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Datasheet

# AS1344

## 42V, DC-DC Boost Converter with adjustable Softstart

## 1 General Description

The AS1344 boost converter contains a 1.4A internal switch in a tiny TDFN-10 3x3mm package. The device operates from a 0.9V to 3.6V supply, and can boost voltages up to 42V output.

The output voltage can easily be adjusted by an external resistor divider.

The AS1344 uses a unique control scheme providing the highest efficiency over a wide range of load conditions. An internal 1.4A MOSFET reduces external component count, and a fixed high switching frequency (1MHz) allows for tiny surface-mount components.

The AS1344 also features power-OK circuitry which monitors the output voltage.

The device also offers a Softstart function which limits the current during startup. The current during startup can be easily adjusted with the value of $R_V$. For $R_V$ = 0Ω, there is no softstart.

Additionally the AS1344 features a low quiescent supply current and a shutdown mode to save power. During shutdown an output disconnect switch separates the input from the output.

The AS1344 is ideal for LCD or OLED panels with low current requirements and can also be used in a wide range of other applications.

The device is available in a low-profile TDFN-10 3x3mm package.

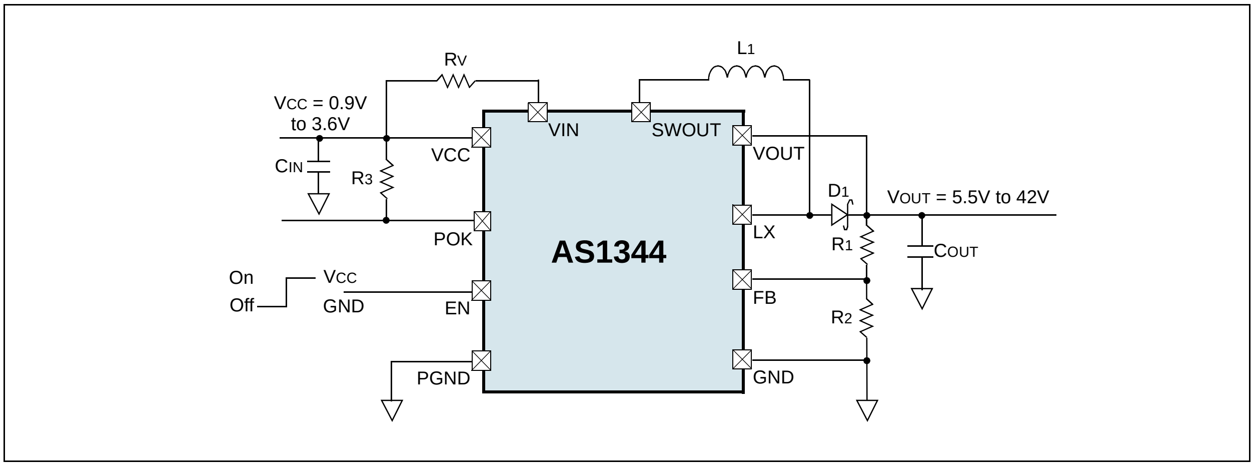
## 2 Key Features

- 5.5V to 42V Adjustable Output Voltage
- 0.9V to 3.6V Supply Voltage Range
- High Output Current:
  - 30mA @ 12V $V_{OUT}$, from 1.5V $V_{CC}$
- Efficiency: Up to 85%
- Switching Frequency: 1MHz
- Output Disconnect Function
- Softstart Function with adjustable Current Limit
- Output Discharge Function
- Power-OK Output
- Quiescent Current: 22µA
- Shutdown Current: 0.1µA
- TDFN-10 3x3mm Package

## 3 Applications

The device is ideal for OLED display power supply, LCD bias generators, mobile/cordless phones, palmtop computers, PDAs and organizers, handy terminals, driving LEDs or any other portable, battery-powered device.

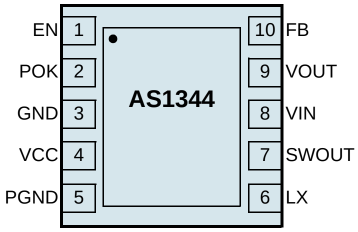
*Figure 1. AS1344 - Typical Application Diagram*



# 4 Pinout

## Pin Assignments

*Figure 2. Pin Assignments (Top View)*



## Pin Descriptions

*Table 1. Pin Descriptions*

| Pin Number | Pin Name | Description |
|---|---|---|
| 1 | EN | **Active-High Enable Input**. A logic low on this pin shuts down the device and reduces the supply current to 0.1µA.<br>GND: device in shutdown.<br>$V_{CC}$ : normal operation. |
| 2 | POK | **Power-OK**.<br>0: $V_{OUT}$ < 90% of $V_{OUTNOM}$.<br>1: $V_{OUT}$ > 90% of $V_{OUTNOM}$. |
| 3 | GND | **Ground** |
| 4 | VCC | **+0.9V to +3.6V Supply Voltage**. Bypass this pin to GND with a ≥10µF capacitor. |
| 5 | PGND | **Ground.** Should be the starpoint of $C_{IN}$ and $C_{OUT}$. |
| 6 | LX | **Inductor**. The drain of the internal N-channel MOSFET.<br>**Note:** This pin is high impedance in shutdown. |
| 7 | SWOUT | **Shutdown Disconnect Switch Out.** Disconnects the input from the output during shutdown. |
| 8 | VIN | **Supply Connection.** Connect a resistor between pin VIN and pin VCC for limiting the input current during startup. |
| 9 | VOUT | **+5.5 to +42V Output Voltage.** This pin also powers the AS1344 after startup. Bypass this pin to GND with a ≥4.7µF capacitor. |
| 10 | FB | **Feedback Pin**. Feedback input to the $g_m$ error amplifier. Connect a resistor divider tap to this pin. The output voltage can be adjusted from 5.5V to 42V by:<br>$V_{OUT} = 1.25V[1 + (R_1/R_2)]$ |

# 5 Absolute Maximum Ratings

Stresses beyond those listed in Table 2 may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in Electrical Characteristics on page 4 is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

*Table 2. Absolute Maximum Ratings*

| Parameter | Min | Max | Units | Comments |
|---|---|---|---|---|
| VCC, VIN, EN, SWOUT, POK, FB to GND | | 5 | V | |
| VOUT, LX to GND | | 45 | | |
| Thermal Resistance $\Theta_{JA}$ | 36.7 | | ºC/W | on PCB |
| ESD | 2 | | kV | *HBM MIL-Std. 883E 3015.7* methods |
| Latch-Up | -200 | +100 | mA | @25°C, *JEDEC 78* |
| Operating Temperature Range | -40 | +85 | ºC | |
| Storage Temperature Range | -65 | +150 | ºC | |
| Junction Temperature | | 125 | ºC | |
| Package Body Temperature | | +260 | ºC | The reflow peak soldering temperature (body temperature) specified is in accordance with *IPC/JEDEC J-STD-020D "Moisture/Reflow Sensitivity Classification for Non-Hermetic Solid State Surface Mount Devices".*<br>The lead finish for Pb-free leaded packages is matte tin (100% Sn). |

# 6 Electrical Characteristics

*$V_{CC}$ = EN = 3.6V, $T_{AMB}$ = -40 to +85ºC (unless otherwise specified). Typ values are at $T_{AMB}$ = +25ºC.*

*Table 3. Electrical Characteristics*

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Maximum Supply Voltage | | | | 3.6 | V |
| | Minimum Supply Voltage | $V_{OUT}$ = 12V, $R_V$ = 0Ω, no load | | 0.9 | 1.1 | V |
| | Minimum Start-Up Voltage | $V_{OUT}$ = 12V, $I_{LOAD}$ = 1mA, $R_V$ = 0Ω | | 0.95 | 1.2 | V |
| $V_{OUT}$ | Output Voltage Range | | 5.5 | | 42 | V |
| $I_Q$ | Quiescent Current | $V_{OUT}$ = 6V, $V_{FB}$=1.3V | | 22 | 30 | µA |
| $I_{SHDN}$ | Shutdown Current | EN = GND, $T_{AMB}$ = +25ºC | | 0.02 | 1 | µA |
| $\Delta V_{LNR}$ | $V_{CC}$ Line Regulation | $V_{OUT}$ = 15V, $I_{LOAD}$ = 1mA, $V_{CC}$ = 1.8 to 3.6V | | 0.05 | | %/V |
| $\Delta V_{LDR}$ | Load Regulation | $V_{OUT}$ = 15V, $I_{LOAD}$ = 0 to 20mA | | 0.01 | | %/mA |
| $\eta$ | Efficiency | $L_1$ = 6.8µH, $V_{OUT}$ = 12V, $I_{LOAD}$ = 50mA | | 85 | | % |
| $V_{FB}$ | Feedback Voltage | | 1.225 | 1.25 | 1.275 | V |
| $I_{FB}$ | Feedback Input Bias Current | $V_{FB}$ = 1.3V | | 1 | 100 | nA |
| **DC-DC Switches** | | | | | | |
| $R_{LX}$ | NMOS Switch On-Resistance | $I_{LX}$ = 100mA | | 0.9 | 1.5 | Ω |
| $R_{P\_ON}$ | PMOS Switch On-Resistance | $I_{SWout}$ = -100mA | | 0.3 | 1.0 | |
| $I_{LX\_LEAK}$ | LX Leakage Current | $V_{LX}$ = 42V | | 15 | | nA |
| $I_{P\_LEAK}$ | Switch Leakage Current | P-channel | | 10 | | |
| **Control Inputs** | | | | | | |
| $V_{IH}$ | EN Input Threshold | 1.1V ≤ $V_{CC}$ ≤ 3.6V | 0.7 x $V_{CC}$ | | | V |
| $V_{IL}$ | | | | | 0.3 x $V_{CC}$ | |
| $V_{EN}$ | EN Input Voltage | | 0 | | 3.6 | V |
| $I_{EN}$ | EN Input Current | $V_{EN}$ = 0 to 3.6V | | 1 | | nA |
| **POK Output** | | | | | | |
| $V_{OL}$ | POK Output Low Voltage | POK sinking 1mA | | 0.01 | 0.2 | V |
| | POK Output High Leakage Current | POK = 3.6V | | 1 | 500 | nA |
| | POK Threshold | Falling edge, referenced to $V_{OUT(NOM)}$ | 87 | 90 | 93 | % |
| **Oscillator** | | | | | | |
| $f_{CLK}$ | Oscillator Frequency | | 0.85 | 1 | 1.15 | MHz |
| | Maximum Duty Cycle | | 90 | 95 | | % |

