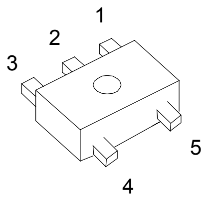
VERY LOW DROP AND LOW NOISE VOLTAGE REGULATOR LOW ESR CAP. COMPATIBLE, WITH INHIBIT FUNCTION

DESCRIPTION

The UTC LD1985 is a 150mA fixed output voltage regulator. The ultra low drop voltage and the low quiescent current make them particularly suitable for low noise, low power applications, and in battery powered systems. In sleep mode quiescent current is less than 1μA when INHIBIT pin is pulled low. Shutdown Logic Control Function is available on pin 3 (TTL compatible). This means that when the device is used as local regulator, it is possible to put a part of the board in standby, decreasing the total power consumption.

An external capacitor, C_{BYP}=10nF, connected between bypass pin and GND reduce the noise to 30μVrms.

Typical application are in cellular phone, palmtop laptop computer, personal digital assistant (PDA), personal stereo, camcorder and camera.



SOT-25

1:V_{IN} 2:GND 3:INHIBIT
4:Bypass 5:V_{OUT}

FEATURES

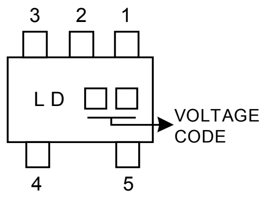
*VERY LOW DROPOUT VOLTAGE (280mV at 150mA AND 7mV at 1mA LOAD)
*VERY LOW QUIESCENT CURRENT (2mA Typ. at 150mA LOAD AND 80μA at NO LOAD)
*OUTPUT CURRENT UP TO 150mA
*LOGIC CONTROLLED ELECTRONIC SHUTDOWN
*OUTPUT VOLTAGE OF 1.5, 1.8, 2.5, 2.8, 2.85, 3, 3.1, 3.2, 3.3, 3.5, 3.6, 3.8, 4, 4.7, 5V
*INTERNAL CURRENT AND THERMAL LIMIT
*AVAILABLE IN ± 1% TOLLERANCE (at 25℃, A VERSION)
*LOW OUTPUT NOISE VOLTAGE 30μVrms

PIN DESCRIPTION

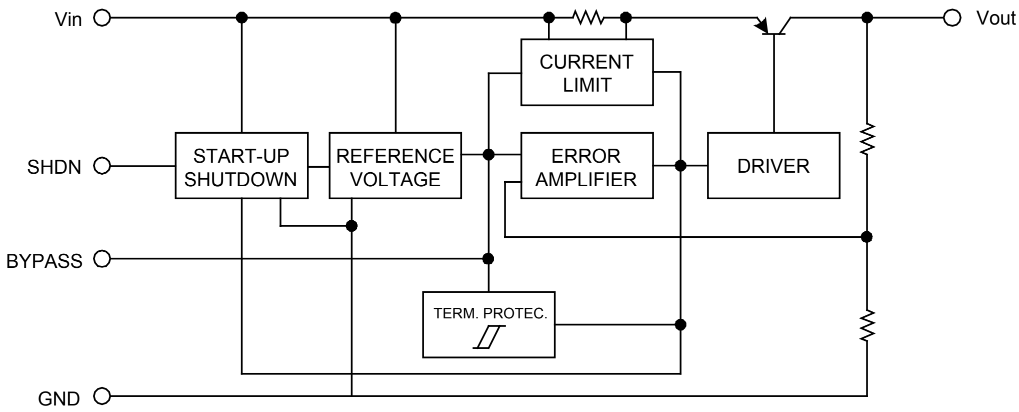
PIN NO.	PIN NAME	FUNCTION
1	IN	Input Port
2	GND	Ground Pin
3	INHIBIT	Control switch ON/OFF. Inhibit is not internally pulled-up; it cannot be left floating. Disable the device when connected to GND or to a positive voltage less than 0.18V
4	Bypass	Bypass Pin: Capacitor to be connected to GND in order to improve the thermal noise performances.
5	OUT	Output Port

