

Features

- Input Voltage Range: 2.4 V to 5.5 V
- Output Voltage Options:
 - Fixed Voltage: 1.2 V, 1.5 V, 1.8 V, 2.5 V, 2.7 V, 2.8 V, 2.9 V, 3 V, 3.3 V
 - Adjustable Voltage: 0.8 V to 5 V
- High Output Accuracy:
 - ±1% Typical Under Room Temperature
 - ±2% Through Operating Conditions
- Maximum Output Current: 300 mA
- Low Dropout Voltage: 200 mV at 300 mA
- Low Quiescent Current and Shutdown Current
- Foldback Current Limit and Thermal Protection
- Stable with 2.2 µF Ceramic Capacitor
- Inrush Input Current Limitation During Start-up
- Thermal Shutdown Protection
- Junction Temperature Range: −40°C to +125°C
- Package options: SOT23-5, SC70-5, 1×1 DFN-4

Applications

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

Description

The TPL730 series products are high-performance and low-dropout linear regulators. The TPL730 series products support a maximum 300 mA output current with low-quiescent current and high PSRR. The TPL730 series products are stable with ceramic output capacitors from 2.2 μ F to 10 μ F.

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

The TPL730 series products provide several output voltage version options including fixed version and adjustable version with $\pm 2\%$ output voltage accuracy over operating conditions. The TPL730 series products are guaranteed over the junction temperature range from -40 °C to +125 °C.



Typical Application Schematic

TPL730 Fixed Output Voltage

TPL730 Adjustable Output Voltage



Product Family Table

Order Number	Output Voltage (V)	Package
TPL730ADJ-5TR	Adjustable (0.8 V ~ 5 V)	SOT23-5
TPL730F12-5TR	Fixed 1.2 V	SOT23-5
TPL730F15-5TR	Fixed 1.5 V	SOT23-5
TPL730F18-5TR	Fixed 1.8 V	SOT23-5
TPL730F25-5TR	Fixed 2.5 V	SOT23-5
TPL730F27-5TR	Fixed 2.7 V	SOT23-5
TPL730F28-5TR	Fixed 2.8 V	SOT23-5
TPL730F29-5TR	Fixed 2.9 V	SOT23-5
TPL730F30-5TR	Fixed 3.0 V	SOT23-5
TPL730F33-5TR	Fixed 3.3 V	SOT23-5
TPL730ADJ-CR	Adjustable (0.8 V ~ 5 V)	SC70-5
TPL730F12-CR	Fixed 1.2 V	SC70-5
TPL730F15-CR	Fixed 1.5 V	SC70-5
TPL730F18-CR	Fixed 1.8 V	SC70-5
TPL730F25-CR	Fixed 2.5 V	SC70-5
TPL730F27-CR	Fixed 2.7 V	SC70-5
TPL730F28-CR	Fixed 2.8 V	SC70-5
TPL730F29-CR	Fixed 2.9 V	SC70-5
TPL730F30-CR	Fixed 3.0 V	SC70-5
TPL730F33-CR	Fixed 3.3 V	SC70-5
TPL730F12-FR	Fixed 1.2 V	1×1 DFN-4
TPL730F15-FR	Fixed 1.5 V	1×1 DFN-4
TPL730F18-FR	Fixed 1.8 V	1×1 DFN-4
TPL730F25-FR	Fixed 2.5 V	1×1 DFN-4
TPL730F27-FR	Fixed 2.7 V	1×1 DFN-4
TPL730F28-FR	Fixed 2.8 V	1×1 DFN-4
TPL730F29-FR	Fixed 2.9 V	1×1 DFN-4
TPL730F30-FR	Fixed 3.0 V	1×1 DFN-4
TPL730F33-FR	Fixed 3.3 V	1×1 DFN-4



