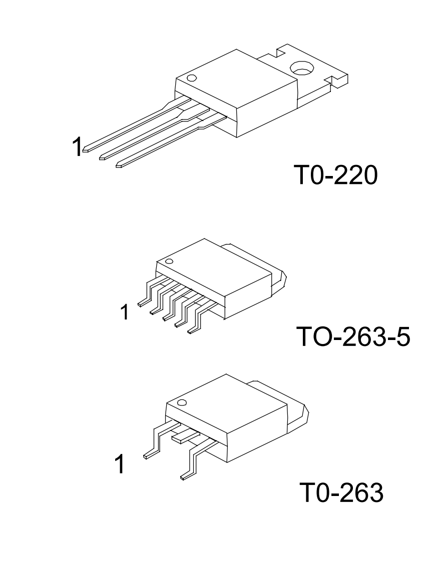
500mA LOW DROPOUT VOLTAGE REGULATOR



TO-220/TO263 : 1:Input 2:GND 3:Output

TO-263-5 : 1: N/C 2: ON/OFF 3: GND

4: Input 5: Output

DESCRIPTION

The UTC LM2937-XX is a positive voltage regulator capable of supplying up to 500mA of load current. The use of a PNP power transistor provides a low dropout voltage characteristic. With a load current of 500mA the minimum input to output voltage differential required for the output to remain in regulation is typically 0.5V(1V guaranteed maximum over the full operating temperature range). Special circuitry has been incorporated to minimize the quiescent current to typically only 10mA with a full 500mA load current when the input to output voltage differential is greater than 3V.

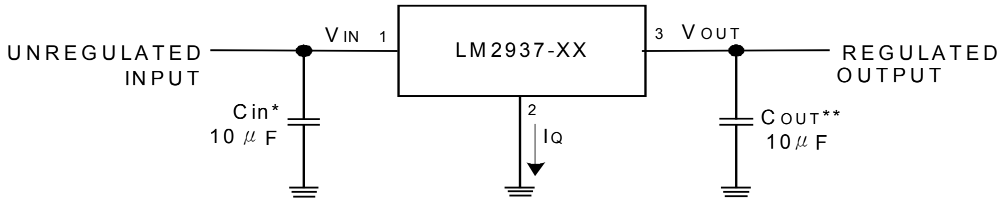
The UTC LM2937-XX requires an output bypass capacitor for stability. As with most low dropout regulators, the ESR of this capacitor remains a critical design parameter, but the LM2937 includes special compensation circuitry that relaxes ESR requirements. The UTC LM2937-XX is stable for all ESR below 3Ω.This allows the use of low ESR chip capacitors.

Ideally suited for automotive applications, the UTC LM2937-XX will protect itself and any load circuitry from reverse battery connections, two-battery jumps and up to +60V/-50V load dump transients. Familiar regulator features such as short circuit and thermal shutdown protection are also built in.

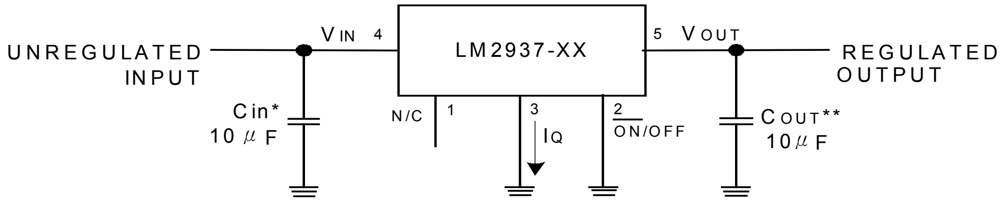
FEATURES

*Fully specified for operation over -40°C to +125°C
*Output current in excess of 500mA
*Output trimmed for 5% tolerance under all operating conditions
*Typical dropout voltage of 0.5V at full rated load current
*Wide output capacitor ESR range, up to 3Ω
*Reverse battery protection
*Internal short circuit and thermal overload protection
*60V input transient protection
*Mirror image insertion protection
*Built-in ON/OFF control function

TYPICAL APPLICATION



ON/OFF CONTROL APPLICATION



* Required if the regulator is located more than 3 inches from the power supply filter capacitors.

