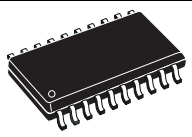


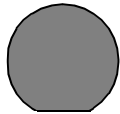
## QUAD LOW SIDE DRIVER

- WIDE OPERATING SUPPLY VOLTAGE RANGE FROM 4.5V UP TO 32V FOR TRANSIENT 45V
- VERY LOW STANDBY QUIESCENT CURRENT  $< 2\mu\text{A}$
- INPUT TO OUTPUT SIGNAL TRANSFER FUNCTION PROGRAMMABLE
- HIGH SIGNAL RANGE FROM -0.3V UP TO 32V FOR ALL INPUTS
- TTL AND CMOS COMPATIBLE INPUTS
- DEFINED OUTPUT OFF STATE FOR OPEN INPUTS
- FOUR OPEN DRAIN DMOS OUTPUTS, WITH  $R_{\text{DSon}} = 1.5\Omega$  FOR  $V_{\text{S}} > 6\text{V}$  AT  $25^\circ\text{C}$
- OUTPUT CURRENT LIMITATION
- CONTROLLED OUTPUT SLOPE FOR LOW EMI
- OVERTEMPERATURE PROTECTION FOR EACH CHANNEL
- INTEGRATED OUTPUT CLAMPING FOR FAST INDUCTIVE RECIRCULATION  $V_{\text{FB}} > 45\text{V}$

**MULTIPOWER BCD TECHNOLOGY**



**SO20 & SO20(12+4+4)**



**BARE DIE**

**ORDERING NUMBER:**

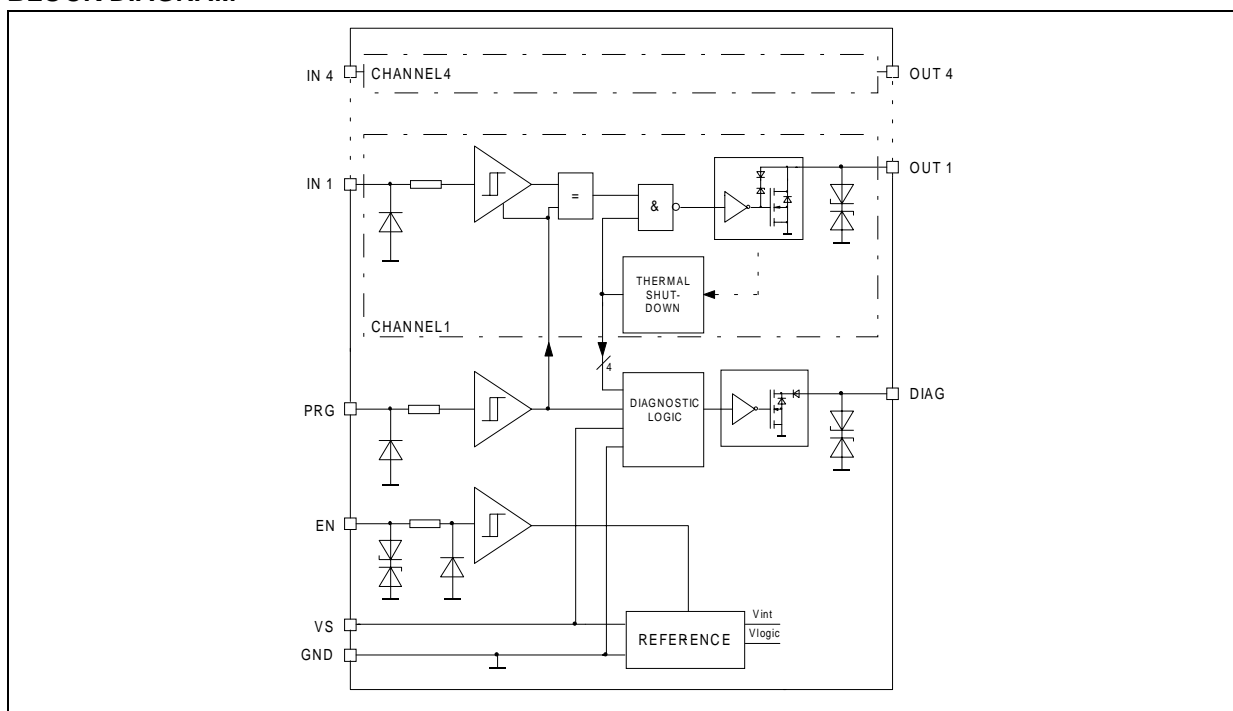
<b>L9339MD</b>	(SO20 12+4+4)
<b>L9339</b>	(SO20)
<b>L9339DIE1</b>	(BARE DIE)

