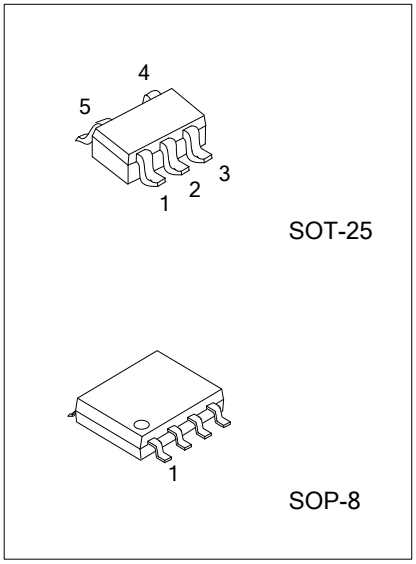
# 600mA CMOS LDO




## ■ DESCRIPTION

The UTC **L1186** is a COMS positive linear regulator. One of its features is the very low quiescent current typical as low as 30μA and its dropout voltage is extremely low with 600mA output current.

The internal circuit includes thermal shutdown and current fold-back to prevent device failure when the circuit is operated in the bad conditions.

In application, the UTC **L1186** needs a low noise, regulated supply. For stable operation, the output capacitance value should be 2.2μF or more.

The UTC **L1186** is an ideal for battery applications, such as instrumentations, portable electronics, wireless devices, cordless phones, PC peripherals, and battery powered widgets.

## ■ FEATURES

* Accurate to Within 1.5%
* Quiescent Current: 30μA
* Internal Over-Temperature Shutdown
* With Current Limiting
* Internal Short Circuit Current Fold-Back
* With Noise Reduction Bypass Capacitor
* Has Power-Saving Shutdown Mode
* Very Low Temperature Coefficient

## ■ ORDERING INFORMATION

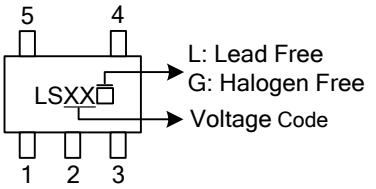
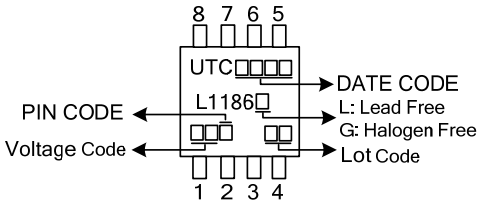
| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen Free | | |
| L1186L-xx-AF5-R | L1186G-xx-AF5-R | SOT-25 | Tape Reel |
| L1186L-xx-S08-A-R | L1186G-xx-S08-A-R | SOP-8 | Tape Reel |
| L1186L-xx-S08-A-T | L1186G-xx-S08-A-T | SOP-8 | Tube |
| L1186L-xx-S08-B-R | L1186G-xx-S08-B-R | SOP-8 | Tape Reel |
| L1186L-xx-S08-B-T | L1186G-xx-S08-B-T | SOP-8 | Tube |

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

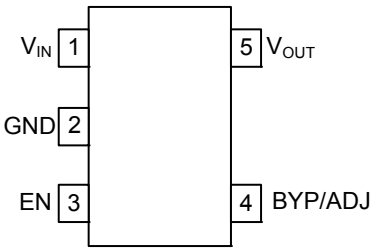
L1186L-xx-AF5-X-R

| | |
|---|---|
| (1)Packing Type | (1) R: Tape Reel |
| (2)Pin Assignment | (2) refer to Pin Configuration (FOR SOP-8) |
| (3)Package Type | (3) AF5: SOT-25, S08: SOP-8 |
| (4)Output Voltage Code | (4) xx: Refer to Marking Information |
| (5)Lead Free | (5) G: Halogen Free L:Lead Free |

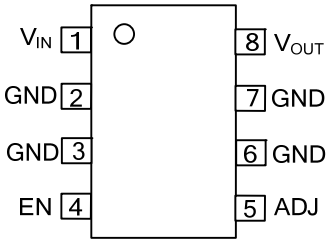
## ■ MARKING INFORMATION

| PACKAGE | VOLTAGE CODE | MARKING |
|---|---|---|
| SOT-25 | 15 :1.5V<br>28 :2.8V<br>AD:ADJ |  |
| SOP-8 | |  |

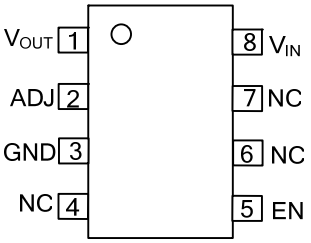
## ■ PIN CONFIGURATION




SOT-25




SOP-8(A)

