

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

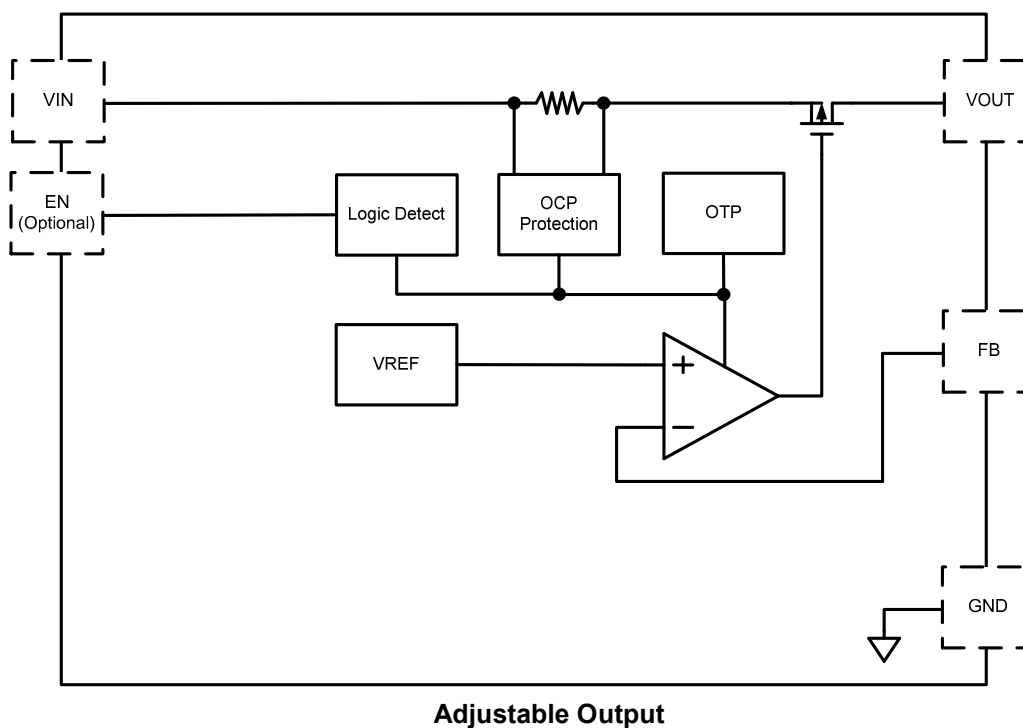
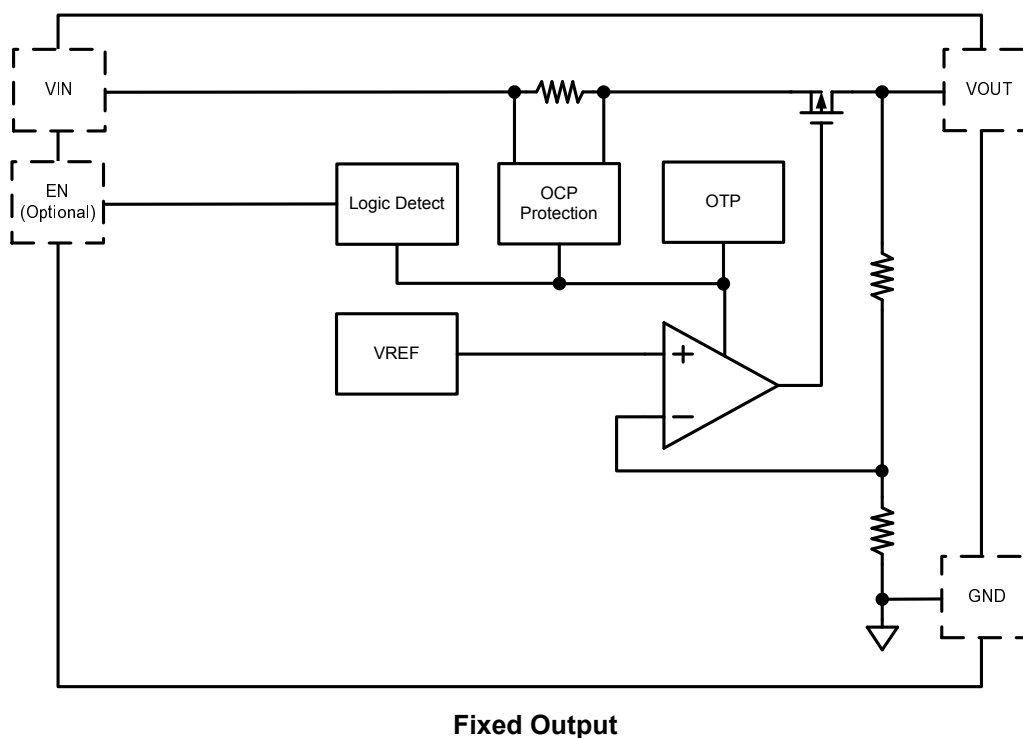
- Operating Input Voltage : 2.2V~5.5V
- Has Fixed Output Voltage (Fixed- V_{OUT}) And Adjustable Output Voltage (Adj- V_{OUT}) Options
- Fixed Output voltage range: 1.0V to 4.1V by 0.1V steps
- Output current is up to 300 mA
- Built-in Over Current Protection (OCP), Short Circuit Protection (SCP), and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

