



2A Step-Down DC/DC Converter for LED Driving

Features

- Input Voltage from 3.6V to 23V
- Low Feedback Voltage of 0.25V Allows Output Voltage from 0.25V to VCC
- Duty Ratio : 0% to 100% PWM Control
- Typical Oscillation Frequency of 330KHz for the APE1832 or 500kHz for the APE1832A
- LED Backlight and High Power LED Application
- Enable/Disable Function
- Current Limit (CL), Thermal Shutdown and Short Circuit Protection (SCP).
- Built-in Internal P-channel MOSFET Switch.
- Stable without an Output Capacitor
- RoHS-compliant, halogen-free SO-8 Package.

Description

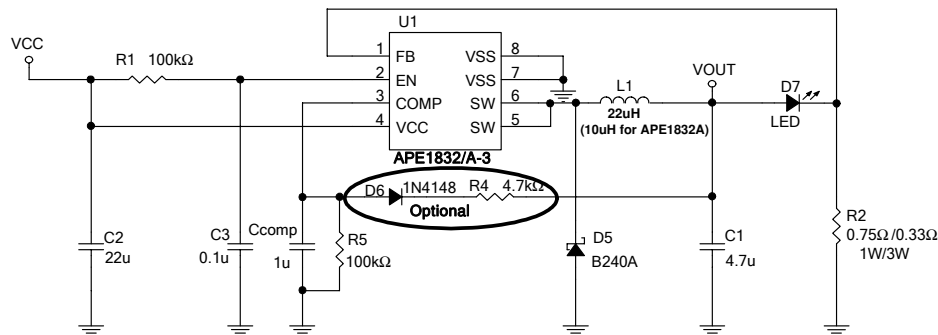
The APE1832/AM-HF-3 are step-down switching regulators with PWM control. These devices include a reference voltage source, oscillation circuit, error amplifier, and an internal P-channel MOSFET switch.

The APE1832 provides low-ripple power, high efficiency, and excellent transient characteristics. The PWM control circuit is able to adjust the duty ratio linearly from 0 up to 100%. An enable function, an over-current protect function and short circuit protect function are built inside, and when an OCP or SCP event happens, the operation frequency will be reduced. Also, an internal compensation block is built in for minimum external component count.

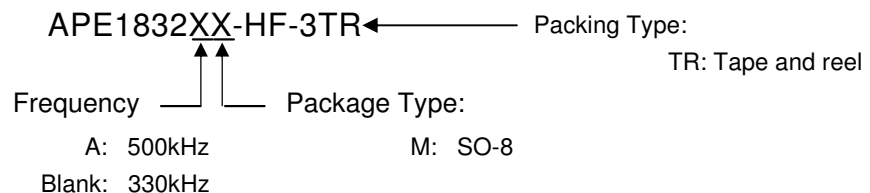
Using the internal P-channel Power MOSFET, along with a coil, capacitors, and a diode connected externally, these ICs can function as step-down switching regulators. Using the SO-8 package, these devices can serve as ideal power supply units for portable devices, providing low current consumption. As this converter accommodates an input voltage up to 23V, it is also suitable for operation via an AC adapter.

Typical Application

1W and 3W LED Driver with DC Input



Ordering information



Example:

APE1832M-HF-3TR : 330kHz, in RoHS-compliant, halogen-free SO-8, shipped on tape and reel (3000 pcs/reel).

APE1832AM-HF-3TR : 500kHz, in RoHS-compliant, halogen-free SO-8, shipped on tape and reel (3000 pcs/reel).



Absolute Maximum Ratings (at $T_A = 25^\circ\text{C}$)

V_{CC} PIN Voltage(V_{CC})	-----	$V_{SS} -0.3\text{V}$ to $V_{SS} +25\text{V}$
Feedback PIN Voltage(V_{FB})	-----	$V_{SS} -0.3\text{V}$ to V_{CC}
ON/OFF PIN Voltage(V_{EN})	-----	$V_{SS} -0.3\text{V}$ to $V_{CC} + 0.3\text{V}$
Switch PIN Voltage(V_{SW})	-----	$V_{SS} -0.3\text{V}$ to $V_{CC} + 0.3\text{V}$
Power Dissipation(P_D)	-----	Internally Limited
Storage Temperature Range(T_{ST})	-----	-40°C to 150°C
Operating Temperature Range(T_{OP})	-----	-40°C to 125°C
Operating Supply Voltage(V_{OP})	-----	$+3.6\text{V}$ to $+23\text{V}$
Thermal Resistance from Junction to Case($R_{th_{JC}}$)		25°C/W
Thermal Resistance from Junction to Ambient($R_{th_{JA}}$)		70°C/W