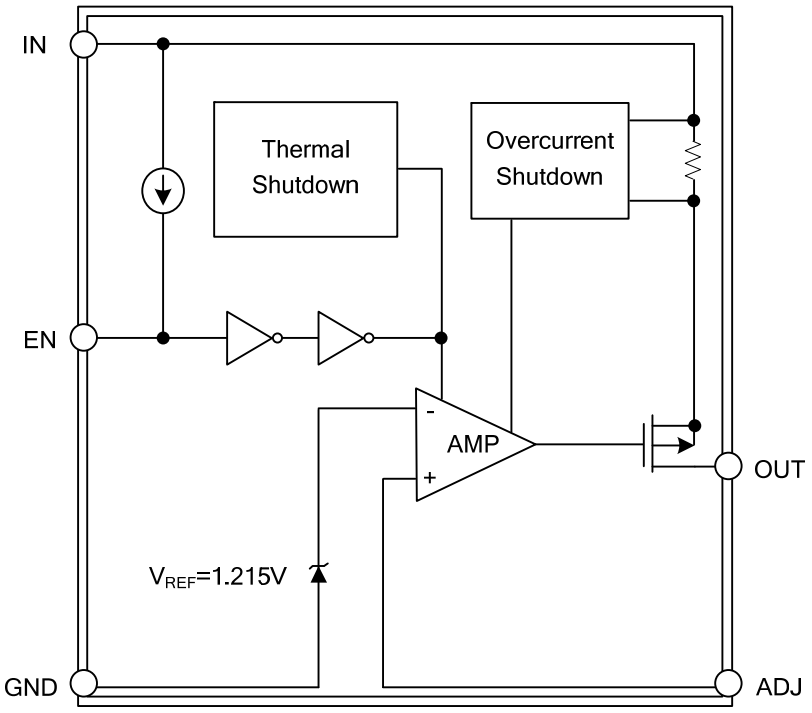



SOP-8(B)

## ■ PIN DESCRIPTION

| PIN NO | | | PIN NAME | DESCRIPTION |
|---|---|---|---|---|
| SOT-25 | SOP-8(A) | SOP-8(B) | | |
| 1 | 1 | 8 | $V_{IN}$ | Input for voltage input. |
| 2 | 2,3,6,7 | 3 | GND | Ground. |
| 3 | 4 | 5 | EN | Enable pin. |
| 4 | 5 | 2 | BYP/ADJ | Noise Reduction Bypass Capacitor/ Adjusted Voltage |
| 5 | 8 | 1 | $V_{OUT}$ | Output voltage pin |
| | | 4,6,7 | NC | No connection |

## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATING ($T_A$ = 25°C, unless otherwise specified.)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Input Voltage | | $V_{IN}$ | 8 | V |
| Output Voltage | | $V_{OUT}$ | GND-0.3 ~ $V_{IN}$+0.3 | V |
| Output Current | | $I_{OUT}$ | $\frac{P_D}{V_{IN}-V_{OUT}}$ | A |
| Power Dissipation | SOT-25 | $P_D$ | 400 | mW |
| | SOP-8 | | 600 | |
| Junction Temperature | | $T_J$ | 150 | °C |
| Operating Temperature | | $T_{OPR}$ | -40~+85 | °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-25 | $\theta_{JA}$ | 260 | °C/W |
| | SOP-8 | | 200 | |
| Junction to Case (Note) | SOT-25 | $\theta_{JC}$ | 81 | °C/W |
| | SOP-8 | | 65 | |

