



## UR5512

## LINEAR INTEGRATED CIRCUIT

### 2A DDR BUS TERMINATION REGULATOR

#### DESCRIPTION

The UTC **UR5512** is a linear regulator which provides up to 2 Amp bi-directional driving and sinking capability for DDR SDRAM bus terminator application. The output termination voltage tracks the reference voltage applied at  $V_{REF}$  pin. A resistor divider connected to  $V_{IN}$ , GND and  $V_{REF}$  pins is used to force a reference voltage to  $V_{REF}$  pin.

The UTC **UR5512** contains a high-speed operational amplifier to provide excellent response to line/load transient. An active-low shutdown ( $V_{REF}$ ) pin provides Suspend to RAM (STR) functionality. Additional features include current limiting protection, on-chip thermal shut-down protection.

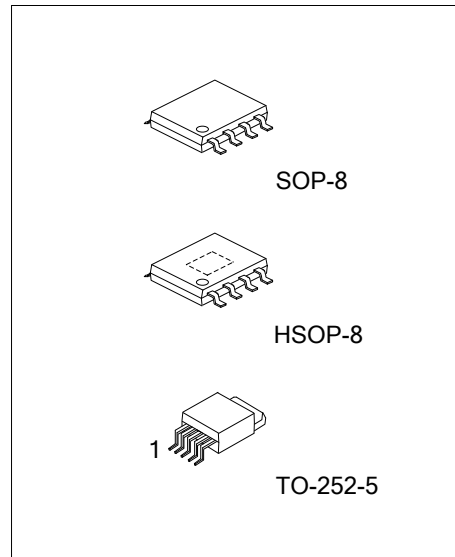
#### FEATURES

- \* DDR-I and DDR-II termination voltage applications
- \* Driving and sinking current up to 2A
- \* Low output voltage offset (within 20mV@±2A)
- \* Adjustable output voltage by external resistors
- \* Suspend to RAM (STR) functionality
- \* Current limiting protection
- \* Thermal protection
- \* Cost-effective and easy to use

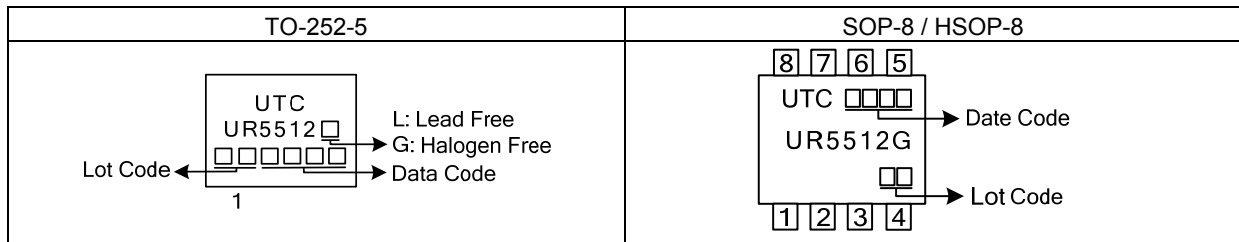
#### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
-	UR5512G-S08-R	SOP-8	Tape Reel
-	UR5512G-SH2-R	HSOP-8	Tape Reel
UR5512L-TN5-R	UR5512G-TN5-R	TO-252-5	Tape Reel

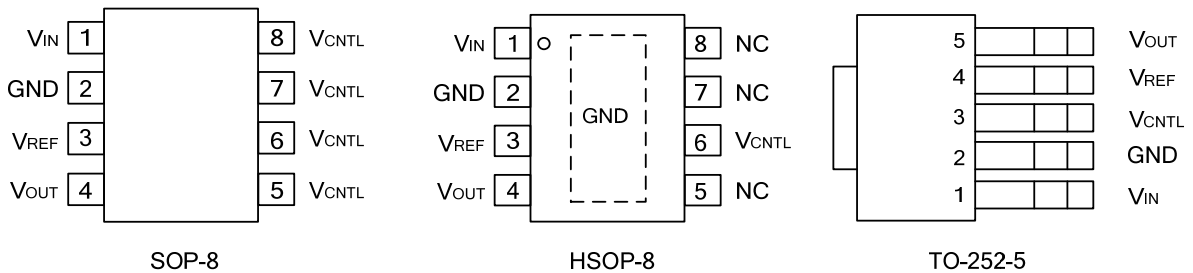
<p>UR5512G-S08-R</p> <ul style="list-style-type: none"> <li>(1)Packing Type</li> <li>(2)Package Type</li> <li>(3)Green Package</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel</li> <li>(2) S08: SOP-8, SH2: HSOP-8, TN5: TO-252-5</li> <li>(3) G: Halogen Free and Lead Free, L: Lead Free</li> </ul>
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## MARKING



