TLV733P Capacitor-Free, 300-mA, Low-Dropout Regulator in 1-mm × 1-mm X2SON Package

1 Features

- Input Voltage Range: 1.4 V to 5.5 V
- Stable Operation With or Without Capacitors
- Foldback Overcurrent Protection
- Packages:
  - 1.0-mm × 1.0-mm X2SON (4)
  - SOT-23 (5)
- Very Low Dropout: 125 mV at 300 mA (3.3 V_{OUT})
- Accuracy: 1% typical, 1.4% maximum
- Low I_Q: 34 µA
- Available in Fixed-Output Voltages: 1.0 V to 3.3 V
- High PSRR: 50 dB at 1 kHz
- Active Output Discharge

2 Applications

- Tablets
- Smartphones
- Notebook and Desktop Computers
- Portable Industrial and Consumer Products
- WLAN and Other PC Add-On Cards
- Camera Modules

3 Description

The TLV733 series of low-dropout linear regulators (LDOs) are ultra-small, low quiescent current LDOs that can source 300 mA with good line and load transient performance. These devices provide a typical accuracy of 1%.

The TLV733 series is designed with a modern capacitor-free architecture to ensure stability without an input or output capacitor. The removal of the output capacitor allows for a very small solution size, and can eliminate inrush current at startup. However, the TLV733 series is also stable with ceramic output capacitors if an output capacitor is necessary. The TLV733 also provides foldback current control during device power-up and enabling if an output capacitor is used. This functionality is especially important in battery-operated devices.

The TLV733 provides an active pull-down circuit to quickly discharge output loads when disabled.

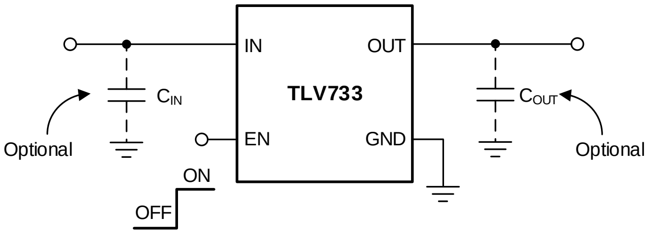
The TLV733 series is available in standard DBV (SOT-23) and DQN (X2SON) packages.

Device Information[1]

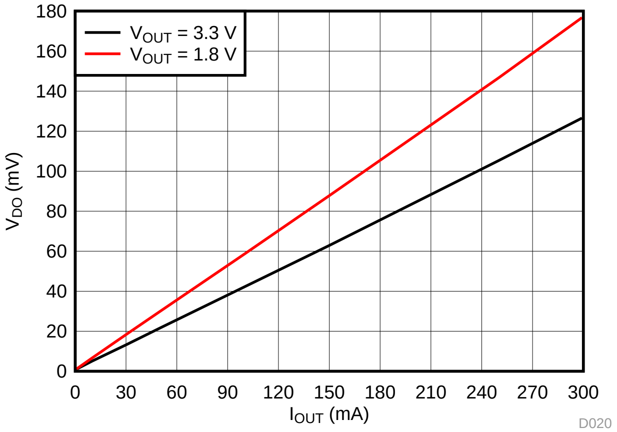
PART NUMBER	PACKAGE	BODY SIZE (NOM)
TLV733P	SOT-23 (5)	2.90 mm × 1.60 mm
	X2SON (4)	1.00 mm × 1.00 mm

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

Typical Application Circuit



Dropout Voltage vs Output Current



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

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4 Revision History

Changes from Revision B (November 2015) to Revision C **Page**

- Changed description of EN pin from 0.9 V to $V_{EN(HI)}$ and from 0.35 V to $V_{EN(LO)}$ 4
- Deleted typical specifications from $V_{EN(HI)}$ and $V_{EN(LO)}$ parameters 6
- Added maximum specification to I_{LIM} parameter 6
- Changed *Shutdown and Output Enable* title from *Shutdown* and changed first paragraph 14
- Added DBV package to last paragraph of *Power Dissipation* section 17
- Added (3) to *Device Nomenclature* table 21

Changes from Revision A (December 2014) to Revision B **Page**

- Changed Low Dropout Feature bullet value from 122 mV to 125 mV to match value in *Electrical Characteristics* 1
- Changed V_{OUT} labels on front page plot 1
- Changed min junction temperature value from –55 to –40 in *Absolute Maximum Ratings* table 5
- Changed max junction temperature value from 160 to 150 in *Absolute Maximum Ratings* table 5
- Changed max storage temperature value from 150 to 160 in *Absolute Maximum Ratings* table 5
- Added test condition to line regulation parameter in *Electrical Characteristics* table 6
- Changed unit for line regulation parameter from mV/V to mV 6
- Added test condition to load regulation parameter in *Electrical Characteristics* table 6

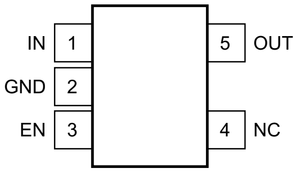
Changes from Original (October 2014) to Revision A **Page**

- Changed top page header information for data sheet to reflect device family instead of individual devices 1
- Changed Input Voltage Range Features bullet to be first in list 1
- Changed *Typical Application Circuit* on front page; corrected error in optional capacitor identification 1
- Changed format of I/O column contents and order of packages in *Pin Functions* table 4
- Moved storage temperature range specification to *Absolute Maximum Ratings* table 5
- Changed *Handling Ratings* table title to *ESD Ratings*, updated table format 5
- Added new first row to the V_{DO} parameter in the *Electrical Characteristics* table 6

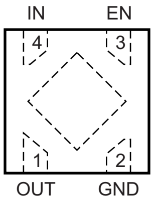
- Changed condition text for Figure 34 17
- Added *Evaluation Module* subsection 21
- Deleted *Related Links* section 21

5 Pin Configuration and Functions

DBV Package
5-Pin SOT-23
Top View



DQN Package
4-Pin 1-mm × 1-mm X2SON
Top View



Pin Functions

PIN			I/O	DESCRIPTION
	NO.			
NAME	DQN	DBV		
EN	3	3	I	Enable pin. Drive EN greater than $V_{EN(HI)}$ to turn on the regulator. Drive EN less than $V_{EN(LO)}$ to put the LDO into shutdown mode.
GND	2	2	—	Ground pin
IN	4	1	I	Input pin. A small capacitor is recommended from this pin to ground. See the *Input and Output Capacitor Selection* section for more details.
NC	N/A	4	—	No internal connection
OUT	1	5	O	Regulated output voltage pin. For best transient response, use a small 1-µF ceramic capacitor from this pin to ground. See the *Input and Output Capacitor Selection* section for more details.
Thermal pad		—	—	The thermal pad is electrically connected to the GND node. Connect to the GND plane for improved thermal performance.

6 Specifications

6.1 Absolute Maximum Ratings

over operating junction temperature range (unless otherwise noted); all voltages are with respect to GND[1]

		MIN	MAX	UNIT
Voltage	V_{IN}	–0.3	6.0	V
	V_{EN}	–0.3	V_{IN} + 0.3	
	V_{OUT}	–0.3	3.6	
Current	I_{OUT}	Internally limited		A
Output short-circuit duration		Indefinite		
Temperature	Operating junction, T_J	–40	150	°C
	Storage, T_{stg}	–65	160	

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001[1]	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101[2]	±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
Input range, V_{IN}	1.4		5.5	V
Output range, V_{OUT}	1.0		3.3	V
Output current, I_{OUT}	0		300	mA
Enable range, V_{EN}	0		V_{IN}	V
Junction temperature, T_J	–40		125	°C

6.4 Thermal Information

THERMAL METRIC[1]		TLV733P		UNIT
		DQN (X2SON)	DBV (SOT-23)	
		4 PINS	5 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	218.6	228.4	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	164.8	151.5	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	164.9	55.8	°C/W
ψ_{JT}	Junction-to-top characterization parameter	5.6	31.4	°C/W
ψ_{JB}	Junction-to-board characterization parameter	163.9	54.8	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	131.4	N/A	°C/W

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

6.5 Electrical Characteristics

At operating temperature range (T_J = –40°C to +125°C), V_{IN} = V_{OUT}(nom) + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, and C_{IN} = C_{OUT} = 1 µF (unless otherwise noted). All typical values at T_J = 25°C.

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{IN}	Input voltage			1.4		5.5	V
	DC output accuracy	T_J = 25°C		–1%		1%	
		–40°C ≤ T_J ≤ +125°C		–1.4%		1.4%	
UVLO	Undervoltage lockout	V_{IN} rising			1.3	1.4	V
		V_{IN} falling			1.25		
$\Delta V_{O(\Delta VI)}$	Line regulation	ΔVI = V_{IN}(nom) to V_{IN}(nom) + 1			1		mV
$\Delta V_{O(\Delta IO)}$	Load regulation	ΔIO = 1 mA to 300 mA	DQN package		16		mV
			DBV package		25		
V_{DO}	Dropout voltage[1]	V_{OUT} = 0.98 × V_{OUT}(nom), I_{OUT} = 300 mA	V_{OUT} = 1.1 V, –40°C ≤ T_J ≤ 85°C			460	mV
			1.2 V ≤ V_{OUT} < 1.5 V, –40°C ≤ T_J ≤ 85°C			420	
			1.5 V ≤ V_{OUT} < 1.8 V, –40°C ≤ T_J ≤ 85°C			370	
			1.8 V ≤ V_{OUT} < 2.5 V, –40°C ≤ T_J ≤ 85°C			270	
			2.5 V ≤ V_{OUT} < 3.3 V, –40°C ≤ T_J ≤ 85°C			260	
			V_{OUT} = 3.3 V, –40°C ≤ T_J ≤ 85°C		125	220	
			1.2 V ≤ V_{OUT} < 1.5 V, –40°C ≤ T_J ≤ 125°C			450	
			1.5 V ≤ V_{OUT} < 1.8 V, –40°C ≤ T_J ≤ 125°C			400	
			1.8 V ≤ V_{OUT} < 2.5 V, –40°C ≤ T_J ≤ 125°C			300	
			2.5 V ≤ V_{OUT} < 3.3 V, –40°C ≤ T_J ≤ 125°C			290	
			V_{OUT} = 3.3 V, –40°C ≤ T_J ≤ 125°C		125	270	
I_{GND}	Ground pin current	I_{OUT} = 0 mA			34	60	µA
I_{SHDN}	Shutdown current	V_{EN} ≤ 0.35 V, 2.0 V ≤ V_{IN} ≤ 5.5 V, T_J = 25°C			0.1	1	µA
PSRR	Power-supply rejection ratio	V_{OUT} = 1.8 V, I_{OUT} = 300 mA	f = 100 Hz		68		dB
			f = 10 kHz		35		
			f = 100 kHz		28		
V_n	Output noise voltage	BW = 10 Hz to 100 kHz, V_{OUT} = 1.8 V, I_{OUT} = 10 mA			120		μV_{RMS}
$V_{EN(HI)}$	EN pin high voltage (enabled)			0.9			V
$V_{EN(LO)}$	EN pin low voltage (disabled)					0.35	V
I_{EN}	EN pin current	V_{EN} = 5.5 V			0.01		µA
t_{STR}	Startup time	Time from EN assertion to 98% × V_{OUT}(nom), V_{OUT} = 1.0 V, I_{OUT} = 0 mA			250		µs
		Time from EN assertion to 98% × V_{OUT}(nom), V_{OUT} = 3.3 V, I_{OUT} = 0 mA			800		
	Pull-down resistor	V_{IN} = 2.3 V			120		Ω
I_{LIM}	Output current limit			360		700	mA
I_{OS}	Short-circuit current limit	V_{OUT} shorted to GND, V_{OUT} = 1.0 V			150		mA
		V_{OUT} shorted to GND, V_{OUT} = 3.3 V			170		
T_{sd}	Thermal shutdown	Shutdown, temperature increasing			160		°C
		Reset, temperature decreasing			140		

(1) Dropout voltage for the TLV73310P is not valid at room temperature. The device engages undervoltage lockout (V_{IN} < $UVLO_{FALL}$) before the dropout condition is met.

