300mA, High PSRR, Dual Output Low-Dropout Regulator with Fast Output Discharge Function

Description

FP6128 is a dual output, low dropout, high PSRR, low quiescent current linear regulators with fast output discharge function. FP6128 can supply 200mA output current with a lower dropout voltage about 300mV for each channel.

FP6128 is suitable for portable and wireless application such as mobile phone and portable hand-sets. FP6128 is designed and optimized to work with low-value, low cost ceramic capacitors. FP6128 consumes less than 0.1μA during shutdown mode which is independent for each channel, allowing for flexibility in power management. Besides its current limit protection and on chip thermal shutdown features provide protection against any combination of overload or ambient temperature that could exceed junction temperature.

FP6128 can discharge the output voltage very fast when the device is disabled.

FP6128 doesn't need external bypass capacitor and still could get better noise performance. Tiny SOT-23-6 and TDFN-6 packages are attractive for hand-held applications.

Features

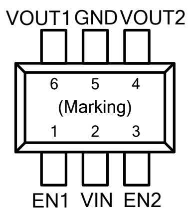
- Low Dropout Voltage: 300mV at I_{OUT}=200mA
- Guaranteed 300mA Output Current Per Channel
- Very Low Quiescent Current: 25μA
- High Power Supply Rejection Ratio: 70dB at 10kHz
- Highly Accurate: ±2%
- Needs Only 1μF Ceramic Capacitor for Stability
- Thermal Shutdown and Current Limiting Protection
- Output Discharge Function
- Tiny SOT-23-6 and TDFN-6 Packages
- RoHS Compliant

Applications

- Mobile Phone
- Portable or Wireless Instrument
- Camera
- PDA and Notebook Computer

Pin Assignment

S6 Package (SOT-23-6)



WD Package (TDFN-6) (1.6mm×1.6mm)

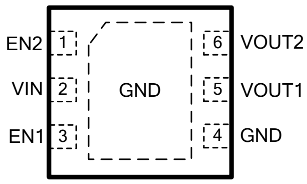
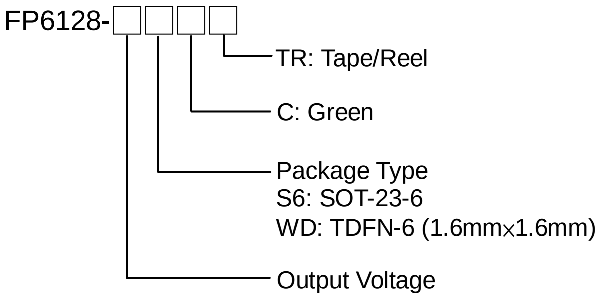


