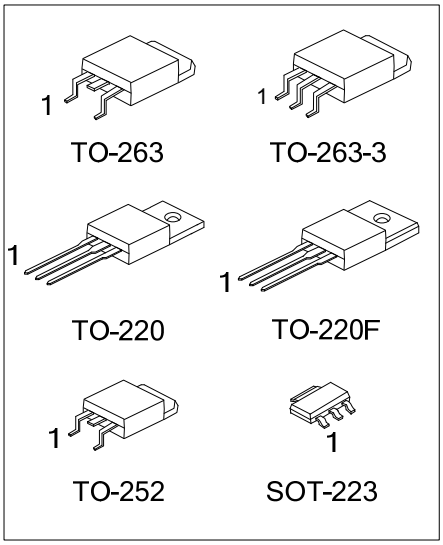
LM2940

LINEAR INTEGRATED CIRCUIT

1A LOW-DROPOUT POSITIVE VOLTAGE REGULATOR



■ DESCRIPTION

The UTC **LM2940** is a low dropout regulator designed to provide output current up to 1A with a typically 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.

UTC **LM2940** offers low quiescent current (typically 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).

■ FEATURES

* 500mV Typically Dropout at 1A
* Output Current in Excess of 1A
* Low Quiescent Current
* Reversed-Battery Protection
* Current Limit and Thermal Shutdown.
* Mirror Image Insertion Protection

■ ORDERING INFORMATION

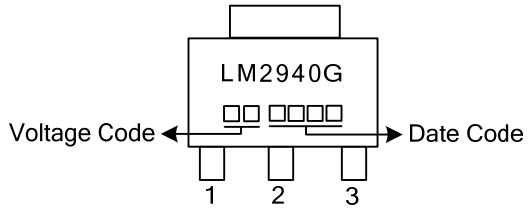
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
-	LM2940G-xx-AA3-R	SOT-223	I	G	O	Tape Reel
LM2940L-xx-TA3-T	LM2940G-xx-TA3-T	TO-220	I	G	O	Tube
LM2940L-xx-TF3-T	LM2940G-xx-TF3-T	TO-220F	I	G	O	Tube
LM2940L-xx-TN3-R	LM2940G-xx-TN3-R	TO-252	I	G	O	Tape Reel
LM2940L-xx-TQ2-R	LM2940G-xx-TQ2-R	TO-263	I	G	O	Tape Reel
LM2940L-xx-TQ2-T	LM2940G-xx-TQ2-T	TO-263	I	G	O	Tube
LM2940L-xx-TQ3-R	LM2940G-xx-TQ3-R	TO-263-3	I	G	O	Tape Reel
LM2940L-xx-TQ3-T	LM2940G-xx-TQ3-T	TO-263-3	I	G	O	Tube

Notes: 1. xx: Output Voltage, refer to Marking Information.
2. Pin Assignment: I: V_{IN} G: GND O:V_{OUT}

LM2940G-xx-AA3-R
(1)Packing Type
(2)Package Type
(3)Output Voltage Code
(4)Green Package

(1) R: Tape Reel, T: Tube
(2) AA3: SOT-223, TA3: TO-220, TF3: TO-220F
TN3: TO-252, TQ2: TO-263, TQ3: TO-263-3
(3) xx: refer to Marking Information
(4) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING INFORMATION

<table>
<tr><th>PACKAGE</th><th>VOLTAGE CODE</th><th>MARKING</th></tr>
<tr><td>SOT-223</td><td rowspan="2">50 : 5V
60 : 6V
80 : 8V
90 : 9V
10 :10V
12 :12V
15 :15V</td><td> 
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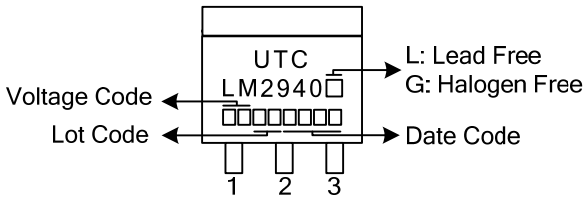
TO-252
TO-263
TO-263-3</td><td> 
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■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNIT
Input Voltage		V_{IN}	26	V
Power Dissipation		P_D	Internally limited	
Junction Temperature		T_J	+150	°C
Ambient Operating Temperature	TO-220/TO-220F TO-263-3/TO-263	T_{OPR}	-40 ~ +125	°C
	SOT-223/ TO-252		-40 ~ +85	
Storage Temperature		T_{STG}	-65 ~ +150	°C

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.

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	SOT-223	θ_{JA}	174	°C/W
	TO-220/TO-220F		60	
	TO-263/TO-263-3		80	
	TO-252		125	
Junction to Case	TO-220/TO-263 TO-263-3	θ_{JC}	4	°C/W
	TO-220F		6	
	TO-252		12	
	SOT-223		15	

■ ELECTRICAL CHARACTERISTICS

(T_A=T_J =25°C, V_{IN}=V_{OUT}+5V, I_{OUT}=1A and C_{OUT}=22μF, unless otherwise specified.)

