DESCRIPTION

The A6015 is a high performance positive voltage regulator designed for use in applications requiring very low Input voltage and very low dropout voltage at up to 1.5A. It operates with a V_{IN} as low as 1.1V and V_{DD} voltage 3V with output voltage programmable as low as 0.8V. The significant feature includes ultra low dropout, ideal for applications where V_{OUT} is very close to V_{IN}. Additionally, there is an enable pin to further reduce power dissipation while shutdown.

The A6015 provides excellent regulation over variations in line, load and temperature. And provides a power OK signal to indicate if the voltage level of V_{OUT} reaches 90% of its rating value.

The A6015 is available in PSOP8 package.

FEATURES

- Maximum 1.5A Low-Dropout Voltage Regulator
- High Accuracy Output Voltage ±1.5%
- Typically 150mV Dropout at 1.5A
- Power Good Output
- Output Voltage Pull Low Resistance when Disable
- Thermal and Over Current Protection
- Available in PSOP8 Package

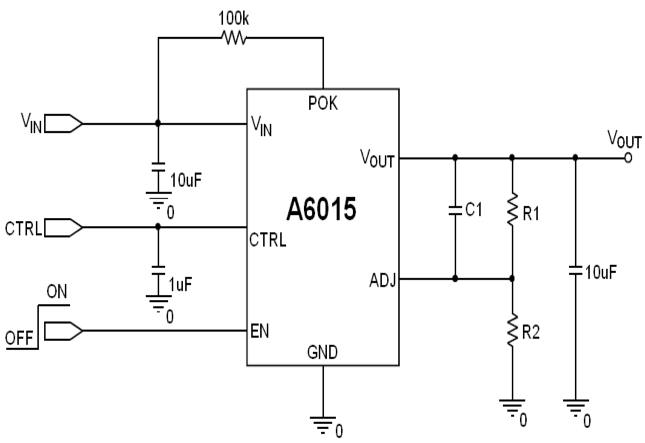
APPLICATION

- Front Side Bus V_{TT} (1.2V/1.5A)
- NoteBook PC Applications
- Motherboard Applications

ORDERING INFORMATION

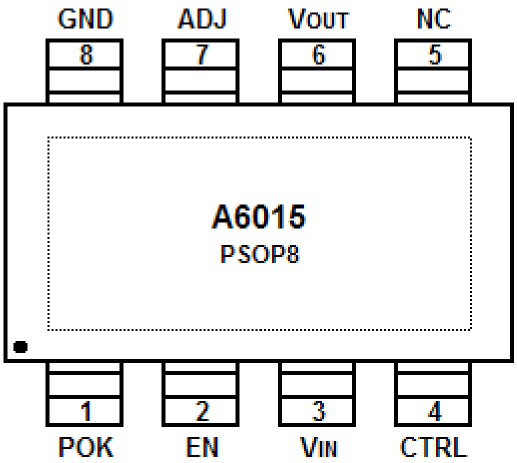
Package Type	Part Number	
PSOP8	MP8	A6015MP8R
		A6015MP8VR
Note	R: Tape & Reel V: Halogen free Package ADJ only	
AiT provides all RoHS products Suffix " V " means Halogen free Package		

TYPICAL APPLICATION



V_{OUT} = 0.8V x (1+R1/R2)

PIN DESCRIPTION



Top View

Pin #	Symbol	Function
1	POK	Power Good Open Drain Output
2	EN	Chip Enable (Active-High)
3	V_{IN}	Supply Input Voltage
4	CTRL	Supply Voltage of Control Circuitry
5	NC	No Internal Connection
6	V_{OUT}	Output Voltage
7	ADJ	Set the output voltage by the feedback resistors V_{OUT} =0.8V x (R1 + R2)/R2
8	GND	Ground. The exposed pad must be soldered to a large PCB and connected to GND for maximum power dissipation.