Figure 1. Pin Assignment of FP6128

Ordering Information



	VOUT1	VOUT2
F	1.8V	2.8V

SOT-23-6 Marking

Part Number	Product Code
FP6128-FS6C	**FC6**

TDFN-6 (1.6mm×1.6mm) Marking

Part Number	Product Code
FP6128-FWDC	**A**

Typical Application Circuit

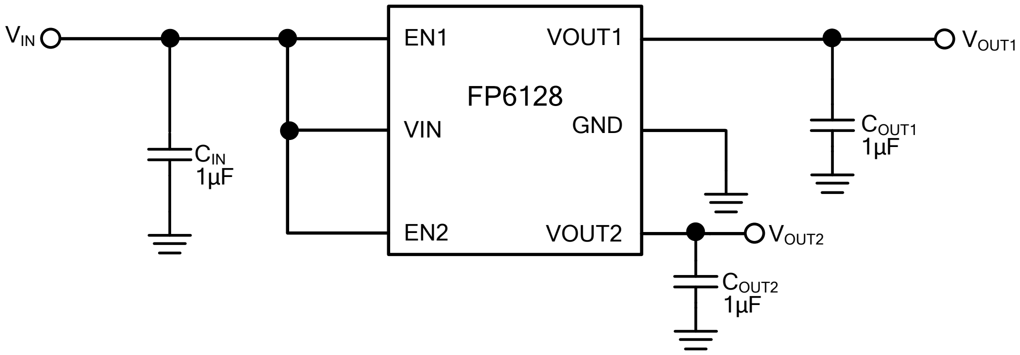


Figure 2. Typical Application Circuit of FP6128

Note：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 No. (SOT-23-6)	Pin No. (TDFN-6)	Pin Function
EN2	**3**	**1**	Logic input control VOUT2 active or shut off. The enable pin can't be left floating and must be tied to the Vin pin if not used. The shutdown mode which is independent for each channel, allowing for flexibility in power management.
VIN	**2**	**2**	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.
EN1	**1**	**3**	Logic input control VOUT1 active or shut off. The enable pin can't be left floating and must be tied to the Vin pin if not used. The shutdown mode which is independent for each channel, allowing for flexibility in power management.
GND	**5**	**4**	Common ground pin
VOUT1	**6**	**5**	The output supplies power to loads. The output capacitor is required to prevent output voltage unstable. The FP6128 is stable with an output capacitor 1μF or greater. The larger output capacitor will be required for application with large transit load to limit peak voltage transits, besides could reduce output noise, improve stability and PSRR.
VOUT2	**4**	**6**	The output supplies power to loads. The output capacitor is required to prevent output voltage unstable. The FP6128 is stable with an output capacitor 1μF or greater. The larger output capacitor will be required for application with large transit load to limit peak voltage transits, besides could reduce output noise, improve stability and PSRR.

Absolute Maximum Ratings

- Supply Input Voltage (VIN) --- +6V
- Other Pin Voltage (EN1, EN2, VOUT1, VOUT2) -- +6V
- Maximum Junction Temperature (T_J) -- +150ºC
- Power Dissipation @25ºC, (P_D)
  - SOT-23-6 --- +0.4W
  - TDFN-6 (1.6mm×1.6mm) --- +0.63W
- Package Thermal Resistance, (θ_{JA})
  - SOT-23-6 --- +250ºC/W
  - TDFN-6 (1.6mm×1.6mm) --- +160ºC/W
- Storage Temperature Range (T_S) -- -65ºC to +150ºC
- Lead Temperature (Soldering, 10 sec.) (T_{LEAD}) --- +260ºC

Note1：Stresses beyond those listed under “Absolute Maximum Ratings" may cause permanent damage to the device.

Recommended Operating Conditions

- Input Voltage (V_{IN}) -- +2.0V to +5.5V
- Operating Temperature Range (T_{OPR}) -- -40ºC to +85ºC

