TC4426M/TC4427M/TC4428M

1.5A Dual High-Speed Power MOSFET Drivers

Features

- High Peak Output Current – 1.5A
- Wide Input Supply Voltage Operating Range:
  - 4.5V to 18V
- High Capacitive Load Drive Capability – 1000 pF in 25 ns (typ.)
- Short Delay Times – 40 ns (typ.)
- Matched Rise and Fall Times
- Low Supply Current:
  - With Logic '1' Input – 4 mA
  - With Logic '0' Input – 400 µA
- Low Output Impedance – 7Ω
- Latch-Up Protected: Will Withstand 0.5A Reverse Current
- Input: Will Withstand Negative Inputs Up to 5V
- ESD Protected – 4 kV
- Pin-Compatible with the TC426M/TC427M/TC428M, TC4426AM/TC4427AM/TC4428AM Devices
- Wide Operating Temperature Range:
  - -55°C to +125°C
- See TC4426/TC4427/TC4428 data sheet (DS21422) for additional temperature range and packaging offerings

Applications

- Switch-mode Power Supplies
- Line Drivers
- Pulse Transformer Drive

General Description

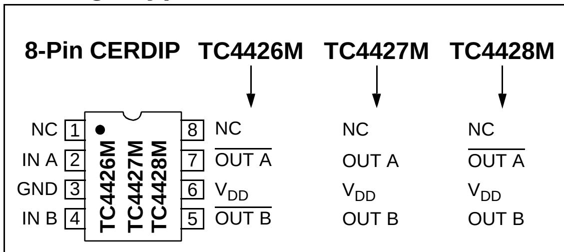
The TC4426M/TC4427M/TC4428M are improved versions of the earlier TC426M/TC427M/TC428M family of MOSFET drivers. The TC4426M/TC4427M/TC4428M devices have matched rise and fall times when charging and discharging the gate of a MOSFET.

These devices are highly latch-up resistant under any conditions within their power and voltage ratings. They are not subject to damage when up to 5V of noise spiking (of either polarity) occurs on the ground pin. They can accept, without damage or logic upset, up to 500 mA of reverse current (of either polarity) being forced back into their outputs. All terminals are fully protected against Electrostatic Discharge (ESD) up to 4 kV.

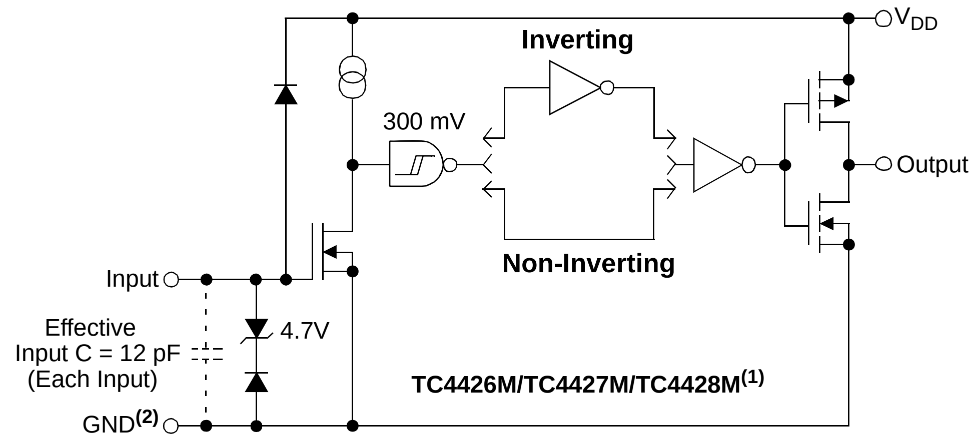
The TC4426M/TC4427M/TC4428M MOSFET drivers can easily charge/discharge 1000 pF gate capacitances in under 30 ns and provide low enough impedances in both the on and off states to ensure the MOSFET's intended state will not be affected, even by large transients.

The TC4426AM/TC4427AM/TC4428AM family of devices are also compatible drivers. The TC4426AM/TC4427AM/TC4428AM devices have matched leading and falling edge input-to-output delay times, in addition to the matched rise and fall times of the TC4426M/TC4427M/TC4428M devices.

