

Pulse Width Modulation Circuit

Description

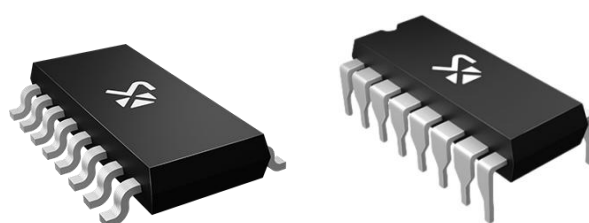
SKI3524 is a pulse-width modulation (PWM) controller designed for switching power supplies. It integrates a reference voltage source, error amplifier, oscillator, PWM modulator, pulse width control flip-flop, dual alternating outputs, current limiting circuit, and shutdown circuit.

This controller is suitable for switching power supply control of any polarity, transformer-coupled DC-DC switching power supplies, transformer boost and polarity conversion, as well as other power supply applications. The operating temperature range of SKI3524 is 0° C to +70° C.

Features

- Integrated 5V reference voltage source
- Oscillation frequency range: 100Hz~300KHz
- Excellent external synchronization function
- Dual outputs with 50mA per channel
- Built-in current limiting circuit
- Complete PWM control circuit
- Single-ended or push-pull output
- Total power supply current consumption less than 10mA

Package Outline Drawing



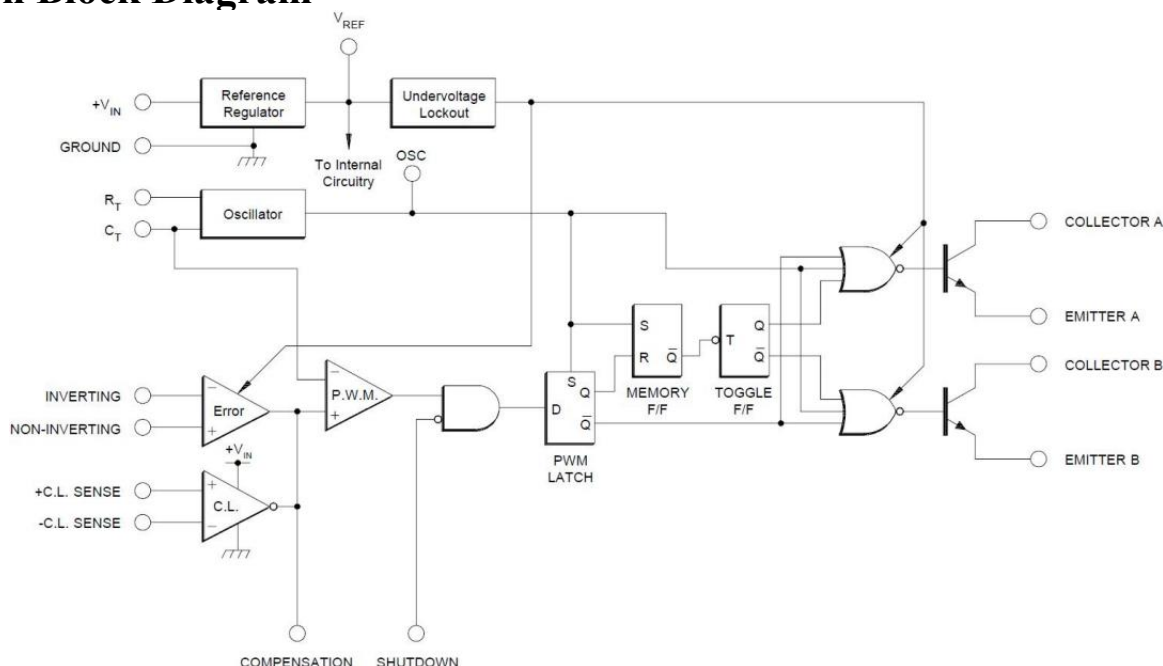
SOP-16

DIP-16

Ordering Information

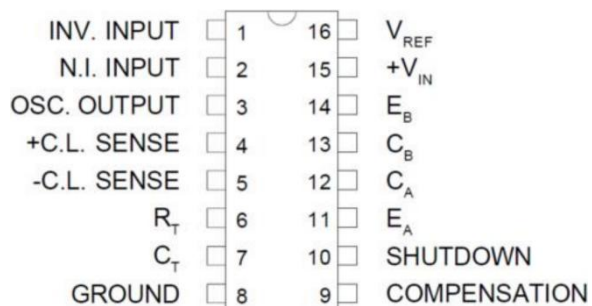
Type	Marking	Package
SKI3524-D16	3524	DIP-16
SKI3524-P16	3524	SOP-16

