PWM CONTROL 2A STEP-DOWN CONVERTER

FEATURES

- **Input Voltage : 4.5V to 23V**
- **Output Voltage : 0.8V to VCC**
- **Duty Ratio : 0% to 100% PWM Control**
- **Oscillation Frequency : 330KHz Typ.**
- **Current Limit(CL), Enable Function.**
- **Thermal Shutdown Function.**
- **Short Circuit Protect (SCP).**
- **Built-in Internal SW P-channel MOS.**
- **SO-8 Pb-Free Package**

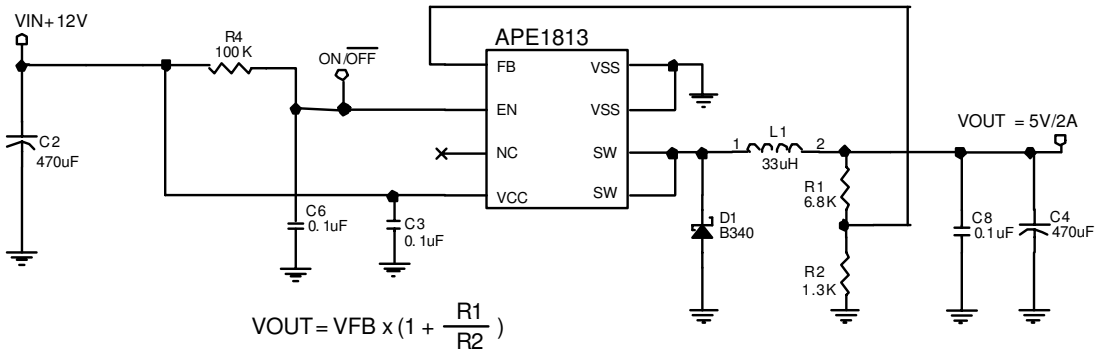
DESCRIPTION

APE1813 consists of step-down switching regulator with PWM control. These devise include a reference voltage source, oscillation circuit, error amplifier, internal PMOS and etc.

APE1813 provides low-ripple power, high efficiency, and excellent transient characteristics. The PWM control circuit is able to the duty ratio linearly form 0 up to 100%. An enable function, an over current protect function and short circuit protect function are built inside, and when OCP or SCP happens, the operation frequency will be reduced. Also, an internal compensation block is built in to minimum external component count.

With the addition of an internal P-channel Power MOS, a coil, capacitors, and a diode connected externally, these ICs can function as step-down switching regulators. They serve as ideal power supply units for portable devices when coupled with the SO-8 package, providing such outstanding features as low current consumption. Since this converter can accommodate an input voltage up to 23V, it is also suitable for the operation via an AC adapter.

TYPICAL APPLICATION



$$VOUT = VFB \times (1 + \frac{R1}{R2})$$

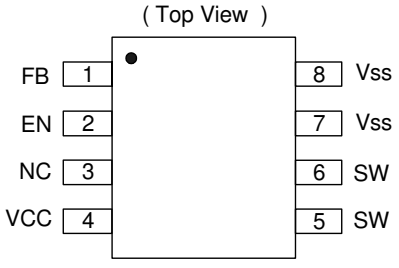
VFB = 0.8V ; R2 suggest 0.8K ~ 6k

ORDERING/PACKAGE INFORMATION

APE1813X

Package Type

M : SO-8



SO-8

ABSOLUTE MAXIMUM RATINGS (at T_A=25℃)

V_{CC} PIN Voltage(V_{CC}) ---------- V_{SS} -0.3V to V_{SS} +25V
Feedback PIN Voltage(V_{FB}) ---------- V_{SS} -0.3V to V_{CC}
ON/OFF PIN Voltage(V_{EN}) ---------- V_{SS} -0.3V to V_{CC} + 0.3V
Switch PIN Voltage(V_{SW}) ---------- V_{SS} -0.3V to V_{CC} + 0.3V
Power Dissipation(P_D) ---------- Internally Limited
Storage Temperature Range(T_{ST}) ---------- -40℃ To 150℃
Junction Temperature Range(T_J) ---------- -20℃ To 125℃
Operating Supply Voltage(V_{OP}) ---------- +4.5V to +23V
Output Current(I_{OUT}) ---------- 0 to 2A
Thermal Resistance from Junction to Case(Rth_{JC}) 25℃/W
Thermal Resistance from Junction to Ambient(Rth_{JA}) 70℃/W

Note. Rth_{JA} is measured with the PCB copper area(need connect to SW pins) of approximately 1 in^2(Multi-layer).

