1A, Low Noise, Ultra High PSRR, Low-Dropout Linear Regulator

1 FEATURES

- **Input Voltage Range: 2.2V to 6V**
- **Output Voltage Range:**
  - **Fixed Option: 0.8V, 1.0V, 1.2V, 1.8V, 2.5V, 3V, 3.3V and 5.0V**
  - **Adjustable Option: 0.8V to 5.5V**
- **Up to 1A Load Current**
- **Ultra High PSRR: 66dB at 1kHz**
- **Excellent Noise Immunity**
- **Very Low Dropout: 175mV Typical at 1A**
- **−40°C to 125°C Operating Junction Temperature Range**
- **Fast Response Over Load and Line Transient**
- **Stable with a 4.7μF Output Ceramic Capacitor**
- **Accurate Output Voltage ±3%**
- **Enable Control**
- **Over-Current Protection**
- **Over-Temperature Protection**

2 APPLICATIONS

- **Telecom/Networking Cards**
- **Motherboards/Peripheral Cards**
- **Industrial Applications**
- **Wireless Infrastructures**
- **Set-Top Boxes**
- **Medical Equipments**
- **Notebook Computers**
- **Battery Powered Systems**

3 DESCRIPTIONS

The RS3242 is a high performance positive low dropout (LDO) regulator designed for applications requiring very low dropout voltage and ultra-high Power Supply Ripple Rejection (PSRR) at up to 1A. The input voltage range is from 2.2V to 6V and the output voltage is programmable as low as 0.8V. A P-MOSFET switch provides excellent transient response with just a 4.7μF ceramic output capacitor. The external enable control effectively reduces power dissipation while shutdown and further output noise immunity is achieved through bypass capacitor on NR pin.

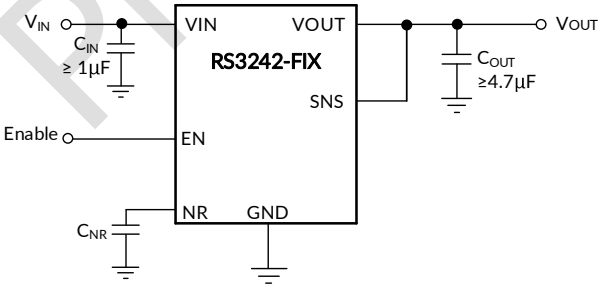
The device is available in the DFN3X3-8 package and is specified from −40°C to 125°C.

Device Information (1)

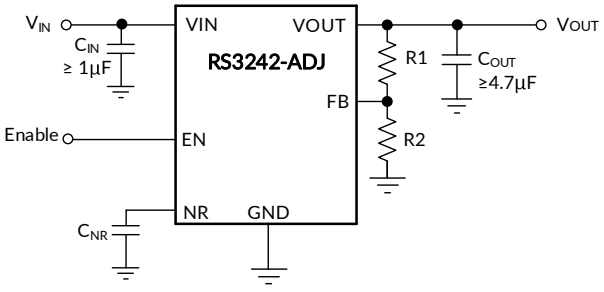
PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS3242	DFN3X3-8	3.00mm×3.00mm

(1) For all available packages, see the orderable addendum at the next page of the data sheet.

4 TYPICAL APPLICATION

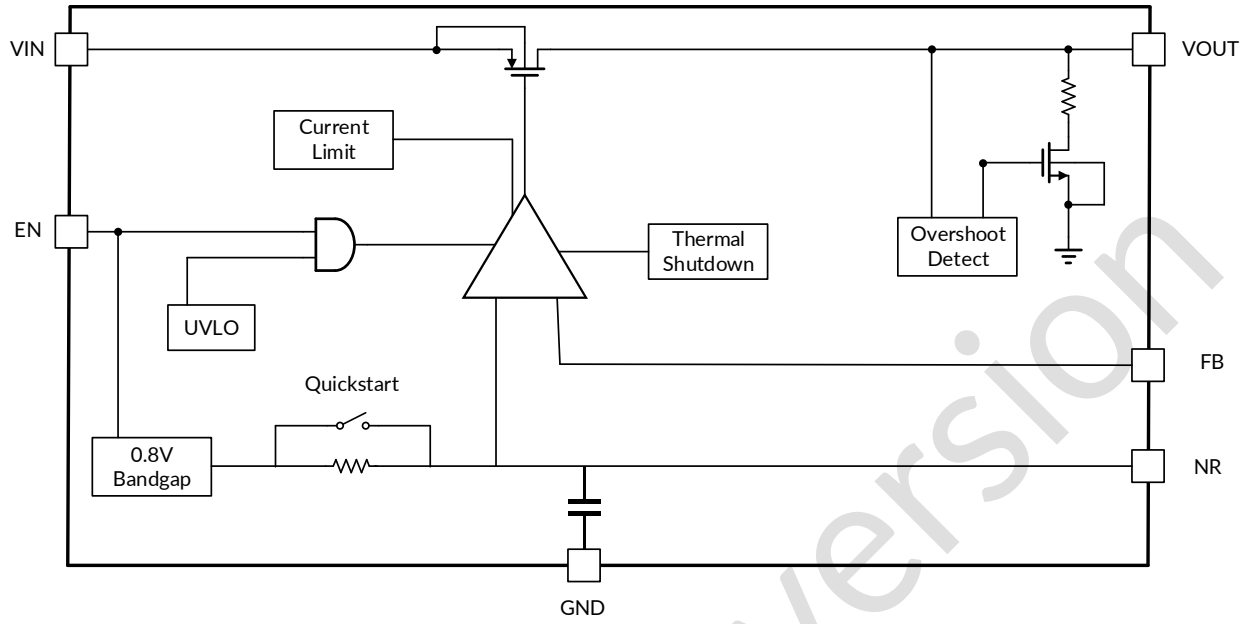


Fixed Voltage Typical Application Circuit



Adjustable Voltage Typical Application Circuit

5 FUNCTIONAL BLOCK DIAGRAM



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6 REVISION HISTORY

Note: Page numbers for previous revisions may different from page numbers in the current version.

