AME, Inc.

AME9172   Bus Termination Regulator

■ General Description

The AME9172 is a voltage regulator which could convert the input voltage ranging from 1.3V to 6V to an output voltage that user settled. The regulator can provide sourcing or sinking current. The AME9172 used in conjunction with series termination resistors, provides an excellent voltage source for active termination schemes of high speed transmission lines as those seen in high speed memory buses and distributed backplane designs.

The voltage output of the regulator can be used as a termination voltage for DDR SDRAM.

Current limits in both sourcing and sinking mode, plus on-chip thermal shutdown make the circuit tolerant of the output fault conditions.
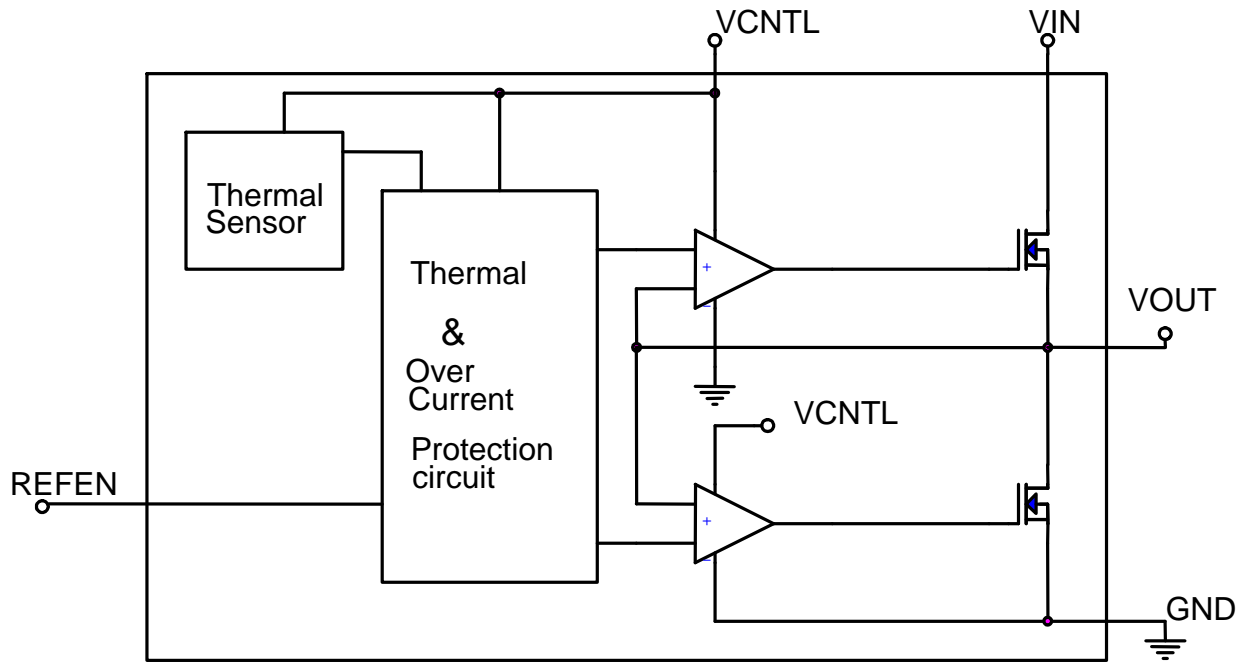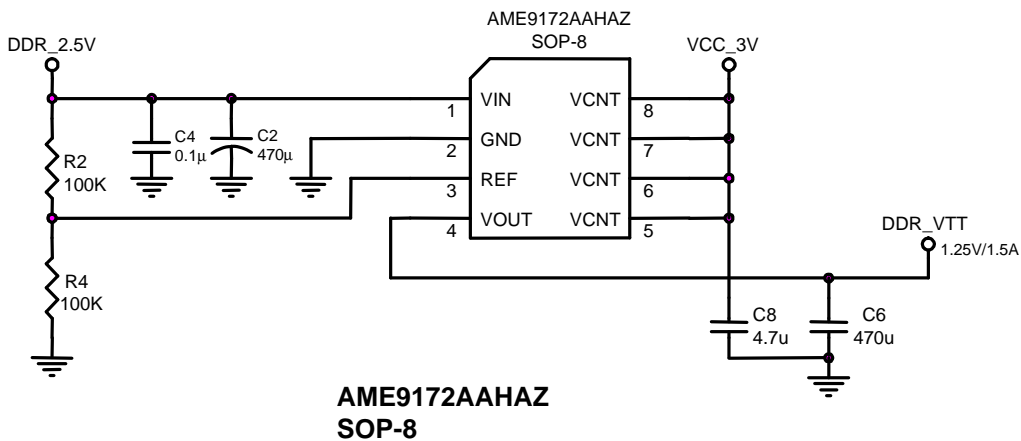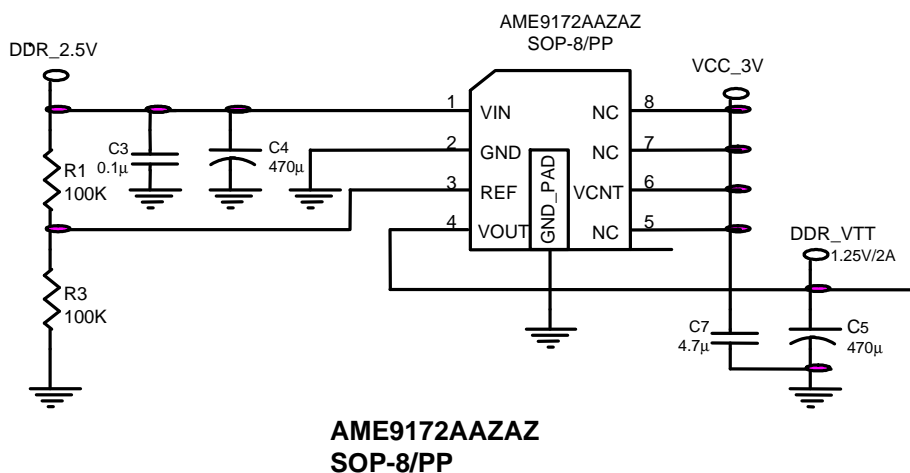
■ Features

