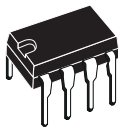
ST755

ADJUSTABLE INVERTING NEGATIVE OUTPUT CURRENT MODE PWM REGULATORS

- 2.7V TO 11V INPUT TO ADJUSTABLE NEGATIVE OUTPUT CONVERSION
- 1W GUARANTEED OUTPUT POWER (V_{in}>4.5V, T≤70°C)
- 68% TYP. EFFICENCY AT 6V
- VERY LOW QUIESCENT CURRENT: 1.2mA IN ON MODE, 10µA IN SHUT DOWN MODE
- SOFT START
- VERY LOW NOISE OUTPUT
- 160KHz FIXED FREQUENCY OSCILLATOR
- MIXED BIPOLAR-CMOS TECHNOLOGY



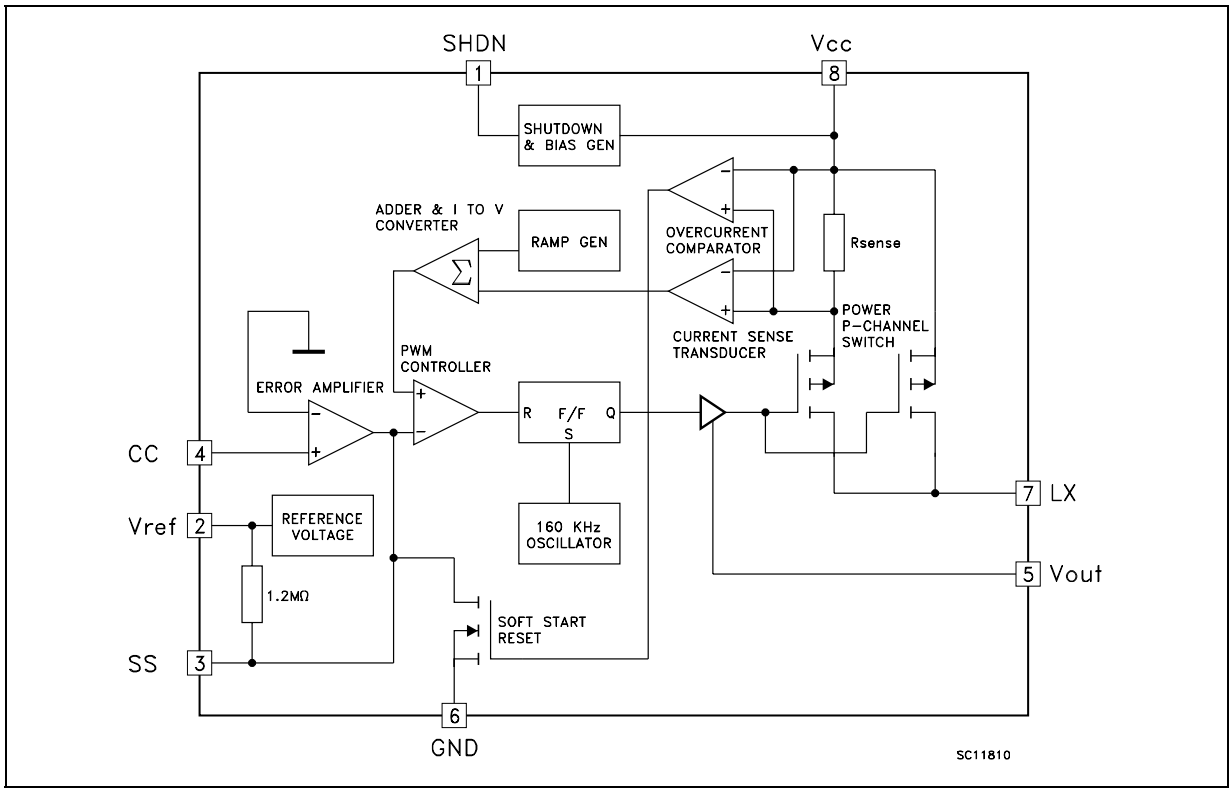
DIP-8

SO-8

DESCRIPTION

The ST755 is an adjustable inverting switch-mode DC-DC rergulator with internal Power MOSFET that generaters an adjustable negative output from a voltage input of 2.7V to 11V, output current guaranteed at 200mA (for V_{in}>4.5V, V_{out} = -5V and 0°C ≤ Ta ≤ 70°C) and 275mA (typical value at T_a = 25 °C, V_{out} = -5V). A logic controlled shut down pin that interfaces directly with microprocessor reduces supply current to only 10µA. Input to Output differential voltage is limited to $V_{in}+|V_{out}|$<12.7V. No load supply current is 1.2mA.

