1.5A DDR TERMINATION REGULATOR AP2301

General Description

The AP2301 linear regulator is designed to meet the JEDEC specification SSTL-2 and SSTL-18 for termination of DDR-SDRAM. The regulator can sink or source up to 1.5A current continuously, offers enough current for most DDR applications. Output voltage is designed to track the reference voltage within a 2% tolerance for load regulation while preventing shooting through on the output stage. On-chip thermal limiting provides protection against a combination of high current and ambient temperature which would create an excessive junction temperature.

The AP2301, 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 AP2301 is available in SOIC-8 and TO-252-5L packages.

Features

- Support Both DDR I ($1.25V_{TT}$) and DDR II ($0.9V_{TT}$) Requirements
- Source and Sink Current up to 1.5A
- High Accuracy Output Voltage at Full-load
- Adjustable V_{OUT} by External Resistors
- Shutdown for Standby or Suspend Mode Operation with High-impedance Output

Applications

- DDR-SDRAM Termination
- DDR-II Termination
- SSTL-2 Termination

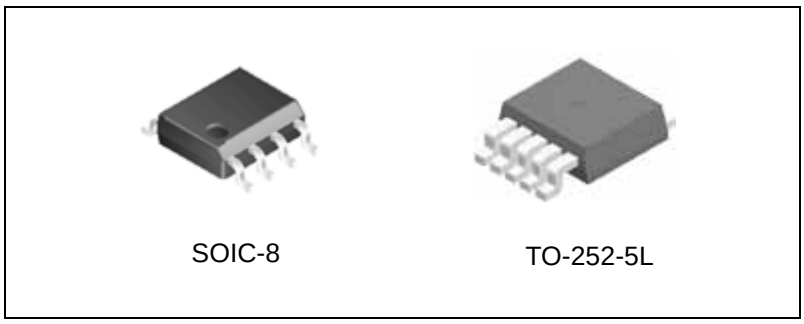


Figure 1. Package Types of AP2301

Pin Configuration

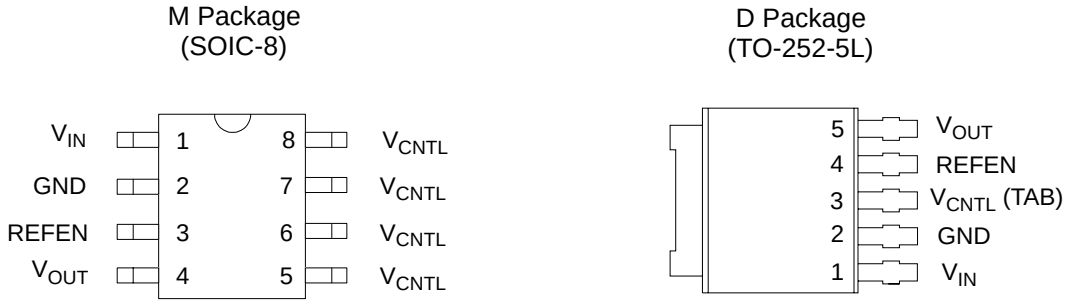


Figure 2. Pin Configuration of AP2301 (Top View)

Pin Description

Pin Number		Pin Name	Function
SOIC-8	TO-252-5L		
1	1	V_{IN}	Power Input
2	2	GND	Ground
3	4	REFEN	Reference Voltage Input and Chip Enable
4	5	V_{OUT}	Output Voltage
5, 6, 7, 8	3	V_{CNTL}	Supply Voltage for Internal Circuit (Internally Connected for SOIC-8), (TAB for TO-252-5L)

