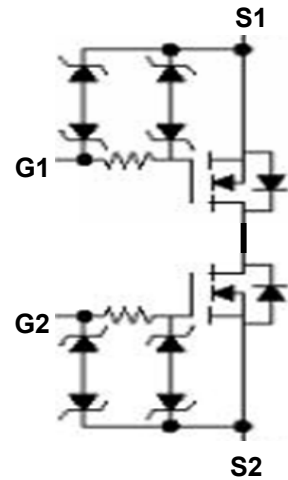


GWS8902 – Dual 20V N-Channel Power MOSFET

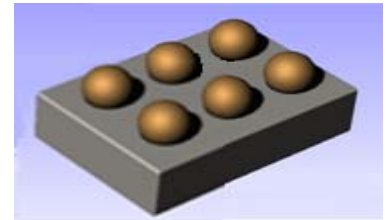
General Description

Great Wall Semiconductor's new low cost, state of the art Lateral Power™ MOSFET process technology in chip-scale packaging minimizes PCB space and $R_{DS(ON)}$ plus reduces overall system cost.



Features

- 36mΩ typ. at 4.5 Volts
- 48mΩ typ. at 2.5 Volts
- Excellent thermal characteristics.
- Rated for High Electrical Overstress Performance of 15A short circuit and over current.
- Integrated gate diodes provide Electro-Static Discharge (ESD) protection of 2500V HBM.



Maximum Ratings and Thermal Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	5 secs	Steady State	Unit	
Drain-Source Voltage	V_{DS}	20		V	
Gate-Source Voltage	V_{GS}	± 12			
Drain Current ^a	I_D	$T_A=25^\circ\text{C}$	5.0	3.9	A
		$T_A=85^\circ\text{C}$	3.4	2.8	
Pulsed Drain Current	I_{DM}	40			
Maximum Power Dissipation ^a	P_D	$T_A=25^\circ\text{C}$	1.7	1.00	W
		$T_A=85^\circ\text{C}$	0.80	0.50	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to 150		$^\circ\text{C}$	

Thermal Resistance Ratings					
Parameter		Symbol	Typ	Max	Unit
Junction-to-Ambient	t ≤ 5 sec	R_{thJA}	60	75	$^\circ\text{C}/\text{W}$
	Steady State		95	120	
Junction-to-Foot (Lead)	Steady State	R_{thJF}	18	22	

^a Surface Mounted on FR4 Board.

Electrical Characteristics ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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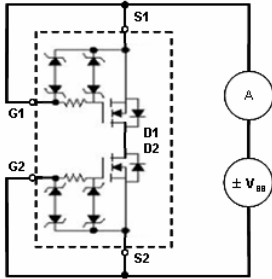
Static

Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0V, V_{DS} = 20V$			1	μA
Gate Body Leakage	I_{GSS}	$V_{DS} = 0V, V_{GS} = +/-12V$			+/-10	μA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	0.5	0.6	1.5	V
Source1-to-Source2 On-State Resistance	$r_{S1S2(on)}$	$V_{GS} = 4.5V, I_{SS} = 1A$		36	45	m Ω
		$V_{GS} = 3.7V, I_{SS} = 1A$		41	48	
		$V_{GS} = 2.5V, I_{SS} = 1A$		48	57	
		$V_{GS} = 1.8V, I_{SS} = 1A$		60	72	
Source-Drain Diode Voltage	V_{SD}	$V_{GS} = 0, I_D = 6.5A$	0.8	1.0	1.2	V

Dynamic

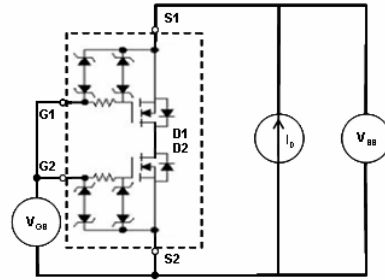
Total Gate Charge	Q_g	$V_{DS} = 10V, I_D = 4.0A, V_{GS} = 5.0V$		12		nC
Input Capacitance	C_{iss}	$V_{DS} = 20V, V_{GS} = 0V, f = 1\text{ MHz}$		870		pF
Output Capacitance	C_{oss}			320		
Reverse Transfer Capacitance	C_{rss}			240		

