TP162C Series

600mA,2uA, Higt PSRR Voltage Reaulators

www.sot23.com.tw

Features

- 2μA Ground Current at no Load
- ±2% Output Accuracy
- 600mA Output Current
- 10nA Disable Current (by option)
- Wide Operating Input Voltage Range: 1.2V to 5.5V
- Dropout Voltage: 0.32V at 600mA/ V_{OUT} 3.3V
- Support Fixed Output Voltage 1.2V, 1.5V, 1.6V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V
- Stable with Ceramic or Tantalum Capacitor
- Current Limit Protection
  Over Temperature Protection
- SOT23-3, SOT23-5, DFN-4(1x1) and DFN-6(2x2) Packages

Applications

- Portable, Battery Powered Equipment
- Low Power Microcontrollers
- Laptop, Palmtops and PDAs
- Wireless Communication Equipment
- Audio/Video Equipment
- Car Navigation Systems

General Descri tion

The TP162C series are a group of low-dropout (LDO) voltage regulators offering the benefits of wide input voltage range from 1.2V to 5.5V, low dropout voltage, low power consumption, and miniaturized packaging.
Quiescent current of only 2μA makes these devices ideal for powering the battery-powered, always-on systems that require very little idle-state power dissipation to a longer service life. There is an option of shutdown mode by selecting the parts with the EN pin and pulling it low. The shutdown current in this mode goes down to only 10nA (typical).
The TP162C series of linear regulators are stable with the ceramic output capacitor over its wide input range from 1.2V to 5.5V and the entire range of output load current (0mA to 600mA).

Ordering Information

TP162C33S5

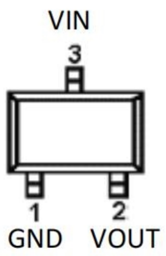
S5:SOT23-5 Package
S3L:SOT23-3 Package
D4:DFN1X1-4L Package
D6:DFN2X2-6LPackage

Output voltage: 12=1.2V
15=1.5V
18=1.8V
30=3.0V
33=3.3V
XX=X.XV

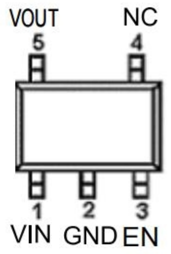
Marking:

TP162C33S5 : P E33
TP162C30S5 : P E30
TP162C28S5 : P E28
TP162C18S5 : P E18
TP162C15S5 : P E15
TP162C12S5 : P E12

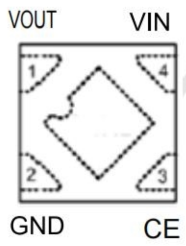
PIN CONFIGURATION



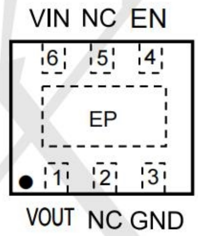
SOT23-3



SOT23-5



DFN4(1X1)



DFN2X2-6L

Typical Application Circuit

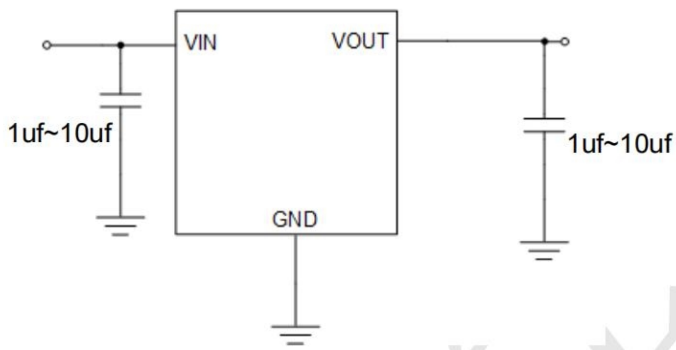


Figure 1: Application circuit of Fixed V_{OUT} LDO

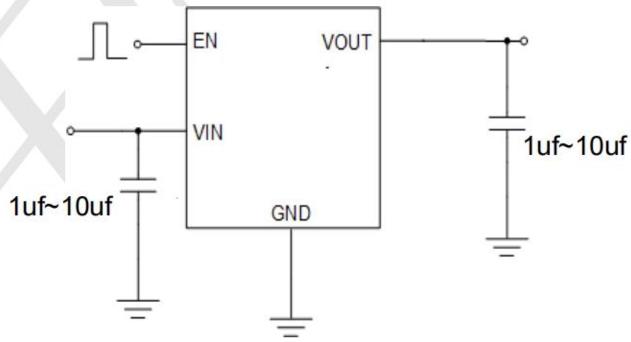


Figure 2: Application circuit of Fixed V_{OUT} LDO with enable functio

ABSOLUTE MAXIMUM RATINGS

VIN Pin to GND Pin Voltage .... -0.3V to 6.5V
VOUT Pin and EN 'oltage .... -0.3V to 6V
VOUT Pin to VIN Pin Voltage .... -6V to 0.3V
Storage Temperature Range .... -60ºC~150ºC
Lead Temperature (Soldering, 10 sec) 260ºC
Junction Temperature 150ºC
Operating Ambient Temperature Range T_A .... -40ºC~85ºC

