SK6216H 24V 300mA Ultra-high PSRR LDO

GENERAL DESCRIPTION

SK6216H is a high input voltage and ultra high PSRR 300mA LDO with enable function specifically designed for portable battery-powered applications which require low quiescent current.

The SK6216H is capable of offering an adjustable output voltage from 1.0V~5.0V. The quiescent current consumption of type 50uA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

The SK6216H are available in SOT23-5L, DFN2x2-6L packages.

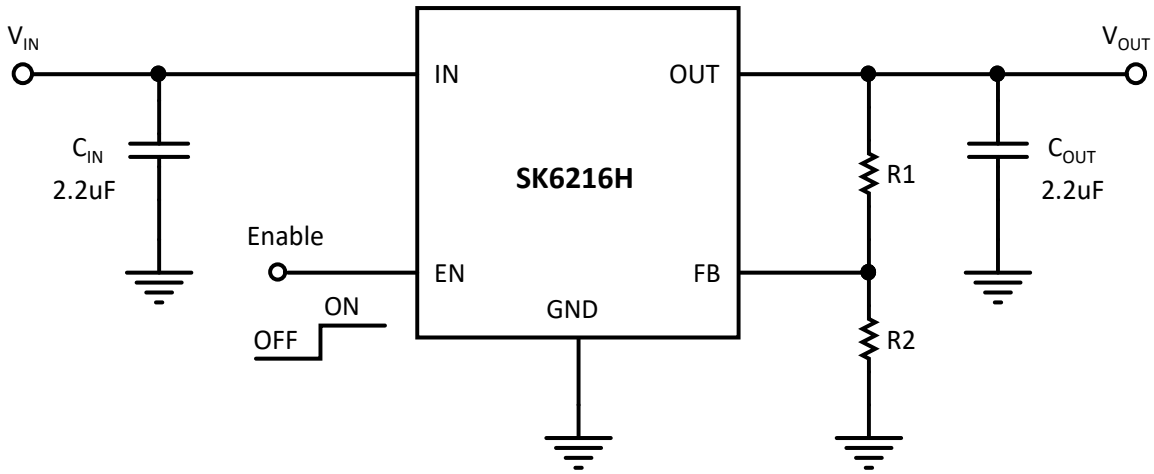
FEATURES

- Input Voltage Range: 3V~24V
- Adjustable Output Range: 1.0V~5.0V
- Maximum Output Current: 300mA
- Ultra High PSRR: 90dB@1KHz
- Dropout Voltage: 270mV@V_{OUT}=3.3V, I_{OUT}=150mA
- Quiescent Current: 50μA Typ.
- Fast Load Transient Response
- Excellent Line Regulation / Load Regulation
- Operating Temperature Range: -40~85°C

APPLICATIONS

- Battery powered equipment
- Voltage regulator for microprocessor
- Voltage regulator for LAN cards
- Wireless communication equipment
- Audio/Video equipment

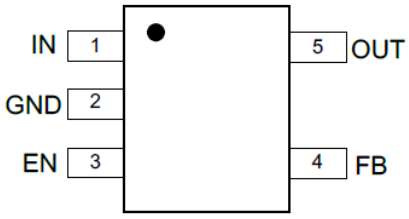
TYPICAL APPLICATION CIRCUIT



Note: V_{OUT}=0.6V*(R1+R2)/R2, and recommended R2=100K~1MΩ.

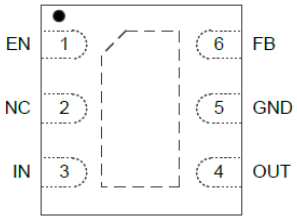
PIN CONFIGURATION

TOP VIEW



SOT23-5L

TOP VIEW



DFN-6L

PIN DESCRIPTION

Pin No.		Pin Name	Pin Function
SOT23-5	DFN2x2-6		
1	3	IN	Supply input pin.
2	5	GND	Ground.
3	1	EN	Enable control input, active high.
4	6	FB	Set the output voltage
5	4	OUT	Output pin.
-	2	NC	No connection

