

**Low-Power Off-line Primary Side Regulation Controller****AP3772H****General Description**

The AP3772H is a high performance AC/DC power supply controller for battery charger and adapter applications. The device uses Pulse Frequency Modulation (PFM) method to build discontinuous conduction mode (DCM) flyback power supplies.

The AP3772H provides accurate constant voltage, constant current (CV/CC) regulation without requiring an opto-coupler and the secondary control circuitry. It also eliminates the need of loop compensation circuitry while maintaining good stability. The AP3772H can achieve excellent regulation and high average efficiency, yet meets no-load consumption less than 30mW. It can also achieve excellent dynamic performance while maintaining 30mW standby power with AP4340.

The AP3772H has a built-in fixed cable voltage drop compensation function. The magnitude of the cable compensation voltage is set as 3% of the rated output voltage. It also has an adjustable built-in line compensation function to achieve tight CC.

The AP3772H is available in SOT-23-6 package.

**Features**

- Primary Side Control for Tight Constant Current and Constant Voltage
- 30mW No-load Input Power
- Excellent Dynamic Performance with AP4340
- Bipolar Junction Transistor (BJT) Driving
- Proprietary Adjustable Line Compensation for CC Variation
- Constant and Built-in 6%, 3% and No Cable Voltage Drop Compensation
- Enhanced Audio Noise Suppression
- Open Circuit Protection
- Over Voltage Protection
- Short Circuit Protection
- SOT-23-6 package

**Applications**

- Adapters/Chargers for Cell/cordless Phones, PDAs, MP3 and Other Portable Devices
- LED Driver
- Standby and Auxiliary Power Supplies

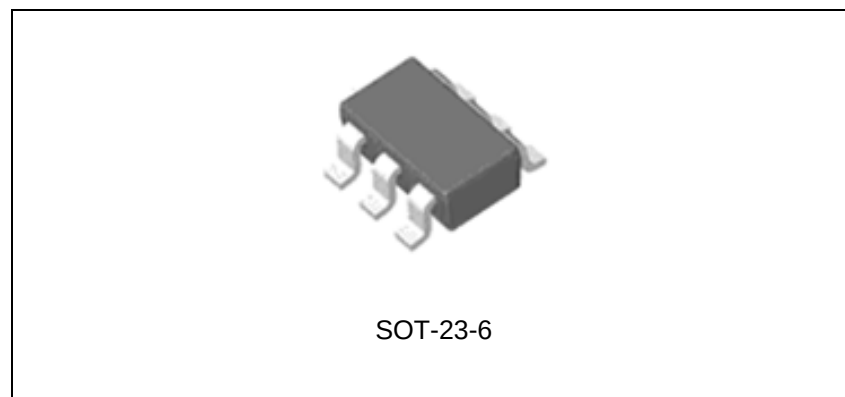


Figure 1. Package Type of AP3772H

## Low-Power Off-line Primary Side Regulation Controller

**AP3772H**

### Pin Configuration

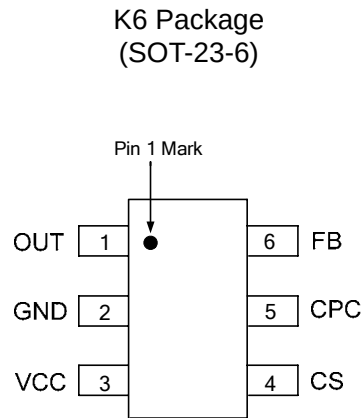


Figure 2. Pin Configuration of AP3772H (Top View)

### Pin Description

| Pin Number | Pin Name | Function                                                                                                                                                                                                                                                                              |
|------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1          | OUT      | The OUT pin is used to turn on and turn off the power switch. When turning on the power switch, the OUT pin will output 30mA source current to support the base current of the power BJT. When turning off the power switch, the resistance between the OUT and GND will become to 5Ω |
| 2          | GND      | The GND pin is the ground of the IC. When the power BJT is turned off, a fast reverse sinking current to the gate of BJT will flow out from this pin. Attention should be paid to in the PCB layout                                                                                   |
| 3          | VCC      | The VCC pin supplies the power 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 VCC pin                                                                                                             |
| 4          | CS       | The CS is the current sense pin of the IC. The IC will turn off the power BJT according to the voltage on the CS pin. When the power BJT is on, a current is output from the CS pin which is proportional to the line voltage to realize the function of line compensation            |
| 5          | CPC      | A capacitor more than 10nF should be connected to this pin. The voltage of CPC pin is linear to load of the system and it is used for the functions of cable voltage drop compensation and audio noise suppression                                                                    |
| 6          | FB       | The CV and CC regulation are realized based on the voltage sampling of this pin                                                                                                                                                                                                       |