MARKING INFORMATION

PART NUMBER	VOLTAGE	VOLTAGE CODE	PART NUMBER	VOLTAGE	VOLTAGE CODE	MARKING
LD1985-1.5V	1.5V	15	LD1985-3.3V	3.3V	33	
LD1985-1.8V	1.8V	18	LD1985-3.5V	3.5V	35	
LD1985-2.5V	2.5V	25	LD1985-3.6V	3.6V	36	
LD1985-2.8V	2.8V	28	LD1985-3.8V	3.8V	38	
LD1985-2.85V	2.85V	2J	LD1985-4.0V	4.0V	40	
LD1985-3.0V	3.0V	30	LD1985-4.7V	4.7V	47	
LD1985-3.1V	3.1V	31	LD1985-5.0V	5.0V	50	
LD1985-3.2V	3.2V	32				



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
DC Input Voltage	V_i	7	V
INHIBIT Input Voltage	V_{INH}	7	V
Output Current	I_o	Internally limited	
Power Dissipation	P_{tot}	Internally limited	
Storage Temperature Range	T_{stg}	-65 ~ +150	℃
Operating Junction Temperature Range	T_{op}	-40 ~ +125	℃

THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Thermal Resistance Junction-case	$R_{thj\text{-}case}$	81	℃/W

ELECTRICAL CHARACTERISTICS FOR LD1985 Vo±1.0%

(T_J=25℃, V_i=Vo+1V, Io=1mA, V_{SHDN}=2V, C_i=1μF, Co=1μF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Operating Input Voltage	Vop		2.5		7	V
Output Voltage	Vo	V_i=2.5V	1.485	1.5	1.515	V
		Io=1 ~ 150mA	1.462		1.538	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	1.447		1.553	V
Output Voltage	Vo	V_i=2.8V	1.782	1.8	1.818	V
		Io=1 ~ 150mA	1.755		1.845	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	1.737		1.863	V
Output Voltage	Vo	V_i=3.5V	2.475	2.5	2.525	V
		Io=1 ~ 150mA	2.4375		2.5625	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.4125		2.5875	V
Output Voltage	Vo	V_i=3.8V	2.772	2.8	2.828	V
		Io=1 ~ 150mA	2.730		2.870	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.702		2.898	V
Output Voltage	Vo	V_i=3.85V	2.821	2.85	2.879	V
		Io=1 ~ 150mA	2.778		2.921	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.750		2.950	V
Output Voltage	Vo	V_i=4.0V	2.970	3.0	3.030	V
		Io=1 ~ 150mA	2.925		3.075	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.895		3.105	V
Output Voltage	Vo	V_i=4.1V	3.069	3.1	3.131	V
		Io=1 ~ 150mA	3.022		3.1775	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.9915		3.2085	V
Output Voltage	Vo	V_i=4.2V	3.168	3.2	3.232	V
		Io=1 ~ 150mA	3.120		3.280	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.088		3.312	V
Output Voltage	Vo	V_i=4.3V	3.267	3.3	3.333	V
		Io=1 ~ 150mA	3.2175		3.3825	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.1845		3.4155	V
Output Voltage	Vo	V_i=4.5V	3.465	3.5	3.535	V
		Io=1 ~ 150mA	3.412		3.587	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.377		3.622	V
Output Voltage	Vo	V_i=4.6V	3.564	3.6	3.636	V
		Io=1 ~ 150mA	3.510		3.690	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.474		3.726	V
Output Voltage	Vo	V_i=4.8V	3.762	3.8	3.838	V
		Io=1 ~ 150mA	3.705		3.895	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.667		3.933	V
Output Voltage	Vo	V_i=5.0V	3.96	4	4.04	V
		Io=1 ~ 150mA	3.9		4.1	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.86		4.14	V
Output Voltage	Vo	V_i=5.7V	4.653	4.7	4.747	V
		Io=1 ~ 150mA	4.582		4.817	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	4.5355		4.8645	V
Output Voltage	Vo	V_i=6.0V	4.95	5	5.05	V
		Io=1 ~ 150mA	4.875		5.125	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	4.825		5.175	V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Short Circuit Current	Isc	R_L=0		400		mA
Line Regulation	△Vo/△V_i	V_i=Vo+1V ~ 16V, Io=1mA		0.003	0.014	%/V_i
		V_i=Vo+1V ~ 16V, Io=1mA T_J=-40 ~ 125℃			0.032	%/V_i
Dropout Voltage	V_d	Io=0		1	3	mV
		T_J=-40 ~ 125℃, Io=0			5	mV
		Io=1mA		7	10	mV
		Io=1mA, T_J=-40 ~ 125℃			15	mV
		Io=10mA		40	60	mV
		Io=10mA, T_J=-40 ~ 125℃			90	mV
		Io=50mA		120	150	mV
		Io=50mA, T_J=-40 ~ 125℃			225	mV
		Io=150mA		280	350	mV
		Io=150mA, T_J=-40 ~ 125℃			575	mV
Quiescent Current	I_d	Io=0		80	100	μA
		T_J=-40 ~ 125℃, Io=0			150	μA
		Io=1mA		100	150	μA
		Io=1mA, T_J=-40 ~ 125℃			200	μA
		Io=10mA		200	300	μA
		Io=10mA, T_J=-40 ~ 125℃			400	μA
		Io=50mA		600	900	μA
		Io=50mA, T_J=-40 ~ 125℃			1200	μA
		Io=150mA		2000	3000	μA
		Io=150mA, T_J=-40 ~ 125℃			4000	μA
		OFF MODE V_{INH}<0.18V		0		μA
		OFF MODE V_{INH}<0.18V T_J=-40 ~ 125℃			2	μA
Supply Voltage Rejection	SVR	C_{BYP}=0.01μF, Co=10μF, f=1KHz		45		dB
Control Input Logic Low	V_{IL}	T_J=-40 ~ 125℃			0.15	V
Control Input Logic High	V_{IH}	T_J=-40 ~ 125℃	2			V
Control Input Current	I_{INH}	T_J=-40 ~ 125℃, V_{SHDN}=5V		5	15	μA
		T_J=-40 ~ 125℃, V_{SHDN}=0V		0	-1	μA
Output Noise Voltage	eN	B=300Hz ~ 50KHz C_{BYP}=0.01μF, Co=10μF		30		μV

