

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:

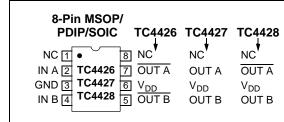
The TC4426/TC4427/TC4428 are improved versions of the earlier TC426/TC427/TC428 family of MOSFET drivers. The TC4426/TC4427/TC4428 devices have matched rise and fall times when charging and discharging the gate of a MOSFET.

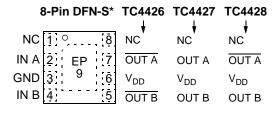
These devices are highly latch-up resistant under any conditions within their power and voltage ratings. They are not subject to damage when up to 5V of noise spiking (of either polarity) occurs on the ground pin. They can accept, without damage or logic upset, up to 500 mA of reverse current (of either 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.

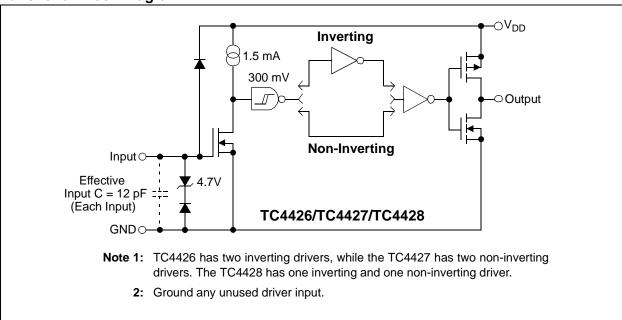
Package Types





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

Functional Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage	+22V
Input Voltage, IN A or IN B($V_{DD} + 0.3$)	V) to (GND – 5V)
Package Power Dissipation ($T_A \le +70$ °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, $T_A = +25^{\circ}C$ with $4.5V \le V_{DD} \le 18V$.									
Parameters	Sym.	Min.	Тур.	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	$0V \le V_{IN} \le V_{DD}$			
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	_	Α	V _{DD} = 18V			
Latch-Up Protection	I _{REV}	_	> 0.5	_	Α	Duty cycle \leq 2%, t \leq 300 µs			
Withstand Reverse Current						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	mA	V _{IN} = 3V (Both inputs)			
		_	_	0.4		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.

DC CHARACTERISTICS (OVER OPERATING TEMPERATURE RANGE)

Electrical Specifications: Unless otherwise noted, over operating temperature range with $4.5V \le V_{DD} \le 18V$.								
Parameters	Sym.	Min.	Тур.	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	μΑ	$0V \le V_{IN} \le V_{DD}$		
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	_	Α	V _{DD} = 18V		
Latch-Up Protection Withstand Reverse Current	I_{REV}	_	>0.5	_	Α	Duty cycle \leq 2%, t \leq 300 μ s 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	IS	_	=	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.	Тур.	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	TJ	_	_	+150	°C		
Storage Temperature Range	T _A	-65	_	+150	°C		
Package Thermal Resistances							
Thermal Resistance, 8L-6x5 DFN-S	$\theta_{\sf JA}$	_	33.2	_	°C/W		
Thermal Resistance, 8L-MSOP	$\theta_{\sf JA}$	_	206	_	°C/W		
Thermal Resistance, 8L-PDIP	$\theta_{\sf JA}$	_	125	_	°C/W		
Thermal Resistance, 8L-SOIC	$\theta_{\sf JA}$	_	155	_	°C/W		

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

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, $T_A = +25^{\circ}C$ with $4.5V \le V_{DD} \le 18V$.

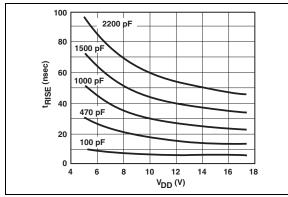


FIGURE 2-1: Rise Time vs. Supply Voltage.

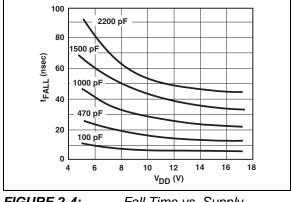


FIGURE 2-4: Fall Time vs. Supply Voltage.