Functional Block Diagram

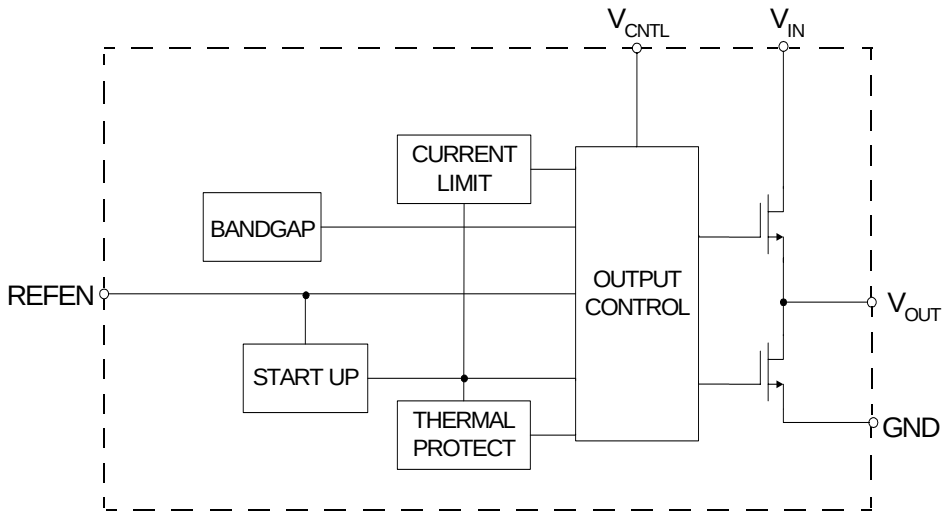
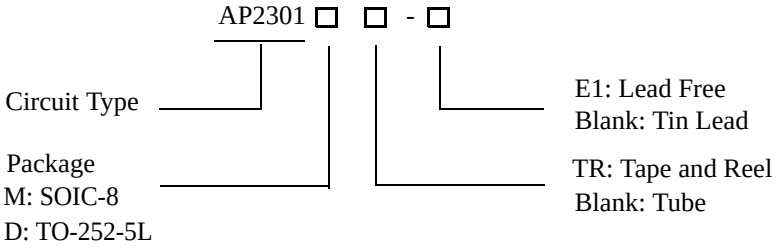


Figure 3. Functional Block Diagram of AP2301

Ordering Information



Package	Temperature Range	Part Number		Marking ID		Packing Type
		Tin Lead	Lead Free	Tin Lead	Lead Free	
SOIC-8	0 to 125°C	AP2301M	AP2301M-E1	2301M	2301M-E1	Tube
		AP2301MTR	AP2301MTR-E1	2301M	2301M-E1	Tape & Reel
TO-252-5L	0 to 125°C	AP2301D	AP2301D-E1	AP2301D	AP2301D-E1	Tube
		AP2301DTR	AP2301DTR-E1	AP2301D	AP2301D-E1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value		Unit
Supply Voltage for Internal Circuit	V_{CNTL}	7		V
Power Dissipation	P_D	Internally Limited		W
ESD (Human Body Model)	ESD	2		KV
Junction Temperature	T_J	150		^oC
Storage Temperature Range	T_{STG}	-65 to 150		^oC
Lead Temperature (Soldering, 10sec)	T_{LEAD}	260		^oC
Package Thermal Resistance (Free Air)	θ_{JA}	SOIC-8	160	$^oC/W$
		TO-252-5L	130	

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	Typ	Max	Unit
Supply Voltage for Internal Circuit		V_{CNTL} (Note 2, 3)		3.3	6	V
Power Input	DDR I	V_{IN}	1.6	2.5	V_{CNTL}	V
	DDR II			1.8		
Junction Temperature		T_J	0		125	^oC

Note 2: Keep $V_{CNTL} \geqslant V_{IN}$ in power on and power off sequences.

Note 3: For safe operation, V_{CNTL} MUST be tied to 3.3V rather than 5V.

Electrical Characteristics

(T_J=25°C, V_{IN}=2.5V, V_{CNTL}=3.3V, V_{REFEN}=1.25V, C_{OUT}=10μF (Ceramic), unless otherwise specified.)

Parameter		Symbol	Conditions	Min	Typ	Max	Unit
Output Offset Voltage		V_{OS}	I_L=0A (Note 4)	-20	0	20	mV
Load Regulation	DDR I	$\Delta V_{OUT}/V_{OUT}$	I_L=0 to 1.5A		0.8	2	%
			I_L=0 to -1.5A		0.8	2	
	DDR II		I_L=0 to 1.5A		1.2	3	
			I_L=0 to -1.5A		1.2	3	
Quiescent Current of V_{CNTL}		I_Q	No Load		3	5	mA
Leakage Current in Shutdown Mode		I_{SHDN}	V_{REFEN}<0.2V, R_L=180Ω		3	6	μA
Protection							
Current Limit		I_{LIMIT}		2.1			A
Thermal Shutdown Temperature		T_{SHDN}	3.3V ≤V_{CNTL} ≤5V		150		°C
Thermal Shutdown Hysteresis					50		°C
Shutdown Function							
Shutdown Threshold Trigger			Output = High	0.8			V
			Output = Low			0.2	

Note 4: V_{OS} is the voltage measurement defined as V_{OUT} subtracted from V_{REFEN}.

