LSP9800

1A, 6.5V Adjustable LDO Linear Regulator

General Description

The LSP9800 is a low dropout linear regulator with 1A output current. It is suitable with both low ESR ceramic and electrolytic capacitors, and stable with of 4.7uF ceramic capacitors or higher value. The LSP9800 provide several protections, such as over current protection (OCP), short circuit protection (SCP) and over temperature protection (OTP) to prevent any combination application conditions. The output voltage accuracy is within 2%.LSP9800 is available in SOT223-3L and TO252-3L package.

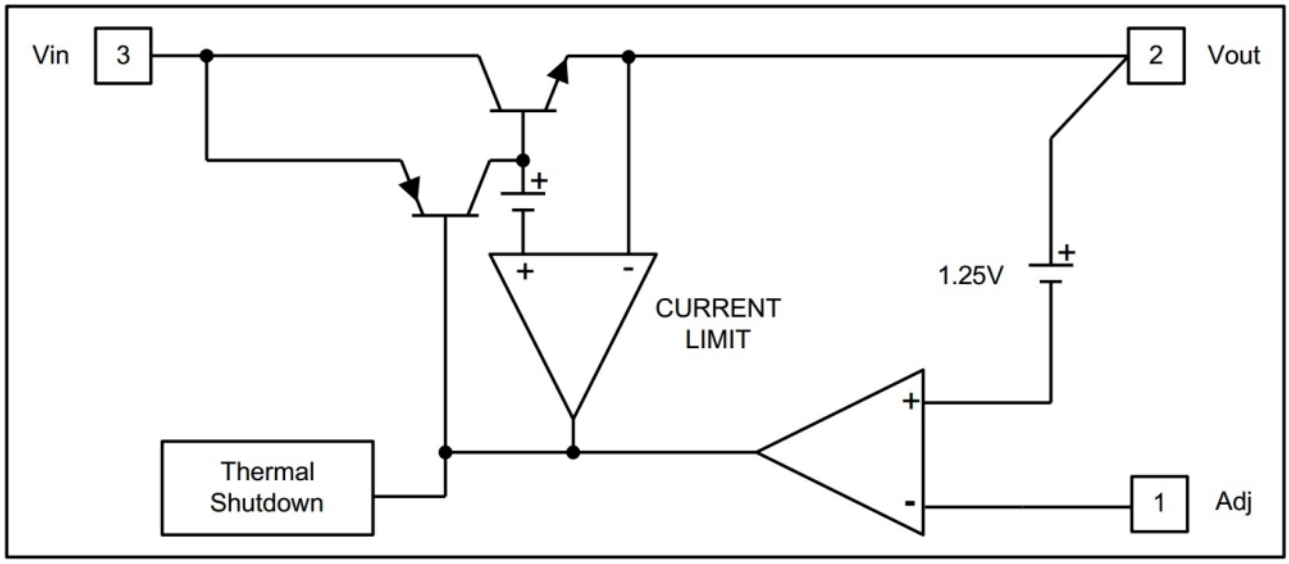
Features

- Maximum Operating Input Voltage : 6.5V
- 3-Terminal Adjustable Voltage from 1.25V
- High PSRR : Up to 65dB
- Fast Load Transient Response
- Built-in Over Current Protection
- Built-in Short Circuit Protection
- Built-in Over Temperature Protection
- Stable with Ceramic Capacitors of 4.7uF
- Package : SOT223-3L, TO252-3L

Applications

- LCD TV / Monitor
- Set-Top Box
- Portable DVD player
- VOIP
- Telecom Equipment
- PC / Mother Board
- NIC / Switch
- Graphic Card

Block Diagram & Symbol



Ordering Information

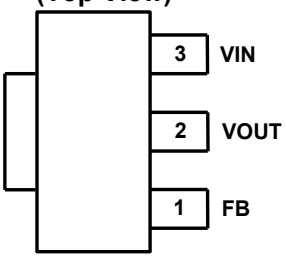
LSP 9800 - X XX X

- X → Output Voltage
- XX → Package
- X → Packing

Output Voltage	Package	Packing
Blank : ADJ	E3 : SOT223-3L D3 : TO252-3L	A : Tape & Reel

