



## L8561

Preliminary

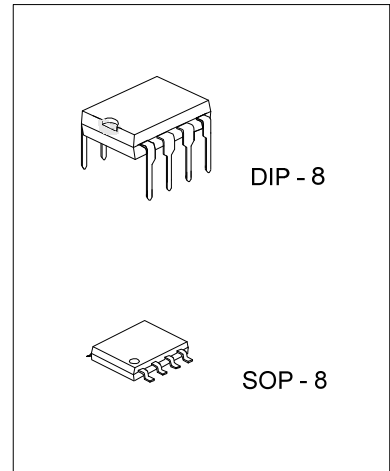
**LINEAR INTEGRATED CIRCUIT**

### POWER FACTOR CORRECTOR

#### DESCRIPTION

The UTC **L8561** is a Power Factor Corrector, which can work in wide input voltage range applications (from 85V ~ 265V) with an excellent THD. It has very low start up current (about 20 uA) and a disable function on the ZCD pin, which is designed to keep lower current consumption in stand by mode.

The device is operating in transition mode, and is able to drive a Power MOS or IGBT with a  $\pm 400\text{mA}$  current for sourcing and sinking.



#### FEATURES

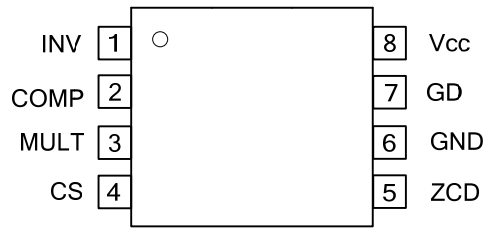
- \* 1% Precision (@  $T_J = 25^\circ\text{C}$ ) Internal Reference Voltage
- \* Output Overvoltage Protection
- \* Very Low Power Start-Up Current
- \* Current Sense Filter On Chip
- \* Disable Function (with ZCD pin)
- \* Transition Mode Operation
- \* Gate Driving Current:  $\pm 400\text{mA}$
- \* 15V Gate clamped

#### ORDERING INFORMATION

| Ordering Number |              | Package | Packing   |
|-----------------|--------------|---------|-----------|
| Lead Free       | Halogen Free |         |           |
| L8561L-D08-T    | L8561G-D08-T | DIP-8   | Tube      |
| L8561L-S08-R    | L8561G-S08-R | SOP-8   | Tape Reel |

|   |   |
|---|---|
| <p>L8561L-D08-T</p> <p>(1)Packing Type<br/>(2)Package Type<br/>(3)Lead Free</p> | <p>(1) R: Tape Reel, T: Tube<br/>(2) S08: SOP-8, D08: DIP-8<br/>(3) G: Halogen Free, L: Lead Free</p> |
|---|---|

