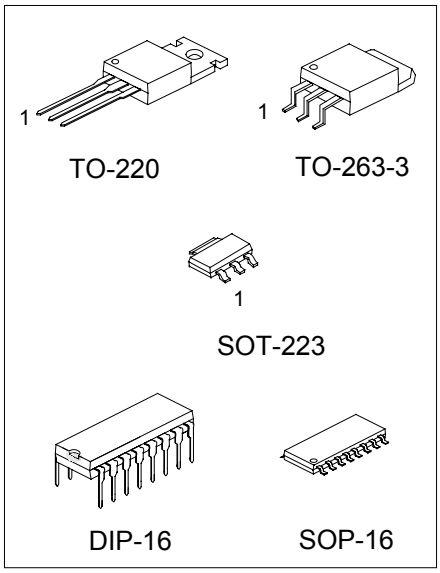
1A LOW-DROPOUT VOLTAGE REGULATOR



1: V_{IN} 2: GND 3: V_{OUT}

DESCRIPTION

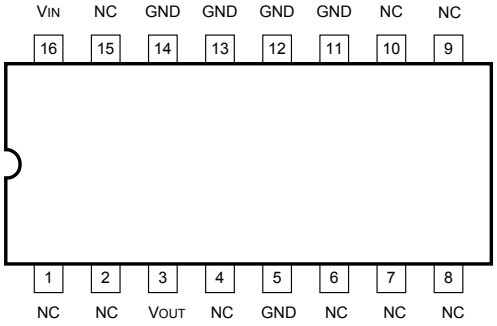
The UTC LM2940 is a positive voltage regulator features the ability to source 1A of output current with a dropout voltage of typically 0.5V and a maximum of 1V over the entire temperature range. Furthermore, a quiescent current reduction circuit has been included which reduces the ground current when the differential between the input voltage and the output voltage exceeds approximately 3V.The quiescent current with 1A of output current and an input-output differential of 5V is therefore only 30mA.Higher quiescent currents only exist when the regulator is in the dropout mode (V_{IN}-V_{OUT}≤3V).

Designed also for vehicular applications, the UTC LM2940 is protected from reverse battery installations or 2-battery jumps. During line transients, such as load dump when the input voltage can momentarily exceed the specified maximum operating voltage, the regulator will automatically shut down to protect both the internal circuits and the load. The UTC LM2940 cannot be harmed by temporary mirror-image insertion. Familiar regulator features such as short circuit and thermal overload protection are also provided.

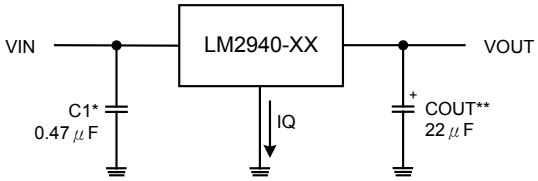
FEATURES

*Dropout voltage typically 0.5V @Io=1A
*Output current in excess of 1A
*Output voltage trimmed before assembly
*Reverse battery protection
*Internal short circuit current limit
*Mirror image insertion protection
*P^+ Product Enhancement tested.

PIN CONFIGURATIONS (16 PIN)



TYPICAL APPLICATION



*Required if regulator is located far from power supply filter.

**C_{OUT} must be at least 22μF to maintain stability. May be increased without bound to maintain regulation during transients. Locate as close as possible to the regulator. This capacitor must be rated over the same operating temperature range as the regulator and the ESR is critical.

ABSOLUTE MAXIMUM RATINGS (Note 1)

PARAMETER	SYMBOL	VALUE	UNIT
Input Voltage	V_{IN}	26	V
Internal Power Dissipation (note 2)		Internally limited	
Operating temperature TO-220/TO-263-3 SOT-223 DIP/SOP	Topr	 -40 ~ +125 -40 ~ +85 -55 ~ +125	°C
Storage temperature	Tstg	-65 ~ +150	°C
Maximum Junction Temperature	Tj	150	°C
ESD Susceptibility (note 3)		2	kV

