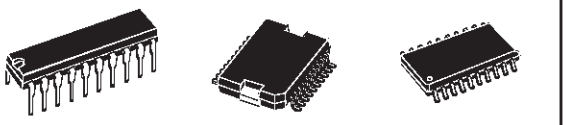
L6225

DUAL DMOS FULL BRIDGE MOTOR DRIVER

PRELIMINARY DATA

- OPERATING SUPPLY VOLTAGE FROM 8 TO 52V
- 2.8A PEAK CURRENT (1.4A DC)
- $R_{DS\ (ON)}$ 0.73Ω TYP. VALUE @ T_j = 25 °C
- CROSS CONDUCTION PROTECTION
- THERMAL SHUTDOWN
- OPERATING FREQUENCY UP TO 100KHz
- HIGH SIDE OVER CURRENT PROTECTION
- CMOS/TTL INPUT
- INTRINSIC FAST FREE WHEELING DIODES
- UNDER VOLTAGE LOCKOUT



PowerDIP20 (16+2+2)	PowerSO20	SO20 (16+2+2)

ORDERING NUMBERS:

L6225N	L6225PD	L6225D

TYPICAL APPLICATIONS

- STEPPER MOTOR
- DUAL OR QUAD DC MOTOR

DESCRIPTION

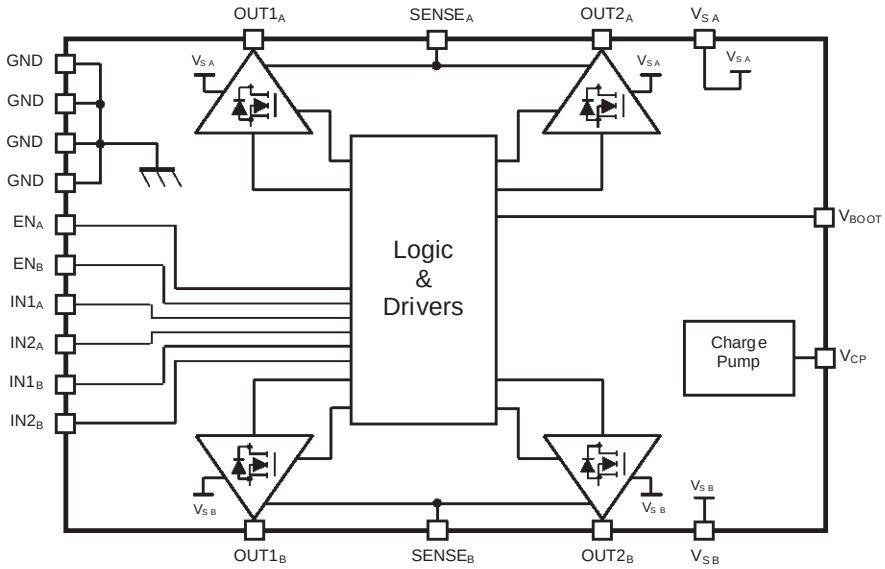
The L6225 is a dual full bridge driver for motor control applications manufactured with Multipower BCD technology which combines isolated DMOS power transistors with CMOS and bipolar circuits on the same chip.

The Logic Inputs are CMOS/TTL and µP compatible. The High Side switches are protected against unsafe over current conditions.

