SK6055B High PSRR, Low Dropout, 500mA RF LDO

GENERAL DESCRIPTION

The SK6055B series are CMOS-based low-dropout, low-power linear regulators, offering 500mA with low dropout voltage, high ripple rejection, high output accuracy and low supply current.

The SK6055B series consist of an accurate voltage-reference block, an error amplifier, a voltage-setting resistor net, a PMOSFET pass device, a thermal-shutdown circuit, and a current limit circuit with short protection.

The SK6055B series use a type of outstanding CMOS process to minimize the supply current. A low on-resistance PMOS pass device is equipped for lower dropout voltage. The device also possess the EN function to save more energy and extend the battery life.

The SK6055B series are available in DFN1x1-4, DFN1.2x1.2-4,and SOT23-5 package.

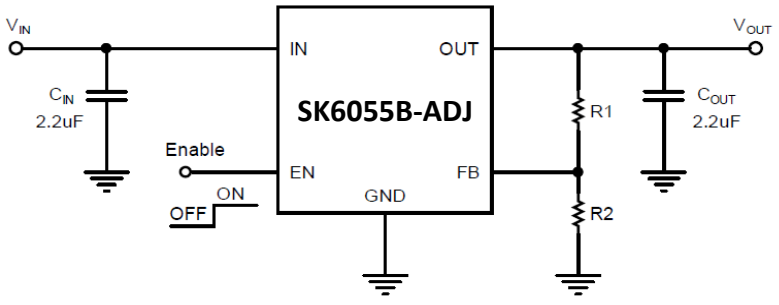
FEATURE

- Wide Input Voltage Range: 1.9V to 5.5V
- Maximum Load Current: 500mA
- Fixed Output Voltage Options: 1.0 ~ 3.6V
- Adjustable Output Voltage Range: 0.8 ~ 5.0V
- High PSRR: 75dB @1KHz
- Ultra Low Dropout: 260mV @ I_{OUT}=500mA, when V_{OUT}=3.3V
- Low IQ: 50μA (typ.)
- Excellent Load / Line Transient
- Built-in Over Current Protection
- Built-in Thermal Shutdown Circuit
- Built-in Inrush Current Suppression Circuit and Current Limit
- With Auto Discharge

APPLICATIONS

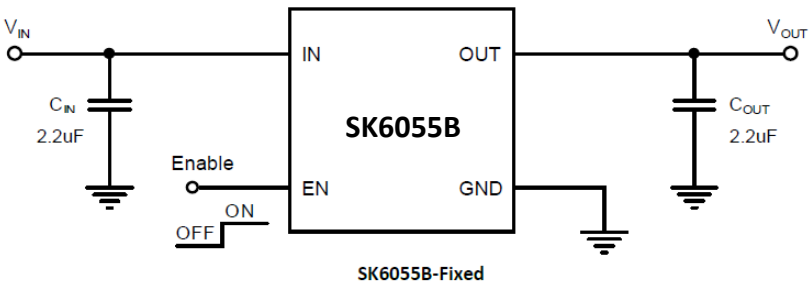
- Smart Phones and Cellular Phones
- MP3/MP4 Player
- Digital Still Cameras
- Portable instruments

TYPICAL APPLICATION CIRCUIT



SK6055B-ADJ

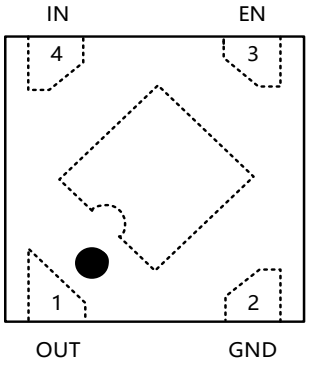
*: V_{OUT}=(1+R1/R2)×0.8V ,R2 recommend 100KΩ ~ 1MΩ.



SK6055B-Fixed

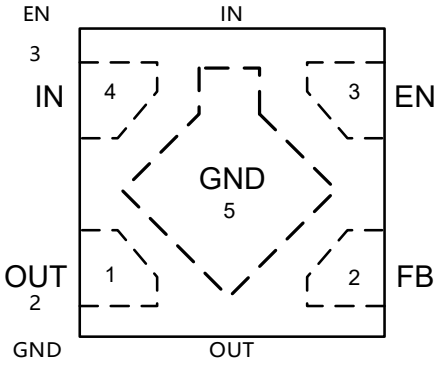
PIN CONFIGURATION

TOP VIEW



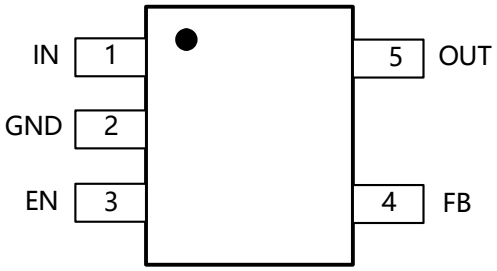
DFN1x1-4

TOP VIEW



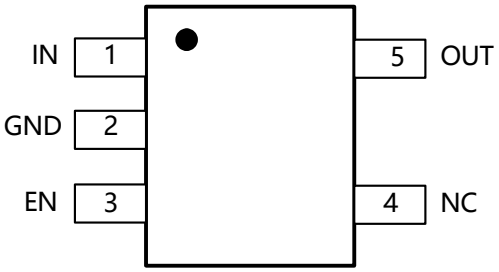
DFN1.2X1.2-4

TOP VIEW



SOT23-5 (ADJ)

TOP VIEW



SOT23-5 (Fixed)

PIN DESCRIPTION

Pin No.			Pin Name	Pin Function
DFN1X1-4	DFN1.2X1.2-4	SOT23-5		
1	1	5	OUT	Output pin.
2	5	2	GND	Ground.
3	3	3	EN	Enable control input, active high.
4	4	1	IN	Supply input pin
/	2	4	FB / NC	Feedback voltage (adjustable voltage version only): $V_{OUT}=V_{FB}*(1+R1/R2)$; or no connection (fixed voltage version only)

ORDERING INFORMATION

Part Number	Package	Temperature	Quantity/ Reel
SK6055BD4-ADJ	DFN1.2x1.2-4	-40 ~ +85℃	3,000
SK6055BS5-ADJ	SOT23-5	-40 ~ +85℃	3,000
SK6055BD4-XX	DFN1x1-4	-40 ~ +85℃	10,000
SK6055BS5-XX	SOT23-5	-40 ~ +85℃	3,000

Note: XX indicates 1.0V~3.6V by 0.1V step. For example, 28 means product outputs 2.8V.

SK6055B devices are Pb-free and RoHS compliant.

ABSOLUTE MAXIMUM RATINGS (Note1)

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage (IN Pin)	6.0	V
V_{EN}	Input Voltage (EN Pin)	-0.3 to 6.0	V
V_{FB}	Input Voltage (FB Pin)	-0.3 to 6.0	V
V_{OUT}	Output Voltage (OUT Pin)	-0.3 to 6.0	V
T_A	Operating Temperature Range	-40 to +150	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C
ESD	HB (ESDA/JEDEC JS-001-2017)	±4.0	kV
	CD (ESDA/JEDEC JS-002-2014)	±1.5	kV
LU	Latch up Current aximum Rating (JESD78E)	±200	mA

Note (1): Stresses above the maximum values listed may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings, exceeding any one of these values may cause irreversible damage to the integrated circuit.

