SGS-THOMSON MICROELECTRONICS

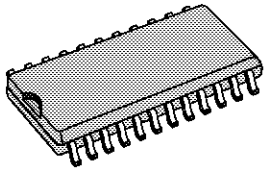
L9326

DUAL INTELLIGENT POWER LOW SIDE SWITCH

PRODUCT PREVIEW

- DUAL POWER LOW SIDE DRIVER WITH LOW R_{DSON} TYPICALLY 250mΩ (T_J = 25°C)
- INTERNAL OUTPUT CLAMPING DIODES V_{FB} = 50V FOR INDUCTIVE RECIRCULATION
- LIMITED OUTPUT VOLTAGE SLEW RATE FOR LOW EMI
- µP COMPATIBLE ENABLE AND INPUT
- WIDE OPERATING SUPPLY VOLTAGE RANGE 6.5V TO 40V
- REAL TIME DIAGNOSTIC FUNCTIONS:
  - OUTPUT SHORTED TO GND
  - OUTPUT SHORTED TO VSS
  - OPEN LOAD
  - OVERTEMPERATURE
- DEVICE PROTECTION FUNCTIONS
  - OVERLOAD DISABLE
  - THERMAL SHUTDOWN

MULTIPOWER BCD TECHNOLOGY



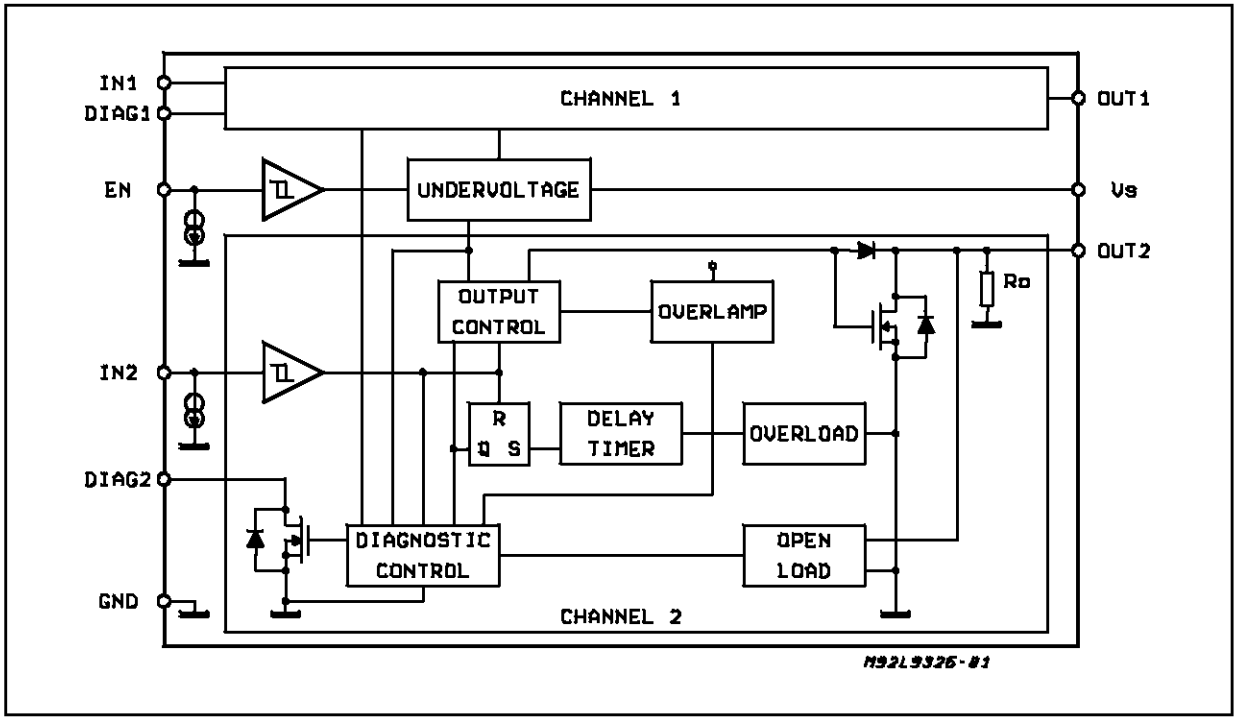
SO24 (16+4+4)

ORDERING NUMBER: L9326

DESCRIPTION

The L9326 is a monolithic integrated dual low side driver realized in an advanced Multipower-BCD mixed technology. It is especially intended to drive valves in automotive enviroment. Its inputs are µP compatible for easy driving. Particular care has been taken to protect the device against failures, to avoid electro-magnetic interferences and to offer extensive real time diagnostic.

