

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 350 μ A. 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 600 μ A 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	Power Dissipation ($T_{amb}=25^{\circ}\text{C}$)	
Output Current(I_o)	200mA	SOT223	2W(Note 3)
Operating Temperature	-55 to 125°C	TO92	600mW
Storage Temperature	-65 to 150°C		

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 $T_{amb}=125^{\circ}\text{C}$.
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 (1 μF 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): $T_j=25^{\circ}\text{C}$, $I_o=100\text{mA}$, $V_{in}=6.85\text{V}$

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	$f=10\text{Hz}$ to 10kHz		75		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_o$	Ripple Rejection	$V_{in}=5.85$ to 18V $f=120\text{Hz}$	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	$I_o=5.0\text{mA}$ τ		0.1		mV/ $^{\circ}\text{C}$

$\tau=T_j=-55$ to 125°C

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ZSR300 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=7\text{V}$

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	$f=10\text{Hz}$ to 10kHz		75		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=6$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.1		$\text{mV}/^{\circ}\text{C}$

ZSR330 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=7.3\text{V}$

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	$f=10\text{Hz}$ to 10kHz		50		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=6.3$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.1		$\text{mV}/^{\circ}\text{C}$

$\tau=T_j=-55$ to 125°C

ZSR SERIES

ZSR400 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=8\text{V}$

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 $I_O^0=1$ 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	$f=10\text{Hz}$ to 10kHz		75		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=7$ to 18V $f=120\text{Hz}$	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		6	5.3		V

ZSR485 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=8.85\text{V}$

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 $I_O^0=1$ 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	$f=10\text{Hz}$ to 10kHz		50		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=7.85$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.1		mV/ $^{\circ}\text{C}$

$\tau = T_j = -55$ to 125°C

ZSR SERIES

ZSR1000 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=14\text{V}$

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	$f=10\text{Hz}$ to 10kHz		150		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=13$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.25		$\text{mV}/^{\circ}\text{C}$

ZSR1200 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=16\text{V}$

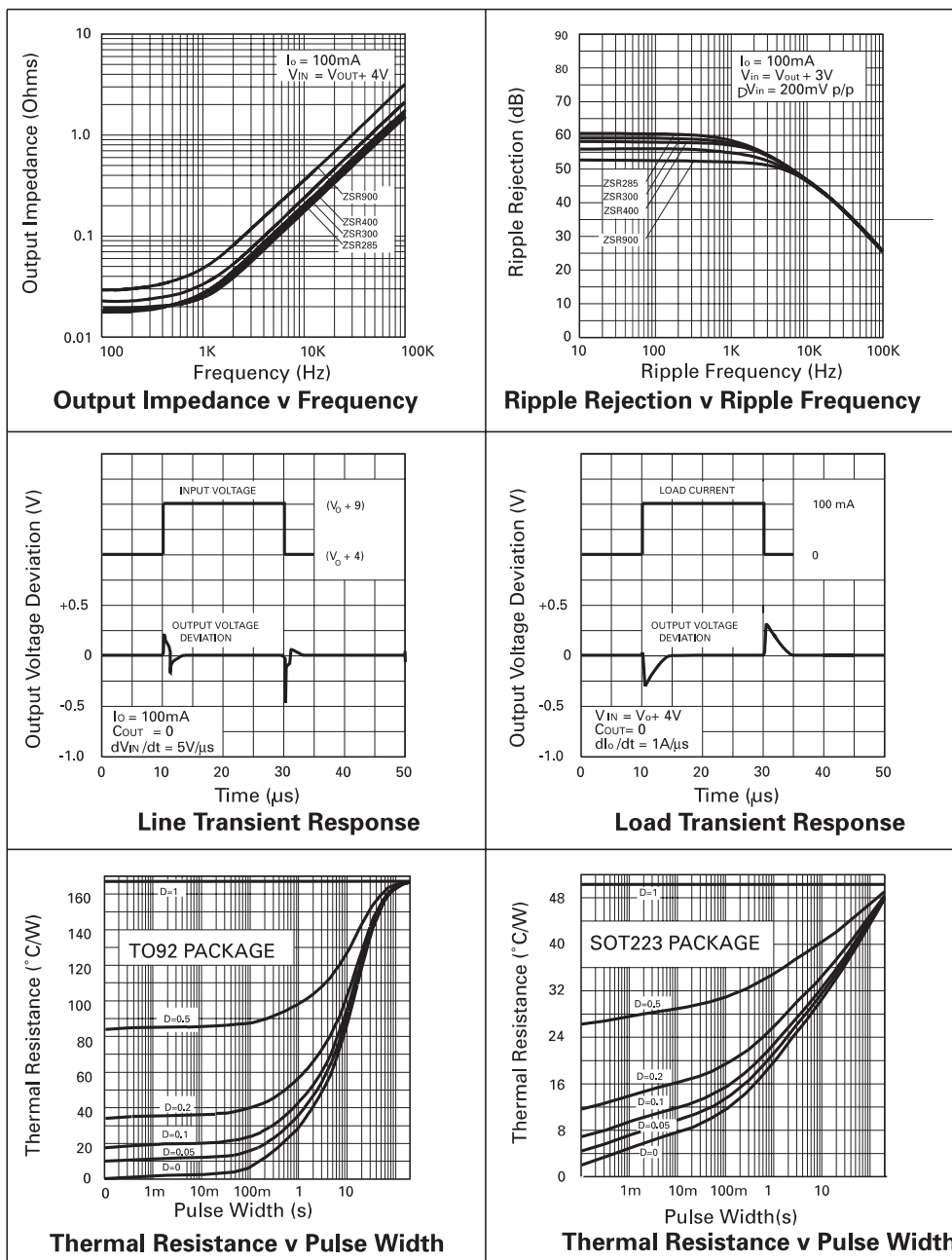
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		11.7	12	12.3	V
		$I_O=1$ to 200mA τ	11.52		12.48	V
		$V_{in}=14$ to 20V $I_O=1$ to 100mA τ	11.52		12.48	V
ΔV_O	Line Regulation	$V_{in}=14$ to 20V		12	40	mV
ΔV_O	Load Regulation	$I_O=1$ to 200mA $I_O=1$ to 100mA		9 3	30	mV mV
I_q	Quiescent 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	$f=10\text{Hz}$ to 10kHz		150		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=15$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.25		$\text{mV}/^{\circ}\text{C}$

