

## GENERAL DESCRIPTION

OB2252 is a highly integrated current mode PWM control IC optimized for high performance, low standby power and cost effective off-line flyback converter applications in sub 10W range.

PWM frequency is internal constant and it is trimmed to tight range. At no load or light load condition, the IC operates in 'Extended burst mode' to minimize switching loss. Lower standby power and higher conversion efficiency is thus achieved.

VDD low startup current and low operating current contribute to a reliable power on startup design with OB2252. A large value resistor could thus be used in the startup circuit to minimize the standby power.

The internal slope compensation improves system large signal stability and reduces the possible sub-harmonic oscillation at higher than 50% PWM duty cycle output. Leading-edge blanking on current sense (CS) input removes the signal glitch due to snubber circuit diode reverse recovery and thus greatly reduces the external component count and system cost in the design.

OB2252 offers complete protection coverage with automatic self-recovery feature including Cycle-by-Cycle current limiting (OCP), over load protection (OLP), VDD over voltage clamp and under voltage lockout (UVLO). Excellent EMI performance is achieved with On-Bright proprietary frequency shuffling technique together with soft switching control at the totem pole Base drive output.

The tone energy at below 20KHZ is minimized in the design and audio noise is eliminated during operation.

OB2252 is offered in SOT23-6, SOP-8 and DIP-8 packages.

## FEATURES

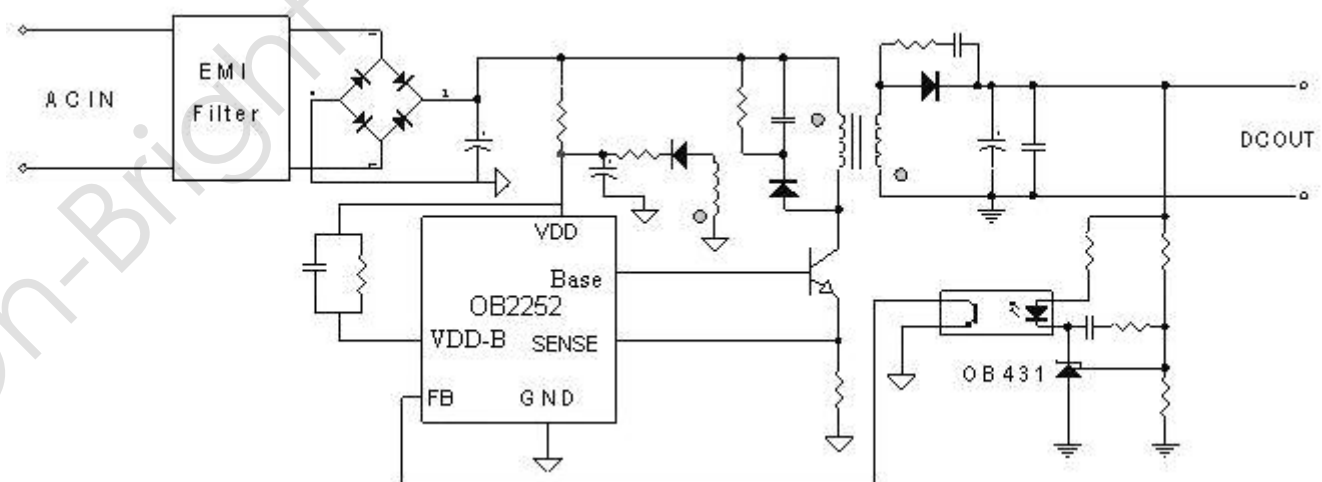
- Optimized for sub 10W Application Driving Power BJT
- Soft Start with 4 mS
- Frequency Shuffling for Improved EMI
- Extended Burst Mode Control For Improved Efficiency and Minimum Standby Power Design
- Audio Noise Free Operation
- Fixed 50KHZ Switching Frequency
- Internal Synchronized Slope Compensation
- Low VDD Startup Current and Low Operating Current
- Leading Edge Blanking on Current Sense Input
- Good Protection Coverage With Auto Self-Recovery
  - VDD Over Voltage Clamp and Under Voltage Lockout with Hysteresis (UVLO)
  - On-Bright Proprietary Line Input Compensated Cycle-by-Cycle Over-current Threshold Setting For Constant Output Power Limiting Over Universal Input Voltage Range.
  - Overload Protection (OLP).

