

350mA High Speed Low Power LDO

Features

- Low Power Consumption: 50 μ A (Typ.)
- Low Voltage Drops: 0.15V@50mA
- Standby Mode: 0.1 μ A
- Low Temperature Coefficient
- Active Discharge Function
- High Ripple Rejection: 70dB@100Hz (Typ.)
- High Input Voltage (up to 8V)
- Output Voltage Accuracy: Tolerance \pm 2%
- Build-in Enable / Output Current Limit
- SOT23/23-3/23-5/DFN1 \times 1-4/DFN2 \times 2-6 Package

Applications

- Cellular Handsets
- Battery-Powered Equipment
- Wi-Fi Router
- Hand-Held Instruments
- Portable Information Application
- General power supply

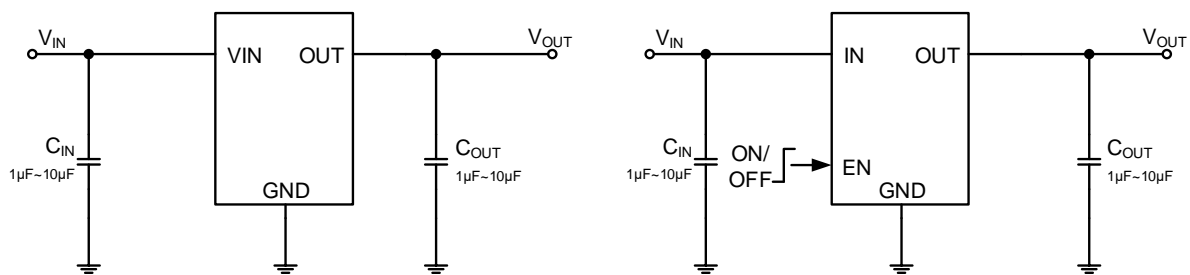
General Description

The RY6212 series are highly accurate, low noise, CMOS LDO Voltage Regulators. Offering low output noise, high ripple rejection ratio, low dropout and very fast turn-on times, the RY6212 series is ideal for today's cutting-edge mobile phone. Internally the RY6212 includes a reference voltage source, error amplifiers, driver transistors, current limiters and phase compensators.

The RY6212's current limiters' feedback circuit also operates as a short protect for the output current limiter and the output pin. The output voltage is set by current trimming. Voltages are selectable in 100mV steps within a range of 0.9V to 5.0V.

The RY6212 series is also fully compatible with low ESR ceramic capacitors, reducing cost and improving output stability. This high level of output stability is maintained even during frequent load fluctuations, due to the excellent transient response performance and high PSRR achieved across a broad range of frequencies. The EN function allows the output of regulator to be turned off, resulting in greatly reduced power consumption. The RY6212 series are available in SOT23-5, SOT23-3, SOT23, DFN1 \times 1-4, DFN2 \times 2-6 package.

Typical Application Circuit



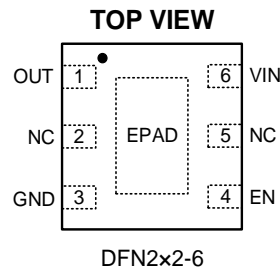
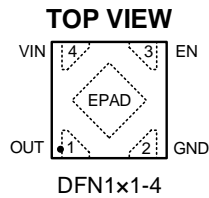
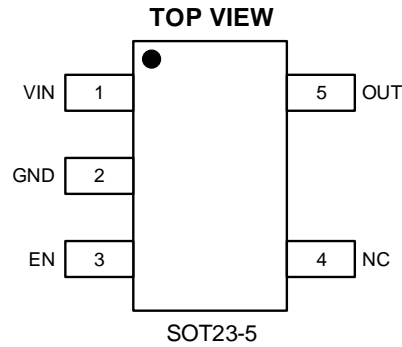
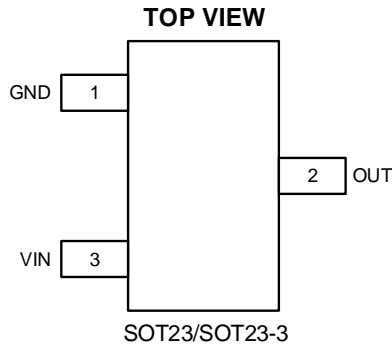
SOT23/SOT23-3 Typical Application Circuit

SOT23-5/DFN1 \times 1-4/DFN2 \times 2-6 Typical Application Circuit

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Pin Description

Pin Configuration



Pin Description

SOT23 / SOT23-3 Pin No.	SOT23-5 Pin No.	DFN1x1-4 Pin No.	DFN2x2-6 Pin No.	Pin Name	Function
3	1	4	6	VIN	Input voltage pin for the regulator.
1	2	2	3	GND	Ground pin.
-	3	3	4	EN	Enable Control (Active high), Driving EN over 0.9 V turns on the regulator. Driving EN below 0.4 V puts the regulator into shutdown mode.
-	-	-	5	NC	Not Connected.
-	4	-	2	NC	Not Connected.
2	5	1	1	OUT	Output voltage pin for the regulator.
-	-	EPAD	EPAD	EPAD	Exposed pad should be connected directly to the GND pin.

