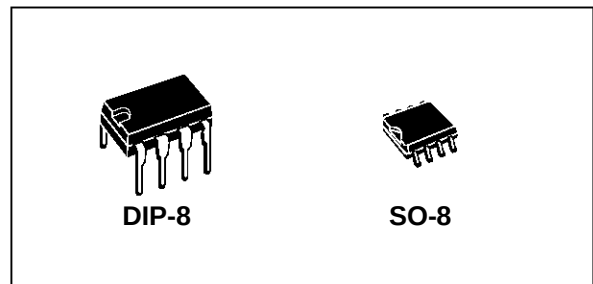


## LOW DROP VOLTAGE REGULATOR DRIVE FOR EXTERNAL N-CHANNEL POWER MOSFET

- VERY LOW DROPOUT POWER MOSFET DRIVER
- HIGH PRECISION  $V_{ref} = 2.5V (\pm 1\%)$
- VERY LOW CURRENT DRAIN (TYP. 2mA)
- REFERENCE OUTPUT CURRENT UP TO 20mA
- OPERATING SUPPLY VOLTAGE FROM 5V TO 30V
- MAXIMUM INPUT VOLTAGE ON-GATE PIN (N. 8) UP TO 60V
- INTERNAL CURRENT LIMIT OPERATIONAL AMPLIFIER OFFSET TRIMMED AT  $50mV \pm 7mV$
- NO CAPACITOR IS NEEDED FOR STABILITY OF REFERENCE OUTPUT
- TEMPERATURE RANGE  $0^{\circ}C$  TO  $70^{\circ}C$

### APPLICATION

- ULTRA HIGH CURRENT ULTRA LOW DROPOUT VOLTAGE REGULATOR
- CONSTANT HIGH CURRENT SOURCE

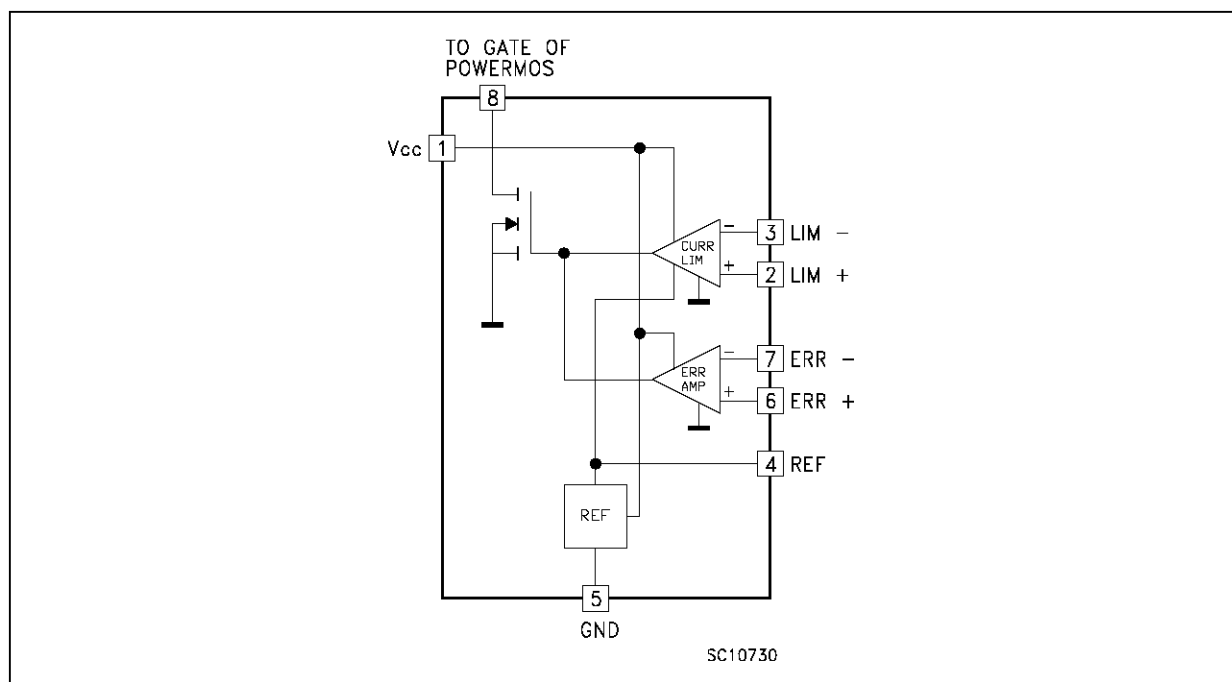


- LOW PARTS COUNT 5V TO 3.3V COMPUTER SUPPLY
- LOW NOISE/LOW DROP SMPS POST REGULATOR

### DESCRIPTION

The LPR30 is a very Low Dropout Regulator Controller in a single IC solution for very high current low dropout linear voltage regulator. It uses an external N-CHANNEL POWER MOSFET as the linear pass element. The LPR30 features a dropout voltage as low as the  $R_{DS(on)}$  of the

### BLOCK DIAGRAM



## LPR30

external Power MOSFET multiplied by the output current. Consequently the output current can be as high as the POWER MOSFET can provide (also using an adequate heatsink).

The  $V_{CC}$  of the LPR30 range from 5V to 30V. For very low drop voltage operation, the LPR30 requires an external gate drive supply to provide the control voltage needed to drive the gate of the external POWER MOSFET.