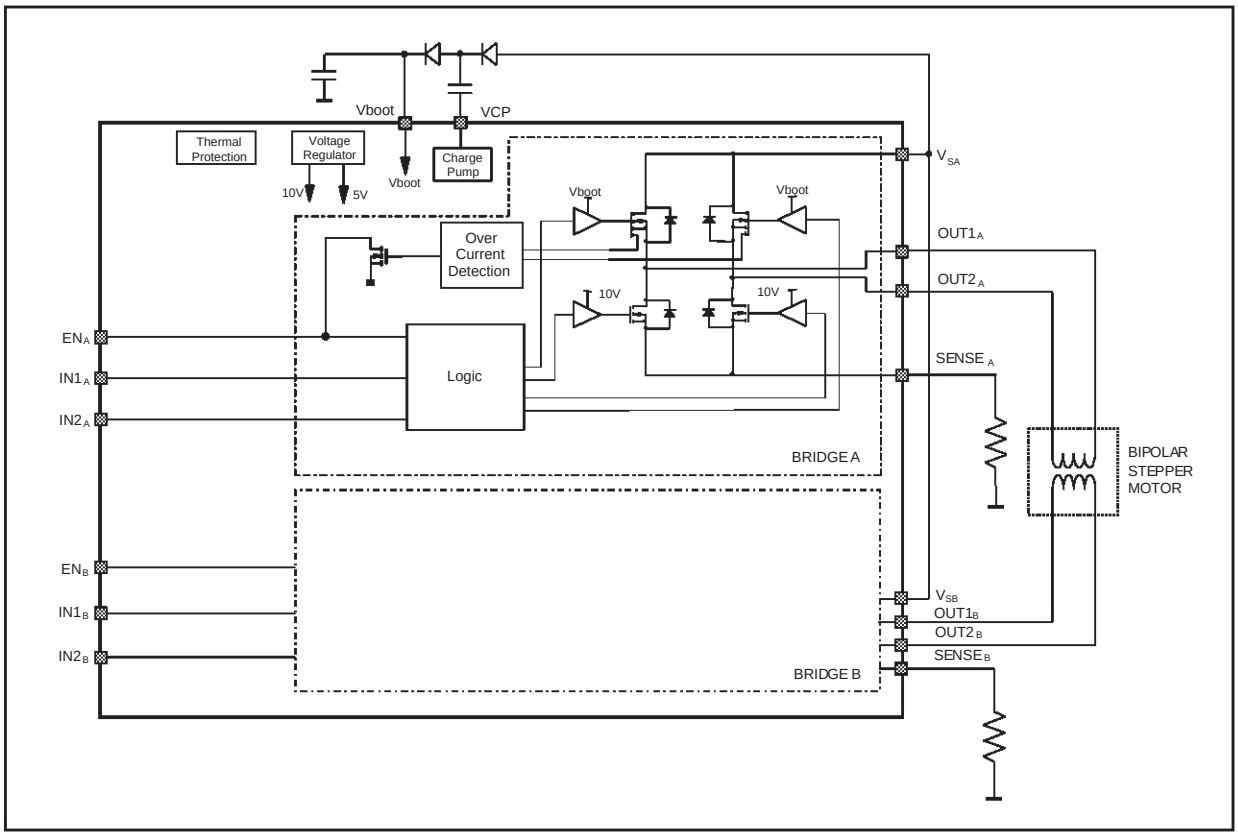
Each full bridge is controlled by a separate Enable and has a sense pin for the current sense resistor insertion. Another feature is the thermal shutdown.

The L6225 is assembled in PowerDIP20(16+2+2), PowerSO20 and SO20(16+2+2) packages.

BLOCK DIAGRAM



FUNCTIONAL BLOCK DIAGRAM



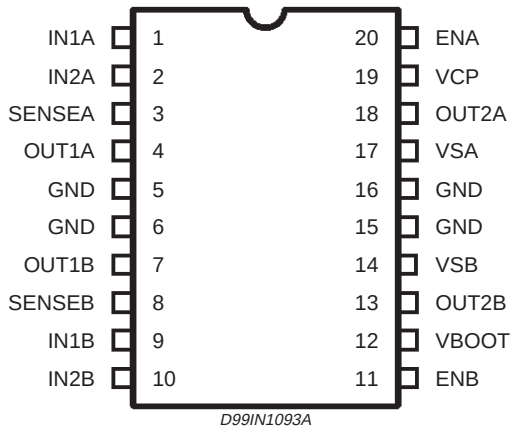
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Test conditions	Value	Unit
V_S	Supply Voltage		60	V
V_{IN},V_{EN}	Input and Enable Voltage Range		-0.3 to +7	V
V_{SENSE}	DC Sensing Voltage Range		-1 to +4	V
V_{BOOT}	Bootstrap Peak Voltage		V_S + 10	V
$I_{S(peak)}$	Pulsed Supply Current (for each V_S pin), internally limited by the overcurrent protection	t_{PULSE} < 1ms	3.55	A
I_S	DC Supply Current (for each V_S pin)		1.4	A
V_{OD}	Differential Voltage Between $V_{S\,A}$, $OUT1_A$, $OUT2_A$, $SENSE_A$ and $V_{S\,B}$, $OUT1_B$, $OUT2_B$, $SENSE_B$		60	V
T_{stg}, T_{OP}	Storage and Operating Temperature Range		-40 to 150	°C

