

MB7500

PULSE WIDTH MODULATION CONTROL CIRCUITS

General Description

The MB7500 incorporates on a single chip all the functions required in the construction of a pulse-width-modulation (PWM) control circuit.

The MB7500 consist of 5.0V reference voltage circuit, two error amplifiers, a pulse-steering control flip-flop, an output control circuit, a PWM comparator, a dead time comparator and an oscillator. The precision of voltage reference (Vref) is improved up to $\pm 1\%$ with trimming. This provides a better output voltage regulation.

The uncommitted output transistors can be configured in either common-emitter or emitter-follower output topology. The MB7500 provides for push-pull or single-ended output operation, which can be selected through the output control function. The architecture of this device prohibits the possibility of either output being pulsed twice during push-pull operation. The operating temperature range is $-20^\circ\text{C} \sim +85^\circ\text{C}$

Features

- Internal Regulator Provides a Stable 5.0V Reference Supply Trimmed to $\pm 1\%$ Accuracy.
- Uncommitted Output TR for 200mA Sink or Source Current.
- Output Control for Push-Pull or Single-Ended Operation.
- Variable Duty Cycle by Dead Time Control (Pin 4) Complete PWM Control Circuit.
- On-Chip Oscillator with Master or Slave Operation.
- Internal Circuit Prohibits Double Pulse at Either Output.

Application

- SMPS
- Back Light Inverter



CBC Microelectronics
<http://www.cbcv.net>



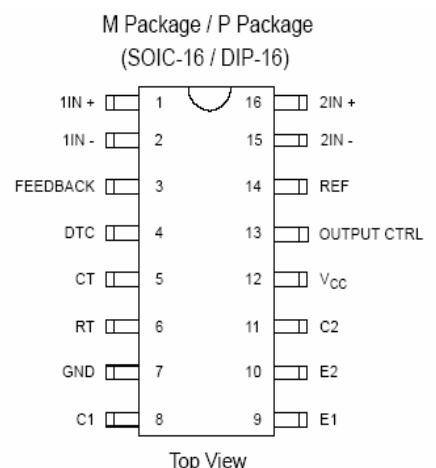
SOIC-16



DIP-16

Figure 1: Package Types of MB7500

Pin Configuration (DIP-16 / SOP-16)



