

# LM2852 2A 500/1500 kHz Synchronous Buck Regulator

## 1 Features

- Input Voltage Range of 2.85 V to 5.5 V
- Factory EEPROM Set Output Voltages from 0.8 V to 3.3 V in 100-mV Increments
- Maximum Load Current of 2 A
- Voltage Mode Control
- Internal Type-Three Compensation
- Switching Frequency of 500 kHz or 1.5 MHz
- Low Standby Current of 10  $\mu$ A
- Internal 60-m $\Omega$  MOSFET Switches
- Standard Voltage Options 0.8/1/1.2/1.5/1.8/2.5/3.3 V

## 2 Applications

- Low Voltage Point of Load Regulation
- Local Solution for FPGA/DSP/ASIC Core Power
- Broadband Networking and Communications Infrastructure
- Portable Computing

## 3 Description

The LM2852 synchronous buck regulator is a high frequency step-down switching voltage regulator capable of driving up to a 2A load with excellent line and load regulation. The LM2852 can accept an input voltage between 2.85 V and

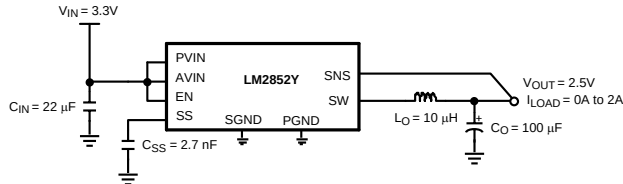
5.5 V and deliver an output voltage that is factory programmable from 0.8 V to 3.3 V in 100-mV increments. The LM2852 is available with a choice of two switching frequencies – 500 kHz (LM2852Y) or 1.5 MHz (LM2852X). It also features internal, type-three compensation to deliver a low component count solution. The exposed-pad HTSSOP-14 package enhances the thermal performance of the LM2852.

### Device Information<sup>(1)</sup>

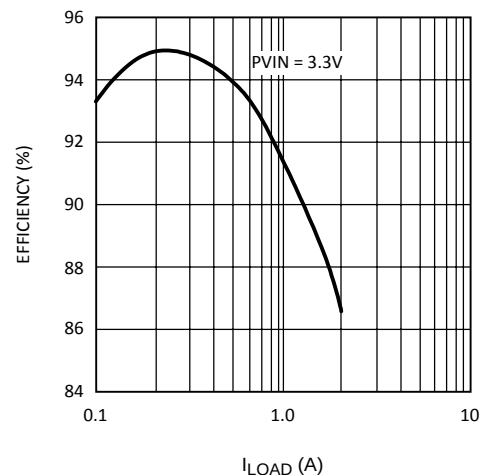
| PART NUMBER | PACKAGE     | BODY SIZE (NOM)          |
|-------------|-------------|--------------------------|
| LM2852      | HTSSOP (14) | 5.00 mm $\times$ 4.40 mm |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

### Typical Application Circuit



**Figure 1. Efficiency vs  $I_{LOAD}$**



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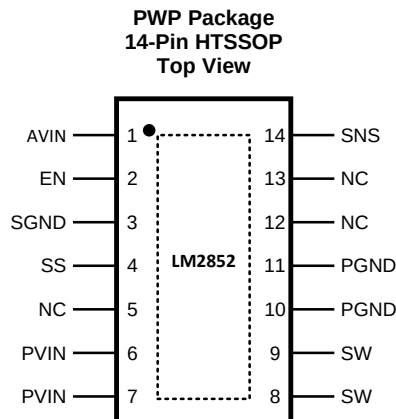
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## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision D (April 2013) to Revision E                                                                                                                                                                                                                                                                                                                                                  | Page     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <ul style="list-style-type: none"> <li>Added <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i>, <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section .....</li> </ul> | <b>1</b> |

## 5 Pin Configuration and Functions



### Pin Functions

| PIN     |           | I/O | DESCRIPTION                                                                                                                                       |
|---------|-----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME    | NO.       |     |                                                                                                                                                   |
| AVIN    | 1         | I   | Chip bias input pin. This provides power to the logic of the chip. Connect to the input voltage or a separate rail.                               |
| EN      | 2         | I   | Enable. Connect this pin to ground to disable the chip; connect to AVIN or leave floating to enable the chip; enable is internally pulled up.     |
| Exposed |           |     | Connect to ground.                                                                                                                                |
| NC      | 5, 12, 13 |     | No connect. These pins must be tied to ground or left floating in the application.                                                                |
| PGND    | 10, 11    | G   | Power ground. Connect this to an internal ground plane or other large ground plane.                                                               |
| PVIN    | 6, 7      | I   | Input supply pin. PVIN is connected to the input voltage. This rail connects to the source of the internal power PFET.                            |
| SGND    | 3         | G   | Signal ground.                                                                                                                                    |
| SNS     | 14        | O   | Output voltage sense pin. Connect this pin to the output voltage as close to the load as possible.                                                |
| SS      | 4         | I   | Soft-start pin. Connect this pin to a small capacitor to control startup. The soft-start capacitance range is restricted to values 1 nF to 50 nF. |
| SW      | 8, 9      | O   | Switch pin. Connect to the output inductor.                                                                                                       |

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)(2)</sup>

|                                       |                      | MIN                | MAX | UNIT |
|---------------------------------------|----------------------|--------------------|-----|------|
| PVIN, AVIN, EN, SNS                   |                      |                    | 6.5 | V    |
| Power dissipation                     |                      | Internally limited |     |      |
| 14-Pin exposed pad HTSSOP package     | Infrared (15 sec)    |                    | 220 | °C   |
|                                       | Vapor phase (60 sec) |                    | 215 | °C   |
| Maximum junction temperature          |                      |                    | 150 | °C   |
| Storage temperature, T <sub>stg</sub> |                      | -65                | 150 | °C   |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.

### 6.2 ESD Ratings

|                    |                         |                                                                   | VALUE | UNIT |
|--------------------|-------------------------|-------------------------------------------------------------------|-------|------|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup> | ±2000 | V    |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

|                      | MIN  | MAX | UNIT |
|----------------------|------|-----|------|
| PVIN to GND          | 1.5  | 5.5 | V    |
| AVIN to GND          | 2.85 | 5.5 | V    |
| Junction temperature | -40  | 125 | °C   |

### 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                              | LM2852       | UNIT |
|-------------------------------|----------------------------------------------|--------------|------|
|                               |                                              | PWP (HTSSOP) |      |
|                               |                                              | 14 PINS      |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 39.2         | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 24.1         | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 20.1         | °C/W |
| ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 0.6          | °C/W |
| ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 19.8         | °C/W |
| R <sub>θJC(bot)</sub>         | Junction-to-case (bottom) thermal resistance | 1.7          | °C/W |

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 6.5 Electrical Characteristics

AVIN = PVIN = 5 V unless otherwise indicated under the Test Conditions column. Limits apply over the junction temperature ( $T_J$ ) range of  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  (unless otherwise noted). Minimum and Maximum limits are ensured through test, design, or statistical correlation. Typical values represent the most likely parametric norm at  $T_J = 25^{\circ}\text{C}$ , and are provided for reference purposes only.