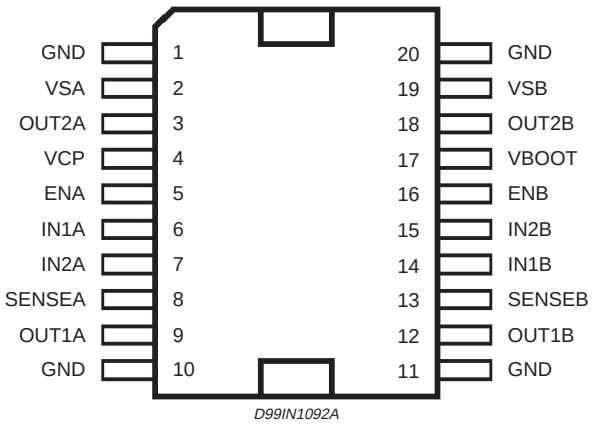
RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	MIN	MAX	Unit
V_S	Supply Voltage	12	52	V
V_{OD}	Differential Voltage Between $V_{S\,A}$, $OUT1_A$, $OUT2_A$, $SENSE_A$ and $V_{S\,B}$, $OUT1_B$, $OUT2_B$, $SENSE_B$		52	V
V_{SENSE}	Sensing voltage (pulsed tw<t_{rr}) (DC)	-6 -1	6 1	V V
V_{ref}	V_{ref} Operating Voltage	-0.1	5	V
I_{OUT}	DC Output Current		1.4	A
T_j	Operating Junction Temperature	-25	+125	°C
f_{sw}	Switching Frequency		100	kHz

PIN CONNECTION (Top View)



PowerDIP20/SO20



PowerSO20

PIN DESCRIPTION

Name	PowerSO20	PowerDIP20/ SO20	Function
V_{SA}	2	17	Supply Voltage of the Bridge A.
V_{SB}	19	14	Supply Voltage of the Bridge B. This pin must be connected to V_{SA}.
$OUT1_A$ $OUT2_A$	9 3	4 18	Bridge A outputs.
$OUT1_B$ $OUT2_B$	12 18	7 13	Bridge B outputs.
$SENSE_A$	8	3	Sense resistor for the bridge A
$SENSE_B$	13	8	Sense resistor for the bridge B
GND	1,10,11,20	5, 6,15,16	Common ground terminals. In Powerdip and SO packages, these pins are also used for heat dissipation toward the PCB.
EN_A	5	20	Enable of the Bridge A. A LOW logic level applied to this pin switches off all the power DMOSs of the related bridge. The Bridge A over current protection open drain is internally connected to this pin.
EN_B	16	11	Enable of the Bridge B. A LOW logic level applied to this pin switches off all the power DMOSs of the related bridge. The Bridge B over current protection open drain is internally connected to this pin.
$IN1_A$ $IN2_A$	6 7	1 2	Logic inputs of the Bridge B. Provided the ENA signal is HIGH, a HIGH logic level applied to any of these pins switches on the related high side power DMOS, while a logic LOW switches on the related low side power DMOS .
$IN1_B$ $IN2_B$	14 15	9 10	Logic inputs of the Bridge B. Provided the ENB signal is HIGH, a HIGH logic level applied to any of these pins switches on the related high side power DMOS, while a logic LOW switches on the related low side power DMOS .
V_{CP}	4	19	Bootstrap Oscillator. Oscillator output for the external charge pump.
V_{BOOT}	17	12	Supply voltage to overdrive the upper DMOSs.

