

UTC TL1451 LINEAR INTEGRATED CIRCUIT

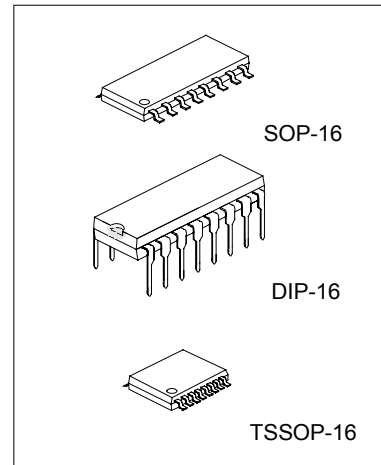
DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUITS

DESCRIPTION

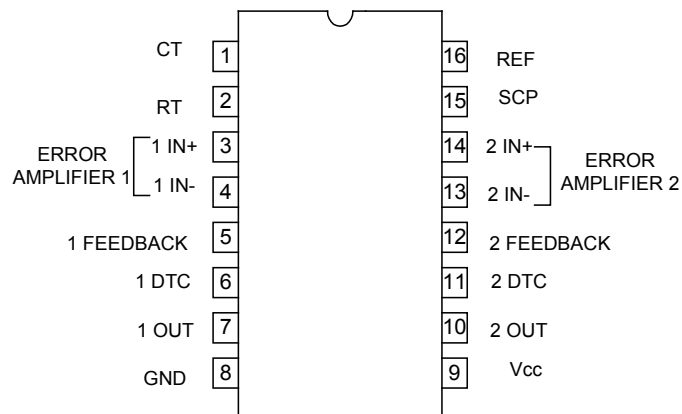
The UTC TL1451 incorporates on a single monolithic chip all the functions required in the construction of two pulse-width-modulation (PWM) control circuits. Designed primarily for power supply control, the TL1451 contains an on-chip 2.5V regulator, two error amplifiers, an adjustable oscillator, two dead-time comparators, undervoltage lockout circuitry, and dual common-emitter output transistor circuits.

FEATURES

- *Complete PWM Power control Circuitry
- *Completely Synchronized Operation
- *Internal Undervoltage Lockout Protection
- *Wide Supply Voltage Range
- *Internal Short-Circuit Protection
- *Oscillator Frequency...500kHz Max
- *Variable Dead Time Provides Control Over Total Range
- *Internal Regulator Provides a Stable 2.5V Reference Supply

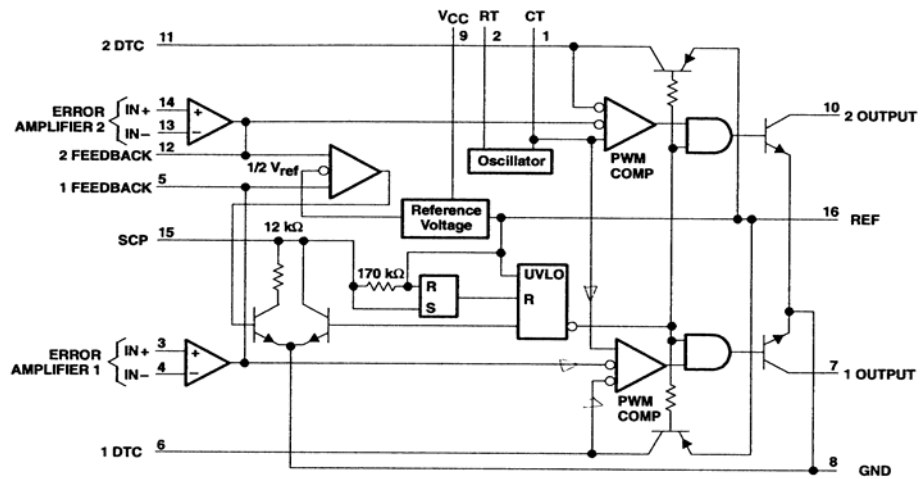


PIN CONFIGURATIONS



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BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS (Unless otherwise noted all is over operating free air temperature range)

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	51	V
Amplifier Input Voltage	V_I	20	V
Collector Output Voltage	V_O	51	V
Collector Output Current	I_O	21	mA
Power Dissipation : $T_A \leq 25^\circ\text{C}$ DIP-16 SOP-16 TSSOP-16		1000 500 700	mW
Operating free-air Temperature Range	T_A	-20 TO 85	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 TO 150	$^\circ\text{C}$
Lead Temperature 1.6mm from Case for 10 Sec.	T_{case}	260	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE		UNIT
		MIN	MAX	
Supply Voltage	V_{CC}	3.6	50	V
Amplifier Input Voltage	V_I	1.05	1.45	V
Collector Output Voltage	V_O		50	V
Collector Output Current(each Transistor)	I_O		20	mA
Current into Feedback Terminal			45	μA
Feedback Resistor	R_F	100		$k\Omega$
Timing Capacitor	C_T	150	15000	pF
Timing Resistor	R_T	5.1	100	$k\Omega$
Oscillator frequency		1	500	kHz
Operating Free-Air Temperature	T_A	-20	85	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range, $V_{CC}=6\text{V}$, $f=200\text{kHz}$, $T_A=25^\circ\text{C}$, Unless otherwise specified)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference Section					
Output Voltage	Io=1mA	2.4	2.5	2.6	V
Output Voltage Change with Temperature	TA=-20°C to 25°C TA=25°C to 85°C		-0.1 -0.2	±1% ±1%	
Input Voltage Regulation	Vcc=3.6V to 40V		2	12.5	mV
Output Voltage Regulation	Io=0.1mA to 1mA		1	7.5	mV
Short-Circuit Output Current	Vo=0	3	10	30	mA
Undervoltage Lockout Section					
Upper Threshold Voltage (Vcc)	Io(ref)=0.1mA, TA=25°C		2.72		V
Lower Threshold Voltage (Vcc)			2.6		V
Hysteresis (Vcc)		80	120		mV
Reset Threshold voltage (Vcc)		1.5	1.9		V
Short-Circuit Protection Control Section					

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PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Threshold Voltage(SCP)	TA=25°C	0.65	0.7	0.75	V
Standby Voltage(SCP)	No pullup	140	185	230	mV
Latched Input Voltage (SCP)	No pullup		60	120	mV
Input (source) Current	VI=0.7V, TA=25°C	-10	-15	-20	μA
Comparator Threshold Voltage (FEEDBACK)			1.18		V
Oscillator Section					
Frequency	CT=330pF, RT=10kΩ		200		kHz
Standard deviation of frequency	CT=330pF, RT=10kΩ		10%		
Frequency Change with Voltage	Vcc=3.6V to 40V		1%		
Frequency Change with Temperature	TA=-20°C to 25°C TA=25°C to 85°C		-0.4% -0.2%	±2% ±2%	
Dead-Time Control Section					
Input bias Current (DTC)				1	μA
Latch mode (source) Current (DTC)	TA=25°C	-80	-145		μA
Latched Input Voltage (DTC)	Io=40μA	2.3			V
Input threshold Voltage at f=10kHz (DTC)	Zero duty cycle Maximum duty cycle	1.2	2.05 1.45	2.25	V
Error-Amplifier Section					
Input Offset Voltage	Vo (FEEDBACK)=1.25V			±6	mV
Input Offset Current	Vo (FEEDBACK)=1.25V			±100	nA
Input Bias current	Vo (FEEDBACK)=1.25V		160	500	nA
Common-Mode Input Voltage Range	Vcc=3.6V to 40V	1.05 to 1.45			V
Open-loop Voltage Amplification	RF=200kΩ	70	80		dB
Unity-gain Bandwidth			1.5		MHz
Common-mode Rejection Ratio		60	80		dB
Positive Output Voltage Swing		Vref-0.1			V
Negative Output Voltage Swing				1	V
Output (sink) Current (FEEDBACK)	VID=-0.1V, Vo=1.25V	0.5	1.6		mA
Output (source) Current (FEEDBACK)	VID=0.1V, Vo=1.25V	-45	-70		μA
Output Section					
Collector off-state Current	Vo=50V			10	μA
Output Saturation Voltage	Io=10mA		1.2	2	V
Short-Circuit Output Current	Vo=6V		90		mA
PWM Comparator Section					
Input Threshold Voltage at f=10kHz (FEEDBACK)	Zero duty cycle Maximum duty cycle	1.2	2.05 1.45	2.25	V
TOTAL DEVICE					
Standby Supply Current	Off-state		1.3	1.8	mA
Average Supply Current	RT=10kΩ		1.7	2.4	mA

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TEST CIRCUIT

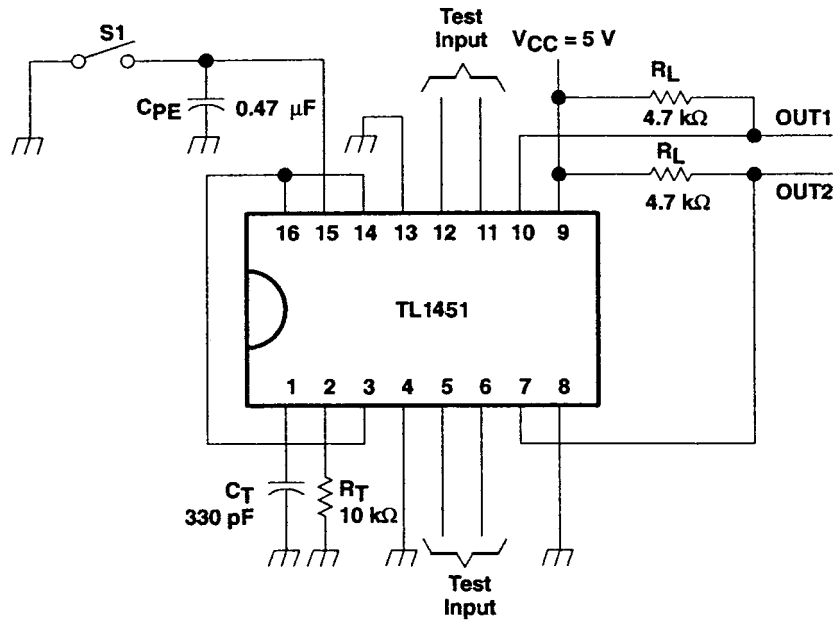
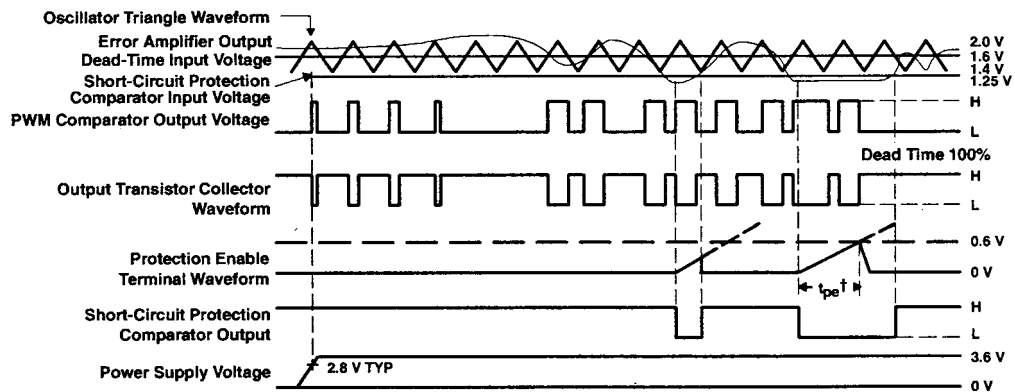


