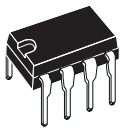
L4949E

MULTIFUNCTION VERY LOW DROP VOLTAGE REGULATOR

- OPERATING DC SUPPLY VOLTAGE RANGE 5V - 28V
- TRANSIENT SUPPLY VOLTAGE UP TO 40V
- EXTREMELY LOW QUIESCENT CURRENT IN STANDBY MODE
- HIGH PRECISION STANDBY OUTPUT VOLTAGE 5V±1%
- OUTPUT CURRENT CAPABILITY UP TO 100mA
- VERY LOW DROPOUT VOLTAGE LESS THAN 0.5V
- RESET CIRCUIT SENSING THE OUTPUT VOLTAGE
- PROGRAMMABLE RESET PULSE DELAY WITH EXTERNAL CAPACITOR
- VOLTAGE SENSE COMPARATOR
- THERMAL SHUTDOWN AND SHORT CIRCUIT PROTECTIONS



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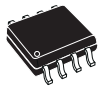
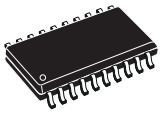


SO8



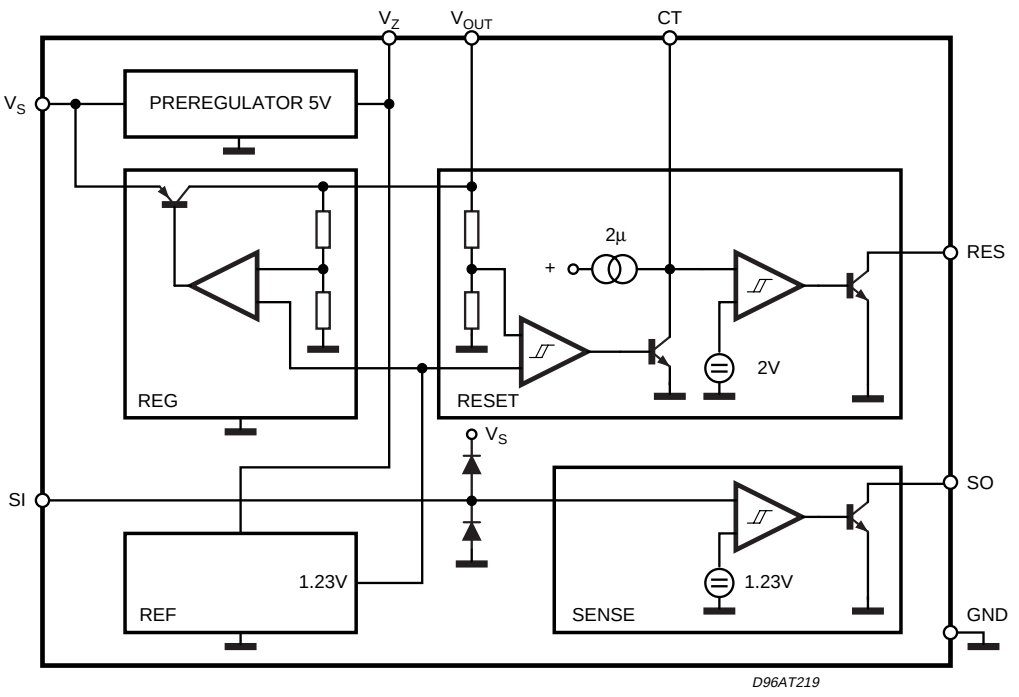
SO20W (12+4+4)

ORDERING NUMBERS: L4949E (Minidip)
L4949ED (SO8)
L4949EP (SO20W)

DESCRIPTION

The L4949E is a monolithic integrated 5V voltage regulator with a very low dropout output and additional functions as power-on reset and input voltage sense. It is designed for supplying the microcomputer controlled systems especially in automotive applications.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