THERMAL INFORMATION

Symbol	Package	Ratings	Value	Unit
$R\theta_{JA}$	DFN1×1-4	Thermal Characteristics, Thermal Resistance, Junction-to-Air	250	°C/W
	DFN1.2×1.2-4		180	°C/W
	SOT23-5		250	°C/W

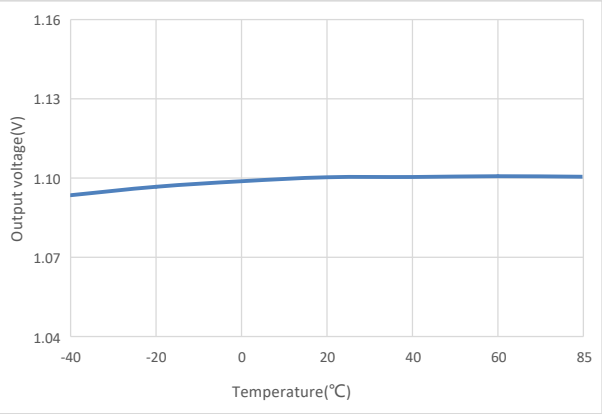
ELECTRICAL CHARACTERISTICS

V_{IN}= V_{SET}+1V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 2.2μF, T_A = 25 °C, unless specified otherwise.

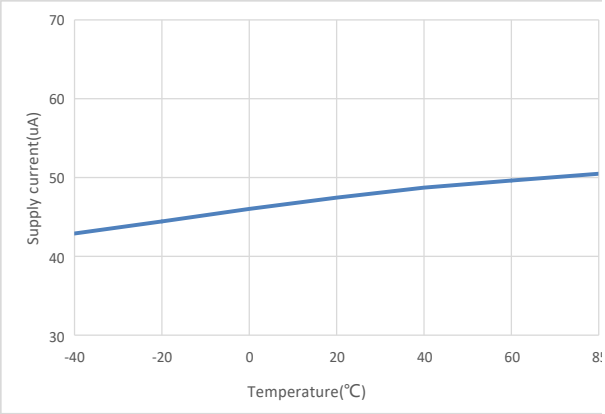
Symbol	Item	Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage		1.9		5.5	V
V_{OUT}	Output Voltage		×0.98		×1.02	V
V_{FB}	FB Voltage	T_A = 25°C	0.784	0.800	0.818	V
		T_A = -40°C ~ 85°C	0.776	0.800	0.824	V
ΔV_{OUT} /ΔI_{OUT}	Load Regulation	V_{IN} = V_{SET} + 1V, 1mA ≤ I_{OUT} ≤ 0.5A		20	50	mV
V_{DIF}	Dropout Voltage	1.0V ≤ V_{SET} < 1.6V, I_{OUT} = 0.5A, V_{OUT} dropping to 0.98×V_{SET}			900	mV
		1.7V ≤ V_{SET} < 2.6V, I_{OUT} = 0.5A, V_{OUT} dropping to 0.98×V_{SET}		350	500	mV
		2.6 ≤ V_{SET} < 3.6V, I_{OUT} = 0.5A, V_{OUT} dropping to 0.98×V_{SET}		260	400	mV
I_{SS}	Supply Current	I_{OUT} = 0mA		50	85	μA
$I_{Standby}$	Standby Current	V_{EN} = 0V		0	1	μA
ΔV_{OUT} /ΔV_{IN}	Line Regulation	V_{SET} + 0.5V ≤ V_{IN} ≤ 5.5V (V_{IN} ≥ 1.4V)		0.02		%/V
PSRR	Power Supply Rejection Ratio	f = 1kHz, Ripple 0.2Vp-p, V_{IN} = V_{SET} + 1.0V, I_{OUT} = 30mA		75		dB
I_{LI}	Output Current Limit	V_{IN} = V_{SET}+1V		700	1200	mA
I_{Short}	Short Current Limit	V_{OUT} = 0V		150	240	mA
R_{PD}	EN Pull-down Resistance			1		Ω
V_{IH}	EN Input Voltage High		0.9			V
V_{IL}	EN Input Voltage Low				0.40	V
R_{DIS}	Auto-discharge Resistance	V_{IN} = 4V, V_{EN} = 0V		80		Ω
T_{TSD}	Thermal Shutdown Temperature			155		°C
T_{TSR}	Thermal Shutdown Released Temperature			130		°C

TYPICAL PERFORMANCE CHARACTERISTICS

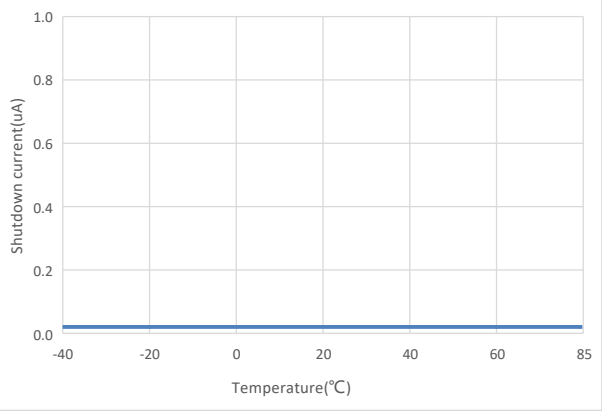
V_{IN} = V_{SET} + 1.0V, V_{SET} = 1.1V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 2.2µF, T_A = 25°C, unless specified otherwise.



