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TC4426/TC4427/TC4428

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 (typical)
- Short Delay Times: 40 ns (typical)
- 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: Withstands 0.5A Reverse Current
- Input Withstands Negative Inputs Up to 5V
- Electrostatic Discharge (ESD) Protected: 2.0 kV
- Space-saving 8-Pin MSOP and 8-Pin 6x5 DFN-S Packages

Applications:

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

General Description:

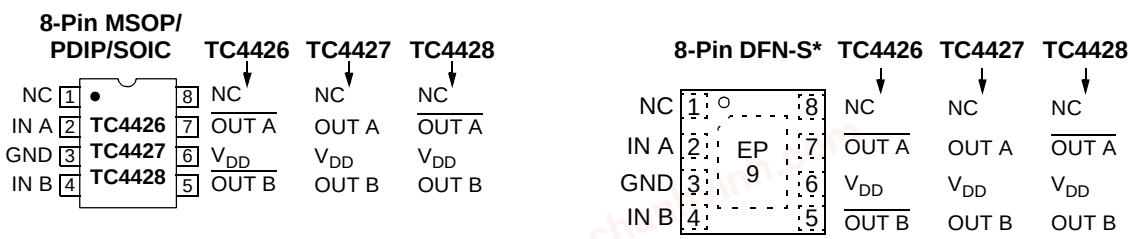
The TC4426/TC4427/TC4428 are improved versions of the earlier TC426/TC427/TC428 family of MOSFET drivers. The TC4426/TC4427/TC4428 devices have matched rise and fall times when charging and discharging the gate of a MOSFET.

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 2.0 kV.

The TC4426/TC4427/TC4428 MOSFET drivers can easily charge/discharge 1000 pF gate capacitances in under 30 ns. These devices provide low enough impedances in both the On and Off states to ensure the MOSFET's intended state is not affected, even by large transients.

Other compatible drivers are the TC4426A/TC4427A/TC4428A family of devices. The TC4426A/TC4427A/TC4428A devices have matched leading and falling edge input-to-output delay times, in addition to the matched rise and fall times of the TC4426/TC4427/TC4428 devices.

Package Types

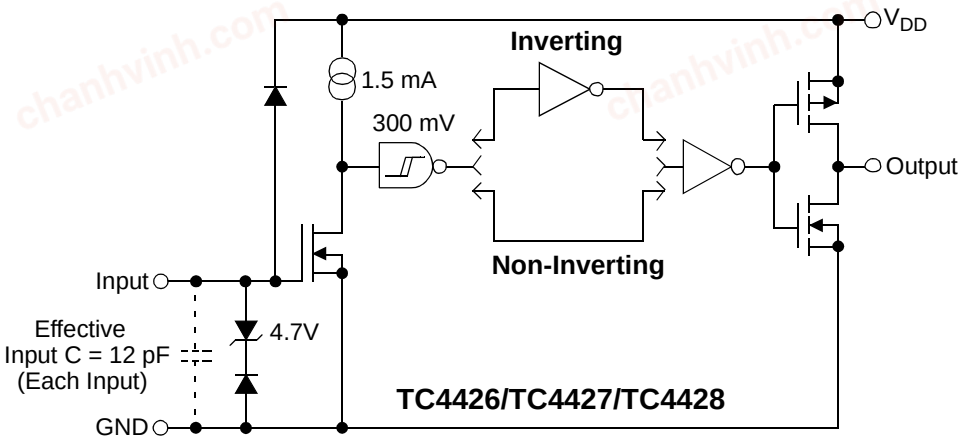


* Includes Exposed Thermal Pad (EP); see Table 3-1.

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Functional Block Diagram



Note 1: TC4426 has two inverting drivers, while the TC4427 has two non-inverting drivers. The TC4428 has one inverting and one non-inverting driver.

2: Ground any unused driver input.

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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 ($T_A \leq +70°C$)

DFN-S ..... Note 3

MSOP ..... 340 mW

PDIP ..... 730 mW

SOIC ..... 470 mW

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 $\leq V_{DD} \leq$ 18V.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Input						
Logic ‘1’, High Input Voltage	V_{IH}	2.4	—	—	V	Note 2
Logic ‘0’, Low Input Voltage	V_{IL}	—	—	0.8	V	
Input Current	I_{IN}	-1.0	—	+1.0	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	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	—	19	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.

2: For V temperature range devices, the V_{IH} (Min) limit is 2.0V.

3: Package power dissipation is dependent on the copper pad area on the PCB.

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DC CHARACTERISTICS (OVER OPERATING TEMPERATURE RANGE)

Electrical Specifications: Unless otherwise noted, over operating temperature range with 4.5V ≤ V_{DD} ≤ 18V.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Input						
Logic '1', High Input Voltage	V_{IH}	2.4	—	—	V	**Note 2**
Logic '0', Low Input Voltage	V_{IL}	—	—	0.8	V	
Input Current	I_{IN}	-10	—	+10	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	—	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 ≤ 2%, t ≤ 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.

2: For V temperature range devices, the V_{IH} (Min) limit is 2.0V.

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	°C	
Specified Temperature Range (E)	T_A	-40	—	+85	°C	
Specified Temperature Range (V)	T_A	-40	—	+125	°C	
Maximum Junction Temperature	T_J	—	—	+150	°C	
Storage Temperature Range	T_A	-65	—	+150	°C	
Package Thermal Resistances						
Thermal Resistance, 8L-6x5 DFN-S	θ_{JA}	—	33.2	—	°C/W	
Thermal Resistance, 8L-MSOP	θ_{JA}	—	206	—	°C/W	
Thermal Resistance, 8L-PDIP	θ_{JA}	—	125	—	°C/W	
Thermal Resistance, 8L-SOIC	θ_{JA}	—	155	—	°C/W	

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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 ≤ V_{DD} ≤ 18V.