Thermal Resistance Junction to Case, $R\theta_{JC}$	SOT23-3	115°C/W
	SOT23-5	115°C/W
	DFN-4(1x1)	65°C/W
	DFN-6(2x2)	30°C/W
Thermal Resistance Junction to Ambient, $R\theta_{JA}$	SOT23-3	250°C/W
	SOT23-5	250°C/W
	DFN-4(1x1)	195°C/W
	DFN-6(2x2)	165°C/W

Electrical Characteristics (T_A=25 C unless otherwise noted)

(V_{IN} =5V, V_{EN} = 5V T_A=25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{IN}		1.2	--	5.5	V
DC Output Voltage Accuracy		I_{LOAD} =0.1mA	-2		2	%
Dropout Voltage (I_{LOAD} =600mA) (Note 3)	V_{DROP_3V}	V_{OUT} ≥ 3V		0.32		V
	$V_{DROP\_2.8V}$	V_{OUT} = 2.8V		0.36		
	$V_{DROP\_2.5V}$	V_{OUT} = 2.5V		0.36		
	$V_{DROP\_1.8V}$	V_{OUT} = 1.8V		0.57		
	$V_{DROP\_1.5V}$	V_{OUT} = 1.5V		0.71		
	V	V = 1.2V		0.8		
Ground Current	I_Q	I_{LOAD} = 0mA		2		μA
Shutdown Ground Current	I_{SD}	V_{EN} = 0V,		0.01	0.5	μA
V_{OUT} Shutdown Leakage Current	I_{LEAK}	V_{OUT} = 0V		0.01	0.5	
Enable Threshold Voltage	V_{IH}	EN Rising			2	V
	V_{IL}	EN Falling	0.6			
EN Input Current	I_{EN}	V_{EN} = 5V		10	100	nA
Line Regulation	ΔLINE	I_{LOAD} =30mA, 1.5V ≤ V_{IN} ≤ 5.5V or (V_{OUT} + 0.2V) ≤ V_{IN} ≤ 5.5V		0.2		%
Load Regulation	ΔLOAD	10mA ≤ I_{LOAD} ≤ 0.3A		0.2		%
Output Current Limit	I_{LIM}	V_{OUT} =0	601	1100		mA
Power Supply Rejection Ratio (I_{LOAD} =5mA)	PSRR	V_{OUT} =1.2V, V_{IN} = 2V; f = 100Hz	--	80	--	dB
		V_{OUT} =1.2V, V_{IN} = 2V; f = 1kHz	--	75	--	
Output Voltage Noise (BW = 10Hz to 100kHz, C_{OUT} =1μF,)		V_{IN} = 3.5V I_{LOAD} =0.1A; V_{OUT} =0.9V	--	40	--	$μV_{RMS}$
		V_{IN} = 3.5V I_{LOAD} =0.1A; V_{OUT} =2.8V	--	50	--	
Thermal Shutdown Temperature	T_{SD}	I_{LOAD} =10mA	--	155	--	°C
Thermal Shutdown Hysteresis	$ΔT_{SD}$		--	15	--	°C
Discharge Resistance		EN = 0V , V_{OUT} = 0.1V	--	100	--	Ω

Note 1. Stresses beyond those listed "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions may affect device reliability.

Note 2. θ_{JA} is measured at T_A = 25°C on a TECH PUBLICboard.

Note 3. $V_{DROP} = V_{IN} - V_{OUT}$ when the V_{OUT} is 98% of its target value.

