



## P1686

## LINEAR INTEGRATED CIRCUIT

### 600KHZ, 3A STEP-DOWN CURRENT MDOE SWITCHING REGULATOR

#### DESCRIPTION

As a current mode switching regulator with an integrated switch, the UTC **P1686** is operating at 600kHz with separate sync and enable functions. In order to avoid frequency beating in noise sensitive applications the sync function allows customers to synchronize to a faster clock. Cost effective low power solutions is considered in the integrated switch ,and so peak switch current 3 amps. Very small passive components is considered in High frequency of operation. Current mode operation: fast dynamic response and instantaneous duty cycle adjustment as the input changes, as a ideal for CPE applications where the input is a wall plug power.

The low shutdown current as ideal for portable applications when battery life is important.

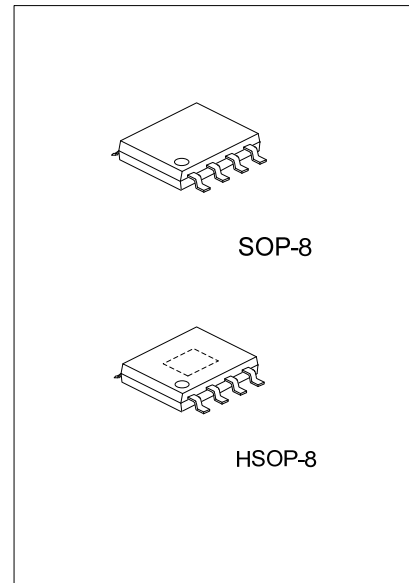
The UTC **P1686** is synchronizable to a frequency from 750kHz to 1.2MHz.

#### FEATURES

- \* Integrated 3 Amp switch
- \* 600kHz frequency of operation
- \* Current mode controller
- \* Synchronizable to higher frequency up to 1.2MHz
- \* 6μA low shutdown current

#### ORDERING INFORMATION

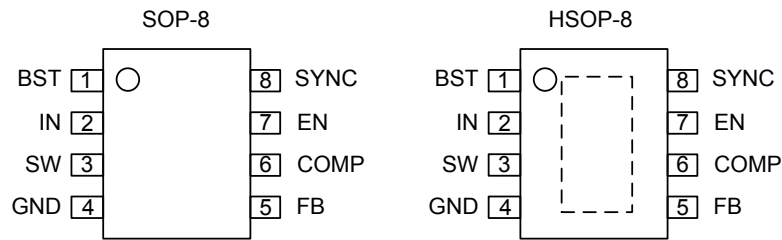
Ordering Number		Package	Packing
Normal	Lead Free Plating		
P1686-S08-R	P1686L-S08-R	SOP-8	Tape Reel
P1686-S08-T	P1686L-S08-T	SOP-8	Tube
P1686-SH2-R	P1686L-SH2-R	HSOP-8	Tape Reel
P1686-SH2-T	P1686L-SH2-T	HSOP-8	Tube



\*Pb-free plating product number: P1686L

<p>P1686L-S08-R</p> <pre> ├── (1)Packing Type ├── (2)Package Type └── (3)Lead Plating </pre>	<p>(1) R: Tape Reel, T: Tube  (2) S08: SOP-8, SH2: HSOP-8  (3) L: Lead Free Plating, Blank: Pb/Sn</p>
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## ■ PIN CONFIGURATION