Block Diagram

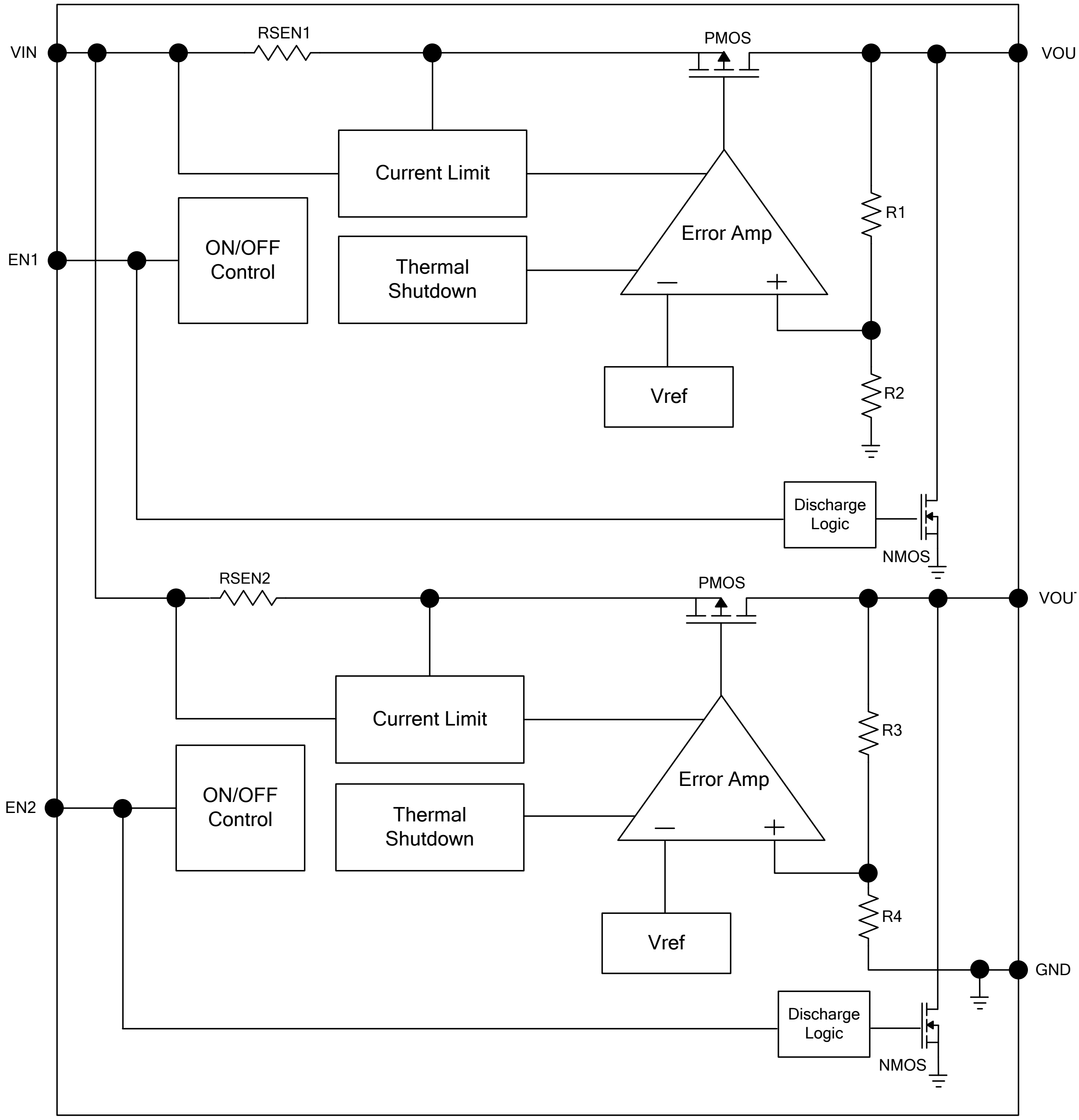


Figure 3. Block Diagram of FP6128

Electrical Characteristics

($V_{IN}=V_{OUT}+1V$, $V_{EN1}=V_{EN2}=V_{IN}$, $C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, $T_A=25^oC$, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage Accuracy		$I_{OUT}=1mA$		-2		+2	%
Current Limit	I_{LIMIT}	$R_{Load}=1\Omega$		300			mA
Quiescent Current	I_Q	$I_{OUT}=0mA$ (Single Channel)			25	50	μA
Dropout Voltage (Note2)	V_{DROP}	$I_{OUT}=150mA$	$V_{OUT}=1.5V$		910	1100	mV
			$V_{OUT}=1.8V$		750	900	
			$V_{OUT}=2.5V$		500	600	
			$V_{OUT}=3.0V$		270	330	
			$V_{OUT}=3.3V$		230	270	
		$I_{OUT}=300mA$	$V_{OUT}=1.5V$		1600	1920	
			$V_{OUT}=1.8V$		1450	1750	
			$V_{OUT}=2.5V$		980	1170	
			$V_{OUT}=3.0V$		510	610	
			$V_{OUT}=3.3V$		400	480	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	$I_{OUT}=1mA$, $V_{IN}=V_{OUT}$ +1V to 5V			0.01	0.20	% / V
Load Regulation (Note3)	ΔV_{OUT}	$I_{OUT}=1mA$ to 200mA			25	60	mV
Ripple Rejection (Note4)	PSRR	$V_{IN}=V_{OUT}+1V$ f_{RIPPLE} = 10kHz			70		dB
Output Noise Voltage (Note4)	V_{NO}	$C_{OUT}=1\mu F$, $I_{OUT}=0mA$			30		μV_{RMS}
Output Discharge Resistor		$V_{EN1}=V_{EN2}=GND$, V_{OUT} =1.8V			100		Ω
Standby Current	I_{STBY}	$V_{EN1}=V_{EN2}=GND$, Shutdown				1	μA
EN Input Bias Current	I_{IB}	$V_{EN1}=V_{EN2}=V_{IN}$ or GND				100	nA
EN "High" Threshold	V_{IH}	Start-up		1.0			V
EN "Low" Threshold	V_{IL}	Shutdown				0.4	V
Temperature Coefficient (Note4)	T_C	$I_{OUT}=1mA$, $V_{IN}=5V$			100		ppm/ºC
Thermal Shutdown Temperature (Note4)	T_{SD}				160		ºC
	ΔT_{SD}	Hysteresis			25		ºC

Note 2：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 3：Load regulation and dropout voltage are measured at a constant junction temperature by using a 40ms low duty cycle current pulse.

Note 4：Guarantee by design.