UTC LM2940-5.0V ELECTRICAL CHARACTERISTICS

(T_A=Tj =25°C, V_{IN}=Vo+5V, I_O=1A and C_O=22μF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	6.25V≤V_{IN}≤26V, 5mA≤Io≤1A	4.85	5.00	5.15	V
Line regulation	△Vo	Vo+2V≤V_{IN}≤26V, I_O=5mA		20	50	mV
Load Regulation	△Vo	50mA≤I_O≤1A		35	50	mV
Output Impedance	Ro	100 mADC and 20mArms, fo=120Hz		35		mΩ
Quiescent Current	IQ	Vo+2V≤V_{IN}≤26V, I_O=5mA		10	15	mA
		V_{IN}= Vo+5V, I_O=1A		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, I_O=5mA		150		μVrms
Ripple Rejection	RR	fo=120Hz, 1Vrms, I_O=100mA	60	72		dB
Long Term Stability				20		mV/ 1000Hr
Dropout Voltage	Vd	I_O=1A		0.5	0.8	V
		I_O=100mA		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	Ro=100Ω, T≤100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	Ro=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	Ro=100Ω, T≤100ms	-50	-75		V

UTC LM2940-8.0V ELECTRICAL CHARACTERISTICS

(T_A=Tj =25°C,V_{IN}=Vo+5V,I_O=1A and C_O=22μF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	9.4V≤V_{IN}≤26V, 5mA≤Io≤1A	7.76	8.00	8.24	V
Line regulation	△Vo	Vo+2V≤V_{IN}≤26V, I_O=5mA		20	80	mV
Load Regulation	△Vo	50mA≤I_O≤1A		55	80	mV
Output Impedance	Ro	100 mADC and 20mArms, fo=120Hz		55		mΩ
Quiescent Current	I_Q	Vo+2V≤V_{IN}≤26V, I_O=5mA		10	15	mA
		V_{IN}= Vo+5V, I_O=1A		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, I_O=5mA		240		μVrms
Ripple Rejection	RR	fo=120Hz, 1Vrms, I_O=100mA	54	66		dB
Long Term Stability				32		mV/ 1000Hr
Dropout Voltage	Vd	I_O=1A		0.5	0.8	V
		I_O=100mA		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	Ro=100Ω, T≤100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	Ro=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	Ro=100Ω, T≤100ms	-50	-75		V

UTC LM2940-9.0V ELECTRICAL CHARACTERISTICS

(T_A=Tj =25°C,V_{IN}=Vo+5V,I_O=1A and C_O=22μF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	10.5V≤V_{IN}≤26V, 5mA≤Io≤1A	8.73	9.00	9.27	V
Line regulation	△Vo	Vo+2V≤V_{IN}≤26V, I_O=5mA		20	90	mV
Load Regulation	△Vo	50mA≤I_O≤1A		60	90	mV
Output Impedance	Ro	100 mADC and 20mArms, fo=120Hz		60		mΩ
Quiescent Current	I_Q	Vo+2V≤V_{IN}≤26V, I_O=5mA		10	15	mA
		V_{IN}= Vo+5V, I_O=1A		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, I_O=5mA		270		μVrms
Ripple Rejection	RR	fo=120Hz, 1Vrms, I_O=100mA	52	64		dB
Long Term Stability				34		mV/ 1000Hr
Dropout Voltage	Vd	I_O=1A		0.5	0.8	V
		I_O=100mA		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	Ro=100Ω, T≤100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	Ro=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	Ro=100Ω, T≤100ms	-50	-75		V

UTC LM2940-10V ELECTRICAL CHARACTERISTICS

(T_A=Tj =25°C,V_{IN}=Vo+5V,I_O=1A and C_O=22μF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	11.5V≤V_{IN}≤26V, 5mA≤Io≤1A	9.70	10.00	10.30	V
Line regulation	△Vo	Vo+2V≤V_{IN}≤26V, I_O=5mA		20	100	mV
Load Regulation	△Vo	50mA≤I_O≤1A		65	100	mV
Output Impedance	Ro	100 mADC and 20mArms, fo=120Hz		65		mΩ
Quiescent Current	I_Q	Vo+2V≤V_{IN}≤26V, I_O=5mA		10	15	mA
		V_{IN}= Vo+5V, I_O=1A		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, I_O=5mA		300		μVrms
Ripple Rejection	RR	fo=120Hz, 1Vrms, I_O=100mA	51	63		dB
Long Term Stability				36		mV/ 1000Hr
Dropout Voltage	Vd	I_O=1A		0.5	0.8	V
		I_O=100mA		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	Ro=100Ω, T≤100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	Ro=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	Ro=100Ω, T≤100ms	-50	-75		V