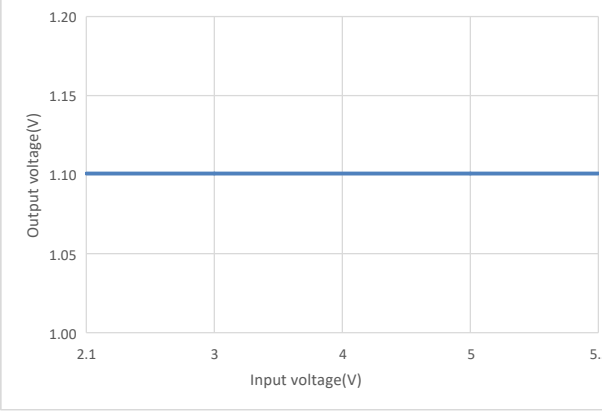
Output Voltage VS Temperature



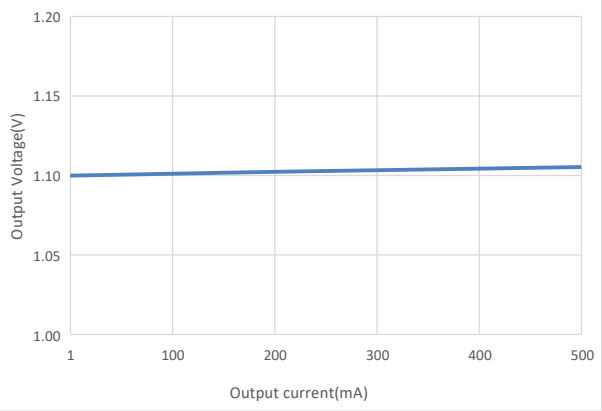
Supply Current VS Temperature



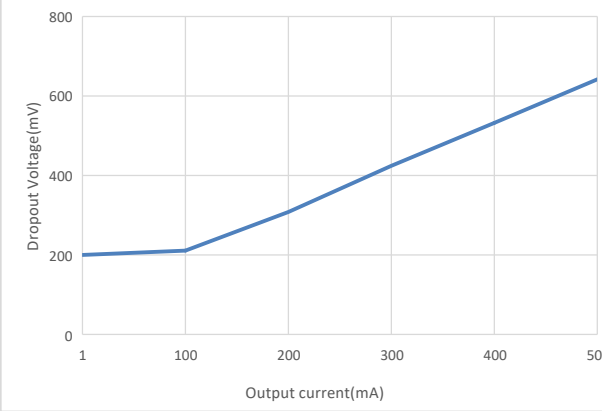
Shutdown Current VS Temperature



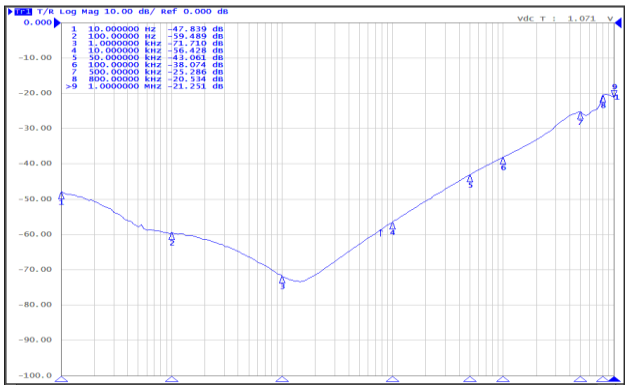
Output Voltage VS Input Voltage



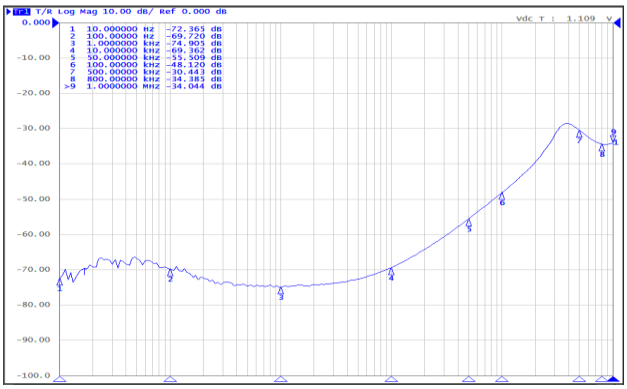
Output Voltage VS Output Current



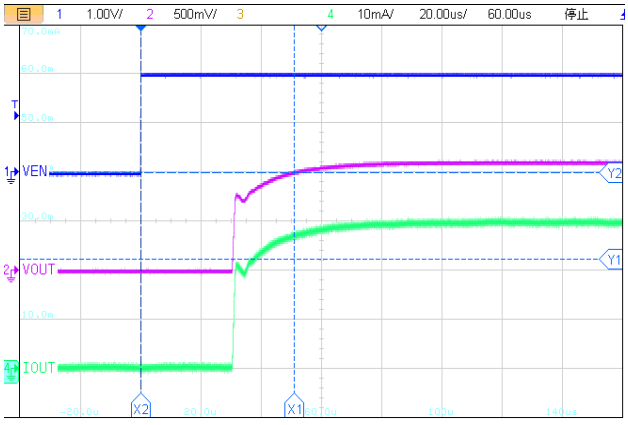
Dropout Voltage VS Output Current



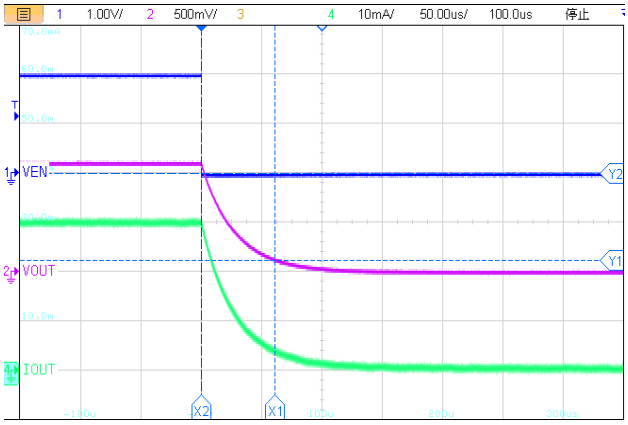
PSRR (I_{OUT}=30mA)



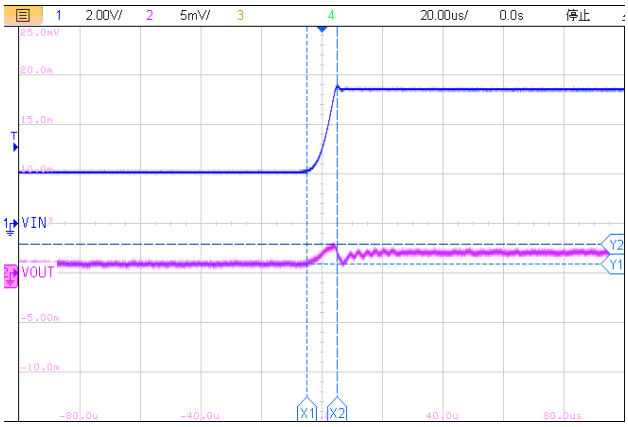
PSRR (I_{OUT}=0.5A)



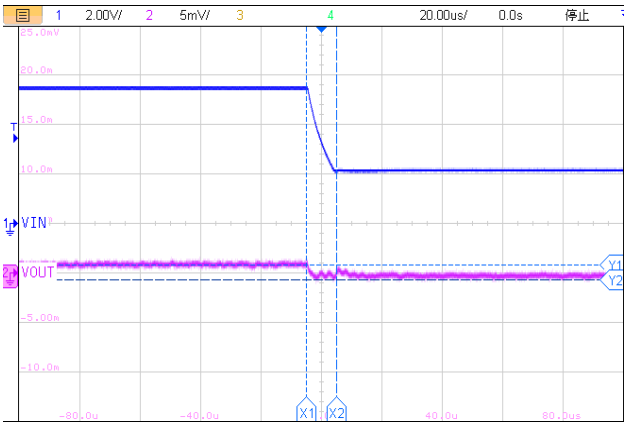
t_{ON}=51us (I_{OUT}=30mA)



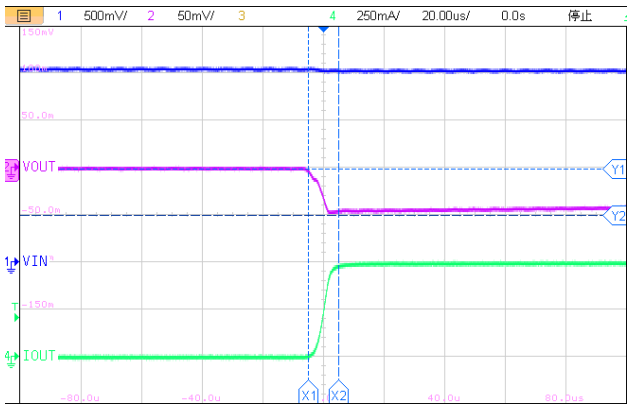
t_{OFF}=61us (I_{OUT}=30mA)



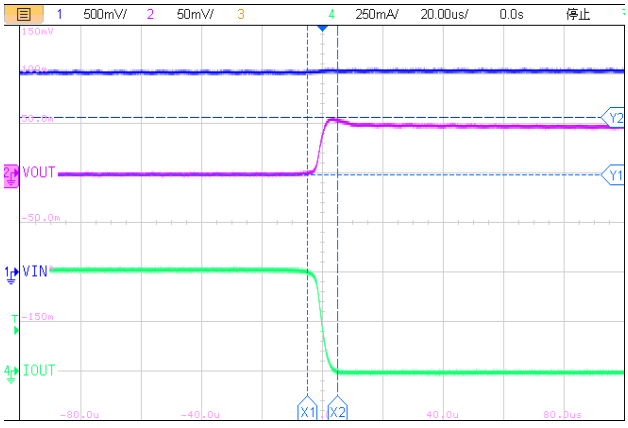
Line transient(2.1~5.5V t=10us ΔV=2mV)



Line transient(5.5~2.1V t=10us ΔV=1.5mV)



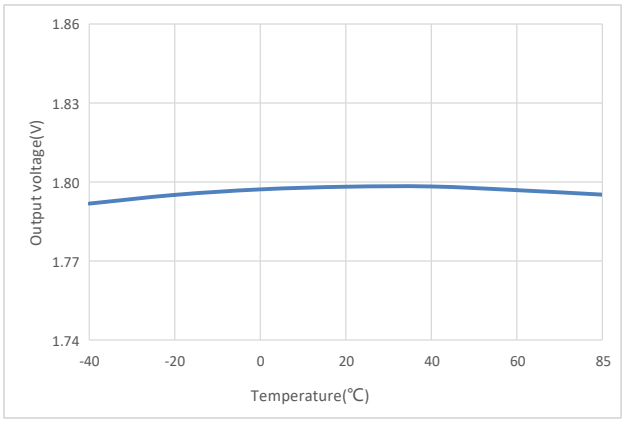
Load transient(1mA~0.5A t=10us ΔV=48.75mV)