## PIN CONFIGURATIONS

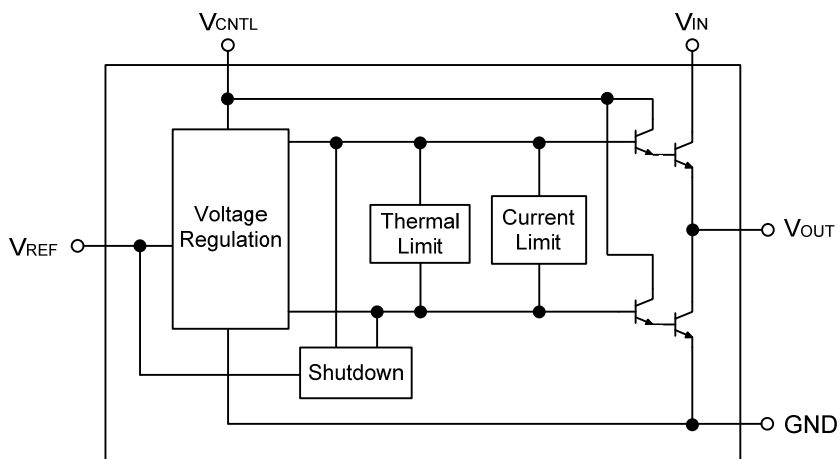


NC: No Connection

## PIN DESCRIPTION

PIN NAME	PIN TYPE	PIN DESCRIPTION
$V_{IN}$	I	Power input pin
GND	O	Ground pin
$V_{CNTRL}$	I	Power input pin for internal control circuit
$V_{REF}$	I	Reference voltage input and active-low shutdown control pin
$V_{OUT}$	O	Output voltage pin

## BLOCK DIAGRAM



### ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
V <sub>CNTL</sub> Control Voltage	V <sub>CNTL</sub>	-0.2 ~ 7	V
V <sub>IN</sub> Supply Voltage	V <sub>IN</sub>	-0.2 ~ 6	V
Power Dissipation	P <sub>D</sub>	Internally Limited	W
Junction Temperature	T <sub>J</sub>	+125	°C
Storage Temperature	T <sub>STG</sub>	-40 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RANGE	UNIT
V <sub>CNTL</sub> Control Voltage (Note 1)	V <sub>CNTL</sub>	3.1 ~ 6	V
V <sub>IN</sub> Supply Voltage	V <sub>IN</sub>	1.6 ~ 5.5	V
V <sub>REF</sub> Input Voltage	V <sub>REF</sub>	0.85 ~ 1.75	V
V <sub>OUT</sub> Output Voltage (Note 2)	V <sub>OUT</sub>	V <sub>REF</sub> ± 0.02	V
V <sub>OUT</sub> Output Current	I <sub>OUT</sub>	-2 ~ +2	A
Junction Temperature	T <sub>J</sub>	0 ~ +125	°C

Note: The V<sub>OUT</sub> tracks the V<sub>REF</sub> with additional voltage offset and load regulation.

### ■ ELECTRICAL CHARACTERISTICS

(V<sub>IN</sub> = 1.8V, V<sub>CNTL</sub> = 5V, V<sub>REFEN</sub> = 0.5V<sub>IN</sub>), Ta = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>INPUT CURRENT</b>						
Operation Current of V <sub>CNTL</sub>	I <sub>CNTL</sub>	I <sub>OUT</sub> = 0A		2	4	mA
		V <sub>REF</sub> =GND (Shutdown)		1.9		mA
Current into V <sub>REF</sub> Pin	I <sub>REF</sub>	V <sub>REF</sub> = 1.25V		200	500	nA
		V <sub>REF</sub> = GND (Shutdown)		20	40	μA
Standby Current	I <sub>STB</sub>	V <sub>REF</sub> < 0.2V, R <sub>LOAD</sub> = 180Ω		50	90	μA
<b>OUTPUT VOLTAGE</b>						
Output Voltage Offset (V <sub>OUT</sub> - V <sub>REF</sub> )	V <sub>O(OFF)</sub>	I <sub>OUT</sub> = 0A	-20	6	+20	mV
Load Regulation	ΔV <sub>LOAD</sub>	I <sub>OUT</sub> = ±1.5A	-20		+20	mV
<b>PROTECTION</b>						
Current limit	I <sub>LIMIT</sub>		2.0			A
Thermal Shutdown Temperature	T <sub>SD</sub>	V <sub>CNTL</sub> = 5V	125	180		°C
Thermal Shutdown Hysteresis	ΔT <sub>SD</sub>	V <sub>CNTL</sub> = 5V		40		°C
<b>REFEN Shutdown</b>						
Shutdown Threshold	V <sub>IH</sub>	Enable	0.6			V
	V <sub>IL</sub>	Shutdown			0.15	V

## ■ FUNCTIONAL DESCRIPTION

### General Information

The UTC **UR5512** is a linear regulator designed for DDR SDRAM bus terminator application. The output,  $V_{OUT}$  is capable of sourcing or sinking current up to 2A peak while regulating the output voltage to within 20mV offset. The UTC **UR5512** has excellent response to load regulation while preventing shoot through. Active-low shutdown mechanism and fault protections. The UTC **UR5512** is available in several packages to meet different power dissipation and surface mount applications.

