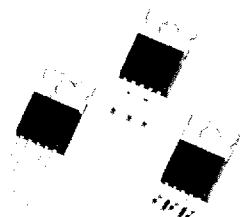
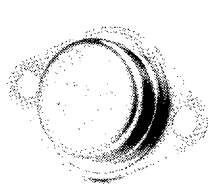


# 5 AMP DC-TO-DC MICROCONVERTER

**LSH-6355**  
**LSH-6455**



## FEATURES

- Military temperature range
- Complete DC-to-DC converter
- 70% minimum efficiency
- 80kHz switching frequency
- Programmable output voltage from 5 to 31 Volts
- Preset output voltage of 5.05 Volts  $\pm 1.5\%$
- Current limit and thermal shutdown
- Inhibit/enable control pin

## DESCRIPTION

The LSH-6355/LSH-6455 switching regulator is a micro-hybrid circuit designed for use in step-down applications requiring accurate output voltages over combined variations of line, load and temperature. This unique product greatly simplifies switching power supply design. The LSH-6355/LSH-6455 microconverter includes a switching regulator, catch diode and compensation network within a TO-220 style package. Just add a choke and two capacitors to obtain an efficient DC-to-DC converter for 5 Volts at 5 Amps. To increase the output voltage, simply add a programming resistor. The current limit and thermal shutdown features of the LSH-6355/LSH-6455 fully protect the device against overstress conditions.

In order to accommodate various mounting and operating temperature requirements, the LSH-6355 and LSH-6455 are available in 4 package options. The LSH-6355 is offered in 3 TO-220 style lead formations: straight in-line, staggered vertical mount and

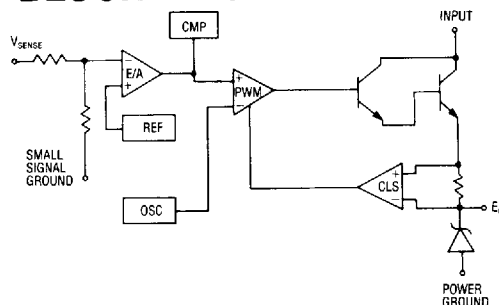
## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                                                 | SYMBOL        | MAXIMUM                    | UNITS                |
|---------------------------------------------------------------------------|---------------|----------------------------|----------------------|
| Input Voltage<br>LSH-6355<br>LSH-6455                                     | $V_{IN}$      | 35<br>40                   | Volts                |
| Power Dissipation                                                         | $P_D$         | Internally Limited         | Watts                |
| Thermal Resistance<br>Junction to Case                                    | $\theta_{JC}$ | 4.5                        | $^{\circ}\text{C/W}$ |
| Operating Junction<br>Temp. Range<br>TO-220<br>TO-3                       | $T_J$         | - 25 to 125<br>- 55 to 150 | $^{\circ}\text{C}$   |
| Storage Temperature<br>Range<br>TO-3<br>TO-220                            | $T_{STG}$     | - 65 to 150<br>- 25 to 125 | $^{\circ}\text{C}$   |
| Lead Temperature<br>(Soldering)<br>10 Sec. for TO-220<br>60 Sec. for TO-3 | $T_{LEAD}$    | 260<br>300                 | $^{\circ}\text{C}$   |

## DEVICE SELECTION GUIDE

| DEVICE     | $V_{IN}$ MAX | $V_{OUT}$ MAX | LEADS                |
|------------|--------------|---------------|----------------------|
| LSH-6355P  | 35           | 27            | Straight in-line     |
| LSH-6355PV | 35           | 27            | Vertical staggered   |
| LSH-6355PH | 35           | 27            | Horizontal staggered |
| LSH-6455P  | 40           | 31            | Straight in-line     |
| LSH-6455PV | 40           | 31            | Vertical staggered   |
| LSH-6455PH | 40           | 31            | Horizontal staggered |
| LSH-6455   | 40           | 31            | TO-3                 |
| LSH-6455M  | 40           | 31            | TO-3 MIL Screened    |

## BLOCK DIAGRAM



staggered horizontal mount. A full military temperature range hermetic TO-3 together with inhibit/enable control pin is also available in the LSH-6455.

LSH-6355  
LSH-6455

## 5 AMP DC-TO-DC MICROCONVERTER

### ELECTRICAL CHARACTERISTICS

Input test conditions are as follows:  $V_{IN} = 24\text{VDC}$ ,  $V_O = 5\text{VDC}$ ,  
 $I_O = 5\text{A}$ ,  $T_J = 25^\circ\text{C}$ , unless otherwise specified.

