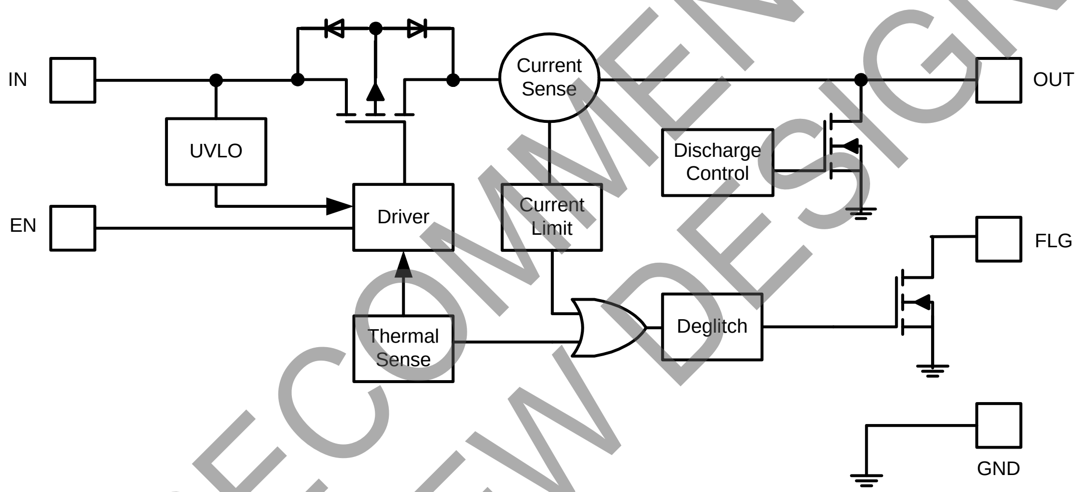
Pin Descriptions

Pin Number	Pin Name	Function
1	OUT	Voltage Output Pin
2	GND	Ground Pin of the Circuitry
3	FLG	Over Current and Over temperature fault report; Open-Drain flag is active low when triggered.
4	EN	Enable Input
		AP22802A: Active High
		AP22802B: Active Low
5	IN	Voltage Input Pin

Functional Block Diagram



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

Symbol	Parameter		Ratings	Unit
ESD HBM	Human Body ESD Protection		2000	V
ESD MM	Machine Model ESD Protection		200	V
V_{IN}	Input Voltage		-0.3 to 5.7	V
V_{OUT}	Output Voltage		-0.3 to (V_{IN} +0.3)	V
V_{EN}	Enable Voltage		-0.3 to (V_{IN} +0.3)	V
I_L	Load Current		Internal Limited	A
$T_{J(max)}$	Maximum Junction Temperature		+150	°C
T_{ST}	Storage Temperature		-65 to +150	°C
$R_{θJA}$	Thermal Resistance, Junction to Ambient	SOT25 (Note 5)	180	°C/W
$R_{θJC}$	Thermal Resistance, Junction to Case	SOT25 (Note 5)	50	°C/W

Notes: 4. Stresses greater than the '*Absolute Maximum Ratings*' specified above can cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability can be affected by exposure to absolute maximum rating conditions for extended periods of time.

5. Test condition for SOT25: Device mounted on 1”×1” FR-4 substrate PC board, 2oz copper with minimum recommended pad layout.

Recommended Operating Conditions (Note 6)

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	2.7	5.5	V
I_{OUT}	Output Current	0	2	A
V_{IL}	EN Input Logic Low Voltage	0	0.5	V
V_{IH}	EN Input Logic High Voltage	1.5	V_{IN}	V
T_A	Operating Ambient Temperature	-40	+85	°C

Electrical Characteristics (V_{IN} = 5V @ T_A = +25°C, C_{IN} = 1µF, C_L = 100nF, unless otherwise specified.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{UVLO}	Input UVLO	V_{IN} Rising	1.6	2.0	2.4	V
ΔV_{UVLO}	Input UVLO Hysteresis	V_{IN} Decreasing	—	75	—	mV
I_{SHDN}	Input Shutdown Current	Disabled, OUT = Open	—	0.1	1	µA
I_Q	Input Quiescent Current	Enabled, OUT = Open	—	50	—	µA
I_{LEAK}	Input Leakage Current	Disabled, OUT Grounded	—	0.1	1	µA
I_{REV}	Reverse Leakage Current	Disabled, V_{IN} = 0V, V_{OUT} = 5V, I_{REV} at V_{IN}	—	0.01	1	µA
$R_{DS(ON)}$	Switch On-Resistance	V_{IN} = 5V, I_{OUT} = 2.0A, T_A = +25°C	—	50	—	mΩ
		V_{IN} = 3.3V, I_{OUT} = 2.0A, T_A = +25°C	—	60	—	
I_{LIMIT}	Over Load Current Limit	V_{IN} = 5V, V_{OUT} = 4.5V	2.2	2.7	3.2	A
I_{SHORT}	Short-Circuit Current Limit	Enabled into Short Circuit	—	1.1	—	A
t_{SHORT}	Short-Circuit Response Time	V_{IN} = 5V, No Load Figure 1	—	0.7	—	µs
V_{IL}	EN Input Logic Low Voltage	V_{IN} = 2.7V to 5.5V	—	—	0.5	V
V_{IH}	EN Input Logic High Voltage	V_{IN} = 2.7V to 5.5V	1.5	—	—	V
$I_{LEAK-EN}$	EN Input Leakage	V_{IN} = 5V, V_{EN} = 0V and 5.5V	—	0.01	1	µA
I_{LEAK-O}	Output Leakage Current	Disabled, V_{OUT} = 0V	—	0.5	1	µA
$t_{D(ON)}$	Output Turn-On Delay Time	C_L = 4.7µF, R_{LOAD} = 10Ω @ V_{IN} = 3.3V Figure 2	—	1.7	—	ms
t_R	Output Turn-On Rise Time	C_L = 4.7µF, R_{LOAD} = 10Ω @ V_{IN} = 3.3V Figure 2	1.0	2.1	3.5	ms
$t_{D(OFF)}$	Output Turn-Off Delay Time	C_L = 4.7µF, R_{LOAD} = 10Ω @ V_{IN} = 3.3V Figure 2	—	0.2	—	ms
t_F	Output Turn-Off Fall Time	C_L = 4.7µF, R_{LOAD} = 100Ω @ V_{IN} = 3.3V Figure 2	—	0.65	—	ms
R_{FLG}	FLG output FET On-Resistance	I_{FLG} = 10mA	—	40	60	Ω
I_{FOH}	FLG Off Current	V_{FLG} = 5V	—	0.01	1	µA
t_{Blank}	FLG Blanking Time	Assertion or deassertion due to overcurrent and over-temperature condition	2	6	13	ms
t_{DIS}	Discharge Time	C_L = 1µF, V_{IN} = 5V, Disabled to V_{OUT} < 0.5V	—	0.4	—	ms
R_{DIS}	Discharge Resistance	V_{IN} = 5V, Disabled, I_{OUT} = 1mA	—	90	—	Ω
T_{SHDN}	Thermal Shutdown Threshold	Enabled	—	+140	—	°C
T_{HYS}	Thermal Shutdown Hysteresis	—	—	+60	—	°C

