AUTOMOTIVE COMPLIANT 300mA HIGH PSRR LOW NOISE LDO WITH ENABLE

Description

The AP7343Q is a low dropout regulator with high output voltage accuracy, low $R_{DS(ON)}$, high PSRR, low output noise and low quiescent current. This regulator is based on a CMOS process.

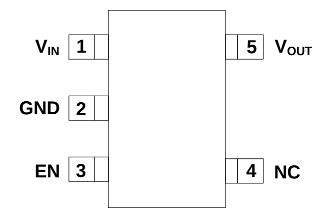
The AP7343Q includes a voltage reference, error amplifier, current limit circuit, and an enable input to turn it on and off. With the integrated resistor network fixed output voltage versions can be delivered.

With its low power consumption and, line and load transient responses the AP7343Q is well suited for noise sensitive automotive applications.

The AP7343Q is packaged in SOT25 package, which allows for the smallest footprint and dense PCB layout.

Pin Assignments

(Top View)



SOT25

Applications

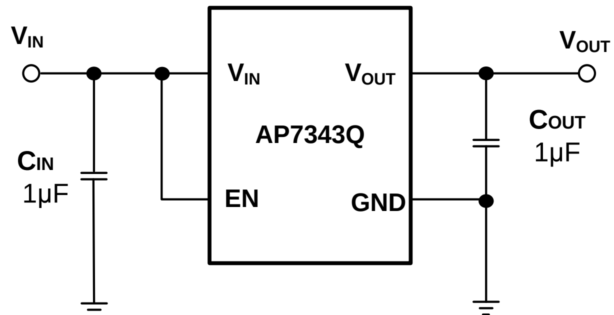
- Infotainment Power Supplies
- Automotive RF Supply
- Cameras
- Automotive POL in ADAS
- Automotive Wireless Communication

Features

- Low V_{IN} and Wide V_{IN} Range: 1.7V to 5.25V
- -40°C to +125°C Temperature Range
- Guarantee Output Current: 300mA
- V_{OUT} Accuracy ±1%
- Ripple Rejection 75dB at 1kHz
- Low Output Noise, 60µVrms from 10Hz to 100kHz
- Quiescent Current as Low as 35µA
- V_{OUT} Fixed 0.9V to 3.6V
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**
- **Qualified to AEC-Q100 Standards for High Reliability**
- **AEC-Q100 Grade 1**
- **PPAP Capable (Note 4)**

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. Automotive products are AEC-Q100 qualified and are PPAP capable. Refer to https://www.diodes.com/quality/.

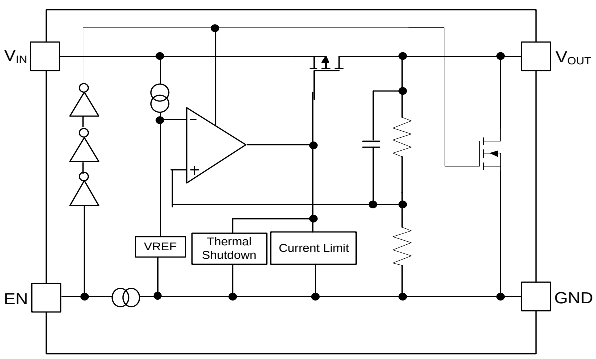
Typical Applications Circuit



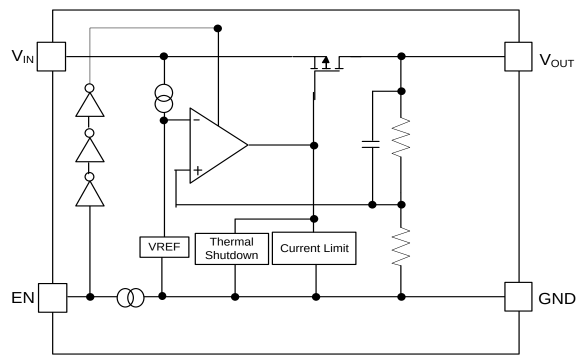
Pin Descriptions

Pin Number	Pin Name	Function
1	V_{IN}	Power Input Pin
2	GND	Ground
3	EN	Enable Pin This pin must be driven either high or low and must not be floating. Driving this pin high enables the regulator, and pulling it low puts the regulator into shutdown mode
4	NC	No Connection
5	V_{OUT}	Power Output Pin

Functional Block Diagram



AP7343DQ (With Discharge)



AP7343Q (Without Discharge)

Absolute Maximum Ratings (Note 5) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Ratings	Unit
ESD HBM	Human Body Mode ESD Protection	> 2	kV
ESD CDM	Charge Device Model	±500	V
V_{IN}	Input Voltage	6.0	V
V_{EN}	Input Voltage for EN Pin	6.0	V
V_{OUT}	Output Voltage	-0.3 to V_{IN} + 0.3	V
I_{OUT}	Output Current	400	mA
P_D	Power Dissipation	400	mW
T_J	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature	-55 to +150	°C

Note: 5. a). Stresses beyond those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only and functional operation of the device at these conditions is not implied. Exposure to absolute-maximum-rated conditions for extended period can affect device reliability.
b). Ratings apply to ambient temperature at +25°C. The JEDEC High-K board design used to derive this data was a 2 inch × 2 inch multilayer board with 1oz. internal power and ground planes and 2oz. copper traces on the top and bottom of the board.

Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

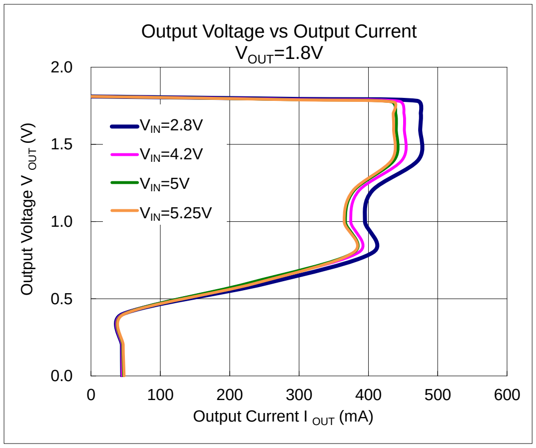
Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	1.7	5.25	V
I_{OUT}	Output Current	0	300	mA
T_J	Operating Junction Temperature	-40	+125	°C
T_A	Operating Ambient Temperature	-40	+125	°C

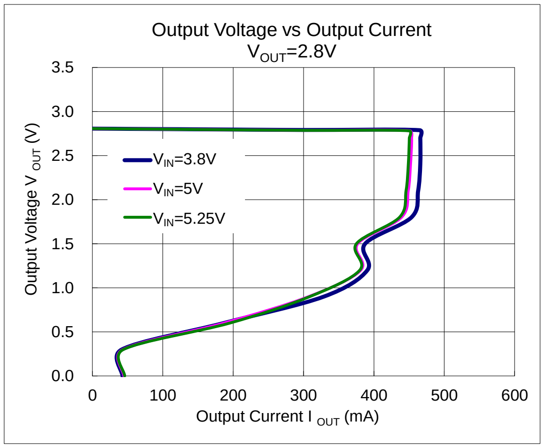
Electrical Characteristics (@T_A = +25°C, V_{IN} = V_{OUT} +1.0V, C_{IN} = C_{OUT} = 1.0µF, I_{OUT} = 1.0mA, unless otherwise specified.)