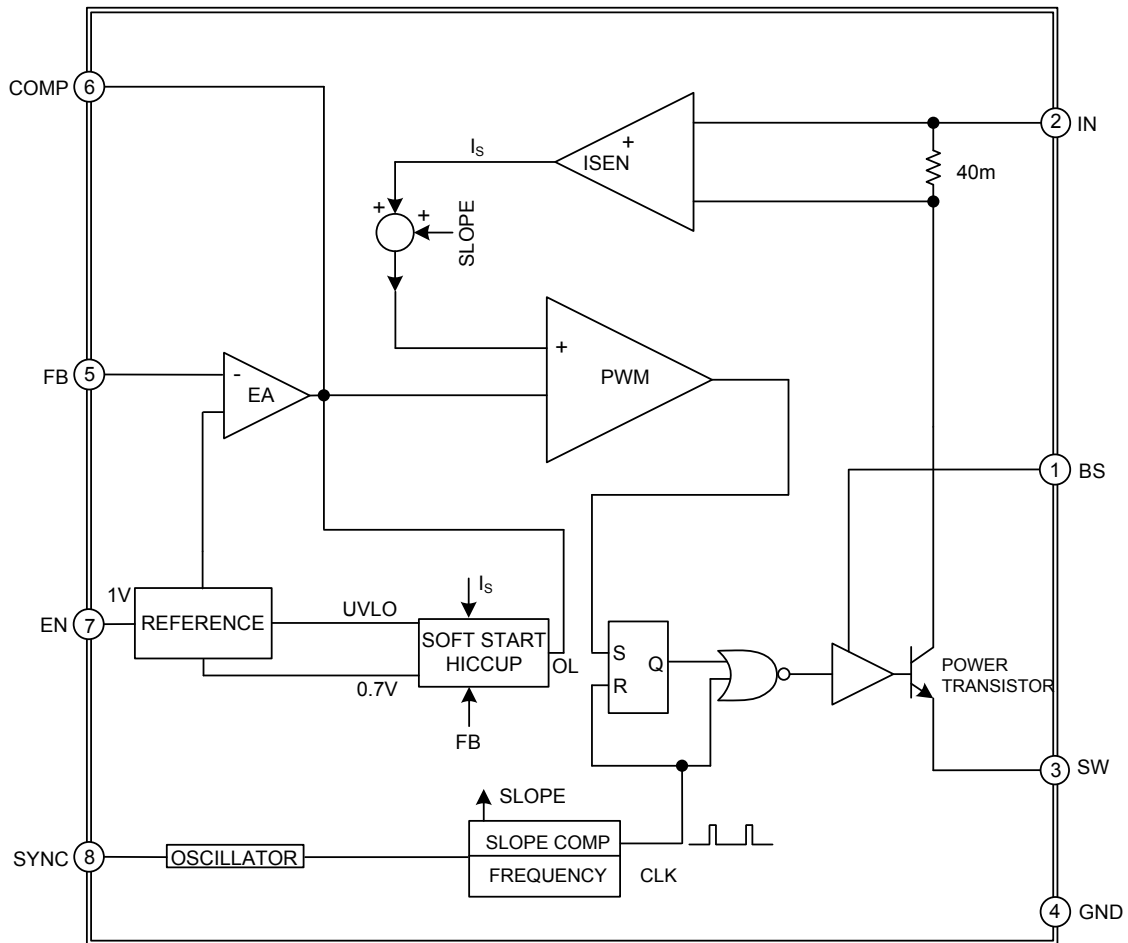
## ■ PIN DESCRIPTION

PIN NO.	PIN NAME	PIN FUNCTION
1	BST	Providing power to the internal NPN switch. To turn on for this switch the lowest voltage is 2.7V.
2	IN	This PIN delivers all control and power circuitry's power, and sees high di/dt during switching. A decoupling capacitor is better to be attached to this pin very closely.
3	SW	This PIN is the emitter of the internal switch and should be connected with the external freewheeling diode very closely.
4	GND	Almost all voltages are measured with respect to this pin. The decoupling capacitor and the freewheeling diode is better to be connected to this PIN as short as possible.
5	FB	Input of feedback for adjustable output controllers.
6	COMP	Output of the internal error amplifier and also input of the peak current comparator. To achieve the specified performance a compensation network is connected to this pin.
7	EN	Chip enable input. EN is high: the regulator switched on; EN is low: off. EN is low: the regulator is in standby mode, and the input supply current is reduced to a few microamperes.
8	SYNC	Synchronous control pin used to synchronize the internal oscillator to an external pulse control signal. But it should be connected to GND when not used.