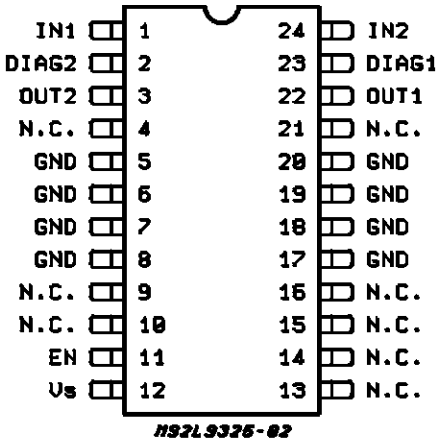
BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{SDC}	DC Supply Voltage	– 1.5 to 40	V
VS_{TR}	Transient Supply Voltage $t \leq 500ms$	60	V
VIN,EN	Input Voltage |10mA|	– 1.5 to 6	V
I_O	Output Load Current	internal limited	
VO_{DC}	DC Output Voltage	45	V
VO_{TR}	Transient Output Voltage $R_L \geq 4\Omega$	60	V
IOR	Reverse Output Current (limited by load)	– 4	A
UD_{DC}	Diagnostic DC Output Voltage	– 0.3 to 20	V
EO	Switch-off energy t_{EO} = 250ms, t = 5ms	50	mJ
T_{jEO}	Junction Temperature during Switch-off	175	°C
T_j	Junction Temperature	– 40 to +150	°C
T_{stg}	Storage Temperature	– 55 to +150	°C

PIN CONNECTION (Top view)



THERMAL DATA

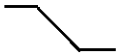
Symbol	Parameter	Value	Unit
T_{jDIS}	Thermal Disable Junction Temperature Threshold	160 to 190	°C

ELECTRICAL CHARACTERISTICS (Operating range: 6.5V < VS ≤ 32V (45V for t ≤ 500ms), – 40°C ≤ T_J ≤ 150°C unless otherwise specified).

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
IO_u	Open Load Current	$V_{EN} = V_{IN} = H$	2.5	125	250	mA
VO_u	Open Load Voltage	V_{EN} = H, V_{EN} = L	0.525V_S	0.55V_S	0.575V_S	
IO_O	Over Load Current Threshold	$T_j \leq 150°C$	5			A
RO	Internal Output Pull Down	V_{EN} = L	14	20	36	kΩ
$V_{(EN,IN)L}$	Logic Input Low Voltage	VS > 4.5V $I_{EN,IN} \leq 10mA$	– 1.5		1	V
$V_{(EN,IN)H}$	Logic Input High Voltage	VS > 4.5V	2		5.5	V
$V_{(EN,IN)hys}$	Logic Input Hysteresis	VS > 4.5V	0.2	0.4		V
I_{EN}	Logic Input Sink Current	VS > 4.5V $0.5V \leq V_{EN} \leq 5.5V$	21	30	39	µA
I_{IN}	Logic Input Sink Current	VS > 4.5V $0.5V \leq V_{IN} \leq 5.5V$	70	100	130	µA
R_{DSON}	Output on Resistance	T_j = 150°C VS > 9.5V I_O = 2A		400	500	mΩ
VO_C	Output Voltage During Clamping		45	52	60	V
IS_{SB}	Static Standby Supply Current	V_{EN} = L		0.4	1	mA
IS	DC Supply Current	$V_{EN} = V_{IN}$ = H		0.4	5	mA
VD_L	Diagnostic Output Low Voltage	I_O = 2mA VS ≥ 4.5V			0.5	V
ID_{LE}	Diagnostic Output Leakage Current	VS = 0 or VS = Open; VD = 5.5V $T_j \leq 125°C$		0.1	10	µA
I_D	Diagnostic Output Current Capability	VD ≤ 20V DIAG = L		4		mA
t_{DOL}	Diagnostic Overload Delay Switch-off time	Fig. 1 IO > IO_o	50	100	200	µs
$S_{ON,OFF}$	Output (fall,rise) slew rate	Fig. 2 $R_L = 6Ω$	1000	1500	2000	V/ms
$t_{D\ ON}$		Fig.2			12.5	µs
$t_{D\ OFF}$	Output Delay Time	9V ≤ VS ≤ 16V	7.5		27.5	µs
$t_{D\ IOu}$	Open Load Diagnostic Delay Time	$R_L \leq 6Ω$			35	µs

