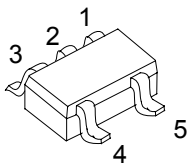
VERY LOW DROP AND LOW NOISE VOLTAGE REGULATOR LOW ESR CAP. COMPATIBLE, WITH INHIBIT FUNCTION



SOT-25

*Pb-free plating product number: LD1985L

■ DESCRIPTION

The UTC LD1985 is a 150mA fixed output voltage regulator with ultra low drop voltage and the low quiescent current. It is specially designed for low noise, low power applications and in battery powered systems, such as Cell phones, palmtop laptop computer, PDAs, DSC.

The quiescent current in sleep mode is less than 1μA when INHIBIT pin is pulled low. Due to Shutdown Logic Control Function is available on pin 3 (TTL compatible), 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 Besides, an external capacitor, C_{BYP}=10nF, connected between bypass pin and GND could reduce the noise to 30μVrms.

■ 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, 5.0V
*Internal current and thermal limit
*± 1% tolerance version is available.(at 25℃)
*Low output noise voltage 30μVrms

■ ORDERING INFORMATION

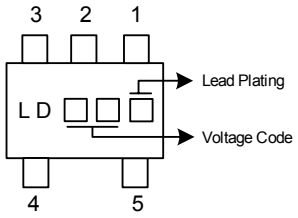
Order Number		Package	Packing
Normal	Lead Free Plating		
LD1985-xx-AF5-R	LD1985L-xx-AF5-R	SOT-25	Tape Reel

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

LD1985L-xx-AF5-R

(1)Packing Type	(1) R: Tape Reel
(2)Package Type	(2) AF5: SOT-25
(3)Output Voltage Code	(3) xx: refer to Marking Information
(4)Lead Plating	(4) L: Lead Free Plating, Blank: Pb/Sn

■ MARKING INFORMATION

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

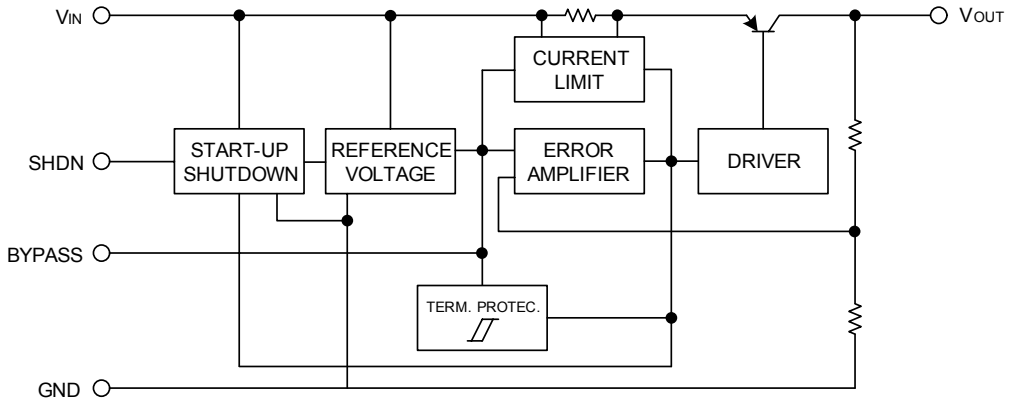
■ PIN DESCRIPTION

PIN NO.	PIN NAME	FUNCTION
1	V_{IN}	Input
2	GND	Ground
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	V_{OUT}	Output

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Thermal Resistance Junction-Case	θ_{JC}	81	℃/W

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (Ta=25℃)

PARAMETER	SYMBOL	RATINGS	UNIT
DC Input Voltage	V_{IN}	7	V
INHIBIT Input Voltage	V_{INH}	7	V
Output Current	I_{OUT}	Internally limited	
Power Dissipation	P_D	Internally limited	
Operating Junction Temperature	T_{OPR}	-20~+125	℃
Storage Temperature	T_{STG}	-40~+150	℃

Note 1. 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.
2. The device is guaranteed to meet performance specification within 0℃~+70℃ operating temperature range and assured by design from -20℃~+125℃

