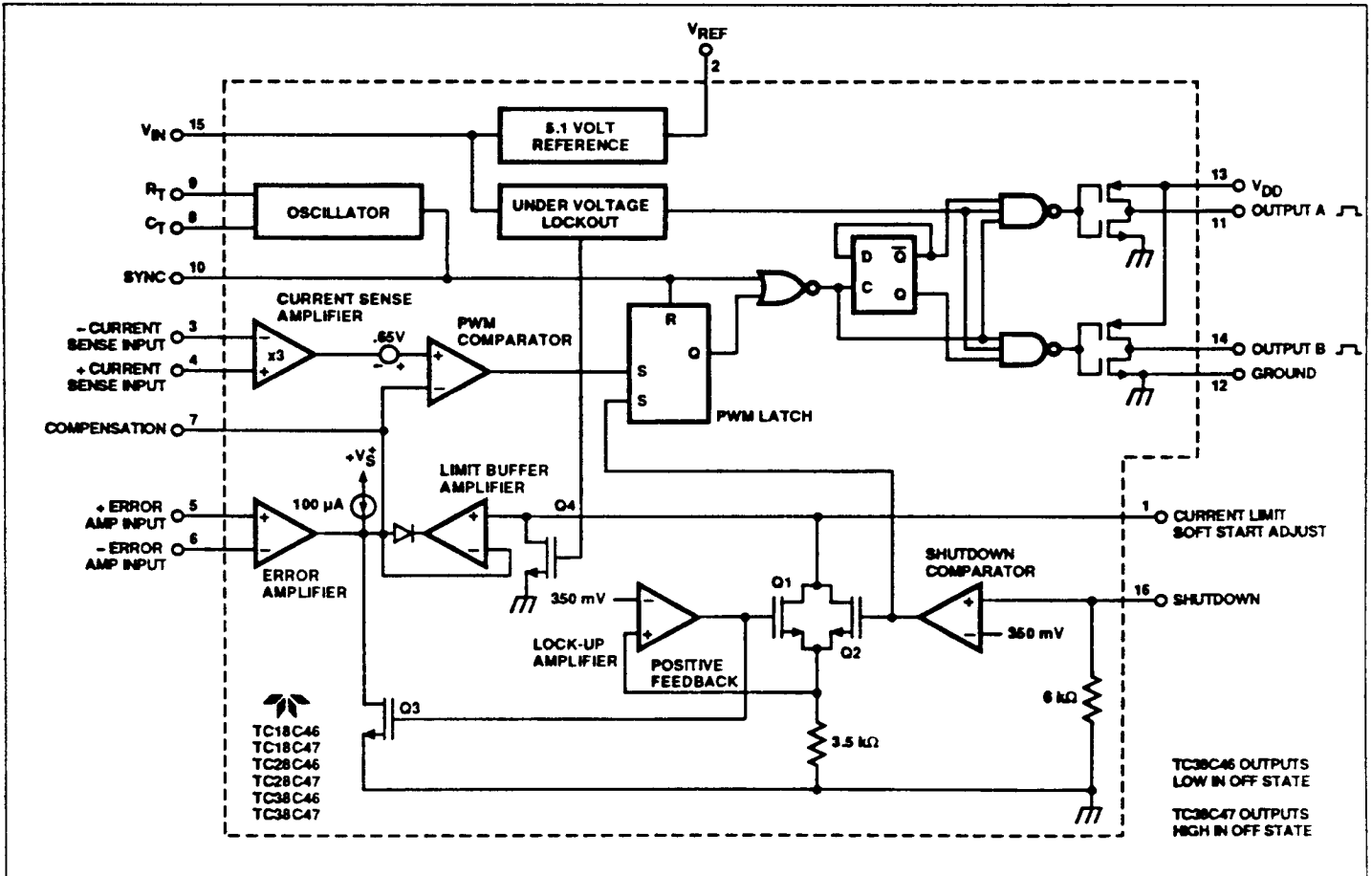


# CMOS CURRENT MODE PWM CONTROLLER

## FEATURES

- Isolated Output Drive
- Low Power CMOS Construction
- Low Supply Current .....2 mA Typ
- Wide Supply Voltage Operation .....8V to 18V
- Latch-Up Immunity .....500 mA on Outputs
- Above and Below Rail Input Protection .....6V
- High Output Drive .....500 mA Peak
- Current Mode Control
- Fast Rise/Fall Time .....50 ns @ 1000 pF
- High Frequency Operation .....500 kHz
- UV Hysteresis Guaranteed
- Programmable Current Limit
- Shutdown Pin Available
- Double Ended
- Soft Start
- Low Prop Delay Current Amp to Output ..... < 350 ns Typ
- Low Prop Delay Shutdown to Output ..... < 400 ns Typ
- TC38C46/47 Pin Compatible with Unित्रोde UC3846/3847
- ESD Protected .....±2 kV

## BLOCK DIAGRAM



TC18C46/7  
TC28C46/7  
TC38C46/7

## GENERAL DESCRIPTION

The TC38C46/47 are current mode CMOS PWM control ICs. These only draw 2 mA supply current, so they can be driven without a costly 50-60 Hz transformer. The output drive stage is capable of high drive currents, 300 mA typical.

The TC38C46/47 are pin compatible with earlier bipolar products so that designers can easily update older designs. A number of improvements have been added.

This second generation part has been designed with an isolated drive stage. Unlike its cousin, the TC170, the output stage of the TC38C46/47 can be run from a separate power supply such as a secondary winding on an output transformer. This allows for bootstrap start-up of the power supply.

