



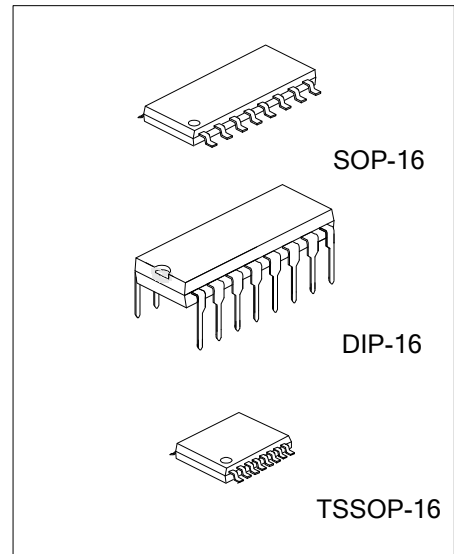
# TL1451

## 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 UTC **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

■ ORDERING INFORMATION

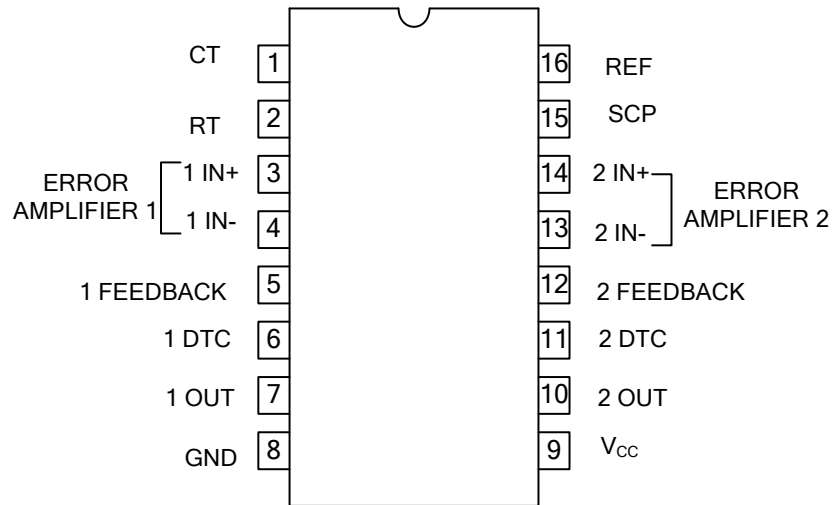
Ordering Number		Package	Packing
Lead Free	Halogen Free		
TL1451L-D16-T	TL1451G-D16-T	DIP-16	Tube
-	TL1451G-P16-R	TSSOP-16	Tape Reel
-	TL1451G-S16-R	SOP-16	Tape Reel

<p>TL1451L-D16-T</p> <ul style="list-style-type: none"> <li>(1) Packing Type</li> <li>(2) Package Type</li> <li>(3) Green Package</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel, T: Tube</li> <li>(2) D16: DIP-16, P16: TSSOP-16, S16: SOP-16</li> <li>(3) L: Lead Free, G: Halogen Free and Lead Free</li> </ul>
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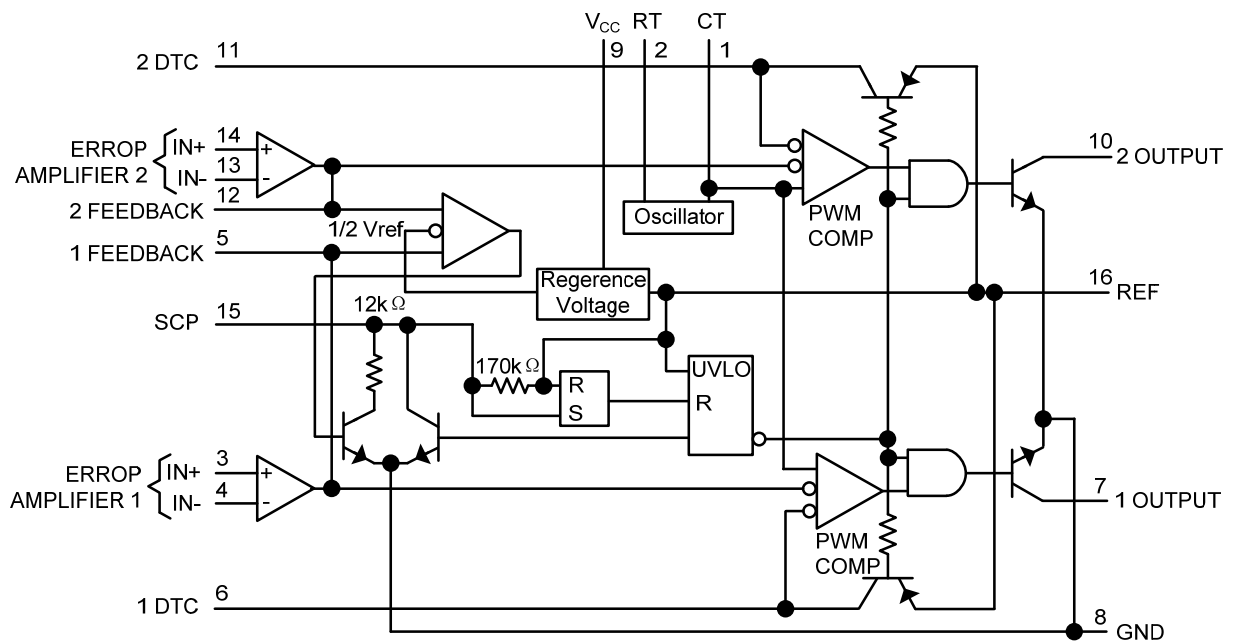
■ MARKING

