

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

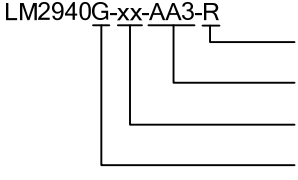
- * 500mV Typically Dropout at 1A
- * Output Current in Excess of 1A
- * Low Quiescent Current
- * Reversed-Battery Protection
- * Current Limit and Thermal Shutdown.
- * Mirror Image Insertion Protection

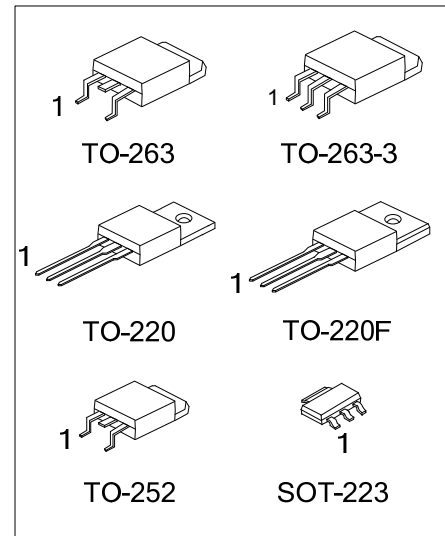
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
-	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}

	(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



LM2940

LINEAR INTEGRATED CIRCUIT

■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223	50 : 5V 60 : 6V 80 : 8V 90 : 9V 10 : 10V 12 : 12V 15 : 15V	Diagram of SOT-223 package marking. The top of the package is labeled "LM2940G". Below this, there are two groups of markings: "Voltage Code" (two digits) and "Date Code" (four digits). The package has three pins labeled 1, 2, and 3.
TO-220 TO-252 TO-263 TO-263-3		Diagram of TO-220/TO-252/TO-263/TO-263-3 package marking. The top of the package is labeled "UTC". Below this, there is a group of markings: "LM2940" followed by a small square. To the right of this group, there are two labels: "L: Lead Free" and "G: Halogen Free". Below the "LM2940" group, there are two groups of markings: "Voltage Code" (two digits) and "Lot Code" (four digits). To the right of these, there is a "Date Code" (four digits). The package has three pins labeled 1, 2, and 3.

■ 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	T_{OPR}	-40 ~ +125	°C
	TO-263-3/TO-263			
	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	θ_{JC}	4	°C/W
	TO-263-3			
	TO-220F		6	
	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	ΔV_{OUT}	$V_{OUT} + 2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_{OUT} = 5\text{mA}$		20	50	mV
Load Regulation	ΔV_{OUT}	$50\text{mA} \leq I_{OUT} \leq 1\text{A}$		35	50	mV
Output Impedance	R_{OUT}	100 mA DC and 20mA _{RMS} , $f_O = 120\text{Hz}$		35		mΩ
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		μV _{RMS}
Ripple Rejection	RR	$f_O = 120\text{Hz}$, 1V _{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	ΔV_{OUT}	$V_{OUT}+2V \leq V_{IN} \leq 26V$, $I_{OUT}=5mA$		20	60	mV
Load Regulation	ΔV_{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 Ω
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		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}	$R_{OUT}=100\Omega$, $T \leq 100ms$	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	ΔV_{OUT}	$V_{OUT}+2V \leq V_{IN} \leq 26V$, $I_{OUT}=5mA$		20	80	mV
Load Regulation	ΔV_{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 Ω
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		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}	$R_{OUT}=100\Omega$, $T \leq 100ms$	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	ΔV_{OUT}	$V_{OUT}+2V \leq V_{IN} \leq 26V$, $I_{OUT}=5mA$		20	90	mV
Load Regulation	ΔV_{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 Ω
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		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}	$R_{OUT}=100\Omega$, $T \leq 100ms$	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	ΔV_{OUT}	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		20	100	mV
Load Regulation	ΔV_{OUT}	$50mA \leq I_{OUT} \leq 1A$		65	100	mV
Output Impedance	R_{OUT}	100mA DC and 20mA _{RMS} , $f_0 = 120Hz$		65		m Ω
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		μV_{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	ΔV_{OUT}	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		20	120	mV
Load Regulation	ΔV_{OUT}	$50mA \leq I_{OUT} \leq 1A$		55	120	mV
Output Impedance	R_{OUT}	100mA DC and 20mA _{RMS} , $f_0 = 120Hz$		80		m Ω
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		μV_{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

