# 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 nsec (typ.)
- Short Delay Times – 40 nsec (typ.)
- Matched Rise and Fall Times
- Low Supply Current:
  - With Logic '1' Input – 4 mA
  - With Logic '0' Input – 400 µA
- Low Output Impedance – 7Ω
- Latch-Up Protected: Will Withstand 0.5A Reverse Current
- Input Will Withstand Negative Inputs Up to 5V
- ESD Protected – 4 kV
- Pinouts Same as TC426/TC427/TC428

### 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.

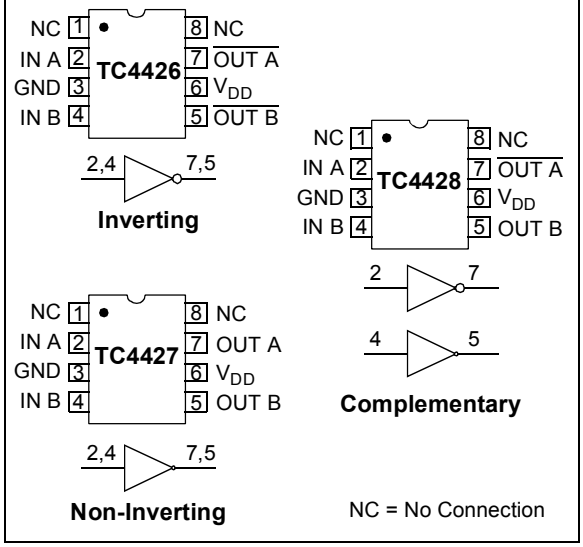
These devices are highly latch-up resistant under any conditions within their power and voltage ratings. They are not subject to damage when up to 5V of noise spiking (of either polarity) occurs on the ground pin. They can accept, without damage or logic upset, up to 500 mA of reverse current (of either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

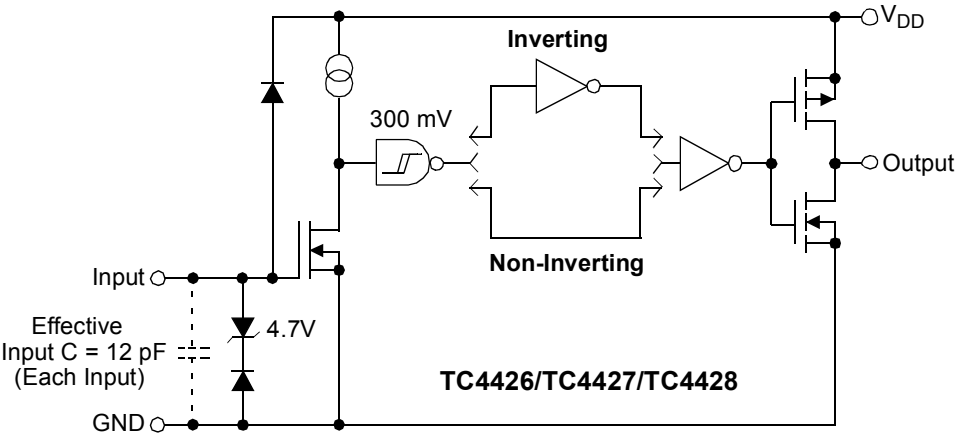
Other compatible drivers are the TC4426A/TC4427A/TC4428A family of devices. The TC4426A/TC4427A/TC4428A devices have matched leading and falling edge input-to-output delay times, in addition to the matched rise and fall times of the TC4426/TC4427/TC4428 devices.

### Package Types

**8-Pin SOIC/MSOP/PDIP/CERDIP**



## Functional Block Diagram




**Note 1:** TC4426 has two inverting drivers; TC4427 has two non-inverting drivers; TC4428 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
MSOP ..... 340 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, $T_A$ = +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 µsec $V_{DD}$ = 18V |
| **Switching Time (Note 1)** | | | | | | |
| Rise Time | $t_R$ | — | 19 | 30 | nsec | **Figure 4-1** |
| Fall Time | $t_F$ | — | 25 | 30 | nsec | **Figure 4-1** |
| Delay Time | $t_{D1}$ | — | 20 | 30 | nsec | **Figure 4-1** |
| Delay Time | $t_{D2}$ | — | 40 | 50 | nsec | **Figure 4-1** |
| Power Supply | | | | | | |
| Power Supply Current | $I_S$ | —<br>— | —<br>— | 4.5<br>0.4 | mA | $V_{IN}$ = 3V (Both inputs)<br>$V_{IN}$ = 0V (Both inputs) |

