



LAMBDA SEMICONDUCTORS

LSH 6335, LSH 6435, LSH 6535
3 AMP DC-TO-DC MICROCONVERTERS

FEATURES

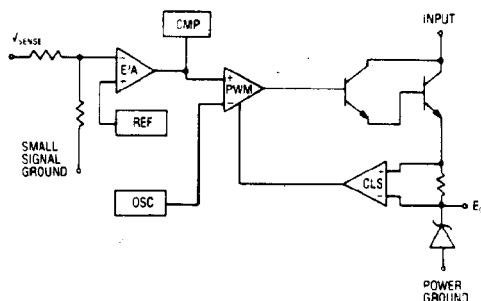
- o Complete DC-to-DC converter
- o 70% minimum efficiency
- o 70kHz switching frequency
- o Programmable output voltage from 5 to 35 volts
- o Preset output voltage of 5.05 Volts \pm 1.5%
- o Current limit and thermal shutdown

DESCRIPTION

The LSH 6335/6435/6535 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 6335/6435/6535 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 3 Amps. To increase the output voltage, simply add a programming resistor. The current limit and thermal shutdown features of the LSH 6335/6435/6535 fully protect the device against overstress conditions.

The LSH 6335/6435/6535 TO-220 style plastic package is available in three options to accommodate various mounting requirements. Available lead formations are straight in-line, staggered for vertical mount and staggered for horizontal mount.

BLOCK DIAGRAM



PRELIMINARY
9/12/88

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MAXIMUM	UNITS
Input Voltage LSH 6335 LSH 6435 LSH 6535	V_{IN}	35 40 45	Volts
Power Dissipation	P_D	Internally Limited	Watts
Thermal Resistance Junction to Case	θ_{JC}	7	$^{\circ}C/W$
Operating Junction Temperature Range	T_J	-25 to 125	$^{\circ}C$
Storage Tempera- ture Range	T_{STG}	-65 to 150	$^{\circ}C$
Lead Temperature (Soldering, 10 Seconds)	T_{LEAD}	260	$^{\circ}C$

DEVICE SELECTION GUIDE

DEVICE	V_{IN} MAX	V_{OUT} MAX	LEADS
LSH 6335P	35	27	Straight in-line
LSH 6335PV	35	27	Vertical staggered
LSH 6335PH	35	27	Horizontal staggered
LSH 6435P	40	31	Straight in-line
LSH 6435PV	40	31	Vertical staggered
LSH 6435PH	40	31	Horizontal staggered
LSH 6535P	45	35	Straight in-line
LSH 6535PV	45	35	Vertical staggered
LSH 6535PH	45	35	Horizontal staggered

ELECTRICAL CHARACTERISTICS

Input test conditions are as follows: $V_{IN} = 24\text{VDC}$, $V_O = 5\text{VDC}$,
 $I_O = 3\text{A}$, $T_J = 25^\circ\text{C}$, unless otherwise specified.

Parameter	Symbol	Test Conditions			Test Limits			Units
		V_{IN}	I_O	T_J	Minimum	Typical	Maximum	
Output Voltage ¹	V_O	12V to $V_{IN(MAX)}$	0A 0.3A to 3A	- 25 to 125°C	4.97 4.80	5.05	5.13 5.30	Volts
Line Regulation ¹	$REG_{(LINE)}$	12V to $V_{IN(MAX)}$				90		mV
Load Regulation ¹	$REG_{(LOAD)}$		0.3A to 3A			45		mV
System Efficiency	η			- 25 to 125°C	70	75		%
Switching Frequency	f_{sx}		50mA		58	70	86	kHz
Quiescent Current	I_O	$V_{IN(MAX)}$	0A			18	30	mA
Peak Current Limit Threshold	I_{CL}			- 25 to 125°C	3.3		5.5	Amps
Output Noise and Ripple ⁴	V_N					50		mV _{pk-pk}
LSH 6335		30V + 5V _{pk-pk}						
LSH 6435		35V + 5V _{pk-pk}						
LSH 6535		40V + 5V _{pk-pk}						
Turn On Overshoot			0.5A to 3A			0		mV
Unit Step Load Change			0A to 3A 3A to 0.05A			0 250 ²		mV mV _{pk}
Programming Resistance ³		12V to $V_{IN(MAX)}$		- 25 to 125°C		0.2		Volts/k Ω