## Functional Block Diagram

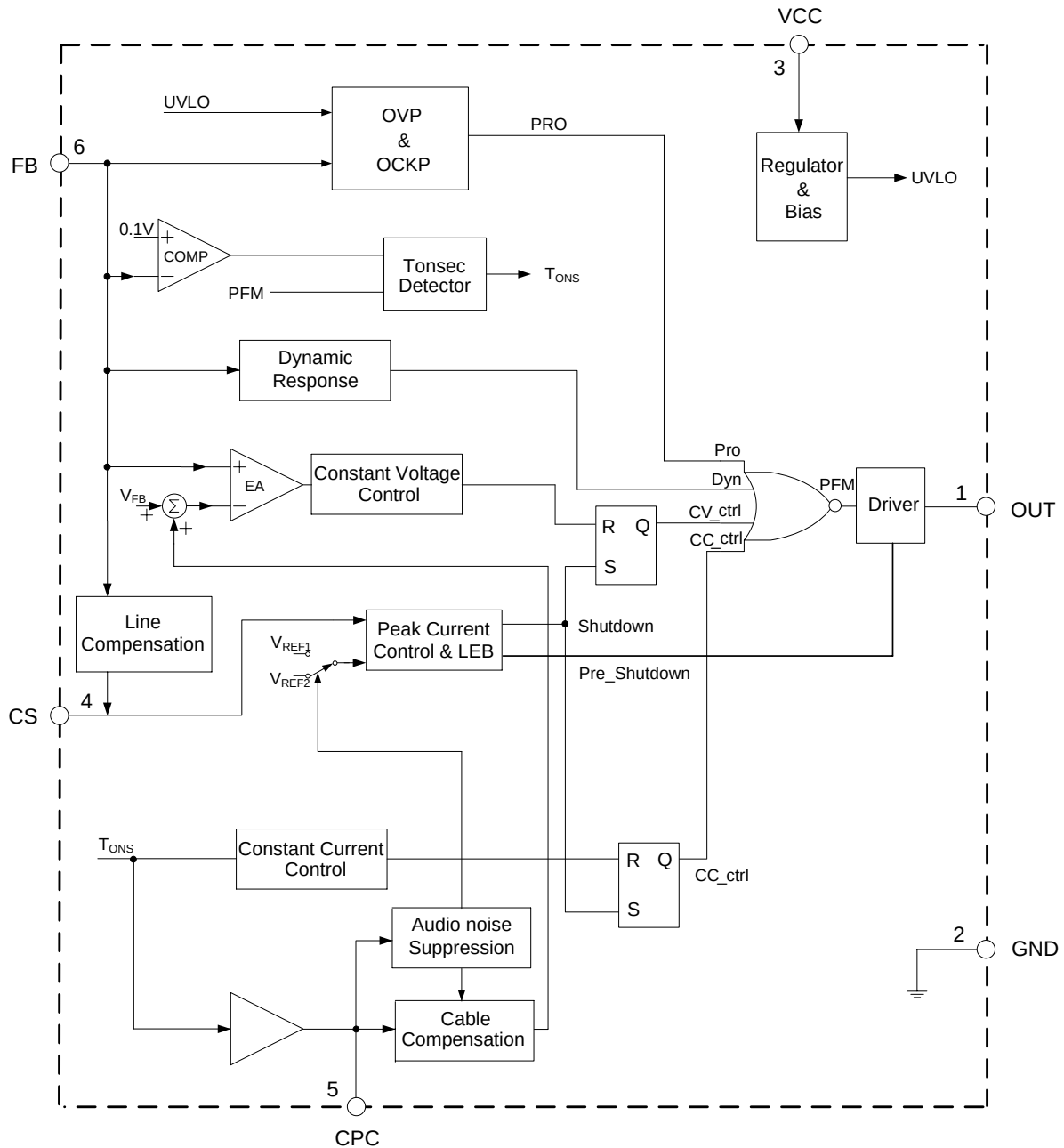
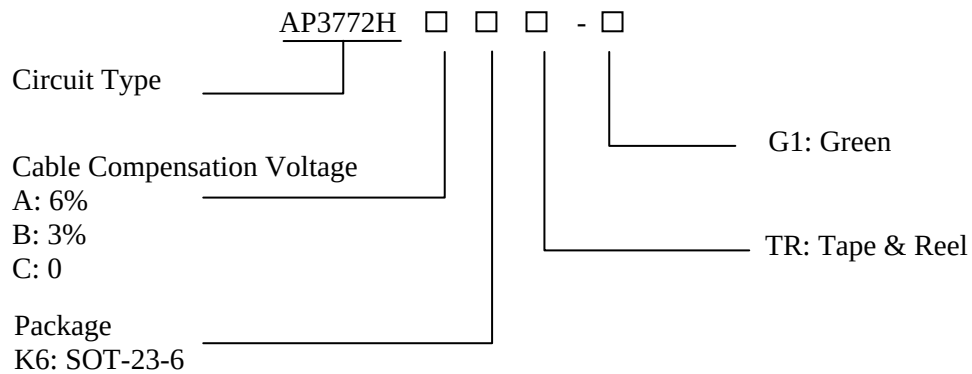


