



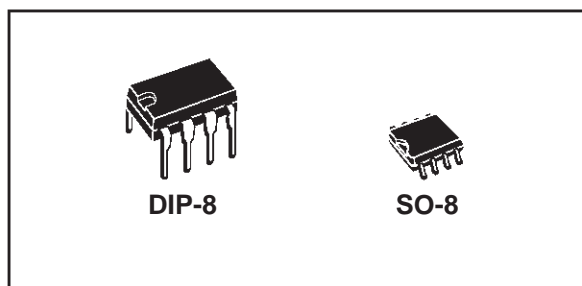
# ST755

## ADJUSTABLE INVERTING NEGATIVE OUTPUT CURRENT MODE PWM REGULATORS

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

### DESCRIPTION

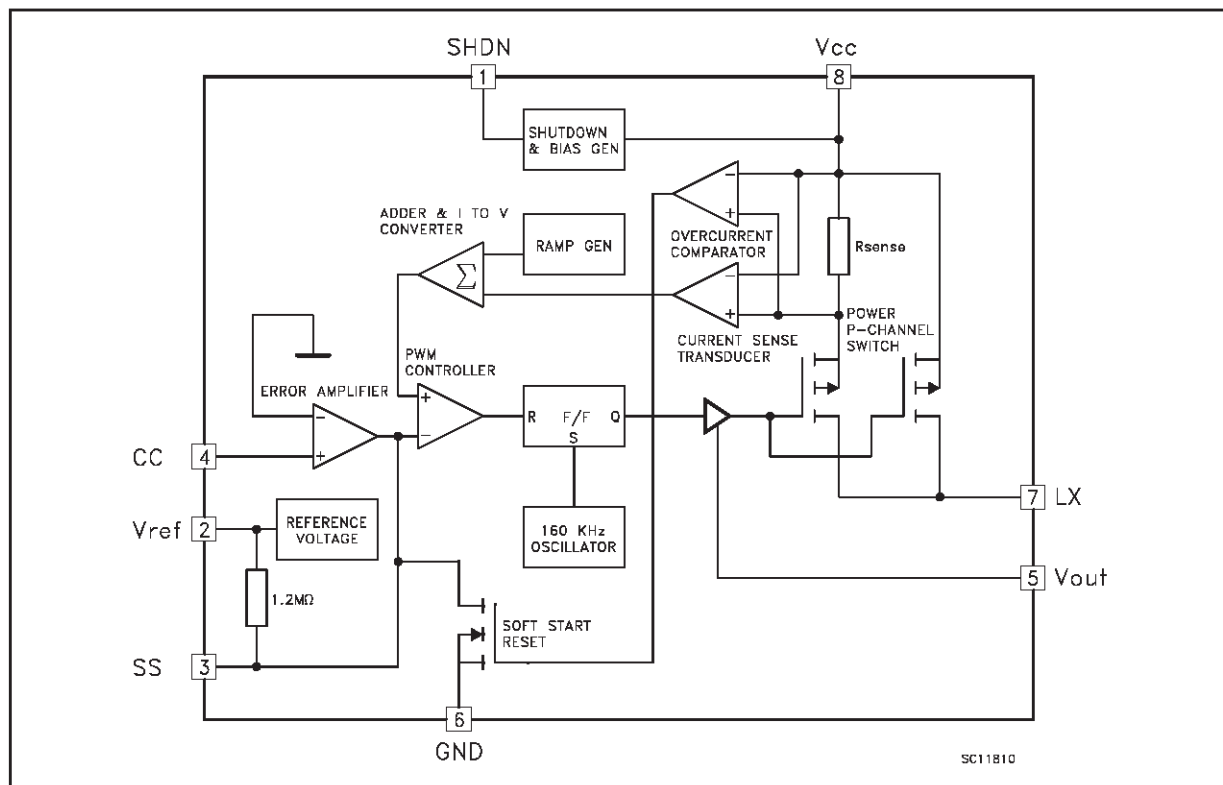
The ST755 is an adjustable inverting switch-mode DC-DC regulator with internal Power MOSFET that generates an adjustable negative output from a voltage input of 2.7V to 11V, output current guaranteed at 200mA (for



$V_{in} > 4.5V$ ,  $V_{out} = -5V$  and  $0^{\circ}C \leq T_a \leq 70^{\circ}C$ ) and 275mA (typical value at  $T_a = 25^{\circ}C$ ,  $V_{out} = -5V$ ).

