

Data Sheet
D372A
Electroluminescent
Lamp Driver IC



MSOP-10

General Description:

The Durel® D372A Lamp Driver is part of a family of switch-mode IC drivers intended to reduce EL system cost, improve performance and to simplify the design, specification, and manufacture of EL backlighting systems. This driver is optimized for cellular phone and databank backlighting applications.

Features

- Flexible Wave shaping Capability
- High Efficiency
- Small Package Size
- Adjustable Output Frequency
- High AC Voltage Output
- External Clock Compatible

Applications

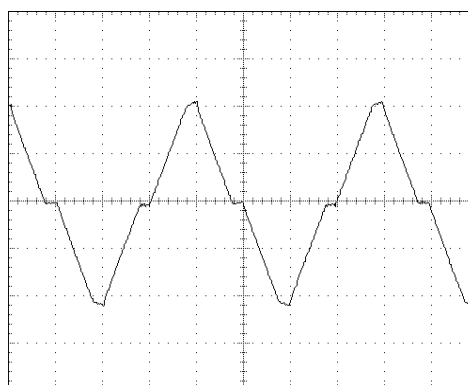
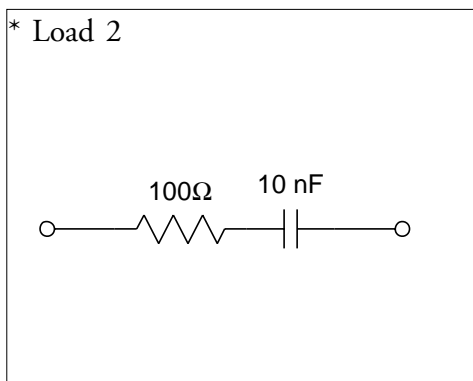
- Cellular / PHS Phones
- Data Banks
- LCD Backlighting

Lamp Driver Specifications:

($V_+ = 3.3V$, $C_S = 22nF$, $CLF = 2.0nF$, $CHF = 68pF$, $L = 2.2mH/4\Omega$, $E = V_+$, $R_D = 820\Omega$, Load 2*, $T_a = 25^\circ C$, unless otherwise specified)

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Conditions
Supply Current	I		21	29	mA	
Standby Current			5	1000	nA	E = GND
Enable Current			15		μA	E = 3.0V
Enable Voltage	E	2.6			V	
On					V	
Off				0.4	V	
Inductor Frequency	HF		21		kHz	CHF=68pF
Lamp Frequency	LF	180	260	340	Hz	CLF=2.0nF
Output Voltage	VOUT	140	170		V _{pp}	

Typical Waveform (EL₁ - EL₂)



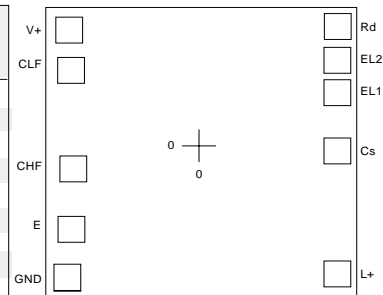
Absolute Maximum Ratings:

Parameter	Symbol	Minimum	Maximum	Unit	Comments
Supply voltage				V	
Operating range	V+	2.0	6.5		
Withstand range		-0.5	9.0		
Output Voltage	Vout		220	V _{pp}	Peak to peak voltage
Enable voltage	E	-0.5	(V+) +0.5	V	
Operating temperature	T _a	-40	85	°C	
Storage temperature	T _s	-65	150	°C	
Solder Temperature		245	300	°C	5 second soak
CHF (Pin3) Voltage	VCHF	GND	(V+) +0.5	V	
CLF (Pin2) Voltage	VCLF	GND	(V+) +0.5	V	

Note: The absolute maximum ratings are stress ratings only. Functional operation of the device at these ratings or any other conditions above those indicated in the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect life of lamp or driver.