**Required for stability. C_{OUT} must be at least 10μF(over the full expected operating temperature range) and located as close as possible to the regulator. The equivalent series resistance, ESR ,of this capacitor may be as high as 3Ω.

ABSOLUTE MAXIMUM RATINGS(Note 1)

PARAMETER	SYMBOL	RATING	UNIT
Internal Power Dissipation(Note 2)		Internally limited	
Input Voltage	V_{IN}	26	V
Storage temperature Range	Tstg	-65 ~ +150	°C
Maximum Junction Temperature	Tj	150	°C

LM2937-3.3V ELECTRICAL CHARACTERISTICS

($V_{IN}=V_{NOM}+5V, I_O=500mA, C_{out}=10\mu F$, $T_j=T_A=25°C$,unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT.
Output Voltage	V_o	$5mA \le I_O \le 500mA$	3.21	3.30	3.39	V
Line Regulation	$\triangle V_O$	$V_o+2V \le V_{IN} \le 26V$, $I_O=5mA$		9	30	mV
Load Regulation	$\triangle V_O$	$5mA \le I_O \le 500mA$		3	30	mV
Quiescent Current	I_Q	$(V_o+2V) \le V_{IN} \le 26V, I_O=5mA$		2	10	mA
		$V_{IN}= V_o+5V$, $I_O=500mA$		10	20	mA
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, $I_O=5mA$		100		μVrms
Long Term Stability		1000Hrs		12		mV

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT.
Dropout Voltage	V_D	IO=500mA		0.5	1.0	V
		IO=50mA		110	250	mV
Short Circuit Current	I_S		0.6	1.0		A
Peak Line Transient Voltage	T_{in}	tf≤100ms ,RL=100Ω	60	75		V
Reverse DC Input Voltage	V_{Rin}	VO ≥-0.6V ,RL=100Ω	-15	-30		V
Reverse Transient Input Voltage	V_{TRRI}	tf<1ms ,RL=100Ω	-50	-75		V

LM2937-5.0V ELECTRICAL CHARACTERISTICS

(VIN=V_{NOM}+5V,IO=500mA,C_{out} =10µF, Tj=TA=25°C,,unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT.
Output Voltage	V_o	5mA≤IO≤500mA	4.85	5.00	5.15	V
Line Regulation	$\triangle V_O$	Vo+2V≤VIN≤26V, IO=5mA		15	50	mV
Load Regulation	$\triangle V_O$	5mA≤IO≤500mA		5	50	mV
Quiescent Current	I_Q	(Vo+2V)≤VIN ≤26V,IO=5mA		2	10	mA
		VIN= Vo+5V, IO=500mA		10	20	mA
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, IO=5mA		150		µVrms
Long Term Stability		1000Hrs		20		mV
Dropout Voltage	V_D	IO=500mA		0.5	1.0	V
		IO=50mA		110	250	mV
Short Circuit Current	I_S		0.6	1.0		A
Peak Line Transient Voltage	T_{in}	tf≤100ms ,RL=100Ω	60	75		V
Reverse DC Input Voltage	V_{Rin}	VO ≥-0.6V ,RL=100Ω	-15	-30		V
Reverse Transient Input Voltage	V_{TRRI}	tf<1ms ,RL=100Ω	-50	-75		V

LM2937-8.0V ELECTRICAL CHARACTERISTICS

(VIN=V_{NOM}+5V,IO=500mA,C_{out} =10µF, Tj=TA=25°C,,unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT.
Output Voltage	V_o	5mA≤IO≤500mA	7.76	8.00	8.24	V
Line Regulation	$\triangle V_O$	Vo+2V≤VIN≤26V, IO=5mA		24	80	mV
Load Regulation	$\triangle V_O$	5mA≤IO≤500mA		8	80	mV
Quiescent Current	I_Q	(Vo+2V)≤VIN ≤26V,IO=5mA		2	10	mA
		VIN= Vo+5V, IO=500mA		10	20	mA
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, IO=5mA		240		µVrms
Long Term Stability		1000Hrs		32		mV
Dropout Voltage	V_D	IO=500mA		0.5	1.0	V
		IO=50mA		110	250	mV
Short Circuit Current	I_S		0.6	1.0		A
Peak Line Transient Voltage	T_{in}	tf≤100ms ,RL=100Ω	60	75		V
Reverse DC Input Voltage	V_{Rin}	VO ≥-0.6V ,RL=100Ω	-15	-30		V
Reverse Transient Input Voltage	V_{TRRI}	tf<1ms ,RL=100Ω	-50	-75		V

