BL2940

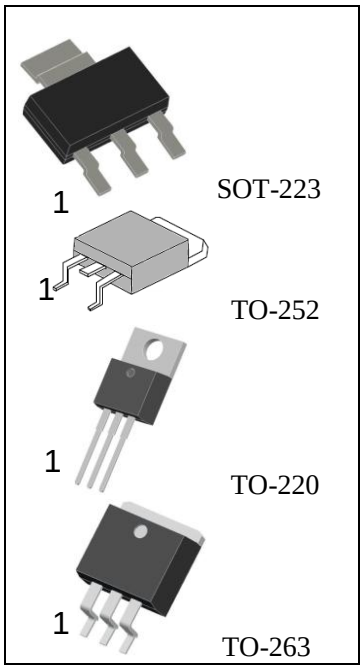
1A Low-Dropout Voltage Regulator

General Description

The BL2940 is a low dropout regulator designed to provide output current up to 1A with a typical 500mV dropout Voltage and a maximum of 1V. It is capable of reducing the ground current when the differential between the input voltage and the output voltage outrun 3V.

The BL2940 offers low quiescent current (typical current 30mA at 1A and an input-output differential of 5V). Higher quiescent currents only exist when the regulator is in the dropout mode (V_{IN}-V_{OUT}≤3V).

The BL2940 is available in SOT-223 ,TO-252 ,TO-220 and TO-263 package.



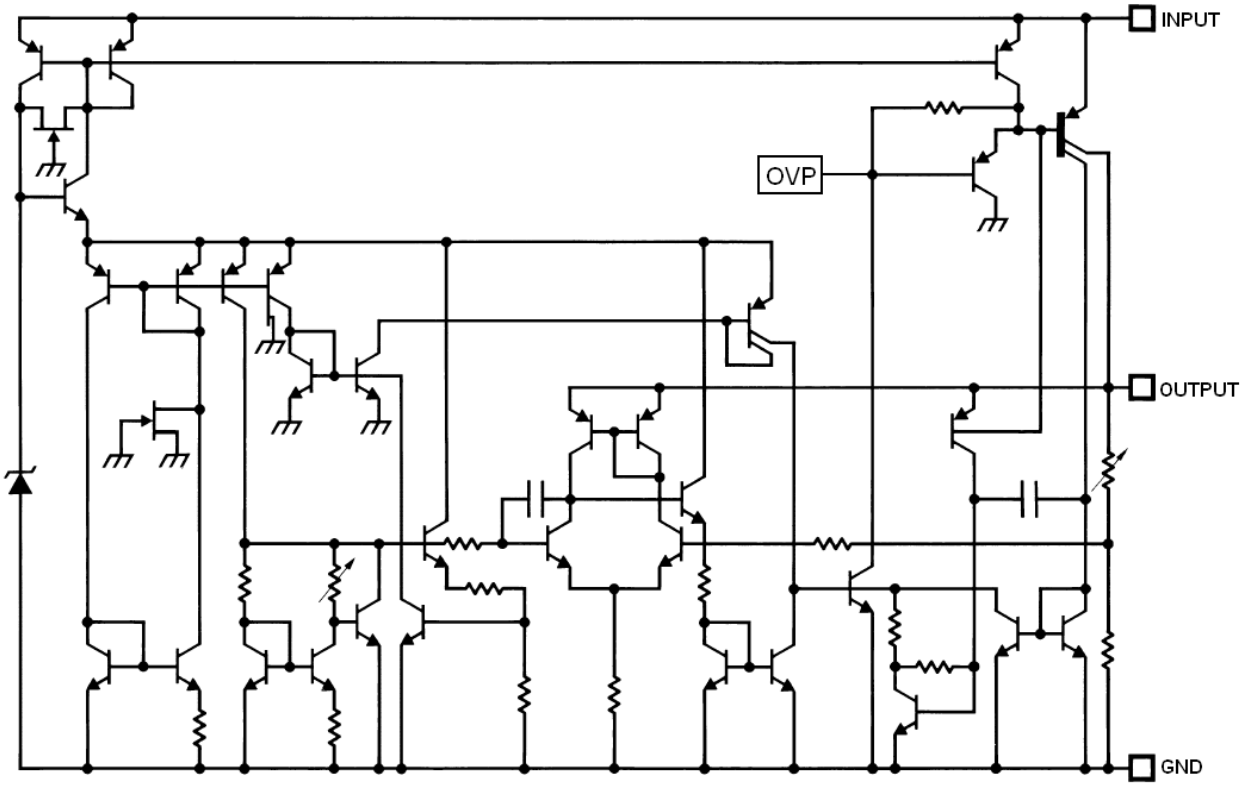
Features

- 500mV Typical Dropout at 1A
- Output Current In Excess of 1A
- Low Quiescent Current
- Reverse-Battery Protection
- Current Limit and Thermal Shutdown
- Mirror Image Insertion Protection

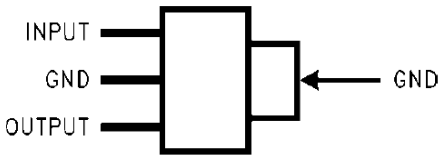
Applications

- Powering VGA & Sound Card
- LCD Monitor
- Battery Powered Equipments / Laptop & Notebook
- SMPS Post Regulator / DC to DC Modules
- High Efficiency Linear Power Supply
- Adjustable Power Supply
- Bar Code Scanners