Physical Data:

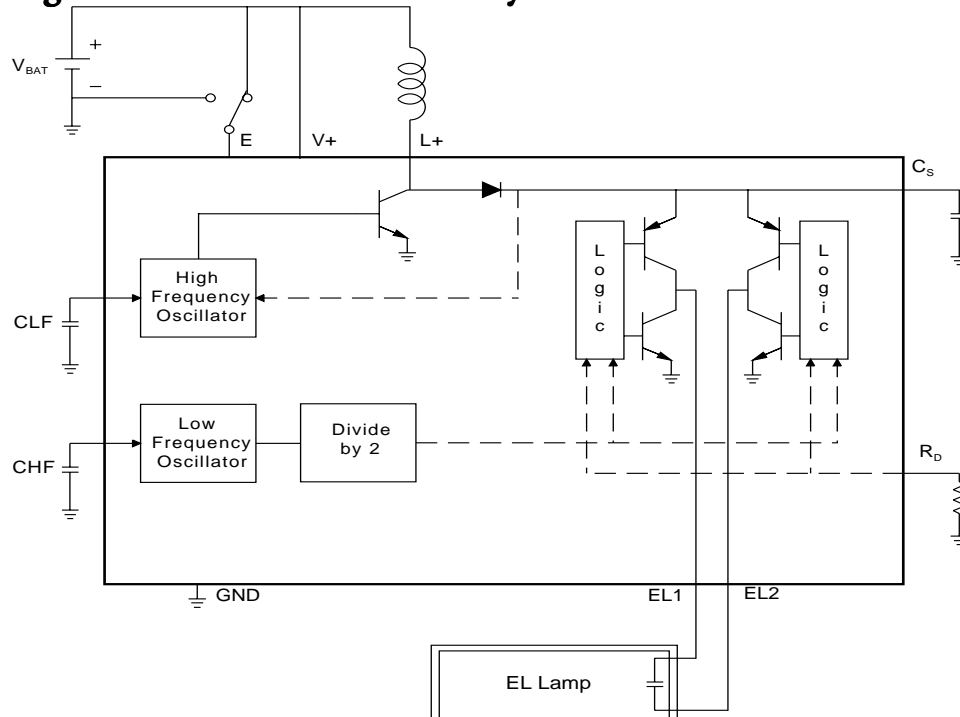
Pad Center Locations Name	X _{um}	Y _{um}	MSOP Pin-outs	Function
V+			1	System power input
CLF			2	Capacitor input to low frequency oscillator
CHF	Contact		3	Capacitor input to high frequency oscillator
E	Factory		4	System enable
GND	for Pad		5	Power ground
L+	Locations		6	Inductor connection
CS			7	High voltage storage capacitor
EL ₁			8	EL lamp connection
EL ₂			9	EL lamp connection
R _D			10	Wave shaping resistor



Notes:

1. Dimensions are in microns, unless otherwise noted.
2. Bond pads are typically 100 x 100.
3. Pad center coordinates are relative to origin on center of die.
4. Base of die should be grounded.

Block Diagram of the Inverter Circuitry:

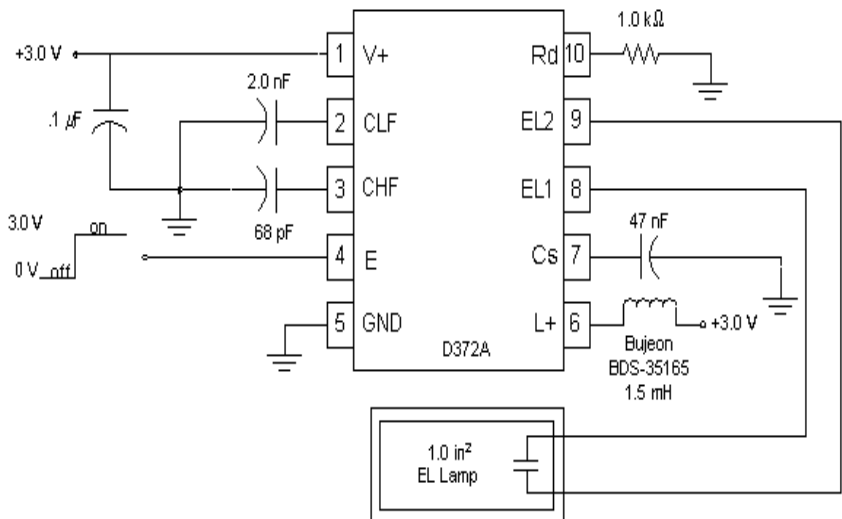


Typical D372A EL Driver Configuration:

3.0V Cellular LCD

Typical Output

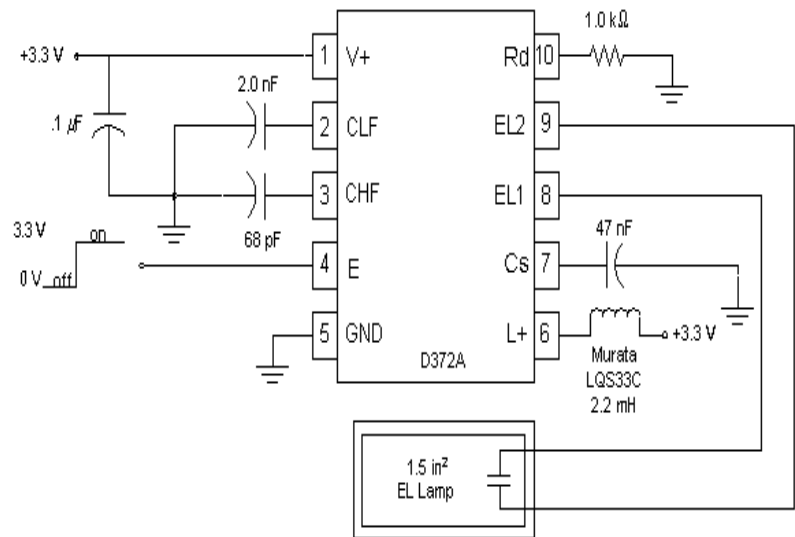
Brightness = 6.9 fL (23.6 Cd/m²)
 Lamp Frequency = 280 Hz
 Supply Current = 22mA
 V_{pp} = 210
 Load = 1.0in²



3.3 V Cellular Display and Keypad

Typical Output

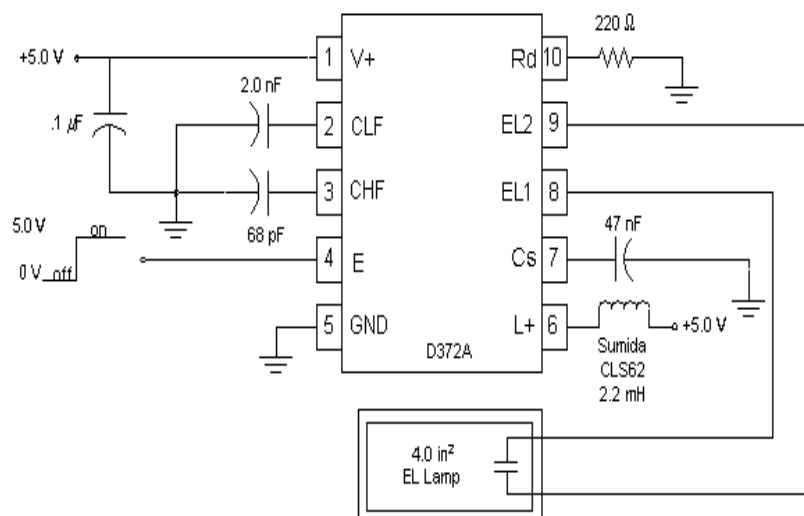
Brightness = 6.0 fL (20.5 Cd/m²)
 Lamp Frequency = 280 Hz
 Supply Current = 19mA
 V_{pp} = 210
 Load = 1.5in²