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Order Information ⁽¹⁾
RY6212-①②③④

Designator	Symbol	Description		
①②	Integer	Output Voltage		
③	M5	SOT23-5		
	M	SOT23-3		
	N	SOT23		
	D4	DFN1×1-4		
	D6	DFN2×2-6		
④	R	RoHS / Pb Free		
	G	Halogen Free		
Part No.	Model	Description	Package	T/R Qty
70607001	RY6212-12M5R	RY6212-12M5R LDO, 1.2V, SOT23-5	SOT23-5	3000PCS
70607002	RY6212-15M5R	RY6212-15M5R LDO, 1.5V, SOT23-5	SOT23-5	3000PCS
70607003	RY6212-18M5R	RY6212-18M5R LDO, 1.8V, SOT23-5	SOT23-5	3000PCS
70607004	RY6212-25M5R	RY6212-25M5R LDO, 2.5V, SOT23-5	SOT23-5	3000PCS
70607005	RY6212-28M5R	RY6212-28M5R LDO, 2.8V, SOT23-5	SOT23-5	3000PCS
70607006	RY6212-30M5R	RY6212-30M5R LDO, 3.0V, SOT23-5	SOT23-5	3000PCS
70607007	RY6212-33M5R	RY6212-33M5R LDO, 3.3V, SOT23-5	SOT23-5	3000PCS
70607008	RY6212-36M5R	RY6212-36M5R LDO, 3.6V, SOT23-5	SOT23-5	3000PCS
70607041	RY6212-12MR	RY6212-12MR LDO, 1.2V, SOT23-3	SOT23-3	3000PCS
70607042	RY6212-15MR	RY6212-15MR LDO, 1.5V, SOT23-3	SOT23-3	3000PCS
70607043	RY6212-18MR	RY6212-18MR LDO, 1.8V, SOT23-3	SOT23-3	3000PCS
70607044	RY6212-25MR	RY6212-25MR LDO, 2.5V, SOT23-3	SOT23-3	3000PCS
70607045	RY6212-28MR	RY6212-28MR LDO, 2.8V, SOT23-3	SOT23-3	3000PCS
70607046	RY6212-30MR	RY6212-30MR LDO, 3.0V, SOT23-3	SOT23-3	3000PCS
70607047	RY6212-33MR	RY6212-33MR LDO, 3.3V, SOT23-3	SOT23-3	3000PCS
70607048	RY6212-36MR	RY6212-36MR LDO, 3.6V, SOT23-3	SOT23-3	3000PCS
70607061	RY6212-12NR	RY6212-12NR LDO, 1.2V, SOT23	SOT23	3000PCS
70607062	RY6212-15NR	RY6212-15NR LDO, 1.5V, SOT23	SOT23	3000PCS
70607063	RY6212-18NR	RY6212-18NR LDO, 1.8V, SOT23	SOT23	3000PCS
70607064	RY6212-25NR	RY6212-25NR LDO, 2.5V, SOT23	SOT23	3000PCS
70607065	RY6212-28NR	RY6212-28NR LDO, 2.8V, SOT23	SOT23	3000PCS
70607066	RY6212-30NR	RY6212-30NR LDO, 3.0V, SOT23	SOT23	3000PCS
70607067	RY6212-33NR	RY6212-33NR LDO, 3.3V, SOT23	SOT23	3000PCS

