Melexis
Microelectronic Integrated Systems

US5881

CMOS Multi - Purpose Switch

Features and Benefits

- Chopper stabilized amplifier stage
- Optimized for brushless DC motor applications
- Miniature high reliability package
- Operation down to 3.5V
- CMOS for optimum stability, quality and cost

Ordering Information

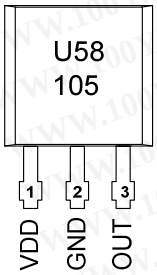
Part No.	Temperature Suffix	Package Code	Option code
US5881	E (-40°C to 85°C)	SO (SOT-23) or UA(TO-92)	ESO or EUA
US5881	L (-40°C to 150°C)	SO (SOT-23) or UA(TO-92)	LSO or LUA

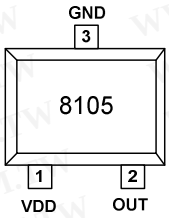
* Contact factory or sales representative for legacy temperature options

Applications

- Solid state switch
- Limit Switch
- Current Limit
- Interrupter
- Current sensing

Pinout:





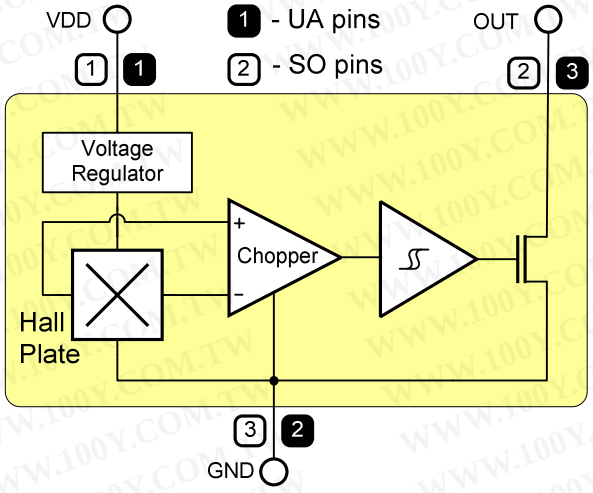
UA Package:

Pin1: VDD - Supply
Pin2: GND - Ground
Pin3: OUT - Output

SO Package:

Pin1: VDD - Supply
Pin2: OUT – Output
Pin3: GND - Ground

1 Functional Diagram



Note: Static electricity sensitive device; please observe ESD precautions. Reverse voltage protection is not included. For reverse polarity protection, a 100Ohm resistor in series with V_{DD} is recommended.

2 Description

The US5881 is a unipolar Hall Effect sensor IC fabricated from mixed signal CMOS technology It incorporates advanced chopper stabilization techniques to provide accurate and stable magnetic switch points. There are many applications for this sensor in addition to those listed above. The design specifications and performance have been optimized for applications of solid state switches.

The output transistor will be switched on (Bop) in the presence of a sufficiently strong South pole magnetic field facing the marked side of the package. Similarly, the output will be switched off (Brp) in the presence of a weaker South field and remain off with “0” field.

The SOT-23 device is magnetically reversed from the UA package. The SOT-23 output transistor will be switched on (Bop) in the presence of a sufficiently strong North pole magnetic field subjected to the marked side of the package.

Table of Contents

3 Glossary of Terms

MilliTesla (mT), Gauss: Units of magnetic flux density; 1 milliTesla = 10 Gauss.

4 Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Supply Voltage (Operating)	V_{DD}	24	V
Supply Current (Fault)	I_{DD}	50	mA
Output Voltage	V_{OUT}	24	V
Output Current (Fault)	I_{OUT}	50	mA
Operating Temperature Range "E"	T_A	-40 to 85	℃
Operating Temperature Range "L"	T_A	-40 to 150	℃
Power Dissipation, temp. range "E", UA/SO packages	P_D	500/278	mW
Power Dissipation, temp. range "L", UA/SO packages	P_D	700/389	mW
Maximum Junction Temperature, temp. range "E"	T_J	125	℃
Maximum Junction Temperature, temp. range "L"	T_J	165	℃
Storage Temperature	T_S	-65 to 150	°C

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

5 US5881 Electrical Characteristics

DC operating parameters: T_A = 25°C, V_{DD} = 12V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Voltage	VDD	Operating	3.5		24	V
Supply current	I_{DD}	B < B_{RP}	1.5	2.5	5.0	mA
Saturation Voltage	$V_{DS(on)}$	I_{OUT} = 20mA, B > B_{op}		0.4	0.5	V
Output Leakage	I_{OFF}	B < B_{RP}, V_{OUT}=24V		0.01	10	uA
Output Rise Time	t_r	V_{DD} = 12V, R_L = 1k, C_L = 20pF		0.04		us
Output Fall Time	t_f	V_{DD} = 12V, R_L = 1k, C_L = 20pF		0.18		us

