High-Speed, 6A Single MOSFET Drivers

ABSOLUTE MAXIMUM RATINGS

Supply Voltage V_{DD} to GND ..... +20V
Input Voltage V_{IN} ..... -0.3V to (V_{DD} + 0.3V)
Continuous Power Dissipation (T_A = +70°C)
Plastic DIP (derate 9.09mW/°C above +70°C) 727mW
SO (derate 5.88mW/°C above +70°C) 471mW
CERDIP (derate 8.00mW/°C above +70°C) 640mW

Operating Temperature Ranges:
MAX442_C__ , MXT429C__ ..... 0°C to +70°C
MAX442_E__ , MXT429E__ ..... -40°C to +85°C
MAX442_MJA, MXT429MJA ..... -55°C to +125°C
Storage Temperature Range ..... -65°C to +160°C
Lead Temperature (soldering, 10sec) ..... +300°C

Stresses beyond 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 beyond 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

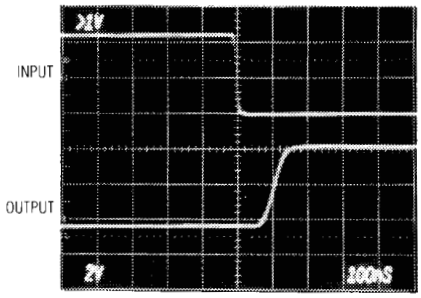
(MAX4420/MAX4429 V_{DD} = +4.5V to +18V, MXT429 V_{DD} = +7V to +18V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MAX4420/MAX4429 MIN	MAX4420/MAX4429 TYP	MAX4420/MAX4429 MAX	MXT429 MIN	MXT429 TYP	MXT429 MAX	UNITS
Operating Range	V_{DD}			4.5		18	7		18	V
Power Supply Current	I_{DD}	V_{IN} = 3V	T_A = +25°C		0.45	1.5		0.45	5.0	mA
			T_A = T_{MIN} to T_{MAX}			3.0			12.0	
		V_{IN} = 0V	T_A = +25°C		0.045	0.150		0.045	0.5	
			T_A = T_{MIN} to T_{MAX}			0.400			1.0	
Logic 1 Input Voltage	V_{IH}			2.4			2.4			V
Logic 0 Input Voltage	V_{IL}					0.8			0.8	V
IN Leakage Current	I_{IN}	V_{IN} = 0V to V_{DD}				±10			±10	µA
Output High Voltage	V_{OH}	No load		V_{DD} - 25			V_{DD} - 25			mV
Output Low Voltage	V_{OL}	No load				25			25	mV
Peak Output Current	I_{OUT}	V_{DD} = 18V	T_A = +25°C		6			6		A
Output Resistance	R_{OUT}	V_{DD} = 18V, I_{OUT} = 10mA, V_{IN} = 0.8V or 2.4V	T_A = +25°C		1.5	2.5		1.5	2.5	Ω
			T_A = T_{MIN} to T_{MAX}			5.0			5.0	
Rise Time (Note 1)	t_R	Figure 1	T_A = +25°C		25	30		25	35	ns
			T_A = T_{MIN} to T_{MAX}			60			70	
Fall Time (Note 1)	t_F	Figure 1	TA = +25°C		25	30		25	35	ns
			T_A = T_{MIN} to T_{MAX}			60			70	
Delay Time (Note 1)	t_{D1}	Figure 1	T_A = +25°C		35	60		35	75	ns
			T_A = T_{MIN} to T_{MAX}			100			100	
	t_{D2}	Figure 1	T_A = +25°C		40	60		40	75	
			T_A = T_{MIN} to T_{MAX}			100			120	

Note 1: Switching times guaranteed by design, not tested. See Figure 1 for timing measurement circuit, V_{DD} = 18V.