THERMAL INFORMATION

Parameter	Symbol	Max	Units
Thermal Resistance (Junction to Ambient)	θ_{JA}	90	°C/W
Thermal Resistance (Junction to Case)	θ_{JC}	11	°C/W
Internal Power Dissipation (@T_A = 25°C)	P_D	1100	mW

ABSOLUTE MAXIMUM RATINGS

V_{IN}, CTRL, Input Voltage	6.0V
Output Current	1.5A
Output Pin Voltage	GND-0.3V to V_{IN} + 0.3V
Lead Soldering Temperature (5 sec)	260°C
Storage Temperature	-65°C to 150°C
ESD Rating	Class B

Stresses above 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 in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Maximum Supply Voltage	5.5V
Junction Temperature Range	-40°C to 125°C
Operation Temperature	-40°C to 85°C

ELECTRICAL CHARACTERISTICS

V_{IN} = V_{OUT} + 0.5V, V_{CTRL} = V_{EN} = 5V, T_A = 25°C, C_{IN} = C_{OUT} = 10μF, unless otherwise noted.

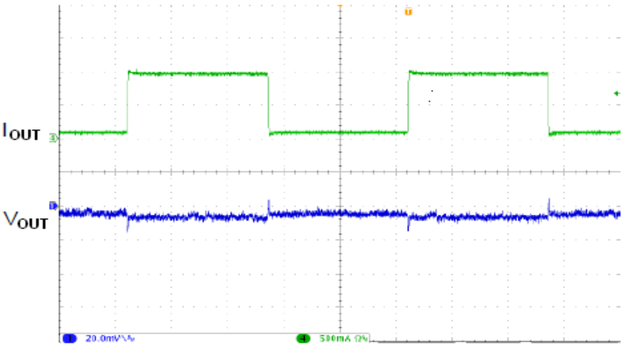
Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
V_{IN} Input Voltage	V_{IN}	V_{OUT} = V_{REF}	1.1	-	5.5	V
CTRL Input Voltage	V_{CTRL}		3	-	5.5	V
POR Threshold	V_{TH_CTRL}		2.5	2.7	-	V
	V_{TH_VIN}		0.8	0.9		
POR Hysteresis	V_{YHS_CTRL}		-	0.4	-	V
	V_{YHS_VIN}			0.5		
Quiescent Current	I_Q	I_{OUT} = 0mA	-	0.5	1.2	mA
CTRL Input Current in Shutdown	I_{SD_CTRL}	V_{EN} = 0V	-	5	-	uA
CTRL Input Current in Shutdown	I_{SD_VIN}	V_{EN} = 0V	-	-	1	uA
Output Voltage Accuracy	V_{OUT}	I_{OUT} = 1mA to 1.5A	-1.5	-	1.5	%
Current Limit	I_{OUT}		-	3	-	A
Short Current	I_{SHORT}	V_{OUT} = 0V	-	1	-	A
Feedback Voltage	V_{REF}	V_{OUT} = V_{REF}	0.788	0.8	0.812	V
Feedback Leakage Current	I_{REF}		-	-	20	nA
Dropout Voltage	V_{DROP}	I_{OUT} = 1A	-	100	-	mV
		I_{OUT} = 1.5A		150		
Line Regulation	LNR	I_{OUT} = 1mA, V_{IN} = V_{OUT} + 0.5V to 5.5V	-0.15	0.1	0.15	%/V
Load Regulation	LDR	V_{IN} = V_{OUT}+1V, I_{OUT} = 1mA to 1.5A	-2	0.2	2	%
V_{OUT} Pull Low Resistor	R_{PL}	V_{EN} = 0V	-	100	-	Ω
Temperature Coefficient	T_C	I_{OUT} = 1mA	-	40	-	ppm/℃
Over Temperature Shutdown	OTS	I_{OUT} = 1mA	-	170	-	℃
Over Temperature Hysteresis	OTH	I_{OUT} = 1mA	-	40	-	℃
Power Supply Ripple Rejection	PSRR	V_{PP} = 200mV, f=100Hz	-	65	-	dB
		f=1kHz		60		
EN Bias Current	I_{EN}	V_{EN} = V_{CTRL} = 5V	-	5	-	uA
EN Input High Threshold	V_{IH}	V_{IN} = 2.5V to 5V	1.5	-	-	V
EN Input Low Threshold	V_{IL}	V_{IN} = 2.5V to 5V	-	-	0.3	V
POK Threshold Voltage	V_{TH_OK}	V_{REF} Rising	90	-	94	%
POK Hysteresis	-		3	10	-	%
POK Pull Low Voltage	-	POK sinks 5mA Current	-	0.2	0.4	V
POK Delay Time	T_{DELAY}	From V_{REF} = V_{TH_OK} to rising edge of the V_{POK}	1	2	4	mS

NOTE: Output current is limited by P_D, maximum I_{OUT} = P_D / ($V_{IN (MAX)}$ - V_{OUT}).

