High-side Power Distribution Switch with Enable AP2821

General Description

The AP2821 is an integrated high-side power switch that consists of TTL compatible enables input, a charge pump, and N-Channel MOSFET. The switch's low RDS (ON), 120mΩ, meets USB voltage drop requirements. It includes soft-start to limit inrush current, over-current protection with fold-back, and thermal shutdown to avoid switch failure during hot plug-in. Under voltage lockout (UVLO) function is used to ensure the device remain off unless there is a valid input voltage present. And no reverse current when power off, with shutdown pull-low resistor to discharge the output capacitor when EN is disable.

The AP2821 is available in standard package of SOT-23-5.

Features

- Low MOSFET on Resistance: 120mΩ @V_{IN}=5.0V
- Compliant to USB Specifications
- Operating Voltage Range: 2.7V to 5.5V
- Low Supply Current: 35μA (Typ.)
- Low Shutdown Current: <1μA
- Current Limit with Fold-back: 2A
- Under-voltage Lockout
- Soft Start-up
- Over-current Protection
- Over Temperature Protection
- Load Short Protection with Fold-back
- No Reverse Current when Power off
- Pass System ESD: IEC61000-4-2
  ± 16KV (Air Discharge) and ± 8KV (Contact Discharge) on USB Connector

Applications

- USB Power Management
- USB Bus/Self Powered Hubs
- Hot-plug Power Supplies
- Battery-charger Circuits
- Notebooks, Motherboard PCs

SOT-23-5

Figure 1. Package Type of AP2821

Pin Configuration

K Package
（SOT-23-5）

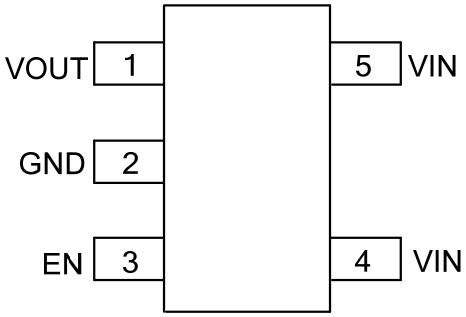


Figure 2. Pin Configuration of AP2821 (Top View)

Pin Descriptions

Pin No.	Name	Descriptions
1	VOUT	Switch Output Voltage
2	GND	Ground
3	EN	Chip Enable Control Input, Active High
4, 5	VIN	Supply Input Pin

Functional Block Diagram

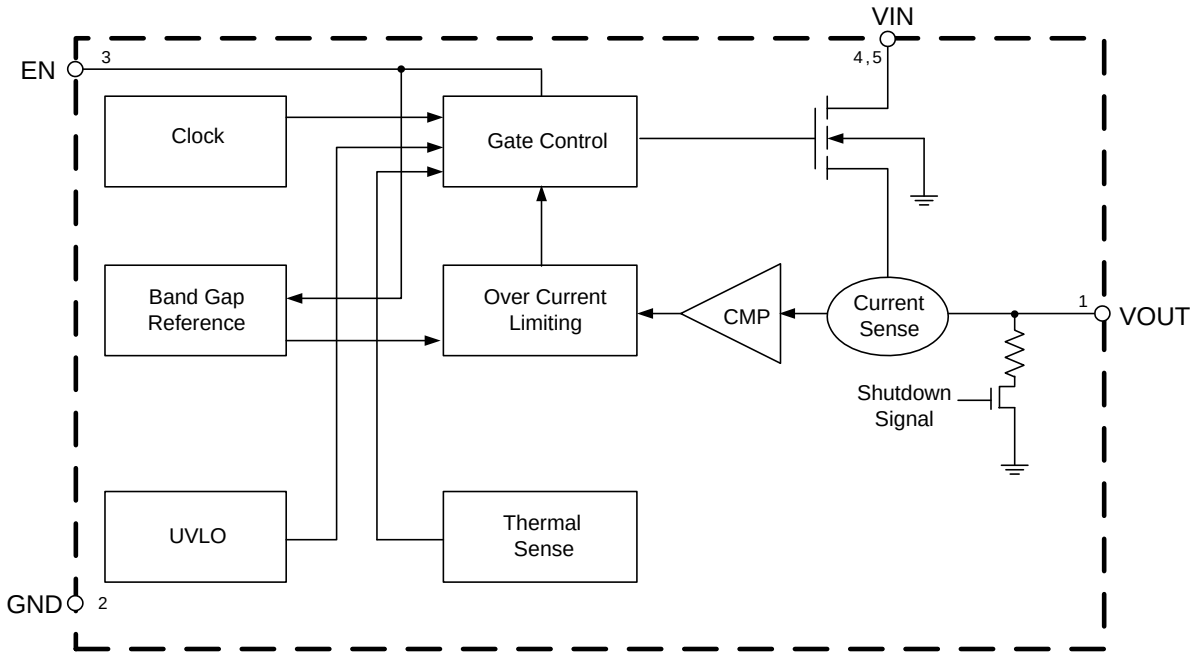
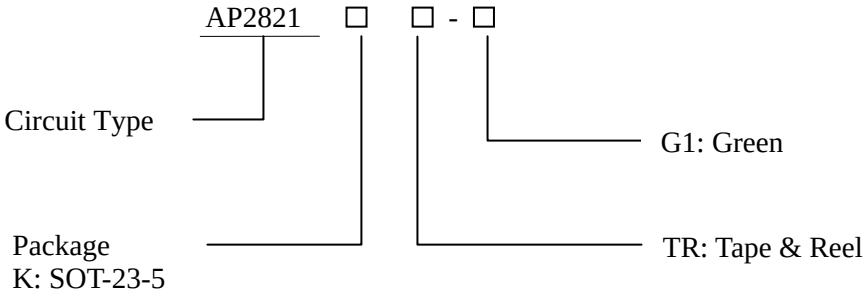