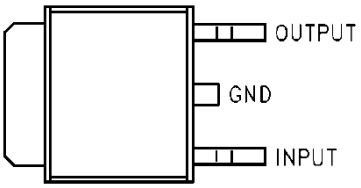
Functional Block Diagram



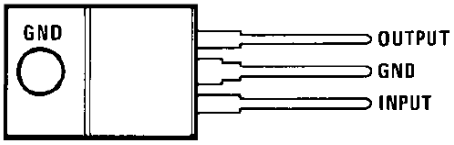
Pin Configuration



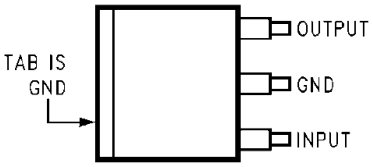
SOT-223



TO-252



TO-220



TO-263

Pin Description

Pin Number		Pin Name	Function Description
SOT-223、TO-252 TO-220、TO-263	1	INPUT	Input pin
	2	GND	Ground
	3	OUTPUT	Output pin

Absolute Maximum Ratings (Ta=25℃) *Note

Parameter Name		Symbol	Value	Unit
Input Voltage		Vin	26	V
Internal Power Dissipation		P_D	Internally limited	
Maximum Junction Temperature		T_J	150	℃
Storage Temperature Range		T_{STG}	-65 ~ +150	℃
Operating Temperature	SOT-223	T_{OPR}	-40 ~ +85	℃
	TO-252		-40 ~ +125	
	TO-220		-40 ~ +125	
	TO-263		-40 ~ +125	

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

Electrical Characteristics

(V_{IN}=V_O+5V, I_{OUT}=1A, C_O=22μF, T_A = T_J = 25℃, Unless otherwise specified.)

Parameter Name	Symbol	Test Conditions	BL2940-5V			BL2940-8V			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	Vout	5mA≤I_O≤1A	6.25V ≤ V_{IN} ≤ 26V			9.4V ≤ V_{IN} ≤ 26V			V
			4.85	5.00	5.15	7.76	8.00	8.24	
Line Regulation	LNR	V_O+2V ≤ V_{IN} ≤ 26V I_O = 5mA		20	50		20	80	mV
Load Regulation	LDR	50mA ≤ I_O ≤ 1A		35	50		55	80	mV
Output Impedance	Ro	100mA_{DC} and 20mArms, f_O =120Hz		35			55		mΩ
Quiescent Current	IQ	V_O+2V ≤ V_{IN} ≤ 26V I_O =5mA		10	15		10	15	mA
Output Noise Voltage	eN	10Hz ~ 100kHz, I_O =5mA		150			240		μVrms
Ripple Rejection	RR	f_O =120Hz, 1Vrms I_O =100mA	60	72		54	66		dB
Long Term Stability				20			32		mV/ 1000Hr
Dropout Voltage	V_D	I_O =1A		0.5	0.8		0.5	0.8	V
		I_O =100mA		110	150		110	150	mV
Short Circuit Current	Isc		1.6	1.9		1.6	1.9		A
Maximum Line Transient	T_{IN}	R_O =100Ω T ≤ 100ms	60	75		60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_O =100Ω		-30	-15		-30	-15	V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_O =100Ω T ≤ 100ms		-75	-50		-75	-50	V

Note: Output current will decrease with temperature increase but will not drop below 1A at the maximum specified temperature.

Electrical Characteristics (Cont.)

(V_{IN}=V_O+5V, I_O=1A, C_O=22μF, T_A = T_J = 25℃, unless otherwise specified.)

Parameter Name	Symbol	Test Conditions	BL2940-9V			BL2940-10V			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	Vout	5mA ≤ I_O ≤ 1A	10.5V ≤ V_{IN} ≤ 26V			11.5V ≤ V_{IN} ≤ 26V			V
			8.73	9.00	9.27	9.70	10.0	10.3	
Line Regulation	LNR	V_O+2V≤V_{IN}≤26V I_O =5mA		20	90		20	100	mV
Load Regulation	LDR	50mA≤I_O≤1A		60	90		65	100	mV
Output Impedance	Ro	100mA_{DC} and 20mArms, f_O =120Hz		60			65		mΩ
Quiescent Current	IQ	V_O+2V≤V_{IN}≤26V I_O =5mA		10	15		10	15	mA
Output Noise Voltage	eN	10Hz ~ 100kHz, I_O =5mA		270			300		μVrms
Ripple Rejection	RR	f_O =120Hz, 1Vrms I_O =100mA	52	64		51	63		dB
Long term Stability				34			36		mV/ 1000Hr
Dropout Voltage	V_D	I_O =1A		0.5	0.8		0.5	0.8	V
		I_O =100mA		110	150		110	150	mV
Short Circuit Current	Isc		1.6	1.9		1.6	1.9		A
Maximum Line Transient	T_{IN}	R_O =100Ω T≤1ms	45	55		45	55		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_O =100Ω		-30	-15		-30	-15	V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_O =100Ω T≤1ms		-55	-45		-55	-45	V

Note: Output current will decrease with temperature increase but will not drop below 1A at the maximum specified temperature.

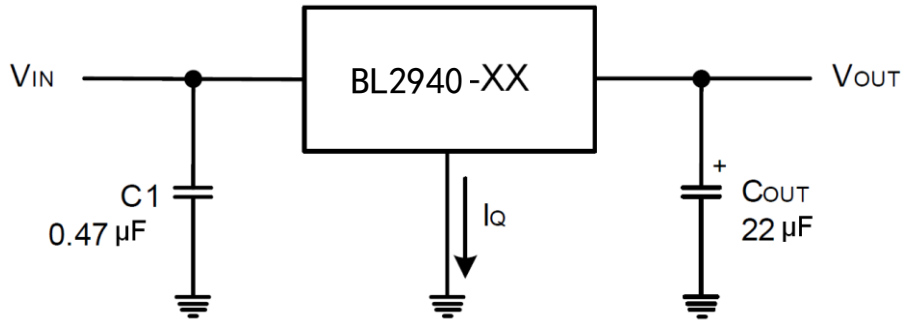
Electrical Characteristics (Cont.)

(V_{IN}=V_O+5V, I_O=1A, C_O=22μF, T_A = T_J = 25℃, Unless otherwise specified.)

Parameter Name	Symbol	Test Conditions	BL2940-12V			BL2940-15V			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	Vout	5mA≤I_O≤1A	13.6V≤V_{IN}≤26V			16.75V≤V_{IN}≤26V			V
			11.64	12.0	12.36	14.55	15.0	15.45	
Line Regulation	LNR	V_O+2V≤V_{IN}≤26V I_O =5mA		20	120		20	150	mV
Load Regulation	LDR	50mA≤I_O≤1A		55	120		70	150	mV
Output Impedance	Ro	100mA_{DC} and 20mArms, f_O =120Hz		80			100		mΩ
Quiescent Current	IQ	V_O+2V≤V_{IN}≤26V I_O =5mA		10	15		10	15	mA
Output Noise Voltage	eN	10Hz-100kHz, I_O =5mA		360			450		μVrms
Ripple Rejection	RR	f_O =120Hz, 1Vrms I_O =100mA	54	66		52	64		dB
Long term Stability				48			60		mV/ 1000Hr
Dropout Voltage	V_D	I_O =1A		0.5	0.8		0.5	0.8	V
		I_O =100mA		110	150		110	150	mV
Short Circuit Current	Isc		1.6	1.9		1.6	1.9		A
Maximum Line Transient	T_{IN}	R_O =100Ω T≤1ms	45	55		45	55		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_O =100Ω		-30	-15		-30	-15	V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_O =100Ω T≤1ms		-55	-45		-55	-45	V

Note: Output current will decrease with temperature increase but will not drop below 1A at the maximum specified temperature.

Typical Application



Note：1.C1 is required if regulator is located far from power supply filter.

2.C_{OUT} must be higher than 22μF for stability, and locate as close as possible to the regulator.

Application Information

External Capacitors

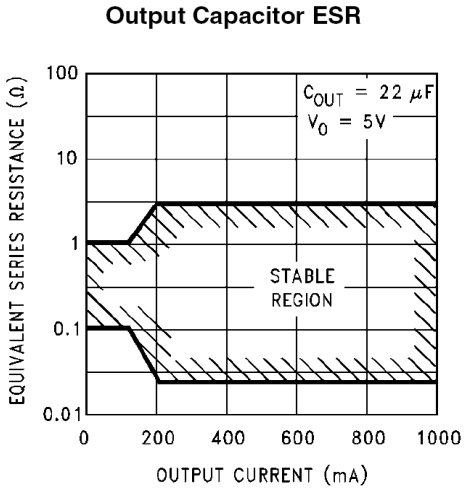
The output capacitor is critical to maintaining regulator stability, and must meet the required conditions for both ESR (Equivalent Series Resistance) and minimum amount of capacitance.

Minimum Capacitance:

The minimum output capacitance required to maintain stability is 22 μF (this value may be increased without limit). Larger values of output capacitance will give improved transient response.

ESR Limits:

The ESR of the output capacitor will cause loop instability if it is too high or too low. The acceptable range of ESR plotted versus load current is shown in the graph below. It is essential that the output capacitor meet these requirements, or oscillations can result.



ESR Limits

It is important to note that for most capacitors, ESR is specified only at room temperature. However, the designer must ensure that the ESR will stay inside the limits shown over the entire operating temperature range for the design.

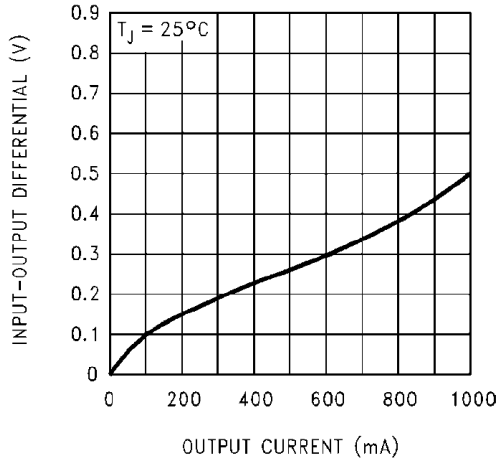
For aluminum electrolytic capacitors, ESR will increase by about 30X as the temperature is reduced from 25℃ to −40℃. This type of capacitor is not well-suited for low temperature operation.

Solid tantalum capacitors have a more stable ESR over temperature, but are more expensive than aluminum electrolytics. A cost-effective approach sometimes used is to parallel an aluminum electrolytic with a solid Tantalum, with the total capacitance split about 75/25% with the Aluminum being the larger value.

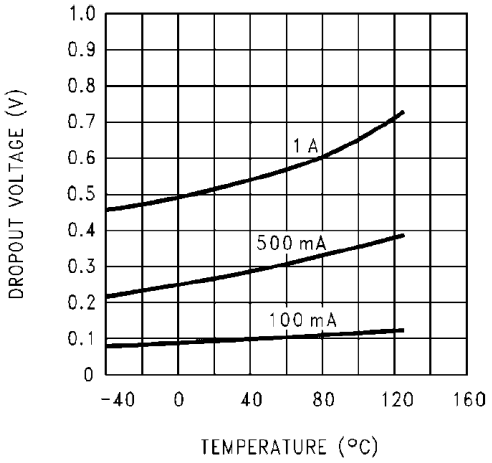
If two capacitors are paralleled, the effective ESR is the parallel of the two individual values. The "flatter" ESR of the Tantalum will keep the effective ESR from rising as quickly at low temperatures.

