Description

The DIODES AP22980 is a single channel high side power switch with slew rate control, tri-state soft-start and active output discharge path in compact size.

The AP22980 contains an n-channel MOSFET that supports 6A of maximum continuous current and operates over an input range of 0.285V to 5.5V. The wide input voltage range and high current capability enable the device to be used in various systems and applications. The AP22980 has ultra-low ON-resistance of typical 5.1mΩ, which can minimize the voltage drop and power loss.

Low quiescent supply current of typical 60µA makes it ideal for system where standby power consumption is a concern.

The AP22980 offers multiple VOUT slew rates by tri-state logic input of SS pin, which does not require external component.

The AP22980 has 50Ω on-chip resistor for quick output discharge when switch is disabled to avoid unknown state caused by floating condition to downstream load.

Overtemperature protection circuitry is triggered if the junction temperature exceeds +150°C, thereby protecting the AP22980 and downstream circuit from potential damage.

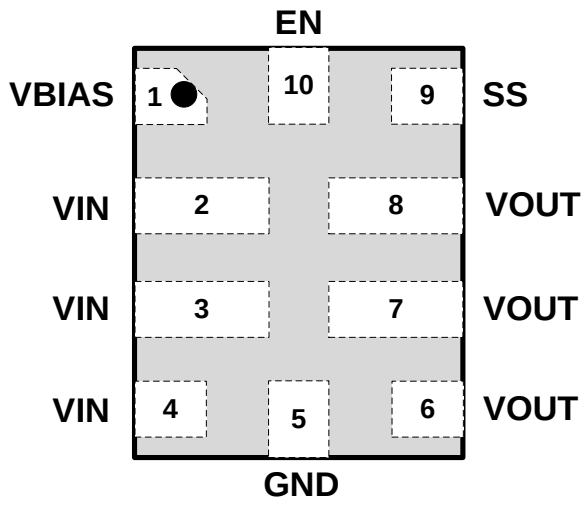
The AP22980 is available in compact W-QFN1520-10 package.

Applications

- Solid state drives (SSD)
- Laptops, desktops
- Tablet PCs
- Servers

Pin Assignments

(Top View)



W-QFN1520-10

Features

- Integrated Single Channel Load Switch
- 0.285V to VBIAS (up to 5.5V) Input Voltage Range
- 2.2V to 5.5V VBIAS Voltage Range
- Low R_{ON} of 5.1mΩ typ (V_{BIAS} = 5V)
- 6A Maximum Continuous Current
- Low Quiescent Current of 60µA typ
- Tri-State Slew Rate Control at V_{IN} = 3.3V
  - 15mV/µs (V_{SS} = Floating)
  - 2mV/µs (V_{SS} = HIGH)
  - 1mV/µs (V_{SS} = LOW)
- Quick Output Discharge (QOD)
- Low Voltage Logic Enable
  - 1.2V/1.8V/2.5V/3.3V Logic Compatible
- Active HIGH Operation
- Thermal Shutdown
- ESD Protection: 2kV of HBM and 1kV of CDM
- Smaller Form Factor Package W-QFN1520-10
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. 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.

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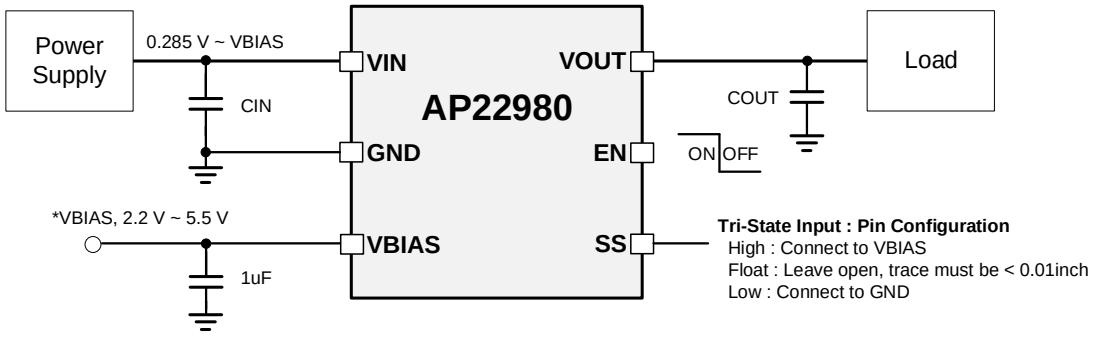
Typical Applications Circuit

