1A Low Dropout Linear Regulator

Description

The FP6136 series are low dropout, positive linear regulators with very low quiescent current. The FP6136 can supply 1A output current with low dropout voltage at about 1.1V.

The FP6136 regulator is able to operate with output capacitors as small as 1µF for stability. The FP6136 also offers on chip thermal shutdown feature to provide protection against overload or any condition when the ambient temperature exceeds the junction temperature.

The FP6136 series are available in a space-saving SOT-223 and TDFN-8 (3mmx3mm) packages.

Features

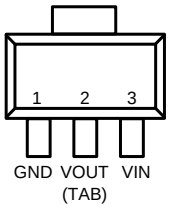
- Low Dropout Voltage of 1.1V at 1A
- Guaranteed 1A Output Current
- Very Low Quiescent Current at about 35µA
- Max. ±2% Output Accuracy
- Needs Only 1µF Capacitor for Stability
- Thermal Shutdown Protection
- Current Limit Protection
- Low-ESR Ceramic Capacitor for Output Stability
- RoHS Compliant

Applications

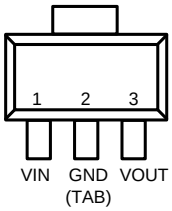
- DVD/CD-ROM, CD/RW
- Wireless Device
- LCD Module
- Battery Power System
- Card Reader
- XDSL Router

Pin Assignments

GR3 Package (SOT-223)



IR3 Package (SOT-223)



WD Package TDFN-8 (3mmx3mm)

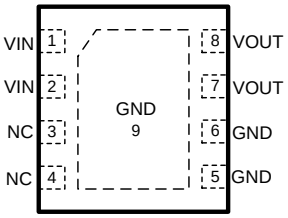


Figure 1. Pin Assignment of FP6136

Ordering Information

FP6136 □□□□

- TR: Tape/Reel
- P: Green
  G: Green
- Package Type
  GR3: SOT-223
  IR3: SOT-223
  WD: TDFN-8 (3mm×3mm)
- Output Voltage
  15: 1.5V
  18: 1.8V
  25: 2.5V
  30: 3.0V
  33: 3.3V

Note1: Please consult Fitipower sales office or authorized distributor for availability of special output voltages.

Typical Application Circuit

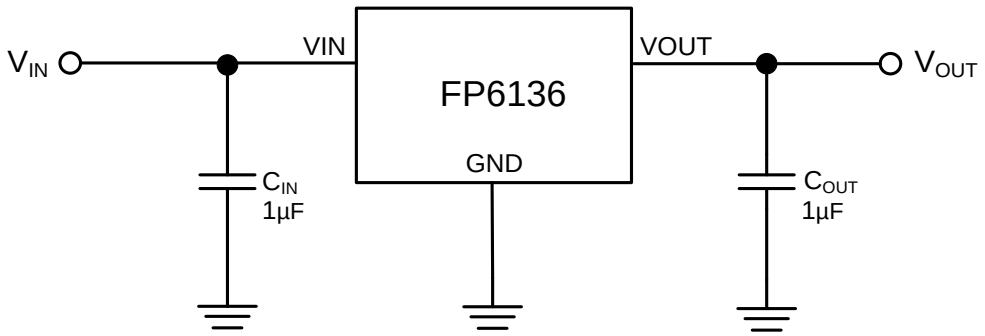


Figure 2. Typical Application Circuit of FP6136

Note 2：To prevent oscillation, it is recommended to use minimum 1µF X7R or X5R dielectric capacitors if ceramics are used as input/output capacitors.

Functional Pin Description

Pin Name	Pin Function
VIN	Power is supplied to this device from this pin which requires an input filter capacitor. In general, the input capacitor in the range of 1µF to 10µF is sufficient.
VOUT	The output supplies power to loads. The output capacitor is required to prevent output voltage unstable. The FP6136 is stable with an output capacitor which is 1µF or greater. The larger output capacitor will be required for application with large transit load to limit peak voltage transits. Besides, it could reduce output noise, improve stability and PSRR.
GND	Common ground pin

Block Diagram

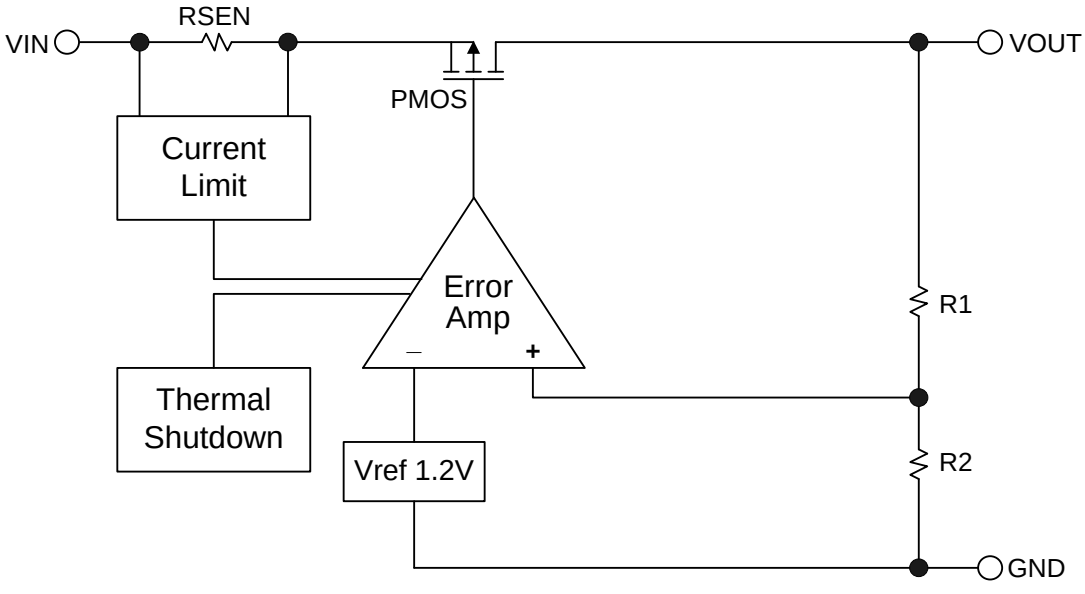


Figure 3. Block Diagram of FP6136

Absolute Maximum Ratings

- Supply Input Voltage (V_{IN}) ---------- +6V
- Power Dissipation @TA=25°C, (P_D)
  - SOT-223 ---------- +0.74W
  - TDFN-8 (3mmx3mm) ---------- +1.54W
- Package Thermal Resistance, (θ_{JA})
  - SOT-223 ---------- +135°C/W
  - TDFN-8 (3mmx3mm) ---------- +65°C/W
- Maximum Junction Temperature (TJ) ---------- +150°C
- Storage Temperature Range (T_S) ---------- -65°C to +150°C
- Lead Temperature (Soldering, 10sec.) (T_{LEAD}) ---------- +260°C

Note：Stresses beyond those listed under “Absolute Maximum Ratings" may cause permanent damage to the device.

Recommended Operating Conditions

- Input Voltage (V_{IN}) ---------- +2.8V to +5.5V
- Operating Temperature Range (T_{OPR}) ---------- -40°C to +85°C

Electrical Characteristics

(V_{IN}=V_{OUT}+1.2V or V_{IN}=3.5V whichever is greater, C_{IN}=1μF, C_{OUT}=1μF, T_A=25ºC, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage Accuracy	ΔV_{OUT}	I_O= 1mA		-2		+2	%
Current Limit	I_{LIMIT}	R_{Load}=1Ω		1			A
Quiescent Current	I_Q	I_O= 0mA			35	70	μA
Dropout Voltage (Note4)	V_{DROP}	I_O=1A	1.2V ≤ V_{OUT} ≤ 2.0V		1.6	2.1	V
			2.0V < V_{OUT} ≤ 2.8V		1.3	1.7	
			2.8V < V_{OUT} ≤ 4.5V		1.1	1.4	
Line Regulation	ΔV_{LINE}	I_O=1mA, V_{IN}=V_{OUT} +1V to 5V			1	5	mV
Load Regulation (Note5)	ΔV_{LOAD}	I_O=0mA to 1A			50	90	mV
Ripple Rejection	PSRR	V_{IN}=V_{OUT}+1V f_{RIPPLE} = 120Hz, C_{OUT} = 1μF			60		dB
Temperature Coefficient (Note6)	T.C.	I_{OUT} = 1mA, V_{IN} = 5V			100		ppm/ºC
Thermal Shutdown Temperature (Note6)	T_{SD}				160		ºC
	ΔT_{SD}	Hysteresis			15		ºC