# 7 Typical Operating Characteristics

Parts used for measurments: 6.8µH (MOS6020-682) Inductor, 10µF (GRM21BR60J106KE19) $C_{IN}$ and 4.7µF (GRM32ER71H475KA88) $C_{OUT}$, (PMEG4010BEA) $D_1$;

*Figure 3. Efficiency vs. Output Current; $V_{OUT}$ = 6V*

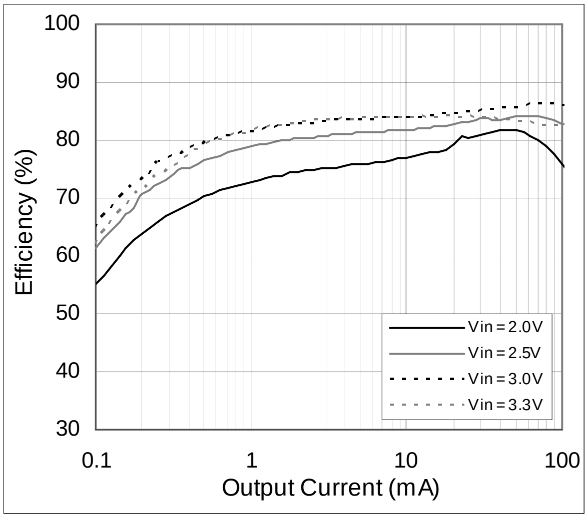


*Figure 4. Efficiency vs. Output Current; $V_{OUT}$ = 12V*

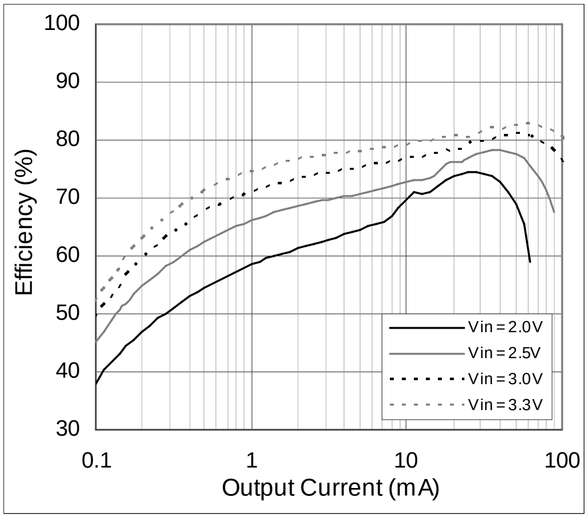


*Figure 5. Efficiency vs. Output Current; $V_{OUT}$ = 18V*

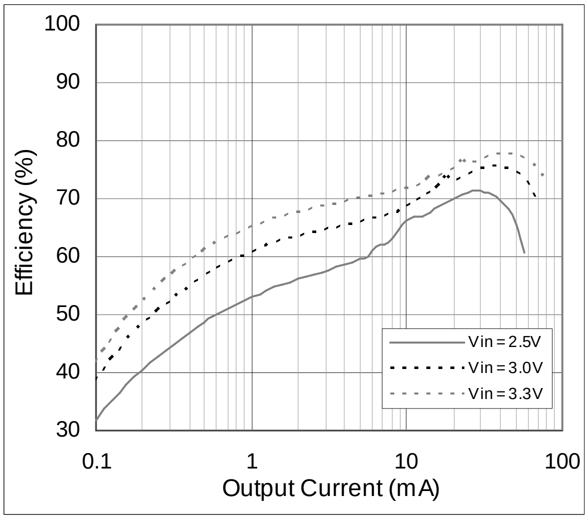


*Figure 6. Efficiency vs. Output Current; $V_{OUT}$ = 24V*

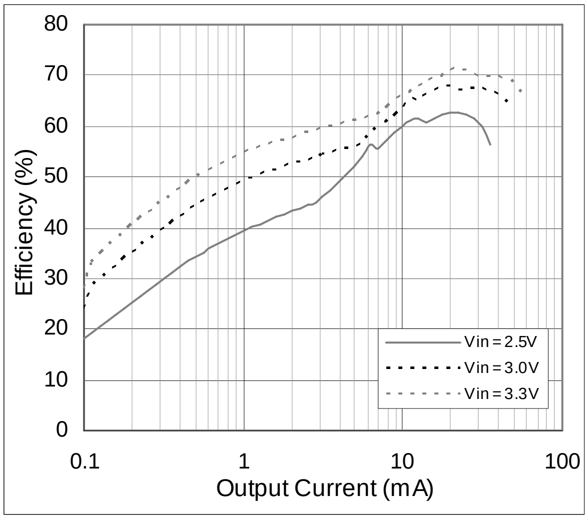


*Figure 7. Efficiency vs. Input Voltage; $V_{OUT}$ = 12V*

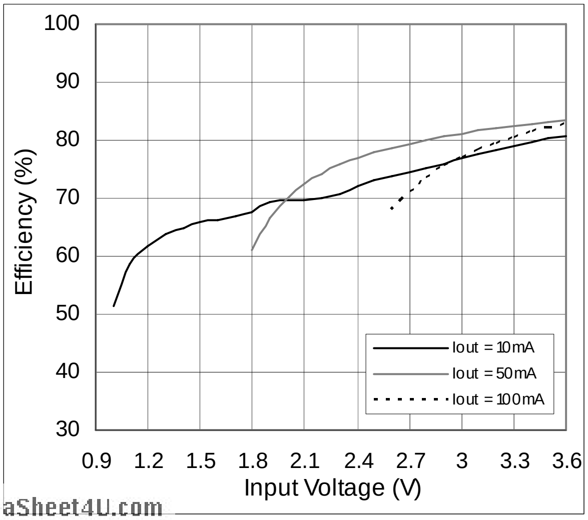


*Figure 8. Efficiency vs. Input Voltage; $I_{OUT}$ = 10mA*

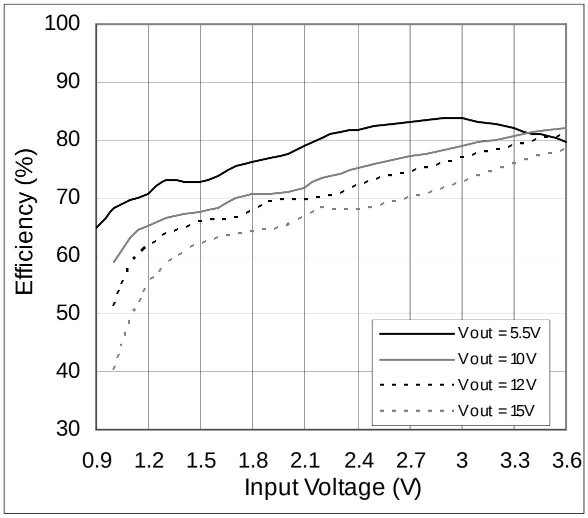


*Figure 9. Output Voltage vs. Temperature; VOUT=18V*

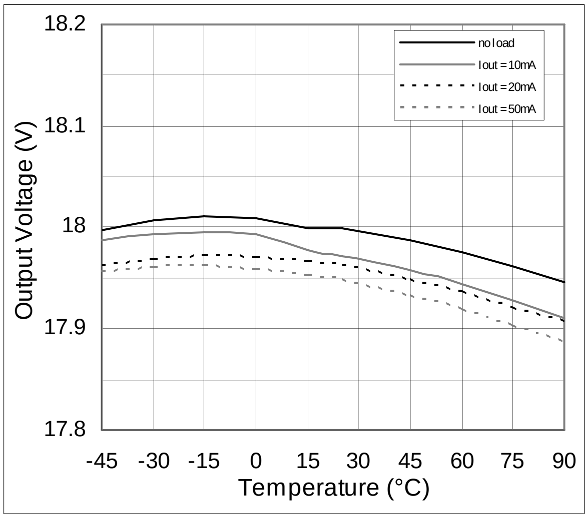


*Figure 10. Output voltage vs. Input Voltage; VOUT=12V, (line regulation)*

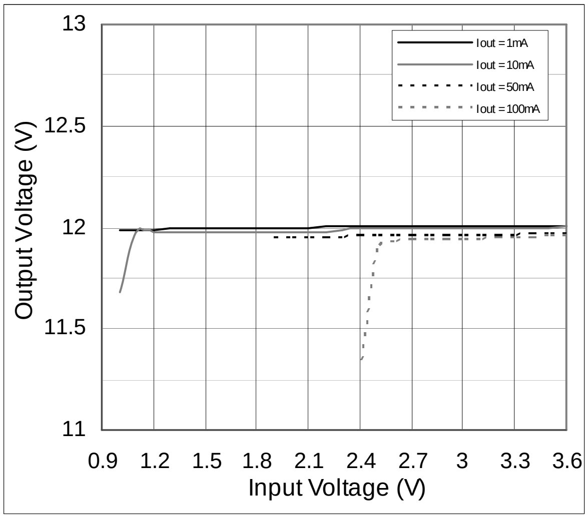


*Figure 11. Output Voltage vs. Load Current; VOUT=12V, VIN=1.5V, (load regualtion)*