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Revision History

Date	Revision	Notes
2018-09-18	Rev.Pre.0	Preliminary Version
2018-11-26	Rev.A.0	Initial Release
2019-02-11	Rev.A.1	 Added SC70-5 package Added 1.5 V, 2.7 V, 2.9 V voltage options Added link to Figure 11 and Figure 12
2020-08-15	Rev.A.2	 Changed "Soft-start Limits Input Current Surge During Enable" to "Inrush Input Current Limitation During Start-up" Added power dissipation limitation Added description of "Short-Circuit Protection"
2021-03-09	Rev.A.3	 Corrected typical value of current limit in Feature Description Added Tape and Reel Information Updated Junction Temperature Range
2022-05-08	Rev.A.4	Corrected the test condition in the Electrical Characteristics table
2022-08-21	Rev.A.5	Corrected the pin number of the SC70-5 package



Pin Configuration and Functions

TPL730 Series 5-Pin SOT23 Package Top View IN 1 5 OUT GND 2 EN 3 4 NC/FB

TPL730 Series



Pin Functions

	Pin			1/0	Description			
Name	SOT23-5	SC70-5	DFN-4	I/O	Description			
IN	1	1	4	Ι	Input voltage pin. Bypass IN to GND with a 1 μF or greater capacitor.			
OUT	5	5	1	0	Regulated output voltage pin. Bypass OUT to GND with a 2.2 μF or greater capacitor.			
EN	3	3	3	Ι	Regulator enable pin. Drive EN high to turn on the regulator; drive EN low to turn off the regulator. For automatic startup, connect EN to IN directly.			
GND	2	2	2	Ι	Ground reference pin. Connect the GND pin to the PCB ground plane directly.			
NC	4	4	Ι	Ι	No connection.			
FB	4	4	-	I	Output feedback pin (Adjustable version only). Connect to a resistor divider to adjust the output voltage.			

(1) Thermal pad must be connected to the PCB ground plane to maximize the thermal performance.





Specifications

Absolute Maximum Ratings

	Parameter	Min	Мах	Unit
Vin, Ven	Input Voltage	-0.3	6	V
Vout	Output Voltage	-0.3	6	V
V _{FB}	Feedback Voltage (Adjustable version only)	-0.3	6	V
TJ	Junction Temperature Range	-40	150	°C
Tstg	Storage Temperature Range	-65	150	°C
ΤL	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
НВМ	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	Мах	Unit
V _{IN}	Input Voltage	2.4	5.5	V
V _{EN}	Enable Voltage	0	VIN	V
Vout	Output Voltage	0	5	V
V _{FB}	Feedback Voltage (Adjustable version only)	0	Vout	V
Іоит	Output Current	0	300	mA
	Power Dissipation (SOT23-5 Package)	0	300	mW
PD	Power Dissipation (SC70-5 Package)	0	300	mW
	Power Dissipation (1×1 DFN-4 Package)	0	300	mW
TJ	Operating Junction Temperature Range	-40	125	°C

Thermal Information

Package Type	θ _{JA}	θ」ϲ	Unit
SOT23-5	280	62	°C/W
SC70-5	310	80	°C/W
1×1 DFN-4	210	110	°C/W



Electrical Characteristics

All test conditions: $V_{IN} = V_{OUT(NOM)} + 0.5 \text{ V}$ or 2.4 V, whichever is greater; $C_{OUT} = 2.2 \mu F$, $T_A = +25^{\circ}C$, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Тур	Мах	Unit
Supply Vo	oltage and Current					
V _{IN}	Input Voltage Range		2.4		5.5	V
		I _{OUT} = 0 mA		49		μA
Ignd	Ground Pin Current	Iоит = 100 mA		200		μA
ISHDN	Shutdown Current	EN = GND		20		nA
UVLO		V _{IN} rising		1.9		V
UVLU	V _{IN} under-voltage Lock-out	Hysteresis		200		mV
Enable Inj	out Voltage and Current					
VIH(EN)	EN Logic-Input High Level (enable)		1.2		Vin	V
VIL(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					
		T _J = +25°C		1%		
Vout	Output Voltage Accuracy	-40°C ≤ T _J ≤ +125°C	-2%		2%	
V_{FB}	Feedback Pin Voltage	ADJ version only	0.784	0.8	0.816	V
ΔVουτ	Line Regulation	V_{IN} = 2.4 V or $V_{OUT(NOM)}$ + 0.5 V to 5.5 V, I_{OUT} = 1 mA		1	5	mV
	Load Regulation	I _{OUT} = 1 mA to 300 mA		20		mV
V (1)	Drement Velterre	V _{IN} = 0.98 × V _{OUT(NOM)} , I _{OUT} = 100 mA		75		mV
V _{DO} ⁽¹⁾	Dropout Voltage	V _{IN} = 0.98 × V _{OUT(NOM)} , I _{OUT} = 300 mA		200	250	mV
Іоит	Output Current	Vout in regulation	0		300	mA
Icl	Output Current Limit	$V_{OUT} = 0.9 \times V_{OUT(NOM)}$	350	1000	1400	mA