LM2937-10.0V ELECTRICAL CHARACTERISTICS

(VIN=V_{NOM}+5V,IO=500mA,C_{out} =10µF, Tj=TA=25°C,,unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT.
Output Voltage	V_o	5mA≤IO≤500mA	9.70	10.00	10.30	V
Line Regulation	$\triangle V_O$	Vo+2V≤VIN≤26V, IO=5mA		30	100	mV

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT.
Load Regulation	$\triangle V_O$	5mA≤IO≤500mA		10	100	mV
Quiescent Current	I_Q	(Vo+2V)≤VIN ≤26V,IO=5mA		2	10	mA
		VIN= Vo+5V, IO=500mA		10	20	mA
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, IO=5mA		300		μVrms
Long Term Stability		1000Hrs		40		mV
Dropout Voltage	V_D	IO=500mA		0.5	1.0	V
		IO=50mA		110	250	mV
Short Circuit Current	I_S		0.6	1.0		A
Peak Line Transient Voltage	T_{in}	tf≤100ms ,RL=100Ω	60	75		V
Reverse DC Input Voltage	V_{Rin}	VO ≥-0.6V ,RL=100Ω	-15	-30		V
Reverse Transient Input Voltage	V_{TRRI}	tf<1ms ,RL=100Ω	-50	-75		V

LM2937-12.0V ELECTRICAL CHARACTERISTICS

($V_{IN}=V_{NOM}+5V$, $I_O=500mA$, C_{out} =10μF, Tj=TA=25°C,,unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT.
Output Voltage	V_o	5mA≤IO≤500mA	11.64	12.00	12.36	V
Line Regulation	$\triangle V_O$	Vo+2V≤VIN≤26V, IO=5mA		36	120	mV
Load Regulation	$\triangle V_O$	5mA≤IO≤500mA		12	120	mV
Quiescent Current	I_Q	(Vo+2V)≤VIN ≤26V,IO=5mA		2	10	mA
		VIN= Vo+5V, IO=500mA		10	20	mA
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, IO=5mA		360		μVrms
Long Term Stability		1000Hrs		44		mV
Dropout Voltage	V_D	IO=500mA		0.5	1.0	V
		IO=50mA		110	250	mV
Short Circuit Current	I_S		0.6	1.0		A
Peak Line Transient Voltage	T_{in}	tf≤100ms ,RL=100Ω	60	75		V
Reverse DC Input Voltage	V_{Rin}	VO ≥-0.6V ,RL=100Ω	-15	-30		V
Reverse Transient Input Voltage	V_{TRRI}	tf<1ms ,RL=100Ω	-50	-75		V

LM2937-15.0V ELECTRICAL CHARACTERISTICS

($V_{IN}=V_{NOM}+5V$, $I_O=500mA$, C_{out} =10μF, Tj=TA=25°C,,unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT.
Output Voltage	V_o	5mA≤IO≤500mA	14.55	15.00	15.45	V
Line Regulation	$\triangle V_O$	Vo+2V≤VIN≤26V, IO=5mA		45	150	mV
Load Regulation	$\triangle V_O$	5mA≤IO≤500mA		15	150	mV
Quiescent Current	I_Q	(Vo+2V)≤VIN ≤26V,IO=5mA		2	10	mA
		VIN= Vo+5V, IO=500mA		10	20	mA
Output Noise Voltage	V_{NOISE}	10Hz-100kHz, IO=5mA		450		μVrms
Long Term Stability		1000Hrs		56		mV
Dropout Voltage	V_D	IO=500mA		0.5	1.0	V
		IO=50mA		110	250	mV
Short Circuit Current	I_S		0.6	1.0		A
Peak Line Transient Voltage	T_{in}	tf≤100ms ,RL=100Ω	60	75		V
Reverse DC Input Voltage	V_{Rin}	VO ≥-0.6V ,RL=100Ω	-15	-30		V
Reverse Transient Input Voltage	V_{TRRI}	tf<1ms ,RL=100Ω	-50	-75		V

