MICROCHIP TC4426A/TC4427A/TC4428A

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 nsec (typ.)
- Short Delay Times – 30 nsec (typ.)
- Matched Rise, Fall and Delay Times
- Low Supply Current:
  - With Logic '1' Input – 1 mA (typ.)
  - With Logic '0' Input – 100 µA (typ.)
- Low Output Impedance – 7Ω (typ.)
- Latch-Up Protected: Will Withstand 0.5A Reverse Current
- Input Will Withstand Negative Inputs Up to 5V
- ESD Protected – 4 kV
- Pinouts the same as TC426/TC427/TC428 and TC4426/TC4427/TC4428
- Space-saving 8-Pin MSOP Package

Applications

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

General Description

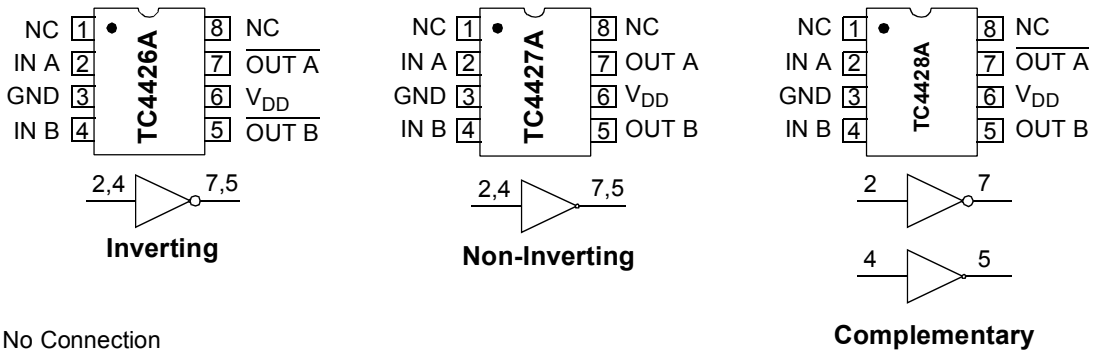
The TC4426A/TC4427A/TC4428A are improved versions of the earlier TC4426/TC4427/TC4428 family of MOSFET drivers. In addition to matched rise and fall times, the TC4426A/TC4427A/TC4428A devices have matched leading and falling edge propagation delay times.

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 up to 4 kV.

The TC4426A/TC4427A/TC4428A MOSFET drivers can easily charge/discharge 1000 pF gate capacitances in under 30 nsec 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.

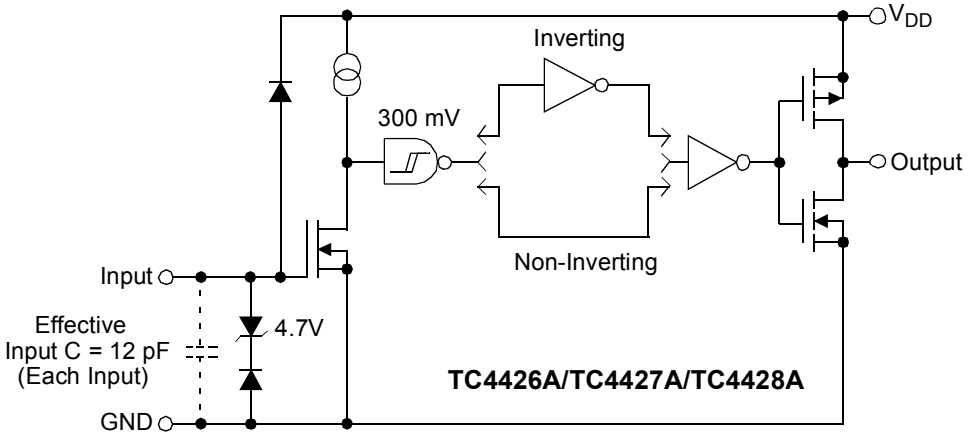
Package Types

8-Pin MSOP/PDIP/SOIC/CERDIP



NC = No Connection

Functional Block Diagram



Note 1: TC4426A has two inverting drivers; TC4427A has two non-inverting drivers; TC4428A 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)

Package Power Dissipation ($T_A \leq 70°C$)
- PDIP ..... 730 mW
- CERDIP ..... 800 mW
- SOIC ..... 470 mW
- MSOP ..... 340 mW

† **Notice:** 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, 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}	-1.0 -10	— —	+1.0 +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	— — — —	7 7 8 8	9 10 11 12	Ω	I_{OUT} = 10 mA, V_{DD} = 18V, T_A = +25°C 0°C $\leq T_A \leq$ +70°C -40°C $\leq T_A \leq$ +85°C -40°C $\leq T_A \leq$ +125°C
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 µsec V_{DD} = 18V
Switching Time (Note 1)						
Rise Time	t_R	— — — —	25 27 29 30	35 40 40 40	nsec	T_A = +25°C 0°C $\leq T_A \leq$ +70°C -40°C $\leq T_A \leq$ +85°C -40°C $\leq T_A \leq$ +125°C, **Figure 4-1**
Fall Time	t_F	— — — —	25 27 29 30	35 40 40 40	nsec	T_A = +25°C 0°C $\leq T_A \leq$ +70°C -40°C $\leq T_A \leq$ +85°C -40°C $\leq T_A \leq$ +125°C, **Figure 4-1**
Delay Time	t_{D1}	— — — —	30 33 35 38	35 40 45 50	nsec	T_A = +25°C 0°C $\leq T_A \leq$ +70°C -40°C $\leq T_A \leq$ +85°C -40°C $\leq T_A \leq$ +125°C, **Figure 4-1**
Delay Time	t_{D2}	— — — —	30 33 35 38	35 40 45 50	nsec	T_A = +25°C 0°C $\leq T_A \leq$ +70°C -40°C $\leq T_A \leq$ +85°C -40°C $\leq T_A \leq$ +125°C, **Figure 4-1**

Note 1: Switching times ensured by design.