VERSION	Change Date	Change Item
A.0	2024/12/17	Preliminary version completed
A.0.1	2025/07/18	1. Update PACKAGE/ORDERING INFORMATION 2. Modify PIN CONFIGURATION AND FUNCTIONS 3. Update KEY PARAMETER LIST OF TAPE AND REEL

7 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	V_{OUT}(V)	V_{OUT} Accuracy	PACKAGE LEAD	PACKAGE MARKING (2)	MSL (3)	PACKAGE OPTION
RS3242	RS3242-0.8XDC8	0.8	±3%	DFN3X3-8	RS3242A	MSL3	Tape and Reel, 5000
	RS3242-1.0XDC8	1.0	±3%	DFN3X3-8	RS3242B	MSL3	Tape and Reel, 5000
	RS3242-1.2XDC8	1.2	±3%	DFN3X3-8	RS3242C	MSL3	Tape and Reel, 5000
	RS3242-1.8XDC8	1.8	±3%	DFN3X3-8	RS3242D	MSL3	Tape and Reel, 5000
	RS3242-2.5XDC8	2.5	±3%	DFN3X3-8	RS3242E	MSL3	Tape and Reel, 5000
	RS3242-3.0XDC8	3.0	±3%	DFN3X3-8	RS3242F	MSL3	Tape and Reel, 5000
	RS3242-3.3XDC8	3.3	±3%	DFN3X3-8	RS3242G	MSL3	Tape and Reel, 5000
	RS3242-5.0XDC8	5.0	±3%	DFN3X3-8	RS3242H	MSL3	Tape and Reel, 5000
	RS3242-ADJ8XDC8	ADJ	±3%	DFN3X3-8	RS3242K	MSL3	Tape and Reel, 5000

NOTE:

(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.

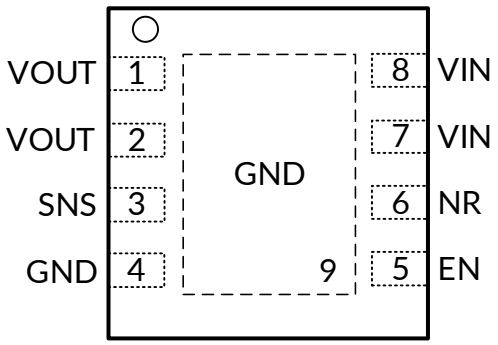
(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

8 PIN CONFIGURATION AND FUNCTIONS

RS3242-Fixed Output

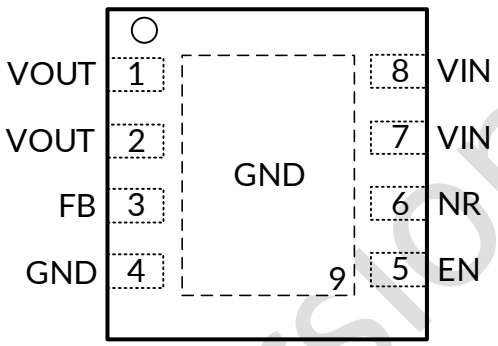
TOP VIEW



DFN3X3-8

RS3242-ADJ

TOP VIEW



DFN3X3-8

PIN DESCRIPTION

PIN	NAME	FUNCTION
1, 2	VOUT	Output of the regulator. Decouple this pin to GND with at least 4.7μF for stability.
3	FB	Feedback voltage input. This pin is used to set the desired output voltage via an external resistive divider. The feedback reference voltage is 0.8V typically.
	SNS	Output Voltage Sense Input Pin (fixed voltage version only). Connect this pin to the load side of the output trace only in the fixed voltage version
4, 9 (Exposed Pad)	GND	System ground. The exposed pad must be soldered to a large PCB and connected to GND for maximum power dissipation.
5	EN	Enable control input. Connecting this pin to logic high enables the regulator or driving this pin low puts it into shutdown mode. EN can be connected to IN if not used. (EN pin is not allowed to be left floating.)
6	NR	Noise reduction input. Decouple this pin to GND with an external capacitor can not only reduce output noise to very low levels but also slow down the VOUT rise like a soft-start behavior.
7, 8	VIN	Supply input. A minimum of 1μF ceramic capacitor should be placed as close as possible to this pin for better noise rejection.

9 SPECIFICATIONS

9.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1)

			MIN	MAX	UNIT
V_{IN}	Input Voltage		-0.3	7	V
V_{EN}	Enable Input Voltage		-0.3	7	V
I_{OUT}	Current		Internally limited		A
θ_{JA}	Package Thermal Impedance (2)	DFN3X3-8		35	°C/W
T_J	Junction Temperature (3)		-40	150	°C
T_{stg}	Storage Temperature		-65	150	°C

(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 may affect device reliability.

(2) θ_{JA} is measured under natural convection (still air) at T_A = 25°C with the component mounted on a high effective-thermal-conductivity four-layer test board on a JEDEC 51-7 thermal measurement standard. θ_{JC} is measured at the exposed pad of the package.

(3) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

9.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM), ANSI/ESDA/JEDEC JS001-2024	±2000	V
		Charge Device Model (CDM), ANSI/ESDA/JEDEC JS-002-2022	±1000	V

ESD SENSITIVITY CAUTION

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.

9.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{IN}	Input Voltage Range on V_{IN}	2.2	6	V
V_{OUT}	Output Voltage	0.8	5.5	V
I_{OUT}	Output Current Range on I_{OUT}	0	1000	mA
C_{OUT}	Output Capacitor	4.7	100	µF
T_J	Junction Temperature	-40	125	°C

9.4 Electrical Characteristics

Over operating temperature range (−40°C ≤ T_J ≤ 125°C), V_{IN}=V_{OUT}(nom)+0.5V or 2.2V, V_{OUT} = 0.8V and 5.5V, I_{OUT} = 1mA, V_{EN} = 2.2V, C_{NR} = 10nF, C_{OUT} = 4.7µF, (unless otherwise noted); typical values are at T_J=25°C.