**Note 1:** Switching times ensured by design.

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

## 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 µsec $V_{DD}$ = 18V |
| **Switching Time (Note 1)** | | | | | | |
| Rise Time | $t_R$ | — | — | 40 | nsec | **Figure 4-1** |
| Fall Time | $t_F$ | — | — | 40 | nsec | **Figure 4-1** |
| Delay Time | $t_{D1}$ | — | — | 40 | nsec | **Figure 4-1** |
| Delay Time | $t_{D2}$ | — | — | 60 | nsec | **Figure 4-1** |
| **Power Supply** | | | | | | |
| Power Supply Current | $I_S$ | —<br>— | —<br>— | 8.0<br>0.6 | mA | $V_{IN}$ = 3V (Both inputs)<br>$V_{IN}$ = 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 | ºC | |
| Specified Temperature Range (E) | $T_A$ | -40 | — | +85 | ºC | |
| Specified Temperature Range (V) | $T_A$ | -40 | — | +125 | ºC | |
| Specified Temperature Range (M) | $T_A$ | -55 | — | +125 | ºC | |
| Maximum Junction Temperature | $T_J$ | — | — | +150 | ºC | |
| Storage Temperature Range | $T_A$ | -65 | — | +150 | ºC | |
| **Package Thermal Resistances** | | | | | | |
| Thermal Resistance, 8L-MSOP | $\theta_{JA}$ | — | 206 | — | ºC/W | |
| Thermal Resistance, 8L-SOIC | $\theta_{JA}$ | — | 155 | — | ºC/W | |
| Thermal Resistance, 8L-PDIP | $\theta_{JA}$ | — | 125 | — | ºC/W | |
| Thermal Resistance, 8L-CERDIP | $\theta_{JA}$ | — | 150 | — | ºC/W | |

