SGS-THOMSON
MICROELECTRONICS

L6220
L6220N

QUAD DARLINGTON SWITCHES

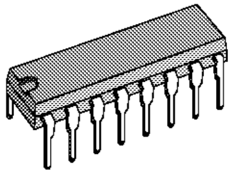
- TWO NON INVERTING + TWO INVERTING INPUTS WITH INHIBIT
- OUTPUT VOLTAGE UP TO 50V
- OUTPUT CURRENT UP TO 1.8A
- VERY LOW SATURATION VOLTAGE
- TTL COMPATIBLE INPUTS
- INTEGRAL FAST RECIRCULATION DIODES

DESCRIPTION

The L6220 monolithic quad darlington switch is designed for high current, high voltage switching applications. Each of the four switches is controlled by a logic input and all four are controlled by a common inhibit input. All inputs are TTL-compatible for direct connection to logic circuits.

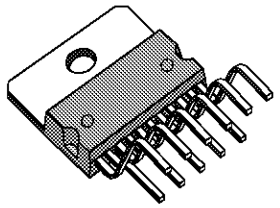
Each switch consists of an open-collector darlington transistor plus a fast diode for switching applications with inductive loads. The emitters of the four switches are commoned. Any number of inputs and outputs of the same device may be paralleled.

Two versions are available : the L6220 mounted in a Powerdip 12 + 2 + 2 package and the L6220N mounted in a 15-lead Multiwatt package.



Powerdip 12 + 2 + 2
(Plastic Package)

ORDERING NUMBER : L6220

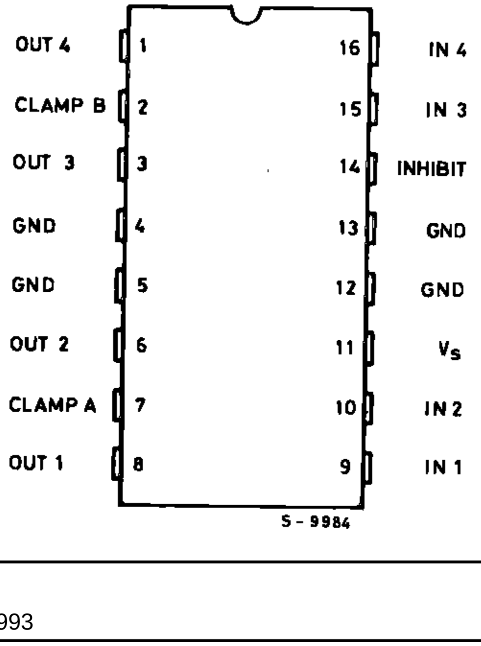


Multiwatt 15
(Plastic Package)

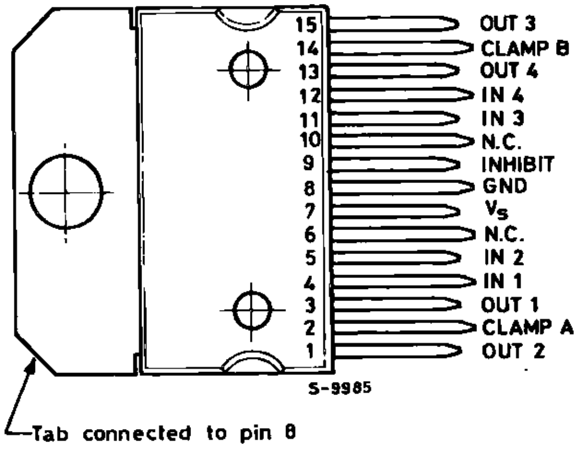
ORDERING NUMBER : L6220N

PIN CONNECTIONS (top views)

L6220 (Powerdip)