### Output Voltage Regulation

The output voltage tracks the reference voltage applied at  $V_{REF}$  pin. Two internal NPN pass transistors act as the buffered output regulate the output voltage by sourcing current from  $V_{IN}$  pin or sinking current to GND pin. An internal Kelvin sensing scheme is use at the  $V_{OUT}$  pin to improve load regulation at various load current. Since the UTC **UR5512** exhibits excellent response to load transient, lesser amount of capacitors can be used.

### Current Limit

An internal current limiting sensor is used to monitor the maximum output current to prevent damages from overload or short-circuit condition. Increasing the input voltage of  $V_{IN}$  or  $V_{CNTL}$  will get higher current-limit points.

### Shutdown and Soft-Start

An additional function of the  $V_{REF}$  pin is acting as a shutdown control input that can be used for suspend to RAM functionality. Applying and holding a voltage below 0.15V to  $V_{REF}$  pin shuts down the output of the regulator. An external NPN transistor or N-channel MOSFET is used to pull down the  $V_{REF}$  pin voltage; while applying a "high" signal to turn on the transistor. During shutdown condition, the two pass transistors are turned off and the output  $V_{OUT}$  will tri-state; sourcing or sinking no current. When releasing the  $V_{REF}$  pin, the current through the resistor divider charges the capacitor  $C_{SS}$  to initiate a soft-start cycle.

### Thermal Shutdown

If the junction temperature exceeds the thermal shutdown ( $T_J = +150^{\circ}\text{C}$ ) then the part will enter a shutdown state. A thermal sensor turns off both pass transistors, allowing the device to cool down. After the junction temperature reduces by  $40^{\circ}\text{C}$ , the regulator starts to regulate again; resulting in a pulsed output during continuous thermal overload conditions.

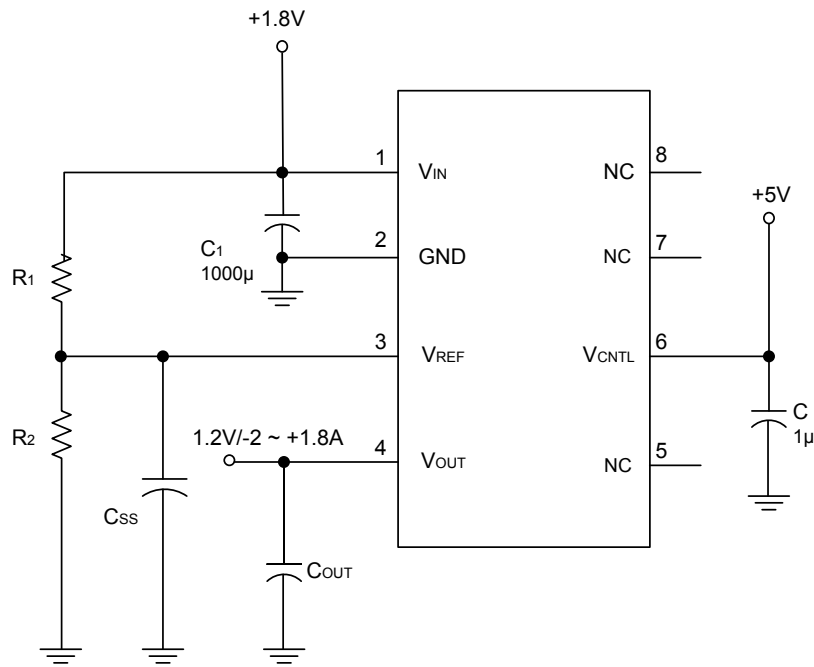
### Power Inputs

Input powers up sequence are not required for  $V_{IN}$  and  $V_{CNTL}$ . Be careful; do not apply voltage to  $V_{OUT}$  when there is no  $V_{CNTL}$  voltage presented. This is due to the internal parasitic diodes between  $V_{OUT}$  to  $V_{IN}$  and  $V_{OUT}$  to  $V_{CNTL}$  which will be forward bias.