## 2.0 TYPICAL PERFORMANCE CURVES

**Note:** The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

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

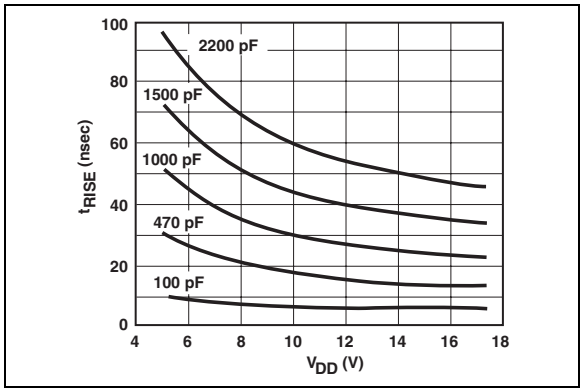



***FIGURE 2-1:*** *Rise Time vs. Supply Voltage.*

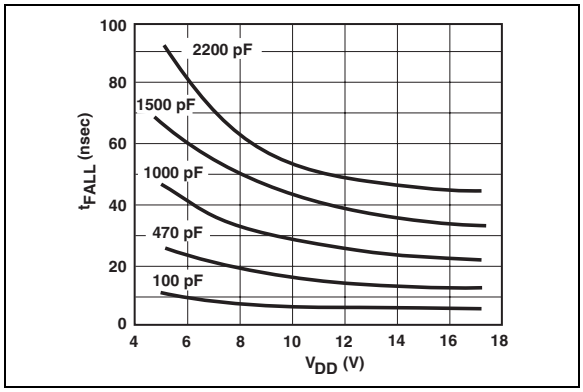



***FIGURE 2-4:*** *Fall Time vs. Supply Voltage.*

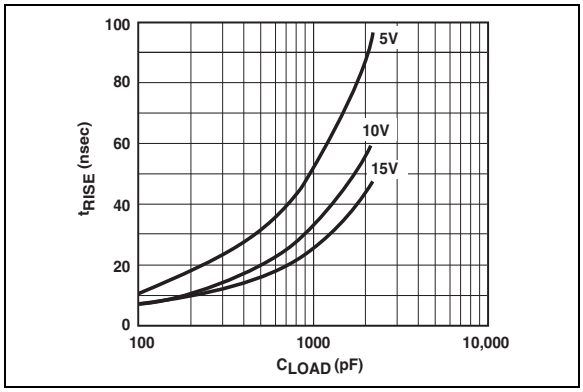



***FIGURE 2-2:*** *Rise Time vs. Capacitive Load.*

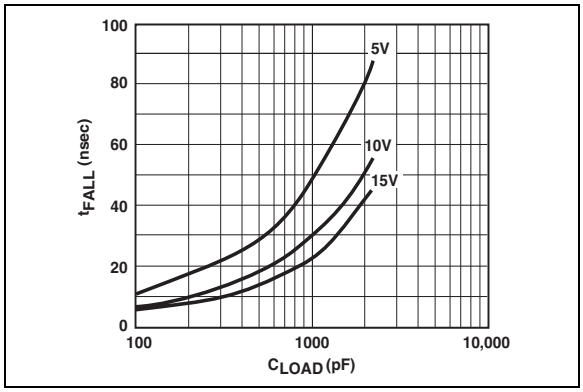



***FIGURE 2-5:*** *Fall Time vs. Capacitive Load.*

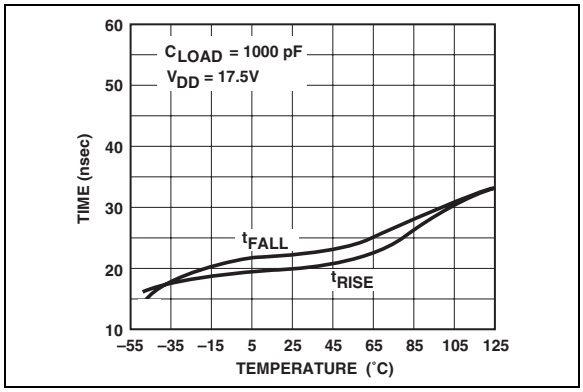



***FIGURE 2-3:*** *Rise and Fall Times vs. Temperature.*

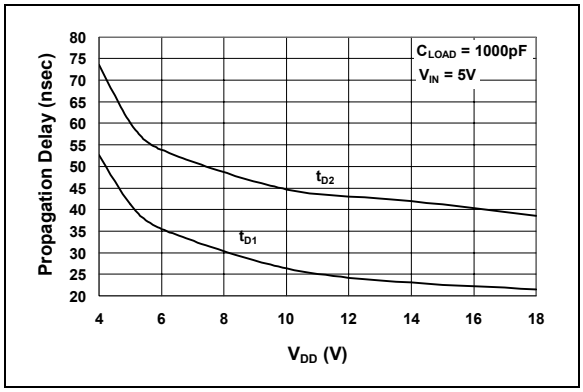



***FIGURE 2-6:*** *Propagation Delay Time vs. Supply Voltage.*

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

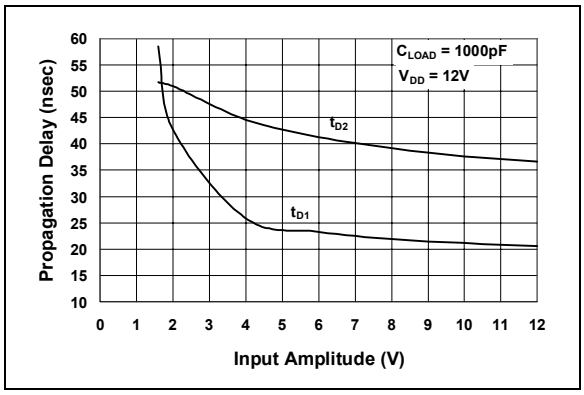