The regulator output is constant-current limited when the controller detects 50mV across an external sense resistor.

It has an internal high precision ( $\pm 1\%$ ) Voltage Reference at 2.5V

The output regulated voltage is possible to program to any voltage from 1V to more than 50V.

Flexible design is achieved by the availability of the Voltage Reference Output through an external pin (N.4) that is able to supply more than 20mA as load current. The LPR30 is available in 8 pin plastic DIP and in SO-8 for SMD. In both package versions it is able to operate from 0°C to 70°C.

### ABSOLUTE MAXIMUM RATINGS

| Symbol     | Parameter                            | Value              | Unit |
|------------|--------------------------------------|--------------------|------|
| $V_{CC}$   | DC Input Voltage                     | 36                 | V    |
| $I_{OREF}$ | Reference Output Current             | Internally Limited |      |
| $P_{tot}$  | Power Dissipation                    | 1                  | W    |
| $T_{op}$   | Operating Junction Temperature Range | 0 to 70            | °C   |
| $T_{stg}$  | Storage Temperature Range            | - 40 to 150        | °C   |
| $V_{gate}$ | Maximum Gate Voltage (pin n8)        | 60                 | V    |
| $I_{gate}$ | Maximum Gate Current (pin n8)        | 200                | mA   |

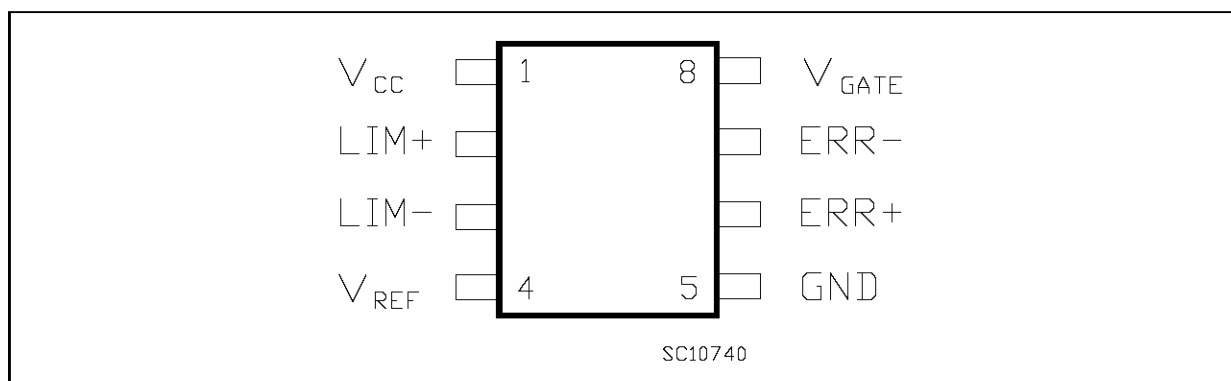
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

### THERMAL DATA

| Symbol        | Parameter                                   | DIP-8      | SO-8       | Unit |
|---------------|---------------------------------------------|------------|------------|------|
| $R_{thj-amb}$ | Thermal Resistance Junction-ambient (*) Max | 130 to 180 | 100 to 150 | °C/W |

(\*) This value depends from thermal design of PCB on which the device is mounted.

### CONNECTION DIAGRAM (top view)



### ORDERING NUMBERS

| Type  | DIP-8  | SO-8   | SO-8 (tape & reel) |
|-------|--------|--------|--------------------|
| LPR30 | LPR30N | LPR30D | LPR30D-TR          |

**ELECTRICAL CHARACTERISTICS**(Refer to the test circuits,  $V_{CC} = 10V$ ,  $T_j = 25\text{ }^{\circ}C$  unless otherwise specified.)**GENERAL**

| Symbol     | Parameter                 | Test Conditions                                                                                                                            | Min. | Typ. | Max. | Unit    |
|------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------|
| $V_{CC}$   | Operating Supply Voltage  |                                                                                                                                            | 5    |      | 30   | V       |
| $I_{CC}$   | Supply Current            | $I_K = 0\text{ }\mu A$ $V_{CC} = 30\text{ V}$<br>$T_j = 0\text{ to }70\text{ }^{\circ}C$<br>$ERR(-), LIM(-) = 1V$<br>$ERR(+), LIM(+) = 0V$ |      | 2    | 4    | mA      |
| $V_{OSAT}$ | Output Saturation Voltage | $V_{CC} = 5\text{ V}$ $I_O = 100\text{ mA}$<br>$T_j = 0\text{ to }70\text{ }^{\circ}C$<br>$ERR(-), LIM(-) = 1V$<br>$ERR(+), LIM(+) = 0V$   |      | 280  | 500  | mV      |
| $I_{OLK}$  | Output Leakage Current    | $V_{CC} = 5\text{ V}$ $V_O = 60\text{ V}$<br>$ERR(-), LIM(-) = 0V$<br>$ERR(+), LIM(+) = 1V$                                                |      |      | 100  | $\mu A$ |