■ ELECTRICAL CHARACTRISTICS

(T_J=25℃, V_{IN}=V_{OUT}+1V, I_{OUT}=1mA, V_{SHDN}=2V, C_{IN}=1μF, C_{OUT}=1μF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Operating Input Voltage	$V_{IN(OPR)}$			2.5		7.0	V
Output Voltage	V_{OUT}	V_{IN}=2.5V	1.0%	1.485	1.5	1.515	V
			1.5%	1.477		1.523	
		I_{OUT}=1 ~ 150mA	1.0%	1.462		1.538	V
			1.5%	1.455		1.545	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	1.447		1.553	V
			1.5%	1.440		1.560	
Output Voltage	V_{OUT}	V_{IN}=2.8V	1.0%	1.782	1.8	1.818	V
			1.5%	1.773		1.827	
		I_{OUT}=1 ~ 150mA	1.0%	1.755		1.845	V
			1.5%	1.746		1.854	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	1.737		1.863	V
			1.5%	1.728		1.872	
Output Voltage	V_{OUT}	V_{IN}=3.5V	1.0%	2.475	2.5	2.525	V
			1.5%	2.4625		2.5375	
		I_{OUT}=1 ~ 150mA	1.0%	2.4375		2.5625	V
			1.5%	2.425		2.575	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	2.4125		2.5875	V
			1.5%	2.4		2.6	
Output Voltage	V_{OUT}	V_{IN}=3.8V	1.0%	2.772	2.8	2.828	V
			1.5%	2.758		2.842	
		I_{OUT}=1 ~ 150mA	1.0%	2.730		2.870	V
			1.5%	2.716		2.884	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	2.702		2.898	V
			1.5%	2.688		2.912	
Output Voltage	V_{OUT}	V_{IN}=3.85V	1.0%	2.821	2.85	2.879	V
			1.5%	2.807		2.893	
		I_{OUT}=1 ~ 150mA	1.0%	2.778		2.921	V
			1.5%	2.764		2.935	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	2.750		2.950	V
			1.5%	2.736		2.964	
Output Voltage	V_{OUT}	V_{IN}=4.0V	1.0%	2.970	3.0	3.030	V
			1.5%	2.955		3.045	
		I_{OUT}=1 ~ 150mA	1.0%	2.925		3.075	V
			1.5%	2.91		3.09	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	2.895		3.105	V
			1.5%	2.88		3.12	

■ ELECTRICAL CHARACTRISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	V_{IN}=4.1V	1.0%	3.069	3.1	3.131	V
			1.5%	3.0535		3.1465	
		I_{OUT}=1 ~ 150mA	1.0%	3.022		3.1775	V
			1.5%	3.007		3.193	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	2.9915		3.2085	V
			1.5%	2.976		3.224	
Output Voltage	V_{OUT}	V_{IN}=4.2V	1.0%	3.168	3.2	3.232	V
			1.5%	3.152		3.248	
		I_{OUT}=1 ~ 150mA	1.0%	3.120		3.280	V
			1.5%	3.104		3.296	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	3.088		3.312	V
			1.5%	3.072		3.328	
Output Voltage	V_{OUT}	V_{IN}=4.3V	1.0%	3.267	3.3	3.333	V
			1.5%	3.2505		3.3495	
		I_{OUT}=1 ~ 150mA	1.0%	3.2175		3.3825	V
			1.5%	3.201		3.399	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	3.1845		3.4155	V
			1.5%	3.168		3.432	
Output Voltage	V_{OUT}	V_{IN}=4.5V	1.0%	3.465	3.5	3.535	V
			1.5%	3.447		3.552	
		I_{OUT}=1 ~ 150mA	1.0%	3.412		3.587	V
			1.5%	3.395		3.605	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	3.377		3.622	V
			1.5%	3.360		3.640	
Output Voltage	V_{OUT}	V_{IN}=4.6V	1.0%	3.564	3.6	3.636	V
			1.5%	3.546		3.654	
		I_{OUT}=1 ~ 150mA	1.0%	3.510		3.690	V
			1.5%	3.492		3.708	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	3.474		3.726	V
			1.5%	3.456		3.744	
Output Voltage	V_{OUT}	V_{IN}=4.8V	1.0%	3.762	3.8	3.838	V
			1.5%	3.743		3.857	
		I_{OUT}=1 ~ 150mA	1.0%	3.705		3.895	V
			1.5%	3.686		3.914	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	3.667		3.933	V
			1.5%	3.648		3.952	
Output Voltage	V_{OUT}	V_{IN}=5.0V	1.0%	3.96	4.0	4.04	V
			1.5%	3.94		4.06	
		I_{OUT}=1 ~ 150mA	1.0%	3.9		4.1	V
			1.5%	3.88		4.12	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	3.86		4.14	V
			1.5%	3.84		4.16	
Output Voltage	V_{OUT}	V_{IN}=5.7V	1.0%	4.653	4.7	4.747	V
			1.5%	4.6295		4.7705	
		I_{OUT}=1 ~ 150mA	1.0%	4.582		4.817	V
			1.5%	4.559		4.841	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	4.5355		4.8645	V
			1.5%	4.512		4.888	

