Features

- Operating Voltage:1.8V to 5.5V
- Built-in N-MOS, 100mΩ(typ) $R_{DS,ON}$
- Quiescent Current: 60μA(typ)
- Shutdown Current <1μA
- Built-in Current Limit
- Built-in Soft-Start.
- Built-in Under Voltage Lock Function
- Built-in Thermal Protection
- TTL Control Input
- SOT-23-5 Package

Applications

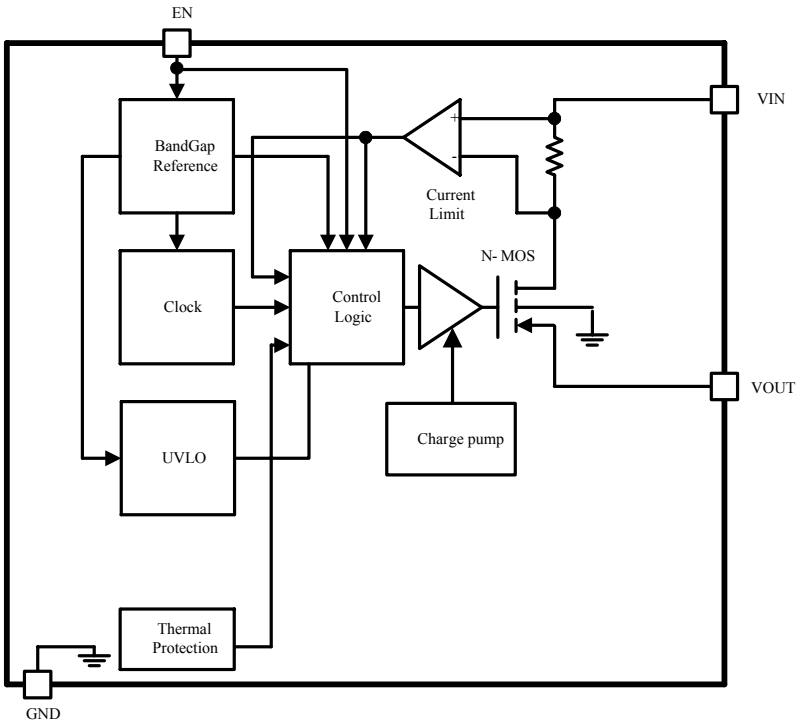
- USB Power Measurement
- Notebook computers
- Battery-Charger Circuits
- Hot Plug-in Power Supplies

General Description

The AT1605 is a smart high-side power switch to be able to supply up 2.0A from input source. The device features preventable reverse current flow from OUT to Input by free of parasitic body diode, when output voltage exceeds the input voltage, the N-MOS is turned off. The AT1605 includes built-in low on-resistance of NMOS to saved conductive loss, charge pump circuitry to drive N-MOS, built-in current limit, soft-start, thermal protection and under voltage lock function. Operating voltage range between 1.8V and 5.5V supports one Li-Ion or adaptor source.

The device is ideal for notebook computer, self-powered and bus powered USB application. The low quiescent current is conducive to saved power consumption. The AT1605 is available in 5-pin SOT-23-5 packages.

Block Diagram



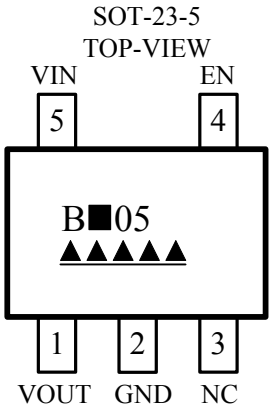
Aimtron reserves the right without notice to change this circuitry and specifications.

