50V Low Current Consumption

150mA CMOS Voltage Regulator

S-LR6675 Series

■ INTRODUCTION

The S-LR6675 series are a group of positive voltage regulators manufactured by CMOS technologies with low power consumption and low dropout voltage, which provide large output currents even when the difference of the input-output voltage is small. The S-LR6675 series can deliver 150mA output current and allow an input voltage as high as 60V. The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

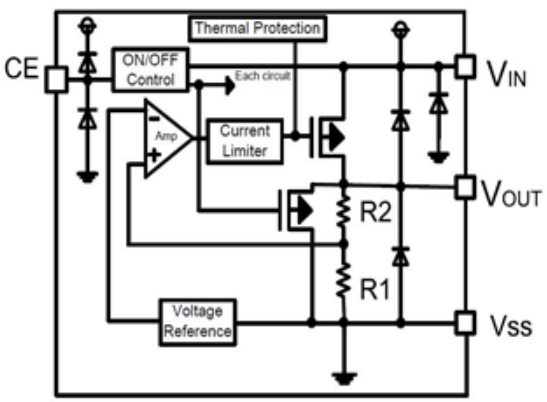
■ FEATURES

- Low Quiescent Current:3μA
- Operating Voltage Range: 2.5V～50V
- Output Current: 150mA
- Low Dropout Voltage：
  500mV@50mA(V_{OUT}=3.3V)
- Output Voltage: 1.2~ 12.0V
- High Accuracy: ±2%/±1%（Typ.）
- High Power Supply Rejection Ratio:
  80dB@1kHz
- Low Output Noise:
  27xV_{OUT} μV_{RMS} (10Hz~100kHz)
- Excellent Line and Load Transient Response
- Built-in Current Limiter, Short-Circuit Protection
- Over-Temperature Protection
- S-Prefix for Automotive And Other Applications Requiring Unique Site and Control Change Requirements;

■ APPLICATIONS

- Cordless Phones
- Radio control systems
- Laptop, Palmtops and PDAs
- Single-lens reflex DSC
- PC peripherals with memory
- Wireless Communication Equipments
- Portable Audio Video Equipments
- Car Navigation Systems
- LAN Cards
- Ultra Low Power Microcontroller

■ BLOCK DIAGRAM



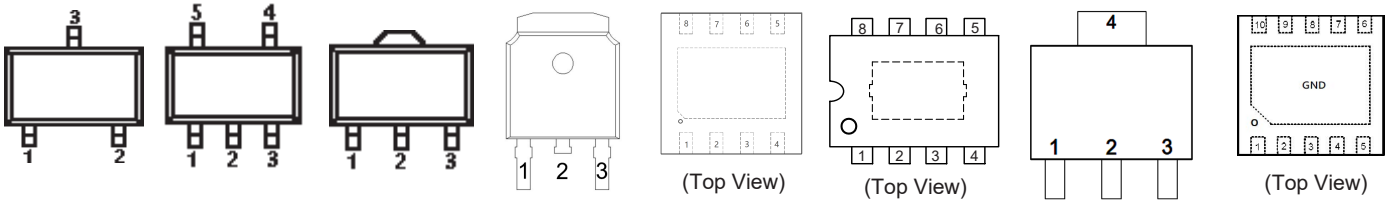
■ ORDER INFORMATION

S-LR6675①②③④

DESIGNATOR	SYMBOL	DESCRIPTION
①	A	Without EN
	B	With Shutdown Function
②	Integer	Output Voltage e.g.5.0V = 50 12.0V = 120
③	M/ MC/ MY	Package:SOT-23-3/5
	P/PT/PL	Package:SOT-89-3
	D	Package:TO-252(DPAK)
	U/UN	Package:DFN3030-8
	XE/XEN/XEM	Package:ESOP-8
	S	Package:SOT223
	H	Package:DFN3030-10
④	-	2% Accuracy
	1	1% Accuracy

■ PIN CONFIGURATION

SOT-23-3 SOT-23-5 SOT-89-3 TO-252 DFN3030-8 ESOP-8 SOT223 DFN3030-10



S-LR6675A

PIN NUMBER						PIN NAME	FUNCTION
SOT-23-3			SOT-89-3				
M	MC	MY	P	PT	PL		
1	3	3	1	2	2	V_{SS}	Ground
2	2	1	3	1	3	V_{OUT}	Output
3	1	2	2	3	1	V_{IN}	Power input

S-LR6675A/B
SOT-23-5

PIN NUMBER			SYMBOL	FUNCTION
M	MT	MH		
1	5	1	V_{IN}	Power Input Pin
2	1,2(Note)	3,4	V_{SS}	Ground
3	3	—	CE	Chip Enable Pin
4	—	2	NC	No Connection
5	4	5	V_{OUT}	Output Pin

Note: The GND pin must be wired together when it is mounted on board.

S-LR6675A
TO-252

PIN NUMBER	SYMBOL	FUNCTION
D		
1	V_{IN}	Power Input Pin
2	V_{SS}	Ground
3	V_{OUT}	Output Pin

S-LR6675A
SOT223

PIN NUMBER	PIN NAME	FUNCTION
S		
1	V_{IN}	Power Input
2	V_{SS}	Ground
3	Vout	Output
4	V_{SS}	Ground

■ PIN CONFIGURATION (continued)

S-LR6675B
DFN3030-8

PIN NUMBER		SYMBOL	FUNCTION
U	UN		
1	5	V_{IN}	Power Input Pin
2	6	NC	No Connection
3	7	GND	Ground
4	8	NC	No Connection
5	1	NC	No Connection
6	2	V_{OUT}	Output Pin
7	3	NC	No Connection
8	4	CE	Chip Enable Pin
EP		Thermal PAD	Ground

Note: The GND pin must be wired together when it is mounted on board.

S-LR6675B
ESOP-8

PIN NUMBER			SYMBOL	FUNCTION
XE	XEN	XEM		
1	8	1	V_{OUT}	Output Pin
2,6	3,7	2,3,4,6	NC	No Connection
3	4,5,6	5	GND	Ground
4,5	—	—	NU	Not Used, connect to GND or leave floating
7	2	7	CE	Chip Enable Pin
8	1	8	V_{IN}	Power Input Pin

Note: The GND pin must be wired together when it is mounted on board.

S-LR6675B
DFN3030-10

PIN NUMBER	SYMBOL	FUNCTION
H		
1	V_{IN}	Power Input Pin
2	NC	No Connection
3	CE	Chip Enable Pin
4	NC	No Connection
5	GND	Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	V_{OUT}	Output Pin
10	NC	No Connection
EP	Thermal PAD	Ground

Note: The GND pin must be wired together when it is mounted on board.