Typical Performance Curves

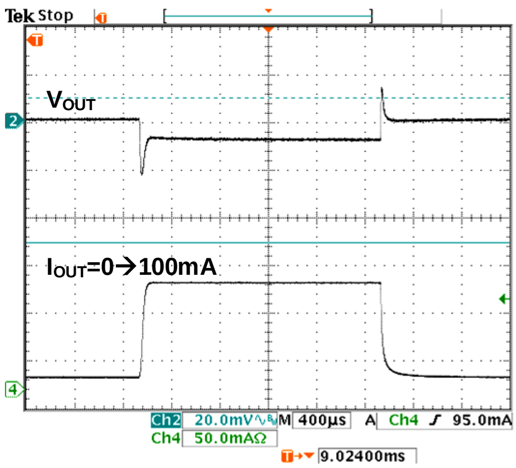


Figure 4. Load Transition Response
(V_{IN}=2.8V, V_{OUT}=1.8V)

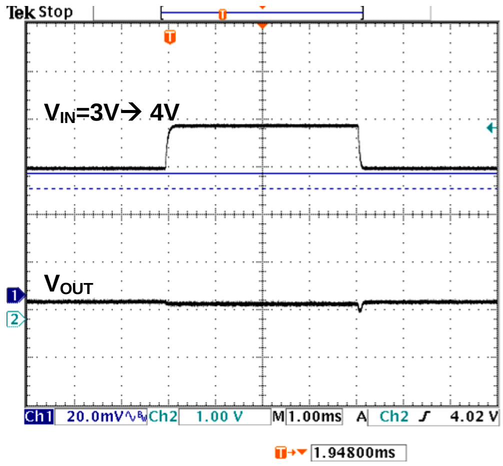


Figure 5. Line Transition Response
(V_{OUT}=1.8V, I_{OUT}=10mA)

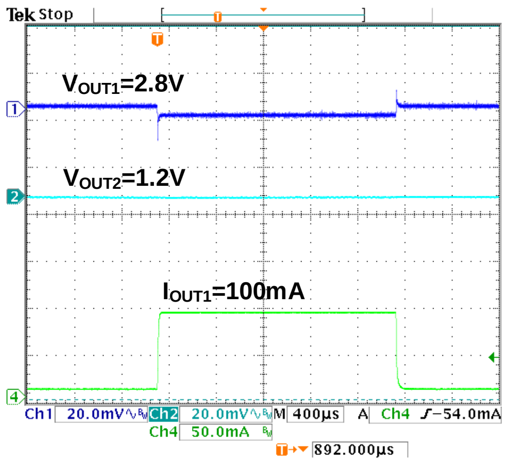


Figure 6. Dual Channel Crosstalk Test

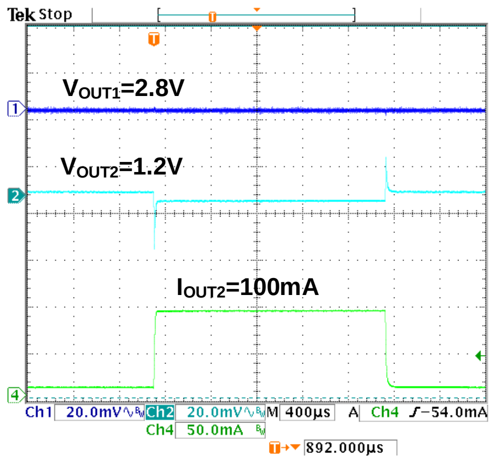


Figure 7. Dual Channel Crosstalk Test

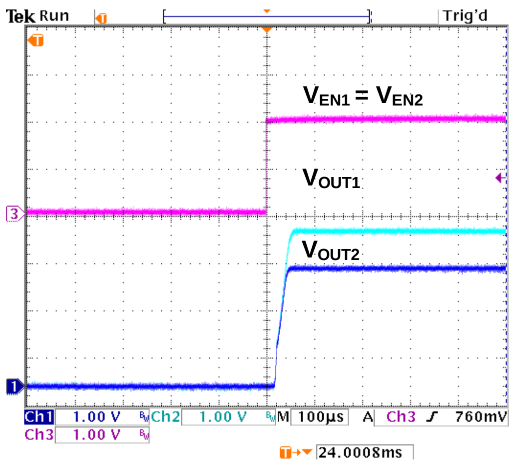


Figure 8. Enable Test
(V_{IN}=4V, V_{OUT1}=3.3V, V_{OUT2}=2.8V, I_{OUT}=30mA)

Typical Performance Curves (Continued)

