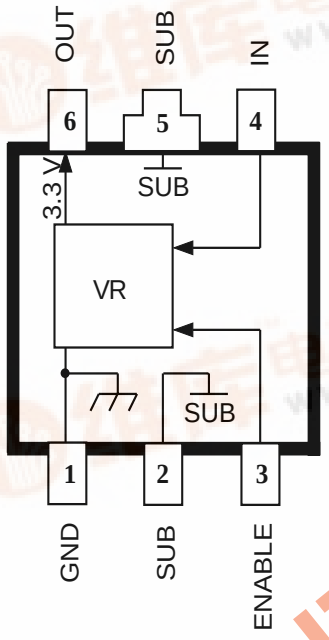
8186

Data Sheet
27468.14

LOW-DROPOUT, 3.3 V REGULATOR — HIGH EFFICIENCY

PRELIMINARY INFORMATION
(subject to change without notice)
January 12, 1995



Dwg. PS-021-1

ABSOLUTE MAXIMUM RATINGS

Input Voltage, V_I . . . . . **10 V**
Output Current, I_O . . . . . **150 mA***
Enable Input Voltage, V_E . . . . . **V_I**
Operating Temperature Range,
T_A . . . . . **-20°C to +85°C**
Junction Temperature, T_J . . . **+150°C†**
Storage Temperature Range,
T_S . . . . . **-40°C to +150°C**

* Output current rating is limited by input voltage, duty cycle, and ambient temperature. Under any set of conditions, do not exceed a junction temperature of +150°C. See next page.

† Fault conditions that produce excessive junction temperature will activate device thermal shutdown circuitry. These conditions can be tolerated but should be avoided.

Designed specifically to meet the requirement for extended operation of battery-powered equipment such as cordless and cellular telephones, the A8186SLU voltage regulator offers the reduced dropout voltage and quiescent current essential for maximum battery life. Applicable also to palmtop computers and personal data assistants, the device delivers a regulated, continuous 3.3 V output at up to 75 mA under normal operating conditions, or to 150 mA (transient) under worst-case conditions.

A PMOS pass element provides a typical dropout voltage of only 85 mV at 60 mA of load current. The low dropout voltage permits deeper battery discharge before output regulation is lost. Furthermore, quiescent current does not increase as the dropout voltage is approached, an ideal feature in standby/resume power systems where data integrity is crucial. Regulator accuracy and excellent temperature characteristics are provided by a bandgap reference. An ENABLE input gives the designer complete control over power up, standby, or power down.

This device is supplied in a 6-lead small-outline plastic package (similar to the SOT-89/TO-243AA) for surface-mount applications. The A8186SLU is rated for operation over a temperature range of -20°C to +85°C.

FEATURES AND BENEFITS

- High Efficiency Provides Extended Battery Life
- 85 mV Typical Dropout Voltage at I_O = 60 mA
- 45 µA Typical Quiescent Current at V_I = 6 V
  Less Than 1 µA “Sleep” Current
- Up to 150 mA Output Current
- CMOS-Compatible ON/OFF Control
  For Power-Up, Standby, or Shutdown
- Internal Thermal Protection
- Surface-Mount Package