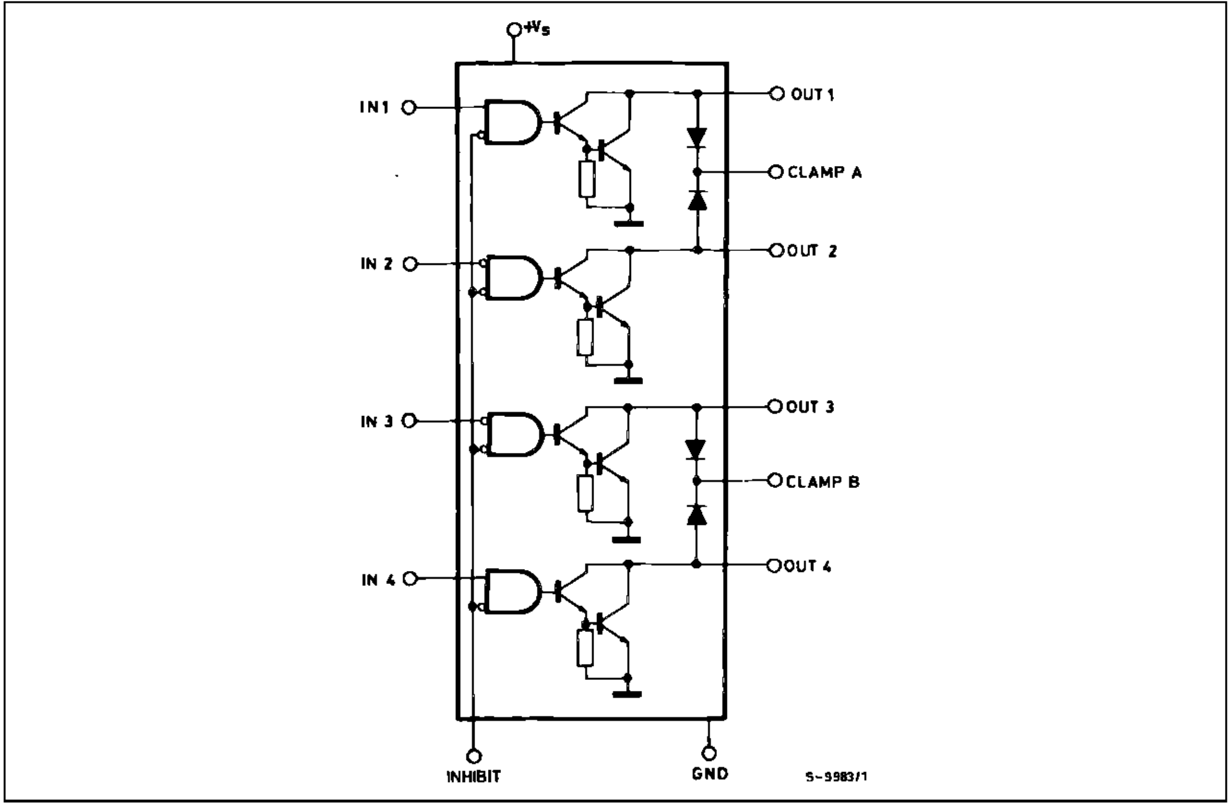
L6220N (Multiwatt-15)



PIN FUNCTIONS (see block diagram)

Name	Function
IN 1	Input to Driver 1
IN 2	Input to Driver 2
OUT 1	Output of Driver 1
OUT 2	Output of Driver 2
CLAMP A	Diode Clamp to Driver 1 and Driver 2
IN 3	Input to Driver 3
IN 4	Input to Driver 4
OUT 3	Output of Driver 3
OUT 4	Output of Driver 4
CLAMP B	Diode Clamp to Driver 3 and Driver 4
INHIBIT	Inhibit Input to all Drivers
V_S	Logic Supply Voltage
GND	Common Ground

BLOCK DIAGRAM



TRUTH TABLE

Inhibit	Input 1, 4	Power Out	Inhibit	Inputs 2, 3	Power Out
L	H	ON	L	L	ON
L	L	OFF	L	H	OFF
H	X	OFF	H	X	OFF

For each input : H = High level
L = Low level

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_o	Ouput Voltage	50	V
V_s	Logic Supply Voltage	7	V
V_{IN}, V_{INH}	Input Voltage, Inhibit Voltage	V_s	
I_C	Continuous Collector Current (for each channel)	1.8	A
I_C	Collector Peak Current (repetitive, duty cycle = 10 % t_{on} = 5 ms)	2.5	A
I_C	Collector Peak Current (non repetitive, t = 10 µs)	3.2	A
T_{op}	Operating Temperature Range (junction)	– 40 to + 150	°C
T_{stg}	Storage Temperature Range	– 55 to + 150	°C
I_{sub}	Output Substrate Current	350	mA
P_{tot}	Total Power Dissipation at T_{pins} = 90°C (Powerdip) at T_{case} = 90°C (Multiwatt) at T_{amb} = 70°C (Powerdip) at T_{amb} = 70°C (Multiwatt)	4.3 20 1 2.3	W W W W

THERMAL DATA

Symbol	Parameter		Powerdip	Multiwatt–15	Unit
$R_{th\ j\text{-}pins}$	Thermal Resistance Junction-pins	Max.	14	-	°C/W
$R_{th\ j\text{-}case}$	Thermal Resistance Junction-case	Max.	-	3	°C/W
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction-ambient	Max.	80	35	°C/W