ORDERING INFORMATION

PART NO	PACKAGE	TEMPERATURE	TAPE & REEL
SK6216HS5-ADJ	SOT23-5L	-40 ~ +85℃	3000/REEL
SK6216HD6-ADJ	DFN2x2-6L	-40 ~ +85℃	3000/REEL

ABSOLUTE MAXIMUM RATINGS (Note 1)

Symbol	Rating	Value	Unit
V_{IN}	Input Voltage	-0.3~30	V
V_{OUT}	Output Voltage	-0.3~6	V
V_{EN}	Chip Enable Input	-0.3~30	V
$T_{J(MAX)}$	Maximum Junction Temperature	150	°C
T_{STG}	Storage Temperature	-55~150	°C
ESD (Note 2)	HBM Capability	2000	V
	CDM Capability	1500	V
I_{LU} (Note 3)	Latch up Current Maximum Rating	200	mA

Note (1): Stresses exceeding those listed in the "Absolute Maximum Ratings" table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Note (2): ESD Human Body Model tested per EIA/JESD22-A114, CDM tested per JESD22-C101;

Note (3): Latch up Current Maximum Rating tested per JEDEC78.

THERMAL INFORMATION

Symbol	Ratings	Packages	Value	Unit
$R_{\theta JA}$	Thermal Characteristics, Thermal Resistance, Junction-to-Air	SOT23-5L	312	°C/W
		DNF-6L	125	

RECOMMANDED OPERATING RANGE

SYMBOL	ITEMS	VALUE	UNIT
V_{IN}	Supply Voltage	3 ~ 24	V
I_{OUT}	Output Current	0 ~ 300	mA
C_{IN}	Input Ceramic Capacitor Value	1 ~ 10	uF
C_{OUT}	Output Ceramic Capacitor Value	1 ~ 10	uF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 ~100	mΩ
T_{OPT}	Operating Ambient Temperature	-40 ~ +85	°C

ELECTRICAL CHARACTERISTICS

V_{IN} =V_{OUT}+2V; I_{OUT} = 10mA, C_{IN} = C_{OUT} = 2.2μF, T_A = -40°C ~ 85°C, Typical values are at T_A = +25°C, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Operating Input Voltage(Note 4)		3		24	V
V_{FB}	FB Voltage	T_A = +25°C	0.591	0.600	0.609	V
		-40°C ≤ T_A ≤ 85°C	0.588		0.612	V
$Line_{REG}$	Line Regulation	V_{OUT}+2 ≤ V_{IN} ≤ 24V I_{OUT} = 10mA		0.05	0.20	%/V
V_{DROP}	Dropout Voltage(Note 5) I_{OUT}=300mA	V_{OUT} = 3.3V T_A = +25°C		600	950	mV
	Dropout Voltage(Note 5) I_{OUT}=150mA	V_{OUT} = 3.3V T_A = +25°C		270	450	mV
$V_{LoadREG}$	Load Regulation	1mA ≤ I_{OUT} ≤ 300mA, V_{IN} =V_{OUT}+2V T_A=+25°C			40	mV
$I_{\_LMT}$	Current Limit	V_{IN} =V_{OUT}+2V, T_A = +25°C	300	500		mA
$I_{\_SHORT}$	Short Current Limit	V_{IN} =V_{OUT}+2V, T_A = +25°C		100		mA
I_Q	Quiescent Current	I_{OUT} = 0mA, T_A = +25°C		50	80	μA
I_{Q_OFF}	Standby Current	V_{EN} = 0V, T_A = 25°C		0.1	1	μA
V_{ENH}	EN Pin Threshold Voltage	EN Input Voltage “H”	1.0			V
V_{ENL}	EN Pin Threshold Voltage	EN Input Voltage “L”			0.4	V
I_{EN}	EN Pin Current	V_{EN}=0-24V		1		uA
PSRR	Power Supply Rejection Ratio V_{IN} =V_{OUT}+2V I_{OUT} = 20mA	f = 1 kHz		90		dB
eN	Output Noise Voltage(Note 6)	V_{IN} = V_{OUT}+2V, I_{OUT} = 1mA, f = 10Hz to 100KHz, (V_{OUT} =3.3V) C_{OUT} = 1μF		70		μVrms
R_{DIS}	Output discharge FET Rdson	V_{EN}<V_{IL}(output disable)		100		Ω
T_{SD}	Thermal Shutdown Temperature(Note 6)	Temperature Increasing from T_A=+25°C		155		°C
T_{SDH}	Thermal Shutdown Hysteresis(Note 6)	Temperature Falling from TSD		25		°C