For LM2940-5.0V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	6.25V ≤ V_{IN} ≤ 26V, 5mA ≤ I_{OUT} ≤ 1A	4.85	5.00	5.15	V
Line Regulation	△V_{OUT}	V_{OUT}+2V ≤ V_{IN} ≤ 26V, I_{OUT}=5mA		20	50	mV
Load Regulation	△V_{OUT}	50mA ≤ I_{OUT} ≤ 1A		35	50	mV
Output Impedance	R_{OUT}	100 mA DC and 20mA_{RMS}, f_O=120Hz		35		mΩ
Quiescent Current	I_Q	V_{OUT}+2V ≤ V_{IN} ≤ 26V, I_{OUT}=5mA		10	15	mA
Output Noise Voltage	e_N	10Hz-100kHz, I_{OUT}=5mA		150		μV_{RMS}
Ripple Rejection	RR	f_O=120Hz, 1V_{RMS}, I_{OUT}=100mA	54	72		dB
Long Term Stability				20		mV/1000Hr
Dropout Voltage	V_D	I_{OUT}=1A		0.5	0.8	V
		I_{OUT}=100mA		0.13	0.15	
Short Circuit Current	I_{SC}	(Note)		2.5		A
Maximum Line Transient	T_{IN}	R_{OUT}=100Ω, T ≤ 100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_{OUT}=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_{OUT}=100Ω, T ≤ 100ms	-50	-75		V

■ ELECTRICAL CHARACTERISTICS(Cont.)

For LM2940-6.0V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	7.5V ≤ V_{IN} ≤ 26V, 5mA ≤ I_{OUT} ≤ 1A	5.82	6.00	6.18	V
Line Regulation	$\triangle V_{OUT}$	V_{OUT}+2V ≤ V_{IN} ≤ 26V, I_{OUT}=5mA		20	60	mV
Load Regulation	$\triangle V_{OUT}$	50mA ≤ I_{OUT} ≤ 1A		40	60	mV
Output Impedance	R_{OUT}	100 mA DC and 20mA_{RMS}, f_O=120Hz		40		mΩ
Quiescent Current	I_Q	V_{OUT}+2V ≤ V_{IN} ≤ 26V, I_{OUT}=5mA		10	15	mA
Output Noise Voltage	e_N	10Hz-100kHz, I_{OUT}=5mA		180		μV_{RMS}
Ripple Rejection	RR	f_O=120Hz, 1V_{RMS}, I_{OUT}=100mA	60	72		dB
Long Term Stability				20		mV/1000Hr
Dropout Voltage	V_D	I_{OUT}=1A		0.5	0.8	V
		I_{OUT}=100mA		0.13	0.15	
Short Circuit Current	I_{SC}	(Note)		2.5		A
Maximum Line Transient	T_{IN}	R_{OUT}=100Ω, T ≤ 100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_{OUT}=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_{OUT}=100Ω, T ≤ 100ms	-50	-75		V

For LM2940-8.0V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	9.4V ≤ V_{IN} ≤ 26V, 5mA ≤ I_{OUT} ≤ 1A	7.76	8.00	8.24	V
Line regulation	$\triangle V_{OUT}$	V_{OUT} +2V ≤ V_{IN} ≤ 26V, I_{OUT}=5mA		20	80	mV
Load Regulation	$\triangle V_{OUT}$	50mA ≤ I_{OUT} ≤1A		55	80	mV
Output Impedance	R_{OUT}	100 mA DC and 20mA_{RMS}, f_O=120Hz		55		mΩ
Quiescent Current	I_Q	V_{OUT} +2V ≤ V_{IN} ≤ 26V, I_{OUT} =5mA		10	15	mA
Output Noise Voltage	e_N	10Hz-100kHz, I_{OUT} =5mA		240		μV_{RMS}
Ripple Rejection	RR	f_O=120Hz, 1V_{RMS}, I_{OUT} =100mA	54	66		dB
Long Term Stability				32		mV/1000Hr
Dropout Voltage	V_D	I_{OUT} =1A		0.5	0.8	V
		I_{OUT} =100mA		0.13	0.15	
Short Circuit Current	I_{SC}	(Note)		2.5		A
Maximum Line Transient	T_{IN}	R_{OUT}=100Ω, T ≤ 100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_{OUT}=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_{OUT}=100Ω, T ≤ 100ms	-50	-75		V

