Description

The GM66100/1/2 series are 1A ultra low-dropout linear voltage regulators that provide low-voltage, high output current from an extremely small package.

The GM66100/1/2 offers extremely low dropout (typically 410 m V at 1A) and low ground current (typically 12mA at 1A).

The GM66100 offers 3 Lead packages with a fixed output voltage options while GM66101/2 offer SO8 packages for fixed and adjustable output voltages accordingly.

The GM66100/1/2 is ideal for PC add-in cards that need to convert from standard 5V to 3.3V, 3.3V to 2.5V or 2.5V to 1.8V. A guaranteed maximum dropout voltage of 630mV over all operating conditions allows the GM66100/1/2 provide 2.5V from a supply as low as 3.13V and 1.8V from a supply as low as 2.43V.

The GM66100/1/2 is fully protected with over current limiting, thermal shutdown, and reversed-battery protection.

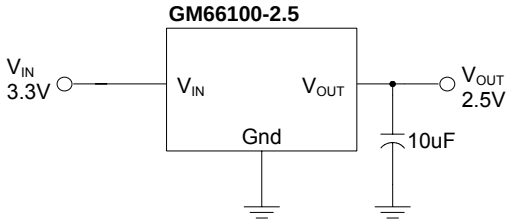
Features

- **Fixed and adjustable output voltages**
- **Typical 410mV Dropout Voltage @ 1A**
- **1A minimum guaranteed output current**
- **Accurate 1% Guaranteed Tolerance**
- **Current limiting and thermal shutdown**
- **Reverse-battery Protection**
- **Reversed leakage protection**
- **Fast Transient Response**

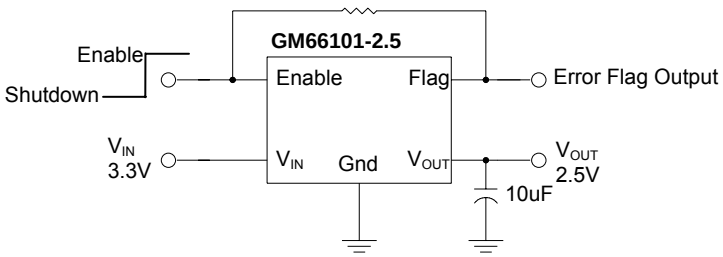
Application

High Efficiency Linear Regulators	**Battery Powered Equipment**
Ideal for 3.0V to 2.5V conversion	**Automotive Electronics**
Ideal for 2.5V to 1.8V conversion	**Post Regulators for Switching Supplies**

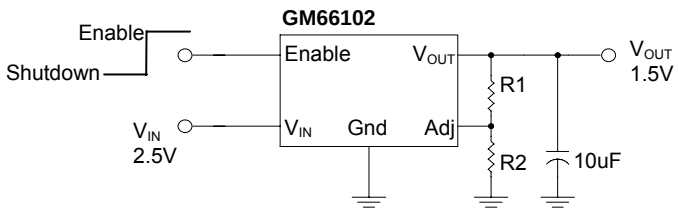
Typical Application Circuits



2.5V/1A Regulator



2.5V/1A Regulator with Error Flag

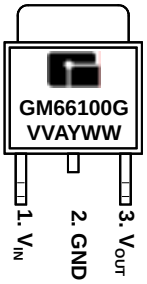


1.5V/1A Adjustable Regulator

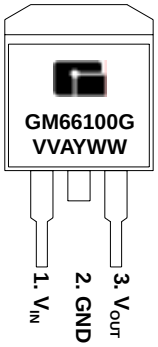
Marking Information and Pin Configurations (Top View)

GM66100

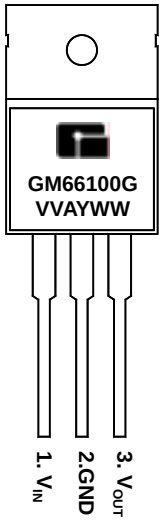
TO 252 (D-PAK)



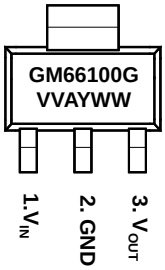
TO 263 (D^2-PAK)



TO 220



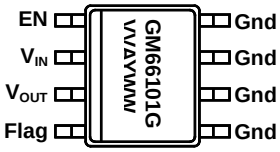
SOT223



G: Green Product
VV: Fixed Output (15 = 1.5V, 25 = 3.3V…)
A: Assembly / Test site code
Y: Year
WW: Week

GM66101

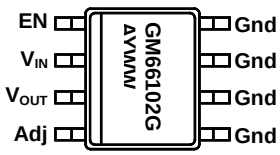
SO8



G: Green Product
VV: Fixed Output (15 = 1.5V, 25 = 3.3V…)
A: Assembly / Test site code
Y: Year
WW: Week

GM66102

SO8



G: Green Product
A: Assembly / Test site code
Y: Year
WW: Week

Ordering Information

Ordering Number	Output Voltage	Package	Shipping
GM66100			
GM66100-1.8TA3RG	1.8V	TO-263	800 Units / Reel
GM66100-1.8TB3TG	1.8V	TO-220	50 Units/Tube
GM66100-1.8TC3TG	1.8V	TO-252	2,500 Units/Reel
GM66100-1.8ST3RG	1.8V	SOT-223	2,500 Units/Reel
GM66100-2.5TA3RG	2.5V	TO-263	800 Units / Reel
GM66100-2.5TB3TG	2.5V	TO-220	50 Units/Tube
GM66100-2.5TC3RG	2.5V	TO-252	2,500 Units / Reel
GM66100-2.5ST3RG	2.5V	SOT223	2,500 Units / Reel
GM66100-3.3TA3RG	3.3V	TO-263	800 Units / Reel
GM66100-3.3TB3TG	3.3V	TO-220	50 Units/Tube
GM66100-3.3TC3TG	3.3V	TO-252	2,500 Units/Reel
GM66100-3.3ST3RG	3.3V	SOT-223	2,500 Units/Reel
GM66100-5.0TA3RG	5.0V	TO-263	800 Units / Reel
GM66100-5.0TB3TG	5.0V	TO-220	50 Units/Tube
GM66100-5.0TC3RG	5.0V	TO-252	2,500 Units / Reel
GM66100-5.0ST3RG	5.0V	SOT223	2,500 Units / Reel

Ordering Information (continued)

Ordering Number	Output Voltage	Package	Shipping
GM66101			
GM66101-1.8S8RG	1.8V	SOP-8	2,500 Units/Reel
GM66101-2.5S8RG	2.5V	SOP-8	2,500 Units/Reel
GM66101-3.3S8RG	3.3V	SOP-8	2,500 Units/Reel

Ordering Information (continued)

Ordering Number	Output Voltage	Package	Shipping
GM66102			
GM66102S8RG	Adj	SOP-8	2,500 Units/Reel

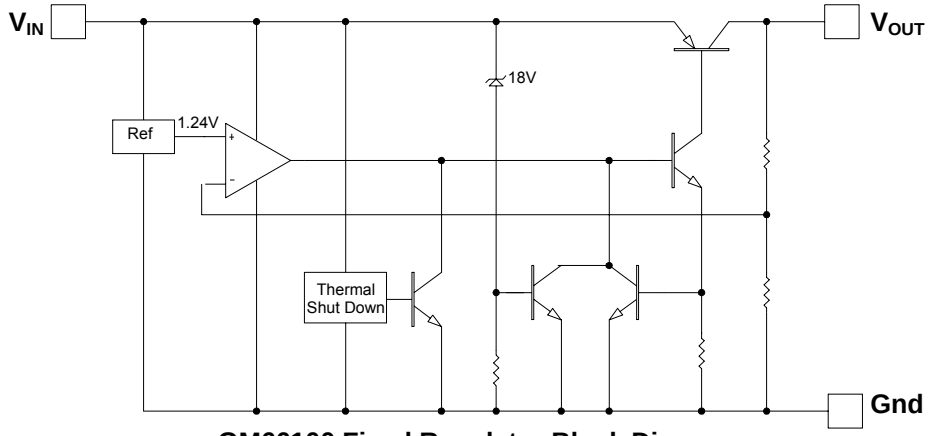
Absolute Maximum Ratings (Note 1)

Rating	Symbol	Value	Unit
Supply Voltage	V_{IN}	-20 to +20	V
Enable Voltage	V_{EN}	+20	V
Storage Temperature Range	T_{STG}	- 65 to 150	°C
Lead Temperature (Soldering, 10 sec)		+ 260	°C
ESD	**Note 3**		

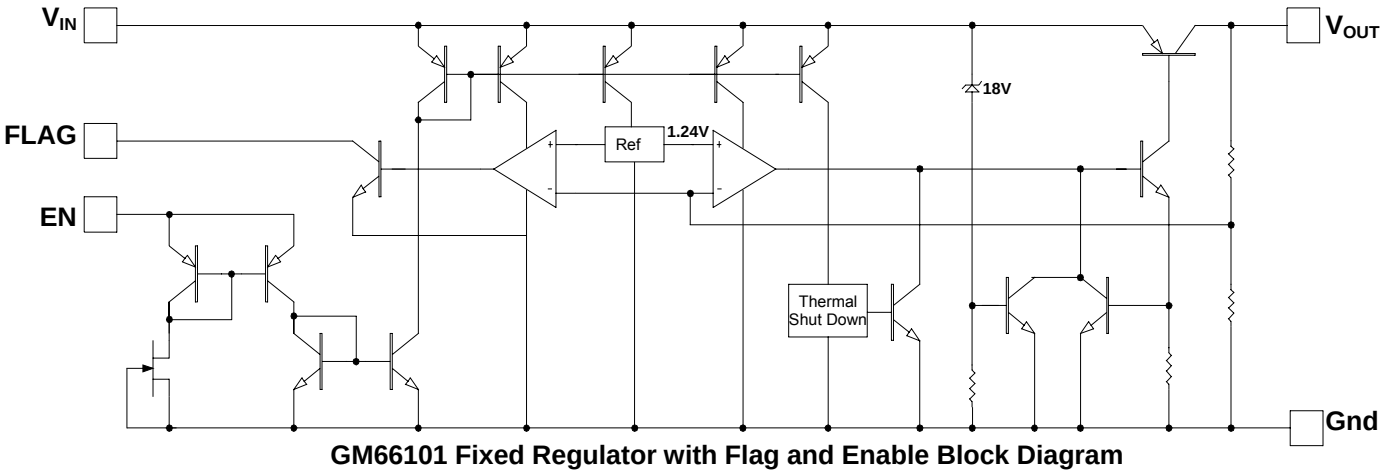
Operating Ratings (Note 2)

Rating		Symbol	Value	Unit
Supply Voltage		V_{IN}	2.25 to 16	V
Enable Voltage		V_{EN}	2.25 to 16	V
Maximum Power Dissipation		$P_{D(MAX)}$	**Note 4**	
Junction Temperature Range		T_J	-40 to 125	°C
Package Thermal Resistances	SOT223	θ_{JC}	15	°C/W
	SO8		20	°C/W