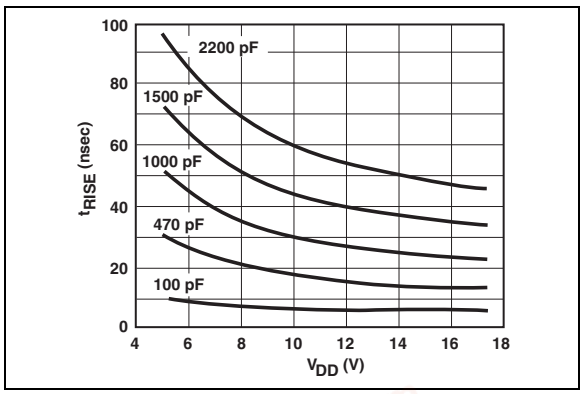


FIGURE 2-1: *Rise Time vs. Supply Voltage.*

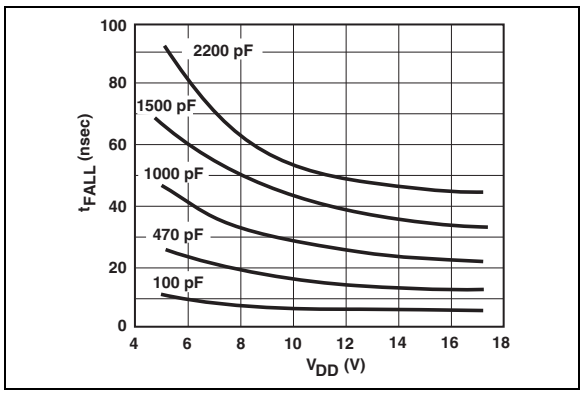


FIGURE 2-4: *Fall Time vs. Supply Voltage.*

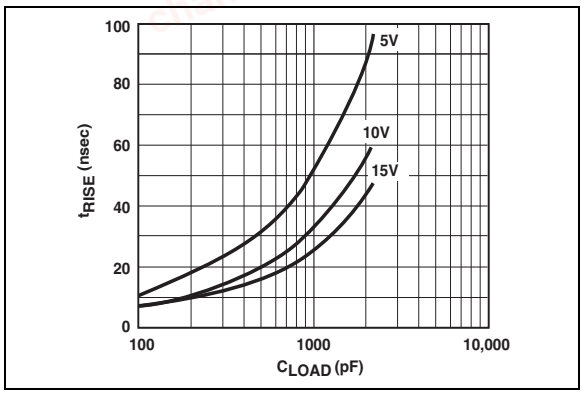


FIGURE 2-2: *Rise Time vs. Capacitive Load.*

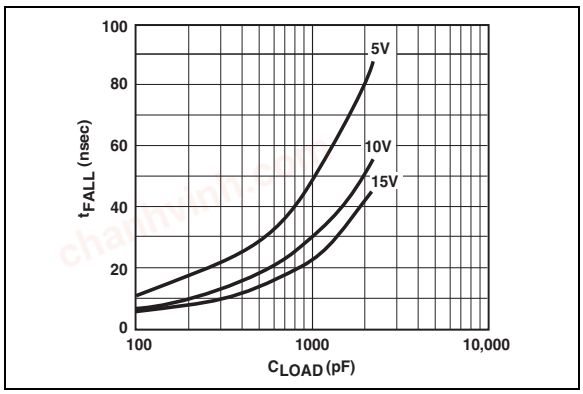


FIGURE 2-5: *Fall Time vs. Capacitive Load.*

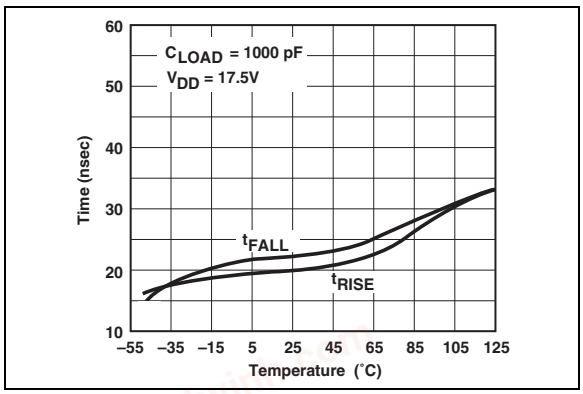


FIGURE 2-3: *Rise and Fall Times vs. Temperature.*

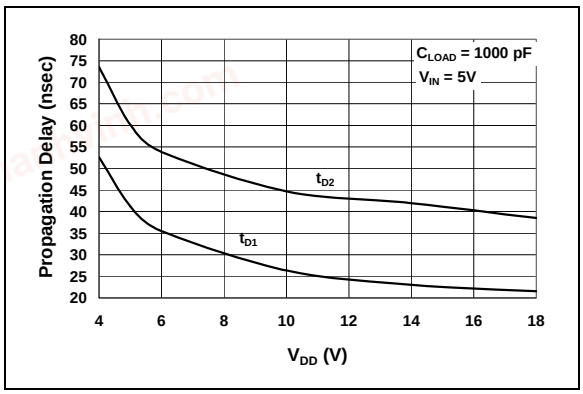


FIGURE 2-6: *Propagation Delay Time vs. Supply Voltage.*

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

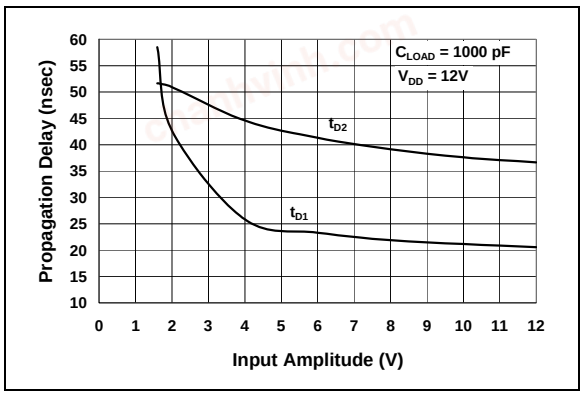


FIGURE 2-7: *Propagation Delay Time vs. Input Amplitude.*

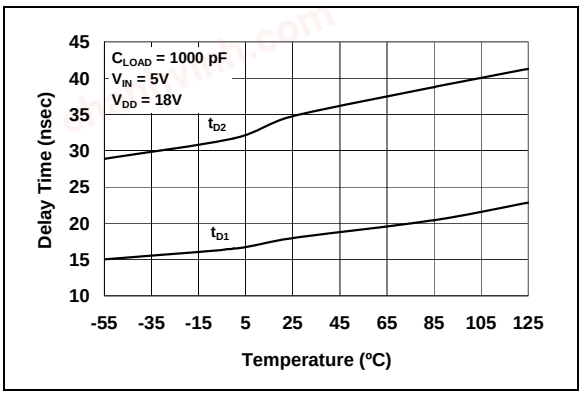


FIGURE 2-10: *Propagation Delay Time vs. Temperature.*

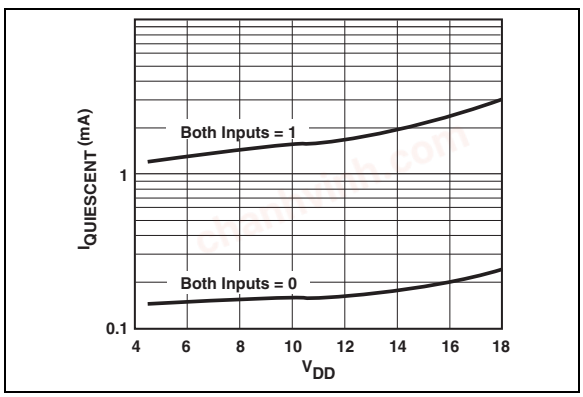


FIGURE 2-8: *Supply Current vs. Supply Voltage.*

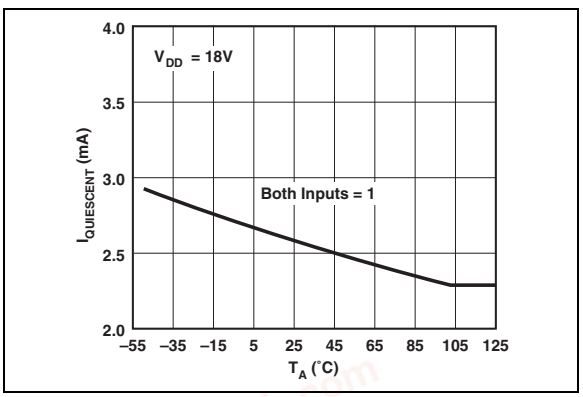


FIGURE 2-11: *Supply Current vs. Temperature.*

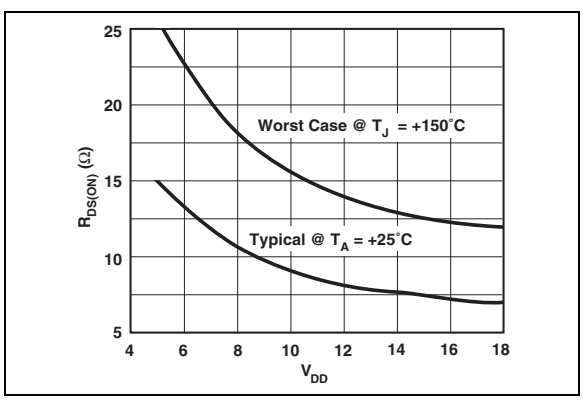


FIGURE 2-9: *Output Resistance (R_{OH}) vs. Supply Voltage.*

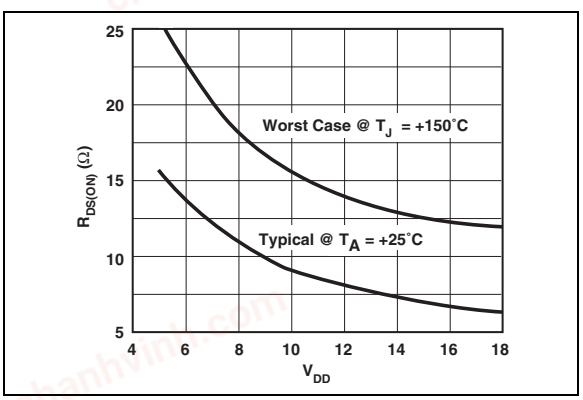


FIGURE 2-12: *Output Resistance (R_{OL}) vs. Supply Voltage.*

