



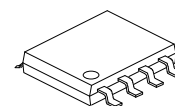
LOW POWER OFF-LINE CC/CV PRIMARY-SIDE POWER SWITCH

■ DESCRIPTION

The UTC **PSRB05** is a primary control switch mode charger and adapter applications. Built-in VcBO for 800V power BJT.

The UTC **PSRB05** operates in primary-side sensing and regulation. Opto-coupler and TL431 could be eliminated. It can achieve good CC/CV characteristics and less than 75mW standby power can be achieved.

The UTC **PSRB05** achieves high precision CV/CC regulation and high power efficiency. It offers comprehensive protection coverage with auto-recovery features including cycle-by-cycle current limiting, open circuit protection, over voltage protection, short circuit protection etc.



SOP-8

■ FEATURES

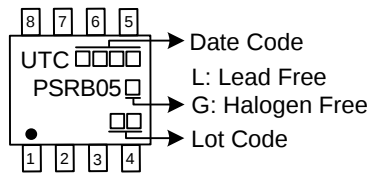
- * Built-in 800V Power BJT
- * High precision constant current regulation at universal AC input
- * Primary side control without TL431 and opto-coupler
- * Programmable cable compensation in CV mode
- * Programmable line voltage compensation
- * $\leq 75\text{mW}$ standby power consumption
- * Frequency hopping to reduce system EMI
- * Built-in leading edge blanking
- * Open circuit protection
- * Over voltage protection

■ ORDERING INFORMATION

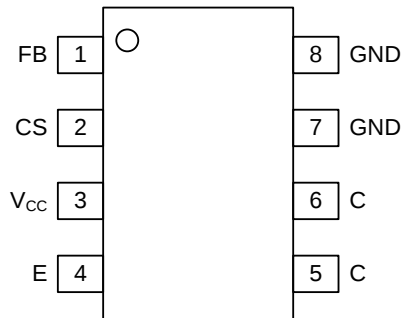
Ordering Number		Package	Packing
Lead Free	Halogen Free		
PSRB05L-S08-R	PSRB05G-S08-R	SOP-8	Tape Reel

PSRB05G-S08-R (1) Packing Type (2) Package Type (3) Green Package	(1) R: Tape Reel (2) S08: SOP-8 (3) G: Halogen Free and Lead Free, L: Lead Free
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MARKING



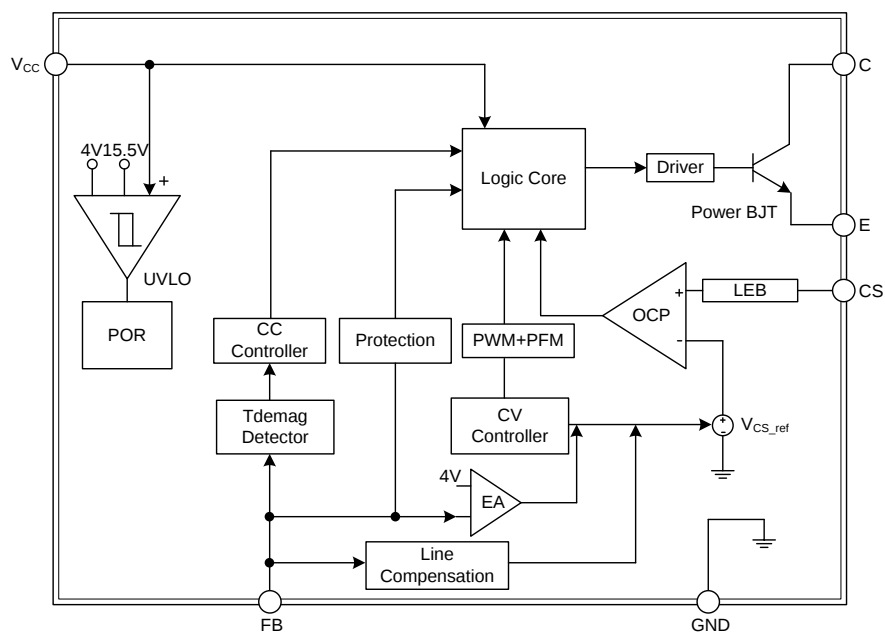
PIN CONFIGURATION



PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	FB	The voltage feedback from the auxiliary winding
2	CS	Current sense input
3	V _{CC}	Power Supply
4	E	Power BJT E Pin
5, 6	C	Power BJT C Pin
7, 8	GND	Ground

BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
V _{CC} Voltage	V _{CC}	-0.3 ~ 30	V
CS Input Voltage	CS	-0.3 ~ 7	V
FB Input Voltage	FB	-30 ~ 8.5	V
Power Dissipation	P _{DMAX}	0.45	W
ESD	HBM	2	KV
Operating Junction Temperature	T _J	-40 ~ +150	°C
Storage Temperature	T _{STG}	-55 ~ +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 CHARACTERISTICS

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ_{JA}	90	°C/W

■ OUTPUT POWER TABLE

PARAMETER		RATINGS	UNIT
Adapter	230VAC±15%	6	W
	85~264VAC	5	W

Note: Maximum practical continuous power in an Adapter design with sufficient drain pattern as a heat sink, at 50°C ambient.