## ORDERING INFORMATION

| Part No.   | Configuration | Pkg./Temperature                   |
|------------|---------------|------------------------------------|
| TC18C46MJE | Non-Inverting | 16-Pin CerDIP<br>-55 to +125°C     |
| TC18C47MJE | Inverting     | 16-Pin CerDIP<br>-55 to +125°C     |
| TC28C46EOE | Non-Inverting | 16-Pin SOIC (wide)<br>-40 to +85°C |
| TC28C46EPE | Non-Inverting | 16-Pin Plastic DIP<br>-40 to +85°C |
| TC28C47EOE | Non-Inverting | 16-Pin SOIC (wide)<br>-40 to +85°C |
| TC28C47EPE | Non-Inverting | 16-Pin Plastic DIP<br>-40 to +85°C |
| TC38C46COE | Non-Inverting | 16-Pin SOIC (wide)<br>0 to +70°C   |
| TC38C46CPE | Non-Inverting | 16-Pin Plastic DIP<br>0 to +70°C   |
| TC38C47COE | Inverting     | 16-Pin SOIC (wide)<br>0 to +70°C   |
| TC38C47CPE | Inverting     | 16-Pin Plastic DIP<br>0 to +70°C   |

## ABSOLUTE MAXIMUM RATINGS

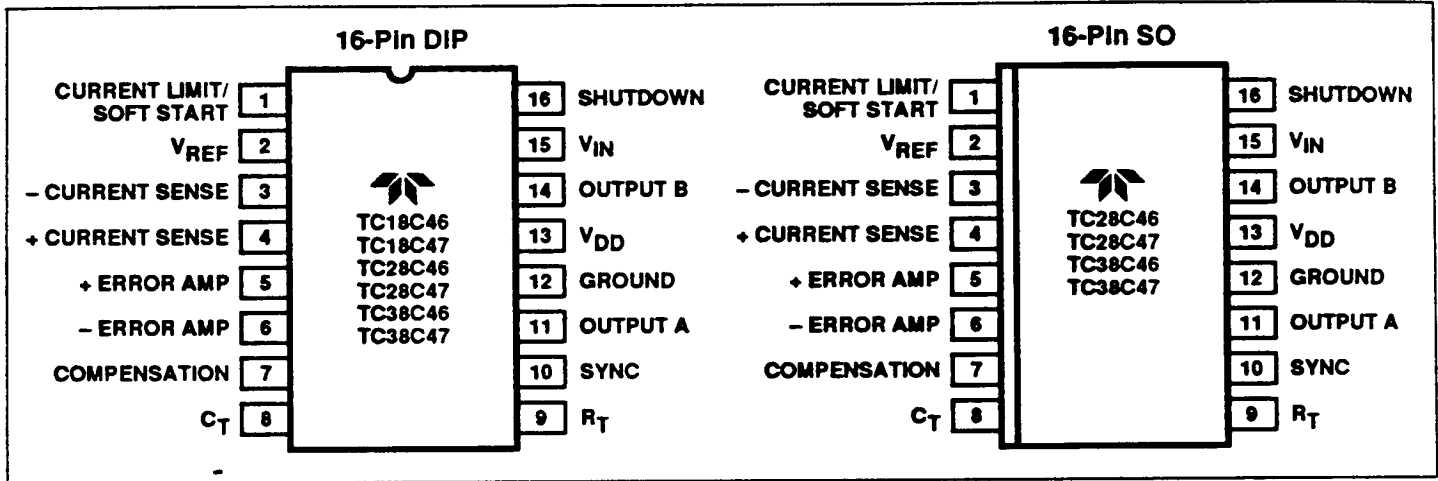
|   |                           |
|---|---------------------------|
| Output Current, Source or Sink (Pins 1, 14) | 500 mA                    |
| Analog Inputs (Pins 3, 4, 5, 6, 16)         | -0.3V to +V <sub>IN</sub> |
| Reference Output Current (Pin 2)            | -30 mA                    |
| Sync Output Current (Pin 10)                | -5 mA                     |
| Error Amplifier Output Current (Pin 7)      | -5 mA                     |
| Soft Start Sink Current (Pin 1)             | 50 mA                     |
| Oscillator Charging Current (Pin 9)         | 5 mA                      |
| Supply Voltage                              | 18V                       |
| Maximum Chip Temperature                    | 150 °C                    |
| Storage Temperature                         | -65°C to +150°C           |
| Lead Temperature (10 sec)                   | 300 °C                    |
| Package Thermal Resistance                  |                           |
| CerDIP R <sub>θJ-A</sub>                    | 150°C/W                   |
| CerDIP R <sub>θJ-C</sub>                    | 55°C/W                    |
| PDIP R <sub>θJ-A</sub>                      | 125°C/W                   |
| PDIP R <sub>θJ-C</sub>                      | 45°C/W                    |
| SOIC R <sub>θJ-A</sub>                      | 250°C/W                   |
| SOIC R <sub>θJ-A</sub>                      | 75°C/W                    |

- NOTES:
1. All voltages are with respect to Ground, Pin 12. Currents are positive into, negative out of the specified terminal.
  2. Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. 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 operational sections of the specifications is not implied. Exposure to Absolute Maximum Rating Conditions for extended periods may affect device reliability.

# CMOS CURRENT MODE PWM CONTROLLER

TC18C46/7  
TC28C46/7  
TC38C46/7

## PIN CONFIGURATION



**ELECTRICAL CHARACTERISTICS:** unless otherwise stated, these specifications apply for  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$  for TC18C46/TC18C47;  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$  for the TC28C46/TC28C47; and  $0^\circ\text{C}$  to  $+70^\circ\text{C}$  for the TC38C46/TC38C47;  $V_{IN} = V_{DD} = 16\text{V}$ ;  $R_T = 30.1\text{k}\Omega$ ;  $C_T = 270\text{pF}$ .