DC CHARACTERISTICS (CONTINUED)

Electrical Specifications: Unless otherwise noted, over operating temperature range with 4.5V ≤ V_{DD} ≤ 18V.						
Parameters	**Sym**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
Power Supply						
Power Supply Current	I_S	— —	1.0 0.1	2.0 0.2	mA	V_{IN} = 3V (Both inputs) V_{IN} = 0V (Both inputs), V_{DD} = 18V

Note 1: Switching times ensured by design.

TEMPERATURE CHARACTERISTICS

Electrical Specifications: Unless otherwise noted, all parameters apply with 4.5V ≤ V_{DD} ≤ 18V.						
Parameters	**Sym**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
Temperature Ranges						
Specified Temperature Range (C)	T_A	0	—	+70	ºC	
Specified Temperature Range (E)	T_A	-40	—	+85	ºC	
Specified Temperature Range (M)	T_A	-55	—	+125	ºC	
Specified Temperature Range (V)	T_A	-40	—	+125	ºC	
Maximum Junction Temperature	T_J	—	—	+150	ºC	
Storage Temperature Range	T_A	-65	—	+150	ºC	
Package Thermal Resistances						
Thermal Resistance, 8L-MSOP	θ_{JA}	—	206	—	ºC/W	
Thermal Resistance, 8L-PDIP	θ_{JA}	—	125	—	ºC/W	
Thermal Resistance, 8L-CERDIP	θ_{JA}	—	150	—	ºC/W	
Thermal Resistance, 8L-SOIC	θ_{JA}	—	155	—	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, over operating temperature range with 4.5V $\leq V_{DD} \leq$ 18V.