DIP-16	SOP-16 / TSSOP-16

## PIN CONFIGURATION



## BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=25°C, unless otherwise specified)

PARAMETER		SYMBOL	VALUE	UNIT
Supply Voltage		V <sub>CC</sub>	51	V
Amplifier Input Voltage		V <sub>IN</sub>	20	V
Collector Output Voltage		V <sub>OUT</sub>	51	V
Collector Output Current		I <sub>OUT</sub>	21	mA
Power Dissipation	DIP-16	P <sub>D</sub>	1000	mW
	SOP-16		500	
	TSSOP-16		700	
Junction Temperature		T <sub>J</sub>	+125	°C
Operating Temperature		T <sub>OPR</sub>	-20 ~ +85	°C
Storage Temperature		T <sub>STG</sub>	-40 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Supply Voltage	V <sub>CC</sub>	3.6		50	V
Amplifier Input Voltage	V <sub>IN</sub>	1.05		1.45	V
Collector Output Voltage	V <sub>OUT</sub>			50	V
Collector Output Current(each Transistor)	I <sub>OUT</sub>			20	mA
Current into Feedback Terminal	I <sub>FB</sub>			45	μA
Feedback Resistor	R <sub>F</sub>	100			kΩ
Timing Capacitor	C <sub>T</sub>	150		15000	pF
Timing Resistor	R <sub>T</sub>	8		100	kΩ
Oscillator frequency	F <sub>OSC</sub>	1		350	kHz
Operating Temperature	T <sub>OPR</sub>	-20		85	°C

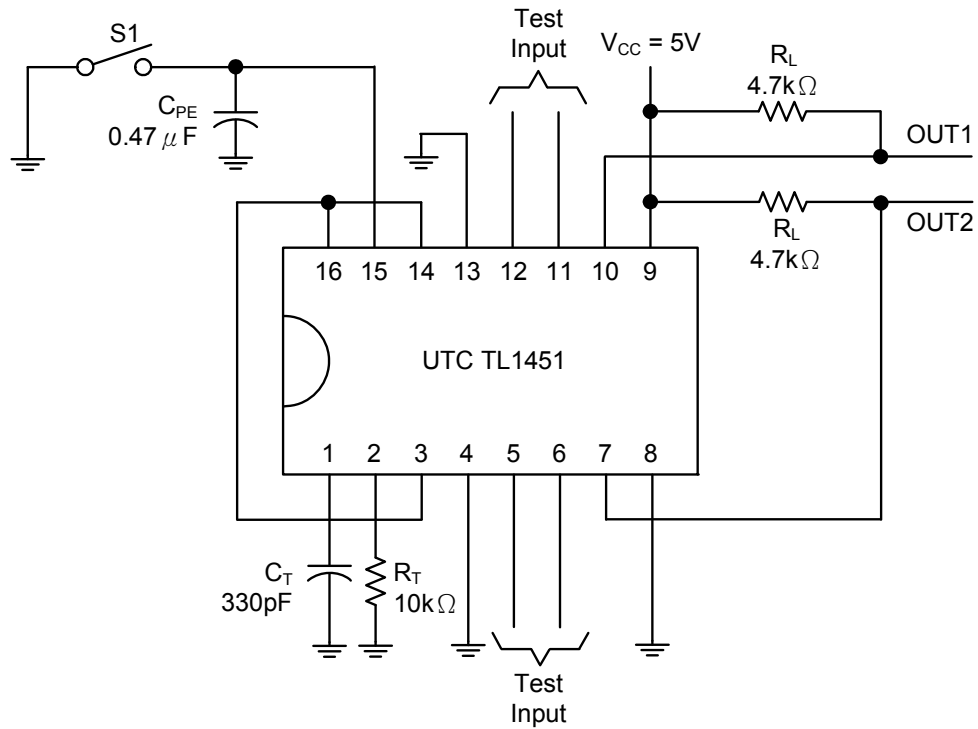
■ ELECTRICAL CHARACTERISTICS (V<sub>CC</sub>=6V, f=200kHz, T<sub>a</sub>=25°C, unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
<b>Reference Section</b>							
Output Voltage	V <sub>OUT</sub>	I <sub>OUT</sub> =1mA	2.4	2.5	2.6	V	
Output Voltage Change with Temperature		T <sub>a</sub> = -20°C ~ 25°C		-0.1	±1	%	
		T <sub>a</sub> = 25°C ~ 85°C		-0.2	±1		
Input Voltage Regulation	ΔV <sub>IN</sub>	V <sub>CC</sub> =3.6V ~ 40V		2	12.5	mV	
Output Voltage Regulation	ΔV <sub>OUT</sub>	I <sub>OUT</sub> =0.1mA ~ 1mA		1	7.5	mV	
Short-Circuit Output Current	I <sub>OUT</sub>	V <sub>OUT</sub> =0	3	10	30	mA	
<b>Undervoltage Lockout Section</b>							
Threshold Voltage (V <sub>CC</sub> )	Upper	V <sub>THR</sub>	I <sub>OUT(REF)</sub> =0.1mA		2.72	V	
	Lower				2.6	V	
Hysteresis (V <sub>CC</sub> )				V <sub>HYS</sub>		120	mV
Reset Threshold voltage (V <sub>CC</sub> )					1.5	1.9	V
<b>Short-Circuit Protection Control Section</b>							
Input Threshold Voltage(SCP)	V <sub>IN(THR)</sub>		0.60	0.67	0.75	V	
Standby Voltage(SCP)	V <sub>STN-BY</sub>	No pullup	140	185	230	mV	
Latched Input Voltage (SCP)	V <sub>IN(LAT)</sub>	No pullup		60	120	mV	
Input (source) Current	I <sub>IN(SOURCE)</sub>	V <sub>IN</sub> =0.7V	-10	-15	-20	μA	
Comparator Threshold Voltage (FEEDBACK)	V <sub>THR</sub>			1.18		V	