| PARAMETER                          |                                  | TEST CONDITIONS                                                                    |                                 | MIN    | TYP  | MAX    | UNIT |
|------------------------------------|----------------------------------|------------------------------------------------------------------------------------|---------------------------------|--------|------|--------|------|
| SYSTEM PARAMETERS                  |                                  |                                                                                    |                                 |        |      |        |      |
| V <sub>OUT</sub>                   | Voltage tolerance <sup>(1)</sup> | V <sub>OUT</sub> = 0.8-V option                                                    |                                 | 0.782  |      | 0.818  | V    |
|                                    |                                  | V <sub>OUT</sub> = 1-V option                                                      |                                 | 0.9775 |      | 1.0225 |      |
|                                    |                                  | V <sub>OUT</sub> = 1.2-V option                                                    |                                 | 1.173  |      | 1.227  |      |
|                                    |                                  | V <sub>OUT</sub> = 1.5-V option                                                    |                                 | 1.4663 |      | 1.5337 |      |
|                                    |                                  | V <sub>OUT</sub> = 1.8-V option                                                    |                                 | 1.7595 |      | 1.8405 |      |
|                                    |                                  | V <sub>OUT</sub> = 2.5-V option                                                    |                                 | 2.4437 |      | 2.5563 |      |
|                                    |                                  | V <sub>OUT</sub> = 3-V option                                                      |                                 | 2.9325 |      | 3.0675 |      |
|                                    |                                  | V <sub>OUT</sub> = 3.3-V option                                                    |                                 | 3.2257 |      | 3.3743 |      |
| ΔV <sub>OUT</sub> /ΔAVIN           | Line regulation <sup>(1)</sup>   | V <sub>OUT</sub> = 0.8 V, 1 V, 1.2 V, 1.5 V, 1.8 V or 2.5 V, 2.85 V ≤ AVIN ≤ 5.5 V | T <sub>J</sub> = −40°C to 125°C |        |      | 0.6%   |      |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 0.2% |        |      |
|                                    |                                  | V <sub>OUT</sub> = 3.3 V, 3.5 V ≤ AVIN ≤ 5.5 V                                     | T <sub>J</sub> = −40°C to 125°C |        |      | 0.6%   |      |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 0.2% |        |      |
| ΔV <sub>OUT</sub> /ΔI <sub>O</sub> | Load regulation                  | Normal operation                                                                   | T <sub>J</sub> = 25°C           |        | 8    |        | mV/A |
| V <sub>ON</sub>                    | UVLO threshold (AVIN)            | Rising                                                                             | T <sub>J</sub> = −40°C to 125°C |        |      | 2.85   | V    |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 2.47 |        |      |
|                                    |                                  | Falling hysteresis                                                                 | T <sub>J</sub> = −40°C to 125°C | 85     |      | 210    | mV   |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 150  |        |      |
| r <sub>DS(on)-P</sub>              | PFET ON resistance               | I <sub>sw</sub> = 2 A                                                              | T <sub>J</sub> = −40°C to 125°C |        |      | 140    | mΩ   |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 75   |        |      |
| r <sub>DS(on)-N</sub>              | NFET ON resistance               | I <sub>sw</sub> = 2 A                                                              | T <sub>J</sub> = −40°C to 125°C |        |      | 120    | mΩ   |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 55   |        |      |
| R <sub>SS</sub>                    | Soft-start resistance            | T <sub>J</sub> = 25°C                                                              |                                 |        |      | 400    | kΩ   |
| I <sub>CL</sub>                    | Peak current limit threshold     | LM2852X                                                                            | T <sub>J</sub> = −40°C to 125°C | 2.75   |      | 4.95   | A    |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 4    |        |      |
|                                    |                                  | LM2852Y                                                                            | T <sub>J</sub> = −40°C to 125°C | 2.25   |      | 3.65   |      |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 3    |        |      |
| I <sub>Q</sub>                     | Operating current                | Non-switching                                                                      | T <sub>J</sub> = −40°C to 125°C |        |      | 2      | mA   |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 0.85 |        |      |
| I <sub>SD</sub>                    | Shutdown quiescent current       | EN = 0 V                                                                           | T <sub>J</sub> = −40°C to 125°C |        |      | 25     | μA   |
|                                    |                                  |                                                                                    | T <sub>J</sub> = 25°C           |        | 10   |        |      |
| R <sub>SNS</sub>                   | Sense pin resistance             | T <sub>J</sub> = 25°C                                                              |                                 |        |      | 400    | kΩ   |

(1)  $V_{OUT}$  measured in a non-switching, closed-loop configuration at the SNS pin.

## LM2852

SNVS325E –JANUARY 2005–REVISED JANUARY 2016

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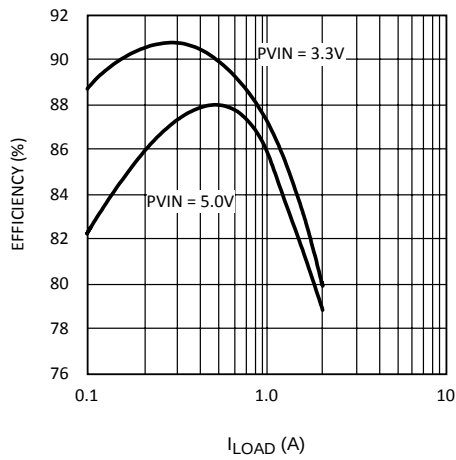
### Electrical Characteristics (continued)

AVIN = PVIN = 5 V unless otherwise indicated under the Test Conditions column. Limits apply over the junction temperature ( $T_J$ ) range of  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  (unless otherwise noted). Minimum and Maximum limits are ensured through test, design, or statistical correlation. Typical values represent the most likely parametric norm at  $T_J = 25^{\circ}\text{C}$ , and are provided for reference purposes only.

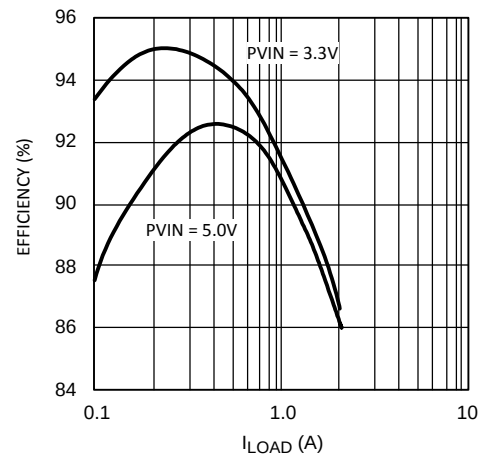
| PARAMETER                     |                                     | TEST CONDITIONS       |                                 | MIN  | TYP  | MAX  | UNIT      |
|-------------------------------|-------------------------------------|-----------------------|---------------------------------|------|------|------|-----------|
| PWM                           |                                     |                       |                                 |      |      |      |           |
| f <sub>osc</sub>              | LM2852X                             | 1500-kHz option.      | T <sub>J</sub> = −40°C to 125°C | 1050 |      | 1825 | kHz       |
|                               |                                     |                       | T <sub>J</sub> = 25°C           |      | 1500 |      |           |
|                               | LM2852Y                             | 500-kHz option.       | T <sub>J</sub> = −40°C to 125°C | 325  |      | 625  | kHz       |
|                               |                                     |                       | T <sub>J</sub> = 25°C           |      | 500  |      |           |
| D <sub>range</sub>            | Duty cycle                          |                       |                                 | 0%   |      | 100% |           |
| ENABLE CONTROL <sup>(2)</sup> |                                     |                       |                                 |      |      |      |           |
| V <sub>IH</sub>               | EN pin minimum high input           |                       |                                 | 75   |      |      | % of AVIN |
| V <sub>IL</sub>               | EN pin maximum low input            |                       |                                 |      |      | 25   | % of AVIN |
| I <sub>EN</sub>               | EN pin pullup current               | EN = 0 V              | T <sub>J</sub> = 25°C           | 1.2  |      |      | μA        |
| THERMAL CONTROLS              |                                     |                       |                                 |      |      |      |           |
| T <sub>SD</sub>               | T <sub>J</sub> for thermal shutdown | T <sub>J</sub> = 25°C |                                 | 165  |      |      | °C        |
| T <sub>SD-HYS</sub>           | Hysteresis for thermal shutdown     | T <sub>J</sub> = 25°C |                                 | 10   |      |      | °C        |

(2) The enable pin is internally pulled up, so the LM2852 is automatically enabled unless an external enable voltage is applied.

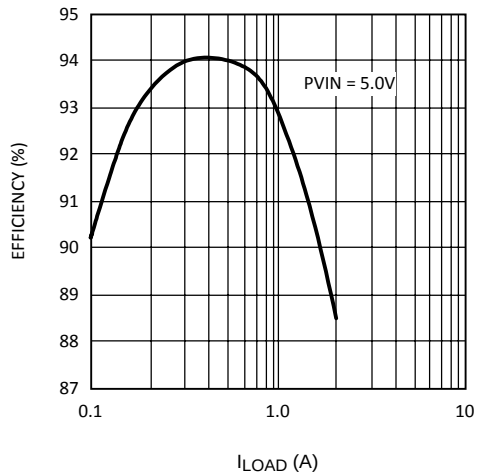
## 6.6 LM2852Y Typical Characteristics (500 kHz)



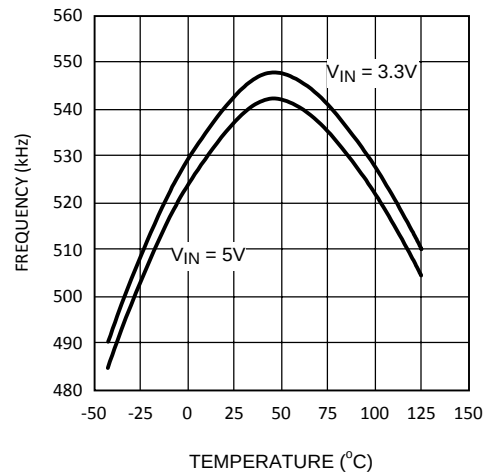
**Figure 2. Efficiency vs  $I_{LOAD}$   $V_{OUT} = 1.5$  V**