Figure 1.

TIMING DIAGRAM



† Protection Enable Time, $t_{pe} = (0.051 \times 10^6 \times C_{pe})$ in seconds

Figure 2.

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TYPICAL CHARACTERISTICS

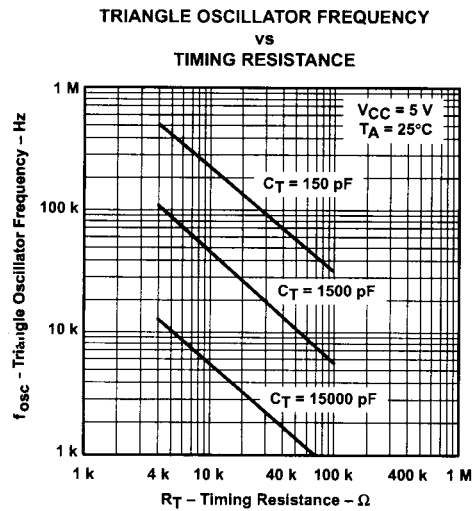


Figure 3

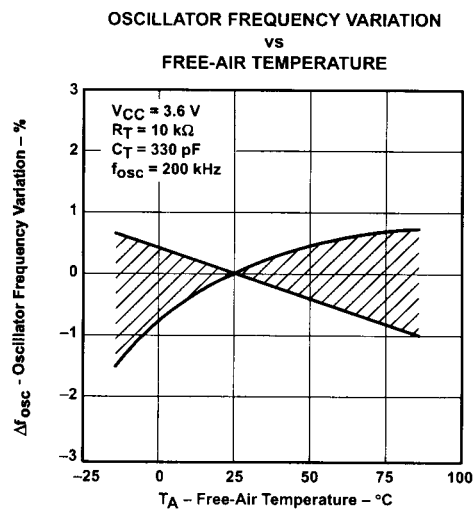


Figure 4

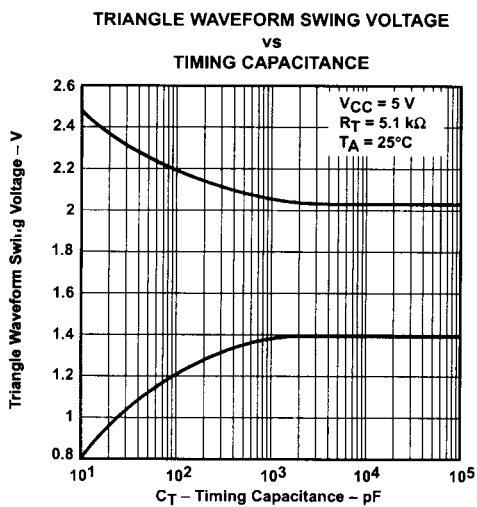


Figure 5

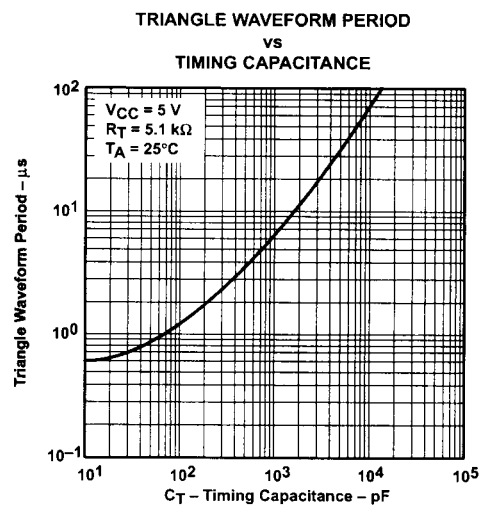


Figure 6

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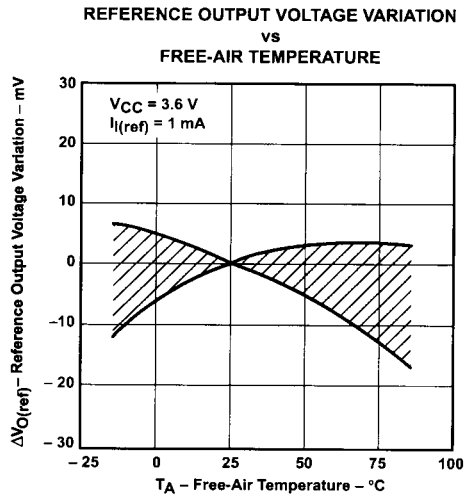