- STATUS MONITORING FOR
  - OVERTEMPERATURE
  - DISCONNECTED GROUND OR SUPPLY VOLTAGE

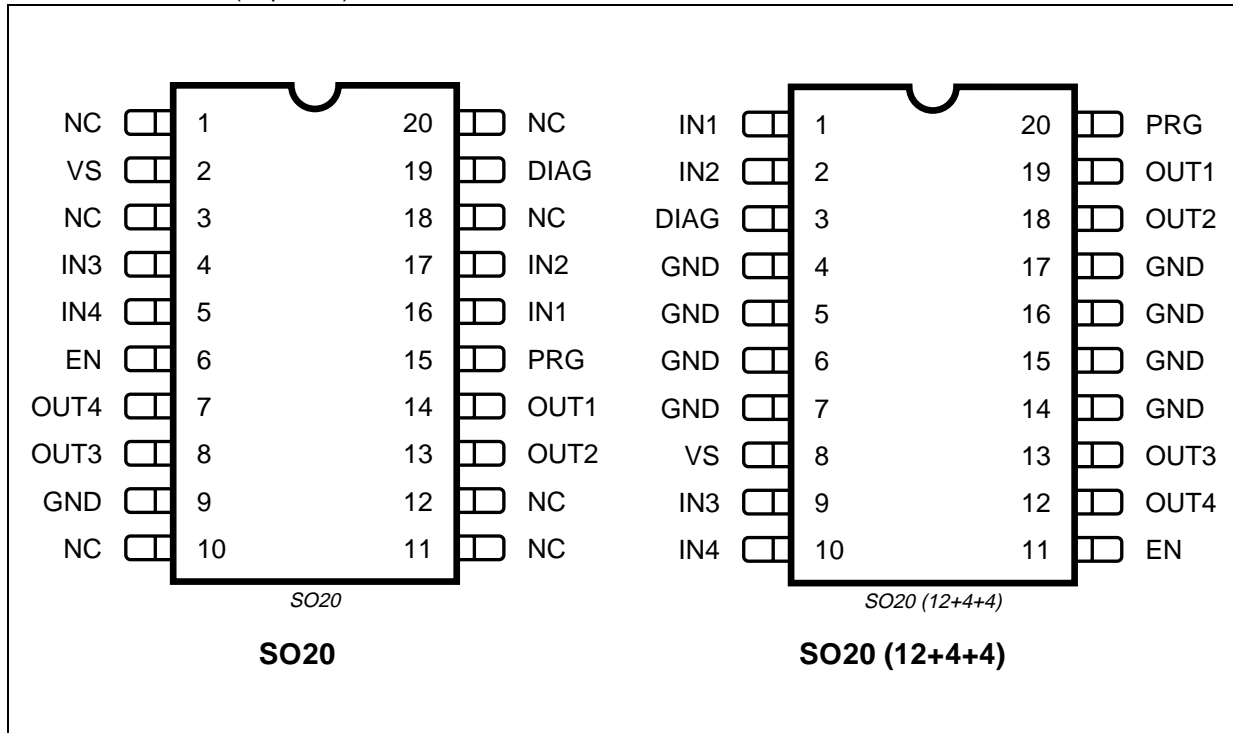
### DESCRIPTION

The L9339 is a monolithic integrated quad low side driver. It is intended to drive lines, lamps or relays in automotive or industrial applications.