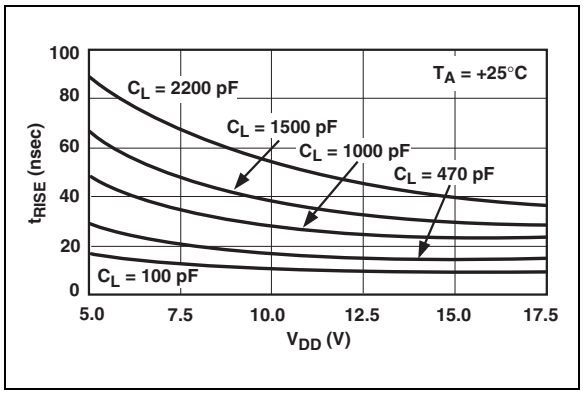


FIGURE 2-1: *Rise Time vs. Supply Voltage.*

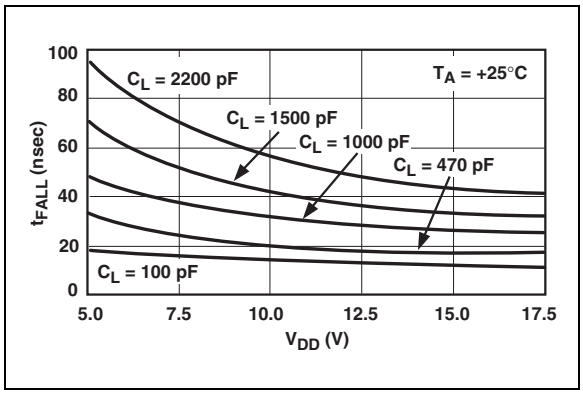


FIGURE 2-4: *Fall Time vs. Supply Voltage.*

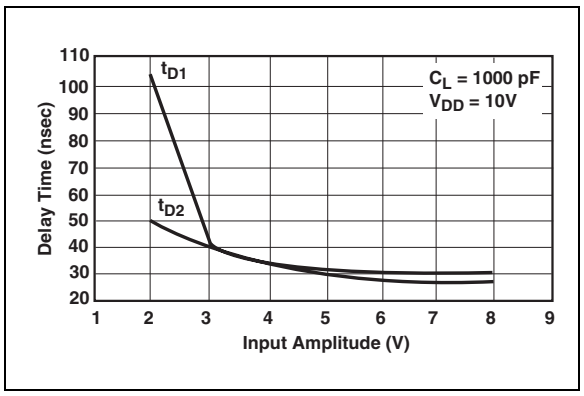


FIGURE 2-2: *Delay Time vs. Input Amplitude.*

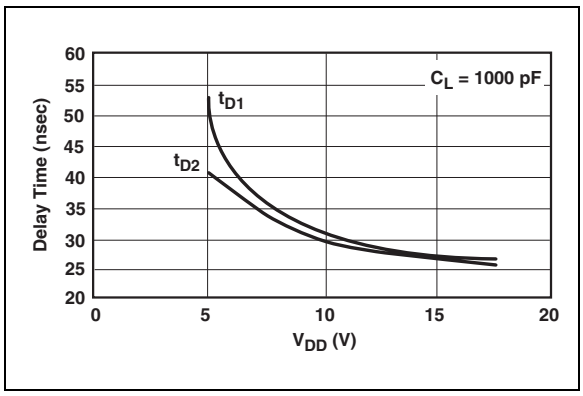


FIGURE 2-5: *Propagation Delay Time vs. Supply Voltage.*

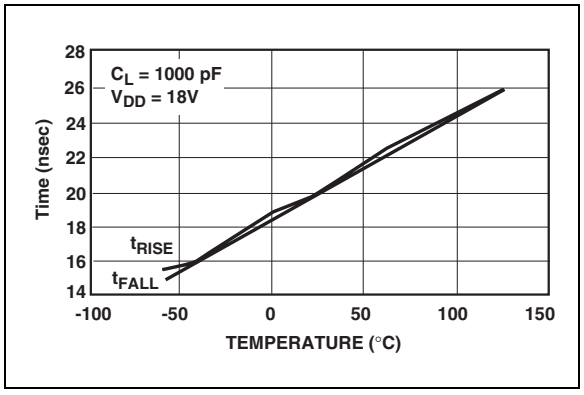


FIGURE 2-3: *Rise and Fall Times vs. Temperature.*

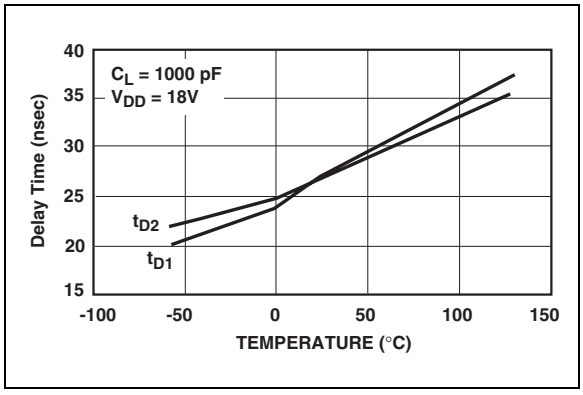


FIGURE 2-6: *Propagation Delay Time vs. Temperature.*

Note: Unless otherwise indicated, over operating temperature range with $4.5V \leq V_{DD} \leq 18V$.

