High PSRR Low Noise 300mA RF LDO

DESCRIPTION

The SUM3643 family of low-dropout (LDO), low-power linear regulators offers high power supply rejection ratio (PSRR) while maintaining very low 2 μA ground current, suitable for RF applications. The family uses an advanced CMOS process and a PMOSFET pass device to achieve fast start-up, low noise, excellent transient response, and excellent PSRR performance. The SUM3643 is stable with a 1.0 μF ceramic output capacitor, and uses a precision voltage reference and feedback loop to achieve a worst-case accuracy of 2% over all load, line, process, and temperature variations. It is offered in a small DFN1.0 × 1.0-4 / SOT23-3 / SOT23-5 packages, which are ideal for small form factor portable equipment such as wireless handsets and PDAs.

The SUM3643 is available in fixed output voltage range from 1.0 V to 5.0 V.

FEATURES

- Wide Input Voltage Range: 1.6 V ~ 5.5 V
- Up to 300 mA Load Current
- Fixed Output Voltage Range: 1.0 V ~ 5.0 V
- Other Output Voltage Options Available on Request
- Low Quiescent Current Typical 2 μA
- Low Dropout: 260 mV at 300 mA Load
- Low Noise: 80 μV_{RMS} at 1.2 V output
- Ultra-Fast Start-Up Time: 100 μs
- Excellent Load/Line Transient Response
- Line Regulation: 0.03% typical
- Package: DFN1.0 × 1.0-4; SOT23-3; SOT23-5

APPLICATIONS

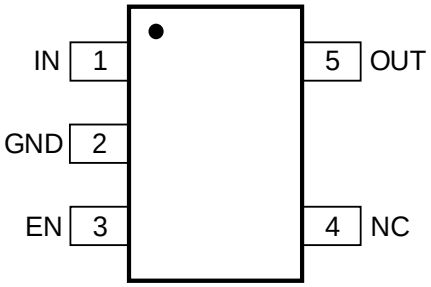
- Smart Phones and Cellular Phones
- PDAs
- MP3/MP4 Player
- Digital Still Cameras
- Portable instruments

ORDER INFORMATION

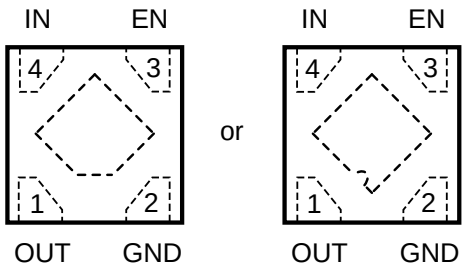
Model	Package	Ordering Number	Packing Option
SUM3643	DFN1.0 × 1.0-4	SUM3643-XXYB	Tape and Reel, 10000
	SOT23-3	SUM3643-XXKA3	Tape and Reel, 3000
	SOT23-5	SUM3643-XXKA5	Tape and Reel, 3000

*XX: When expressed as 18, the output voltage is 1.8 V; when expressed as 30 the output voltage is 3.0 V.

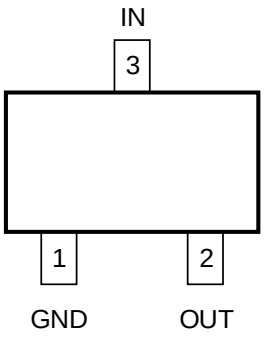
PIN CONFIGURATION (Top View)