Ordering Information

Part number	Package	Marking	Current Limit
AT1605B■X_GRE	SOT-23-5	B■05: Date Code with one button line	1.5A

■ : Enable Control H: High Active L: Low Active

Pin Configuration



Pin Description

Symbol	Pin No.	Descript
VOUT	1	Output Voltage
GND	2	Power Ground
NC	3	Not Connection
EN	4	Enable Control Input
VIN	5	Power Supply

Absolute Maximum Ratings

Parameter	Condition	Rated Value		Unit
		Min.	Max.	
Power Supply Voltage	—	-0.3	+6	V
Input Pin Voltage	EN	-0.3	+6	V
Output Current Limit	—	-	2	A
Continuous Power dissipation(T_A=85°C)	—	-	0.39	W
Package Thermal Resistance(θ_{JA})	SOT25	-	165	C °/W
Operating temperature T_A	—	-40	+85	°C
Junction temperature T_j		-	150	°C
Storage temperature	—	-55	+150	°C
ESD Susceptibility(HBM)		-	3	KV
ESD Susceptibility(MM)		-	200	V

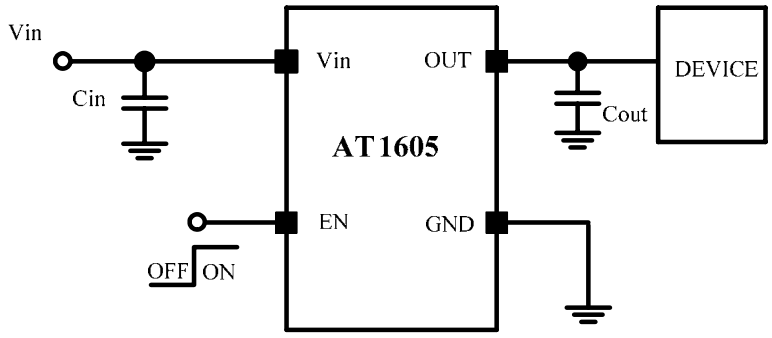
Note1: Permanent device damage may occur if Absolute Maximum Ratings are exceeded. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical Characteristics

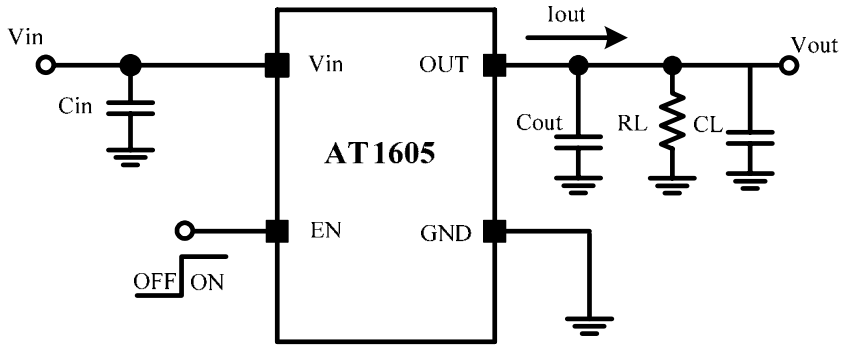
(VIN =5V, Cin=1μF, Cout=1μF, RL=10Ω T_a =+25℃ , unless otherwise noted.)

Parameter	Symbol	Condition	Values			Unit
			Min.	Typ.	Max.	
Input Supply Range	V_{IN}		1.8	--	5.5	V
Quiescent Current	I_Q	I_{OUT}=0A, EN=High	-	60	-	μA
Shutdown Current	I_{SHDN}	EN=Low	-	-	1	μA
Switch On-Resistance	R_{SW}	I_{OUT}=0.5A	-	100	130	mΩ
Output Turn-on Rising Time	T_{RT}			450		μS
Current Limit Threshold	I_{LIMT}	AT1605B, R_{LOAD}=1Ω	1.1	1.5	2.1	A
Short Circuit Current	I_{SC}	AT1605B, R_{LOAD}=0Ω	-	1	-	A
Forward Leakage Current	$I_{Leakage}$	EN=Low, Vout=0V	-	-	1	μA
VIN Under Voltage Lockout	UVLO		1.2	1.4	1.7	V
VIN Under Voltage Hysteresis	V_{HS}		50	100	150	mV
EN Input Voltage Threshold	V_{EN}		1.9	2	2.1	V
EN Input Voltage Hysteresis	V_{ENHS}		300	400	500	mV
Thermal Limit	T_L		-	130	-	°C
Thermal Limit Hysteresis	T_{HS}		-	20	-	°C

Typical Application Circuit



Test Circuit



Function Description

Enable Control

Digital logic of EN provides an electrical ON/OFF control of the power supply. Connecting this pin to ground or to any voltage less than EN input threshold will completely turn OFF the Bias. In this state, current drain from the input supply is less than 1μA; the internal reference, comparators, and biasing circuitry turn off. EN works as a simple on/off control. Drive EN high to enable the device, or drive EN low for shutdown.