Note: 6. Refer to the typical application circuit.

Performance Characteristics

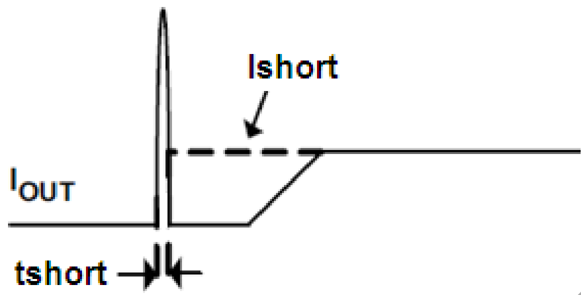


Figure 1. Response Time to Short Circuit Waveform

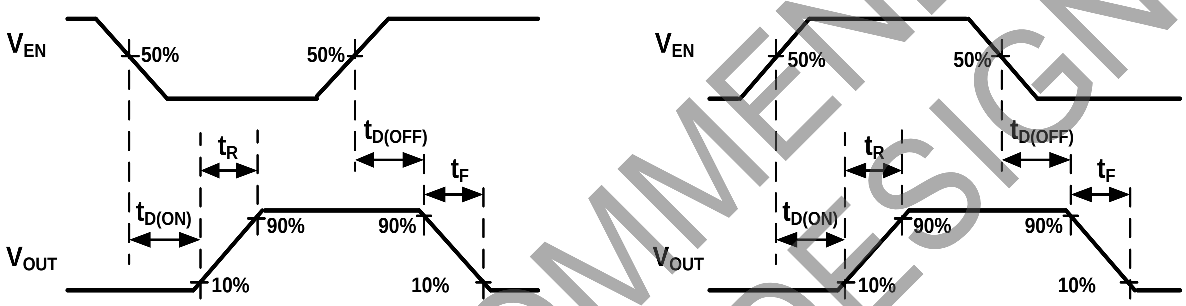
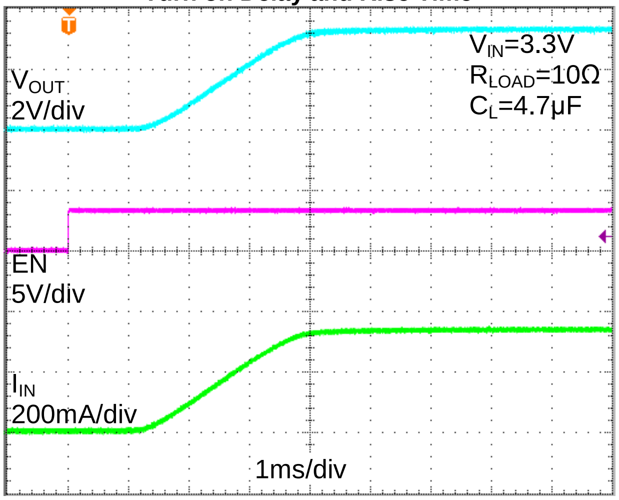


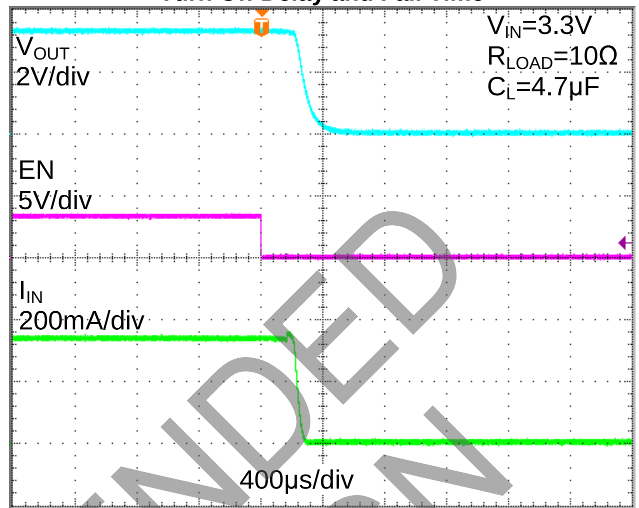
Figure 2. Voltage Waveforms: AP22802B (Active Low, left), AP22802A (Active High, right)

Performance Characteristics (continued) (T_A = +25°C, V_{IN} = 5V, C_{IN} = 1μF, C_L = 0.1μF, unless otherwise specified.)

