

Description

The AP7315Q 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 AP7315Q is available with fixed output voltage variants with an enable input to turn it on and off. It is available with output discharge (AP7315DQ) and without (AP7315Q) output discharge function.

With its low power consumption and line and load transient responses, the AP7315Q is well suited for noise sensitive automotive applications.

The AP7315Q is qualified to AEC-Q100 Grade 1 in SOT25 and is Automotive Compliant, supporting PPAPs.

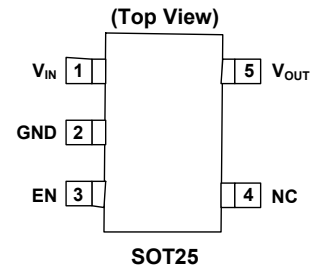
Features

- Wide V_{IN} Range: 1.7V to 5.25V
- -40°C to $+125^{\circ}\text{C}$ Temperature Range
- Guarantee Output Current, 150mA
- V_{OUT} Accuracy $\pm 1\%$
- Ripple Rejection 75dB at 1kHz
- Low Output Noise, 60 μV_{rms} from 10Hz to 100kHz
- Quiescent Current as Low as 35 μA
- V_{OUT} Fixed 1.1V to 3.3V
- Moisture Sensitivity: Level 1 Per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 @3
- Weight: 0.016 grams (Approximate)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen- and Antimony-Free, Green Device (Note 3)**
- **The AP7315Q is suitable for automotive applications requiring specific change control; this part is AEC-Q100 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

- 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.

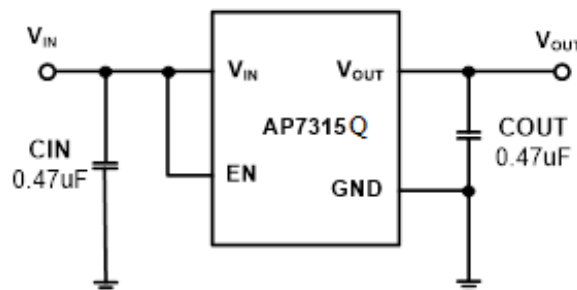
Pin Assignments



Applications

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

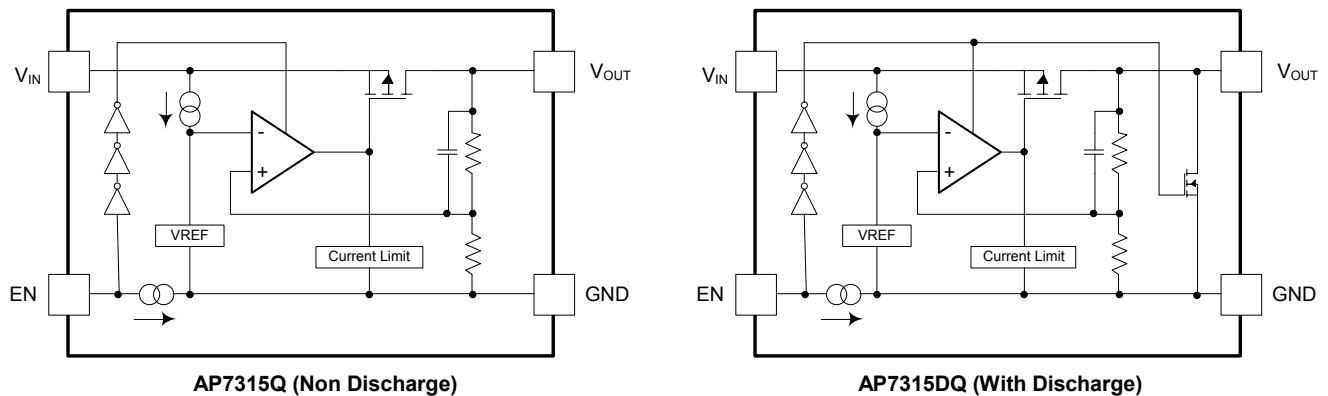
Typical Applications Circuit



Pin Descriptions

Pin Number	Pin Name	Function
1	V _{IN}	Power Input Pin
2	GND	Ground
3	EN	Enable Pin This pin should 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



Absolute Maximum Ratings (Note 4) (@ 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 EN	6.0	V
V _{OUT}	Output Voltage	-0.3 to V _{IN} +0.3	V
I _{OUT}	Output Current	300	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: 4. 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 periods can affect device reliability.
b). Ratings apply to ambient temperature at +25°C. The JEDEC High-K board design used to derive this data is a 2in. × 2in. multilayer board with 1oz. internal power and ground planes and 2oz. copper traces on the top and bottom of the board.

Recommended Operating Conditions (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage Range	1.7	5.25	V
I_{OUT}	Output Current	0	150	mA
T_J	Operating Junction Temperature	-40	+125	$^\circ\text{C}$
T_A	Operating Ambient Temperature (Note 5)	-40	+125	$^\circ\text{C}$

Note: 5. Ambient temperature range is subject to the junction temperature not exceeding 125°C .