### BLOCK DIAGRAM



**PIN CONNECTION** (Top view)



**PIN FUNCTION**

Pin Name	Description	Package	
		SO 20	SO 20 (SO 12+4+4)
VS	Supply Voltage	2	8
GND	Ground	9	4, 5, 6, 7, 14, 15, 16, 17
EN	Enable	6	11
PRG	Programing	15	20
DIAG	Diagnostic	19	3
IN 1	Input 1	16	1
IN 2	Input 2	17	2
IN 3	Input 3	4	9
IN 4	Input 4	5	10
OUT 1	OUTPUT 1	14	19
OUT 2	OUTPUT 2	13	18
OUT 3	OUTPUT 3	8	13
OUT 4	OUTPUT 4	7	12
NC	Not Connected	1,3,10,11,12,18,20	-

**ABSOLUTE MAXIMUM RATINGS** (no damage or latch)

Symbol	Parameter	Value	Unit
V <sub>S</sub>	Supply voltage	DC	-0.3 ... 32
	Supply voltage	Pulse (T ≤ 400ms)	-0.3 ... 45
dV <sub>S</sub> /dt	Supply voltage transient	-10 ... +10	V/μs
V <sub>IN</sub> , V <sub>PRG</sub>	Input, Programming	DC voltage	-0.3 ... 32
	Input, Programming	Pulse (T ≤ 400ms)	-0.3 ... 45
I <sub>IN</sub>	Negative input current	-10	mA
V <sub>EN</sub>	Enable voltage	DC	-24 ... 32
	Enable voltage	Pulse (T ≤ 400ms)	-24 ... 45
V <sub>OUT</sub>	Output voltage	-0.3 ... 45 <sup>1)</sup>	V
I <sub>OUT</sub>	Negative output current	-1	A
	Positive output current	internal limited	
V <sub>DIAG</sub>	Diagnostic output voltage	DC	-0.3 ... 32
	Diagnostic output voltage	Pulse (T ≤ 400ms)	-0.3 ... 45

Notes: 1. In flyback phase the output voltage can reach 60V.

ESD according to MIL 883C; tested at 2KV; corresponds to maximum energy dissipation 0.2mJ.

**THERMAL DATA**

Symbol	Parameter	Min.	Typ.	Max.	Unit.
T <sub>JSDon</sub>	Temperature shutdown switch-on-threshold	160		200	°C
T <sub>JSDoff</sub>	Temperature shutdown switch-off-threshold	140		180	°C

**SO 12+4+4**

R <sub>th j-pin</sub>	Thermal resistance junction to pins			15	°C/W
R <sub>th j-amb</sub>	Thermal resistance junction to ambient <sup>2)</sup>			50	°C/W

**SO 20**

R <sub>th j-amb</sub>	Thermal resistance junction to ambient <sup>3)</sup>			97	°C/W
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2. With 6cm<sup>2</sup> on board heat sink area.

3. Mounted on SMPCB2 board

**ELECTRICAL CHARACTERISTICS**

The electrical characteristics are valid within the below defined Operating Conditions, unless otherwise specified. The function is guaranteed by design until  $T_{JSDon}$  switch-on-threshold.

- $V_S$  Supply voltage 4.5 V to 32 V
  - $T_j$  Junction temperature -40 °C to 150 °C
  - $T_{amb}$  Ambient Temperature -40 °C to 125 °C
- Note: Ambient test temperature = -40 °C to 125 °C

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
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**SUPPLY:**

$I_Q$	Quiescent current	$-0.3V \leq V_{EN} \leq 0.5V; V_S = 14 V; T_a \leq 125 \text{ }^\circ\text{C}$		<2	10	$\mu\text{A}$
		$-0.3V \leq V_{EN} \leq 0.5V; V_S = 14 V; T_a \leq 150 \text{ }^\circ\text{C}$			50	$\mu\text{A}$
		$V_{EN} \geq 3.2V; V_S \leq 14V$		1.5	2	mA