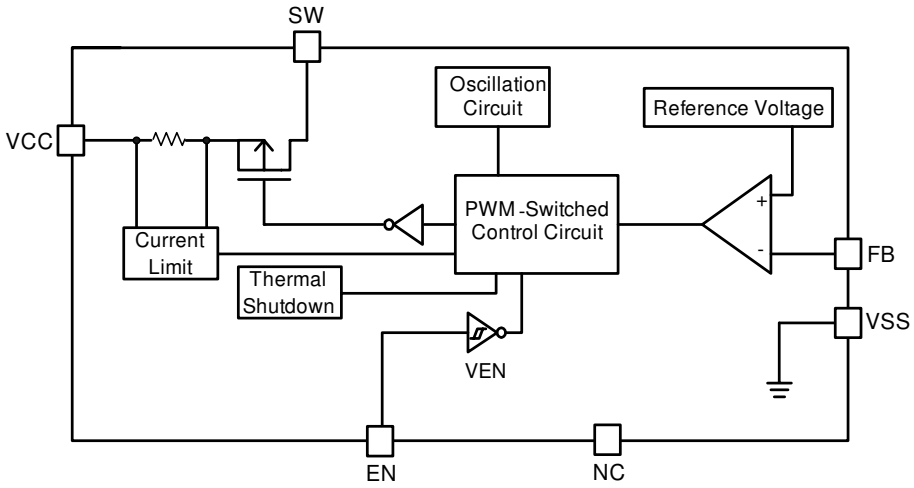
ELECTRICAL SPECIFICATIONS (V_{IN}=12V, V_{OUT}=3.3V, T_A=25℃, unless otherwise specified)

Parameter	SYM	TEST CONDITION		MIN	TYP	MAX	UNITS
Feedback Voltage	V_{FB}	I_{OUT}=0.1A		0.784	0.8	0.816	V
Quiescent Current	I_{CCQ}	V_{FB}=1.2V force driver off		-	3	5	mA
Feedback Bias Current	I_{FB}	I_{OUT}=0.1A		-	0.1	0.5	uA
Shutdown Supply Current	I_{SD}	V_{EN} =0V		-	2	10	uA
Current Limit	I_{CL}			2.5	-	-	A
Line Regulation	△VOUT/VOUT	V_{CC} = 8V~23V, I_{OUT}=0.2A		-	1	2	%
Load Regulation	△VOUT/VOUT	I_{OUT} = 0.1 to 2A		-	0.2	0.5	%
Oscillation Frequency	F_{OSC}	SW pin		260	330	400	KHz
Switching Rising Time	Tr	I_{OUT}=2A		-	15	-	ns
Switching Falling Time	Tf	I_{OUT}=2A		-	15	-	ns
EN Pin Logic Input Threshold Voltage	V_{ENH}	Slew rate ≥ 80mV/μs		2	-	-	V
	V_{ENL}	Slew rate ≥ 80mV/μs		-	-	0.8	
EN Pin Input Current	I_{ENH}	V_{EN}=2.5V (ON)		-	20	-	uA
	I_{ENL}	V_{EN}=0.3V (OFF)		-	-10	-	
Internal MOSFET R_{DSON}	R_{DSON}	V_{CC}=12V, V_{FB}=0V		-	100	130	mΩ
Efficiency	EFFI	V_{CC}=12V, V_{OUT}=5V	I_{OUT}=1A	-	92	-	%
			I_{OUT}=2A		91		

PIN DESCRIPTIONS

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)
SW	Switch Pin. Connect External Inductor & Diode here.
NC	No Connect Pin
V_{CC}	IC Power Supply Pin

BLOCK DIAGRAM



FUNCTION PIN DESCRIPTION

PWM Control

The APE1813 consists of DC/DC converters that employ a pulse-width modulation (PWM) system. In converters of the APE1813, the pulse width varies in a range from 0 to 100%, according to the load current. The ripple voltage produced by the switching can easily be removed through a filter because the switching frequency remains constant. Therefore, these converters provide a low-ripple power over broad ranges of input voltage and load current.