Charge Pump

The higher of supply battery powers the internal charge pump. The charge pump provides power to the current limit amplifier and allows the N-MOS gate voltage to be higher the battery supply voltage. A gate voltage that is higher than the source voltage is necessary to turn on the N-MOS.

Under-Voltage Lockout (UVLO)

The under voltage lockout prevents the device from misoperation at low input voltage.

Soft-Start

Soft-start is built-in on chip. When power up, the soft-start function is immediately active to nominal voltage by a constant current. During this time, the soft-start voltage directly controls the N-MOS on-time to reduce input surge currents. The maximum load current is available after the soft-start cycle is completed.

Over-Current Limit

The AT1605 provides cycle-by-cycle over-current protection. Current limit is accomplished using a separate dedicated comparator. The current limit signals control logic block to limit current of N-MOS in event that the current of flowing N-MOS is greater than the current limit value. The current-limit feature protection against a hard short or over-current fault at the output.

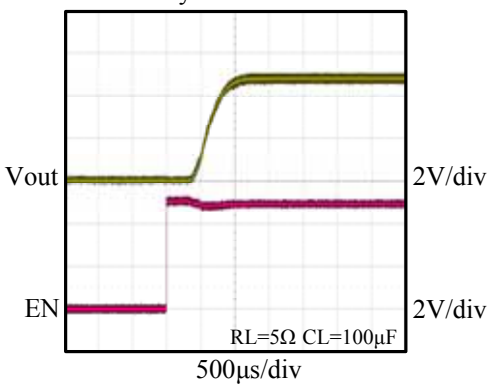
Thermal-Overload Protection

Thermal-overload protection limits total power dissipation in the AT1605. When the junction temperature exceeds Tj=130°C, a thermal sensor activates the thermal protection, which shuts down the IC, allowing the IC to cool. Once the device cools down by 20°C, IC will automatically recover normal operation. For continuous operation, do not exceed the absolute maximum junction-temperature rating of Tj=150°C.

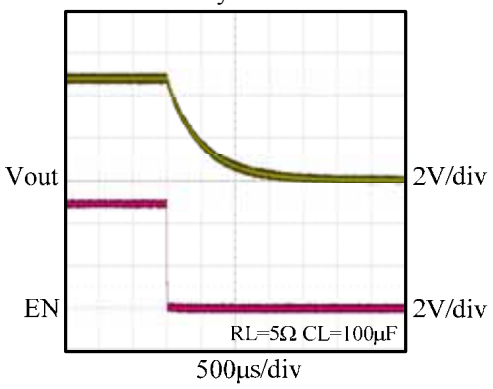
Typical characteristics:

AT1605BH VIN=5V Cin=1μF Cout=1μF T_A=25°C

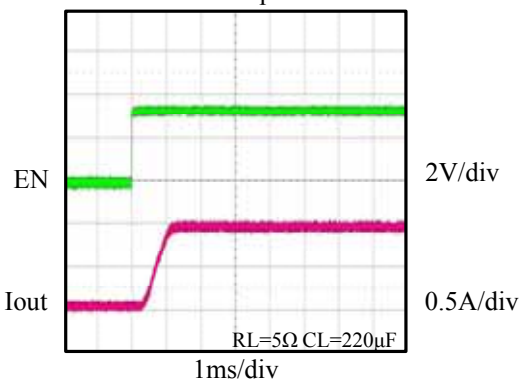
Turn on Delay Time and Rise Time



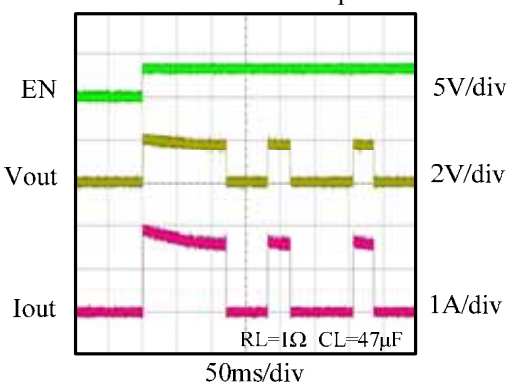
Turn off Delay Time and Fall Time



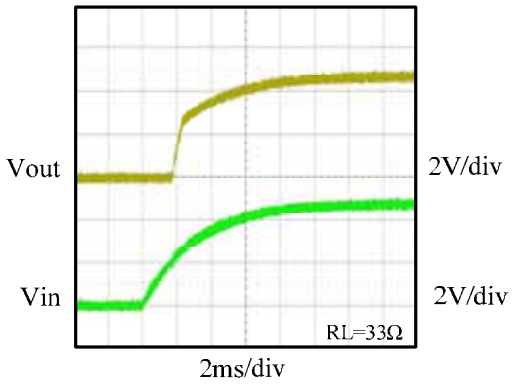
Turn on and Output Current



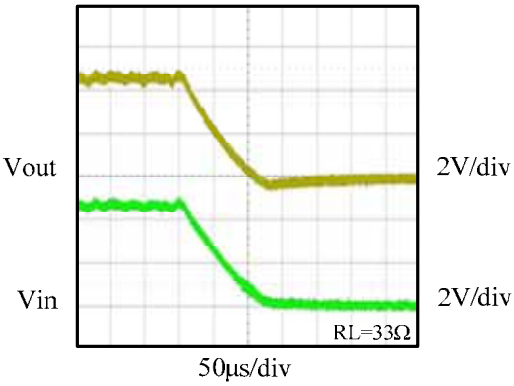
Thermal Shutdown Response



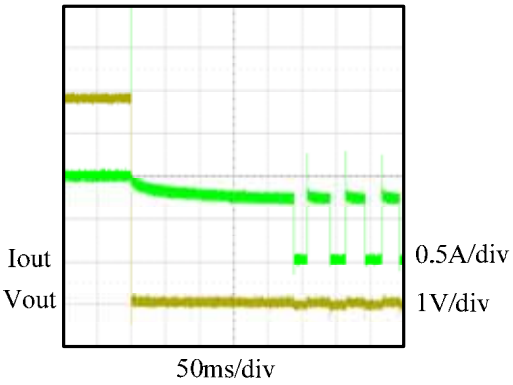
UVLO Protection at Rising

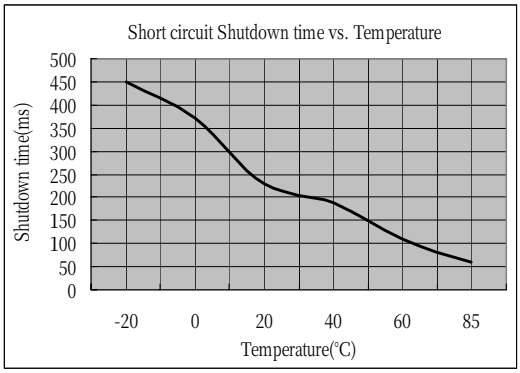