Electrical Characteristics

(@ $T_A = +25^\circ\text{C}$, unless otherwise specified. $V_{EN} = V_{IN} = V_{OUT} + 1.0\text{V}$, $C_{IN} = C_{OUT} = 0.47\mu\text{F}$, $I_{OUT} = 1.0\text{mA}$)

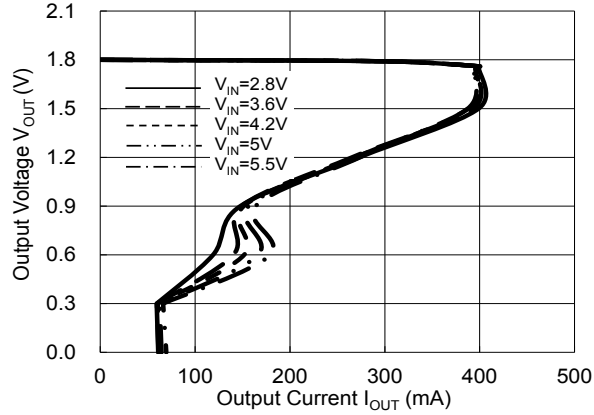
Parameter	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy (Note 6)	$V_{OUT} \geq 2.0\text{V}$, $V_{IN} = V_{OUT} + 1\text{V}$, $T_A = +25^\circ\text{C}$	$V_{OUT} \times 0.99$	V_{OUT}	$V_{OUT} \times 1.01$	V
	$V_{OUT} < 2.0\text{V}$, $V_{IN} = V_{OUT} + 1\text{V}$, $T_A = +25^\circ\text{C}$	$V_{OUT} - 20\text{mV}$	V_{OUT}	$V_{OUT} + 20\text{mV}$	V
Line Regulation ($dV_{OUT}/dV_{IN}/V_{OUT}$)	$V_{IN} = (V_{OUT} - \text{Nom} + 1.0\text{V})$ to 5.25V , $I_{OUT} = 1.0\text{mA}$	—	0.02	0.1	%/V
Load Regulation ($dV_{OUT}/V_{OUT}/dI_{OUT}$)	$V_{IN} = V_{OUT} - \text{Nom} + 1.0\text{V}$, $I_{OUT} = 1\text{mA}$ to 150mA	—	0.5	1.0	%/A
Quiescent Current (Note 7)	$I_{OUT} = 0\text{mA}$	20	35	60	μA
	$I_{OUT} = 150\text{mA}$	30	60	100	
I_{STANDBY}	$V_{EN} = 0\text{V}$ (Disabled)	—	0.01	1.0	μA
Output Current	—	150	—	—	mA
Fold-back Short Current (Note 8)	V_{OUT} Short to Ground	—	55	—	mA
PSRR (Note 9)	$V_{IN} = (V_{OUT} + 1\text{V})V_{DC} + 0.2V_{p-pAC}$, $V_{OUT} \geq 1.8\text{V}$, $I_{OUT} = 30\text{mA}$ $f = 1\text{kHz}$	—	75	—	dB
Output Noise Voltage (Notes 9, 10)	$BW = 10\text{Hz}$ to 100kHz , $I_{OUT} = 30\text{mA}$	—	60	—	μV_{rms}
Dropout Voltage (Note 11)	$I_{OUT} = 150\text{mA}$	$1.1\text{V} \leq V_{OUT} < 1.5\text{V}$	—	0.50	V
		$1.5\text{V} \leq V_{OUT} < 1.7\text{V}$	—	0.38	
		$1.7\text{V} \leq V_{OUT} < 2.0\text{V}$	—	0.34	
		$2.0\text{V} \leq V_{OUT} < 2.5\text{V}$	—	0.28	
		$2.5\text{V} \leq V_{OUT} < 2.8\text{V}$	—	0.22	
		$2.8\text{V} \leq V_{OUT} \leq 3.3\text{V}$	—	0.21	
Output Voltage Temperature Coefficient	$I_{OUT} = 30\text{mA}$, $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	—	± 30	—	ppm/ $^\circ\text{C}$
EN Input Low Voltage	—	0	—	0.5	V
EN Input High Voltage	—	1.3	—	5.25	V
EN Input Leakage	$V_{EN} = 0$, $V_{IN} = 5.0\text{V}$ or $V_{EN} = 5.0\text{V}$, $V_{IN} = 0\text{V}$	-1.0	—	+1.0	μA
On Resistance of N-channel for Auto-Discharge (Note 12)	$V_{IN} = 4.0\text{V}$, $V_{EN} = 0\text{V}$ (Disabled)	—	30	—	Ω
Thermal Resistance (Note 13) Junction to Ambient (Θ_{JA})	—	—	179	—	$^\circ\text{C}/\text{W}$
Junction to Case (Θ_{JC})	—	—	52	—	

- Notes:
- Potential multiple grades based on following output voltage accuracy.
 - Quiescent current is defined here is the difference in current between the input and the output.
 - Short circuit current is measured with V_{OUT} pulled to GND.
 - This specification is guaranteed by design.
 - To make sure lowest environment noise minimizes the influence on noise measurement.
 - Dropout voltage is the voltage difference between the input and the output at which the output voltage drops 2% below its nominal value
 - AP7315Q has 2 options for output, built-in discharge and non-discharge.
 - Thermal impedances measured on PCB of type and size with which top layer and bottom layer metal coverage