Typical Characteristics

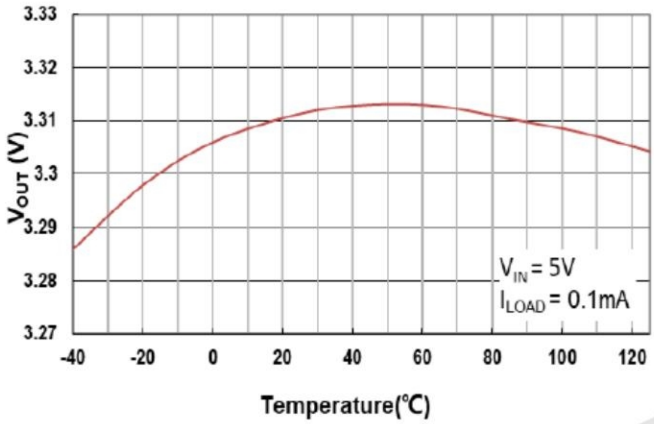


Fig. 5 Output Voltage vs. Temperature

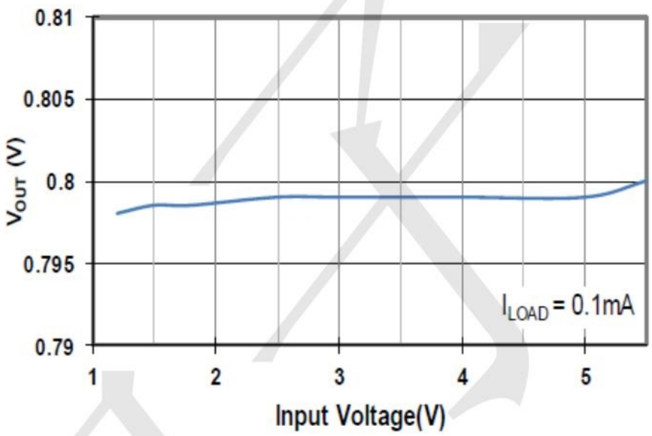


Fig. 6 Output Voltage vs. Input Voltage

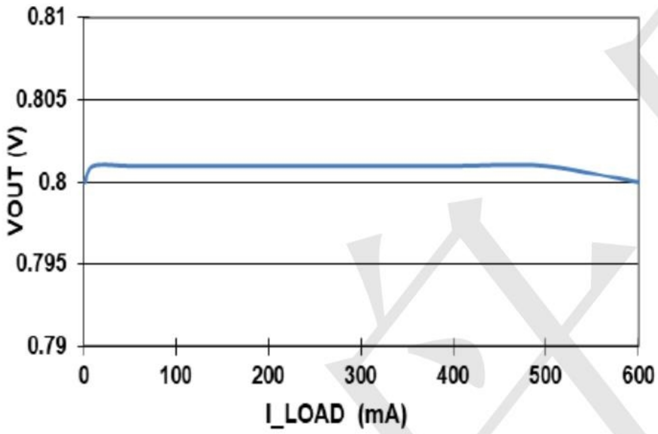


Fig. 7 Output Voltage vs. Load Current

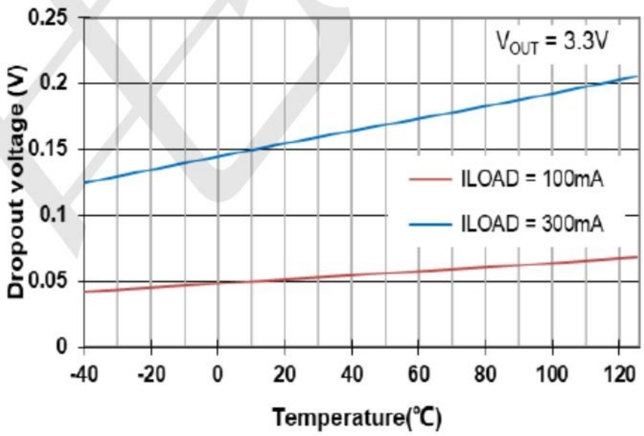


Fig. 8 Dropout Voltage vs. Temperature

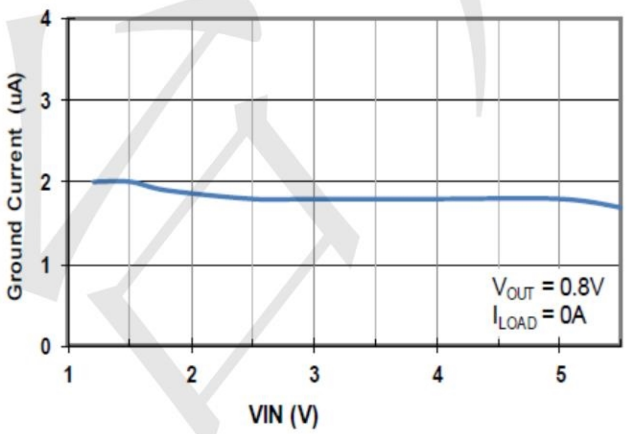


Fig. 9 Ground Current vs. Input Voltage

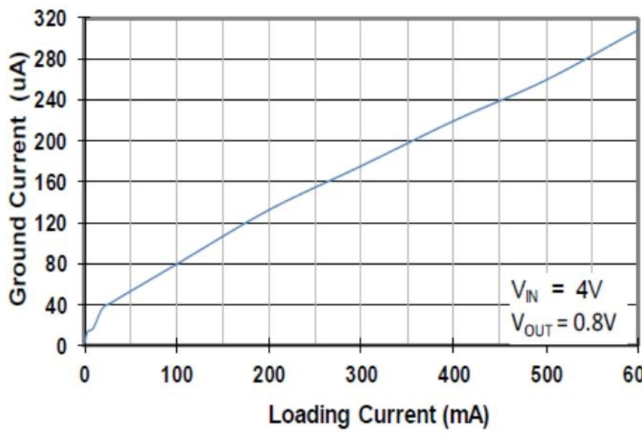
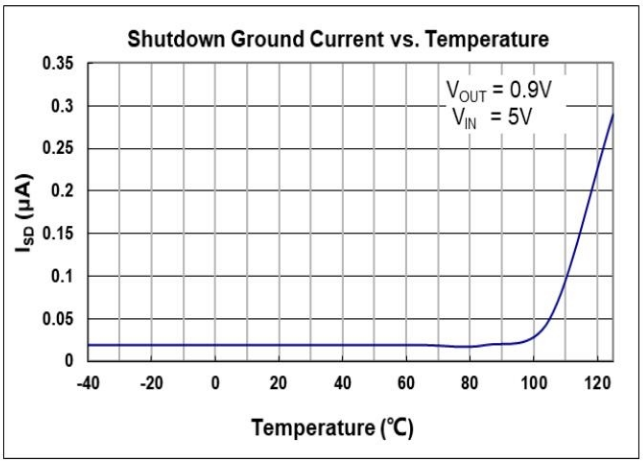
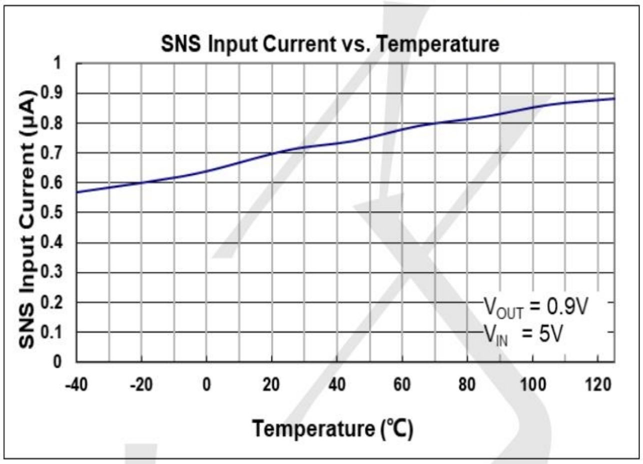
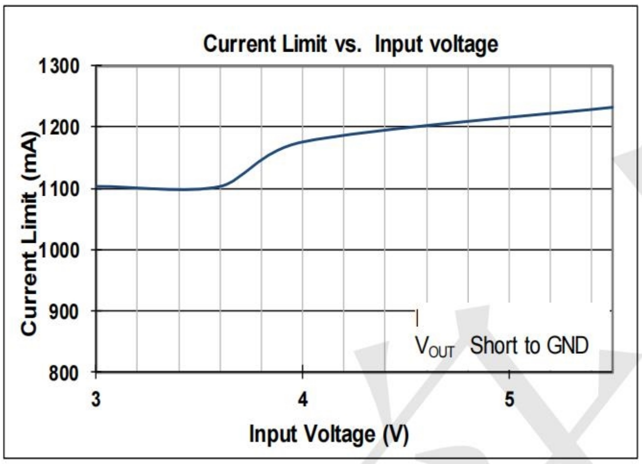


