DIO7709
300mA Low Iq , Wide Input Voltage Low Dropout Regulator

Features

- Operating Input Voltage Range: 2.5V to 30V
- Fixed Voltage Options Available: 1.2V to 5V (upon request)
- Ultra−Low Quiescent Current: typ. 4μA over Temperature
- PSRR: 60dB at 1kHz
- Stable with Small 1μF Ceramic Capacitor
- Soft−start to Reduce Inrush Current and Overshoots
- Thermal Shutdown and Current Limit Protection
- SOA Limiting for High Vin/High Iout – Static/ Dynamic
- Available in SOT89-3，SOT23-5 and SOT23-3 Packages
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Descriptions

The DIO7709 is 300mA LDO Linear Voltage Regulator. It is a very stable and accurate device with ultra−low quiescent current consumption (typ. 4μA over the full temperature range) and a wide input voltage range (up to 30V). The regulator incorporates several protection features such as Thermal Shutdown and Current Limiting.

Applications

- Wireless Chargers
- Portable Equipment
- Communication Systems

Typical Applications

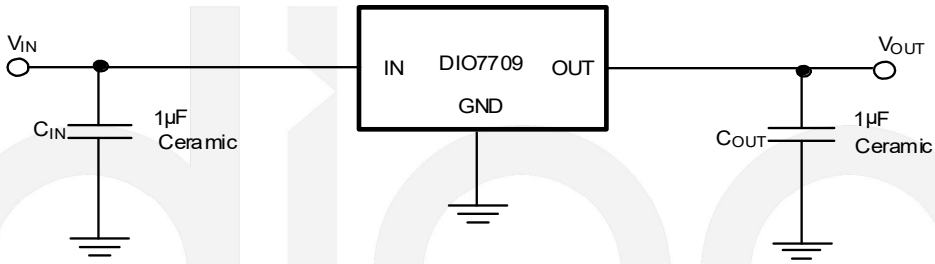
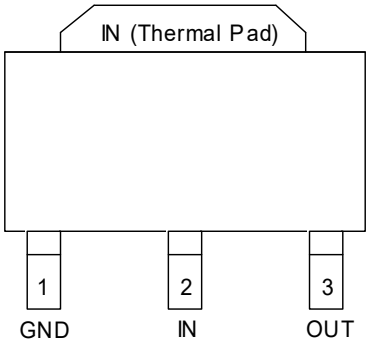


Figure 1. Typical Application Schematic

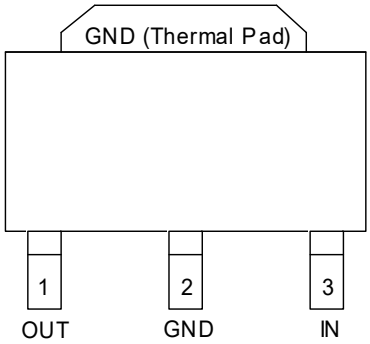
Ordering Information

Order Part Number	Voltage Option	Top Marking		T_A	Package	
DIO7709120TC3	1.2V	D7709B	Green	-40 to 85°C	SOT89-3	Tape & Reel,2500
DIO7709150TC3	1.5V	D7709C	Green	-40 to 85°C	SOT89-3	Tape & Reel,2500
DIO7709180TC3	1.8V	D7709D	Green	-40 to 85°C	SOT89-3	Tape & Reel,2500
DIO7709250TC3	2.5V	D7709E	Green	-40 to 85°C	SOT89-3	Tape & Reel,2500
DIO7709300TC3	3.0V	D7709F	Green	-40 to 85°C	SOT89-3	Tape & Reel,2500
DIO7709330TC3	3.3V	D7709G	Green	-40 to 85°C	SOT89-3	Tape & Reel,2500
DIO7709R330TC3	3.3V	252X	Green	-40 to 85°C	SOT89-3	Tape & Reel,2500
DIO7709120ST5	1.2V	YW9B	Green	-40 to 85°C	SOT23-5	Tape & Reel,3000
DIO7709150ST5	1.5V	YW9C	Green	-40 to 85°C	SOT23-5	Tape & Reel,3000
DIO7709180ST5	1.8V	YW9D	Green	-40 to 85°C	SOT23-5	Tape & Reel,3000
DIO7709250ST5	2.5V	YW9E	Green	-40 to 85°C	SOT23-5	Tape & Reel,3000
DIO7709300ST5	3.0V	YW9F	Green	-40 to 85°C	SOT23-5	Tape & Reel,3000
DIO7709330ST5	3.3V	YW9G	Green	-40 to 85°C	SOT23-5	Tape & Reel,3000
DIO7709120ST3	1.2V	YW9B	Green	-40 to 85°C	SOT23-3	Tape & Reel,3000
DIO7709150ST3	1.5V	YW9C	Green	-40 to 85°C	SOT23-3	Tape & Reel,3000
DIO7709180ST3	1.8V	YW9D	Green	-40 to 85°C	SOT23-3	Tape & Reel,3000
DIO7709250ST3	2.5V	YW9E	Green	-40 to 85°C	SOT23-3	Tape & Reel,3000
DIO7709300ST3	3.0V	YW9F	Green	-40 to 85°C	SOT23-3	Tape & Reel,3000
DIO7709330ST3	3.3V	YW9G	Green	-40 to 85°C	SOT23-3	Tape & Reel,3000