Figure 3. Functional Block Diagram of AP2821

Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOT-23-5	-40 to 85°C	AP2821KTR-G1	G4E	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and Green.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Power Supply Voltage	V_{IN}	6.0	V
Operating Junction Temperature Range	T_J	150	ºC
Storage Temperature Range	T_{STG}	-65 to 150	ºC
Lead Temperature (Soldering,10 Seconds)	T_{LEAD}	260	ºC
Thermal Resistance (Junction to Ambient)	θ_{JA}	235	ºC/W
ESD (Machine Model)		200	V
ESD (Human Body Model)		2000	V

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” may 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 may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{IN}	2.7	5.5	V
Ambient Operation Temperature Range	T_A	-40	85	°C

Electrical Characteristics

(V_{IN}=5.0V, C_{IN}=4.7μF, C_{OUT}=4.7μF, Typical T_A=25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		2.7		5.5	V
Switch On Resistance	$R_{DS(ON)}$	V_{IN}=5V, I_{OUT}=0.5A		120	140	mΩ
Current Limit	I_{LIMIT}	V_{OUT}=4.0V	1.5	2.0	2.8	A
Supply Current	I_{SUPPLY}	V_{IN}=5V, R_{LOAD} Open		35	65	μA
Fold-back Short Current	I_{SHORT}	V_{OUT}=0V		1.5		A
Shutdown Supply Current	$I_{SHUTDOWN}$	V_{EN}=0V, Shutdown Mode		0.1	1	μA
Output Leakage Current	$I_{LEAKAGE}$	V_{EN}=0V, V_{OUT}=0V		0.1	1	μA
Enable High Voltage	V_{ENH}	Enable Logic High	2.0		6.0	V
Enable Low Voltage	V_{ENL}	Enable Logic Low	0		1.2	V
Enable Pin Input Current	I_{EN}	Force 0V to 5.0V at EN Pin	0		1.0	μA
Under Voltage Lockout Threshold Voltage	V_{UVLO}	V_{IN} Increasing from 0V	2.2	2.5	2.7	V
Under Voltage Hysteresis	V_{UVLOHY}			0.2		V
Reverse Current	$I_{REVERSE}$	V_{EN}=0V, V_{OUT}>V_{IN}		0.1	1.0	μA
Shutdown Pull Low Resistance	$R_{DISCHARGE}$	V_{EN} is disable		100	250	Ω
Output Turn-on Time	t_{ON}	From Enable Active to 90% of Output, R_L=10Ω		1.9		ms
Thermal Shutdown Temperature	T_{OTSD}			145		°C
Thermal Shutdown Hysteresis	T_{HYOTSD}			20		
Thermal Resistance (Junction to Case)	θ_{JC}			70		°C/W

