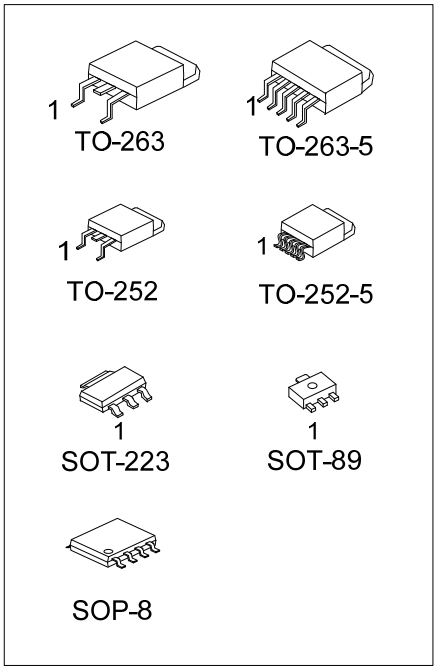
1.5A LOW DROPOUT LINEAR REGULATOR



■ DESCRIPTION

The UTC **LR3965** belonged to low-noise, low-dropout, linear regulators operate from 2.25V to 6V input and are guaranteed to deliver 1.5A. Wide range of preset output voltage options are available. Built-in low on-resistance transistor provides low dropout voltage and large output current. The UTC **LR3965** is designed and optimized for battery-powered systems to work with low noise.

The UTC **LR3965** consumes less than 0.01μA in shutdown mode. Other features include ultra low dropout voltage, current limiting protection, thermal shutdown protection and high ripple rejection ratio.

■ FEATURES

* 1.5A Guaranteed Output Current
* 0.01μA Shutdown Current
* 40mV Dropout at 150mA Load
* Low Temperature Coefficient
* Current Limiting Protection
* Thermal Shutdown Protection
* Excellent Line/Load Transient
* SENSE Option Improves Load Regulation

■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
LR3965L-xx-AB3-C-R	LR3965G-xx-AB3-C-R	SOT-89	G	I	O	-	-	-	-	-	Tape Reel
LR3965L-xx-AA3-D-R	LR3965G-xx-AA3-D-R	SOT-223	I	G	O	-	-	-	-	-	Tape Reel
LR3965L-xx-TN3-A-R	LR3965G-xx-TN3-A-R	TO-252	G	O	I	-	-	-	-	-	Tape Reel
LR3965L-xx-TN3-D-R	LR3965G-xx-TN3-D-R	TO-252	I	G	O	-	-	-	-	-	Tape Reel
LR3965L-xx-TQ2-A-R	LR3965G-xx-TQ2-A-R	TO-263	G	O	I	-	-	-	-	-	Tape Reel
LR3965L-xx-TQ2-A-T	LR3965G-xx-TQ2-A-T	TO-263	G	O	I	-	-	-	-	-	Tube
LR3965L-xx-TQ2-D-R	LR3965G-xx-TQ2-D-R	TO-263	I	G	O	-	-	-	-	-	Tape Reel
LR3965L-xx-TQ2-D-T	LR3965G-xx-TQ2-D-T	TO-263	I	G	O	-	-	-	-	-	Tube
LR3965L-xx-TN5-R	LR3965G-xx-TN5-R	TO-252-5	S	I	G	O	A	-	-	-	Tape Reel
LR3965L-xx-TQ5-R	LR3965G-xx-TQ5-R	TO-263-5	S	I	G	O	A	-	-	-	Tape Reel
LR3965L-xx-TQ5-T	LR3965G-xx-TQ5-T	TO-263-5	S	I	G	O	A	-	-	-	Tube
LR3965L-xx-S08-R	LR3965G-xx-S08-R	SOP-8	S	I	O	A	G	G	G	G	Tape Reel