Function Block Diagram





Pin Description



Absolute Maximum Ratings ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	42	V
Collector Voltage	V_C	40	V
Logic Input Voltage	V_{IL}	-0.3~5.5	V
Current Limit Pin Differential Input	$V_{DIFF(LIM)}$	-0.3~0.3	V
Output Current per Channel	I_O	100	mA
Reference Voltage Load	I_{REF}	40	mA
Oscillator Pin Charging Current	I_{OSC}	5	mA
Operating Junction Temperature	T_J	150	$^{\circ}\text{C}$
Operating Ambient Temperature	T_A	0~70	$^{\circ}\text{C}$

Recommended Operating Conditions ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	8~40	V
Collector Voltage	V_C	0~40	V
Error Amplifier Common-Mode Input Voltage	V_{CM}	1.8~3.4	V
Current Limit Pin differential Input	$V_{DIFF(LIM)}$	-0.3~0.3	V
Output Current per Channel	I_O	0~50	mA
Reference Voltage Load	$I_{REF(Load)}$	0~20	mA
Oscillator Pin Charging Current	$I_{OSC(Charge)}$	0.03~2	mA
Oscillation Frequency	F_{OSC}	0.1~300	KHz
Oscillation Resistance	R_T	1.8~100	K Ω
Oscillation Capacitance	C_T	1~1000	nF
Operating Junction Temperature	T_J	150	$^{\circ}\text{C}$
Operating Ambient Temperature	T_A	0~70	$^{\circ}\text{C}$



Electrical Characteristics($T_A=25^{\circ}\text{C}$, $V_{CC}=20\text{ V}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Reference Voltage Section $V_{REF}(I_L=0\text{mA}$ unless stated otherwise)						
Output Voltage	V_{REF}		4.8	5.0	5.2	V
Line Regulation	$\Delta V_{REF(\text{Line})}$	$V_{IN}=8\text{V}\sim 40\text{V}$			30	mV
Load Regulation	$\Delta V_{REF(\text{Load})}$	$I_L=0\sim 20\text{mA}$			50	mV
Reference Short-Circuit Current	$I_{REF\text{SHORT}}$	$V_{REF}=0\text{V}$	25		150	mA
Oscillator Section ($F_{OSC}=40\text{KHz}$, $R_T=2.9\text{k}\Omega$, $C_T=0.01\mu\text{F}$ Unless Stated Otherwise)						
Operating Frequency	F_{OSC}		36		44	KHz
Frequency Voltage Drift	$\Delta F_{OSC(VIN)}$	$V_{IN}=8\text{V}\sim 40\text{V}$			1	%
Maximum Oscillation Frequency	$F_{OSC(\text{MAX})}$	$R_T=2\text{K}\Omega$, $C_T=1\text{nF}$	200	400		KHz
Oscillation Waveform Peak Value	$F_{OSC(\text{Peak})}$		3		3.9	V
Oscillation Waveform Valley Value	$V_{OSC(\text{Valley})}$		0.6		1.2	V
Oscillation Pulse Width	$t_{OSC(\text{PW})}$		0.3		1.5	μs
Error Amplifier Section EA($V_{cm}=2.5\text{V}$ Unless Stated Otherwise)						
Input Offset Voltage	V_{IO}				10	mV
Input Bias Current	I_{IB}				10	μA
Input Offset Current	I_{IO}				2	μA
DC Open-Loop Gain	A_V		60			dB
Output Low Level	V_{OL}	$V_{PIN1}-V_{PIN2} > 150\text{mV}$		0.2	0.5	V
Output High Level	V_{OH}	$V_{PIN2}-V_{PIN1} > 150\text{mV}$	3.8	4.2		V
Input Common-Mode Rejection Ratio	CMRR	$V_{CM}=1.8\text{V}\sim 3.4\text{V}$	70			dB
PWM Comparator Section						
Minimum Duty Cycle	Min Duty	$V_{COMP}=0.5\text{V}$			0	%
Maximum Duty Cycle	Max Duty	$V_{COMP}=3.6\text{V}$	45	49		