(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: $V_{IN} - V_{DROPOUT}$.



Electrical Characteristics (Continued)

All test conditions: $V_{IN} = V_{OUT(NOM)} + 0.5 V$ or 2.4 V, whichever is greater; $C_{OUT} = 2.2 \mu$ F, $T_A = +25^{\circ}$ C, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Regulated	Output Voltage and Curre	nt				
		I _{OUT} = 100 mA, f = 1 kHz		60		dB
	Power Supply Rejection Ratio (fixed version)	l _{OUT} = 100 mA, f = 100 kHz		40		dB
PSRR		Iout = 100 mA, f = 1 MHz		40		dB
PORK		I _{OUT} = 100 mA, f = 1 kHz, C _{BP} = 100 nF		65		dB
	Power Supply Rejection	I _{OUT} = 100 mA, f = 100 kHz, C _{BP} = 100 nF		60		dB
Ratio (ADJ version)	l _{OUT} = 100 mA, f = 1 MHz, C _{BP} = 100 nF		45		dB	
V _N V _N Output Noise Voltage (fixed version) Output Noise Voltage (ADJ version)	1 0	I _{OUT} = 100 mA, BW = 100 Hz to 80 kHz		130		µV _{RMS}
		I _{ОUT} = 100 mA, BW = 100 Hz to 80 kHz, С _{BP} = 100 nF		40		μV _{RMS}
T (2)	Start-up Time (fixed version)	Ι _{ΟUT} = 300 mA, C _{OUT} = 2.2 μF		150		μs
T _{STR} ⁽²⁾ Start-up Time (ADJ version)		I _{OUT} = 300 mA, C _{OUT} = 2.2 μF, C _{BP} = 100 nF		15		ms
Temperatu	ire Range					
T	Thermal Shutdown Temperature			170		°C
Tsd	Thermal Shutdown Hysteresis			30		°C

(2) Start-up time from EN assertion to 0.98 × $V_{OUT(NOM)}$.



Typical Performance Characteristics

All test conditions: $V_{IN} = V_{OUT(NOM)} + 0.5$ V or 2.4 V, whichever is greater; $C_{OUT} = 2.2$ µF, $T_A = +25^{\circ}C$, unless otherwise noted.





Typical Performance Characteristics (Continued)

All test conditions: $V_{IN} = V_{OUT(NOM)} + 0.5 V$ or 2.4 V, whichever is greater; $C_{OUT} = 2.2 \mu$ F, $T_A = +25^{\circ}$ C, unless otherwise noted.





Detailed Description

Overview

The TPL730 devices products are 300 mA high PSRR, low-dropout linear regulators with the very low quiescent current. These voltage regulators operate from 2.4 V to 5.5 V and consume 49 μ A of quiescent current at no load and only 20 nA when in shutdown mode.

The TPL730 series are available in fixed voltage versions of 1.2 V, 1.5 V, 1.8 V, 2.5 V, 2.7 V, 2.8 V, 2.9 V, 3 V, and 3.3 V, and adjustable voltage version of 0.8 V to 5 V with $\pm 2\%$ output voltage accuracy over operating conditions.

Functional Block Diagram



TPL730 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.



