

# TLV707, TLV707P

## 200-mA, Low- $I_Q$ , Low-Noise, Low-Dropout Regulator for Portable Devices

### 1 Features

- Typical accuracy: 0.5%
- Supports 200-mA output
- Low  $I_Q$ : 25  $\mu$ A
- Fixed-output voltage combinations possible from 0.85 V to 5.0 V<sup>(1)</sup>
- High PSRR:
  - 70 dB at 100 Hz
  - 50 dB at 1 MHz
- Stable with effective capacitance of 0.1  $\mu$ F<sup>(2)</sup>
- Thermal shutdown and overcurrent protection
- Package: 1-mm  $\times$  1-mm DQN (X2SON) <sup>1 2</sup>

### 2 Applications

- [Smart phones and wireless handsets](#)
- [Gaming and toys](#)
- [WLAN](#) and other PC add-on cards
- [TVs and set-top boxes](#)
- [Wearable electronics](#)

### 3 Description

The TLV707 series (TLV707 and TLV707P) of low-dropout linear regulators (LDOs) are low quiescent current devices with excellent line and load transient performance for power-sensitive applications. These devices provide a typical accuracy of 0.5%. All versions have thermal shutdown and overcurrent protection for safety.

Furthermore, these devices are stable with an effective output capacitance of only 0.1  $\mu$ F. This feature enables the use of cost-effective capacitors that have higher bias voltages and temperature derating. These devices also regulate to the specified accuracy with no output load.

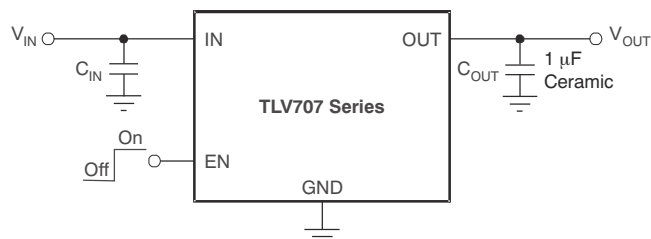
The TLV707P also provides an active pulldown circuit to quickly discharge the outputs.

The TLV707 series of LDOs are available in a 1-mm  $\times$  1-mm DQN (X2SON) package that makes them desirable for handheld applications.

#### Package Information

| PART NUMBER | PACKAGE <sup>(1)</sup> | PACKAGE SIZE <sup>(2)</sup> |
|-------------|------------------------|-----------------------------|
| TLV707      | DQN (X2SON, 4)         | 1.00 mm $\times$ 1.00 mm    |
| TLV707P     |                        |                             |

- (1) For all available packages, see the package option addendum at the end of the data sheet.
- (2) The package size (length  $\times$  width) is a nominal value and includes pins, where applicable.



**Typical Application Circuit**

<sup>1</sup> For all available voltage options, see the package option addendum at the end of the data sheet.

<sup>2</sup> See the [Mechanical, Packaging, and Orderable Information](#) section for more details.



## Table of Contents

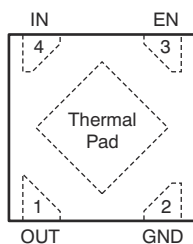
|                                                |           |                                                                  |           |
|------------------------------------------------|-----------|------------------------------------------------------------------|-----------|
| <b>1 Features</b> .....                        | <b>1</b>  | <b>8 Application and Implementation</b> .....                    | <b>19</b> |
| <b>2 Applications</b> .....                    | <b>1</b>  | 8.1 Application Information.....                                 | 19        |
| <b>3 Description</b> .....                     | <b>1</b>  | 8.2 Typical Application.....                                     | 19        |
| <b>4 Revision History</b> .....                | <b>2</b>  | 8.3 Best Design Practices.....                                   | 22        |
| <b>5 Pin Configuration and Functions</b> ..... | <b>3</b>  | 8.4 Power Supply Recommendations.....                            | 23        |
| <b>6 Specifications</b> .....                  | <b>4</b>  | 8.5 Layout.....                                                  | 23        |
| 6.1 Absolute Maximum Ratings.....              | 4         | <b>9 Device and Documentation Support</b> .....                  | <b>25</b> |
| 6.2 ESD Ratings.....                           | 4         | 9.1 Device Support.....                                          | 25        |
| 6.3 Recommended Operating Conditions.....      | 4         | 9.2 Documentation Support.....                                   | 25        |
| 6.4 Thermal Information.....                   | 4         | 9.3 Receiving Notification of Documentation Updates.....         | 25        |
| 6.5 Electrical Characteristics.....            | 5         | 9.4 Support Resources.....                                       | 25        |
| 6.6 Typical Characteristics.....               | 6         | 9.5 Trademarks.....                                              | 25        |
| <b>7 Detailed Description</b> .....            | <b>16</b> | 9.6 Electrostatic Discharge Caution.....                         | 26        |
| 7.1 Overview.....                              | 16        | 9.7 Glossary.....                                                | 26        |
| 7.2 Functional Block Diagrams.....             | 16        | <b>10 Mechanical, Packaging, and Orderable Information</b> ..... | <b>26</b> |
| 7.3 Feature Description.....                   | 17        |                                                                  |           |
| 7.4 Device Functional Modes.....               | 18        |                                                                  |           |

## 4 Revision History

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

|                                                                                                                      |             |
|----------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Changes from Revision F (May 2018) to Revision G (June 2023)</b>                                                  | <b>Page</b> |
| • Added TLV707xxA information to document.....                                                                       | 1           |
| • Added TLV707xxA information to $V_{(DO)}$ and $I_{CL}$ parameters in <i>Electrical Characteristics</i> table ..... | 5           |
| • Added TLV707xxA information to <i>Device Nomenclature</i> section.....                                             | 25          |
| <b>Changes from Revision E (February 2016) to Revision F (May 2018)</b>                                              | <b>Page</b> |
| • Changed $V_{(ESD)}$ HBM value from $\pm 2000$ V to $\pm 4000$ V in <i>ESD Ratings</i> table.....                   | 4           |

## 5 Pin Configuration and Functions



**Figure 5-1. DQN Package, 4-Pin X2SON (Top View)**

**Table 5-1. Pin Functions**

| PIN  |     | I/O | DESCRIPTION                                                                                                                                                                                                                    |
|------|-----|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME | NO. |     |                                                                                                                                                                                                                                |
| EN   | 3   | I   | Enable pin. Driving EN over 0.9 V turns on the regulator. Driving EN below 0.4 V puts the regulator into shutdown mode. For TLV707P, output voltage is discharged through an internal 120-Ω resistor when device is shut down. |
| GND  | 2   | —   | Ground pin                                                                                                                                                                                                                     |
| IN   | 4   | I   | Input pin. For good transient performance, place a small 1-μF ceramic capacitor from this pin to ground. See <a href="#">Input and Output Capacitor Requirements</a> for more details.                                         |
| OUT  | 1   | O   | Regulated output voltage pin. A small 1-μF ceramic capacitor is required from this pin to ground to assure stability. See <a href="#">Input and Output Capacitor Requirements</a> for more details.                            |

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating junction temperature range (unless otherwise noted)<sup>(1)</sup>

|                               |                           | MIN                | MAX | UNIT |
|-------------------------------|---------------------------|--------------------|-----|------|
| Voltage <sup>(2)</sup>        | IN                        | −0.3               | 6.0 | V    |
|                               | EN                        | −0.3               | 6.0 | V    |
|                               | OUT                       | −0.3               | 6.0 | V    |
| Current (source)              | OUT                       | Internally limited |     |      |
| Output short-circuit duration |                           | Indefinite         |     |      |
| Temperature                   | Operating junction, $T_J$ | −55                | 150 | °C   |
|                               | Storage, $T_{stg}$        | −55                | 150 | °C   |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltages are with respect to network ground pin.

### 6.2 ESD Ratings

|             |                         |                                                                         | VALUE | UNIT |
|-------------|-------------------------|-------------------------------------------------------------------------|-------|------|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM) QSS 009-105 (JESD22-A114A) <sup>(1)</sup>        | ±4000 | V    |
|             |                         | Charged device model (CDM) QSS 009-147 (JESD22-C101B.01) <sup>(2)</sup> | ±500  |      |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions

over operating junction temperature range (unless otherwise noted)

|           |                                | MIN | NOM | MAX | UNIT |
|-----------|--------------------------------|-----|-----|-----|------|
| $V_{IN}$  | Input voltage                  | 2.0 |     | 5.5 | V    |
| $I_{OUT}$ | Output current                 | 0   |     | 200 | mA   |
| $T_J$     | Operating junction temperature | −40 |     | 125 | °C   |

### 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                              | TLV707, TLV707P | UNIT |
|-------------------------------|----------------------------------------------|-----------------|------|
|                               |                                              | DQN (X2SON)     |      |
|                               |                                              | 4 PINS          |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance       | 208.1           | °C/W |
| $R_{\theta JC(top)}$          | Junction-to-case (top) thermal resistance    | 108.8           | °C/W |
| $R_{\theta JB}$               | Junction-to-board thermal resistance         | 159.4           | °C/W |
| $\Psi_{JT}$                   | Junction-to-top characterization parameter   | 3.8             | °C/W |
| $\Psi_{JB}$                   | Junction-to-board characterization parameter | 159.4           | °C/W |
| $R_{\theta JC(bot)}$          | Junction-to-case (bottom) thermal resistance | 110.2           | °C/W |

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

## 6.5 Electrical Characteristics

at  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater);  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = V_{IN}$ ,  $C_{OUT} = 0.47\text{ }\mu\text{F}$ , and  $T_J = -40^\circ\text{C}$  to  $+85^\circ\text{C}$  (unless otherwise noted); typical values are at  $T_J = 25^\circ\text{C}$

| PARAMETER             |                                                 | TEST CONDITIONS                                                                                     |                                  |                           | MIN   | TYP  | MAX             | UNIT              |
|-----------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------|---------------------------|-------|------|-----------------|-------------------|
| V <sub>OUT</sub>      | Output voltage range                            |                                                                                                     |                                  |                           | 0.85  |      | 5               | V                 |
|                       | DC output accuracy                              |                                                                                                     |                                  |                           | 0.5%  |      |                 |                   |
|                       |                                                 | V <sub>OUT</sub> ≥ 0.85 V                                                                           |                                  |                           | −1.5% |      | 1.5%            |                   |
| ΔV <sub>O</sub> (ΔVI) | Line regulation                                 |                                                                                                     |                                  |                           |       | 1    | 5               | mV                |
| ΔV <sub>O</sub> (ΔIO) | Load regulation                                 | 0 mA ≤ I <sub>OUT</sub> ≤ 150 mA                                                                    |                                  |                           |       | 10   | 20              | mV                |
| V <sub>(DO)</sub>     | Dropout voltage                                 | V <sub>IN</sub> = 0.98 x V <sub>OUT(nom)</sub>                                                      | 2.0 V < V <sub>OUT</sub> ≤ 2.4 V | I <sub>OUT</sub> = 30 mA  | 65    |      | mV              |                   |
|                       |                                                 |                                                                                                     |                                  | I <sub>OUT</sub> = 150 mA | 325   | 360  |                 |                   |
|                       |                                                 |                                                                                                     | 2.4 V < V <sub>OUT</sub> ≤ 2.8 V | I <sub>OUT</sub> = 30 mA  | 50    |      |                 |                   |
|                       |                                                 |                                                                                                     |                                  | I <sub>OUT</sub> = 150 mA | 250   | 300  |                 |                   |
|                       |                                                 |                                                                                                     | 2.8 V < V <sub>OUT</sub> ≤ 3.3 V | I <sub>OUT</sub> = 30 mA  | 45    |      |                 |                   |
|                       |                                                 |                                                                                                     |                                  | I <sub>OUT</sub> = 150 mA | 220   | 270  |                 |                   |
|                       |                                                 |                                                                                                     | 3.3 V < V <sub>OUT</sub> ≤ 5.0 V | I <sub>OUT</sub> = 30 mA  | 40    |      |                 |                   |
|                       |                                                 |                                                                                                     |                                  | I <sub>OUT</sub> = 150 mA | 200   | 250  |                 |                   |
| V <sub>(DO)</sub>     | Dropout voltage, TLV707xxA                      | V <sub>IN</sub> = 0.98 × V <sub>OUT(nom)</sub>                                                      | 2.0 V < V <sub>OUT</sub> ≤ 2.5 V | I <sub>OUT</sub> = 30 mA  | 65    |      | mV              |                   |
|                       |                                                 |                                                                                                     |                                  | I <sub>OUT</sub> = 150 mA | 325   | 360  |                 |                   |
|                       |                                                 |                                                                                                     | 2.5 V < V <sub>OUT</sub> ≤ 3.1 V | I <sub>OUT</sub> = 30 mA  | 50    |      |                 |                   |
|                       |                                                 |                                                                                                     |                                  | I <sub>OUT</sub> = 150 mA | 250   | 300  |                 |                   |
|                       |                                                 |                                                                                                     | 3.1 V < V <sub>OUT</sub> ≤ 3.5 V | I <sub>OUT</sub> = 30 mA  | 45    |      |                 |                   |
|                       |                                                 |                                                                                                     |                                  | I <sub>OUT</sub> = 150 mA | 220   | 280  |                 |                   |
|                       |                                                 |                                                                                                     | 3.5 V < V <sub>OUT</sub> ≤ 5.0 V | I <sub>OUT</sub> = 30 mA  | 40    |      |                 |                   |
|                       |                                                 |                                                                                                     |                                  | I <sub>OUT</sub> = 150 mA | 200   | 260  |                 |                   |
| I <sub>CL</sub>       | Output current limit                            | V <sub>OUT</sub> = 0.9 × V <sub>OUT(nom)</sub>                                                      |                                  |                           | 240   | 300  | 450             | mA                |
| I <sub>CL</sub>       | Output current limit, TLV707xxA                 | V <sub>OUT</sub> = 0.9 × V <sub>OUT(nom)</sub> ; V <sub>OUT(nom)</sub> ≤ 1.5 V                      |                                  |                           | 220   | 300  | 450             | mA                |
|                       |                                                 | V <sub>OUT</sub> = 0.9 × V <sub>OUT(nom)</sub> ; V <sub>OUT(nom)</sub> > 1.5 V                      |                                  |                           | 240   | 300  | 450             |                   |
| I <sub>(GND)</sub>    | Ground pin current                              | I <sub>OUT</sub> = 0 mA                                                                             |                                  |                           |       | 25   | 50              | μA                |
| I <sub>(EN)</sub>     | EN pin current                                  | V <sub>EN</sub> = 5.5 V                                                                             |                                  |                           |       | 0.01 |                 | μA                |
| I <sub>SHUTDOWN</sub> | Shutdown current                                | V <sub>EN</sub> ≤ 0.4 V, 2.0 V ≤ V <sub>IN</sub> ≤ 4.5 V                                            |                                  |                           |       | 1    |                 | μA                |
| V <sub>IL(EN)</sub>   | EN pin low-level input voltage (disable device) |                                                                                                     |                                  |                           | 0     |      | 0.4             | V                 |
| V <sub>IH(EN)</sub>   | EN pin high-level input voltage (enable device) |                                                                                                     |                                  |                           | 0.9   |      | V <sub>IN</sub> | V                 |
| PSRR                  | Power-supply rejection ratio                    | V <sub>IN</sub> = 3.3 V, V <sub>OUT</sub> = 2.8 V, I <sub>OUT</sub> = 30 mA                         | f = 100 Hz                       | 70                        |       | dB   |                 |                   |
|                       |                                                 |                                                                                                     | f = 10 kHz                       | 55                        |       |      |                 |                   |
|                       |                                                 |                                                                                                     | f = 1 MHz                        | 50                        |       |      |                 |                   |
| V <sub>n</sub>        | Output noise voltage                            | BW = 100 Hz to 100 kHz, V <sub>IN</sub> = 2.3 V, V <sub>OUT</sub> = 1.8 V, I <sub>OUT</sub> = 10 mA |                                  |                           |       | 45   |                 | μV <sub>RMS</sub> |
| t <sub>STR</sub>      | Start-up time <sup>(1)</sup>                    | C <sub>OUT</sub> = 1.0 μF, I <sub>OUT</sub> = 150 mA                                                |                                  |                           |       | 100  |                 | μs                |
| R <sub>PULLDOWN</sub> | Pulldown resistance (TLV707P only)              |                                                                                                     |                                  |                           |       | 120  |                 | Ω                 |

(1) Start-up time = time from EN assertion to  $0.98 \times V_{OUT}$ .

