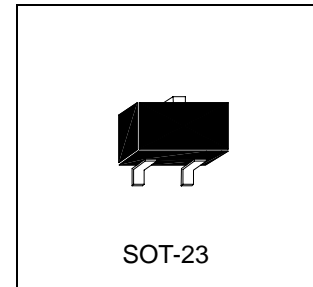




**HUN2211 / HUN2212 / HUN2213 / HUN2214 / HUN2215  
 HUN2216 / HUN2230 / HUN2231 / HUN2232 / HUN2233  
 HUN2234 / HUN2235 / HUN2236 / HUN2237 / HUN2238  
 HUN2240 / HUN2241**

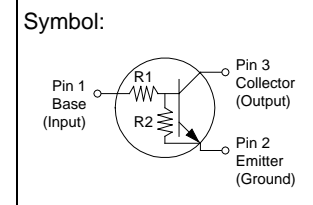
NPN Silicon Surface Mount Transistor with Monolithic Bias Resistor Network



SOT-23

### Description

This new series of digital transistors is designed to replace a single device and its external resistor bias network. The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. The BRT eliminates these individual components by integrating them into a single device. The use of a BRT can reduce both system cost and board space. The device is housed in the SOT-23 package which is designed for low power surface Mount applications.



- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Moisture Sensitivity Level: 1
- ESD Rating: Human Body Model: Class1, Machine Model: Class B
- The SOT-23 package can be soldered using wave or reflow. (The modified gull-winged leads absorb thermal stress during soldering eliminating the possibility of damage to the die.)
- Available in 8mm embossed tape and reel. Use the device number to order the 7 inch / 3,000 unit reel.

### Maximum Ratings (T<sub>A</sub>=25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CBO</sub>	50	Vdc
Collector-Emitter Voltage	V <sub>CEO</sub>	50	Vdc
Collector Current	I <sub>C</sub>	100	mAdc
Total Power Dissipation @ T <sub>A</sub> =25°C	P <sub>D</sub>	200	mW
Derate above 25°C (Note1)		1.6	mW/°C

Note1: Device mounted on a FR-4 glass epoxy printed circuit board using the minimum recommended footprint.

### Thermal Characteristics

Rating	Symbol	Value	Unit
Thermal Resistance-Junction-to-Ambient	R <sub>θJA</sub>	625	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to +150	°C
Maximum Temperature for Soldering Purposes	T <sub>L</sub>	260	°C
Time in Solder Bath		10	Sec



## Device Marking and Resistor Values

Device	Package	Marking	R1(K)	R2(K)	Shipping
HUN2211	SOT-23	A8A	10	10	3000/Tape & Reel
HUN2212	SOT-23	A8B	22	22	3000/Tape & Reel
HUN2213	SOT-23	A8C	47	47	3000/Tape & Reel
HUN2214	SOT-23	A8D	10	47	3000/Tape & Reel
HUN2215	SOT-23	A8E	10	∞	3000/Tape & Reel
HUN2216	SOT-23	A8F	4.7	∞	3000/Tape & Reel
HUN2230	SOT-23	A8G	1	1	3000/Tape & Reel
HUN2231	SOT-23	A8H	2.2	2.2	3000/Tape & Reel
HUN2232	SOT-23	A8J	4.7	4.7	3000/Tape & Reel
HUN2233	SOT-23	A8K	4.7	47	3000/Tape & Reel
HUN2234	SOT-23	A8L	22	47	3000/Tape & Reel
HUN2235	SOT-23	A8M	2.2	47	3000/Tape & Reel
HUN2236	SOT-23	A8N	100	100	3000/Tape & Reel
HUN2237	SOT-23	A8P	47	22	3000/Tape & Reel
HUN2238	SOT-23	A8R	2.2	∞	3000/Tape & Reel
HUN2240	SOT-23	A8T	47	∞	3000/Tape & Reel
HUN2241	SOT-23	A8U	100	∞	3000/Tape & Reel

## Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Characteristic	Symbol	Min.	Typ.	Max.	Unit	
<i>Off Characteristics</i>						
Collector-Base Cutoff Current (V <sub>CB</sub> =50V, I <sub>E</sub> =0)	I <sub>CBO</sub>	-	-	100	nAdc	
Collector-Emitter Cutoff Current (V <sub>CE</sub> =50V, I <sub>B</sub> =0)	I <sub>CEO</sub>	-	-	500	nAdc	
Emitter-Base Cutoff Current (V <sub>EB</sub> =6V, I <sub>C</sub> =0)	HUN2211	-	-	0.5	mAdc	
	HUN2212	-	-	0.2		
	HUN2213	-	-	0.1		
	HUN2214	-	-	0.2		
	HUN2215	-	-	0.9		
	HUN2216	-	-	1.9		
	HUN2230	-	-	4.3		
	HUN2231	-	-	2.3		
	HUN2232	I <sub>EBO</sub>	-	-		1.5
	HUN2233	-	-	0.18		
	HUN2234	-	-	0.13		
	HUN2235	-	-	0.2		
	HUN2236	-	-	0.05		
	HUN2237	-	-	0.13		
HUN2238	-	-	4			
HUN2240	-	-	0.2			
HUN2241	-	-	0.1			
Collector-Base Breakdown Voltage (I <sub>C</sub> =10uA, I <sub>E</sub> =0)	V <sub>(BR)CBO</sub>	50	-	-	Vdc	
Collector-Emitter Breakdown Voltage (I <sub>C</sub> =2mA, I <sub>B</sub> =0)	*V <sub>(BR)CEO</sub>	50	-	-	Vdc	

\*Pulse Test: Pulse Width ≤300us, Duty Cycle≤2%



### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
<i>*On Characteristics</i>					
DC Current Gain (V <sub>CE</sub> =10V, I <sub>C</sub> =5mA)	HUN2211	35	60	-	
	HUN2212	60	100	-	
	HUN2213	80	140	-	
	HUN2214	80	140	-	
	HUN2215	160	350	-	
	HUN2216	160	350	-	
	HUN2230	3	5	-	
	HUN2231	8	15	-	
	HUN2232	15	30	-	
	HUN2233	80	200	-	
	HUN2234	80	150	-	
	HUN2235	80	140	-	
	HUN2236	80	150	-	
	HUN2237	80	140	-	
	HUN2238	160	350	-	
HUN2240	160	350	-		
HUN2241	160	350	-		
Collector-Emitter Saturation Voltage (I <sub>C</sub> =10mA, I <sub>B</sub> =0.3mA) (I <sub>C</sub> =10mA, I <sub>B</sub> =5mA) HUN2230/HUN2231 (I <sub>C</sub> =10mA, I <sub>B</sub> =1mA) HUN2215/HUN2216/HUN2232/HUN2233 HUN2234/HUN2235/HUN2238	V <sub>CE(sat)</sub>	-	-	0.25	Vdc

*\*On Characteristics*

Output Voltage (on) (V <sub>CC</sub> =5V, V <sub>B</sub> =2.5V, R <sub>L</sub> =1kΩ)	HUN2211	-	-	0.2	Vdc
	HUN2212	-	-	0.2	
	HUN2214	-	-	0.2	
	HUN2215	-	-	0.2	
	HUN2216	-	-	0.2	
	HUN2230	-	-	0.2	
	HUN2231	-	-	0.2	
	HUN2232	-	-	0.2	
	HUN2233	-	-	0.2	
	HUN2234	-	-	0.2	
	HUN2235	-	-	0.2	
	HUN2238	-	-	0.2	
	(V <sub>CC</sub> =5V, V <sub>B</sub> =3.5V, R <sub>L</sub> =1kΩ)	HUN2213	-	-	
	HUN2240	-	-	0.2	
(V <sub>CC</sub> =5V, V <sub>B</sub> =5.5V, R <sub>L</sub> =1kΩ)	HUN2236	-	-	0.2	
(V <sub>CC</sub> =5V, V <sub>B</sub> =4.0V, R <sub>L</sub> =1kΩ)	HUN2237	-	-	0.2	
(V <sub>CC</sub> =5V, V <sub>B</sub> =5V, R <sub>L</sub> =1kΩ)	HUN2241	-	-	0.2	

\*Pulse Test: Pulse Width ≤300us, Duty Cycle≤2%



### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Characteristic	Symbol	Min.	Typ.	Max.	Unit			
<i>*On Characteristics</i>								
Output Voltage (off) (V <sub>CC</sub> =5V, V <sub>B</sub> =0.5V, R <sub>L</sub> =1kΩ)	V <sub>OH</sub>	4.9	-	-	Vdc			
(V <sub>CC</sub> =5V, V <sub>B</sub> =0.25V, R <sub>L</sub> =1kΩ)								
HUN2215								
HUN2216								
HUN2233								
HUN2238								
(V <sub>CC</sub> =5V, V <sub>B</sub> =0.05V, R <sub>L</sub> =1kΩ)	HUN2240							
Input Resistor	R <sub>1</sub>				kΩ			
						HUN2230		
						HUN2211		
						HUN2212		
						HUN2213		
						HUN2214		
						HUN2215		
						HUN2216		
						HUN2230		
						HUN2231		
						HUN2232		
						HUN2233		
						HUN2234		
						HUN2235		
						HUN2236		
						HUN2237		
HUN2238								
HUN2240								
HUN2241								
Resistor Ratio HUN2211/HUN2212/HUN2213 /HUN2236 HUN2214 HUN2215/HUN2216/HUN2238/HUN2240 HUN2241 HUN2230/HUN2231/HUN2232 HUN2233 HUN2234 HUN2235 HUN2237	R <sub>1</sub> /R <sub>2</sub>							
						0.8	1	1.2
						0.17	0.21	0.25
						-	-	-
						-	-	-
						0.8	1	1.2
						0.055	0.1	0.185
						0.38	0.47	0.56
0.038	0.047	0.056						
1.7	2.1	2.6						

