

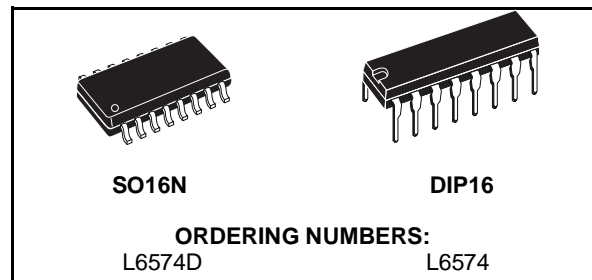
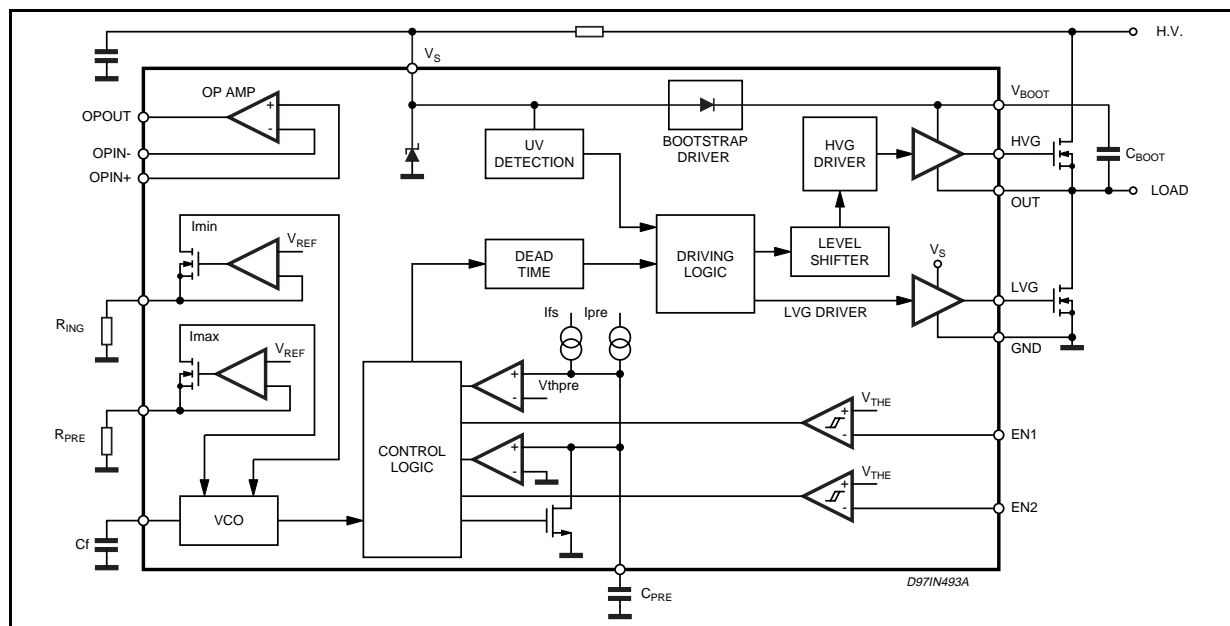
## CFL/TL BALLAST DRIVER PREHEAT AND DIMMING

- HIGH VOLTAGE RAIL UP TO 600V
- $dV/dt$  IMMUNITY  $\pm 50$  V/ns IN FULL TEMPERATURE RANGE
- DRIVER CURRENT CAPABILITY:  
250mA SOURCE  
450mA SINK
- SWITCHING TIMES 80/40ns RISE/FALL WITH 1nF LOAD
- CMOS SHUT DOWN INPUT
- UNDER VOLTAGE LOCK OUT
- PREHEAT AND FREQUENCY SHIFTING TIMING
- SENSE OP AMP FOR CLOSED LOOP CONTROL OR PROTECTION FEATURES
- HIGH ACCURACY CURRENT CONTROLLED OSCILLATOR
- INTEGRATED BOOTSTRAP DIODE
- CLAMPING ON  $V_s$ .
- SO16, DIP 16 PACKAGE

### DESCRIPTION

In order to ensure voltage ratings in excess of 600V, the L6574 is manufactured with BCD OFF LINE technology, which makes it well suited for lamp ballast applications.

