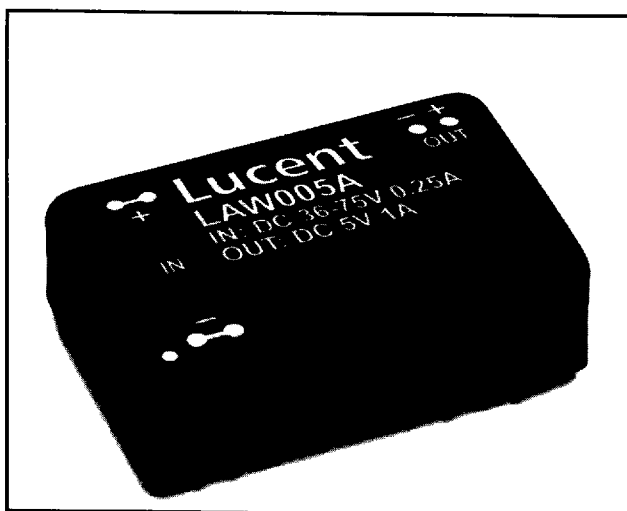




LAW005-Series Power Modules: 36 Vdc to 75 Vdc Inputs; 5 W



The LAW005-Series Power Modules use advanced, surface-mount technology and deliver high-quality, compact, dc-dc conversion at an economical price.

Options

- Short pin 2.8 mm $\pm$ 0.25 mm (0.110 in. $\pm$ 0.010 in.)

Description

The LAW005-Series Power Modules are low-profile dc-dc converters that operate over an input voltage range of 36 Vdc to 75 Vdc and provide precisely regulated single and dual outputs. The -25°C to $+71^{\circ}\text{C}$ operating temperature range makes it ideal for electronic data processing applications. The outputs are isolated from the inputs, allowing versatile polarity configurations and grounding connections. The modules have a maximum power rating of 5 W and a typical full-load efficiency of 80%.

Built-in filtering for both input and output minimizes the need for external filtering.

Features

- Small footprint: 32 mm x 20 mm (1.25 in. x 0.8 in.)
- Low profile: 10 mm (0.40 in.)
- Wide input voltage range: 36 Vdc to 75 Vdc
- Output current limiting, unlimited duration
- Short-circuit shutdown
- Output overvoltage clamp
- Input-to-output isolation 1500 Vdc
- Operating ambient temperature range: -25°C to $+71^{\circ}\text{C}$ with no derating
- 12.5 W per cubic inch
- Within FCC and VDE Class A radiated limits
- UL* Recognition, CSA† Certification, and VDE License approvals pending
- CE mark pending for 73/23/EEC and 93/68/EEC directives‡
- Metal case
- Burn in 4 hours @ 50°C , full load

* UL is a registered trademark of Underwriters Laboratories, Inc.

† CSA is a registered trademark of Canadian Standards Association.

‡ This product is intended for integration into end-use equipment. All the required procedures for CE marking of end-use equipment should be followed. (The CE mark is placed on selected products.)

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
Input Voltage:				
Continuous	V_I	0	80	Vdc
Transient (100 ms)	$V_{I, trans}$	0	100	V
Operating Ambient Temperature* (natural convection)	T_A	-25	71	°C
Storage Temperature	T_{stg}	-55	105	°C
I/O Isolation Voltage	—	—	1500	Vdc
Operating Case Temperature	T_c	—	105	°C

* At full load, derate linearly to 0 W at 100 °C. Unit guaranteed to start at -40 °C. All parameters will be within specification at $T_{case} = -25$ °C.

Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage and resistive load from -25 °C to +71 °C.

Table 1. Input Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	V_I	36	48	75	Vdc
Maximum Input Current ($V_I = 0$ V to $V_{I, max}$; $I_O = I_{O, max}$)	$I_{I, max}$	—	250	—	mA
Inrush Transient	i^2t	—	0.008	—	A ² s
Input Reflected-ripple Current	I_i	—	5	—	mAp-p

Fusing Considerations

CAUTION: This power module is not internally fused. An input line fuse must always be used.

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of a sophisticated power architecture. To preserve maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a normal-blow, dc fuse with a maximum rating of 5 A (see Safety Considerations section). Based on the information provided in this data sheet on inrush energy and maximum dc input current, the same type of fuse with a lower rating can be used. Refer to the fuse manufacturer's data for further information.