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

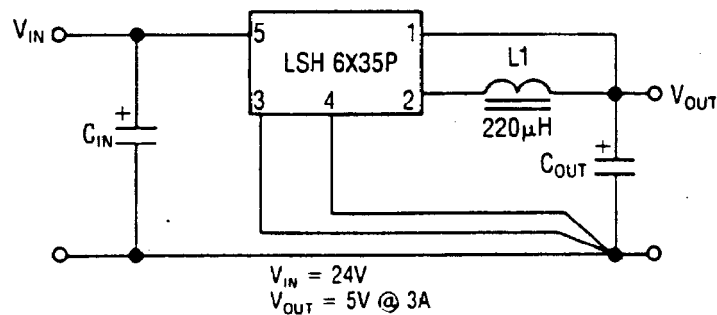
⁽²⁾ 10mS duration.

⁽³⁾ V_O programming above 5.05V.

⁽⁴⁾ 120 Hz input ripple.

TYPICAL APPLICATION

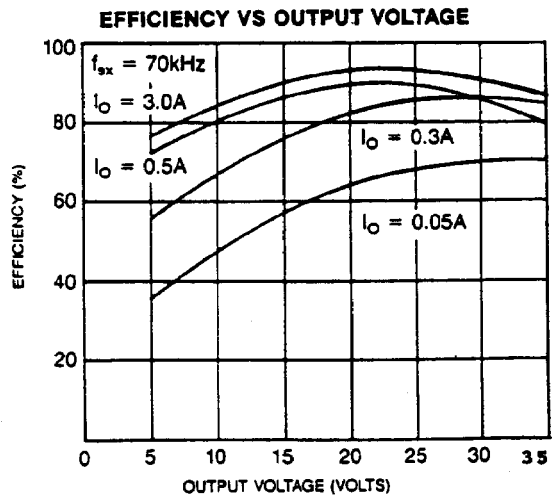
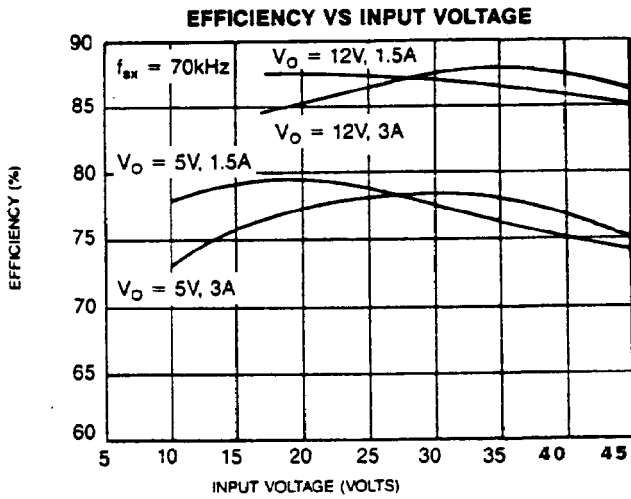
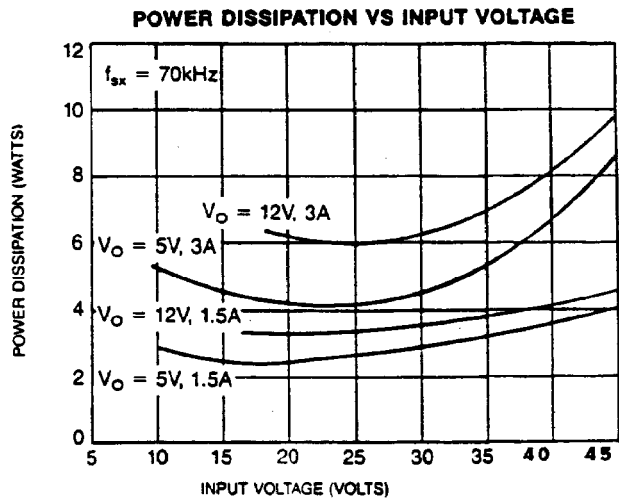
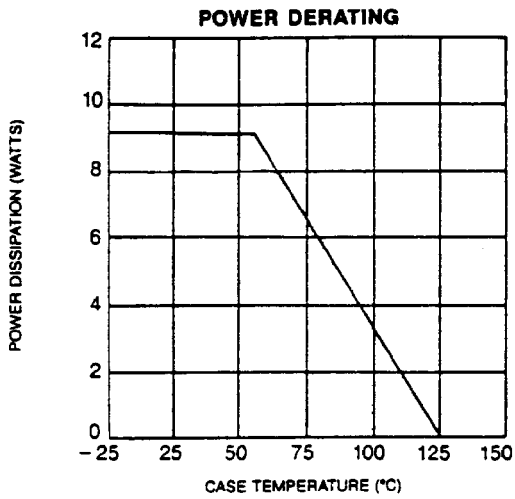
DC-TO-DC STEP-DOWN CONVERTER^{1,2}