Note 4：The dropout voltage is defined as V_{IN}-V_{OUT}, which is measured when V_{OUT} drops 2% of its normal value with the specified output current.

Note 5：Load regulation and dropout voltage are measured at a constant junction temperature by using a 40ms low duty cycle current pulse.

Note 6：Guarantee by design.

Typical Performance Curves

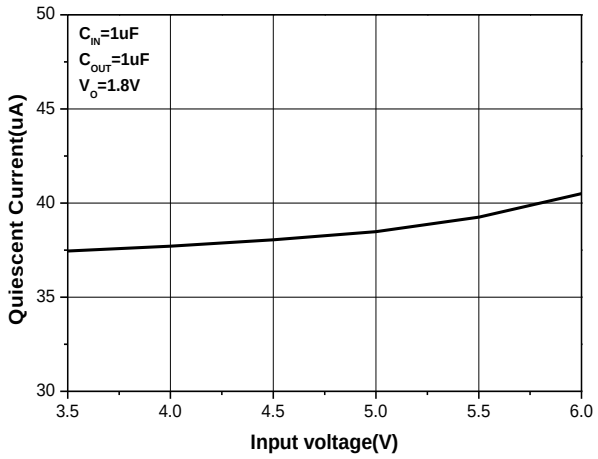


Figure 4. Quiescent Current vs. Input Voltage