Figure 7

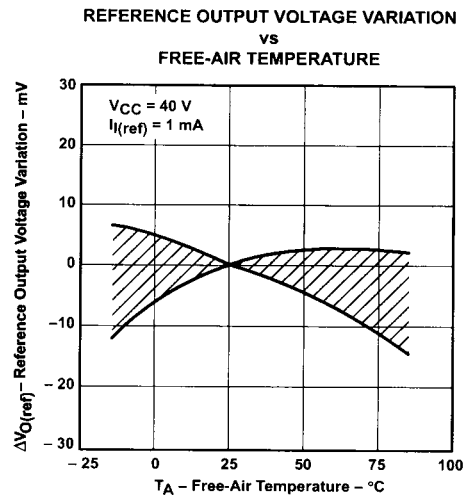


Figure 8

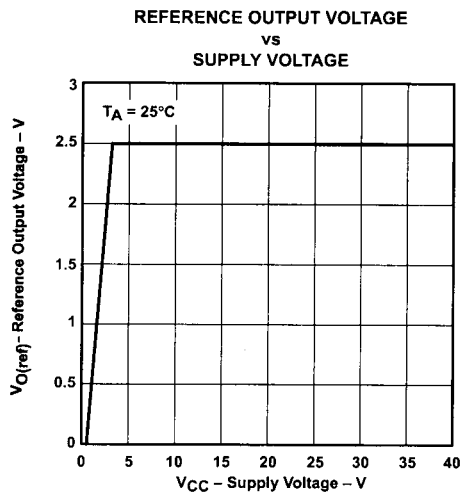


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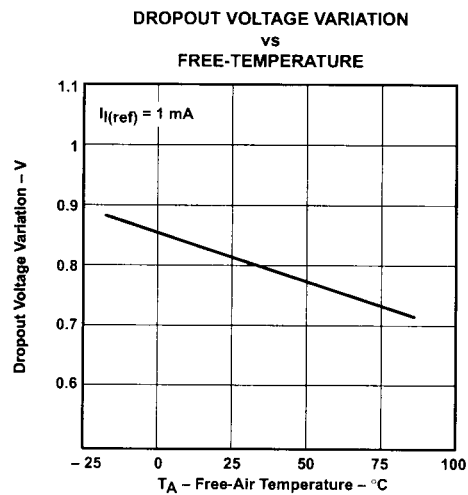
