



TL1451

LINEAR INTEGRATED CIRCUIT

DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUITS

DESCRIPTION

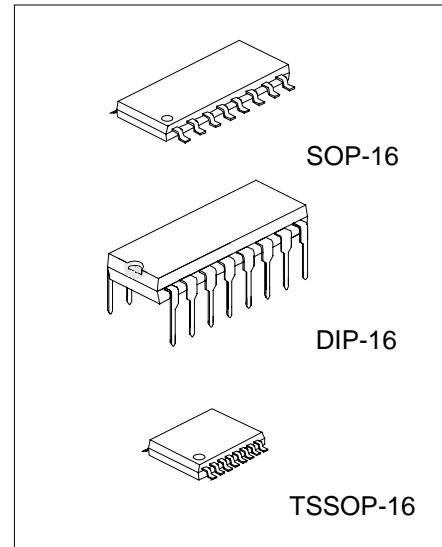
The UTC **TL1451** incorporates on a single monolithic chip all the functions required in the construction of two pulse-width-modulation (PWM) control circuits. Designed primarily for power supply control, the UTC **TL1451** contains an on-chip 2.5V regulator, two error amplifiers, an adjustable oscillator, 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

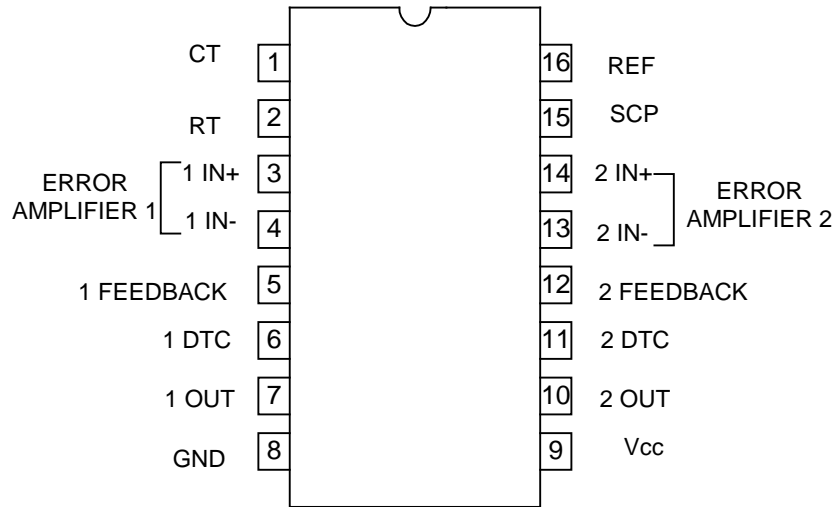
ORDERING INFORMATION

Order Number		Package	Packing
Normal	Lead free plating		
TL1451-S16-R	TL1451L-S16-R	SOP-16	Tape Reel
TL1451-S16-T	TL1451L-S16-T	SOP-16	Tube
TL1451-P16-R	TL1451L-P16-R	TSSOP-16	Tape Reel
TL1451-P16-T	TL1451L-P16-T	TSSOP-16	Tube
TL1451-D16-T	TL1451L-D16-T	DIP-16	Tube

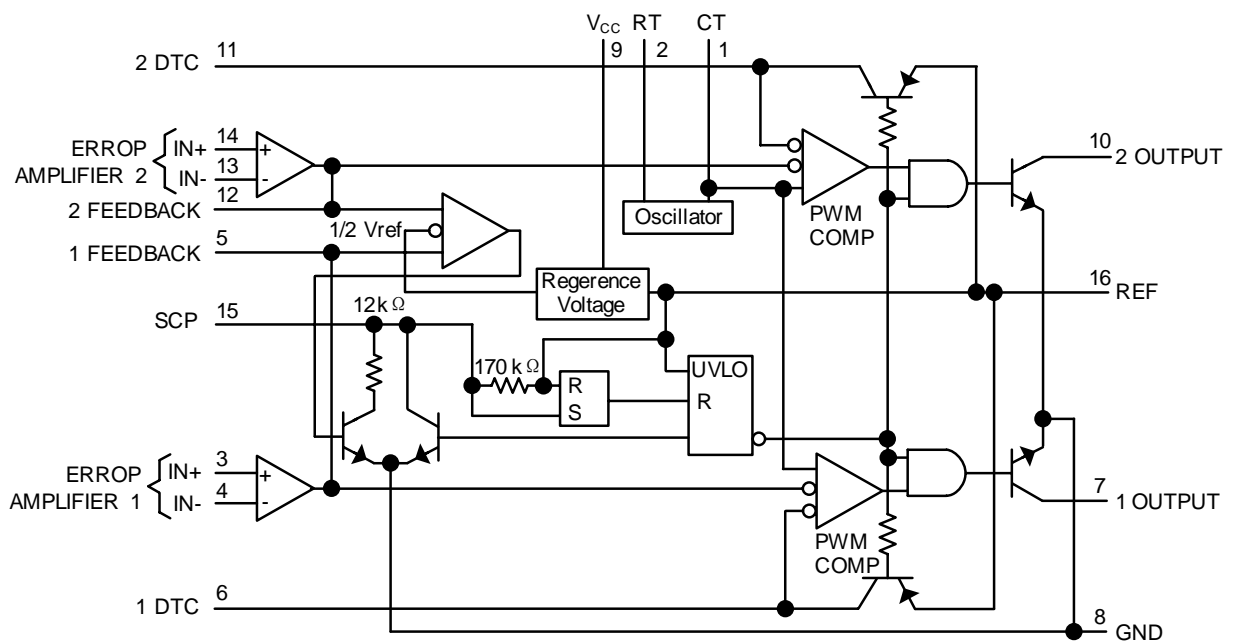


*Pb-free plating product number: TL1451L

PIN CONFIGURATION



BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (T_a=25°C, unless otherwise specified)

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

Note 1. 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.

2. The device is guaranteed to meet performance specification within 0 ~ +70 operating temperature range and assured by design from -20 ~ +85 .