Test Circuit 1: I_{DSS} , Zero Gate Voltage Drain Current



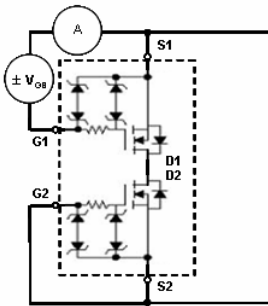
FET (1) I_{DSS} : $V_{S2}=V_{G2}=20V, V_{S1}=V_{G1}=0V$
 FET (2) I_{DSS} : $V_{S1}=V_{G1}=20V, V_{S2}=V_{G2}=0V$

Test Circuit 2: $R_{S1S2(ON)}$, S1- to-S2 On State Resistance

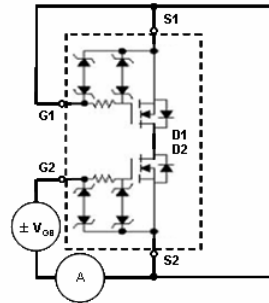


$$R_{S1S2(ON)} = V_{DS} / I_D$$

Test Circuit 3: I_{GSS} , Gate Body Leakage

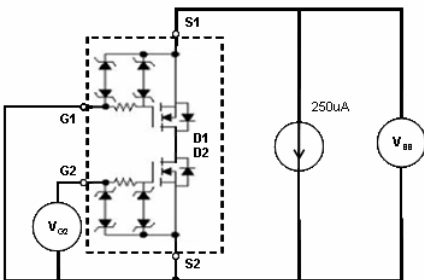


FET (1) I_{GSS} : $V_{GS1} = \pm 12V, V_{S1}=V_{S2}=V_{G2}=0V$

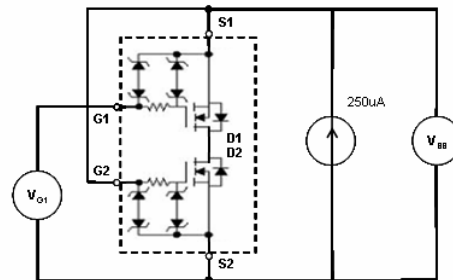


FET (2) I_{GSS} : $V_{GS2} = \pm 12V, V_{S1}=V_{S2}=V_{G1}=0V$

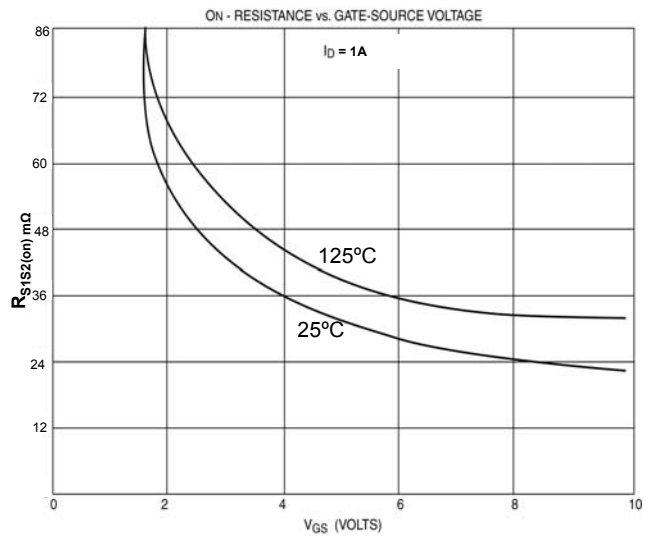
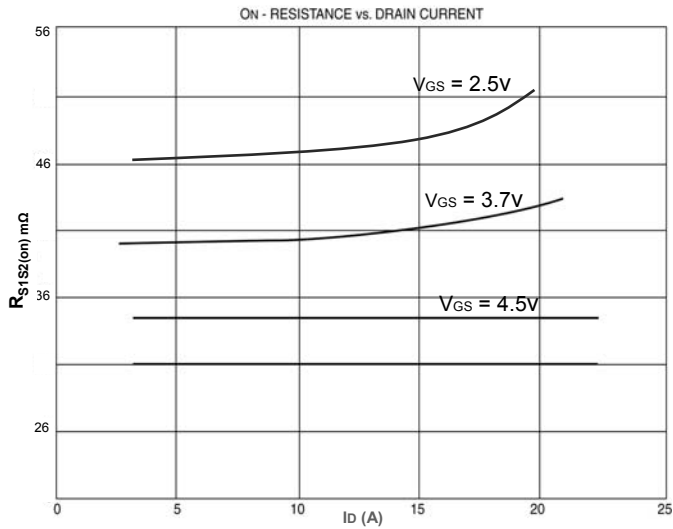
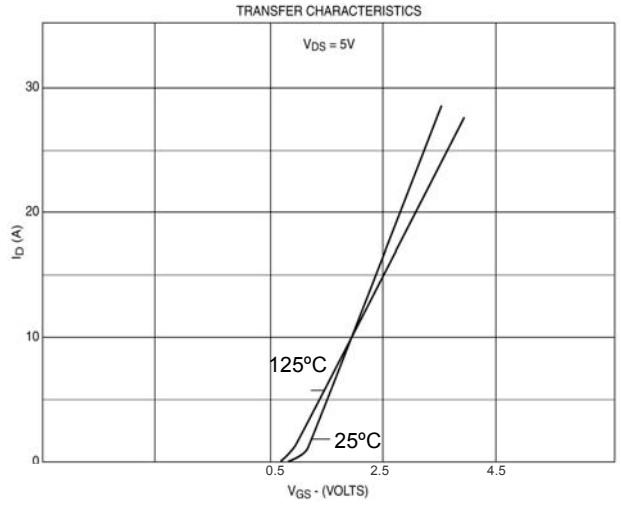
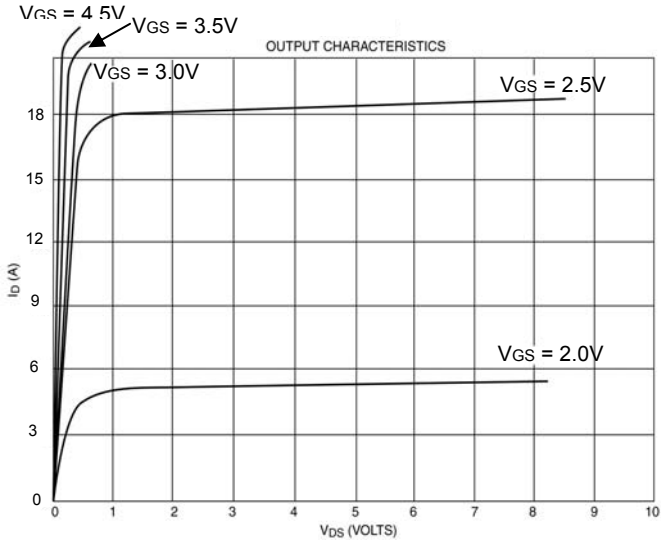
Test Circuit 4: $V_{GS(th)}$, Gate Body Leakage

