

## LM2852 2A 500/1500kHz Synchronous SIMPLE SWITCHER® Buck Regulator

Check for Samples: [LM2852](#)

### FEATURES

- Input Voltage Range of 2.85 to 5.5V
- Factory EEPROM Set Output Voltages from 0.8V to 3.3V in 100mV Increments
- Maximum Load Current of 2A
- Voltage Mode Control
- Internal Type-Three Compensation
- Switching Frequency of 500kHz or 1.5MHz
- Low Standby Current of 10µA
- Internal 60 mΩ MOSFET Switches
- Standard Voltage Options  
0.8/1.0/1.2/1.5/1.8/2.5/3.3 Volts

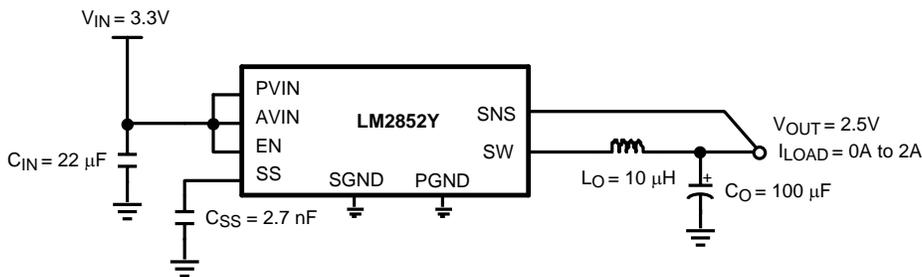
### DESCRIPTION

The LM2852 SIMPLE SWITCHER® 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 2.85V and 5.5V and deliver an output voltage that is factory programmable from 0.8V to 3.3V in 100mV increments. The LM2852 is available with a choice of two switching frequencies - 500kHz (LM2852Y) or 1.5MHz (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.

### APPLICATIONS

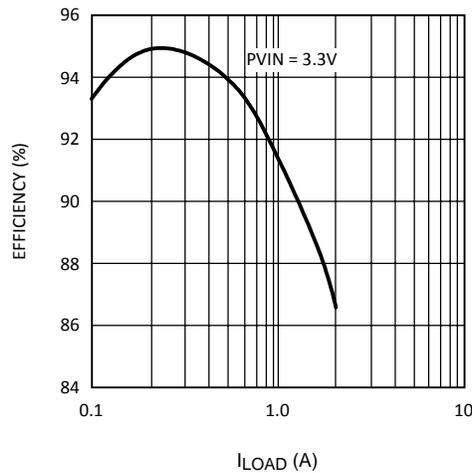
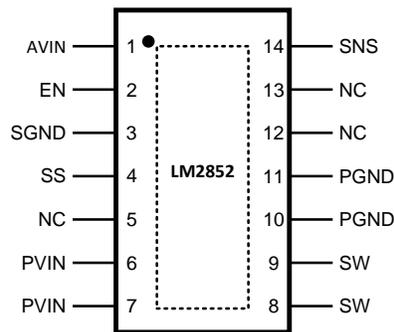
- Low Voltage Point of Load Regulation
- Local Solution for FPGA/DSP/ASIC Core Power
- Broadband Networking and Communications Infrastructure
- Portable Computing

### Typical Application Circuit



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**Figure 1. Efficiency vs  $I_{LOAD}$** **Connection Diagram****Figure 2. 14-Pin HTSSOP – Top View  
See Package Number PWP0014A****PIN DESCRIPTIONS**

|  |
|--|
| <b>AVIN (Pin 1):</b> Chip bias input pin. This provides power to the logic of the chip. Connect to the input voltage or a separate rail.                             |
| <b>EN (Pin 2):</b> 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.     |
| <b>SGND (Pin 3):</b> Signal ground.  |
| <b>SS (Pin 4):</b> 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. |
| <b>NC (Pins 5, 12 and 13):</b> No connect. These pins must be tied to ground or left floating in the application.  |
| <b>PVIN (Pins 6, 7):</b> Input supply pin. PVIN is connected to the input voltage. This rail connects to the source of the internal power PFET.                      |
| <b>SW (Pins 8, 9):</b> Switch pin. Connect to the output inductor.   |
| <b>PGND (Pins 10, 11):</b> Power ground. Connect this to an internal ground plane or other large ground plane.   |
| <b>SNS (Pin 14):</b> Output voltage sense pin. Connect this pin to the output voltage as close to the load as possible.  |
| <b>Exposed Pad:</b> Connect to ground.   |



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.

### Absolute Maximum Ratings<sup>(1)(2)</sup>

|                                   |                      |                    |
|-----------------------------------|----------------------|--------------------|
| PVIN, AVIN, EN, SNS               |                      | -0.3V to 6.5V      |
| ESD Susceptibility <sup>(3)</sup> |                      | 2kV                |
| Power Dissipation                 |                      | Internally Limited |
| Storage Temperature Range         |                      | -65°C to +150°C    |
| Maximum Junction Temp.            |                      | 150°C              |
| 14-Pin Exposed Pad HTSSOP Package | Infrared (15 sec)    | 220°C              |
|                                   | Vapor Phase (60 sec) | 215°C              |
| Soldering (10 sec)                |                      | 260°C              |

- (1) Absolute maximum ratings indicate limits beyond which damage to the device may occur. Operating Range indicates conditions for which the device is intended to be functional, but does not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.
- (3) Human body model: 1.5kΩ in series with 100pF. SW and PVIN pins are derated to 1.5kV

### Operating Ratings<sup>(1)</sup>

|                      |  |                 |
|----------------------|--|-----------------|
| PVIN to GND          |  | 1.5V to 5.5V    |
| AVIN to GND          |  | 2.85V to 5.5V   |
| Junction Temperature |  | -40°C to +125°C |
| $\theta_{JA}$        |  | 38°C/W          |

- (1) Absolute maximum ratings indicate limits beyond which damage to the device may occur. Operating Range indicates conditions for which the device is intended to be functional, but does not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics.

