

Features

- Input Voltage Range: 2.5 V to 5.5 V
- Output Voltage Options:
 - Fixed Voltage: 1.2 V, 1.5 V, 1.8 V, 2.5 V, 2.8 V, 3 V, 3.3 V
 - Adjustable Voltage: 0.8 V to 5 V
- High Output Accuracy:
 - $\pm 2\%$ Through Operating Conditions
- Maximum Output Current: 500 mA
- Low Dropout Voltage: 500 mV MAX at 500 mA
- Low Quiescent Current and Shutdown Current
- Foldback Current Limit and Thermal Protection
- Stable with 2.2- μ F Ceramic Capacitor
- Thermal Shutdown Protection
- Junction Temperature Range: -40°C to $+125^{\circ}\text{C}$
- Package Options: SOT23-5

Applications

- Handheld Devices with Battery Power Supply
- POS
- Video Surveillance
- Wireless and IoT Modules

Description

The TLV700 series is a high-performance and low-dropout linear regulator. The TLV700 series supports a maximum 500-mA output current with a low-quiescent current and high PSRR. The TLV700 series of products is stable with ceramic output capacitors from 2.2 μ F to 10 μ F.

The TLV700 series of products has a high PSRR with 60 dB at 1 kHz. This feature makes the TLV700 series very suitable for power-sensitive applications with high noise from the previous stage power supply. A quiescent current of as low as 49 μ A and only 20-nA shutdown current make the TPL730 series an ideal choice for portable devices with a battery power supply. The current limit foldback and thermal overload protection circuits improve reliability under heavy load conditions.

The TLV700 series provides several output voltage version options, including the fixed version and the adjustable version with $\pm 2\%$ output voltage accuracy over operating conditions. The TLV700 series is guaranteed over the junction temperature range from -40°C to $+125^{\circ}\text{C}$.

Typical Application Circuit

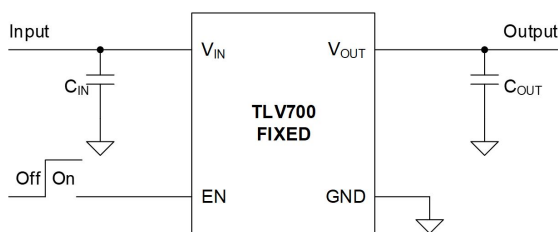


Figure 1. TLV700 Fixed Output Voltage

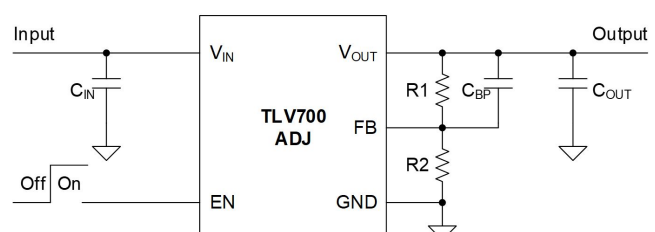


Figure 2. TLV700 Adjustable Output Voltage

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Product Family Table

Order Number	Output Voltage (V)	Package
TLV700ADJ-C5TR	Adjustable (0.8 V ~ 5 V)	SOT23-5
TLV700F12-C5TR	Fixed 1.2 V	SOT23-5
TLV700F15-C5TR	Fixed 1.5 V	SOT23-5
TLV700F18-C5TR	Fixed 1.8 V	SOT23-5
TLV700F25-C5TR	Fixed 2.5 V	SOT23-5
TLV700F28-C5TR	Fixed 2.8 V	SOT23-5
TLV700F30-C5TR	Fixed 3.0 V	SOT23-5
TLV700F33-C5TR	Fixed 3.3 V	SOT23-5

Revision History

Date	Revision	Notes
2019-01-01	Rev.A.0	Initial Release
2019-06-30	Rev.A.1	Added 1.5 V output voltage option
2020-08-15	Rev.A.2	Added description of "Short-Circuit Protection"
2023-04-15	Rev.A.3	Upgraded Output Current to 500 mA
2026-03-31	Rev.A.4	The following updates are all about the new datasheet formats or types, and the actual product remains unchanged. • Updated the datasheet format. • Updated Applications.