SOT23-5



DFN1.0 × 1.0-4

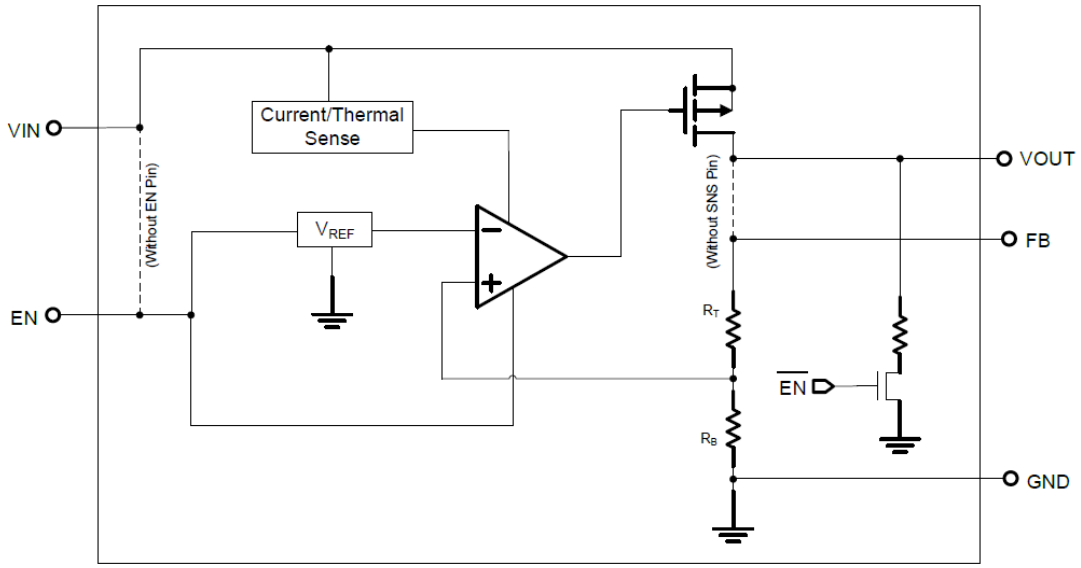


SOT23-3

PIN FUNCTION

Pin Number			Pin Name	Function
SOT23-5	DFN1.0×1.0-4	SOT23-3		
1	4	3	IN	Supply input pin. Must be closely decoupled to GND with a 1μF or greater ceramic capacitor.
2	2	1	GND	Ground.
3	3		EN	Enable control input, active high. Do not leave EN floating.
4			NC	No connection.
5	1	2	OUT	Output pin. Bypass a 1 μF ceramic capacitor from this pin to ground.

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Input Capacitor

A 1 μF ceramic capacitor is recommended to connect between IN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both IN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1 μF to 2.2 μF, Equivalent Series Resistance (ESR) is from 5 mΩ to 100 mΩ, and temperature characteristics is X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to OUT and GND pins.

ON/OFF Input Operation

The SUM3643 is turned on by setting the EN pin high, and is turned off by pulling it low. If this feature is not used, the EN pin should be tied to IN pin to keep the regulator output on at all time.

High PSRR and Low Noise

RF circuits such as LNA (low-noise amplifier), up/down-converter, mixer, PLL, VCO, and IF stage, require low noise and high PSRR LDOs. The temperature-compensated crystal oscillator circuit requires very high PSRR at RF power amplifier burst frequency. For instance, minimum 65 dB PSRR at 217 Hz is recommended for the GSM handsets.

In order to provide good audio quality, the audio power supply for hand-free, game, MP3, and multimedia applications in cellular phones, require low-noise and high PSRR at audio frequency range (20 Hz - 20 kHz). The SUM3643, with PSRR of 74 dB at 1 kHz, is suitable for most of these applications that require high PSRR and low noise.

Ultra Fast Start-up

After enabled, the SUM3643 is able to provide full power in as little as tens of microseconds, typically 100 μs. This feature will help load circuitry move in and out of standby mode in real time, eventually extend battery life for mobile phones and other portable devices.

Fast Transient Response

Fast transient response LDOs can also extend battery life. TDMA-based cell phone protocols such as Global System for Mobile Communications (GSM) have a transmit/receive duty factor of only 12.5 percent, enabling power savings by putting much of the baseband circuitry into standby mode in between transmit cycles. In baseband circuits, the load often transitions virtually instantaneously from 100 μA to 100 mA. To meet this load requirement, the LDO must react very quickly without a large voltage drop or overshoot — a requirement that cannot be met with conventional, general-purpose LDOs.