***FIGURE 2-7:*** *Propagation Delay Time vs. Input Amplitude.*

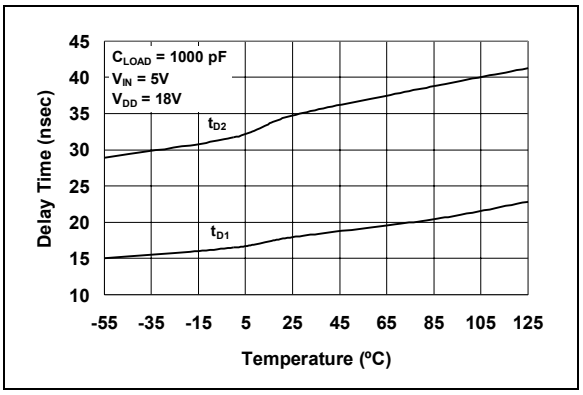



***FIGURE 2-10:*** *Propagation Delay Time vs. Temperature.*

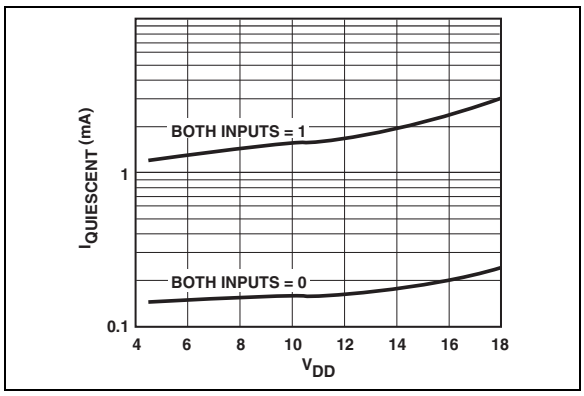



***FIGURE 2-8:*** *Supply Current vs. Supply Voltage.*

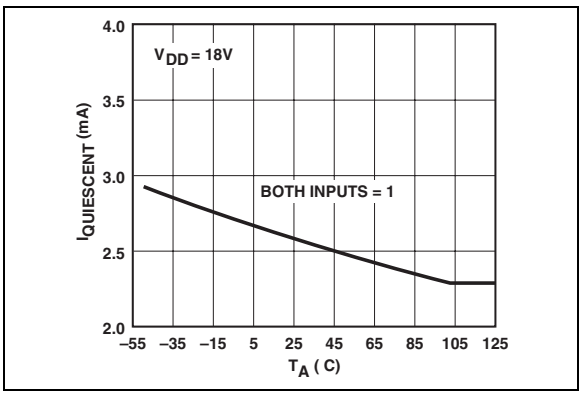



***FIGURE 2-11:*** *Supply Current vs. Temperature.*

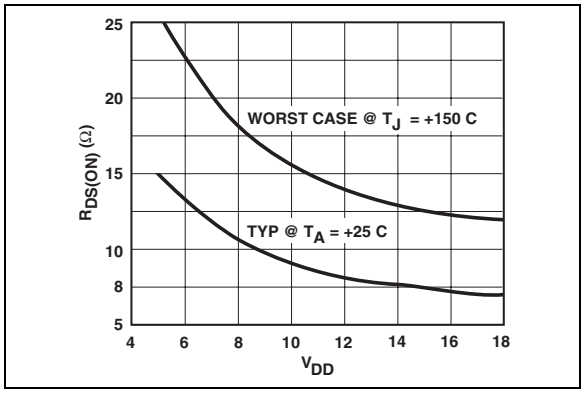



***FIGURE 2-9:*** *Output Resistance ($R_{OH}$) vs. Supply Voltage.*

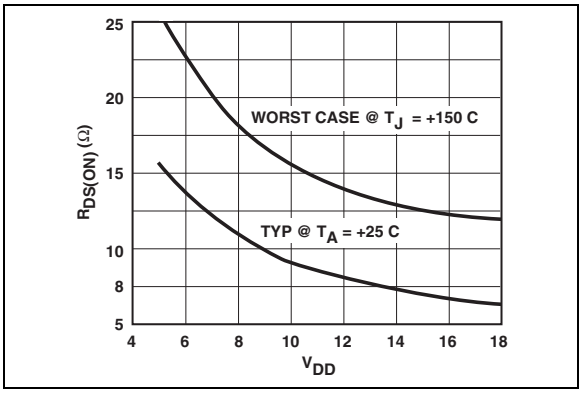



***FIGURE 2-12:*** *Output Resistance ($R_{OL}$) vs. Supply Voltage.*

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

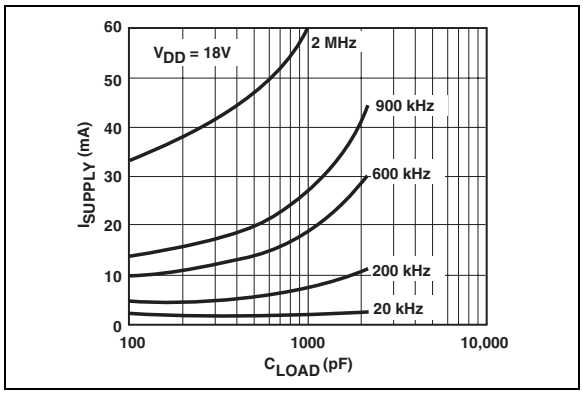



***FIGURE 2-13:*** *Supply Current vs. Capacitive Load.*

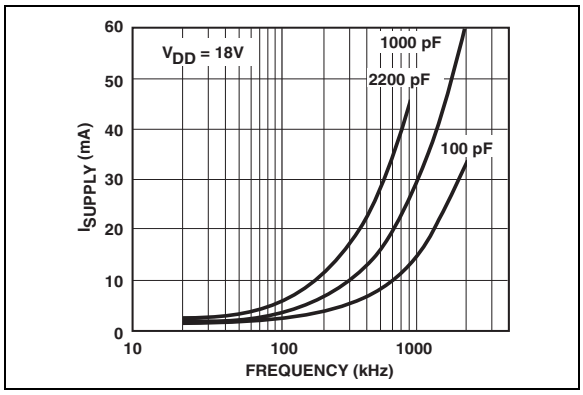



***FIGURE 2-16:*** *Supply Current vs. Frequency.*

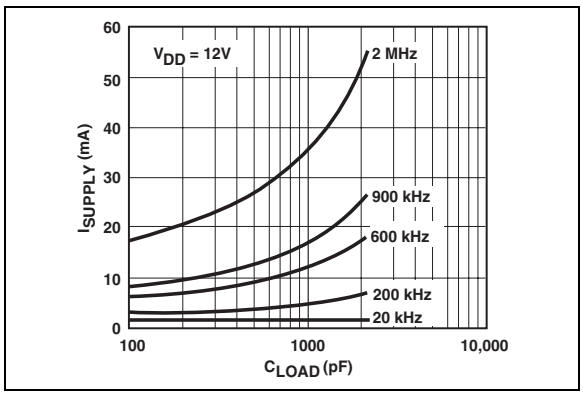



