GENERAL DESCRIPTION

The HP6513 series is a high accuracy, high input voltage low quiescent current, high speed, and low dropout liner regulator with high ripple rejection.
The input voltage is up to 40V and load current is up to 300mA at V_{OUT} = 5V & V_{IN} = 7V. The device is manufactured with BCD process. The HP6513 offers over-current limit, soft start and over temperature protection to ensure the device working in well conditions.

The HP6513 regulators is available in standard SOT89-3L, SOT23-5L and SOT23-3L packages. Standard products are Pb-free and Halogen-free.

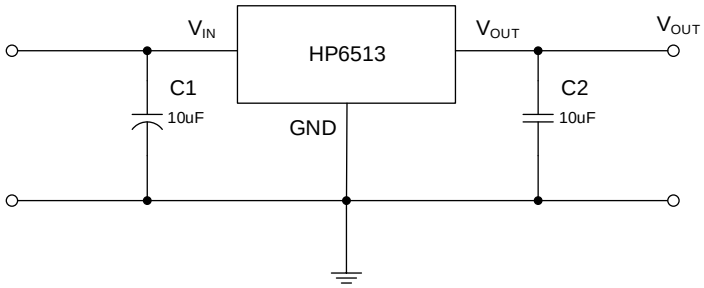
FEATURES

- Input voltage: 4.75V~40V
- Output voltage: 1.8V~5.7V
- Output accuracy: ⩽ ±2%, Please see ordering information
- Output current: 150mA (Typ.)
  Up to 300mA @ V_{IN} = 7V, V_{OUT} = 5V, HP6513T3A package
- PSRR: 60dB @ 100Hz
- Dropout voltage: 600mV @ I_{OUT} = 100mA
- Quiescent current: 4.2μA @ V_{IN} = 12V(Typ.)
- ESD HBM: 8KV
- Recommend capacitor: 10μF

APPLICATIONS

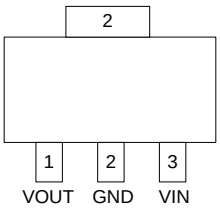
- Smart electric meter
- In-car entertainment
- Electric bicycle

TYPICAL APPLICATION CIRCUIT



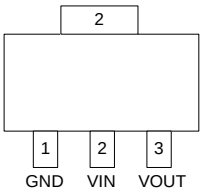
In plugging application, C1 is recommended to use 10uF electrolytic capacitor or 10uF MLCC with 2 ohm series resistors to prevent chip burning due to the large input voltage spike when plugging. See APPLICATION INFORMATION for more information. C2 is recommend to use 10uF, and 1uF to 10uF can be used by customer according to special application.

PIN ASSIGNMENT



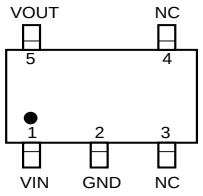
SOT89-3L（Top View）

HP6513T3A SOT89-3L



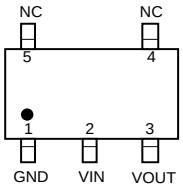
SOT89-3L（Top View）

HP6513T3B **SOT89-3L**



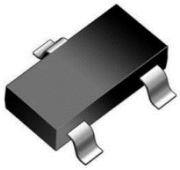
SOT23-5L（Top View）

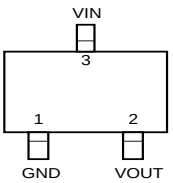
HP6513S5A **SOT23-5L**



SOT23-5L（Top View）

HP6513S5B **SOT23-5L**





SOT23-3L（Top View）

HP6513S3 **SOT23-3L**

PIN DESCRIPTION

PIN NO	SYMBOL	I/O	DESCRIPTTION
HP6513T3A			
1	VOUT	O	Output
2	GND	Ground	Ground
3	VIN	Power	Input

PIN NO HP6513T3B	SYMBOL	I/O	DESCRIPTTION
1	GND	Ground	Ground
2	VIN	Power	Input
3	VOUT	O	Output

PIN NO HP6513S5A	SYMBOL	I/O	DESCRIPTTION
1	VIN	Power	Input
2	GND	Ground	Ground
3	NC	-	Not connect
4	NC	-	Not connect
5	VOUT	O	Output

PIN NO HP6513S5B	SYMBOL	I/O	DESCRIPTTION
1	GND	Ground	Ground
2	VIN	Power	Input
3	VOUT	O	Output
4	NC	-	Not connect
5	NC	-	Not connect

PIN NO HP6513S3	SYMBOL	I/O	DESCRIPTTION
1	GND	Ground	Ground
2	VOUT	O	Output
3	VIN	Power	Input

ORDERING INFORMATION

PART NO	ACCURACY	PACAKGE	TEMPERATURE	TAPE & REEL
HP6513T3A-XX	2%	SOT89-3L	-40 ~ +105℃	2500/REEL
HP6513T3B-XX	2%	SOT89-3L	-40 ~ +105℃	2500/REEL
HP6513T3B-XX-A	1%	SOT89-3L	-40 ~ +105℃	2500/REEL
HP6513S5A-XX	2%	SOT23-5L	-40 ~ +105℃	3000/REEL
HP6513S5B-XX	2%	SOT23-5L	-40 ~ +105℃	3000/REEL
HP6513S3-XX	2%	SOT23-3L	-40 ~ +105℃	3000/REEL

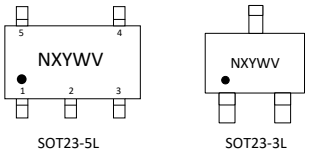
"XX": several fixed output voltages ranging from 1.8V to 5.7V. E.g. "33": V_{OUT} = 3.3V

PART NUMBER RULES

HP6513 [1]-[2]-[3]

Code	Description
[1]	Package: S3: SOT23-3L S5A/S5B: SOT23-5L T3A/T3B: SOT89-3L
[2]	Voltage version: XX: several fixed output voltages ranging from 1.8V to 5.7V Example: 33: 3.3V
[3]	Voltage accuracy code： Blank: 2% A: 1%

MARKING DESCRIPTION



SOT23-5L SOT23-3L

"N": Product Code. Here "O" stands for "HP6513S3", "Q" stands for "HP6513S5A", "P" stands for "HP6513S5B".

