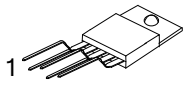
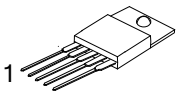
P1596

LINEAR INTEGRATED CIRCUIT

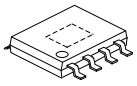
150KHZ, 1.5A PWM BUCK DC/DC CONVERTER



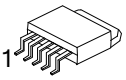
TO-220B



TO-220-5



HSOP-8



TO-263-5

■ DESCRIPTION

The UTC **P1596** series is a step-down switching regulator able to provide 1.5A output current. The available output voltages are 2.5V, 3.3V, 5V, 12V and an adjustable output version.

■ FEATURES

* Output load current: 1.5A
* Adjustable version output voltage range, 1.23V ~ 18V±4%
* 150KHz ±15% fixed switching frequency
* Voltage mode non-synchronous PWM control
* Thermal-shutdown and current-limit protection
* Operating voltage can be up to 24V
* Low power standby mode
* High efficiency
* Internal current and thermal limit
* Built-in switching transistor on chip

■ ORDERING INFORMATION

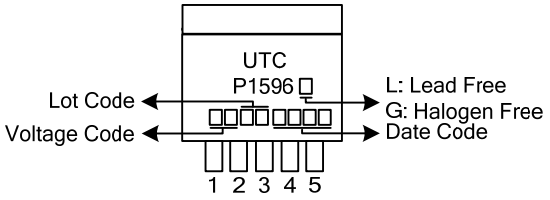
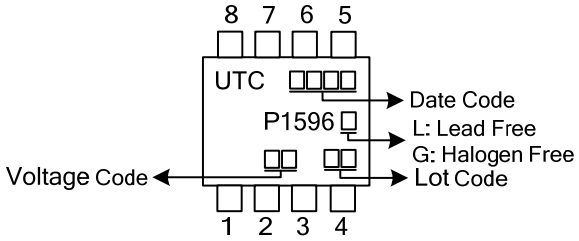
Ordering Number		Package	Packing
Lead Free	Halogen Free		
P1596L-xx-TA5-T	P1596G-xx-TA5-T	TO-220-5	Tube
P1596L-xx-TB5-T	P1596G-xx-TB5-T	TO-220B	Tube
P1596L-xx-SH2-R	P1596G-xx-SH2-R	HSOP-8	Tape Reel
P1596L-xx-TQ5-T	P1596G-xx-TQ5-T	TO-263-5	Tube
P1596L-xx-TQ5-R	P1596G-xx-TQ5-R	TO-263-5	Tape Reel

Note: xx: Output Voltage, refer to Marking Information.

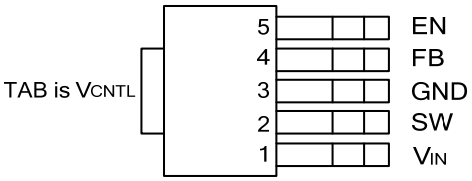
P1596L-xx-TA5-T
(1)Packing Type
(2)Package Type
(3)Output Voltage Code
(4)Lead Free

(1) T: Tube, R: Tape Reel
(2) TA5: TO-220-5, TB5: TO-220B, TQ5: TO-263-5
SH2: HSOP-8
(3) xx: refer to Marking Information
(4) L: Lead Free, G: Halogen Free

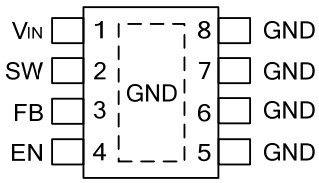
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-220-5 TO-220B TO-263-5	25:2.5V 33:3.3V 50:5.0V 12:12V AD:ADJ	
HSOP-8		