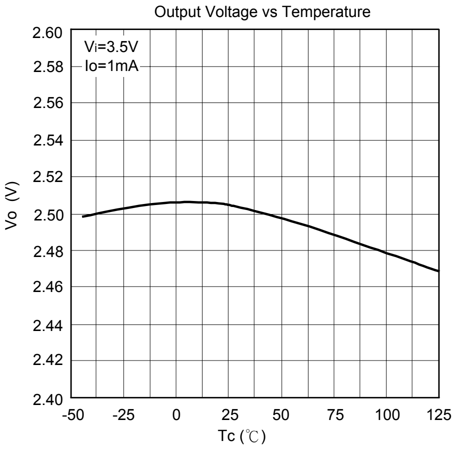
ELECTRICAL CHARACTERISTICS FOR LD1985 Vo±1.5%

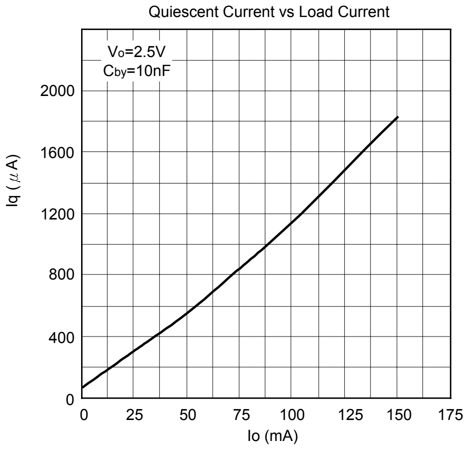
(T_J=25℃, V_i=Vo+1V, Io=1mA, V_{SHDN}=2V, C_i=1μF, Co=1μF, unless otherwise specified)