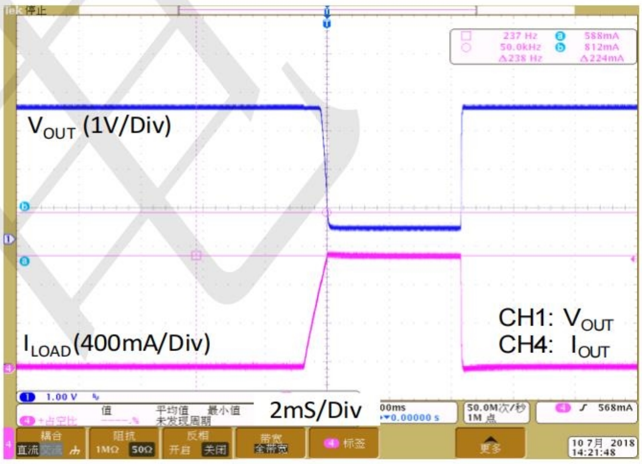
Fig. 10 Ground Current vs. Loading Current



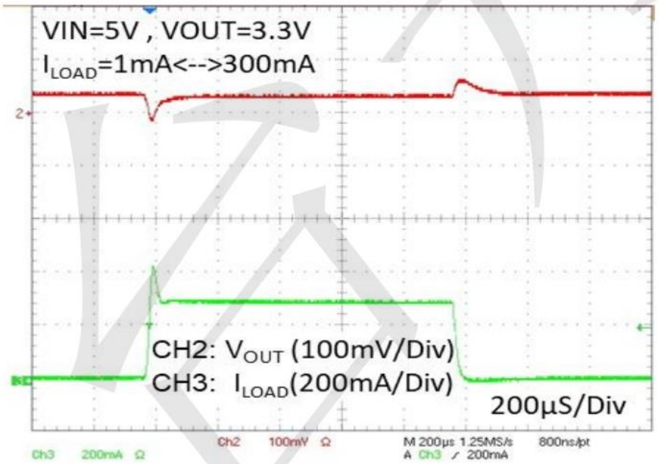




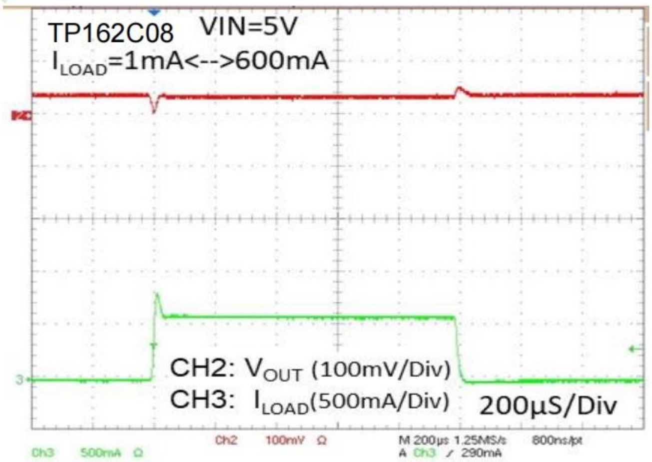
Current Limit Response



Load Transient Response I



Load Transient Response II



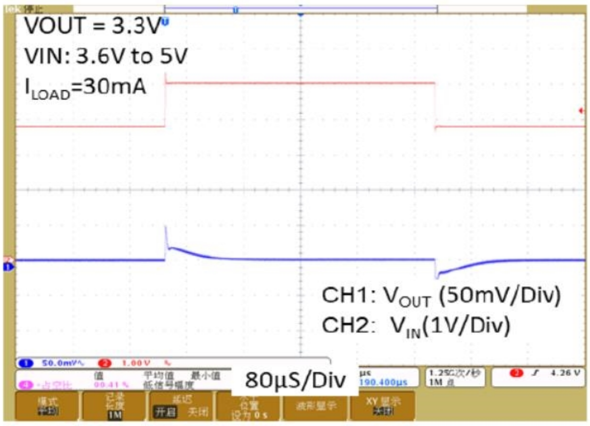


Fig. 17 Line Transient Response

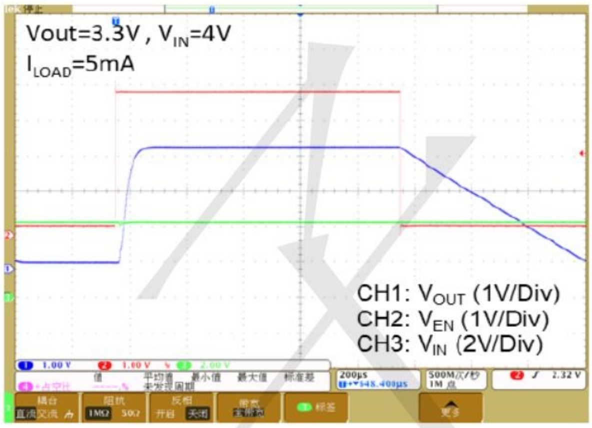


Fig. 18 V_{OUT} Turn On/Off by EN

BLOCK DIAGRAM

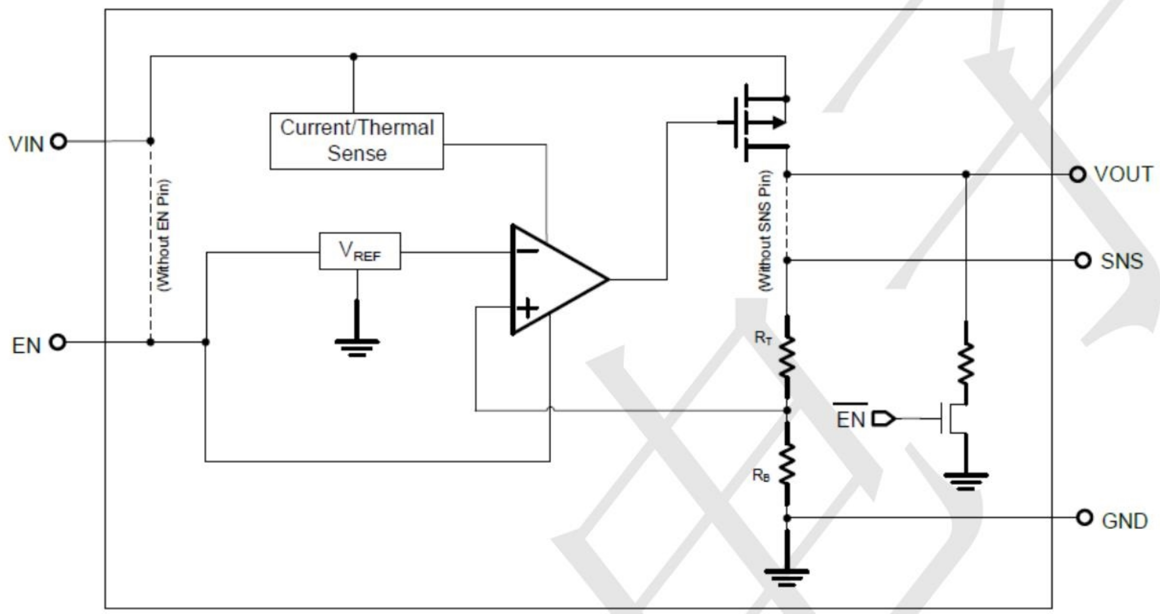


Figure 2. TP162C Block Diagram

Input and Output Capacitor Requirements

The external input and output capacitors of TP162C series must be properly selected for stability and performance. Use a 1μF or larger input capacitor and place it close to the IC's V_{IN} and GND pins. Any output capacitor meeting the minimum 1mΩ ESR (Equivalent Series Resistance) and effective capacitance between 1μF and 22μF requirement may be used. Place the output capacitor close to the IC's V_{OUT} and GND pins. Increasing capacitance and decreasing ESR can improve the circuit's PSRR and line transient response.

Current Limit

The TP162C series contain the current limiter of output power transistor, which monitors and controls the transistor, limiting the output current to 1100mA (typical).

The output can be shorted to ground indefinitely without damaging the part.

Dropout Voltage

The TP162C series use a PMOS pass transistor to achieve low dropout. When (V_{IN} – V_{OUT}) is less than the dropout voltage (V_{DROP}), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. V_{DROP} scales approximately with the output current because the PMOS device behaves as a resistor in dropout condition.

As any linear regulator, PSRR and transient response are degraded as (V_{IN} – V_{OUT}) approaches dropout condition.

OTP (Over Temperature Protection)

The over temperature protection function of TP162C series will turn off the P-MOSFET when the junction temperature exceeds 155°C (typ.). Once the junction temperature cools down by approximately 15°C, the regulator will automatically resume operation.

Thermal Application

For continuous operation, do not exceed the absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated as below:

T_A=25°C,TECHPUBLIC PCB,

The max PD (Max) = (125°C − 25°C) / (200°C/W) = 0.5W for SOT-23-3 & SOT-23-5 packages.