| Parameter                    | Test Conditions  | TC18C46/47<br>TC28C46/47 |            |            | TC38C46/47       |            |            | Units                |
|------------------------------|--|--------------------------|------------|------------|------------------|------------|------------|----------------------|
|                              |  | Min                      | Typ        | Max        | Min              | Typ        | Max        |                      |
| <b>Reference Section</b>     |  |                          |            |            |                  |            |            |                      |
| Output Voltage               | $T_I = 25^\circ\text{C}$ , $I_O = 1\text{mA}$                              | 5.0                      | 5.1        | 5.2        | 5.0              | 5.1        | 5.2        | V                    |
| Line Regulation              | $V_{IN} = 8\text{V}$ to $16\text{V}$                                       | —                        | $\pm 4$    | $\pm 20$   | —                | $\pm 4$    | $\pm 20$   | mV                   |
| Load Regulation              | $I_O = 1\text{mA}$ to $10\text{mA}$  | —                        | $\pm 4$    | $\pm 20$   | —                | $\pm 4$    | $\pm 20$   | mV                   |
| Temp Coefficient             | Over Operating Range, (note 1)   | —                        | $\pm 0.2$  | $\pm 0.5$  | —                | $\pm 0.2$  | $\pm 0.5$  | mV/ $^\circ\text{C}$ |
| Total Output Range           | Line, Load, and Temperature (note 1)                                       | 4.97                     | —          | 5.24       | 4.94             | —          | 5.26       | V                    |
| Long Term Drift              | $T_I = 125^\circ\text{C}$ , 1000 Hrs (note 1)                              | —                        | $\pm 50$   | —          | —                | $\pm 50$   | —          | mV                   |
| Short Circuit Output Current | $V_{REF} = 0\text{V}$  | 20                       | —          | 70         | 20               | —          | 70         | mA                   |
| Output Noise Voltage         | $10\text{Hz} \leq f \leq 10\text{kHz}$ , $T_I = 25^\circ\text{C}$ (note 1) | —                        | 22         | —          | —                | 22         | —          | $\mu\text{V(rms)}$   |
| <b>Oscillator Section</b>    |  |                          |            |            |                  |            |            |                      |
| Initial Accuracy             | $T_I = 25^\circ\text{C}$   | 96.5                     | 102        | 106.5      | 96.5             | 101        | 106.5      | kHz                  |
| Voltage Coefficient          | $V_{IN} = 8\text{V}$ to $16\text{V}$                                       | —                        | $\pm 1$    | $\pm 1.5$  | —                | $\pm 1$    | $\pm 1.5$  | %/V                  |
| Temp Coefficient             | Over Operating Range (note 1)  | —                        | $\pm 0.04$ | $\pm 0.06$ | —                | $\pm 0.04$ | $\pm 0.06$ | %/ $^\circ\text{C}$  |
| Clock Ramp Reset Current     |  | 1.2                      | 2          | 3          | 1.2              | 2          | 3          | mA                   |
| Osc Ramp Amplitude           |  | 3.6                      | 3.8        | 4          | 3.6              | 3.8        | 4          | V                    |
| Sync Output High Level       | (note 1)   | $V_{DD}$<br>-0.5         | —          | —          | $V_{DD}$<br>-0.5 | —          | —          | V                    |
| Sync Output Low Level        | (note 1)   | —                        | —          | 0.5        | —                | —          | 0.5        | V                    |
| Sync Input High Level        | Pin 8 = 0V, (note 1)   | —                        | 8.5        | —          | —                | 8.5        | —          | V                    |
| Sync Input Low Level         | Pin 8 = 0V, (note 1)   | —                        | 8.5        | 5          | —                | 8.5        | 5          | V                    |
| Sync Input Current           | Sync Voltage = 5.25V, Pin 8 = 0V   | —                        | $\pm 5$    | $\pm 50$   | —                | $\pm 5$    | $\pm 50$   | nA                   |

# CMOS CURRENT MODE PWM CONTROLLER

TC18C46/7  
TC28C46/7  
TC38C46/7

**ELECTRICAL CHARACTERISTICS (Cont):** unless otherwise stated, these specifications apply for  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$  for TC18C46/TC18C47;  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$  for the TC28C46/TC28C47; and  $0^\circ\text{C}$  to  $+70^\circ\text{C}$  for the TC38C46/TC38C47;  $V_{IN} = V_{DD} = 16\text{V}$ ;  $R_T = 30.1\text{k}$ ;  $C_T = 270\text{pF}$ .

| Parameter   | Test Conditions   | TC18C46/47<br>TC28C46/47 |           |           | TC38C46/47 |           |           | Units            |
|---|---|--------------------------|-----------|-----------|------------|-----------|-----------|------------------|
|   |   | Min                      | Typ       | Max       | Min        | Typ       | Max       |                  |
| <b>Error Amp Section</b>                                      |   |                          |           |           |            |           |           |                  |
| Input Offset Voltage  |   | —                        | $\pm 5$   | $\pm 25$  | —          | $\pm 5$   | $\pm 25$  | mV               |
| Input Bias Current  |   | —                        | $\pm 10$  | $\pm 100$ | —          | $\pm 0.1$ | $\pm 0.5$ | nA               |
| Input Offset Current  |   | —                        | $\pm 10$  | $\pm 100$ | —          | $\pm 0.1$ | $\pm 0.5$ | nA               |
| Open Loop Voltage Gain  | $\Delta V_O = 1\text{V to } 6\text{V}$ , $R_L = 100\text{k}$                      | 70                       | 90        | —         | 70         | 90        | —         | dB               |
| Gain Bandwidth Product  | $T_f = 25^\circ\text{C}$ (note 1)   | 0.7                      | 1         | —         | 0.7        | 1         | —         | MHz              |
| CMRR  | $V_{CM} = 0\text{V to } 11\text{V}$   | 70                       | 90        | —         | 70         | 90        | —         | dB               |
| PSRR  | $V_{IN} = 8\text{V to } 16\text{V}$   | 70                       | 90        | —         | 70         | 90        | —         | dB               |
| Output Sink Current   | $V(EA-) = 5\text{V}$ , $V(EA+) = 4.9\text{V}$ ,<br>$V(\text{COMP}) = 1.2\text{V}$ | 2                        | 4         | —         | 2          | 4         | —         | mA               |
| Output Source Current   | $V(EA-) = 5\text{V}$ , $V(EA+) = 5.1\text{V}$ ,<br>$V(\text{COMP}) = 2.5\text{V}$ | 5                        | 10        | —         | 5          | 10        | —         | mA               |
| High Level Output Volt  | $R_L = (\text{COMP}) 5\text{ k}\Omega$ to GND, $A_{CL} = 300$                     | 4.9                      | 5         | 5.1       | 4.9        | 5         | 5.1       | V                |
| Low Level Output Volt   | $R_L = (\text{COMP}) 5\text{ k}\Omega$ to GND, $A_{CL} = 300$                     | —                        | 0.4       | 0.9       | —          | 0.4       | 0.9       | V                |
| Slew Rate   |   | 1.3                      | 2         | —         | 1.3        | 2         | —         | V/ $\mu\text{s}$ |
| <b>Current Sense Section</b>                                  |   |                          |           |           |            |           |           |                  |
| Amplifier Gain  | (notes 2, 3)  | 2.7                      | 3         | 3.4       | 2.7        | 3         | 3.4       | V                |
| Max Differential Input Signal ( $V_{P_{in4}} - V_{P_{in3}}$ ) | (note 2)  | 1.1                      | 1.5       | 1.8       | 1.1        | 1.5       | 1.8       | V                |
| Input Offset Voltage  | (note 2)  | 0.4                      | 0.65      | 0.85      | 0.4        | 0.65      | 0.85      | V                |
| CMRR  | $V_{CM} = 1\text{V to } 12\text{V}$ , (note 2)                                    | 40                       | 60        | —         | 40         | 60        | —         | dB               |
| PSRR  | $V_{IN} = 8\text{V to } 16\text{V}$ , (note 2)                                    | 40                       | 60        | —         | 40         | 60        | —         | dB               |
| Input Bias Current  | (note 1)  | —                        | $\pm 1$   | $\pm 100$ | —          | $\pm 1$   | $\pm 100$ | nA               |
| Input Offset Current  | (note 1)  | —                        | $\pm 0.1$ | $\pm 2$   | —          | $\pm 0.1$ | $\pm 2$   | nA               |
| Input Common Mode Range (note 1)                              |   | 0                        | —         | 11        | 0          | —         | 11        | V                |
| Delay to Outputs  | $T_f = 25^\circ\text{C}$ , (note 1)   | 150                      | 225       | 400       | 150        | 225       | 400       | ns               |
| <b>Current Limit Adjust Section</b>                           |   |                          |           |           |            |           |           |                  |
| Current Limit Voltage Offset                                  |   | —                        | $\pm 1$   | $\pm 25$  | —          | $\pm 1$   | $\pm 25$  | mV               |
| Input Impedance (Shutdown Unlatched)                          |   | 3                        | 3.5       | 4         | 3          | 3.5       | 4         | k $\Omega$       |
| <b>Shutdown Terminal Section</b>                              |   |                          |           |           |            |           |           |                  |
| Threshold Voltage   |   | 320                      | 360       | 400       | 320        | 360       | 400       | mV               |
| Input Voltage Range (note 1)                                  |   | 0                        | —         | $V_{IN}$  | 0          | —         | $V_{IN}$  | V                |
| Min Latching Current ( $I_{P_{in1}}$ ) (note 4)               |   | 140                      | —         | —         | 140        | —         | —         | $\mu\text{A}$    |
| Max Non-Latching Current ( $I_{P_{in1}}$ ) (note 5)           |   | —                        | —         | 65        | —          | —         | 65        | $\mu\text{A}$    |
| Min Pulse Width (note 1)                                      |   | 100                      | 50        | —         | 100        | 50        | —         | ns               |
| Delay to Outputs (note 1)                                     |   | 125                      | 250       | 400       | 125        | 250       | 400       | ns               |