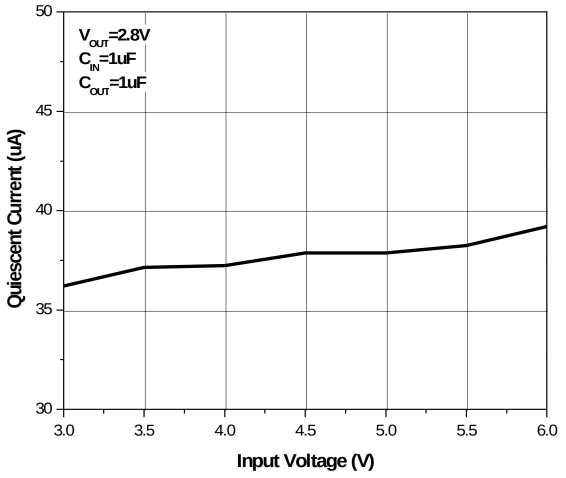


Figure 9. Quiescent Current vs. Input Voltage

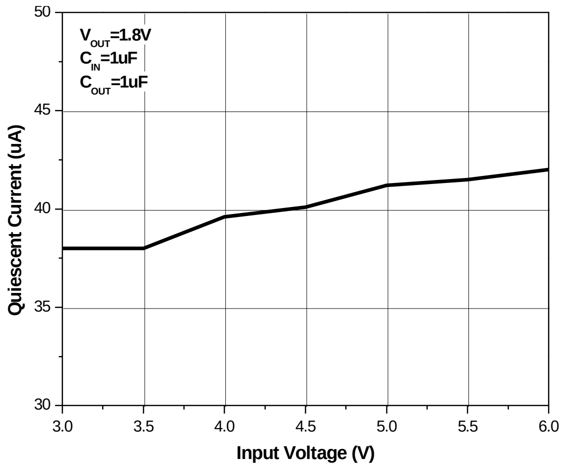


Figure 10. Quiescent Current vs. Input Voltage

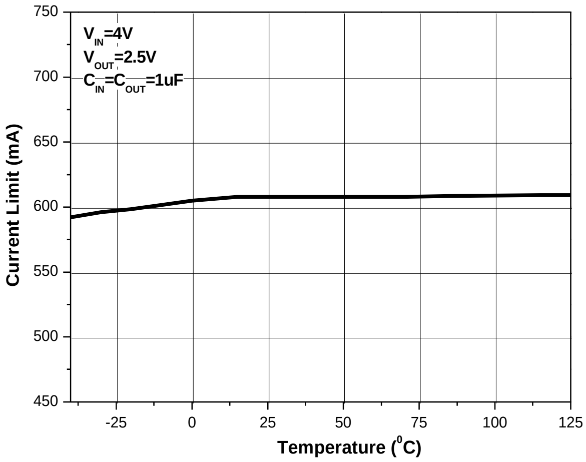


Figure 11. Current Limit vs. Temperature

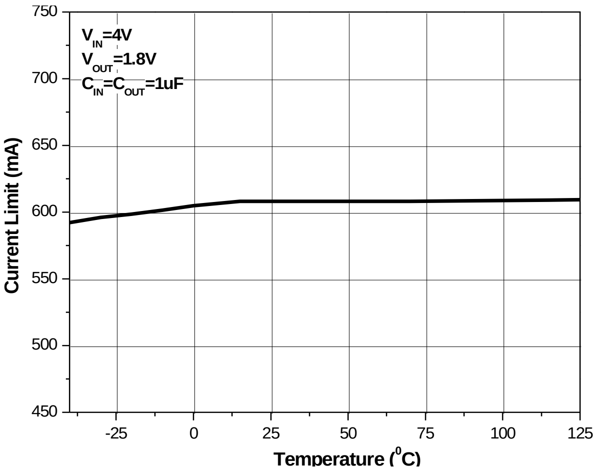


Figure 12. Current Limit vs. Temperature

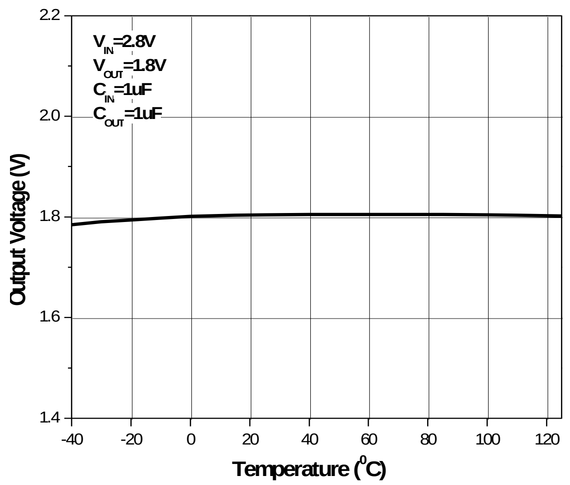


Figure 13. Output Voltage vs. Temperature

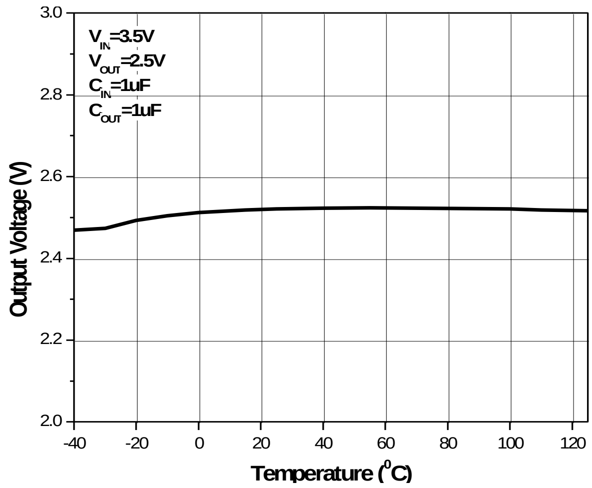


Figure 14. Output Voltage vs. Temperature

Typical Performance Curves (Continued)