Pin Configuration and Functions

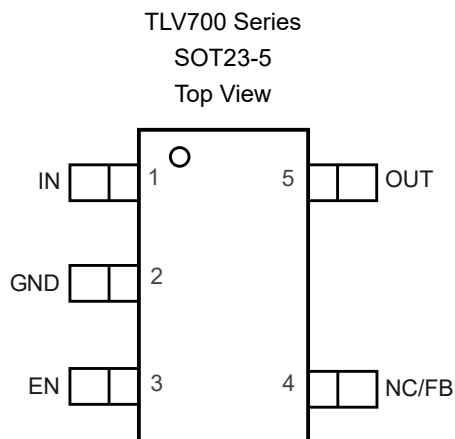


Table 1. Pin Functions

Pin No. SOT23-5	Name	I/O	Description
1	IN	I	The input voltage pin. Bypass IN to GND with a 1- μ F or greater capacitor.
5	OUT	O	The regulated output voltage pin. Bypass OUT to GND with a 2.2- μ F or greater capacitor.
3	EN	I	The regulator enable pin. Drive EN high to turn on the regulator; drive EN low to turn off the regulator. For the automatic startup, connect EN to IN directly.
2	GND	-	The ground reference pin. Connect the GND pin to the PCB ground plane directly.
4	NC	-	Not connected.
4	FB	I	The output feedback pin (adjustable version only). Connect to a resistor divider to adjust the output voltage. And connect C_{BP} with capacitance from 1 nF to 200 nF between FB and OUT.

Specifications

Absolute Maximum Ratings

Parameter		Min	Max	Unit
V _{IN} , V _{EN}	Input Voltage	-0.3	6	V
V _{OUT}	Output Voltage	-0.3	6	V
V _{FB}	Feedback Voltage (Adjustable Version only)	-0.3	6	V
T _J	Maximum Operating Junction Temperature	-40	150	°C
T _{STG}	Storage Temperature Range	-65	150	°C
T _L	Lead Temperature (Soldering, 10 sec)		260	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

(2) All voltage values are with respect to GND.

ESD, Electrostatic Discharge Protection

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±8	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002 ⁽²⁾	±2	kV

(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.

Recommended Operating Conditions

Parameter		Min	Max	Unit
V _{IN}	Input Voltage	2.5	5.5	V
V _{EN}	Enable Voltage	0	V _{IN}	V
V _{OUT}	Output Voltage	0	5	V
V _{FB}	Feedback Voltage (Adjustable Version Only)	0	V _{OUT}	V
I _{OUT}	Output Current	0	500	mA
T _J	Operating Junction Temperature Range	-40	125	°C

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOT23-5	280	62	°C/W

500-mA Output, High PSRR, Low-Dropout Linear Regulator
Electrical Characteristics