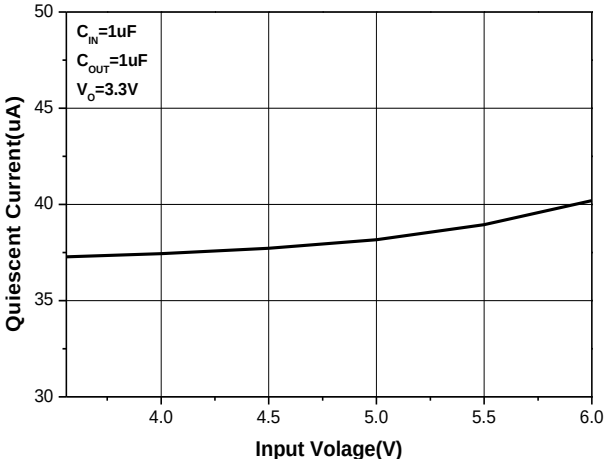


Figure 5. Quiescent Current vs. Input Voltage

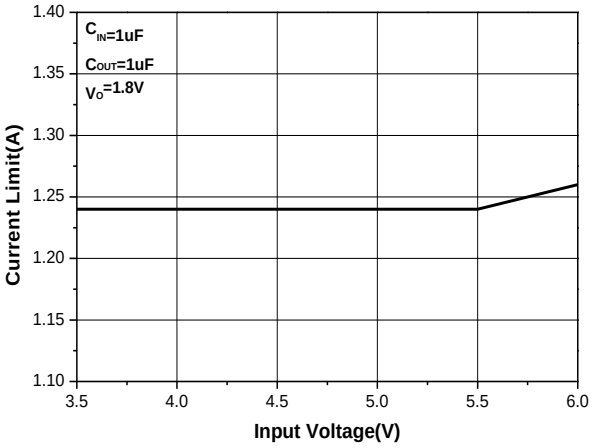


Figure 6. Current limit vs. Input Voltage

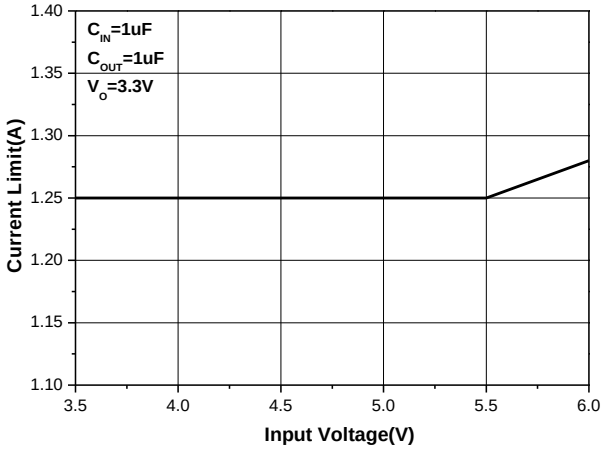


Figure 7. Current Limit vs. Input Voltage

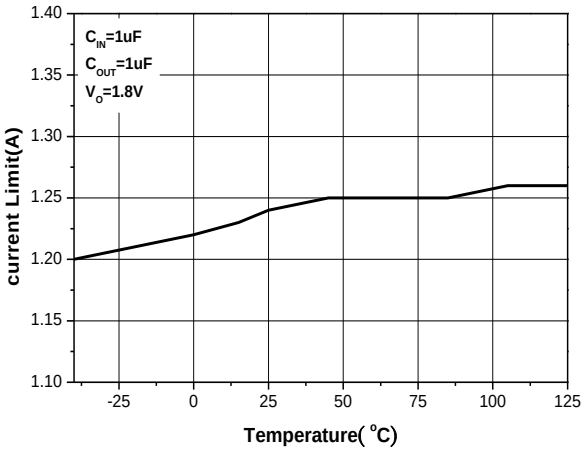


Figure 8. Current limit vs. Temperature

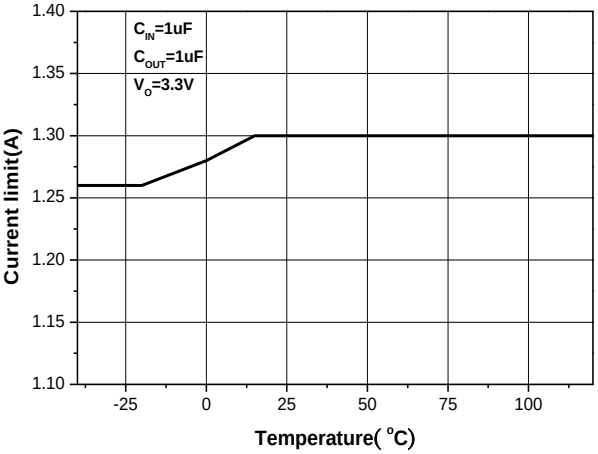


Figure 9. Current limit vs. Temperature

Typical Performance Curves (Continued)