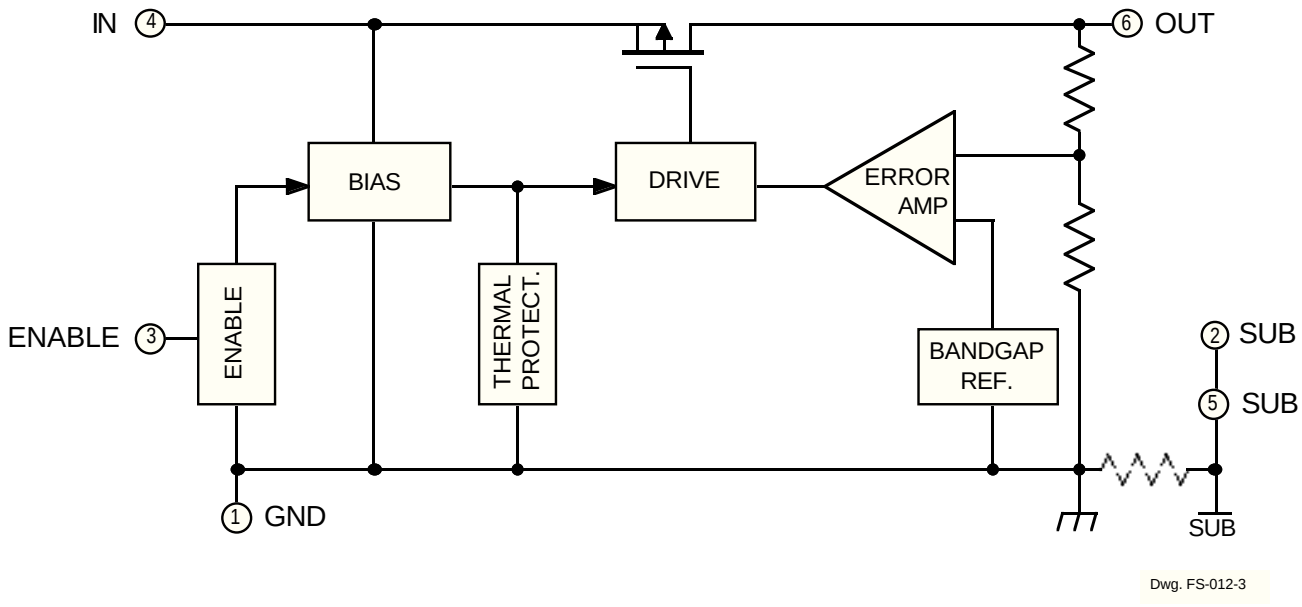
APPLICATIONS

- Cordless and Cellular Telephones
- Personal Data Assistants
- Personal Communicators
- Palmtop Computers

Always order by complete part number: **A8186SLU** .

8186
LOW-DROPOUT, 3.3 V REGULATOR

FUNCTIONAL BLOCK DIAGRAM



Terminal numbering is in accordance with EIA/JEDEC convention. Where EIAJ conventions apply, the tab is not numbered, resulting in terminal 6 being designated terminal 5.

For proper operation, terminals 1 and 2 must be externally connected together.

MAXIMUM ALLOWABLE OUTPUT CURRENT with device mounted on 2.24" x 2.24" (56.9 mm x 56.9 mm) solder-coated copper-clad board in still air.

	Maximum Allowable Output Current in Milliamperes with V_I = 8 V, T_J = 150°C, Period ≤10 s*								
	dc (Duty Cycle)								
T_A	100%	90%	80%	70%	60%	50%	40%	30%	20%
25°C	100	115	125	145	150	150	150	150	150
50°C	80	90	100	115	135	150	150	150	150
70°C	65	70	80	90	110	130	150	150	150
85°C	50	60	65	75	85	105	130	150	150

* $I_O = (T_J - T_A)/([V_I - V_O] R_{\theta JA} \bullet dc) = (150 - T_A)/(4.7 \bullet 258 \bullet dc)$

Output current rating can be increased (to 150 mA maximum) by heat sinking or reducing the input voltage. Conditions that produce excessive junction temperature will activate device thermal shutdown circuitry. These conditions can be tolerated but should be avoided.

ELECTRICAL CHARACTERISTICS at T_A = +25°C (unless otherwise noted).