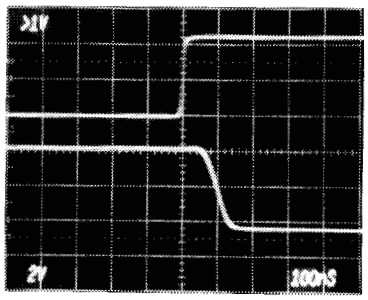
Typical Operating Characteristics

MAX4429 SWITCHING SPEED (INPUT HIGH TO LOW)



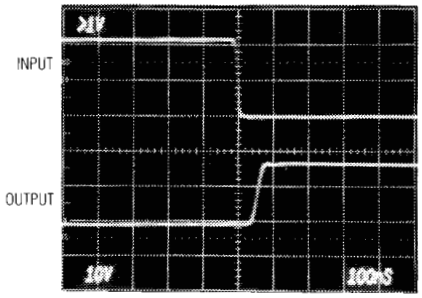
V_{DD} = 4.5V, CL = 2500pF, TIME = 100ns/div,
V_{IN} = 5V TO 0V,
T_A = +25°C

MAX4429 SWITCHING SPEED (INPUT LOW TO HIGH)



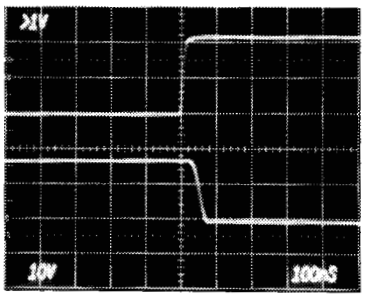
V_{DD} = 4.5V, CL = 2500pF, TIME = 100ns/div,
V_{IN} = 0V TO 5V,
T_A = +25°C

MAX4429 SWITCHING SPEED (INPUT HIGH TO LOW)



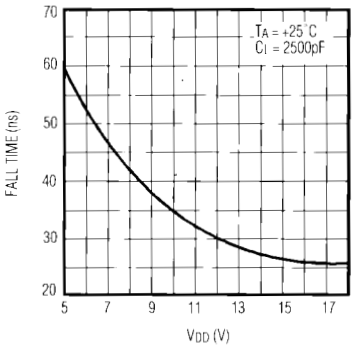
V_{DD} = 18V, CL = 2500pF, TIME = 100ns/div,
V_{IN} = 5V TO 0V,
T_A = +25°C

MAX4429 SWITCHING SPEED (INPUT LOW TO HIGH)

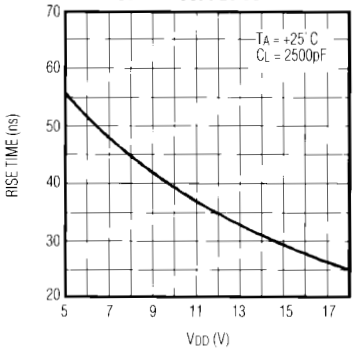


V_{DD} = 18V, CL = 2500pF, TIME = 100ns/div,
V_{IN} = 0V TO 5V,
T_A = +25°C

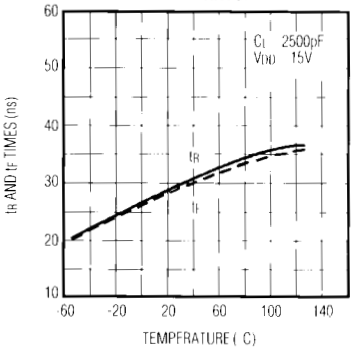
FALL TIME vs. POSITIVE SUPPLY VOLTAGE



RISE TIME vs. POSITIVE SUPPLY VOLTAGE



RISE AND FALL TIMES vs. TEMPERATURE



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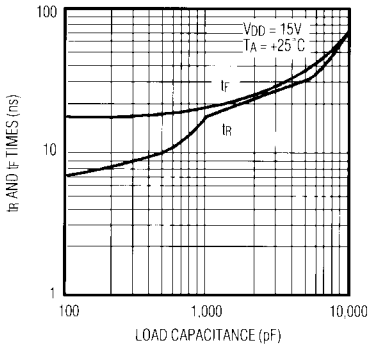
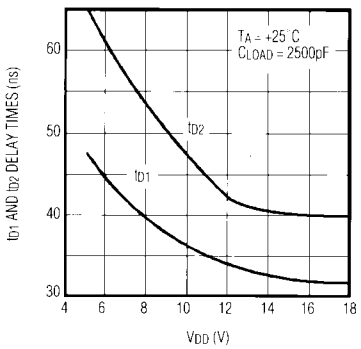
Typical Operating Characteristics (continued)