**REFERENCE BLOCK**

| Symbol                      | Parameter                       | Test Conditions                                                                      | Min.          | Typ.       | Max.          | Unit    |
|-----------------------------|---------------------------------|--------------------------------------------------------------------------------------|---------------|------------|---------------|---------|
| $V_{REF}$                   | Reference Output Voltage        | $I_K = 10\text{ mA}$<br>$I_K = 10\text{ mA}$ $T_j = 0\text{ to }70\text{ }^{\circ}C$ | 2.475<br>2.45 | 2.5<br>2.5 | 2.525<br>2.55 | V<br>V  |
| $I_K$                       | Reference Output Current        |                                                                                      | 20            |            |               | mA      |
| $\Delta V_{REF}/\Delta I_K$ | Reference Output Voltage Change | $I_K = 1\text{ to }20\text{ mA}$ $C_{REF} = 0\text{ pF}$                             |               | 3          |               | mV      |
| SVR                         | Supply Voltage Rejection        | $V_{IN} < 10\text{ V} \pm 1V$ $f = 120\text{ Hz}$ $C_{REF} = 0\text{ pF}$            |               | 70         |               | dB      |
| eN                          | Output Noise                    | $B = 10\text{ Hz to }10\text{ KHz}$<br>$I_K = 10\text{ mA}$ $C_{REF} = 0\text{ pF}$  |               | 50         |               | $\mu V$ |