■ PIN CONFIGURATION



TO-220-5, TO-220B, TO-263-5

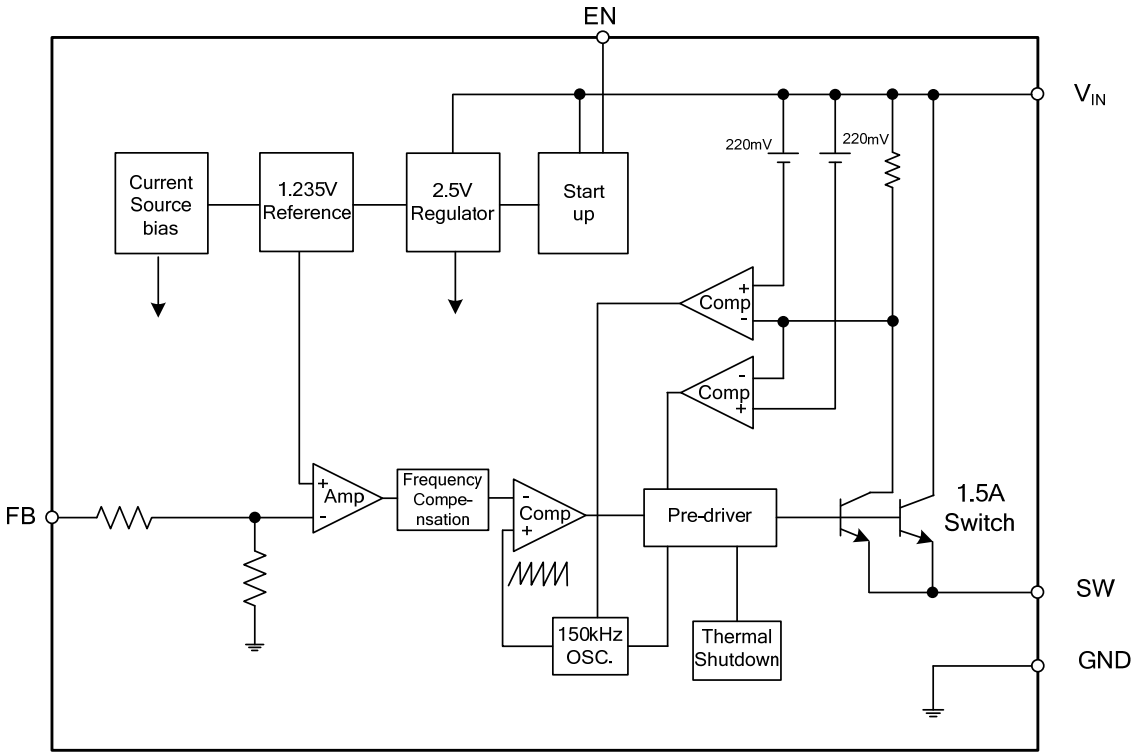


HSOP-8

■ PIN DESCRIPTIONS

PIN NO.	PIN NAME	DESCRITION
FOR TO-220-5, TO-220B, TO-263-5		
1	V_{IN}	Operating voltage input
2	SW	Switching output
3	GND	Ground
4	FB	Feedback voltage
5	EN	ON/OFF shutdown
FOR HSOP-8		
PIN NO.	PIN NAME	DESCRITION
1	V_{IN}	Operating voltage input
2	SW	Switching output
3	FB	Feedback input
4	EN	Enable pin
5, 6, 7, 8	GND	Ground

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Maximum Supply Voltage	V_{CC}	28	V
Operating Voltage	V_{OPR}	4.5 ~ 22	V
ON/OFF Pin Input Voltage	$V_{ON/OFF}$	-0.3 ~ +18	V
Feedback Pin Voltage	V_{FB}	-0.3 ~ +18	V
Output Voltage to Ground (Steady State)	V_{OUT}	-1	V
Power Dissipation	P_D	Internally limited	W
Operating Temperature	T_{OPR}	-40 ~ +125	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C