## 6.6 Typical Characteristics

at  $T_J = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^{\circ}\text{C}$

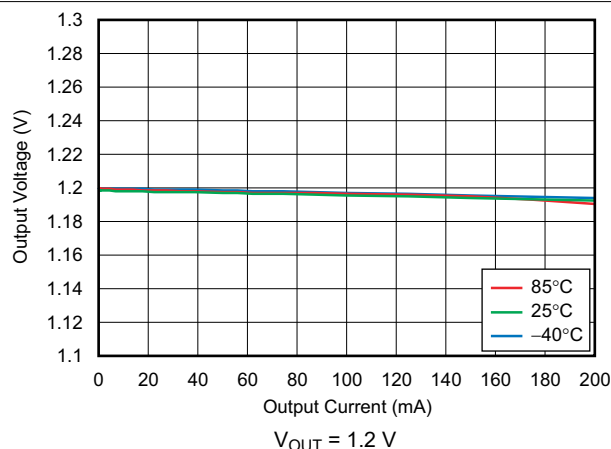


Figure 6-1. Load Regulation

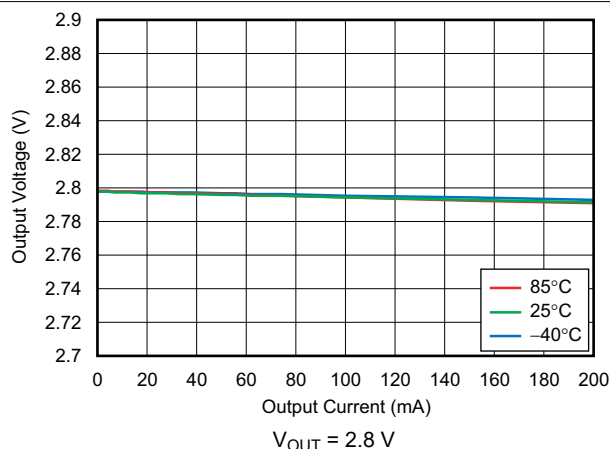


Figure 6-2. Load Regulation

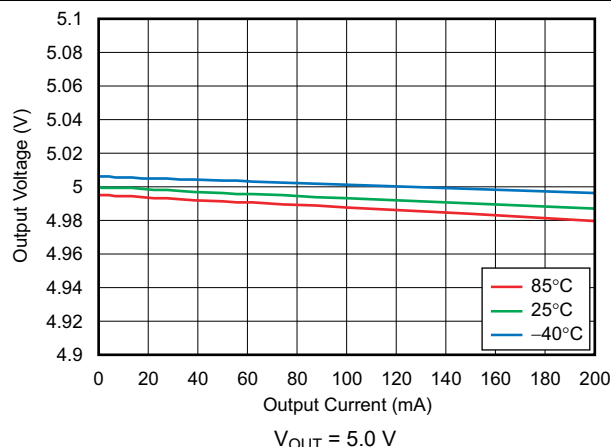


Figure 6-3. Load Regulation

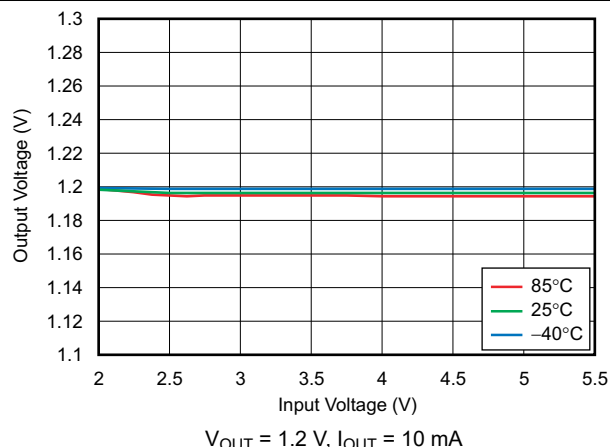


Figure 6-4. Line Regulation

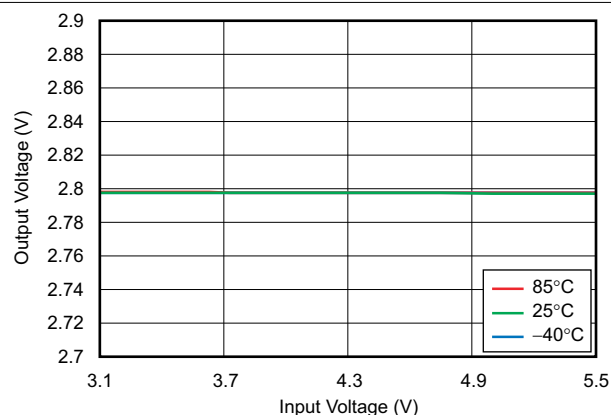


Figure 6-5. Line Regulation

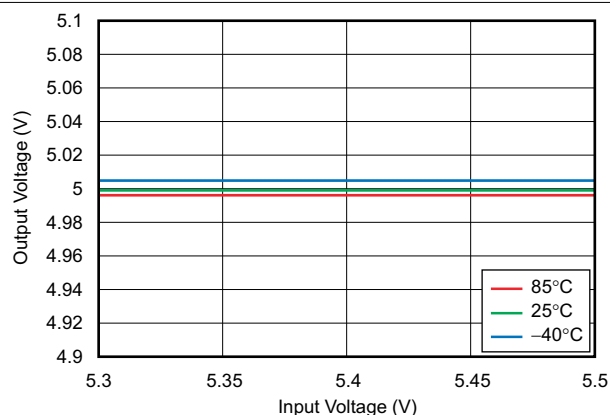


Figure 6-6. Line Regulation

## 6.6 Typical Characteristics (continued)

at  $T_J = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^{\circ}\text{C}$

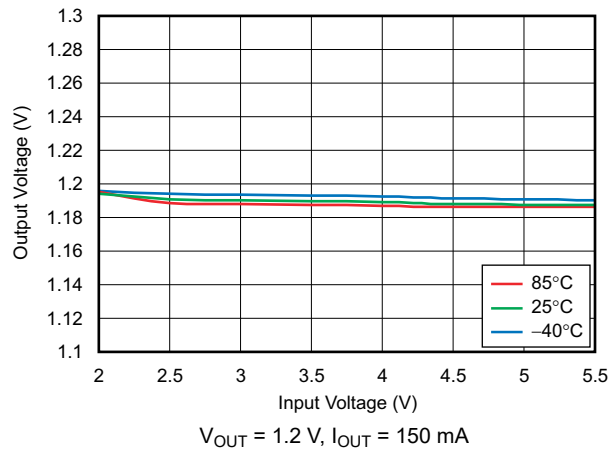


Figure 6-7. Line Regulation

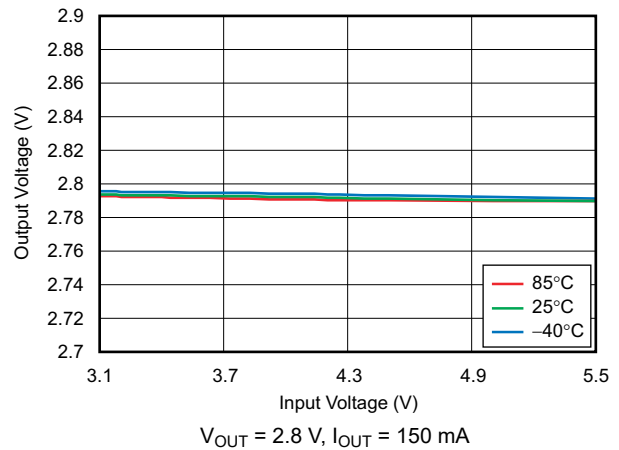


Figure 6-8. Line Regulation

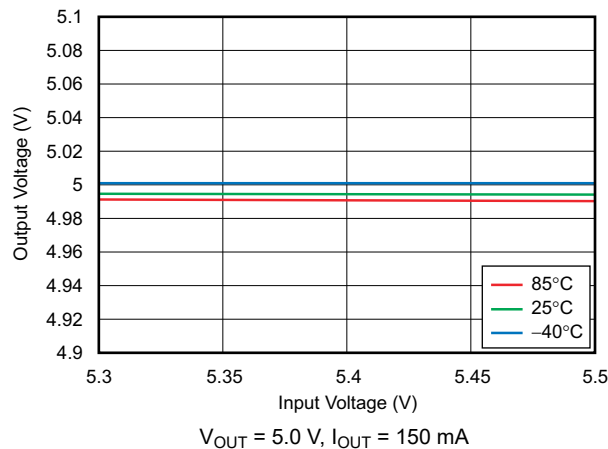


Figure 6-9. Line Regulation

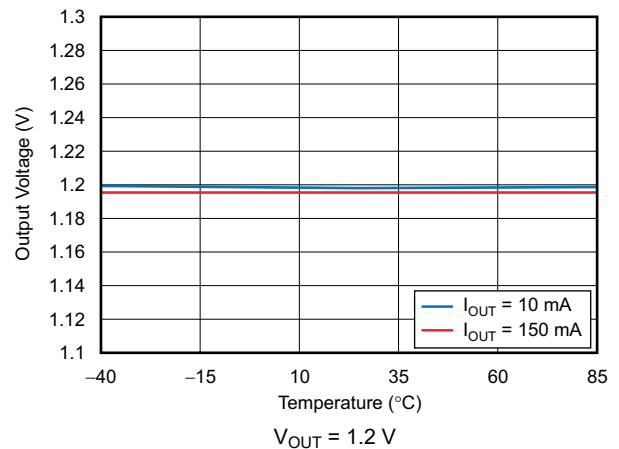


Figure 6-10. Output Voltage vs Temperature

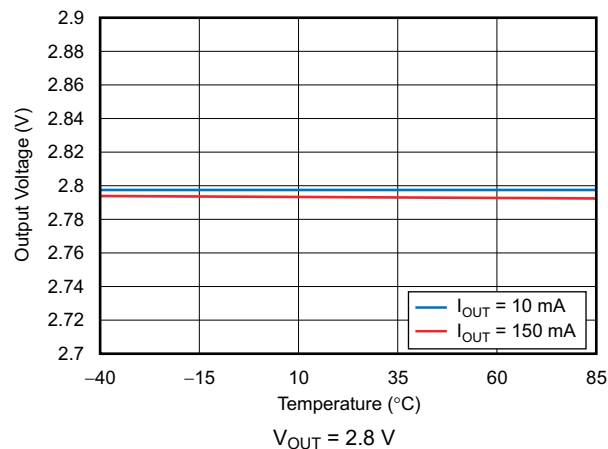


Figure 6-11. Output Voltage vs Temperature

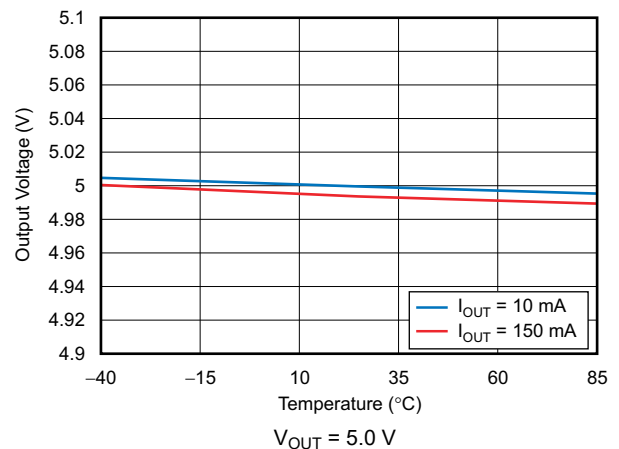


Figure 6-12. Output Voltage vs Temperature

## 6.6 Typical Characteristics (continued)

at  $T_J = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^\circ\text{C}$

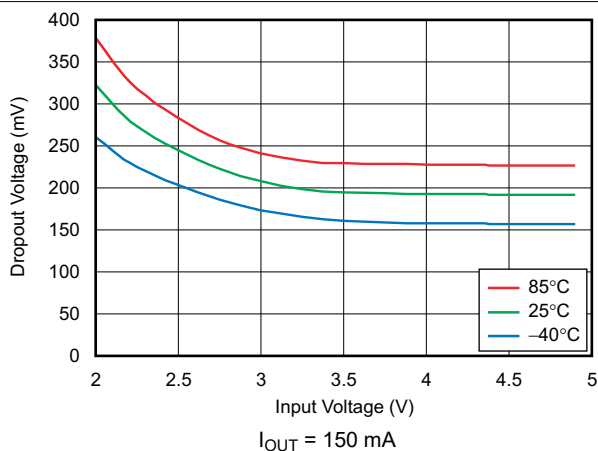


Figure 6-13. Dropout Voltage vs Input Voltage

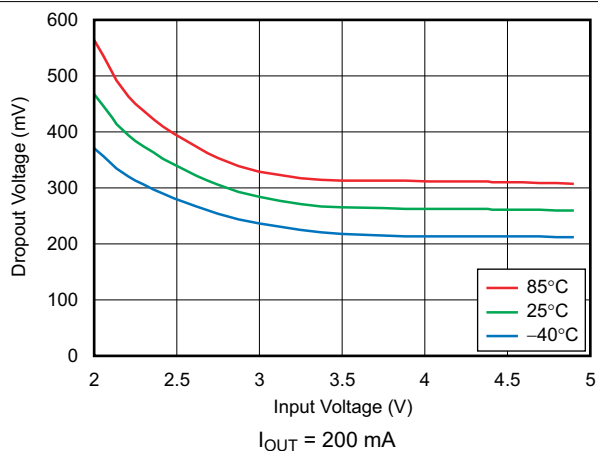


Figure 6-14. Dropout Voltage vs Input Voltage

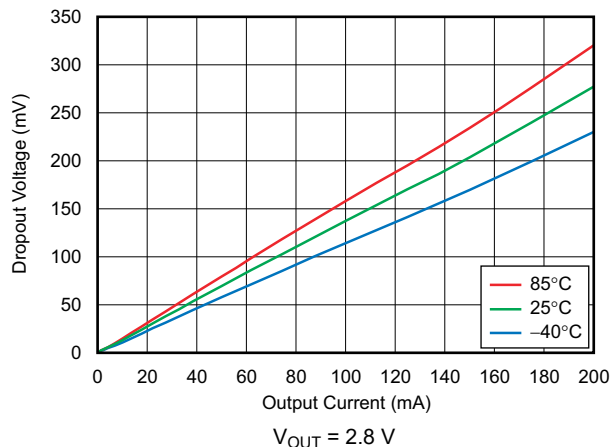


Figure 6-15. Dropout Voltage vs Output Current

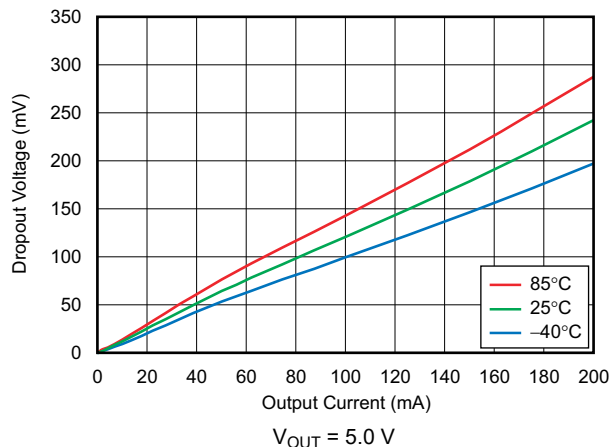


Figure 6-16. Dropout Voltage vs Output Current