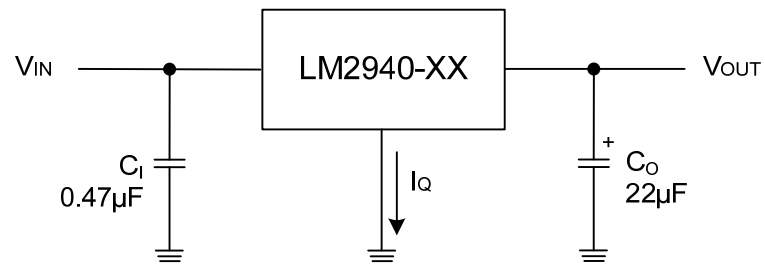
■ ELECTRICAL CHARACTERISTICS(Cont.)

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	ΔV_{OUT}	$V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$		20	150	mV
Load Regulation	ΔV_{OUT}	$50mA \leq I_{OUT} \leq 1A$		70	150	mV
Output Impedance	R_{OUT}	100mA DC and 20mA _{RMS} , $f_0=120Hz$		100		m Ω
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		μV_{RMS}
Ripple Rejection	RR	$f_0=120Hz, 1V_{RMS}, I_{OUT} = 100mA$	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.

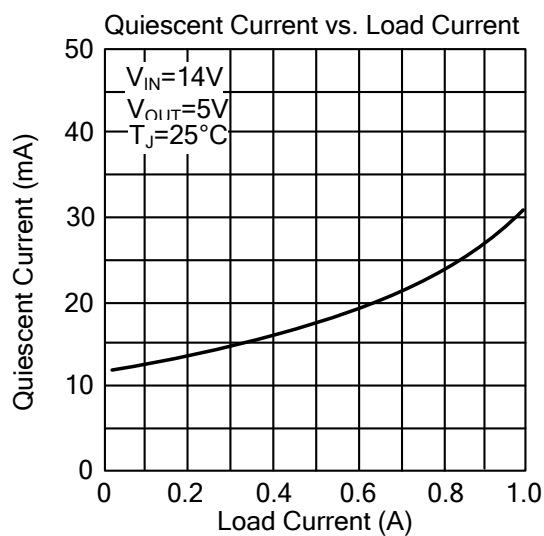
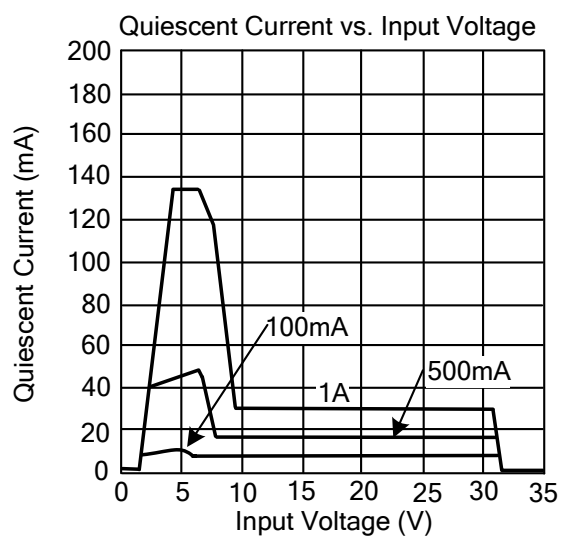
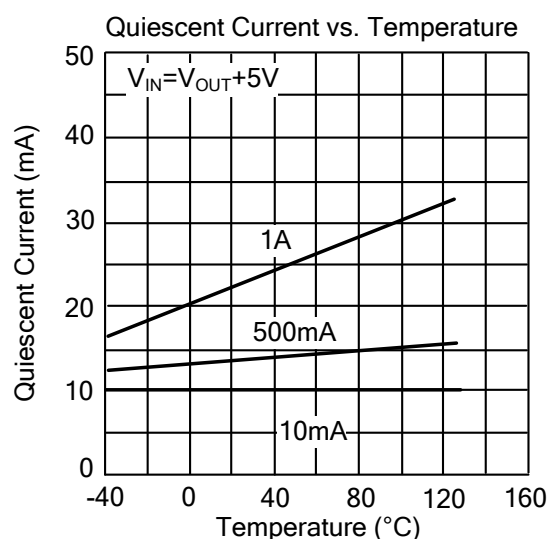
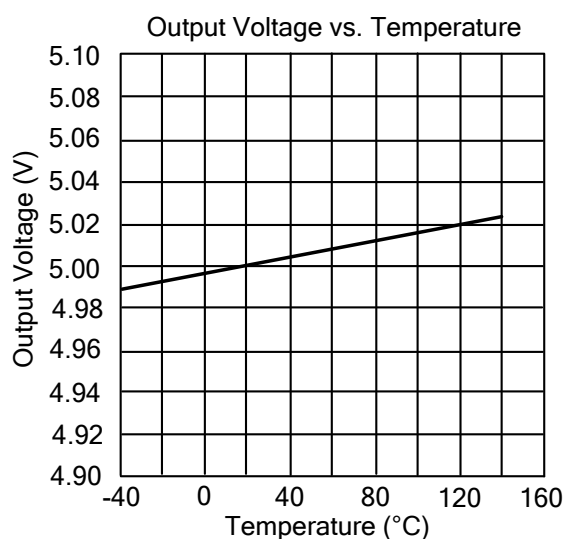
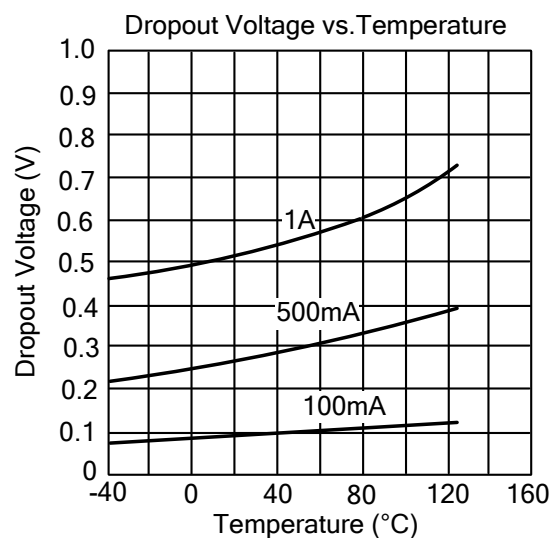
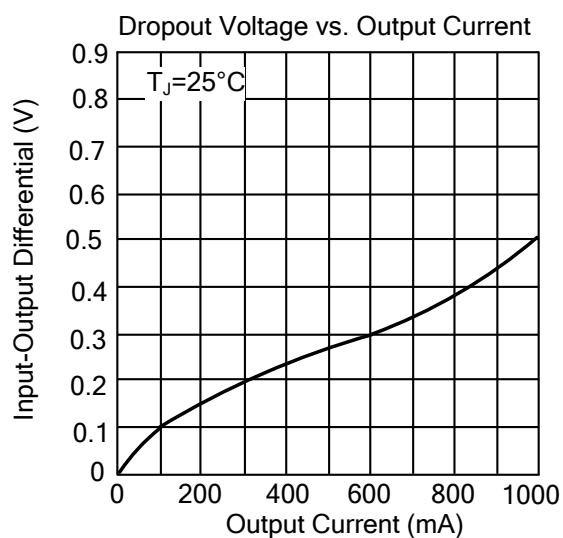
■ TYPICAL APPLICATION