## Electrical Characteristics

AVIN = PVIN = 5V unless otherwise indicated under the **Conditions** column. Limits in standard type are for  $T_J = 25^\circ\text{C}$  only; limits in **boldface type** apply over the junction temperature ( $T_J$ ) range of  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ . 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.

| Symbol                                       | Parameter                        | Conditions  | Min           | Typ  | Max           | Units            |
|--|----------------------------------|---|---------------|------|---------------|------------------|
| <b>SYSTEM PARAMETERS</b>                     |                                  |   |               |      |               |                  |
| $V_{\text{OUT}}$                             | Voltage Tolerance <sup>(1)</sup> | $V_{\text{OUT}} = 0.8\text{V}$ option   | <b>0.782</b>  |      | <b>0.818</b>  | V                |
|  |                                  | $V_{\text{OUT}} = 1.0\text{V}$ option   | <b>0.9775</b> |      | <b>1.0225</b> |                  |
|  |                                  | $V_{\text{OUT}} = 1.2\text{V}$ option   | <b>1.1730</b> |      | <b>1.2270</b> |                  |
|  |                                  | $V_{\text{OUT}} = 1.5\text{V}$ option   | <b>1.4663</b> |      | <b>1.5337</b> |                  |
|  |                                  | $V_{\text{OUT}} = 1.8\text{V}$ option   | <b>1.7595</b> |      | <b>1.8405</b> |                  |
|  |                                  | $V_{\text{OUT}} = 2.5\text{V}$ option   | <b>2.4437</b> |      | <b>2.5563</b> |                  |
|  |                                  | $V_{\text{OUT}} = 3.0\text{V}$ option   | <b>2.9325</b> |      | <b>3.0675</b> |                  |
|  |                                  | $V_{\text{OUT}} = 3.3\text{V}$ option   | <b>3.2257</b> |      | <b>3.3743</b> |                  |
| $\Delta V_{\text{OUT}}/\Delta V_{\text{IN}}$ | Line Regulation <sup>(1)</sup>   | $V_{\text{OUT}} = 0.8\text{V}, 1.0\text{V}, 1.2\text{V}, 1.5\text{V}, 1.8\text{V}$ or $2.5\text{V}$<br>$2.85\text{V} \leq \text{AVIN} \leq 5.5\text{V}$ |               | 0.2  | <b>0.6</b>    | %                |
|  |                                  | $V_{\text{OUT}} = 3.3\text{V}$<br>$3.5\text{V} \leq \text{AVIN} \leq 5.5\text{V}$   |               | 0.2  | <b>0.6</b>    | %                |
| $\Delta V_{\text{OUT}}/\Delta I_{\text{O}}$  | Load Regulation                  | Normal operation  |               | 8    |               | mV/A             |
| $V_{\text{ON}}$                              | UVLO Threshold (AVIN)            | Rising  |               | 2.47 | <b>2.85</b>   | V                |
|  |                                  | Falling Hysteresis  | <b>85</b>     | 150  | <b>210</b>    | mV               |
| $r_{\text{DSON-P}}$                          | PFET On Resistance               | $I_{\text{sw}} = 2\text{A}$   |               | 75   | <b>140</b>    | m $\Omega$       |
| $r_{\text{DSON-N}}$                          | NFET On Resistance               | $I_{\text{sw}} = 2\text{A}$   |               | 55   | <b>120</b>    | m $\Omega$       |
| $R_{\text{SS}}$                              | Soft-start resistance            |   |               | 400  |               | k $\Omega$       |
| $I_{\text{CL}}$                              | Peak Current Limit Threshold     | LM2852X   | <b>2.75</b>   | 4    | <b>4.95</b>   | A                |
|  |                                  | LM2852Y   | <b>2.25</b>   | 3    | <b>3.65</b>   |                  |
| $I_{\text{Q}}$                               | Operating Current                | Non-switching   |               | 0.85 | <b>2</b>      | mA               |
| $I_{\text{SD}}$                              | Shutdown Quiescent Current       | $\text{EN} = 0\text{V}$   |               | 10   | <b>25</b>     | $\mu\text{A}$    |
| $R_{\text{SNS}}$                             | Sense pin resistance             |   |               | 400  |               | k $\Omega$       |
| <b>PWM</b>                                   |                                  |   |               |      |               |                  |
| $f_{\text{osc}}$                             | LM2852X                          | 1500kHz option.   | <b>1050</b>   | 1500 | <b>1825</b>   | kHz              |
|  | LM2852Y                          | 500kHz option.  | <b>325</b>    | 500  | <b>625</b>    |                  |
| $D_{\text{range}}$                           | Duty Cycle Range                 |   | <b>0</b>      |      | <b>100</b>    | %                |
| <b>ENABLE CONTROL<sup>(2)</sup></b>          |                                  |   |               |      |               |                  |
| $V_{\text{IH}}$                              | EN Pin Minimum High Input        |   | <b>75</b>     |      |               | % of AVIN        |
| $V_{\text{IL}}$                              | EN Pin Maximum Low Input         |   |               |      | <b>25</b>     | % of AVIN        |
| $I_{\text{EN}}$                              | EN Pin Pullup Current            | $\text{EN} = 0\text{V}$   |               | 1.2  |               | $\mu\text{A}$    |
| <b>THERMAL CONTROLS</b>                      |                                  |   |               |      |               |                  |
| $T_{\text{SD}}$                              | $T_J$ for Thermal Shutdown       |   |               | 165  |               | $^\circ\text{C}$ |
| $T_{\text{SD-HYS}}$                          | Hysteresis for Thermal Shutdown  |   |               | 10   |               | $^\circ\text{C}$ |

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

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

LM2852Y Typical Performance Characteristics (500kHz)

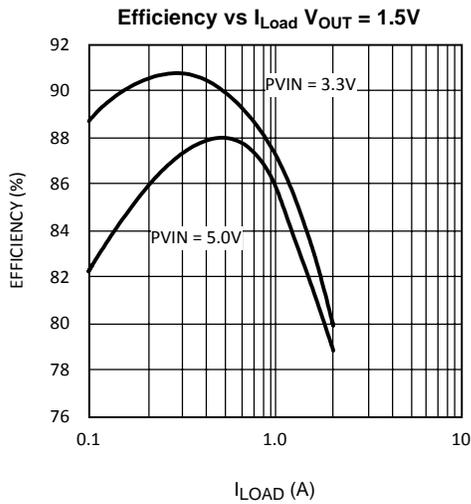


Figure 3.

