Open-Drain Microprocessor Supervisory Circuit in 4-Lead SOT-143

ADM6315

FEATURES

- Specified over temperature
- Low power consumption (5 µA typical)
- Precision voltage monitor of voltages from 2.5 V to 5 V at 100 mV increments
- Reset assertion down to V_{CC} > 1 V
- Reset timeout periods: 1 ms, 20 ms, 140 ms, or 1120 ms (min)
- Built-in manual reset
- Pin compatible with the ADM811
- Available in SOT-143 package

APPLICATIONS

- Microprocessor systems
- Controllers
- Intelligent instruments
- Automotive systems
- Safety systems
- Portable instruments

FUNCTIONAL BLOCK DIAGRAM

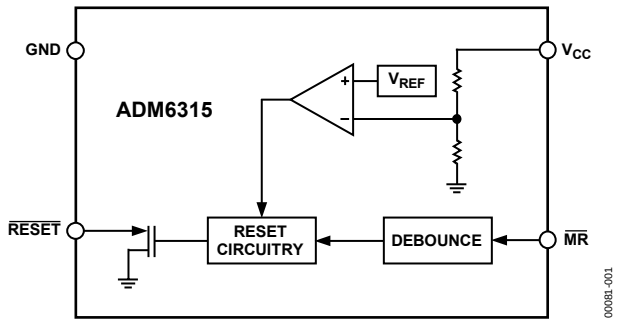

Figure 1.

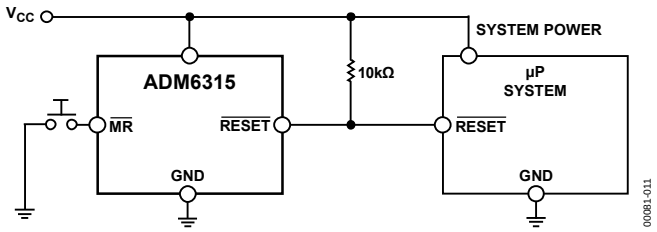

Figure 2. Typical Operating Circuit

GENERAL DESCRIPTION

The ADM6315 is a reliable voltage-monitoring device that is suitable for use in most voltage-monitoring applications.

The ADM6315 is designed to monitor as little as a 1.8% degradation of a power supply voltage. The ADM6315 can monitor all voltages (at 100 mV increments) from 2.5 V to 5 V.

Included in this circuit is a debounced manual reset input. $\overline{\text{RESET}}$ can be activated using an ordinary switch (pulling $\overline{\text{MR}}$ low), a low input from another digital device, or a degradation of the supply voltage.

The manual reset function is very useful, especially if the circuit in which the ADM6315 is operating enters into a state that can be detected only by the user. Allowing the user to reset a system manually can reduce the damage or danger that could otherwise be caused by an out-of-control or locked-up system.

The ADM6315 comes in a cost- and space-efficient SOT-143 package.

Rev. D

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REVISION HISTORY

4/06—Rev. C to Rev. D

Updated Format ..... Universal
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12/03—Rev. B to Rev. C

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2/03—Rev. A to Rev. B

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10/01—Rev. 0 to Rev. A

Edits to Table III 7
Edits to Table IV 7

1999—Revision 0: Initial Version

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SPECIFICATIONS

V_{CC} = full operating range, $T_A = T_{MIN}$ to T_{MAX}, V_{CC} typical = 5 V, unless otherwise noted.

Table 1.