## APPLICATIONS

Offline AC/DC flyback converter for

- Battery Charger
- PDA power supplies
- Digital Cameras
- Power Adaptor
- Set-Top Box Power Supplies
- Open-frame SMPS

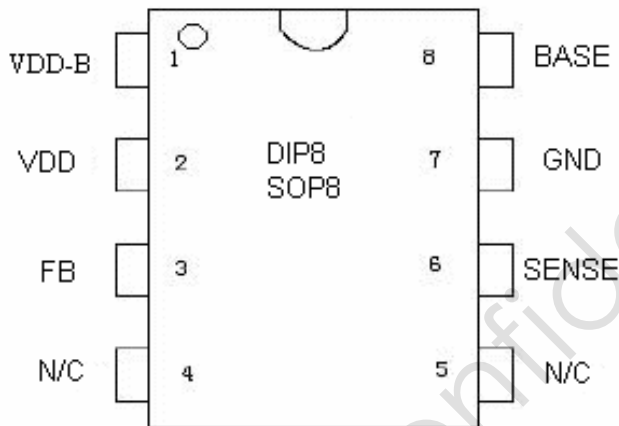
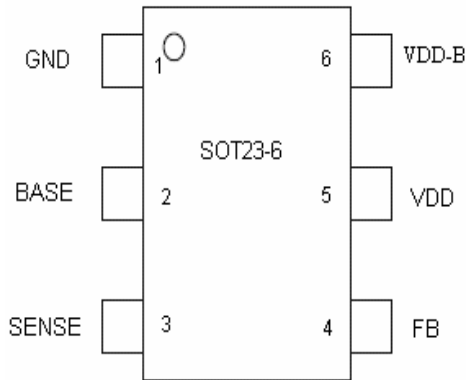
## TYPICAL APPLICATION



## GENERAL INFORMATION

### Pin Configuration

The OB2252 is offered in SOT23-6, DIP8 and SOP8 packages, shown as below.



### Ordering Information

Part Number	Description
OB2252AP	DIP8, Pb-free
OB2252CP	SOP8, Pb-free
OB2252MP	SOT23-6, Pb-free

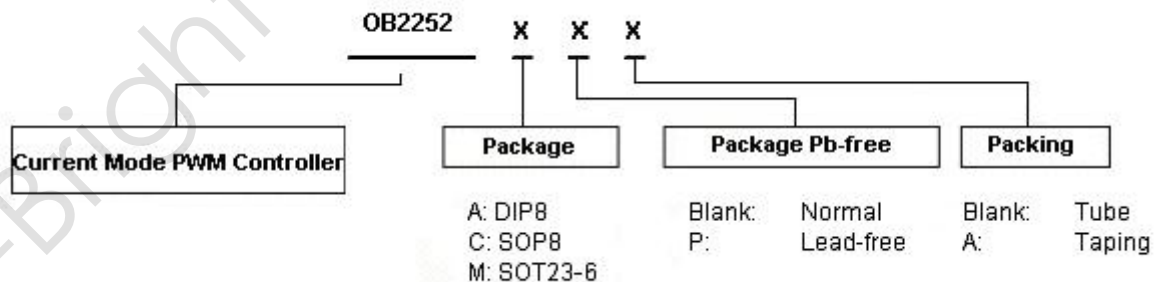
### Package Dissipation Rating

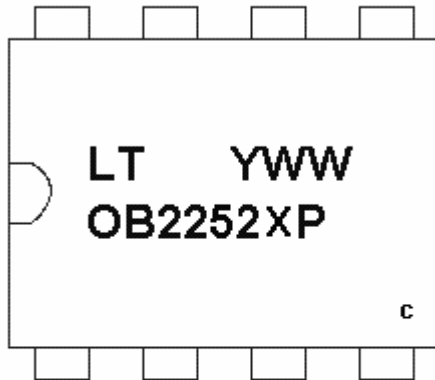
	R <sub>θJA</sub> (°C/W)
DIP8	90
SOP8	150
SOT23-6	200

### Absolute Maximum Ratings

Parameter	Value
VDD Input Voltage	30 V
VDD-B Input Voltage	30 V
VDD Input DC Current	10mA
V <sub>FB</sub> Input Voltage	-0.3 to 7V
V <sub>SENSE</sub> Input Voltage to Sense Pin	-0.3 to 7V
V <sub>RI</sub> Input Voltage to RI Pin	-0.3 to 7V
Min/Max Operating Junction Temperature T <sub>J</sub>	-20 to 150 °C
Min/Max Storage Temperature T <sub>stg</sub>	-55 to 160 °C
Lead Temperature (Soldering, 10secs)	260 °C

**Note:** Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.



**Marking Information**
**DIP8  
SOP8**


X: A for DIP8

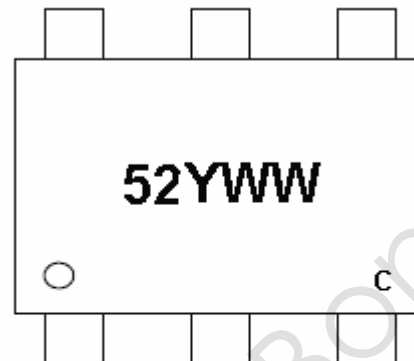
C for SOP8

P: Pb-free Package

Y: Year Code (0-9)

WW: Week Code (1-52)