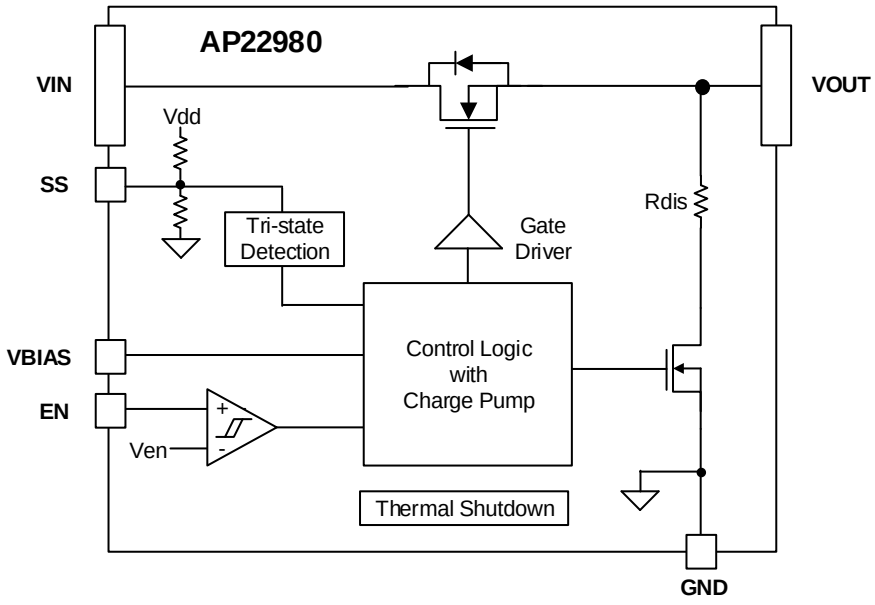


* If V_{IN} is higher than 2.2V then VBIAS pin can be connected to VIN.

Pin Descriptions

Pin Name	Pin Number	Function
VBIAS	1	VBIAS Input. Power supply to the device.
VIN	2, 3, 4	Power Switch Input. Place bypass capacitor to GND.
GND	5	Ground
VOUT	6, 7, 8	Power Switch Output. Place bypass capacitor to GND.
SS	9	Tri-State Slew Rate Control Input (HIGH/Floating/LOW).
EN	10	Active HIGH Enable Input. Do not leave floating.

Functional Block Diagram



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Absolute Maximum Ratings (@ T_A = +25°C, unless otherwise specified.) (Note 4)

Symbol	Parameter	Ratings	Unit
ESD HBM	Human Body ESD Protection	±2	kV
ESD CDM	Charged Device Model ESD Protection	±1	V
V_{IN}	Input Voltage at VIN Pin	-0.3 to +6	V
V_{BIAS}	Bias Supply Voltage	-0.3 to +6	V
V_{OUT}	Output Voltage at VOUT Pin	-0.3 to +6	V
V_{EN}, V_{SS}	Voltage at EN and SS Pins	-0.3 to +6	V
I_L	Load Current	6	A
$T_{J(max)}$	Maximum Junction Temperature	+150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
P_D	Power Dissipation (Note 5)	1.57	W
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance (Note 5)	55	°C/W
$R_{\theta JC(top)}$	Junction-to-Case (Top) Thermal Resistance (Note 5)	7.7	°C/W

Notes: 4. Stresses greater than 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 or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.

5. $R_{\theta JA}$ and $R_{\theta JC}$ are measured at T_A = +25°C on a high effective thermal conductivity four-layer test board per JEDEC 51-7.

Recommended Operating Conditions (@ T_A = +25°C, unless otherwise specified.) (Note 6)

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	0.285	V_{BIAS}	V
V_{BIAS}	Bias Supply Voltage	2.2	5.5	V
V_{EN}, V_{SS}	Enable and Soft-Start Voltage	0	5.5	V
V_{OUT}	Output Voltage	—	V_{IN}	V
C_{IN}	Input Bypass Capacitor	1	—	µF
C_{OUT}	Output Bypass Capacitor	0.1	94	µF
T_A	Operating Ambient Temperature	-40	+105	°C

Note: 6. Refer to the *Typical Applications Circuit*.

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Electrical Characteristics

(T_J = -40°C to +105°C, V_{IN} = 0.285V to 5.5V, V_{BIAS} = 5.5V, C_{IN} = 1µF, C_L = 1µF, V_{EN} = 3.3V and V_{SS} = Floating, typical values are at T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
Device							
I_{BIAS_Q}	VBIAS Quiescent Current	V_{EN} = V_{IN} = V_{BIAS} = 5V, I_{OUT} = 0A		—	60	—	µA
		V_{EN} = V_{IN} = V_{BIAS} = 3.3V, I_{OUT} = 0A		—	—	60	µA
I_{BIAS_OFF}	VBIAS OFF Supply Current	V_{EN} = 0V, V_{OUT} = 0V		—	—	3.5	µA
I_{IN_SD}	Input Shutdown Leakage	V_{EN} = 0V, V_{OUT} = 0V, T_A = -40°C to +85°C	V_{IN} = 5V	—	0.03	2.0	µA
			V_{IN} = 3.3V	—	0.03	1.5	µA
			V_{IN} = 1.8V	—	0.02	1.2	µA
			V_{IN} = 1.125V	—	0.01	1.1	µA
			V_{IN} = 0.5V	—	0.01	1.0	µA
		V_{EN} = 0V, V_{OUT} = 0V, T_A = -40°C to +105°C	V_{IN} = 5V	—	—	6.0	µA
			V_{IN} = 3.3V	—	—	5.0	µA
			V_{IN} = 1.8V	—	—	4.0	µA
			V_{IN} = 1.125V	—	—	3.5	µA
			V_{IN} = 0.5V	—	—	3.0	µA
I_{LEAK_EN}	EN Input Leakage	V_{EN} = 5.5V		—	—	0.1	µA
V_{ENR}	EN Rise Threshold	EN Rise		0.8	0.9	1.0	V
V_{ENF}	EN Fall Threshold	EN Fall		0.6	0.7	0.8	V
t_{EN_DEG}	EN Deglitch Time (Note 7)	—		1	1.3	—	µs
V_{SSH}	SS Logic HIGH Voltage (Note 7)	Logic Input HIGH		1.05	—	—	V
V_{SSL}	SS Logic LOW Voltage (Note 7)	Logic Input LOW		—	—	0.5	V
R_{DIS}	Output Discharge Resistance	V_{EN} = 0V, I_{DIS} = 10mA		40	50	60	Ω
T_{SDN}	Thermal Shutdown (Note 8)	Threshold		—	+150	—	°C
		Hysteresis		—	+25	—	°C
Power Switch							
R_{ON}	ON Resistance	V_{EN} = V_{BIAS}, I_{OUT} = 200mA, T_A = +25°C	V_{IN} = 5V	—	5.1	—	mΩ
			V_{IN} = 3.3V	—	5.2	—	mΩ
			V_{IN} = 1.8V	—	5.2	—	mΩ
			V_{IN} = 1.125V	—	5.2	—	mΩ
			V_{IN} = 0.285V	—	5.2	—	mΩ
		V_{EN} = V_{BIAS}, I_{OUT} = 200mA, T_A = -40°C to +105°C	V_{IN} = 5V	—	5.1	7.5	mΩ
			V_{IN} = 3.3V	—	5.2	7.8	mΩ
			V_{IN} = 1.8V	—	5.2	7.8	mΩ
			V_{IN} = 1.125V	—	5.2	7.8	mΩ
			V_{IN} = 0.285V	—	5.2	7.8	mΩ
		V_{IN} = 2.0V, I_{OUT} = 200mA, T_A = +25°C	V_{BIAS} = 5V	—	5.1	—	mΩ
			V_{BIAS} = 3.3V	—	5.2	—	mΩ
			V_{BIAS} = 2.5V	—	5.3	—	mΩ
			V_{BIAS} = 2.2V	—	5.4	—	mΩ
		V_{IN} = 2.0V, I_{OUT} = 200mA, T_A = -40°C to +105°C	V_{BIAS} = 5V	—	5.1	7.5	mΩ
			V_{BIAS} = 3.3V	—	5.2	7.8	mΩ
			V_{BIAS} = 2.5V	—	5.3	8.0	mΩ
			V_{BIAS} = 2.2V	—	5.4	8.0	mΩ