### BLOCK DIAGRAM



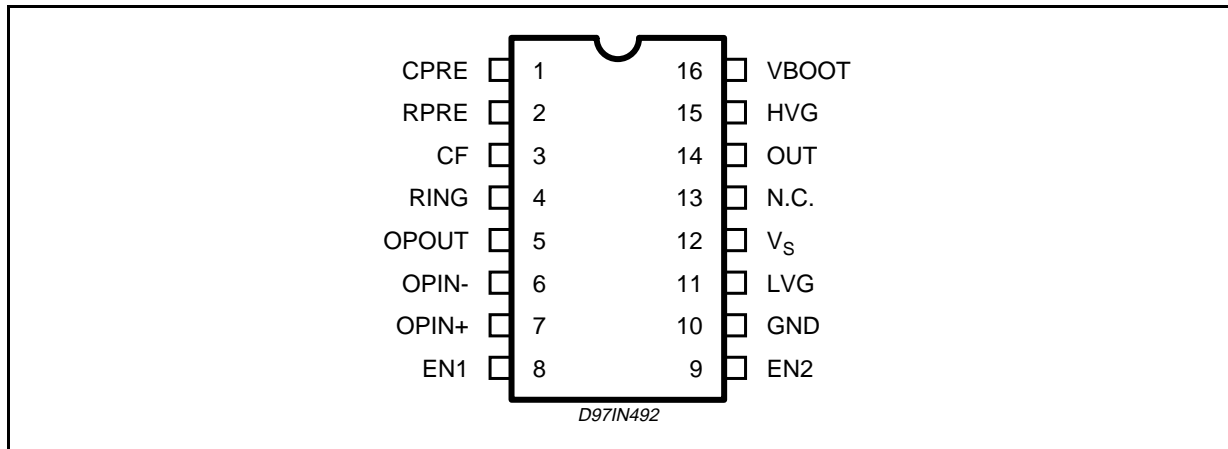
The device is intended to drive two power MOSFETS, in the classical half bridge topology, ensuring all the features needed to drive and properly control a fluorescent bulb.

A dedicated timing section in the L6574 allows the user set the necessary parameters for proper preheat and ignition of the lamp.

Also, an OP AMP is available to implement closed loop control of the lamp current during normal lamp burning.

An integrated bootstrap section, eliminating the normally required bootstrap diode and the zener clamping on  $V_s$ , makes the L6574 well suited for low cost applications where few additional components are needed to build a high performance ballast.

## PIN CONNECTION



## THERMAL DATA

Symbol	Parameter	DIP16	SO16N	Unit	
$R_{th\ j-amb}$	Thermal Resistance Junction to ambient	Max.	80	120	°C/W

## PINS DESCRIPTION

N.	Name	Function
1	Cpre	Preheat Timing Capacitor
2	Rpre	Maximum Oscillation Frequency Setting. Low Impedence Voltage Source. See also Cf
3	Cf	Oscillator Frequency Setting (see also Ring, Rpre)
4	Ring	Minimum Oscillation Frequency Setting. Low Impedence Voltage Source. See also Cf
5	OPout	Sense OP AMP Output. Low Impedence
6	OPin-	Sense OP Amp Inverting Input. High Impedence
7	OPin+	Sense OP AMP Non Inverting Input High Impedence.
8	EN1	Half Bridge Enable
9	EN2	Half Bridge Enable
10	GND	Ground
11	LVG	Low Side Driver Output
12	Vs	Supply Voltage with Internal Zener Clamp.
13	N.C.	Non Connected
14	OUT	High Side Driver Reference
15	HVG	High Side Driver Output
16	Vboot	Bootstrapped Supply Voltage

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$I_S$	Supply Current (*)	25	mA
$V_{LVG}$	Low Side Output	-0.3 to $V_S + 0.3$	V
$V_{OUT}$	High Side Reference	-1 to $V_{BOOT} - 18$	V
$V_{HVG}$	High Side Output	-1 to $V_{BOOT}$	V
$V_{BOOT}$	Floating Supply Voltage	-1 to 618	V
$dV_{BOOT}/dt$	$V_{BOOT}$ pin Slew rate (repetitive)	$\pm 50$	V/ns
$dV_{OUT}/dt$	OUT pin Slew Rate (repetitive)	$\pm 50$	V/ns
$V_{ir}$	Forced Input Voltage (pins Ring, Rpre)	-0.3 to 5	V
$V_{ic}$	Forced Input Voltage (pins Cpre, Cf)	-0.3 to 5	V
$V_{EN1}, V_{EN2}$	Enable Input Voltage	-0.3 to 5	V
$I_{EN1}, I_{EN2}$	Enable Input Current	$\pm 3$	mA
$V_{opc}$	Sense Op Amp Common Mode Range	-0.3 to 5	V
$V_{opd}$	Sense Op Amp Differential Mode Range	$\pm 5$	V
$V_{opo}$	Sense Op Amp Output Voltage (forced)	4.6	V
$T_{stg}, T_j$	Storage Temperature	-40 to +150	°C
$T_{amb}$	Ambient Temperature	-40 to +125	°C