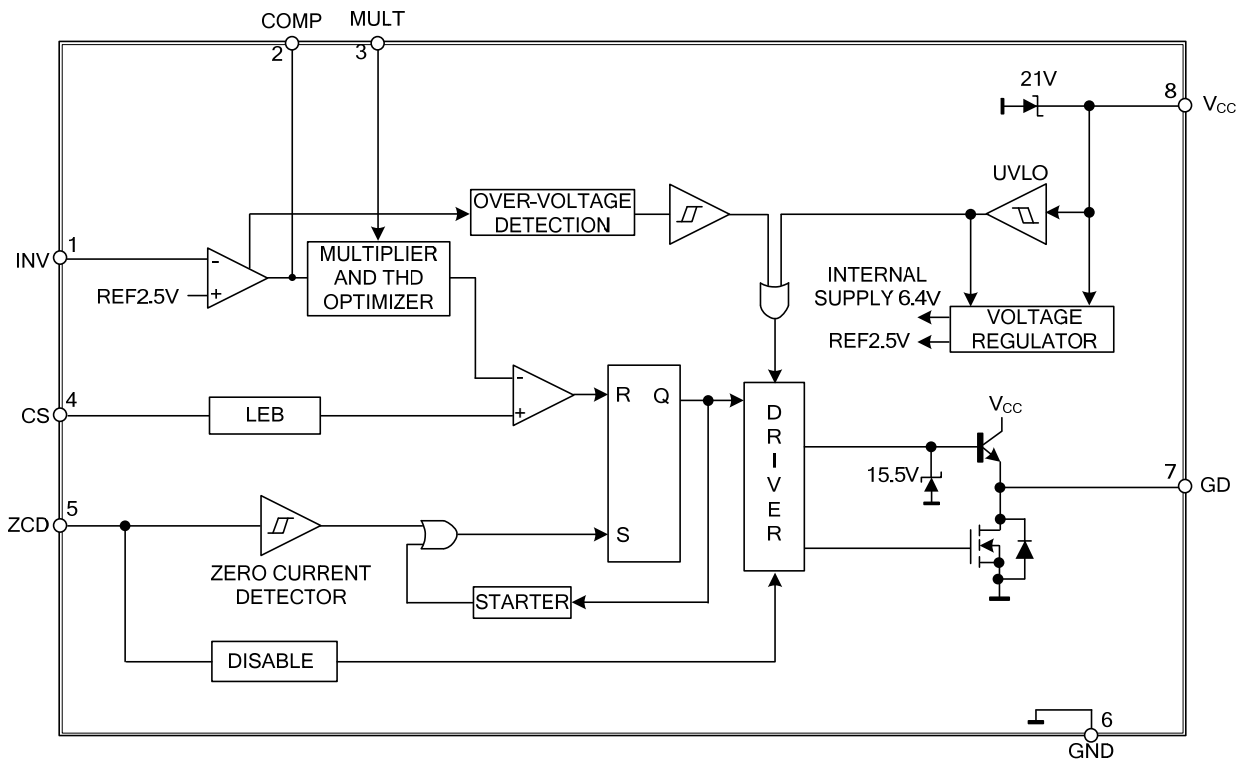
■ PIN CONFIGURATION



■ PIN DESCRIPTION

| PIN NO | PIN NAME        | DESCRIPTION                             |
|--------|-----------------|---|
| 1      | INV             | Inverting input of the error amplifier. |
| 2      | COMP            | Output of the error amplifier.          |
| 3      | MULT            | Input of the multiplier stage.          |
| 4      | CS              | Input of the current sense stage.       |
| 5      | ZCD             | Input of the zero current detection .   |
| 6      | GND             | Ground.                                 |
| 7      | GD              | Gate driver output.                     |
| 8      | V <sub>CC</sub> | Voltage supply.                         |

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (Ta=25°C, unless otherwise specified)

| PARAMETER                            | SYMBOL           | RATINGS                   | UNIT     |
|--------------------------------------|------------------|---------------------------|----------|
| Analog Inputs & Outputs              | INV, COMP MULT   | -0.3 ~ 7                  | V        |
| Current Sense Input                  | CS               | -0.3 ~ 7                  | V        |
| Iq+Iz (IGD = 0)                      | IVCC             | 30                        | mA       |
| Output Totem Pole Peak Current (2ms) | IGD              | ±700                      | mA       |
| Zero Current Detector                | ZCD              | 50 (source)<br>-10 (sink) | mA<br>mA |
| Power Dissipation @ Ta=50°C          | SOP-8            | P <sub>TOT</sub>          | 1        |
|                                      | DIP-8            |                           | 0.65     |
| Junction Temperature                 | T <sub>J</sub>   | 125                       | °C       |
| Operating Temperature                | T <sub>OPR</sub> | -20 ~ +85                 | °C       |
| Storage Temperature                  | T <sub>STG</sub> | -40 ~ +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.

■ ELECTRICAL CHARACTERISTICS (Ta=-25°C ~ 125°C, V<sub>CC</sub>=14.5V, unless otherwise specified)