Notes: 7. Parameter guaranteed by design.
8. Parameter guaranteed by design and characterization.

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Switching Characteristics (T_J = -40°C to +105°C, V_{IN} = 0.285V to 5.5V, V_{BIAS} = 5.5V, C_{IN} = 1µF, C_L = 0.1µF, V_{EN} = 5V and V_{SS} = Floating, typical values are at T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Tri-State Slew Rate with SS Pin						
t_{DON}	ON Delay Time	—	—	25	50	µs
SR	Output Slew Rate (1% to 90% of V_{OUT})	V_{IN} = 3.3V, V_{SS} = Floating	—	15	—	mV/µs
		V_{IN} = 3.3V, V_{SS} = HIGH	—	2	—	mV/µs
		V_{IN} = 3.3V, V_{SS} = LOW	—	1	—	mV/µs
t_{DOFF}	OFF Delay Time	—	—	—	7	µs
$t_{FALL_4.7µF}$	Output Fall Time	R_L = 100Ω, C_L = 4.7µF	—	90	—	µs
V_{IN} = 5V, V_{EN} = V_{BIAS} = 5V, V_{SS} = 3.3V, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	25	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	2550	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	2575	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	3.5	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	5.3	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	8.8	—	µs
V_{IN} = 5V, V_{EN} = V_{BIAS} = 5V, V_{SS} = 0V, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	30	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	5000	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	5030	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	3.5	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	5.0	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	8.5	—	µs
V_{IN} = 5V, V_{EN} = V_{BIAS} = 5V, V_{SS} = Floating, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	20	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	350	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	370	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	3.5	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	5.0	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	8.5	—	µs
V_{IN} = 0.285V, V_{EN} = V_{BIAS} = 5V, V_{SS} = 3.3V, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	30	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	350	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	380	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	6	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	12	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	18	—	µs
V_{IN} = 0.285V, V_{EN} = V_{BIAS} = 5V, V_{SS} = 0V, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	30	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	650	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	680	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	6	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	12	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	18	—	µs
V_{IN} = 0.285V, V_{EN} = V_{BIAS} = 5V, V_{SS} = Floating, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	20	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	40	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	60	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	6	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	12	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	18	—	µs

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Switching Characteristics (T_J = -40°C to +105°C, V_{IN} = 0.285V to 2.2V, V_{BIAS} = 2.2V, C_{IN} = 1µF, C_L = 0.1µF, V_{EN} = 2.2V and V_{SS} = Floating, typical values are at T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN} = 1.8V, V_{EN} = V_{BIAS} = 2.2V, V_{SS} = 3.3V, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	35	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	1500	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	1535	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	4	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	6.0	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	10	—	µs
V_{IN} = 1.8V, V_{EN} = V_{BIAS} = 2.2V, V_{SS} = 0V, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	35	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	3100	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	3135	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	4.0	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	5.5	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	9.5	—	µs
V_{IN} = 1.8V, V_{EN} = V_{BIAS} = 2.2V, V_{SS} = Floating, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	20	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	270	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	290	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	4.0	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	6.0	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	10	—	µs
V_{IN} = 0.285V, V_{EN} = V_{BIAS} = 2.2V, V_{SS} = 3.3V, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	30	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	430	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	460	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	5.5	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	6.5	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	12.0	—	µs
V_{IN} = 0.285V, V_{EN} = V_{BIAS} = 2.2V, V_{SS} = 0V, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	30	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	750	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	780	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	5.5	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	6.5	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	12.0	—	µs
V_{IN} = 0.285V, V_{EN} = V_{BIAS} = 2.2V, V_{SS} = Floating, T_A = +25°C (Unless otherwise noted)						
t_{DON}	ON Delay Time	R_L = 100Ω, C_L = 0.1µF	—	20	—	µs
t_{RISE}	Output Rise Time	R_L = 100Ω, C_L = 0.1µF	—	70	—	µs
t_{ON}	Output Turn ON Time	R_L = 100Ω, C_L = 0.1µF	—	90	—	µs
t_{DOFF}	OFF Delay Time	R_L = 100Ω, C_L = 0.1µF	—	5.5	—	µs
t_{FALL}	Output Fall Time	R_L = 100Ω, C_L = 0.1µF	—	6.5	—	µs
t_{OFF}	Output Turn OFF Time	R_L = 100Ω, C_L = 0.1µF	—	12.0	—	µs