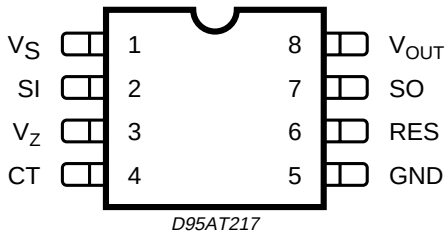
Symbol	Parameter	Value	Unit
V_{SDC}	DC Operating Supply Voltage	28	V
V_{STR}	Transient Supply Voltage (T < 1s)	40	V
I_O	Output Current	Internally Limited	
V_O	Output Voltage	20	V
V_{RES}, V_{SO}	Output Voltage	20	V
I_{RES}, I_{SO}	Output Current	5	mA
V_Z	Preregulator Output Voltage	7	V
I_Z	Preregulator Output Current	5	mA
T_J	Junction Temperature	-40 to +150	°C
T_{stg}	Storage Temperature Range	-55 to +150	°C

Note: The circuit is ESD protected according to MIL-STD-883C

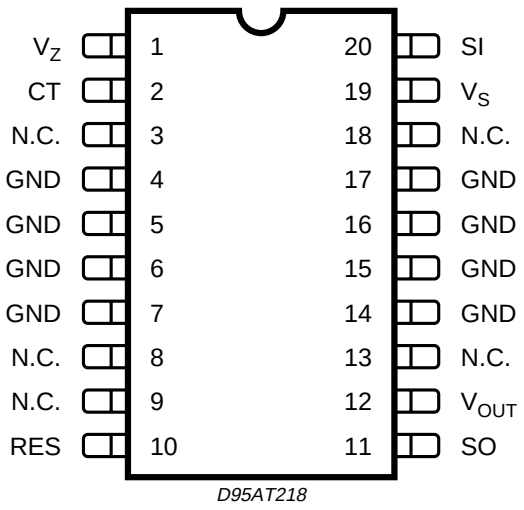
THERMAL DATA

Symbol	Description		Minidip	SO-8	SO20L	Unit
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction-ambient	Max	100	200	50	°C/W
$R_{th\ j\text{-}pins}$	Thermal Resistance Junction-pins	Max			15	°C/W
TJSD	Thermal Shutdown Junction temperature		165			°C

PIN CONNECTIONS



MINIDIP/SO8



SO20

ELECTRICAL CHARACTERISTICS (V_S = 14V; -40°C < T_j < 125°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C; I_O = 1mA	4.95	5	5.05	V
V_O	Output Voltage	6V < V_{IN} < 28V, 1mA < I_O < 50mA	4.90	5	5.10	V
V_O	Output Voltage	V_{IN} = 40V; T < 1s 5mA < I_O < 100mA	4.75		5.25	V
V_{DP}	Dropout Voltage	I_O = 10mA I_O = 50mA I_O = 100mA		0.1 0.2 0.3	0.25 0.4 0.5	V V V
V_{IO}	Input to Output Voltage Difference in Undervoltage Condition	V_{IN} = 4V, I_O = 35mA			0.4	V
I_{outh} **	Max Output Leakage	V_{IN} = 25V, V_O = 5.5V	20	50	80	µA
V_{OL}	Line Regulation	6V < V_{IN} < 28V; I_O = 1mA			20	mV
V_{OLO}	Load Regulation	1mA < I_O < 100mA			30	mV
I_{LIM}	Current Limit	V_O = 4.5V V_O = 4.5V, T_J = 25°C V_O = 0V (note 1)	105 120	200 100	400 400 	mA mA mA
I_{QSE}	Quiescent Current	I_O = 0.3mA; T_J < 100°C		200	300	µA
I_Q	Quiescent Current	I_O = 100mA			5	mA

** With this test we guarantee that with no output current the output voltage will not exceed 5.5V

RESET

V_{RT}	Reset Thereshold Voltage			V_O -0.5V		V
V_{RTH}	Reset Thereshold Hysteresis		50	100	200	mV
t_{RD}	Reset Pulse Delay	C_T = 100nF; T_R ≥100µs	55	100	180	ms
V_{RL}	Reset Output Low Voltage	R_{RES} = 10KΩ to V_O V_S ≥ 1.5V			0.4	V
I_{RH}	Reset Output High Leakage Current	V_{RES} = 5V			1	µA
V_{CTth}	Delay Comparator Thereshold			2		V
$V_{CTth, hy}$	Delay Comparator Thereshold Hysteresis			100		mV