Note. $R_{th_{JA}}$ is measured with the PCB copper area (must be connected to SW pins) of approx. 1 in^2 (multi-layer)

Electrical Characteristics

($V_{IN}=12\text{V}$, $T_A=25^\circ\text{C}$, unless otherwise specified)

Parameter	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS	
Feedback Voltage	V_{FB}	$I_{OUT}=0.2\text{A}$	0.24	0.25	0.26	V	
Quiescent Current	I_{CCQ}	$V_{FB}=1.2\text{V}$ force driver off	-	3	5	mA	
Feedback Bias Current	I_{FB}	$I_{OUT}=0.1\text{A}$	-	0.1	0.5	μA	
Shutdown Supply Current	I_{SD}	$V_{EN}=0\text{V}$	-	2	10	μA	
Switch Current	I_{SW}		2.5	-	-	A	
Line Regulation	$\Delta V_{OUT}/V_{OUT}$	$V_{CC} = 5\text{V}\sim 23\text{V}$, $I_{OUT}=0.2\text{A}$	-	1	2	%	
Load Regulation	$\Delta V_{OUT}/V_{OUT}$	$I_{OUT} = 0.1$ to 2A	-	0.2	0.5	%	
Oscillation Frequency	F_{OSC}	APE1832	260	330	400	kHz	
		APE1832A	400	500	600		
EN Pin Logic Input Threshold Voltage	V_{SH}	Slew rate $\geq 120\text{mV}/\mu\text{s}$	2	-	-	V	
	V_{SL}	Slew rate $\geq 120\text{mV}/\mu\text{s}$	-	-	0.8		
EN Pin Input Current	I_{SH}	$V_{EN}=2.5\text{V}$ (ON)	-	20	-	μA	
	I_{SL}	$V_{EN}=0.3\text{V}$ (OFF)	-	-10	-	μA	
Internal MOSFET R_{DSON}	R_{DSON}	$V_{CC}=5\text{V}$, $V_{FB}=0\text{V}$	-	100	140	m Ω	
		$V_{CC}=12\text{V}$, $V_{FB}=0\text{V}$	-	70	100		
Efficiency	EFFI	$V_{OUT} = 5\text{V}$	$I_{OUT} = 1\text{A}$	-	91	-	%
			$I_{OUT} = 2\text{A}$	-	91	-	
Thermal Shutdown Temp	TSD		-	140	-	$^\circ\text{C}$	

THIS PRODUCT IS SENSITIVE TO ELECTROSTATIC DISCHARGE, PLEASE HANDLE WITH CAUTION.

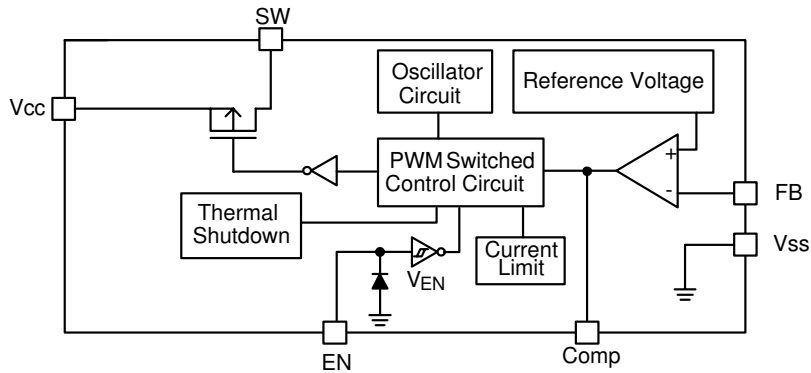
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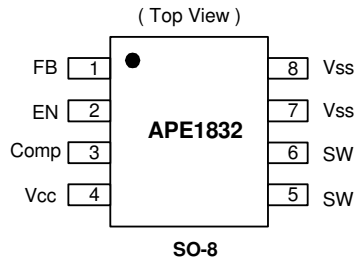
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Block Diagram



Pin Assignment



Pin Assignment

PIN SYMBOL	PIN DESCRIPTION
V _{SS}	GND Pin
FB	Feedback Pin
EN	Power -Off Pin H : Normal Operation(Step-down) L : Step-down Operation Stopped (all circuits deactivated)
Comp	Compensation Pin
SW	Switch Pin. Connect External Inductor and Diode here.
V _{CC}	IC Power Supply Pin



Application Information

PWM CONTROL

The APE1832/A is a DC/DC converter that employs a pulse-width modulation (PWM) system. In converters like the APE1832/A, the pulse width varies in a range from 0 to 100%, according to the load current. The ripple voltage produced by the switching noise can easily be removed through a filter because the switching frequency remains constant. Therefore, these converters provide low-ripple power over broad ranges of input voltage and load current.