# CMOS CURRENT MODE PWM CONTROLLER

TC18C46/7  
TC28C46/7  
TC38C46/7

**ELECTRICAL CHARACTERISTICS (Cont):** unless otherwise stated, these specifications apply for  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$  for TC18C46/TC18C47;  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$  for the TC28C46/TC28C47; and  $0^\circ\text{C}$  to  $+70^\circ\text{C}$  for the TC38C46/TC38C47;  $V_{IN} = V_{DD} = 16\text{V}$ ;  $R_T = 30.1\text{k}$ ;  $C_T = 270\text{pF}$ .

| Parameter                           | Test Conditions            | TC18C46/47<br>TC28C46/47 |     |     | TC38C46/47 |     |     | Units         |
|-------------------------------------|----------------------------|--------------------------|-----|-----|------------|-----|-----|---------------|
|                                     |                            | Min                      | Typ | Max | Min        | Typ | Max |               |
| <b>Output Section</b>               |                            |                          |     |     |            |     |     |               |
| Output Low Level $r_{DS(ON)}$       | $I_{SINK} = 20\text{mA}$   | —                        | 10  | 20  | —          | 10  | 20  | $\Omega$      |
| Output High Level $r_{DS(ON)}$      | $I_{SOURCE} = 20\text{mA}$ | —                        | 20  | 35  | —          | 20  | 35  | $\Omega$      |
| Output Rise Time                    | $C_L = 1\text{mF}$         | —                        | 55  | 90  | —          | 55  | 90  | ns            |
| Output Fall Time                    | $C_L = 1\text{mF}$         | —                        | 55  | 90  | —          | 55  | 90  | ns            |
| <b>Undervoltage Lockout Section</b> |                            |                          |     |     |            |     |     |               |
| Undervoltage Threshold              |                            | 6.6                      | 7   | 7.3 | 6.6        | 7   | 7.3 | V             |
| Start Threshold                     |                            | 7.5                      | 7.8 | 8   | 7.5        | 7.8 | 8   | V             |
| Threshold Hysteresis                |                            | 0.6                      | 0.8 | 1   | 0.6        | 0.8 | 1   | V             |
| <b>Total Standby Current</b>        |                            |                          |     |     |            |     |     |               |
| Supply Current                      |                            | —                        | 1.2 | 2.5 | —          | 1.2 | 2   | mA            |
| Start-Up Current                    |                            | —                        | 250 | 350 | —          | 250 | 350 | $\mu\text{A}$ |

- NOTES:**
1. These parameters, although guaranteed over the recommended operating conditions, are not tested in production.
  2. Parameter measured at trip point of latch with  $V_{Pin 6} = V_{REF}$ .  $V_{Pin 16} = 0\text{V}$ .
  3. Amplifier gain is defined as:  $G = \frac{\Delta V_{Pin 7}}{\Delta V_{Pin 4}}$ ;  $\Delta V_{Pin 4} = 0\text{V}$  to  $1\text{V}$

4. Current into Pin 1 guaranteed to latch circuit in shutdown state.
5. Current into Pin 1 guaranteed not to latch circuit in shutdown state.

TC18C46/7  
TC28C46/7  
TC38C46/7

## Peak Current Limit Setup

Resistors R1 and R2 at the current limit input (pin 1) set the peak current limit (Figure 1). The potential at pin 1 is easily calculated:

$$V1 = V_{REF} \frac{R2}{R1 + R2}$$

R1 should be selected first. The shutdown circuit feature is not latched for  $(V_{REF} - 0.35)/R1 < 65 \mu\text{A}$  and is latched for currents greater than  $140 \mu\text{A}$ .

The error amplifier output voltage is clamped from going above V1 through the limit buffer amplifier. Peak current is sensed by RS and amplified by the current amplifier which has a fixed gain of 3.

$I_{PCL}$ , the peak current limit, is the current that causes the PWM comparator noninverting input to exceed V1; the potential at the inverting input. Once the comparator trip point is exceeded, both outputs are disabled.

