



rev 1.5

## Single/Dual Low Voltage, Low Power Microcontroller Power Supply Supervisor

### General Description

The ASM6381 - ASM6390 are cost effective +1.8V to +5V power supply supervisor circuits optimized for low-power microprocessor ( $\mu\text{P}$ ), microcontroller ( $\mu\text{C}$ ) and digital systems. They provide a reset output during power-up, power-down and brown-out conditions. They provide excellent reliability by eliminating external components and adjustments.

A reset signal is issued if the power supply voltage drops below a preset reset threshold and is asserted for a minimum reset timeout period after the supply has risen above the reset threshold. The reset timeout periods are available from 1ms to 1200ms. The ASM6381, ASM6384 and ASM6387 have a push-pull active-low reset output. The ASM6382, ASM6385 and ASM6388 have a push-pull active-high reset output, and the ASM6383, ASM6386, ASM6389 and ASM6390 have an open-drain active-low reset output. The ASM6384, ASM6385 and ASM6386 also feature a manual reset input.

The ASM6387, ASM6388, ASM6389 have an auxiliary input RESET IN for monitoring a second voltage. The ASM6390 offers a manual reset input with a longer  $V_{\text{CC}}$  reset timeout period and a shorter manual reset timeout.

The reset output state is guaranteed to be in the correct logic state for  $V_{\text{CC}}$  down to 1V. The reset comparator is designed to ignore fast transients on  $V_{\text{CC}}$ .

Low supply current makes the ASM6381 - ASM6390 ideal for use in portable and battery operated equipments. The ASM6381 - ASM6383 are available in a compact, industry standard 3-pin SC70 package and the ASM6384 - ASM6390 are available in a compact, industry standard 4-pin SC70 package. The ASM63811, ASM63812, ASM63832 are available in 3-pin SOT23 package. ASM63813 is available in 3-pin and 5-pin SOT23 package.

Reset thresholds are available from +1.58V to 4.63V in approximately 100mV increments to support +1.8V to +5V systems.

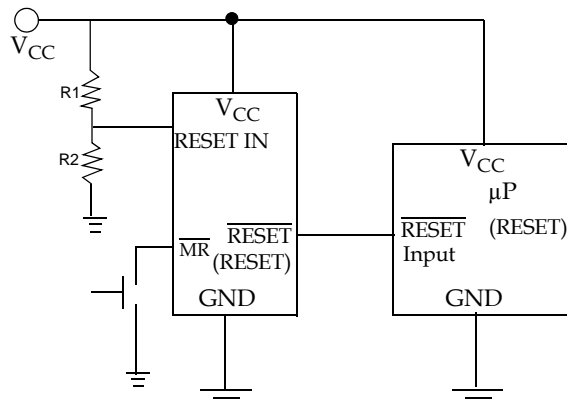
### Features:

- Factory-set Reset Threshold Voltages ranging from +1.58V to 4.63V.
- Monitor 1.8V to 5V supplies.
- Push-Pull Active-low reset valid with 1.0V supply.
- Small 3-pin SC-70, 4-pin SC-70, 3-pin and 5-pin SOT23 packages.
- No external components.
- Specified over full temperature range:  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- Seven Reset Timeout periods: 1ms, 20ms, 140ms, 280ms, 560ms, 1120ms, 1200ms (min).
- Low power consumption:  $3\mu\text{A}$  at +1.8V.
- Auxiliary RESET IN
- Manual Reset input.

### Applications

- Embedded controllers
- Portable/Battery operated systems
- Intelligent instruments
- Wireless communication systems
- PDAs and handheld equipment
- Computers

### Typical Operating Circuit

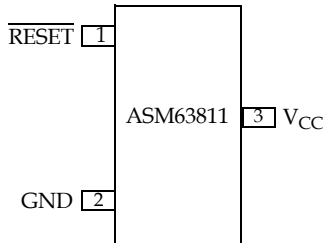




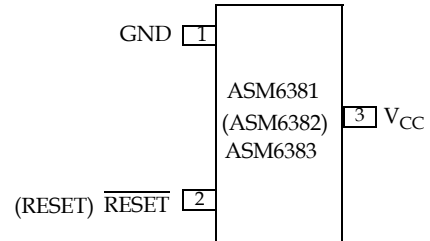
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Pin Diagram

