



## 8561

Preliminary

CMOS IC

### POWER FACTOR CORRECTOR

#### DESCRIPTION

The UTC **8561** 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 50 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.

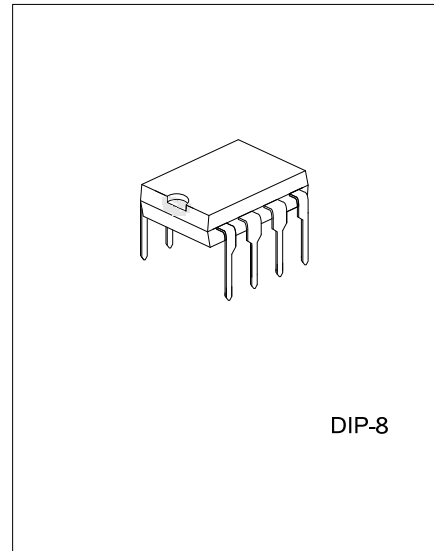
#### FEATURES

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

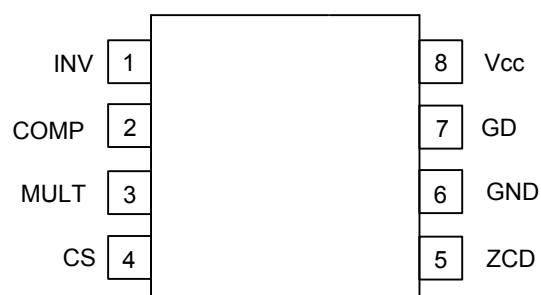
#### ORDERING INFORMATION

| Ordering Number   |              | Package | Packing |
|-------------------|--------------|---------|---------|
| Lead Free Plating | Halogen Free |         |         |
| 8561L-D08-T       | 8561G-D08-T  | DIP-8   | Tube    |

|   |   |
|---|---|
| <p>8561G-D08-T</p> <p>(1)Packing Type<br/>(2)Package Type<br/>(3)Halogen Free</p> | <p>(1) T: Tube<br/>(2) D08: DIP-8<br/>(3) G: halogen Free, L: Lead Free Plating</p> |
|---|---|