Package Types



Functional Block Diagram



Note 1: The TC4426M has two inverting drivers; the TC4427M has two non-inverting drivers; the TC4428M has one inverting and one non-inverting driver.

2: Ground any unused driver input.

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage ....+22V
Input Voltage, IN A or IN B..........(V_{DD} + 0.3V) to (GND – 5V)
Storage Temperature Range.........................-65°C to +150°C
Maximum Junction Temperature................................+150°C

† 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 = +25ºC 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}	-1.0	—	+1.0	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	R_O	—	7	10	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Peak Output Current	I_{PK}	—	1.5	—	A	V_{DD} = 18V
Latch-Up Protection Withstand Reverse Current	I_{REV}	—	>0.5	—	A	Duty cycle ≤ 2%, t ≤ 300 µs V_{DD} = 18V
Switching Time (Note 1)						
Rise Time	t_R	—	19	30	ns	**Figure 4-1**
Fall Time	t_F	—	25	30	ns	**Figure 4-1**
Delay Time	t_{D1}	—	20	30	ns	**Figure 4-1**
Delay Time	t_{D2}	—	40	50	ns	**Figure 4-1**
Power Supply						
Power Supply Current	I_S	— —	— —	4.5 0.4	mA	V_{IN} = 3V (Both inputs) V_{IN} = 0V (Both inputs)

Note 1: Switching times ensured by design.

DC CHARACTERISTICS (OVER OPERATING TEMPERATURE RANGE)

Electrical Specifications: Unless otherwise noted, over operating temperature range with 4.5V $\leq V_{DD} \leq$ 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	$0V \leq V_{IN} \leq V_{DD}$
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	R_O	—	9	12	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Peak Output Current	I_{PK}	—	1.5	—	A	V_{DD} = 18V
Latch-Up Protection Withstand Reverse Current	I_{REV}	—	>0.5	—	A	Duty cycle $\leq$ 2%, t $\leq$ 300 µs V_{DD} = 18V
Switching Time (Note 1)						
Rise Time	t_R	—	—	40	ns	**Figure 4-1**
Fall Time	t_F	—	—	40	ns	**Figure 4-1**
Delay Time	t_{D1}	—	—	40	ns	**Figure 4-1**
Delay Time	t_{D2}	—	—	60	ns	**Figure 4-1**
Power Supply						
Power Supply Current	I_S	— —	— —	8.0 0.6	mA	V_{IN} = 3V (Both inputs) V_{IN} = 0V (Both inputs)

Note 1: Switching times ensured by design.

TEMPERATURE CHARACTERISTICS

Electrical Specifications: Unless otherwise noted, all parameters apply with 4.5V $\leq V_{DD} \leq$ 18V.						
Parameters	**Sym**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
Temperature Ranges						
Specified Temperature Range (M)	T_A	-55	—	+125	ºC	
Maximum Junction Temperature	T_J	—	—	+150	ºC	
Storage Temperature Range	T_A	-65	—	+150	ºC	
Package Thermal Resistances						
Thermal Resistance, 8L-CERDIP	θ_{JA}	—	150	—	ºC/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 = +25ºC with 4.5V $\leq V_{DD} \leq$ 18V.