Top View

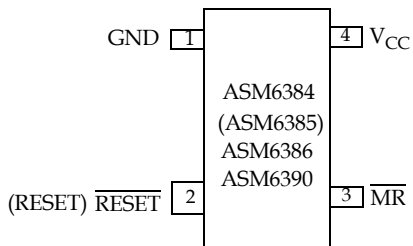
3SOT23



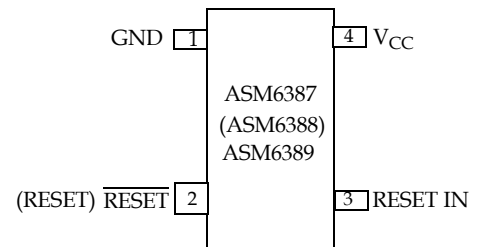
3SC-70



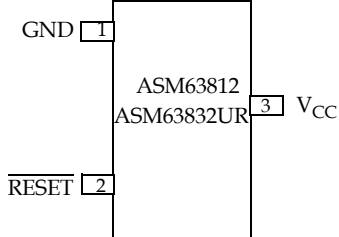
4SC-70



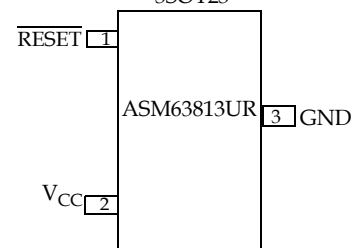
4SC-70



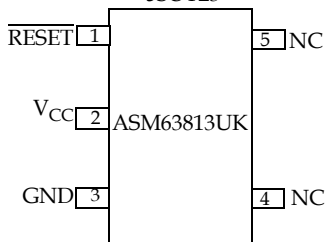
3SOT23



3SOT23



5SOT23





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## Pin Description

Pin #											Pin Name	Function
ASM63813UR	ASM63813UK	ASM63812	ASM63811	ASM63832	ASM6381 ASM6383	ASM6382	ASM6384/ ASM6386/ ASM6390	ASM6385	ASM6387/ ASM6389	ASM6388		
5SOT23	3SOT23	3SOT23	3SOT23	3SOT23	3SC-70	4SC-70						
3	3	1	2	1	1	1	1	1	1	1	GND	Ground.
1	1	2	1	2	2	-	2	-	2	-	$\overline{\text{RESET}}$	RESET is asserted LOW if $V_{CC}$ falls below $V_{TH}$ and remains LOW for $T_{RST}$ after $V_{CC}$ exceeds the threshold.
-	-	-	-	-	-	2	-	2	-	2	RESET	RESET is asserted HIGH if $V_{CC}$ falls below $V_{TH}$ and remains HIGH for $T_{RST}$ after $V_{CC}$ exceeds the threshold.
-	-	-	-	-	-	-	3	3	-	-	$\overline{\text{MR}}$	Manual Reset Input. A logic LOW on $\overline{\text{MR}}$ asserts reset. Reset remains active as long as $\overline{\text{MR}}$ is LOW and for $T_{MRST}$ after $\overline{\text{MR}}$ returns HIGH. The active low input has an internal 20k. pull-up resistor. The input should be left open if not used. It can be driven by TTL or CMOS logic or shorted to ground by a switch.
-	-	-	-	-	-	-	-	-	3	3	RESETIN	Auxiliary Reset input. Reset asserts when either $V_{CC}$ or RESET IN falls below its threshold voltage.
2	2	3	3	3	3	3	4	4	4	4	$V_{CC}$	Power supply input voltage.



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## Detailed Description

A proper reset input enables a microprocessor or a microcontroller to start in a known state. ASM6381 - ASM6390 assert reset to prevent code execution errors during power-up, power-down and brown-out conditions.

### Manual Reset ( $\overline{\text{MR}}$ ) Input

A logic low on  $\overline{\text{MR}}$  asserts reset.  $\overline{\text{MR}}$  is internally pulled high through a 63k $\Omega$  resistor (for ASM6381-ASM6389, 1.35K $\Omega$  for ASM6390) and can be driven by TTL/CMOS gates or with open collector/drain outputs.  $\overline{\text{MR}}$  can be left open if not used.  $\overline{\text{MR}}$  may be connected to ground through a normally-open momentary switch without an external debounce circuit.

A 0.1 $\mu\text{F}$  capacitor from  $\overline{\text{MR}}$  to ground can be added for additional noise immunity.