TYPICAL PERFORMANCE CHARACTERISTICS

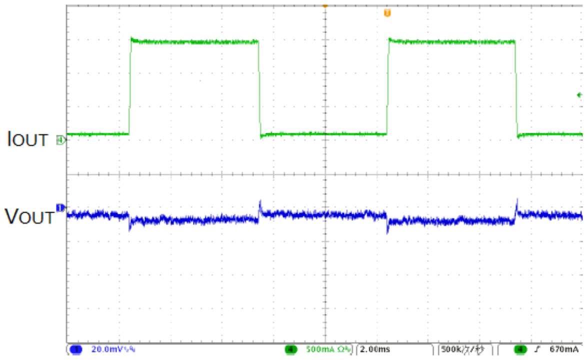
T_A = 25°C, C_{IN} = C_{OUT} = 10μF, unless otherwise noted

1. Load Transient Response



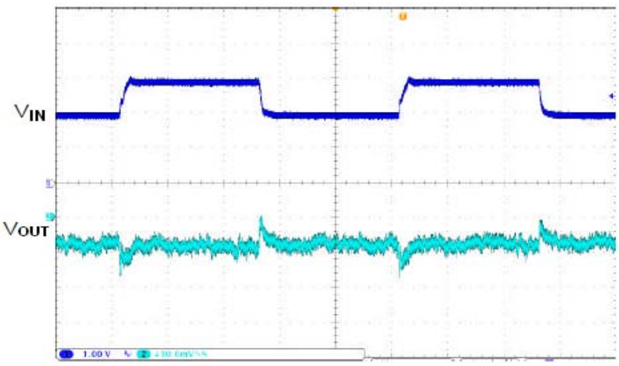
V_{CTRL}=5V,V_{IN}=1.8V,V_{OUT}=1.2V,I_{OUT}=0.1~1A

2. Load Transient Response



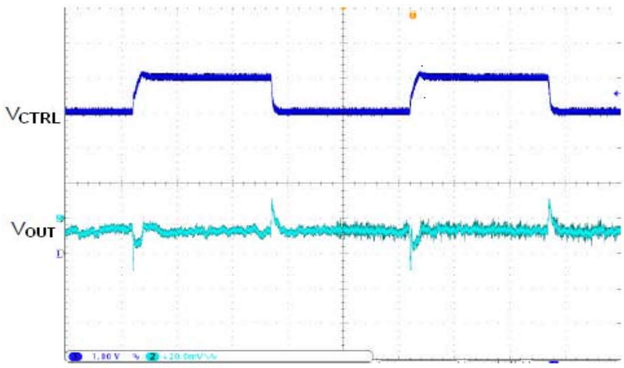
V_{CTRL}=5V,V_{IN}=1.8V,V_{OUT}=1.2V,I_{OUT}=0.1~1.5A

3. Line Transient Response



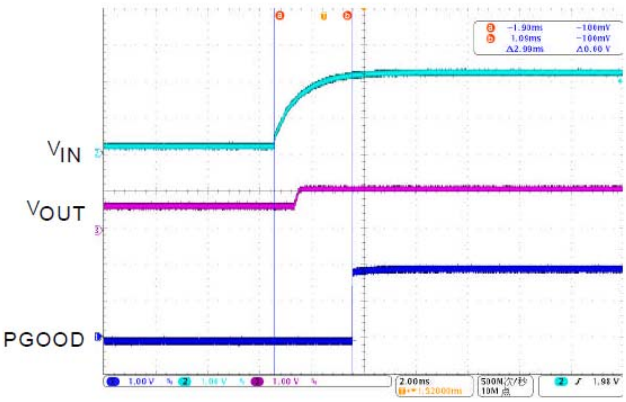
V_{CTRL}=5V,V_{IN}=2~3V,V_{OUT}=1.2V,I_{OUT}=100mA