Typical Characteristics

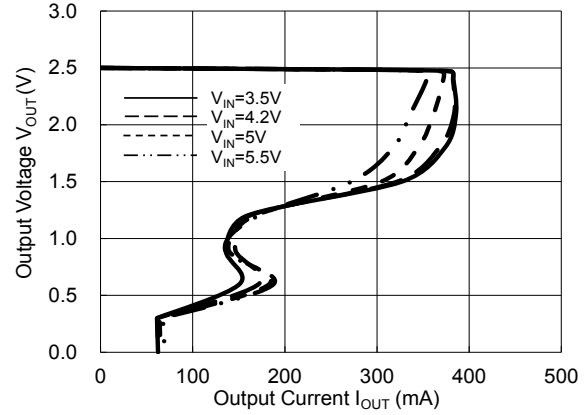
Output Voltage vs. Output Current

AP7315Q-18



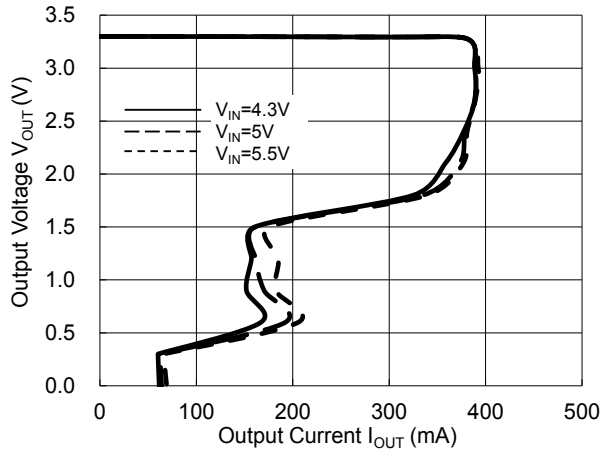
Output Voltage vs. Output Current

AP7315Q-25

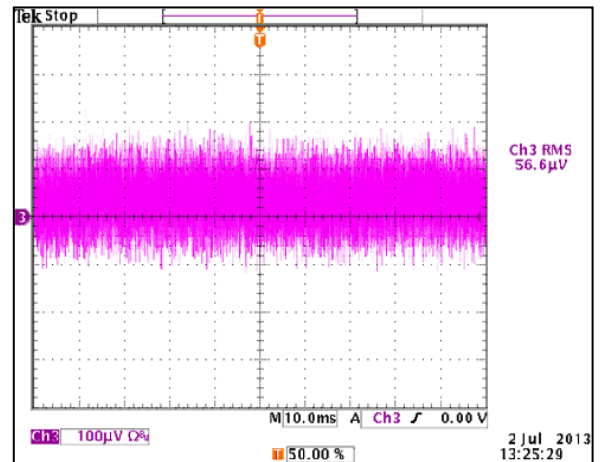


Output Voltage vs. Output Current

AP7315Q-33

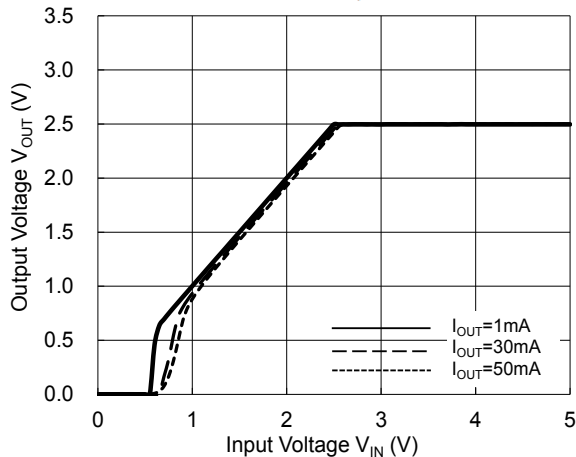


Output Noise (AP7315Q-33)



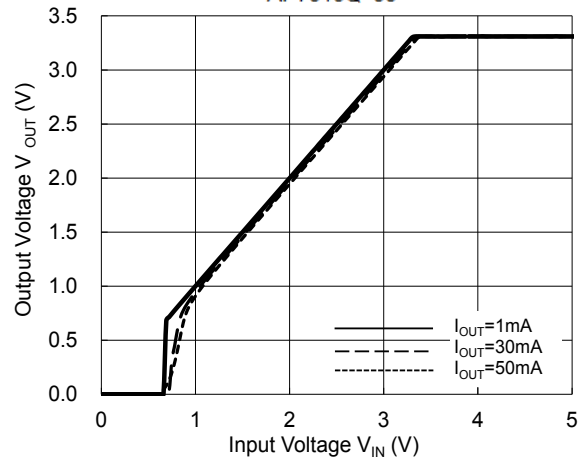
Output Voltage vs. Input Voltage

AP7315Q-25

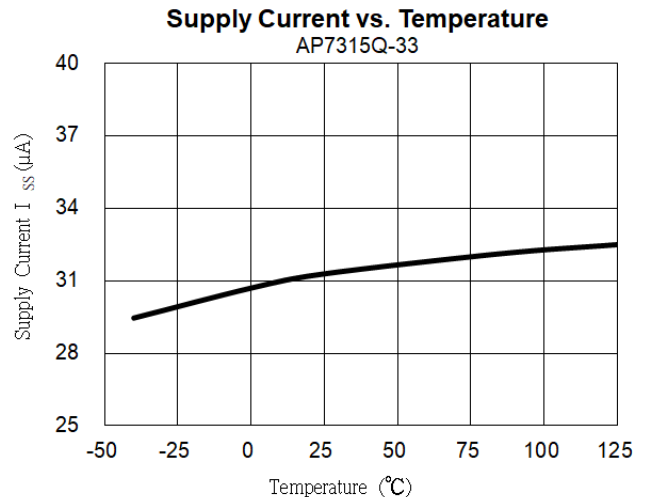
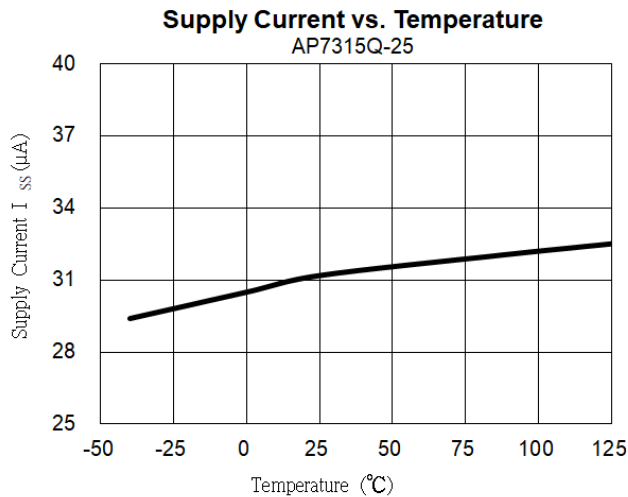
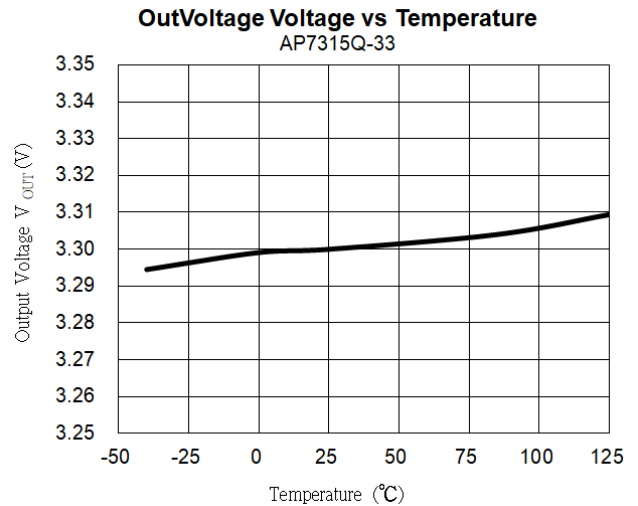
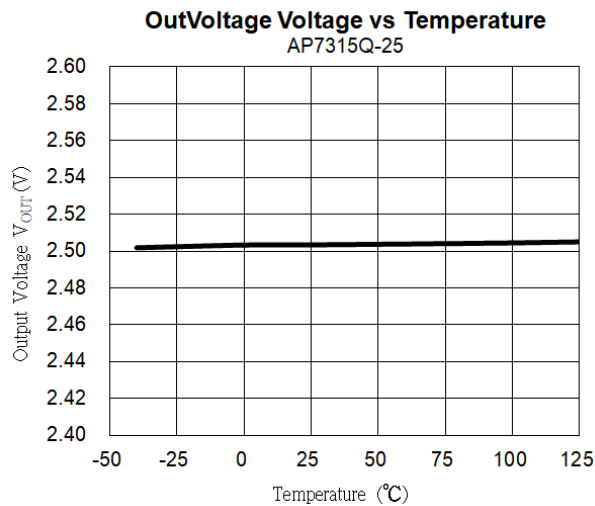
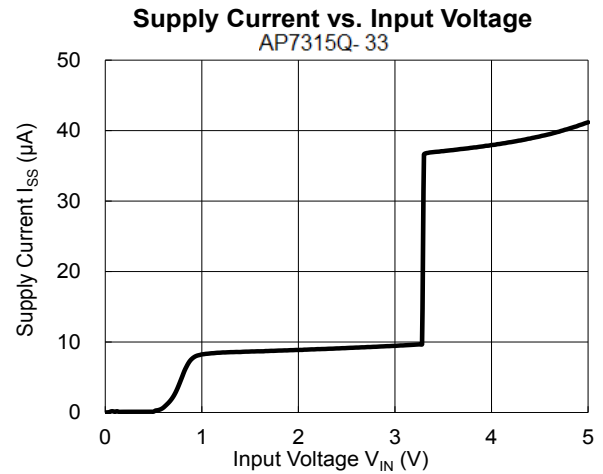
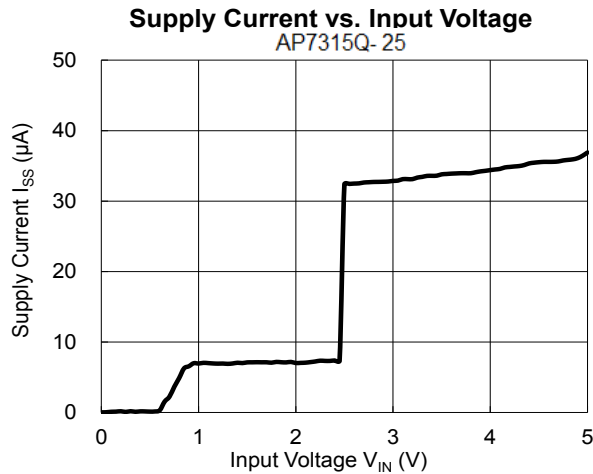


Output Voltage vs. Input Voltage

AP7315Q-33

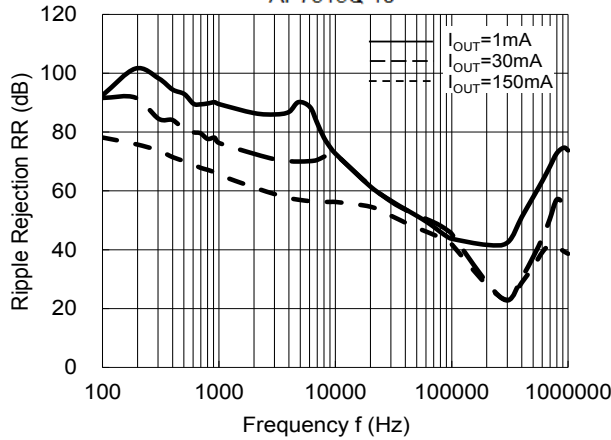


Typical Characteristics (continued)

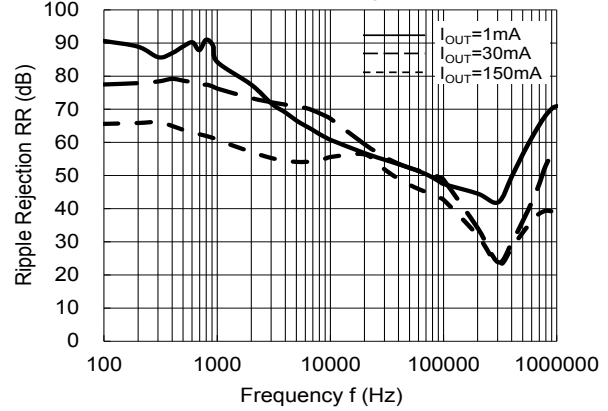


Typical Characteristics (cont.)