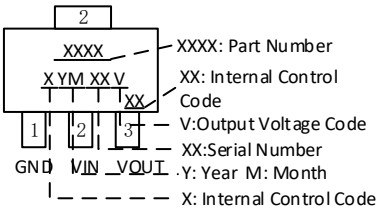
"X": Internal Control Code

"Y": Internal Control Code

"W": Week of manufacturing. "A" stands for week 1, "Z" stands for week 26, "a" stands for week 27, "z" stands for week 52.

"V" : Output voltage code.

SOT89-3L：



TYPICAL OUTPUT VOLTAGE CODE TABLE

V_{OUT}	CODE	V_{OUT}	CODE
3.0V	G	3.3V	H
3.6V	I	5.0V	K

ABSOLUTE MAXIMUM RATINGS (Note)

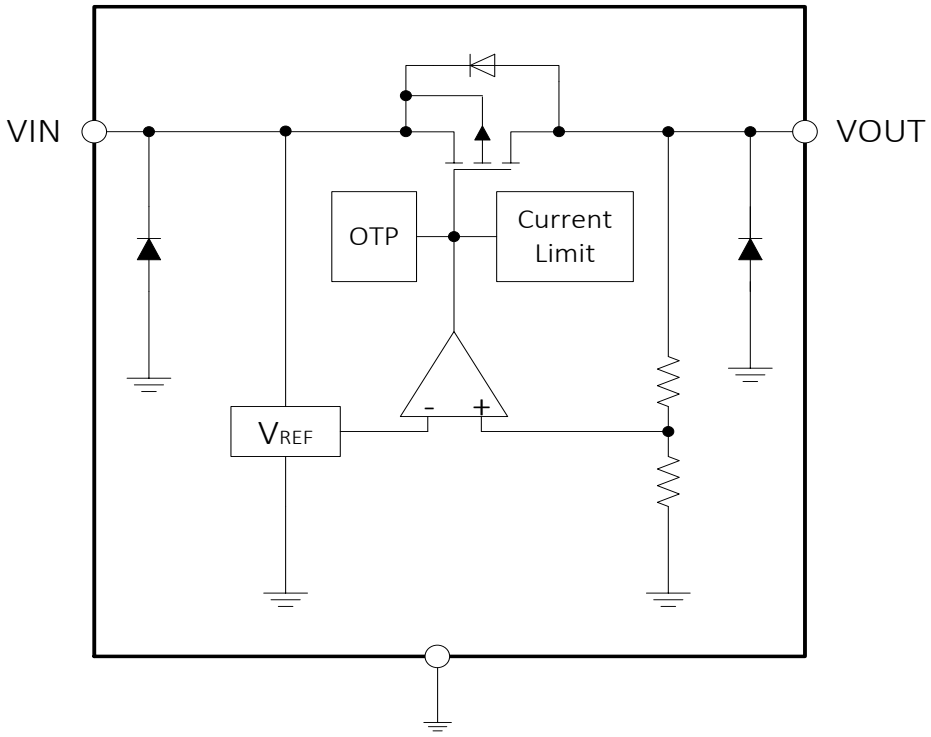
SYMBOL	ITEMS		VALUE	UNIT
V_{IN}	Input Voltage		-0.3~45	V
V_{OUT}	Output Voltage		-0.3~6.5	V
P_{DMAX}	Power Dissipation		OTP Limited	/
$R_{\theta JA}$	Junction to Ambient Thermal Resistance	SOT23-3	220	℃/W
		SOT23-5	200	℃/W
		SOT89-3	75	℃/W
T_J	Junction Temperature		-40~150	℃
T_{STG}	Storage Temperature		-55 to 150	℃
T_{SOLDER}	Package Lead Soldering Temperature (10s)		260	℃
ESD MM	Machine Mode		200	V
ESD HBM	Human Body Mode		8000	V

Note: *Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.*

RECOMMANDED OPERATING RANGE

SYMBOL	ITEMS	VALUE	UNIT
V_{IN}	V_{IN} Supply Voltage	4.75 to 40	V
$R_{\theta JA}$	Thermal Resistance on Application PCB	45	℃/W
T_{OPT}	Operating Temperature	-40 to +105	℃
C_{IN}	Electrolytic capacitor	≥10	μF
	Ceramic capacitor	0.1 to 10	μF
C_O	Electrolytic capacitor	≥10	μF
	Ceramic capacitor	1 to 10	μF

SIMPLIFIED BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

The following specifications apply for V_{IN} = 12V, T_A = 25℃, C_{IN} = C_{OUT} = 10μF, unless specified otherwise.