11

| Parameter                                                    | Symbol         | Test Conditions                          |                          |           | Test Limits  |          |              | Units                  |
|--------------------------------------------------------------|----------------|------------------------------------------|--------------------------|-----------|--------------|----------|--------------|------------------------|
|                                                              |                | $V_{IN}$                                 | $I_O$                    | $T_J^5$   | Minimum      | Typical  | Maximum      |                        |
| Output Voltage <sup>1</sup>                                  | $V_O$          | 12V to $V_{IN (MAX)}$                    | 5mA<br>0.5A to 5A        | Over Temp | 4.97<br>4.80 | 5.05     | 5.13<br>5.30 | Volts                  |
| Line Regulation <sup>1</sup>                                 | $REG_{(LINE)}$ | 12V to $V_{IN (MAX)}$                    |                          |           |              | 90       |              | mV                     |
| Load Regulation <sup>1</sup>                                 | $REG_{(LOAD)}$ |                                          | 0.5A to 5A               |           |              | 45       |              | mV                     |
| System Efficiency                                            | $\eta$         |                                          |                          | Over Temp | 70           | 75       |              | %                      |
| Switching Frequency                                          | $f_{SX}$       |                                          | 50mA                     |           | 60           | 80       | 100          | kHz                    |
| Quiescent Current                                            | $I_Q$          | $V_{IN (MAX)}$                           | 0A                       |           |              | 18       | 30           | mA                     |
| Peak Current Limit Knee                                      | $I_{CL}$       |                                          |                          | Over Temp | 5.5          |          |              | Amps                   |
| Short Circuit Current Limit                                  | $I_{SC}$       |                                          |                          |           |              | 9.5      |              | Amps                   |
| Output Noise and Ripple <sup>4</sup><br>LSH-6355<br>LSH-6455 | $V_N$          | 30V + $5V_{pk-pk}$<br>35V + $5V_{pk-pk}$ |                          |           |              | 50       |              | mV <sub>pk-pk</sub>    |
| Turn On Overshoot                                            |                |                                          | 0.5A to 5A               |           |              | 0        |              | mV                     |
| Unit Step Load Change <sup>2</sup>                           |                |                                          | 5mA to 2A<br>5A to 0.05A |           |              | 0<br>250 |              | mV<br>mV <sub>pk</sub> |
| Programming Resistance <sup>3</sup>                          |                | 12V to $V_{IN (MAX)}$                    |                          | Over Temp |              | 0.2      |              | Volts/k $\Omega$       |

(1) Low duty cycle, pulse testing with Kelvin connections required.

(2) 10mS duration.

(3)  $V_O$  programming above 5.05V.

(4) 120 Hz input ripple.

(5) Over temperature -  $25^\circ\text{C}$  to  $125^\circ\text{C}$  for TO-220;  $-55^\circ\text{C}$  to  $150^\circ\text{C}$  for TO-3.

### MILITARY SCREENING

100% screened in accordance with MIL-STD-883, Method 5004 Class B

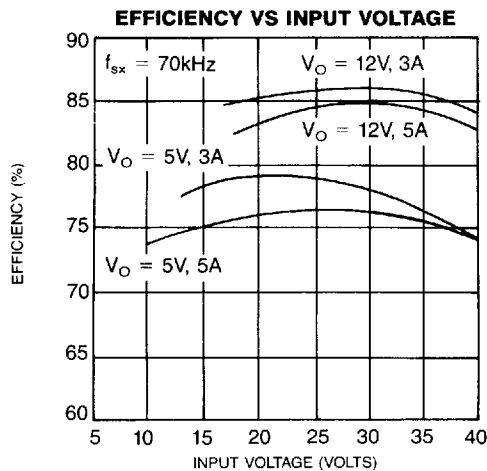
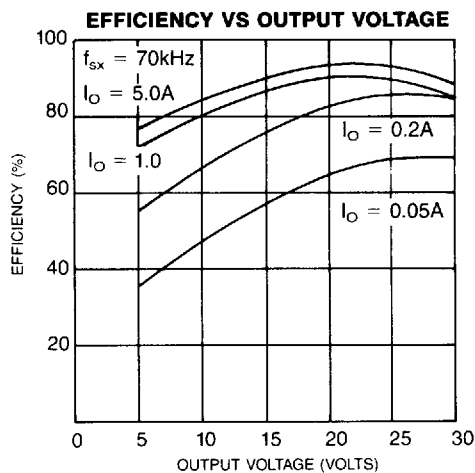
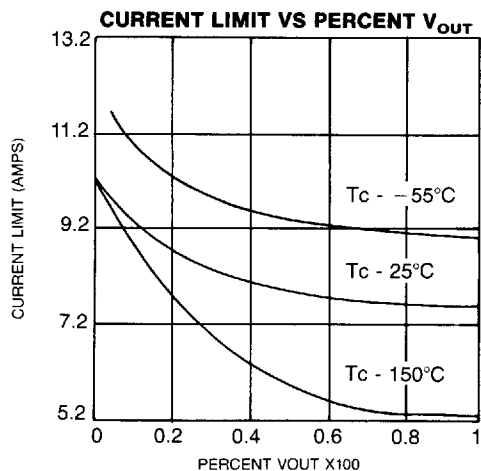
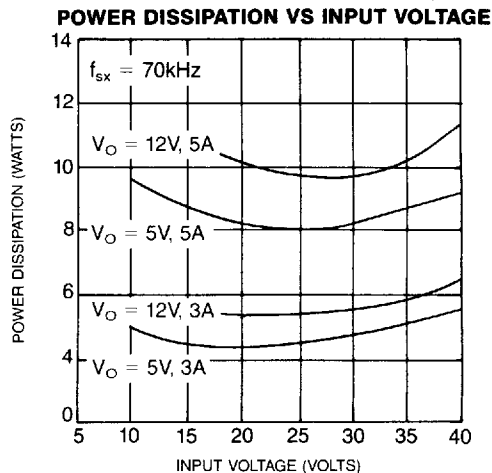
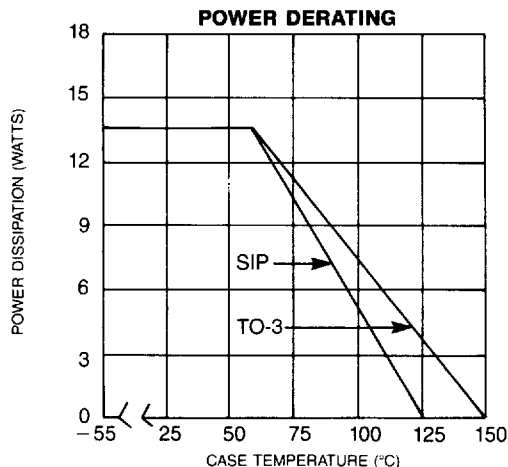
| Screen                | MIL-STD-883<br>Test Method |
|-----------------------|----------------------------|
| Internal Visual       | 2010                       |
| Temperature Cycling   | 1010                       |
| Constant Acceleration | 2010                       |
| Hermeticity           | 1014                       |
| Electricals           | Per Specification          |
| Burn-In               | 1015                       |
| External Visual       | 2009                       |