### Reset Output Operation

In  $\mu\text{P}$  /  $\mu\text{C}$  systems it is important to have the processor and the system begin operation from a known state. A reset output to a processor is provided to prevent improper operations during power supply sequencing or low voltage brown-out conditions.

The ASM6381-ASM6390 are designed to monitor the system power supply voltages and issue a reset signal when the levels are out of range. RESET outputs are guaranteed to be active for  $V_{\text{CC}}$  above 1.0V. When  $V_{\text{CC}}$  exceeds the reset threshold, an internal timer keeps RESET active for the reset timeout period, after which RESET becomes inactive. If  $V_{\text{CC}}$  drops below the reset threshold, RESET automatically becomes active. Alternatively, external circuitry or an operator can initiate this condition using the Manual Reset ( $\overline{\text{MR}}$ ) pin.  $\overline{\text{MR}}$  can be left open if it is not used.  $\overline{\text{MR}}$  can be driven by TTL/CMOS logic or even an external switch.

### RESET IN Comparator

Reset asserts when either  $V_{\text{CC}}$  or RESET IN falls below its respective threshold. RESET IN is compared to an internal +1.27V reference. If the voltage at RESET IN is less than

1.27V, reset is asserted. The RESET IN can be used as a secondary power supply monitor input by implementing a resistor divider at RESET IN pin.

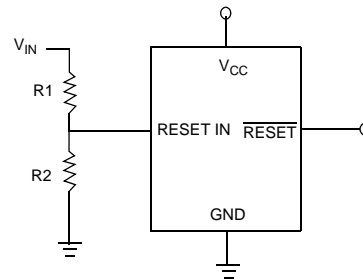
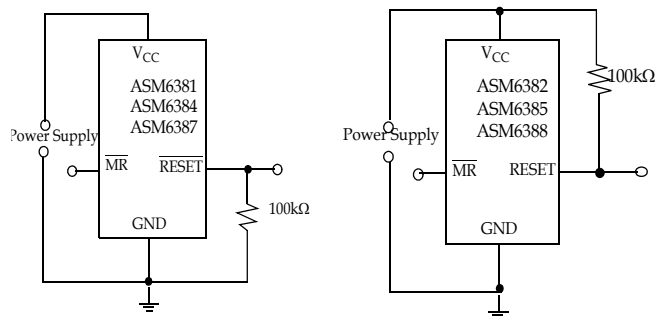


Figure 1: RESET IN Comparator

### Valid Reset with $V_{\text{CC}}$ under 1.0V

To ensure logic inputs connected to the ASM6381 - ASM6390 are in a known state when  $V_{\text{CC}}$  is under 1.0V, a 100k $\Omega$  pull-down resistor at  $\overline{\text{RESETE}}$  is needed. The value is not critical. A 100k $\Omega$  pull-up resistor to  $V_{\text{CC}}$  is needed with the RESET pin.

Figure 2: RESET valid with  $V_{\text{CC}}$  under 1.0V

## Application Information

### Negative $V_{\text{CC}}$ Transients

The ASM6381 - ASM6390 protect  $\mu\text{Ps}$  from brownouts and low  $V_{\text{CC}}$ . Short duration transients of 100mV amplitude and 35 $\mu\text{s}$  or less duration typically do not cause a false RESET.



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Absolute Maximum Ratings Table 1:

Parameter	Min	Max	Units
Pin Terminal Voltage With Respect To Ground			
$V_{CC}$	-0.3	6.0	V
RESET, $\overline{\text{RESET}}$	-0.3	$V_{CC} + 0.3$	V
Input current at $V_{CC}$		20	mA
Output current: RESET, $\overline{\text{RESET}}$		20	mA
Rate of Rise at $V_{CC}$		100	V/ $\mu$ s
ESD rating			
HBM		2	KV
MM		200	V
Note: These are stress ratings only and the functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability.			

Absolute Maximum Ratings Table 2:

Parameter	Min	Max	Units
Power Dissipation ( $T_A = 70^\circ\text{C}$ )	235	245	mW
Operating temperature range	-40	125	$^\circ\text{C}$
Storage temperature range	-65	150	$^\circ\text{C}$
Lead temperature (Soldering, 10 sec)		300	$^\circ\text{C}$
Note: These are stress ratings only and the functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability.			