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Supply Voltage	V _{CC}	3.6		50	V
Amplifier Input Voltage	V _{IN}	1.05		1.45	V
Collector Output Voltage	V _{OUT}			50	V
Collector Output Current(each Transistor)	I _{OUT}			20	mA
Current into Feedback Terminal	I _{FB}			45	μA
Feedback Resistor	R _F	100			kΩ
Timing Capacitor	C _T	150		15000	pF
Timing Resistor	R _T	5.1		100	kΩ
Oscillator frequency	F _{OSC}	1		500	kHz
Operating Temperature	T _{OPR}	-20		85	°C

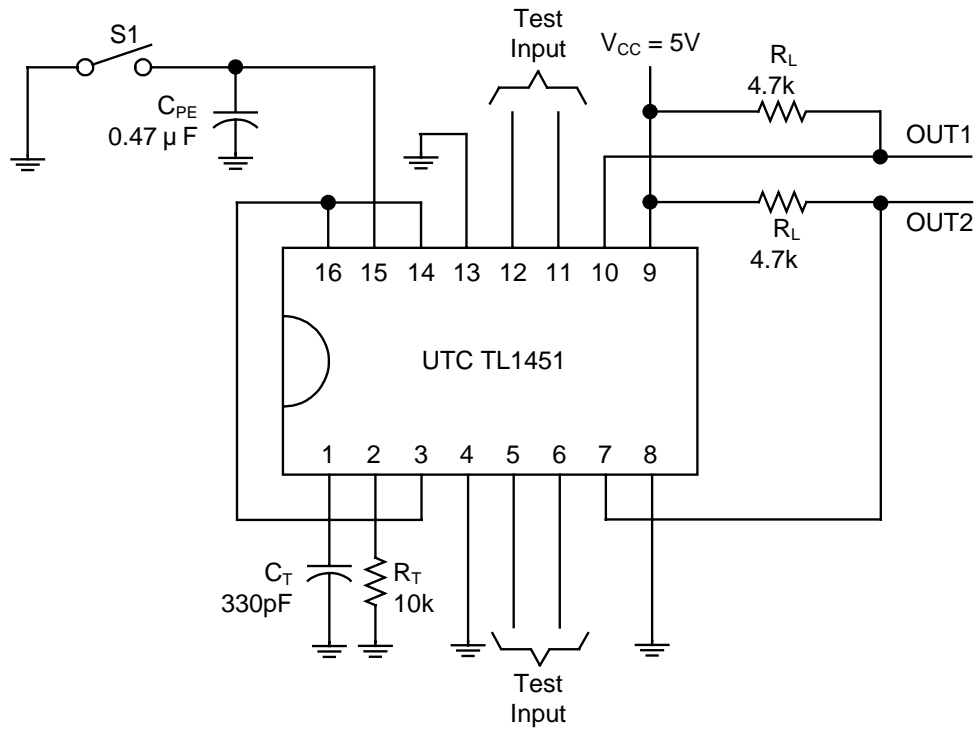
■ ELECTRICAL CHARACTERISTICS(V_{CC}=6V, f=200kHz, T_a=25°C, unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT		
Reference Section								
Output Voltage	V _{OUT}	I _{OUT} =1mA	2.4	2.5	2.6	V		
Output Voltage Change with Temperature		T _a = -20°C ~ 25°C		-0.1	±1	%		
		T _a = 25°C ~ 85°C		-0.2	±1			
Input Voltage Regulation	V _{IN}	V _{CC} =3.6V ~ 40V		2	12.5	mV		
Output Voltage Regulation	V _{OUT}	I _{OUT} =0.1mA ~ 1mA		1	7.5	mV		
Short-Circuit Output Current	I _{OUT}	V _{OUT} =0	3	10	30	mA		
Undervoltage Lockout Section								
Threshold Voltage (V _{CC})	Upper	V _{THR}	I _{OUT(REF)} =0.1mA		2.72		V	
	Lower				2.6		V	
Hysteresis (V _{CC})				V _{HYS}		80	120	mV
Reset Threshold voltage (V _{CC})						1.5	1.9	V
Short-Circuit Protection Control Section								
Input Threshold Voltage(SCP)	V _{IN(THR)}		0.65	0.7	0.75	V		
Standby Voltage(SCP)	V _{STN-BY}	No pullup	140	185	230	mV		
Latched Input Voltage (SCP)	V _{IN(LAT)}	No pullup		60	120	mV		
Input (source) Current	I _{IN(source)}	V _{IN} =0.7V	-10	-15	-20	μA		
Comparator Threshold Voltage (FEEDBACK)	V _{THR}			1.18		V		

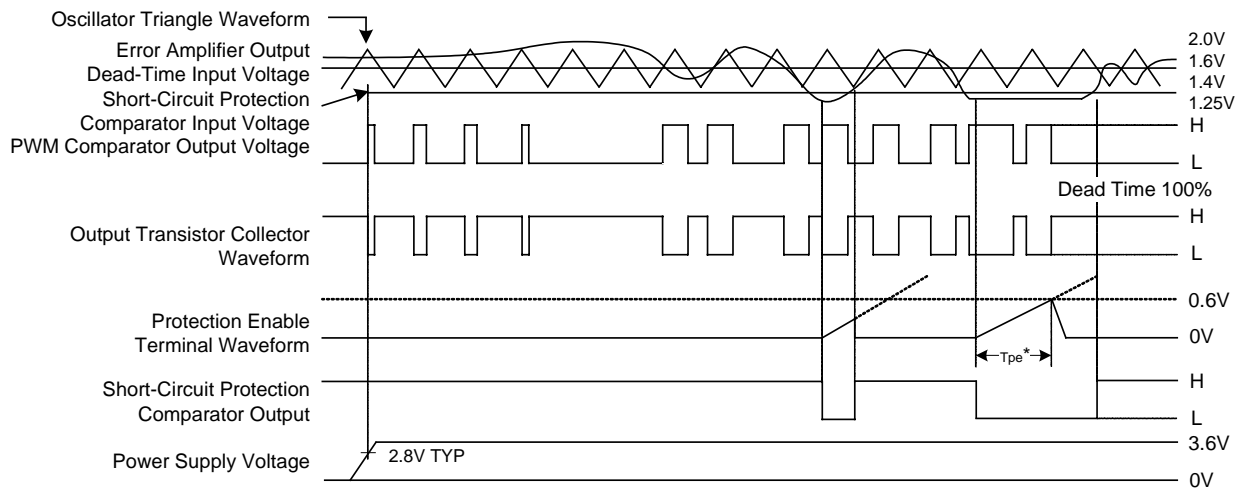
■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Oscillator Section						
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	± 2	%
		$T_A=25^\circ\text{C} \sim 85^\circ\text{C}$		-0.2	± 2	
Dead-Time Control Section						
Input bias Current (DTC)	$I_{IN(BIAS)}$				1	μA
Latch mode (source) Current (DTC)			-80	-145		μA
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		
Error-Amplifier Section						
Input Offset Voltage	$V_{IN(OFF)}$	$V_{OUT}(\text{FEEDBACK})=1.25\text{V}$			± 6	mV
Input Offset Current	$I_{IN(OFF)}$	$V_{OUT}(\text{FEEDBACK})=1.25\text{V}$			± 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)	$I_{OUT(SOU)}$	$V_{ID}=0.1\text{V}$, $V_{OUT}=1.25\text{V}$	-45	-70		μA
Output Section						
Collector off-state Current	I_{OFF}	$V_{OUT}=50\text{V}$			10	μA
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
PWM Comparator Section						
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		
TOTAL DEVICE						
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