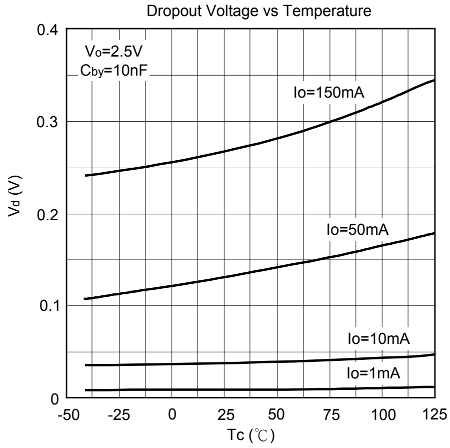
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Operating Input Voltage	Vop		2.5		7	V
Output Voltage	Vo	V_i=2.5V	1.477	1.5	1.523	V
		Io=1 ~ 150mA	1.455		1.545	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	1.440		1.560	V
Output Voltage	Vo	V_i=2.8V	1.773	1.8	1.827	V
		Io=1 ~ 150mA	1.746		1.854	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	1.728		1.872	V
Output Voltage	Vo	V_i=3.5V	2.4625	2.5	2.5375	V
		Io=1 ~ 150mA	2.425		2.575	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.4		2.6	V
Output Voltage	Vo	V_i=3.8V	2.758	2.8	2.842	V
		Io=1 ~ 150mA	2.716		2.884	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.688		2.912	V
Output Voltage	Vo	V_i=3.85V	2.807	2.85	2.893	V
		Io=1 ~ 150mA	2.764		2.935	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.736		2.964	V
Output Voltage	Vo	V_i=4.0V	2.955	3.0	3.045	V
		Io=1 ~ 150mA	2.91		3.09	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.88		3.12	V
Output Voltage	Vo	V_i=4.1V	3.0535	3.1	3.1465	V
		Io=1 ~ 150mA	3.007		3.193	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	2.976		3.224	V
Output Voltage	Vo	V_i=4.2V	3.152	3.2	3.248	V
		Io=1 ~ 150mA	3.104		3.296	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.072		3.328	V
Output Voltage	Vo	V_i=4.3V	3.2505	3.3	3.3495	V
		Io=1 ~ 150mA	3.201		3.399	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.168		3.432	V
Output Voltage	Vo	V_i=4.5V	3.447	3.5	3.552	V
		Io=1 ~ 150mA	3.395		3.605	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.360		3.640	V
Output Voltage	Vo	V_i=4.6V	3.546	3.6	3.654	V
		Io=1 ~ 150mA	3.492		3.708	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.456		3.744	V
Output Voltage	Vo	V_i=4.8V	3.743	3.8	3.857	V
		Io=1 ~ 150mA	3.686		3.914	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.648		3.952	V
Output Voltage	Vo	V_i=5.0V	3.94	4	4.06	V
		Io=1 ~ 150mA	3.88		4.12	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	3.84		4.16	V
Output Voltage	Vo	V_i=5.7V	4.6295	4.7	4.7705	V
		Io=1 ~ 150mA	4.559		4.841	V
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	4.512		4.888	V
Output Voltage	Vo	V_i=6.0V	4.925	5	5.075	V
		Io=1 ~ 150mA	4.85		5.15	V