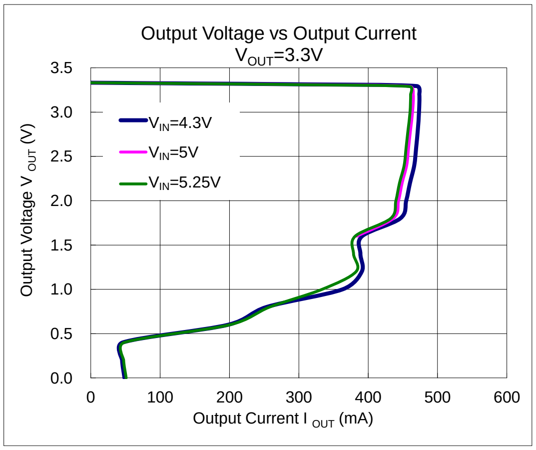
Parameter	Condition		Min	Typ	Max	Unit
Input Voltage	T_A = -40°C to +85°C		1.7	—	5.25	V
Output Voltage Accuracy (Note 12)	V_{OUT}(T) ≥ 2.0V, V_{IN} = V_{OUT}(T)+1V	T_A = +25°C	V_{OUT}(T)* 0.99	V_{OUT}(T)	V_{OUT}(T)* 1.01	V
	V_{OUT}(T) < 2.0V, V_{IN} = V_{OUT}(T)+1V	T_A = +25°C	V_{OUT}(T)- 20mV	V_{OUT}(T)	V_{OUT}(T)+ 20mV	
Line Regulation ($dV_{OUT}/dV_{IN}/V_{OUT}$)	V_{IN} = ($V_{OUT-Nom}$ +1.0V) to 5.25V, I_{OUT} = 1.0mA		—	0.02	0.1	%/V
Load Regulation	V_{IN} = $V_{OUT-Nom}$ +1.0V, I_{OUT} = 1mA to 300mA		—	15	30	mV
Quiescent Current (Note 7)	I_{OUT} = 0mA		—	35	60	µA
$I_{STANDBY}$	V_{EN} = 0V (Disabled)		—	0.01	1.0	µA
Output Current	—		300	—	—	mA
Fold-back Short Current (Note 8)	V_{OUT} Short to Ground		—	55	—	mA
PSRR (Note 9)	V_{IN} = (V_{OUT}+1V) V_{DC} + 0.2Vp-pAC, V_{OUT} ≥ 1.8V, I_{OUT} = 30mA	f = 1kHz	—	75	—	dB
Output Noise Voltage (Note 9) (Note 10)	BW = 10Hz to 100kHz, I_{OUT} = 30mA		—	60	—	µVrms
Dropout Voltage (Note 6)	I_{OUT} = 300mA (SOT25)	V_{OUT} = 0.9V	—	0.51	0.82	V
		1.0V < V_{OUT} ≤ 1.2V	—	0.46	0.72	
		1.2V < V_{OUT} ≤ 1.4V	—	0.39	0.60	
		1.4V < V_{OUT} ≤ 1.7V	—	0.35	0.46	
		1.7V < V_{OUT} ≤ 2.1V	—	0.30	0.41	
		2.1V < V_{OUT} ≤ 2.5V	—	0.26	0.36	
		2.5V < V_{OUT} ≤ 3.0V	—	0.25	0.32	
		3.0V < V_{OUT} ≤ 3.6V	—	0.22	0.31	
Output Voltage Temperature Coefficient	I_{OUT} = 30mA, T_A = -40°C to +125°C		—	±30	—	ppm/°C
Thermal Shutdown Threshold (TSHDN)	—		—	+150	—	°C
Thermal Shutdown Hysteresis (THYS)	—		—	+20	—	°C
EN Input Low Voltage	—		0	—	0.5	V
EN Input High Voltage	—		1.3	—	5.25	V
EN Input Leakage	V_{EN} = 0, V_{IN} = 5.0V or V_{EN} = 5.0V, V_{IN} = 0V		-1.0	—	+1.0	µA
On Resistance of N-Channel for Auto-Discharge (Note 11)	V_{IN} = 4.0V, V_{EN} = 0V (Disabled)		—	30	—	Ω
Thermal Resistance Junction to Ambient (θ_{JA})	SOT25		—	179	—	°C/W
Thermal Resistance Junction to Case (θ_{JC})	SOT25		—	52	—	

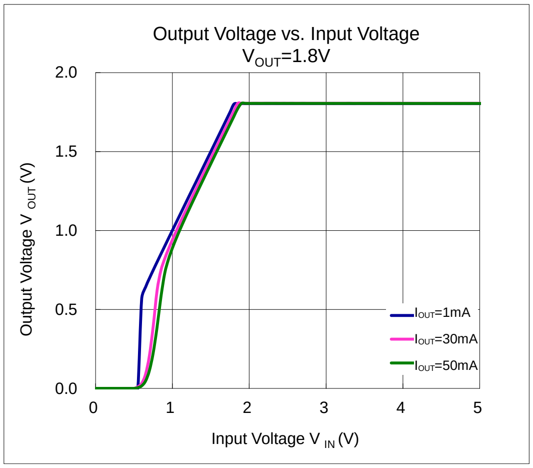
Notes:
6. Dropout voltage is the voltage difference between the input and the output at which the output voltage drops 2% below its nominal value.
7. Quiescent current is defined here is the difference in current between the input and the output.
8. Short circuit current is measured with V_{OUT} pulled to GND.
9. This specification is guaranteed by design.
10. To make sure lowest environment noise minimizes the influence on noise measurement.
11. AP7343Q has two options for output, built-in discharge and non-discharge.
12. Potential multiple grades based on following output voltage accuracy.