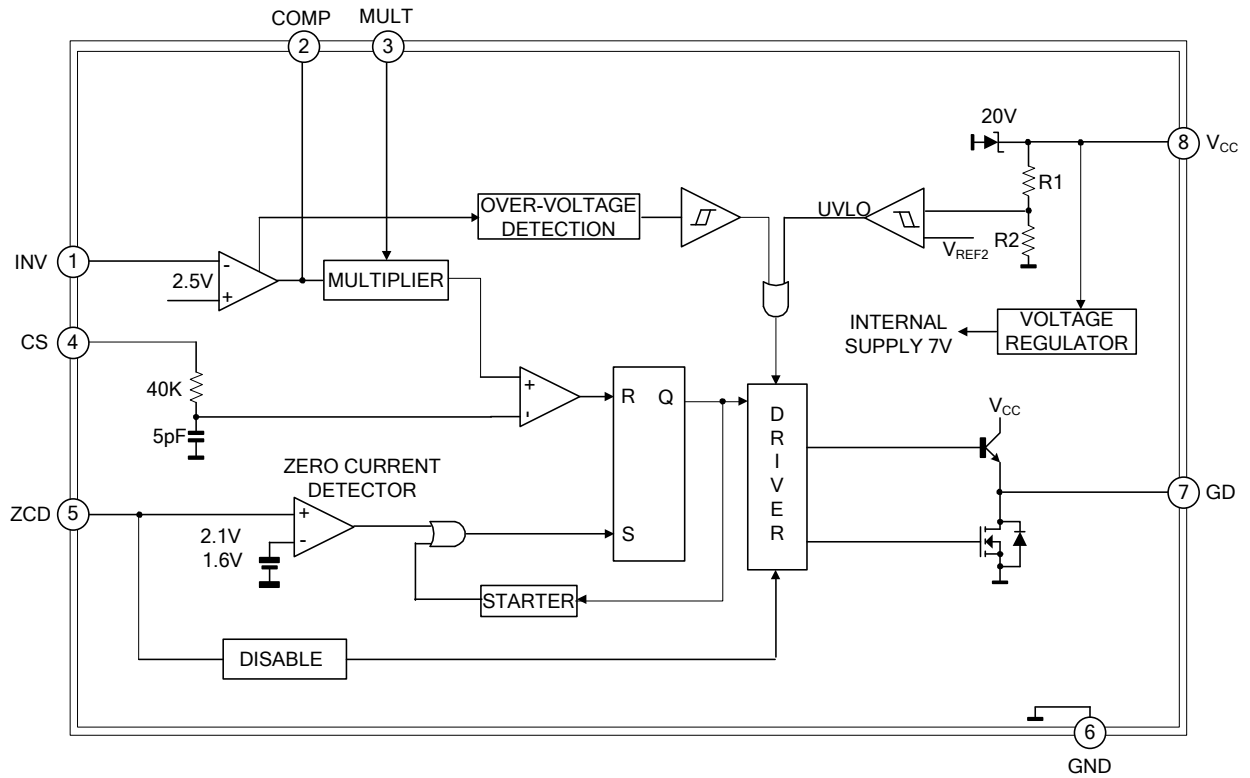
## ■ PIN CONFIGURATION



## ■ 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 RATINGS (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)                      | IV <sub>CC</sub> | 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                    | P <sub>D</sub>   | 0.65                      | W        |
| Junction Temperature                 | T <sub>J</sub>   | 150                       | °C       |
| Storage Temperature                  | T <sub>STG</sub> | -55 ~ +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 (V<sub>CC</sub>=14.5V, Ta=-25°C ~ 125°C, 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>                     |   | 11    | 12      | 13    | V    |
| Turn-OFF Threshold               | 8   | V <sub>CC(OFF)</sub>                    |   | 8.7   | 9.5     | 10.3  | V    |
| Hysteresis                       | 8   | Hys                                     |   | 2.2   | 2.5     | 2.8   | V    |
| <b>SUPPLY CURRENT SECTION</b>    |     |   |   |       |         |       |      |
| Start-up Current                 | 8   | I <sub>START-U</sub>                    | before turn-on (V <sub>CC</sub> =11V)                             | 20    | 50      | 90    | μA   |
| Quiescent Current                | 8   | I <sub>q</sub>                          |   |       | 2.6     | 4     | mA   |
| Operating Supply Current         | 8   | I <sub>CC</sub>                         | C <sub>L</sub> =1nF @ 70KHz                                       |       | 4       | 5.5   | mA   |
|                                  |     |   | In OVP condition V <sub>pin1</sub> =2.7V                          |       | 1.4     |       | mA   |
| Quiescent Current                | 8   | I <sub>q</sub>                          | V <sub>PIN5</sub> ≤150mA, V <sub>CC</sub> >V <sub>CC off</sub>    |       | 1.4     |       | mA   |
|                                  | 8   |   | V <sub>PIN5</sub> ≤150mV, V <sub>CC</sub> <V <sub>CC off</sub>    | 20    | 50      | 90    | μA   |
| Zener Voltage                    | 8   | V <sub>Z</sub>                          | I <sub>CC</sub> =25mA   | 18    | 20      | 30    | 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    |
|                                  |     |   | 12V<V <sub>CC</sub> <18V  | 2.44  |         | 2.56  | V    |
| Line Regulation                  |     |   | V <sub>CC</sub> =12 ~ 18V   |       | 2       | 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>                          |   |       | 1       |       | 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  |       | 5.8     |       | V    |
| Lower Clamp Voltage              |     |   | I <sub>SINK</sub> =0.5mA  |       | 2.25    |       | V    |
| <b>MULTIPLIER SECTION</b>        |     |   |   |       |         |       |      |
| Linear Operating Voltage         | 3   | V <sub>MULT</sub>                       |   | 0~ 3  | 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                      | 0.45  | 0.6     | 0.75  | 1/V  |
| <b>CURRENT SENSE COMPARATOR</b>  |     |   |   |       |         |       |      |
| Current Sense Reference Clamp    | 4   | V <sub>CS</sub>                         | V <sub>MULT</sub> =2.5V<br>V <sub>COMP</sub> =Upper Clamp Voltage | 1.6   | 1.7     | 1.8   | V    |
| Input Bias Current               | 4   | I <sub>CS</sub>                         | V <sub>OS</sub> =0  |       | -0.05   | -1    | μA   |
| Delay to Output                  | 4   | t <sub>d(H-L)</sub>                     |   |       | 200     | 450   | ns   |
| Current Sense Offset             | 4   |   |   |       | 0       | 15    | mV   |

