ZSR SERIES

2.85 TO 12 VOLT FIXED POSITIVE LOCAL VOLTAGE REGULATOR

DEVICE DESCRIPTION

The ZSR Series three terminal fixed positive voltage regulators feature internal circuit current limit and thermal shutdown making the devices difficult to destroy. The circuit design allows creation of any custom voltage in the range 2.85 to 12 volts. The devices are available in a small outline surface mount package, ideal for applications where space saving is important, as well as through hole TO92 style packaging. The devices are suited to local voltage regulation applications, where problems could be encountered with distributed single source regulation, as well as more general voltage regulation applications.

The ZSR Series show performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350μA. Output voltage change, with input voltage and load current, is much lower than competitive devices. The ZSR devices are completely stable with no external components.

FEATURES

- 2.85 to 12 Volt
- Output current up to 200mA
- Tight initial tolerance of 2.5%
- Low 600μa quiescent current
- -55 to 125°C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit
- Small outline SOT223 package
- TO92 package

VOLTAGE RANGE

ZSR285	2.85V
ZSR300	3.0V
ZSR330	3.3V
ZSR400	4.0V
ZSR485	4.85V
ZSR500	5.0V
ZSR520	5.2V
ZSR600	6.0V
ZSR800	8.0V
ZSR900	9.0V
ZSR1000	10.0V
ZSR1200	12.0V

ZSR SERIES

ABSOLUTE MAXIMUM RATING

Input voltage	20V
Output Current(I_o)	200mA
Operating Temperature	-55 to 125°C
Storage Temperature	-65 to 150°C

Power Dissipation (T_{amb}=25°C)

SOT223	2W(Note 3)
TO92	600mW

ELECTRICAL CHARACTERISTICS

Notes:

1. The maximum operating input voltage and output current of the device will be governed by the maximum power dissipation of the selected package. Maximum package power dissipation is specified at 25 °C and must be linearly derated to zero at T_{amb}=125°C.

2. The following data represents pulse test conditions with junction temperatures as indicated at the initiation of the test. Continuous operation of the devices with the stated conditions might exceed the power dissipation limits of the chosen package.

3. Maximum power dissipation for the SOT223 and SO8 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.

4. The shut down feature of the device operates if its temperature exceeds its design limit as might occur during external faults, short circuits etc. If the regulator is supplied from an inductive source then a large voltage transient, on the regulator input, can result should the shut down circuit operate. It is advised that a capacitor (1µF or greater) should be applied across the regulator input to ensure that the maximum voltage rating of the device is not exceeded under shutdown conditions.

ZSR285 TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=6.85V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		2.78	2.85	2.92	V
		I_O=1 to 200mA τ	2.736		2.964	V
		V_{in}=4.85 to 20V I_O=1 to 100mA τ	2.736		2.964	V
ΔV_O	Line Regulation	V_{in}=4.85 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=4.85 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=5.85 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		4.85	4.55		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

τ=T_j=-55 to 125°C

ZSR300 TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=7V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		2.92	3.0	3.08	V
		I_O=1 to 200mA τ	2.88		3.12	V
		V_{in}=5 to 20V I_O=1 to 100mA τ	2.88		3.12	V
ΔV_O	Line Regulation	V_{in}=5 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=5 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=6 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		5	4.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

ZSR330 TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=7.3V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		3.218	3.3	3.382	V
		I_O=1 to 200mA τ	3.168		3.432	V
		V_{in}=5.3 to 20V I_O=1 to 100mA τ	3.168		3.432	V
ΔV_O	Line Regulation	V_{in}=5.3 to 20V		7.5	30	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=5.3 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		50		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=6.3 to 18V f=120Hz	50	64		dB
V_{in}	Input Voltage Required To Maintain Regulation		5.3	5		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

τ=T_j=-55 to 125°C

ZSR400 TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=8V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		3.9	4.0	4.1	V
		I_O=1 to 200mA τ	3.84		4.16	V
		V_{in}=6 to 20V I_O=1 to 100mA τ	3.84		4.16	V
ΔV_O	Line Regulation	V_{in}=6 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=6 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=7 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		6	5.3		V

