFIX CASE 626



TO-220 T SUFFIX CASE 314D

PIN CONNECTIONS





NOTE: Duplicate pins must *both* be connected for proper operation.

NC = No connection

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 8 of this data sheet.

ABSOLUTE MAXIMUM RATINGS*

Rating	Symbol	Value	Unit
Power Dissipation ($T_A \le 70^{\circ}C$) PDIP 5-Pin TO-220	-	730 1.6	W
Power Dissipation ($T_C \le 25^{\circ}C$) 5–Pin TO–220 (With Heat Sink)	-	12.5	W
Derating Factors (To Ambient) PDIP 5-Pin TO-220	-	8.0 12	mW/°C
Thermal Impedance (To Case) 5-Pin TO-220 R _{0JC}	_	10	°C/W
Storage Temperature	T _{stg}	-65 to +150	°C
Operating Temperature (Chip)	-	150	°C
Operating Temperature (Ambient) TO–220 Version PDIP Version	-	0 to +70 -40 to +85	.c
Lead Temperature (10 Seconds)		300	°C
Supply Voltage	V _{CC}	20	٧
Input Voltage	->	V _{DD} +3.0 to GND –5.0	V
Input Current (V _{IN} > V _{DD})		50	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 affect device reliability.

ELECTRICAL CHARACTERISTICS ($T_A = 25^{\circ}C$ with $4.5 \text{ V} \leq V_{DD} \leq 18 \text{ V}$ unless otherwise specified.)

Characteristics	Test Conditions	Symbol	Min	Тур	Max	Unit
Input						
Logic 1 Input Voltage	(A) (F)	V _{IH}	2.4	1.8	_	V
Logic 0 Input Voltage		V _{IL}	_	1.3	0.8	V
Input Current	$0 \text{ V} \leq V_{\text{IN}} \leq V_{\text{DD}}$	I _{IN}	-10	_	10	μΑ
Output						
High Output Voltage	See Figure 1	V _{OH}	V _{DD} – 0.025	_	-	V
Low Output Voltage	See Figure 1	V _{OL}	_	_	0.025	V
Output Resistance, High	V _{DD} = 18 V, I _O = 10 mA	R _O	-	1.4	-	Ω
Output Resistance, Low	V _{DD} = 18 V, I _O = 10 mA	R _O	-	0.9	1.7	Ω
Peak Output Current	V _{DD} = 18 V	I _{PK}	-	9.0	-	Α
Continuous Output Current	$10 \text{ V} \le \text{ V}_{DD} \le 18 \text{ V}, \text{ T}_{C} = 25^{\circ}$ (TC4421/22 CAT only)	I _{DC}	2.0	-	_	А
Latch–Up Protection	Duty Cycle ≤ 2% Withstand Reverse Current	I _{REV}	>1500 t ≤ 300 μs	-	-	mA
Switching Time (Note 1)						
Rise Time	Figure 1, C _L = 10,000 pF	t _R	-	60	75	nsec
Fall Time	Figure 1, C _L = 10,000 pF	t _F	-	60	75	nsec
Delay Time	Figure 1	t _{D1}	-	30	60	nsec
Delay Time	Figure 1	t _{D2}	_	33	60	nsec

^{1.} Switching times guaranteed by design.