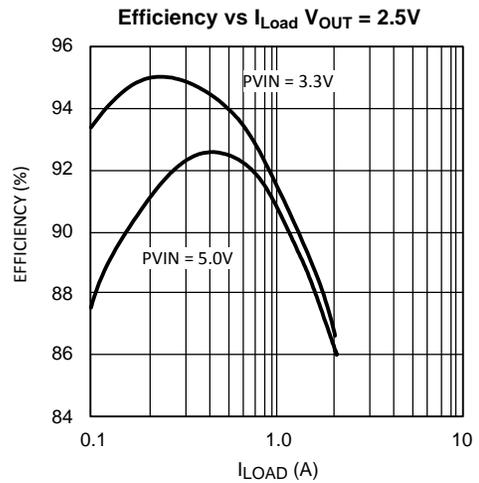


Figure 4.

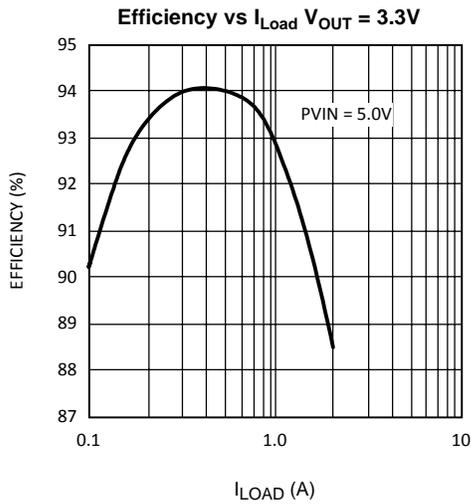


Figure 5.

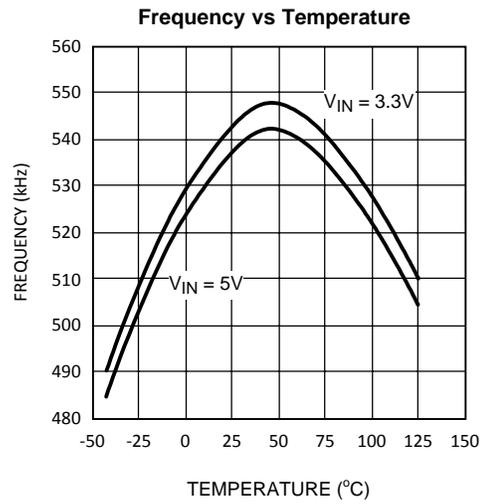
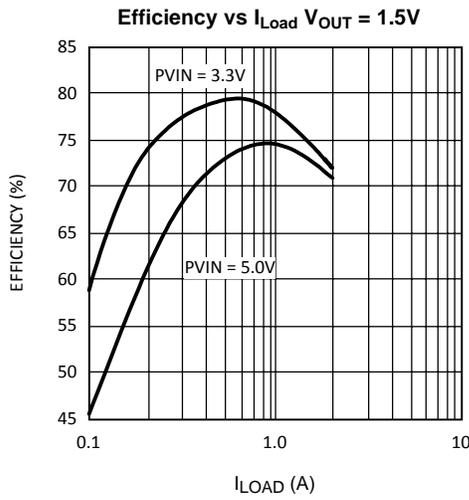
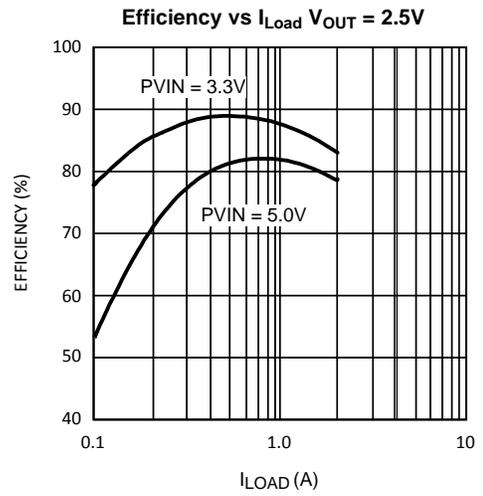


Figure 6.

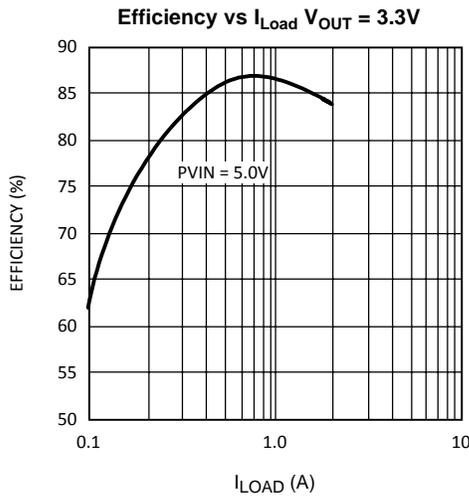
**LM2852X Typical Performance Characteristics (1500kHz)**



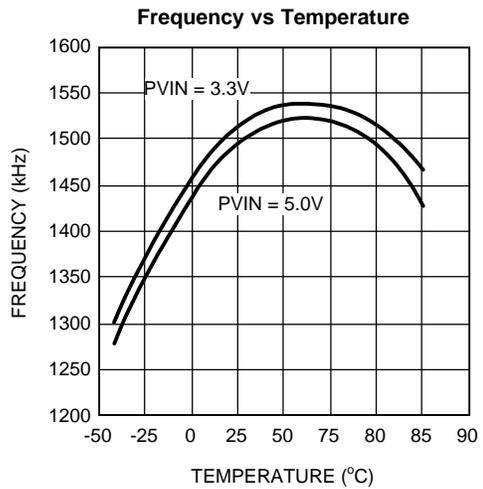
**Figure 7.**



**Figure 8.**



**Figure 9.**



**Figure 10.**

LM2852 Typical Performance Characteristics (Both Y and X Versions)

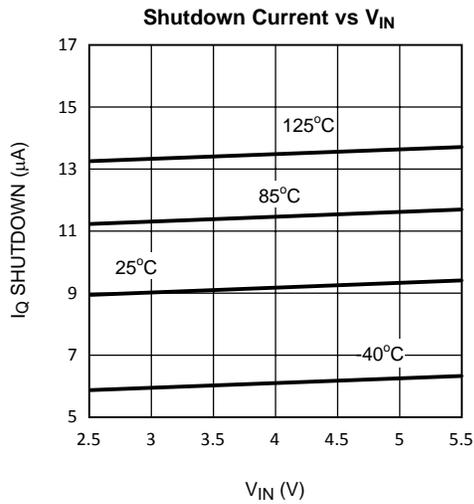


Figure 11.