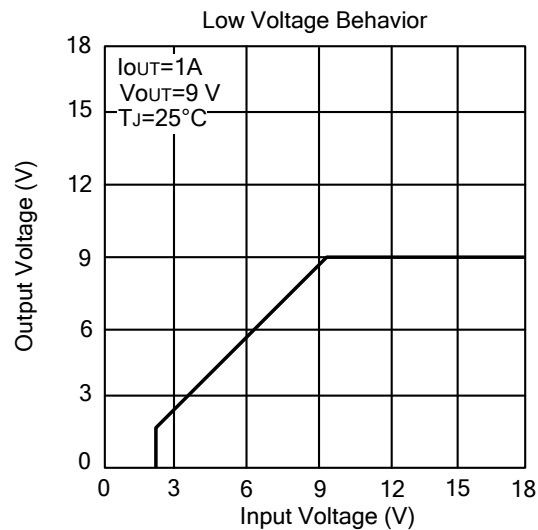
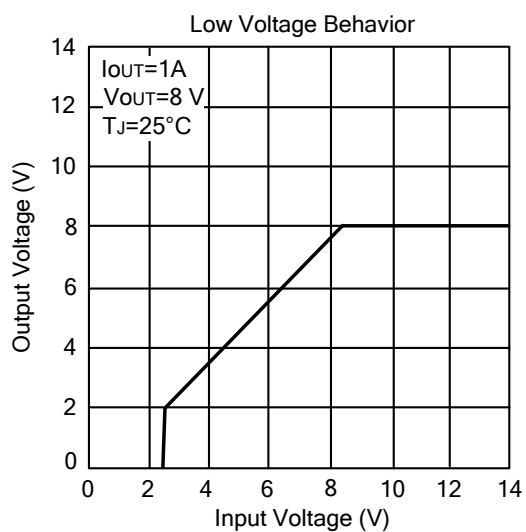
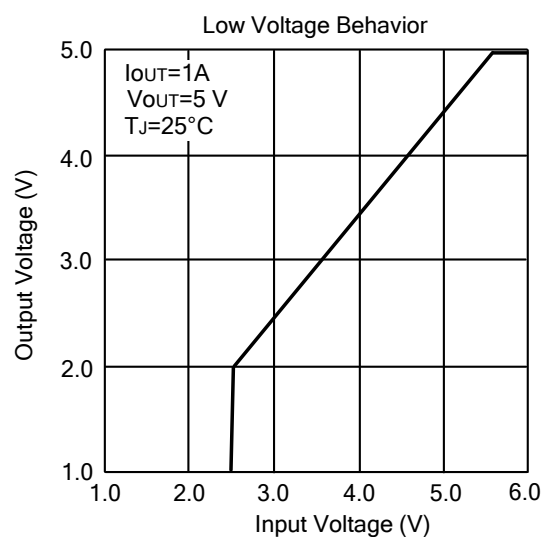
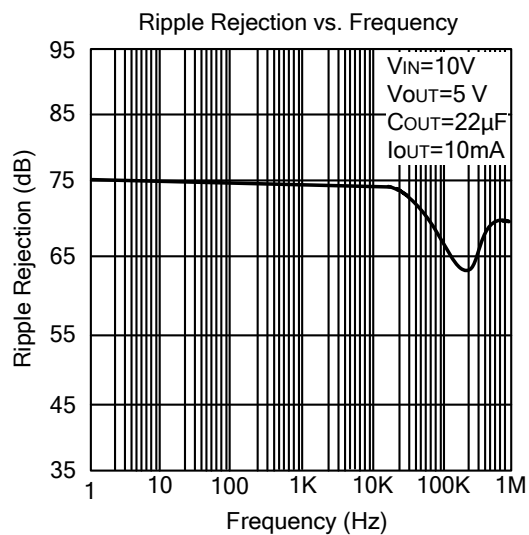