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70607068	RY6212-36NR	RY6212-36NR LDO, 3.6V, SOT23	SOT23	3000PCS
70607081	RY6212-12D4R	RY6212-12D4R LDO, 1.2V, DFN1×1-4	DFN1×1-4	5000PCS
70607082	RY6212-15D4R	RY6212-15D4R LDO, 1.5V, DFN1×1-4	DFN1×1-4	5000PCS
70607083	RY6212-18D4R	RY6212-18D4R LDO, 1.8V, DFN1×1-4	DFN1×1-4	5000PCS
70607084	RY6212-25D4R	RY6212-25D4R LDO, 2.5V, DFN1×1-4	DFN1×1-4	5000PCS
70607085	RY6212-28D4R	RY6212-28D4R LDO, 2.8V, DFN1×1-4	DFN1×1-4	5000PCS
70607086	RY6212-2CD4R	RY6212-2CD4R LDO, 2.85V, DFN1×1-4	DFN1×1-4	5000PCS
70607087	RY6212-30D4R	RY6212-30D4R LDO, 3.0V, DFN1×1-4	DFN1×1-4	5000PCS
70607088	RY6212-33D4R	RY6212-33D4R LDO, 3.3V, DFN1×1-4	DFN1×1-4	5000PCS
70607089	RY6212-36D4R	RY6212-36D4R LDO, 3.6V, DFN1×1-4	DFN1×1-4	5000PCS
70607101	RY6212-12D6R	RY6212-12D6R LDO, 1.2V, DFN2×2-6	DFN2×2-6	5000PCS
70607102	RY6212-15D6R	RY6212-15D6R LDO, 1.5V, DFN2×2-6	DFN2×2-6	5000PCS
70607103	RY6212-18D6R	RY6212-18D6R LDO, 1.8V, DFN2×2-6	DFN2×2-6	5000PCS
70607104	RY6212-25D6R	RY6212-25D6R LDO, 2.5V, DFN2×2-6	DFN2×2-6	5000PCS
70607105	RY6212-28D6R	RY6212-28D6R LDO, 2.8V, DFN2×2-6	DFN2×2-6	5000PCS
70607106	RY6212-2CD6R	RY6212-2CD6R LDO, 2.85V, DFN2×2-6	DFN2×2-6	5000PCS
70607107	RY6212-30D6R	RY6212-30D6R LDO, 3.0V, DFN2×2-6	DFN2×2-6	5000PCS
70607108	RY6212-33D6R	RY6212-33D6R LDO, 3.3V, DFN2×2-6	DFN2×2-6	5000PCS
70607109	RY6212-36D6R	RY6212-36D6R LDO, 3.6V, DFN2×2-6	DFN2×2-6	5000PCS

Note (1): All RYCHIP parts are Pb-Free and adhere to the RoHS directive.

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Mark Rule SOT23-5/SOT23-3/SOT23

Voltage (V)	SOT23-5/SOT23-3/SOT23
1.2	LVBL
1.5	LVEL
1.8	LVKL
2.5	LVTL
2.8	LVXL
3.0	LVZL
3.3	LV2L
3.6	LA2L

Represents product series

Mark	Product Series
L	RY6212

Represents type of regulator

Mark		Product Series
V _{OUT} : 0.1V-3.3V	V _{OUT} : 3.4V-6.0V	RY6212
V	A	

Represents output Voltage

Mark	Output Voltage(V)				Mark	Output Voltage(V)			
0	-	3.1	-	3.15	F	1.6	4.6	1.65	4.65
1	-	3.2	-	3.25	H	1.7	4.7	1.75	4.75
2	-	3.3	-	3.35	K	1.8	4.8	1.85	4.85
3	-	3.4	-	3.45	L	1.9	4.9	1.95	4.95
4	-	3.5	-	3.55	M	2.0	5.0	2.05	-
5	-	3.6	-	3.65	N	2.1	-	2.15	-
6	-	3.7	-	3.75	P	2.2	-	2.25	-
7	-	3.8	-	3.85	R	2.3	-	2.35	--
8	0.9	3.9	0.95	3.95	S	2.4	-	2.45	-
9	1.0	4.0	1.05	4.05	T	2.5	-	2.55	-
A	1.1	4.1	1.15	4.15	U	2.6	-	2.65	-
B	1.2	4.2	1.25	4.25	V	2.7	-	2.75	-
C	1.3	4.3	1.35	4.35	X	2.8	-	2.85	-
D	1.4	4.4	1.45	4.45	Y	2.9	-	2.95	-
E	1.5	4.5	1.55	4.55	Z	3.0	-	3.05	-

Represents production lot number

L: The week of manufacturing. "A" stands for week 1, "Z" stands for week 26, "a" stands for week 27, "z" stands for week 52.

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Mark Rule DFN1 × 1-4/ DFN2 × 2-6