The SUM3643's fast transient response from 0 to 300 mA provides stable voltage supply for fast DSP and GSM chipset with fast changing load.

Low Quiescent Current

The SUM3643, consuming only around 2 μA for all input range and output loading, provides great power saving in portable and low power applications.

Current Limit Protection

When output current at the OUT pin is higher than current limit threshold or the OUT pin, the current limit protection will be triggered and clamp the output current to approximately 400 mA to prevent over-current and to protect the regulator from damage due to overheating.

Thermal Shutdown Protection

Thermal protection disables the output when the junction temperature rises to approximately +145°C, allowing the device to cool down. When the junction temperature reduces to approximately +125°C the output circuitry is enabled again. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits the heat dissipation of the regulator, protecting it from damage due to overheating.

RECOMMENDED OPERATING CONDITIONS

Parameter	Rating	Unit
Operating Temperature Range	-40 to +85	℃

ABSOLUTE MAXIMUM RATINGS(2)

Parameter		Rating		Unit
IN Voltage		-0.3 to 6.5		V
Other Pin Voltage		-0.3 to V_{IN} + 0.3		V
Maximum Load Current		400		mA
Junction to Ambient Thermal Resistance (θ_{JA}),(1)		SOT23-5	250	℃/W
		SOT23-3	360	
		DFN1.0 × 1.0-4	280	
Junction Temperature		150		℃
Storage Temperature		-65 to 150		℃
Lead Temperature (Soldering, 10 sec)		300		℃
ESD Protection	HBM	± 6000		V
	CDM	± 2000		
Latch-up		± 200		mA

NOTE:

(1) This particular frame decreases the total thermal resistance of the package and increases its ability to dissipate power when an appropriate area of copper on the printed circuit board is available for heat-sinking.

(2) 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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SUMSEMI recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

SUMSEMI reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SUMSEMI sales office to get the latest datasheet.

ELECTRICAL CHARACTERISTICS

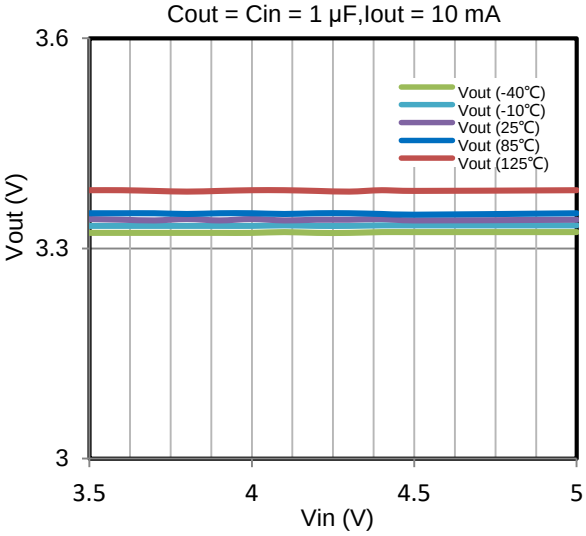
(V_{IN} = V_{EN} = 3.6 V, T_A = 25 °C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Operation Range	V_{IN}		1.6		5.5	V
Dropout Voltage	V_{DROP}	V_{OUT} ≥ 2.8 V, I_{OUT} = 300 mA		260	350	mV
Input Under Voltage Protection	UVP	V_{EN} = 1 V, V_{OUT} > 1 V			1.6	V
DC Supply Quiescent Current	I_{Q_ON}	Active mode: V_{EN} = V_{IN}		2		μA
DC Supply Shutdown Current	I_{Q_OFF}	V_{EN} = 0 V		0.01	1	μA
Regulated Output Voltage	V_{OUT}	I_{OUT} = 1 mA, -40℃ ≤ T_A ≤ 85℃	-2		2	%
Output Voltage Line Regulation		V_{IN} = V_{OUT} + 1 V to 5.5 V, I_{OUT} = 10 mA		0.03	0.2	%
Output Voltage Load Regulation		I_{OUT} from 0 mA to 300 mA			50	mv
Soft-start Time		from Enable to Power On		100		μs
Current Limit		R_{LOAD} = 1 Ω	300			mA
Power Supply Rejection Ratio	PSRR	f = 1 kHz, C_{OUT} = 1 μF, I_{OUT} = 10 mA		74		dB
Output Noise		10 Hz to100 kHz, I_{OUT} = 150 mA, V_{OUT} = 2.8 V, C_{OUT} = 1 μF		120		μV_{RMS}
		10 Hz to100 kHz, I_{OUT} = 150 mA, V_{OUT} = 1.2 V, C_{OUT} = 1 μF		80		
EN Low Threshold					0.22	V
EN High Threshold			0.8			V
EN Pin Input Current	I_{EN}			0	0.1	μA
Over-temperature Shutdown Threshold				145		℃
Over-temperature Shutdown Hysteresis				20		℃
Output resistance of auto discharge at off state	R_{LOW}	ENx = 0 V, V_{IN} = 4 V		30		Ω