ZSR485 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=8.85V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		4.729	4.85	4.971	V
		I_O=1 to 200mA τ	4.656		5.044	V
		V_{in}=6.8 to 20V I_O=1 to 100mA τ	4.656		5.044	V
ΔV_O	Line Regulation	V_{in}=6.85 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=6.85 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		50		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=7.85 to 18V f=120Hz	50	64		dB
V_{in}	Input Voltage Required To Maintain Regulation		6.85	6.55		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

τ =T_j = -55 to 125°C

ZSR1000 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=14V

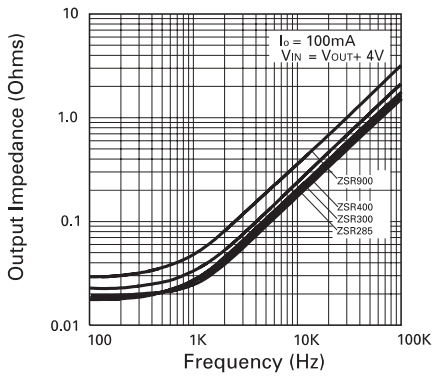
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		9.75	10	10.25	V
		I_O=1 to 200mA τ	9.6		10.4	V
		V_{in}=12 to 20V I_O=1 to 100mA τ	9.6		10.4	V
ΔV_O	Line Regulation	V_{in}=12 to 20V		12	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		9 3	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=12 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		150		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=13 to 18V f=120Hz	43	57		dB
V_{in}	Input Voltage Required To Maintain Regulation		12	11.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.25		mV/°C

ZSR1200 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=16V

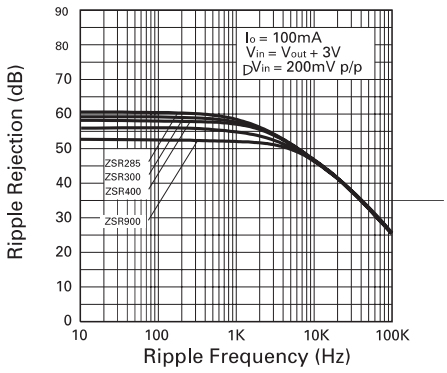
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		11.7	12	12.3	V
		I_O=1 to 200mA τ	11.52		12.48	V
		V_{in}=14 to 20V I_O=1 to 100mA τ	11.52		12.48	V
ΔV_O	Line Regulation	V_{in}=14 to 20V		12	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		9 3	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=14 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		150		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=15 to 18V f=120Hz	43	57		dB
V_{in}	Input Voltage Required To Maintain Regulation		14	13.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.25		mV/°C