Voltage (V)	DFN1 × 1-4/ DFN2 × 2-6
1.2	LL12
1.5	LL15
1.8	LL18
2.5	LL25
2.8	LL28
2.85	LL2C
3.0	LL30
3.3	LL33
3.6	LL36

Represents product series

Mark	Product Series
L	RY6212

Represents production lot number

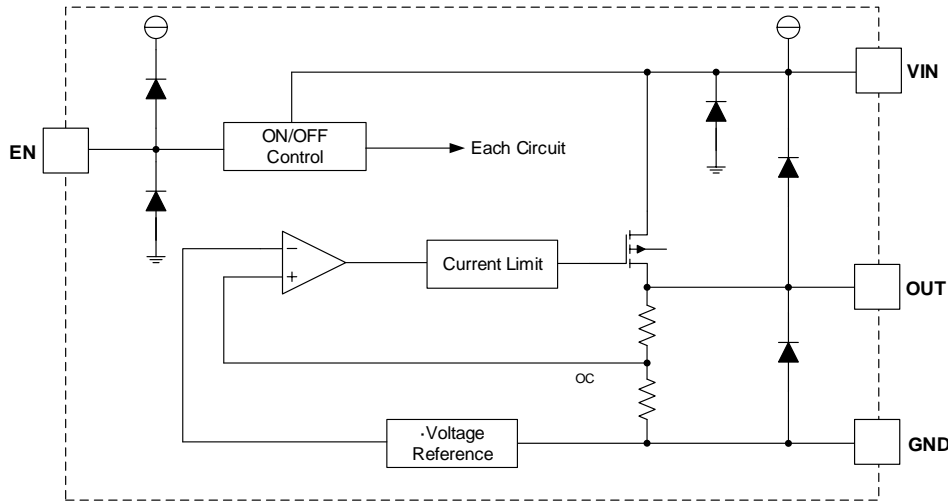
Mark	Lot Number
<u>L</u>	The week of manufacturing. “A” stands for week 1, “Z” stands for week 26, “a” stands for week 27, “z” stands for week 52.

Represents output Voltage

Mark	Output Voltage(V)
<u>VV</u>	Output voltage code. Example: 12=1.2V 28=2.8V 2C=2.85V

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Functional Block Diagram



Functional Block Diagram

Specifications

Absolute Maximum Ratings ⁽¹⁾ ⁽²⁾

Item	Min	Max	Unit
V _{IN} voltage	2.0	8.0	V
V _{OUT} voltage	1.2	3.3	V
Output Current ⁽³⁾	350		mA
Power dissipation ⁽⁴⁾	Internally Limited		
Operating Ambient Temperature	-40	85	°C
Maximum junction temperature		150	°C
Storage temperature, T _{stg}	-50	85	°C
Lead Temperature (Soldering, 10sec.)		260	°C

Note (1): Exceeding these ratings may damage the device.

Note (2): The device is not guaranteed to function outside of its operating conditions.

Note (3): $I_{OUT} = P_D / (V_{IN} - V_{OUT})$

Note (4): The maximum allowable power dissipation is a function of the maximum junction temperature, T_{J(MAX)}, the junction-to-ambient thermal resistance, R_{θJA}, and the ambient temperature, T_A. The maximum allowable power dissipation at any ambient temperature is calculated using: $P_{D(MAX)} = (T_{J(MAX)} - T_A) / R_{θJA}$. Exceeding the maximum allowable power dissipation causes excessive die temperature, and the regulator goes into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage. Thermal shutdown engages at T_J=155°C (typical) and disengages at T_J= 140°C (typical).

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Recommended Operating Conditions

Item	Min	Max	Unit
Operating junction temperature ⁽¹⁾	-40	125	°C
Operating temperature range	-40	85	°C
Input voltage V _{IN}	2	6.5	V
Output current	0	300	mA

Note (1): All limits specified at room temperature (T_A = 25°C) unless otherwise specified. All room temperature limits are 100% production tested. All limits at temperature extremes are ensured through correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).

Thermal Information

Item	Description	SOT23	SOT23	DFN1×1	DFN2×2	Unit
		3 Pin	5 Pin	4 Pin	6 Pin	
R _{θJA}	Junction-to-ambient thermal resistance ⁽¹⁾⁽²⁾	280	230	220	96	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	125	152	165	90	°C/W
R _{θJB}	Junction-to-board thermal resistance	65	56	165	66	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	8	31	5.5	3.2	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	61	55	164	66	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	N/A	N/A	131	41	°C/W

Note (1): The package thermal impedance is calculated in accordance to JESD 51-7.

Note (2): Thermal Resistances were simulated on a 4-layer, JEDEC board

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Electrical Characteristics

T_A = 25°C, unless otherwise noted.