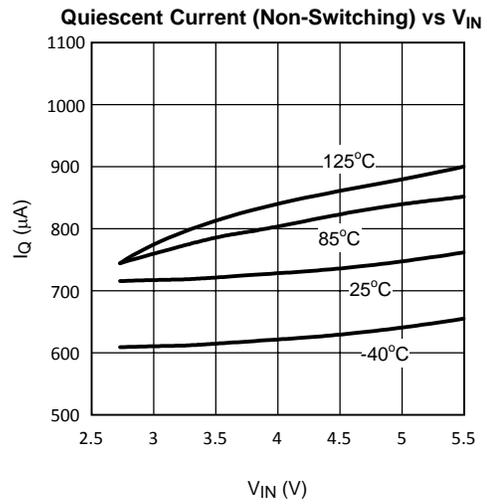


Figure 12.

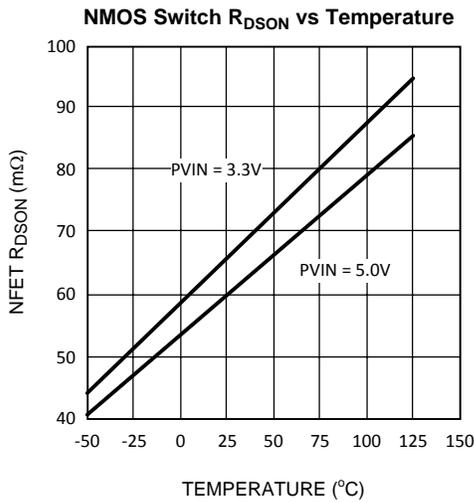


Figure 13.

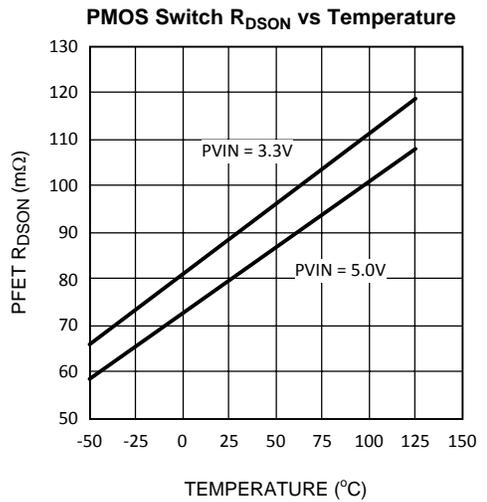
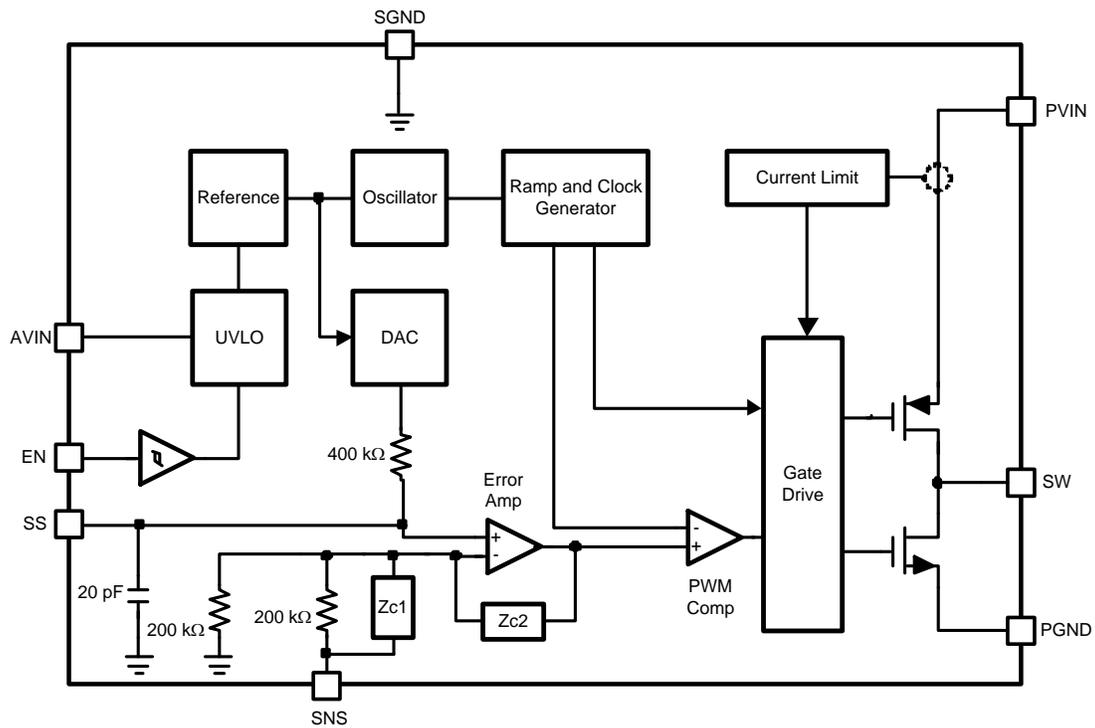


Figure 14.

Block Diagram



## APPLICATIONS INFORMATION

The LM2852 is a DC-DC synchronous buck regulator belonging to Texas Instrument's SIMPLE SWITCHER family. Integration of the PWM controller, power switches and compensation network greatly reduces the component count required to implement a switching power supply. A typical application requires only four components: an input capacitor, a soft-start capacitor, an output filter capacitor and an output filter inductor.

### 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:

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

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  $C_{IN}$  should 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.

### 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 200k $\Omega$  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 20pF 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 will vary 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 3V output, a 100  $\mu$ F output capacitance and a 3A current limit threshold would require a time of 100  $\mu$ s:

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

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  $RC=1\text{ms}$ . The DAC resistor, R, is 400 k $\Omega$  so C can be calculated to be 2.5nF. A 2.7nF ceramic capacitor can be chosen to yield approximately a 3ms start-up time.

