Ultralow Power, 3-Lead, SOT-23 Microprocessor Reset Circuits

ADM6326/ADM6328/ADM6346/ADM6348

FEATURES

- Ultralow supply current of 1 µA maximum (ADM6326/ADM6328)
- Accurate monitoring of 2.5 V, 3 V, 3.3 V, and 5 V rails
- Reset thresholds available in increments from 2.2 V to 4.63 V
- Glitch immunity from negative-going V_{CC} transients
- 2 reset output options
  - Push-pull $\overline{\text{RESET}}$ (ADM6326/ADM6346)
  - Open-drain $\overline{\text{RESET}}$ (ADM6328/ADM6348)
- Minimum reset timeout of 100 ms
- Operating temperature range of −40°C to +85°C
- 3-lead SOT-23 package

APPLICATIONS

- Telecommunications
- Microprocessor systems
- Desktop and notebook computers
- Portable equipment

FUNCTIONAL BLOCK DIAGRAMS

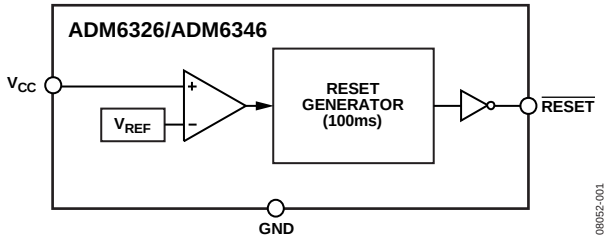

Figure 1.

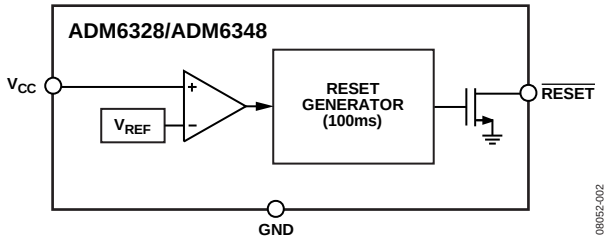

Figure 2.

GENERAL DESCRIPTION

The ADM6326/ADM6328/ADM6346/ADM6348 devices provide low cost solutions for protecting sensitive circuitry, such as microprocessor and telecommunications circuitry.

With built-in glitch immunity, ultralow supply currents, and 24 reset threshold voltage options, the ADM6326/ADM6328/ADM6346/ADM6348 not only ensure that systems are immune to fast transients on V_{CC}, but also that the devices are suitable for monitoring a variety of supply voltages in low power, portable equipment.

These devices provide a reset output during power-up, power-down, and brownout conditions. On power-up, an internal timer holds $\overline{\text{RESET}}$ asserted for at least 100 ms. This holds the microprocessor in a reset state until conditions have stabilized. The reset output remains operational with V_{CC} as low as 1 V.

The ADM6326 and ADM6346 have an active low push-pull reset output. The ADM6328 and ADM6348 have an active low open-drain reset output, which requires an external pull-up resistor. The ADM6326 and ADM6328 offer a choice of ten reset thresholds in increments between 2.2 V and 3.08 V, whereas the ADM6346 and ADM6348 offer a choice of 14 reset thresholds between 3.3 V and 4.63 V.

These devices are available in a 3-lead SOT-23 package and operate over the extended temperature range of −40°C to +85°C.

Rev. 0
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REVISION HISTORY

9/09—Revision 0: Initial Version

SPECIFICATIONS

T_A = −40°C to +85°C, unless otherwise noted. Typical values are at T_A = 25°C and V_{CC} = 3 V. Overtemperature limits are guaranteed by design.

Table 1.