■ ABSOLUTE MAXIMUM RATINGS(1)

(Unless otherwise specified, T_A=25°C)

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage(2)		V_{IN}	-0.3~65	V
Output Voltage(2)		V_{OUT}	-0.3~15	V
CE Pin Voltage(2)		V_{CE}	-0.3~V_{IN}+0.3	V
Output Current		I_{OUT}	400	mA
Power Dissipation	SOT-23	P_D	0.3	W
	SOT-25		0.4	W
	SOT-89		0.5	W
Operating Junction Temperature Range		T_j	-40~125	°C
Storage Temperature		T_{stg}	-40~125	°C
Lead Temperature(Soldering, 10 sec)		T_{solder}	260	°C
ESD rating(3)		Human Body Model-(HBM)	2	kV
		Machine Model- (MM)	200	V

(1) Stresses beyond those listed under *absolute maximum ratings may* cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods my affect device reliability.

(2) All voltages are with respect to network ground terminal.

(3) ESD testing is performed according to the respective AEC-Q100 standard.

The human body model is a 100 pF capacitor discharged through a 1.5kΩ resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin.

■ RECOMMENDED OPERATING CONDITIONS

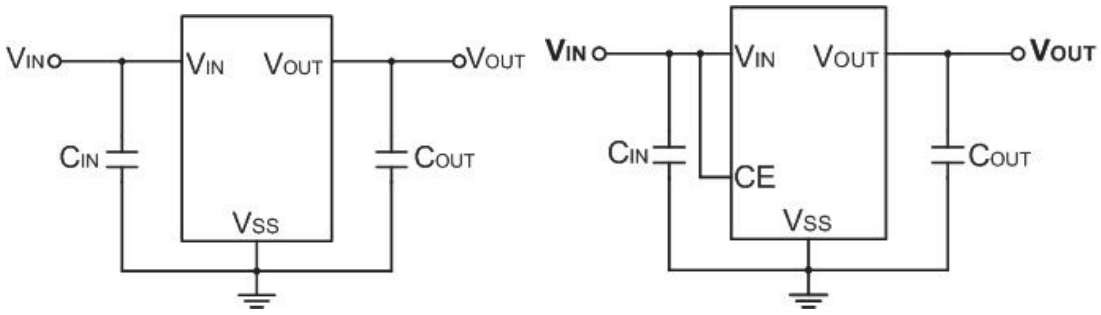
PARAMETER	MIN.	NOM.	MAX.	UNITS
Supply voltage at V_{IN}	2.5		50	V
Operating junction temperature range, T_j	-40		125	°C
Operating free air temperature range, T_A	-40		125	°C

■ ELECTRICAL CHARACTERISTICS

S-LR6675 Series (V_{CE}=V_{IN}=V_{OUT}+2V, C_{IN}=C_{OUT}=1μF, T_A=25℃, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.(4)	MAX.	UNITS
Input Voltage	V_{IN}			2.5	—	50	V
Output Voltage Range	V_{OUT}			1.2	—	12	V
DC Output Accuracy		I_{OUT}=1mA		-2	—	2	%
				-1	—	1	%
Dropout Voltage	V_{dif}(5)	I_{OUT} =50mA,V_{OUT}=3.3V		—	500	—	mV
Supply Current	I_{SS}	I_{OUT}=0A	V_{OUT}≤5.0V	—	3	6	μA
			V_{OUT}>5.0V		5	10	μA
Standby Current	I_{STBY}	CE = V_{SS}			0.1	0.5	μA
Line Regulation	$\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta V_{IN}}$	I_{OUT} =10mA V_{OUT} +1V≤V_{IN}≤18V		—	0.01	0.3	%/V
Load Regulation	ΔV_{OUT}	V_{IN}= V_{OUT} +1V, 1mA≤I_{OUT}≤100mA		—	10	—	mV
Temperature Coefficient	$\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta T_A}$	I_{OUT}=10mA, -40°C<T_A<125°C			50		ppm
Output Current Limit	I_{LIM}	V_{OUT}= 0.5 x $V_{OUT(Normal)}$, V_{IN} = 5V		150	250		mA
Short Current	I_{SHORT}	V_{OUT} =V_{SS}		—	20	—	mA
Power Supply Rejection Ratio	PSRR	I_{OUT}=50mA	100Hz		75		dB
			1kHz	—	80	—	
			10kHz	—	60	—	
			100kHz	—	45	—	
Output Noise Voltage	V_{ON}	BW=10Hz to 100kHz		—	27 x V_{OUT}	—	μV_{RMS}
Thermal Shutdown Temperature	T_{SD}	——		—	170	—	°C
Thermal Shutdown Hysteresis	$\triangle T_{SD}$	——		—	20	—	°C
CE "High" Voltage	V_{CE}"H"			1.5		V_{IN}	V
CE "Low" Voltage	V_{CE}"L"					0.3	V

■ TYPICAL APPLICATION CIRCUIT



External Components List

Symbol	Description
C_{IN}	1.0μF or more
C_{OUT}	1.0μF or more，10μF is recommended

■ APPLICATION INFORMATION

■ Selection of Input/ Output Capacitors

Phase compensation is provided to secure operation even when the load current is varied. For this purpose, use a 1.0μF or more output capacitor (C_{OUT}) with good frequency characteristics and proper ESR (Equivalent Series Resistance). Connect a 1.0μF or more input capacitor (C_{IN}) between the V_{IN} pin and the V_{SS} pin as close as possible to the pins.
The value of the output overshoot or undershoot transient response varies depending on the value of the output capacitor.
When selecting the output capacitor, perform sufficient evaluation, including evaluation of temperature characteristics, on the actual device.

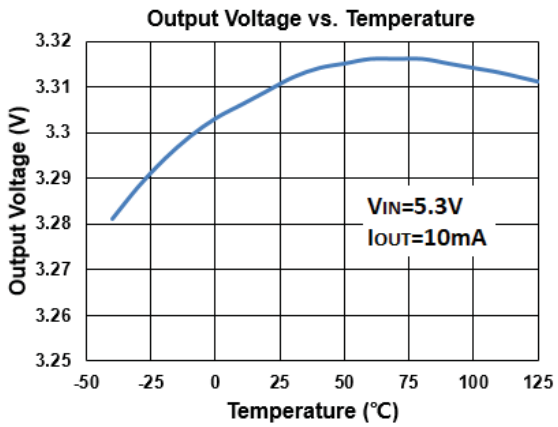
In the design of portable devices the ceramic capacitors are often chosen because of their small size, low equivalent series resistance (ESR) and high RMS current capability. Also, designers have been looking to ceramic capacitors due to shortages of tantalum capacitors.