Figure 3. Functional Block Diagram of AP3772H

**Low-Power Off-line Primary Side Regulation Controller****AP3772H****Ordering Information**

| Package  | Temperature Range | Cable Compensation Voltage | Part Number     | Marking ID | Packing Type |
|----------|-------------------|----------------------------|-----------------|------------|--------------|
| SOT-23-6 | -40 to 85°C       | 6%                         | AP3772HAK6TR-G1 | GBC        | Tape & Reel  |
|          |                   | 3%                         | AP3772HBK6TR-G1 | GKJ        | Tape & Reel  |
|          |                   | 0                          | AP3772HCK6TR-G1 | GJD        | Tape & Reel  |

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

**Absolute Maximum Ratings (Note 1)**

| Parameter                                | Symbol        | Value              | Unit |
|------------------------------------------|---------------|--------------------|------|
| Supply Voltage                           | $V_{CC}$      | -0.3 to 30         | V    |
| CS, CPC to GND                           |               | -0.3 to 7          | V    |
| FB Input Voltage                         | $V_{FB}$      | -40 to 10          | V    |
| Source Current at OUT Pin                | $I_{SOURCE}$  | Internally Limited | A    |
| Operating Junction Temperature           | $T_J$         | 150                | °C   |
| Storage Temperature                      | $T_{STG}$     | -65 to 150         | °C   |
| Lead Temperature (Soldering, 10 sec)     | $T_{LEAD}$    | 300                | °C   |
| Thermal Resistance (Junction to Ambient) | $\theta_{JA}$ | 200                | °C/W |

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” 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 under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

**Low-Power Off-line Primary Side Regulation Controller****AP3772H****Electrical Characteristics** $V_{CC}=15V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.