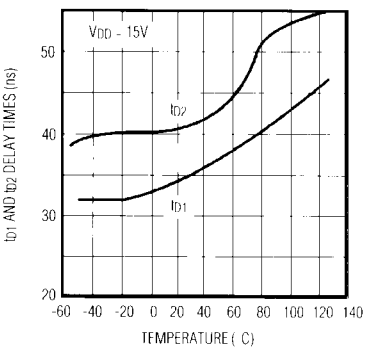
RISE AND FALL TIME vs. LOAD CAPACITANCE



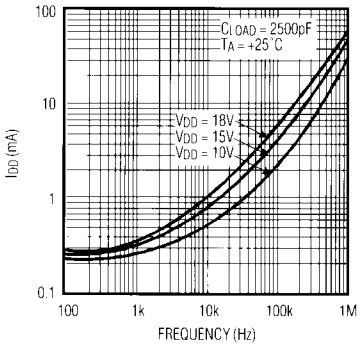
DELAY TIMES vs. POSITIVE SUPPLY VOLTAGE



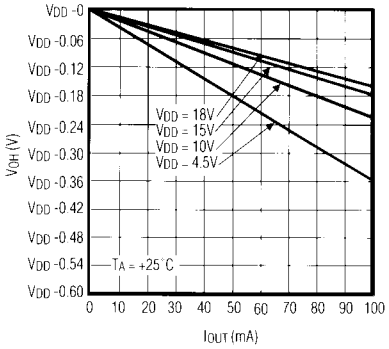
DELAY TIMES vs. TEMPERATURE



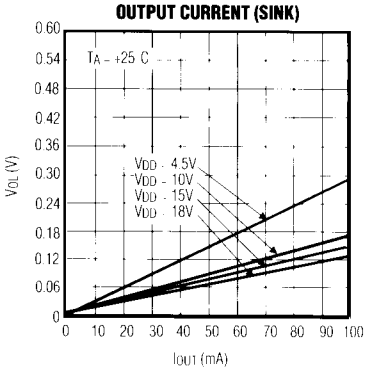
POSITIVE SUPPLY CURRENT vs. FREQUENCY



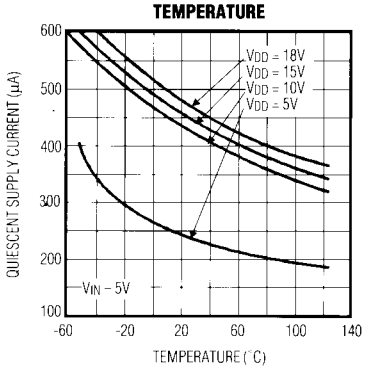
OUTPUT HIGH VOLTAGE vs. OUTPUT CURRENT



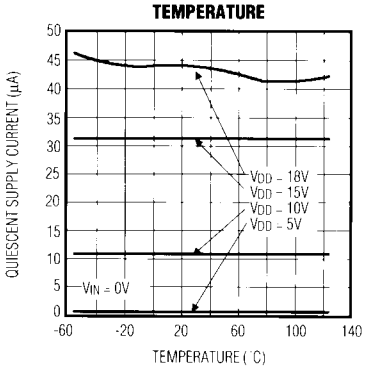
OUTPUT LOW VOLTAGE vs. OUTPUT CURRENT (SINK)