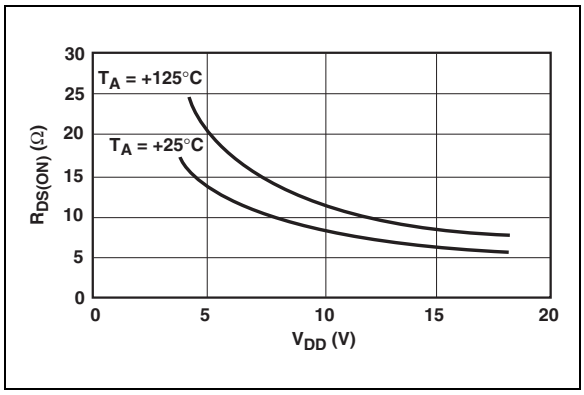


FIGURE 2-7: *High-State Output Resistance.*

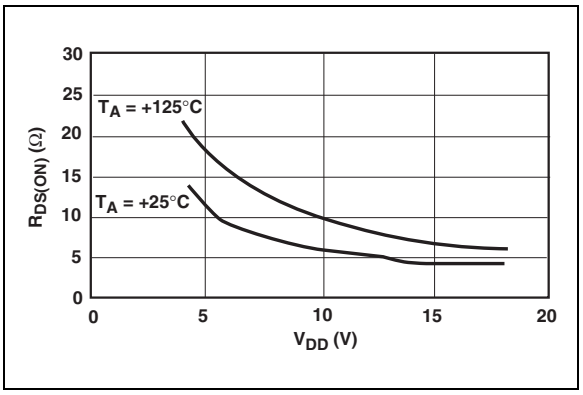


FIGURE 2-10: *Low State Output Resistance.*

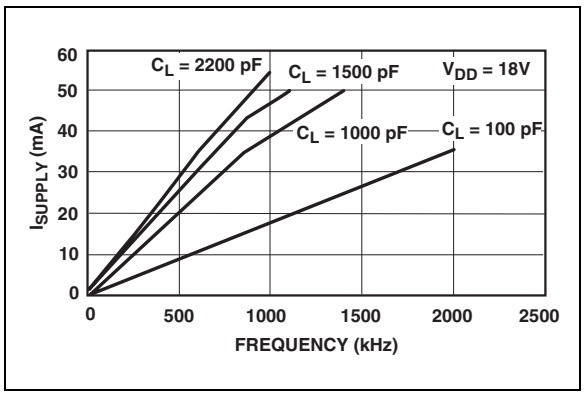


FIGURE 2-8: *Supply Current vs. Frequency.*

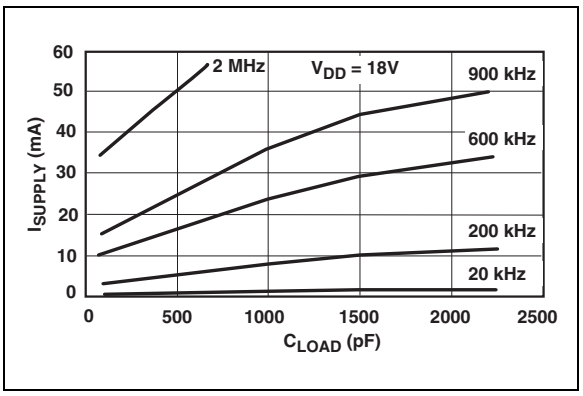


FIGURE 2-11: *Supply Current vs. Capacitive Load.*

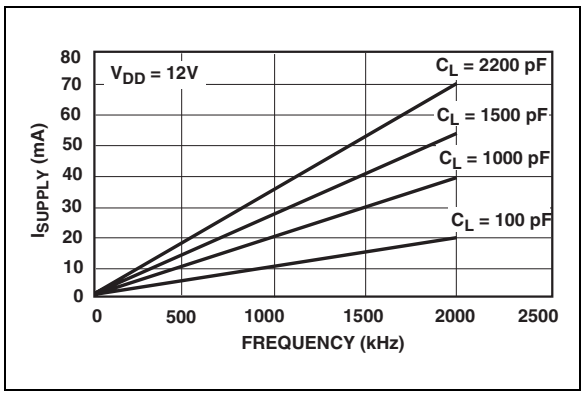


FIGURE 2-9: *Supply Current vs. Frequency.*

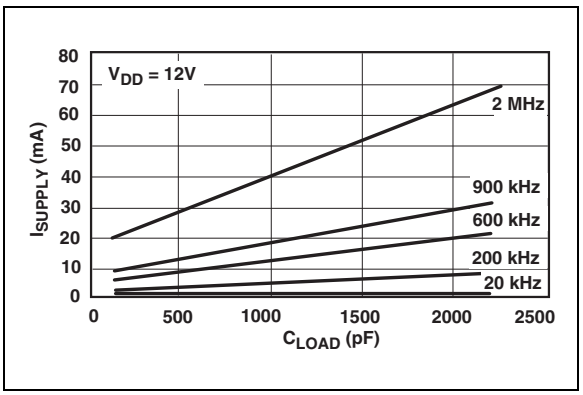


FIGURE 2-12: *Supply Current vs. Capacitive Load.*

Note: Unless otherwise indicated, over operating temperature range with 4.5V $\leq V_{DD} \leq$ 18V.