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

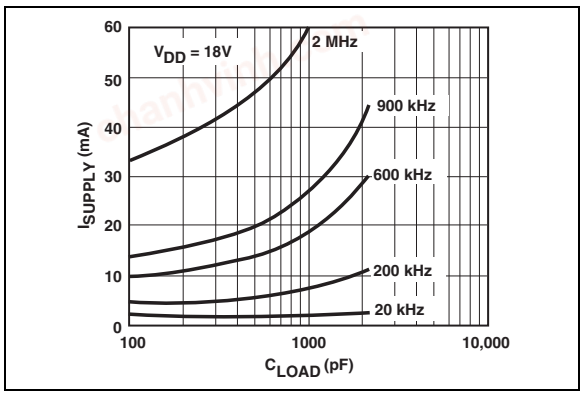


FIGURE 2-13: *Supply Current vs. Capacitive Load.*

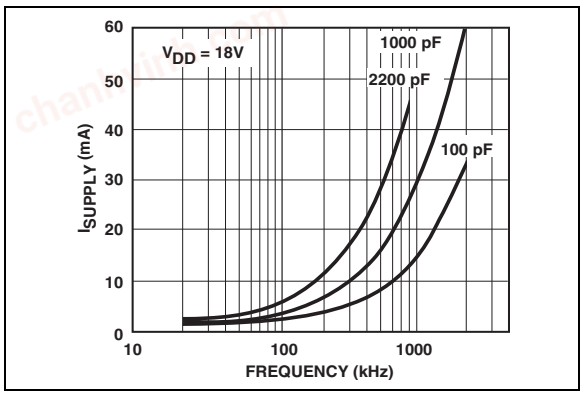


FIGURE 2-16: *Supply Current vs. Frequency.*

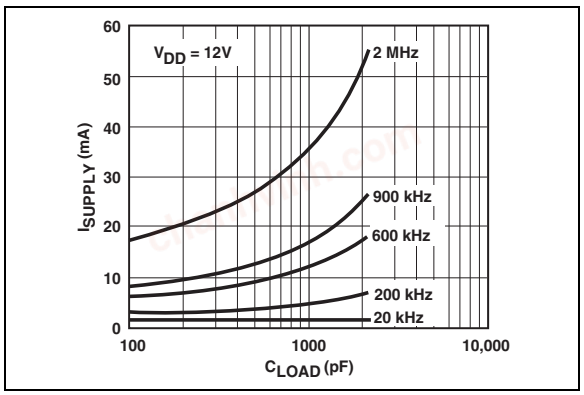


FIGURE 2-14: *Supply Current vs. Capacitive Load.*

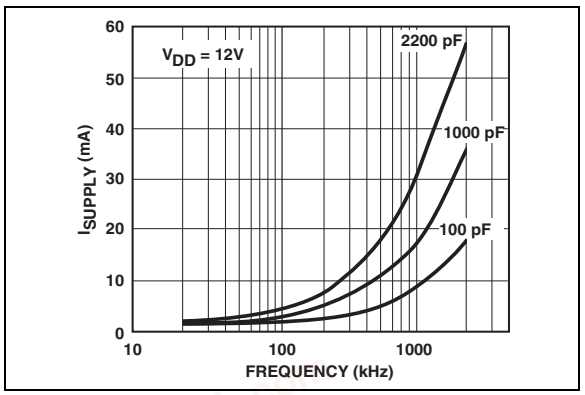


FIGURE 2-17: *Supply Current vs. Frequency.*

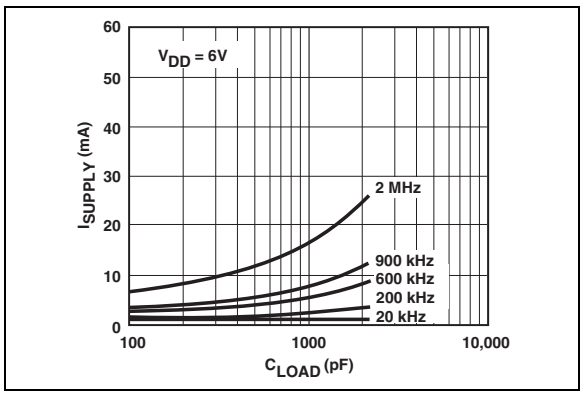


FIGURE 2-15: *Supply Current vs. Capacitive Load.*

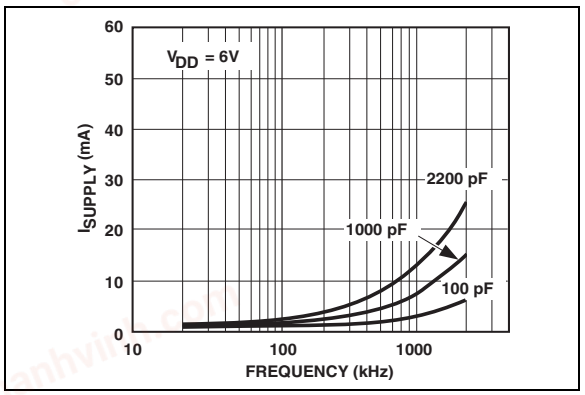
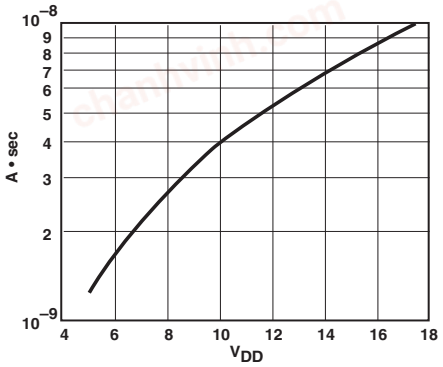


FIGURE 2-18: *Supply Current vs. Frequency.*

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



Note: The values on 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.*

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3.0 PIN DESCRIPTIONS

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

TABLE 3-1: PIN FUNCTION TABLE (1)

8-Pin PDIP/ MSOP/SOIC	8-Pin DFN-S	Symbol	Description
1	1	NC	No connection
2	2	IN A	Input A
3	3	GND	Ground
4	4	IN B	Input B
5	5	OUT B	Output B
6	6	V_{DD}	Supply input
7	7	OUT A	Output A
8	8	NC	No connection
—	PAD	NC	Exposed Metal Pad

Note 1: Duplicate pins must be connected for proper operation.