| Parameter                                     | Symbol                                    | Conditions                                                  | Min                | Typ  | Max | Unit |    |
|-----------------------------------------------|-------------------------------------------|-------------------------------------------------------------|--------------------|------|-----|------|----|
| UVLO SECTION                                  |                                           |                                                             |                    |      |     |      |    |
| Startup Threshold                             | V <sub>TH</sub> (ST)                      |                                                             | 13                 | 15.5 | 18  | V    |    |
| Minimal Operating Voltage                     | V <sub>OPR</sub> (MIN)                    |                                                             | 3                  | 3.5  | 4.5 | V    |    |
| STANDBY CURRENT SECTION                       |                                           |                                                             |                    |      |     |      |    |
| Startup Current                               | I <sub>ST</sub>                           | V <sub>CC</sub> =V <sub>TH</sub> (ST)-1V,<br>Before startup | 0                  | 0.2  | 0.6 | μA   |    |
| Operating Current                             | I <sub>CC</sub> (OPR)                     | Static current                                              | 250                | 500  | 600 | μA   |    |
| DRIVE OUTPUT SECTION                          |                                           |                                                             |                    |      |     |      |    |
| Output Current                                | Sink                                      | I <sub>SINK</sub>                                           | Apply 1V @ OUT pin | 150  | 330 | 500  | mA |
|                                               | Source                                    | I <sub>SOURCE</sub>                                         |                    | 30   | 40  | 50   | mA |
| Maximum Off Time                              | t <sub>OFF</sub> (MAX)                    |                                                             | 14                 | 18   | 25  | ms   |    |
| CURRENT SENSE SECTION                         |                                           |                                                             |                    |      |     |      |    |
| Current Sense Threshold Voltage at Heavy Load | V <sub>CS1</sub>                          |                                                             | 500                | 525  | 550 | mV   |    |
| Leading Edge Blanking                         | t <sub>LEB</sub>                          | The minimum power switch turn on time                       | 300                | 500  | 650 | ns   |    |
| FEEDBACK INPUT SECTION                        |                                           |                                                             |                    |      |     |      |    |
| Input Resistance of FB Pin                    | R <sub>FB</sub>                           | V <sub>FB</sub> =4V                                         | 1                  | 1.6  | 2   | MΩ   |    |
| Feedback Threshold                            | V <sub>FB</sub>                           |                                                             | 3.98               | 4.04 | 4.1 | V    |    |
| LINE COMPENSATION SECTION                     |                                           |                                                             |                    |      |     |      |    |
| Line Compensation Transconductance (Note 2)   | g <sub>m</sub>                            |                                                             | 0.8                | 1.2  | 1.6 | μS   |    |
| CABLE COMPENSATION SECTION                    |                                           |                                                             |                    |      |     |      |    |
| Cable Compensation Voltage                    | ΔV <sub>FB_CABLE</sub> /V <sub>FB</sub> % | AP3772HA                                                    | 5                  | 6    | 7   | %    |    |
|                                               |                                           | AP3772HB                                                    | 2                  | 3    | 4   |      |    |
|                                               |                                           | AP3772HC                                                    |                    | 0    |     |      |    |
| DYNAMIC FUNCTION SECTION                      |                                           |                                                             |                    |      |     |      |    |
| Delay Time for Dynamic Function               | t <sub>D</sub>                            |                                                             | 110                | 150  | 200 | μs   |    |
| Trigger Voltage for Dynamic Function          | V <sub>TRIGGER</sub>                      |                                                             | 120                | 150  | 180 | mV   |    |
| PROTECTION SECTION                            |                                           |                                                             |                    |      |     |      |    |
| Over Voltage Protection                       | V <sub>FB</sub> (OVP)                     |                                                             | 7                  | 8    | 9   | V    |    |
| Maximum On Time of Primary Side               | tonp (MAX)                                |                                                             | 20                 | 35   | 50  | μs   |    |

Note 2: Line compensation voltage on CS pin:  $\Delta V_{CS} = V_{IN\_DC} \cdot \frac{N_{AUX}}{N_{PRI}} \cdot \frac{R_6}{R_6 + R_7} \cdot g_m \cdot R_{LINE}$