$\tau = T_j = -55$ to 125°C

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ZSR285 ZSR300 ZSR400 ZSR900

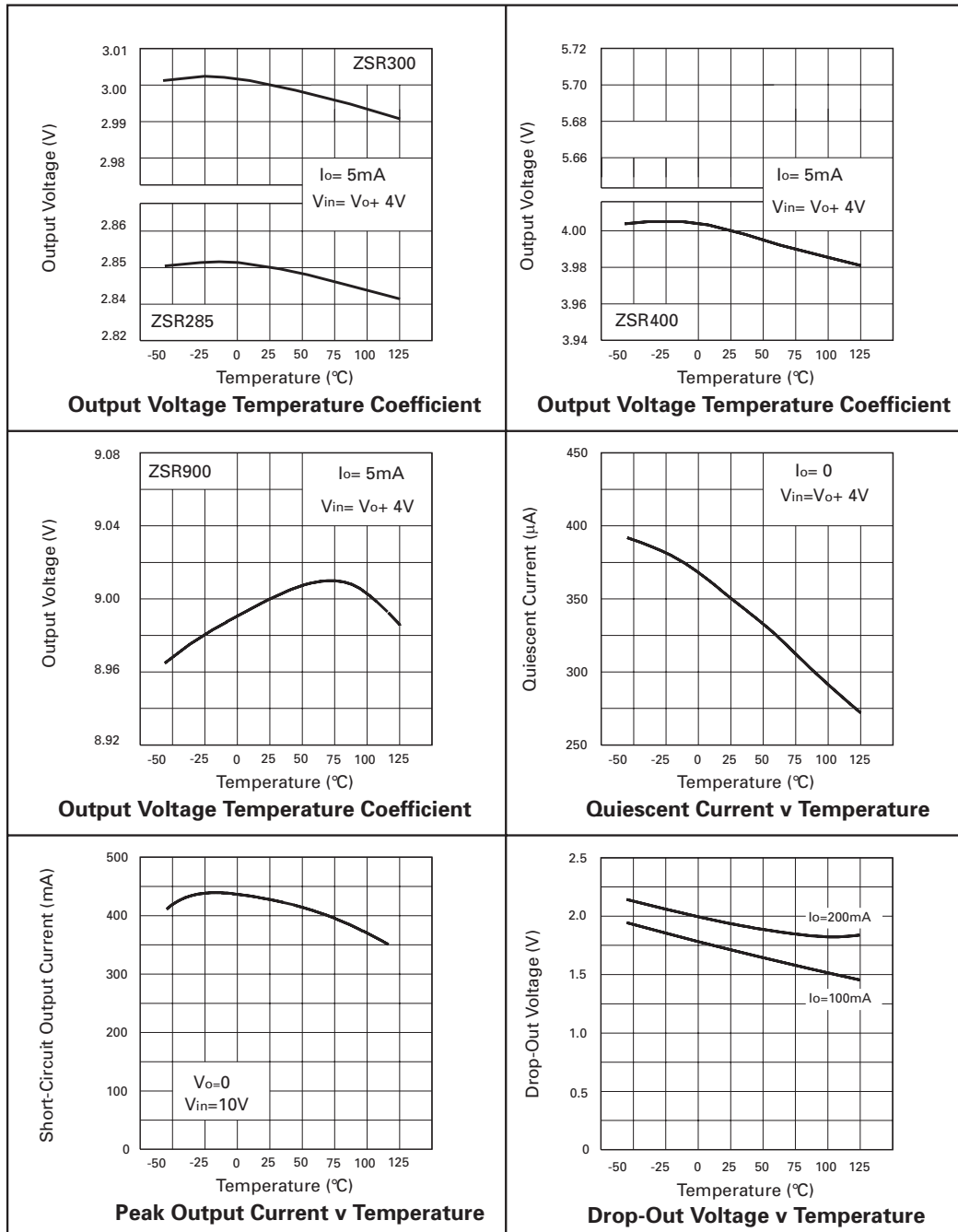
TYPICAL CHARACTERISTICS



ZSR285 ZSR300 ZSR400 ZSR900

ZSR SERIES

TYPICAL CHARACTERISTICS



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ZSR600 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=10\text{V}$

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	$f=10\text{Hz}$ to 10kHz		90		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=9$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.15		mV/ $^{\circ}\text{C}$

$\tau = T_j = -55$ to 125°C

ZSR500 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=9\text{V}$

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	$f=10\text{Hz}$ to 10kHz		75		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=8$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.1		mV/ $^{\circ}\text{C}$

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ZSR520 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$,

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	$f=10\text{Hz}$ to 10kHz		75		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=8.2$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.1		$\text{mV}/^{\circ}\text{C}$