C: Optional Internal Code

**SOT26**


Y: Year Code (0-9)

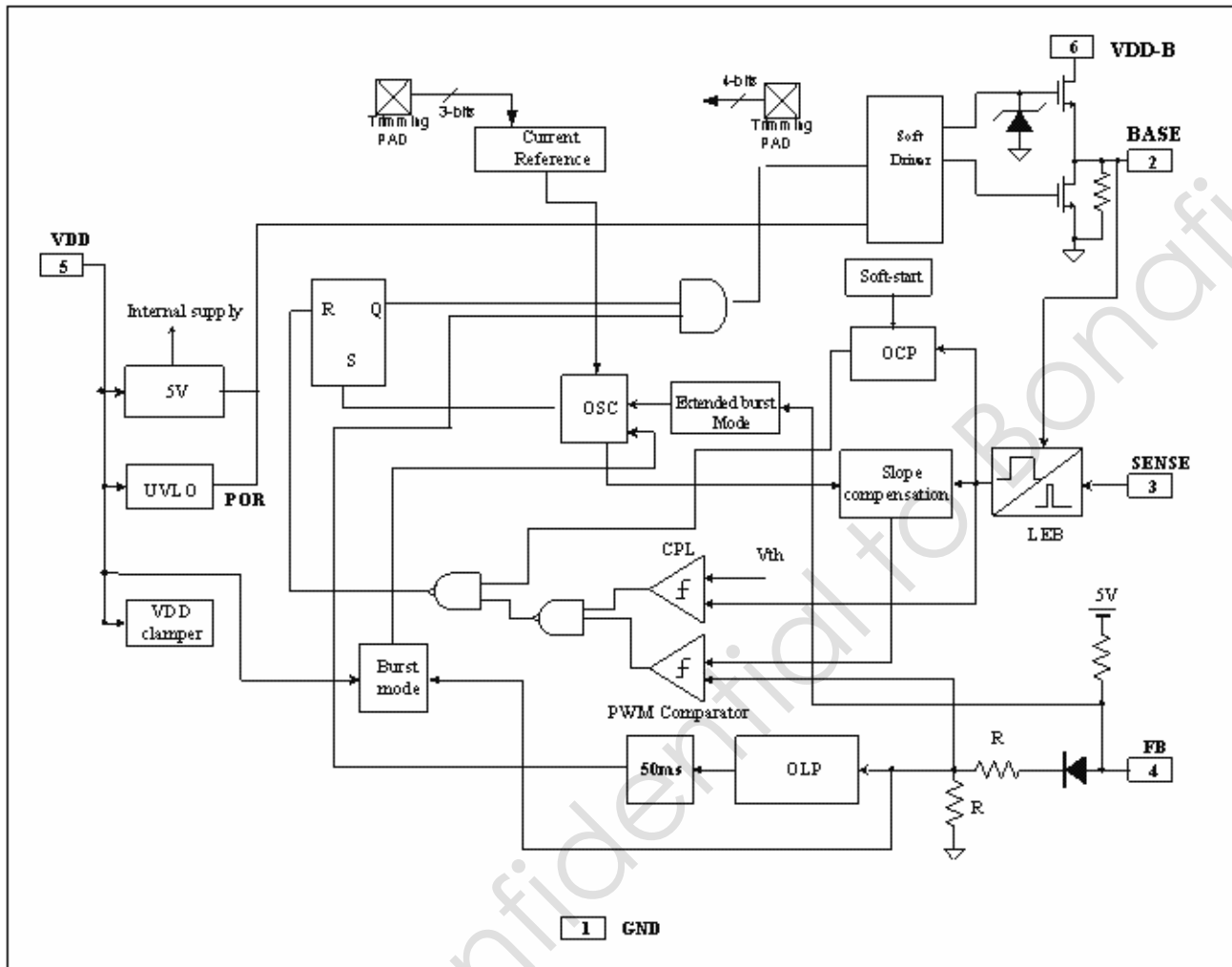
WW: Week Code (1-52)

C: Optional Internal Code

**TERMINAL ASSIGNMENTS**

Pin Name	I/O	Description
GND	P	Ground
FB	I	Feedback input pin. The PWM duty cycle is determined by voltage level into this pin and the current-sense signal at Pin 3.
VDD-B	P	Power Supply specifically for Base Driver
SENSE	I	Current sense input pin. Connected to BJT current sensing resistor node.
VDD	P	Chip DC power supply pin.
BASE	O	Totem-pole Base drive output for the power BJT.