**Inputs, IN1 - IN4; Programming, PRG:**

$V_{INlow}$	Input voltage LOW		-0.3		2.0	V
$V_{INhigh}$	Input voltage HIGH		2.8		32	V
$I_{IN}$	Input current	$V_{IN} = 0 \dots 32V$	-15		25	$\mu\text{A}$

**Enable EN:**

$V_{ENlow}$	Input voltage LOW		-24		1	V
$V_{ENhigh}$	Input voltage HIGH		3.2		$V_S$	V
$R_{EN}$	Input impedance	$-24 V < V_{IN} < 2.5 V$	10			k $\Omega$
$I_{EN}$	Input current	$2.5 V \leq V_{IN} \leq 32V$		20	80	$\mu\text{A}$

**Outputs OUT1- OUT4**

$R_{Dson}$	Output ON-resistor	$V_S \geq 6V, I_O = 0.3A$		1.7	3.8	$\Omega$
$I_{OLeak}$	Leakage current	$V_O=V_S = 14 V; T_a \leq 125 \text{ }^\circ\text{C}$		$\leq 1$	5	$\mu\text{A}$
		$V_O=V_S = 14 V; T_a \leq 150 \text{ }^\circ\text{C}$			25	$\mu\text{A}$
$V_{Oclamp}$	Output voltage during clamping	time < 200 $\mu\text{s}$ $10 \text{ mA} \leq I_O \leq 0.3 \text{ A}$	45	52	60	V
$I_{OSC}$	Short-circuit current	$4.5V \leq V_S \leq 6V$	0.3		1	A
		$V_S > 6V$	0.4	0.7	1	A
$C_O$	internal output capacities	$V_O \geq 4.5V$			100	pF

**Diagnostic Output DIAG**

$V_{Dlow}$	Output voltage LOW	$I_{DL} \leq 0.6\text{mA}$			1.3	V
$I_{Dmax}$	Max. output current	internal current limitation $V_D = 14V$	1	5	15	mA

## ELECTRICAL CHARACTERISTICS (Continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$I_{DLeak}$	Leakage current	$V_D = V_S = 14\text{ V}; T_a \leq 125\text{ }^\circ\text{C}$		$\leq 0.1$	1	$\mu\text{A}$
		$V_D = V_S = 14\text{ V}; T_a \leq 150\text{ }^\circ\text{C}$			5	$\mu\text{A}$