6.6 Typical Characteristics

at operating temperature range (T_J = –40°C to +125°C), V_{IN} = V_{OUT}(nom) + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, and C_{IN} = C_{OUT} = 1 µF (unless otherwise noted)

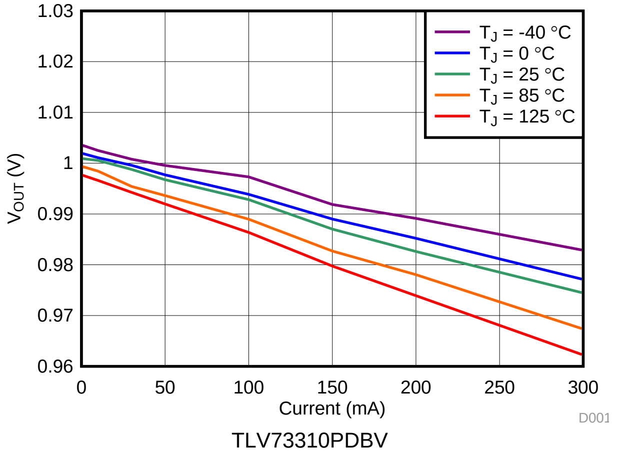


Figure 1. 1.0-V Load Regulation vs I_{OUT} and Temperature

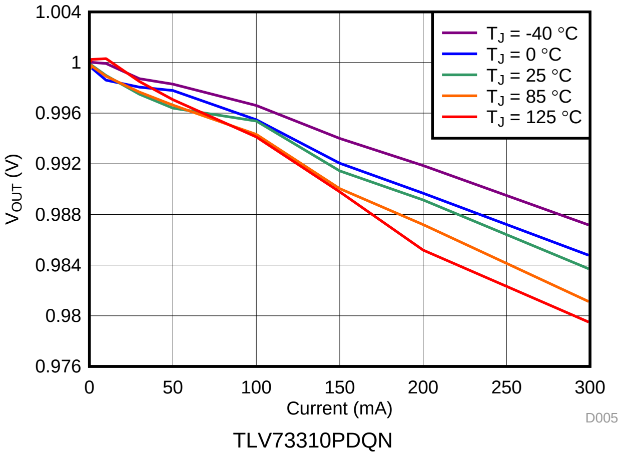


Figure 2. 1.0-V Load Regulation vs I_{OUT} and Temperature

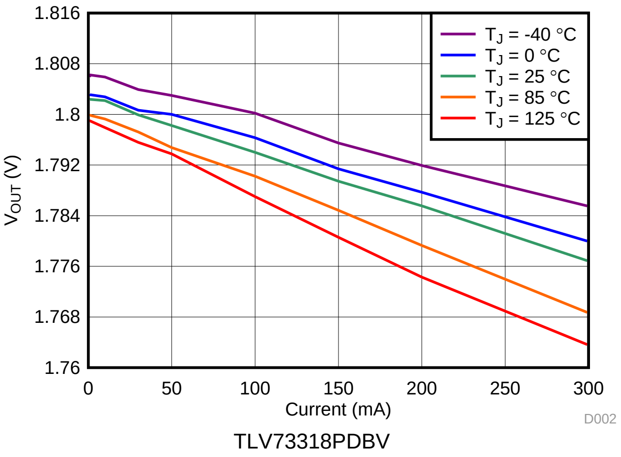


Figure 3. 1.8-V Load Regulation vs I_O and Temperature

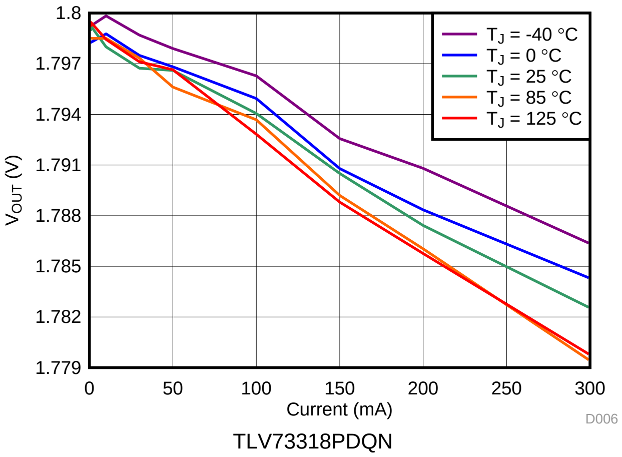


Figure 4. 1.8-V Load Regulation vs I_{OUT} and Temperature

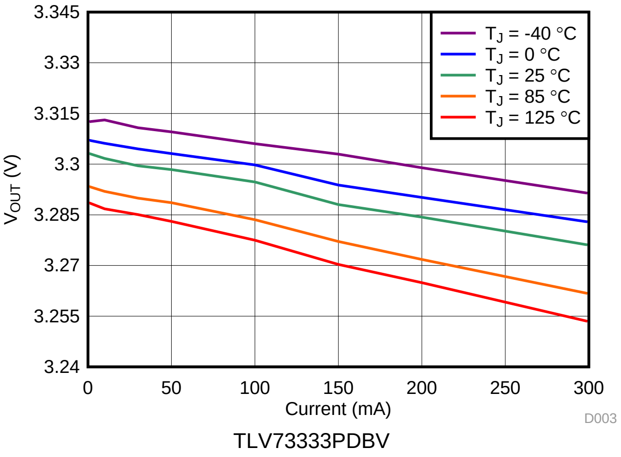


Figure 5. 3.3-V Load Regulation vs I_{OUT} and Temperature

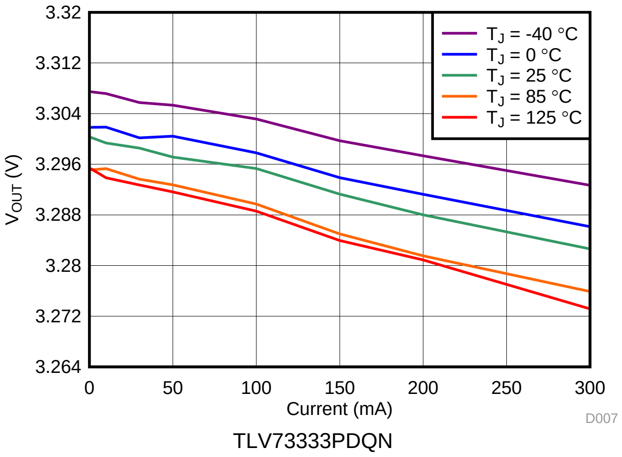
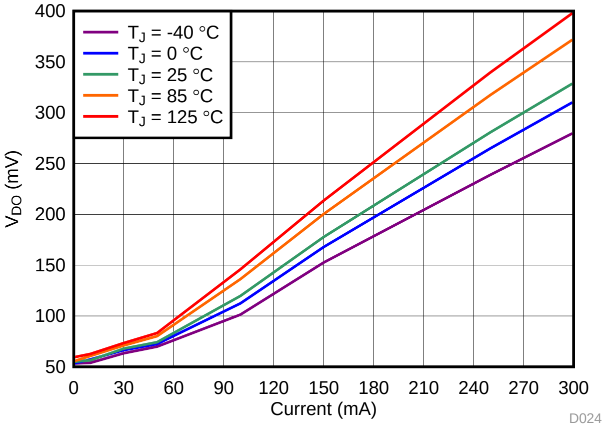


Figure 6. 3.3-V Load Regulation vs I_{OUT} and Temperature

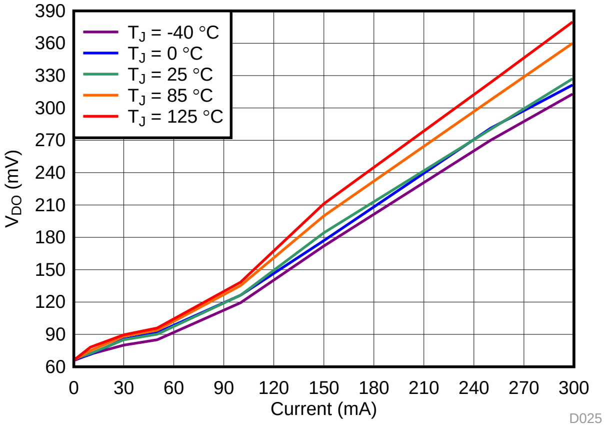
Typical Characteristics (continued)

at operating temperature range (T_J = –40°C to +125°C), V_{IN} = V_{OUT}(nom) + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, and C_{IN} = C_{OUT} = 1 µF (unless otherwise noted)



