

## **General Description**

The LSP2015 is a low dropout linear regulator (LDO) family with 300mA output current. The output voltage can be fixed or adjustable, and are stable with 1.0uF or higher value ceramic capacitors.

The LSP2015 family provides several protections, such as over current protection (OCP), short circuit protection (SCP) and over temperature protection (OTP) to protect themselves from fault application conditions.

This family of LDOs have many different packages and pin assignments. The users can refer the ordering information of this datasheet to choice the most suitable LDOs for their applications.

## **Features**

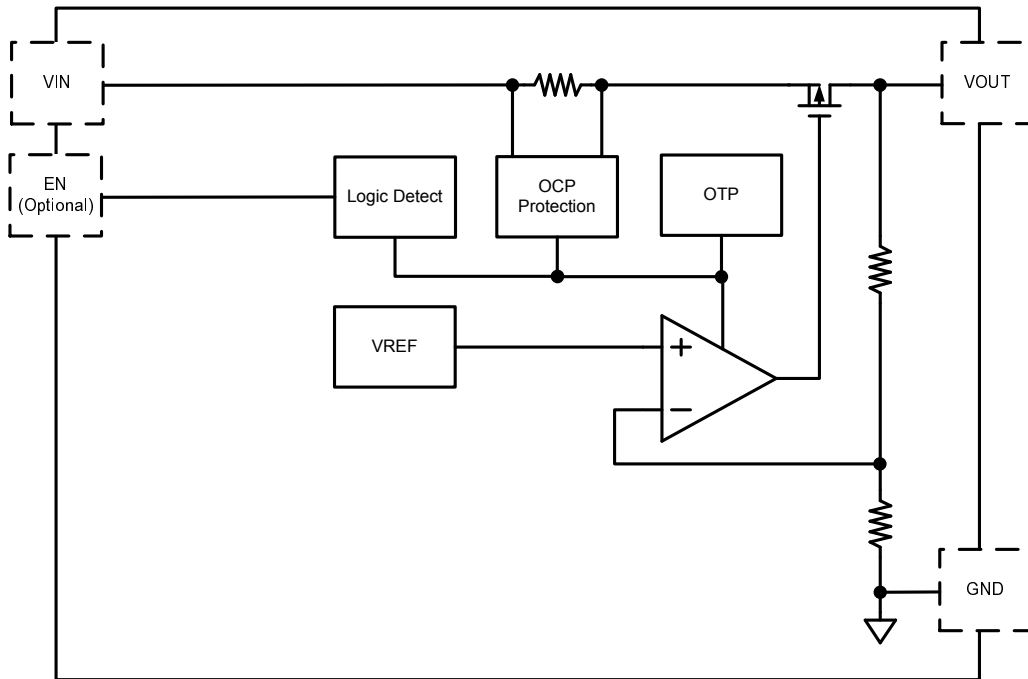
- Operating Input Voltage : 2.2V~5.5V
- Has Fixed Output Voltage (Fixed- $V_{OUT}$ ) And Adjustable Output Voltage (Adj- $V_{OUT}$ ) Options
- Fixed Output voltage range: 1.0V to 4.1V by 0.1V steps
- Output current is up to 300 mA
- Built-in Over Current Protection (OCP), Short Circuit Protection (SCP), and Over Temperature Protection (OTP)
- Package : SOT23-3L, SOT23-5L, SC82-4L, SC70-5L, SOT89-3L and TO92-3L Packages

## **Applications**

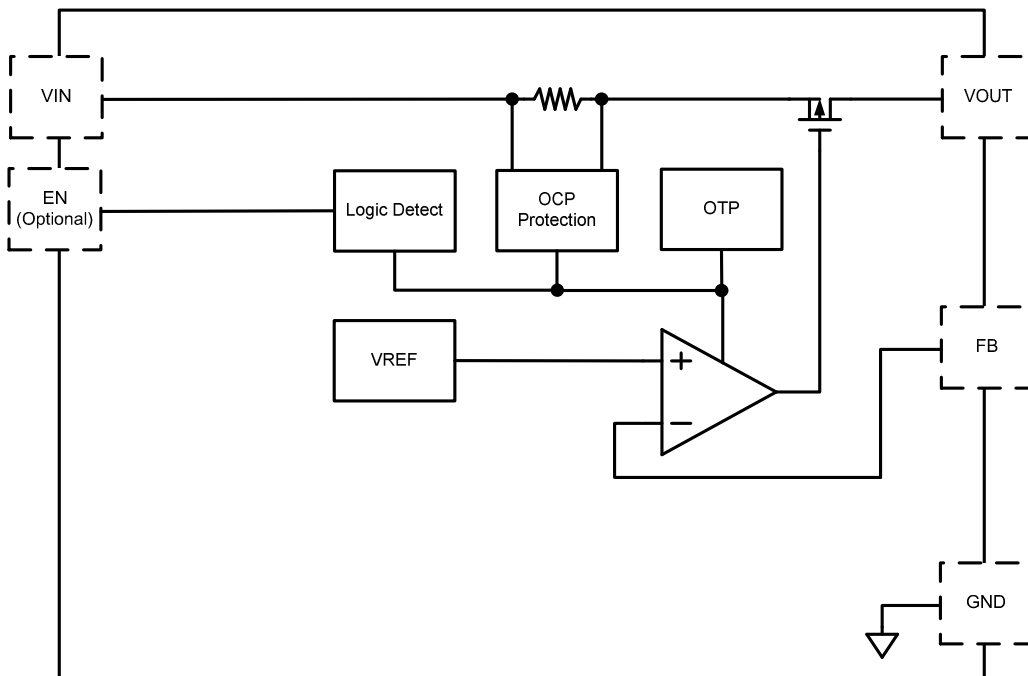
- Portable Electronics
- Wireless Applications
- Battery Power Devices

Please be aware that an <b>Important Notice</b> concerning availability, disclaimers, and use in critical applications of LSC products is at the end of this document.
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**Block Diagram**