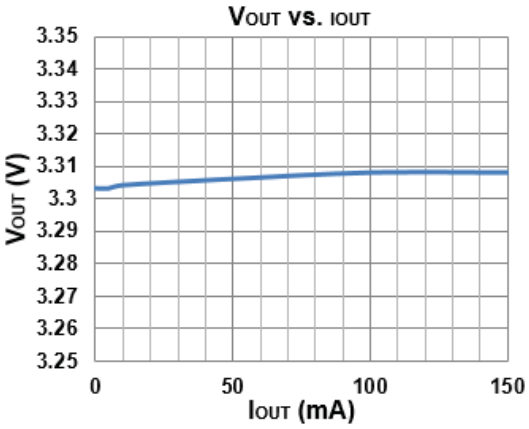
Unfortunately, using ceramic capacitors for input filtering can cause problems. Applying a voltage step to a ceramic capacitor causes a large current surge that stores energy in the inductances of the power leads. A large voltage spike is created when the stored energy is transferred from these inductances into the ceramic capacitor. These voltage spikes can easily be twice the amplitude of the input voltage step.

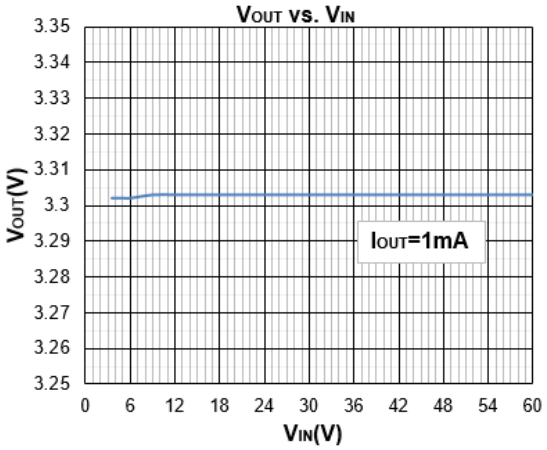
Many types of capacitors can be used for input bypassing, however, caution must be exercised when using multilayer ceramic capacitors (MLCC). Because of the self-resonant and high Q characteristics of some types of ceramic capacitors, high voltage transients can be generated under some start-up conditions, such as connecting the LDO input to a live power source. Adding a 3Ω resistor in series with an X5R ceramic capacitor will minimize start-up voltage transients.

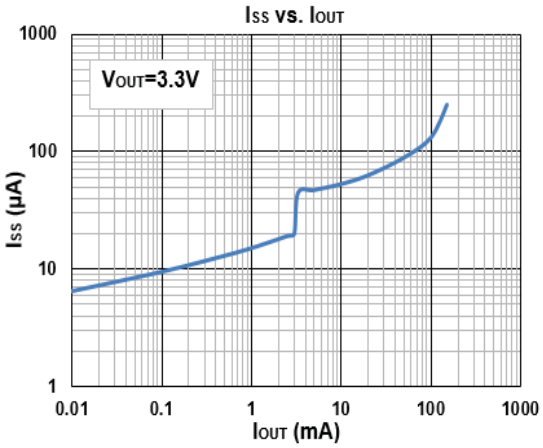
■ TYPICAL PERFORMANCE CHARACTERISTICS

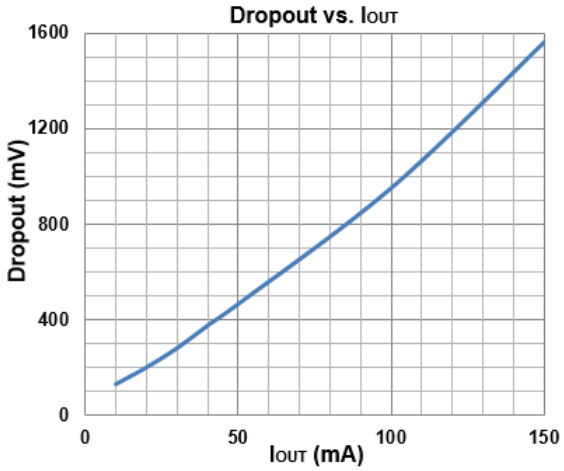
(V_{CE}=V_{IN}=V_{OUT}+2V, C_{IN}=1μF, C_{OUT}=10μF , T_A=25℃, unless otherwise specified)