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Units	
Input Voltage	V _{IN}		2		6.5	V	
Output Voltage	V _{OUT}	V _{IN} =V _{OUT} +1V 1.0mA≤I _{OUT} ≤30mA	V _{OUT} ×0.98		V _{OUT} ×1.02	V	
Output Current	I _{OUT}	V _{IN} ≥V _{OUT(S)} +1.0V		350		mA	
Dropout Voltage	V _{drop}	I _{OUT} =50 mA	-	0.10	0.15	V	
		I _{OUT} =100 mA	-	0.20	0.30		
Line Regulations	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V _{OUT(S)} +0.5 V≤V _{IN} ≤7V I _{OUT} =30mA	-	0.20	0.30	%/V	
Load Regulation	ΔV _{OUT}	V _{IN} =V _{OUT(S)} +1.0 V 1.0mA≤I _{OUT} ≤100mA	-	50	100	mV	
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{T_A \times V_{OUT}}$	V _{IN} =V _{OUT(S)} +1.0V, I _{OUT} =10mA -40°C≤T _A ≤85°C	-	±100	-	ppm/ °C	
Supply Current	I _{SS1}	V _{IN} =V _{OUT(S)} +1.0 V	-	50	70	μA	
Shutdown Current	I _{shut}	V _{IN} =5V, V _{EN} =0			0.1	μA	
Power Supply Rejection Ratio	PSRR	V _{OUT} =1.2V, V _{IN} =2V	f = 100Hz	-	70	-	dB
			f = 1kHz		65	-	dB
Output Voltage Noise (BW=10Hz to 100kHz, C _{OUT} =10μF)		V _{IN} = 3.5V I _{LOAD} =0.1A	V _{OUT} =0.9V		30		μV _{RMS}
			V _{OUT} =2.8V		40		
Short-circuit Current	I _{short}	V _{IN} =V _{OUT(S)} +1.0V, ON/OFF Terminal is ON, V _{OUT} =0V	-	100	-	mA	
EN “High Voltage	V _{ENH}		0.9			V	
EN “Low” Voltage	V _{ENL}				0.4	V	
EN “High Current	I _{ENH}	V _{IN} =V _{EN} =V _{OUT(T)} +1V	-0.1		0.1	μA	
EN “Low” Current	I _{ENL}	V _{IN} =V _{OUT(T)} +1V, V _{EN} =V _{SS}	-0.1		0.1	μA	
Thermal Shutdown Temperature	T _{SD}	I _{LOAD} =10mA		155		°C	
Thermal Shutdown Hysteresis	ΔT _{SD}				15		°C

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Applications Information

Low ESR Capacitors

With the RY6212 series, a stable output voltage is achievable even if used with low ESR capacitors as a phase compensation circuit is built-in. In order to ensure the effectiveness of the phase compensation, we suggest that an output capacitor (C_{OUT}) is connected as close as possible to the output pin (V_{OUT}) and the GND pin. Please use an output capacitor with a capacitance value of 10uF. Also, please connect an input capacitor (C_{IN}) of 10uF between the V_{IN} pin and the GND pin in order to ensure a stable power input. Stable phase compensation may not be ensured if the capacitor runs out capacitance when depending on bias and temperature. In case the capacitor depends on the bias and temperature, please make sure the capacitor can ensure the actual capacitance.

Current Limiter, Short-Circuit Protection

The RY6212 series includes a combination of a fixed current limiter circuit & a feedback circuit, which aid the operations of the current limiter and circuit protection. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. As a result of this drop-in output voltage, the feedback circuit operates, output voltage drops further and output current decreases. When the output pin is shorted, a current of about 50mA flows.

EN pin

The IC's internal circuitry can be shutdown via the signal from the EN pin with the RY6212 series. Driving EN over 0.9 V turns on the regulator. Driving EN below 0.4 V puts the regulator into shutdown mode. The operational logic of the IC's EN pin is selectable. Note that as the standard RY6212 type's regulator is 'High Active/No Pull-Down', operations will become unstable with the EN pin open. Although the EN pin is equal to an inverter input with CMOS hysteresis, with either the pull-up or pull-down options, the EN pin input current will increase when the IC is in operation. We suggest that you use this IC with either a V_{IN} voltage or a GND voltage input at the EN pin. If this IC is used with the correct specifications for the EN pin, the operational logic is fixed and the IC will operate normally. However, supply current may increase as a result of through current in the IC's internal circuitry.

