



MICROCHIP 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 (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 μ A
- Low Output Impedance – 7 Ω
- 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 TC426/TC427/TC428
- Space-saving 8-Pin MSOP and 8-Pin 6x5 DFN 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 4 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 will not be 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



TC4426/TC4427/TC4428

Functional Block Diagram



TC4426/TC4427/TC4428

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 ($T_A \leq 70^\circ C$)
DFN **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.

PIN FUNCTION TABLE

| Name | Function |
|----------|---------------|
| NC | No Connection |
| IN A | Input A |
| GND | Ground |
| IN B | Input B |
| OUT B | Output B |
| V_{DD} | Supply Input |
| OUT A | Output A |
| NC | No Connection |

DC CHARACTERISTICS

| Electrical Specifications: Unless otherwise noted, $T_A = +25^\circ C$ 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 | $I_{OUT} = 10\text{ mA}$, $V_{DD} = 18V$ |
| Peak Output Current | I_{PK} | — | 1.5 | — | A | $V_{DD} = 18V$ |
| Latch-Up Protection Withstand Reverse Current | I_{REV} | — | > 0.5 | — | A | Duty cycle $\leq 2\%$, $t \leq 300\ \mu s$ $V_{DD} = 18V$ |
| 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.

TC4426/TC4427/TC4428

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 | Note 2 |
| 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 | $I_{OUT} = 10 \text{ mA}$, $V_{DD} = 18V$ |
| Peak Output Current | I_{PK} | — | 1.5 | — | A | $V_{DD} = 18V$ |
| Latch-Up Protection Withstand Reverse Current | I_{REV} | — | >0.5 | — | A | Duty cycle $\leq 2\%$, $t \leq 300 \mu s$ $V_{DD} = 18V$ |
| 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 | I_S | — | — | 8.0 | mA | $V_{IN} = 3V$ (Both inputs) |
| | | — | — | 0.6 | | $V_{IN} = 0V$ (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 $4.5V \leq V_{DD} \leq 18V$. | | | | | | |
|--|---------------|-----|------|------|---------------|------------|
| Parameters | Sym | Min | Typ | Max | Units | Conditions |
| Temperature Ranges | | | | | | |
| Specified Temperature Range (C) | T_A | 0 | — | +70 | $^{\circ}C$ | |
| Specified Temperature Range (E) | T_A | -40 | — | +85 | $^{\circ}C$ | |
| Specified Temperature Range (V) | T_A | -40 | — | +125 | $^{\circ}C$ | |
| Maximum Junction Temperature | T_J | — | — | +150 | $^{\circ}C$ | |
| Storage Temperature Range | T_A | -65 | — | +150 | $^{\circ}C$ | |
| Package Thermal Resistances | | | | | | |
| Thermal Resistance, 8L-6x5 DFN | θ_{JA} | — | 33.2 | — | $^{\circ}C/W$ | |
| Thermal Resistance, 8L-MSOP | θ_{JA} | — | 206 | — | $^{\circ}C/W$ | |
| Thermal Resistance, 8L-PDIP | θ_{JA} | — | 125 | — | $^{\circ}C/W$ | |
| Thermal Resistance, 8L-SOIC | θ_{JA} | — | 155 | — | $^{\circ}C/W$ | |

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



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



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



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



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 | 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 currents will flow 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 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, to aid in heat removal from the package.

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4.0 APPLICATIONS INFORMATION



FIGURE 4-1: Switching Time Test Circuit.

5.0 PACKAGING INFORMATION

5.1 Package Marking Information

8-Lead DFN



Example:



8-Lead MSOP



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 |
| | (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.

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8-Lead Plastic Dual Flat No Lead Package (MF) 6x5 mm Body (DFN-S) – Saw Singulated

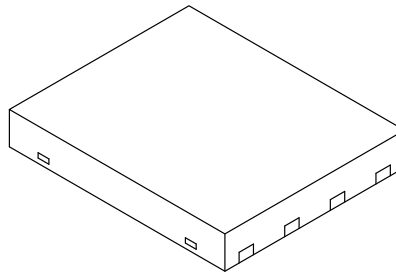
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



TOP VIEW



BOTTOM VIEW



| Units | | INCHES | | | MILLIMETERS* | | |
|--------------------|----|----------|-------|------|--------------|------|------|
| Dimension Limits | | MIN | NOM | MAX | MIN | NOM | MAX |
| Number of Pins | n | | 8 | | | 8 | |
| Pitch | p | .050 BSC | | | 1.27 BSC | | |
| Overall Height | A | .033 | .035 | .037 | 0.85 | 0.90 | 0.95 |
| Package Thickness | A2 | .031 | .035 | .037 | 0.80 | 0.89 | 0.95 |
| Standoff | A1 | .000 | .0004 | .002 | 0.00 | 0.01 | 0.05 |
| Base Thickness | A3 | .007 | .008 | .009 | 0.17 | 0.20 | 0.23 |
| Overall Length | E | .195 | .197 | .199 | 4.95 | 5.00 | 5.05 |
| Exposed Pad Length | E2 | .152 | .157 | .163 | 3.85 | 4.00 | 4.15 |
| Overall Width | D | .234 | .236 | .238 | 5.95 | 6.00 | 6.05 |
| Exposed Pad Width | D2 | .089 | .091 | .093 | 2.25 | 2.30 | 2.35 |
| Lead Width | B | .014 | .016 | .019 | 0.35 | 0.40 | 0.47 |
| Lead Length | L | .024 | | .026 | 0.60 | | 0.65 |

Notes:

JEDEC equivalent: MO-220

Drawing No. C04-122

Revised 11/3/03

TC4426/TC4427/TC4428

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

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



| Dimension Limits | Units | INCHES | | | MILLIMETERS* | | |
|--------------------------|-------|----------|------|------|--------------|------|------|
| | | 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 BSC | | | 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.

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

See ASME Y14.5M

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

See ASME Y14.5M

JEDEC Equivalent: MO-187

Drawing No. C04-111

Revised 07-21-05

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

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



| Dimension Limits | Units | INCHES* | | | MILLIMETERS | | |
|----------------------------|-------|---------|------|------|-------------|------|-------|
| | | 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

TC4426/TC4427/TC4428

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

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



| Dimension Limits | Units | INCHES* | | | MILLIMETERS | | |
|--------------------------|-------|---------|------|------|-------------|------|------|
| | | 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

TC4426/TC4427/TC4428

6.0 REVISION HISTORY

Revision E (December 2012)

Added a note to each package outline drawing.

TC4426/TC4427/TC4428

PRODUCT IDENTIFICATION SYSTEM

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

| <u>PART NO.</u> | X | XX | XXX | X | Examples: |
|--------------------|-------------------|--|-------------|---------|--|
| Device | Temperature Range | Package | Tape & Reel | PB Free | |
| Device: | TC4426: | 1.5A Dual MOSFET Driver, Inverting | | | a) TC4426COA: 1.5A Dual Inverting MOSFET driver, 0°C to +70°C SOIC package. |
| | TC4427: | 1.5A Dual MOSFET Driver, Non-Inverting | | | b) TC4426EUA: 1.5A Dual Inverting MOSFET driver, -40°C to +85°C. MSOP package. |
| | TC4428: | 1.5A Dual MOSFET Driver, Complementary | | | c) TC4426EMF: 1.5A Dual Inverting MOSFET driver, -40°C to +85°C, DFN package. |
| Temperature Range: | C = | 0°C to +70°C (PDIP and SOIC only) | | | a) TC4427CPA: 1.5A Dual Non-Inverting MOSFET driver, 0°C to +70°C PDIP package. |
| | E = | -40°C to +85°C | | | b) TC4427EPA: 1.5A Dual Non-Inverting MOSFET driver, -40°C to +85°C PDIP package. |
| | V = | -40°C to +125°C | | | a) TC4428COA713: 1.5A Dual Complementary MOSFET driver, 0°C to +70°C, SOIC package, Tape and Reel. |
| Package: | MF = | Dual, Flat, No-Lead (6X5 mm Body), 8-lead | | | b) TC4428EMF: 1.5A Dual Complementary, MOSFET driver, -40°C to +85°C DFN package. |
| | 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) | | | |

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 Worldwide Site (www.microchip.com)

Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.

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NOTES:

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