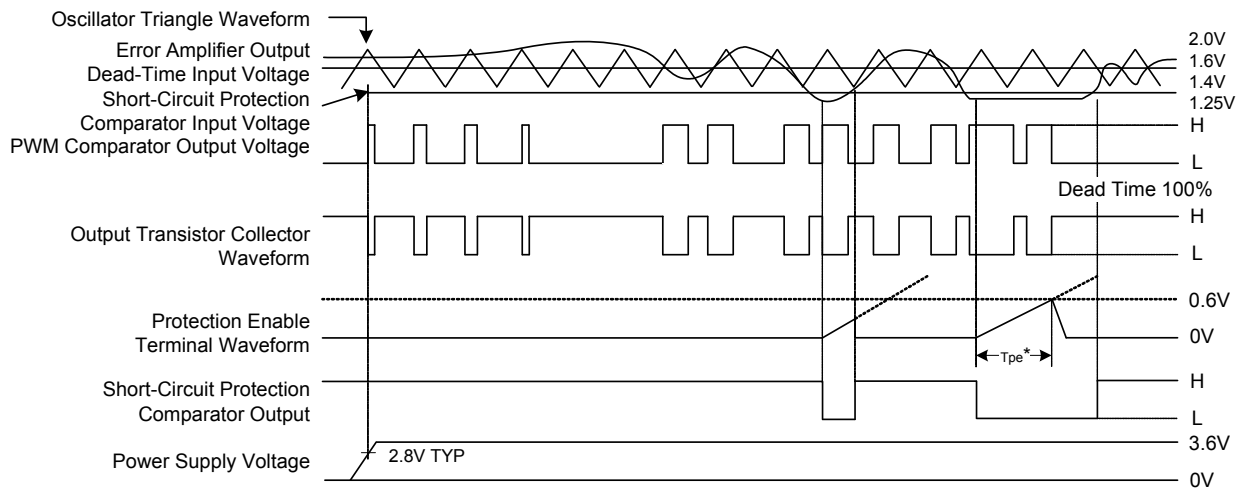
### ■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Oscillator Section</b>						
Frequency	F	$C_T=330\text{pF}$ , $R_T=10\text{k}\Omega$		200		kHz
Standard deviation of frequency		$C_T=330\text{pF}$ , $R_T=10\text{k}\Omega$		10%		
Frequency Change with Voltage		$V_{CC}=3.6\text{V} \sim 40\text{V}$		1%		
Frequency Change with Temperature		$T_A=-20^\circ\text{C} \sim 25^\circ\text{C}$		-0.4	$\pm 2$	%
		$T_A=25^\circ\text{C} \sim 85^\circ\text{C}$		-0.2	$\pm 2$	
<b>Dead-Time Control Section</b>						
Input bias Current (DTC)	$I_{IN(BIAS)}$				1	$\mu\text{A}$
Latch mode (source) Current (DTC)			-80	-145		$\mu\text{A}$
Latched Input Voltage (DTC)	$V_{IN}$	$I_{OUT}=40\mu\text{A}$	2.3			V
Input threshold Voltage at $f=10\text{kHz}$ (DTC)	$V_{IN(THR)}$	Zero duty cycle		2.05	2.25	V
		Maximum duty cycle	1.2	1.45		
<b>Error-Amplifier Section</b>						
Input Offset Voltage	$V_{IN(OFF)}$	$V_{OUT}(\text{FEEDBACK})=1.25\text{V}$			$\pm 6$	mV
Input Offset Current	$I_{IN(OFF)}$	$V_{OUT}(\text{FEEDBACK})=1.25\text{V}$			$\pm 100$	nA
Input Bias current	$I_{IN(BIAS)}$	$V_{OUT}(\text{FEEDBACK})=1.25\text{V}$		160	500	nA
Common-Mode Input Voltage Range	$V_{IN(CM)}$	$V_{CC}=3.6\text{V} \sim 40\text{V}$	1.05~ 1.45			V
Open-loop Voltage Amplification		$R_F=200\text{k}\Omega$	70	80		dB
Unity-gain Bandwidth	$B_G$			1.5		MHz
Common-mode Rejection Ratio	RR		60	80		dB
Positive Output Voltage Swing	$V_{OUT}$		$V_{ref}-0.1$			V
Negative Output Voltage Swing	$V_{OUT}$				1	V
Output (sink) Current (FEEDBACK)	$I_{OUT(SIN)}$	$V_{ID}=-0.1\text{V}$ , $V_{OUT}=1.25\text{V}$	0.5	1.6		mA
Output (source) Current (FEEDBACK)	$I_{OUT(SOU)}$	$V_{ID}=0.1\text{V}$ , $V_{OUT}=1.25\text{V}$	-30	-40		$\mu\text{A}$
<b>Output Section</b>						
Collector off-state Current	$I_{OFF}$	$V_{OUT}=50\text{V}$			10	$\mu\text{A}$
Output Saturation Voltage	$V_{OUT(SAT)}$	$I_{OUT}=10\text{mA}$		1.2	2	V
Short-Circuit Output Current	$I_{OUT(SHT)}$	$V_{OUT}=6\text{V}$		90		mA
<b>PWM Comparator Section</b>						
Input Threshold Voltage at $f=10\text{kHz}$ (FEEDBACK)	$V_{I(THR)}$	Zero duty cycle		2.05	2.25	V
		Maximum duty cycle	1.2	1.45		
<b>TOTAL DEVICE</b>						
Standby Supply Current	$I_{STN-BY}$	Off-state		1.3	1.8	mA
Average Supply Current		$R_T=10\text{k}\Omega$		1.7	2.4	mA