- Support Both DDR 1 (1.25VTT), DDR 2 (0.9VTT) & DDR 3 (0.75VTT) Requirements
- Capable of Sourcing and Sinking Current
- Current-limiting Protection
- Thermal Protection
- Integrated Power MOSFETs
- Generates Termination Voltages for SSTL-2
- High Accuracy Output Voltage at Full-Load
- Adjustable VOUT by External Resistors
- Minimum External Components
- Shutdown for Standby or Suspend Mode Operation with High-impedance Output
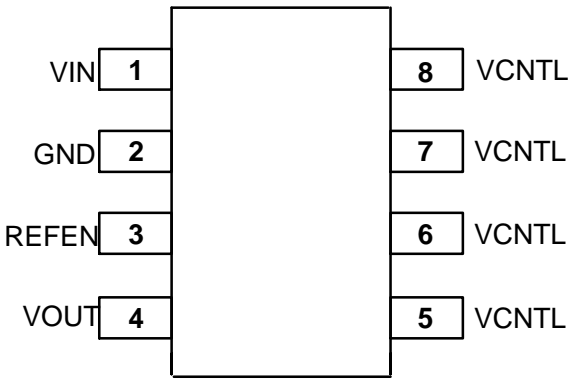- All AME′s Lead Free Products Meet RoHS Standards

■ Applications

- DDR Memory Termination Supply
- Active Termination Buses
- Desktop PC/AGP Graphics
- Supply Splitters
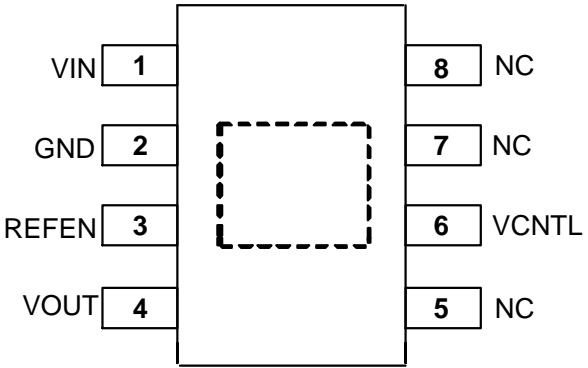- Set Top Box/IPC

■ Block Diagram

■ Application Circuit

Fig 1 : Application Circuit AME9172AAHAZ

Fig 2 : Application Circuit AME9172AAZAZ

■ Pin Configuration

Part Number	Pin Configurations
AME9172AAHAZ (SOP-8)	VIN 1 / 8 VCNTL GND 2 / 7 VCNTL REFEN 3 / 6 VCNTL VOUT 4 / 5 VCNTL

AME9172 Pin Assignment

Part Number	Pin Configurations
AME9172AAZAZ (SOP-8/PP)	VIN 1 / 8 NC GND 2 / 7 NC REFEN 3 / 6 VCNTL VOUT 4 / 5 NC NC= No internal connection ☐ = Thermal Pad (Connected to GND plane for better heat dissipation). The Pad of dimension is 0.090 x 0.090 (Inch)

AME9172 Pin Assignment

■ Ordering Information

AME9172 **x x x x x**

- Special Feature
- Number of Pins
- Package Type
- Operating Ambient Temperature Range
- Pin Configuration

Pin Configuration	Operating Ambient Temperature Range	Package Type	Number of Pins	Special Feature
A: 1. VIN (SOP-8) 2. GND 3. REF 4. VOUT 5. VCNT 6. VCNT 7. VCNT 8. VCNT A: 1. VIN (SOP-8/PP) 2. GND 3. REF 4. VOUT 5. NC 6. VCNT 7. NC 8. NC	A: -25°C to 85°C	H: SOP Z: SOP/PP	A: 8	Z: Lead free

■ Ordering Information

Part Number	Marking*	Output Voltage	Package	Operating Ambient Temperature Range
AME9172AAHAZ	9172 AAHA yyww	N/A	SOP-8	-25°C to 85°C
AME9172AAZAZ	9172 AAZA yyww	N/A	SOP-8/PP	-25°C to 85°C

Note: yyww represents the date code.
 * A line on top of the first letter represents lead free plating such as $\overline{9}172$
Please consult AME sales office or authorized Rep./Distributor for package type availability.

■ Pin Description

Pin name	Pin Description
VIN	Power Input
GND	Ground
VCNTL	Driving Voltage
REFEN	Input voltage reference & chip enable
VOUT	Output Voltage

■ Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
VIN	Input Voltage. VIN to GND	6	V
PD	Power Disspation	Internally Limit	W
VESD	ESD Rating (Human Body Mode)	2	KV
TSTG	Storage Temperature	150	^{O}C
TL	Lead Temperature (Soldering. 5sec)	245	^{O}C

■ Thermal Characteristics

Symbol	Parameter	Symbol	Unit
θ_{JC}	Thermal Resistance In Case		^{O}C/W
	SOP-8	25.7	
	SOP-8/PP	12	

■ Recommended Operating Conditions

Symbol	Parameter	Rating	Unit
VIN	Supply Voltage to VIN	1.5 to 3.3	V
VCNT	Supply Voltage to VCNT	3.3	V
*I_{OUT}	Output Current of VOUT Pin *	-2 to 2	A
T_J	Junction Temperature	-25 to 125	^{O}C

* The symbol "+" means the VOUT sources current to load; the symbol "-" means the VOUT sinks current to GND

■ Electrical Specifications

Limits in standard typeface are for $T_A = 25$, unless otherwise specified:
DDR1 => $V_{IN} = 2.5V$, $V_{CNTL} = 3.3V$, $V_{REFEN} = 0.5V_{IN}$. (Note2)

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output Offset Voltage	V_{OS}	$I_{OUT} = 0A$ (Note 1)		-20	0	20	mV
Load Regulation (DDR 1 / 2 / 3)	V_{LOAD}	$I_L = 0$ to 1.5A (Fig 4)		-20	0	20	mV
		$I_L = 0$ to -1.5A		-20	0	20	
Input Voltage Range (DDR 1 / 2 / 3)	V_{IN}	Keep $V_{CNTL} \geq V_{IN}$ on operation power on and power off	DDR 1	1.8	2.5	4	V
			DDR 2	1.6	1.8	4	
			DDR 3	1.3	1.5	4	
	V_{CNTL}		DDR 1 / 2 / 3	2.5	3.3	6	
Operating Current of V_{CNTL}	I_{CNTL}	No Load			1.4		mA
Short Circuit Protection							
DDR 1 / 2 / 3 Current Limit	I_{LIMIT}	Fig 6,7		2.0			A
Over Temperature Protection							
Thermal Shutdown Temperature	T_{SD}	$3.3V \leq V_{CNTL} \leq 5 V$		125			°C
Thermal Shutdown Hysteresis		Guaranteed by design			30		

Note1: V_{OS} offset is the voltage measurement defined as V_{OUT} subtracted from V_{REFEN}.
Note2: DDR3 => $V_{IN} = 1.5V$, $V_{CNTL} = 3.3V$, $V_{REFEN} = 0.5V_{IN}$
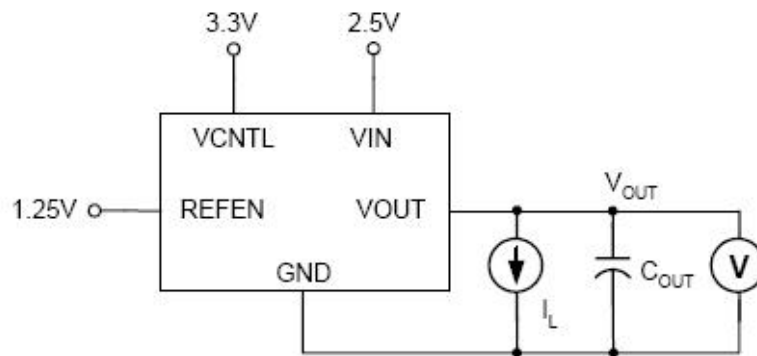
■ Test Circuit