All test conditions: $V_{IN} = V_{OUT(NOM)} + 0.5\text{ V}$ or 2.5 V , whichever is greater; $C_{OUT} = 2.2\text{ }\mu\text{F}$, $T_A = +25^\circ\text{C}$, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supply Voltage and Current						
V _{IN}	Input Voltage Range		2.5		5.5	V
I _{GND}	Ground Pin Current	I _{OUT} = 0 mA		50		μA
I _{SHDN}	Shutdown Current	EN = GND		1		nA
UVLO	V _{IN} Under-Voltage Lock-out	V _{IN} Rising		2		V
		Hysteresis		200		mV
Enable Input Voltage and Current						
V _{IH} (EN)	EN Logic-Input High Level (Enable)		1.2		V _{IN}	V
V _{IL} (EN)	EN Logic-Input Low Level (Disable)		0		0.4	V
I _{EN}	EN Pin Leakage Current	EN = 5 V		1		μA
Regulated Output Voltage and Current						
V _{OUT}	Output Voltage Accuracy	T _J = +25°C		1%		
		−40°C ≤ T _J ≤ +125°C	−2%		2%	
V _{FB}	Feedback Pin Voltage	ADJ Version Only		0.8		V
ΔV _{OUT}	Line Regulation	V _{IN} = 2.5 V or V _{OUT} (NOM) + 0.5 V to 5.5 V, I _{OUT} = 1 mA		4	10	mV
	Load Regulation	I _{OUT} = 1 mA to 500 mA		25		mV
V _{DO} ⁽¹⁾	Dropout Voltage	V _{IN} = 0.98 × V _{OUT} (NOM), I _{OUT} = 100 mA		80		mV
		V _{IN} = 0.98 × V _{OUT} (NOM), I _{OUT} = 300 mA		240	300	mV
		V _{IN} = 0.98 × V _{OUT} (NOM), I _{OUT} = 500 mA		400	500	mV
I _{OUT}	Output Current	V _{OUT} in Regulation	0		500	mA
I _{CL}	Output Current Limit	V _{OUT} = 0.9 × V _{OUT} (NOM)	550		1200	mA
Regulated Output Voltage and Current						
PSRR	Power Supply Rejection Ratio	I _{OUT} = 100 mA, f = 1 kHz		60		dB
		I _{OUT} = 100 mA, f = 1 MHz		40		dB
V _N	Output Noise Voltage	I _{OUT} = 100 mA, BW = 100 Hz to 80 kHz		150		μV _{RMS}
T _{STR} ⁽²⁾	Start-up Time (Fixed Version)	I _{OUT} = 300 mA, C _{OUT} = 2.2 μF		150		μs
	Start-up Time (ADJ Version)	I _{OUT} = 300 mA, C _{OUT} = 2.2 μF, C _{BP} = 100 nF		15		ms
Temperature Range						
T _{SD}	Thermal Shutdown Temperature			170		°C

500-mA Output, High PSRR, Low-Dropout Linear Regulator

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
	Thermal Shutdown Hysteresis			30		°C

- (1) Dropout voltage is the minimum input-to-output voltage differential needed to maintain regulation at a specified output current. In dropout, the output voltage will be equal to $V_{IN} - V_{DROPOUT}$.
- (2) The start-up time from EN assertion to $0.98 \times V_{OUT(NOM)}$.

Typical Performance Characteristics

All test conditions: $V_{IN} = V_{OUT(NOM)} + 0.5\text{ V}$ or 2.5 V , whichever is greater; $C_{OUT} = 2.2\text{ }\mu\text{F}$, $T_A = +25^\circ\text{C}$, unless otherwise noted.