PARAMETER	SYMBOL	CONDITIONS		MIN(2)	TYP(3)	MAX(2)	UNIT
POWER SUPPLY AND CURRENTS							
Input Voltage (1)	V_{IN}			2.2		6	V
Under Voltage Lockout	UVLO	V_{IN} rising			2.1		V
Hysteresis	V_{HYS}	V_{IN} falling			200		mV
Quiescent Current	I_Q	V_{EN} = 1.2V, I_{OUT} = 0mA			125		µA
Ground Pin Current	I_{GND}	V_{EN} = 1.2V, I_{OUT} = 1A, V_{OUT}=3.3V			485		µA
Shutdown Current	I_{SD}	V_{EN} = 0V, V_{IN}=6V			0.01		µA
OUTPUT VOLTAGE							
Output Voltage Range	V_{OUT}			0.8		5.5	V
Feedback Voltage	V_{FB}	Adjustable Only			0.8		V
Feedback Pin Current	I_{FB}	V_{IN} = 6V, V_{FB} = 0.8V			0.001		µA
DC Output Accuracy (1)	ΔV_{OUT}	V_{IN}= V_{OUT}(nom)+0.5V to 6V, I_{OUT} =1mA to 1A			±3		%
Output Voltage Temperature Coefficient (4)	$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$	T_J = -40°C ~+85°C, I_{OUT} = 1mA			80		ppm/°C
		T_J = -40°C ~+125°C, I_{OUT} = 1mA			70		
Line Regulation (1)	$\Delta V_{OUT(\Delta VIN)}$	V_{IN} = V_{OUT} + 0.5V to 6V, I_{OUT} = 1mA			0.2		%/V
Load Regulation (1)	$\Delta V_{OUT(\Delta IOUT)}$	V_{IN} =V_{OUT} +0.5V, I_{OUT} = 1mA to 1A			20		mV
Maximum Output Current (5)	I_{OUTMAX}			1			A
DROPOUT VOLTAGE							
Dropout Voltage (6)	V_{DO}	I_{OUT} = 1A	Adjustable Only, V_{IN}=2.2V, FB=GND		320		mV
			V_{OUT} = 3.3V		230		
			V_{OUT} = 5.0V		175		
POWER SUPPLY REJECTION RATIO AND NOISE							
Power Supply Rejection Ratio (7)	PSRR	V_{IN} = 4.3V, V_{OUT} = 3.3V, C_{NR} = 10nF, I_{OUT} = 750mA	f = 100Hz		65		dB
			f = 1KHz		66		dB
			f = 10KHz		49		dB
			f = 100KHz		40		dB
			f = 1MHz		33		dB
Output Noise Voltage (7)	V_N	BW= 10Hz to 100kHz, V_{IN} = 4.3V, V_{OUT} = 3.3V, I_{OUT} = 100mA	C_{NR} = 1nF		78		μV_{RMS}
			C_{NR} = 10nF		47		μV_{RMS}
			C_{NR} = 100nF		37		μV_{RMS}
ENABLE AND STARTUP TIME							
Enable High (Enabled)	V_{IH}	V_{IN} = 2.2V to 6V, EN rising		1.2			V
Enable Low (Shutdown)	V_{IL}	V_{IN} = 2.2V to 6V, EN falling				0.4	V
Enable Pin Current, Enabled	I_{EN}	V_{EN} = V_{IN} = 6V			0.03		µA
Output discharge FET Rdson	R_{DIS}	V_{IN}=5V, V_{EN}<V_{IL} (output disable)			300		Ω
Startup Time	t_{STR}	V_{OUT} = 3.3V, I_{OUT}=10mA, C_{OUT} = 4.7µF	C_{NR} = none		55		µs
			C_{NR} = 1nF		95		µs
			C_{NR} = 10nF		910		µs

PROTECTIONS						
Over Current Limit	I_{LMT}	V_{OUT} = 0.85 x V_{OUT}		1300		mA
Thermal Shutdown Threshold (7)	T_{SD}	Shutdown, temperature increasing		155		°C
		Reset, temperature decreasing		135		°C

(1) Minimum V_{IN} = V_{OUT} + V_{DO} or 2.2V, whichever is greater.
(2) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.
(4) Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.
(5) Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature and the other environment factors of system. Attention should be paid to the dropout voltage when V_{IN} < V_{OUT} + V_{DROP}.
(6) V_{DROP} FT test method: test the V_{OUT} voltage at V_{SET} +$V_{DROPMAX}$ with output current.
(7) Guaranteed by design and characterization, not a FT item.

9.5 Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

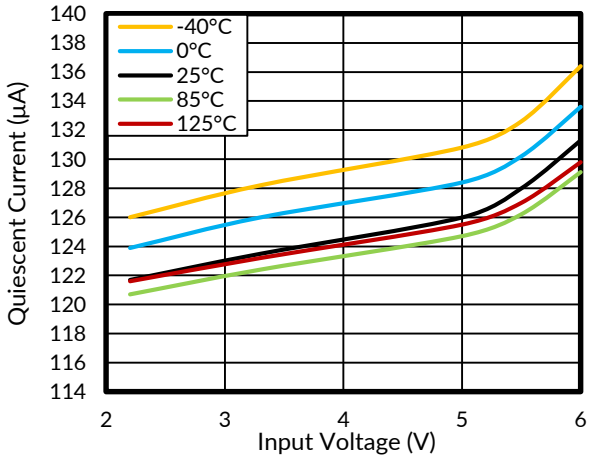


Figure 1. Quiescent Current vs Input Voltage

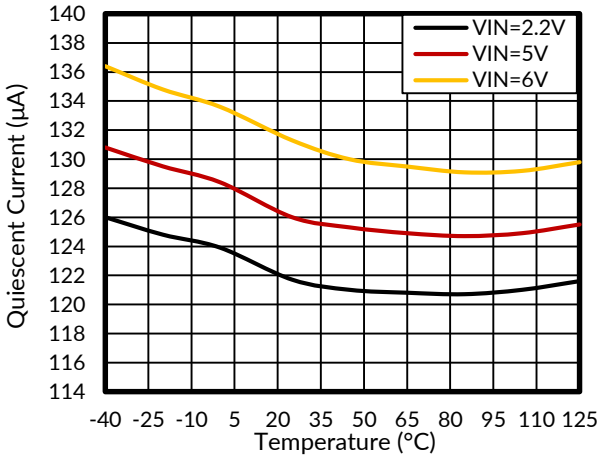


Figure 2. Quiescent Current vs Temperature

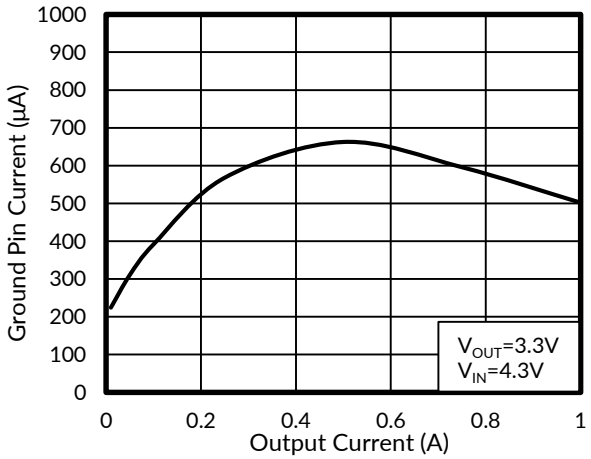


Figure 3. Ground Pin Current vs Output Current

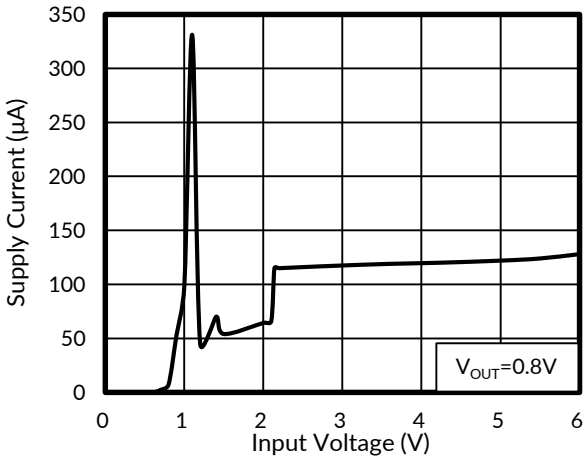


Figure 4. Supply Current vs Input Voltage

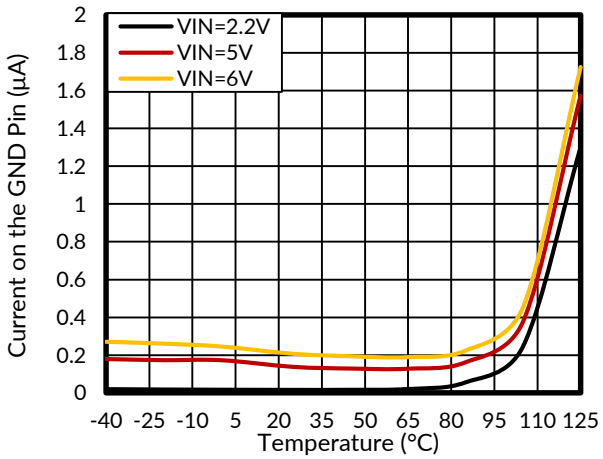


Figure 5. Shutdown Current vs Temperature

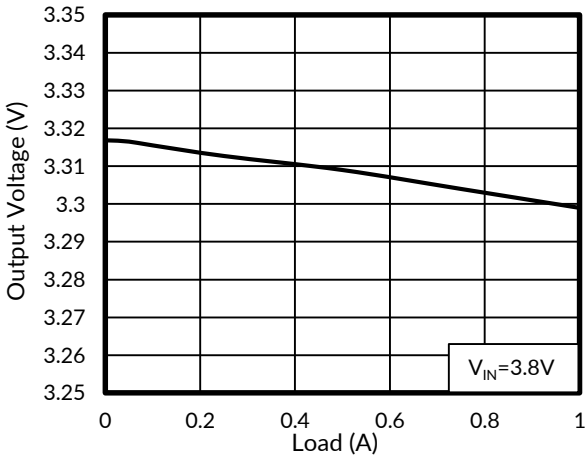


Figure 6. Load Regulation

Typical Characteristics

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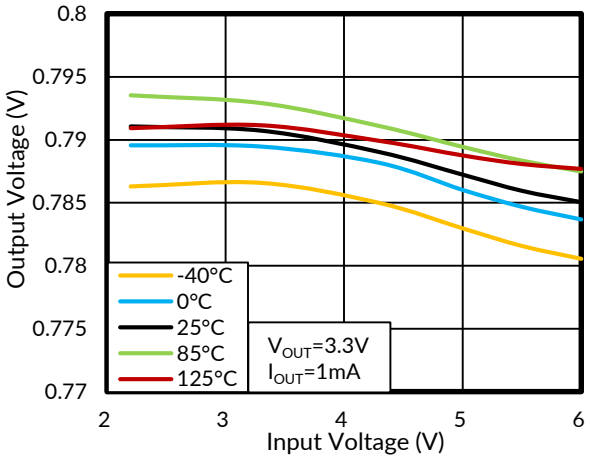