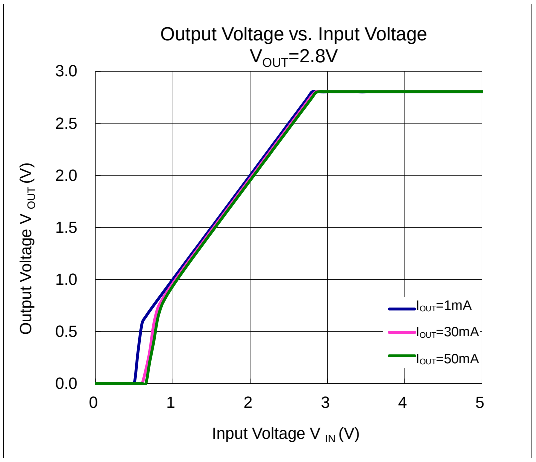
Typical Characteristics

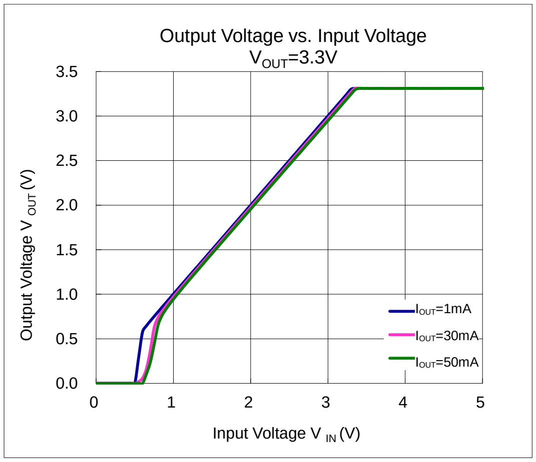




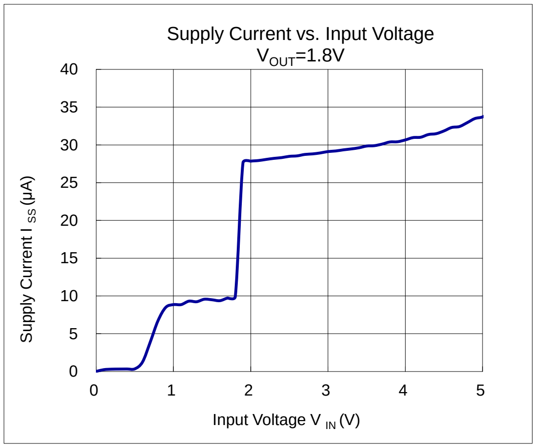


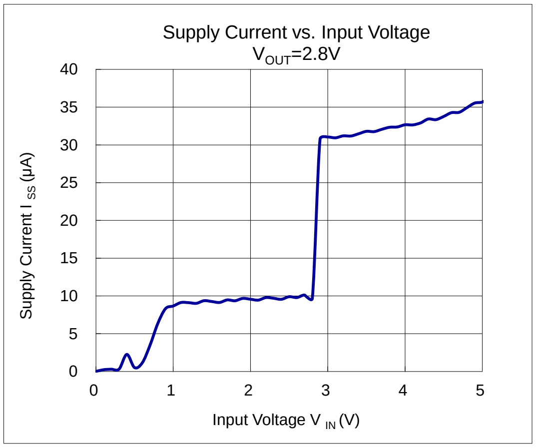


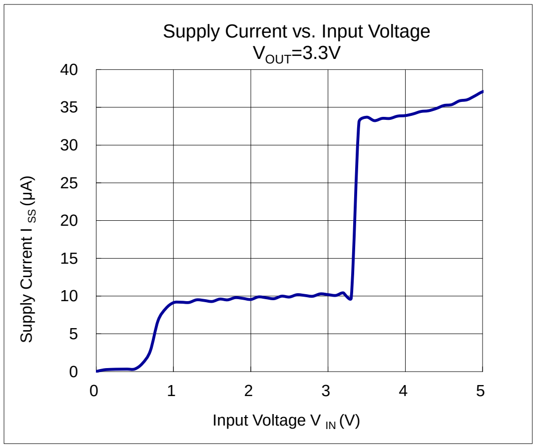


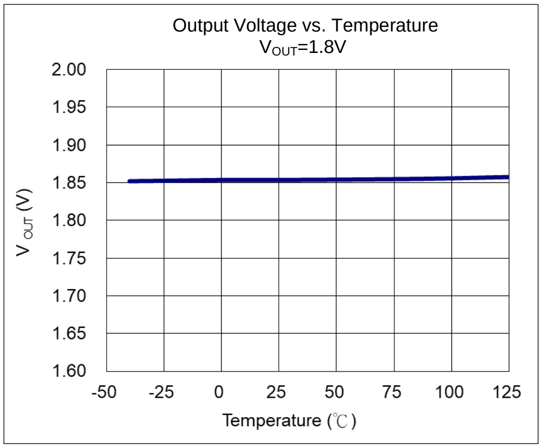


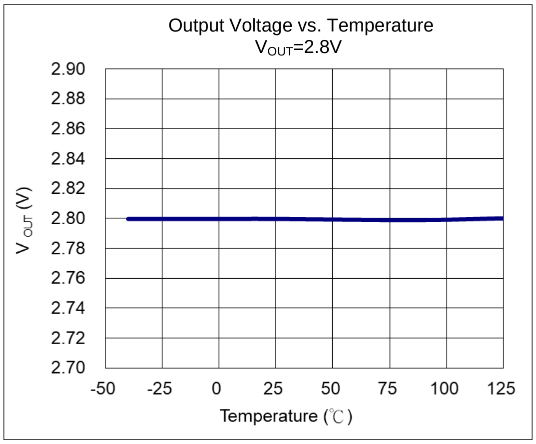
Typical Characteristics (continued)

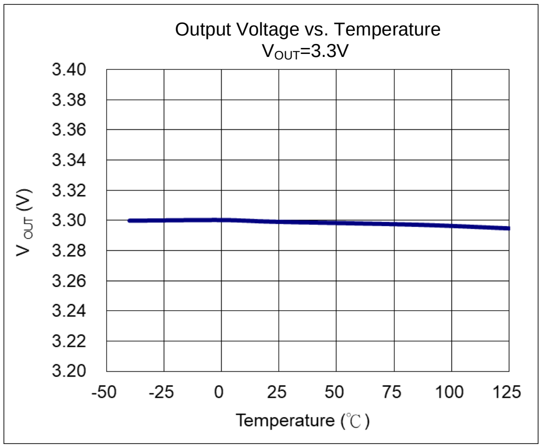












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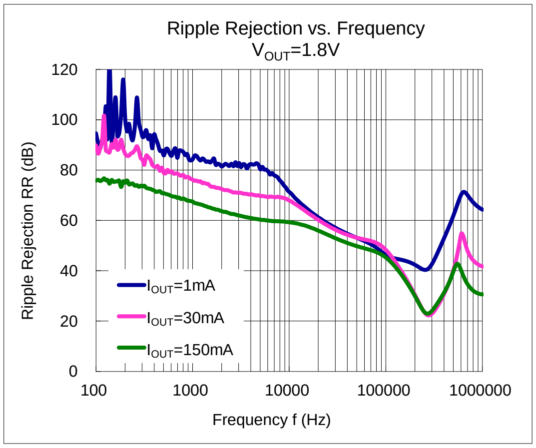