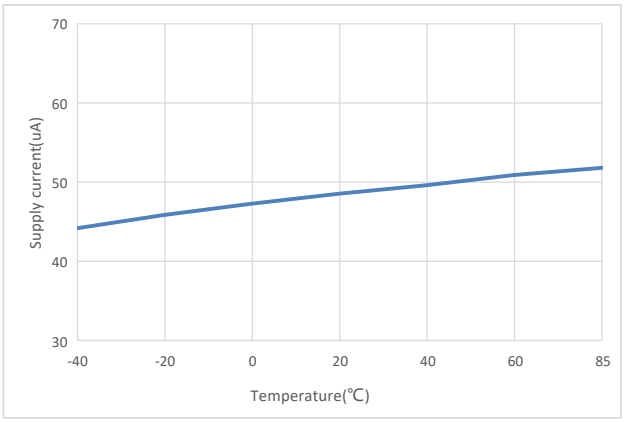
Load transient(0.5A~1mA t=10us ΔV=57.5mV)

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

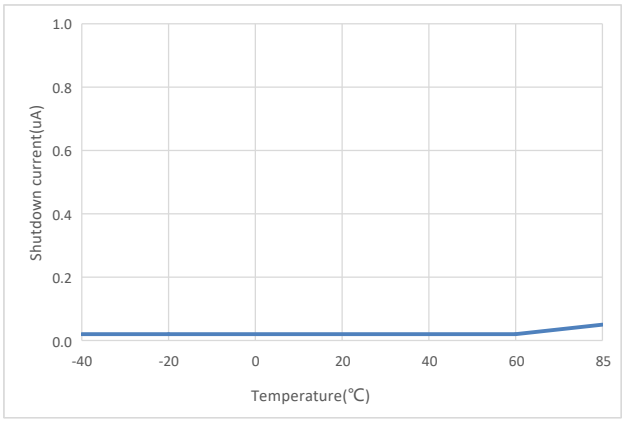
$V_{IN} = V_{SET} + 1.0V$, $V_{SET} = 1.8V$, $I_{OUT} = 1mA$, $C_{IN} = C_{OUT} = 2.2\mu F$, $T_A = 25°C$, unless specified otherwise.