SYMBOL	ITEMS	CONDITIONS		MIN	TYP	MAX	UNIT
V_{IN}	Input Range	I_{OUT} = 10mA		4.75		40	V
V_{OUT}	Output Range	I_{OUT} = 10mA	HP6513T3B-XX-A	V_{OUT}x0.99	V_{OUT}	V_{OUT}x1.01	
			Others	V_{OUT}x0.98	V_{OUT}	V_{OUT}x1.02	V
$\triangle V_{OUT}$	Output Voltage	V_{IN} = 12V, I_{OUT} = 10mA		4.9	5	5.1	V
				3.234	3.3	3.366	
				2.94	3.0	3.06	
I_Q	Quiescent Current	V_{IN} = 7V, I_{OUT} = 0			4	6	μA
		V_{IN} = 24V, I_{OUT} = 0			4.6	6.7	
		V_{IN} = 40V, I_{OUT} = 0			5.4	8.2	
I_{OUT}	Maximum Output Current (1)				150	300	mA
V_{DROP}	Dropout Voltage	I_{OUT} = 10mA			60	90	mV
		I_{OUT} = 100mA			600	900	
$\triangle V_{LINE}$	Line Regulation	V_{IN} =7 ~ 24V, V_{OUT} = 5V, I_{OUT} = 1mA			0.02	0.03	%/V
		V_{IN} = 7 ~ 45V, V_{OUT} = 5V, I_{OUT} = 1mA			0.08	0.1	
$\triangle V_{LOAD}$	Load Regulation	V_{IN} = 7V, I_{OUT} = 1 ~ 100mA			19	37	mV
I_{SHORT}	Short Current	V_{OUT} Short to GND with 1Ω (1ms pulse), V_{IN} = 12V			180		mA
PSRR	Power Supply Rejection Rate	V_{IN} = 10V, V_{PP} = 0.5V, I_{OUT} = 1mA	F = 100Hz		60		dB
			F = 1kHz		50		
			F = 10kHz		40		
e_{NO}	Output Noise Voltage	10Hz to 100kHz, C_{OUT} = 10μF, I_{OUT}=10mA			±100		μV_{RMS}
T_{SD}	Thermal Shutdown Protection	V_{IN} = 12V, I_{OUT} = 1mA			165		℃
T_{SD_HYS}	OTP Hysteresis				25		℃
$\Delta V_O/\Delta T$	Temperature Coefficient				±0.5		mV/℃

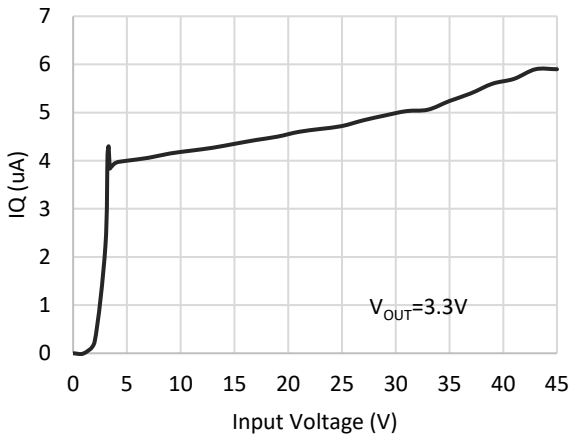
NOTES:

Maximum output current is affected by the gap between Vin and Vout, the package type (different power dissipation), the PCB layout, size of metal trace, the thermal conduction between metal layers, ambient temperature and the other system environment factors.

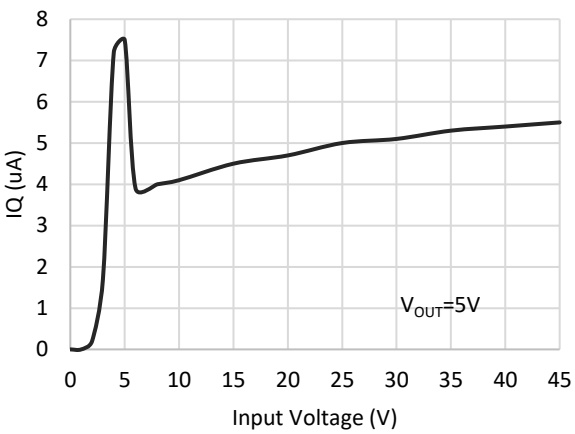
TYPICAL PERFORMANCE CHARACTERISTICS

C_{IN} = 10µF, C_{OUT} = 10µF, T_{OPT} = 25℃, unless specified otherwise. (HP6513T3A Package)