### 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 1nF to 50nF.

## 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.

## 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 Option     | $V_{OUT}$ (V) | $PV_{IN}$ (V) | L ( $\mu$ H) |     | C ( $\mu$ F) |     | $C_{ESR}$ (m $\Omega$ ) |     |
|----------------------|---------------|---------------|--------------|-----|--------------|-----|-------------------------|-----|
|                      |               |               | Min          | Max | Min          | Max | Min                     | Max |
| LM2852Y<br>(500kHz)  | 0.8           | 3.3           | 10           | 15  | 100          | 220 | 70                      | 200 |
|                      | 0.8           | 5.0           | 10           | 15  | 100          | 120 | 70                      | 200 |
|                      | 1.0           | 3.3           | 10           | 15  | 100          | 180 | 70                      | 200 |
|                      | 1.0           | 5.0           | 10           | 15  | 100          | 180 | 70                      | 200 |
|                      | 1.2           | 3.3           | 10           | 15  | 100          | 180 | 70                      | 200 |
|                      | 1.2           | 5.0           | 15           | 22  | 100          | 120 | 70                      | 200 |
|                      | 1.5           | 3.3           | 10           | 15  | 100          | 120 | 70                      | 200 |
|                      | 1.5           | 5.0           | 22           | 22  | 100          | 120 | 70                      | 200 |
|                      | 1.8           | 3.3           | 10           | 15  | 100          | 120 | 100                     | 200 |
|                      | 1.8           | 5.0           | 22           | 33  | 100          | 120 | 100                     | 200 |
|                      | 2.5           | 3.3           | 6.8          | 10  | 68           | 120 | 95                      | 275 |
|                      | 2.5           | 5.0           | 15           | 22  | 68           | 120 | 95                      | 275 |
| 3.3                  | 5.0           | 15            | 22           | 68  | 100          | 100 | 275                     |     |
| LM2852X<br>(1500kHz) | 0.8           | 3.3           | 1            | 10  | 10           | 10  | 10                      | 275 |
|                      | 0.8           | 5.0           |              |     |              |     |                         |     |
|                      | 1.0           | 3.3           |              |     |              |     |                         |     |
|                      | 1.0           | 5.0           |              |     |              |     |                         |     |
|                      | 1.2           | 3.3           |              |     |              |     |                         |     |
|                      | 1.2           | 5.0           |              |     |              |     |                         |     |
|                      | 1.5           | 3.3           |              |     |              |     |                         |     |
|                      | 1.5           | 5.0           |              |     |              |     |                         |     |
|                      | 1.8           | 3.3           |              |     |              |     |                         |     |
|                      | 1.8           | 5.0           |              |     |              |     |                         |     |
|                      | 2.5           | 3.3           |              |     |              |     |                         |     |
|                      | 2.5           | 5.0           |              |     |              |     |                         |     |
| 3.3                  | 5.0           |               |              |     |              |     |                         |     |

The 1500kHz version is designed for ceramic output capacitors which typically have very low ESR (<10m $\Omega$ .)

## 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 the following equation:

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

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

$$\Delta I_L = \frac{\frac{1.2V}{5V} \times (5V - 1.2V)}{500 \text{ kHz} \times 15 \mu\text{H}} = 121.6 \text{ mA} \quad (4)$$

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

## 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 should be greater than the maximum expected inductor current to avoid saturation. Below is a table of 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                    | D03316P-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 |

## OUTPUT FILTER CAPACITORS

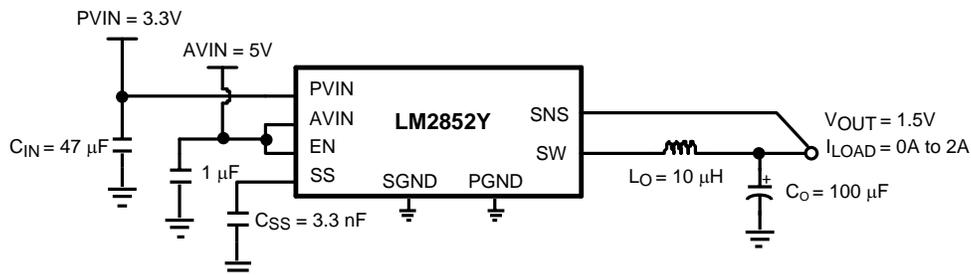
The capacitors that may be used in the output filter with the LM2852 are limited in value and ESR range according to [Table 1](#). Below are some examples of capacitors that can typically be used in an LM2852 application.

**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              |

## 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 3.3V, use output filter component values recommended for 3.3V. PVIN must always be equal to or less than AVIN.



## 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.

## LAYOUT HINTS

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

1. The input bulk capacitor,  $C_{IN}$ , should 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 will be 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 should be made as close to the load as possible so that the voltage at the load is the expected regulated value. The sense line should not run too close to nodes with high EMI (such as the switch node) to minimize interference.
- The switch node connections should be low resistance to reduce power losses. Low resistance means the trace between the switch pin and the inductor should be wide. However, the area of the switch node should 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 V<sub>OUT</sub> 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.

### LM2852 Example Circuit Schematic

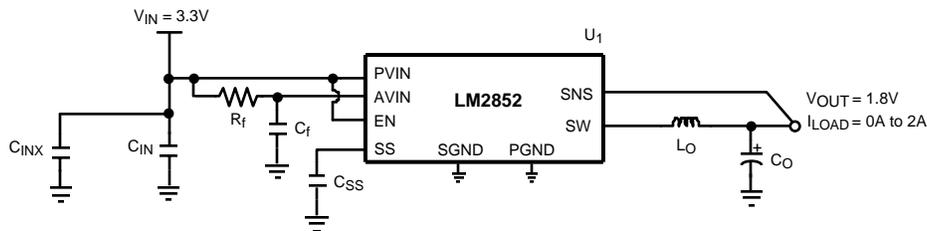


Figure 15.

