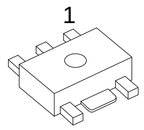
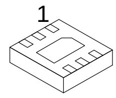
1.0A FAST ULTRA LOW DROPOUT LINEAR REGULATOR



SOT-89-5



DFN2020-6

■ DESCRIPTION

The UTC **LR1805/LR1805AD** operate from a +1.5V ~ +6V input supply as fast ultra low-dropout linear regulators. Wide output voltage range options are available. The fast response characteristic to make UTC **LR1805/LR1805AD** suitable for low voltage microprocessor application. The low quiescent current operation and low dropout quality caused by the CMOS process.

The UTC **LR1805/LR1805AD** has low dropout voltage. The ground pin current is typically 60uA.

Output Voltage Precision: Multiple output voltage options are available and ranging from 1.2V ~ 5.0V at room temperature with a guaranteed accuracy of ±1.5%, and ±3.0% when varying line and load.

The output voltage types of UTC **LR1805-xx** are fixed one in the IC and UTC **LR1805AD** are adjustable one.

■ FEATURES

* Low Dropout Voltage
* The Guaranteed Output Current is 1A DC
* Output Voltage Accuracy ± 1.5%
* Over temperature Protection And Over current Protection

■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
LR1805L-xx-AB5-R	LR1805G-xx-AB5-R	SOT-89-5	Tape Reel
LR1805L-K06B-2020-R	LR1805G-K06B-2020-R	DFN2020-6B	Tape Reel

LR1805G-xx-AB5-R	
(1)Packing Type	(1) R: Tape Reel
(2)Package Type	(2) AB5: SOT-89-5, K06B-2020: DFN2020-6B
(3)Output Voltage Code	(3) xx: refer to Marking Information
(4)Green Package	(4) G: Halogen Free and Lead Free, L: Lead Free

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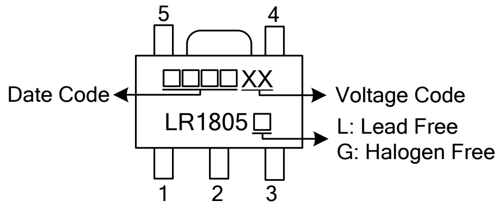
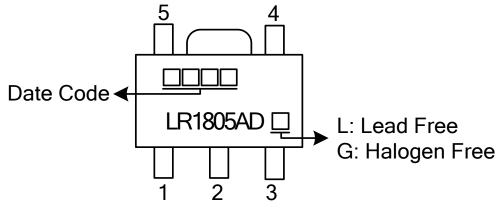
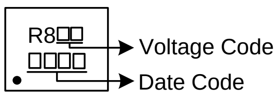
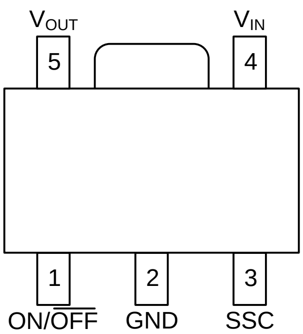
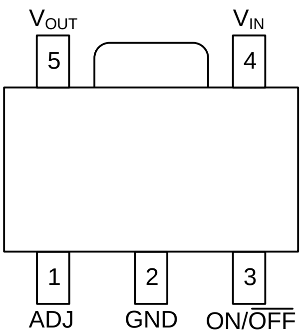
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-89-5	12: 1.2V 15 : 1.5V 18: 1.8V 25: 2.5V 30: 3.0V 33: 3.3V 50: 5.0V	
SOT-89-5	AD: ADJ	
DFN2020-6B	12: 1.2V 15 : 1.5V 18: 1.8V 25: 2.5V 30: 3.0V 33: 3.3V 50: 5.0V	

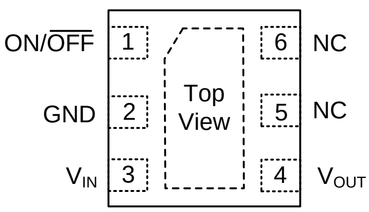
■ PIN CONFIGURATION



SOT-89 (Fixed)



SOT-89 (Adjustable)