Power dissipation (PD) is equal to the product of the output current and the voltage drop across the output pass element, as shown in the equation below:

$$PD = (V_{IN} – V_{OUT}) \times I_{OUT}$$

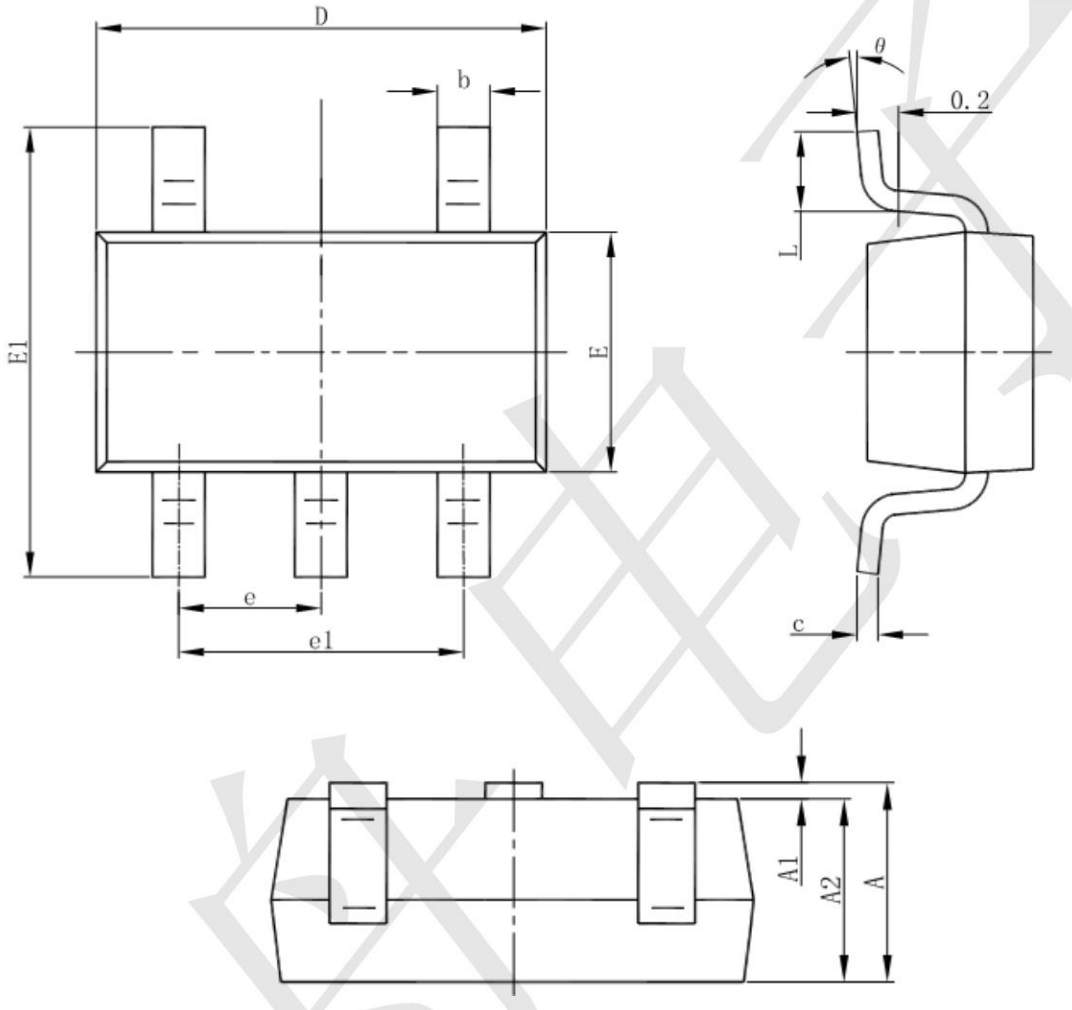
Layout Consideration

By placing input and output capacitors on the same side of the PCB as the LDO, and placing them as close as is practical to the package can achieve the best performance. The ground connections for input and output capacitors must be back to the TP162C ground pin using as wide and as short of a copper trace as is practical.

Connections using long trace lengths, narrow trace widths, and/or connections through via must be avoided. These add parasitic inductances and resistance that results in worse performance especially during transient conditions.

