



P1696

LINEAR INTEGRATED CIRCUIT

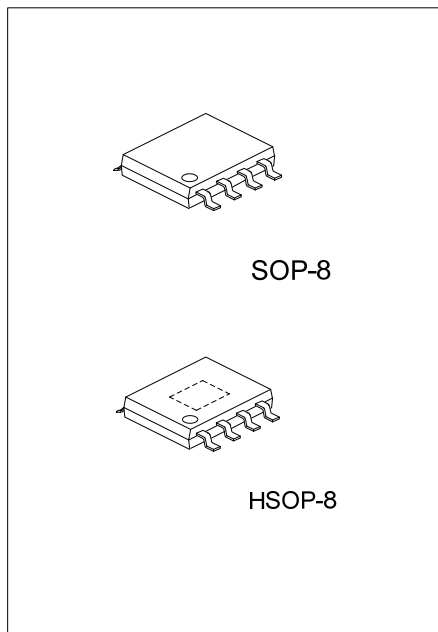
200KHZ, 2A PWM STEP-DOWN DC/DC CONVERTER

DESCRIPTION

The UTC **P1696** series is a step-down switching regulator able to provide 2A output current. The available output voltages are 2.5V, 3.3V, 5V, 12V, and an adjustable output version.

FEATURES

- *Output load current: 2A
- *Adjustable version output voltage range, 1.23V ~ 17.5V±4%
- *Operating voltage can be up to 24V
- *Low power standby mode
- *High efficiency
- *Internal OCP and OTP



ORDERING INFORMATION

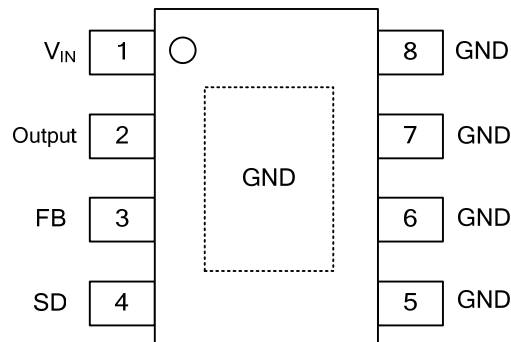
Ordering Number		Package	Packing
Lead Free	Halogen Free		
P1696L-xx-S08-T	P1696G-xx-S08-T	SOP-8	Tube
P1696L-xx-S08-R	P1696G-xx-S08-R	SOP-8	Tape Reel
P1696L-xx-SH2-R	P1696G-xx-SH2-R	HSOP-8	Tape Reel

<p>P1696L-xx-S08-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Output Voltage Code</p> <p>(4) Lead Free</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) S08: SOP-8, SH2: HSOP-8</p> <p>(3) xx: refer to Output Voltage Code</p> <p>(4) L: Lead Free, G: Halogen Free</p>
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MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOP-8 HSOP-8	25: 2.5V 33: 3.3V 50: 5.0V 12: 12V AD: ADJ	<p>8 7 6 5 UTC P1696 Date Code L: Lead Free G: Halogen Free Lot Code Voltage Code 1 2 3 4</p>

