Current Mode PWM Control

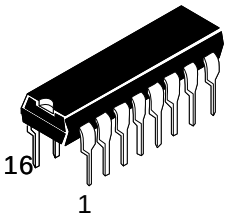
DESCRIPTION

The HT3846A IC provides all of the necessary features to implement fixed frequency, current mode control schemes while maintaining minimum external parts count. The superior performance of this technique can be measured in improved line regulation, enhanced load response characteristics, and a simpler, easier-to-design control loop. Topological advantages include inherent pulse-by-pulse current limiting capability, automatic symmetry correction for push-pull converters, and the ability to parallel "power modulest' while maintaining equal current sharing.

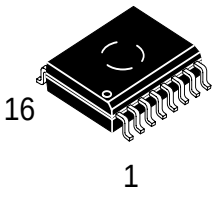
Other features include fully latched operation, double pulse suppression, deadline adjust capability, and a ± 1% trimmed bandgap reference.

FEATURES

- Automatic Feed Foward Compensation
- Programmalbe Pulse-by-Pluse Current
- Automatic Symmetry Correction in Push-pull Configuration
- Enhanced Load Response Characteristics
- Parallel Operation Capability for Modular Power Systems
- Differential Current Sense Amplifier with Wide Common Mode Range
- Double Pulse Suppression
- 500mA (Peak) Totem- pole Outputs
- 1% Bandgap Reference
- Under-voltage Lockout
- Soft Start Capability
- Shutdown Terminal
- 500 kHZ Operation