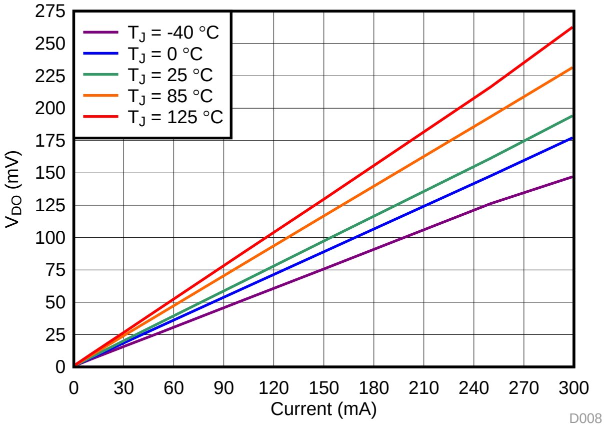
TLV73312PDBV

Figure 7. 1.2-V Dropout Voltage vs I_{OUT} and Temperature



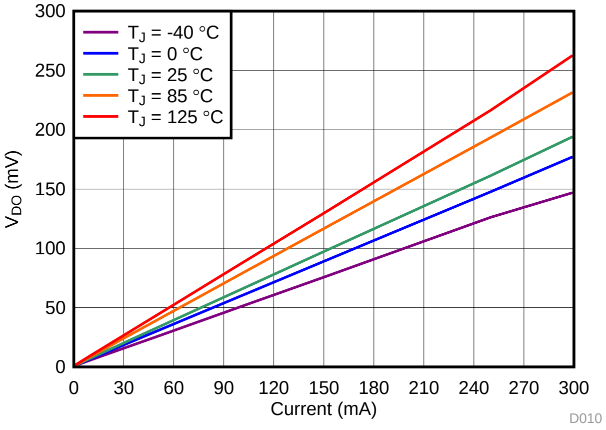
TLV73312PDQN

Figure 8. 1.2-V Dropout Voltage vs I_{OUT} and Temperature



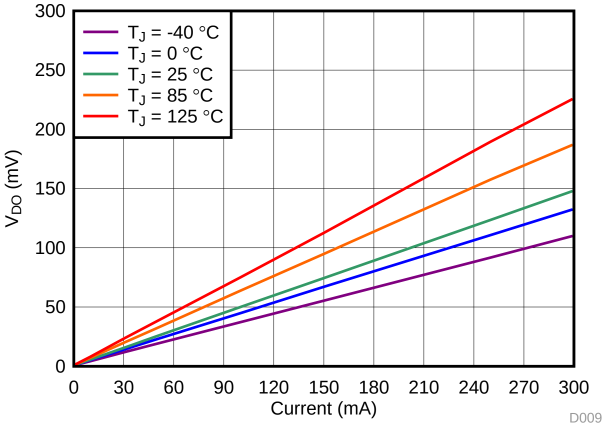
TLV73318PDBV

Figure 9. 1.8-V Dropout Voltage vs I_{OUT} and Temperature



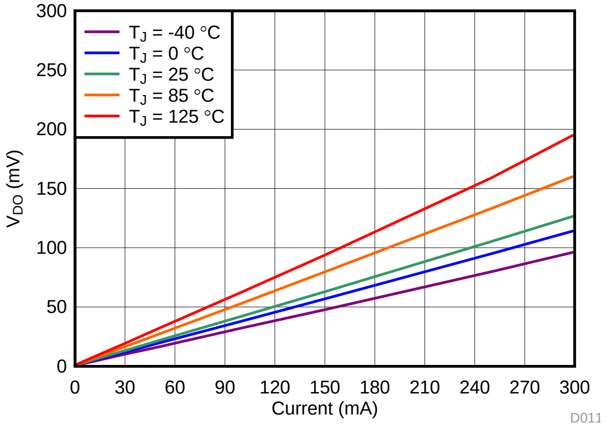
TLV73318PDQN

Figure 10. 1.8-V Dropout Voltage vs I_{OUT} and Temperature



TLV73333PDBV

Figure 11. 3.3-V Dropout Voltage vs I_{OUT} and Temperature

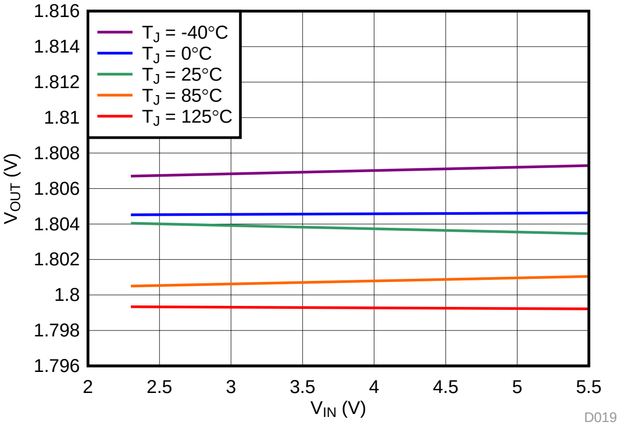


TLV73333PDQN

Figure 12. 3.3-V Dropout Voltage vs I_{OUT} and Temperature

Typical Characteristics (continued)

at operating temperature range (T_J = –40°C to +125°C), V_{IN} = V_{OUT}(nom) + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, and C_{IN} = C_{OUT} = 1 µF (unless otherwise noted)



TLV73318PDBV

Figure 13. 1.8-V Regulation vs V_{IN} (Line Regulation) and Temperature

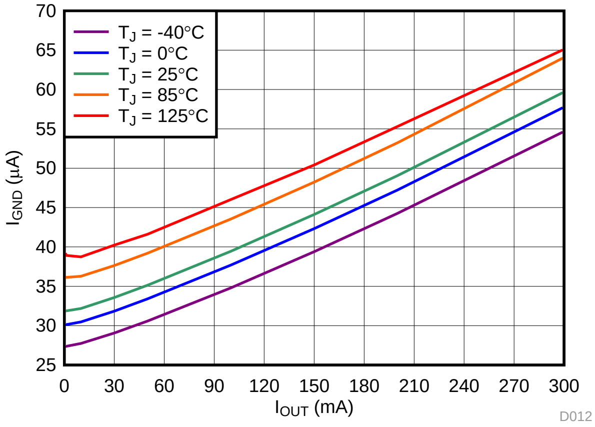


Figure 14. Ground Pin Current vs I_{OUT} and Temperature

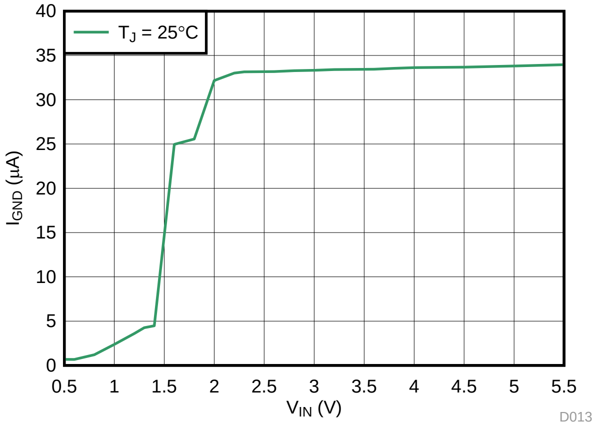
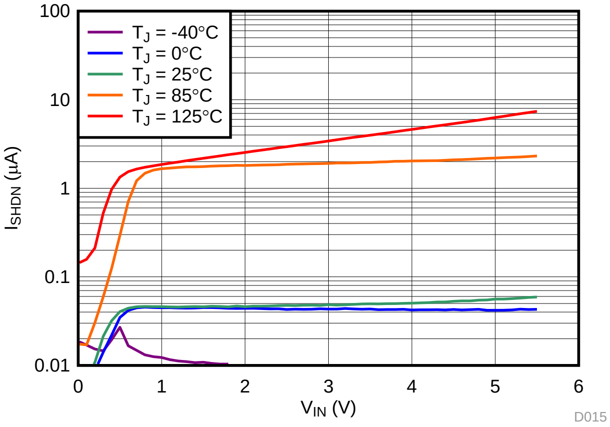


Figure 15. Ground Pin Current vs V_{IN}



I_{OUT} = 0 mA

Figure 16. Shutdown Current vs V_{IN} and Temperature

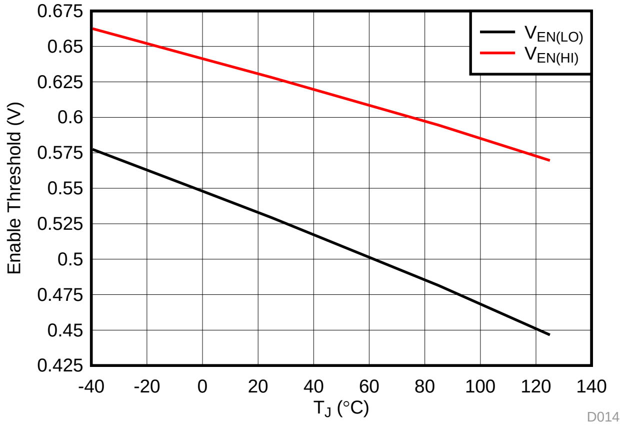
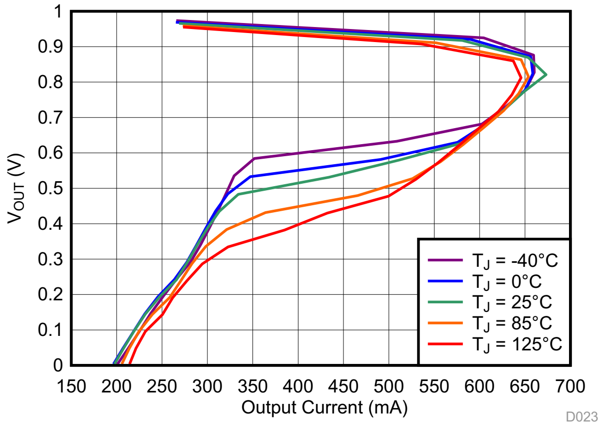


Figure 17. Enable Threshold vs Temperature

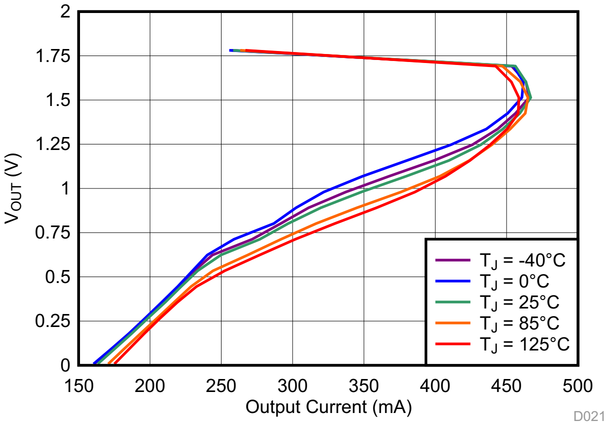


TLV73310PDBV

Figure 18. 1.0-V Foldback Current Limit vs I_{OUT} and Temperature

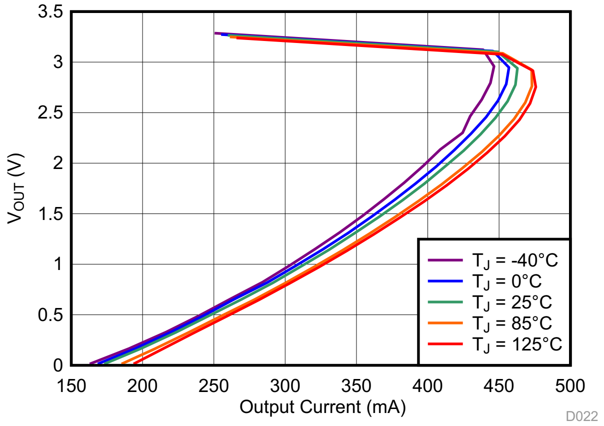
Typical Characteristics (continued)

at operating temperature range (T_J = –40°C to +125°C), V_{IN} = V_{OUT}(nom) + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, and C_{IN} = C_{OUT} = 1 µF (unless otherwise noted)