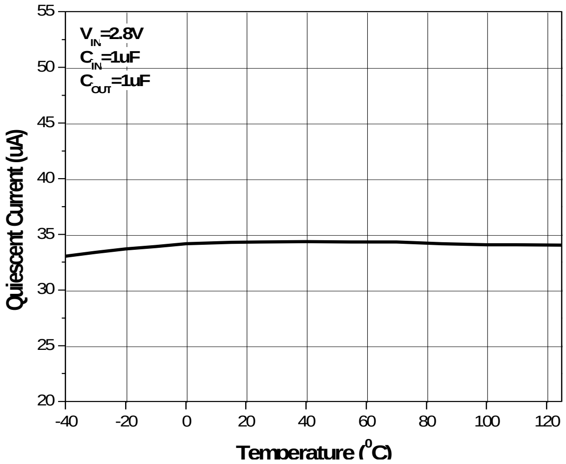


Figure 15. Quiescent Current vs. Temperature (V_{IN}=2.8V, V_{OUT}=1.8V)

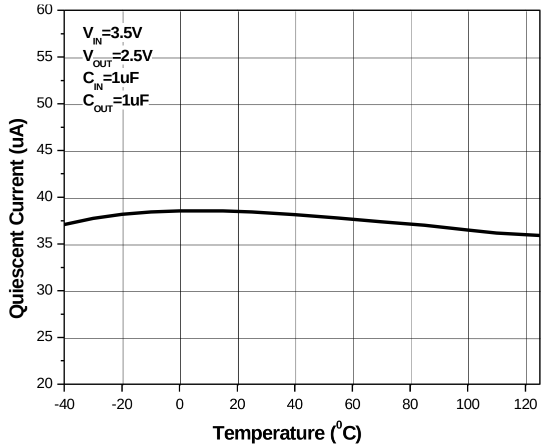


Figure 16. Quiescent Current vs. Temperature (V_{IN}=3.5V, V_{OUT}=2.5V)