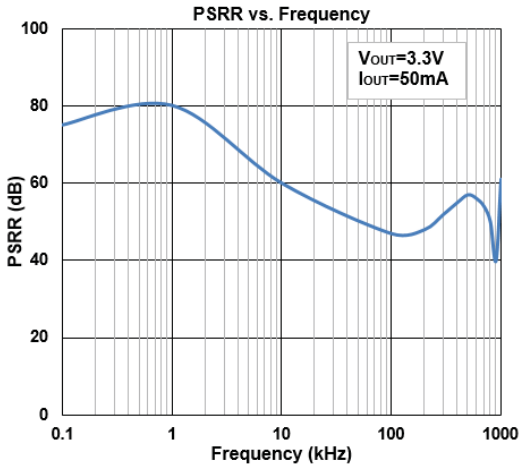






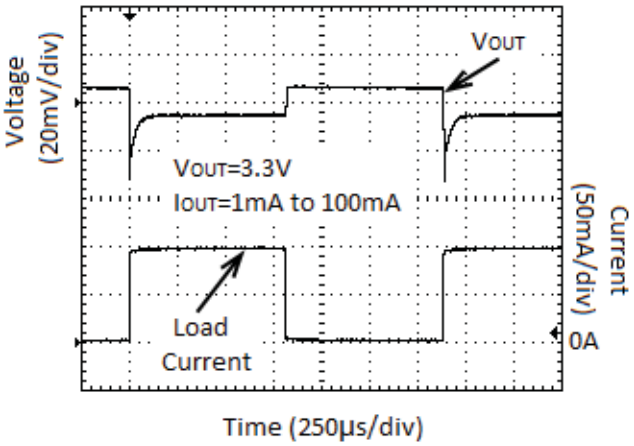


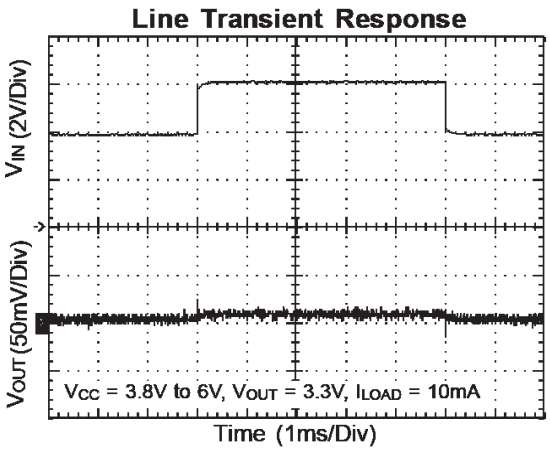


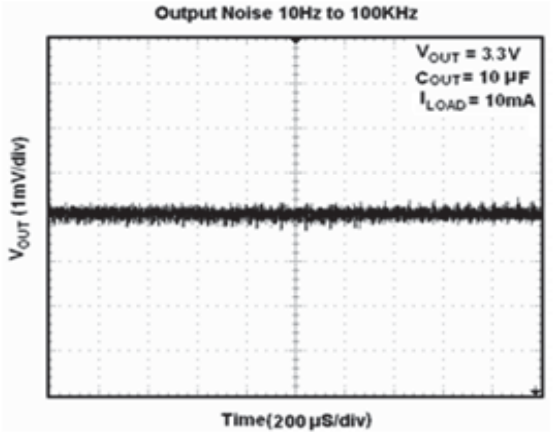


■ TYPICAL PERFORMANCE CHARACTERISTICS

(V_{CE}=V_{IN}=V_{OUT}+2V, C_{IN}=1μF, C_{OUT}=10μF , T_A=25℃, unless otherwise specified)

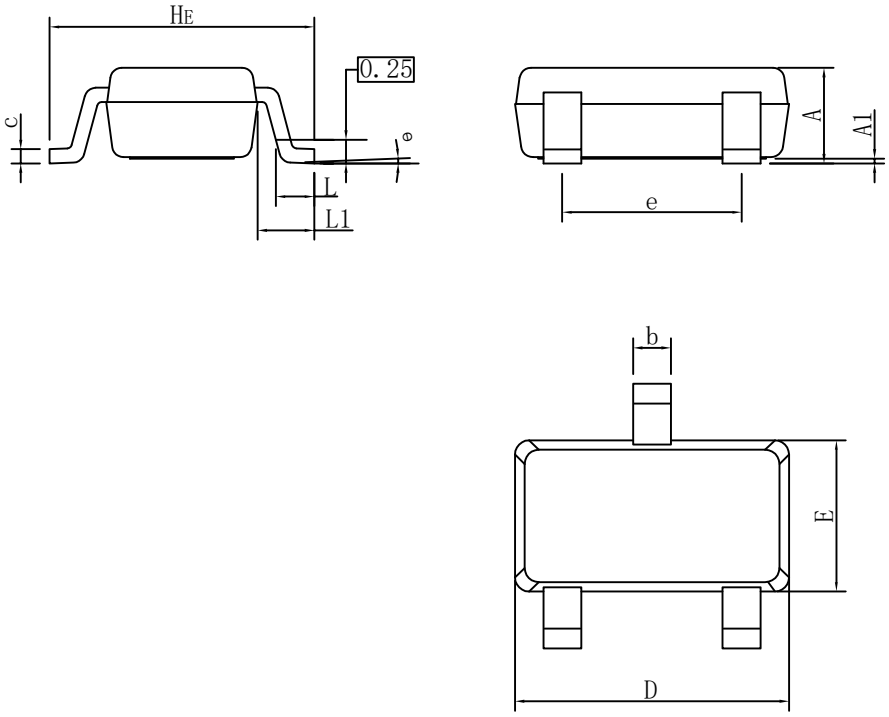






■ PACKAGING INFORMATION

● SOT-23-3 PACKAGE OUTLINE DIMENSIONS

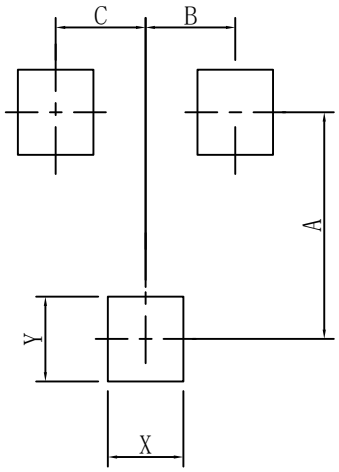


SOT23LC			
DIM	MIN	NOR	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.30	0.40	0.50
c	0.10	0.17	0.20
D	2.80	2.90	3.00
E	1.50	1.60	1.70
e	1.80	1.90	2.00
L	0.20	0.40	0.60
L1	0.60REF		
HE	2.60	2.80	3.00
θ	0°	-	10°
All Dimensions in mm			

GENERAL NOTES

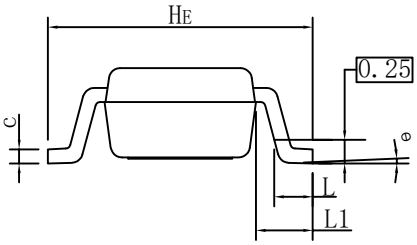
1. Top package surface finish Ra0.4±0.2um
2. Bottom package surface finish Ra0.7±0.2um
3. Side package surface finish Ra0.4±0.2um

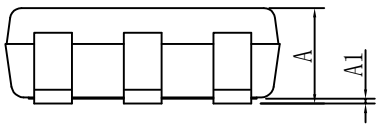
Suggested Pad layout

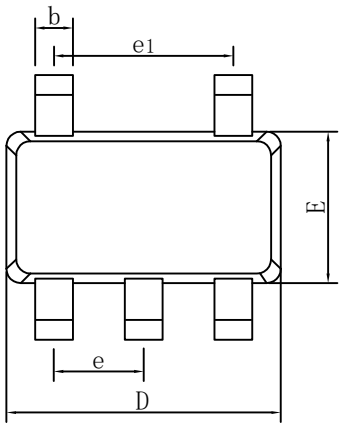


SOT23LC	
DIM	(mm)
X	0.80
Y	0.90
A	2.40
B	0.95
C	0.95

● SOT-23-5 PACKAGE OUTLINE DIMENSIONS





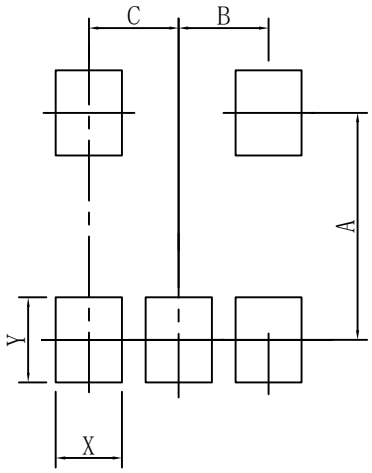


SOT25			
DIM	MIN	NOR	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.30	0.40	0.50
c	0.10	0.17	0.20
D	2.80	2.90	3.00
E	1.50	1.60	1.70
e	0.85	0.95	1.05
e1	1.80	1.90	2.00
L	0.20	0.40	0.60
L1	0.60REF		
HE	2.60	2.80	3.00
θ	0°	-	10°