Table 4. Bill of Materials for 500kHz (LM2852Y) 3.3V<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     | 2A Buck   | HTSSOP-14     |               | 1   | TI              |
| L <sub>O</sub>   | DO3316P-153        | Inductor  |               | 15 μH         | 1   | Coilcraft       |
| C <sub>O</sub> * | 595D107X_6R3C2T    | Capacitor | Case Code "C" | 100 μF ±20%   | 1   | Vishay-Sprague  |
| C <sub>IN</sub>  | GRM32ER60J476ME20B | Capacitor | 1210          | 47μF/X5R/6.3V | 1   | Murata          |
| C <sub>INX</sub> | GRM21BR71C105KA01B | Capacitor | 0805          | 1μF/X7R/16V   | 1   | Murata          |
| C <sub>SS</sub>  | VJ0805Y272KXXA     | Capacitor | 0805          | 2.7nF ±10%    | 1   | Vishay-Vitramon |
| R <sub>f</sub>   | CRCW060310R0F      | Resistor  | 0603          | 10Ω ±10%      | 1   | Vishay-Dale     |
| C <sub>f</sub>   | GRM21BR71C105KA01B | Capacitor | 0805          | 1μF/X7R/16V   | 1   | Murata          |

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

| ID               | Part Number        | Type      | Size      | Parameters    | Qty | Vendor          |
|------------------|--------------------|-----------|-----------|---------------|-----|-----------------|
| U <sub>1</sub>   | LM2852XMXA-1.8     | 2A Buck   | HTSSOP-14 |               | 1   | TI              |
| L <sub>O</sub>   | DO1813P-102HC      | Inductor  |           | 1 μH          | 1   | Coilcraft       |
| C <sub>O</sub>   | GRM32DR61E106K     | Capacitor | 1210      | 10 μF/X5R/25V | 1   | Murata          |
| C <sub>IN</sub>  | GRM32ER60J476ME20B | Capacitor | 1210      | 47μF/X5R/6.3V | 1   | Murata          |
| C <sub>INX</sub> | GRM21BR71C105KA01B | Capacitor | 0805      | 1μF/X7R/16V   | 1   | Murata          |
| C <sub>SS</sub>  | VJ0805Y272KXXA     | Capacitor | 0805      | 2.7nF ±10%    | 1   | Vishay-Vitramon |
| R <sub>f</sub>   | CRCW060310R0F      | Resistor  | 0603      | 10Ω ±10%      | 1   | Vishay-Dale     |
| C <sub>f</sub>   | GRM21BR71C105KA01B | Capacitor | 0805      | 1μF/X7R/16V   | 1   | Murata          |

## REVISION HISTORY

| Changes from Revision C (April 2013) to Revision D         | Page               |
|--|--------------------|
| • Changed layout of National Data Sheet to TI format ..... | <a href="#">13</a> |

**PACKAGING INFORMATION**

| Orderable Device    | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|---------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|-------------------------|-------------------------|
| LM2852XMXA-0.8      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>0.8            | <a href="#">Samples</a> |
| LM2852XMXA-0.8/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>0.8            | <a href="#">Samples</a> |
| LM2852XMXA-1.0      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>1.0            | <a href="#">Samples</a> |
| LM2852XMXA-1.0/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>1.0            | <a href="#">Samples</a> |
| LM2852XMXA-1.2      | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>1.2            | <a href="#">Samples</a> |
| LM2852XMXA-1.2/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>1.2            | <a href="#">Samples</a> |
| LM2852XMXA-1.5      | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>1.5            | <a href="#">Samples</a> |
| LM2852XMXA-1.5/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>1.5            | <a href="#">Samples</a> |
| LM2852XMXA-1.8      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>1.8            | <a href="#">Samples</a> |
| LM2852XMXA-1.8/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>1.8            | <a href="#">Samples</a> |
| LM2852XMXA-2.5      | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>2.5            | <a href="#">Samples</a> |
| LM2852XMXA-2.5/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>2.5            | <a href="#">Samples</a> |
| LM2852XMXA-3.0      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              |              | 2852X<br>3.0            | <a href="#">Samples</a> |
| LM2852XMXA-3.0/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   |              | 2852X<br>3.0            | <a href="#">Samples</a> |
| LM2852XMXA-3.3      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>3.3            | <a href="#">Samples</a> |
| LM2852XMXA-3.3/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>3.3            | <a href="#">Samples</a> |
| LM2852XMXAX-0.8     | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>0.8            | <a href="#">Samples</a> |

| Orderable Device    | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|---------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|-------------------------|-------------------------|
| LM2852XMXX-0.8/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>0.8            | <a href="#">Samples</a> |
| LM2852XMXX-1.0      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>1.0            | <a href="#">Samples</a> |
| LM2852XMXX-1.0/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>1.0            | <a href="#">Samples</a> |
| LM2852XMXX-1.2      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>1.2            | <a href="#">Samples</a> |
| LM2852XMXX-1.2/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>1.2            | <a href="#">Samples</a> |
| LM2852XMXX-1.5      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>1.5            | <a href="#">Samples</a> |
| LM2852XMXX-1.5/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>1.5            | <a href="#">Samples</a> |
| LM2852XMXX-1.8      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>1.8            | <a href="#">Samples</a> |
| LM2852XMXX-1.8/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>1.8            | <a href="#">Samples</a> |
| LM2852XMXX-2.5      | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>2.5            | <a href="#">Samples</a> |
| LM2852XMXX-2.5/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>2.5            | <a href="#">Samples</a> |
| LM2852XMXX-3.0      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              |              | 2852X<br>3.0            | <a href="#">Samples</a> |
| LM2852XMXX-3.0/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   |              | 2852X<br>3.0            | <a href="#">Samples</a> |
| LM2852XMXX-3.3      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852X<br>3.3            | <a href="#">Samples</a> |
| LM2852XMXX-3.3/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852X<br>3.3            | <a href="#">Samples</a> |
| LM2852YMXA-0.8      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-0.8           | <a href="#">Samples</a> |
| LM2852YMXA-0.8/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-0.8           | <a href="#">Samples</a> |
| LM2852YMXA-1.0      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-1.0           | <a href="#">Samples</a> |