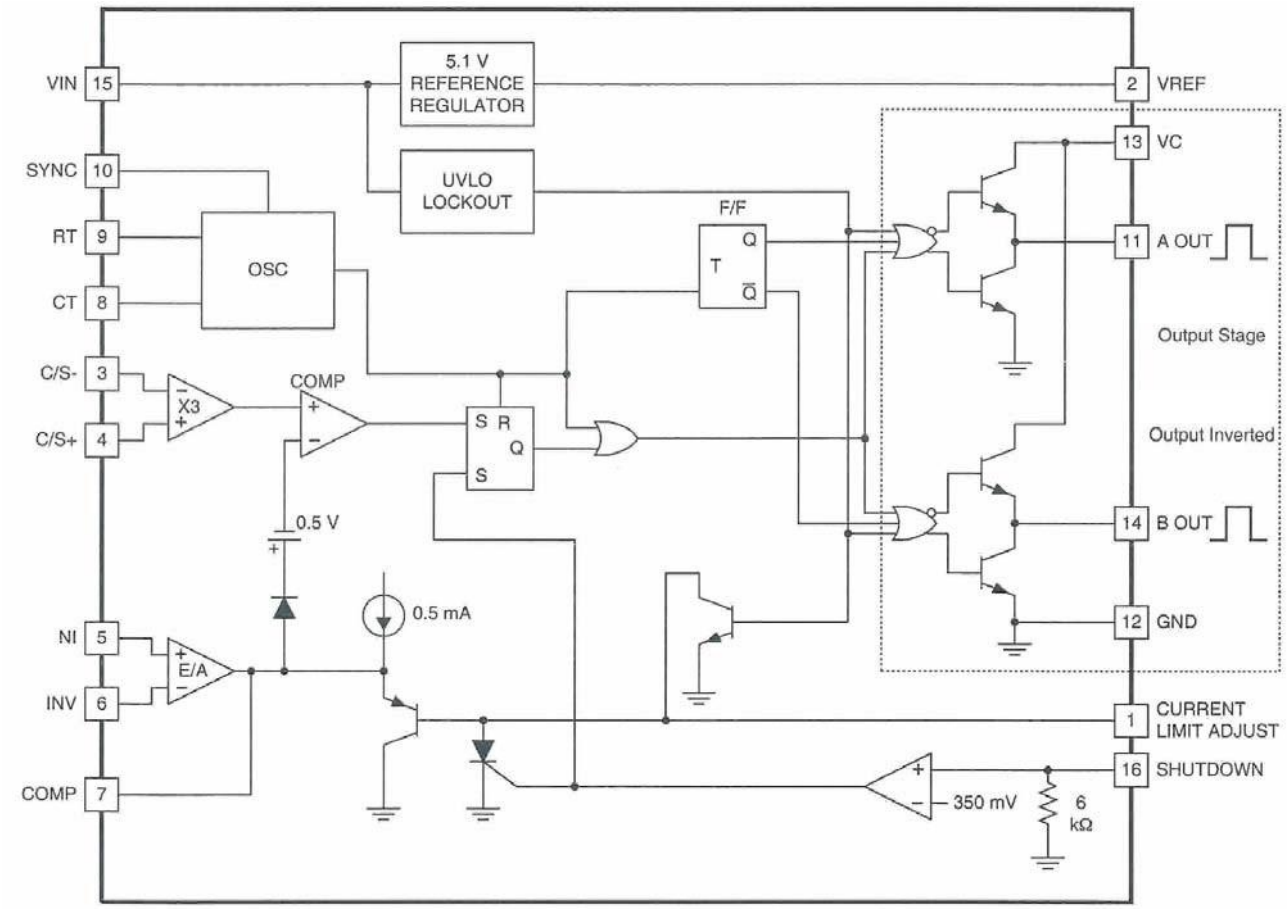


HT3846ANZ: DIP16-300-2.54

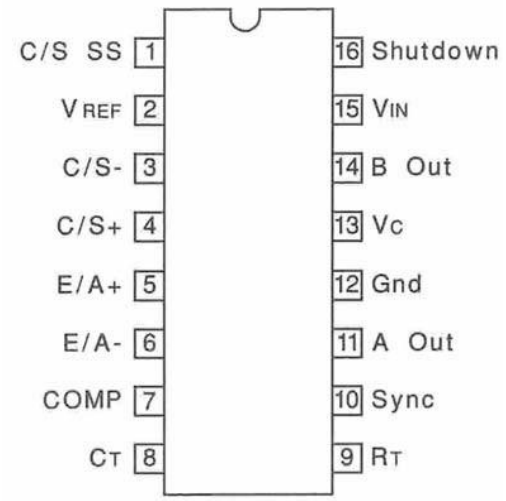


HT3846ARWZ:WSOP16-300-1.27

BLOCK DIAGRAM



PIN CONNECTION



PIN DESCRIPTION

PACKAGE PIN FUNCTION	
FUNCTION	PIN
C/S SS	1
V_{REF}	2
C/S-	3
C/S+	4
E/A+	5
E/A-	6
Comp	7
C_T	8
R_T	9
Sync	10
A Out	11
Gnd	12
Vc	13
B Out	14
V_{IN}	15
Shutdown	16

ABSOLUTE MAXIMUM RATINGS *

Characteristic		Limit	Unit
Supply voltage(pin 15)		40	V
Collector supply voltage(pin 13)		40	V
Output current,source or sink(pins 11,14)		500	mA
Analog inputs(pins 3,4,5,6,16)		-0.3～+V_{IN}	V
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
Power dissipation	Ta=25℃	1000	mW
	Tc=25℃	2000	mW
Storage temperature range		-65～+150	℃
Lead temperature (soldering, 10 seconds)		300	℃

Note 1. AIl voltages are with respect to Ground, Pin 13 . Currents are positive into, negative out of the speflcied terminal. Consult Packaging Section of Databook for thermal lhitafbns and considerations of packages. Pin numbers refer to DIL and SOlC packages only.

ELECTRICAL CHARACTERISTICS:

(Unless otherwise slated, these specifications apply for 0℃ to + 70 °C V_{IN} = 15V , R_T =10 k, C_T=4.7nF, T_A=T_J.)

Characteristic	Test conditions	Min.	Typ.	Max	Unit
Reference Section					
Output voltage	T_J=25℃,I_O=1mA	5.00	5.10	5.20	V
Line regulation	V_{IN} =8V to 40V		5	20	mV
Load regulation	I_L=1mA to 10mA		3	15	mV
Temperature stability	Over operating range *2		0.4		mV/℃
Total output variation	Line,load and temperature *2	4.95		5.25	V
Output noise voltage	10Hz≤ f≤ 10kHz, T_J=25℃ *2		100		μV
Long term stability	T_J=25℃,1000Hrs *2		5		mV
Short circuit output current	V_{REF}=0V	-10	-45		mA

Continues:

Characteristic	Test conditions	Min.	Typ.	Max	Unit
Oscillator Section					
Initial accuracy	T_J=25℃	39	43	47	kHz
Voltage stability	V_{IN} =8V to 40V		-1	2	%
Temperature stability	Over operating range *2		-1		%
Sync output high level		3.9	4.35		V
Sync output low level			2.3	2.5	V
Sync input high level	Pin 8= 0V	3.9			V
Sync input low level	Pin 8= 0V			2.5	V
Sync input current	Sync voltage=3.9V,Pin 8=0V		1.3	1.5	mA
Error Amp Section					
Input offset voltage			0.5	10	mV
Input bias current			-0.6	-2	μA
Input offset current			40	250	nA
Common mode range	V_{IN} =8V to 40V	0		V_{IN}-2	V
Open loop voltage gain	Δ Vo=1.2V to 3V, V_{CM} =2V	80	105		dB
Unity gain bandwidth	T_J=25℃ *2	0.7	1.0		MHz
CMRR	V_{CM}=0V to 38V, V_{IN}=40V	75	100		dB
PSRR	V_{IN} =8V to 40V	80	105		dB
Output sink current	V_{ID}=-15mV to -5V, V_{PIN7}=1.2V	2	6		mA
Output source current	V_{ID} =15 mV to 5V, V_{PIN7}=2.5V	-0.4	-0.5		mA
High level output voltage	R_L =(Pin 7) 15kΩ	4.3	4.6		V
Low level output voltage			0.7	1	V
Current Sense Amplifier Section					
Amplifier gain	V_{PIN3} =0V, Pin 1 open *3,4	2.5	2.75	3.0	V
Maximum differential input signal (V_{PIN4}-V_{PIN3})	Pin 1 open *3 R_L =(Pin 7) 15kΩ	1.1	1.2		V
Input offset voltage	V_{PIN1} =0.5V, Pin7 open *3		5	25	mV
CMRR	V_{CM} =1V to 12V	60	83		dB
PSRR	V_{IN} =8V to 40V	60	84		dB
Input bias current	V_{PIN1} =0.5V, Pin7 open *3		-2.5	-10	μA
Input offset current	V_{PIN1} =0.5V, Pin7 open *3		0.08	1	μA
Input common mode range		0		V_{IN}-3	V
Delay to outputs	T_J=25℃ *2		200	500	ns

Continues:

Characteristic	Test conditions	Min.	Typ.	Max	Unit
Current Limit Adjust Section					
Current limit offset	V_{PIN3} =0V, V_{PIN4} =0V,Pin 7 open *3	0.45	0.5	0.55	V
Input bias current	V_{PIN5}= V_{REF}, V_{PIN6}=0V		-10	-30	μA
Shutdown Terminal Section					
Threshold voltage		250	350	400	mV
Input voltage range		0		V_{IN}	V
Minimum latching current (I_{PIN1})	*6	3.0	1.5		mA
Shutdown Terminal Section (cont.)					
Maximum non-latching current (I_{PIN1})	*7		1.5	0.8	mA
Delay to outputs	T_J=25℃ *2		300	600	ns
Output Section					
Collector-emitter voltage		40			V
Collector leakage current	Vc=40V *5			200	μA
Output low level	I_{SINK}=20mA		0.1	0.4	V
	I_{SINK}=100mA		0.4	2.1	V
Output high level	I_{SOURCE}=20mA	13	13.5		V
	I_{SOURCE}=100mA	12	13.5		V
Rise time	C_L =1nF, T_J=25℃ *2		50	300	ns
Fall time	C_L =1nF, T_J=25℃ *2		50	300	ns
Under-Voltage Lockout Section					
Start-up threshold			7.7	8.0	V
Threshold hysteresis			0.75		V
Total Standby Current					
Supply current			17	21	mA

*2. These parameters, although ensured over the recommended operating conditions, are not 100% tested in production.

