ACE3555R

1CH ADJ Current-Limited Power Distribution Switch

Description

The ACE3555R Power Distribution Switch features internal current limiting to prevent damage to host devices due to faulty load conditions. The ACE3555R develops ultra-low on-resistance switch with programmable current limiting to protect the power source from over current and short circuit conditions. It integrates the over temperature protection and discharges the output capacitor during the shutdown. In case the output is pulled higher than the input voltage under the shutdown, the ACE3555R can block the current flowing from the output to the input. The ACE3555R is available in SOT-23-5 package.

Features

- Single-Channel Power Distribution Switch
- Programmable Current Limit in 0.08A~2A Output Current
- Enable polarity: Active High
- 2.4V to 5.5V Supply Range
- Under-Voltage Lockout
- -40°C to +85°C Ambient Temperature Range
- Accurate Current Limit
- 15μA Quiescent Current
- 80mΩ MOSFET
- Thermal-Shutdown Protection
- Built-In Soft Start
- Reverse Current Blocking (No Body Diode)
- Available in SOT23-5 Package

Application

- Set-Top Boxes
- Wi-Fi Router/AP
- USB 3G Datacard/ USB Dongle
- ONT Boxes
- USB Ports and Hubs, Laptops, and Desktops
- Smartphone and PDA
- MiniPCI Accessories

Absolute Maximum Ratings (1)(2)(3)

Parameter	Range
All Pins Voltage	-0.3V to 6V
Operating Virtual Junction (T_J)	-40°C to 150°C
Ambient Temperature Operating Range (T_A)	-40°C to 85°C
Storage Temperature Range (T_S)	-55°C to 150°C
Lead Temperature (Soldering, 10s) (T_L)	260°C
Junction-to-ambient thermal resistance ($R_{\theta JA}$)	200°C/W
Junction-to-case thermal resistance ($R_{\theta JC}$)	130°C/W

Note 1: Exceeding these ratings may damage the device.

Note 2: The device is not guaranteed to function outside of its operating conditions.

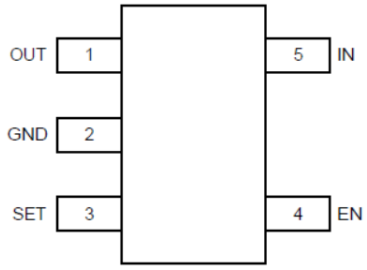
Note 3: θ_{JA} is measured in the natural convection at T_A = 25°C on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard. Pin 2 of SOT-23-5 packages is the case position for θ_{JC} measurement.

Recommended Operating Conditions

Parameter	Value
Input Voltage Pin	2.4V to 5.5V
All Other Pins	V to 5.5V
Junction Temperature Range (T_J)	-40°C to 125°C
Ambient Temperature Range (T_A)	-40°C to 85°C

Packaging Type

SOT23-5



Pin Description

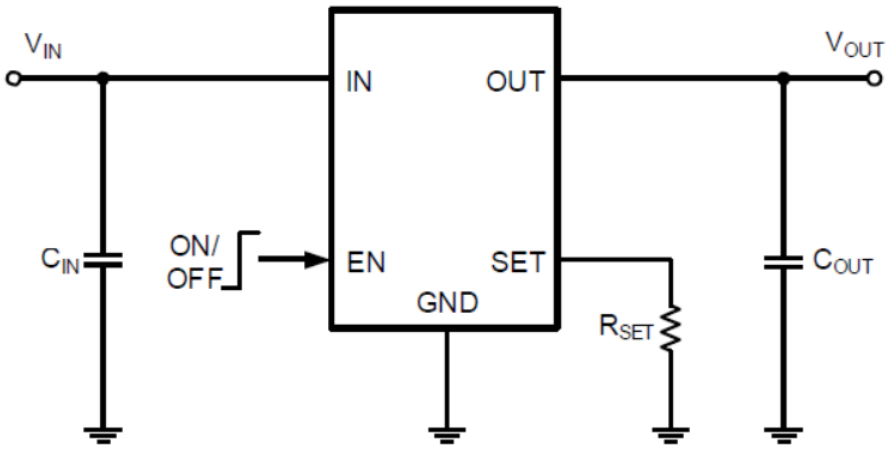
SOT23-5	Description	Function
1	OUT	Output Pin.
2	GND	Ground Pin.
3	SET	Current limit programming Pin. Connect a resistor R_{SET} from this pin to GND to program the current limit.
4	EN	ON/OFF control. Pull high to enable IC, do not float.
5	IN	Power Supply Pin

