

DIO7910

300 mA, Ultra-Low-Noise, Low- I_Q LDO

Features

- Operating input voltage range: 1.6 V to 5.5 V
- Output voltage range: 0.8 V to 3.3 V
- Output current: 300 mA
- Ultra-low quiescent current: Typ. 25 μ A
- Dropout voltage : 170 mV at $I_{OUT} = 300$ mA
- PSRR: 75 dB at 1 kHz, $I_{OUT} = 20$ mA
- Output voltage tolerance: $\pm 1\%$
- Stable with ceramic capacitors 1 μ F
- Thermal-overload protection
- Short-circuit protection
- Quick output discharge
- DIO7910A: available
- DIO7910B: not available
- Available in small DFN1*1-4, SOT23-5, DFN0.8*0.8-4, and SC70-5 packages
- These devices are Pb-Free, halogen Free/BFR free, and are RoHS compliant

Applications

- MP3/MP4 Players
- Cellphones, radiophone, digital cameras
- Bluetooth, wireless handsets
- Others portable electronics devices

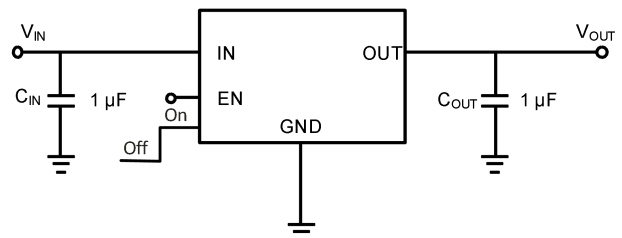
Descriptions

The DIO7910 series is a high-accuracy, low-noise, high-speed, high-PSRR, and low-dropout CMOS linear regulator with high ripple rejection. The devices offer a new level of cost-effective performance in cellular phones, laptop and notebook computers, and other portable devices.

The DIO7910 has the fold-back maximum output current which depends on the output voltage. So the current limit functions both as a short circuit protection and as an output current limiter.

The device is available in DFN1*1-4, SOT23-5, DFN0.8*0.8-4, and SC70-5 packages.

Typical Applications





DIO7910

300 mA, Ultra-Low-Noise, Low-I_q LDO

Ordering Information

Order Part Number	Top Marking	RoHS	T _A	Package	
DIO7910AaaST5	KAXYW	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7910AaaEN4	YWKX	Green	-40 to 125°C	DFN1*1-4	Tape & Reel, 10000
DIO7910AaaCN4	D	Green	-40 to 125°C	DFN0.8*0.8-4	Tape & Reel, 5000
DIO7910AaaSC5	YWKX	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000
DIO7910BaaST5	KBXYW	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7910BaaEN4	YVWX	Green	-40 to 125°C	DFN1*1-4	Tape & Reel, 10000
DIO7910BaaCN4	D	Green	-40 to 125°C	DFN0.8*0.8-4	Tape & Reel, 5000
DIO7910BaaSC5	YVWX	Green	-40 to 125°C	SC70-5	Tape & Reel, 3000

Output Voltage Options

Option Code "aa"	08	10	11	12	15	18	25	28	30	33
Voltage	0.8 V	1.0 V	1.1 V	1.2 V	1.5 V	1.8 V	2.5 V	2.8 V	3.0 V	3.3 V

Marking Definition: KAXYW/YWKX/D/KBXYW/YVWX

KAXYW	KA: product code; Y: year code; W: week code
YWKX	Y: year code; W: week code; K: product code
D	D: product code
KBXYW	KB: product code; Y: year code; W: week code
YVWX	Y: year code; W: week code; V: product code

Voltage code

Option Code "X"	D	E	C	F	G	H	J	K	M	N
Voltage	0.8 V	1.0 V	1.1 V	1.2 V	1.5 V	1.8 V	2.5 V	2.8 V	3.0 V	3.3 V