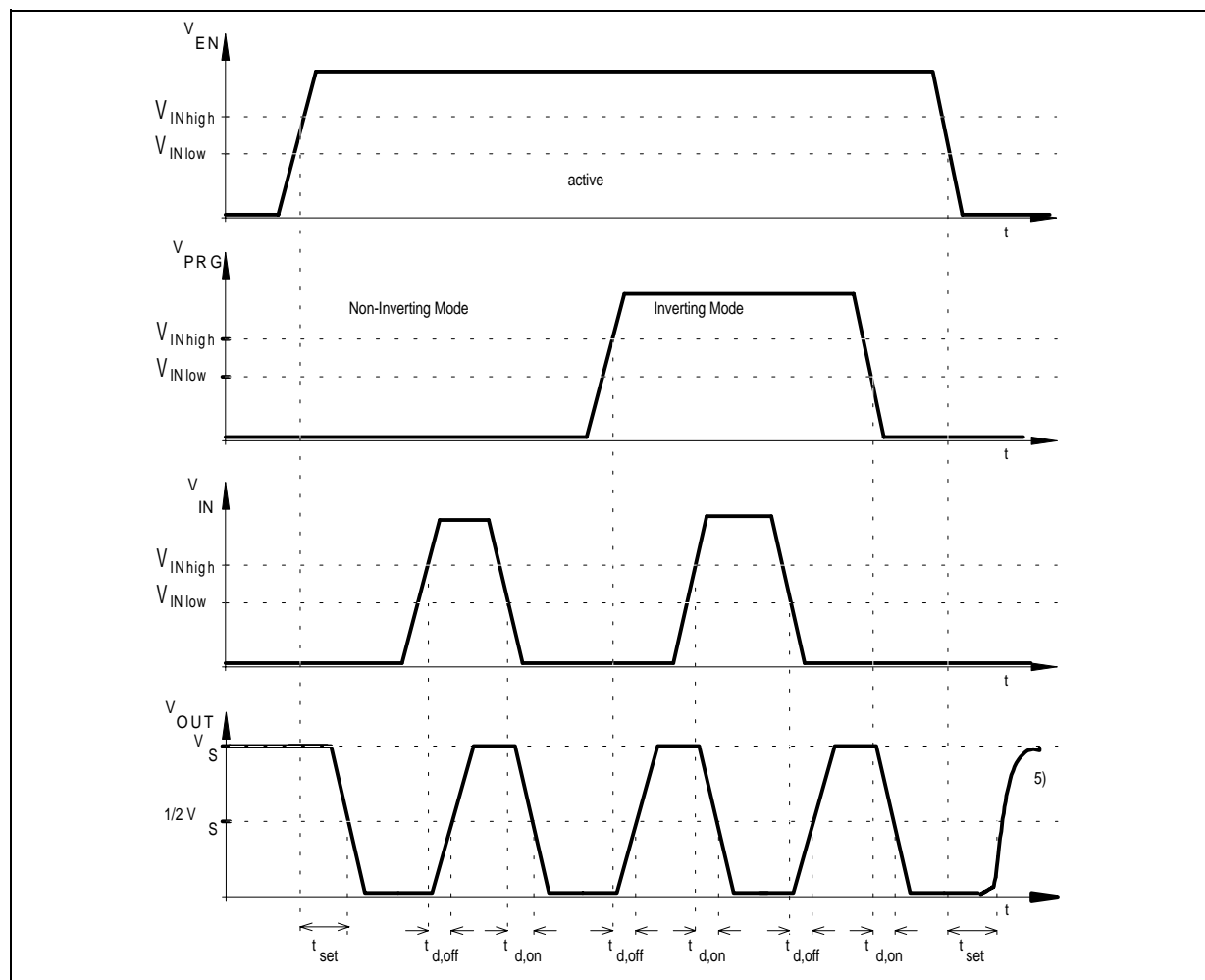
TIMING CHARACTERISTICS <sup>4)</sup>

$t_{d,on}$	On delay time	$V_S = 14\text{ V}, C_{ext} = 0\text{pF}$ $10\text{mA} \leq I_O \leq 200\text{mA}$		2	3.5	$\mu\text{s}$
$t_{d,off}$	Off delay time			3	4.5	$\mu\text{s}$
$t_{set}$	Enable settling time				10	$\mu\text{s}$
$t_{d,DIAG}$	ON or OFF Diagnostic delay time				10	$\mu\text{s}$
$S_{out}$	Output voltage slopes		2.5	9	16	$\text{V}/\mu\text{s}$

Note : All parameters are measured at  $T_{amb} = 125^\circ\text{C}$ .

4. See also Fig.3 Timing Characteristics

Figure 1.



5. Output voltage slope not controlled for enable low!

**FUNCTIONAL DESCRIPTION**

The L9339 is a quad low side driver for lines, lamps or inductive loads in automotive and industrial applications. The logic input levels are TTL and CMOS compatible. This allows the device to be driven directly by a micro-controller. For the noise immunity, all input thresholds has a hysteresis of typ. 100mV. At each input (IN and PRG) voltages from -0.3V to 32V can be applied, EN can withstand voltages from -25V to 32V. The device is activated with a 'high' signal on ENable. ENable 'low' switches the device into the sleep mode. In this mode the quiescent current is less than 10µA. A high signal on PRoGramming input changes the signal transfer polarity from noninverting into the inverting mode. This pin can be connected to V<sub>S</sub> or GND. The forced status of the PRG and EN pin is low, if these pins are not connected. This forced condition leads to a mode change if the PRG pin was high before the interruption. Independent of the PRoGramming input, the OUTput switches off, if the signal INput pin is not connected.