τ =T_j = -55 to 125 °C

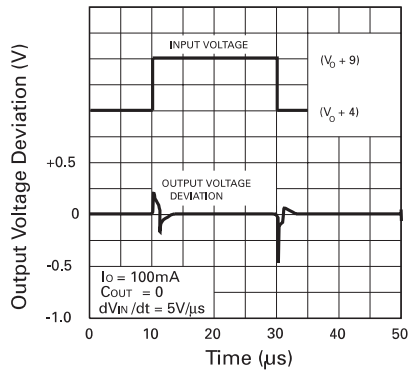
TYPICAL CHARACTERISTICS



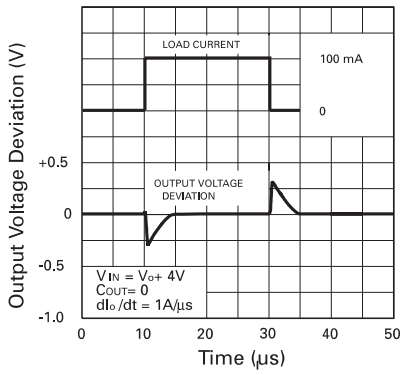
Output Impedance v Frequency



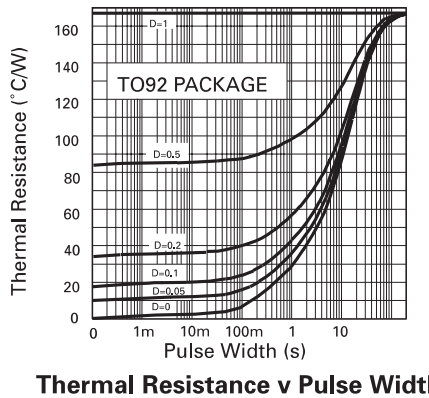
Ripple Rejection v Ripple Frequency



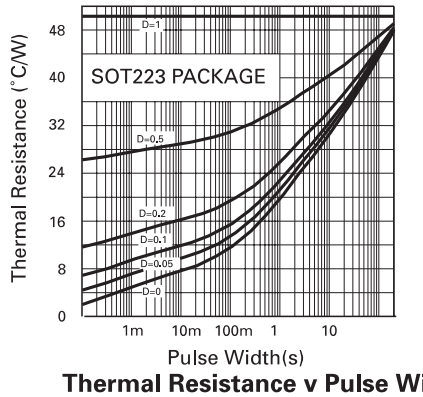
Line Transient Response



Load Transient Response

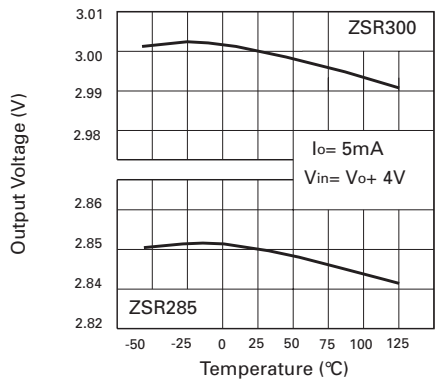


Thermal Resistance v Pulse Width

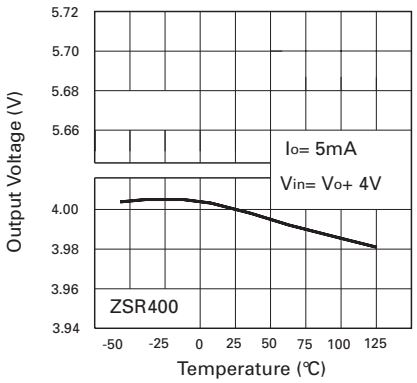


Thermal Resistance v Pulse Width

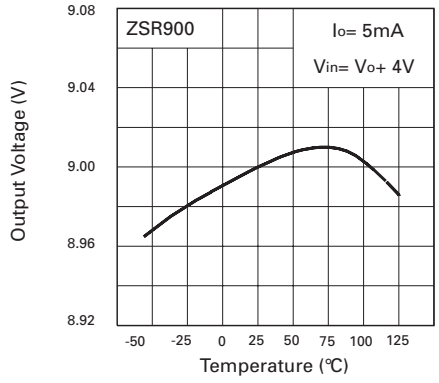
TYPICAL CHARACTERISTICS



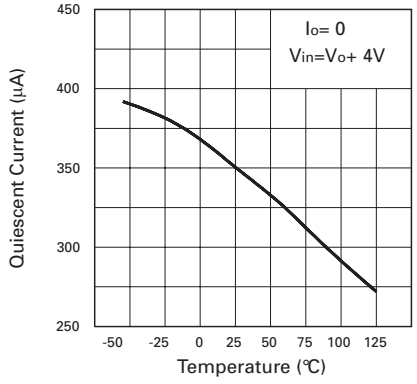
Output Voltage Temperature Coefficient



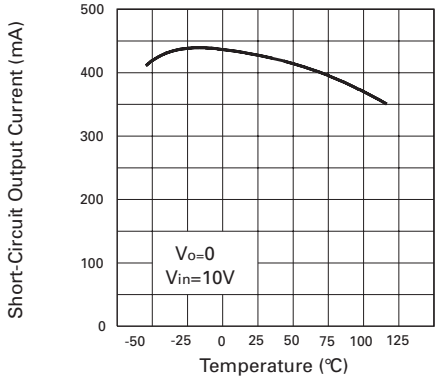
Output Voltage Temperature Coefficient



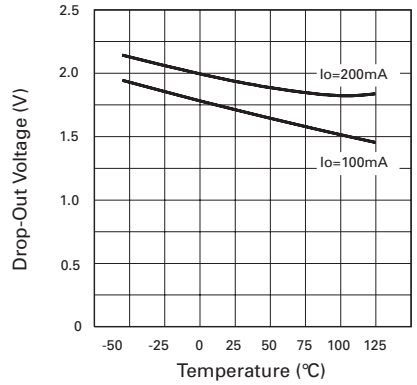
Output Voltage Temperature Coefficient



Quiescent Current v Temperature



Peak Output Current v Temperature



Drop-Out Voltage v Temperature

ZSR600 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=10V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		5.85	6	6.15	V
		I_O=1 to 200mA τ	5.76		6.24	V
		V_{in}=8 to 20V I_O=1 to 100mA τ	5.76		6.24	V
ΔV_O	Line Regulation	V_{in}=8 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		7 2.5	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=8 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		90		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=9 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		8	7.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.15		mV/°C

τ =T_j = -55 to 125 °C

ZSR500 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=9V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		4.875	5	5.125	V
		I_O=1 to 200mA τ	4.8		5.2	V
		V_{in}=7 to 20V I_O=1 to 100mA τ	4.8		5.2	V
ΔV_O	Line Regulation	V_{in}=7 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=7 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		7	6.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

ZSR520 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA,

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		5.070	5.2	5.330	V
		I_O=1 to 200mA τ	4.99		5.41	V
		V_{in}=7.2 to 20V I_O=1 to 100mA τ	4.99		5.41	V
ΔV_O	Line Regulation	V_{in}=7.2 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=7.2 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8.2 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		7.2	6.9		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