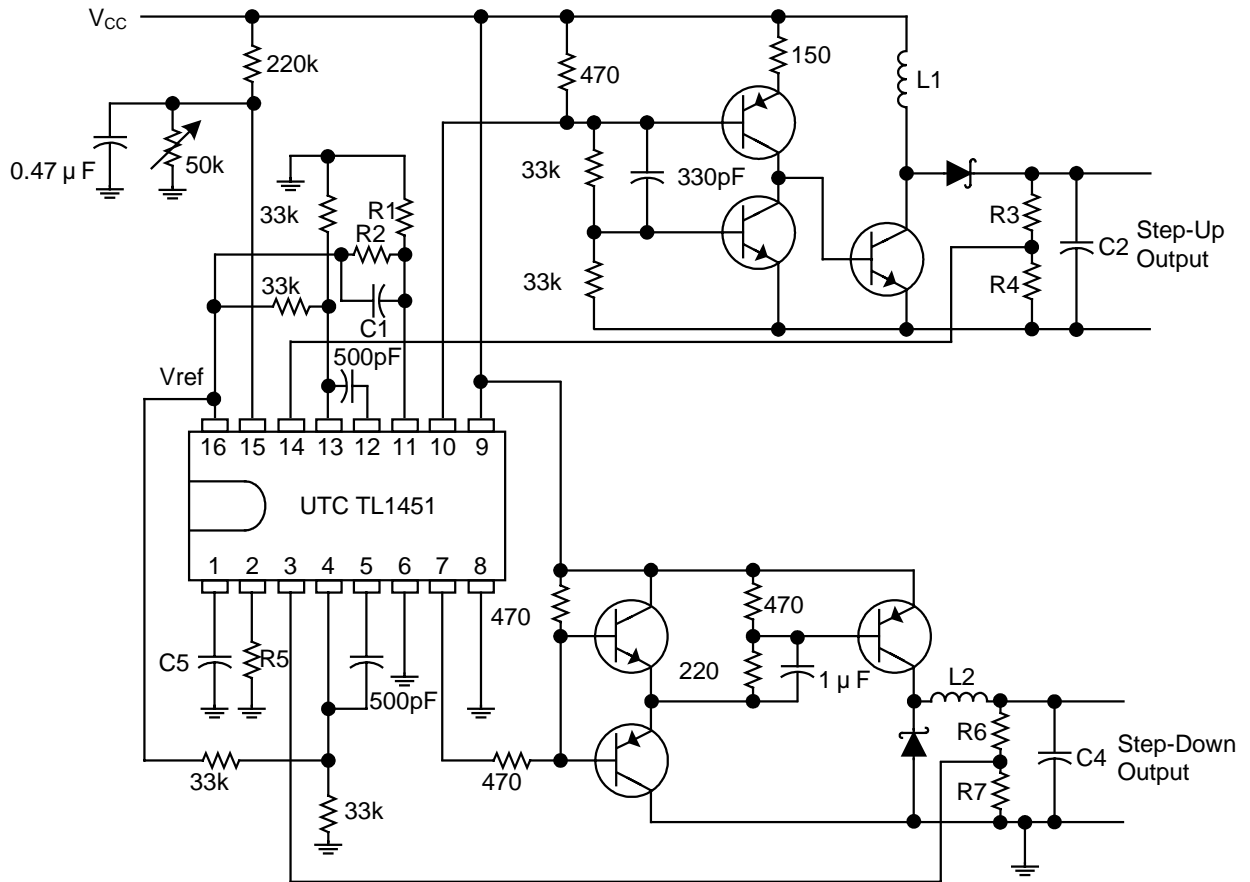
■ TIMING DIAGRAM



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

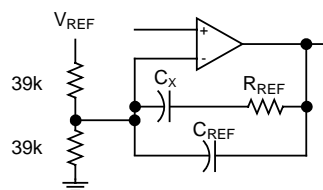
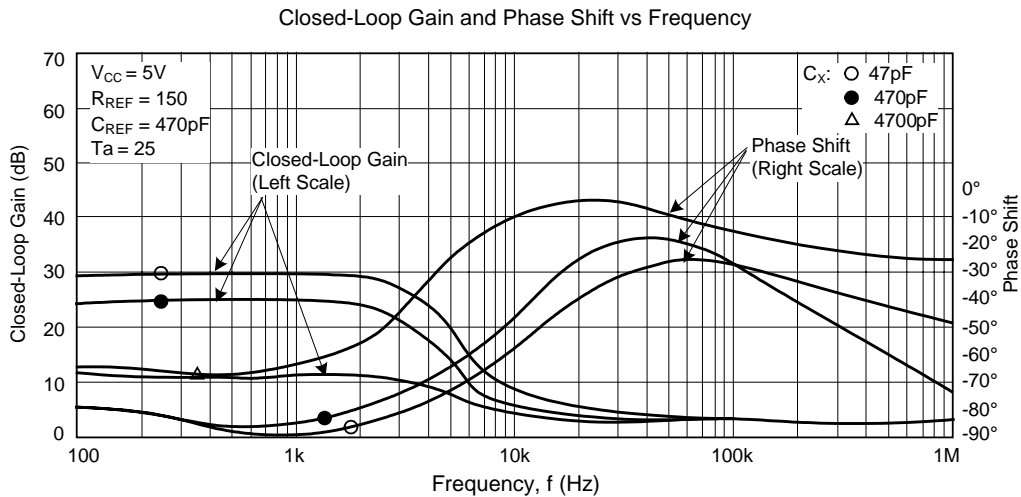
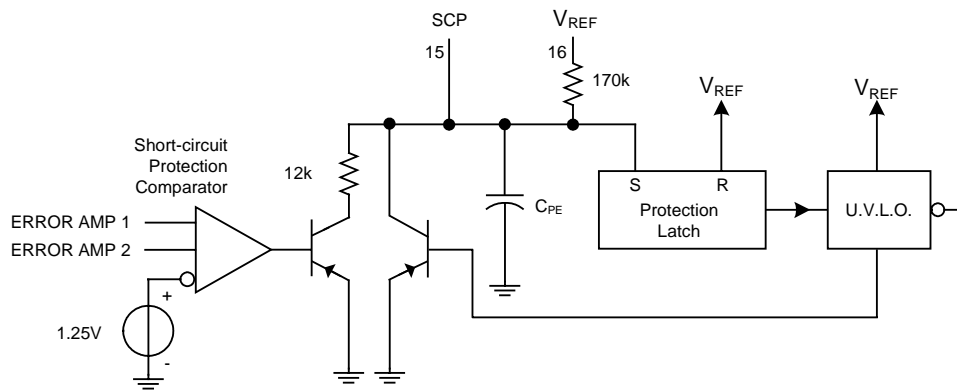
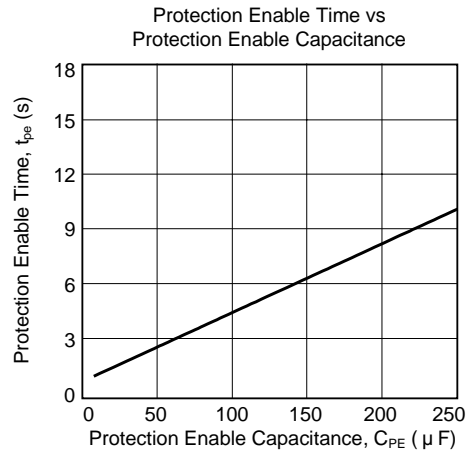
APPLICATION INFORMATION

HIGH-SPEED DUAL SWITCHING REGULATOR