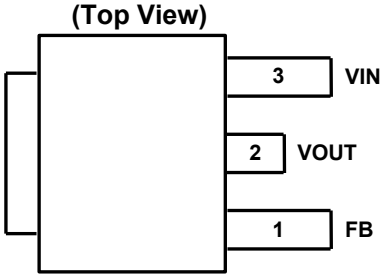
Pin Assignment

SOT223-3L
(Top View)



Tab is Pin 2

TO252-3L
(Top View)



Tab is Pin 2

Pin Descriptions

Pin Name	Pin Description
FB	Feedback Pin
VOUT	Voltage Output
VIN	Voltage Input

Absolute Maximum Ratings(at T_A=25°C)

Note: Operate over the “Absolute Maximum Ratings” may cause permanent damage to the device. Exposure to such conditions for extended time may still affect the reliability of the device.

Characteristics		Symbol	Rating	Unit
VCC Pin Voltage		V_{CC}	-0.3 to 8	V
Feedback Pin Voltage		V_{FB}	-0.3 to VCC	V
Storage Temperature Range		T_{STG}	-65 to +150	°C
Maximum Junction Temperature		T_{JC}	150	°C
Thermal Resistance (Junction to Case)	SOT223-3L	θjc	31	°C/W
	TO252-3L		30	
Thermal Resistance (Junction to Ambient)	SOT223-3L	θja	125	°C/W
	TO252-3L		140	
Power dissipation	SOT223-3L	P_D	800	mW
	TO252-3L		1000	
Moisture Sensitivity		MSL	Please refer the MSL label on the IC package bag/carton for detail	

Note1: Ratings apply to ambient temperature at 25°C

Recommended Operating Conditions

Characteristics	Min	Max	Unit
Input Voltage		6.5	V
Output Current (note)	0	1000	mA
Operating Junction Temperature Range	-20	125	°C

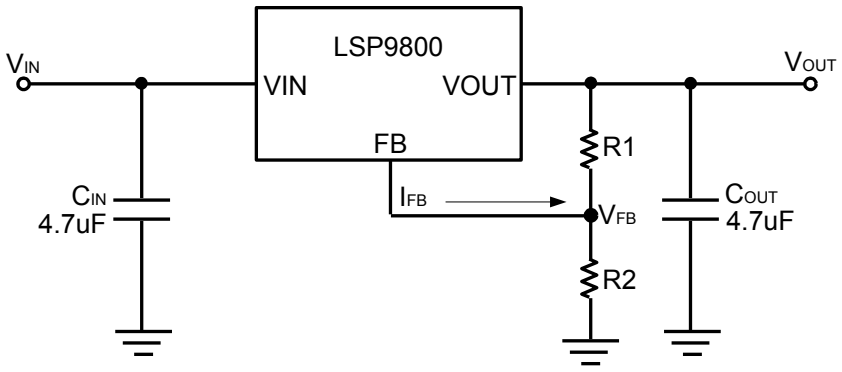
Note: If the power dissipation is high, the internal thermal shutdown protection of LSP9800 will limit the output current. The SOT223 package has lower power dissipation capability than the capability of TO252 because the thermal resistance of SOT223 is higher.

Electrical Characteristics

(VIN = 5V, TA= 25°C unless otherwise specified.)

Parameter	Test Conditions	Min	Typ	Max	Unit
Reference Voltage (VFB)	I_O = 10mA , T_A = 25°C	1.225	1.250	1.275	V
Line Regulation	I_O = 10mA,V_{OUT}+1.5V<V_{IN}<6.5V, T_A = 25°C			0.3	%
Load Regulation	V_{IN}=3.3V,Vadj=0,0mA<Io<1A, T_A = 25°C			1	%
Dropout Voltage (VIN-VOUT)	I_{OUT}=1A, ΔVOUT=1%Vout			1.4	V
Current Limit	(V_{IN}-V_{OUT}) = 5V	1.1			A
Thermal Regulation	T_A = 25°C, 30ms pulse		0.008	0.04	%/W
Ripple Rejection	F = 120Hz, C_{OUT} = 25uF ,I_{OUT} = 1.0A		65		dB
Adjust pin current			60		uA
Minimum Load Current				3	mA
Temperature Stability	I_O = 10mA		0.5		%
Thermal Shutdown	Junction temperature		150		°C
Thermal Shutdown Hysteresis			25		°C