Parameter	Min	Typ	Max	Unit	Test Conditions/Comments
SUPPLY					
Operating Voltage	1		5.5	V	T_A = −40°C to +85°C
V_{CC} Supply Current		5	12	µA	V_{CC} = 5.5 V, no load, T_A = −40°C to +85°C
			15	µA	V_{CC} = 5.5 V, no load, T_A = −40°C to +125°C
		4	10	µA	V_{CC} = 3.6 V, no load, T_A = −40°C to +85°C
			12	µA	V_{CC} = 3.6 V, no load, T_A = −40°C to +125°C
$\overline{\text{RESET}}$ VOLTAGE THRESHOLD (V_{TH})	V_{TH} − 1.8%	V_{TH}	V_{TH} + 1.8%	V	T_A = 25°C
	V_{TH} − 2.5%		V_{TH} + 2.5%	V	T_A = −40°C to +85°C
	V_{TH} − 3.5%		V_{TH} + 3.5%	V	T_A = −40°C to +125°C
$\overline{\text{RESET}}$ THRESHOLD TEMPERATURE COEFFICIENT		60		ppm/°C	
V_{CC} TO RESET DELAY		35		µs	V_{CC} = falling at 1 mV/µs
$\overline{\text{RESET}}$ ACTIVE TIMEOUT PERIOD					
ADM6315xxD1	1	1.4	2	ms	T_A = −40°C to +85°C
	0.8		2.4	ms	T_A = −40°C to +125°C
ADM6315xxD2	20	28	40	ms	T_A = −40°C to +85°C
	16		48	ms	T_A = −40°C to +125°C
ADM6315xxD3	140	200	280	ms	T_A = −40°C to +85°C
	112		336	ms	T_A = −40°C to +125°C
ADM6315xxD4	1120	1570	2240	ms	T_A = −40°C to +85°C
	896		2688	ms	T_A = −40°C to +125°C
MANUAL RESET					
Input Threshold	0.8			V	V_{TH} > 4 V (V_{IL})
			2.4	V	V_{TH} > 4 V (V_{IH})
	0.3 × V_{CC}			V	V_{TH} < 4 V (V_{IL})
			0.7 × V_{CC}	V	V_{TH} < 4 V (V_{IH})
Minimum Input Pulse	1			µs	
Glitch Rejection		100		ns	
To Reset Delay		500		ns	
Pull-Up Resistance	32	63	100	kΩ	
$\overline{\text{RESET}}$ OUTPUT					
Output Voltage			0.4	V	V_{CC} > 4.25 V, I_{SINK} = 3.2 mA
			0.3	V	V_{CC} > 2.5 V, I_{SINK} = 1.2 mA
			0.3	V	V_{CC} > 1 V, I_{SINK} = 80 µA
Output Leakage Current			1	µA	V_{CC} > V_{TH}, $\overline{\text{RESET}}$ deasserted

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ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 2.

Parameter	Rating
Terminal Voltage (With Respect to Ground)	
V_{CC}	−0.3 V to +6 V
All Other Inputs	−0.3 V to +6 V
Input Current	
V_{CC}	20 mA
Output Current	
$\overline{RESET}$	20 mA
Power Dissipation (T_A = 70°C)	
RA-4 (SOT-143)	
Derate by 4 mW/°C Above 70°C	320 mW
θ_{JA} Thermal Impedance	330°C/W
Operating Temperature Range	−40°C to +125°C
Storage Temperature Range	−65°C to +160°C
Lead Temperature (Soldering, 10 sec)	300°C
Vapor Phase (60 sec)	215°C
Infrared (15 sec)	220°C
ESD Rating	2.5 kV

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

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PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

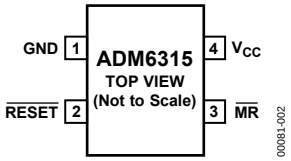

Figure 3.

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	GND	Ground Reference for All Signals. 0 V.
2	$\overline{\text{RESET}}$	Active Low Logic Output. $\overline{\text{RESET}}$ remains low while V_{CC} is below the reset threshold or when $\overline{\text{MR}}$ is low. $\overline{\text{RESET}}$ then remains low for a minimum of 1 ms, 20 ms, 140 ms, or 1120 ms after V_{CC} rises above the reset threshold and $\overline{\text{MR}}$ is high.
3	$\overline{\text{MR}}$	Manual Reset. This active low debounced input ignores input pulses of 100 ns (typical) and is guaranteed to accept input pulses of greater than 1 µs. Leave floating when not used.
4	V_{CC}	Monitored Supply Voltage.