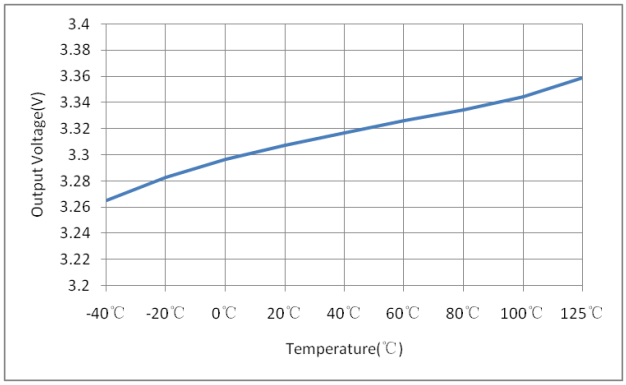
Note (4). The minimum operating voltage is 3V. V_{DROP}=$V_{IN(min)}$-V_{OUT}.

Note (5). V_{DROP} FT test method: test the V_{OUT} voltage at V_{SET}+$V_{DROPMAX}$ with 300mA output current.

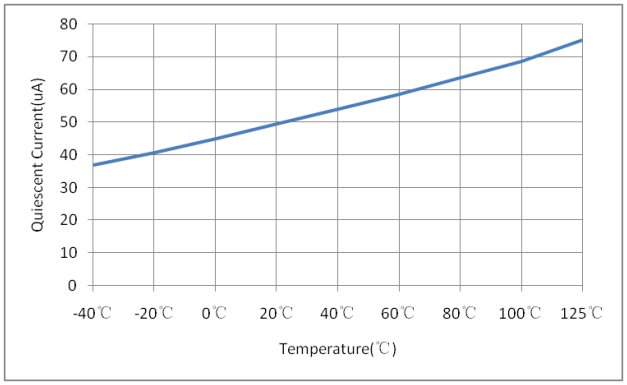
Note (6). Guaranteed by design and characterization. not a FT item.

TYPICAL PERFORMANCE CHARACTERISTICS

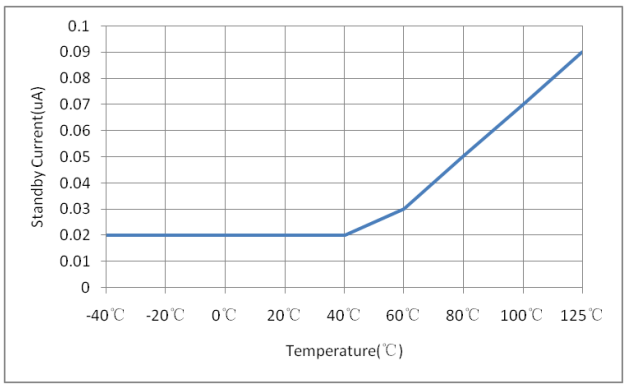
V_{OUT}=3.3V, V_{IN} =V_{OUT}+2V, I_{OUT} = 10mA, R1=200kΩ, R2=900kΩ, C_{IN} = C_{OUT} = 1.0μF. Typical values are at TA = +25°C, unless otherwise noted.