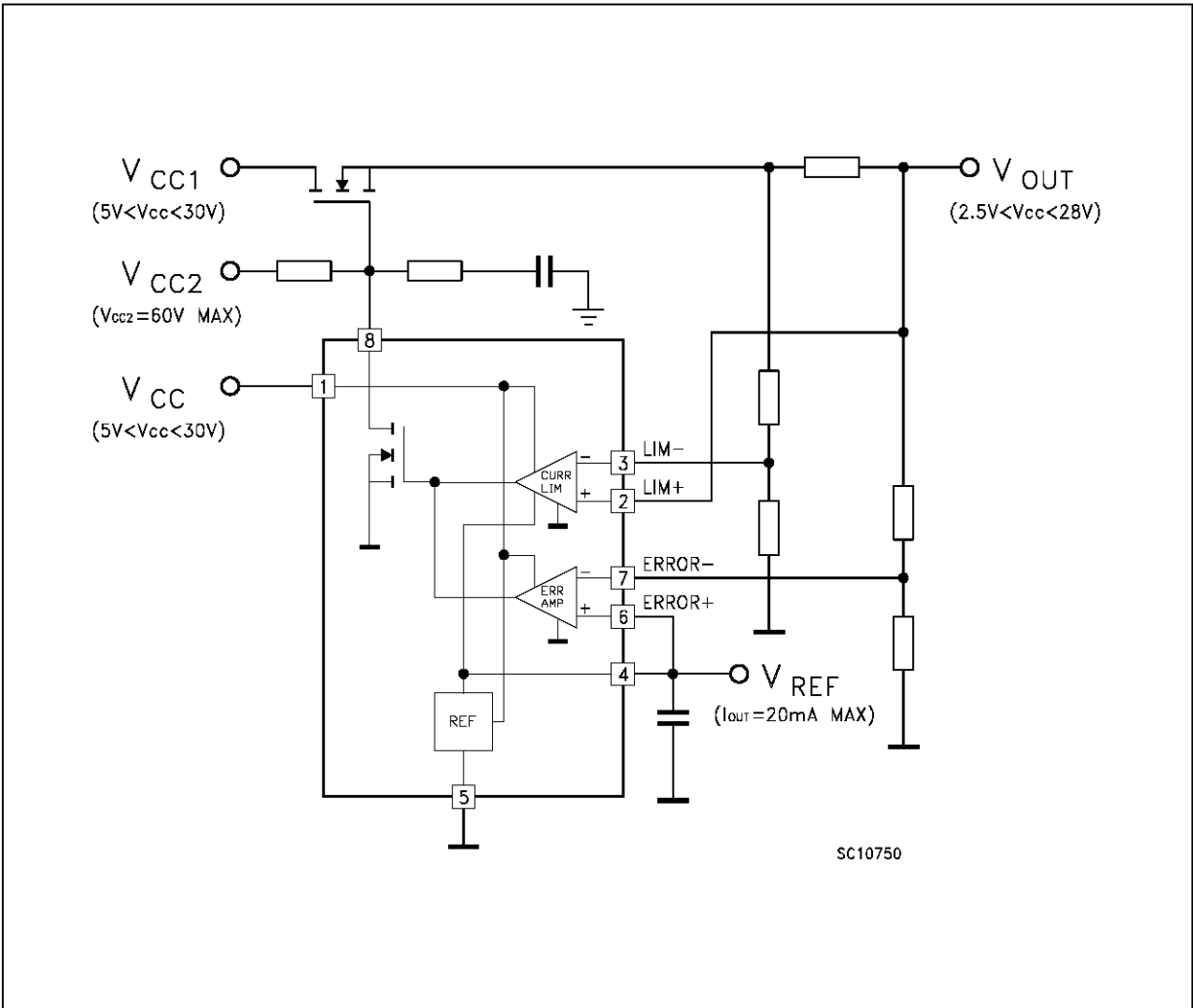
**ERROR AMPLIFIER BLOCK**

| Symbol   | Parameter                       | Test Conditions                                                                                  | Min.     | Typ. | Max.       | Unit     |
|----------|---------------------------------|--------------------------------------------------------------------------------------------------|----------|------|------------|----------|
| $I_B$    | Input Bias Current              |                                                                                                  |          | 0.3  | 1          | $\mu A$  |
| $V_{OS}$ | Input Offset Voltage            | $V_{CC} = 5\text{ to }30\text{ V}$ $T_j = 0\text{ to }70\text{ }^{\circ}C$                       |          |      | 5          | mV       |
| $I_{OS}$ | Input Offset Current            |                                                                                                  |          | 5    | 50         | nA       |
| $G_V$    | Open Loop Gain                  | $T_j = 0\text{ to }70\text{ }^{\circ}C$                                                          | 80       |      |            | dB       |
| $V_{CM}$ | Input Common Mode Voltage Range | $T_j = 0\text{ to }70\text{ }^{\circ}C$                                                          | 1        |      | $V_{CC}-1$ | V        |
| CMR      | Common Mode Rejection           |                                                                                                  |          | 70   |            | dB       |
| SVR      | Supply Voltage Rejection        | $V_{IN} = 9\text{ to }11V$ $f = 120\text{ Hz}$<br>$V_{IN} = 9\text{ to }11V$ $f = 10\text{ KHz}$ | 70<br>60 |      |            | dB<br>dB |

**CURRENT LIMITING BLOCK**

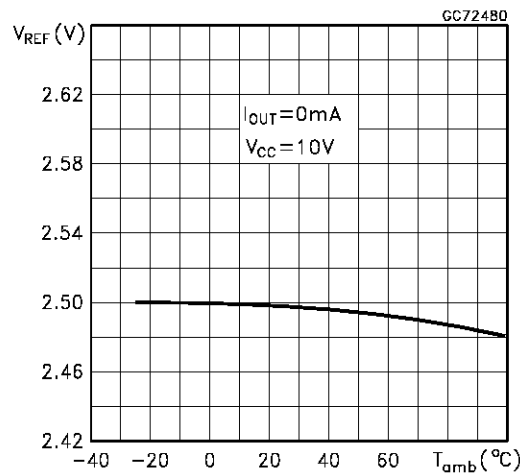
| Symbol   | Parameter                       | Test Conditions                         | Min. | Typ. | Max.       | Unit    |
|----------|---------------------------------|-----------------------------------------|------|------|------------|---------|
| $I_B$    | Input Bias Current              |                                         |      |      | 0.5        | $\mu A$ |
| $V_{OS}$ | Input Offset Voltage            | $T_j = 0\text{ to }70\text{ }^{\circ}C$ | 43   | 50   | 57         | V       |
| $G_V$    | Open Loop Gain                  | $T_j = 0\text{ to }70\text{ }^{\circ}C$ | 50   |      |            | dB      |
| $V_{CM}$ | Input Common Mode Voltage Range | $T_j = 0\text{ to }70\text{ }^{\circ}C$ | 0    |      | $V_{CC}-3$ | V       |

TEST CIRCUIT

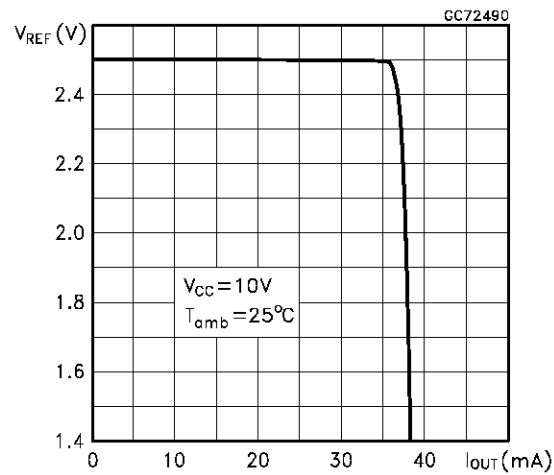


TYPICAL PERFORMANCE CHARACTERISTICS

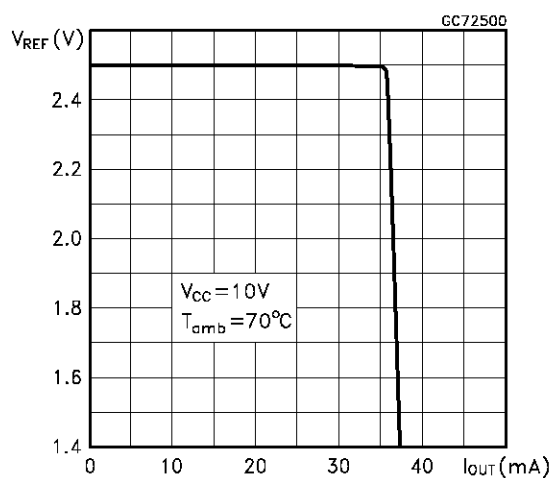
Reference Output Voltage vs Temperature



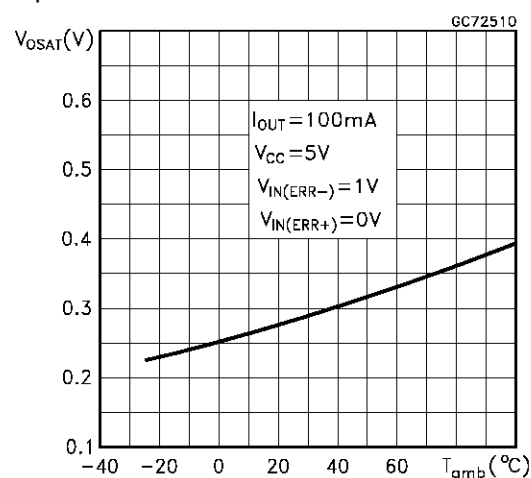
Reference Output Voltage vs Load Current



