

## High-Speed, 6A Single MOSFET Drivers

### ABSOLUTE MAXIMUM RATINGS

Supply Voltage $V_{DD}$ to GND	+20V	Operating Temperature Ranges:	
Input Voltage $V_{IN}$	-0.3V to ( $V_{DD}$ + 0.3V)	MAX442_C__, MXT429C__	0°C to +70°C
Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )		MAX442_E__, MXT429E__	-40°C to +85°C
Plastic DIP (derate 9.09mW/°C above +70°C)	727mW	MAX442_MJA, MXT429MJA	-55°C to +125°C
SO (derate 5.88mW/°C above +70°C)	471mW	Storage Temperature Range	-65°C to +160°C
CERDIP (derate 8.00mW/°C above +70°C)	640mW	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  $V_{DD} = +4.5\text{V}$  to +18V, MXT429  $V_{DD} = +7\text{V}$  to +18V,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MAX4420/MAX4429			MXT429			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
Operating Range	$V_{DD}$			4.5		18	7		18	V
Power Supply Current	$I_{DD}$	$V_{IN} = 3\text{V}$	$T_A = +25^\circ\text{C}$	0.45	1.5		0.45	5.0		mA
			$T_A = T_{MIN}$ to $T_{MAX}$			3.0		12.0		
		$V_{IN} = 0\text{V}$	$T_A = +25^\circ\text{C}$	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	$I_{IN}$	$V_{IN} = 0\text{V}$ to $V_{DD}$				$\pm 10$		$\pm 10$	$\mu\text{A}$	
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	$I_{OUT}$	$V_{DD} = 18\text{V}$	$T_A = +25^\circ\text{C}$	6		6		6		A
Output Resistance	$R_{OUT}$	$V_{DD} = 18\text{V}$ , $I_{OUT} = 10\text{mA}$ , $V_{IN} = 0.8\text{V}$ or $2.4\text{V}$	$T_A = +25^\circ\text{C}$	1.5	2.5		1.5	2.5		$\Omega$
			$T_A = T_{MIN}$ to $T_{MAX}$			5.0		5.0		
Rise Time (Note 1)	$t_R$	Figure 1	$T_A = +25^\circ\text{C}$	25	30		25	35		ns
			$T_A = T_{MIN}$ to $T_{MAX}$			60		70		
Fall Time (Note 1)	$t_F$	Figure 1	$T_A = +25^\circ\text{C}$	25	30		25	35		ns
			$T_A = T_{MIN}$ to $T_{MAX}$			60		70		
Delay Time (Note 1)	$t_{D1}$	Figure 1	$T_A = +25^\circ\text{C}$	35	60		35	75		ns
			$T_A = T_{MIN}$ to $T_{MAX}$			100		100		
	$t_{D2}$	Figure 1	$T_A = +25^\circ\text{C}$	40	60		40	75		
			$T_A = T_{MIN}$ to $T_{MAX}$			100		120		

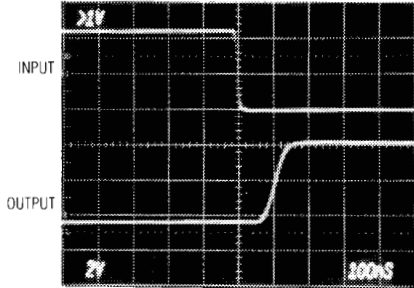
**Note 1:** Switching times guaranteed by design, not tested. See Figure 1 for timing measurement circuit,  $V_{DD} = 18\text{V}$ .

# High-Speed, 6A Single MOSFET Drivers

## Typical Operating Characteristics

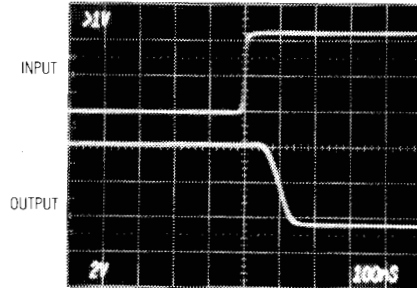
MAX4420/MAX4429/MXT429

**MAX4429 SWITCHING SPEED (INPUT HIGH TO LOW)**



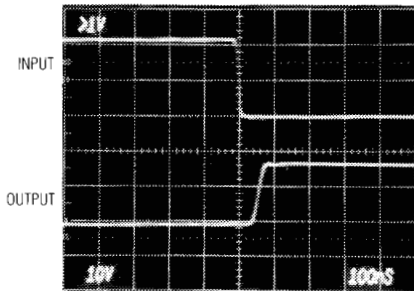
$V_{DD} = 4.5V$ ,  $C_L = 2500pF$ , TIME = 100ns/div,  
 $V_{IN} = 5V$  TO 0V,  
 $T_A = +25^\circ C$