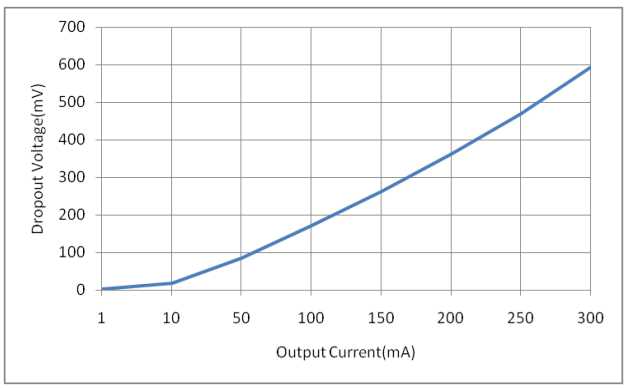
Output Voltage vs. Temperature



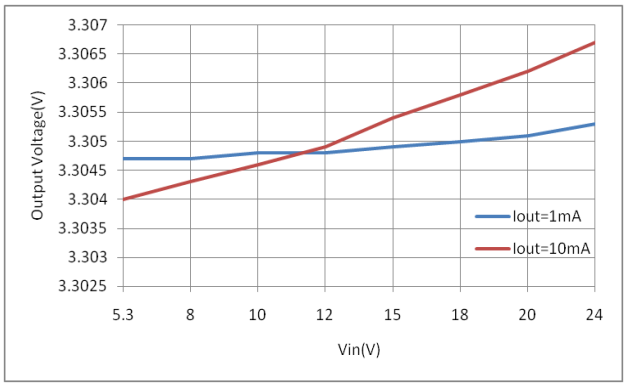
Quiescent Current vs. Temperature



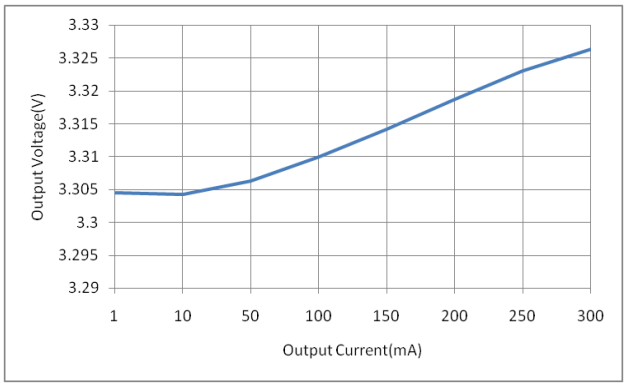
Standby Current vs. Temperature



Dropout Voltage vs. Output Current



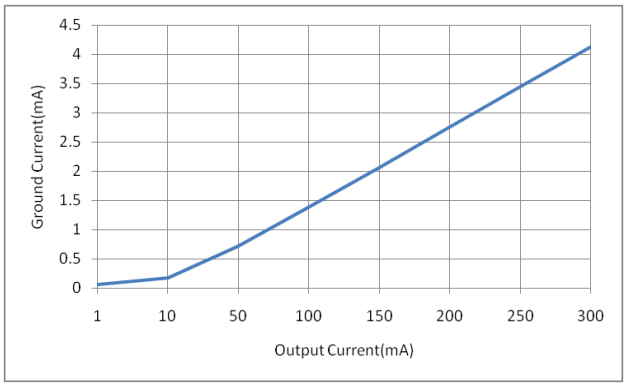
Output Voltage vs. Input Voltage



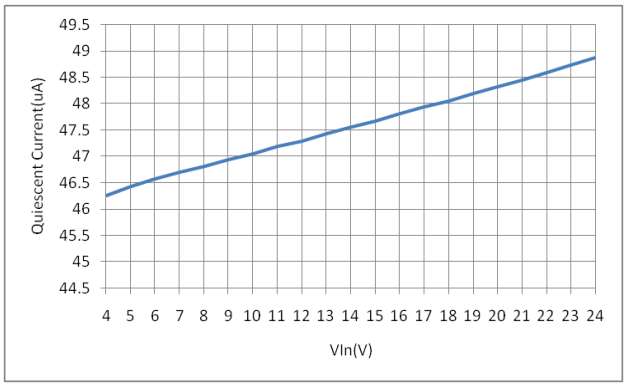
Output Voltage vs. Output Current

TYPICAL PERFORMANCE CHARACTERISTICS(Continued)