A logic controlled shut down pin that interfaces directly with microprocessor reduces supply current to only 10 $\mu$ A. 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

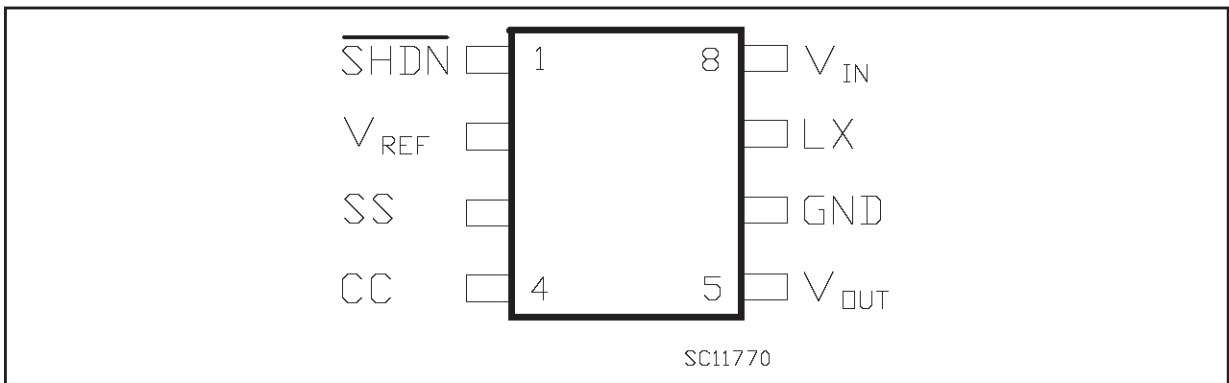
Symbol	Parameter	Value	Unit
$V_{CC}$	DC Input Voltage to GND (Note1)	-0.3 to 12	V
	Shutdown Voltage, SS Voltage, CC Voltage	-0.3 to $V_{CC}+0.3$	V
$V_{LX}$	Switch Voltage (LX to $V_{CC}$ )	-12.5 to +0.3	V
$V_{FB}$	Feedback Voltage ( $V_{OUT}$ to GND)	-11 to +0.9	V
$I_{LX}$	Peak Switch Current	2	A
$P_{tot}$	Power Dissipation (at 70°C) (for <b>DIP-8</b> ) (for <b>SO-8</b> )	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  $T_a = 25^\circ C$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{IN}$	Input Voltage		2.7		11	V
$V_o$	Output Voltage	$I_o = 0\text{ mA to }200\text{ mA}$ $V_{CC} = 4.5\text{ to }6.2\text{ V}$	-5.25	-5	-4.75	V
$I_o$	Output Current	$V_{CC} = 4.5\text{ to }6.2\text{ V}$ $T_a = 0^\circ C\text{ to }70^\circ C$ $V_{CC} = 4.5\text{ to }6.2\text{ V}$ $T_a = -40^\circ C\text{ to }85^\circ C$ $V_{CC} = 4\text{ V}$ $V_{out} = -5\text{ V}$ $V_{CC} = 2.7\text{ V}$ $V_{out} = -5\text{ V}$	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	$\mu A$
$I_{SC}$	Short Circuit Current			1.2		A
$\Delta V_o$	Line Regulation	$V_{CC} = 4\text{ to }6.2\text{ V}$		0.1		%/V
$\Delta V_o$	Load Regulation	$I_o = 0\text{ mA to }200\text{ mA}$		0.003		%/mA
$V_{REF}$	Reference Voltage	$T_a = 25^\circ C$	1.18	1.25	1.32	V
$\Delta V_{REF}$	Reference Drift	$T_a = T_{min}\text{ to }T_{max}$		50		ppm/ $^\circ C$
$R_{DS(on)}$	LX On Resistance			0.7		$\Omega$
$I_{LEAK}$	LX Leakage Current	$V_{DS} = 10\text{ V}$		1		$\mu A$
$I_{SH}$	Shutdown Pin Current				1	$\mu A$
$V_{il}$	Shutdown Input Low Threshold				0.25	V
$V_{ih}$	Shutdown Input High Threshold		2			V
$f_o$	Oscillator Frequency			160		KHz
$\eta$	Power Efficiency	$I_o = 100\text{ mA}$		68		%
CC	Compensation Pin Impedance			7.5		K $\Omega$