FUNCTION PIN DESCRIPTION

Setting The Output Voltage

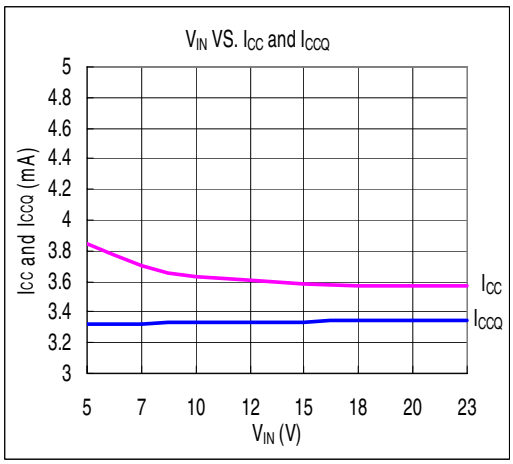
Application circuit item shows the basic application circuit with adjustable output version. The external resistor sets the output voltage according to the following equation:

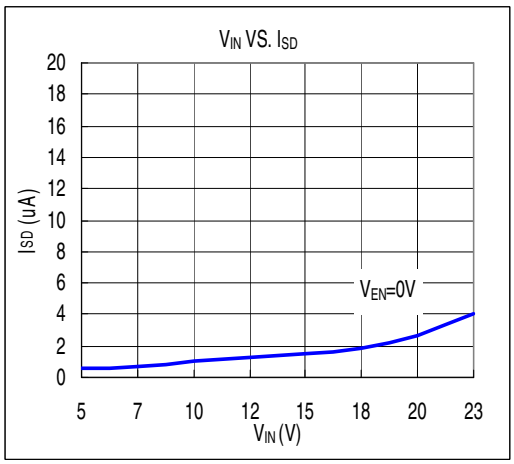
$$V_{OUT} = 0.8V \times \left(1 + \frac{R1}{R2}\right)$$

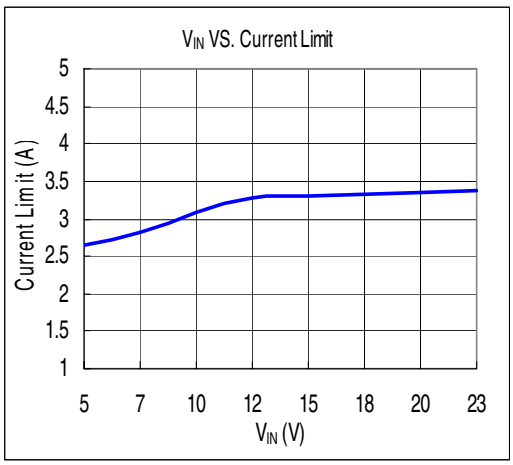
Table 1 Resistor select for output voltage setting

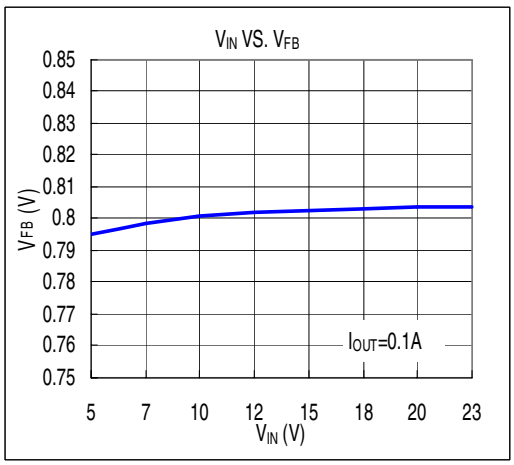
V_{OUT}	R2	R1
5V	1.3K	6.8K
3.3V	1.5K	4.7K
2.5V	2.2K	4.7K
1.8V	2K	2.5K
1.5V	2.2K	2.0K
1.2V	3K	1.5K
1.0V	3K	0.75K