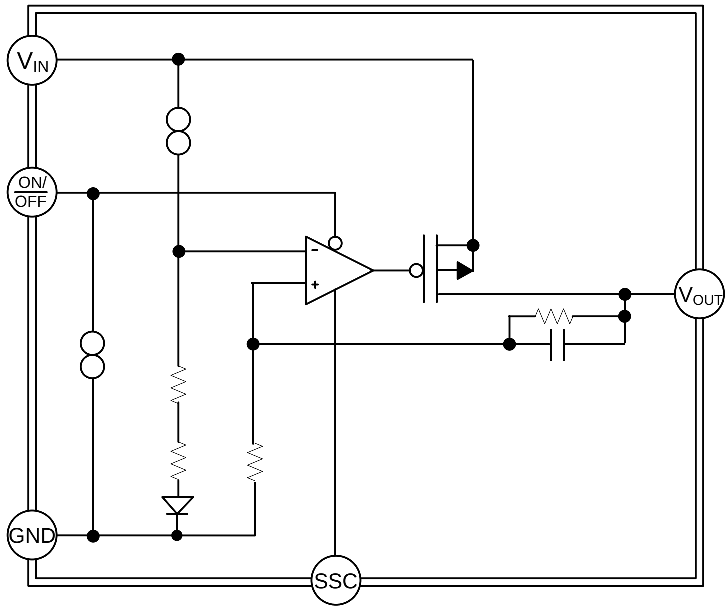
DFN2020-6

■ PIN DESCRIPTION

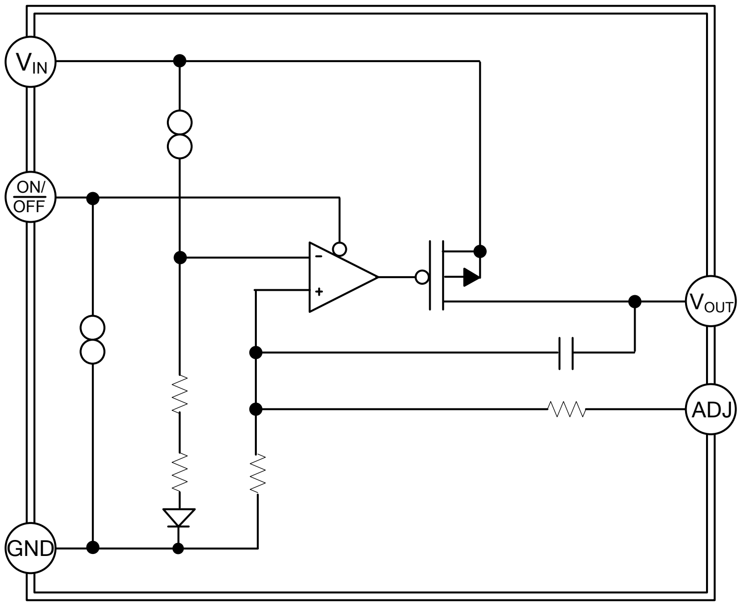
PIN NO.			PIN NAME	DESCRIPTION
SOT-89 (Fixed)	SOT-89 (Adjustable)	DFN2020-6B		
1	3	1	ON/ $\overline{OFF}$	ON/OFF select pin, Active High
2	2	2	GND	GND
3	-	-	SSC	Inrush current limit pin
4	4	3	V_{IN}	Input Voltage
5	5	4	V_{OUT}	Output Voltage
-	1	-	ADJ	Adjustable Pin

■ BLOCK DIAGRAM

Fixed Output Voltage



Adjustable Output Voltage



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	6.5	V
Shutdown Input Voltage	$V_{IN(SHDN)}$	V_{IN}	V
Maximum Operating Current (DC)		1	A
Power Dissipation (Note 3)	P_D	Internally Limited	
Junction Temperature	T_J	+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	SOT-89-5	θ_{JA}	185	°C/W
	DFN2020-6B		135	°C/W
Junction to Case	SOT-89-5	θ_{JC}	85	°C/W
	DFN2020-6B		28	°C/W

■ ELECTRICAL CHARACTERISTICS (T_J = 25°C, unless otherwise specified.)