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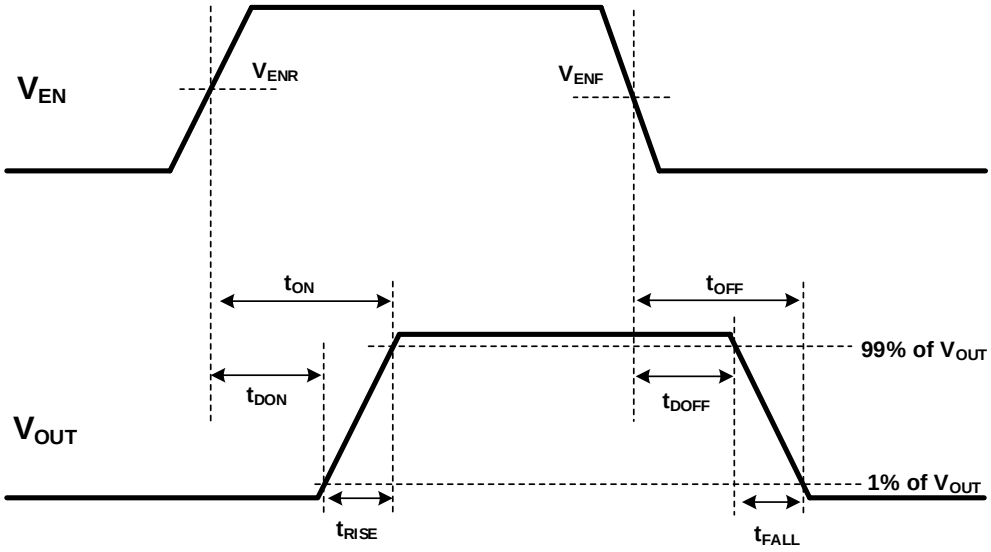
Typical $t_{DON}/t_{RISE}/t_{ON}/t_{DOFF}/t_{FALL}/t_{OFF}$ Waveforms



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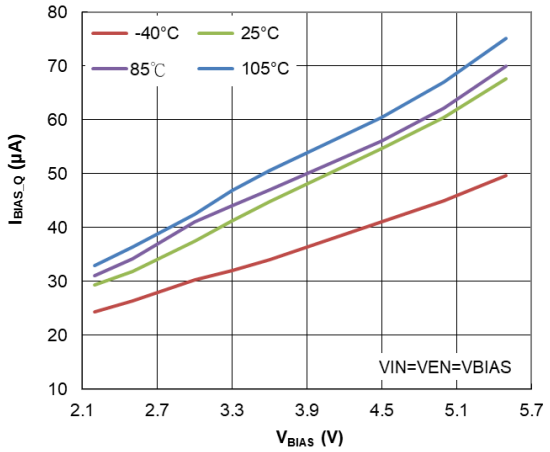
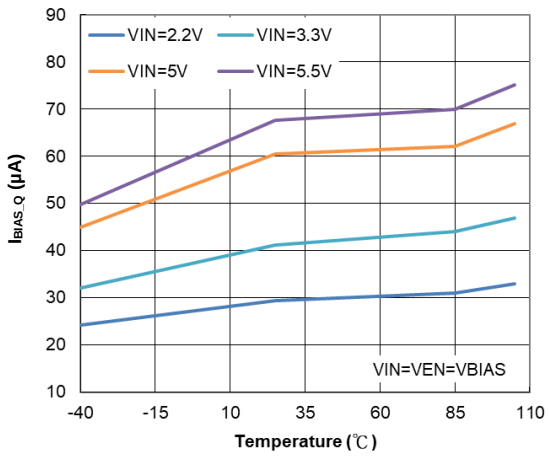
Typical Performance Characteristics