¹ $C_{IN} = 330\mu\text{F}$; $C_{OUT} = 1000\mu\text{F}$

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

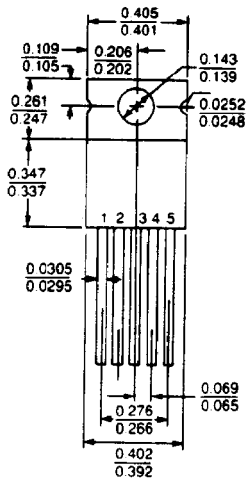
OPERATIONAL DATA



DEVICE OUTLINE

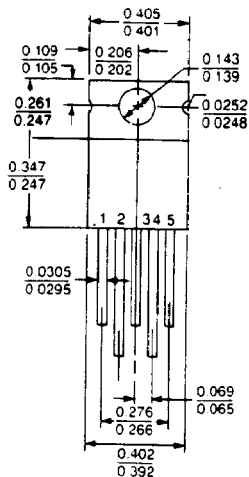
LSH 6X35P

(Front View)



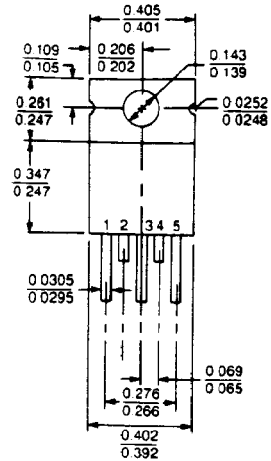
LSH 6X35PV

(Front View)

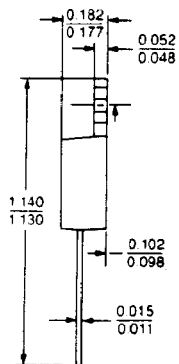


LSH 6X35PH

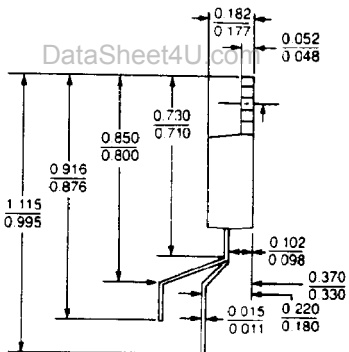
(Front View)



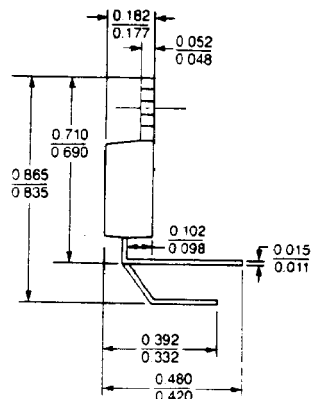
(Side View)



(Side View)



(Side View)



- | | | |
|---|---|----------------------------|
| 1 | - | V _{SENSE} |
| 2 | - | E _O |
| 3 | - | Small Signal Ground |
| 4 | - | Power Ground |
| 5 | - | Input |
| | | Tab is Small Signal Ground |

NOTE: All dimensions are in inches.