■ ELECTRICAL CHARACTRISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	V_{IN}=6.0V	1.0%	4.95	5.0	5.05	V
			1.5%	4.925		5.075	
		I_{OUT}=1 ~ 150mA	1.0%	4.875		5.125	V
			1.5%	4.85		5.15	
		I_{OUT} =1 ~ 150mA, T_J=-20 ~ 125℃	1.0%	4.825		5.175	V
			1.5%	4.8		5.2	
Short Circuit Current	Isc	R_L=0			400		mA
Line Regulation	△Vo/△V_I	V_{IN} =Vo+1V ~ 7V, I_{OUT} =1mA			0.003	0.014	%/V_{IN}
		V_{IN} =Vo+1V ~ 7V, I_{OUT} =1mA, T_J=-20 ~ 125℃				0.032	%/ V_{IN}
Dropout Voltage	V_D	I_{OUT} =0			1	3	mV
		I_{OUT} =0, T_J=-20 ~ 125℃				5	mV
		I_{OUT} =1mA			7	10	mV
		I_{OUT} =1mA, T_J=-20 ~ 125℃				15	mV
		I_{OUT} =10mA			40	60	mV
		I_{OUT} =10mA, T_J=-20 ~ 125℃				90	mV
		I_{OUT} =50mA			120	150	mV
		I_{OUT} =50mA, T_J=-20 ~ 125℃				225	mV
		I_{OUT} =150mA			280	350	mV
		I_{OUT} =150mA, T_J=-20 ~ 125℃				575	mV
Quiescent Current	I_Q	I_{OUT} =0			80	100	μA
		I_{OUT} =0, T_J=-20 ~ 125℃				150	μA
		I_{OUT} =1mA			100	150	μA
		I_{OUT} =1mA, T_J=-20 ~ 125℃				200	μA
		I_{OUT} =10mA			200	300	μA
		I_{OUT} =10mA, T_J=-20 ~ 125℃				400	μA
		I_{OUT} =50mA			600	900	μA
		I_{OUT} =50mA, T_J=-20 ~ 125℃				1200	μA
		I_{OUT} =150mA			2000	3000	μA
		I_{OUT} =150mA, T_J=-20 ~ 125℃				4000	μA
		OFF mode V_{INH}<0.18V			0		μA
		OFF mode V_{INH}<0.18V, T_J=-20 ~ 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=-20 ~ 125℃				0.15	V
Control Input Logic High	V_{IH}	T_J=-20 ~ 125℃		2			V
Control Input Current	I_{INH}	T_J=-20 ~ 125℃, V_{SHDN}=5V			5	15	μA
		T_J=-20 ~ 125℃, V_{SHDN}=0V			0	-1	μA
Output Noise Voltage	eN	B=300Hz ~ 50KHz, C_{BYP}=0.01μF, Co=10μF			30		μV

■ APPLICATION INFORMATION

EXTERNAL CAPACITORS

An external capacitor for regulator stability is required. This capacitor must be selected to meet the requirements of minimum capacitance and equivalent series resistance. It is recommended to solder input and output capacitors as close as possible to the relative pins.