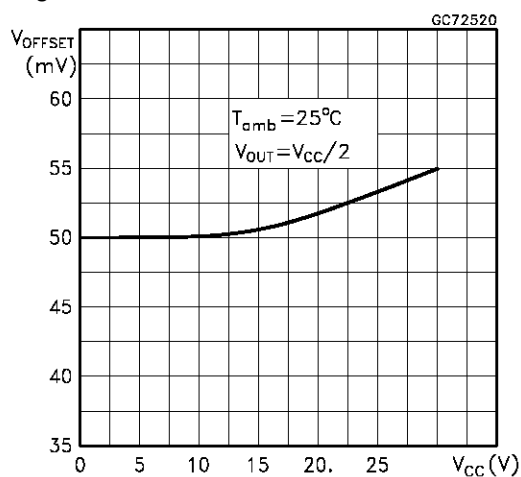
Reference Output Voltage vs Load Current



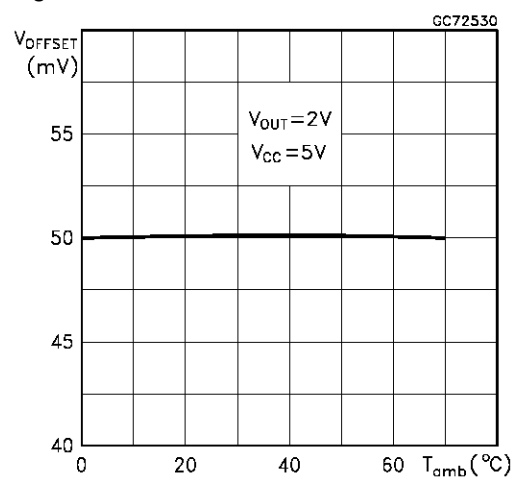
Error Amplifier Output Saturation Voltage vs Temperature



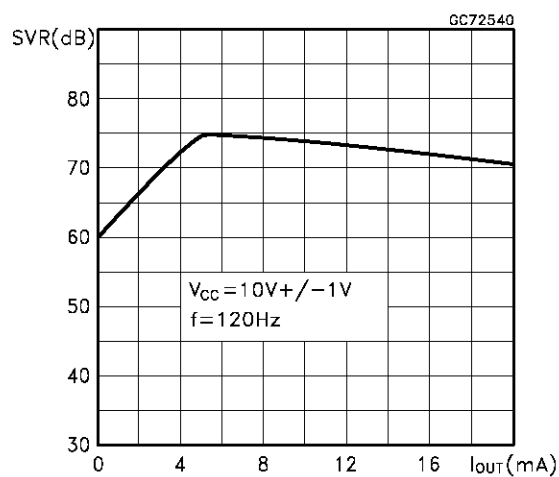
Current Limit Input Offset Voltage vs Supply Voltage



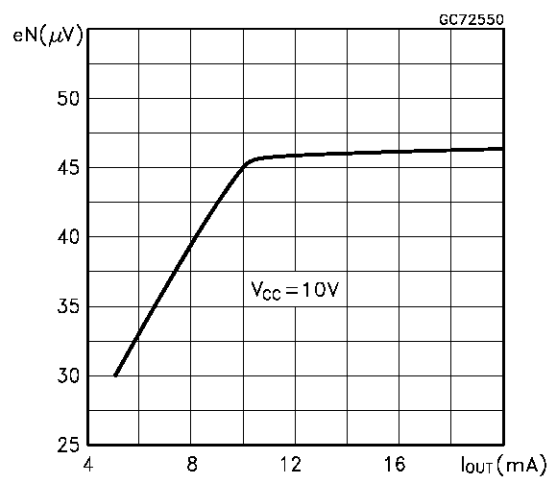
Current Limit Input Offset Voltage vs Supply Voltage