Typical Performance Characteristics

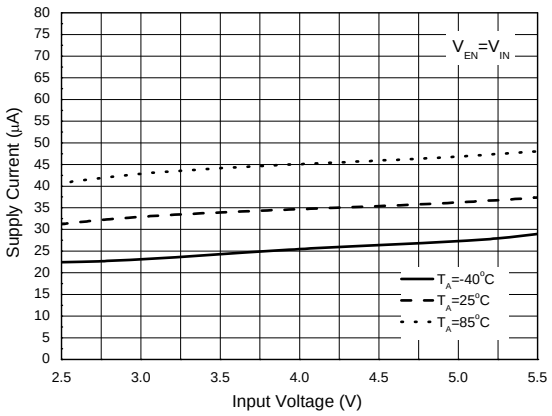


Figure 4. Supply Current vs. Input Voltage

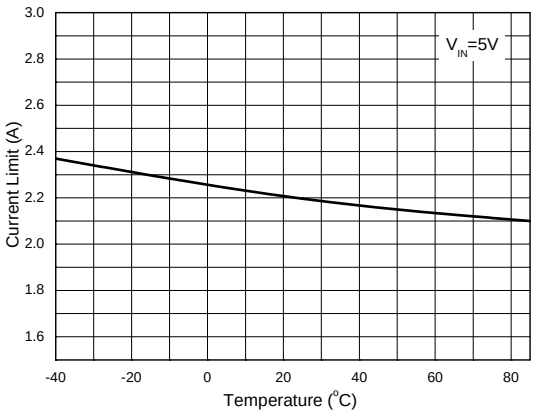


Figure 5. Current Limit vs. Temperature

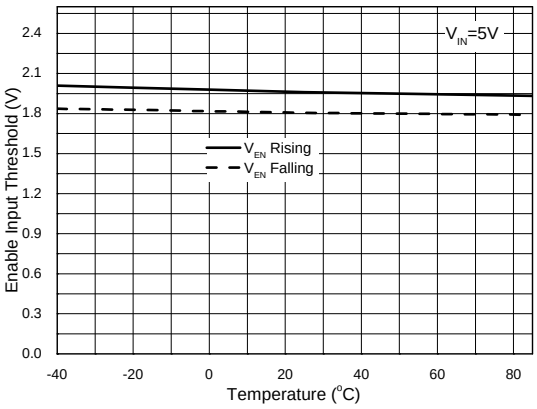


Figure 6. Enable Input Threshold vs. Temperature

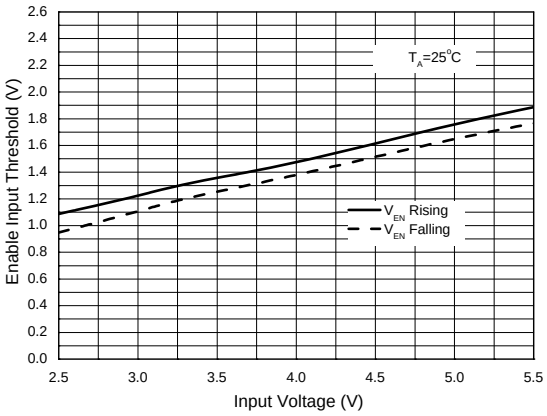


Figure 7. Enable Input Threshold vs. Input Voltage

Typical Performance Characteristics (Continued)