For LM2940-9.0V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	10.5V ≤ V_{IN} ≤ 26V, 5mA ≤ I_{OUT} ≤ 1A	8.73	9.00	9.27	V
Line regulation	$\triangle V_{OUT}$	V_{OUT} +2V ≤ V_{IN} ≤ 26V, I_{OUT} =5mA		20	90	mV
Load Regulation	$\triangle V_{OUT}$	50mA ≤ I_{OUT} ≤ 1A		60	90	mV
Output Impedance	R_{OUT}	100 mA DC and 20mA_{RMS}, f_O=120Hz		60		mΩ
Quiescent Current	I_Q	V_{OUT} +2V ≤ VIN ≤ 26V, I_{OUT} =5mA		10	15	mA
Output Noise Voltage	e_N	10Hz-100kHz, I_{OUT} =5mA		270		μV_{RMS}
Ripple Rejection	RR	f_O=120Hz, 1V_{RMS}, I_{OUT} =100mA	52	64		dB
Long Term Stability				34		mV/1000Hr
Dropout Voltage	V_D	I_{OUT} =1A		0.5	0.8	V
		I_{OUT} =100mA		0.13	0.15	
Short Circuit Current	I_{SC}	(Note)		2.5		A
Maximum Line Transient	T_{IN}	R_{OUT}=100Ω, T ≤ 100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_{OUT}=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_{OUT}=100Ω, T ≤ 100ms	-50	-75		V

■ ELECTRICAL CHARACTERISTICS(Cont.)

For LM2940-10V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	11.5V ≤ V_{IN} ≤ 26V, 5mA ≤ I_{OUT} ≤ 1A	9.70	10.00	10.30	V
Line regulation	$\triangle V_{OUT}$	V_{OUT} +2V ≤ V_{IN} ≤ 26V, I_{OUT} =5mA		20	100	mV
Load Regulation	$\triangle V_{OUT}$	50mA ≤ I_{OUT} ≤ 1A		65	100	mV
Output Impedance	R_{OUT}	100mA DC and 20mA_{RMS}, f_O=120Hz		65		mΩ
Quiescent Current	I_Q	V_{OUT} +2V ≤ V_{IN} ≤ 26V, I_{OUT} =5mA		10	15	mA
Output Noise Voltage	e_N	10Hz-100kHz, I_{OUT} =5mA		300		μV_{RMS}
Ripple Rejection	RR	f_O=120Hz, 1V_{RMS}, I_{OUT} =100mA	51	63		dB
Long Term Stability				36		mV/1000Hr
Dropout Voltage	V_D	I_{OUT} =1A		0.5	0.8	V
		I_{OUT} =100mA		0.13	0.15	
Short Circuit Current	I_{SC}	(Note)		2.5		A
Maximum Line Transient	T_{IN}	R_{OUT}=100Ω, T ≤ 100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_{OUT}=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_{OUT}=100Ω, T ≤ 100ms	-50	-75		V

UTC LM2940-12V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	13.6V ≤ V_{IN} ≤ 26V, 5mA ≤ I_{OUT} ≤ 1A	11.64	12.00	12.36	V
Line regulation	$\triangle V_{OUT}$	V_{OUT} +2V ≤ V_{IN} ≤ 26V, I_{OUT} =5mA		20	120	mV
Load Regulation	$\triangle V_{OUT}$	50mA ≤ I_{OUT} ≤ 1A		55	120	mV
Output Impedance	R_{OUT}	100mA DC and 20mA_{RMS}, f_O=120Hz		80		mΩ
Quiescent Current	I_Q	V_{OUT} +2V ≤ V_{IN} ≤ 26V, I_{OUT} =5mA		10	15	mA
Output Noise Voltage	e_N	10Hz-100kHz, I_{OUT} =5mA		360		μV_{RMS}
Ripple Rejection	RR	f_O=120Hz, 1V_{RMS}s, I_{OUT} =100mA	54	66		dB
Long Term Stability				48		mV/1000Hr
Dropout Voltage	V_D	I_{OUT} =1A		0.5	0.8	V
		I_{OUT} =100mA		0.11	0.15	
Short Circuit Current	I_{SC}	(Note)		2.5		A
Maximum Line Transient	T_{IN}	R_{OUT}=100Ω, T ≤ 100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_{OUT}=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_{OUT}=100Ω, T ≤ 100ms	-50	-75		V

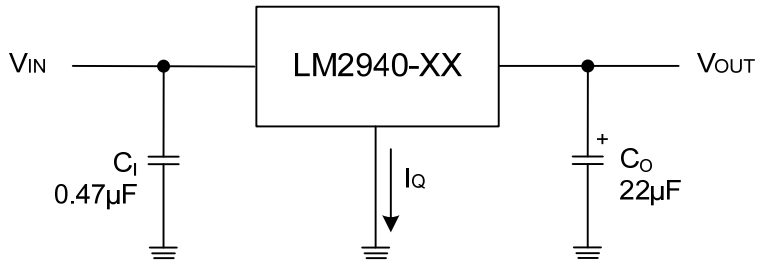
■ ELECTRICAL CHARACTERISTICS(Cont.)