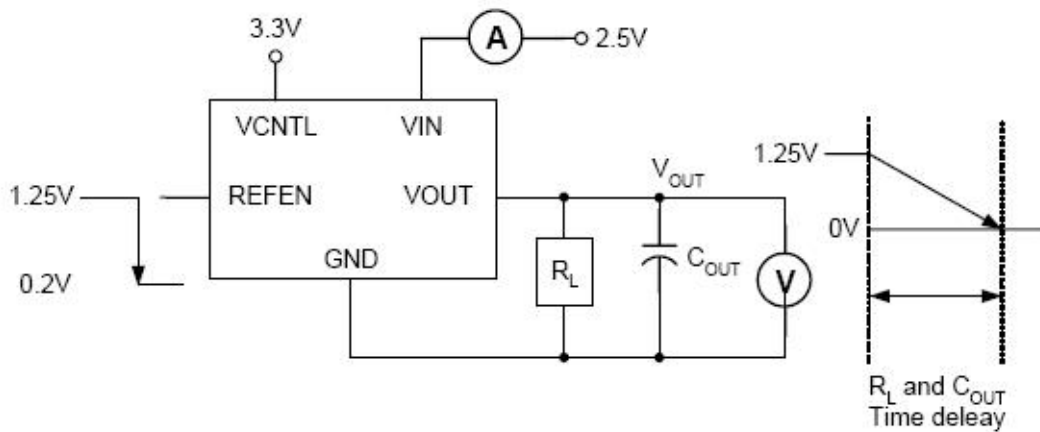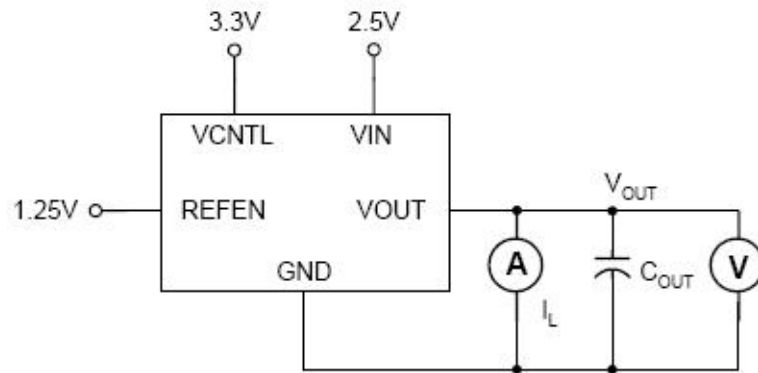**Fig 4: Output Voltage Tolerance, V_{OUT}**