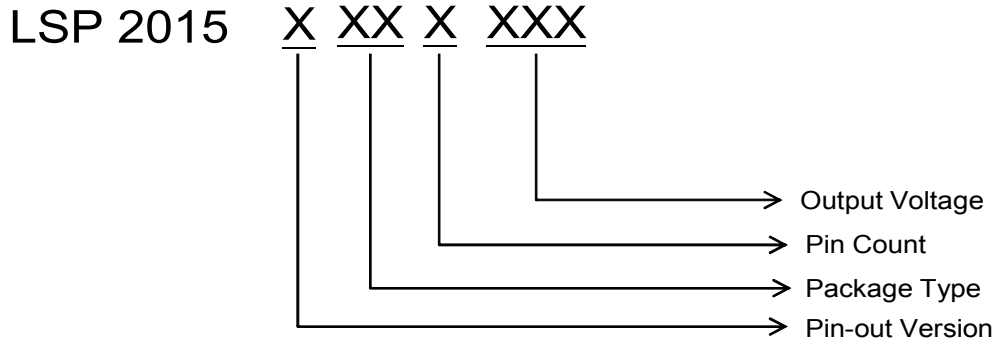


**Fixed Output**



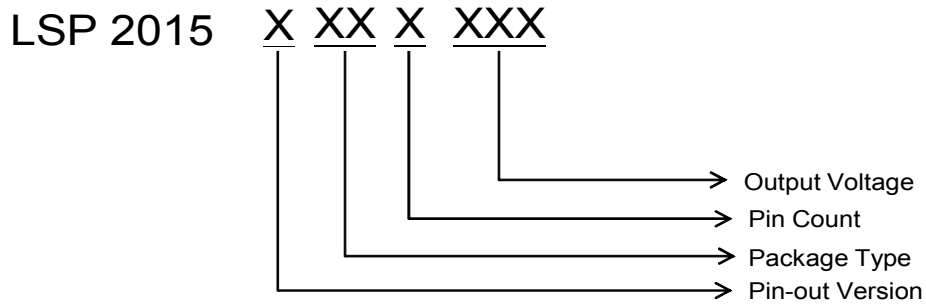
**Adjustable Output**

**Ordering Information**



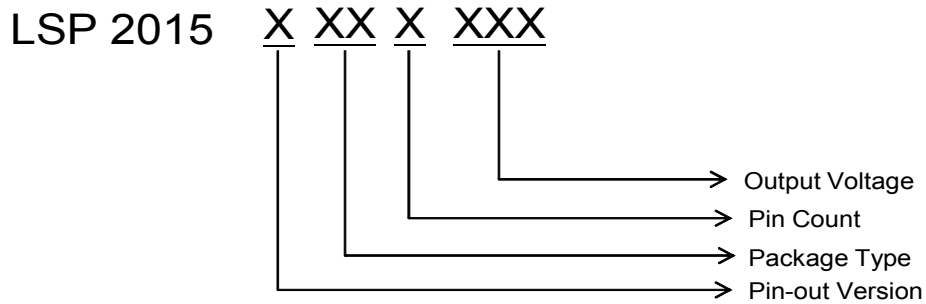
Pin-out Version	Package Type	Pin Count	Output Voltage
<p>A      1. GND (SOT23-3L) 2. VOUT (SOT89-3L) 3. VIN (TO92-3L)</p>	<p>AA : SOT23 AR : TO92 AT : SOT89</p>	<p>B : 3</p>	<p>100 : 1.00V 120 : 1.20V 150 : 1.50V 180 : 1.80V 200 : 2.00V 250 : 2.50V 280 : 2.80V 330 : 3.30V 410 : 4.10V</p>
<p>B      1. VIN (SOT23-3L) 2. GND (SOT89-3L) 3. VOUT</p>			
<p>C      1. VOUT (SOT89-3L) 2. GND          3. VIN</p>			
<p>D      1. GND (SOT89-3L) 2. VIN          3. VOUT</p>			

**Ordering Information (Contd.)**



Pin-out Version	Package Type	Pin Count	Output Voltage
A (SC82) 1. EN 2. GND 3. VOUT 4. VIN	AU : SC82	C : 4	100 : 1.00V 120 : 1.20V 150 : 1.50V 180 : 1.80V 200 : 2.00V 250 : 2.50V 280 : 2.80V 330 : 3.30V 410 : 4.10V

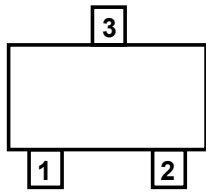
**Ordering Information (Contd.)**



Pin-out Version	Package Type	Pin Count	Output Voltage
<p>A      1. GND (SOT23-5L) 2. VIN (SC70-5L) 3. VOUT           4. NC           5. NC</p> <p>B      1. VIN (SOT23-5L) 2. GND (SC70-5L) 3. EN           4. FB           5. VOUT</p> <p>C      1. VIN (SOT23-5L) 2. GND (SC70-5L) 3. EN           4. NC           5. VOUT</p>	<p>AA : SOT23 AS : SC70</p>	<p>D : 5</p>	<p>ADJ : Adjustable 100 : 1.00V 120 : 1.20V 150 : 1.50V 180 : 1.80V 200 : 2.00V 250 : 2.50V 280 : 2.80V 330 : 3.30V 410 : 4.10V</p>

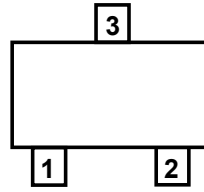
**Pin Assignment**

**SOT23-3L**  
Top View



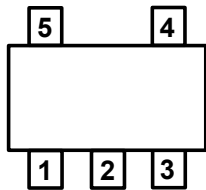
**LSP2015AAAB**  
1. GND  
2. VOUT  
3. VIN

**SOT23-3L**  
Top View



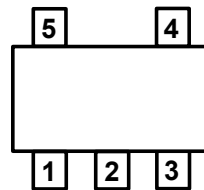
**LSP2015BAAB**  
1. VIN  
2. GND  
3. VOUT