5.0 V PDA

Typical Output

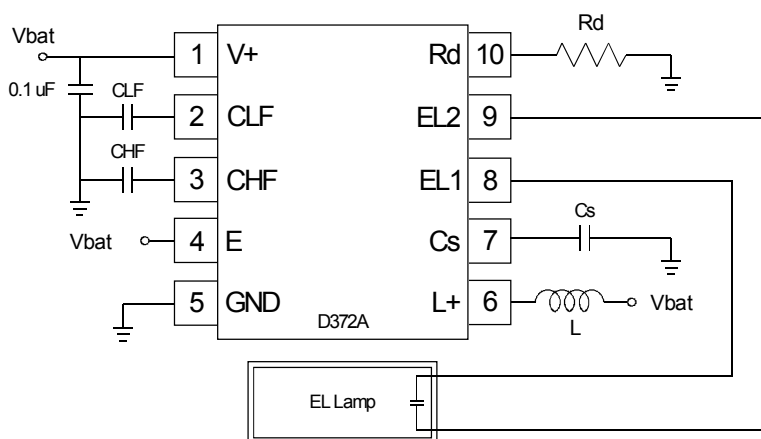
Brightness = 6.9fL (23.6 Cd/m²)
 Lamp Frequency = 280 Hz
 Supply Current = 17mA
 V_{pp} = 210
 Load = 4in²



DESIGNING WITH D372

The Durel® D372 chip inverter is part of a family of switch-mode IC drivers intended to reduce EL system cost, improve EL system performance, and simplify design. This powerful IC and a few components make a complete lamp driving circuit ideal for cellular phones, pagers, personal digital assistants (PDAs), and other applications using liquid crystal displays (LCDs).

A typical D372 circuit is represented in Figure 1. This application guideline is furnished to help you optimize your EL driver circuit design. It provides typical system outputs, such as lamp luminance and supply current draw, for various circuit configurations. Durel also provides a Designer's Kit, which includes a printed circuit board to aid you in developing an EL lamp driver configuration that meets your requirements.



I. Lamp Frequency

Selecting the appropriate value of capacitor (CLF) for the low frequency oscillator will set the output frequency of the D372 inverter. Figure 2 graphically represents the effect of the CLF capacitor value on the oscillator frequency at $V_+ = 3.0V$.

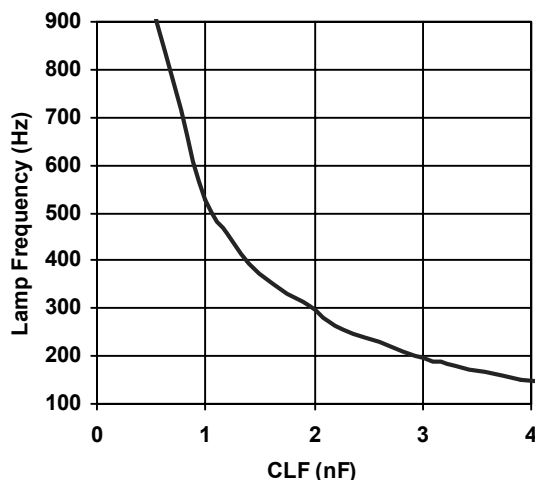


Figure 2: Typical Lamp frequency vs. CLF capacitor

The lamp frequency may also be controlled with an external clock signal. The resulting lamp frequency will be half of the clock signal frequency. The differential output voltage will increase in magnitude during the high portion of the clock signal and decrease during the low portion of the clock signal. Lamp frequencies of 200-500Hz are typically used.