Electrical Specifications (continued)

Table 2. Output Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Voltage (Over all line, load, and temperature conditions until end of life.)	LAW005A	V_o	4.80	—	5.20	Vdc
	LAW005B	V_o	11.52	—	12.48	Vdc
	LAW005C	V_o	14.40	—	15.60	Vdc
	LAW005F	V_o	3.17	—	3.43	Vdc
	LAW005BK	V_{o1}	11.52	—	12.48	Vdc
		V_{o2}	-11.52	—	-12.48	Vdc
	LAW005CL	V_{o1}	14.40	—	15.60	Vdc
		V_{o2}	-14.40	—	-15.60	Vdc
Output Voltage Set Point ($V_i = 48$ V; $I_o = I_{o, \max}$; $T_A = 25$ °C)	LAW005A	$V_{o, \text{set}}$	4.95	5.00	5.05	Vdc
	LAW005B	$V_{o, \text{set}}$	11.88	12.00	12.12	Vdc
	LAW005C	$V_{o, \text{set}}$	14.85	15.00	15.15	Vdc
	LAW005F	$V_{o, \text{set}}$	3.26	3.3	3.33	Vdc
	LAW005BK	$V_{o1, \text{set}}$	11.88	12.00	12.12	Vdc
		$V_{o2, \text{set}}$	11.88	12.00	12.12	Vdc
	LAW005CL	$V_{o1, \text{set}}$	14.85	15.00	15.15	Vdc
		$V_{o2, \text{set}}$	14.85	15.00	15.15	Vdc
Output Regulation: Line ($V_i = 36$ V to 75 V) Load ($I_o = 25\%$ $I_{o, \max}$) Load ($I_o = 50\%$ $I_{o, \max}$ to $I_{o, \max}$) Temperature ($T_A = -25$ °C to $+71$ °C)	All	—	—	—	0.2	% V_o
	LAW005A	—	—	—	0.5	% V_o
	LAW005B	—	—	—	0.5	% V_o
	LAW005C	—	—	—	0.5	% V_o
	LAW005F	—	—	—	0.5	% V_o
	LAW005BK	—	—	—	1.0	% V_o
	LAW005CL	—	—	—	1.0	% V_o
	All	—	—	—	0.2	% V_o
Output Ripple and Noise: RMS Peak-to-peak (5 Hz to 20 MHz)	All	—	—	—	10	mVrms
	All	—	—	—	75	mVp-p
Output Current (At $I_o < I_{o, \min}$, the modules may exceed output ripple specifications.)	LAW005A	I_o	0.050	—	1.0	A
	LAW005B	I_o	0.024	—	0.47	A
	LAW005C	I_o	0.020	—	0.40	A
	LAW005F	I_o	0.050	—	1.0	A
	LAW005BK	I_{o1}	0.012	—	0.23	A
		I_{o2}	0.012	—	0.23	A
	LAW005CL	I_{o1}	0.010	—	0.19	A
		I_{o2}	0.010	—	0.19	A
Output Current-limit Inception $V_o = 90\% \times V_{o, \text{set}}$	All	—	—	165	—	% $I_{o, \max}$
Output Short-circuit Current (duration typ. 8 ms before shutdown) ($V_o \leq 60\% V_{o, \text{nom}}$)	All	I_o	—	300	—	% $I_{o, \max}$
Efficiency (V_i, nom ; $I_o = I_{o, \max}$; $T_A = 25$ °C)	LAW005A	η	74	78	—	%
	LAW005B	η	77	80	—	%
	LAW005C	η	78	82	—	%
	LAW005F	η	71	73	—	%
	LAW005BK	η	77	80	—	%
	LAW005CL	η	78	80	—	%

Electrical Specifications (continued)

Table 2. Output Specifications (continued)