MB7500

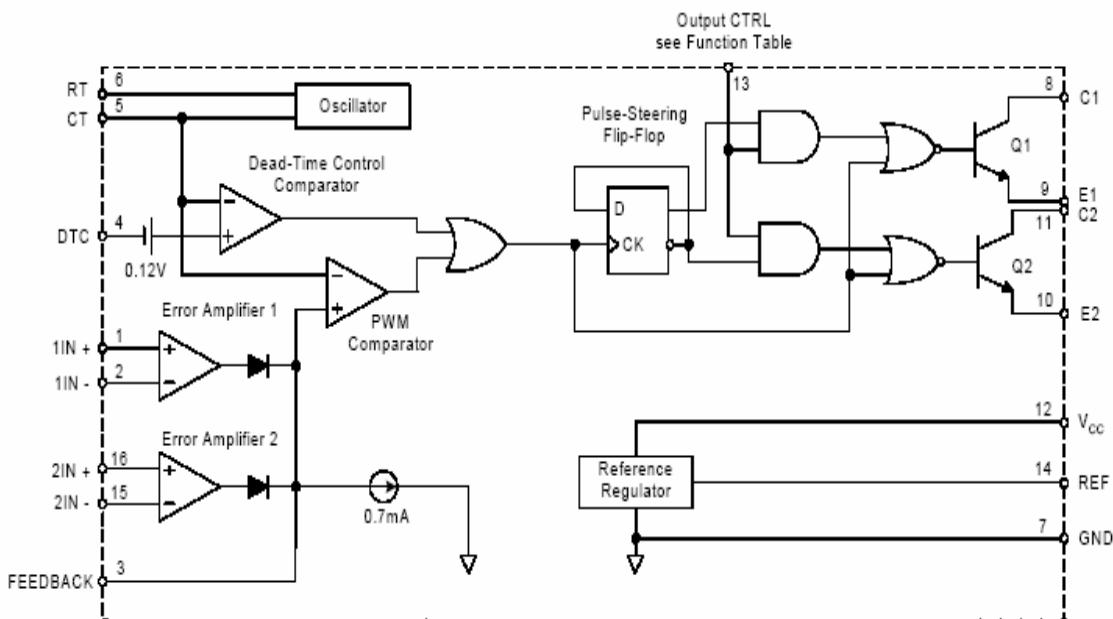
Order Information

MB7500	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Circuit Type				
Blank: Vref 5.0v				
Blank: Pb Free				
G: Halogen Free				

TR : Tape/Reel
Blank : Tube
Package
M:SOP8
P:DIP8

Product No.	Package	Part Number		Marking ID		Packing Type
		Pb-free	Halogen-Free	Pb-free	Halogen-Free	
MB7500	SOP-16	MB7500M	MB7500GM	MB7500M	MB7500GM	Tube
		MB7500MTR	MB7500GMTR	MB7500M	MB7500GM	Tape & Reel
	DIP-16	MB7500P	MB7500GP	MB7500P	MB7500GP	Tube

Function Block Diagram



Function Table

Input to Output Control	Output Function
V _I =GND	Single-ended or Parallel Output
V _I =V _{REF}	Normal Push-Pull Operation

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Absolute Maximum Ratings

Parameter	Symbol	Value		Unit
Supply Voltage	V _{CC}	40		V
Amplifier Input Voltage	V _I	-0.3 to V _{CC} +0.3		V
Collector Output Voltage	V _O	40		V
Collector Output Current	I _O	250		mA
Package Thermal Impedance	θ _{JA}	M Package	73	°C/W
		P Package	67	
Lead Temperature 1.6mm from case for 10 seconds		260		°C
Storage Temperature Range	T _{STG}	-65 to 150		°C
ESD Rating (Machine Model)		200		V

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	V _{CC}	7.0	15	36	V
Collector Output Voltage	V _{C1} , V _{C2}		30	36	V
Collector Output Current (Each Transistor)	I _{C1} , I _{C2}			200	mA
Amplifier Input Voltage	V _{IN}	0.3		V _{CC} -2.0	V
Current Into FEEDBACK Terminal	I _{IB}			0.3	mA
Reference Output Current	I _{REF}			10	mA
Timing Resistor	R _T	1.8	30	500	KΩ
Timing Capacitor	C _T	0.00047	0.001	10	uF
Oscillator Frequency	f _{OSC}	1.0	40	200	KHz
PWM Input Voltage (Pin3, 4, 13)		0.3		5.3	V
Operating Free-Air Temperature	T _A	-40		85	°C

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Electrical Characteristics

($V_{CC}=20V$, $f=10KHz$, $T_A= +25^\circ C$, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
REFERENCE SECTION						
Reference Output Voltage for MB7500	V_{REF}	$I_{REF}=1mA$	4.95	5.00	5.05	V
		$I_{REF}=1mA, T_A=-20\sim 85^\circ C$	4.90	5.0	5.1	
Line Regulation	R_{LINE}	$V_{CC}=7V$ to $36V$		2.0	25	mV
Load Regulation	R_{LOAD}	$I_{REF}=1mA$ to $10mA$		1.0	15	mV
Short Circuit Output Current	I_{SC}	$V_{REF}=0V$	10	35	50	mA
OSCILLATOR SECTION						
Oscillation Frequency	f_{OSC}	$C_T=0.001\mu F, R_T=30K$		40		KHz
		$C_T=0.001\mu F, R_T=12K$	9.2	10	10.8	
		$C_T=0.001\mu F, R_T=30K$ $T_A=-40\sim 85^\circ C$	9.0		12	
Frequency Change with Temperature	$\Delta f/\Delta T$	$C_T=0.01\mu F, R_T=12K$ $T_A=-20\sim 85^\circ C$			1	%
DEAD TIME CONTROL SECTION						
Input Bias Current	I_{BIAS}	$V_{CC}=15V, 0V \leq V_4 \geq 5.25V$		-2.0	-10	uA
Maximum Duty Cycle	$D_{(MAX)}$	$V_{CC}=15V, V_4=0V$ $Pin13=V_{REF}$	45			%
Input Threshold Voltage	V_{ITH}	Zero Duty Cycle		3.0	3.3	V
ERROR AMP SECTION						
Input Offset Voltage	V_{IO}	$V3=2.5V$		2.0	10	mV
Input Offset Current	I_{IO}	$V3=2.5V$		25	250	nA
Input Bias Current	I_{BIAS}	$V3=2.5V$		0.2	1.0	uA