\*Pulse Test: Pulse Width ≤300us, Duty Cycle≤2%



### SOT-23 Dimension

3-Lead SOT-23 Plastic  
Surface Mounted Package  
HSMC Package Code: N

**Marking:**

Series Code  
(See Page 2)

Pb Free Mark  
Pb-Free: "●" (Note)  
Normal: None

Note: Pb-free product can distinguish by the green label or the extra description on the right side of the label.

Pin Style: 1.Base 2.Emitter 3.Collector

Material:

- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	2.80	3.04
B	1.20	1.60
C	0.89	1.30
D	0.30	0.50
G	1.70	2.30
H	0.013	0.10
J	0.085	0.177
K	0.32	0.67
L	0.85	1.15
S	2.10	2.75
V	0.25	0.65

\*: Typical, Unit: mm

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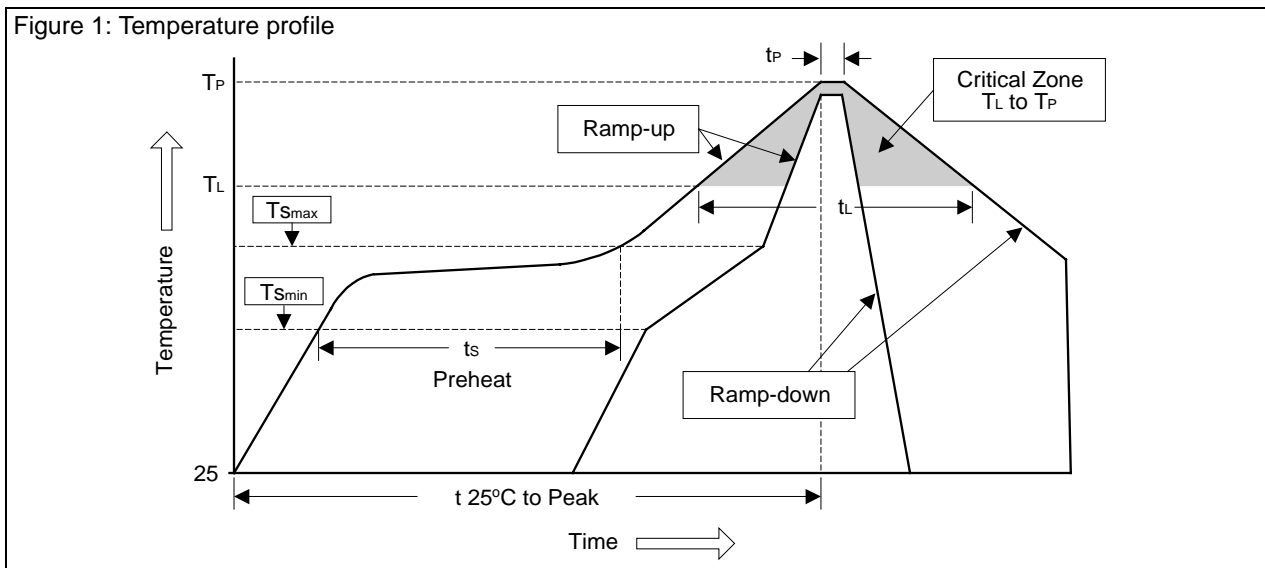
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## Soldering Methods for HSMC's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate ( $T_L$ to $T_P$ )	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min ( $T_{Smin}$ )	100°C	150°C
- Temperature Max ( $T_{Smax}$ )	150°C	200°C
- Time (min to max) ( $t_s$ )	60~120 sec	60~180 sec
$T_{Smax}$ to $T_L$		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature ( $T_L$ )	183°C	217°C
- Time ( $t_L$ )	60~150 sec	60~150 sec
Peak Temperature ( $T_P$ )	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature ( $t_p$ )	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec