2.85 TO 10 VOLT FIXED POSITIVE LOCAL VOLTAGE REGULATOR

ZSR SERIES

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZSR Series three terminal fixed positive voltage regulators feature internal circuit current limit and thermal shutdown making the devices almost impossible to destroy. The circuit design allows creation of any custom voltage in the range 2.85 to 10 volts.The devices are available in small outline surface mount packages, 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.

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

- Small outline SO8 and SOT223 packages
- TO92 package
- 2.85 to 10 Volt
- Output current up to 200mA
- Tight initial tolerance
- Low quiescent current
- -55 to 125°C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit

VOLTAGE RANGE

ZSR330	3.3V
ZSR500	5V
ZSR600	6V
ZSR800	8V
ZSR1000	10V

Contact Zetex Marketing for availability of other voltages

CONNECTION TABLE			
Pin	SO8	SOT223	TO92
1	IN	OUT	IN
2	Gnd	Gnd	Gnd
3	Gnd	IN	OUT
4	N/C	-	-
5	N/C	-	-
6	Gnd	-	-
7	Gnd	-	-
8	OUT	-	-
Pack	N8	G	C
see Diagrams Page 2 - 5			

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
SO8	780mW(Note 3)

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 SO8 and SOT223 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.

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 T_j=-55 to 125°C	3.168		3.432	V
		V_{in}=5.3 to 20V I_O=1 to 100mA T_j=-55 to 125°C	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	T_j=-55 to 125°C		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=5.3 to 20V			50 100	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 T_j=-55 to 125°C		0.1		mV/°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 T_j=-55 to 125°C	4.8		5.2	V
		V_{in}=7 to 20V I_O=1 to 100mA T_j=-55 to 125°C	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	T_j=-55 to 125°C		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=7 to 20V			50 100	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 T_j=-55 to 125°C		0.1		mV/°C

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 T_j=-55 to 125°C	5.76		6.24	V
		V_{in}=8 to 20V I_O=1 to 100mA T_j=-55 to 125°C	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	T_j=-55 to 125°C		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=8 to 20V			50 100	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 T_j=-55 to 125°C		0.15		mV/°C

ZSR SERIES

ZSR800

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

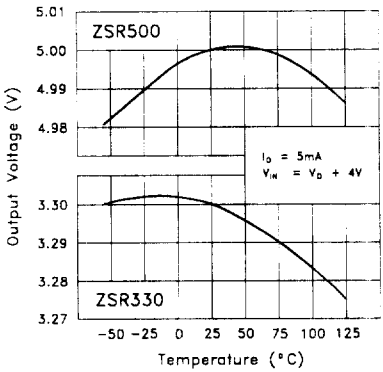
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		7.8	8	8.2	V
		I_O=1 to 200mA T_j=-55 to 125°C	7.68		8.32	V
		V_{in}=10 to 20V I_O=1 to 100mA T_j=-55 to 125°C	7.68		8.32	V
ΔV_O	Line Regulation	V_{in}=10 to 20V		11	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		8 3	30	mV mV
I_q	Quiescent Current	T_j=-55 to 125°C		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=10 to 20V			50 100	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 T_j=-55 to 125°C		0.25		mV/°C

ZSR1000

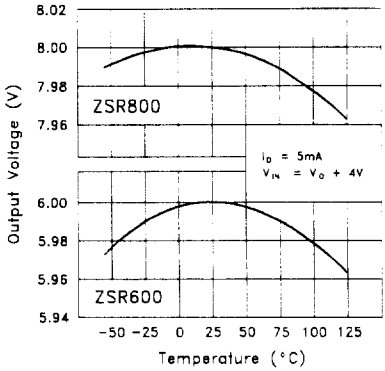
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=14V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		9.75	10	10.25	V
		I_O=1 to 200mA T_j=-55 to 125°C	9.6		10.4	V
		V_{in}=12 to 20V I_O=1 to 100mA T_j=-55 to 125°C	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	T_j=-55 to 125°C		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=12 to 20V			50 100	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 T_j=-55 to 125°C		0.25		mV/°C

