MB7500

PULSE WIDTH MODULATION CONTROL CIRCUITS

CBC Microelectronics
http://www.cbcv.net

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±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℃～+85℃

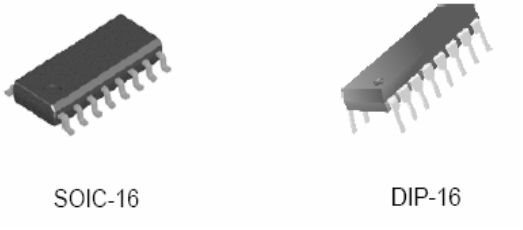


Figure 1: Package Types of MB7500

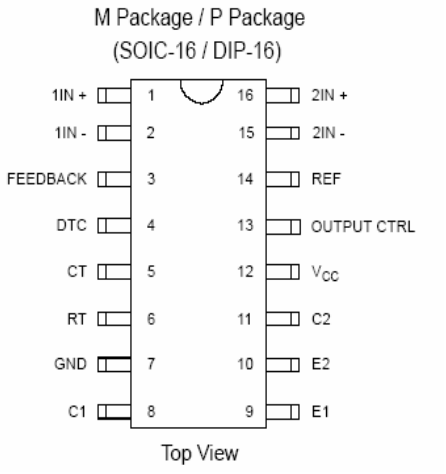
Features

- Internal Regulator Provides a Stable 4.95V Reference Supply Trimmed to ±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

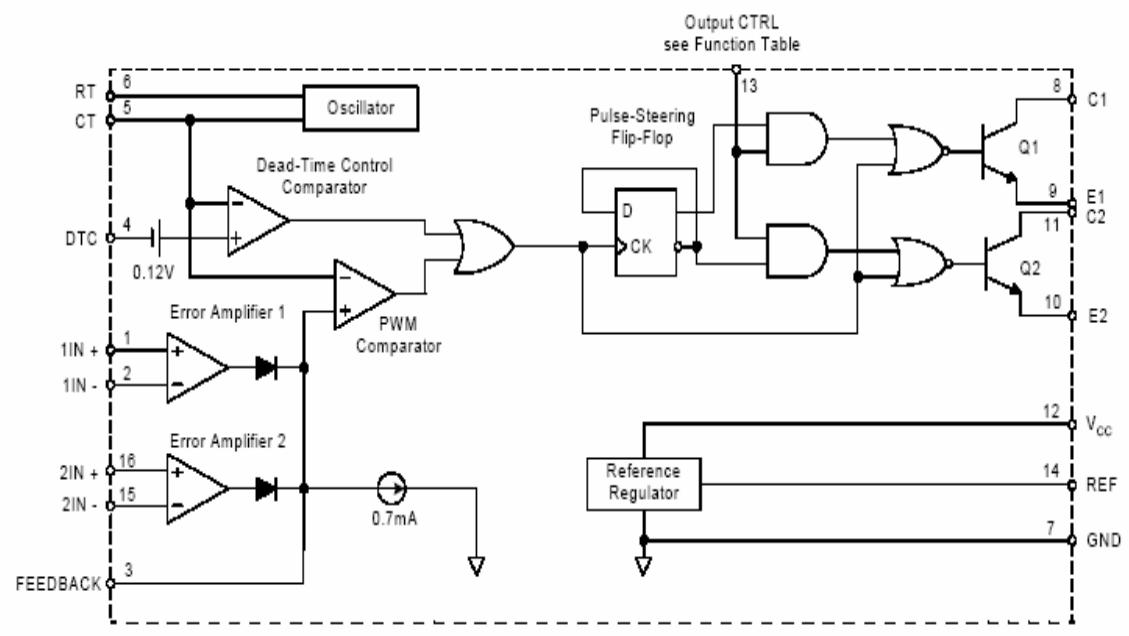
Pin Configuration (DIP-16 / SOP-16)



Order Information

Package	Temperature Range	Part Number	Marketing ID	Packing Type
SOIC-16	-20℃～85℃	MB7500M	MB7500M	Tube
		MB7500MTR	MB7500MTR	Tape and Reel
DIP-16		MB7500P	MB7500P	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