BLOCK DIAGRAM

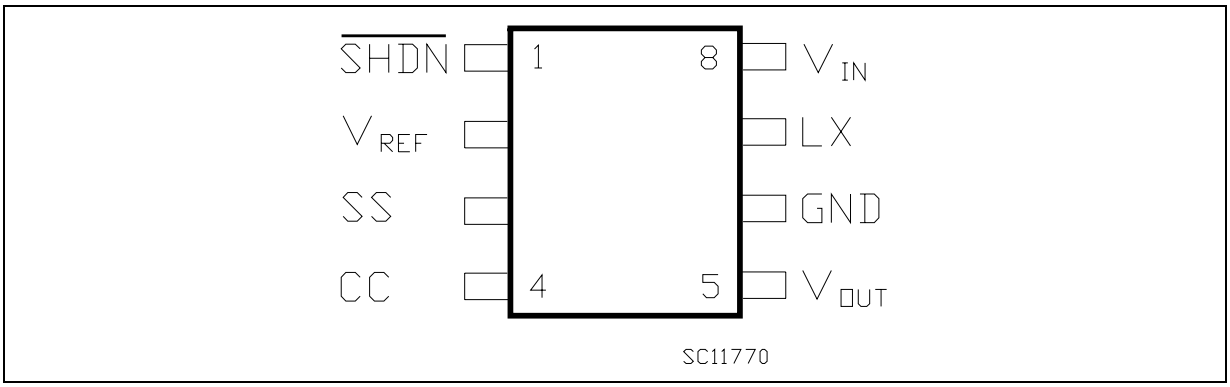


ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{cc}	DC Input Voltage to GND (Note1)	-0.3 to 12	V
	Shutdown Voltage, SS Voltage, CC Voltage	-0.3 to V_{CC}+0.3	V
V_{LX}	Switch Voltage (LX to V_{CC})	-12.5 to +0.3	V
V_{FB}	Feedback Voltage (V_{OUT} to GND)	-11 to +0.9	V
I_{LX}	Peak Switch Current	2	A
P_{tot}	Power Dissipation (at 70°C) (for **DIP-8**) (for **SO-8**)	725 470	mW
T_{op}	Operating Ambient Temperature Range	-40 to 85	°C
T_{stg}	Storage Temperature Range	-55 to 150	°C

Absolute Maximum Rating are those values beyond which damage to the device may occur.
Functional operation under these condition is not implied.
Note 1: The input to output differential voltage is limited to V_{CC}+|V_{OUT}|<12.7V

CONNECTION DIAGRAM AND (top view)



PIN CONNECTIONS

Pin No	Symbol	Name and Function
1	SHDN	SHUT-DOWN Control (V_{CC} = On, GND=Shutdown)
2	V_{ref}	Reference Output Voltage (1.25V)
3	SS	Soft Start
4	CC	Compensation Input
5	V_{out}	Negative Output Voltage
6	GND	Ground
7	LX	Switch Output
8	V_{CC}	Positive Supply-Voltage Input