## Typical Performance Characteristics

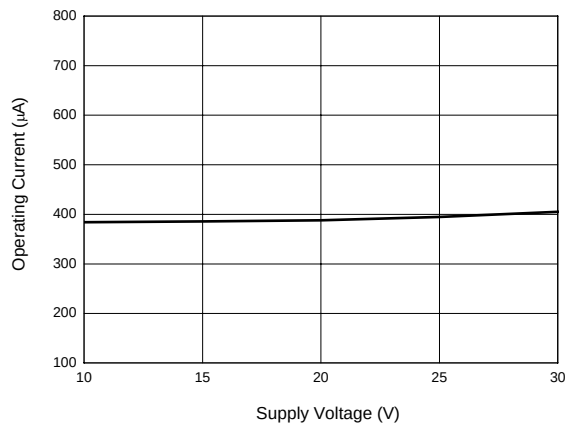


Figure 4. Operating Current vs. Supply Voltage

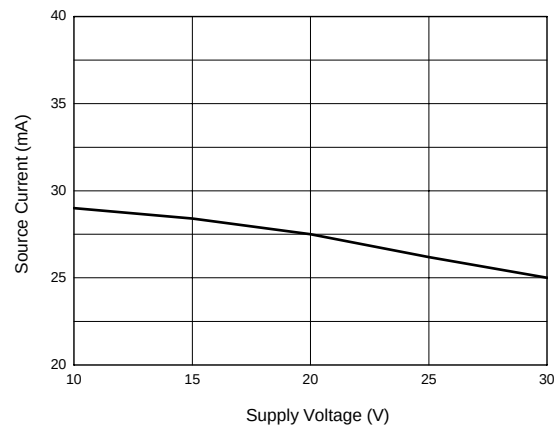


Figure 5. Source Current vs. Supply Voltage

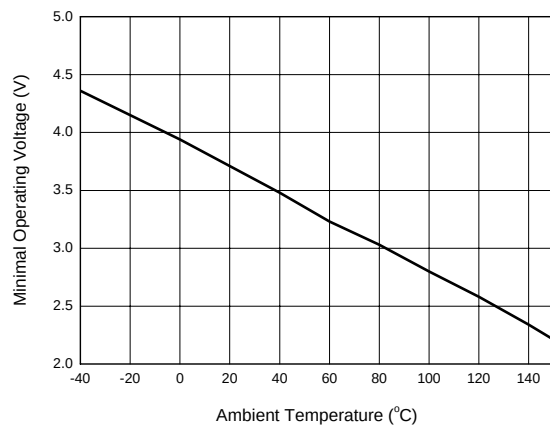


Figure 6. Minimal Operating Voltage vs. Ambient Temperature

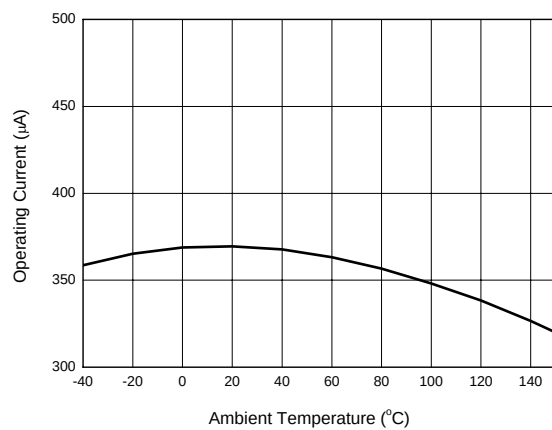


Figure 7. Operating Current vs. Ambient Temperature



## Typical Performance Characteristics (Continued)

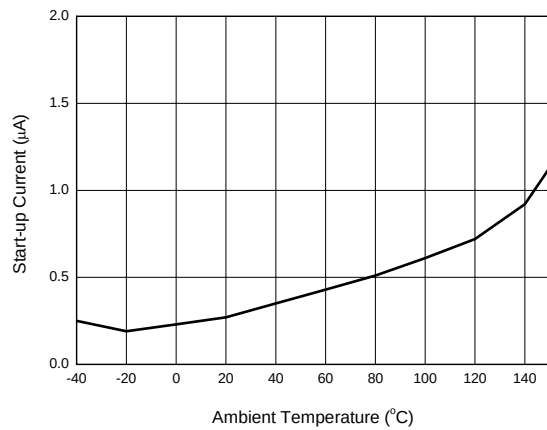