| PARAMETER                        | PIN | SYMBOL                                  | TEST CONDITIONS  | MIN    | TYP     | MAX   | UNIT |
|----------------------------------|-----|---|--|--------|---------|-------|------|
| <b>SUPPLY VOLTAGE SECTION</b>    |     |   |  |        |         |       |      |
| Operating Range                  | 8   | V <sub>CC</sub>                         | after turn-on  | 11     |         | 18    | V    |
| Turn-on Threshold                | 8   | V <sub>CC ON</sub>                      |  | 14     | 15.3    | 16.5  | V    |
| Turn-off Threshold               | 8   | V <sub>CC OFF</sub>                     |  | 7.2    | 7.9     | 8.7   | V    |
| Hysteresis                       | 8   | Hys                                     |  | 6.5    |         | 8.3   | V    |
| <b>SUPPLY CURRENT SECTION</b>    |     |   |  |        |         |       |      |
| Start-up Current                 | 8   | I <sub>START-U</sub>                    | V <sub>CC ON</sub> -1V   |        | 30      | 50    | μA   |
| Quiescent Current                | 8   | I <sub>q</sub>                          |  |        | 6       | 9     | mA   |
| Operating Supply Current         | 8   | I <sub>CC</sub>                         | C <sub>L</sub> =1nF @ 70KHz                                    |        | 10      | 15    | mA   |
|                                  |     |   | In OVP condition V <sub>pin1</sub> =2.7V                       |        |         | 6.8   | mA   |
| Quiescent Current                | 8   | I <sub>q</sub>                          | V <sub>PIN5</sub> ≤150mV, V <sub>CC</sub> >V <sub>CC off</sub> |        |         | 6     | mA   |
|                                  | 8   |   | V <sub>PIN5</sub> ≤150mV, V <sub>CC</sub> <V <sub>CC off</sub> | 4      | 7       | 10    | μA   |
| Zener Voltage                    | 8   | V <sub>Z</sub>                          | I <sub>CC</sub> =20mA  | 18     | 21      | 24    | V    |
| <b>ERROR AMPLIFIER SECTION</b>   |     |   |  |        |         |       |      |
| Voltage Feedback Input Threshold | 1   | V <sub>INV</sub>                        | Ta=25°C  | 2.465  | 2.5     | 2.535 | V    |
|                                  |     |   | 10.3V<V <sub>CC</sub> <18V                                     | 2.44   |         | 2.56  | V    |
| Line Regulation                  |     |   | V <sub>CC</sub> =10.3 ~ 18V                                    |        | 3       | 5     | mV   |
| Input Bias Current               | 1   | I <sub>INV</sub>                        |  |        | -100    | -1000 | μA   |
| Voltage Gain                     |     | G <sub>V</sub>                          | Open loop  | 60     | 80      |       | dB   |
| Gain Bandwidth                   |     | G <sub>B</sub>                          |  |        | 0.8     |       | MHz  |
| Source Current                   | 2   | I <sub>COMP</sub>                       | V <sub>COMP</sub> =4V, V <sub>INV</sub> =2.4V                  | -2     | -4      | -8    | mA   |
| Sink Current                     |     |   | V <sub>COMP</sub> =4V, V <sub>INV</sub> =2.6V                  | 2.5    | 4.5     |       | mA   |
| Upper Clamp Voltage              | 2   | V <sub>COMP</sub>                       | I <sub>SOURCE</sub> =0.5mA                                     | 4.5    | 5       | 5.5   | V    |
| Lower Clamp Voltage              |     |   | I <sub>SINK</sub> =0.5mA                                       | 2.25   | 2.4     | 2.55  | V    |
| <b>MULTIPLIER SECTION</b>        |     |   |  |        |         |       |      |
| Linear Operating Voltage         | 3   | V <sub>MULT</sub>                       |  | 0~ 2.5 | 0 ~ 3.5 |       | V    |
| Output Max.Slope                 |     | $\frac{\Delta V_{CS}}{\Delta V_{MULT}}$ | V <sub>MULT</sub> =from 0V ~ 0.5V                              | 1.65   | 1.9     |       |      |
|                                  |     |   | V <sub>COMP</sub> =Upper ClamVoltage                           |        |         |       |      |
| Gain                             |     | K                                       | V <sub>MULT</sub> =1V, V <sub>COMP</sub> =4V                   | 0.5    | 0.7     | 0.9   | 1/V  |

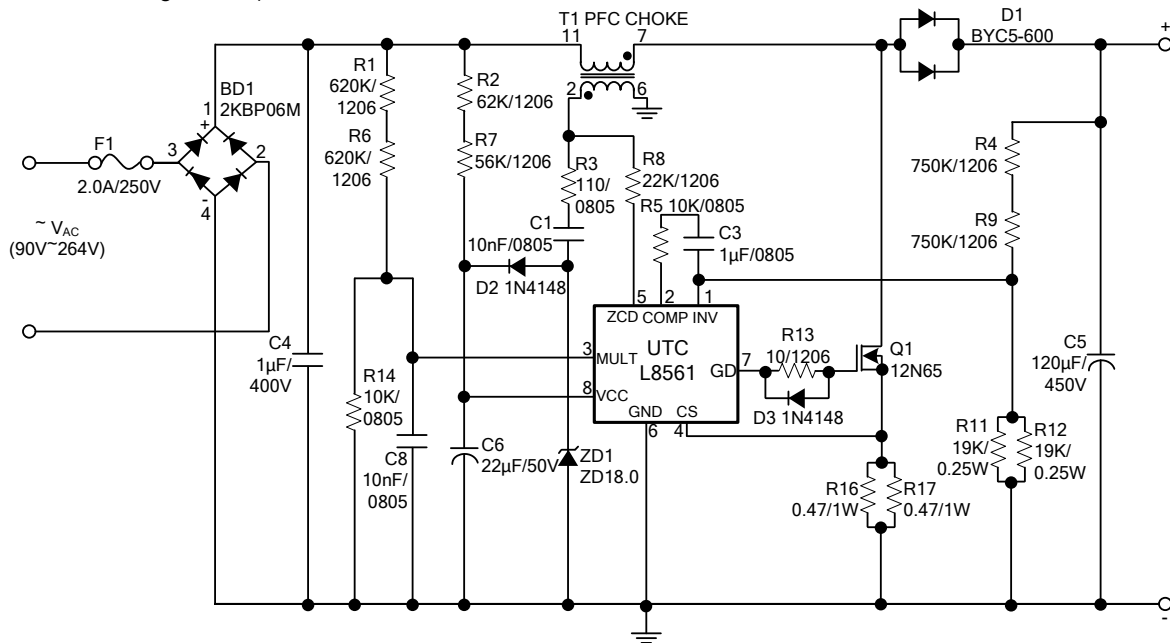
## ■ ELECTRICAL CHARACTERISTICS(Cont.)