Do not overload or short the Output to Ground. If the above conditions are observed, 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  $0.7\Omega$  - 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

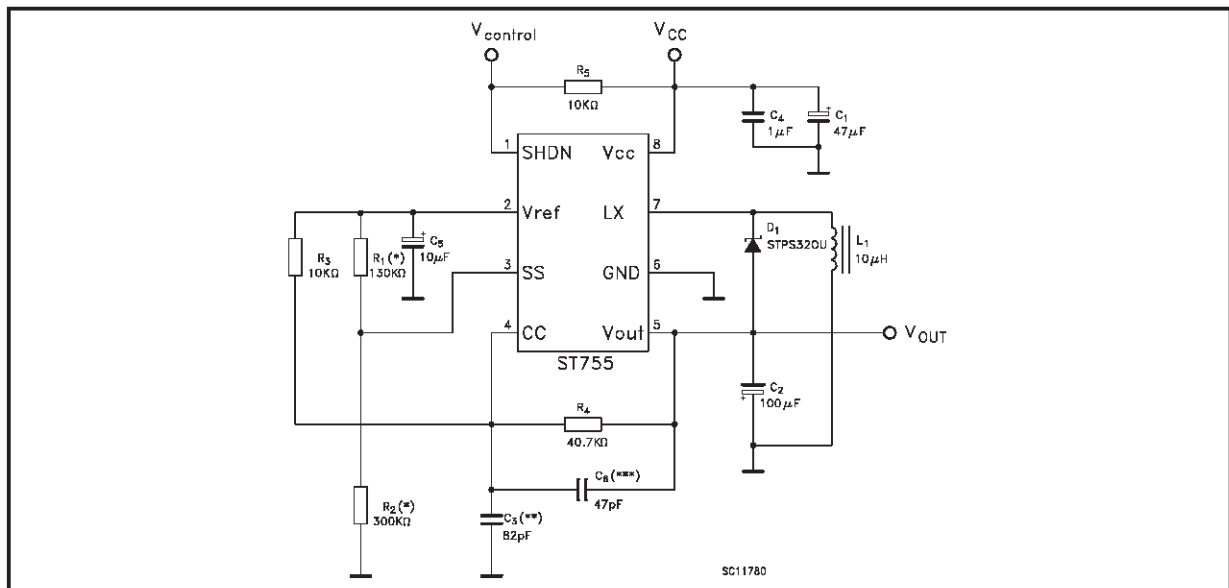
PWM comparator in order to keep 0V on the CC input. So  $R_3$  and  $R_4$  resistors are calculated by the following formulae  $R_4 = (|V_{out}|/V_{ref}) * R_3$  (see fig 1). For  $R_3$  can be chosen any value between  $2K\Omega$  and  $20K\Omega$ . Soft-Start (SS) input is a voltage dependent-output current limit (see figure 9, Switch Current Limit vs. SS Input Voltage). SS pin is internally pulled to  $V_{ref}$  through a  $1.2\text{ M}\Omega$  resistor. Applying an appropriate 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 divider ( $R_1$  and  $R_2$ ), the maximum LX current limit can be lowered according to the diagram showed in figure 9. When SHDN input is low, the total current consumption is reduced to  $10\mu A$ .