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	℃/W
		P Package	67	
Lead Temperature 1.6mm from case for 10 seconds		260		℃
Storage Temperature Range	T_{STG}	-65 to 150		℃
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	KQ
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	℃

Electrical Characteristics
(V_{CC}=20V, f=10KHz, T_A= +25℃, 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=-20～85℃	4.85	4.95	5.05	
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
OSCILLATIOR SECTION						
Oscillation Frequency	f_{OSC}	C_T=0.001uF, R_T=30K		40		KHz
		C_T=0.001uF, R_T=12K	9.2	10	10.8	
		C_T=0.001uF, R_T=30K T_A=-40～85℃	9.0		12	
Frequency Change with Temperature	△f/△T	C_T=0.01uF, R_T=12K T_A=-20～85℃			1	%
DEAD TIME CONTROL SECTION						
Input Bias Current	I_{BIAS}	V_{CC}=15V, 0V≤V_4≥5.25V		-2.0	-10	uA
Maximum Duty Cycle	$D_{(MAX)}$	V_{CC}=15V, V4=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

Electrical Characteristics (Cont'd)
(V_{CC}=20V, f=10KHz, T_A= +25℃, unless otherwise specified)

Common Mode Input Voltage	V_{CM}	7V≤V_{CC}≤36V	-0.3		V_{CC}	V
Open-Loop Voltage Gain	G_{VO}	0.5V≤V3≤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, V3=0.7V	0.3	0.7		mA
Output Source Current (Feedback)	I_{SOURCE}	V_{ID}=15mV to 5V, V3=3.5V	-2			mA
PWM COMPARATOR SECTION						
Input Threshold Voltage	V_{ITH}	Zero Duty Cycle		4	4.5	V
Input Sink Current	I_{SINK}	V3=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	V
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=40V, V_E=0V			-100	uA
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