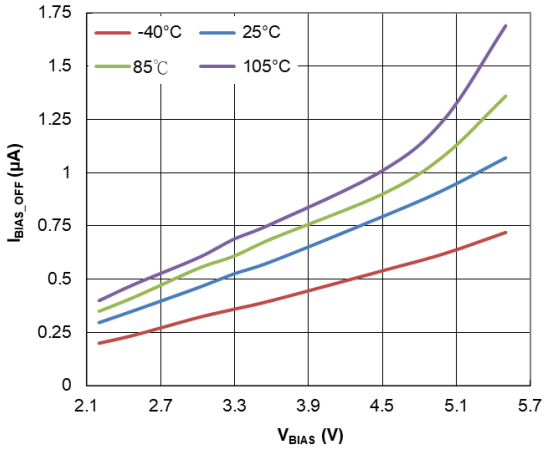
Quiescent Current vs. BIAS Voltage



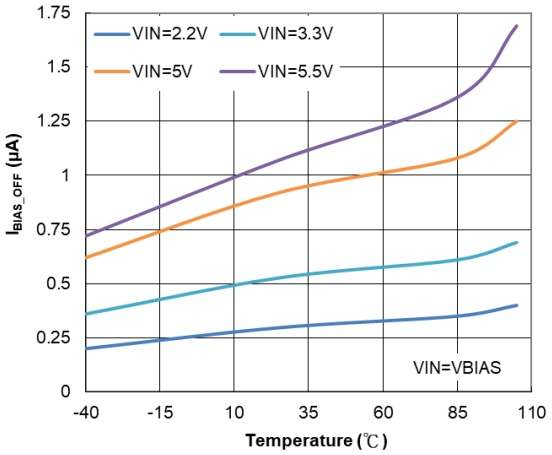
Quiescent Current vs. Temperature



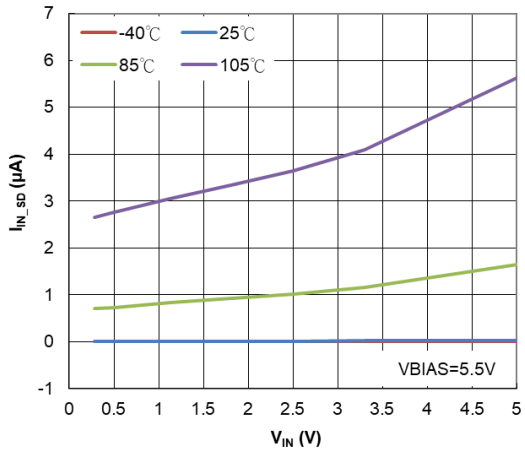
VBIAS OFF Supply Current vs. BIAS Voltage



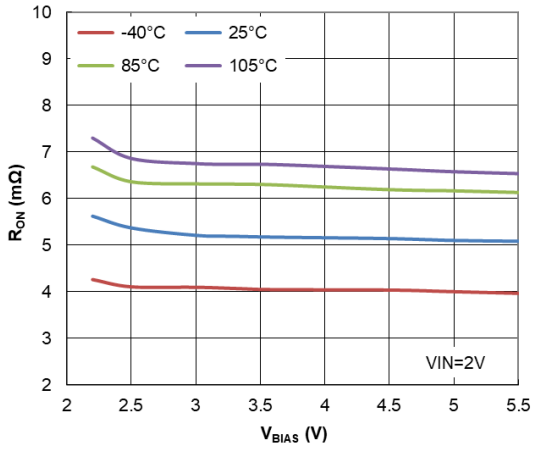
VBIAS OFF Supply Current vs. Temperature



Shutdown Current vs. Input Voltage



Switch On-Resistance vs. BIAS Voltage



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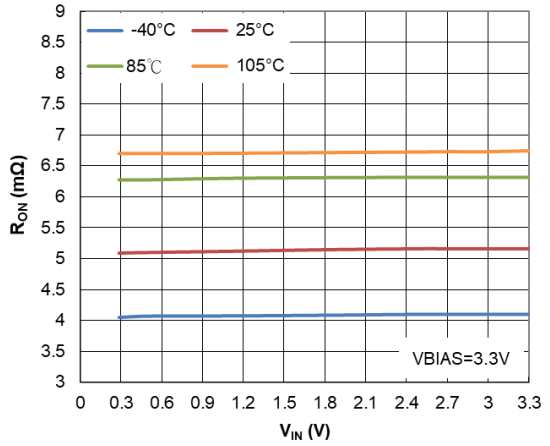
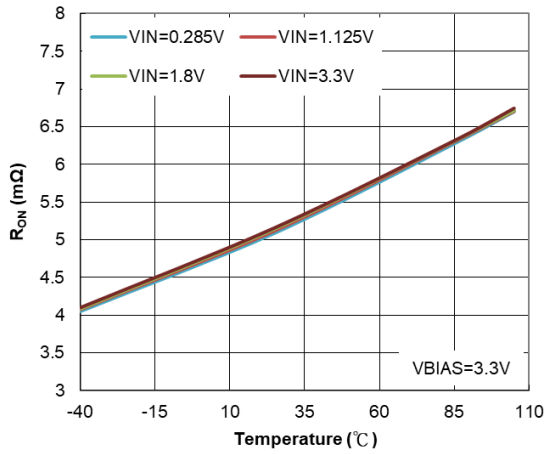
Typical Performance Characteristics (continued)