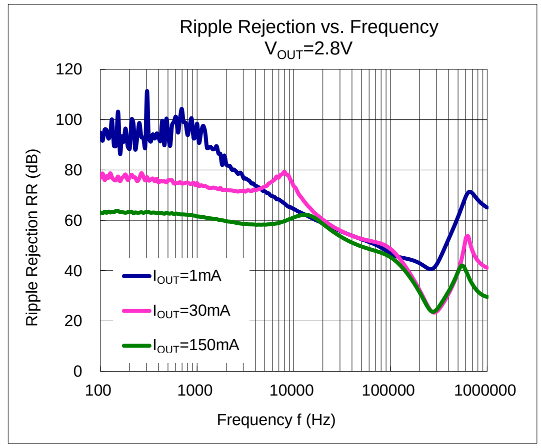

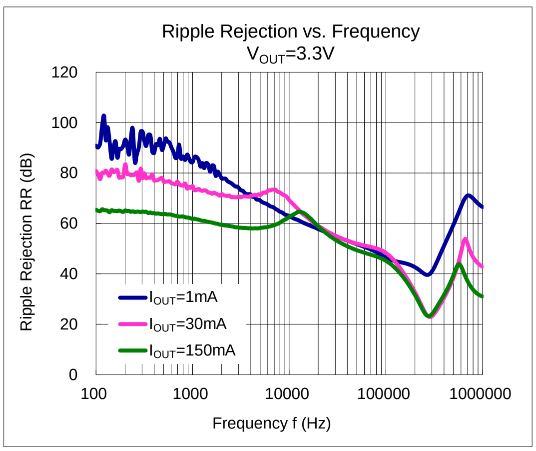

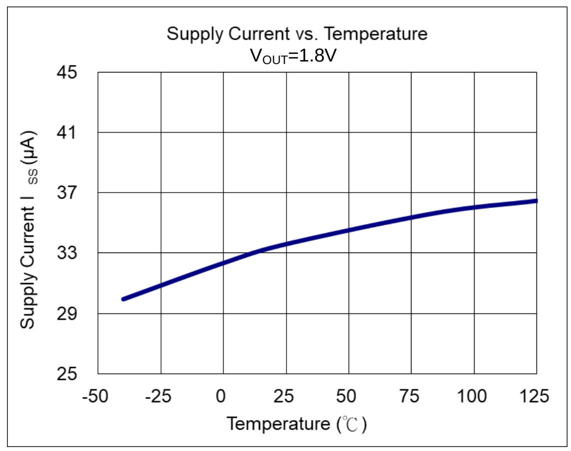

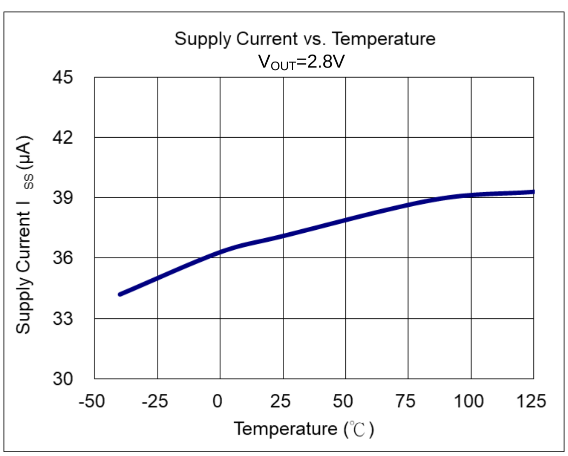

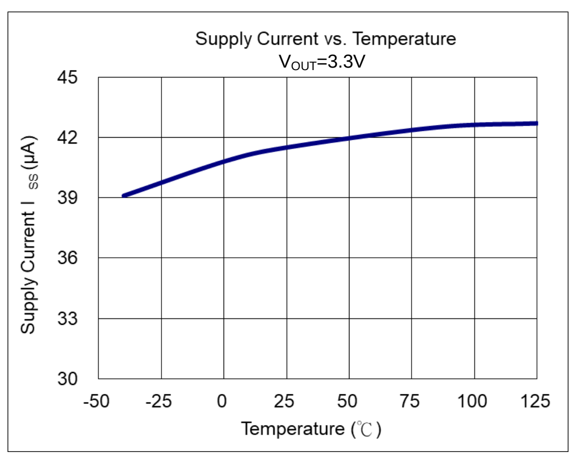

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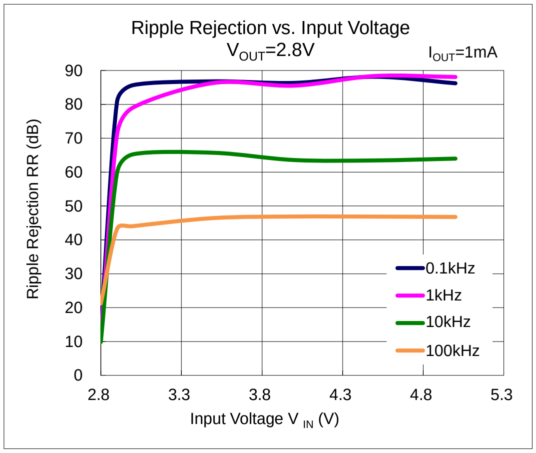
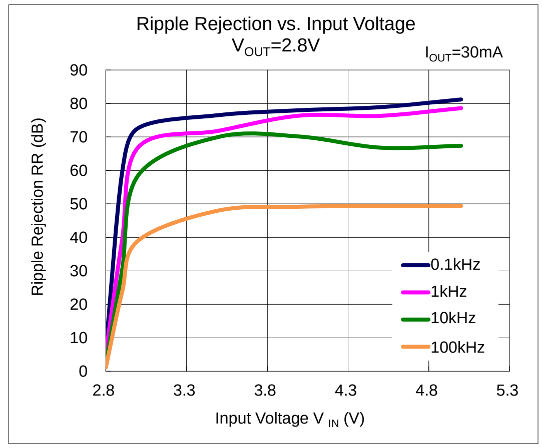
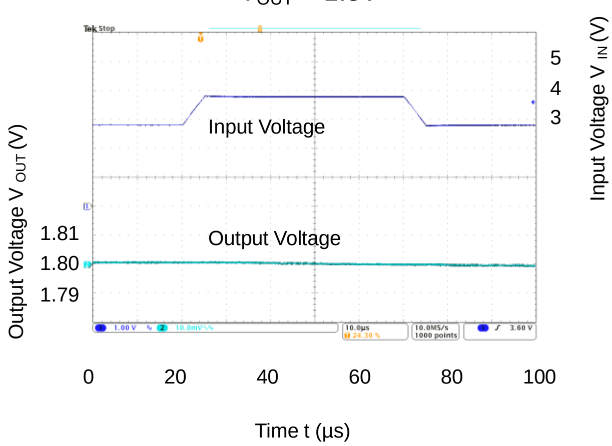


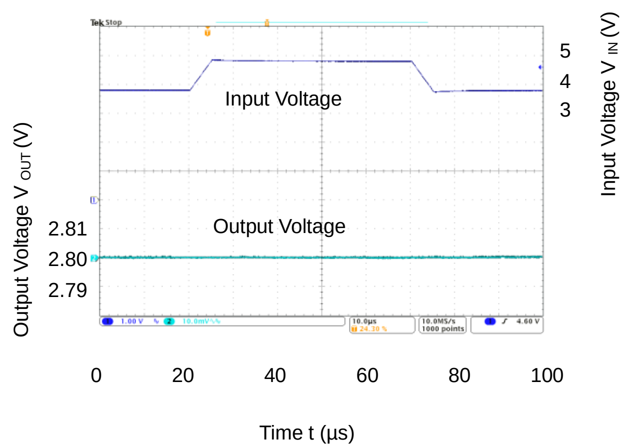


Line Transient Response Waveforms (I_{OUT} = 30mA, t_R = t_F = 5μs, C_{IN} = None, C_{OUT1} = C_{OUT2} = 1μF, T_A = +25°C)