3.1 Inputs A and B

MOSFET driver inputs A and 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)

Ground is the device return pin. The Ground pin(s) should have a low-impedance connection to the bias supply source return. High peak current flows out the Ground pin(s) when the capacitive load is being discharged.

3.3 Output A and B

MOSFET driver outputs A and 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.

3.5 Exposed Metal Pad

The exposed metal pad of the 6x5 DFN-S package is not internally connected to any potential. Therefore, this pad can be connected to a ground plane or other copper plane on a Printed Circuit Board (PCB), to aid in heat removal from the package.

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4.0 APPLICATIONS INFORMATION

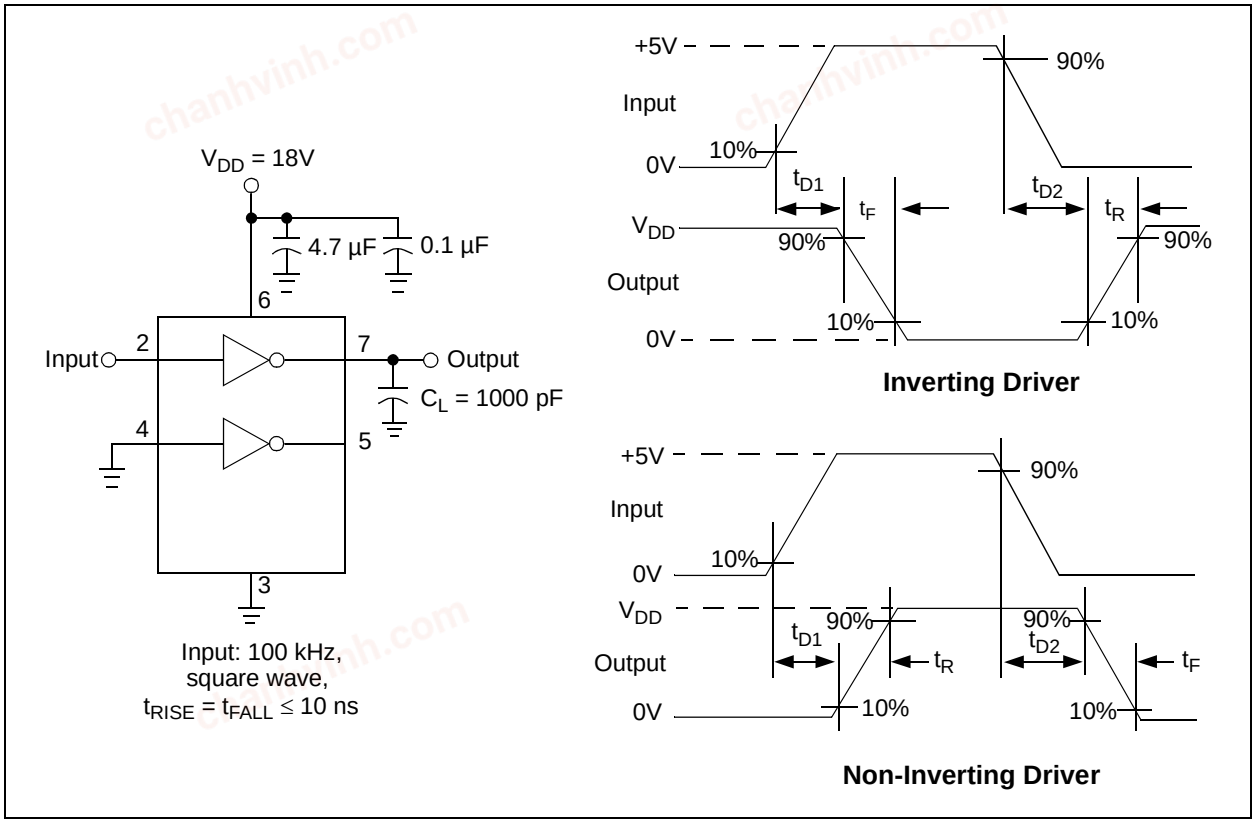


FIGURE 4-1: *Switching Time Test Circuit.*

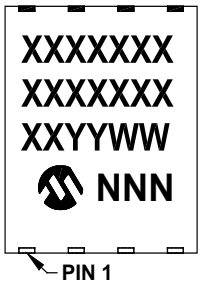
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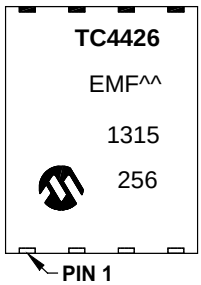
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

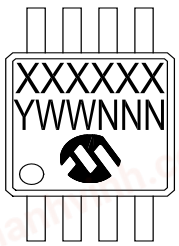
8-Lead DFN-S (6x5x0.9 mm)



Example



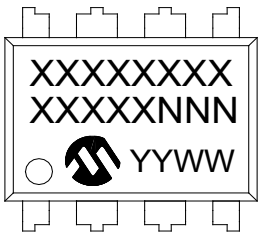
8-Lead MSOP (3x3 mm)



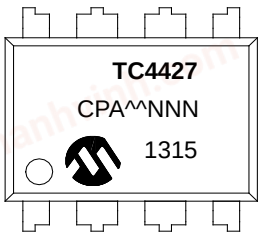
Example



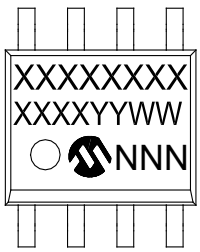
8-Lead PDIP (300 mil)