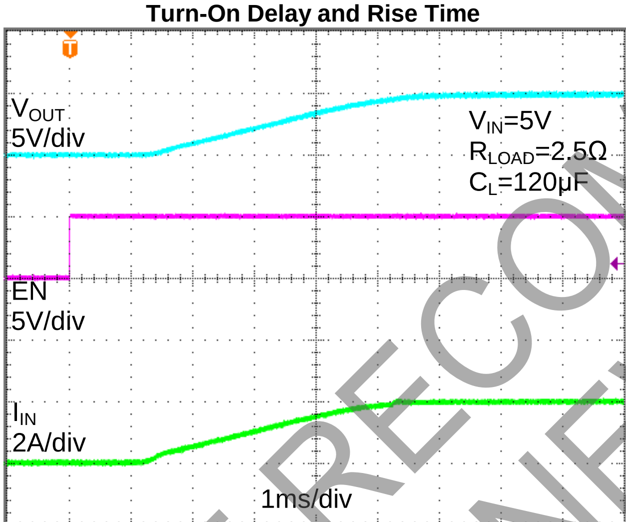
Turn on Delay and Rise Time



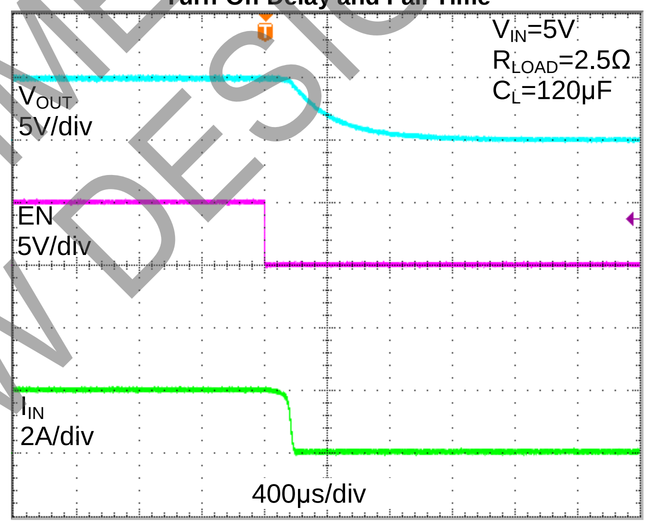
Turn Off Delay and Fall Time



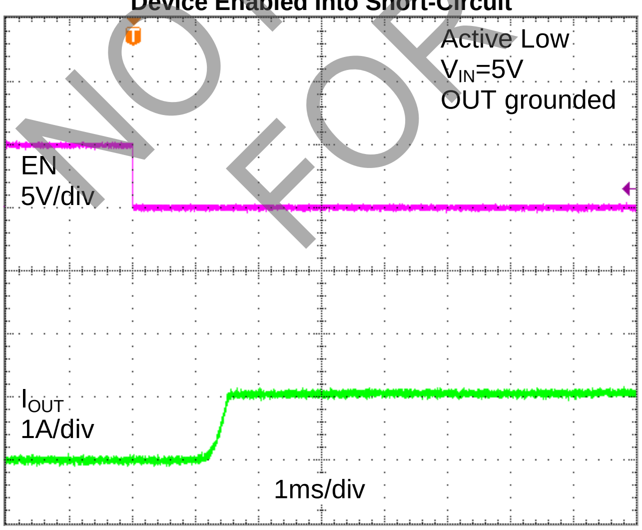
Turn-On Delay and Rise Time



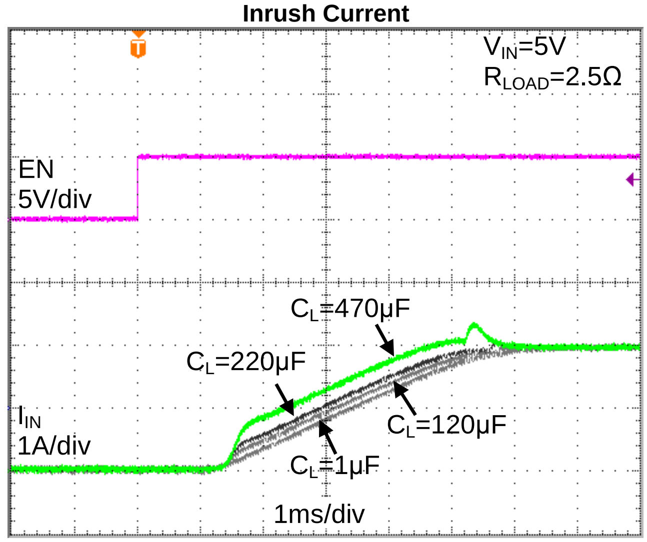
Turn-Off Delay and Fall Time



Device Enabled Into Short-Circuit

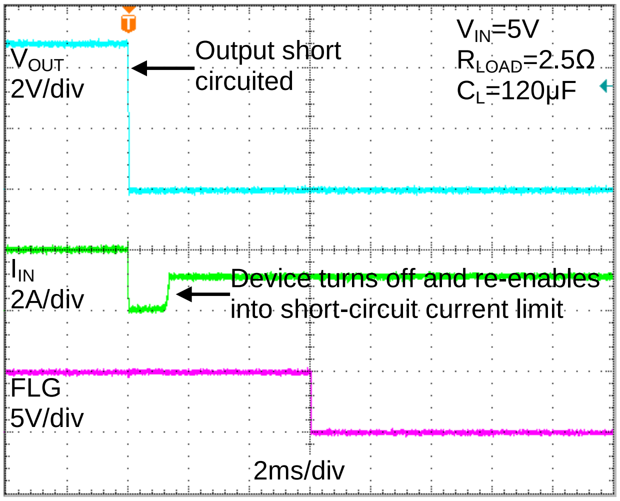


Inrush Current

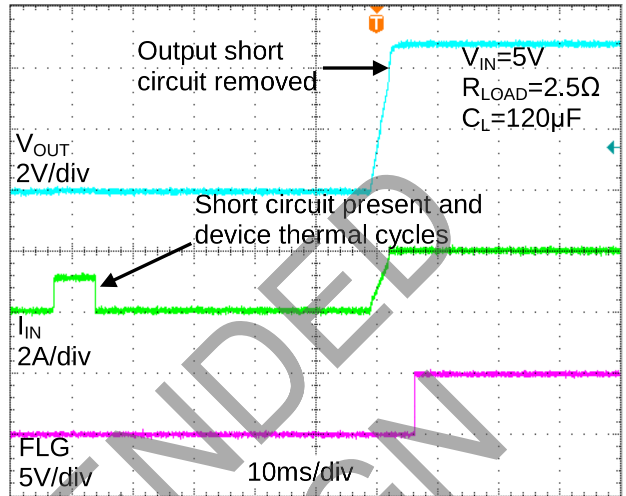


Performance Characteristics (continued) (T_A = +25°C, V_{IN} = 5V, C_{IN} = 1µF, C_L = 0.1µF, unless otherwise specified.)