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Electrical Characteristics (Cont'd)

($V_{CC}=20V$, $f=10KHz$, $T_A= +25^\circ C$, unless otherwise specified)

Common Mode Input Voltage	V_{CM}	$7V \leq V_{CC} \leq 36V$	-0.3		V_{CC}	V
Open-Loop Voltage Gain	G_{VO}	$0.5V \leq V_3 \leq 3.5V$	70	95		dB
Unit-Gain Bandwidth	BW			650		KHz
Common-Mode Rejection Ratio	$CMRR$		65	80		dB
Output Sink Current (Feedback)	I_{SINK}	$V_{ID}=-15mV$ to $-5V$, $V_3=0.7V$	0.3	0.7		mA
Output Source Current (Feedback)	I_{SOURCE}	$V_{ID}=15mV$ to $5V$, $V_3=3.5V$	-2			mA
PWM COMPARATOR SECTION						
Input Threshold Voltage	V_{ITH}	Zero Duty Cycle		4	4.5	V
Input Sink Current	I_{SINK}	$V_3=0.7V$	0.3	0.7		mA
OUTPUT SECTION						
Output Saturation Voltage Common Emitter	$V_{CE(SAT)}$	$V_E=0V$, $I_C=200mA$		1.1	1.3	V
Output Saturation Voltage Emitter Follower	$V_{CC(SAT)}$	$V_{CC}=15V$, $I_E=-200mA$		1.5	2.5	
Collector Off-State Current	$I_{C(OFF)}$	$V_{CC}=36V$, $V_{CE}=36V$		2	100	uA
Emitter Off-State Current	$I_{E(OFF)}$	$V_{CC}=V_C=36V$, $V_E=0V$			-100	
TOTAL DEVICE						
Supply Current	ICC	$Pin6=V_{REF}$, $V_{CC}=15V$		6	10	mA
OUTPUT SWITCHING CHARACTERISTIC						
Rise Time (Common Emitter, Emitter Follower)	t_R			100	200	ns
Fall Time (Common Emitter, Emitter Follower)	t_F			25	100	ns

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Parameter Measurement information