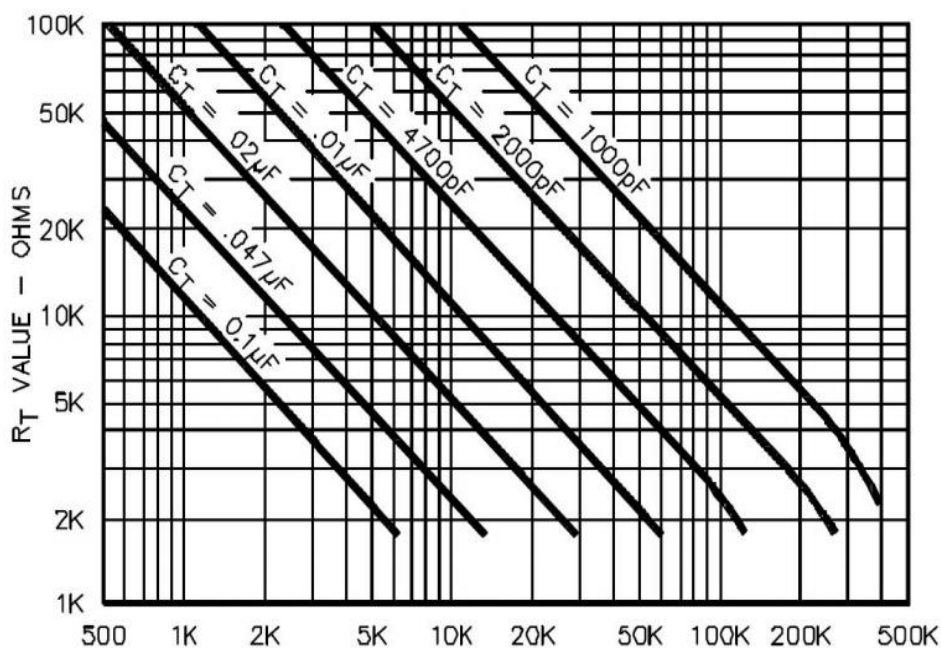


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Current Limit Amplifier Section ($V_{CM}=0V$)						
Input Threshold Voltage	V_{sense}		180		220	mV
Input Bias Current	I_B				200	μA
Shutdown Section						
Shutdown Threshold Voltage	V_{th}		0.5	0.8	1.2	V
Output Section(per Channel)						
Collector Leakage Current	I_{CLK}	$V_{CE}=40V$			50	μA
Collector Saturation Voltage	V_{CSAT}	$I_C=50mA$			2	V
Emitter Output Voltage	V_E	$I_E=50mA$	17			V
Collector Output Rise Time	t_r	$R_C=2K$			0.4	μs
Collector Output Fall Time	t_f	$R_C=2K$			0.2	μs
Overall Circuit						
Quiescent Operating Current	I_{CC}	$V_{IN}=40V$			10	mA