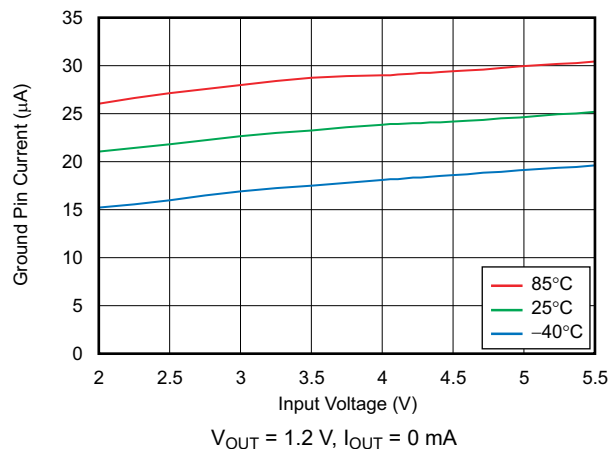


Figure 6-17. Ground Pin Current vs Input Voltage

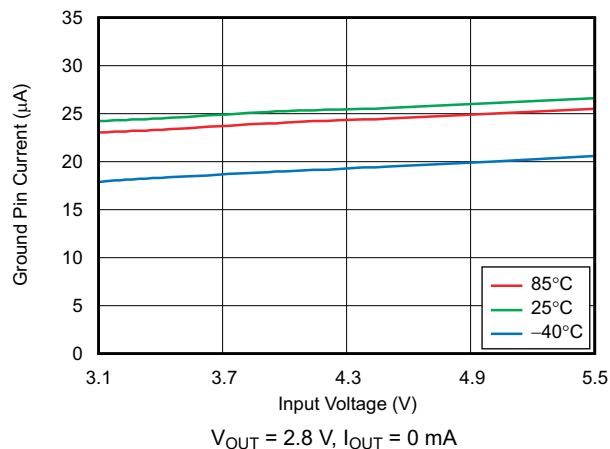


Figure 6-18. Ground Pin Current vs Input Voltage



## 6.6 Typical Characteristics (continued)

at  $T_J = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^\circ\text{C}$

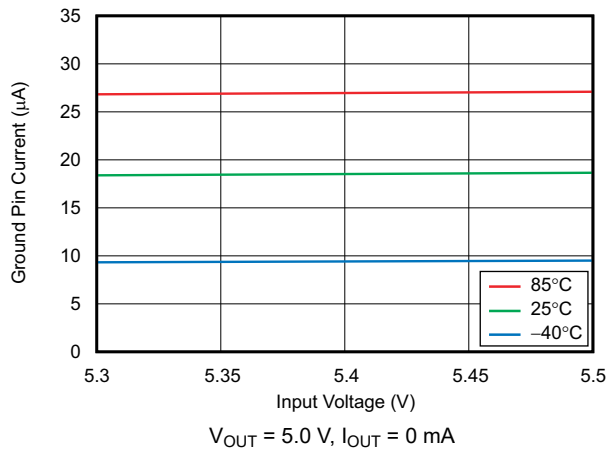


Figure 6-19. Ground Pin Current vs Input Voltage

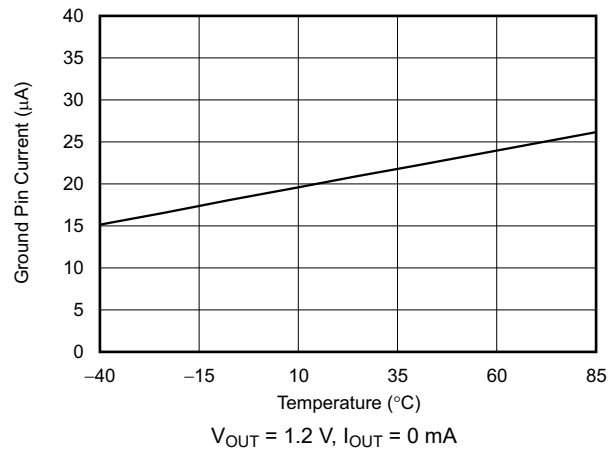


Figure 6-20. Ground Pin Current vs Temperature

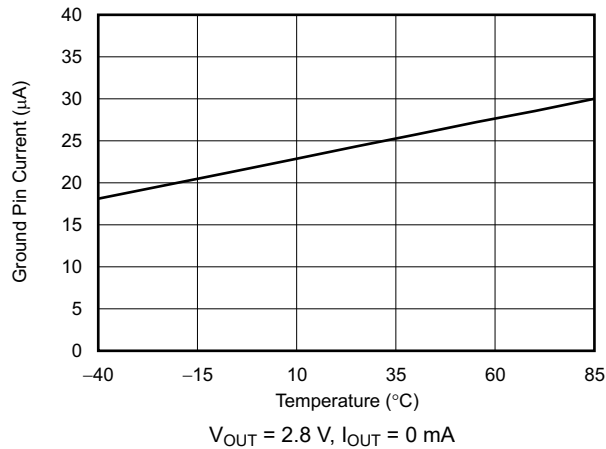


Figure 6-21. Ground Pin Current vs Temperature

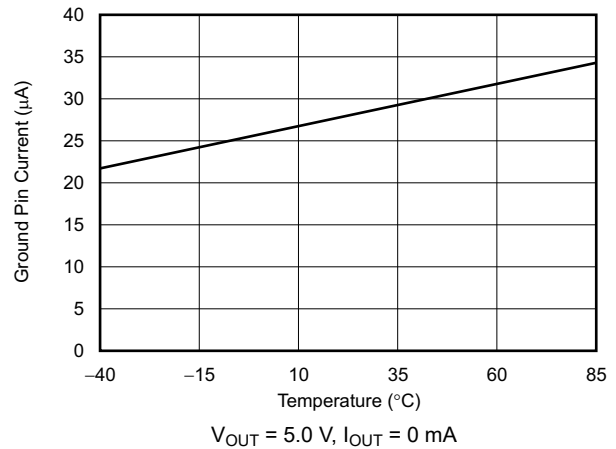


Figure 6-22. Ground Pin Current vs Temperature

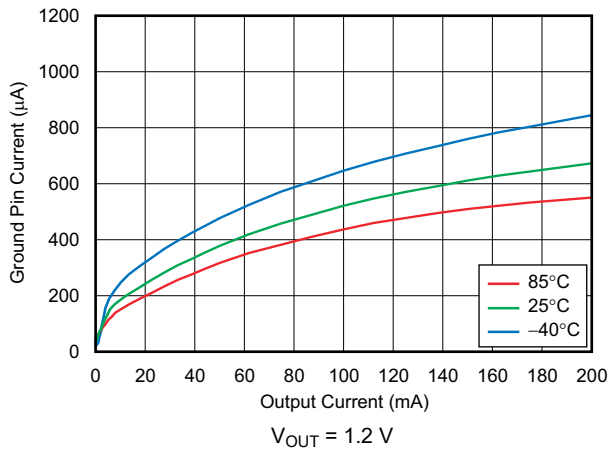


Figure 6-23. Ground Pin Current vs Output Current

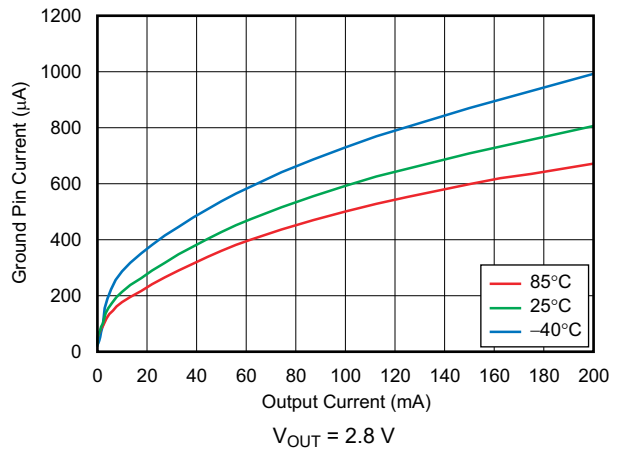


Figure 6-24. Ground Pin Current vs Output Current

## 6.6 Typical Characteristics (continued)

at  $T_J = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^{\circ}\text{C}$

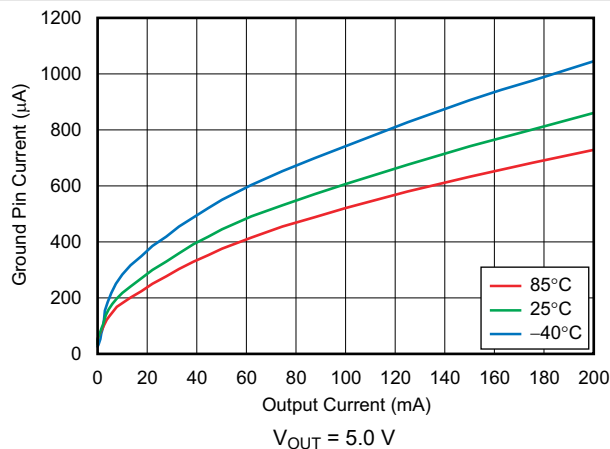


Figure 6-25. Ground Pin Current vs Output Current

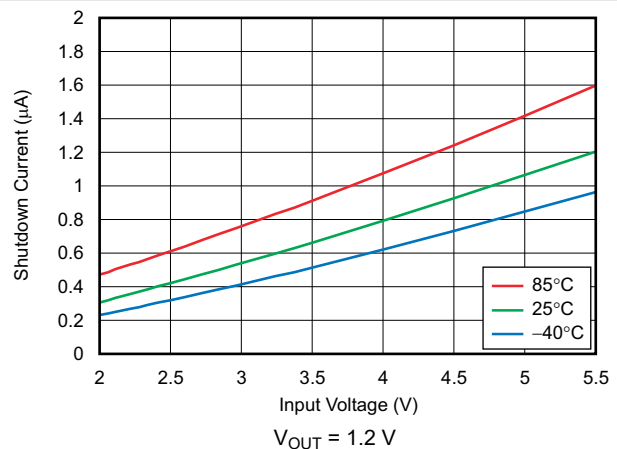


Figure 6-26. Shutdown Current vs Input Voltage

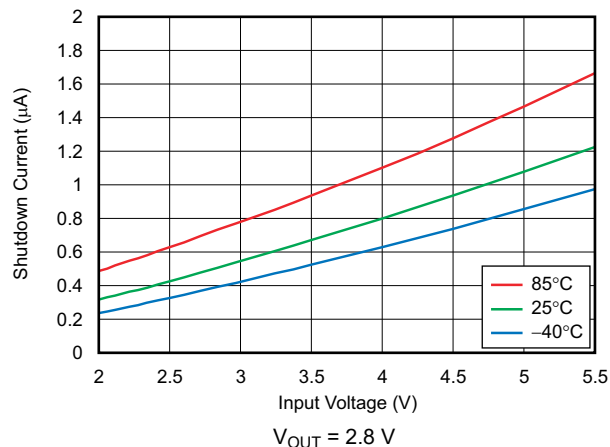


Figure 6-27. Shutdown Current vs Input Voltage

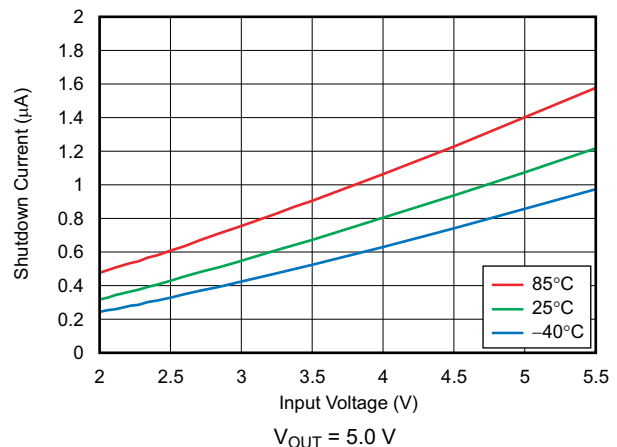


Figure 6-28. Shutdown Current vs Input Voltage

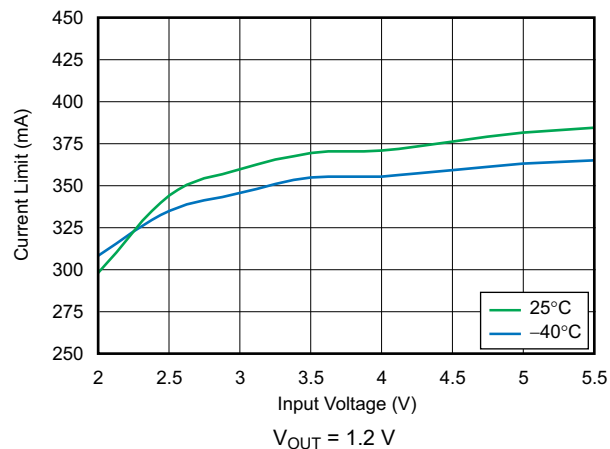


Figure 6-29. Current Limit vs Input Voltage

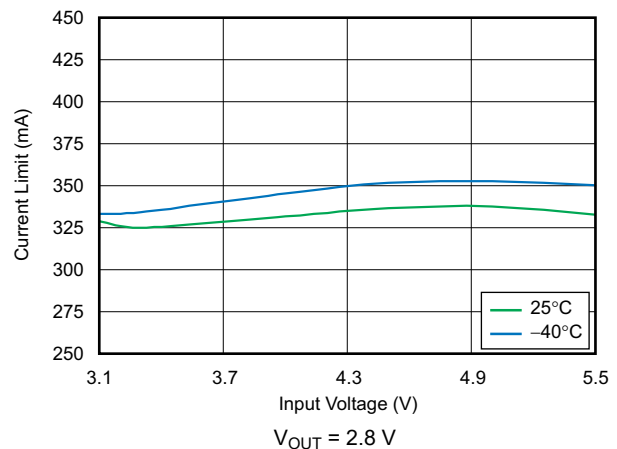


Figure 6-30. Current Limit vs Input Voltage

## 6.6 Typical Characteristics (continued)

at  $T_J = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^\circ\text{C}$