Pin Assignments

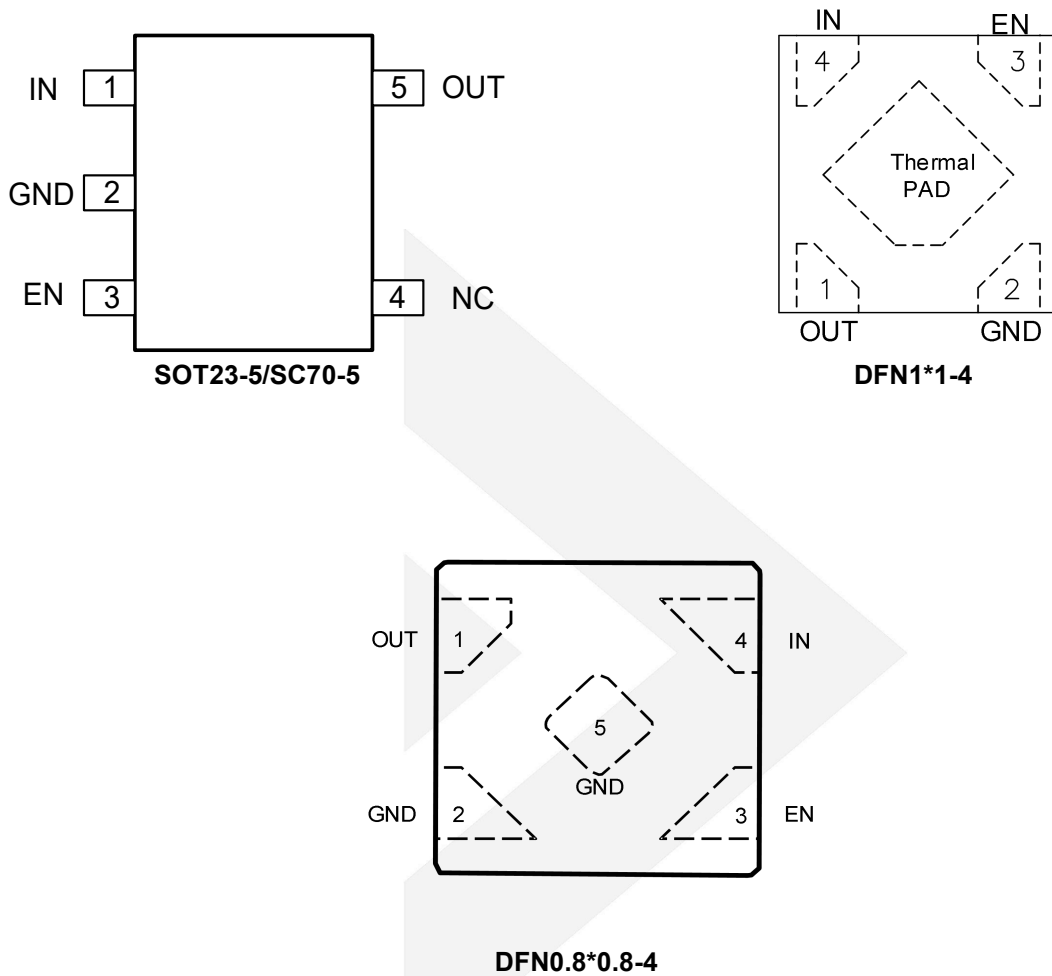


Figure 1 Pin Assignment (Top View)

Pin Definitions

Pin Name	Description
OUT	Output voltage pin.
EN	Enable pin. This pin has an internal pull-down resistor. A logic low reduces the supply current to less than 1 μ A. Connect to logic "High" for normal operation.
GND	Power supply ground.
IN	Input voltage pin.
NC	No connection.

Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Parameter		Rating	Unit
Input voltage V_{IN}		-0.3 to 6.5	V
Output voltage V_{OUT}		-0.3 to V_{IN}	V
Chip enable input V_{EN}		-0.3 to V_{IN}	V
Output current I_{OUT}		300	mA
Lead temperature range		260	°C
Operating junction temperature $T_{J(MAX)}$		150	°C
Storage temperature T_{STG}		-55 to 150	°C
MSL	SOT23-5	Level-3	
	SC70-5		
	DFN1*1-4	Level-1	
	DFN0.8*0.8-4		
ESD	HBM	8000	V

Recommend Operating Ratings

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding them or designing to absolute maximum ratings.

Parameter		Rating	Unit
Operating supply voltage		1.6~5.5	V
Operating temperature range		-40~125	°C
Thermal resistance, $R_{\theta JA}$	SOT23-5	235	°C/W
	DFN1*1-4	250	
	DFN0.8*0.8-4	400	
	SC70-5	307.6	

Electrical Characteristics

$V_{IN} = (V_{OUT} + 1 \text{ V})$, $I_{OUT} = 1 \text{ mA}$, $C_{IN} = C_{OUT} = 1.0 \text{ }\mu\text{F}$, Full = -40°C to 125°C , Typical values are at $T_A = 25^{\circ}\text{C}$, unless otherwise specified.

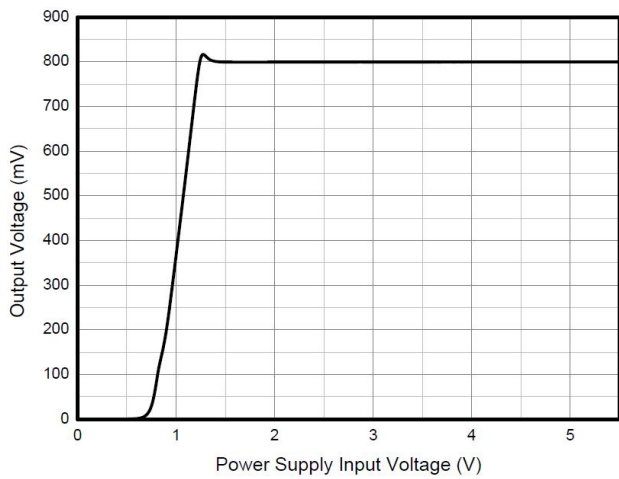
Symbol	Parameter	Condition	Min	Typ	Max	Unit
V_{IN}	Input voltage		1.6		5.5	V
$V_{OUT}^{(1)}$	Output voltage		0.8		3.3	V
	Output accuracy	$V_{OUT} < 2 \text{ V}$, $T_A = +25^{\circ}\text{C}$	-20	V_{OUT}	+20	mV
		$V_{OUT} \geq 2 \text{ V}$, $T_A = +25^{\circ}\text{C}$	-1%	V_{OUT}	1%	V
I_{LIM}	Output current limit	$V_{OUT} = 90\% V_{OUT(NOM)}$		480		mA
V_{DROP}	Dropout voltage	$V_{OUT} = 0.95 \times V_{OUT(NOM)}$, $I_{OUT} = 300 \text{ mA}$	$V_{OUT(SET)} = 0.8 \text{ V}$	950		mV
			$V_{OUT(SET)} = 1.2 \text{ V}$	650		
			$V_{OUT(SET)} = 1.8 \text{ V}$	280		
			$V_{OUT(SET)} = 2.5 \text{ V}$	200		
			$V_{OUT(SET)} = 2.8 \text{ V}$	170		
			$V_{OUT(SET)} = 3.0 \text{ V}$	160		
			$V_{OUT(SET)} = 3.3 \text{ V}$	150		
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line regulation	$(V_{OUT(NOM)} + 1.0 \text{ V}) \leq V_{IN} \leq 5.5 \text{ V}$		0.02		%/V
ΔV_{OUT}	Load regulation	$I_{OUT} = 0 \text{ mA}$ to 350 mA , $T_A = +25^{\circ}\text{C}$			40	mV
I_Q	Quiescent current	No load		25		μA
I_{SC}	Short circuit current	$V_{OUT} = 0 \text{ V}$		220		mA
I_{SHDN}	Shut-down current	$V_{EN} = 0 \text{ V}$, $V_{IN} = 5.5 \text{ V}$		0.1		μA
PSRR	Power supply rejection rate	$I_{OUT} = 20 \text{ mA}$	$f = 100 \text{ Hz}$	80		dB
			$f = 1 \text{ kHz}$	75		dB
			$f = 10 \text{ kHz}$	70		dB
			$f = 100 \text{ kHz}$	60		dB
			$f = 1 \text{ MHz}$	45		dB
V_{IH}	EN pin threshold voltage	EN logic high voltage	1			V
V_{IL}		EN logic low voltage			0.4	V
I_{EN}	EN pull-down current	$V_{EN} = 5.5 \text{ V}$		0.1		μA
e_n	Output voltage noise	$f = 10 \text{ Hz}$ to 100 kHz , $V_{OUT} = 2.8 \text{ V}$, $I_{OUT} = 1 \text{ mA}$		70		μV_{RMS}
T_{SD}	Thermal shutdown threshold	Shutdown, temperature increasing	$I_{OUT} = 1 \text{ mA}$	175		$^{\circ}\text{C}$
		Reset, temperature decreasing		145		
R_{DISCH}	Output discharge	$V_{EN} \leq 0.2 \text{ V}$, $V_{IN} = 5 \text{ V}$ (only A version)		100		Ω