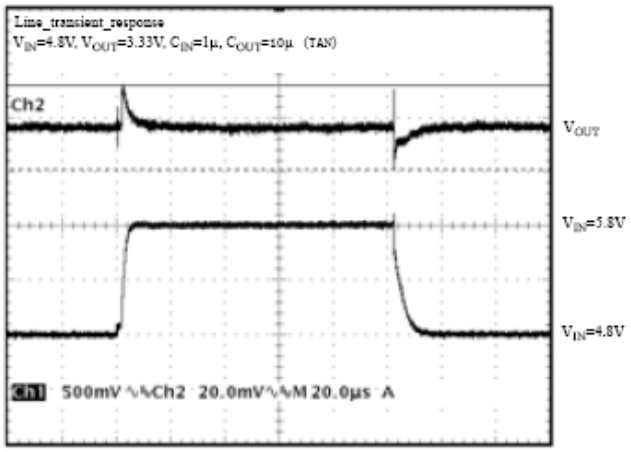
Application Circuit



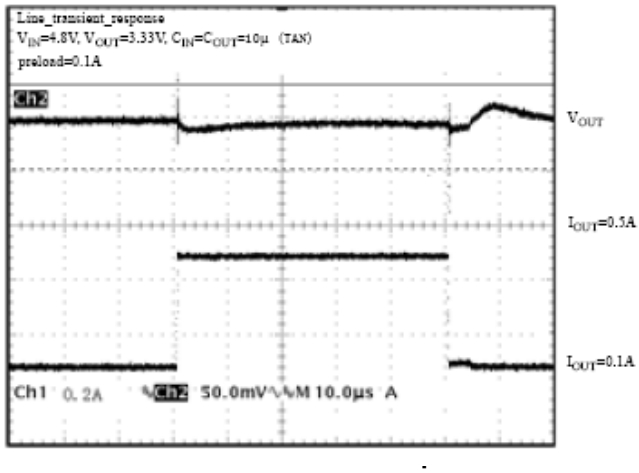
$V_{OUT}=V_{FB} \times (1+R2/R1)+I_{FB} \times R2$
$V_{FB}=1.25V$; $I_{FB}=60uA$

The LSP9800 keeps a constant 1.25V between the output pin and the feedback pin. By placing a resistor R1 across these two pins a constant current flows through R1, adding to the IFB current and into the R2 resistor producing a voltage equal to the (1.25/R1)*R2+IFB*R2 which will be added to the 1.25V to set the output voltage. This is summarized in the above equation. Since the minimum load current requirement of the LSP9800 is 3mA, R1 is typically selected to be < 416Ω resistor so that it automatically satisfies the minimum current requirement. Notice that since IFB is typically in the range of 60uA it only adds a small error to the output voltage and should only be considered when a very precise output voltage setting is required. For example, in a typical 3.3V application, R1=124Ω and R2=205Ω can be used. The error due to IFB is only ~0.3% of the nominal set point. The C1, C2 capacitor are 4.7uF (Low ESR Ceramic, MLCC), and its ESR should be larger than 15mΩ, otherwise need to use electrolytic capacitor, and 10uF is a typical value.

