

## DIO7708X390

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

#### Features

- Operating Input Voltage Range: 2.5V to 15V
- Fixed Voltage: 3.9V
- Ultra-Low Quiescent Current: typ. 3 $\mu$ A over Temperature
- PSRR: 60dB at 1kHz
- Stable with Small 1 $\mu$ F 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 and SOT23-5 Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### Descriptions

The DIO7708X390 is 300mA LDO Linear Voltage Regulator. It is a very stable and accurate device with ultra-low quiescent current consumption (typ. 3 $\mu$ A over the full temperature range) and a wide input voltage range (up to 15V). The regulator incorporates several protection features such as Thermal Shutdown and Current Limiting.

#### Applications

- Wireless Chargers
- Portable Equipment
- Communication Systems

#### Typical Applications

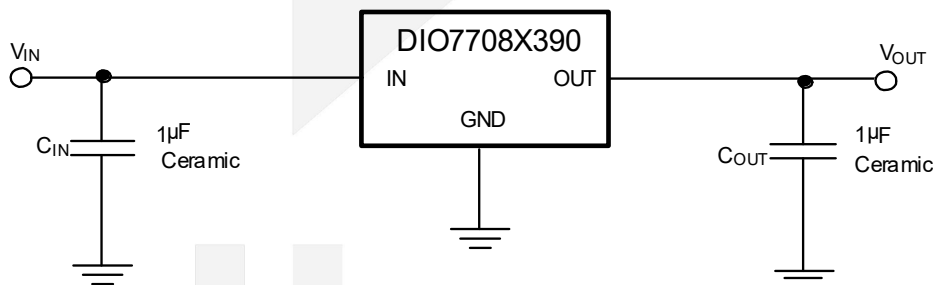


Figure 1. Typical Application Schematic

#### Ordering Information

Order Part Number	Voltage Option	Top Marking		T <sub>A</sub>	Package	
DIO7708X390TC3	3.9V	DGV8X9	Green	-40 to 85°C	SOT89-3	Tape & Reel,2500
DIO7708X390ST5	3.9V	CCYW	Green	-40 to 85°C	SOT23-5	Tape & Reel,3000

## Pin Assignment

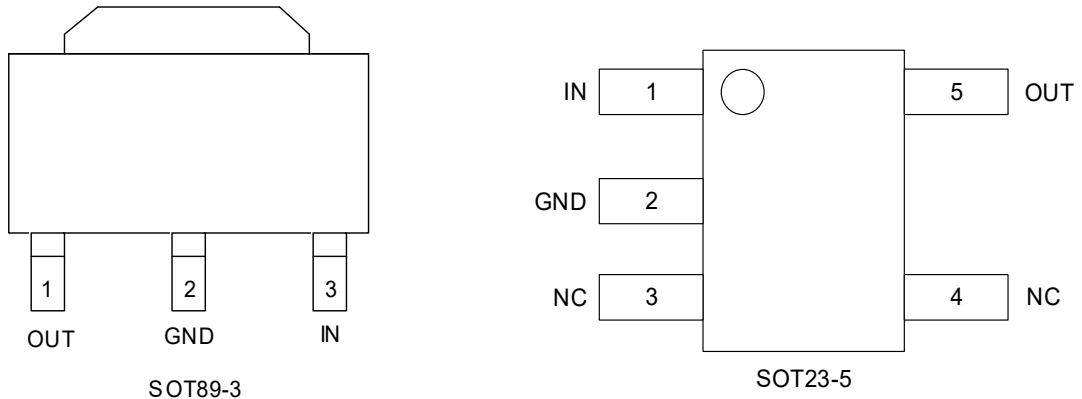


Figure 2. Top View

## 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 1 $\mu$ F 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 15	V
$V_{OUT}$	Output Voltage	-0.3 to $V_{IN}+0.3$ (max. 6)	V
$t_{SC}$	Output Short Circuit Duration	Indefinite	s
$T_{J(MAX)}$	Maximum Junction Temperature	150	$^{\circ}$ C
$T_{STG}$	Storage Temperature	-55 to 150	$^{\circ}$ C
HBM	ESD Capability, Human Body Model	2000	V