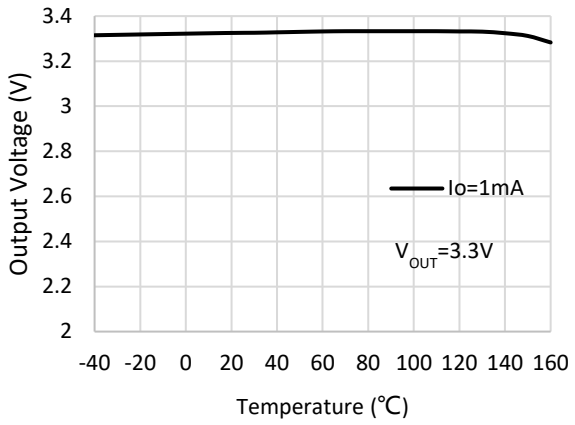
IQ vs. Input Voltage



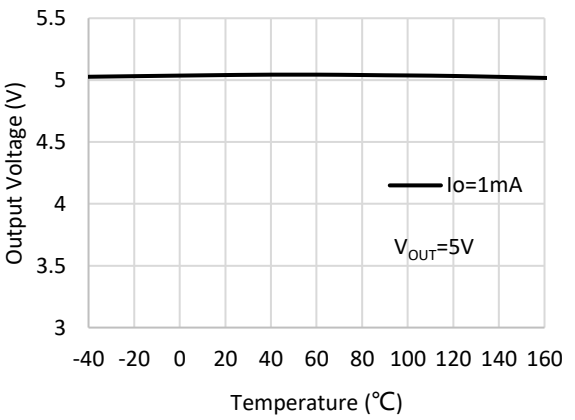
IQ vs. Input Voltage



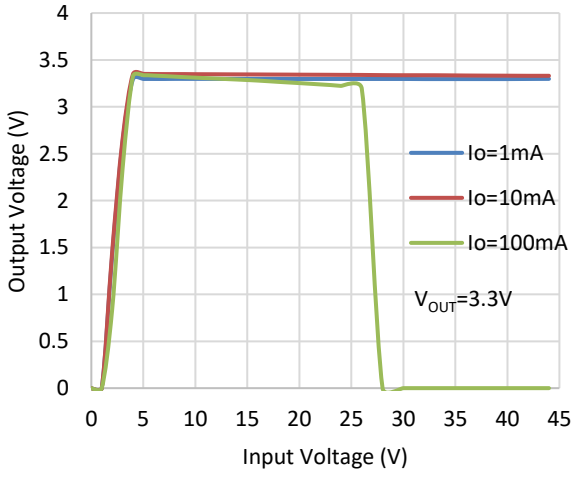
Output Voltage vs. Temperature



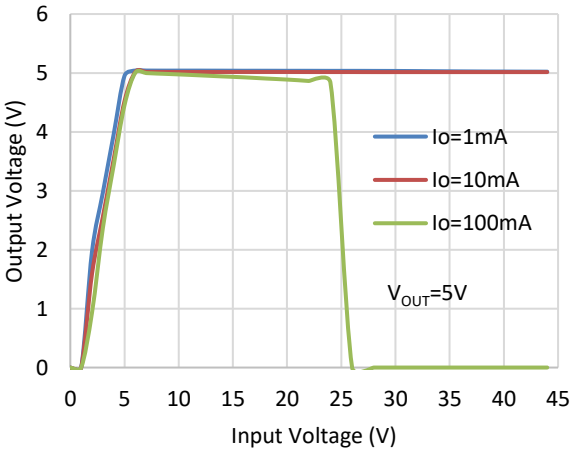
Output Voltage vs. Temperature



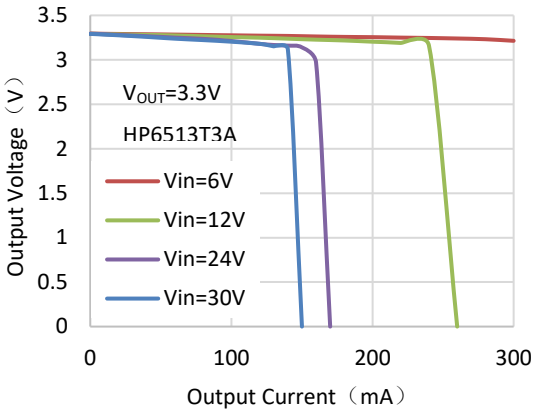
Output Voltage vs. Input Voltage



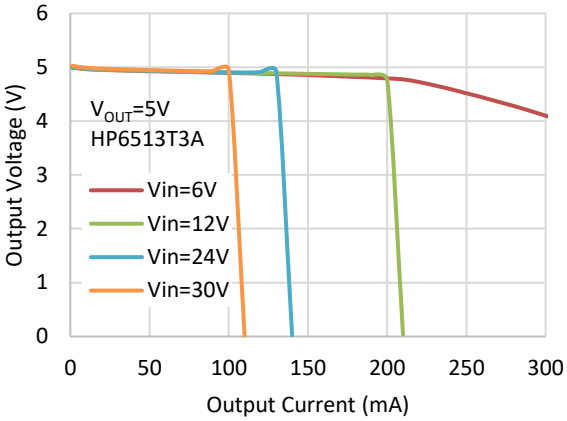
Output Voltage vs. Input Voltage



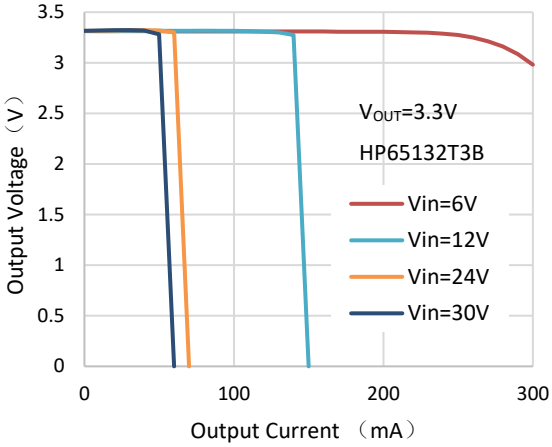
Output Voltage vs. Output Current



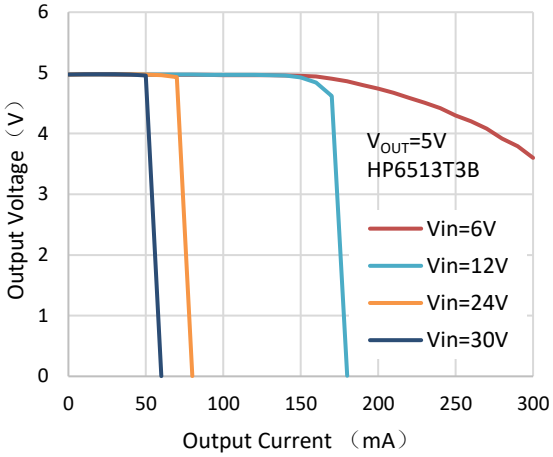
Output Voltage vs. Output Current



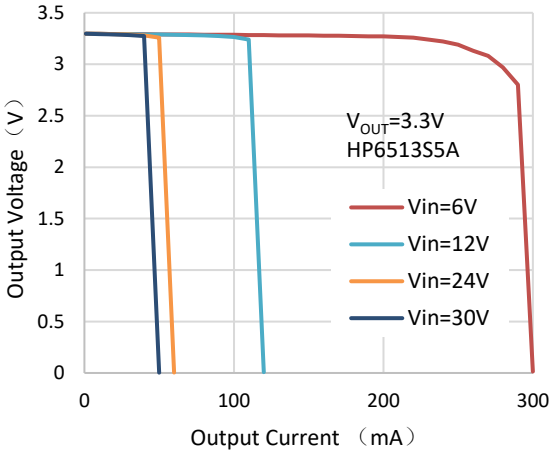
Output Voltage vs. Output Current



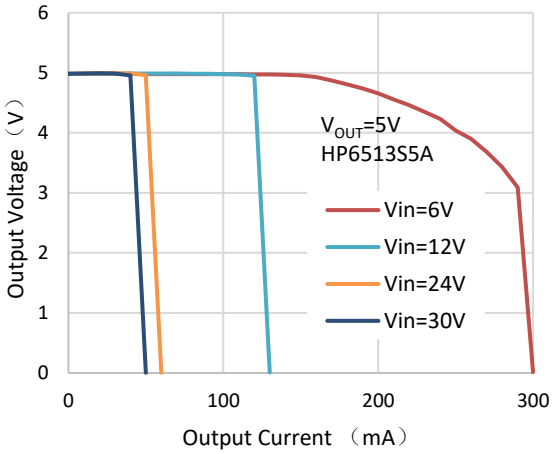
Output Voltage vs. Output Current



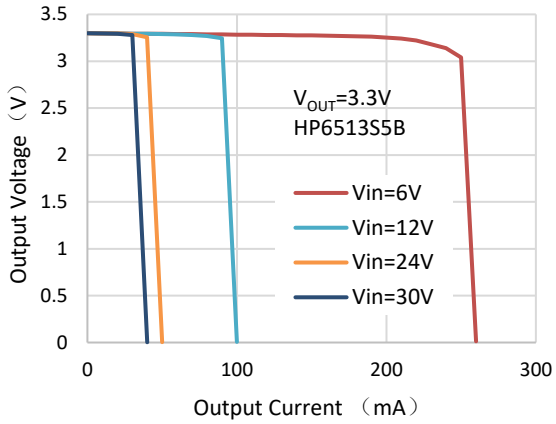
Output Voltage vs. Output Current



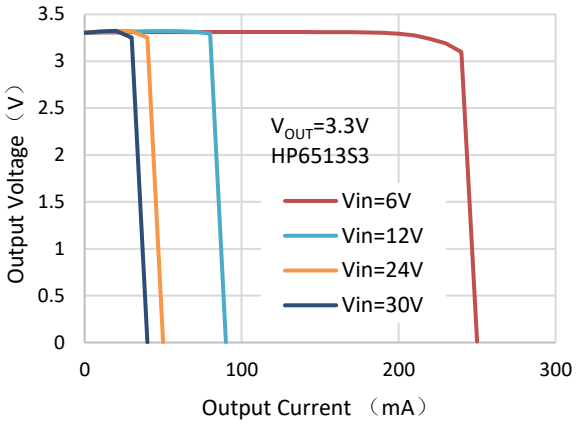
Output Voltage vs. Output Current