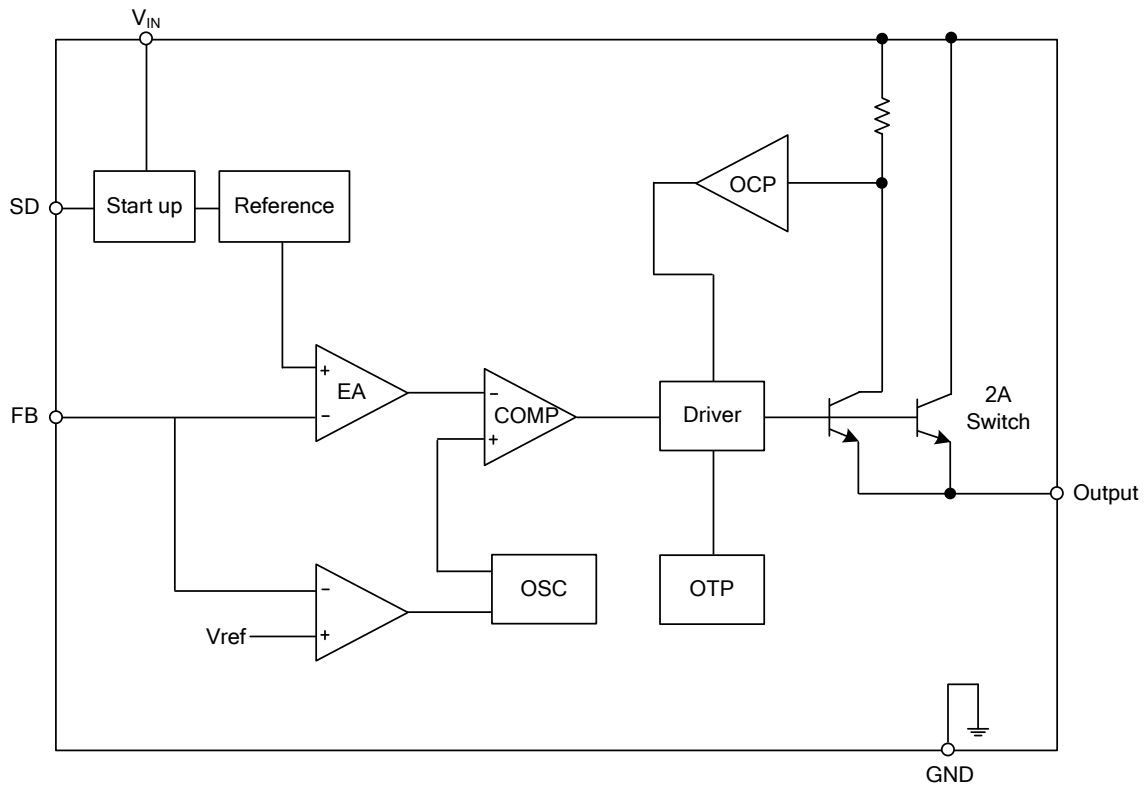
PIN CONFIGURATION



PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	V_{IN}	Power input
2	Output	Switching
3	FB	Feedback Voltage
4	SD	Enable input
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 ~ 24	V
ON/OFF Pin Input Voltage	$V_{ON/OFF}$	-0.3 ~ +12	V
Feedback Pin Voltage	V_{FB}	-0.3 ~ +12	V
Output Voltage to Ground (Steady State)	V_{OUT}	-1	V
Power Dissipation	P_D	Internally limited	mW
Junction Temperature	T_J	+150	°C
Operating Temperature	T_{OPR}	-40 ~ +125	°C
Storage Temperature	T_{STG}	-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.

■ ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT		
Output Voltage	2.5V	V_{OUT}	$5.0\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 2\text{A}$		2.4	2.5	2.6	V
	3.3V		$6.0\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 2\text{A}$	3.168	3.3	3.432	V	
	5.0V		$7.5\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 2\text{A}$	4.8	5.0	5.2	V	
	12V		$15\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 2\text{A}$	11.52	12.0	12.48	V	
Efficiency	2.5V	η	$V_{IN}=12\text{V}$, $I_{LOAD}=2\text{A}$			73		%
	3.3V		$V_{IN}=12\text{V}$, $I_{LOAD}=2\text{A}$			75		%
	5.0V		$V_{IN}=12\text{V}$, $I_{LOAD}=2\text{A}$			80		%
	12V		$V_{IN}=24\text{V}$, $I_{LOAD}=2\text{A}$			80		%
UTC P1696-ADJ								
Feedback Voltage	VFB	$4.5\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 2\text{A}$ V_{OUT} programmed for 3V	1.19	1.230	1.267	V		
Efficiency	η	$V_{IN}=12\text{V}$, $V_{OUT}=3\text{V}$, $I_{LOAD}=2\text{A}$		75		%		
ALL OUTPUT VOLTAGE								
Feedback Bias Current	I_{BIAS}	Adjustable Version Only, $V_{FB}=1.3\text{V}$		10	50	nA		
Oscillator Frequency	f_{OSC}	(Note 1)	170	200	230	kHz		
Saturation Voltage	V_{SAT}	$I_{OUT}=2\text{A}$ (Note 2, 3)		1.16	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)		2.5		A		
Output Leakage Current	I_L	Output=0V (Notes 2, 4)			50	μA		
		Output=-1V (Note 5)		2	30	mA		
Quiescent Current	I_Q	(Note 4)		5	10	mA		
Standby Quiescent Current	I_{STBY}	ON/OFF Pin=5V (OFF) (Note 5)		80	200	μA		
ON/OFF CONTROL								
ON /OFF Pin Logic Input Threshold Voltag	V_{IH}	Low (Regulator ON)		1.3		V		
	V_{IL}	High (Regulator OFF)		1.3		V		
ON /OFF Pin Input Current	I_H	VLOGIC=2.5V (Regulator OFF)		5	15	μA		
	I_L	VLOGIC=0.5V (Regulator ON)		0.02	5	μA		

Note 1: The switching frequency is reduced when the second stage current limit is activated.