***FIGURE 2-14:*** *Supply Current vs. Capacitive Load.*

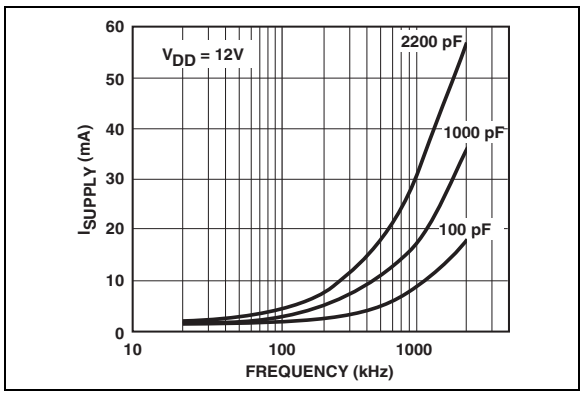



***FIGURE 2-17:*** *Supply Current vs. Frequency.*

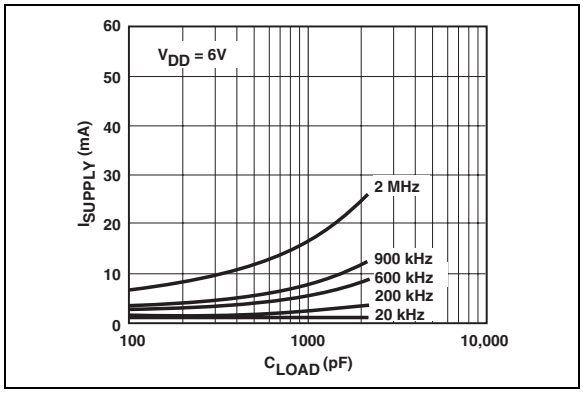



***FIGURE 2-15:*** *Supply Current vs. Capacitive Load.*

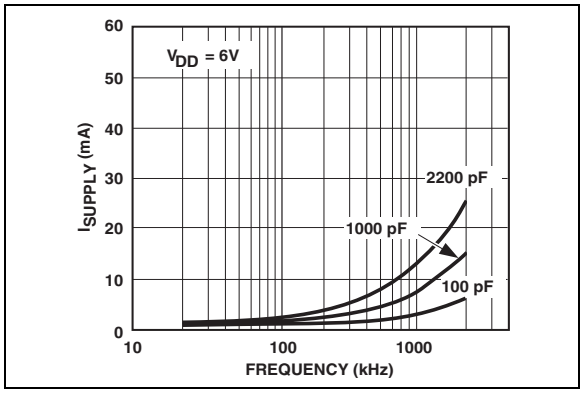



***FIGURE 2-18:*** *Supply Current vs. Frequency.*

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

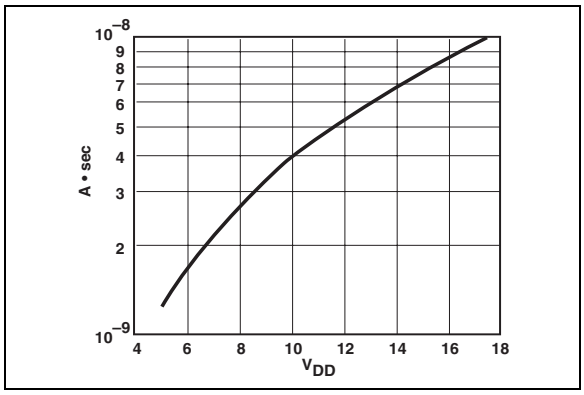



***FIGURE 2-19:*** *Crossover Energy vs. Supply Voltage.*

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

## 3.0 PIN DESCRIPTIONS

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

**TABLE 3-1: PIN FUNCTION TABLE**

| Pin No. | 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 that prevents output glitching even when the rise and fall time of the input signal is very slow.

### 3.2 Ground (GND)

Ground.