UTC LM2940-15V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	16.75V ≤ V_{IN} ≤ 26V, 5mA ≤ I_{OUT} ≤ 1A	14.55	15.00	15.45	V
Line regulation	$\triangle V_{OUT}$	V_{OUT} +2V ≤ V_{IN} ≤ 26V, I_{OUT} =5mA		20	150	mV
Load Regulation	$\triangle V_{OUT}$	50mA ≤ I_{OUT} ≤ 1A		70	150	mV
Output Impedance	R_{OUT}	100mA DC and 20mA_{RMS}, f_O=120Hz		100		mΩ
Quiescent Current	I_Q	V_{OUT} +2V ≤ V_{IN} ≤ 26V, I_{OUT} =5mA		10	15	mA
Output Noise Voltage	e_N	10Hz-100kHz, I_{OUT} =5mA		450		μV_{RMS}
Ripple Rejection	RR	f_O=120Hz, 1V_{RMS}, I_{OUT} =100mA	52	64		dB
Long Term Stability				60		mV/1000Hr
Dropout Voltage	V_D	I_{OUT} =1A		0.5	0.8	V
		I_{OUT} =100mA		0.11	0.15	
Short Circuit Current	I_{SC}	(Note)		2.5		A
Maximum Line Transient	T_{IN}	R_{OUT}=100Ω, T ≤ 100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	R_{OUT}=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	R_{OUT}=100Ω, T ≤ 100ms	-50	-75		V

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

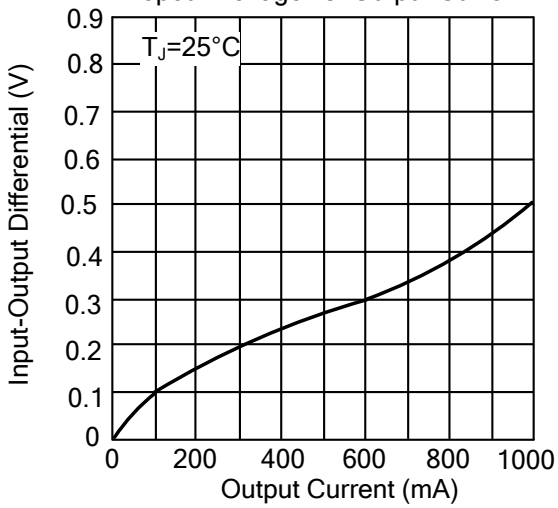
■ TYPICAL APPLICATION



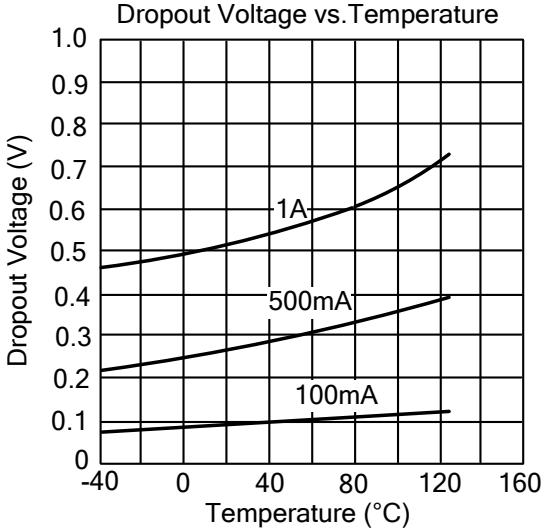
Note: 1. C_1 is required if regulator is located far from power supply filter.
2. C_O must be higher than 22μF for stability, and locate as close as possible to the regulator.