Characteristics Curve

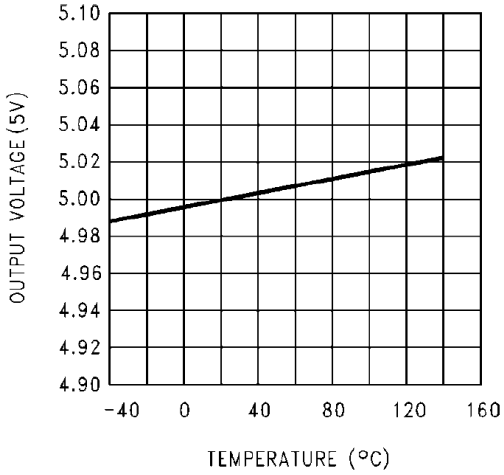
Dropout Voltage



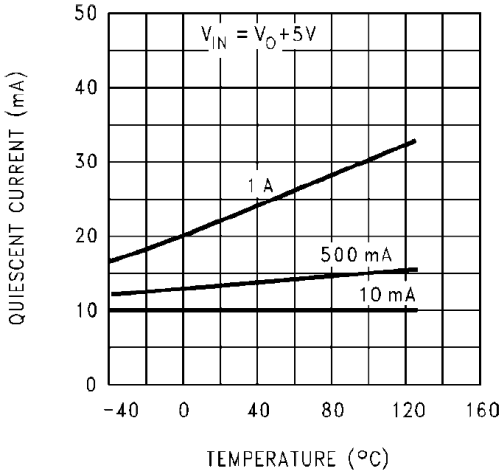
Dropout Voltage vs. Temperature



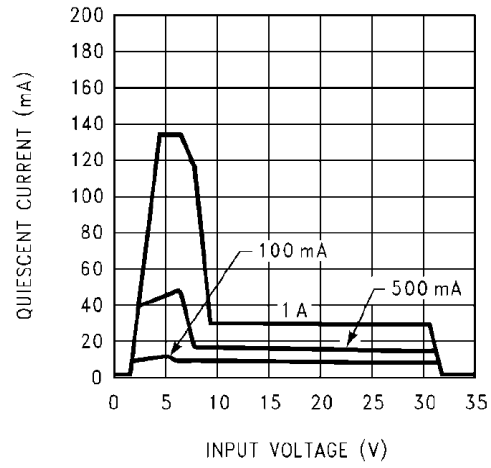
Output Voltage vs. Temperature



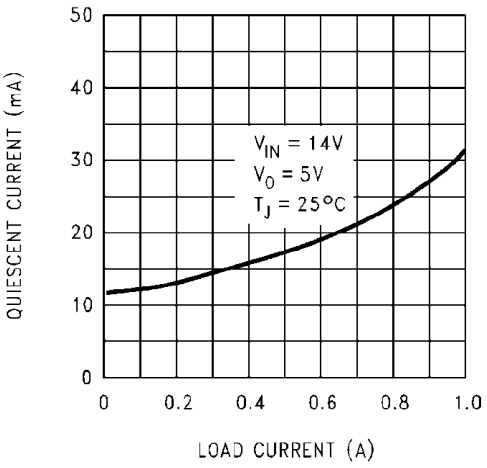
Quiescent Current vs. Temperature



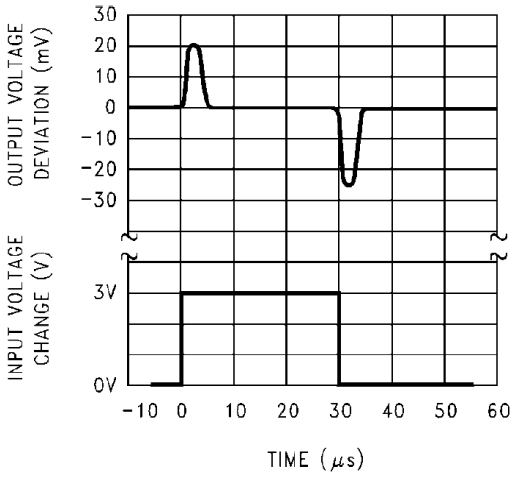
Quiescent Current



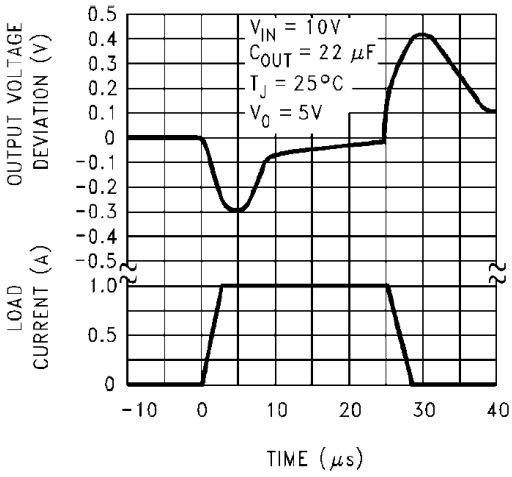
Quiescent Current



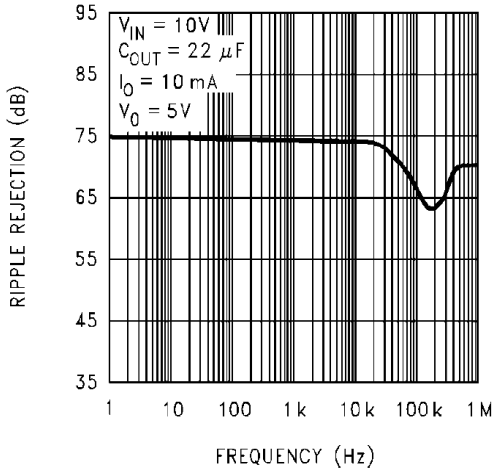
Line Transient Response



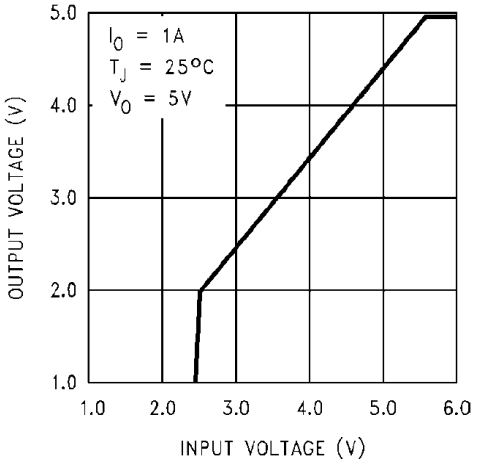