4. Line Transient Response



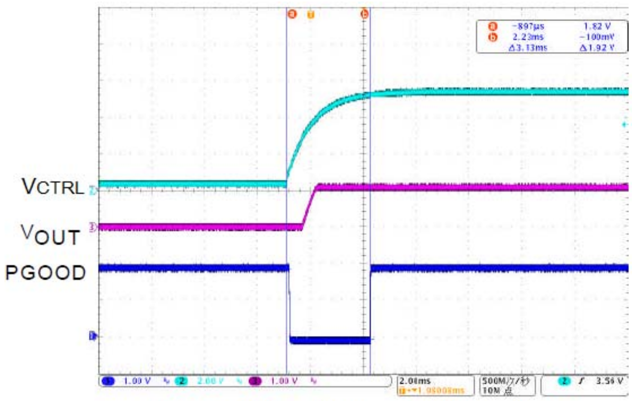
V_{CTRL}=4~5V,V_{IN}=2V,V_{OUT}=1.2V,I_{OUT}=100mA

5. Start Up from V_{IN}



V_{CTRL}=5V,V_{IN}=2V,V_{OUT}=1.2V,I_{OUT}=1.5A

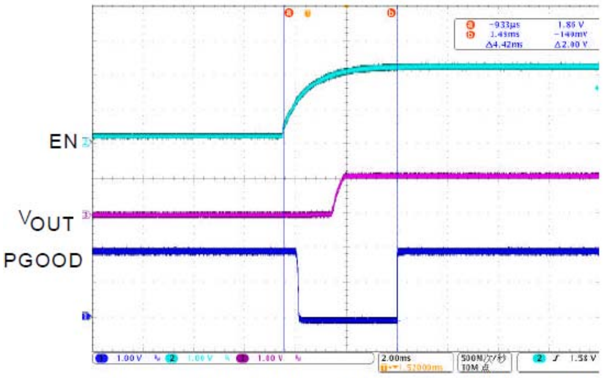
6. Start Up from CTRL



V_{CTRL}=5V,V_{IN}=2V,V_{OUT}=1.2V,I_{OUT}=1.5A

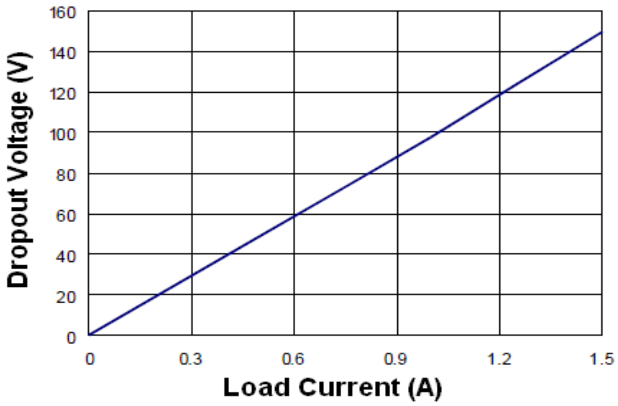
T_A = 25°C, C_{IN} = C_{OUT} = 10μF, unless otherwise noted.