**BLOCK DIAGRAM**



**ELECTRICAL CHARACTERISTICS**

 (T<sub>A</sub> = 25°C if not otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Supply Voltage (VDD)</b>						
I_VDD_Startup	VDD Start up Current	VDD=14.5V, Measure Leakage current into VDD		5	20	uA
I_VDD_Operation	Operation Current	VDD=16V, V <sub>FB</sub> =3V		1.6		mA
UVLO(ON)	VDD Under Voltage Lockout Enter		8.7	9.7	10.7	V
UVLO(OFF)	VDD Under Voltage Lockout Exit (Recovery)		14.6	15.8	17.0	V
OVP(ON)	Over voltage protection voltage	VDD=18V, CS=0V, FB=3V Ramp up VDD until Base clock is off	27.0	28.5	30.0	V
VDD_Clamp	VDD Zener Clamp Voltage	I <sub>DD</sub> = 10 mA		30.5		V
<b>Feedback Input Section(FB Pin)</b>						
V <sub>FB_Open</sub>	V <sub>FB</sub> Open Loop Voltage		5.4	5.7	6.0	V
I <sub>FB_Short</sub>	FB pin short circuit current	Short FB pin to GND and measure current		1.45		mA
V <sub>TH_0D</sub>	Zero Duty Cycle FB Threshold Voltage	VDD=16V		1.1		V
V <sub>TH_Burst</sub>	Burst Mode FB Threshold Voltage			1.6		V
V <sub>TH_PL</sub>	Power Limiting FB Threshold Voltage			3.7		V
T <sub>D_PL</sub>	Power limiting Debounce Time			50		mSec
Z <sub>FB_IN</sub>	Input Impedance			4		Kohm
<b>Current Sense Input(Sense Pin)</b>						
Soft start time				4		ms
T <sub>blanking</sub>	Leading edge blanking time			270		ns
Z <sub>SENSE_IN</sub>	Input Impedance			40		Kohm
T <sub>D_OC</sub>	Over Current Detection and Control Delay	From Over Current Occurs till the Basedrive output start to turn off		120		nSec
V <sub>TH_OC</sub>	Internal Current Limiting Threshold Voltage	FB=3.3V, F=50KHZ	0.72	0.77	0.82	V
<b>Oscillator</b>						
F <sub>OSC</sub>	Normal Oscillation Frequency	VDD = 16V	45	50	55	KHZ
Δf_Temp	Frequency Temperature Stability	VDD = 16V		5		%

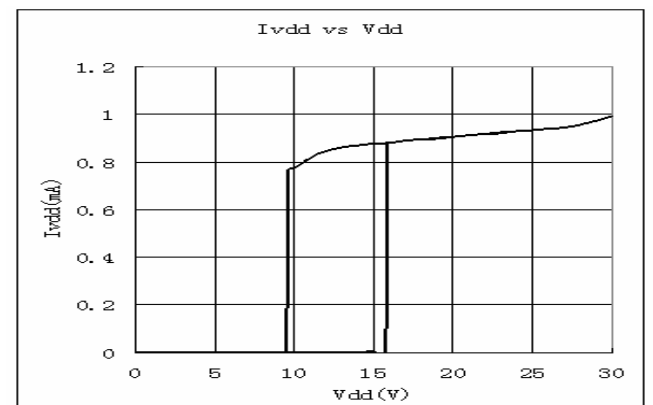
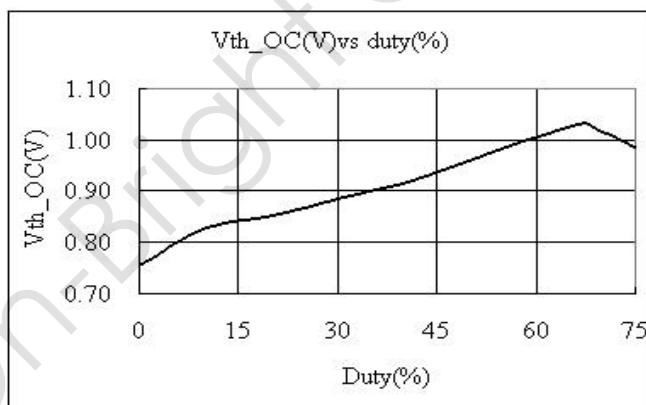
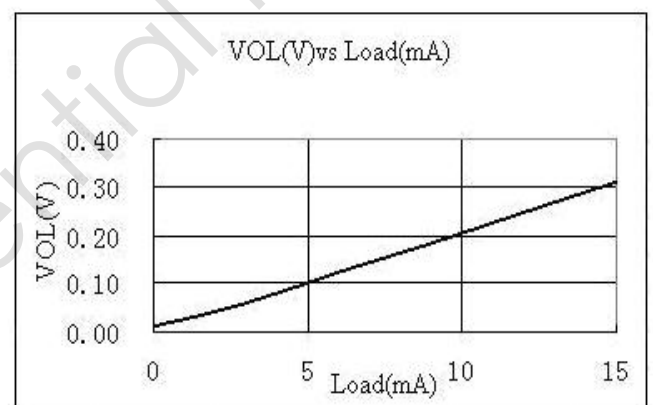
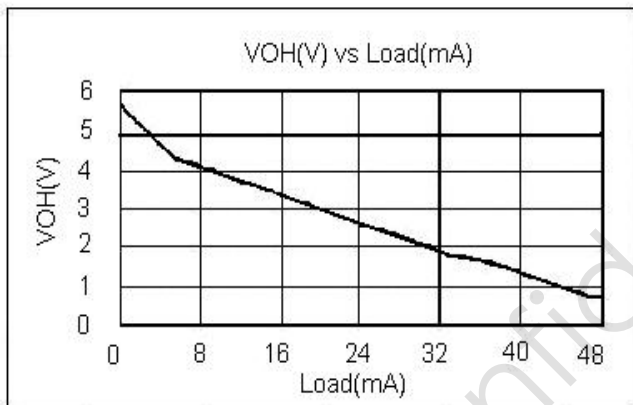
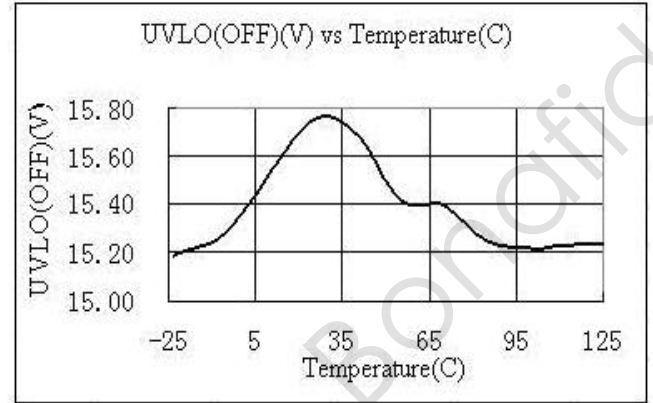
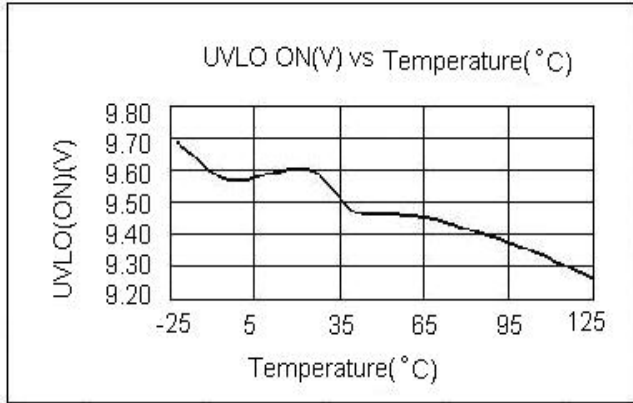
**Current Mode PWM Controller for BJT<sup>Freq Shuffling</sup>**