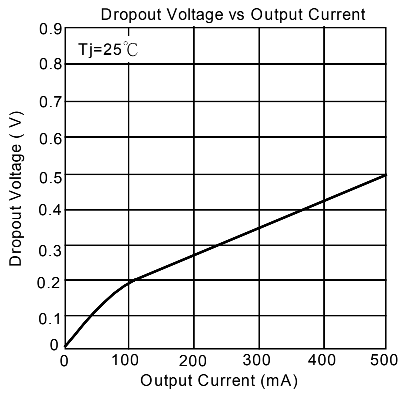
ON/OFF CONTROL

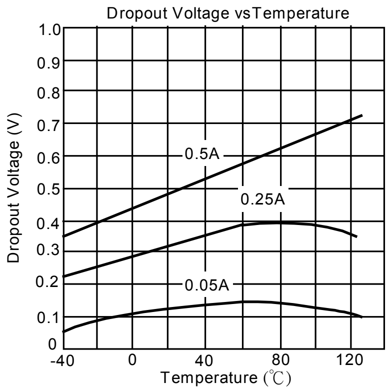
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT.
ON/OFF Threshold Voltage ON	V_{ON}	IO≦0.5A			0.8	V
ON/OFF Threshold Voltage OFF	V_{OFF}	IO≦0.5A	2.0			V
ON/OFF Threshold Current	$I_{ON/OFF}$	VON/OFF=2.0V,Io=0.5A		50	100	μA

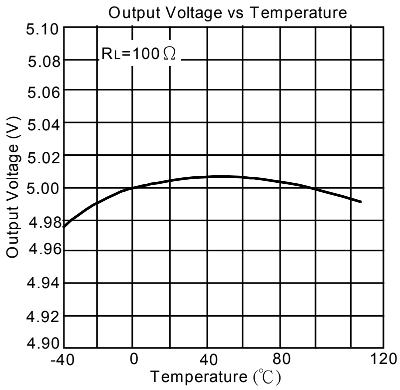
Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Electrical Specifications do not apply when operating the device outside of its rated Operating Conditions.

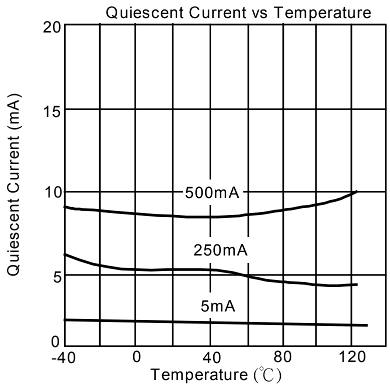
Note 2: The maximum allowable power dissipation at any ambient temperature is $P_{MAX}=(125-T_A)/\Theta_{JA}$, where 125 is the maximum junction temperature for operation, T_A is the ambient temperature, and Θ_{JA} is the junction to ambient thermal resistance. If this dissipation is exceeded, the die temperature will rise above 125°C and the electrical specifications do not apply. If the die temperature rises above 150°C, the LM2937 will go into thermal shutdown. For the LM2937, the junction to ambient thermal resistance ΘJA is 65°C/W, for the TO-220 package and 73°C/W for the TO-263 package. When used with a heat sink, Θ_{JA} is the sum of the LM2937 junction to case thermal resistance Θ_{JC} of 3°C/W and the heat sink case to ambient thermal resistance. If the TO-263 package is used, the thermal resistance can be reduced by increasing P.C. board copper area thermally connected to the package.