(\*) The device has an internal Clamping Zener between GND and the  $V_{CC}$  pin, it must not be supplied by a Low Impedance Voltage Source.  
 Note: ESD immunity for pins 14, 15 and 16 is guaranteed up to 900V (Human Body Model)

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
$V_S$	Supply Voltage	10 to $V_{CL}$	V
$V_{OUT} (*)$	High Side Reference	-1 to $V_{BOOT} - V_{CL}$	V
$V_{BOOT} (*)$	Floating Supply Voltage	500	V

(\*) If the condition  $V_{boot} - V_{out} < 18$  is guaranteed,  $V_{out}$  can range from -3 to 580V.

ELECTRICAL CHARACTERISTICS ( $V_S = 12V$ ;  $V_{BOOT} - V_{OUT} = 12V$ ;  $T_{amb} = 25^\circ C$ )

Symbol	Pin	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>Supply Voltage</b>							
$V_{suvp}$	12	$V_S$ Turn On Threshold		9.5	10.2	10.9	V
$V_{suvn}$		$V_S$ Turn Off Threshold		7.3	8	8.7	V
$V_{suvh}$		Supply Voltage Under Voltage Hysteresys			2.2		V
$V_{cl}$		Supply Voltage Clamping		14.6	15.6	16.6	V
$I_{su}$		Start Up Current	$V_S < V_{suvn}$			250	$\mu A$
$I_q$		Quiescent Current, $f_{out} = 60kHz$ , no load.	$V_S > V_{suvp}$		2		mA
<b>High voltage Section</b>							
$I_{bootleak}$	16	BOOT pin leakage current	$V_{BOOT} = 580V$			5	$\mu A$
$I_{outleak}$	14	OUT pin Leakage Current	$V_{OUT} = 562V$			5	$\mu A$
<b>High/Low Side Drivers</b>							
$I_{hvgso}$	15	High Side Driver Source Current	$V_{HVG} - V_{OUT} = 0$	170	250		mA
$I_{hvgSI}$	15	High Side Driver Sink Current	$V_{HVG} - V_{BOOT} = 0$	300	450		mA
$I_{lvgsO}$	11	Low Side Drive Source Current	$V_{LVG} - GND = 0$	170	250		mA
$I_{lvgsI}$	11	Low Side Drive Source Current	$V_{LVG} - V_S = 0$	300	450		mA
$t_{rise}$	15, 11	Low/High Side Output Rise Time	$C_{load} = 1nF$		80	120	ns
$t_{fall}$		Low/High Side Output Fall Time	$C_{load} = 1nF$		50	80	ns

## ELECTRICAL CHARACTERISTICS (Continued)

Symbol	Pin	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>Oscillator</b>							
D <sub>C</sub>	14	Output Duty Cycle		48	50	52	%
f <sub>ing</sub>	14	Minimum Output Oscillation Frequency	C <sub>F</sub> = 470pF; R <sub>ing</sub> = 50kΩ	58.2	60	61.8	kHz
f <sub>pre</sub>		Maximum Output Oscillation Frequency	C <sub>F</sub> = 470pF; R <sub>ing</sub> = 50kΩ; R <sub>pre</sub> = 47kΩ	114	120	126	kHz
V <sub>ref</sub>	2,4	Voltage to current converters threshold		1.9	2	2.1	V
t <sub>d</sub>	14	Dead Time between Low and High Side Conduction		0.8	1.25	1.7	μs
<b>Timing Section</b>							
k <sub>pre</sub>	1	Pre Heat Timing constant	C <sub>pre</sub> = 330nF	1.15	1.5	1.85	s/μF
k <sub>fs</sub>		Frequency Shift Timing Constant	C <sub>pre</sub> = 330nF	0.115	0.15	0.185	s/μF
V <sub>thpre</sub>		Pre Heat Timing Comparator Threshold		3.3	3.5	3.7	V
<b>Sense OP AMP</b>							
I <sub>ib</sub>	6,7	Input Bias current				0.1	μA
V <sub>io</sub>		Input Offset Voltage		-10		10	mV
R <sub>out</sub>	5	Output Resistance		200		300	Ω
I <sub>out+</sub>		Sink Output Current	V <sub>out</sub> = 0.2V	0.5			mA
I <sub>out-</sub>		Source Output Current	V <sub>out</sub> = 4.5V	0.5			mA
V <sub>ic</sub>	6,7	Common Mode Input Range		-0.2		3	V
GBW		Sense Op Amp Gain Band Width Product			1		MHz
G <sub>dc</sub>		DC Open Loop Gain			80		dB
<b>Comparators</b>							
V <sub>the</sub>	8,9	Enabling Comparators Threshold		0.56	0.6	0.64	V
V <sub>hys</sub>		Enabling Comparators Hysteresis		20		100	mV
t <sub>pulse</sub>		Minimum Pulse length			200		ns