**Figure 3. Efficiency vs  $I_{LOAD}$   $V_{OUT} = 2.5$  V**



**Figure 4. Efficiency vs  $I_{LOAD}$   $V_{OUT} = 3.3$  V**



**Figure 5. Frequency vs Temperature**

## 6.7 LM2852X Typical Characteristics (1500 kHz)

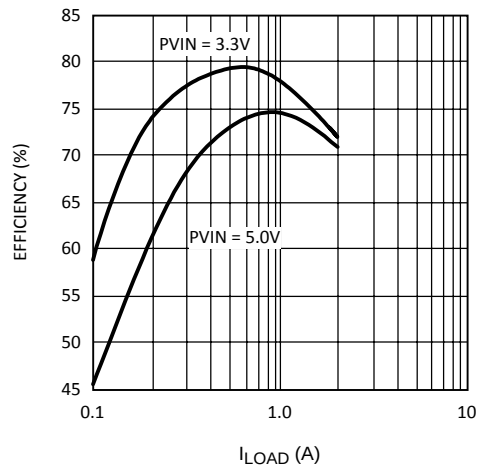


Figure 6. Efficiency vs  $I_{LOAD}$   $V_{OUT} = 1.5 V$

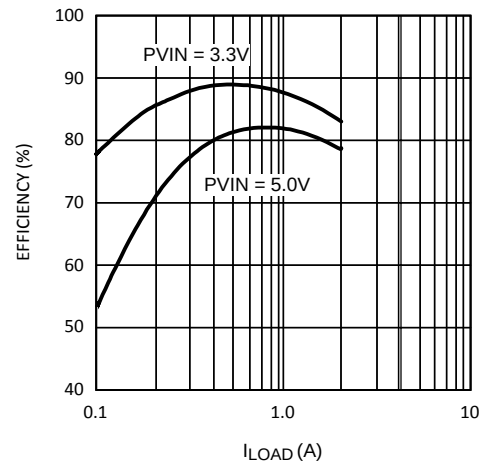


Figure 7. Efficiency vs  $I_{LOAD}$   $V_{OUT} = 2.5 V$

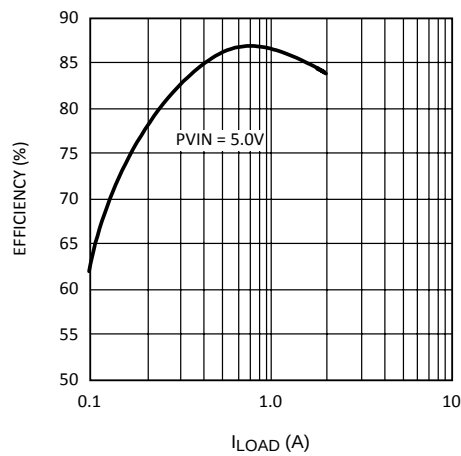


Figure 8. Efficiency vs  $I_{LOAD}$   $V_{OUT} = 3.3 V$

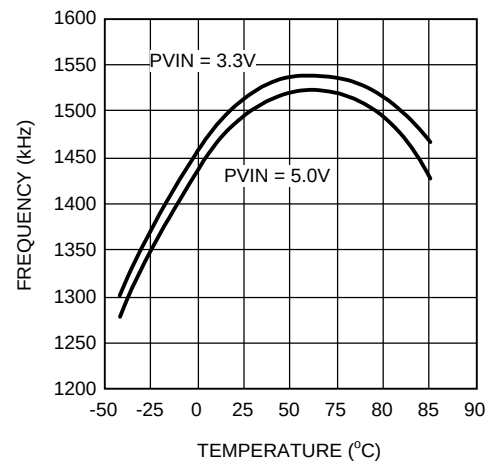


Figure 9. Frequency vs Temperature



## 6.8 LM2852 Typical Characteristics (Both Y and X Versions)

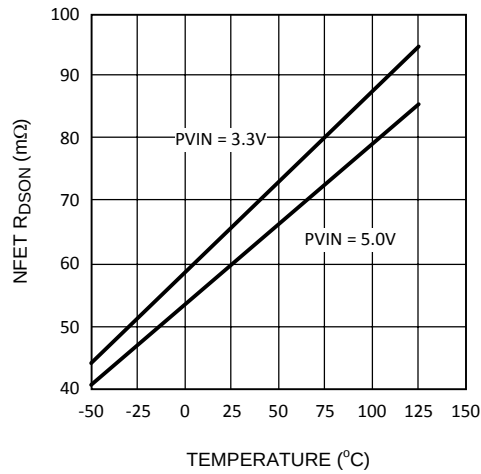


Figure 10. NMOS Switch  $R_{DS(on)}$  vs Temperature

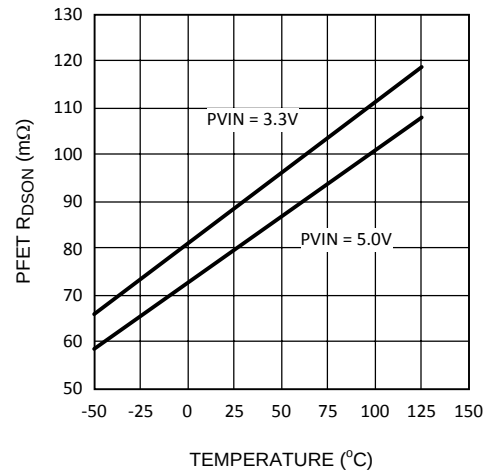


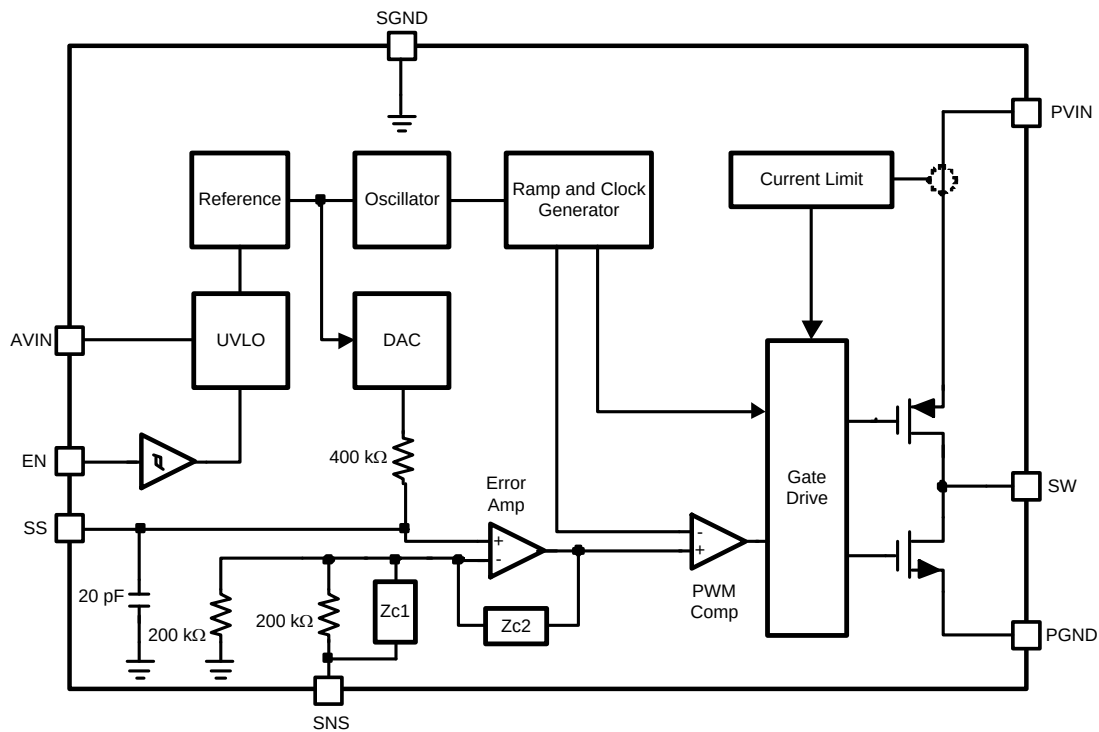
Figure 11. PMOS Switch  $R_{DS(on)}$  vs Temperature

## 7 Detailed Description

### 7.1 Overview

The LM2852 is a DC-DC synchronous buck regulator. Integration of the PWM controller, power switches and compensation network greatly reduces the component count required to implement a switching power supply.