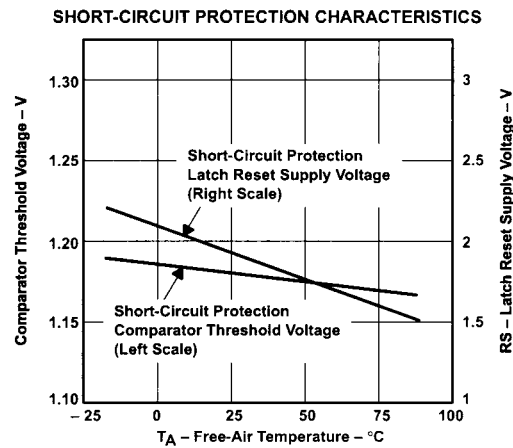
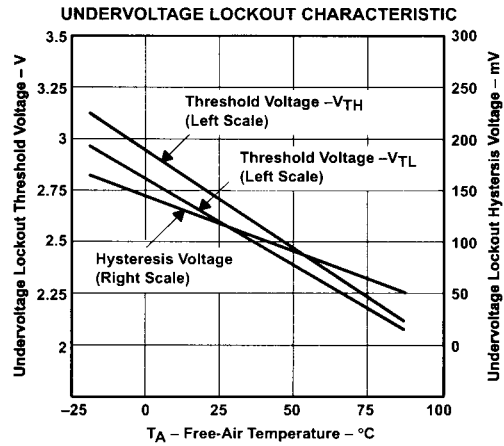
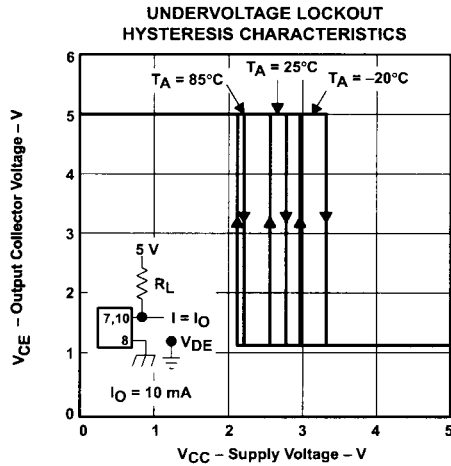
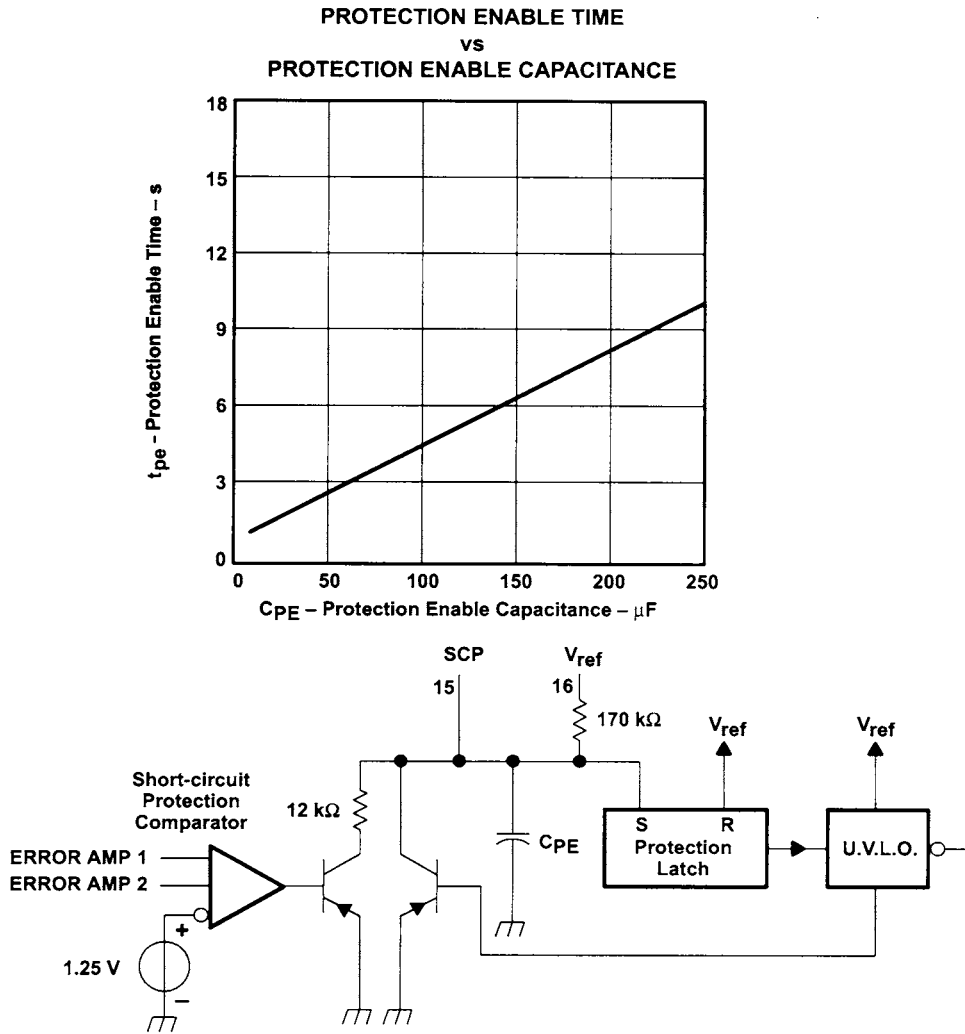