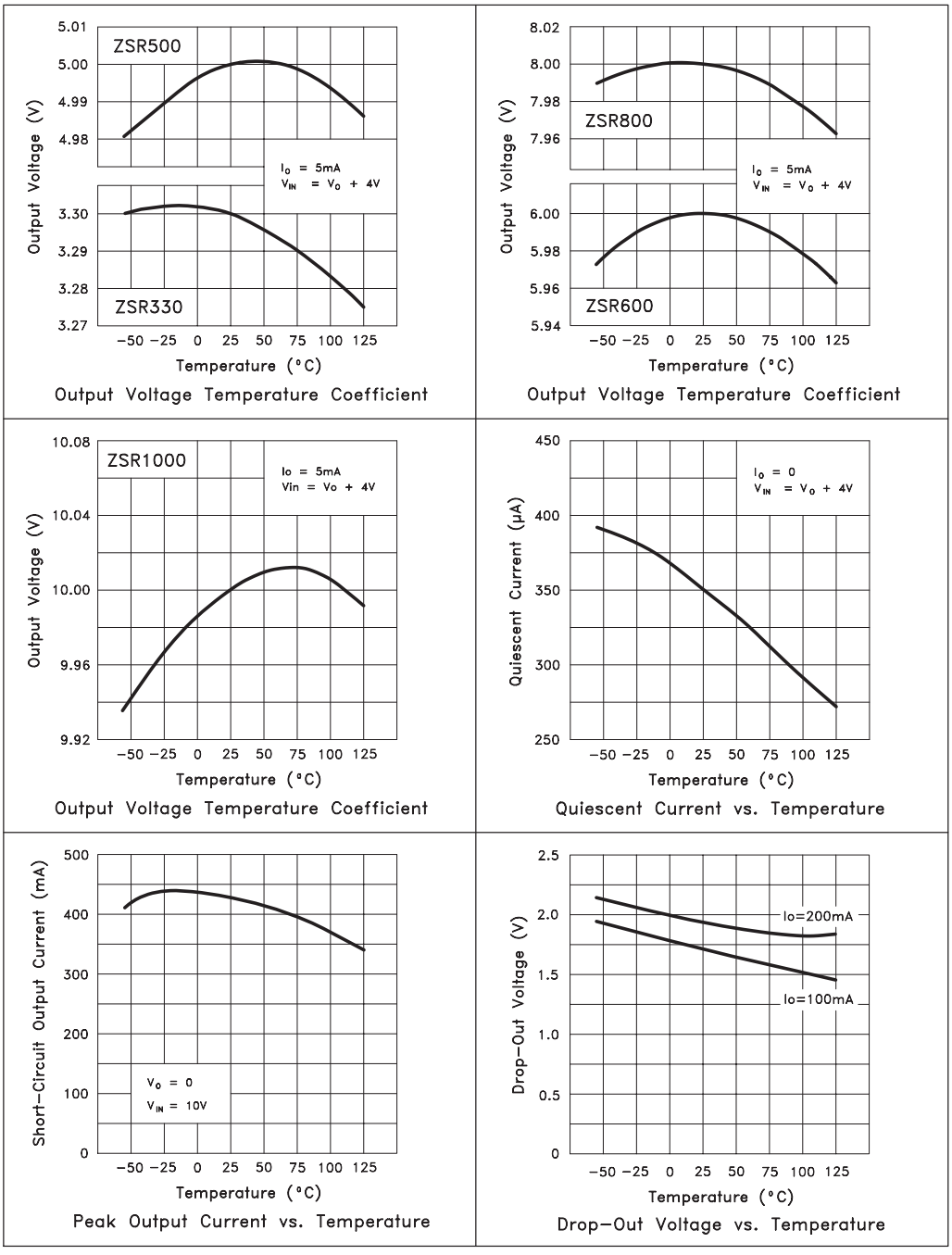
τ =T_j = -55 to 125 °C

ZSR900 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=13V

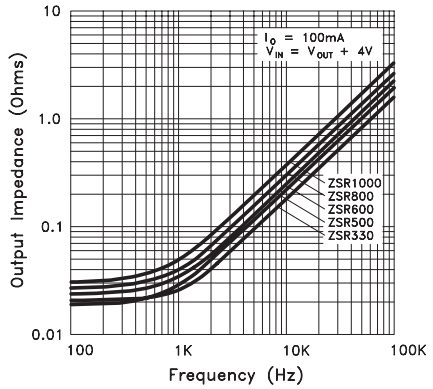
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		8.775	9.0	9.225	V
		I_O=1 to 200mA τ	8.64		9.36	V
		V_{in}=11 to 20V I_O=1 to 100mA τ	8.64		9.36	V
ΔV_O	Line Regulation	V_{in}=11 to 20V		12	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		9 3	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=11 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		150		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=12 to 18V f=120Hz	43	57		dB
V_{in}	Input Voltage Required To Maintain Regulation		11	10.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.25		mV/°C