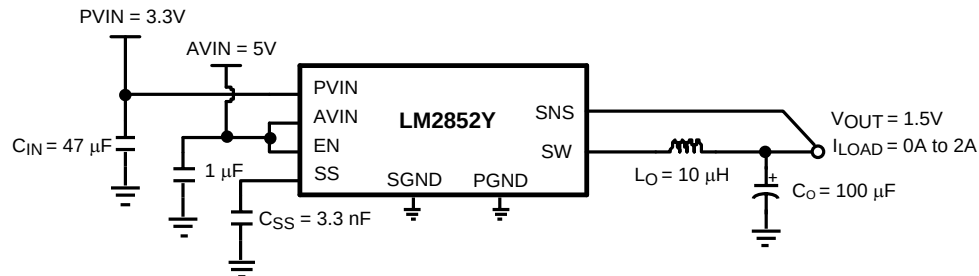
### 7.2 Functional Block Diagram



## 7.3 Feature Description

### 7.3.1 Split-Rail Operation

The LM2852 can be powered using two separate voltages for AVIN and PVIN. AVIN is the supply for the control logic; PVIN is the supply for the power FETs. The output filter components need to be chosen based on the value of PVIN. For PVIN levels lower than 3.3 V, use output filter component values recommended for 3.3 V. PVIN must always be equal to or less than AVIN.



**Figure 12. Split-Rail Operation**

### 7.3.2 Switch Node Protection

The LM2852 includes protection circuitry that monitors the voltage on the switch pin. Under certain conditions, switching is disabled in order to protect the switching devices. One result of the protection circuitry may be observed when power to the LM2852 is applied with no or light load on the output. The output regulates to the rated voltage, but no switching may be observed. As soon as the output is loaded, the LM2852 begins normal switching operation.

## 7.4 Device Functional Modes

The LM2852 Enable pin is internally pulled up so that the part is enabled anytime the input voltage exceeds the UVLO threshold. A pulldown resistor can be used to set the enable input to low.

## 8 Application and Implementation

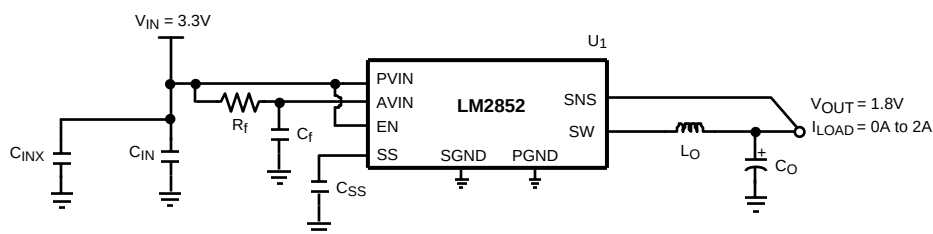
### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers must validate and test their design implementation to confirm system functionality.

### 8.1 Application Information

The LM2852 is a DC-DC synchronous buck regulator capable of driving a maximum load current of 2A, with an input range of 2.85 V to 5.5 V and a variable output range of 0.8 V to 3.3 V. [Figure 13](#) is a schematic example of a typical application.

### 8.2 Typical Application



**Figure 13. LM2852 Example Circuit Schematic**

#### 8.2.1 Design Requirements

A typical application requires only four components: an input capacitor, a soft-start capacitor, an output filter capacitor and an output filter inductor. To properly size the components for the application, the designer needs the following parameters: input voltage range, output voltage, output current range, and required switching frequency. These four main parameters affect the choices of component available to achieve a proper system behavior.

#### 8.2.2 Detailed Design Procedure

##### 8.2.2.1 Input Capacitor ( $C_{IN}$ )

Fast switching of large currents in the buck converter places a heavy demand on the voltage source supplying PVIN. The input capacitor,  $C_{IN}$ , supplies extra charge when the switcher needs to draw a burst of current from the supply. The RMS current rating and the voltage rating of the  $C_{IN}$  capacitor are therefore important in the selection of  $C_{IN}$ . The RMS current specification can be approximated by [Equation 1](#):

$$I_{RMS} = I_{LOAD} \sqrt{D(1-D)}$$

where

- $D$  is the duty cycle,  $V_{OUT}/V_{IN}$ .  $C_{IN}$  also provides filtering of the supply. (1)

Trace resistance and inductance degrade the benefits of the input capacitor, so  $C_{IN}$  must be placed very close to PVIN in the layout. A 22- $\mu$ F or 47- $\mu$ F ceramic capacitor is typically sufficient for  $C_{IN}$ . In parallel with the large input capacitance a smaller capacitor may be added such as a 1- $\mu$ F ceramic for higher frequency filtering.

## Typical Application (continued)

### 8.2.2.2 Soft-Start Capacitor ( $C_{SS}$ )

The DAC that sets the reference voltage of the error amp sources a current through a resistor to set the reference voltage. The reference voltage is one half of the output voltage of the switcher due to the 200 k $\Omega$  divider connected to the SNS pin. Upon start-up, the output voltage of the switcher tracks the reference voltage with a two to one ratio as the DAC current charges the capacitance connected to the reference voltage node. Internal capacitance of 20 pF is permanently attached to the reference voltage node which is also connected to the soft-start pin, SS. Adding a soft-start capacitor externally increases the time it takes for the output voltage to reach its final level.

The charging time required for the reference voltage can be estimated using the RC time constant of the DAC resistor and the capacitance connected to the SS pin. Three RC time constant periods are needed for the reference voltage to reach 95% of its final value. The actual start-up time varies with differences in the DAC resistance and higher-order effects.

If little or no soft-start capacitance is connected, then the start-up time may be determined by the time required for the current limit current to charge the output filter capacitance. The capacitor charging equation  $I = C \Delta V / \Delta t$  can be used to estimate the start-up time in this case. For example, a part with a 3-V output, a 100- $\mu$ F output capacitance and a 3-A current limit threshold would require a time of 100  $\mu$ s, seen in [Equation 2](#):

$$\Delta t = C \frac{\Delta V}{I} = 100 \mu\text{F} \frac{3\text{V}}{3\text{A}} = 100 \mu\text{s} \quad (2)$$

Since it is undesirable for the power supply to start up in current limit, a soft-start capacitor must be chosen to force the LM2852 to start up in a more controlled fashion based on the charging of the soft-start capacitance. In this example, suppose a 3 ms start time is desired. Three time constants are required for charging the soft-start capacitor to 95% of the final reference voltage. So in this case  $RC = 1$  ms. The DAC resistor, R, is 400 k $\Omega$  so C can be calculated to be 2.5 nF. A 2.7-nF ceramic capacitor can be chosen to yield approximately a 3 ms start-up time.

### 8.2.2.3 Soft-Start Capacitor ( $C_{SS}$ ) and Fault Conditions

Various fault conditions such as short circuit and UVLO of the LM2852 activate internal circuitry designed to control the voltage on the soft-start capacitor. For example, during a short circuit current limit event, the output voltage typically falls to a low voltage. During this time, the soft-start voltage is forced to track the output so that once the short is removed, the LM2852 can restart gracefully from whatever voltage the output reached during the short circuit event. The range of soft-start capacitors is therefore restricted to values 1 nF to 50 nF.

### 8.2.2.4 Compensation

The LM2852 provides a highly integrated solution to power supply design. The compensation of the LM2852, which is type-three, is included on-chip. The benefit to integrated compensation is straightforward, simple power supply design. Since the output filter capacitor and inductor values impact the compensation of the control loop, the range of L, C and  $C_{ESR}$  values is restricted in order to ensure stability.

## Typical Application (continued)

### 8.2.2.5 Output Filter Values

**Table 1** details the recommended inductor and capacitor ranges for the LM2852 that are suggested for various typical output voltages. Values slightly different than those recommended may be used, however the phase margin of the power supply may be degraded.