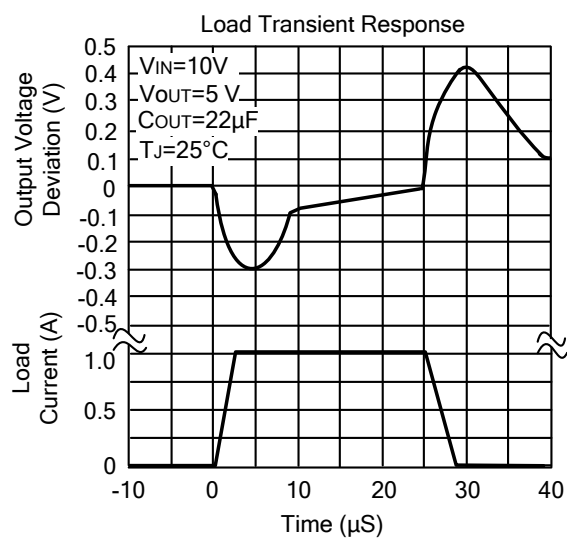
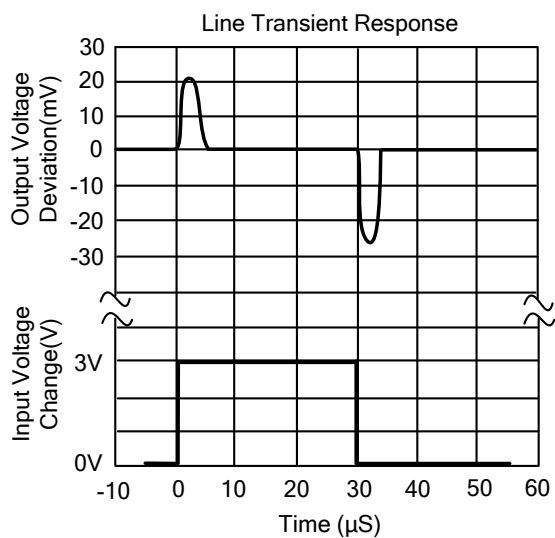
Note: 1. C_1 is required if regulator is located far from power supply filter.