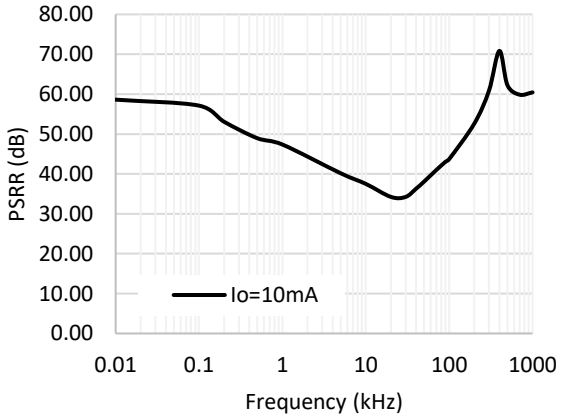
Output Voltage vs. Output Current



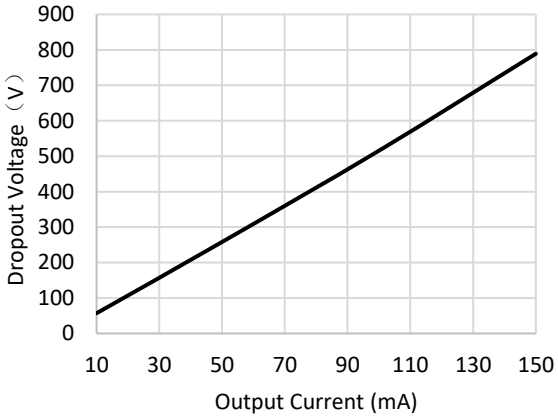
Output Voltage vs. Output Current



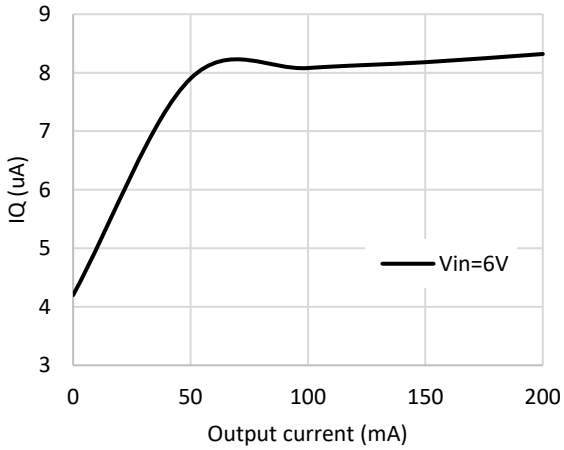
PSRR vs. Frequency



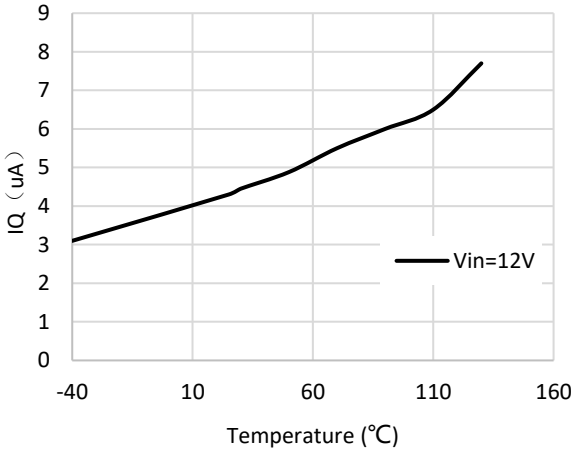
Dropout Voltage vs. Output Current

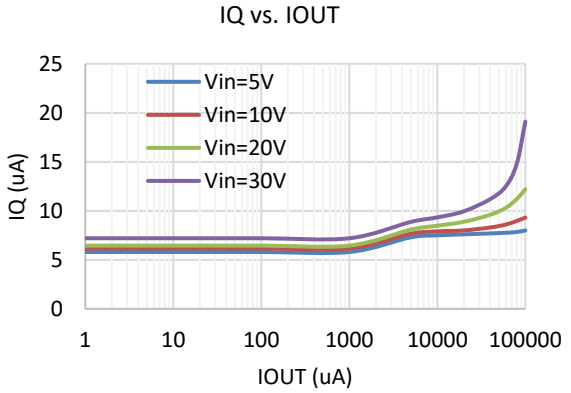


IQ vs. Output current



IQ vs. Temperature

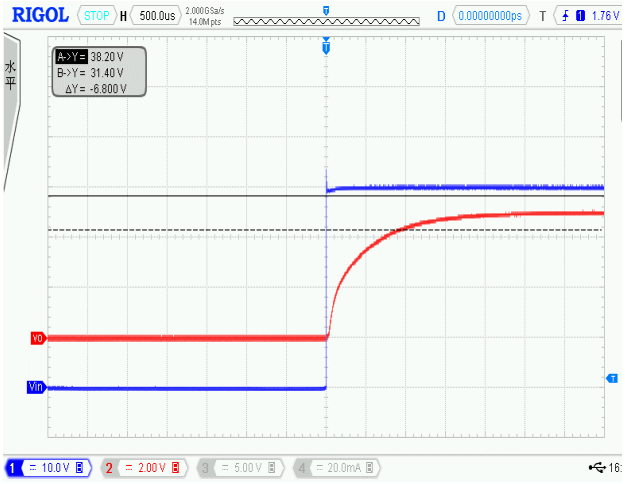


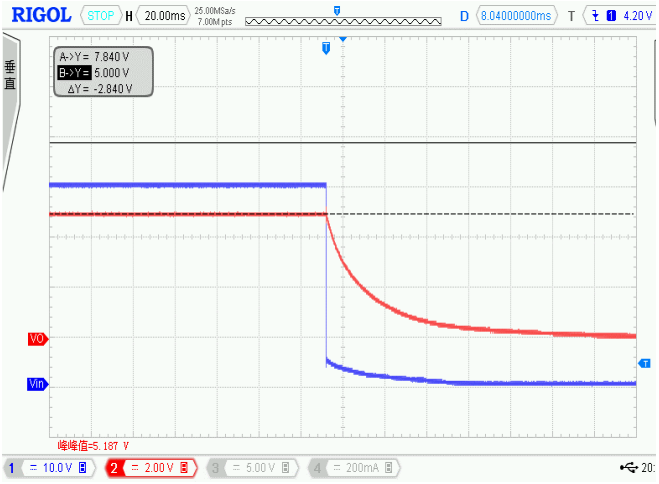


Power ON/OFF

CH1：V_{IN} CH2：V_{OUT}

V_{IN}=40V I_{OUT}=1mA V_{OUT}=5V

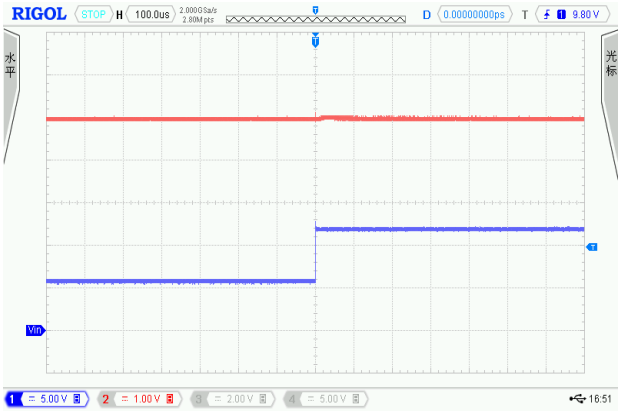




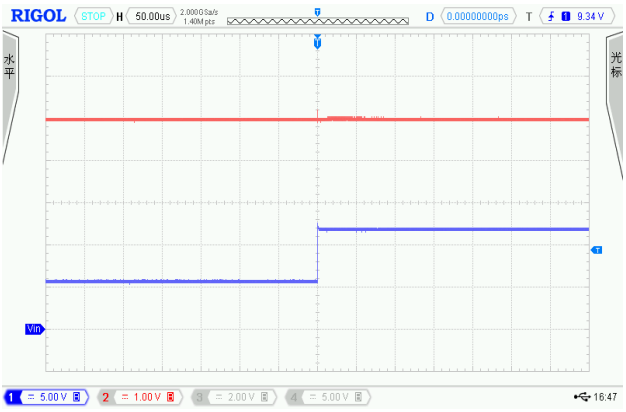
Line Transient

CH1：V_{IN} CH2：V_{OUT}

V_{IN}=6V-12V I_{OUT}=1mA V_{OUT}=5V



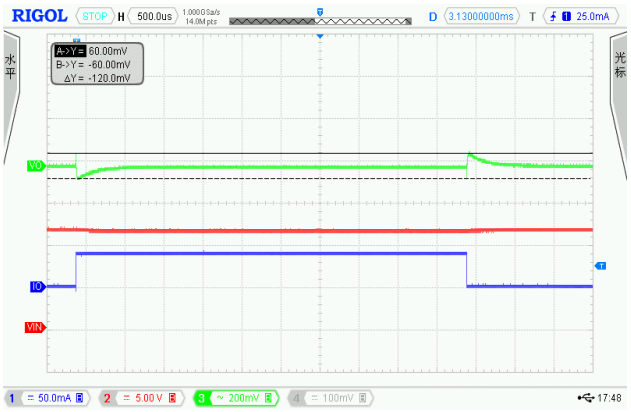
V_{IN}=6V-12V I_{OUT}=10mA V_{OUT}=5V



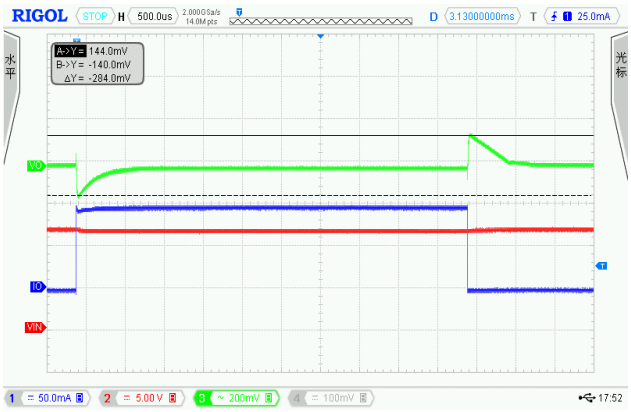
Load Transient

CH1：I_{OUT} CH2：V_{IN} CH3：V_{OUT}