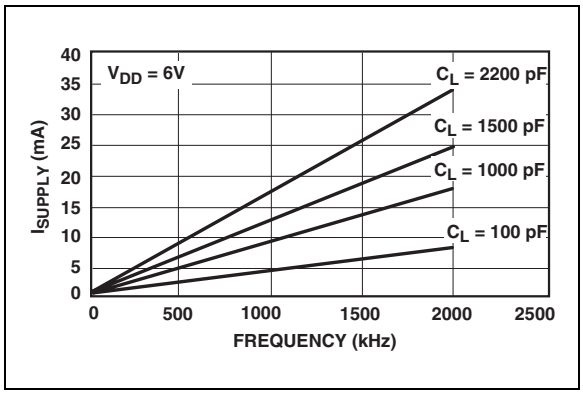


FIGURE 2-13: *Supply Current vs. Frequency.*

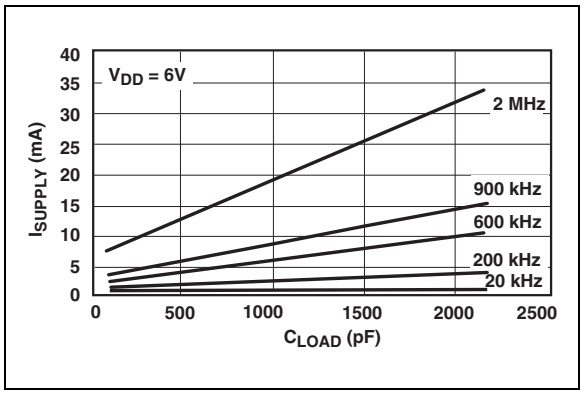


FIGURE 2-15: *Supply Current vs. Capacitive Load.*

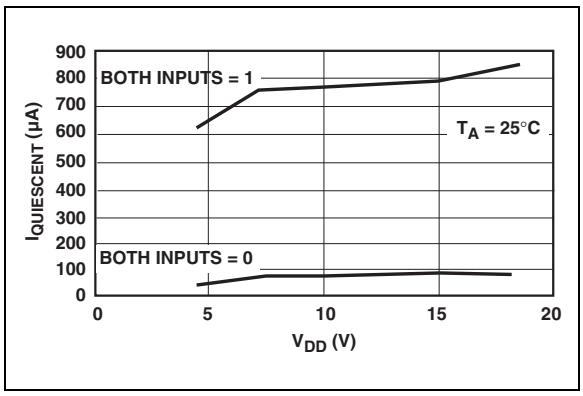


FIGURE 2-14: *Quiescent Supply Current vs. Voltage.*

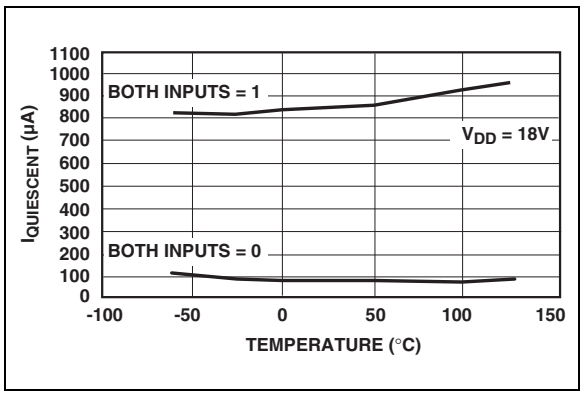


FIGURE 2-16: *Quiescent Supply Current vs. Temperature.*

3.0 PIN DESCRIPTIONS

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

TABLE 3-1: PIN FUNCTION TABLE

Pin No. (8-Pin MSOP, PDIP, SOIC, 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

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

3.2 Ground (GND)

The ground pin is the return path for both the bias current and the high peak current that discharges the external load capacitance. The ground pin should be tied into a ground plane or have a very short trace to the bias supply source return.

3.3 Output A & B

MOSFET driver outputs A & B are low-impedance, CMOS push-pull style outputs. The pull-down and pull-up devices are 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.

4.0 APPLICATIONS INFORMATION

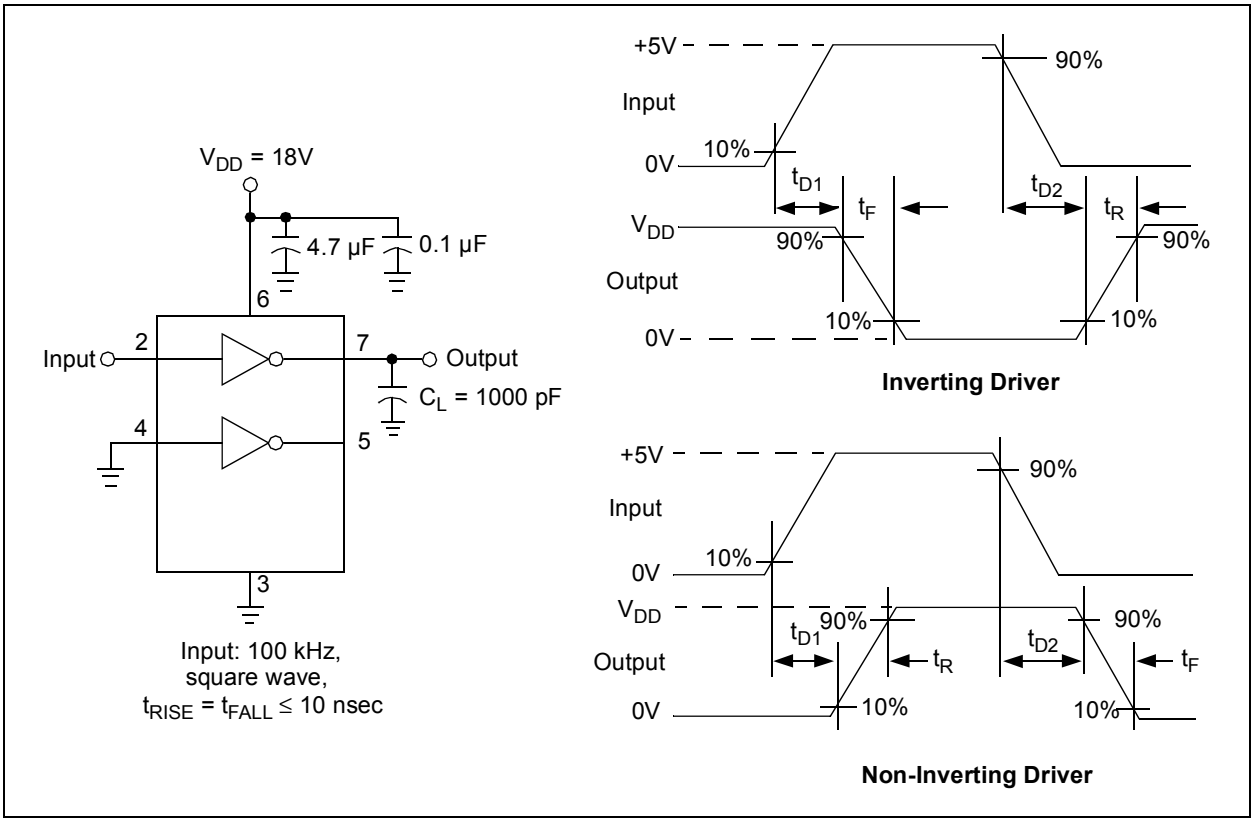
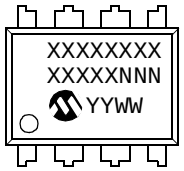


FIGURE 4-1: *Switching Time Test Circuit.*

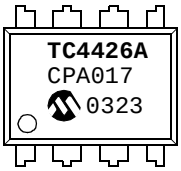
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

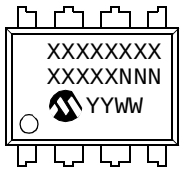
8-Lead PDIP (300 mil)



