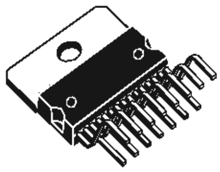
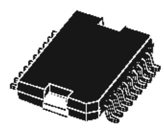
DUALFULL-BRIDGEDRIVER

- OPERATINGSUPPLYVOLTAGEUPTO46V
- TOTALDCCURRENTUPTO4A
- LOWSATURATIONVOLTAGE
- OVERTEMPERATUREPROTECTION
- LOGICAL"0"INPUTVOLTAGEUPTO1.5V (HIGHNOISEIMMUNITY)



Multiwatt15



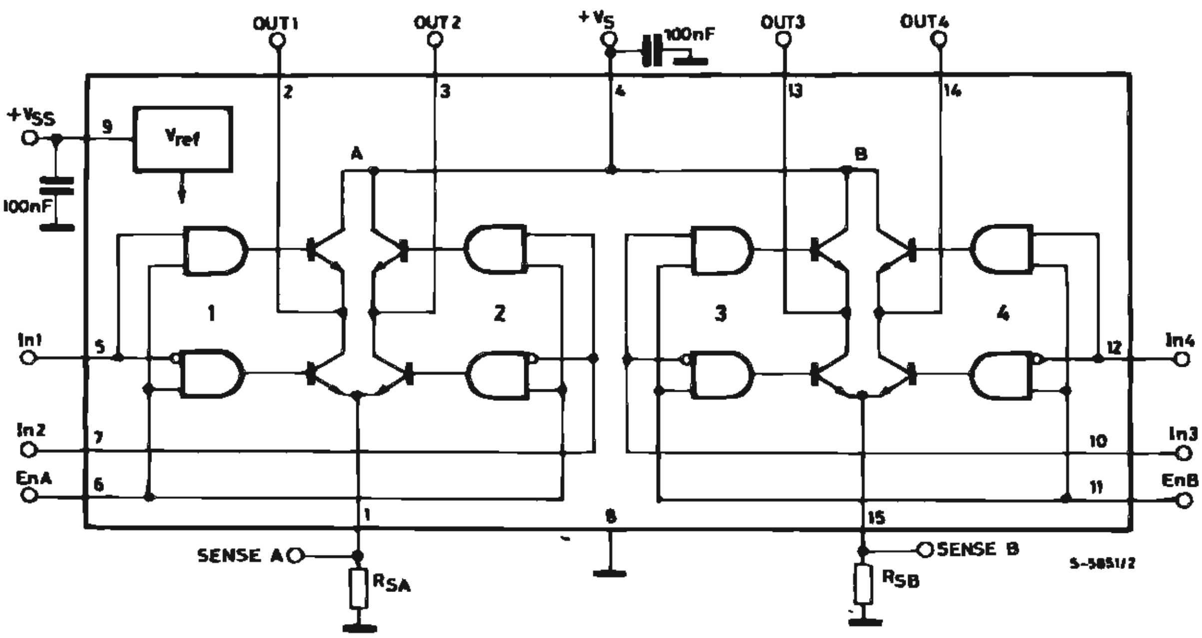
PowerSO20

ORDERINGNUMBERS: L298N(MultiwattVert.)
L298HN(MultiwattHoriz.)
L298P(PowerSO20)

DESCRIPTION

TheL298isanintegratedmonolithiccircuitina15-leadMultiwattandPowerSO20packages.Itisa highvoltage,highcurrentdualfull-bridgedriverde-signedtoacceptstandardTTLlogiclevelsanddrive inductiveloadssuchasrelays,solenoids,DCand steppingmotors.Twoenableinputsareprovidedto enableordisablethedeviceindependentlyofthein-putsignals.Theemittersofthelowertransistorsof eachbridgeareconnectedtogetherandthecorre-spondingexternalterminalcanbeusedforthecon-nectionofanexternalsensingresistor.Anadditional supplyinputisprovidedsothatthelogicworksata lowervoltage.