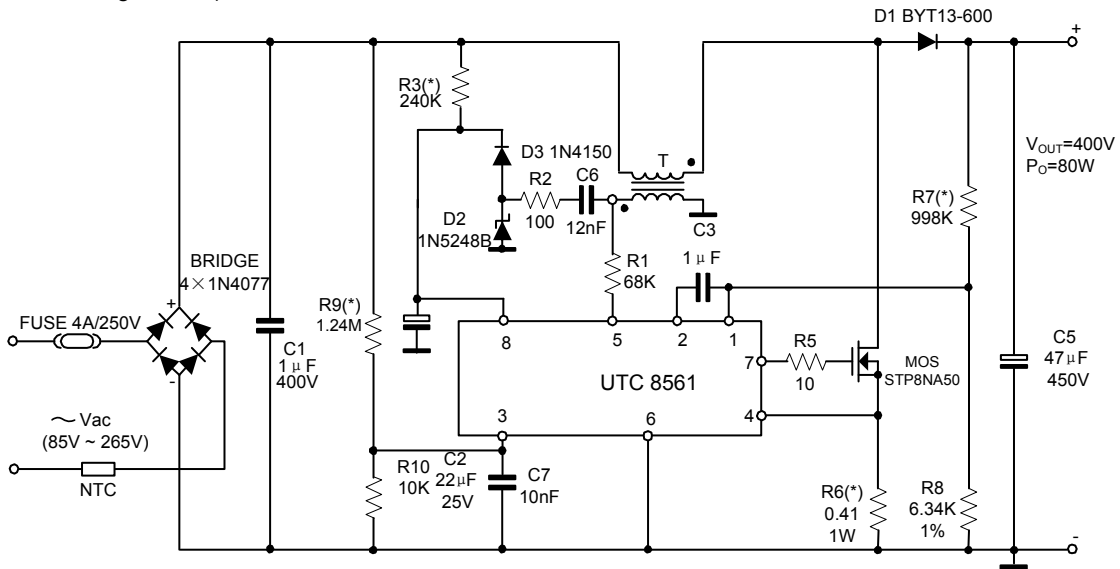
■ ELECTRICAL CHARACTERISTICS (Cont.)

| PARAMETER                                  | PIN | SYMBOL        | TEST CONDITIONS                        | MIN | TYP  | MAX  | UNIT    |
|--|-----|---------------|--|-----|------|------|---------|
| <b>ZERO CURRENT DETECTOR</b>               |     |               |  |     |      |      |         |
| Input Threshold Voltage Rising Edge (Note) | 5   | $V_{ZCD}$     |  |     | 2.1  |      | V       |
| Hysteresis (Note)                          |     |               |  | 0.3 | 0.5  | 0.7  | V       |
| Upper Clamp Voltage                        | 5   | $V_{ZCD}$     | $I_{ZCD}=20\mu A$                      | 4.5 | 5.0  | 6.8  | V       |
| Upper Clamp Voltage                        | 5   | $V_{ZCD}$     | $I_{ZCD}=3mA$                          | 4.7 | 5.1  | 7    | V       |
| Lower Clamp Voltage                        | 5   | $V_{ZCD}$     | $I_{ZCD}=3mA$                          | 0.3 | 0.65 | 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   | $V_{DIS}$     |  |     | 200  | 300  | mV      |
| Restart Current After Disable              | 5   | $I_{ZCD}$     | $V_{ZCD} < V_{dis}, V_{CC} > V_{COFF}$ |     | -200 | -300 | $\mu A$ |
| <b>OUTPUT SECTION</b>                      |     |               |  |     |      |      |         |
| Dropout Voltage                            | 7   | $V_{GD}$      | $I_{GDsource}=200mA$                   |     | 1.2  | 2    | V       |
|  |     |               | $I_{GDsource}=20mA$                    |     | 0.7  | 1    | V       |
|  |     |               | $I_{GDsink}=200mA$                     |     |      | 1.5  | V       |
|  |     |               | $I_{GDsink}=20mA$                      |     |      | 0.3  | 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   | $I_{GD(OFF)}$ | $V_{CC}=3.5V, V_{GD}=1V$               | 5   | 10   |      | mA      |
| <b>OUTPUT OVERVOLTAGE SECTION</b>          |     |               |  |     |      |      |         |
| OVP Triggering Current                     | 2   | $I_{OVP}$     |  | 35  | 40   | 45   | $\mu A$ |
| Static OVP Threshold                       |     |               |  | 2.1 | 2.25 | 2.4  | V       |
| <b>RESTART TIMER</b>                       |     |               |  |     |      |      |         |
| Start Timer                                |     | $t_{START}$   |  | 70  | 150  | 400  | $\mu s$ |

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

## ■ TYPICAL APPLICATION CIRCUIT

(80W, Wide-range Mains)



(\*) R3 = 2 × 120KΩ  
 R6 = 0.82Ω / 2  
 R7 = 2 × 499KΩ, 1%  
 R9 = 2 × 620KΩ

### TRANSFORMER

T: core THOMSON-CSF B1ET2910A(ETD29×16×10mm)OR EQUIVALENT (OREGA 473201A8)  
 primary 90T of Litz wire 10×0.2mm  
 secondary 7T of #27 AWG (0.15mm)  
 gap 1.25mm for a total primary inductance of 0.8mH

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