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## Electrical Characteristics

$V_{IN} = 2.5V$  or  $(V_{OUT} + 1.0V)$ ,  $T_A = 25^\circ C$ , whatever is greater;  $I_{OUT} = 1mA$ ,  $C_{IN} = C_{OUT} = 1\mu F$ , unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{IN}$	Operating Input Voltage		2.5		15	V
$V_{OUT}$	Output Voltage Accuracy (fixed versions)	$-40^\circ C \leq T_J \leq 125^\circ C$ , $V_{OUT} + 1V < V_{IN} < 16V$ , $0.1mA < I_{OUT} < 300mA$ (Note 2)	-2%		2%	V
Reg <sub>LINE</sub>	Line Regulation	$V_{OUT} + 1V \leq V_{IN} \leq 16V$ , $I_{OUT} = 1mA$		10		mV
Reg <sub>LOAD</sub>	Load Regulation	$I_{OUT} = 0.1mA$ to $300mA$		10		mV
$V_{DO}$	Dropout voltage	$V_{DO} = V_{IN} - (V_{OUT(NOM)} - 3\%)$ , $I_{OUT} = 100mA$		150		mV
		$V_{DO} = V_{IN} - (V_{OUT(NOM)} - 3\%)$ , $I_{OUT} = 200mA$		320		
$I_{LIM}$	Maximum Output Current	$V_{IN} = V_{OUT} + 1V$ (Note 2)	300		800	mA
$I_Q$	Quiescent Current	$I_{OUT} = 0mA$		3.0	3.9	uA
PSRR	Power Supply Rejection Ratio	$I_{OUT} = 1mA$ , $C_{OUT} = 1\mu F$ $f = 1kHz$		60		dB
$V_N$	Output Noise Voltage	$I_{OUT} = 10mA$ $f = 100Hz$ to $100kHz$		36		uVrms
$T_{SD}$	Thermal Shutdown Temperature (Note 3)	Temperature increasing from $T_J = 25^\circ C$		150		°C
$T_{SDH}$	Thermal Shutdown Hysteresis (Note 3)	Temperature falling from $T_{SD}$		25		°C

Specifications subject to change without notice.

**Note:**

1. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
2. Respect SOA
3. Guaranteed by design and characterization.

### Functional Block Diagram

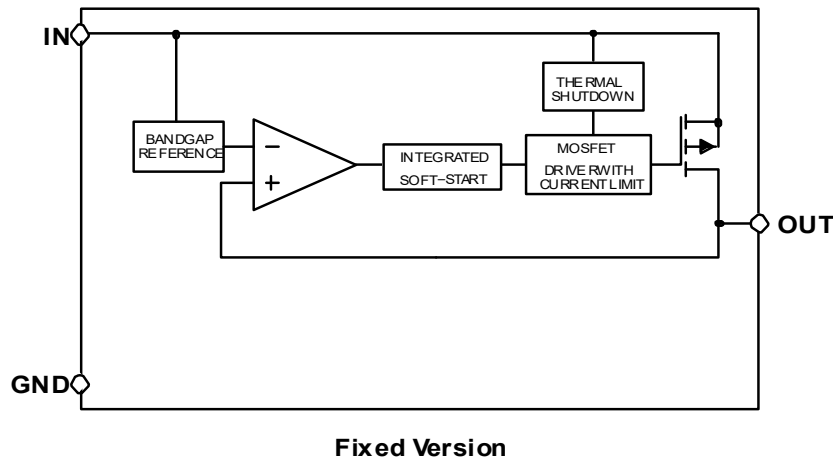


Figure 3. Functional Block Diagram

### Application Information

The DIO7708X390 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<sub>IN</sub>)

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<sub>OUT</sub>)

The DIO7708X390 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 125°C.

The maximum power dissipation the DIO7708X390 can handle is given by:

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



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The power dissipated by the DIO7708X390 for given application conditions can be calculated from the following equations:

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

or

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

### 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 DIO7708X390, and make traces as short as possible.



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### CONTACT US

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