Each output driver has a current limitation of min 0.4A and a independent thermal shut-down. The thermal shut-down deactivates that output, which exceeds temperature switch off level. When the junction temperature decreases 20K below this temperature threshold the output will be activated again (hysteresis of the thermal shut-down function). The slew rate of the output voltage is limited to max. 14V/µs, to reduce the electromagnetic radiation of the loads and its wiring. For inductive loads a output voltage clamp of typically 52V is implemented.

The DIAGnostic is an open drain output with an additional series diode. The logic status depends on the PRoGramming pin. If the PRG pin is 'low' the DIAG output becomes low, if the device works correctly. At thermal shut-down of one channel the DIAGnostic output becomes high. If the PRG pin is 'high' this output is switched off at normal function and switched on at overtemperature.

**Diagnostic Table**

<b>Pins</b>	<b>EN</b>	<b>PRG</b>	<b>IN</b>	<b>OUT</b>	<b>DIAG</b>
Correct function	H	L	L	L (on)	L (on)
	H	L	H	H (off)	L (on)
	H	H	L	H (off)	H (off)
	H	H	H	L (on)	H (off)
	L	X	X	H (off)	H (off)
Overtemperature or supply voltage	H	L	X	H (off) *	H (off)
Overtemperature	H	H	X	H(off) *	L(on)