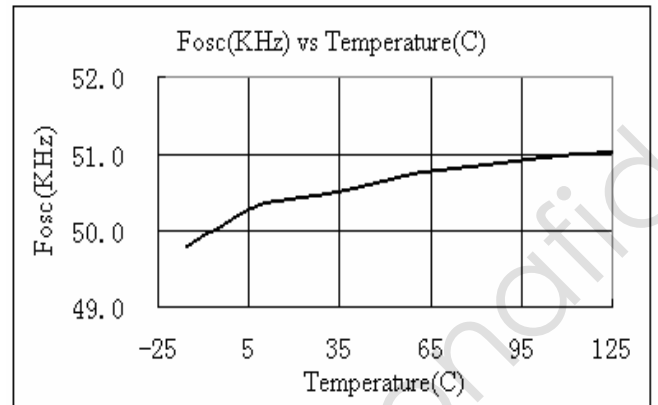
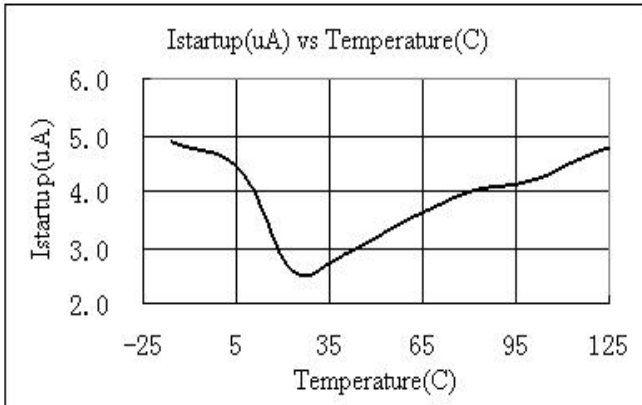
$\Delta f_{VDD}$	Frequency Voltage Stability	VDD = 16-20V		5		%
D_max	Maximum duty cycle	FB=3.3V, CS =0V VDD=16V	70	80	90	%
F_Burst	Burst Mode Base Frequency	VDD = 16V		19		KHZ
<b>Base Drive Output</b>						
VOL	Output Low Level	VDD = 16V, I <sub>o</sub> = -20 mA			0.3	V
VOH	Output High Level	VDD = 16V, I <sub>o</sub> = 20 mA	3			V
<b>Frequency Shuffling</b>						
$\Delta f_{OSC}$	Frequency Modulation range /Base frequency		-4		4	%

On-Bright Confidential to Bonafide

### CHARACTERIZATION PLOTS

(The characteristic graphs are normalized at Ta=25°C)







## OPERATION DESCRIPTION

The OB2252 is a highly integrated PWM controller IC optimized for off-line flyback converter applications in sub 10W power range. The 'Extended burst mode' control greatly reduces the standby power consumption and helps the design easily meeting the international power conservation requirements.