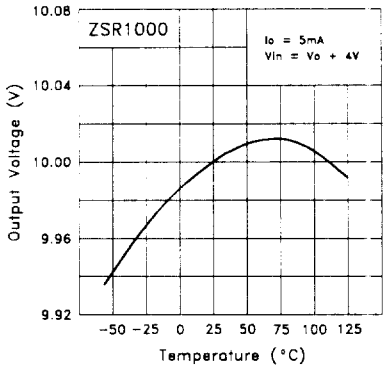
TYPICAL CHARACTERISTICS



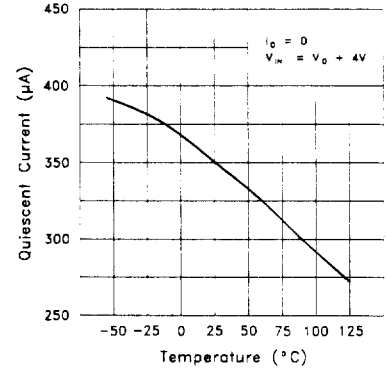
Output Voltage Temperature Coefficient



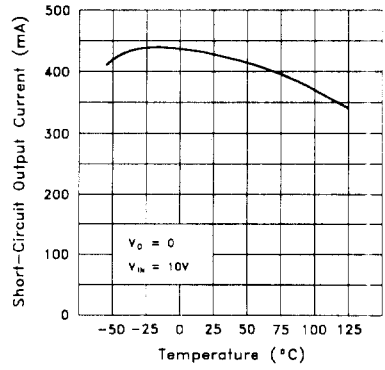
Output Voltage Temperature Coefficient



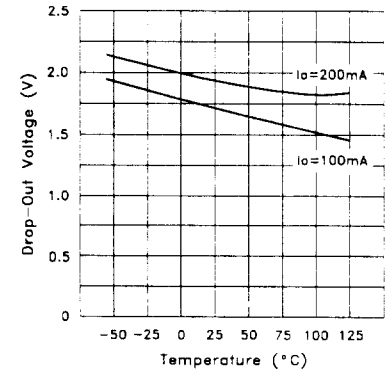
Output Voltage Temperature Coefficient



Quiescent Current vs. Temperature



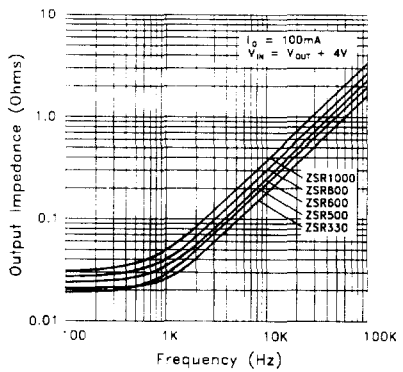
Peak Output Current vs. Temperature



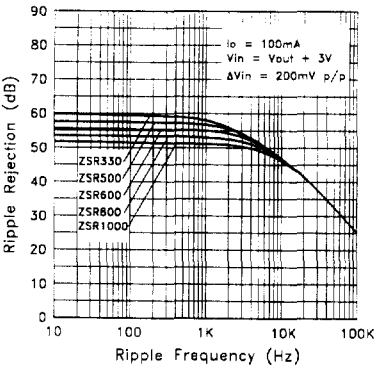
Drop−Out Voltage vs. Temperature

ZSR SERIES

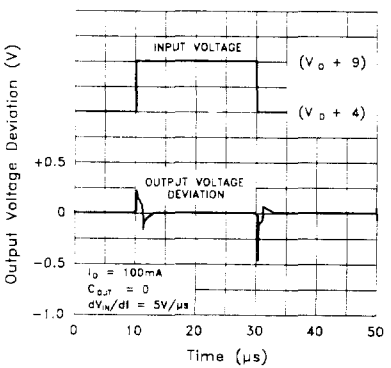
TYPICAL CHARACTERISTICS



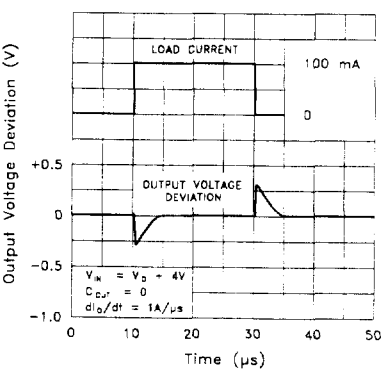
Output Impedance vs. Frequency



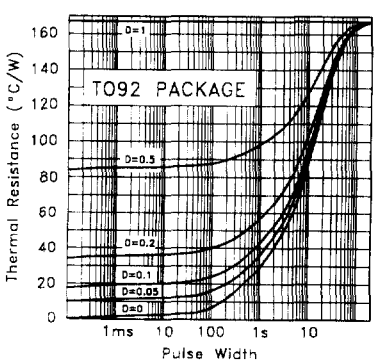
Ripple Rejection vs. Ripple Frequency



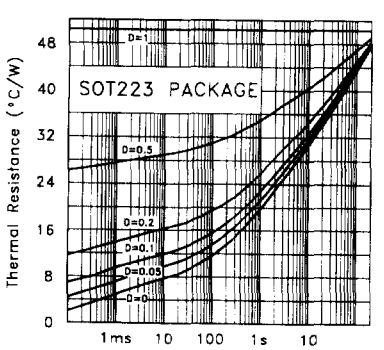
Line Transient Response



Load Transient Response

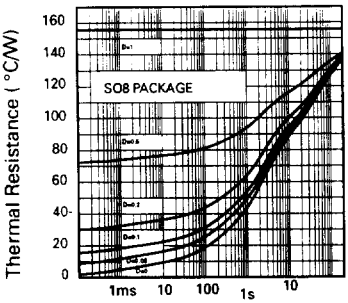


Thermal Resistance vs. Pulse Width

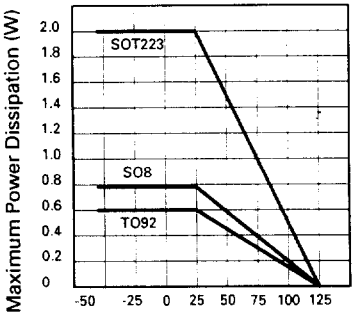


Thermal Resistance vs. Pulse Width

TYPICAL CHARACTERISTICS



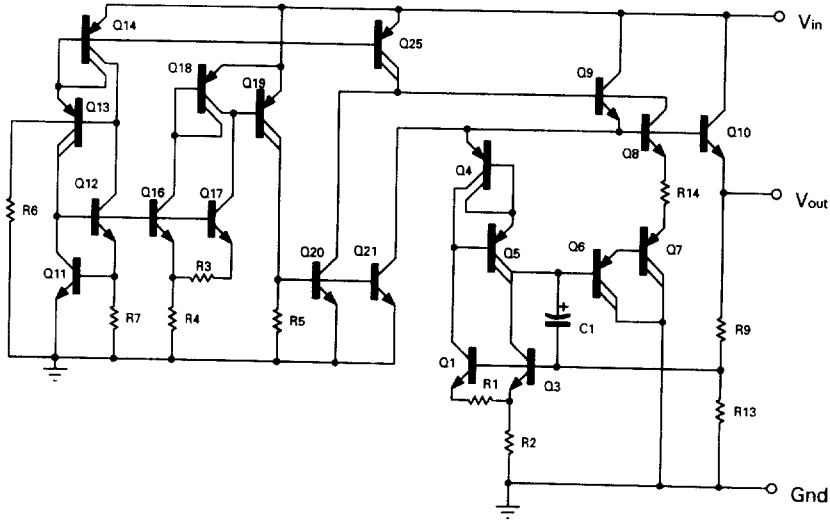
Thermal Resistance vs. Pulse Width



Power Dissipation Derating

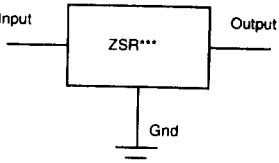
ZSR SERIES

SCHEMATIC DIAGRAM

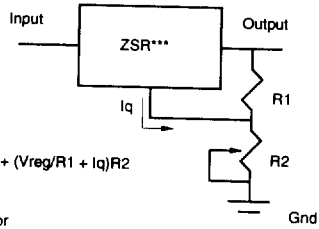


APPLICATIONS

Fixed Output Regulator

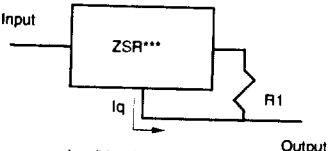


Adjustable Output Regulator



Vo= Vreg + (Vreg/R1 + Iq)R2