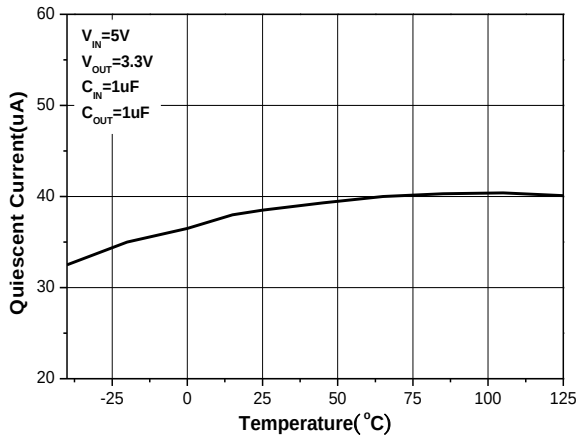


Figure 10. Quiescent Current vs. Temperature

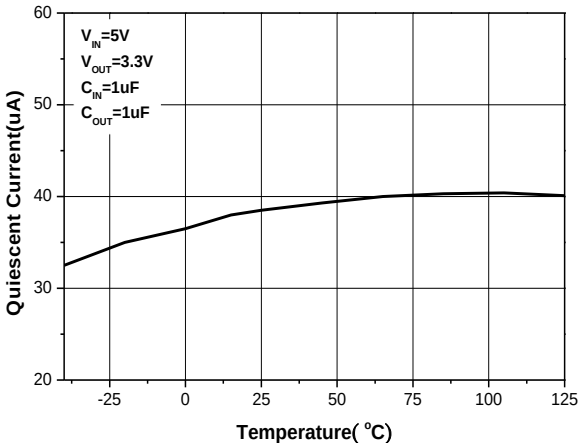


Figure 11. Quiescent Current vs. Temperature

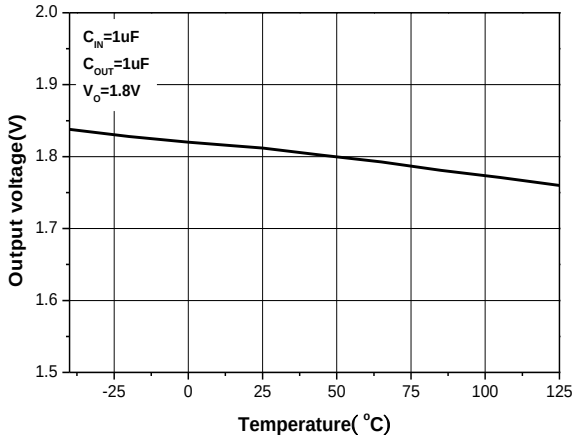


Figure 12. Temperature Stability

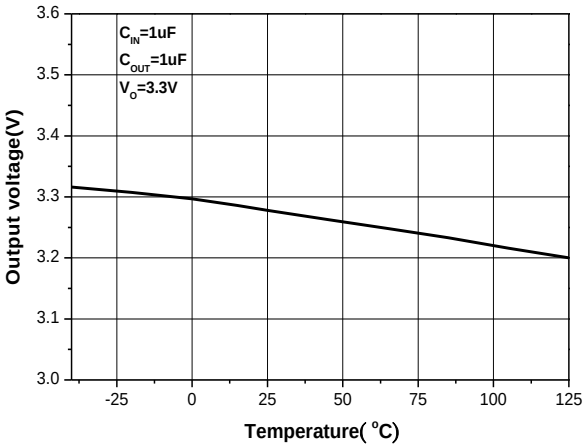


Figure 13. Temperature Stability

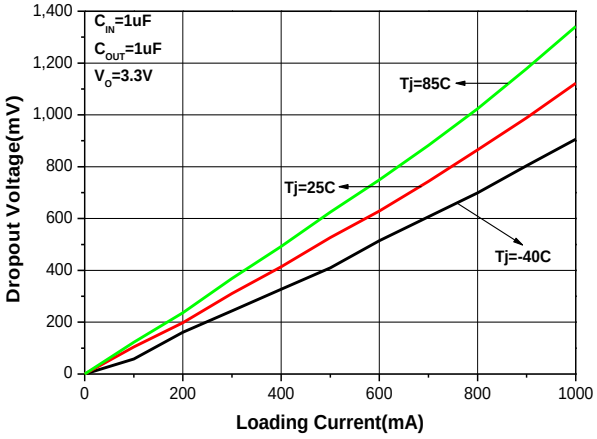


Figure 14. Dropout Voltage vs. Loading Current

Typical Performance Curves (Continued)