Notes on Use

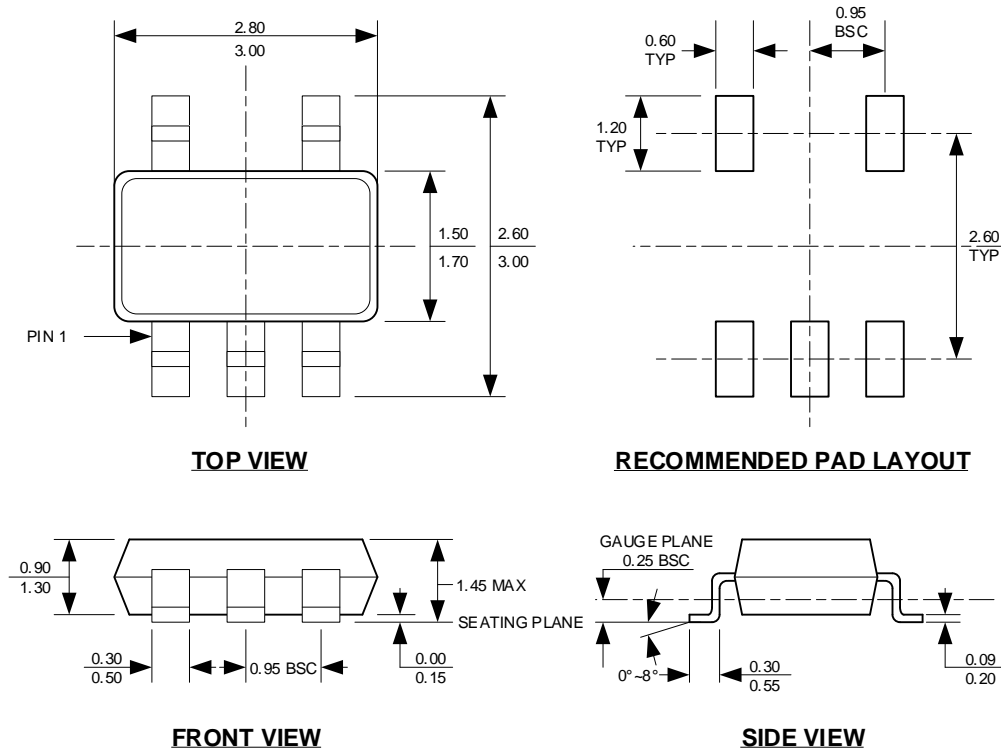
1. Please use this IC within the stated absolute maximum ratings. The IC is liable to malfunction should the ratings be exceeded.
2. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please keep the resistance low between V_{IN} and GND wiring in particular.
3. Please wire the input capacitor (C_{IN}) and the output capacitor (C_{OUT}) as close to the IC as possible.

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Packaging Information

5-Pin SOT23 Packaging Information

SOT23-5



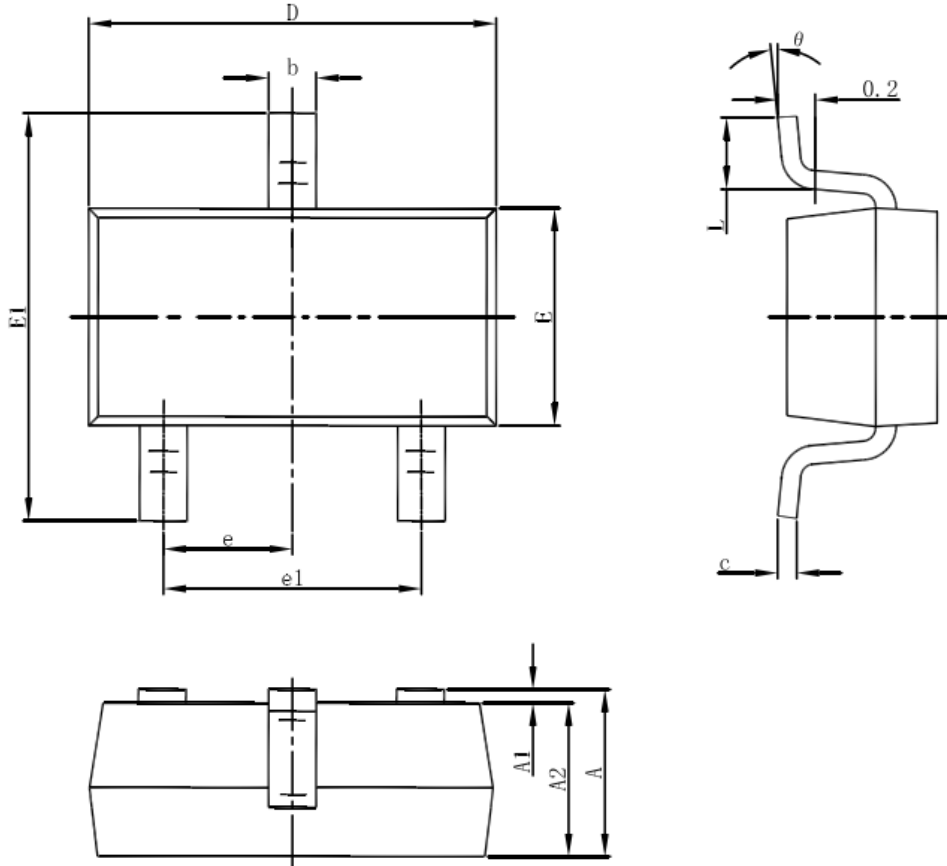
NOTE:

1. CONTROL DIMENSION IS IN INCHES. DIMENSION IN BRACKET IS IN MILLIMETERS.
2. PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
3. PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
4. LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.004" INCHES MAX.
5. DRAWING CONFORMS TO JEDEC MS-012, VARIATION BA.
6. DRAWING IS NOT TO SCALE.