2. C_O must be higher than $22\mu F$ for stability, and locate as close as possible to the regulator.

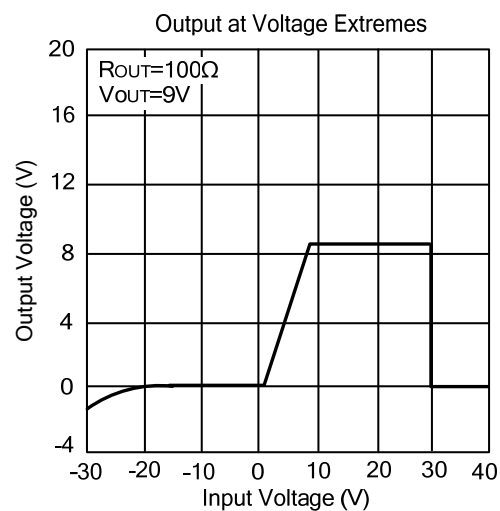
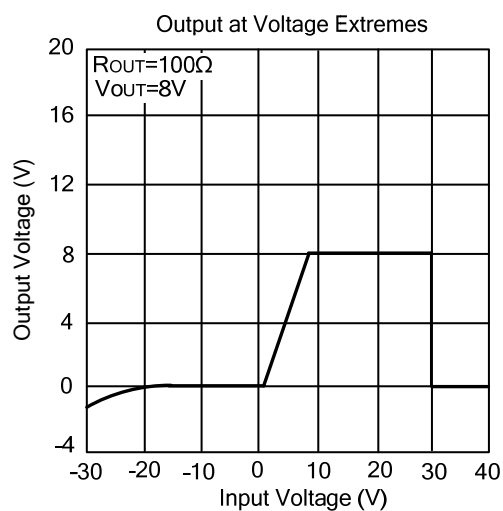
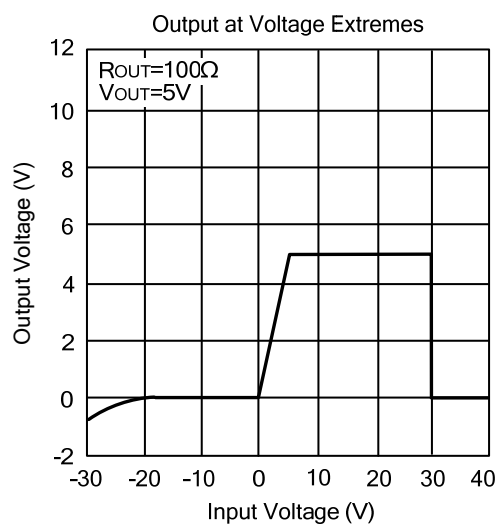
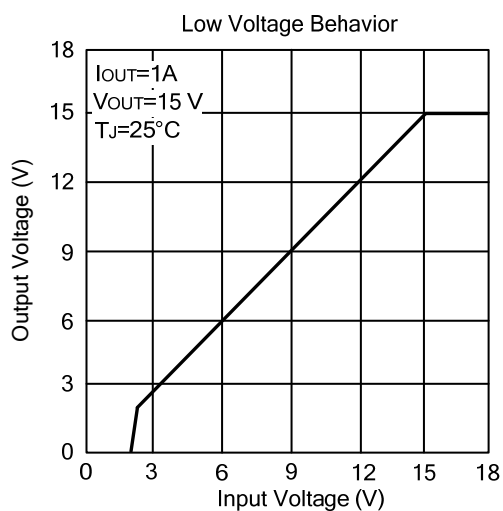
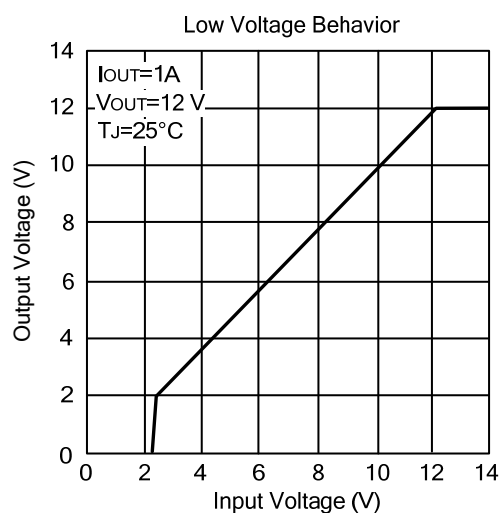
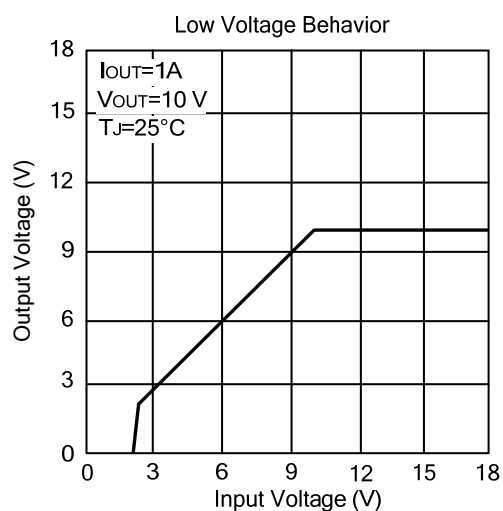
■ TYPICAL CHARACTERISTICS