UTC LM2940-12V ELECTRICAL CHARACTERISTICS

(T_A=Tj =25°C,V_{IN}=Vo+5V,I_O=1A and C_O=22μF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	13.6V≤V_{IN}≤26V, 5mA≤Io≤1A	11.64	12.00	12.36	V
Line regulation	△Vo	Vo+2V≤V_{IN}≤26V, I_O=5mA		20	120	mV
Load Regulation	△Vo	50mA≤I_O≤1A		55	120	mV
Output Impedance	Ro	100 mADC and 20mArms, fo=120Hz		80		mΩ
Quiescent Current	I_Q	Vo+2V≤V_{IN}≤26V, I_O=5mA		10	15	mA
		V_{IN}= Vo+5V, I_O=1A		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, I_O=5mA		360		μVrms
Ripple Rejection	RR	fo=120Hz, 1Vrms, I_O=100mA	54	66		dB
Long Term Stability				48		mV/ 1000Hr
Dropout Voltage	Vd	I_O=1A		0.5	0.8	V
		I_O=100mA		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	Ro=100Ω, T≤100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	Ro=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	Ro=100Ω, T≤100ms	-50	-75		V

UTC LM2940-15V ELECTRICAL CHARACTERISTICS

(T_A=Tj =25°C,V_{IN}=Vo+5V,I_O=1A and C_O=22μF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	16.75V≤V_{IN}≤26V, 5mA≤Io≤1A	14.55	15.00	15.45	V
Line regulation	△Vo	Vo+2V≤V_{IN}≤26V, I_O=5mA		20	150	mV
Load Regulation	△Vo	50mA≤I_O≤1A		70	150	mV
Output Impedance	Ro	100 mADC and 20mArms, fo=120Hz		100		mΩ
Quiescent Current	I_Q	Vo+2V≤V_{IN}≤26V, I_O=5mA		10	15	mA
		V_{IN}= Vo+5V, I_O=1A		30	45	
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, I_O=5mA		450		μVrms
Ripple Rejection	RR	fo=120Hz, 1Vrms, I_O=100mA	52	64		dB
Long Term Stability				60		mV/ 1000Hr
Dropout Voltage	Vd	I_O=1A		0.5	0.8	V
		I_O=100mA		0.11	0.15	
Short Circuit Current	I_S	(note 4)	1.6	1.9		A
Maximum Line Transient	T_{IN}	Ro=100Ω, T≤100ms	60	75		V
Reverse Polarity DC Input Voltage	V_{RIN}	Ro=100Ω	-15	-30		V
Reverse Polarity Transient Input Voltage	V_{TRRI}	Ro=100Ω, T≤100ms	-50	-75		V

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Conditions are conditions under which the device functions but the specifications might not be guaranteed. For guaranteed specifications and test conditions see the Electrical Characteristics.

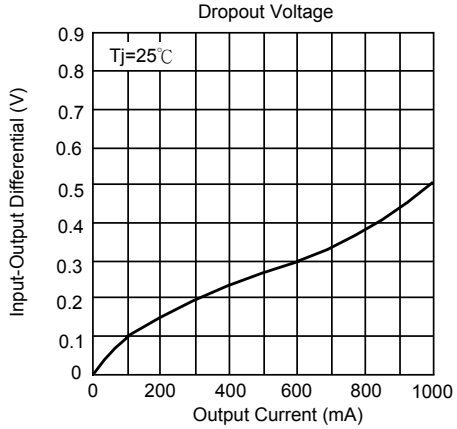
Note 2: The maximum allowable power dissipation is a function of the maximum junction temperature, Tj, the junction to ambient thermal resistance, θ_{J-A}, and the ambient temperature, T_A .Exceeding the maximum allowable power dissipation will cause excessive die temperature, and the regulator will go into thermal shutdown. The value of θ_{J-A}(for devices in still air with no heatsink) is 60°C/W for the TO-220 package ,80°C/W for the TO-263-3 package, and 174°C/W for SOT-223 package. The effective value of θ_{J-A} can be reduced by using a heatsink.

Note 3: ESD rating is based on the human body model,100pF discharged through 1.5kΩ.