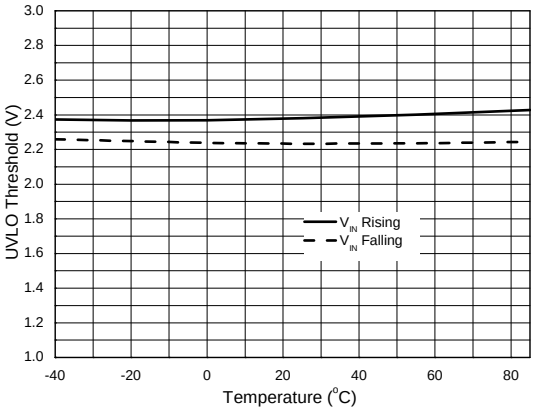


Figure 8. UVLO Threshold Voltage vs. Temperature

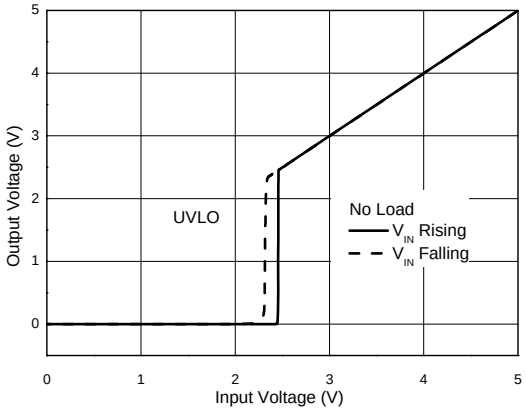


Figure 9. UVLO Function

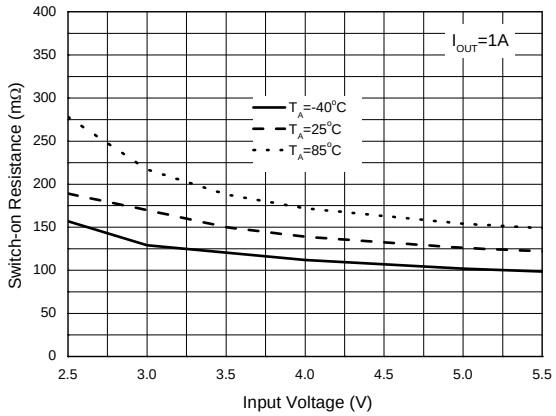


Figure 10. Switch-on Resistance vs. Input Voltage

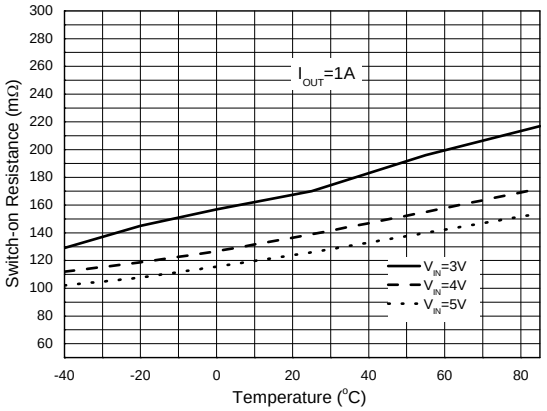


Figure 11. Switch-on Resistance vs. Temperature

Typical Performance Characteristics (Continued)

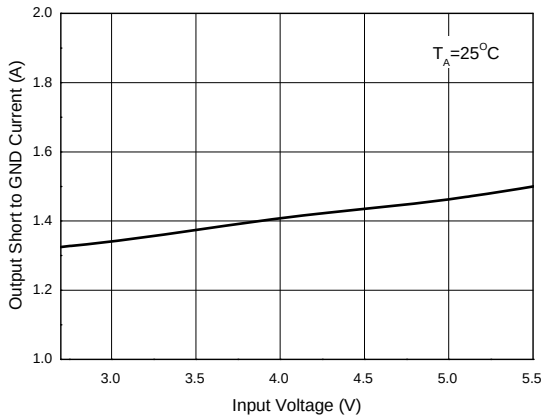


Figure 12. Output Short to GND Current vs. Input Voltage

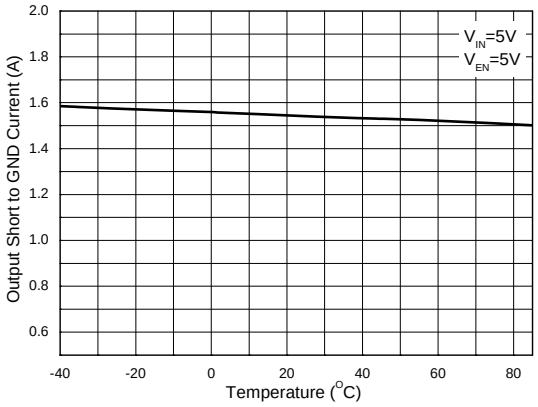


Figure 13. Output Short to GND Current vs. Temperature

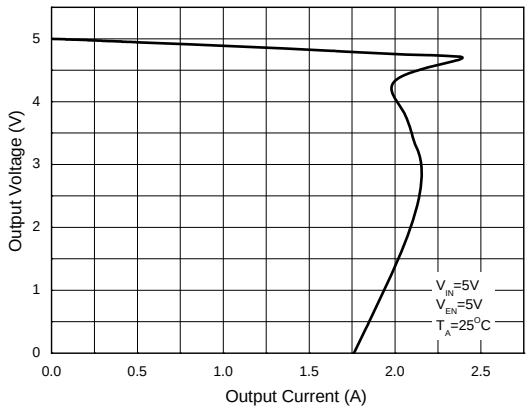


Figure 14. Output Voltage vs. Output Current

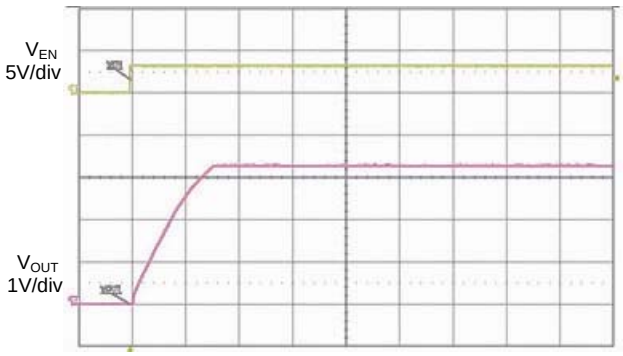


Figure 15. Switch Turn-on and Rise Time (V_{IN}=3.3V, C_{OUT}=4.7μF, No Load)

Typical Performance Characteristics (Continued)