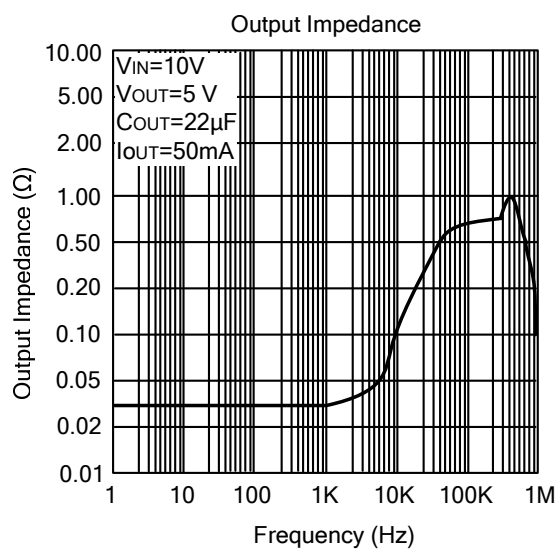
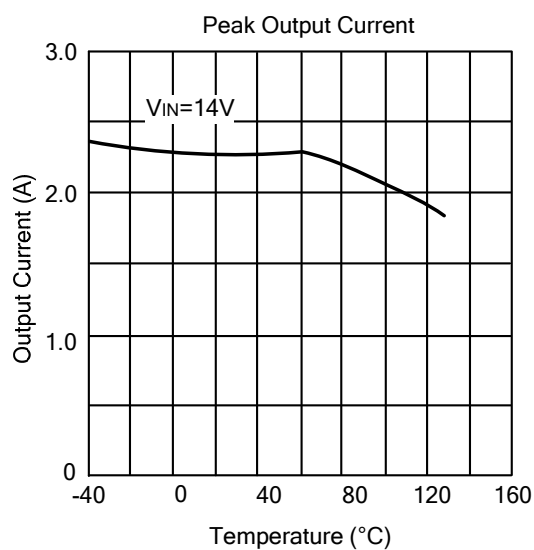
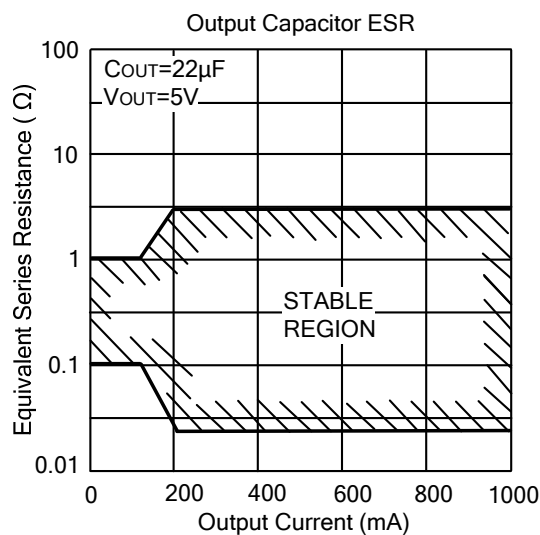
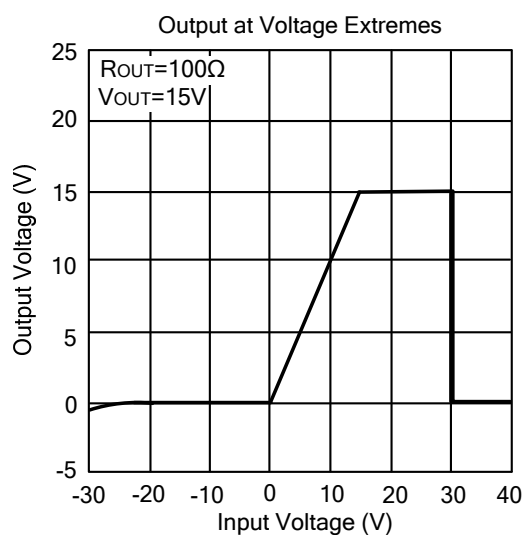
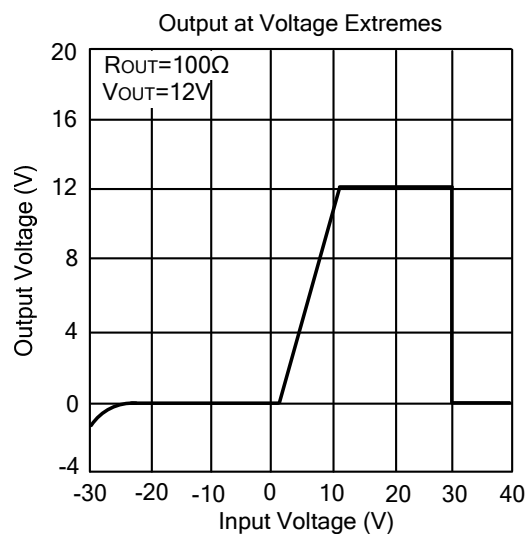
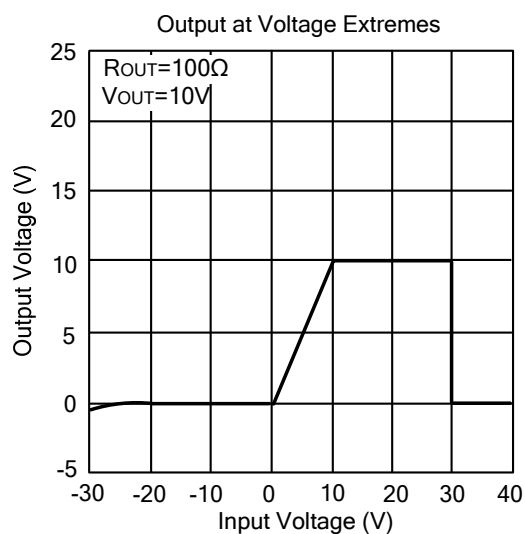