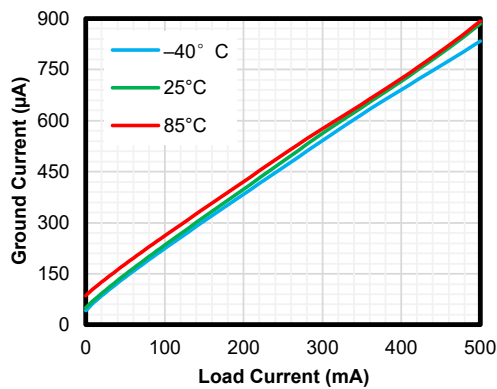


Figure 3. Quiescent Current vs. Output Current

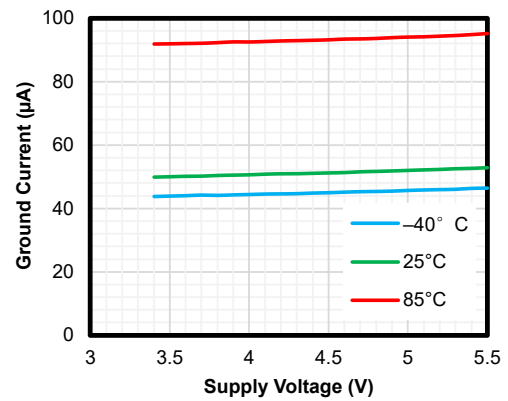


Figure 4. Quiescent Current vs. Input Voltage

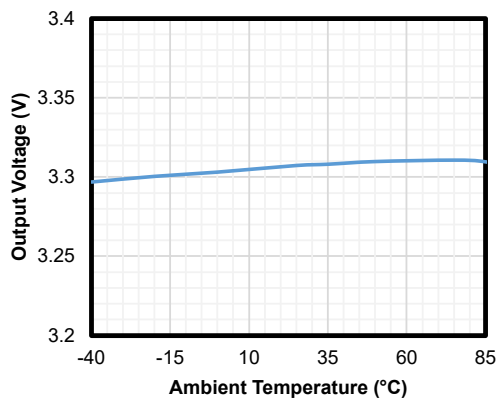


Figure 5. Output Accuracy vs. Ambient Temperature

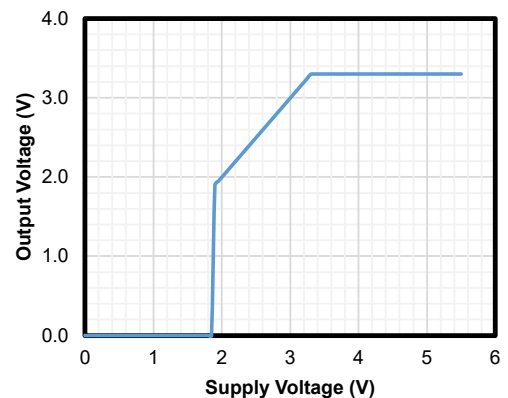


Figure 6. Output Voltage vs. Supply Voltage

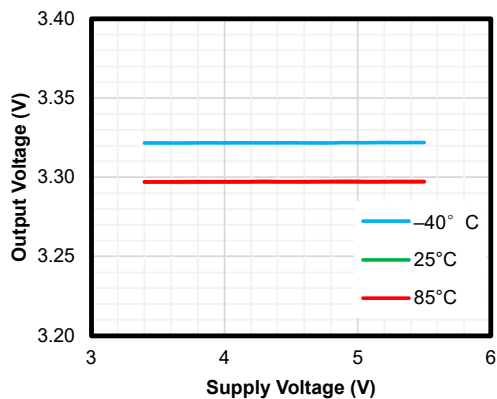


Figure 7. Line Regulation

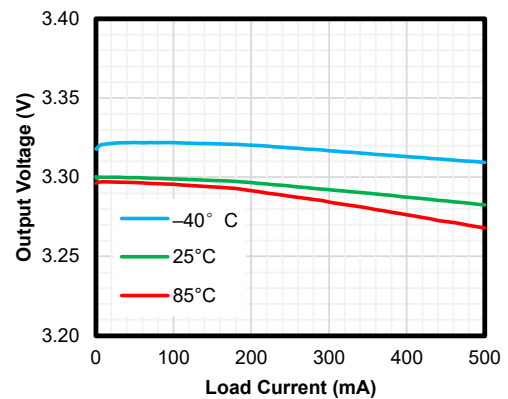
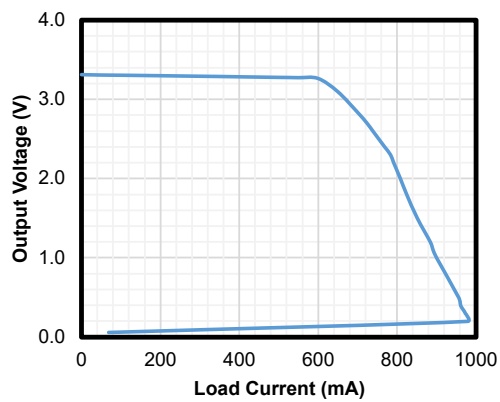
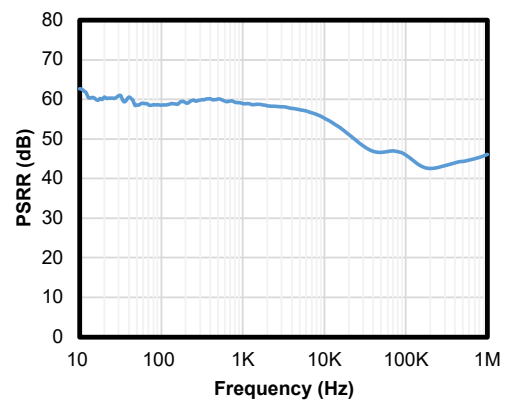