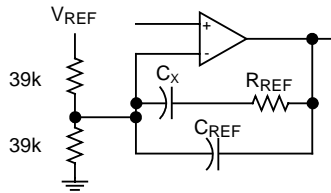
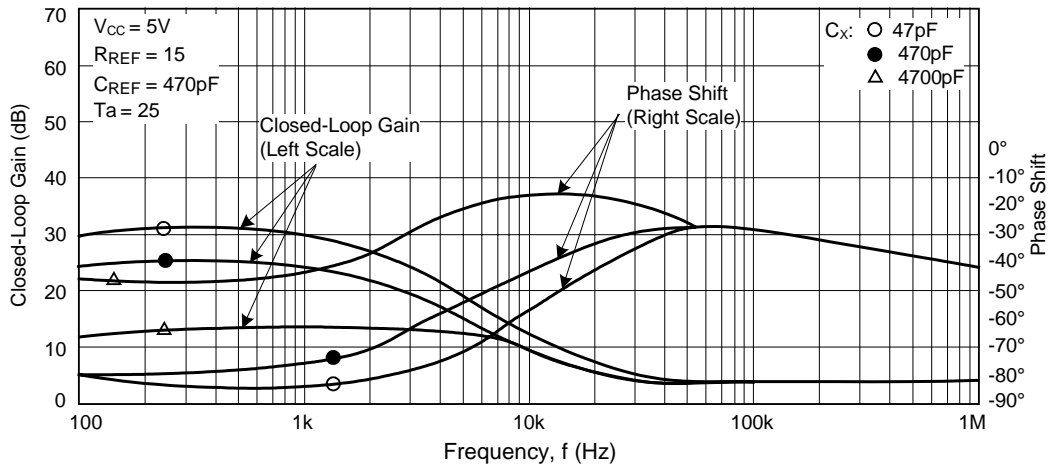
NOTE A: Values for R1 through R7, C1 through C4, and L1 and L2 depend upon individual application.

■ TYPICAL CHARACTERISTICS

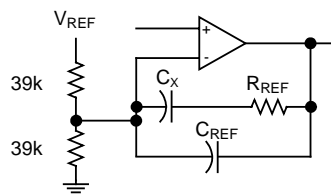
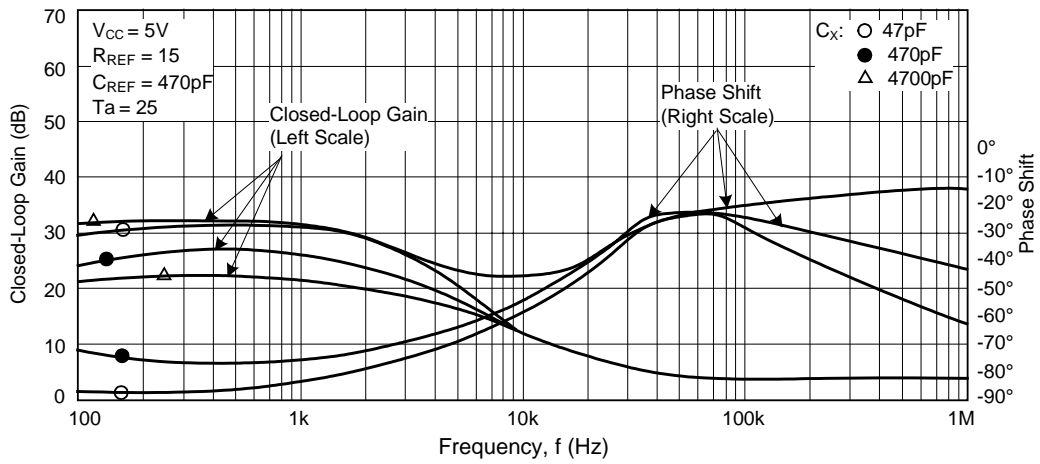


■ TYPICAL CHARACTERISTICS(cont.)