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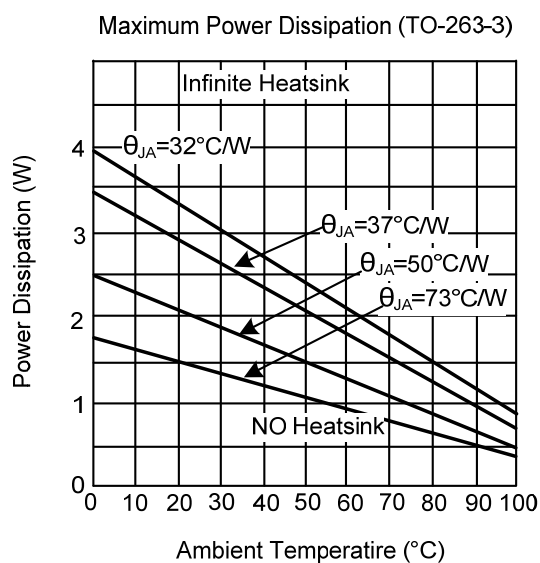
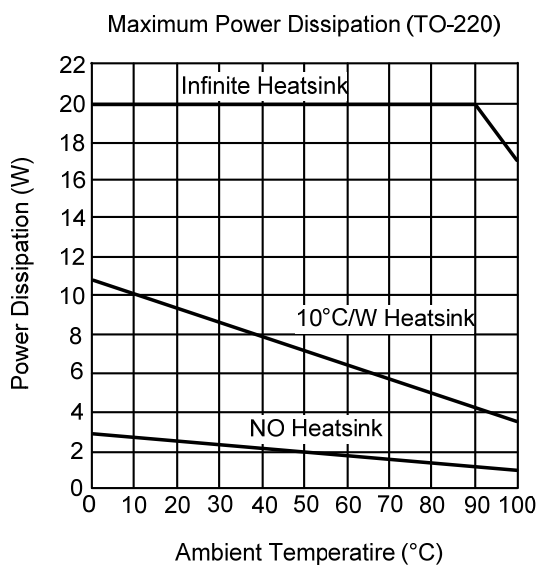
■ TYPICAL CHARACTERISTICS (Cont.)



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■ TYPICAL CHARACTERISTICS (Cont.)



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