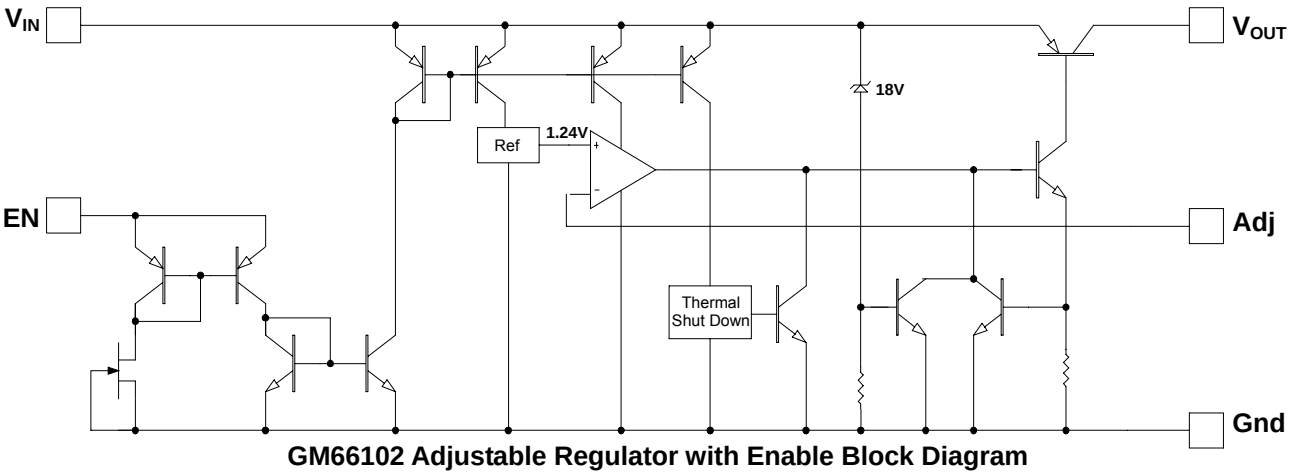
Block Diagram



GM66100 Fixed Regulator Block Diagram



GM66101 Fixed Regulator with Flag and Enable Block Diagram



GM66102 Adjustable Regulator with Enable Block Diagram

Electrical Characteristics:

(V_{IN} = V_{OUT} + 1V, V_{EN} = 2.25V,Unless otherwise specified: T_J = 25°C, Bold values are guaranteed across the full operating temperature range)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output Voltage	I_O = 10mA	V_{OUT}	-1		1	%
	10mA ≤ I_O ≤ 1A, V_{OUT} + 1V ≤ V_{IN} ≤ 8V		**-2**		**-2**	
Line Regulation	I_O = 10mA, V_{OUT} + 1V ≤ V_{IN} ≤ 16V	ΔV_{OI}		0.06	0.5	%
Load Regulation	V_{IN} = V_{OUT} + 1V, 10mA ≤ I_O ≤ 1A	ΔV_{OL}		0.2	1.0	%
Output Temperature Coefficient	**Note 5**	$\Delta V_{OUT}/\Delta T$		40	100	ppm/°C
Dropout Voltage, **Note 6**	I_O = 100mA, ΔV_{OI} = -1%	V_{DO}		150	200	mV
					250	
	I_O = 500mA, ΔV_{OI} = -1%			275		
	I_O = 750mA, ΔV_{OI} = -1%			330	500	
	I_O = 1A, ΔV_{OI} = -1%			410	**550**	
					630	
Ground Current **Note 7**	I_O = 100mA, V_{IN} = V_{OUT} + 1V	I_{GND}		700		µA
	I_O = 500mA, V_{IN} = V_{OUT} + 1V			4		mA
	I_O = 750mA, V_{IN} = V_{OUT} + 1V			7		
	I_O = 1A, V_{IN} = V_{OUT} + 1V			12	**20**	
Current Limit	V_{OUT} = 0V, V_{IN} = V_{OUT} + 1V	I_{CL}		1.8	2.5	A

Enable Input

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Enable Input Voltage	Logic low (OFF)	$V_{EN(low)}$			08	V
	Logic High (ON)	$V_{EN(high)}$	2.25			
Enable Input Current	V_{EN} = 2.25V	$I_{EN(low)}$	1	15	30	µA
					75	
	V_{EN} = 0.8V	$I_{EN(high)}$			2	
					4	

Flag Output

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output Leakage Current	V_{OH} = 16V	$I_{FLG(leak)}$		0.01	1	µA
					2	
Output Low Voltage **Note 8**	V_{IN} = 0.9V+V_{OUT} Nominal, I_{CL}=250µA	$V_{FLG\ (DO)}$		240	300	mV
					400	
Low Threshold	% of V_{OUT}		93			%
High Threshold	% of V_{OUT}				**99.2**	
Hysteresis				1		
Enable Input Current		$I_{EN(low)}$	1	15	30	µA
					75	
	V_{EN} = 0.8V	$I_{EN(high)}$			2	
					4	

GM66102 Only

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Reference Voltage		V_{REF}	1.228	1.24	1.252	V
			1.215		**1.265**	
	Note 9		**1.203**		**1.277**	
Adjust Pin Bias Current		I_{ADJ}		40	80	µA
					120	
Reference Voltage Temp Coefficient **Note 5**		$\Delta V_{REF}/\Delta T$		20		ppm/°C
Adjust Pin Bias Current Temp Coefficient		$\Delta I_{ADJ}/\Delta T$		0.1	99.2	nA/°C

Note 1: Exceeding the absolute maximum ratings may damage the device.
Note 2: The device is not guaranteed to function outside its operating rating.
Note 3: Devices are ESD sensitive. Handling precautions is recommended.
Note 4: $P_{D(MAX)} = (T_{J(MAX)} - T_A)/\theta_{JA}$, where θ_{JA} is junction to ambient thermal resistance
Note 5: Output voltage temperature coefficient is $\Delta V_{OUT(worst\ case)}/(T_{J(MAX)}-T_{J(MIN)})$, where $T_{J(MAX)}$ is 125°C and $T_{J(MIN)}$ is 0°C
Note 6: $V_{DO} = V_{IN} - V_{OUT}$ when V_{OUT} decreases to 99% of its nominal output voltage with $V_{IN} = V_{OUT} + 1V$. For output voltage below 2.25V, dropout voltage is the input-to-output voltage differential with the minimum input voltage being 2.25V. Minimum input operating voltage is 2.25V.
Note 7: I_{GND} is the quiescent current. $I_{IN} = I_{GND} + I_{OUT}$
Note 8: For adjustable device and fixed device with $V_{OUT} \geq 2.5V$
Note 9: $V_{REF} \leq V_{OUT} \leq (V_{IN} - 1V)$, $2.25V \leq V_{IN} \leq 16V$, $10mA \leq I_L \leq 1A$

Application Information

The GM66100/1/2 is a low dropout voltage regulator suitable for applications which ultra low dropout performance is needed. Unlike older NPN-pass transistor designs, where the minimum dropout voltage is limited by the base-to-emitter voltage drop and collector-to-emitter saturation voltage, dropout performance of the PNP output of these devices is limited only by the low V_{CE} saturation voltage.

The GM66100/1/2 regulator is fully protected from damage due to fault conditions. Linear current limiting is provided. Output current during overload conditions is constant. Thermal shutdown disables the device when the die temperature exceeds the maximum safe operating temperature. Transient protection allows device (and load) survival even when the input voltage spikes above and below nominal. The output structure of these regulators allows voltages in excess of the desired output voltage to be applied without reverse current flow.

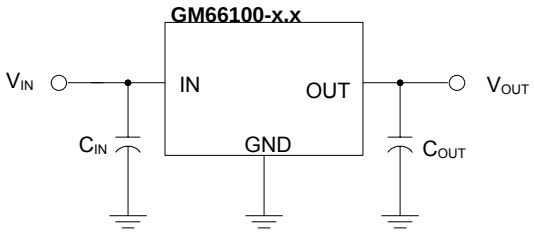


Figure 1. Capacitor Requirements

Output Capacitor

An output capacitor is required for the GM66100/1/2 to maintain stability and improve transient response. Proper capacitor selection is important to ensure proper operation. The output capacitor selection is dependent upon the ESR (equivalent series resistance) of the output capacitor to maintain stability.

When the output capacitor is 10μF or greater, the ESR value of the output capacitor should be less than 2Ω for the purpose of transient response improvement as well as stability. Ultra-low-ESR capacitors (<100mΩ), such as ceramic chip capacitors, may promote instability. A low-ESR solid tantalum capacitor works extremely well and provides good transient response and stability over temperature. Aluminum electrolytes can also be used, as long as the ESR of the capacitor is <2Ω.

The value of the output capacitor can be increased without limit. Higher capacitance values help to improve transient response and ripple rejection and reduce output noise.

Input Capacitor

An input capacitor of 1μF or greater is recommended when the device is more than 4 inches away from the bulk ac supply capacitance or when the supply is a battery. Small, surface mount, ceramic chip capacitors can be used for bypassing. Larger values will help to improve ripple rejection by bypassing the input to the regulator, further improving the integrity of the output voltage.

Error Flag

The GM66101 features an error flag (FLG), which monitors the output voltage and sends out an error signal when the output voltage drops 5% below its expected value. The error flag is an open-collector output that pulls low under fault conditions and may sink up to 10mA. Low output voltage signifies a number of possible problems, including an over current fault (the device is in current limit) or low input voltage. The flag output is inoperative during over temperature conditions. A pull-up resistor from FLG to either V_{IN} or V_{OUT} is required for proper operation. For information regarding the minimum and maximum values of pull-up resistance, refer to the graph in the typical characteristics section of the data sheet.

Enable Input

The GM66101 and GM66102 feature an active-high enable input (EN) which allows on-off control of the regulator. The EN input has TTL/CMOS compatible thresholds for simple logic interfacing. EN may be directly tied to V_{IN} and pulled up to the maximum supply voltage.

Transient Response and 3.3V to 2.5V or 2.5V to 1.8V Conversion

The GM66100 series has excellent transient response to variations input voltage and load current. The device has been designed to respond quickly to load current variations and input voltage variations. Large output capacitors are not required to obtain this performance. A standard 10μF output capacitor, preferably tantalum, is all that is required. Larger values help to improve performance even further.

By virtue of its low-dropout voltage, this device does not saturate into dropout as readily as similar NPN-based designs. When converting from 3.3V to 2.5V or 2.5V to 1.8V, the NPN based regulators are already operating in dropout, with typical dropout requirements of 1.2V or greater. To convert down to 2.5V or 1.8V without operating in dropout, NPN based regulators require an input voltage of 3.7V at the very least.

The GM66100 regulator will provide excellent performance with an input as low as 3.0V or 2.5V respectively. This gives the PNP based regulators a distinct advantage over older, NPN based linear regulators.

Minimum Load Current

The GM66100/1/2 regulator is specified between finite loads. If the output current is too small, leakage currents dominate and the output voltage rises. A 10mA minimum load current is necessary for proper regulation.