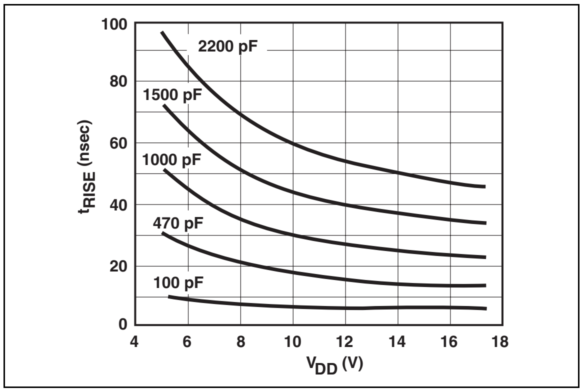


FIGURE 2-1: *Rise Time vs. Supply Voltage.*

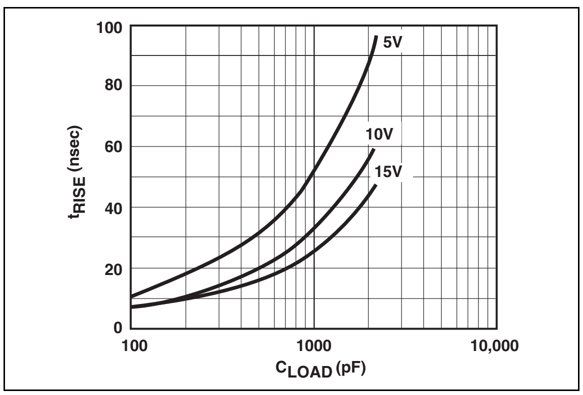


FIGURE 2-2: *Rise Time vs. Capacitive Load.*

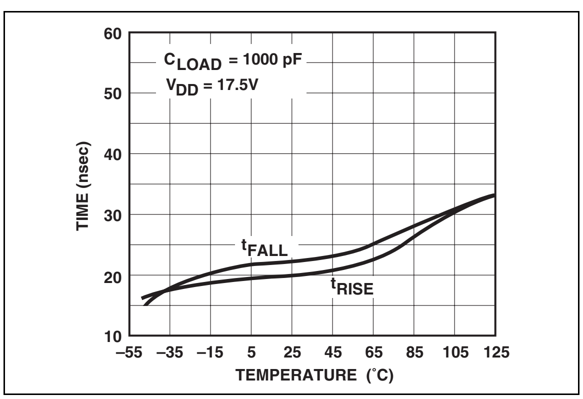


FIGURE 2-3: *Rise and Fall Times vs. Temperature.*

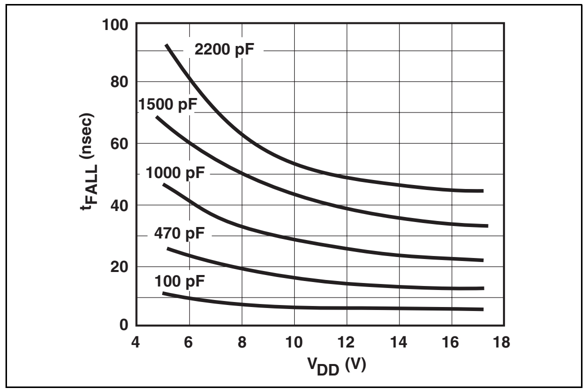


FIGURE 2-4: *Fall Time vs. Supply Voltage.*

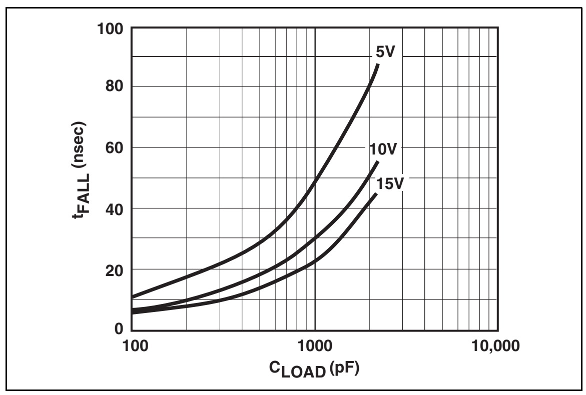


FIGURE 2-5: *Fall Time vs. Capacitive Load.*

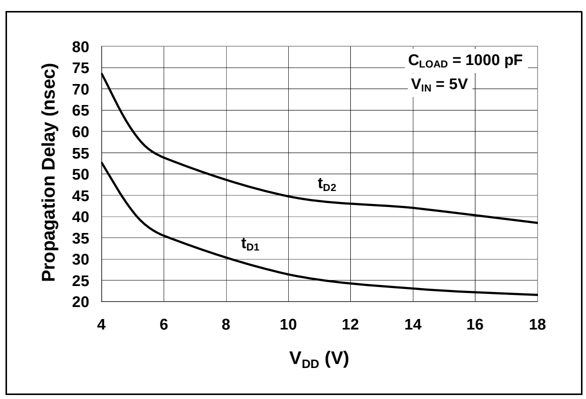


FIGURE 2-6: *Propagation Delay Time vs. Supply Voltage.*

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

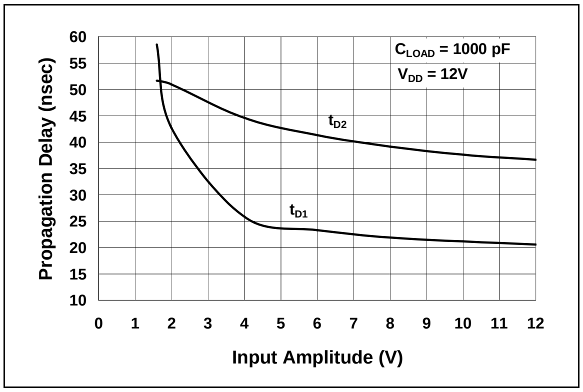


FIGURE 2-7: *Propagation Delay Time vs. Input Amplitude.*

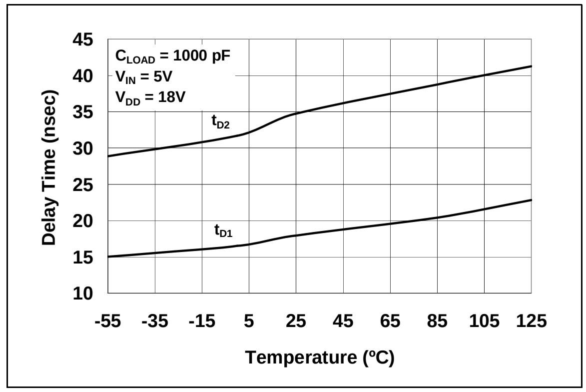


FIGURE 2-10: *Propagation Delay Time vs. Temperature.*

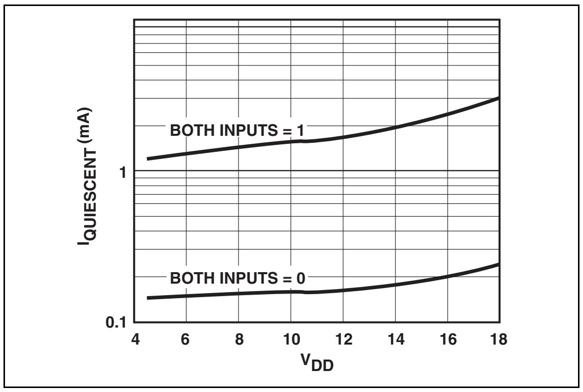


FIGURE 2-8: *Supply Current vs. Supply Voltage.*

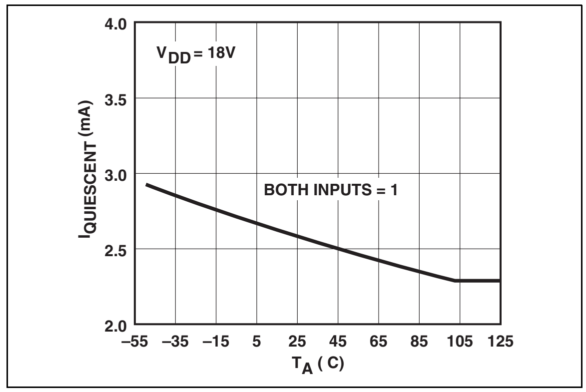


FIGURE 2-11: *Supply Current vs. Temperature.*

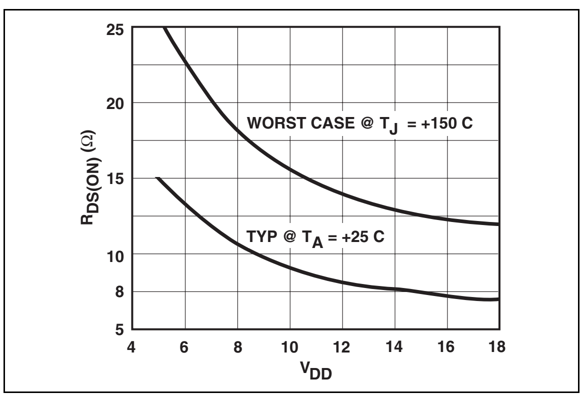


FIGURE 2-9: *Output Resistance (R_{OH}) vs. Supply Voltage.*

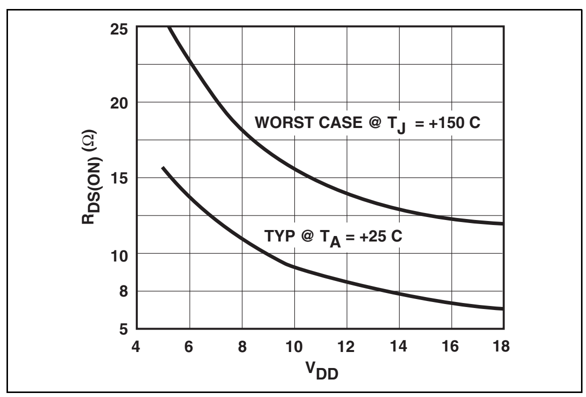


FIGURE 2-12: *Output Resistance (R_{OL}) vs. Supply Voltage.*

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

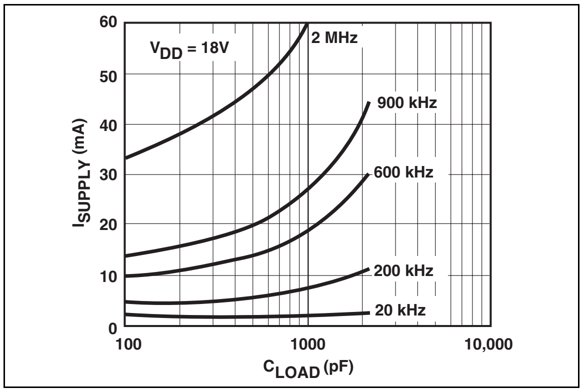


FIGURE 2-13: *Supply Current vs. Capacitive Load.*

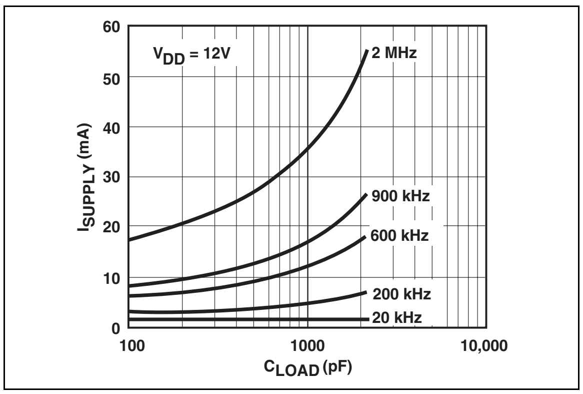


FIGURE 2-14: *Supply Current vs. Capacitive Load.*

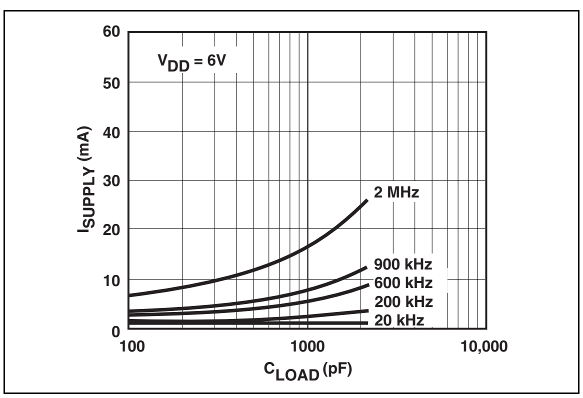