Figure 8. Start-up Current vs. Ambient Temperature

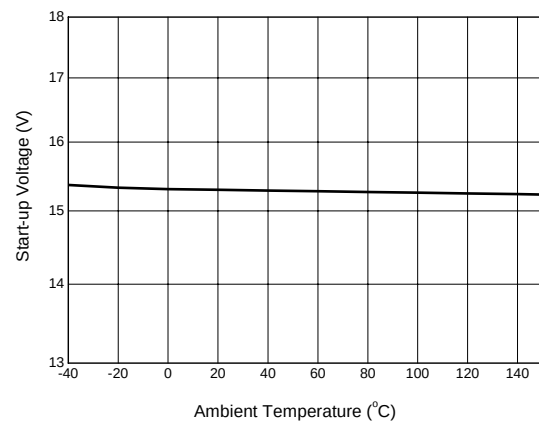


Figure 9. Start-up Voltage vs. Ambient Temperature

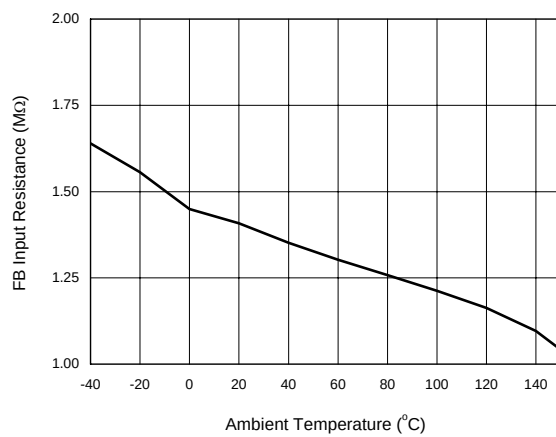


Figure 10. FB Input Resistance vs. Ambient Temperature

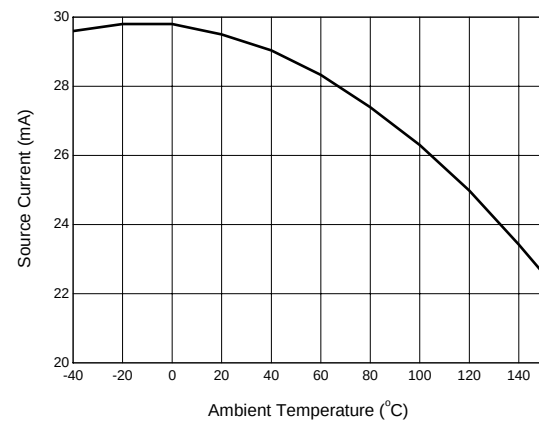


Figure 11. Source Current vs. Ambient Temperature

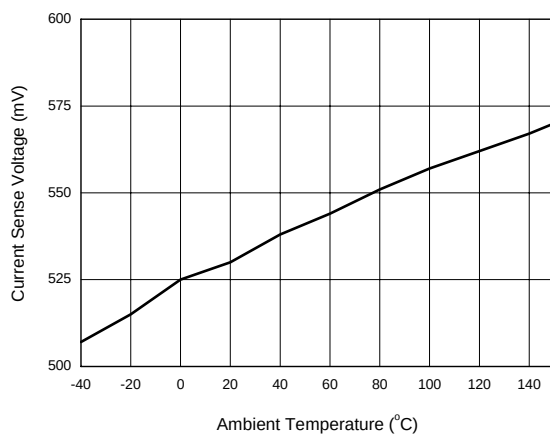
**Typical Performance Characteristics (Continued)**

