



## 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 ( $V_{IN}-V_{OUT}\leq 3V$ ).

#### 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

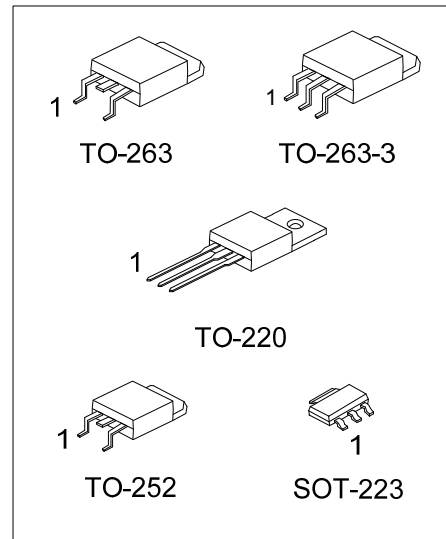
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
LM2940L-xx-AA3-R	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-TN3-R	LM2940G-xx-TN3-R	TO-252	I	G	O	Tape Reel
LM2940L-xx-TN3-T	LM2940G-xx-TN3-T	TO-252	I	G	O	Tube
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

Note: 1. xx: Output Voltage, refer to Marking Information.

2. Pin Assignment: I:  $V_{IN}$  G: GND O:  $V_{OUT}$

<p>LM2940L-xx-AA3-R</p> <p>(1)Packing Type (2)Package Type (3)Output Voltage Code (4)Lead Free</p>	<p>(1) R: Tape Reel, T: Tube (2) AA3: SOT-223, TA3: TO-220, TN3: TO-252, TQ2: TO-263, TQ3: TO-263-3 (3) xx: refer to Marking Information (4) G: Halogen Free, L: Lead Free</p>
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### MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223	50 : 5V 60 : 6V 80 : 8V 90 : 9V	
TO-220 TO-252 TO-263 TO-263-3	10 : 10V 12 : 12V 15 : 15V	

### ■ 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-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	$\theta_{JA}$	174	°C/W
	TO-220		60	
	TO-263/TO-263-3		80	
	TO-252		125	
Junction to Case	TO-220/ TO-263/TO-263-3	$\theta_{JC}$	4	°C/W
	TO-252		12	
	SOT-223		15	

### ■ ELECTRICAL CHARACTERISTICS

( $T_A=T_J=25^\circ\text{C}$ ,  $V_{IN}=V_{OUT}+5\text{V}$ ,  $I_{OUT}=1\text{A}$  and  $C_{OUT}=22\mu\text{F}$ , unless otherwise specified.)

#### For LM2940-5.0V

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

■ ELECTRICAL CHARACTERISTICS(Cont.)

**For LM2940-6.0V**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$7.5V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$	5.82	6.00	6.18	V
Line Regulation	$\Delta V_{OUT}$	$V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$		20	60	mV
Load Regulation	$\Delta V_{OUT}$	$50mA \leq I_{OUT} \leq 1A$		40	60	mV
Output Impedance	$R_{OUT}$	100 mA DC and $20mA_{RMS}, f_o=120Hz$		40		m $\Omega$
Quiescent Current	$I_Q$	$V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$		10	15	mA
Output Noise Voltage	$e_N$	10Hz-100kHz, $I_{OUT}=5mA$		180		$\mu V_{RMS}$
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	$T_{IN}$	$R_{OUT}=100\Omega, T \leq 100ms$	60	75		V
Reverse Polarity DC Input Voltage	$V_{RIN}$	$R_{OUT}=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	$V_{TRRI}$	$R_{OUT}=100\Omega, T \leq 100ms$	-50	-75		V

**For LM2940-8.0V**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$9.4V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$	7.76	8.00	8.24	V
Line regulation	$\Delta V_{OUT}$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$		20	80	mV
Load Regulation	$\Delta V_{OUT}$	$50mA \leq I_{OUT} \leq 1A$		55	80	mV
Output Impedance	$R_{OUT}$	100 mA DC and $20mA_{RMS}, f_o=120Hz$		55		m $\Omega$
Quiescent Current	$I_Q$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		10	15	mA
Output Noise Voltage	$e_N$	10Hz-100kHz, $I_{OUT} = 5mA$		240		$\mu V_{RMS}$
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	$T_{IN}$	$R_{OUT}=100\Omega, T \leq 100ms$	60	75		V
Reverse Polarity DC Input Voltage	$V_{RIN}$	$R_{OUT}=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	$V_{TRRI}$	$R_{OUT}=100\Omega, T \leq 100ms$	-50	-75		V