Parameter	Min	Typ	Max	Unit	Test Conditions/Comments
OPERATING VOLTAGE RANGE, V_{CC}	1.0		5.5	V	
INPUT CURRENT, I_{CC}		0.5	1.0	µA	ADM6326/ADM6328 only, V_{CC} = 3.0 V for $V_{TH} \leq$ 2.93 V, V_{CC} = 3.2 V for V_{TH} > 2.93 V, no load
		1.0	1.75	µA	V_{CC} = 5.5 V, no load
RESET THRESHOLD					
Threshold Voltage, V_{TH} (See Table 2)	V_{TH} − 2.5%	V_{TH}	V_{TH} + 2.5%	V	
	V_{TH} − 1.5%	V_{TH}	V_{TH} + 1.5%	V	T_A = 25°C
Temperature Coefficient		40		ppm/°C	
Hysteresis					
ADM6326/ADM6328		6.3		mV	
ADM6346/ADM6348		9.5		mV	
TIMING CHARACTERISTICS					
V_{CC} to Reset Delay (t_{RD})		20		µs	V_{CC} = V_{TH} to (V_{TH} − 100 mV)
Reset Active Timeout Period (t_{RP})	100	185	280	ms	
$\overline{\text{RESET}}$ OUTPUT VOLTAGE LOW, V_{OL}			0.3	V	V_{CC} > 2.1 V, I_{SINK} = 1.6 mA, reset asserted
			0.4	V	$V_{CC} \geq$ 1.2 V, I_{SINK} = 100 µA, reset asserted
$\overline{\text{RESET}}$ OUTPUT VOLTAGE HIGH, V_{OH}	0.8 × V_{CC}			V	ADM6326 only, V_{CC} = 3.2 V, I_{SOURCE} = 500 µA
	0.8 × V_{CC}			V	ADM6326/ADM6346 only, V_{CC} = 4.5 V, I_{SOURCE} = 800 µA, $V_{TH} \leq$ 4.38 V
	0.8 × V_{CC}			V	ADM6326/ADM6346 only, V_{CC} = $V_{TH(MAX)}$, I_{SOURCE} = 800 µA, $V_{TH} \geq$ 4.5 V
OPEN-DRAIN $\overline{\text{RESET}}$ OUTPUT LEAKAGE CURRENT			0.1	µA	

Table 2. Reset Threshold Voltage

	T_A = 25°C			T_A = −40°C to +85°C		
Parameter	Min	Typ	Max	Min	Max	Unit
RESET THRESHOLD VOLTAGE (V_{TH})						
ADM632x-22	2.167	2.2	2.233	2.145	2.25	V
ADM632x-23	2.285	2.32	2.355	2.262	2.375	V
ADM632x-24	2.364	2.4	2.436	2.34	2.46	V
ADM632x-25	2.462	2.5	2.537	2.437	2.562	V
ADM632x-26	2.591	2.63	2.669	2.564	2.696	V
ADM632x-27	2.66	2.7	2.741	2.633	2.768	V
ADM632x-28	2.758	2.8	2.842	2.73	2.87	V
ADM632x-29	2.886	2.93	2.974	2.857	3.0	V
ADM632x-30	2.955	3.00	3.045	2.925	3.075	V
ADM632x-31	3.034	3.08	3.126	3.003	3.15	V
ADM634x-33	3.25	3.3	3.35	3.217	3.383	V
ADM634x-34	3.349	3.4	3.451	3.315	3.485	V
ADM634x-35	3.447	3.5	3.552	3.412	3.587	V
ADM634x-36	3.546	3.6	3.654	3.51	3.69	V
ADM634x-37	3.644	3.7	3.755	3.607	3.792	V
ADM634x-38	3.743	3.8	3.857	3.705	3.895	V
ADM634x-39	3.841	3.9	3.958	3.802	3.997	V
ADM634x-40	3.94	4.0	4.06	3.9	4.1	V
ADM634x-41	4.038	4.1	4.161	3.997	4.202	V
ADM634x-42	4.137	4.2	4.263	4.095	4.305	V
ADM634x-43	4.235	4.3	4.364	4.192	4.407	V
ADM634x-44	4.314	4.38	4.446	4.27	4.489	V
ADM634x-45	4.432	4.5	4.567	4.387	4.612	V
ADM634x-46	4.56	4.63	4.699	4.514	4.746	V

ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
Supply Voltage, V_{CC}	−0.3 V to +6 V
Input Current, I_{CC}	20 mA
Output Voltage	
Push-Pull $\overline{RESET}$	−0.3 V to (V_{CC} + 0.3 V)
Open-Drain $\overline{RESET}$	−0.3 V to +6 V
Output Current ($\overline{RESET}$)	20 mA
Rate of Rise of V_{CC}	100 V/µs
Temperature	
Storage	−65°C to +155°C
Operating	−40°C to +85°C
Soldering (10 sec)	300°C

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.