ORDERING NUMBERS

Type	DIP-8	SO-8 (Tube)	SO-8 (T&R)
ST755	ST755CN	ST755CD	ST755CD-TR

ELECTRICAL CHARACTERISTICS (Refer to the test circuits, V_{CC} = 5V, V_{out} = -5.25 to -4.75V, I_{load} = 0mA, $T_a = T_{min}$ to T_{max} unless otherwise specified. Typical Value are referred at T_a = 25 ^oC)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage		2.7		11	V
V_o	Output Voltage	I_o = 0 mA to 200 mA V_{CC} = 4.5 to 6.2 V	-5.25	-5	-4.75	V
I_o	Output Current	V_{CC} = 4.5 to 6.2 V T_a = 0 ^oC to 70 ^oC V_{CC} = 4.5 to 6.2 V T_a = -40 ^oC to 85 ^oC V_{CC} = 4 V V_{out} = -5 V V_{CC} = 2.7 V V_{out} = -5 V	200 175	275 175 125		mA mA mA mA
I_{SUPPLY}	Supply Current (Including Switching Current)	No Load, $V_{SHDN} = V_{CC}$		1.2	3.5	mA
I_{OFF}	Standby Current	No Load, V_{SHDN} = 0V		10	100	µA
I_{SC}	Short Circuit Current			1.2		A
ΔV_o	Line Regulation	V_{CC} = 4 to 6.2 V		0.1		%/V
ΔV_o	Load Regulation	I_o = 0 mA to 200 mA		0.003		%/mA
V_{REF}	Reference Voltage	T_a = 25 ^oC	1.18	1.25	1.32	V
ΔV_{REF}	Reference Dritft	$T_a = T_{min}$ to T_{max}		50		ppm/^oC
R_{DSON}	LX On Resistance			0.7		Ω
I_{LEAK}	LX Leakage Current	V_{DS} = 10 V		1		µA
I_{SH}	Shutdown Pin Current				1	µA
V_{il}	Shutdown Input Low Threshold				0.25	V
V_{ih}	Shutdown Input High Threshold		2			V
f_o	Oscillator Frequency			160		KHz
ν	Power Efficency	I_o = 100 mA		68		%
CC	Compensation Pin Impedance			7.5		KΩ

Do not overload or short the Output to Ground. If the above conditions are observerd, the device may be damaged.

APPLICATION INFORMATION

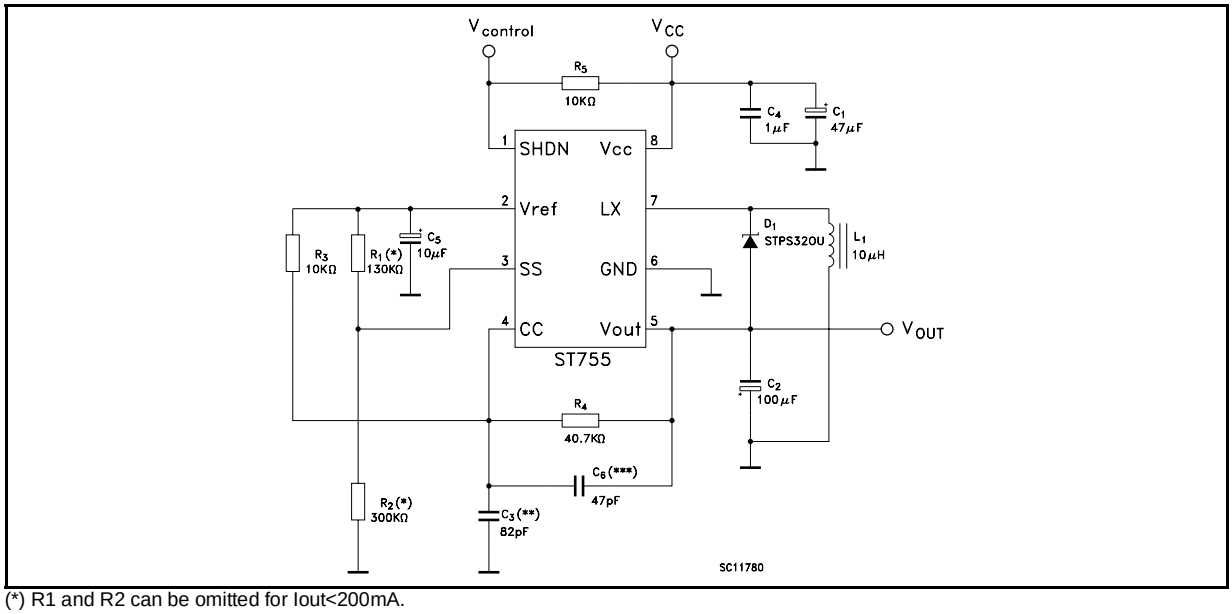
The ST755 is an IC developed for voltage conversion from an input voltage ranging from +2.4V to 11V to a regulated adjustable negative output limited by $|V_{out}| \leq 12.7V-V_{IN}$. The circuit adopts a current-mode PWM control scheme to achieve good efficiency , high stability and low noise performance. The figure in the first page shown the detailed block diagram of the device. ST755 is realized in a BCD technology in order to achieve high temperature stability, the best REFERENCE precision , a very low quiescent current and jitter free operations. The final stage is built around a 0.7Ω - 2A P-Channel Power MOS. A fraction of the output current is splitted out for current detection.Internal clock frequency is fixed to 160KHz. Error amplifier drives the PWM comparator in order to keep 0V on the CC input. So R_3 and R_4 resistors are calculated by the following formulae $R_4 = (|V_{out}|/V_{ref})*R_3$ (see fig 1). For R_3 can be choosen any value between 2KΩ and 20KΩ. Soft-Start (SS) input is a voltage dependent-output current limit (see figure 9, Switch Current Limit vs. SS Input Voltage). SS pin is internally pulled to V_{ref} through a 1.2 MΩ resistor. Applying an appropiate capacitor at SS input is possible to obtain a soft-start current limitation during power up. Forcing Soft-Start (SS) input to a lower voltage through a resistive voltage driver (R_1 and R_2), the maximum LX curent limit can be lowered according the diagram showed in figure 9. When SHDN input is low, the total current consumption is reduced to 10µA.

APPLICATION CIRCUIT

To achieve the best performances from switching power supply topology, particular care to layout drawing is needed, in order to minimize EMI and obtain low noise, jitter free operation moreover, it ensures the full device functionality. Layout design proposed on demoboard (see picture 2) helps to lower the developing time.

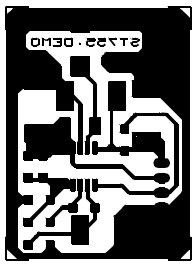
Wire lengths must be minimized, filter and by-pass capacitors C_1, C_2 and C_3 must be low ESR type, placed as close possible to the integrated circuit. The 10µH inductor must be chosen built on a core, taking care that saturation current should be higher than the peak LX switch current. See the PEAK INDUCTOR CURRENT vs. LOAD CURRENT graph (figure 6)

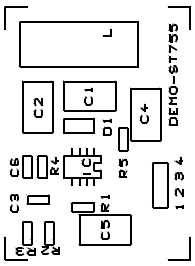
Figure 1: TYPICAL APPLICATION CIRCUIT



(*) R1 and R2 can be omitted for Iout<200mA.
(**) C6: Very low noise but poor transient and load response speed.
(***) C3 (alternative to C6): faster transient and load response.

Figure 2: Printed Demoboard





Symbol	Pin
V_{CC}	1
V_{out}	2
SHDN	3
GND	4

Component Values

Capacitor	Value	Unit	Resistor	Value	Unit
C1	47	µF	R1	130	KΩ
C2	100	µF	R2	300	KΩ
C3	82	pF	R3	10	KΩ
C4	1	µF	R4	40.7	KΩ
C5	10	µF	R5	10	KΩ
C6	47	pF			