For LR1805xx

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}			1.5		6	V
Output Voltage (Note 3)	$V_{OUT(E)}$	$V_{IN}=V_{OUT(S)}+1V$ $I_{OUT}=100mA$	$1.0V \le V_{OUT(S)} < 1.5V$	$V_{OUT(S)}$ – 0.015	$V_{OUT(S)}$	$V_{OUT(S)}$ + 0.015	V
			$1.5V \le V_{OUT(S)} \le 5.0V$	$V_{OUT(S)}$ x 0.99	$V_{OUT(S)}$	$V_{OUT(S)}$ x 1.01	V
Output Voltage Line Regulation	$\triangle V_{OUT1}/(\triangle V_{IN} \times V_{OUT})$	$V_{OUT(S)}+0.5V \le V_{IN} \le 5.5V$, $I_{OUT}=100mA$			0.05	0.2	%/V
Output Voltage Load Regulation	$\triangle V_{OUT2}$	$V_{IN}=V_{OUT(S)}+0.5V$ $1mA \le I_{OUT} \le 300mA$		-20		20	mV
Dropout Voltage(Note 4)	V_{drop}	$I_{OUT}=300mA$	$1.2V \le V_{OUT(S)} < 1.5V$		0.34	0.38	V
			$1.5V \le V_{OUT(S)} < 2.6V$		0.15	0.20	
			$2.6V \le V_{OUT(S)} \le 5.0V$		0.07	0.1	
		$I_{OUT}=1000mA$	$1.2V \le V_{OUT(S)} < 1.5V$		0.7		
			$1.5V \le V_{OUT(S)} < 2.0V$		0.50		
			$2.0V \le V_{OUT(S)} < 2.6V$		0.38		
			$2.6V \le V_{OUT(S)} \le 5.0V$		0.30		
Output Current(Note 5)	I_{OUT}	$V_{IN} \ge V_{OUT(S)}+1V$		1000 (Note 7)			mA
Ground Pin Current In Normal Operation Mode	I_{SS1}	$V_{IN}=V_{OUT(S)}+1V$, ON/$\overline{\text{OFF}}$ pin=ON, No Load			60	90	uA
Ground Pin Current In Power-off Mode	I_{SS2}	$V_{IN}=V_{OUT(S)}+1V$, ON/$\overline{\text{OFF}}$ pin=OFF, No Load			0.1	1.0	uA
Short Circuit Current	I_{SC}	$V_{IN}=V_{OUT(S)}+1V$, ON/$\overline{\text{OFF}}$ pin=ON, $V_{OUT}=0V$			0.5		A
ON/$\overline{\text{OFF}}$ Pin Input Voltage “H”	V_{SH}	$V_{IN}=V_{OUT(S)}+1V$, $R_L=1.0K\Omega$ Determinied by V_{OUT} output level		1.0			V
ON/$\overline{\text{OFF}}$ Pin Input Voltage “L”	V_{SL}					0.3	
ON/$\overline{\text{OFF}}$ Pin Input Current “H”	I_{SH}	$V_{IN}=V_{OUT(S)}+1V$, $V_{ON/\overline{OFF}}$=5.5V			1.0		uA
ON/$\overline{\text{OFF}}$ Pin Input Current “L”	I_{SL}	$V_{IN}=V_{OUT(S)}+1V$, $V_{ON/\overline{OFF}}$=0V		-0.1		0.1	uA
Inrush current limit time	Trush	$V_{IN}=V_{OUT(S)}+1V$, ON/$\overline{\text{OFF}}$ pin=ON, I_{OUT}=1000mA,Css=0 nF			0.4		mS
		$V_{IN}=V_{OUT(S)}+1V$, ON/$\overline{\text{OFF}}$ pin=ON, I_{OUT}=1000mA,Css=1.0 nF			0.7		
Ripple Rejection	|RR|	$V_{IN}=V_{OUT(S)}+1V$, f=1khz, $\triangle V_{rip}$=0.5Vrms, $I_{OUT}=100mA$	$1.2V \le V_{OUT(S)} < 3.0V$		65		dB
			$3.0V \le V_{OUT(S)} \le 3.5V$		60		
			$3.5V \le V_{OUT(S)} \le 5.0V$		55		
Thermal Shutdown detection temperature	T_{SD}	Junction temperature			150		°C
Thermal Shutdown release temperature	T_{SR}	Junction temperature			120		°C

■ ELECTRICAL CHARACTERISTICS (Cont.)