SETTING THE OUTPUT VOLTAGE

The application circuits shown on page 5 show basic application circuits for the APE1832 adjustable output version. The external resistor sets the LED output current according to the following equation:

$$I_{LED} = 0.25V/R2$$

Table 1 Resistor select for LED output current setting

I_{LED}	R2
350mA	0.715Ω 87.5mW
750mA	0.333Ω 189mW
1.5A	0.167Ω 375mW

RDS(ON) CURRENT LIMITING

The current limit threshold is set by the internal circuit.

COMPENSATION

The COMP pin connects R5 and Ccomp to GND, and values are shown on page 5. With DC input, the optional circuit for compensation is to connect R4 and a 1N4148 diode to Vout, in order to protect short circuit and thermal shutdown releases for the LED.

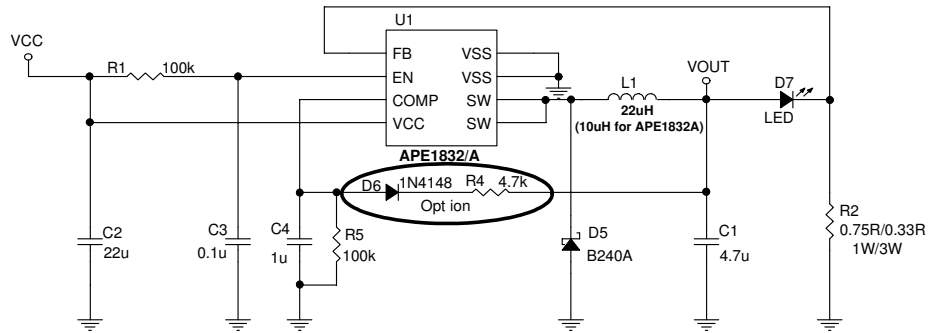
PCB LAYOUT GUIDE

If you need lower case and/or junction temperatures, or larger P_D (power dissipation), the dual SW pins (5 and 6) on the SO-8 package are internally connected to the die pad. The PCB layout should allow for the maximum possible copper area at the SW pins.



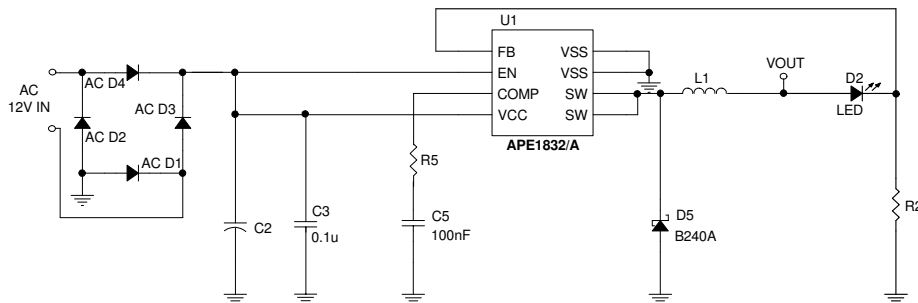
Typical Applications

A) 1W/3W LED Driver with DC Input



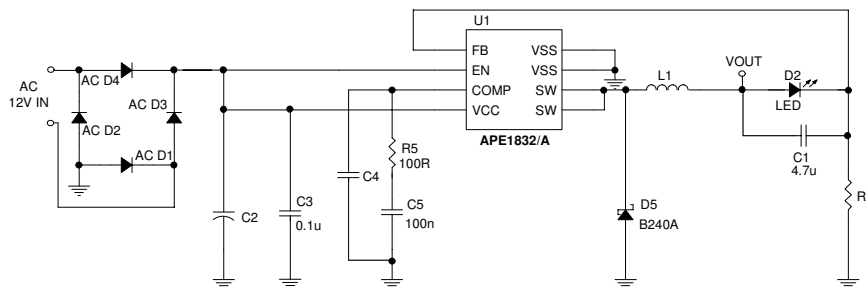
B) 1W/3W LED Driver with AC Input

(1) with no output capacitor



Part No.	I _{LED}	R2		C2	R5	L1
APE1832	350mA	0.715Ω	87.5mW	100μF	0.22kΩ	68μH
	750mA	0.333Ω	189mW	220μF	0.47kΩ	
	1000mA	0.250Ω	250mW	330μF	0.47kΩ	
APE1832A	350mA	0.715Ω	87.5mW	100μF	0.22kΩ	47μH
	750mA	0.333Ω	189mW	220μF	0.47kΩ	
	1000mA	0.250Ω	250mW	330μF	0.47kΩ	