Parameter Measurement information

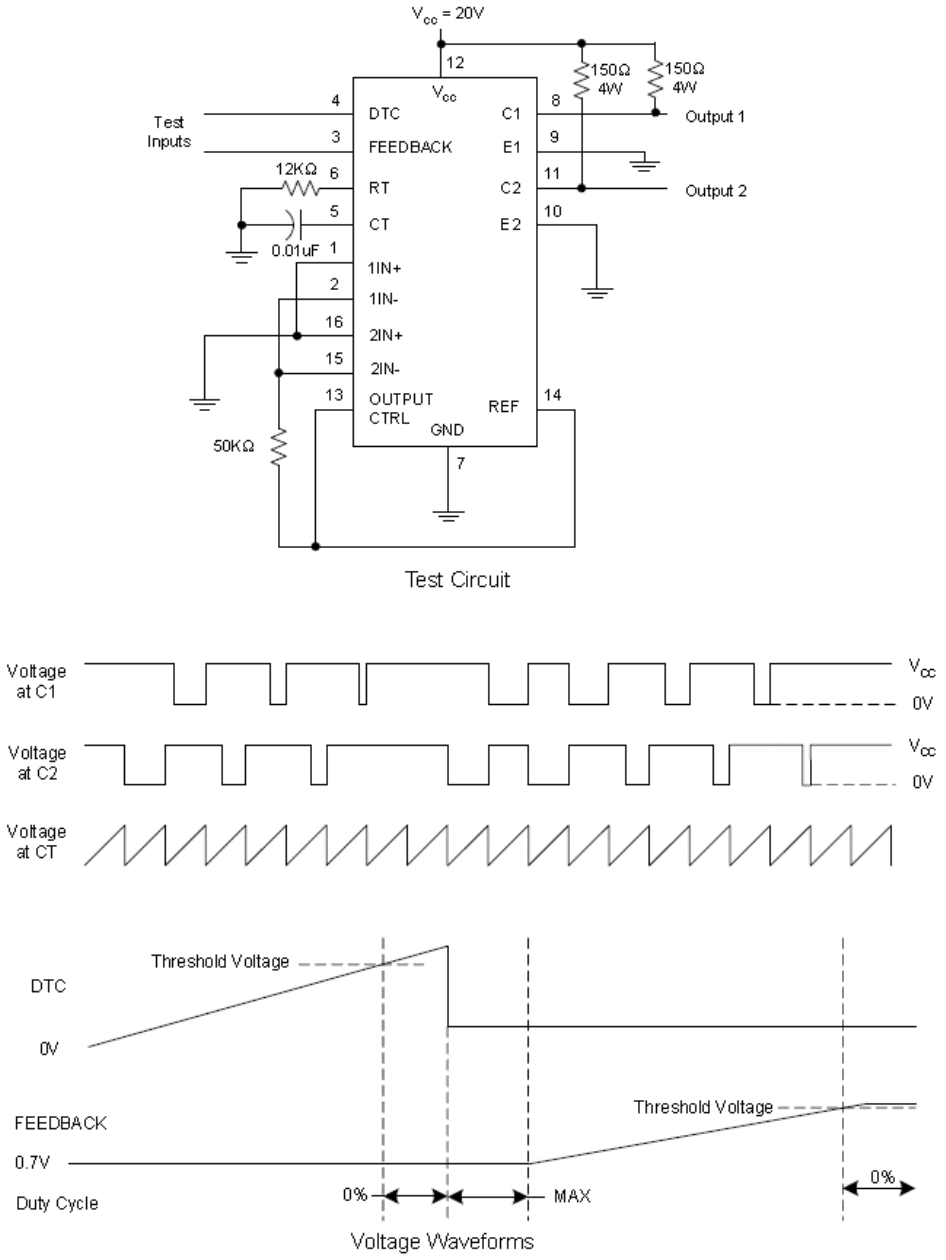


Figure 2 Operational Test Circuit and Waveforms

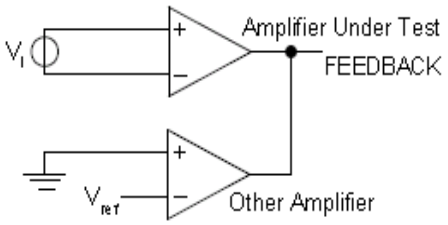