| Orderable Device     | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|----------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|-------------------------|-------------------------|
| LM2852YMXA-1.0/NOPB  | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-1.0           | <a href="#">Samples</a> |
| LM2852YMXA-1.2       | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-1.2           | <a href="#">Samples</a> |
| LM2852YMXA-1.2/NOPB  | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-1.2           | <a href="#">Samples</a> |
| LM2852YMXA-1.3       | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              |              | 2852Y<br>1.3            | <a href="#">Samples</a> |
| LM2852YMXA-1.3/NOPB  | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   |              | 2852Y<br>1.3            | <a href="#">Samples</a> |
| LM2852YMXA-1.5       | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-1.5           | <a href="#">Samples</a> |
| LM2852YMXA-1.5/NOPB  | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-1.5           | <a href="#">Samples</a> |
| LM2852YMXA-1.8       | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-1.8           | <a href="#">Samples</a> |
| LM2852YMXA-1.8/NOPB  | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-1.8           | <a href="#">Samples</a> |
| LM2852YMXA-2.5       | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-2.5           | <a href="#">Samples</a> |
| LM2852YMXA-2.5/NOPB  | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-2.5           | <a href="#">Samples</a> |
| LM2852YMXA-3.0       | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              |              | 2852Y<br>3.0            | <a href="#">Samples</a> |
| LM2852YMXA-3.0/NOPB  | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   |              | 2852Y<br>3.0            | <a href="#">Samples</a> |
| LM2852YMXA-3.3       | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-3.3           | <a href="#">Samples</a> |
| LM2852YMXA-3.3/NOPB  | ACTIVE        | HTSSOP       | PWP                | 14   | 94             | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-3.3           | <a href="#">Samples</a> |
| LM2852YMXAX-0.8      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-0.8           | <a href="#">Samples</a> |
| LM2852YMXAX-0.8/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-0.8           | <a href="#">Samples</a> |
| LM2852YMXAX-1.0      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-1.0           | <a href="#">Samples</a> |

| Orderable Device     | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|----------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|-------------------------|-------------------------|
| LM2852YMXAX-1.0/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-1.0           | <a href="#">Samples</a> |
| LM2852YMXAX-1.2      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-1.2           | <a href="#">Samples</a> |
| LM2852YMXAX-1.2/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-1.2           | <a href="#">Samples</a> |
| LM2852YMXAX-1.3      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              |              | 2852Y<br>1.3            | <a href="#">Samples</a> |
| LM2852YMXAX-1.3/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   |              | 2852Y<br>1.3            | <a href="#">Samples</a> |
| LM2852YMXAX-1.5      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-1.5           | <a href="#">Samples</a> |
| LM2852YMXAX-1.5/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-1.5           | <a href="#">Samples</a> |
| LM2852YMXAX-1.8      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-1.8           | <a href="#">Samples</a> |
| LM2852YMXAX-1.8/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-1.8           | <a href="#">Samples</a> |
| LM2852YMXAX-2.5      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-2.5           | <a href="#">Samples</a> |
| LM2852YMXAX-2.5/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-2.5           | <a href="#">Samples</a> |
| LM2852YMXAX-3.0      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              |              | 2852Y<br>3.0            | <a href="#">Samples</a> |
| LM2852YMXAX-3.0/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   |              | 2852Y<br>3.0            | <a href="#">Samples</a> |
| LM2852YMXAX-3.3      | ACTIVE        | HTSSOP       | PWP                | 14   |                | TBD                        | Call TI          | Call TI              | -40 to 125   | 2852Y<br>-3.3           | <a href="#">Samples</a> |
| LM2852YMXAX-3.3/NOPB | ACTIVE        | HTSSOP       | PWP                | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU SN            | Level-1-260C-UNLIM   | -40 to 125   | 2852Y<br>-3.3           | <a href="#">Samples</a> |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

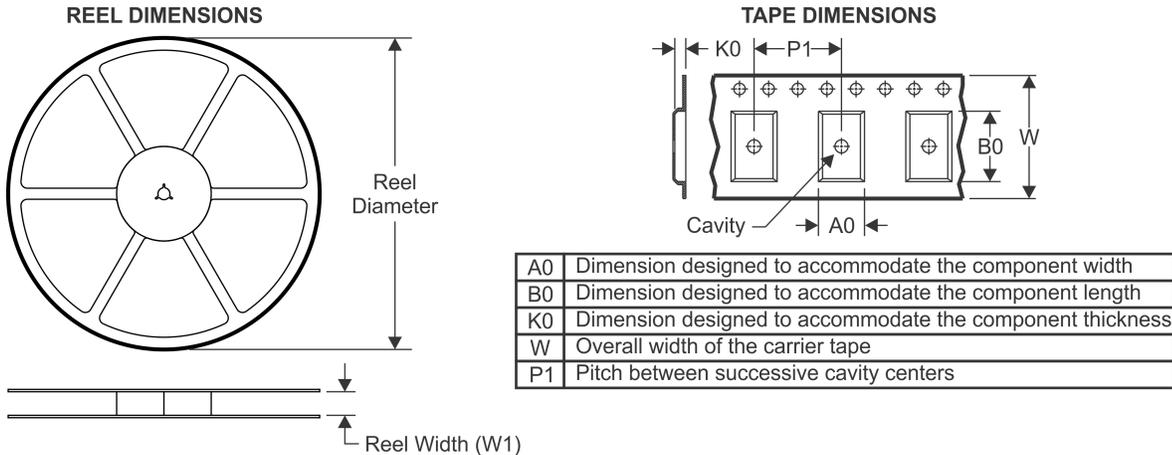
<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

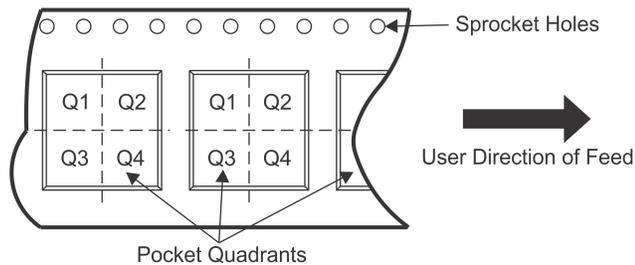
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TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