**High/Low Side Driving Section:**

High and low side driving sections provide the proper drive to the external power MOSFET. A high sink/source driving current (450/250 mA typical) ensures fast switching times when a size 4 external power MOSFET needs to be driven.

**Bootstrap Section:**

A patented integrated bootstrap section replaces an external bootstrap diode. This section together with a bootstrap capacitor provides the bootstrap voltage to drive the high side power MOSFET. This function is achieved using a high voltage DMOS driver which is driven synchronously with the low side external power MOSFET. For a safe operation, current flow into the V<sub>boot</sub> pin is inhibited, even though ZVS operation may not be ensured.

**Timing Section:**

To set the proper preheat time (t<sub>pre</sub>=k<sub>pre</sub>\*C<sub>pre</sub>) for the bulb, a capacitor is connected to the C<sub>pre</sub> pin which is charged with a fixed current. During t<sub>pre</sub>, the output is switching at f<sub>pre</sub> (see Oscillator Section). When the t<sub>pre</sub> expires, the C<sub>pre</sub> capacitor is discharged and then recharged with a different current. This sets a second time interval t<sub>sh</sub> (0.1 times the selected preheat time t<sub>pre</sub>) during which frequency shifting from f<sub>pre</sub> to f<sub>ing</sub> is performed to ensure lamp ignition.

**Oscillator Section:**

A voltage controlled oscillator, with the selected frequencies f<sub>pre</sub> and f<sub>ing</sub>, drives the output half bridge. Independently selected, f<sub>pre</sub> is effective during t<sub>pre</sub> and f<sub>ing</sub> is effective during normal lamp burning. When working open loop, f<sub>pre</sub> and

ring are the highest and lowest allowed oscillation frequencies.

Closed loop control of the lamp current under normal operation can be achieved with the L6574. This is accomplished by automatic adjustment of the oscillator frequency. The OP AMP output is fed through a resistor diode network to the Ring pin. See AN 993.

**OP AMP Section:**

The integrated OP AMP offers low output impedance, wide bandwidth, high input impedance and wide common mode range. It can be readily used to implement closed loop control (see Oscillator Section) of the lamp current.