*3. Parameter measured at trip point of latch with V_{PIN5} = V_{REF}; V_{PIN6} = 0V

*4. Amplifier gain defined as: $G = \frac{\Delta V_{PIN7}}{\Delta V_{PIN4}}$; V_{PIN4} =0 to 1.0V

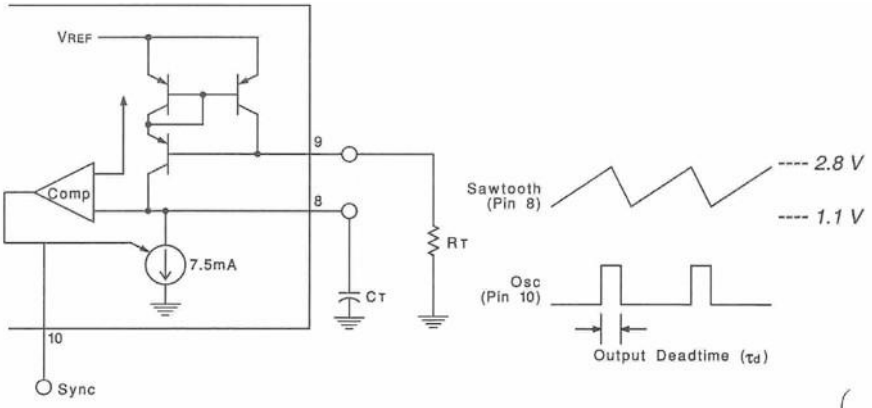
*5. Applies to HT3846A only due to polarity of outputs

*6. Current into Pin1 ensured to latch circuit in shutdown state.

*7. Current into Pin1 ensured not to latch circuit in shutdown state.

APPLICATION DATA

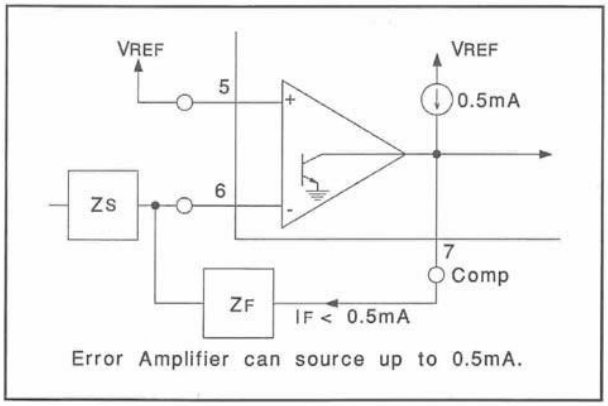
Oscillator Circuit



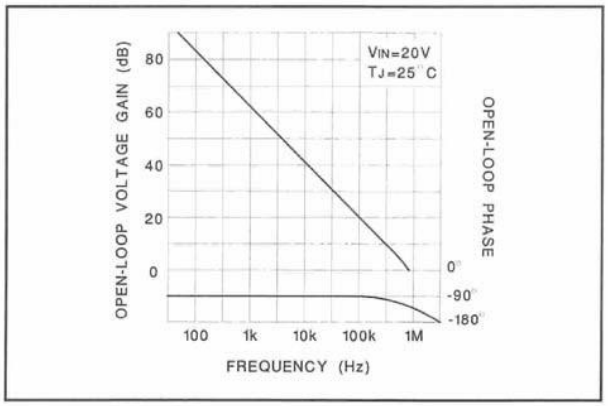
Output deadtime is determined by the external capacitor, CT, according to the formula: $\tau d\ (\mu s) = 145CT\ (\mu f)\left(\frac{ID}{ID - \frac{3.6}{RT\ (k\Omega)}}\right)$.

ID = Oscillator discharge current at 25°C is typically 7.5.
For large values of RT: $\tau d\ (\mu s) \approx 145CT\ (\mu f)$.
Oscillator frequency is approximated by the formula: $fT\ (kHz) \approx \frac{2.2}{RT\ (k\Omega) \bullet CT\ (\mu f)}$.

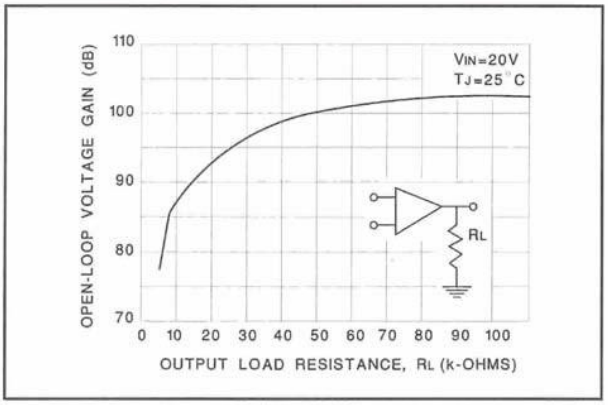
Error Amp Output Configuration



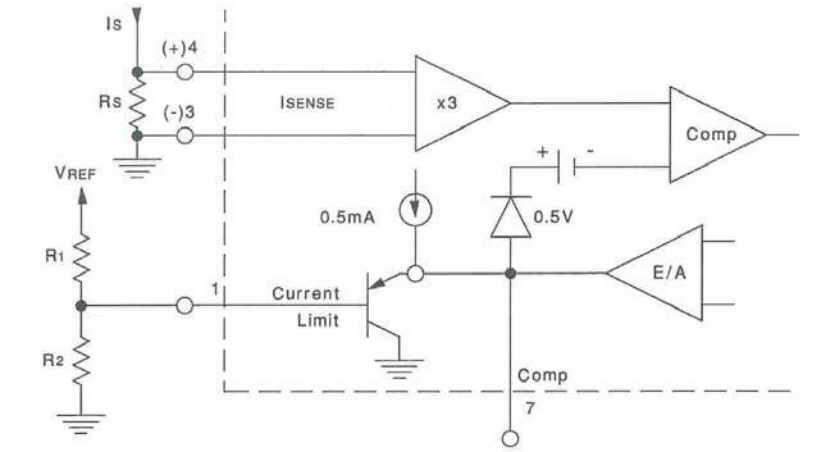
Error Amp Gain and Phase vs Frequency