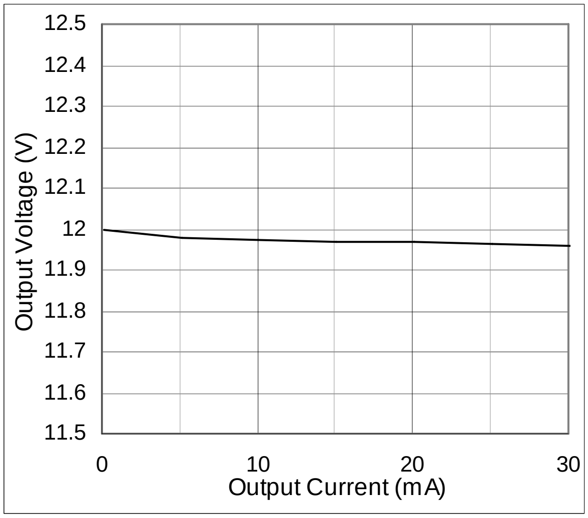


*Figure 12. Maximum Output current vs. Input Voltage; VOUT = 12, 15, 18, 24, 36V; (90% Voutnom)*

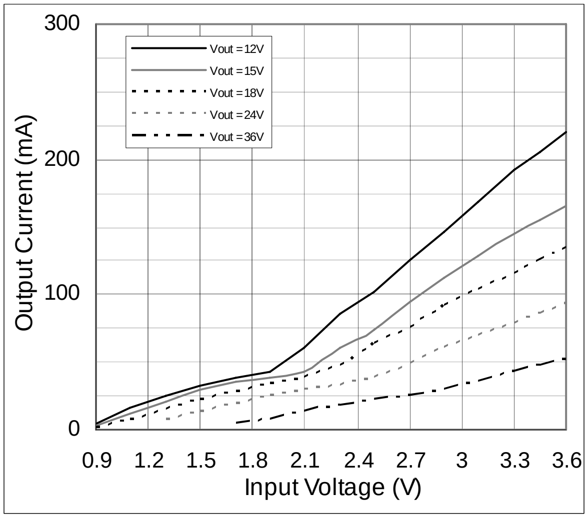


*Figure 13. Maximum Output current vs. VOUT; VCC = 1.5V, 3V*

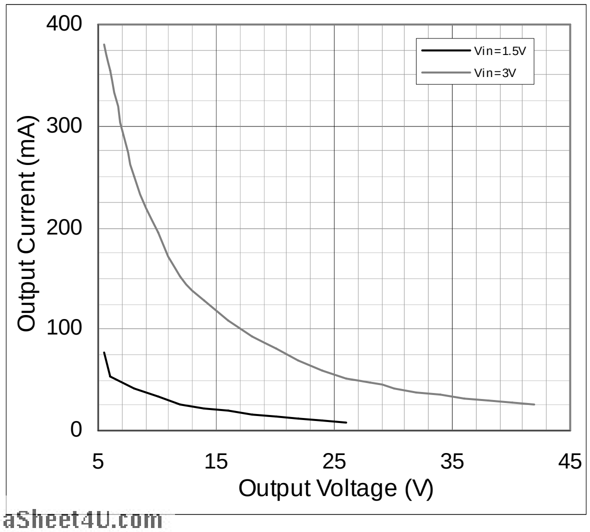


*Figure 14. Start-Up Voltage vs. Output Current; VCC = 0.9V to 3.6V, (95% Voutnom)*