6 US5881 Magnetic Characteristics

DC operating parameters: T_A = 25°C, V_{DD} = 12V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Operating Point	B_{OP}	E/LUA, E/LSO, Ta=25,Vdd=12VDC	15.0	25.0	30.0	mT
Release Point	B_{RP}	E/LUA, E/LSO, Ta=25,Vdd=12VDC	9.5	20	-	mT
Hysteresis	B_{HYS}	E/LUA, E/LSO, Ta=25,Vdd=12VDC	2.0	4.3	5.5	mT

Note: 1 mT = 10 Gauss

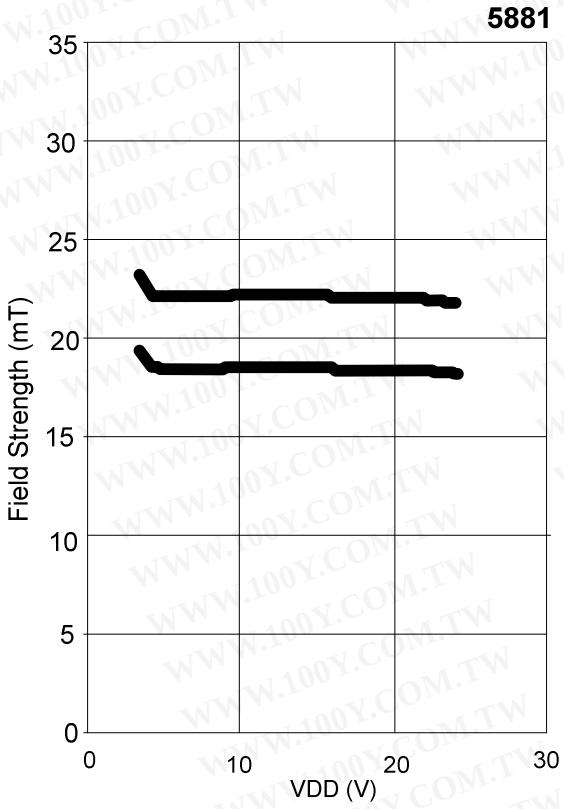
7 Unique Features

CMOS Hall IC Technology
The chopper stabilized amplifier uses switched capacitor techniques to eliminate the amplifier offset voltage, which, in bipolar devices, is a major source of temperature sensitive drift. CMOS makes this advanced technique possible. The CMOS chip is also much smaller than a bipolar chip, allowing very sophisticated circuitry to be placed in less space. The small chip size also contributes to lower physical stress and less power consumption.

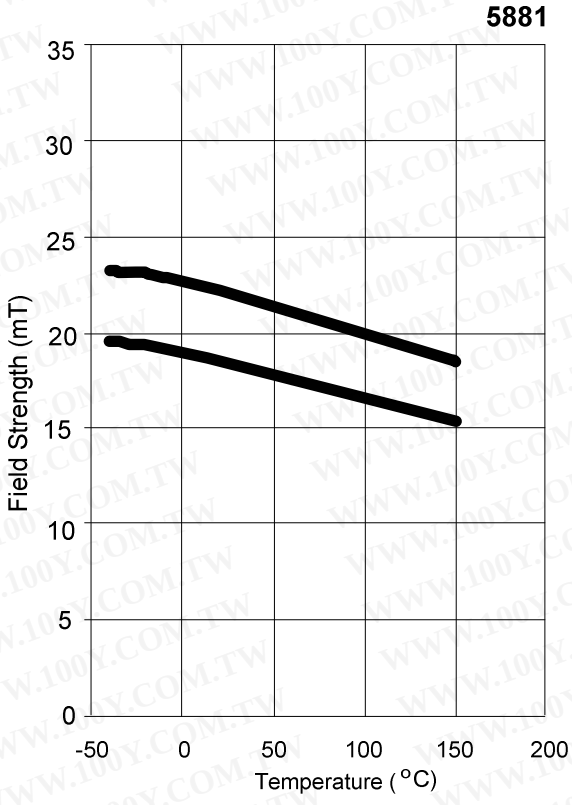
Applications
If reverse supply protection is desired, use a resistor in series with the V_{DD} pin. The resistor will limit the supply current (Fault), I_{DD} , to 50mA .For severe EMC conditions , use the application circuit on page 7.