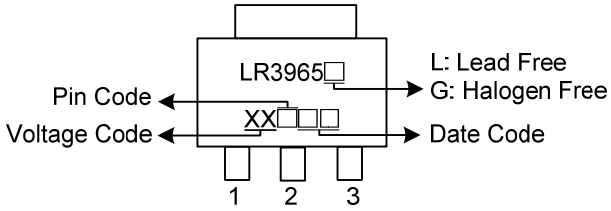
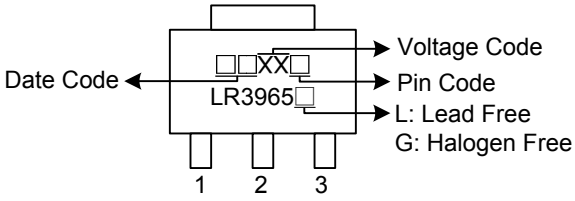
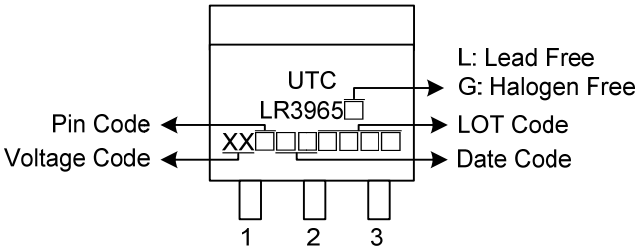
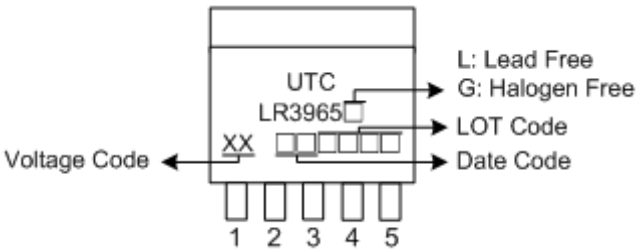
Note: Pin Assignment: I:V_{IN} O:V_{OUT} G:GND S: $\overline{SHDN}$ A: ADJ/SENSE/SS/POK

LR3965L-xx-AA3-D-R

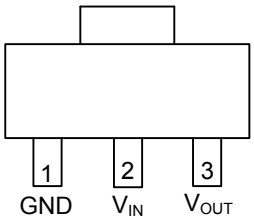
(1)Packing Type
(2)Pin Assignment
(3)Package Type
(4)Output Voltage Code
(5)Lead Plating

(1) R: Tape Reel, T: Tube
(2) refer to Pin Assignment
(3) AA3: SOT-223, AB3: SOT-89, TN3: TO-252
TN5: TO-252-5, TQ2: TO-263, TQ5-TO-263-5
S08: SOP-8
(4) xx: refer to Marking Information
(5) G: Halogen Free, L: Lead Free

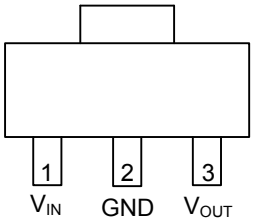
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223	12 :1.2V 18 :1.8V 25 :2.5V 33 :3.3V 50 :5.0V	
SOT-89		
TO-252 TO-263		
TO-252-5 TO-263-5	12 :1.2V 18 :1.8V 25 :2.5V 33 :3.3V 50 :5.0V AD :ADJ	