QUIESCENT SUPPLY CURRENT vs. TEMPERATURE



QUIESCENT SUPPLY CURRENT vs. TEMPERATURE



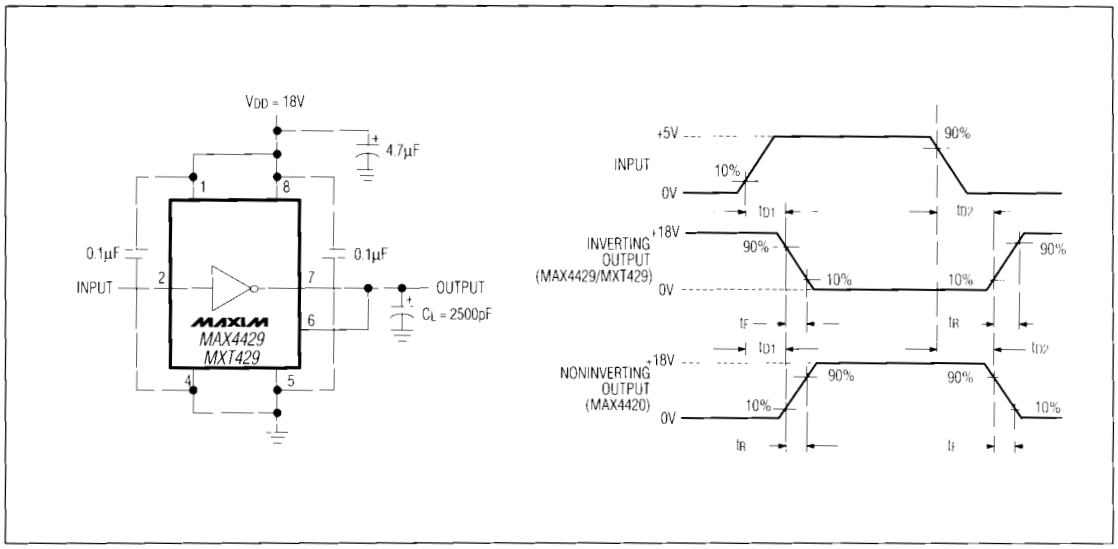


Figure 1. Switching-Time Measurement Circuit

Applications Information

The MAX4420/MAX4429/MXT429 have easy-to-drive inputs. However, the input must not be allowed to stay between V_{IH} and V_{IL} for more than 500ns. The power supply (V_{DD}) inputs must always be tied together, as should the outputs (OUT).

Supply bypassing and grounding are extremely important, as the peak supply and output currents can be greater than 6A. Ground drops are a form of negative feedback with inverters, and therefore will degrade the delay and transition time. Ringing may also be a problem with large $\Delta V/\Delta t$ and/or large AC currents.

Suggested bypass capacitors are a 4.7µF (low ESR) capacitor in parallel with 0.1µF ceramic capacitors, mounted as close as possible to the device. Use a ground plane if possible, or separate ground returns for inputs and outputs. Ringing can be minimized with a 5Ω resistor in series with the output, but this will degrade output transition time.

Power Dissipation

Power dissipation of the MAX4420/MAX4429/MXT429 consists of:

1) input inverter losses
2) crowbar current through the output devices
3) output current (either capacitive or resistive).

The sum of these must be kept below the maximum power-dissipation limit.

The DC input inverter losses are typically 45µA when the input is low and 450µA when the input is high.

The crowbar current through an output device making a transition is approximately 100mA for a few nanoseconds. This is a small portion of the total supply current, except for high switching frequencies or a small load capacitance (100pF).

The MAX4420/MAX4429/MXT429 power dissipation when driving a ground referenced resistive load is:

$$P = D \times R_{ON(max)} \times I_{LOAD}^2$$

where D is the percentage of time the MAX4420/MAX4429/MXT429 output pulls high, $R_{ON(max)}$ is the maximum on resistance of the device with the output high, and I_{LOAD} is the load current of the MAX4420/MAX4429/MXT429.

For capacitive loads, the power dissipation is:

$$P = C_{LOAD} \times V_{DD}^2 \times FREQ$$

where C_{LOAD} is the capacitive load, V_{DD} is the MAX4420/MAX4429/MXT429 supply voltage, and FREQ is the toggle frequency.

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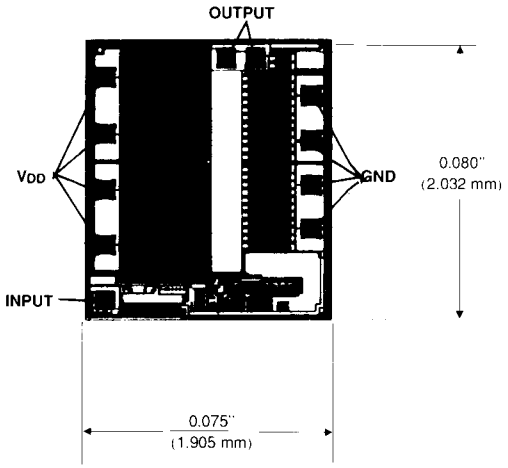
Ordering Information (continued)

PART	TEMP. RANGE	PIN-PACKAGE
MXT429CPA	0°C to +70°C	8 Plastic DIP
MXT429CSA	0°C to +70°C	8 SO
MXT429C/D	0°C to +70°C	Dice*
MXT429EPA	-40°C to +85°C	8 Plastic DIP
MXT429ESA	-40°C to +85°C	8 SO
MXT429MJA	-55°C to +125°C	8 CERDIP**

* *Dice are specified at T_A = +25°C.*

** *Contact factory for availability and processing to MIL-STD-883 and DESC-SMD.*

Chip Topography



TRANSISTOR COUNT: 16;
SUBSTRATE CONNECTED TO V_{DD}.