**For LM2940-9.0V**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$10.5V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$	8.73	9.00	9.27	V
Line regulation	$\Delta V_{OUT}$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		20	90	mV
Load Regulation	$\Delta V_{OUT}$	$50mA \leq I_{OUT} \leq 1A$		60	90	mV
Output Impedance	$R_{OUT}$	100 mA DC and $20mA_{RMS}, f_o=120Hz$		60		m $\Omega$
Quiescent Current	$I_Q$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		10	15	mA
Output Noise Voltage	$e_N$	10Hz-100kHz, $I_{OUT} = 5mA$		270		$\mu V_{RMS}$
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	$T_{IN}$	$R_{OUT}=100\Omega, T \leq 100ms$	60	75		V
Reverse Polarity DC Input Voltage	$V_{RIN}$	$R_{OUT}=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	$V_{TRRI}$	$R_{OUT}=100\Omega, T \leq 100ms$	-50	-75		V

■ ELECTRICAL CHARACTERISTICS(Cont.)

For LM2940-10V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$11.5V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$	9.70	10.00	10.30	V
Line regulation	$\Delta V_{OUT}$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		20	100	mV
Load Regulation	$\Delta V_{OUT}$	$50mA \leq I_{OUT} \leq 1A$		65	100	mV
Output Impedance	$R_{OUT}$	100mA DC and 20mA <sub>RMS</sub> , $f_0=120Hz$		65		m $\Omega$
Quiescent Current	$I_Q$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		10	15	mA
Output Noise Voltage	$e_N$	10Hz-100kHz, $I_{OUT} = 5mA$		300		$\mu V_{RMS}$
Ripple Rejection	RR	$f_0=120Hz, 1V_{RMS}, I_{OUT} = 100mA$	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	$T_{IN}$	$R_{OUT}=100\Omega, T \leq 100ms$	60	75		V
Reverse Polarity DC Input Voltage	$V_{RIN}$	$R_{OUT}=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	$V_{TRRI}$	$R_{OUT}=100\Omega, T \leq 100ms$	-50	-75		V

UTC LM2940-12V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$13.6V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$	11.64	12.00	12.36	V
Line regulation	$\Delta V_{OUT}$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		20	120	mV
Load Regulation	$\Delta V_{OUT}$	$50mA \leq I_{OUT} \leq 1A$		55	120	mV
Output Impedance	$R_{OUT}$	100mA DC and 20mA <sub>RMS</sub> , $f_0=120Hz$		80		m $\Omega$
Quiescent Current	$I_Q$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		10	15	mA
Output Noise Voltage	$e_N$	10Hz-100kHz, $I_{OUT} = 5mA$		360		$\mu V_{RMS}$
Ripple Rejection	RR	$f_0=120Hz, 1V_{RMS}, I_{OUT} = 100mA$	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	$T_{IN}$	$R_{OUT}=100\Omega, T \leq 100ms$	60	75		V
Reverse Polarity DC Input Voltage	$V_{RIN}$	$R_{OUT}=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	$V_{TRRI}$	$R_{OUT}=100\Omega, T \leq 100ms$	-50	-75		V

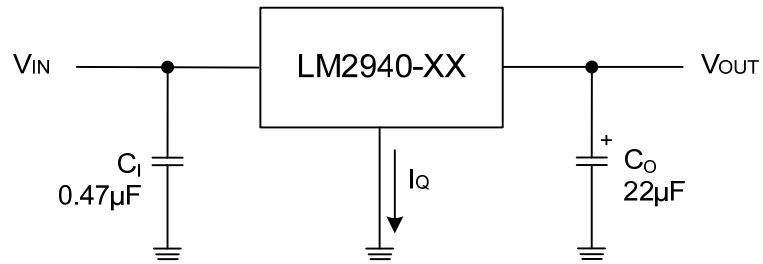
■ ELECTRICAL CHARACTERISTICS(Cont.)