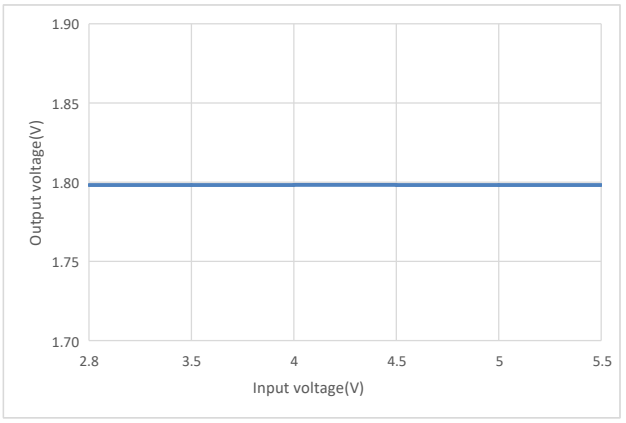
Output Voltage VS Temperature



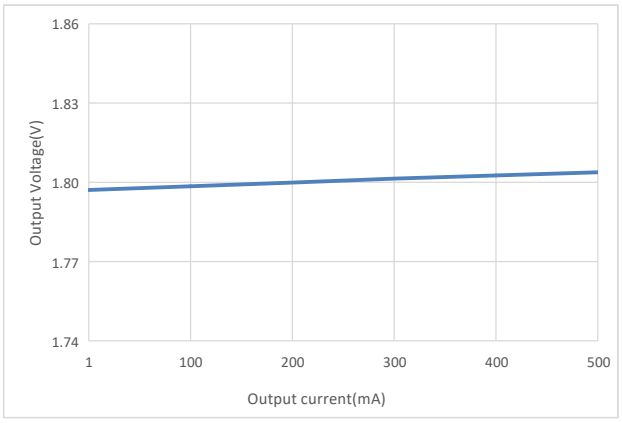
Supply Current VS Temperature



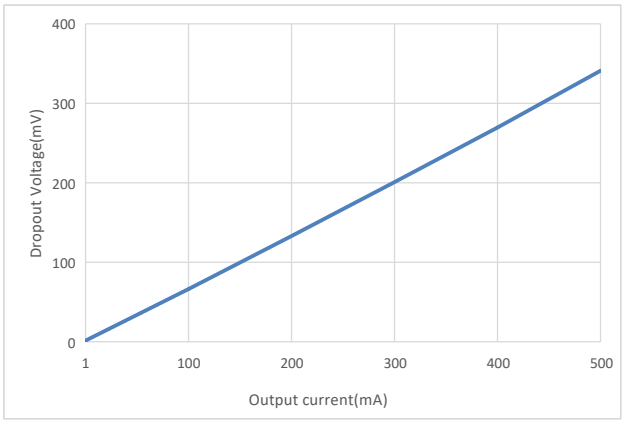
Shutdown Current VS Temperature



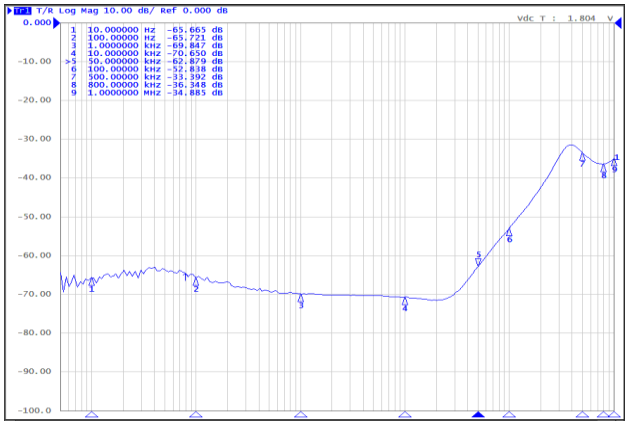
Output Voltage VS Input Voltage



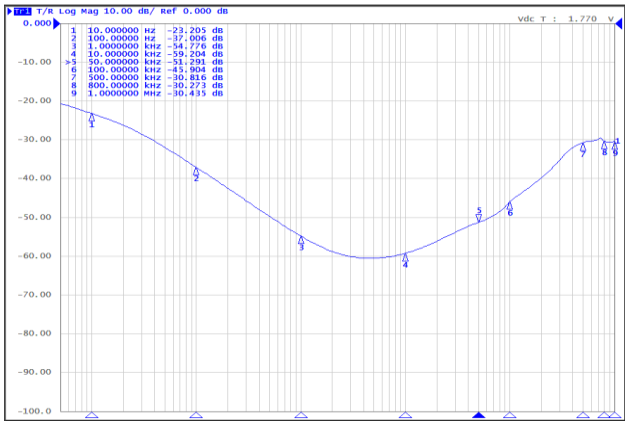
Output Voltage VS Output Current



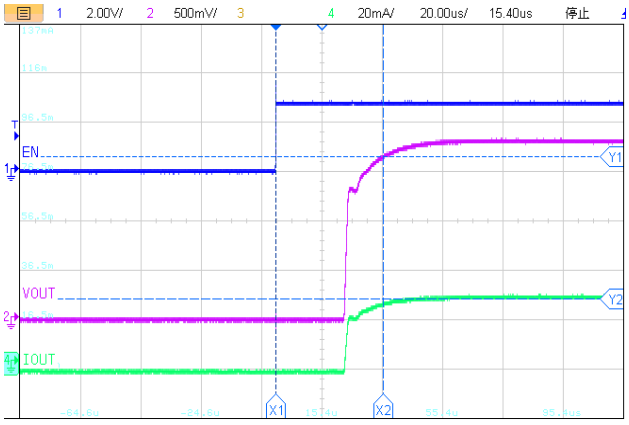
Dropout Voltage VS Output Current



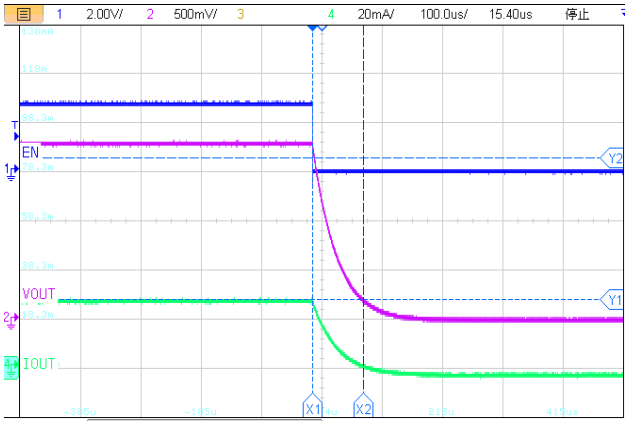
PSRR (I_{OUT}=30mA)



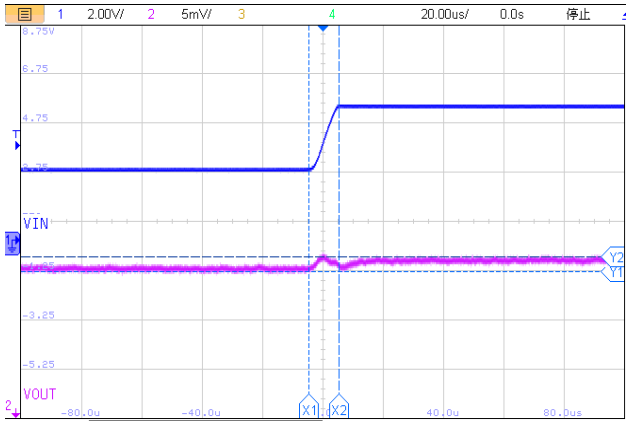
PSRR (I_{OUT}=0.5A)



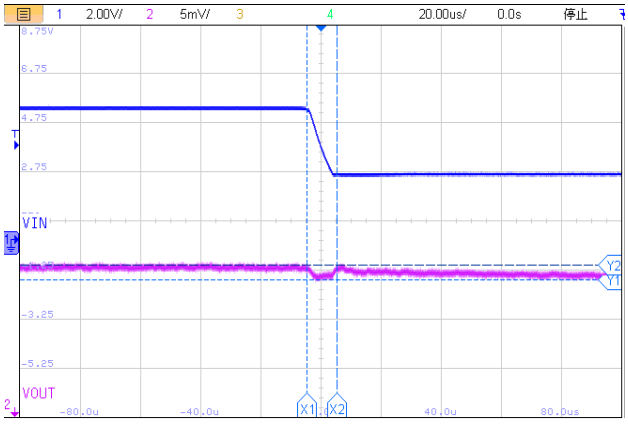
t_{ON}=35.8us(I_{OUT}=30mA)



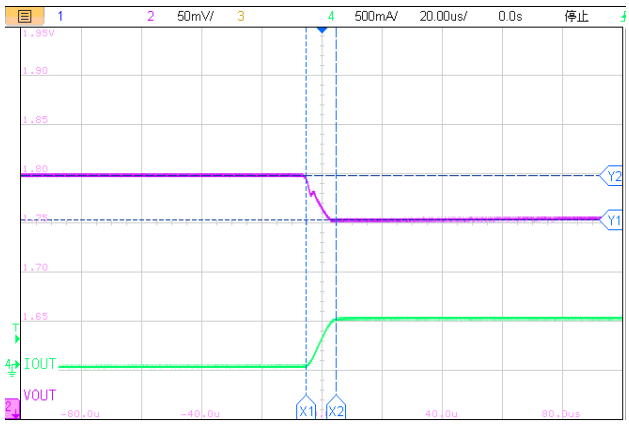
t_{OFF}=84us (I_{OUT}=30mA)



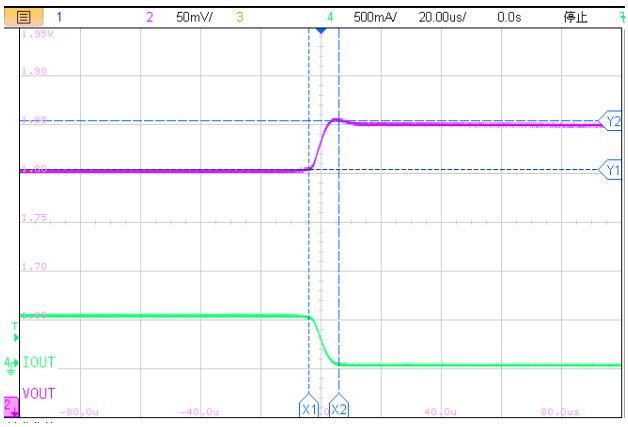
Line transient(2.8~5.5V t=10us ΔV=1.5mV)



Line transient(5.5~2.8V t=10us ΔV=1.5mV)



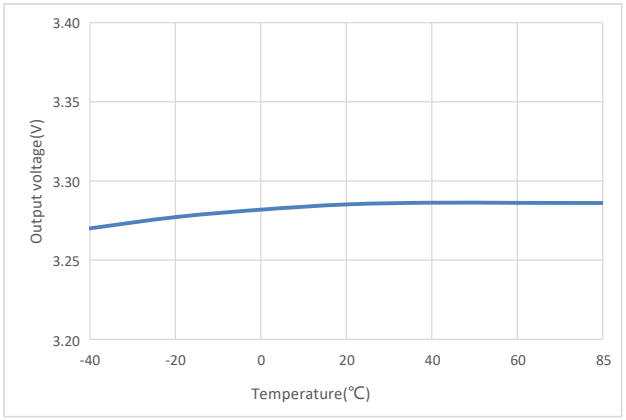
Load transient(1mA~0.5A t=10us ΔV=45mV)



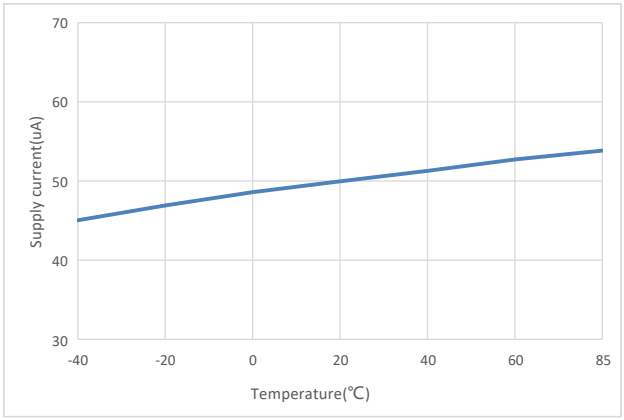
Load transient(0.5A~1mA t=10us ΔV=50mV)

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

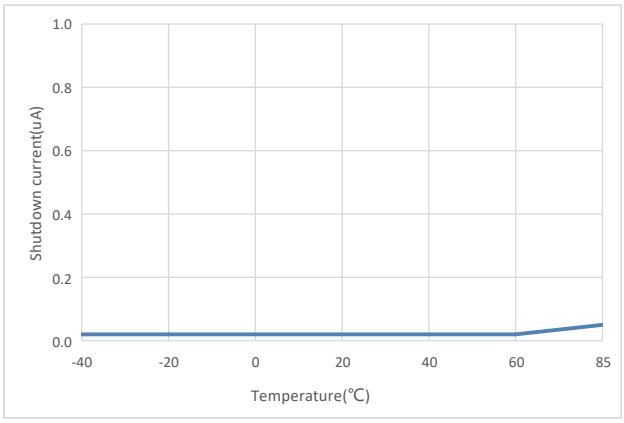
V_{IN} = V_{SET} + 1.0V, V_{SET} = 3.3V, I_{OUT} = 1mA, C_{IN} = C_{OUT} = 2.2µF, T_A = 25°C, unless specified otherwise.