Applications

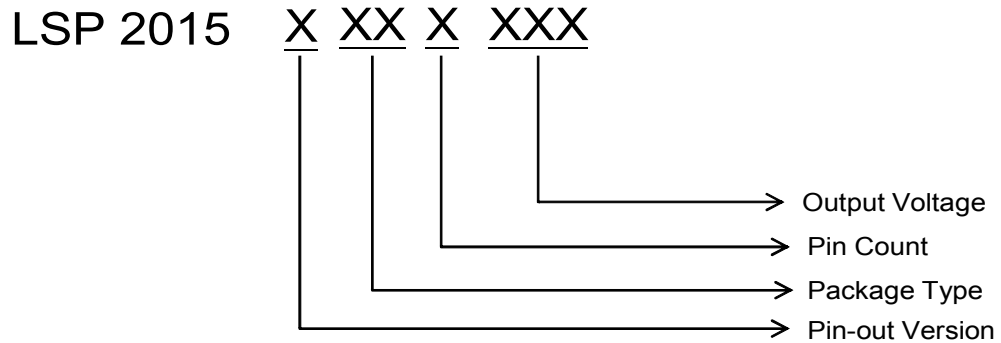
- Portable Electronics
- Wireless Applications
- Battery Power Devices

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

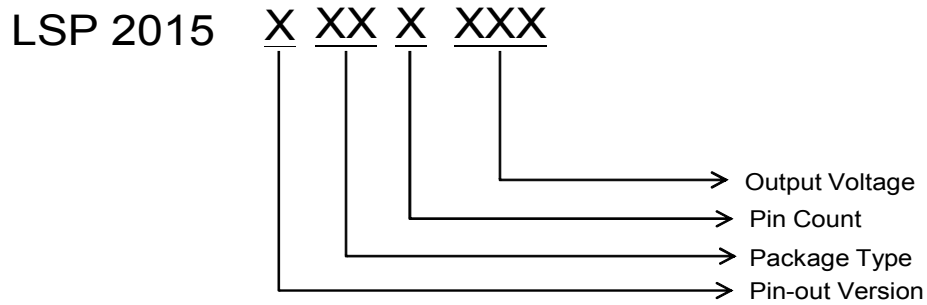


Ordering Information



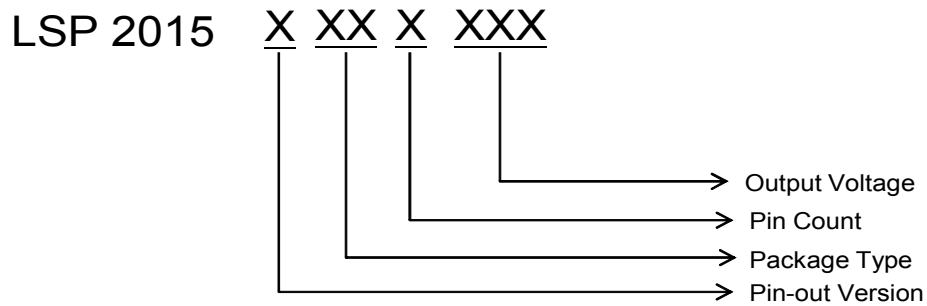
Pin-out Version	Package Type	Pin Count	Output Voltage
A 1. GND (SOT23-3L) 2. VOUT (SOT89-3L) 3. VIN (TO92-3L) B 1. VIN (SOT23-3L) 2. GND (SOT89-3L) 3. VOUT C 1. VOUT (SOT89-3L) 2. GND 3. VIN D 1. GND (SOT89-3L) 2. VIN 3. VOUT	AA : SOT23 AR : TO92 AT : SOT89	B : 3	100 : 1.00V 120 : 1.20V 150 : 1.50V 180 : 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
A 1. EN (SC82) 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

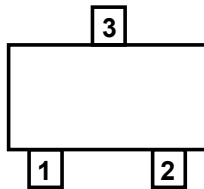
Ordering Information (Contd.)