UTC LM2940-15V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$16.75V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$	14.55	15.00	15.45	V
Line regulation	$\Delta V_{OUT}$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		20	150	mV
Load Regulation	$\Delta V_{OUT}$	$50mA \leq I_{OUT} \leq 1A$		70	150	mV
Output Impedance	$R_{OUT}$	100mA DC and 20mA <sub>RMS</sub> , $f_o=120Hz$		100		m $\Omega$
Quiescent Current	$I_Q$	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		10	15	mA
Output Noise Voltage	$e_N$	10Hz-100kHz, $I_{OUT} = 5mA$		450		$\mu V_{RMS}$
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	$T_{IN}$	$R_{OUT}=100\Omega, T \leq 100ms$	60	75		V
Reverse Polarity DC Input Voltage	$V_{RIN}$	$R_{OUT}=100\Omega$	-15	-30		V
Reverse Polarity Transient Input Voltage	$V_{TRRI}$	$R_{OUT}=100\Omega, T \leq 100ms$	-50	-75		V

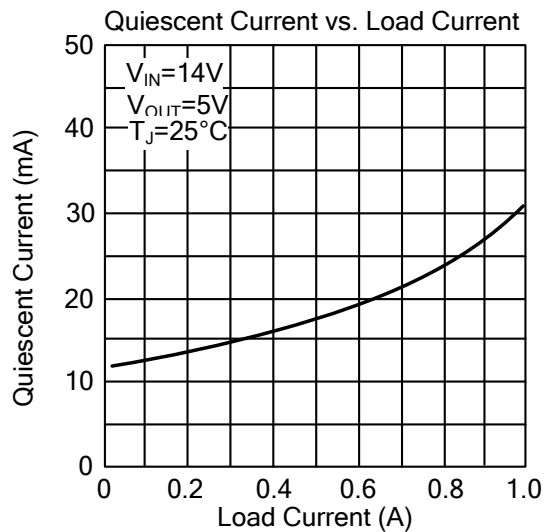
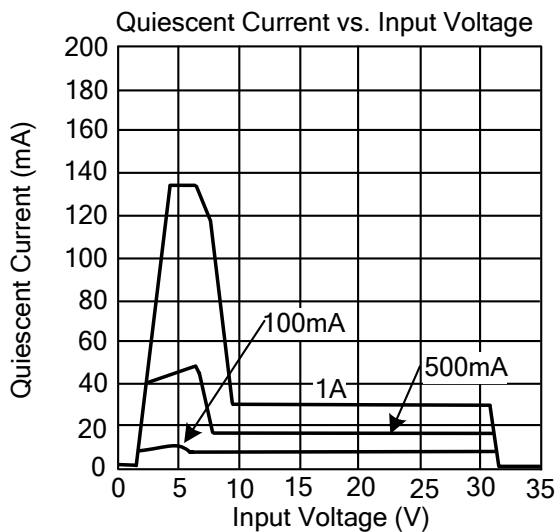
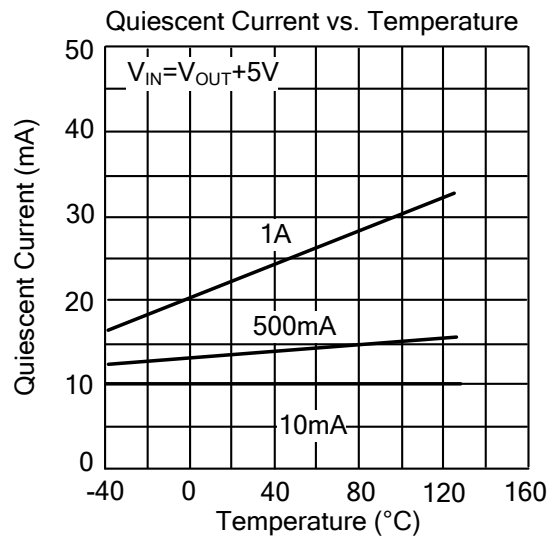
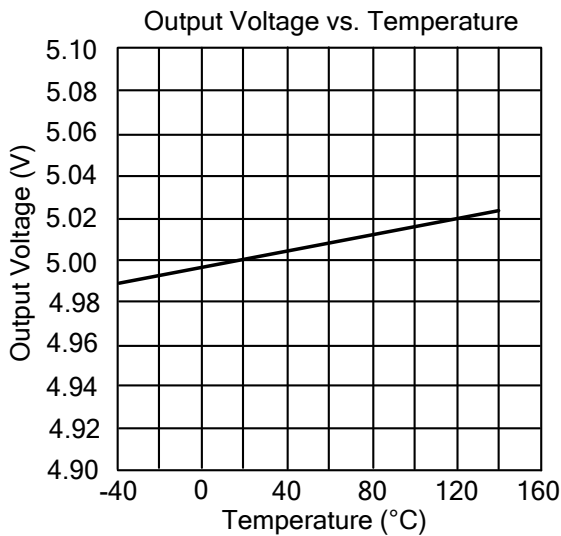
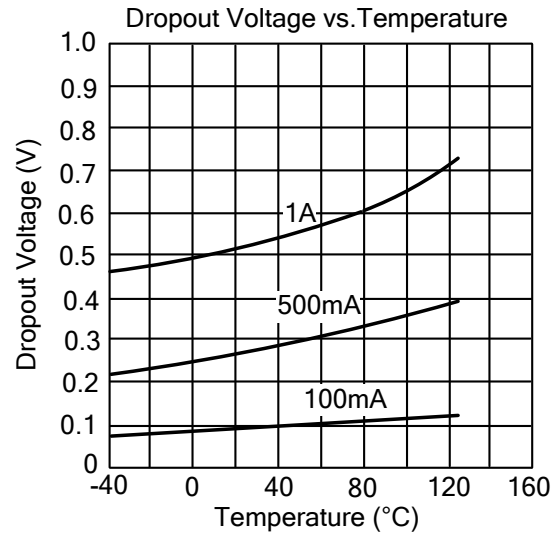
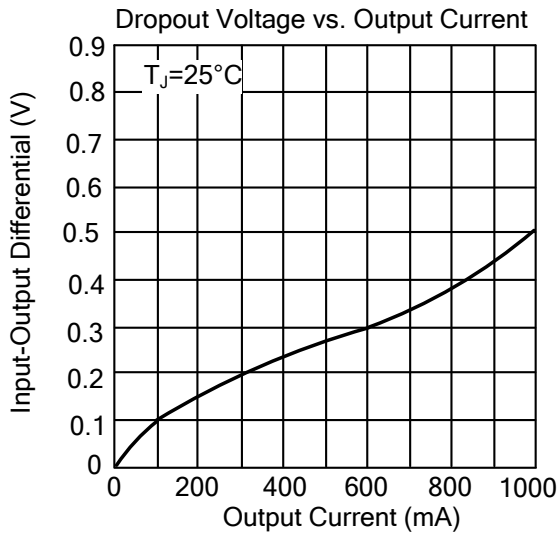
Note: Output current will decrease with temperature increase but will not drop below 1A at the maximum specified temperature.