**Table 1. Output Filter Values**

| FREQUENCY<br>OPTION   | V <sub>OUT</sub> (V) | P <sub>VIN</sub> (V) | L (μH) |     | C (μF) |     | C <sub>ESR</sub> (mΩ)                                                                                                 |     |
|-----------------------|----------------------|----------------------|--------|-----|--------|-----|-----------------------------------------------------------------------------------------------------------------------|-----|
|                       |                      |                      | MIN    | MAX | MIN    | MAX | MIN                                                                                                                   | MAX |
| LM2852Y<br>(500 kHz)  | 0.8                  | 3.3                  | 10     | 15  | 100    | 220 | 70                                                                                                                    | 200 |
|                       | 0.8                  | 5                    | 10     | 15  | 100    | 120 | 70                                                                                                                    | 200 |
|                       | 1                    | 3.3                  | 10     | 15  | 100    | 180 | 70                                                                                                                    | 200 |
|                       | 1                    | 5                    | 10     | 15  | 100    | 180 | 70                                                                                                                    | 200 |
|                       | 1.2                  | 3.3                  | 10     | 15  | 100    | 180 | 70                                                                                                                    | 200 |
|                       | 1.2                  | 5                    | 15     | 22  | 100    | 120 | 70                                                                                                                    | 200 |
|                       | 1.5                  | 3.3                  | 10     | 15  | 100    | 120 | 70                                                                                                                    | 200 |
|                       | 1.5                  | 5                    | 22     | 22  | 100    | 120 | 70                                                                                                                    | 200 |
|                       | 1.8                  | 3.3                  | 10     | 15  | 100    | 120 | 100                                                                                                                   | 200 |
|                       | 1.8                  | 5                    | 22     | 33  | 100    | 120 | 100                                                                                                                   | 200 |
|                       | 2.5                  | 3.3                  | 6.8    | 10  | 68     | 120 | 95                                                                                                                    | 275 |
|                       | 2.5                  | 5                    | 15     | 22  | 68     | 120 | 95                                                                                                                    | 275 |
|                       | 3.3                  | 5                    | 15     | 22  | 68     | 100 | 100                                                                                                                   | 275 |
| LM2852X<br>(1500 kHz) | 0.8                  | 3.3                  | 1      | 10  | 10     | 10  | The 1500-kHz version is<br>designed for ceramic output<br>capacitors, which typically have<br>very low ESR (< 10 mΩ.) |     |
|                       | 0.8                  | 5                    |        |     |        |     |                                                                                                                       |     |
|                       | 1                    | 3.3                  |        |     |        |     |                                                                                                                       |     |
|                       | 1                    | 5                    |        |     |        |     |                                                                                                                       |     |
|                       | 1.2                  | 3.3                  |        |     |        |     |                                                                                                                       |     |
|                       | 1.2                  | 5                    |        |     |        |     |                                                                                                                       |     |
|                       | 1.5                  | 3.3                  |        |     |        |     |                                                                                                                       |     |
|                       | 1.5                  | 5                    |        |     |        |     |                                                                                                                       |     |
|                       | 1.8                  | 3.3                  |        |     |        |     |                                                                                                                       |     |
|                       | 1.8                  | 5                    |        |     |        |     |                                                                                                                       |     |
|                       | 2.5                  | 3.3                  |        |     |        |     |                                                                                                                       |     |
|                       | 2.5                  | 5                    |        |     |        |     |                                                                                                                       |     |
|                       | 3.3                  | 5                    |        |     |        |     |                                                                                                                       |     |

### 8.2.2.6 Choosing an Inductance Value

The current ripple present in the output filter inductor is determined by the input voltage, output voltage, switching frequency and inductance according to [Equation 3](#):

$$\Delta I_L = \frac{D \times (V_{IN} - V_{OUT})}{f \times L}$$

where

- $\Delta I_L$  is the peak-to-peak current ripple.
- D is the duty cycle  $V_{OUT}/V_{IN}$ .
- $V_{IN}$  is the input voltage applied to the PVIN pin.
- $V_{OUT}$  is the output voltage of the switcher.
- f is the switching frequency.
- L is the inductance of the output filter inductor.

(3)

Knowing the current ripple is important for inductor selection since the peak current through the inductor is the load current plus one half the ripple current. Care must be taken to ensure the peak inductor current does not reach a level high enough to trip the current limit circuitry of the LM2852.

As an example, consider a 5-V to 1.2-V conversion and a 500-kHz switching frequency. According to [Table 1](#), a 15- $\mu$ H inductor may be used. Calculating the expected peak-to-peak ripple, as seen in [Equation 4](#).

$$\Delta I_L = \frac{\frac{1.2V}{5V} \times (5V - 1.2V)}{500 \text{ kHz} \times 15 \mu\text{H}} = 121.6 \text{ mA}$$

(4)

The maximum inductor current for a 2-A load would therefore be 2 A plus 60.8 mA, 2.0608 A. As shown in the ripple equation, the current ripple is inversely proportional to inductance.

### 8.2.2.7 Output Filter Inductors

Once the inductance value is chosen, the key parameter for selecting the output filter inductor is its saturation current ( $I_{sat}$ ) specification. Typically  $I_{sat}$  is given by the manufacturer as the current at which the inductance of the coil falls to a certain percentage of the nominal inductance. The  $I_{sat}$  of an inductor used in an application must be greater than the maximum expected inductor current to avoid saturation. [Table 2](#) lists the inductors that may be suitable in LM2852 applications.

**Table 2. LM2852 Output Filter Inductors**

| INDUCTANCE ( $\mu$ H) | PART NUMBER    | VENDOR    |
|-----------------------|----------------|-----------|
| 1                     | DO1608C-102    | Coilcraft |
| 1                     | DO1813P-102HC  | Coilcraft |
| 6.8                   | DO3316P-682    | Coilcraft |
| 7                     | MSS1038-702NBC | Coilcraft |
| 10                    | DO3316P-103    | Coilcraft |
| 10                    | MSS1038-103NBC | Coilcraft |
| 12                    | MSS1038-123NBC | Coilcraft |
| 15                    | DO3316P-153    | Coilcraft |
| 15                    | MSS1038-153NBC | Coilcraft |
| 18                    | MSS1038-183NBC | Coilcraft |
| 22                    | DO3316P-223    | Coilcraft |
| 22                    | MSS1038-223NBC | Coilcraft |
| 22                    | DO3340P-223    | Coilcraft |
| 27                    | MSS1038-273NBC | Coilcraft |
| 33                    | MSS1038-333NBC | Coilcraft |
| 33                    | DO3340P-333    | Coilcraft |

### 8.2.2.8 Output Filter Capacitors

The capacitors that may be used in the output filter with the LM2852 are limited in value and ESR range according to [Table 1](#). [Table 3](#) lists some examples of capacitors that can typically be used in an LM2852 application.

**Table 3. LM2852 Output Filter Capacitors**

| CAPACITANCE ( $\mu\text{F}$ ) | PART NUMBER       | CHEMISTRY     | VENDOR           |
|-------------------------------|-------------------|---------------|------------------|
| 10                            | GRM31MR61A106KE19 | Ceramic       | Murata           |
| 10                            | GRM32DR61E106K    | Ceramic       | Murata           |
| 68                            | 595D686X_010C2T   | Tantalum      | Vishay - Sprague |
| 68                            | 595D686X_016D2T   | Tantalum      | Vishay - Sprague |
| 100                           | 595D107X_6R3C2T   | Tantalum      | Vishay - Sprague |
| 100                           | 595D107X_016D2T   | Tantalum      | Vishay - Sprague |
| 100                           | NOSC107M004R0150  | Niobium Oxide | AVX              |
| 100                           | NOSD107M006R0100  | Niobium Oxide | AVX              |
| 120                           | 595D127X_004C2T   | Tantalum      | Vishay - Sprague |
| 120                           | 595D127X_010D2T   | Tantalum      | Vishay - Sprague |
| 150                           | 595D157X_004C2T   | Tantalum      | Vishay - Sprague |
| 150                           | 595D157X_016D2T   | Tantalum      | Vishay - Sprague |
| 150                           | NOSC157M004R0150  | Niobium Oxide | AVX              |
| 150                           | NOSD157M006R0100  | Niobium Oxide | AVX              |
| 220                           | 595D227X_004D2T   | Tantalum      | Vishay - Sprague |
| 220                           | NOSD227M004R0100  | Niobium Oxide | AVX              |
| 220                           | NOSE227M006R0100  | Niobium Oxide | AVX              |

**Table 4. Bill of Materials for 500kHz (LM2852Y) 3.3 V<sub>IN</sub> to 1.8 V<sub>OUT</sub> Conversion**

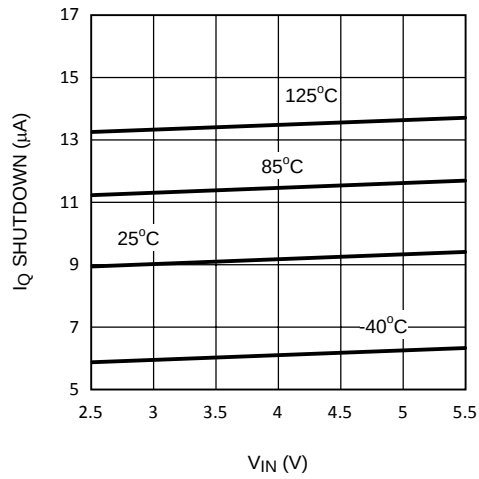
| ID               | PART NUMBER        | TYPE      | SIZE          | PARAMETERS                              | QTY | VENDOR          |
|------------------|--------------------|-----------|---------------|-----------------------------------------|-----|-----------------|
| U <sub>1</sub>   | LM2852YMXA-1.8     | 2-A buck  | HTSSOP-14     |                                         | 1   | TI              |
| L <sub>O</sub>   | DO3316P-153        | Inductor  |               | 15 $\mu\text{H}$                        | 1   | Coilcraft       |
| C <sub>O</sub> * | 595D107X_6R3C2T    | Capacitor | Case Code "C" | 100 $\mu\text{F}$ $\pm 20\%$            | 1   | Vishay-Sprague  |
| C <sub>IN</sub>  | GRM32ER60J476ME20B | Capacitor | 1210          | 47 $\mu\text{F}/\text{X5R}/6.3\text{V}$ | 1   | Murata          |
| C <sub>INX</sub> | GRM21BR71C105KA01B | Capacitor | 0805          | 1 $\mu\text{F}/\text{X7R}/16\text{V}$   | 1   | Murata          |
| C <sub>SS</sub>  | VJ0805Y272KXXA     | Capacitor | 0805          | 2.7 nF $\pm 10\%$                       | 1   | Vishay-Vitramon |
| R <sub>f</sub>   | CRCW060310R0F      | Resistor  | 0603          | 10 $\Omega$ $\pm 10\%$                  | 1   | Vishay-Dale     |
| C <sub>f</sub>   | GRM21BR71C105KA01B | Capacitor | 0805          | 1 $\mu\text{F}/\text{X7R}/16\text{V}$   | 1   | Murata          |

