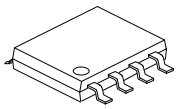
PRIMARY SIDE REGULATED SWITCHING MODE POWER SUPPLY CONTROLLER



SOP-8

■ DESCRIPTION

The UTC **UPSR105** is a high performance AC/DC power supply controller for battery charger and adapter applications. It can meet less than 10mW standby power for “Super Star” charger criteria. The device uses Pulse Frequency Modulation (PFM) method to build discontinuous conduction mode (DCM) flyback power supplies.

The UTC **UPSR105** provides accurate constant voltage (CV), constant current (CC) and outstanding dynamic performance without requiring an opto-coupler. It also eliminates the need of loop compensation circuitry while maintaining stability.

The UTC **UPSR105** is equipped with both cable drop compensation function to meet various cables with different lengths and gauges and adjustable line voltage compensation function.

When UTC **UPSR105** is used with 2nd-side synchronous rectification, better under-shoot performance and higher conversion efficiency can be achieved.

The UTC **UPSR105** has internal over temperature protection for itself, and also provides dedicated pin for ex ternal over temperature protection.

■ FEATURES

* Primary Side Control for Eliminating Opto-coupler
* 10mW No-load Input Power
* Flyback Topology in DCM Operation
* External Adjustable Line Compensation for CC
* External Adjustable Cable Compensation for CV
* Multiple PWM/PFM Control Mode to Improve Audio Noise Efficiency
* V_{CS} Jitter to Reduce System EMI
* Valley-on for the Higher Efficiency and Better EMI
* Multiple Protections:
  -Over Voltage Protection (OVP)
  -Output Short Circuit Protection (SCP)
  -Transformer Saturation Protection (TSP) via Primary Peak
  -Current Limitation
  -OTP and External Over Temperature Protection (OTP)
* Matching 2nd-side synchronous rectification with Schottky Synchronous Rectifier Solution

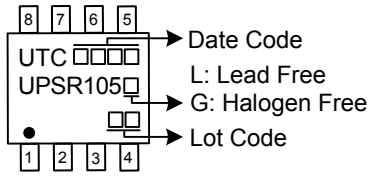
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
UPSR105L-S08-R	UPSR105G-S08-R	SOP-8	Tape Reel

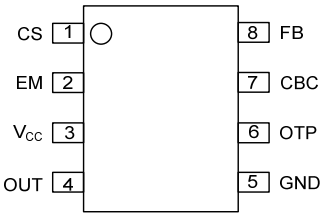
UPSR105G-S08-R
- (1)Packing Type
- (2)Package Type
- (3)Green Package

(1) R: Tape Reel
(2) S08: SOP-8
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