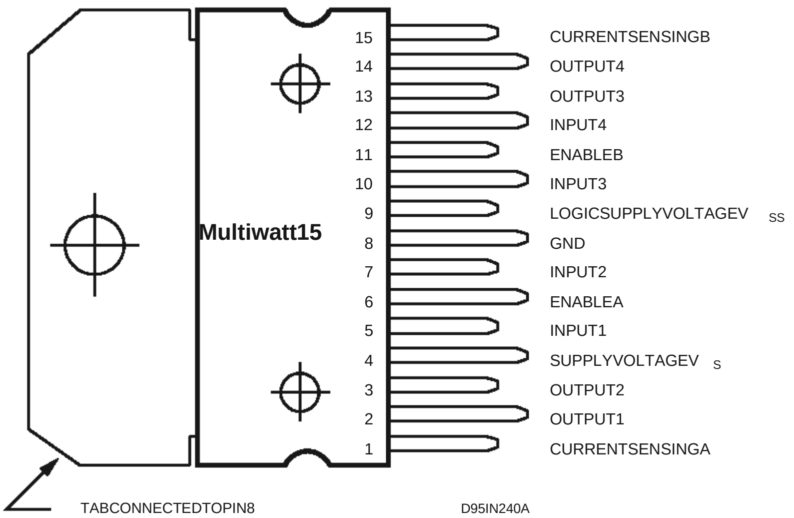
BLOCKDIAGRAM

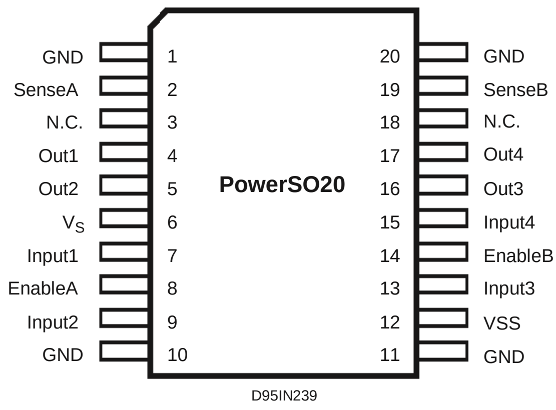


ABSOLUTEMAXIMUMRATINGS

Symbol	Parameter	Value	Unit
V_S	PowerSupply	50	V
V_{SS}	LogicSupplyVoltage	7	V
V_I, V_{en}	InputandEnableVoltage	–0.3to7	V
I_O	PeakOutputCurrent(eachChannel) –NonRepetitive(t=100 μs) –Repetitive(80%on–20%off;t_{on} =10 ms) –DCOperation	 3 2.5 2	 A A A
V_{sens}	SensingVoltage	–1to2.3	V
P_{tot}	TotalPowerDissipation(T_{case} =75 °C)	25	W
T_{op}	JunctionOperatingTemperature	–25to130	°C
T_{stg}, T_j	StorageandJunctionTemperature	–40to150	°C

PINCONNECTIONS (topview)





THERMALDATA

Symbol	Parameter		PowerSO20	Multiwatt15	Unit
$R_{thj-case}$	ThermalResistanceJunction-case	Max.	–	3	°C/W
$R_{thj-amb}$	ThermalResistanceJunction-ambient	Max.	13(*)	35	°C/W

(*) Mountedonaluminumsubstrate

PIN FUNCTIONS (refer to the block diagram)

MW.15	PowerSO	Name	Function
1;15	2;19	Sense A; Sense B	Between this pin and ground is connected the sense resistor to control the current of the load.
2;3	4;5	Out 1; Out 2	Outputs of the Bridge A; the current that flows through the load connected between these two pins is monitored at pin 1.
4	6	V_S	Supply Voltage for the Power Output Stages. A non-inductive 100nF capacitor must be connected between this pin and ground.
5;7	7;9	Input 1; Input 2	TTL Compatible Inputs of the Bridge A.
6;11	8;14	Enable A; Enable B	TTL Compatible Enable Input: the L state disables the bridge A (enable A) and/or the bridge B (enable B).
8	1,10,11,20	GND	Ground.
9	12	VSS	Supply Voltage for the Logic Blocks. A100nF capacitor must be connected between this pin and ground.
10; 12	13;15	Input 3; Input 4	TTL Compatible Inputs of the Bridge B.
13; 14	16;17	Out 3; Out 4	Outputs of the Bridge B. The current that flows through the load connected between these two pins is monitored at pin 15.
–	3;18	N.C.	Not Connected

ELECTRICAL CHARACTERISTICS (V_S = 42V; V_{SS} = 5V, T_j = 25°C; unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_S	Supply Voltage (pin 4)	Operative Condition	V_{IH} +2.5		46	V
V_{SS}	Logic Supply Voltage (pin 9)		4.5	5	7	V
I_S	Quiescent Supply Current (pin 4)	V_{en} = H; I_L = 0 V_i = L V_i = H		13 50	22 70	mA mA
		V_{en} = L V_i = X			4	mA
I_{SS}	Quiescent Current from V_{SS} (pin 9)	V_{en} = H; I_L = 0 V_i = L V_i = H		24 7	36 12	mA mA
		V_{en} = L V_i = X			6	mA
V_{iL}	Input Low Voltage (pins 5, 7, 10, 12)		–0.3		1.5	V
V_{iH}	Input High Voltage (pins 5, 7, 10, 12)		2.3		VSS	V
I_{iL}	Low Voltage Input Current (pins 5, 7, 10, 12)	V_i = L			–10	μA
I_{iH}	High Voltage Input Current (pins 5, 7, 10, 12)	Vi = H ≤ V_{SS} –0.6V		30	100	μA
V_{en} = L	Enable Low Voltage (pins 6, 11)		–0.3		1.5	V
V_{en} = H	Enable High Voltage (pins 6, 11)		2.3		V_{SS}	V
I_{en} = L	Low Voltage Enable Current (pins 6, 11)	V_{en} = L			–10	μA
I_{en} = H	High Voltage Enable Current (pins 6, 11)	V_{en} = H ≤ V_{SS} –0.6V		30	100	μA
$V_{CEsat(H)}$	Source Saturation Voltage	I_L = 1A I_L = 2A	0.95	1.35 2	1.7 2.7	V V
$V_{CEsat(L)}$	Sink Saturation Voltage	I_L = 1A (5) I_L = 2A (5)	0.85	1.2 1.7	1.6 2.3	V V
V_{CEsat}	Total Drop	I_L = 1A (5) I_L = 2A (5)	1.80		3.2 4.9	V V
V_{sens}	Sensing Voltage (pins 1, 15)		–1 (1)		2	V