SENSE

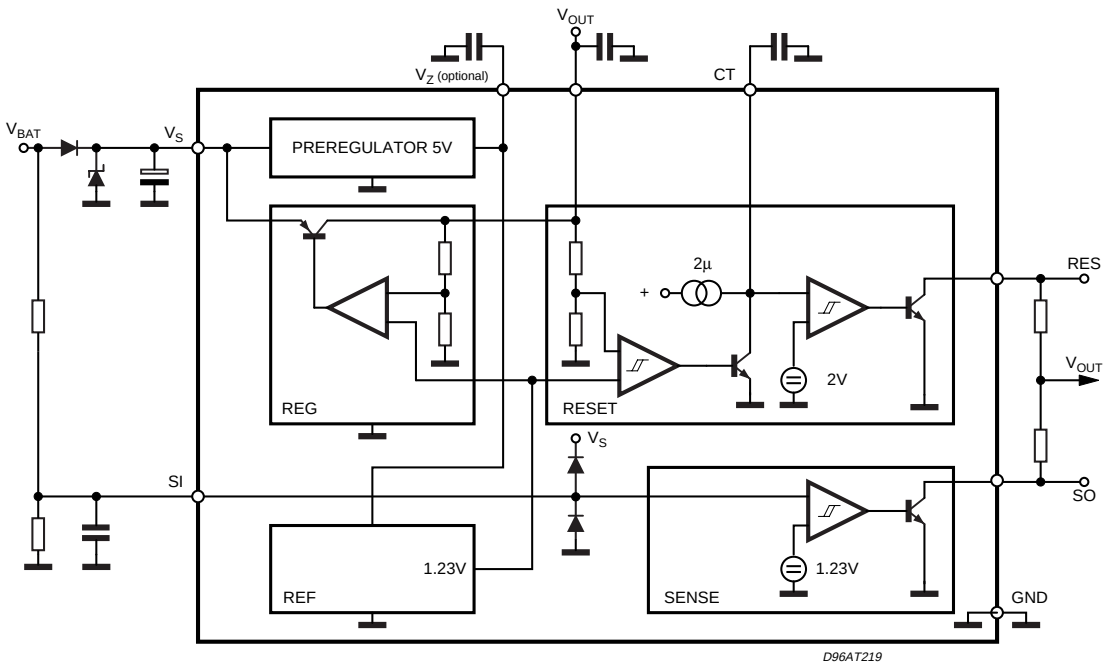
V_{st}	Sense Low Thereshold		1.16	1.23	1.35	V
V_{sth}	Sense Thereshold Hysteresis		20	100	200	mV
V_{SL}	Sense Output Low Voltage	V_{SI} ≤ 1.16V; V_S ≥ 3V R_{SO} = 10KΩ to V_O			0.4	V
I_{SH}	Sense Output Leakage	V_{SO} = 5V; V_{SI} ≥ 1.5V			1	µA
I_{SI}	Sense Input Current	V_{SI} = 0	-20	-8	-3	µA

PREREGULATOR

V_Z	Preregulator Output Voltage	I_Z = 10µA	4.5	5	6	V
I_Z	Preregulator Output Current				10	µA

Note 1: Foldback characteristic

APPLICATION CIRCUIT



For stability: $C_S \geq 1\mu F$, $C_O \geq 4.7\mu F$, ESR < 10Ω at 10KHz
Recommended for application: $C_S = C_O = 10\mu F$ to $100\mu F$

APPLICATION INFORMATION

Supply Voltage Transient

High supply voltage transients can cause a reset output signal disturbation.

For supply voltages greater than 8V the circuit shows a high immunity of the reset output against supply transients of more than 100V/µs.
For supply voltages less than 8V supply transients of more than 0.4V/µs can cause a reset signal disturbation.

To improve the transient behaviour for supply voltages less than 8V a capacitor at pin 3 can be used.

A capacitor at pin 3 (C3 ≤ 1µF) reduces also the output noise.