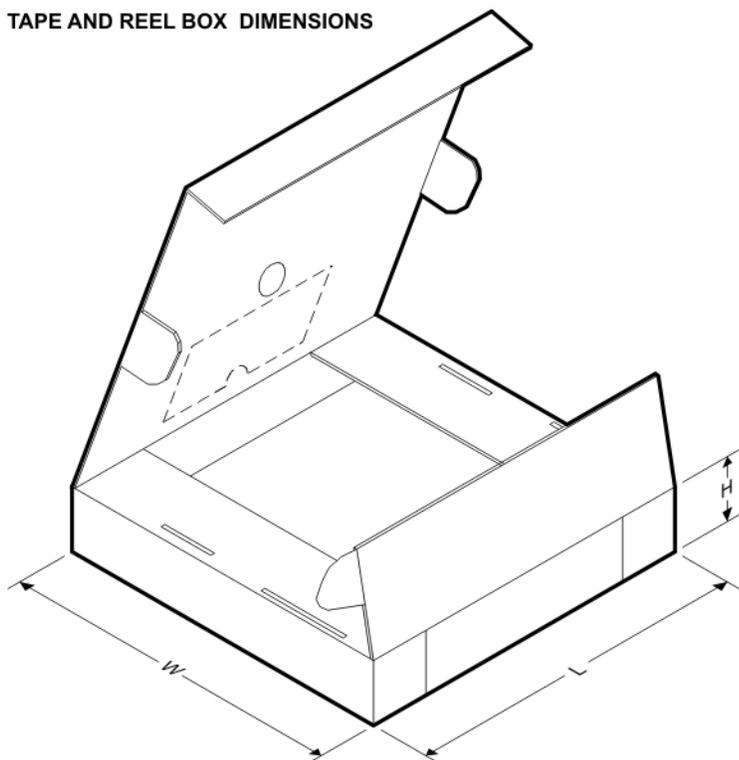


\*All dimensions are nominal

| 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 |
|-----------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LM2852XMXX-0.8/NOP B  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XMXX-1.0/NOP B  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XMXX-1.2/NOP B  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XMXX-1.5/NOP B  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XMXX-1.8/NOP B  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XMXX-2.5        | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XMXX-2.5/NOP B  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XMXX-3.0/NOP B  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852XMXX-3.3/NOP B  | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YMXAX-0.8/NOP B | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YMXAX-1.0/NOP B | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 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-1.2/NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YMXAX-1.3/NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YMXAX-1.5/NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YMXAX-1.8/NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YMXAX-2.5/NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YMXAX-3.0/NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |
| LM2852YMXAX-3.3/NOPB | HTSSOP       | PWP             | 14   | 2500 | 330.0              | 12.4               | 6.95    | 8.3     | 1.6     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

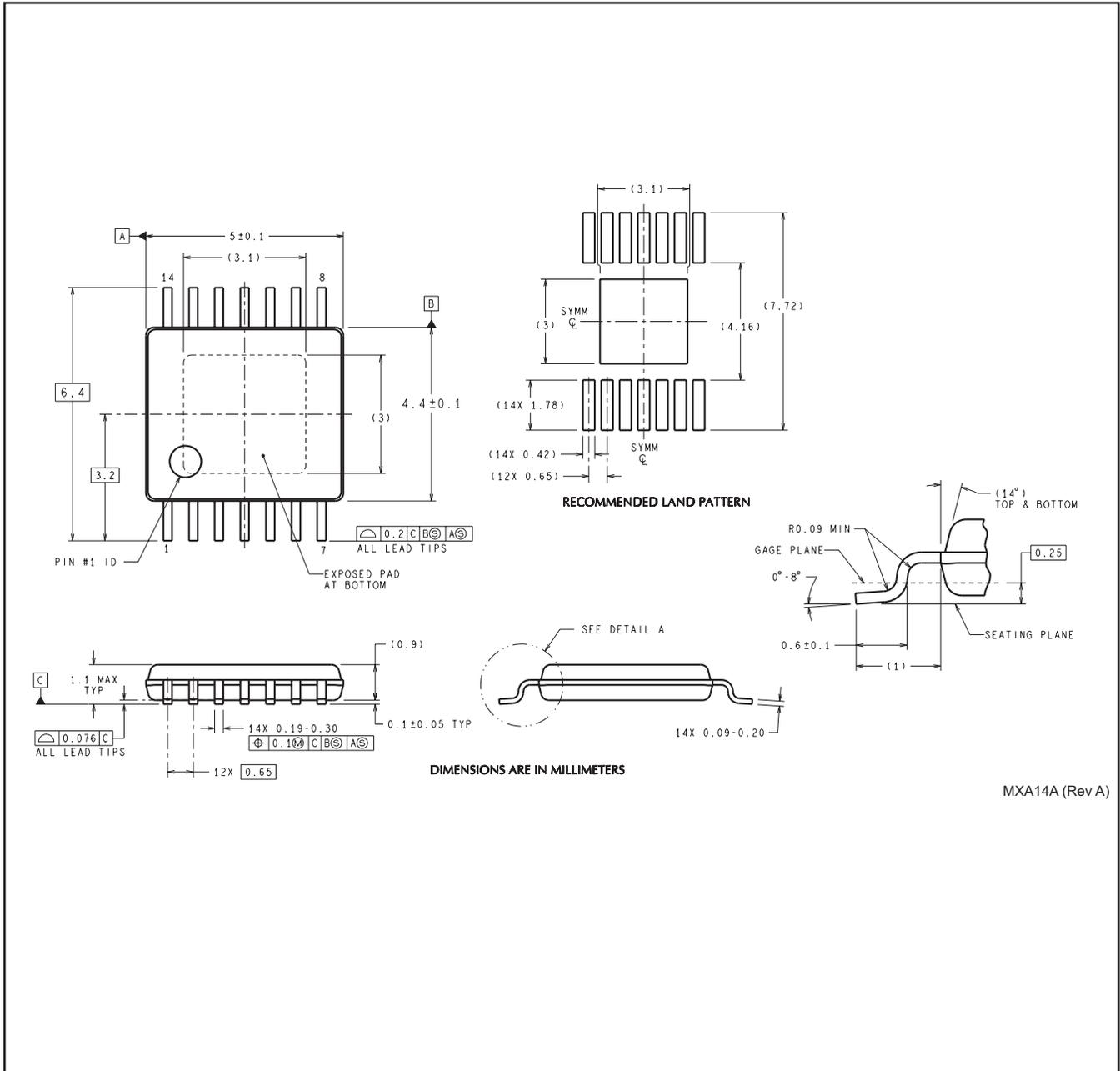


\*All dimensions are nominal

| Device                | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM2852XMEXAX-0.8/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMEXAX-1.0/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMEXAX-1.2/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMEXAX-1.5/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMEXAX-1.8/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |

| Device               | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LM2852XMVAX-2.5      | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMVAX-2.5/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMVAX-3.0/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852XMVAX-3.3/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMVAX-0.8/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMVAX-1.0/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMVAX-1.2/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMVAX-1.3/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMVAX-1.5/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMVAX-1.8/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMVAX-2.5/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMVAX-3.0/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |
| LM2852YMVAX-3.3/NOPB | HTSSOP       | PWP             | 14   | 2500 | 367.0       | 367.0      | 35.0        |

PWP0014A



MXA14A (Rev A)

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