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## Electrical Characteristics:

Unless otherwise noted,  $V_{CC}$  is over the full voltage range,  $T_A = -40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . Typical values at  $T_A = 25^{\circ}\text{C}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{CC}$	Input Voltage Range	$T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$	1.0		5.5	V	
$I_{CC}$	$V_{CC}$ Supply Current	$V_{CC} < 5.5\text{V}$ $V_{CC} < 3.6\text{V}$ $V_{CC} < 2.5\text{V}$ $V_{CC} < 1.8\text{V}$		7 6 4 3	13 11 7 6	$\mu\text{A}$	
$V_{TH}$	$V_{CC}$ Reset Threshold (See Table 3)	$T_A = 25^{\circ}\text{C}$ $T_A = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$	$V_{TH} - 1.5\%$ $V_{TH} - 2.5\%$	$V_{TH}$ $V_{TH}$	$V_{TH} + 1.5\%$ $V_{TH} + 2.5\%$	V	
$V_{TH}/^{\circ}\text{C}$	Reset Threshold Temp Coefficient			60		ppm/ $^{\circ}\text{C}$	
	$V_{CC}$ to Reset Delay	$V_{CC} = V_{TH} + 100\text{mV}$ to $V_{TH} - 100\text{mV}$ $V_{CC}$ falling at $10\text{mV}/\mu\text{s}$		35		$\mu\text{s}$	
$t_{RP}$	ASM6381 - ASM6389 Reset Active Timeout Period (See Table 4)	D1	1		2	ms	
		D2	20		40		
		D3	140		280		
		D5	280		560		
		D6	560		1120		
		D4	1120		2240		
		D7	1200		2400		
$t_{RP}$	Reset Timeout Period (ASM6390)	$\overline{\text{MR}}$ timeout period	D4	140		280	ms
			D7	150		300	
		$V_{CC}$ timeout period	D4	1120		2240	
			D7	1200		2400	
$V_{IL}$	$\overline{\text{MR}}$ Input Voltage	$V_{TH} < 4\text{V}$			$0.3 V_{CC}$	V	
$V_{IH}$				$0.7 V_{CC}$			
$V_{IL}$		$V_{TH} > 4\text{V}$			0.8		
$V_{IH}$			2.4				
$t_{MR}$	$\overline{\text{MR}}$ Minimum Input Pulse Width		1			$\mu\text{s}$	

## Notes:

1. Production testing done at  $T_A = 25^{\circ}\text{C}$ . Over-temperature specifications guaranteed by design only, using six sigma design limits.



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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
	$\overline{MR}$ Glitch Immunity			100		ns
$t_{MD}$	$\overline{MR}$ to Reset Propagation Delay			200		ns
	$\overline{MR}$ Internal Pullup Resistance	ASM6381 - ASM6389	32	63	100	k $\Omega$
		ASM6390	0.8	1.35	2.3	k $\Omega$
$V_{THRST}$	RESET IN Input Threshold	$T_A = +25^\circ\text{C}$	1.245	1.27	1.295	V
		$T_A = 0^\circ\text{C to } +85^\circ\text{C}$	1.232		1.308	V
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	1.219		1.321	V
	RESET IN to RESET Delay	$V_{RESETIN} = V_{THRST} + 40\text{mV to } V_{THRST} - 40\text{mV}$ $V_{RESETIN}$ falling at 4mV/ $\mu\text{s}$		4.5		$\mu\text{s}$
$I_{RESETIN}$	RESET IN Input Leakage Current		-50	$\pm 1$	+50	nA
$V_{OL}$	Open-Drain $\overline{RESET}$ Output Voltage	$V_{CC} \geq 4.5\text{V}, I_{SINK} = 3.2\text{mA}$			0.4	V
		$V_{CC} \geq 2.5\text{V}, I_{SINK} = 1.2\text{mA}$			0.3	
		$V_{CC} > 1.0\text{V}, I_{SINK} = 80\mu\text{A}$			0.3	
$I_{LKG}$	Open-Drain $\overline{RESET}$ Output Leakage Current	$V_{CC} > V_{TH}$			1.0	$\mu\text{A}$
$V_{OH}$	Push-Pull $\overline{RESET}$ Output Voltage	$V_{CC} \geq 4.5\text{V}, I_{SOURCE} = 800\mu\text{A}$	$0.8V_{CC}$			V
		$V_{CC} > 2.5\text{V}, I_{SOURCE} = 500\mu\text{A}$	$0.8V_{CC}$			
$V_{OL}$		$V_{CC} \geq 4.5\text{V}, I_{SINK} = 3.2\text{mA}$			0.4	
		$V_{CC} \geq 2.5\text{V}, I_{SINK} = 1.2\text{mA}$			0.3	
		$V_{CC} \geq 1.0\text{V}, I_{SINK} = 80\mu\text{A}$			0.3	

## Notes:

1. Production testing done at  $T_A = 25^\circ\text{C}$ . Over-temperature specifications guaranteed by design only, using six sigma design limits.