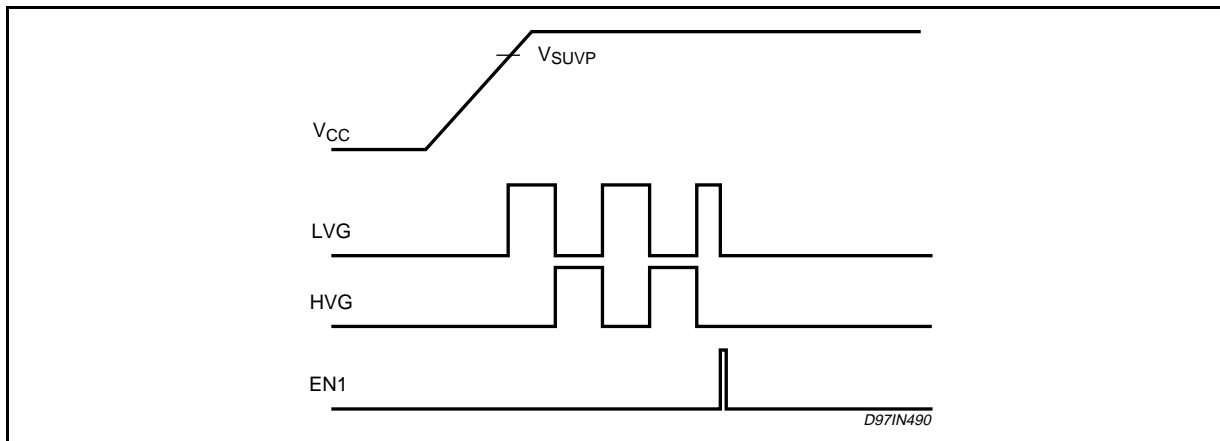
**EN1, EN2 Comparators:**

Two CMOS comparators, with thresholds set at 0.6 V (typical) are available to implement protection methods (such as overvoltage, lamp removal, etc.). Short pulses (>200nsec) at the comparator inputs are recognized.

The EN1 input (active high) forces the L6574 in the shut down state (e.g. LVG low, HVG low, oscillator stopped) in the event of an undervoltage condition. Normal operating condition is resumed after a power-off power-on sequence or when EN2 input is high.

The EN2 input (active high) also restarts a pre-heat sequence (see timing diagrams).

**TIMING DIAGRAMS**



**TIMING DIAGRAMS**

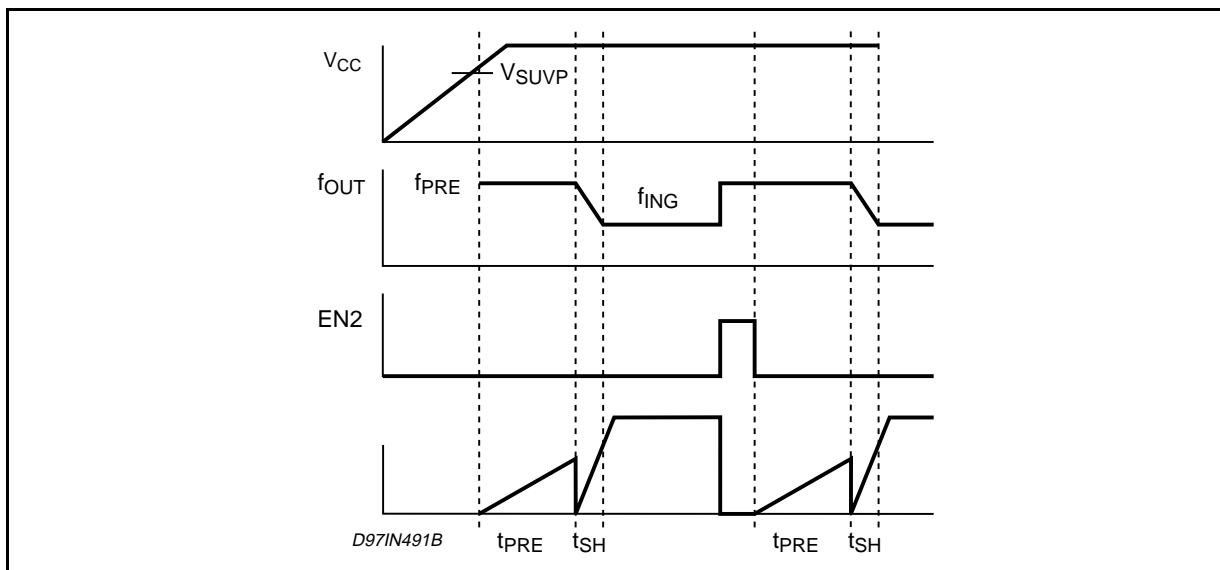


Figure 1.  $f_{ING}$  vs.  $R_{ING}$ .