Figure 8. Load Regulation

500-mA Output, High PSRR, Low-Dropout Linear Regulator**Figure 9. Foldback Current Limit****Figure 10. PSRR**

Detailed Description

Overview

The TLV700 devices are 500 mA high PSRR, low-dropout linear regulators with very low quiescent current. These voltage regulators operate from 2.5 V to 5.5 V and consume 50 μ A of quiescent current at no load.

The TLV700 series is available in fixed voltage versions of 1.2 V, 1.5 V, 1.8 V, 2.5 V, 2.8 V, 3 V, and 3.3 V, and also adjustable voltage version of 0.8 V to 5 V with $\pm 2\%$ output voltage accuracy over operating conditions.

Functional Block Diagram

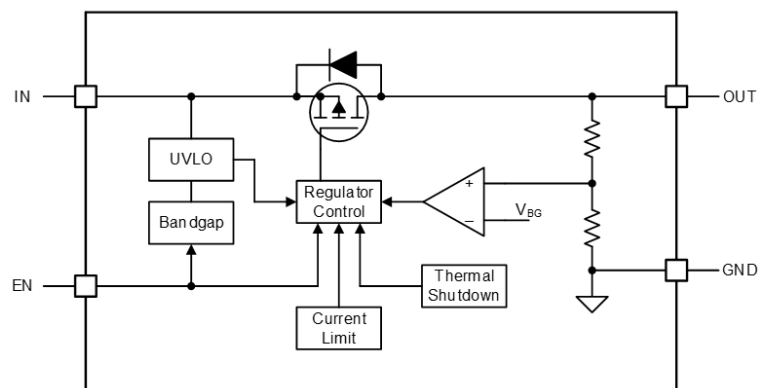


Figure 11. TLV700 Series Fixed Output Version

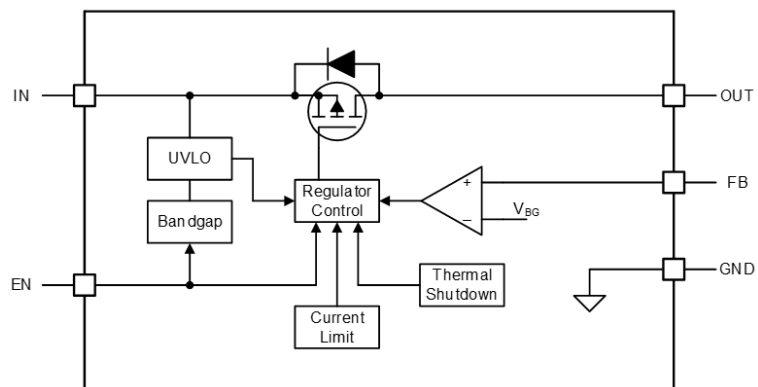


Figure 12. TLV700 Series Adjustable Output Version

Feature Description

Enable

The enable pin (EN) is active high. Connect this pin to the GPIO of an external processor or digital logic control circuit to enable and disable the device. Or connect this pin to the IN pin for self-bias applications.

500-mA Output, High PSRR, Low-Dropout Linear Regulator

Under-Voltage Lockout (UVLO)

The TLV700 series uses an under-voltage lockout circuit (UVLO = 2 V) to keep the output shut off until the internal circuitry operates properly.

Regulated Output Voltage

The TLV700 series is available in fixed voltage versions of 1.2 V, 1.5 V, 1.8 V, 2.5 V, 2.8 V, 3 V, and 3.3 V. When the input voltage is higher than $V_{OUT(NOM)} + V_{DO}$ or 2.5 V, the output pin is the regulated output based on the selected voltage version. When the input voltage falls below $V_{OUT(NOM)} + V_{DO}$ or 2.5 V, the output pin tracks the input voltage minus the dropout voltage based on the load current. When the input voltage drops below the UVLO threshold, the output keeps shut off.