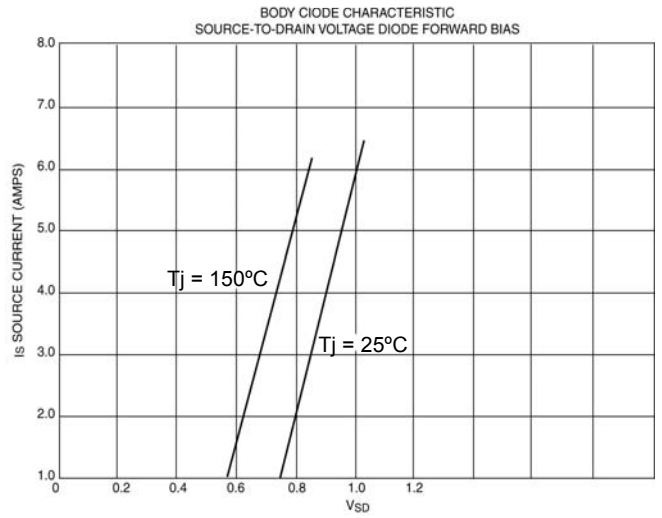
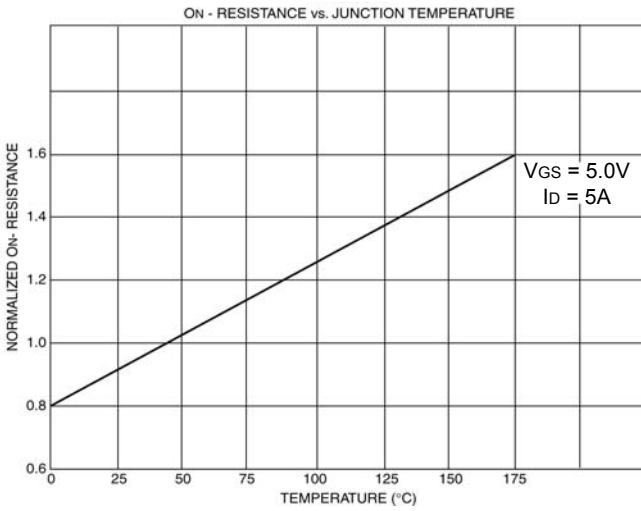
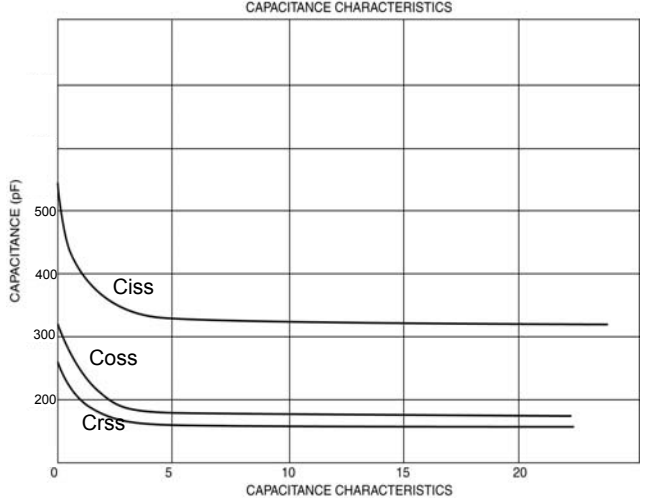
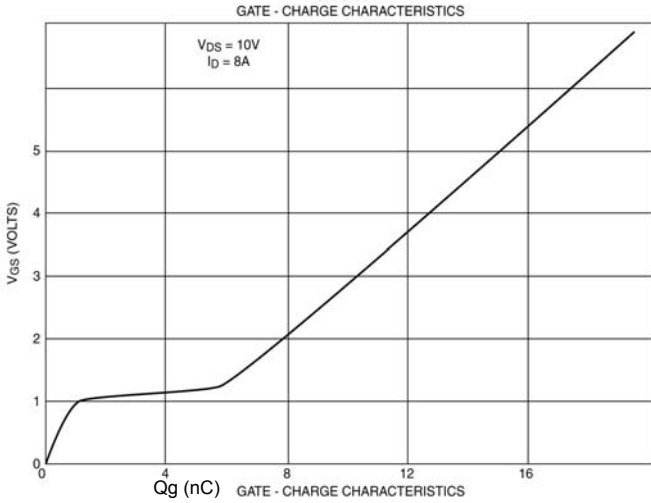


FET (1) $V_{GS(th)1} = V_{SS}$
 Where: $V_{G1}=V_{S2}, V_{S1}=0V, V_{G2}=4.5V, I_{SS}=250uA$

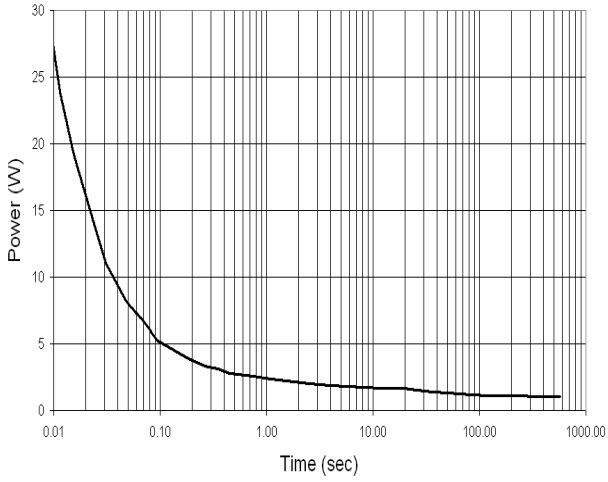


FET (2) $V_{GS(th)2} = V_{SS}$
 Where: $V_{G2}=V_{S2}, V_{S1}=0V, V_{G1}=4.5V, I_{SS}=250uA$