Pin Assignment



SOT89-3
DIO7709XXXTC3



SOT89-3
DIO7709R330TC3

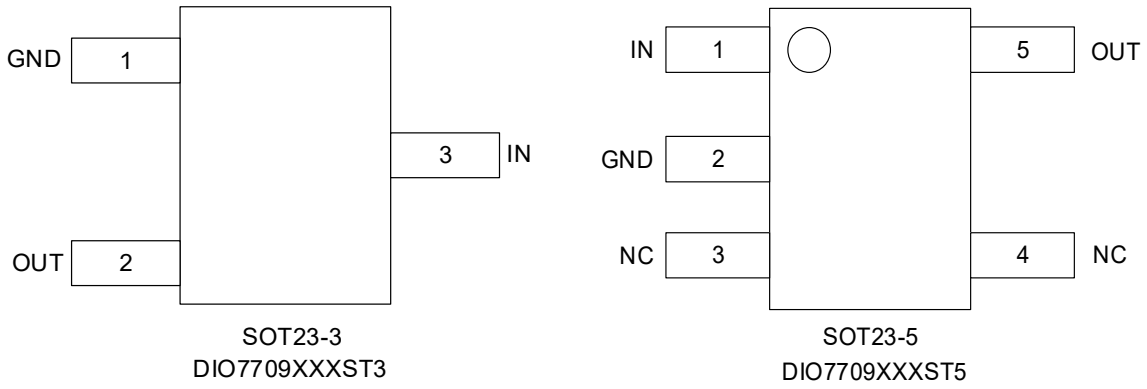


Figure 2. Top View

Pin Descriptions

Name	Description
IN	Input pin. A small capacitor is needed from this pin to ground to assure stability.
GND	Power supply ground.
OUT	Regulated output voltage pin. A small 1μF ceramic capacitor is needed from this pin to ground to assure stability.
NC	No connection.

Absolute Maximum Ratings

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Symbol	Parameter	Rating	Unit
V_{IN}	Input Voltage (Note 1)	−0.3 to 30	V
V_{OUT}	Output Voltage	−0.3 to V_{IN}+0.3 (max. 6)	V
$T_{J(MAX)}$	Maximum Junction Temperature	150	℃
T_{STG}	Storage Temperature	−55 to 150	℃
HBM	ESD Capability, Human Body Model	2000	V

Thermal Information

Thermal Metric		DIO7709 (SOT89-3)	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance	100	°C/W

Electrical Characteristics

-40°C ≤ T_J ≤ 125°C; V_{IN} = 2.5V or (V_{OUT} + 1.0V), whatever is greater; I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1μF, unless otherwise noted.