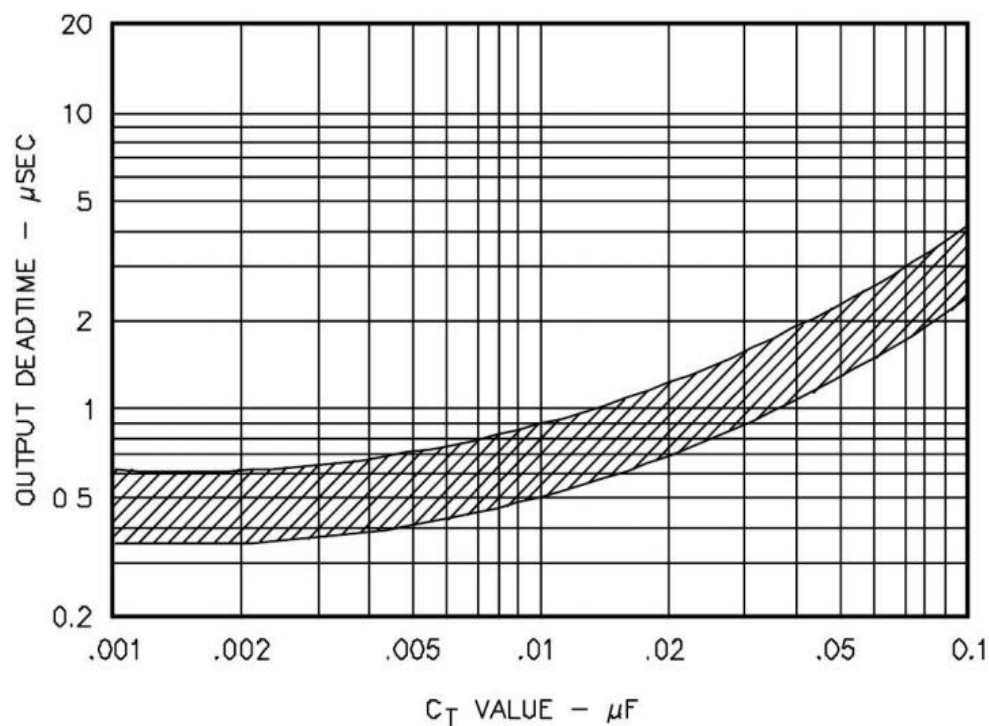
Typical Characteristics

Relationship Between Oscillation
Frequency and R_t , C_t



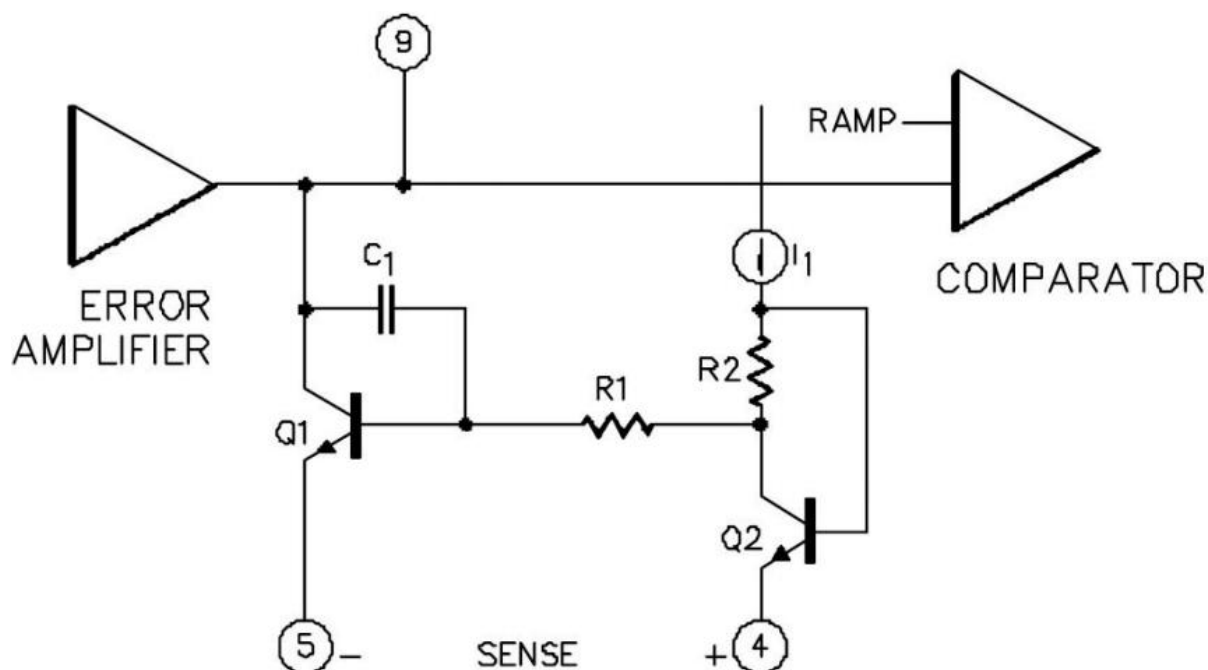


Relationship Between Dead Time and C_T



Typical Applications

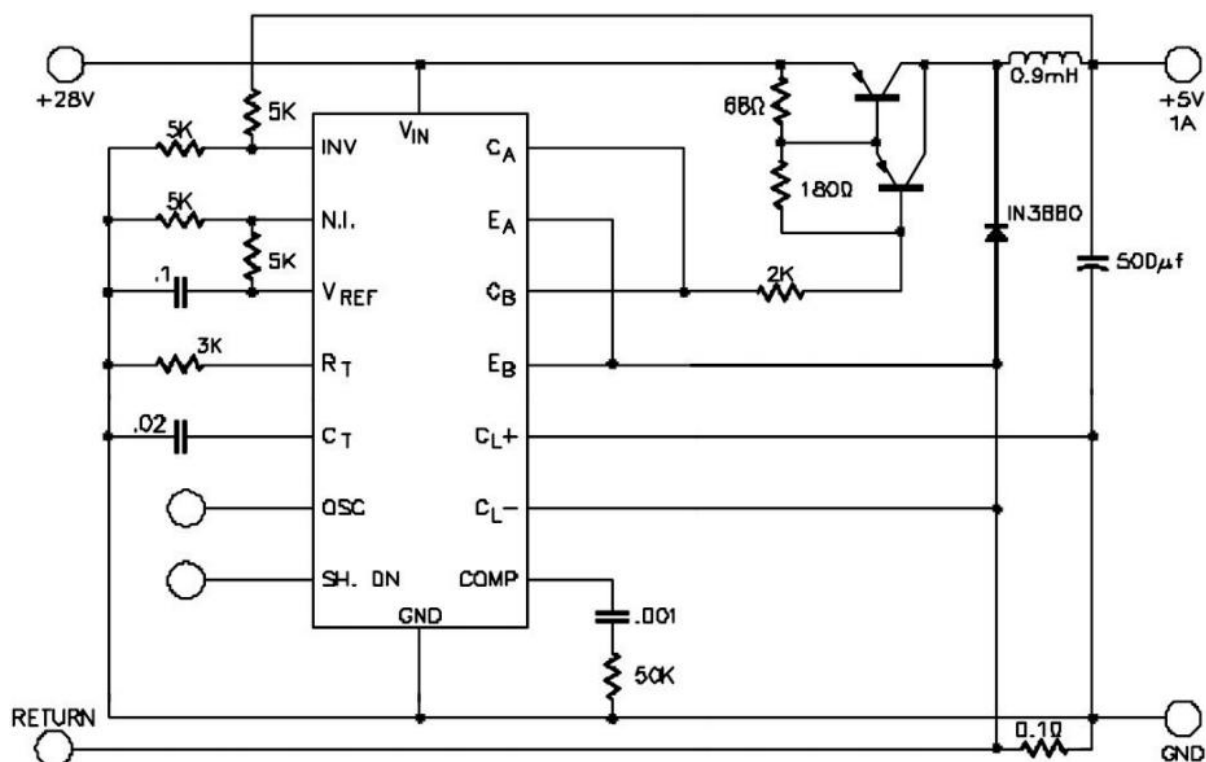
1. Internal Current Limiting Circuit Schematic