### Reference Voltage

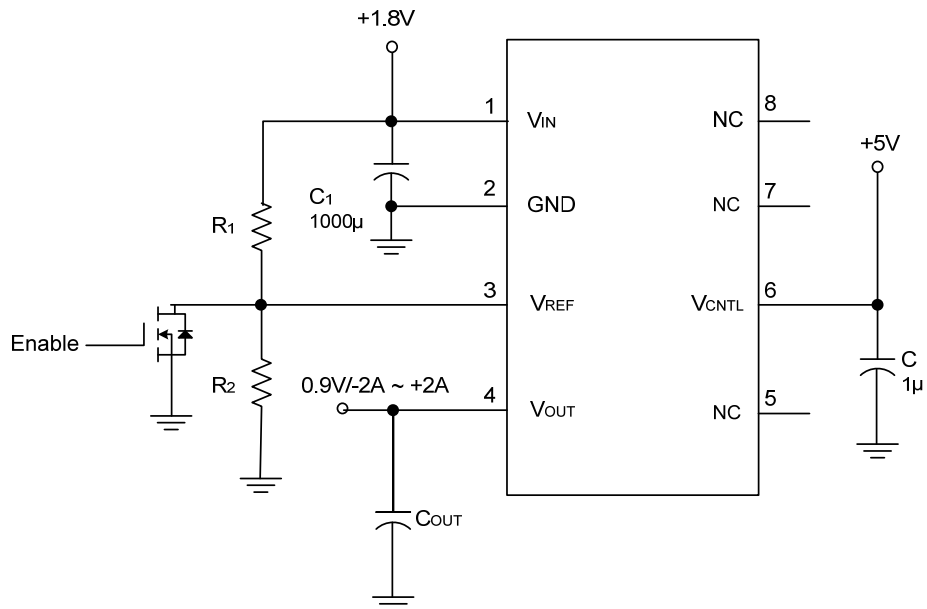
The reference voltage is programmed by a resistor divider between  $V_{IN}$  and GND pins. The recommended resistor is  $< 5\text{k}\Omega$  to maintain the accuracy of the output voltage. For improved the performance, an external bypass capacitor can be used, located close to  $V_{REF}$  pin to help with noise. A ceramic capacitor can be use and is selected to be greater than  $0.1\mu\text{F}$ . Do not place any additional loading on this reference input pin.

## ■ TYPICAL APPLICATIONS CIRCUIT

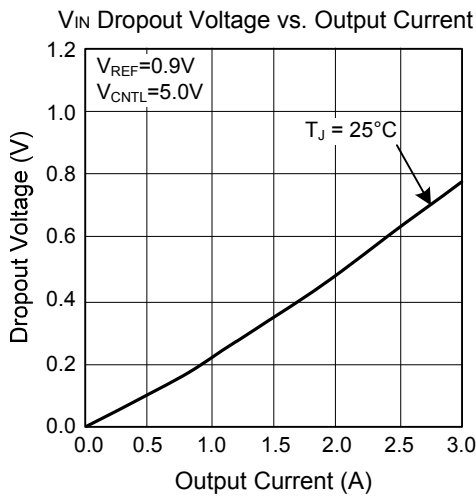
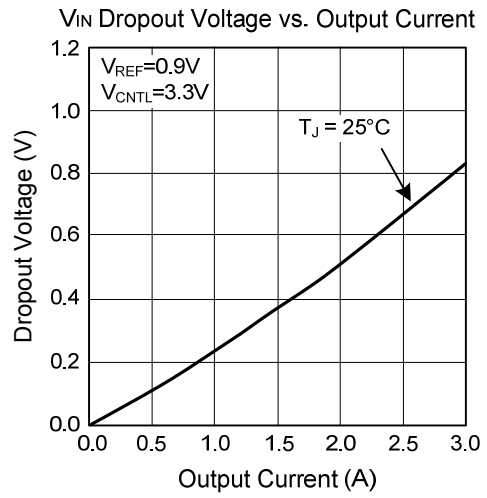
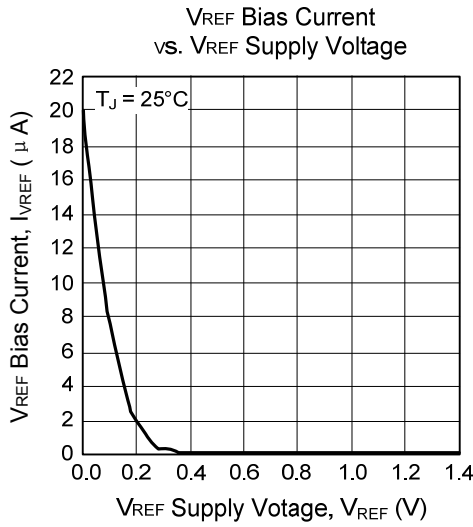


$$V_{REF} = V_{IN} \cdot \frac{R_2}{R_1 + R_2} \text{ (V)}$$

$V_{OUT}$  track  $V_{REF}$



■ TYPICAL CHARACTERISTICS



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