Figure 3 Error Amplifier Characteristics

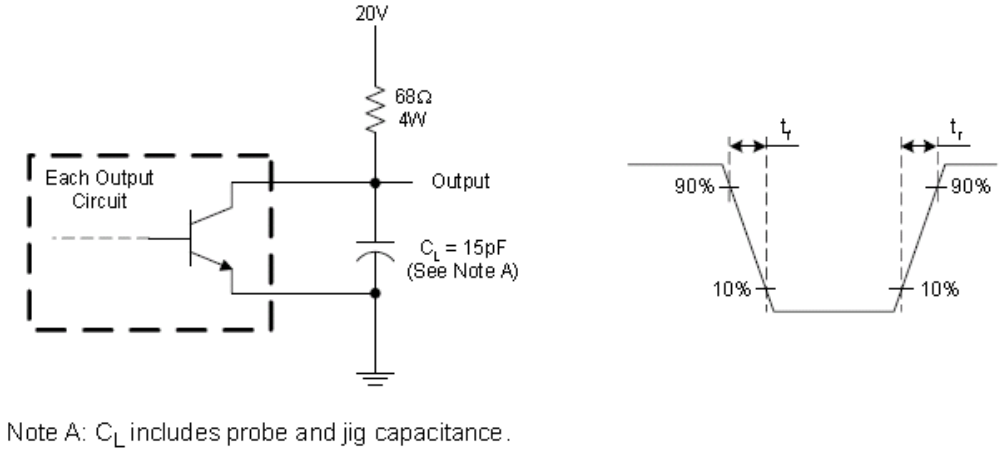


Figure 4 Common-Emitter Configuration

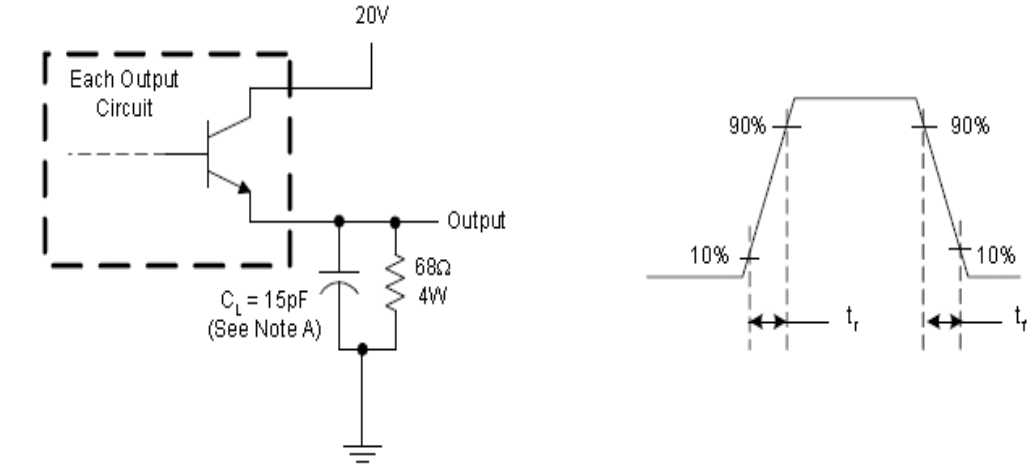