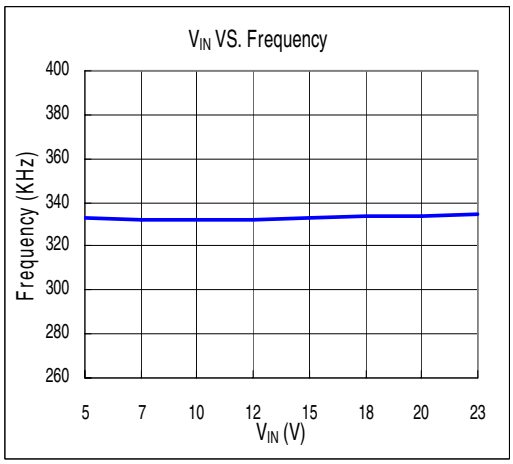
TYPICAL PERFORMANCE CHARACTERISTICS

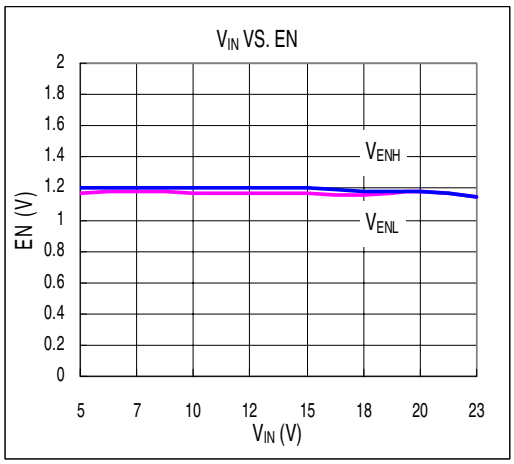












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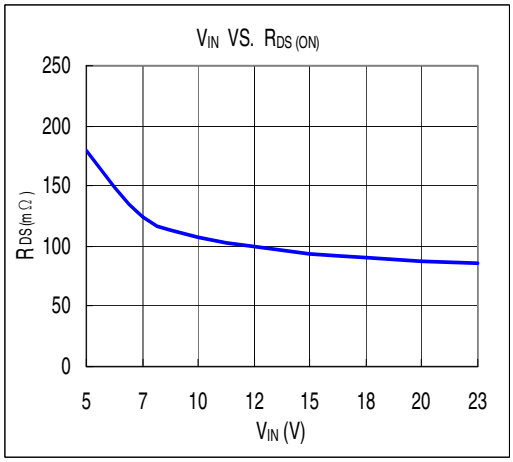