Note: $\theta_{JC}$ on center of molding compound if IC has on tab

## ■ ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C, unless otherwise specified.)

**Fixed Voltage**

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | | | Note1 | | 7 | V |
| Output Voltage Accuracy | $V_{OUT}$ | $I_{OUT}$=1mA | | -1.5 | | 1.5 | % |
| Line Regulation | $\frac{\Delta V_{OUT}}{V_{OUT}}$ | $I_{OUT}$=1mA | 1.4V<$V_{OUT}$≤2.0V | -0.15 | | 0.15 | % |
| | | $V_{IN}$=$V_{OUT}$+1~$V_{OUT}$+2 | 2.0V<$V_{OUT}$<4.0V | -0.1 | 0.02 | 0.1 | % |
| Load Regulation | $\frac{\Delta V_{OUT}}{V_{OUT}}$ | $I_{OUT}$=1mA~600 mA | | | 0.2 | 1 | % |
| Output Current | $I_{OUT}$ | $V_{OUT}$>1.2V | | 600 | | | mA |
| Current Limit | $I_{LIMIT}$ | $V_{OUT}$>1.2V | | 600 | 800 | | mA |
| Short Circuit Current | $I_{SC}$ | $V_{OUT}$<0.8V | | | 300 | 600 | mA |
| Quiescent Current | $I_Q$ | $I_{OUT}$=0mA | | | 30 | 50 | μA |
| Ground Pin Current | $I_{GND}$ | $I_{OUT}$=1mA~600mA | | | 35 | | μA |
| Dropout Voltage | $V_D$ | $I_{OUT}$ =600mA | 1.4V<$V_{O(NOM)}$≤2.0V | | | 1400 | mV |
| | | $V_{OUT}$=$V_{O(NOM)}$-2.0% | 2.0V<$V_{O(NOM)}$≤2.8V | | | 800 | mV |
| Over Temperature Shutdown | OTS | | | | 150 | | °C |
| Over Temperature Hysteresis | OTH | | | | 30 | | °C |
| Temperature Coefficient of Output Voltage | $T_CV_O$ | | | | 30 | | ppm/°C |
| Power Supply Rejection | PSRR | $I_{OUT}$ =100mA | f=1kHz | | 75 | | dB |
| | | $C_{OUT}$=2.2μF ceramic | f=10kHz | | 55 | | dB |
| | | $C_{BYP}$=0.01μF | f=100kHz | | 30 | | dB |
| Output Voltage Noise | eN | f=10Hz~100kHz, $I_{OUT}$ =10mA $C_{OUT}$=2.2μF , $C_{BYP}$=0.1μF | | | 30 | | μVrms |
| EN Input Threshold | $V_{EH}$ | $V_{IN}$=2.7V~7V | | 2.0 | | $V_{IN}$ | V |
| | $V_{EL}$ | $V_{IN}$=2.7V~7V | | 0 | | 0.4 | V |
| EN Input Bias Current | $I_{EH}$ | $V_{EN}$=$V_{IN}$, $V_{IN}$=2.7V~7V | | | | 0.1 | μA |
| | $I_{EL}$ | $V_{EN}$=0V, $V_{IN}$=2.7V~7V | | | | 0.5 | μA |
| Shutdown Supply Current | $I_{SD}$ | $V_{IN}$=5V, $V_{OUT}$ =0V, $V_{EN}$<$V_{EL}$ | | | 0.5 | 1 | μA |
| PG Leakage Current | $I_{LC}$ | $V_{PG}$=7V | | | | 1 | μA |