THERMAL RESISTANCE

θ_{JA} is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages.

Table 4. Thermal Resistance

Package Type	θ_{JA}	Unit
3-Lead SOT-23	270	°C/W

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

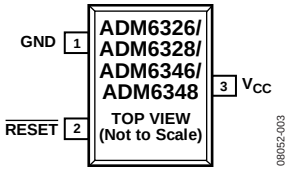


Figure 3. ADM6326/ADM6328/ADM6346/ADM6348 Pin Configuration

Table 5. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	GND	Ground Reference for All Signals; 0 V.
2	$\overline{\text{RESET}}$	Active Low Logic Output. This pin is low when V_{CC} is less than the reset threshold; it remains low for 185 ms (typical) after V_{CC} becomes greater than the reset threshold.
3	V_{CC}	Supply Voltage Being Monitored.

TYPICAL PERFORMANCE CHARACTERISTICS

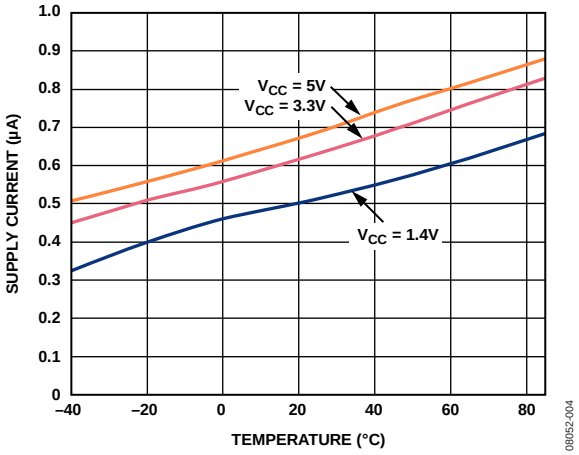


Figure 4. Supply Current vs. Temperature

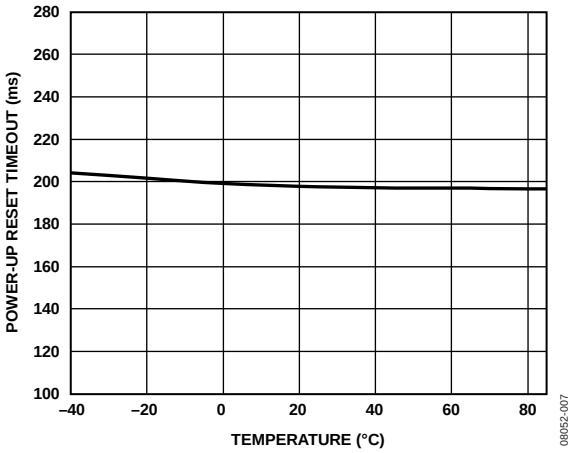


Figure 6. Power-Up Reset Timeout vs. Temperature

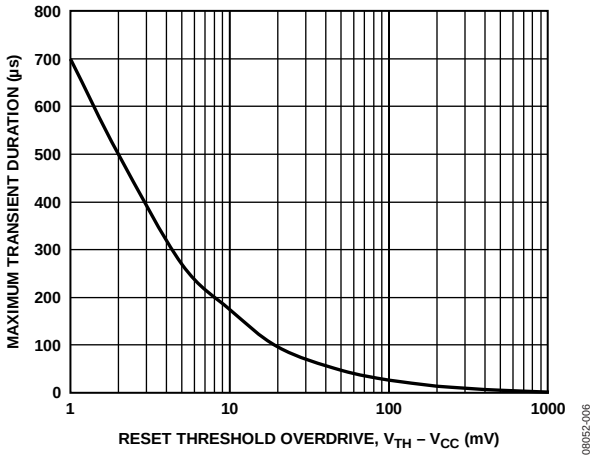


Figure 5. Maximum Transient Duration vs. Reset Threshold Overdrive

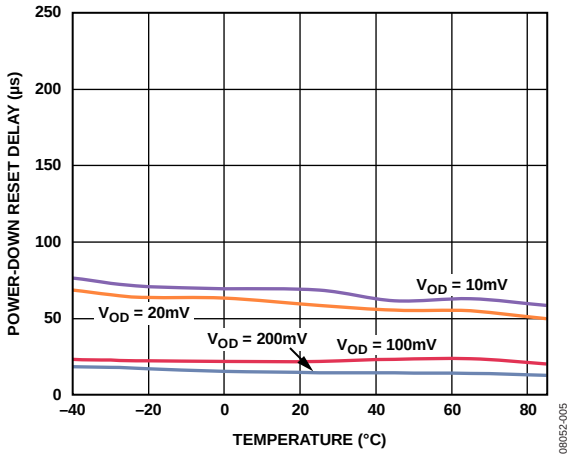


Figure 7. Power-Down Reset Delay vs. Temperature

THEORY OF OPERATION

The ADM6326/ADM6328/ADM6346/ADM6348 are 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. Ultralow supply currents make these devices particularly suitable for use in low power, portable equipment.

RESET OUTPUT

The ADM6326 and ADM6346 have an active low, push-pull reset output, whereas the ADM6328 and ADM6348 have an active low, open-drain reset output, which requires an external pull-up resistor. The $\overline{\text{RESET}}$ signal is guaranteed to be valid for V_{CC} down to 1 V.