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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>OH</sub>	Push-Pull RESET Output Voltage	V <sub>CC</sub> >=4.5V, I <sub>SOURCE</sub> = 800μA	0.8V <sub>CC</sub>			V
		V <sub>CC</sub> >=2.5V, I <sub>SOURCE</sub> = 500μA	0.8V <sub>CC</sub>			
		V <sub>CC</sub> >=1.8V, I <sub>SOURCE</sub> = 150μA	0.8V <sub>CC</sub>			
V <sub>OL</sub>		V <sub>CC</sub> > 1.0V, I <sub>SOURCE</sub> = 1μA	0.8V <sub>CC</sub>			
		V <sub>CC</sub> >= 4.5V, I <sub>SINK</sub> = 3.2mA			0.4	
		V <sub>CC</sub> >= 2.5V, I <sub>SINK</sub> = 1.2mA			0.3	

## Notes:

1. Production testing done at T<sub>A</sub> = 25°C. Over-temperature specifications guaranteed by design only, using six sigma design limits.

Reset Thresholds (-40°C to +125°C): Table 3

SUFFIX	V <sub>TH</sub> (min)	V <sub>TH</sub> (nom)	V <sub>TH</sub> (max)
46	4.51	4.63	4.74
45	4.39	4.50	4.61
44	4.27	4.38	4.48
43	4.19	4.30	4.41
42	4.10	4.20	4.31
41	4.00	4.10	4.20
40	3.90	4.00	4.10
39	3.80	3.90	4.00
38	3.71	3.80	3.90
37	3.61	3.70	3.79
36	3.51	3.60	3.69
35	3.41	3.50	3.59
34	3.32	3.40	3.49
33	3.22	3.30	3.38
32	3.12	3.20	3.28
31	3.00	3.08	3.15
30	2.93	3.00	3.08
29	2.85	2.93	3.00
28	2.73	2.80	2.87





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SUFFIX	$V_{TH}(\text{min})$	$V_{TH}(\text{nom})$	$V_{TH}(\text{max})$
27	2.63	2.70	2.77
26	2.56	2.63	2.69
25	2.44	2.50	2.56
24	2.34	2.40	2.46
23	2.26	2.31	2.37
22	2.13	2.19	2.24
21	2.05	2.10	2.15
20	1.95	2.00	2.05
19	1.85	1.90	1.95
18	1.76	1.80	1.85
17	1.62	1.67	1.71
16	1.54	1.58	1.61

Reset Timeout Delay: Table 4

SUFFIX	MIN
D1	1ms
D2	20ms
D3	140ms
D5	280ms
D6	560ms
D4	1120ms
D7	1200ms
ASM6390XSyyTD4	1120/140ms*
ASM6390XSyyTD7	1200/150ms*

\* The ASM6390 has a 1120ms or 1200ms  $\overline{\text{RESET}}$  timeout and a 140ms or 150ms  $\overline{\text{MR}}$  timeout.



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## Selection Guide

Part Number	Output Stage	RESET Polarity	$\overline{\text{MR}}$	RESET IN	3SC-70 Package	4SC-70 Package	3SOT-23	5SOT-23
ASM6381	Push-Pull	LOW			◆			
ASM6382	Push-Pull	HIGH			◆			
ASM6383	Open-Drain	LOW			◆			
ASM6384	Push-Pull	LOW	◆			◆		
ASM6385	Push-Pull	HIGH	◆			◆		
ASM6386	Open-Drain	LOW	◆			◆		
ASM6387	Push-Pull	LOW		◆		◆		
ASM6388	Push-Pull	HIGH		◆		◆		
ASM6389	Open-Drain	LOW		◆		◆		
ASM6390	Open-Drain	LOW	◆			◆		
ASM63811	Push-Pull	LOW					◆	
ASM63812	Push-Pull	LOW					◆	
ASM63813	Push-Pull	LOW					◆	◆
ASM63832	Open-Drain	LOW					◆	