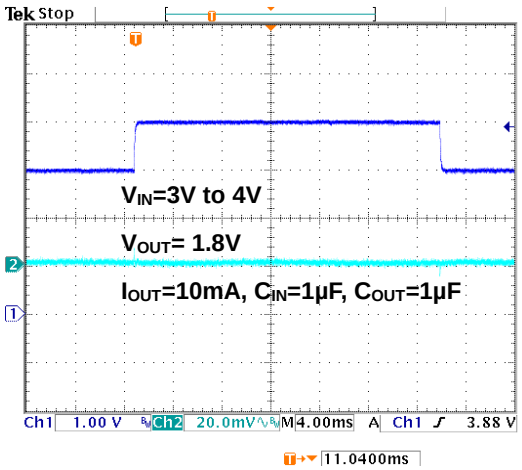


Figure 15. Line Transition Response

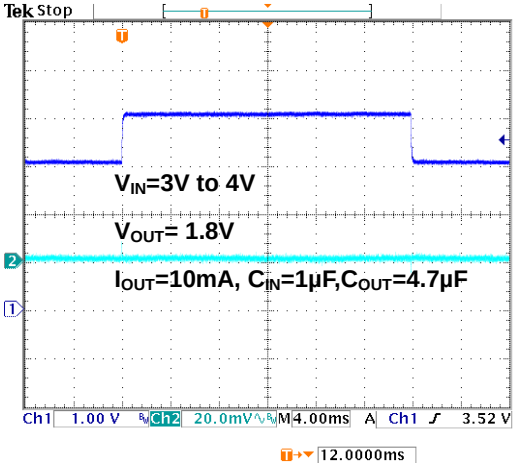


Figure 16. Line Transition Response

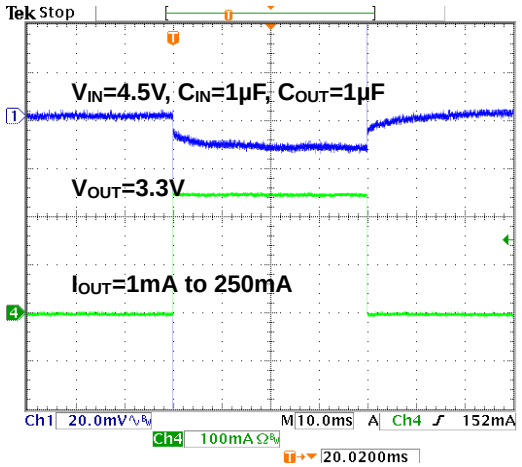


Figure 17. Load Transition Response

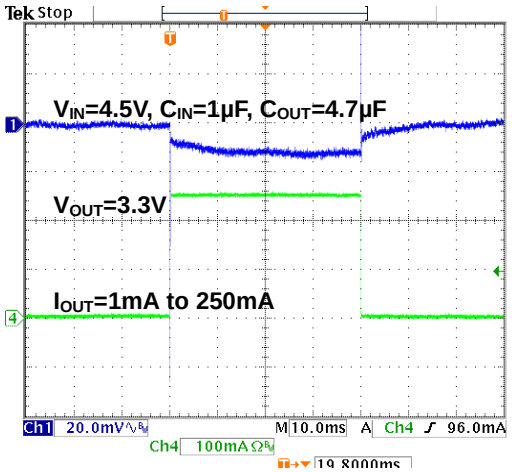


Figure 18. Load Transition Response

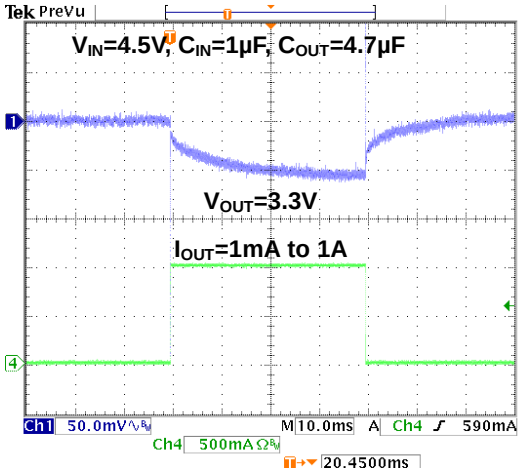


Figure 19. Load Transition Response

Application Information

The FP6136 series are low dropout linear regulators that could provide 1A output current at dropout voltage about 1.1V. Besides, current limit and on chip thermal shutdown features provide protection against overload or any condition when the ambient temperature exceeds the junction temperature.

Output and Input Capacitor

The FP6136 regulator is designed to be stable with a wide range of output capacitors. The ESR of the output capacitor affects stability. Larger value of the output capacitor decreases the peak deviations and improves transition response for larger current changes.