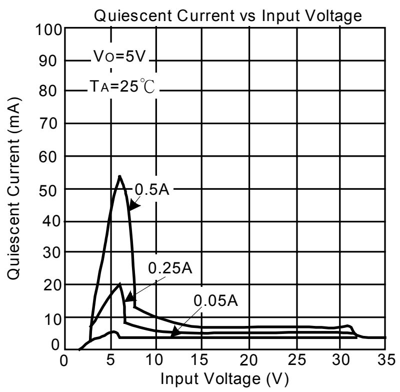
TYPICAL PERFORMANCE CHARACTERISTICS

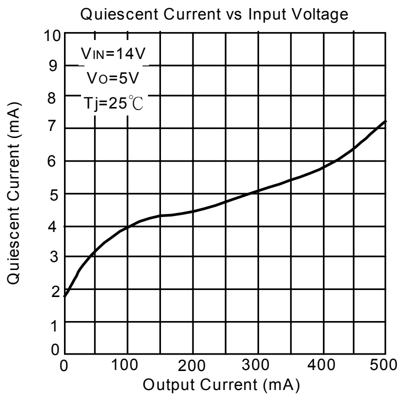




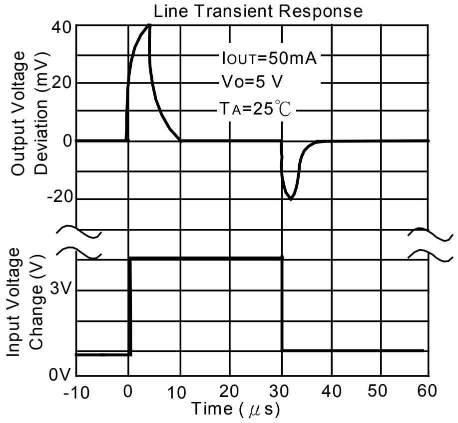




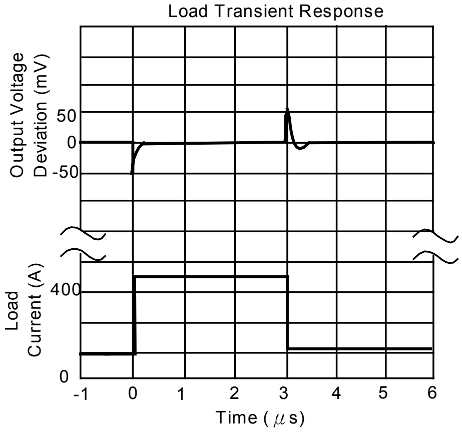




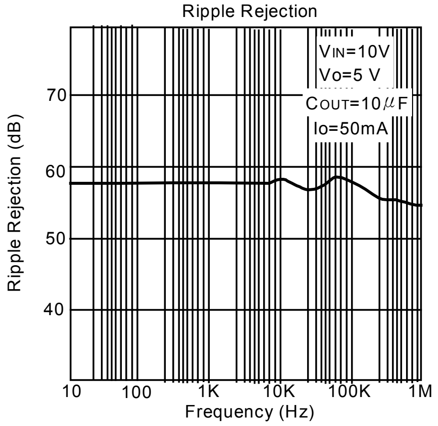
Line Transient Response



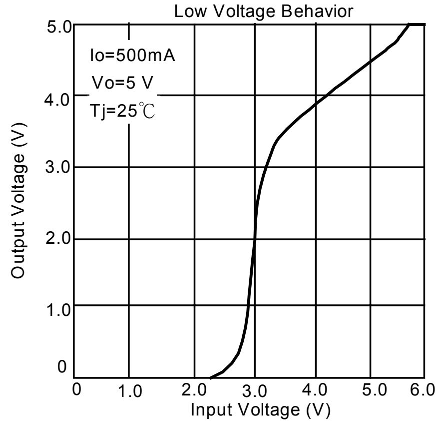
Load Transient Response



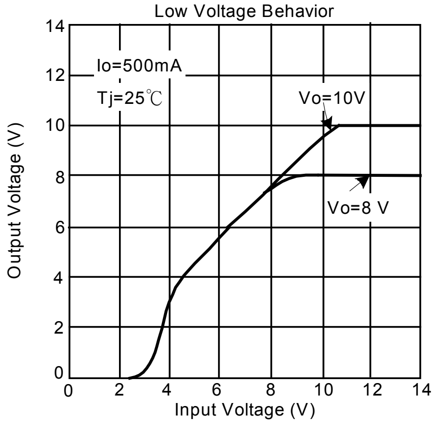
Ripple Rejection



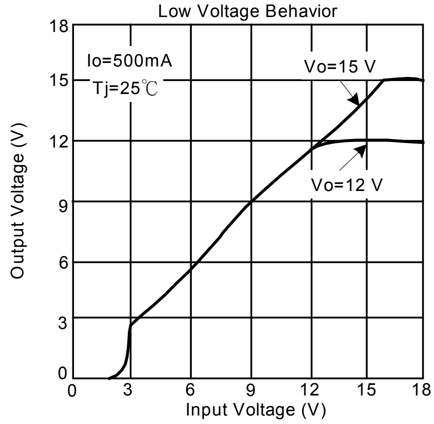
Low Voltage Behavior

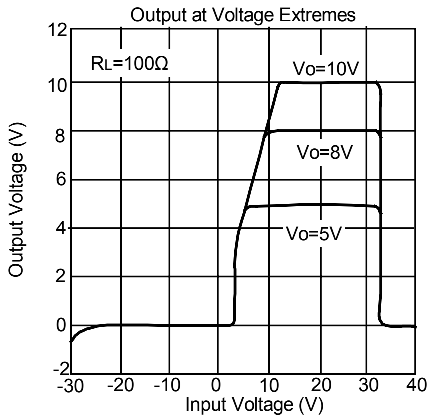


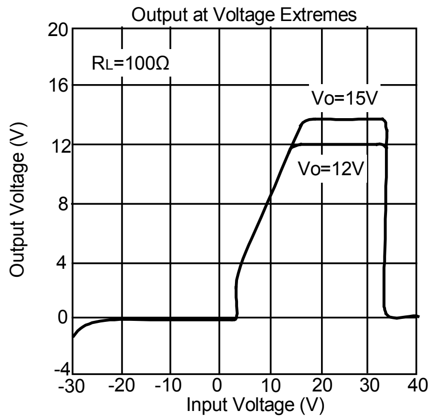
Low Voltage Behavior

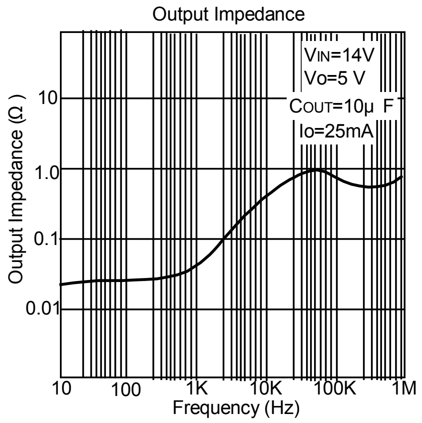


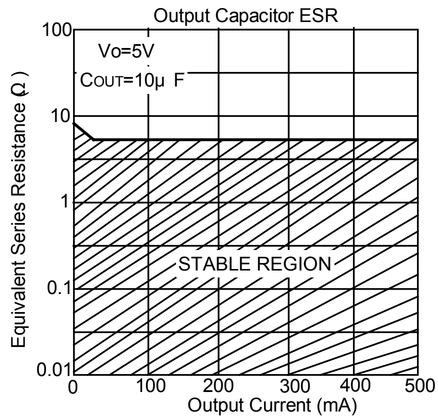
Low Voltage Behavior