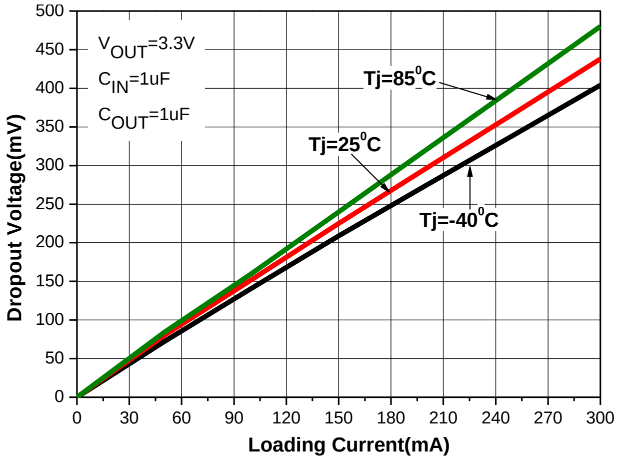


Figure 17. V_{OUT}=3.3V Dropout vs. Temperature

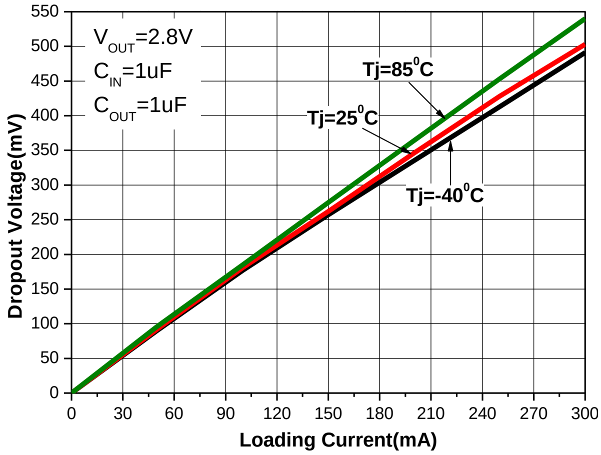


Figure 18. V_{OUT}=2.8V Dropout vs. Temperature

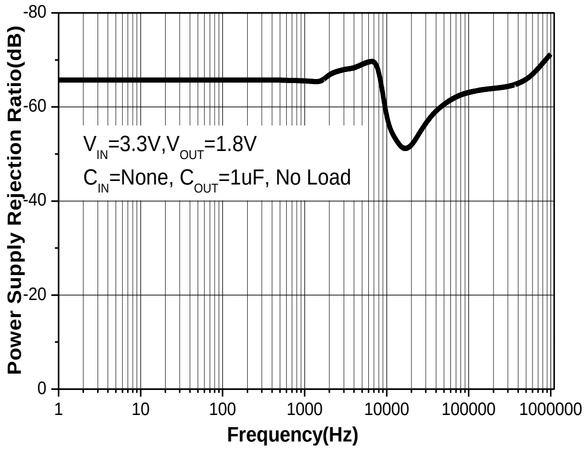


Figure 19. Power Supply Rejection Ratio vs. Frequency

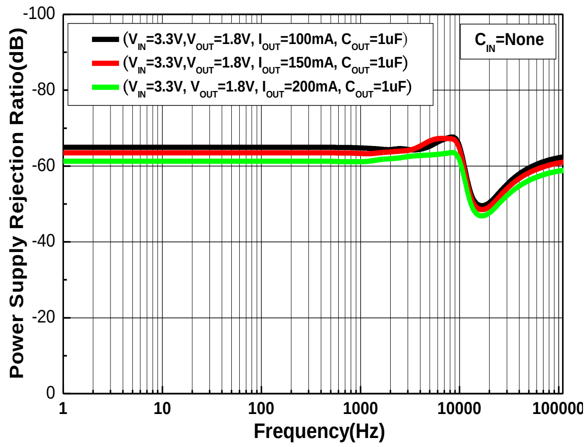


Figure 20. Power Supply Rejection Ratio vs. Frequency

Application Information

The FP6128 include 2 independent output channels. Current limit and on chip thermal shutdown features provide protection against any combination of overload or ambient temperature that could exceed maximum junction temperature.

EN Control

Force EN pin high to enable the FP6128 and turned off the device by pulling it low. The EN pin can't be floated and must be tied to the Vin if not used. The enable control is independent to each channel.

PSRR (Power Supply Rejection Ratio)

The FP6128 has high 70dB PSRR. Ripple rejection is the ability of the regulator to reduce input voltage ripple. It is specified with a 10kHz and $1V_{P-P}$ signal applying to input, with 1μF output capacitor. Ripple rejection, expressed in dB, is the ratio of output ripple to input ripple.

Thermal Shutdown

Thermal shutdown is employed to protect the device damage from the junction temperature exceed safe margins due mainly to short circuit or current limit. Moreover, the device returns normally operation when the junction temperature down to a constant temperature. Though temperature protection circuit is built in to protect IC, the maximum power dissipation design within Tj(max) is needed. The thermal protection is independent to each channel.

Thermal Consideration

The power handling capability of the device will be limited by maximum 125°C operation junction temperature. 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.

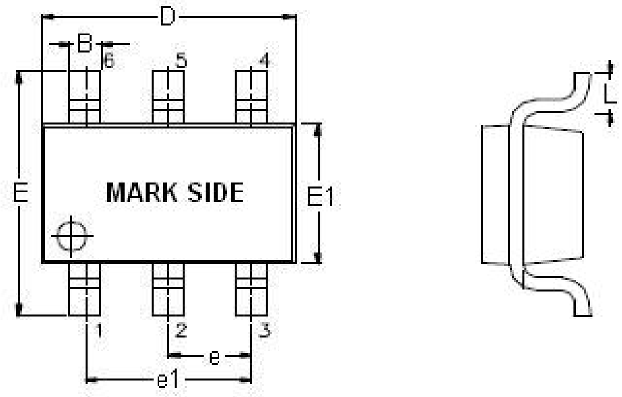
Capacitor Selection

The ceramic capacitor is ideal for FP6128 application. The ESR of the output capacitor affects stability. Larger value of the output capacitor decreases the peak deviations and improves transient response for larger current changes.

The capacitor types (ceramic, aluminum, and tantalum) have different characterizations such as voltage and temperature 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 because X5R or X7R hold their capacitance over wide voltage and temperature ranges than other Y5V or Z5U types. The ESR of output capacitor is very important because it generates a zero to provide phase lead for loop stability. The input capacitor can reduced peak current and noise at power source.