When the ADM6326/ADM6328/ADM6346/ADM6348 are powered up, the $\overline{\text{RESET}}$ output remains low for a period typically equal to the $\overline{\text{RESET}}$ active timeout period of 185 ms. This feature allows adequate time for the system to power up correctly and for the power supply to stabilize before any devices are brought out of reset and are allowed to begin executing instructions. Initializing a system in this way provides a more reliable startup for microprocessor systems.

When the monitored voltage falls below its associated threshold (V_{TH}), $\overline{\text{RESET}}$ is asserted within 20 µs (typical). Asserting $\overline{\text{RESET}}$ this quickly means that the entire system can be reset at once before any part of the system's voltage falls below its recommended operating voltage. This system reset can avoid dangerous and/or erroneous operation of a microprocessor based system.

INTERFACING TO OTHER DEVICES

The active low, open-drain reset output of the ADM6328 and ADM6348 makes these devices ideal for integration with devices such as microprocessors with bidirectional reset pins. Simply connect the $\overline{\text{RESET}}$ output of the ADM6328 or ADM6348 to the $\overline{\text{RESET}}$ input of the microprocessor using a single pull-up resistor to allow either device to initiate a system reset (see Figure 8).

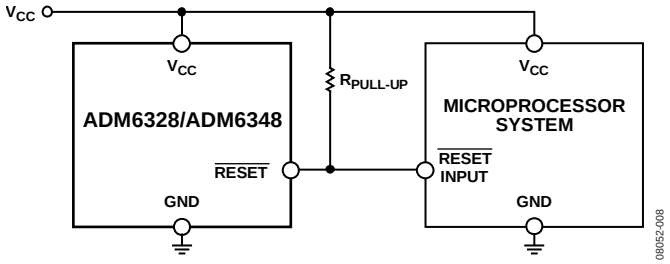


Figure 8. Interfacing to a Microprocessor with a Bidirectional Reset Pin

TRANSIENT IMMUNITY

To avoid unnecessary resets caused by fast power supply transients, the ADM6326/ADM6328/ADM6346/ADM6348 provide glitch immunity from negative-going V_{CC} transients.

Figure 5 shows the $\overline{\text{RESET}}$ comparator overdrive (that is, the maximum magnitude of negative-going pulses with respect to the typical threshold) vs. the pulse duration without a reset.