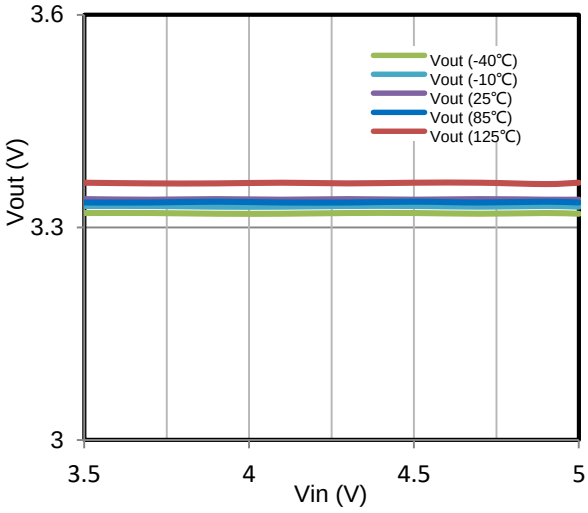
Note: Production test at + 25℃. Specifications over the temperature range are guaranteed by design and characterization.

TYPICAL PERFORMANCE CURVES

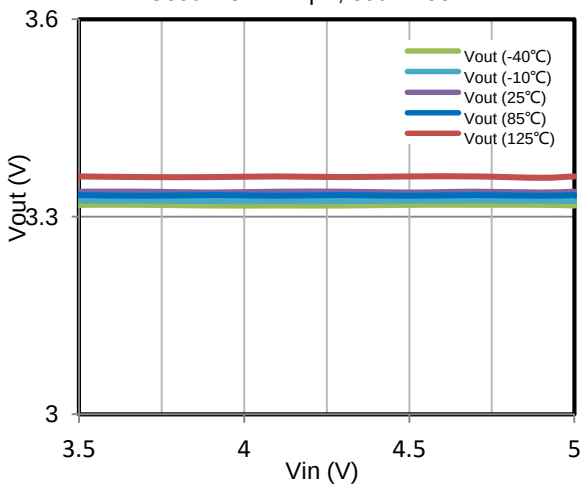
Line Regulation Vout vs Vin
Cout = Cin = 1 μF,Iout = 10 mA



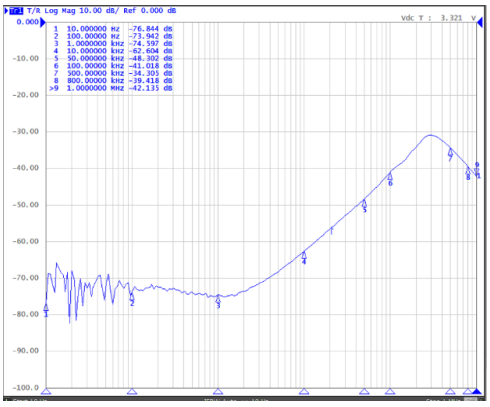
Line Regulation Vout vs Vin
Cout = Cin = 1 μF,Iout = 50 mA