**Table 5. Bill of Materials for 1500-kHz (LM2852X) 3.3-V to 1.8-V Conversion**

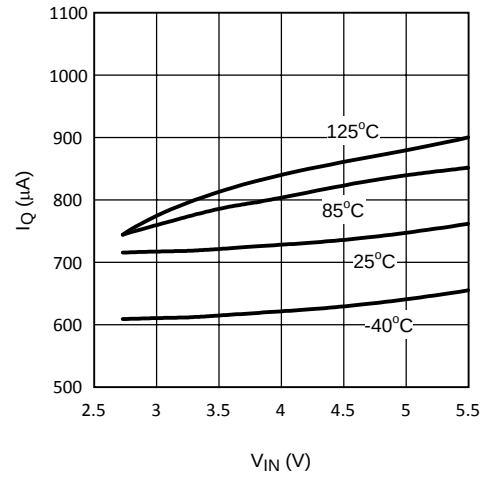
| ID               | PART NUMBER        | TYPE      | SIZE      | PARAMETERS                              | QTY | VENDOR          |
|------------------|--------------------|-----------|-----------|-----------------------------------------|-----|-----------------|
| U <sub>1</sub>   | LM2852XMXA-1.8     | 2-A buck  | HTSSOP-14 |                                         | 1   | TI              |
| L <sub>O</sub>   | DO1813P-102HC      | Inductor  |           | 1 $\mu\text{H}$                         | 1   | Coilcraft       |
| C <sub>O</sub>   | GRM32DR61E106K     | Capacitor | 1210      | 10 $\mu\text{F}/\text{X5R}/25\text{V}$  | 1   | Murata          |
| C <sub>IN</sub>  | GRM32ER60J476ME20B | Capacitor | 1210      | 47 $\mu\text{F}/\text{X5R}/6.3\text{V}$ | 1   | Murata          |
| C <sub>INX</sub> | GRM21BR71C105KA01B | Capacitor | 0805      | 1 $\mu\text{F}/\text{X7R}/16\text{V}$   | 1   | Murata          |
| C <sub>SS</sub>  | VJ0805Y272KXXA     | Capacitor | 0805      | 2.7 nF $\pm 10\%$                       | 1   | Vishay-Vitramon |
| R <sub>f</sub>   | CRCW060310R0F      | Resistor  | 0603      | 10 $\Omega$ $\pm 10\%$                  | 1   | Vishay-Dale     |
| C <sub>f</sub>   | GRM21BR71C105KA01B | Capacitor | 0805      | 1 $\mu\text{F}/\text{X7R}/16\text{V}$   | 1   | Murata          |



### 8.2.3 Application Curves



**Figure 14. Shutdown Current vs V<sub>IN</sub>**



**Figure 15. Quiescent Current (Non-Switching) vs V<sub>IN</sub>**

## 9 Power Supply Recommendations

The LM2852 is designed to operate from various DC power supplies. If so, VIN input must be protected from reversal voltage and voltage dump over 6.5 V. The impedance of the input supply rail must be low enough that the input current transient does not cause drop below VIN UVLO level. If the input supply is connected by using long wires, additional bulk capacitance may be required in addition to normal input capacitor.

## 10 Layout

### 10.1 Layout Guidelines

These are several guidelines to follow while designing the PCB layout for an LM2852 application.

- The input bulk capacitor,  $C_{IN}$ , must be placed very close to the PVIN pin to keep the resistance as low as possible between the capacitor and the pin. High-current levels are present in this connection
- All ground connections must be tied together. Use a broad ground plane, for example a completely filled back plane, to establish the lowest resistance possible between all ground connections
- The sense pin connection must be made as close to the load as possible so that the voltage at the load is the expected regulated value. The sense line must not run too close to nodes with high EMI (such as the switch node) to minimize interference
- The switch node connections must be low resistance to reduce power losses. Low resistance means the trace between the switch pin and the inductor must be wide. However, the area of the switch node must not be too large since EMI increases with greater area. So connect the inductor to the switch pin with a short, but wide trace. Other high current connections in the application such as PVIN and VOUT assume the same trade off between low resistance and EMI
- Allow area under the chip to solder the entire exposed die attach pad to ground for improved thermal and electrical performance

### 10.2 Layout Example

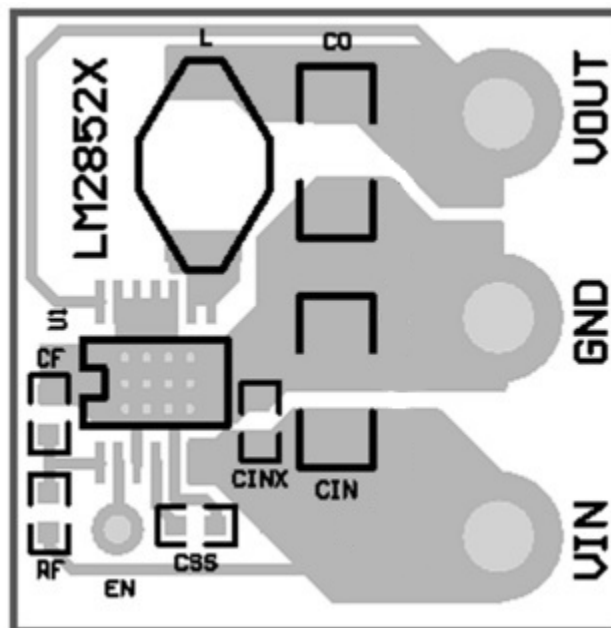


Figure 16. PCB Layout Example

## 11 Device and Documentation Support

### 11.1 Device Support

#### 11.1.1 Third-Party Products Disclaimer

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### 11.2 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At [e2e.ti.com](http://e2e.ti.com), you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 11.3 Trademarks

E2E is a trademark of Texas Instruments.  
All other trademarks are the property of their respective owners.

### 11.4 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 11.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

| Orderable part number                | Status<br>(1) | Material type<br>(2) | Package   Pins    | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|--------------------------------------|---------------|----------------------|-------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| LM2852XMXA-1.0/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.0        |
| <a href="#">LM2852XMXA-1.0/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.0        |
| LM2852XMXA-1.2/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.2        |
| <a href="#">LM2852XMXA-1.2/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.2        |
| LM2852XMXA-1.5/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.5        |
| <a href="#">LM2852XMXA-1.5/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.5        |
| LM2852XMXA-1.8/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.8        |
| <a href="#">LM2852XMXA-1.8/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.8        |
| LM2852XMXA-2.5/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>2.5        |
| <a href="#">LM2852XMXA-2.5/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>2.5        |
| LM2852XMXA-3.3/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>3.3        |
| <a href="#">LM2852XMXA-3.3/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>3.3        |
| LM2852XMXAX-1.2/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.2        |
| <a href="#">LM2852XMXAX-1.2/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.2        |
| LM2852XMXAX-1.5/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.5        |
| <a href="#">LM2852XMXAX-1.5/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.5        |

| Orderable part number                | Status<br>(1) | Material type<br>(2) | Package   Pins    | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|--------------------------------------|---------------|----------------------|-------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| LM2852XMXAX-1.8/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.8        |
| <a href="#">LM2852XMXAX-1.8/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>1.8        |
| LM2852XMXAX-2.5/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>2.5        |
| <a href="#">LM2852XMXAX-2.5/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>2.5        |
| LM2852XMXAX-3.3/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>3.3        |
| <a href="#">LM2852XMXAX-3.3/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852X<br>3.3        |
| LM2852YMXA-1.0/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.0       |
| <a href="#">LM2852YMXA-1.0/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.0       |
| LM2852YMXA-1.2/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.2       |
| <a href="#">LM2852YMXA-1.2/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.2       |
| LM2852YMXA-1.3/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>1.3        |
| <a href="#">LM2852YMXA-1.3/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -            | 2852Y<br>1.3        |
| LM2852YMXA-1.5/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.5       |
| <a href="#">LM2852YMXA-1.5/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.5       |
| LM2852YMXA-1.8/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.8       |
| <a href="#">LM2852YMXA-1.8/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.8       |
| LM2852YMXA-2.5/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-2.5       |