ELECTRICAL CHARACTERISTICS

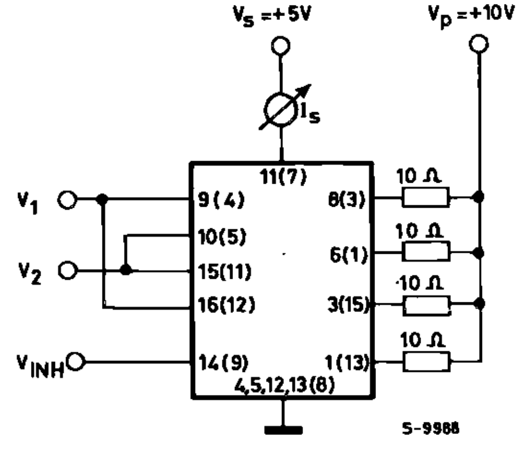
Refer to the test circuits Fig. 1 to Fig.9 (V_S = 5V, T_{amb} = 25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_S	Logic Supply Voltage		4.5		5.5	V
I_s	Logic Supply Current	All Outputs ON, I_C = 0.7A All Outputs OFF			20 20	mA MA
$V_{CE\ (sus)}$	Output Sustaining Voltage	I_C =100mA, V_{INH} = V_{INH}H	46			V
I_{CEX}	Output Leakage Current	V_{CE} = 50V, $V_{IN\ 1.4}$ = V_{INH}H			1	mA
$V_{CE\ (sat)}$	Collector Emitter Saturation Voltage (one output on ; all others off.)	V_s = 4.5V, $V_{IN\ 2.3}$ = V_{IN}L V_{INH} = V_{INH}L I_C = 0.6A I_C = 1A I_C = 1.8A			1 1.2 1.6	V
V_{IN}L, V_{INH}L	Input Low Voltage				0.8	V
I_{IN}L, I_{INH}L	Input Low Current	V_{IN} = V_{IN}L, V_{INH} = V_{INH}L			- 100	µA
V_{IN}H, V_{INH}H	Input High Voltage		2.0			V
I_{IN}H, I_{INH}H	Input High Current	V_{IN} = V_{IN}H, V_{INH} = V_{INH}H			± 10	µA
I_R	Clamp Diode Leakage Current	V_R = 50V, V_{INH} = V_{INH}H			100	µA
V_F	Clamp Diode Forward Voltage	I_F = 1A I_F = 1.8A			1.6 2.0	V V
$t_{d\ (on)}$	Turn on Delay Time	V_p = 5V, R_L = 10Ω			2	µs
$t_{d\ (off)}$	Turn off Delay Time	V_p = 5V, R_L = 10Ω			5	µs
$\Delta\ I_s$	Logic Supply Current Variation	V_{IN} = 5V, V_{EN} = 5V I_{out} = – 300mA for each Channel			120	mA

TEST CIRCUITS

(X) = Referred to Multiwatt package
X = Referred to Powerdip package

Figure 1 : Logic Supply Current.



Set V_1 = 4.5V, V_2 = 0.8V, V_{INH} = 4.5V or V_1 = 0.8V, V_2 = 4.5V, V_{INH} = 0.8 for I_S (all outputs off).
Set V_1 = 2V, V_2 = 0.8V, V_{INH} = 0.8V for I_S (all outputs on).

Figure 2 : Output Sustaining Voltage.

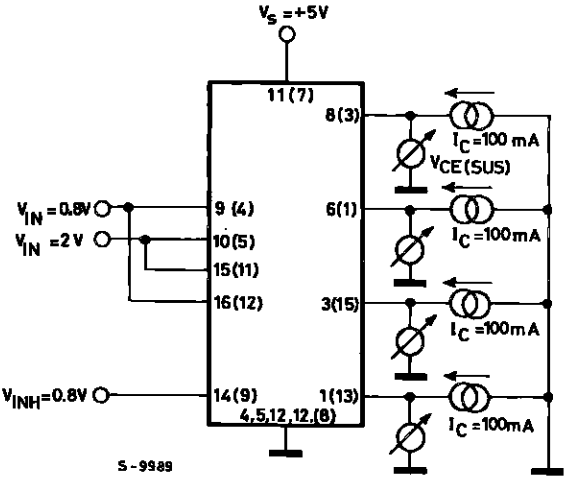


Figure 3 : Output Leakage Current.

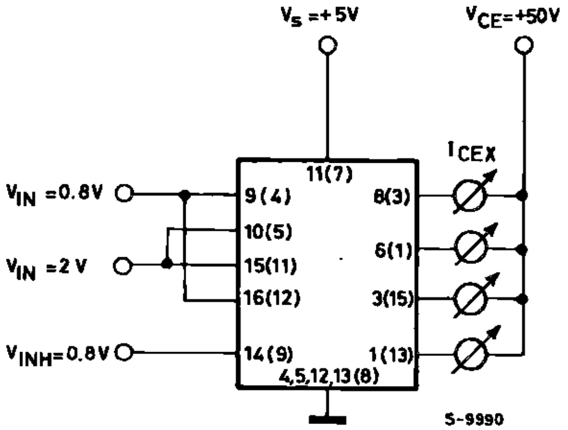


Figure 4 : Collector-emitter Saturation

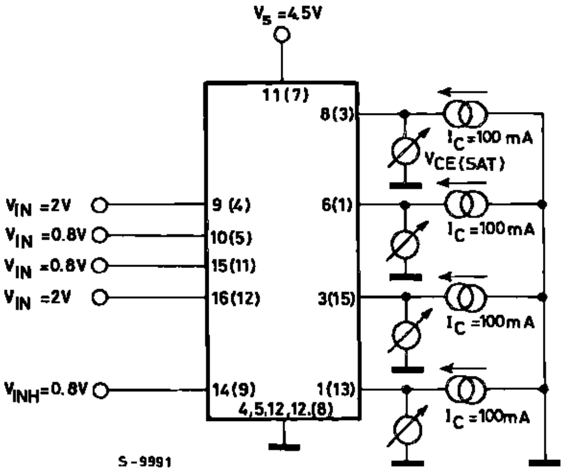
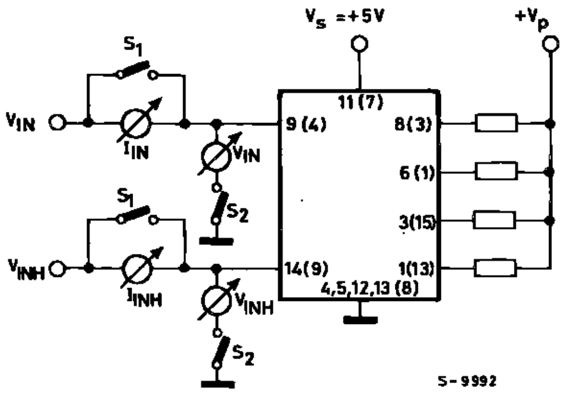


Figure 5 : Logic Input Characteristics.