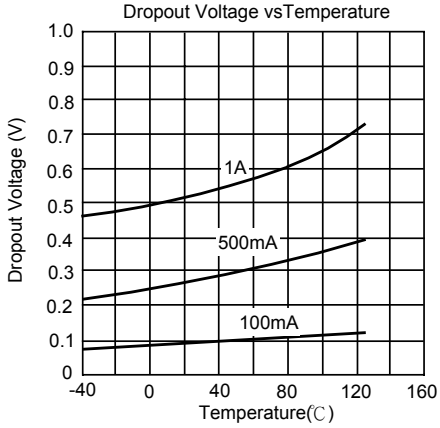
Note 4: Output current will decrease with increasing temperature but will not drop below 1A at the maximum specified temperature.

TYPICAL PERFORMANCE CHARACTERISTICS

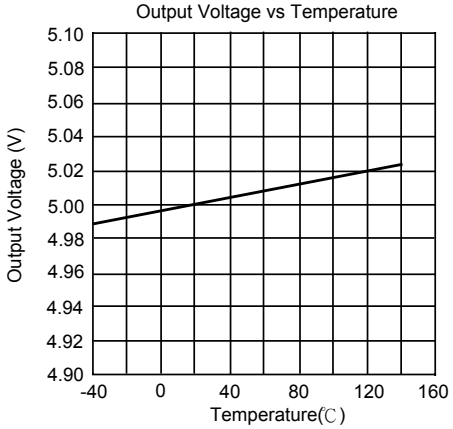
Dropout Voltage



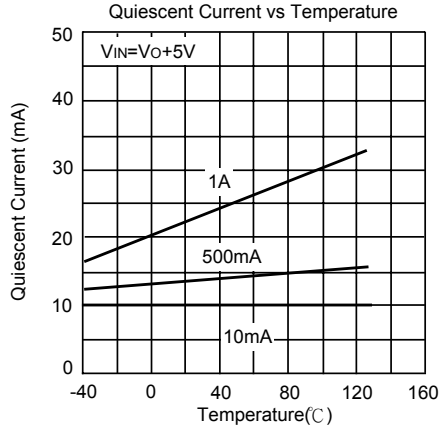
Dropout Voltage vsTemperature



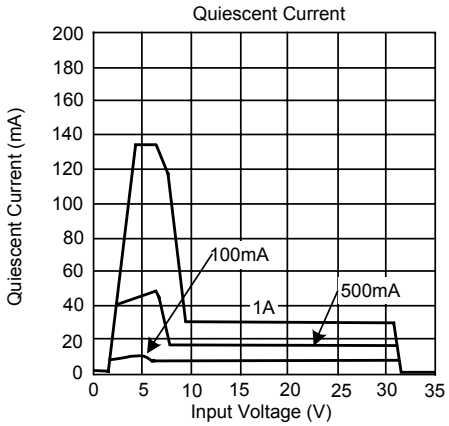
Output Voltage vs Temperature



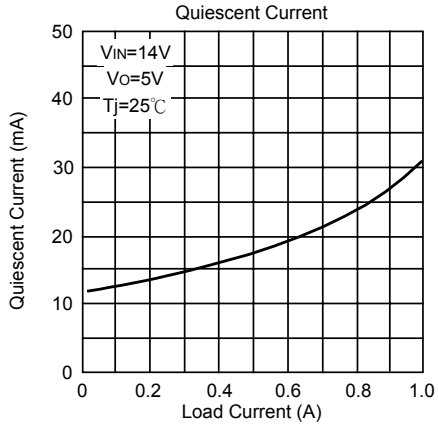