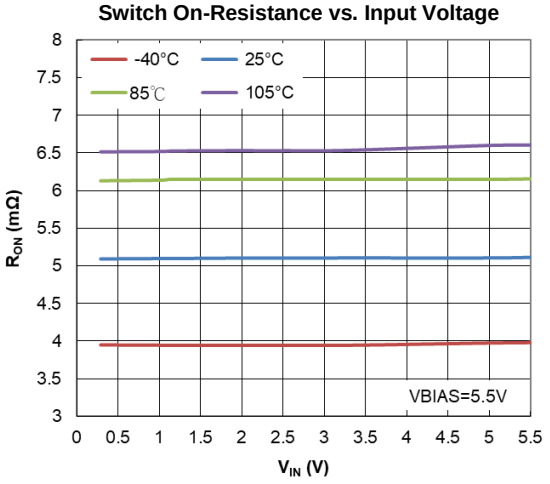
Switch On-Resistance vs. Input Voltage



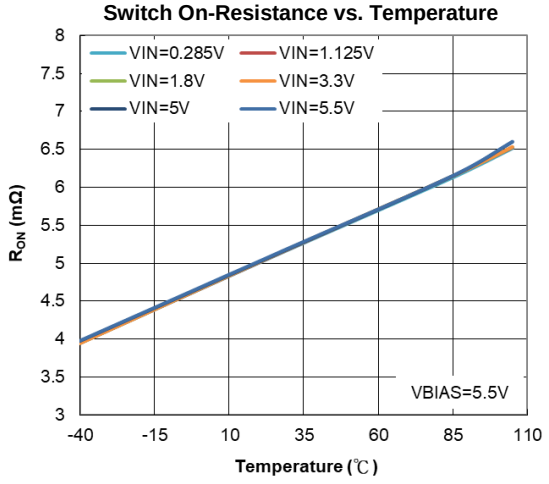
Switch On-Resistance vs. Temperature



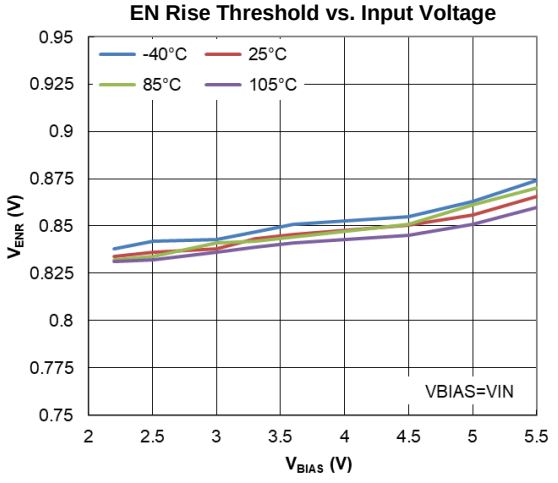
Switch On-Resistance vs. Input Voltage



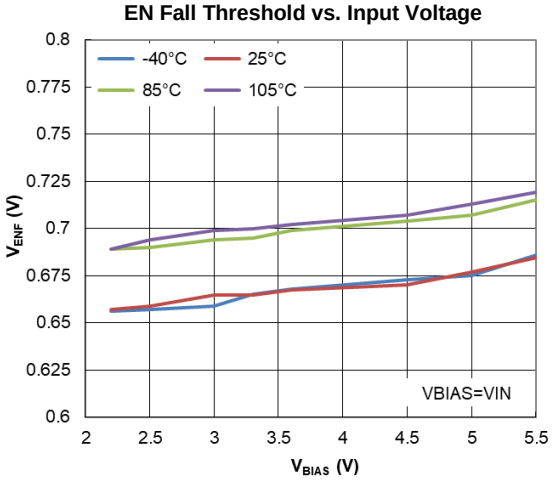
Switch On-Resistance vs. Temperature



EN Rise Threshold vs. Input Voltage



EN Fall Threshold vs. Input Voltage



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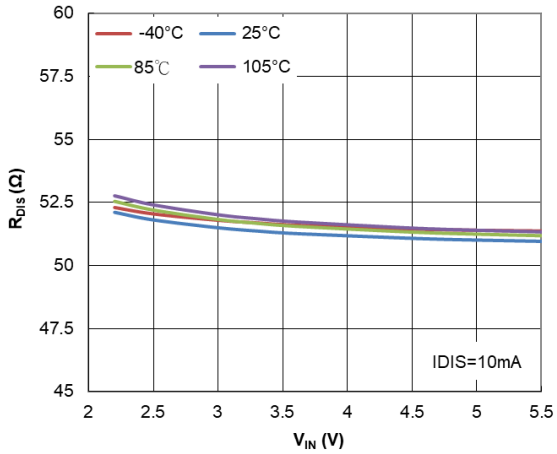
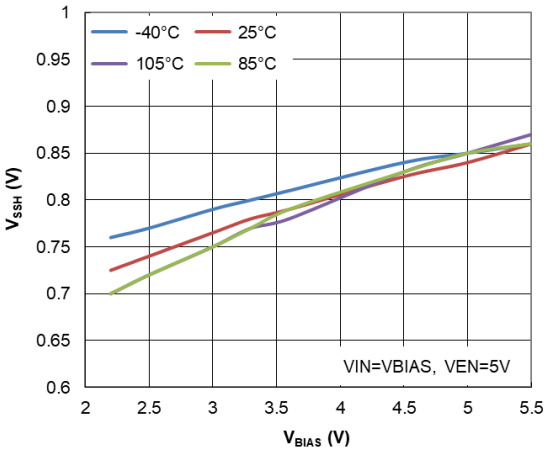
Typical Performance Characteristics (continued)