- **Startup Current and Start up Control**

Startup current of OB2252 is designed to be very low so that VDD could be charged up above UVLO threshold level and device starts up quickly. A large value startup resistor can therefore be used to minimize the power loss yet reliable startup in application. For AC/DC adaptor with universal input range design, a 2 M $\Omega$ , 1/8 W startup resistor could be used together with a VDD capacitor to provide a fast startup and yet low power dissipation design solution.

- **Operating Current**

The Operating current of OB2252 is low at 2mA. Good efficiency is achieved with OB2252 low operating current together with 'Extended burst mode' control features.

- **Soft Start**

OB2252 features an internal 4ms soft start to soften the electrical stress occurring in the power supply during startup. It is activated during the power on sequence. As soon as VDD reaches UVLO(OFF), the peak current is gradually increased from nearly zero to the maximum clamping level 0.77V. Every restart up is followed by a soft start.

- **Frequency shuffling for EMI improvement**

The frequency Shuffling/jittering (switching frequency modulation) is implemented in OB2252. The oscillation frequency is modulated with a pseudo random source so that the tone energy is spread out. The spread spectrum minimizes the conduction band EMI and therefore eases the system design.

- **Extended Burst Mode Operation**

At light load or zero load condition, most of the power dissipation in a switching mode power supply is from switching loss on the BJT transistor, the core loss of the transformer and the loss on the snubber circuit. The magnitude of power loss is in proportion to the switching frequency. Lower

switching frequency leads to the reduction on the power loss and thus conserves the energy.

OB2252 self adjusts the switching frequency according to the loading condition. The switch frequency is reduced at light/no load condition to improve the conversion efficiency. At light load/no load condition, the FB input drops below burst mode threshold level and device enters Burst Mode control. The Base drive output switches only when VDD voltage drops below a preset level and FB input is active to output an on state. Otherwise the Base drive remains at off state to minimize the switching loss and reduces the standby power consumption to the greatest extend.

The frequency control also eliminates the audio noise at any loading conditions.

- **Oscillator Operation**

The switching frequency of OB2252 is internally fixed at 50KHZ. No external frequency setting components are required for PCB design simplification.

- **Current Sensing and Leading Edge Blanking**

Cycle-by-Cycle current limiting is offered in OB2252 current mode PWM control. The current of the power BJT is detected by a sensing resistor into the sense pin. An internal leading edge blanking circuit chops off the sensed voltage spike at initial BJT on state due to Snubber diode reverse recovery and surge base current of power BJT so that the external RC filtering on sense input is no longer needed. The current limiting comparator is disabled and cannot turn off the power BJT during the blanking period. The PWM duty cycle is determined by the current sense input voltage and the FB input voltage.

- **Internal Synchronized Slope Compensation**

Built-in slope compensation circuit adds voltage ramp onto the current sense input voltage for PWM generation. This greatly improves the close loop stability at CCM and prevents the sub-harmonic oscillation and thus reduces the output ripple voltage.

- **Base Drive**

OB2252 Base Terminal is connected to the base of external power BJT for power switch control. The base current is determined by the resistor connected between VDD and VDDB. With fixed  $\beta$  BJT, too weak base drive compromise the output power

## Current Mode PWM Controller for BJT<sup>Freq Shuffling</sup>

while too strong Base drive results in longer than normal BJT recovery time and thus affect switching efficiency.

A good tradeoff is achieved through the built-in totem pole Base design with right output strength and dead time control. The low idle loss and good EMI system design is easier to achieve with this dedicated control scheme.

- **Protection Controls**

Good power supply system reliability is achieved with its rich protection features including Cycle-by-Cycle current limiting (OCP), Over Load Protection (OLP) and over voltage clamp, Under Voltage Lockout on VDD (UVLO).