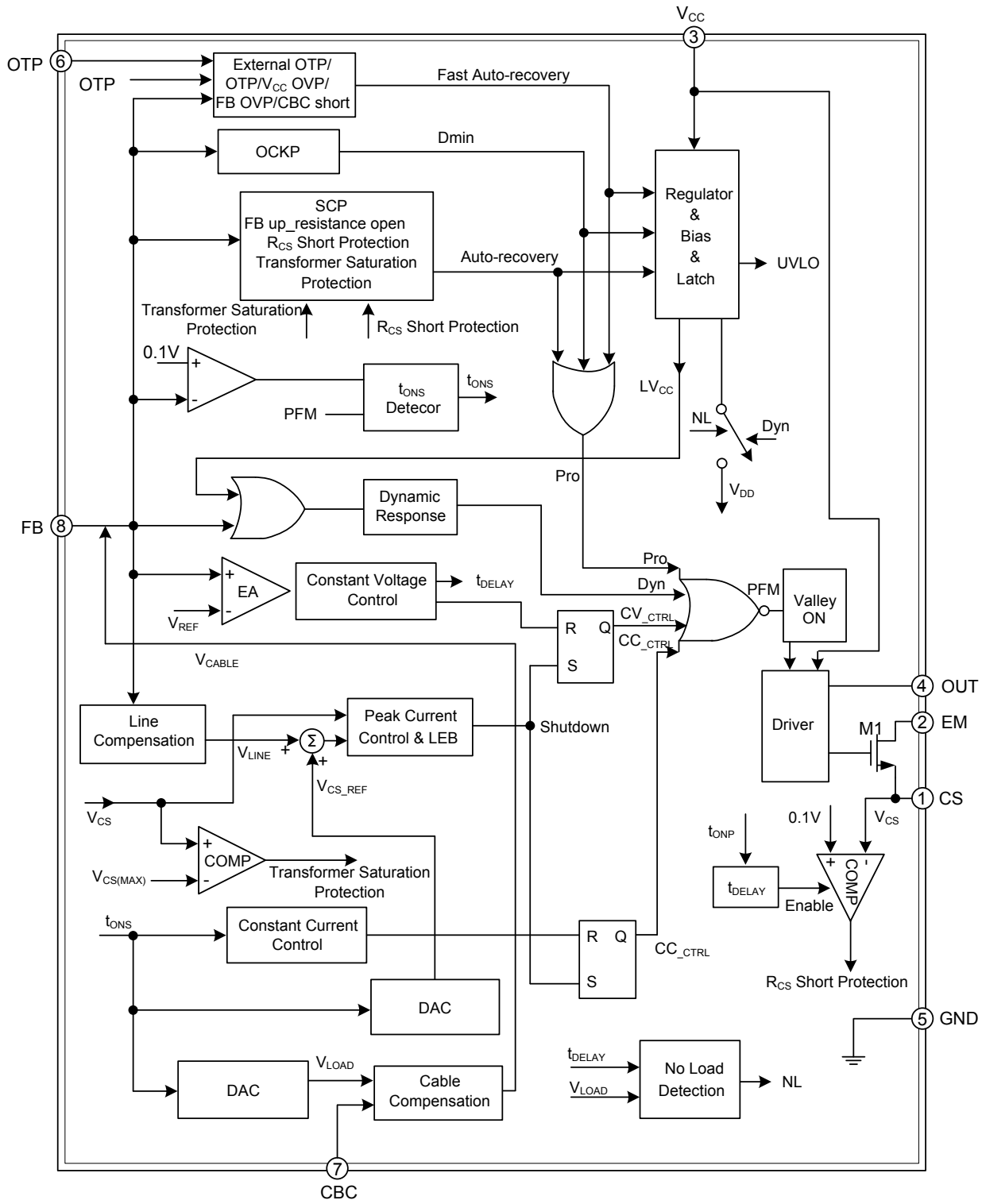
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	CS	Sense primary side current for turning off the external power MOSFET and deliver a voltage proportional to the line voltage for compensation from FB pin
2	EM	Connected to the source of external power MOSFET
3	V_{CC}	The power supply for the IC. In order to get the correct operation of the IC, a capacitor with low ESR should be placed as close as possible to the V_{CC} pin
4	OUT	Turn on and turn off the external power MOSFET
5	GND	The ground of the IC
6	OTP	The external over temperature protection
7	CBC	This pin connects a resistor to GND for output cable voltage drop compensation
8	FB	Voltage feedback. The CV and CC regulation are realized based on the voltage sampling of this pin

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Voltage at V_{CC} to GND	V_{CC}	-0.3 ~ 30	V
Voltage at OUT, EM to GND		-0.3 ~ 22	V
Voltage at CS, CBC,OTP to GND		-0.3 ~ 7.4	V
FB Input Voltage	V_{FB}	-0.7 ~ 7.4	V
Operating Junction Temperature	T_J	-40 ~ +150	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C

Notes: 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. Device mounted on FR-4 substrate P_C board, 2oz copper, with 1inch square copper plate.

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ_{JA}	100	°C/W
Junction to Case	θ_{JC}	20	°C/W

Note: When mounted on a standard single-sided FR-4 board with 300 mm^2 Cu (at least 35μm thick) connected to all collectors and CS pins.

■ ELECTRICAL CHARACTERISTICS (V_{CC}=15V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
STARTUP AND UVLO SECTION						
Startup Threshold	$V_{TH\ ST}$		11	13	15	V
Minimum Operating Voltage	$V_{OPR(MIN)}$		5.5	5.9	6.3	V
STANDBY CURRENT SECTION						
Startup Current	I_{ST}	V_{CC}=$V_{TH\ ST}$-1V before Startup	0	0.5	1	μA
Standby Current	$I_{CC\ NL}$	At No Load	5	17.5	30	μA
Operating Current	$I_{CC\ OPR}$	Static Current	350	450	550	μA
DRIVING OUTPUT SECTION						
Gate Voltage	V_{GATE}		9	10.5	12	V
Peak Driver Source Current	$I_{SOURCE\ PEAK}$		15	20.5	26	mA
Sink Resistance	$R_{DS(ON)}$		2	2.3	2.6	Ω
OPERATING FREQUENCY SECTION (NL MODE TO FULL LOAD)						
The Maximum Operating Frequency	$f_{S(MAX)}$	100% full load			80	kHz
Sample Time	$t_{sample\ H}$	40% to 100% full load	4.8	5.2	5.7	μs
	$t_{sample\ L}$	NL Mode to 8% full load	2.4	2.7	3.0	μs
OPERATING FREQUENCY SECTION (NL MODE)						
CBC Pin Voltage to Enter NL Mode	$V_{CBC(EN)}$		55	60	65	mV
Off Time to Enter NL Mode	$t_{OFF(EN)}$	From the end of t_{ONS}	168	224	280	μs
Off Time to Exit NL Mode	$t_{OFF(EX)}$	From the end of t_{ONS}	168	224	280	μs
FREQUENCY JITTER						
V_{CS} Modulation	$\Delta V_{CS}/V_{CS}$	NL to full load	4.5	5	5.5	%
V_{CS} Modulation Frequency	f_{MOD}	NL to full load	1.8	2	2.2	kHz
CURRENT SENSE SECTION						
Peak Current Sense Threshold Voltage	$V_{CS\ H}$	40% to 100% full load	537	565	593	mV
	$V_{CS\ L}$	0% to 8% full load	243	255	267	mV
Built-in Line Compensation Resistor	R_{LINE}	(Note 2)	108	120	132	Ω
Leading Edge Blanking	t_{LEB}		400	625	850	ns
CONSTANT VOLTAGE SECTION						
Feedback Threshold Voltage	V_{FB}	Closed loop test of V_{OUT}	2.45	2.50	2.55	V
Maximum CBC Voltage for Cable Compensation	$V_{CBC(MAX)}$		1.4	1.45	1.5	V

■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
CONSTANT CURRENT SECTION						
Secondary Winding Conduction Duty	t_{ONS}/t_{SW}	Tested @ V_{FB}=2V		1/2		
VALLEY-ON SECTION						
Valid Off Time of Valley-on	t_{VAL-ON}	From the end of t_{ONS}	20	27	34	μs
DYNAMIC SECTION						
Trigger Voltage for Dynamic Function	$V_{TRIGGER}$		40	62.5	85	mV
Delay Time for Dynamic Function	t_{DELAY}	From the end of t_{ONS}	99	127	155	μs
Under Voltage of FB Pin for $V_{CS\ H}$	$V_{UV\ H}$		2.23	2.27	2.32	V
PROTECTION FUNCTION SECTION						
Over Voltage Protection at FB Pin	$V_{FB(OVP)}$		3.5	3.75	4	V
Over Voltage Protection at V_{CC} Pin	$V_{CC(OVP)}$		27	28.5	30	V
Maximum Turn-on Time	$t_{ONP(MAX)}$		14	18	22	μs
Maximum Off Time	$t_{OFF(MAX)}$		11	14	17	ms
Minimum Peak Current Sense Voltage at $t_{ONP(MAX)}$	$V_{CS(MIN)}$		135	150	165	mV
Maximum EM Voltage for Transformer Saturation Protection	$V_{EM(MAX)}$	(Note 1)	1.8	2	2.2	V
Short Circuit Protection	$V_{FB(SCP)}$	V_{FB} @ Hiccup	1.57	1.61	1.65	V
Minimum Typical Time under $V_{FB(SCP)}$	$t_{SCP(MIN)}$		32	43	54	ms
Maximum Typical Time under $V_{FB(SCP)}$	$t_{SCP(MAX)}$		43	57	71	ms
External OTP Shutdown Threshold	V_{OTP}		0.49	0.52	0.55	V
External OTP Recovery Threshold	$V_{OTP\ REC}$		0.99	1.05	1.11	V
External OTP Shutdown Current	I_{OTP}		94	102	110	μA
Shutdown Temperature	T_{OTP}		+125	+135	+145	°C
Temperature Hysteresis	T_{HYS}		+37	+40	+43	°C

Notes: 1. These parameters are not 100% tested, guaranteed by design and characterization.

2. Line compensation voltage on CS reference: $\Delta V_{CS\_REF} = 0.35 \times \frac{R_{LINE}}{R_{FB1} + R_{LINE}} \times V_{AUX}$.

■ TYPICAL APPLICATION CIRCUIT