Set S_1, S_2 open, V_{IN}, V_{INH} = 0.8V for I_{IN} L, I_{INH} L
Set S_1, S_2 open, V_{IN}, V_{INH} = 2V for I_{IN} H, I_{INH} H
Set S_1, S_2 close, V_{IN}, V_{INH} = 0.8V for V_{IN} L, V_{INH} L
Set S_1, S_2 close, V_{IN}, V_{INH} = 2V for V_{IN} H, V_{INH} H.

Figure 6 : Clamp Diode Leakage Current.

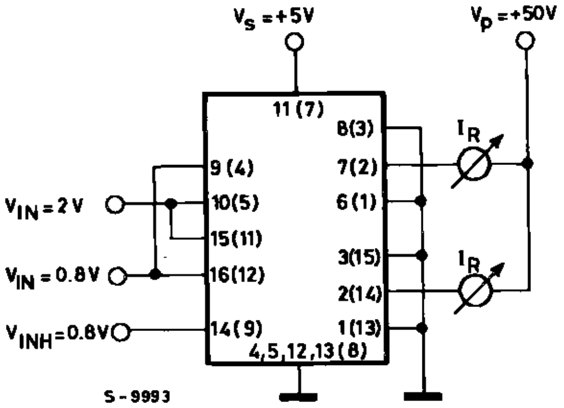


Figure 7 : Clamp Diode Forward Voltage.

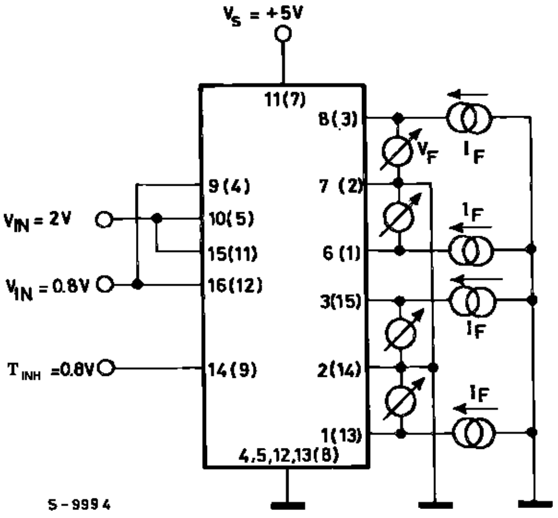


Figure 8 : Switching Times Test Circuit.

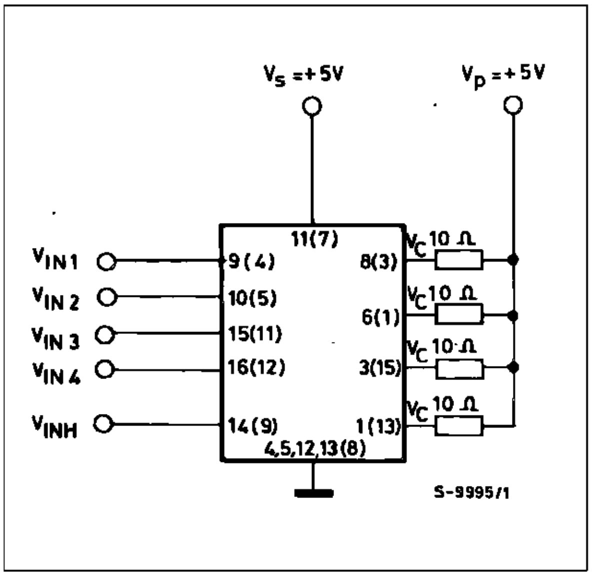


Figure 9 : Switching Times Waveforms.