Load Transient Response



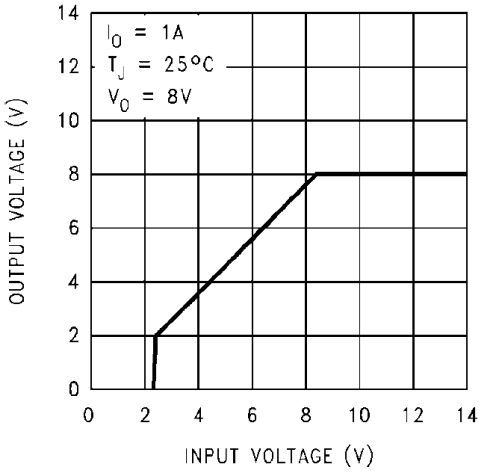
Ripple Rejection



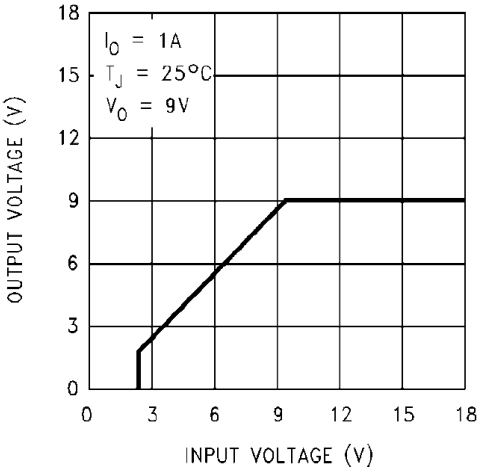
Low Voltage Behavior



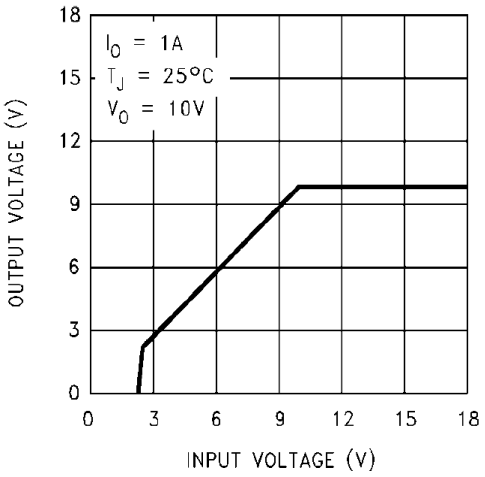
Low Voltage Behavior



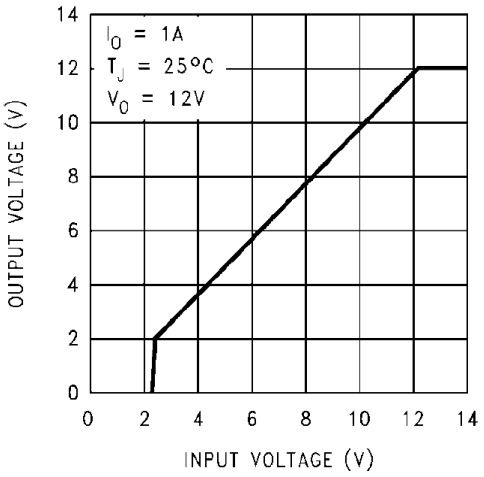
Low Voltage Behavior



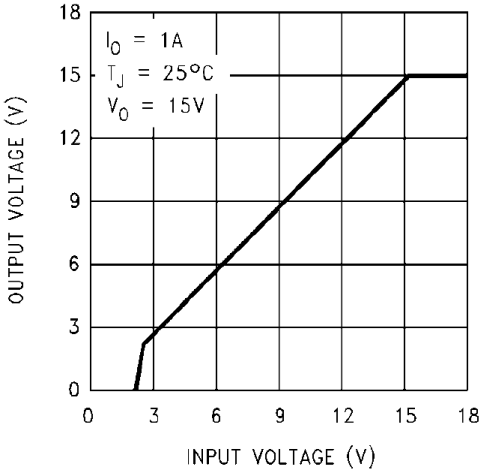
Low Voltage Behavior



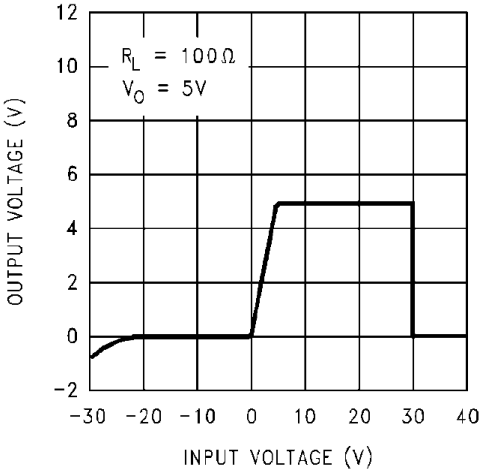
Low Voltage Behavior



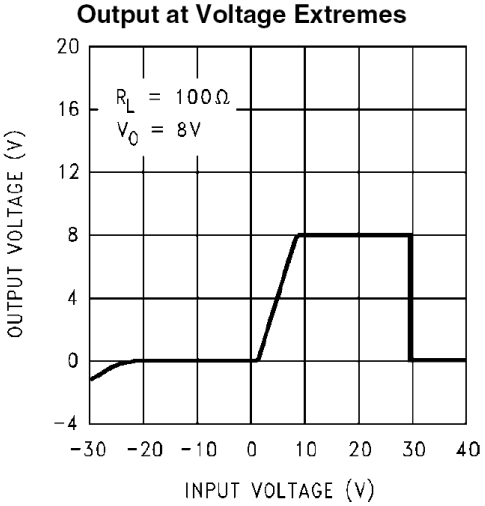
Low Voltage Behavior



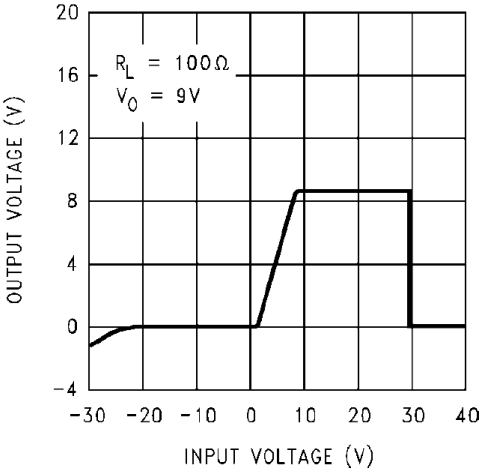