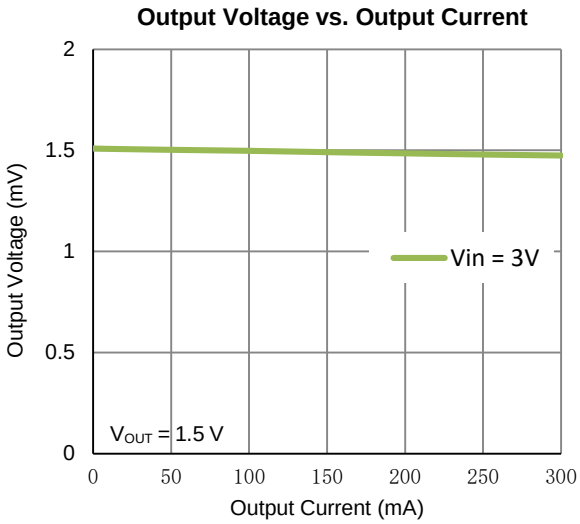
Line Regulation Vout vs Vin
Cout = Cin = 1 μF,Iout = 200 mA

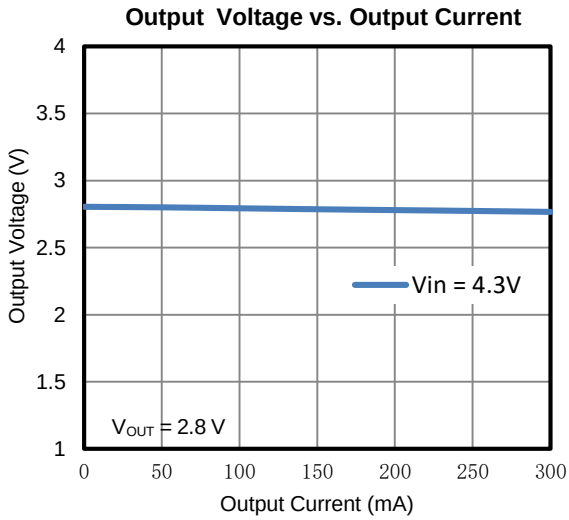


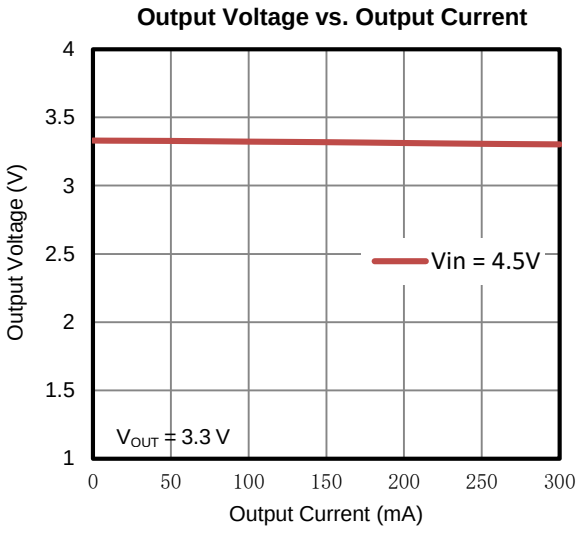
PSRR
V_{OUT} = 3.3 V, I_{OUT} = 10 mA



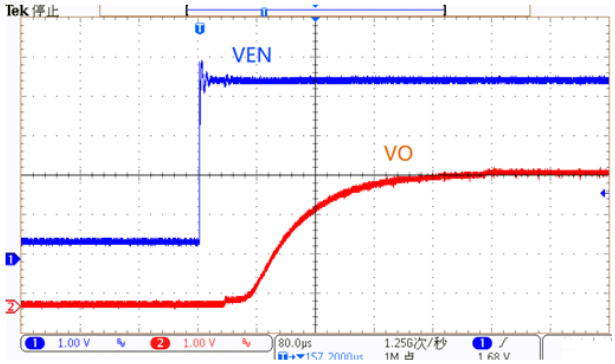
TYPICAL PERFORMANCE CURVES





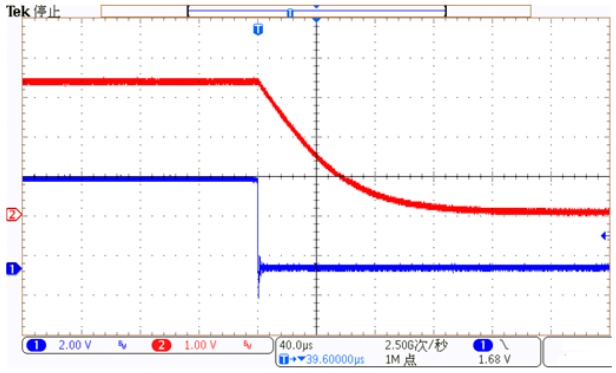


Start up



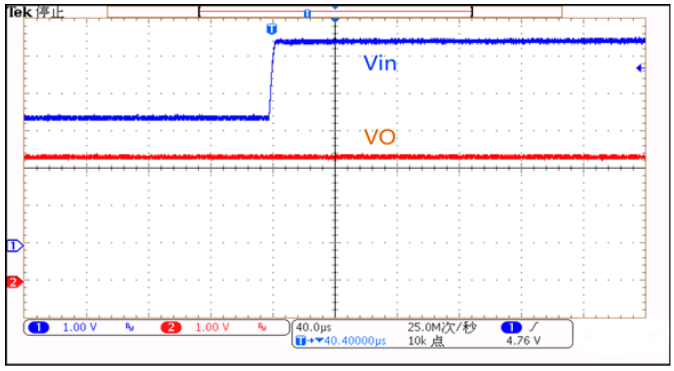
CIN/COUT = 1 µF, VEN = 4.3 V, VOUT = 3.3 V, IOUT = 1 mA