### ■ TEST CIRCUIT



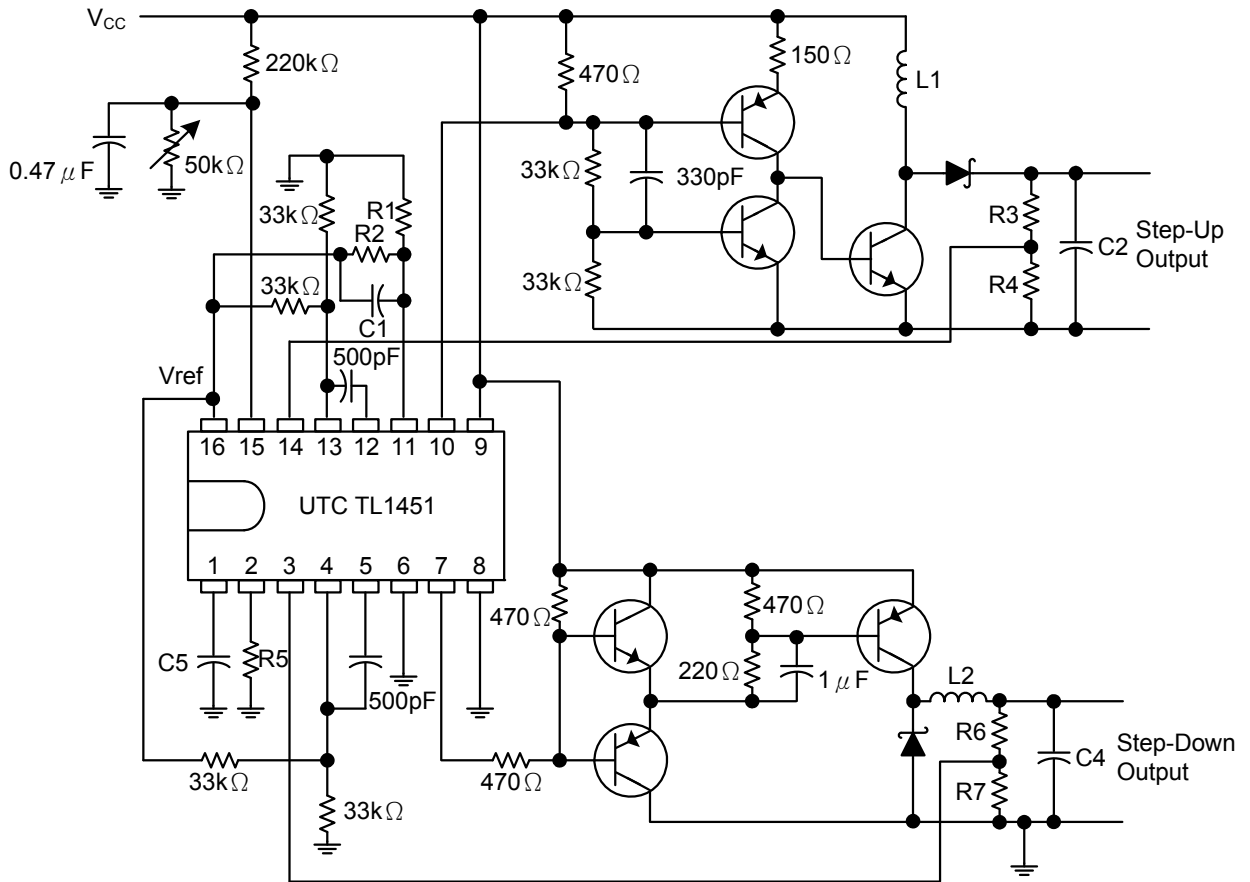
### ■ TIMING DIAGRAM



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

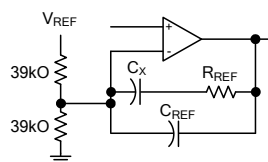
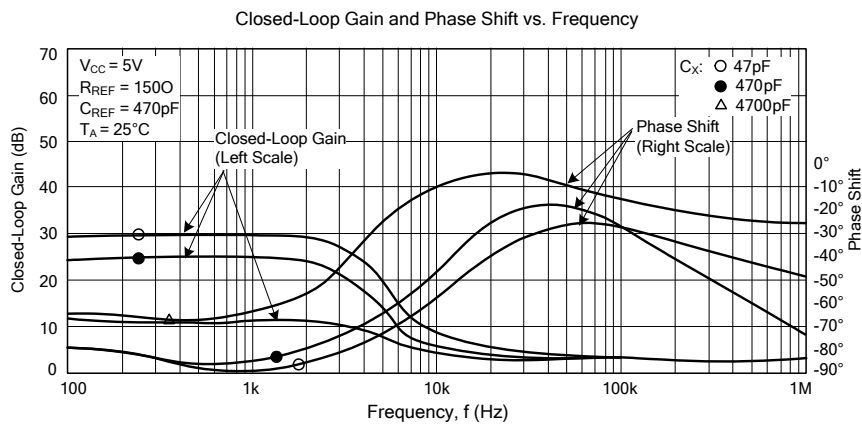
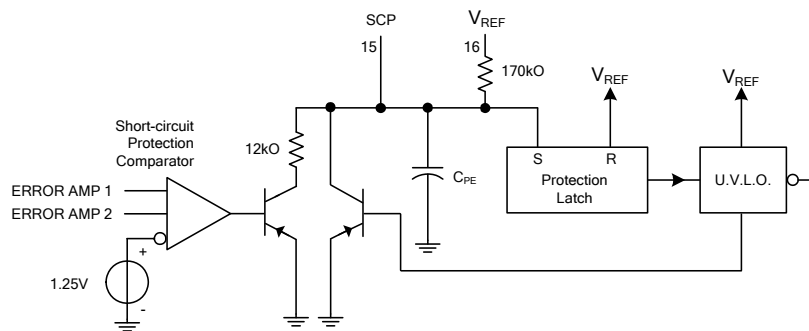
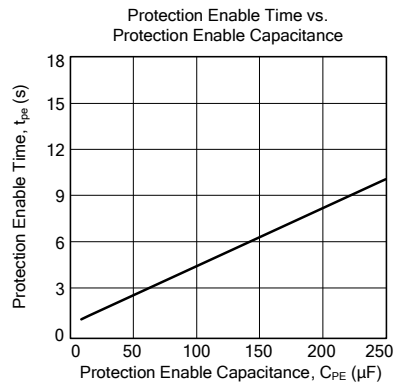
### ■ APPLICATION INFORMATION