	resistance				
t _{ON}	Turn-on time	From assertion of V _{EN} to V _{OUT} = 90% V _{OUT(NOM)}		120	μs

Note (1): It is not recommended to use at 125°C without load.

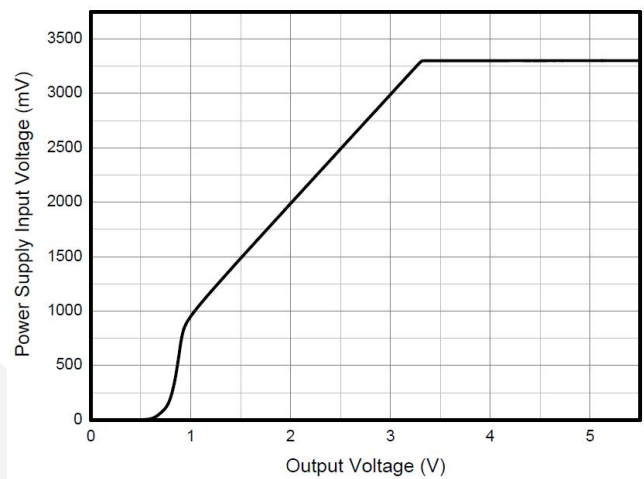


Typical Performance Characteristics



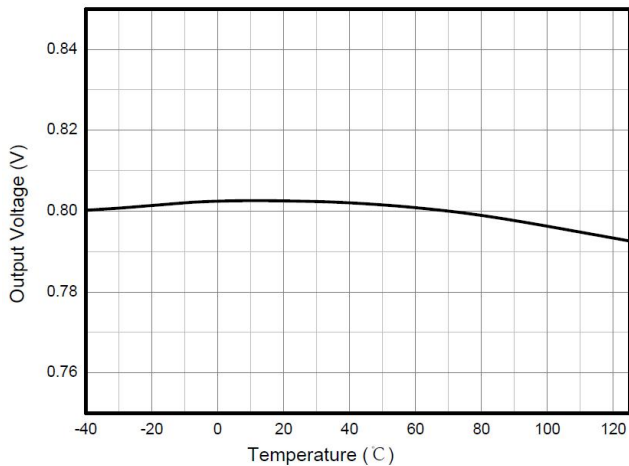
$C_{IN} = C_{OUT} = 1 \mu F$, $I_{OUT} = 1 \text{ mA}$, $V_{OUT} = 0.8 \text{ V}$

Figure 2. Output voltage vs input voltage



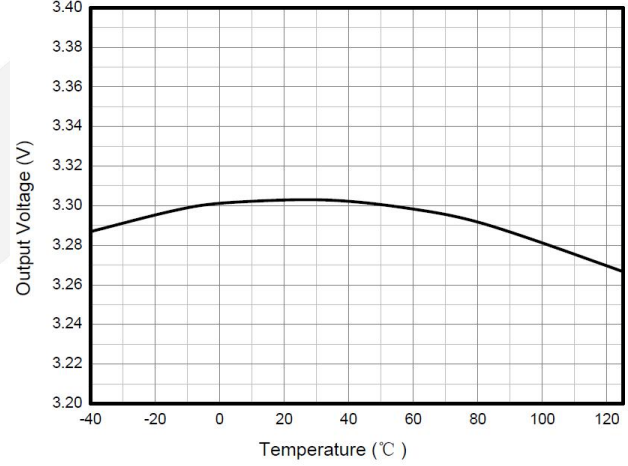
$C_{IN} = C_{OUT} = 1 \mu F$, $I_{OUT} = 1 \text{ mA}$, $V_{OUT} = 3.3 \text{ V}$

Figure 3. Output voltage vs input voltage



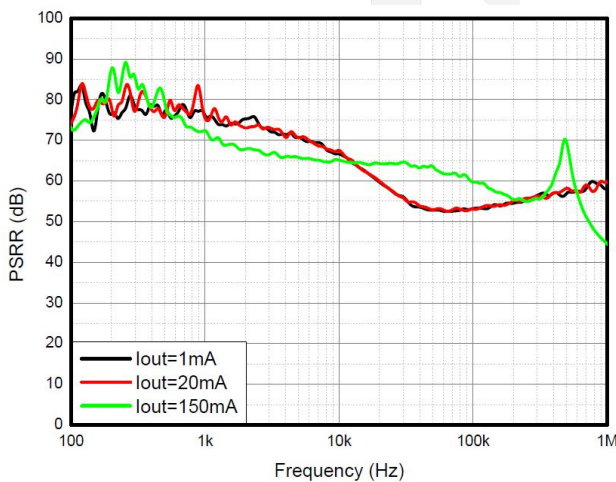
$V_{OUT} = 0.8 \text{ V}$, $C_{IN} = C_{OUT} = 1 \mu F$, $I_{OUT} = 1 \text{ mA}$