Example



8-Lead SOIC (150 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

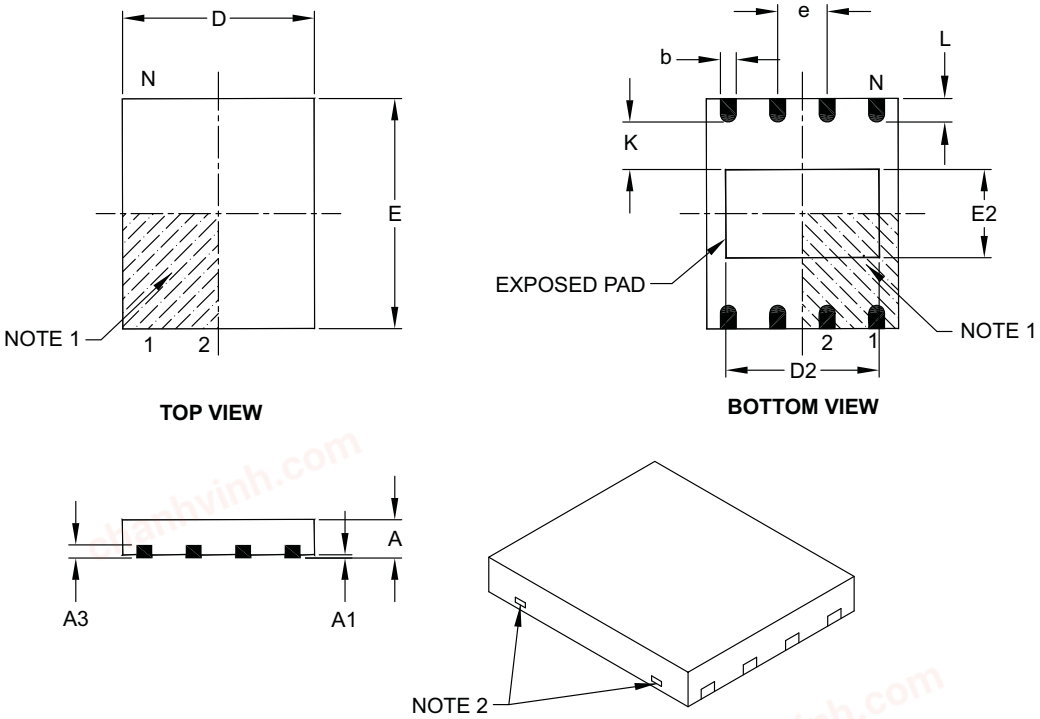
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line thus limiting the number of available characters for customer specific information.

***** Standard device marking consists of Microchip part number, year code, week code and traceability code.

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8-Lead Plastic Dual Flat, No Lead Package (MF) – 6x5 mm Body [DFN-S]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		1.27 BSC	
Overall Height	A	0.80	0.85	1.00
Standoff	A1	0.00	0.01	0.05
Contact Thickness	A3		0.20 REF	
Overall Length	D		5.00 BSC	
Overall Width	E		6.00 BSC	
Exposed Pad Length	D2	3.90	4.00	4.10
Exposed Pad Width	E2	2.20	2.30	2.40
Contact Width	b	0.35	0.40	0.48
Contact Length	L	0.50	0.60	0.75
Contact-to-Exposed Pad	K	0.20	–	–

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package may have one or more exposed tie bars at ends.
3. Package is saw singulated.
4. Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.
REF: Reference Dimension, usually without tolerance, for information purposes only.

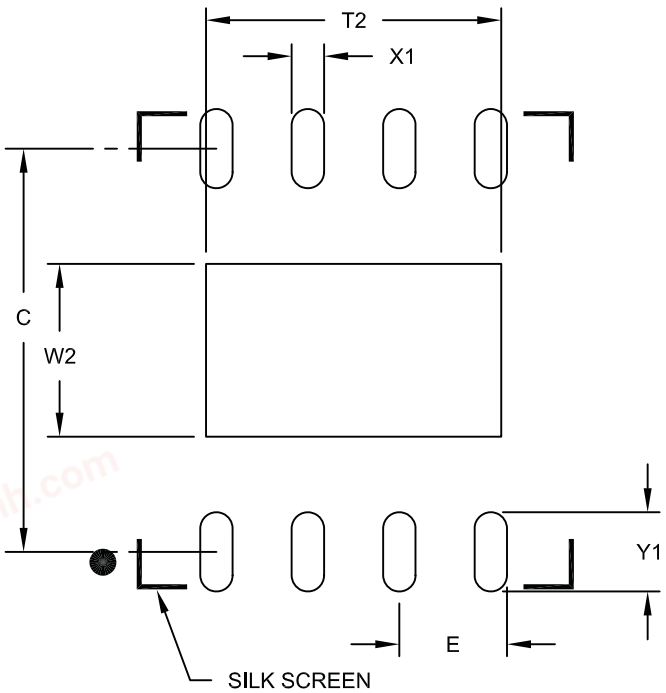
Microchip Technology Drawing C04-122B

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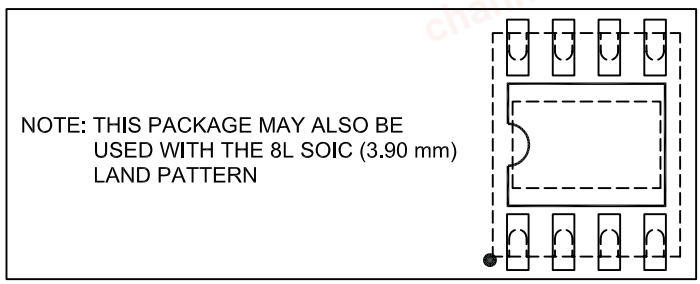
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8-Lead Plastic Dual Flat, No Lead Package (MF) - 6x5 mm Body [DFN-S]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		1.27 BSC	
Optional Center Pad Width	W2			2.40
Optional Center Pad Length	T2			4.10
Contact Pad Spacing	C		5.60	
Contact Pad Width (X8)	X1			0.45
Contact Pad Length (X8)	Y1			1.10