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

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Case	TO-220B/TO-220-5	θ_{JC}	3	°C/W
	HSOP-8		45	
	TO-263-5		4	

■ ELECTRICAL CHARACTERISTICS

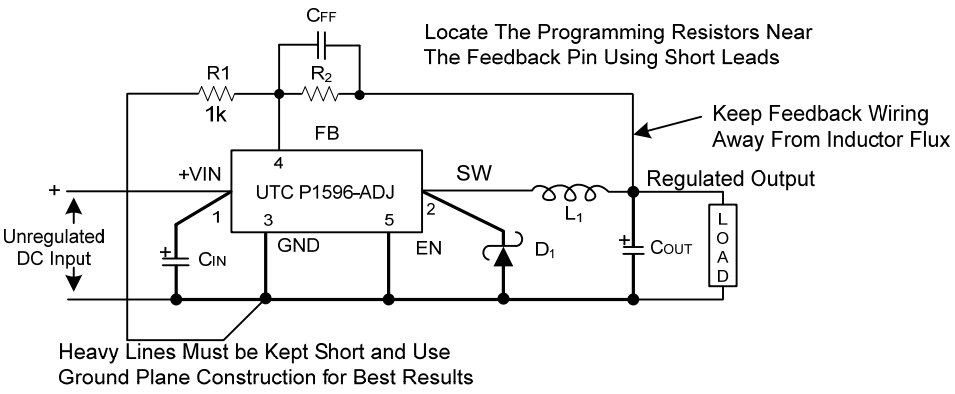
(T_J=25°C, V_{IN}=12V for the 2.5V 3.3V, 5V, and Adjustable version and V_{IN}=24V for the 12V version, I_{LOAD}=500mA.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	2.5V	V_{OUT}	3.8V≦V_{IN}≦24V, 0.2A≦I_{LOAD}≦1.5A	2.4	2.5	2.6	V
	3.3V		4.75V≦V_{IN}≦24V, 0.2A≦I_{LOAD}≦1.5A	3.168	3.3	3.432	V
	5.0V		7V≦V_{IN}≦24V, 0.2A≦I_{LOAD}≦1.5A	4.8	5.0	5.2	V
	12V		15V≦V_{IN}≦24V, 0.2A≦I_{LOAD}≦1.5A	11.52	12	12.48	V
Efficiency	2.5V	η	V_{IN}=12V, I_{LOAD}=1.5A		73		%
	3.3V		V_{IN}=12V, I_{LOAD}=1.5A		73		%
	5.0V		V_{IN}=12V, I_{LOAD}=1.5A		80		%
	12V		V_{IN}=24V, I_{LOAD}=1.5A		72		%
UTC P1596-ADJ							
Output Feedback		V_{FB}	4.75V≦V_{IN}≦24V, 0.2A≦I_{LOAD}≦1.5A V_{OUT} Programmed for 3V	1.193	1.23	1.267	V
Efficiency		η	V_{IN}=12V, I_{LOAD}=1.5A		78		%
ALL OUTPUT VOLTAGE							
Feedback Bias Current		I_{BIAS}	Adjustable Version Only, V_{FB}=1.3V		-10	-50	nA
Oscillator Frequency		f_{OSC}	(Note 1)	127	150	173	KHz
Saturation Voltage		V_{SAT}	I_{OUT}=2A (Note 2, 3)		1.25	1.4	V
Max Duty Cycle (ON)		DC	(Note 3)		100		%
Min Duty Cycle (OFF)			(Note 4)		0		
Current Limit		I_{CL}	Peak Current (Notes 2, 3)	1.8	2.25	3.45	A
Output Leakage Current		I_L	Output=0V (Notes 2, 4)			-200	μA
			Output=-1V, V_{IN} = 24V		-5		mA
Quiescent Current		I_Q	(Note 4)		5	10	mA
Standby Quiescent Current		I_{STBY}	ON/OFF Pin=5V (OFF) , V_{IN} = 24V		70	150	μA

Note 1: The switching frequency is reduced when the second stage current limit is activated.
2: No diode, inductor or capacitor connected to output pin.
3: Feedback pin removed from output and connected to 0V to force the output transistor switch ON.
4: Feedback pin removed from output and connected to 12V for the 2.5V 3.3V, 5V, and the ADJ. version, and 15V for the 12V version, to force the output transistor switch OFF.