## 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 C1, C2 and C3 must be low ESR type, placed as close possible to the integrated circuit. The 10 $\mu$ H 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

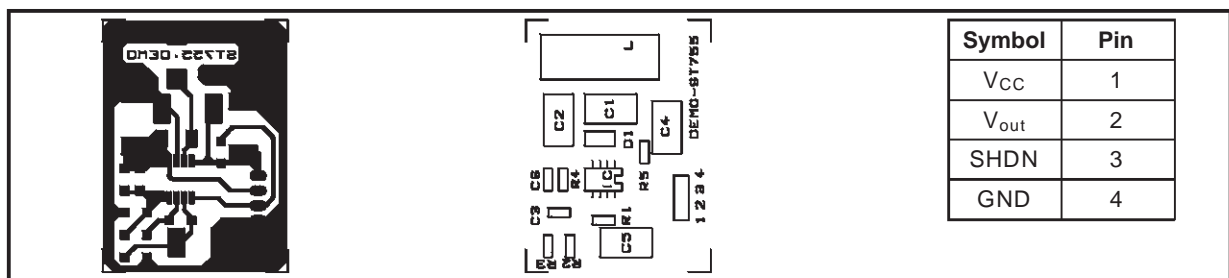


(\*) R1 and R2 can be omitted for Iout < 200mA.

(\*\*) C6: Very low noise but poor transient and load response speed.

(\*\*\*) C3 (alternative to C6): faster transient and load response.

Figure 2: Printed Demoboard



### Component Values

Capacitor	Value	Unit	Resistor	Value	Unit
C1	47	$\mu$ F	R1	130	K $\Omega$
C2	100	$\mu$ F	R2	300	K $\Omega$
C3	82	pF	R3	10	K $\Omega$
C4	1	$\mu$ F	R4	40.7	K $\Omega$
C5	10	$\mu$ F	R5	10	K $\Omega$
C6	47	pF			