Under-voltage Lockout (UVLO)

The TPL730 series use an under-voltage lockout circuit (UVLO = 1.9 V) to keep the output shut off until the internal circuitry operates properly.

Regulated Output Voltage

The TPL730 series are available in fixed voltage versions of 1.2 V, 1.5 V, 1.8 V, 2.5 V, 2.7 V, 2.8 V, 2.9 V, 3 V, and 3.3 V. When the input voltage is higher than $V_{OUT(NOM)} + V_{DO}$ or 2.4 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 2.4 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 TPL730 series are 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). Suggest select resistor value of (R1 + R2) between 10 k Ω and 100 k Ω .

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

Current Limit

The TPL730 series integrates an internal foldback current limit that helps to protect the regulator during fault conditions. When the output is shorted, the LDO supplies a typical current of 1000 mA. 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 TPL730 series integrates 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 TPL730 series is limited to a typical value of 150 mA.

Thermal Shutdown

During normal operation, LDO junction temperature should not exceed 125°C. When the junction temperature exceeds the thermal shutdown threshold, the LDO shut down the output immediately. Until when 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 TPL730 devices are a series of 300 mA high PSRR, low-dropout linear regulators with low quiescent current. The following application schematic shows a typical usage of the TPL730 series.

Typical Application

Figure 11 and Figure 12 show the typical application schematic of the TPL730 series.



Figure 11. TPL730 Fixed Output Voltage



Figure 12 TPL730 Adjustable Output Voltage

Input Capacitor and Output Capacitor

3PEAK recommends adding a 1 μ F or greater capacitor with a 0.1 μ F bypass capacitor in parallel at 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 TPL730 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.

Both input capacitors and output capacitors must be placed as close to the device pins as possible.



Power Dissipation

3PFA

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

The power dissipation can be calculated using Equation 2.

$$\mathbf{P}_{\mathrm{D}} = \left(\mathbf{V}_{\mathrm{IN}} - \mathbf{V}_{\mathrm{OUT}}\right) \times \mathbf{I}_{\mathrm{OUT}} + \mathbf{V}_{\mathrm{IN}} \times \mathbf{I}_{\mathrm{GND}}$$
(2)

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

$$\mathbf{T}_{\mathbf{J}} = \mathbf{T}_{\mathbf{A}} + \mathbf{P}_{\mathbf{D}} \times \boldsymbol{\theta}_{\mathbf{J}\mathbf{A}}$$
(3)

Layout

Layout Guideline

• Both input capacitors and output capacitors must be placed as close to the device pins 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, 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×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
TPL730ADJ-5TR	SOT23-5	180.0	13.1	3.2	3.2	1.4	4.0	8.0	Q3
TPL730Fxx-5TR	SOT23-5	180.0	13.1	3.2	3.2	1.4	4.0	8.0	Q3
TPL730ADJ-CR	SC70-5	178.0	12.3	2.4	2.5	1.2	4.0	8.0	Q3
TPL730Fxx-CR	SC70-5	178.0	12.3	2.4	2.5	1.2	4.0	8.0	Q3
TPL730Fxx-FR	1×1 DFN-4	180.0	10.0	1.16	1.16	0.5	2.0	8.0	Q1

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



Package Outline Dimensions

SOT23-5





SC70-5

Package Outline Dimensions		SC5	(SO	Г353 [.]	-5-A)
		(
		Dim	ensions	Dime	nsions
	Symbol		illimeters	In Ir	nches
		MIN	MAX	MIN	MAX
	A	0.850	1.100	0.033	0.043
	A1	0.000	0.100	0.000	0.004
	A2	0.800	1.000	0.031	0.039
	b	0.150	0.350	0.006	0.014
	с	0.110	0.230	0.004	0.009
	D	2.000	2.200	0.079	0.087
	E	2.150	2.450	0.085	0.096
	E1	1.150	1.350	0.045	0.053
NOTES	е	<u> </u>	0 BSC		6 BSC
1. Do not include mold flash or protrusion.	L	0.260	0.460	0.010	0.018
2. This drawing is subject to change without notice.	θ	0	8	0	8