Ordering information

ACE3555R XX + H

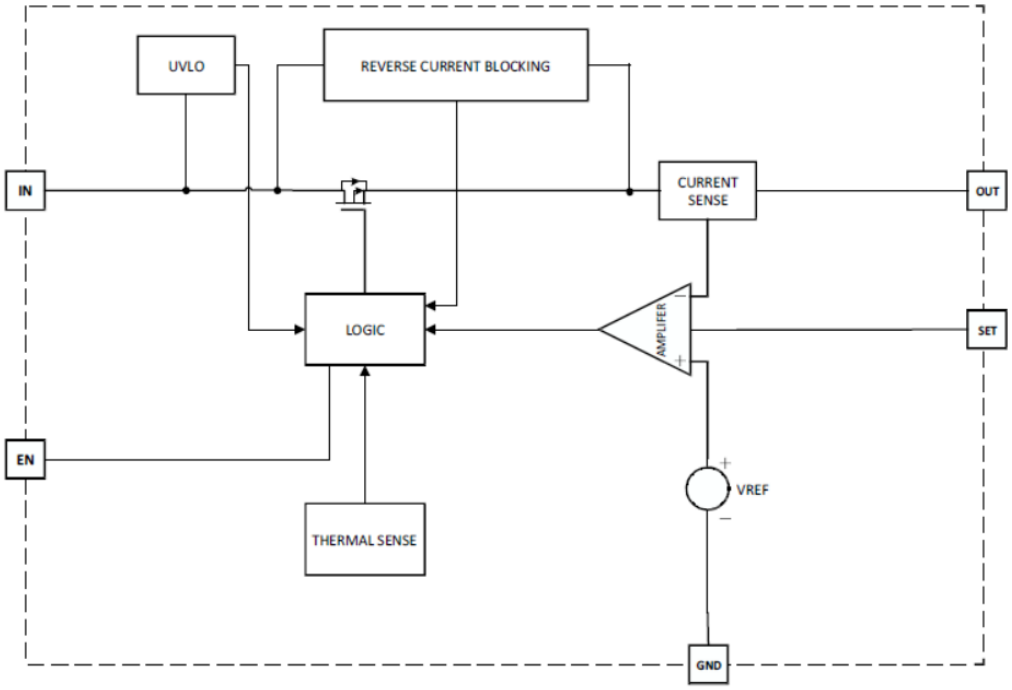
- Halogen - free
- Pb - free
- BN: SOT-23-5

Typical Application Circuit



Basic Application Circuit

Block Diagram



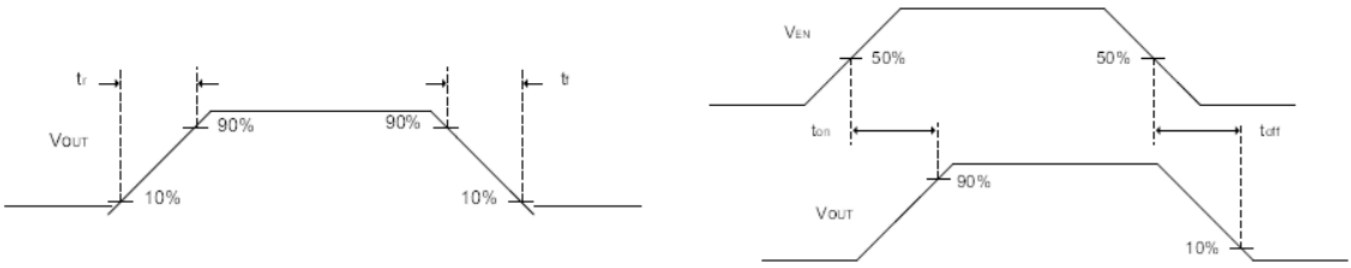
Electrical Characteristics (V_{IN} = 5V, C_L=1μF, per channel, T_A = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Unit
Input Voltage Range	V_{IN}		2.4		5.5	V
Shutdown Input Current	I_{SHDN}	Open load, IC Disabled		0.1	1	μA
Quiescent Supply Current	I_Q	Open load, IC Enabled		15		μA
FET RON	$R_{DS(ON)1}$			80		mΩ
ENB Rising Threshold	$V_{ENB(H)}$		2			V
ENB Falling Threshold	$V_{ENB(L)}$				0.8	V
ENB Leakage	I_{ENB}	V_{ENB}=5.5V			1	μA
IN UVLO Threshold	$V_{IN,UVLO}$	Minimum Duty Cycle			2.3	V
IN UVLO Hysteresis	$V_{IN,HYS}$			0.1		V
Over Current Limit	I_{LIM}	R_{SET}=6.8kΩ	0.75	1.0	1.25	A
	$I_{LIM(MIN)}$			0.08		A
	$I_{LIM(MAX)}$			2		A
Thermal Shutdown Temperature	T_{SD}			130		℃
Thermal Shutdown Hysteresis	T_{HYS}			20		℃

Typical Performance Characteristics (1) (2)

Note (1): Performance waveforms are tested on the evaluation board.