$\tau=T_j = -55$ to 125°C

ZSR900 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=13\text{V}$

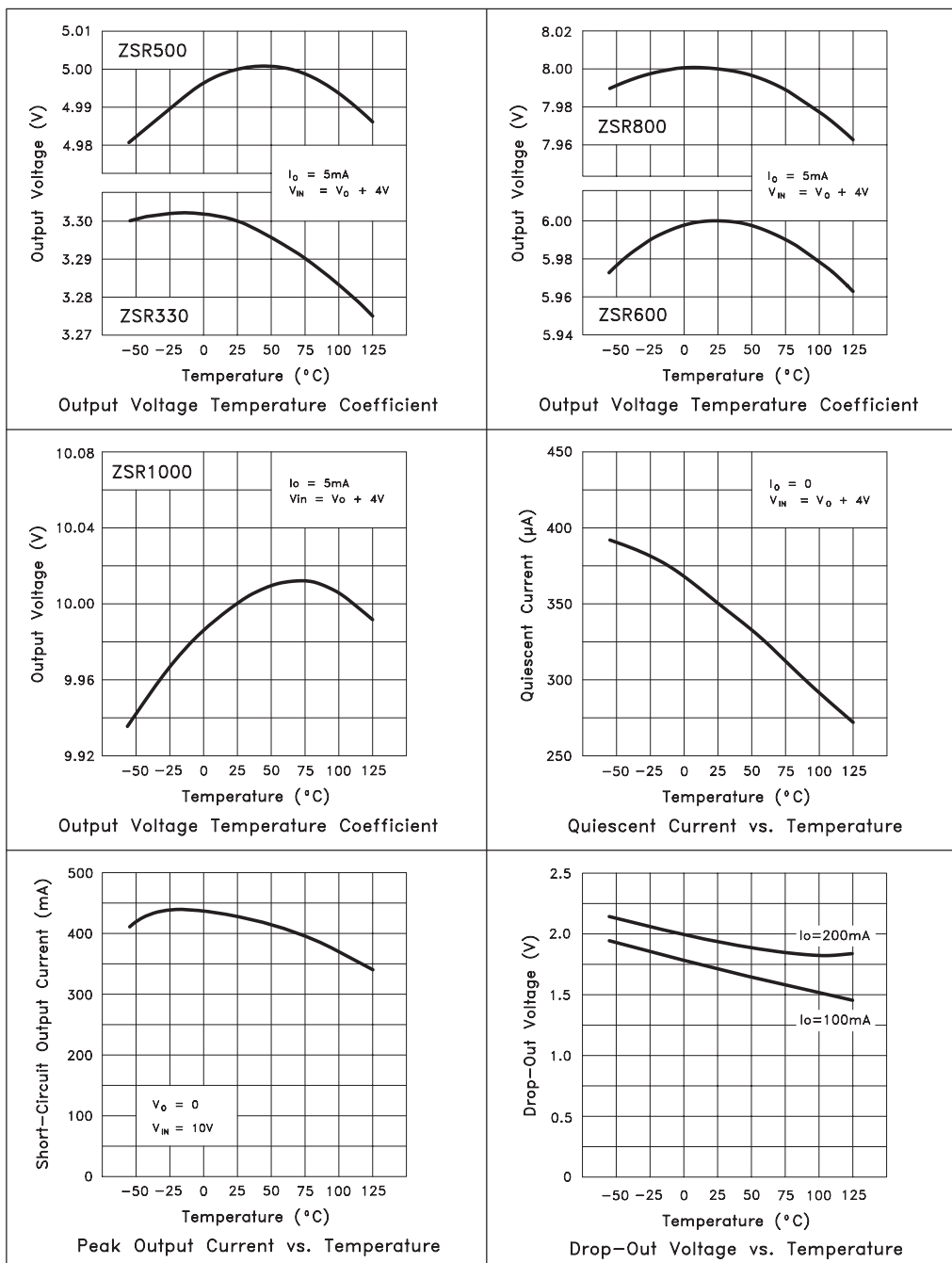
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		8.775	9.0	9.225	V
		$I_O=1$ to 200mA τ	8.64		9.36	V
		$V_{in}=11$ to 20V $I_O=1$ to 100mA τ	8.64		9.36	V
ΔV_O	Line Regulation	$V_{in}=11$ to 20V		12	40	mV
ΔV_O	Load Regulation	$I_O=1$ to 200mA $I_O=1$ to 100mA		9 3	30	mV mV
I_q	Quiescent 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	$f=10\text{Hz}$ to 10kHz		150		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=12$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.25		$\text{mV}/^{\circ}\text{C}$

$\tau=T_j = -55$ to 125°C

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ZSR330 ZSR500 ZSR600 ZSR800 ZSR1000