#### HIGH-SPEED DUAL SWITCHING REGULATOR

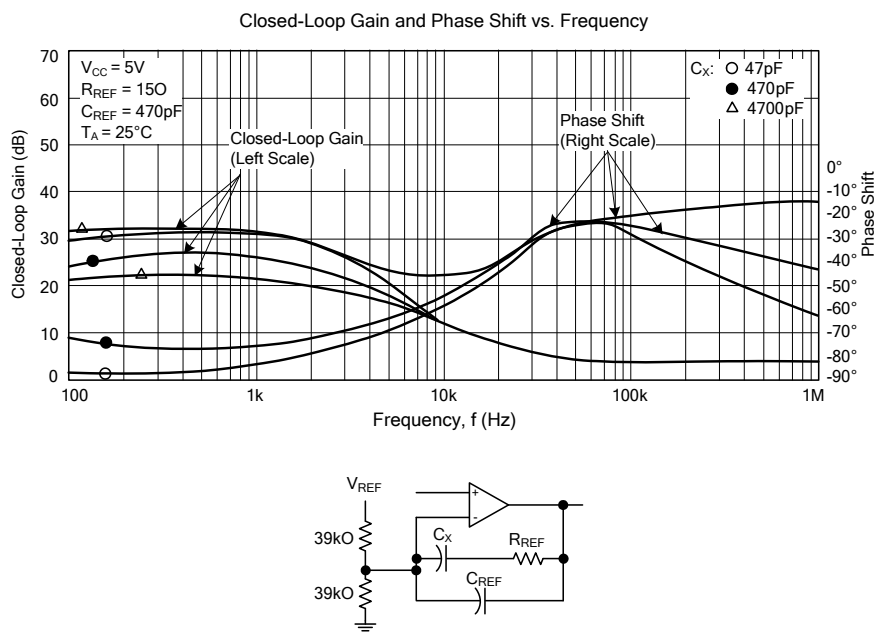
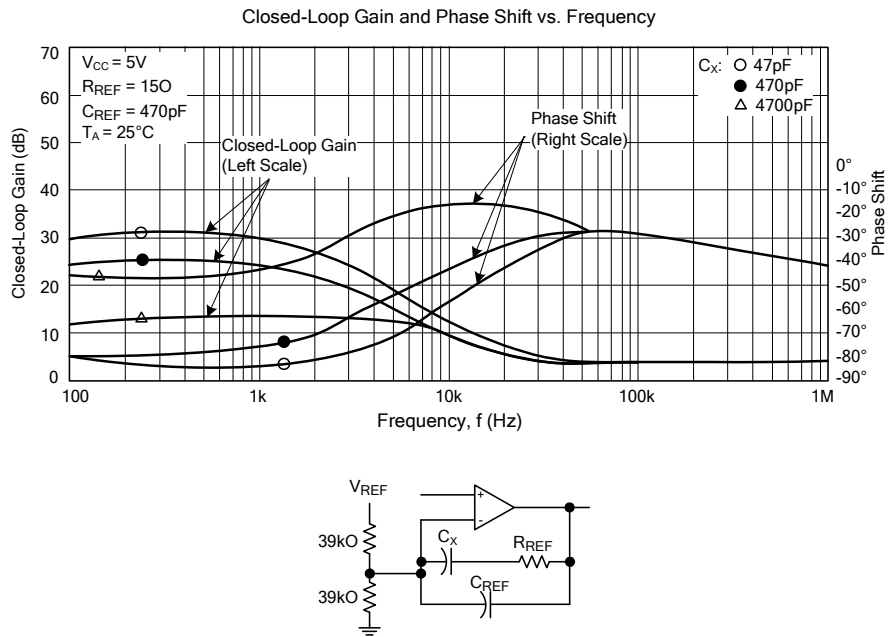


NOTE A: Values for R1 through R7, C1 through C4, and L1 and L2 depend upon individual application.

## TYPICAL CHARACTERISTICS

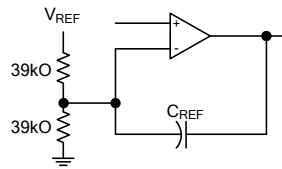
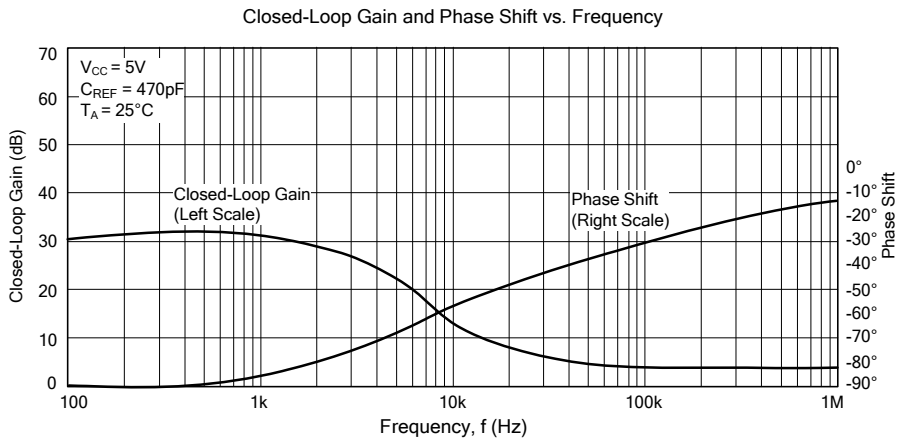