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

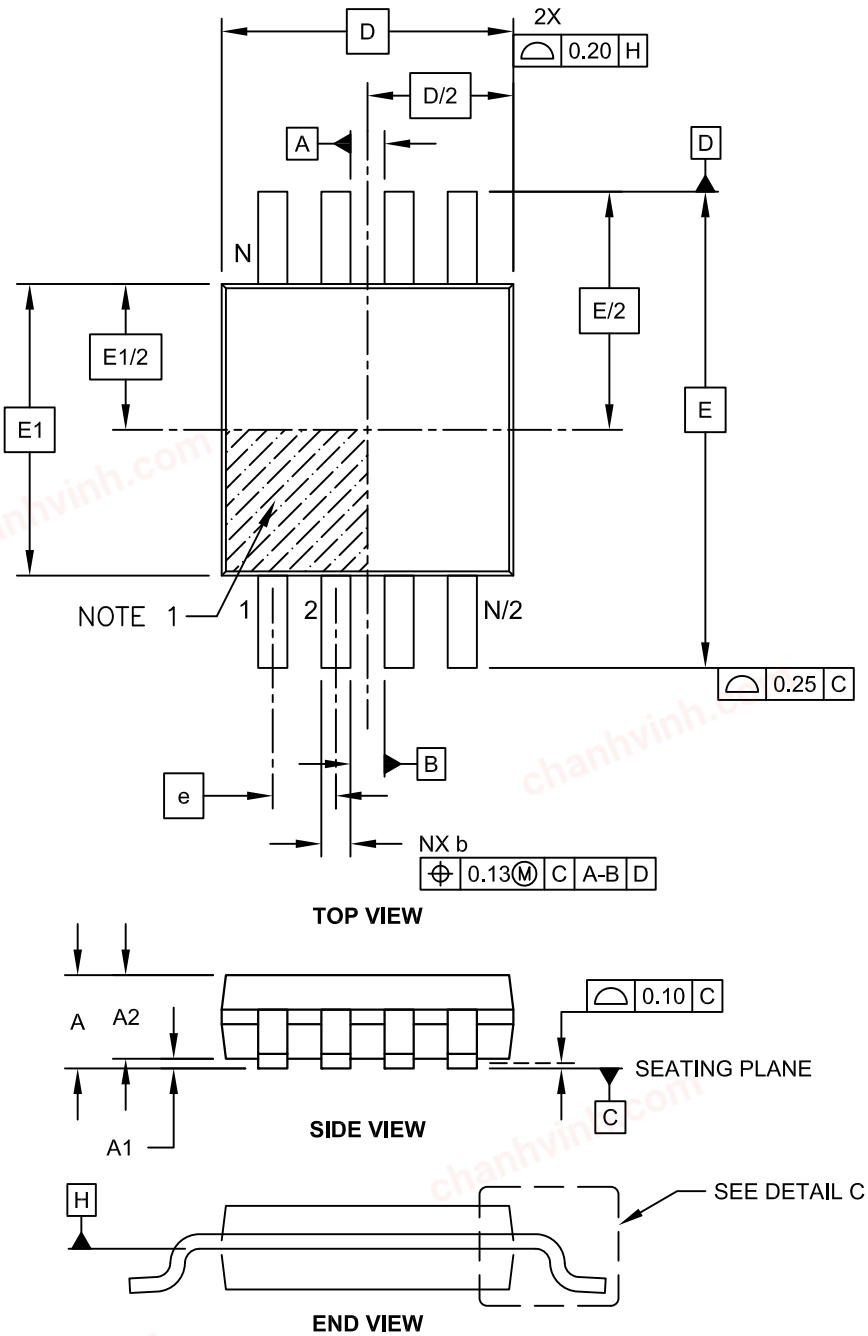
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8-Lead Plastic Micro Small Outline Package (UA) [MSOP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



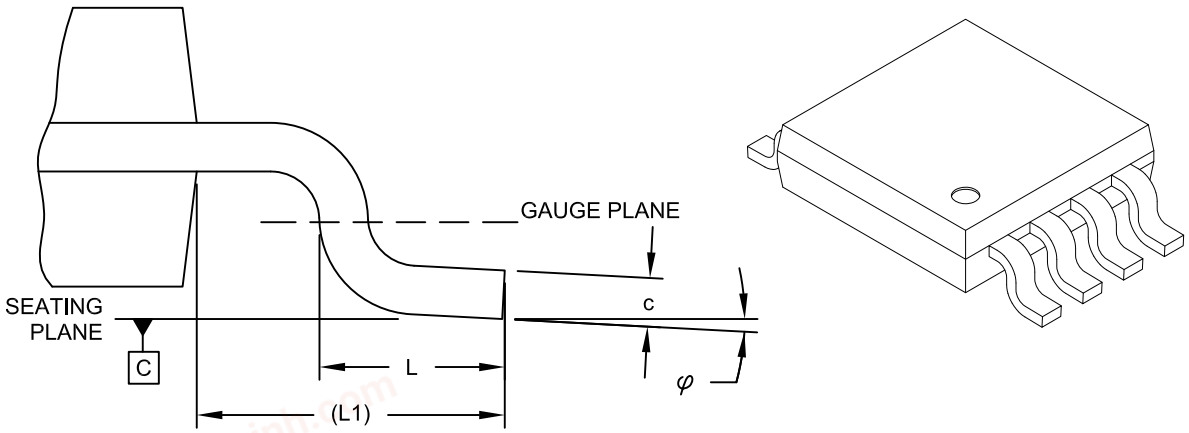
Microchip Technology Drawing C04-111C Sheet 1 of 2

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

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



DETAIL C

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		0.65 BSC	
Overall Height	A	-	-	1.10
Molded Package Thickness	A2	0.75	0.85	0.95
Standoff	A1	0.00	-	0.15
Overall Width	E		4.90 BSC	
Molded Package Width	E1		3.00 BSC	
Overall Length	D		3.00 BSC	
Foot Length	L	0.40	0.60	0.80
Footprint	L1		0.95 REF	
Foot Angle	φ	0°	-	8°
Lead Thickness	c	0.08	-	0.23
Lead Width	b	0.22	-	0.40

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
3. Dimensioning and tolerancing per ASME Y14.5M.
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
   REF: Reference Dimension, usually without tolerance, for information purposes only.

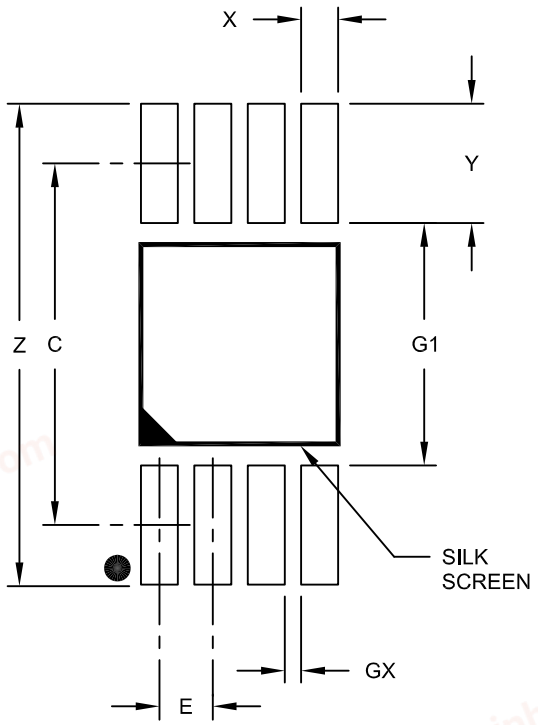
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8-Lead Plastic Micro Small Outline Package (UA) [MSOP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		0.65 BSC	
Contact Pad Spacing	C		4.40	
Overall Width	Z			5.85
Contact Pad Width (X8)	X1			0.45
Contact Pad Length (X8)	Y1			1.45
Distance Between Pads	G1	2.95		
Distance Between Pads	GX	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