Figure 7. Line Regulation

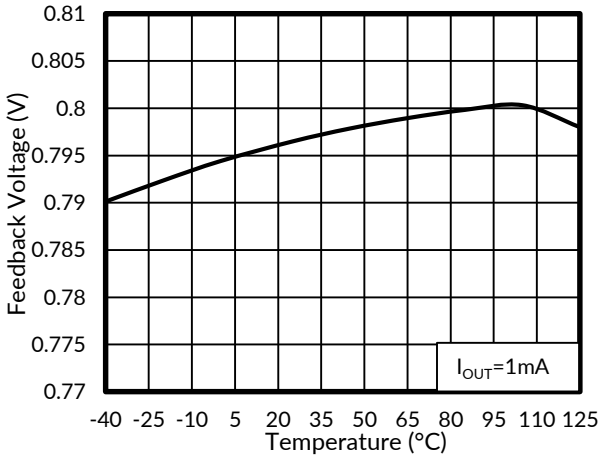

Figure 8. Feedback Voltage vs Junction Temperature

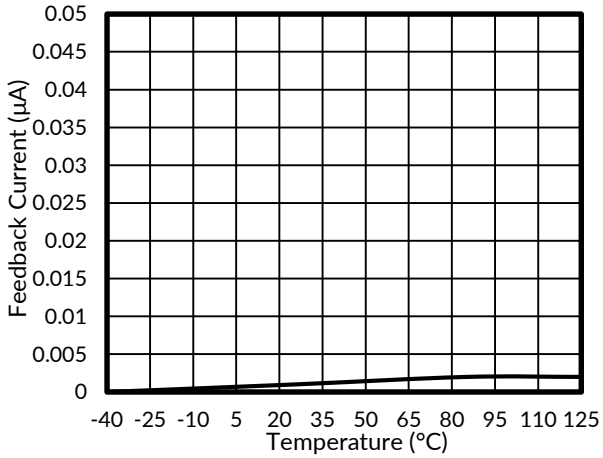

Figure 9. Feedback Pin Current vs Junction Temperature

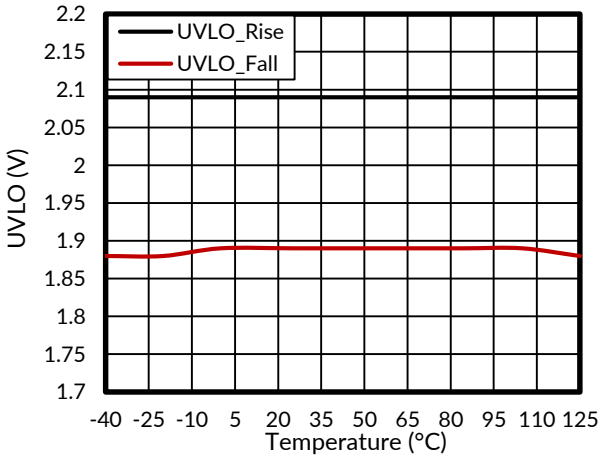

Figure 10. UVLO vs Junction Temperature

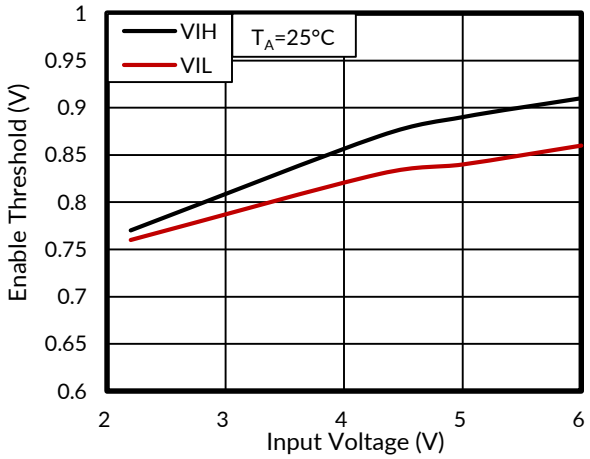

Figure 11. Enable Threshold vs Input Voltage

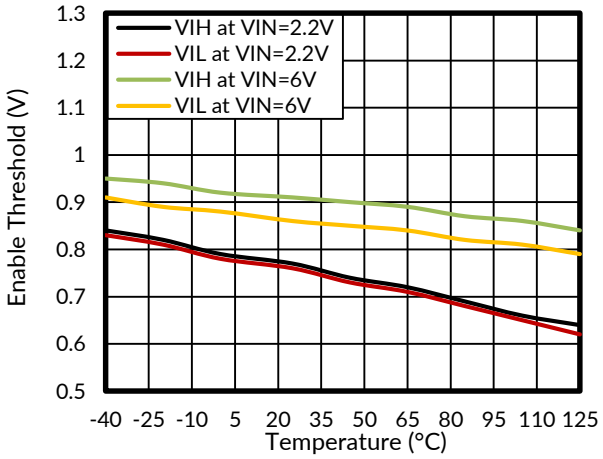

Figure 12. Enable Threshold vs Junction Temperature

Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

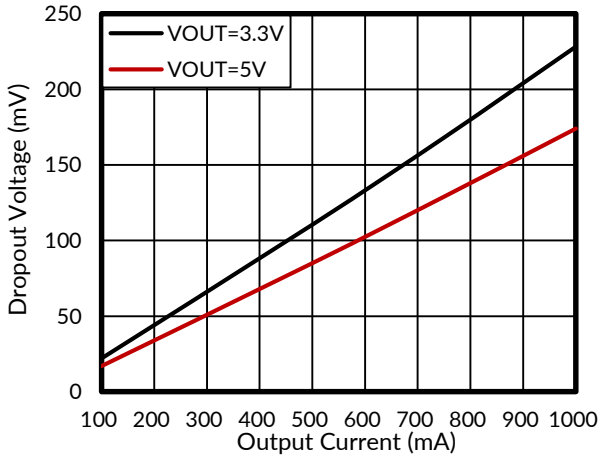

Figure 13. Dropout Voltage vs Output Current

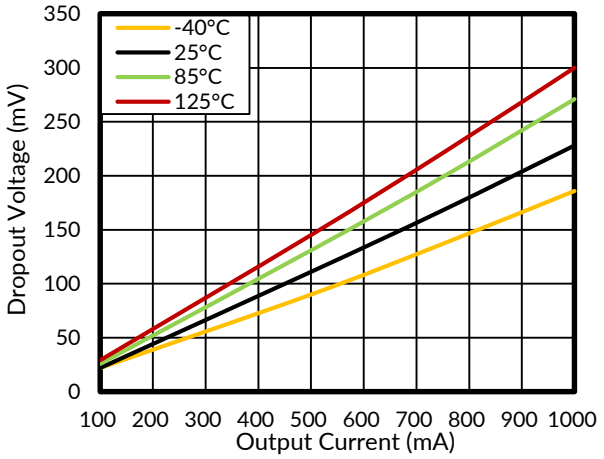

Figure 14. Dropout Voltage vs Output Current

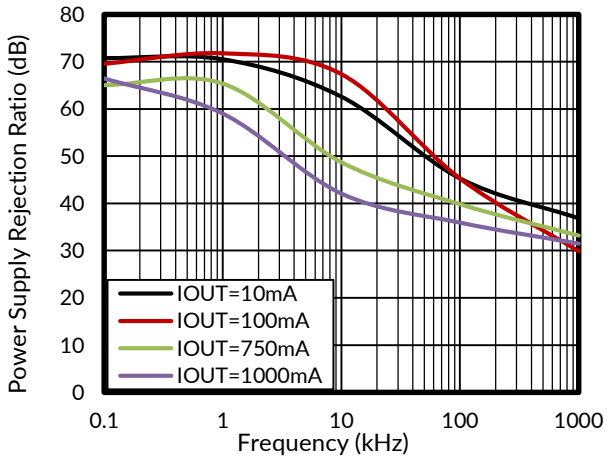

Figure 15. Power Supply Rejection Ratio vs Frequency

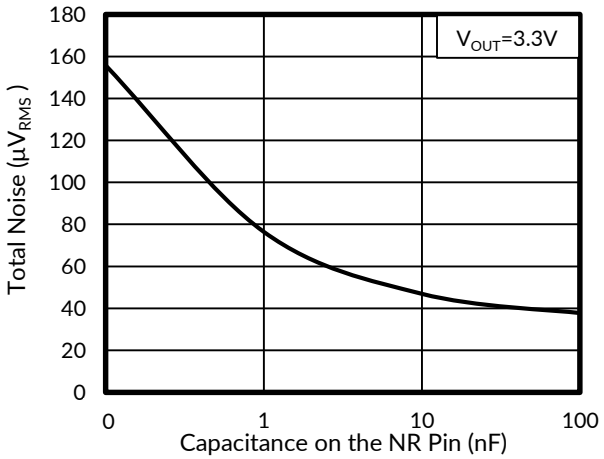

Figure 16. RMS Noise vs C_{NR}

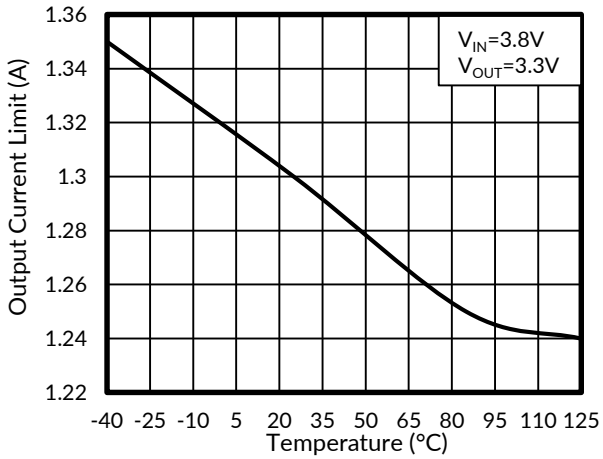

Figure 17. Output Current Limit vs Temperature

Typical Characteristics

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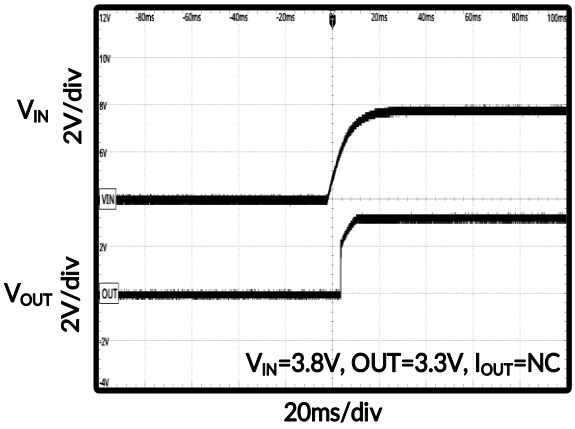