X = not relevant

\* selective for each channel at overtemperature

Figure 2. Application for Inverting Transfer Polarity

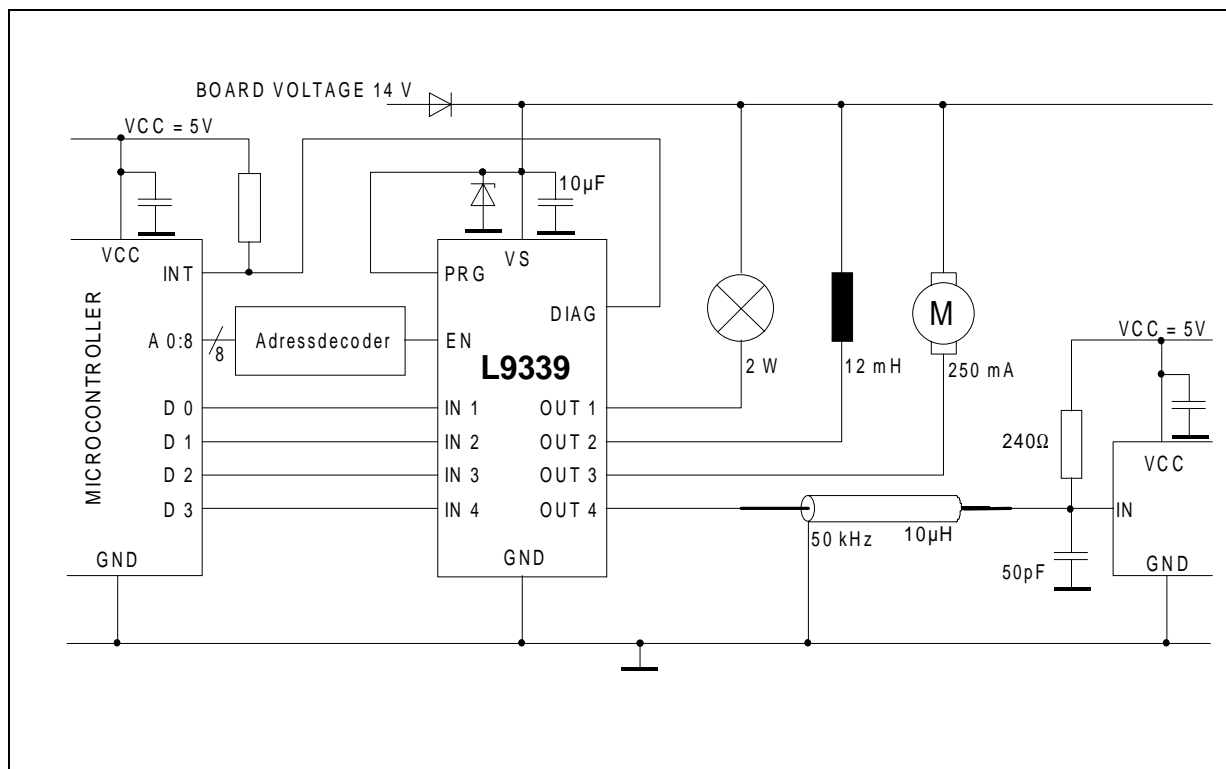
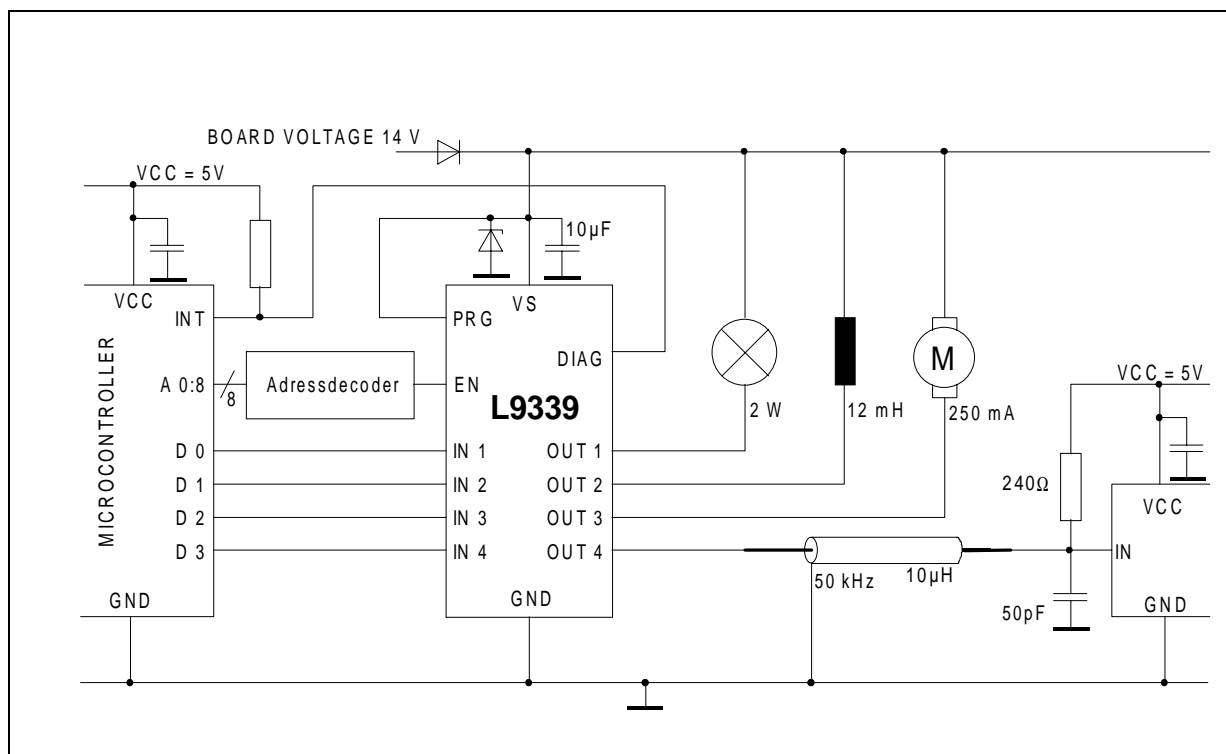