### 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. A value of 1.0 µF is suggested.

## 4.0 APPLICATIONS INFORMATION

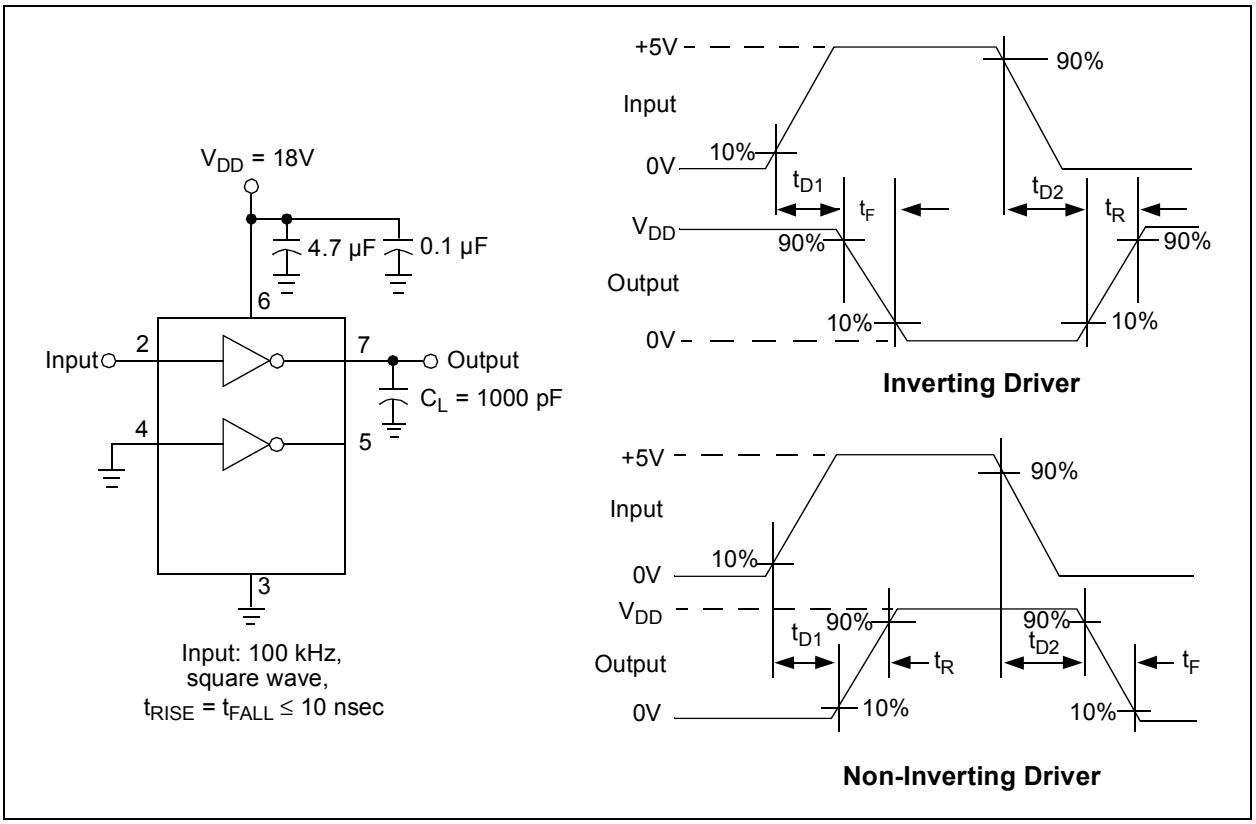
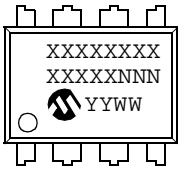



***FIGURE 4-1:*** *Switching Time Test Circuit.*

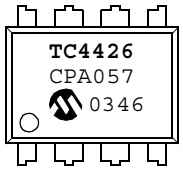
## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information

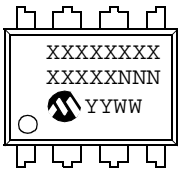
8-Lead PDIP (300 mil)



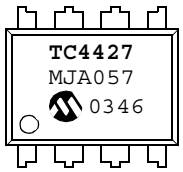

Example:



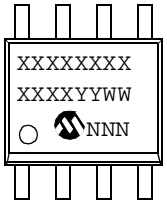

8-Lead CERDIP (300 mil)



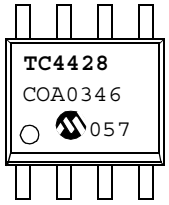

Example:



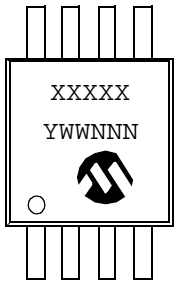

8-Lead SOIC (150 mil)



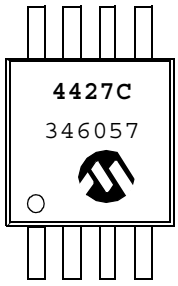

Example:




8-Lead MSOP




Example:

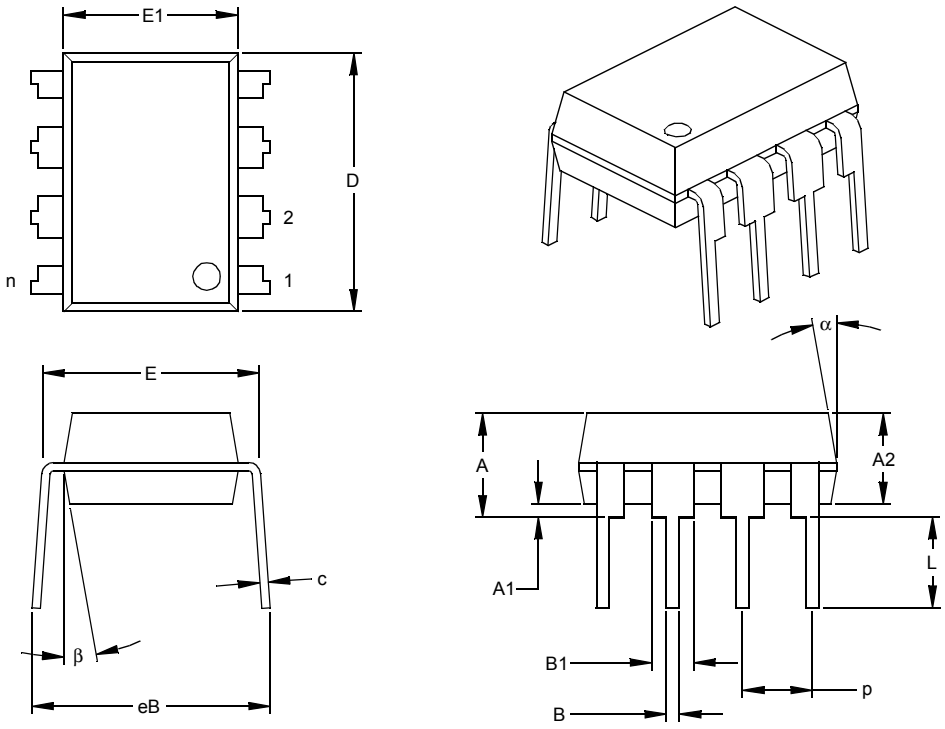



| | | |
|---|---|---|
| **Legend:** | XX...X | Customer specific information* |
| | Y | Year code (last digit of calendar year) |
| | YY | Year code (last 2 digits of calendar year) |
| | WW | Week code (week of January 1 is week ‘01’) |
| | NNN | Alphanumeric traceability code |

**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 In-line (P) – 300 mil (PDIP)

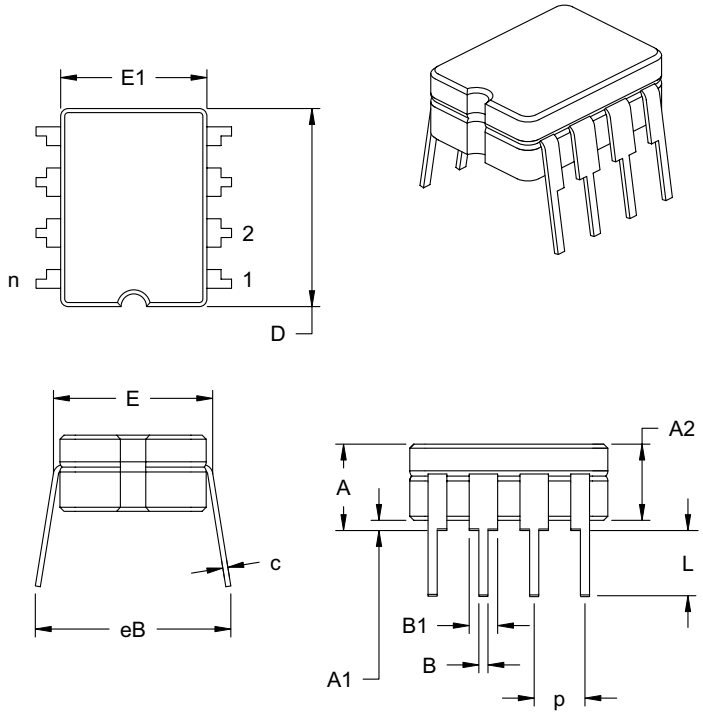



| Units | | INCHES* | | | MILLIMETERS | | |
|---|---|---|---|---|---|---|---|
| Dimension Limits | | MIN | NOM | MAX | MIN | NOM | MAX |
| Number of Pins | n | | 8 | | | 8 | |
| Pitch | p | | .100 | | | 2.54 | |
| Top to Seating Plane | A | .140 | .155 | .170 | 3.56 | 3.94 | 4.32 |
| Molded Package Thickness | 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)