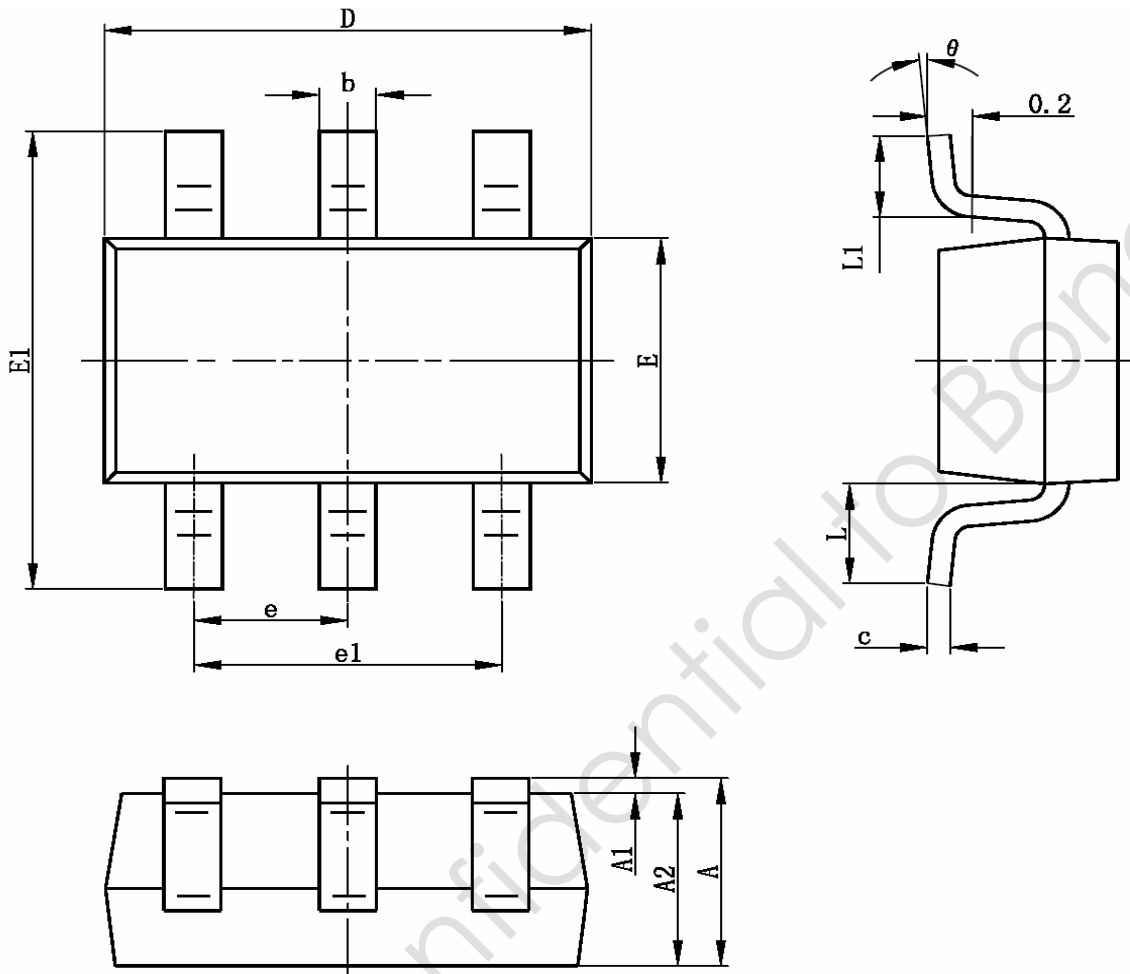
With On-Bright Proprietary technology, the OCP is line voltage compensated to achieve constant output power limit over the universal input voltage range.

At overload condition when FB input voltage exceeds power limit threshold value for more than TD\_PL, control circuit reacts to shut down the output power BJT. Device restarts when VDD voltage drops below UVLO limit.

VDD is supplied by transformer auxiliary winding output. It is clamped when VDD is higher than 30V. The power BJT is shut down when VDD drops below 9.7V (UVLO limit) and device enters power on restart-up sequence thereafter.