Package informantion

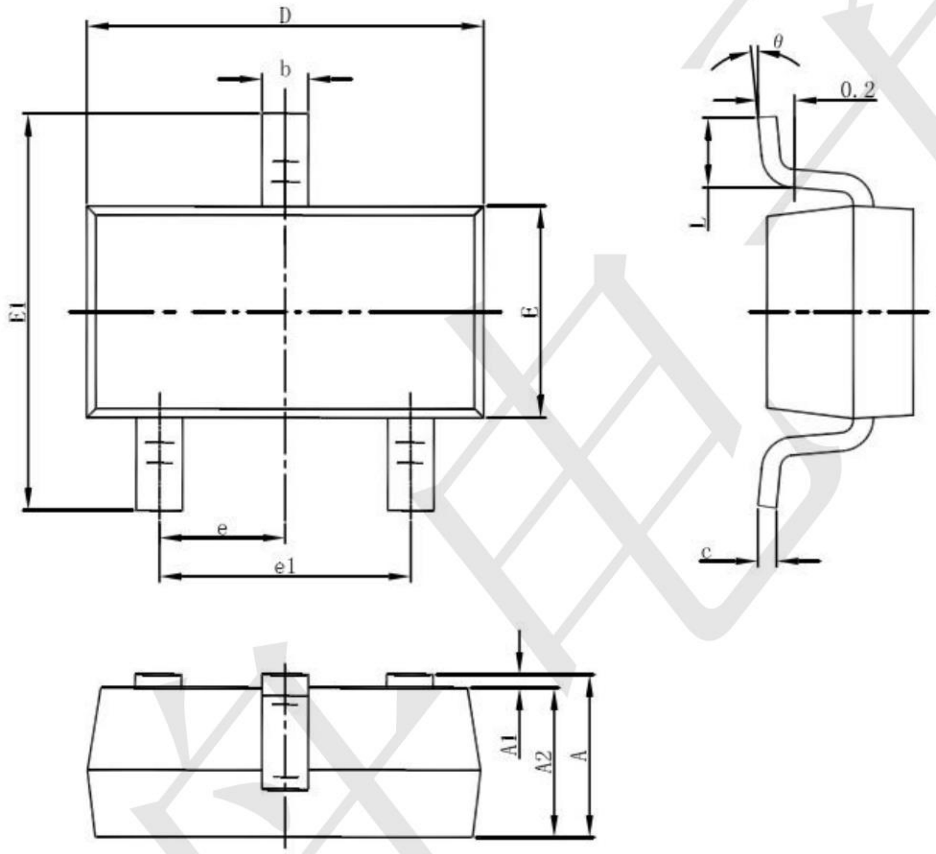
SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