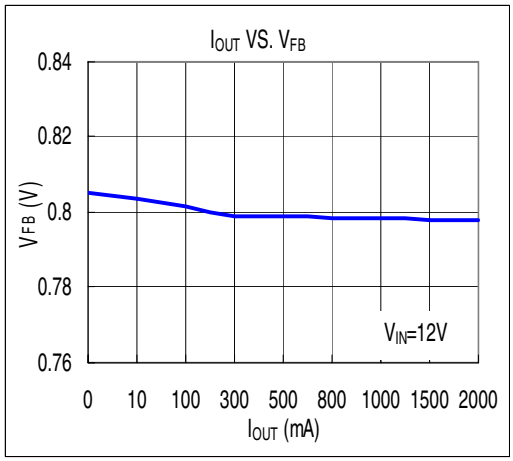

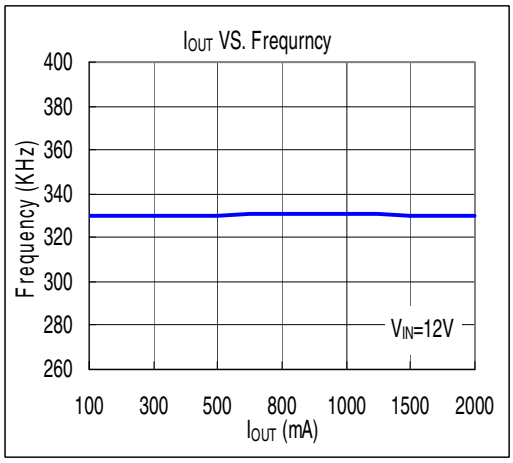

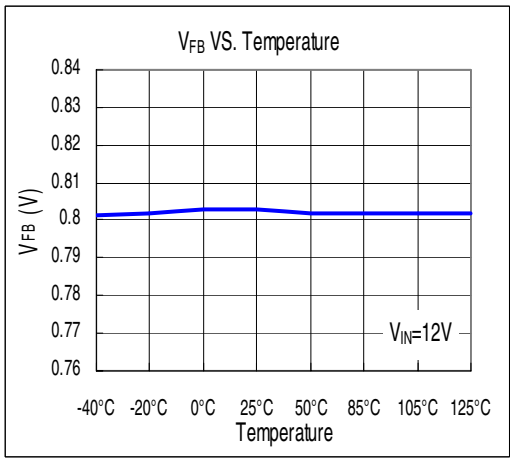

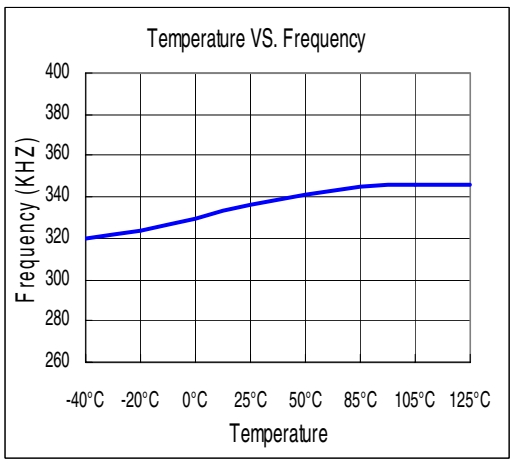

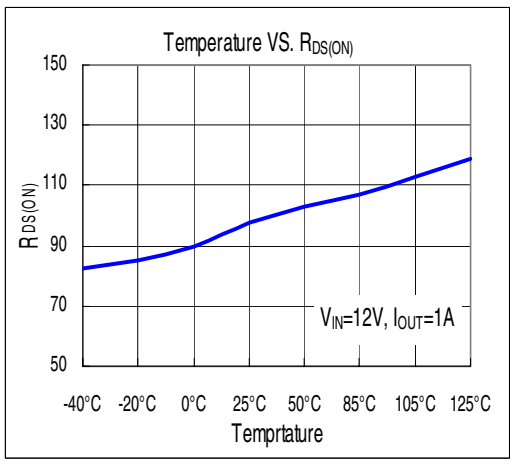

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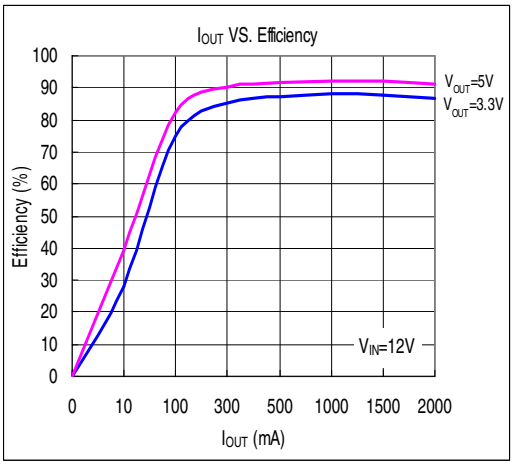
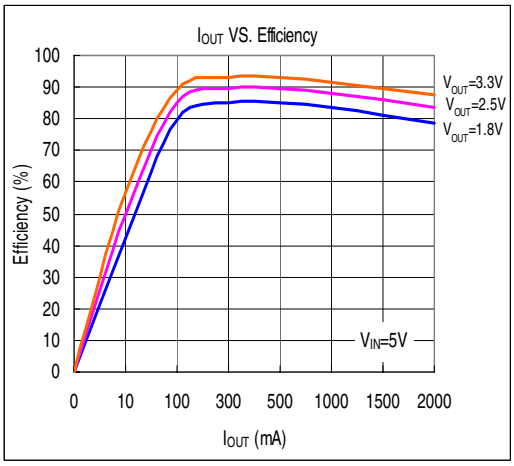
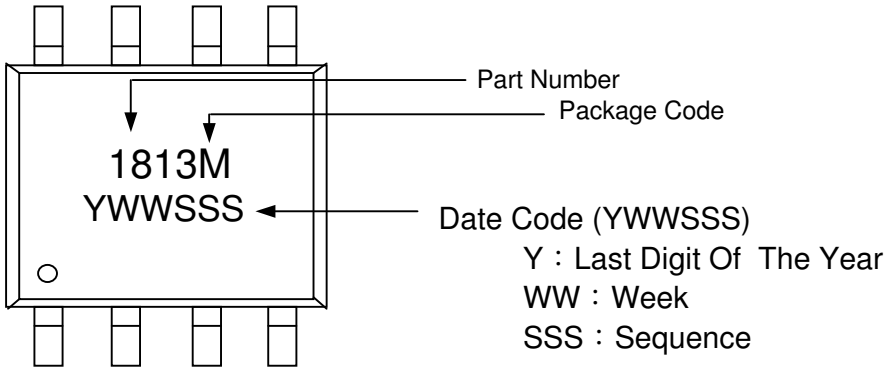