| Orderable part number                | Status<br>(1) | Material type<br>(2) | Package   Pins    | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|--------------------------------------|---------------|----------------------|-------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">LM2852YMXA-2.5/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-2.5       |
| LM2852YMXA-3.3/NO.A                  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-3.3       |
| <a href="#">LM2852YMXA-3.3/NOPB</a>  | Active        | Production           | HTSSOP (PWP)   14 | 94   TUBE             | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-3.3       |
| LM2852YMXAX-1.0/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.0       |
| <a href="#">LM2852YMXAX-1.0/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.0       |
| LM2852YMXAX-1.2/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.2       |
| <a href="#">LM2852YMXAX-1.2/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.2       |
| LM2852YMXAX-1.5/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.5       |
| <a href="#">LM2852YMXAX-1.5/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.5       |
| LM2852YMXAX-1.8/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.8       |
| <a href="#">LM2852YMXAX-1.8/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-1.8       |
| LM2852YMXAX-2.5/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-2.5       |
| <a href="#">LM2852YMXAX-2.5/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-2.5       |
| LM2852YMXAX-3.3/NO.A                 | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-3.3       |
| <a href="#">LM2852YMXAX-3.3/NOPB</a> | Active        | Production           | HTSSOP (PWP)   14 | 2500   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 2852Y<br>-3.3       |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## TAPE AND REEL INFORMATION



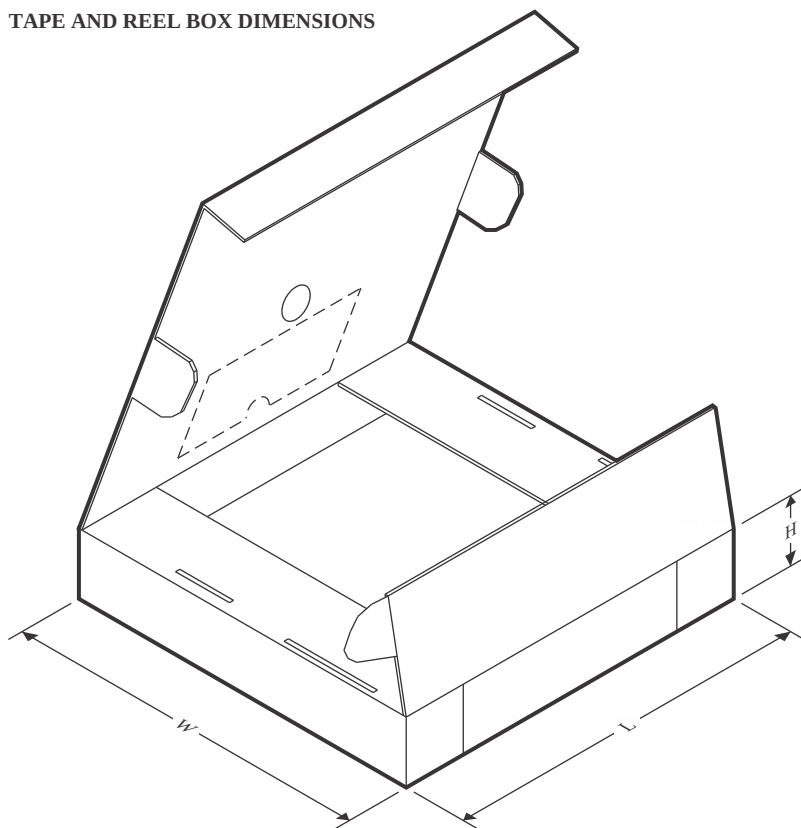
\*All dimensions are nominal

| Device                | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM2852XXAX-1.2/ NOPB  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XXAX-1.5/ NOPB  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XXAX-1.8/ NOPB  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XXAX-2.5/ NOPB  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XXAX-3.3/ NOPB  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YXXAX-1.0/ NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YXXAX-1.2/ NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YXXAX-1.5/ NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YXXAX-1.8/ NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |



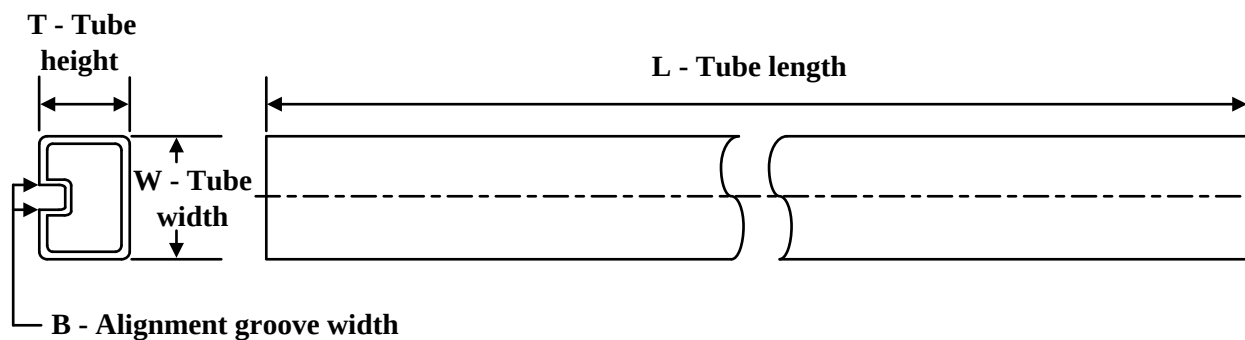
| Device                | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM2852YMXAX-2.5/ NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YMXAX-3.3/ NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



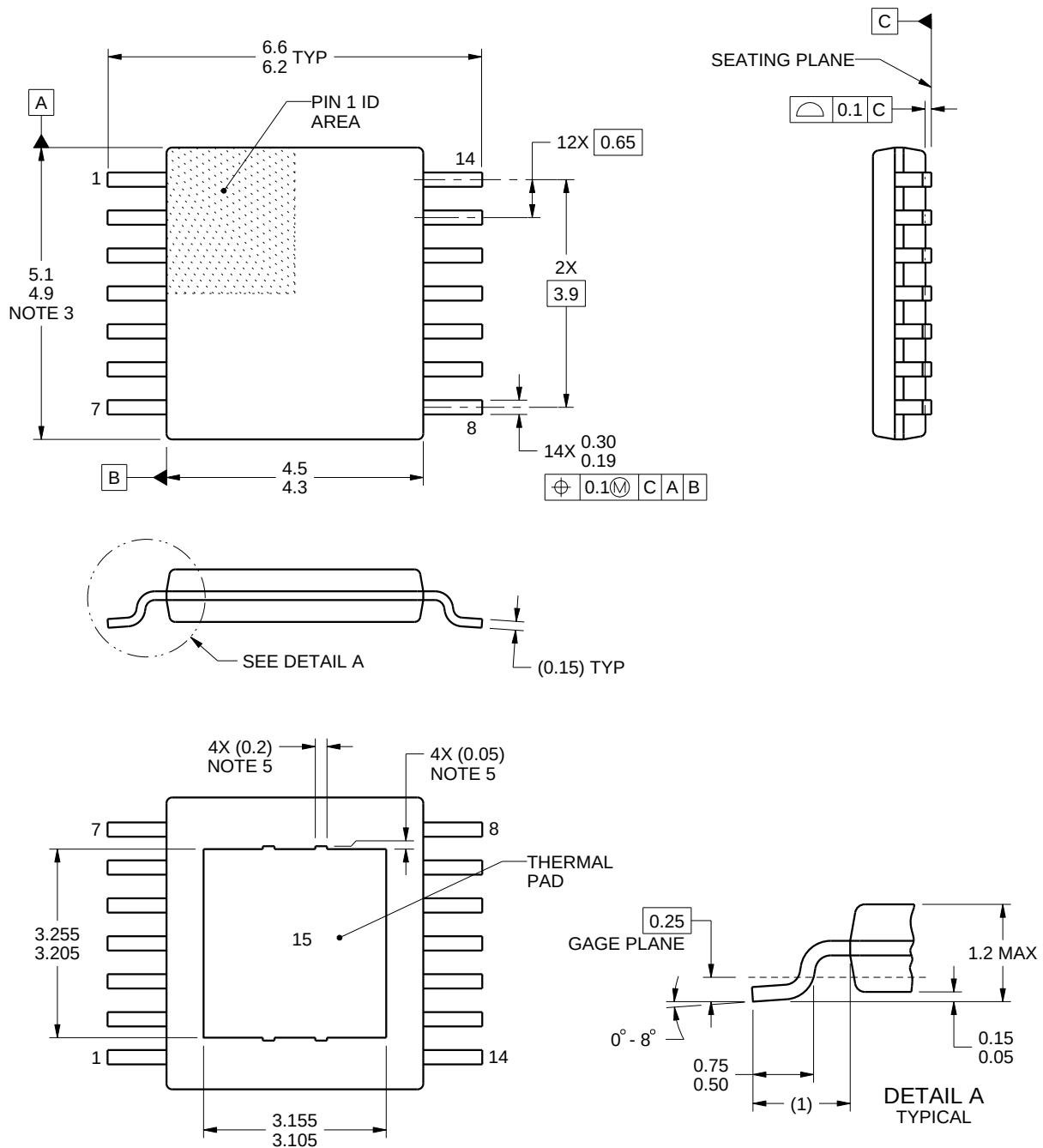
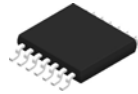
\*All dimensions are nominal