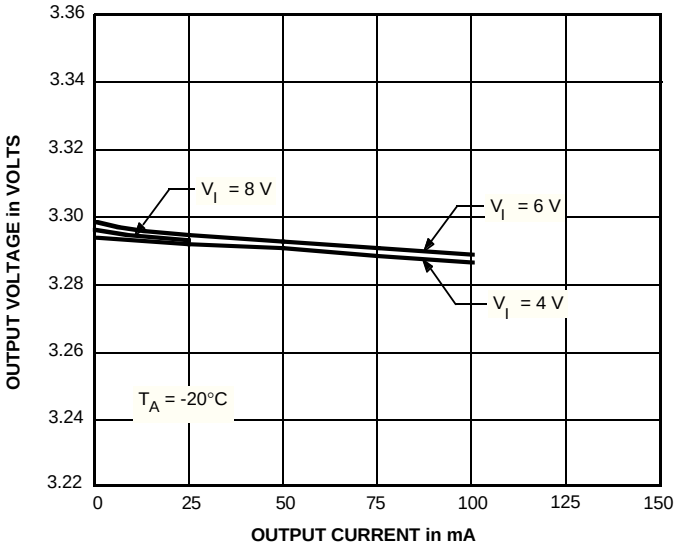
Characteristic	Symbol	Test Conditions		Limits Min.	Limits Typ.	Limits Max.	Units
Output Voltage	V_O	4 V ≤ V_I ≤ 8 V,	T_A = +25°C	3.25	3.30	3.35	V
		10 µA ≤ I_O ≤ 100 mA*	-20°C ≤ T_A ≤ +85°C	3.20	3.30	3.40	V
		V_I = 3.3 V, I_O = 60 mA*, -20°C ≤ T_A ≤ +85°C		3.00	—	—	V
Output Volt. Temp. Coeff.	α_{VO}	V_I = 6 V, I_O = 10 mA		—	—	±1.0	mV/°C
Line Regulation	$\Delta V_{O(\Delta VI)}$	6 V ≤ V_I ≤ 8 V, I_O = 1 mA		—	8.0	12	mV
		4 V ≤ V_I ≤ 6 V, I_O = 1 mA		—	10	20	mV
Load Regulation	$\Delta V_{O(\Delta IO)}$	1 mA ≤ I_O ≤ 100 mA*, V_I = 8 V		—	20	30	mV
		1 mA ≤ I_O ≤ 100 mA*, V_I = 6 V		—	13	25	mV
		1 mA ≤ I_O ≤ 100 mA*, V_I = 4 V		—	8.0	20	mV
Dropout Voltage	$V_I$min - V_O	I_O = 60 mA*		—	85	150	mV
		I_O = 125 mA*		—	190	300	mV
Quiescent Current (GND terminal current)	I_Q	V_I = 6 V, 1 mA ≤ I_O ≤ 100 mA*, V_E ≥ 2.0 V		—	45	60	µA
		V_I = 8 V, 1 mA ≤ I_O ≤ 100 mA*, V_E ≥ 2.0 V		—	50	65	µA
	$I_{Q(off)}$	4 V ≤ V_I ≤ 8 V, V_E ≤ 0.8 V		—	0.05	1.0	µA
ENABLE Input Voltage	V_{EH}	4 V ≤ V_I ≤ 8 V,	Output ON	2.0	—	—	V
	V_{EL}	-20°C ≤ T_A ≤ +85°C	Output OFF	—	—	0.8	V
ENABLE Input Current	I_E	T_A ≤ +85°C, V_E = V_I = 8 V		—	—	±0.1	µA
Thermal Shutdown Temp.	T_J			150	—	—	°C
Thermal Resistance	$R_{\theta JA}$	Mounted on 2.24" x 2.24" solder-coated copper-clad board in still air		—	258	—	°C/W

Typical values are at T_A = +25°C and are given for circuit design information only.

* Pulse test (≤20 ms). See previous page for duty cycle limitations.