Quiescent Current vs Temperature



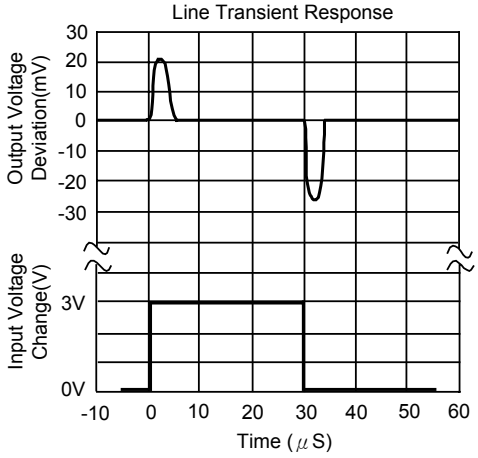
Quiescent Current



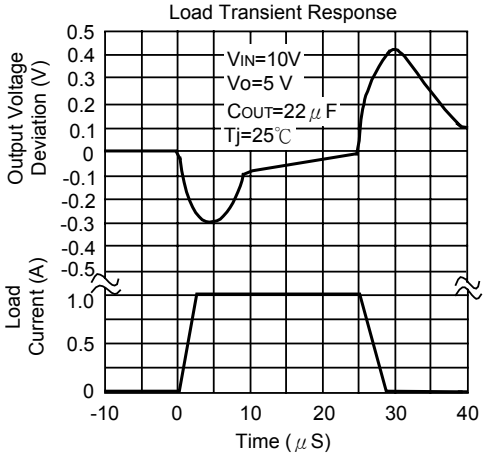
Quiescent Current



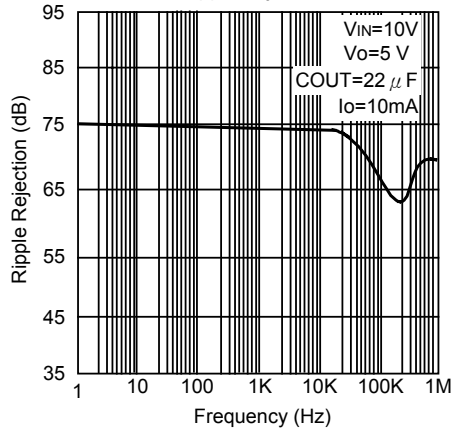
Line Transient Response



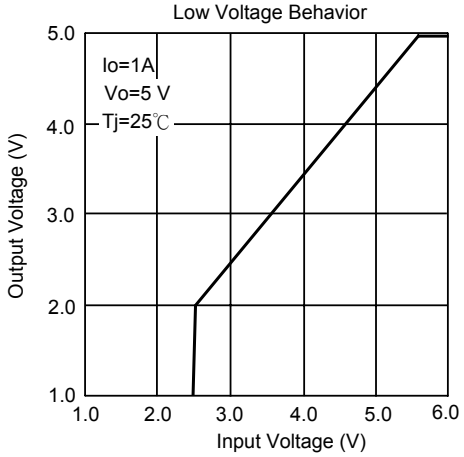
Load Transient Response



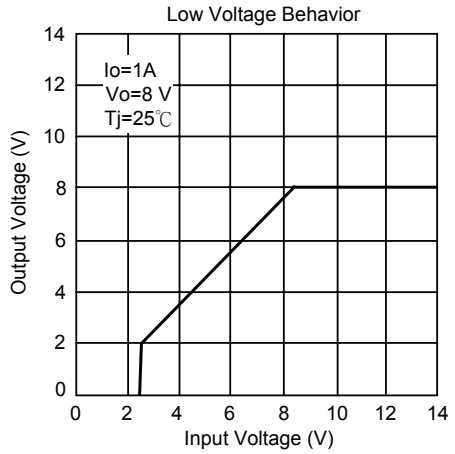
Ripple Rejection



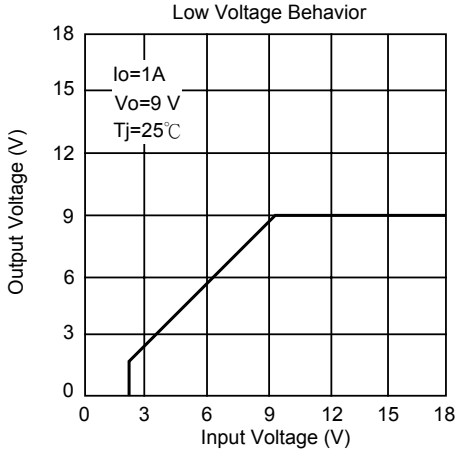
Low Voltage Behavior



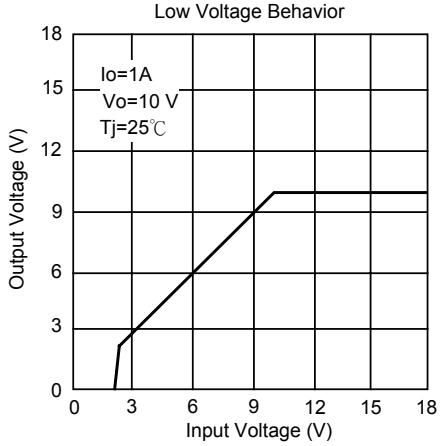