7. Start Up from EN

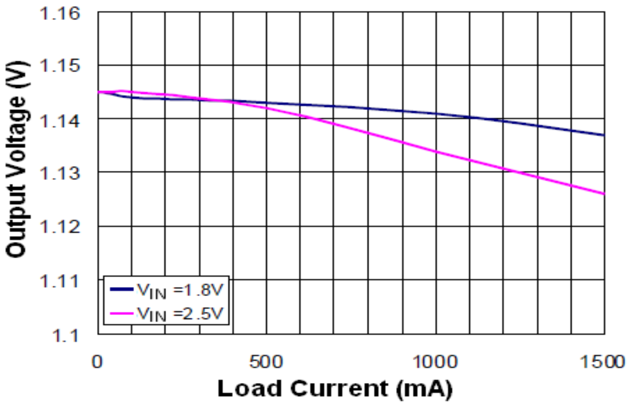


V_{CTRL}=5V,V_{IN}=2V,V_{EN}=0~2V,V_{OUT}=1.2V,I_{OUT}=1.5A

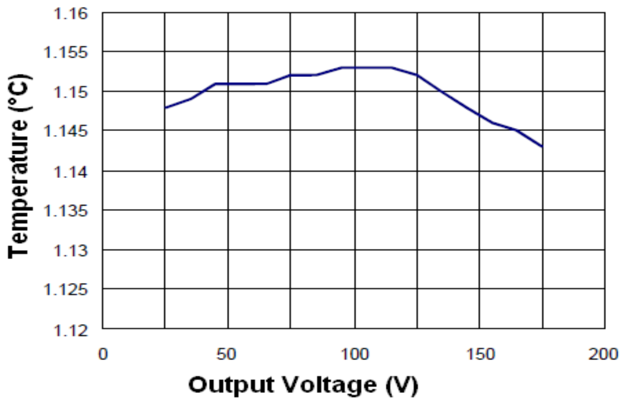
8. Dropout Voltage vs. Load Current



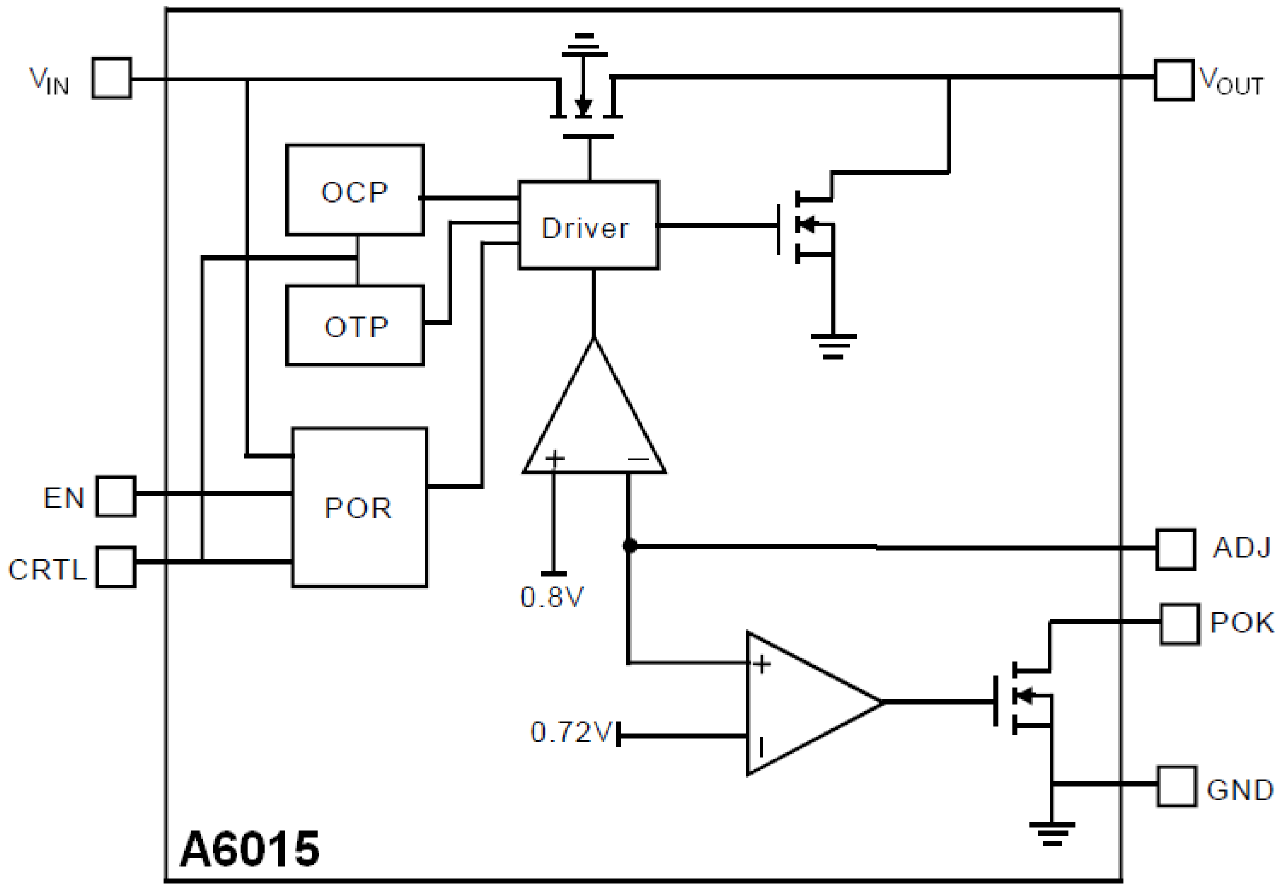
9. Output Voltage vs. Load Current



10. Output Voltage vs. Temperature



BLOCK DIAGRAM



DETAILED INFORMATION

Capacitor Selection and Regulator Stability

Similar to any low dropout regulator, the external capacitors used with the A6015 must be carefully selected for regulator stability and performance.