Shutdown



CIN/COUT = 1 µF, VEN = 4.3 V, VOUT = 3.3 V, IOUT = 1 mA

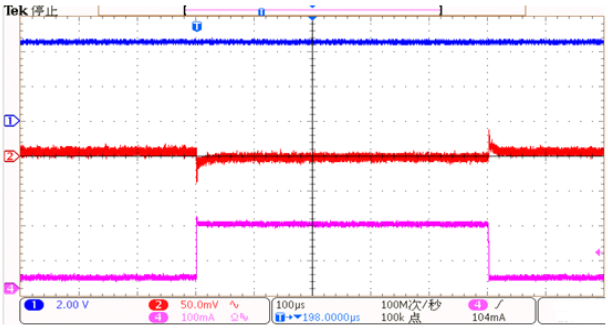
Line Transient Response



CIN/COUT = 1 µF, VIN = 4 V to 6 V, VOUT = 3.3 V, IOUT = 1 mA

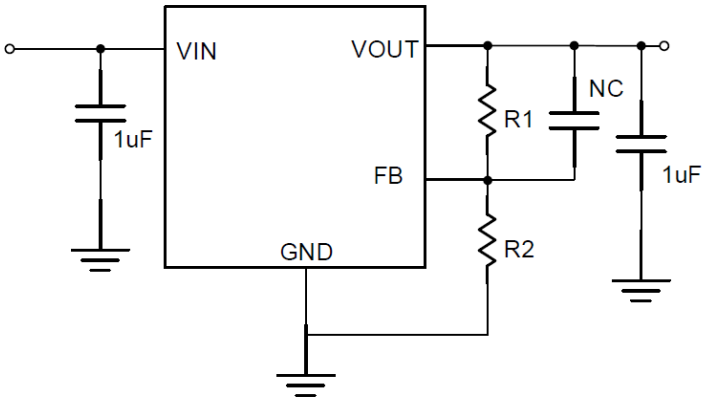
TYPICAL PERFORMANCE CURVES