Low Voltage Behavior



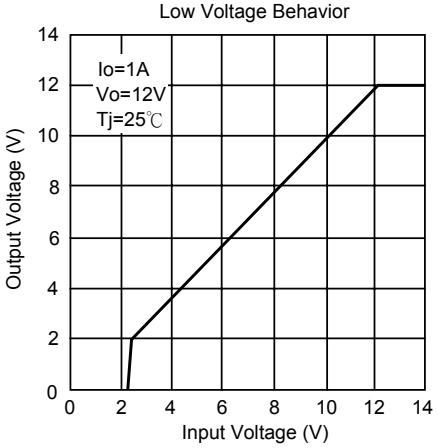
Low Voltage Behavior



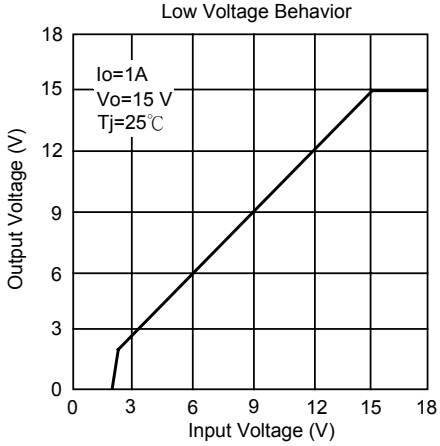
Low Voltage Behavior



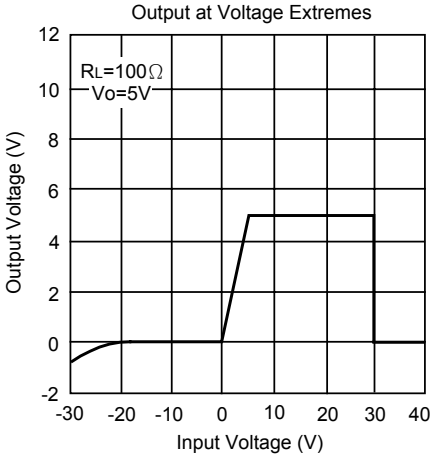
Low Voltage Behavior



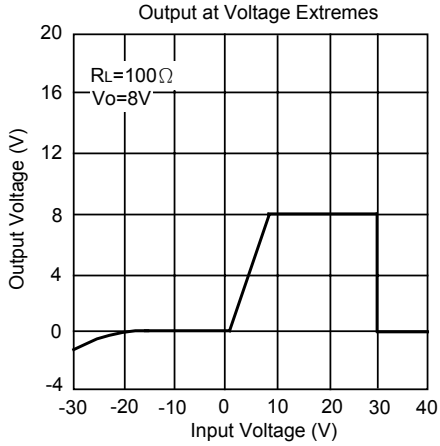
Low Voltage Behavior



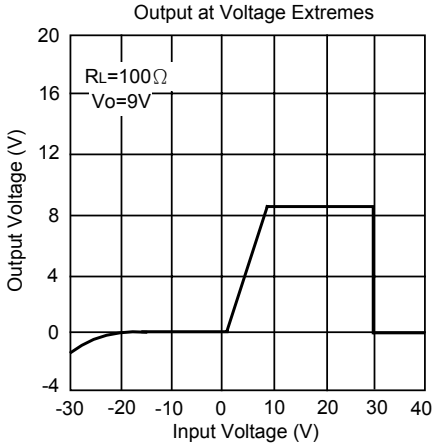
Output at Voltage Extremes



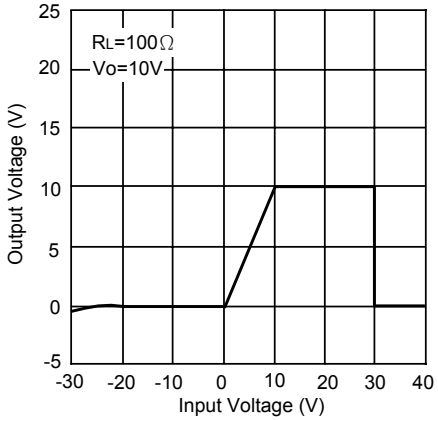
Output at Voltage Extremes



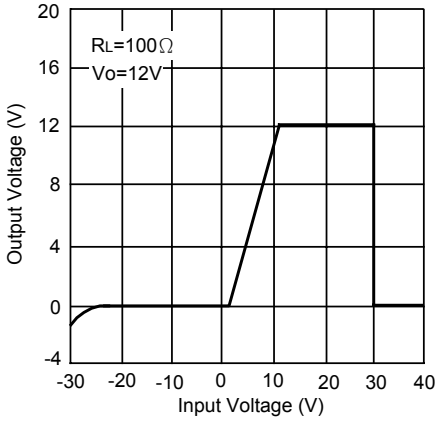
