/V/IXI/VI

High-Speed, 6A Single MOSFET Drivers

General Description

The MAX4420, MAX4429 and MXT429 are single-output MOSFET drivers designed to translate TTL/CMOS inputs to high-voltage/high-current outputs. The low 1.5Ω output impedance and 6A peak current output allow them to rapidly switch high-capacitance power MOSFETs, improving efficiency.

A 40ns delay time and a 25ns rise or fall time (while driving 2500pF to 18V) minimize power losses during MOSFET switching transitions.

The MAX4420/MAX4429/MXT429 interface easily with either CMOS or bipolar switch-mode controllers because their logic inputs draw under 10µA. The outputs swing to within 25mV of GND or the power-supply rail, which can be 4.5V to 18V for the MAX4420/MAX4429, and 7V to 18V for the MXT429.

Power-supply quiescent current is typically 45µA and 450µA for logic input low and high, respectively. The MAX4420 has a non inverting output. The MAX4429 and MXT429 have inverting outputs.

For dual drivers, refer to the MAX626/MAX627/MAX628 and MAX4426/MAX4427/MAX4428 data sheets.

Applications

Switching Power Supplies

DC-DC Converters

Motor Controllers

Pin-Diode Drivers

Pin Configurations
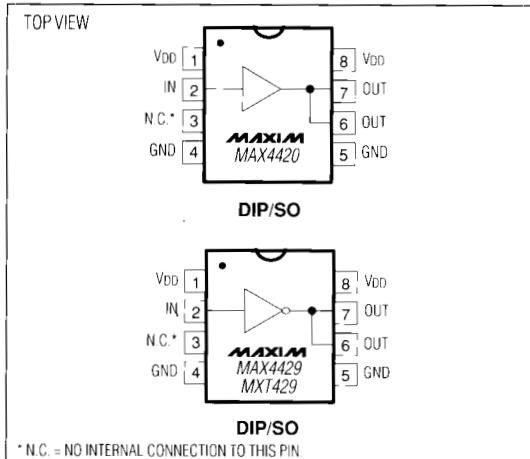
Features

♦ **TTL/CMOS Compatible (I_{IN} ≤ 10µA)**

♦ **4.5V to 18V Supply Range (MAX4420/MAX4429)**

♦ **1.5Ω Output Resistance**

♦ **6A Peak Output Current**

♦ **40ns Delay Time**

♦ **25ns Rise and Fall Times (2500pF Load)**

♦ **Output Swings to within 25mV of V_{DD} and GND**

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX4420CPA	0°C to +70°C	8 Plastic DIP
MAX4420CSA	0°C to +70°C	8 SO
MAX4420C/D	0°C to +70°C	Dice*
MAX4420EPA	-40°C to +85°C	8 Plastic DIP
MAX4420ESA	-40°C to +85°C	8 SO
MAX4420MJA	-55°C to +125°C	8 CERDIP**
MAX4429CPA	0°C to +70°C	8 Plastic DIP
MAX4429CSA	0°C to +70°C	8 SO
MAX4429C/D	0°C to +70°C	Dice*
MAX4429EPA	-40°C to +85°C	8 Plastic DIP
MAX4429ESA	-40°C to +85°C	8 SO
MAX4429MJA	-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.

Typical Operating Circuit

MAX4420/MAX4429/MXT429 (vertical side text)
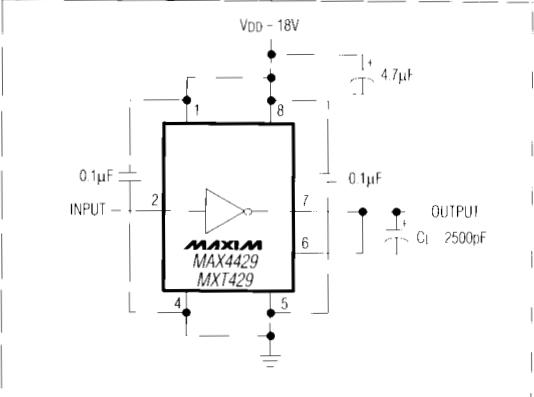
High-Speed, 6A Single MOSFET Drivers

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			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 = 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	T_A = +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.