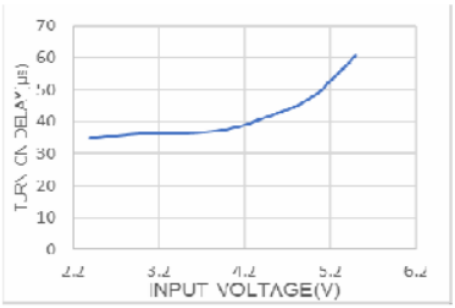
Note (2): V_{IN} = 5V, C_{OUT} = 1μF, R_{SET} = 6.8kΩ, T_A = +25°C, unless otherwise noted.



Tr, Tf, Ton, Toff waveforms

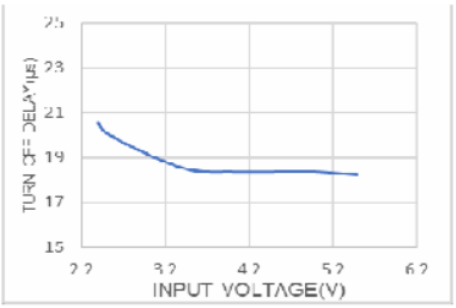
Turn on Delay vs. Input Voltage

V_{EN}=5V, R_{LOAD}=5Ω



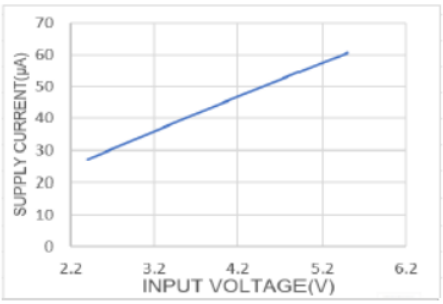
Turn off Delay vs. Input Voltage

V_{EN}=5V, R_{LOAD}=5Ω



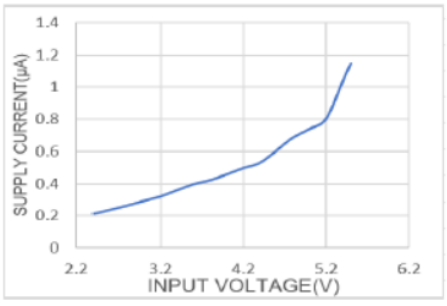
Supply Current, Output Enabled vs. Input Voltage

V_{EN} = 5V



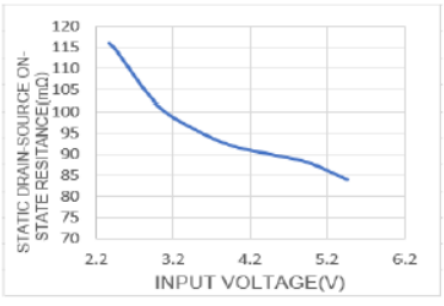
Supply Current, Output Disabled vs. Input Voltage

V_{EN} = 0V



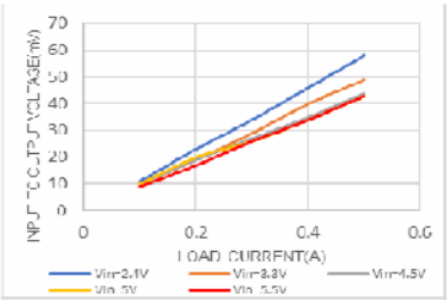
Static Drain-Source On-State Resistance vs. Input Voltage