For LR1805AD

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}		1.5		6	V
Reference Voltage for Adjustable Voltage Regulator	V_{OUT}	$V_{OUT}=V_{ADJ}$, $V_{IN}=2.0V$, $I_{OUT}=100mA$	0.985	1.0	1.015	V
Output Voltage Range	RV_{OUT}		1.0		5.0	V
Internal Resistance Value of Adjust Pin	R_{IC}			1.0		MΩ
Output Voltage Line Regulation	$\triangle V_{OUT1}/(\triangle V_{IN}\times V_{OUT})$	$V_{OUT(S)}+0.5V\le V_{IN}\le 5.5V$, $I_{OUT}=100mA$		0.05	0.2	%/V
Output Voltage Load Regulation	$\triangle V_{OUT2}$	$V_{IN}=V_{OUT(S)}+1V$, $1mA\le I_{OUT}\le 300mA$	-20		20	mV
Dropout Voltage(Note 4)	V_{drop}	$V_{OUT}=V_{ADJ}$, $I_{OUT}=300mA$		0.54	0.58	V
		$V_{OUT}=V_{ADJ}$, $I_{OUT}=1000mA$		0.90		V
Output Current(Note 5)	I_{OUT}	$V_{IN}\ge V_{OUT(S)}+1V$	1000 (Note 7)			mA
Ground Pin Current In Normal Operation Mode	I_{SS1}	$V_{IN}=V_{OUT(S)}+1V$, ON/$\overline{\text{OFF}}$ pin=ON, No Load		60	90	uA
Ground Pin Current In Power-off Mode	I_{SS2}	$V_{IN}=V_{OUT(S)}+1V$, ON/$\overline{\text{OFF}}$ pin=OFF, No Load		0.1	1.0	uA
Short Circuit Current	I_{SC}	$V_{IN}=V_{OUT(S)}+1V$, ON/$\overline{\text{OFF}}$ pin=ON, $V_{OUT}=0V$		0.5		A
ON/$\overline{\text{OFF}}$ Pin Input Voltage "H"	V_{SH}	$V_{IN}=V_{OUT(S)}+1V$, $R_L=1.0K\Omega$ Determinied by V_{OUT} output level	1.0			V
ON/$\overline{\text{OFF}}$ Pin Input Voltage "L"	V_{SL}				0.3	V
ON/$\overline{\text{OFF}}$ Pin Input Current "H"	I_{SH}	$V_{IN}=V_{OUT(S)}+1V$, $V_{ON/\overline{OFF}}=5.5V$		1.0		uA
ON/$\overline{\text{OFF}}$ Pin Input Current "L"	I_{SL}	$V_{IN}=V_{OUT(S)}+1V$, $V_{ON/\overline{OFF}}=0V$	-0.1		0.1	uA
Inrush current limit time	Trush	$V_{IN}=V_{OUT(S)}+1V$, ON/$\overline{\text{OFF}}$ pin=ON, $I_{OUT}=1000mA$		0.4		mS
Ripple Rejection	$\lvert RR \rvert$	$V_{IN}=V_{OUT(S)}+1V$, f=1khz, $\triangle V_{rip}=0.5Vrms$, $I_{OUT}=100mA$; $1.2V\le V_{OUT(S)}<3.0V$		65		dB
		$V_{IN}=V_{OUT(S)}+1V$, f=1khz, $\triangle V_{rip}=0.5Vrms$, $I_{OUT}=100mA$; $3.0V\le V_{OUT(S)}\le 3.5V$		60		dB
Thermal Shutdown detection temperature	T_{SD}	Junction temperature		150		°C
Thermal Shutdown release temperature	T_{SR}	Junction temperature		120		°C

Notes: 1. The UTC **LR1805** output must be diode-clamped to ground. If used in a dual-supply system where the regulator load is returned to a negative supply.