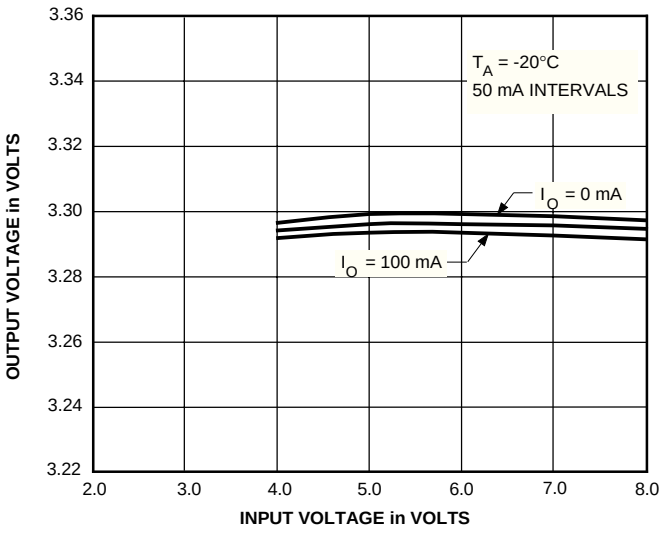
TYPICAL CHARACTERISTICS

LOAD REGULATION

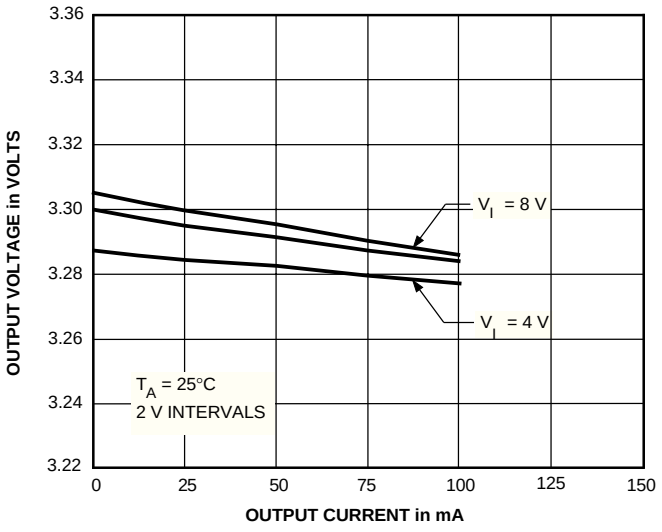


Dwg. GP-052-6

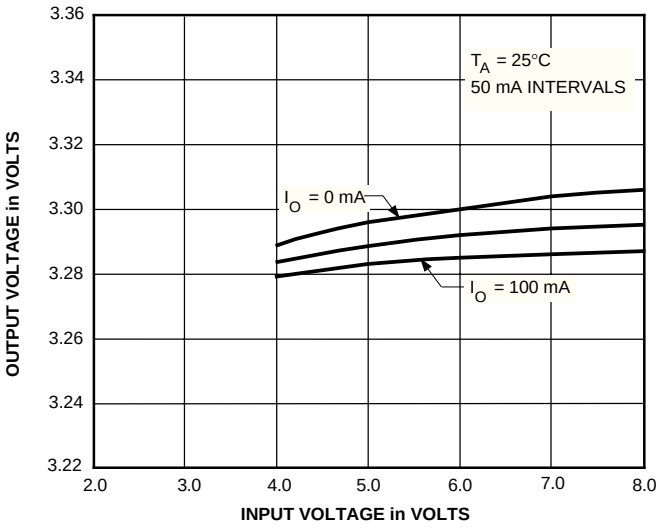
LINE REGULATION



Dwg. GP-053-6



Dwg. GP-052-7

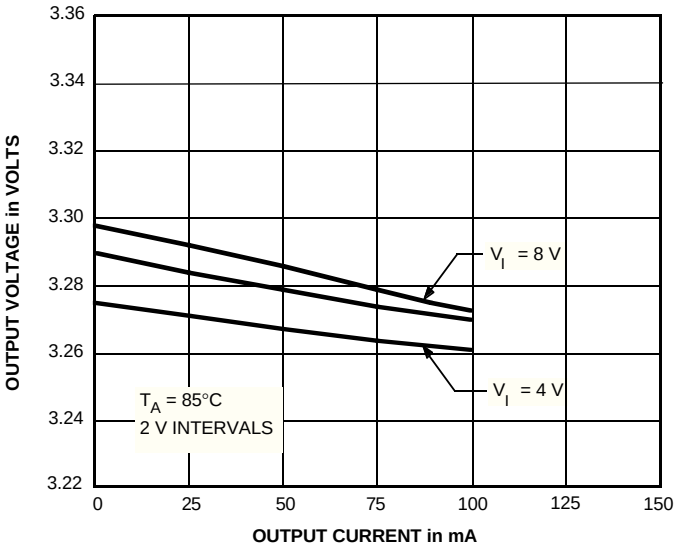


Dwg. GP-053-7

CAUTION: Maximum allowable duty cycle will be significantly less than 100% at high temperatures, at high input voltages, or at high output currents. See Maximum Allowable Output Current table.

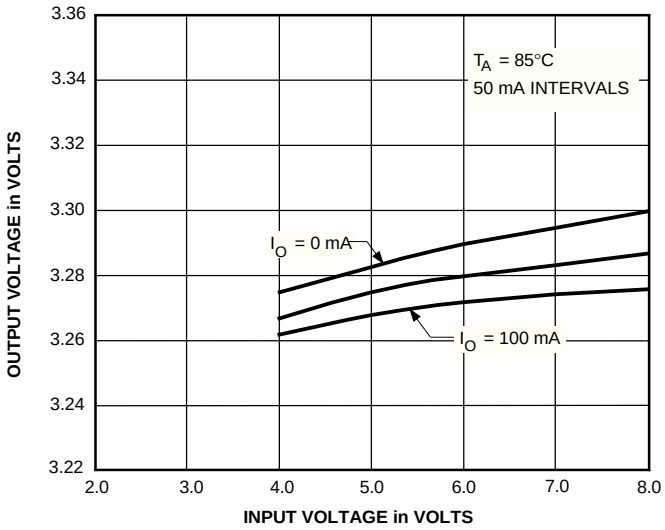
TYPICAL CHARACTERISTICS (cont,d)