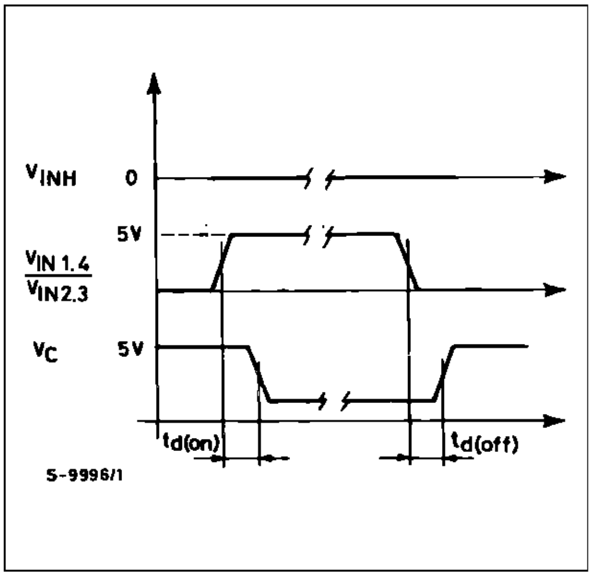


Figure 10 : Collector Saturation Voltage versus Collector Current

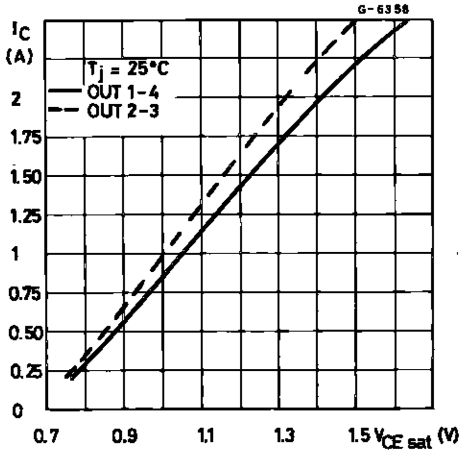


Figure 11 : Free- wheeling Diode ForwardVoltage versus Diode Current

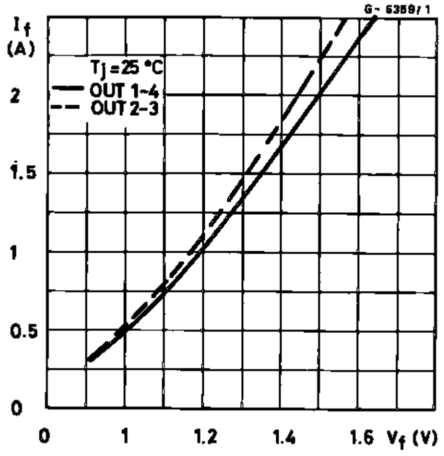


Figure 12 : Collector Saturation Voltage versus Junction Temperature at IC = 1A

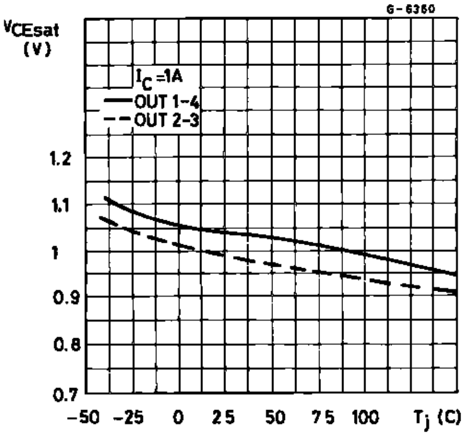


Figure 13 : Free-wheeling Diode Forward Voltage versus Junction Temperature at If = 1A

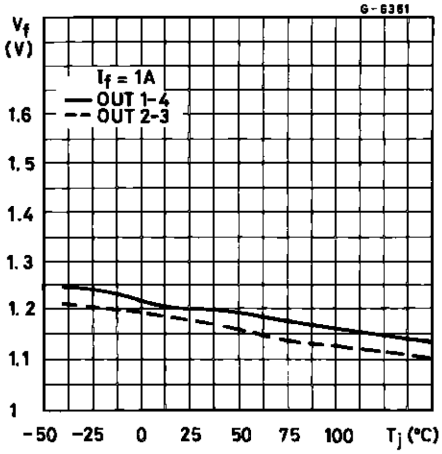


Figure 14 : Collector Saturation Voltage versus Junction Temperature at IC = 1.8A

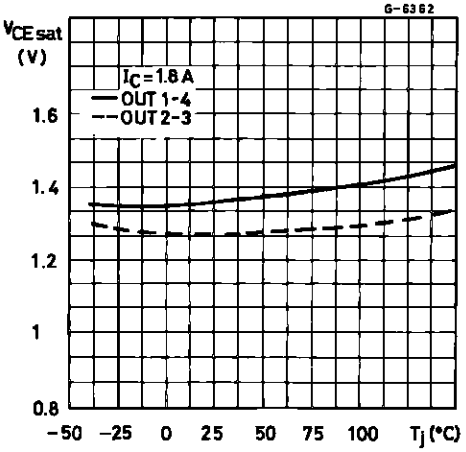


Figure 15 : Free-wheeling Diode Forward Voltage versus Junction Temperature at IF = 1.8A

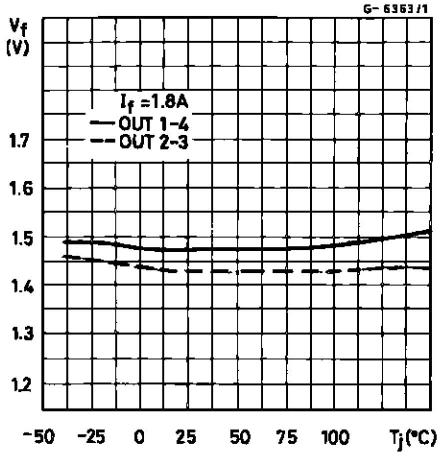


Figure 16.