THERMAL DATA

Symbol	Description	PowerDIP20	SO20	PowerSO20	Unit
$R_{th\text{-}j\text{-}pins}$	MaximumThermal Resistance Junction-Pins	13	15	-	°C/W
$R_{th\text{-}j\text{-}case}$	Maximum Thermal Resistance Junction-Case	-	-	2	°C/W
$R_{th\text{-}j\text{-}amb1}$	MaximumThermal Resistance Junction-Ambient (1)	41	51	-	°C/W
$R_{th\text{-}j\text{-}amb1}$	Maximum Thermal Resistance Junction-Ambient (2)	-	-	36	°C/W
$R_{th\text{-}j\text{-}amb1}$	MaximumThermal Resistance Junction-Ambient (3)	-	-	16	°C/W
$R_{th\text{-}j\text{-}amb2}$	Maximum Thermal Resistance Junction-Ambient (4)	57	78	63	°C/W

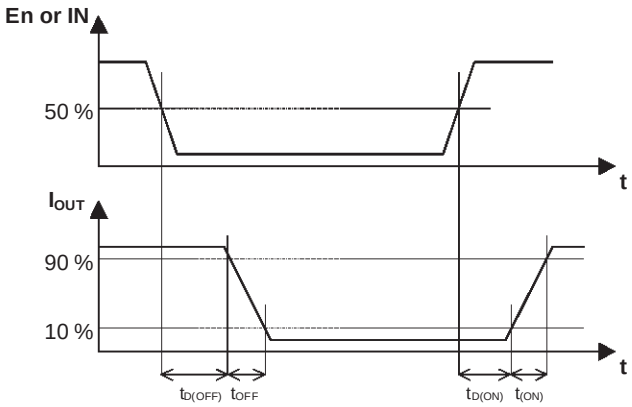
(1) Mounted on a multilayer FR4 PCB with a dissipating copper surface on the bottom side of 6 cm^2 (with a thickness of 35 µm).
(2) Mounted on a multilayer FR4 PCB with a dissipating copper surface on the top side of 6 cm^2 (with a thickness of 35 µm).
(3) Mounted on a multilayer FR4 PCB with a dissipating copper surface on the top side of 6 cm^2 (with a thickness of 35 µm), 16 via holes and a ground layer.
(4) Mounted on a multiplayer PCB without any heatsinking surface on the board.

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, V_S = 48V, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_S	Supply Voltage		8		52	V
I_S	Quiescent Supply Current	All Bridges OFF; -25°C<T_j < 125 °C		5.5	10	mA
T_j	Thermal Shutdown Temperature		150			°C
Output DMOS Transistors						
I_{DSS}	Leakage Current	V_S = 52V			1	mA
$R_{DS(ON)}$	High-side + Low-side Switch ON Resistance	T_j = 25 °C		1.47	1.69	Ω
		T_j =125 °C		2.35	2.7	Ω
Source Drain Diodes						
V_{SD}	Forward ON Voltage	I_{SD} = 1.4A, EN = LOW			1.2	V
t_{rr}	Reverse Recovery Time	I_f = 1.4A		300		ns
t_{fr}	Forward Recovery Time			200		ns
Switching Rates						
$t_{D(on)EN}$	Enable to out turn ON delay time (5)	I_{LOAD} = 1.4 A		250		ns
$t_{D(on)IN}$	Input to out turn ON delay time (5)			600		ns
t_{ON}	Output rise time(5)		20	105	300	ns
$t_{D(off)EN}$	Enable to out turn OFF delay time(5)			450		ns
$t_{D(off)IN}$	Input to out turn OFF delay time (5)			500		ns
t_{off}	Output fall time(5)		20	78	300	ns
t_{dt}	Dead time protection			1		µs
f_{CP}	Charge pump frequency			0.75	1	MHz
UVLO comp						
$V_{th(ON)}$	Turn ON threshold		6.6	7	7.4	V
$V_{th(OFF)}$	Turn OFF threshold		5.6	6	6.4	V
Logic Input						
V_{INL}	Low level logic input voltage		-0.3		0.8	V
V_{INH}	High level logic input voltage		2		7	V
I_{INH}	High level logic input current	$V_{IN, EN}$ = 5 V			70	µA
I_{INL}	Low level logic input current	$V_{IN, EN}$ = GND			-10	µA
Over Current Protection						
$I_{S\ OVER}$	Input supply over current protection threshold		2	2.8	3.55	A
V_{DIAG}	Open drain low level output voltage	I = 4 mA			0.4	V

(5) Resistive load used. See Fig. 1.