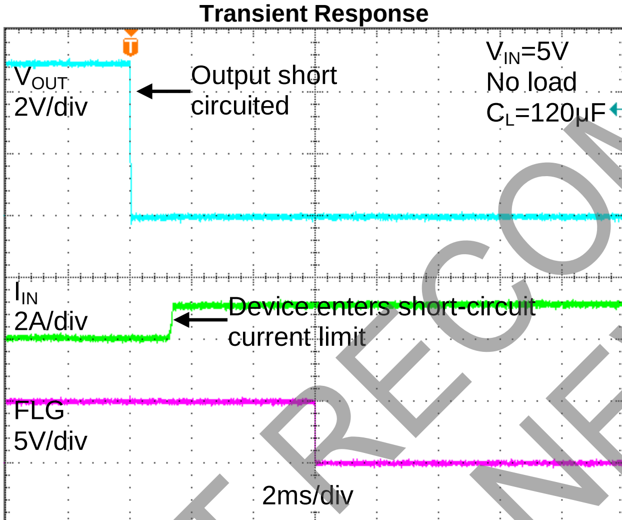
Full-Load to Short-Circuit Transient Response



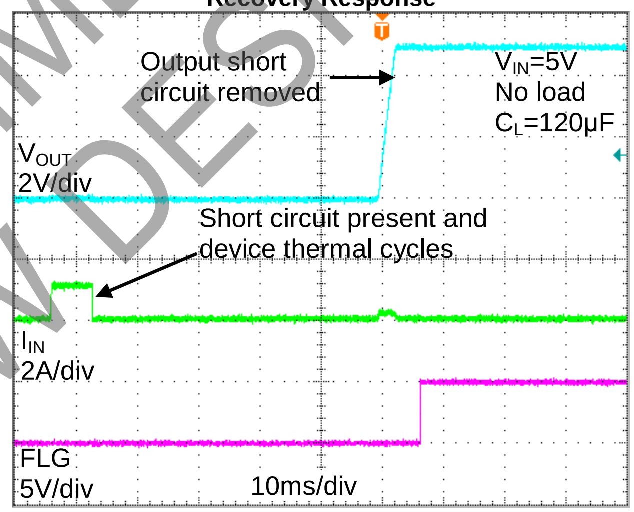
Short-Circuit to Full-Load Recovery Response



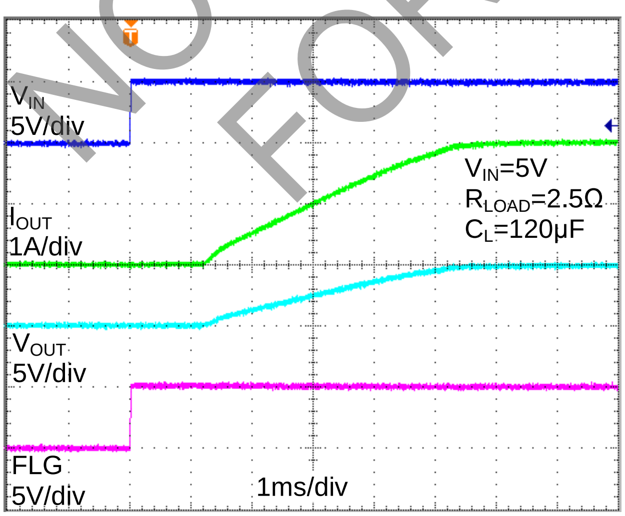
No-Load to Short-Circuit Transient Response



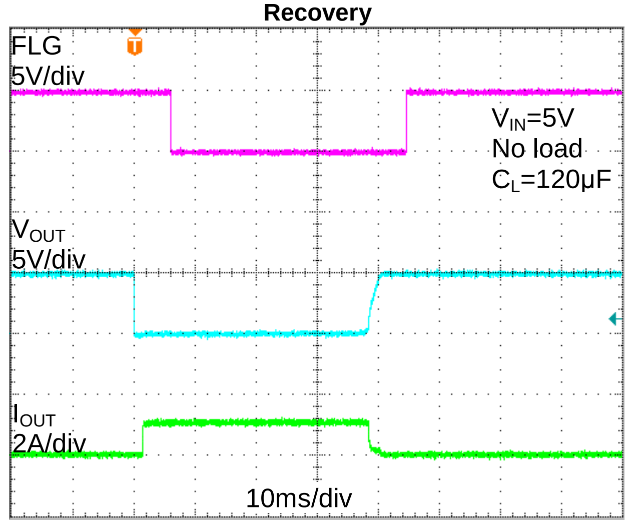
Short-Circuit to No-Load Recovery Response