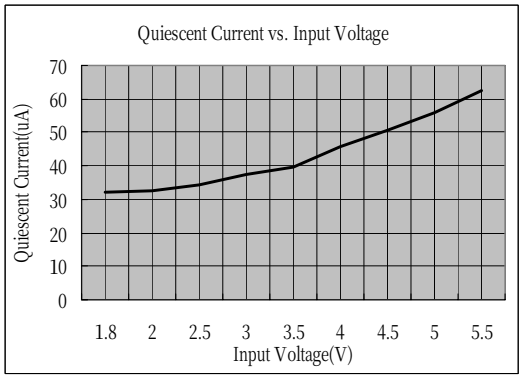
UVLO Protection at Falling

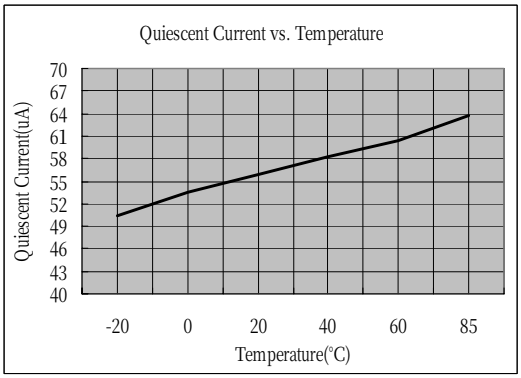


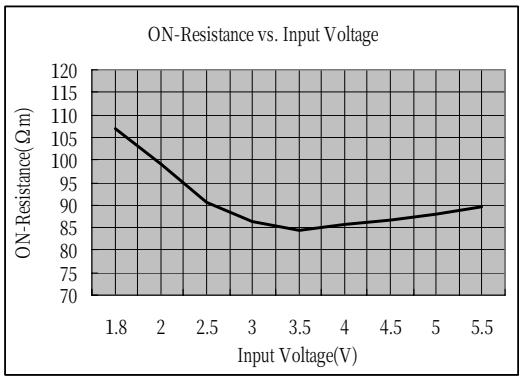
Short Circuit Protection

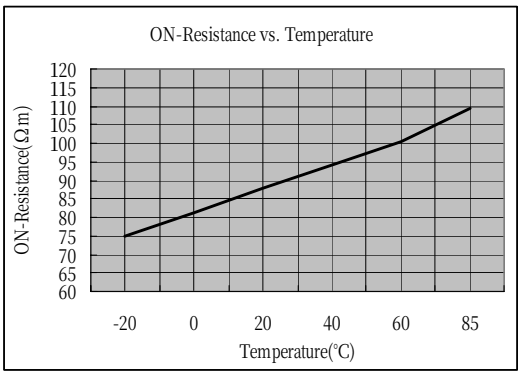


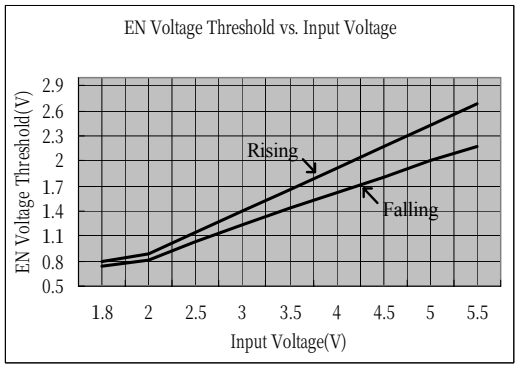


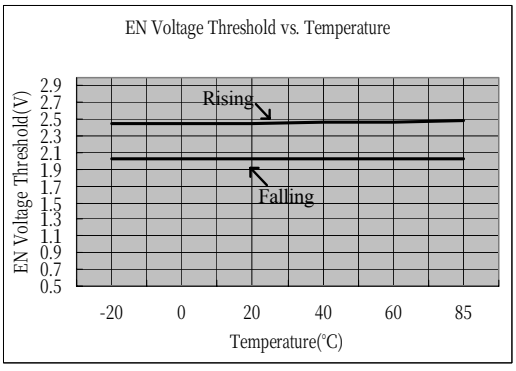


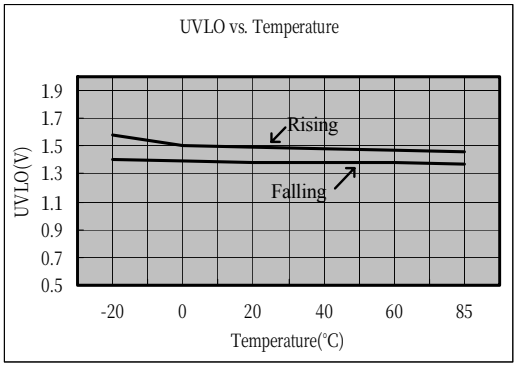


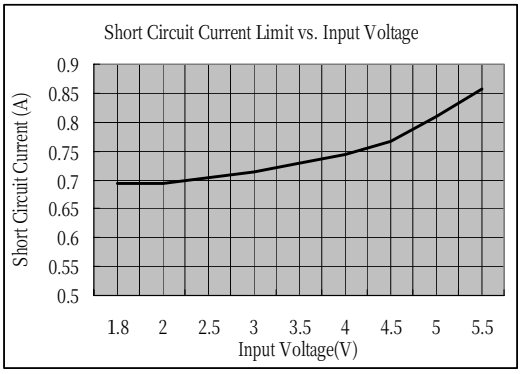


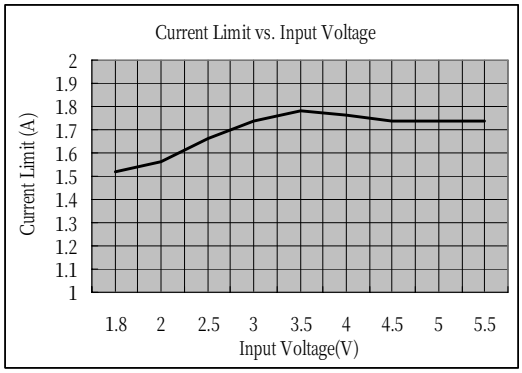


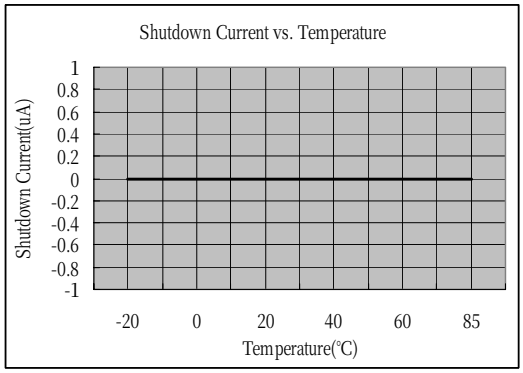