Figure 1. Switching rates definition



CIRCUIT DESCRIPTION

The L6225 is a dual full bridge IC designed to drive DC or stepper motors and other inductive loads. Each bridge has 4 power DMOS transistors with a typical $R_{DS(ON)}$ of 0.3 Ohm. Any of the 4 half bridges can be controlled independently by means of the 4 TTL/CMOS compatible inputs $IN1_A$, $IN2_A$, $IN1_B$, $IN2_B$, and 2 enable ENA, ENB .

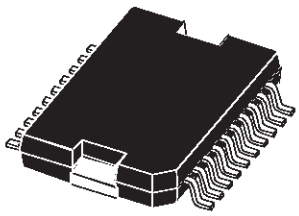
External connections are provided so that sensing resistor can be added for constant current chopping application.

A non dissipative current sensing on the supply rails of the high side power DMOSs of each bridge, an internal reference and an internal open drain, with a pull down capability of 4mA (typical value), will pull to GND the ENABLE pin of the bridge under fault conditions, turning OFF all the four PowerDMOSs. This ensures a protection against short circuit to GND and between two phases of each of the two independent full bridges. By using an external R-C on the EN pins, the off time before recovering normal operation conditions after a fault can be easily programmed, by means of the accurate threshold of the logic inputs. Note that protection against short to the supply rail is typically provided by the external current control circuitry. The trip point of this protection is set at 2.8A (typ value).

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	

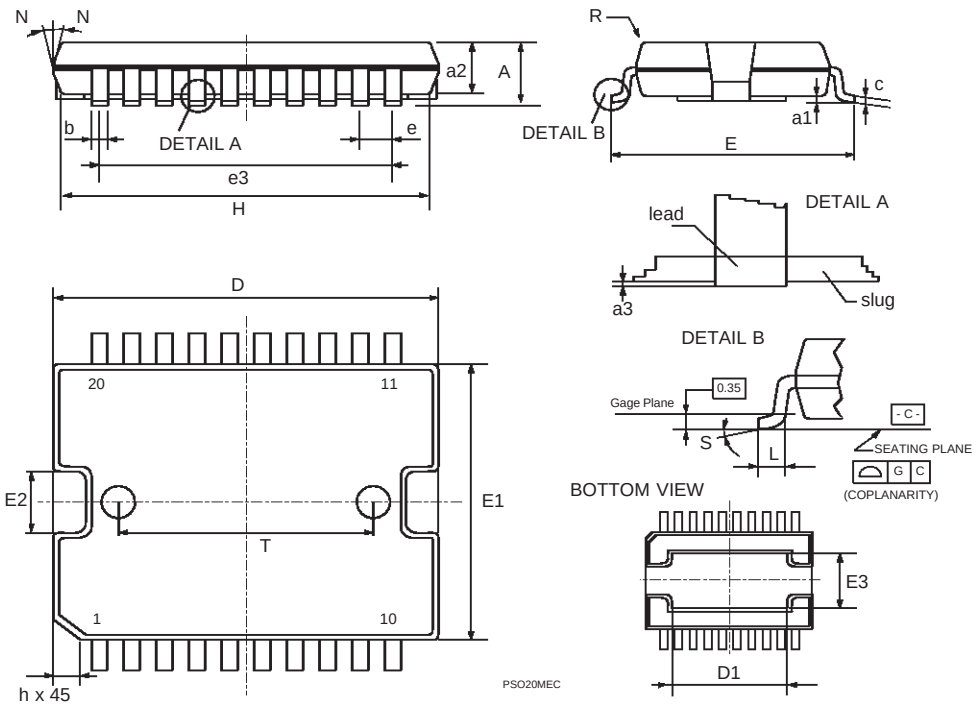
(1) "D and F" do not include mold flash or protrusions.
- Mold flash or protrusions shall not exceed 0.15 mm (0.006").
- Critical dimensions: "E", "G" and "a3"