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3-Pin SOT23 Outline Dimensions

SOT23-3

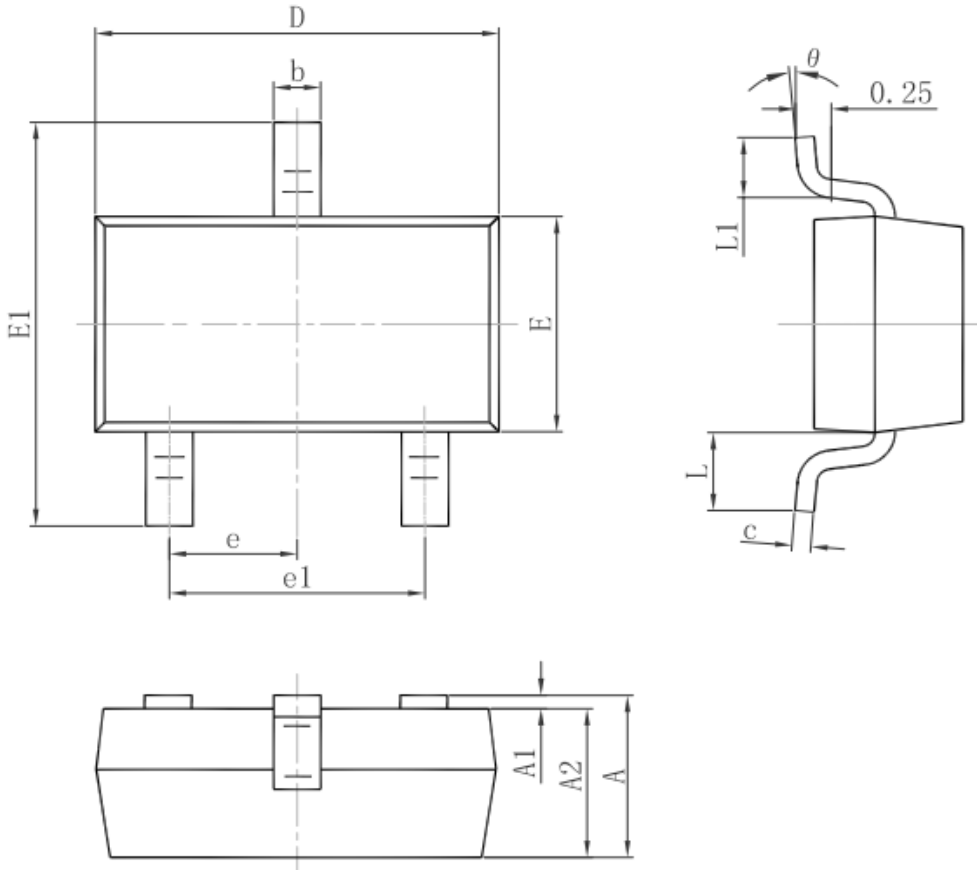


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

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3-Pin SOT23 Outline Dimensions

SOT23

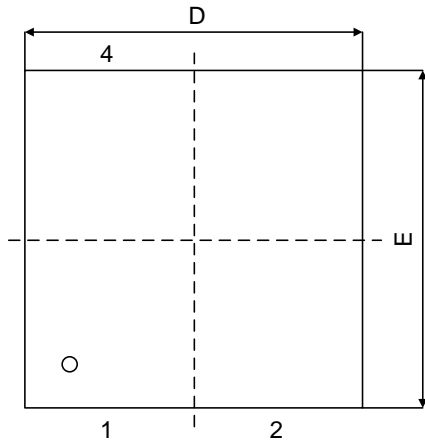


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP.	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

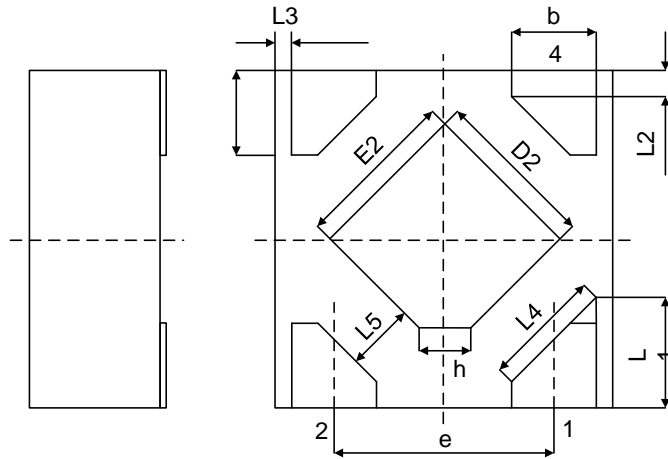
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4-Pin DFN1x1 Packaging Information