V_{EN} = 5V, I_{LOAD}=0.5A

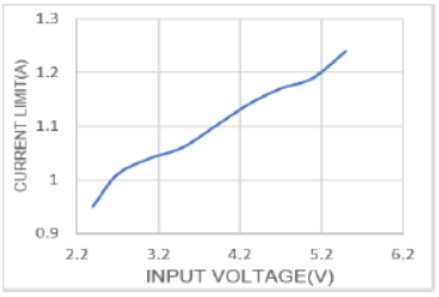


Input to Output Voltage vs. Load Current

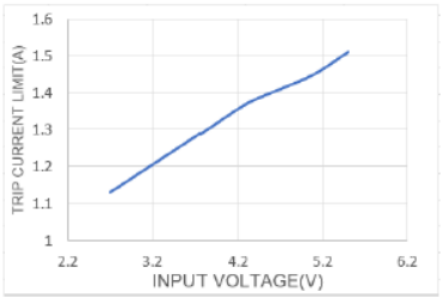
V_{EN} = 5V



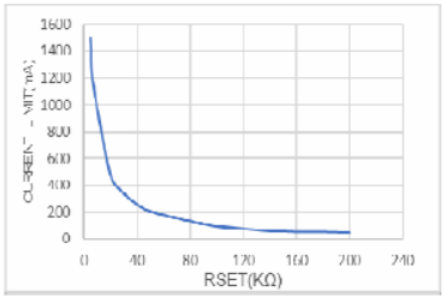
Current Limit vs. Input Voltage



Threshold Trip Current vs. Input Voltage

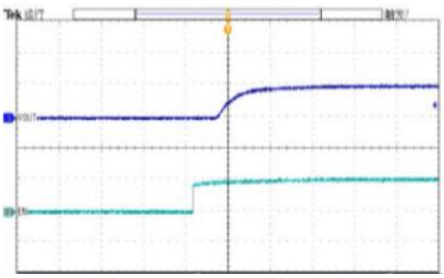


Current Limit vs. R_{SET}

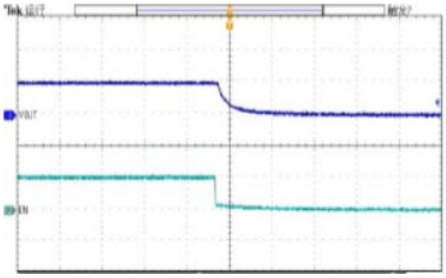


Turn on Delay Rise Time

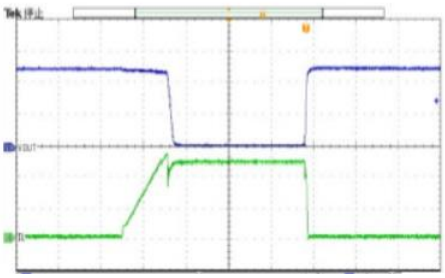
V_{EN} = 5V, R_{LOAD}=5Ω



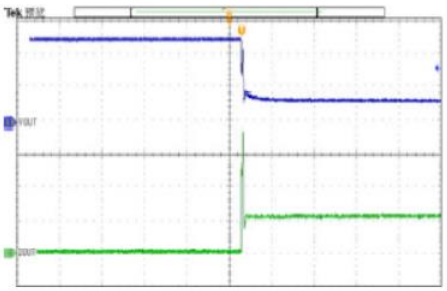
Turn off Delay Fall Time



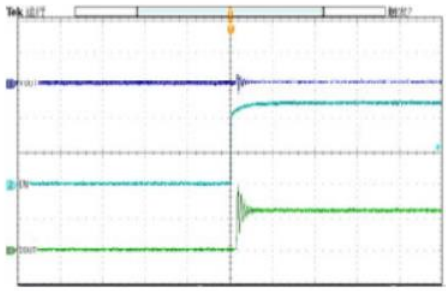
Threshold Trip Current with Ramped Load Enabled Device



1Ω Load Connected to Enabled Device

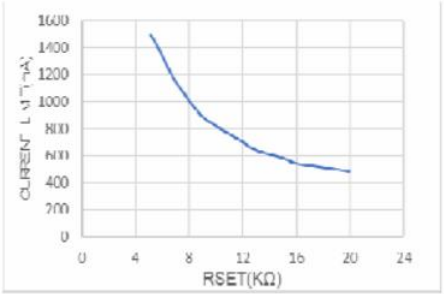


Short Circuit Current, Device Enabled into Short



Current Limit vs. R_{SET}

I_{LIM}=0.4~1.5A



Functions Description

Current Limit

The ACE3555R provides a constant current limit that can be programmed by an external resistor. Once the device reaches its current limit threshold, the internal circuit regulates the gate voltage to hold the current in the power MOSFET constant. Below table can be taken as a reference to choose R_{SET} to set the current limit threshold.

Table 1 Current Limit Threshold Setting

R_{SET} (kΩ)	Typical Current Limit (mA)
5.1	1360
5.6	1250
6.8	1020
7.5	930
8.2	870
10	730
12	615
15	500
18	420
30	260
51	160
82	100
100	88

Over Current

When the load exceeds trip current (minimum threshold current triggering constant-current mode) or short circuited, ACE3555R switches into to constant-current mode (current limit value). ACE3555R will be shut down only if the overcurrent condition stays long enough to trigger thermal protection.