Typical values are at T_J = 25°C. (Note 2)

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_{IN}	Operating Input Voltage			2.5		30	V
V_{OUT}	Output Voltage Accuracy (fixed versions)	−40°C ≤ T_J ≤ 125°C, V_{OUT} + 1V < V_{IN} < 30V, 0.1mA < I_{OUT} < 300mA (Note 4)	V_{OUT} < 1.8V	−3%		3%	V
			V_{OUT} ≥ 1.8V	−2%		2%	
Reg_{LINE}	Line Regulation	V_{OUT} + 1V ≤ V_{IN} ≤ 30V, I_{OUT}=1mA			10		mV
Reg_{LOAD}	Load Regulation	I_{OUT} = 0.1mA to 300mA			10		mV
V_{DO}	Dropout voltage	V_{DO} = V_{IN}–($V_{OUT(NOM)}$– 3%), I_{OUT} = 150mA (Note 3)	2.1V – 2.4V		480		mV
			2.5V – 2.7V		300		
			2.8V – 3.2V		280		
			3.3V – 4.9V		260		
			5V		240		
I_{LIM}	Maximum Output Current	V_{IN} = V_{OUT} + 1V(Note 4)		300		800	mA
I_Q	Quiescent Current	I_{OUT} = 0mA			4.0	8.0	uA
I_{GND}	Ground current	I_{OUT} = 10mA			50		uA
		I_{OUT} = 300mA			300		
PSRR	Power Supply Rejection Ratio	V_{IN} = 3.5V + 100mV_{pp} V_{OUT} = 2.5V I_{OUT} = 1mA, C_{OUT} = 1μF	f = 1kHz		60		dB
V_N	Output Noise Voltage	V_{OUT} = 1.2V, I_{OUT} = 10mA f = 100Hz to 100kHz			36		uVrms
T_{SD}	Thermal Shutdown Temperature (Note 5)	Temperature increasing from T_J = 25°C			150		℃
T_{SDH}	Thermal Shutdown Hysteresis(Note 5)	Temperature falling from T_{SD}			25		℃

Specifications subject to change without notice.

Note:

1. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
2. Performance guaranteed over the indicated operating temperature range by design and/or characterization production tested at T_J = T_A =25°C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
3. Voltage dropout for voltage variants below 2.1V is given by minimum input voltage 2.5V.
4. Respect SOA
5. Guaranteed by design and characterization.