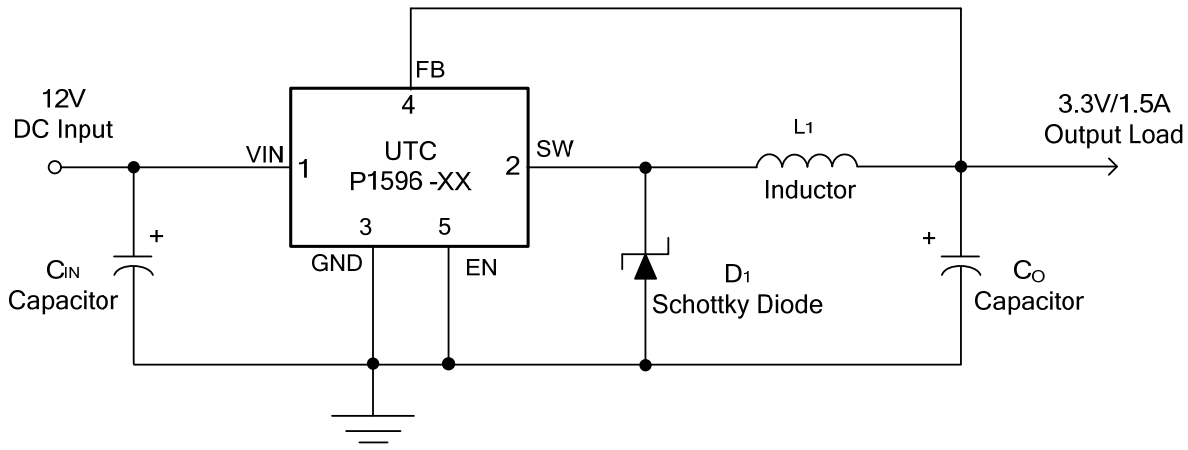
■ TYPICAL APPLICATION

FOR ADJUSTABLE OUTPUT VOLTAGE VERSION

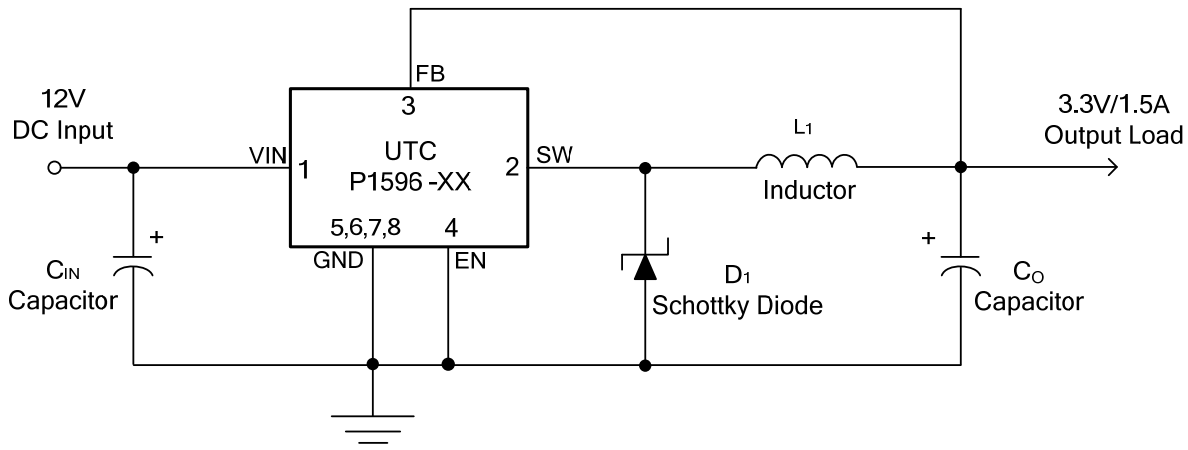


$V_{OUT} \times (R_1/(R_1+ R_2))=V_{REF}$
$V_{OUT} = V_{REF}(1+ R_2/R_1)$
Where V_{REF}=1.23V
$R_2=R_1((V_{OUT} / V_{REF})-1)$

FOR FIXED OUTPUT VOLTAGE VERSIONS

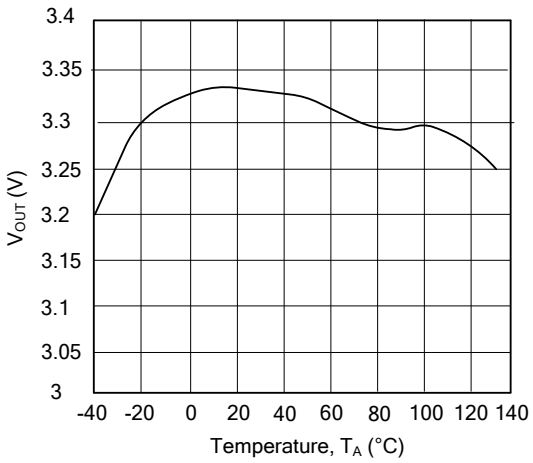


FOR HSOP-8 FIXED OUTPUT VOLTAGE VERSIONS

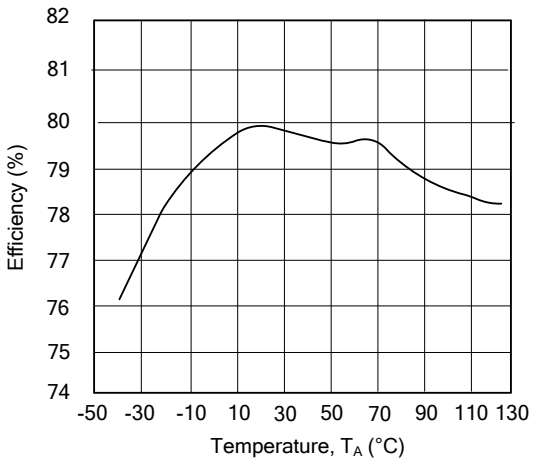


■ TYPICAL CHARACTERISTICS

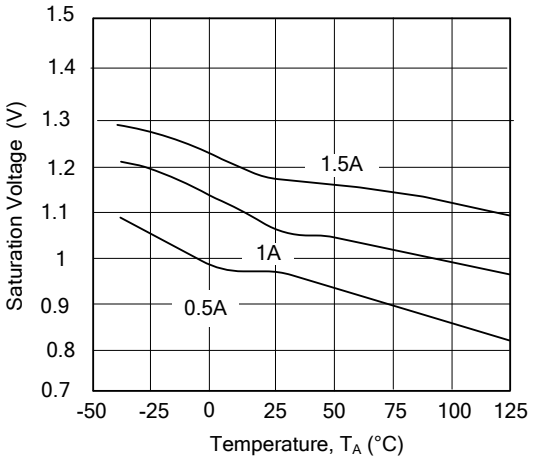
Output Voltage v.s. Temperature
(V_{IN}=12V, I_{OUT}=1.5A)