**MAX4429 SWITCHING SPEED (INPUT LOW TO HIGH)**



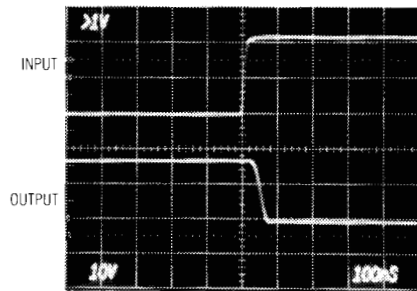
$V_{DD} = 4.5V$ ,  $C_L = 2500pF$ , TIME = 100ns/div,  
 $V_{IN} = 0V$  TO 5V,  
 $T_A = +25^\circ C$

**MAX4429 SWITCHING SPEED (INPUT HIGH TO LOW)**



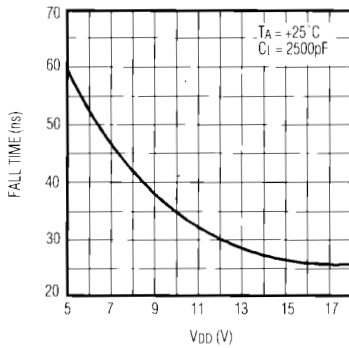
$V_{DD} = 18V$ ,  $C_L = 2500pF$ , TIME = 100ns/div,  
 $V_{IN} = 5V$  TO 0V,  
 $T_A = +25^\circ C$

**MAX4429 SWITCHING SPEED (INPUT LOW TO HIGH)**

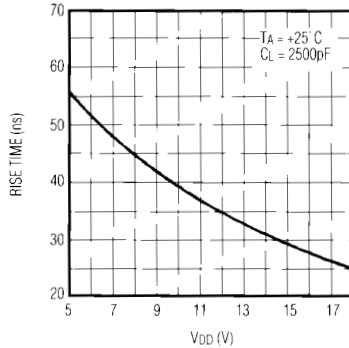


$V_{DD} = 18V$ ,  $C_L = 2500pF$ , TIME = 100ns/div,  
 $V_{IN} = 0V$  TO 5V,  
 $T_A = +25^\circ C$

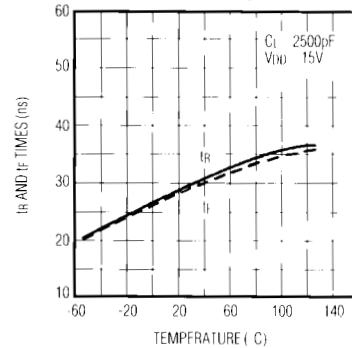
**FALL TIME vs. POSITIVE SUPPLY VOLTAGE**



**RISE TIME vs. POSITIVE SUPPLY VOLTAGE**

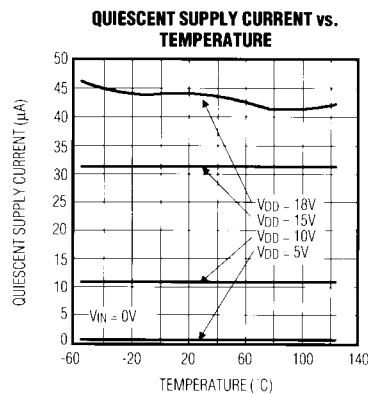
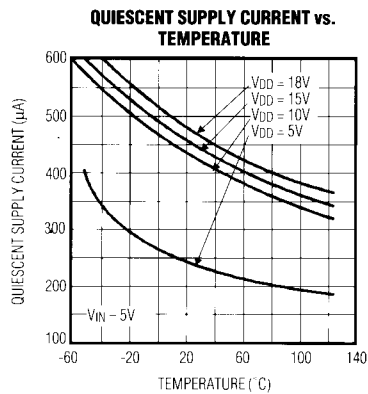
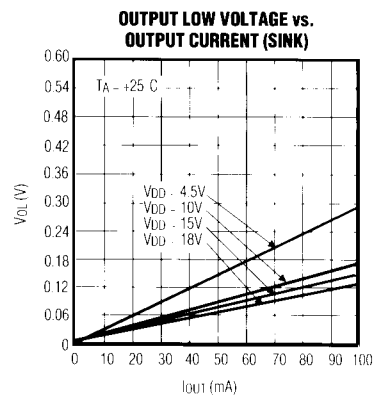
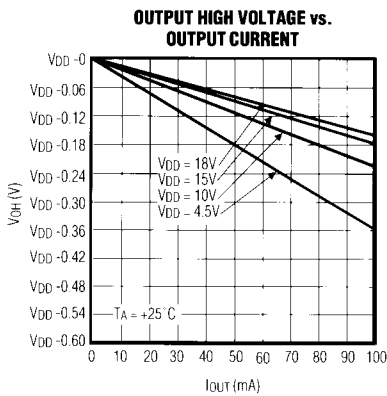
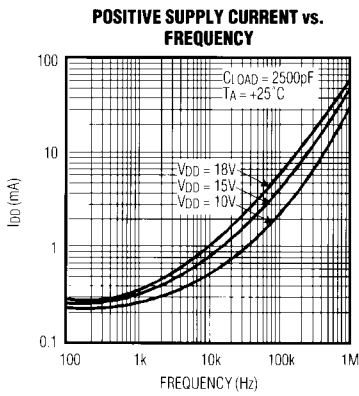
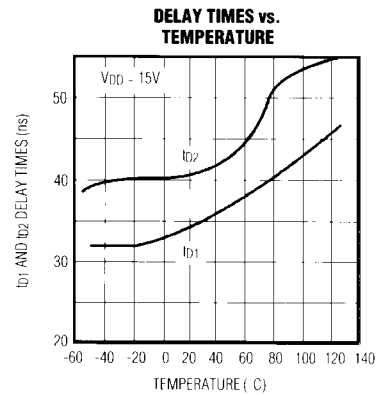
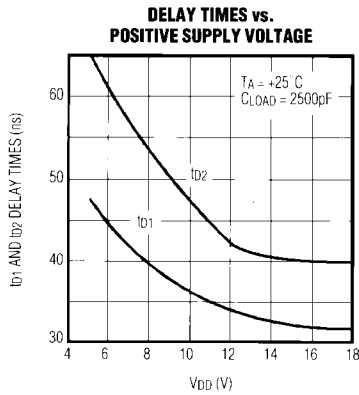
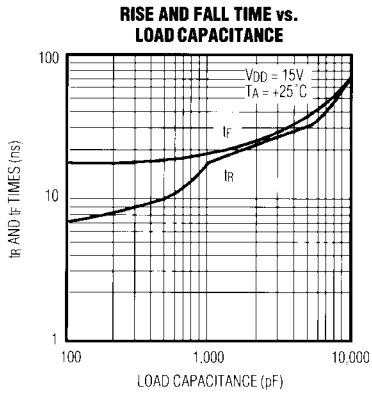