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TYPICAL PERFORMANCE CHARACTERISTICS

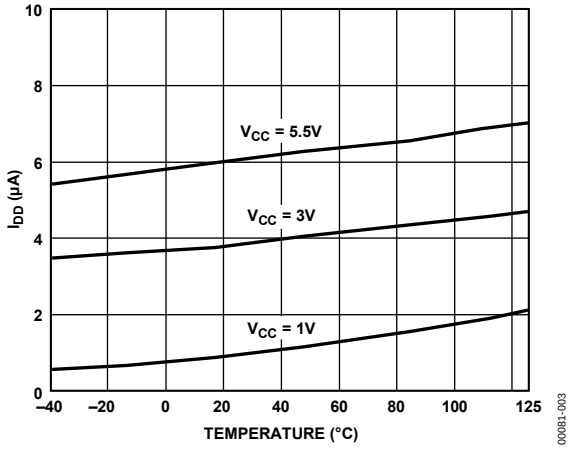

Figure 4. Supply Current vs. Temperature

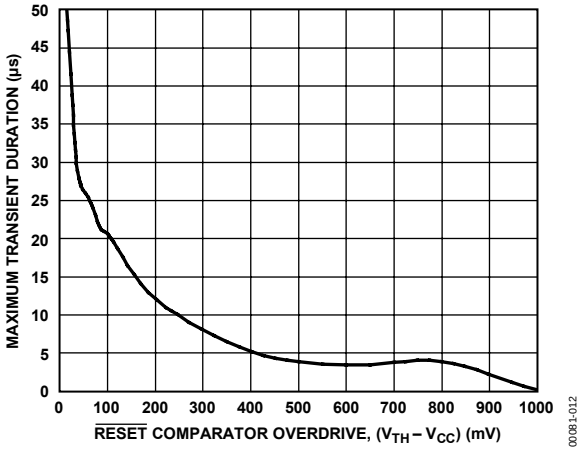

Figure 7. Maximum Transient Duration vs. $\overline{RESET}$ Comparator Overdrive

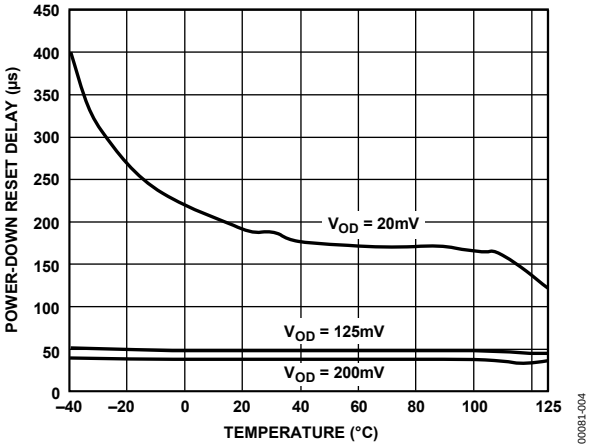

Figure 5. Power-Down Reset Delay vs. Temperature

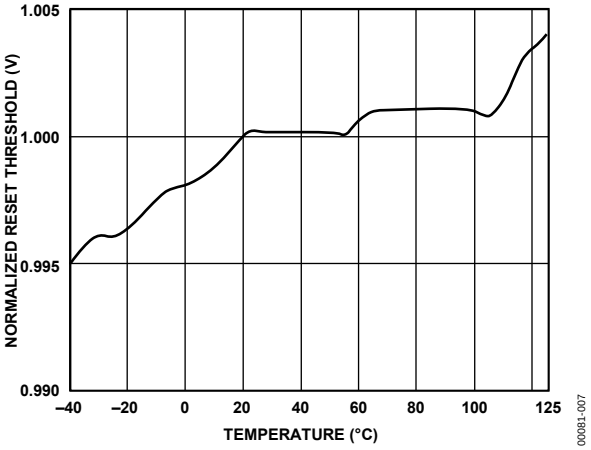

Figure 8. Normalized Reset Threshold vs. Temperature (V_{CC} Falling)