■ TYPICAL CHARACTERISTICS

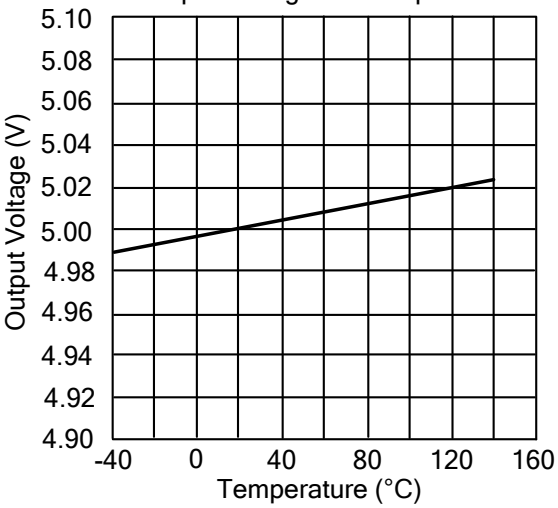
Dropout Voltage vs. Output Current



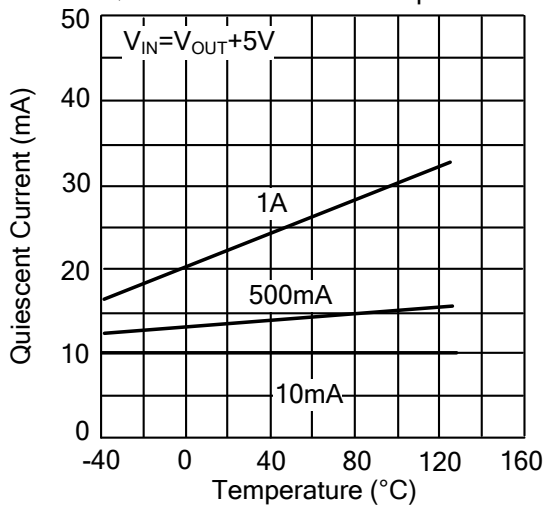
Dropout Voltage vs.Temperature



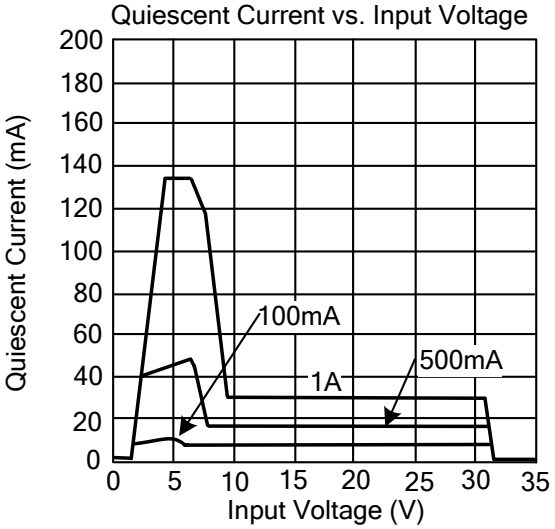
Output Voltage vs. Temperature



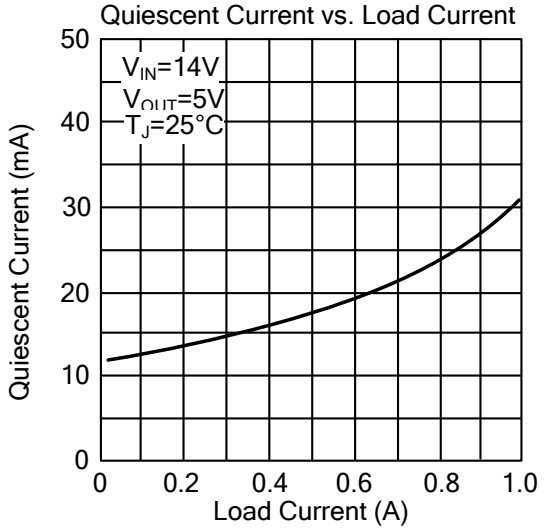
Quiescent Current vs. Temperature



Quiescent Current vs. Input Voltage

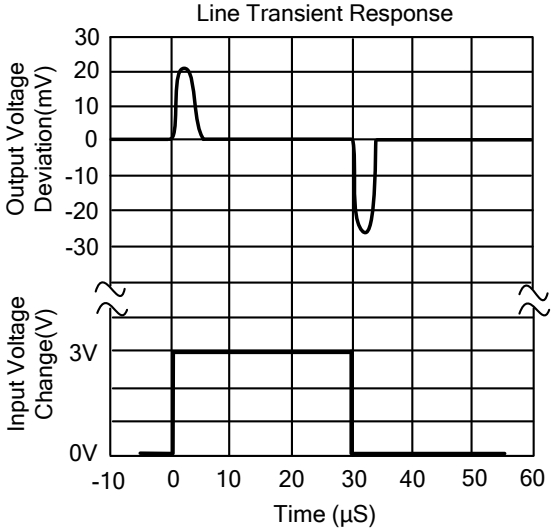


Quiescent Current vs. Load Current

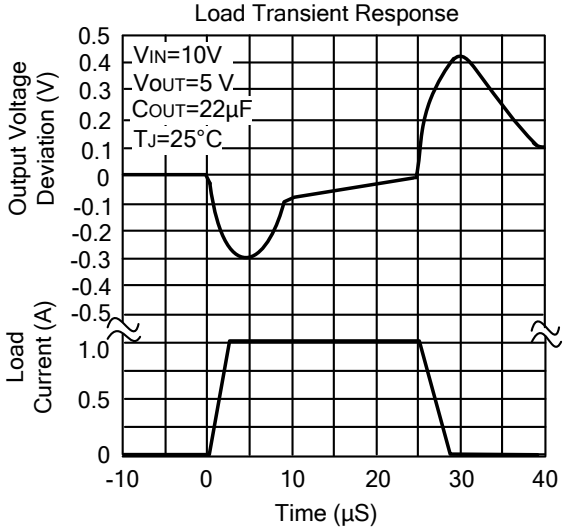


■ TYPICAL CHARACTERISTICS (Cont.)