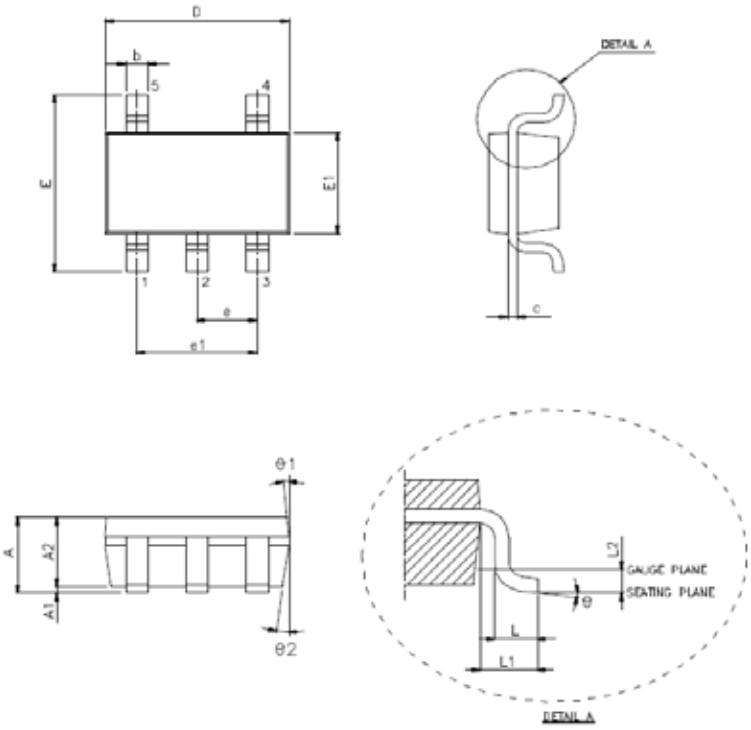

UVLO vs. Temperature
UVLO(V)
1.9
1.7
1.5
1.3
1.1
0.9
0.7
0.5
Rising
Falling
-20
0
20
40
60
85
Temperature(℃)


Short Circuit Current Limit vs. Input Voltage
Short Circuit Current (A)
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
1.8
2
2.5
3
3.5
4
4.5
5
5.5
Input Voltage(V)


Current Limit vs. Input Voltage
Current Limit (A)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
1.8
2
2.5
3
3.5
4
4.5
5
5.5
Input Voltage(V)