MAXIM

High-Speed, 6A Single MOSFET Drivers

MAX4420 SWITCHING SPEED (INPUT HIGH TO LOW)

INPUT

OUTPUT

V$_{DD}$ = 4.5V, CL = 2500pF, TIME = 100ns/div,
V$_{IN}$ = 5V TO 0V,
T$_A$ = +25°C

MAX4420 SWITCHING SPEED (INPUT LOW TO HIGH)

INPUT

OUTPUT

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)

INPUT

OUTPUT
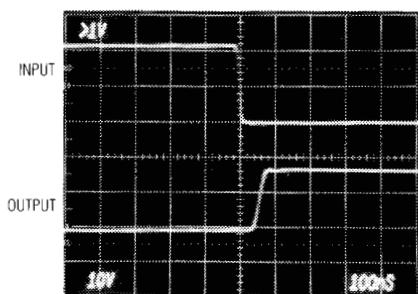
V$_{DD}$ = 18V, CL = 2500pF, TIME = 100ns/div,
V$_{IN}$ = 5V TO 0V,
T$_A$ = +25°C

MAX4429 SWITCHING SPEED (INPUT LOW TO HIGH)

INPUT

OUTPUT
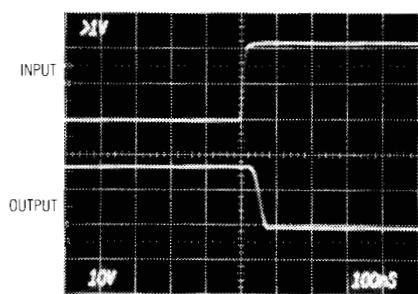
V$_{DD}$ = 18V, CL = 2500pF, TIME = 100ns/div,
V$_{IN}$ = 0V TO 5V,
T$_A$ = +25°C

FALL TIME vs. POSITIVE SUPPLY VOLTAGE
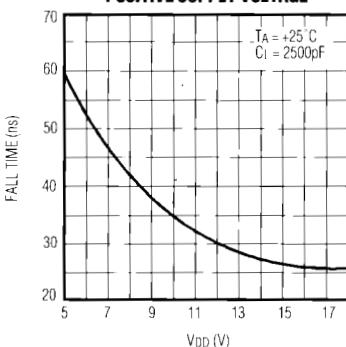

RISE TIME vs. POSITIVE SUPPLY VOLTAGE
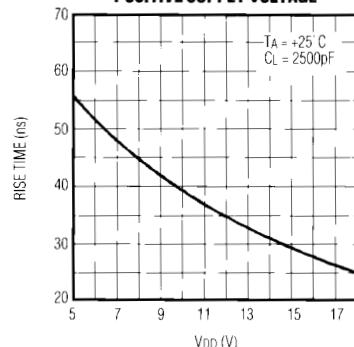
RISE AND FALL TIMES vs. TEMPERATURE

MAX4420/MAX4429/MXT429

MAXIM

3

MAX4420/MAX4429/MXT429
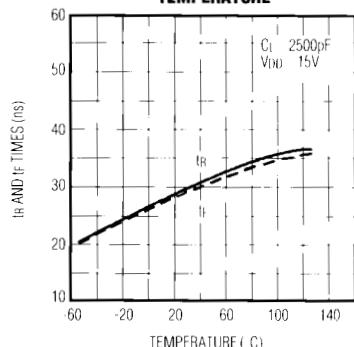
Typical Operating Characteristics (continued)