## Ordering Information

Part Number**	Temperature Range	Package
ASM6381XRyyTzza	-40°C to +125°C	SC70-3
ASM6382XRyyTzza	-40°C to +125°C	SC70-3
ASM6383XRyyTzza	-40°C to +125°C	SC70-3
ASM6384XSyyTzza	-40°C to +125°C	SC70-4
ASM6385XSyyTzza	-40°C to +125°C	SC70-4
ASM6386XSyyTzza	-40°C to +125°C	SC70-4
ASM6387XSyyTzza	-40°C to +125°C	SC70-4
ASM6388XSyyTzza	-40°C to +125°C	SC70-4
ASM6389XSyyTzza	-40°C to +125°C	SC70-4
ASM6390XSyyTzza*	-40°C to +125°C	SC70-4
ASM63811URyyTzza	-40°C to +125°C	SOT23-3
ASM63812URyyTzza	-40°C to +125°C	SOT23-3
ASM63813URyyTzza	-40°C to +125°C	SOT23-3
ASM63813UKyyTzza	-40°C to +125°C	SOT23-5
ASM63832URyyTzza	-40°C to +125°C	SOT23-3

yy - Insert Threshold Voltage suffix (See Table 3) before 'T'.

zz - Insert Reset timeout delay suffix (see Table 4) after 'T'.

\* - ASM6390 is available with D4 or D7 timing only.

\*\* - Add '-T' at the end for Tape and Reel.

a - Insert 'F' for Lead Free parts and 'G' for Green parts.

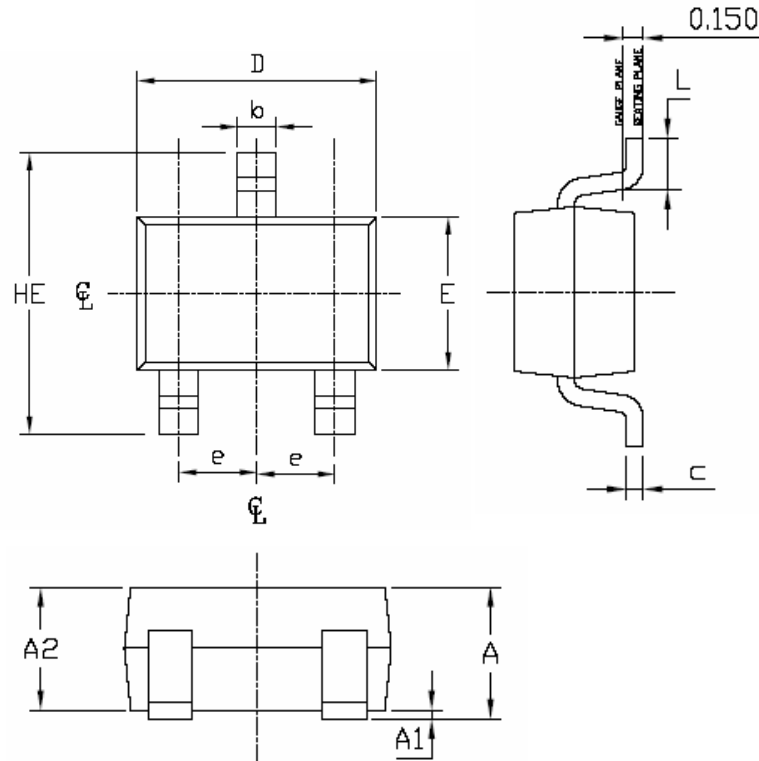
Note: All Alliance Semiconductor Lead Free parts are RoHS compliant. All parts are Lead Free by default. Contact factory for Non Lead Free parts.



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## Package Dimensions

## SC-70 (3 PIN)

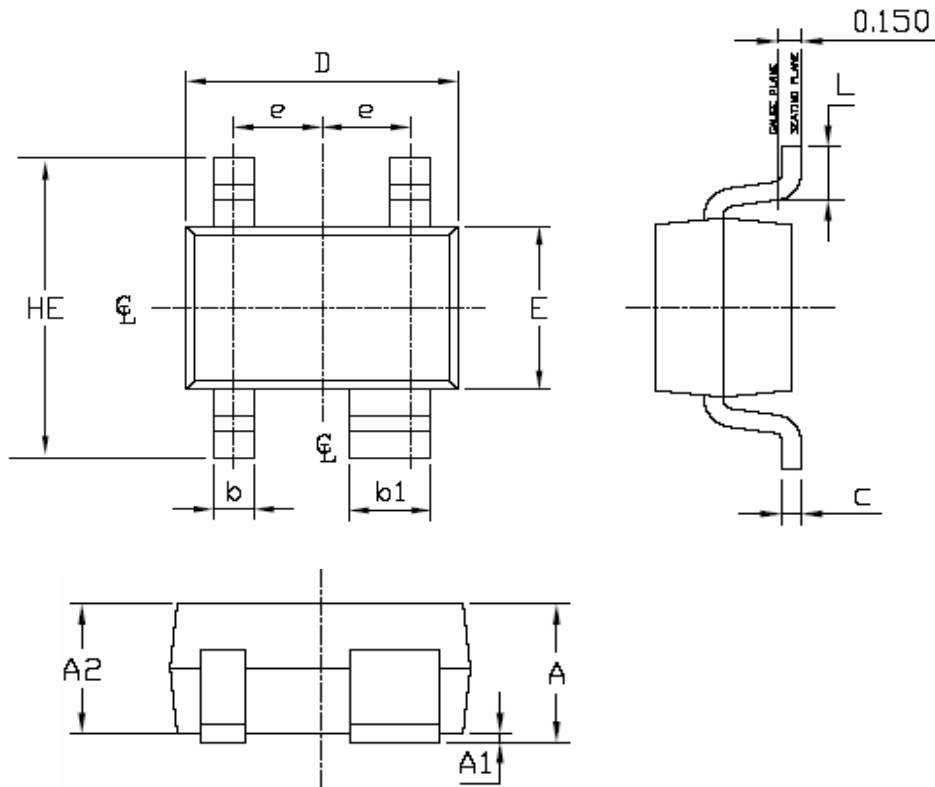


Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
E	0.045	0.053	1.15	1.35
D	0.073	0.089	1.85	2.25
He	0.071	0.094	1.8	2.4
A	0.031	0.043	0.8	1.1
A2	0.031	0.039	0.8	1.0
A1	0.000	0.004	0.0	0.1
b	0.010	0.016	0.25	0.4
e	0.026 BSC		0.65 BSC	
c	0.004	0.007	0.1	0.18
L	0.010	0.018	0.26	0.46



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## SC-70 (4 PIN)

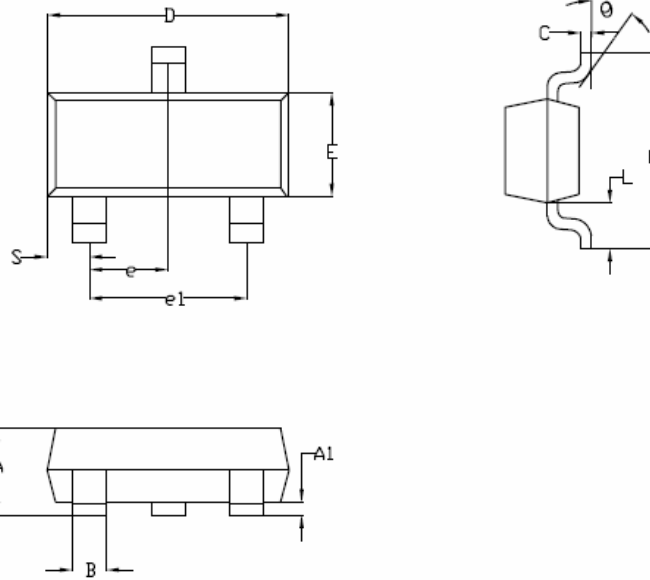


Symbol	Inches		Millimeters	
	Min	Max	Min	Max
E	0.045	0.053	1.15	1.35
D	0.073	0.089	1.85	2.25
He	0.071	0.094	1.8	2.4
A	0.031	0.043	0.8	1.1
A2	0.031	0.039	0.8	1.0
A1	0.000	0.004	0.0	0.1
b	0.010	0.016	0.25	0.4
b1	0.022	0.028	0.55	0.7
e	0.026 BSC		0.65 BSC	
c	0.004	0.007	0.1	0.18
L	0.010	0.018	0.26	0.46