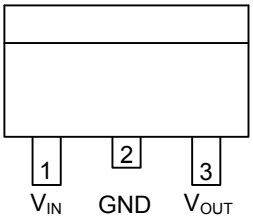
■ PIN CONFIGURATION



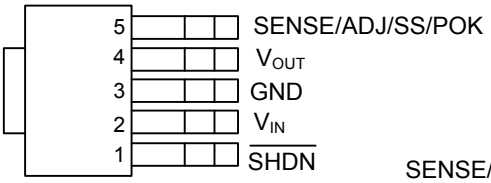
SOT-89



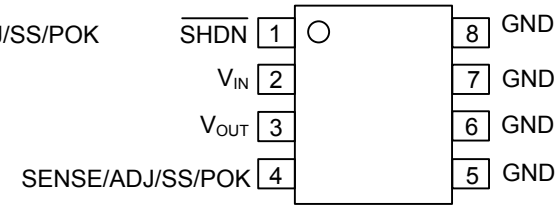
SOT-223



TO-252/TO-263



TO-252-5/TO-263-5

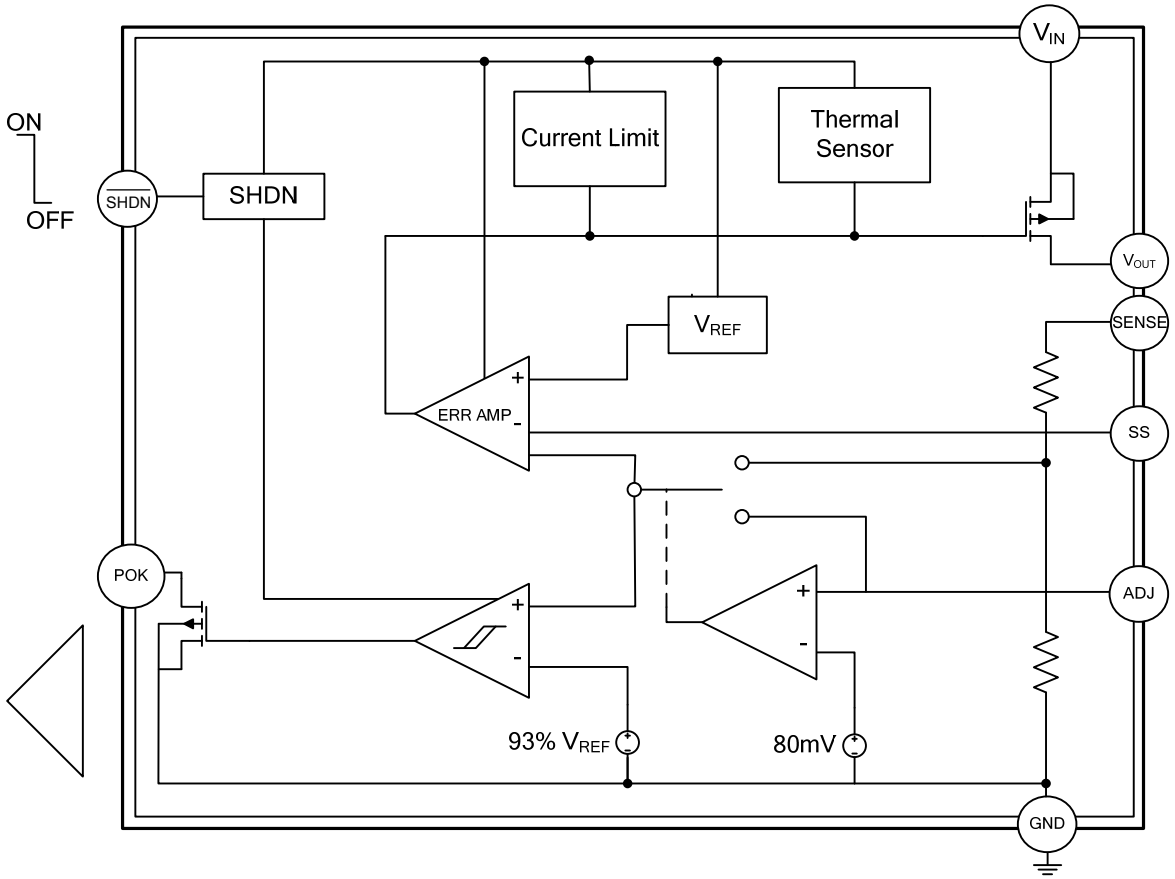


SOP-8

■ PIN DESCRIPTION

PIN NAME	DESCRIPTION
V_{IN}	Power Input Voltage. Supply voltage can range from 2.25V to 6V. Bypass with a 68µF capacitor to GND.
GND	Ground
$\overline{SHDN}$	Active-Low Shutdown Input. A logic low at $\overline{SHDN}$ reduces supply current to 0.01µA. In shutdown, the POK output is low. Connect $\overline{SHDN}$ to V_{IN} for normal operation.
V_{OUT}	Output Voltage
ADJ	Voltage-adjust Input. Connect ADJ to GND for preset output. Connect an external resistive voltage-divider from V_{OUT} to ADJ to set the output voltage between 0.8V and 6V. The ADJ regulation voltage is 800mV or 1.216V.
SENSE	Remote sense pin.
SS	Soft start time setting. For adjustable soft start time version, connect a capacitor from SS to gnd to set the soft start time.
POK	Open-Drain, Active-Low Power-OK Output. POK remains low while the output voltage (VOUT) is below the POK threshold.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (T_a=25°C)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		V_{IN}	6.5	V
Power Dissipation	SOP-8	P_D	606	mW
	SOT-223		714	mw
	SOT-89		500	mW
	TO-252/TO-252-5		952	mW
	TO-263/TO-263-5		1250	mW
Junction Temperature		T_J	+125	°C
Operation Temperature		T_{OPR}	-40 ~ +125	°C
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	RATINGS	UNIT
Junction to Ambient	SOP-8	θ_{JA}	150	°C/W
	SOT-223		165	°C/W
	SOT-89		180	°C/W
	TO-252/TO-252-5		112	°C/W
	TO-263/TO-263-5		64	°C/W
Junction to Case	SOP-8	θ_{JC}	20	°C/W
	SOT-223		15	°C/W
	SOT-89		50	°C/W
	TO-252/TO-252-5		12	°C/W
	TO-263/TO-263-5		4	°C/W