Parameter	Device	Symbol	Min	Typ	Max	Unit
Maximum External Output Capacitance	LAW005A	C _{out}	—	—	1000	μF
	LAW005B	C _{out}	—	—	220	μF
	LAW005C	C _{out}	—	—	150	μF
	LAW005F	C _{out}	—	—	1000	μF
	LAW005BK	C _{out}	—	—	47	μF
	LAW005CL	C _{out}	—	—	47	μF
Dynamic Response ($\Delta I_o/\Delta t = 1 \text{ A}/10 \text{ } \mu\text{s}$, $V_I = V_{I, \text{nom}}$, $T_A = 25 \text{ } ^\circ\text{C}$):						
Load Change from $I_o = 50\%$ to 75% of $I_{o, \text{max}}$:						
Peak Deviation	All	—	—	1	—	% $V_{O, \text{set}}$
Settling Time ($V_o < 10\%$ peak deviation)	All	—	—	0.15	—	ms
Load Change from $I_o = 50\%$ to 25% of $I_{o, \text{max}}$:						
Peak Deviation	All	—	—	1	—	% $V_{O, \text{set}}$
Settling Time ($V_o < 10\%$ peak deviation)	All	—	—	0.15	—	ms

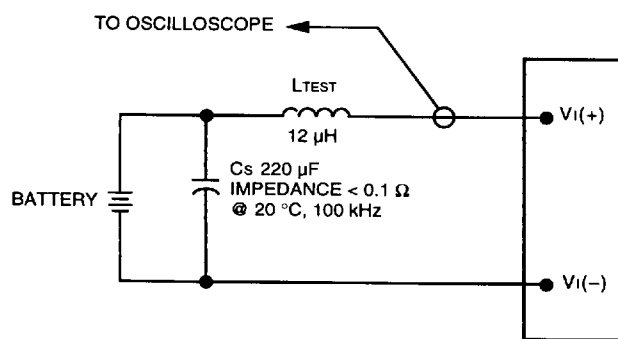
Table 3. Isolation Specifications

Parameter	Min	Typ	Max	Unit
Isolation Capacitance	—	1000	—	pF
Isolation Resistance	100	—	—	MΩ

Table 4. General Specifications

Parameter	Min	Typ	Max	Unit
Calculated MTBF ($I_o = 80\%$ of $I_{o, \text{max}}$; $T_A = 40 \text{ } ^\circ\text{C}$)	TBD			hours
Weight	—	18 (0.64)	20 (0.71)	g (oz.)

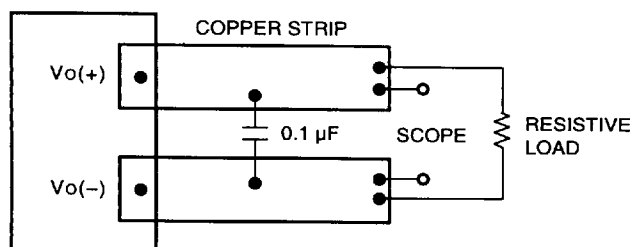
Test Configurations



8-489 (C).a

Note: Input reflected-ripple current is measured with a simulated source impedance of 12 μH. Capacitor Cs offsets possible battery impedance. Current is measured at the input of the module.

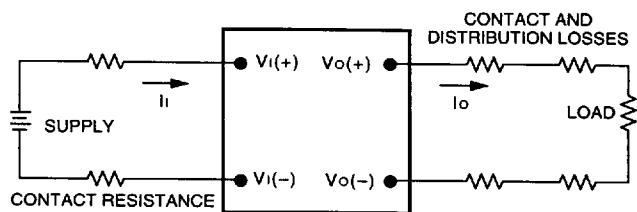
Figure 1. Input Reflected-Ripple Test Setup



8-513 (C)

Note: Use a 0.1 μF ceramic capacitor. Scope measurement should be made using a BNC socket. Position the load between 50.8 mm and 76.2 mm (2 in. and 3 in.) from the module.

Figure 2. Peak-to-Peak Output Noise Measurement Test Setup



8-204 (C)

Note: All measurements are taken at the module terminals. When socketing, place Kelvin connections at module terminals to avoid measurement errors due to socket contact resistance.

$$\eta = \left(\frac{[V_O(+)-V_O(-)]I_O}{[V_I(+)-V_I(-)]I_I} \right) \times 100$$

Figure 3. Output Voltage and Efficiency Measurement Test Setup

Safety Considerations

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e., UL-1950, CSA 22.2-950, and EN60950.