A capacitor C_{IN} of more than 10μF can be employed in the input pin, while there is no upper limit for the capacitance of C_{IN}. Please note that the distance between C_{IN} and the input pin of the A6015 should not exceed 0.5 inch. Ceramic capacitors are suitable for the A6015. Capacitors with larger values and lower ESR (equivalent series resistance) provide better PSRR and line-transient response.

The A6015 is designed specifically to work with low ESR ceramic output capacitors in order to save space and improve performance. Using an output ceramic capacitor whose value is > 10μF with ESR > 5mΩ ensures stability.

Shutdown Input Operation

The A6015 is shut down by pulling the EN input low, and is turned on by tying the EN input to CTRL or leaving the EN input floating.

Input-Output (Dropout) Voltage

A regulator's minimum input-output voltage difference (or dropout voltage) determines the lowest usable supply voltage. The A6015 has a typical 150mV dropout voltage.

Current Limit and Short Circuit Protection

The A6015 features a current limit, which monitors and controls the gate voltage of the pass transistor. The output current can be limited to 3A by regulating the gate voltage. The A6015 also has a built-in short circuit current limit.

Thermal considerations

Thermal protection limits power dissipation in the A6015. When the junction temperature exceeds 170°C, the OTP (Over Temperature Protection) starts the thermal shutdown and turns the pass transistor off. The pass transistor resumes operation after the junction temperature drops below 130°C.

For continuous operation, the junction temperature should be maintained below 125°C. The power dissipation is defined as:

$$P_D = (V_{IN} - V_{OUT}) * I_O + V_{IN} * I_{GND}$$

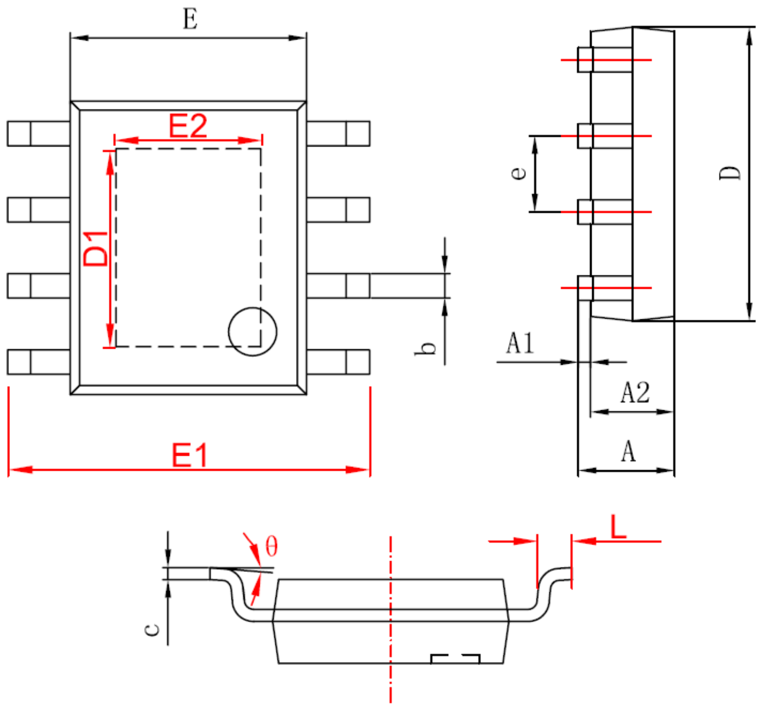
The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surrounding airflow and temperature difference between junction and ambient. The maximum power dissipation can be calculated by the following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where $T_{J(MAX)}$ is the maximum allowable junction temperature 125°C, T_A is the ambient temperature and θ_{JA} is the thermal resistance from the junction to the ambient.

PACKAGE INFORMATION

Dimension in PSOP8 Package (Unit: mm)



Symbol	Min	Max
A	1.350	1.750
A1	0.050	0.150
A2	1.350	1.550
b	0.350	0.49
c	0.190	0.250
D	4.800	5.000
D1	2.280	3.300
E	3.800	4.000
E1	5.800	6.200
E2	2.280	2.410
e	1.270(BSC)	
L	0.400	1.270
θ	0°	8°

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