8 Performance Graphs

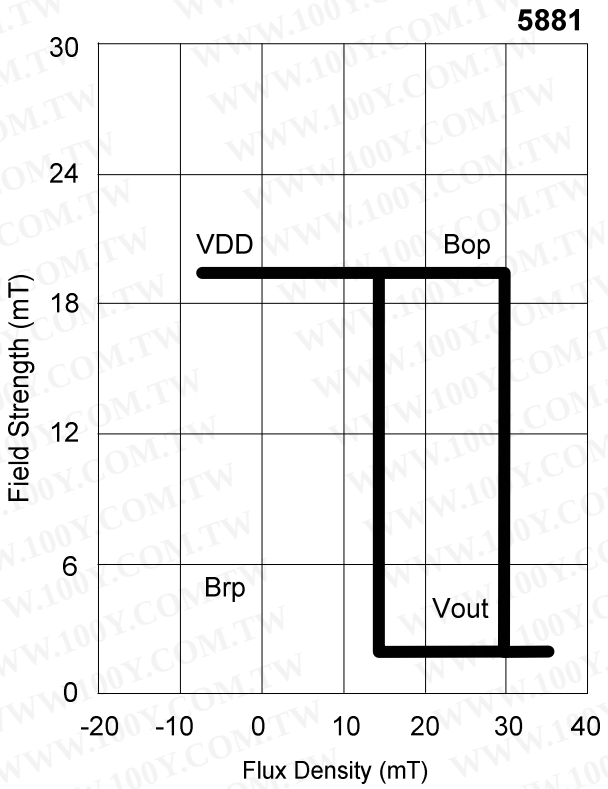
8.1 Typical Magnetic Switch Points vs V_{DD}



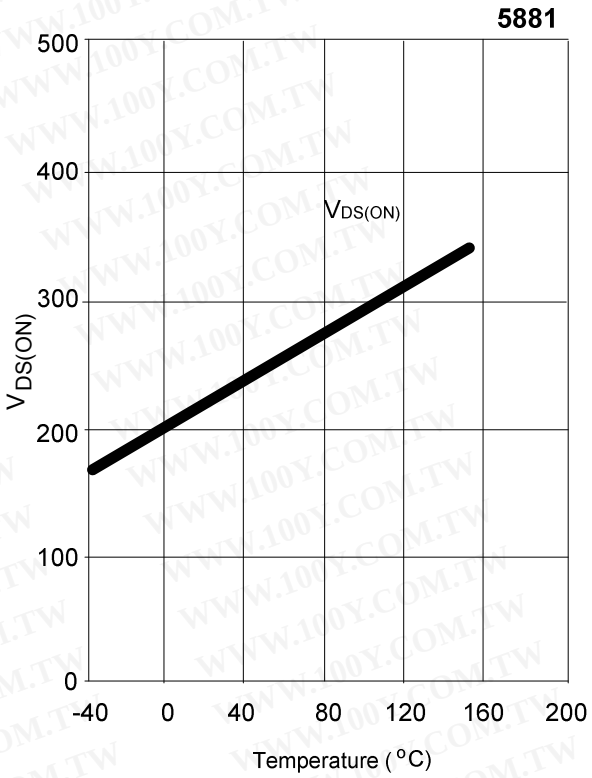
8.2 Magnetic Switch Points vs Temperature



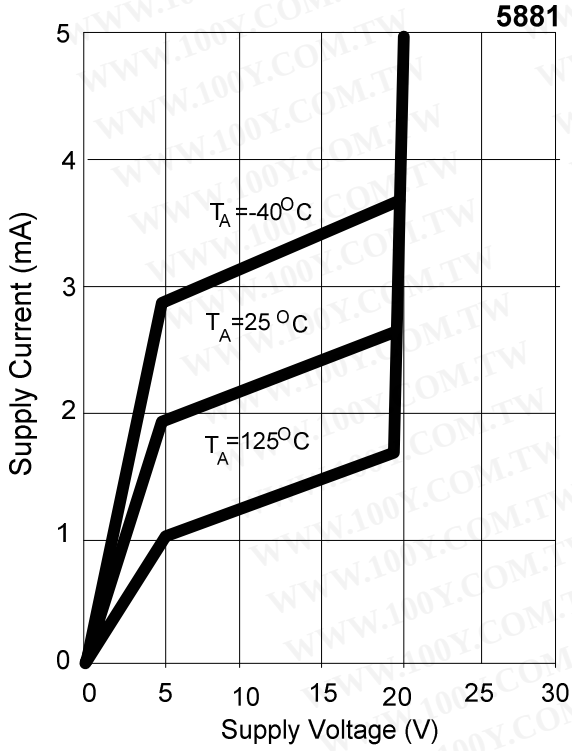
8.3 Output Voltage vs Magnetic Flux Density (Hysteresis)