Power ON

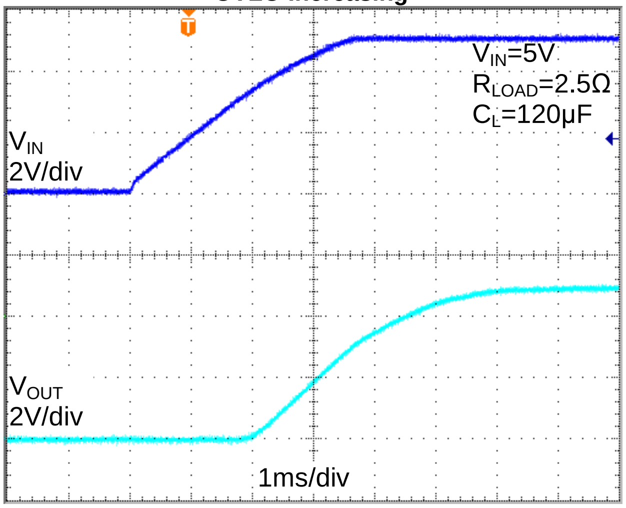


Short-Circuit with Blanking Time and Recovery

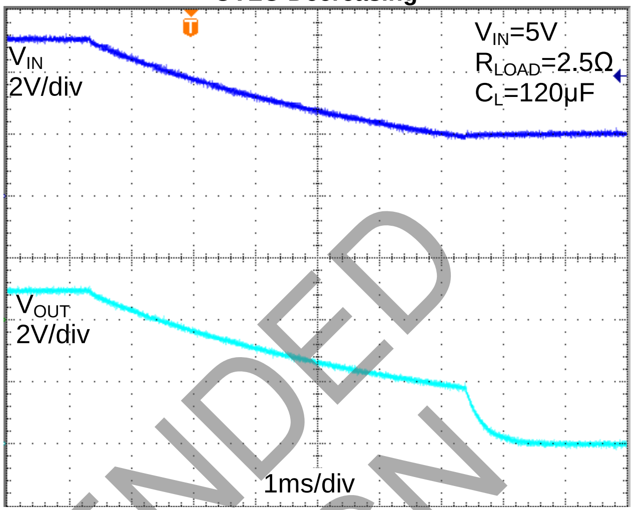


Performance Characteristics (continued) (T_A = +25°C, V_{IN} = 5V, C_{IN} = 1µF, C_L = 0.1µF, unless otherwise specified.)

UVLO Increasing

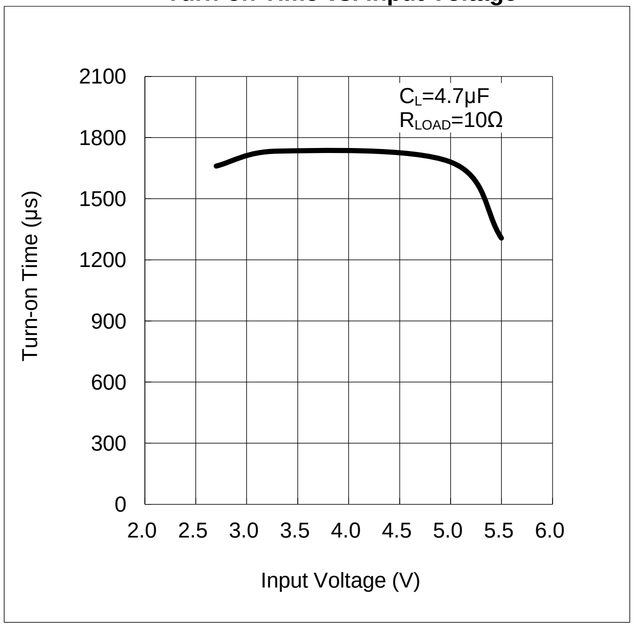


UVLO Decreasing

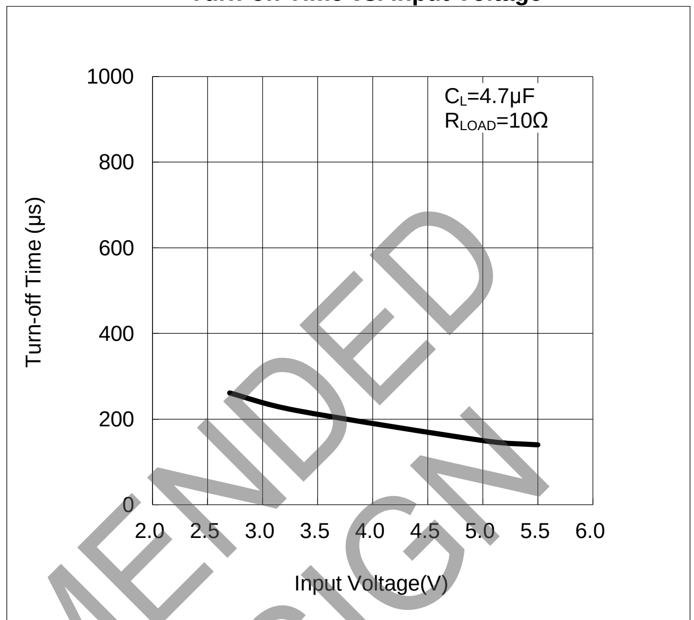


Performance Characteristics (continued) (T_A = +25°C, V_{IN} = 5V, C_{IN} = 1µF, C_L = 0.1µF, unless otherwise specified.)

