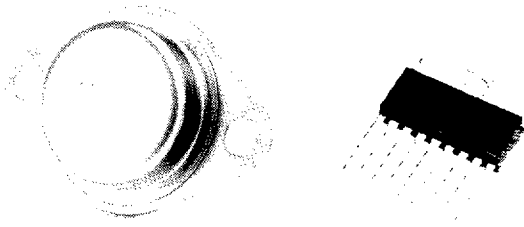


LAS-6330  
LAS-6430

## 3 AMP SWITCHING REGULATORS

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### FEATURES

- DC to 100 kHz operation
- Adjustable output voltage
- Cycle-by-cycle current limit
- Internal thermal shutdown
- Inhibit/enable control pin

### DESCRIPTION

The LAS-6330/LAS-6430 Series are monolithic integrated circuits designed for fixed frequency, pulse width modulated, switching converter applications such as step-down, step-up, flyback, forward, Cũk and voltage inverting DC-to-DC converters and motor controls. The LAS-6330/LAS-6400 Series include a temperature compensated voltage reference, sawtooth oscillator with over-current frequency shift, linear trailing edge pulse width modulator with double pulse suppression logic, transconductance error amplifier, and a 3 amp Darlingtion output transistor with internal current limit protection.

The LAS-6330/LAS-6430 can be used in step-down or step-up applications. The LAS-6331/LAS-6431 are for step-down applications where current limit adjustment is necessary. The LAS-6330/LAS-6430 Series are available in TO-3 steel packages for true hermetic seal and board insertable plastic SIP packages. Full military temperature range is also available for LAS-6430 TO-3 models.

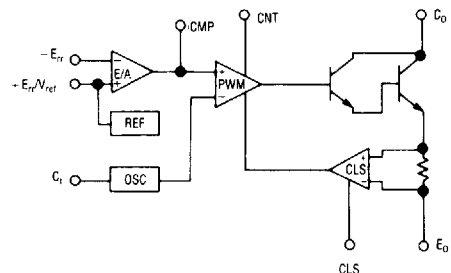
### ABSOLUTE MAXIMUM RATINGS

| PARAMETER  | SYMBOL        | MAXIMUM                                | UNITS                       |
|--|---------------|--|-----------------------------|
| Control Circuit/<br>Output Collector<br>Voltage<br>LAS-6330/31<br>LAS-6430/31            | $V_{CC}/C_O$  | 35<br>40                               | Volts                       |
| Power Dissipation  | $P_D$         | Internally<br>Limited                  | Watts                       |
| Thermal Resistance<br>Junction to Case<br>TO-3<br>SIP                                    | $\theta_{JC}$ | 3.0<br>1.9                             | $^{\circ}\text{C}/\text{W}$ |
| Operating Junction<br>Temperature Range<br>TO-3 LAS-6430/31<br>SIP<br>TO-3 LAS-6330A/31A | $T_J$         | -55 to 150<br>-25 to 125<br>-25 to 125 | $^{\circ}\text{C}$          |
| Storage<br>Temperature Range   | $T_{STG}$     | -65 to 150                             | $^{\circ}\text{C}$          |
| Lead Temperature<br>(Soldering)<br>60 sec for TO-3<br>10 sec for SIP                     | $T_{LEAD}$    | 300<br>260                             | $^{\circ}\text{C}$          |

### DEVICE SELECTION GUIDE

| DEVICE     | $V_{IN}$<br>MAX | $V_{OUT}$<br>MAX | CURRENT<br>LIMIT | PACKAGE     |
|------------|-----------------|------------------|------------------|-------------|
| LAS-6330A  | 35              | 27               | Fixed            | TO-3        |
| LAS-6330P1 | 35              | 27               | Fixed            | Plastic SIP |
| LAS-6331A  | 35              | 27               | Adjustable       | TO-3        |
| LAS-6331P1 | 35              | 27               | Adjustable       | Plastic SIP |
| LAS-6430   | 40              | 31               | Fixed            | TO-3        |
| LAS-6430P  | 40              | 31               | Fixed            | Plastic SIP |
| LAS-6431   | 40              | 31               | Adjustable       | TO-3        |
| LAS-6431P  | 40              | 31               | Adjustable       | Plastic SIP |

### BLOCK DIAGRAM



# 3 AMP SWITCHING REGULATORS

## ELECTRICAL CHARACTERISTICS

Test conditions are as follows:  $V_{CC} = 24V$ ,  $V_O = 5V$ ,  $I_O = 3A$ ,  $C_t = 0.0056\mu F$ ,  
 $T_J = 25^\circ C$ ,  $F_{SX} = 55Khz$ , unless otherwise specified.