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
T_1 (V_i)	Source Current Turn-off Delay	0.5 V_i to 0.9 I_L (2); (4)		1.5		μs
T_2 (V_i)	Source Current Fall Time	0.9 I_L to 0.1 I_L (2); (4)		0.2		μs
T_3 (V_i)	Source Current Turn-on Delay	0.5 V_i to 0.1 I_L (2); (4)		2		μs
T_4 (V_i)	Source Current Rise Time	0.1 I_L to 0.9 I_L (2); (4)		0.7		μs
T_5 (V_i)	Sink Current Turn-off Delay	0.5 V_i to 0.9 I_L (3); (4)		0.7		μs
T_6 (V_i)	Sink Current Fall Time	0.9 I_L to 0.1 I_L (3); (4)		0.25		μs
T_7 (V_i)	Sink Current Turn-on Delay	0.5 V_i to 0.9 I_L (3); (4)		1.6		μs
T_8 (V_i)	Sink Current Rise Time	0.1 I_L to 0.9 I_L (3); (4)		0.2		μs
fc (V_i)	Commutation Frequency	I_L = 2A		25	40	KHz
T_1 (V_{en})	Source Current Turn-off Delay	0.5 V_{en} to 0.9 I_L (2); (4)		3		μs
T_2 (V_{en})	Source Current Fall Time	0.9 I_L to 0.1 I_L (2); (4)		1		μs
T_3 (V_{en})	Source Current Turn-on Delay	0.5 V_{en} to 0.1 I_L (2); (4)		0.3		μs
T_4 (V_{en})	Source Current Rise Time	0.1 I_L to 0.9 I_L (2); (4)		0.4		μs
T_5 (V_{en})	Sink Current Turn-off Delay	0.5 V_{en} to 0.9 I_L (3); (4)		2.2		μs
T_6 (V_{en})	Sink Current Fall Time	0.9 I_L to 0.1 I_L (3); (4)		0.35		μs
T_7 (V_{en})	Sink Current Turn-on Delay	0.5 V_{en} to 0.9 I_L (3); (4)		0.25		μs
T_8 (V_{en})	Sink Current Rise Time	0.1 I_L to 0.9 I_L (3); (4)		0.1		μs

1) 1)Sensing voltage can be –1 V for t ≤ 50 μsec; in steady state V_{sens} min ≥ –0.5 V.
2) See fig. 2.
3) See fig. 4.
4) The load must be a pure resistor.

Figure 1 : Typical Saturation Voltage vs. Output Current.

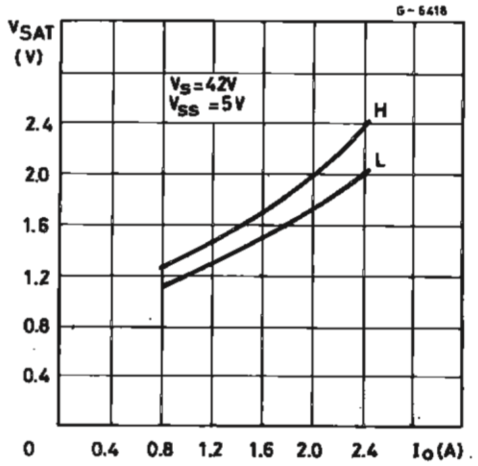
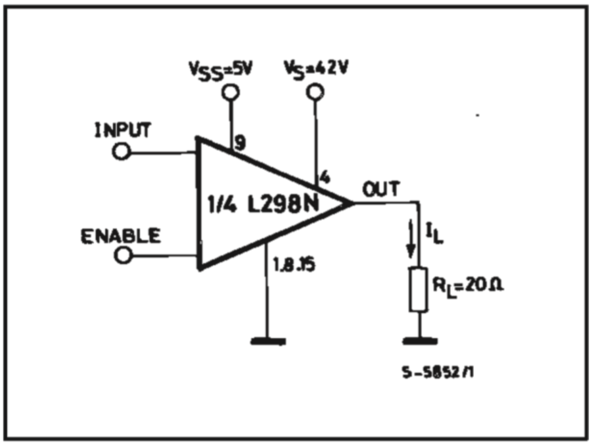


Figure 2 : Switching Times Test Circuits.



Note : For INPUT Switching, set EN = H
For ENABLE Switching, set IN = H

Figure3: SourceCurrentDelayTimesvs.InputorEnableSwitching.

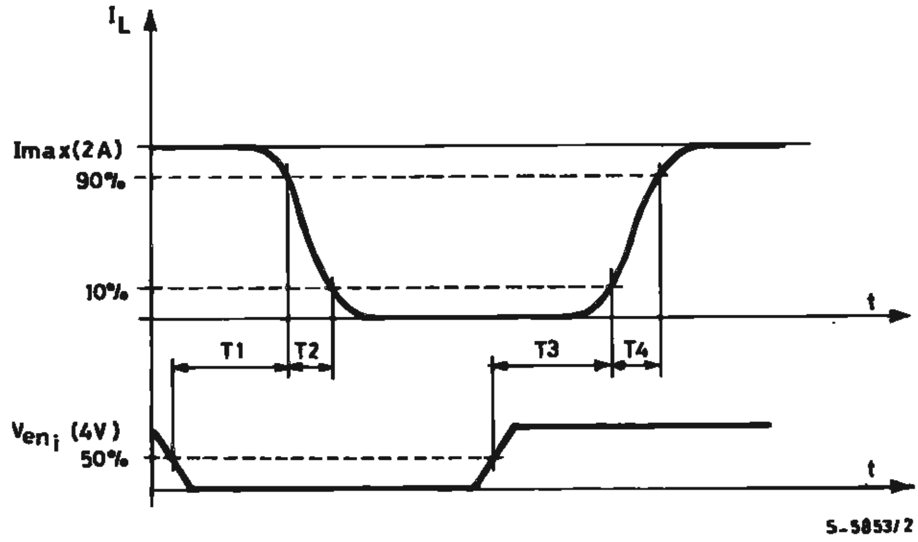
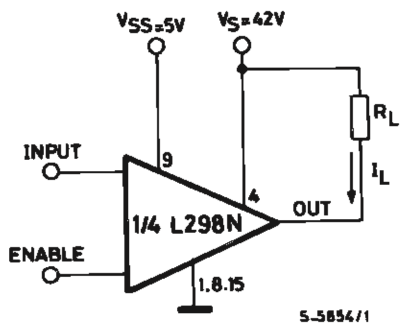


Figure4: SwitchingTimesTestCircuits.