Reference Supply Voltage Rejection vs Output Current



Reference Output Noise vs Output Current



## APPLICATION INFORMATION

Figure 1: LPR30 Typical Application

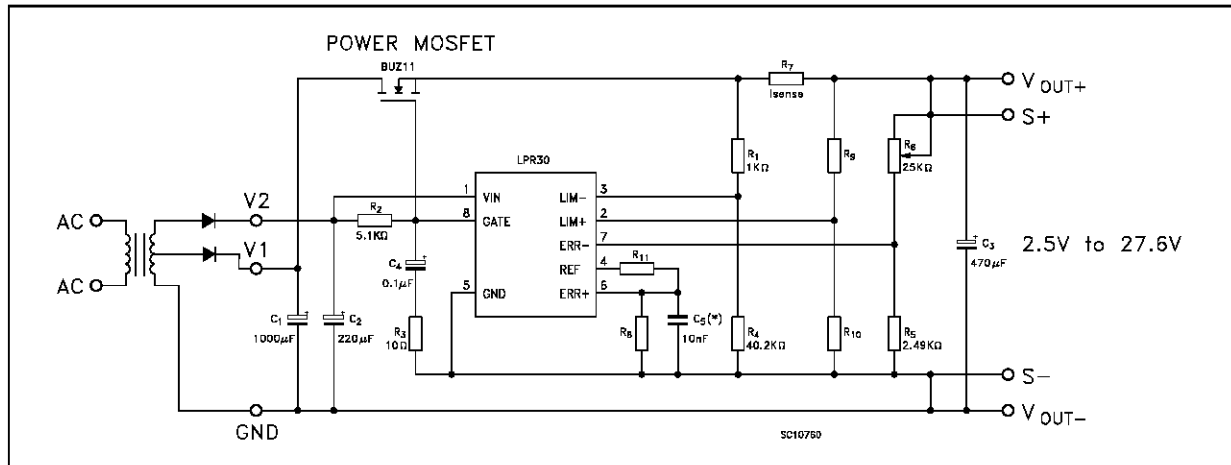
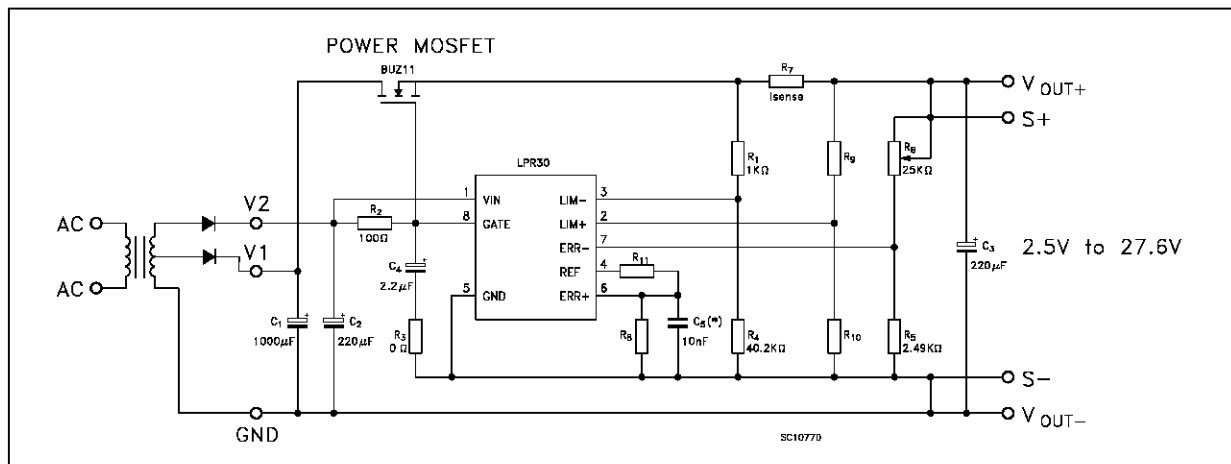
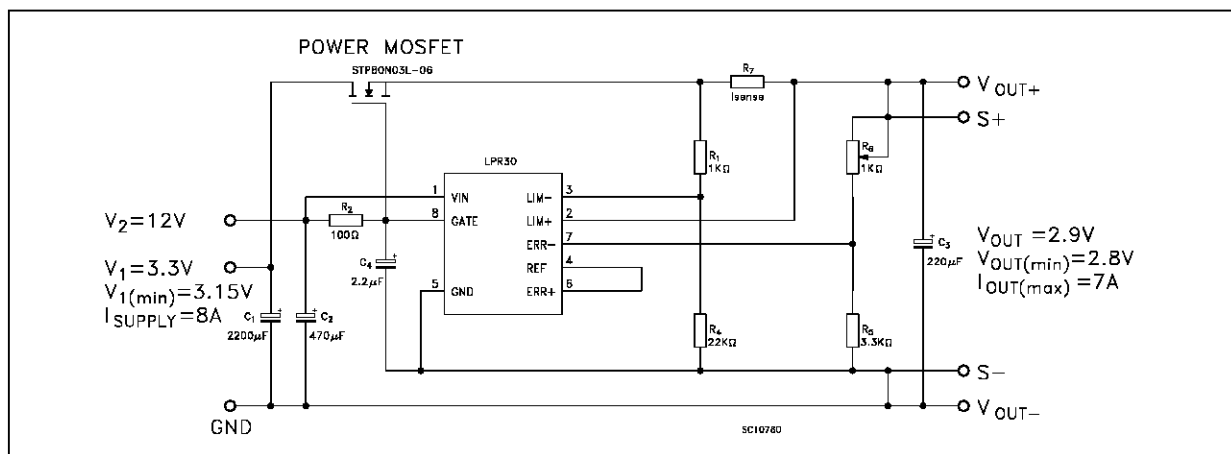


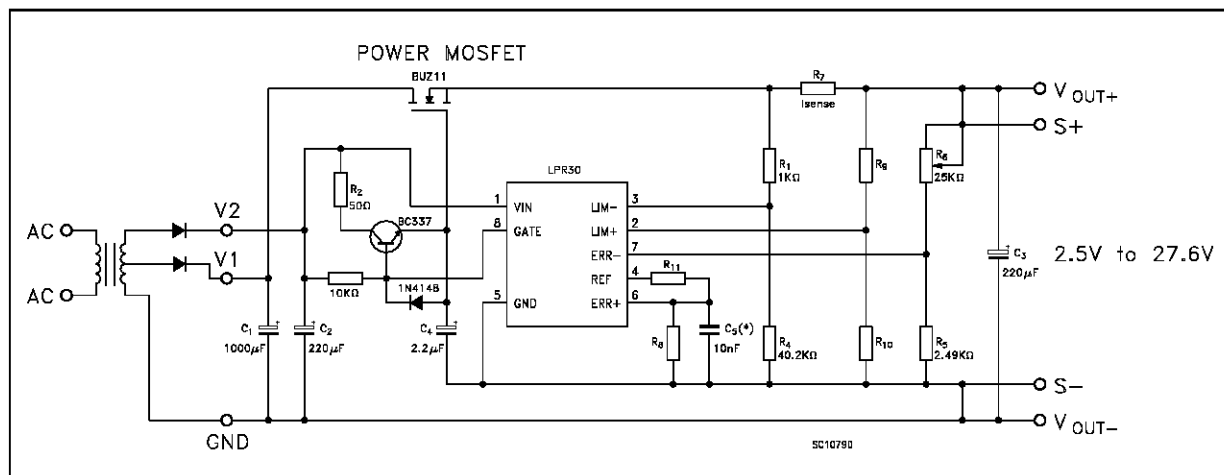
Figure 2: Configuration For Faster Response