Adjustable Output Voltage

The TLV700 series is also available in adjustable voltage versions of 0.8 V to 5 V by selecting suitable external resistor dividers. Use [Equation 1](#) to calculate the output voltage ($V_{FB} = 0.8$ V). Selecting the resistor value of ($R1 + R2$) between 10 k Ω and 100 k Ω is suggested.

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R1}{R2}\right) \quad (1)$$

Current Limit

The TLV700 series integrates an internal foldback current limit that helps to protect the regulator during fault conditions. The output voltage is not regulated when the device is in current limit and is $V_{OUT} = I_{CL} \times R_{LOAD}$.

Short-Circuit Protection

The TLV700 series integrates the short-circuit protection. When the output pin is shorted to ground or forced to a voltage below 0.2 V, the output current of the TLV700 series is limited to a typical value of 150 mA.

Thermal Shutdown

During normal operation, the LDO junction temperature should not exceed 125°C. When the junction temperature exceeds the thermal shutdown threshold, the LDO shuts down the output immediately. Until the junction temperature falls below the thermal shutdown threshold minus thermal shutdown hysteresis, the output turns on again.

Application and Implementation

Note

Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

Application Information

The TLV700 series of devices is a 500-mA high PSRR, low-dropout linear regulator with a low quiescent current. The following application schematic shows a typical usage of the TLV700 series.

Typical Application

Figure 13 and Figure 14 show the typical application schematic of the TPL730 series.

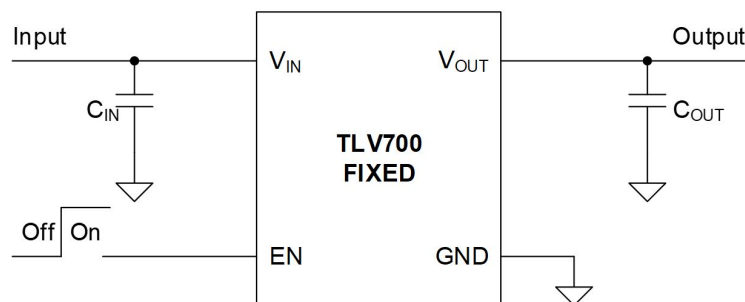


Figure 13. TLV700 Fixed Output Voltage

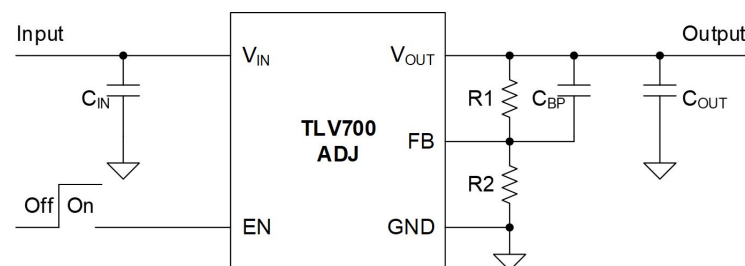


Figure 14. TLV700 Adjustable Output Voltage

Input Capacitor and Output Capacitor

3PEAK recommends adding a 1- μ F or greater capacitor with a 0.1- μ F capacitor in parallel at the IN pin to keep the input voltage stable. The voltage rating of the capacitors must be greater than the maximum input voltage.

To ensure loop stability, the TLV700 series requires an output capacitor with a minimum effective capacitance value of 2.2 μ F. 3PEAK recommends selecting an X5R- or X7R-type ceramic capacitor with low ESR over temperature.

The TLV700 adjustable output version requires a bypass capacitor C_{BP} with a capacitance value from 1nF to 200nF to ensure loop stability.

All capacitors must be placed as close to the pins of the device as possible.