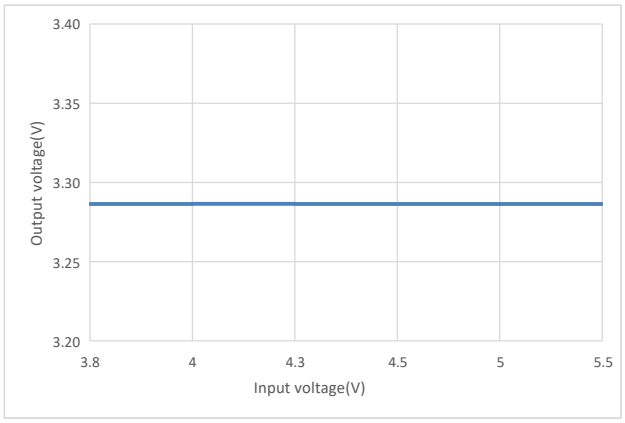
Output Voltage VS Temperature



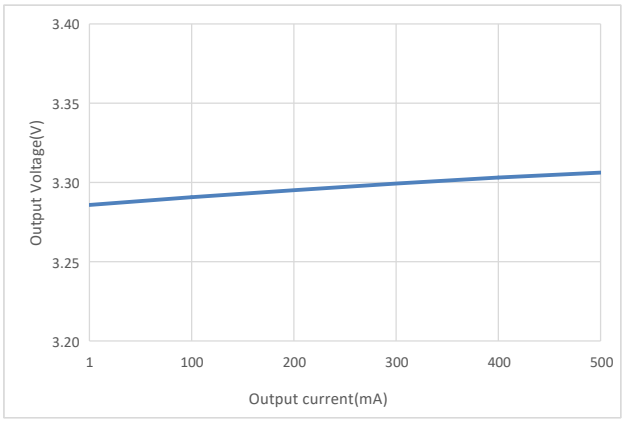
Supply Current VS Temperature



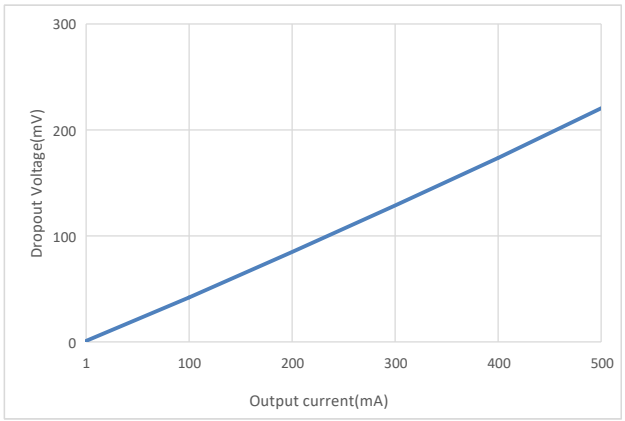
Shutdown Current VS Temperature



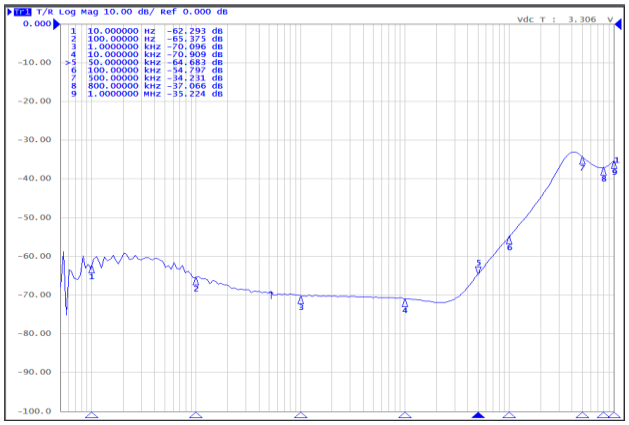
Output Voltage VS Input Voltage



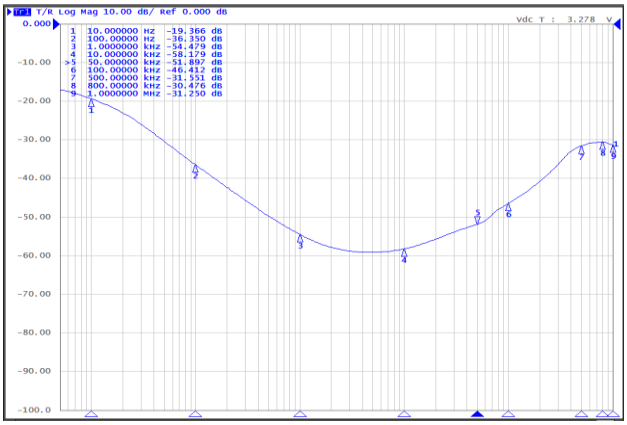
Output Voltage VS Output Current



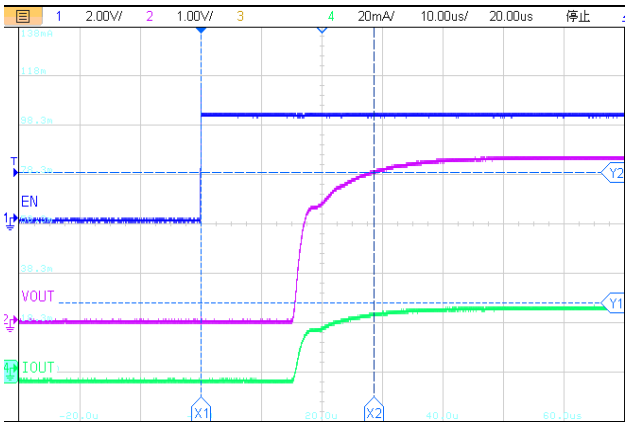
Dropout Voltage VS Output Current



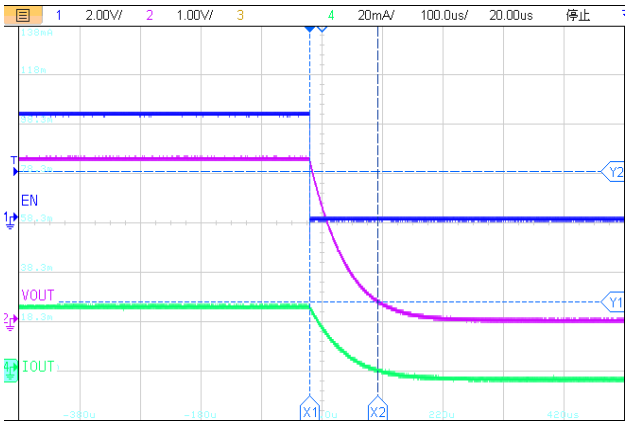
PSRR (I_{OUT}=30mA)