INPUT CAPACITOR

A 1μF input capacitor (ceramic, tantalum or film capacitors can be used) is required with the UTC LD1985 (amount of capacitance can be increased without limit). This capacitor must be located a distance less than 0.5" from the input pin of the device and returned to a clean analog ground.

OUTPUT CAPACITOR

The output capacitor must meet both the requirement for minimum amount of capacitance and E.S.R. (equivalent series resistance) value. 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 over time. Due to the different loop gain and the stability improves for higher output versions, if low E.S.R. ceramic type is used, the recommended minimum output capacitor value are is 1μF for output voltages equal or major than 3.8V, 2.2μF for V_{OUT} going from 1.8~3.3V, and 3.3μF for the other versions. However, if an output capacitor lower than the suggestion, it's possible to make stable the regulator adding a resistor in series to the capacitor. 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_{IN} to keep the regulator output ON over time. 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. R1 and R2 resistors are implanted type; and typical values are respectively 42.6 KΩ and 51.15 KΩ.

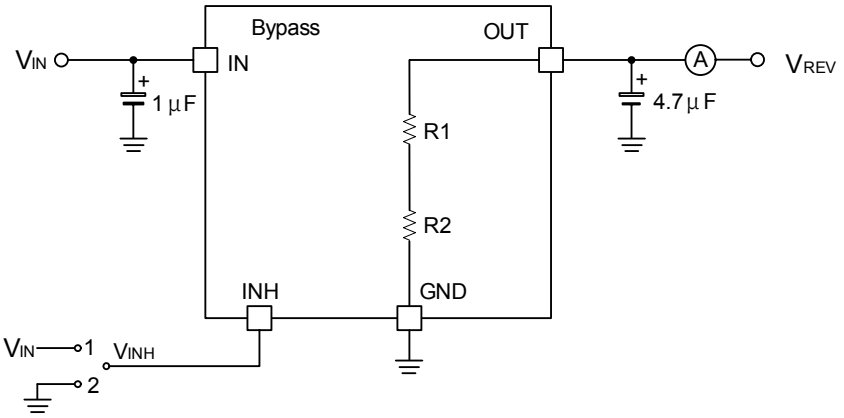
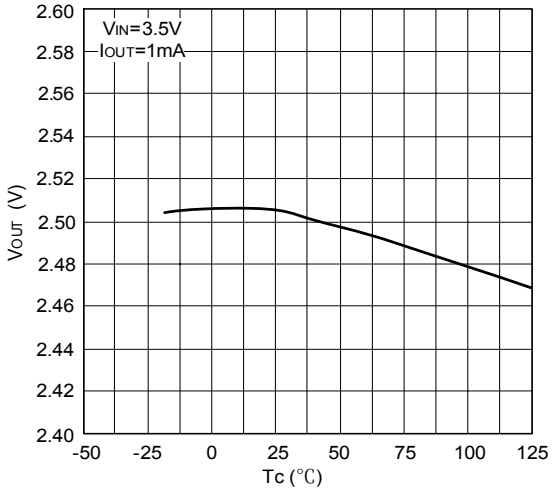