GENERAL NOTES

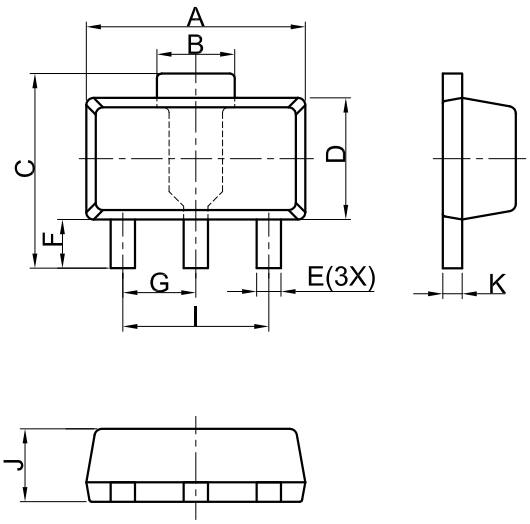
1. Top package surface finish Ra0.4±0.2um
2. Bottom package surface finish Ra0.7±0.2um
3. Side package surface finish Ra0.4±0.2um

Suggested Pad layout



SOT25	
DIM	(mm)
X	0.70
Y	0.90
A	2.40
B	0.95
C	0.95

- **SOT-89-3 PACKAGE OUTLINE DIMENSIONS**

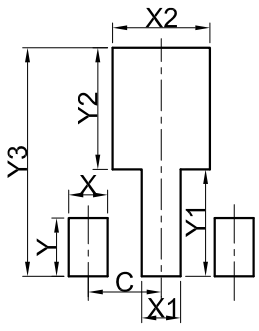


DIM	MIN	NOR	MAX
A	4.40	4.50	4.60
B	1.40	1.60	1.80
C	3.90	4.00	4.25
D		2.50	2.60
E		0.50	0.58
F	0.90	1.00	1.20
G		1.50 BSC	
I		3.00 BSC	
J	1.40	1.50	1.60
K	0.34	0.40	0.50
All Dimensions in mm			

GENERAL NOTES

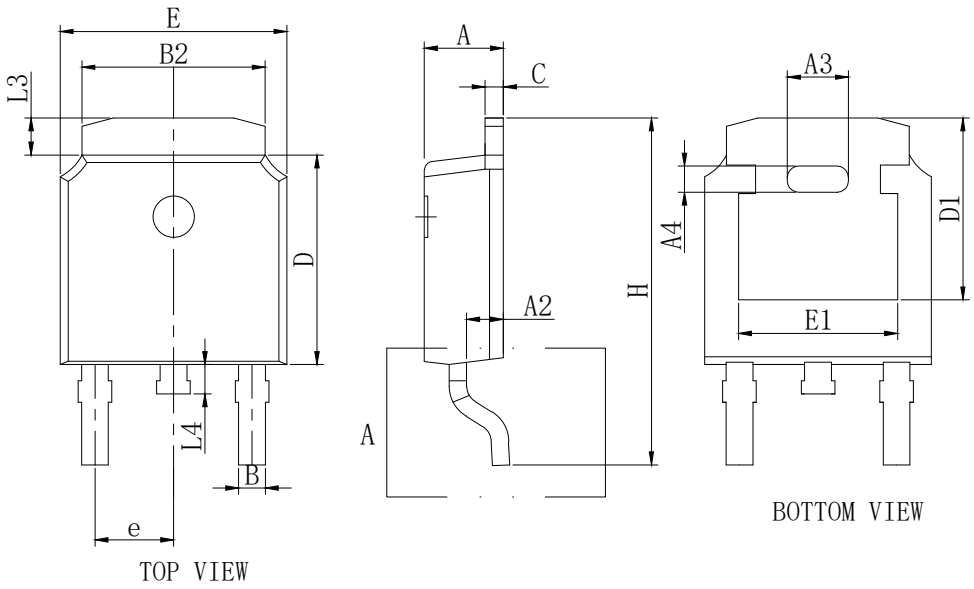
1. Top package surface finish Ra0.4±0.2um
2. Bottom package surface finish Ra0.7±0.2um
3. Side package surface finish Ra0.4±0.2um
4. Protrusion or Gate Burrs shall not exceed 0.10mm per side.

Suggested Pad layout



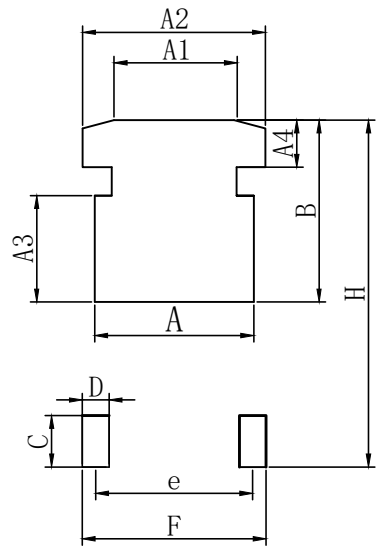
SOT89	
DIM	(mm)
X	0.80
Y	1.20
X1	0.80
Y1	2.20
X2	2.00
Y2	2.50
C	1.50
Y3	4.70

- **TO-252 PACKAGE OUTLINE DIMENSIONS**



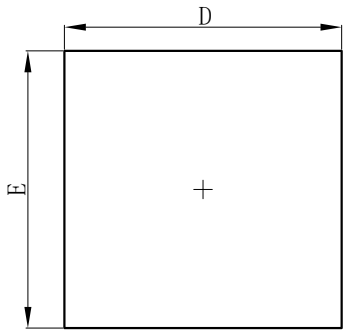
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	2.15	2.30	2.45
A1	0	-	0.20
A2	0.90	1.07	1.17
A3	1.58	1.78	1.98
A4	0.56	0.76	0.96
B	0.68	0.78	0.88
B2	5.20	5.33	5.46
C	0.49	-	0.58
D	5.90	6.10	6.30
D1	5.30REF		
E	6.40	6.60	6.80
E1	4.63	4.83	5.03
e	2.286BSC		
H	9.8	10.10	10.4
L	1.09	1.29	1.49
L1	2.90REF		
L3	0.88	1.08	1.28
L4	0.55	0.80	1.05