# P1686

## LINEAR INTEGRATED CIRCUIT

### ■ BLOCK DIAGRAM



### ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNITS
Input Supply Voltage	$V_{IN}$	-0.3 ~ +28	V
Boost Pin Above $V_{SW}$	$(V_{BST} - V_{SW})$	16	V
Boost Pin Voltage	$V_{BST}$	-0.3 ~ +32	V
EN Pin Voltage	$V_{EN}$	-0.3 ~ +16	V
FB Pin Voltage	$V_{FB}$	-0.3 ~ +6	V
FB Pin Current	$I_{FB}$	1	mA
SYNC Pin Current	$I_{SYNC}$	1	mA
Junction Temperature	$T_J$	150	°C
Operating Temperature	$T_{OPR}$	-40 ~ +85	°C
Storage Temperature	$T_{STG}$	-65 ~ +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.

### ■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNITS
Junction to Ambient	$\theta_{JA}$	36.5	°C/W

### ■ ELECTRICAL CHARACTERISTICS

( $V_{IN} = 12V$ ,  $V_{COMP} = 0.8V$ ,  $V_{BS} = V_{IN} + 5V$ , EN = tied to  $V_{IN}$ , SYNC = 0, SW = open.  $T_A = T_J = -40^\circ C \sim 85^\circ C$ .)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Operating Input Voltage	$V_{IN}$				16(Note 1)	V
Maximum Switch Current Limit	$I_{SW}$			3.0		A
Oscillator Frequency	$f_{OSC}$		550	600	750	kHz
Switch On Voltage Drop	$V_{D(SW)}$	$I_{SW} = 3A$		330		mV
$V_{IN}$ Undervoltage Lockout	$V_{UVLO}$	$T_A = 25^\circ C$		2.60	3	V
$V_{IN}$ Supply Current	$I_Q$	$V_{FB} = V_{OUT(NOM)} + 17\%$		1.0	5	mA
Standby Current	$I_{Q(OFF)}$	$V_{EN} = 0V$ , $V_{IN} = V_{BOOST} = 16V$ , $V_{SW} = 0V$		5	45	$\mu A$
FB Input Current	$I_{FB}$			-0.25	-0.50	$\mu A$
Feedback Voltage			1.176	1.2	1.224	V
Feedback Voltage Line Regulation		$3V < V_{IN} < 16V$ (Note 2)		+3		mV/V
FB to $V_{COMP}$ Voltage Gain (Note 3)		$0.4V \leq V_{COMP} \leq 0.9V$	150	350		
FB to $V_{COMP}$ Transconductance (Note 3)		$\Delta I_{COMP} = \pm 10\mu A$	500	850	1300	$\mu Mho$
$V_{COMP}$ Pin Source Current		$V_{FB} = V_{OUT(NOM)} - 17\%$		70	110	$\mu A$
$V_{COMP}$ Pin Sink Current		$V_{FB} = V_{OUT(NOM)} + 17\%$		70	110	$\mu A$
$V_{COMP}$ Pin to Switch Current Transconductance				2.5		A/V
$V_{COMP}$ Pin Maximum Switching Threshold		Duty cycle = 0%		0.35		V
$V_{COMP}$ Pin Threshold		$I_{SW} = 3A$		0.9		V
Maximum Switch Duty Cycle		$V_{COMP} = 1.2V$ , $I_{SW} = 400mA$	85			%
Minimum Boost Voltage Above Switch (Note 3)	$V_{BOOST}$	$I_{SW} = 3A$ , $0^\circ C \leq T_A \leq 85^\circ C$ $I_{SW} = 2.5A$ , $T_A < 0^\circ C$		1.8	2.7	V
Boost Current	$I_{BOOST}$	$I_{SW} = 1A$		10	15	mA
		$I_{SW} = 3A$ , $0^\circ C \leq T_A \leq 85^\circ C$		30	45	
		$I_{SW} = 2.5A$ , $T_A < 0^\circ C$				
Enable Input Threshold Voltage	$V_{IH}$		3			V
	$V_{IL}$				0.4	V
Enable Input Bias Current	$I_{IL}$	EN = 60mV above threshold		2.5		$\mu A$
	$I_{IH}$	EN = 100mV below threshold		5	15	$\mu A$