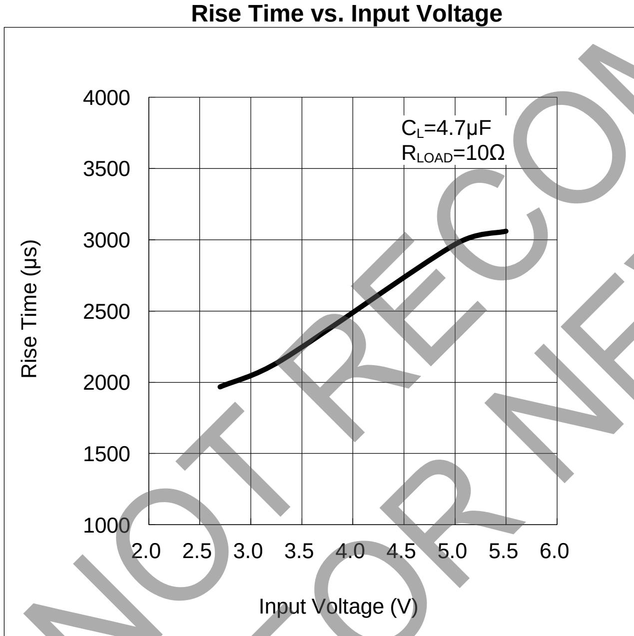
Turn-on Time vs. Input Voltage



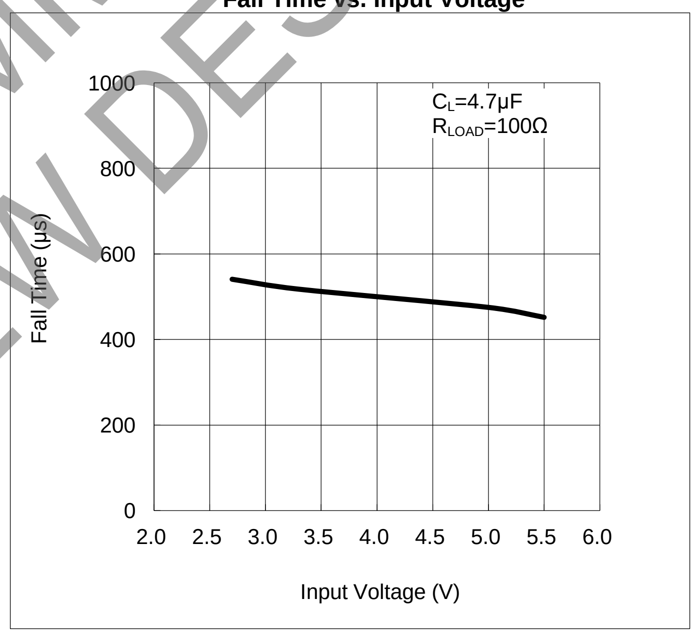
Turn-off Time vs. Input Voltage



Rise Time vs. Input Voltage

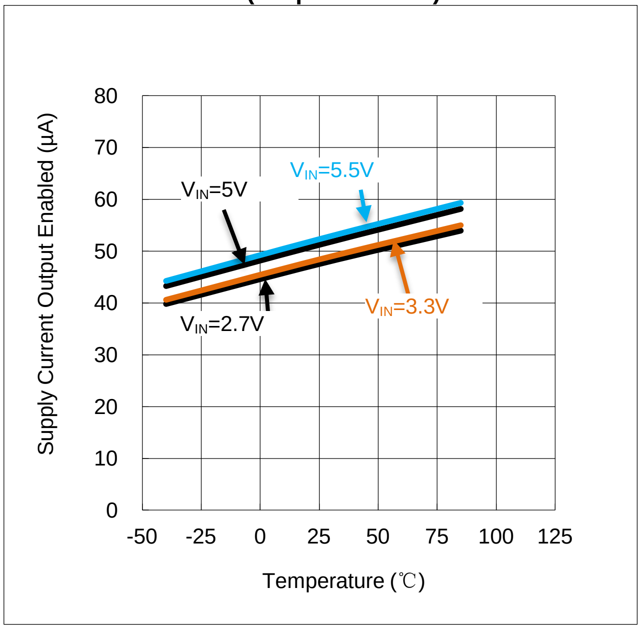


Fall Time vs. Input Voltage

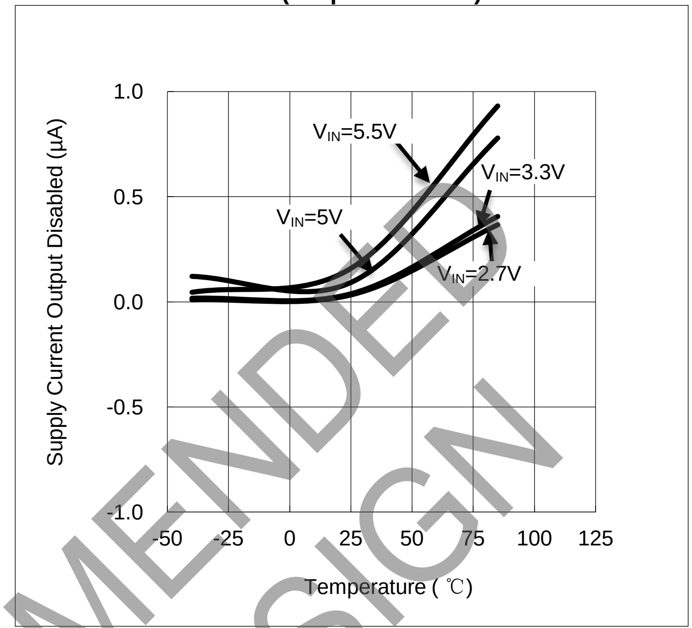


Performance Characteristics (continued) (T_A = +25°C, V_{IN} = 5V, C_{IN} = 1μF, C_L = 0.1μF, unless otherwise specified.)

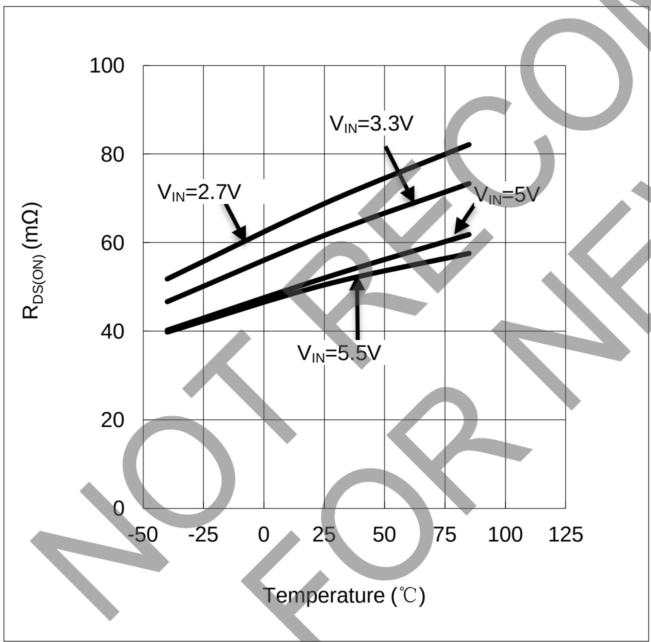
Supply Current vs. Temperature (Output Enabled)