## TYPICAL OPERATING CHARACTERISTICS

Figure 3: Load Current vs Supply Voltage

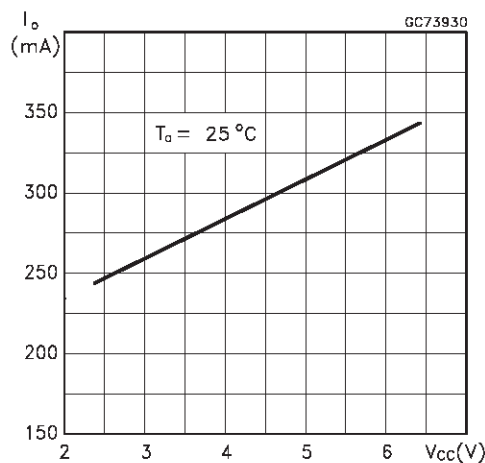


Figure 4: Load Current vs Supply Voltage

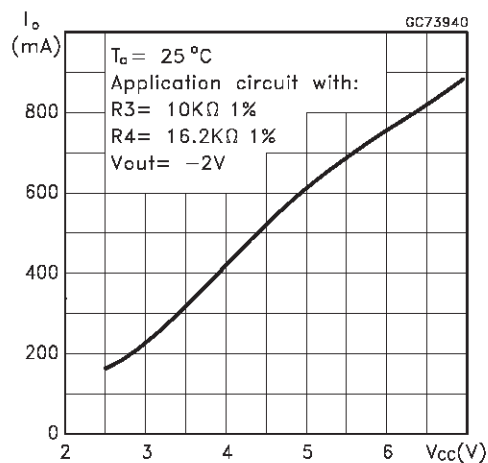


Figure 5: Efficiency vs Load Current

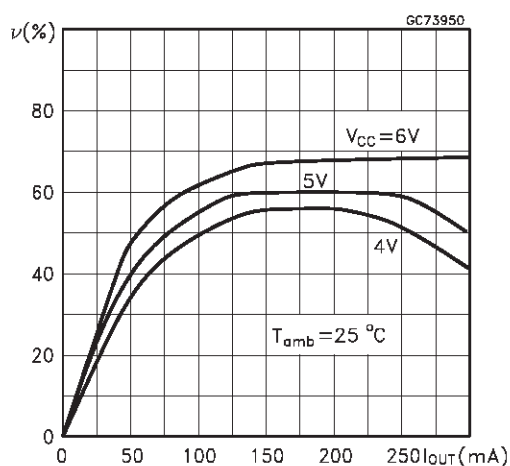


Figure 6: Peak Inductor Current vs Load Current

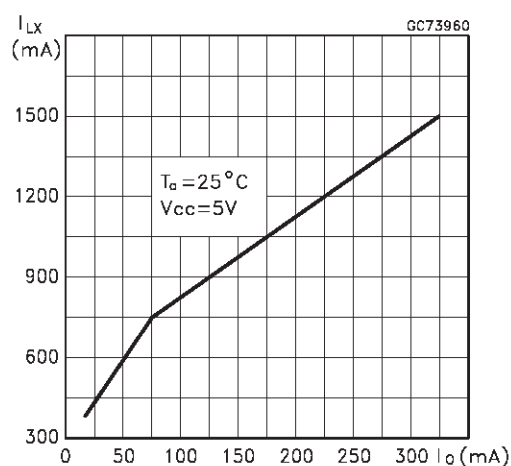


Figure 7: Switch ON Resistance vs Supply Voltage

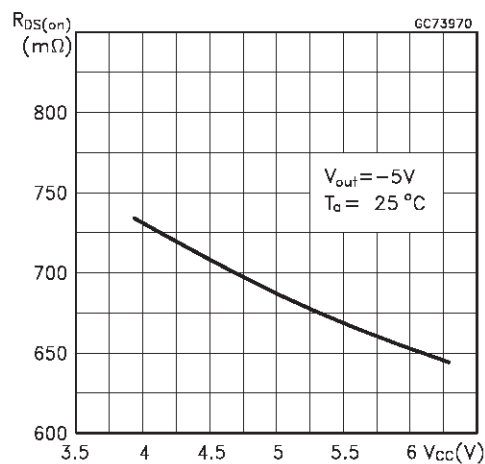
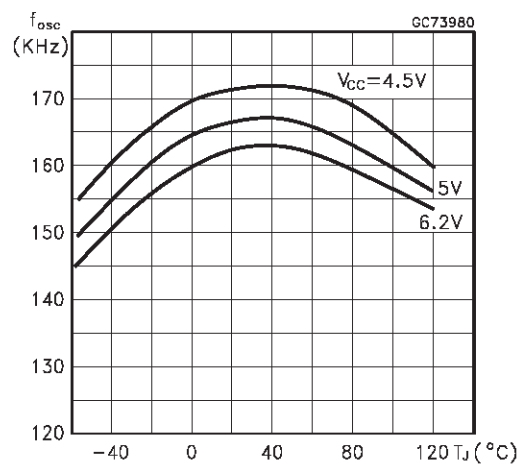


Figure 8: Oscillator Frequency vs Temperature &amp; Supply Voltage



TYPICAL OPERATING CHARACTERISTICS (continued)