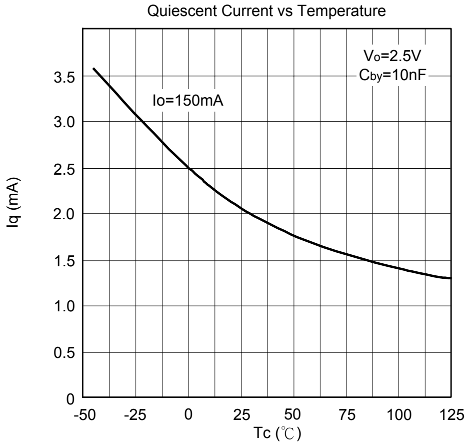
		Io=1 ~ 150mA, T_J=-40 ~ 125℃	4.8		5.2	V
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Short Circuit Current	Isc	R_L=0		400		mA
Line Regulation	△Vo/△V_i	V_i=Vo+1V ~ 16V, Io=1mA		0.03	0.014	%/V_i
		V_i=Vo+1V ~ 16V, Io=1mA T_J=-40 ~ 125℃			0.032	%/V_i
Dropout Voltage	V_d	Io=0		1	3	mV
		T_J=-40 ~ 125℃, Io=0			5	mV
		Io=1mA		7	10	mV
		Io=1mA, T_J=-40 ~ 125℃			15	mV
		Io=10mA		40	60	mV
		Io=10mA, T_J=-40 ~ 125℃			90	mV
		Io=50mA		120	150	mV
		Io=50mA, T_J=-40 ~ 125℃			225	mV
		Io=150mA		280	350	mV
		Io=150mA, T_J=-40 ~ 125℃			575	mV
Quiescent Current	I_d	Io=0		80	100	μA
		T_J=-40 ~ 125℃, Io=0			150	μA
		Io=1mA		100	150	μA
		Io=1mA, T_J=-40 ~ 125℃			200	μA
		Io=10mA		200	300	μA
		Io=10mA, T_J=-40 ~ 125℃			400	μA
		Io=50mA		600	900	μA
		Io=50mA, T_J=-40 ~ 125℃			1200	μA
		Io=150mA		2000	3000	μA
		Io=150mA, T_J=-40 ~ 125℃			4000	μA
		OFF MODE V_{INH}<0.18V		0		μA
		OFF MODE V_{INH}<0.18V T_J=-40 ~ 125℃			2	μA
Supply Voltage Rejection	SVR	C_{BYP}=0.01μF, Co=10μF, f=1KHz		45		dB
Control Input Logic Low	V_{IL}	T_J=-40 ~ 125℃			0.15	V
Control Input Logic High	V_{IH}	T_J=-40 ~ 125℃	2			V
Control Input Current	I_{INH}	T_J=-40 ~ 125℃, V_{SHDN}=5V		5	15	μA
		T_J=-40 ~ 125℃, V_{SHDN}=0V		0	-1	μA
Output Noise Voltage	eN	B=300Hz ~ 50KHz C_{BYP}=0.01μF, Co=10μF		30		μV

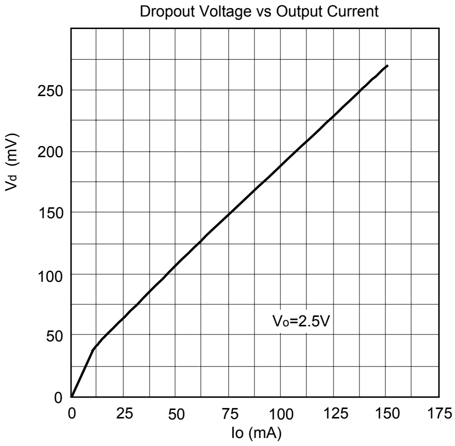
TYPICAL CHARACTERISTICS (T_J=25℃, C_i=1μF, Co=2.2μF, C_{BYP}=100nF, unless otherwise specified)

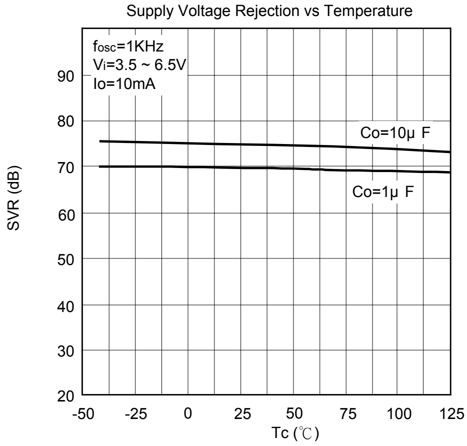

Output Voltage vs Temperature
Vi=3.5V
Io=1mA
Vo (V)
Tc (℃)