1x1 DFN-4





Order Information

Order Number	Junction Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPL730ADJ-5TR	−40 to 125°C	SOT23-5	L6A	MSL3	Tape and Reel, 3,000	Green
TPL730F12-5TR	−40 to 125°C	SOT23-5	L6D	MSL3	Tape and Reel, 3,000	Green
TPL730F15-5TR	−40 to 125°C	SOT23-5	L6K	MSL3	Tape and Reel, 3,000	Green
TPL730F18-5TR	−40 to 125°C	SOT23-5	L6F	MSL3	Tape and Reel, 3,000	Green
TPL730F25-5TR	−40 to 125°C	SOT23-5	L6G	MSL3	Tape and Reel, 3,000	Green
TPL730F27-5TR	−40 to 125°C	SOT23-5	L6L	MSL3	Tape and Reel, 3,000	Green
TPL730F28-5TR	−40 to 125°C	SOT23-5	L6H	MSL3	Tape and Reel, 3,000	Green
TPL730F29-5TR	−40 to 125°C	SOT23-5	L6M	MSL3	Tape and Reel, 3,000	Green
TPL730F30-5TR	−40 to 125°C	SOT23-5	L6I	MSL3	Tape and Reel, 3,000	Green
TPL730F33-5TR	−40 to 125°C	SOT23-5	L6J	MSL3	Tape and Reel, 3,000	Green
TPL730ADJ-CR	−40 to 125°C	SC70-5	L6A	MSL3	Tape and Reel, 3,000	Green
TPL730F12-CR (1)	−40 to 125°C	SC70-5	L6D	MSL3	Tape and Reel, 3,000	Green
TPL730F15-CR (1)	−40 to 125°C	SC70-5	L6K	MSL3	Tape and Reel, 3,000	Green
TPL730F18-CR	−40 to 125°C	SC70-5	L6F	MSL3	Tape and Reel, 3,000	Green
TPL730F25-CR (1)	−40 to 125°C	SC70-5	L6G	MSL3	Tape and Reel, 3,000	Green
TPL730F27-CR (1)	−40 to 125°C	SC70-5	L6L	MSL3	Tape and Reel, 3,000	Green
TPL730F28-CR	−40 to 125°C	SC70-5	L6H	MSL3	Tape and Reel, 3,000	Green
TPL730F29-CR (1)	−40 to 125°C	SC70-5	L6M	MSL3	Tape and Reel, 3,000	Green
TPL730F30-CR	−40 to 125°C	SC70-5	L6I	MSL3	Tape and Reel, 3,000	Green
TPL730F33-CR	−40 to 125°C	SC70-5	L6J	MSL3	Tape and Reel, 3,000	Green

(1) For future products, contact the 3PEAK factory for more information and sample.

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



Order Number	Junction Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPL730F12-FR	−40 to 125°C	DFN1x1-4	L6D	MSL3	Tape and Reel, 12,000	Green
TPL730F15-FR	−40 to 125°C	DFN1x1-4	L6K	MSL3	Tape and Reel, 12,000	Green
TPL730F18-FR	−40 to 125°C	DFN1x1-4	L6F	MSL3	Tape and Reel, 12,000	Green
TPL730F25-FR	−40 to 125°C	DFN1x1-4	L6G	MSL3	Tape and Reel, 12,000	Green
TPL730F27-FR	−40 to 125°C	DFN1x1-4	L6L	MSL3	Tape and Reel, 12,000	Green
TPL730F28-FR	−40 to 125°C	DFN1x1-4	L6H	MSL3	Tape and Reel, 12,000	Green
TPL730F29-FR	−40 to 125°C	DFN1x1-4	L6M	MSL3	Tape and Reel, 12,000	Green
TPL730F30-FR	−40 to 125°C	DFN1x1-4	L6I	MSL3	Tape and Reel, 12,000	Green
TPL730F33-FR	−40 to 125°C	DFN1x1-4	L6J	MSL3	Tape and Reel, 12,000	Green

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



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