Figure 4. Output voltage vs temperature



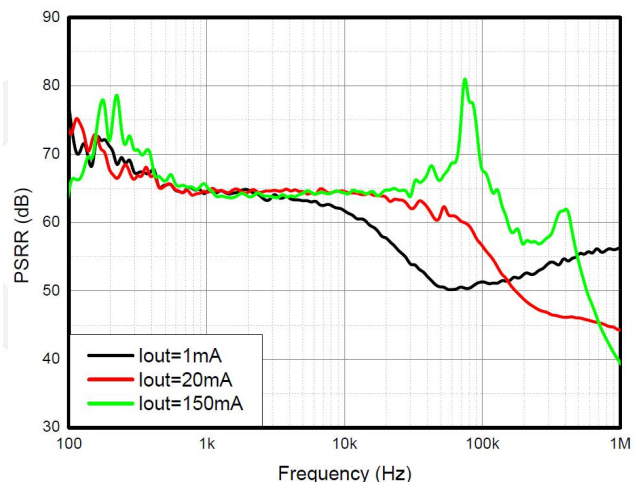
$V_{OUT} = 3.3 \text{ V}$, $C_{IN} = C_{OUT} = 1 \mu F$, $I_{OUT} = 1 \text{ mA}$

Figure 5. Output voltage vs temperature



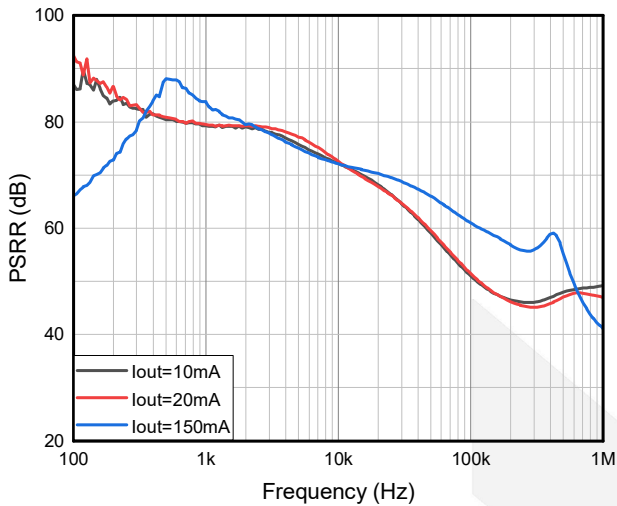
$C_{OUT} = 1 \mu F$, $V_{IN} = (2.5 \text{ V} + 200 \text{ mVpp})$, $V_{OUT} = 0.8 \text{ V}$

Figure 6. PSRR vs frequency



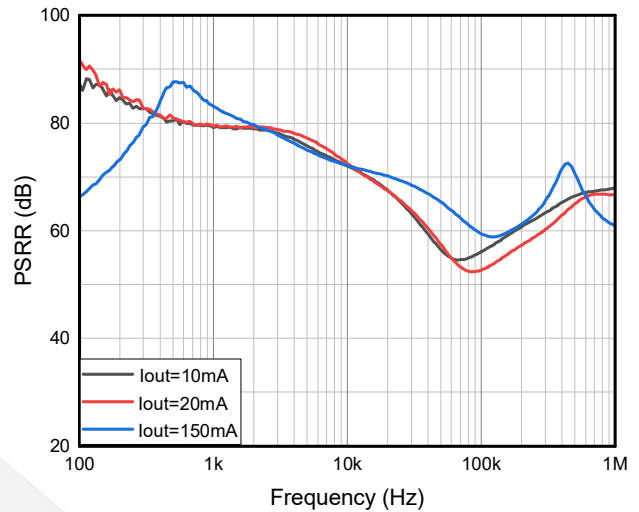
$C_{OUT} = 1 \mu F$, $V_{IN} = (4.3 \text{ V} + 200 \text{ mVpp})$, $V_{OUT} = 3.3 \text{ V}$

Figure 7. PSRR vs frequency



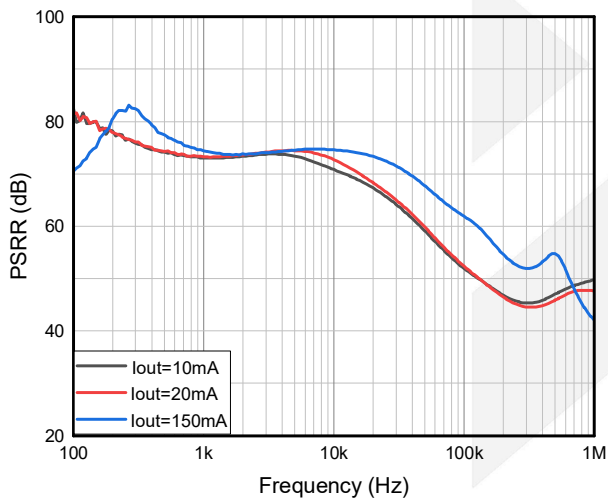
$C_{OUT} = 1 \mu F$, $V_{IN} = (3 V + 500 mV_{PP})$, $V_{OUT} = 1.1 V$