Closed-Loop Gain and Phase Shift vs Frequency

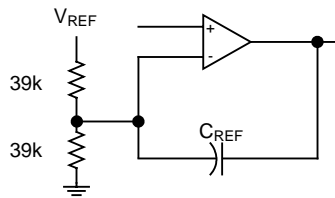
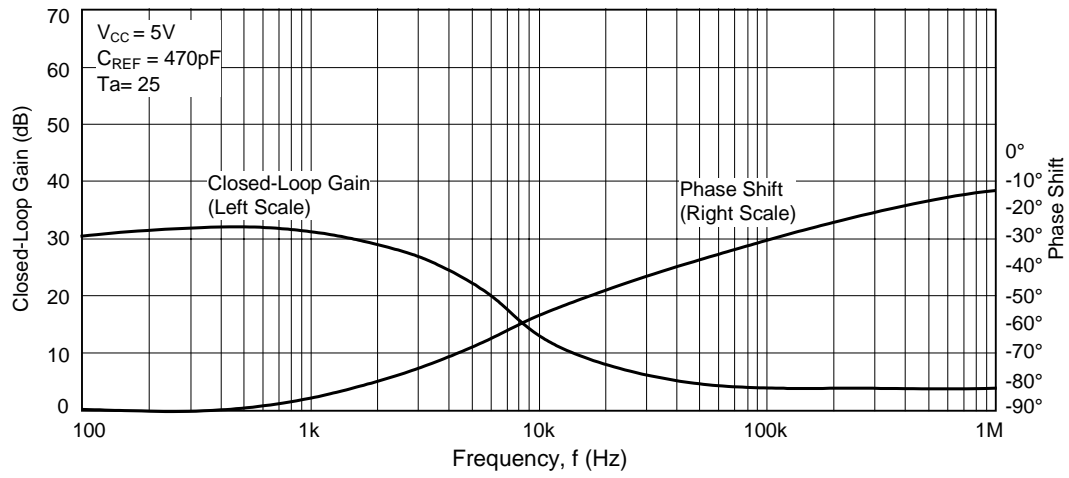


Closed-Loop Gain and Phase Shift vs Frequency

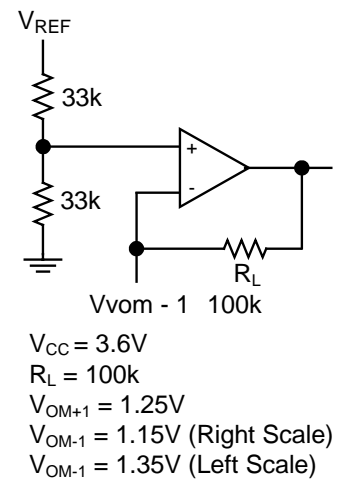
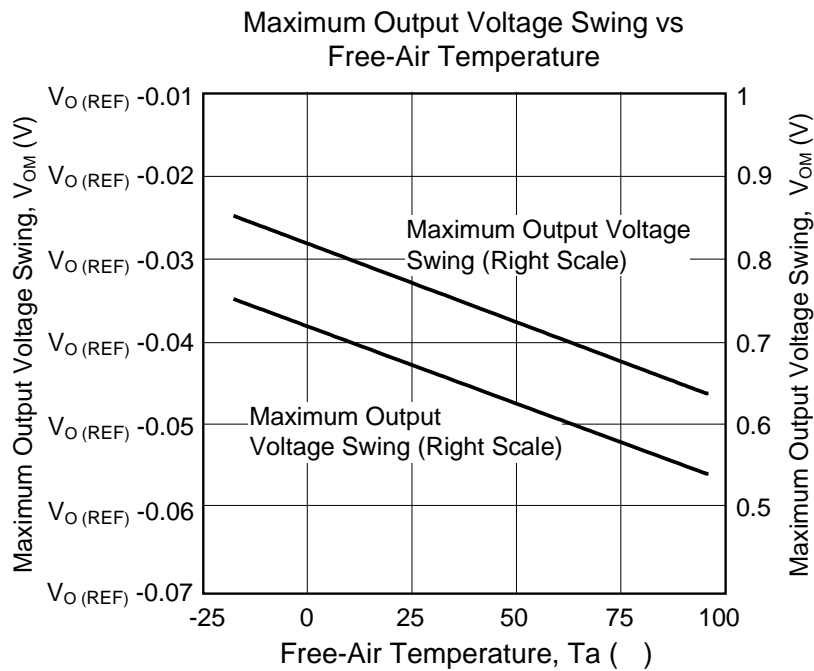
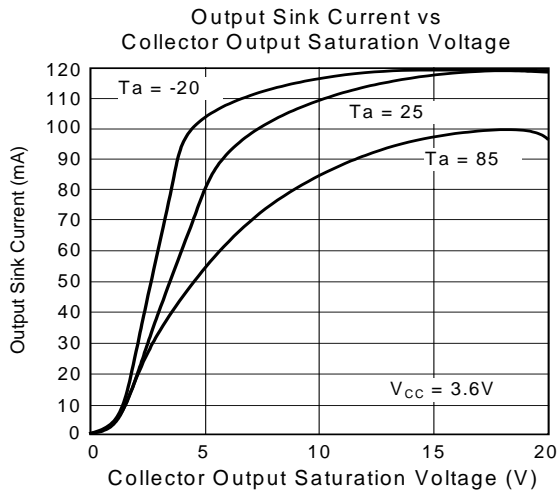


■ TYPICAL CHARACTERISTICS(Cont.)