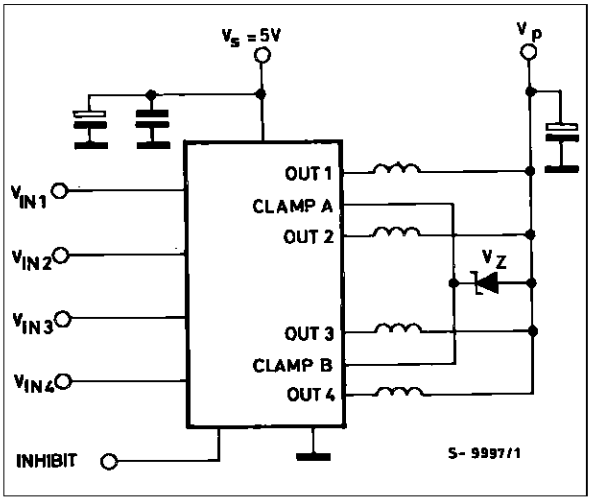
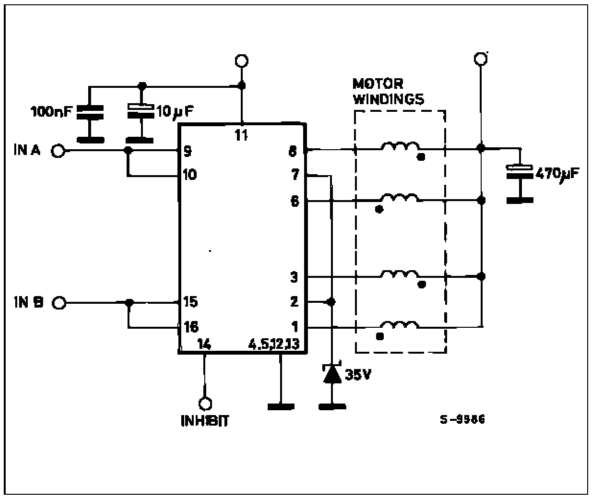


Figure 17 : Unipolar Stepper Motor Driver.



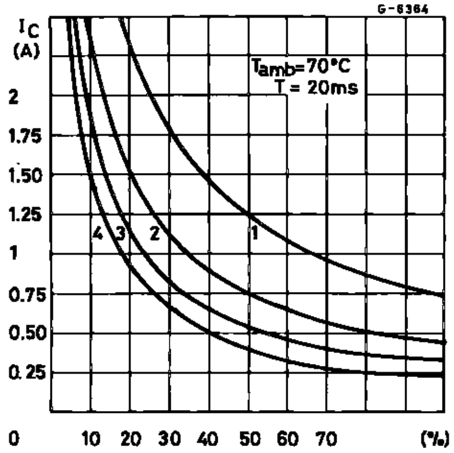
APPLICATION INFORMATION

When inductive loads are driven by L6220/N, a zener diode in series with the integral free-wheeling diodes increases the voltage across which energy stored in the load is discharged and therefore speeds the current decay (Fig. 16). For reliability it is suggested that the zener is chosen so that $V_p + V_z < 35$ V.

The reasons for this are two fold :

1) The zener voltage changes in temperature and current.

Figure 18 : Allowed Peak Collector-current versus Duty Cycle for 1, 2, 3 or 4 Contemporary Working Outputs (L6220).



2) The instantaneous power must be limited to avoid the reverse second breakdown.

The particular internal logic allows an easier full step driving using only two input signals.

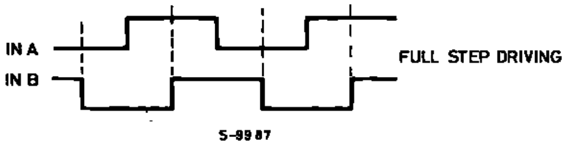
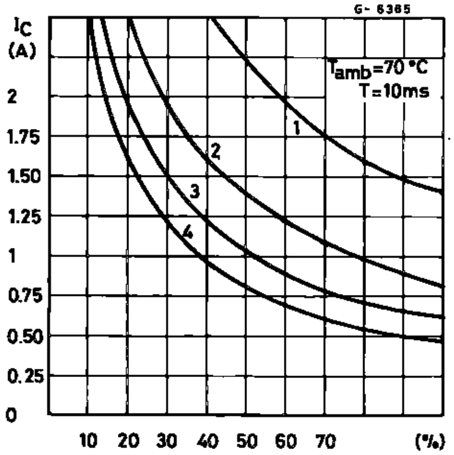


Figure 19 : Allowed Peak Collector Cur-rent versus Duty Cycle for 1, 2, 3 or 4 Contemporary Working Outputs (L6220N).



MOUNTING INSTRUCTION

The $R_{th\ j\text{-}amb}$ of the L6220 can be reduced by soldering the GND pins to a suitable copper area of the printed circuit board (Fig. 20) or to an external heatsink (Fig. 21).

The diagram of figure 22 shows the maximum dissipable power P_{tot} and the $R_{th\ j\text{-}amb}$ as a function of the side " α" of two equal square copper areas having a thickness of 35µ (1.4 mils). During soldering the pins temperature must not exceed 260 °C and the soldering time must not be longer than 12 seconds.

The external heatsink or printed circuit copper area must be connected to electrical ground.