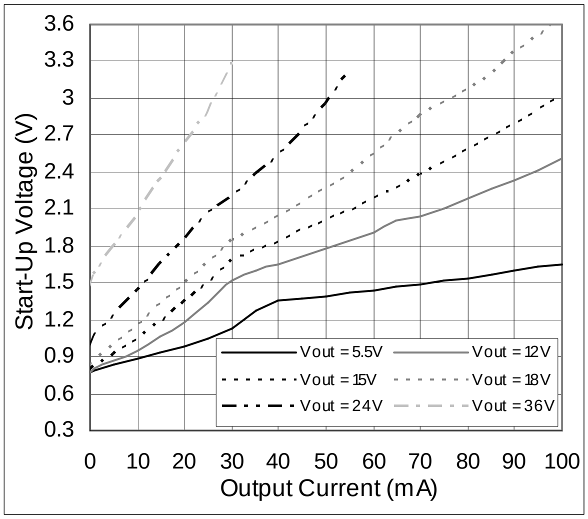


*Figure 15. Shutdown Current vs. Input Voltage*

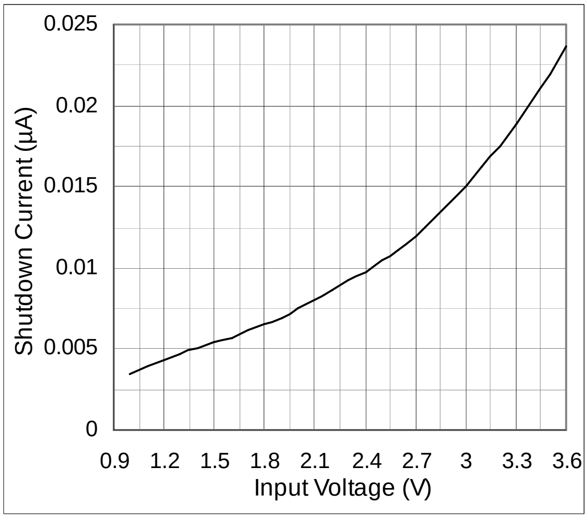


*Figure 16. Shutdown Current vs. Temperature*

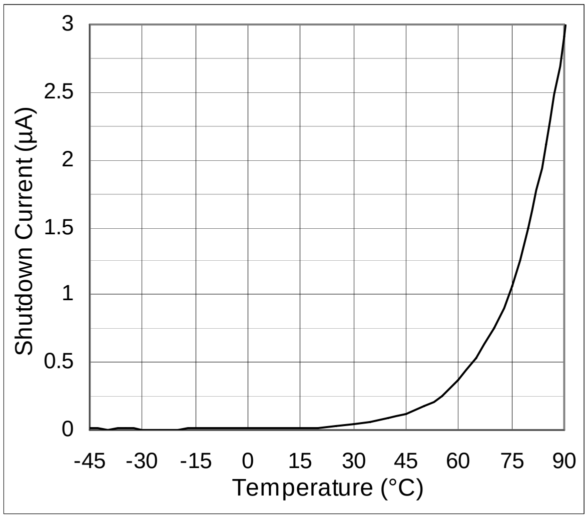


*Figure 17. Switching Frequency vs. Temperature*

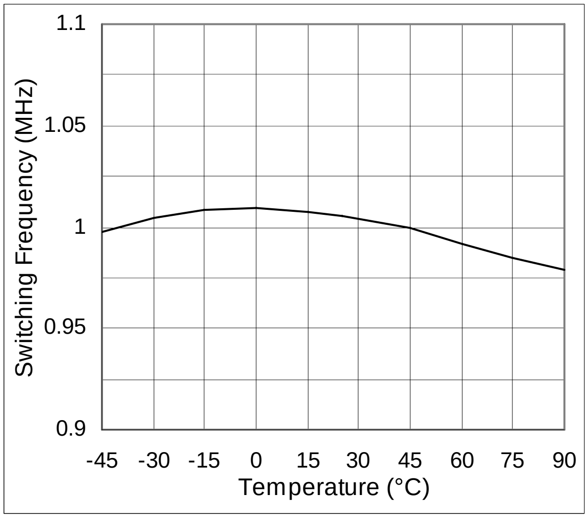


*Figure 18. Feedback Voltage vs. Temperature*

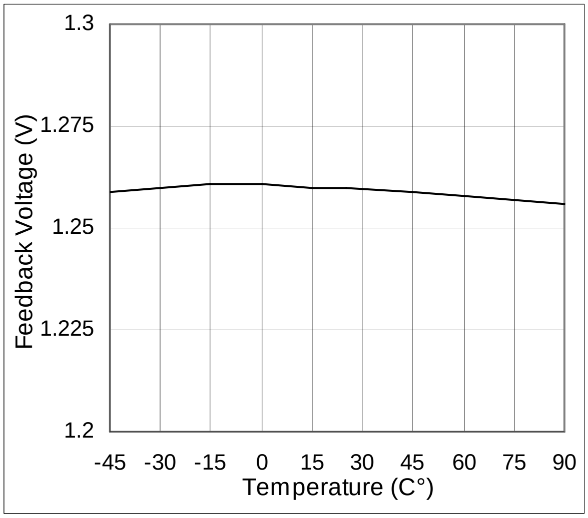


*Figure 19. Quiescent Current vs. Input Voltage*

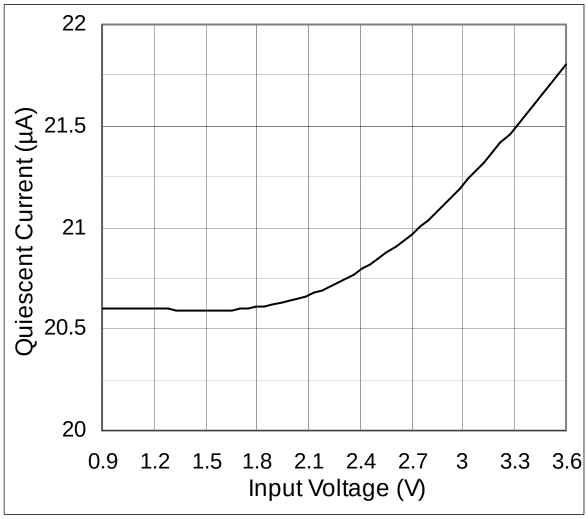


*Figure 20. Startup Waveform; $V_{IN}$ = 1.8V, $C_{OUT}$ = 170µF, $R_V$ = 3Ω*

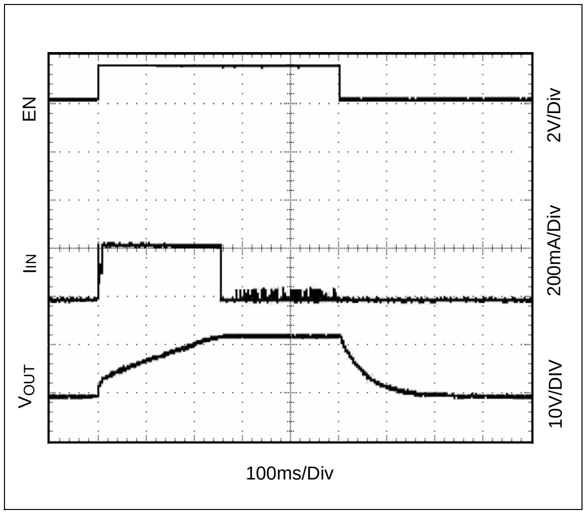


*Figure 21. Startup Waveform, detail; $V_{IN}$ = 1.8V, $C_{OUT}$ = 170µF, $R_V$ = 3Ω*

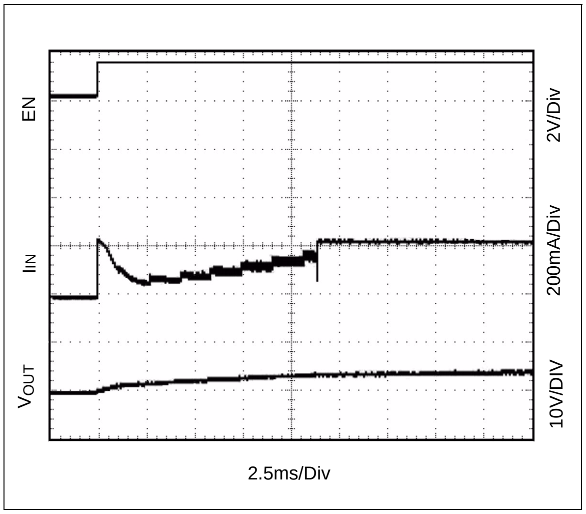


*Figure 22. Startup Waveform; $V_{IN}$ = 2.4V, $C_{OUT}$ = 170µF, $R_V$ = 3Ω*

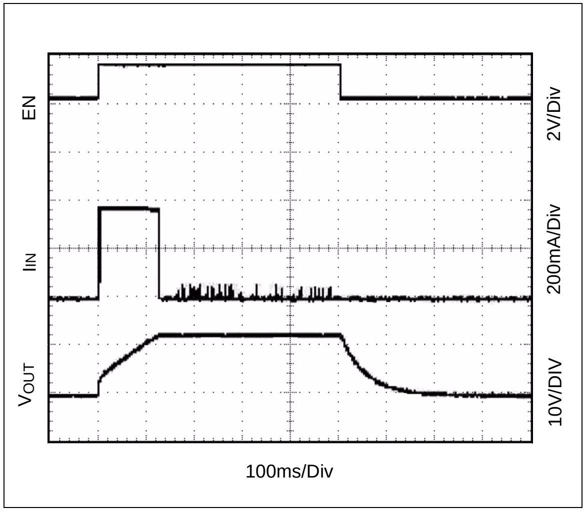


*Figure 23. Startup Waveform, detail; $V_{IN}$ = 2.4V, $C_{OUT}$ = 170µF, $R_V$ = 3Ω*

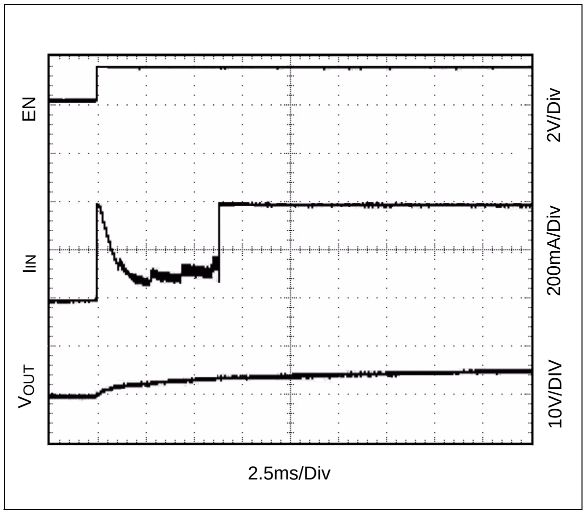


*Figure 24. Startup Waveform; $V_{IN}$ = 3.0V, $C_{OUT}$ = 170µF, $R_V$ = 3Ω*

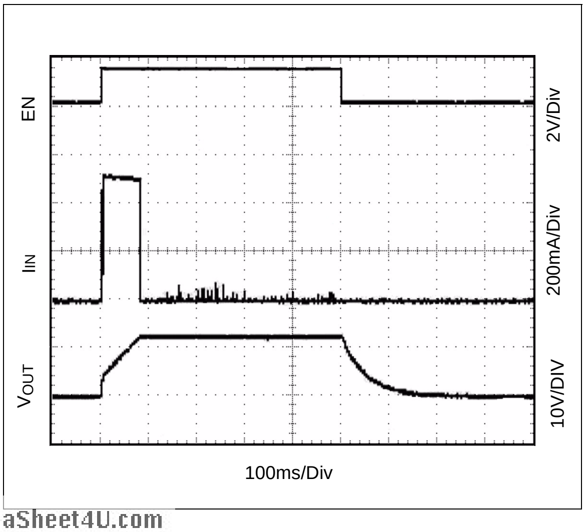


*Figure 25. Startup Waveform, detail; $V_{IN}$ = 3.0V, $C_{OUT}$ = 170µF, $R_V$ = 3Ω*