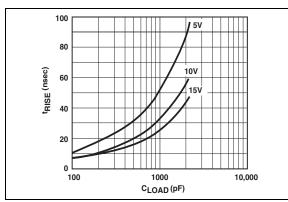


FIGURE 2-2: Rise Time vs. Capacitive Load.

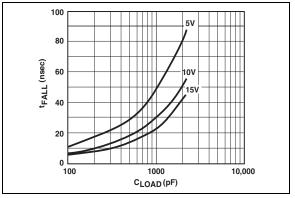


FIGURE 2-5: Fall Time vs. Capacitive Load.

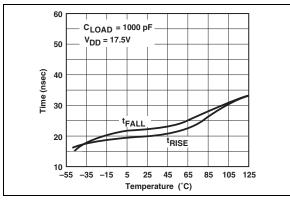


FIGURE 2-3: Rise and Fall Times vs. Temperature.

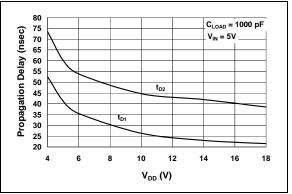


FIGURE 2-6: Propagation Delay Time vs. Supply Voltage.

Note: Unless otherwise indicated, $T_A = +25^{\circ}C$ with $4.5V \le V_{DD} \le 18V$.

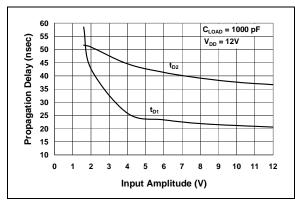


FIGURE 2-7: Propagation Delay Time vs. Input Amplitude.

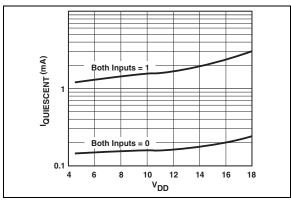


FIGURE 2-8: Supply Current vs. Supply Voltage.

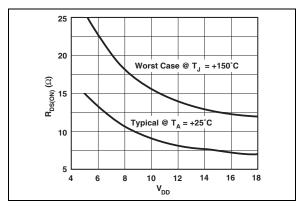


FIGURE 2-9: Output Resistance (R_{OH}) vs. Supply Voltage.

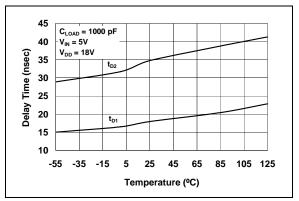


FIGURE 2-10: Propagation Delay Time vs. Temperature.

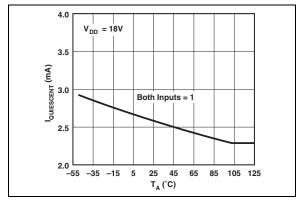


FIGURE 2-11: Supply Current vs. Temperature.

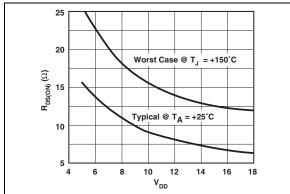


FIGURE 2-12: Output Resistance (R_{OL}) vs. Supply Voltage.

Note: Unless otherwise indicated, $T_A = +25^{\circ}C$ with $4.5V \le V_{DD} \le 18V$.

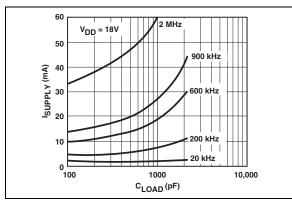


FIGURE 2-13: Supply Current vs. Capacitive Load.

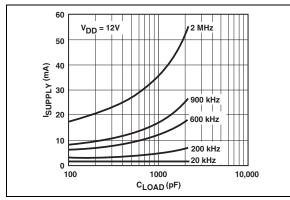


FIGURE 2-14: Supply Current vs. Capacitive Load.