$I_{PCL}$  is easily calculated:

$$I_{PCL} = \frac{V1 - 0.65V}{3 (RS)}$$

where:

$$V1 = V_{REF} \frac{R2}{R1 + R2}$$

$V_{REF}$  = Internal voltage reference = 5.1V

3 = Gain of current-sense amplifier

0.65V = Current limit offset

Both driver outputs (pins 11 and 14) are OFF (low) when the peak current limit is exceeded. When the sensed current goes below  $I_{PCL}$ , the circuit operates normally.

## Output Shutdown

The outputs can be turned off quickly through the shutdown input (pin 16). A signal greater than 360 mV at pin 16 forces the shutdown comparator output high. The PWM latch is held set, disabling the outputs.

Q2 is also turned on. If  $V_{REF}/R1$  is greater than  $140 \mu\text{A}$ , positive feedback through the lock-up amplifier and Q1 keeps the inverting PWM comparator inverting input below 0.65V. Q3 remains on even after the shutdown input signal is removed. This is because the lock-up amplifier is in latched mode driving Q3 on. This state can be cleared only through a power-up cycle. Outputs will be disabled whenever the potential at pin 1 is below 0.65V.

The shutdown terminal gives a fast, direct way to disable the PWM controller output transistors. System protection and remote shutdown applications are possible.

The input pulse to pin 16 should be at least 100 ns wide and have an amplitude of at least 1V in order to get the minimum propagation delay from input to output. If these parameters are met, the delay should be less than 400 ns at 25°C; however, the delay time will increase as the device temperature rises.

## Soft Restart From Shutdown

A soft restart can be programmed if nonlatched shutdown operation is used.

A capacitor at pin 1 will cause a gradual increase in potential toward V1. When the voltage at pin 1 reaches 0.75V, the PWM latch set input is removed and the circuit establishes a regulated output voltage. The soft-start operation forces the PWM output drivers to initially operate with minimum duty cycle and low peak currents.

Even if a soft start is not required, it is necessary to insert a capacitor between pin 1 and ground if the current  $I_L$  is greater than  $140 \mu\text{A}$ . This capacitor will prevent "noise triggering" of the latch, yet minimize the soft-start effect.

## Soft-Start Power-Up

During power-up, a capacitor at R1, R2 initiates a soft-start cycle. As the input voltage (pin 15) exceeds the undervoltage lockout potential (7V), Q4 is turned off, ending undervoltage lockout. Whenever the PWM comparator inverting input is below 0.65V, both outputs are disabled.

When the undervoltage lockout start threshold is exceeded, the capacitor begins to charge. The PWM duty cycle increases until the operating output voltage is reached. Soft-start operation forces the PWM output drivers to initially operate with minimum duty cycle and low peak current.

## Current-Sense Amplifier

The current-sense amplifier operates at a fixed gain of 3. Maximum differential input voltage ( $V_{PIN4} - V_{PIN3}$ ) is 1.1V. Common-mode input voltage range is 0V to  $V_{IN} - 3V$ .

Resistive-sensing methods are shown in Figure 2. In Figure 2(A), a simple RC filter limits transient voltage spikes at pin 4, caused by external output transistor-collector capacitance. Transformer coupling (Figure 3) offers isolation and better power efficiency, but cost and complexity increase.

In order to minimize the propagation delay from the input to the current amplifier to the output terminals, the current ramp should be in the order of  $1 \mu\text{s}$  in width (min). Typical time delay values are in the 225 ns region at 25°C. The delay time increases with device temperature so that at 50°C, the delay times may be increased by as much as 100 ns.