■ ELECTRICAL CHARACTERISTICS (C_{IN} = 68μF, C_{OUT} =33μF, Ta= 25°C, unless otherwise specified)

LR3965-1.2V (V_{IN}=2.25V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}		2.25		6	V
Output Voltage Accuracy (Preset Mode)	V_{OUT}	Ta=25°C , I_{OUT}= 1mA ~1.5A	-2		2	%
		Ta=0~85°C, I_{OUT}= 1mA~1.5A	-3		3	%
Maximum Output Current	I_{OUT}			1.5		A
Short-Circuit Current Limit	I_{LIMIT}	V_{OUT}=0V		2.5		A
Ground Pin Current	I_{GND}	I_{OUT} = 0mA		200		μA
		I_{OUT}= 1mA to 1.5A		250		μA
Dropout Voltage (Note)	V_D	I_{OUT}=1.5A		1000	1050	mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN}=V_{OUT}+V_D~6V		0.08	0.18	%/V
Load Regulation	ΔV_{OUT}	V_{IN}=V_{OUT}+V_D, I_{OUT}=10mA~1.5A		0.25	0.5	%
Output Voltage Noise	eN	f=10Hz to1MHz, C_{OUT}=33μF		300		μV_{RMS}
Shutdown Supply Current	I_{OFF}	$\overline{SHDN}$ = GND		0.01	5	μA
Shutdown Threshold	V_{IH}		1.6			V
	V_{IL}				0.6	V
Thermal Shutdown Temperature	T_{SHDN}			170		°C
Thermal Shutdown Hysteresis	DT_{SHDN}			20		°C
ADJ Voltage	V_{REF}	Measured on ADJ, I_{OUT} =10mA	0.774	0.8	0.826	V
ADJ Mode Threshold				80		mV
Adjustable Output Voltage			0.8		5	V
POK Output Low Voltage	V_{OL}	Sinking 2mA		5	50	mV
Operating Voltage Range for Valid POK Output		Sinking 100μA	1.0		5.5	V
POK Output High Leakage Current		V_{POK}=5.5V			100	nA
POK Threshold		Rising edge, referred to V_{OUT}(NOMINAL)	90	93	96	%
Adjustable Output Voltage			0.8		5	V

LR3965-1.8V (V_{IN} = V_{OUT} + 1V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}		2.8		6	V
Output Voltage Accuracy (Preset Mode)	V_{OUT}	Ta=25°C , I_{OUT}= 1mA ~1.5A	-2		2	%
		Ta=0~85°C, I_{OUT}= 1mA~1.5A	-3		3	%
Maximum Output Current	I_{OUT}			1.5		A
Short-Circuit Current Limit	I_{LIMIT}			2.5		A
Ground Pin Current	I_{GND}	I_{OUT} = 0mA		200		μA
		I_{OUT}= 1mA to 1.5A		250		μA
Dropout Voltage (Note)	V_D	I_{OUT}=1.5A			550	mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN}=V_{OUT}+1V~6V			0.55	%/V
Load Regulation	ΔV_{OUT}	V_{IN}=V_{OUT}+1V, I_{OUT}=10mA~1.5A			0.50	%
Output Voltage Noise	eN	f=10Hz to1MHz, C_{OUT}=33μF		300		μV_{RMS}
Shutdown Supply Current	I_{OFF}	$\overline{SHDN}$ = GND		0.01	5	μA
Shutdown Threshold	V_{IH}		1.6			V
	V_{IL}				0.6	V
Thermal Shutdown Temperature	T_{SHDN}			170		°C
Thermal Shutdown Hysteresis	DT_{SHDN}			20		°C
ADJ Voltage	V_{REF}	Measured on ADJ, I_{OUT} =10mA	0.774	0.8	0.826	V
ADJ Mode Threshold				80		mV
Adjustable Output Voltage			0.8		5	V

■ ELECTRICAL CHARACTERISTICS(Cont.)