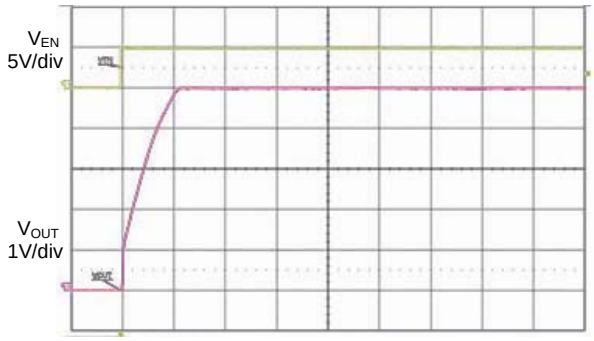


Figure 16. Switch Turn-on and Rise Time
(V_{IN}=5.0V, C_{OUT}=4.7μF, No Load)

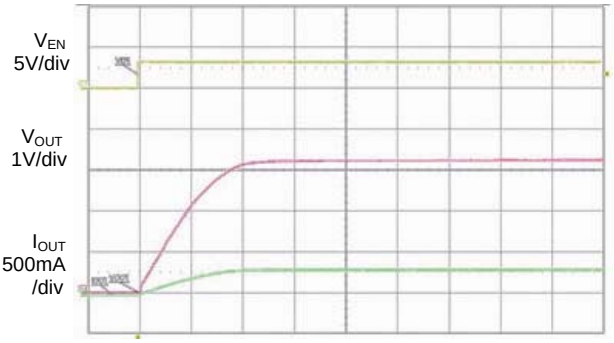


Figure 17. Switch Turn-on and Rise Time
(V_{IN}=3.3V, C_{OUT}=4.7μF, R_L=10Ω)

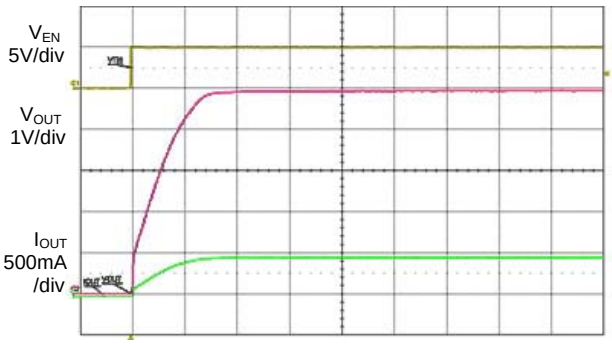


Figure 18. Switch Turn-on and Rise Time
(V_{IN}=5.0V, C_{OUT}=4.7μF, R_L=10Ω)

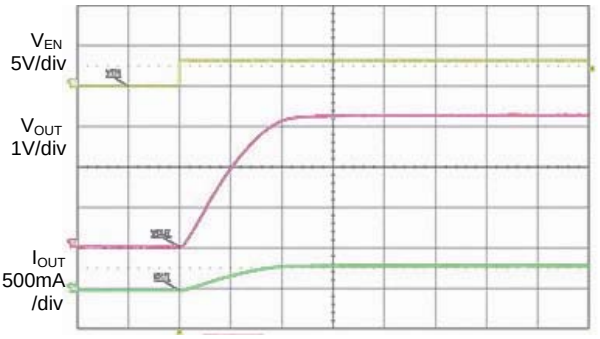


Figure 19. Switch Turn-on and Rise Time
(V_{IN}=3.3V, C_{OUT}=100μF, R_L=10Ω)

Typical Performance Characteristics (Continued)

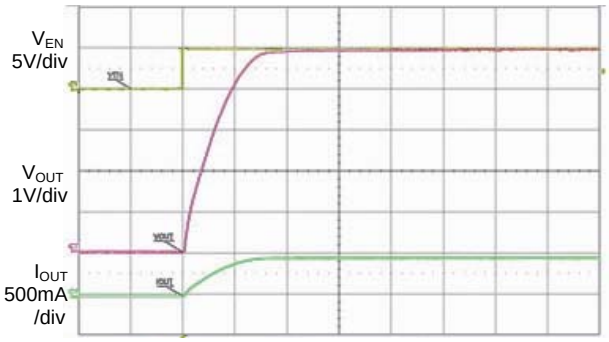


Figure 20. Switch Turn-on and Rise Time
(V_{IN}=5.0V, C_{OUT}=100μF, R_L=10Ω)

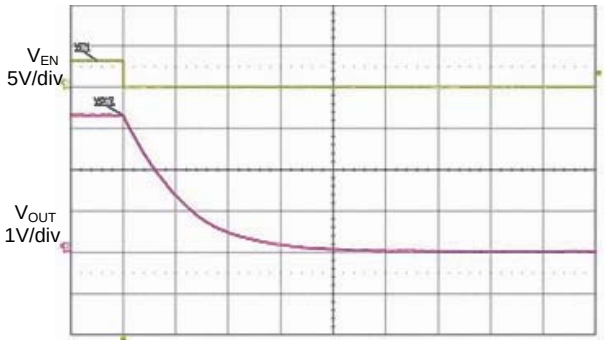


Figure 21. Switch Turn-off and Fall Time
(V_{IN}=3.3V, C_{OUT}=4.7μF, No Load)