MARKING INFORMATION

SO-8



PACKAGE OUTLINES

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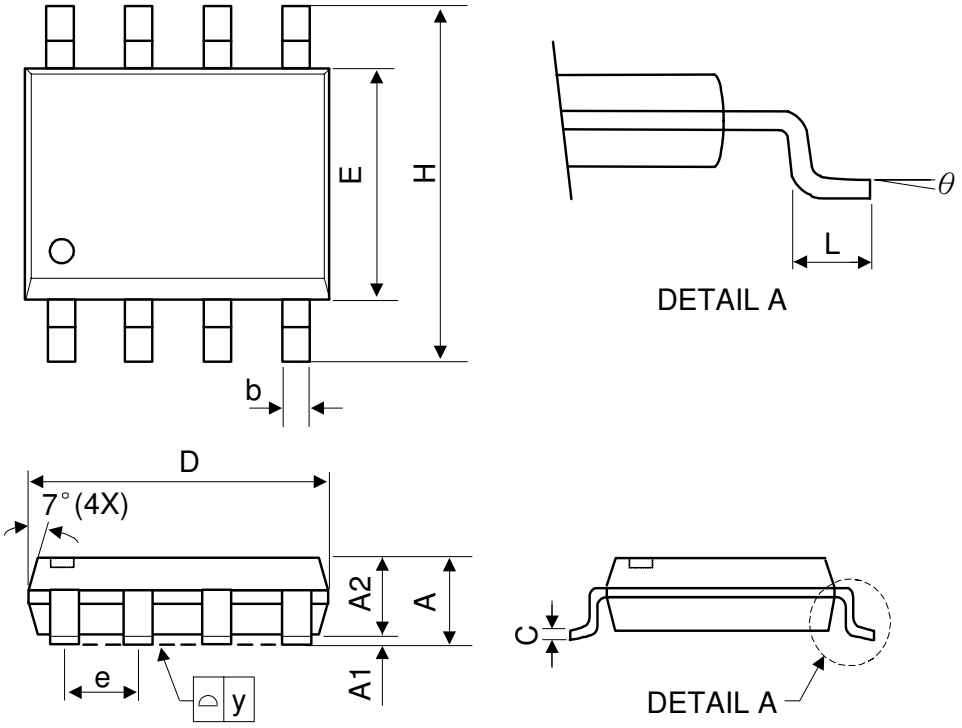

Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.75	-	-	0.069
A1	0.1	-	0.25	0.04	-	0.1
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
θ	0°	-	8°	0°	-	8°

Mold flash shall not exceed 0.25mm per side

JEDEC outline: MS-012 AA