Pin-out Version	Package Type	Pin Count	Output Voltage
A 1. GND (SOT23-5L) 2. VIN (SC70-5L) 3. VOUT 4. NC 5. NC	AA : SOT23 AS : SC70	D : 5	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
B 1. VIN (SOT23-5L) 2. GND (SC70-5L) 3. EN 4. FB 5. VOUT			
C 1. VIN (SOT23-5L) 2. GND (SC70-5L) 3. EN 4. NC 5. VOUT			

Pin Assignment

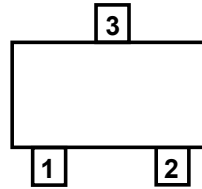
**SOT23-3L
Top View**



LSP2015AAAB

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

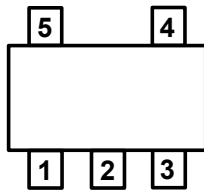
**SOT23-3L
Top View**



LSP2015BAAB

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

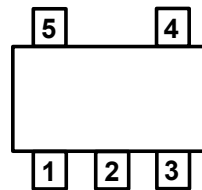
**SOT23-5L
SC70-5L
Top View**



**LSP2015AAAD
LSP2015AASD**

- 1. GND
- 2. VIN
- 3. VOUT
- 4. NC
- 5. NC

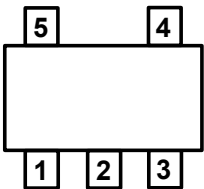
**SOT23-5L
SC70-5L
Top View**



**LSP2015BAAD
LSP2015BASD**

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

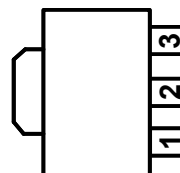
**SOT23-5L
SC70-5L
Top View**



**LSP2015CAAD
LSP2015CASD**

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

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

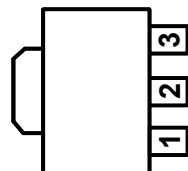


Tab Is Connected to Pin2

LSP2015AATB

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

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

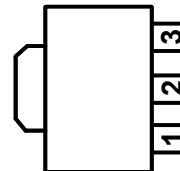


Tab Is Connected to Pin2

LSP2015BATB

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

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



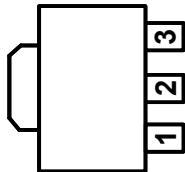
Tab Is Connected to Pin2

LSP2015CATB

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

Pin Assignment (Contd.)

SOT89-3L
(Top View)

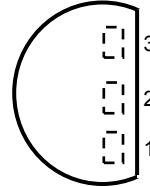


Tab Is Connected to Pin2

LSP2015DATB

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

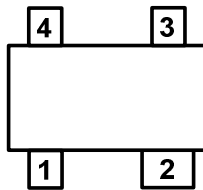
TO92-3L
(Top View)



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 _{IN}	Voltage input. The input capacitor in the range of 1uF to 10uF is sufficient.
GND	Ground
V _{OUT}	LDO Output
FB (Optional)	Feedback Input for Setting the Output Voltage. Connect to an external resistor divider for adjustable output operation.
EN (Optional)	Enable pin (Active High) 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 _{IN} Pin Voltage		V _{IN}	GND - 0.3 to GND + 6	V
FB, EN and V _{OUT} pin Voltages		V _{FB} , V _{EN} & V _{OUT}	GND - 0.3 to VIN + 0.3	V
Maximum I _{OUT} Current (Note 1)		I _{OUT}	Internal Limit	mA
Junction Temperature Range		T _J	-40 to +125	°C
Storage Temperature Range		T _{STR}	-40 to +150	°C
Lead Temperature (Soldering, 10 Seconds)		T _{Lead}	260	°C
ESD Withstand Voltage: -Human Body Model (HBM), Model = 2 -Machine Model (MM) Model = B		V _{ESD}	2000 200	V V
Thermal Resistance (Junction to Ambient)	SOT23-3L	θ _{JA}	280	°C/W
	SOT23-5L		280	
	SC70-5L		400	
	SC82		400	
Power Dissipation	SOT23-3L	P _D	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_{OUT} 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_{θJA} is highly dependent on the PCB heat sink area.