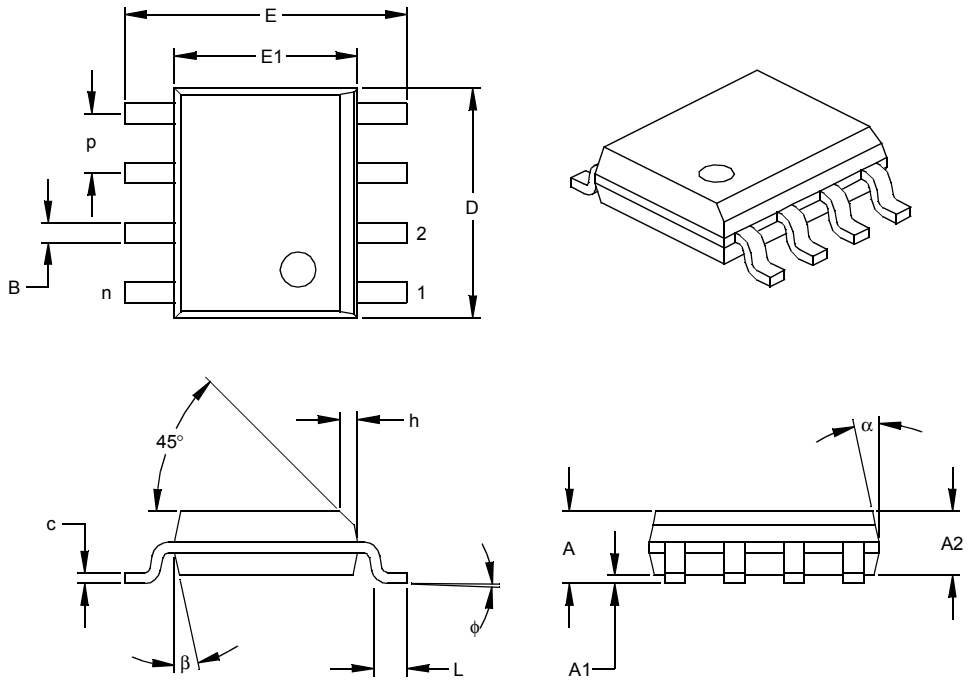

| Units | | INCHES* | | | MILLIMETERS | | |
|---|---|---|---|---|---|---|---|
| Dimension Limits | | MIN | NOM | MAX | MIN | NOM | MAX |
| Number of Pins | n | | 8 | | | 8 | |
| Pitch | p | | .100 | | | 2.54 | |
| Top to Seating Plane | A | .160 | .180 | .200 | 4.06 | 4.57 | 5.08 |
| Standoff § | A1 | .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 (SN) – Narrow, 150 mil (SOIC)

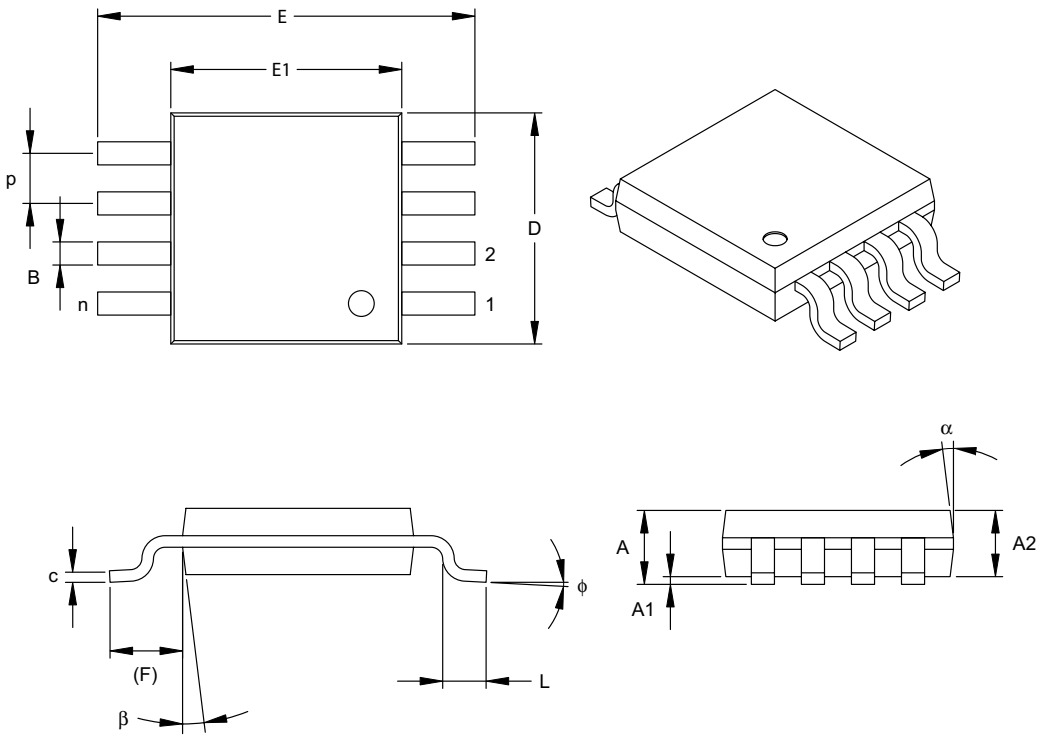



| Units | | INCHES* | | | MILLIMETERS | | |
|---|---|---|---|---|---|---|---|
| Dimension Limits | | MIN | NOM | MAX | MIN | NOM | MAX |
| Number of Pins | n | | 8 | | | 8 | |
| Pitch | p | | .050 | | | 1.27 | |
| Overall Height | A | .053 | .061 | .069 | 1.35 | 1.55 | 1.75 |
| Molded Package Thickness | 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 (MS) (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

**NOTES:**

## PRODUCT IDENTIFICATION SYSTEM

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

| PART NO. | X | /XX |
|---|---|---|
| Device | Temperature Range | Package |

| | | |
|---|---|---|
| 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 |
| | 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) |
| | UA = | Plastic Micro Small Outline (MSOP), 8-lead |
| | UA713 = | Plastic Micro Small Outline (MSOP), 8-lead (Tape and Reel) |
| | PA = | Plastic DIP (300 mil Body), 8-lead |

**Examples:**

a) TC4426COA: 1.5A Dual MOSFET driver, SOIC package, 0°C to +70°C.

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

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

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

a) TC4428MJA: 1.5A Dual MOSFET driver, CDIP package, -55°C to +125°C.

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

### Sales and Support

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1. Your local Microchip sales office
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3. The Microchip Worldwide Site (www.microchip.com)

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- Microchip is willing to work with the customer who is concerned about the integrity of their code.
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