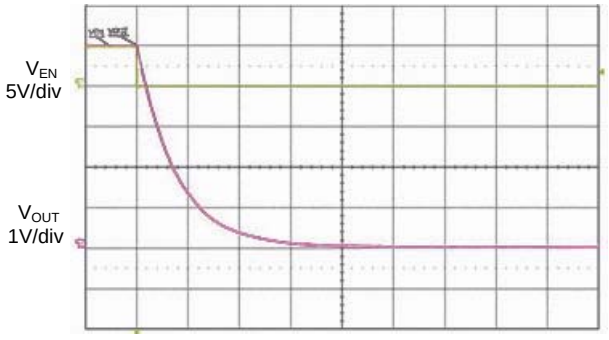


Figure 22. Switch Turn-off and Fall Time
(V_{IN}=5.0V, C_{OUT}=4.7μF, No Load)

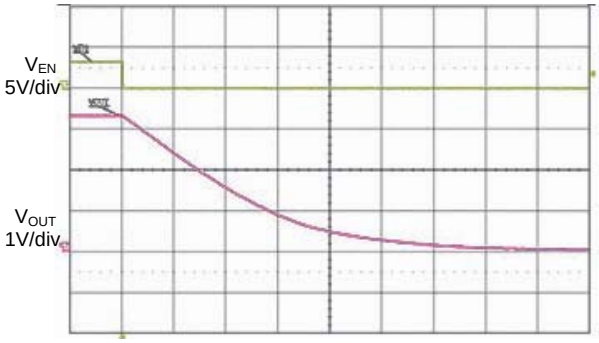


Figure 23. Switch Turn-off and Fall Time
(V_{IN}=3.3V, C_{OUT}=100μF, No Load)

Typical Performance Characteristics (Continued)

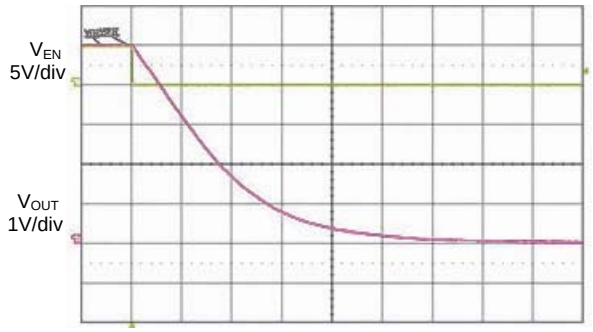


Figure 24. Switch Turn-off and Fall Time
(V_{IN}=5.0V, C_{OUT}=100µF, No Load)

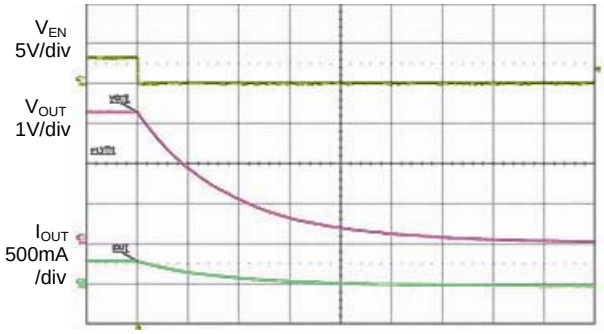


Figure 25. Switch Turn-off and Fall Time
(V_{IN}=3.3V, C_{OUT}=100µF, R_L=10Ω)

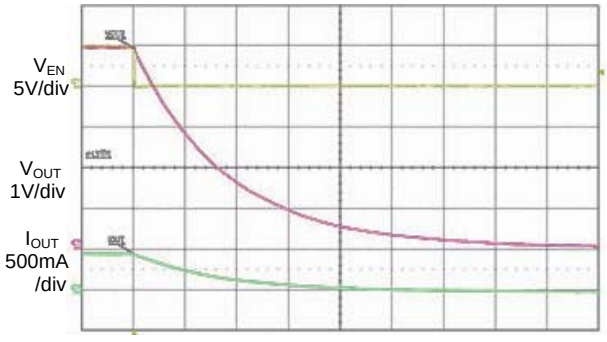


Figure 26. Switch Turn-off and Fall Time
(V_{IN}=5.0V, C_{OUT}=100µF, R_L=10Ω)