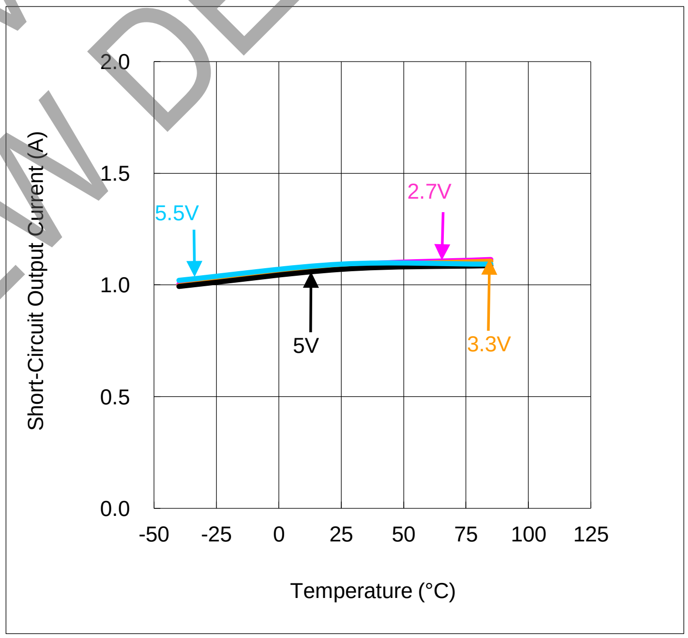
Supply Current vs. Temperature (Output Disabled)



$R_{DS(ON)}$ vs. Temperature

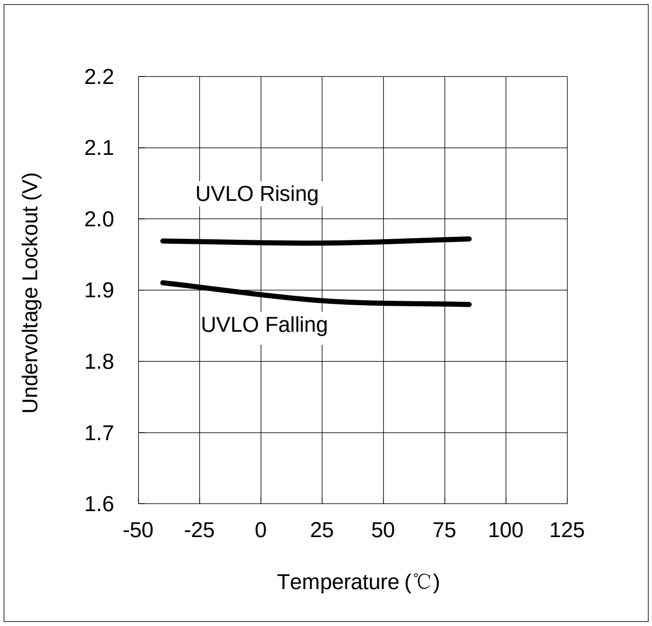


Short-Circuit Output Current vs. Temperature

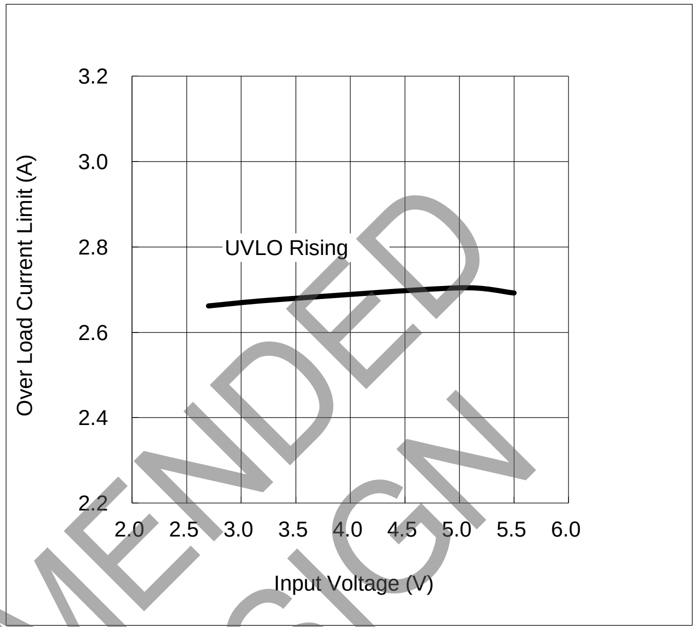


Performance Characteristics (continued) (T_A = +25°C, V_{IN} = 5V, C_{IN} = 1µF, C_L = 0.1µF, unless otherwise specified.)

Under Voltage Lockout vs. Temperature



Over Load Current Limit vs. Input Voltage



Application Information

Power Supply Considerations

A 1µF X7R or X5R ceramic bypass capacitor between IN and GND, close to the device, is recommended. Placing a high-value capacitor (10µF minimum) on both input and output pins is recommended when the output transient load is heavy. This precaution reduces power-supply transients that may cause ringing on the input. Additionally, bypassing the output with a 0.01µF to 0.1µF ceramic capacitor improves the immunity of the device to short-circuit transients.

FLG Response

When an over-current or over-temperature shutdown condition is encountered, the FLG open-drain output goes active low after a nominal 6ms deglitch timeout. The FLG output remains low until both over-current and over-temperature conditions are removed. Connecting a heavy capacitive load to the output of the device can cause a momentary over-current condition, which does not trigger the FLG due to the 6ms deglitch timeout. The AP22802 is designed to eliminate false over-current reporting without the need of external components to remove unwanted pulses.