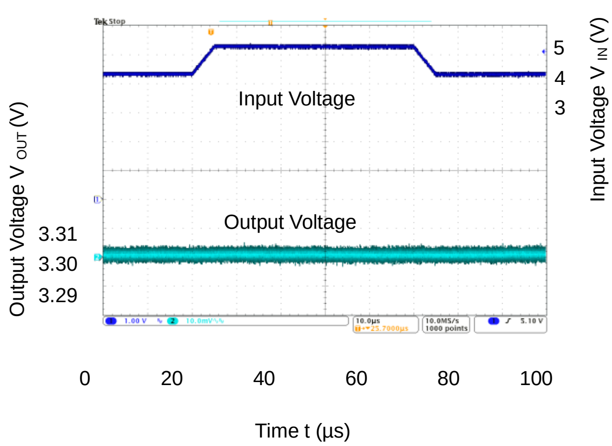
V_{OUT} = 1.8V



V_{OUT} = 2.8V

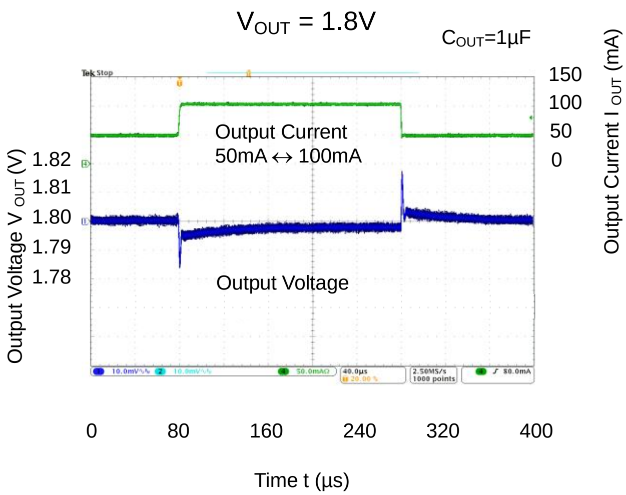


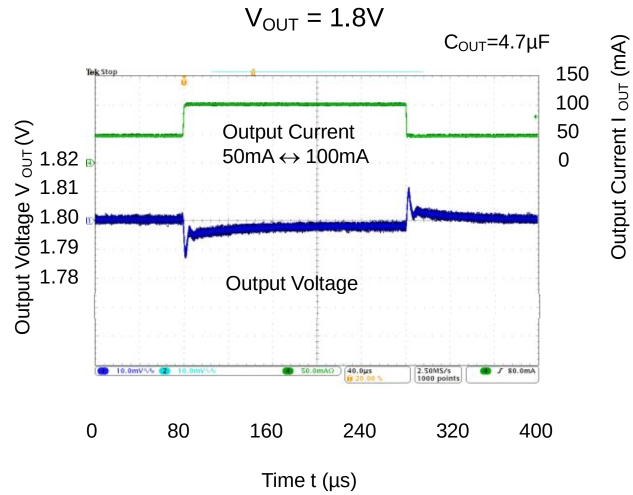
V_{OUT} = 3.3V

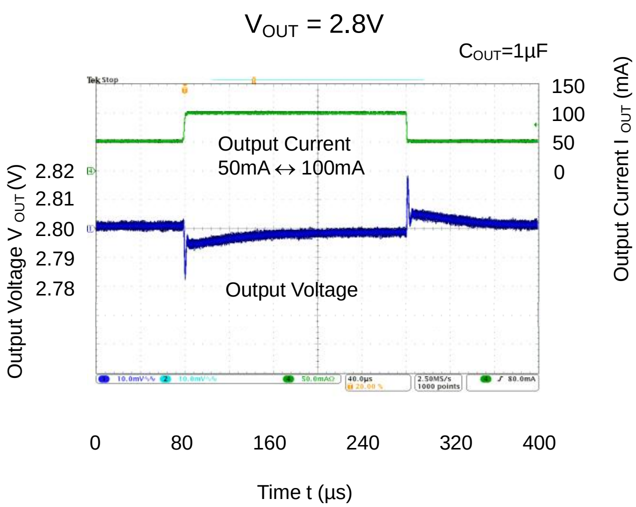


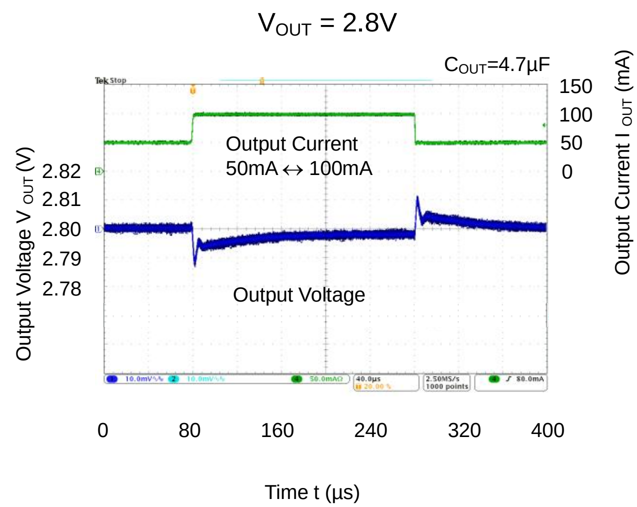
Typical Characteristics (continued)

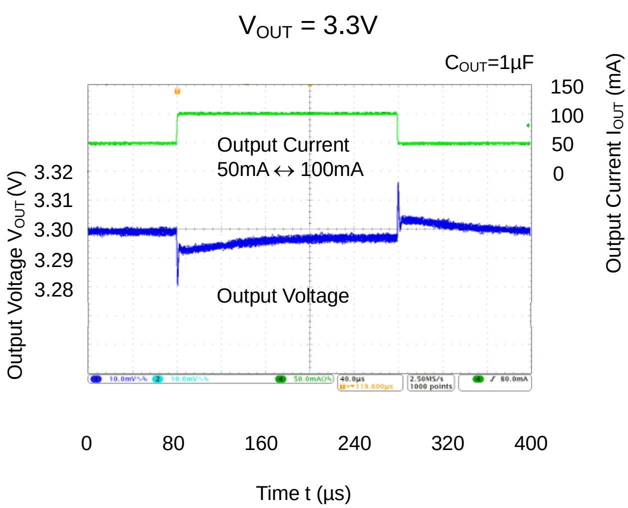
Load Transient Response Waveforms ($V_{IN} = V_{OUT}$+1V, C_{IN} = 1µF, T_A = +25°C)

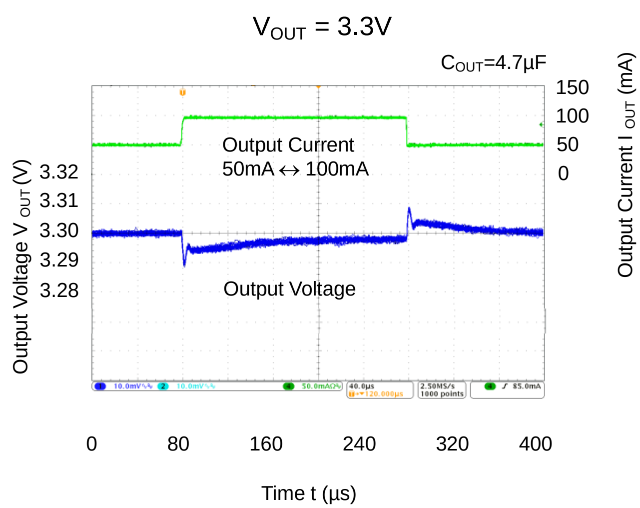








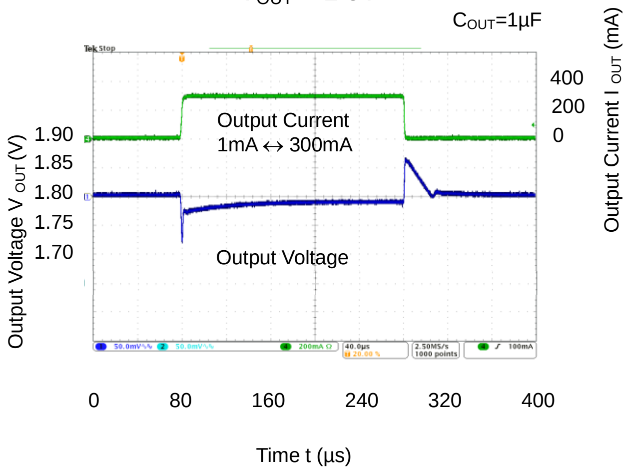




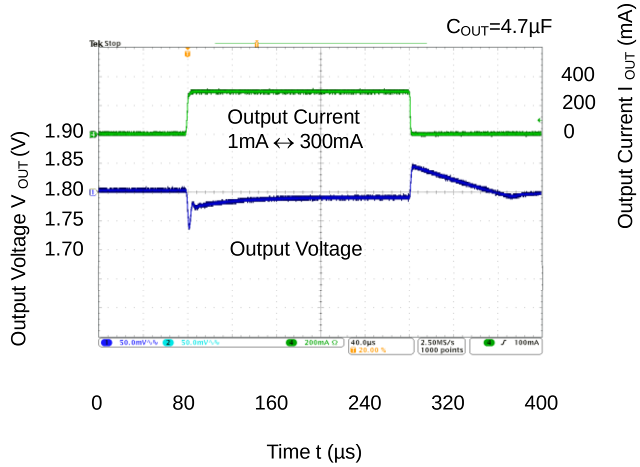
Typical Characteristics (continued)