Error Amp Open-Logic D.C. Gain vs Load Resistance

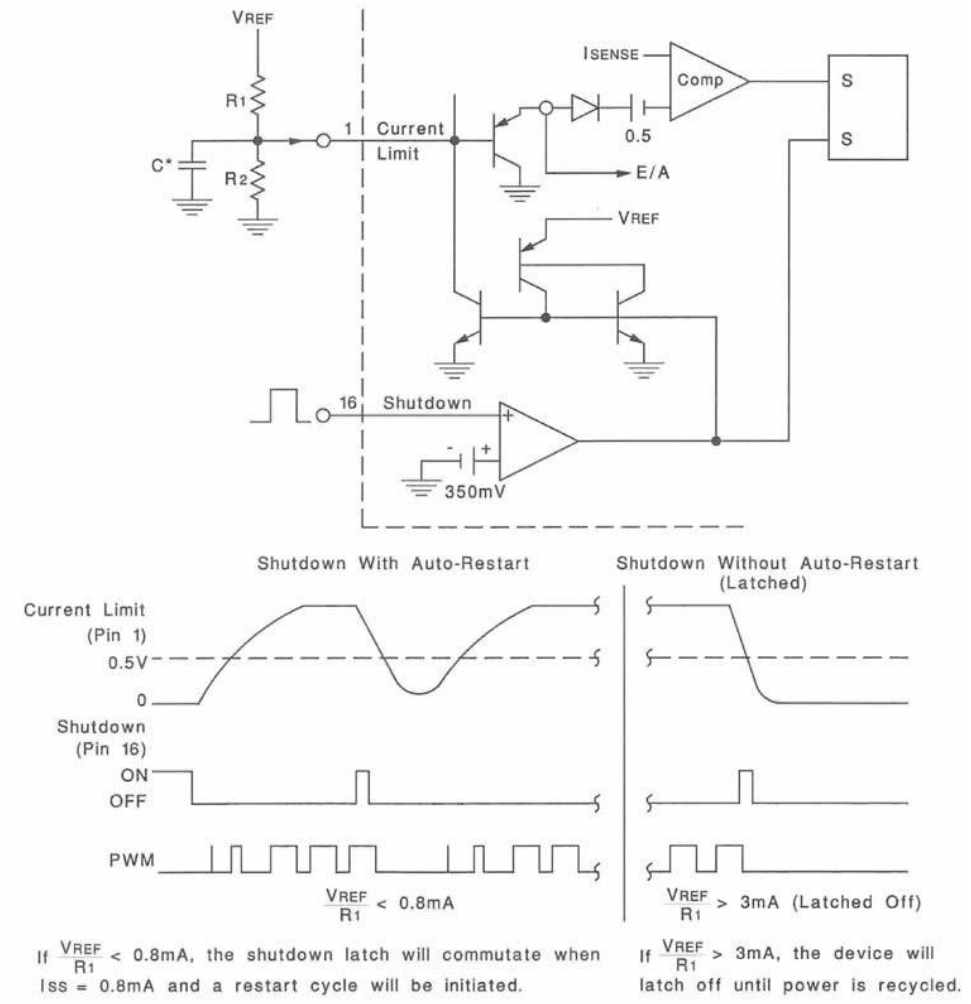


Pulse by Pulse Current Limiting



Peak Current (Is) is determined by the formula: $IS = \frac{\frac{R2\,VREF}{R1 + R2} - 0.5}{3RS}$

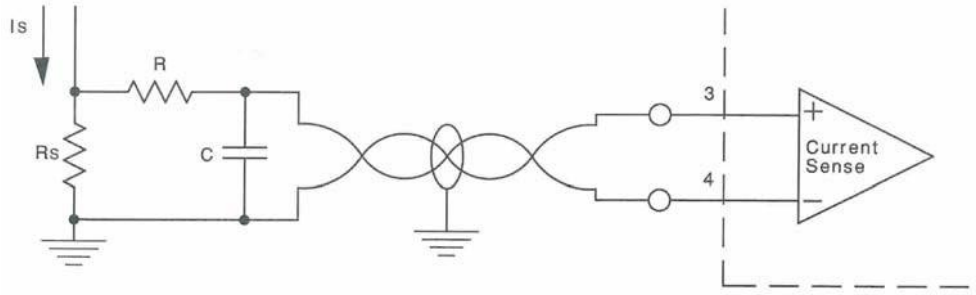
Soft Start and Shutdown/Restart Function



If $\frac{VREF}{R1}$ < 0.8mA, the shutdown latch will commutate when Iss = 0.8mA and a restart cycle will be initiated.