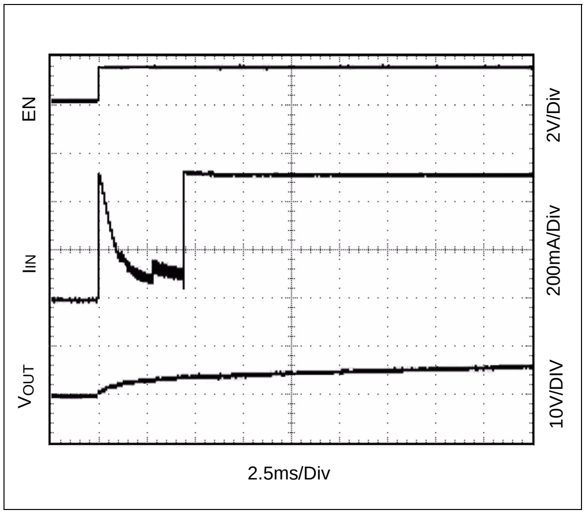


*Figure 26. Transient Line Regulation;
$V_{OUT}$ = 18V, $I_{LOAD}$ = 1mA*

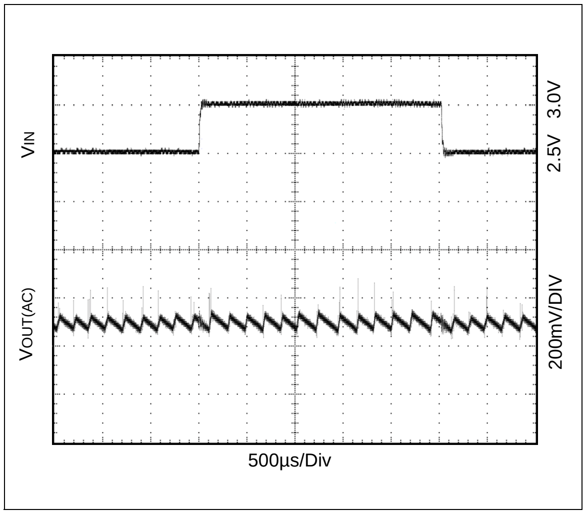


*Figure 27. Transient Line Regulation;
$V_{OUT}$ = 18V, $I_{LOAD}$ = 20mA*

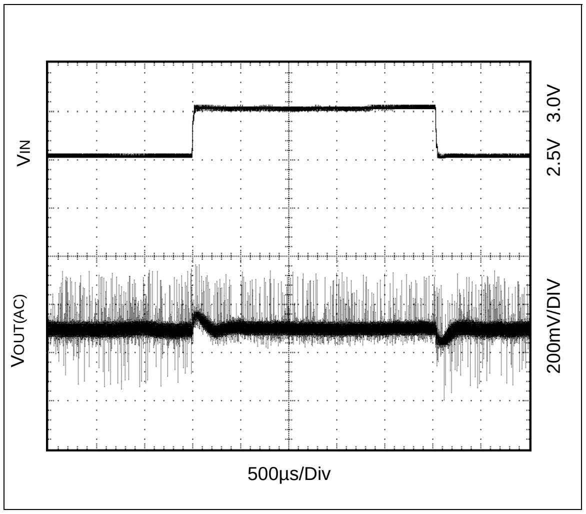


*Figure 28. Output Voltage Ripple;
$V_{OUT}$ = 18V, $I_{OUT}$ = 1mA*

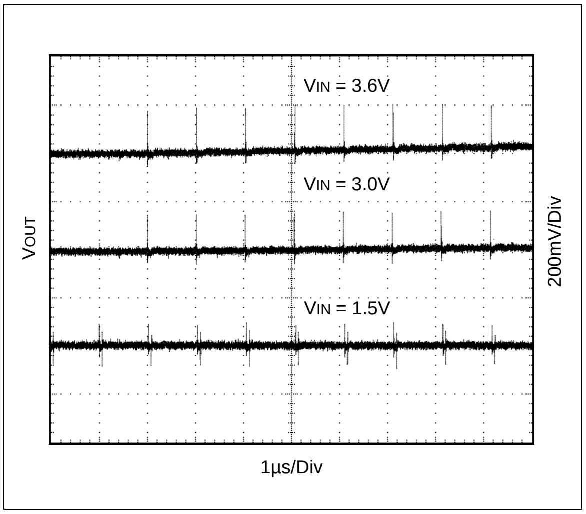


*Figure 29. Output Voltage Ripple;
$V_{OUT}$ = 18V, $I_{OUT}$ = 20mA*

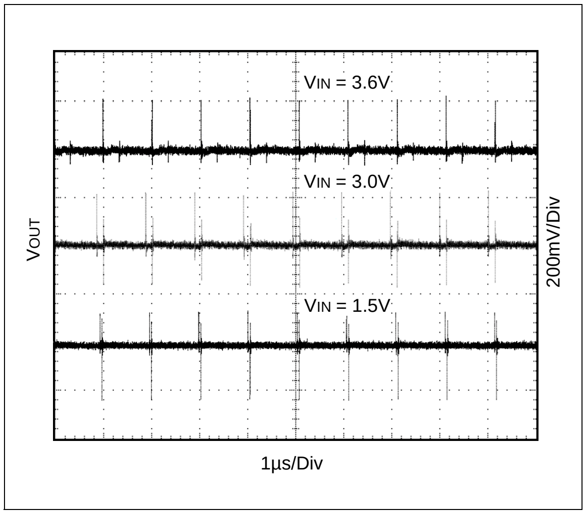


*Figure 30. Load Transient Response ON;
$V_{CC}$ = 3V, $V_{OUT}$ = 18V*

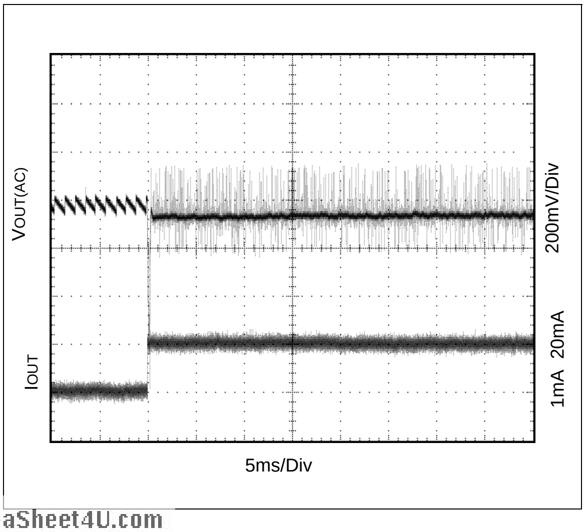
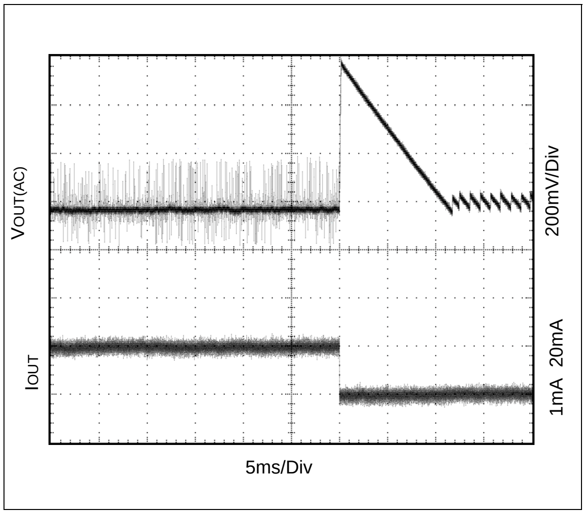


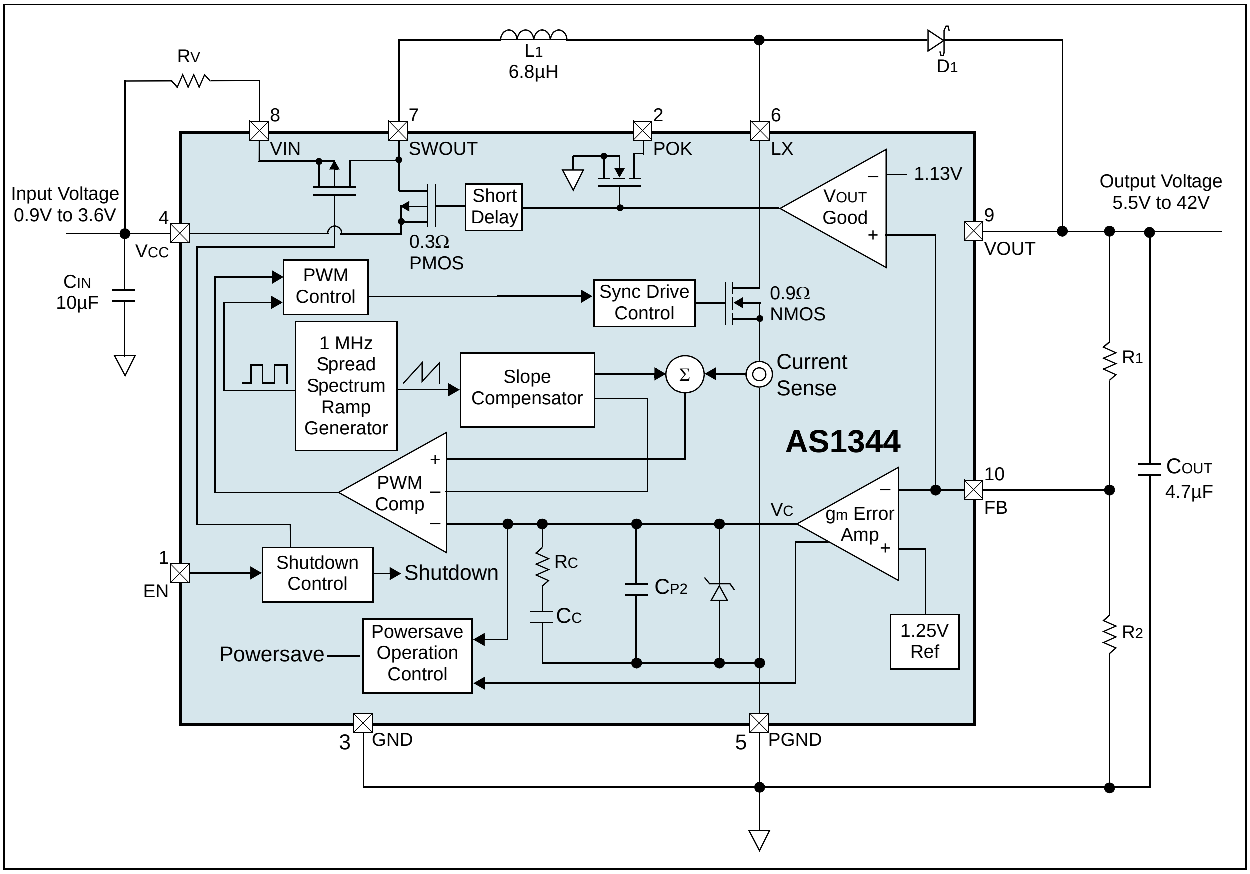
*Figure 31. Load Transient Response OFF;
$V_{CC}$ = 3V, $V_{OUT}$ = 18V*



# 8 Detailed Description

The AS1344 features a current limiting circuitry, a fixed-frequency PWM architecture, power-OK circuitry, thermal protection, and an automatic powersave mode in a tiny package, and maintains high efficiency at light loads.