τ=T_j = -55 to 125°C

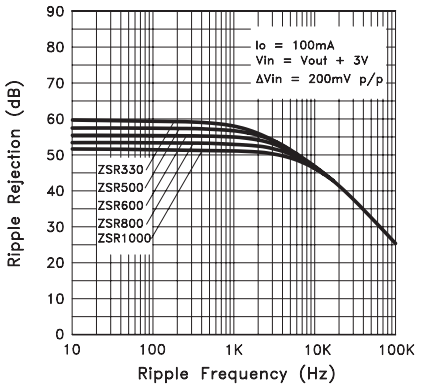
TYPICAL CHARACTERISTICS



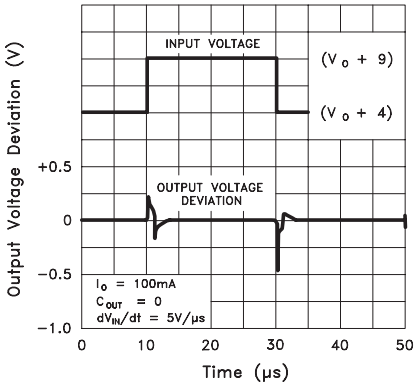
TYPICAL CHARACTERISTICS



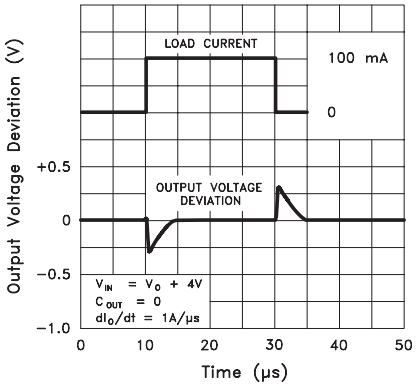
Output Impedance vs. Frequency



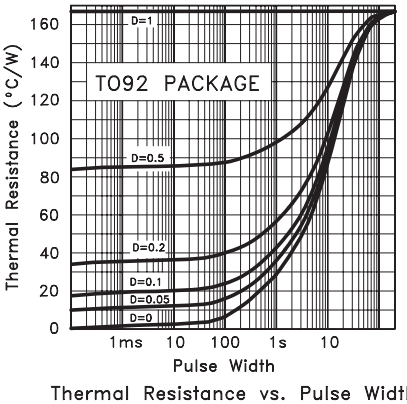
Ripple Rejection vs. Ripple Frequency



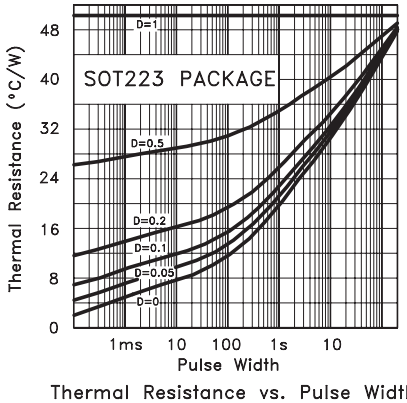
Line Transient Response



Load Transient Response



Thermal Resistance vs. Pulse Width



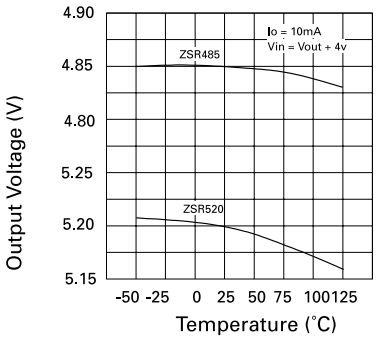
Thermal Resistance vs. Pulse Width

ZSR800 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=12V

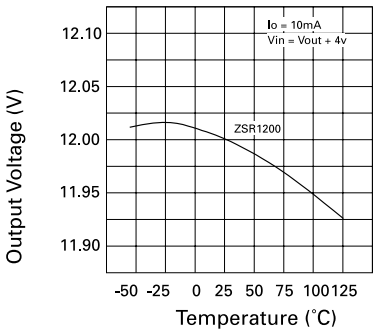
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		7.8	8	8.2	V
		I_O=1 to 200mA τ	7.68		8.32	V
		V_{in}=10 to 20V I_O=1 to 100mA τ	7.68		8.32	V
ΔV_O	Line Regulation	V_{in}=10 to 20V		11	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		8 3	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=10 to 20V			100 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10kHz		115		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=11 to 18V f=120Hz	44	60		dB
V_{in}	Input Voltage Required To Maintain Regulation		10	9.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.25		mV/°C