RISE AND FALL TIME vs. LOAD CAPACITANCE
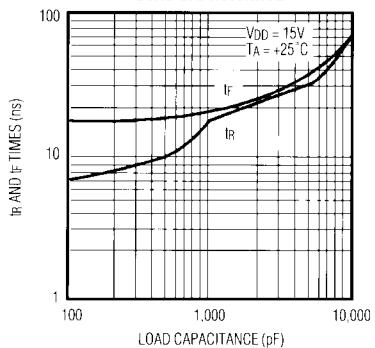
DELAY TIMES vs. POSITIVE SUPPLY VOLTAGE
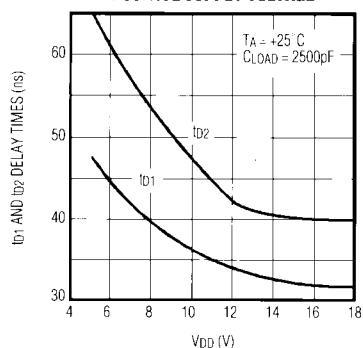
DELAY TIMES vs. TEMPERATURE
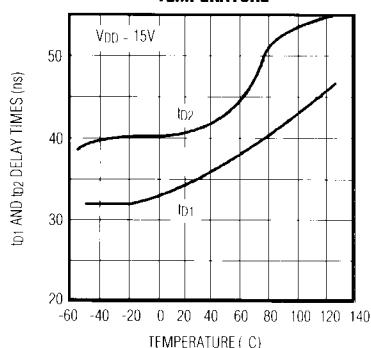
POSITIVE SUPPLY CURRENT vs. FREQUENCY
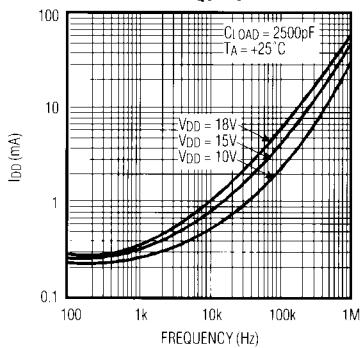
OUTPUT HIGH VOLTAGE vs. OUTPUT CURRENT
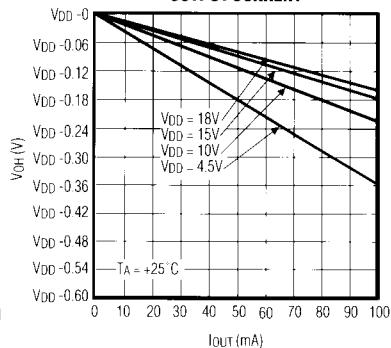
OUTPUT LOW VOLTAGE vs. OUTPUT CURRENT (SINK)
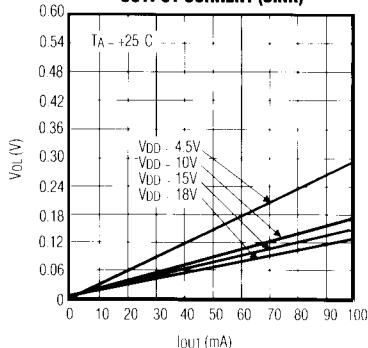
QUIESCENT SUPPLY CURRENT vs. TEMPERATURE
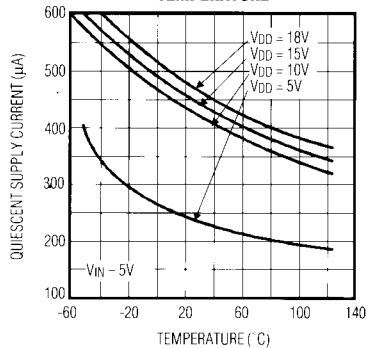
QUIESCENT SUPPLY CURRENT vs. TEMPERATURE

MAXIM
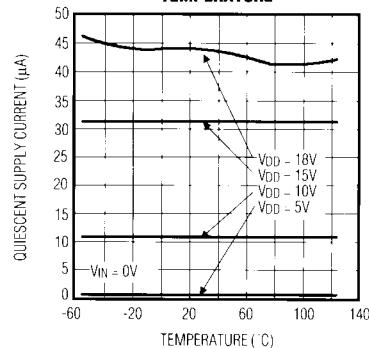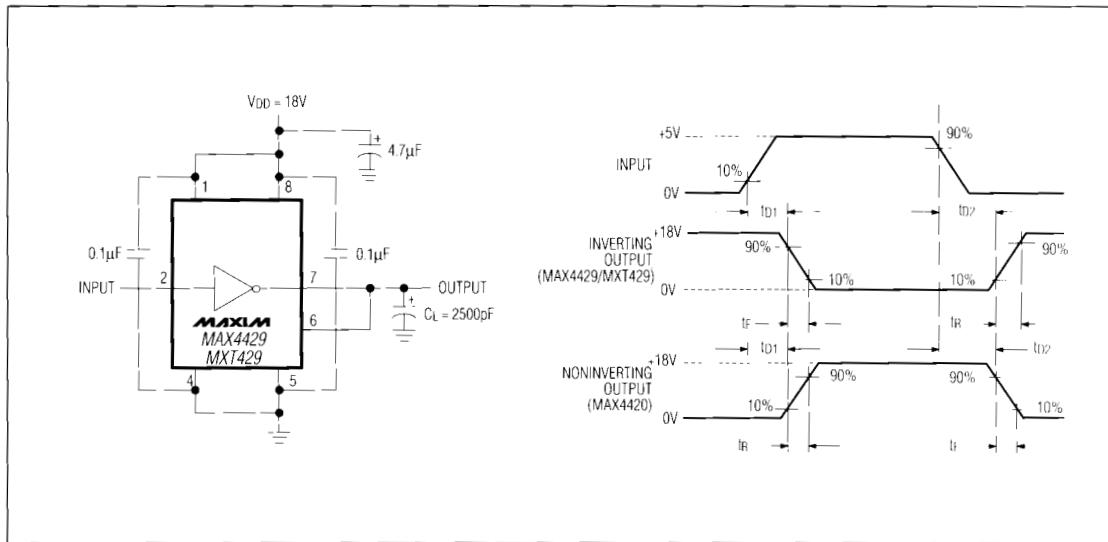
Figure 1. Switching-Time Measurement Circuit

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.