8.4 Typical Saturation Voltage vc Temperature (VDD=12V; Iout=20mA)

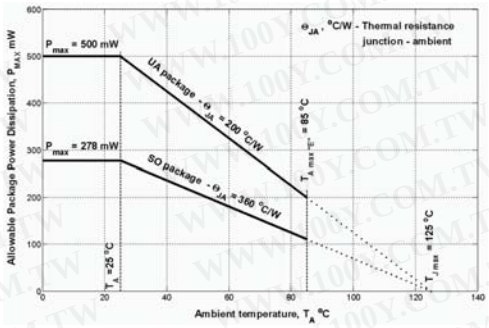


8.5 Typical Supply Current vs V_{DD}

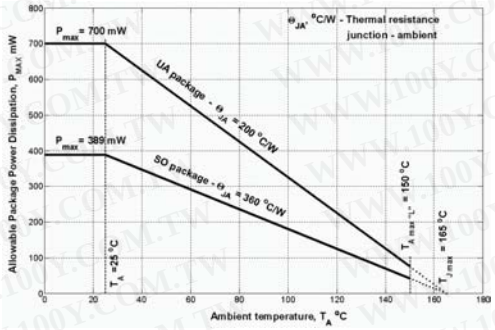


8.6 Maximal Power Dissipation (MPD) Versus Temperature

8.6.1 MPD for "E" temperature range



8.6.2 MPD for "L" temperature range



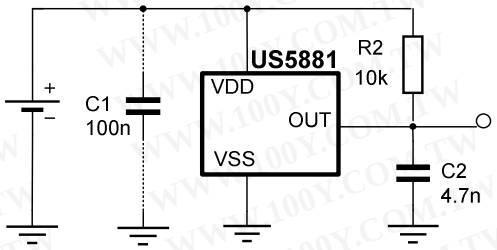
The thermal resistance Θ_{JA} and rated power dissipation are defined in accordance with EIA/JESD51-3 Standard.

9 Pin Definitions and Descriptions

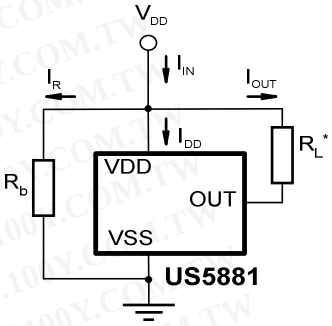
UA Pins	SO Pins	Pin Name	Type	Description
1	1	VDD	Supply	Supply
3	2	OUT	Output	Hall output (clamped)
2	3	VSS	Ground	Ground

10 Application Information

10.1 Typical Three-Wire Application Circuit



10.2 Two-Wire Circuit

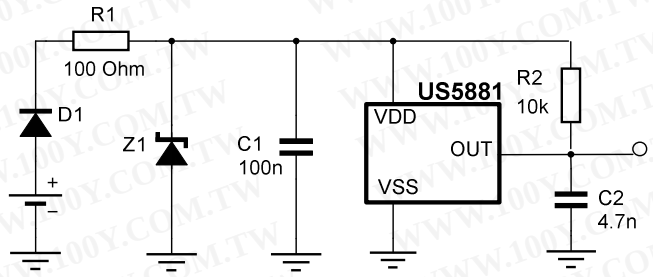


Note:
With this circuit, precise ON and OFF currents can be detected using only two connecting wires.

The resistors RL and Rb can be used to bias the input current. Refer to the part specifications for limiting values.