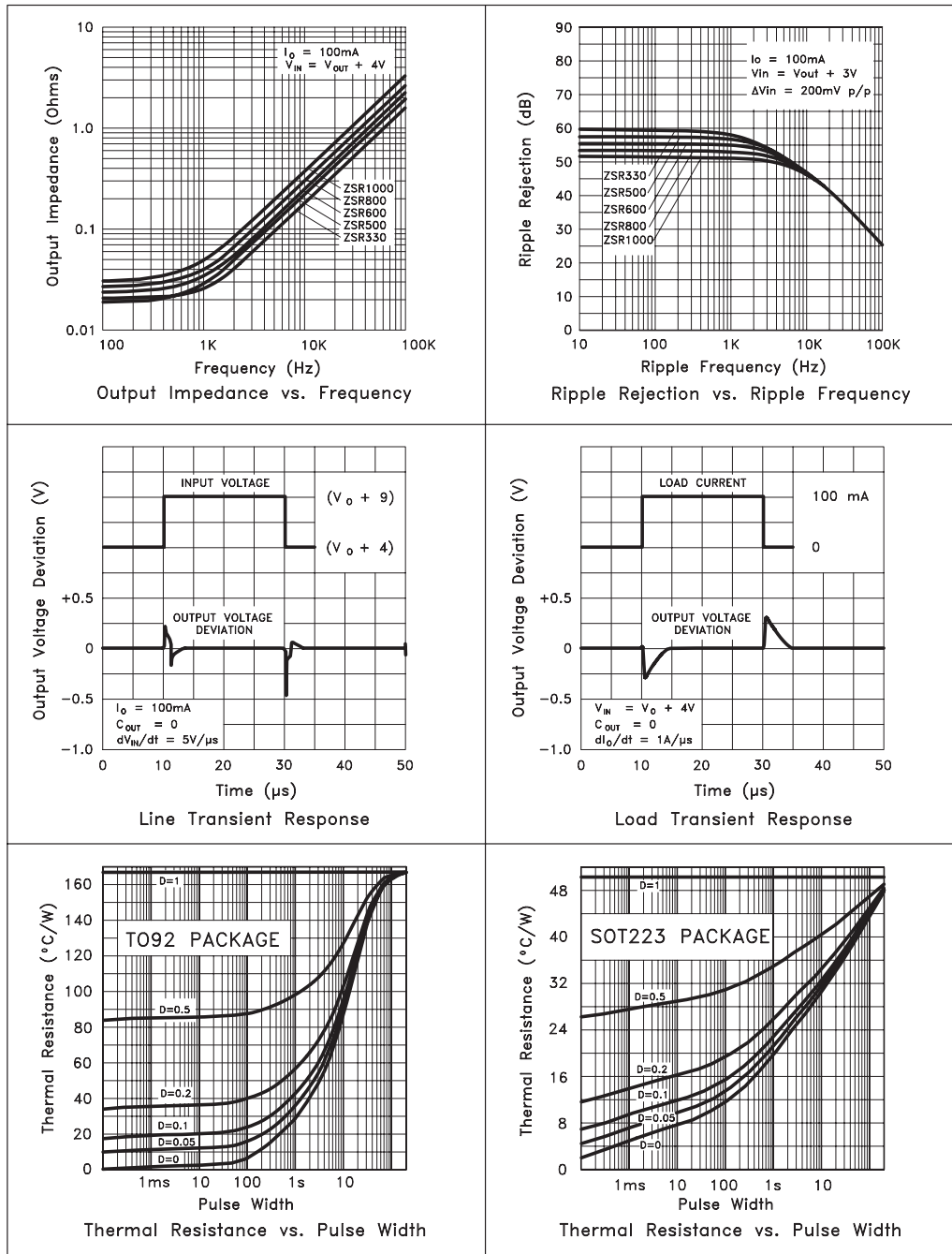
TYPICAL CHARACTERISTICS



ZSR330 ZSR500 ZSR600 ZSR800 ZSR1000

ZSR SERIES

TYPICAL CHARACTERISTICS



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ZSR800 TEST CONDITIONS (Unless otherwise stated): $T_j=25^{\circ}\text{C}$, $I_O=100\text{mA}$, $V_{in}=12\text{V}$