Typical Performance Characteristic

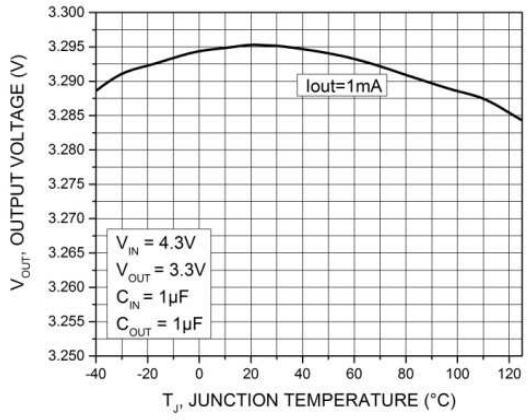


Figure 3. Output Voltage vs Temperature
V_{OUT}=3.3V

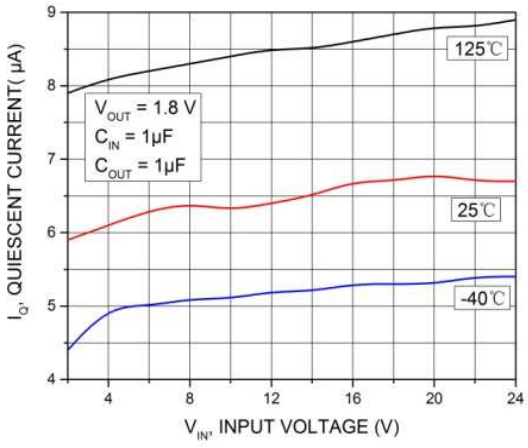


Figure 4. Quiescent Current vs Input Voltage
V_{OUT}=1.8V

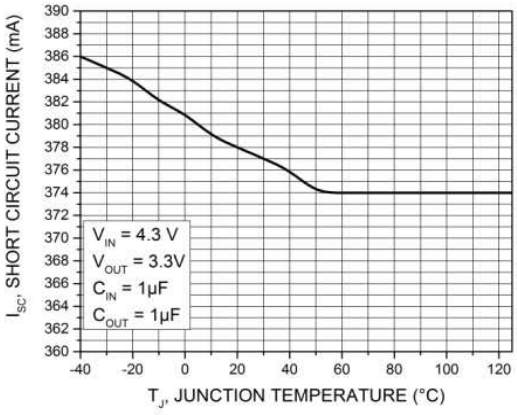


Figure 5. Short Circuit Current vs Temperature
V_{OUT}=3.3V

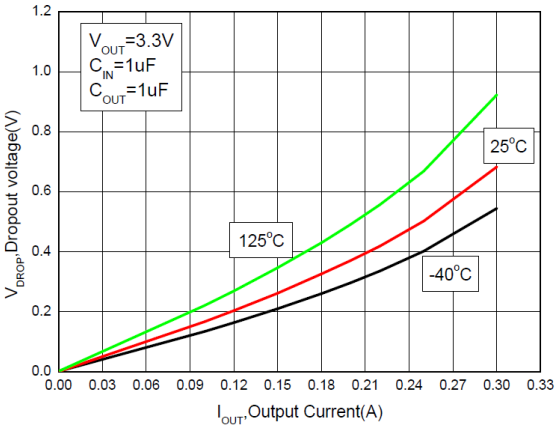


Figure 6. Dropout Voltage vs Output Current
V_{OUT}=3.3V

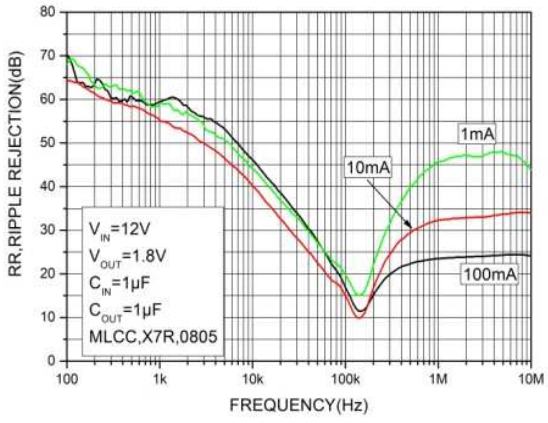


Figure 7. Power Supply Rejection Ratio vs Current

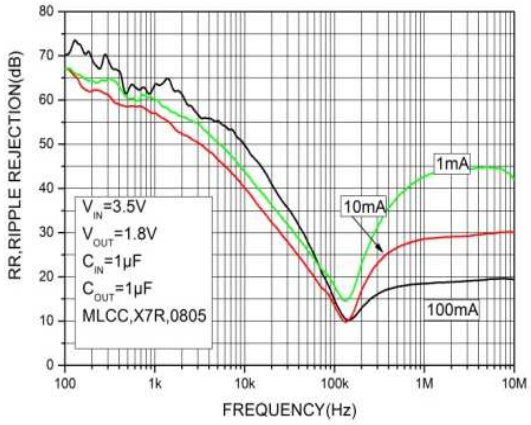


Figure 8. Power Supply Rejection Ratio vs Current

V_{IN}=12V, C_{OUT}=1μF

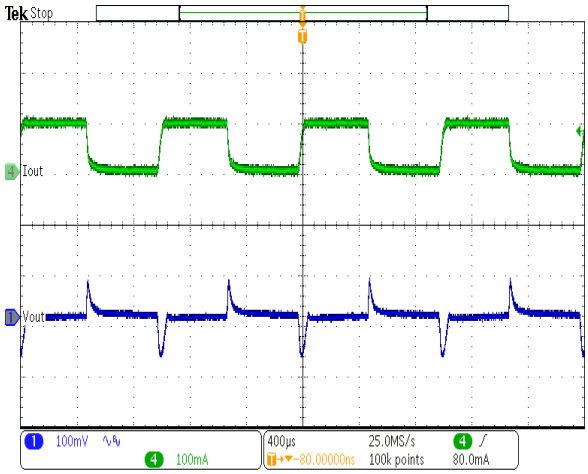


Figure 9. Load transient response
V_{IN}=2.8V, V_{OUT}=1.8V, I_{LOAD}=5mA~100mA

V_{IN}=3.5V, C_{OUT}=1μF

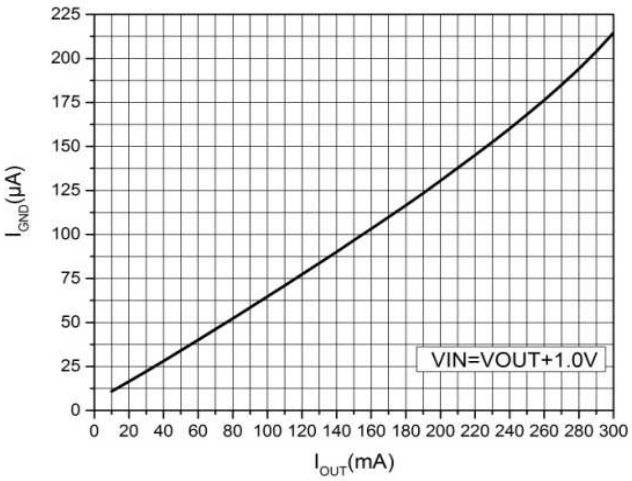
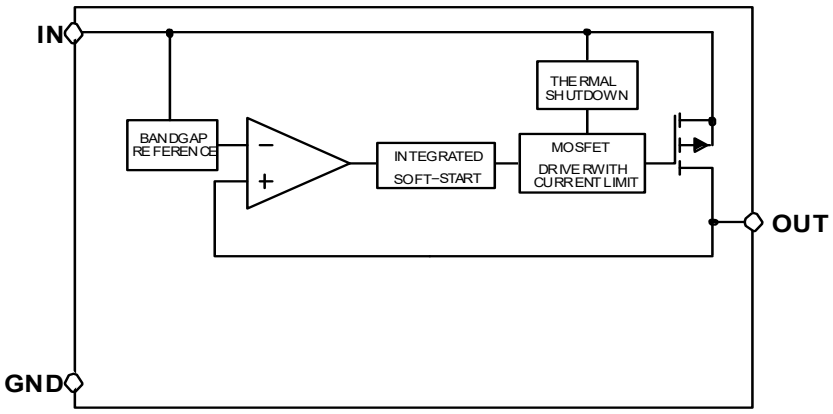


Figure 10. I_{GND} vs I_{OUT}

Functional Block Diagrap



Fixed Version

Figure 11. Functional Block Diagrap

Application Information

The DIO7709 is the member of new family of Wide Input Voltage Range Low Dropout Regulators which delivers Ultra Low Ground Current consumption, Good Noise and Power Supply Rejection Ratio Performance.

Input Decoupling (C_{IN})

It is recommended to connect at least 1μF ceramic X5R or X7R capacitor between IN and GND pin of the device. This capacitor will provide a low impedance path for any unwanted AC signals or noise superimposed onto constant input voltage. The good input capacitor will limit the influence of input trace inductances and source resistance during sudden load current changes.