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| Parameter                                 | Symbol         | Test Conditions  |                      |           | Test Limits |                          |         | Units                            |
|---|----------------|--|----------------------|-----------|-------------|--------------------------|---------|----------------------------------|
|   |                | $V_{CC}$   | $I_O$                | $T_J^2$   | Minimum     | Typical                  | Maximum |                                  |
| <b>REFERENCE SECTION</b>                  |                |  |                      |           |             |                          |         |                                  |
| Reference Voltage <sup>1</sup>            | $V_{REF}$      |  |                      |           | 2.137       | 2.25                     | 2.363   | Volts                            |
| LAS-6300<br>LAS-6400                      |                | 12 to $V_{IN}$<br>(max)  | 0.3A<br>to<br>3A     | Over Temp | 2.10        |                          | 2.43    | Volts                            |
| Load Regulation <sup>1</sup>              | $REG_{(LOAD)}$ |  | 0.3A<br>to<br>3A     |           |             | 0.4                      | 1.0     | % $V_{REF}$                      |
| Line Regulation <sup>1</sup>              | $REG_{(LINE)}$ | 12V to $V_{IN}$<br>(max)                                       |                      |           |             | 0.9                      | 1.0     | % $V_{REF}$                      |
| Temperature Coefficient                   | $T_C$          |  |                      | Over Temp |             | 0.01                     |         | %/ $^\circ C$                    |
| <b>OSCILLATOR SECTION</b>                 |                |  |                      |           |             |                          |         |                                  |
| Initial Frequency Accuracy                | $F_{SX}$       |  |                      |           | -33         | $\pm 10$                 | +33     | %                                |
| Line Regulation of Frequency <sup>1</sup> | $REG_{(LINE)}$ | 12V to $V_{IN}$<br>(max)                                       |                      |           |             | 0.12                     | 2.7     | % $F_{SX}$                       |
| Frequency Temperature Coefficient         | $T_C$          |  |                      | Over Temp |             | 0.05                     |         | %/ $^\circ C$                    |
| Sawtooth Duty Cycle                       | d.c.           |  |                      |           |             | 85                       |         | %                                |
| <b>ERROR AMPLIFIER SECTION</b>            |                |  |                      |           |             |                          |         |                                  |
| Input Offset Voltage                      |                |  |                      |           |             | $\pm 5$                  |         | mV                               |
| Transconductance                          |                |  |                      |           |             | 2.7                      |         | mA/V                             |
| Output Sink/Source Current                |                |  |                      |           |             | 0.26                     |         | mA                               |
| Input Common Mode Range                   |                |  |                      |           | 1.5         |                          | 3.0     | Volts                            |
| Open Loop Voltage Gain                    |                |  |                      |           | 50          | 60                       |         | dB                               |
| <b>OUTPUT SECTION</b>                     |                |  |                      |           |             |                          |         |                                  |
| Peak Current Limit Knee                   | $I_P$          |  |                      | Over Temp | 3.3         |                          |         | Amps                             |
| Short Circuit Current Limit               | $I_{SC}$       |  |                      |           |             | 7.5                      |         | Amps                             |
| Output Saturation Voltage                 | $V_O$ (sat)    | $C_O = V_{CC}$<br>$C_O = V_{CC}$<br>$E_O = GND$<br>$E_O = GND$ | 1A<br>3A<br>1A<br>3A |           |             | 1.8<br>2.2<br>1.0<br>1.4 | 2.3     | Volts<br>Volts<br>Volts<br>Volts |
| Efficiency <sup>3</sup>                   | $\eta$         |  |                      |           | 70          | 79                       |         | %                                |
|   |                |  |                      | Over Temp | 65          |                          |         | %                                |
| Current Rise Time <sup>3</sup>            | $t_R$          |  | Inductive Load       |           |             | 50                       | 100     | nS                               |
| Current Fall Time <sup>3</sup>            | $t_F$          |  | Inductive Load       |           |             | 700                      | 900     | nS                               |
| <b>CONTROL PIN</b>                        |                |  |                      |           |             |                          |         |                                  |
| Output Inhibit                            |                |  |                      |           | 0.64        | 0.75                     | 1.06    | Volts                            |
| Quiescent Current                         | $I_Q$          |  | Output $E_O$ Off     |           |             | 18                       |         | mA                               |
|   |                |  | Output $E_O$ On      |           |             |                          | 30      | mA                               |