OUTLINE AND MECHANICAL DATA



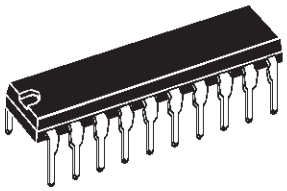
JEDEC MO-166

PowerSO20

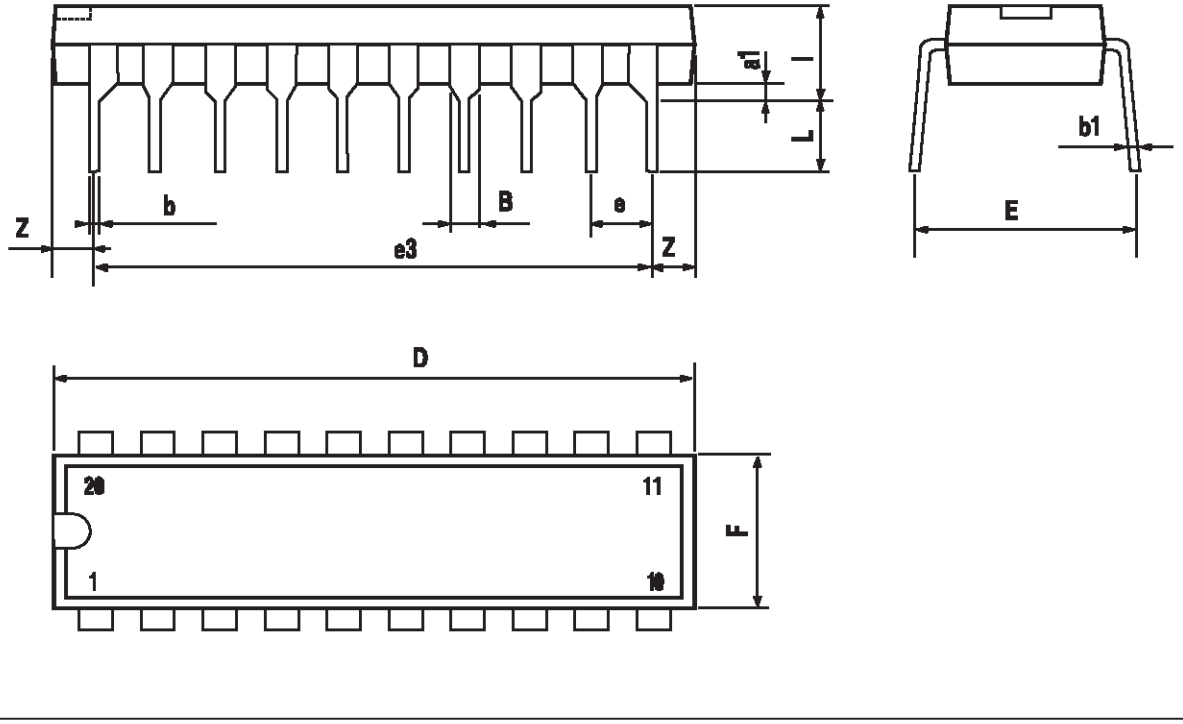


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.85		1.40	0.033		0.055
b		0.50			0.020	
b1	0.38		0.50	0.015		0.020
D			24.80			0.976
E		8.80			0.346	
e		2.54			0.100	
e3		22.86			0.900	
F			7.10			0.280
I			5.10			0.201
L		3.30			0.130	
Z			1.27			0.050

OUTLINE AND MECHANICAL DATA

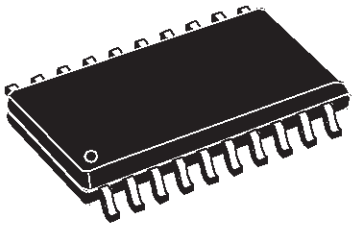


Powerdip 20



DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.35		2.65	0.093		0.104
A1	0.1		0.3	0.004		0.012
B	0.33		0.51	0.013		0.020
C	0.23		0.32	0.009		0.013
D	12.6		13	0.496		0.512
E	7.4		7.6	0.291		0.299
e		1.27			0.050	
H	10		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
L	0.4		1.27	0.016		0.050
K	0° (min.)8° (max.)					

OUTLINE AND MECHANICAL DATA



SO20