τ =T_j = -55 to 125°C

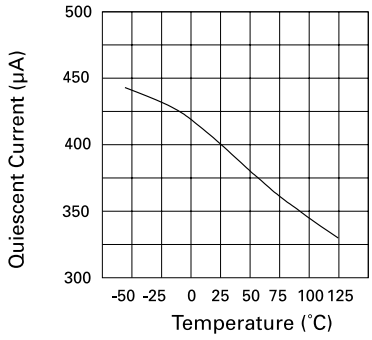
TYPICAL CHARACTERISTICS



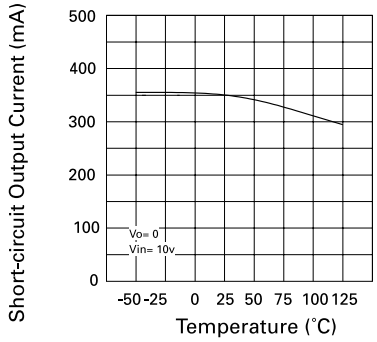
Output Voltage Temperature Coefficient



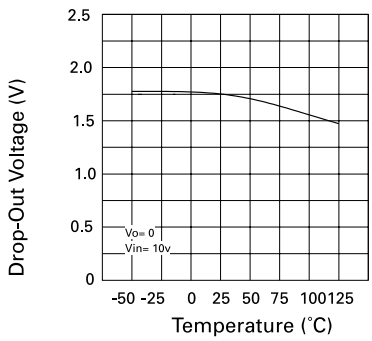
Output Voltage Temperature Coefficient



Quiescent Current v Temperature



Peak Output Current v Temperature

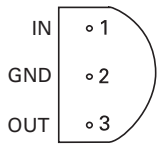


Drop-Out Votlage v Temperature

ZSR SERIES

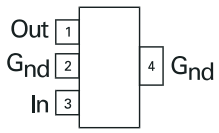
CONNECTION DIAGRAMS

TO92 Package Suffix – C



Bottom View

SOT223 Package Suffix – G



Top View –
Connect pin 4 to pin 2 or leave pin 4 electrically isolated

ORDERING INFORMATION

Part No	Package	Partmark
ZSR ▲ C	TO92	ZSR ▲
ZSR ▲ G	SOT223	ZSR ▲

▲ Voltage Option

eg 3V device in TO92 package
part number ZSR300C
part marked ZSR300 *

eg 12V device in SOT223 package
part number ZSR1200G
part marked ZSR1200 *

SOT223 is supplied on tape in 7" reels of 1000, suffix TA or 13" reels of 4000, suffix TC. Order code e.g. ZSR300GTA.

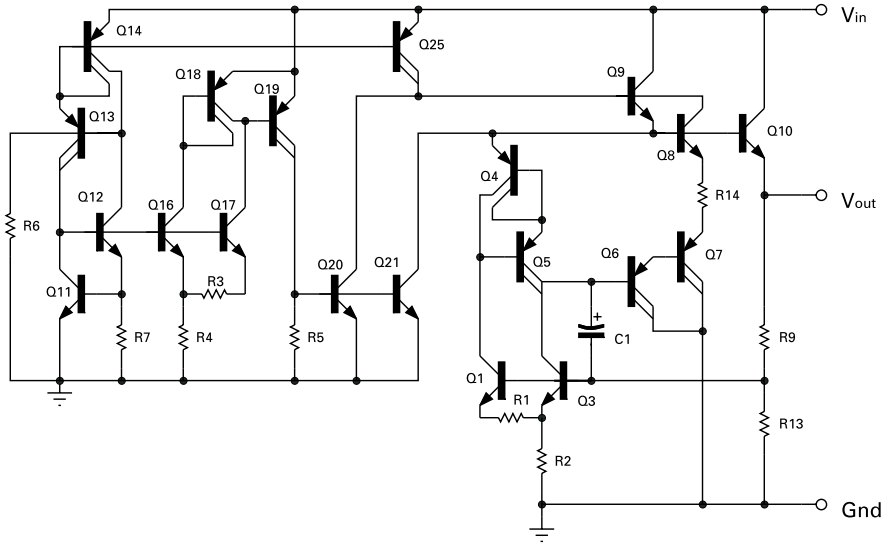
TO92 is supplied loose in boxes of 4000, no suffix, or taped and wound on a reel of 1500, suffix STOB, or taped and folded in concertina form of 1500, suffix STZ.

OPTIONS

Voltage	Voltage Option ▲	TO92	SOT223
2.85V	285	3	3
3.0V	300	3	3
3.3V	330	3	3
4.0V	400	3	3
4.85V	485	3	3
5.0V	500	3	3
5.2V	520	3	3
6.0V	600	3	3
8.0V	800	3	3
9.0V	900	3	3
10.0V	1000	3	3
12.0V	1200	3	3

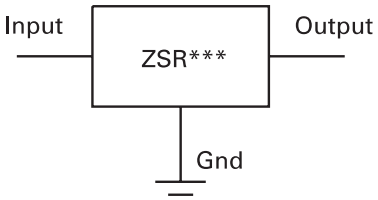
* **NOTE:** Exception. ZSR1000 part mark is ZSR100 for all package options