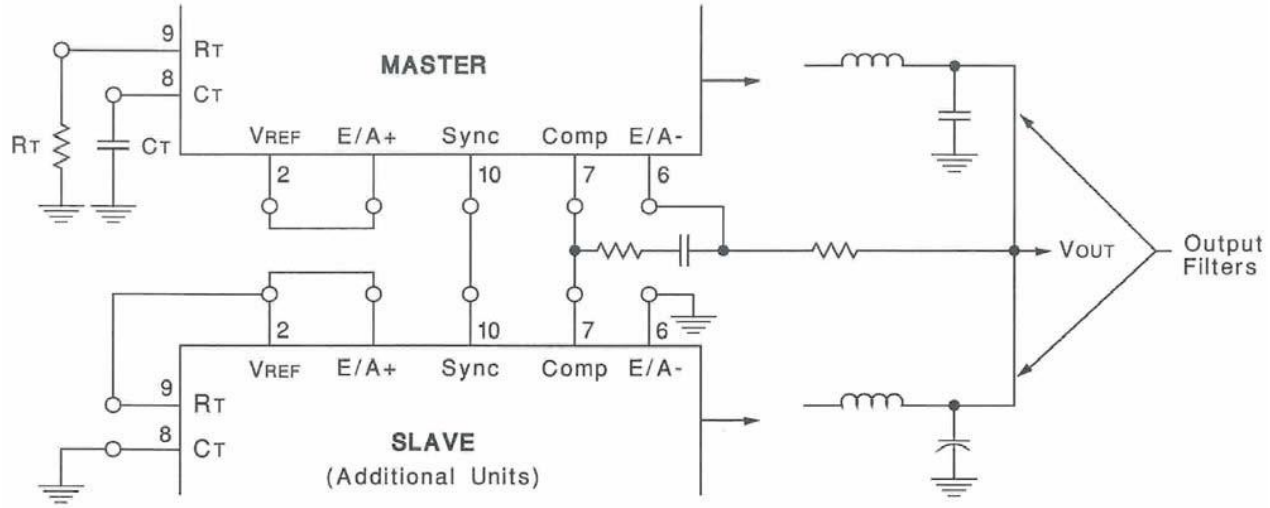
If $\frac{VREF}{R1}$ > 3mA, the device will latch off until power is recycled.

Current Sense Amp Connection



A small RC filter may be required in some applications to reduce switch transients. Differential input allows remote, noise free sensing.