Output at Voltage Extremes



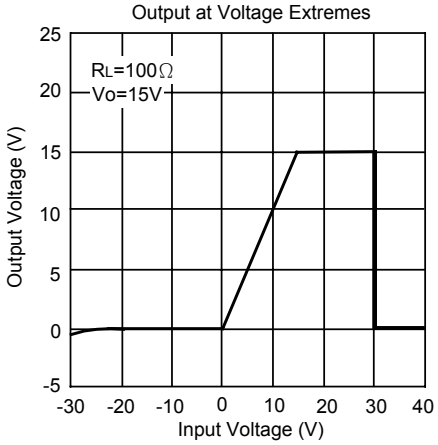
Output at Voltage Extremes



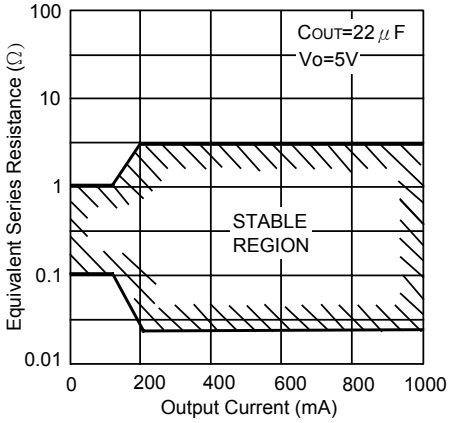
Output at Voltage Extremes



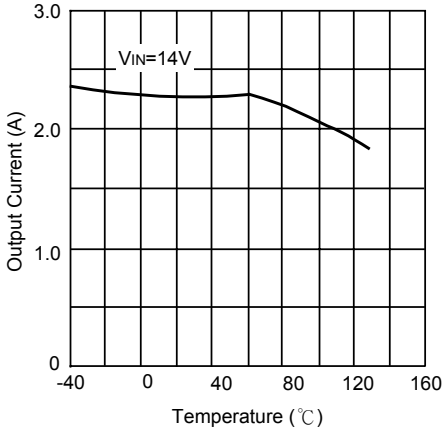
Output at Voltage Extremes



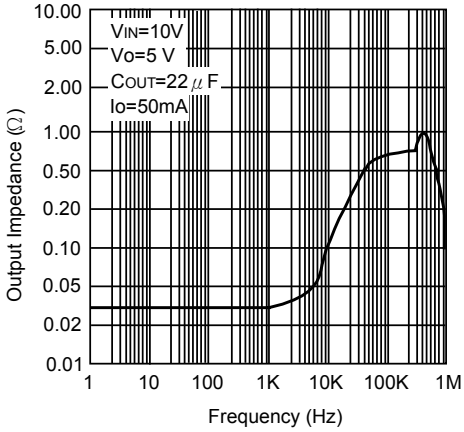
Output Capacitor ESR



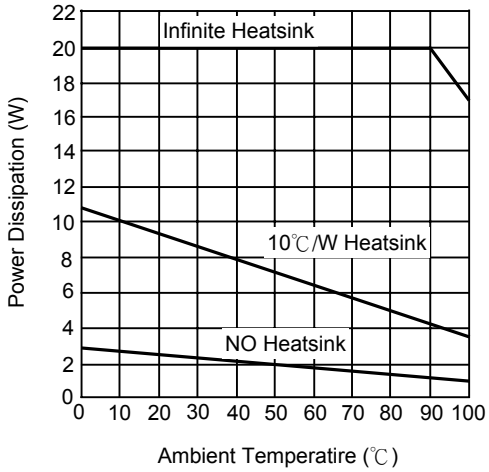
Peak Output Current



Output Impedance



Maximum Power Dissipation (TO-220)



Maximum Power Dissipation (TO-263-3)