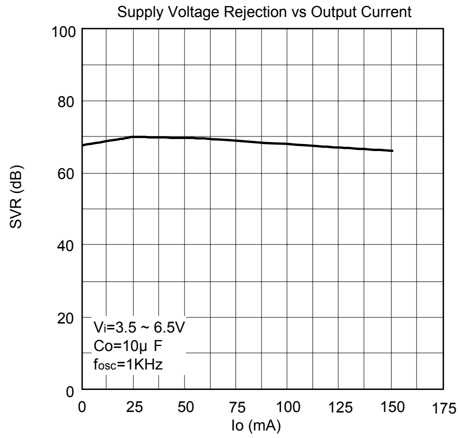

Quiescent Current vs Load Current
Vo=2.5V
Cby=10nF
Iq (μA)
Io (mA)

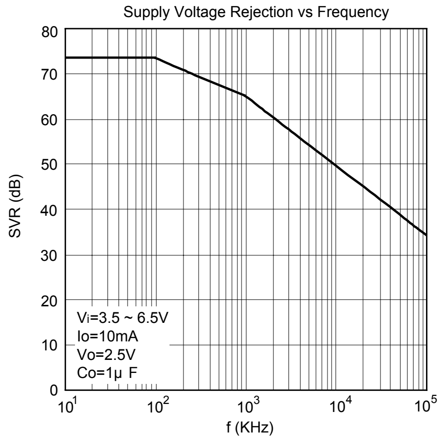

Dropout Voltage vs Temperature
Vo=2.5V
Cby=10nF
Io=150mA
Io=50mA
Io=10mA
Io=1mA
Vd (V)
Tc (℃)

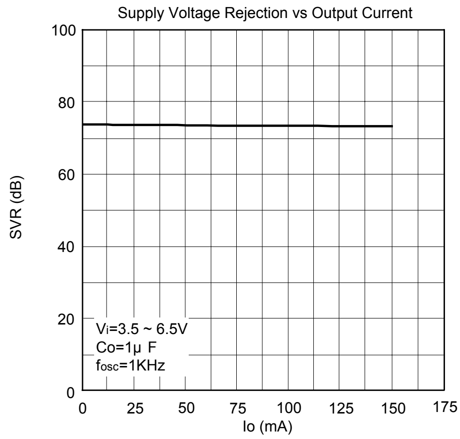

Quiescent Current vs Temperature
Vo=2.5V
Cby=10nF
Io=150mA
Iq (mA)
Tc (℃)

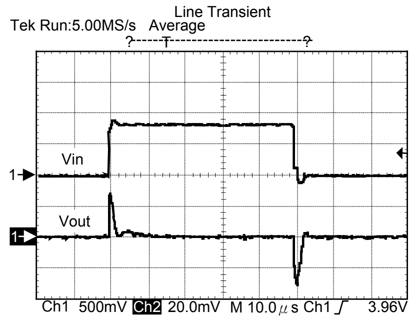

Dropout Voltage vs Output Current
Vo=2.5V
Vd (mV)
Io (mA)


Supply Voltage Rejection vs Temperature
fosc=1KHz
Vi=3.5 ~ 6.5V
Io=10mA
Co=10μ F
Co=1μ F
SVR (dB)
Tc (℃)