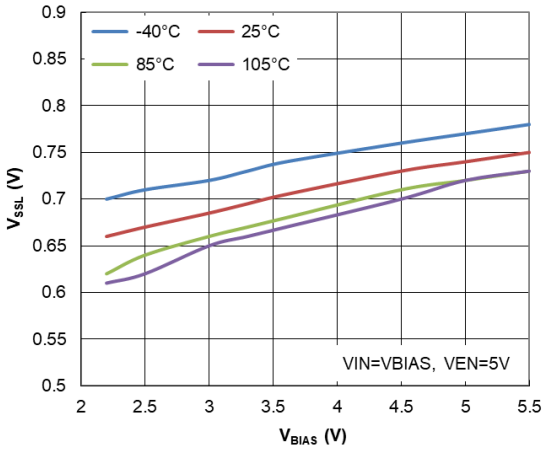
Discharge Resistance vs. Input Voltage



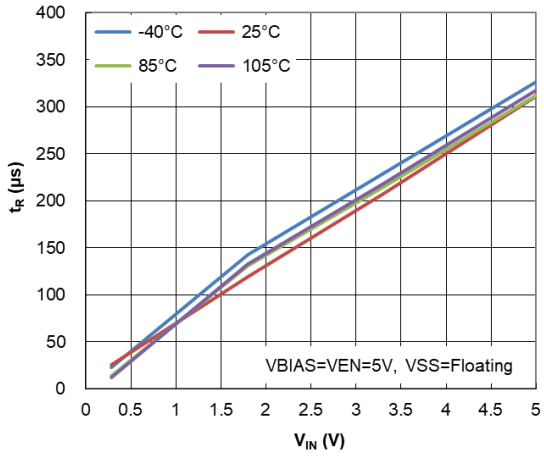
SS High Threshold vs. Input Voltage



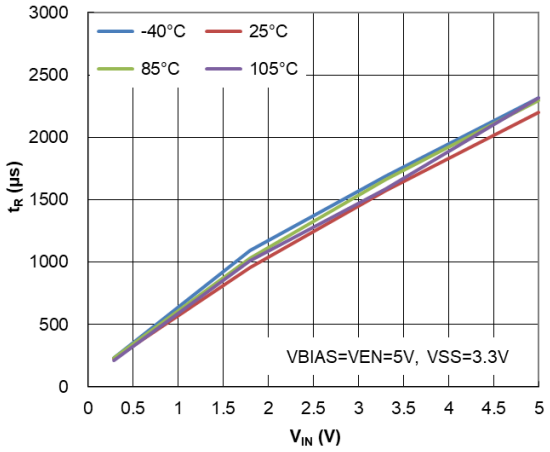
SS Low Threshold vs. Input Voltage



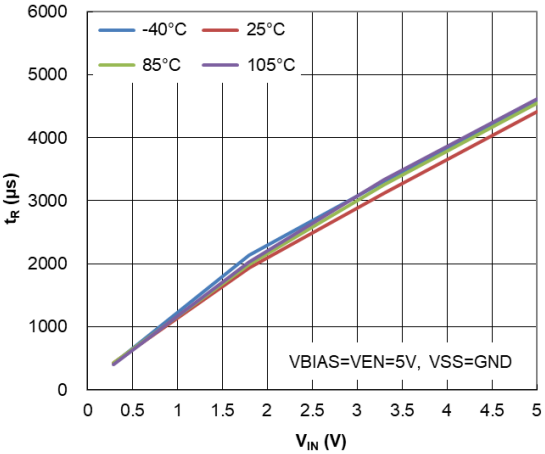
Output Rise Time vs. Input Voltage



Output Rise Time vs. Input Voltage



Output Rise Time vs. Input Voltage



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Application Information

Enable/Disable Control

The EN pin controls the state of the power switch. AP22980 is enabled when the EN pin is asserted high and the device is disabled when EN pin is asserted low. The EN input is compatible with both TTL and CMOS logic. This pin cannot be left floating and must be tied either high or low for proper functionality.

Input Capacitor

To limit the voltage drop on the input supply when the switch turns on into a discharged load capacitor resulting in a transient inrush current, a capacitor needs to be placed between VIN and GND. Use 1μF capacitor or a larger value for high-current applications. Place the capacitor close to the VIN pins.

Output Capacitor

The recommended output capacitor value is 0.1μF when switching lighter load. For heavier loads close to 6A, it is recommended that the VIN and VOUT trace lengths need to be a minimum. In addition, a bulk capacitor (≥ 10μF) may also be placed close to the VOUT pin. If using a bulk capacitor on VOUT, it is important to control the inrush current by choosing an appropriate soft-start time in order to minimize the droop on the input supply.

Tri-State Soft-Start Time

Soft-start slew rate can be set by tri-state input with SS pin. The tri-state SS pin status is latched upon initial power-up when VBIAS becomes valid state and the first EN pin goes high, so it is recommended to set SS pin state prior to valid VBIAS and EN goes to HIGH. In order to avoid wrong state detection, an external capacitor is not allowed and if using an external pullup or pulldown resistor, it is recommended to use less than 10kΩ respectively. For floating state resistance between SS and GND, it needs to be higher than 2MΩ. When Float state is desired, it is recommended to use as minimum trace as possible (< 0.01in) to avoid noise coupling by adjacent signal and minimize parasitic capacitance. Please refer to *PCB Layout Example*.

The input inrush current can be controlled by selecting appropriate soft-start time. The table below shows the slew rate on V_{OUT} by V_{SS} conditions as follows.

V_{SS}	Slew Rate	Unit
HIGH (> 1.05V)	2	mV/μs
LOW (< 0.5V)	1	
Floating (> 2MΩ)	16.7	

Quick Output Discharge (QOD)

The AP22980 includes a QOD (Quick Output Discharge) feature with typical 50Ω of an internal discharge resistor. When the switch is disabled by EN pin or switch is enabled and during ON delay time (t_{DON}), an internal discharge resistor is connected between VOUT and GND to remove the remaining charge from the output. Even if the switch is in OFF state without valid VBIAS, QOD stays working.