Typical Performance Characteristics

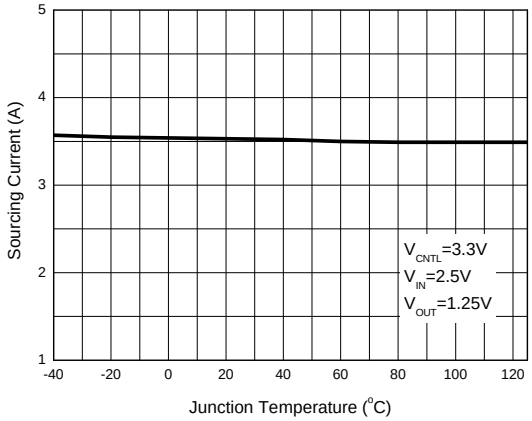


Figure 4. Sourcing Current vs. Junction Temperature

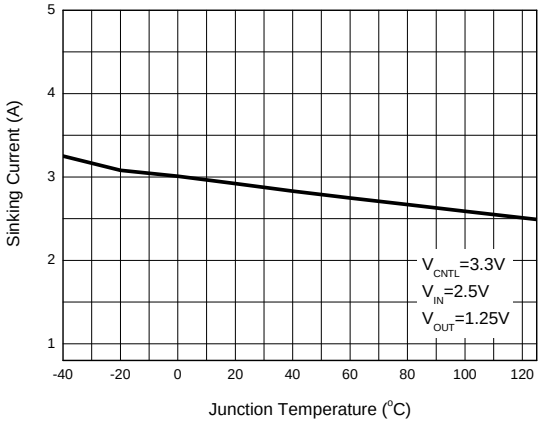


Figure 5. Sinking Current vs. Junction Temperature

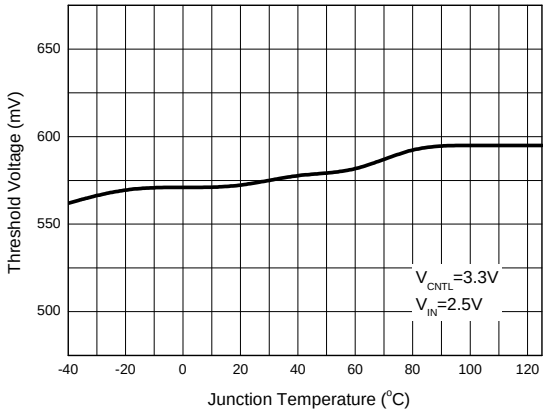


Figure 6. Threshold Voltage vs. Junction Temperature

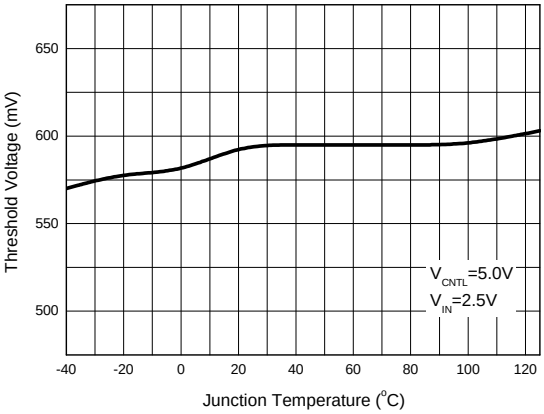


Figure 7. Threshold Voltage vs. Junction Temperature

Typical Performance Characteristics (Continued)

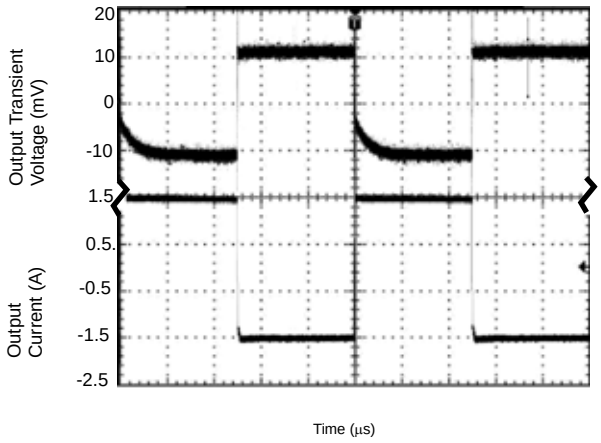


Figure 8. 0.9V_{TT} at 1.5A Transient Response
(Conditions:V_{IN}=2.5V, V_{CNTL}=3.3V, C_{OUT}=10μF)