Output at Voltage Extremes



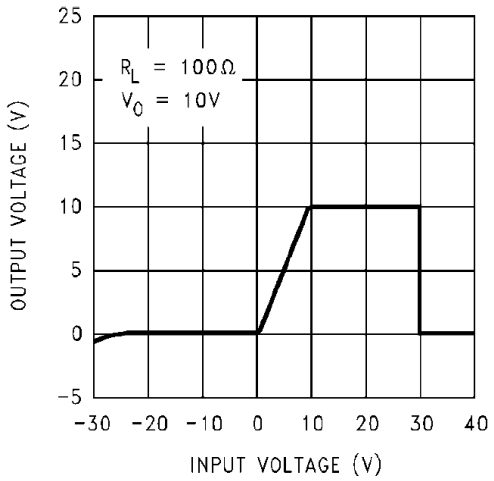
Output at Voltage Extremes



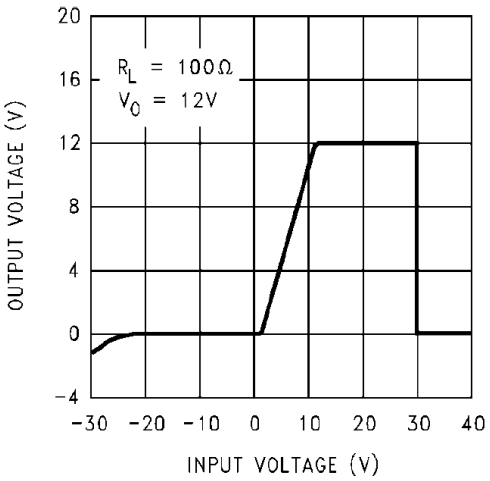
Output at Voltage Extremes



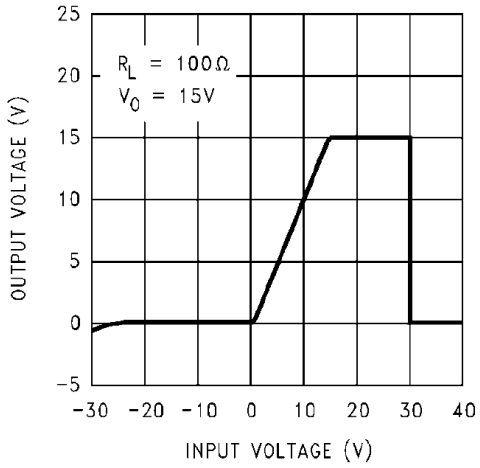
Output at Voltage Extremes



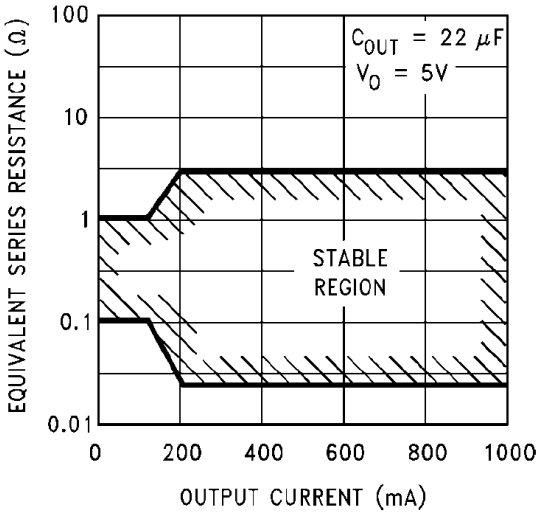
Output at Voltage Extremes



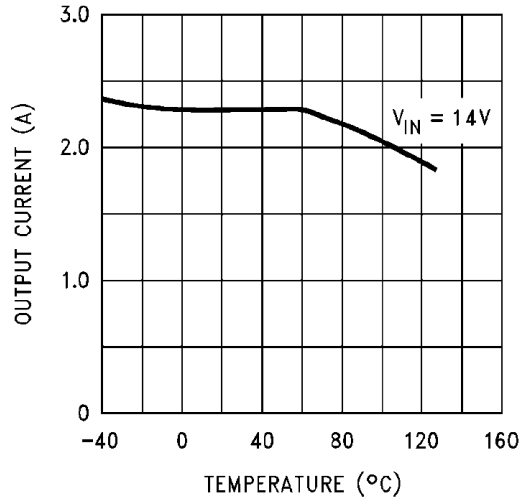
Output at Voltage Extremes



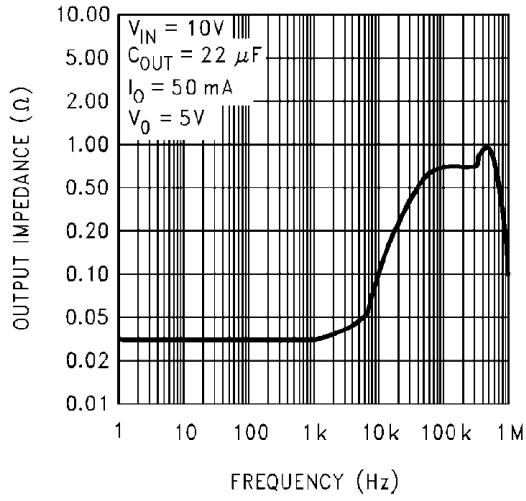
Output Capacitor ESR



Peak Output Current

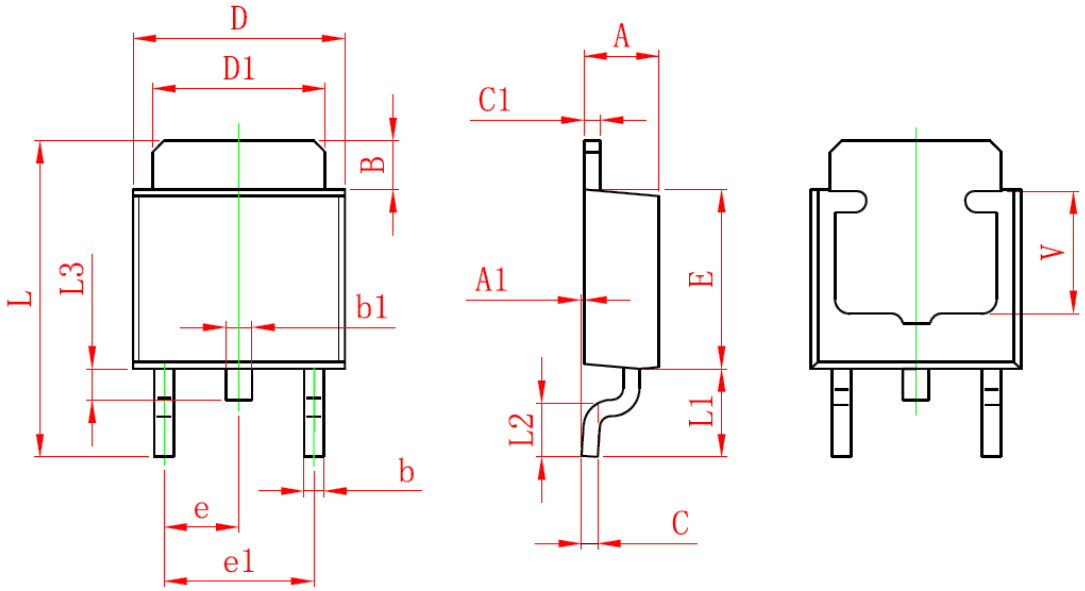