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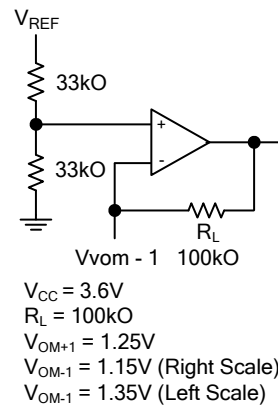
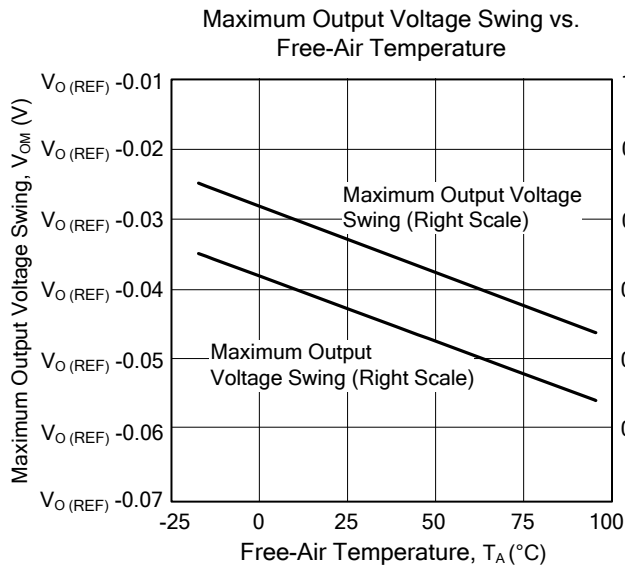
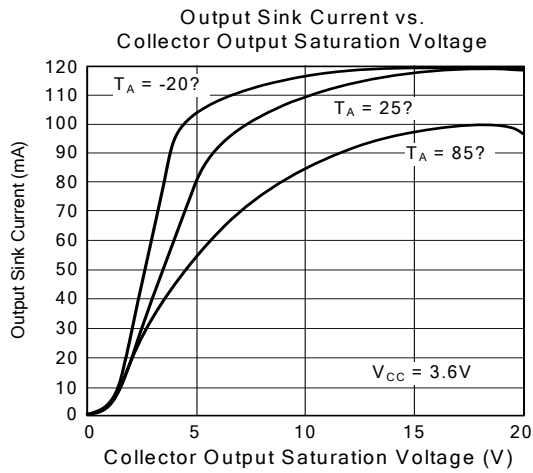




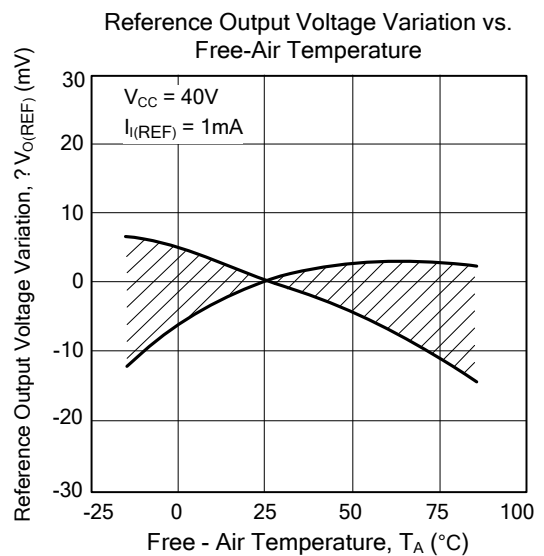
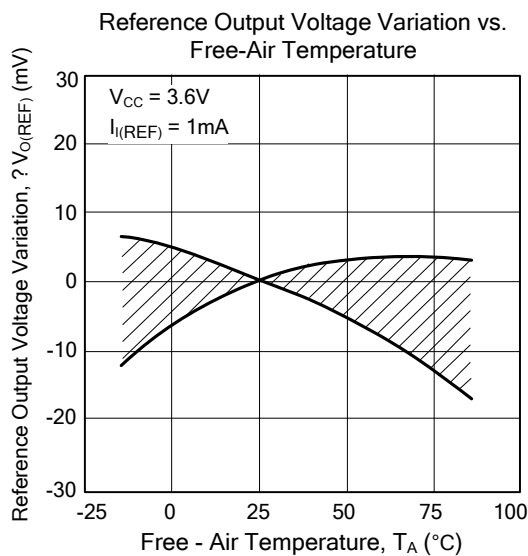
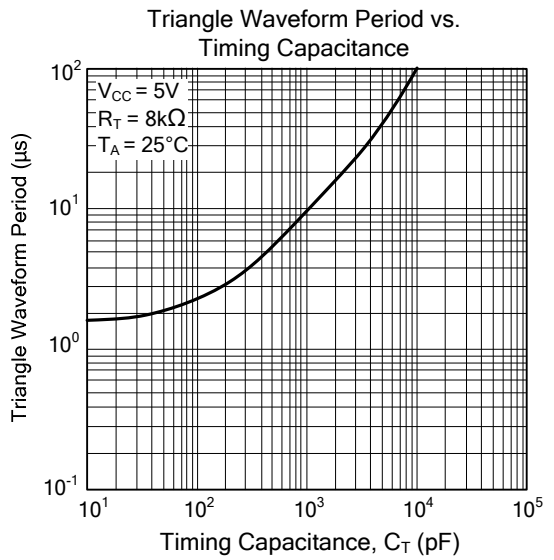
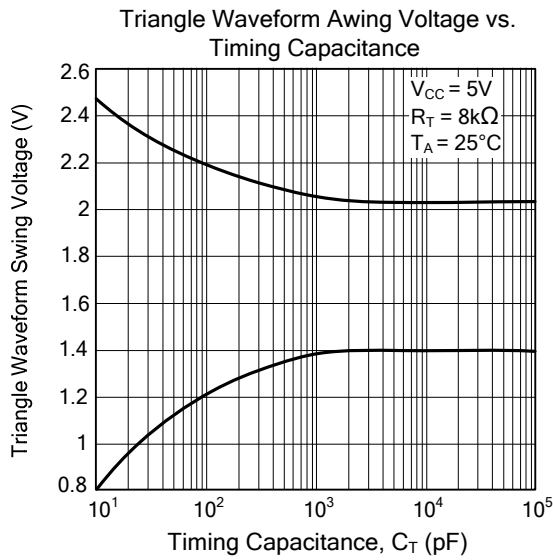
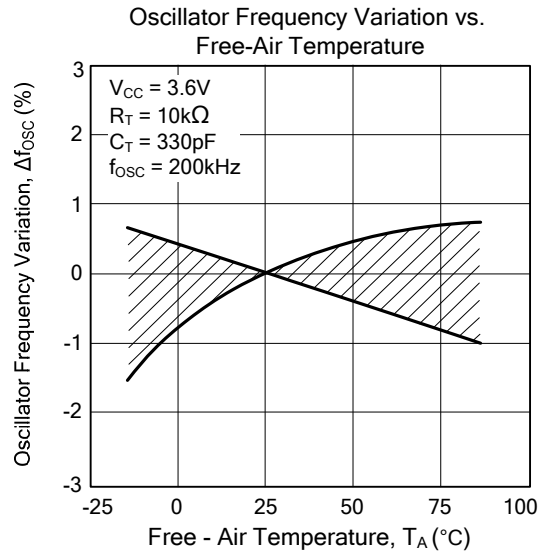
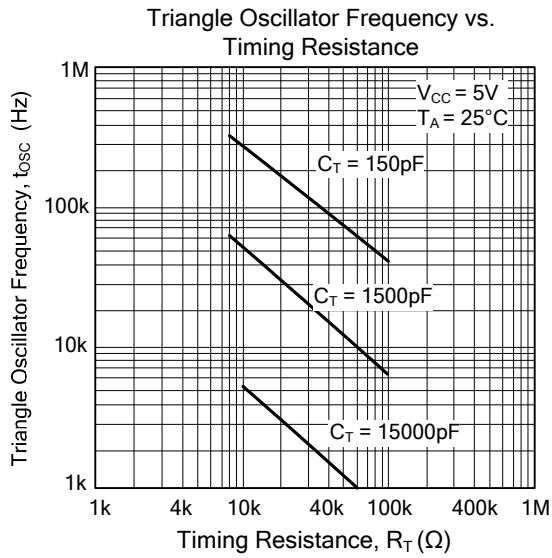
■ TYPICAL CHARACTERISTICS(Cont.)