DIAGNOSTIC TABLE

Operating Range: 6.5V < VS ≤ 32V (45V for t ≤ 500ms), – 40°C ≤ T_J ≤ 150°C

Conditions	EN	IN	Out	Diag
Normal Function	L H H	X L H	OFF OFF ON (*)	L L H
Over Load I_O > 5A	X	X	OFF	L
160°C < T_j ≤ 190°C Overtemperature	X X	L H	OFF OFF	H L
Open Load V_O < 0.6V I_O < 250mA	X L H	L H H	OFF OFF ON (*)	H H L
Reset Over Load Latch	X		D.C.	D.C.

(*) For VS < 6.5V, Out = Undefined

Figure 1: Diagnostic Overload Delay Time

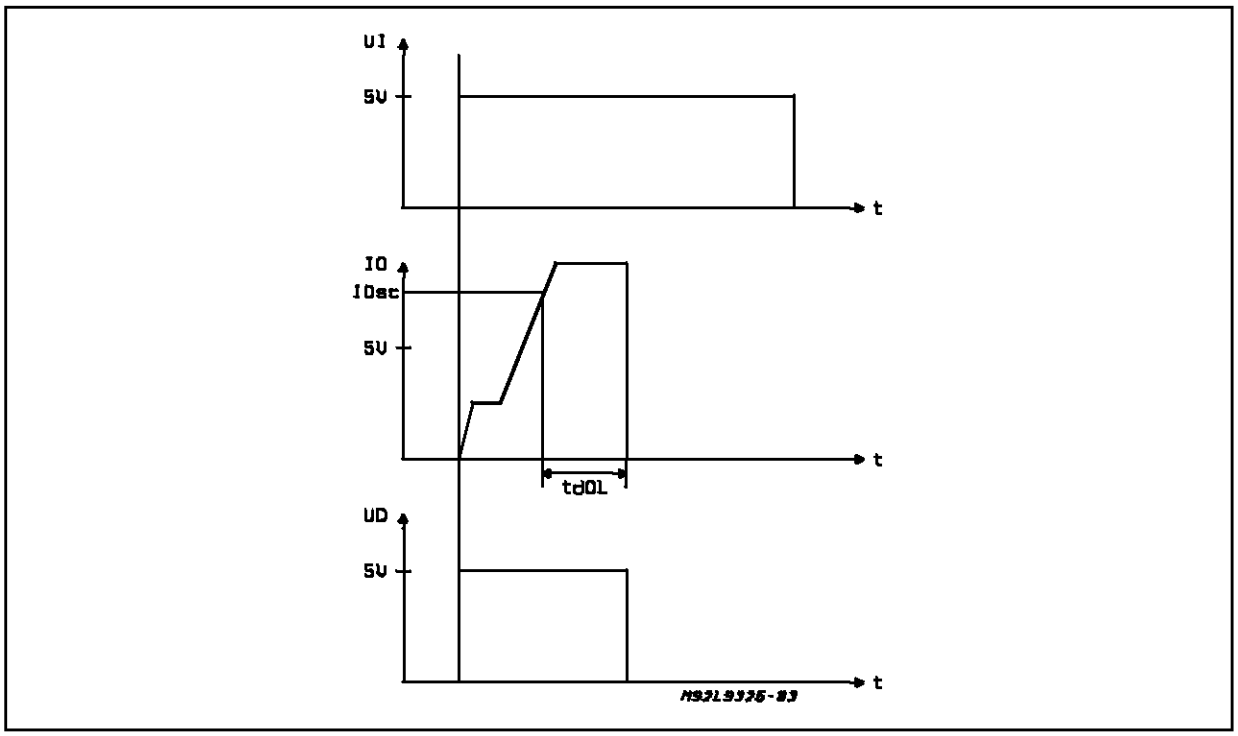


Figure 2: Output Slope

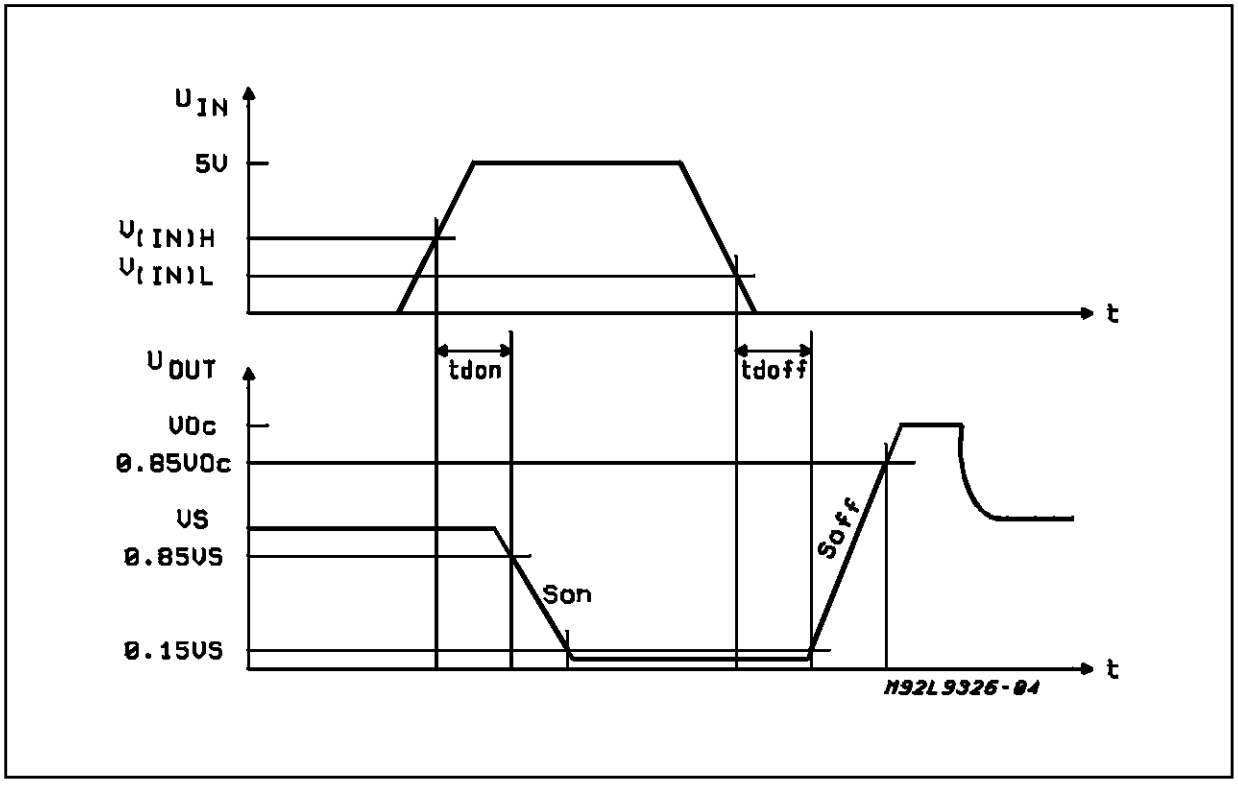
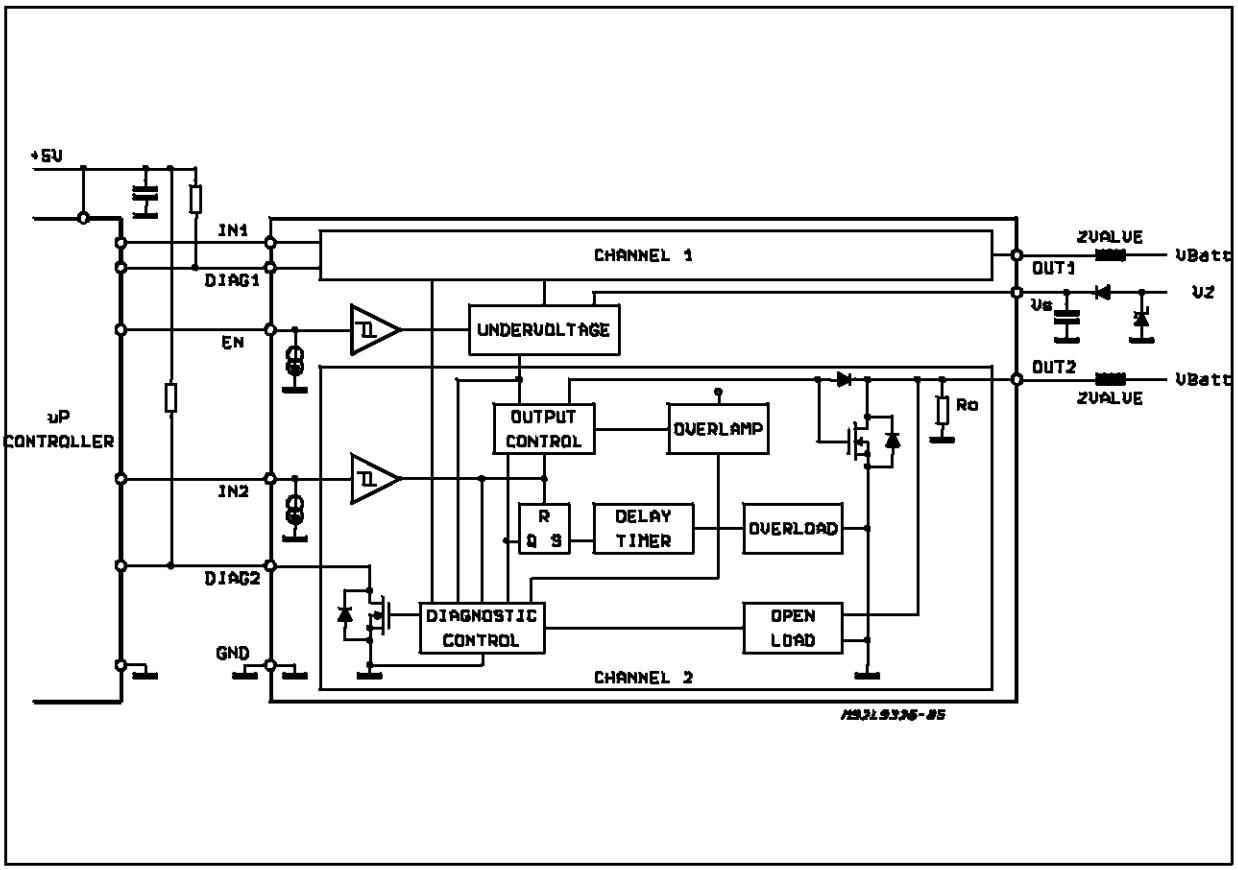