**RISE AND FALL TIMES vs. TEMPERATURE**



# High-Speed, 6A Single MOSFET Drivers

## Typical Operating Characteristics (continued)



# High-Speed, 6A Single MOSFET Drivers

**MAX4420/MAX4429/MXT429**

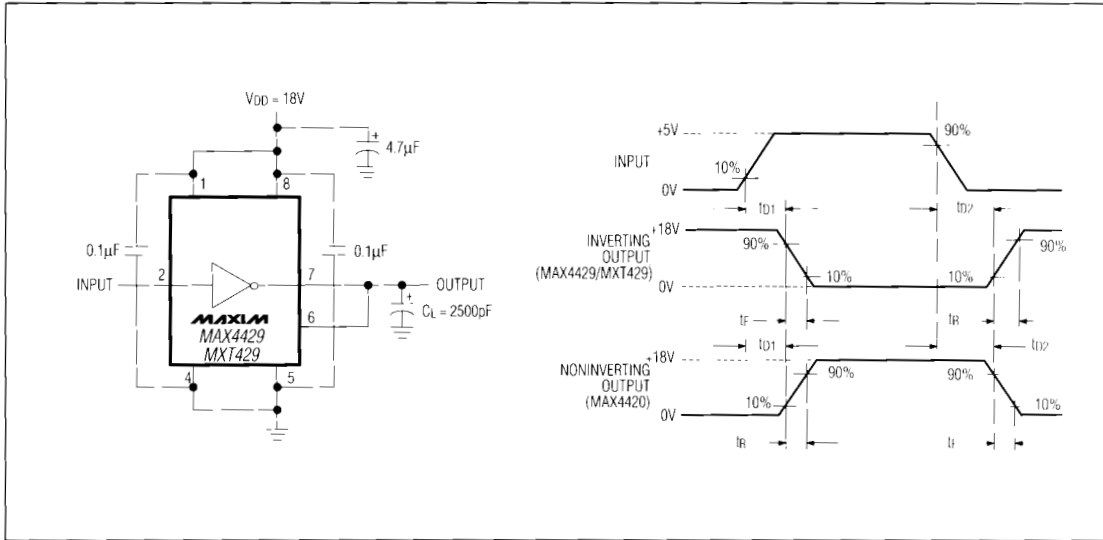


Figure 1. Switching-Time Measurement Circuit

## 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:

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

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

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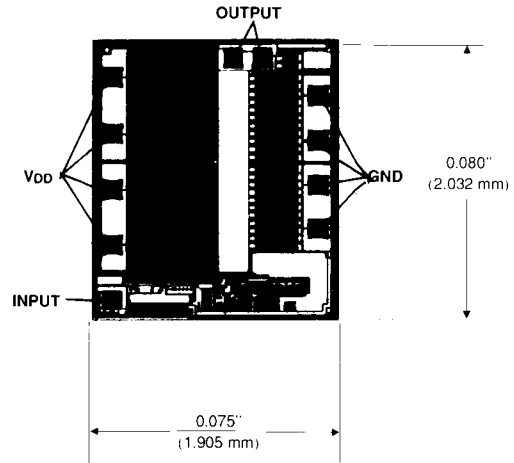
### Ordering Information (continued)

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  $T_A = +25^\circ\text{C}$ .

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

### Chip Topography



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

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