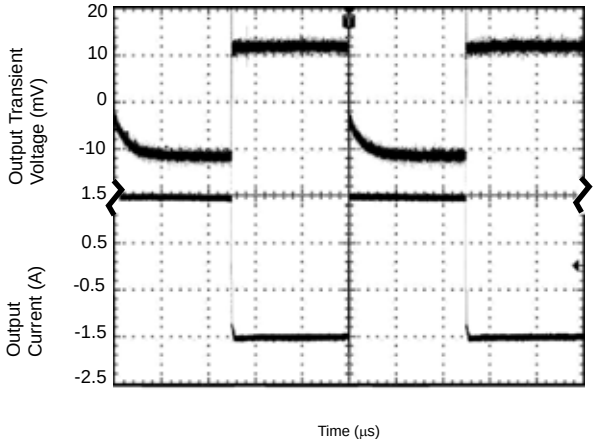


Figure 9. 1.25V_{TT} at 1.5A Transient Response
(Conditions:V_{IN}=2.5V, V_{CNTL}=3.3V, C_{OUT}=10μF)

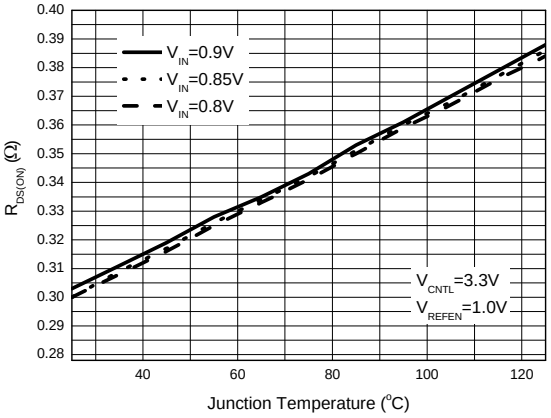


Figure 10. $R_{DS(on)}$ vs. Junction Temperature

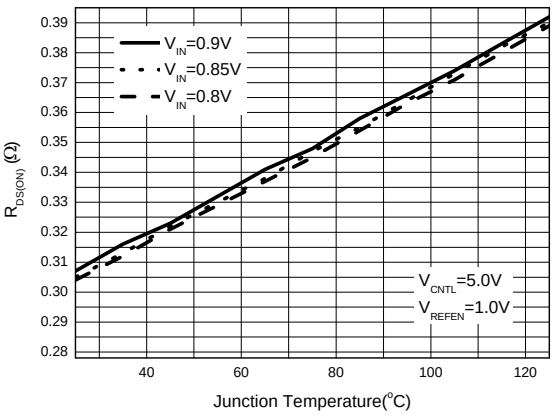


Figure 11. $R_{DS(on)}$ vs. Junction Temperature

Typical Performance Characteristics (Continued)