FIGURE 2-15: *Supply Current vs. Capacitive Load.*

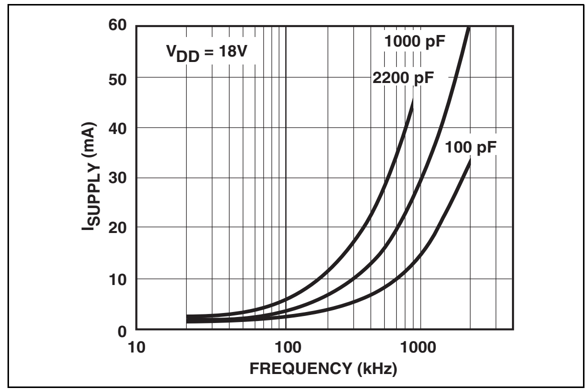


FIGURE 2-16: *Supply Current vs. Frequency.*

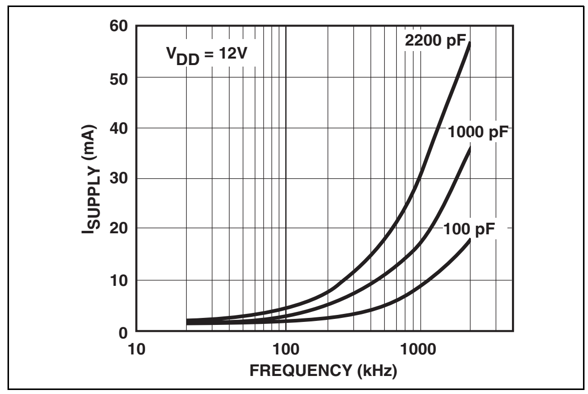


FIGURE 2-17: *Supply Current vs. Frequency.*

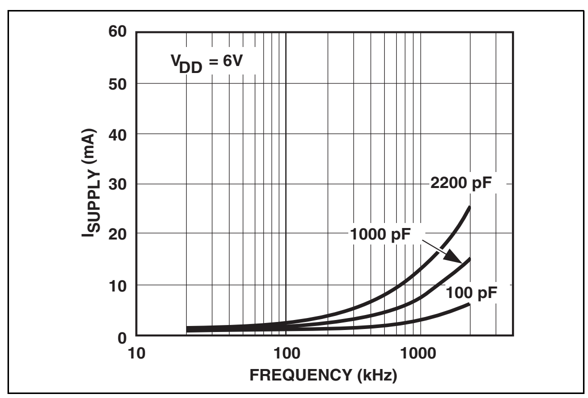
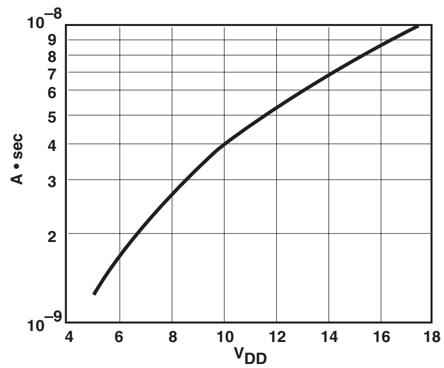


FIGURE 2-18: *Supply Current vs. Frequency.*

Note: Unless otherwise indicated, T_A = +25ºC with 4.5V $\leq V_{DD} \leq$ 18V.



Note: The values seen in this graph represent the loss seen by both drivers in a package during one complete cycle. For a single driver, divide the stated values by 2. For a single transition of a single driver, divide the stated value by 4.

FIGURE 2-19: *Crossover Energy vs. Supply Voltage.*

3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 3-1.

TABLE 3-1: PIN FUNCTION TABLE

8-Pin CERDIP	Symbol	Description
1	NC	No connection
2	IN A	Input A
3	GND	Ground
4	IN B	Input B
5	OUT B	Output B
6	V_{DD}	Supply input
7	OUT A	Output A
8	NC	No connection

3.1 Inputs A & B (IN A and IN B)

MOSFET drivers IN A & B are high-impedance, TTL/ CMOS-compatible inputs. These inputs also have 300 mV of hysteresis between the high and low thresholds that prevents output glitching even when the rise and fall time of the input signal is very slow.

3.2 Ground (GND)

GND is the device return pin. The ground pin(s) should have a low-impedance connection to the bias supply source return. High peak currents will flow out of the ground pin(s) when the capacitive load is being discharged.