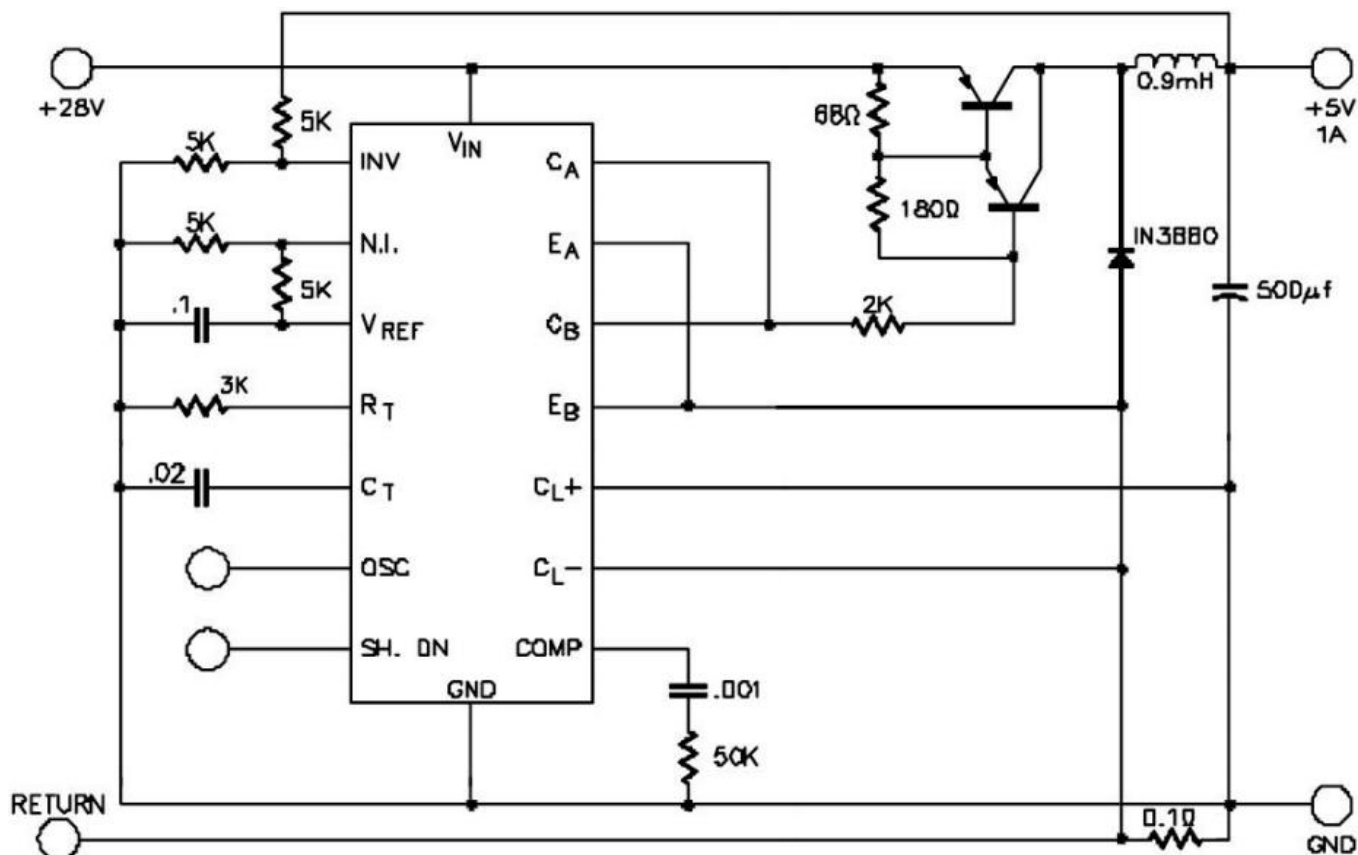


SKI3524

2.Single-Ended Output Application (Terminal output control with duty cycle up to 0~90%)