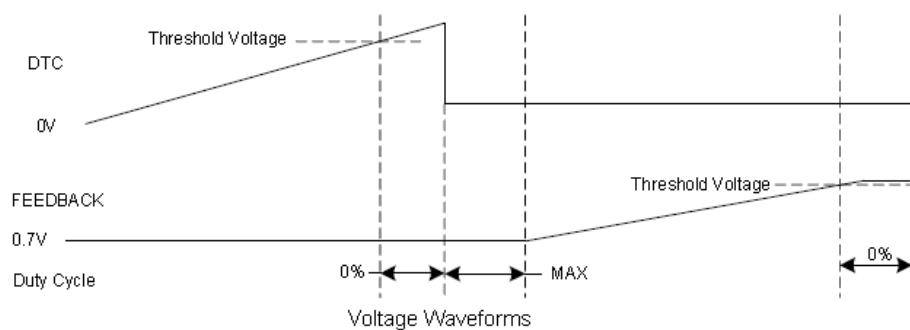
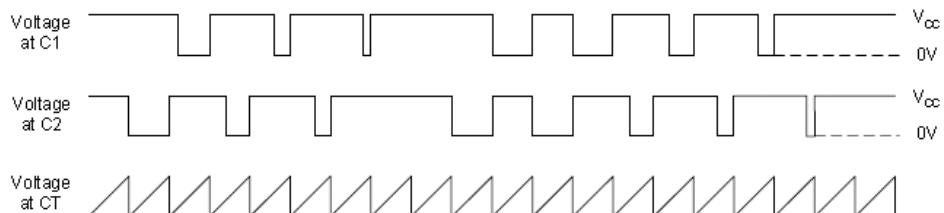
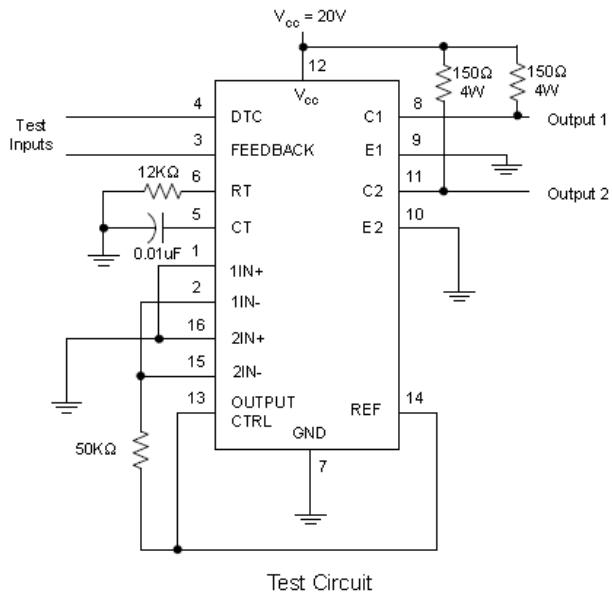


Figure 2 Operational Test Circuit and Waveforms

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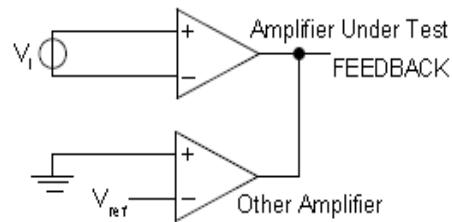
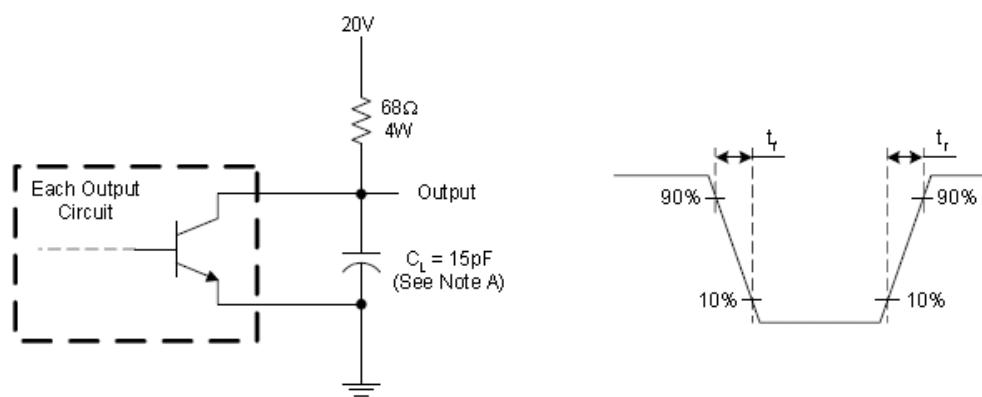
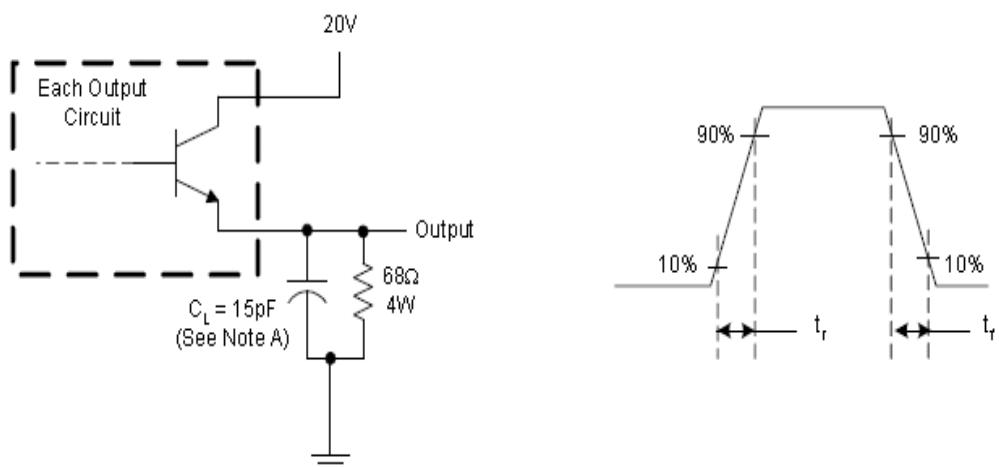