■ ELECTRICAL CHARACTERISTICS (V_{CC}=16V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY SECTION						
Turn-On Threshold Voltage	V _{CC_ST}		13	15.5	18	V
Turn-Off Threshold Voltage	V _{CC_UVLO}		3.5	4.5	5	V
Start Up Current	I _{ST}	V _{CC} = V _{CC_ST} -1V		0.5	1.2	uA
Operating Current	I _{CC}			500		uA
DRIVE SECTION						
Output Current Source	I _{SOURCE}			30		mA
Output Current Sink	I _{SINK}		150	200	330	mA
CURRENT SENSE SECTION						
Current Sense Threshold Voltage At CC Mode	V _{CS1}			500		mV
Current Sense Threshold Voltage At Light Load	V _{CS2}			330		mV
Leading Edge Blank Time	T _{LEB}			500		ns
FEEDBACK VOLTAGE SECTION						
Input Resistance Of FB Pin	R _{FB}	V _{FB} =4V	1	1.6	2	MΩ
Feedback	V _{FB}		3.94	4	4.06	V
LINE COMPENSATION SECTION						
Line Compensation Voltage	V _{COMP_LINE}	V _{FB} =-10V, R _{LINE} =30K		120		mV
PROTECTION SECTION						
FB Over Voltage Protection	V _{FB_OVP}		6.5	7.0	7.5	V
Max On Time Of Primary Side	T _{ON_MAX}			25		uS
BUILT-IN POWER BJT SECTION						
C, B Withstand Voltage	V _{CBO}	I _C =0.1mA	800			V
E Saturation Current	I _{CESAT}	I _B =30mA		0.5		A

■ OPERATION DESCRIPTION

The UTC **PSRB05** is a primary control switch mode charger and adapter applications. It operates in primary-side sensing and regulation. Opto-coupler and TL431 could be eliminated. Proprietary built-in CV and CC control can achieve high precision CV/CC performance. The device work with discontinuous conduction mode (DCM) flyback converters.

Start Up Control

The V_{CC} pin of UTC **PSRB05** is connected to the line input through a resistor. A large value start up resistor can be used to minimize the power loss in application because the start current of UTC **PSRB05** is less than 1.2uA. When the V_{CC} voltage reaches V_{CC_ST} , the internal start up circuit is disabled and the IC turns on.

Constant Voltage Operation

The output voltage is defined by the transmission ratio between the secondary and auxiliary winding. The UTC **PSRB05** captures the auxiliary winding feedback voltage at FB pin and operates in constant-voltage (CV) mode to regulate the output voltage. The output voltage V_O is given by:

$$V_O = \frac{4 \times (R_{FBL} + R_{FBH})}{R_{FBL}} \times \frac{N_s}{N_{aux}} - \Delta V \quad (1)$$

Where R_{FBL} is FB pin pull down resistor, R_{FBH} is FB pin pull up resistor, ΔV indicates the drop voltage of the output diode.

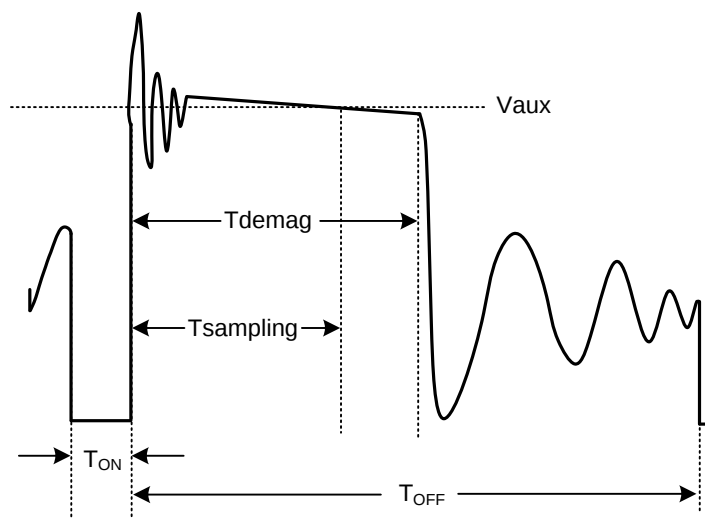


Figure 1. Auxiliary Voltage Waveform

Via a resistor divider connected between the auxiliary winding and FB, the V_{aux} is sampled at the $T_{sampling}$ end and it is hold until the next sampling. The sampled voltage is compared with 4.0V reference voltage and the error is amplified. The error amplifier output reflects the load condition and controls the T_{OFF} time and the I_{pk} to regulate the output voltage, thus constant output voltage can be achieved.