Figure 20 : Example of P.C. Board Copperarea which is used as Heatsink

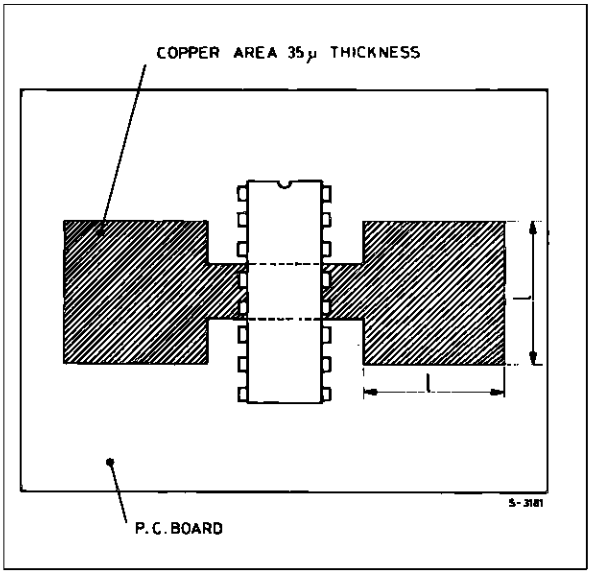


Figure 21 : External Heatsink Mounting Example

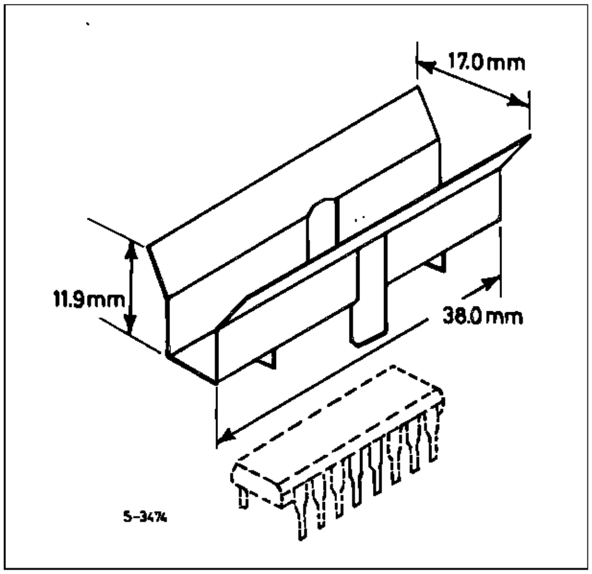


Figure 22 : Maximum Dissipable Power and Junction to Ambient Thermal Resistance versus Side ”α”

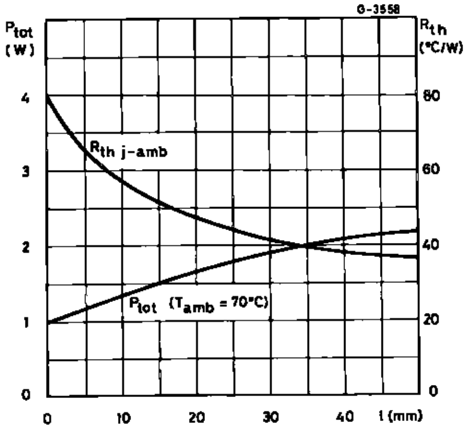
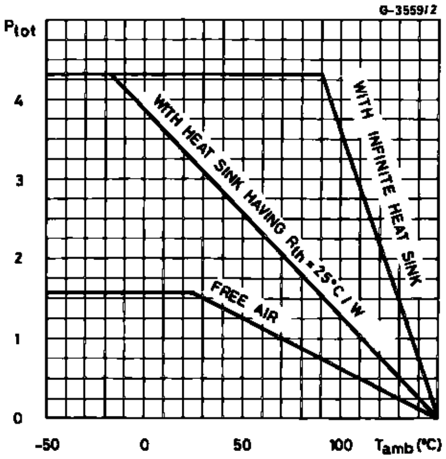
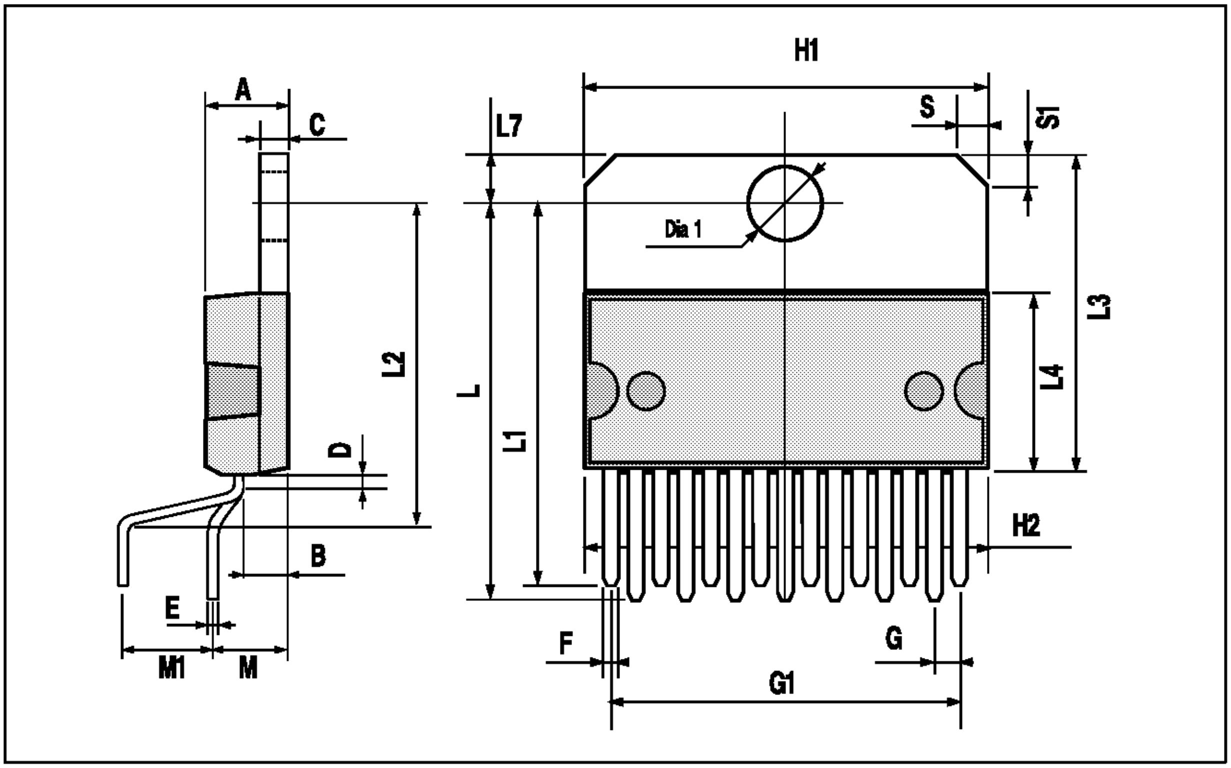