Load Transient Response Waveforms ($V_{IN} = V_{OUT}$+1V, C_{IN} = 1µF, T_A = +25°C)

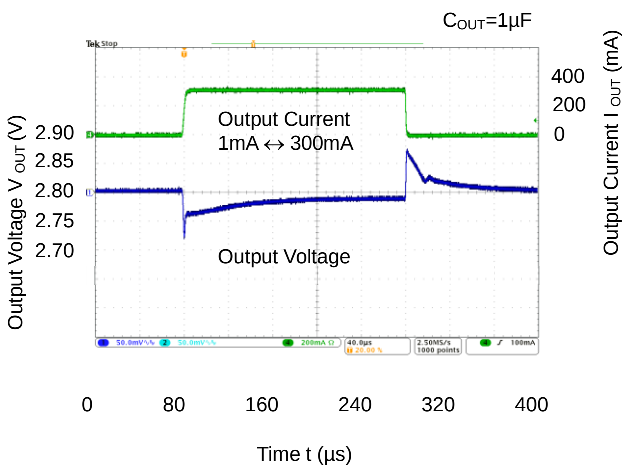
V_{OUT} = 1.8V



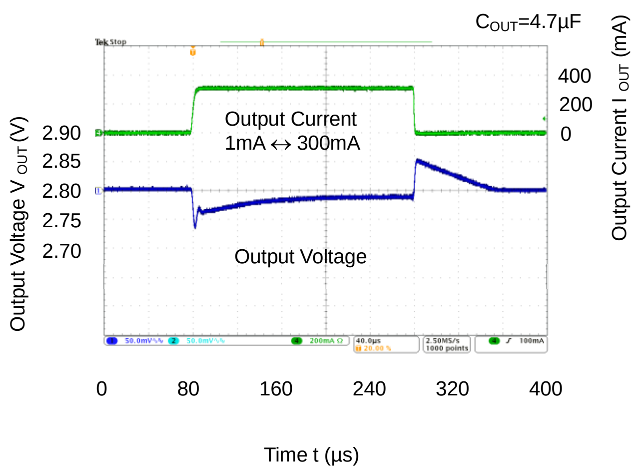
V_{OUT} = 1.8V



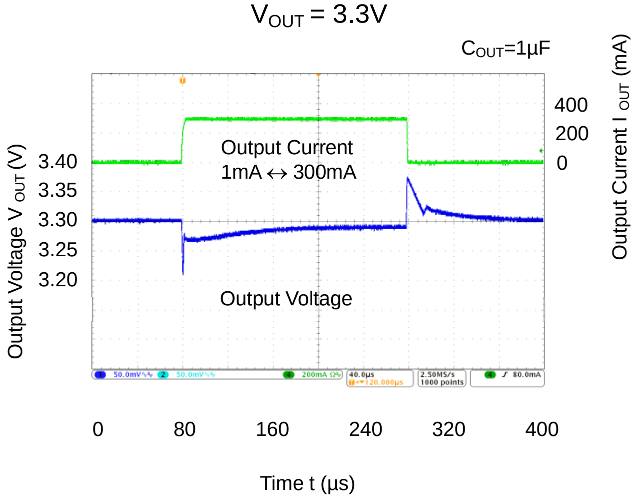
V_{OUT} = 2.8V



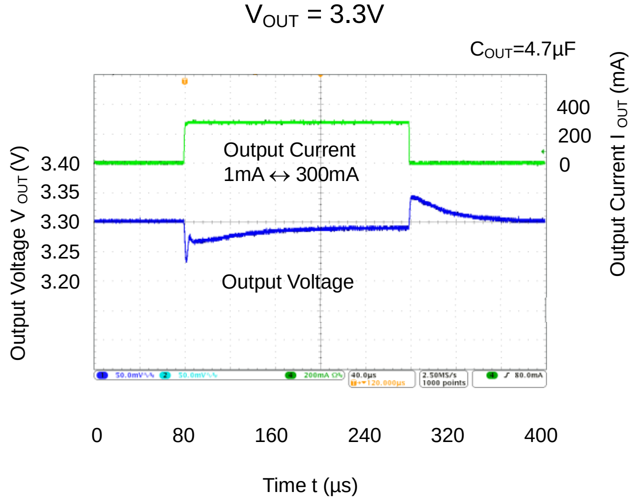
V_{OUT} = 2.8V



V_{OUT} = 3.3V



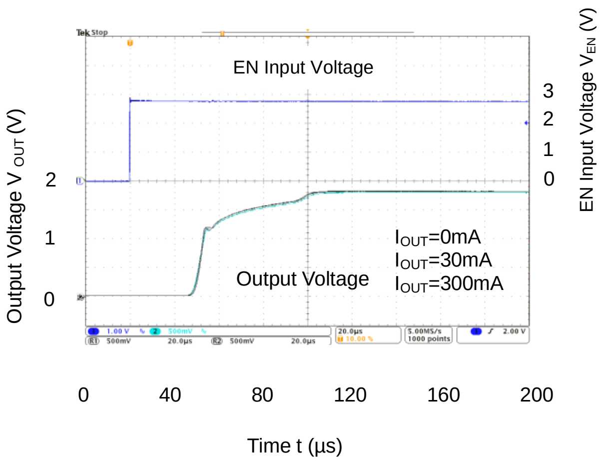
V_{OUT} = 3.3V



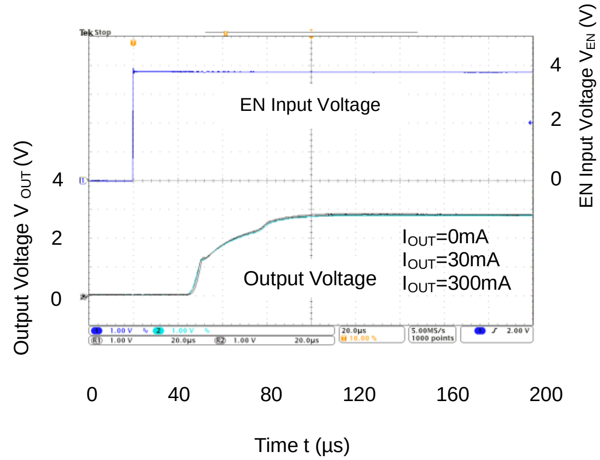
Typical Characteristics (continued)

Turn On & Off Waveforms ($V_{IN} = V_{OUT}$+1V, C_{IN} = 1µF, C_{OUT} = 1µF, T_A = +25°C)