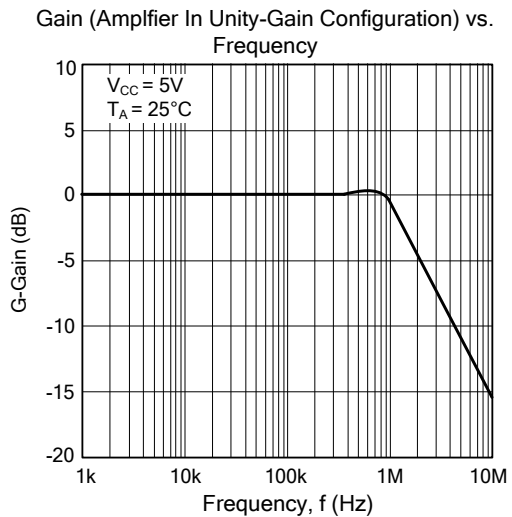
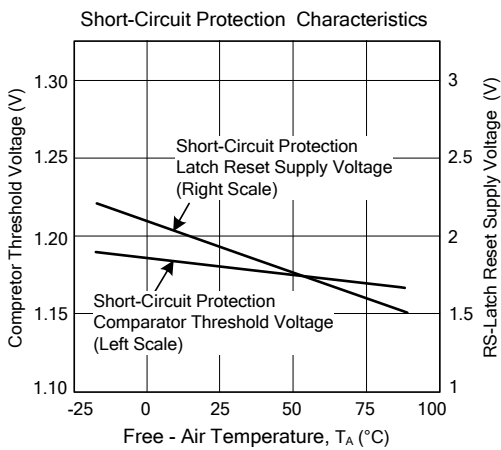
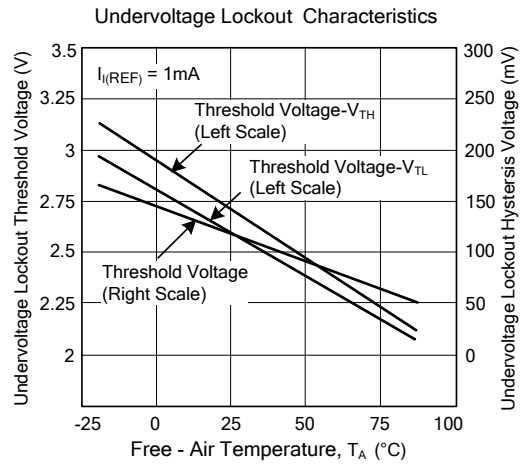
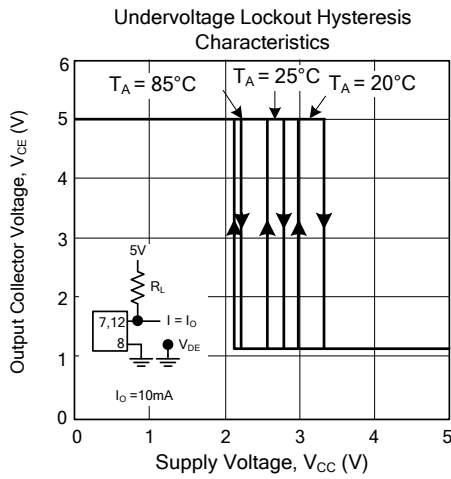
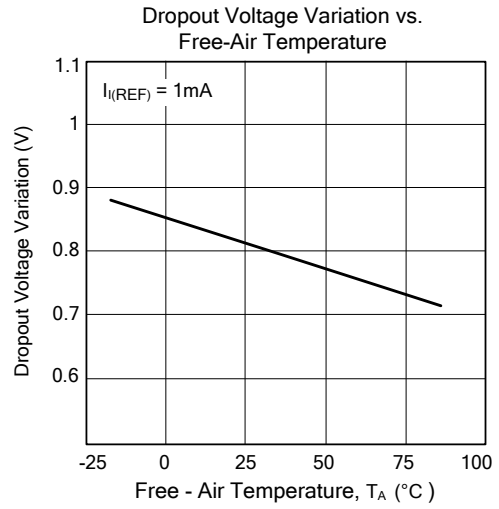
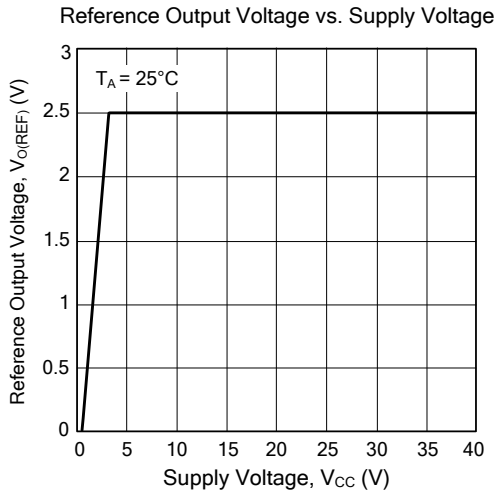
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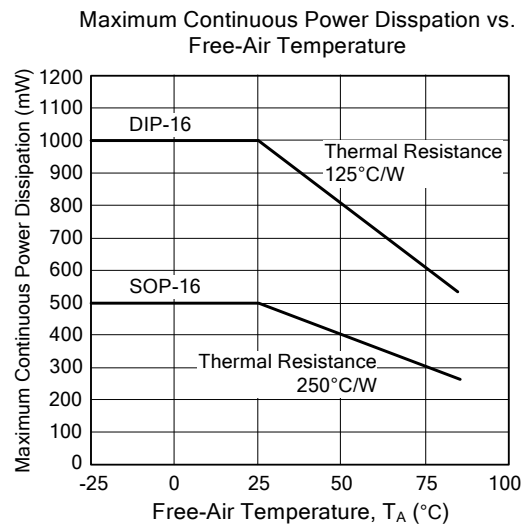