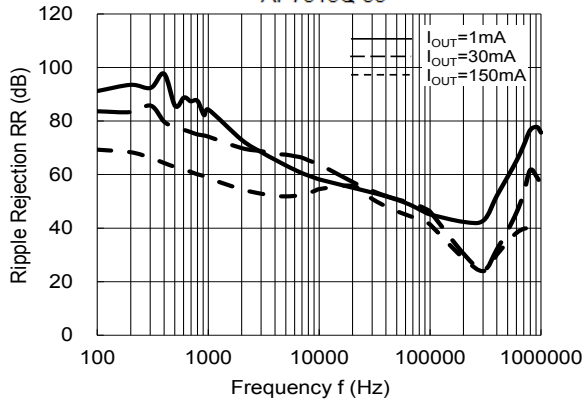
Ripple Rejection vs. Frequency
AP7315Q-18



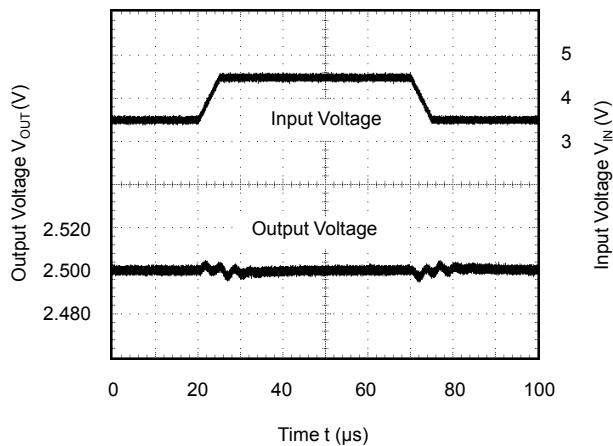
Ripple Rejection vs. Frequency
AP7315Q-25



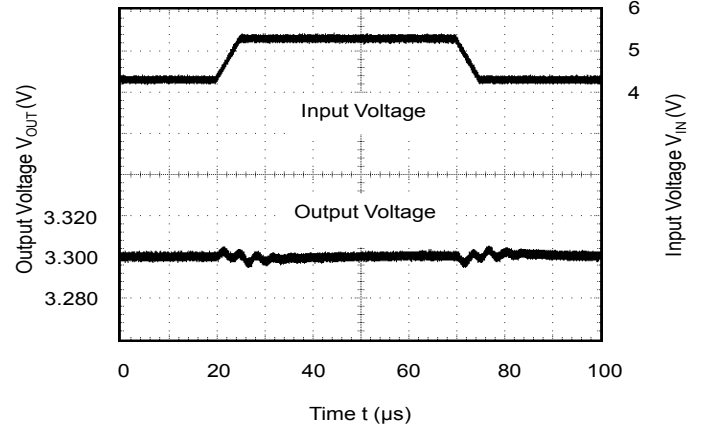
Ripple Rejection vs. Frequency
AP7315Q-33