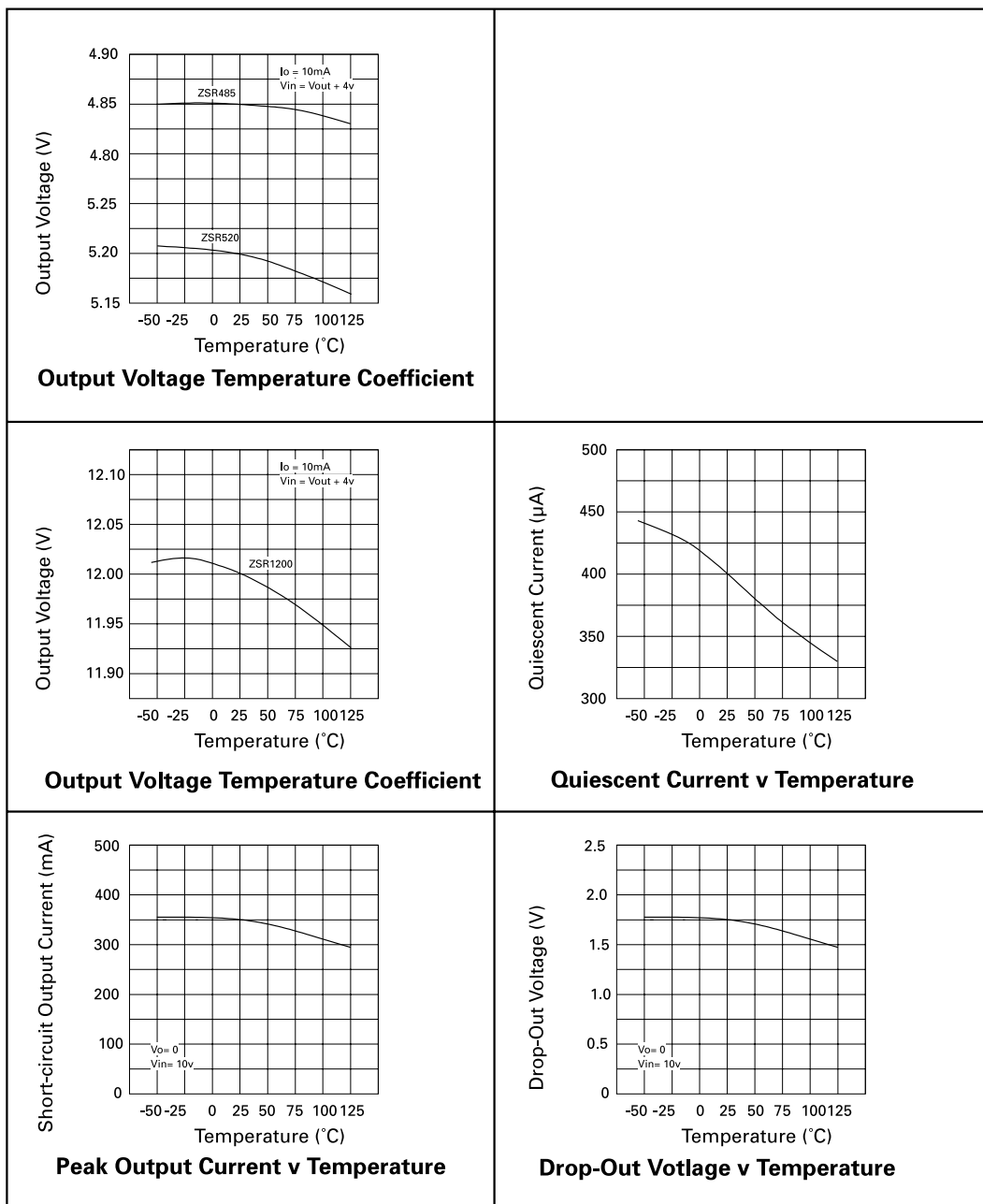
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		7.8	8	8.2	V
		$I_O=1$ to 200mA τ	7.68		8.32	V
		$V_{in}=10$ to 20V $I_O=1$ to 100mA τ	7.68		8.32	V
ΔV_O	Line Regulation	$V_{in}=10$ to 20V		11	40	mV
ΔV_O	Load Regulation	$I_O=1$ to 200mA $I_O=1$ to 100mA		8 3	30	mV mV
I_q	Quiescent 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	$f=10\text{Hz}$ to 10kHz		115		$\mu\text{V rms}$
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	$V_{in}=11$ to 18V $f=120\text{Hz}$	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	$I_O=5.0\text{mA}$ τ		0.25		$\text{mV}/^{\circ}\text{C}$

$\tau = T_j = -55$ to 125°C

ZSR485 ZSR520 ZSR1200

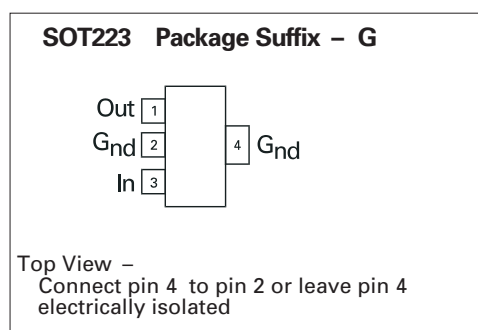
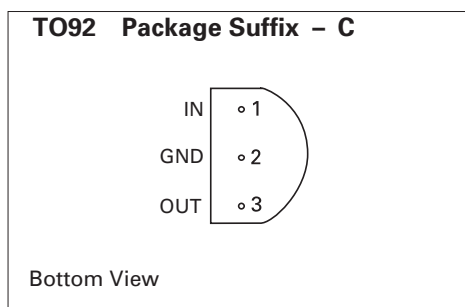
ZSR SERIES

TYPICAL CHARACTERISTICS



ZSR SERIES

CONNECTION DIAGRAMS



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.