Figure 18. Power On

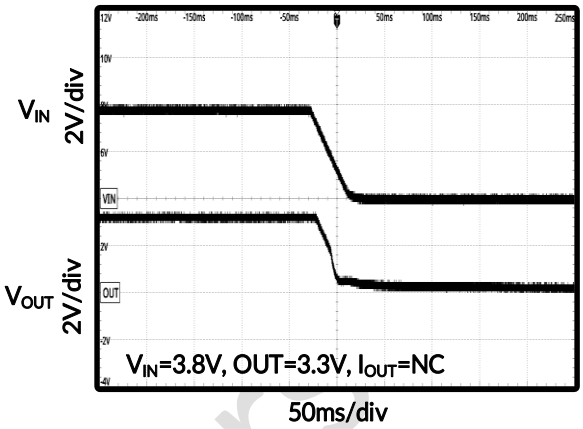


Figure 19. Power Off

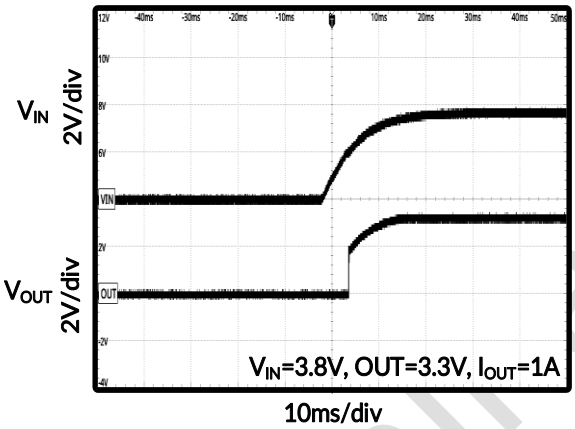


Figure 20. Power On

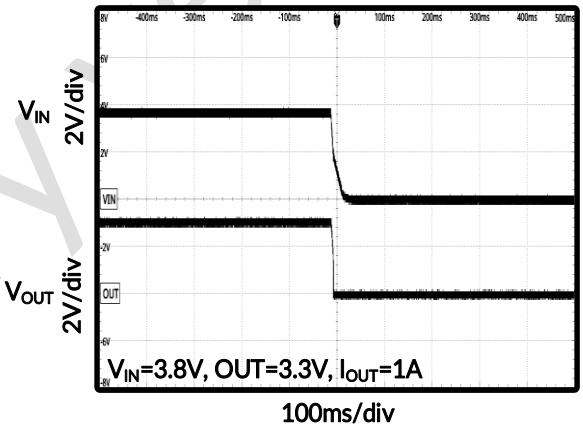


Figure 21. Power Off

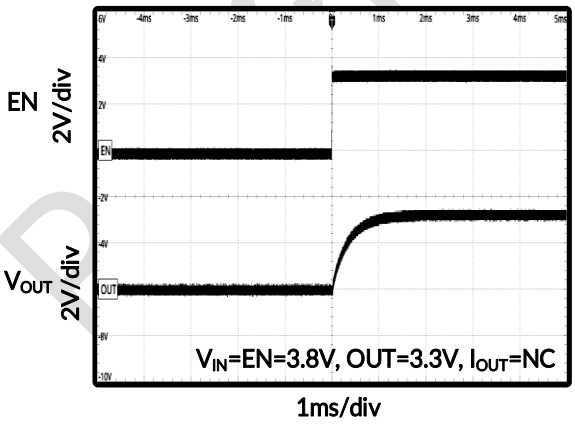


Figure 22. Turn On

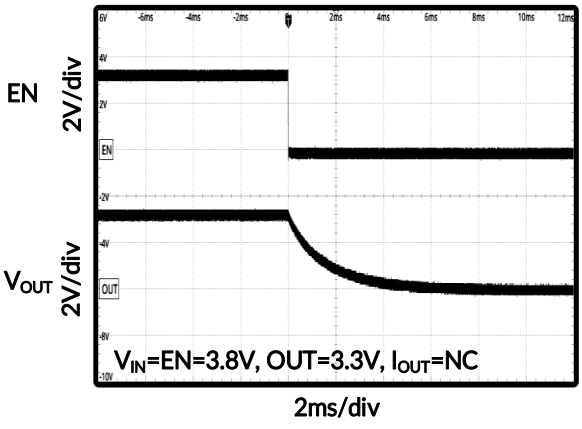


Figure 23. Turn Off

Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

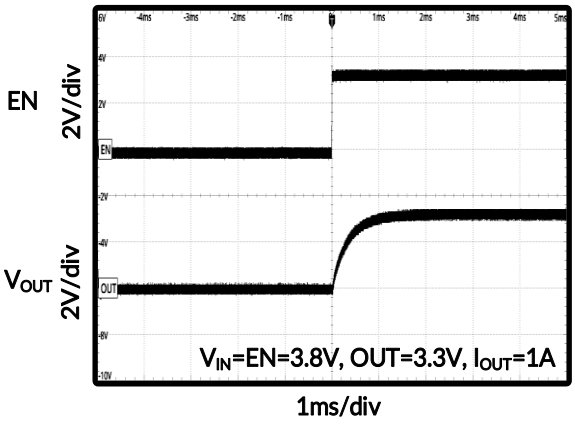


Figure 24. Turn On

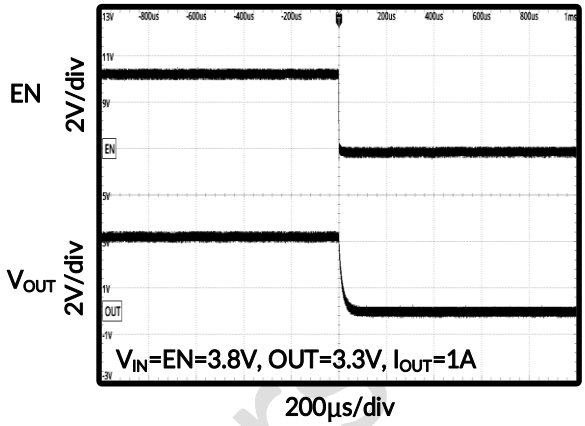


Figure 25. Turn Off

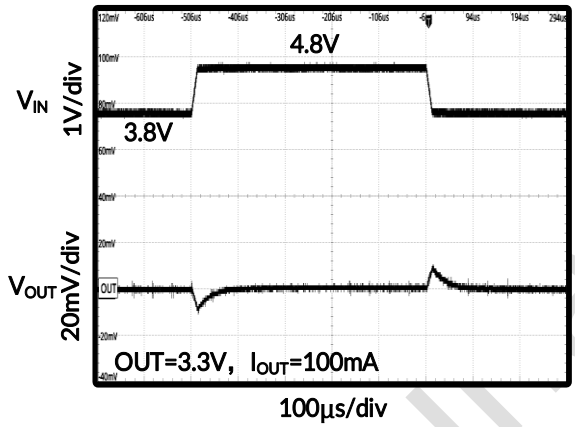


Figure 26. Line Transient Response

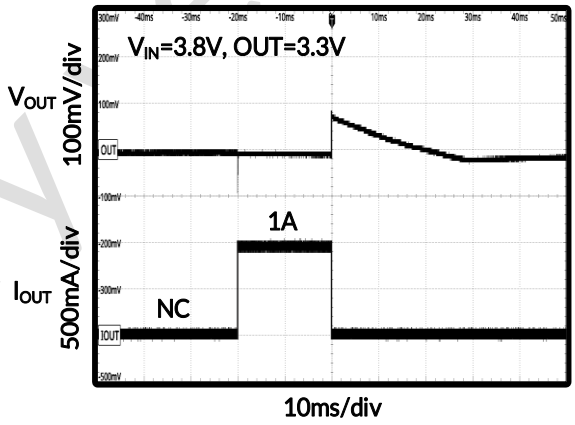


Figure 27. Load Transient Response

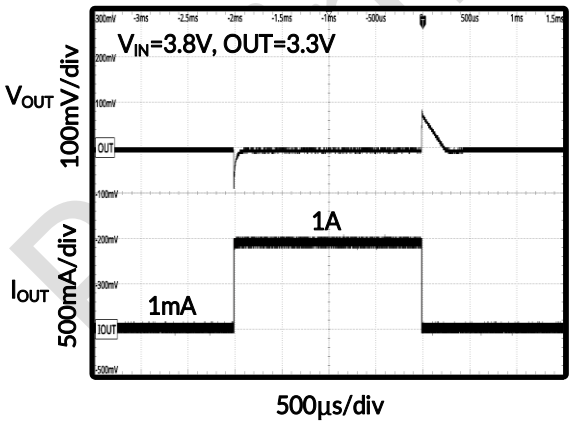


Figure 28. Load Transient Response

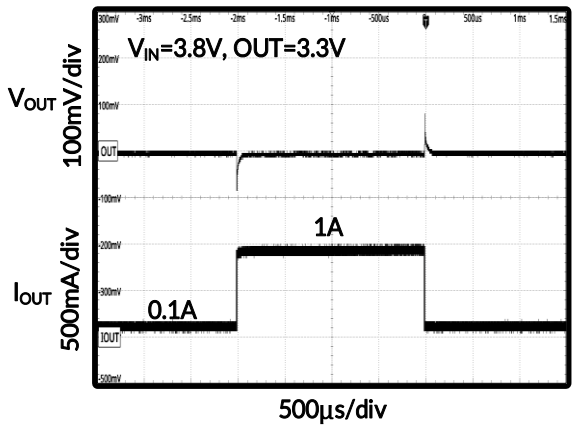


Figure 29. Load Transient Response

10 FEATURE DESCRIPTION

10.1 Internal Current-Limit

The RS3242 internal current-limit helps protect the regulator during fault conditions. During current-limit, the output sources a fixed amount of current that is largely independent of the output voltage. For reliable operation, do not operate the device in current-limit for extended periods of time.

The RS3242 family of devices has a built-in body diode that conducts current when the voltage at the VOUT pin exceeds the voltage at the VIN pin. This current is not limited, so if extended reverse voltage operation is anticipated, external limiting can be appropriate.

10.2 Shutdown

The enable pin (EN) is active high and is compatible with standard and low-voltage TTL-CMOS levels. When shutdown capability is not required, the EN pin can be connected to the VIN pin.

10.3 Startup and Noise Reduction Capacitor