Package informantion

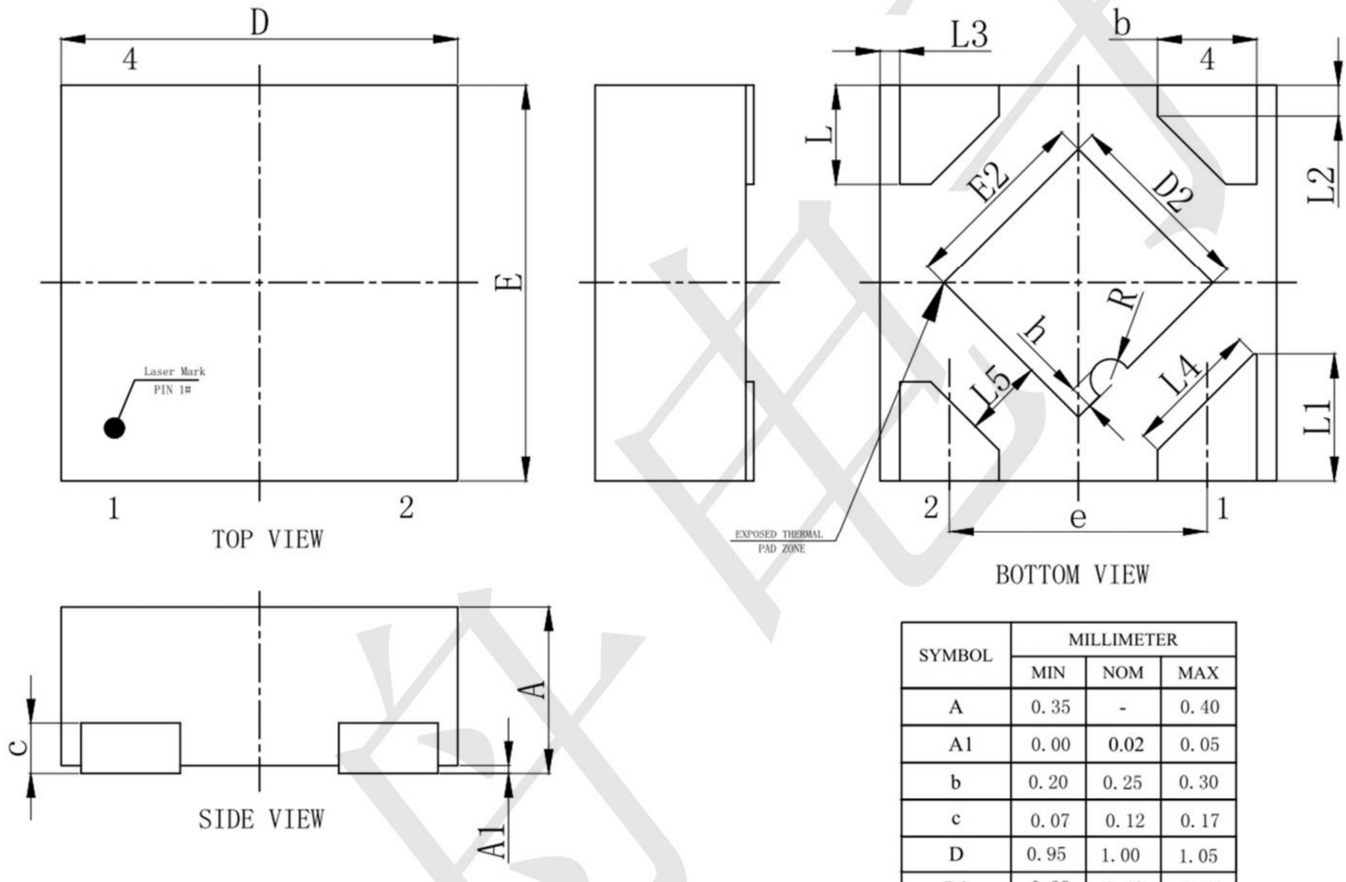
SOT23-3



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

Package informantion

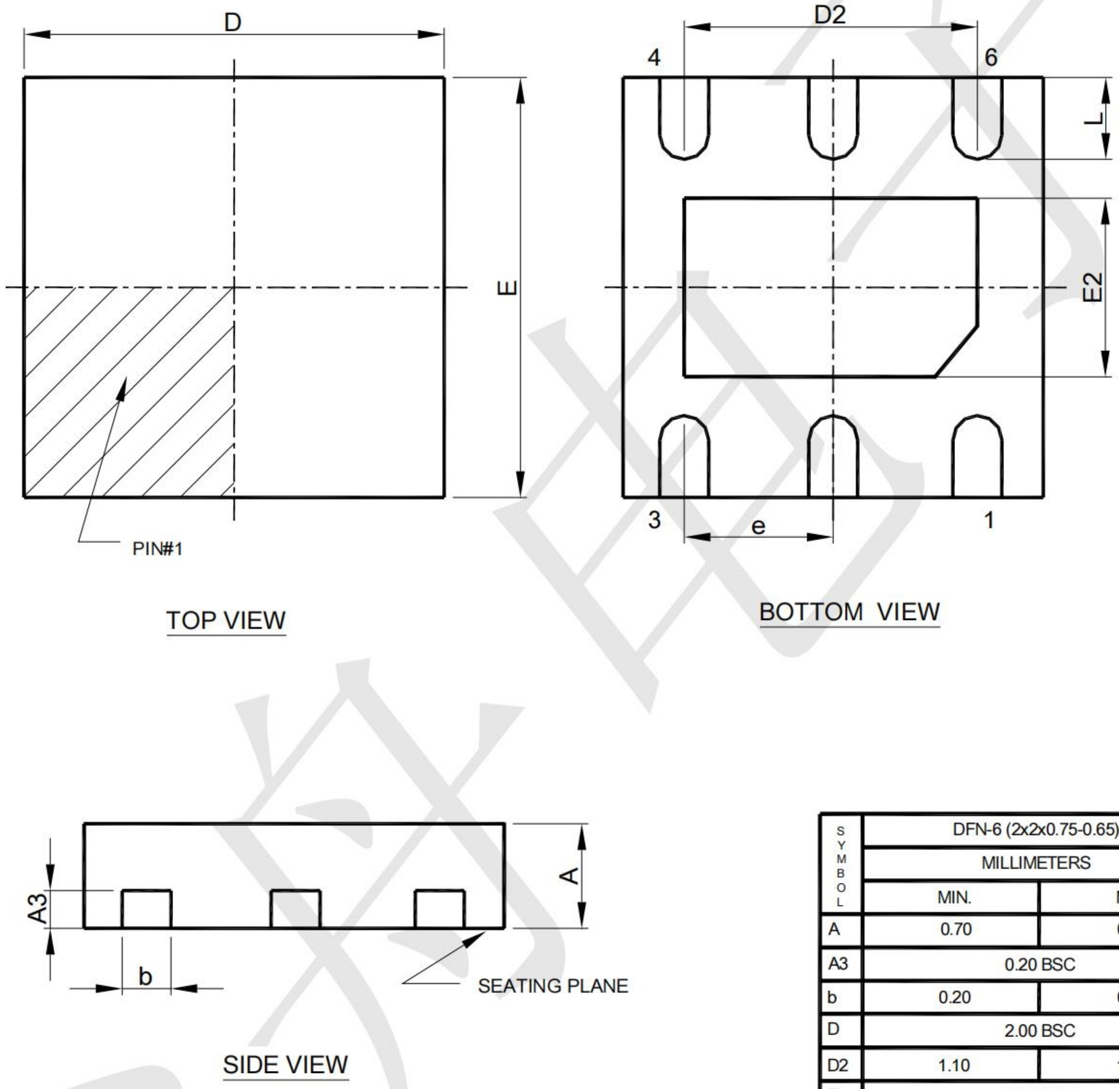
DFN1X1-4L



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.35	-	0.40
A1	0.00	0.02	0.05
b	0.20	0.25	0.30
c	0.07	0.12	0.17
D	0.95	1.00	1.05
D2	0.38	0.48	0.58
e	0.65BSC		
E	0.95	1.00	1.05
E2	0.38	0.48	0.58
L	0.20	0.25	0.30
L1	0.27	0.32	0.37
L2	0.077REF		
L3	0.05REF		
L4	0.34REF		
L5	0.20REF		
R	0.05REF		
h	0.06REF		

Package informantion

DFN2X2-6L



SYMBOL	DFN-6 (2x2x0.75-0.65)	
	MILLIMETERS	
	MIN.	MAX.
A	0.70	0.80
A3	0.20 BSC	
b	0.20	0.35
D	2.00 BSC	
D2	1.10	1.60
E	2.00 BSC	
E2	0.55	0.85
e	0.65 BSC	
L	0.25	0.45