Adjustable Regulator Design

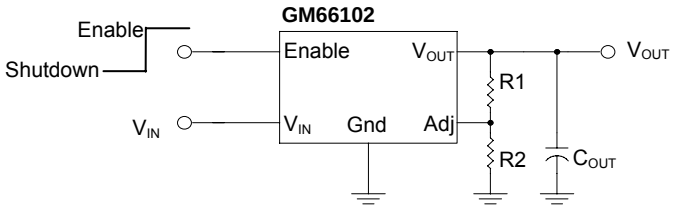


Figure 2. Adjustable Regulator with Resistors

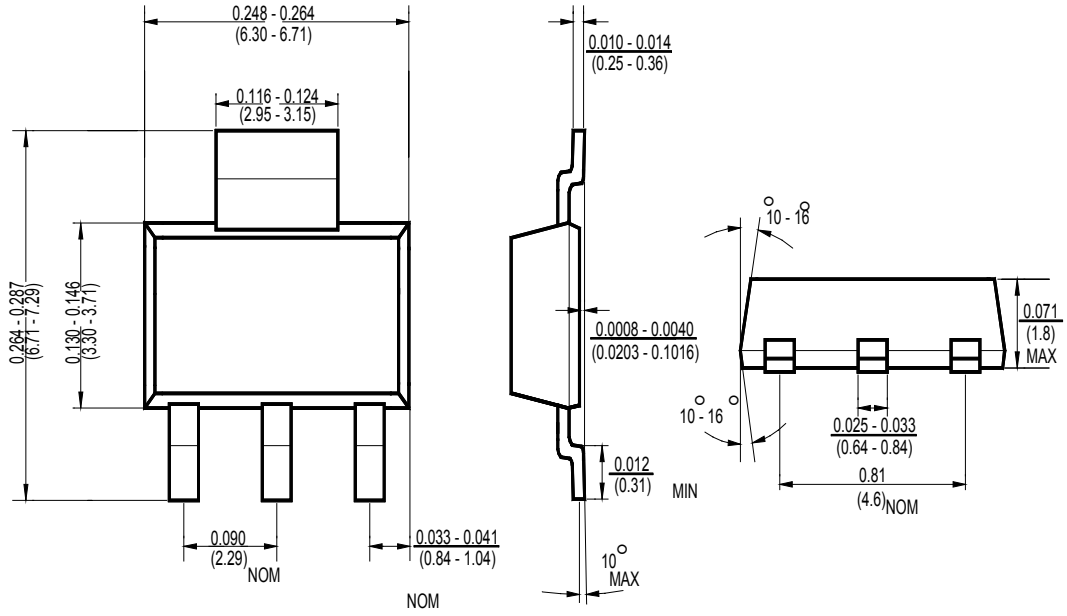
$$V_{OUT} = 1.24V \times (1+ R1/R2)$$

The GM66102 allows programming the output voltage anywhere between 1.24V and the 16V maximum operating rating of the family. Two resistors are used. The resistor values are calculated by:

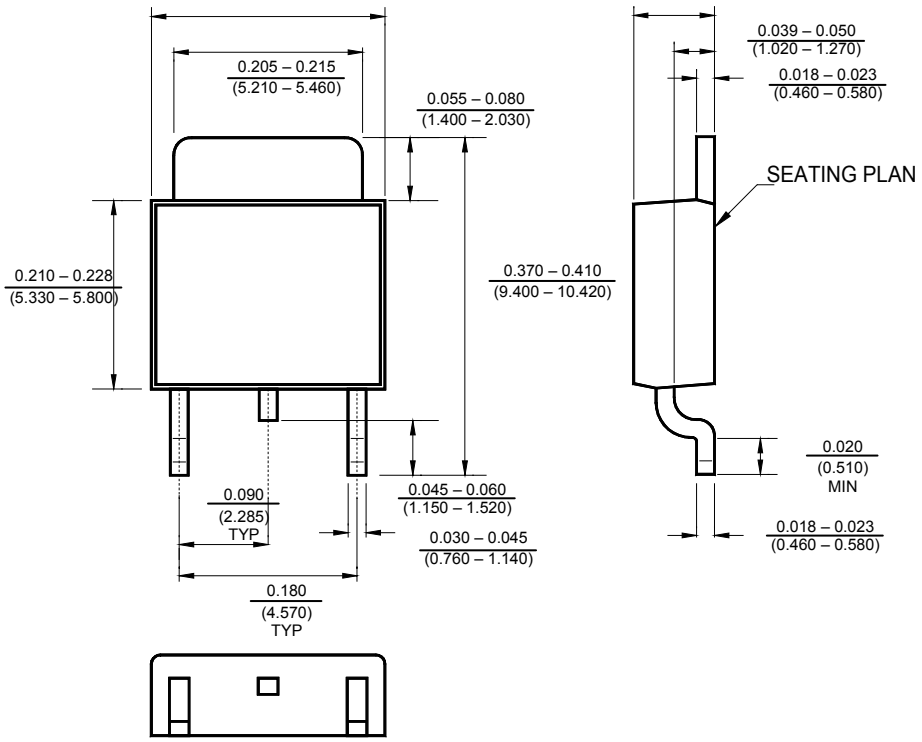
$$R1 = R2 \times (V_{OUT}/1.24 - 1)$$

Where V_{OUT} is the desired output voltage. Figure 2 shows component definition. Applications with widely varying load currents may scale the resistors to draw the minimum load current required for proper operation (see above).

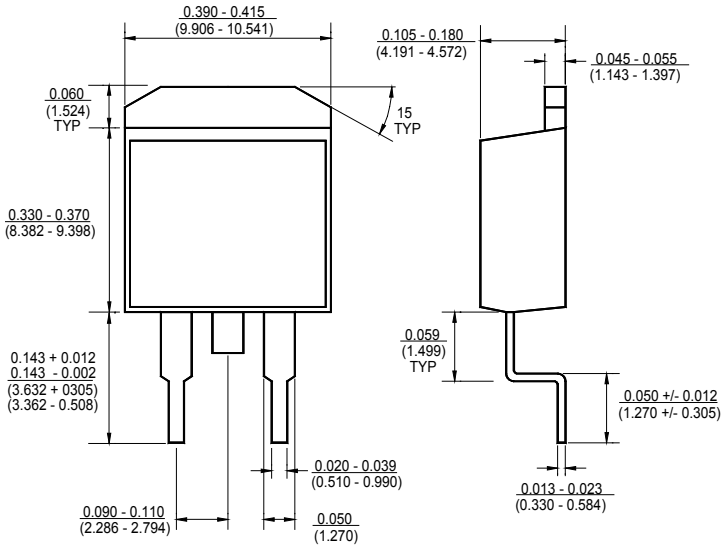
Package Outline Dimensions – SOT223



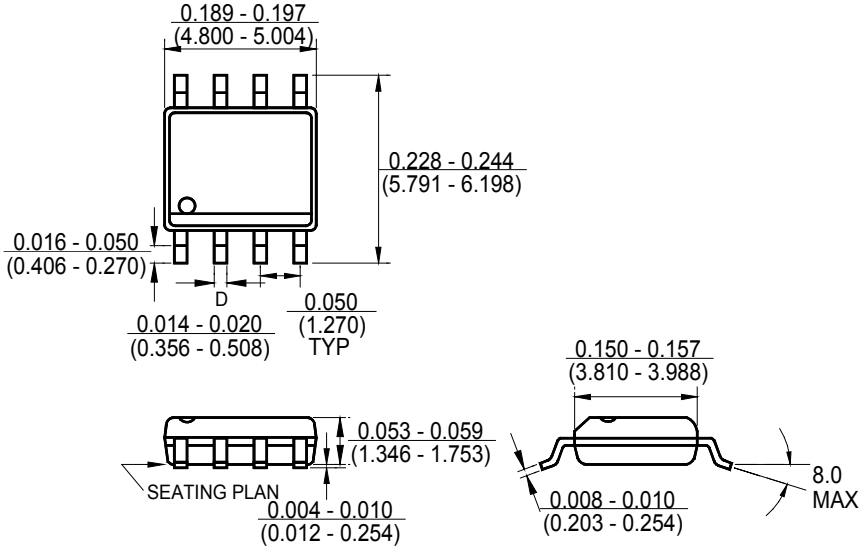
Package Outline Dimensions – TO252



Package Outline Dimensions – TO263



Package Outline Dimensions – SO 8



Ordering Number

GM	66100	-1.8	TA3	R	G
APM Gamma Micro	Circuit Type	Output Voltage 1.8 = 1.8V 2.5 = 2.5V 3.3 = 3.3V 5.0 = 5.0V	Package Type TA3: TO263 TB3: TO220 TC3: TO252 ST3: SOT223	Shipping Type R:Taping& Reel T: Tube	Blank: Pb-free G:Green

GM	66101	-1.8	S8	R	G
APM Gamma Micro	Circuit Type	Output Voltage 1.8 = 1.8V 2.5 = 2.5V 3.3 = 3.3V 5.0 = 5.0V	Package Type S8: SOP-8	Shipping Type R:Taping& Reel T:Tube	Blank: Pb-free G:Green

GM	66102		S8	R	G
APM Gamma Micro	Circuit Type	Output Voltage Adj	Package Type S8: SOP-8	Shipping Type R:Taping& Reel T:Tube	Blank: Pb-free G:Green

Note:

Pb-free products:

- RoHS compliant and compatible with the current require-ments of IPC/JEDEC J-STD-020.
- Suitable for use in SnPb or Pb-free soldering processes with 100% matte tin (Sn) plating.

Green products:

- Lead-free (RoHS compliant)
- Halogen free(Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight)

GM66300 Series

3.0A ULTRA LOW DROPOUT VOLTAGE REGULATORS

Description

The GM66300, GM66301 and GM66302 are 3.0A, low dropout linear voltage regulators that provide a low voltage, high-current output with a minimum of external components. Utilizing proprietary Super beta PNP pass element, the GM66300/1/2 offers extremely low dropout (typically 400mV at 3.0A) and low ground current (typically 36mA at 3.0A).

The GM66300/1/2 is ideal for PC add-in cards that need to convert from standard 3.3V to 2.5V or 2.5V to 1.8V. A guaranteed maximum dropout voltage of 500mV over all operating conditions allows the GM66300/1/2 to provide 2.5V from a supply as low as 3V, and 1.8V from a supply as low as 2.5V. The GM66300/1/2 also has fast transient response for heavy switching applications. The device requires only 47µF of output capacitance to maintain stability and achieve fast transient response.

The GM66300/1/2 is fully protected with over current limiting, thermal shutdown, reversed-battery protection, reversed-leakage protection, and reversed-lead insertion. The GM66301 offers a TTL-logic compatible enable pin and an error flag that indicates under voltage and over current conditions. Offered in fixed voltages, the GM66300/1 comes in the TO-220 and TO-263 packages and is an ideal upgrade to older, NPN-based linear voltage regulators.

The GM66302 is adjustable version, with On/Off feature.