Figure 9: Switch Current Limit vs Soft Start Voltage

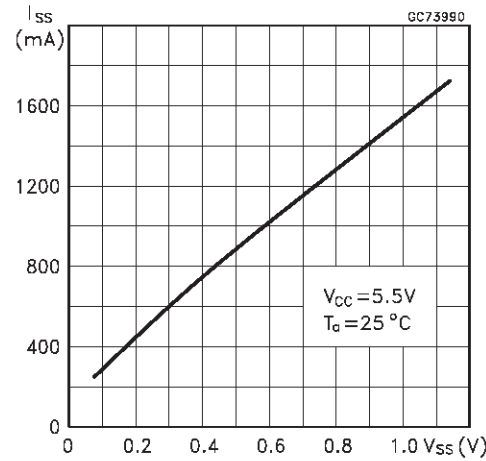


Figure 10: Reference Voltage vs temperature

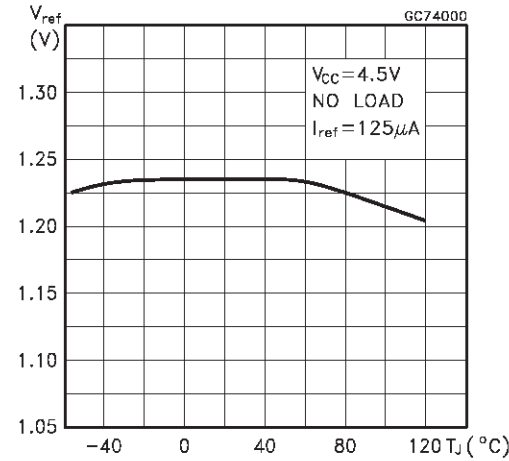
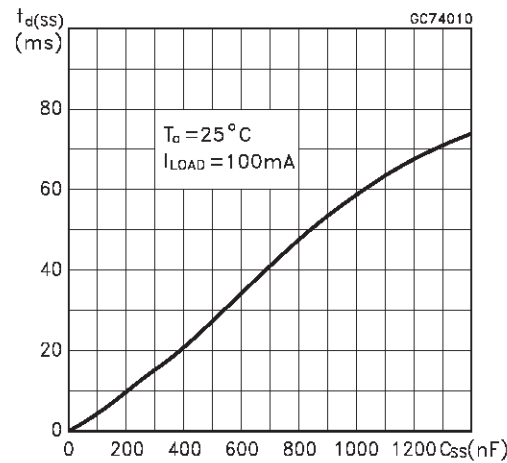
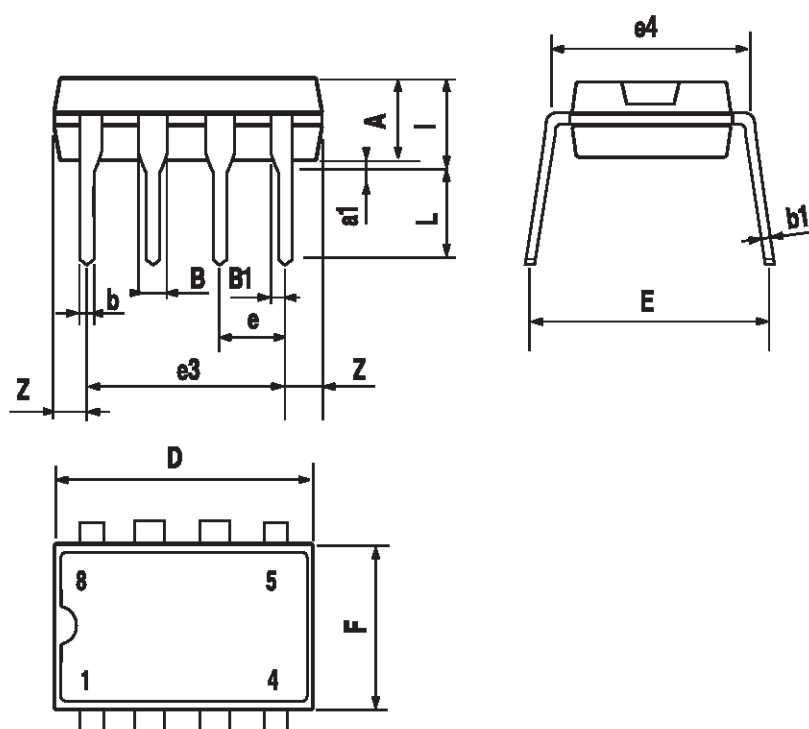