Figure 5 Emitter-Follower Configuration

Typical Performance Characteristics

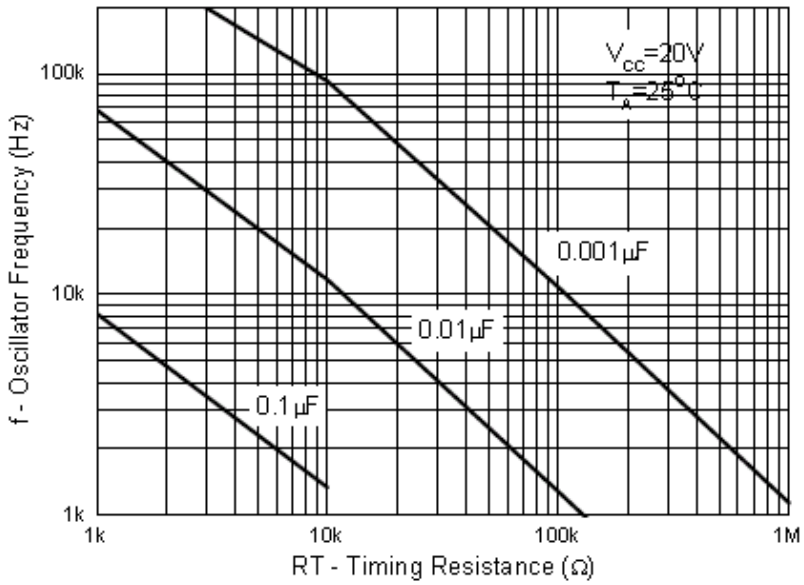


Figure 6 Oscillator Frequency vs. RT and

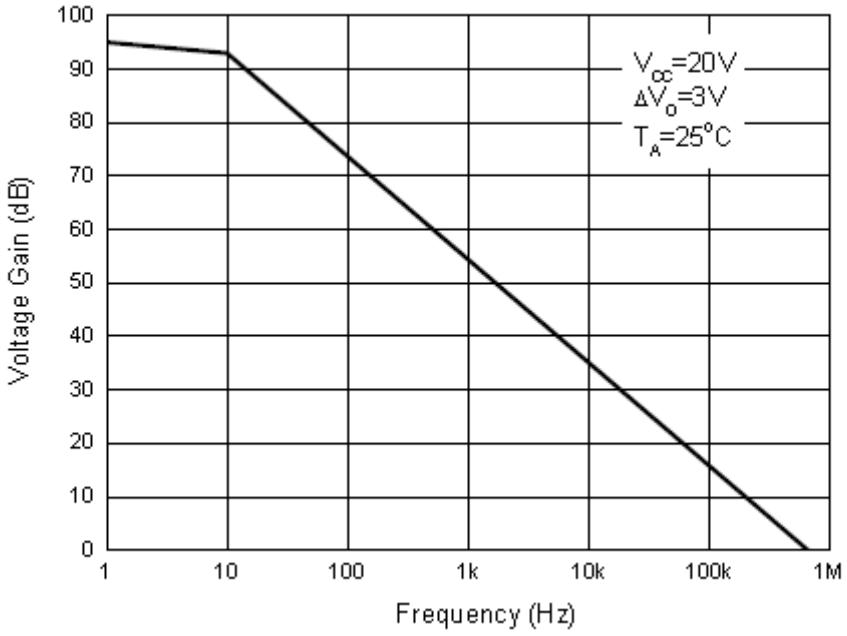