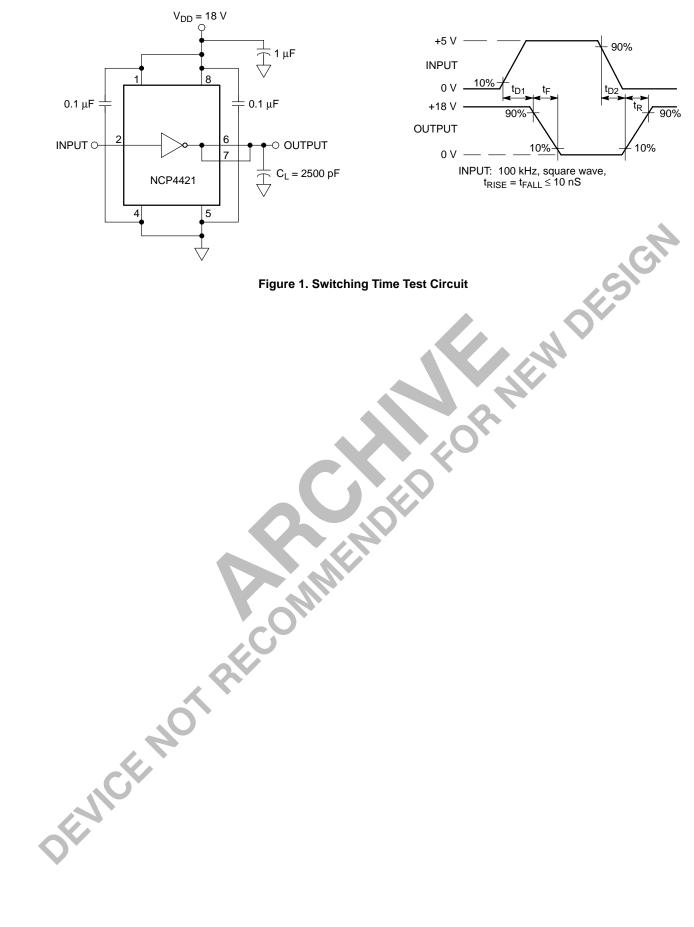
ELECTRICAL CHARACTERISTICS (continued) ($T_A = 25^{\circ}C$ with $4.5 \text{ V} \leq V_{DD} \leq 18 \text{ V}$ unless otherwise specified.)

Characteristics	Test Conditions	Symbol	Min	Тур	Max	Unit		
Power Supply								
Power Supply Current	V _{IN} = 3.0 V V _{IN} = 0 V	I _S	- -	0.2 55	1.5 150	mA μA		
Operating Input Voltage –		V _{DD}	4.5	_	18	V		
Input								
Logic 1 Input Voltage	-	V _{IH}	2.4	_	-	V		
Logic 0 Input Voltage	-	V _{IL}	-	_	0.8	V		
Input Current	$0 \text{ V} \leq V_{\text{IN}} \leq V_{\text{DD}}$	I _{IN}	-10	_	10	μΑ		

ELECTRICAL CHARACTERISTICS (Measured over operating temperature range with $4.5 \text{ V} \leq \text{V}_\text{S} \leq 18 \text{ V}$ unless otherwise specified.)

Characteristics	Test Conditions	Symbol	Min	Тур	Max	Unit
Input					1,3	
Logic 1 Input Voltage	-	V _{IH}	2.4	-	V -	V
Logic 0 Input Voltage	-	V _{IL}	/	+	0.8	V
Input Current	$0 \text{ V} \leq V_{\text{IN}} \leq V_{\text{DD}}$	lin	-10	113	10	μΑ
Output						
High Output Voltage	See Figure 1	V _{OH}	V _{DD} – 0.025	_	-	V
Low Output Voltage	See Figure 1	V _{OL}	(Q-)	_	0.025	V
Output Resistance, High	put Resistance, High $V_{DD} = 18 \text{ V}, I_{O} = 10 \text{ mA}$		0)-	2.4	3.6	W
Output Resistance, Low	$V_{DD} = 18 \text{ V}, I_{O} = 10 \text{ mA}$		-	1.8	2.7	W
Switching Time (Note 1)		.0				
Rise Time	Figure 1, C _L = 10,000 pF	t _R	_	60	120	nsec
Fall Time	Figure 1, C _L = 10,000 pF	t _F	_	60	120	nsec
Delay Time	Figure 1	t _{D1}	_	50	80	nsec
Delay Time Figure 1		t _{D2}	_	65	80	nsec
Power Supply						•
Power Supply Current	V _{IN} = 3.0 V V _{IN} = 0 V	I _S	_ _	0.45 0.06	3.0 0.2	mA
Operating Input Voltage	-	V_{DD}	4.5	-	18	V

Switching times guaranteed by design.



TYPICAL ELECTRICAL CHARACTERISTICS

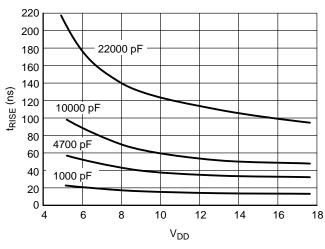
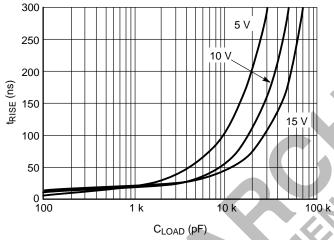


Figure 2. Rise Time vs. Supply Voltage

Figure 3. Fall Time vs. Supply Voltage



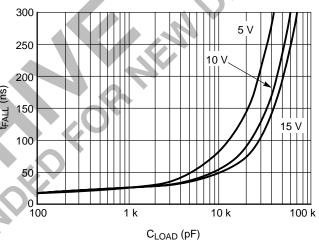
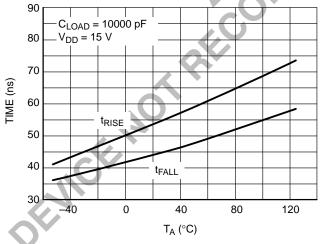


Figure 4. Rise Time vs. Capacitive Load

Figure 5. Fall Time vs. Capacitive Load



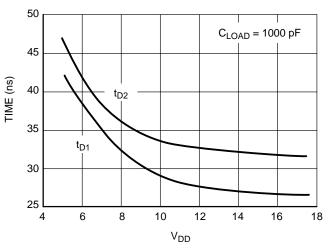
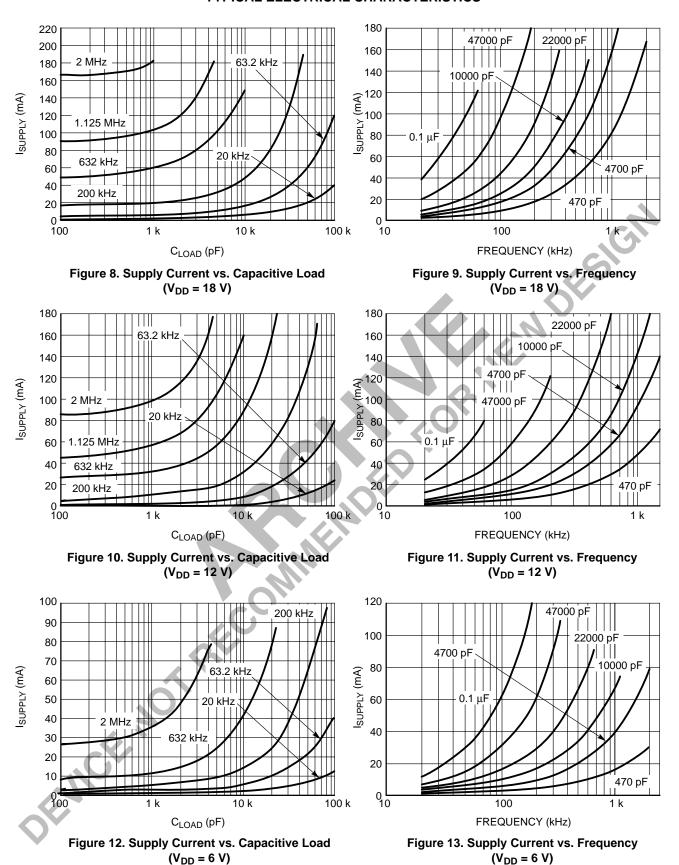