Recommended Operating Conditions

Characteristics	Symbol	Min	Max	Unit
Supply Input Voltage	V _{IN}	2.2	5.5	V
Junction Temperature Range	T _J	-40	125	°C
Ambient Temperature Range	T _A	-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
Input Voltage (All Versions)							
Input Voltage Range (Note 4)	V _{IN}			2.2	-	5.5	V
Feedback Voltage (ADJ-V _{OUT} Versions)							
FB Voltage	V _{FB}	V _{IN} =V _{IN(min)} to 5.5V, I _{OUT} =1mA (T _A = 25° 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
V _{OUT} Voltage (Fixed-V _{OUT} Versions)							
Output Voltage Accuracy	△V _{OUT}	V _{IN} =V _{IN(min)} to 5.5V, I _{OUT} =1mA (T _A = 25° C)		-1.5	-	+1.5	%
Quiescent Current	I _Q	V _{IN} =2.5V,When V _{OUT} =≤2V		-	50	70	uA
		V _{IN} = V _{OUT} +1V, When V _{OUT} ≥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 ≤ V _{OUT} ≤ 2.0V	-	-	1200	mV
			2.0V < V _{OUT} ≤ 2.5V	-	-	500	
			2.5V < V _{OUT} < 4.5V	-	-	270	
Current Limit (Note 5)	I _{LIMIT}	V _{OUT} = V _{OUT(NON)} X 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}	ΔV _{LINE}	I _{OUT} =1mA, V _{IN} =V _{OUT} +1V to 5.5V		-	0.1	0.2	%/V
Load Regulation (Note 6) $\frac{\Delta V_{OUT}}{V_{OUT}} \times 100\%$	ΔV _{LOAD}	I _{OUT} =1m~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
LDO Basic Characteristics (All Versions)						
V_{OUT} Temperature Coefficient (Note 7)	T_C	$I_{OUT} = 10mA$	-	30	-	ppm/ $^\circ C$
Ripple Rejection (Note 7)	PSRR	$I_{OUT} = 10mA$, $f = 1KHz$	-	60	-	db
Thermal Shutdown (Note 7)	T_S		-	155	-	$^\circ C$
Thermal Shutdown Hysteresis (Note 7)	T_{SH}		-	30	-	$^\circ C$
Enable (EN, Optional)						
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	μA

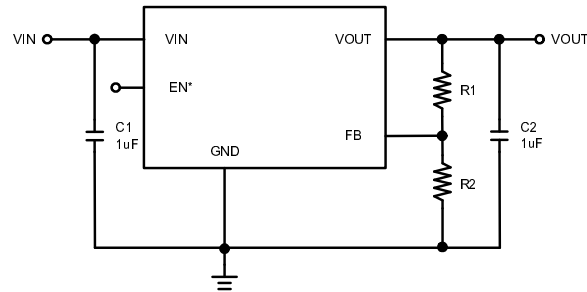
Note 4: Minimum V_{IN} voltage is defined by output adds a dropout voltage, $V_{IN(min)} = V_{OUT} + V_{DROPOUT}$.

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

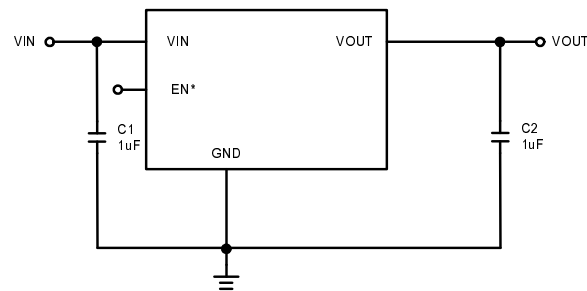
Note 6. Load Regulation is measured at constant junction temperature by using pulsed testing with a low ON time.

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

Application Circuit



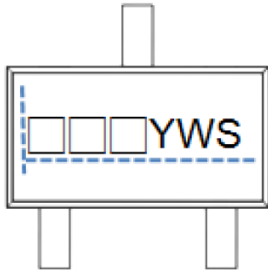
Adjustable Output
(*Optional Pin or Component)



Fixed Output
(*Optional Pin or Component)

Marking Information

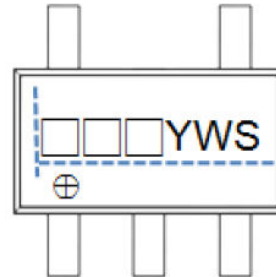
(1) SOT23-3L



- 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

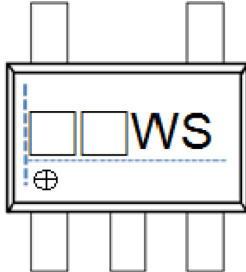


- 1) □□□ = Marking Name
 APC = LSP2015AAAD100
 APD = LSP2015AAAD120
 APE = LSP2015AAAD150
 APF = LSP2015AAAD180
 APH = LSP2015AAAD200
 APG = LSP2015AAAD250
 APW = LSP2015AAAD280
 APJ = LSP2015AAAD330
 APX = LSP2015AAAD410
 APK = LSP2015BAADADJ
 AP7 = LSP2015CAAD100
 APO = LSP2015CAAD120
 APP = LSP2015CAAD150
 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.)

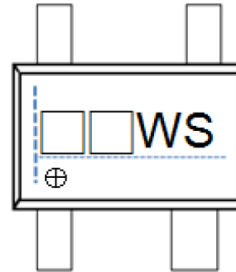
(3) SC70-5L (SOT353)



- 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)

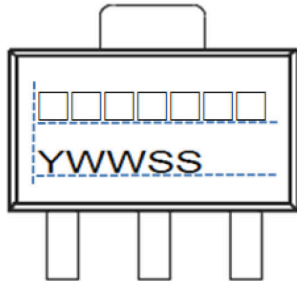


- 1) ☐☐☐ = Marking Name
A2 = LSP2015AAUC100
AO = LSP2015AAUC120
AP = LSP2015AAUC150
AR = LSP2015AAUC180
A3 = LSP2015AAUC200
A4 = LSP2015AAUC250
AS = LSP2015AAUC280
5Y = LSP2015AAUC300
AT = LSP2015AAUC330
A5 = LSP2015AAUC410

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

Marking Information (Contd.)

(5) SOT89-3L



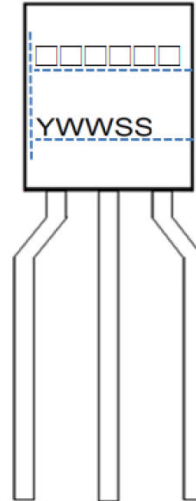
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 2015A12 = LSP2015AATB120
 2015A15 = LSP2015AATB150
 2015A18 = LSP2015AATB180
 2015A20 = LSP2015AATB200
 2015A25 = LSP2015AATB250
 2015A28 = LSP2015AATB280
 2015A33 = LSP2015AATB330
 2015A41 = LSP2015AATB410
 2015B10 = LSP2015BATB100
 2015B12 = LSP2015BATB120
 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