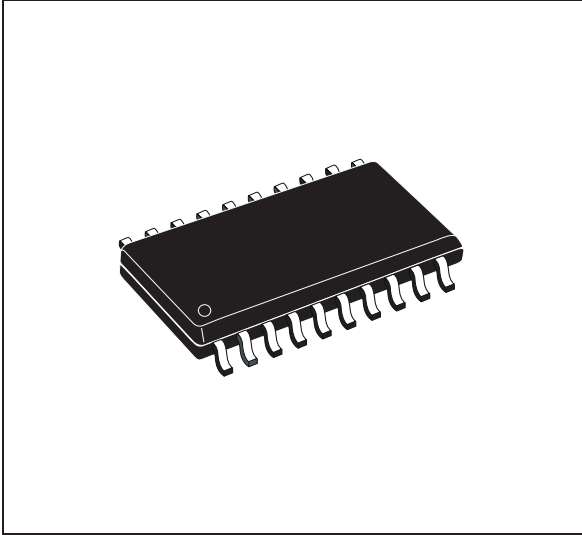
Figure 3. Application for Non Inverting Transfer Polarity



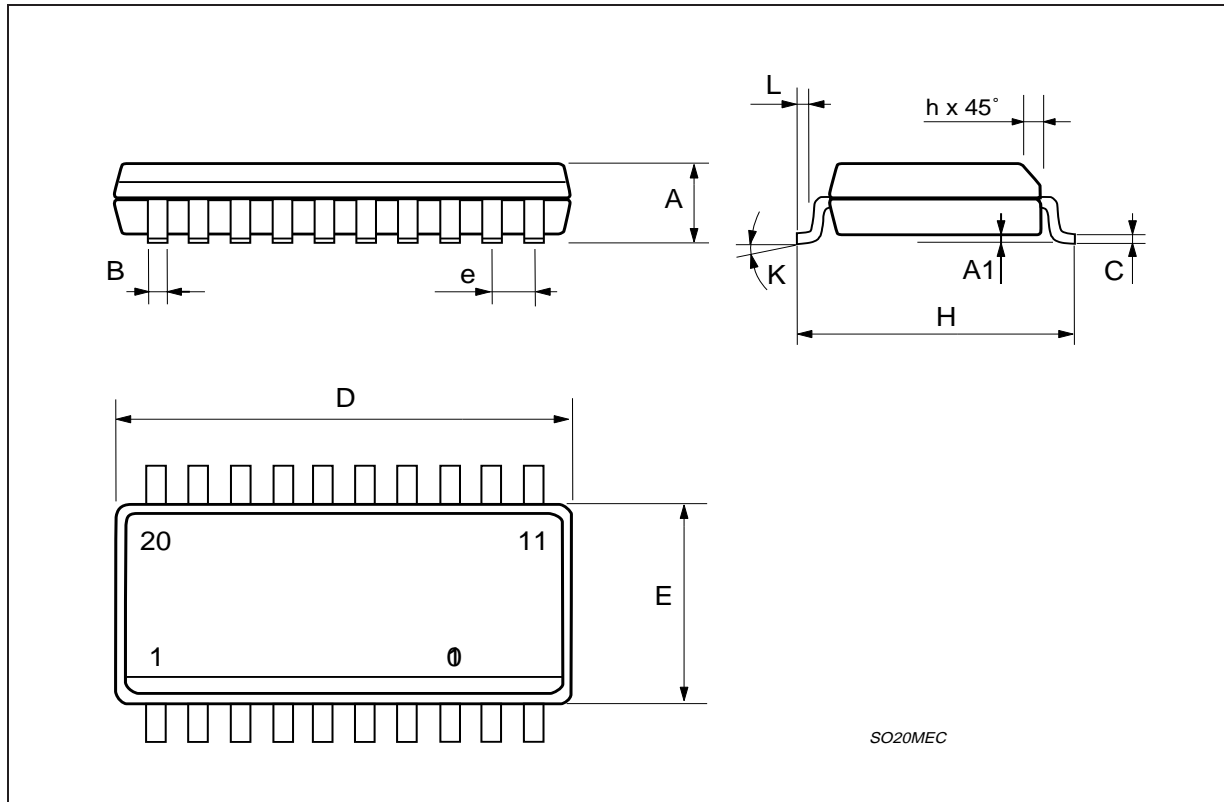
Note: We recommend to use the device for driving inductive loads with flyback energy  $E_{FB} \leq 2mJ$ .

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 & SO20(12+4+4)**



SO20MEC



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