Over-Current and Short Circuit Protection

An internal sensing FET is employed to check for over-current conditions. Unlike current-sense resistors, sense FETs do not increase the series resistance of the current path. When an overcurrent condition is detected, the device maintains a constant output current and reduces the output voltage accordingly. Complete shutdown occurs only if the fault stays long enough to activate thermal limiting.

Three possible overload conditions can occur. In the first condition, the output has been shorted to GND before the device is enabled or before VIN has been applied. The AP22802 senses the short circuit and immediately clamps output current to a certain safe level.

In the second condition, an output short or an overload occurs while the device is enabled. At the instance the overload occurs, higher current may flow for a very short period of time before the current limit function can react. After the current limit function has tripped, the device switches into current limiting mode and the current is clamped at I_{LIMIT}, or I_{SHORT}.

In the third condition, the load has been gradually increased beyond the recommended operating current. The current is permitted to rise until the current-limit threshold (I_{TRIG}) is reached or until the thermal limit of the device is exceeded. The AP22802 is capable of delivering current up to the current-limit threshold without damaging the device. Once the threshold has been reached, the device switches into its current limiting mode and is set at I_{LIMIT}.

Thermal Protection

Thermal protection prevents the IC from damage when heavy-overload or short-circuit faults are present for extended periods of time. The AP22802 implements a thermal sensing to monitor the operating junction temperature of the power distribution switch. Once the die temperature rises to approximately +140°C due to excessive power dissipation in an over-current or short-circuit condition the internal thermal sense circuitry turns the power switch off, thus preventing the power switch from damage. Hysteresis is built into the thermal sense circuit allowing the device to cool down approximately +60°C before the switch turns back on. The switch continues to cycle in this manner until the load fault or input power is removed. The FLG open-drain output is asserted when an over-temperature shutdown or over-current occurs with 6ms deglitch.

ON/OFF Input Operator

The EN input allows the output current to be switched on and off using a GPIO compatible input. The high signal (switch on) should be at least 1.5V, and the low signal (switch off) no higher than 0.5V. This pin should NOT be left floating. It is advisable to hold the EN signal low when applying or removing power.

Under-voltage Lockout (UVLO)

Under-voltage lockout function (UVLO) keeps the internal power switch from being turned on until the power supply has reached at least 2V, even if the switch is enabled. Whenever the input voltage falls below approximately 2V, the power switch is quickly turned off. This facilitates the design of hot-insertion systems where it is not possible to turn off the power switch before input power is removed.

Discharge Function

The discharge function of the device is active when enable is disabled or de-asserted. The discharge function with the N-MOS power switch implementation is activated and offers a resistive discharge path for the external storage capacitor. This is designed for discharging any residue of the output voltage when either no external output resistance or load resistance is present at the output.

Application Information (continued)

Power Dissipation and Junction Temperature

The low on-resistance of the internal MOSFET allows the small surface-mount packages to pass large current. Using the maximum operating ambient temperature (T_A) and $R_{DS(ON)}$, the power dissipation can be calculated by:

$P_D = R_{DS(ON)} \times I^2$

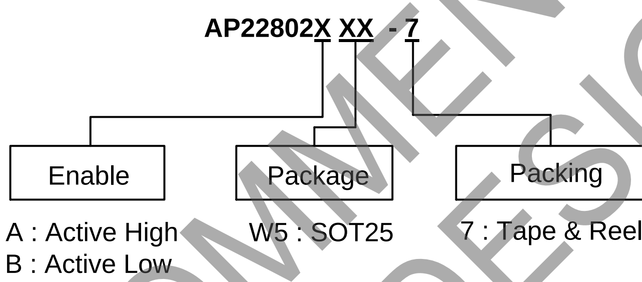
Finally, calculate the junction temperature:

$T_J = P_D \times R_{\theta JA} + T_A$

Where:

T_A = Ambient temperature °C
$R_{\theta JA}$ = Thermal resistance
P_D = Total power dissipation

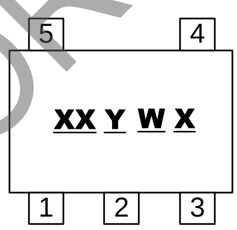
Ordering Information



Part Number	Package Code	Packaging	7" Tape and Reel	
			Quantity	Part Number Suffix
AP22802AW5-7	W5	SOT25	3000/Tape & Reel	-7
AP22802BW5-7	W5	SOT25	3000/Tape & Reel	-7

Marking Information

(Top View)



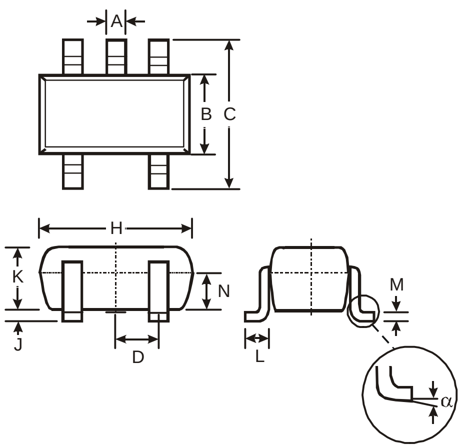
XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents 52 and 53 week
X : A~Z : Green

Part Number	Package Type	Identification Code
AP22802AW5-7	SOT25	XA
AP22802BW5-7	SOT25	XB

Package Outline Dimensions

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

SOT25

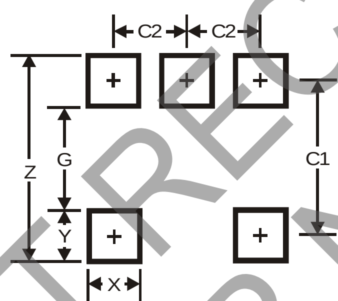


SOT25			
Dim	**Min**	**Max**	**Typ**
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	—	—	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	—
All Dimensions in mm			

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

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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

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