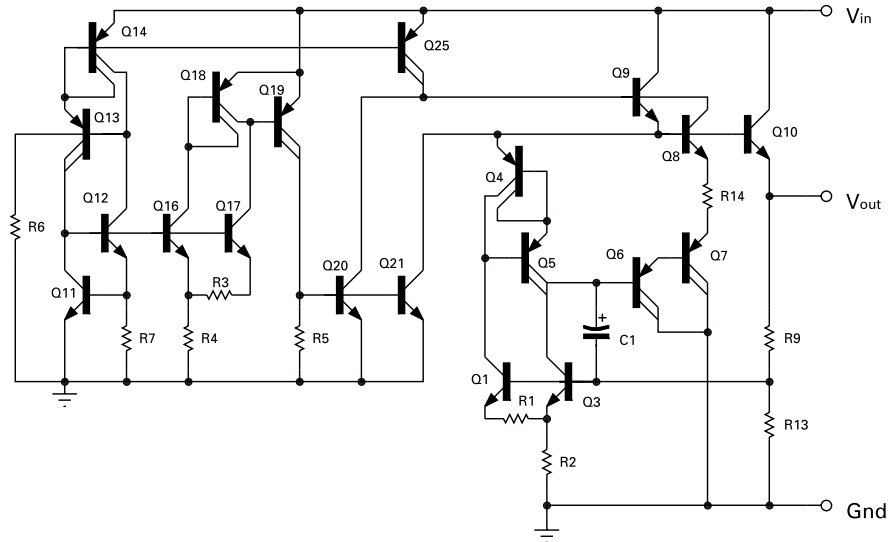
OPTIONS

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

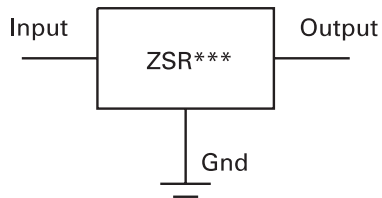
ZSR SERIES

SCHEMATIC DIAGRAM

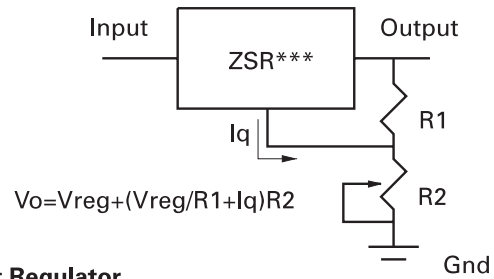


APPLICATIONS

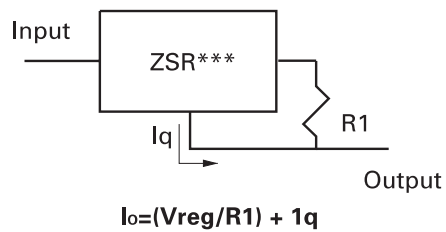
Fixed Output Regulator



Adjustable Output Regulator



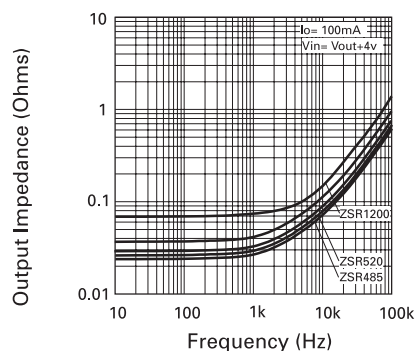
Current Regulator



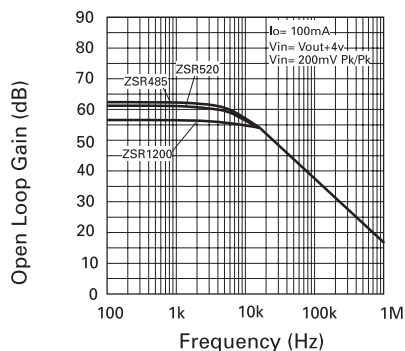
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ZSR485 ZSR520 ZSR1200