Output Impedance



Outline Dimensions

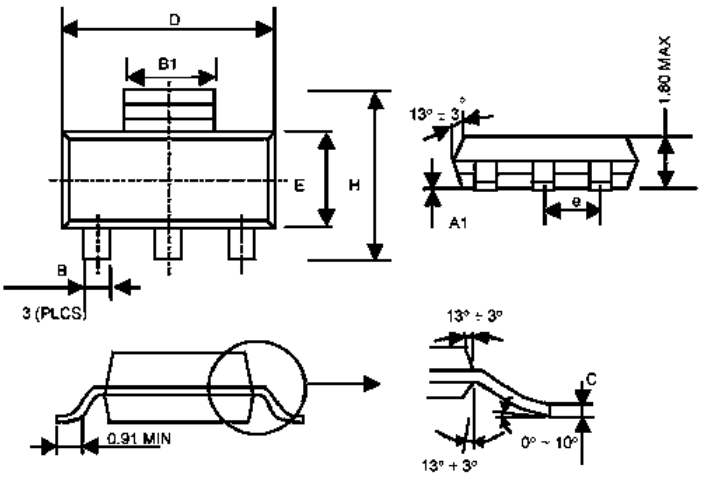
TO-252 Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
B	1.350	1.650	0.053	0.065
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.430	0.580	0.017	0.023
c1	0.430	0.580	0.017	0.023
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	5.700	0.213	0.224
e	2.300 TYP.		0.091 TYP.	
e1	4.500	4.700	0.177	0.185
L	9.500	9.900	0.374	0.390
L1	2.550	2.900	0.100	0.114
L2	1.400	1.780	0.055	0.070
L3	0.600	0.900	0.024	0.035
V	3.800 REF.		0.150 REF.	