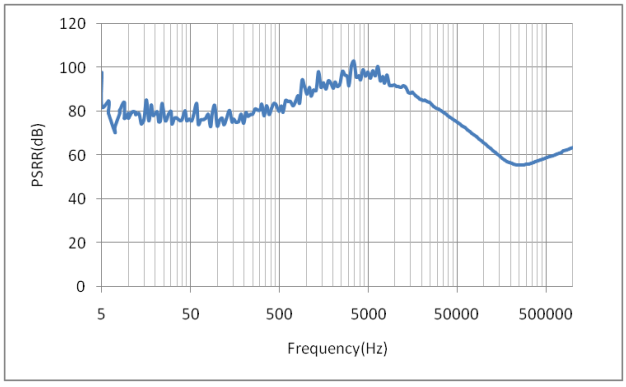
V_{OUT}=3.3V, V_{IN} =V_{OUT}+2V, I_{OUT}= 10mA, R1=200kΩ, R2=900kΩ, C_{IN} = C_{OUT} = 1.0μF. Typical values are at TA = +25°C, unless otherwise noted.



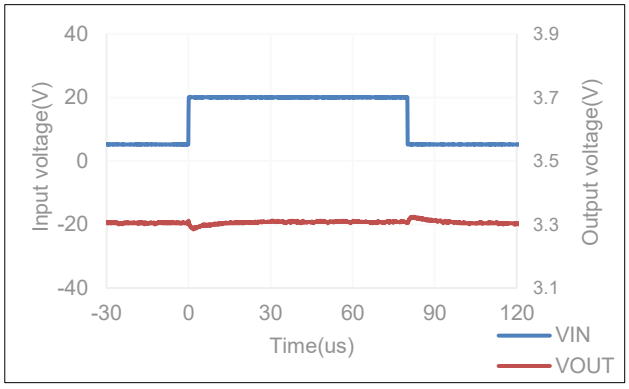
Ground Current vs. Output Current



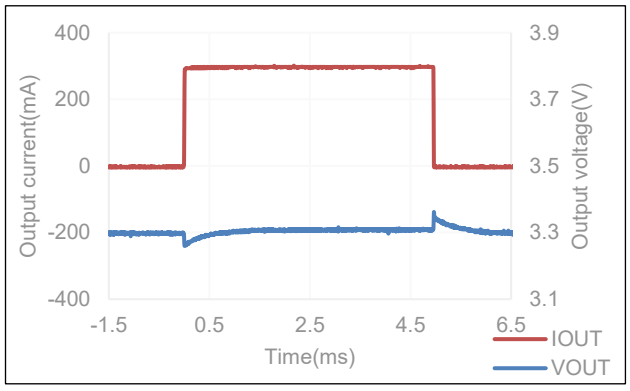
Quiescent Current vs. Input Voltage



PSRR

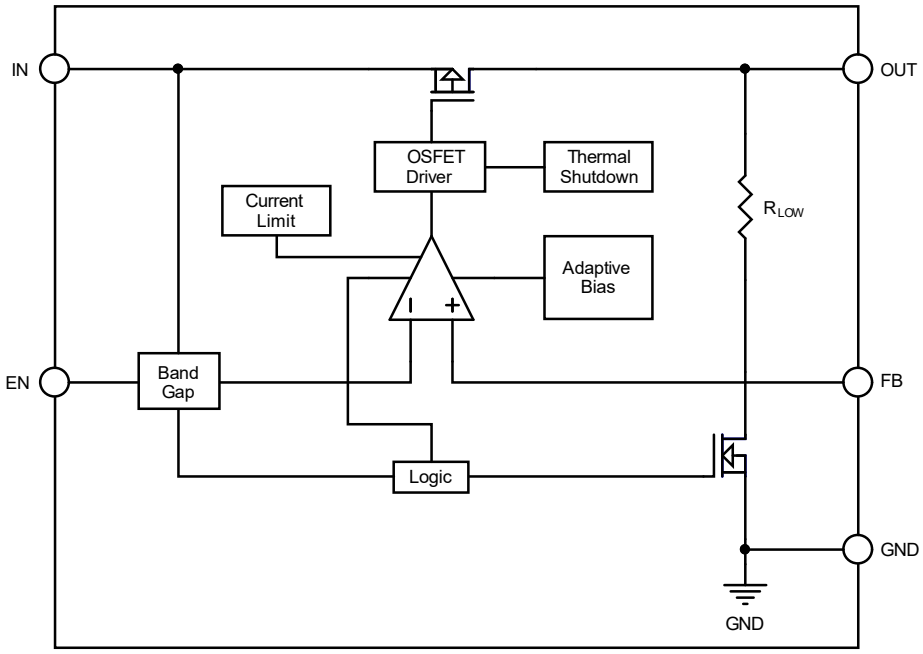


Line-Transient Response (I_{OUT}=20mA)



Load-Transient Response

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Input Capacitor

A 1μF~10uF ceramic capacitor is recommended to connect between VIN 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 VIN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1μF to 10μF, Equivalent Series Resistance (ESR) is from 5mΩ to 100mΩ, 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 SK6216H delivers the output power when it is set to enable state. When it works in disable state, there is no output power and the operation quiescent current is almost zero. The enable pin (EN) is active high.

Dropout Voltage

The SK6216H uses a PMOS pass transistor to achieve low dropout. When (V_{IN} – V_{OUT}) is less than the dropout voltage (V_{DO}), 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_{DO} scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as (V_{IN} – V_{OUT}) approaches dropout operation.

Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 155°C. Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 130°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the LDO from damage as a result of overheating. Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the (V_{IN} – V_{OUT}) voltage and the load current. For reliable operation, limit junction temperature to 150°C maximum.

Thermal Consideration

For continuous operation, do not exceed 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 by the following formula :

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction to ambient thermal resistance.

For recommended operating condition specifications the maximum junction temperature is 150°C and T_A is the ambient temperature. The junction to ambient thermal resistance, θ_{JA} is layout dependent.

The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance θ_{JA}.

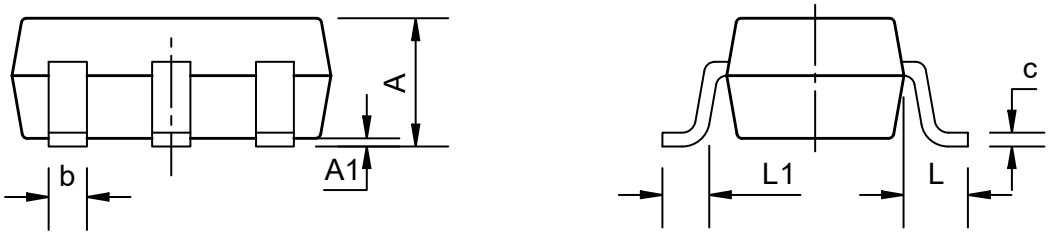
Current- Limit Protection

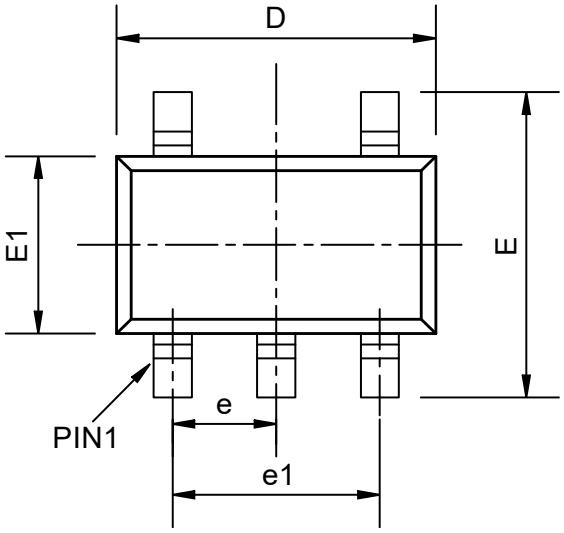
The SK6216H provides current limit function to prevent the device from damages during over-load or shorted-circuit condition. This current is detected by an internal sensing transistor.