Current Regulator



Io= (Vreg/R1) + Iq

2.85 TO 10 VOLT FIXED POSITIVE LOCAL VOLTAGE REGULATOR

ZSR SERIES

ISSUE 1 - DECEMBER 1995

DEVICE DESCRIPTION

The ZSR Series three terminal fixed positive voltage regulators feature internal circuit current limit and thermal shutdown making the devices almost impossible to destroy. The circuit design allows creation of any custom voltage in the range 2.85 to 10 volts.The devices are available in small outline surface mount packages, 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

- Small outline SO8 and SOT223 packages
- TO92 package
- 2.85 to 10 Volt
- Output current up to 200mA
- Tight initial tolerance
- Low quiescent current
- -55 to 125°C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit

VOLTAGE RANGE

ZSR285	2.85V
ZSR300	3.0V
ZSR400	4.0V
ZSR570	5.7V
ZSR900	9.0V

Contact Zetex Marketing for availability of other voltages

CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	IN	OUT	IN
2	Gnd	Gnd	Gnd
3	Gnd	IN	OUT
4	N/C	-	-
5	N/C	-	-
6	Gnd	-	-
7	Gnd	-	-
8	OUT	-	-
Pack	N8	G	C

see Diagrams Page 2 - 5

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
SO8	780mW(Note 3)

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 SO8 and SOT223 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			50 100	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			50 100	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