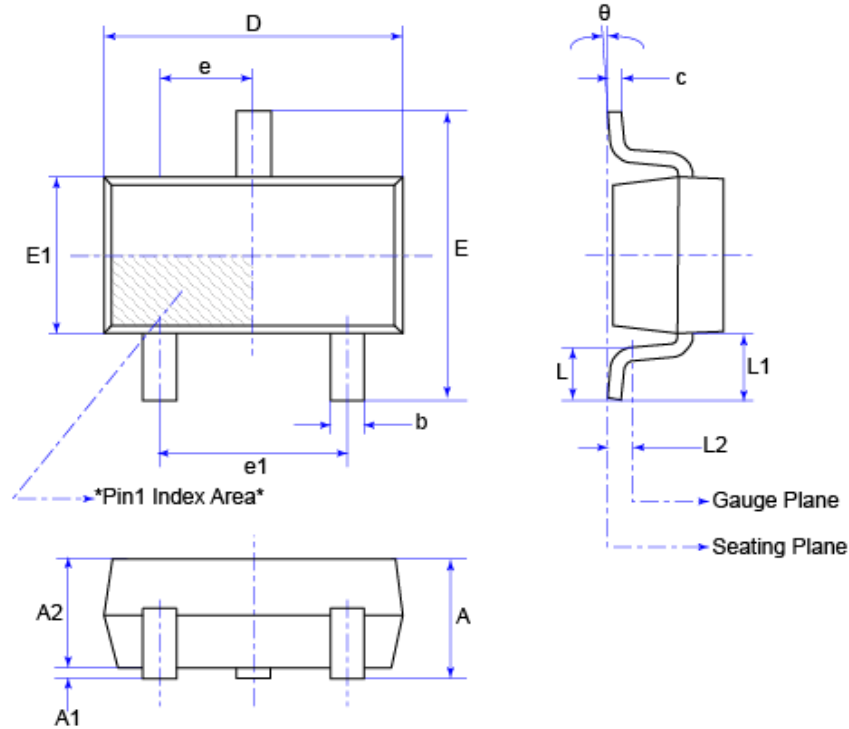
1) □□□□□□ = Marking Name

2) YWWSS = Date Code

Y = Year
 WW = Week
 SS = Internal Code

Mechanical Information

(1) SOT23-3L

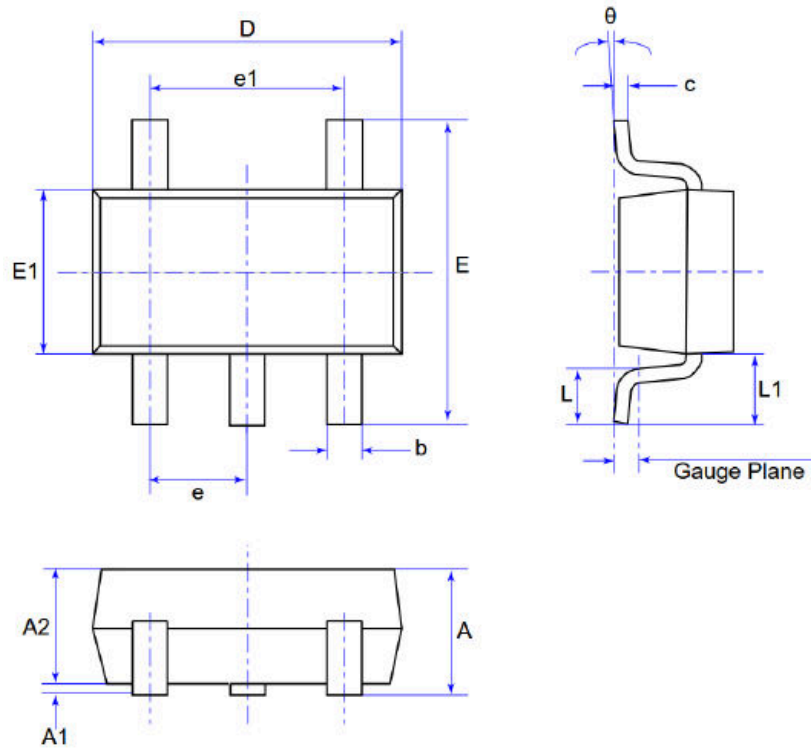


Unit: mm