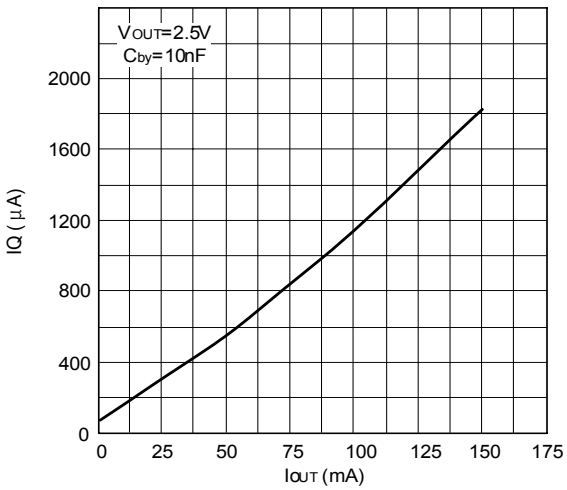
Fig 1. REVERSE CURRENT TEST CIRCUIT

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

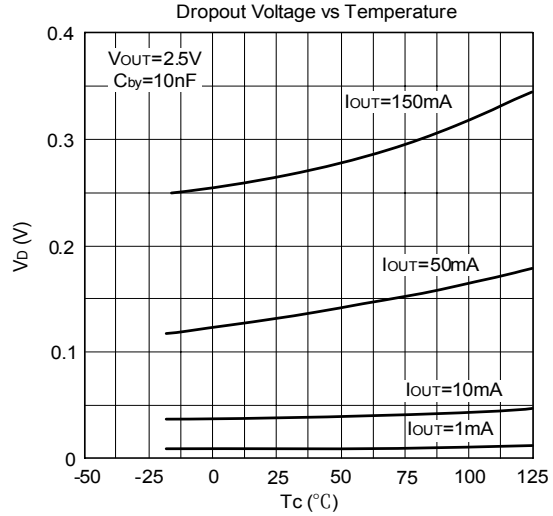
Output Voltage vs Temperature



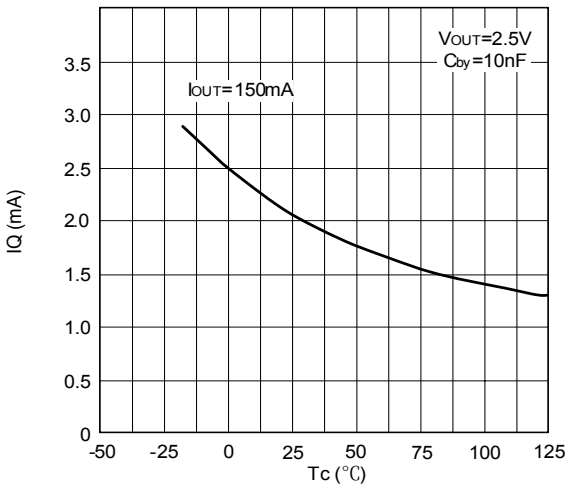
Quiescent Current vs Load Current



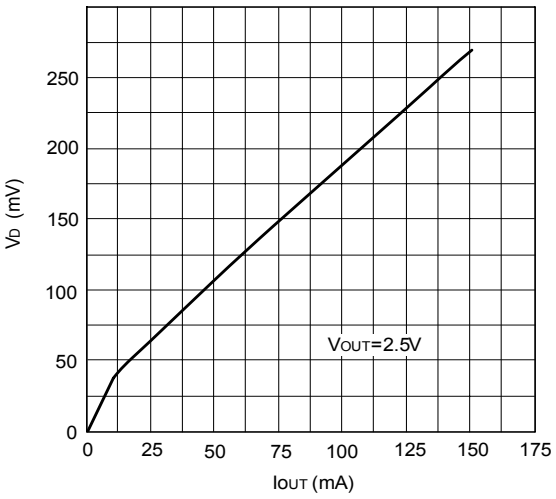
Dropout Voltage vs Temperature