Note: ForINPUTSwitching,setEN=H
ForENABLESwitching,setIN=L

Figure5: SinkCurrentDelayTimesvs.Input0VEnableSwitching.

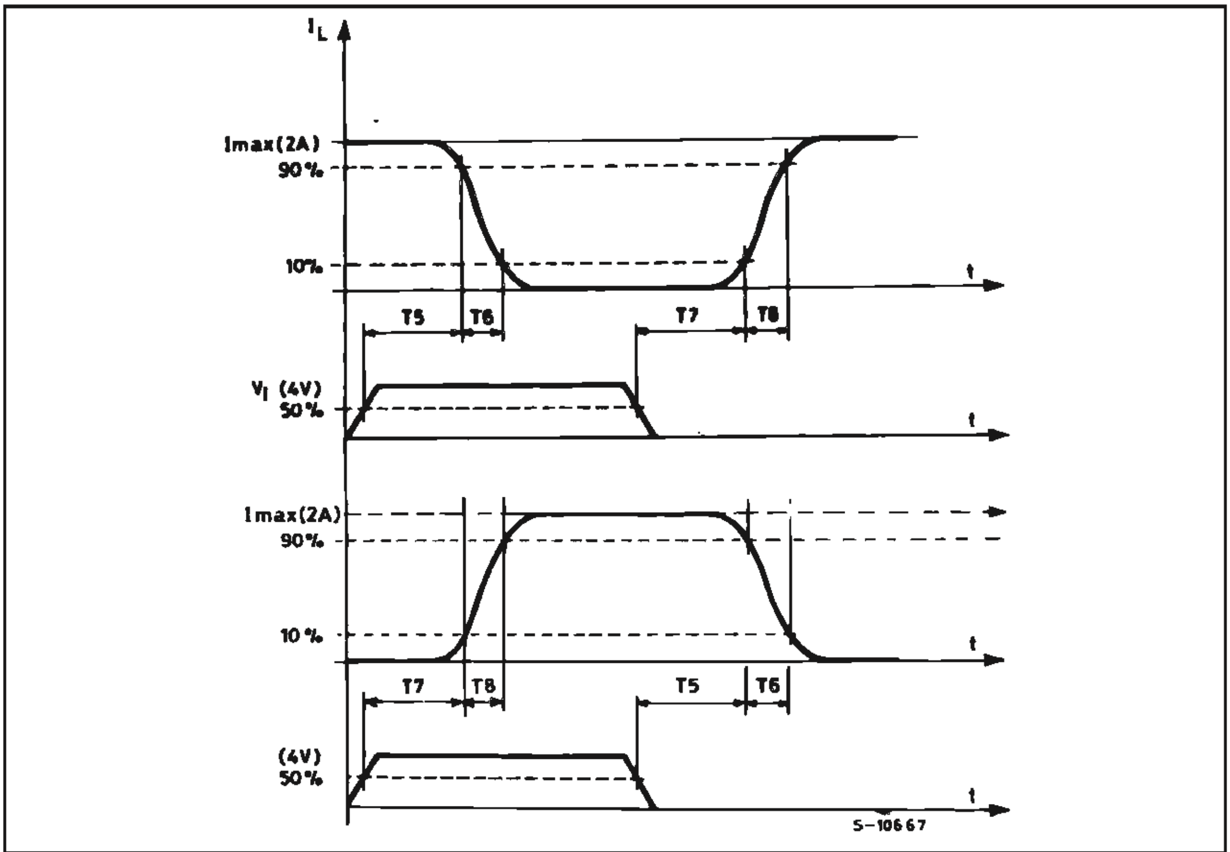
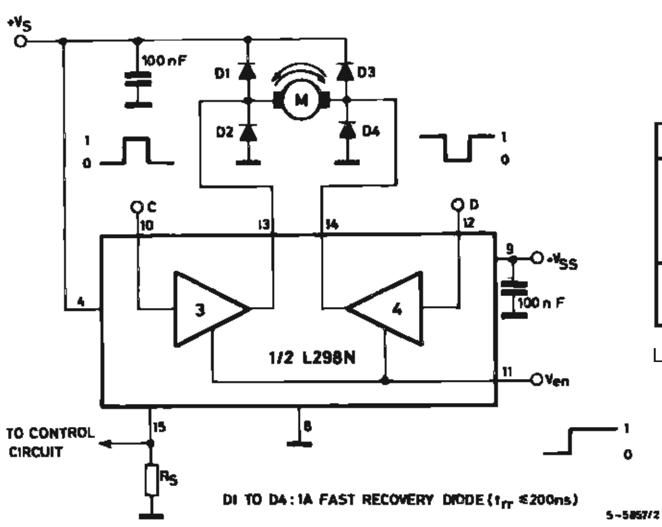


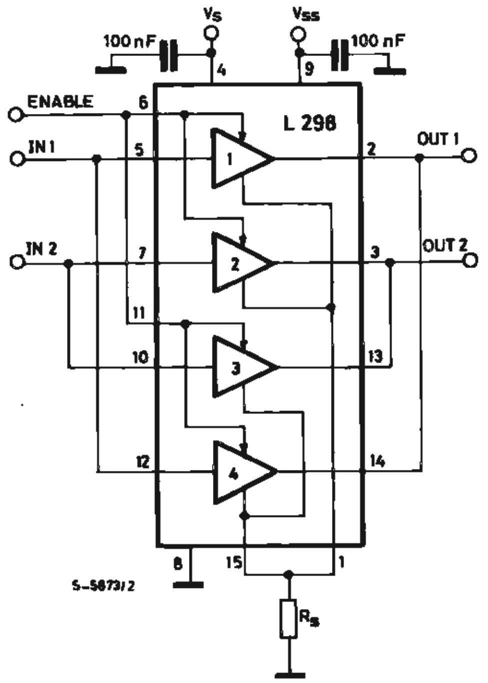
Figure6: BidirectionalDCMotorControl.