The capacitor types (aluminum, ceramic, and tantalum) have different characterizations such as temperature and voltage coefficients. All ceramic capacitors are manufactured with a variety of dielectrics, each with different behavior across temperature and applications. Common dielectrics used are X5R, X7R and Y5V. It is recommended to use 1μF to 10μF X5R or X7R dielectric ceramic capacitors with 30mΩ to 50mΩ ESR range between device outputs to ground for transient stability. The FP6136 is designed to be stable with low ESR ceramic capacitors and higher values of capacitors, and ESR could improve output stability. So the ESR of output capacitor is very important because it generates a zero to provide phase lead for loop stability.

There are no requirements for the ESR on the input capacitor, but its voltage and temperature coefficient have to be considered for device application environment.

Protection Features

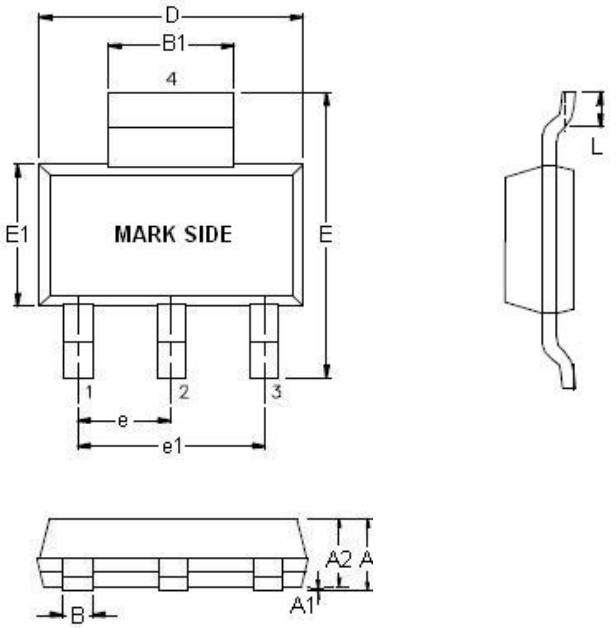
In order to prevent overloading or thermal condition from damaging device, FP6136 regulator has internal thermal and current limit functions designed to protect the device. It will rapidly shut off PMOS pass element during over temperature condition.

Thermal Consideration

The power handling capability of the device will be limited by allowable operation junction temperature (125°C). The power dissipated by the device will be estimated by $P_D = I_{OUT} \times (V_{IN}-V_{OUT})$. The power dissipation should be lower than the maximum power dissipation listed in “Absolute Maximum Ratings” section.

Outline Information

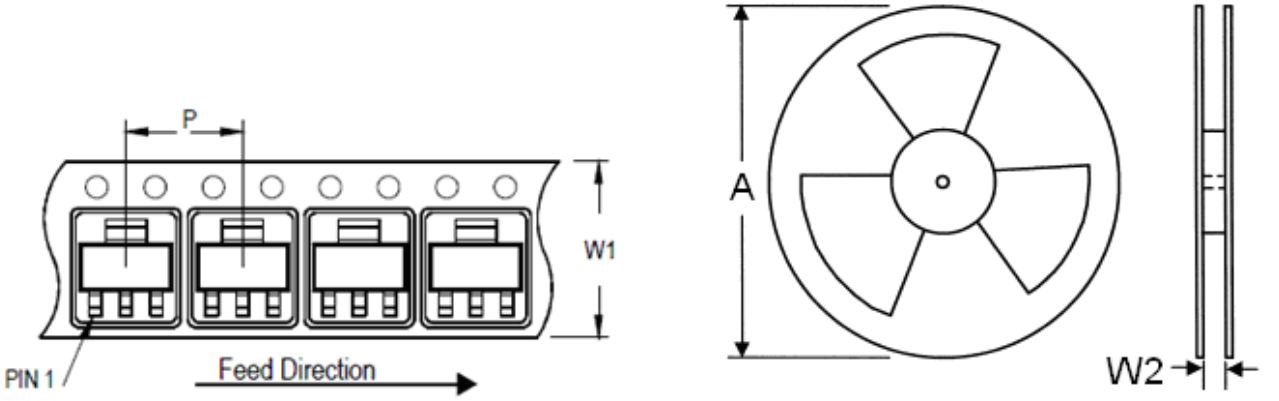
SOT-223 Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	1.55	1.80
A1	0.05	0.10
A2	1.50	1.70
B	0.60	0.84
B1	2.85	3.10
D	6.30	6.70
E1	3.30	3.70
E	6.70	7.30
e	2.20	2.40
e1	4.50	4.70
L	0.75	0.85