3.3 Output A & B (OUT A and OUT B)

MOSFET drivers OUT A & B are low-impedance, CMOS push-pull style outputs. The pull-down and pull-up devices are of equal strength, making the rise and fall times equivalent.

3.4 Supply Input (V_{DD})

The V_{DD} input is the bias supply for the MOSFET driver and is rated for 4.5V to 18V with respect to the ground pin. The V_{DD} input should be bypassed with local ceramic capacitors. The value of these capacitors should be chosen based on the capacitive load that is being driven. A value of 1.0 µF is suggested.

4.0 APPLICATIONS INFORMATION

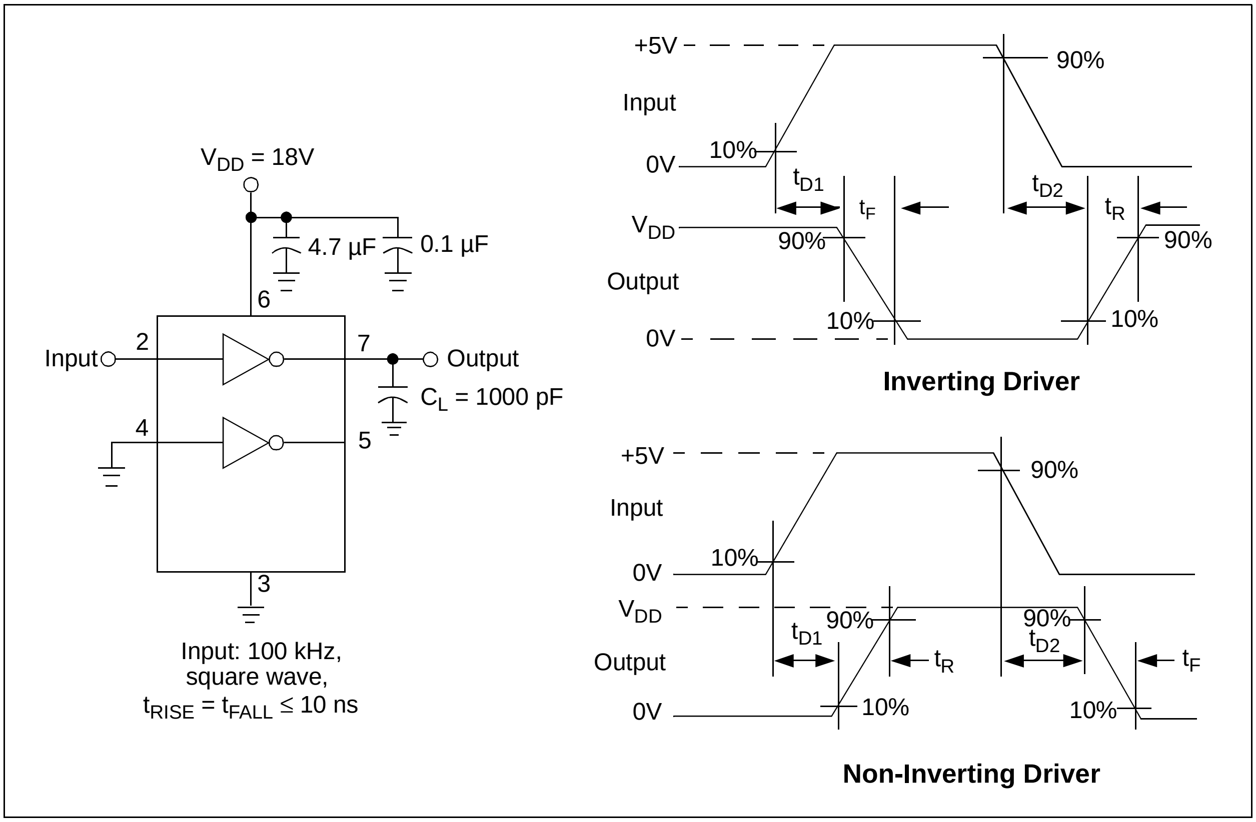
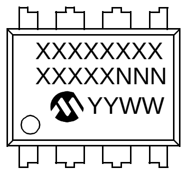