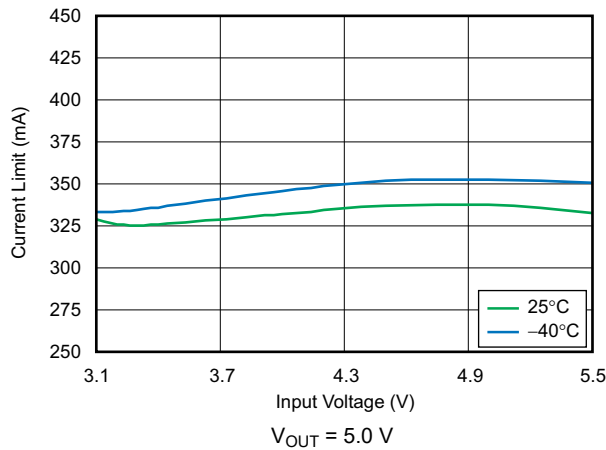


Figure 6-31. Current Limit vs Input Voltage

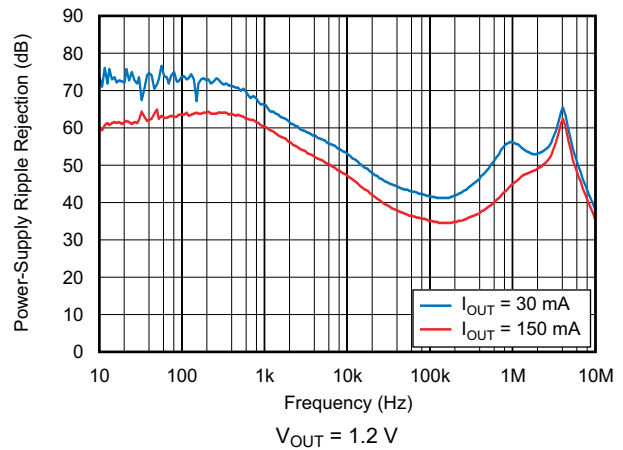


Figure 6-32. Power-Supply Ripple Rejection vs Frequency

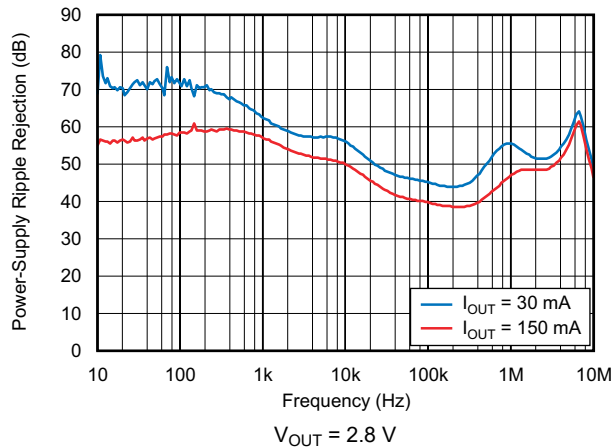


Figure 6-33. Power-Supply Ripple Rejection vs Frequency

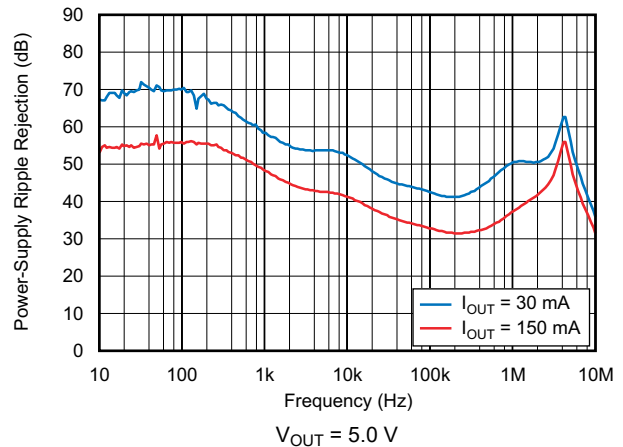


Figure 6-34. Power-Supply Ripple Rejection vs Frequency

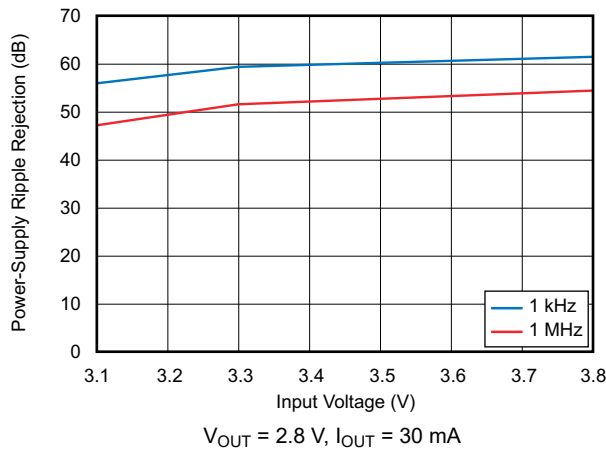


Figure 6-35. Power-Supply Ripple Rejection vs Input Voltage

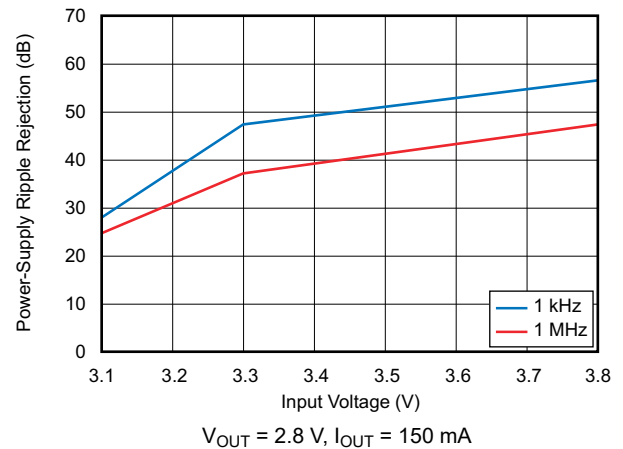


Figure 6-36. Power-Supply Ripple Rejection vs Input Voltage

## 6.6 Typical Characteristics (continued)

at  $T_J = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^\circ\text{C}$

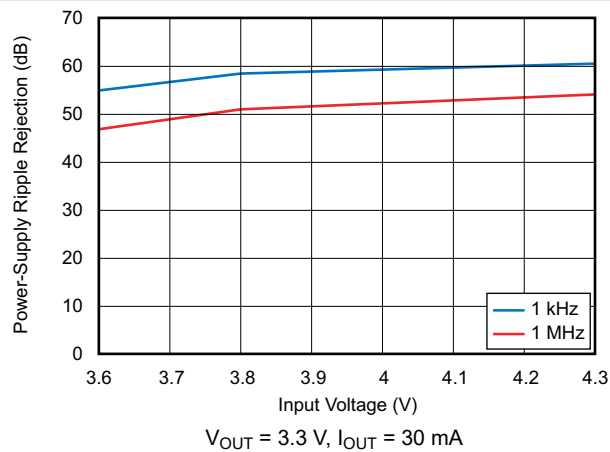


Figure 6-37. Power-Supply Ripple Rejection vs Input Voltage

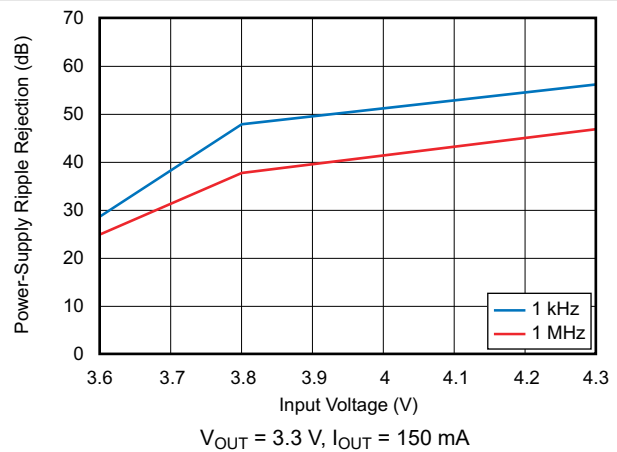


Figure 6-38. Power-Supply Ripple Rejection vs Input Voltage

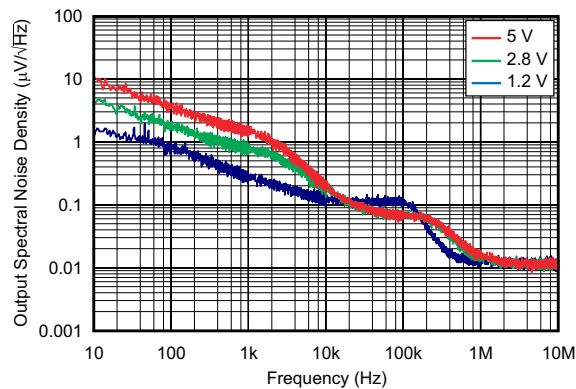


Figure 6-39. Output Spectral Noise Density vs Frequency

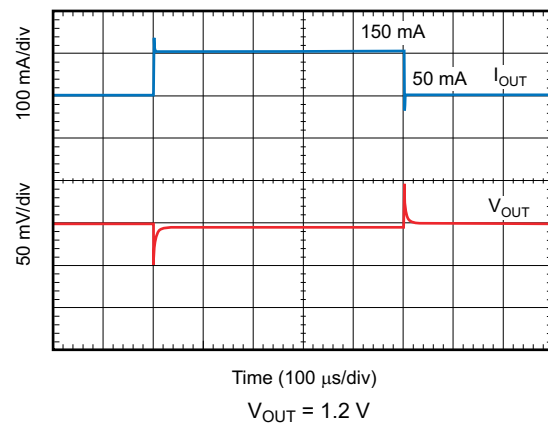


Figure 6-40. Load Transient Response

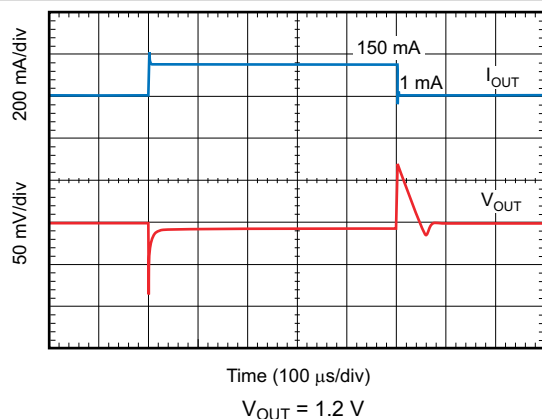


Figure 6-41. Load Transient Response

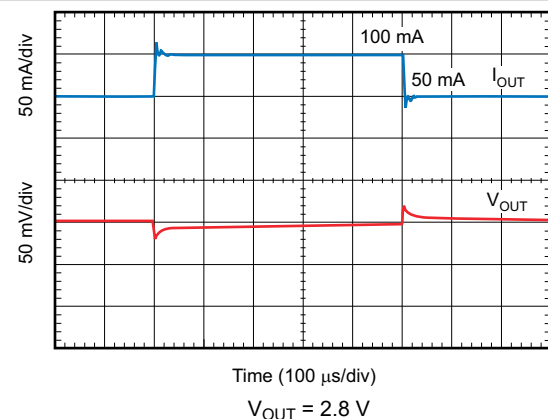
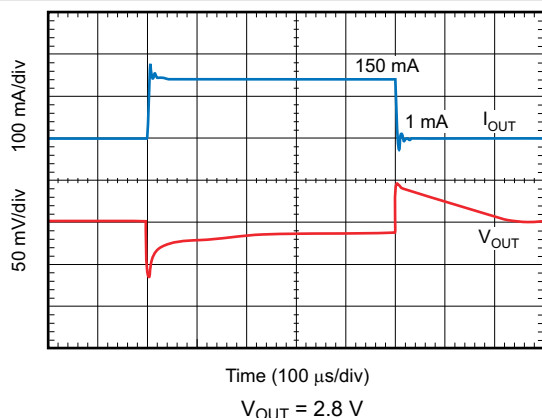


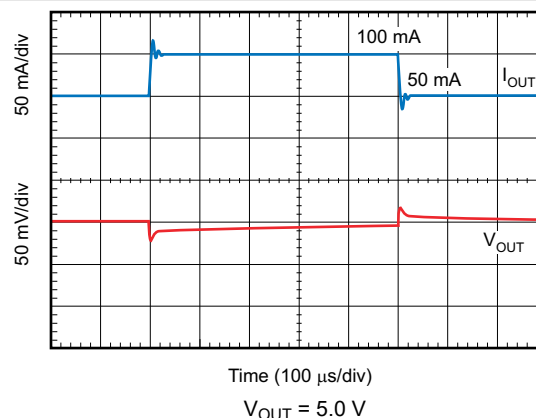
Figure 6-42. Load Transient Response

## 6.6 Typical Characteristics (continued)

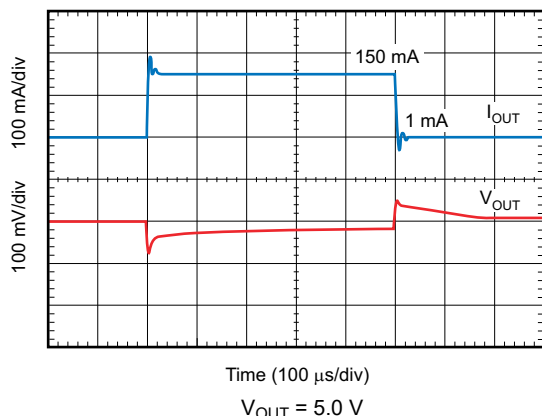
at  $T_J = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^{\circ}\text{C}$



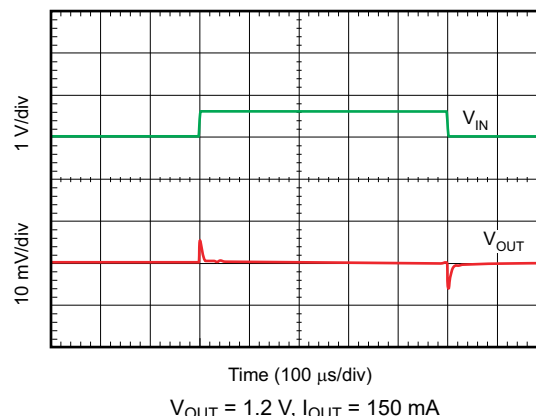
**Figure 6-43. Load Transient Response**



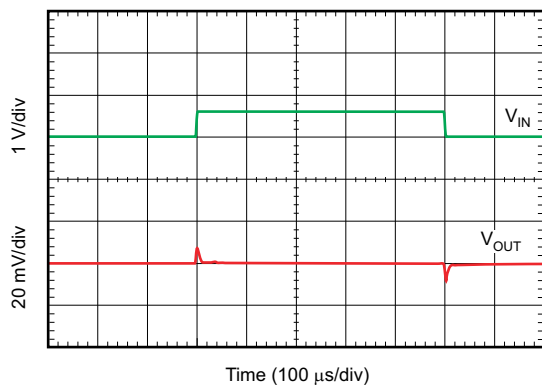
**Figure 6-44. Load Transient Response**



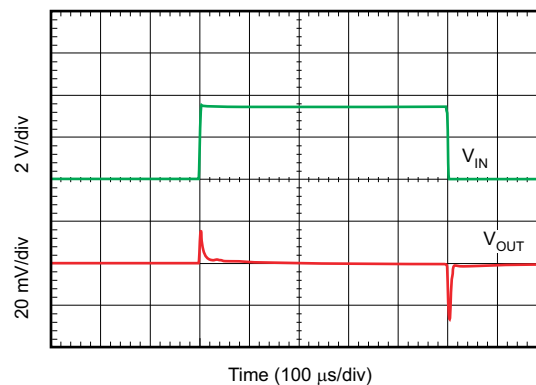
**Figure 6-45. Load Transient Response**



**Figure 6-46. Line Transient Response**



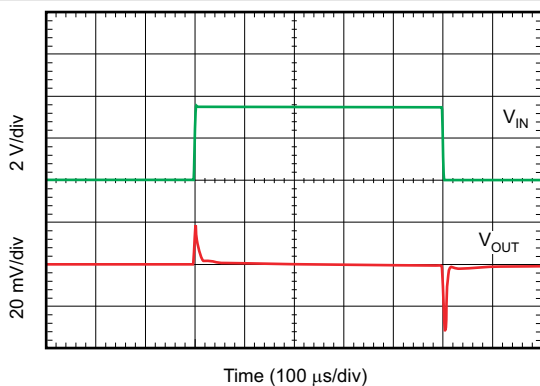
**Figure 6-47. Line Transient Response**



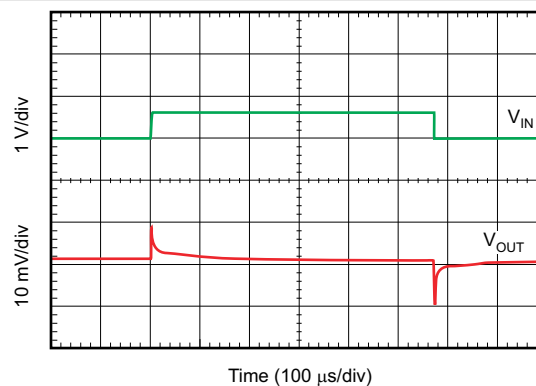
**Figure 6-48. Line Transient Response**

## 6.6 Typical Characteristics (continued)

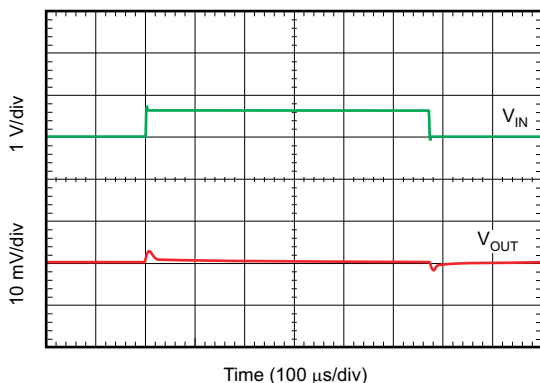
at  $T_J = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^{\circ}\text{C}$



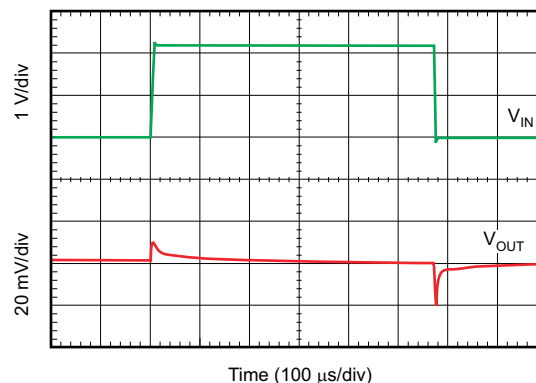
**Figure 6-49. Line Transient Response**



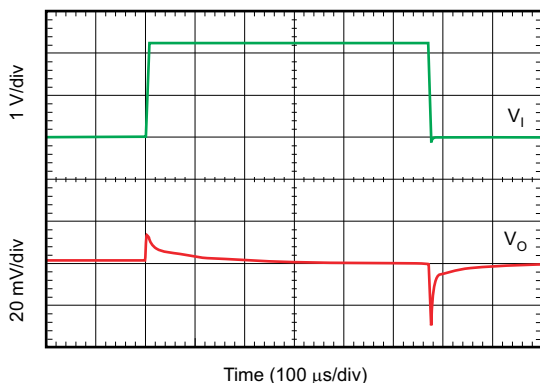
**Figure 6-50. Line Transient Response**



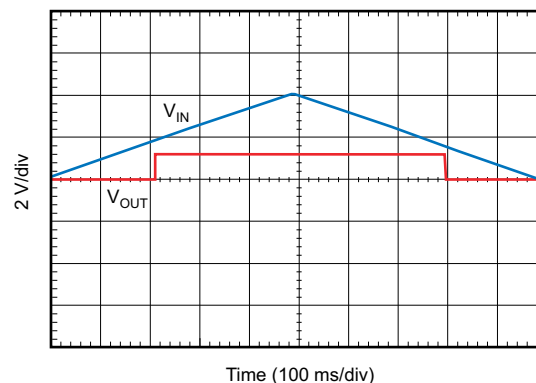
**Figure 6-51. Line Transient Response**



**Figure 6-52. Line Transient Response**



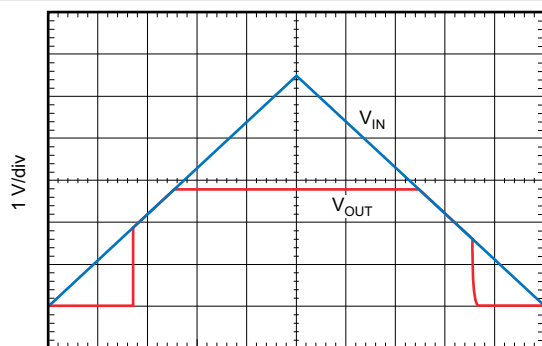
**Figure 6-53. Line Transient Response**



**Figure 6-54.  $V_{IN}$  Ramp Up, Ramp Down Response**

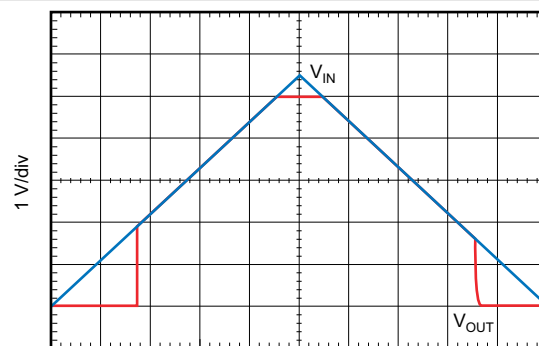
## 6.6 Typical Characteristics (continued)

at  $T_J = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.5\text{ V}$  or  $2.0\text{ V}$  (whichever is greater),  $I_{OUT} = 10\text{ mA}$ ,  $V_{EN} = V_{IN}$ , and  $C_{OUT} = 1\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^{\circ}\text{C}$



Time (100 ms/div)  
 $V_{OUT} = 2.8\text{ V}$ ,  $I_{OUT} = 30\text{ mA}$

**Figure 6-55.  $V_{IN}$  Ramp Up, Ramp Down Response**



Time (100 ms/div)  
 $V_{OUT} = 5\text{ V}$ ,  $I_{OUT} = 30\text{ mA}$

**Figure 6-56.  $V_{IN}$  Ramp Up, Ramp Down Response**

## 7 Detailed Description

### 7.1 Overview

The TLV707 series (TLV707 and TLV707P) belongs to a family of low-dropout regulators (LDOs). This device consumes low quiescent current and delivers excellent line and load transient performance. These characteristics, combined with low noise and very good PSRR with little ( $V_{IN} - V_{OUT}$ ) headroom, make this device designed for portable RF applications.

### 7.2 Functional Block Diagrams

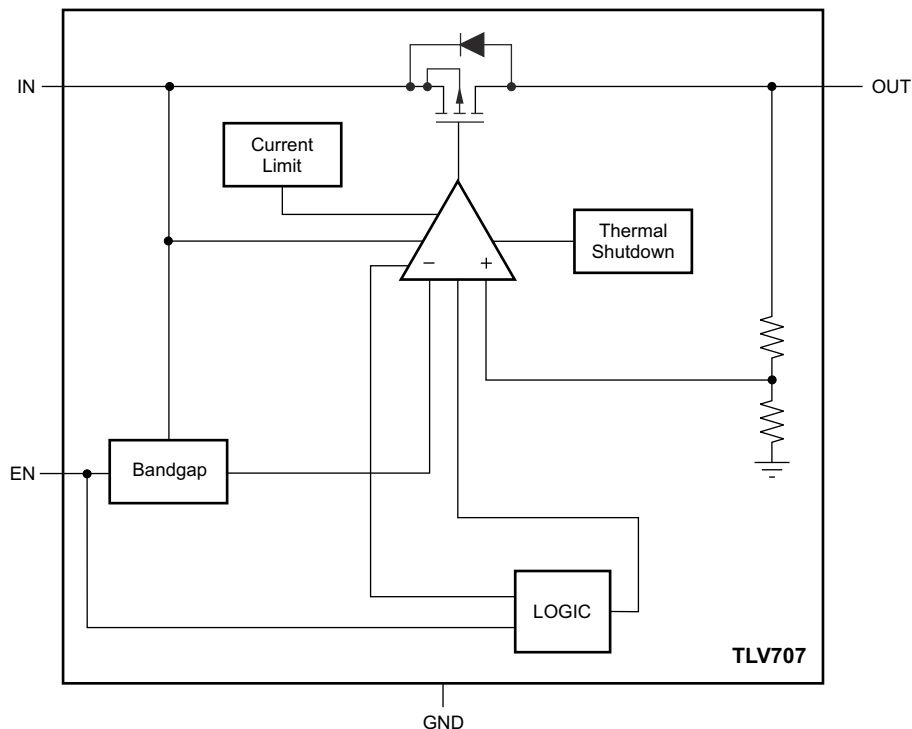
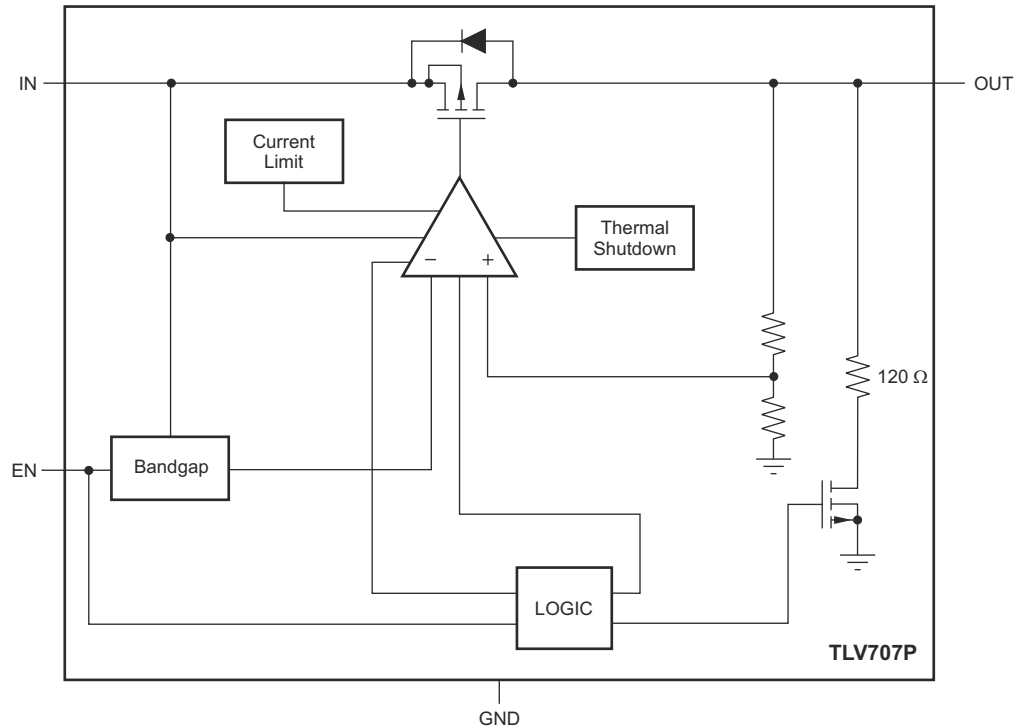


Figure 7-1. TLV707 Block Diagram





**Figure 7-2. TLV707P Block Diagram**

## 7.3 Feature Description

This LDO regulator offers current limit and thermal protection. The operating junction temperature of this device is  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

### 7.3.1 Internal Current Limit

The internal current limit helps protect the regulator during fault conditions. During current limit, the output sources a fixed amount of current that is largely independent of the output voltage. In such a case, the output voltage is not regulated, and is  $V_{\text{OUT}} = I_{\text{LIMIT}} \times R_{\text{LOAD}}$ . The PMOS pass transistor dissipates  $(V_{\text{IN}} - V_{\text{OUT}}) \times I_{\text{LIMIT}}$  until thermal shutdown is triggered and the device turns off. When the device cools, the internal thermal shutdown circuit turns the device back on. If the fault condition continues, the device cycles between current limit and thermal shutdown; see the [Thermal Information](#) table for more details.

The PMOS pass transistor has a built-in body diode that conducts current when the voltage at OUT exceeds the voltage at IN. This current is not limited, so if extended reverse voltage operation is anticipated, external limiting to 5% of the rated output current is recommended.

### 7.3.2 Shutdown

The enable pin (EN) is active high. The device is enabled when voltage at the EN pin goes above 0.9 V. This relatively lower voltage value required to turn on the LDO can also be used to power the device when connected to a GPIO of a newer processor, where the GPIO logic 1 voltage level is lower than that of traditional microcontrollers. The device is turned off when the EN pin is held at less than 0.4 V. When shutdown capability is not required, EN can be connected to the IN pin.

The TLV707P version has internal active pulldown circuitry that discharges the output with a time constant as given by [Equation 1](#):

$$\tau = \frac{(120 \cdot R_L)}{(120 + R_L)} \cdot C_{OUT} \quad (1)$$

where:

- $R_L$  = Load resistance
- $C_{OUT}$  = Output capacitor

### 7.4 Device Functional Modes

The TLV707 series is specified over the recommended operating conditions (see the [Recommended Operating Conditions](#) table). The specifications can possibly not be met when exposed to conditions outside of the recommended operating range.

In order to turn on the regulator, the EN pin must be driven over 0.9 V. Driving the EN pin below 0.4 V causes the regulator to enter shutdown mode.

In shutdown, the current consumption of the device is reduced to 1  $\mu$ A, typically.