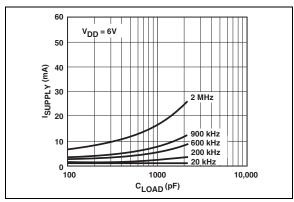


FIGURE 2-15: Supply Current vs. Capacitive Load.

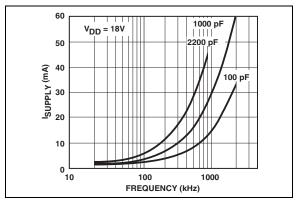


FIGURE 2-16: Supply Current vs. Frequency.

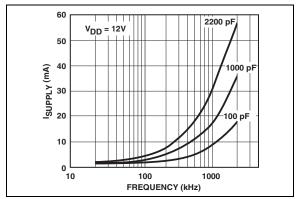


FIGURE 2-17: Supply Current vs. Frequency.

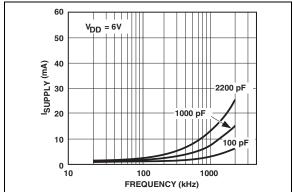
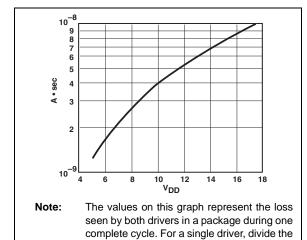


FIGURE 2-18: Supply Current vs. Frequency.

Note: Unless otherwise indicated, $T_A = +25^{\circ}C$ with $4.5V \le V_{DD} \le 18V$.



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 (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.

4.0 APPLICATIONS INFORMATION

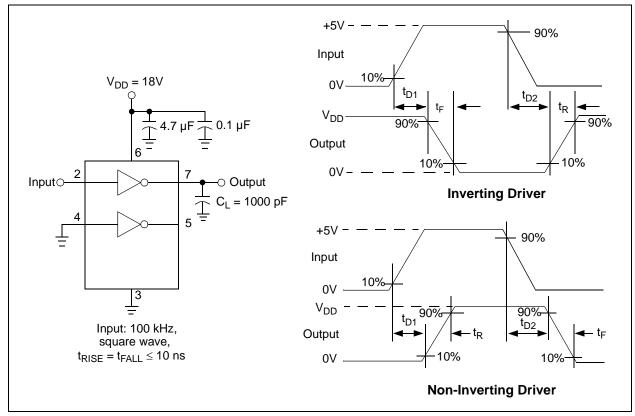


FIGURE 4-1: Switching Time Test Circuit.

5.0 PACKAGING INFORMATION

5.1 Package Marking Information

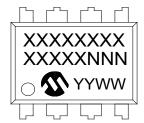
8-Lead DFN-S (6x5x0.9 mm)



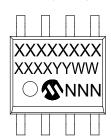
8-Lead MSOP (3x3 mm)



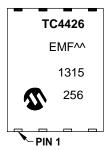
8-Lead PDIP (300 mil)



8-Lead SOIC (150 mil)



Example



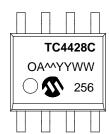
Example



Example



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')

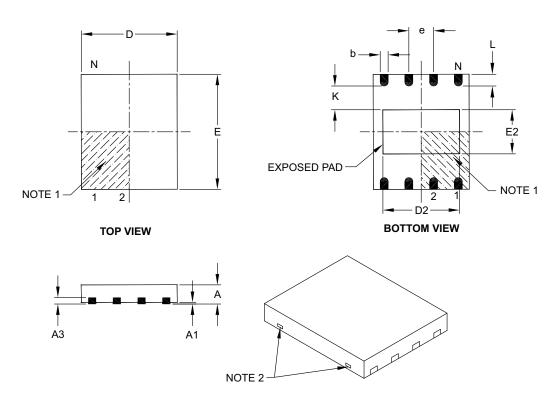
NNN Alphanumeric traceability code

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.

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	Dimension Limits		NOM	MAX
Number of Pins	N		8	
Pitch	е		1.27 BSC	
Overall Height	Α	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	Е		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.