Fig 5: Current in Shutdown Mode, I_{SHDN}
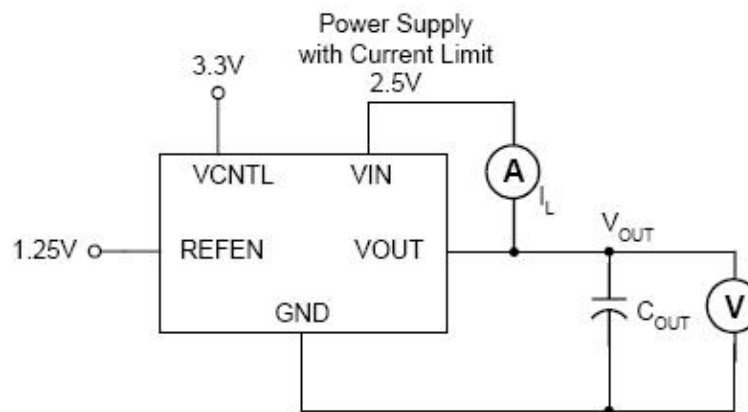
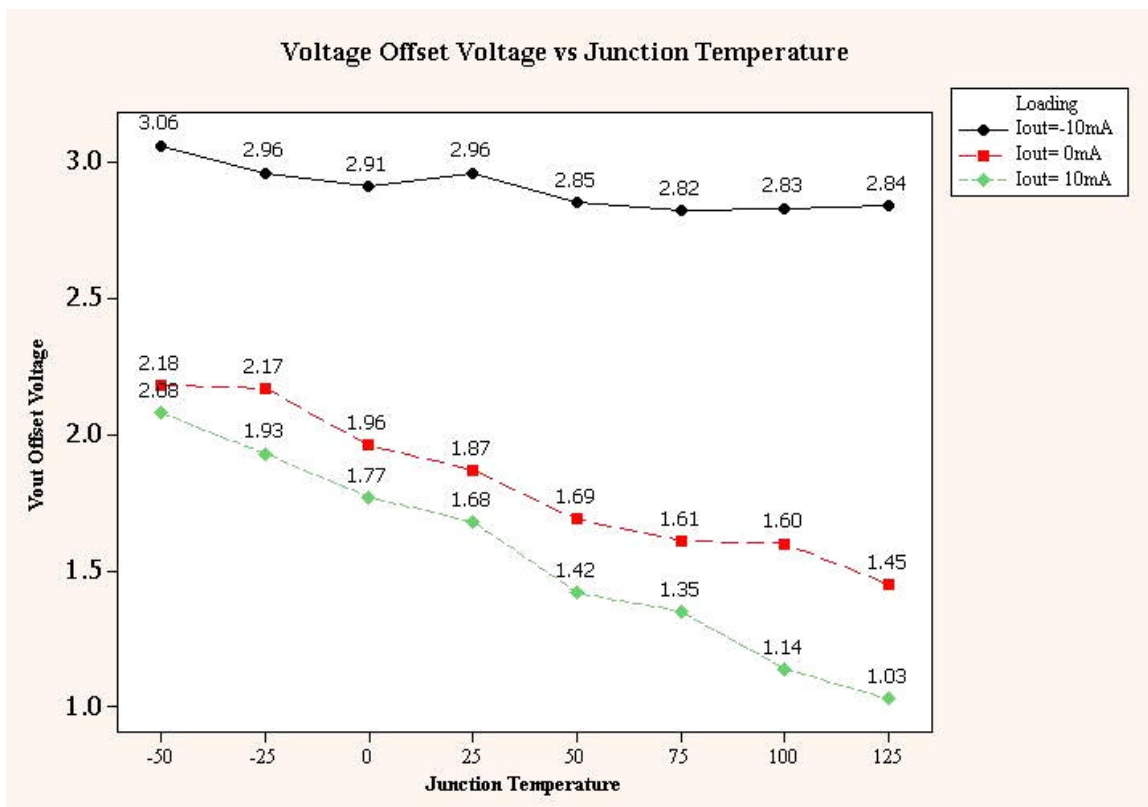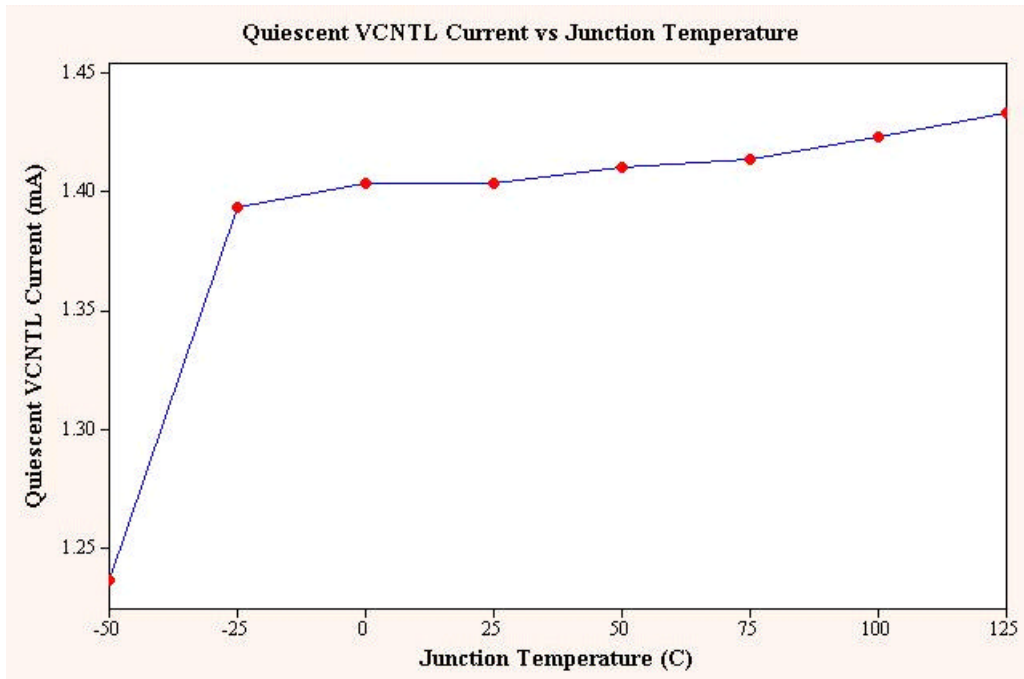