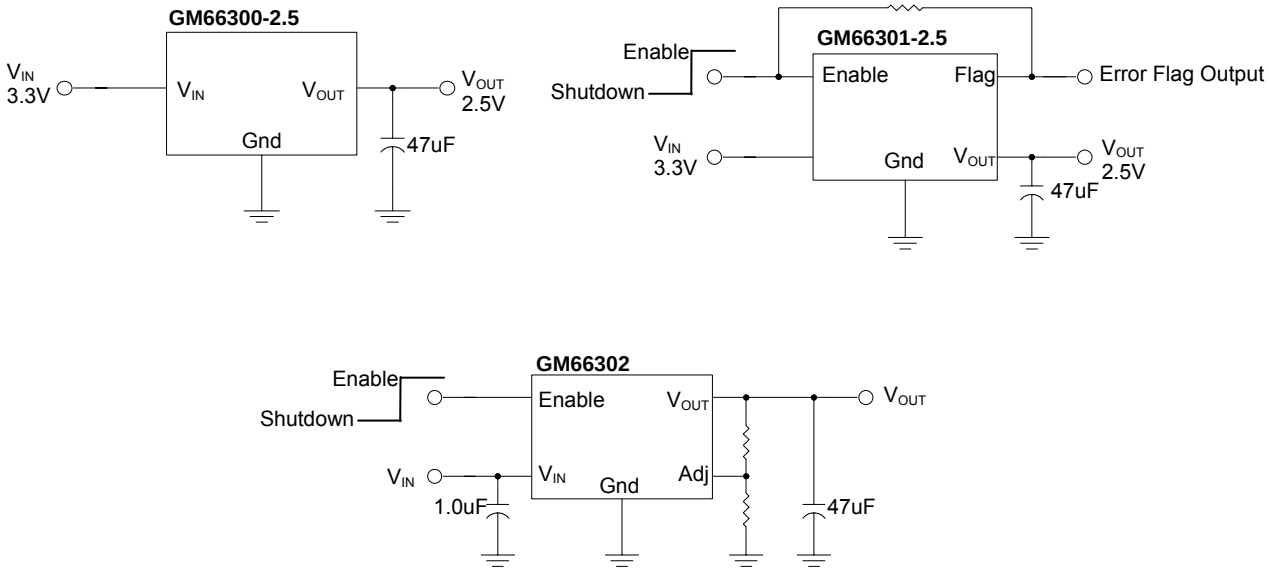
Features

- **3.0A minimum guaranteed output current**
- **500mV maximum dropout voltage over temperature, which is ideal for 3.0V to 2.5V conversion and 2.5V to 1.8V conversion.**
- **1% initial accuracy**
- **Low ground current**
- **Current limiting and Thermal shutdown**
- **Reversed-battery protection**
- **Reversed-leakage protection**
- **Fast transient response**
- **Error flag output (GM66301 only)**
- **Adjustable version (GM66302 only)**

Application

- **PC Add-in Cards**
- **High Efficiency Linear Power Supplies**
- **Multi-media and PC Processor Supplies**
- **Low Voltage Microcontrollers**
- **Automotive Electronics**

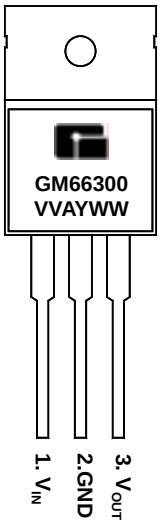
Typical Application Circuits



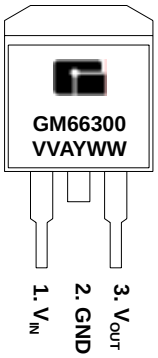
Marking Information and Pin Configurations (Top View)

GM66300 (Pb Free)

TO 220



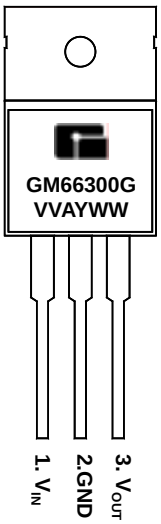
TO 263
(D^2-PAK)



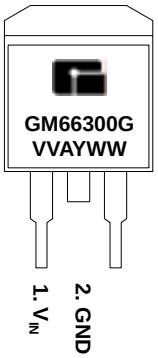
VV: Voltage suffix (15 = 1.5V, 50 = 5.0V…A = Adj)
A: Assembly / Test site code
Y: Year
WW: Week

GM66300 (Green Product)

TO 220



TO 263
(D^2-PAK)

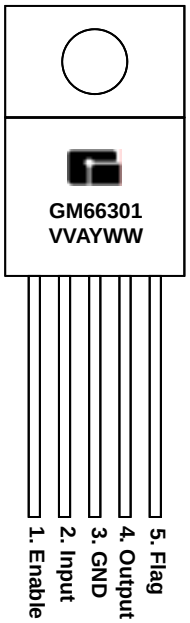


G: Green Product
VV: Voltage suffix (15 = 1.5V, 50 = 5.0V…A = Adj)
A: Assembly / Test site code
Y: Year
WW: Week

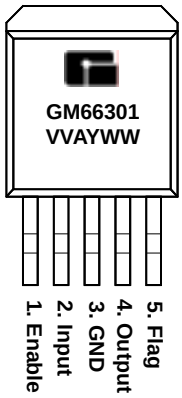
Marking Information and Pin Configurations (Top View)

GM66301 (Pb Free)

5L TO 220



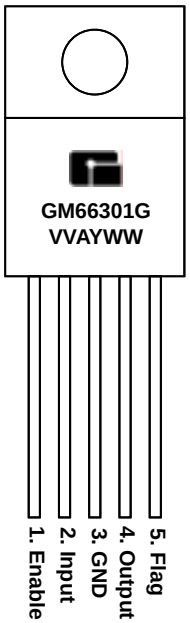
5L TO 263



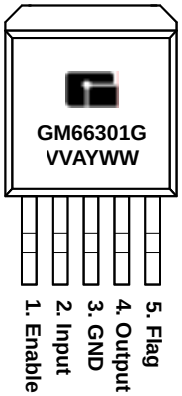
VV: Voltage suffix (15 = 1.5V, 50 = 5.0V…A = Adj)
A: Assembly / Test site code
Y: Year
WW: Week

GM66301 (Green Product)

5L TO 220



5L TO 263

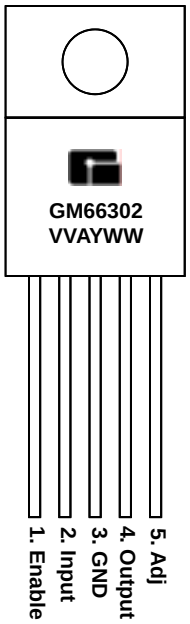


G: Green Product
VV: Voltage suffix (15 = 1.5V, 50 = 5.0V…A = Adj)
A: Assembly / Test site code
Y: Year
WW: Week

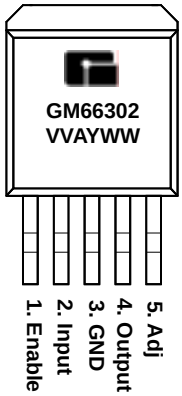
Marking Information and Pin Configurations (Top View)

GM66302 (Pb Free)

5L TO 220



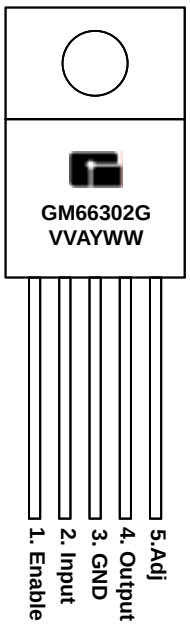
5L TO 263



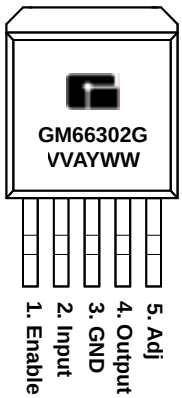
VV: Voltage suffix (15 = 1.5V, 50 = 5.0V…A = Adj)
A: Assembly / Test site code
Y: Year
WW: Week

GM66302 (Green Product)

5L TO 220



5L TO 263



G: Green Product
VV: Voltage suffix (15 = 1.5V, 50 = 5.0V…A = Adj)
A: Assembly / Test site code
Y: Year
WW: Week

Ordering Information – Pb Free

Ordering Number	Output Voltage	Package	Shipping
GM66300			
GM66300-1.8TA3T	1.8V	TO-263	50 Units/Tube
GM66300-1.8TA3R	1.8V	TO-263	800 Units / Reel
GM66300-1.8TB3T	1.8V	TO-220	50 Units/Tube
GM66300-2.5TA3T	2.5V	TO-263	50 Units/Tube
GM66300-2.5TA3R	2.5V	TO-263	800 Units / Reel
GM66300-2.5TB3T	2.5V	TO-220	50 Units/Tube
GM66300-3.3TA3T	3.3V	TO-263	50 Units/Tube
GM66300-3.3TA3R	3.3V	TO-263	800 Units / Reel
GM66300-3.3TB3T	3.3V	TO-220	50 Units/Tube
GM66300-5.0TA3T	5.0V	TO-263	50 Units/Tube
GM66300-5.0TA3R	5.0V	TO-263	800 Units / Reel
GM66300-5.0TB3T	5.0V	TO-220	50 Units/Tube

Ordering Information – Green Product

Ordering Number	Output Voltage	Package	Shipping
GM66300			
GM66300-1.8TA3TG	1.8V	TO-263	50 Units/Tube
GM66300-1.8TA3RG	1.8V	TO-263	800 Units / Reel
GM66300-1.8TB3TG	1.8V	TO-220	50 Units/Tube
GM66300-2.5TA3TG	2.5V	TO-263	50 Units/Tube
GM66300-2.5TA3RG	2.5V	TO-263	800 Units / Reel
GM66300-2.5TB3TG	2.5V	TO-220	50 Units/Tube
GM66300-3.3TA3TG	3.3V	TO-263	50 Units/Tube
GM66300-3.3TA3RG	3.3V	TO-263	800 Units / Reel
GM66300-3.3TB3TG	3.3V	TO-220	50 Units/Tube
GM66300-5.0TA3TG	5.0V	TO-263	50 Units/Tube
GM66300-5.0TA3RG	5.0V	TO-263	800 Units / Reel
GM66300-5.0TB3TG	5.0V	TO-220	50 Units/Tube

Ordering Information – Pb Free

Ordering Number	Output Voltage	Package	Shipping
GM66301			
GM66301-1.8TA5T	1.8V	5L-TO-263	50 Units/Tube
GM66301-1.8TA5R	1.8V	5L-TO-263	800 Units / Reel
GM66301-1.8TB5T	1.8V	5L-TO-220	50 Units/Tube
GM66301-2.5TA5T	2.5V	5L-TO-263	50 Units/Tube
GM66301-2.5TA5R	2.5V	5L-TO-263	800 Units / Reel
GM66301-2.5TB5T	2.5V	5L-TO-220	50 Units/Tube
GM66301-3.3TA5T	3.3V	5L-TO-263	50 Units/Tube
GM66301-3.3TA5R	3.3V	5L-TO-263	800 Units / Reel
GM66301-3.3TB5T	3.3V	5L-TO-220	50 Units/Tube
GM66301-5.0TA5T	5.0V	5L-TO-263	50 Units/Tube
GM66301-5.0TA5R	5.0V	5L-TO-263	800 Units / Reel
GM66301-5.0TB5T	5.0V	5L-TO-220	50 Units/Tube