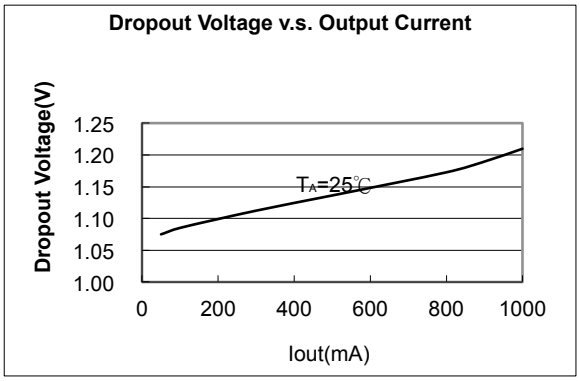
Typical Characteristics



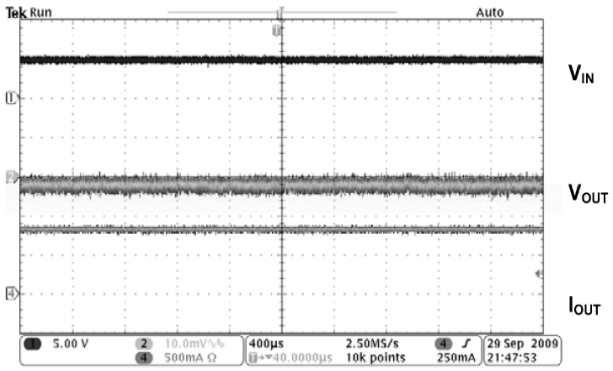
Line Transient Response



Load Transient Response



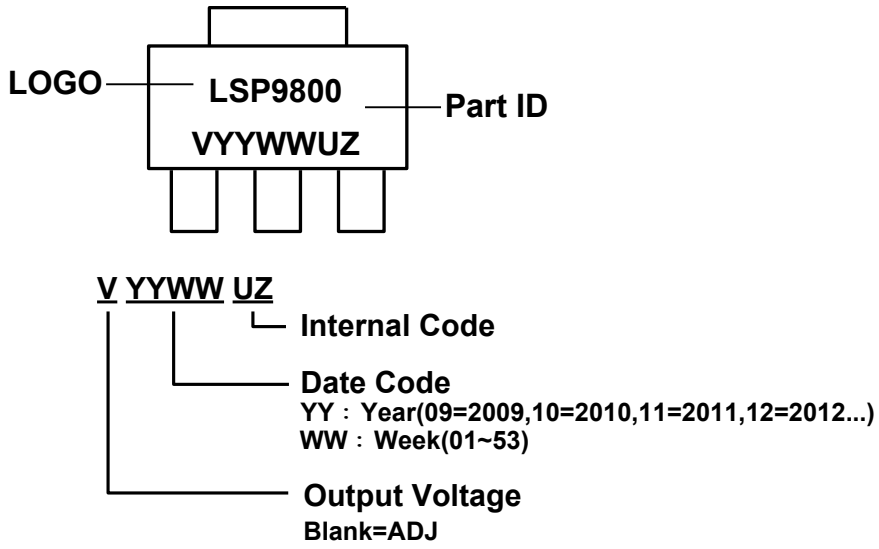
Dropout Voltage vs Output Current



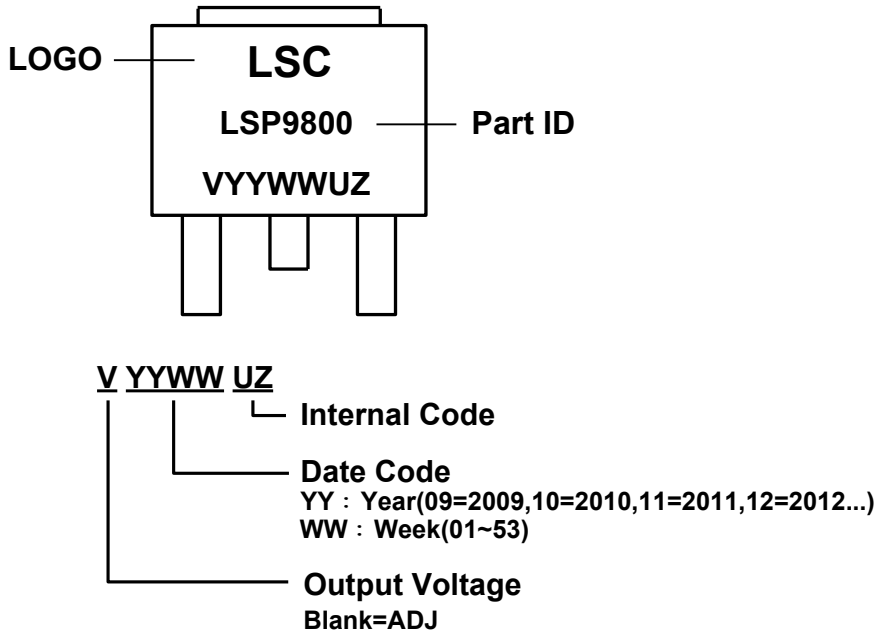
Output Voltage Ripple and Noise

Marking Information

(1) SOT223-3L

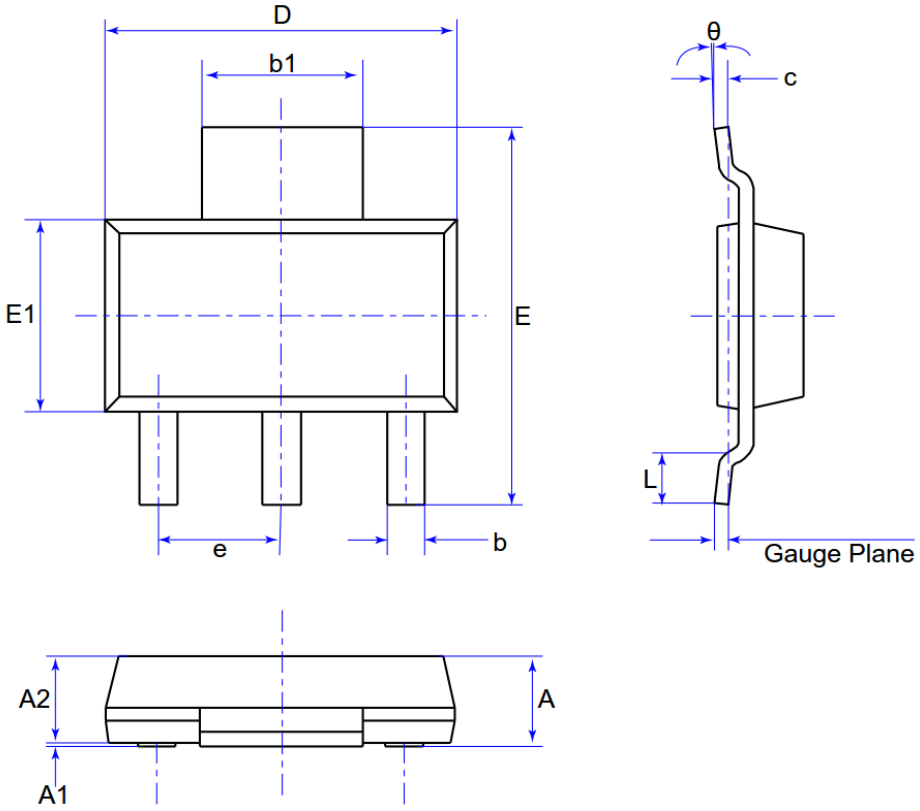


(2) TO252-3L



Mechanical Information

(1) Package type: SOT223-3L

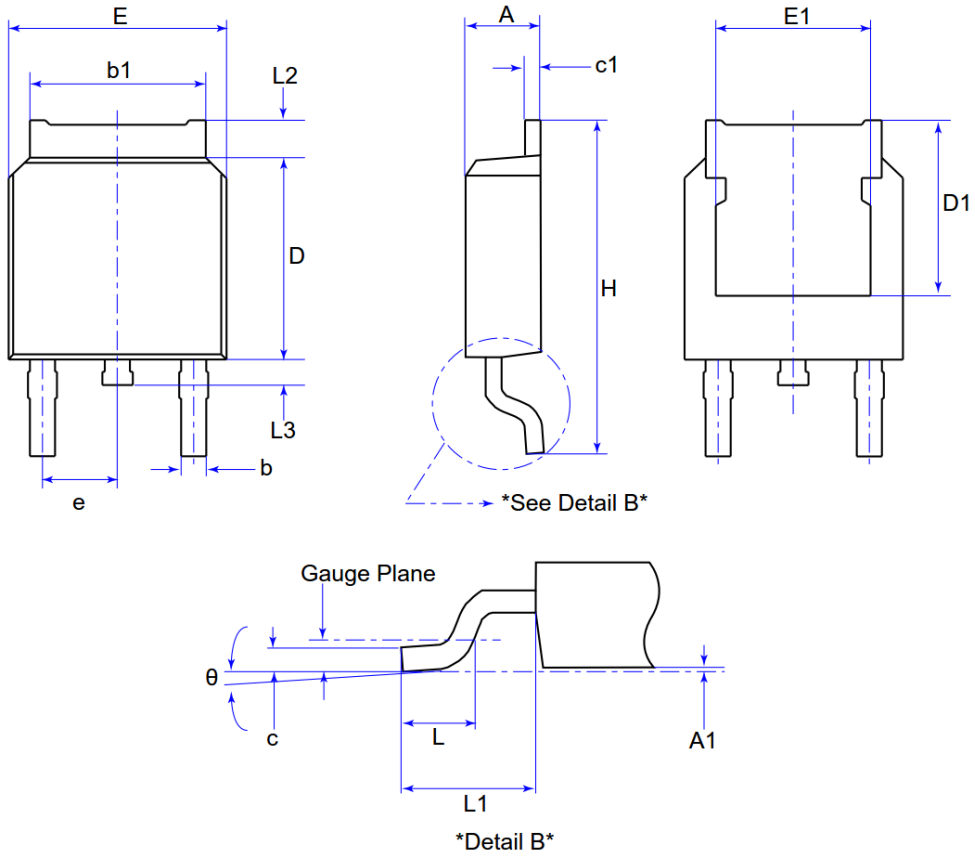


Unit: mm

Symbol	Min	Max
A	-	1.80
A1	-	0.10
A2	1.45	1.75
b	0.66	0.84
c	0.23	0.35
D	6.20	6.70
b1	3.00 REF	
E	6.70	7.30
E1	3.30	3.70
e	2.30 BSC	
L	0.75	-
θ	0^{o}	10^{o}
Gauge Plane	0.30 REF	

Mechanical Information (Continued)

(2) Package type: TO252



Unit: mm

Symbol	Min	Max
A	2.200	2.400
A1	-	0.127
b	0.660	0.860
b1	5.334 REF	
c	0.460	0.600
c1	0.460	0.580
D	6.000	6.200
D1	5.300 REF	
E	6.500	6.700
E1	4.830 REF	
e	2.186	2.400
H	9.800	10.400
L	1.400	1.700
L1	2.900 REF	
Gauge Plane	0.508 REF	
L2	0.900	1.300
L3	0.600	1.000
θ	0^{o}	8^{o}

MSL (Moisture Sensitive Level) Information

IPC/JEDEC J-STD-020D.1 Moisture Sensitivity Levels Table

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS				
			Standard		Accelerated Equivalent [1]		
					eV 0.40-0.48	eV 0.30-0.39	CONDITION
	TIME	CONDITION	TIME (hours)	CONDITION	TIME (hours)	TIME (hours)	
1	Unlimited	≤30 °C /85% RH	168 +5/-0	85 °C /85% RH	NA	NA	NA
2	1 year	≤30 °C /60% RH	168 +5/-0	85 °C /60% RH	NA	NA	NA
2a	4 weeks	≤30 °C /60% RH	696[2] +5/-0	30 °C /60% RH	120 -1/+0	168 -1/+0	60 °C/ 60% RH
3	168 hours	≤30 °C /60% RH	192[2] +5/-0	30 °C /60% RH	40 -1/+0	52 -1/+0	60 °C/ 60% RH
4	72 hours	≤30 °C /60% RH	96[2] +2/-0	30 °C /60% RH	20 +0.5/-0	24 +0.5/-0	60 °C/ 60% RH
5	48 hours	≤30 °C /60% RH	72[2] +2/-0	30 °C /60% RH	15 +0.5/-0	20 +0.5/-0	60 °C/ 60% RH
a	24 hours	≤30 °C /60% RH	48[2] +2/-0	30 °C /60% RH	10 +0.5/-0	13 +0.5/-0	60 °C/ 60% RH
6	Time on Label (TOL)	≤30 °C /60% RH	TOL	30 °C /60% RH	NA	NA	NA

Note 1: CAUTION - To use the ‘‘accelerated equivalent’’ soak conditions, correlation of damage response (including electrical, after soak and reflow), should be established with the ‘‘standard’’ soak conditions. Alternatively, if the known activation energy for moisture diffusion of the package materials is in the range of 0.40 - 0.48 eV or 0.30 - 0.39 eV, the ‘‘accelerated equivalent’’ may be used. Accelerated soak times may vary due to material properties (e.g .mold compound, encapsulant, etc.). JEDEC document JESD22-A120 provides a method for determining the diffusion coefficient.

Note 2: The standard soak time includes a default value of 24 hours for semiconductor manufacturer’s exposure time (MET) between bake and bag and includes the maximum time allowed out of the bag at the distributor’s facility. If the actual MET is less than 24 hours the soak time may be reduced. For soak conditions of 30 °C/60% RH, the soak time is reduced by 1 hour for each hour the MET is less than 24 hours. For soak conditions of 60 °C/60% RH, the soak time is reduced by 1 hour for each 5 hours the MET is less than 24 hours. If the actual MET is greater than 24 hours the soak time must be increased. If soak conditions are 30 °C/60% RH, the soak time is increased 1 hour for each hour that the actual MET exceeds 24 hours. If soak conditions are 60 °C/60% RH, the soak time is increased 1 hour for each 5 hours that the actual MET exceeds 24 hours.