2. Devices must be derated based on package thermal resistance at elevated temperatures.

3. $V_{OUT(S)}$: Specified output voltage
$V_{OUT(E)}$: Actual output voltage
Output voltage when fixing I_{OUT}(=100ma) and inputting $V_{OUT(S)}+1.0V$

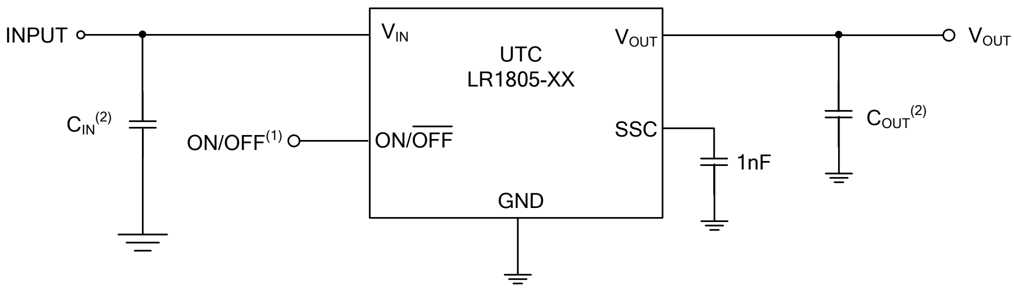
4. $Vdrop=V_{IN1}-(V_{OUT3}\times 0.98)$
V_{OUT3} is the output voltage when $V_{IN}=V_{OUT(S)}+1.0V$ and I_{OUT}=300mA, 1000mA.

5. The output current at which the output voltage becomes 95% of $V_{OUT(E)}$ after gradually increasing the output current.

6. The output current can be at least this value.
Due to restrictions on the package power dissipation, this value may not be satisfied. Attention should be paid to the power dissipation of the package when the output current is large.
This specification is guaranteed by design.

■ TYPICAL APPLICATION CIRCUIT

Fixed Output Voltage



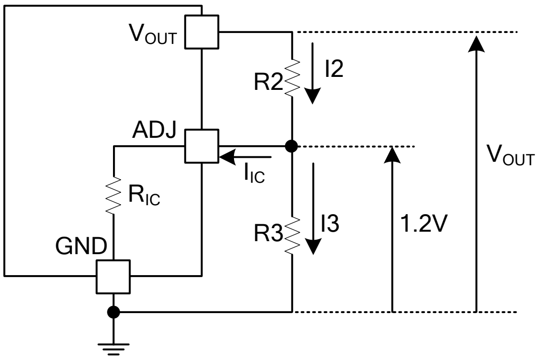
(1) ON/$\overline{OFF}$ pins must be pulled high through a 10kΩ pull-up resistor.

(2) Generally a series regulator may cause oscillation, depending on the selection of external parts. The following conditions are recommended for this IC. However, be sure to perform sufficient evaluation under the actual usage conditions for selection, including evaluation of temperature characteristics.

Input capacitor (C_{IN}): 2.2μF or more
Output capacitor (C_L): 2.2μF or more

■ TYPICAL APPLICATION CIRCUIT (Cont.)

Adjustable Output Voltage



The Output Voltage may be adjustable for any output voltage between its 1.2V reference and its V_{DD} setting level. An external pair of resistors is required, as shown above.

The complete equation for the output voltage is described step by step as follows;

$I2 = I_{IC} + I3$ (1)

$I3 = 1.2 / R3$ (2)

Thus,

$I2 = I_{IC} + 1.2 / R3$ (3)

Therefore,

$V_{OUT} = 1.2 + R2 \times I2$ (4)

Put Equation (3) into Equation (4), then

$V_{OUT} = 1.2 + R2\ (I_{IC} + 1.2 / R3)$

$= 1.2\ (1 + R2 / R3) + R2 \times I_{IC}$ (5)

In 2nd term, or $R2 \times I_{IC}$ will produce an error in V_{OUT}.

In Equation (5),

$I_{IC} = 1.2 / R_{IC}$ (6)

$R2 \times I_{IC} = R2 \times 1.2 / R_{IC}$

$= 1.2 \times R2 / R_{IC}$ (7)

For better accuracy, choosing R2 ($<<R_{IC}$) reduces this error.

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