500-mA Output, High PSRR, Low-Dropout Linear Regulator**Power Dissipation**

During normal operation, the LDO junction temperature should not exceed 125°C. Use the equations below to calculate the power dissipation and estimate the junction temperature.

The power dissipation can be calculated using [Equation 2](#).

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

The junction temperature can be estimated using [Equation 3](#). θ_{JA} is the junction-to-ambient thermal resistance (See [Thermal Information](#)).

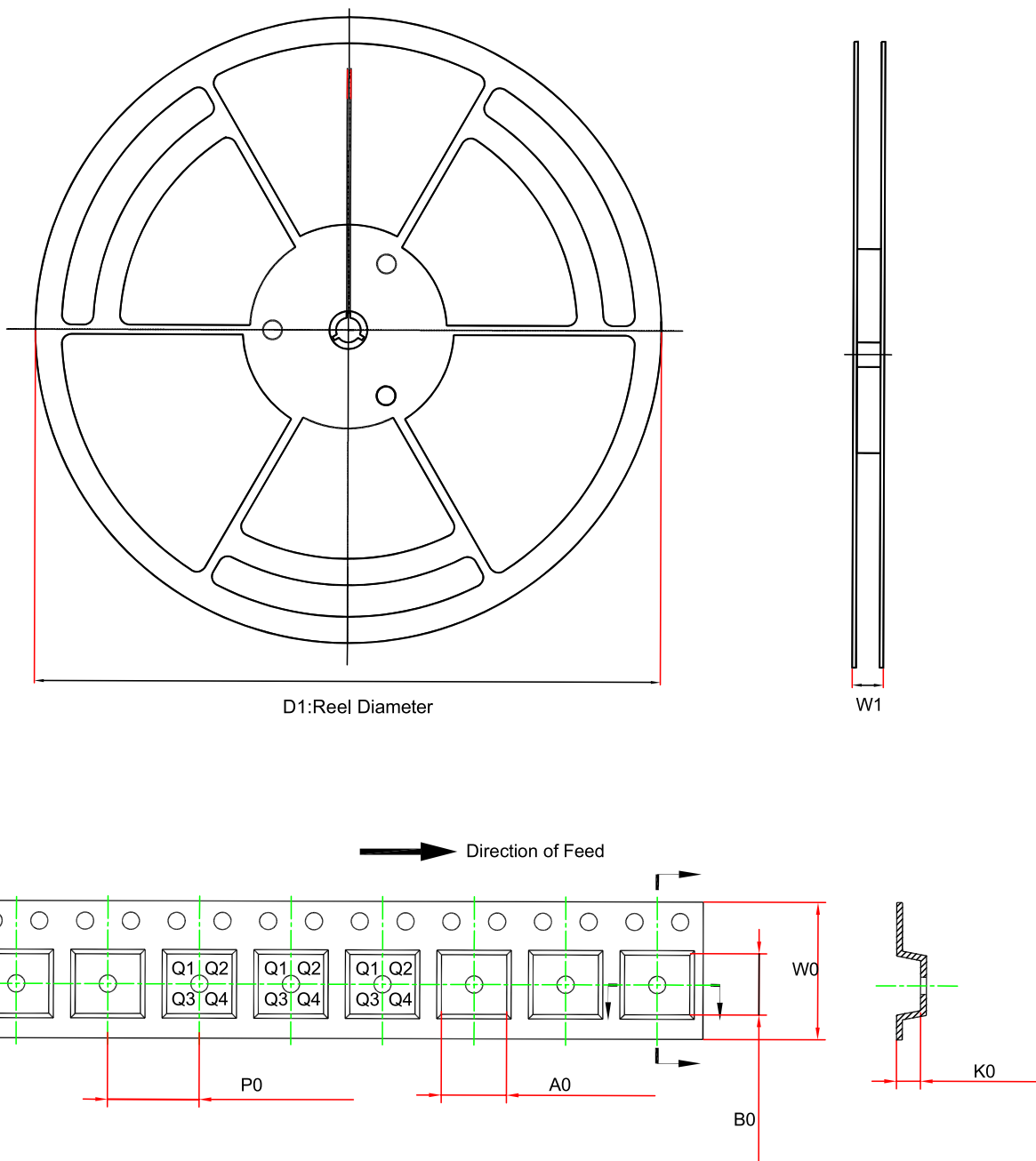
$$T_J = T_A + P_D \times \theta_{JA} \quad (3)$$