Note: Followed From JEDEC TO-261-C.

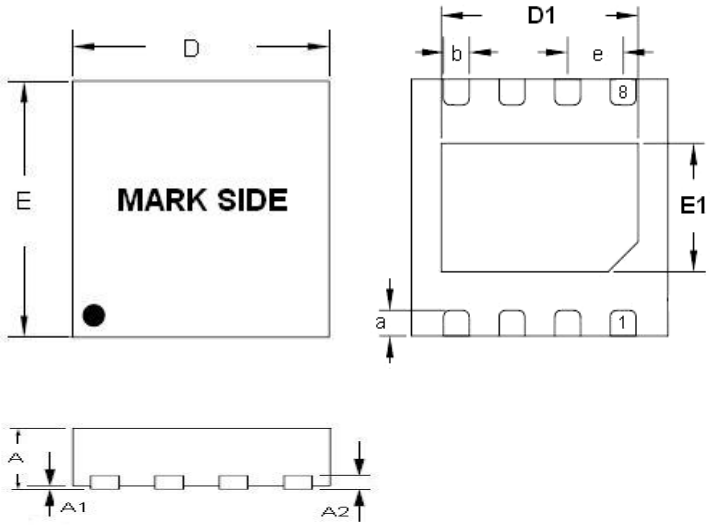
Carrier Dimensions



Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
12	8	13	330	12.4	300~1000	3,000

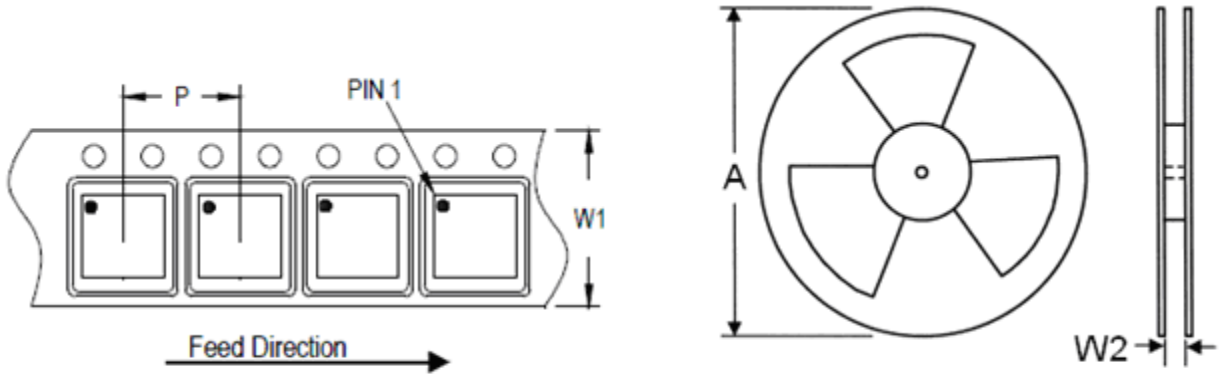
Outline Information (Continued)

TDFN-8 3mm x 3mm (Pitch:0.65mm) Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	0.70	0.80
A1	0.00	0.05
A2	0.18	0.25
D	2.90	3.10
E	2.90	3.10
a	0.30	0.50
b	0.25	0.35
e	0.60	0.70
D1	1.60	2.50
E1	1.35	1.75

Carrier Dimensions



Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
12	8	13	330	12.4	400~1000	3,000