*Figure 32. Block Diagram with Shutdown Disconnect Switch*



Automatic powersave mode regulates the output and also reduces average current flow into the device, resulting in high efficiency at light loads. When the output increases sufficiently, the powersave comparator output remains high, resulting in continuous operation.

For each oscillator cycle, the power switch is enabled. A voltage proportional to switch current is added to a stabilizing ramp and the resulting sum is delivered to the positive terminal of the PWM comparator.

The error amplifier compares the voltage at FB with the internal 1.25V reference and generates an error signal ($V_C$). When $V_C$ is below the powersave mode threshold voltage the automatic powersave-mode is activated and the hysteretic comparator disables the power circuitry, with only the low-power circuitry still active (total current consumption is minimized).

When a load is applied, $V_{FB}$ decreases; $V_C$ increases and enables the power circuitry and the device starts switching. In light loads, the output voltage (and the voltage at FB) will increase until the powersave comparator disables the power circuitry, causing the output voltage to decrease again. This cycle is repeated resulting in low-frequency ripple at the output.

## POK Function

The POK output indicates if the output voltage is within 90% of the nominal voltage level. As long as the output voltage is within regulation the open-drain POK output is high impedance. The POK output can be tied to any external voltage up to a maximum of 5V via a pull-up resistance R3 (see Typical Application on page 12). If the output voltage drops below 90% of the nominal voltage the POK pin is pulled to GND.

**Note:** It is important to consider that in shutdown mode the POK output is pulled to $V_{CC}$ in order to save current.

# 9 Application Information

## Shutdown and Output Discharge

A logic low on the EN pin shuts down the AS1344 and a logic high on the EN pin powers on the device. In shutdown mode the supply current drops to below 3µA and the POK pin is set to high impedance to maximize battery life.

When the battery disconnect switch is used, the battery is disconnected from the output and the output is discharged down to 0V. The time for fully discharging the output depends on the $C_{OUT}$ and on the load.

**Note:** Pin EN should not be left floating. If the shutdown feature is not used, connect EN to $V_{CC}$. The output will be discharged during shutdown but the output also must be fully discharged before the device is enabled again.

## Battery Disconnect

The AS1344 has an integrated PMOS switch that can be used to disconnect the battery during shutdown. The operation voltage of this switch is limited to 3.6V. When EN is high, the switch is closed and supplies the inductor. Due to the $R_{ON}$ resistance the efficiency is slightly lower if the battery disconnect switch is used.

$$P_{LOSS} = I_{IN}^2 \times R_{ON} \qquad \text{(EQ 1)}$$

## Softstart Function

To limit the input current during startup a resistor $R_V$ can be connected between the pins VIN and VCC. For the correlation between the resistor value, the supply voltage and the startup time see Figure 33. For the correlation between resistor value, the supply voltage and the peak current see Figure 34. Connect VIN directly to VCC (no resistor) to disable the softstart Function.

As an example some peak current and time values are listed at a given Rv in Table 4.

*Table 4. Timing for Softstart @ $V_{CC}$= 2.4V, $C_{OUT}$ = 155µF,*

| $R_V$ [Ω] | 0 | 1.0 | 1.5 | 2.0 | 2.4 | 3.0 |
|---|---|---|---|---|---|---|
| $I_{PEAK}$ [A] | 1.76 | 0.81 | 0.66 | 0.56 | 0.50 | 0.42 |
| t [ms] | 25 | 76 | 100 | 130 | 156 | 204 |

*Figure 33. Startup Time; $C_{IN}$ = 150µF, $C_{OUT}$ = 155µF*

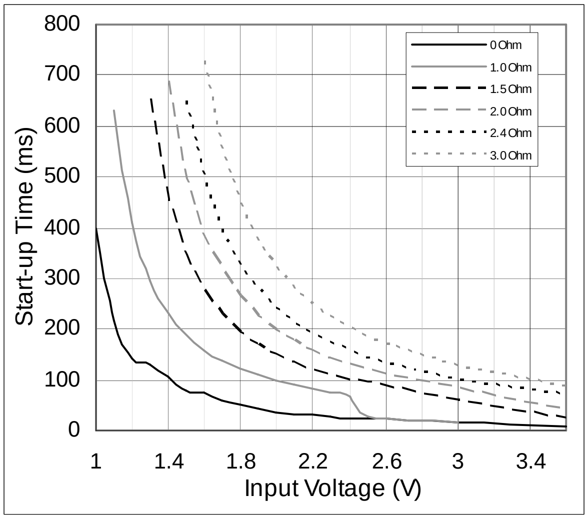
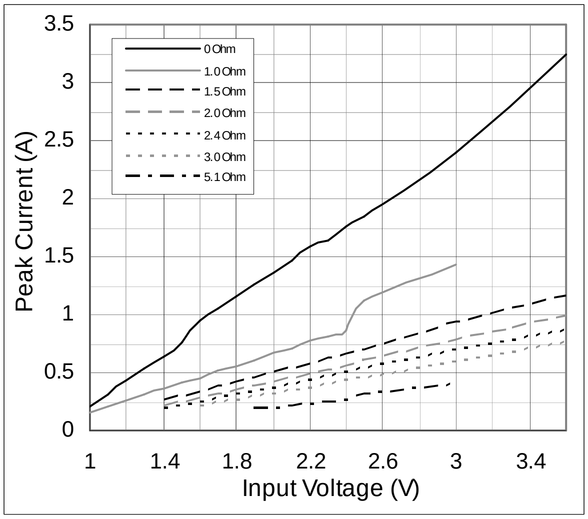


*Figure 34. Peak Current; $C_{IN}$ = 10µF, $C_{OUT}$ = 155µF*



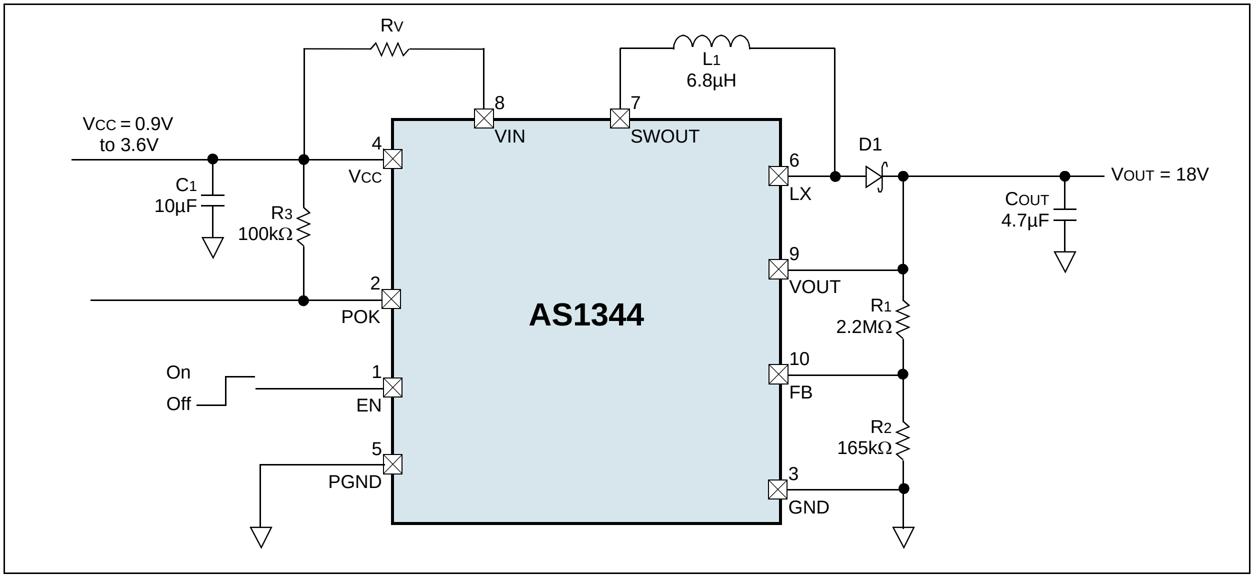
## Thermal Protection

To protect the device from short circuit or excessive power dissipation of the auxiliary NPNs, the integrated thermal protection switches off the device when the junction temperature ($T_J$) reaches 140ºC (typ). When $T_J$ decreases to approximately 135ºC, the device will resume normal operation. If the thermal overload condition is not corrected, the device will switch on and off while maintaining $T_J$ within the range between 135 and 140ºC.

## Setting Output Voltage

Output voltage can be adjusted by connecting a voltage divider between pins VOUT and FB (see Figure 35).

*Figure 35. Typical Application*



The output voltage can adjusted by selecting different values for $R_1$ and $R_2$. For $R_2$, select a value between 10k and 200kΩ.