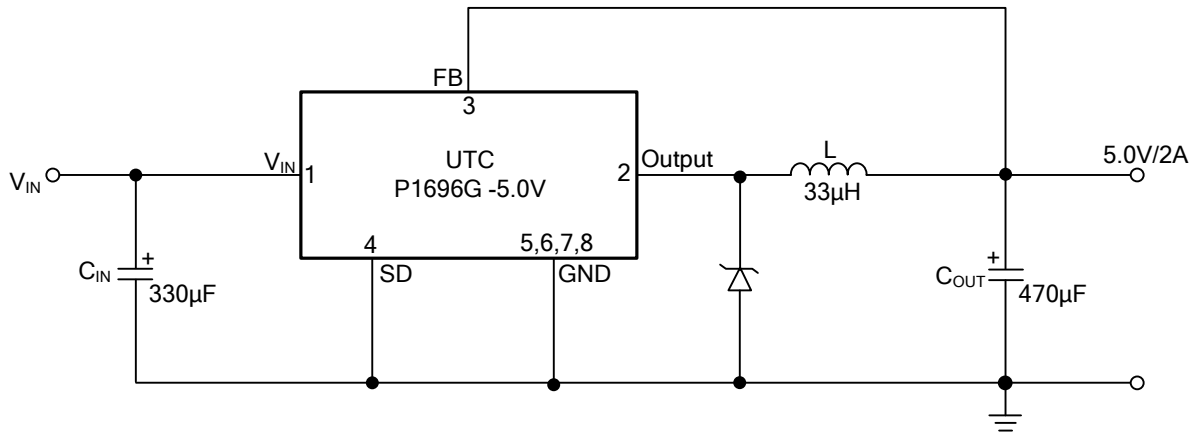
2: No diode, inductor or capacitor connected to output pin.

3: Feedback pin removed from output and connected to 0V to force the output transistor switch ON.

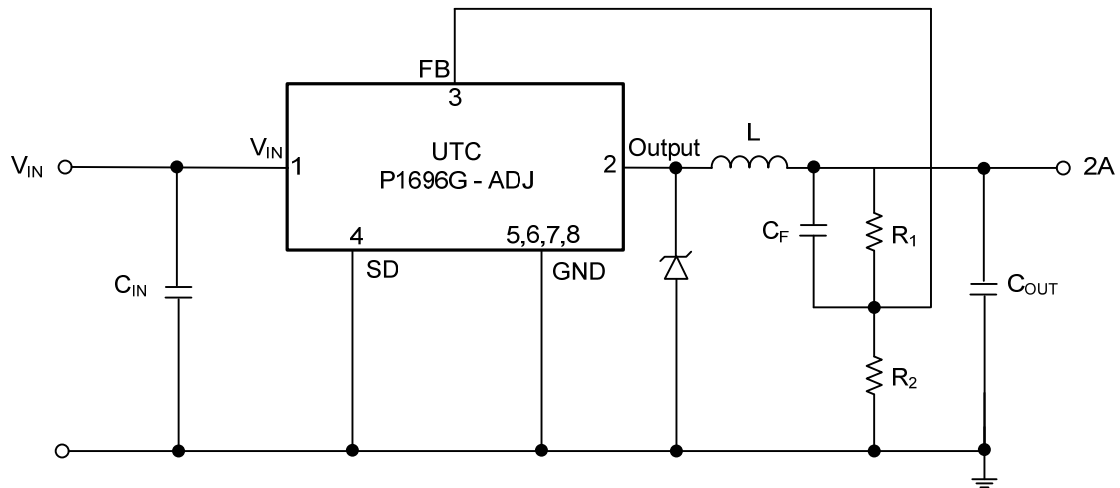
4: Feedback pin removed from output and connected to 12V for the 2.5V 3.3V, 5V, and the ADJ. version, and 15V for the 12V version, to force the output transistor switch OFF.