LR3965-2.5V(V_{IN} = V_{OUT} + 1V)

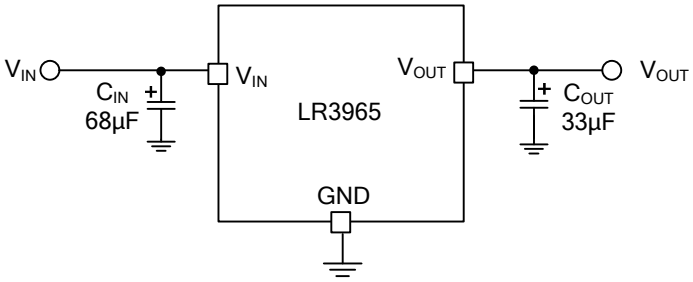
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}		3.5		6	V
Output Voltage Accuracy (Preset Mode)	V_{OUT}	T_a=25°C , I_{OUT}= 1mA ~1.5A	-2		2	%
		T_a=0~85°C, I_{OUT}= 1mA~1.5A	-3		3	%
Maximum Output Current	I_{OUT}			1.5		A
Short-Circuit Current Limit	I_{LIMIT}			2.5		A
Ground Pin Current	I_{GND}	I_{OUT} = 0mA		200		μA
		I_{OUT}= 1mA to 1.5A		250		μA
Dropout Voltage (Note)	V_D	I_{OUT}=1.5A			550	mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN}=V_{OUT}+1V~6V			0.55	%/V
Load Regulation	ΔV_{OUT}	V_{IN}=V_{OUT}+1V, I_{OUT}=10mA~1.5A			0.50	%
Output Voltage Noise	eN	f=10Hz to1MHz, C_{OUT}=33μF		300		μV_{RMS}
Shutdown Supply Current	I_{OFF}	$\overline{SHDN}$ = GND		0.01	5	μA
Shutdown Threshold	V_{IH}		1.6			V
	V_{IL}				0.6	V
Thermal Shutdown Temperature	T_{SHDN}			170		°C
Thermal Shutdown Hysteresis	DT_{SHDN}			20		°C
ADJ Voltage	V_{REF}	Measured on ADJ, I_{OUT} =10mA	0.774	0.8	0.826	V
ADJ Mode Threshold				80		mV
Adjustable Output Voltage			0.8		5	V