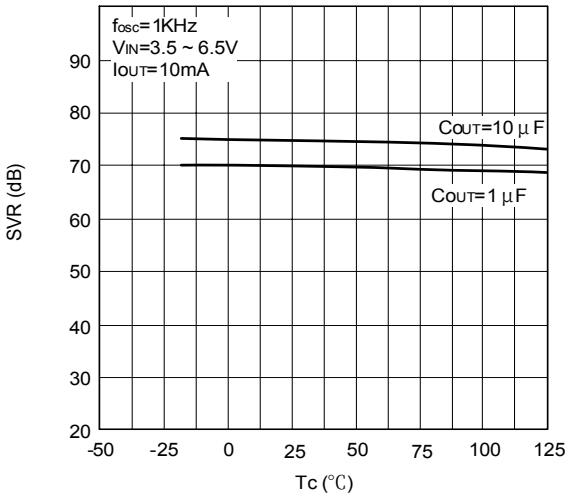
Quiescent Current vs Temperature



Dropout Voltage vs Output Current

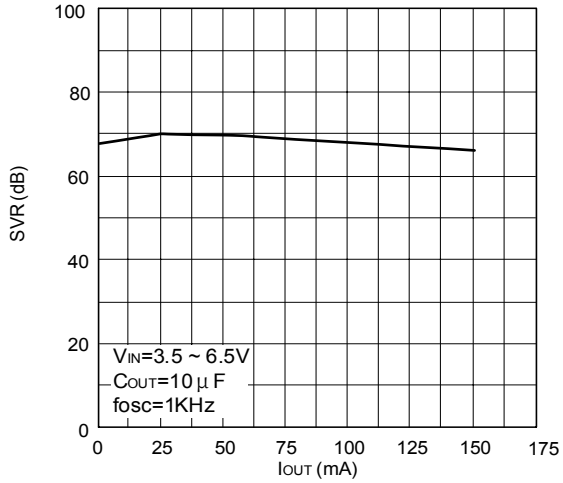


Supply Voltage Rejection vs Temperature

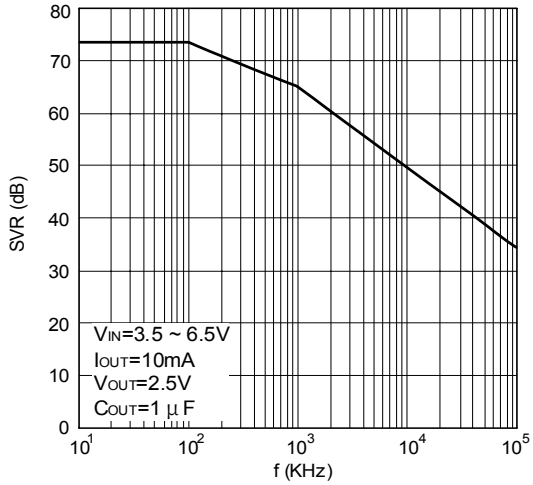


■ TYPICAL CHARACTERISTICS(Cont.)

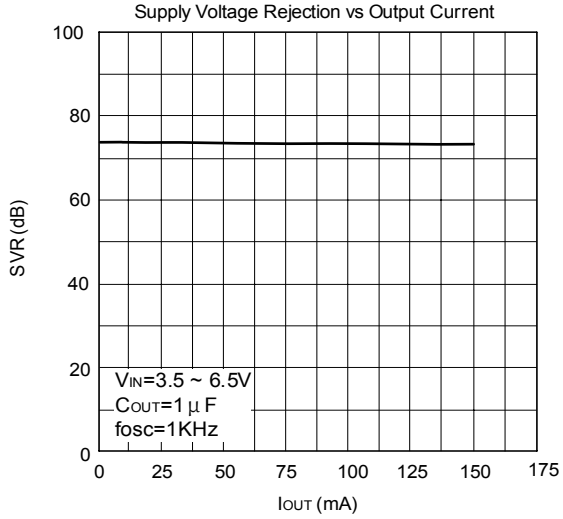
Supply Voltage Rejection vs Output Current