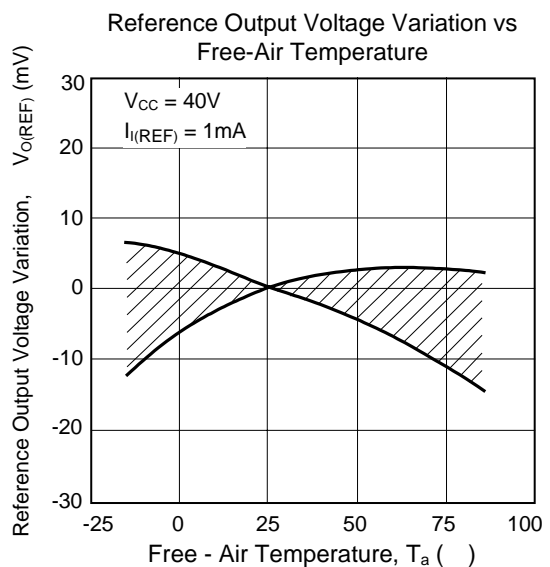
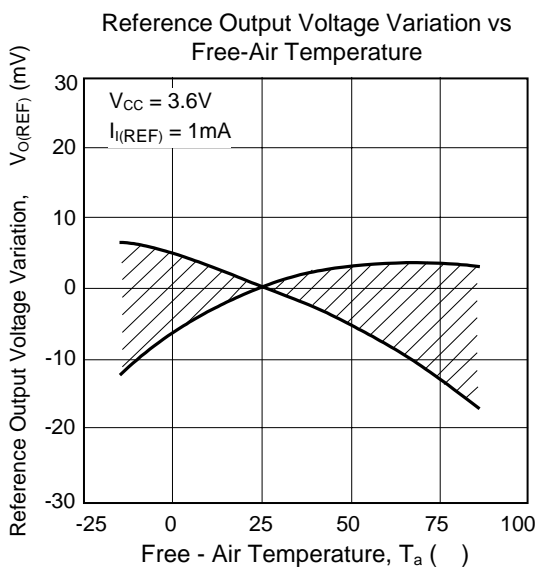
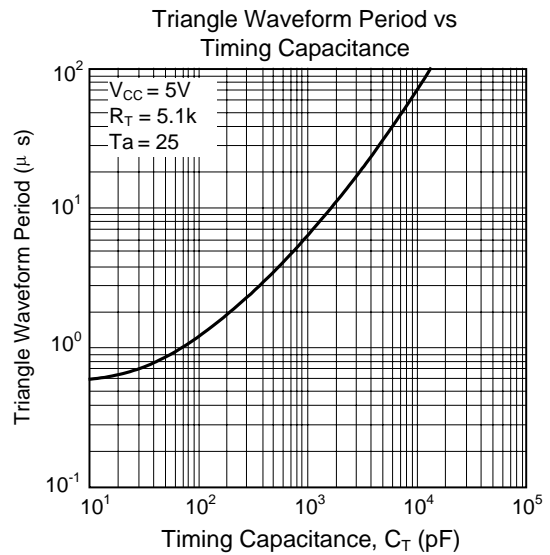
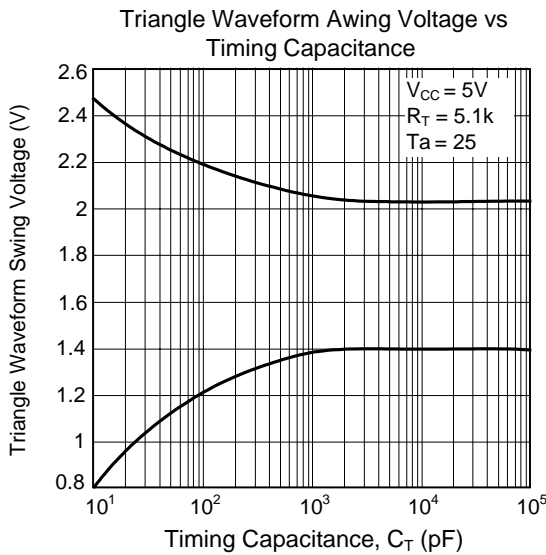
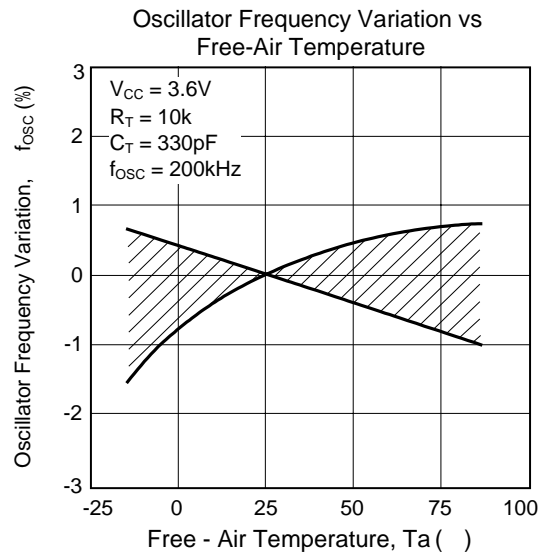
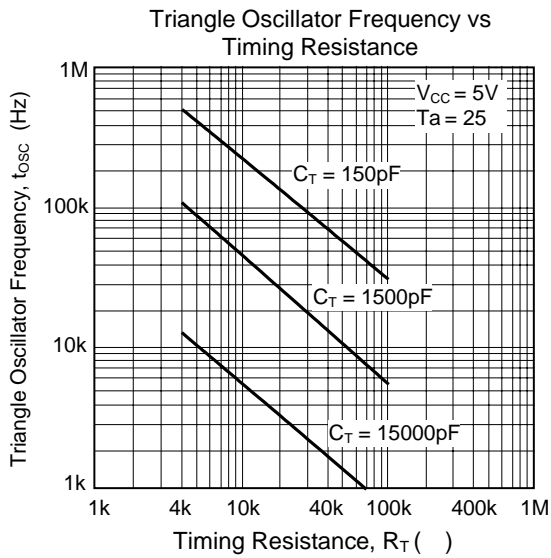
Closed-Loop Gain and Phase Shift vs Frequency



■ TYPICAL CHARACTERISTICS(Cont.)