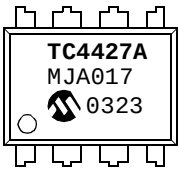
Example:



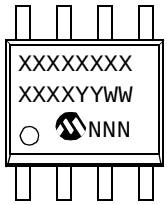
8-Lead CERDIP (300 mil)



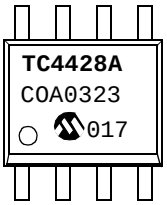
Example:



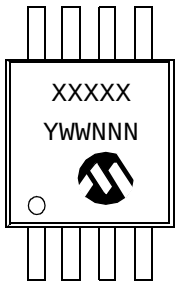
8-Lead SOIC (150 mil)



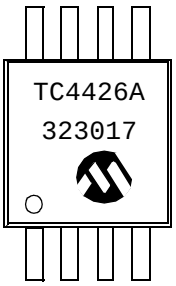
Example:



8-Lead MSOP



Example:

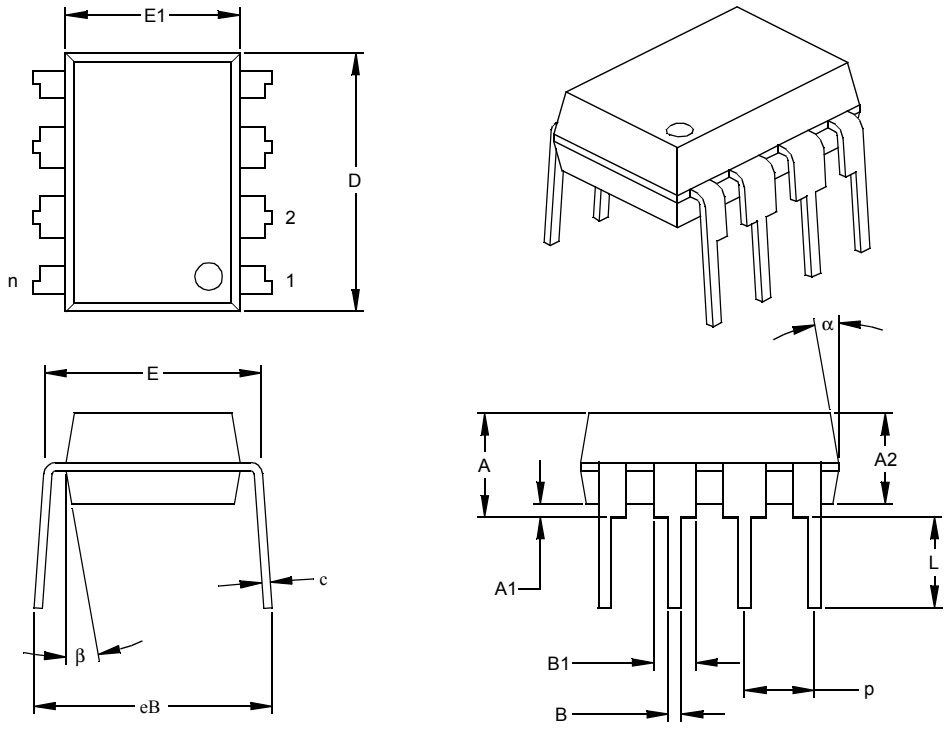


Legend:	XX...X	Customer specific information*
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code

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.

***** Standard marking consists of Microchip part number, year code, week code, traceability code (facility code, mask rev#, and assembly code).

8-Lead Plastic Dual In-line (PA) – 300 mil (PDIP)