SCHEMATIC DIAGRAM

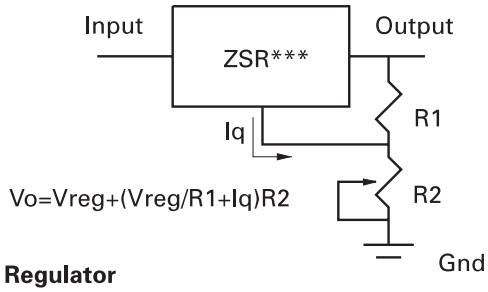


APPLICATIONS

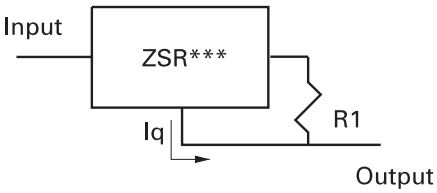
Fixed Output Regulator



Adjustable Output Regulator

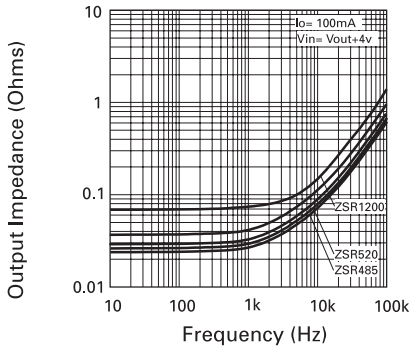


Current Regulator

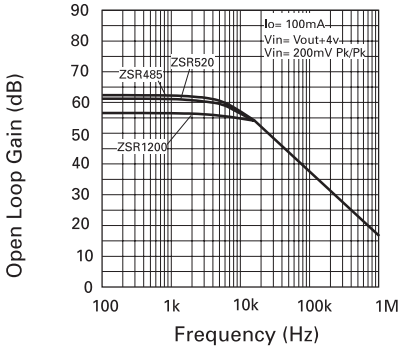


I_O=(Vreg/R1) + 1q

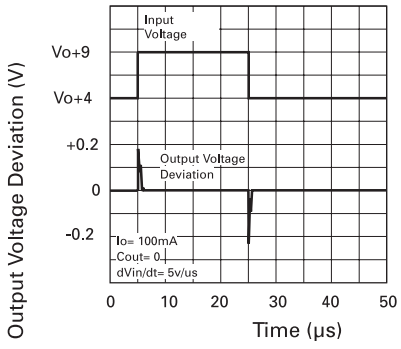
TYPICAL CHARACTERISTICS



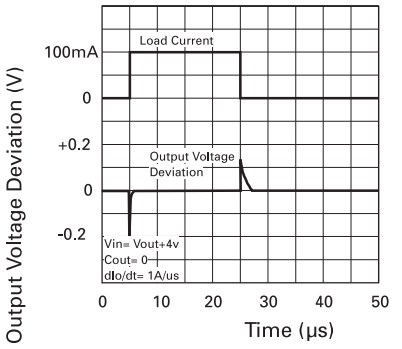
Output Impedance v Frequency



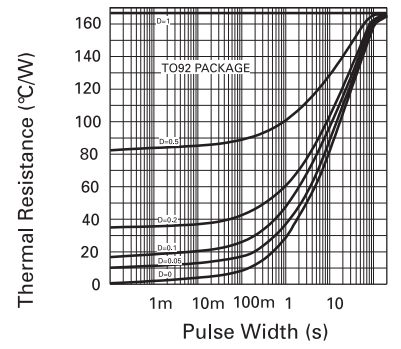
Ripple Rejection v Ripple Frequency



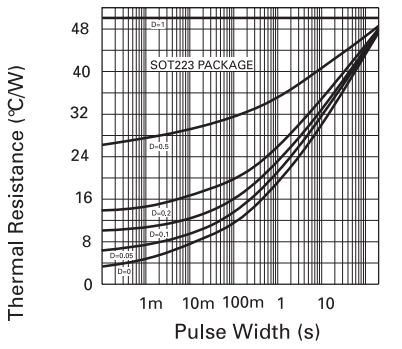
Line Transient Response



Load Transient Response

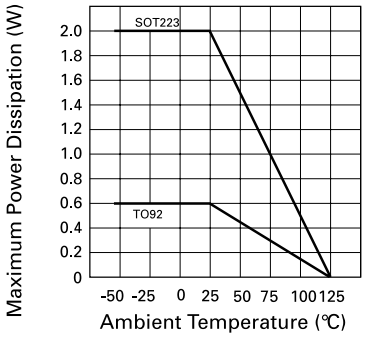


Thermal Resistance v Pulse Width



Thermal Resistance v Pulse Width

TYPICAL CHARACTERISTICS



Power dissipation Derating

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