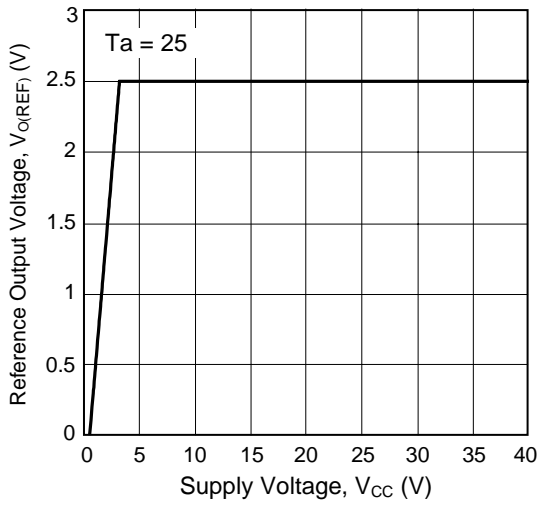


TYPICAL CHARACTERISTICS

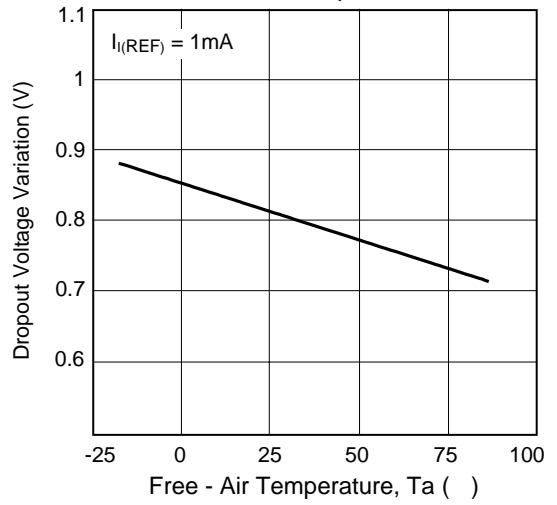


■ TYPICAL CHARACTERISTICS(Cont.)

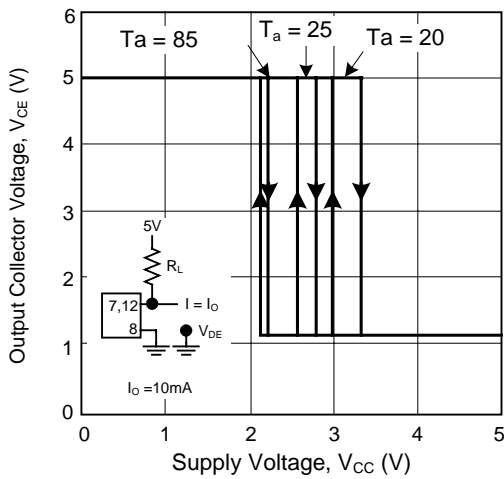
Reference Output Voltage vs Supply Voltage



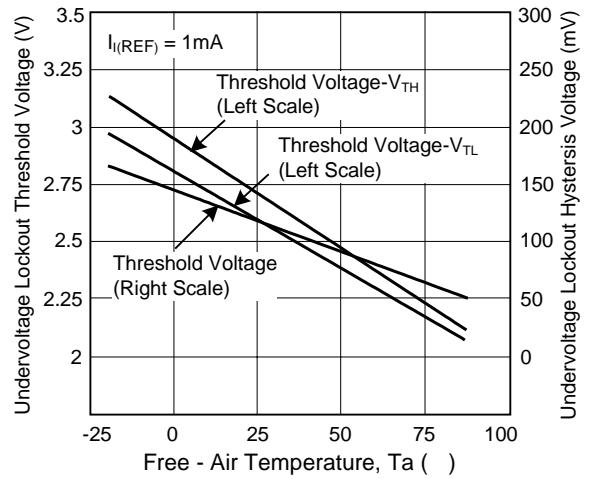
Dropout Voltage Variation vs Free-Air Temperature



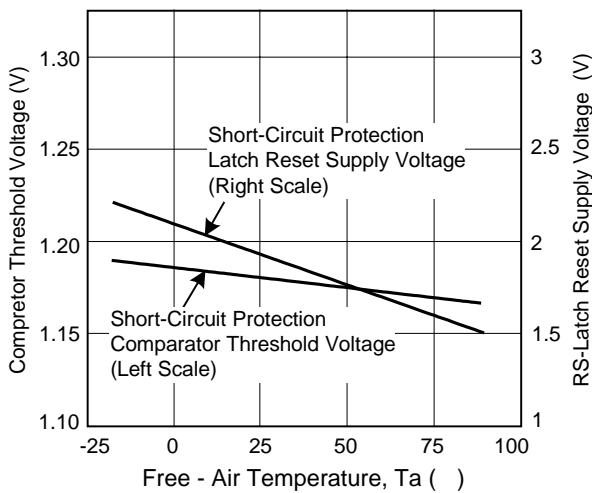
Undervoltage Lockout Hysteresis Characteristics