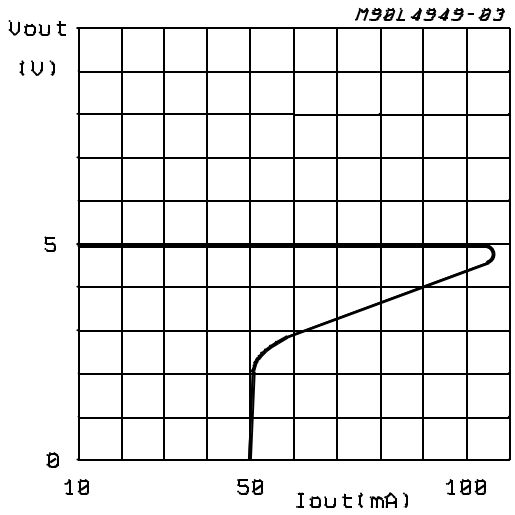
FUNCTIONAL DESCRIPTION

The L4949E is a monolithic integrated voltage regulator, based on the STM modular voltage regulator approch. Several outstanding features and auxiliary functions are implemented to meet the requirements of supplying microprocessor systems in automotive applications. Nevertheless, it is suitable also in other applications where the present functions are required. The modular approach of this device allows to get easily also other features and functions when required.

Voltage Regulator

The voltage regulator uses an Isolated Collector Vertical PNP transistor as a regulating element.

Figure 1: Foldback Characteristic of V_O



With this structure very low dropout voltage at currents up to 100mA is obtained. The dropout operation of the standby regulator is maintained down to 3V input supply voltage. The output voltage is regulated up to the transient input supply voltage of 40V. With this feature no functional interruption due to overvoltage pulses is generated. The typical curve showing the standby output voltage as a function of the input supply voltage is shown in Fig. 2. The current consumption of the device (quiescent current) is less than 300µA.

To reduce the quiescent current peak in the undervoltage region and to improve the transient response in this region, the dropout voltage is controlled, the quiescent current as a function of the supply input voltage is shown in Fig. 3.

Figure 2: Output Voltage vs. Input Voltage

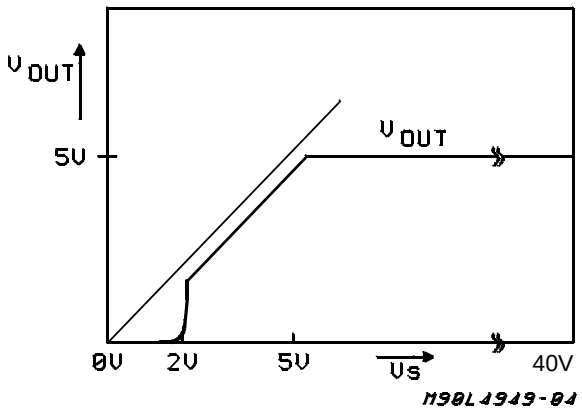
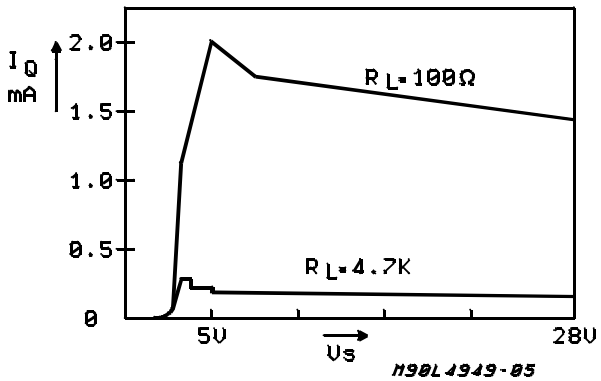


Figure 3: Quiescent Current vs. Supply Voltage



Preregulator

To improve the transient immunity a preregulator stabilized the internal supply voltage to 5V. This internal voltage is present at Pin 3 (V_Z). This voltage should not be used as an output because the output capability is very small (≤10µA).

This output may be used as an option when a better transient behaviour for supply voltages less than 8V is required (see also application note).

In this case a capacitor (100nF - 1µF) must be connected between Pin 3 and GND. If this feature is not used Pin 3 must be left open.

Reset Circuit

The block circuit diagram of the reset circuit is shown in Fig. 4. The reset circuit supervises the output voltage.