Shutdown Current vs. Temperature
Shutdown Current(uA)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-20
0
20
40
60
85
Temperature(℃)

Package Outline: SOT-23-5

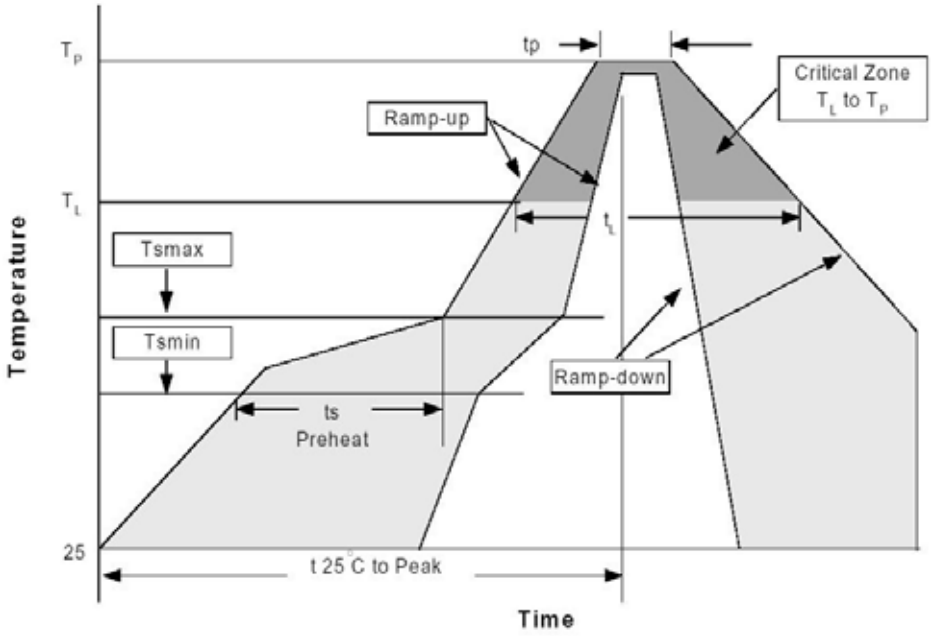


VARIATION(ALL DIMENSIONS SHOWN IN MM)

SYMBOL	MIN.	NOM.	MAX.
A	1.05	1.20	1.35
A1	0.05	0.10	0.15
A2	1.00	1.10	1.20
b	0.25	–	0.50
c	0.08	–	0.20
D	2.70	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95 BSC.		
e1	1.90 BSC.		
L	0.30	0.45	0.55
L1	0.60 REF.		
L2	0.25 BSC.		
θ	0°	5°	10°
θ1	3°	5°	7°
θ2	6°	8°	10°

NOTE : 1.JEDEC OUTLINE : MO-178 AA

Reflow Profiles



Profile Feature	Sn-Pb Eutectic Assembly		Pb-Free Assembly	
	Large Body Pkg. thickness ≥2.5mm or Pkg. volume ≥350mm^3	Small Body Pkg. thickness <2.5mm or Pkg. volume <350mm^3	Large Body Pkg. thickness ≥2.5mm or Pkg. volume ≥350mm^3	Small Body Pkg. thickness ≥2.5mm or Pkg. volume ≥350mm^3
Average ramp-up rate (T_L to T_P)	3°C/second max.		3°C/second max.	
Preheat -Temperature Min(Tsmin) -Temperature Max (Tsmax) -Time (min to max)(ts)	 100°C 150°C 60-120 seconds		 150°C 200°C 60-180 seconds	
Tsmax to T_L -Ramp-up Rate			3°C/second max.	
Time maintained above: -Temperature (T_L) -Time (t_L)	 183°C 60-150 seconds		 217°C 60-150 seconds	
Peak Temperature(T_P)	225+0/-5°C	240+0/-5°C	245+0/-5°C	250+0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10-30 seconds	10-30 seconds	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.		3°C/second max.	
Time 25°C to Peak Temperature	6 minutes max.		8 minutes max.	

***All temperatures refer to topside of the package, measured on the package body surface.**