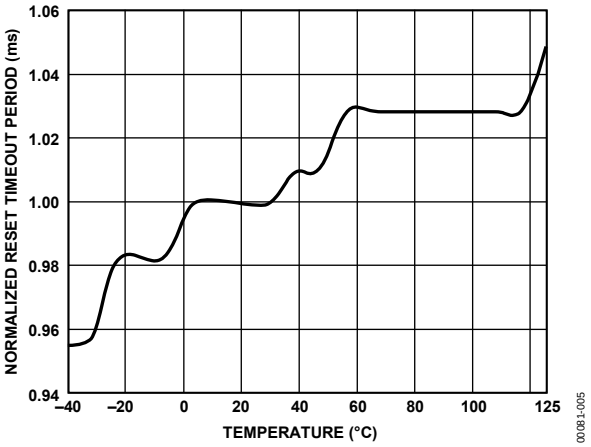

Figure 6. Normalized Reset Timeout Period vs. Temperature (V_{CC} Rising)

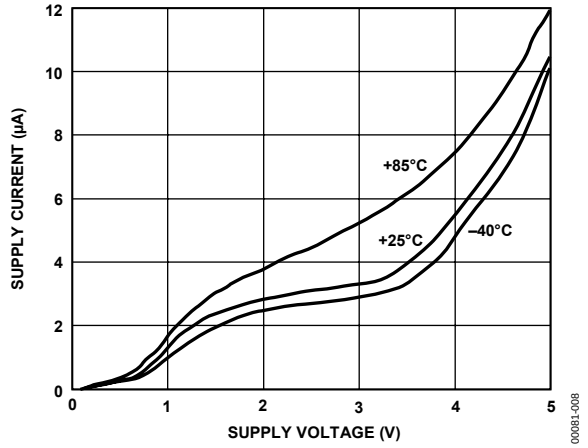

Figure 9. Supply Current vs. Supply Voltage

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THEORY OF OPERATION

INTERFACING TO OTHER DEVICES' OUTPUT

The ADM6315 series is designed to integrate with as many devices as possible. One feature of the ADM6315 is the $\overline{\text{RESET}}$ open-drain output, which can sink current from sources with a voltage greater than the V_{CC} of the ADM6315 input, making it suitable for use in more diverse applications.

BENEFITS OF A VERY ACCURATE $\overline{\text{RESET}}$ THRESHOLD

Because the ADM6315 series can operate effectively even when there are large degradations of the supply voltages (due to an accurate internal voltage reference circuit), the possibility of a malfunction during a power failure is greatly reduced.

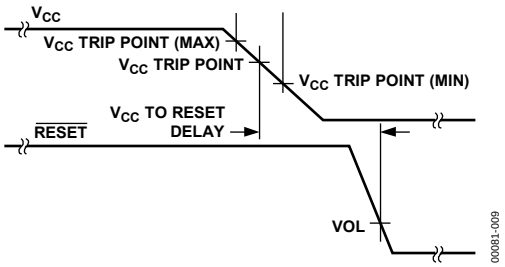

Figure 10. V_{CC} Power-Down/Brownout Timing Diagram

DETAILED DESCRIPTION

The ADM6315 is designed to protect the integrity of a system's operation by ensuring the proper operation of the system during power-up, power-down, and brownout conditions.