## 8 Application and Implementation

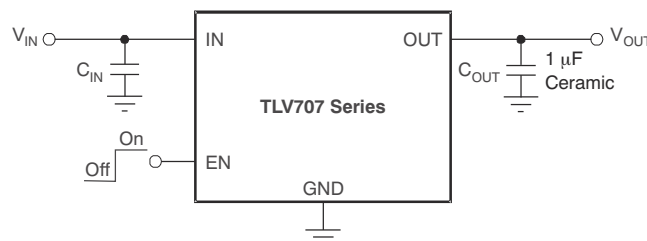
### Note

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, as well as validating and testing their design implementation to confirm system functionality.

### 8.1 Application Information

The TLV707 series is a low-dropout regulator (LDO) with low quiescent current that delivers excellent line and load transient performance. This LDO regulator offers current limit and thermal protection. The operating junction temperature of this device series is  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

### 8.2 Typical Application



**Figure 8-1. Typical Application Circuit**

#### 8.2.1 Design Requirements

Provide an input supply with adequate headroom to meet minimum VIN requirements (as shown in [Table 8-1](#)), compensate for the GND pin current, and to power the load.

**Table 8-1. Design Parameters**

| PARAMETER      | DESIGN REQUIREMENT |
|----------------|--------------------|
| Input voltage  | 1.8 V–3.6 V        |
| Output voltage | 1.2 V              |
| Output current | 100 mA             |

#### 8.2.2 Detailed Design Procedure

##### 8.2.2.1 Input and Output Capacitor Requirements

Generally, 1.0- $\mu\text{F}$  X5R- and X7R-type ceramic capacitors are recommended because these capacitors have minimal variation in value and equivalent series resistance (ESR) over temperature.

However, the TLV707 is designed to be stable with an effective capacitance of 0.1  $\mu\text{F}$  or larger at the output. Thus, the device is stable with capacitors of other dielectric types as well, as long as the effective capacitance under operating bias voltage and temperature is greater than 0.1  $\mu\text{F}$ . This effective capacitance refers to the capacitance that the LDO detects under operating bias voltage and temperature conditions; that is, the capacitance after taking both bias voltage and temperature derating into consideration. In addition to allowing the use of less expensive dielectrics, this capability of being stable with 0.1- $\mu\text{F}$  effective capacitance also enables the use of smaller footprint capacitors that have higher derating in size- and space-constrained applications.

Using a 0.1- $\mu\text{F}$  rated capacitor at the output of the LDO does not ensure stability because the effective capacitance under the specified operating conditions is less than 0.1  $\mu\text{F}$ . Maximum ESR must be less than 200 m $\Omega$ .

Although an input capacitor is not required for stability, good analog design practice is to connect a 0.1- $\mu\text{F}$  to 1.0- $\mu\text{F}$ , low ESR capacitor across the IN pin and GND pin of the regulator. This capacitor counteracts reactive

input sources and improves transient response, noise rejection, and ripple rejection. A higher-value capacitor can be necessary if large, fast rise-time load transients are anticipated, or if the device is not located close to the power source. If source impedance is more than 2-Ω, a 0.1-μF input capacitor can be necessary to provide stability.

#### **8.2.2.2 Dropout Voltage**

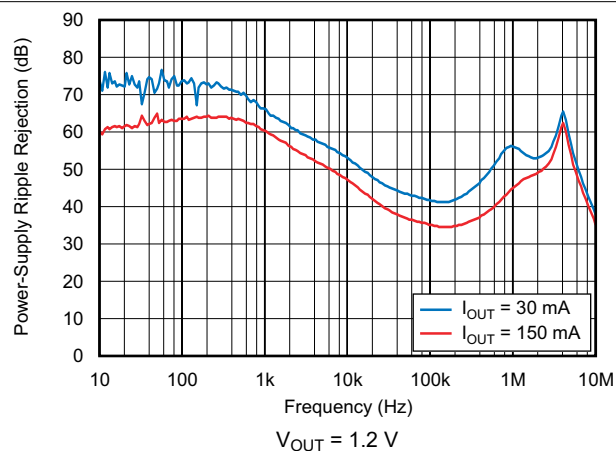
The TLV707 series of LDOs use a PMOS pass transistor to achieve low dropout. When  $(V_{IN} - V_{OUT})$  is less than the dropout voltage ( $V_{DO}$ ), the PMOS pass transistor is in the linear region of operation and the input-to-output resistance is the  $R_{DS(ON)}$  of the PMOS pass transistor.  $V_{DO}$  scales approximately with output current because the PMOS transistor functions similar to a resistor in dropout.

As with any linear regulator, PSRR and transient response are degraded when  $(V_{IN} - V_{OUT})$  approaches dropout.

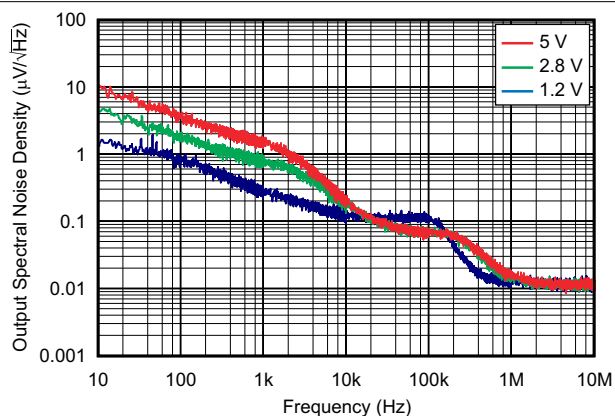
#### **8.2.2.3 Transient Response**

As with any regulator, increasing the size of the output capacitor reduces over- and undershoot magnitude but increases the duration of the transient response.

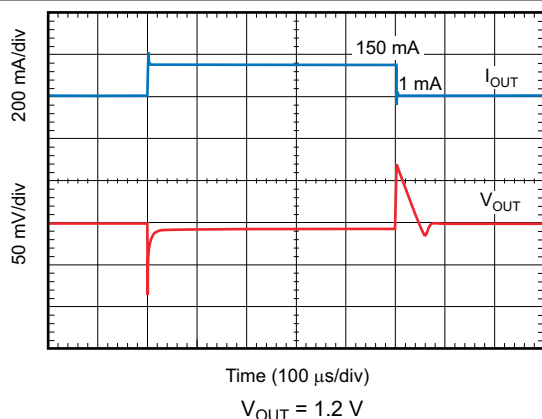
## 8.2.3 Application Curves



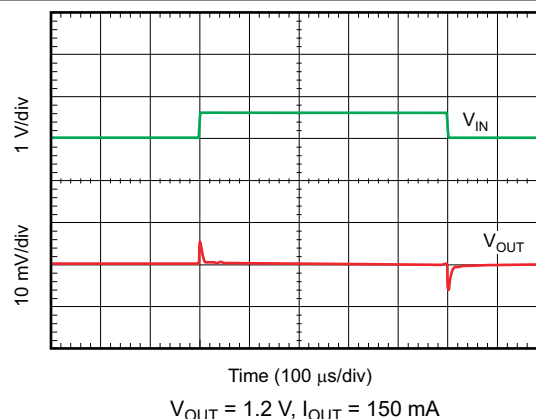
**Figure 8-2. Power-Supply Ripple Rejection vs Frequency**



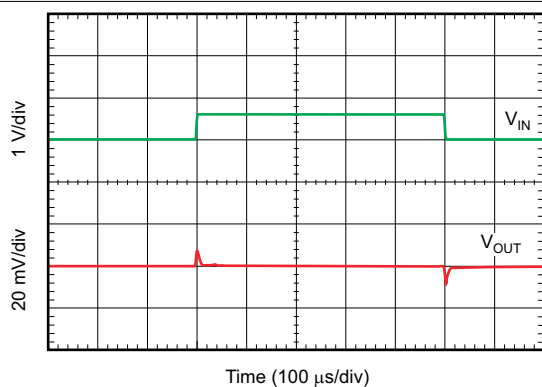
**Figure 8-3. Output Spectral Noise Density vs Frequency**



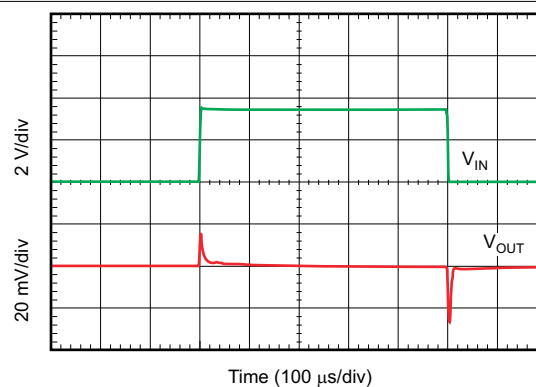
**Figure 8-4. Load Transient Response**



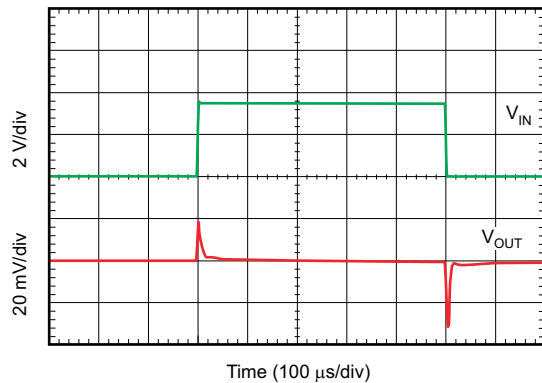
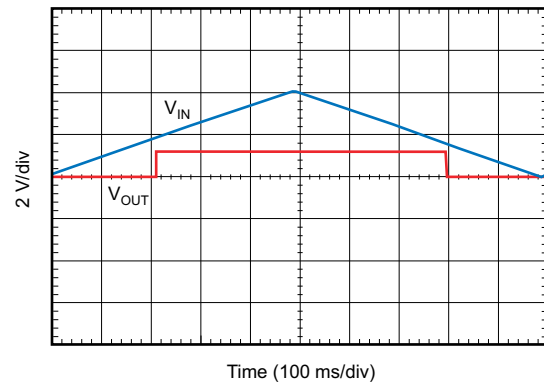
**Figure 8-5. Line Transient Response**



**Figure 8-6. Line Transient Response**



**Figure 8-7. Line Transient Response**


 $V_{OUT} = 1.2 \text{ V}$ ,  $I_{OUT} = 200 \text{ mA}$ 
**Figure 8-8. Line Transient Response**
 $V_{OUT} = 1.2 \text{ V}$ ,  $I_{OUT} = 30 \text{ mA}$ 
**Figure 8-9.  $V_{IN}$  Ramp Up, Ramp Down Response**

### 8.3 Best Design Practices

Place at least one 1.0- $\mu$ F ceramic capacitor as close as possible to the OUT pin of the regulator.

Do not place the output capacitor more than 10 mm away from the regulator.

Connect a 1.0- $\mu$ F low equivalent series resistance (ESR) capacitor across the IN pin and GND input of the regulator for improved transient performance.

Do not exceed the absolute maximum ratings.

## 8.4 Power Supply Recommendations

The device is designed to operate from an input voltage supply range between 2.0 V and 5.5 V. The input voltage range provides adequate headroom in order for the device to have a regulated output. This input supply must be well regulated (see [Figure 6-46](#) through [Figure 6-53](#)). If the input supply is noisy, additional input capacitors with low ESR help improve the output noise performance.

## 8.5 Layout

### 8.5.1 Layout Guidelines

#### 8.5.1.1 Board Layout Recommendations to Improve PSRR and Noise Performance

Place input and output capacitors as close to the device pins as possible. To improve ac performance (such as PSRR, output noise, and transient response), design the board with separate ground planes for  $V_{IN}$  and  $V_{OUT}$ , with the ground plane connected only at the GND pin of the device, as shown in [Figure 8-10](#). In addition, connect the ground connection for the output capacitor directly to the GND pin of the device. High ESR capacitors can degrade PSRR performance.

#### 8.5.1.2 Package Mounting

Solder pad footprint recommendations are available from TI's website at [www.ti.com](http://www.ti.com). The recommended land pattern for the DQN (X2SON-4) package is provided in the [Mechanical, Packaging, and Orderable Information](#) section.

#### 8.5.1.3 Thermal Considerations

Thermal protection disables the output when the junction temperature rises to approximately 160°C, allowing the device to cool. When the junction temperature cools to approximately 140°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit can cycle on and off. This cycling limits the dissipation of the regulator, thus protecting the regulator from damage as a result of overheating.

Any tendency to activate the thermal protection circuit indicates excessive power dissipation or an inadequate heat sink. For reliable operation, limit junction temperature to 125°C (maximum). To estimate the margin of safety in a complete design (including heat sink), increase the ambient temperature until the thermal protection is triggered; use worst-case loads and signal conditions.

For good reliability, thermal protection triggers at least 35°C above the maximum expected ambient condition of the particular application. This configuration produces a worst-case junction temperature of 125°C at the highest expected ambient temperature and worst-case load.

The internal protection circuitry of the LDO is designed to protect against overload conditions. This circuitry is not intended to replace proper heat sinking. Continuously running the LDO into thermal shutdown degrades device reliability.

#### 8.5.1.4 Power Dissipation

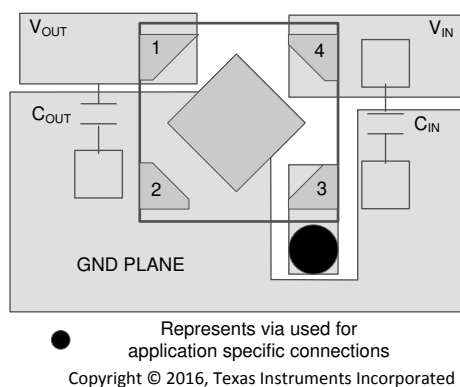
The ability to remove heat from the die is different for each package type, presenting different considerations in the printed-circuit-board (PCB) layout. The PCB area around the device that is free of other components moves the heat from the device to the ambient air.

Performance data for JEDEC low- and high-K boards are given in the [Thermal Information](#) table. Using heavier copper increases the effectiveness in removing heat from the device. The addition of plated through-holes to heat-dissipating layers also improves heat sink effectiveness.

Power dissipation depends on input voltage and load conditions. Power dissipation ( $P_D$ ) is equal to the product of the output current and the voltage drop across the output pass element, as shown in [Equation 2](#).

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} \quad (2)$$

## 8.5.2 Layout Example



**Figure 8-10. Recommended Layout Example**



## 9 Device and Documentation Support

### 9.1 Device Support

#### 9.1.1 Development Support

##### 9.1.1.1 Evaluation Modules

An evaluation module (EVM) is available to assist in the initial circuit performance evaluation using the TLV707 and TLV707P. [SLVU416](#) details the design kits and evaluation modules for TLV70728EVM-612.

The EVM can be requested at the Texas Instruments web site through the [TLV707](#) and [TLV707P](#) product folders, or purchased [directly from the TI eStore](#).

##### 9.1.1.2 Spice Models

Computer simulation of circuit performance using SPICE is often useful when analyzing the performance of analog circuits and systems. A SPICE model for the TLV707 and TLV707P is available through the respective device product folders under *Simulation Models*.