Inputs		Function
V_{en} = H	C=H;D=L	Forward
	C=L;D=H	Reverse
	C=D	FastMotorStop
V_{en} = L	C=X;D=X	FreeRunning MotorStop

L=Low H=High X=Don’tcare

Figure7: Forhighercurrents,outputscanbeparalleled.Takecaretoparallelchannel1withchannel4 andchannel2withchannel3.



APPLICATIONINFORMATION(Refertotheblockdiagram)

1.1.POWEROUTPUTSTAGE

TheL298integratestwopoweroutputstages(A;B). Thepoweroutputstageisabridgeconfiguration anditsoutputscandriveaninductiveloadincom-monordifferenzialmode,dependingonthestateof theinputs.Thecurrentthatflowsthroughtheload comesoutfromthebridgeatthesenseoutput:an externalresistor(R_{SA};R_{SB}.) allowstodetectthein-tensityofthiscurrent.

1.2.INPUTSTAGE

Eachbridgeisdrivenbymeansoffourgatesthein-putofwhichareIn1;In2;EnAandIn3;In4;EnB. TheIninputssetthebridgestatewhenTheEninput ishigh;alowstateoftheEninputinhibitsthebridge. AlltheinputsareTTLcompatible.

2.SUGGESTIONS

Anoninductivecapacitor,usuallyof100nF,must beforeseenbetweenbothVsandVss,toground, asnearaspossibletoGNDpin.Whenthelargeca-pacitorofthepowersupplyistoofarfromtheIC,a secondsmalleronemustbeforeseennearthe L298.

Thesenseresistor,notofawirewoundtype,must begroundednearthenegativepoleofVsthatmust beneartheGNDpinoftheI.C.

Eachinputmustbeconnectedtothesourceofthe drivingsignalsbymeansofaveryshortpath.

Turn-OnandTurn-Off:BeforetoTurn-ONtheSup-plyVoltageandbeforetoTurnitOFF,theEnablein-putmustbedriventotheLowstate.

3.APPLICATIONS

Fig6showsabidirectionalDCmotorcontrolSche-maticDiagramforwhichonlyonebridgeisneeded. TheexternalbridgeofdiodesD1toD4ismadeby fourfastrecoveryelements($t_{rr} \leq$ 200 nsec)that mustbechosenofaVFaslowaspossibleatthe worstcaseoftheloadcurrent.

Thesenseoutputvoltagecanbeusedtocontrolthe currentamplitudebychoppingtheinputs,ortopro-videovercurrentprotectionbyswitchinglowtheen-ableinput.

Thebrakefunction(Fastmotorstop)requiresthat theAbsoluteMaximumRatingof2Ampsmust neverbeovercome.

Whentherepetitivepeakcurrentneededfromthe loadishigherthan2Amps,aparalleledconfigura-tioncanbechosen(SeeFig.7).

Anexternalbridgeofdiodesarerequiredwhenin-ductiveloadsaredrivenandwhentheinputsofthe ICarechopped;Shottkydiodeswouldbepreferred.

Thissolutioncandriveuntil3AmpsInDCoperation anduntil3.5Ampsofarepetitivepeakcurrent.

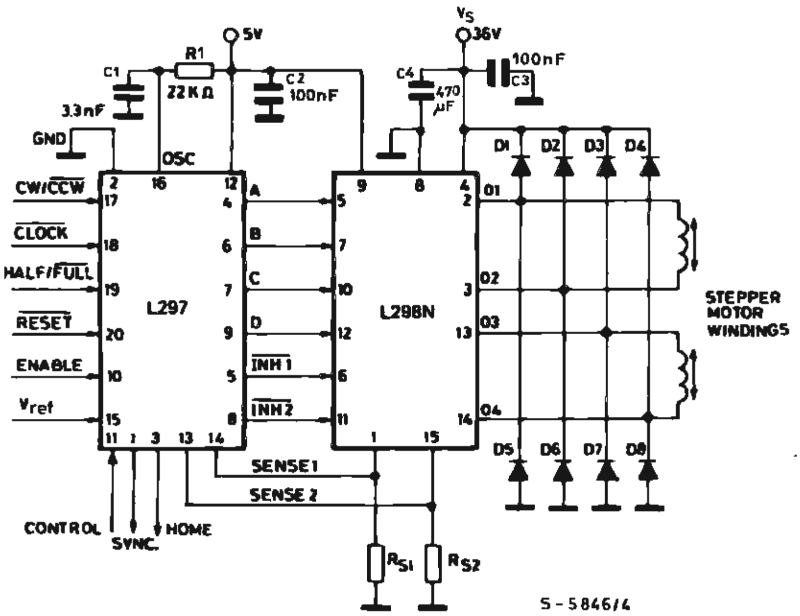
OnFig8itisshownthedrivingofatwophasebipolar steppermotor;theneededsignalstodrivethein- putsoftheL298aregenerated,inthisexample, fromtheICL297.