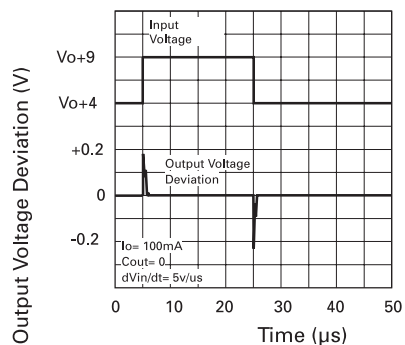
TYPICAL CHARACTERISTICS



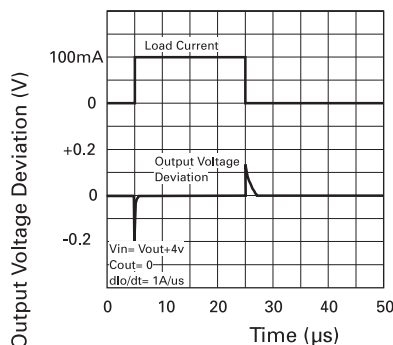
Output Impedance v Frequency



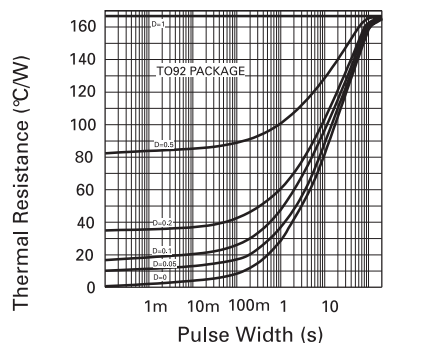
Ripple Rejection v Ripple Frequency



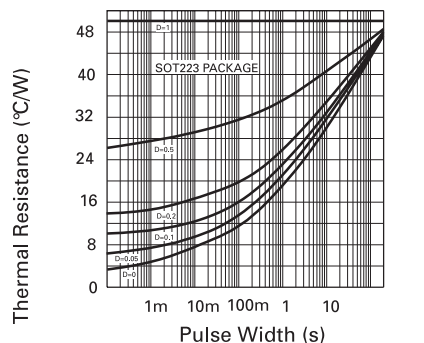
Line Transient Response



Load Transient Response



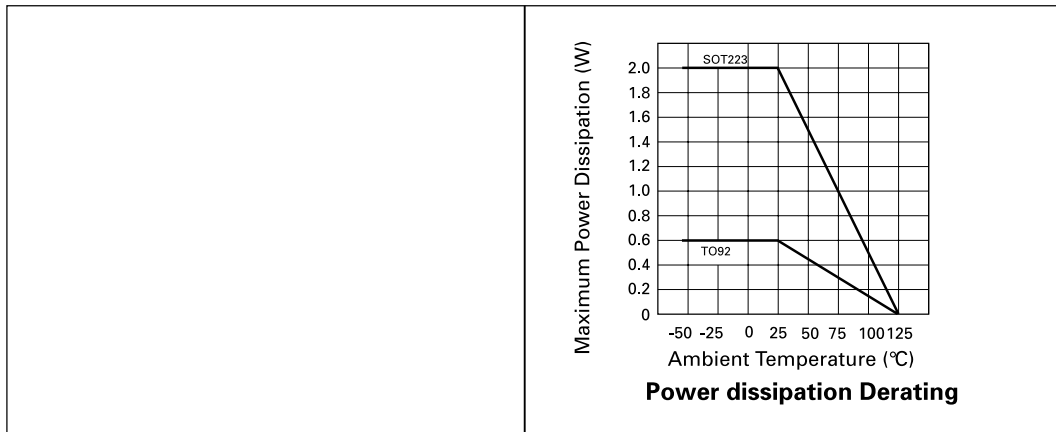
Thermal Resistance v Pulse Width



Thermal Resistance v Pulse Width

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TYPICAL CHARACTERISTICS



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