### ■ TYPICAL APPLICATION



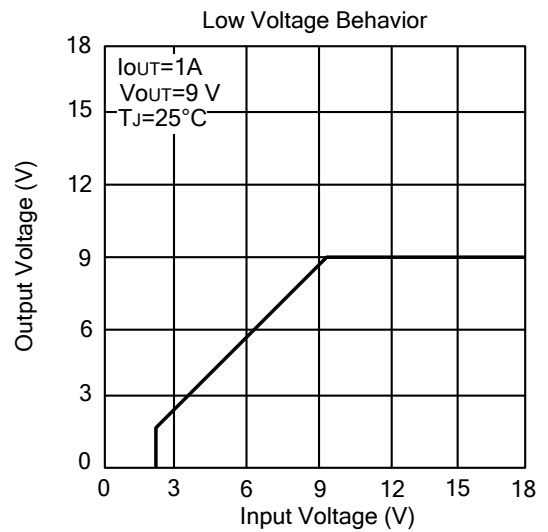
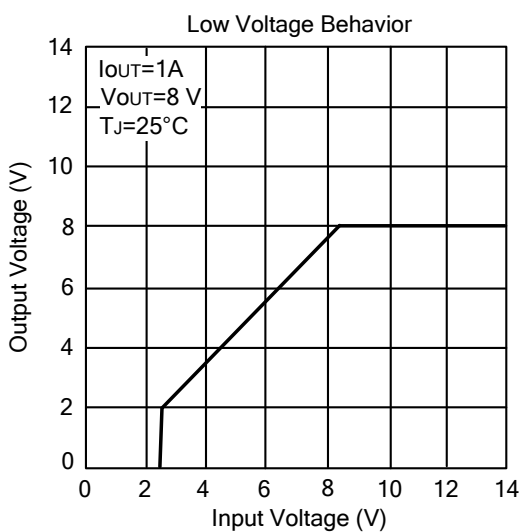
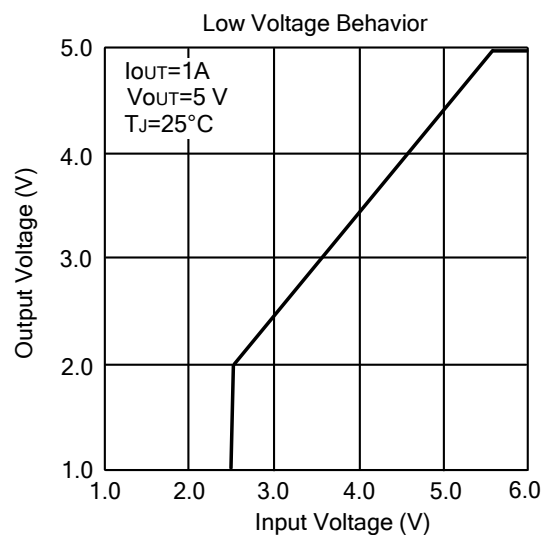
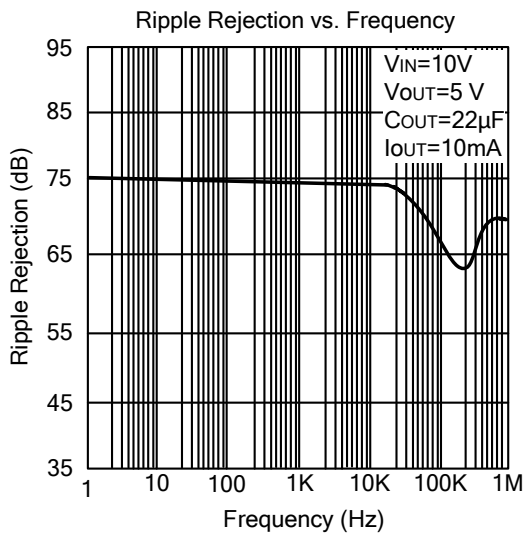
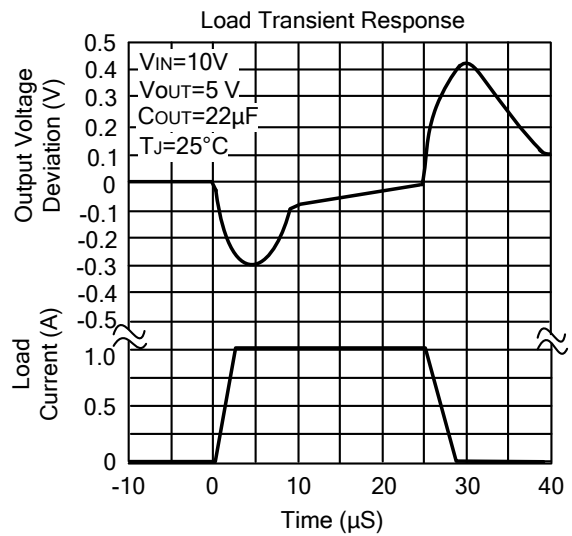
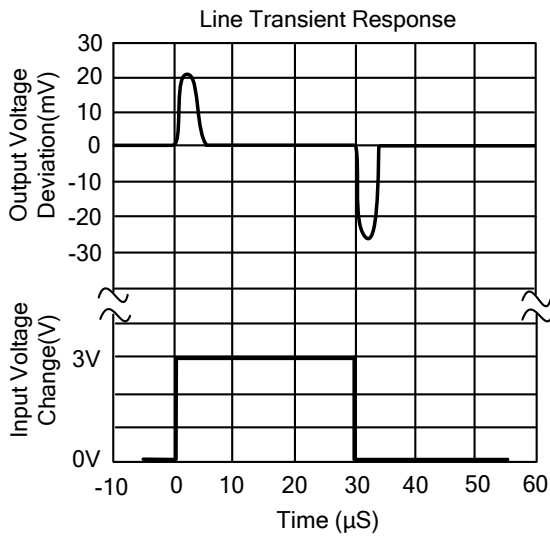
- Note: 1.  $C_1$  is required if regulator is located far from power supply filter.  
2.  $C_0$  must be higher than  $22\mu\text{F}$  for stability, and locate as close as possible to the regulator.