High-Speed, 6A Single MOSFET Drivers

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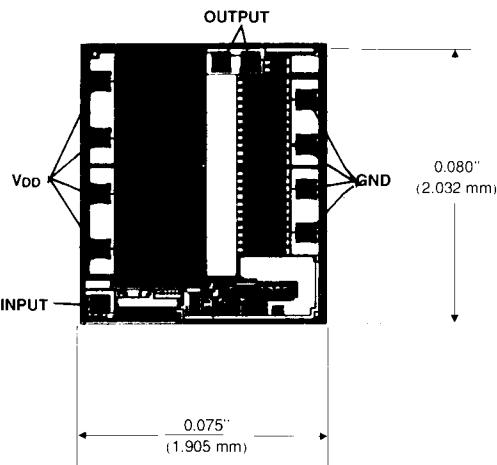
TRANSISTOR COUNT: 16;
SUBSTRATE CONNECTED TO V_{DD}.

MAXIM

MAX4420

Part Number Table

Notes:

1. See the MAX4420 QuickView Data Sheet for further information on this product family or downloa MAX4420 full data sheet (PDF, 248kB).
2. Other options and links for purchasing parts are listed at: http://www.maxim-ic.com/sales.
3. Didn't Find What You Need? Ask our applications engineers. Expert assistance in finding parts, usu one business day.
4. Part number suffixes: T or T&R = tape and reel; + = RoHS/lead-free; # = RoHS/lead-exempt. Mo data sheet or Part Naming Conventions.
5. * Some packages have variations, listed on the drawing. "PkgCode/Variation" tells which variatio uses.

Part Number	Free Sample	Buy Direct	Package: TYPE PINS SIZE DRAWING CODE/VAR *	Temp	RoHS/ Materi
MAX4420EJA			Ceramic DIP;8 pin;.300" Dwg: 21-0045A (PDF) Use pkgcode/variation: J8-2*	-40C to +85C	RoHS/ Materi
MAX4420MJA			Ceramic DIP;8 pin;.300" Dwg: 21-0045A (PDF) Use pkgcode/variation: J8-2*	-55C to +125C	RoHS/ Materi
MAX4420MJA/883B			Ceramic DIP;8 pin;.300" Dwg: 21-0045A (PDF) Use pkgcode/variation: J8-2*	-55C to +125C	RoHS/ Materi
MAX4420C/D					RoHS/
MAX4420CPA+			PDIP;8 pin;.300" Dwg: 21-0043D (PDF) Use pkgcode/variation: P8+1*	0C to +70C	RoHS/ Materi
MAX4420CPA			PDIP;8 pin;.300" Dwg: 21-0043D (PDF) Use pkgcode/variation: P8-1*	0C to +70C	RoHS/ Materi
MAX4420EPA+			PDIP;8 pin;.300" Dwg: 21-0043D (PDF) Use pkgcode/variation: P8+1*	-40C to +85C	RoHS/ Materi

MAX4420EPA			PDIP;8 pin;.300" Dwg: 21-0043D (PDF) Use pkgcode/variation: P8-1*	-40C to +85C	RoHS/ Materi
MAX4420CSA+T			SOIC;8 pin;.150" Dwg: 21-0041B (PDF) Use pkgcode/variation: S8+5*	0C to +70C	RoHS/ Materi
MAX4420CSA+			SOIC;8 pin;.150" Dwg: 21-0041B (PDF) Use pkgcode/variation: S8+5*	0C to +70C	RoHS/ Materi
MAX4420CSA-T			SOIC;8 pin;.150" Dwg: 21-0041B (PDF) Use pkgcode/variation: S8-5*	0C to +70C	RoHS/ Materi
MAX4420CSA			SOIC;8 pin;.150" Dwg: 21-0041B (PDF) Use pkgcode/variation: S8-5*	0C to +70C	RoHS/ Materi
MAX4420ESA+T			SOIC;8 pin;.150" Dwg: 21-0041B (PDF) Use pkgcode/variation: S8+5*	-40C to +85C	RoHS/ Materi
MAX4420ESA-T			SOIC;8 pin;.150" Dwg: 21-0041B (PDF) Use pkgcode/variation: S8-5*	-40C to +85C	RoHS/ Materi
MAX4420ESA			SOIC;8 pin;.150" Dwg: 21-0041B (PDF) Use pkgcode/variation: S8-5*	-40C to +85C	RoHS/ Materi
MAX4420ESA+			SOIC;8 pin;.150" Dwg: 21-0041B (PDF) Use pkgcode/variation: S8+5*	-40C to +85C	RoHS/ Materi

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