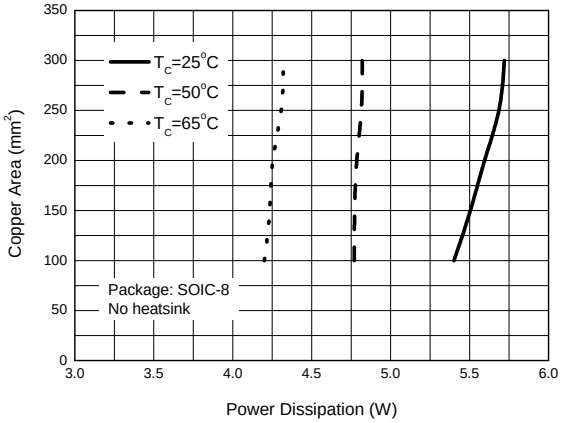


Figure 12. Copper Area vs. Power Dissipation

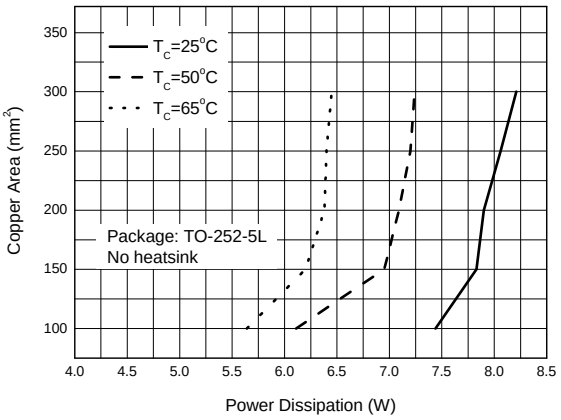


Figure 13. Copper Area vs. Power Dissipation

Typical Application

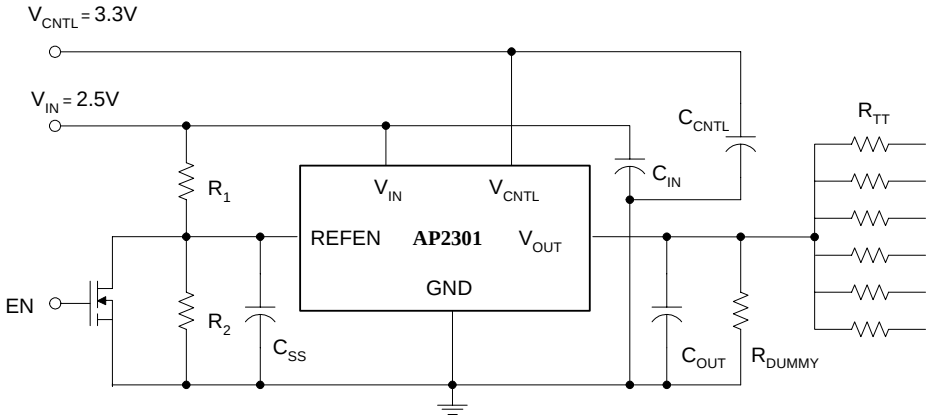
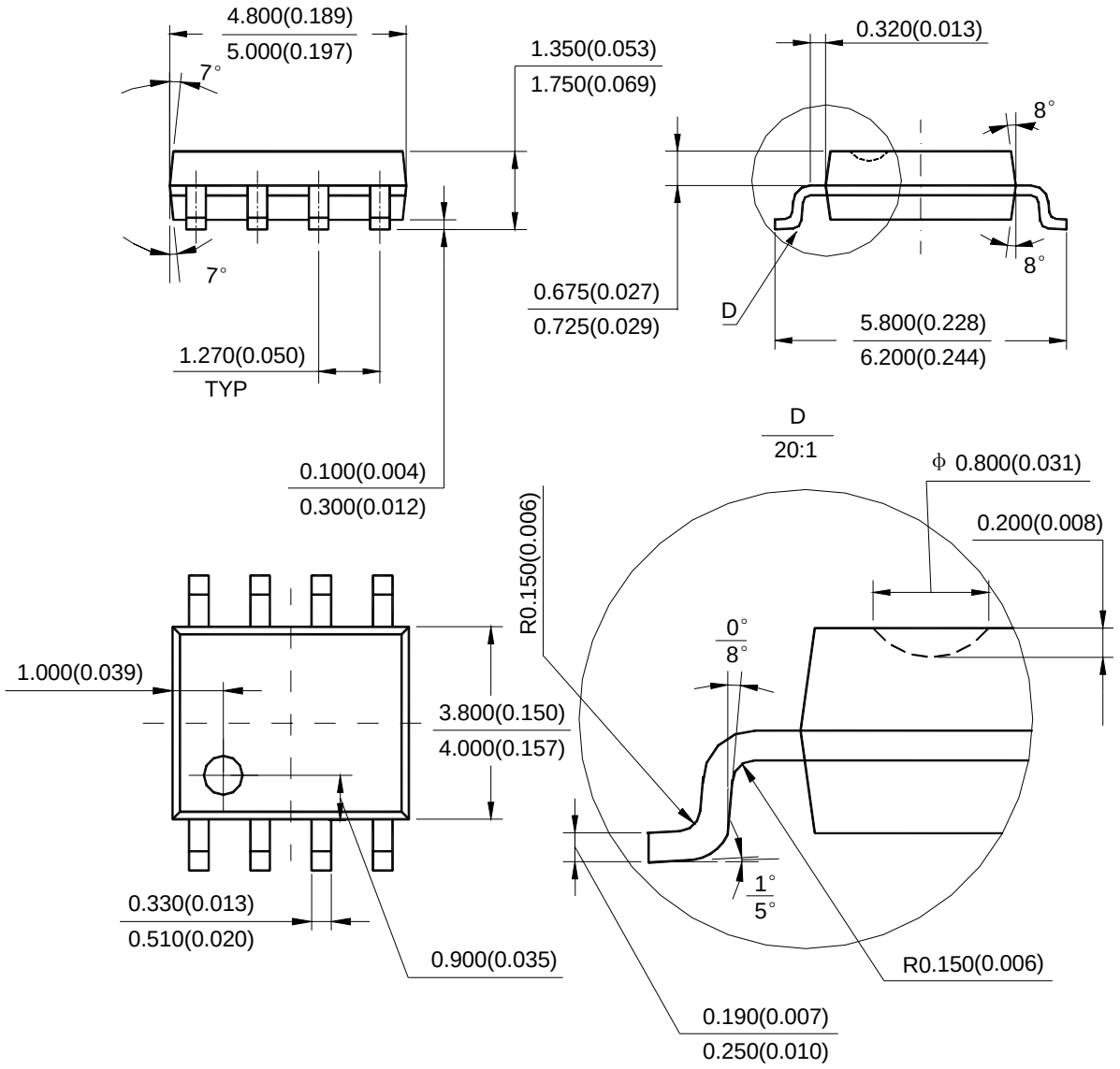