B_{RP} : $I_{OFF} = I_R + I_{DD} = V_{DD}/R_b + I_{DD}$
B_{OP} : $I_{ON} = I_{OFF} + I_{OUT} = I_{OFF} + V_{DD}/R_L$

10.3 Severe Environment Three-Wire Circuit



11 Reliability Information

This Melexis device is classified and qualified regarding soldering technology, solderability and moisture sensitivity level, as defined in this specification, according to following test methods:

- IPC/JEDEC J-STD-020
  Moisture/Reflow Sensitivity Classification For Nonhermetic Solid State Surface Mount Devices
  (classification reflow profiles according to table 5-2)
- EIA/JEDEC JESD22-A113
  Preconditioning of Nonhermetic Surface Mount Devices Prior to Reliability Testing
  (reflow profiles according to table 2)
- CECC00802
  Standard Method For The Specification of Surface Mounting Components (SMDs) of Assessed Quality
- EIA/JEDEC JESD22-B106
  Resistance to soldering temperature for through-hole mounted devices
- EN60749-15
  Resistance to soldering temperature for through-hole mounted devices
- MIL 883 Method 2003 / EIA/JEDEC JESD22-B102
  Solderability

For all soldering technologies deviating from above mentioned standard conditions (regarding peak temperature, temperature gradient, temperature profile etc) additional classification and qualification tests have to be agreed upon with Melexis.

The application of Wave Soldering for SMD's is allowed only after consulting Melexis regarding assurance of adhesive strength between device and board.

Based on Melexis commitment to environmental responsibility, European legislation (Directive on the Restriction of the Use of Certain Hazardous substances, RoHS) and customer requests, Melexis has installed a Roadmap to qualify their package families for lead free processes also.
Various lead free generic qualifications are running, current results on request.

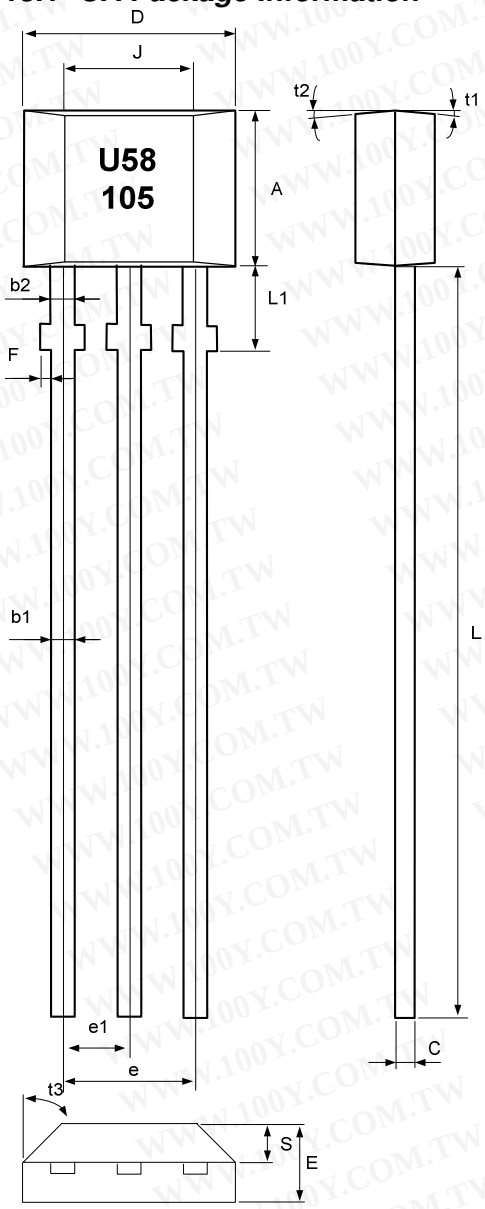
For more information on manufacturability/solderability see quality page at our website:
http://www.melexis.com/html/pdf/MLXleadfree-statement.pdf