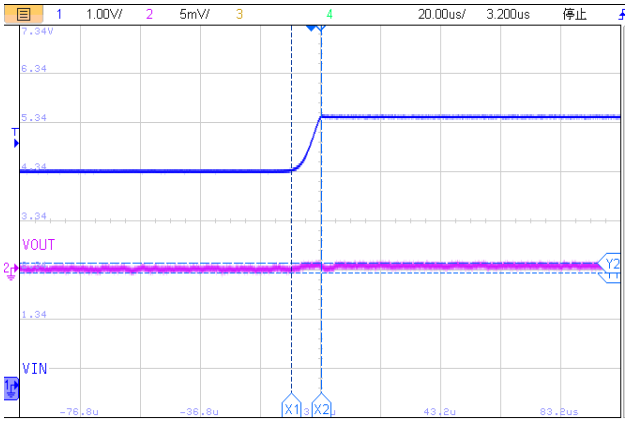
PSRR (I_{OUT}=0.5A)



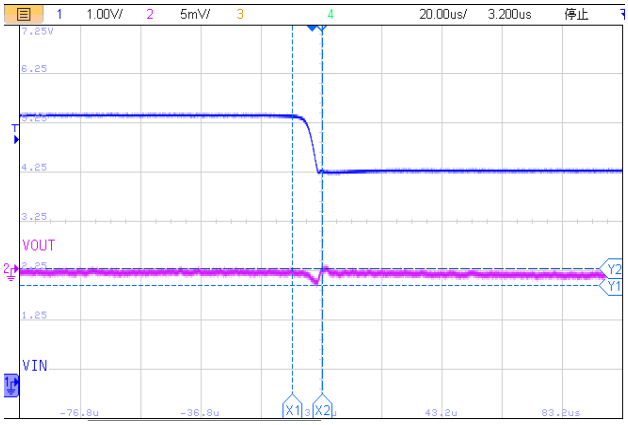
t_{ON}=28.6us (I_{OUT}=30mA)



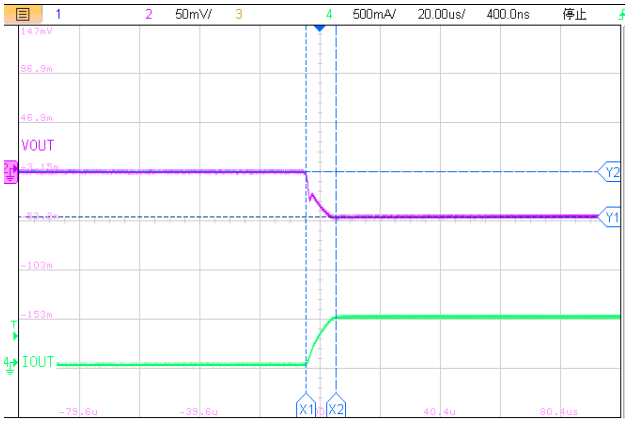
t_{OFF}=112us (I_{OUT}=30mA)



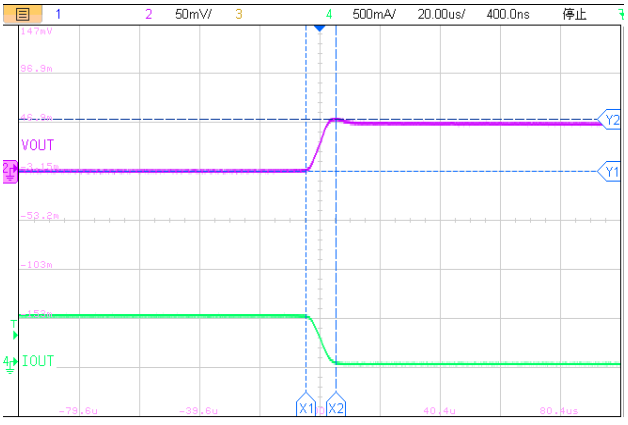
Line transient(4.3~5.5V t=10us æV=1.0mV)



Line transient(5.5~4.3V t=10us æV=1.7mV)

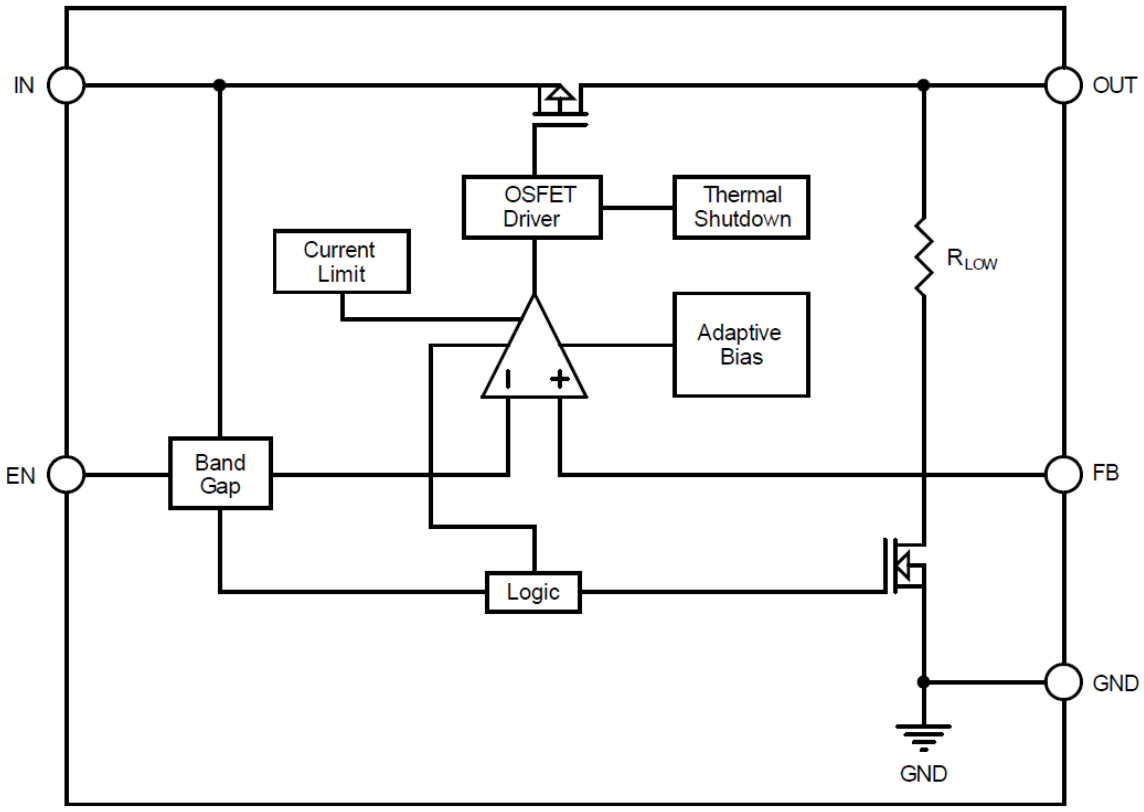


Load transient(1mA~0.5A t=10us ΔV=46.25mV)



Load transient(0.5A~1mA t=10us ΔV=52.5mV)

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Input Capacitor

A 2.2µF capacitor is recommended to connect between IN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both IN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is 2.2µF, ceramic capacitor is recommended, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/ overshoot. Place output capacitor as close as possible to OUT and GND pins.

Enable

The SK6055B is turned on by setting the EN pin to “H”. Since the EN pin is neither pulled down or float, The SK6055B is closed.

Current Limit Protection

When output current of VOUT pin is higher than current limit threshold or the VOUT pin is direct short to GND, the current limit protection will be triggered and clamp the output current at a predesigned level to prevent over-current and thermal damage.

Thermal Shutdown Protection

Thermal protection disables the output when the junction temperature rises to approximately +155°C, allowing to cool down. When the junction temperature reduce to approximately +130°C the output circuit is enabled again. Depending on power dissipation, thermal resistance and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits the heat dissipation of the regulator, protecting it from damage due to overheating.

