

Description

AP5056H is a complete single-chip lithium-ion battery constant current/constant voltage linear power management chip. Its MSOP-8/SOP-8 package and minimal peripheral components are very suitable for portable products, and AP5056H is specifically designed for USB power supply specifications. Based on the internal MOSFET structure, there is no need for external sensing resistors and isolation diodes. When the external ambient temperature is too high or working at high power, thermal feedback can adjust the charging current to reduce the chip temperature. The charging voltage is fixed at 4.2V, and the charging current can be set through an external resistor. When the charging current drops to 1/10 of the set value after reaching the final float voltage, AP5056H will automatically terminate the charging cycle.

When the input terminal (adapter or USB power supply) is unplugged, AP5056H automatically enters a low current state, and the battery leakage current will drop below 0.5 μ A. AP5056H can also be set to the shutdown state, reducing the power supply current to 180 μ A.

Other features include: battery temperature monitoring, undervoltage lockout, automatic recharging, and two status pins to display charging and charging termination

- Input voltage up to 20V
- Input overvoltage protection: 6.1V
- Programmable charging current up to 1000mA
- No need for external MOSFETs, sensing resistors, and isolation diodes
- Constant current/constant voltage operation, with thermal regulation function that maximizes charging rate without overheating hazard. Directly manage charging of a single lithium-ion battery from the USB interface
- Pre set charging voltage of 4.2V
- Charging current monitor output for battery level detection
- Automatically recharge
- Charging status dual output, no battery and fault status display
- Terminate charging with 1/10 charging current
- Stop working state current 180 μ A
- 2.9V trickle charging threshold voltage
- Soft start limits surge current
- Battery temperature detection function

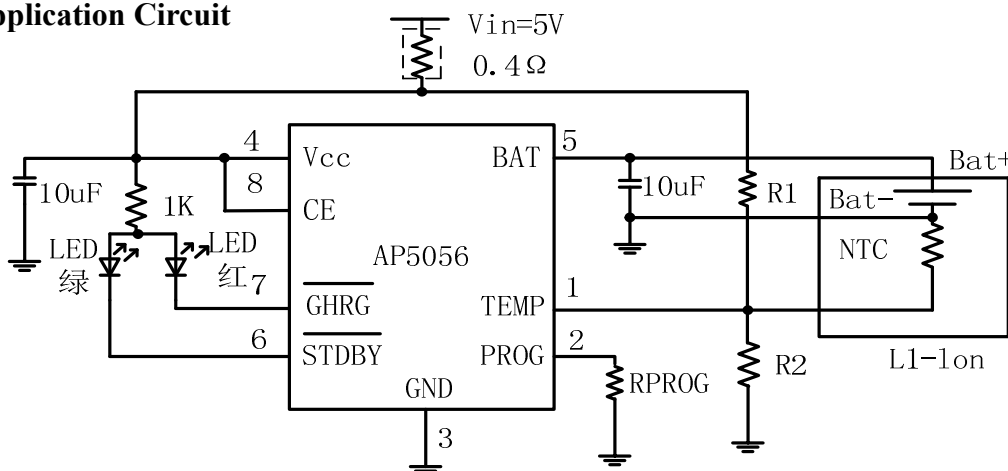
Applications

- Cellular Telephones, PDAs, MP3 /MP4 Players
- Charging Docks and Cradles
- Bluetooth 、GPS Applications