When the ADM6315 is powered up, the $\overline{\text{RESET}}$ output of the ADM6315 remains low for a period typically equal to the $\overline{\text{RESET}}$ active timeout period. This is designed to give the system time to power up correctly and for the power supply to stabilize before any devices are brought out of reset and allowed to begin executing instructions. Initializing a system in this way provides a more reliable startup for microprocessor systems.

When a brownout condition occurs (assuming V_{CC} is falling at 1 mV/µs), the ADM6315 produces a reset in typically 35 µs. Producing a reset this fast means that the entire system can be reset together before any part of the system's voltage falls below its recommended operating voltage. This can avoid dangerous and/or erroneous operation of a microprocessor-based system.

MANUAL RESET INPUT

The ADM6315 also provides an additional input, $\overline{\text{MR}}$. This input can be used either as a means for the system operator to reset the system manually via a switch or for a digital circuit to reset the system.

The $\overline{\text{MR}}$ input (typically) ignores negative-going pulses that are faster than 100 ns, and it is guaranteed to accept any negative-going input pulse of a duration greater than or equal to 1 µs. If $\overline{\text{MR}}$ is connected to long cables or is used in a noisy environment, placing a 1 µF decoupling capacitor between the $\overline{\text{MR}}$ input and ground further improves the glitch immunity of the ADM6315.

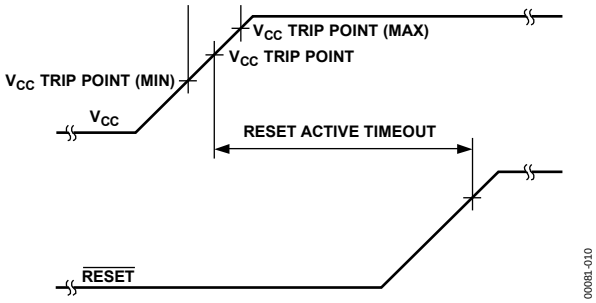

Figure 11. V_{CC} Power-Up Timing Diagram

TRANSIENT IMMUNITY

As well as being an accurate reset circuit, the ADM6315 has good immunity from negative-going transients (see Figure 7). Because of this characteristic, the ADM6315 is suitable for use in noisy environments.

Figure 7 shows the $\overline{\text{RESET}}$ comparator overdrive (the maximum magnitude of negative-going pulses with respect to the typical reset threshold) vs. the pulse duration without a reset.