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

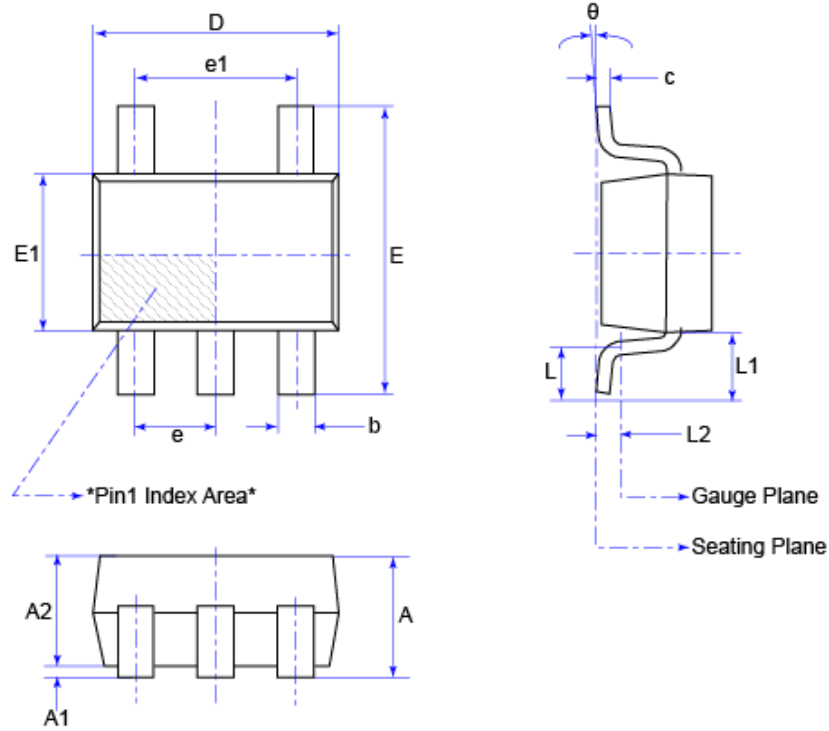


Unit: mm

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)

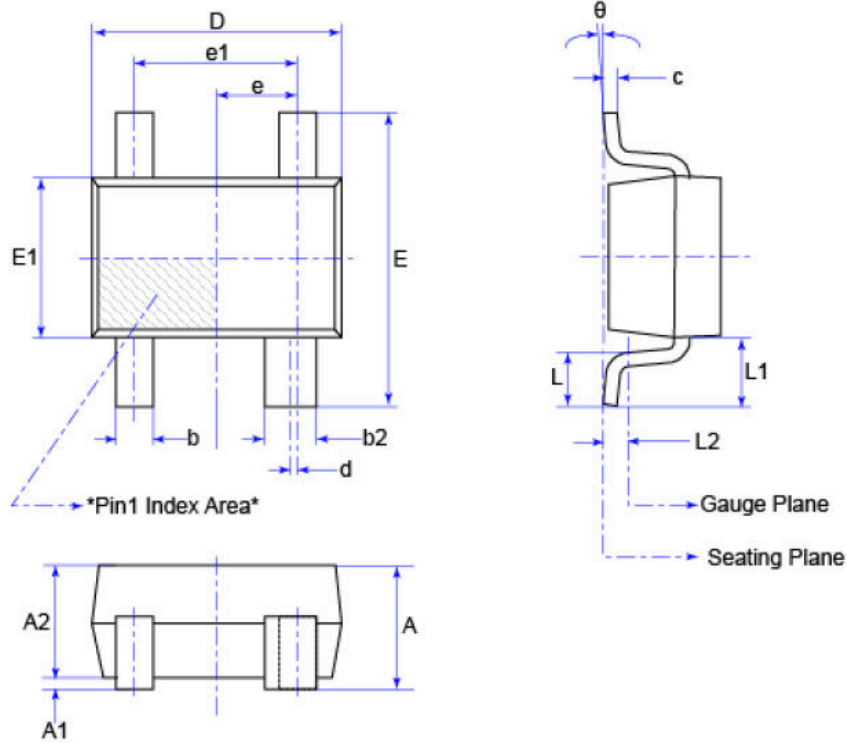


Unit: mm

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)