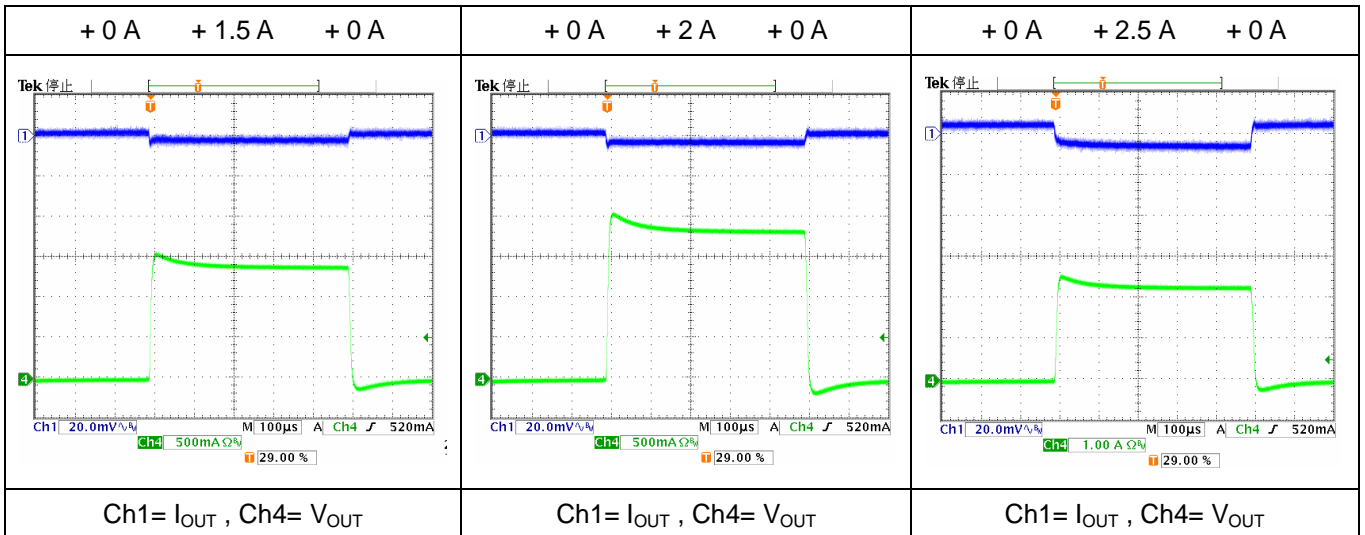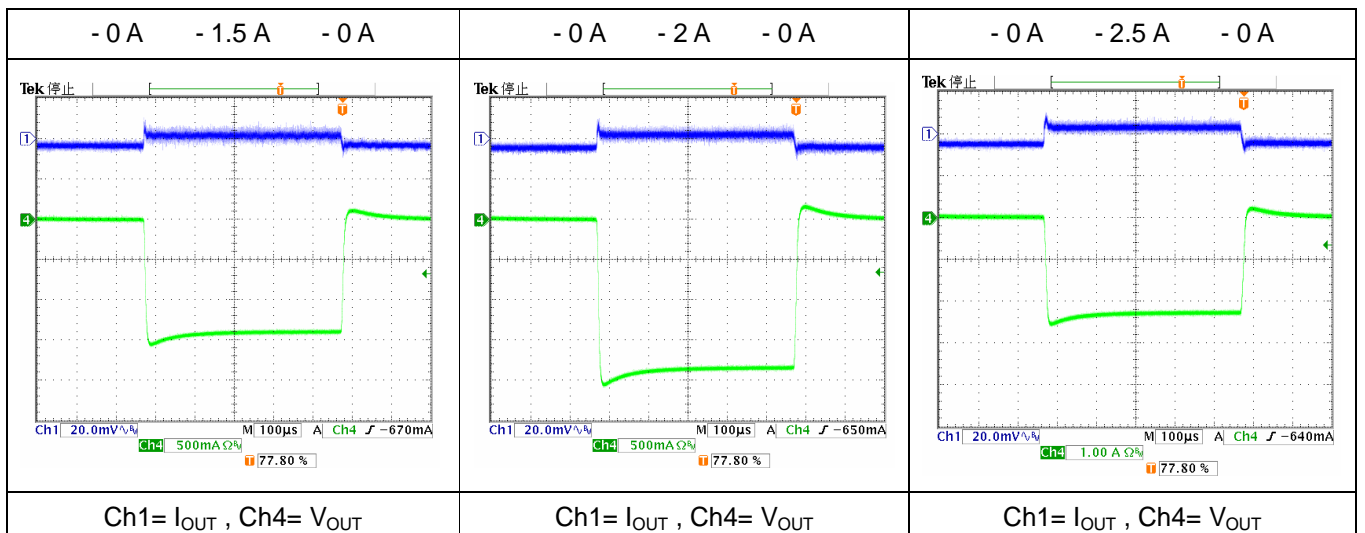**Figure 6: Current Limit for High Side, I$_{CLHIGH}$**