Layout

Layout Guideline

- Both input capacitors and output capacitors must be placed as close to the pins of the device as possible.
- It is recommended to bypass the input pin to ground with a 0.1- μ F bypass capacitor. The loop area formed by the bypass capacitor connection, the IN pin, and the GND pin of the system must be as small as possible.
- It is recommended to use wide trace lengths or thick copper weight to minimize $I \times R$ drop and heat dissipation.

Tape and Reel Information



Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TLV700ADJ-C5TR	SOT23-5	180.0	13.1	3.2	3.2	1.4	4.0	8.0	Q3
TLV700Fxx-C5TR	SOT23-5	180.0	13.1	3.2	3.2	1.4	4.0	8.0	Q3

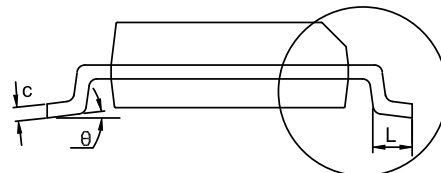
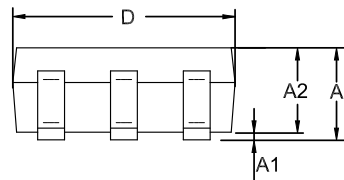
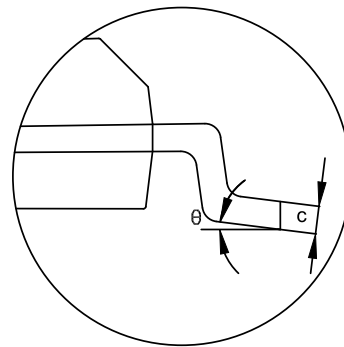
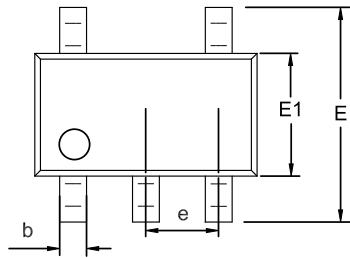
(1) The output voltage value, xx = 12 to 33, e.g., 33 means 3.3-V output voltage.

Package Outline Dimensions

SOT23-5

Package Outline Dimensions

S5T(SOT23-5-A)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.150	0.000	0.006
A2	1.000	1.200	0.039	0.047
b	0.280	0.500	0.011	0.020
c	0.100	0.230	0.004	0.009
D	2.820	3.020	0.111	0.119
E	2.600	3.000	0.102	0.118
E1	1.500	1.720	0.059	0.068
e	0.950 BSC		0.037 BSC	
L	0.300	0.600	0.012	0.024
θ	0	8°	0	8°

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TLV700ADJ-C5TR	-40 to 125°C	SOT23-5	L6A	3	Tape and Reel, 3,000	Green
TLV700F12-C5TR	-40 to 125°C	SOT23-5	L6D	3	Tape and Reel, 3,000	Green
TLV700F15-C5TR	-40 to 125°C	SOT23-5	L6K	3	Tape and Reel, 3,000	Green
TLV700F18-C5TR	-40 to 125°C	SOT23-5	L6F	3	Tape and Reel, 3,000	Green
TLV700F25-C5TR	-40 to 125°C	SOT23-5	L6G	3	Tape and Reel, 3,000	Green
TLV700F28-C5TR	-40 to 125°C	SOT23-5	L6H	3	Tape and Reel, 3,000	Green
TLV700F30-C5TR	-40 to 125°C	SOT23-5	L6I	3	Tape and Reel, 3,000	Green
TLV700F33-C5TR	-40 to 125°C	SOT23-5	L6J	3	Tape and Reel, 3,000	Green

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

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