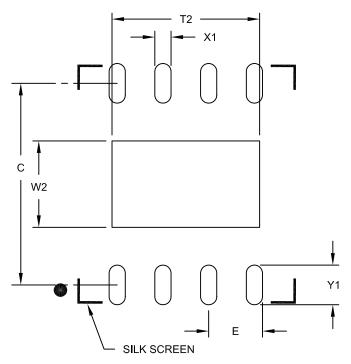
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

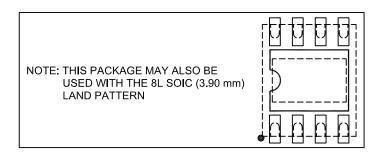
Microchip Technology Drawing C04-122B

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



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

Notes

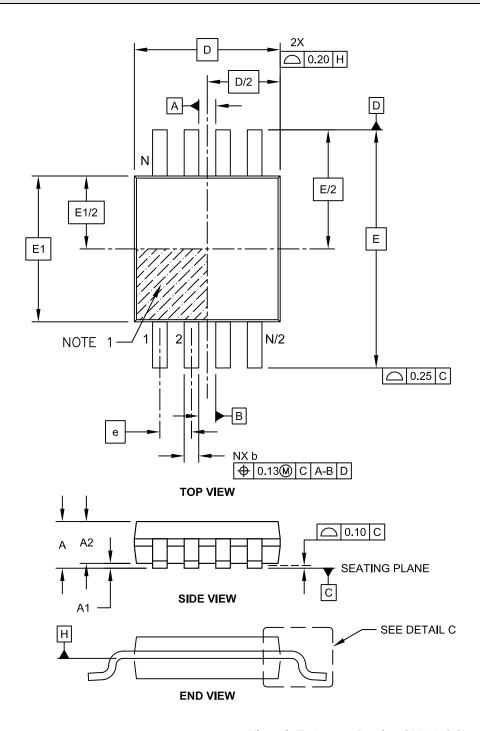
1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing No. C04-2122A

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

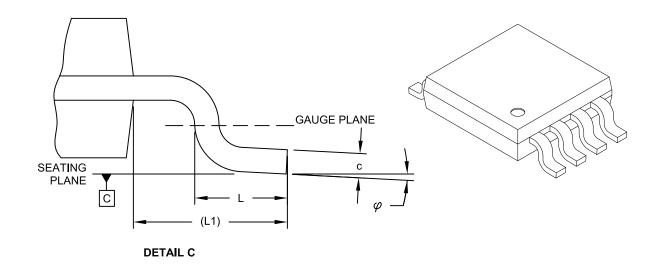
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-111C Sheet 1 of 2

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



	MILLIMETERS			
Dimension	Limits	MIN	NOM	MAX
Number of Pins	N			
Pitch	е		0.65 BSC	
Overall Height	Α	=	-	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	С	0.08	-	0.23
Lead Width	b	0.22	-	0.40

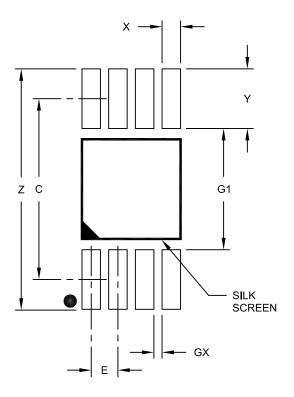
Notes:

- 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.

Microchip Technology Drawing C04-111C Sheet 2 of 2

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			S
Dimension	Dimension Limits			MAX
Contact Pitch	Е		0.65 BSC	
Contact Pad Spacing	С		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:

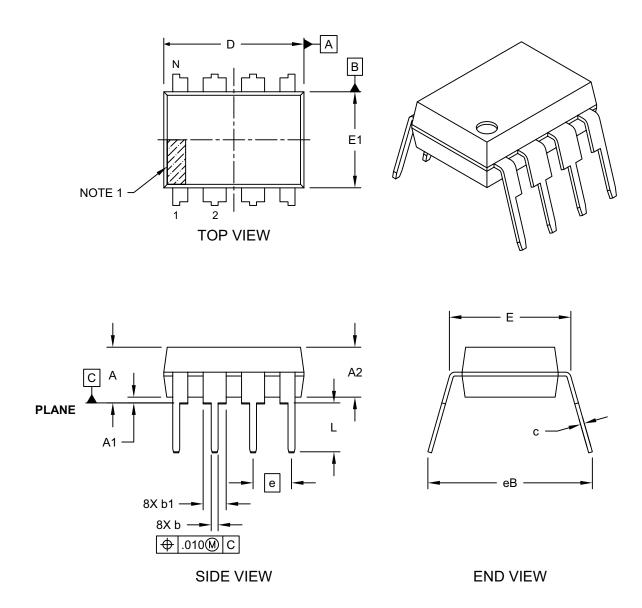
1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing No. C04-2111A

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

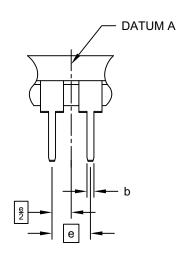
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



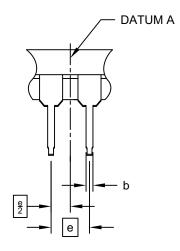
Microchip Technology Drawing No. C04-018D Sheet 1 of 2

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



ALTERNATE LEAD DESIGN (VENDOR DEPENDENT)



		INCHES		
Dimension	Dimension Limits		NOM	MAX
Number of Pins	N		8	
Pitch	е		.100 BSC	
Top to Seating Plane	Α	ı	ı	.210
Molded Package Thickness	A2	.115	.130	.195
Base to Seating Plane	A1	.015	1	1
Shoulder to Shoulder Width	Е	.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	С	.008	.010	.015
Upper Lead Width	b1	.040	.060	.070
Lower Lead Width	b	.014	.018	.022
Overall Row Spacing §	eВ	-	-	.430

Notes:

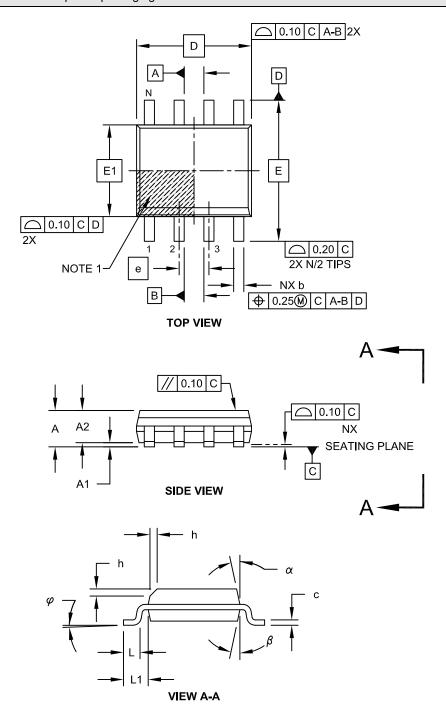
- 1. Pin 1 visual index feature may vary, but must be located within the hatched area.
- 2. § Significant Characteristic
- 3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
- 4. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing No. C04-018D Sheet 2 of 2

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

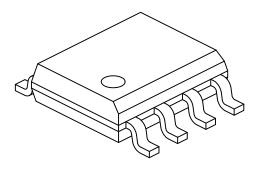
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



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

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



	MILLIMETERS				
Dimension	Limits	MIN	NOM	MAX	
Number of Pins	N		8		
Pitch	е		1.27 BSC		
Overall Height	Α	Ī	ı	1.75	
Molded Package Thickness	A2	1.25	ı	-	
Standoff §	A1	0.10	ı	0.25	
Overall Width	Е	6.00 BSC			
Molded Package Width	E1	3.90 BSC			
Overall Length	D		4.90 BSC		
Chamfer (Optional)	h	0.25	ı	0.50	
Foot Length	Г	0.40	-	1.27	
Footprint	L1		1.04 REF		
Foot Angle	φ	0°	ı	8°	
Lead Thickness	C	0.17	-	0.25	
Lead Width	b	0.31	ı	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