## TYPICAL CHARACTERISTICS

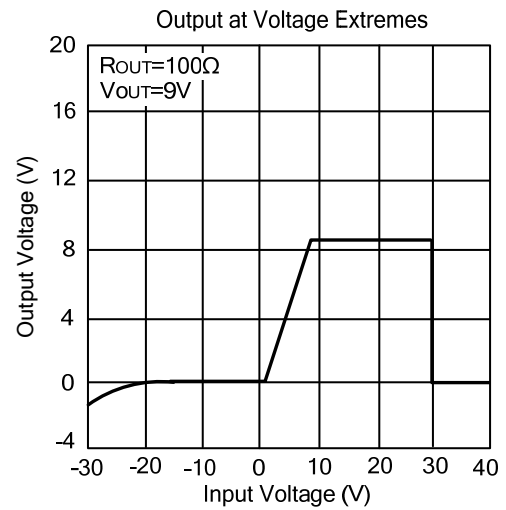
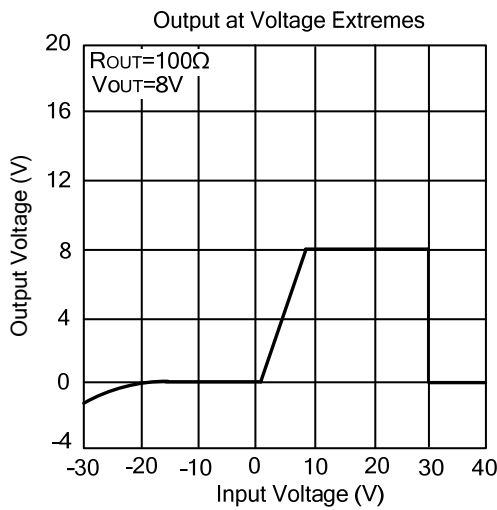
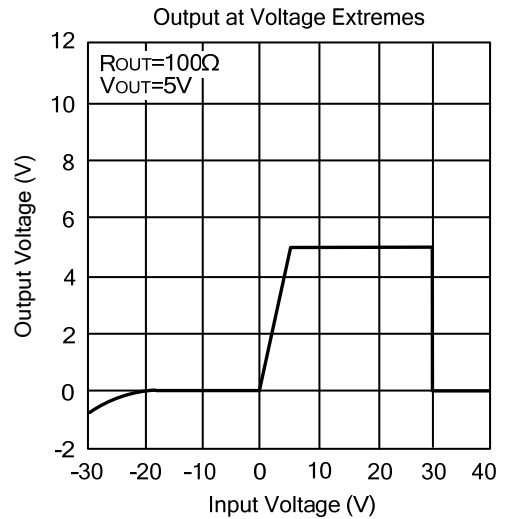
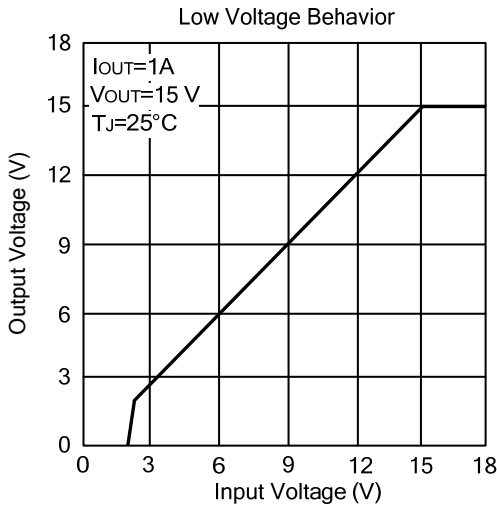
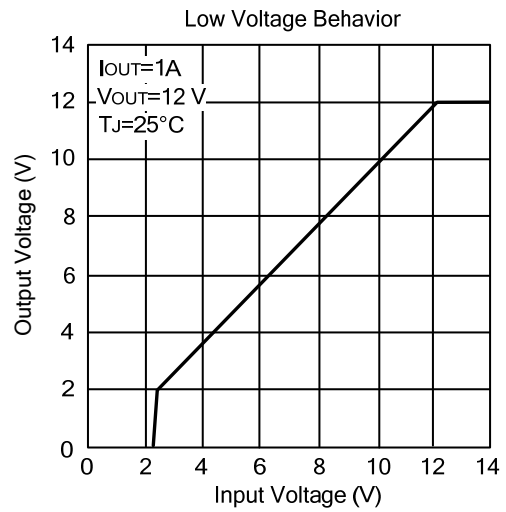
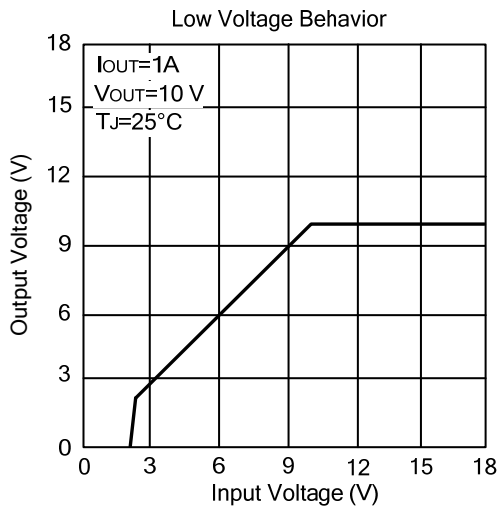