Fig9showsanexampleofP.C.B.designedforthe applicationofFig8.

Fig10showsasecondtwophasebipolarstepper motorcontrolcircuitwherethecurrentiscontrolled bytheI.C.L6506.

Figure8: TwoPhaseBipolarStepperMotorCircuit.

Thiscircuitdrivesbipolarsteppermotorswithwindingcurrentsupto2A.Thediodesarefast2Atypes.



$R_{S1} = R_{S2} = 0.5\ \Omega$

D1toD8=2AFastdiodes $\left\{ \begin{array}{l} V_F \leq 1.2\ V @ I=2A \\ trr \leq 200\ ns \end{array} \right.$

Figure9: SuggestedPrintedCircuitBoardLayoutfortheCircuitoffig.8(1:1scale).

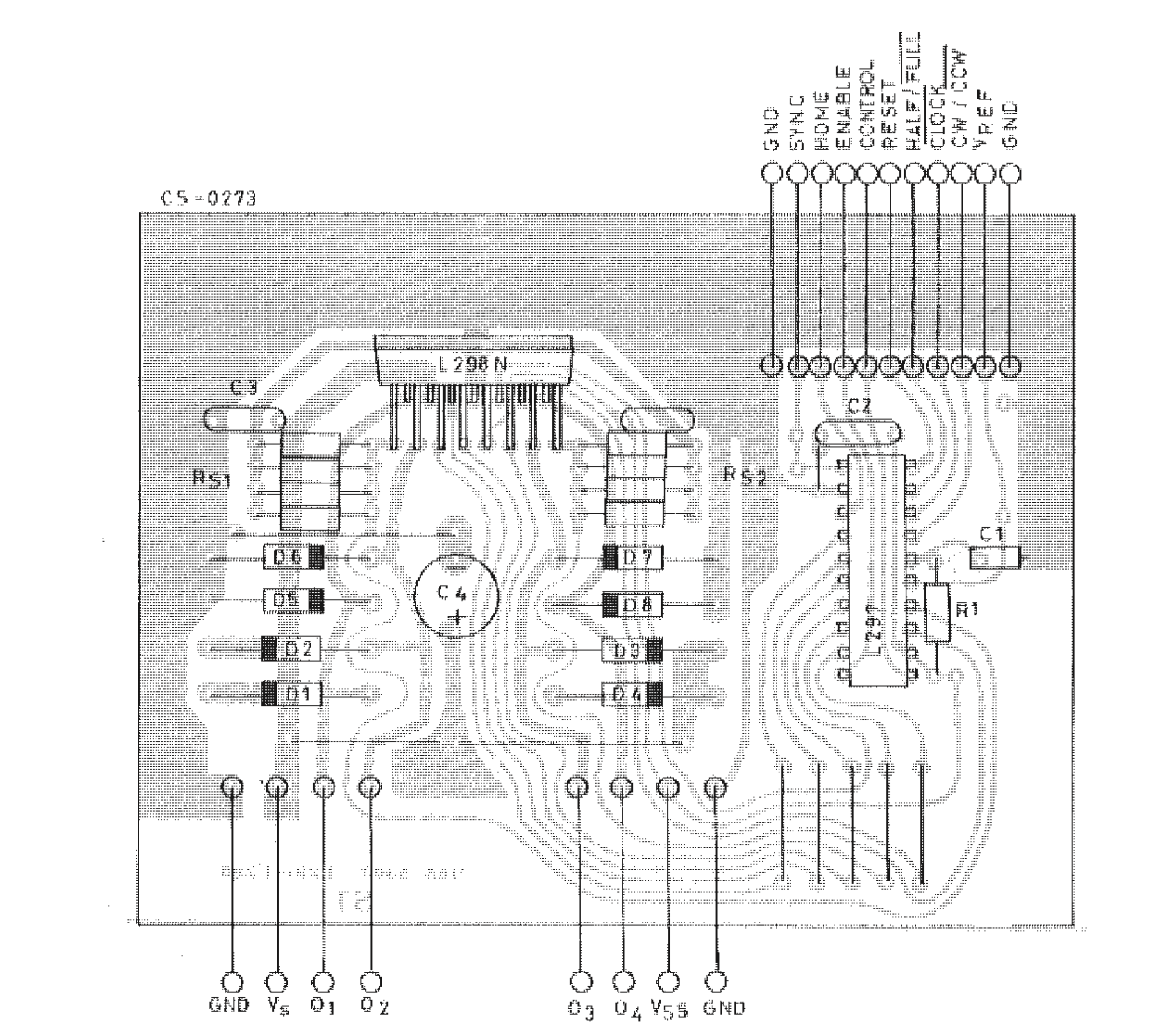
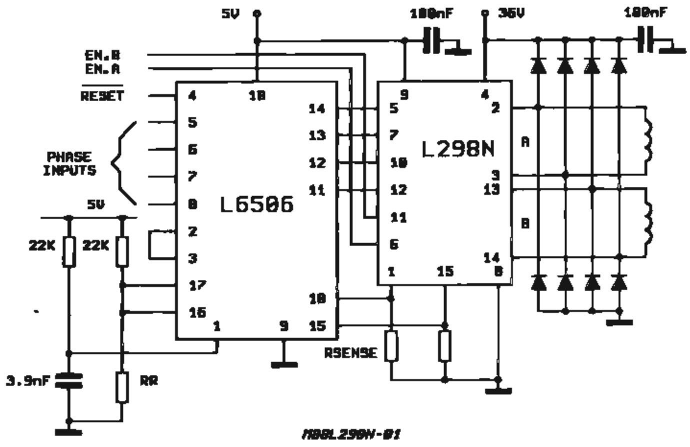


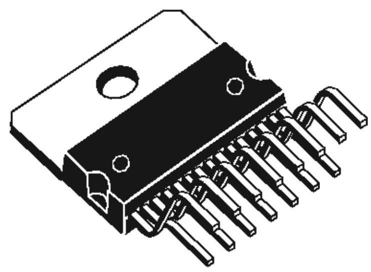
Figure10: TwoPhaseBipolarStepperMotorControlCircuitbyUsingtheCurrentControllerL6506.