| Device               | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM2852XMXX-1.2/NOPB  | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMXX-1.5/NOPB  | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMXX-1.8/NOPB  | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMXX-2.5/NOPB  | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMXX-3.3/NOPB  | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMXAX-1.0/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMXAX-1.2/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMXAX-1.5/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMXAX-1.8/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMXAX-2.5/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMXAX-3.3/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |

**TUBE**


\*All dimensions are nominal

| Device              | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|---------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| LM2852XMXA-1.0/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-1.0/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-1.2/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-1.2/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-1.5/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-1.5/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-1.8/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-1.8/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-2.5/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-2.5/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-3.3/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852XMXA-3.3/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.0/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.0/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.2/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.2/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.3/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.3/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.5/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.5/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.8/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-1.8/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-2.5/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-2.5/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-3.3/NO.A | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |
| LM2852YMXA-3.3/NOPB | PWP          | HTSSOP       | 14   | 94  | 495    | 8      | 2514.6 | 4.06   |



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## NOTES:

PowerPAD is a trademark of Texas Instruments.

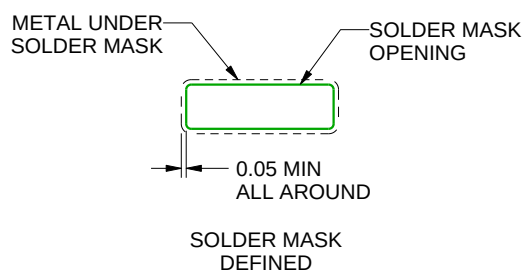
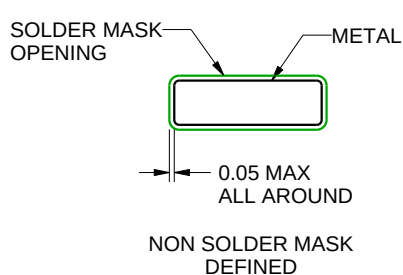
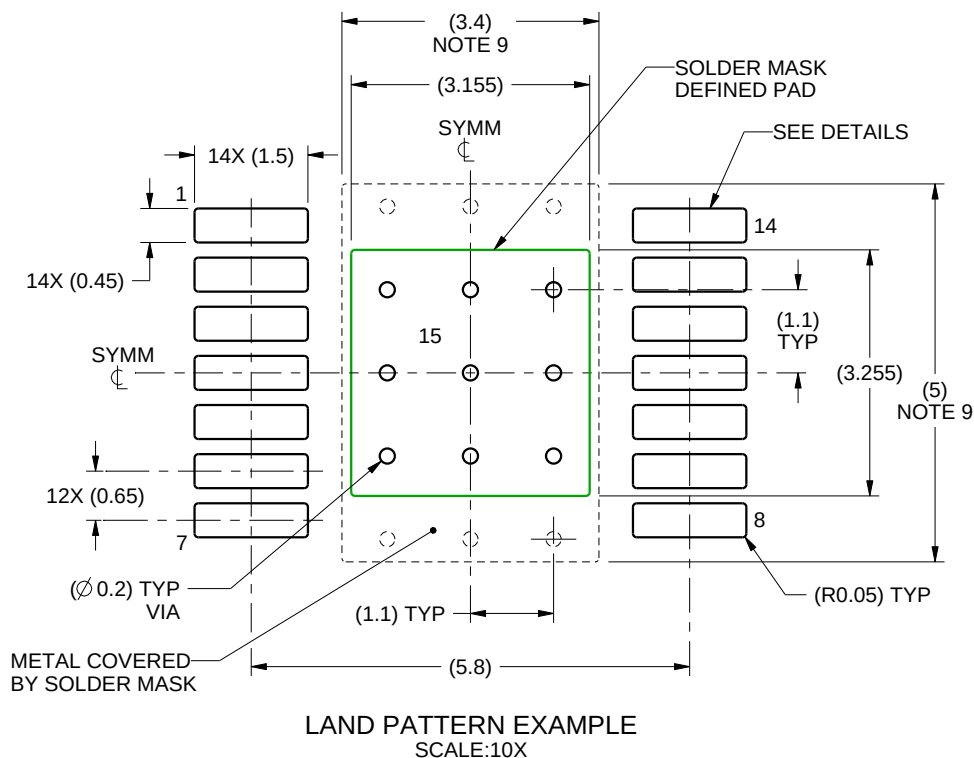
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-153.
5. Features may differ and may not be present.

# EXAMPLE BOARD LAYOUT

PWP0014A

PowerPAD™ TSSOP - 1.2 mm max height

PLASTIC SMALL OUTLINE



SOLDER MASK DETAILS  
PADS 1-14

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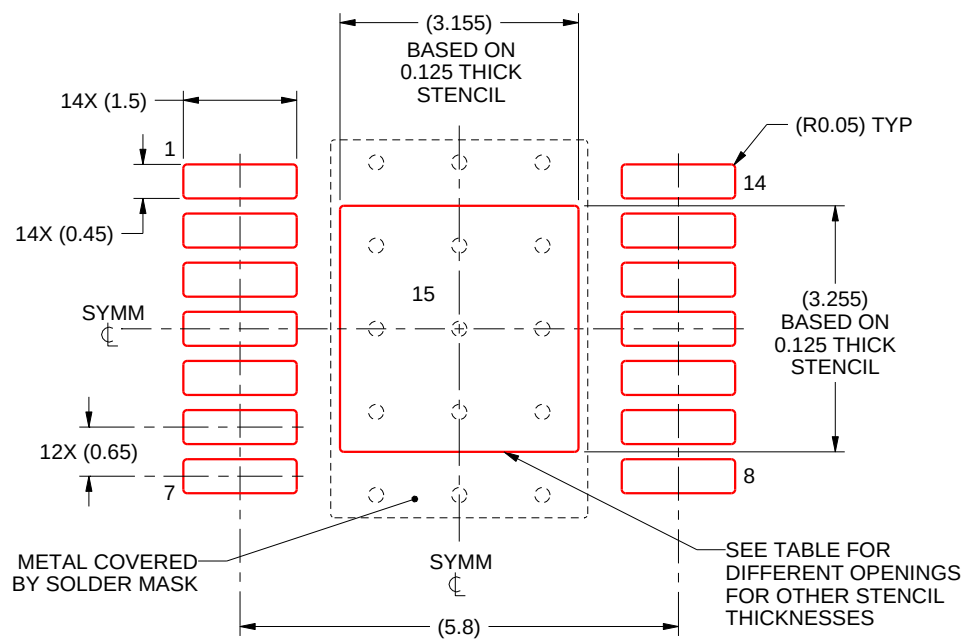
NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature numbers SLMA002 ([www.ti.com/lit/slma002](http://www.ti.com/lit/slma002)) and SLMA004 ([www.ti.com/lit/slma004](http://www.ti.com/lit/slma004)).
9. Size of metal pad may vary due to creepage requirement.

**PWP0014A**

## PowerPAD™ TSSOP - 1.2 mm max height

## PLASTIC SMALL OUTLINE



SOLDER PASTE EXAMPLE  
EXPOSED PAD  
100% PRINTED SOLDER COVERAGE BY AREA  
SCALE:10X

| STENCIL THICKNESS | SOLDER STENCIL OPENING |
|-------------------|------------------------|
| 0.1               | 3.53 X 3.64            |
| 0.125             | 3.155 X 3.255 (SHOWN)  |
| 0.15              | 2.88 X 2.97            |
| 0.175             | 2.67 X 2.75            |

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NOTES: (continued)

10. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
11. Board assembly site may have different recommendations for stencil design.

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