Figure 12. Current Sense Voltage vs. Ambient Temperature

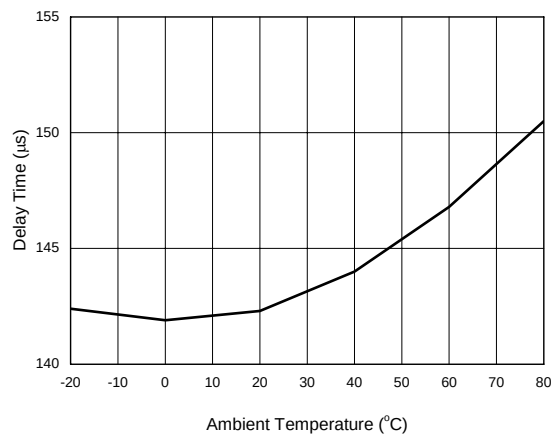


Figure 13. Delay Time vs. Ambient Temperature

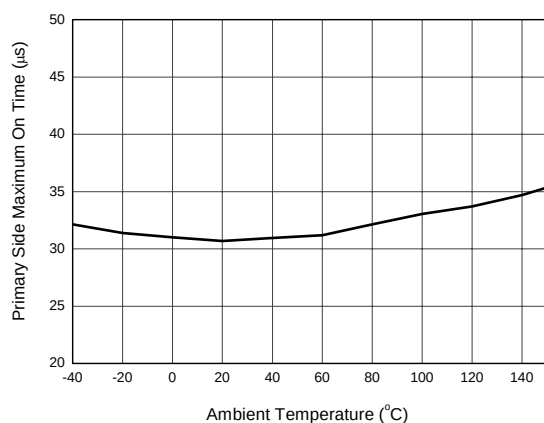


Figure 14. Primary Side Maximum On Time vs. Ambient Temperature

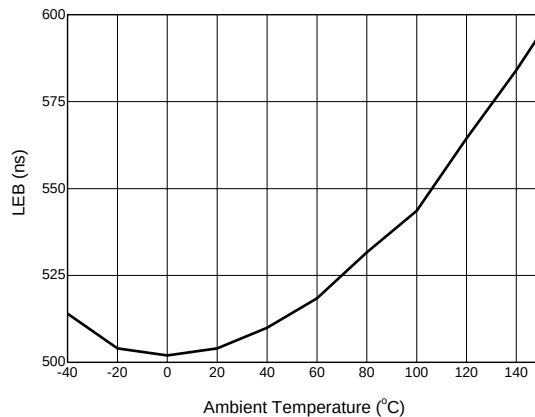


Figure 15. LEB vs. Ambient Temperature

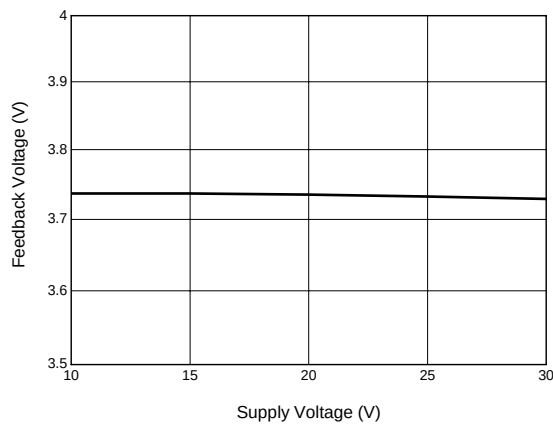
**Typical Performance Characteristics (Continued)**

Figure 16. Feedback Voltage vs. Supply Voltage

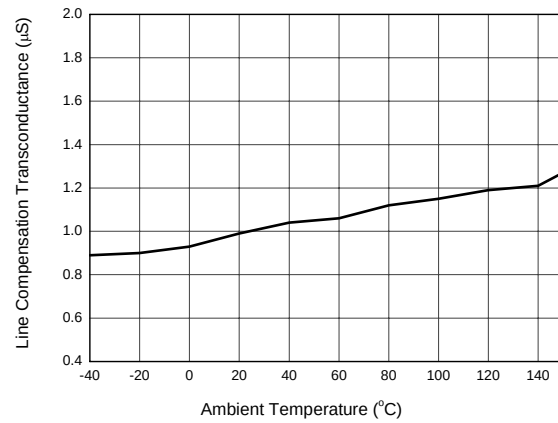


Figure 17. Line Compensation Transconductance vs. Ambient Temperature

## Typical Application

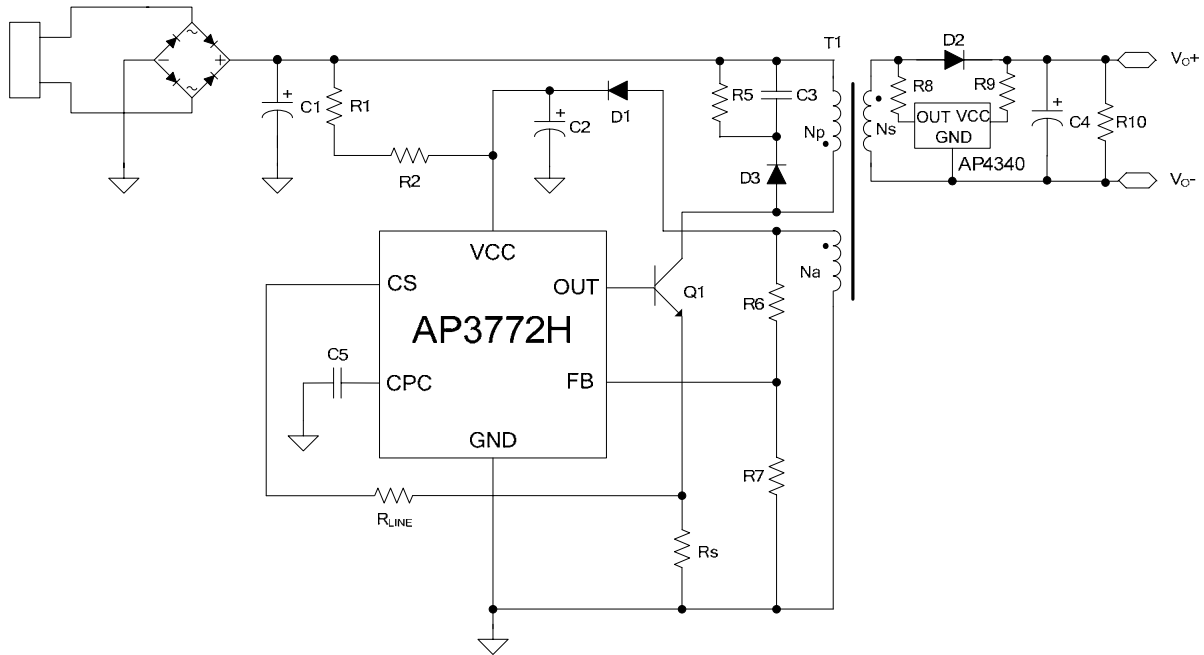


Figure 18. 5V/1A Output for Battery Charger of Mobile Phone  
(The AP4340 Is Used to Achieve Fast Dynamic Response)