TYPICAL OPERATING CHARACTERISTICS

Figure 3: Load Current vs Supply Voltage

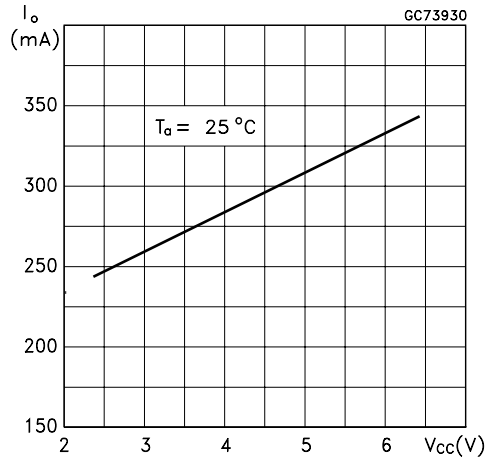


Figure 4: Load Current vs Supply Voltage

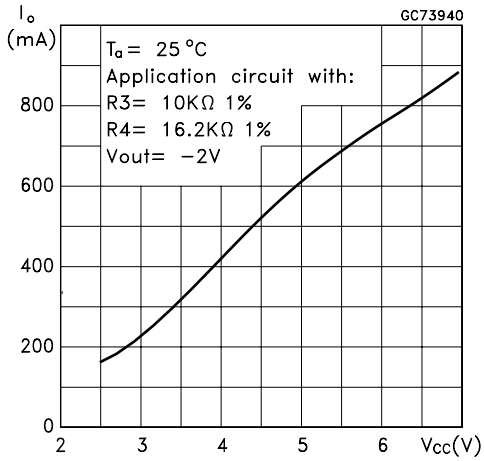


Figure 5: Efficency vs Load Current

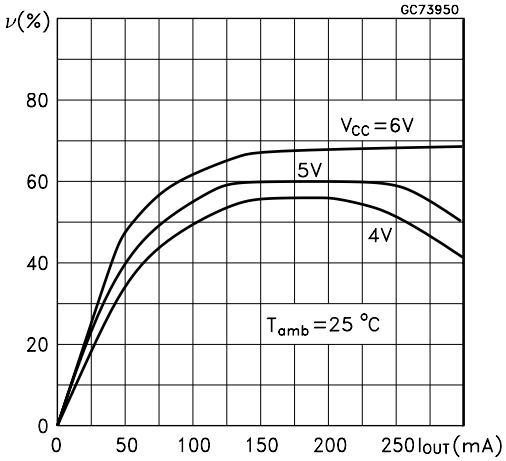


Figure 6: Peak InductorCurrent vs Load Current

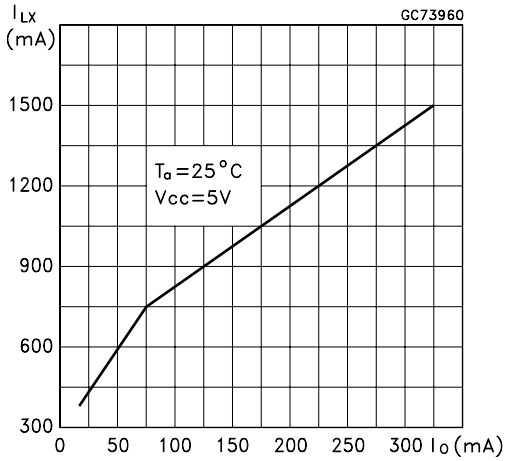


Figure 7: Switch ON Resistance vs Supply Voltage

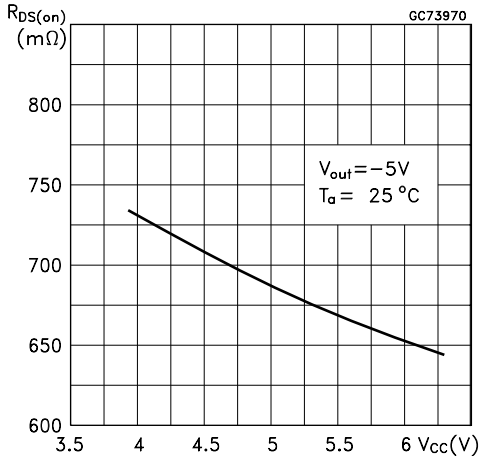
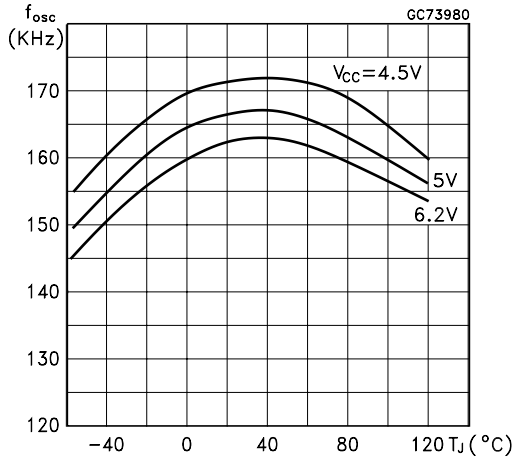


Figure 8: Oscillator Frequency vs Temperature & Supply Voltage



TYPICAL OPERATING CHARACTERISTICS (continued)

Figure 9: Switch Current Limit vs Soft Start Voltage

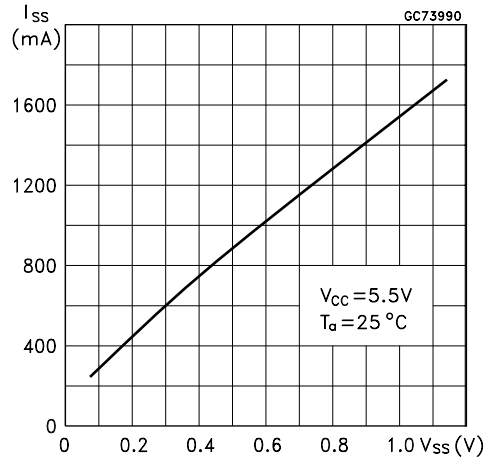


Figure 10: Reference Voltage vs temperature

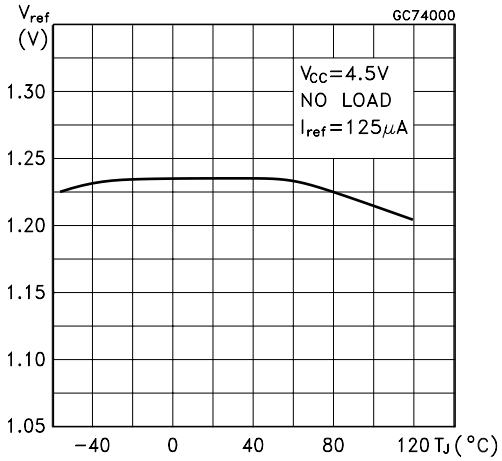
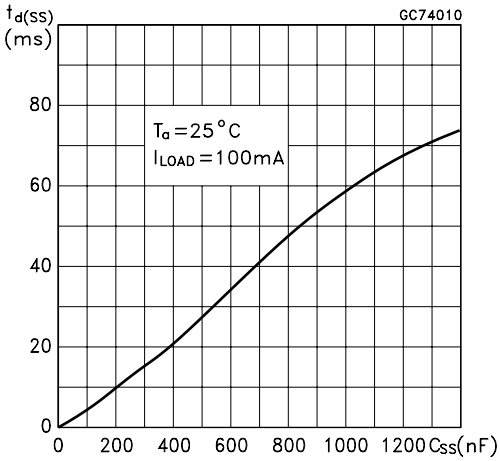
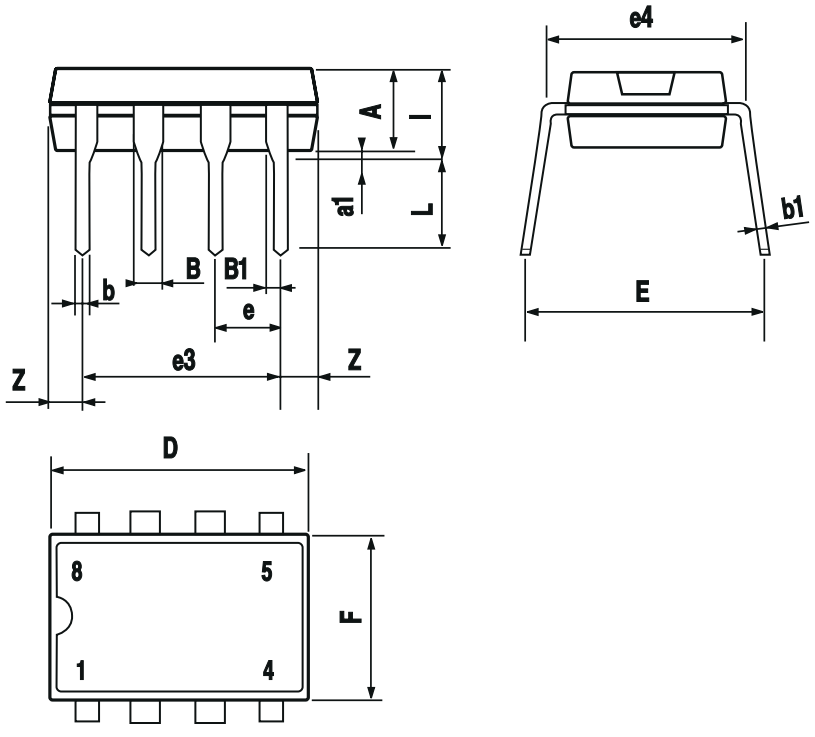