LOAD REGULATION



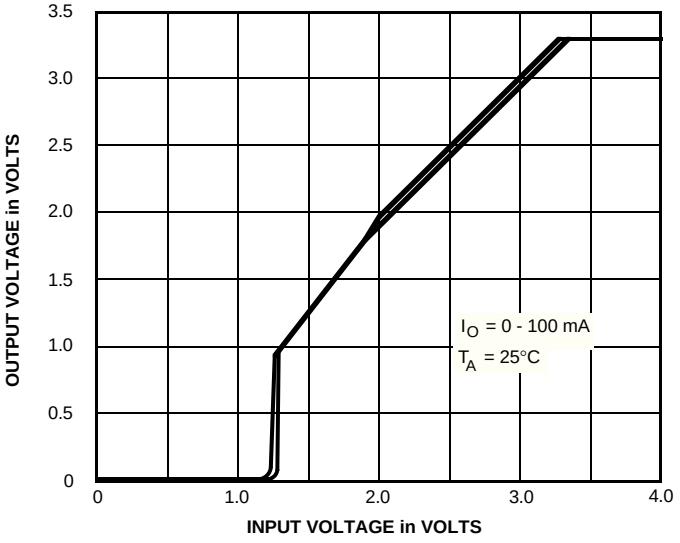
Dwg. GP-052-8

LINE REGULATION

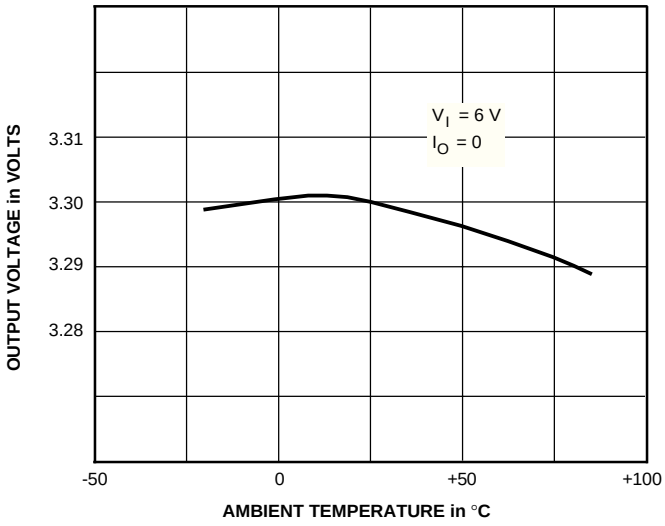


Dwg. GP-053-8

OUTPUT VOLTAGE



Dwg. GP-059-1

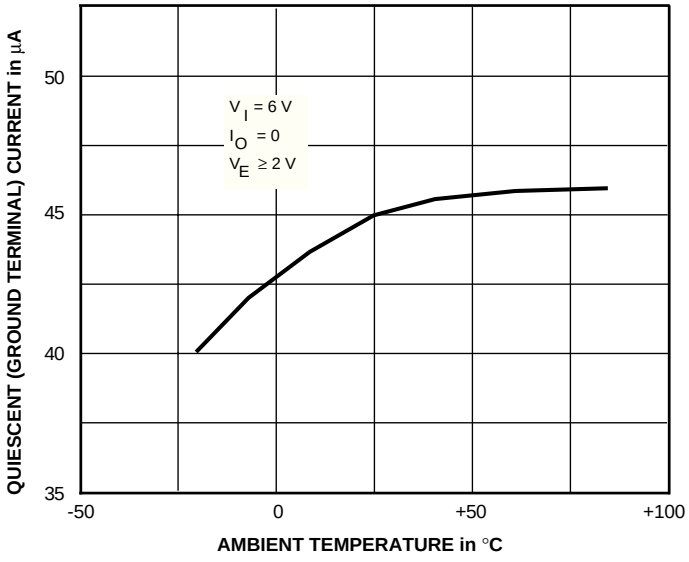


Dwg. GP-050-2

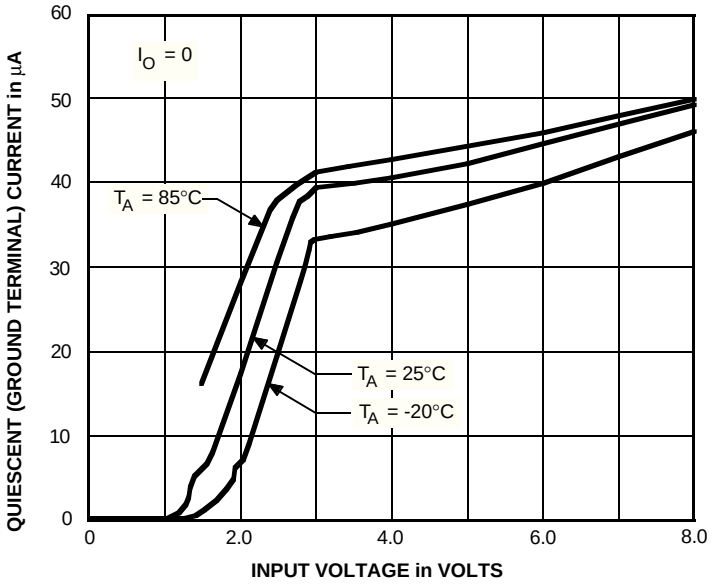
CAUTION: Maximum allowable duty cycle will be significantly less than 100% at high temperatures, at high input voltages, or at high output currents. See Maximum Allowable Output Current table.