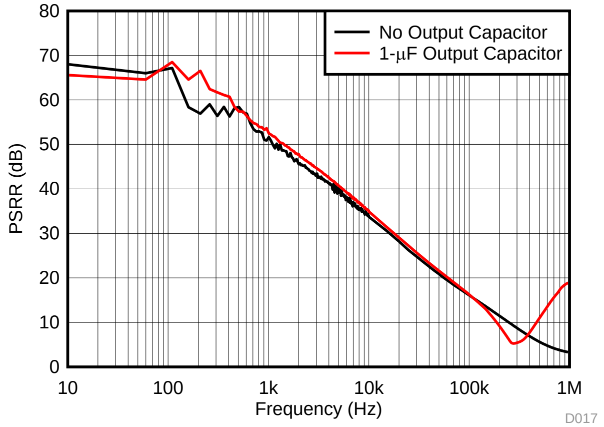
TLV73318PDBV

Figure 19. 1.8-V Foldback Current Limit vs I_{OUT} and Temperature



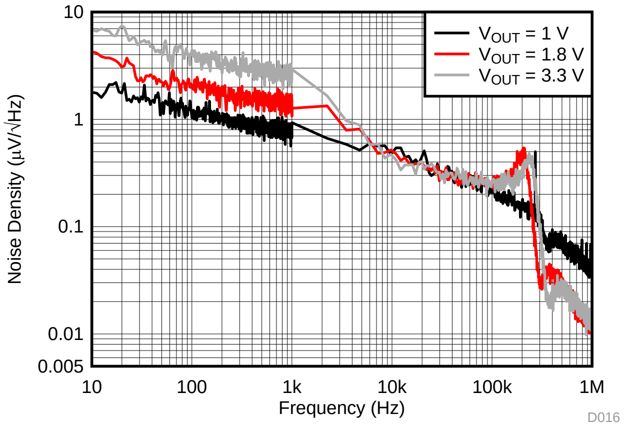
TLV73333PDBV

Figure 20. 3.3-V Foldback Current Limit vs I_{OUT} and Temperature



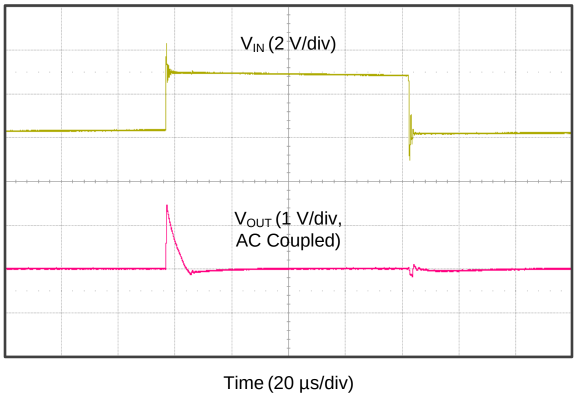
TLV73318PDQN, I_{OUT} = 300 mA

Figure 21. Power-Supply Rejection Ratio vs Frequency



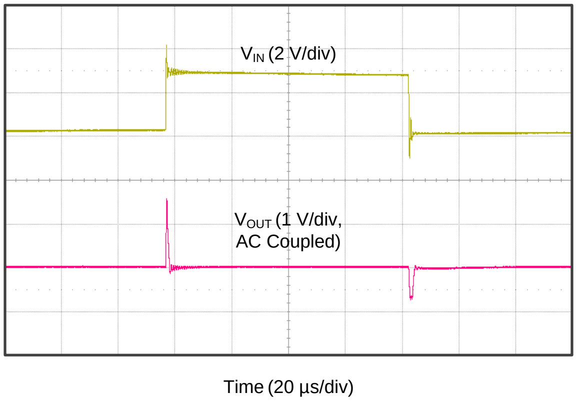
I_{OUT} = 300 mA

Figure 22. Output Spectral Noise Density



TLV73318PDBV, I_{OUT} = 10 mA, 1-µF output capacitor

Figure 23. Line Transient

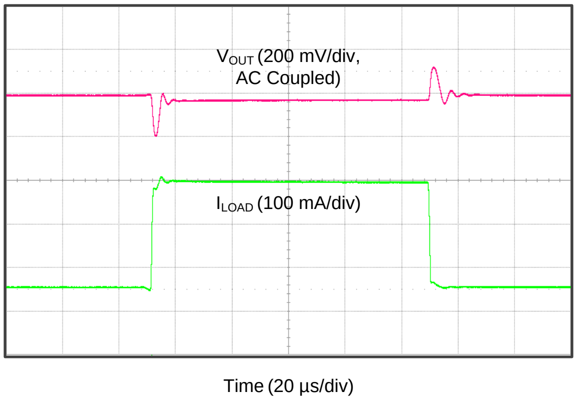


TLV73318PDBV, I_{OUT} = 300 mA, 1-µF output capacitor

Figure 24. Line Transient

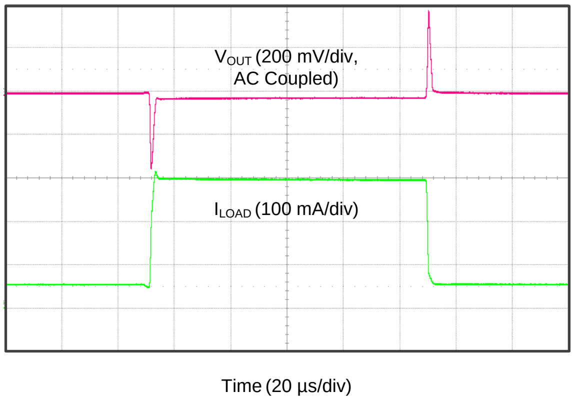
Typical Characteristics (continued)

at operating temperature range (T_J = –40°C to +125°C), V_{IN} = V_{OUT}(nom) + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, and C_{IN} = C_{OUT} = 1 µF (unless otherwise noted)



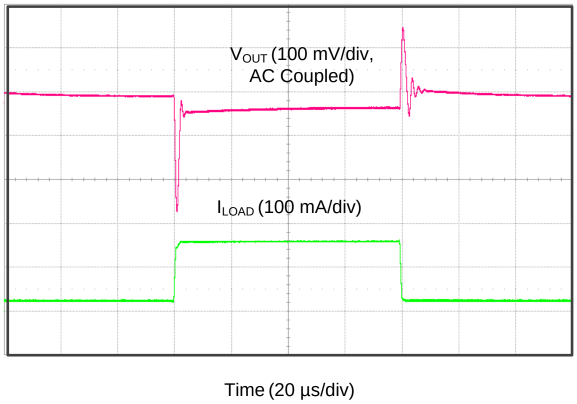
TLV73310PDBV, V_{IN} = 2.0 V, 1-µF output capacitor, output current slew rate = 0.25 A/µs

Figure 25. 1.0-V, 50-mA to 300-mA Load Transient



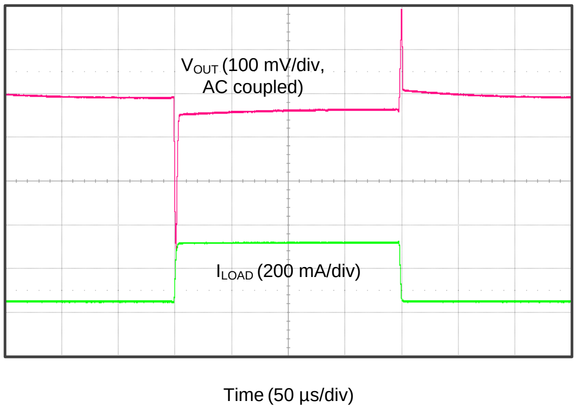
TLV73310PDBV, V_{IN} = 2.0 V, no output capacitor, output current slew rate = 0.25 A/µs

Figure 26. 1.0 V, 50-mA to 300-mA Load Transient



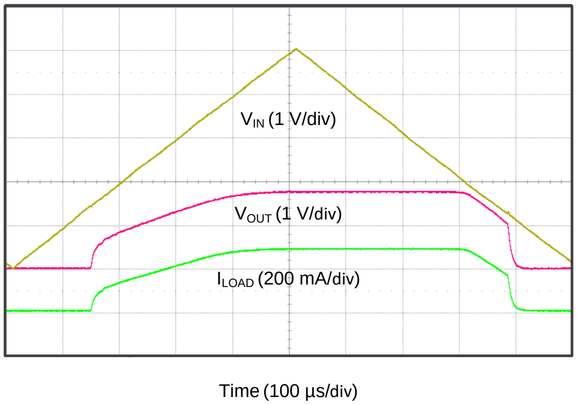
TLV73333PDBV, V_{IN} = 3.8 V,1-µF output capacitor, output current slew rate = 0.25 A/µs

Figure 27. 3.3 V, 50-mA to 300-mA Load Transient



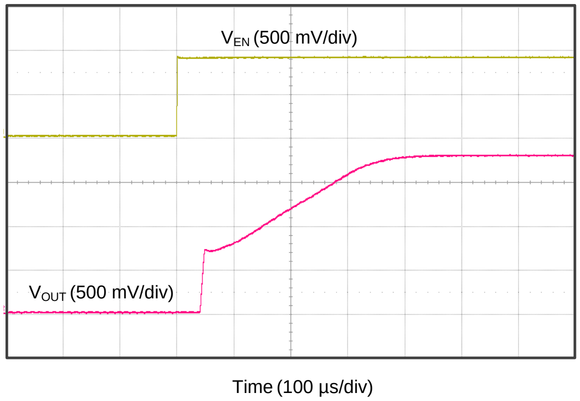
TLV73333PDBV, V_{IN} = 3.8 V, no output capacitor, output current slew rate = 0.25 A/µs

Figure 28. 3.3 V, 50-mA to 300-mA Load Transient



TLV73318PDBV, R_L = 6.2 Ω, V_{EN} = V_{IN}, 1-µF output capacitor

Figure 29. V_{IN} Power-Up and Power-Down

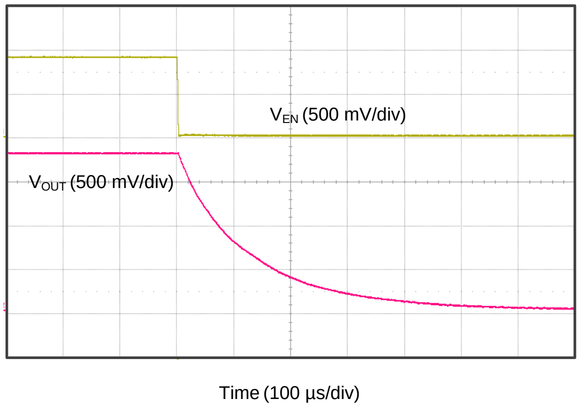


TLV73318PDBV, R_L = 6.2 Ω, 1-µF output capacitor

Figure 30. Startup with EN

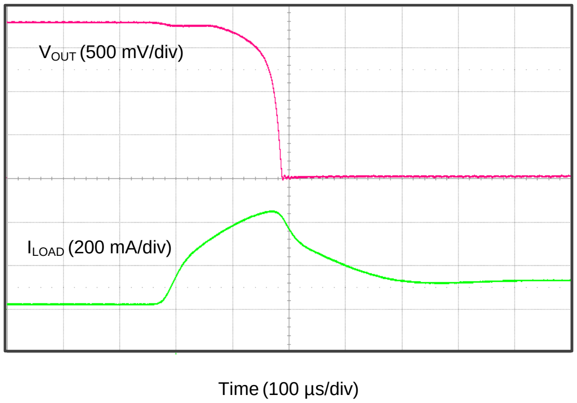
Typical Characteristics (continued)

at operating temperature range (T_J = –40°C to +125°C), V_{IN} = V_{OUT}(nom) + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, and C_{IN} = C_{OUT} = 1 µF (unless otherwise noted)



TLV73318PDBV, I_{OUT} = 300 mA, 1-µF output capacitor

Figure 31. Shutdown Response with Enable



TLV73318PDBV, 1-µF output capacitor

Figure 32. Foldback Current Limit Response

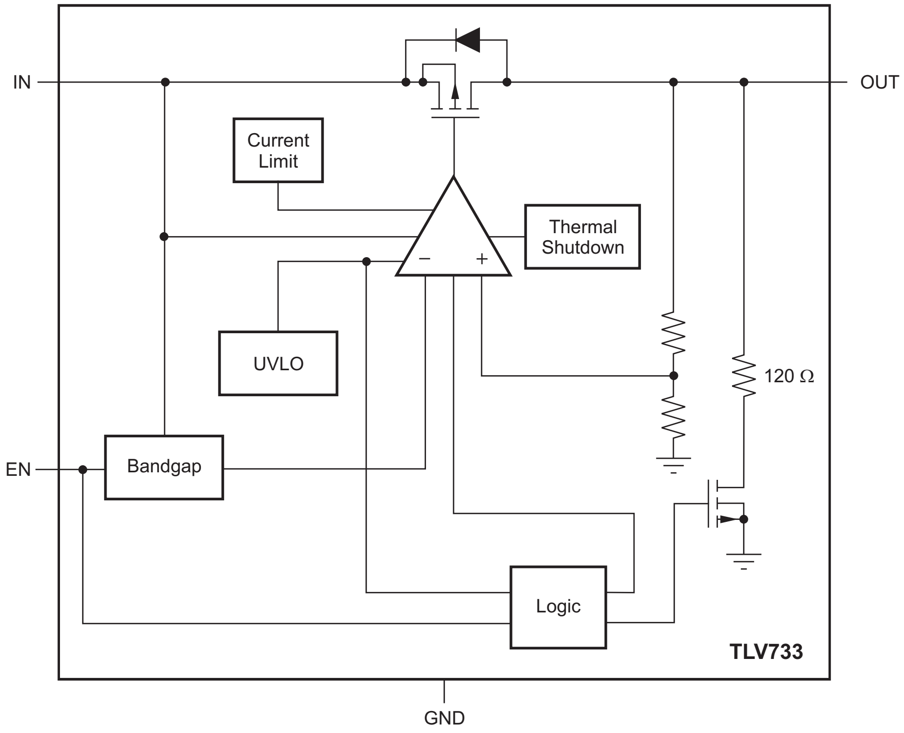
7 Detailed Description

7.1 Overview

The TLV733 belongs to a new family of next-generation, low-dropout regulators (LDOs). These devices consume low quiescent current and deliver excellent line and load transient performance. These characteristics, combined with low noise, good PSRR with low dropout voltage, make this family of devices ideal for portable consumer applications.