Figure 23 : Maximum Allowable Power Dissipation versus Ambient Temperature



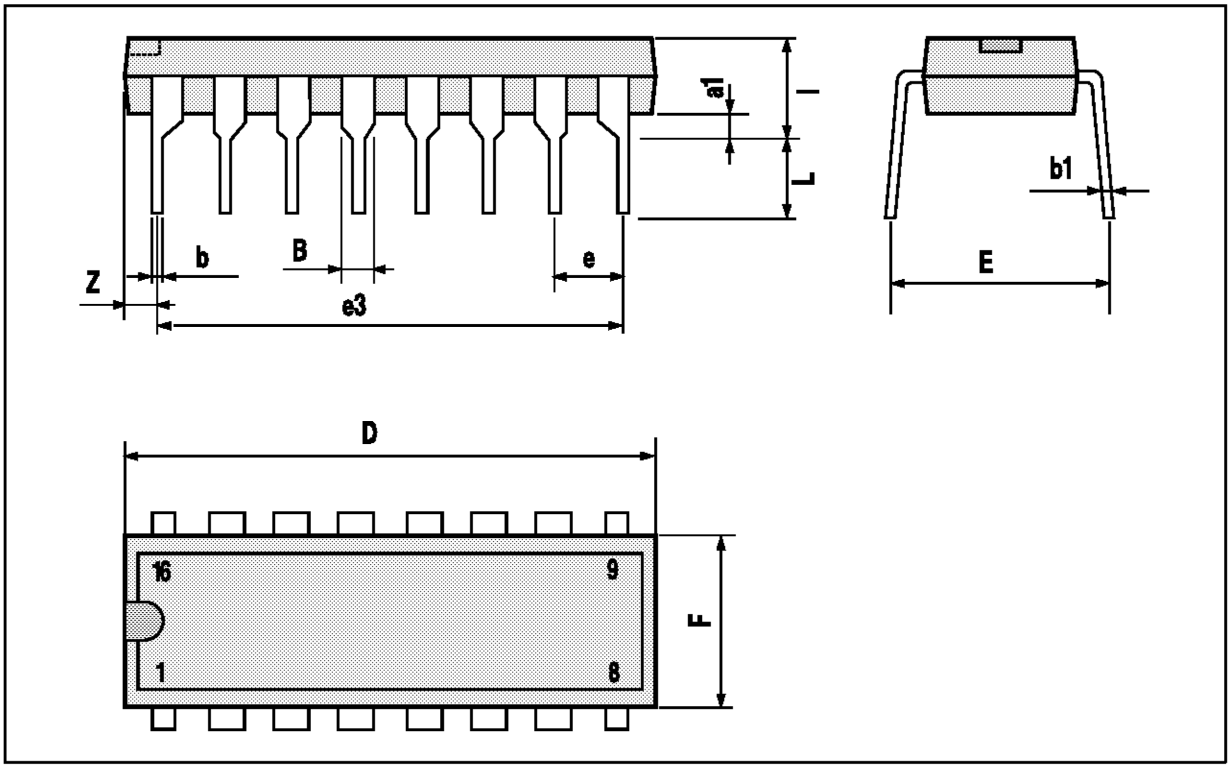
MULTIWATT15 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
D		1			0.039	
E	0.49		0.55	0.019		0.022
F	0.66		0.75	0.026		0.030
G	1.14	1.27	1.4	0.045	0.050	0.055
G1	17.57	17.78	17.91	0.692	0.700	0.705
H1	19.6			0.772		
H2			20.2			0.795
L	22.1		22.6	0.870		0.890
L1	22		22.5	0.866		0.886
L2	17.65		18.1	0.695		0.713
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L7	2.65		2.9	0.104		0.114
M	4.2	4.3	4.6	0.165	0.169	0.181
M1	4.5	5.08	5.3	0.177	0.200	0.209
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
Dia1	3.65		3.85	0.144		0.152



POWERDIP16 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.85		1.40	0.033		0.055
b		0.50			0.020	
b1	0.38		0.50	0.015		0.020
D			20.0			0.787
E		8.80			0.346	
e		2.54			0.100	
e3		17.78			0.700	
F			7.10			0.280
I			5.10			0.201
L		3.30			0.130	
Z			1.27			0.050



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