Load-Transient Response



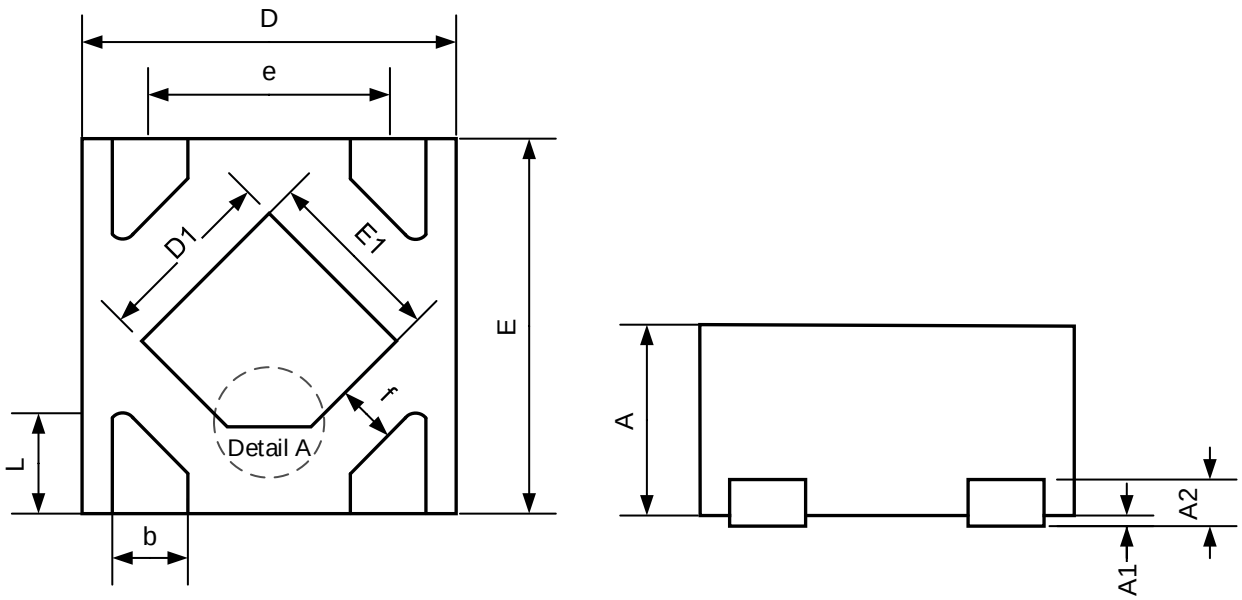
C_{IN}/C_{OUT} = 1 µF, V_{IN} = 4.3 V, V_{OUT} = 3.3 V, I_{OUT} = 20 mA to 200 mA

APPLICATION CIRCUITS



PACKAGE DIMENSION

DFN1.0 × 1.0-4



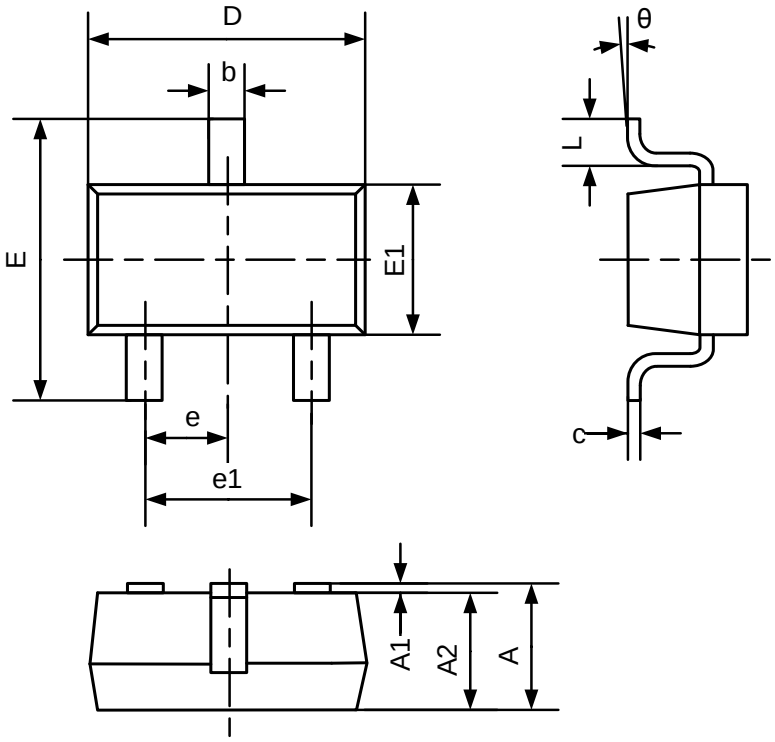
Detail A:

Note: Detail A has two kinds of shapes

Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.400	0.500	0.550
A1	0.000	0.025	0.050
A2		0.125REF	
D	0.950	1.000	1.050
D1	0.380	0.480	0.580
E	0.950	1.000	1.050
E1	0.380	0.480	0.580
b	0.150	0.200	0.250
e		0.650BSC	
f	0.190	0.195	0.200
L	0.150	0.250	0.350

PACKAGE DIMENSION

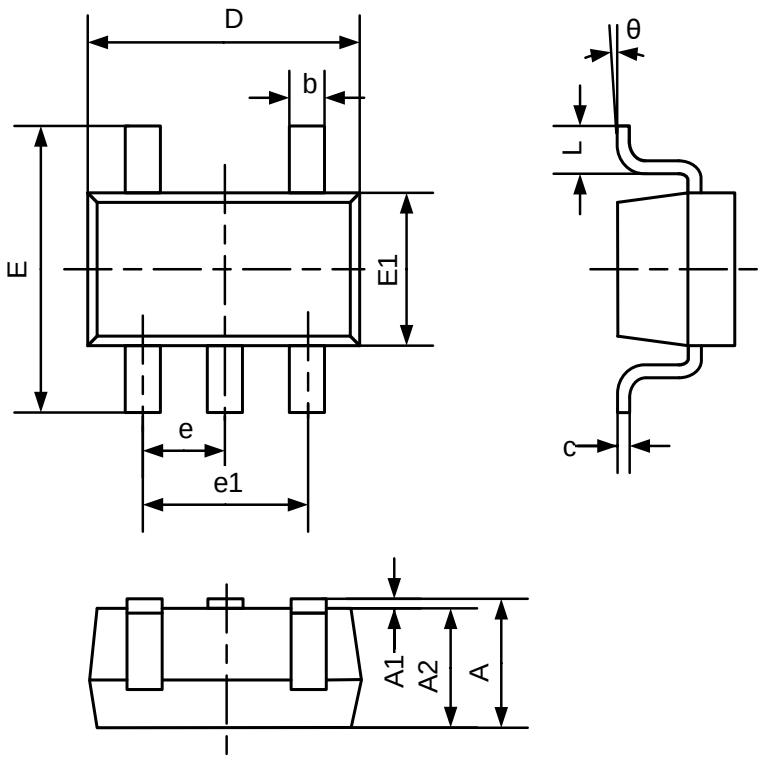
SOT23-3



Symbol	Dimensions In Millimeters	
	MIN	MAX
A	1.050	1.250
A1	0.000	0.100
A2	1.000	1.150
b	0.300	0.400
c	0.100	0.200
D	2.820	3.020
E	2.650	2.950
E1	1.500	1.700
e	0.950BSC	
e1	1.800	2.000
L	0.300	0.600
θ	0°	8°

PACKAGE DIMENSION

SOT23-5



Symbol	Dimensions In Millimeters	
	MIN	MAX
A	0.700	1.250
A1	0.000	0.100
A2	0.700	1.150
b	0.350	0.500
c	0.080	0.200
D	2.820	3.020
E	2.650	2.950
E1	1.500	1.700
e	0.950BSC	
e1	1.800	2.000
L	0.300	0.600
θ	0°	8°

V 1.2