This family of regulators offers foldback current limit, shutdown, and thermal protection. The operating junction temperature for this family of devices is –40°C to 125°C.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Undervoltage Lockout (UVLO)

The TLV733 uses an undervoltage lockout (UVLO) circuit that disables the output until the input voltage is greater than the rising UVLO voltage, $UVLO_{RISE}$. This circuit ensures that the device does not exhibit any unpredictable behavior when the supply voltage is lower than the operational range of the internal circuitry. During UVLO disable, the output is connected to ground with a 120-Ω pulldown resistor.

7.3.2 Shutdown and Output Enable

The enable pin (EN) is active high. Enable the device by forcing the EN pin to exceed $V_{EN(HI)}$. Turn off the device by forcing the EN pin to drop below $V_{EN(LO)}$. If shutdown capability is not required, connect EN to IN. There is no internal pulldown resistor connected to the EN pin.

The TLV733 has an internal pulldown MOSFET that connects a 120-Ω resistor to ground when the device is disabled. The discharge time after disabling depends on the output capacitance (C_{OUT}) and the load resistance (R_L) in parallel with the 120-Ω pulldown resistor. The time constant is calculated in Equation 1:

$$\tau = \frac{120 \cdot R_L}{120 + R_L} \cdot C_{OUT} \tag{1}$$

7.3.3 Internal Foldback Current Limit

The TLV733 has an internal foldback current limit that protects the regulator during fault conditions. The current allowed through the device is reduced as the output voltage falls. When the output is shorted, the LDO supplies a typical current of 150 mA. The output voltage is not regulated when the device is in current limit. In this condition, the output voltage is the product of the regulated current and the load resistance. When the device output is shorted, the PMOS pass transistor dissipates power $[(V_{IN} - V_{OUT}) \times I_{OS}]$ until thermal shutdown is triggered and the device turns off. After the device cools down, 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 foldback current-limit circuit limits the current allowed through the device to current levels lower than the minimum current limit at nominal V_{OUT} current limit (I_{LIM}) during startup. See Figure 18 to Figure 20 for typical foldback current limit values. If the output is loaded by a constant-current load during startup, or if the output voltage is negative when the device is enabled, then the load current demanded by the load may exceed the foldback current limit and the device may not rise to the full output voltage. For constant-current loads, disable the output load until the TLV733 has fully risen to its nominal output voltage.

The TLV733 PMOS pass element has an intrinsic body diode that conducts current when the voltage at the OUT pin exceeds the voltage at the IN pin. Do not force the output voltage to exceed the input voltage because excessively high current may flow through the body diode.

7.3.4 Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 160°C. Disabling the device eliminates the power dissipated by the device, 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 may cycle on and off. This cycling limits regulator dissipation, protecting it from damage as a result of overheating.

Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the ($V_{IN} - V_{OUT}$) voltage and the load current. For reliable operation, limit junction temperature to 125°C maximum. To estimate the margin of safety in a complete design, increase the ambient temperature until the thermal protection is triggered; use worst-case loads and signal conditions.

The TLV733 internal protection circuitry protects against overload conditions but is not intended to be activated in normal operation. Continuously running the TLV733 into thermal shutdown degrades device reliability.

7.4 Device Functional Modes

7.4.1 Normal Operation

The device regulates to the nominal output voltage under the following conditions:

- The input voltage has previously exceeded the UVLO rising voltage and has not decreased below the UVLO falling threshold.
- The input voltage is greater than the nominal output voltage added to the dropout voltage.
- The enable voltage has previously exceeded the enable rising threshold voltage and not decreased below the enable falling threshold.
- The output current is less than the current limit.
- The device junction temperature is less than the thermal shutdown temperature.

7.4.2 Dropout Operation

If the input voltage is lower than the nominal output voltage plus the specified dropout voltage, but all other conditions are met for normal operation, the device operates in dropout mode. In this condition, the output voltage is the same the input voltage minus the dropout voltage. The transient performance of the device is significantly degraded because the pass device is in a triode state and no longer controls the current through the LDO. Line or load transients in dropout may result in large output voltage deviations.

7.4.3 Disabled

The device is disabled under the following conditions:

- The input voltage is less than the UVLO falling voltage, or has not yet exceeded the UVLO rising threshold.
- The enable voltage is less than the enable falling threshold voltage or has not yet exceeded the enable rising threshold.
- The device junction temperature is greater than the thermal shutdown temperature.

When the device is disabled, the active pulldown resistor discharges the output.

Table 1 shows the conditions that lead to the different modes of operation.

Table 1. Device Functional Mode Comparison

OPERATING MODE	PARAMETER			
	V_{IN}	V_{EN}	I_{OUT}	T_J
Normal mode	$V_{IN} > V_{OUT}(nom) + V_{DO}$ and $V_{IN} > UVLO_{RISE}$	$V_{EN} > V_{EN(HI)}$	$I_{OUT} < I_{LIM}$	T_J < 160°C
Dropout mode	$UVLO_{RISE} < V_{IN} < V_{OUT}(nom) + V_{DO}$	$V_{EN} > V_{EN(HI)}$	$I_{OUT} < I_{LIM}$	T_J < 160°C
Disabled mode (any true condition disables the device)	$V_{IN} < UVLO_{FALL}$	$V_{EN} < V_{EN(LO)}$	—	T_J > 160°C

8 Application and Implementation

NOTE

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

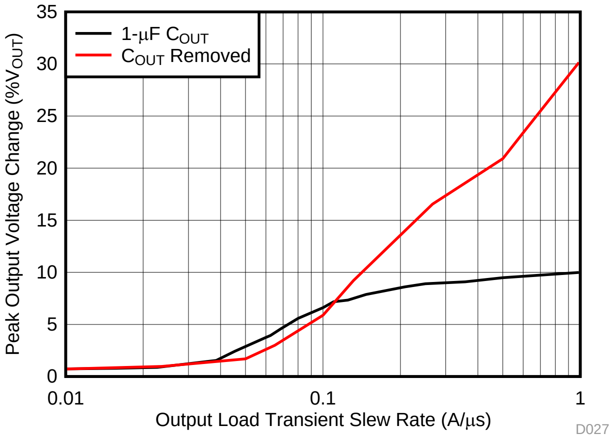
8.1 Application Information

8.1.1 Input and Output Capacitor Selection

The TLV733 uses an advanced internal control loop to obtain stable operation both with and without the use of input or output capacitors. Dynamic performance is improved with the use of an output capacitor, and may be improved with an input capacitor. An output capacitance of 0.1 µF or larger generally provides good dynamic response. Use X5R- and X7R-type ceramic capacitors because these capacitors have minimal variation in value and equivalent series resistance (ESR) over temperature.

Although an input capacitor is not required for stability, increased output impedance from the input supply may compromise the performance of the TLV733. Good analog design practice is to connect a 0.1-µF to 1-µF capacitor from IN to GND. This capacitor counteracts reactive input sources and improves transient response, input ripple, and PSRR. Use an input capacitor if the source impedance is greater than 0.5 Ω. Use a higher-value capacitor if large, fast, rise-time load transients are anticipated, or if the device is located several inches from the input power source.

Figure 33 shows the transient performance improvements with an external 1-µF capacitor on the output versus no output capacitor. The data in this figure are taken with an increasing load step from 50 mA to 300 mA, and the peak output voltage deviation (load transient response) is measured. For low output current slew rates, (< 0.1 A/µs), the transient performance of the device is similar with or without an output capacitor. As the current slew rate is increased, the peak voltage deviation is significantly increased. For loads that exhibit fast current slew rates above 0.1 A/µs, use an output capacitor. For best performance, the maximum recommended output capacitance is 100 µF.



TLV73333PDBV, output current stepped from 50 mA to 300 mA, output voltage change measured at positive dI/dt

Figure 33. Output Voltage Deviation vs Load Step Slew Rate

Some applications benefit from the removal of the output capacitor. In addition to space and cost savings, the removal of the output capacitor lowers inrush current as a result of eliminating the required current flow into the output capacitor upon startup. In these cases, take care to ensure that the load is tolerant of the additional output voltage deviations.

Application Information (continued)

8.1.2 Dropout Voltage

The TLV733 uses a PMOS pass transistor to achieve low dropout. When (V_{IN} – V_{OUT}) is less than the dropout voltage (V_{DO}), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. V_{DO} scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as (V_{IN} – V_{OUT}) approaches dropout operation. See Figure 7 to Figure 12 for typical dropout values.

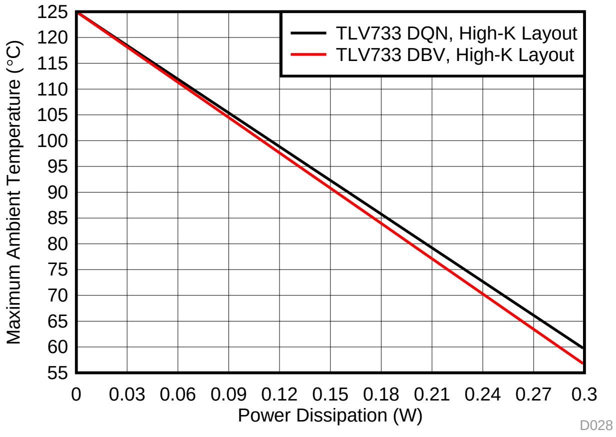
8.1.3 Power Dissipation

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 ambient air. Performance data for JEDEC 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 heatsink effectiveness.

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

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

Figure 34 shows the maximum ambient temperature versus the power dissipation of the TLV733 in the DQN and DBV packages. This figure assumes the device is soldered on JEDEC standard high-K layout with no airflow over the board. Actual board thermal impedances vary widely. If the application requires high power dissipation, having a thorough understanding of the board temperature and thermal impedances is helpful to make sure the TLV733 does not operate continuously above a junction temperature of 125°C.



TLV733, high-K layout

Figure 34. Maximum Ambient Temperature vs Device Power Dissipation

8.2 Typical Applications

8.2.1 DC-DC Converter Post Regulation

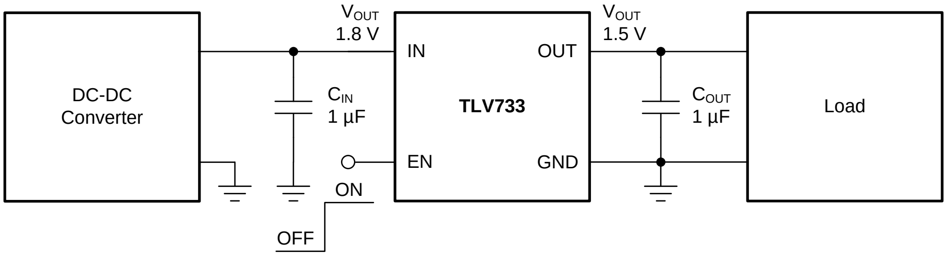


Figure 35. DC-DC Converter Post Regulation

8.2.1.1 Design Requirements

Table 2. Design Parameters

PARAMETER	DESIGN REQUIREMENT
Input voltage	1.8 V, ±5%
Output voltage	1.5 V, ±1%
Output current	200-mA dc, 300-mA peak
Output voltage transient deviation	< 10%, 1-A/µs load step from 50 mA to 200 mA
Maximum ambient temperature	85°C

8.2.1.2 Design Considerations

Input and output capacitors are required to achieve the output voltage transient requirements. Capacitance values of 1 µF are selected to give the maximum output capacitance in a small, low-cost package.