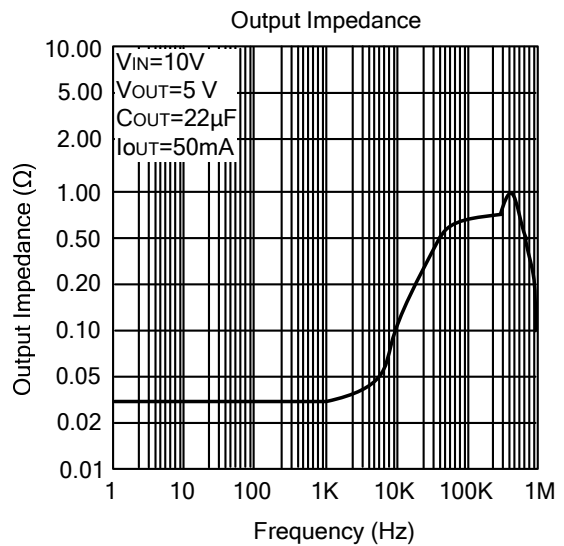
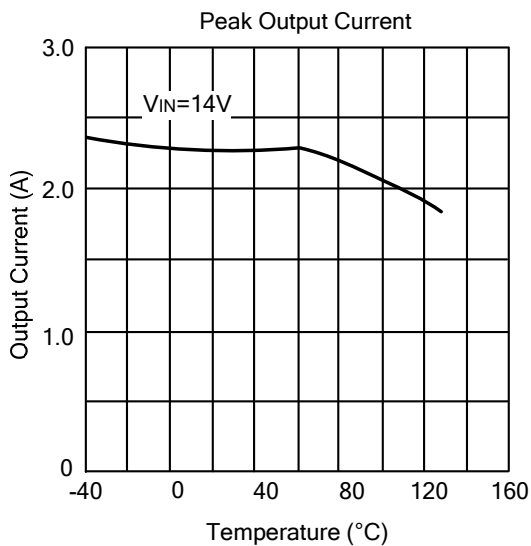
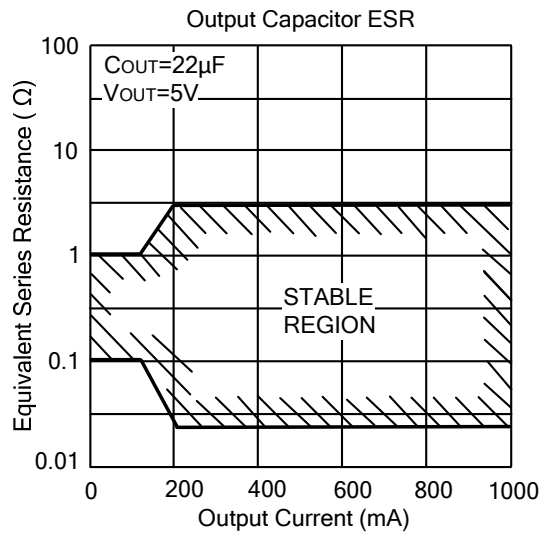
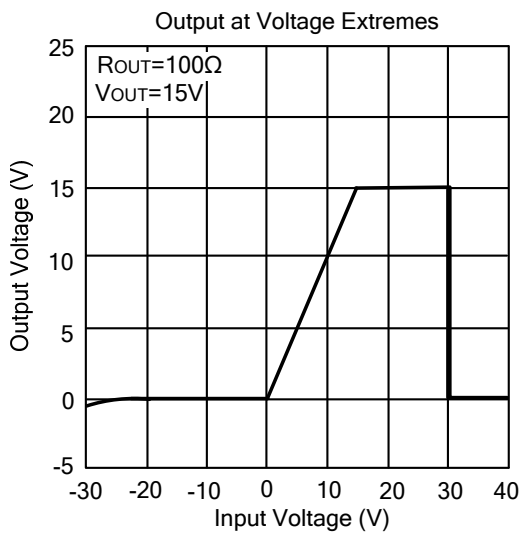
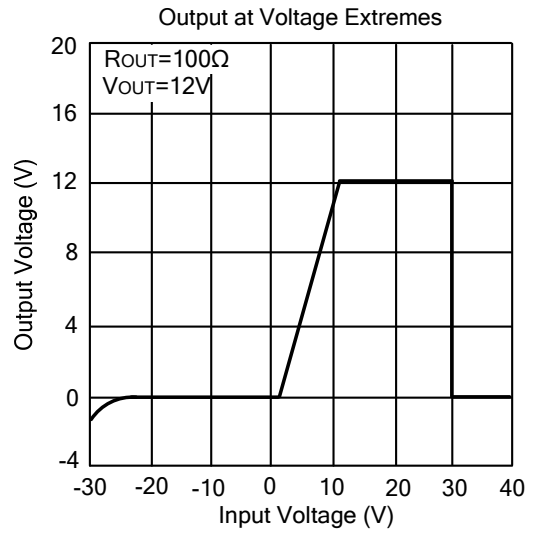
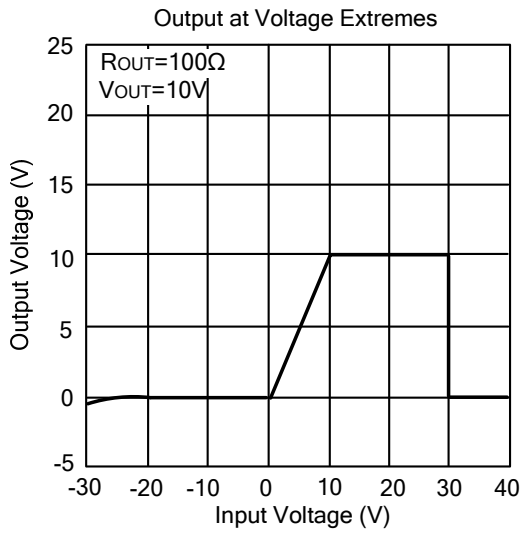
## ■ TYPICAL CHARACTERISTICS (Cont.)