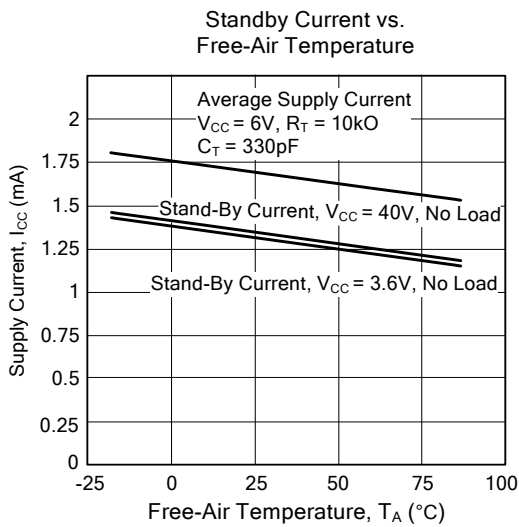
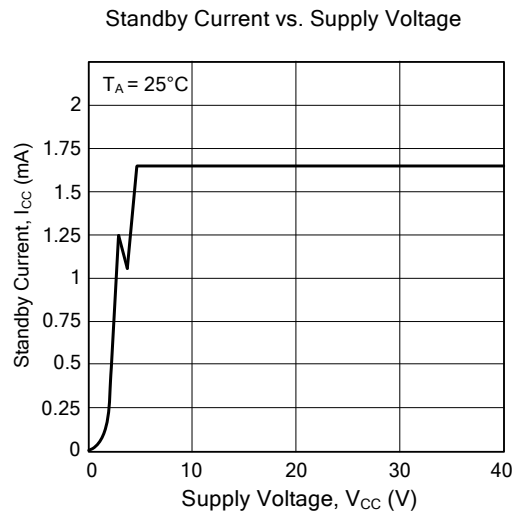
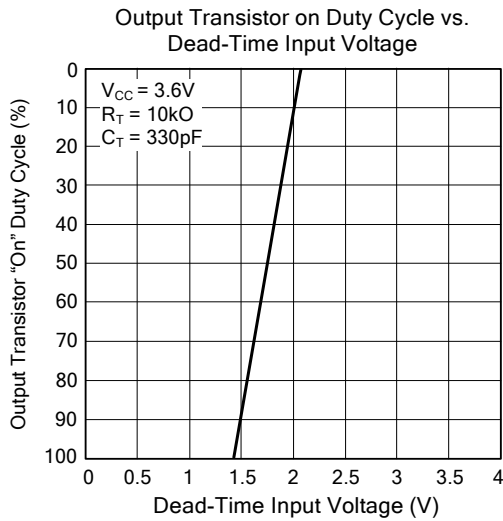
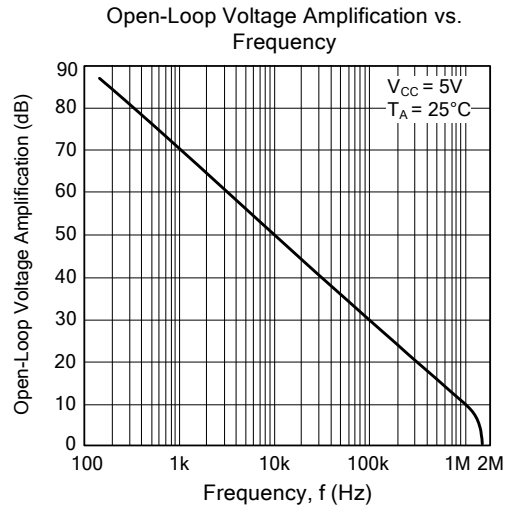
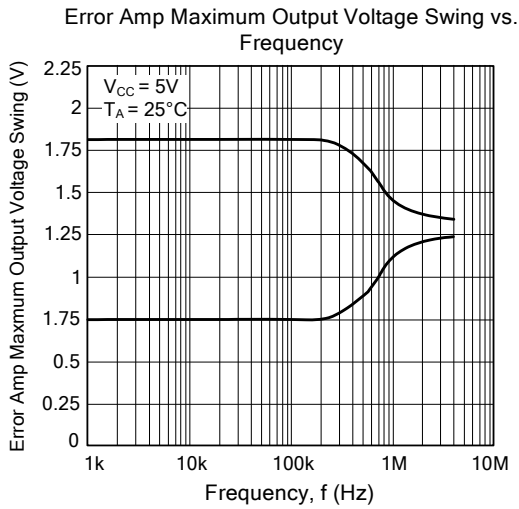
■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS(Cont.)



## TYPICAL CHARACTERISTICS(Cont.)



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