Figure 7 shows the 1.2-V option dropout voltage. Given that dropout voltages are higher for lower output-voltage options, and given that the 1.2-V option dropout voltage is typically less than 300 mV at 125°C, then the 1.5-V option dropout voltage is typically less than 300 mV at 125°C.

Verify that the maximum junction temperature is not exceeded by referring to Figure 34.

8.2.1.3 Application Curve

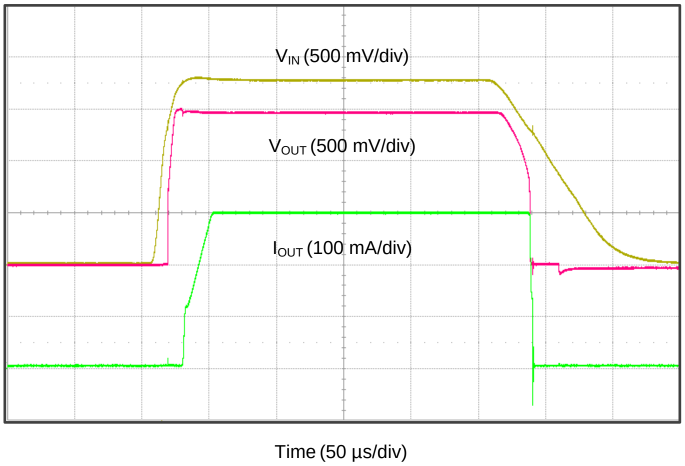


Figure 36. 1.8-V to 1.5-V Regulation at 300 mA

8.2.2 Capacitor-Free Operation from Battery Input Supply

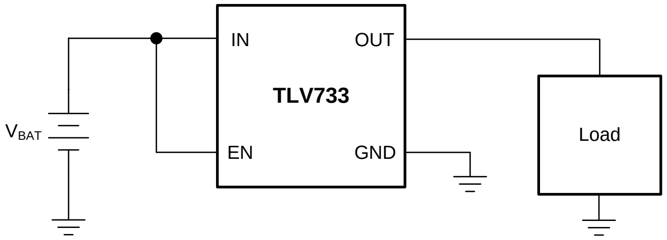


Figure 37. Capacitor-Free Operation from Battery Input Supply

8.2.2.1 Design Requirements

Table 3. Design Parameters

PARAMETER	DESIGN REQUIREMENT
Input voltage	3.0 V to 1.8 V (two 1.5-V batteries)
Output voltage	1.0 V, ±1%
Input current	200 mA, maximum
Output load	100-mA dc
Maximum ambient temperature	70°C

8.2.2.2 Design Considerations

An input capacitor is not required for this design because of the low impedance connection directly to the battery.

No output capacitor allows for the minimal possible inrush current during startup, ensuring the 200-mA maximum input current is not exceeded.

Verify that the maximum junction temperature is not exceeded by referring to Figure 34.

8.2.2.3 Application Curve

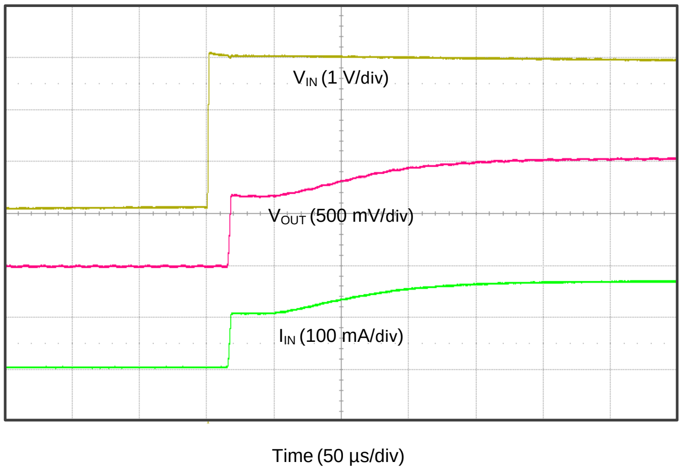


Figure 38. No Inrush Startup, 3.0-V to 1.0-V Regulation

9 Power Supply Recommendations

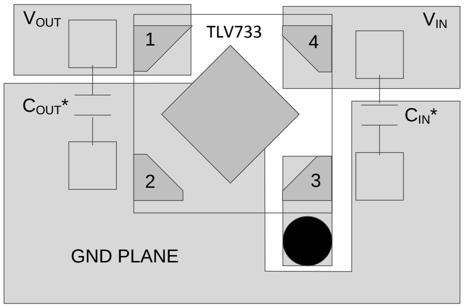
Connect a low output impedance power supply directly to the IN pin of the TLV733. Inductive impedances between the input supply and the IN pin can create significant voltage excursions at the IN pin during startup or load transient events. If inductive impedances are unavoidable, use an input capacitor.

10 Layout

10.1 Layout Guidelines

- Place input and output capacitors as close to the device as possible.
- Use copper planes for device connections, in order to optimize thermal performance.
- Place thermal vias around the device to distribute the heat.
- Do not place a thermal via directly beneath the thermal pad of the DQN package. A via can wick solder or solder paste away from the thermal pad joint during the soldering process, leading to a compromised solder joint on the thermal pad.

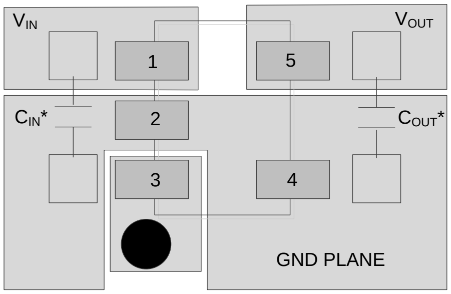
10.2 Layout Examples



● Represents via used for application specific connections

*not required

Figure 39. Layout Example for the DQN Package



● Represents via used for application specific connections

*not required

Figure 40. Layout Example for the DBV Package

11 Device and Documentation Support

11.1 Device Support

11.1.1 Development Support

11.1.1.1 Evaluation Module

An evaluation module (EVM) is available to assist in the initial circuit performance evaluation using the TLV733. The TLV73312PEVM-643 evaluation module (and related user guide) can be requested at the Texas Instruments website through the product folders or purchased directly from the TI eStore.

11.1.2 Device Nomenclature

Table 4. Device Nomenclature(1)(2)

PRODUCT	V_{OUT}
TLV733**xx(x)Pyyyz(3)**	**xx(x)** 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, 28 = 2.8 V; 125 = 1.25 V). **P** indicates an active output discharge feature. All members of the TLV733 family will actively discharge the output when the device is disabled. **yyy** is the package designator. **z** is the package quantity. R is for reel (3000 pieces), T is for tape (250 pieces). **(3)** indicates an alternative tape and reel orientation. 3 indicates that pin 1 is in quadrant 3. See the Package Materials Information addendum for more information.

(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 on www.ti.com.
(2) Output voltages from 1.0 V to 3.3 V in 50-mV increments are available. Contact the factory for details and availability.

11.2 Documentation Support

11.2.1 Related Documentation

Texas Instruments, *TLV73312PDQN-643 Evaluation Module* user guide

11.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* 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.

11.4 Community Resources

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

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

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

11.5 Trademarks

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

11.6 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.

11.7 Glossary

SLYZ022 — *TI Glossary*.

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

12 Mechanical, Packaging, and Orderable Information

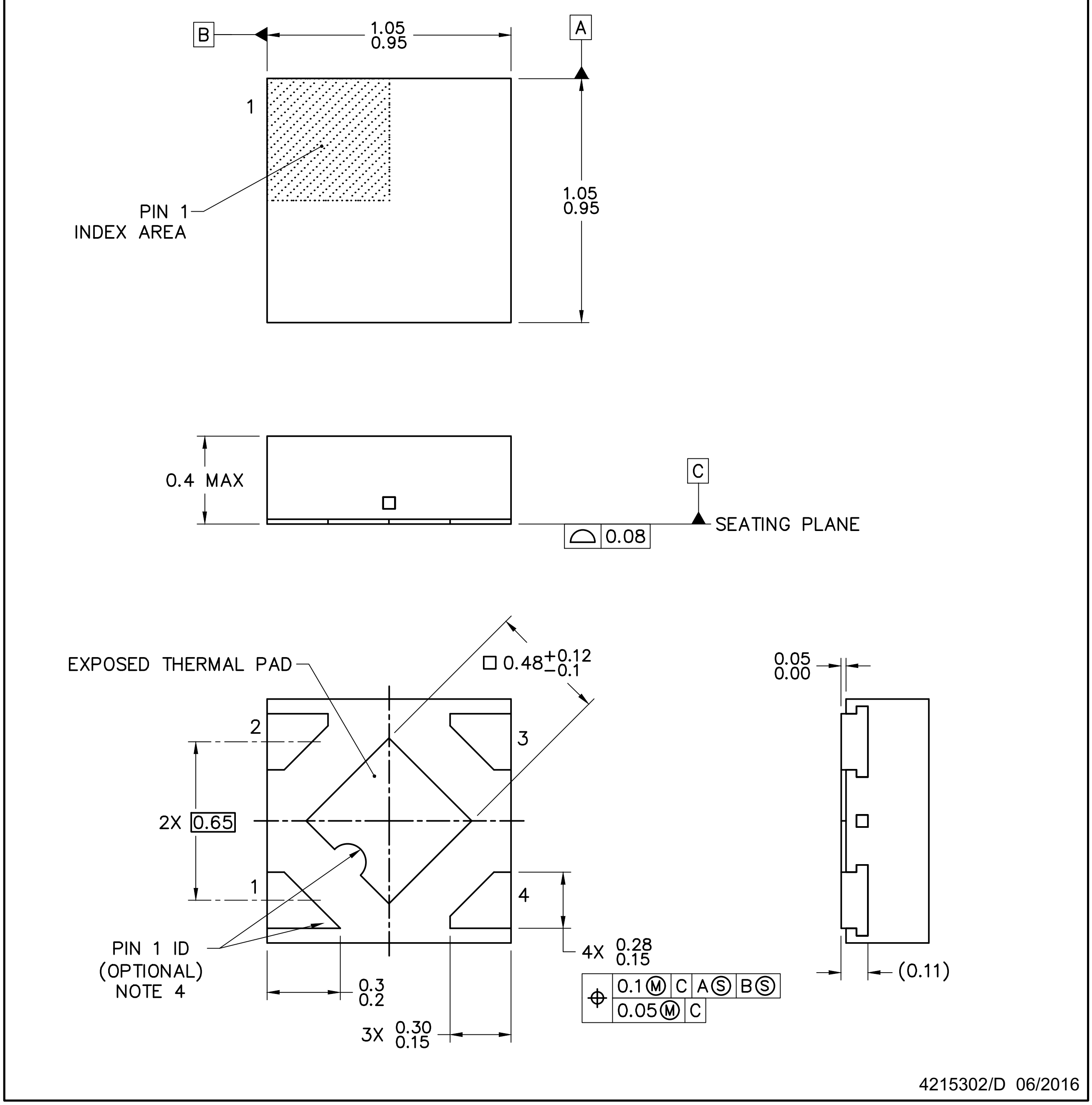
The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand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

PACKAGE OUTLINE

DQN0004A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD


B
1.05
0.95
A
1
PIN 1
INDEX AREA
1.05
0.95
0.4 MAX
C
SEATING PLANE
0.08
EXPOSED THERMAL PAD
0.48 +0.12 −0.1
0.05
0.00
2
3
2X 0.65
1
4
PIN 1 ID
(OPTIONAL)
NOTE 4
0.3
0.2
3X 0.30
0.15
4X 0.28
0.15
0.1 Ⓜ C A Ⓢ B Ⓢ
0.05 Ⓜ C
(0.11)

4215302/D 06/2016

NOTES:

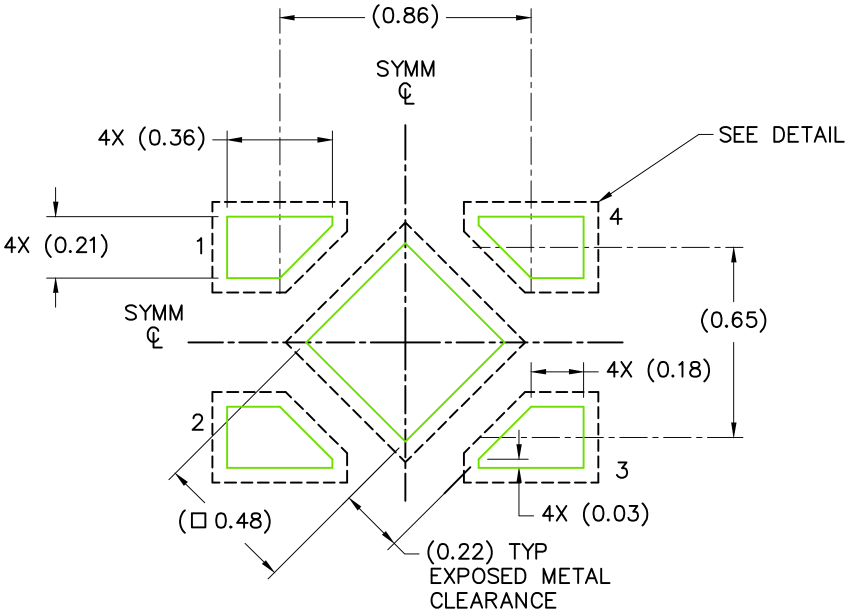
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.
4. Features may not exist. Recommend use of pin 1 marking on top of package for orientation purposes.

EXAMPLE BOARD LAYOUT

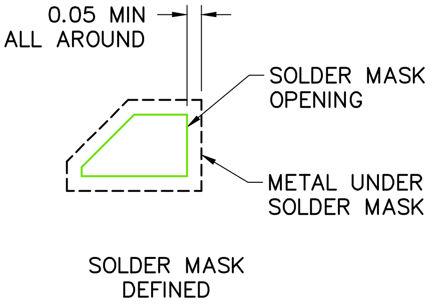
DQN0004A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD


(0.86)
SYMM
℄
4X (0.36)
SEE DETAIL
4X (0.21)
1
4
SYMM
℄
(0.65)
4X (0.18)
2
3
4X (0.03)
(☐ 0.48)
(0.22) TYP
EXPOSED METAL
CLEARANCE

LAND PATTERN EXAMPLE
SCALE: 40X


0.05 MIN
ALL AROUND
SOLDER MASK
OPENING
METAL UNDER
SOLDER MASK
SOLDER MASK
DEFINED

SOLDER MASK DETAIL

4215302/D 06/2016

NOTES: (continued)

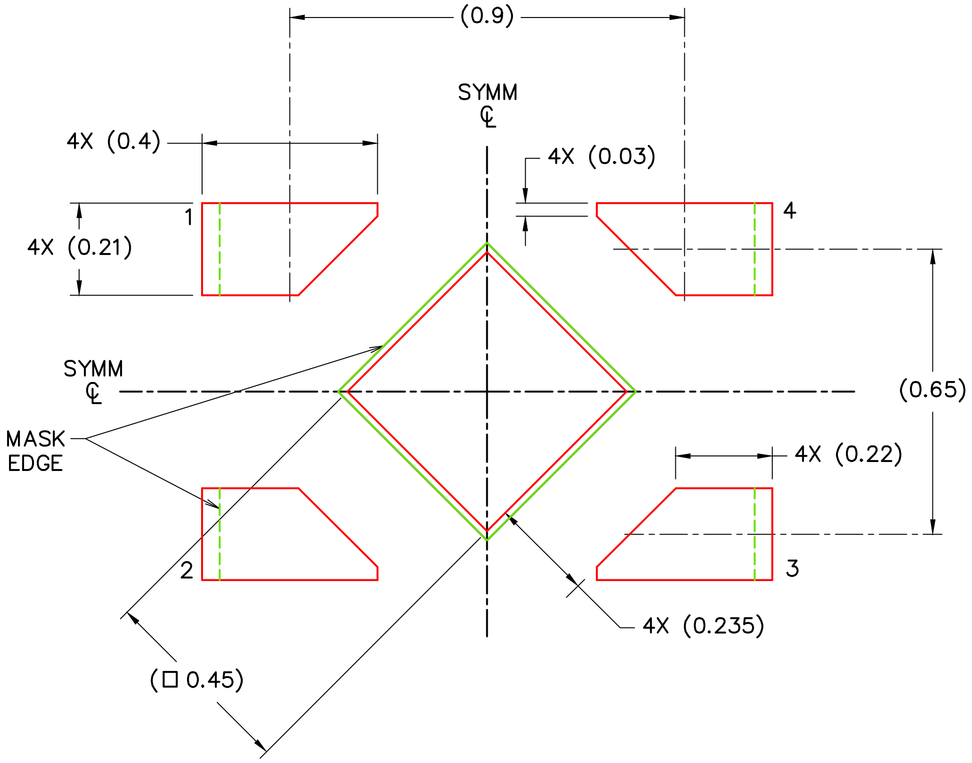
5. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271) .
6. If any vias are implemented, it is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

DQN0004A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.075 – 0.1mm THICK STENCIL

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

4215302/D 06/2016

NOTES: (continued)

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

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TLV73310PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCCQ
TLV73310PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCCQ
TLV73310PDBVRG4	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCCQ
TLV73310PDBVRG4.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCCQ
TLV73310PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCCQ
TLV73310PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCCQ
TLV73310PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FG
TLV73310PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FG
TLV73310PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FG
TLV73310PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FG
TLV73310PDQNTG4	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FG
TLV73310PDQNTG4.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FG
TLV73311PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZBLW
TLV73311PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZBLW
TLV73311PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZBLW
TLV73311PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZBLW
TLV73311PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	GR
TLV73311PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GR
TLV73311PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	GR
TLV73311PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GR
TLV73312PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCDQ
TLV73312PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCDQ
TLV73312PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCDQ
TLV73312PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCDQ
TLV73312PDBVTG4	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCDQ
TLV73312PDBVTG4.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCDQ
TLV73312PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FI
TLV73312PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FI
TLV73312PDQNR3	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FI

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TLV73312PDQNR3.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FI
TLV73312PDQNRG4	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FI
TLV73312PDQNRG4.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FI
TLV73312PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FI
TLV73312PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FI
TLV73315PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCFQ
TLV73315PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCFQ
TLV73315PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCFQ
TLV73315PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCFQ
TLV73315PDBVTG4	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCFQ
TLV73315PDBVTG4.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCFQ
TLV73315PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FJ
TLV73315PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FJ
TLV73315PDQNR3	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FJ
TLV73315PDQNR3.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FJ
TLV73315PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FJ
TLV73315PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FJ
TLV73318PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCGQ
TLV73318PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCGQ
TLV73318PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCGQ
TLV73318PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCGQ
TLV73318PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FK
TLV73318PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FK
TLV73318PDQNR3	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FK
TLV73318PDQNR3.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FK
TLV73318PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FK
TLV73318PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FK
TLV73318PDQNTG4	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FK
TLV73318PDQNTG4.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FK
TLV73325PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCHQ
TLV73325PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCHQ

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TLV73325PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCHQ
TLV73325PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCHQ
TLV73325PDBVTG4	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCHQ
TLV73325PDBVTG4.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCHQ
TLV73325PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FL
TLV73325PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FL
TLV73325PDQNRG4	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FL
TLV73325PDQNRG4.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FL
TLV73325PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FL
TLV73325PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FL
TLV733285PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDRW
TLV733285PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDRW
TLV733285PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDRW
TLV733285PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	ZDRW
TLV733285PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	GZ
TLV733285PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GZ
TLV733285PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	GZ
TLV733285PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GZ
TLV73328PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDQW
TLV73328PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDQW
TLV73328PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDQW
TLV73328PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDQW
TLV73328PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	GY
TLV73328PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GY
TLV73328PDQNR3	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	GY
TLV73328PDQNR3.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GY
TLV73328PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	GY
TLV73328PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GY
TLV73328PDQNTG4	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GY
TLV73328PDQNTG4.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GY
TLV73330PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDMW

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TLV73330PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDMW
TLV73330PDBVRG4	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDMW
TLV73330PDBVRG4.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDMW
TLV73330PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDMW
TLV73330PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ZDMW
TLV73330PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	GW
TLV73330PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GW
TLV73330PDQNRG4	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GW
TLV73330PDQNRG4.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GW
TLV73330PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	GW
TLV73330PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	GW
TLV73333PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCIQ
TLV73333PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCIQ
TLV73333PDBVRG4	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCIQ
TLV73333PDBVRG4.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCIQ
TLV73333PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCIQ
TLV73333PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	VCIQ
TLV73333PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FM
TLV73333PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FM
TLV73333PDQNRG4	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FM
TLV73333PDQNRG4.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FM
TLV73333PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	-40 to 125	FM
TLV73333PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	FM

(1) **Status:** For more details on status, see our product life cycle.

(2) **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.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

[4] **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.

[5] **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.

[6] **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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

OTHER QUALIFIED VERSIONS OF TLV733P :

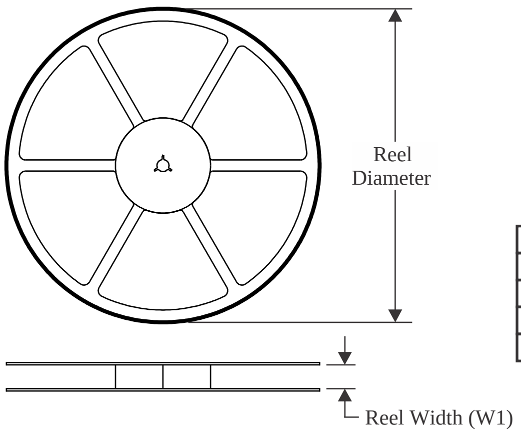
- Automotive : TLV733P-Q1

NOTE: Qualified Version Definitions:

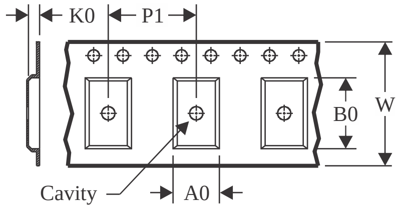
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS

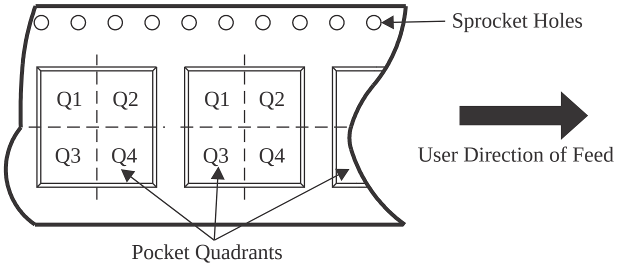


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

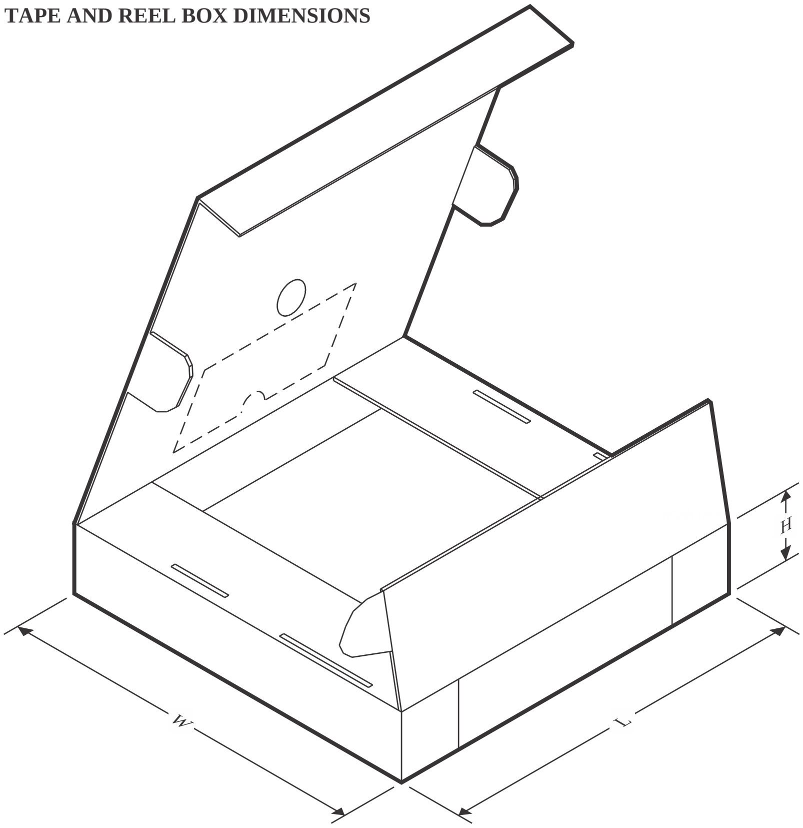


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TLV73310PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73310PDBVRG4	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73310PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73310PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73310PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73310PDQNTG4	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73311PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73311PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73311PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73311PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73312PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73312PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73312PDBVTG4	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73312PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73312PDQNR3	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q3
TLV73312PDQNRG4	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
TLV73312PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73315PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73315PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73315PDBVTG4	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73315PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73315PDQNR3	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q3
TLV73315PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73318PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73318PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73318PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73318PDQNR3	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q3
TLV73318PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73318PDQNTG4	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73325PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73325PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73325PDBVTG4	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73325PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73325PDQNRG4	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73325PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV733285PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV733285PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV733285PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV733285PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73328PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73328PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73328PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73328PDQNR3	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q3
TLV73328PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73328PDQNTG4	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73330PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73330PDBVRG4	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73330PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73330PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73330PDQNRG4	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73330PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73333PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73333PDBVRG4	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73333PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TLV73333PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73333PDQNRG4	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TLV73333PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2

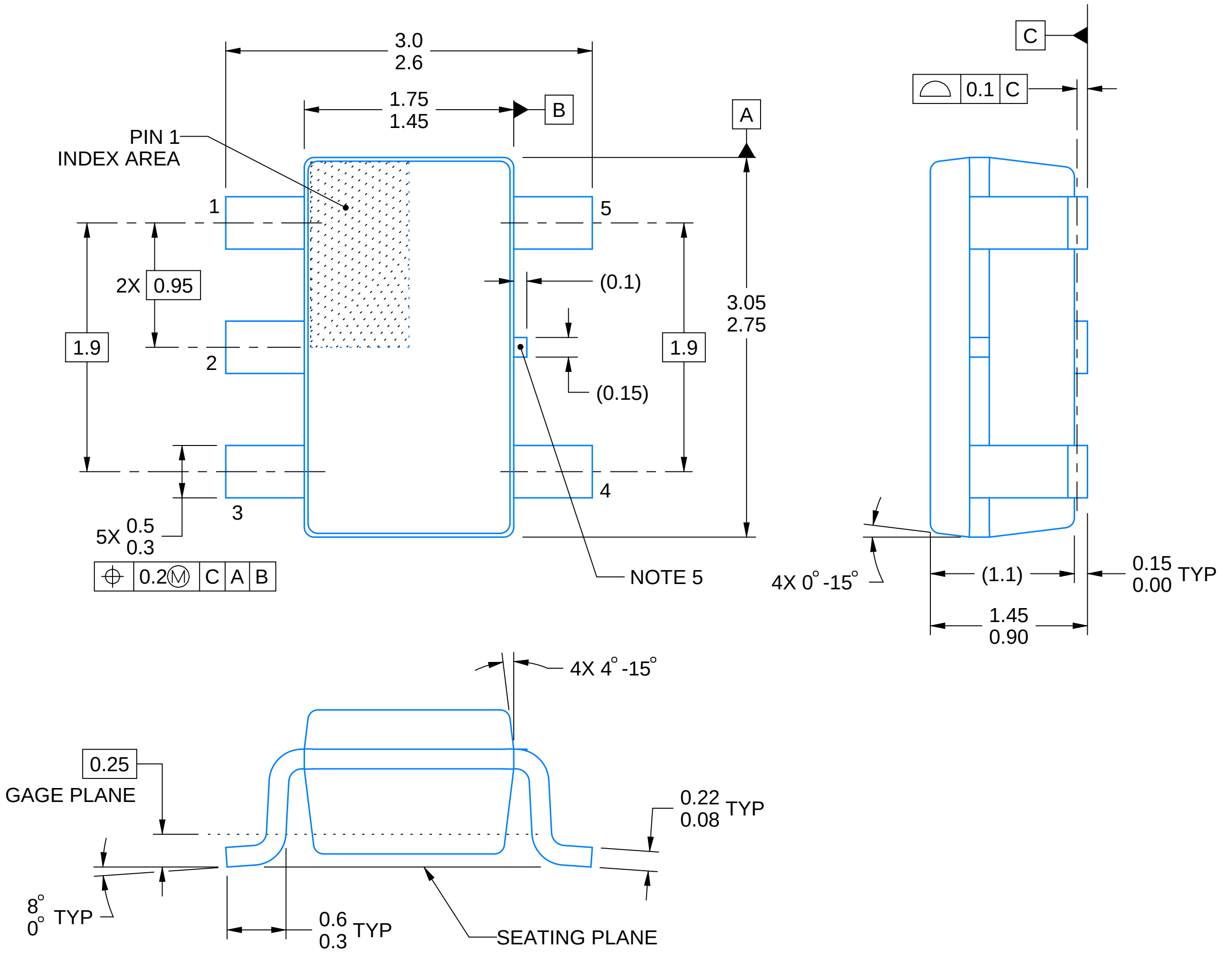
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLV73310PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73310PDBVRG4	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73310PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73310PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73310PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73310PDQNTG4	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73311PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73311PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73311PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73311PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73312PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73312PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73312PDBVTG4	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73312PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73312PDQNR3	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73312PDQNRG4	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73312PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73315PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0

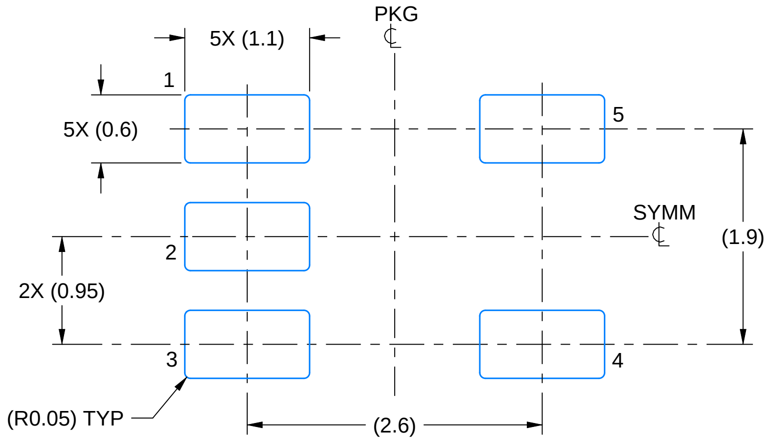
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLV73315PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73315PDBVTG4	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73315PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73315PDQNR3	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73315PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73318PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73318PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73318PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73318PDQNR3	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73318PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73318PDQNTG4	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73325PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73325PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73325PDBVTG4	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73325PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73325PDQNRG4	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73325PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TLV733285PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV733285PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV733285PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV733285PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73328PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73328PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73328PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73328PDQNR3	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73328PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73328PDQNTG4	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73330PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73330PDBVRG4	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73330PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73330PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73330PDQNRG4	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73330PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TLV73333PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73333PDBVRG4	SOT-23	DBV	5	3000	210.0	185.0	35.0
TLV73333PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TLV73333PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73333PDQNRG4	X2SON	DQN	4	3000	210.0	185.0	35.0
TLV73333PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0



3.0
2.6
1.75
1.45
B
A
C
0.1 C
PIN 1
INDEX AREA
1
2
3
4
5
2X 0.95
1.9
1.9
(0.1)
(0.15)
3.05
2.75
5X 0.5
0.3
0.2Ⓜ C A B
NOTE 5
4X 0° -15°
(1.1)
0.15
0.00 TYP
1.45
0.90
4X 4° -15°
0.25
GAGE PLANE
0.22
0.08 TYP
8°
0° TYP
0.6
0.3 TYP
SEATING PLANE

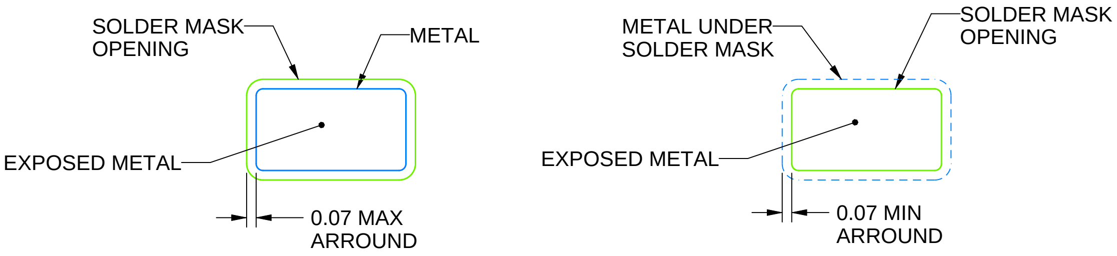
NOTES:

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. Refernce JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.
5. Support pin may differ or may not be present.



5X (1.1)
PKG
℄
1
5X (0.6)
5
SYMM
℄
(1.9)
2
2X (0.95)
3
4
(R0.05) TYP
(2.6)

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK OPENING
METAL
EXPOSED METAL
0.07 MAX ARROUND
METAL UNDER SOLDER MASK
SOLDER MASK OPENING
EXPOSED METAL
0.07 MIN ARROUND

NON SOLDER MASK
DEFINED
(PREFERRED)

SOLDER MASK
DEFINED

SOLDER MASK DETAILS

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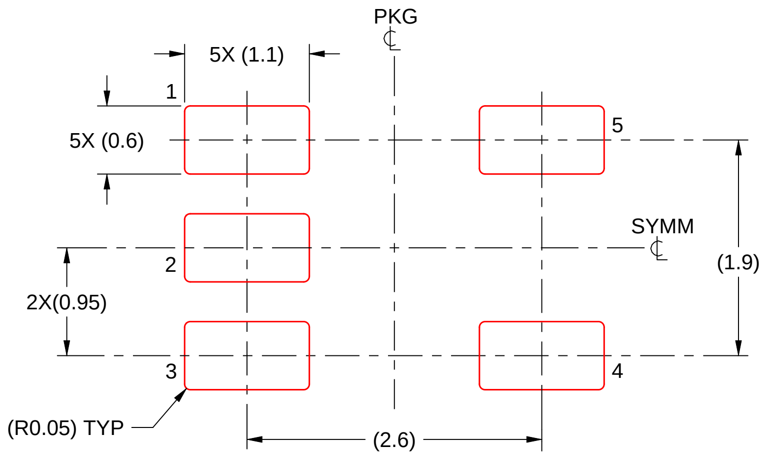
NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

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NOTES: (continued)

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

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