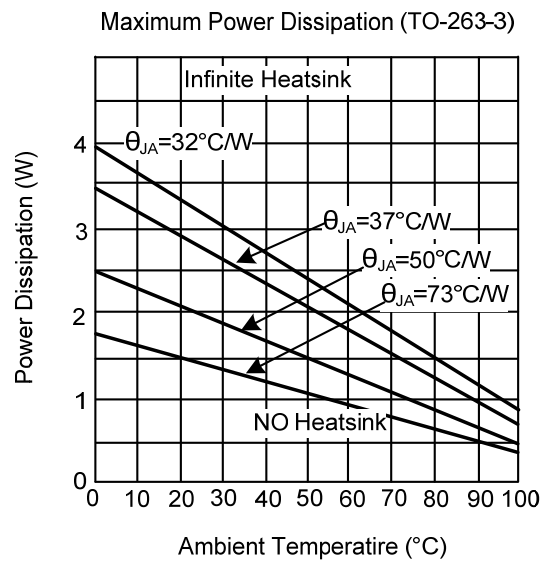
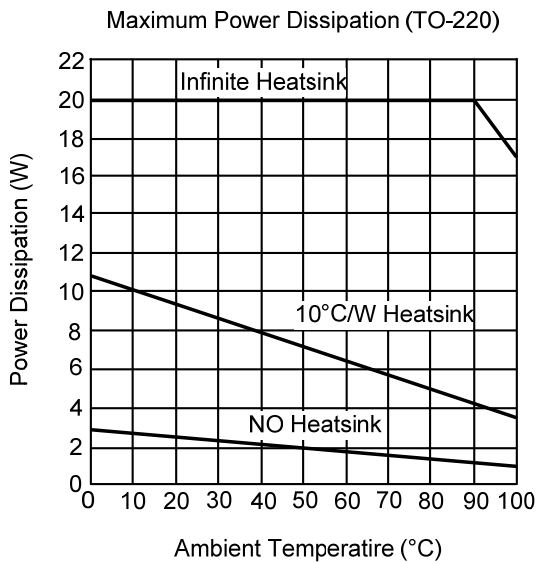
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