For the converter output to be considered meeting the requirements of safety extra-low voltage (SELV), one of the following must be true:

- All inputs are SELV and floating, with the output also floating.
- All inputs are SELV and grounded, with the output also grounded.
- Any non-SELV input must be provided with reinforced insulation from any other hazardous voltages, including the ac mains, and must have a SELV reliability test performed on it in combination with the converters. Inputs must meet SELV requirements.

If the input meets extra-low voltage (ELV) requirements, then the converter's output is considered ELV.

The input to these units is to be provided with a maximum 5 A normal-blow fuse in the ungrounded lead.

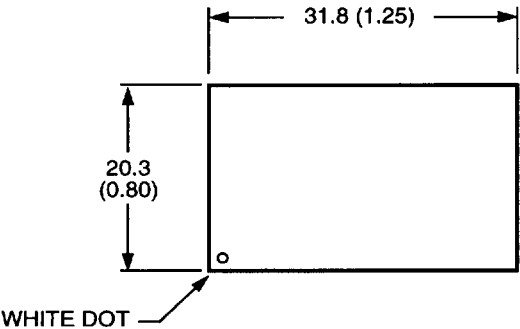
Outline Diagram

Leads are 0.5 mm x 0.3 mm (0.02 in. x 0.012 in.) solder-plated brass.

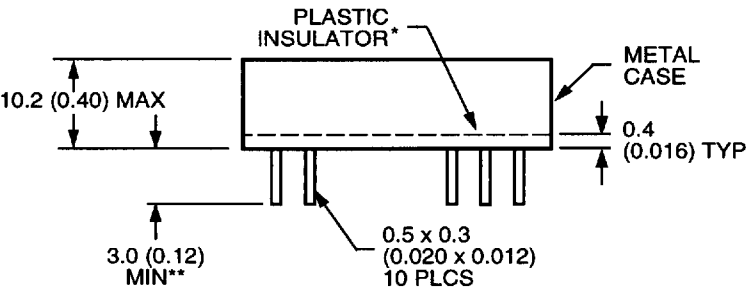
Dimensions are in millimeters and (inches).

Tolerances: x.x mm ± 0.5 mm (x.xx in. ± 0.02 in.)
 x.xx mm ± 0.25 mm (x.xxx in. ± 0.010 in.)

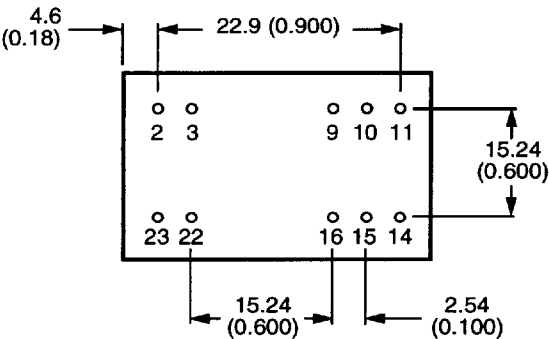
Top View



Side View



Bottom View



Pin	Single	Duals
2	Vi(-)	Vi(-)
3	Vi(-)	Vi(-)
9	NC†	Common
10	NC†	NC†
11	NC†	Vo(-)
14	Vo(+)	Vo(+)
15	NC†	NC†
16	Vo(-)	Common
22	Vi(+)	Vi(+)
23	Vi(+)	Vi(+)

† No connection.

* Note insulation thickness when considering clearance from the PWB traces to the metal case.

** Lead trim option:
2.8 mm ± 0.25 mm (0.110 in. ± 0.010 in.)

8-1366 (C).a

Note: Pinouts are numbered to fit in a standard 24-pin DIP footprint.

Ordering Information

Please contact your Lucent Technologies Microelectronics Group Account Manager or Applications Engineer for pricing and availability of options.

Input Voltage	Output Voltage	Output Power	Device Code	Comcode
48 V	5 V	5 W	LAW005A	108070715
48 V	12 V	5 W	LAW005B	108070723
48 V	15 V	5 W	LAW005C	108070731
48 V	3.3 V	3.3 W	LAW005F	108070749
48 V	+12 V/-12 V	5 W	LAW005BK	108070756
48 V	+15 V/-15 V	5 W	LAW005CL	108070764

Optional features may be ordered using the device code suffix shown below:

Option	Device Code Suffix
Short pin (2.8 mm $\pm$ 0.25 mm)	8