Suggested Pad layout

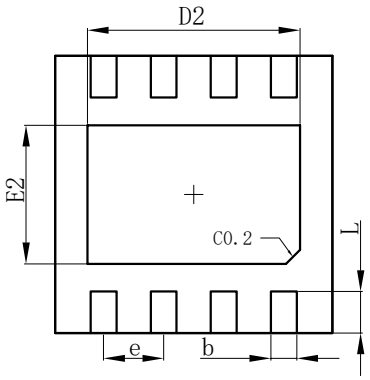


DIM	MIN(mm)
A	6.03
A1	4.50
A2	6.46
A3	4.10
A4	2.37
B	6.50
C	2.50
D	1.68
e	4.57(TYP)
H	12.35
F	6.25

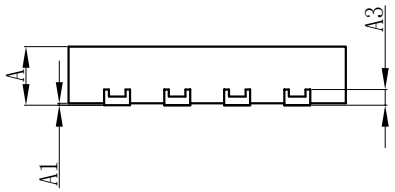
- **DFN3030-8 PACKAGE OUTLINE DIMENSIONS**



TOP VIEW



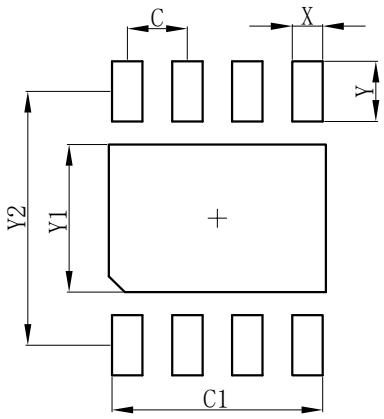
BOTTOM VIEW



SIDE VIEW

DFN3030-8A			
Dim	Min	Typ	Max
D	2.95	3.00	3.05
E	2.95	3.00	3.05
e	–	0.65	–
L	0.40	0.45	0.50
b	0.23	0.28	0.33
A	0.60	0.65	0.70
A1	0	0.02	0.05
A3	–	0.152	–
E2	1.45	1.50	1.55
D2	2.25	2.30	2.35
All Dimensions in mm			

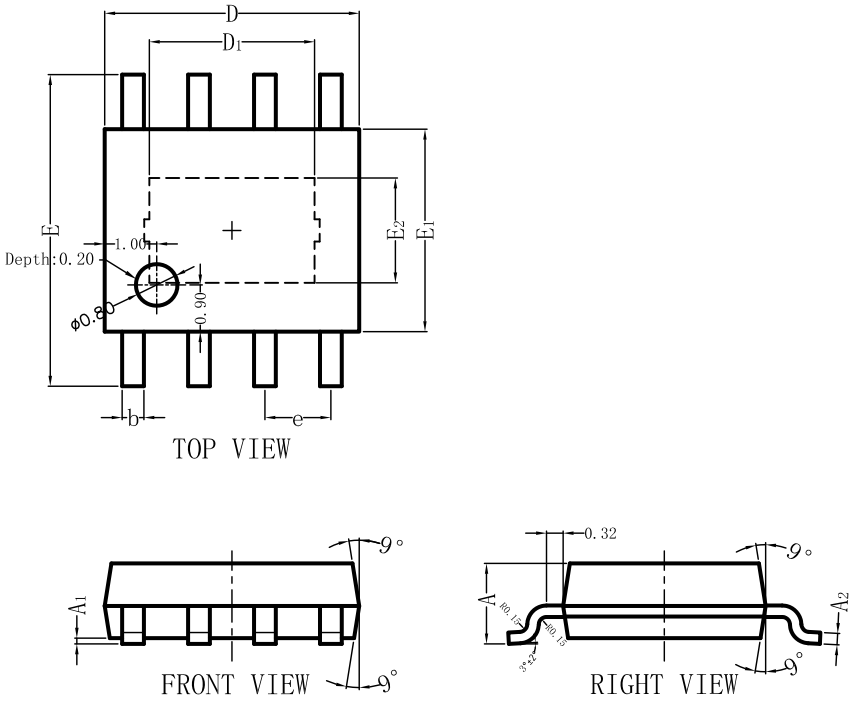
Suggested Pad layout



Dimensions	(mm)
C	0.65
C1	2.28
X	0.33
Y	0.65
Y1	1.60
Y2	2.75

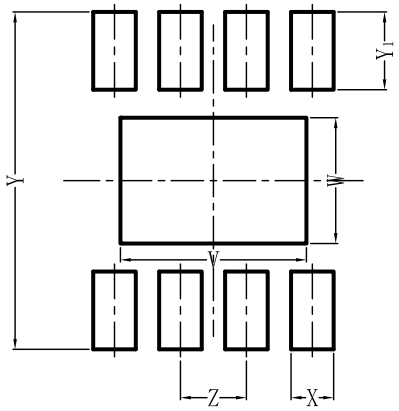
- **ESOP-8 PACKAGE OUTLINE DIMENSIONS**

ESOP8



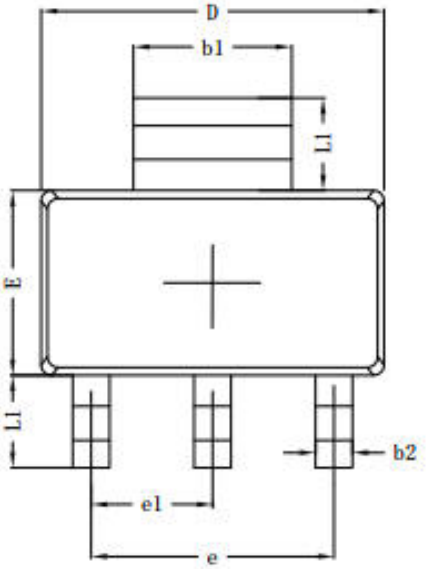
ESOP8 (Unit:mm)			
Dim	Min	Typ	Max
A	1.35	1.55	1.75
A1	0.06	--	0.16
A2	0.19	0.22	0.25
b	0.33	0.42	0.51
D	4.80	4.90	5.00
D1	2.98	3.18	3.38
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
E2	1.82	2.02	2.22
e	1.27BSC		

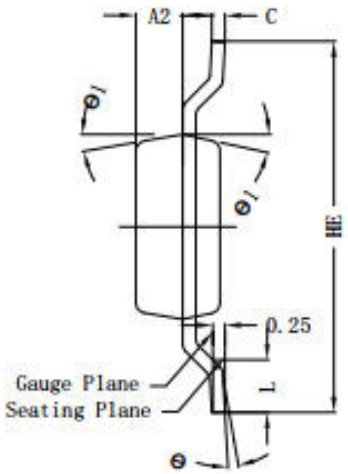
Suggested Pad layout



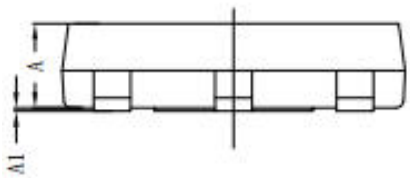
Dimensions	(mm)
V	3.580
W	2.420
X	0.820
Y	6.500
Y1	1.500
Z	1.270