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			50 100	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
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

τ =T_j = -55 to 125°C

ZSR570TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=9.7V

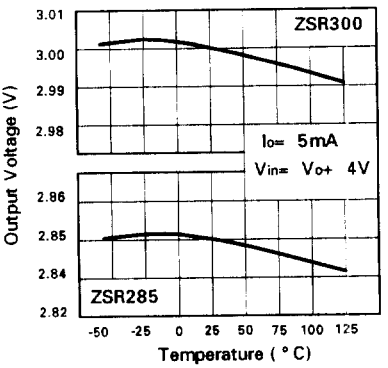
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		5.557	5.7	5.843	V
		I_O=1 to 200mA τ	5.47		5.93	V
		V_{in}=7.7 to 20V I_O=1 to 100mA τ	5.47		5.93	V
ΔV_O	Line Regulation	V_{in}=7.7 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		7 2.5	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=7.7 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		90		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8.7 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		7.7	7.4		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.15		mV/°C

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

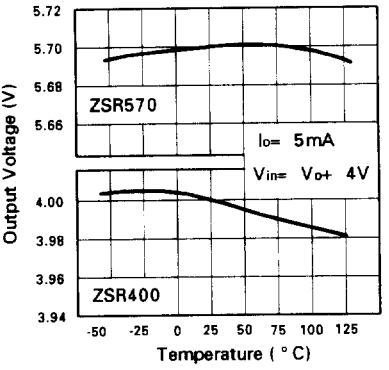
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		8.775	9.0	9.225	V
		I_O=1 to 200mA τ	8.64		9.36	V
		V_{in}=11 to 20V I_O=1 to 100mA τ	8.64		9.36	V
ΔV_O	Line Regulation	V_{in}=11 to 20V		12	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		9 3	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=11 to 20V			50 100	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