II. Inductor Switching Frequency

Selecting the appropriate value of capacitor (CHF) for the high frequency oscillator will set the inductor switching frequency of the D372 inverter. Figure 2 graphically represents the effect of the CHF capacitor value on the oscillator frequency at $V_+ = 3.0V$.

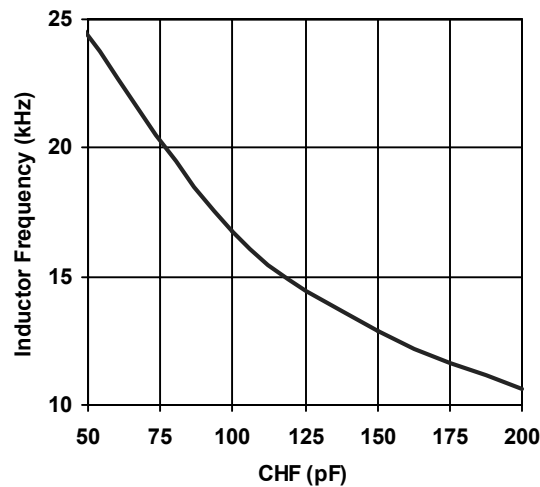


Figure 3: Typical inductor frequency vs. CHF capacitor

The inductor switching frequency may also be controlled with an external clock signal. The inductor will charge during the low portion of the clock signal and discharge into the EL lamp during the high portion of the clock signal.

III. Inductor Selection

The inductor value and inductor switching frequency have the greatest impact on the output brightness and current consumption of the driver. Figures 4 and 5 show typical brightness and current draw of a D372 circuit with several different inductor and CHF values. The CLF value was modified in each case such that the output voltage was approximately 200Vpp. Please note that the DC resistance (DCR) and current rating of inductors with the same inductance value may vary with manufacturer and inductor type. Thus, inductors made by a different manufacturers may yield different outputs, but the trend of the different curves should be similar.