Figure 10

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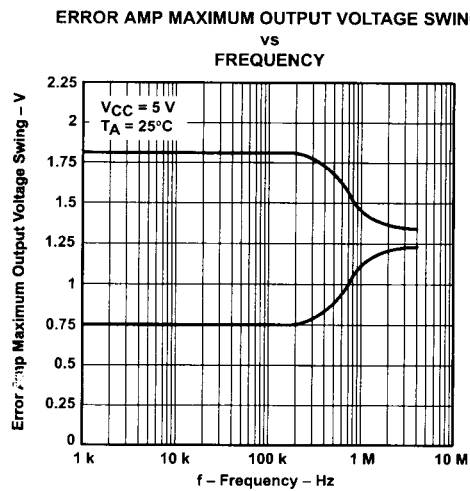


Figure 15

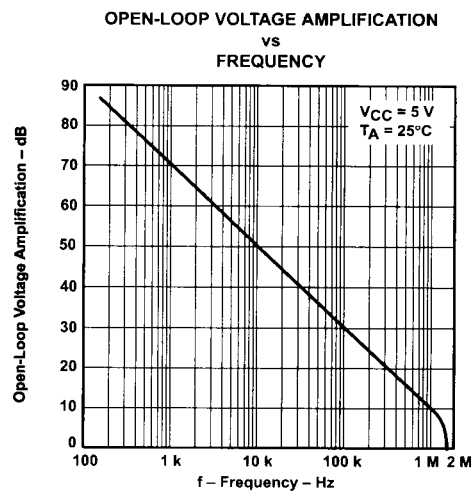


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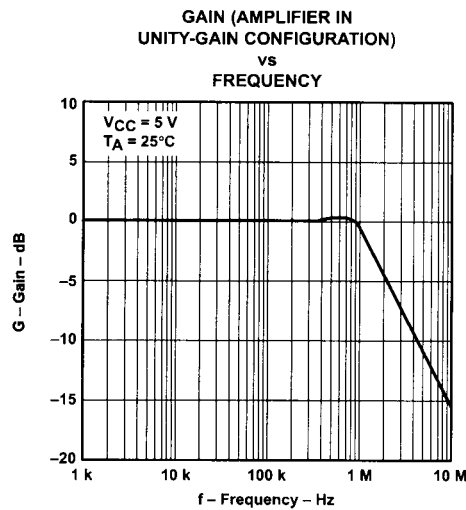
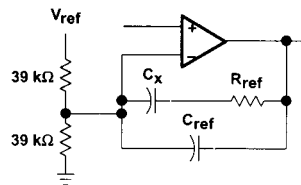
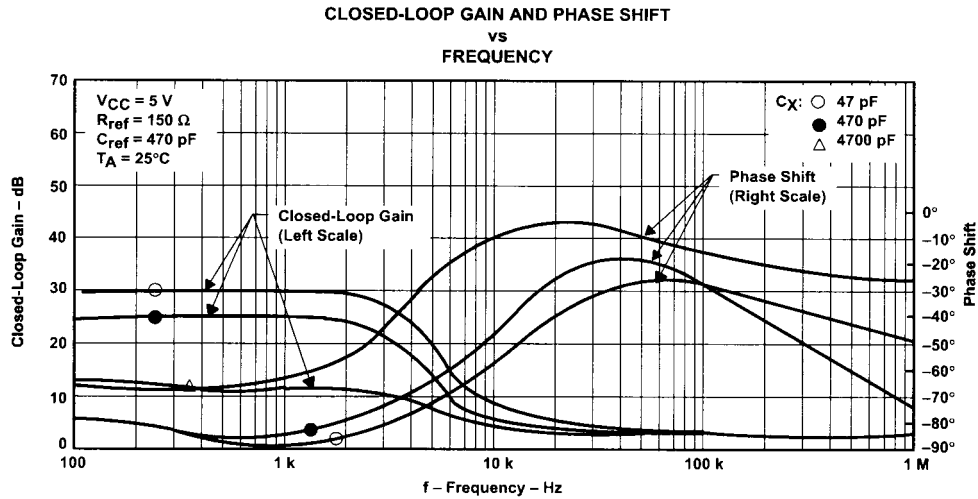


Figure 17

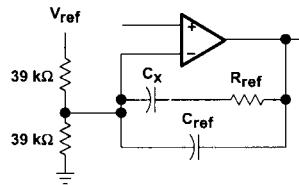
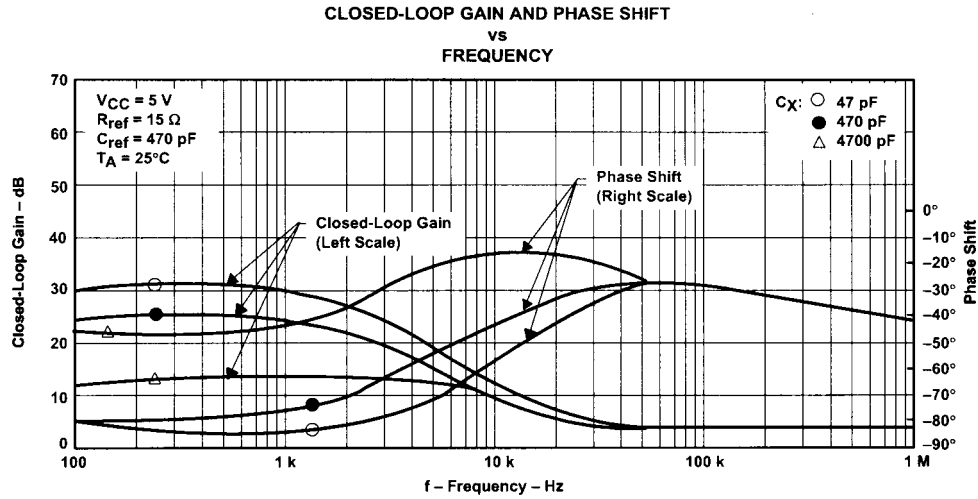
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Test Circuit

Figure 18

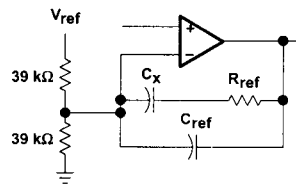
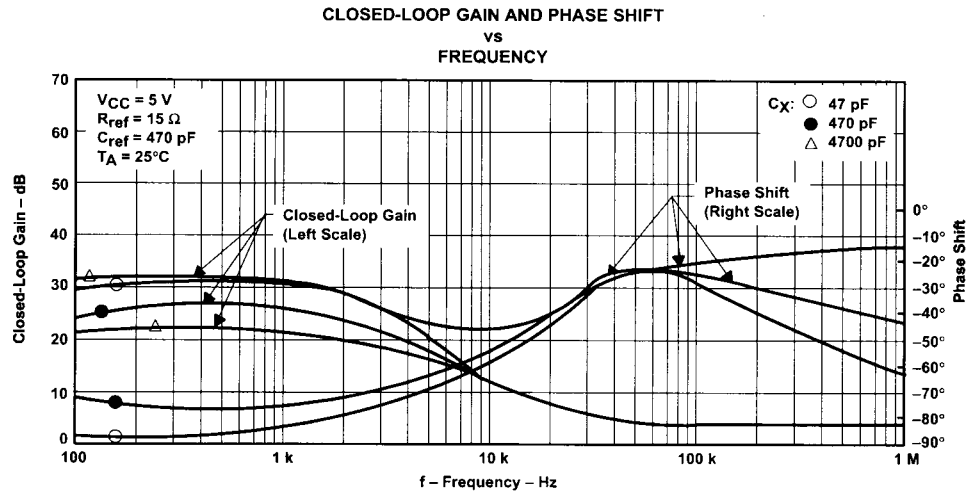
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Test Circuit