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
SYNC Threshold Voltage				1.5		V
SYNC Input Frequency (Note 4)			750		1200	kHz
SYNC Pin Resistance		$V_{\text{SYNC}} = 0.5\text{V}$		20		k $\Omega$

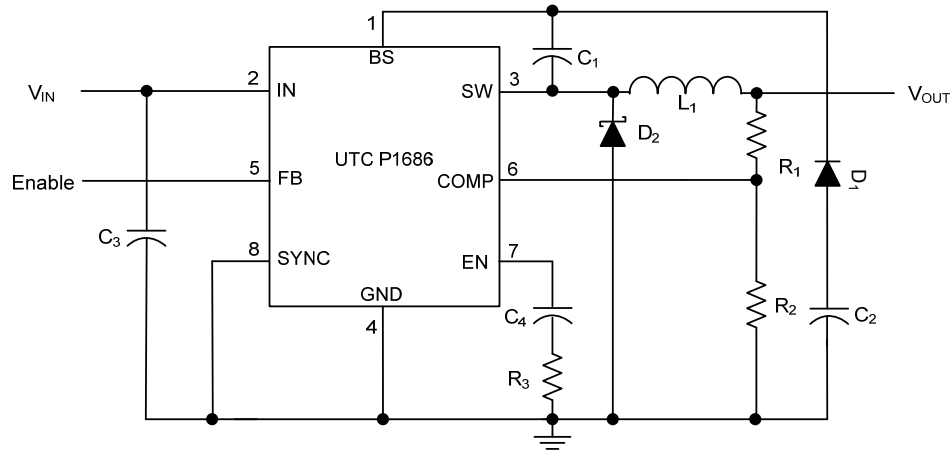
Note: 1. The device may not function properly outside its operating input voltage range.

2. The required minimum input voltage for a regulated output depends on the output voltage and load condition.

3. Guaranteed by design.

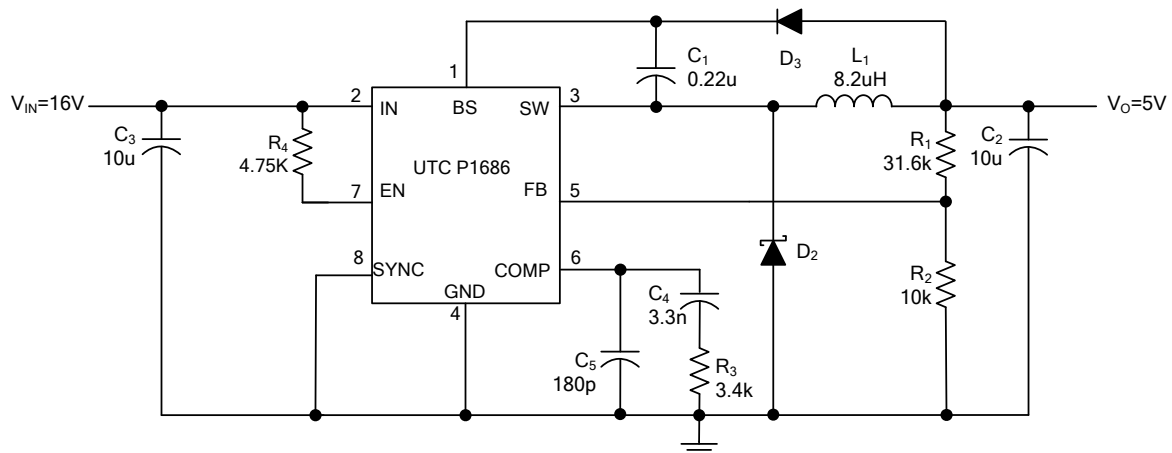
4. For SYNC applications, please contact factory.

### ■ TYPICAL APPLICATION CIRCUIT



### ■ APPLICATION CIRCUIT

Design Example: 16V to 5V at 2A



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