# CMOS CURRENT MODE PWM CONTROLLER

TC18C46/7  
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TC38C46/7

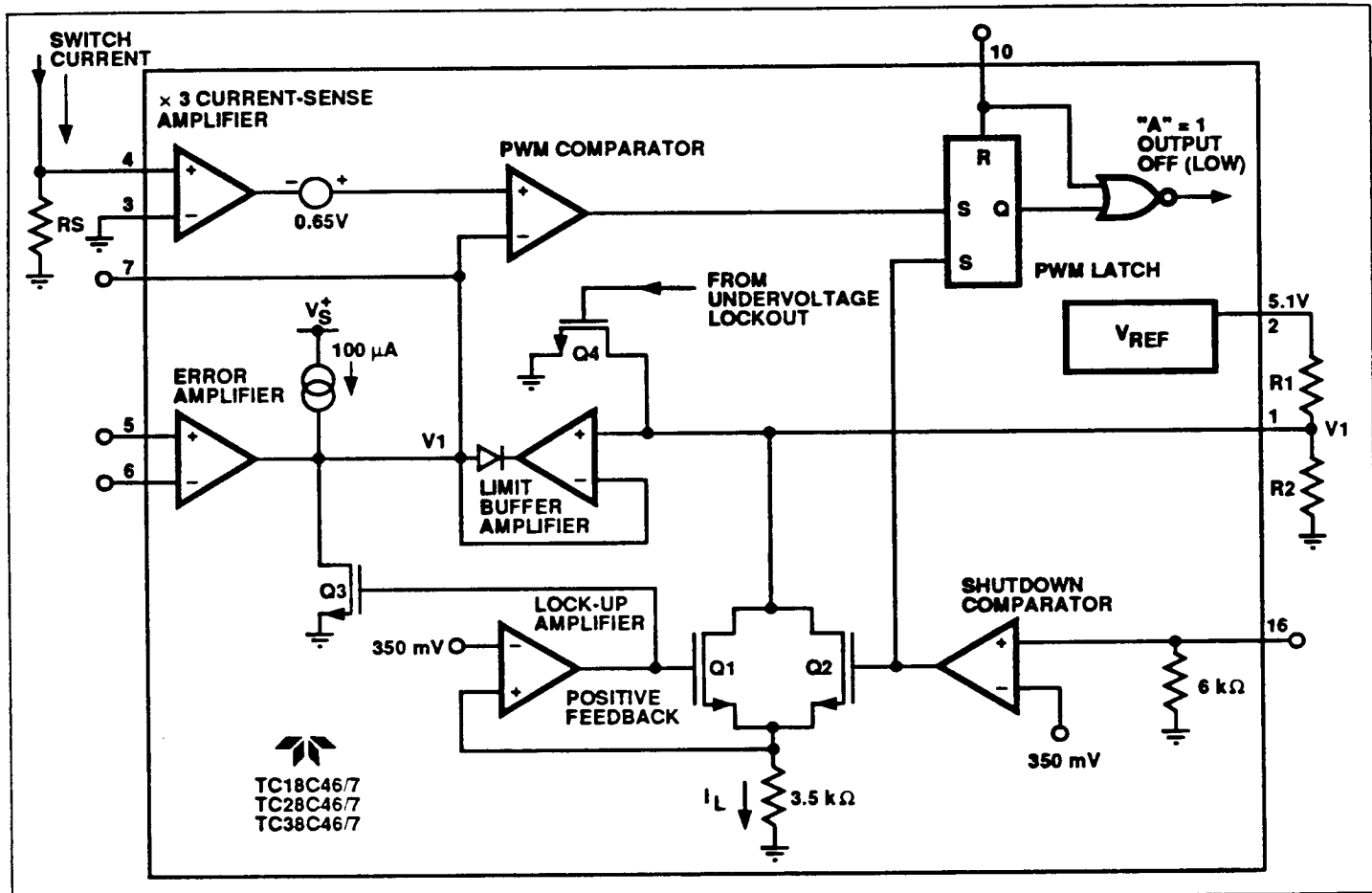


Figure 1 R1 and R2 Set Maximum Peak Output Current

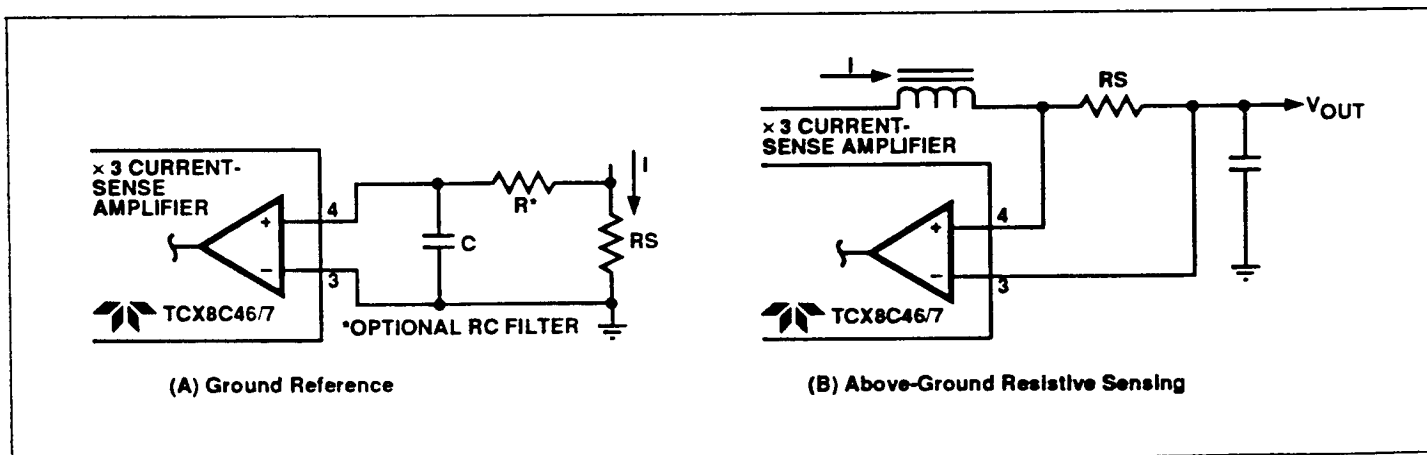


Figure 2 Resistive Sensing



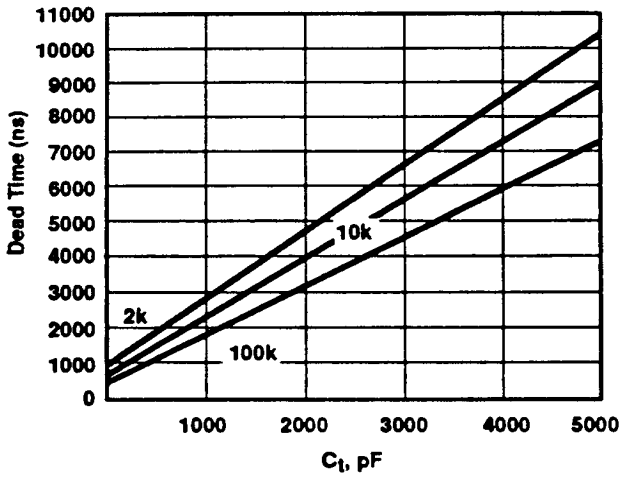




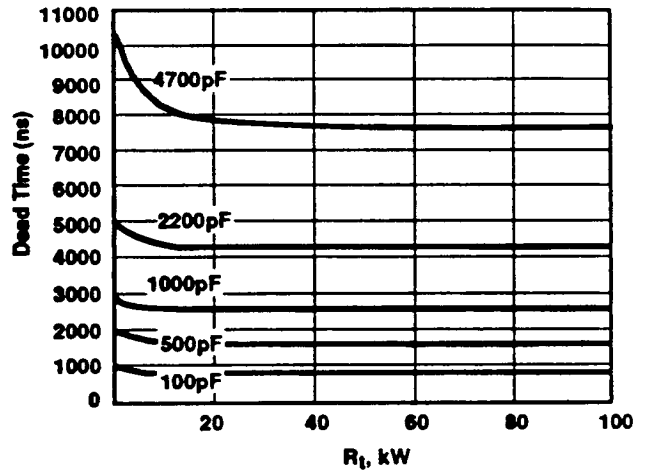
TC18C46/7  
TC28C46/7  
TC38C46/7

TYPICAL CHARACTERISTIC CURVES

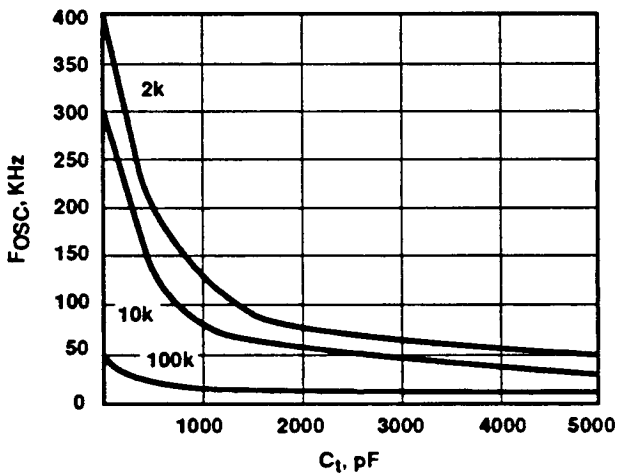
18C46 Dead Time



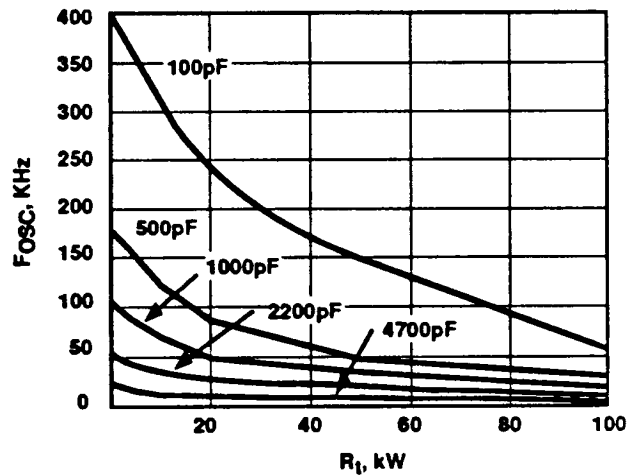
Dead Time vs.  $R_l$   
18C46 Dead Time



Dead Time vs.  $C_t$   
18C46 OSC Frequency



Dead Time vs.  $R_l$   
18C46 OSC Frequency



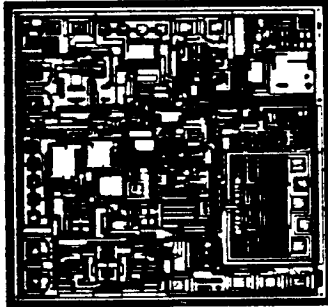
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**PIN DESCRIPTIONS**

| <b>PIN</b> | <b>DESCRIPTION</b>  |
|------------|---|
| 1          | <b>CURRENT LIMIT, SOFT START ADJUST</b> pin is for setting the peak current limit threshold of sense inputs of pin 3 and 4. Second function of this pin is for Soft-Start programming with a capacitor between this pin and ground, pin 12.             |
| 2          | <b>V<sub>REF</sub></b> pin is an output for the reference supply voltage of 5.1 volts. This reference can supply a minimum of 20 mA of output current.  |
| 3          | – <b>CURRENT SENSE INPUT</b> pin is for current sense inverting input for sensing peak current of pass transistor through series current monitor resistor.  |
| 4          | + <b>CURRENT SENSE INPUT</b> pin is the non-inverting input for sensing peak current of pass transistor. The positive end of the current sense resistor is connected here.  |
| 5          | + <b>ERROR AMP INPUT</b> pin is the non-inverting input for sensing voltage feedback from output or voltage regulation.   |