Figure 8. PSRR vs frequency



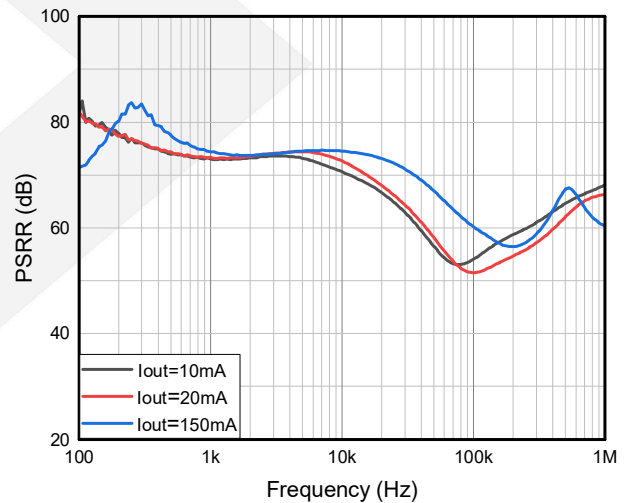
$C_{OUT} = 10 \mu F$, $V_{IN} = (3 V + 500 mV_{PP})$, $V_{OUT} = 1.1 V$

Figure 9. PSRR vs frequency



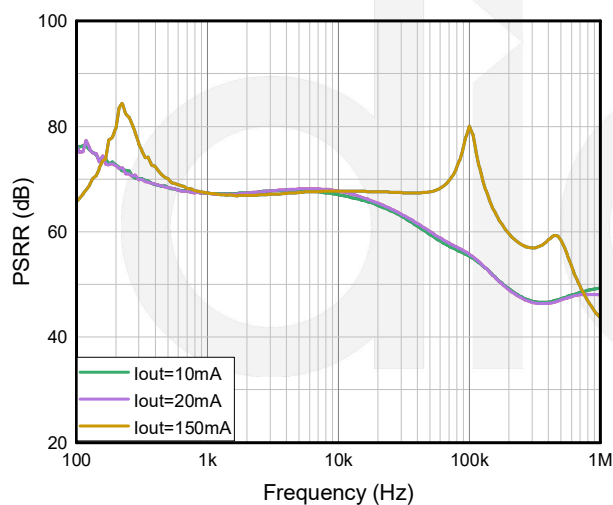
$C_{OUT} = 1 \mu F$, $V_{IN} = (2.8 V + 500 mV_{PP})$, $V_{OUT} = 1.8 V$

Figure 10. PSRR vs frequency



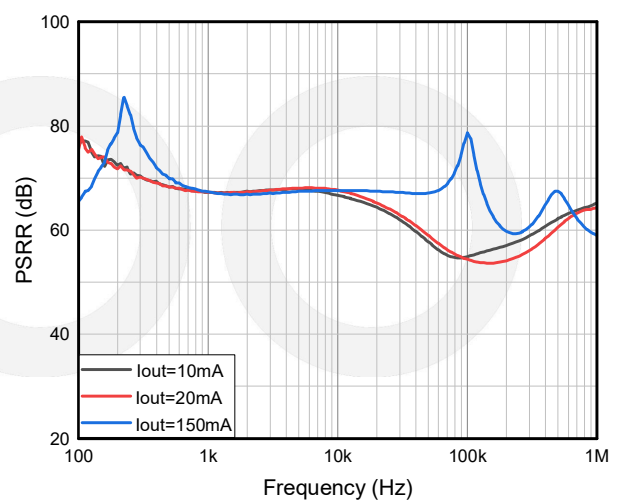
$C_{OUT} = 10 \mu F$, $V_{IN} = (2.8 V + 500 mV_{PP})$, $V_{OUT} = 1.8 V$

Figure 11. PSRR vs frequency



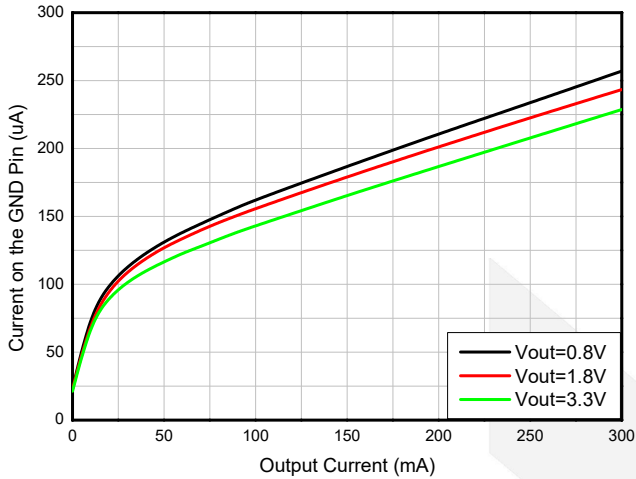
$C_{OUT} = 1 \mu F$, $V_{IN} = (3.8 V + 500 mV_{PP})$, $V_{OUT} = 2.8 V$

Figure 12. PSRR vs frequency



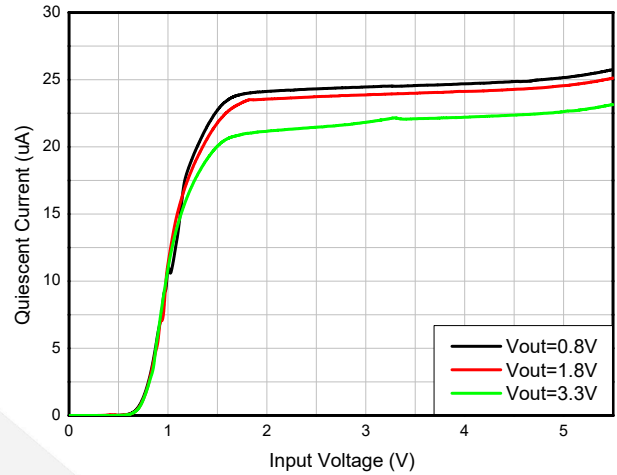
$C_{OUT} = 10 \mu F$, $V_{IN} = (3.8 V + 500 mV_{PP})$, $V_{OUT} = 2.8 V$