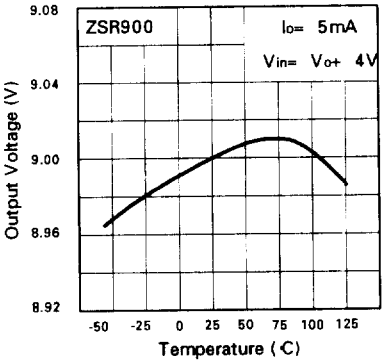
TYPICAL CHARACTERISTICS



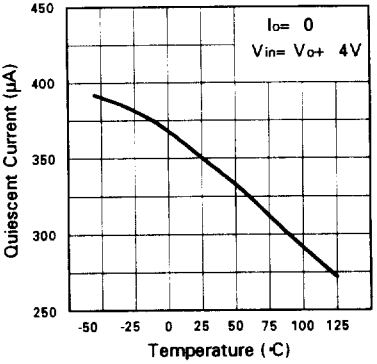
Output Voltage Temperature Coefficient



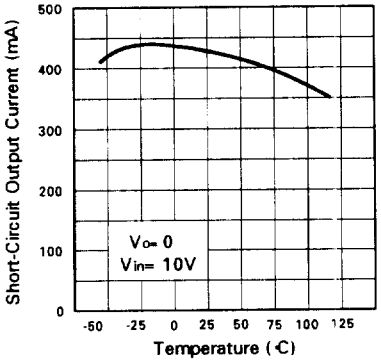
Output Voltage Temperature Coefficient



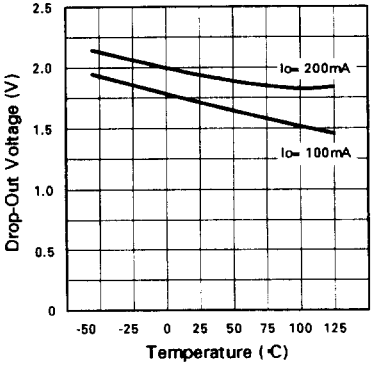
Output Voltage Temperature Coefficient



Quiescent Current vs. Temperature



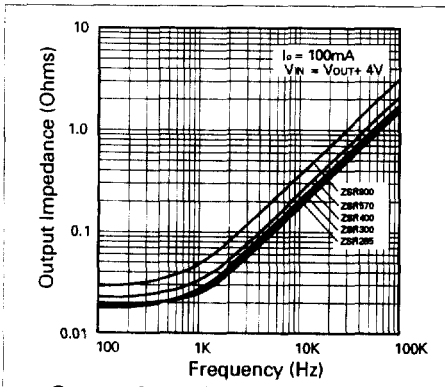
Peak Output Current vs. Temperature



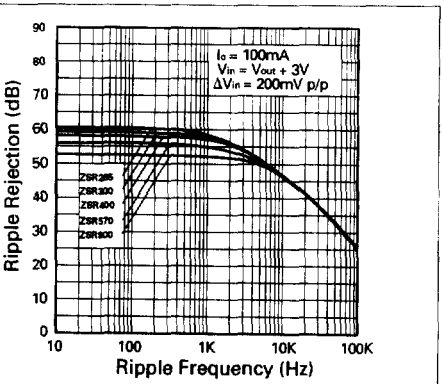
Drop-Out Voltage vs. Temperature

ZSR SERIES

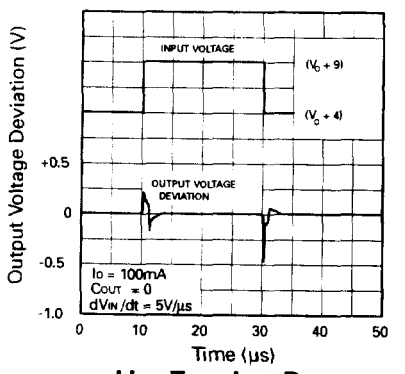
TYPICAL CHARACTERISTICS



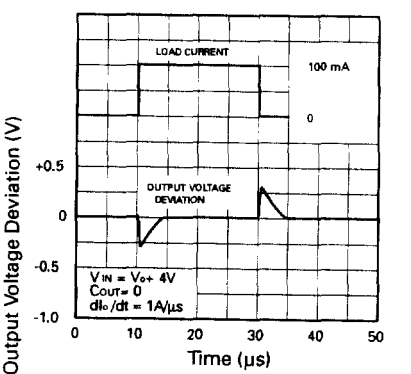
Output Impedance vs. Frequency



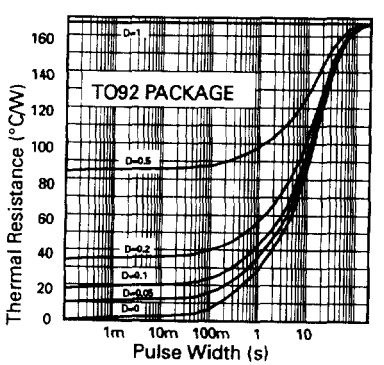