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## Plastic SOT-23 (3-Pin)

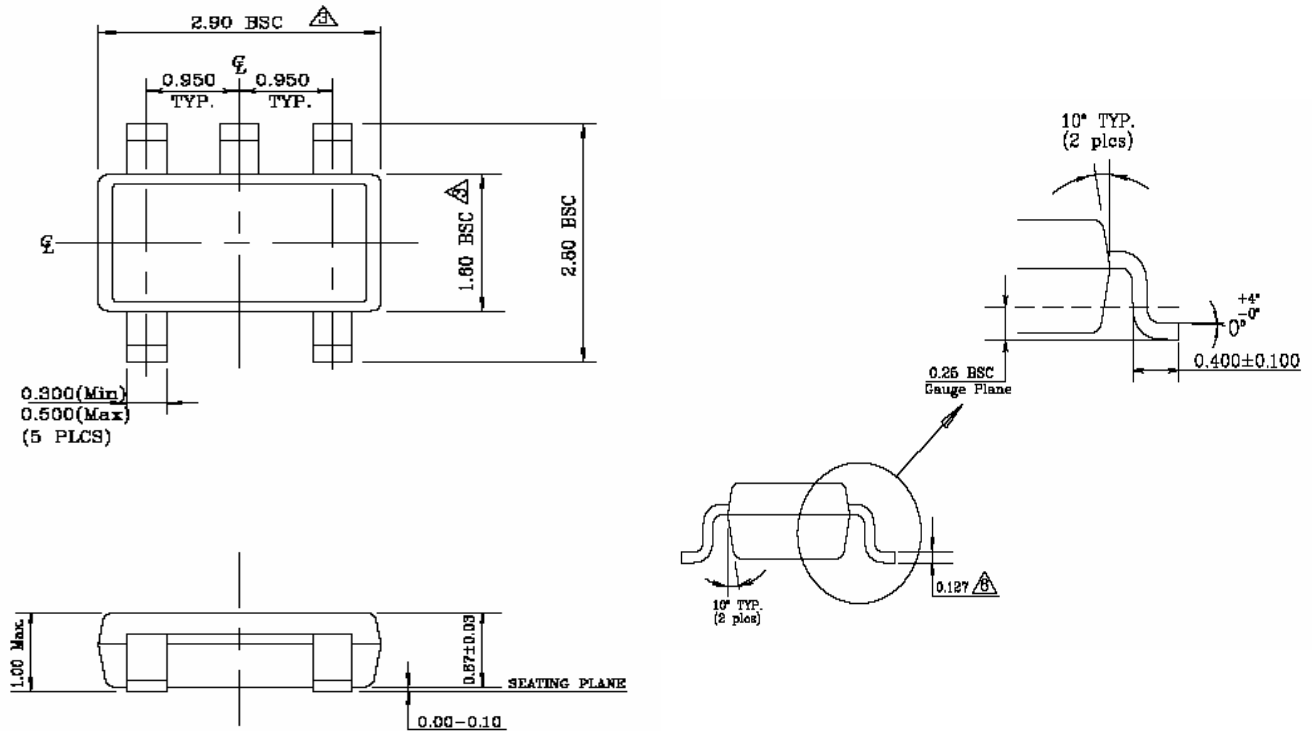


Symbol	Dimensions			
	Inches	Millimeters	Inches	Millimeters
	Min	Max	Min	Max
A	0.030	0.046	0.75	1.17
A1	0.002	0.006	0.05	0.15
B	0.012	0.020	0.30	0.50
C	0.003	0.008	0.08	0.20
D	0.110	0.120	2.80	3.04
E	0.047	0.055	1.20	1.40
e	0.037 BSC		0.95 BSC	
H	0.083	0.104	2.10	2.64
e1	0.075 BSC		1.9 BSC	
L	0.016	0.024	0.40	0.60
θ	0°	8°	0°	8°
S	NA	NA	NA	NA



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5L SOT 23 Package



NOTE:

1. DIMENSIONS ARE IN MM.
2. DRAWING NOT TO SCALE.
3. DIMENSIONS ARE INCLUSIVE OF PLATING.
4. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH AND METAL BURR.
5. MOLD FLASH SHALL NOT EXCEED 0.254MM.
6. JEDEC PACKAGE REFERENCE IS MO-193.



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