Figure 13. PSRR vs frequency



$C_{OUT} = 1 \mu F$, $V_{IN} = (V_{OUT} + 1 V)$ or 2.5 V whichever is higher

Figure 14. Current on the GND pin vs output current



$C_{OUT} = 1 \mu F$, $I_{OUT} = 0 mA$

Figure 15. Quiescent current vs input voltage

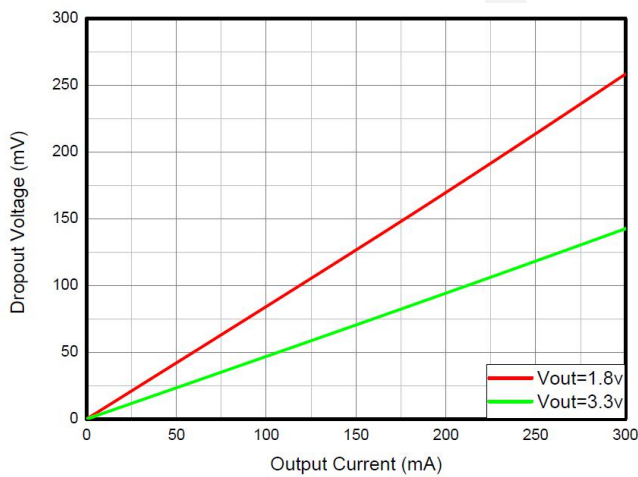
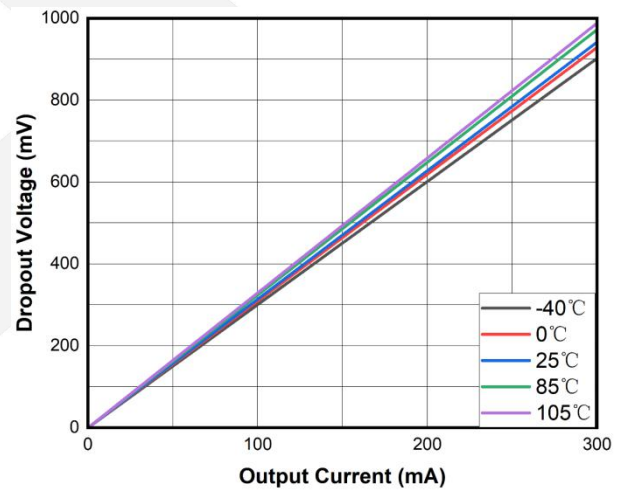
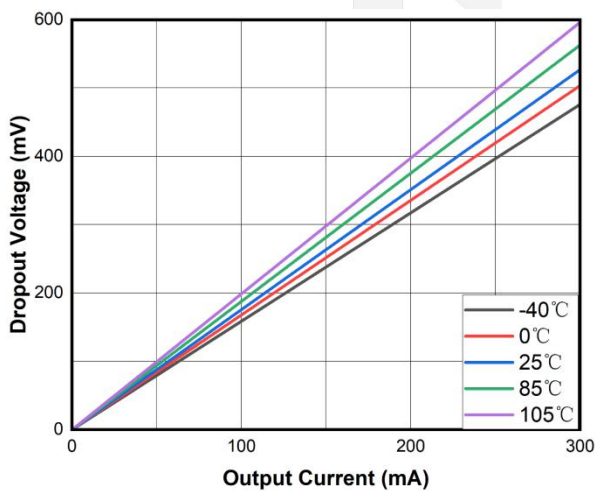


Figure 16. Dropout voltage vs output current



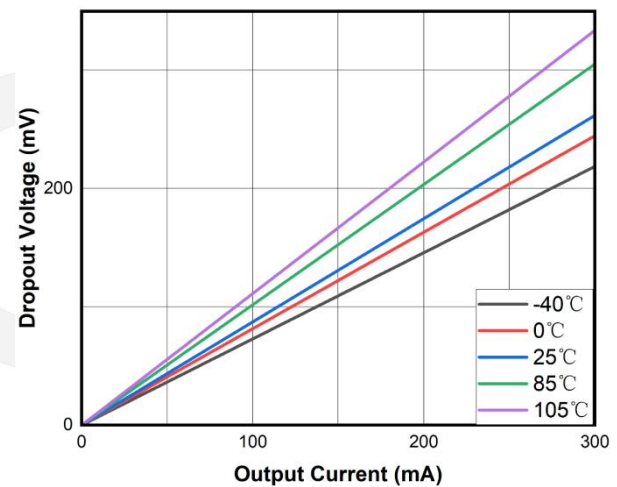
$V_{OUT} = 0.8 V$, $I_L = 300 mA$, $V_{EN} = 1 V$

Figure 17. Dropout voltage vs output current



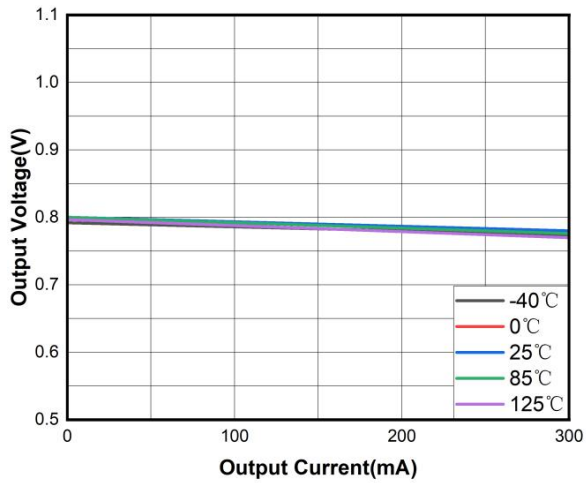
$V_{OUT} = 1.2 V$, $I_L = 300 mA$, $V_{EN} = 1 V$