VBIAS	EN	QOD	Device
Invalid	Don't Care	ON	OFF
Valid	LOW	ON	Disabled
	LOW to HIGH	ON for t_{DON}	Enabled and in soft-start
	HIGH	OFF	Enabled

Thermal Consideration

The maximum junction temperature should be restricted to +150°C under normal operating conditions. The maximum allowable power dissipation $P_{D(MAX)}$ can be calculated as:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

where,

$T_{J(MAX)}$ is the maximum operating junction temperature. For AP22980, $T_{J(MAX)}$ = +150°C.

T_A is the ambient temperature of the device.

θ_{JA} is the junction-to-air thermal impedance.

Board Layout

Good PCB layout is important for improving the thermal performance of the device. All trace lengths should be kept as short as possible. Place input and output capacitors close to the device to minimize the effects of parasitic inductance. The input and output PCB traces should be as wide as possible. SS pin must have minimum trace length (< 0.1in) for float pin configuration to avoid unexpected coupling from adjacent signal.

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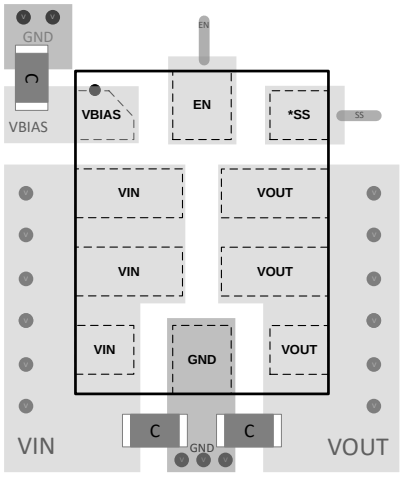
PCB Layout Example



* SS pin trace must be less than 0.01inch for SS = Float configuration.

Ordering Information

AP22980 XXXXX - X

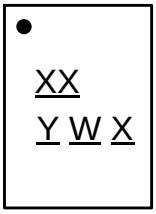
Package	Packing
FCF10 : W-QFN1520-10	7 : Tape & Reel

Part Number	Part Number Suffix	Package Code	Package	Packing	
				Qty.	Carrier
AP22980FCF10-7	-7	FCF10	W-QFN1520-10	3000	7” Tape and Reel

Marking Information

W-QFN1520-10

(Top View)



XX : Identification Code
Y : Year 0 to 9 (ex: 3 = 2023)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AP22980FCF10-7	W-QFN1520-10	A3

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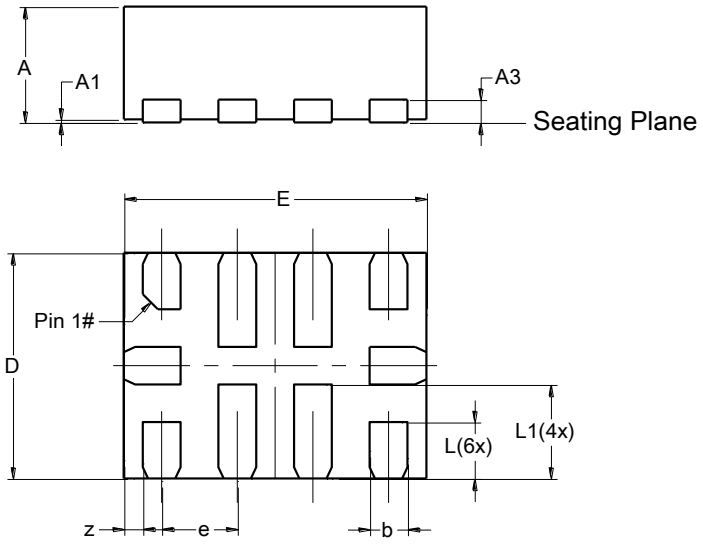
Package Outline Dimensions

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

W-QFN1520-10

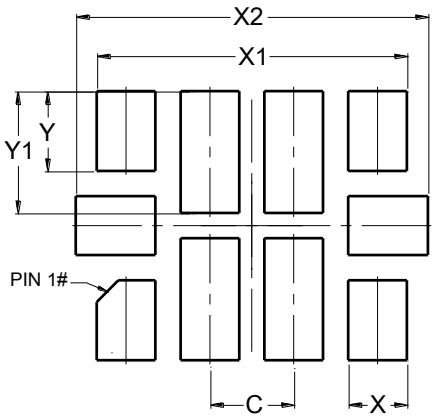


W-QFN1520-10			
Dim	**Min**	**Max**	**Typ**
A	0.70	0.80	0.75
A1	0.00	0.05	0.03
A3	—	—	0.152
b	0.220	0.280	0.250
D	1.45	1.55	1.50
E	1.95	2.05	2.00
e	—	—	0.500
L	0.325	0.425	0.375
L1	0.575	0.675	0.625
z	0.100	0.150	0.125
All Dimensions in mm			

Suggested Pad Layout

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

W-QFN1520-10



Dimensions	Value (in mm)
C	0.500
X	0.350
X1	1.850
X2	2.100
Y	0.475
Y1	0.725
Y2	1.600

Mechanical Data

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.0035 grams (Approximate)

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