(2) with 4.7uF output capacitor

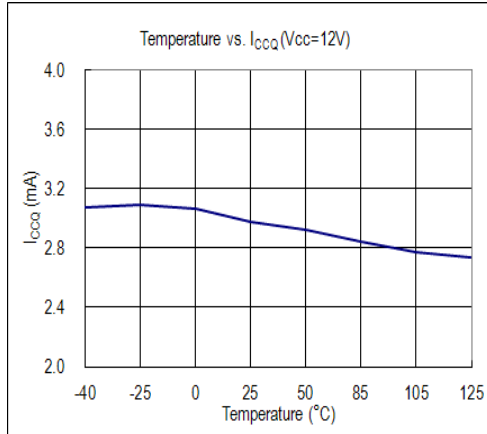


Part No.	I _{LED}	R2		C2	C4	L1
APE1832	350mA	0.715Ω	87.5mW	100μF	10nF	33μH
	750mA	0.333Ω	189mW	220μF		
	1000mA	0.250Ω	250mW	330μF		
APE1832A	350mA	0.715Ω	87.5mW	100μF	3.3nF	22μH
	750mA	0.333Ω	189mW	220μF		
	1000mA	0.250Ω	250mW	330μF		

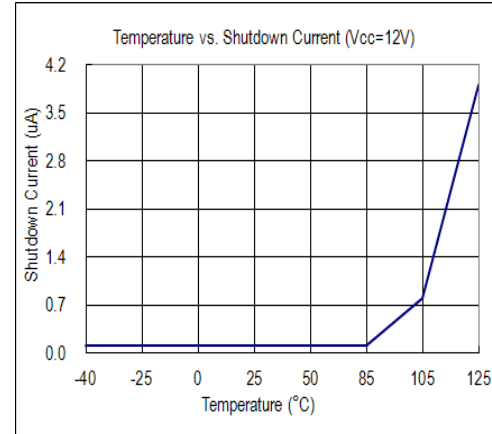


Typical Characteristics

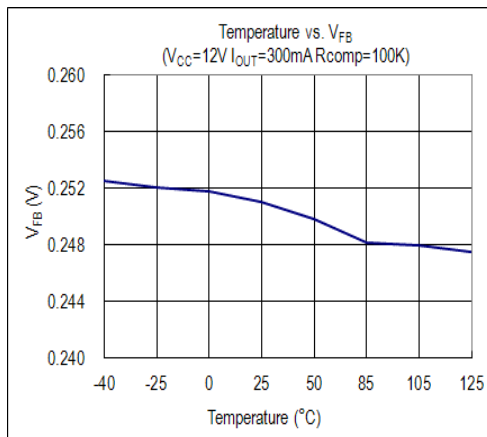
I_{CCQ} vs. Temperature ($V_{CC}=12V$)



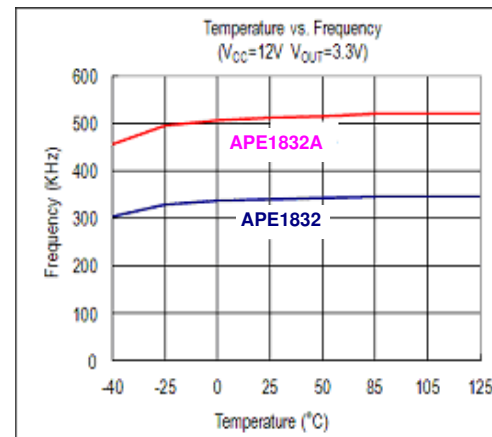
Shutdown Current vs. Temperature ($V_{CC}=12V$)