1 Low duty cycle Pulse Testing with Kelvin Connections required. Die temperature changes must be accounted for separately.

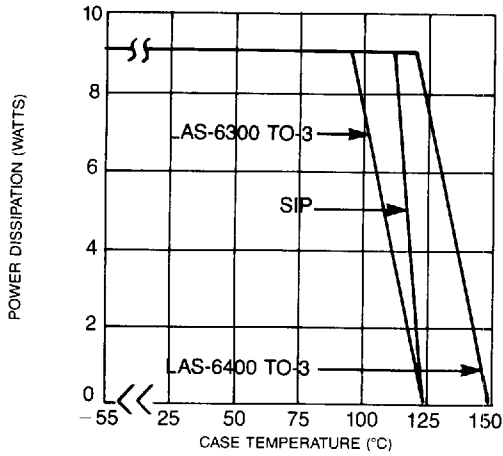
2 Over Temperature,  $T_J = -25^\circ C$  to  $125^\circ C$  for LAS-6300, TO-3, SIP; LAS-6400 SIP, and  $-55^\circ C$  to  $150^\circ C$  for LAS-6400 TO-3

3 Per Test Circuit

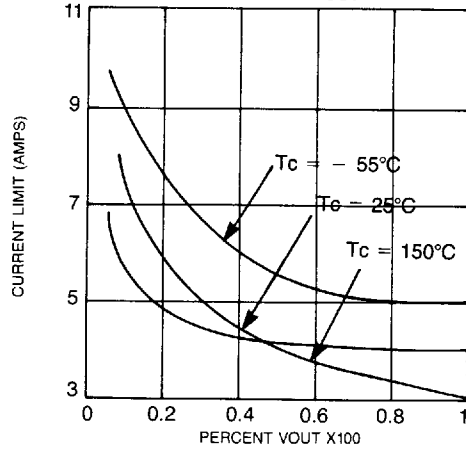
# 3 AMP SWITCHING REGULATORS

## OPERATIONAL DATA

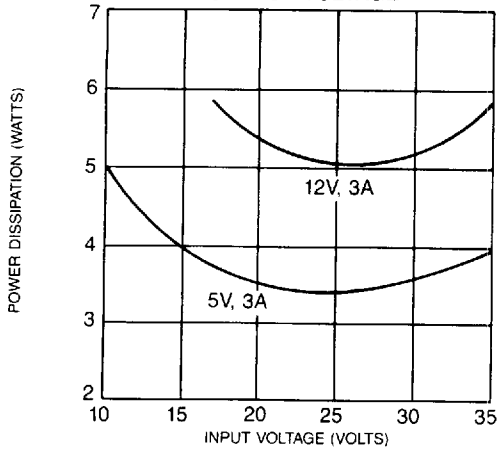
**POWER DERATING**



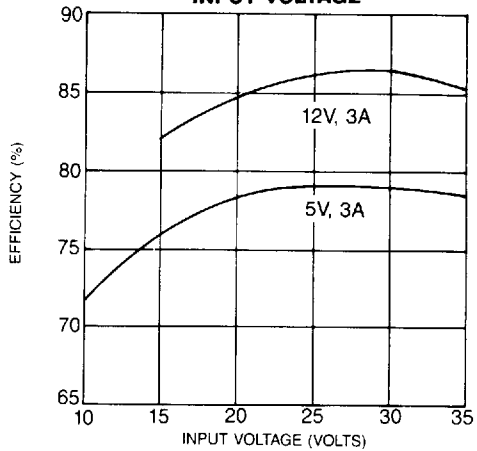
**CURRENT LIMIT VS. PERCENT  $V_{OUT}$**