Figure 18. Dropout voltage vs output current



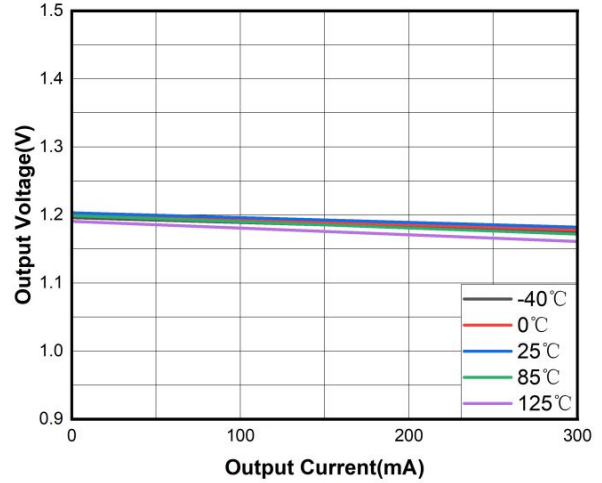
$V_{OUT} = 1.8 V$, $I_L = 300 mA$, $V_{EN} = 1 V$

Figure 19. Dropout voltage vs output current



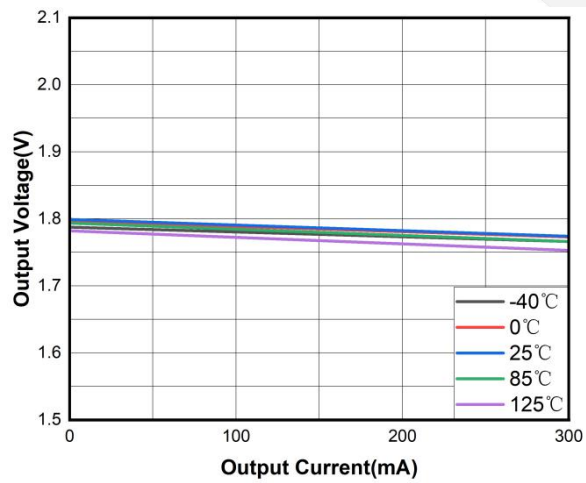
$V_{IN} = 2.5 \text{ V}$, $V_{OUT} = 0.8 \text{ V}$, $V_{EN} = 1 \text{ V}$

Figure 20. Load regulation vs output current



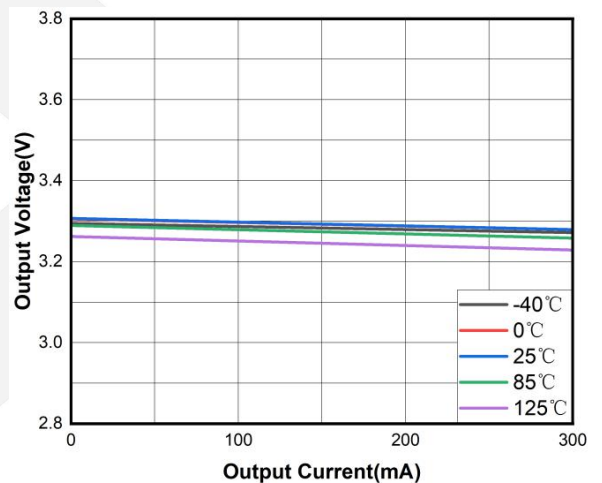
$V_{IN} = 2.5 \text{ V}$, $V_{OUT} = 1.2 \text{ V}$, $V_{EN} = 1 \text{ V}$

Figure 21. Load regulation vs output current



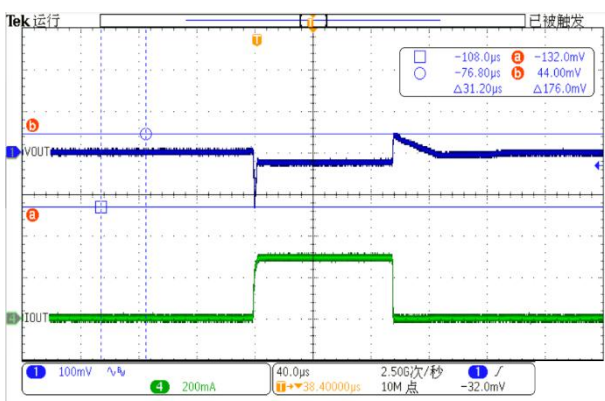
$V_{IN} = 2.8 \text{ V}$, $V_{OUT} = 1.8 \text{ V}$, $V_{EN} = 1 \text{ V}$

Figure 22. Load regulation vs output current



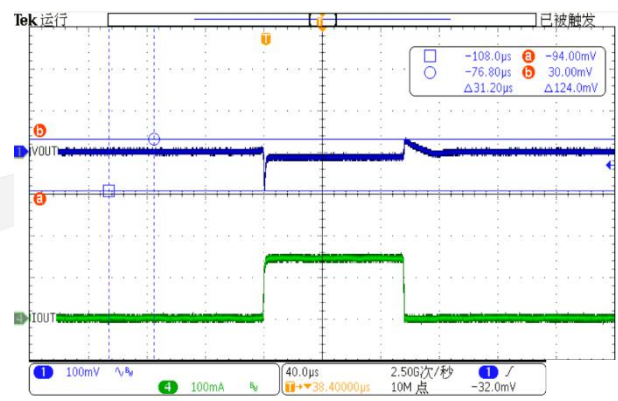
$V_{IN} = 4.3 \text{ V}$, $V_{OUT} = 3.3 \text{ V}$, $V_{EN} = 1 \text{ V}$

Figure 23. Load regulation vs output current



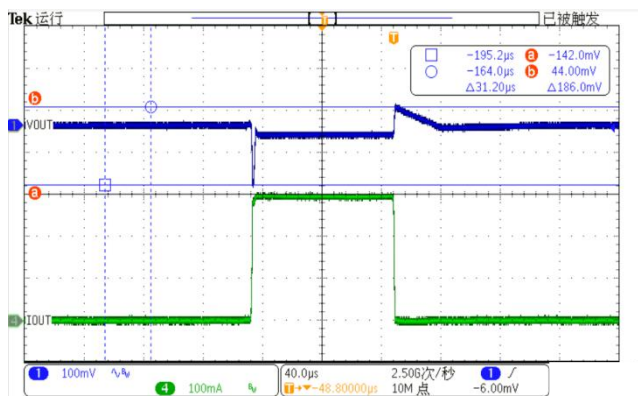
$V_{IN} = 2.5 \text{ V}$, $V_{OUT} = 0.8 \text{ V}$, $C_{IN} = C_{OUT} = 1 \text{ μF}$