Trigger overcurrent protection for different overload conditions occurring in applications:

1. The output has been shorted or overloaded before the device is enabled or input applied. ACE3555R detects the short or overload and immediately switches into a constant-current mode.
2. A short or an overload occurs after the device is enabled. The device switches into constant current mode after the current-limit circuit has been tripped (reached the trip current threshold). However, high current may flow for a short period of time before the current-limit circuit can react.
3. Output current has been gradually increased beyond the recommended operating current. The load current rises until the trip current threshold is reached or until the thermal limit of the device is exceeded. Once the trip threshold has been reached, the device switches into its constant-current mode.

Thermal Protection

If the current limit block starts to regulate the output current, the power loss on power MOSFET will cause the IC temperature rise. The die temperature is internally monitored until the thermal limit is reached. Once this temperature is reached, the switch will turn off to allow the chip to cool until the over temperature fault remove. The over temperature threshold is 130℃ and hysteresis is 20℃.

Under-voltage Lockout (UVLO)

This circuit is used to monitor the input voltage to ensure that the ACE3555R is operating correctly. This UVLO circuit also ensures that there is no operation until the input voltage reaches the minimum spec.

Reverse Current Blocking

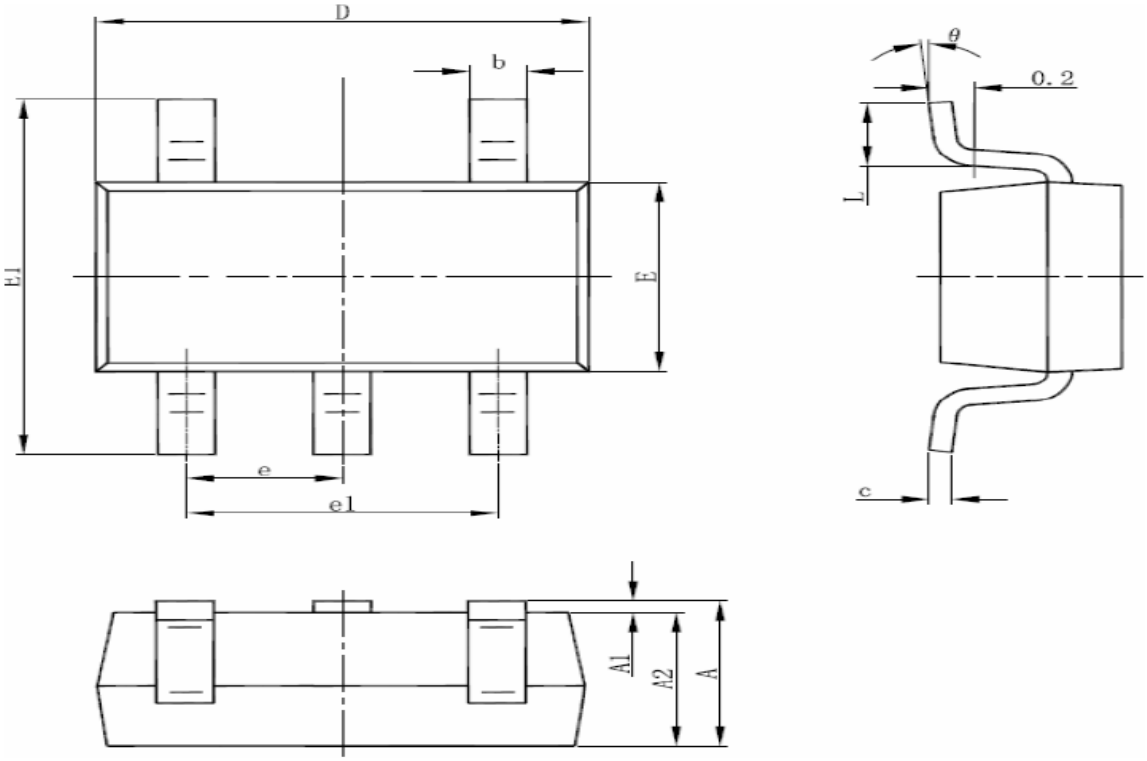
In case the output is pulled higher than the input voltage under the shutdown, the ACE3555R can block the current flowing from the output to the input. This prevents damage to devices on the input side of the ACE3555R by preventing significant current from sinking into the input capacitance.

Output Discharge

ACE3555R has output discharge function. It can discharge the output capacitor by internal pulldown resistance during shutdown.

Packing Information

SOT-23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	3.000	0.104	0.117
e	0.95 (BSC)		0.037 (BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	6°

Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Technology Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and shoes failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.