Figure 19

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Test Circuit

Figure 20

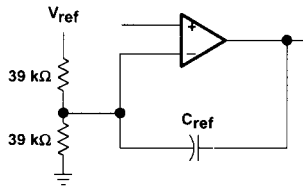
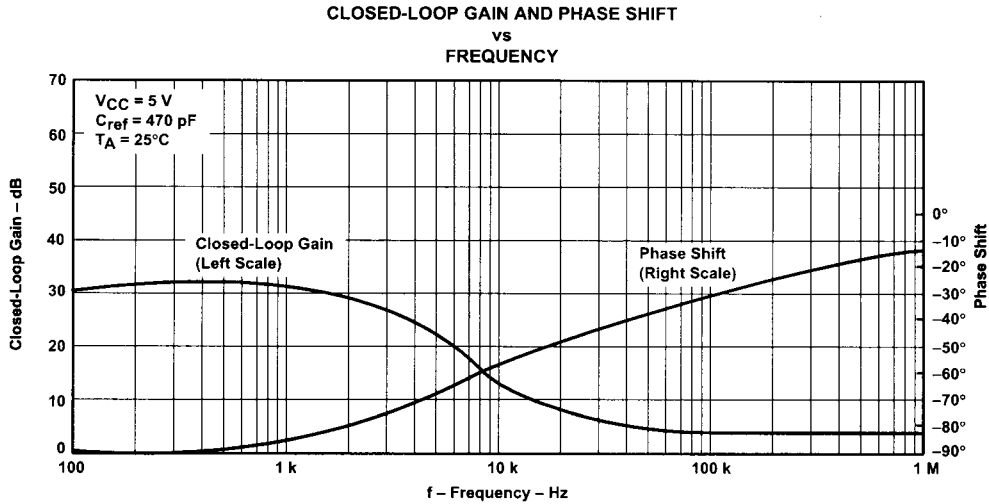


Figure 21

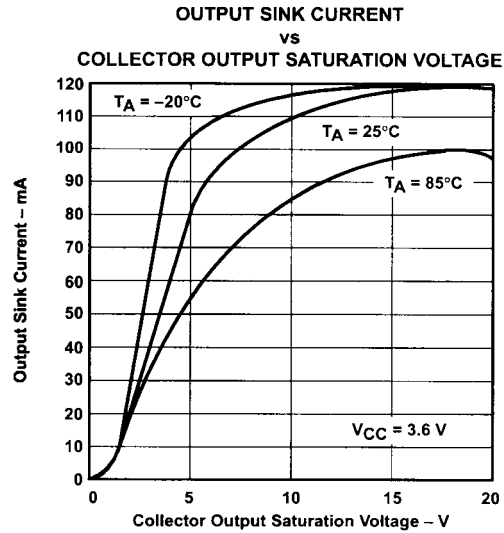


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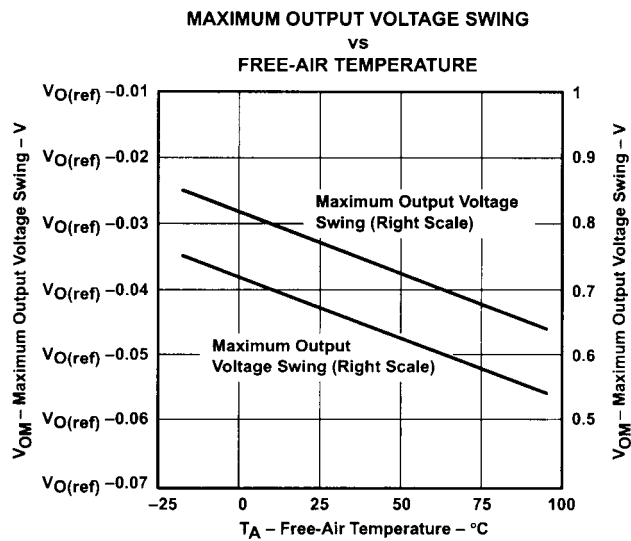
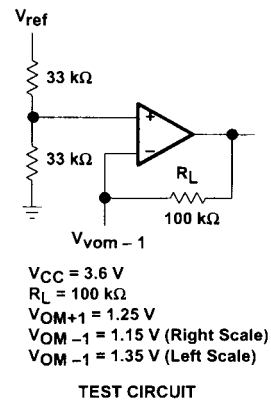