Figure 3: Application Circuit Diagram



CIRCUIT DESCRIPTION

The L9326 is a dual low side driver for inductive loads like valves in automotive enviroment. The device is enabled by a common CMOS compatible ENABLE high signal. The internal pull down resistances at the ENABLE and INPUT pins protect the device in open input conditions against malfunctions. An output slope limitation for du/dt is implemented to reduce the EMI. An integrated active flyback voltage limitation clamps the output voltage during the flyback phase to 50V.

Each driver is protected against short circuit condition [1] the output will be disabled after a short delay time tDOL to suppress spikes [2]. This disable is latched until a negative slope occure at the correspondent input pin. The Thermal disable of the output will be reseted if the junction temperature decreases below 160°C.

For the real time error diagnosis the voltage and the current of the output is compared with internal fixed values VO_u and IO_u to recognize open load ($R_L \geq 20\ K\Omega$) in ON anf OFF conditions.

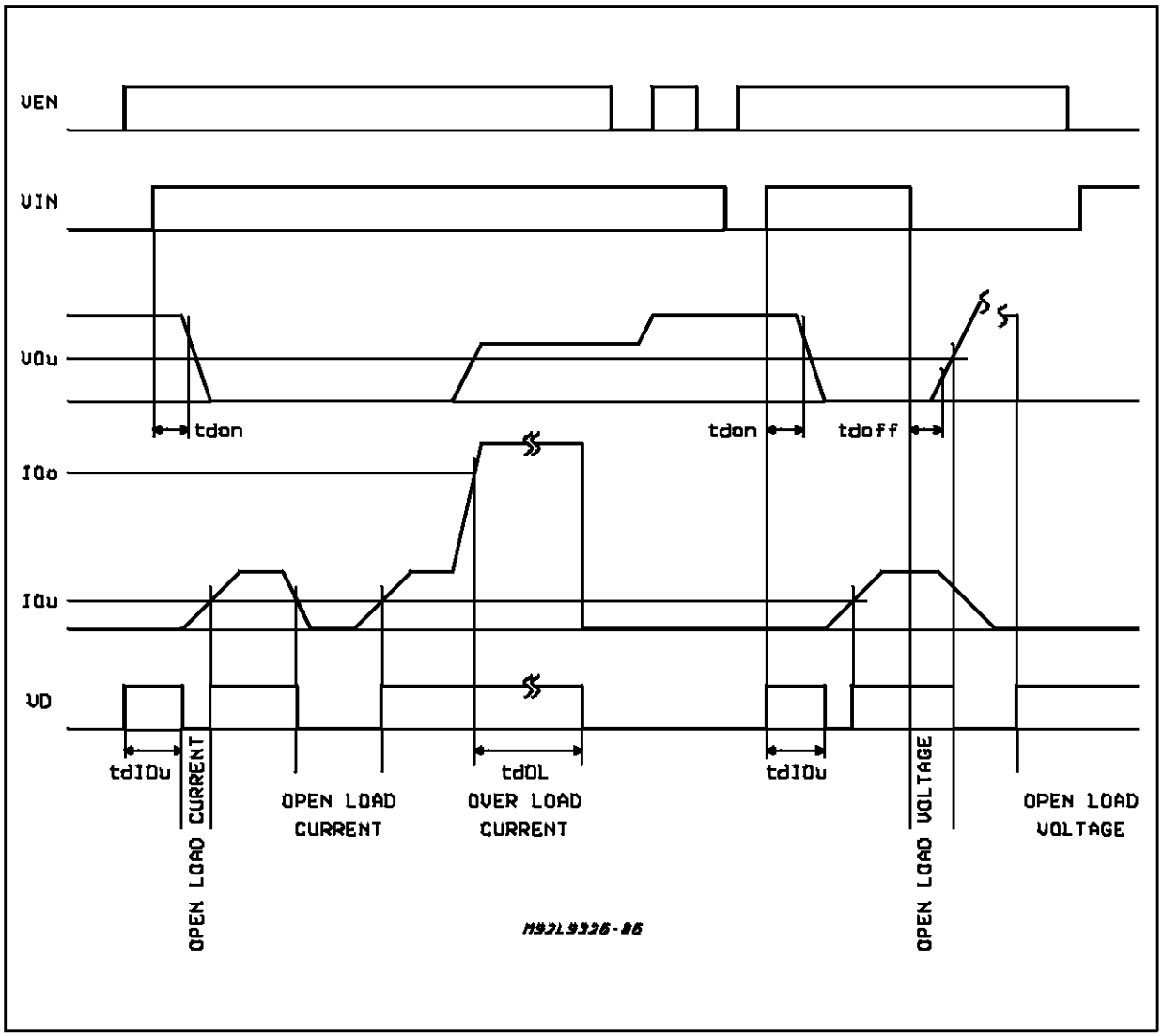
The diagnostic output level in connection with different ENABLE and INPUT conditions allows to recognize four different fail states, under voltage, over load, overtemp and open load.

The diagnostic output is also protected against short circuit up to UD_{max}.

1) overstepeing the over load current thereshold IO_o.

2) During the diagnostic overload delay switch-off time t_{DOL} the output current will be limited only by the R_{DSON} of the output.

Figure 4: Logic Diagram.



SO24 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.35		2.65	0.093		0.104
A1	0.10		0.30	0.004		0.012
A2			2.55			0.100
B	0.33		0.51	0.013		0.0200
C	0.23		0.32	0.009		0.013
D	15.20		15.60	0.598		0.614
E	7.40		7.60	0.291		0.299
e		1.27			0,050	
H	10.0		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
k	0° (min.), 8° (max.)					
L	0.40		1.27	0.016		0.050