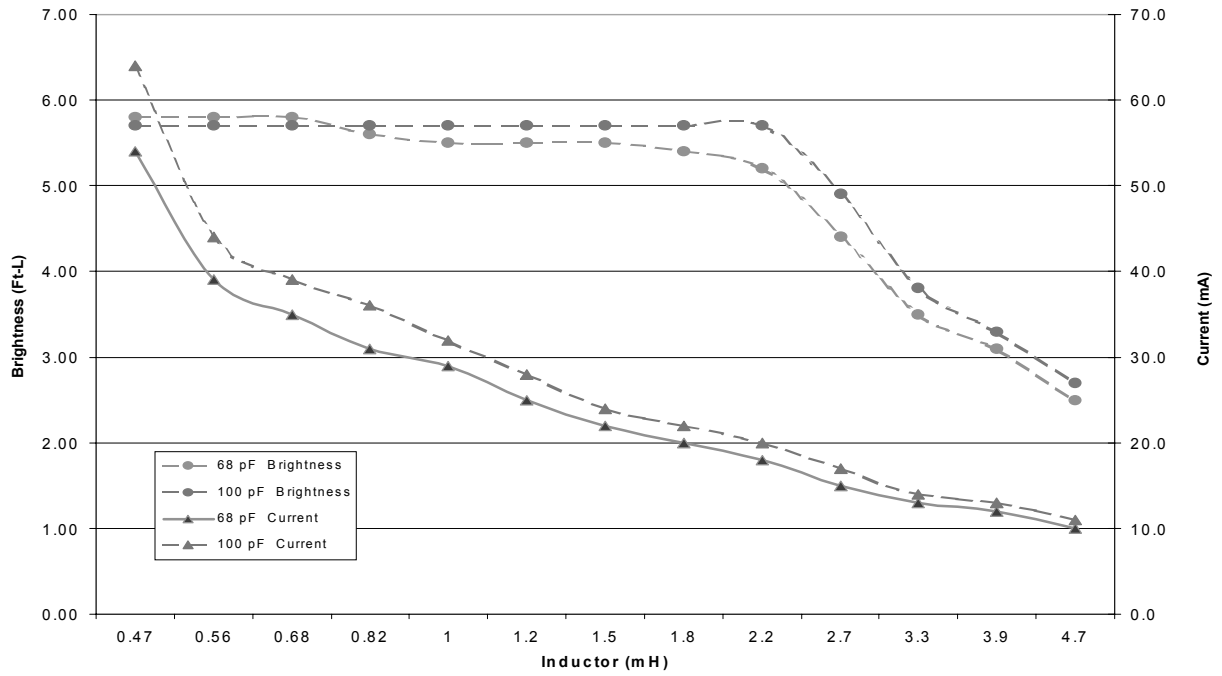


Figure 4: Brightness and current vs. inductor and CHF value.
Conditions: $V_+ = 3.0V$, $Lamp = 1.5in^2$

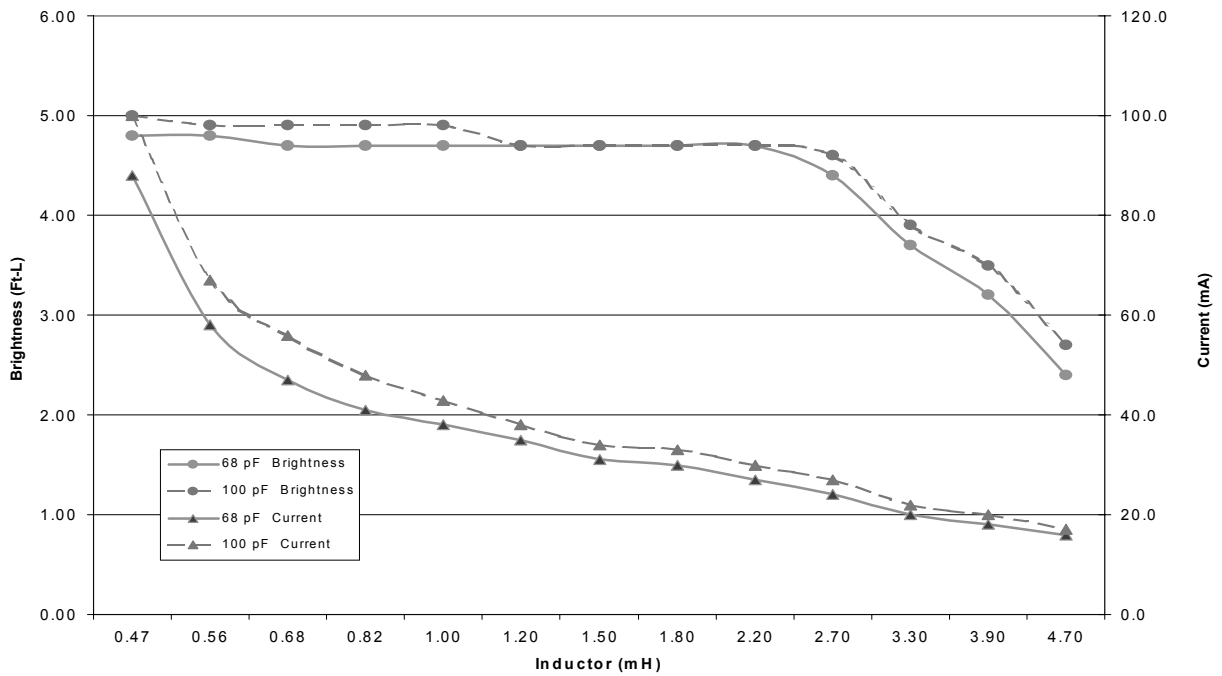


Figure 5: Brightness and current vs. inductor and CHF value.
Conditions: $V_+ = 5.0V$, $Lamp = 4.0in^2$