Ordering Information – Green Product

Ordering Number	Output Voltage	Package	Shipping
GM66301			
GM66301-1.8TA5TG	1.8V	TO-263-5	50 Units/Tube
GM66301-1.8TA5RG	1.8V	TO-263-5	800 Units / Reel
GM66301-1.8TB5TG	1.8V	TO-220-5	50 Units/Tube
GM66301-2.5TA5TG	2.5V	TO-263-5	50 Units/Tube
GM66301-2.5TA5RG	2.5V	TO-263-5	800 Units / Reel
GM66301-2.5TB5TG	2.5V	TO-220-5	50 Units/Tube
GM66301-3.3TA5TG	3.3V	TO-263-5	50 Units/Tube
GM66301-3.3TA5RG	3.3V	TO-263-5	800 Units / Reel
GM66301-3.3TB5TG	3.3V	TO-220-5	50 Units/Tube
GM66301-5.0TA5TG	5.0V	TO-263-5	50 Units/Tube
GM66301-5.0TA5RG	5.0V	TO-263-5	800 Units / Reel
GM66301-5.0TB5TG	5.0V	TO-220-5	50 Units/Tube

Ordering Information – Pb Free

Ordering Number	Output Voltage	Package	Shipping
GM66302			
GM66302TA5T	Adj	TO-263-5	50 Units/Tube
GM66302TA5R	Adj	TO-263-5	800 Units / Reel
GM66302TB5T	Adj	TO-220-5	50 Units/Tube

Ordering Information – Green Product

Ordering Number	Output Voltage	Package	Shipping
GM66302			
GM66302TA5TG	Adj	TO-263-5	50 Units/Tube
GM66302TA5RG	Adj	TO-263-5	800 Units / Reel
GM66302TB5TG	Adj	TO-220-5	50 Units/Tube

Absolute Maximum Ratings

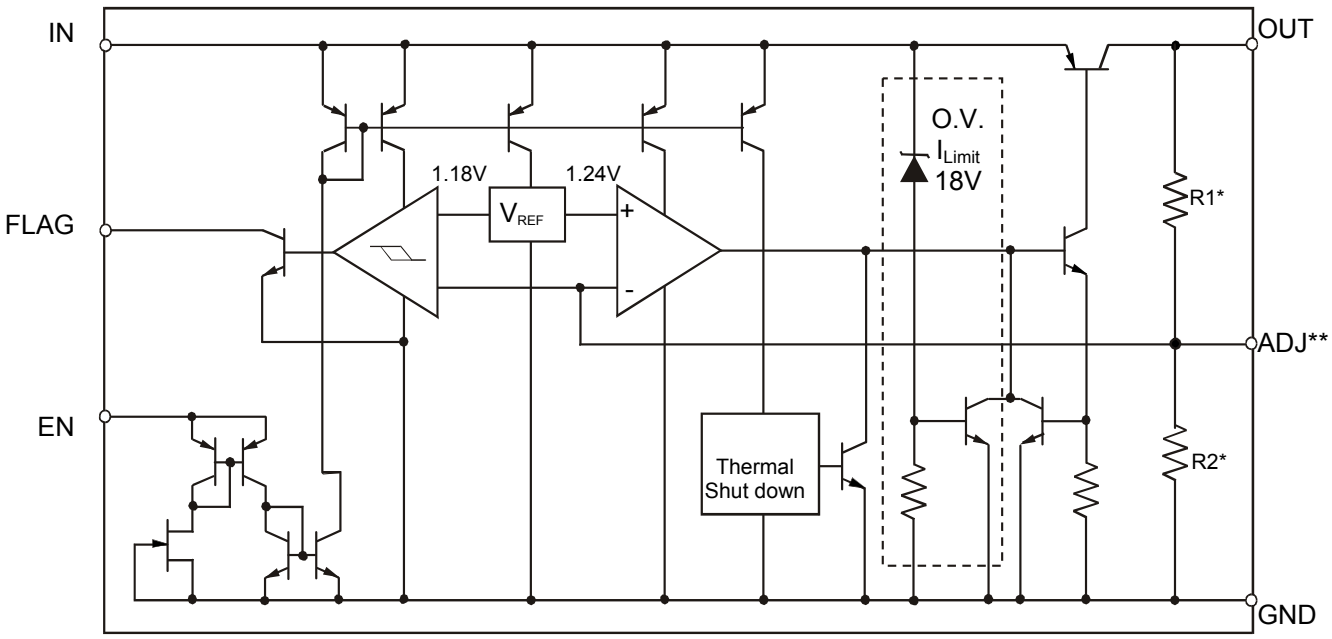
Parameter	Symbol	Value	Unit
Power Dissipation	P_D	Internally Limited	W
Input Power Supply Voltage (Note 1)	V_{IN}	-20 to +20	V
Enable Pin Voltage	V_{EN}	+20	V
Storage Temperature Range	T_{STG}	- 65 to 150	℃
Lead Temperature (Soldering, 5 sec)		+ 260	℃

Note 1: Maximum positive supply voltage of 60V must be of limited duration (<100msec) and duty cycle (< 1%). The maximum continuous supply voltage is 26V.

Operating Ratings

Parameter	Symbol	Value	Unit
Maximum Operating Input Voltage	V_{IN}	2.5 - 16	V
Operating Junction Temperature	T_J	-40 to +125	℃

Block Diagram



* Feedback network in fixed versions only
** Adjustable version only

Electrical Characteristics:

Unless otherwise specified: T_J = 25°C, Bold values are guaranteed across the full operating temperature range.

Parameter	Condition		Symbol	Min	Typ	Max	Unit
Output Voltage	I_O = 10mA		V_{OUT}	-1		1	%
	10mA ≤ I_O ≤ 3.0A, V_{OUT} + 1V ≤ V_{IN} ≤ 8V			**-2**		**2**	
Line Regulation	I_O = 10mA, V_{OUT} + 1V ≤ V_{IN} ≤ 8V		ΔV_{OI}		0.06	0.5	%
Load Regulation	V_{IN} = V_{OUT} + 1V, 10mA ≤ I_O ≤ 3A		ΔV_{OL}		0.2	1.0	%
Output Temperature Coefficient	(Note 5)		$\Delta V_{OUT}/\Delta T$		20	100	ppm/℃
Dropout Voltage (Note 6, Note 9)	ΔV_{OUT} = -1%	I_O = 100mA	V_{DO}		65	**200**	mV
		I_O = 750A			185		
		I_O = 1.5A			250		
		I_O = 3.0A			385	**550**	
Ground Current (Note 7)	I_O = 750mA, V_{IN} = V_{OUT} + 1V		I_{GND}		10	**20**	mA
	I_O = 1.5A, V_{IN} = V_{OUT} + 1V				17		
	I_O = 1.5A, V_{IN} = V_{OUT} + 1V				45		
Ground Pin Current at Dropout	V_{IN} = 0.5V less than specified V_{OUT}, I_O = 10mA		I_{GNDDO}		6		mA
Current Limit	V_{OUT} = 0V, V_{IN} = V_{OUT} + 1V		I_{CL}		4.5		A
Enable Input GM66301/GM66302							
Input Logic Voltage	Low (Off)					**0.8**	V
	High (On)			**2.5**			
Enable Pin Input Current	V_{EN} = 2.5V		I_{EN}		15	30	μA
						75	
	V_{EN} = 0.8V					2	
						4	
Regulator Output Current in Shutdown	(Note 8)		I_{OSD}		10		μA
						20	
Flag Output (GM66301)							
Output Leakage Current	V_{OH} = 16V		$I_{FLG(leak)}$		0.01	1	μA
						2	
Output Low Voltage	V_{IN} = 2.5V, I_{OL} = 250μA, Note 9		$V_{FLG(do)}$		220	300	mV
						400	
Low Threshold	% of V_{OUT}		V_{FLG}	93			%
High Threshold	% of V_{OUT}					99.2	
Hysteresis					1		

Note 1. Exceeding the absolute maximum ratings may damage the device.

Note 2. The device is not guaranteed to function outside its operating rating.

Note 3. Devices are ESD sensitive. Handing precautions recommended.

Note 4. $P_{D(max)}=(T_{J(max)}-T_A)+\theta_{JA}$, where θJA depends upon the printed circuit layout. See “Applications Information”.

Note 5. Output voltage temperature coefficient is .VOUT(worst case)+(TJ(max)- TJ(min)) where TJ(max) is +125°C and TJ(min) is -40°C.

Note 6. VDO=VIN-VOUT when VOUT decreases to 99% of its nominal output voltage with VIN=VOUT+1V. For output voltages below 2.5V, dropout voltage is the input-to-output voltage differential with the minimum input voltage being 2.5V. Minimum input operating voltage is 2.5V.

Note 7. IGND is the quiescent current. IIN=IGND+IOUT.

Note 8. VEN 0.8V, VIN 8V, and VOUT=0V.

Note 9. For 1.8V device, VIN=2.5V.

Typical Application Circuits

The GM66300/01/02 is a high performance, low dropout voltage regulator suitable for moderate to high-current voltage regulator applications. Its 500mV dropout voltage at full load makes it especially valuable in battery-powered systems and a high-efficiency noise filter in post-regulator applications.

Unlike older NPN-pass transistor designs, where the minimum dropout voltage is limited by the base-to-emitter voltage drop and collector-to-emitter saturation voltage, dropout performance of the PNP output of these devices is limited only by the low VCE saturation voltage. A trade-off for the low dropout voltage is a varying base drive requirement. Super beta PNP process reduces this drive requirement to only 2% to 5% of the load current.

The GM66300/01/02 regulator is fully protected from damage due to fault conditions. Current limiting is provided. This limiting is linear, output current during overload conditions is constant. Thermal shutdown disables the device when the die temperature exceeds the maximum safe operating temperature. Transient protection allows device (and load) survival even when the input voltage spikes above and below nominal. The output structure of these regulators allows voltages in excess of the desired output voltage to be applied without reverse current flow.

- ### Thermal design

  Linear regulators are simple to use. The most complicated design parameters to consider are thermal characteristics.

  Thermal design requires four application-specific parameters:

  · Maximum ambient temperature (T_A)

  · Output Current (I_{OUT})

  · Output Voltage (V_{OUT})

  · Input Voltage (V_{IN})

  · Ground Current (I_{GND})

  Calculate the power dissipation of the regulator from these numbers and the device parameters from this datasheet, where the ground current is taken from data sheet

  $$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_{GND}$$

  The heat sink thermal resistance is determined by:

  $$\theta_{JA} = \frac{T_{J(max)} - T_A}{P_D} - (\theta_{JC} + \theta_{CS})$$

  where $T_{J(max)} \leq 125°C$ and θ_{CS} is between 0°C and 2°C/W.

  The heat sink may by significantly reduced in applications where the minimum input voltage is known and is large compared with the dropout voltage. Use a series input resistor to drop excessive voltage and distribute the heat between this resistor and the regulator. The low dropout properties of Super βeta PNP regulators allow significant reductions in regulator power dissipation and the associated heat sink without compromising performance. When this technique is employed, a capacitor of at least 1.0μF is needed directly between the input and regulator ground. Refer to *Application Note 9* for further details and examples on thermal design and heat sink specification.

- ### Output Capacitor

  The GM66300/1/2 requires an output capacitor to maintain stability and improve transient response. Proper capacitor selection is important to ensure proper operation. The GM66300/1/2 output capacitor selection is dependent upon the ESR (equivalent series resistance) of the output capacitor to maintain stability. When the output capacitor is 47μF or greater, the output capacitor should have less than 1. of ESR. This will improve transient response as well as promote stability. Ultra-low ESR capacitors, such as ceramic chip capacitors may promote instability. These very low ESR levels may cause an oscillation and/or underdamped transient response. A low-ESR solid tantalum capacitor works extremely well and provides good transient response and stability over temperature. Aluminum electrolytics can also be used, as long as the ESR of the capacitor is ≤1Ω. The value of the output capacitor can be increased without limit. Higher capacitance values help to improve transient response and ripple rejection and reduce output noise.

- ## Input Capacitor

An input capacitor of 1μF or greater is recommended when the device is more than 4 inches away from the bulk as supply capacitance, or when the supply is a battery. Small, surfacemount, ceramic chip capacitors can be used for the bypassing. Larger values will help to improve ripple rejection by bypassing the input to the regulator, further improving the integrity of the output voltage.

- ## Transient Repsonse and 3.3V to 2.5V and 2.5V to 1.8V Conversions

The GM66300/1/2 has excellent transient response to variations in input voltage and load current. The device has been designed to respond quickly to load current variations and input voltage variations. Large output capacitors are not required to obtain this performance. A standard 47μF output capacitor, preferably tantalum, is all that is required. Larger values help to improve performance even further. By virtue of its low-dropout voltage, this device does not saturate into dropout as readily as similar NPN-based designs.

When converting from 3.3V to 2.5V or 2.5V to 1.8V, the NPN-based regulators are already operating in dropout, with typical dropout requirements of 1.2V or greater. To convert down to 2.5V without operating in dropout, NPN-based regulators require an input voltage of 3.7V at the very least. TheGM66300/1/2 regulator will provide excellent performance with an input as low as 3.0V or 2.5V. This gives the PNP-based regulators a distinct advantage over older, NPN-based linear regulators.

- ## Minimum Load Current

The MIC39300/1/2 regulator is specified between finite loads. If the output current is too small, leakage dominate

and the output voltage rises. A 10mA minimum load current is necessary for proper regulation.

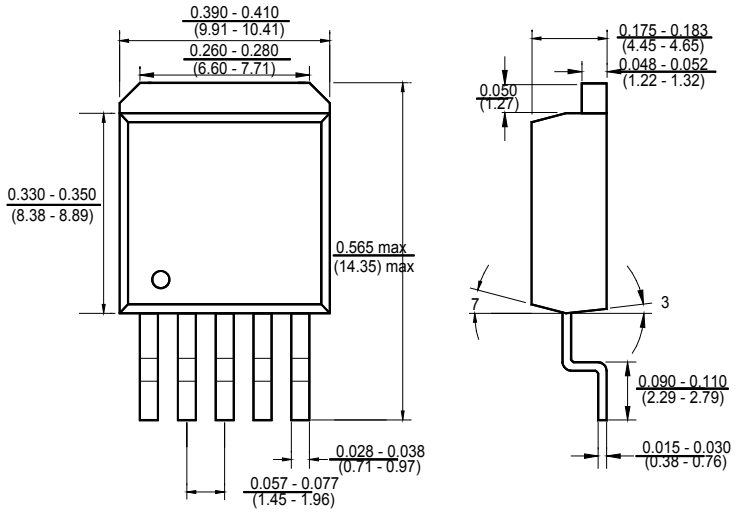
- ## Error Flag

The GM66301 version features an error flag circuit which monitors the output voltage and signals an error condition when the voltage drops 5% below the nominal output voltage. The error flag is an open-collector output that can sink 10mA during a fault condition. Low output voltage can be caused by a number of problems, including an over current fault (device in current limit) or low input voltage. The flag is inoperative during over temperature shutdown. When the error flag is not used, it is best to leave it open. The flag pin can be tied directly to pin 4, the output pin.

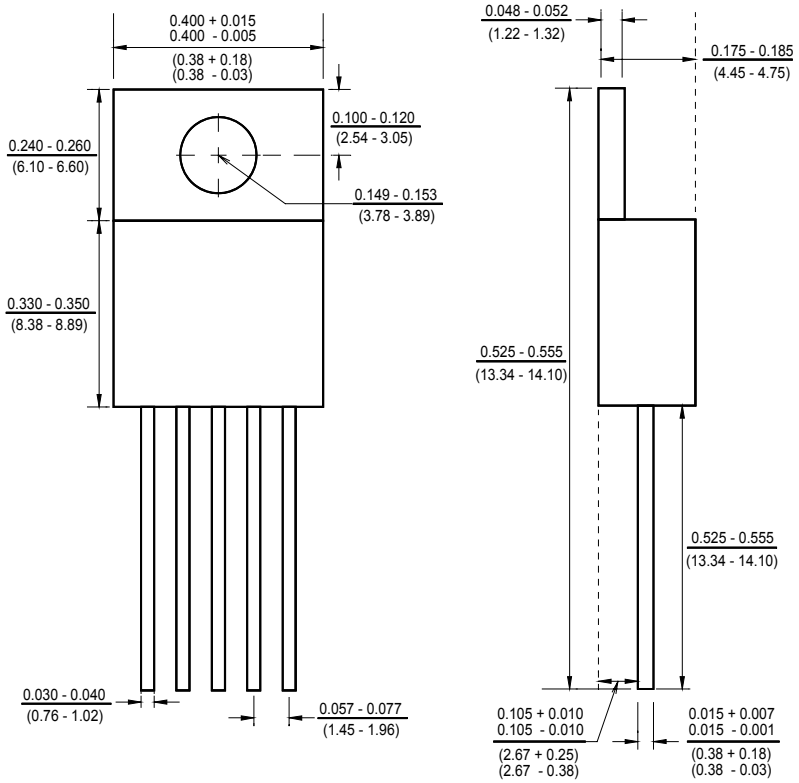
- ## Enable Input

The GM66301/2 version features an enable input for on/off control of the device. Its shutdown state draws “zero” current (only microamperes of leakage). The enable input is TTL/CMOS compatible for simple logic interface, but can be connected to up to 20V. When enabled, it draws approximately 15μA.

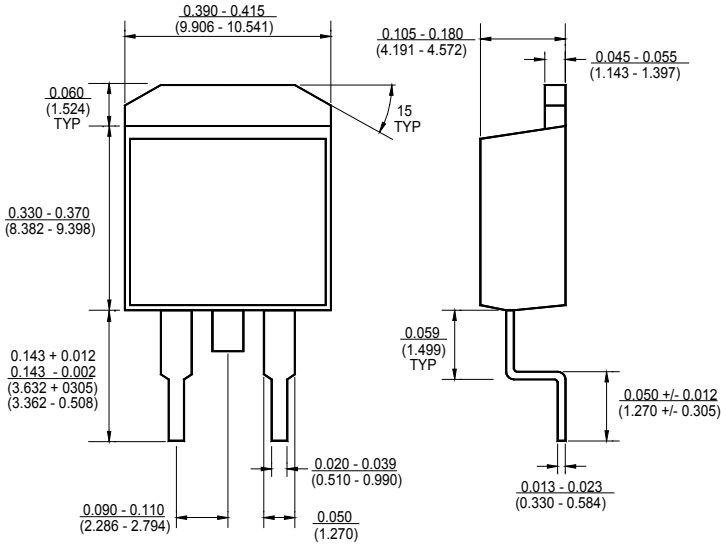
Package Outline Dimensions – TO-263-5



Package Outline Dimensions – TO-220-5



Package Outline Dimensions – TO263



Ordering Number

GM	66300	-1.5	TA3	R	G
APM Gamma Micro	Circuit Type	Output Voltage 1.8 = 1.8V 2.5 = 2.5V 3.3 = 3.3V 5.0 = 5.0V	Package Type TA3: TO263 TB3: TO220	Shipping Type R:Taping& Reel T: Tube	Blank: Pb-free G:Green

GM	66301	-1.5	TA5	R	G
APM Gamma Micro	Circuit Type	Output Voltage 1.8 = 1.8V 2.5 = 2.5V 3.3 = 3.3V 5.0 = 5.0V	Package Type TA5: TO263-5 TB5: TO220-5	Shipping Type R:Taping& Reel T:Tube	Blank: Pb-free G:Green

GM	66302	-A	TA5	R	G
APM Gamma Micro	Circuit Type	Output Voltage Adj	Package Type TA3: TO263-5 TB3: TO220-5	Shipping Type R:Taping& Reel T:Tube	Blank: Pb-free G:Green

GM66500 Series

5A ULTRA LOW DROPOUT VOLTAGE REGULATORS

Description

The GM66500 series is 5.0A low-dropout linear voltage regulators that provide a low-voltage, high-current output with a minimum of external components.

The GM66500 series offers extremely low dropout (typically 400mV at 5.0A) and low ground current (typically 70mA at 5.0A). The GM66500 series is ideal for PC add-in cards that need to convert from standard 3.0V to 2.5V and 2.5V to 1.8V, down to new, lower core voltages. A guaranteed maximum dropout voltage of 500mV over all operating conditions allows the GM66500 series to provide 2.5V from a supply as low as 3V. The GM66500 series also has fast transient response for heavy switching applications. The device requires only 47µF of output capacitance to maintain stability and achieve fast transient response.

The GM66500 series is fully protected with over current limiting, thermal shutdown, reversed-battery protection, reversed-lead insertion protection, and reversed-leakage protection.

The GM66501 series offers a TTL-logic-compatible enable pin and an error flag that indicates under-voltage and over-current conditions. Offered in fixed voltages, 1.8V and 2.5V, the GM66500 series comes in the TO-220 and TO-263 packages and is an ideal upgrade to earlier, NPN- based linear voltage regulators.