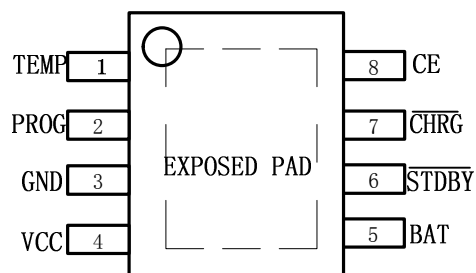
Package

- ESOP-8/MSOP-8

Typical Application Circuit



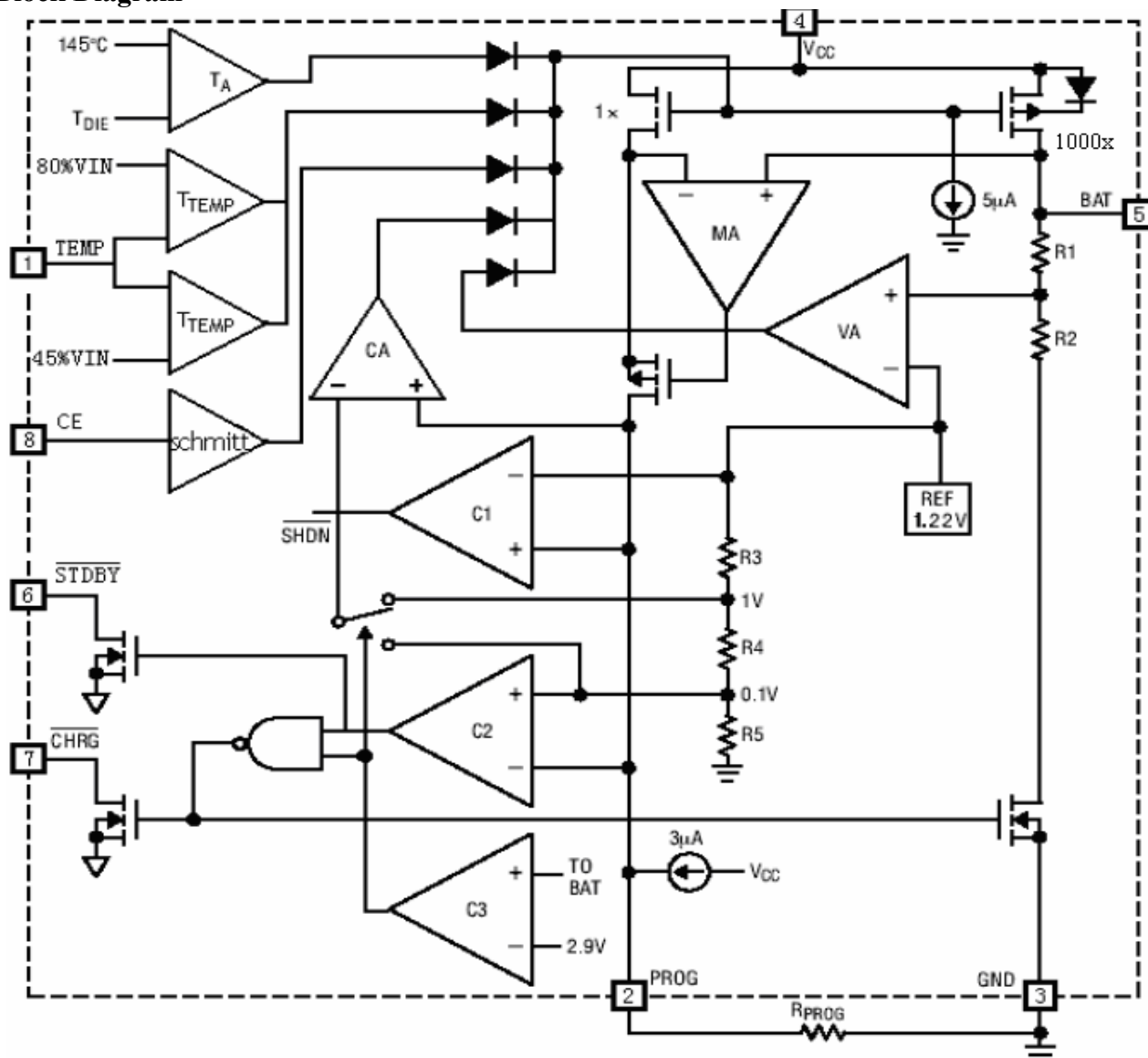
Pin Configuration



Pin Assignment

Pin Number	Pin Name
1	TEMP
2	PROG
3	GND
4	VCC
5	BAT
6	STDBY
7	CHRG
8	CE

Block Diagram



Absolute Maximum Ratings

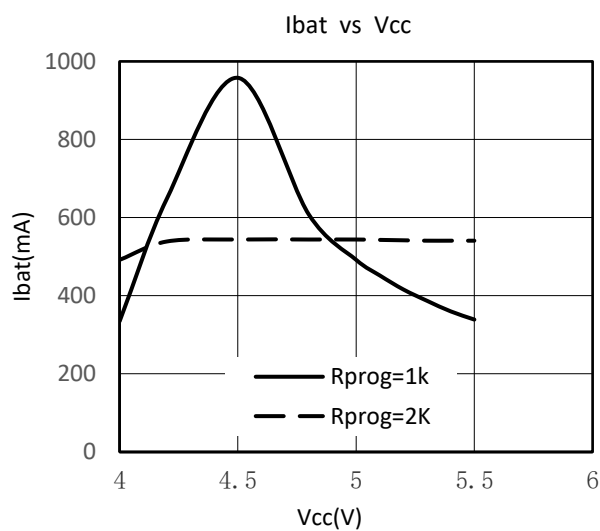
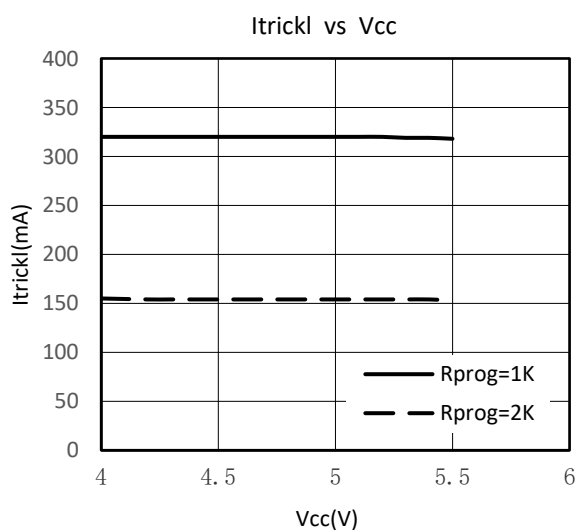
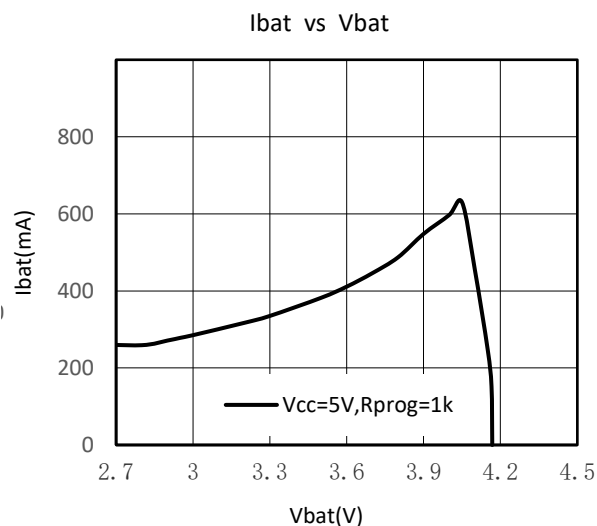
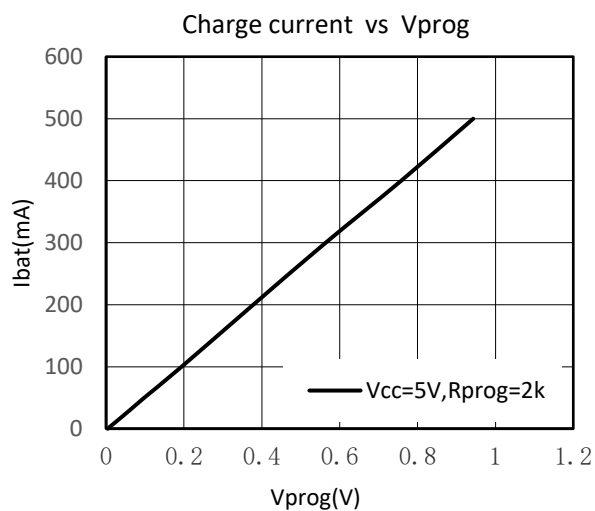
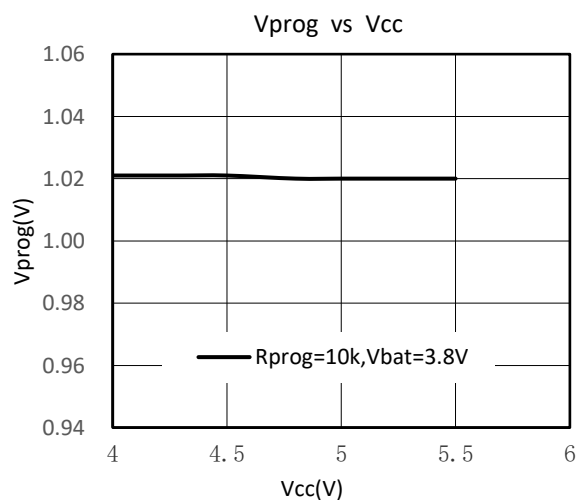
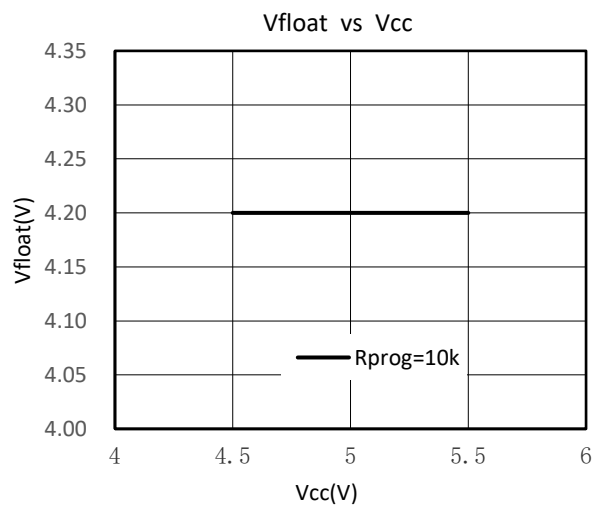
PARAMETER	SYMBOL	MAXIMUM RATING	UNIT
Input Supply Voltage	V_{CC}	$V_{SS}-0.3 \sim V_{SS}+20$	V
CE Voltage	V_{CE}	$V_{SS}-0.3 \sim V_{SS}+5.5+0.3$	
PROG pin Voltage	V_{prog}	$V_{SS}-0.3 \sim V_{CC}+5.5+0.3$	
BAT pin Voltage	V_{bat}	$V_{SS}-0.3 \sim 8$	
CHAG pin Voltage	V_{chrg}	$V_{SS}-0.3 \sim V_{SS}+8$	
BAT pin Current	I_{bat}	1400	mA
PROG pin Current	I_{prog}	1400	μA
Operating Ambient Temperature	T_{opa}	$-40 \sim +85$	$^{\circ}C$
Storage Temperature	T_{str}	$-65 \sim +125$	
Lead Temperature (Soldering, 10s)		260	