Figure 3 Error Amplifier Characteristics



Note A: C_L includes probe and jig capacitance.

Figure 4 Common-Emitter Configuration



Note A: C_L includes probe and jig capacitance.

Figure 5 Emitter-Follower Configuration

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Typical Performance Characteristics

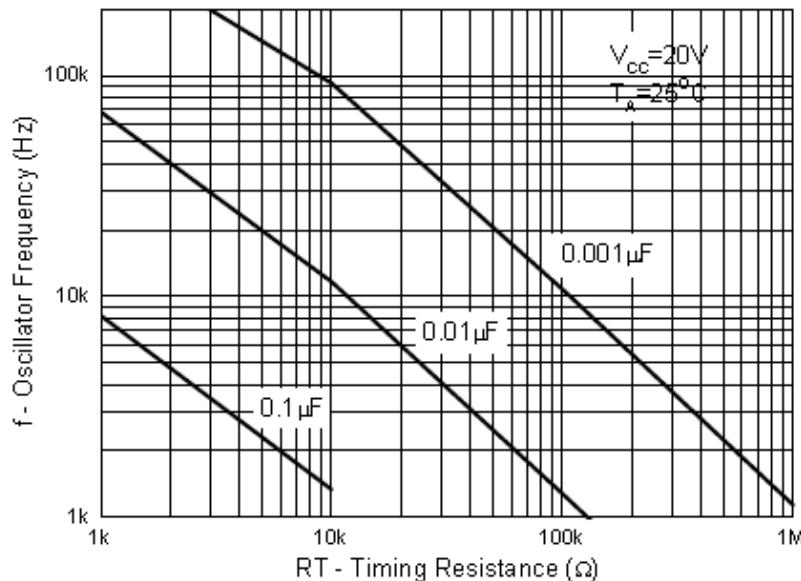


Figure 6 Oscillator Frequency vs. RT and

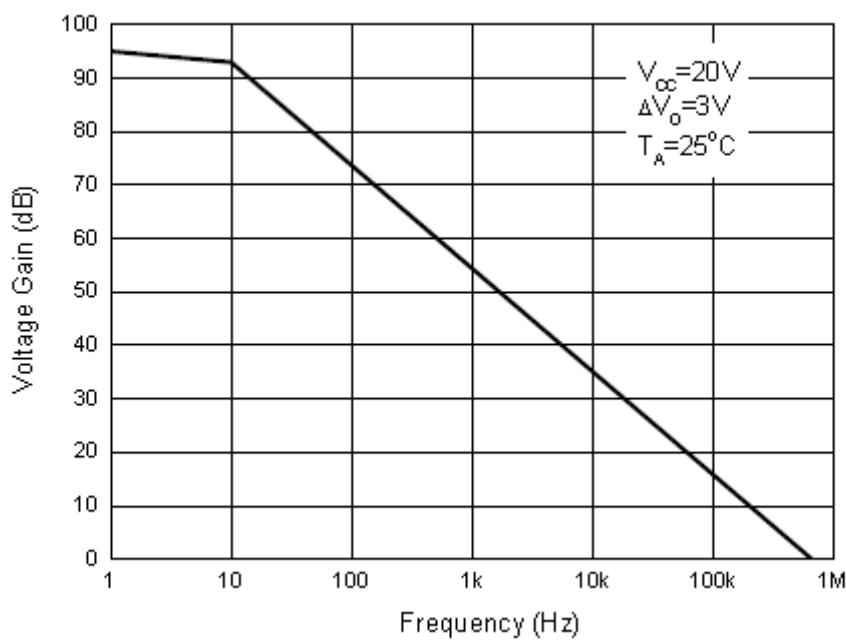


Figure 7 Error Amplifier Small-Signal Voltage Gain vs. Frequency