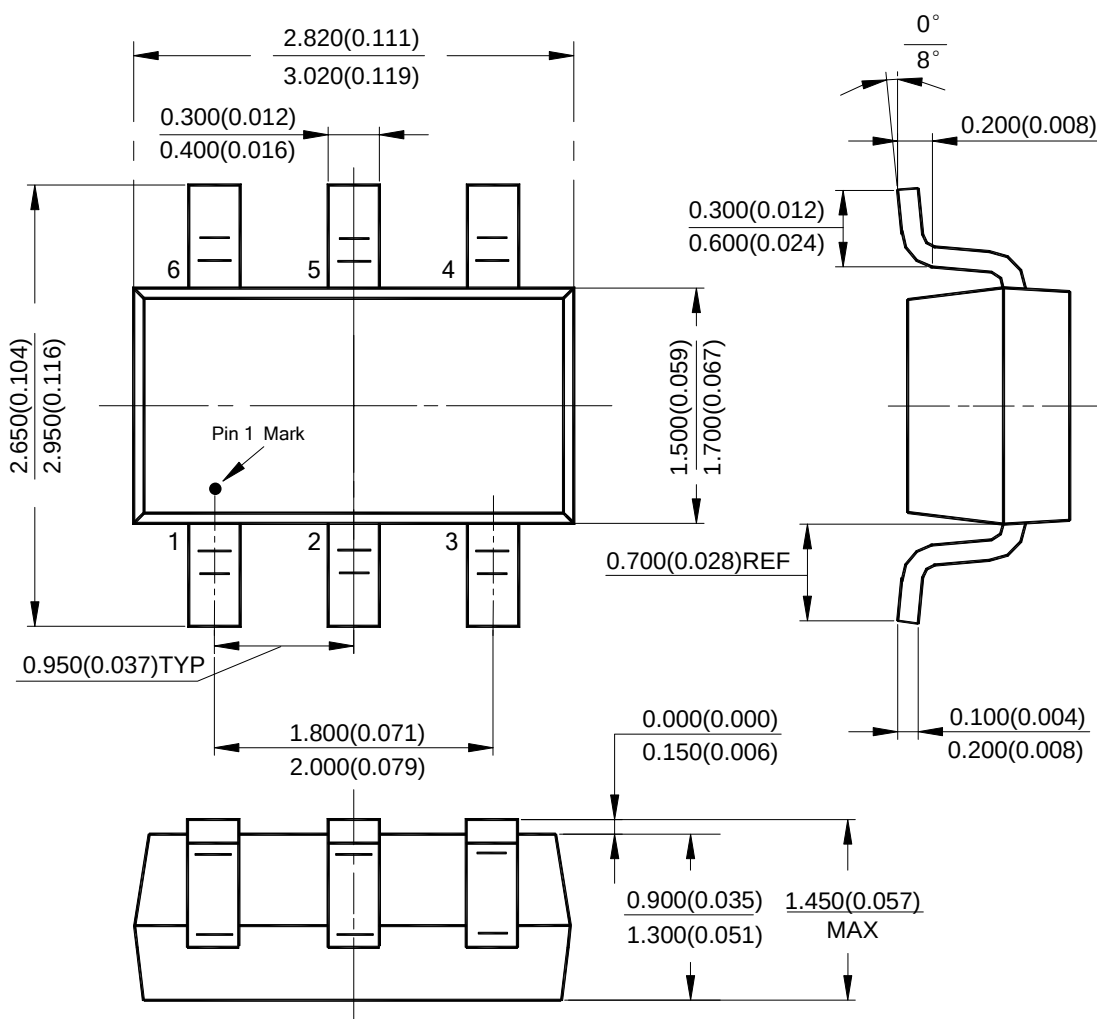
# Low-Power Off-line Primary Side Regulation Controller

## AP3772H

### Mechanical Dimensions

SOT-23-6

Unit: mm(inch)





## **BCD Semiconductor Manufacturing Limited**

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