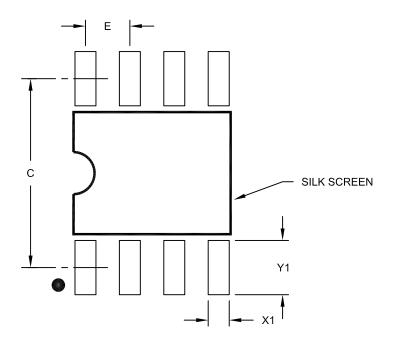
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

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

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			S
Dimension	Dimension Limits		NOM	MAX
Contact Pitch	Е	1.27 BSC		
Contact Pad Spacing	С		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.

Microchip Technology Drawing No. C04-2057A

NOTES:

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.
- 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.

NOTES:

PRODUCT IDENTIFICATION SYSTEM

 $\underline{\text{To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales of fice.}\\$

PART NO. X	ХX	XXX	X	Exa	amples:	
Device Tempe Ran	•	pe & Reel F	PB Free	a)	TC4426COA:	1.5A Dual Inverting MOSFET driver, 0°C to +70°C SOIC package.
Device:	TC4427: 1.5A Dual MC	OSFET Driver, Inv OSFET Driver, No OSFET Driver, Co	n-Inverting	b)	TC4426EUA:	1.5A Dual Inverting MOSFET driver, -40°C to +85°C. MSOP package.
Temperature Range:	C = 0°C to +70°C E = -40°C to +85°C V = -40°C to +125	-	C only)	c)	TC4426EMF:	1.5A Dual Inverting MOSFET driver, -40°C to +85°C, DFN-S package.
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			a)	TC4427CPA:	1.5A Dual Non-Inverting MOSFET driver, 0°C to +70°C PDIP package.
	PA = Plastic DIP (30 UA = Plastic Micro S UA713 = Plastic Micro S (Tape and Rec	00 mil Body), 8-le Small Outline (MS Small Outline (MS	OP), 8-lead	b)	TC4427EPA:	1.5A Dual Non-Inverting MOSFET driver, -40°C to +85°C PDIP package.
				J ∣ a)	TC4428COA713	s: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.

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.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, FlashFlex, flexPWR, JukeBlox, KEELoQ, KEELoQ logo, Kleer, LANCheck, MediaLB, MOST, MOST logo, MPLAB, OptoLyzer, PIC, PICSTART, PIC³² logo, RightTouch, SpyNIC, SST, SST Logo, SuperFlash and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

The Embedded Control Solutions Company and mTouch are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, BodyCom, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, ECAN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, KleerNet, KleerNet logo, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, RightTouch logo, REAL ICE, SQI, Serial Quad I/O, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademarks of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2006-2014, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN:978-1-63276-371-6

QUALITY MANAGEMENT SYSTEM

CERTIFIED BY DNV

= ISO/TS 16949=

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.



Worldwide Sales and Service

AMERICAS

Corporate Office 2355 West Chandler Blvd.

Chandler, AZ 85224-6199
Tel: 480-792-7200

Fax: 480-792-7277 Technical Support:

http://www.microchip.com/

support

Web Address: www.microchip.com

Atlanta

Duluth, GA Tel: 678-957-9614 Fax: 678-957-1455

Austin, TX Tel: 512-257-3370

Boston

Westborough, MA Tel: 774-760-0087 Fax: 774-760-0088

Chicago Itasca, IL

Tel: 630-285-0071 Fax: 630-285-0075

Cleveland

Independence, OH Tel: 216-447-0464 Fax: 216-447-0643

Dallas

Addison, TX Tel: 972-818-7423 Fax: 972-818-2924

Detroit Novi. MI

Tel: 248-848-4000

Houston, TX Tel: 281-894-5983

Indianapolis

Noblesville, IN Tel: 317-773-8323 Fax: 317-773-5453

Los Angeles

Mission Viejo, CA Tel: 949-462-9523 Fax: 949-462-9608

New York, NY Tel: 631-435-6000

San Jose, CA Tel: 408-735-9110

Canada - Toronto Tel: 905-673-0699 Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office

Suites 3707-14, 37th Floor Tower 6, The Gateway Harbour City, Kowloon Hong Kong

Tel: 852-2943-5100 Fax: 852-2401-3431

Australia - Sydney Tel: 61-2-9868-6733

Fax: 61-2-9868-6755

China - Beijing Tel: 86-10-8569-7000 Fax: 86-10-8528-2104

China - Chengdu

Tel: 86-28-8665-5511 Fax: 86-28-8665-7889

China - Chongqing Tel: 86-23-8980-9588

Fax: 86-23-8980-9500 China - Hangzhou

Tel: 86-571-8792-8115 Fax: 86-571-8792-8116

China - Hong Kong SAR

Tel: 852-2943-5100 Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460

Fax: 86-25-8473-2470 China - Qingdao

Tel: 86-532-8502-7355 Fax: 86-532-8502-7205

China - Shanghai Tel: 86-21-5407-5533 Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Eax: 86-24-2334-2324

Fax: 86-24-2334-2393
China - Shenzhen

Tel: 86-755-8864-2200 Fax: 86-755-8203-1760

China - Wuhan Tel: 86-27-5980-5300

Fax: 86-27-5980-5118 China - Xian

Tel: 86-29-8833-7252 Fax: 86-29-8833-7256

China - Xiamen Tel: 86-592-2388138 Fax: 86-592-2388130

China - Zhuhai Tel: 86-756-3210040 Fax: 86-756-3210049

ASIA/PACIFIC

India - Bangalore

Tel: 91-80-3090-4444 Fax: 91-80-3090-4123

India - New Delhi

Tel: 91-11-4160-8631 Fax: 91-11-4160-8632

India - Pune

Tel: 91-20-3019-1500

Japan - Osaka

Tel: 81-6-6152-7160 Fax: 81-6-6152-9310

Japan - Tokyo

Tel: 81-3-6880- 3770 Fax: 81-3-6880-3771

Korea - Daegu

Tel: 82-53-744-4301 Fax: 82-53-744-4302

Korea - Seoul Tel: 82-2-554-7200

Fax: 82-2-558-5932 or 82-2-558-5934

Malaysia - Kuala Lumpur Tel: 60-3-6201-9857

Fax: 60-3-6201-9859

Malaysia - Penang Tel: 60-4-227-8870

Fax: 60-4-227-4068

Philippines - Manila

Tel: 63-2-634-9065 Fax: 63-2-634-9069

Singapore

Tel: 65-6334-8870 Fax: 65-6334-8850

Taiwan - Hsin Chu

Tel: 886-3-5778-366 Fax: 886-3-5770-955

Taiwan - Kaohsiung Tel: 886-7-213-7830

Taiwan - Taipei

Tel: 886-2-2508-8600 Fax: 886-2-2508-0102 Thailand - Bangkok

Tel: 66-2-694-1351 Fax: 66-2-694-1350

EUROPE

Austria - Wels

Tel: 43-7242-2244-39 Fax: 43-7242-2244-393

Denmark - Copenhagen

Tel: 45-4450-2828 Fax: 45-4485-2829

France - Paris

Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

Germany - Dusseldorf

Tel: 49-2129-3766400

Germany - Munich Tel: 49-89-627-144-0

Fax: 49-89-627-144-44 Germany - Pforzheim

Tel: 49-7231-424750

Italy - Milan Tel: 39-0331-742611

Fax: 39-0331-466781

Italy - Venice

Tel: 39-049-7625286

Netherlands - Drunen

Tel: 31-416-690399 Fax: 31-416-690340

Poland - Warsaw

Tel: 48-22-3325737

Spain - Madrid

Tel: 34-91-708-08-90 Fax: 34-91-708-08-91

Sweden - Stockholm Tel: 46-8-5090-4654

UK - Wokingham

Tel: 44-118-921-5800 Fax: 44-118-921-5820

03/25/14

单击下面可查看定价,库存,交付和生命周期等信息

>>Microchip Technology