Figure 3: Configuration For  $V_{IN} = 3.3V$ ,  $V_{OUT} = 2.9V$ ,  $I_{OUT} = 7A$ 

(\*) This capacitor improves noise performance; can be omitted in most applications

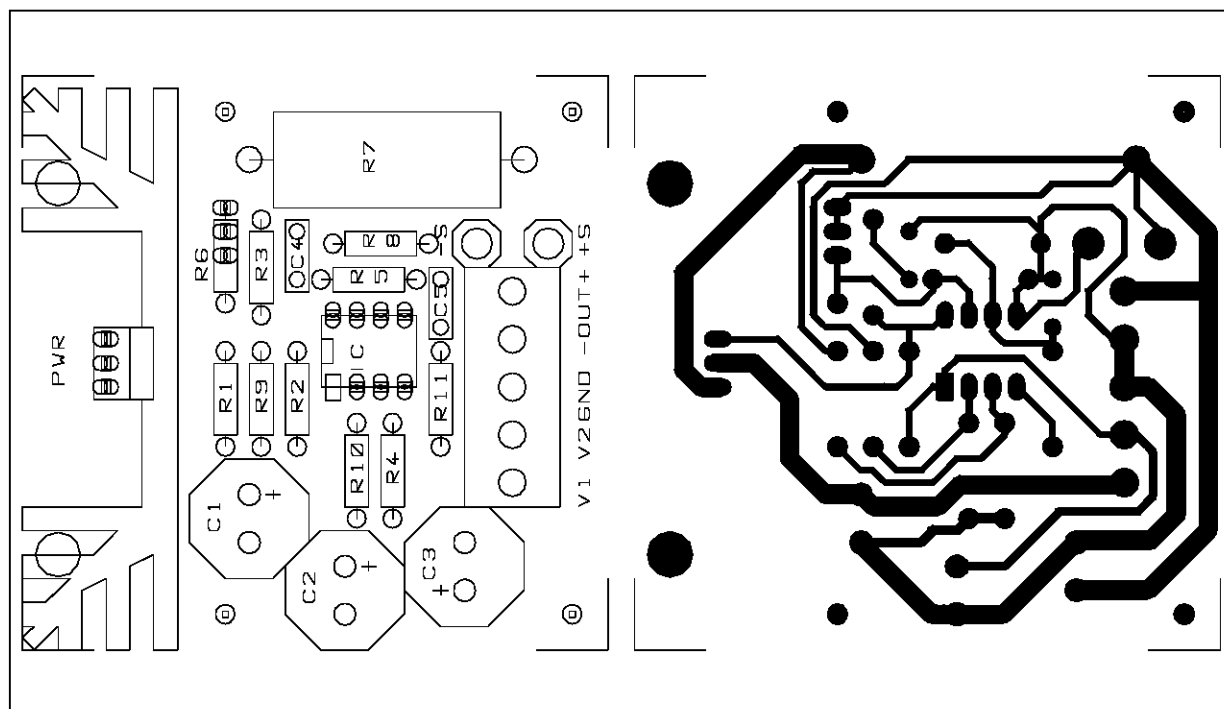
**APPLICATION INFORMATION** (continued)

#### Figure 4: Application For Very Fast Response Speed



(\*) This capacitor improves noise performance; can be omitted in most applications