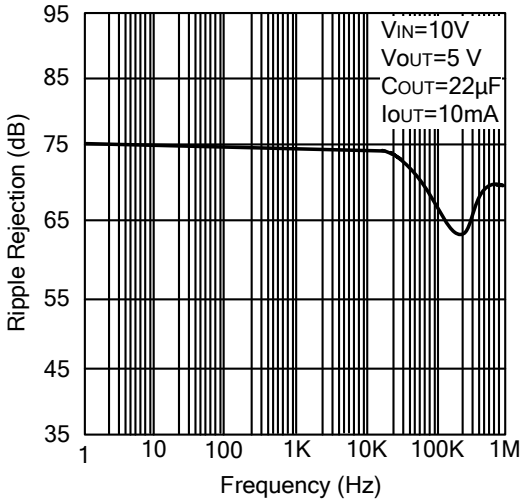
Line Transient Response



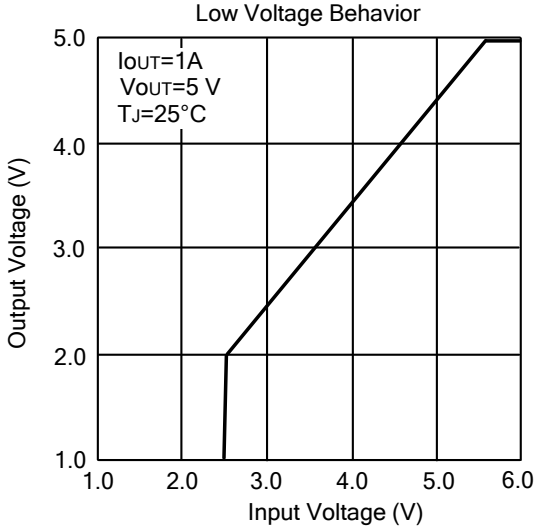
Load Transient Response



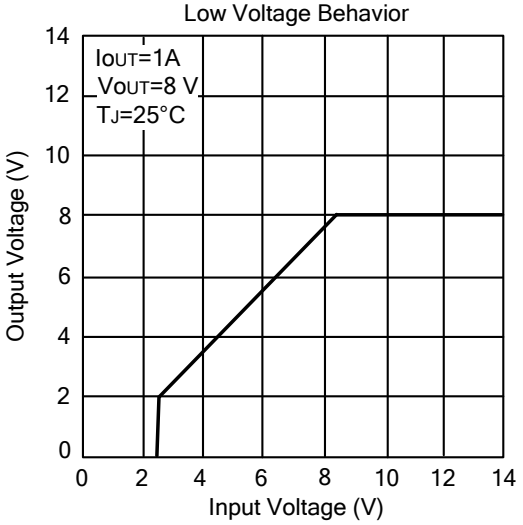
Ripple Rejection vs. Frequency



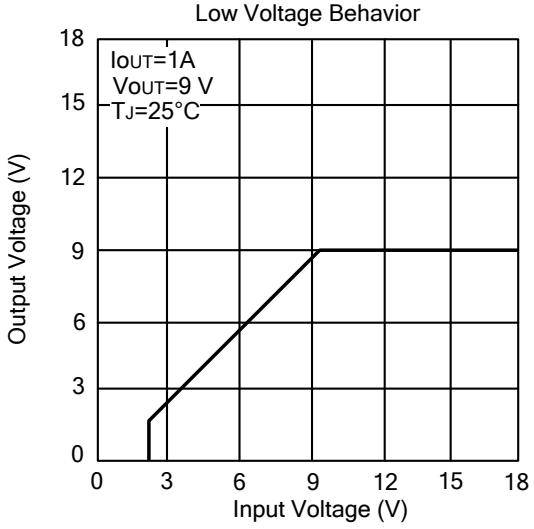
Low Voltage Behavior



Low Voltage Behavior

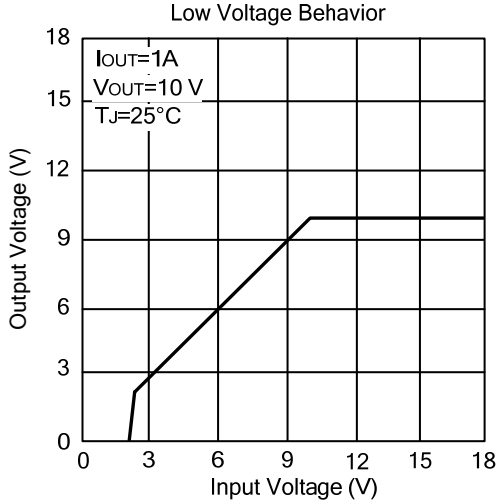


Low Voltage Behavior

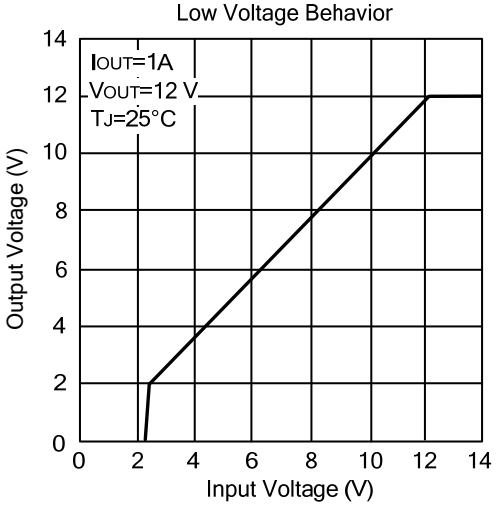


■ TYPICAL CHARACTERISTICS (Cont.)