PCB Layout Consideration

- Place input and output capacitors as close to the device as possible.
- Use copper planes for device connections in order to optimize thermal performance.
- Place thermal vias around the device to distribute heat.
- Do not place a thermal via directly beneath the thermal pad of the DRV package. A via can wick solder or solder paste away from the thermal pad joint during the soldering process, leading to a compromised solder joint on the thermal pad.

PACKAGE DIMENSIONS: SOT23-5L



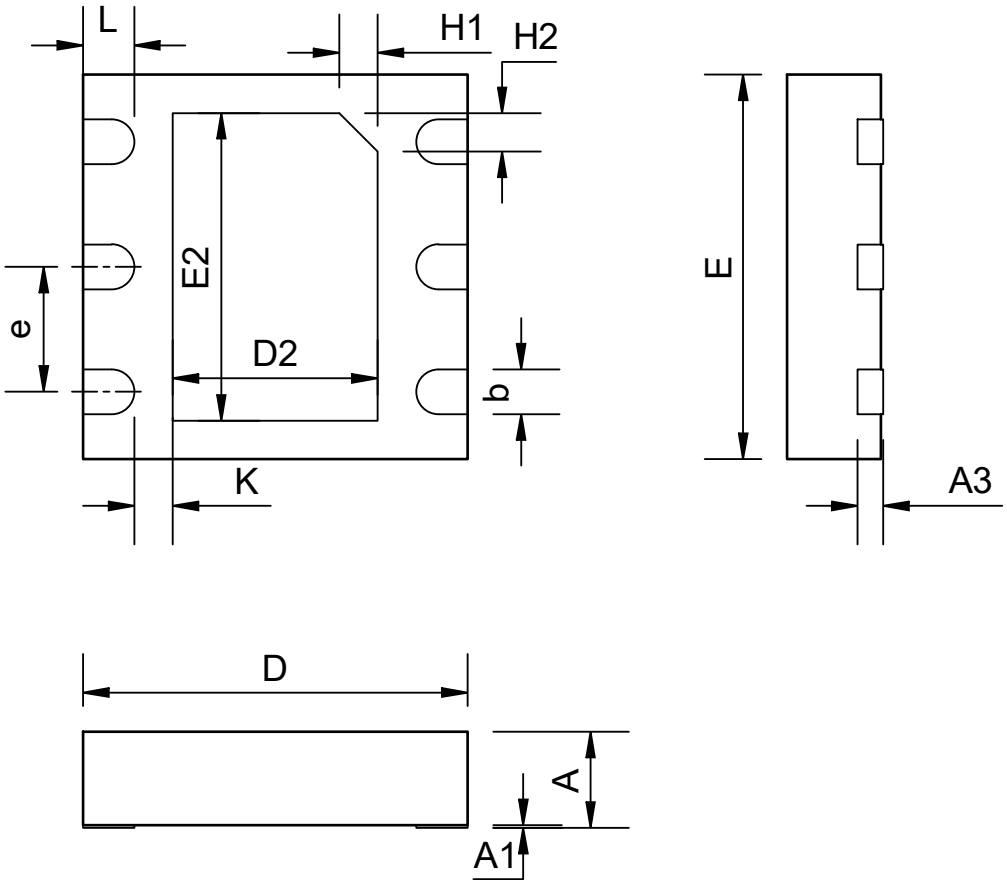


COMMON DIMENSIONS

(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	MAX
A	1.05	1.25
A1	0.03	0.15
b	0.35	0.50
c	0.08	0.20
D	2.82	3.02
E	2.65	3.05
E1	1.50	1.70
e	0.95BSC	
e1	1.80	2.00
L	0.70REF	
L1	0.30	0.60

PACKAGE DIMENSIONS: DFN2x2-6L



COMMON DIMENSIONS

(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	--	0.05
A3	0.18	--	0.25
b	0.25	0.30	0.35
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.90	1.00	1.10
E2	1.50	1.60	1.70
e	0.65BSC		
H1	0.25	0.30	0.35
H2	0.20	0.25	0.30
L	0.20	0.25	0.30
k	0.20	--	--