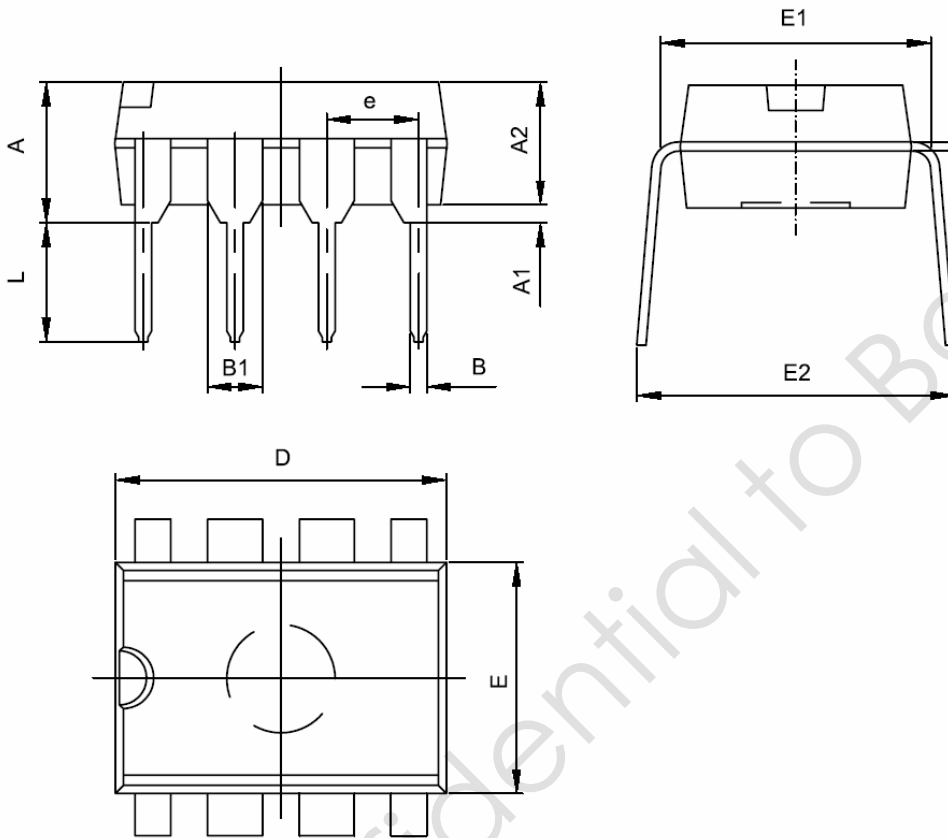
**PACKAGE MECHANICAL DATA**

SOT23-6



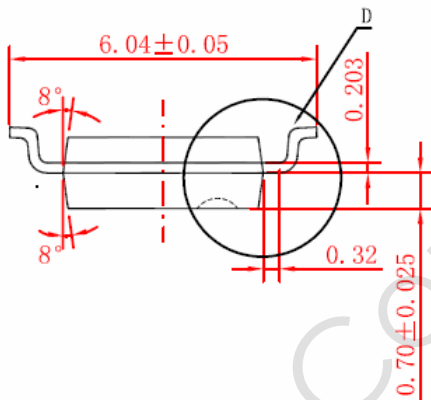
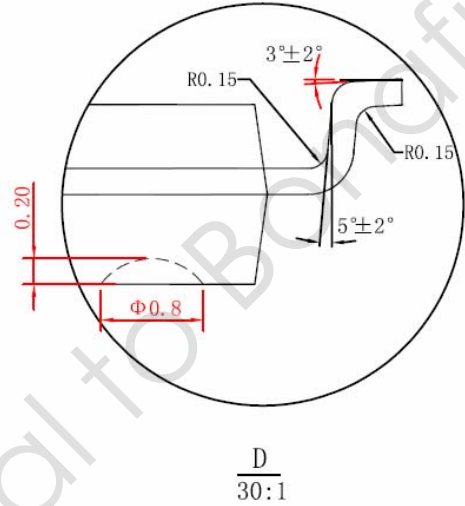
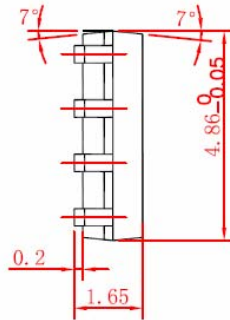
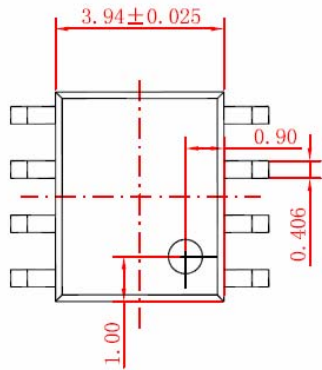
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.400	0.012	0.016
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

8-Pin Plastic DIP



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.360	0.560	0.014	0.022
B1	1.524(TYP)		0.060(TYP)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.620(TYP)		0.300(TYP)	
e	2.540(TYP)		0.100(TYP)	
L	3.000	3.600	0.118	0.142
E2	8.200	9.400	0.323	0.370

8-Pin Plastic SOP



### **IMPORTANT NOTICE**

#### **RIGHT TO MAKE CHANGES**

On-Bright Electronics Corp. reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

#### **WARRANTY INFORMATION**

On-Bright Electronics Corp. warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with its standard warranty. Testing and other quality control techniques are used to the extent it deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

On-Bright Electronics Corp. assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using On-Bright's components, data sheet and application notes. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

#### **LIFE SUPPORT**

On-Bright Electronics Corp.'s products are not designed to be used as components in devices intended to support or sustain human life. On-bright Electronics Corp. will not be held liable for any damages or claims resulting from the use of its products in medical applications.

#### **MILITARY**

On-Bright Electronics Corp.'s products are not designed for use in military applications. On-Bright Electronics Corp. will not be held liable for any damages or claims resulting from the use of its products in military applications.