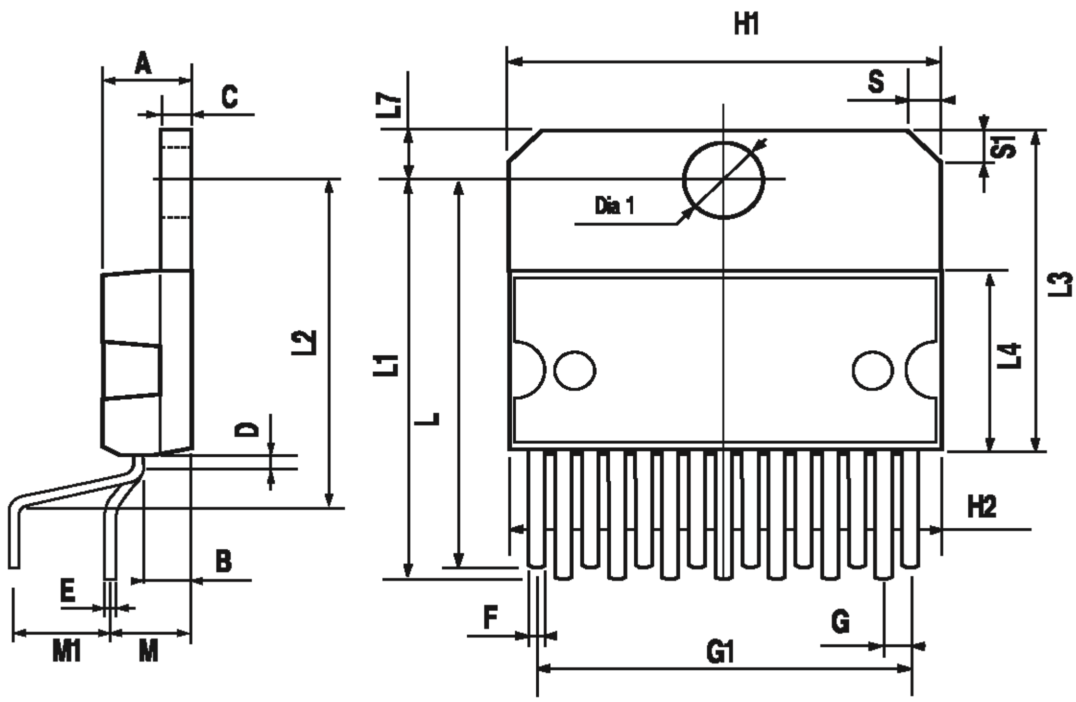
R_R and R_{sense} dependfromtheloadcurrent

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	1.02	1.27	1.52	0.040	0.050	0.060
G1	17.53	17.78	18.03	0.690	0.700	0.710
H1	19.6			0.772		
H2			20.2			0.795
L	21.9	22.2	22.5	0.862	0.874	0.886
L1	21.7	22.1	22.5	0.854	0.870	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	4.25	4.55	4.85	0.167	0.179	0.191
M1	4.63	5.08	5.53	0.182	0.200	0.218
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