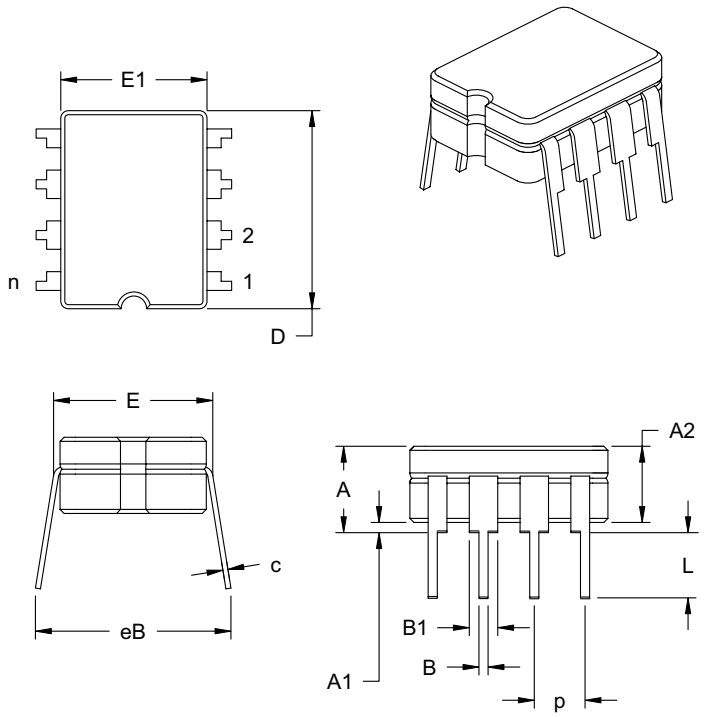


Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.100			2.54	
Top to Seating Plane	A	.140	.155	.170	3.56	3.94	4.32
Molded Package Thickness	A2	.115	.130	.145	2.92	3.30	3.68
Base to Seating Plane	A1	.015			0.38		
Shoulder to Shoulder Width	E	.300	.313	.325	7.62	7.94	8.26
Molded Package Width	E1	.240	.250	.260	6.10	6.35	6.60
Overall Length	D	.360	.373	.385	9.14	9.46	9.78
Tip to Seating Plane	L	.125	.130	.135	3.18	3.30	3.43
Lead Thickness	c	.008	.012	.015	0.20	0.29	0.38
Upper Lead Width	B1	.045	.058	.070	1.14	1.46	1.78
Lower Lead Width	B	.014	.018	.022	0.36	0.46	0.56
Overall Row Spacing §	eB	.310	.370	.430	7.87	9.40	10.92
Mold Draft Angle Top	α	5	10	15	5	10	15
Mold Draft Angle Bottom	β	5	10	15	5	10	15

* Controlling Parameter
§ Significant Characteristic

Notes:
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010” (0.254mm) per side.
JEDEC Equivalent: MS-001
Drawing No. C04-018

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



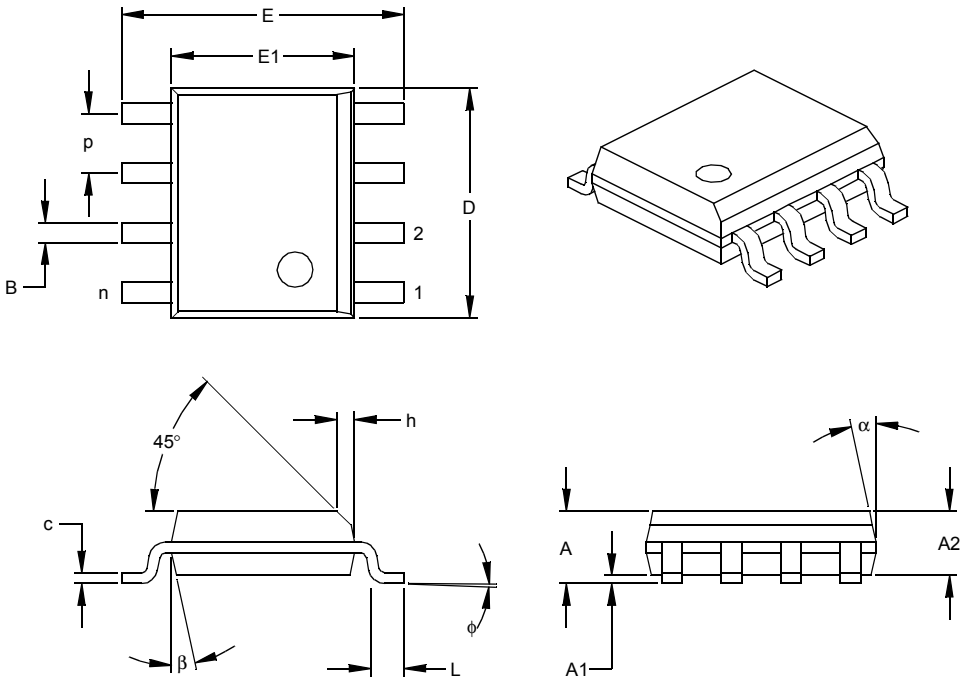
Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.100			2.54	
Top to Seating Plane	A	.160	.180	.200	4.06	4.57	5.08
Standoff §	A1	.020	.030	.040	0.51	0.77	1.02
Shoulder to Shoulder Width	E	.290	.305	.320	7.37	7.75	8.13
Ceramic Pkg. Width	E1	.230	.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

8-Lead Plastic Small Outline (OA) – Narrow, 150 mil (SOIC)