Figure 7: Current Limit for Low Side, I$_{CLLOW}$

■ Typical Characteristics

Quiescent VCNTL Current vs Junction Temperature

Voltage Offset Voltage vs Junction Temperature

■ Operation Waveforms DDR1

Load Transient Response

V_{IN}=2.5V, V_{CNTL}=3.3V
V_{REF} is 1.25V supplied by a regulator
C_{OUT}=1000µF/35V
I_{OUT} slew rate = +-0.25A/mS

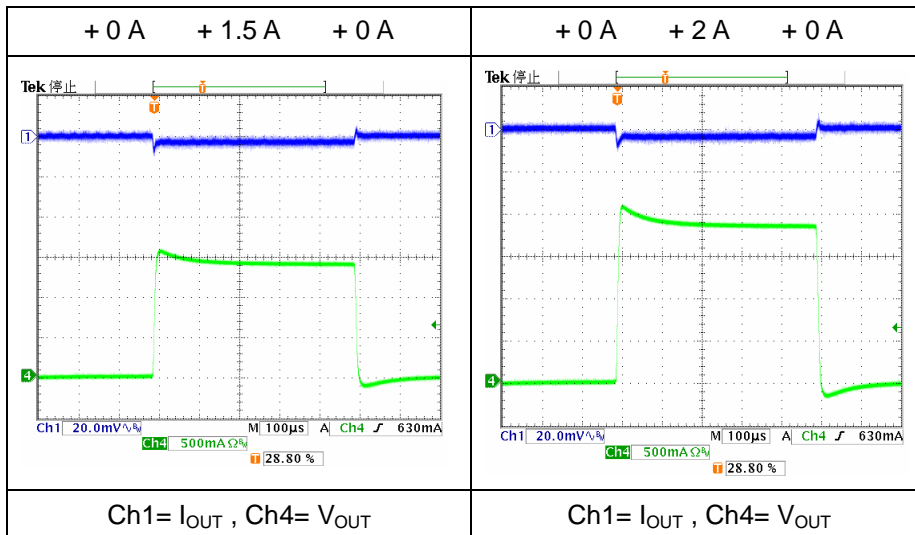| + 0 A + 1.5 A + 0 A	+ 0 A + 2 A + 0 A	+ 0 A + 2.5 A + 0 A
Ch1= I_{OUT} , Ch4= V_{OUT}	Ch1= I_{OUT} , Ch4= V_{OUT}	Ch1= I_{OUT} , Ch4= V_{OUT}

Load Transient Response

V_{IN}=2.5V, V_{CNTL}=3.3V
V_{REF} is 1.25V supplied by a regulator
C_{OUT}=1000µF/35V
I_{OUT} slew rate = +-0.25A/mS

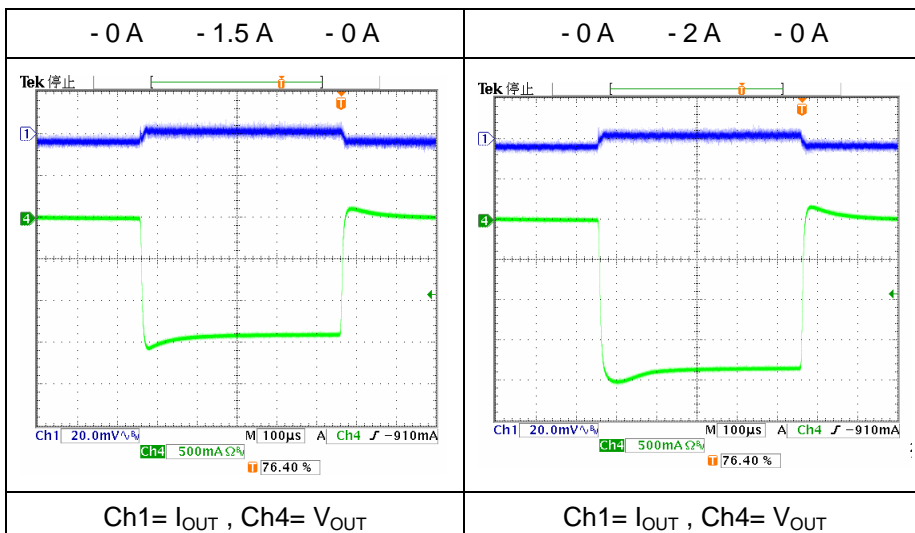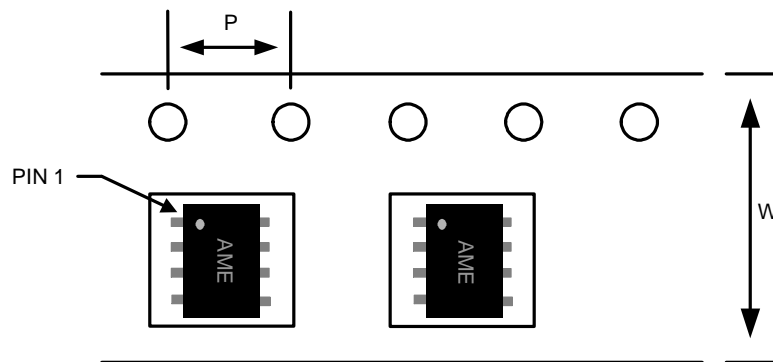| - 0 A - 1.5 A - 0 A	- 0 A - 2 A - 0 A	- 0 A - 2.5 A - 0 A
Ch1= I_{OUT} , Ch4= V_{OUT}	Ch1= I_{OUT} , Ch4= V_{OUT}	Ch1= I_{OUT} , Ch4= V_{OUT}