TYPICAL CHARACTERISTICS (cont,d)

QUIESCENT (GROUND TERMINAL) CURRENT

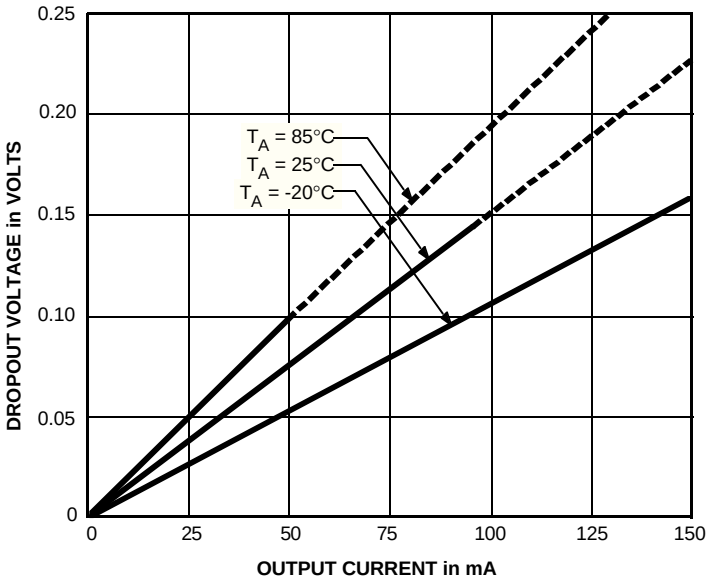


Dwg. GP-051-1



Dwg. GP-058

DROPOUT VOLTAGE



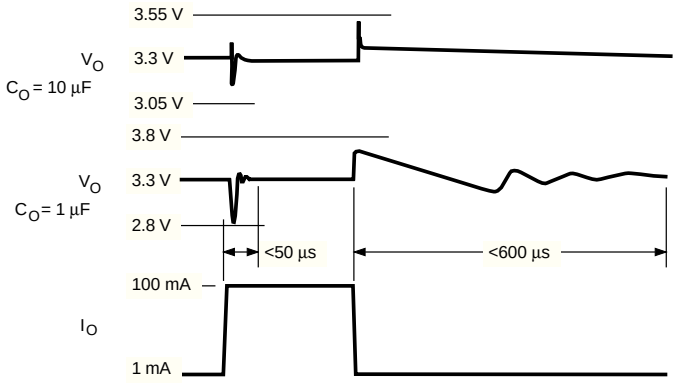
Dwg. GP-054-1

CAUTION: Maximum allowable duty cycle will be significantly less than 100% at high temperatures, at high input voltages, or at high output currents. See Maximum Allowable Output Current table.