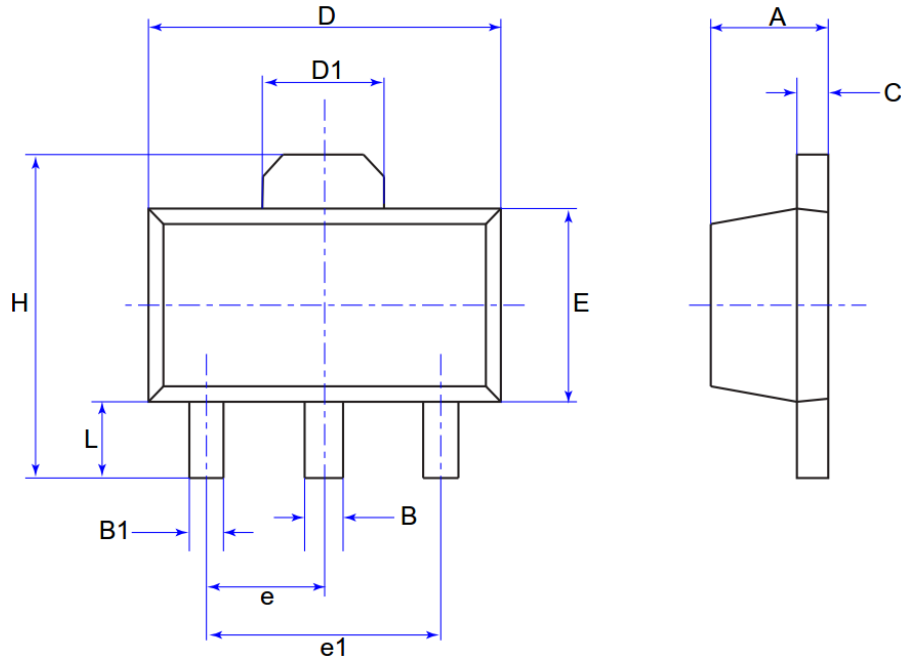


Unit: mm

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

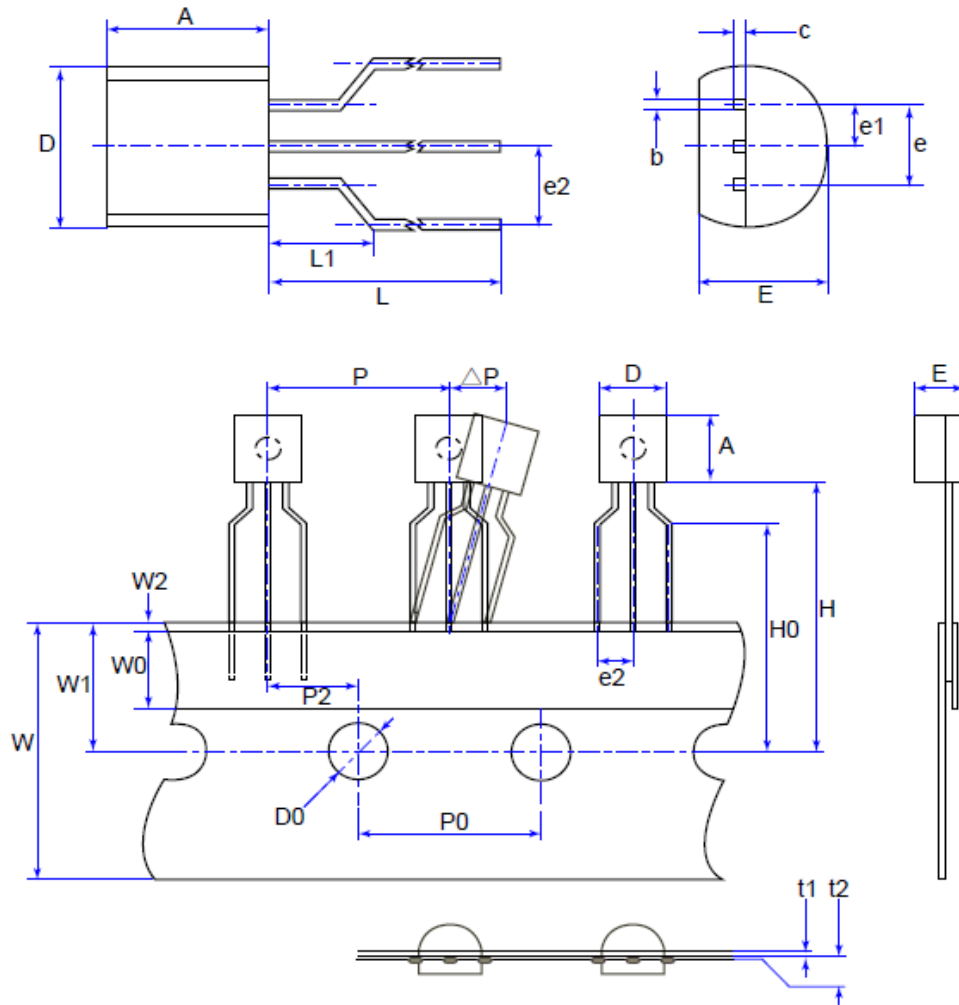


Unit: mm

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 ¹		
	TIME	CONDITION			eV 0.40-0.48	eV 0.30-0.39	CONDITION
			TIME (hours)	CONDITION	TIME (hours)	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 ² +5/-0	30 °C /60% RH	120 -1/+0	168 -1/+0	60 °C/ 60% RH
3	168 hours	≤30 °C /60% RH	192 ² +5/-0	30 °C /60% RH	40 -1/+0	52 -1/+0	60 °C/ 60% RH
4	72 hours	≤30 °C /60% RH	96 ² +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 ² +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 ² +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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