5: $V_{IN} = 24\text{V}$

■ FIXED OUTPUT VOLTAGE VERSIONS



■ ADJUSTABLE OUTPUT VOLTAGE VERSIONS

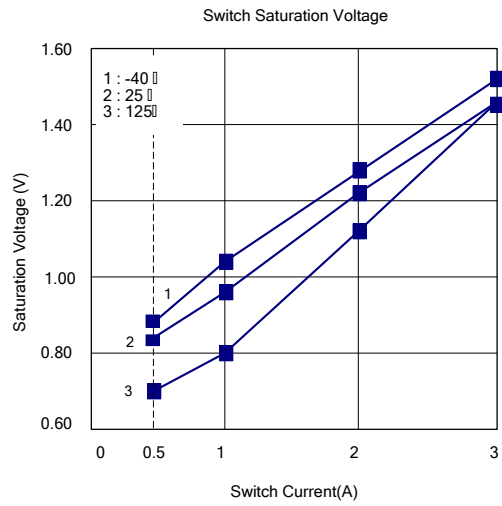
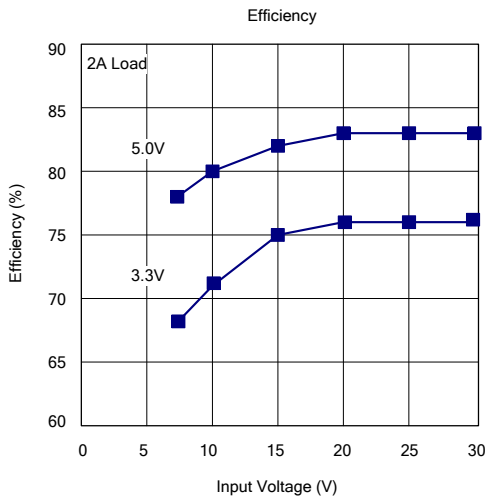
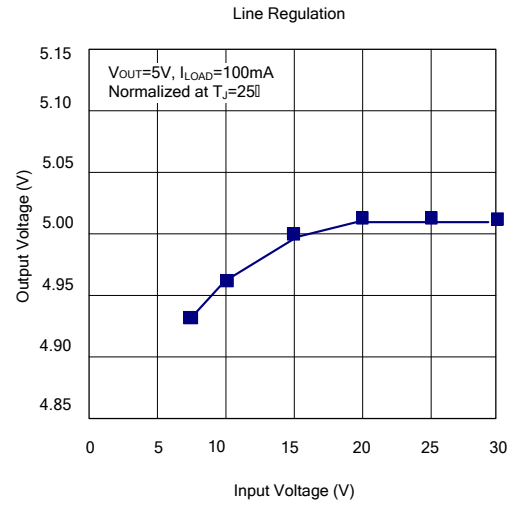
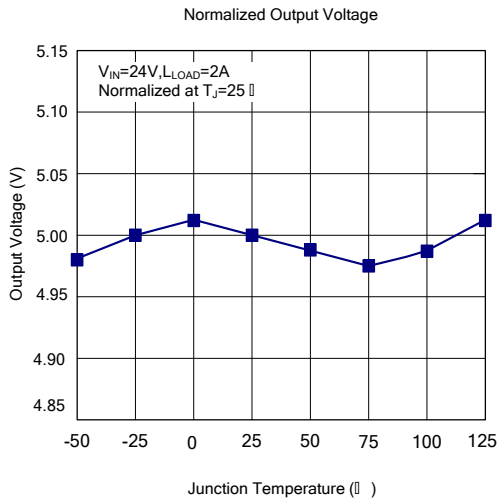


Note: 1. $V_{OUT} = (1 + \frac{R_1}{R_2})V_{FB}$

2. Tested under typical application condition:

C_{IN}	L	C_{OUT}	C_F	
330µF	33µH	470µF	-	
330µF	33µH	220µF	$V_{IN} < 17V$	-
			$V_{IN} \geq 17V$	220pF(option)

TYPICAL CHARACTERISTICS



■ FUNCTION DESCRIPTION

The changes of output load can cause the output voltage changes. The changes can be sensed by FB pin. The output of error amplifier controlling output duty circle makes the output stable.

The **P1696** incorporates an over current protection internally. Once the output is in overcurrent, power transistor must be turned off immediately. In that case, the power transistor will not be damaged by the excessive current.

If over-load or short-circuit condition happens, the oscillation frequency will be reduced, which make the power transistor bears less heat, so the power transistor is protected from damage.

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