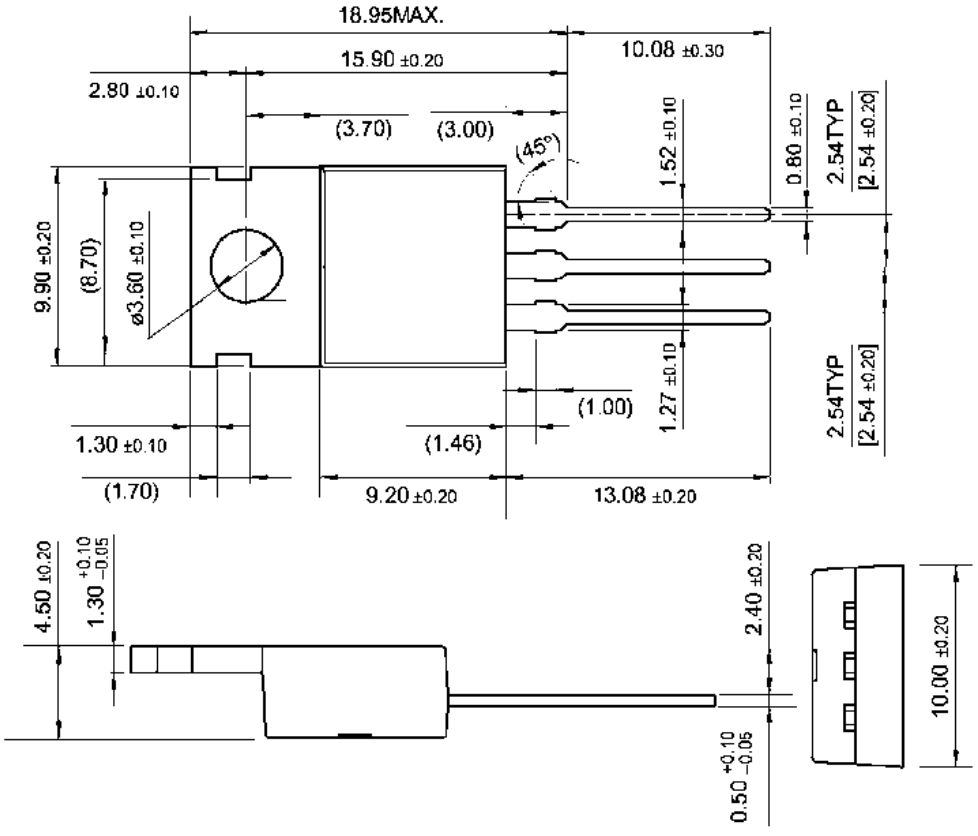
SOT-223 Unit: mm

- **SOT-223**

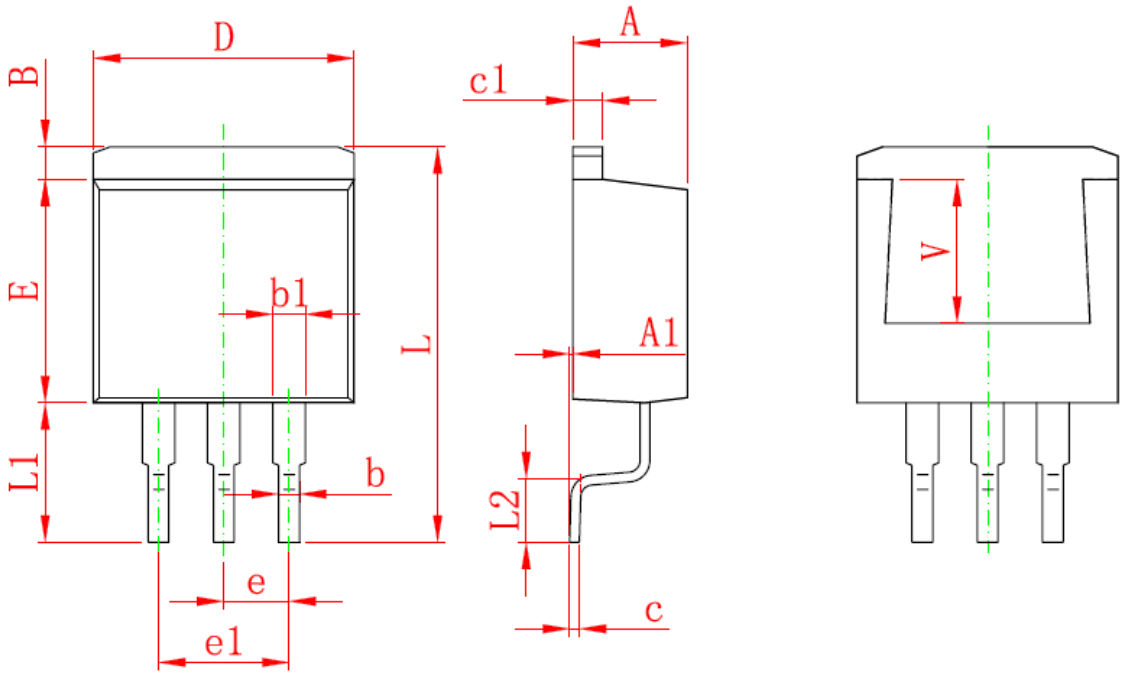


SYMBOL	MIN	MAX
A1	0.02	0.12
B	0.60	0.80
B1	2.90	3.15
C	0.24	0.35
D	6.30	6.80
E	3.30	3.70
e	2.30 (TYP.)	
H	6.70	7.30

TO-220 Unit: mm



TO-263 Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.170	1.370	0.046	0.054
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
e	2.540 TYP		0.100 TYP	
e1	4.980	5.180	0.196	0.204
L	15.050	15.450	0.593	0.608
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108
V	5.600 REF		0.220 REF	