TYPICAL CHARACTERISTICS (concluded)

LOAD TRANSIENT PERFORMANCE

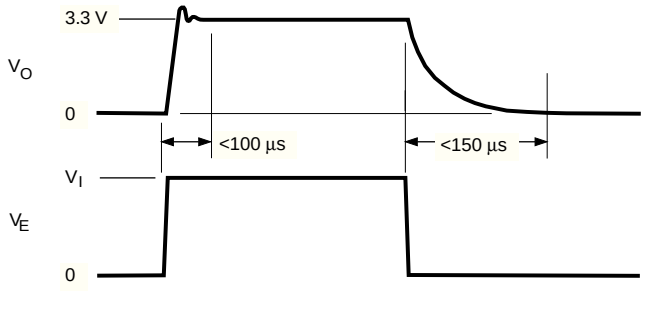
V_I = 3.5 V to 6.5 V, C_O as specified, T_A = 25°C



Dwg. WP-028-1

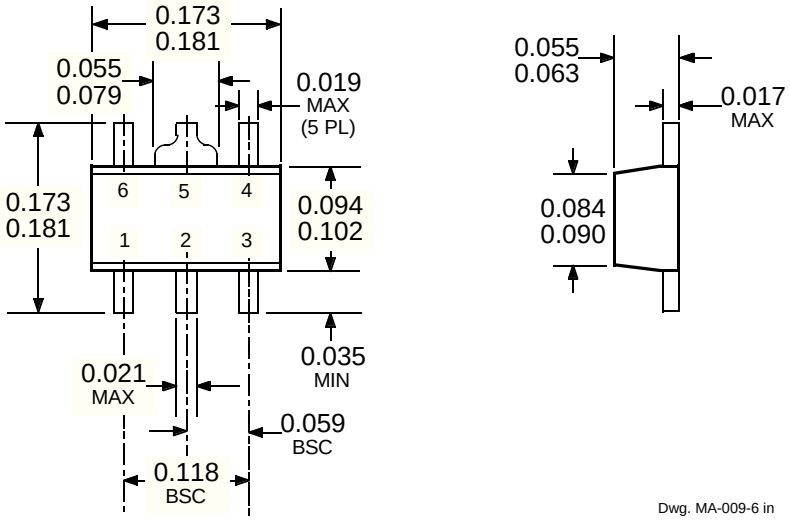
ENABLE TRANSIENT PERFORMANCE

V_I = 3.5 V to 6.5 V, C_O = 1 µF, T_A = 25°C



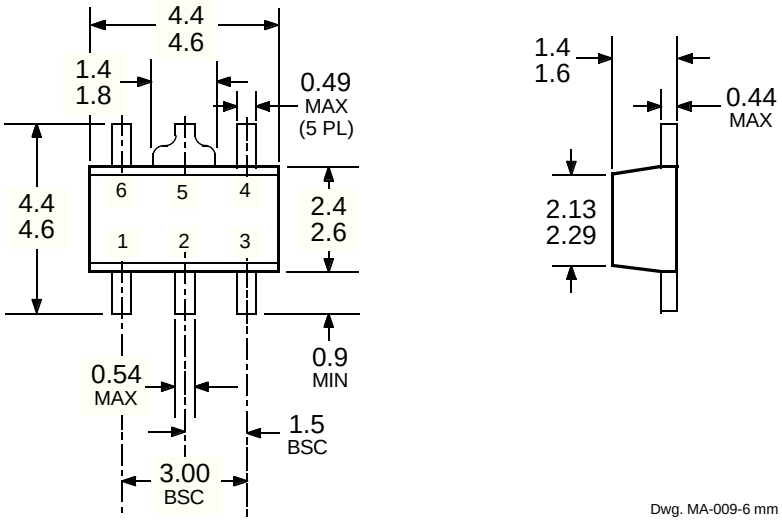
Dwg. WP-027-2

Dimensions in Inches
(for reference only)



Dwg. MA-009-6 in

Dimensions in Millimeters
(controlling dimensions)



Dwg. MA-009-6 mm

NOTES:
1. Lead spacing tolerance is non-cumulative.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Terminal numbering is in accordance with EIA/JEDEC convention. Where EIAJ conventions apply, the tab is not numbered, resulting in terminal 6 being designated terminal 5.