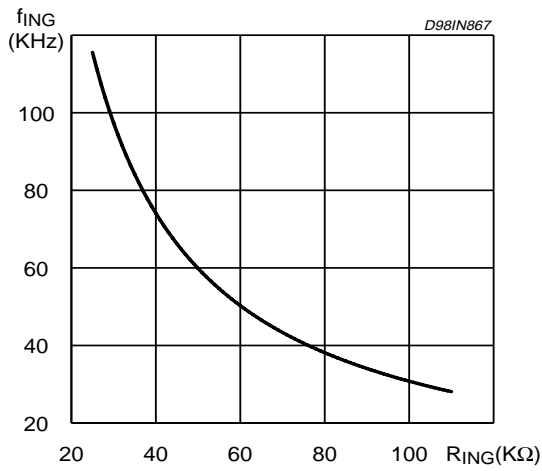


Figure 2.  $\Delta f$  vs.  $R_{PRE}$ , with  $R_{ING} = 33k\Omega$

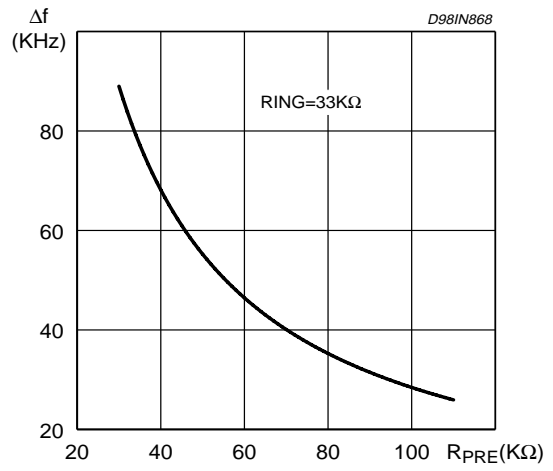


Figure 3.  $\Delta f$  vs.  $R_{PRE}$ , with  $R_{ING} = 50k\Omega$

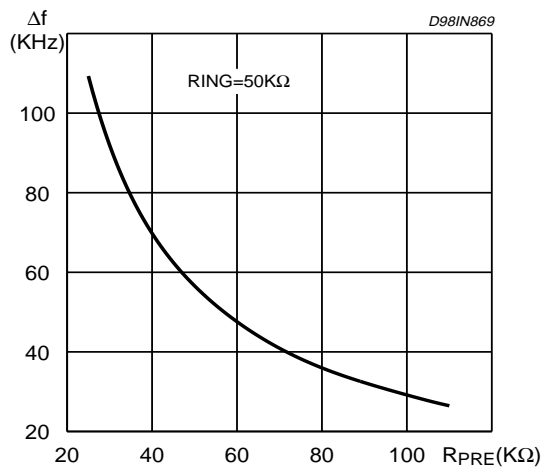


Figure 4.  $\Delta f$  vs.  $R_{PRE}$ , with  $R_{ING} = 100k\Omega$

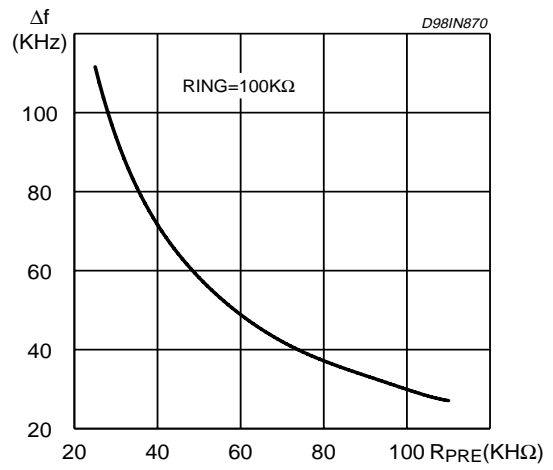


Figure 5.  $f_{ING}$  vs. temperature.

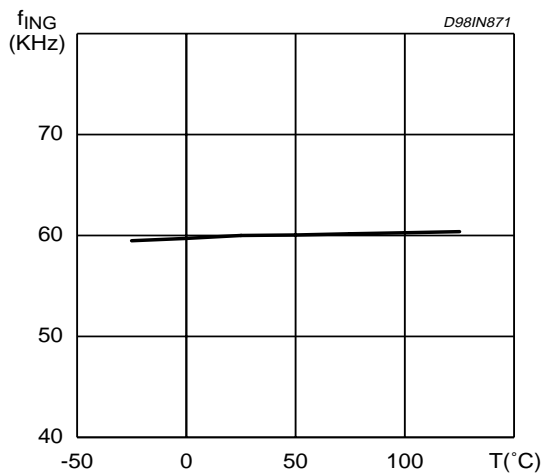
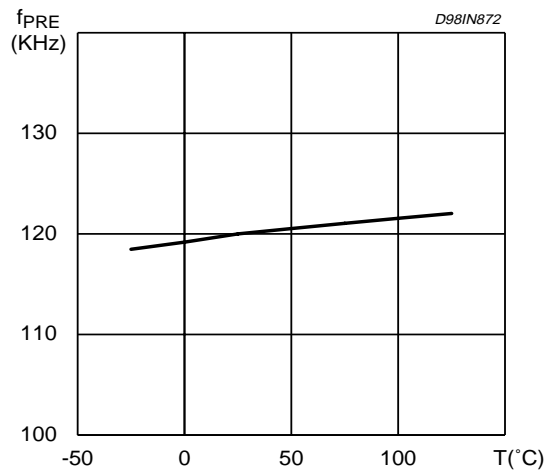
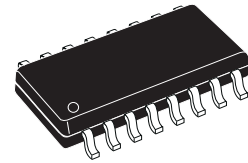


Figure 6.  $f_{PRE}$  vs. temperature.



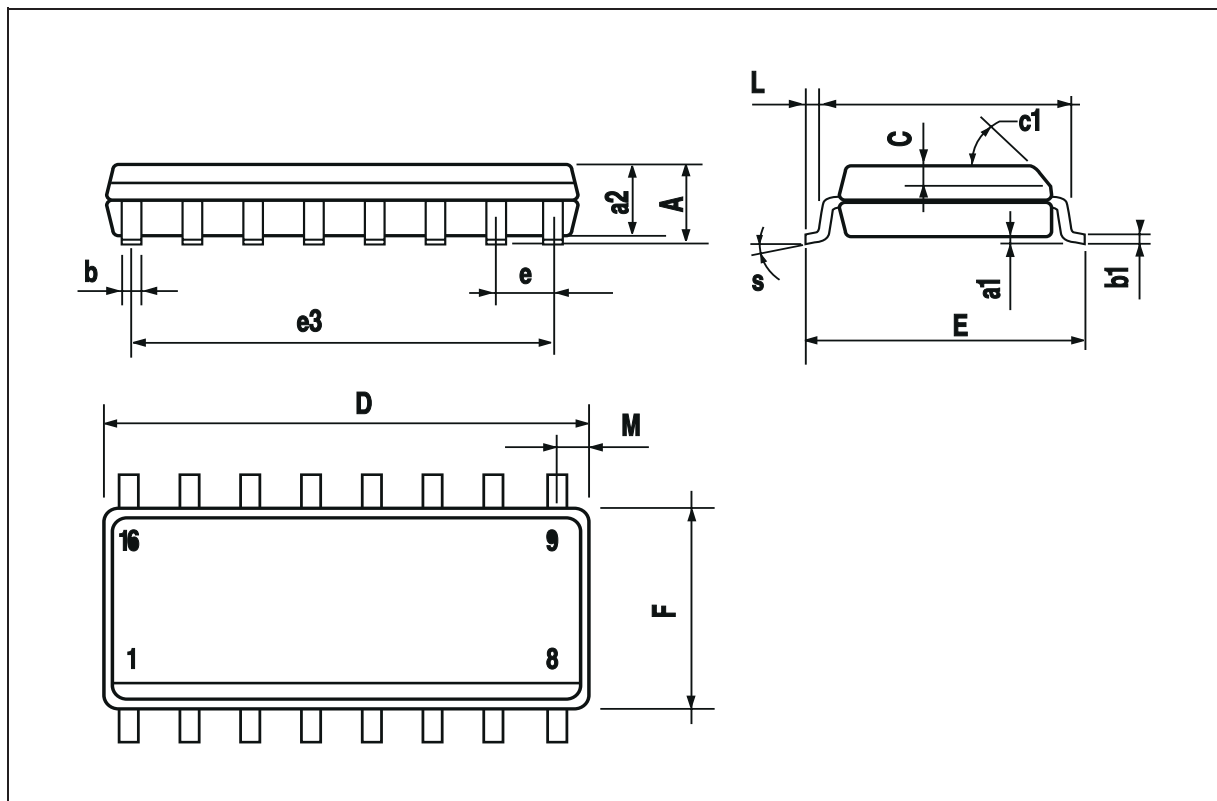
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.069
a1	0.1		0.25	0.004		0.009
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45° (typ.)					
D (1)	9.8		10	0.386		0.394
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F (1)	3.8		4	0.150		0.157
G	4.6		5.3	0.181		0.209
L	0.4		1.27	0.016		0.050
M			0.62			0.024
S	8° (max.)					