Calculate $R_1$ by:

$$R_1 = R_2 \cdot \left( \frac{V_{OUT}}{V_{FB}} - 1 \right) \qquad \text{(EQ 2)}$$

**Where:**

$V_{OUT}$ = 5.5V to 42V, $V_{FB}$ = 1.25V; $V_{OUT} > V_{IN}$

The input bias current of FB has a maximum value of 100nA which allows for large-value resistors. For less than 1% error, the current through $R_2$ should be 100 times the feedback input bias current ($I_{FB}$). That's why the feeback current can be neglected in the calculation of $V_{OUT}$.

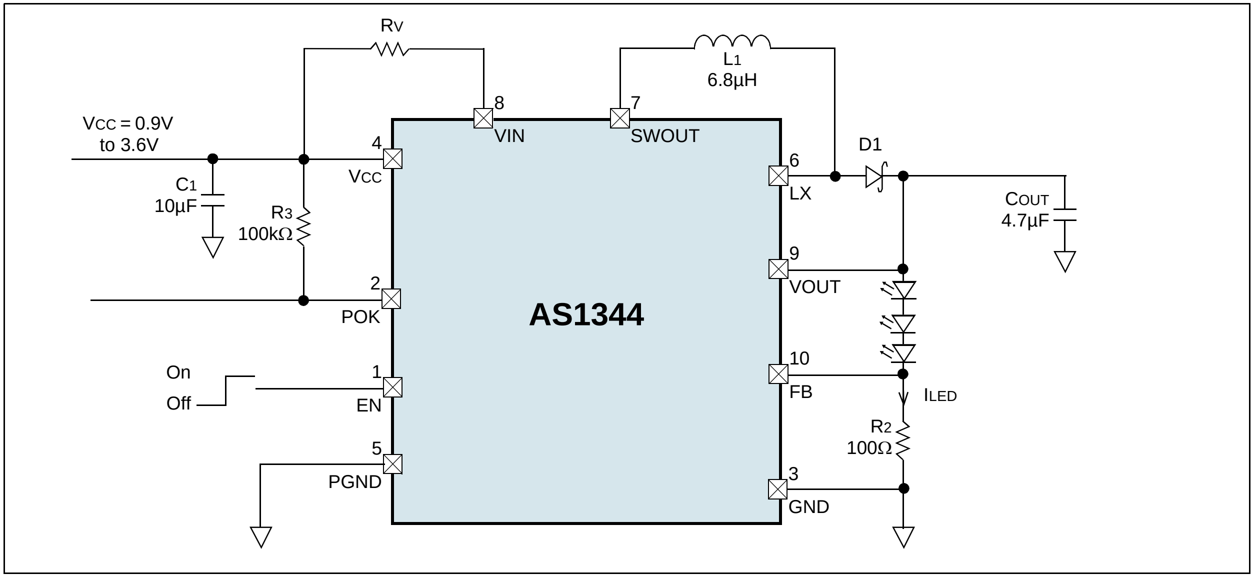
**Note:** For the optimal operation condition the following ratio between $V_{OUT}$ and $V_{IN}$ should be used:

$$V_{OUT} \div V_{IN} \leq 12 \qquad \text{(EQ 3)}$$

## LED Power Supply Application

The AS1344 can also be used for driving LEDs. Just simply connect the LEDs between the pins VOUT and FB. (see Figure 36).

*Figure 36. LED Supply Application*



The output voltage is adjusted automatically to the required voltage of the LEDs. This voltage depends on the forward voltage (VF) of the used LEDs and the Feeback Voltage VFB.

Calculate VOUT by:

$$V_{OUT} = V_F(I_{LED}) \times n + V_{FB} \qquad \text{(EQ 4)}$$

**Note:** The brightness of the LEDs can directly be adjusted by setting the current ILED via the corresponding R2.

Calculate R2 by:

$$I_{LED} = \frac{V_{FB}}{R_2} \qquad \text{(EQ 5)}$$

**Where:**

$V_{FB}$ = 1.25V

n .... number of LEDs

## Inductor Selection

For the external inductor, a 4.7µH or 6.8µH inductor will usually suffice. Minimum inductor size is dependant on the desired efficiency and output current. Inductors with low core losses and small DCR at 1MHz are recommended. It's also recommended to choose an inductor which can handle at least 1.2A without saturating. The MOS6020 is a very good choice because the DCR is quite small and the saturation current exceeds 1.2A. For space limiting applications and input currents below 650mA the EPL2014 can be selected. Efficiency losses due to higher DCR should be considered. (see Figure 37 and Figure 38)

*Table 5. Recommended Inductors*

| Part Number | L | DCR | $I_{SAT}$ @ 20% drop | Dimensions (L/W/T) | Manufacturer |
|---|---|---|---|---|---|
| EPL2014-472MLC | 4.7µH | 0.231Ω | 0.65A | 2.2x2.0x1.4mm | Coilcraft<br>www.coilcraft.com |
| LPS3015-472MLC | 4.7µH | 0.200Ω | 1.2A | 3.1x3.1x1.5mm | |
| LPS4018-682MLC | 6.8µH | 0.150Ω | 1.3A | 4.1x4.1x1.8mm | |
| LPS5030-682ML_ | 6.8µH | 0.099Ω | 1.7A | 4.88x4.88x3.0mm | |
| MOS6020-682MLC | 6.8µH | 0.078Ω | 1.56A | 6.0x6.8x2.4mm | |
| MOS6020-472MLC | 4.7µH | 0.050Ω | 1.82A | 6.0x6.8x2.4mm | |

**Note:** For the Efficiency measurements in Figure 37 and Figure 38 a MBR0540 diode was used for $D_1$.

*Figure 37. Efficiency Comparison of different Inductors; $V_{IN}$ = 3V, $V_{OUT}$ = 18V*

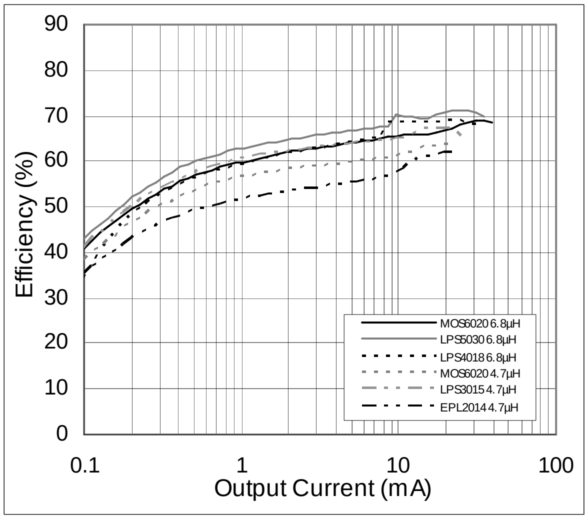
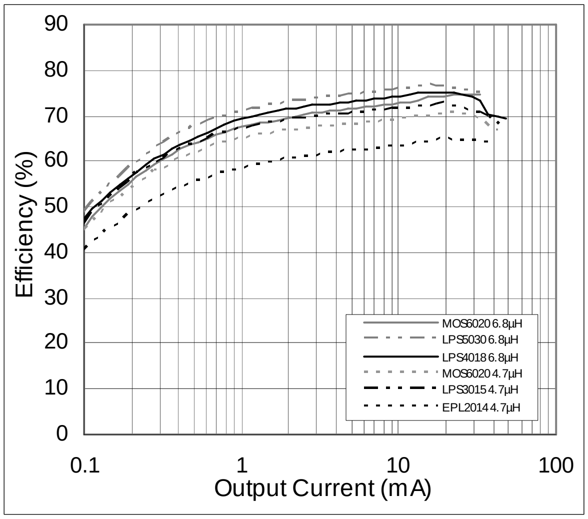


*Figure 38. Efficiency Comparison of different Inductors; $V_{IN}$ = 3.6V, $V_{OUT}$ = 18V*



## Capacitor Selection

A 10µF capacitor is recommended for CIN as well as a 4.7µF for COUT. Small-sized X5R or X7R ceramic capacitors should be used as they retain capacitance over wide ranges of voltages and temperatures.

### Output Capacitor Selection

Low ESR capacitors should be used to minimize VOUT ripple. Multi-layer ceramic capacitors are recommended since they have extremely low ESR and are available in small footprints. A 4.7 to 10µF output capacitor is sufficient for most applications. Larger values up to 22µF may be used to obtain extremely low output voltage ripple and improve transient response. The rated voltage of the capacitor should not be lower than the output voltage.

*Table 6. Recommended Output Capacitors*

| Part Number | C | TC Code | Rated Voltage | Dimensions (L/W/T) | Manufacturer |
|---|---|---|---|---|---|
| GRM32DR71H335KA88B | 3.3µF | X7R | 50V | 1210 | Murata<br>www.murata.com |
| GRM32ER71H475KA88 | 4.7µF | X7R | 50V | 1210 | |
| GRM31CR61E106KA12 | 10µF | X5R | 25V | 1206 | |
| C3225X5R1H335K | 3.3µF | X5R | 50V | 1210 | TDK<br>www.tdk.com |
| C3216X5R1E475K | 4.7µF | X5R | 25V | 1206 | |
| C3225X5R1E106K | 10µF | X5R | 25V | 1210 | |

### Input Capacitor Selection

Low ESR input capacitors reduce input switching noise and reduce the peak current drawn from the battery. Ceramic capacitors are recommended for input decoupling and should be located as close to the device as is practical. A 10µF input capacitor is sufficient for most applications. Larger values may be used for a better stabilization of the supply voltage.