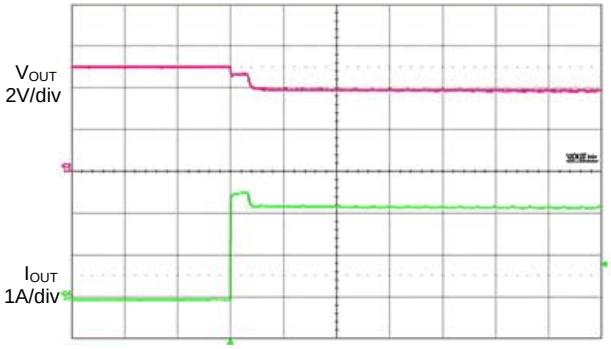


Figure 27. Resistance Load Inrush Response
(C_{OUT}=4.7µF, R_L=1.65Ω)

Typical Performance Characteristics (Continued)

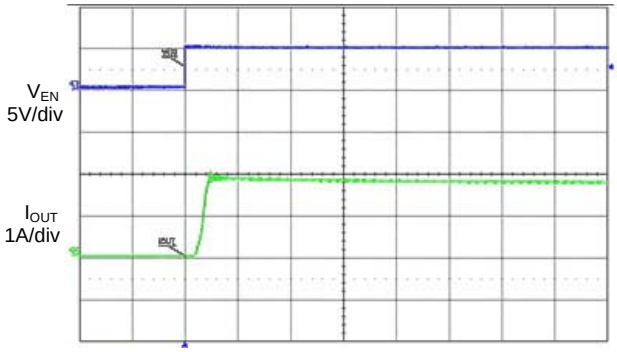


Figure 28. Short-circuit Current, Device Enable into Short (V_{IN}=5.0V, C_{OUT}=4.7μF)

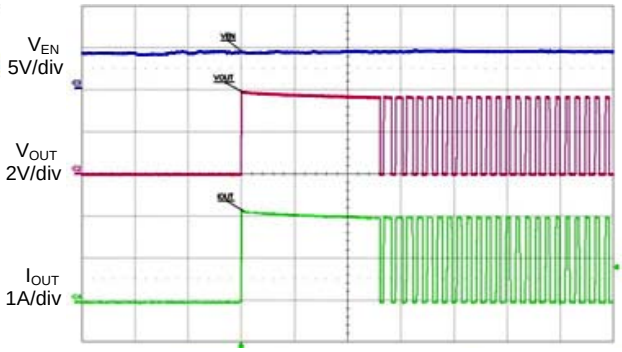
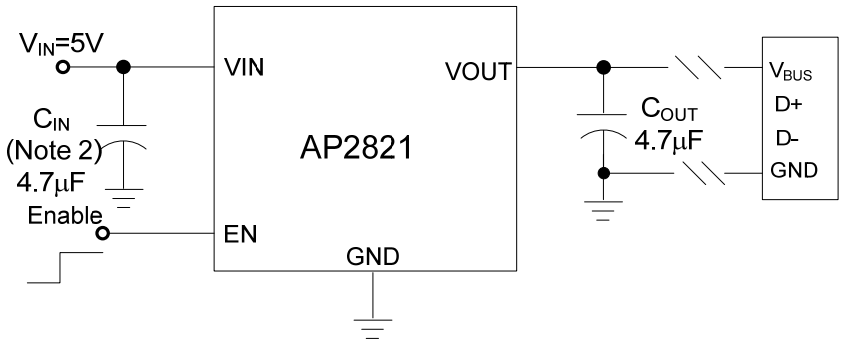


Figure 29. Thermal Shutdown Response (V_{IN}=5.0V, C_{OUT}=4.7μF, R_L=1.65Ω)