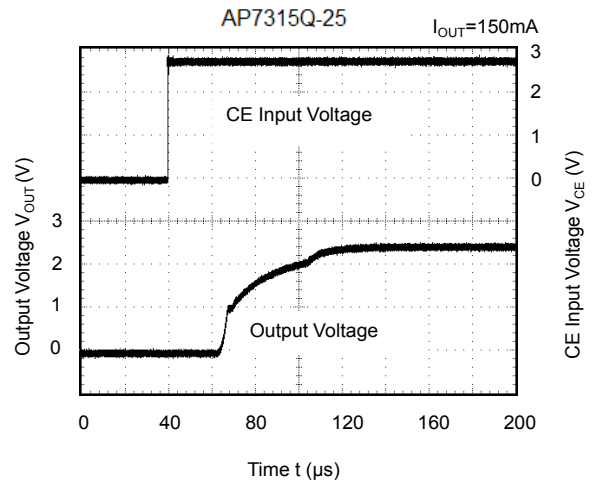
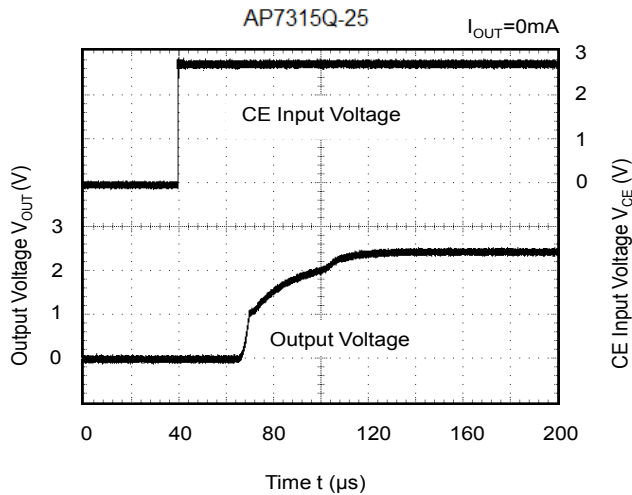
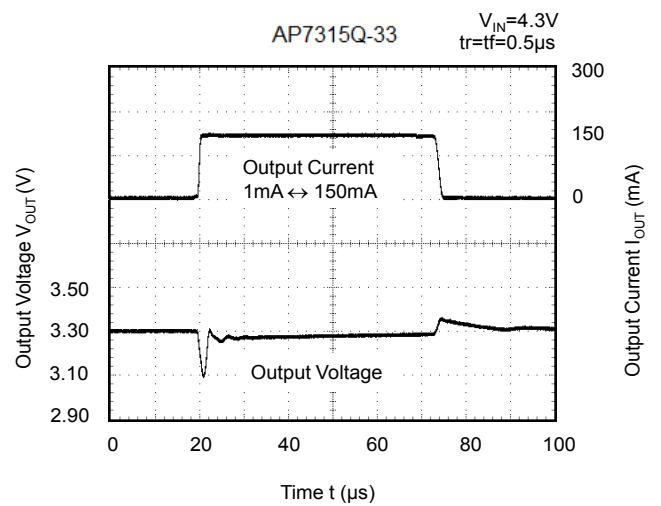
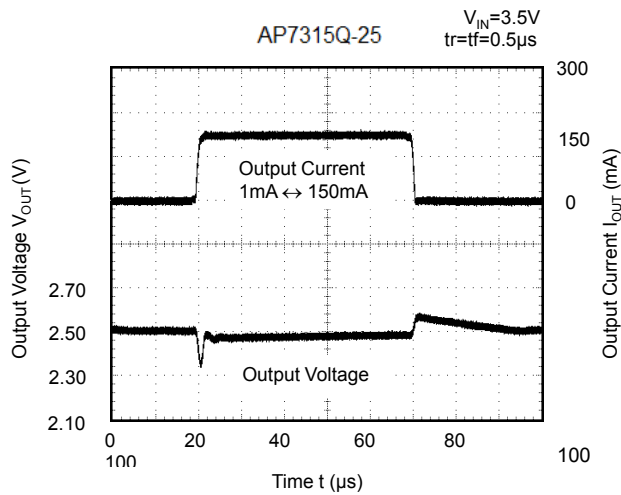
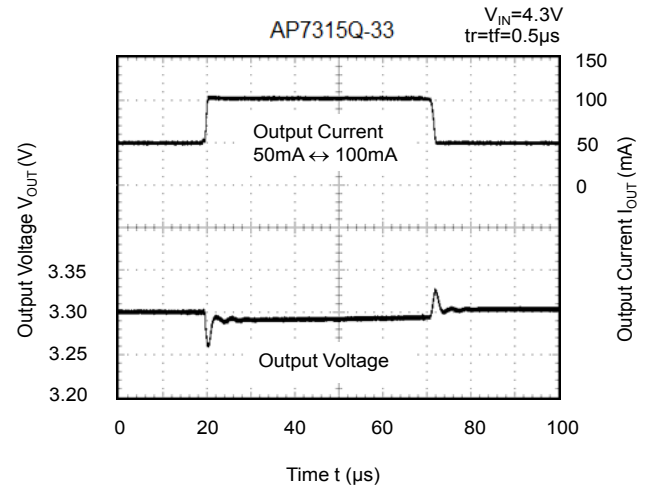
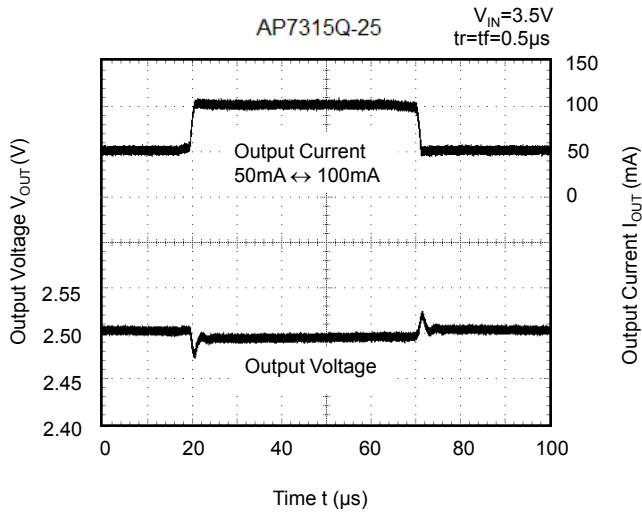
AP7315Q-25