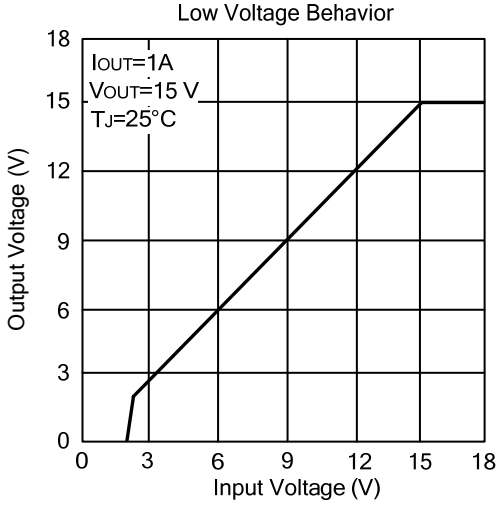
Low Voltage Behavior



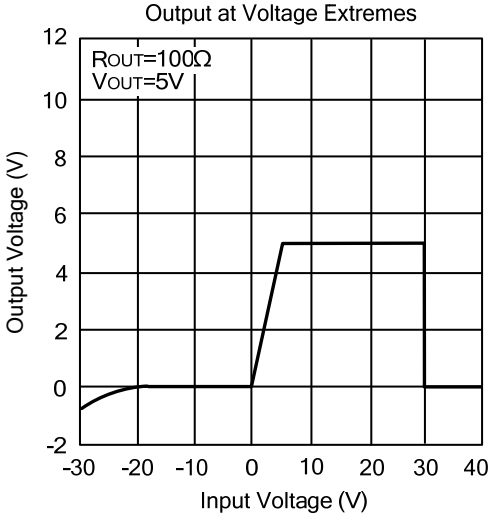
Low Voltage Behavior



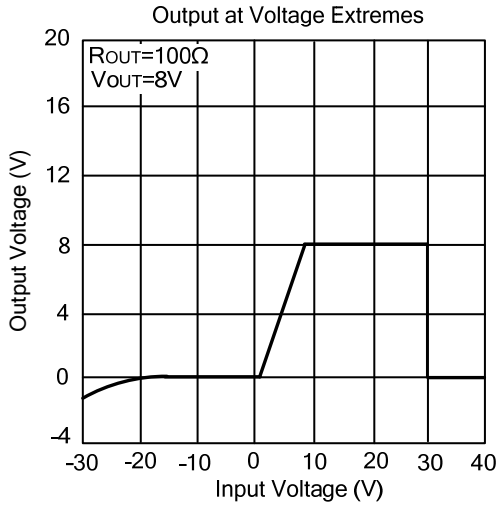
Low Voltage Behavior



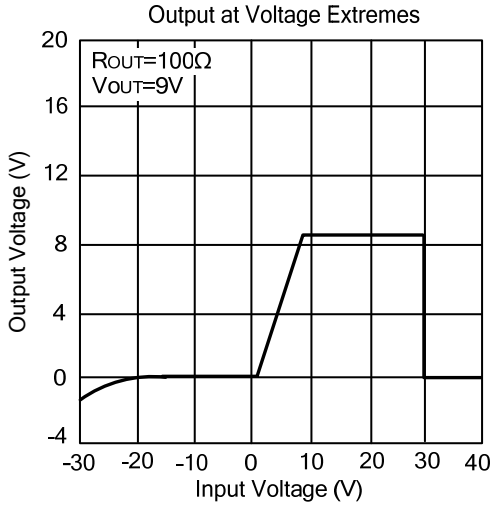
Output at Voltage Extremes



Output at Voltage Extremes

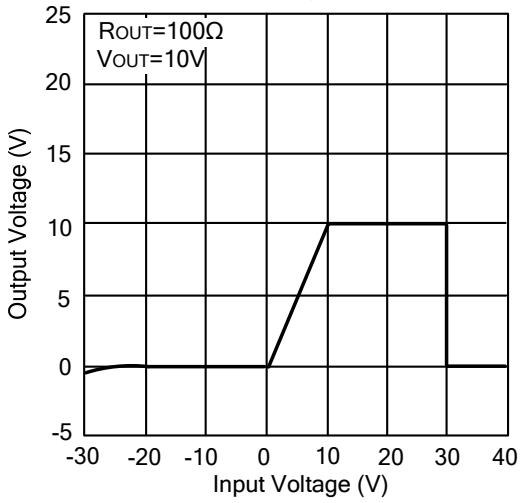


Output at Voltage Extremes

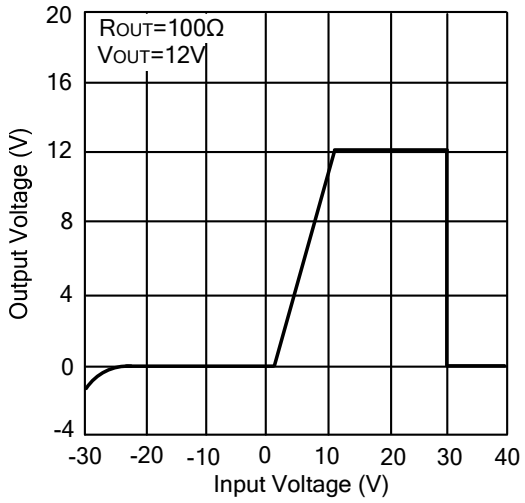


■ TYPICAL CHARACTERISTICS (Cont.)