Figure 7 Error Amplifier Small-Signal Voltage Gain vs. Frequency

Typical Applications

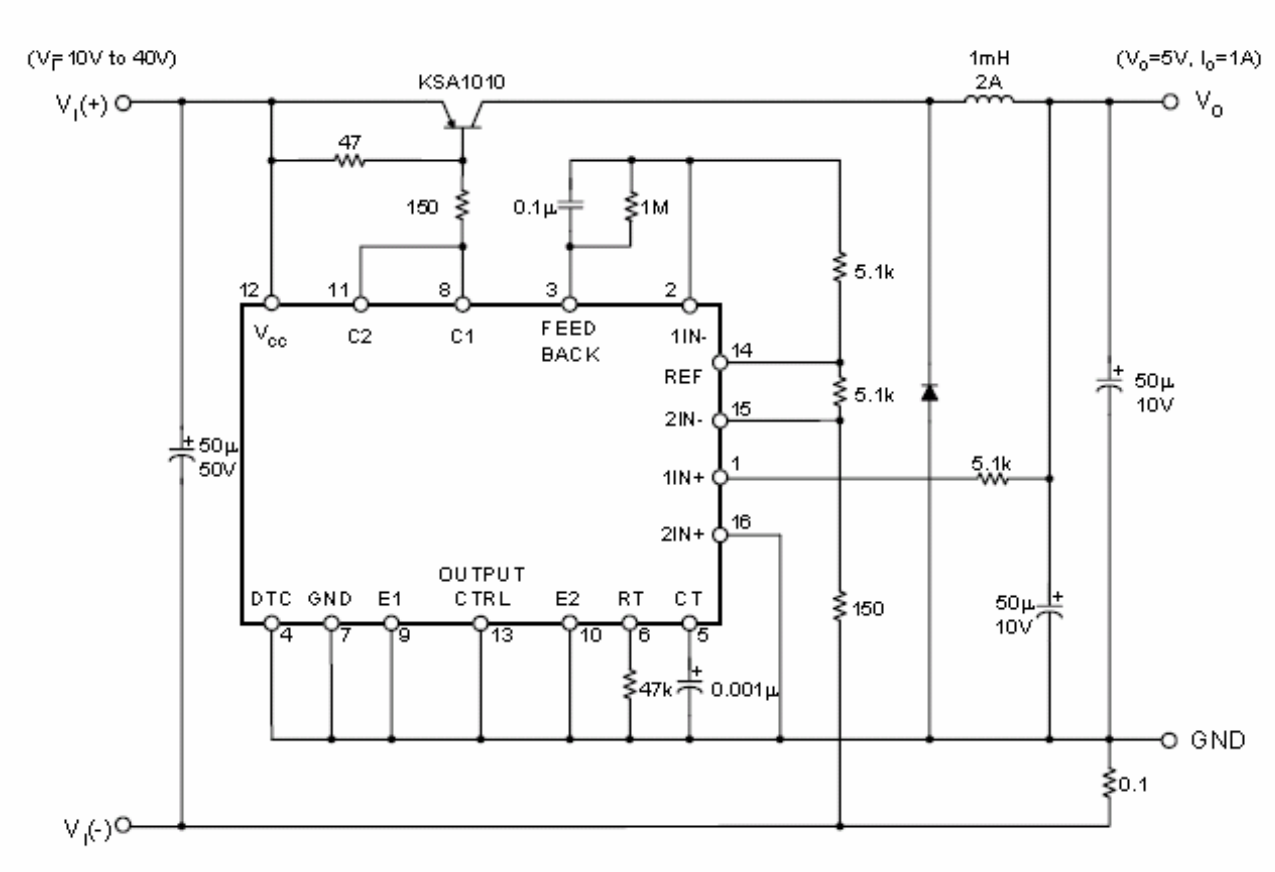
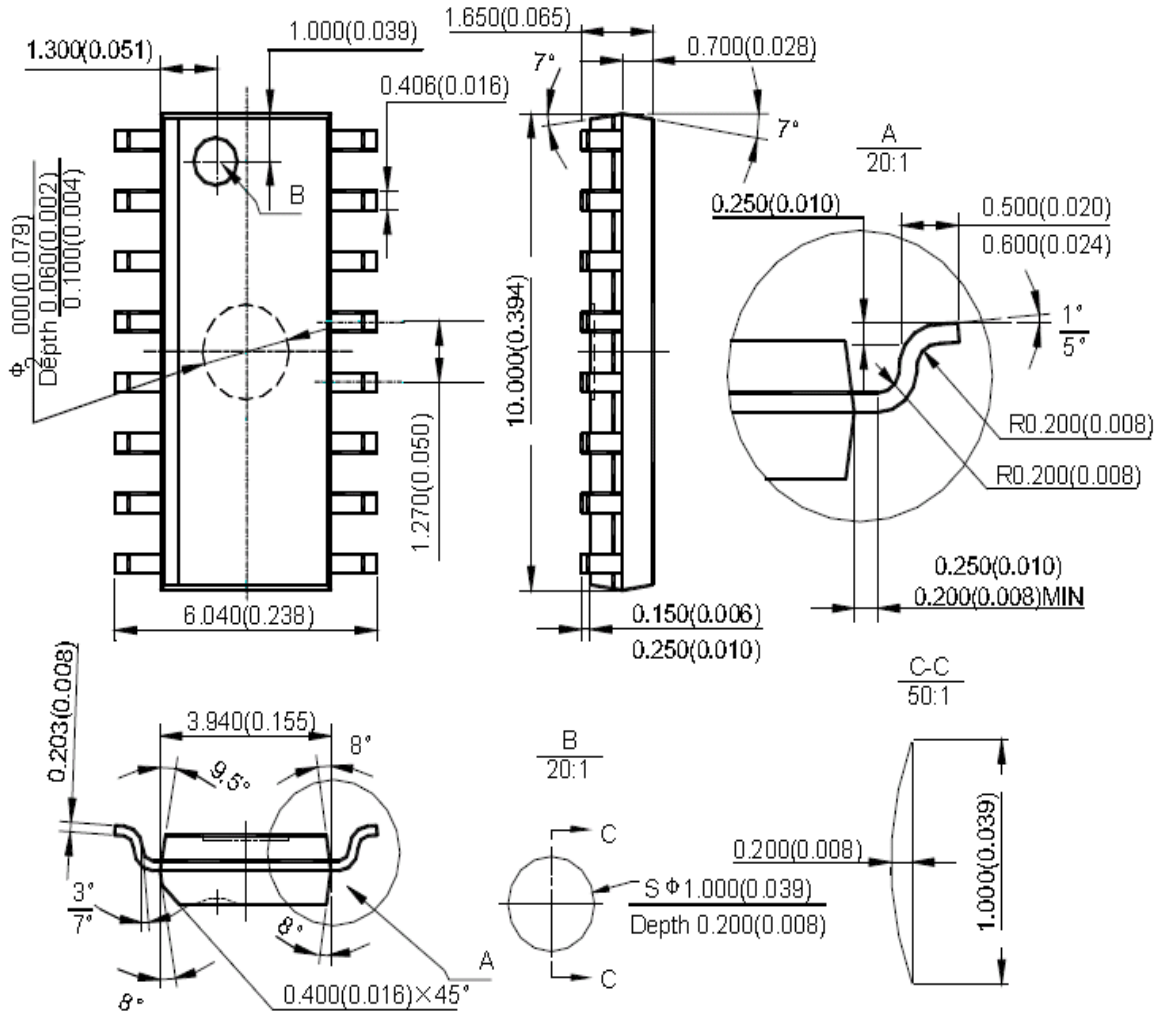