Ripple Rejection vs. Ripple Frequency



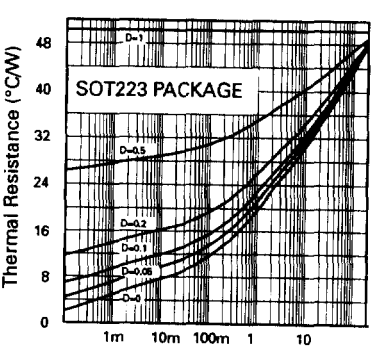
Line Transient Response



Load Transient Response

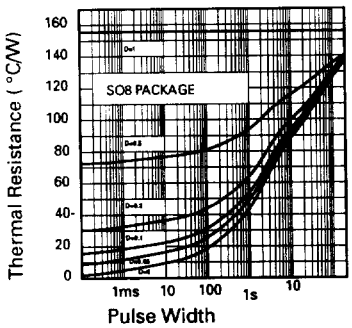


Thermal Resistance v Pulse Width

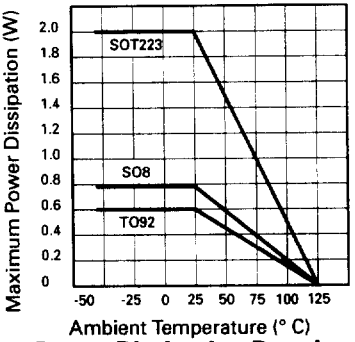


Thermal Resistance v Pulse Width

TYPICAL CHARACTERISTICS



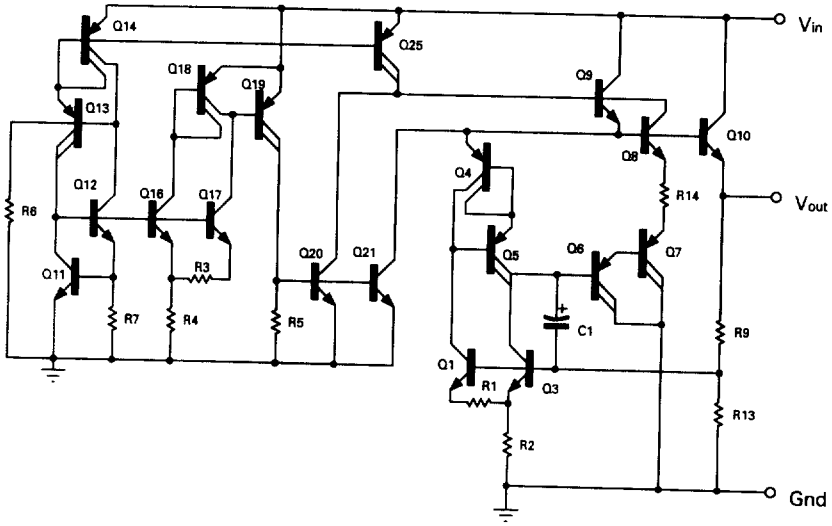
Thermal Resistance vs. Pulse Width



Power Dissipation Derating

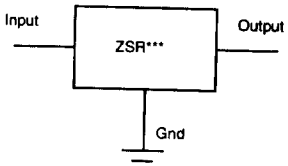
ZSR SERIES

SCHEMATIC DIAGRAM

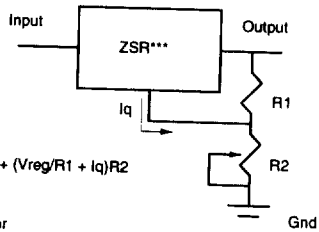


APPLICATIONS

Fixed Output Regulator

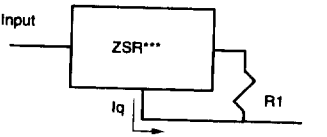


Adjustable Output Regulator



Vo= Vreg + (Vreg/R1 + Iq)R2

Current Regulator



Io= (Vreg/R1) + Iq