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Typical Applications

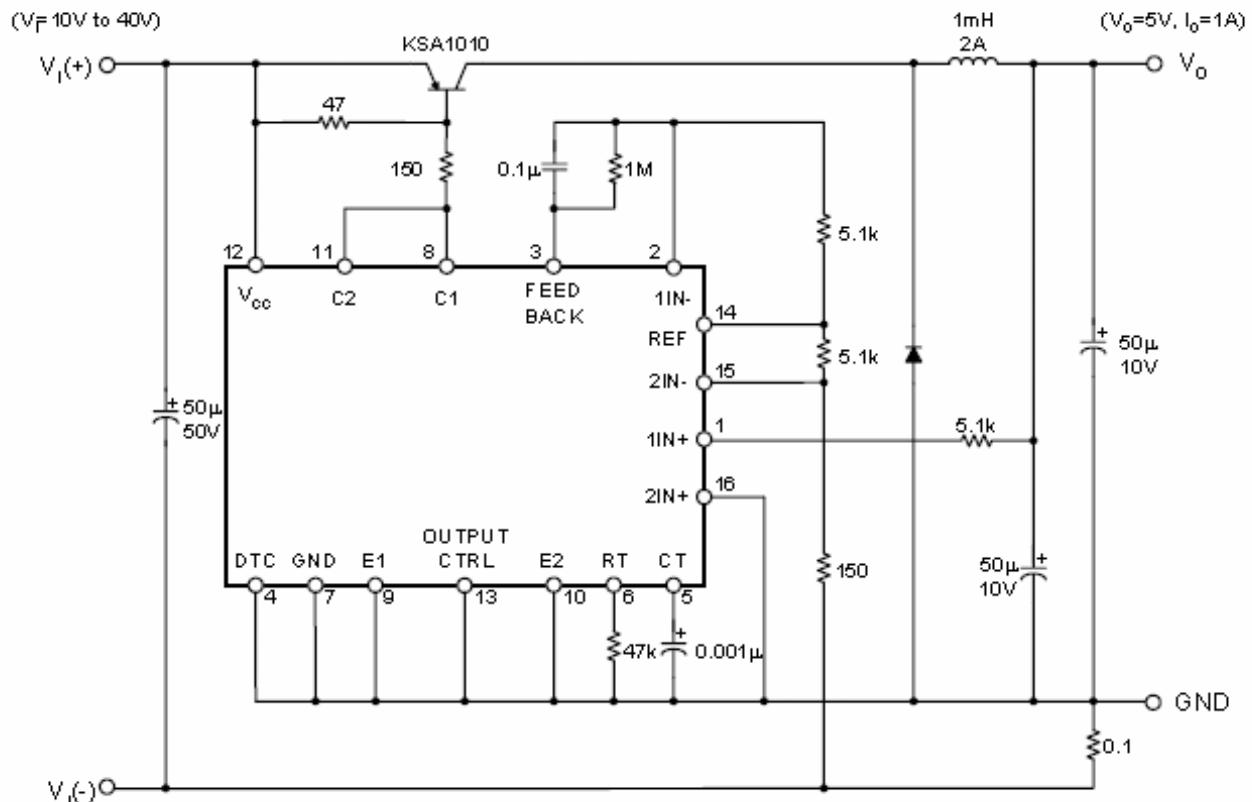


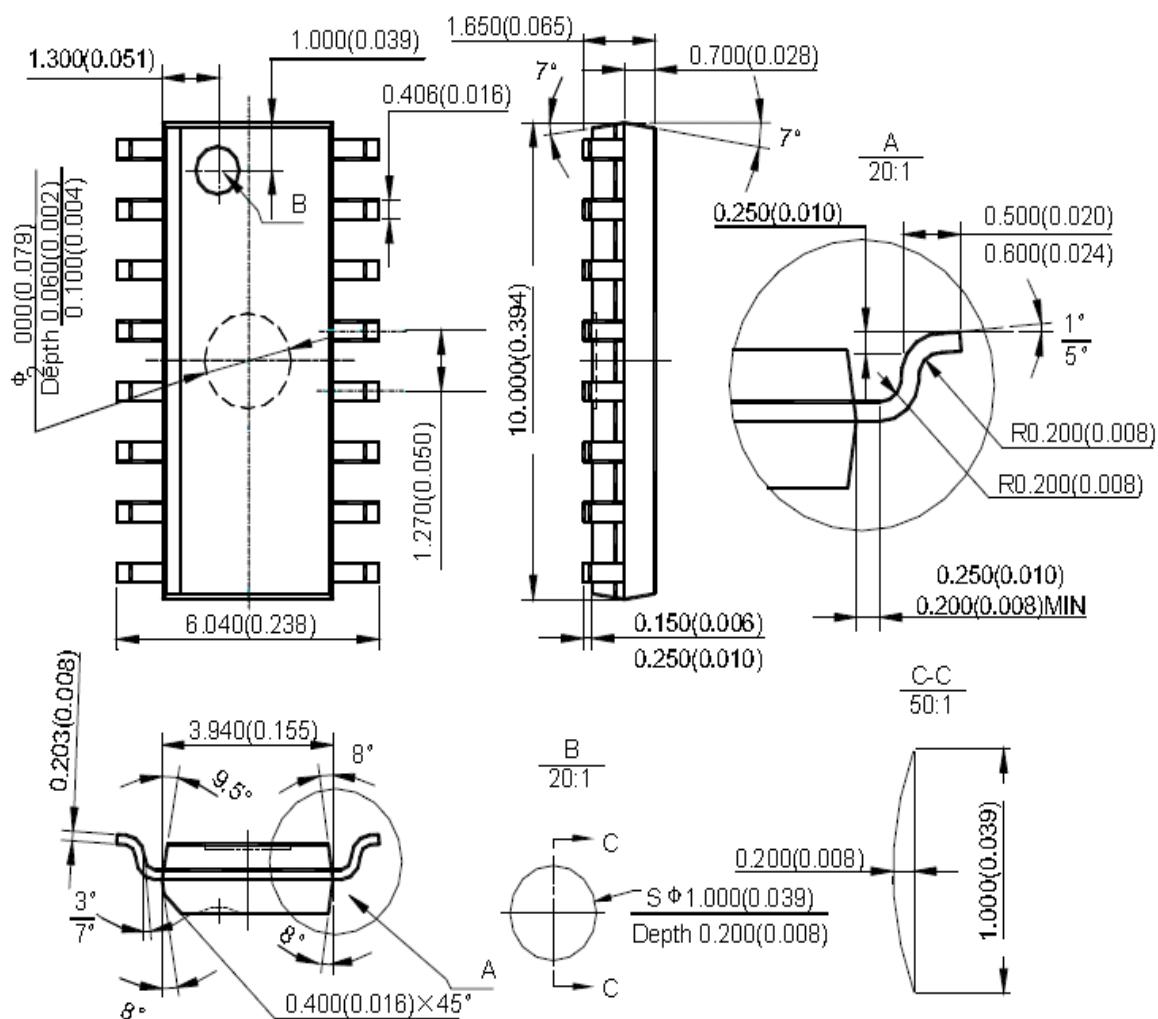
Figure 8 Pulse Width Modulated Step-Down Converter