#### 9.1.2 Device Nomenclature

**Table 9-1. Ordering Information<sup>(1)</sup>**

| PRODUCT               | V <sub>OUT</sub> <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TLV707xx(x)(A)(P)yyyz | <p><b>xx(x)</b> is the nominal output voltage. For output voltages with a resolution of 100 mV, two digits are used in the ordering number; otherwise, three digits are used (for example, 18 = 1.8 V, 285 = 2.85 V).</p> <p><b>A</b> indicates a more recent design revision.</p> <p><b>P</b> is optional; devices with P have an LDO regulator with an active output discharge.</p> <p><b>yyy</b> is the package designator.</p> <p><b>z</b> is the package quantity. Use <b>R</b> for reel (3000 pieces), and <b>T</b> for tape (250 pieces).</p> |

- (1) For the most current package and ordering information see the Package Option Addendum at the end of this document, or visit the device product folder at [www.ti.com](#).
- (2) Output voltages from 0.85 V to 5.0 V in 50-mV increments are available. Contact factory for details and availability.

### 9.2 Documentation Support

#### 9.2.1 Related Documentation

For related documentation see the following:

- Texas Instruments, [TLV70728EVM-612 Evaluation Module user guide](#)

#### 9.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](#). Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 9.4 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is 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](#).

### 9.5 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

## 9.6 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## 9.7 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 10 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 family of 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) |
|--------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">TLV707085DQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BY                  |
| TLV707085DQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BY                  |
| <a href="#">TLV707085DQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BY                  |
| TLV707085DQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BY                  |
| <a href="#">TLV70710DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | BB                  |
| TLV70710DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | BB                  |
| <a href="#">TLV70710DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | BB                  |
| TLV70710DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | BB                  |
| <a href="#">TLV70710PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | BC                  |
| TLV70710PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | BC                  |
| <a href="#">TLV70710PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | BC                  |
| TLV70710PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | BC                  |
| <a href="#">TLV707115DQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | B3                  |
| TLV707115DQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | B3                  |
| <a href="#">TLV707115DQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | B3                  |
| TLV707115DQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | B3                  |
| <a href="#">TLV70711PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C3                  |
| TLV70711PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C3                  |
| <a href="#">TLV70711PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C3                  |
| TLV70711PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C3                  |
| <a href="#">TLV70712APDQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N6                  |
| TLV70712APDQNR.A               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N6                  |
| <a href="#">TLV70712PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | WJ                  |
| TLV70712PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | WJ                  |
| <a href="#">TLV70712PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | WJ                  |
| TLV70712PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | WJ                  |
| <a href="#">TLV707135DQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BD                  |
| TLV707135DQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BD                  |
| <a href="#">TLV707135DQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BD                  |

| 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) |
|--------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| TLV707135DQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BD                  |
| <a href="#">TLV70715PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | WI                  |
| TLV70715PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | WI                  |
| <a href="#">TLV70715PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | WI                  |
| TLV70715PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | WI                  |
| <a href="#">TLV70717DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | GD                  |
| TLV70717DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | GD                  |
| <a href="#">TLV70717DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | GD                  |
| TLV70717DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | GD                  |
| <a href="#">TLV707185ADQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | MZ                  |
| TLV707185ADQNR.A               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | MZ                  |
| <a href="#">TLV707185DQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | ZN                  |
| TLV707185DQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | ZN                  |
| <a href="#">TLV707185DQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | ZN                  |
| TLV707185DQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | ZN                  |
| <a href="#">TLV707185PDQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | B1                  |
| TLV707185PDQNR.B               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | B1                  |
| <a href="#">TLV707185PDQNT</a> | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | B1                  |
| TLV707185PDQNT.B               | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | B1                  |
| <a href="#">TLV70718ADQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | MX                  |
| TLV70718ADQNR.A                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | MX                  |
| <a href="#">TLV70718APDQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N7                  |
| TLV70718APDQNR.A               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N7                  |
| <a href="#">TLV70718DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | ZC                  |
| TLV70718DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | ZC                  |
| <a href="#">TLV70718DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | ZC                  |
| TLV70718DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | ZC                  |
| <a href="#">TLV70718PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | SB                  |
| TLV70718PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SB                  |
| TLV70718PDQNRG4                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SB                  |
| TLV70718PDQNRG4.B              | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SB                  |

| 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="#">TLV70718PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | SB                  |
| TLV70718PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SB                  |
| <a href="#">TLV70719PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | ZM                  |
| TLV70719PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | ZM                  |
| <a href="#">TLV70719PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | ZM                  |
| TLV70719PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | ZM                  |
| <a href="#">TLV70725DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BM                  |
| TLV70725DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BM                  |
| <a href="#">TLV70725DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BM                  |
| TLV70725DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BM                  |
| <a href="#">TLV70725PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | AT                  |
| TLV70725PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | AT                  |
| <a href="#">TLV70725PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | AT                  |
| TLV70725PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | AT                  |
| <a href="#">TLV70726DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | RF                  |
| TLV70726DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | RF                  |
| <a href="#">TLV70726DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | RF                  |
| TLV70726DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | RF                  |
| <a href="#">TLV70726PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | SC                  |
| TLV70726PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | SC                  |
| <a href="#">TLV70726PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | SC                  |
| TLV70726PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | SC                  |
| <a href="#">TLV70727PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C6                  |
| TLV70727PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C6                  |
| <a href="#">TLV70727PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C6                  |
| TLV70727PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C6                  |
| <a href="#">TLV707285DQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | RZ                  |
| TLV707285DQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | RZ                  |
| <a href="#">TLV707285DQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | RZ                  |
| TLV707285DQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | RZ                  |
| <a href="#">TLV707285PDQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | XE                  |

| 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) |
|--------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| TLV707285PDQNR.B               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | XE                  |
| <a href="#">TLV707285PDQNT</a> | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | XE                  |
| TLV707285PDQNT.B               | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | XE                  |
| <a href="#">TLV70728APDQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N8                  |
| TLV70728APDQNR.A               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N8                  |
| <a href="#">TLV70728PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | SD                  |
| TLV70728PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SD                  |
| <a href="#">TLV70728PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | SD                  |
| TLV70728PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SD                  |
| <a href="#">TLV70729DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | BF                  |
| TLV70729DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BF                  |
| <a href="#">TLV70729DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | BF                  |
| TLV70729DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BF                  |
| <a href="#">TLV70729PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | BG                  |
| TLV70729PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | BG                  |
| <a href="#">TLV70729PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | BG                  |
| TLV70729PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | BG                  |
| <a href="#">TLV70730ADQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N1                  |
| TLV70730ADQNR.A                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N1                  |
| <a href="#">TLV70730APDQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N2                  |
| TLV70730APDQNR.A               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N2                  |
| <a href="#">TLV70730DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | HJ                  |
| TLV70730DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | HJ                  |
| <a href="#">TLV70730DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | HJ                  |
| TLV70730DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | HJ                  |
| <a href="#">TLV70730PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | SE                  |
| TLV70730PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SE                  |
| TLV70730PDQNRG4                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SE                  |
| TLV70730PDQNRG4.B              | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SE                  |
| <a href="#">TLV70730PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | SE                  |
| TLV70730PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | SE                  |



| 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="#">TLV70731DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | DI                  |
| TLV70731DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | DI                  |
| <a href="#">TLV70731DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | DI                  |
| TLV70731DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | DI                  |
| <a href="#">TLV70732DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C8                  |
| TLV70732DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C8                  |
| <a href="#">TLV70732DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C8                  |
| TLV70732DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C8                  |
| <a href="#">TLV707335ADQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N5                  |
| TLV707335ADQNR.A               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N5                  |
| <a href="#">TLV707335DQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | F6                  |
| TLV707335DQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | F6                  |
| <a href="#">TLV707335DQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | F6                  |
| TLV707335DQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | F6                  |
| <a href="#">TLV70733ADQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N3                  |
| TLV70733ADQNR.A                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N3                  |
| <a href="#">TLV70733APDQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N4                  |
| TLV70733APDQNR.A               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | N4                  |
| <a href="#">TLV70733DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | YH                  |
| TLV70733DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | YH                  |
| <a href="#">TLV70733DQNR1</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BN                  |
| TLV70733DQNR1.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | BN                  |
| <a href="#">TLV70733DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | YH                  |
| TLV70733DQNT.B                 | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | YH                  |
| <a href="#">TLV70733PDQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | TI                  |
| TLV70733PDQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TI                  |
| <a href="#">TLV70733PDQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | TI                  |
| TLV70733PDQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TI                  |
| <a href="#">TLV70734DQNR</a>   | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | AQ                  |
| TLV70734DQNR.B                 | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | AQ                  |
| <a href="#">TLV70734DQNT</a>   | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | AQ                  |

| 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) |
|-------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| TLV70734DQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | AQ                  |
| <a href="#">TLV70734PDQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | AP                  |
| TLV70734PDQNR.B               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | AP                  |
| <a href="#">TLV70734PDQNT</a> | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | AP                  |
| TLV70734PDQNT.B               | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | AP                  |
| <a href="#">TLV70736DQNR</a>  | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | CC                  |
| TLV70736DQNR.B                | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | CC                  |
| <a href="#">TLV70736DQNT</a>  | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 125   | CC                  |
| TLV70736DQNT.B                | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 125   | CC                  |
| <a href="#">TLV70736PDQNR</a> | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | ZO                  |
| TLV70736PDQNR.B               | Active        | Production           | X2SON (DQN)   4 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | ZO                  |
| <a href="#">TLV70736PDQNT</a> | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | ZO                  |
| TLV70736PDQNT.B               | Active        | Production           | X2SON (DQN)   4 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | ZO                  |

<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.

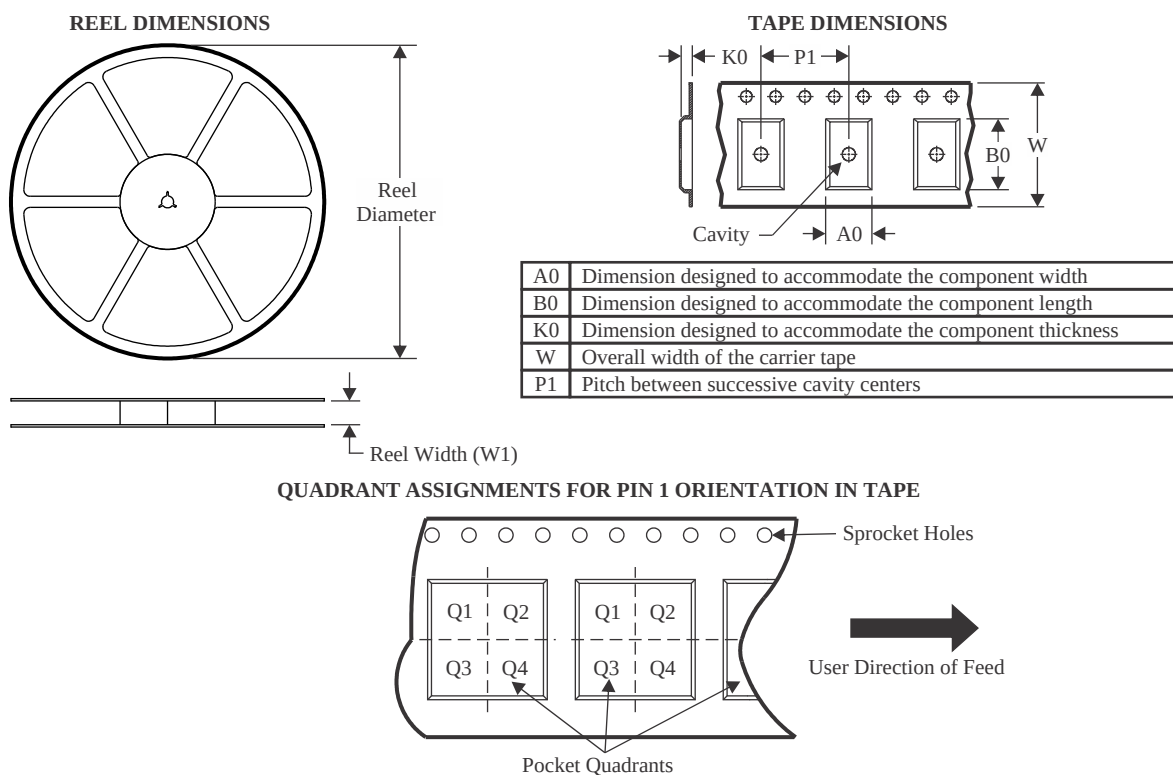
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.



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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

## TAPE AND REEL INFORMATION



\*All dimensions are nominal

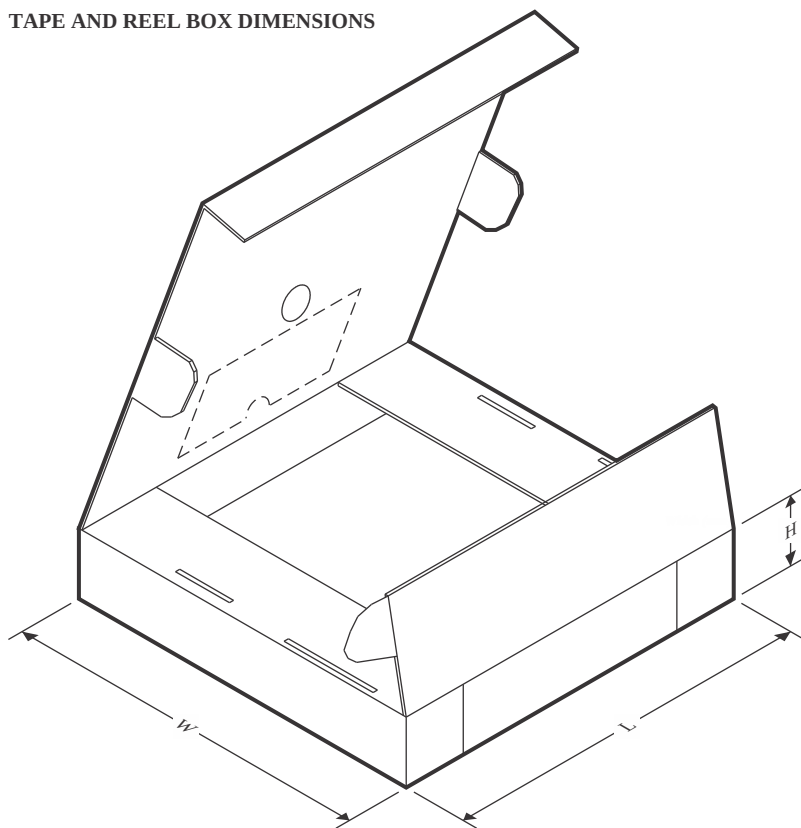
| Device        | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TLV707085DQNR | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707085DQNT | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70710DQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70710DQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70710DQNT  | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70710DQNT  | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70710PDQNR | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70710PDQNR | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70710PDQNT | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70710PDQNT | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV707115DQNR | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV707115DQNR | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707115DQNT | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV707115DQNT | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70711PDQNR | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70711PDQNT | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |

| 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 |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TLV70712APDQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70712PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70712PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707135DQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707135DQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70715PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70715PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70715PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70715PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70717DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70717DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707185ADQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707185DQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707185DQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707185PDQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707185PDQNT  | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70718ADQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70718APDQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70718DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70718DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70718DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70718PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70718PDQNRG4 | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70718PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70719PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70719PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70725DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70725DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70725PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70725PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70726DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70726DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70726DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70726DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70726PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70726PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70726PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70726PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70727PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70727PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707285DQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |

| 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 |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TLV707285DQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707285PDQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707285PDQNT  | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70728APDQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70728PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70728PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70729DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70729DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70729PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70729PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70729PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70729PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70730ADQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70730APDQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70730DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70730DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70730PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70730PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70730PDQNRG4 | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70730PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70731DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70731DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70732DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70732DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707335ADQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707335DQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV707335DQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70733ADQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70733APDQNR  | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70733DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70733DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70733DQNR1   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q1            |
| TLV70733DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70733PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70733PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70734DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70734DQNT    | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70734PDQNR   | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70734PDQNT   | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70736DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70736DQNR    | X2SON        | DQN             | 4    | 3000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |

| 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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TLV70736DQNT  | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| TLV70736DQNT  | X2SON        | DQN             | 4    | 250  | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70736PDQNR | X2SON        | DQN             | 4    | 3000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| TLV70736PDQNT | X2SON        | DQN             | 4    | 250  | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TLV707085DQNR  | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV707085DQNT  | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70710DQNR   | X2SON        | DQN             | 4    | 3000 | 183.0       | 183.0      | 20.0        |
| TLV70710DQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70710DQNT   | X2SON        | DQN             | 4    | 250  | 183.0       | 183.0      | 20.0        |
| TLV70710DQNT   | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70710PDQNR  | X2SON        | DQN             | 4    | 3000 | 183.0       | 183.0      | 20.0        |
| TLV70710PDQNR  | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70710PDQNT  | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70710PDQNT  | X2SON        | DQN             | 4    | 250  | 183.0       | 183.0      | 20.0        |
| TLV707115DQNR  | X2SON        | DQN             | 4    | 3000 | 183.0       | 183.0      | 20.0        |
| TLV707115DQNR  | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV707115DQNT  | X2SON        | DQN             | 4    | 250  | 183.0       | 183.0      | 20.0        |
| TLV707115DQNT  | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70711PDQNR  | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70711PDQNT  | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70712APDQNR | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70712PDQNR  | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |

| Device          | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TLV70712PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV707135DQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV707135DQNT   | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70715PDQNR   | X2SON        | DQN             | 4    | 3000 | 183.0       | 183.0      | 20.0        |
| TLV70715PDQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70715PDQNT   | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70715PDQNT   | X2SON        | DQN             | 4    | 250  | 183.0       | 183.0      | 20.0        |
| TLV70717DQNR    | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70717DQNT    | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV707185ADQNR  | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV707185DQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV707185DQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV707185PDQNR  | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV707185PDQNT  | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70718ADQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70718APDQNR  | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70718DQNR    | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70718DQNR    | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70718DQNT    | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70718PDQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70718PDQNRG4 | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70718PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70719PDQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70719PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70725DQNR    | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70725DQNT    | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70725PDQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70725PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70726DQNR    | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70726DQNR    | X2SON        | DQN             | 4    | 3000 | 183.0       | 183.0      | 20.0        |
| TLV70726DQNT    | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70726DQNT    | X2SON        | DQN             | 4    | 250  | 183.0       | 183.0      | 20.0        |
| TLV70726PDQNR   | X2SON        | DQN             | 4    | 3000 | 183.0       | 183.0      | 20.0        |
| TLV70726PDQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70726PDQNT   | X2SON        | DQN             | 4    | 250  | 183.0       | 183.0      | 20.0        |
| TLV70726PDQNT   | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70727PDQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70727PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV707285DQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV707285DQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV707285PDQNR  | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV707285PDQNT  | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70728APDQNR  | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |

| Device          | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TLV70728PDQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70728PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70729DQNR    | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70729DQNT    | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70729PDQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70729PDQNR   | X2SON        | DQN             | 4    | 3000 | 183.0       | 183.0      | 20.0        |
| TLV70729PDQNT   | X2SON        | DQN             | 4    | 250  | 183.0       | 183.0      | 20.0        |
| TLV70729PDQNT   | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70730ADQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70730APDQNR  | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70730DQNR    | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70730DQNT    | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70730PDQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70730PDQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70730PDQNRG4 | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70730PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70731DQNR    | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70731DQNT    | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70732DQNR    | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70732DQNT    | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV707335ADQNR  | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV707335DQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV707335DQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70733ADQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70733APDQNR  | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70733DQNR    | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70733DQNR    | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70733DQNR1   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70733DQNT    | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70733PDQNR   | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70733PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70734DQNR    | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70734DQNT    | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70734PDQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70734PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |
| TLV70736DQNR    | X2SON        | DQN             | 4    | 3000 | 183.0       | 183.0      | 20.0        |
| TLV70736DQNR    | X2SON        | DQN             | 4    | 3000 | 184.0       | 184.0      | 19.0        |
| TLV70736DQNT    | X2SON        | DQN             | 4    | 250  | 183.0       | 183.0      | 20.0        |
| TLV70736DQNT    | X2SON        | DQN             | 4    | 250  | 184.0       | 184.0      | 19.0        |
| TLV70736PDQNR   | X2SON        | DQN             | 4    | 3000 | 210.0       | 185.0      | 35.0        |
| TLV70736PDQNT   | X2SON        | DQN             | 4    | 250  | 210.0       | 185.0      | 35.0        |



**DQN 4**

## GENERIC PACKAGE VIEW

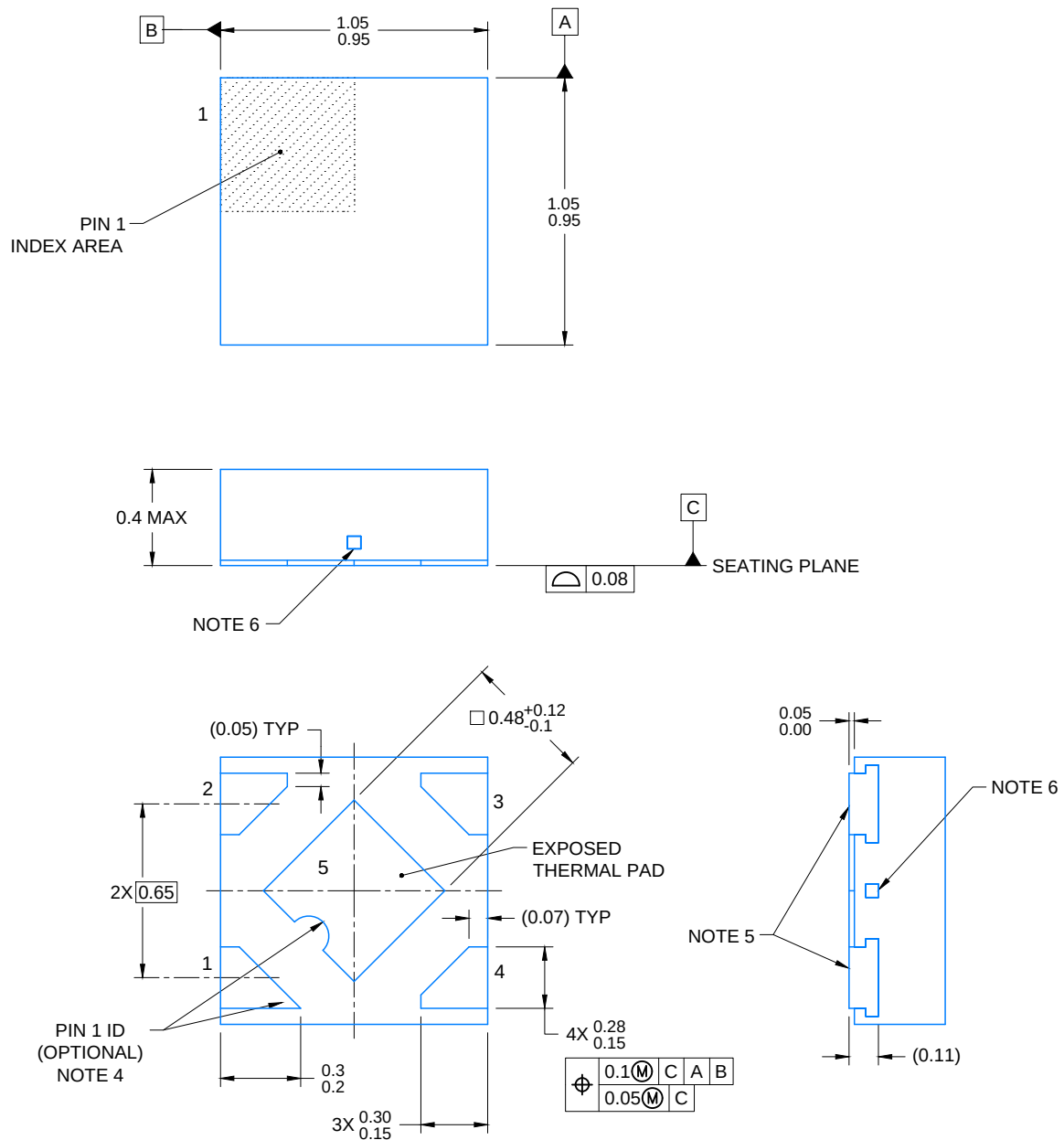
**X2SON - 0.4 mm max height**

PLASTIC SMALL OUTLINE - NO LEAD



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

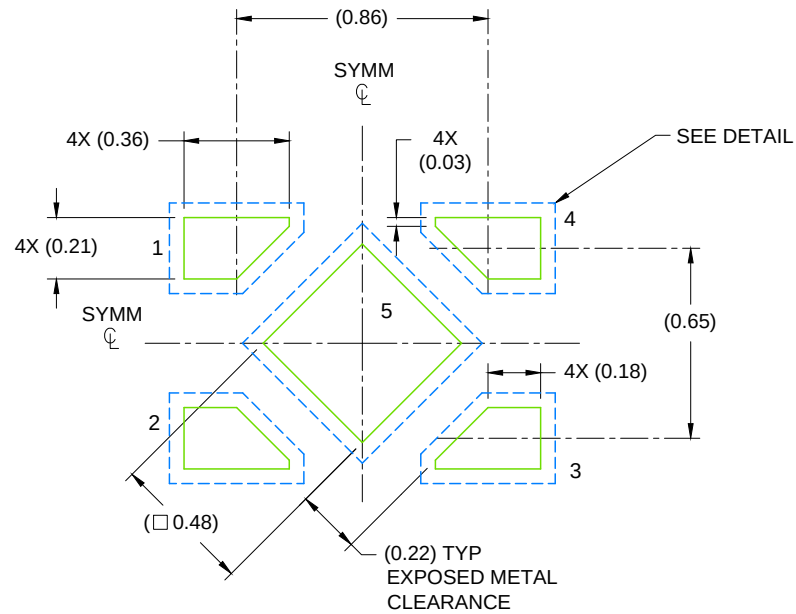
4210367/F



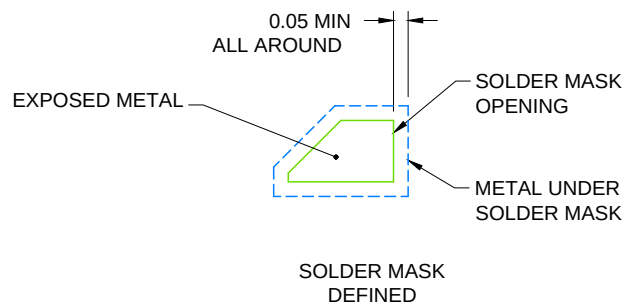
4215302/E 12/2016

NOTES:

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. The package thermal pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.
4. Features may not exist. Recommend use of pin 1 marking on top of package for orientation purposes.
5. Shape of exposed side leads may differ.
6. Number and location of exposed tie bars may vary.



LAND PATTERN EXAMPLE  
SCALE: 40X

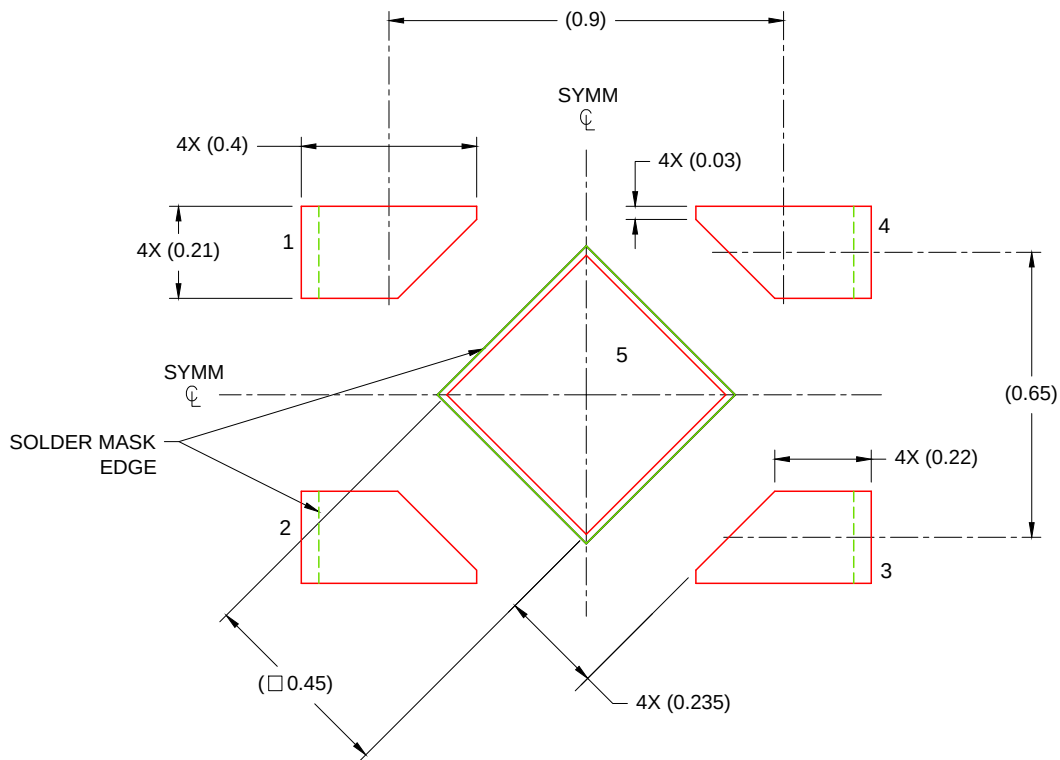


SOLDER MASK DETAIL

4215302/E 12/2016

NOTES: (continued)

7. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).
8. If any vias are implemented, it is recommended that vias under paste be filled, plugged or tented.



SOLDER PASTE EXAMPLE  
 BASED ON 0.075 - 0.1mm THICK STENCIL

EXPOSED PAD  
 88% PRINTED SOLDER COVERAGE BY AREA  
 SCALE: 60X

4215302/E 12/2016

NOTES: (continued)

9. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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