The reset thereshold of 4.5V is defined with the internal reference voltage and standby output drivider.

The reset pulse delay time t_{RD}, is defined with the charge time of an external capacitor C_T:

$$t_{RD} = \frac{C_T \bullet 2V}{2\mu A}$$

The reaction time of the reset circuit originates from the discharge time limitation of the reset capacitor C_T and is proportional to the value of C_T.

The reaction time of the reset circuit increases the noise immunity. Standby output voltage drops below the reset threshold only a bit longer than the reaction time results in a shorter reset delay time.

The nominal reset delay time will be generated for standby output voltage drops longer than approximately 50µs.

The typical reset output waveforms are shown in Fig. 5.

Sense Comparator

The sense comparator compares an input signal with an internal voltage reference of typical 1.23V. The use of an external voltage divider makes this comparator very flexible in the application.

It can be used to supervise the input voltage either before or after the protection diode and to give additional informations to the microprocessor like low voltage warnings.

Figure 4

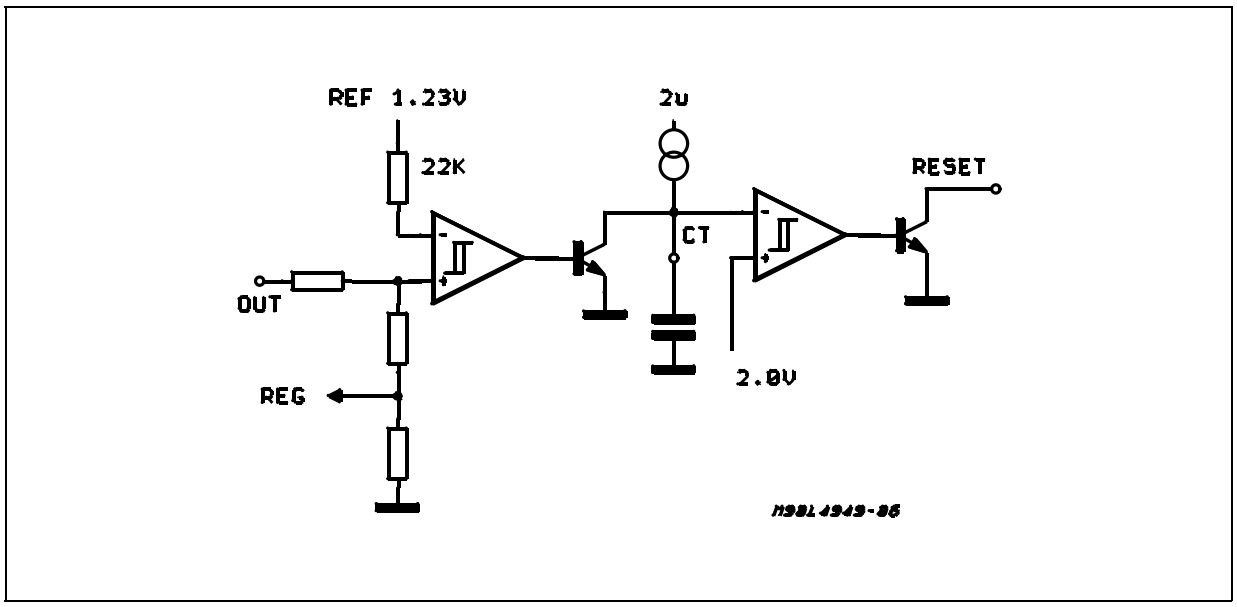
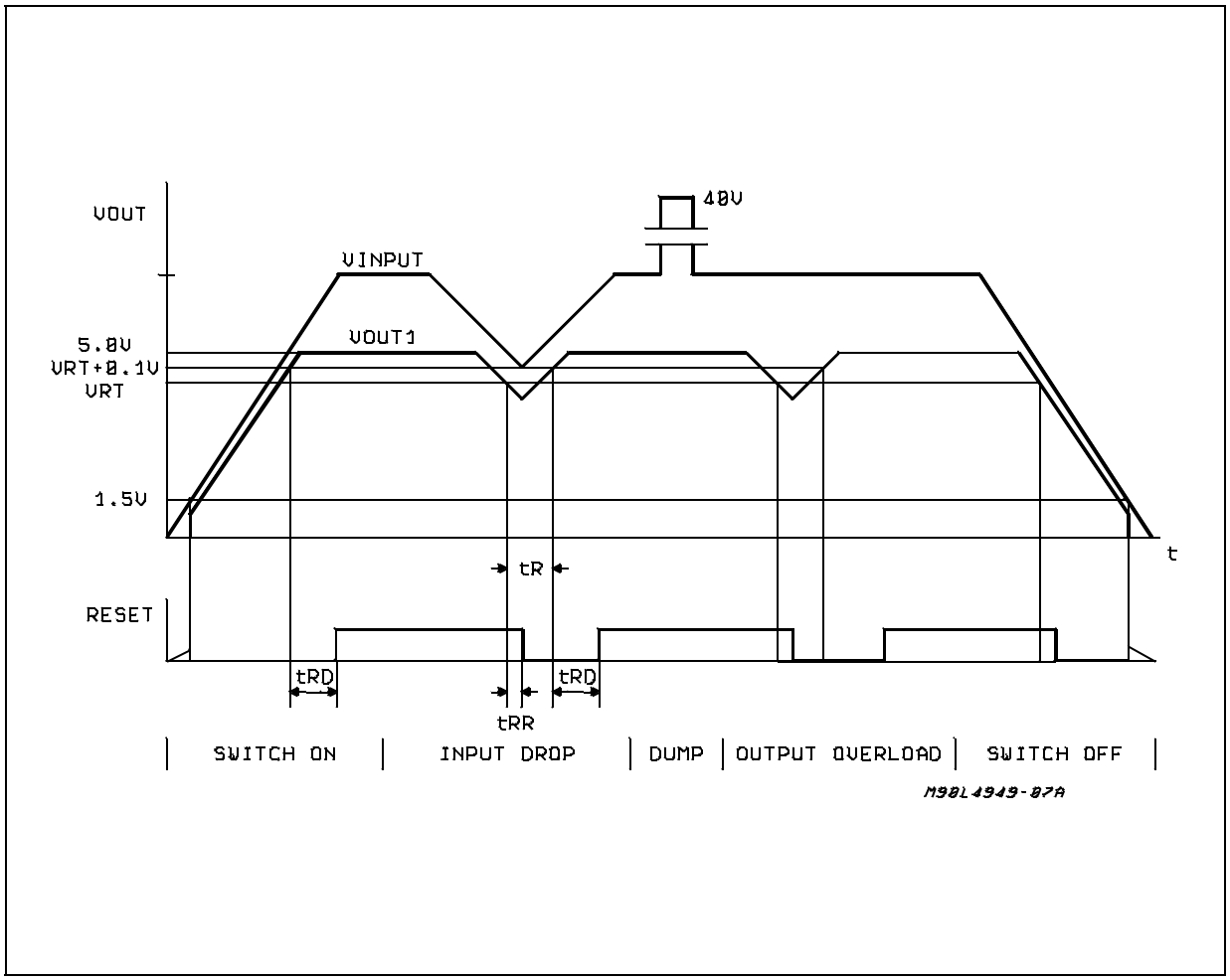
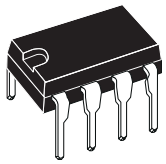


Figure 5



DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0.260
I			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