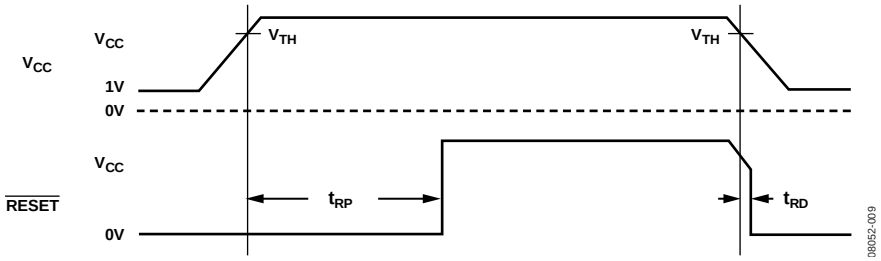
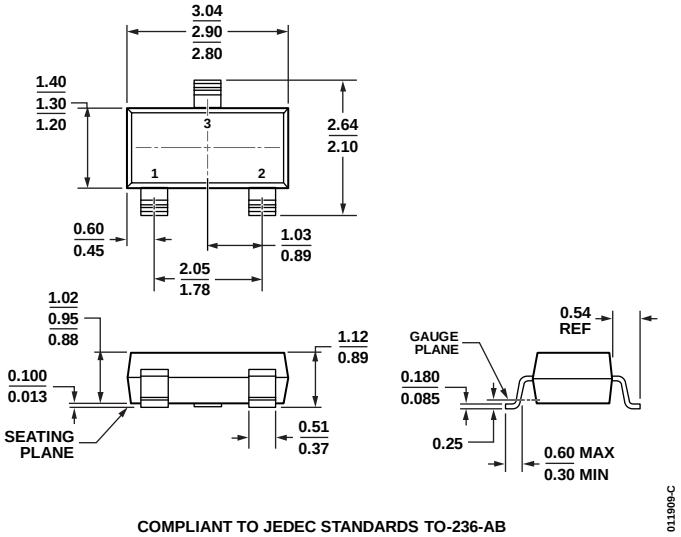