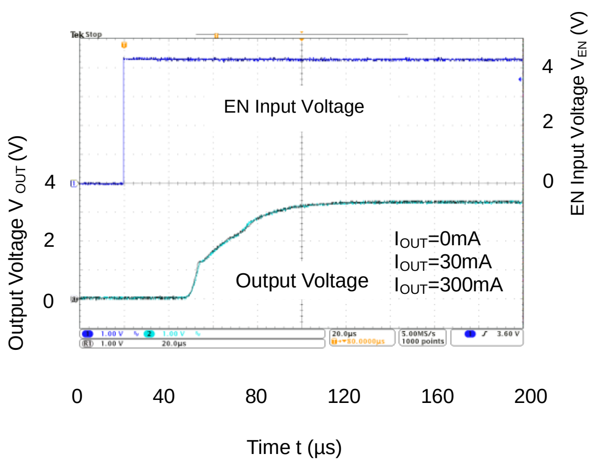
V_{OUT} = 1.8V



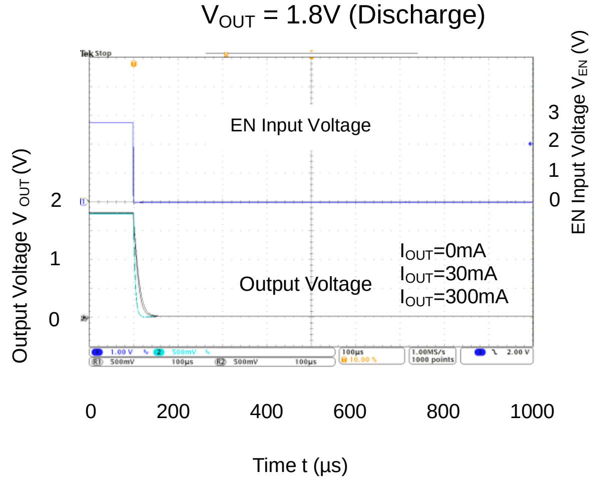
V_{OUT} = 2.8V



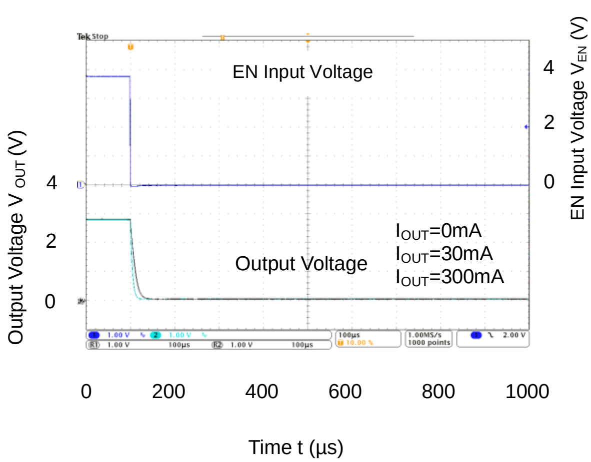
V_{OUT} = 3.3V



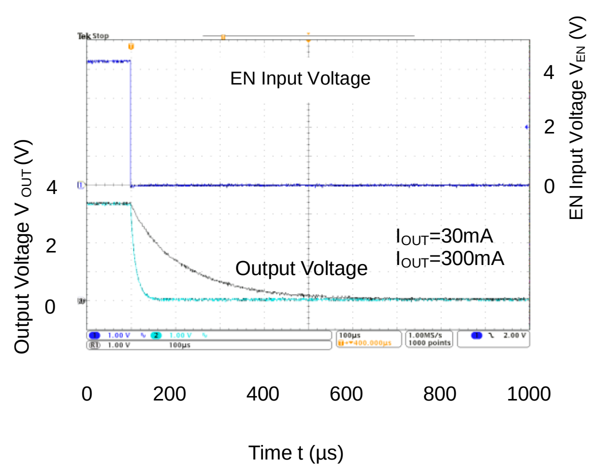
V_{OUT} = 1.8V (Discharge)



V_{OUT} = 2.8V (Discharge)



V_{OUT} = 3.3V (Non-Discharge)



Application Information

Output Capacitor

An output capacitor (C_{OUT}) is required to improve transient response and maintain stability. The AP7343Q is stable with very-small ceramic-output capacitors. The ESR (equivalent series resistance) and capacitance drives the selection. If the application has large load variations, it is recommended to utilize low-ESR bulk capacitors. It is recommended to place ceramic capacitors as close as possible to the load, and the ground pin and care should be taken to reduce the impedance in the layout.

Input Capacitor

To prevent the input voltage from dropping during load steps, it is recommended to utilize an input capacitor (C_{IN}). A minimum 0.47μF ceramic capacitor is recommended between V_{IN} and GND pins to decouple input power supply glitch. This input capacitor must be located as close as possible to the device to assure input stability and reduce noise. For PCB layout, a wide copper trace is required for both V_{IN} and GND pins.

Enable Control

The AP7343Q 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 V_{IN} pin to keep the regulator output on at all times. To ensure proper operation, the signal source used to drive the EN pin must be able to swing above and below the specified turn-on/off voltage thresholds listed in the Electrical Characteristics section.

Short Circuit Protection

When V_{OUT} pin is short-circuit to GND, short-circuit protection is triggered and clamps the output current to approximately 60mA. This feature protects the regulator from overcurrent and damage due to overheating.

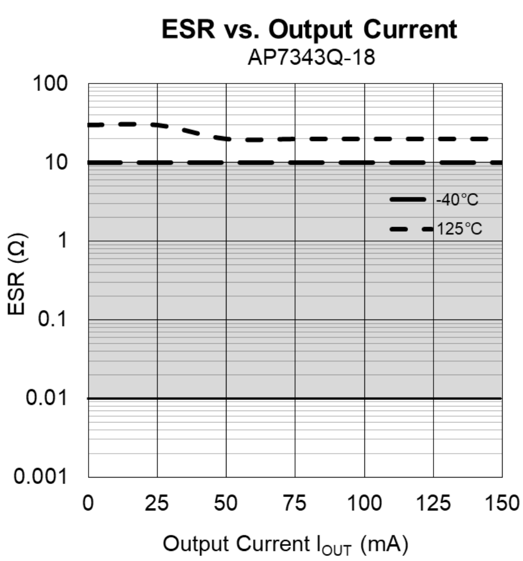
Layout Considerations

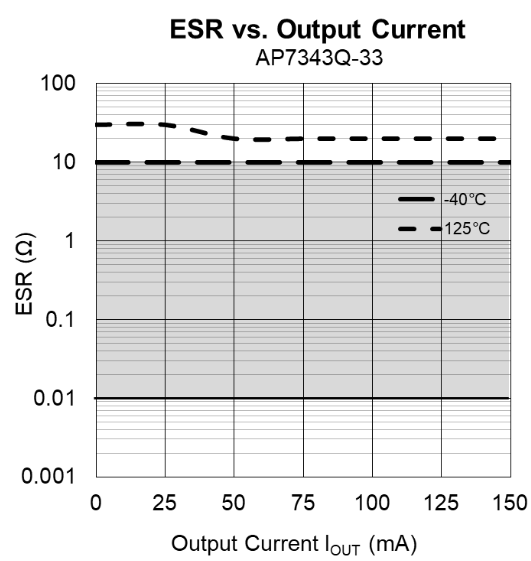
For good ground loop and stability, the input and output capacitors should be located close to the input, output, and ground pins of the device. The regulator ground pin should be connected to the external circuit ground to reduce voltage drop caused by trace impedance. Ground plane is generally used to reduce trace impedance. Wide trace should be used for large current paths from V_{IN} to V_{OUT} and load circuit.

ESR vs. Output Current

Ceramic type output capacitor is recommended for this series; however, the other output capacitors with low ESR also can be used. The relations between I_{OUT} (output current) and ESR of an output capacitor are shown below. The stable region is marked as the hatched area in the graph.