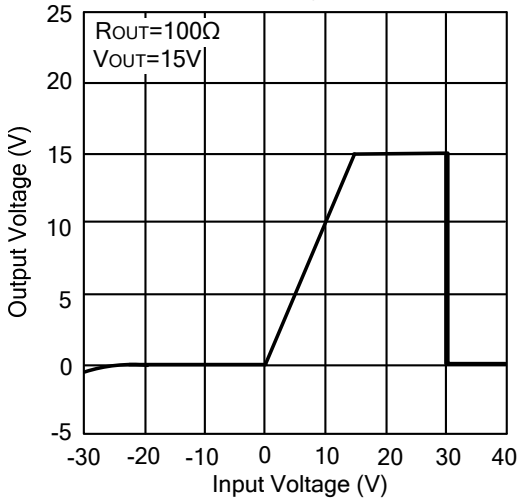
Output at Voltage Extremes



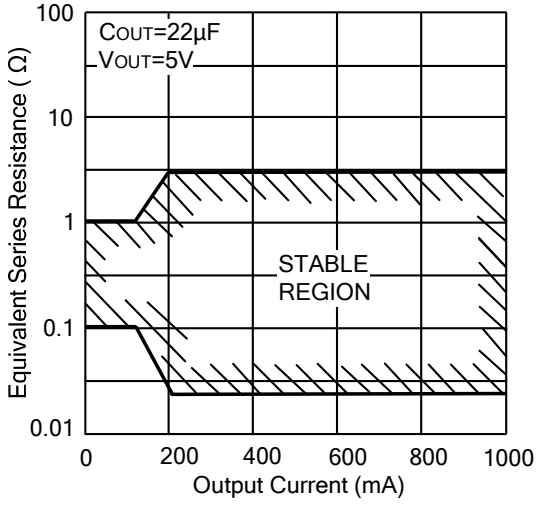
Output at Voltage Extremes



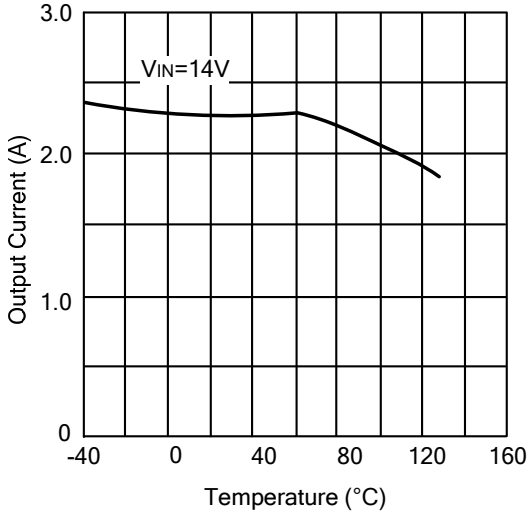
Output at Voltage Extremes



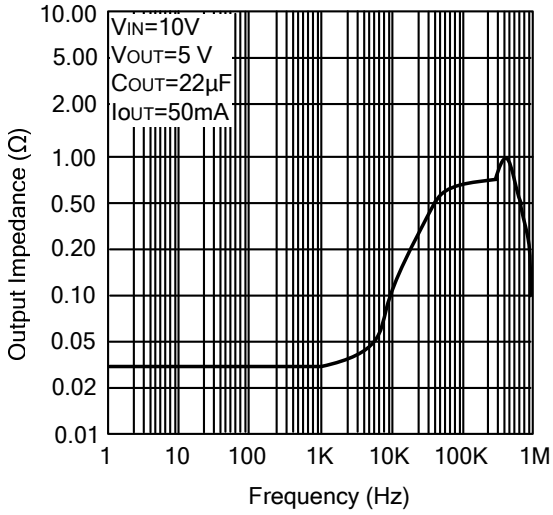
Output Capacitor ESR



Peak Output Current

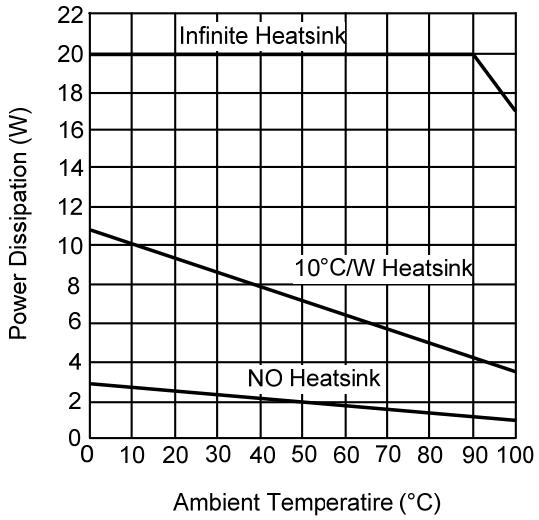


Output Impedance



■ TYPICAL CHARACTERISTICS (Cont.)

Maximum Power Dissipation (TO-220)



Maximum Power Dissipation (TO-263-3)