3.Push-Pull Output Application

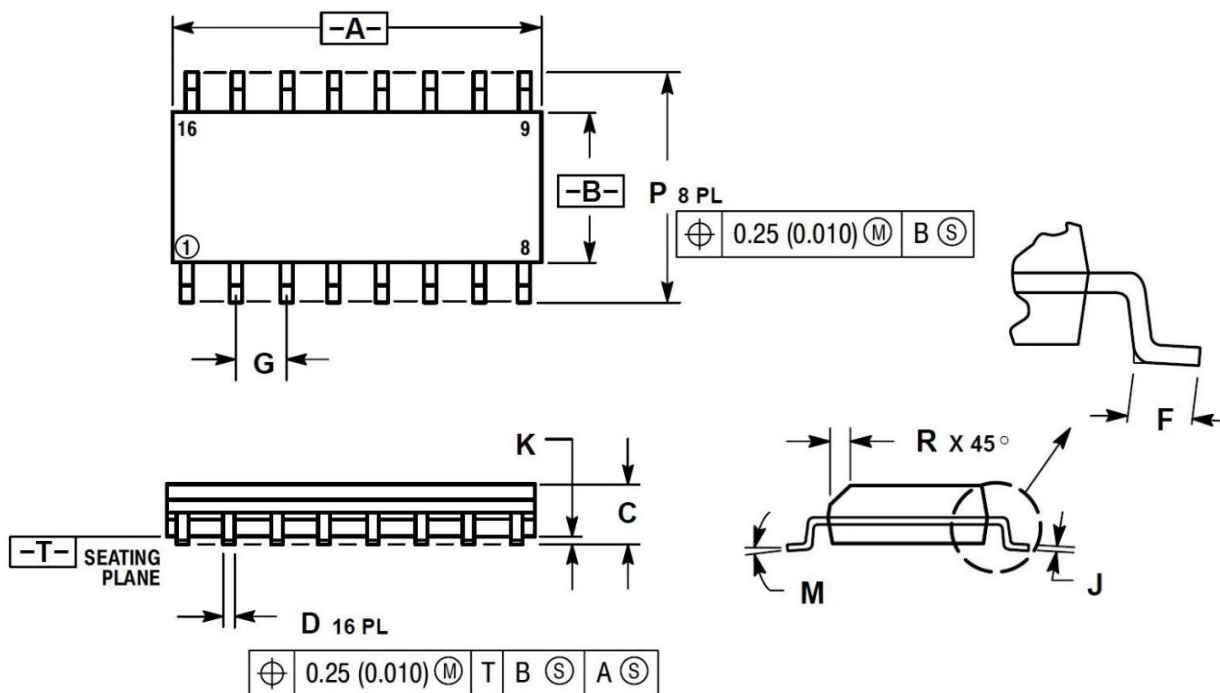




Package Information

SOP-16

Dimensions in mm



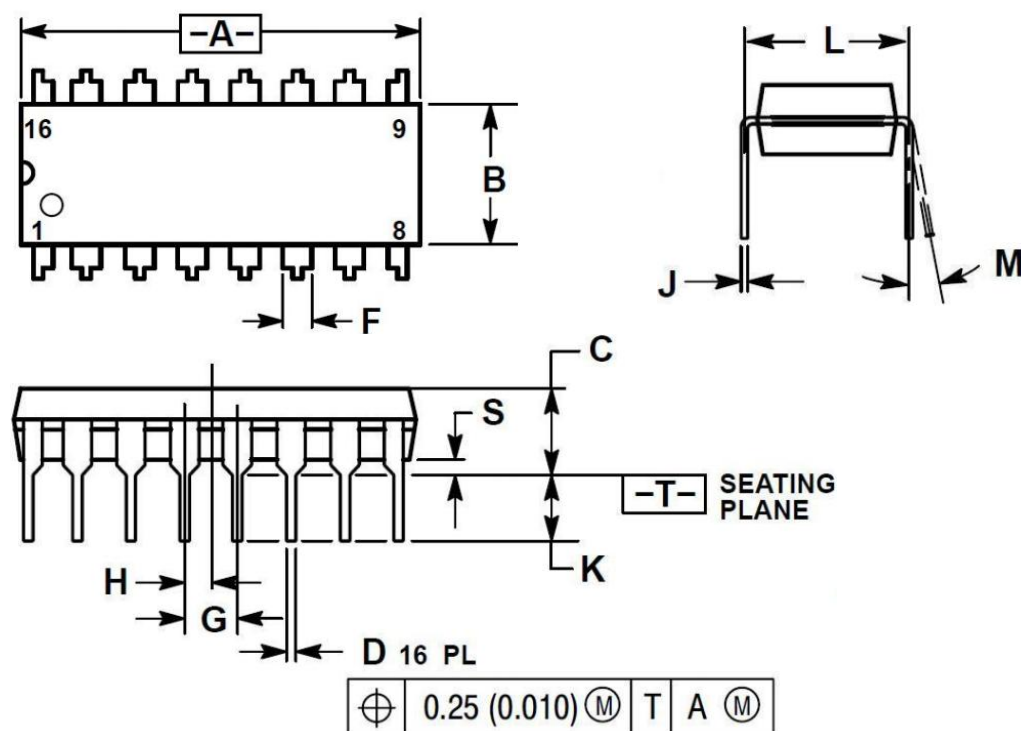
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019



Package Information

DIP-16

Dimensions in mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	18.80	19.55	0.740	0.770
B	6.35	6.85	0.250	0.270
C	3.69	4.44	0.145	0.175
D	0.39	0.53	0.015	0.021
F	1.02	1.77	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	1.27 BSC		0.050 BSC	
J	0.21	0.38	0.008	0.015
K	2.80	3.30	0.110	0.130
L	7.50	7.74	0.295	0.305
M	0°	10°	0°	10°
S	0.51	1.01	0.020	0.040



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