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

Electrical Characteristics

Parameter	Symbol	CONDITION	MIN	TYP	MAX	UNIT
Input supply voltage	V _{CC1}		4.25		20	V
Working voltage	V _{CC2}		4.25		5.5	V
Input voltage OVP	V _{OVP}	V _{CC} Rise	5.8	6.1	6.4	V
OVP Delay	V _{OVP-HYS}			0.25		V
Input power supply current	I _{CC}	Charging mode , R _{PROG} =10K		350		μA
		Standby mode		150	500	μA
		Shutdown mode (R _{PROG} Not connected , V _{CC} <V _{BAT} or V _{CC} <V _{UV})		180		μA
Stable output (float charging) voltage	V _{float}	T _A =25°C, I _{BAT} = 40mA	4.16		4.24	V
BAT Pin current	I _{BAT}	R _{PROG} =2k,Current mode	450	500	550	mA
		R _{PROG} =1k,Current mode	900	1000	1150	mA
		standby mode ,V _{BAT} =4.3V	0	-2.5	-6	μA
		Shutdown mode		-1	-2.5	μA
		Sleep mode ,V _{CC} =0V		-0.05	-0.5	μA
Trickle Charge Current	I _{TRIKL}	V _{BAT} <V _{TRIKL} , R _{PROG} =1k	240	300	360	mA
Trickle charging threshold voltage	V _{TRIKL}	R _{PROG} =10K, V _{BAT} Rise	2.78	2.9	3.05	V
Trickle voltage hysteresis voltage	V _{TRHYS}	R _{PROG} =10k	100	180	250	mV
V _{CC} Undervoltage lockout threshold	V _{UV}	V _{CC} From low to high	3.6	3.8	4.05	V
V _{CC} undervoltage locking hysteresis	V _{UVHYS}		150	200	300	mV
V _{CC} -V _{BAT} Lock threshold voltage	V _{ASD}	V _{CC} From low to high	45	170	400	mV
		V _{CC} From high to low	5	100		mV
C/10Termination current threshold	I _{TERM}	R _{PROG} =1k		0.11		mA/mA
		R _{PROG} =2k		0.11		mA/mA
PROGPin voltage	V _{PROG}	R _{PROG} =1k,Current mode	0.9	1.0	1.1	V
CHRG Pin output low voltage	V _{CHRG}	I _{CHRG} =1mA		1.2	1.5	V
STDBY Pin output low voltage	V _{STDBY}	I _{STDBY} =1mA		1.2	1.5	V
Battery recharge threshold voltage	ΔV _{RECG}	V _{FLOAT} - V _{RECHRG}	80	160	280	mV
CE High voltage	V _{CE-H}	AP5056H	1.2			V
CE Low voltage	V _{CE-L}	AP5056H			0.6	V
TEMP Pin high-end flip voltage	V _{TEMP-H}			80	82	%V _{CC}
TEMP Pin low-end flip voltage	V _{TEMP-L}		42	45		%V _{CC}
Junction temperature in limited temperature mode	T _{lim}			145		°C