# 5 AMP DC-TO-DC MICROCONVERTER

LSH-6355

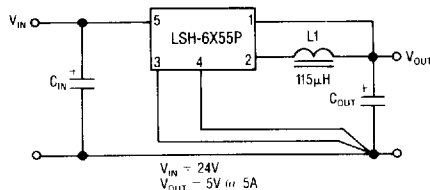
LSH-6455

## OPERATIONAL DATA



## TYPICAL APPLICATION

### DC-TO-DC STEP-DOWN CONVERTER<sup>1,2</sup>



<sup>1</sup>  $C_{IN} = 470\mu\text{F}$ ;  $C_{OUT} = 2200\mu\text{F}$

<sup>2</sup> For output voltages above 5V, add programming resistor between Pin 1 and  $V_{OUT}$ .

LSH-6355  
LSH-6455

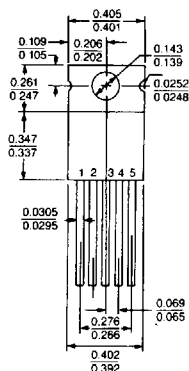
# 5 AMP DC-TO-DC MICROCONVERTER

## DEVICE OUTLINE

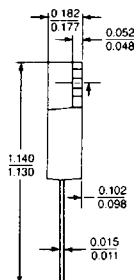
11

LSH-6X55P

(Front View)

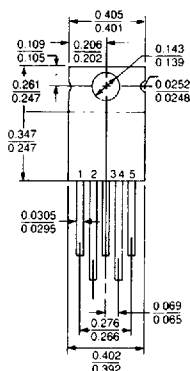


(Side View)

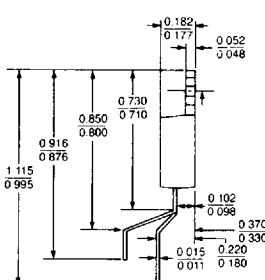


LSH-6X55PV

(Front View)

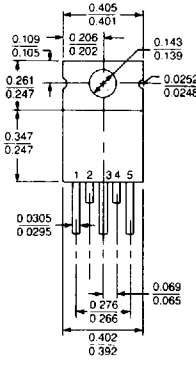


(Side View)

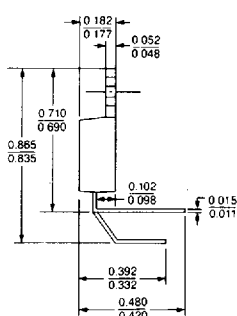


LSH-6X55PH

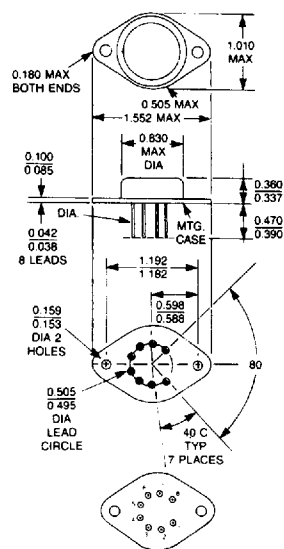
(Front View)



(Side View)



LSH-6455



1 —  $V_{SENSE}$   
2 —  $E_O$   
3 — Small Signal Ground  
4 — Power Ground  
5 — Input  
Tab is Small Signal Ground

1 — CT  
2 — Small Signal Ground  
3 — CNT  
4 — N/C  
5 —  $V_{SENSE}$   
6 —  $E_O$   
7 — Power Ground  
8 — Input  
Case is Small Signal Ground

NOTE: All dimensions are in inches.