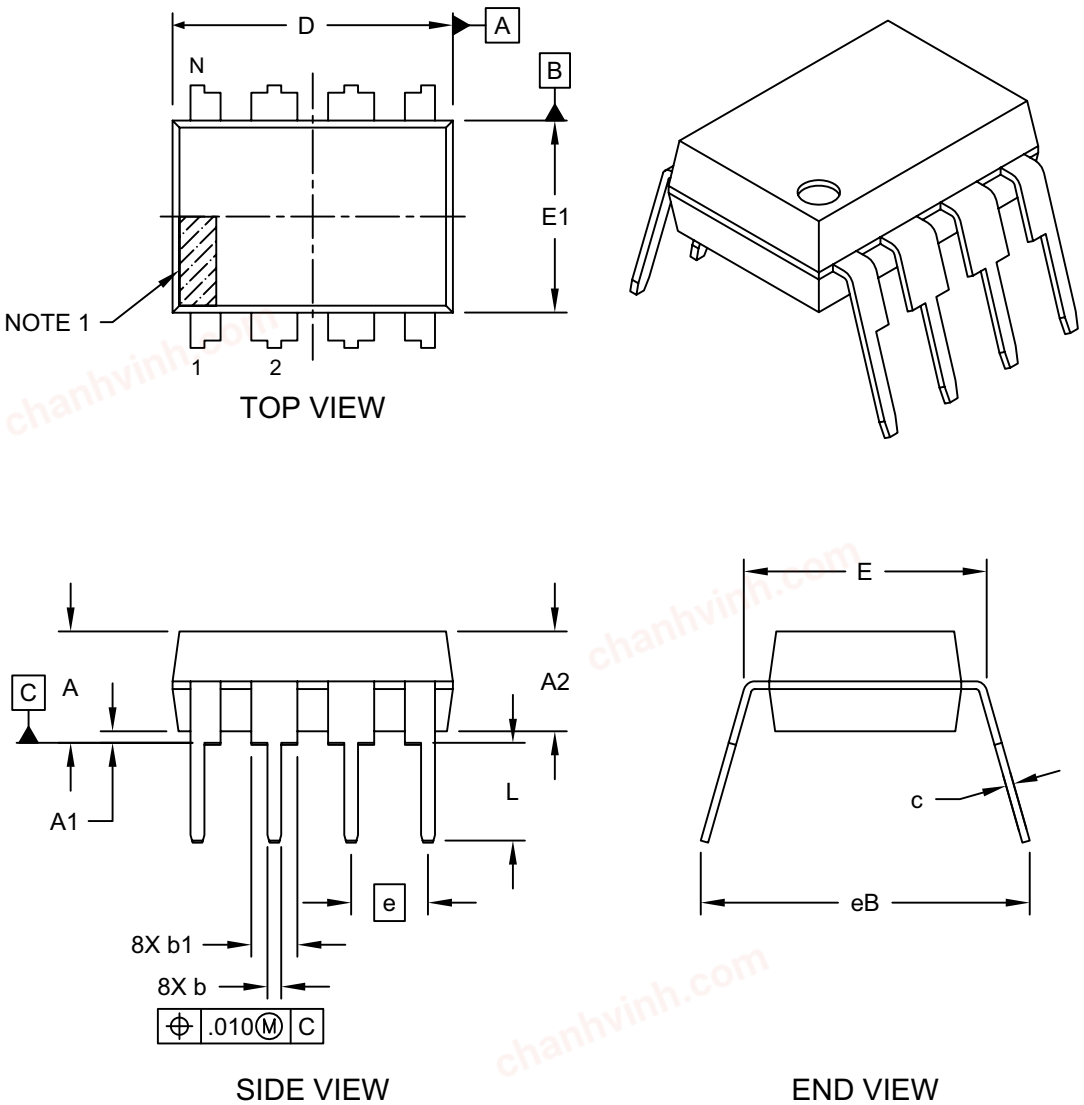
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8-Lead Plastic Dual In-Line (PA) - 300 mil Body [PDIP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging

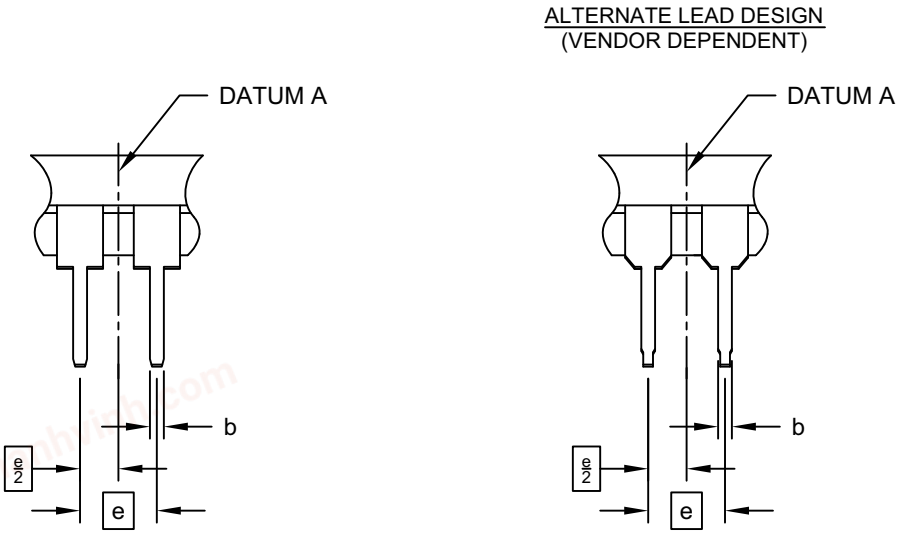


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8-Lead Plastic Dual In-Line (PA) - 300 mil Body [PDIP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		INCHES		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		.100 BSC	
Top to Seating Plane	A	-	-	.210
Molded Package Thickness	A2	.115	.130	.195
Base to Seating Plane	A1	.015	-	-
Shoulder to Shoulder Width	E	.290	.310	.325
Molded Package Width	E1	.240	.250	.280
Overall Length	D	.348	.365	.400
Tip to Seating Plane	L	.115	.130	.150
Lead Thickness	c	.008	.010	.015
Upper Lead Width	b1	.040	.060	.070
Lower Lead Width	b	.014	.018	.022
Overall Row Spacing §	eB	-	-	.430

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
4. Dimensioning and tolerancing per ASME Y14.5M

   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

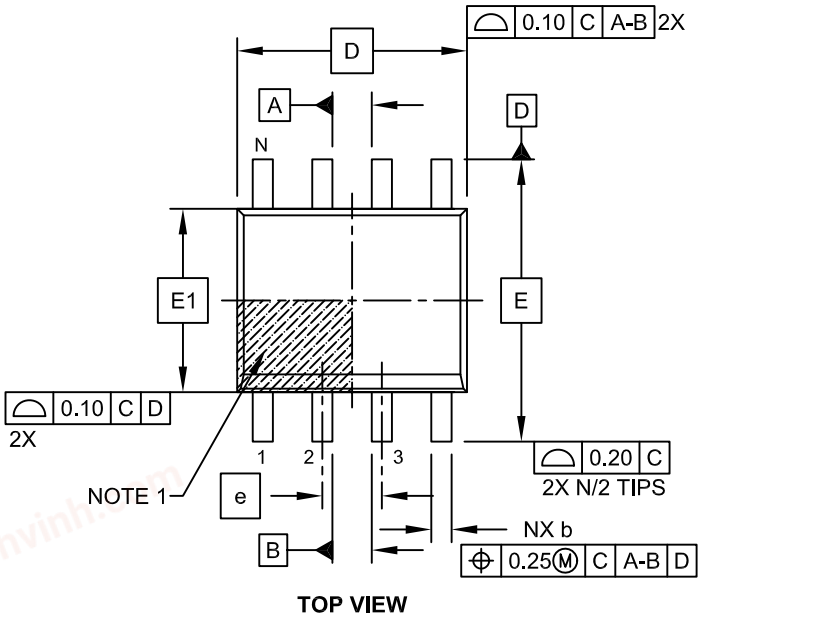
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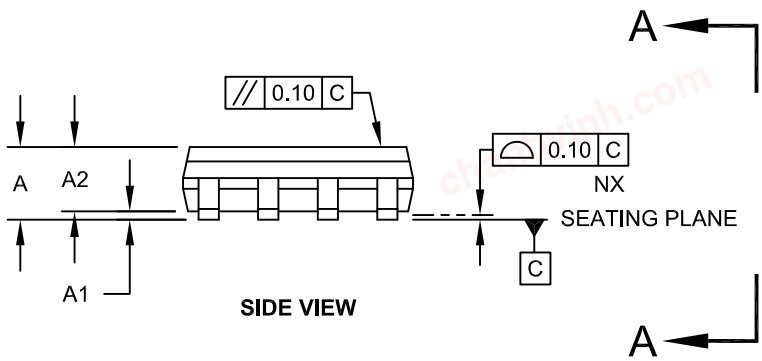
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8-Lead Plastic Small Outline (OA) - Narrow, 3.90 mm Body [SOIC]