Figure 11: Soft Start Delay Time



Plastic DIP-8 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A		3.3			0.130	
a1	0.7			0.028		
B	1.39		1.65	0.055		0.065
B1	0.91		1.04	0.036		0.041
b		0.5			0.020	
b1	0.38		0.5	0.015		0.020
D			9.8			0.386
E		8.8			0.346	
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			7.1			0.280
I			4.8			0.189
L		3.3			0.130	
Z	0.44		1.6	0.017		0.063



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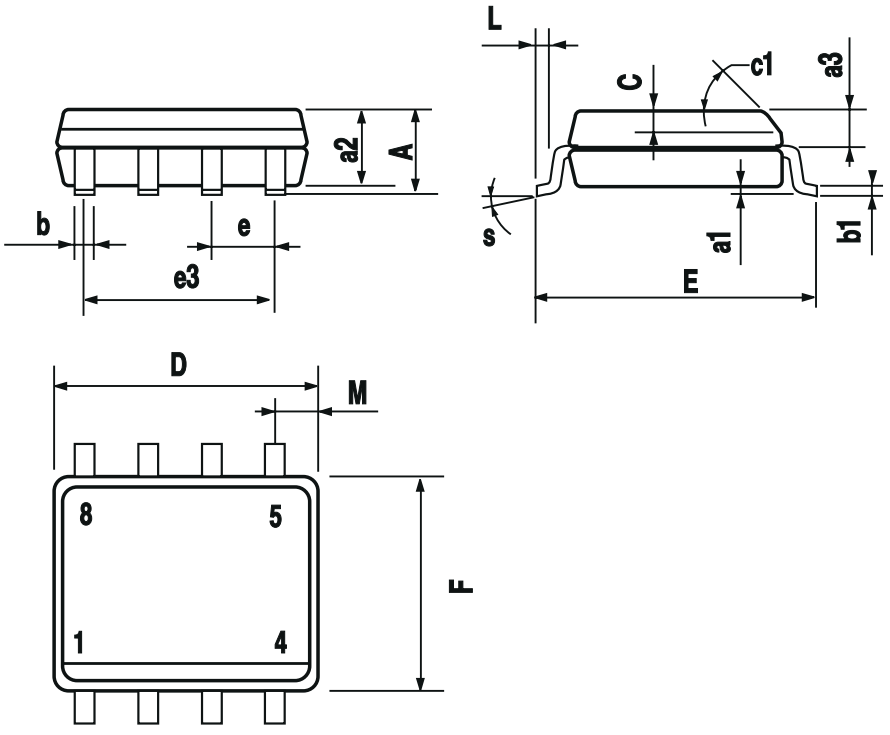
SO-8 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.25	0.003		0.009
a2			1.65			0.064
a3	0.65		0.85	0.025		0.033
b	0.35		0.48	0.013		0.018
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.019
c1	45 (typ.)					
D	4.8		5.0	0.188		0.196
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.14		0.157
L	0.4		1.27	0.015		0.050
M			0.6			0.023
S	8 (max.)					



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