V_{IN}=12V I_{OUT}=1mA to 40mA V_{OUT}=3.3V



V_{IN}=12V I_{OUT}=1mA to 100mA V_{OUT}=3.3V



APPLICATION INFORMATION

INPUT CAPACITOR

An input capacitor of 10µF is required between the VIN and GND pin. The capacitor shall be placed as close as possible to VIN pin, and the use of electrolytic capacitors is recommended. The tolerance and temperature coefficient must be considered in order to ensure the capacitor work within the operation range over the full range of temperature and operating conditions.

OUTPUT CAPACITOR

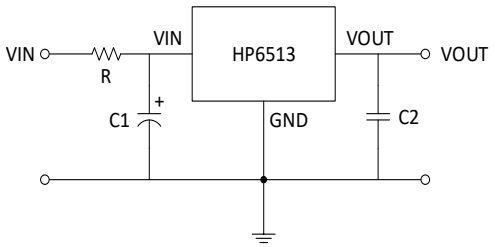
In applications, it is important to select the output capacitor for stable operation. The minimum capacitance for stable and correct operation is 1µF. The capacitance tolerance should be ±30% or better over the operation temperature range. The recommended capacitor type is MLCC.

NO-LOAD STABILITY

The HP6513 will remain stable and in regulation with no external load. This is especially important in CMOS RAM keep-alive applications.

TYPICAL CIRCUIT

The following figure shows a typical application circuit for the HP6513 devices. The value of external components shall be chosen carefully, depending on the application. In plugging application, because the overshoot caused by the insertion and withdrawal of power on the chip may damage the chip, it is recommended that VIN be less than 30V and the input voltage spike should not exceed 45V.



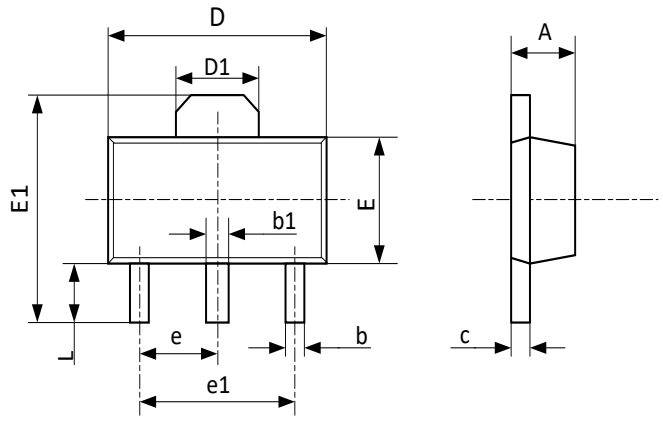
In plugging application, it is suggested that R, C1 are selected as following:

1. C1=10µF ~ 100µF electrolytic capacitor with maximum voltage greater than 50V, R=0
2. C1=1µF ~ 10µF MLCC with maximum voltage greater than 50V and R=2Ω in the type of 1206 – the resistor shall be carefully chosen to make sure enough margin to sustain the surge current during plugging.