| 6          | – <b>ERROR AMP INPUT</b> pin is the inverting input for sensing the reference voltage to regulate the output.   |
| 7          | <b>COMPENSATION</b> pin is for compensation of the feedback loop response.  |
| 8          | <b>C<sub>T</sub></b> pin is for timing capacitor, <b>C<sub>T</sub></b> input to set oscillator frequency in conjunction with pin 9, <b>R<sub>T</sub></b> , resistor input. Second function is for setting crossover dead time of pin 11 and 14 outputs. |
| 9          | <b>R<sub>T</sub></b> pin is for timing resistor, <b>R<sub>T</sub></b> input to set oscillator frequency by setting the constant current charge rate to charge capacitor, <b>C<sub>T</sub></b> .   |
| 10         | <b>SYNC</b> pin is for input or output of oscillator synchronization pulse.   |
| 11         | <b>OUTPUT A</b> pin is the output drive of phase A to drive push pull transistor of phase A.  |
| 12         | <b>GROUND</b> pin is the ground return path for all inputs and output signals.  |
| 13         | <b>V<sub>DD</sub></b> pin is the supply power input terminal which supplies power to operate the output drivers.  |
| 14         | <b>OUTPUT B</b> pin is the output drive of phase B to drive push pull transistor of phase B.  |
| 15         | <b>V<sub>IN</sub></b> pin is voltage bias supply input for circuits except the output drive circuits.   |
| 16         | <b>SHUTDOWN</b> pin is an input for shutdown when 350 mV threshold is exceeded. Both output drives will be terminated.  |

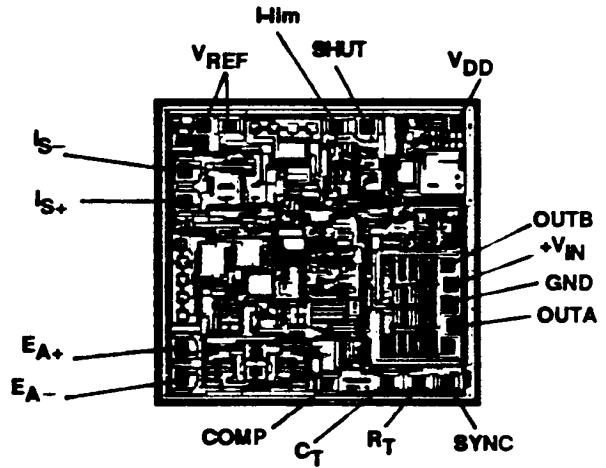
TC18C46/7  
TC28C46/7  
TC38C46/7

**BONDING DIAGRAM**



- Notes: 1. Backside of die is common to  $V_{DD}$   
2. Backside of die is not metallized