Figure 11: Soft Start Delay Time



### Plastic DIP-8 MECHANICAL DATA

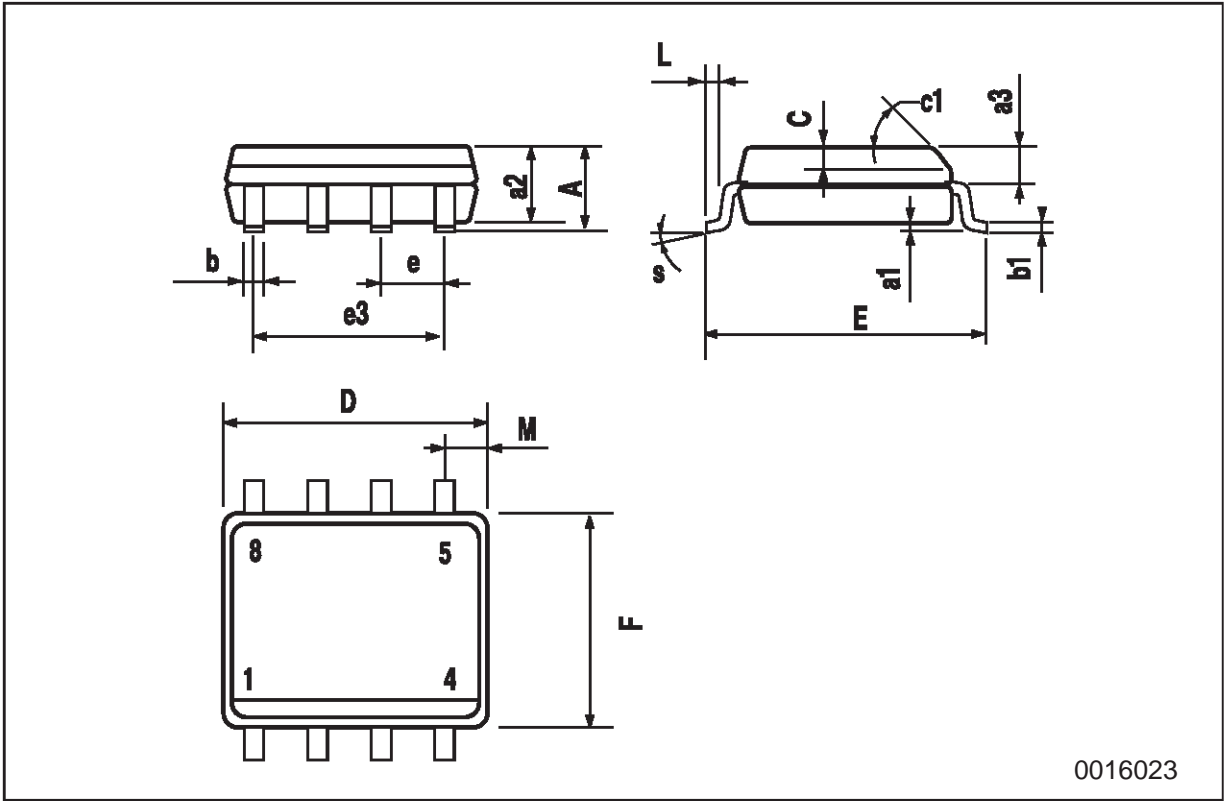
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A		3.3			0.130	
a1	0.7			0.028		
B	1.39		1.65	0.055		0.065
B1	0.91		1.04	0.036		0.041
b		0.5			0.020	
b1	0.38		0.5	0.015		0.020
D			9.8			0.386
E		8.8			0.346	
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			7.1			0.280
I			4.8			0.189
L		3.3	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



P001F

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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