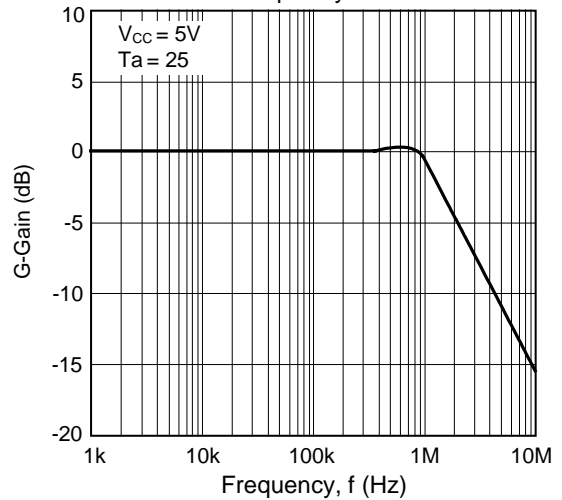
Undervoltage Lockout Characteristics



Short-Circuit Protection Characteristics

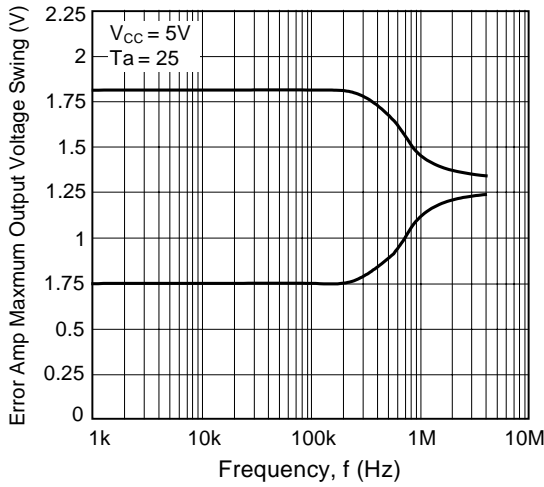


Gain (Amplifier In Unity-Gain Configuration) vs Frequency

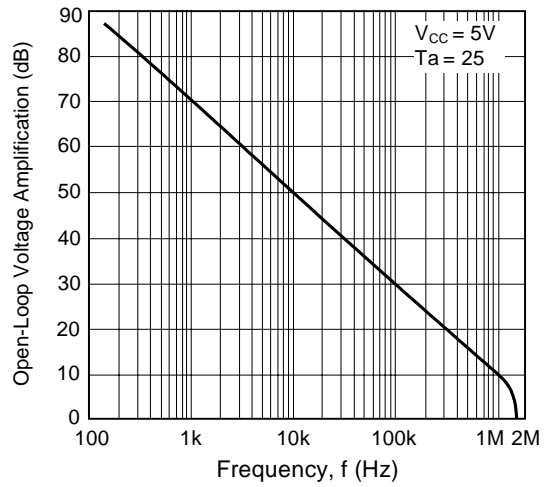


TYPICAL CHARACTERISTICS(Cont.)

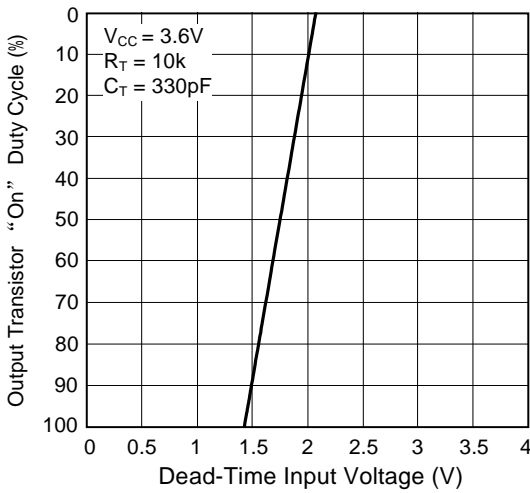
Error Amp Maximum Output Voltage Swing vs Frequency



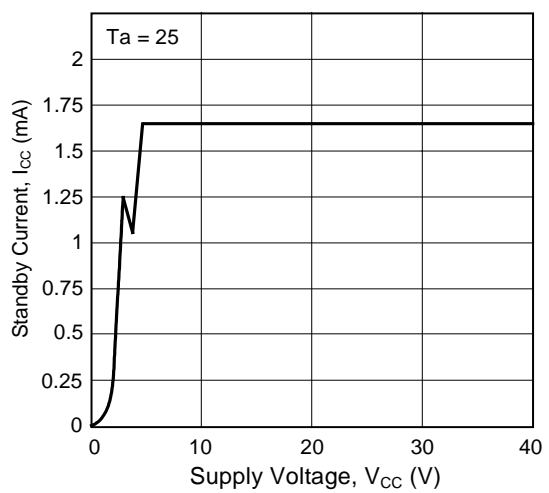
Open-Loop Voltage Amplification vs Frequency



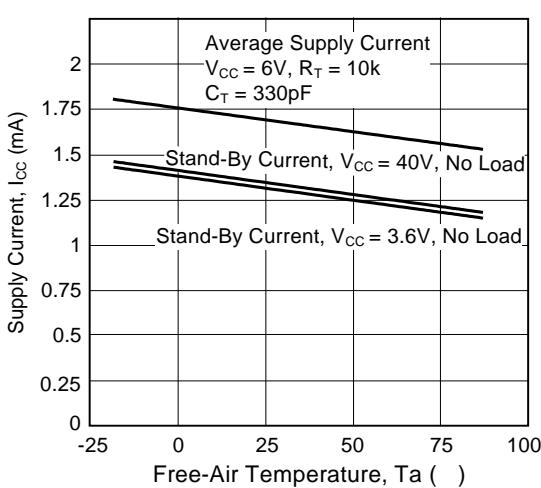
Output Transistor on Duty Cycle vs Dead-Time Input Voltage



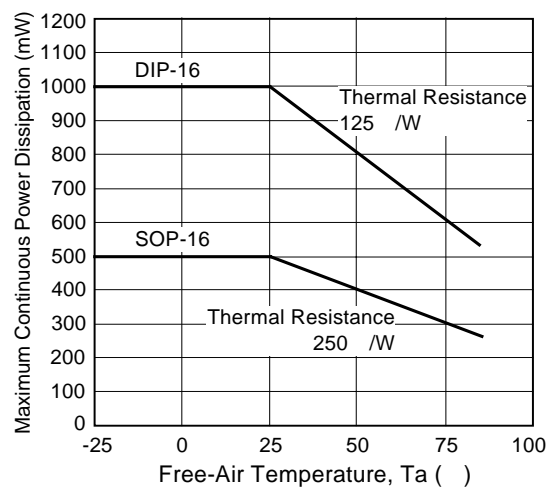
Standby Current vs Supply Voltage



Standby Current vs Free-Air Temperature



Maximum Continuous Power Dissipation vs Free-Air Temperature



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