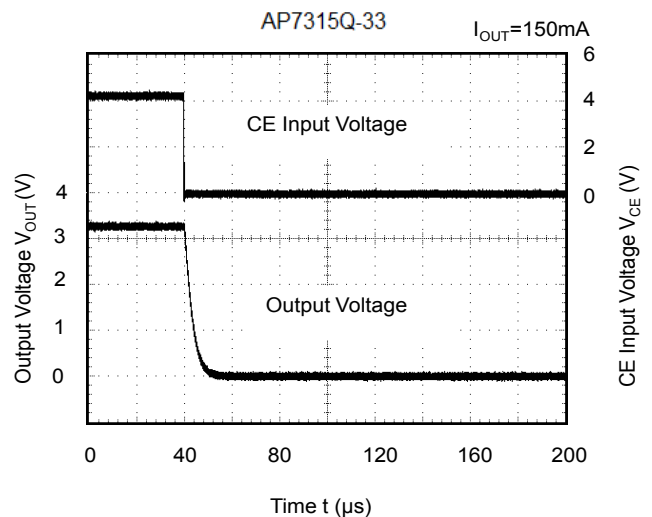
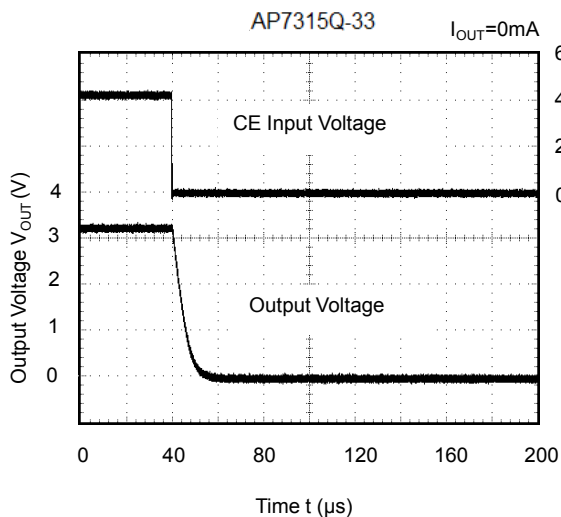
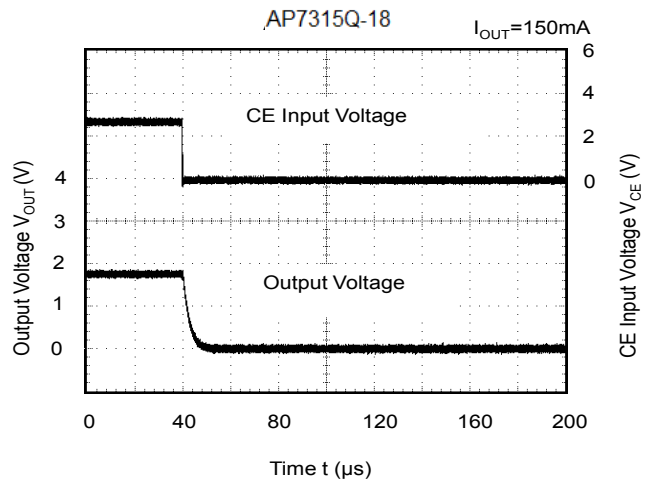
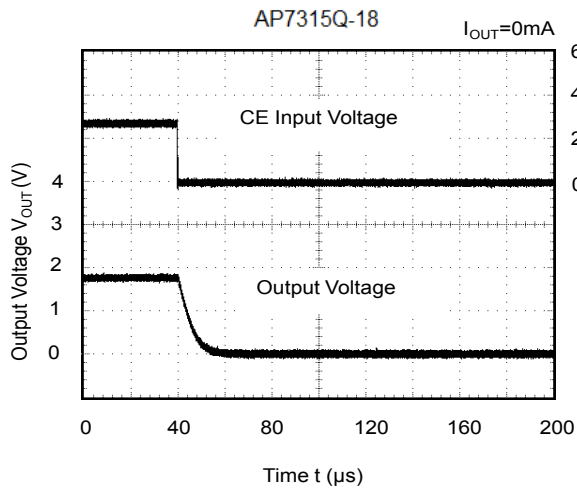
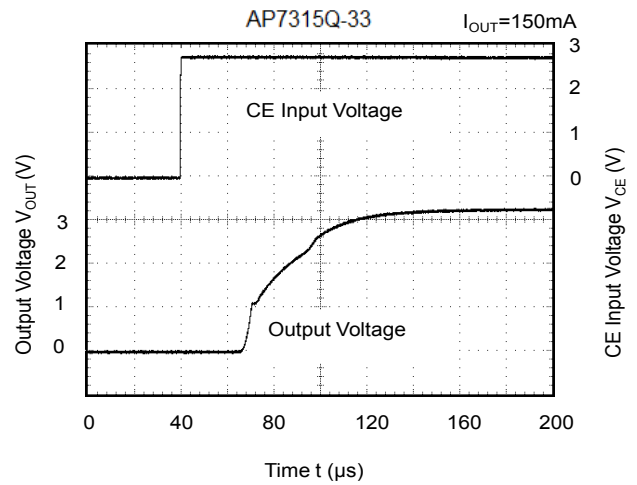
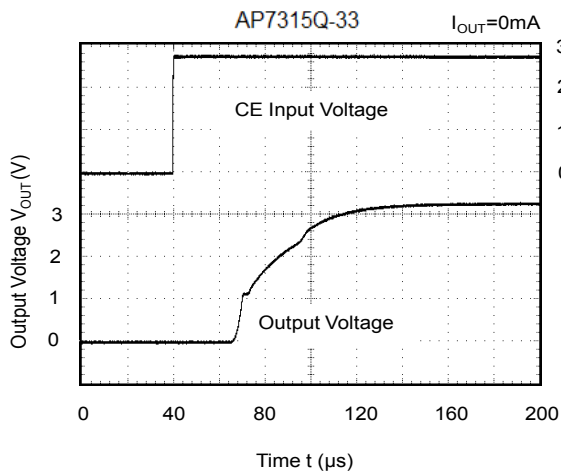
AP7315Q-33



Typical Characteristics (cont.)



Typical Characteristics (cont.)



Application Information

Output Capacitor

An output capacitor (C_{OUT}) is required to improve transient response and maintain stability. The AP7315Q 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. 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 $0.47\mu\text{F}$ 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 AP7315Q 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 the V_{IN} pin to keep the regulator output on at all time. 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 clamp the output current to approximately 60mA. This feature protects the regulator from over-current and damage due to overheating.

Layout Considerations

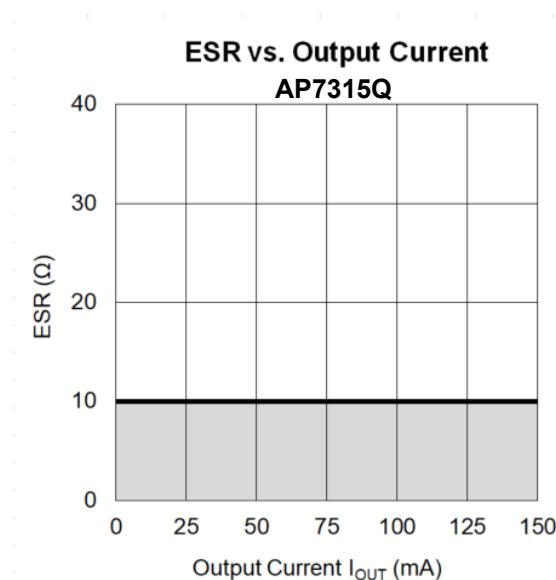
For good ground loop and stability, the input and output capacitors should be located close to the V_{IN} , V_{OUT} , and GND pins of the device. The regulator GND pin should be connected to the external circuit ground to reduce voltage drop caused by trace impedance. Ground plane is generally used to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