**OUTPUT LOCATIONS**



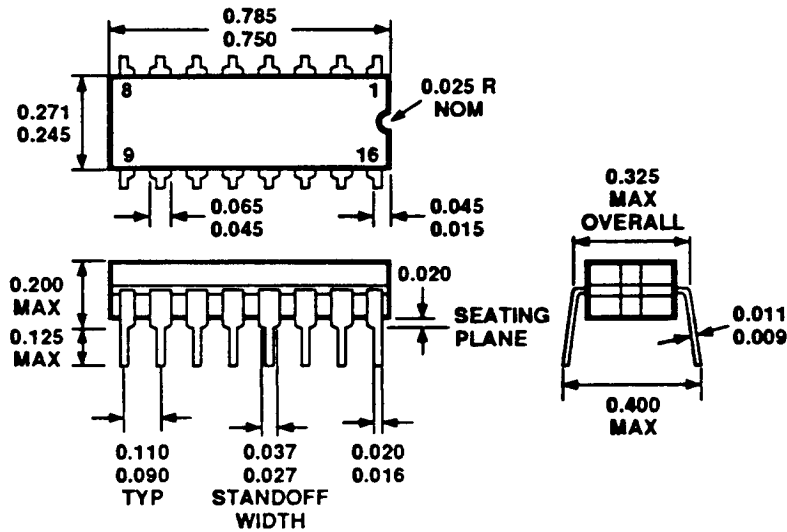
# CMOS CURRENT MODE PWM CONTROLLER

TC18C46/7  
TC28C46/7  
TC38C46/7

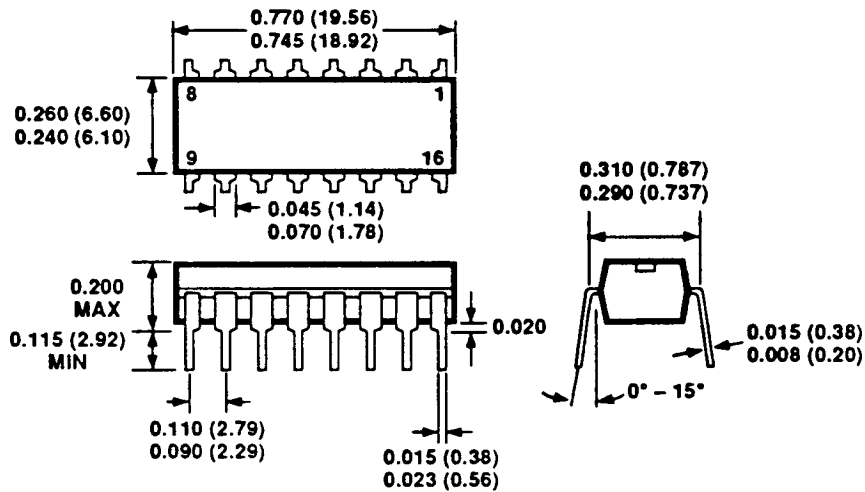
## PACKAGE DIMENSIONS

Dimensions: inches (mm)

### 16-Pin CerDIP (Package JE)

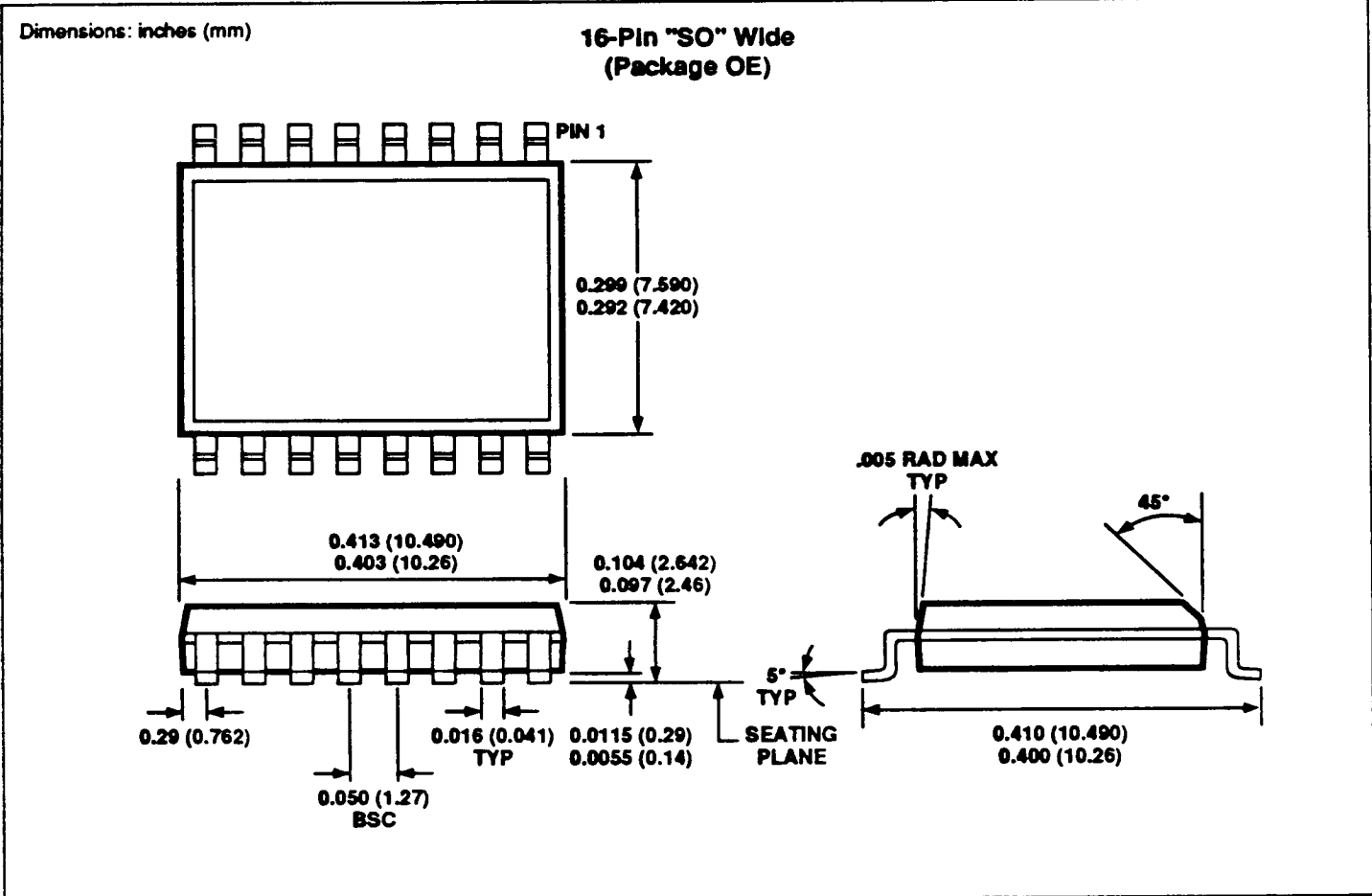


### 16-Pin Plastic DIP (Package PE)



**TC18C46/7  
TC28C46/7  
TC38C46/7**

**PACKAGE DIMENSIONS**



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