OUTLINE AND MECHANICAL DATA

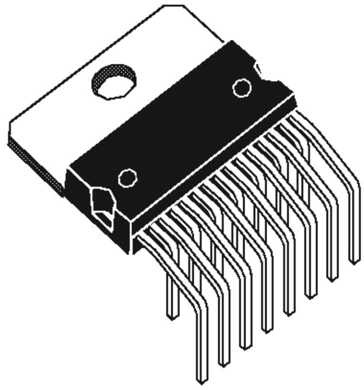


Multiwatt15V

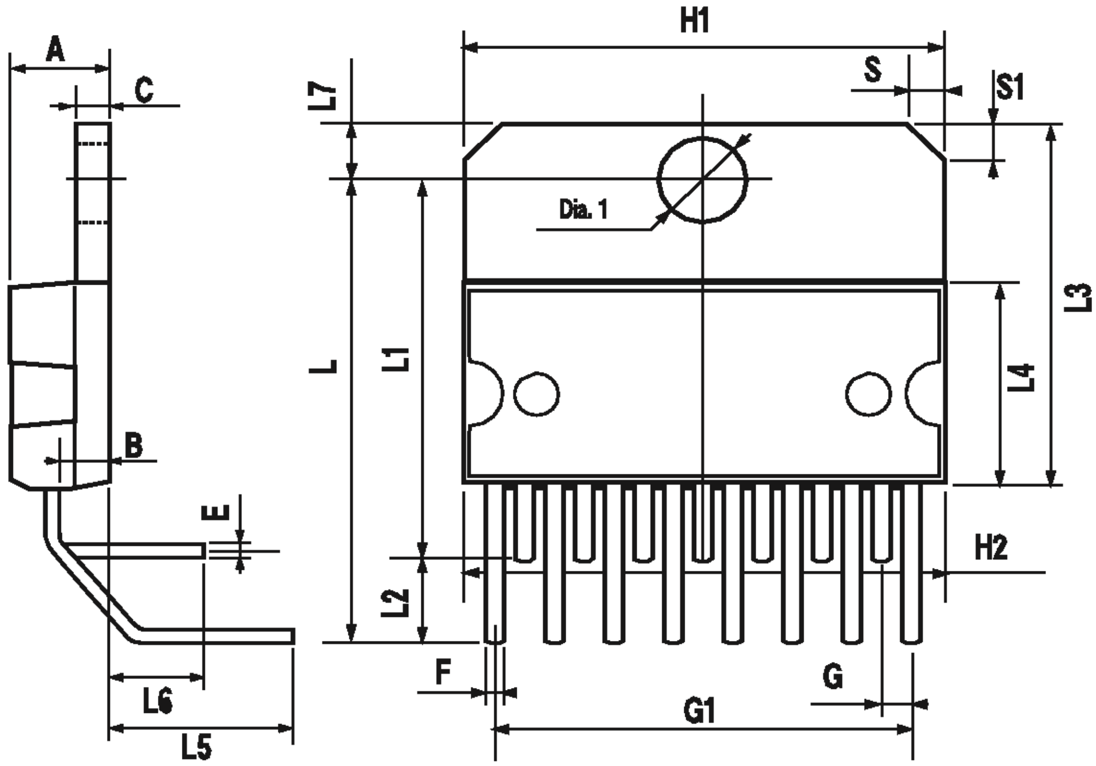


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
E	0.49		0.55	0.019		0.022
F	0.66		0.75	0.026		0.030
G	1.14	1.27	1.4	0.045	0.050	0.055
G1	17.57	17.78	17.91	0.692	0.700	0.705
H1	19.6			0.772		
H2			20.2			0.795
L		20.57			0.810	
L1		18.03			0.710	
L2		2.54			0.100	
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
L5		5.28			0.208	
L6		2.38			0.094	
L7	2.65		2.9	0.104		0.114
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

OUTLINE AND MECHANICAL DATA



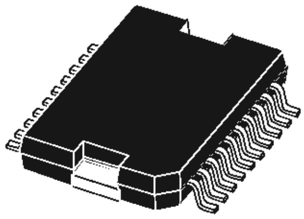
Multiwatt15H



DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			3.6			0.142
a1	0.1		0.3	0.004		0.012
a2			3.3			0.130
a3	0		0.1	0.000		0.004
b	0.4		0.53	0.016		0.021
c	0.23		0.32	0.009		0.013
D(1)	15.8		16	0.622		0.630
D1	9.4		9.8	0.370		0.386
E	13.9		14.5	0.547		0.570
e		1.27			0.050	
e3		11.43			0.450	
E1(1)	10.9		11.1	0.429		0.437
E2			2.9			0.114
E3	5.8		6.2	0.228		0.244
G	0		0.1	0.000		0.004
H	15.5		15.9	0.610		0.626
h			1.1			0.043
L	0.8		1.1	0.031		0.043
N	10° (max.)					
S	8° (max.)					
T		10			0.394	

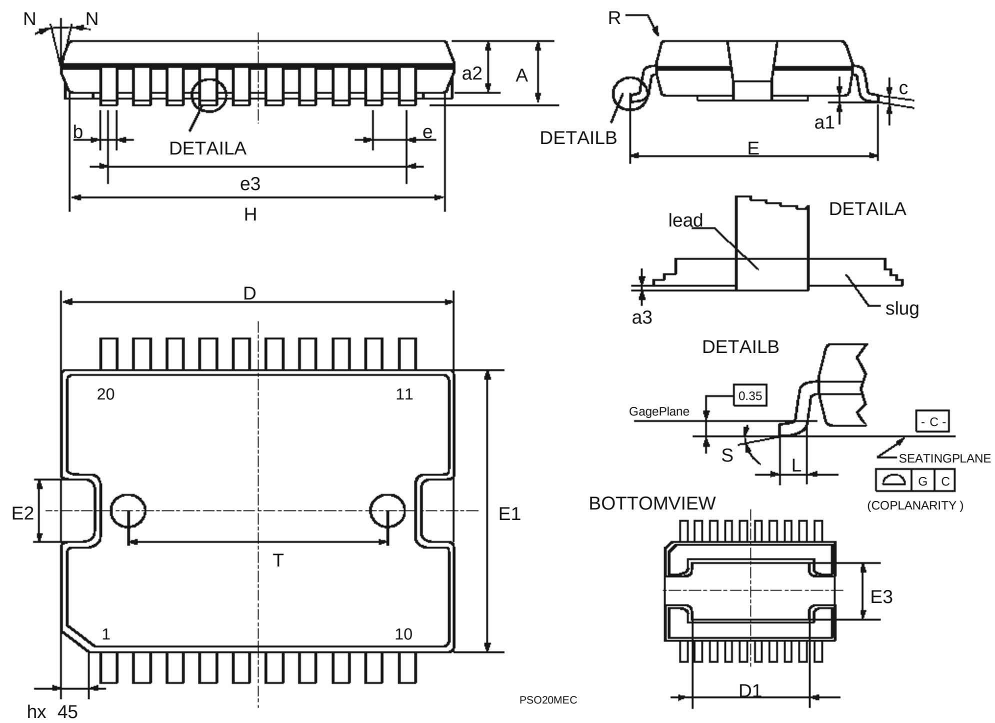
(1) ”DandF”donotincludemoldflashorprotrusions.
- Moldflashorprotrusionsshallnotexceed0.15mm(0.006”).
- Criticaldimensions:”E”,”G”and”a3”

OUTLINEAND MECHANICALDATA



JEDECMO-166

PowerSO20



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