Fixed voltage versions of the RS3242 family of devices use a quick-start circuit to fast-charge the noise reduction capacitor, C_{NR}, if present. This architecture allows the combination of very-low output noise and fast startup times. The NR pin is high impedance so a low-leakage C_{NR} capacitor must be used. Most ceramic capacitors are appropriate in this configuration. A high-quality, C0G-type (NP0) dielectric ceramic capacitor is recommended for C_{NR} when used in environments where abrupt changes in temperature can occur.

10.4 Undervoltage Lockout (UVLO)

The RS3242 family of devices uses an undervoltage lockout circuit to keep the output shut off until the internal circuitry is operating properly.

10.5 Disabled

The device is disabled under the following conditions:

- The input voltage is less than the UVLO threshold minus V_{HYS}, or has not yet exceeded the UVLO threshold.
- The enable voltage is less than the enable falling threshold voltage or has not yet exceeded the enable rising threshold. When disenabled, the pull-down device behaves like a 300Ω resistor to ground.
- The device junction temperature is greater than the thermal shutdown temperature.

11 TYPICAL APPLICATION

11.1 Input and Output Capacitor Requirements

Although an input capacitor is not required for stability, connecting a minimum of 1μF low-equivalent series resistance (ESR) capacitor across the input supply near the regulator is good analog design practice. This capacitor counteracts reactive input sources and improves transient response and ripple rejection. A higher value capacitor can be necessary if large, fast, rise-time load transients are anticipated or if the device is located several inches from the power source.

The RS3242 family of devices is designed to be stable with standard ceramic output capacitors of values 4.7μF or larger. X5R- and X7R-type capacitors are best because they have minimal variation in value and ESR over temperature.