Figure 23



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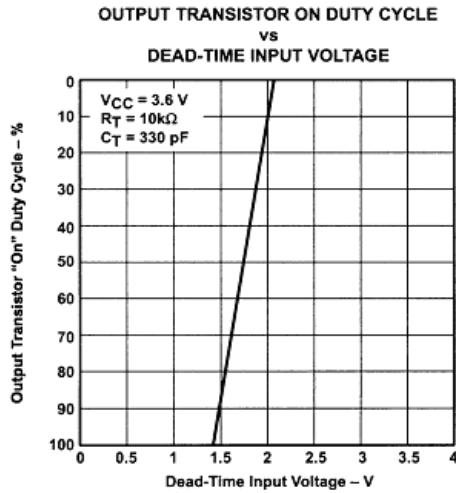


Figure 24

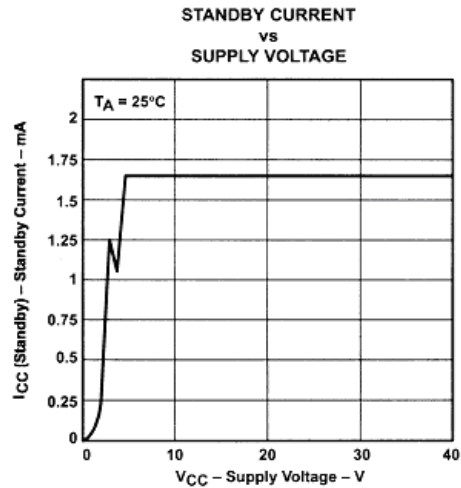


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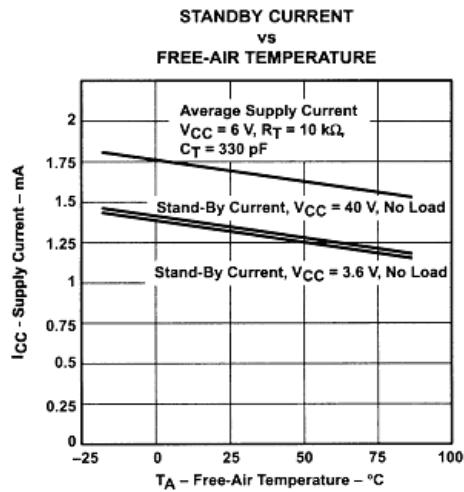


Figure 26

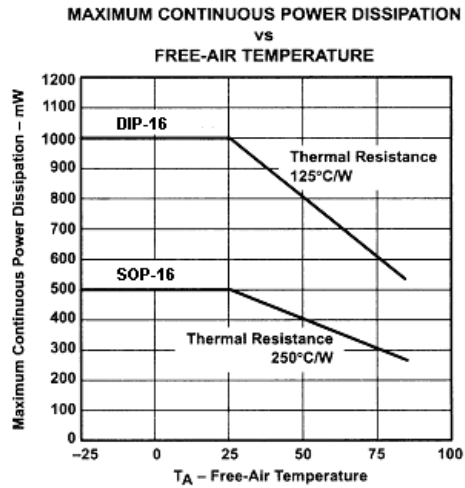
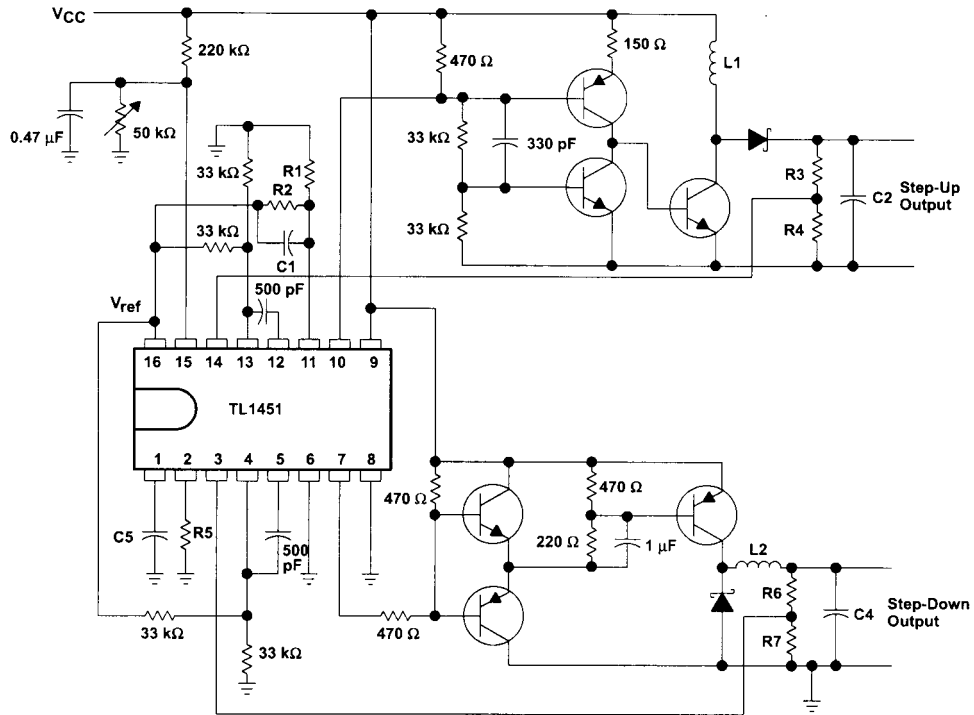


Figure 27

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NOTE A: Values for R1 through R7, C1 through C4, and L1 and L2 depend upon individual application.

Figure 28. High-Speed Dual Switching Regulator