Figure 8 Pulse Width Modulated Step-Down Converter

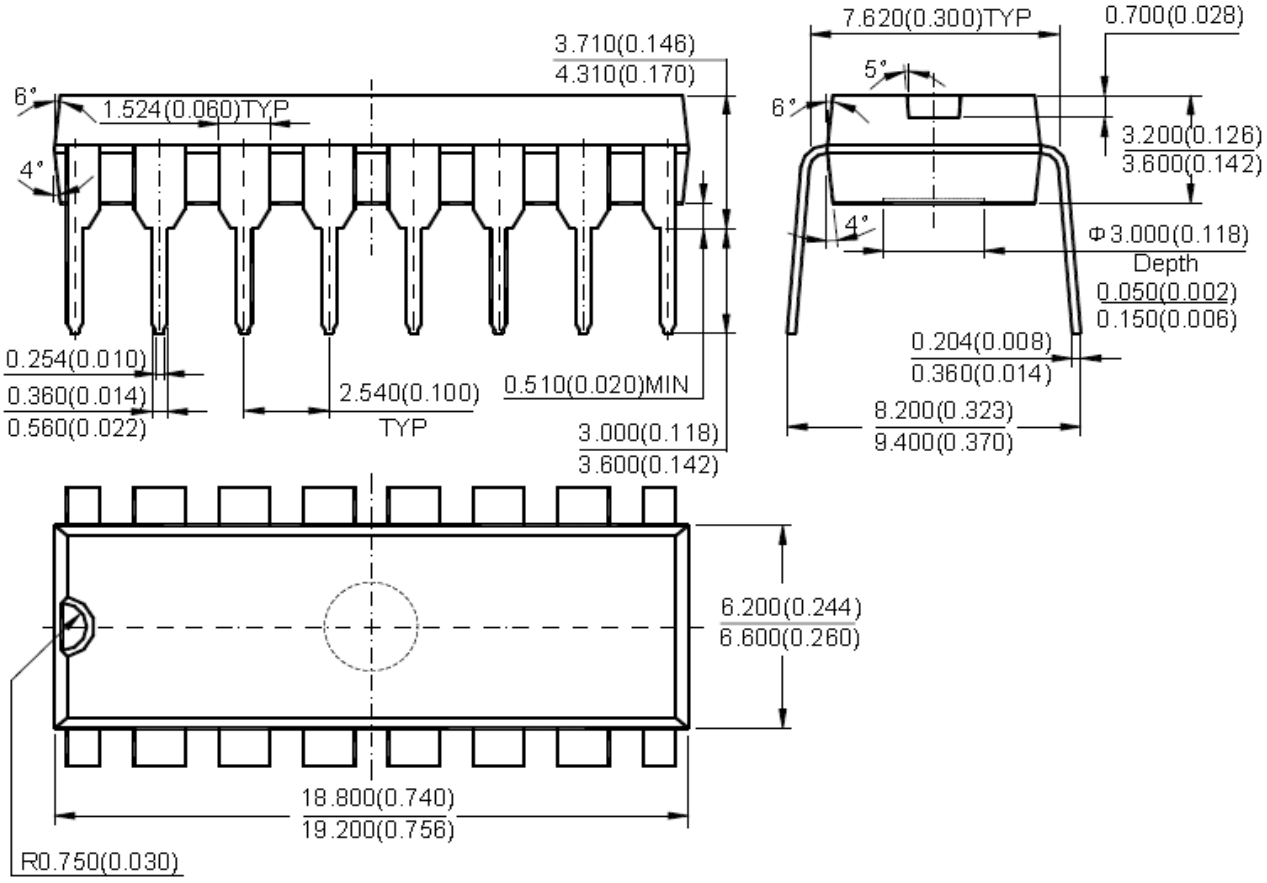
Mechanical Dimensions

SOIC-16 **Unit: mm(inch)**



Mechanical Dimensions (Continued)

DIP-16 **Unit: mm(inch)**



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