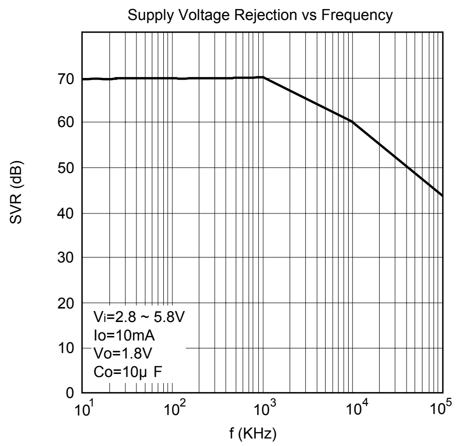


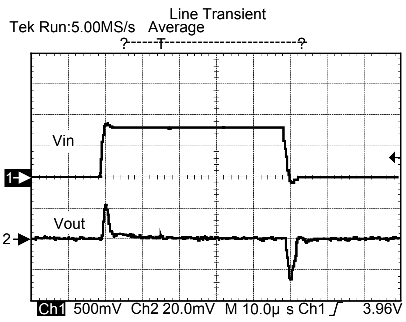






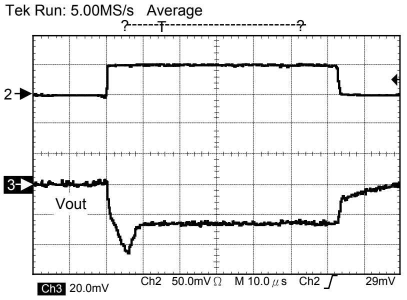
Vo=2.5V, Io=50mA, no Ci, Co=4.7μ F, tr=tf=20ns





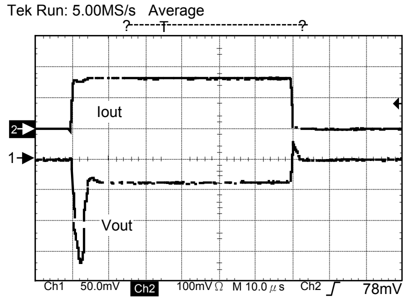
Vo=2.5V, Io=50mA, no Ci, Co=4.7μF, tr=tf=1μs

Load Transient



V_O=2.5V, I_O=0 ~ 50mA, no C_i, C_O=10μ F, t_s=t_r=2ns

Load Transient



V_O=2.5V, I_O=50mA, no C_i, C_O=4.7μ F, t_s=t_r=20ns

APPLICATION INFORMATION

EXTERNAL CAPACITORS

Like any low-dropout regulator, the UTC LD1985 requires external capacitors for regulator stability. This capacitor must be selected to meet the requirements of minimum capacitance and equivalent series resistance. We suggest to solder input and output capacitors as close as possible to the relative pins.

INPUT CAPACITOR

An input capacitor whose value is 1μF is required with the UTC LD1985 (amount of capacitance can be increased without limit). This capacitor must be located a distance of not more than 0.5" from the input pin of the device and returned to a clean analog ground. Any good quality ceramic, tantalum or film capacitors can be used for this capacitor.

OUTPUT CAPACITOR

The UTC LD1985 is designed specifically to work with ceramic output capacitors. It may also be possible to use Tantalum capacitors, but these are not as attractive for reasons of size and cost. By the way, the output capacitor must meet both the requirement for minimum amount of capacitance and E.S.R. (equivalent series resistance) value. Due to the different loop gain, the stability improves for higher output versions and so the suggested minimum output capacitor value, if low E.S.R. ceramic type is used, is 1μF for output voltages equal or major than 3.8V, 2.2μF for V_O going from 1.8 ~ 3.3V, and 3.3μF for the other versions. However, if an output capacitor lower than the suggested one is used, it's possible to make stable the regulator adding a resistor in series to the capacitor.

IMPORTANT:

The output capacitor must maintain its ESR in the stable region over the full operating temperature to assure stability. Also, capacitor tolerance and variation with temperature must be considered to assure the minimum amount of capacitance is provided at all times. This capacitor should be located not more than 0.5" from the output pin of the device and returned to a clean analog ground.

INHIBIT INPUT OPERATION

The inhibit pin can be used to turn OFF the regulator when pulled low, so drastically reducing the current consumption down to less than 1μA. When the inhibit feature is not used, this pin must be tied to V_I to keep the regulator output ON at all times. To assure proper operation, the signal source used to drive the inhibit pin must be able to swing above and below the specified thresholds listed in the electrical characteristics section under V_{IH} V_{IL}. Any slew rate can be used to drive the inhibit.

REVERSE CURRENT

The power transistor used in the UTC LD1985 has not an inherent diode connected between the regulator input and output. If the output is forced above the input, no current will flow from the output to the input across the series pass transistor. When a V_{REV} voltage is applied on the output, the reverse current measured flows to the GND across the two feedback resistors. This current typical value is 160μA. R_1 and R_2 resistors are implanted type;

Typical values are, respectively, 42.6 KΩ and 51.150 KΩ.

Reverse Current Test Circuit