Auto Discharging

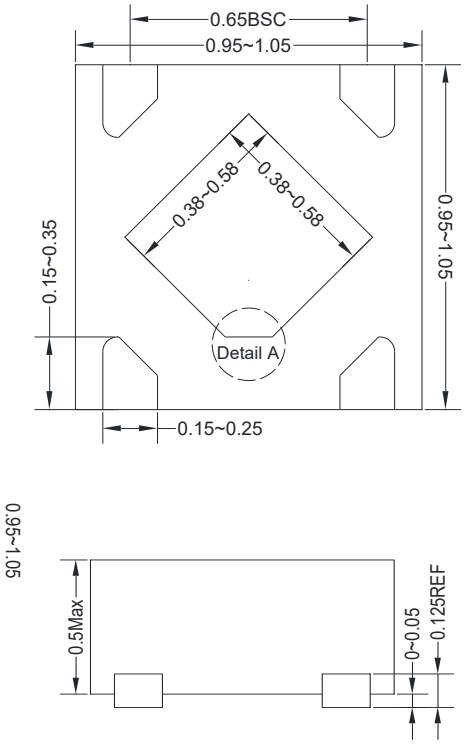
When the EN pin set to “L”, the output circuit will be disable immediately, and the Auto-Discharging circuit will be turned on to discharge the electric charge on output capacitor, and decrease the voltage of VOUT in very short time. The Auto-Discharging function is optional.

Output Voltage

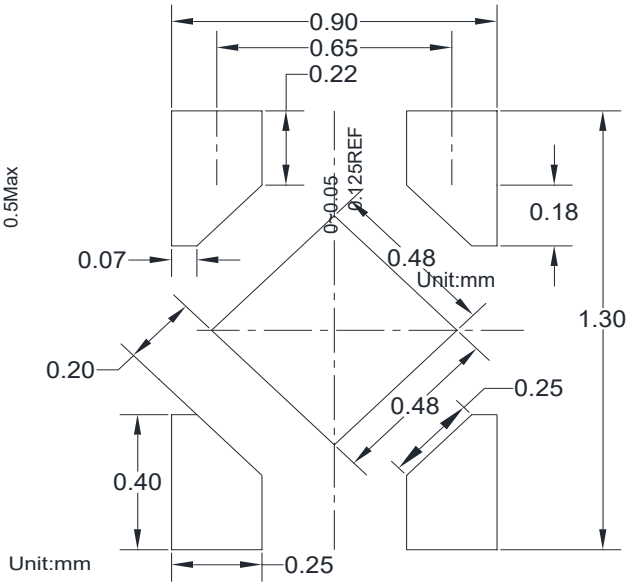
The output voltage is adjustable using external 2 resistors. For better performance of the circuit, the R2 value need to be between 100kΩ and 1 Ω. The output voltage is calculated by:

$$V_{OUT} = (1+R1/R2)\times 0.8\ (V)$$

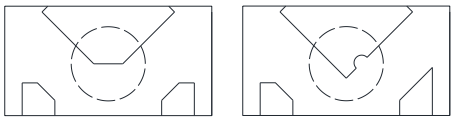
PACKAGE DIMENSIONS: DFN1x1-4



Recommended Land Pattern

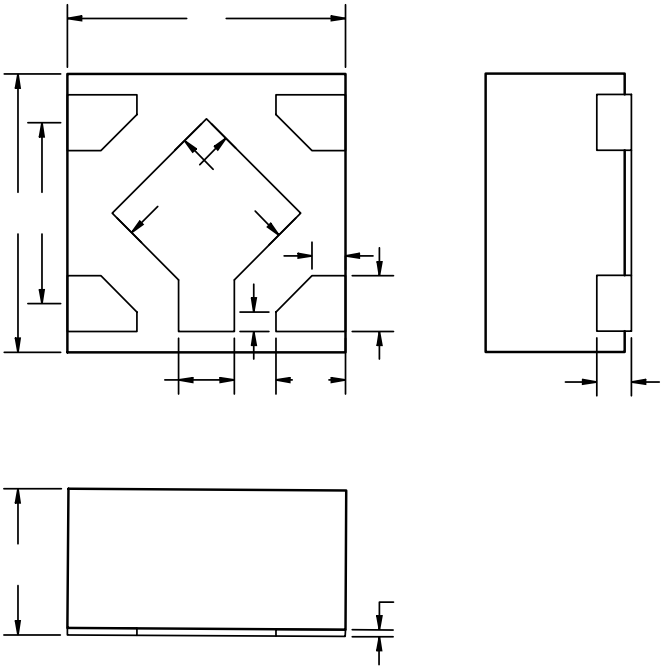


Detail A: (Pin1 shape)



Unit: mm

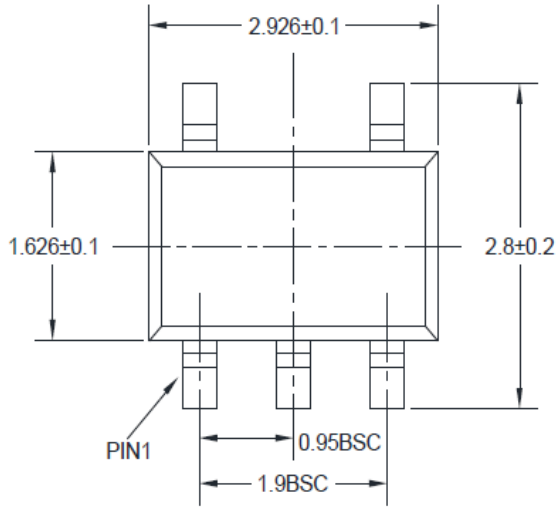
PACKAGE DIMENSIONS: DFN1.2x1.2-4

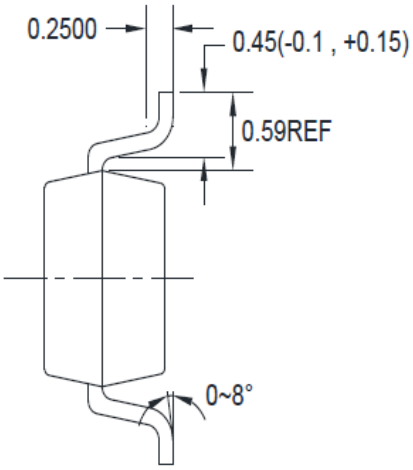


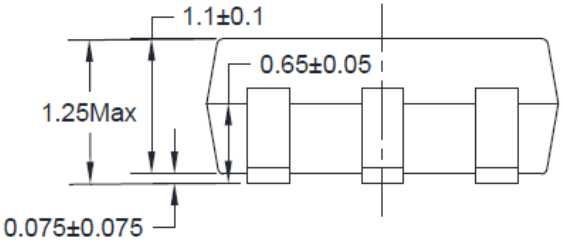
COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

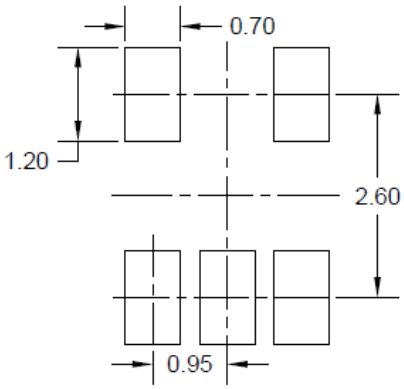
SYMBOL	MIN	NOM	MAX
A	0.35	0.40	0.45
A1		0.13REF	
A2	0.00	0.02	0.05
b	0.25	0.30	0.35
b1		0.12REF	
b2	0.15	0.20	0.25
D	1.15	1.20	1.25
D1	0.58	0.63	0.68
E	1.15	1.20	1.25
E1	0.58	0.63	0.68
e		0.8BSC	
L	0.25	0.30	0.35
L1		0.12REF	

PACKAGE DIMENSIONS: SOT23-5









Recommended Land Pattern

Unit: mm