- **SOT223 PACKAGE OUTLINE DIMENSIONS**

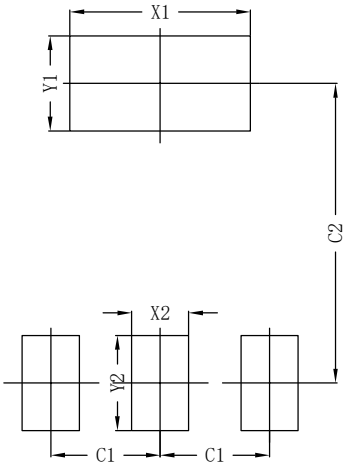




SOT223			
DIM	MIN	NOR	MAX
A	1.50	1.60	1.70
A1	0.00	0.05	0.10
A2	0.80	0.90	1.00
b1	2.90	3.02	3.10
b2	0.60	0.72	0.80
c	0.20	0.27	0.30
D	6.30	6.50	6.70
E	3.30	3.50	3.70
e	4.60BSC		
e1	2.30BSC		
HE	6.80	7.00	7.20
L	0.80	1.00	1.20
L1	1.75(REF)		
θ	0°~8°		
θ1	8°	10°	12°
All Dimensions in mm			



Suggested Pad layout



SOT223	
DIM	(mm)
X1	3.80
Y1	2.00
X2	1.20
Y2	2.00
C1	2.30
C2	6.30

■ ORDER INFORMATION APPENDIX

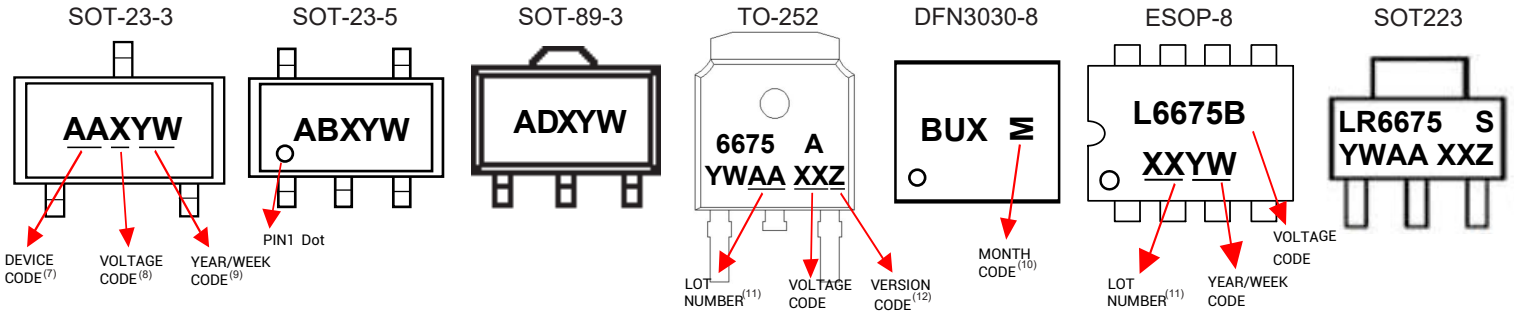
Device(4)	Output Voltage(5)	Package	Marking(6)	Shipping
S-LR6675AxxM	1.2V~12V	SOT-23-3	AAX	3K/Reel
S-LR6675AxxMC	1.2V~12V	SOT-23-3	ACX	3K/Reel
S-LR6675AxxMY	1.2V~12V	SOT-23-3	AYX	3K/Reel
S-LR6675BxxM	1.2V~12V	SOT-23-5	ABX	3K/Reel
S-LR6675AxxMH	1.2V~12V	SOT-23-5	AHX	3K/Reel
S-LR6675AxxP	1.2V~12V	SOT-89-3	ADX	1K/Reel
S-LR6675AxxPL	1.2V~12V	SOT-89-3	ALX	1K/Reel
S-LR6675AxxPT	1.2V~12V	SOT-89-3	ATX	1K/Reel
S-LR6675AxxP1	1.2V~12V	SOT-89-3	AZX	1K/Reel
S-LR6675AxxPT1	1.2V~12V	SOT-89-3	AWX	1K/Reel
S-LR6675AxxD	1.2V~12V	TO-252(DPAK)	6675 A	2.5K/Reel
S-LR6675BxxU	1.2V~12V	DFN3030-8	BUX	3K/Reel
S-LR6675BxxXE	1.2V~12V	ESOP-8	L6675B	4K/Reel
S-LR6675BxxXEN	1.2V~12V	ESOP-8	L6675N	4K/Reel
S-LR6675AxxXEM	1.2V~12V	ESOP-8	L6675M	4K/Reel
S-LR6675AxxS	1.2V~12V	SOT223	LR6675 S	1K/Reel
S-LR6675BxxH	1.2V~12V	DFN3030-10	BHX	2.5K/Reel

(4) The "xx" in part number represents output voltage, eg "18" = 1.8V, "50" = 5.0V.

(5) Output voltage varies from 1.2V to 12.0V, 0.1V an interval.

(6) There are additional marking, which relates to the date code. For detailed information, please refer to MARKING INFORMATION APPENDIX below.

■ MARKING INFORMATION APPENDIX



(7) The first two letters in the Marking represent DEVICE CODE. For TO-252 package, the DEVICE CODE contains five letters. For ESOP-8 package, the DEVICE CODE contains six letters. For SOT223 package, the DEVICE CODE contains seven letters.

(8) The following letter "X" in the Marking changes along with the output voltage, as the chart shows below.

Voltage(V)	···	1.0	1.2	1.5	1.8	2.5	2.7	2.8	3.0	3.0(1%)	3.3	3.3(1%)	3.6	4.0	5.0	5.0(1%)	12	···
Symbol	···	D	E	F	G	H	I	J	K	B	L	Q	M	N	P	m	S	···

For TO-252 and ESOP-8 packages, the VOLTAGE CODE is a two-digit or three-digit number changing along with the output voltage. For example, 18 = 1.8V, 33 = 3.3V, 50 = 5.0V, etc.