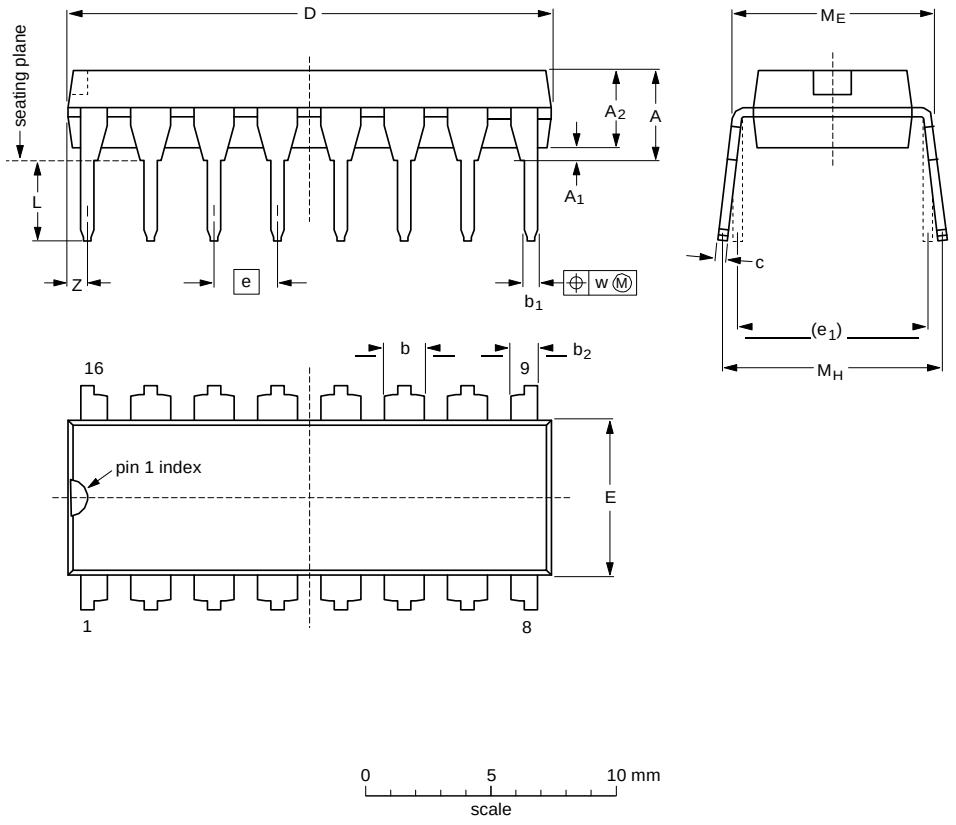
Parallel Operation



Slaving allows parallel operation of two or more units with equal current sharing.

OUTLINE DRAWING

DIP16: plastic dual in-line package; 16 leads (300 mil)



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	b_2	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.030

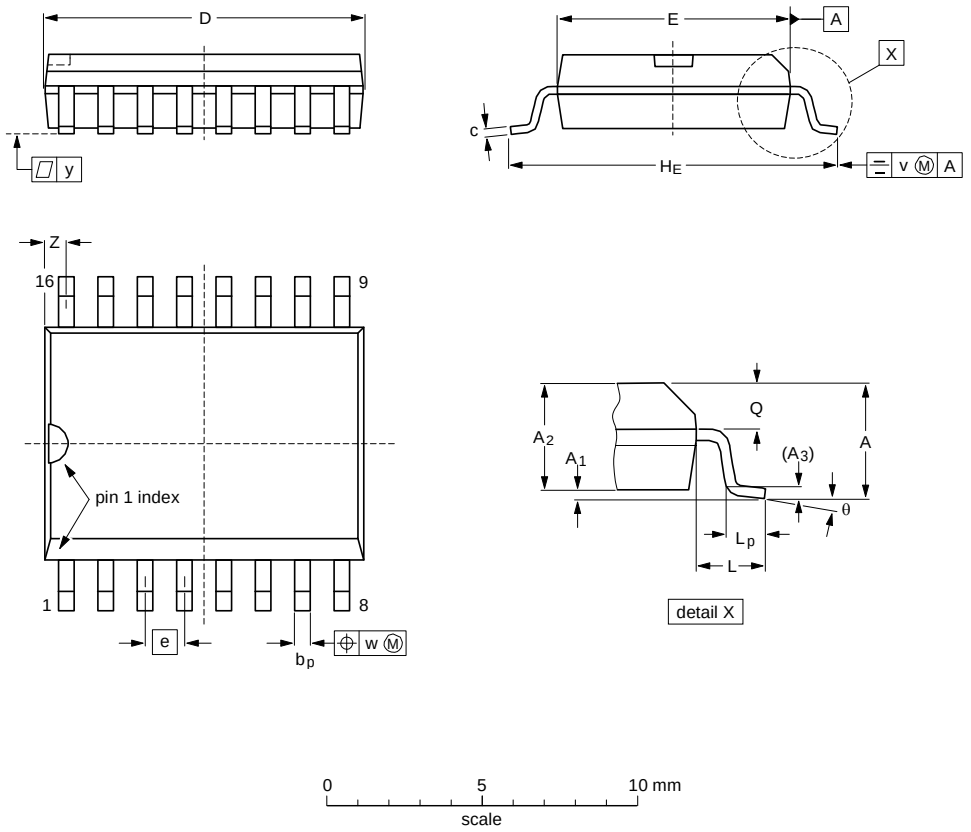
Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-4						~~92-11-17~~ 95-01-14

OUTLINE DRAWING

WSOP16: plastic small outline package; 16 leads; body width 7.5 mm



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	10.5 10.1	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.41 0.40	0.30 0.29	0.050	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT162-1	075E03	MS-013				~~97-05-22~~ 99-12-27