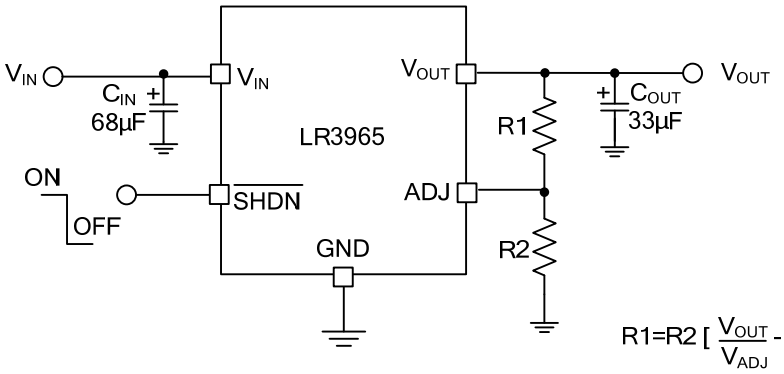
LR3395-5.0V

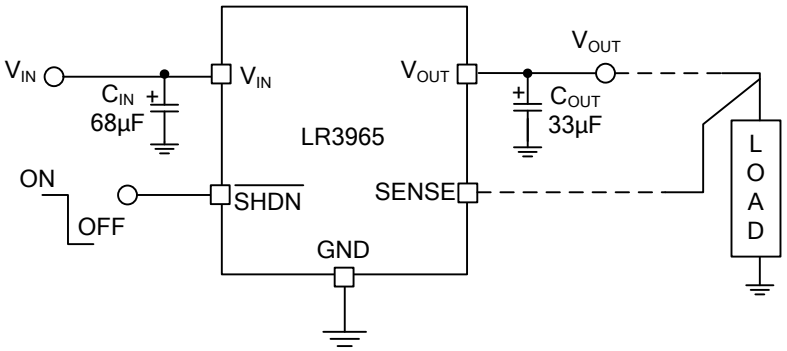
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}		4.3		6	V
Output Voltage Accuracy (Preset Mode)	V_{OUT}	T_a=25°C , I_{OUT}= 1mA ~1.5A	-2		2	%
		T_a=0~85°C, I_{OUT}= 1mA~1.5A	-3		3	%
Maximum Output Current	I_{OUT}			1.5		A
Short-Circuit Current Limit	I_{LIMIT}			2.5		A
Ground Pin Current	I_{GND}	I_{OUT} = 0mA		200		μA
		I_{OUT}= 1mA to 1.5A		250		μA
Dropout Voltage (Note)	V_D	I_{OUT}=1.5A			550	mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN}=V_{OUT}+1V~6V			0.18	%/V
Load Regulation	ΔV_{OUT}	V_{IN}=V_{OUT}+1V, I_{OUT}=10mA~1.5A			0.50	%
Output Voltage Noise	eN	f=10Hz to1MHz, C_{OUT}=33μF		300		μV_{RMS}
Shutdown Supply Current	I_{OFF}	$\overline{SHDN}$ = GND		0.01	5	μA
Shutdown Threshold	V_{IH}		1.6			V
	V_{IL}				0.6	V
Thermal Shutdown Temperature	T_{SHDN}			170		°C
Thermal Shutdown Hysteresis	DT_{SHDN}			20		°C
ADJ Voltage	V_{REF}	Measured on ADJ, I_{OUT} =10mA	0.774	0.8	0.826	V
ADJ Mode Threshold				80		mV
Adjustable Output Voltage			0.8		5	V

Note: The dropout voltage is defined as V_{IN} -V_{OUT}, which is measured when V_{OUT} is $V_{OUT(NORMAL)}$ − 100mV.

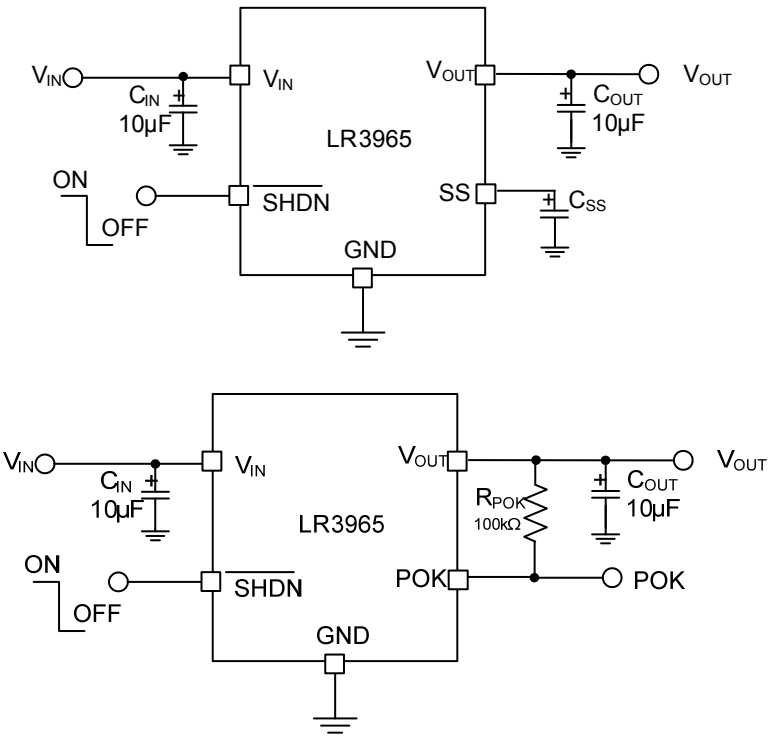
■ TYPICAL APPLICATION CIRCUIT







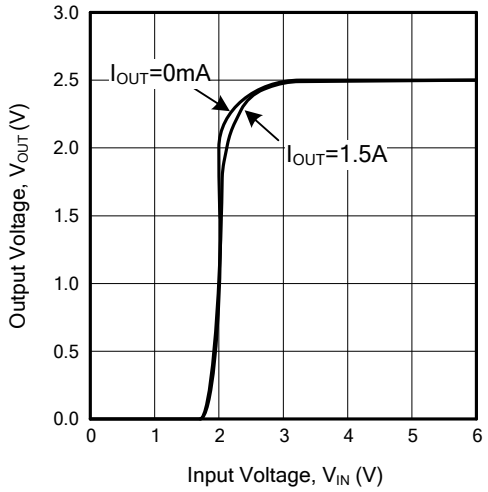
■ TYPICAL APPLICATION CIRCUIT (Cont.)