IV. Wave-Shaping

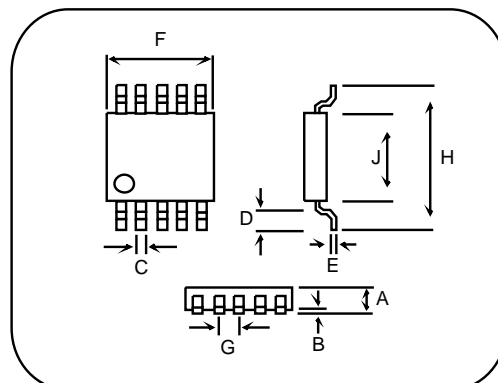
The R_D resistor determines the slope of the charge and discharge portions of the output waveform. The optimal value of this resistor depends on the lamp size and drive conditions. Larger EL lamps typically require smaller values of R_D . In general, smaller values of R_D result in higher initial luminance from the EL lamp. Larger values of R_D can reduce audible noise from the EL lamp and increase lamp life. Typical values range from 200Ω - $2.0k\Omega$. Recommended starting values for various lamp sizes are shown in the table, below.

R_D	Lamp Size
$1.2k\Omega$	$<1.0 \text{ in}^2$
820Ω	$1.0 - 2.0 \text{ in}^2$
470Ω	$2.0 - 4.0 \text{ in}^2$
220Ω	$>4.0 \text{ in}^2$

Ordering Information:

The D372A inverter is available as bare die in probed wafer form or in die trays, and in a standard MSOP-10 plastic package per tube or per tape and reel. A Durel D372A Designer's Kit is available for evaluating and identifying the optimum component values for your application.

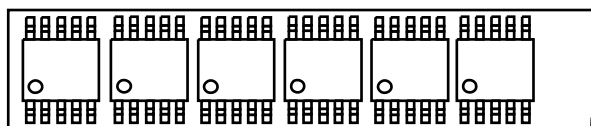
Description	MSOP-10					
	Min.		Typical		Max.	
	mm.	in.	mm.	in.	mm.	in.
A	0.92	0.036	1.00	0.039	1.08	0.043
B	0.05	0.002	0.10	0.004	0.15	0.006
C	0.15	0.006	0.23	0.009	0.31	0.012
D	0.40	0.016	0.55	0.022	0.70	0.028
E	0.13	0.005	0.18	0.007	0.23	0.009
F	2.90	0.114	3.00	0.118	3.10	0.122
G	0.35	0.014	0.50	0.020	0.65	0.026
H	4.75	0.187	4.90	0.193	5.05	0.199
J	2.90	0.114	3.00	0.118	3.10	0.122



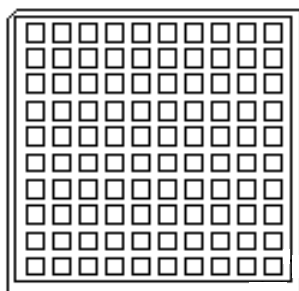
MSOPs are marked with direct logo part number (372A) and wafer lot number. Marking orientation is bottom closest to pin 1 side.

MSOPs in Tubes: 1DDD372AA-M03

Tube-length = 320 mm (12.6 in). 100 units per tube.



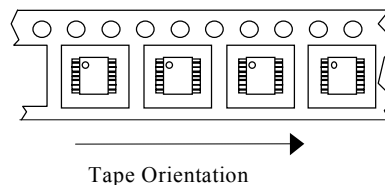
Die in Trays: 1DDD372AA-B02



- Die tray size is 2 inches square
- Total number of pockets is 100
- Pocket depth is 890μm (0.035")
- Pocket area is 2030μm x 2030μm (0.080" x 0.080")

MSOPs in Tape & Reel: 1DDD372AA-M04

Embossed tape on 360 mm diameter reel per EIA-481-2. 2500 units per reel. Quantity marked on reel label.



ISO 9001 Certified

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This inverter is covered by pending U.S. patent applications.