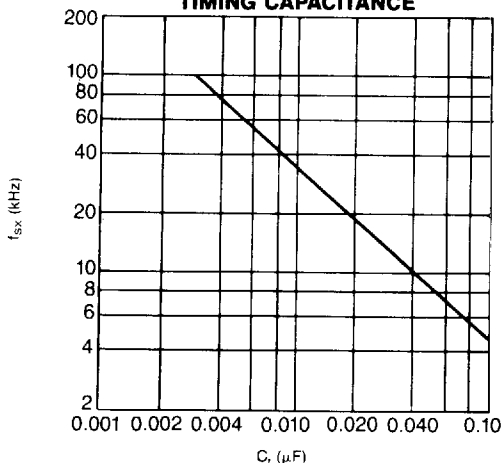
**POWER DISSIPATION VS INPUT VOLTAGE**



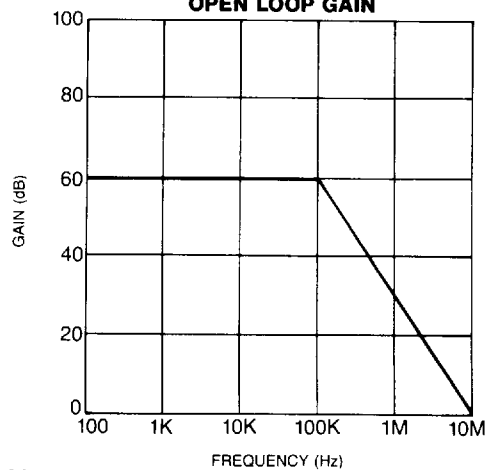
**EFFICIENCY VS INPUT VOLTAGE**



**FREQUENCY VS TIMING CAPACITANCE**



**ERROR AMPLIFIER OPEN LOOP GAIN**



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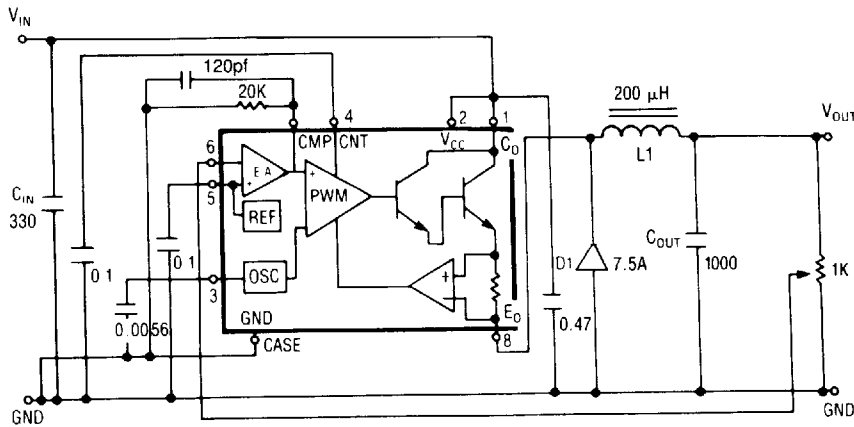
# 3 AMP SWITCHING REGULATORS

LAS-6330  
LAS-6430

## TYPICAL APPLICATIONS

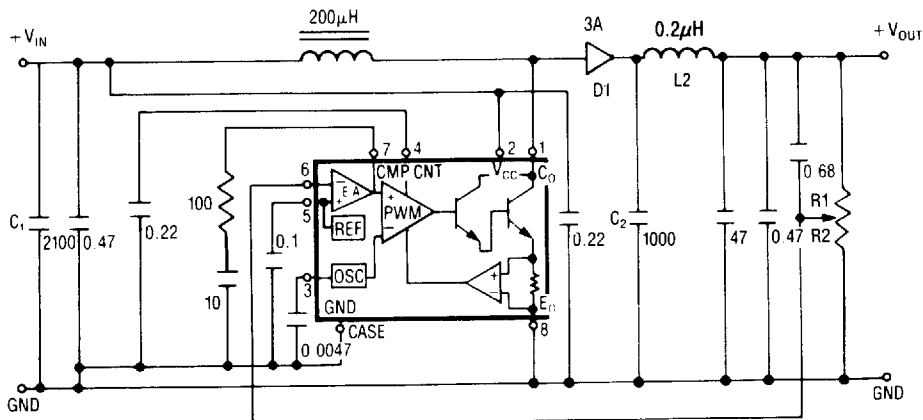
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### DC-TO-DC STEP-DOWN CONVERTER