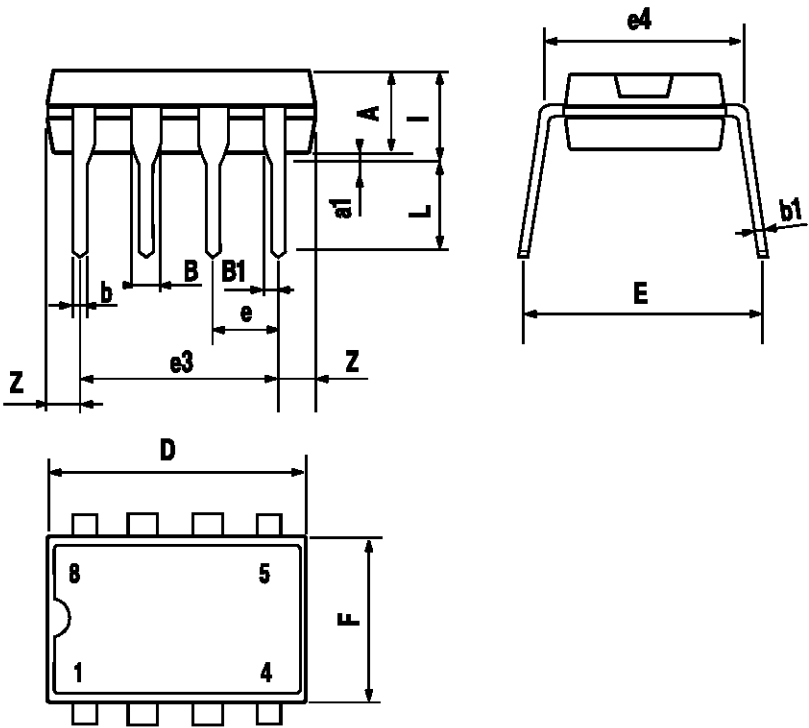
## STANDARD APPLICATION DEMOBOARD



Note: This demoboard refers to the typical application shown in figure 1

Plastic DIP-8 MECHANICAL DATA

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      | 3.3  |      |       | 0.130 |       |
| a1   | 0.7  |      |      | 0.028 |       |       |
| B    | 1.39 |      | 1.65 | 0.055 |       | 0.065 |
| B1   | 0.91 |      | 1.04 | 0.036 |       | 0.041 |
| b    |      | 0.5  |      |       | 0.020 |       |
| b1   | 0.38 |      | 0.5  | 0.015 |       | 0.020 |
| D    |      |      | 9.8  |       |       | 0.386 |
| E    |      | 8.8  |      |       | 0.346 |       |
| e    |      | 2.54 |      |       | 0.100 |       |
| e3   |      | 7.62 |      |       | 0.300 |       |
| e4   |      | 7.62 |      |       | 0.300 |       |
| F    |      |      | 7.1  |       |       | 0.280 |
| I    |      |      | 4.8  |       |       | 0.189 |
| L    |      | 3.3  |      |       | 0.130 |       |
| Z    | 0.44 |      | 1.6  | 0.017 |       | 0.063 |

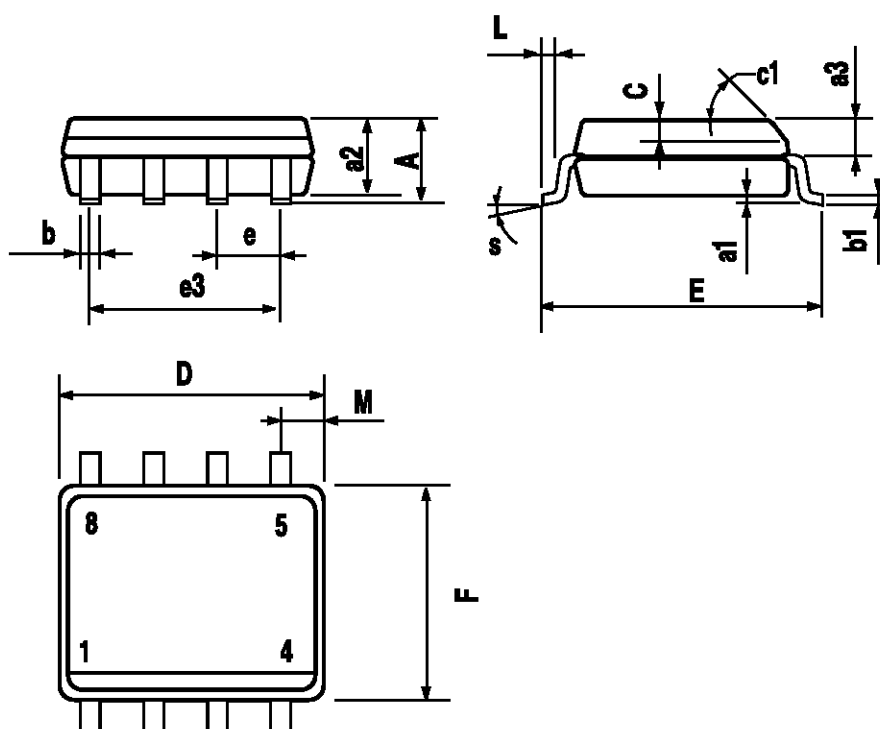


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## SO-8 MECHANICAL DATA

| DIM. | mm        |      |      | inch  |       |       |
|------|-----------|------|------|-------|-------|-------|
|      | MIN.      | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    |           |      | 1.75 |       |       | 0.068 |
| a1   | 0.1       |      | 0.25 | 0.003 |       | 0.009 |
| a2   |           |      | 1.65 |       |       | 0.064 |
| a3   | 0.65      |      | 0.85 | 0.025 |       | 0.033 |
| b    | 0.35      |      | 0.48 | 0.013 |       | 0.018 |
| b1   | 0.19      |      | 0.25 | 0.007 |       | 0.010 |
| C    | 0.25      |      | 0.5  | 0.010 |       | 0.019 |
| c1   | 45 (typ.) |      |      |       |       |       |
| D    | 4.8       |      | 5.0  | 0.188 |       | 0.196 |
| E    | 5.8       |      | 6.2  | 0.228 |       | 0.244 |
| e    |           | 1.27 |      |       | 0.050 |       |
| e3   |           | 3.81 |      |       | 0.150 |       |
| F    | 3.8       |      | 4.0  | 0.14  |       | 0.157 |
| L    | 0.4       |      | 1.27 | 0.015 |       | 0.050 |
| M    |           |      | 0.6  |       |       | 0.023 |
| S    | 8 (max.)  |      |      |       |       |       |



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