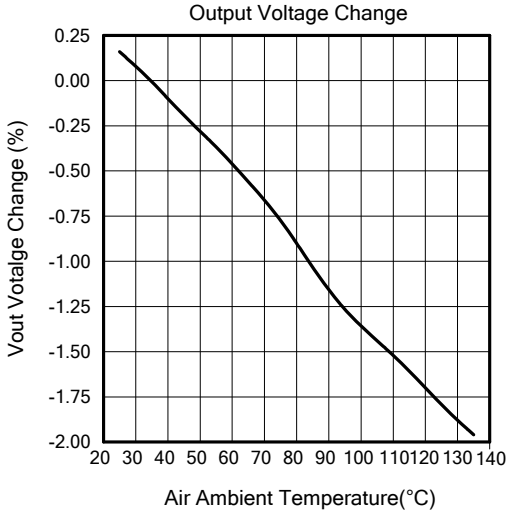
■ TYPICAL CHARACTERISTICS

(V_{IN} = V_{OUT} + 1V or V_{IN} =2.25V whichever is greater , C_{IN} = 68μF, C_{OUT} =33μF，T_a= 25°C, unless otherwise specified)

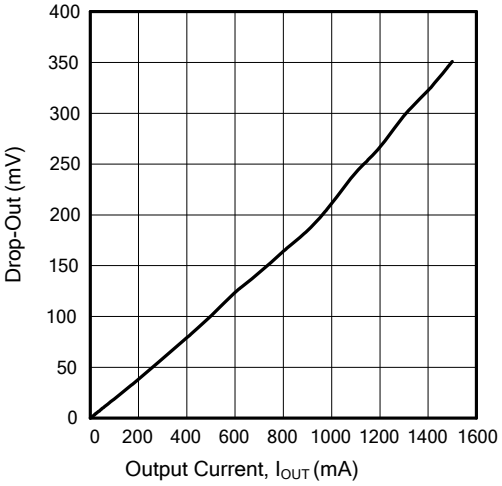
Output Voltage vs Input Voltage



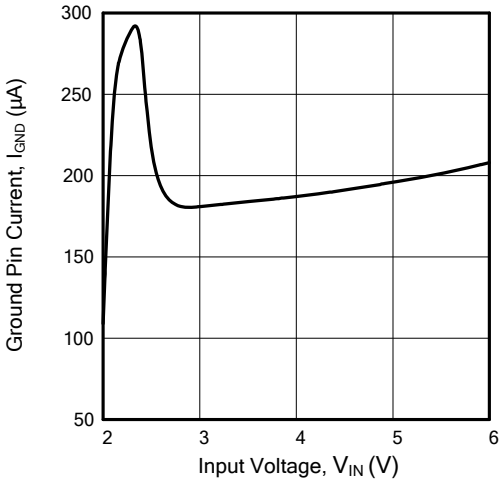
Ambient Temperature vs. Output Voltage Change



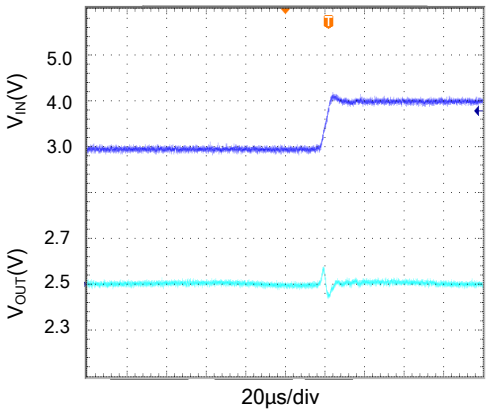
Drop-Out Voltage vs. Load Current



Ground Pin Current vs. Input Voltage



Line Transient Response



Line Transient Response