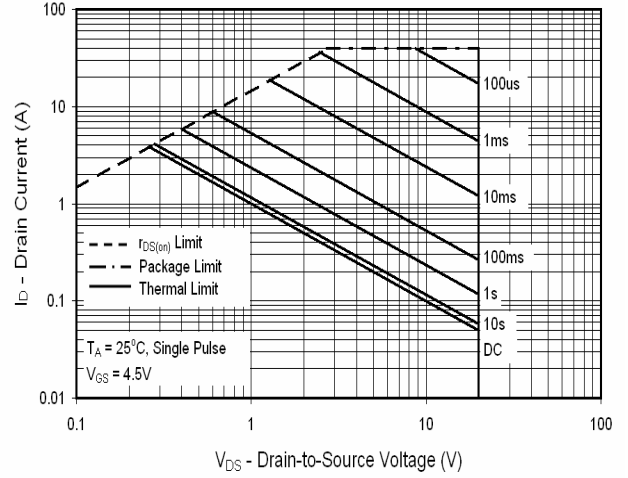




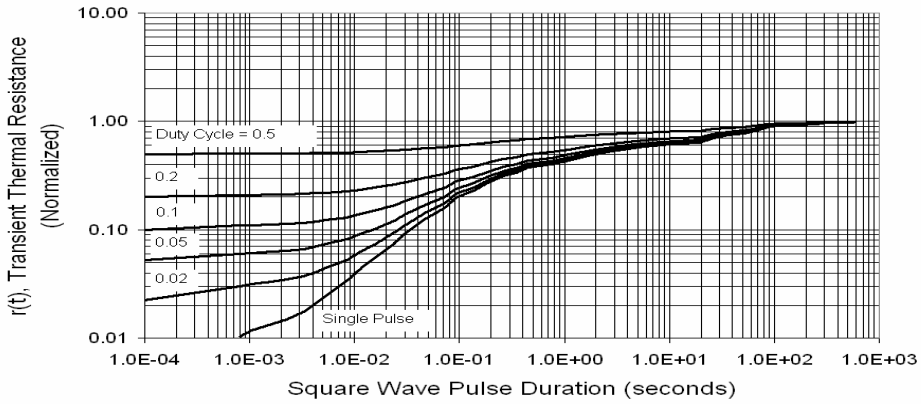
Single Pulse Power, Junction-to-Ambient



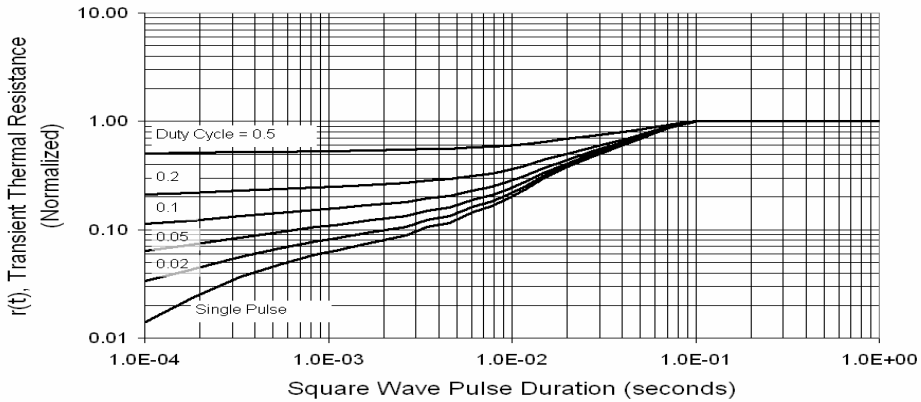
Maximum Rated Forward Biased Safe Operating Area