11.2 Adjustable Device Feedback Resistors

The adjustable-version device requires external feedback divider resistors to set the output voltage. V_{OUT} is set using the feedback divider resistors, R_1 and R_2, according to the following equation:

$$V_{OUT} = V_{FB} \times (1 + R_1 / R_2) \quad (1)$$

To ignore the FB pin current error term in the V_{OUT} equation, set the feedback divider current to 100x the FB pin current listed in the Electrical Characteristics table. This setting provides the maximum feedback divider series resistance, as shown in the following equation:

$$R_1 + R_2 \leq V_{OUT} / (I_{FB} \times 100) \quad (2)$$

12 POWER SUPPLY RECOMMENDATIONS

The device is designed to operate from an input voltage supply range between 2.2V and 6V. The input voltage range must provide adequate headroom in order for the device to have a regulated output. This input supply must be well regulated. If the input supply is noisy, additional input capacitors with low ESR can help improve output noise.

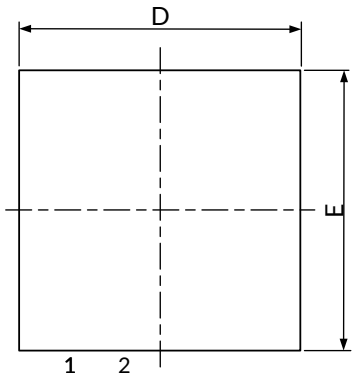
13 LAYOUT

For best overall performance, place all circuit components on the same side of the circuit board and as near as practical to the respective LDO pin connections. Place ground return connections to the input and output capacitor, and to the LDO ground pin as close to each other as possible, connected by a wide, component-side, copper surface. The use of vias and long traces to create LDO component connections is strongly discouraged and negatively affects system performance. This grounding and layout scheme minimizes inductive parasitics, and thereby reduces load-current transients, minimizes noise, and increases circuit stability. A ground reference plane is also recommended and is either embedded in the printed circuit board (PCB) itself or located on the bottom side of the PCB opposite the components. This reference plane serves to assure accuracy of the output voltage, shields the LDO from noise, and behaves similar to a thermal plane to spread (or sink) heat from the LDO device when connected to the exposed thermal pad. In most applications, this ground plane is necessary to meet thermal requirements.

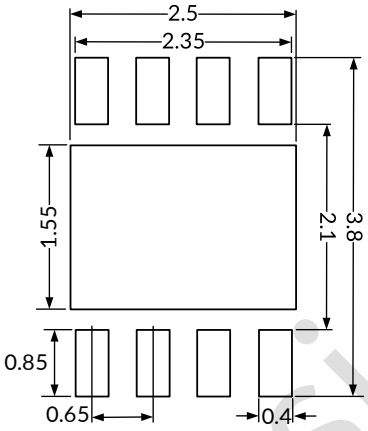
To improve ac performance (such as PSRR, output noise, and transient response), designing the board with separate ground planes for V_{IN} and V_{OUT} is recommended, with each ground plane connected only at the GND pin of the device. In addition, the ground connection for the bypass capacitor must connect directly to the GND pin of the device.

14 PACKAGE OUTLINE DIMENSIONS

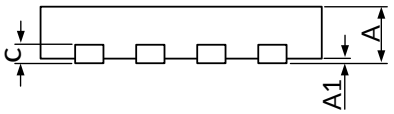
DFN3X3-8 (3)



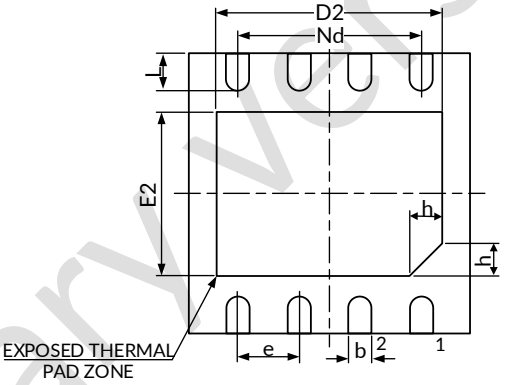
TOP VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



SIDE VIEW



BOTTOM VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.700	0.800	0.028	0.032
A1	-	0.050	-	0.002
b	0.250	0.350	0.010	0.014
c	0.180	0.250	0.007	0.010
D (1)	2.900	3.100	0.114	0.122
D2	2.400	2.600	0.094	0.102
e	0.650 BSC (2)		0.026 BSC (2)	
Nd	1.950 BSC (2)		0.077 BSC (2)	
E (1)	2.900	3.100	0.114	0.122
E2	1.450	1.650	0.057	0.065
L	0.300	0.500	0.012	0.020
h	0.200	0.300	0.008	0.012

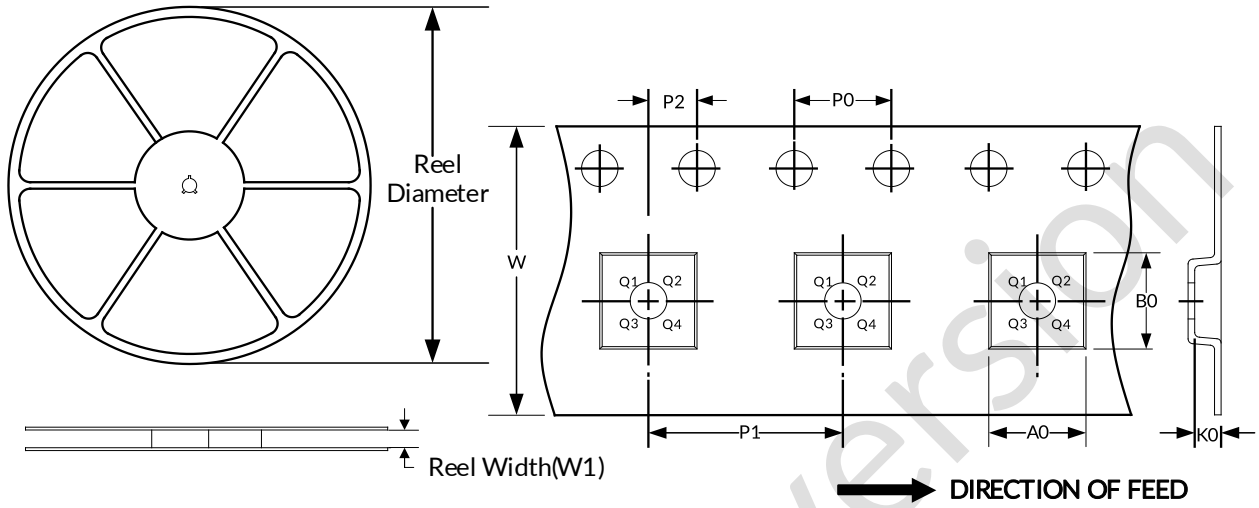
NOTE:

1. Plastic or metal protrusions of 0.075mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

15 TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSION



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
DFN3X3-8	13”	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q2

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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