| PARAMETER                           | PIN | SYMBOL        | TEST CONDITIONS                                    | MIN  | TYP   | MAX  | UNIT    |
|-------------------------------------|-----|---------------|--|------|-------|------|---------|
| <b>CURRENT SENSE COMPARATOR</b>     |     |               |  |      |       |      |         |
| Current Sense Reference Clamp       | 4   | $V_{CS}$      | $V_{MULT}=2.5V$<br>$V_{COMP}$ =Upper Clamp Voltage | 1.6  | 1.7   | 1.8  | V       |
| Input Bias Current                  | 4   | $I_{CS}$      | $V_{OS}=0$   |      | -0.05 | -1   | $\mu A$ |
| Delay to Output                     | 4   | $T_{D(H-L)}$  |  |      | 200   | 450  | ns      |
| <b>ZERO CURRENT DETECTOR</b>        |     |               |  |      |       |      |         |
| Input Threshold Voltage Rising Edge | 5   | $V_{ZCD}$     | (Note 1)   |      | 2.1   |      | V       |
| Hysteresis                          |     |               | (Note 1)   | 0.4  | 0.6   | 0.8  | V       |
| Upper Clamp Voltage                 | 5   | $V_{ZCD}$     | $I_{ZCD}=20\mu A$                                  | 5.9  | 6.5   | 7.3  | V       |
| Upper Clamp Voltage                 | 5   | $V_{ZCD}$     | $I_{ZCD}=3mA$                                      | 6.1  | 6.6   | 7.5  | V       |
| Lower Clamp Voltage                 | 5   | $V_{ZCD}$     | $I_{ZCD}=3mA$                                      | 0.3  | 0.7   | 1    | V       |
| Sink Bias Current                   | 5   | $I_{ZCD}$     | $1V \leq V_{ZCD} \leq 4.5V$                        |      | 2     |      | $\mu A$ |
| Source Current Capability           | 5   | $I_{ZCD}$     |  | -3   |       | -10  | mA      |
| Sink Current Capability             | 5   | $I_{ZCD}$     |  | 3    |       | 10   | mA      |
| Disable threshold                   | 5   | $V_{DIS}$     |  | 100  | 200   | 300  | mV      |
| Restart Current After Disable       | 5   | $I_{ZCD}$     | $V_{ZCD} < V_{DIS}, V_{CC} > V_{COFF}$             | -20  | -50   |      | $\mu A$ |
| <b>OUTPUT SECTION</b>               |     |               |  |      |       |      |         |
| Dropout Voltage                     | 7   | $V_{GD}$      | $I_{GD(SOURCR)}=200mA$                             |      | 1.2   | 2    | V       |
|                                     |     |               | $I_{GD(SOURCR)}=20mA$                              |      | 0.8   | 1.2  | V       |
|                                     |     |               | $I_{GD(SINK)}=200mA$                               |      | 1.2   | 1.9  | V       |
|                                     |     |               | $I_{GD(SINK)}=20mA$                                |      |       | 1.2  | V       |
| Output Voltage Rise Time            | 7   | $t_R$         | $C_L=1nF$  |      | 40    | 100  | ns      |
| Output Voltage Fall Time            | 7   | $t_F$         | $C_L=1nF$  |      | 40    | 100  | ns      |
| IGD Sink Current                    | 7   | $I_{GD(OFF)}$ | $V_{CC}=3.5V, V_{GD}=1V$                           | 10   | 40    |      | mA      |
| <b>OUTPUT OVERVOLTAGE SECTION</b>   |     |               |  |      |       |      |         |
| OVP Triggering Current              | 2   | $I_{OVP}$     |  | 30   | 40    | 50   | $\mu A$ |
| Static OVP Threshold                |     |               |  | 2.25 | 2.4   | 2.55 | V       |
| <b>RESTART TIMER</b>                |     |               |  |      |       |      |         |
| Start Timer                         |     | $t_{START}$   |  | 70   | 130   | 300  | $\mu s$ |

Note: 1. Parameter guaranteed by design, not tested in production.

■ TYPICAL APPLICATION CIRCUIT

(150W, Wide-range Mains)



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