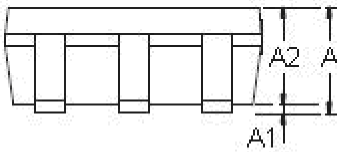
Outline Information

SOT-23-6 Package (Unit: mm)

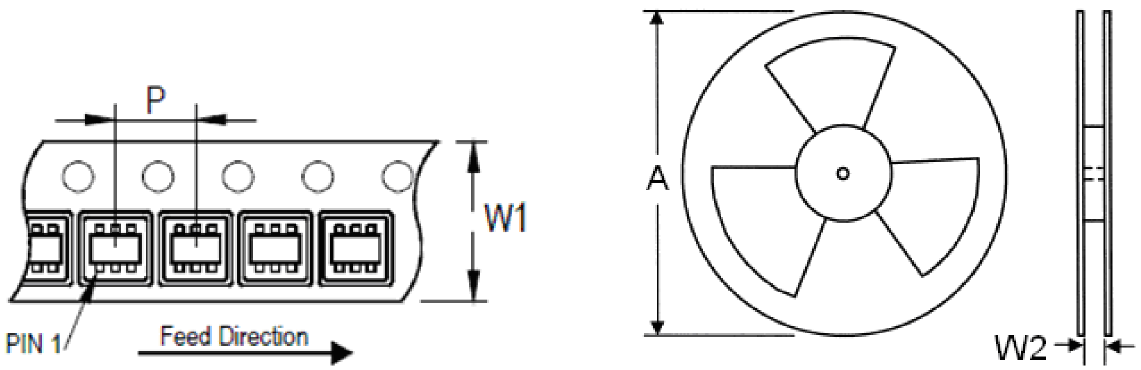


SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	0.90	1.45
A1	0.00	0.15
A2	0.90	1.30
B	0.30	0.50
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.90	1.00
e1	1.80	2.00
L	0.30	0.60

Note：Followed From JEDEC MO-178-C.



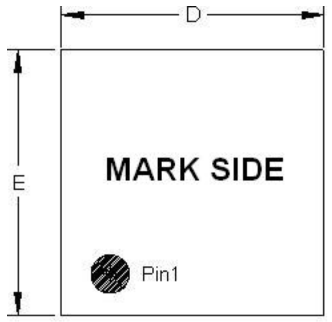
Carrier Dimensions

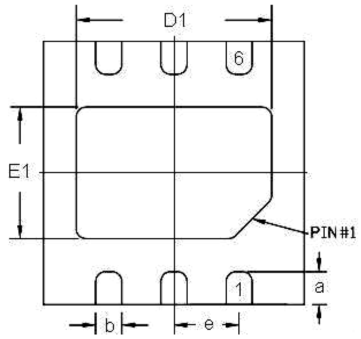


Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
8	4	7	180	8.4	300~1000	3,000

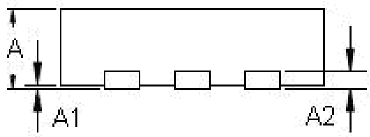
Outline Information (Continued)

TDFN-6 1.6mm×1.6mm Package (Unit: mm)

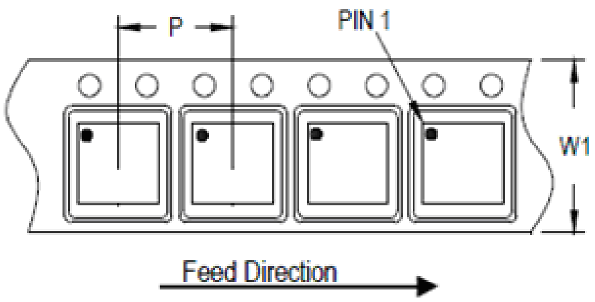


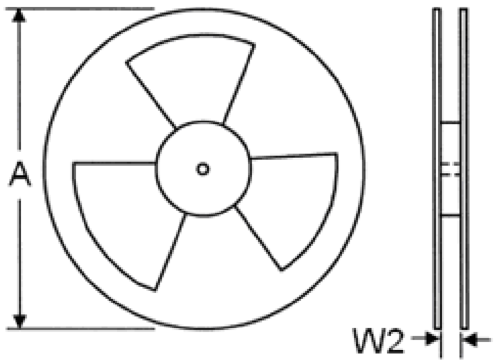


SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	0.70	0.80
A1	0.00	0.05
A2	0.18	0.25
D	1.55	1.65
E	1.55	1.65
a	0.18	0.30
b	0.18	0.30
e	0.45	0.55
D1	0.95	1.05
E1	0.55	0.65



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			
8	4	7	180	8.4	400~1000	3,000

Life Support Policy
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