Typical Performance Characteristics



Pin Function

TEMP (Pin 1): Battery temperature detection input. TEMP pin to receive the battery NTC sensor output. If the TEMP pin voltage is less than the input voltage is greater than 45% or 80% of the input voltage means the battery temperature is too low or too high, then the charge has been suspended.

If the TEMP direct access GND, battery temperature detection canceled, the other charged and functioning properly.

PROG (Pin 2): Charging current setting, monitoring, and turn off pins. Connecting a 1% precision external resistor from the ROG pin to the ground terminal can set the charging current. In the pre charging stage, the voltage of this pin is modulated at 0.3V; During the constant current charging phase, the voltage of this pin is fixed at 1V. In all charging modes, the voltage of the pin can be measured to estimate the charging current according to the following formula:

$$IBAT = (VPROG/RPROG) \cdot 1000$$

The ROG pin can also be used to turn off charging. Disconnecting the programming resistor to ground will allow an internal 3 μ A current to pull up the voltage of the ROG pin. When it reaches the shutdown threshold voltage of 1.21V, the charger enters shutdown mode, charging stops and the input current drops to 180 μ A. This pin is also clamped at approximately 2.4V. Driving this pin with a voltage exceeding the clamp will result in a pulling current of up to 1.5mA. Reconnecting the RPROG to ground will return the charger to normal operating mode.

GND (Pin 3): Ground.

VCC (Pin 4): Input voltage positive input terminal. Provide charging power supply. The VCC voltage range is 4.25V-20V, and the working range is 4.25V-5.5V. A bypass capacitor with at least 10 μ F should be connected. When the voltage difference between the power supply VCC and the BAT pin is less than 30mV, AP5056H enters shutdown mode and IBAT is less than 2 μ A.

BAT (Pin 5): Battery connection end. Provide battery charging current and adjust the final float charging voltage to 4.2V. Set the float voltage from this pin through an internal precision resistor voltage divider, and disconnect it in turn off mode.

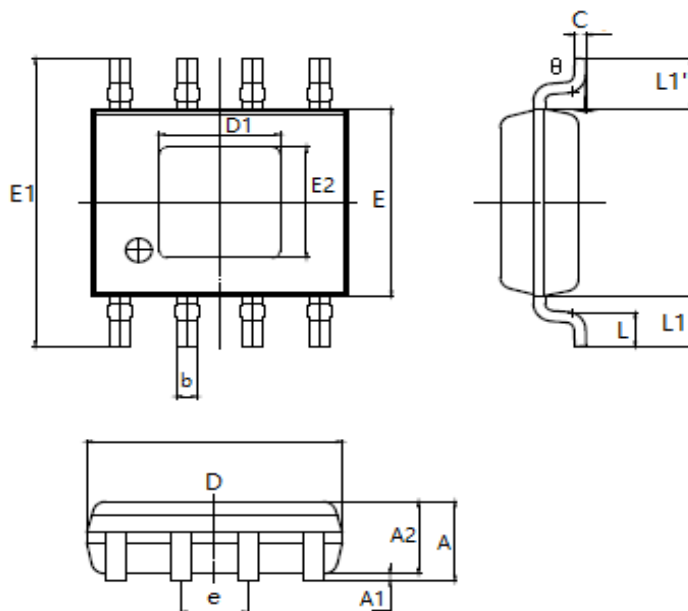
STDBY (Pin 6): Battery charging completion indicator terminal. After the battery is fully charged, STDBY pulls down through the internal switch to indicate that the charging is complete. In addition, the STDBY pin will be in a high impedance state.