**SOT23-5L**  
**SC70-5L**  
Top View



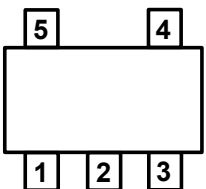
**LSP2015AAAD**  
**LSP2015AASD**  
1. GND  
2. VIN  
3. VOUT  
4. NC  
5. NC

**SOT23-5L**  
**SC70-5L**  
Top View



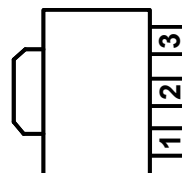
**LSP2015BAAD**  
**LSP2015BASD**  
1. VIN  
2. GND  
3. EN  
4. FB  
5. VOUT

**SOT23-5L**  
**SC70-5L**  
Top View



**LSP2015CAAD**  
**LSP2015CASD**  
1. VIN  
2. GND  
3. EN  
4. NC  
5. VOUT

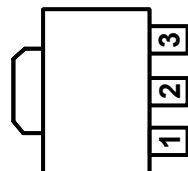
**SOT89-3L**  
(Top View)



**LSP2015AATB**  
1. GND  
2. VOUT  
3. VIN

Tab Is Connected to Pin2

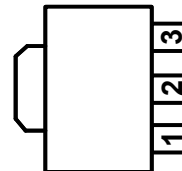
**SOT89-3L**  
(Top View)



**LSP2015BATB**  
1. VIN  
2. GND  
3. VOUT

Tab Is Connected to Pin2

**SOT89-3L**  
(Top View)

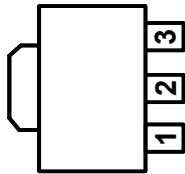


**LSP2015CATB**  
1. VOUT  
2. GND  
3. VIN

Tab Is Connected to Pin2

**Pin Assignment (Contd.)**

**SOT89-3L**  
(Top View)

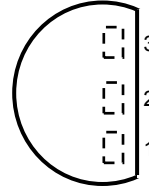


Tab Is Connected to Pin2

**LSP2015DATB**

- 1. GND
- 2. VIN
- 3. VOUT

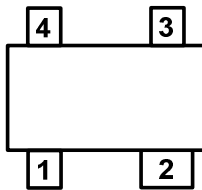
**TO92-3L**  
(Top View)



**LSP2015AARB**

- 1. GND
- 2. VIN
- 3. VOUT

**SC82**  
(Top View)



**LSP2015AAUC**

- 1. EN
- 2. GND
- 3. VOUT
- 4. VIN

**Pin Descriptions**

Pin Name	Pin Description
V <sub>IN</sub>	Voltage input. The input capacitor in the range of 1uF to 10uF is sufficient.
GND	Ground
V <sub>OUT</sub>	LDO Output
FB (Optional)	Feedback Input for Setting the Output Voltage. Connect to an external resistor divider for adjustable output operation.
EN (Optional)	<b>Enable pin (Active High)</b> A pull-high resistor is inside the IC. Need an external Logic-low source to disable the LDO.
NC	No connection



**Absolute Maximum Ratings**

Operate over the “Absolute Maximum Ratings” may cause permanent damage to the device. Exposure to such conditions for extended time may still affect the reliability of the device.

Parameter	Symbol	Value	Unit	
V <sub>IN</sub> Pin Voltage	V <sub>IN</sub>	GND - 0.3 to GND + 6	V	
FB, EN and V <sub>OUT</sub> pin Voltages	V <sub>FB</sub> , V <sub>EN</sub> & V <sub>OUT</sub>	GND - 0.3 to V <sub>IN</sub> + 0.3	V	
Maximum I <sub>OUT</sub> Current (Note 1)	I <sub>OUT</sub>	Internal Limit	mA	
Junction Temperature Range	T <sub>J</sub>	-40 to +125	°C	
Storage Temperature Range	T <sub>STR</sub>	-40 to +150	°C	
Lead Temperature (Soldering, 10 Seconds)	T <sub>Lead</sub>	260	°C	
ESD Withstand Voltage: -Human Body Model (HBM), Model = 2 -Machine Model (MM) Model = B	V <sub>ESD</sub>	2000 200	V V	
Thermal Resistance (Junction to Ambient)	θ <sub>JA</sub>	SOT23-3L	280	°C/W
		SOT23-5L	280	
		SC70-5L	400	
		SC82	400	
Power Dissipation	P <sub>D</sub>	SOT23-3L	400	mW
		SOT23-5L	400	
		SC70-5L	250	
		SC82	250	
Moisture Sensitivity	MSL	Please refer the MSL label on the IC package bag/carton for detail		

Note 1 : The I<sub>OUT</sub> of the LDO will be limited by the thermal protection , if the PCB design can't dissipate the heat generated by the LDO

Note 2 : R<sub>θJA</sub> is highly dependent on the PCB heat sink area.

**Recommended Operating Conditions**

Characteristics	Symbol	Min	Max	Unit
Supply Input Voltage	V <sub>IN</sub>	2.2	5.5	V
Junction Temperature Range	T <sub>J</sub>	-40	125	°C
Ambient Temperature Range	T <sub>A</sub>	-40	85	°C

Note 3 : If the IC experienced OTP, then the temperature may need to drop to < OTP recover temperature to let the IC recover.