FIGURE 4-1: *Switching Time Test Circuit.*

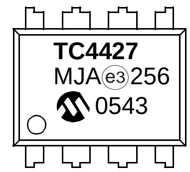
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

8-Lead CERDIP (300 mil)



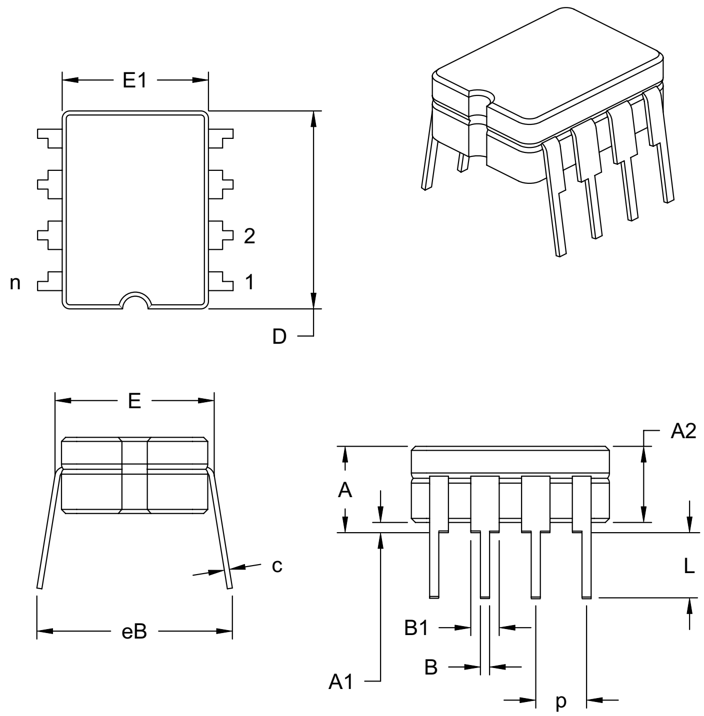
Example:



Legend:	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.

Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

8-Lead Ceramic Dual In-line – 300 mil (CERDIP)



Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.100			2.54	
Top to Seating Plane	A	.160	.180	.200	4.06	4.57	5.08
Standoff §	A1	.020	.030	.040	0.51	0.77	1.02
Shoulder to Shoulder Width	E	.290	.305	.320	7.37	7.75	8.13
Ceramic Pkg. Width	E1	.230	.265	.300	5.84	6.73	7.62
Overall Length	D	.370	.385	.400	9.40	9.78	10.16
Tip to Seating Plane	L	.125	.163	.200	3.18	4.13	5.08
Lead Thickness	c	.008	.012	.015	0.20	0.29	0.38
Upper Lead Width	B1	.045	.055	.065	1.14	1.40	1.65
Lower Lead Width	B	.016	.018	.020	0.41	0.46	0.51
Overall Row Spacing	eB	.320	.360	.400	8.13	9.15	10.16

*Controlling Parameter

JEDEC Equivalent: MS-030

Drawing No. C04-010

APPENDIX A: REVISION HISTORY

Revision A (February 2005)

- Original Release of this Document.

NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

PART NO.	XX
Device and Temperature Range	Package

Device and Temperature Range:	TC4426M:	1.5A Dual MOSFET Driver, Inverting, -55°C to +125°C
	TC4427M:	1.5A Dual MOSFET Driver, Non-Inverting, -55°C to +125°C
	TC4428M:	1.5A Dual MOSFET Driver, Complementary, -55°C to +125°C
Package:	JA =	Ceramic Dual In-line (300 mil Body), 8-lead

Examples:

a) TC4426MJA: 1.5A Dual MOSFET driver, Inverting, -55°C to +125°C, 8LD CERDIP package.

a) TC4427MJA: 1.5A Dual MOSFET driver, Non-Inverting, -55°C to +125°C, 8LD CERDIP package.

a) TC4428MJA: 1.5A Dual MOSFET driver, Complementary, -55°C to +125°C, 8LD CERDIP package.

NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
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