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OUTLINE DIMENSIONS

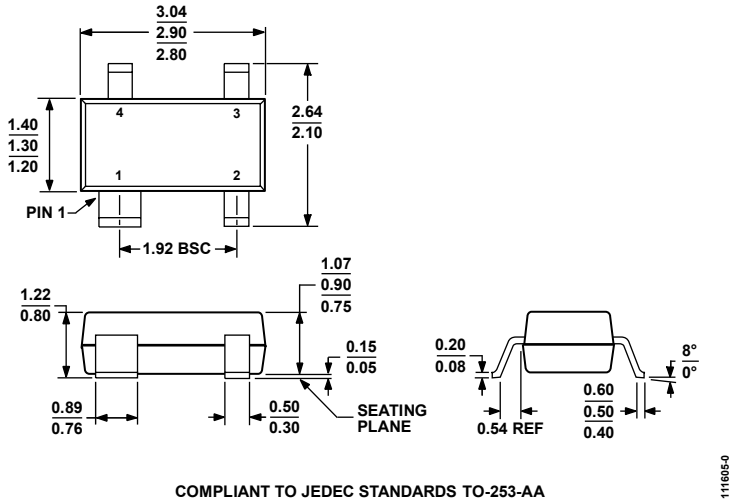

Figure 12. 4-Lead Small Outline Transistor Package [SOT-143]
(RA-4)
Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Trip Point	Minimum Timeout (ms)	Branding
ADM6315-46D1ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	1	MDV
ADM6315-46D1ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	1	MDV
ADM6315-45D1ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	1	MDU
ADM6315-45D1ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	1	MDU
ADM6315-45D1ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	1	M81
ADM6315-44D1ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	1	MDT
ADM6315-44D1ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	1	MDT
ADM6315-31D1ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	1	MDG
ADM6315-31D1ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	1	MDG
ADM6315-31D1ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	1	M7X
ADM6315-31D1ARTZRL[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	1	M7X
ADM6315-29D1ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	1	MDC
ADM6315-29D1ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	1	MDC
ADM6315-29D1ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	1	M7T
ADM6315-26D1ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	1	MDB
ADM6315-26D1ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	1	MDB
ADM6315-26D1ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	1	MDB#
ADM6315-26D1ARTZRL[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	1	MDB#
ADM6315-46D2ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	20	MEV
ADM6315-46D2ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	20	MEV
ADM6315-46D2ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	20	M83
ADM6315-45D2ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	20	MEU
ADM6315-45D2ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	20	MEU
ADM6315-44D2ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	20	MET
ADM6315-44D2ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	20	MET
ADM6315-44D2ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	20	M80
ADM6315-31D2ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	20	MEG
ADM6315-31D2ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	20	MEG
ADM6315-31D2ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	20	M7Y
ADM6315-31D2ARTZRL[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	20	M7Y

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Model	Temperature Range	Package Description	Package Option	Trip Point	Minimum Timeout (ms)	Branding
ADM6315-29D2ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	20	MEC
ADM6315-29D2ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	20	MEC
ADM6315-29D2ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	20	M7U
ADM6315-26D2ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	20	MEB
ADM6315-26D2ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	20	MEB
ADM6315-26D2ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	20	MEB#
ADM6315-26D2ARTZRL[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	20	MEB#
ADM6315-46D3ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	140	MFV
ADM6315-46D3ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	140	MFV
ADM6315-46D3ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	140	M84
ADM6315-45D3ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	140	MFU
ADM6315-45D3ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	140	MFU
ADM6315-45D3ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	140	M82
ADM6315-44D3ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	140	MFT
ADM6315-44D3ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	140	MFT
ADM6315-44D3ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	140	MFT#
ADM6315-44D3ARTZRL[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	140	MFT#
ADM6315-31D3ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	140	MFG
ADM6315-31D3ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	140	MFG
ADM6315-31D3ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	140	M4G
ADM6315-31D3ARTZRL[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	140	M4G
ADM6315-29D3ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	140	MFC
ADM6315-29D3ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	140	MFC
ADM6315-29D3ARTZRL7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	140	M7V
ADM6315-26D3ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	140	MFB
ADM6315-26D3ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	140	MFB
ADM6315-26D3ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	140	MFB#
ADM6315-26D3ARTZRL[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	140	MFB#
ADM6315-46D4ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	1120	MGV
ADM6315-46D4ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	1120	MGV
ADM6315-46D4ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.63	1120	M85
ADM6315-45D4ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	1120	MGU
ADM6315-45D4ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.50	1120	MGU
ADM6315-44D4ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	1120	MGT
ADM6315-44D4ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	1120	MGT
ADM6315-44D4ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	1120	M9H
ADM6315-44D4ARTZRL[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	4.39	1120	M9H
ADM6315-31D4ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	1120	MGG
ADM6315-31D4ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	1120	MGG
ADM6315-31D4ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	3.08	1120	M7Z
ADM6315-29D4ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	1120	MGC
ADM6315-29D4ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	1120	MGC
ADM6315-29D4ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.93	1120	M7W
ADM6315-26D4ARTRL7	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	1120	MGB
ADM6315-26D4ART-RL	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	1120	MGB
ADM6315-26D4ARTZR7[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	1120	MGB#
ADM6315-26D4ARTZRL[1]	−40°C to +125°C	4-Lead Small Outline Transistor [SOT-143]	RA-4	2.63	1120	MGB#

[1] Z = Pb-free part, # denotes lead-free product may be top or bottom marked.

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