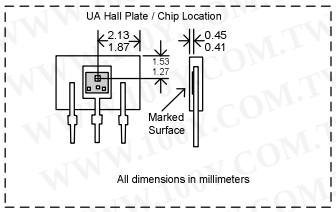
12 ESD Precautions

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

13 Physical Characteristics

13.1 UA Package Information





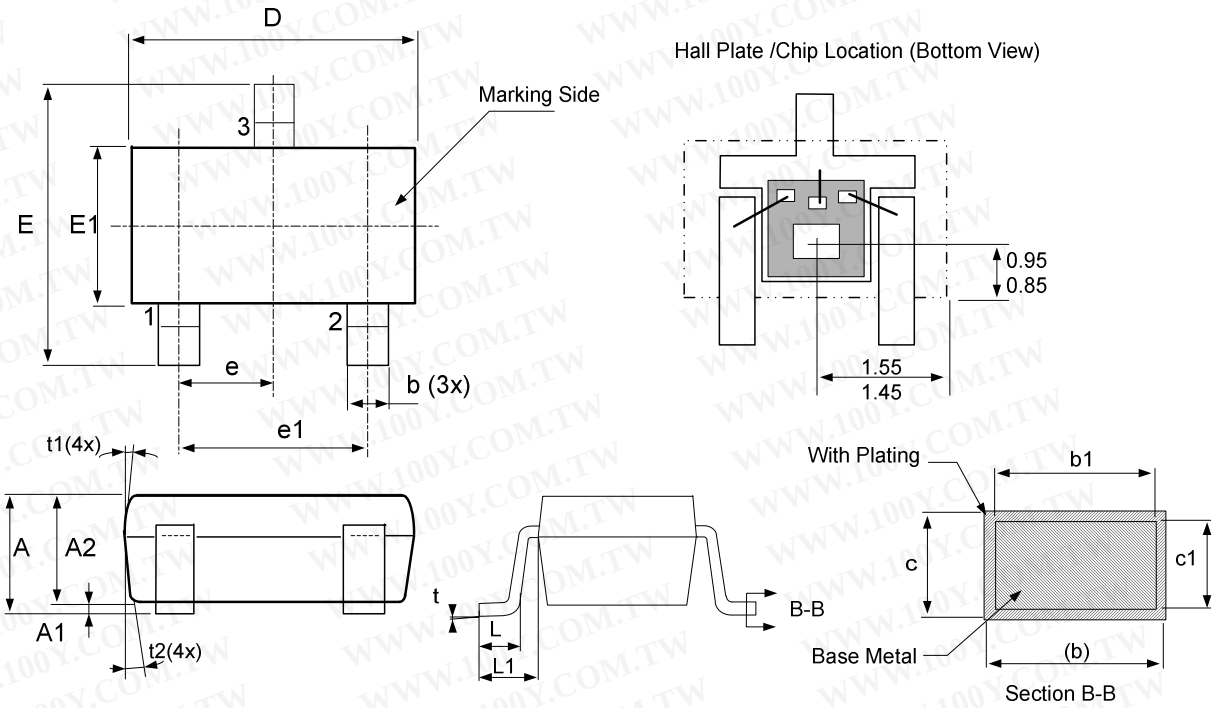
MARKING
Line 1:
1st letter (U) =Supplier (Melexis)
2nd and 3rd digits(58) =Series (5881)

Line2:
1st digit (1) =Year (2001)
2nd and 3rd digits =Week of the year

Symbols	Dimensions in millimeters		
	min	nom	max
A	2.80	3.00	3.20
b1	0.35	0.38	0.41
b2	0.43	0.46	0.48
C	0.35	0.38	0.41
D	3.90	4.10	4.30
e	2.51	2.54	2.57
e1	1.24	1.27	1.30
E	1.40	1.50	1.60
J	2.51	2.62	2.72
L	14.0	14.5	15.0
S	0.63	0.74	0.84
t3	-	45°	-
t2	-	5°	-
t1	-	-	5°
L1	1.55	1.65	1.75
F	0	-	0.20

Note:
1. Controlling Dimension: mm
2. Tolerance: +/-0.004" unless otherwise specified
3. Package dimensions exclude molding flash
4. The end flash shall not exceed 0.005" on each side

13.2 SOT23 Package Information



Note:
1.Dimension D does not include mold flash, protrusions or gate burrs. Mold flash , protrusions or gate burrs shall not exceed 0.10mm per side.
2. Dimension E1 does not include interlead flash or protrusion shall not exceed 0.10mm per side.
3. The package top may be smaller than the package bottom. Dimensions D and E1 are determined at the outermost extremes of the plastic body exclusive or mold flash, tie bar burrs, interlead flash and gate burrs, but including any mismatch between the top and bottom of the molded body.
4. The section B-B apply to the flat section of the lead between 0.08mm and 0.15mm from the lead tip.
5. Marking (on top of the chip)
8YXX - First Digit (2) - part number; YXX- date code(Y - last digit of the Year, XX - week)

Symbols	Dimensions in millimeters		
	min	nom	max
A	1.05	-	1.35
A1	0.05	-	0.15
A2	1.00	1.10	1.20
b	0.25	-	0.50
b1	0.25	0.40	0.45
c	0.08	-	0.20
c1	0.08	0.11	0.15
D	2.70	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
L	0.35	0.45	0.55
L1	0.60 REF		
e	0.95 BSC		
e1	1.90 BSC		
t	0^o	5^o	10^o
t1	3^o	5^o	7^o
t2	6^o	8^o	10^o

14 Disclaimer

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