Figure 14. Typical Application of AP2301

R1=R2=100KΩ, R_{TT}=50Ω /33Ω /25Ω
R_{DUMMY}=1KΩ, as for V_{OUT} discharge when V_{IN} is not present but V_{CNTL} is present
C_{SS}=1μF, C_{IN}=470μF, C_{CNTL}=47μF, C_{OUT}=470μF

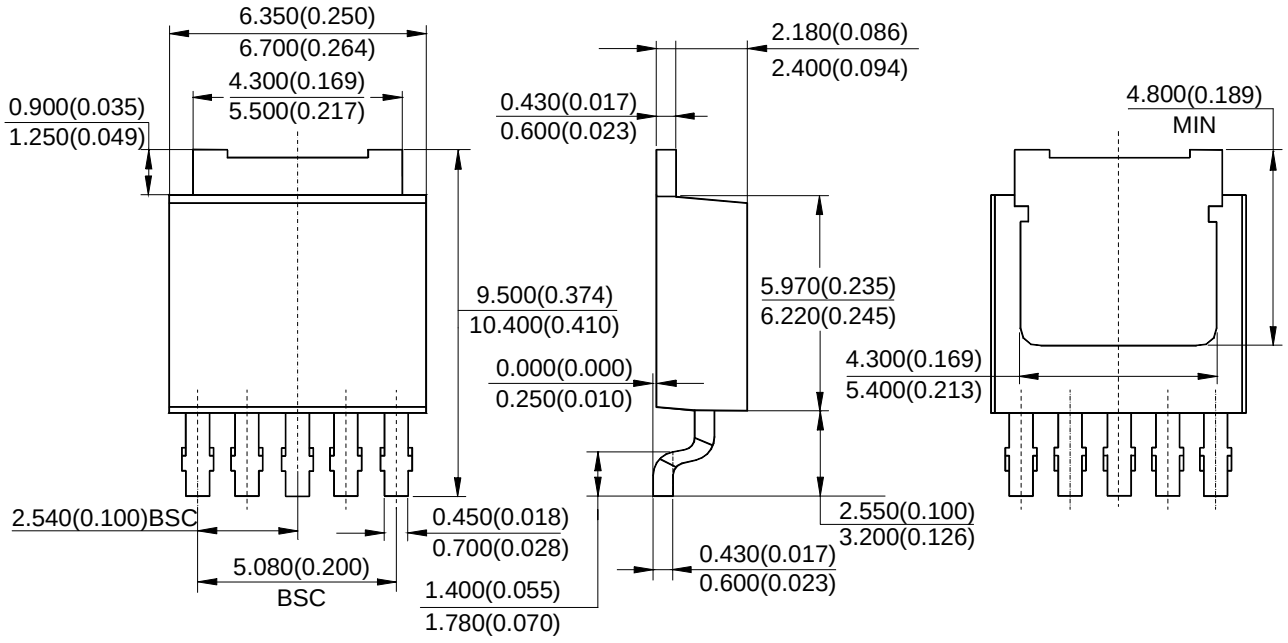
Mechanical Dimensions

SOIC-8 **Unit: mm(inch)**



Mechanical Dimensions (Continued)

TO-252-5L **Unit: mm(inch)**



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