## OUTLINE AND MECHANICAL DATA



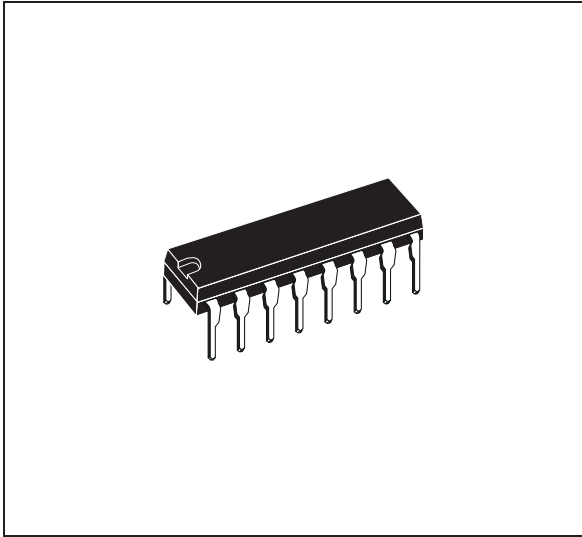
## SO16 Narrow

(1) D and F do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm (.006inch).

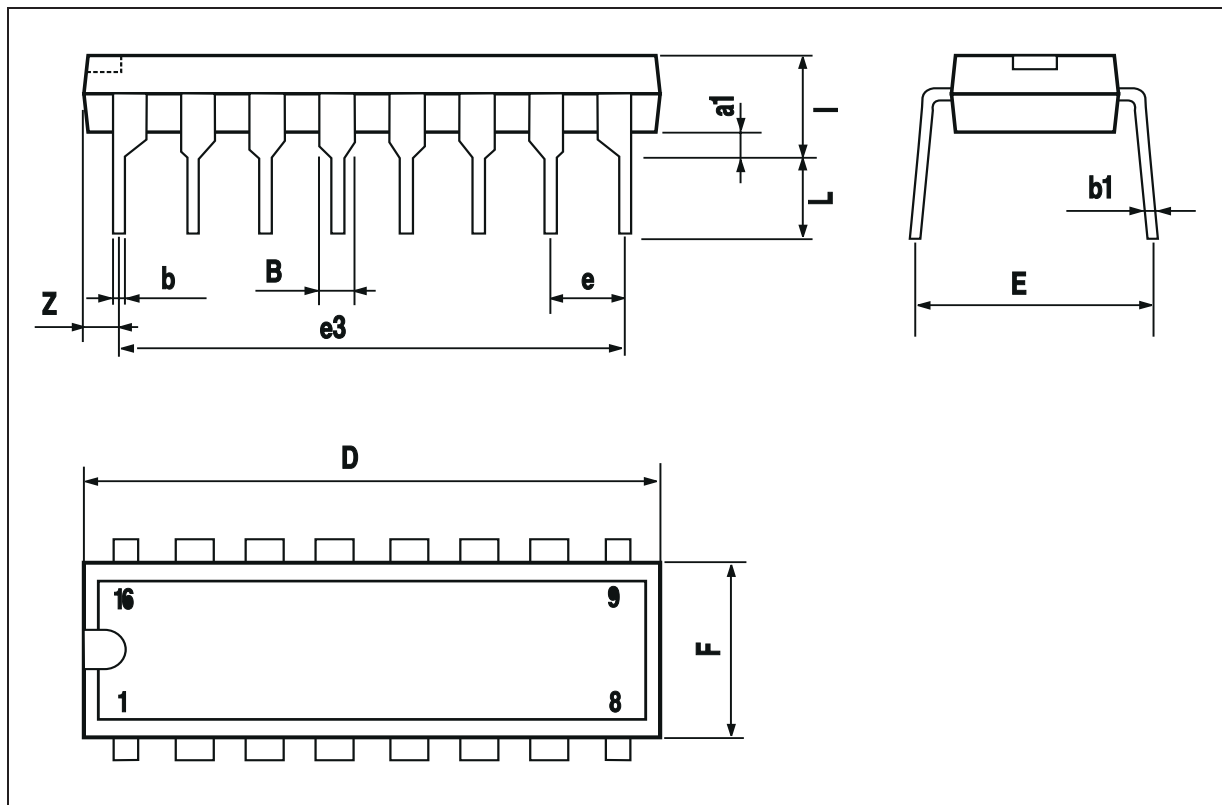


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050

**OUTLINE AND MECHANICAL DATA**



**DIP16**





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