Figure 6. Rise and Fall Times vs. Temperature

Figure 7. Propagation Delay vs. Supply Voltage

TYPICAL ELECTRICAL CHARACTERISTICS



TYPICAL ELECTRICAL CHARACTERISTICS

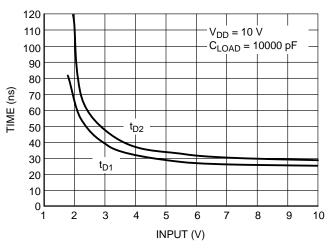


Figure 14. Propagation Delay vs. Input Amplitude

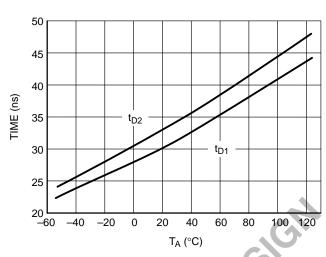


Figure 15. Propagation Delay vs. Temperature

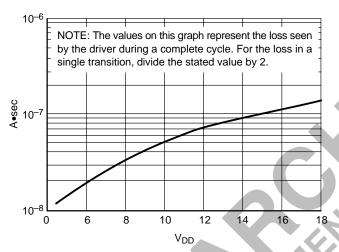


Figure 16. Crossover Energy vs. Supply Voltage

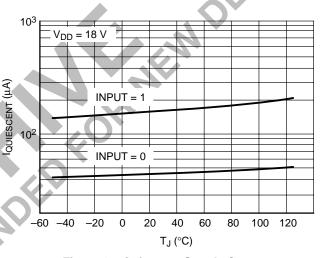


Figure 17. Quiescent Supply Current vs.
Temperature

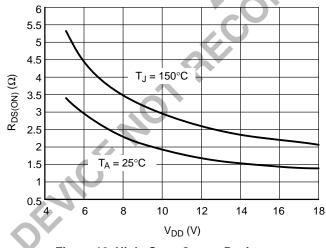


Figure 18. High-State Output Resistance vs. Supply Voltage

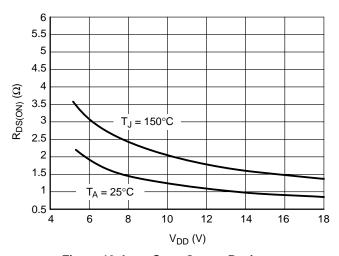


Figure 19. Low–State Output Resistance vs. Supply Voltage

MARKING DIAGRAMS





x = 1 or 2

X = Assembly ID Code

Y = Year

CO = Country of Origin

ORDERING INFORMATION

Device	Package	Temperature Range	Shipping
NCP4421T	5–Pin TO–220	0°C to + 70°C	50 Units/Rail
NCP4421P	8–Pin PDIP	-40°C to + 85°C	50 Units/Rail
NCP4422T	5–Pin TO–220	0°C to + 70°C	50 Units/Rail
NCP4422P	8–Pin PDIP	-40°C to + 85°C	50 Units/Rail
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Notes

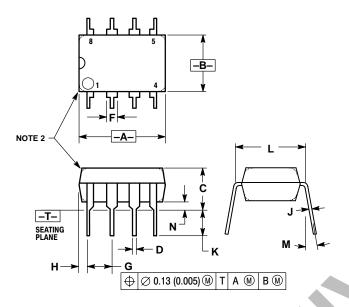


Notes



PACKAGE DIMENSIONS

PDIP P SUFFIX CASE 626-05 ISSUE K

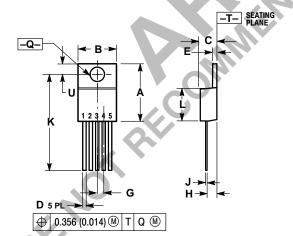


NOTES:

- (OLES: 1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL. 2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS). 3. DIMENSIONING AND TOLERANCING PER ANSI
- Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α	9.40	10.16	0.370	0.400
В	6.10	6.60	0.240	0.260
С	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54	BSC	0.100 BSC	
Н	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M		10°		10°
N	0.76	1.01	0.030	0.040

TO-220 T SUFFIX CASE 314D-04 ISSUE E



NOTES:

- IOTES:

 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

 2. CONTROLLING DIMENSION: INCH.

 3. DIMENSION DOES NOT INCULDE INTERCONNECT BAR (DAMBAR) PROTRUSION. DIMENSION D INCLUDING PROTRUSION SHALL NOT EXCEED 10.92 (0.043) MAXIMUM.

	INCHES		MILLIN	METERS	
DIM	MIN	MAX	MIN	MAX	
Α	0.572	0.613	14.529	15.570	
В	0.390	0.415	9.906	10.541	
С	0.170	0.180	4.318	4.572	
D	0.025	0.038	0.635	0.965	
E	0.048	0.055	1.219	1.397	
G	0.067	0.067 BSC		BSC	
Н	0.087	0.112	2.210	2.845	
J	0.015	0.025	0.381	0.635	
K	0.990	1.045	25.146	26.543	
L	0.320	0.365	8.128	9.271	
Q	0.140	0.153	3.556	3.886	
U	0.105	0.117	2.667	2.972	



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