■ OPERATION DESCRIPTION (Cont.)

Constant Current Operation

When the sampled voltage is below 4.0V reference voltage and the error amplifier output reaches its maximum, thus UTC **PSRB05** operates in constant-current (CC) mode. The CC point and maximum output power can be externally adjusted by external current sense resistor R_{CS} . The larger R_{CS} , the smaller CC point is, and the smaller output power becomes.

In CC operation, the CC loop control function of UTC **PSRB05** will keep a fixed proportion between secondary inductance de-magnetization time (T_{demag}) and switching cycle time (T_{sw}). The fixed proportion is

$$\frac{T_{demag}}{T_{sw}} = \frac{1}{2} \quad (2)$$

Thus the output current is given by:

$$I_{OUT} = \frac{1}{2} \times \frac{N_P}{N_S} \times I_{pk} \times \frac{T_{demag}}{T_{sw}} = \frac{1}{4} \times \frac{N_P}{N_S} \times I_{pk} \quad (3)$$

Where the full load I_{pk} is given by:

$$I_{pk} = \frac{V_{CS}}{R_{CS}} = \frac{500}{R_{CS}} (\text{mA}) \quad (4)$$

Programmable Cable Drop Compensation

UTC **PSRB05** has a built-in cable voltage drop compensation to achieve good load regulation. An offset voltage is generated at FB pin by an internal current flowing into the resistor divider. The voltage drop across the cable is compensated by this offset voltage at FB pin. It can also be programmed by adjusting the resistance of the divider to compensate the drop for various cable lines used.

Programmable Line Voltage Compensation

UTC **PSRB05** has a built-in line voltage compensation to achieve good line voltage regulation. An offset voltage is generated at CS pin by an internal current. The line voltage change across the R_{LINE} is compensated by this offset voltage at CS pin. It can also be programmable by the R_{LINE} from CS pin to E pin.

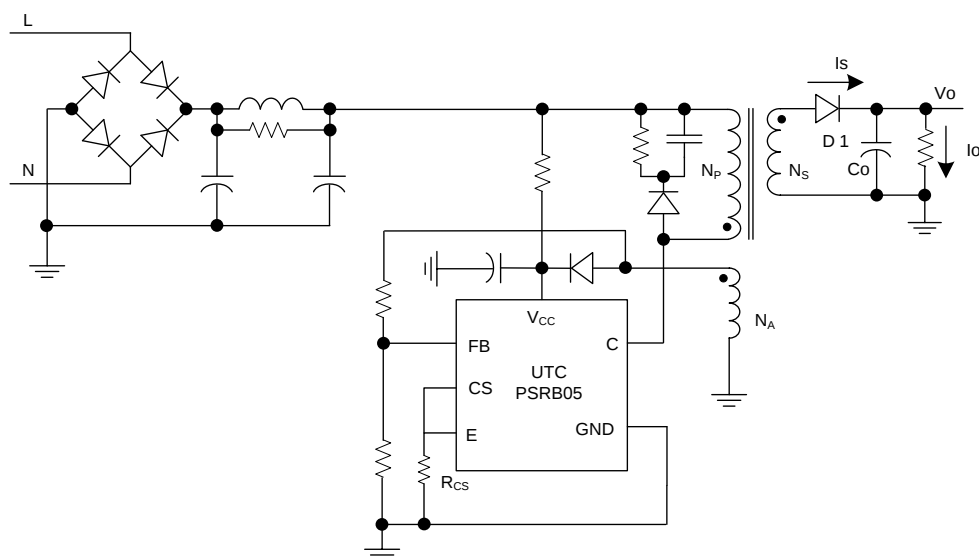
Current Sensing And Leading Edge Blanking

Cycle-by-cycle current limiting is offered in UTC **PSRB05**. The switch current is detected by a sense resistor into the CS pin. When the power switch is turned on, a turn-on spike will occur on this resistor. A 500ns leading-edge blanking is built in to avoid false-termination of the switching pulse so that the external RC filtering is no longer needed.

Protection Control

Good power supply system reliability is achieved with its comprehensive protection features including FB over-voltage protection, short circuit protection, open circuit protection, etc.

■ TYPICAL APPLICATION CIRCUIT



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