Figure 9. $\overline{\text{RESET}}$ Timing

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS TO-236-AB

Figure 10. 3-Lead Small Outline Transistor Package [SOT-23-3] (RT-3)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Typical Threshold Voltage (T_A = 25°C)	$\overline{\text{RESET}}$ Output Structure	Package Description	Package Option	Branding
ADM6326-22ARTZ-R7[2, 3]	2.2 V	Push-Pull	3-Lead SOT-23	RT-3	LAQ
ADM6326-23ARTZ-R7[2]	2.32 V	Push-Pull	3-Lead SOT-23	RT-3	LAR
ADM6326-24ARTZ-R7[2]	2.4 V	Push-Pull	3-Lead SOT-23	RT-3	LAS
ADM6326-25ARTZ-R7[2]	2.5 V	Push-Pull	3-Lead SOT-23	RT-3	LAT
ADM6326-26ARTZ-R7[2]	2.63 V	Push-Pull	3-Lead SOT-23	RT-3	LAU
ADM6326-27ARTZ-R7[2]	2.7 V	Push-Pull	3-Lead SOT-23	RT-3	LAV
ADM6326-28ARTZ-R7[2]	2.8 V	Push-Pull	3-Lead SOT-23	RT-3	LAW
ADM6326-29ARTZ-R7[2]	2.93 V	Push-Pull	3-Lead SOT-23	RT-3	LAX
ADM6326-30ARTZ-R7[2]	3.0 V	Push-Pull	3-Lead SOT-23	RT-3	LAY
ADM6326-31ARTZ-R7[2]	3.08 V	Push-Pull	3-Lead SOT-23	RT-3	LAZ
ADM6328-22ARTZ-R7[2]	2.2 V	Open-Drain	3-Lead SOT-23	RT-3	LB0
ADM6328-23ARTZ-R7[2]	2.32 V	Open-Drain	3-Lead SOT-23	RT-3	LB1
ADM6328-24ARTZ-R7[2]	2.4 V	Open-Drain	3-Lead SOT-23	RT-3	LB2
ADM6328-25ARTZ-R7[2]	2.5 V	Open-Drain	3-Lead SOT-23	RT-3	LB3
ADM6328-26ARTZ-R7[2]	2.63 V	Open-Drain	3-Lead SOT-23	RT-3	LB4
ADM6328-27ARTZ-R7[2]	2.7 V	Open-Drain	3-Lead SOT-23	RT-3	LB5
ADM6328-28ARTZ-R7[2, 3]	2.8 V	Open-Drain	3-Lead SOT-23	RT-3	LB6
ADM6328-29ARTZ-R7[2]	2.93 V	Open-Drain	3-Lead SOT-23	RT-3	LB7
ADM6328-30ARTZ-R7[2]	3.0 V	Open-Drain	3-Lead SOT-23	RT-3	LB8
ADM6328-31ARTZ-R7[2]	3.08 V	Open-Drain	3-Lead SOT-23	RT-3	LB9
ADM6346-33ARTZ-R7[2, 3]	3.3 V	Push-Pull	3-Lead SOT-23	RT-3	LBA
ADM6346-34ARTZ-R7[2]	3.4 V	Push-Pull	3-Lead SOT-23	RT-3	LBC
ADM6346-35ARTZ-R7[2]	3.5 V	Push-Pull	3-Lead SOT-23	RT-3	LBD
ADM6346-36ARTZ-R7[2]	3.6 V	Push-Pull	3-Lead SOT-23	RT-3	LBE
ADM6346-37ARTZ-R7[2]	3.7 V	Push-Pull	3-Lead SOT-23	RT-3	LBF
ADM6346-38ARTZ-R7[2]	3.8 V	Push-Pull	3-Lead SOT-23	RT-3	LBG
ADM6346-39ARTZ-R7[2]	3.9 V	Push-Pull	3-Lead SOT-23	RT-3	LBH
ADM6346-40ARTZ-R7[2]	3.0 V	Push-Pull	3-Lead SOT-23	RT-3	LCN
ADM6346-41ARTZ-R7[2]	4.1 V	Push-Pull	3-Lead SOT-23	RT-3	LCP
ADM6346-42ARTZ-R7[2]	4.2 V	Push-Pull	3-Lead SOT-23	RT-3	LCQ
ADM6346-43ARTZ-R7[2]	4.3 V	Push-Pull	3-Lead SOT-23	RT-3	LCR
ADM6346-44ARTZ-R7[2]	4.38 V	Push-Pull	3-Lead SOT-23	RT-3	LCS
ADM6346-45ARTZ-R7[2]	4.5 V	Push-Pull	3-Lead SOT-23	RT-3	LCT
ADM6346-46ARTZ-R7[2]	4.63 V	Push-Pull	3-Lead SOT-23	RT-3	LCU
ADM6348-33ARTZ-R7[2]	3.3 V	Open-Drain	3-Lead SOT-23	RT-3	LCV
ADM6348-34ARTZ-R7[2]	3.4 V	Open-Drain	3-Lead SOT-23	RT-3	LCW
ADM6348-35ARTZ-R7[2]	3.5 V	Open-Drain	3-Lead SOT-23	RT-3	LCX
ADM6348-36ARTZ-R7[2]	3.6 V	Open-Drain	3-Lead SOT-23	RT-3	LCY
ADM6348-37ARTZ-R7[2]	3.7 V	Open-Drain	3-Lead SOT-23	RT-3	LCZ
ADM6348-38ARTZ-R7[2]	3.8 V	Open-Drain	3-Lead SOT-23	RT-3	LD0
ADM6348-39ARTZ-R7[2]	3.9 V	Open-Drain	3-Lead SOT-23	RT-3	LD1
ADM6348-40ARTZ-R7[2]	3.0 V	Open-Drain	3-Lead SOT-23	RT-3	LD2
ADM6348-41ARTZ-R7[2]	4.1 V	Open-Drain	3-Lead SOT-23	RT-3	LD3
ADM6348-42ARTZ-R7[2]	4.2 V	Open-Drain	3-Lead SOT-23	RT-3	LD4
ADM6348-43ARTZ-R7[2]	4.3 V	Open-Drain	3-Lead SOT-23	RT-3	LD5
ADM6348-44ARTZ-R7[2]	4.38 V	Open-Drain	3-Lead SOT-23	RT-3	LD6
ADM6348-45ARTZ-R7[2]	4.5 V	Open-Drain	3-Lead SOT-23	RT-3	LD7
ADM6348-46ARTZ-R7[2, 3]	4.63 V	Open-Drain	3-Lead SOT-23	RT-3	LD8

[1] Contact sales for the availability of nonstandard models.
[2] Z = RoHS Compliant Part.
[3] Standard model.

NOTES

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