PACKAGE OUTLINE

Package	SOT89-3L	Devices per reel	1000Pcs	Unit	mm

Package Dimension：

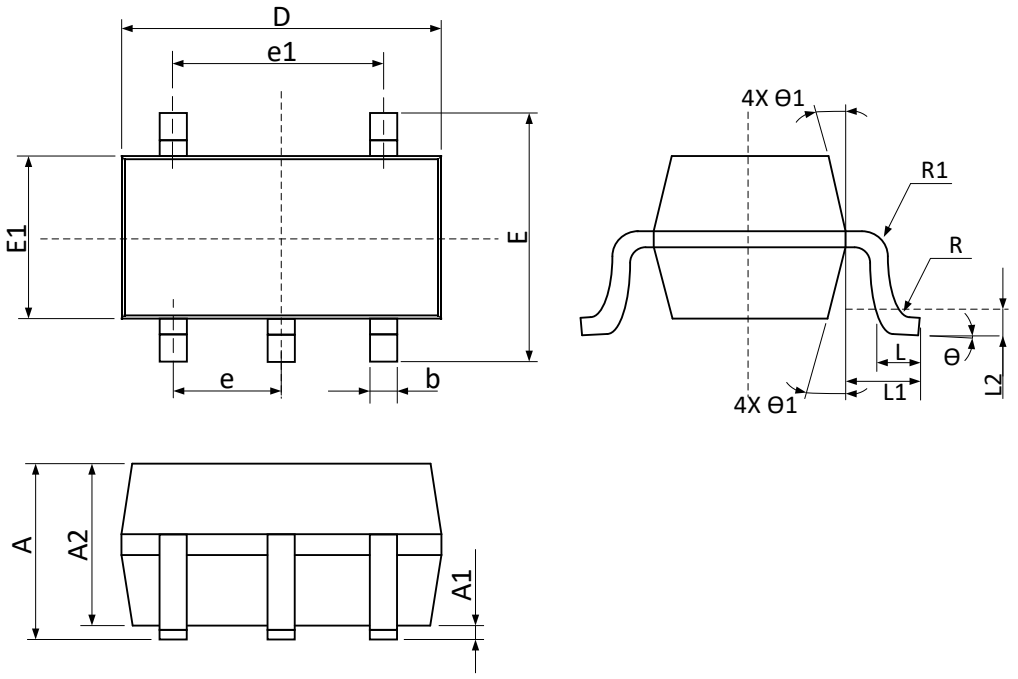


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.350	0.520	0.013	0.197
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.350	2.550	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.100	0.035	0.047

PACKAGE OUTLINE

Package	SOT23-5L	Devices per reel	3000Pcs	Unit	mm

Package Dimension：

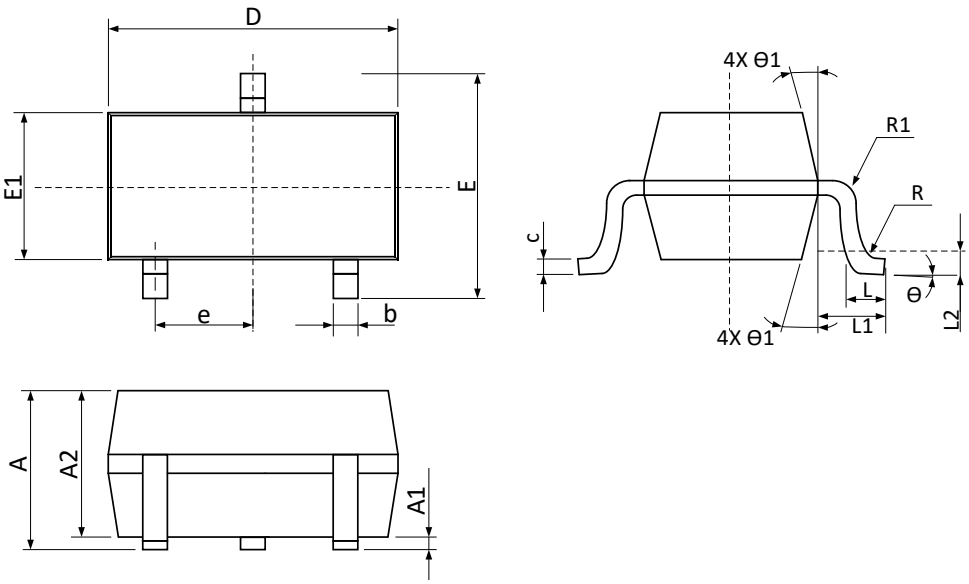


DIMENSIONS IN MILLIMETERS			
SYMBOL	**MINIMUM**	**NOMINAL**	**MAXIMUM**
A	-	-	1.35
A1	0.00	-	0.15
A2	1.00	1.10	1.20
b	0.30	-	0.50
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.30	0.45	0.60
L1	0.60 REF		
L2	0.25 REF		
R	0.10	-	-
R1	0.10	-	0.25
Θ	0°	4°	8°
Θ1	5°	10°	15°

PACKAGE OUTLINE

Package	SOT23-3L	Devices per reel	3000Pcs	Unit	mm

Package Dimension：



DIMENSIONS IN MILLIMETERS			
SYMBOL	**MINIMUM**	**NOMINAL**	**MAXIMUM**
A	-	-	1.35
A1	0.00	-	0.15
A2	1.00	1.10	1.20
b	0.30	-	0.50
c	0.1	-	0.2
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.30	0.45	0.60
L1	0.60 REF		
L2	0.25 REF		
R	0.10	-	-
R1	0.10	-	0.25
Θ	0°	4°	8°
Θ1	5°	10°	15°