**Electrical Characteristics**

( $V_{IN} = V_{OUT} + 1V$  or  $V_{IN} = 2.5V$  whichever is greater,  $C_{IN} = C_{OUT} = 1\mu F$ ,  $T_A = 25^\circ C$ , unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units	
<b>Input Voltage (All Versions)</b>							
Input Voltage Range (Note 4)	$V_{IN}$		2.2	-	5.5	V	
<b>Feedback Voltage ( ADJ-<math>V_{OUT}</math> Versions)</b>							
FB Voltage	$V_{FB}$	$V_{IN} = V_{IN(min)}$ to 5.5V, $I_{OUT} = 1mA$ ( $T_A = 25^\circ C$ )	0.788	0.8	0.812	V	
FB Input Leakage Current	$I_{FB}$	$V_{FB} = 1.0V$ , $V_{IN} = V_{IN(min)}$ to 5.5V,	-100	-	100	nA	
Adjustable Output Voltage Range	$V_{OUT}$		$V_{FB}$	-	4.5	V	
<b><math>V_{OUT}</math> Voltage (Fixed-<math>V_{OUT}</math> Versions)</b>							
Output Voltage Accuracy	$\Delta V_{OUT}$	$V_{IN} = V_{IN(min)}$ to 5.5V, $I_{OUT} = 1mA$ ( $T_A = 25^\circ C$ )	-1.5	-	+1.5	%	
Quiescent Current	$I_Q$	$V_{IN} = 2.5V$ , When $V_{OUT} \leq 2V$	-	50	70	uA	
		$V_{IN} = V_{OUT} + 1V$ , When $V_{OUT} \geq 2V$	-	70	100		
Shutdown Current	$I_{SD}$	$V_{IN} = 5.5V$ , $V_{EN} = 0V$	-	-	1	uA	
Dropout Voltage (Note4)	$V_{DROP}$	$I_{OUT} = 300mA$	$1.0V \leq V_{OUT} \leq 2.0V$	-	-	1200	mV
			$2.0V < V_{OUT} \leq 2.5V$	-	-	500	
			$2.5V < V_{OUT} < 4.5V$	-	-	270	
Current Limit (Note 5)	$I_{LIMIT}$	$V_{OUT} = V_{OUT(NON)} \times 90\%$	300	450		mA	
Short Circuit Current	$I_{short}$	$V_{OUT} < 0.4V$		100	200	mA	
Line Regulation $\frac{\Delta V_{OUT}}{\Delta V_{IN}} \times 100\%$ $V_{OUT}$	$\Delta V_{LINE}$	$I_{OUT} = 1mA$ , $V_{IN} = V_{OUT} + 1V$ to 5.5V	-	0.1	0.2	%/V	
Load Regulation (Note 6) $\frac{\Delta V_{OUT}}{V_{OUT}} \times 100\%$	$\Delta V_{LOAD}$	$I_{OUT} = 1m \sim 300mA$ , $V_{IN} = V_{OUT} + 1V$ or $V_{IN} = 2.5V$ whichever is greater	-	0.8	1	%	

**Electrical Characteristics (Contd.)**

( $V_{IN} = V_{OUT} + 1V$  or  $V_{IN} = 2.5V$  whichever is greater,  $C_{IN} = C_{OUT} = 1\mu F$ ,  $T_A = 25^\circ C$ , unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
<b>LDO Basic Characteristics ( All Versions)</b>						
$V_{OUT}$ Temperature Coefficient (Note 7)	$T_C$	$I_{OUT} = 10mA$	-	30	-	ppm/ °C
Ripple Rejection (Note 7)	PSRR	$I_{OUT} = 10mA$ , $f = 1KHz$	-	60	-	db
Thermal Shutdown (Note 7)	$T_S$		-	155	-	°C
Thermal Shutdown Hysteresis (Note 7)	$T_{SH}$		-	30	-	°C
<b>Enable (EN, Optional)</b>						
Enable Input Threshold	$V_{ENH}$		1.4	-	$V_{IN}$	V
	$V_{ENL}$		0	-	0.4	
Enable Pin Current	$I_{ENH}$	$V_{EN} = V_{IN}$	-	-	0.1	uA

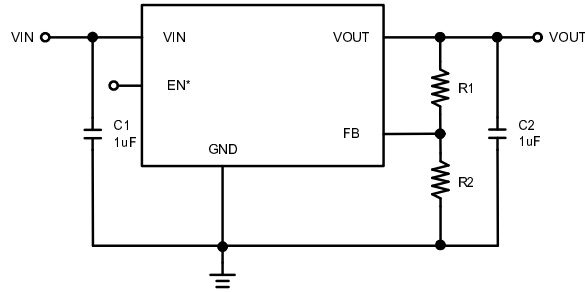
Note 4: Minimum  $V_{IN}$  voltage is defined by output adds a dropout voltage,  $V_{IN(min)} = V_{OUT} + V_{DROPOUT}$ .

Note 5. Current limit and short circuit current are measured at constant junction temperature by using pulsed testing with a low ON time.

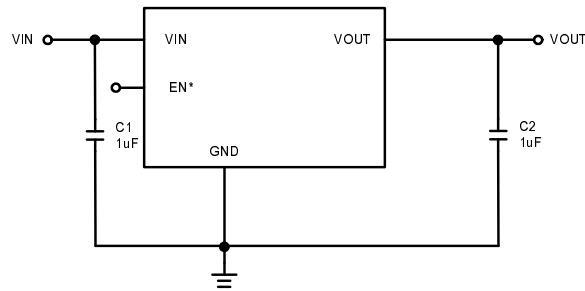
Note 6. Load Regulation is measured at constant junction temperature by using pulsed testing with a low ON time.

Note 7. Guarantee by design. Not test when manufacture.

**Application Circuit**



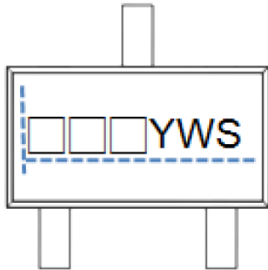
Adjustable Output  
(\*Optional Pin or Component)



Fixed Output  
(\*Optional Pin or Component)

**Marking Information**

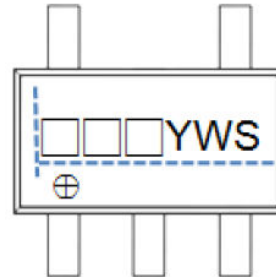
(1) SOT23-3L



- 1) □□□ = Marking Name  
 APC = LSP2015AAAB100  
 APD = LSP2015AAAB120  
 APE = LSP2015AAAB150  
 APF = LSP2015AAAB180  
 APH = LSP2015AAAB200  
 APG = LSP2015AAAB250  
 APW = LSP2015AAAB280  
 APJ = LSP2015AAAB330  
 APX = LSP2015AAAB410  
 AP1 = LSP2015BAAB100  
 APL = LSP2015BAAB120  
 APM = LSP2015BAAB150  
 APN = LSP2015BAAB180  
 AP2 = LSP2015BAAB200  
 AP3 = LSP2015BAAB250  
 AP4 = LSP2015BAAB280  
 AP5 = LSP2015BAAB330

- 2) YWS = Date Code  
 Y = Year  
 W = Week  
 S = Internal Code

(2) SOT23-5L

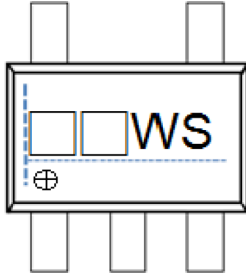


- 1) □□□ = Marking Name  
 APC = LSP2015AAAD100  
 APD = LSP2015AAAD120  
 APE = LSP2015AAAD150  
 APF = LSP2015AAAD180  
 APH = LSP2015AAAD200  
 APG = LSP2015AAAD250  
 APW = LSP2015AAAD280  
 APJ = LSP2015AAAD330  
 APX = LSP2015AAAD410  
 APK = LSP2015BAADADJ  
 AP7 = LSP2015CAAD100  
 APO = LSP2015CAAD120  
 APP = LSP2015CAAD150  
 APR = LSP2015CAAD180  
 AP8 = LSP2015CAAD200  
 APS = LSP2015CAAD250  
 APT = LSP2015CAAD280  
 APB = LSP2015CAAD310  
 APU = LSP2015CAAD330  
 AP9 = LSP2015CAAD410

- 2) YWS = Date Code  
 Y = Year  
 W = Week  
 S = Internal Code

**Marking Information (Contd.)**

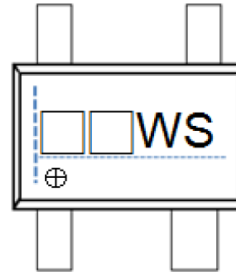
**(3) SC70-5L (SOT353)**



- 1) □□□ = Marking Name  
 A2 = LSP2015AASD100  
 AO = LSP2015AASD120  
 AP = LSP2015AASD150  
 AR = LSP2015AASD180  
 A3 = LSP2015AASD200  
 A4 = LSP2015AASD250  
 AS = LSP2015AASD280  
 AT = LSP2015AASD330  
 A5 = LSP2015AASD410  
 5A = LSP2015BASDADJ  
 A6 = LSP2015CASD100  
 AJ = LSP2015CASD120  
 AK = LSP2015CASD150  
 AL = LSP2015CASD180  
 A7 = LSP2015CASD200  
 AM = LSP2015CASD250  
 AN = LSP2015CASD280  
 5C = LSP2015CASD300  
 A8 = LSP2015CASD330  
 A9 = LSP2015CASD410

- 2) WS = Date Code  
 W = Week  
 S = Internal Code

**(4) SC82 (SOT343R)**

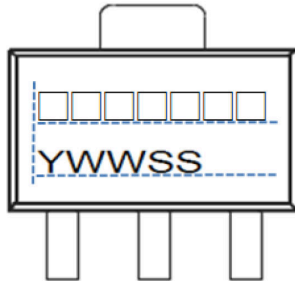


- 1) □□□ = Marking Name  
 A2 = LSP2015AAUC100  
 AO = LSP2015AAUC120  
 AP = LSP2015AAUC150  
 AR = LSP2015AAUC180  
 A3 = LSP2015AAUC200  
 A4 = LSP2015AAUC250  
 AS = LSP2015AAUC280  
 5Y = LSP2015AAUC300  
 AT = LSP2015AAUC330  
 A5 = LSP2015AAUC410

- 2) WS = Date Code  
 W = Week  
 S = Internal Code

**Marking Information (Contd.)**

**(5) SOT89-3L**



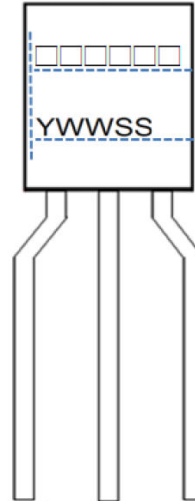
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- 2015A10 = LSP2015AATB100
- 2015A12 = LSP2015AATB120
- 2015A15 = LSP2015AATB150
- 2015A18 = LSP2015AATB180
- 2015A20 = LSP2015AATB200
- 2015A25 = LSP2015AATB250
- 2015A28 = LSP2015AATB280
- 2015A33 = LSP2015AATB330
- 2015A41 = LSP2015AATB410
- 2015B10 = LSP2015BATB100
- 2015B12 = LSP2015BATB120
- 2015B15 = LSP2015BATB150
- 2015B18 = LSP2015BATB180
- 2015B20 = LSP2015BATB200
- 2015B25 = LSP2015BATB250
- 2015B28 = LSP2015BATB280
- 2015B33 = LSP2015BATB330
- 2015B41 = LSP2015BATB410
- 2015C10 = LSP2015CATB100
- 2015C12 = LSP2015CATB120
- 2015C15 = LSP2015CATB150
- 2015C18 = LSP2015CATB180
- 2015C20 = LSP2015CATB200
- 2015C25 = LSP2015CATB250
- 2015C28 = LSP2015CATB280
- 2015C33 = LSP2015CATB330
- 2015C41 = LSP2015CATB410
- 2015D33 = LSP2015DATB330

2) YWWSS = Date Code

- Y = Year
- WW = Week
- SS = Internal Code

**(6) TO92-3L**



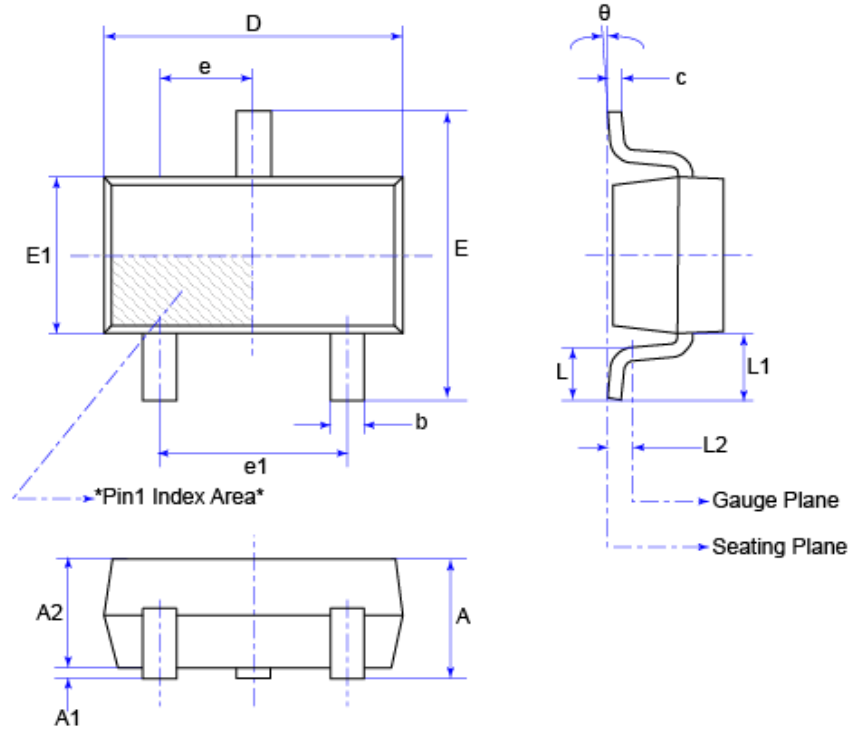
1) □□□□□□ = Marking Name

2) YWWSS = Date Code

- Y = Year
- WW = Week
- SS = Internal Code

**Mechanical Information**

(1) SOT23-3L



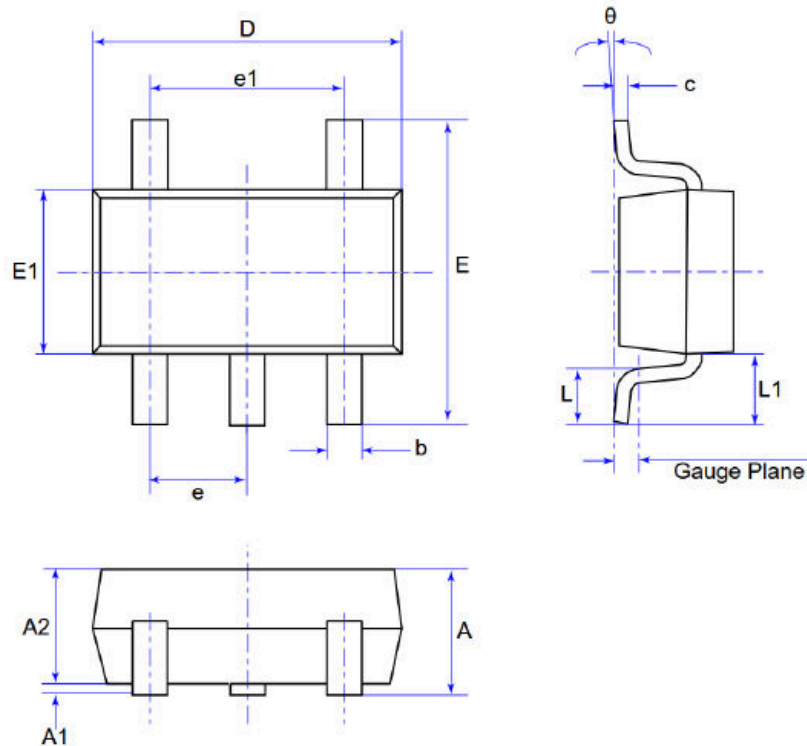
Unit: mm

Symbol	Min	Max
A	-	1.35
A1	0.00	0.15
A2	1.00	1.20
b	0.30	0.50
c	0.08	0.21
D	2.72	3.12
E	2.60	3.00
E1	1.40	1.80
e	0.95 BSC	
e1	1.90 REF	
L	0.30	0.60
L1	0.60 REF	
L2	0.25 BSC	
θ	0°	8°



**Mechanical Information (Contd.)**

(2) SOT23-5L

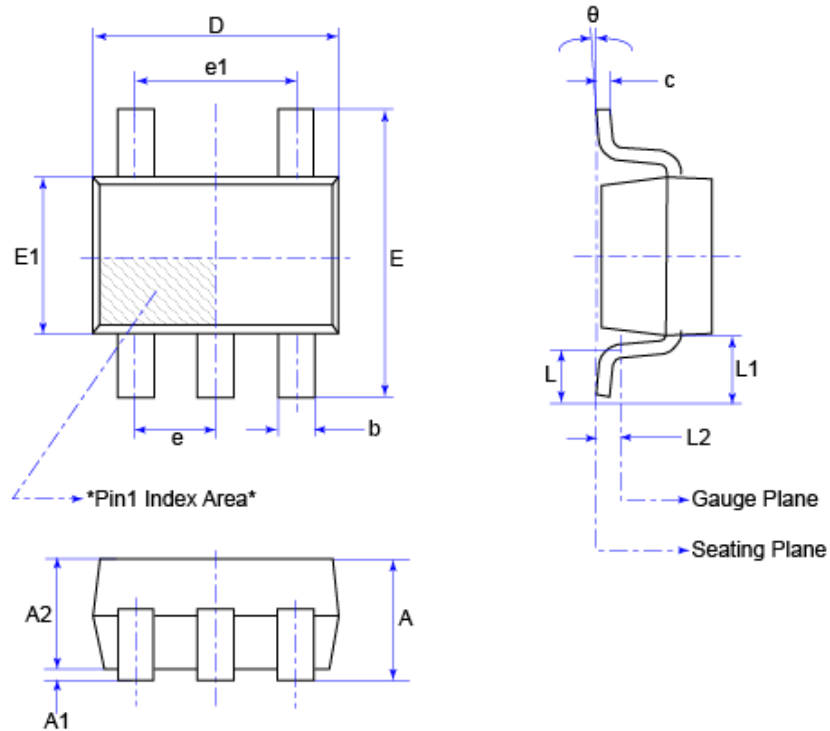


Unit: mm

Symbol	Min	Max
A	-	1.35
A1	-	0.15
A2	1.00	1.20
b	0.30	0.50
c	0.08	0.21
D	2.72	3.12
E	2.60	3.00
E1	1.40	1.80
e	0.95 BSC	
e1	1.80	2.00
L	0.30	0.60
L1	0.60 REF	
Gauge Plane	0.25 REF	
θ	0°	8°

**Mechanical Information (Contd.)**

(3) SC70-5L (SOT353)

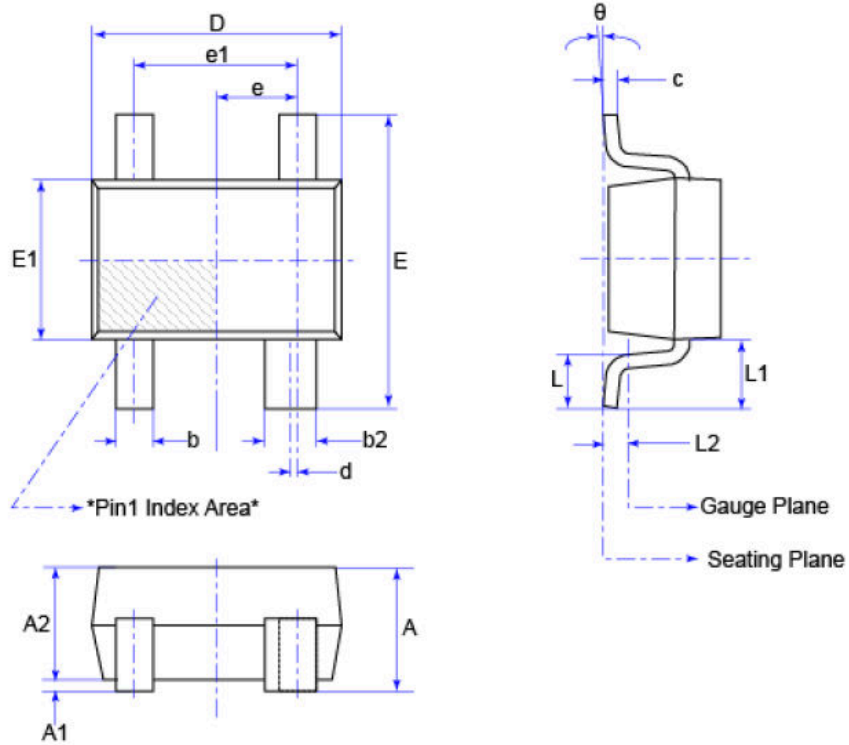


Unit: mm

Symbol	Min	Max
A	0.900	1.100
A1	0.000	0.100
A2	0.900	1.000
b	0.150	0.350
c	0.080	0.150
D	2.000	2.200
E	2.150	2.450
E1	1.150	1.350
e	0.650 TYP	
e1	1.200	1.400
L	0.260	0.460
L1	0.525 REF	
L2	0.200 BSC	
θ	0°	8°

**Mechanical Information (Contd.)**

**(4) SC82 (SOT343R)**

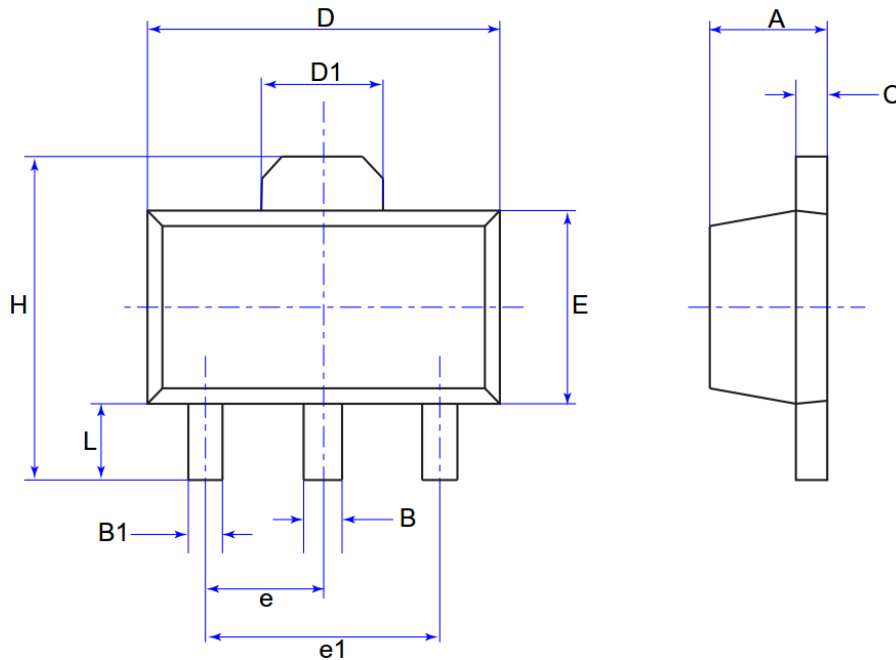


Unit: mm

Symbol	Min	Max
A	0.900	1.100
A1	0.000	0.100
A2	0.900	1.000
b	0.250	0.400
b2	0.350	0.500
c	0.080	0.150
D	2.000	2.200
E	2.150	2.450
E1	1.150	1.350
e	0.650 TYP	
e1	1.200	1.400
L	0.260	0.460
L1	0.525 REF	
L2	0.200 BSC	
θ	0°	8°

**Mechanical Information (Contd.)**

(5) SOT89-3L

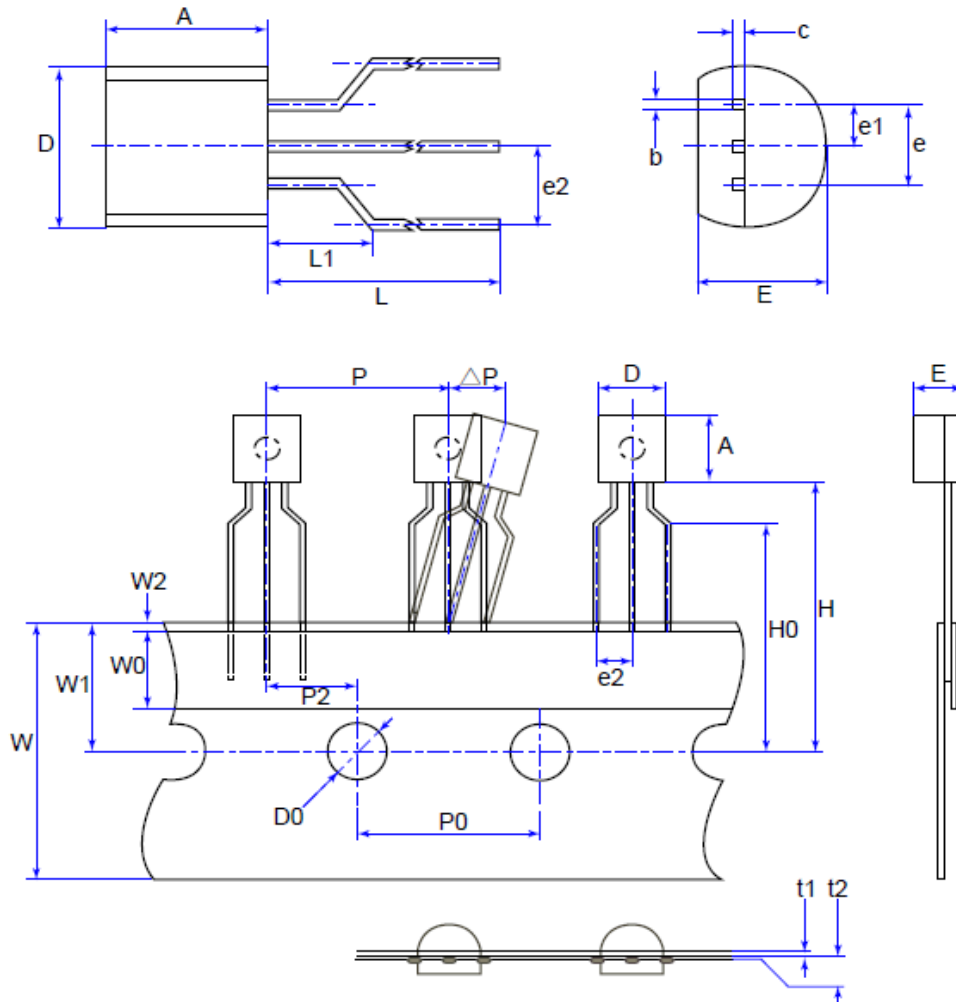


Unit: mm

Symbol	Min	Max
A	1.40	1.60
B	0.35	0.58
B1	0.32	0.58
C	0.35	0.46
D	4.30	4.70
D1	1.60 REF	
E	2.30	2.70
e	1.50 TYP	
e1	3.00 TYP	
H	3.94	4.70
L	0.80	1.20

**Mechanical Information (Contd.)**

(6) TO92-3L



Unit: mm

Symbol	Min	Max
A	4.30	4.70
b	0.38	0.55
c	0.36	0.51
D	4.30	4.70
D0	3.80	4.20
E	3.30	3.70
e	2.44	2.64

**MSL (Moisture Sensitive Level) Information**

**IPC/JEDEC J-STD-020D.1 Moisture Sensitivity Levels Table**

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS				
			Standard		Accelerated Equivalent <sup>1</sup>		
	TIME	CONDITION			TIME (hours)	CONDITION	eV 0.40-0.48 TIME (hours)
1	Unlimited	≤30 °C /85% RH	168 +5/-0	85 °C /85% RH	NA	NA	NA
2	1 year	≤30 °C /60% RH	168 +5/-0	85 °C /60% RH	NA	NA	NA
2a	4 weeks	≤30 °C /60% RH	696 <sup>2</sup> +5/-0	30 °C /60% RH	120 -1/+0	168 -1/+0	60 °C/ 60% RH
3	168 hours	≤30 °C /60% RH	192 <sup>2</sup> +5/-0	30 °C /60% RH	40 -1/+0	52 -1/+0	60 °C/ 60% RH
4	72 hours	≤30 °C /60% RH	96 <sup>2</sup> +2/-0	30 °C /60% RH	20 +0.5/-0	24 +0.5/-0	60 °C/ 60% RH
5	48 hours	≤30 °C /60% RH	72 <sup>2</sup> +2/-0	30 °C /60% RH	15 +0.5/-0	20 +0.5/-0	60 °C/ 60% RH
a	24 hours	≤30 °C /60% RH	48 <sup>2</sup> +2/-0	30 °C /60% RH	10 +0.5/-0	13 +0.5/-0	60 °C/ 60% RH
6	Time on Label (TOL)	≤30 °C /60% RH	TOL	30 °C /60% RH	NA	NA	NA

**Note 1:** CAUTION - To use the “accelerated equivalent” soak conditions, correlation of damage response (including electrical, after soak and reflow), should be established with the “standard” soak conditions. Alternatively, if the known activation energy for moisture diffusion of the package materials is in the range of 0.40 - 0.48 eV or 0.30 - 0.39 eV, the “accelerated equivalent” may be used. Accelerated soak times may vary due to material properties (e.g .mold compound, encapsulant, etc.). JEDEC document JESD22-A120 provides a method for determining the diffusion coefficient.

**Note 2:** The standard soak time includes a default value of 24 hours for semiconductor manufacturer’s exposure time (MET) between bake and bag and includes the maximum time allowed out of the bag at the distributor’s facility. If the actual MET is less than 24 hours the soak time may be reduced. For soak conditions of 30 °C/60% RH, the soak time is reduced by 1 hour for each hour the MET is less than 24 hours. For soak conditions of 60 °C/60% RH, the soak time is reduced by 1 hour for each 5 hours the MET is less than 24 hours. If the actual MET is greater than 24 hours the soak time must be increased. If soak conditions are 30 °C/60% RH, the soak time is increased 1 hour for each hour that the actual MET exceeds 24 hours. If soak conditions are 60 °C/60% RH, the soak time is increased 1 hour for each 5 hours that the actual MET exceeds 24 hours.

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