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Mechanical Dimensions

SOIC-16

Unit: mm(inch)

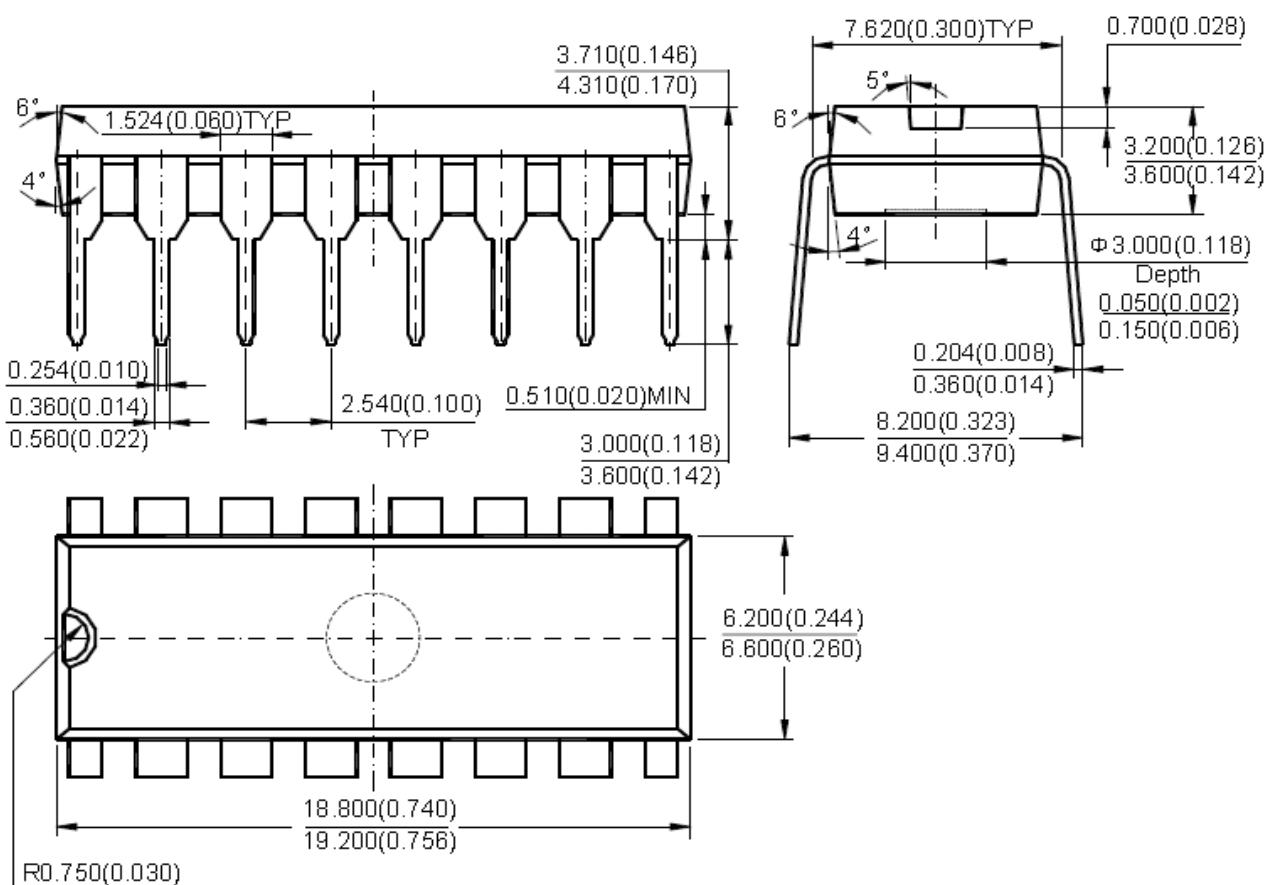


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Mechanical Dimensions (Continued)

DIP-16

Unit: mm(inch)



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