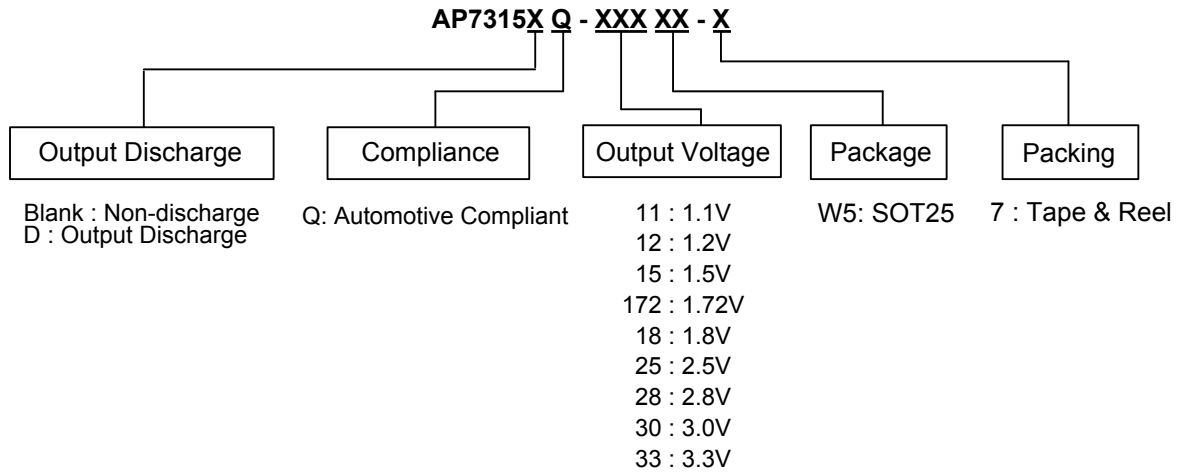
A ceramic type output capacitor is recommended for this series; however, other output capacitors with low ESR may also be used. The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown below. The stable region is marked as the hatched area in the graph.

Measurement Conditions:

Frequency Band: 10Hz to 2MHz, Temperature: -40°C to $+125^{\circ}\text{C}$



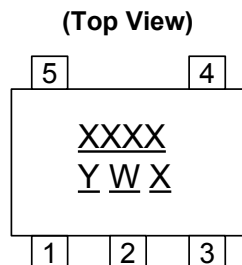
Ordering Information



Part Number (Note 15)	Compliance (Note 16)	Package Code	Packaging (Note 14)	7" Tape and Reel	
				Quantity	Part Number Suffix
AP7315Q-XXXW5-7	Automotive Compliant	W5	SOT25	3000/Tape & Reel	-7
AP7315DQ-XXXW5-7	Automotive Compliant	W5	SOT25	3000/Tape & Reel	-7

Note: 14. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.
 15. Other output voltage variants may be available in 100mV steps. For more information, please contact your local Diodes Sales representative.
 16. AP7315Q and AP7315DQ 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 http://www.diodes.com/quality/product_compliance_definitions/.
 See AP7315 datasheet for commercial qualified versions.

Marking Information



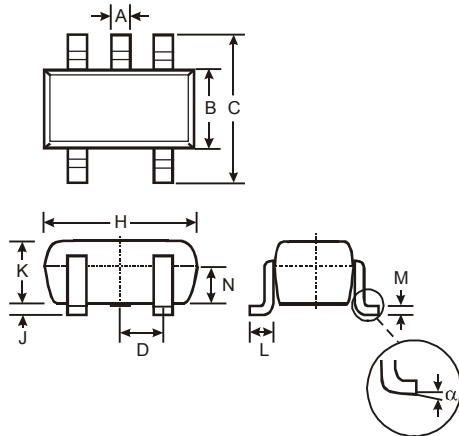
XXXX : Identification Code
Y : Year 0 to 9
W : Week : A to Z : 1 to 26 week;
 a to z : 27 to 52 week; z represents
 52 and 53 week
X : Internal Code

Part Number	Package	Identification Code
AP7315Q-11W5-7	SOT25	15AQ
AP7315Q-12W5-7	SOT25	15BQ
AP7315Q-15W5-7	SOT25	15DQ
AP7315Q-172W5-7	SOT25	15XQ
AP7315Q-18W5-7	SOT25	15EQ
AP7315Q-25W5-7	SOT25	15JQ
AP7315Q-28W5-7	SOT25	15MQ
AP7315Q-30W5-7	SOT25	15RQ
AP7315Q-33W5-7	SOT25	15UQ
AP7315DQ-11W5-7	SOT25	5DAQ
AP7315DQ-12W5-7	SOT25	5DBQ
AP7315DQ-15W5-7	SOT25	5DDQ
AP7315DQ-172W5-7	SOT25	5DYQ
AP7315DQ-18W5-7	SOT25	5DEQ
AP7315DQ-25W5-7	SOT25	5DJQ
AP7315DQ-28W5-7	SOT25	5DMQ
AP7315DQ-30W5-7	SOT25	5DSQ
AP7315DQ-33W5-7	SOT25	5DVQ

Package Outline Dimensions

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

SOT25

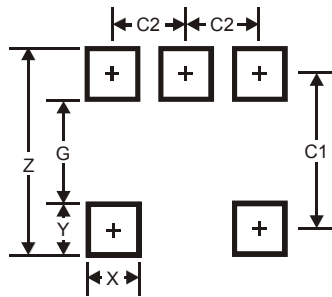


SOT25			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	-	-	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	-
All Dimensions in mm			

Suggested Pad Layout

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

SOT25



Dimensions	Value
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

IMPORTANT NOTICE

1. DIODES INCORPORATED AND ITS SUBSIDIARIES ("DIODES") MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).
2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes products. Diodes products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of the Diodes products for their intended applications, (c) ensuring their applications, which incorporate Diodes products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.
3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.
4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.
5. Diodes products are provided subject to Diodes' Standard Terms and Conditions of Sale (<https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/>) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.
6. Diodes products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.
7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.
8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

Copyright © 2020 Diodes Incorporated

www.diodes.com