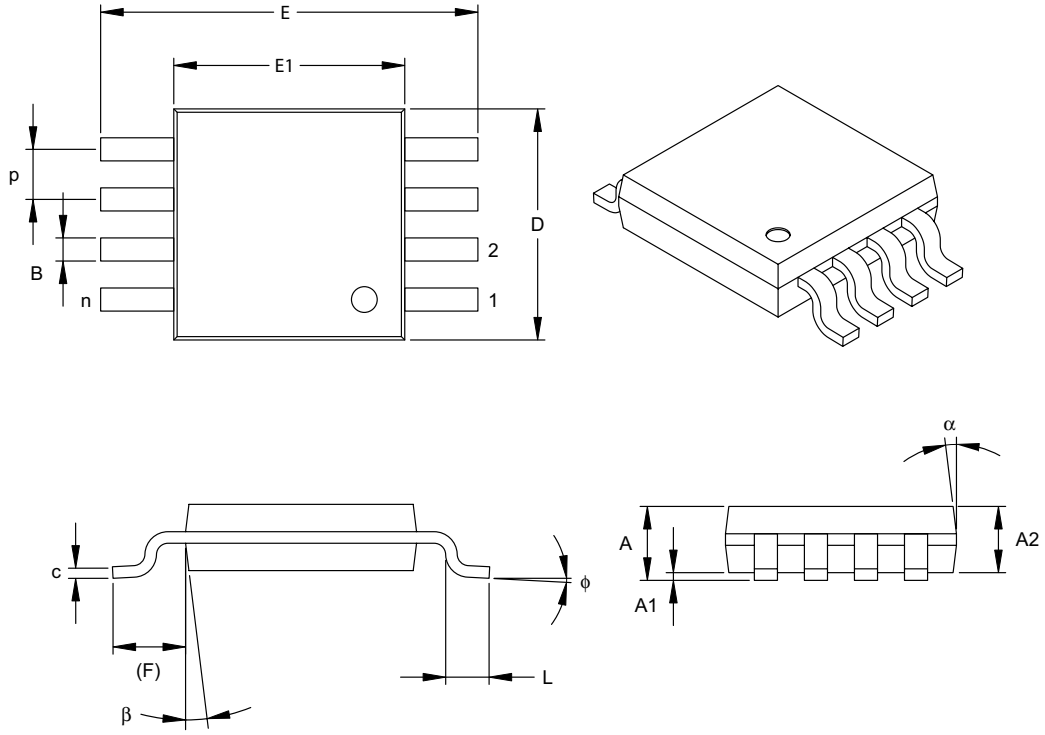


Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.050			1.27	
Overall Height	A	.053	.061	.069	1.35	1.55	1.75
Molded Package Thickness	A2	.052	.056	.061	1.32	1.42	1.55
Standoff §	A1	.004	.007	.010	0.10	0.18	0.25
Overall Width	E	.228	.237	.244	5.79	6.02	6.20
Molded Package Width	E1	.146	.154	.157	3.71	3.91	3.99
Overall Length	D	.189	.193	.197	4.80	4.90	5.00
Chamfer Distance	h	.010	.015	.020	0.25	0.38	0.51
Foot Length	L	.019	.025	.030	0.48	0.62	0.76
Foot Angle	φ	0	4	8	0	4	8
Lead Thickness	c	.008	.009	.010	0.20	0.23	0.25
Lead Width	B	.013	.017	.020	0.33	0.42	0.51
Mold Draft Angle Top	α	0	12	15	0	12	15
Mold Draft Angle Bottom	β	0	12	15	0	12	15

* Controlling Parameter
§ Significant Characteristic

Notes:
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010” (0.254mm) per side.
JEDEC Equivalent: MS-012
Drawing No. C04-057

8-Lead Plastic Micro Small Outline Package (UA) (MSOP)



Units		INCHES			MILLIMETERS*		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.026 BSC			0.65 BSC	
Overall Height	A	-	-	.043	-	-	1.10
Molded Package Thickness	A2	.030	.033	.037	0.75	0.85	0.95
Standoff	A1	.000	-	.006	0.00	-	0.15
Overall Width	E		.193 TYP.			4.90 BSC	
Molded Package Width	E1		.118 BSC			3.00 BSC	
Overall Length	D		.118 BSC			3.00 BSC	
Foot Length	L	.016	.024	.031	0.40	0.60	0.80
Footprint (Reference)	F		.037 REF			0.95 REF	
Foot Angle	φ	0°	-	8°	0°	-	8°
Lead Thickness	c	.003	.006	.009	0.08	-	0.23
Lead Width	B	.009	.012	.016	0.22	-	0.40
Mold Draft Angle Top	α	5°	-	15°	5°	-	15°
Mold Draft Angle Bottom	β	5°	-	15°	5°	-	15°

*Controlling Parameter

Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MO-187

Drawing No. C04-111

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.	X	/XX
Device	Temperature Range	Package

Device:	TC4426A: 1.5A Dual MOSFET Driver, Inverting TC4427A: 1.5A Dual MOSFET Driver, Non-Inverting TC4428A: 1.5A Dual MOSFET Driver, Complimentary
Temperature Range:	C = 0°C to +70°C (PDIP & SOIC Only) E = -40°C to +85°C V = -40ºC to +125°C M = -55°C to +125°C (CERDIP only)
Package:	JA = Ceramic Dual In-line (300 mil Body), 8-lead OA = Plastic SOIC, (150 mil Body), 8-lead OA713 = Plastic SOIC, (150 mil Body), 8-lead (Tape and Reel) PA = Plastic DIP (300 mil Body), 8-lead UA = Plastic Micro Small Outline (MSOP), 8-lead UA713 = Plastic Micro Small Outline (MSOP), 8-lead (Tape and Reel)

Examples:

a) TC4426ACOA: 1.5A Dual MOSFET driver, SOIC package, 0°C to +70°C.

b) TC4426AEOA: 1.5A Dual MOSFET driver, SOIC package, -40°C to +85°C.

a) TC4427ACPA: 1.5A Dual MOSFET driver, PDIP package, 0°C to +70°C.

b) TC4427AEPA: 1.5A Dual MOSFET driver, PDIP package, -40°C to +85°C.

a) TC4428AMJA: 1.5A Dual MOSFET driver, CDIP package, -55°C to +125°C.

b) TC4428ACOA713: 1.5A Dual MOSFET driver, Tape and Reel, SOIC package, 0°C to +70°C.

Sales and Support

Data Sheets

Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

1. Your local Microchip sales office
2. The Microchip Corporate Literature Center U.S. FAX: (480) 792-7277
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