OUTLINE AND MECHANICAL DATA



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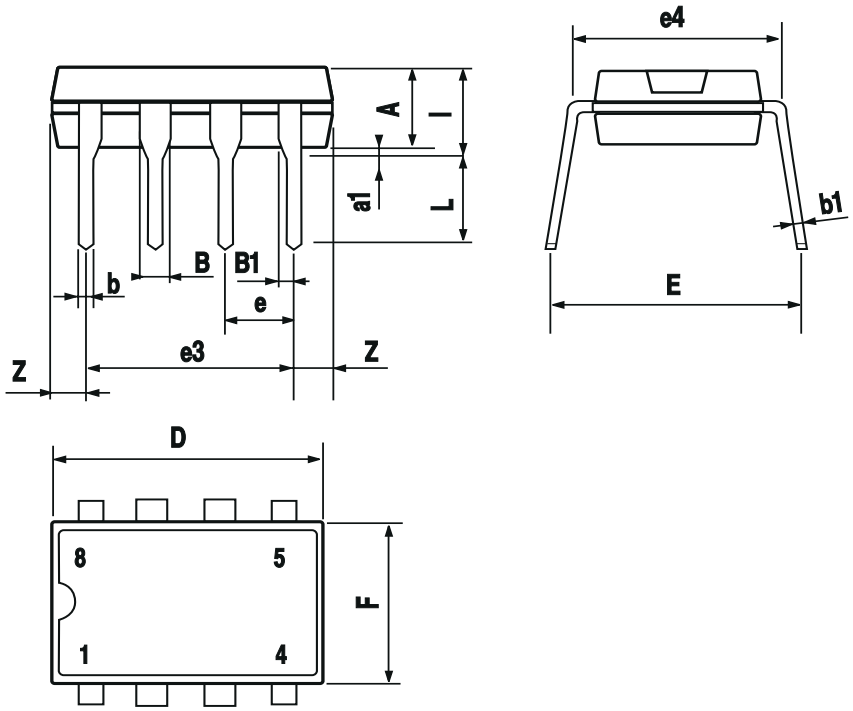
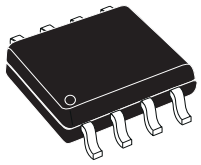


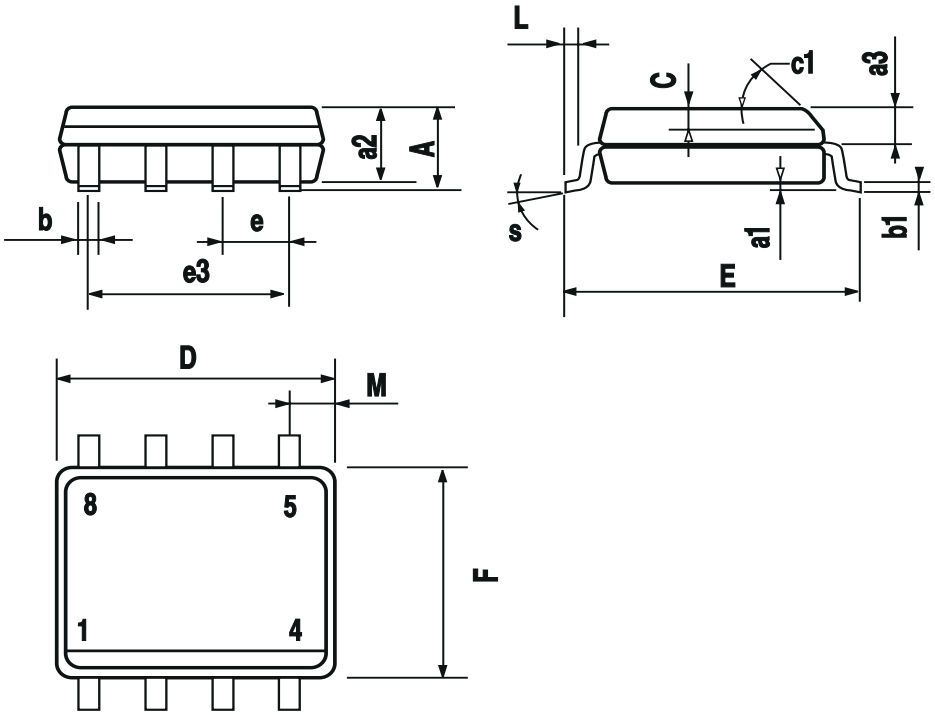
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D (1)	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F (1)	3.8		4.0	0.15		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

(1) D and F do not include mold flash or protrusions. Mold flash or potrusions shall not exceed 0.15mm (.006inch).

OUTLINE AND MECHANICAL DATA

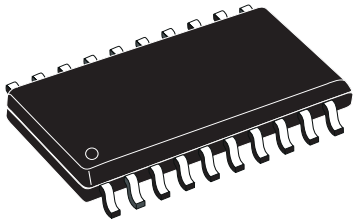


SO8



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