■ Operation Waveforms DDR3

Load Transient Response

V_{IN}=1.5V, V_{CNTL}=3.3V
V_{REF} is 0.75V supplied by a regulator
C_{OUT}=1000μF/35V
I_{OUT} slew rate = +-0.25A/mS

+ 0 A　+ 1.5 A　+ 0 A	+ 0 A　+ 2 A　+ 0 A

Ch1= I_{OUT} , Ch4= V_{OUT}　　　Ch1= I_{OUT} , Ch4= V_{OUT}

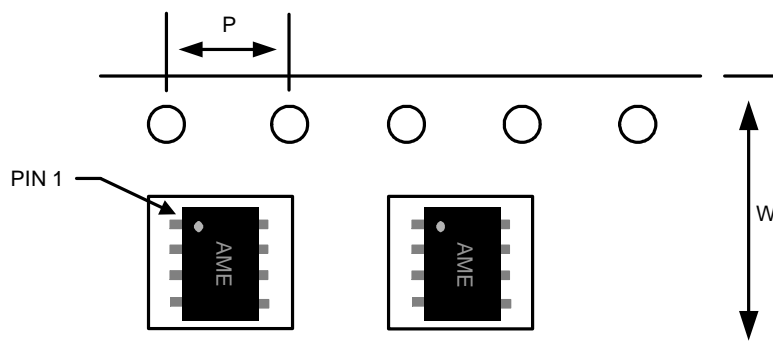## Load Transient Response

V_{IN}=1.5V, V_{CNTL}=3.3V
V_{REF} is 0.75V supplied by a regulator
C_{OUT}=1000μF/35V
I_{OUT} slew rate = +-0.25A/mS

- 0 A　- 1.5 A　- 0 A	- 0 A　- 2 A　- 0 A

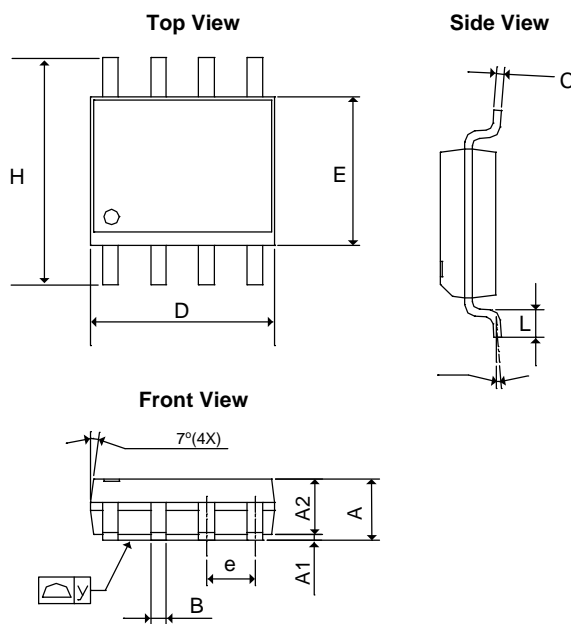Ch1= I_{OUT} , Ch4= V_{OUT}　　　Ch1= I_{OUT} , Ch4= V_{OUT}

■ Tape and Reel Dimension

SOP-8

Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
SOP-8	12.0±0.1 mm	4.0±0.1 mm	2500pcs	330±1 mm

SOP-8/PP

Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
SOP-8/PP	12.0±0.1 mm	4.0±0.1 mm	2500pcs	330±1 mm

AME9172

Bus Termination Regulator

■ Package Dimension

SOP-8

Top View   **Side View**

Front View

7º(4X)

SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.05315	0.0689
A₁	0.10	0.30	0.00394	0.01181
A2	1.473 REF		0.05799 REF	
B	0.33	0.51	0.01299	0.02008
C	0.19	0.25	0.00748	0.00984
D	4.80	5.33	0.18898	0.20984
E	3.80	4.00	0.14961	0.15748
e	1.27 BSC		0.05000 BSC	
L	0.40	1.27	0.01575	0.05000
H	5.80	6.30	0.22835	0.24803
y	-	0.10	-	0.00394
q	0º	8º	0º	8º

SOP-8/PP

Top View   Side View

Front View

SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	-	1.700	-	0.067
A₁	0.050	0.150	0.002	0.006
A2	1.350	1.550	0.053	0.061
C	0.100	0.250	0.004	0.010
E	3.750	4.150	0.148	0.163
E1	5.700	6.300	0.224	0.248
L	0.300	0.700	0.012	0.028
b	0.310	0.510	0.012	0.020
D	4.720	5.120	0.186	0.202
e	1.270 BSC		0.05 BSC	
q	0º	8º	0º	8º

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