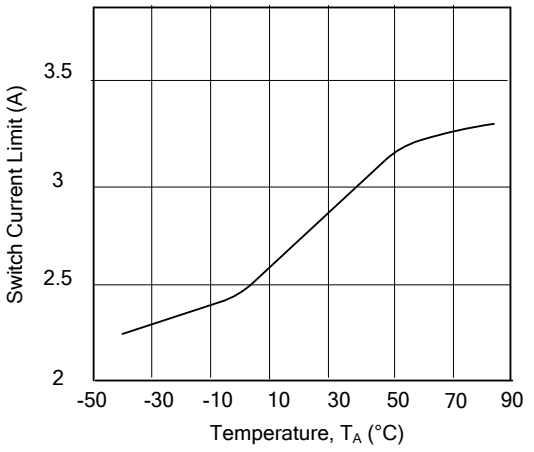
Efficiency v.s. Temperature
(V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=1.5A)



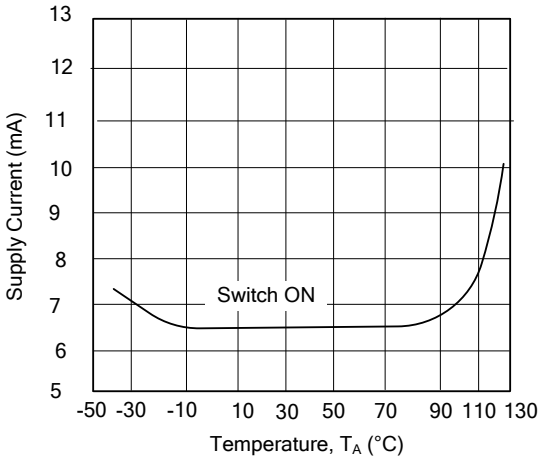
Saturation Voltage v.s. Temperature
(V_{CC}=12V, V_{FB}=0V, V_{SD}=0)



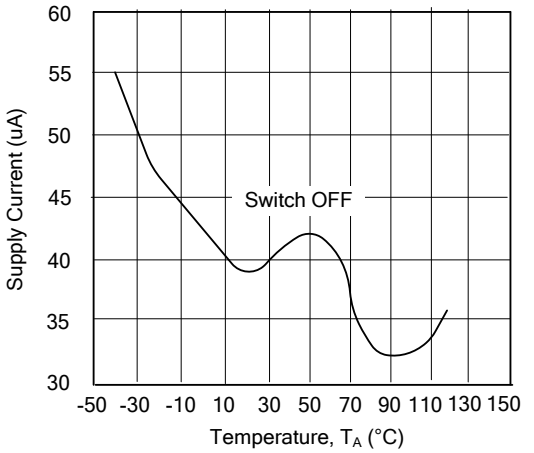
Switch Current Limit v.s. Temperature
(V_{CC}=12V, V_{FB}=0V)



Supply Current v.s. Temperature
(V_{CC}=12V, No Load, $V_{ON/OFF}$=0V,(Switch ON))

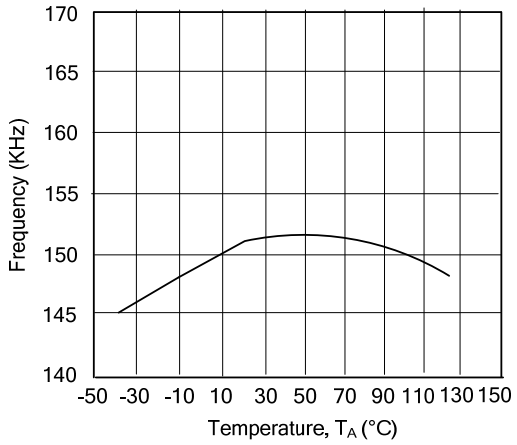


Supply Current v.s. Temperature
(V_{CC}=12V, No Load, $V_{ON/OFF}$=5V,(Switch OFF))



■ TYPICAL CHARACTERISTICS (Cont.)

Frequency v.s. Temperature
(V_{CC}=12V, I_{OUT}=500mA, V_{OUT}=5V)



Feedback Current v.s. Temperature
(V_{CC}=12V, V_{OUT}=5V, V_{FB}=1.3V)