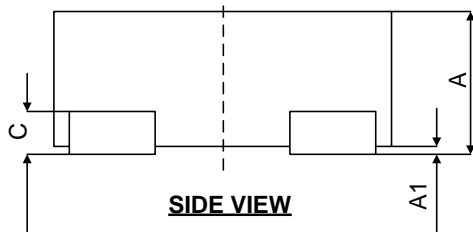
DFN1x1-4



TOP VIEW



BOTTOM VIEW



SIDE VIEW

DIM	Min (mm)	Nom (mm)	Max (mm)
Symbol A	0.35	-	0.40
A1	0	0.02	0.05
b	0.20	0.25	0.30
c	0.02	0.07	0.17
D	0.95	1.00	1.05
D2	0.38	0.48	0.58
e	0.65BSC		
E	0.95	1.00	1.05
E2	0.38	0.48	0.58
L	0.20	0.25	0.30
L2	0.077REF		
L3	0.05REF		
L4	0.34REF		
L5	0.20REF		
h	0.12REF		

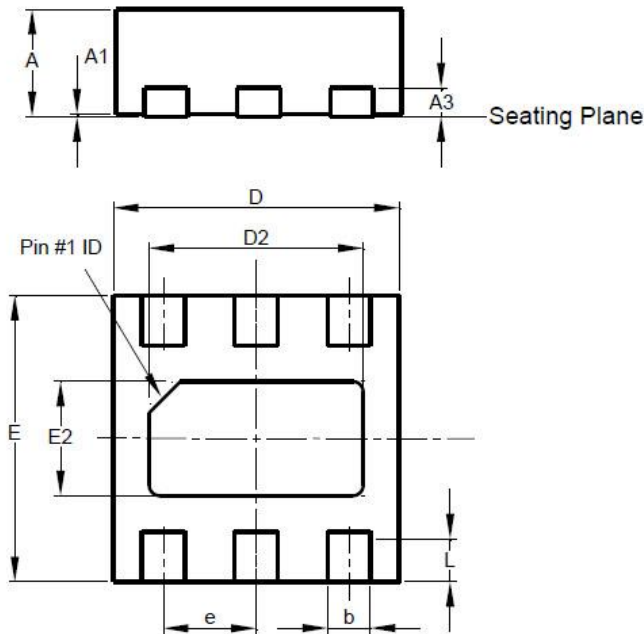
NOTE:

- CONTROL DIMENSION IS IN INCHES. DIMENSION IN BRACKET IS IN MILLIMETERS.
- PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
- PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
- LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.004" INCHES MAX.
- DRAWING CONFORMS TO JEDEC MS-012, VARIATION BA.
- DRAWING IS NOT TO SCALE.

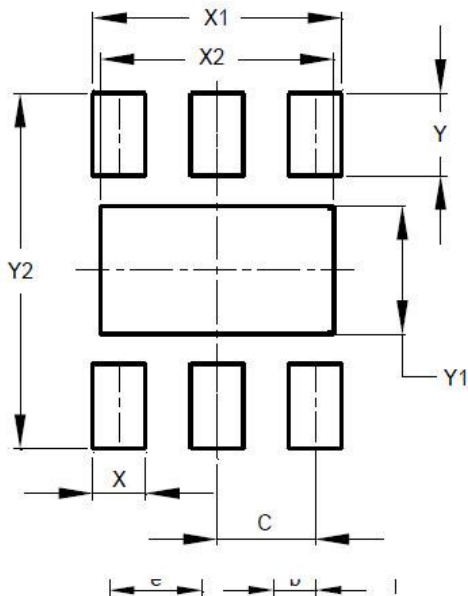
350mA High Speed Low Power LDO

6-Pin DFN2x2 Packaging Information

DFN2x2-6



Dim	Min	Max	Typ
A	0.70	0.80	0.75
A1	0.00	0.05	--
A3	0.20 REF		
b	0.25	0.35	0.30
D	1.95	2.075	2.00
D2	1.35	1.60	1.50
E	1.95	2.075	2.00
E2	0.65	0.90	0.80
e	0.65 BSC		
L	0.25	0.45	0.35
All Dimensions in mm			



Dimensions	Value (in mm)
C	0.650
X	0.350
X1	1.650
X2	1.550
Y	0.545
Y1	0.850
Y2	2.350