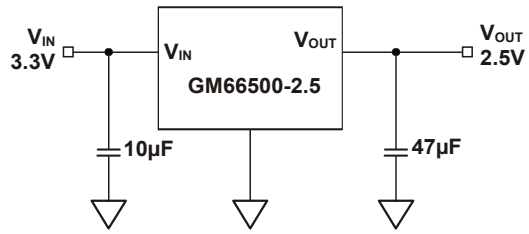
Features

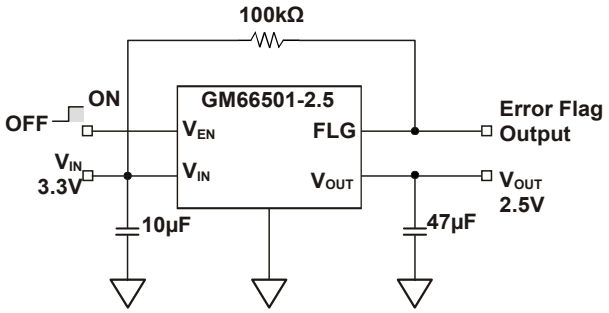
- **5A minimum guaranteed output current**
- **Ultra Low Dropout Voltage of 400mV, designed for 3.0V to 2.5V and 2.5V to 1.8V conversions**
- **1% Accurate Tolerance**
- **Fast Transient Response**
- **Reverse-battery and reverse lead insertion Protection**
- **TTL/CMOS compatible enable pin (GM66501 only)**
- **Error Flag output (GM66501 only)**

Application

- **Low Voltage Digital ICs**
- **LDO linear regulator for PC and add on cards**
- **High efficiency linear power suppliers**
- **SMPS post regulator**
- **Multimedia and PC processor suppliers**
- **Low voltage microprocessors**
- **Strong "ARM" processor supply**
- **SMPS post regulator**

Typical Application Circuits

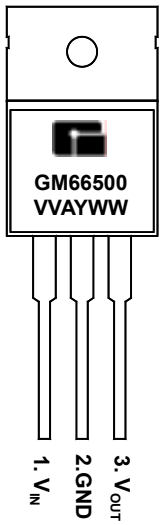




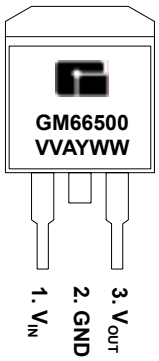
Marking Information and Pin Configurations (Top View)

GM66500 (Pb Free)

TO 220

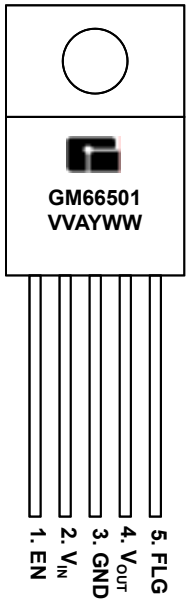


TO 263
(D^2-PAK)

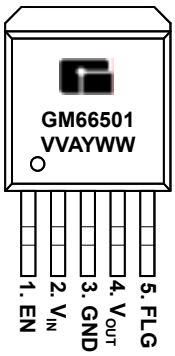


GM66501 (Pb Product)

5L-TO 220



5L-TO 263



VV: Voltage suffix (15 = 1.5V, 50 = 5.0V…A = Adj)
A: Assembly / Test site code
Y: Year
WW: Week

Ordering Information – Pb Free

Ordering Number	Output Voltage	Package	Shipping
GM66500			
GM66500-1.8TA3T	1.8V	TO-263	50 Units/Tube
GM66500-1.8TA3R	1.8V	TO-263	800 Units / Reel
GM66500-1.8TB3T	1.8V	TO-220	50 Units/Tube
GM66500-2.5TA3T	2.5V	TO-263	50 Units/Tube
GM66500-2.5TA3R	2.5V	TO-263	800 Units / Reel
GM66500-2.5TB3T	2.5V	TO-220	50 Units/Tube
GM66500-3.3TA3T	3.3V	TO-263	50 Units/Tube
GM66500-3.3TA3R	3.3V	TO-263	800 Units / Reel
GM66500-3.3TB3T	3.3V	TO-220	50 Units/Tube
GM66500-5.0TA3T	5.0V	TO-263	50 Units/Tube
GM66500-5.0TA3R	5.0V	TO-263	800 Units / Reel
GM66500-5.0TB3T	5.0V	TO-220	50 Units/Tube
GM66500-5.0ST3T	5.0V	SOT-223	80 Units/Tube
GM66500-5.0ST3R	5.0V	SOT-223	2,500 Units / Tape & Reel
GM66501			
GM66501-1.8TA5T	1.8V	TO-263-5	50 Units/Tube
GM66501-1.8TA5R	1.8V	TO-263-5	800 Units / Reel
GM66501-1.8TB5T	1.8V	TO-220-5	50 Units/Tube
GM66501-2.5TA5T	2.5V	TO-263-5	50 Units/Tube
GM66501-2.5TA5R	2.5V	TO-263-5	800 Units / Reel
GM66501-2.5TB5T	2.5V	TO-220-5	50 Units/Tube

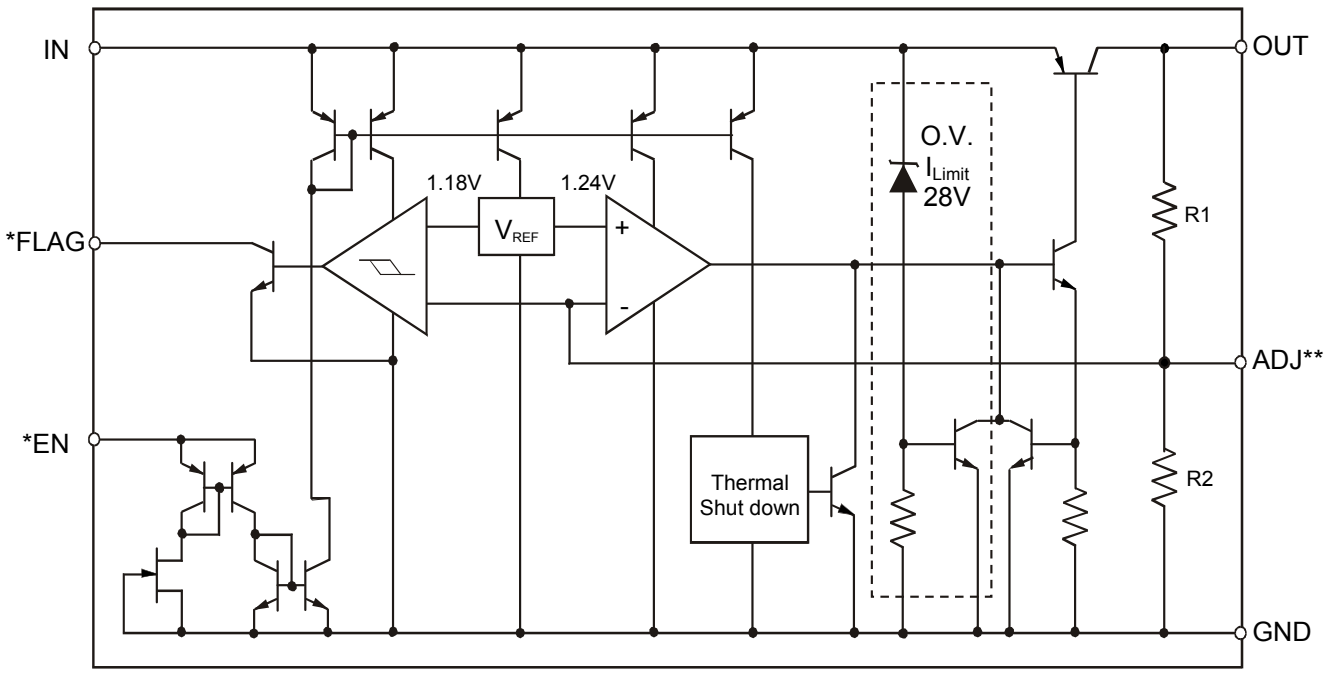
Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Power Dissipation	P_D	Internally Limited	W
Input Power Supply Voltage	V_{IN}	-20 to +20	V
Storage Temperature Range	T_{STG}	- 65 to 150	℃
Lead Temperature (Soldering, 5 sec)		+ 260	℃
ESD (Note 3)			

Operating Ratings (Note 2)

Parameter	Symbol	Value	Unit
Maximum Operating Input Voltage	V_{IN}	+2.25 to +16	V
Enable Voltage	VEN	+16	V
Operating Junction Temperature	T_J	-40 to +125	°C
Thermal Resistance (TO263, TO220)	θ_{JC}	2.0	°C/W

Block Diagram



* GM66501 only

Electrical Characteristics:

(Unless otherwise specified: T_J = 25°C, Bold values are guaranteed across the full operating temperature range.)

Parameter	Condition		Symbol	Min	Typ	Max	Unit
Output Voltage	I_O = 10mA		V_{OUT}	-1		1	%
	10mA ≤ I_O ≤ 5A, V_{OUT} + 1V ≤ V_{IN} ≤ 16V			**-2**		**2**	
Line Regulation	I_O = 10mA, V_{OUT} + 1V ≤ V_{IN} ≤ 16V		ΔV_{OI}		0.06	0.5	%
Load Regulation	V_{IN} = V_{OUT} + 1V, 10mA ≤ I_O ≤ 5A		ΔV_{OL}		0.2	1.0	%
Output Voltage Change with Temperature Coefficient (Note 5)	(Note 5)		$\Delta V_{OUT}/\Delta T$		20	100	ppm/℃
Dropout Voltage (Note 6)	ΔV_{OUT} = -2%	I_O = 250mA	V_{DO}		125	**250**	mV
		I_O = 2.5A			320		
		I_O = 5.0A			400	**575**	
Ground Current (Note 7)	I_O = 2.5AmA, V_{IN} = V_{OUT} +0.8V		I_{GND}		15		mA
	I_O = 5.0AA, V_{IN} = V_{OUT} +0.8V				70		
Ground Pin Current at Dropout	V_{IN} = 0.5V less than specified V_{OUT}, I_O = 10mA		I_{GNDDO}		2.1		mA
Current Limit	V_{OUT} = 0V, V_{IN} = V_{OUT} +1.0V (Note 4)		I_{CL}		7.5		A
Output Noise Voltage	C_{OUT} = 47μF , 10Hz to 100kHz, I_L = 100mA		e_n		260		μV_{RMS}
Enable Input (GM66501)							
Enable Input Voltage	Logic Low (OFF)					**0.8**	V
	Logic High (ON)			**2.25**			
Enable Input Current	V_{EN} = V_{IN}		I_{ENH}		30	35	μA
						75	
	V_{EN} = 0.8V		I_{ENL}			**2**	
						4	
Shutdown Output Current	(Note 8)				10		μA
Flag Output (GM66501)							
Output Leakage Current	V_{OH} =16V				0.01	1	μA
						2	
Output Low Voltage	V_{IN} = 2.25V, I_{OL} = 250μA				220	300	mV
						400	
Low Threshold	1% of V_{OUT}		93				%
High Threshold	1% of V_{OUT}					99.2	%
Hysteresis					1		%

Note 1: Exceeding the absolute maximum ratings may damage the device.

Note 2: The device is not guaranteed to function outside its operating rating..

Note 3: Device are ESD sensitive. Handling precautions recommended.

Note 4: $P_{D(MAX)} = (T_{J(MAX)} – T_A) + \theta_{JA}$, where θ_{JA} depends upon the printed circuit layout.

Note 5: Output voltage temperature coefficient is $V_{OUT(worst\ case)}$, + $(T_{J(MAX)} – T_{J(MIN)})$ where $T_{J(MAX)}$ is +125°C and $T_{J(MIN)}$ is -40°C.

Note 6: $V_{DO} = V_{IN} – V_{OUT}$ when V_{OUT} decreases to 98% of its nominal output voltage with $V_{IN} = V_{OUT} + 1V$. For voltages below 2.25V, dropout voltage is the input-to-output voltage differential with the minimum input voltage being 2.25V. Minimum input operating voltage is 2.25V

Note 7: I_{GND} is the quiescent current. $I_{IN} = I_{GND} + I_{OUT}$

Note 8: $V_{EN} \leq 0.8V$ and $V_{IN} \leq 8V$, $V_{OUT}=0$

Note 9: Design with proper heat sink to dissipate heat to keep chip from thermal protection when $V_{IN} – V_{OUT} > 0.6V$

Application Information

The GM66150 series is a high performance low-dropout voltage regulator suitable for all moderate to high current/voltage regulator applications. The 400mV dropout voltage at full load makes it especially valuable in battery powered systems and as high efficiency noise filters in “post-regulator” applications.