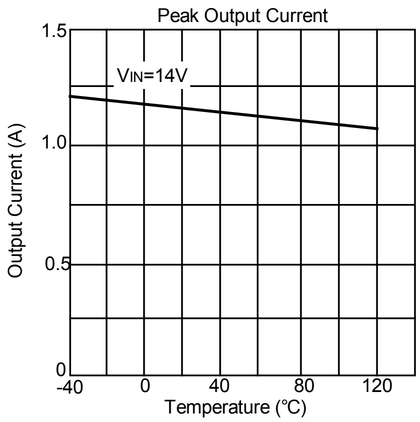



Output at Voltage Extremes
RL=100Ω
Vo=10V
Vo=8V
Vo=5V
Output Voltage (V)
Input Voltage (V)
12
10
8
6
4
2
0
-2
-30 -20 -10 0 10 20 30 40


Output at Voltage Extremes
RL=100Ω
Vo=15V
Vo=12V
Output Voltage (V)
Input Voltage (V)
20
16
12
8
4
0
-4
-30 -20 -10 0 10 20 30 40


Output Impedance
VIN=14V
Vo=5 V
COUT=10μ F
Io=25mA
Output Impedance (Ω)
Frequency (Hz)
10
1.0
0.1
0.01
10 100 1K 10K 100K 1M


Output Capacitor ESR
Vo=5V
COUT=10μ F
STABLE REGION
Equivalent Series Resistance (Ω)
Output Current (mA)
100
10
1
0.1
0.01
0 100 200 300 400 500


Peak Output Current
VIN=14V
Output Current (A)
Temperature (℃)
1.5
1.0
0.5
0
-40 0 40 80 120