Measurement conditions: Frequency Band: 10Hz to 2MHz, Temperature: -40°C to +125°C.





Ordering Information (Notes 13, 14, 15)

AP7343X Q - XX XX - X

Output Discharge	Compliance	Output Voltage	Package	Packing
Blank : Non-discharge D : Output Discharge	Q: Automotive Compliant	09 : 0.9V 10 : 1.0V 11 : 1.1V 12 : 1.2V 15 : 1.5V 18 : 1.8V 25 : 2.5V 27 : 2.7V 28 : 2.8V 29 : 2.9V 30 : 3.0V 33 : 3.3V	W5: SOT25	7 : Tape & Reel

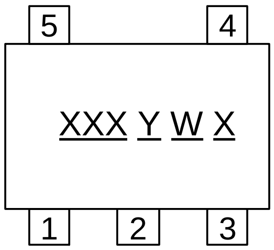
Part Number	Package Code	Packaging	7” Tape and Reel	
			Quantity	Part Number Suffix
AP7343Q-XXW5-7	W5	SOT25	3000/Tape & Reel	-7
AP7343DQ-XXW5-7	W5	SOT25	3000/Tape & Reel	-7

Notes: 13. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.
14. Other output voltage variants may be available in 100mV steps. For more information, please contact your local Diodes Incorporated Sales representative.
15. AP7343Q and AP7343DQ are qualified to AEC-Q100 grade 1 and are classified as “Automotive Compliant” supporting PPAP documentation. Automotive Compliant and standard products are electrically and thermally the same, except where specified. For more information, please refer to https://www.diodes.com/quality/.

Marking Information

(1) SOT25

(Top View)



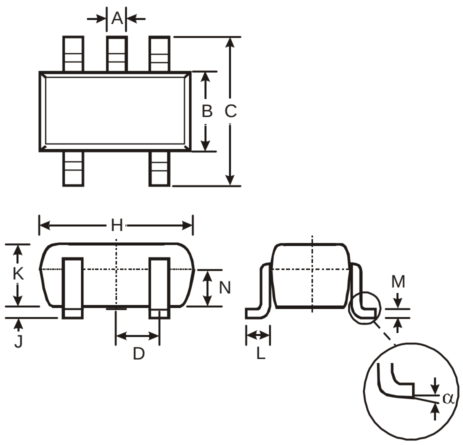
XXX : Identification Code
Y : Year 0 to 9
W : Week : A to Z : 1 to 26 week;
a to z : 27 to 52 week; z represents
52 and 53 week
X : Internal Code

Part Number	Package Type	Identification Code
AP7343Q-09W5-7	SOT25	7BQ
AP7343Q-10W5-7	SOT25	7CQ
AP7343Q-11W5-7	SOT25	7EQ
AP7343Q-12W5-7	SOT25	7FQ
AP7343Q-15W5-7	SOT25	7HQ
AP7343Q-18W5-7	SOT25	7JQ
AP7343Q-25W5-7	SOT25	7NQ
AP7343Q-27W5-7	SOT25	7XQ
AP7343Q-28W5-7	SOT25	7PQ
AP7343Q-29W5-7	SOT25	8AQ
AP7343Q-30W5-7	SOT25	7TQ
AP7343Q-33W5-7	SOT25	7WQ
AP7343DQ-09W5-7	SOT25	8BQ
AP7343DQ-10W5-7	SOT25	8CQ
AP7343DQ-11W5-7	SOT25	8EQ
AP7343DQ-12W5-7	SOT25	8FQ
AP7343DQ-15W5-7	SOT25	8KQ
AP7343DQ-18W5-7	SOT25	8PQ
AP7343DQ-25W5-7	SOT25	8XQ
AP7343DQ-27W5-7	SOT25	8ZQ
AP7343DQ-28W5-7	SOT25	6JQ
AP7343DQ-29W5-7	SOT25	6MQ
AP7343DQ-30W5-7	SOT25	6PQ
AP7343DQ-33W5-7	SOT25	6TQ

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT25

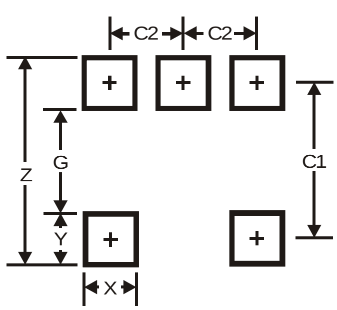


SOT25			
Dim	**Min**	**Max**	**Typ**
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	-	-	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	-
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

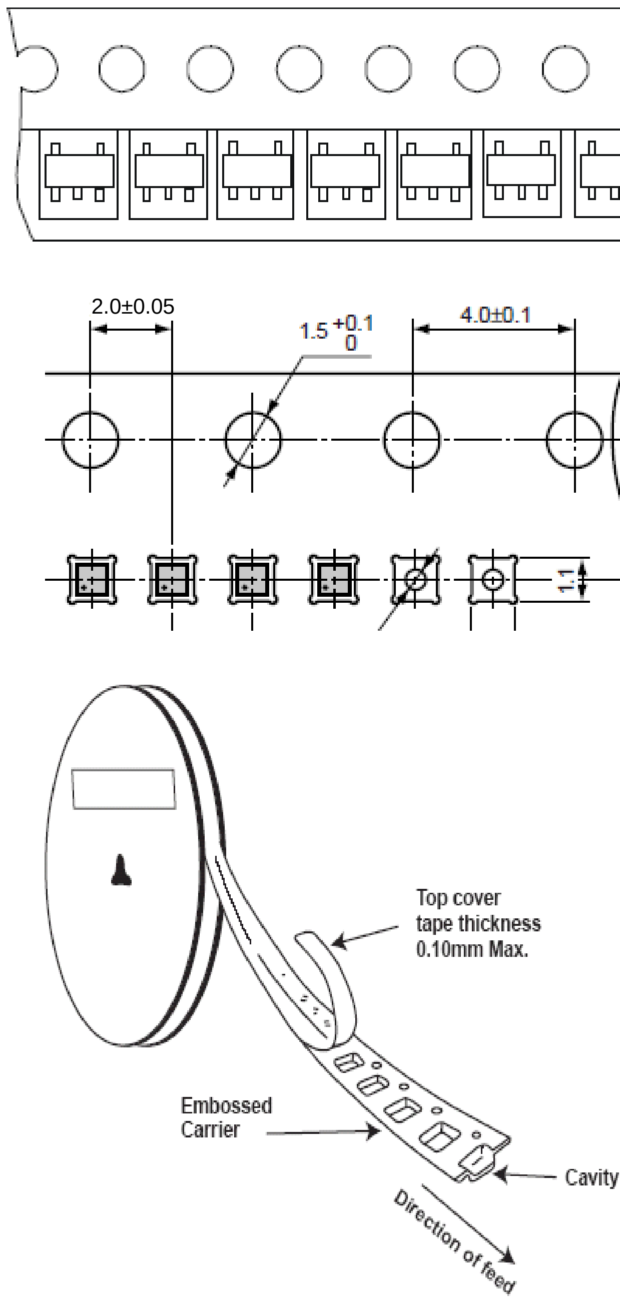
SOT25



Dimensions	Value (in mm)
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

Tape Orientation (All dimensions in mm (inch).)

For AP7343Q-XXW5-7 & AP7343DQ-XXW5-7



Note: 16. The taping orientation of the other package type can be found on our website at https://www.diodes.com/assets/Packaging-Support-Docs/Ap02007.pdf.

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