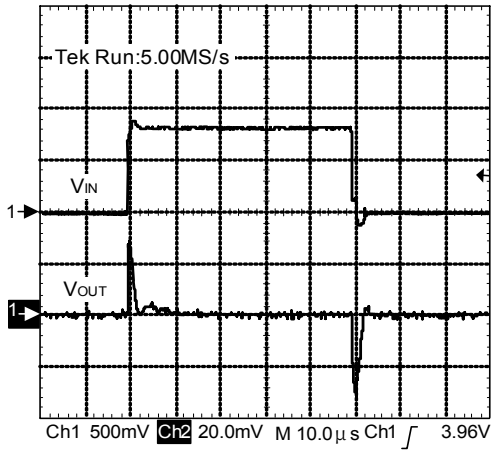
Supply Voltage Rejection vs Frequency



Supply Voltage Rejection vs Output Current

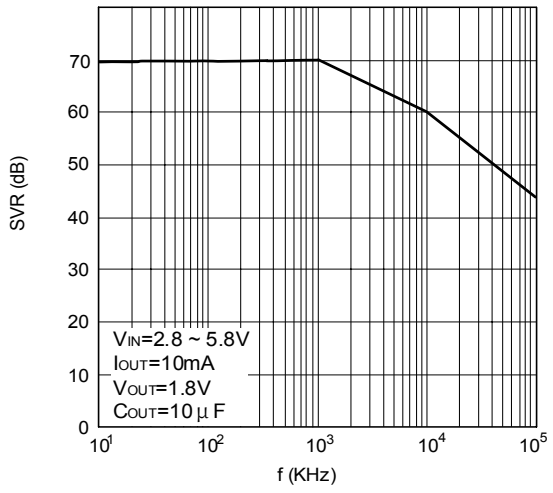


Line Transient

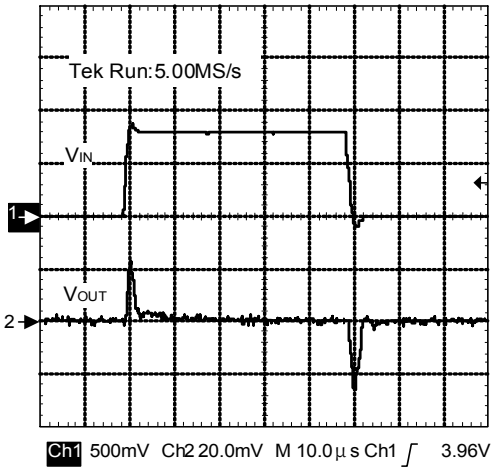


VOUT=2.5V, IOUT=50mA, no CIN, COUT=4.7 μ F, tr=tf=20ns

Supply Voltage Rejection vs Frequency



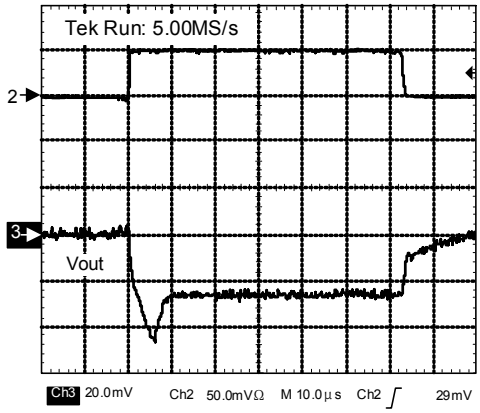
Line Transient



VOUT=2.5V, IOUT=50mA, no CIN, COUT=4.7 μ F, tr=tf=1 μ s

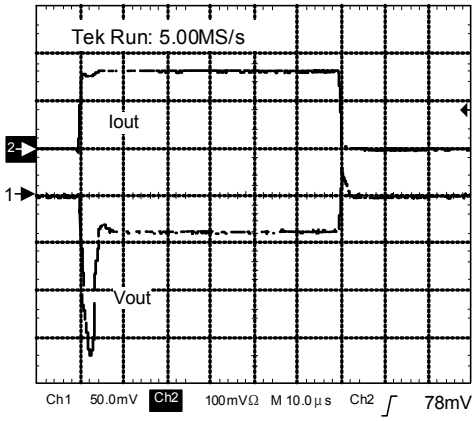
■ TYPICAL CHARACTERISTICS(Cont.)

Load Transient



V_{OUT}=2.5V, I_{OUT}=0~50mA, no C_{IN}, C_{OUT}=10µF, t_s=t_f=2ns

Load Transient



V_{OUT}=2.5V, I_{OUT}=50mA, no C_{IN}, C_{OUT}=4.7µF, t_s=t_f=20ns