CHRG (Pin 7): The charging status indicator terminal for open drain output. When the battery is charging, the CHRG pin is pulled low through the internal N-channel MOSFET, indicating that charging is in progress. Otherwise, the CHRG is in a high resistance state.

CE (Pin 8): The high input level of the chip enables the AP5056H to operate normally. The low input level puts AP5056H in a charging disabled state. The CE pin can be driven by TTL level or CMOS level.

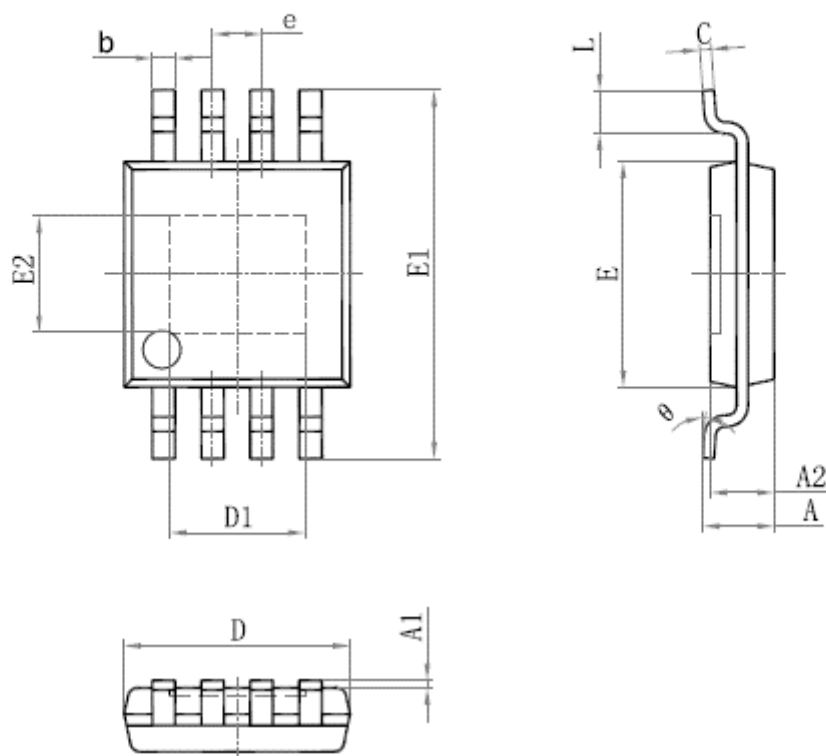
Package Information

ESOP-8



字符	单位 mm		单位 mil	
	最小	最大	最小	最大
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.002	0.006
A2	1.350	1.550	0.053	0.061
b	0.306	0.510	0.012	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
D1	2.170	2.400	0.085	0.094
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.172	2.400	0.090	0.099
e	1.270 ± 0.13		0.050 ± 0.005	
L	0.400	1.270	0.016	0.050
L1	1.025 ± 0.2		0.0404 ± 0.007	
L1- L1'	----	0.12	----	0.005
θ	0°	8°	0°	8°

MSOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
D1	1.700	1.900	0.067	0.075
e	0.65 (BSC)		0.026 (BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
E2	1.450	1.650	0.057	0.065
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

Ordering information

Order Code	Package	Baseqty	Delivery mode
UMW AP5056HSPER	ESOP-8	2500	Tape and Reel
UMW AP5056HMPERB	MSOP-8	4000	Tape and Reel