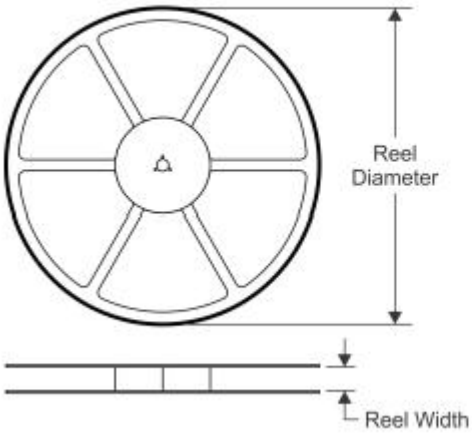
(9) The last two letters in the Marking represent YEAR/WEEK CODE.

(10) For DFN3030-8 and packages, the last letter represents the MONTH CODE. And the MONTH CODE is rotated 90° CCW for internal control purpose.

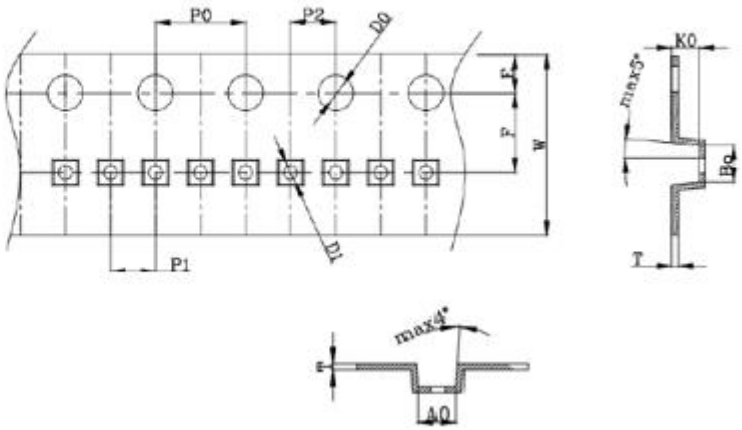
(11) The LOT NUMBER and VERSION CODE are also used for internal production control of the factory.

■ TAPE AND REEL INFORMATION

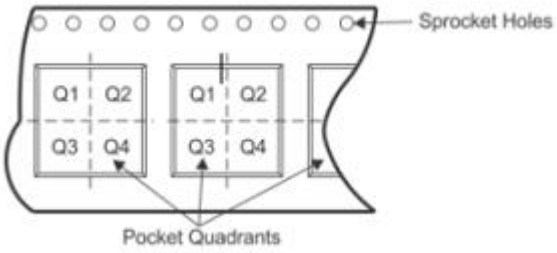
REEL DEMENSIONS



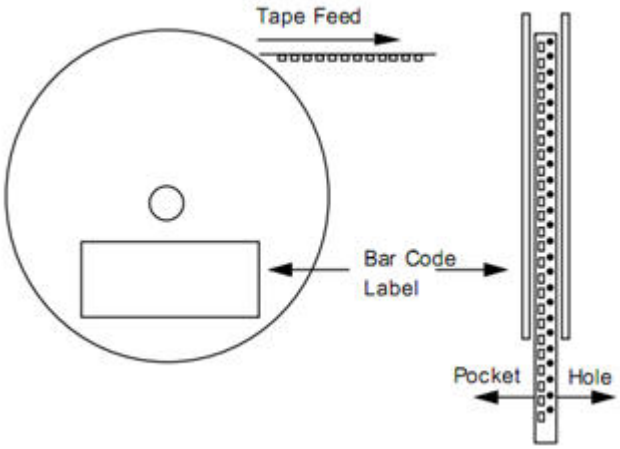
TAPE DEMENSIONS



PIN ORIENTATION



ROLLING ORIENTATION



Device	Package	Reel Diameter (mm)	Reel width (mm)	P0 (mm)	P1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	W (mm)	PIN1
S-LR6675AxxM	SOT-23-3	178±1	9.6±1.2	4.00±0.1	4.00±0.1	3.1±0.1	3.28±0.1	1.32±0.1	8.0±0.1	NA
S-LR6675AxxMC	SOT-23-3	178±1	9.6±1.2	4.00±0.1	4.00±0.1	3.1±0.1	3.28±0.1	1.32±0.1	8.0±0.1	NA
S-LR6675AxxMY	SOT-23-3	178±1	9.6±1.2	4.00±0.1	4.00±0.1	3.1±0.1	3.28±0.1	1.32±0.1	8.0±0.1	NA
S-LR6675BxxM	SOT-23-5	178±1	9.6±1.2	4.00±0.1	8.00±0.1	4.75±0.1	4.2±0.1	1.75±0.1	$12.0^{+0.3}_{-0.1}$	Q3
S-LR6675AxxMH	SOT-23-5	178±1	9.6±1.2	4.00±0.1	8.00±0.1	4.75±0.1	4.2±0.1	1.75±0.1	$12.0^{+0.3}_{-0.1}$	Q3
S-LR6675AxxP	SOT-89-3	178±1	$13.0^{+1}_{-0.5}$	4.00±0.1	8.00±0.1	4.75±0.1	4.2±0.1	1.75±0.1	$12.0^{+0.3}_{-0.1}$	NA
S-LR6675AxxPT	SOT-89-3	178±1	$13.0^{+1}_{-0.5}$	4.00±0.1	8.00±0.1	4.75±0.1	4.2±0.1	1.75±0.1	$12.0^{+0.3}_{-0.1}$	NA
S-LR6675AxxPL	SOT-89-3	178±1	$13.0^{+1}_{-0.5}$	4.00±0.1	8.00±0.1	4.75±0.1	4.2±0.1	1.75±0.1	$12.0^{+0.3}_{-0.1}$	NA
S-LR6675AxxP1	SOT-89-3	178±1	$13.0^{+1}_{-0.5}$	4.00±0.1	8.00±0.1	4.75±0.1	4.2±0.1	1.75±0.1	$12.0^{+0.3}_{-0.1}$	NA
S-LR6675AxxPT1	SOT-89-3	178±1	$13.0^{+1}_{-0.5}$	4.00±0.1	8.00±0.1	4.75±0.1	4.2±0.1	1.75±0.1	$12.0^{+0.3}_{-0.1}$	NA
S-LR6675AxxS	SOT-223	178±1	$13.0^{+1}_{-0.5}$	4.00±0.1	8.00±0.1	4.75±0.1	4.2±0.1	1.75±0.1	$12.0^{+0.3}_{-0.1}$	NA

■ REVISION HISTORY

Version	Description	Update by	Update Date
1.6	Update date code in ESOP-8 package.	Chen S	2023-02-26
1.7	Add device S-LR6675AxxMH, S-LR6375AxxXEM and S-LR6675BxxH. Update voltage code in device markings.	Chen S	2024-04-07

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