## ■ ELECTRICAL CHARACTERISTICS (Cont.)

**Adjusted Voltage**

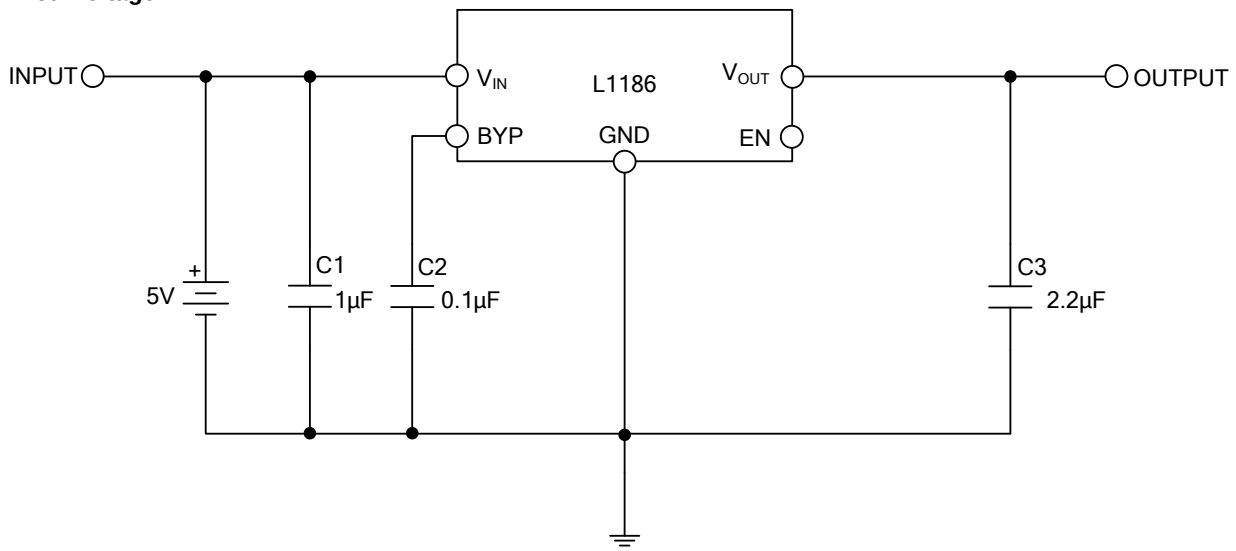
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | | | Note1 | | 7 | V |
| Reference Voltage | $V_{REF}$ | | | 1.196 | 1.215 | 1.234 | V |
| Output Voltage Accuracy | $V_{OUT}$ | $I_{OUT}$=1mA | | -1.5 | | 1.5 | % |
| Line Regulation | $\frac{\Delta V_{OUT}}{V_{OUT}}$ | $V_{IN}=V_{OUT}+V_D$~7V, $I_{OUT}$=1mA | | -0.15 | | 0.15 | % |
| Load Regulation | $\frac{\Delta V_{OUT}}{V_{OUT}}$ | $I_{OUT}$=1mA | 1.4V<$V_{OUT}$≤2.0V | -0.15 | | 0.15 | % |
| | | $V_{IN}=V_{OUT}+1$~$V_{OUT}+2$ | 2.0V<$V_{OUT}$<4.0V | -0.1 | 0.02 | 0.1 | |
| Output Current | $I_{OUT}$ | $V_{OUT}$>1.3V | | 600 | | | mA |
| Current Limit | $I_{LIMIT}$ | $V_{OUT}$>1.3V | | 600 | 800 | | mA |
| Short Circuit Current | $I_{SC}$ | $V_{OUT}$<0.8V | | | 300 | 600 | mA |
| Adjusted Current | $I_{ADJ}$ | $I_{OUT}$=0mA | | | 30 | 50 | μA |
| Ground Pin Current | $I_{GND}$ | $I_{OUT}$=1mA~600mA | | | 35 | | μA |
| Dropout Voltage | $V_D$ | $V_{OUT}=V_{O(NOM)}$-2.0%, $I_{OUT}$ =600mA | | | | 600 | mV |
| Over Temperature Shutdown | OTS | | | | 150 | | °C |
| Over Temperature Hysteresis | OTH | | | | 30 | | °C |
| Temperature Coefficient of Output Voltage | $T_CV_O$ | | | | 30 | | ppm/°C |
| Power Supply Rejection | PSRR | $I_{OUT}$ =100mA | f=1kHz | | 40 | | dB |
| | | $C_{OUT}$=2.2μF ceramic | f=10kHz | | 20 | | dB |
| | | $C_{BYP}$=0.01μF | f=100kHz | | 15 | | dB |
| Output Voltage Noise | eN | f=10Hz~100kHz, $I_{OUT}$ =10mA<br>$C_{OUT}$=2.2μF , $C_{BYP}$=0.1μF | | | 30 | | μVrms |
| EN Input Threshold | $V_{EH}$ | $V_{IN}$=2.7V~7V | | 2.0 | | $V_{IN}$ | V |
| | $V_{EL}$ | $V_{IN}$=2.7V~7V | | 0 | | 0.4 | V |
| EN Input Bias Current | $I_{EH}$ | $V_{EN}=V_{IN}$, $V_{IN}$=2.7V~7V | | | | 0.1 | μA |
| | $I_{EL}$ | $V_{EN}$=0V, $V_{IN}$=2.7V~7V | | | | 0.5 | μA |
| Shutdown Supply Current | $I_{SD}$ | $V_{IN}$=5V, $V_{OUT}$ =0V, $V_{EN}<V_{EL}$ | | | 0.5 | 1 | μA |
| PG Leakage Current | $I_{LC}$ | $V_{PG}$=7V | | | | 1 | μA |

Notes: 1. $V_{IN(MIN)}=V_{OUT}+V_D$

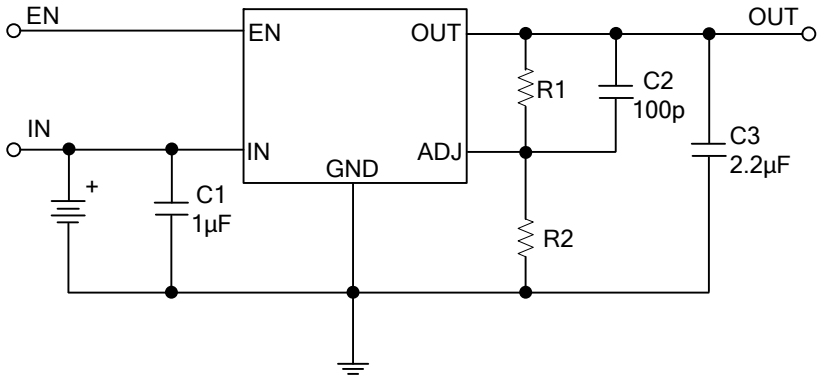
2. To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.

## ■ TYPICAL APPLICATION CIRCUIT

**Fixed Voltage**




**Adjusted Voltage**




$V_{OUT}$ = 1.215 ( R1/R2 +1 )
C2 is unnecessary if R1 or R2 < 20 KΩ
$R_1$ and $R_2$ use resistance value within 1% accuracy for correct for correct $V_{OUT}$

## ■ TYPICAL CHARACTERISTICS