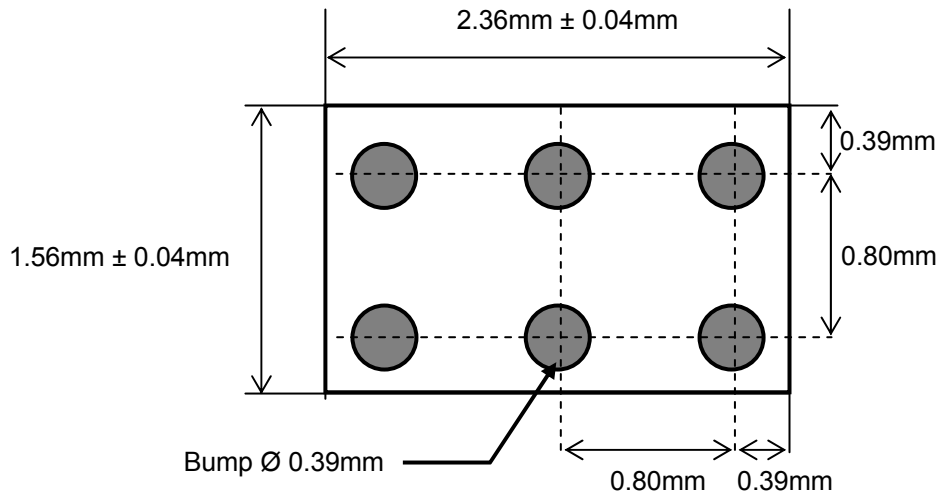
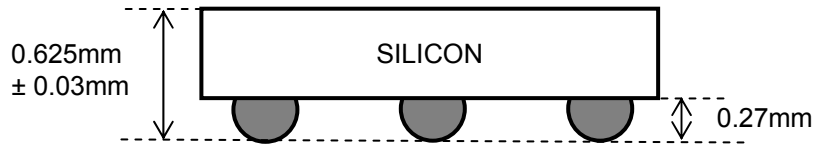
Transient Thermal Response, Junction-to-Ambient



Transient Thermal Response, Junction-to-Foot

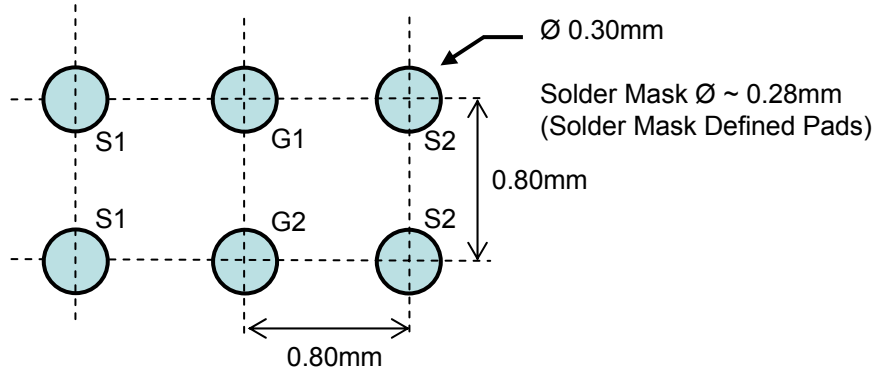


Dimensional Outline and Pad Layout



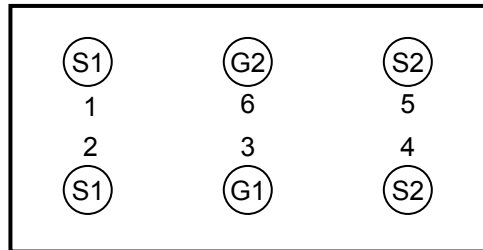
Bumps are Lead Free solder 96.8 Sn / 2.6 Ag / 0.6 Cu