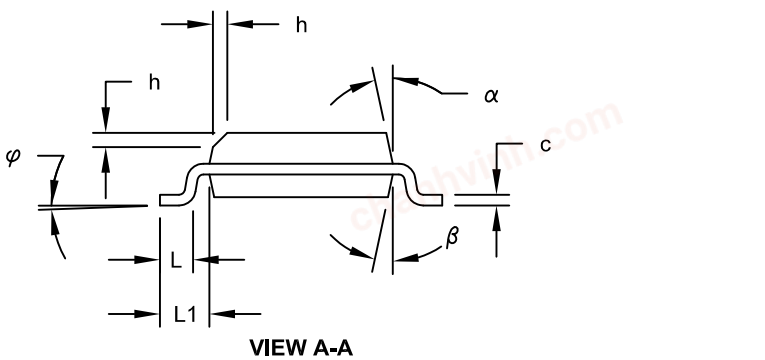
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW



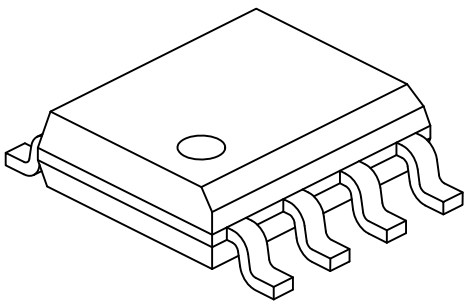
VIEW A-A

Microchip Technology Drawing No. C04-057C Sheet 1 of 2

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8-Lead Plastic Small Outline (OA) - Narrow, 3.90 mm Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		1.27 BSC	
Overall Height	A	-	-	1.75
Molded Package Thickness	A2	1.25	-	-
Standoff §	A1	0.10	-	0.25
Overall Width	E		6.00 BSC	
Molded Package Width	E1		3.90 BSC	
Overall Length	D		4.90 BSC	
Chamfer (Optional)	h	0.25	-	0.50
Foot Length	L	0.40	-	1.27
Footprint	L1		1.04 REF	
Foot Angle	φ	0°	-	8°
Lead Thickness	c	0.17	-	0.25
Lead Width	b	0.31	-	0.51
Mold Draft Angle Top	α	5°	-	15°
Mold Draft Angle Bottom	β	5°	-	15°

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
4. Dimensioning and tolerancing per ASME Y14.5M

   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

   REF: Reference Dimension, usually without tolerance, for information purposes only.

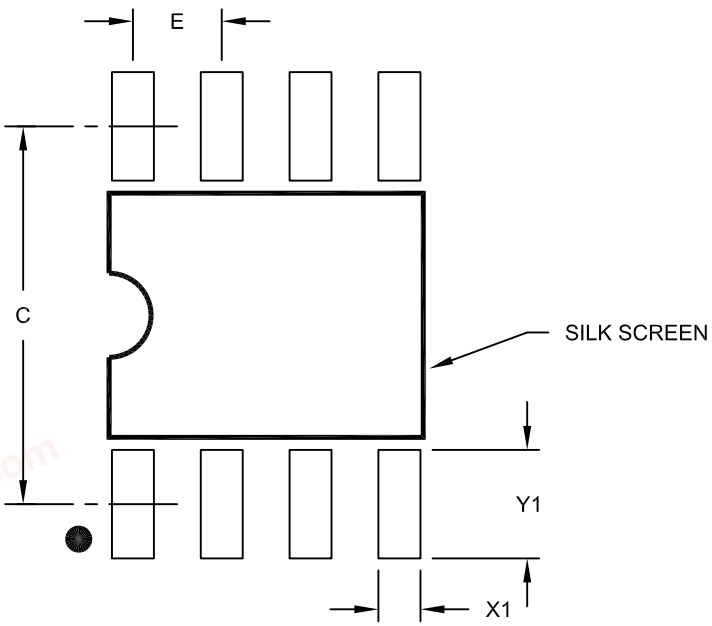
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8-Lead Plastic Small Outline (OA) – Narrow, 3.90 mm Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		1.27 BSC	
Contact Pad Spacing	C		5.40	
Contact Pad Width (X8)	X1			0.60
Contact Pad Length (X8)	Y1			1.55

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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APPENDIX A: REVISION HISTORY

Revision G (July 2014)

The following is the list of modifications:

1. Updated the Functional Block Diagram.

Revision F (September 2013)

The following is the list of modifications:

2. Updated the Electrostatic Discharge (ESD) rating to 2kV in the Features section.
3. Updated the package drawings in **Section 5.0 "Packaging Information"**.
4. Minor typographical and editorial corrections.

Revisions E (December 2012)

- Added a note to each package outline drawing.

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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	XXX	X
Device	Temperature Range	Package	Tape & Reel	PB Free

Device:	TC4426:	1.5A Dual MOSFET Driver, Inverting
	TC4427:	1.5A Dual MOSFET Driver, Non-Inverting
	TC4428:	1.5A Dual MOSFET Driver, Complementary
Temperature Range:	C =	0°C to +70°C (PDIP and SOIC only)
	E =	-40°C to +85°C
	V =	-40°C to +125°C
Package:	MF =	Dual, Flat, No-Lead (6X5 mm Body), 8-lead
	MF713 =	Dual, Flat, No-Lead (6X5 mm Body), 8-lead (Tape and Reel)
	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) TC4426COA: 1.5A Dual Inverting MOSFET driver, 0°C to +70°C SOIC package.

b) TC4426EUA: 1.5A Dual Inverting MOSFET driver, -40°C to +85°C. MSOP package.

c) TC4426EMF: 1.5A Dual Inverting MOSFET driver, -40°C to +85°C, DFN-S package.

a) TC4427CPA: 1.5A Dual Non-Inverting MOSFET driver, 0°C to +70°C PDIP package.

b) TC4427EPA: 1.5A Dual Non-Inverting MOSFET driver, -40°C to +85°C PDIP package.

a) TC4428COA713: 1.5A Dual Complementary MOSFET driver, 0°C to +70°C, SOIC package, Tape and Reel.

b) TC4428EMF: 1.5A Dual Complementary, MOSFET driver, -40°C to +85°C DFN-S package.

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