$V_{IN} = 24V$   
 $V_{OUT} = 5V @ 3A$

### DC-TO-DC STEP-UP CONVERTER



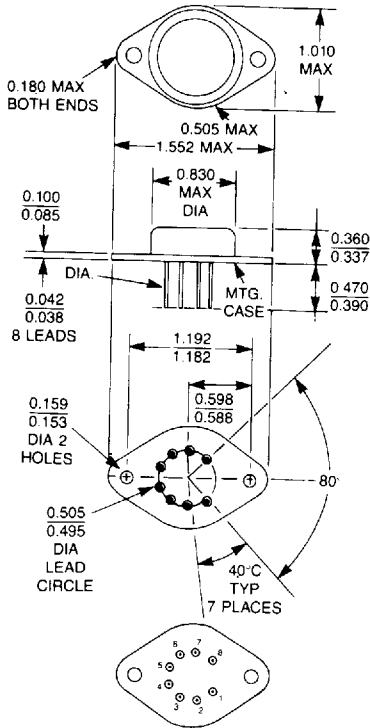
$V_{IN} = 12V$   
 $V_{OUT} = 24V @ 1.0A$

LAS-6330  
LAS-6430

# 3 AMP SWITCHING REGULATORS

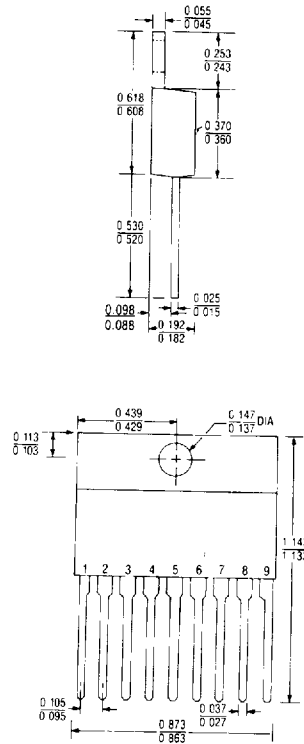
## DEVICE OUTLINE

LAS-6X30, 6X31



Bottom View

LAS-6X30P, 6X31P



Front View

LAS-6X30

|                         |
|-------------------------|
| 1 - C <sub>O</sub>      |
| 2 - V <sub>CC</sub>     |
| 3 - C <sub>t</sub>      |
| 4 - CNT                 |
| 5 - V <sub>REF</sub>    |
| 6 - E <sub>rr</sub> (-) |
| 7 - CMP                 |
| 8 - E <sub>O</sub>      |
| Case is Ground          |

LAS-6X31

|                                     |
|-------------------------------------|
| 1 - C <sub>O</sub> /V <sub>CC</sub> |
| 2 - C <sub>t</sub>                  |
| 3 - CNT                             |
| 4 - V <sub>REF</sub>                |
| 5 - E <sub>rr</sub> (-)             |
| 6 - CMP                             |
| 7 - CLS                             |
| 8 - E <sub>O</sub>                  |
| Case is Ground                      |

LAS-6X30P

|                         |
|-------------------------|
| 1 - C <sub>O</sub>      |
| 2 - V <sub>CC</sub>     |
| 3 - C <sub>t</sub>      |
| 4 - CNT                 |
| 5 - GND                 |
| 6 - V <sub>REF</sub>    |
| 7 - E <sub>rr</sub> (-) |
| 8 - CMP                 |
| 9 - E <sub>O</sub>      |
| Tab is Ground           |

LAS-6X31P

|                                     |
|-------------------------------------|
| 1 - C <sub>O</sub> /V <sub>CC</sub> |
| 2 - C <sub>t</sub>                  |
| 3 - CNT                             |
| 4 - V <sub>REF</sub>                |
| 5 - GND                             |
| 6 - E <sub>rr</sub> (-)             |
| 7 - CMP                             |
| 8 - CLS                             |
| 9 - E <sub>O</sub>                  |
| Tab is Ground                       |

NOTE: All dimensions are in inches.