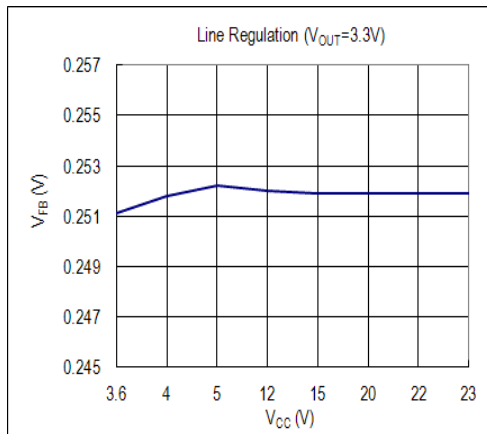
V_{FB} vs. Temperature ($V_{CC}=12V$, $I_{O}=300mA$, $R_{comp}=100k$)



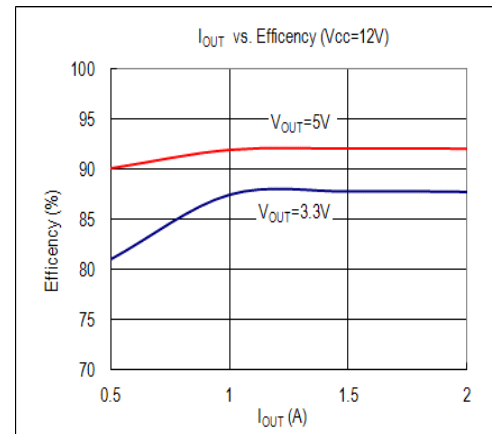
Frequency vs. Temperature ($V_{CC}=12V$, $V_{O}=3.3V$)



Line Regulation ($V_{O}=3.3V$)

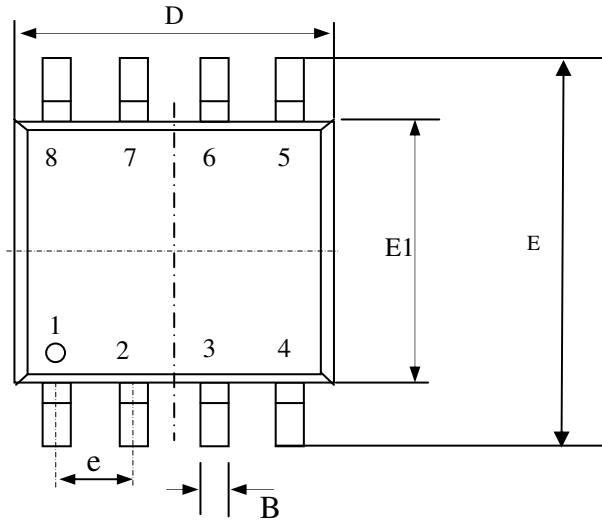


Efficiency vs. Output Current ($V_{CC}=12V$)

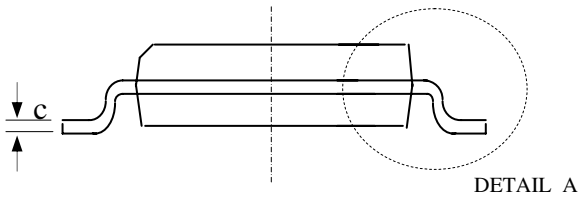
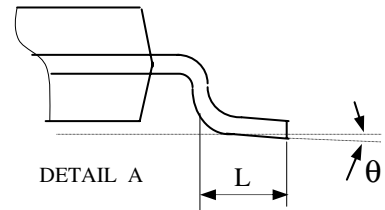
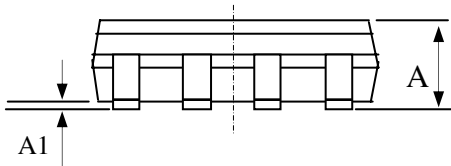




Package Dimensions: SO-8

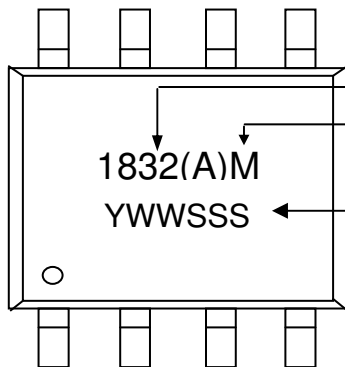


SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.18	0.25
B	0.33	0.41	0.51
C	0.19	0.22	0.25
D	4.80	4.90	5.00
E1	3.80	3.90	4.00
E	5.80	6.15	6.50
L	0.38	0.71	1.27
θ	0	4.00	8.00
e	1.27 TYP		



1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

Marking Information:



Product : APE1832(A)
 Package:
 M = RoHS-compliant halogen-free SO-8
 Date/lot code (YWWSSS)
 Y: Last digit of the year
 WW: Work week
 SSS: Lot code sequence