*Table 7. Recommended Input Capacitors*

| Part Number | C | TC Code | Rated Voltage | Dimensions (L/W/T) | Manufacturer |
|---|---|---|---|---|---|
| GRM21BR60J106KE19 | 10µF | X5R | 6.3V | 0805 | Murata<br>www.murata.com |
| GRM188R60J106ME47 | 10µF | X5R | 6.3V | 0603 | |
| GRM21BR60J226ME39 | 22µF | X5R | 6.3V | 0805 | |
| C1608X5R0J106MB | 10µF | X5R | 6.3V | 0603 | TDK<br>www.tdk.com |
| C2012X5R0J226M | 22µF | X5R | 6.3V | 0805 | |

## Diode Selection

A Schottky diode must be used to carry the output current into the Cout and load during the NMOS switch-off time.

**Note:** Do not use ordinary rectifier diodes, since the slow recovery times will compromise efficiency.

The MBR0520 is a good choice because of the very low forward voltage and the extremely fast switching. If the output voltage exceeds 20V the use of the PMEG4005 or the MBR0540 (40V Schottky diodes) is recommended. These diodes are designed to handle an average forward current of 500mA. In applications with higher loads, the PMEG4010 or the MBRM140 should be used, due to the rated average forward current of 1A.

*Table 8. Recommended Diodes*

| Part Number | Reverse Voltage | Forward Current | Package | Manufacturer |
|---|---|---|---|---|
| MBR0540 | 40V | 0.5A | SOD123 | MCC<br>www.mccsemi.com |
| MBR0520 | 20V | 0.5A | SOD123 | |
| PMEG4005 | 40V | 0.5A | SOD123 | Philips<br>www.nxp.com |
| PMEG4010 | 40V | 1A | SOD123 | |
| MBRM140 | 40V | 1A | SOD123 | ON Semiconductor<br>www.onsemi.com |

*Figure 39. Efficiency Comparison of different Diodes; $V_{IN}$ = 3V, $V_{OUT}$ = 18V, $L_1$ = 6.8µH*

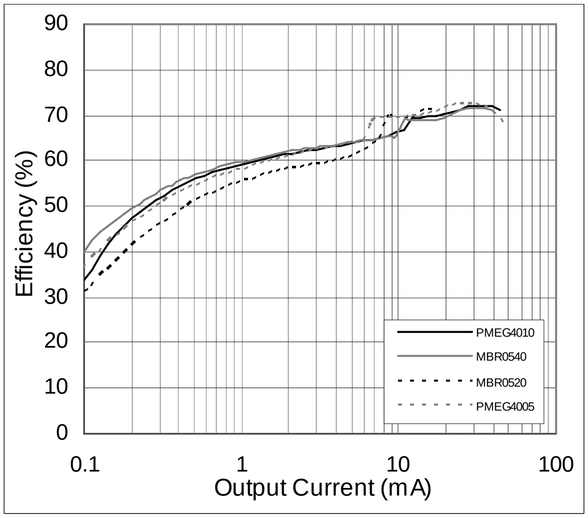
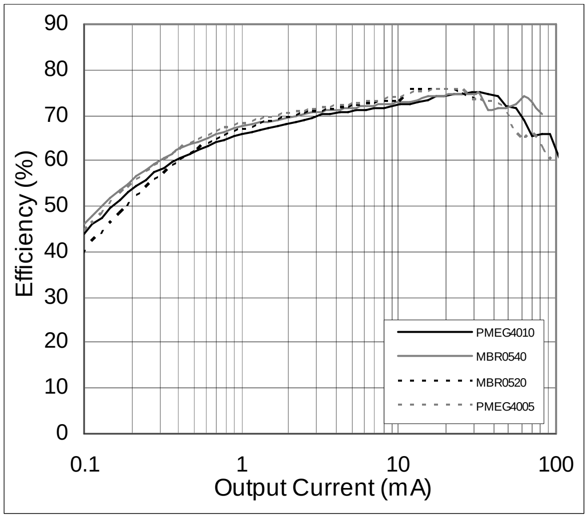


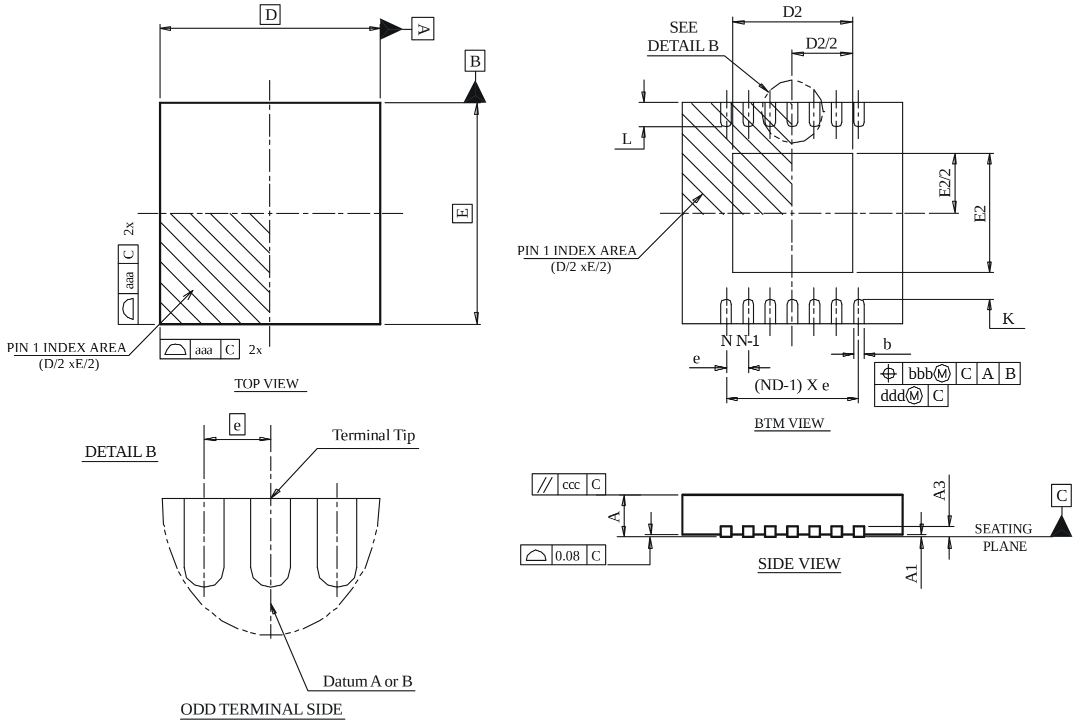
*Figure 40. Efficiency Comparison of different Diodes; $V_{IN}$ = 3.6V, $V_{OUT}$ = 18V, $L_1$ = 6.8µH*



# 10 Package Drawings and Markings

The devices are available in a TDFN-10 3x3mm package.

*Figure 41. TDFN-10 3x3mm Package*



| Symbol | Min | Typ | Max | Notes |
|---|---|---|---|---|
| A | 0.70 | 0.75 | 0.80 | 1, 2 |
| A1 | 0.00 | 0.02 | 0.05 | 1, 2 |
| A3 | | 0.20 REF | | 1, 2 |
| L1 | 0.03 | | 0.15 | 1, 2 |
| L2 | | | 0.13 | 1, 2 |
| aaa | | 0.15 | | 1, 2 |
| bbb | | 0.10 | | 1, 2 |
| ccc | | 0.10 | | 1, 2 |
| ddd | | 0.05 | | 1, 2 |
| eee | | 0.08 | | 1, 2 |
| ggg | | 0.10 | | 1, 2 |

| Symbol | Min | Typ | Max | Notes |
|---|---|---|---|---|
| D BSC | | 3.00 | | 1, 2 |
| E BSC | | 3.00 | | 1, 2 |
| D2 | 1.60 | | 2.50 | 1, 2 |
| E2 | 1.35 | | 1.75 | 1, 2 |
| L | 0.30 | 0.40 | 0.50 | 1, 2 |
| θ | 0º | | 14º | 1, 2 |
| K | 0.20 | | | 1, 2 |
| b | 0.18 | 0.25 | 0.30 | 1, 2, 5 |
| e | | 0.50 | | |
| N | | 10 | | 1, 2 |
| ND | | 5 | | 1, 2, 5 |

**Notes:**

1. Figure 41 is shown for illustration only.
2. All dimensions are in millimeters; angles in degrees.
3. Dimensioning and tolerancing conform to *ASME Y14.5 M-1994*.
4. N is the total number of terminals.
5. The terminal #1 identifier and terminal numbering convention shall conform to *JEDEC 95-1, SPP-012*. Details of terminal #1 identifier are optional, but must be located within the zone indicated. The terminal #1 identifier may be either a mold or marked feature.
6. Dimension b applies to metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip.
7. ND refers to the maximum number of terminals on side D.
8. Unilateral coplanarity zone applies to the exposed heat sink slug as well as the terminals

# 11 Ordering Information

The device is available as the standard products shown in Table 9.

*Table 9. Ordering Information*

| Ordering Code | Marking | Description | Delivery Form | Package |
|---|---|---|---|---|
| AS1344-BTDT | ASR7 | 42V, DC-DC Boost Converter with adjustable Softstart | Tape and Reel | TDFN-10 3x3mm |

**Note:** All products are RoHS compliant and Pb-free.
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