Typical Application

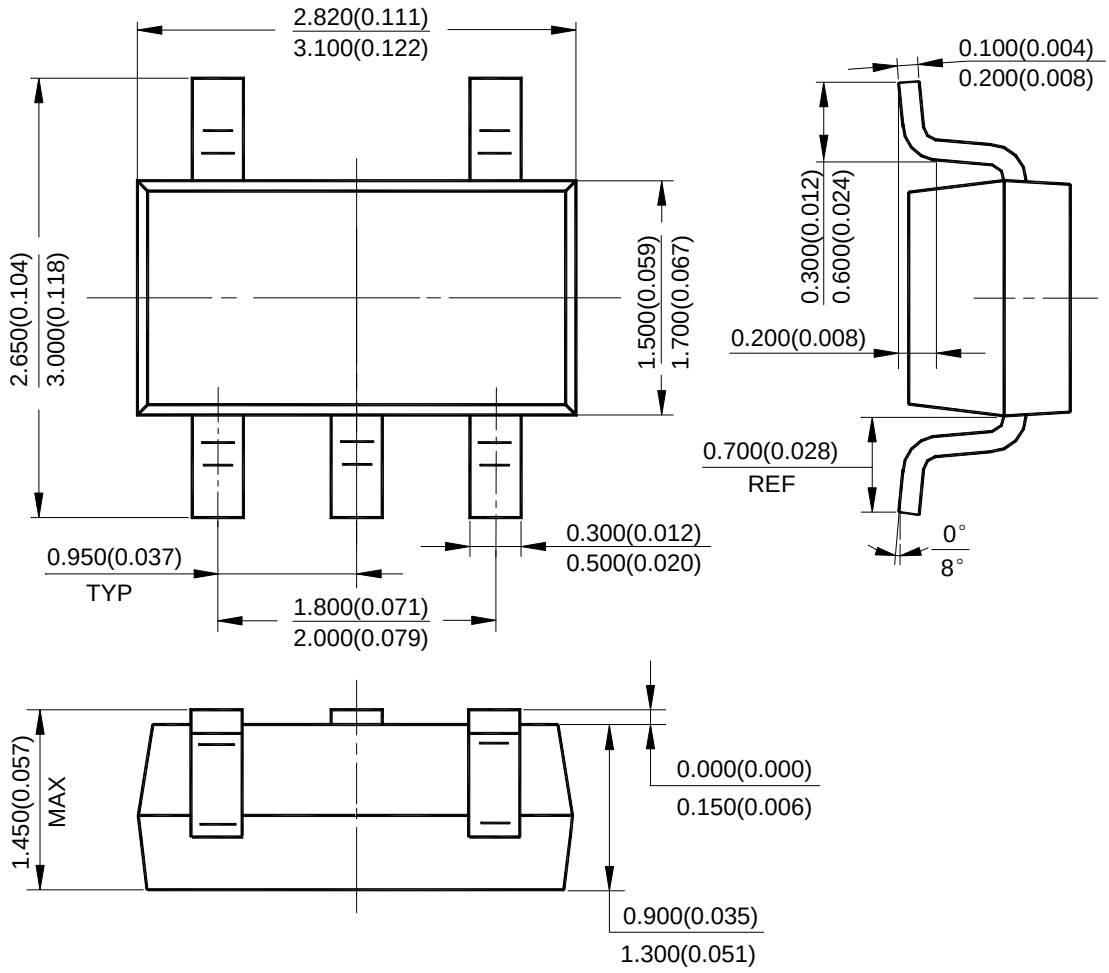


Note 2: 4.7μF input capacitor is enough in most application cases.
If the PCB trace of power rail to V_{IN} is long, larger input capacitor is necessary.

Figure 30. AP2821 Typical Application

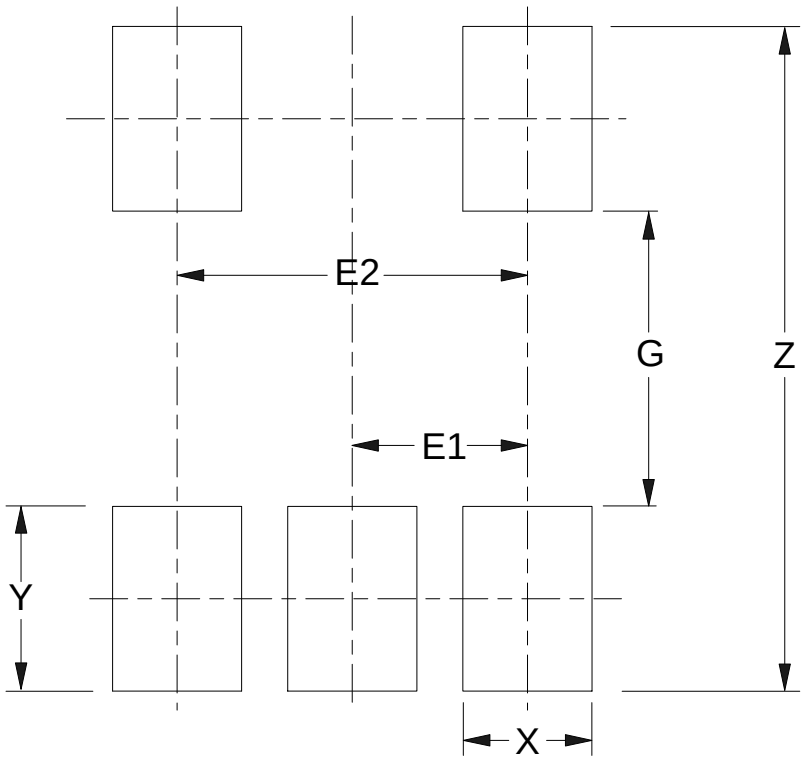
Mechanical Dimensions

SOT-23-5 **Unit: mm(inch)**



Mounting Pad Layout

SOT-23-5



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075

BCD Semiconductor Manufacturing Limited

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LifeElectronics
Живое партнерство

ООО «ЛайфЭлектроникс» **“LifeElectronics” LLC**

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

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С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

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- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
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- *Входной контроль качества.*
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- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
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