Figure 24. Load transient response at load step from 1 mA to 300 mA, $V_{OUT} = 0.8 \text{ V}$



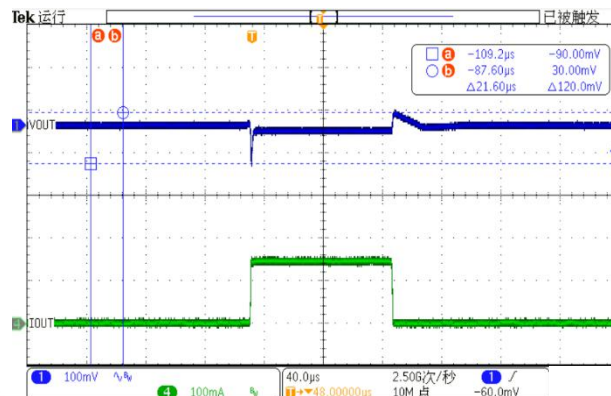
$V_{IN} = 2.5 \text{ V}$, $V_{OUT} = 0.8 \text{ V}$, $C_{IN} = C_{OUT} = 1 \text{ μF}$

Figure 25. Load transient response at load step from 1 mA to 150 mA, $V_{OUT} = 0.8 \text{ V}$



V_{IN} = 4.3 V, V_{OUT} = 3.3 V, C_{IN} = C_{OUT} = 1 µF

Figure 26. Load transient response at load step from 1 mA to 300 mA, V_{OUT} = 3.3 V



V_{IN} = 4.3 V, V_{OUT} = 3.3 V, C_{IN} = C_{OUT} = 1 µF

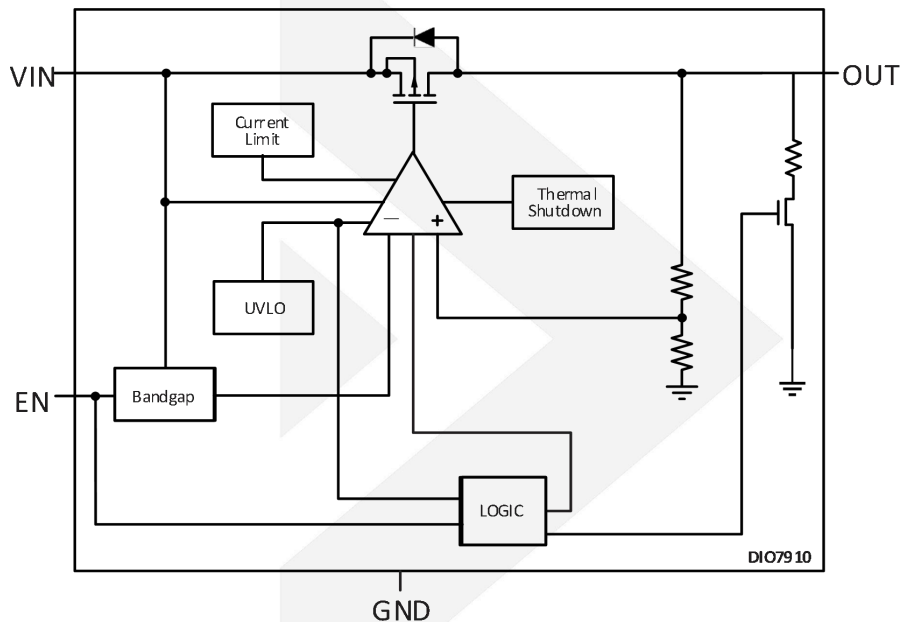
Figure 27. Load transient response at load step from 1 mA to 150 mA, V_{OUT} = 3.3 V

Detailed Description

Overview

The DIO7910 series of LDO linear regulators is low quiescent current devices with excellent line and load transient performance. These LDOs are designed for power-sensitive applications. A precision bandgap and error amplifier provide overall 1% accuracy. Low output noise, very high PSRR, and low dropout voltage make this series of devices ideal for most battery-operated handheld equipment. All device versions have integrated thermal shutdown, and current limit.

Block Diagram



Internal Current Limit

The DIO7910 internal current limit helps to protect the regulator during fault conditions. During the current limit, the output sources a fixed amount of current that is largely independent of the output voltage. In such a case, the output voltage is not regulated and $V_{OUT} = I_{CL} \times R_{LOAD}$. The PMOS pass transistor dissipates $(V_{IN} - V_{OUT}) \times I_{CL}$ until the thermal shutdown is triggered and the device turns off. As the device cools down, it is turned on by the internal thermal shutdown circuit. If the fault condition continues, the device cycles between the current limit and thermal shutdown.

The PMOS pass element in the DIO7910 has a built-in body diode that conducts current when the voltage at OUT exceeds the voltage at IN. This current is not limited, so if extended reverse voltage operation is anticipated, external limiting to 5% of the rated output current is recommended.

Shut down

The enable pin (EN) is active high. The device is enabled when the voltage at the EN pin goes above 1 V. The device is turned off when the EN pin is held at less than 0.4 V. When shutdown capability is not required, EN can be connected to the IN pin.

Dropout Voltage

The DIO7910 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 the output current because the PMOS device behaves as a resistor in dropout.

CONTACT US

Dioo is a professional design and sales corporation for high-quality and performance analog semiconductors. The company focuses on industry markets, such as cell phones, handheld products, laptops, medical equipment, and so on. Dioo's product families include analog signal processing and amplifying, LED drivers, and charger ICs. Go to <http://www.dioo.com> for a complete list of Dioo product families.

For additional product information or full datasheet, please contact our sales department or representatives.