Dimensional Outline and Pad Layout

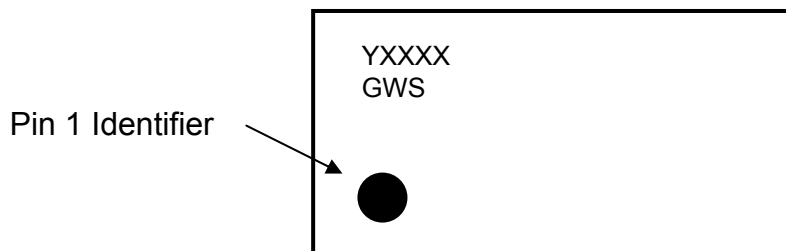


LAND PATTERN
RECOMMENDATION

Bump Side View

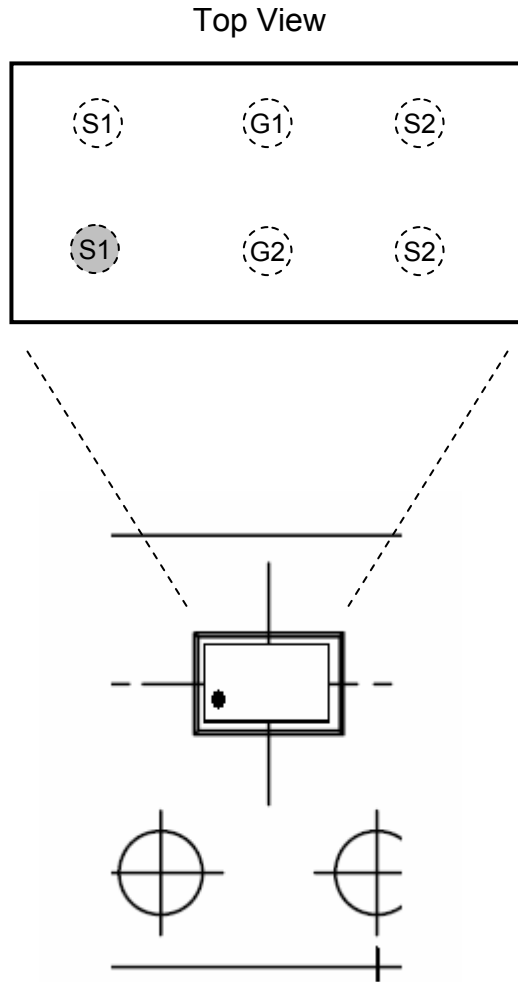


Top View



Y = GWS8902
XXXX = Date/Lot Traceability Code

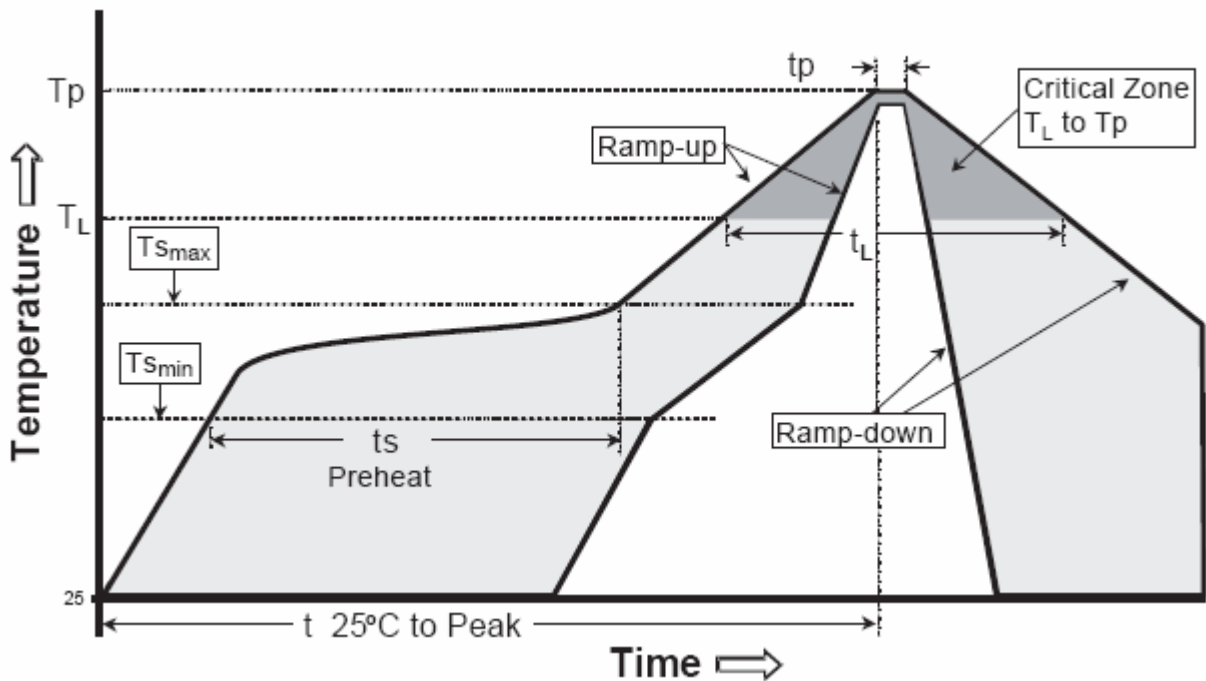
Device Orientation in Tape



Reflow Profile Classification

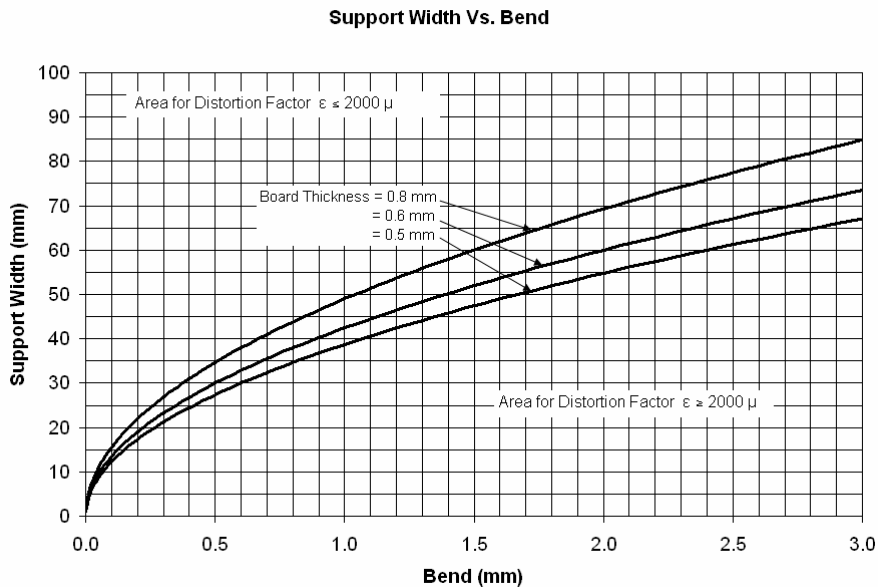
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate ($T_{S_{max}}$ to T_p)	3 °C/second max.	3° C/second max.
Preheat – Temperature Min ($T_{S_{min}}$) – Temperature Max ($T_{S_{max}}$) – Time ($t_{S_{min}}$ to $t_{S_{max}}$)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-180 seconds
Time maintained above: – Temperature (T_L) – Time (t_L)	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak/Classification Temperature (T_p)	240°C	260°C
Time within 5 °C of actual Peak Temperature (t_p)	10-30 seconds	20-40 seconds
Ramp-Down Rate	6 °C/second max.	6 °C/second max.
Time 25 °C to Peak Temperature	6 minutes max.	8 minutes max.

- Note 1:** All temperatures refer to topside of the package, measured on the package body surface.
- 2:** GWS devices can be reflowed a max of 2 times when mounted using our recommended reflow conditions.
- 3:** When repairing after solder reflow, complete with-in 10 seconds for iron temperatures of up to 260°C.

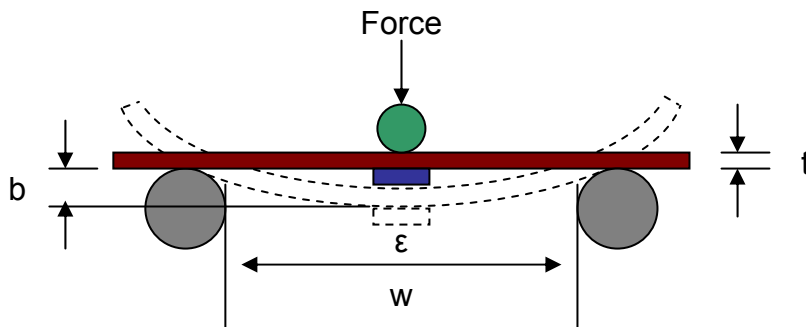


Mechanical Considerations

This product is very small and thin. External stress may cause a breakdown of the package and/or chip. Customers must insure to handle this product with a distortion factor $\epsilon \leq 2000 \mu$. This is represented on the Support Width Vs. Bend graph shown below as the area above the lines. Each line shown represents a typical printed circuit board thicknesses for which the product can be mounted to.



The distortion factor ϵ is defined by the following expression: $\epsilon = 6 * t * b / w^2$
 where: t = board thickness (mm), b = bend (mm), w = support width (mm)



General Precautions and Warnings

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- To minimize the risks of damage to property or injury (including death) to persons arising from defects in Great Wall Semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire containment and anti-failure features.
- When the device listed in this document is intended for usage in Lithium Ion Battery charge and discharge control applications, special precautions must be employed by the customer to prevent device damage should a short circuit occur. For example, a PTC Thermistor can be used by the customer to shut off the power supply if a short-circuit occurs. If the power supply is not shut off during a short circuit, a large short circuit current will flow which may cause the device to catch fire or smoke.