Unlike older NPN pass transistor designs, where the minimum dropout voltage is limited by the base to emitter voltage drop and collector to emitter saturation voltage, dropout performance of the PNP output of these devices is limited only by the low V_{CE} saturation voltage.

The GM66500 series regulator is fully protected from damage due to fault conditions. Current limiting is provided. This limiting is linear, output current during overload conditions is constant. Thermal shutdown disables the device when the die temperature exceeds the maximum safe operating temperature. Transient protection allows device and (load) survival even when the input voltage spikes above and below nominal. The output structure of these regulators allows voltages in excess of the desired output voltage to be applied without reverse current flow.

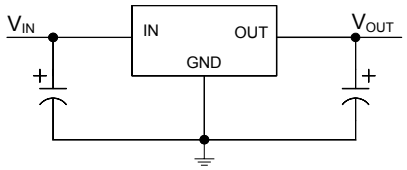


Figure 1.Linear regulators require only two capacitors for operation.

Thermal Design

Linear regulators are simple to use. The most complicated design parameters to consider are thermal characteristics. Thermal design requires the following application-specific parameters:

- Maximum ambient temperature, T_A
- Output Current, I_{OUT}
- Output Voltage, V_{OUT}
- Input Voltage, V_{IN}

First, we calculate the power dissipation of the regulator from these numbers and the device parameters from this datasheet.

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_{GND},$$

Then the heat sink thermal resistance is determined with this formula:

$$\theta_{SA} = \frac{T_{JMAX} - T_A}{P_D} - (\theta_{JC}+\theta_{CS}),$$ where $T_{J(MAX)} \leq 125°C$ and θ_{CS} is between 0 and 20°C/W

The heat sink may be significantly reduced in applications where the minimum input voltage is known and is large compared with the dropout voltage. Use a series input resistor to drop excessive voltage, and distribute the heat between this resistor and the regulator. The low dropout properties of Super Beta PNP regulators allow significant reductions in regulator power dissipation and the associated heat sink without compromising performance. When this technique is employed, a capacitor of at least 1.0μF is needed directly between the input and regulator ground.

Application Information (continued)

Input Capacitor

The GM66500 series requires an output capacitor to maintain stability and improve transient response. Proper capacitor selection is important to ensure proper operation. The GM66500 series output capacitor selection is dependent upon the ESR (equivalent series resistance) of the output capacitor to maintain stability. When the output capacitor is 47μF or greater, the output capacitor should have less than 1 of ESR. This will improve transient response as well as promote stability. Ultra low ESR capacitors, such as ceramic chip capacitors may promote instability. These very low ESR levels may cause an oscillation and or under damped transient response. When larger capacitors are used, the ESR requirement approaches zero. A 100μF ceramic capacitor can be used on the output while maintaining stability. A low ESR 47μF solid tantalum capacitor works extremely well and provides good transient response and stability over temperature.

Aluminum electrolytics can also be used, as long as the ESR of the capacitor is ≤1Ω. The value of the output capacitor can be increased without limit. Higher capacitance values help to improve transient response, ripple rejection, and reduce output noise.

Input Capacitor

An input capacitor of 1μF or greater is recommended when the device is more than 4 inches away from the bulk as supply capacitance, or when the supply is a battery. Small surface mount ceramic chip capacitors can be used for the bypassing. Larger values will help to improve ripple rejection by bypassing the input to the regulator, further improving the integrity of the output voltage.

Transient Response and 3.3V to 2.5V and 2.5V to 1.8V conversions

The GM66500 series has excellent transient response to variations in input voltage and load current. The device has been designed to respond quickly to load current variations and input voltage variations. Large output capacitors are not required to obtain this performance. A standard 47μF output capacitor, preferably tantalum, is all that is required. Larger values improve performance even further.

By virtue of its low dropout voltage, this device does not saturate into dropout as readily as similar NPN based designs. When converting from 3.3V to 2.5V or 2.5V to 1.8V, the NPN based regulators are already operating in dropout, with typical dropout requirements of 1.2V or greater. To convert down to 2.5V without operating in dropout, NPN based regulators require an input voltage of 3.7V at the very least.

The GM66500 series regulator will provides excellent performance with an input as low as 3.0V or 2.5V respectively. This gives the PNP based regulators a distinct advantage over older, NPN based linear regulators. A typical NPN regulator does not have the headroom to do this conversion.

Minimum Load Current

The GM66500 series regulator is specified between finite loads. If the output current is too small, leakage currents dominate and the output voltage rises. A 10mA minimum load current is necessary for proper regulation.

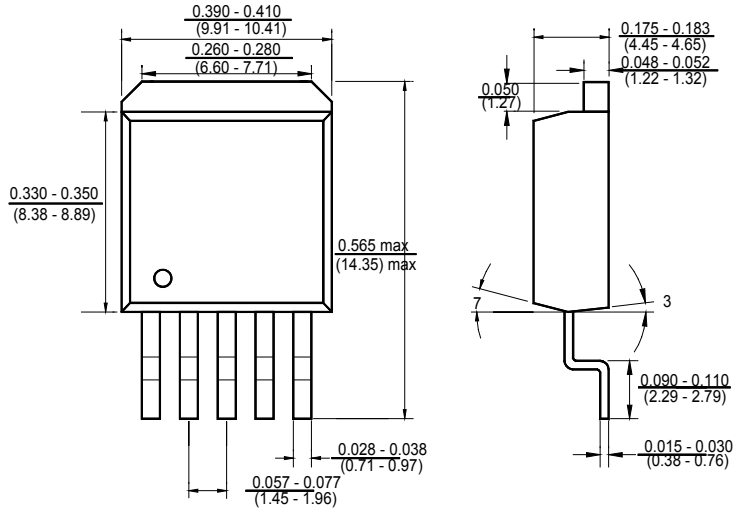
Error Flag

GM66501 versions feature an Error Flag, which looks at the output voltage and signals an error condition when this voltage drops 5% below its nominal output voltage. The error flag is an open collector output that can sink 10mA during a fault condition. Low output voltage can be caused by a number of problems, including an over current fault (device in current limit) or low input voltage. The flag is inoperative during over temperature shutdown. When the error flag is not used, it is best to leave it open. The flag pin can be tied directly to pin 4, the output pin.

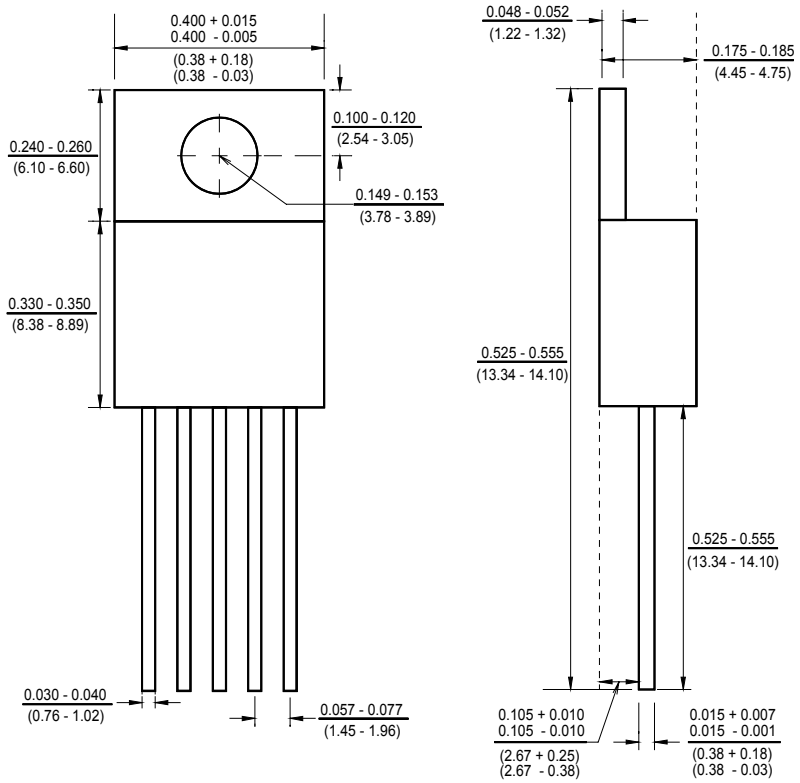
Enable Input

The GM66501 series version features an enable input for ON/OFF control of the device. It's shutdown state draws "zero" current. The enable input is TTL/CMOS compatible for simple logic interface, but can be connected to up to 20V. When enabled, it draws approximately 15μA.

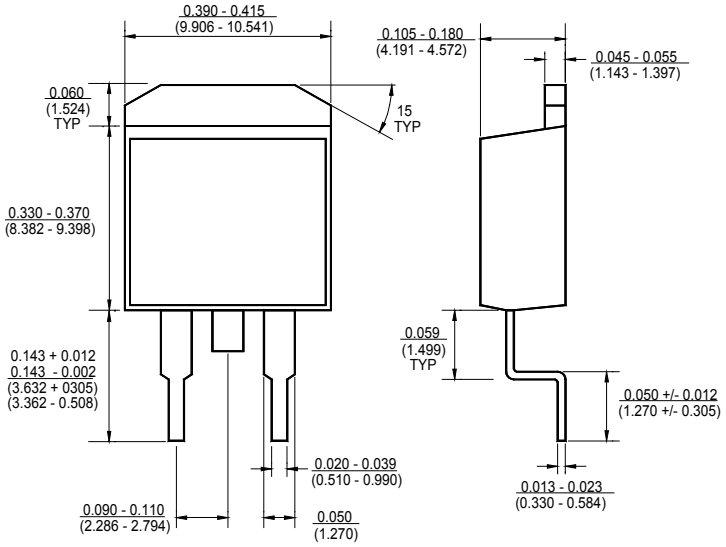
Package Outline Dimensions – TO-263-5



Package Outline Dimensions – TO-220-5



Package Outline Dimensions – TO263



Ordering Number

GM	66500	-1.5	TA3	R	
APM Gamma Micro	Circuit Type	Output Voltage 1.5 = 1.5V 1.8 = 1.8V 2.5 = 2.5V 3.0 = 3.0V 3.3 = 3.3V 5.0 = 5.0V 12 = 12.0V	Package Type TA3: TO263 TB3: TO220 TA5: 5L-TO263 TB5: 5L-TO220	Shipping Type R:Taping& Reel T: Tube	

GM	66151	-1.5	TA5	R	G
APM Gamma Micro	Circuit Type	Output Voltage 1.5 = 1.5V 1.8 = 1.8V 2.5 = 2.5V 3.0 = 3.0V 3.3 = 3.3V 5.0 = 5.0V 12 = 12.0V	Package Type TA5: TO263-5 TB5: TO220-5	Shipping Type R:Taping& Reel T:Tube	Blank: Pb-free G:Green

GM	66152	-A	TA5	R	G
APM Gamma Micro	Circuit Type	Output Voltage Adj	Package Type TA3: TO263-5 TB3: TO220-5	Shipping Type R: Taping & Reel T: Tube	Blank: Pb-free G:Green

GM	66153	-A	TA5	R	G
APM Gamma Micro	Circuit Type	Output Voltage Adj	Package Type TA3: TO263-5 TB3: TO220-5	Shipping Type R: Taping & Reel T: Tube	Blank: Pb-free G:Green