Higher capacitance and lower ESR capacitors will improve the overall line transient response.

Output Decoupling (C_{OUT})

The DIO7709 does not require a minimum Equivalent Series Resistance (ESR) for the output capacitor. The device is designed to be stable with standard ceramics capacitors with values of 1μF or greater. The X5R and X7R types have the lowest capacitance variations over temperature thus they are recommended.

Power Dissipation and Heat Sinking

The maximum power dissipation supported by the device is dependent upon board design and layout. Mounting pad configuration on the PCB, the board material, and the ambient temperature affect the rate of junction temperature rise for the part. For reliable operation junction temperature should be limited to 150°C.

The maximum power dissipation the DIO7709 can handle is given by:

$$P_{D(MAX)} = \frac{[T_{J(MAX)} - T_A]}{R_{\theta JA}} \qquad \text{(eq.1)}$$

The power dissipated by the DIO7709 for given application conditions can be calculated from the following equations:

$$P_D \approx V_{IN} \left(I_{GND} \left(I_{OUT} \right) \right) + I_{OUT}(V_{IN} - V_{OUT}) \qquad \text{(eq.2)}$$

or

$$V_{IN(MAX)} \approx \frac{P_{D(MAX)} + (V_{OUT} \times I_{OUT})}{I_{OUT} + I_{GND}} \qquad \text{(eq.3)}$$

Hints

V_{IN} and GND printed circuit board traces should be as wide as possible. When the impedance of these traces is high, there is a chance to pick up noise or cause the regulator to malfunction. Place external components, especially the output capacitor, as close as possible to the DIO7709, and make traces as short as possible.

CONTACT US

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