



# HE9012

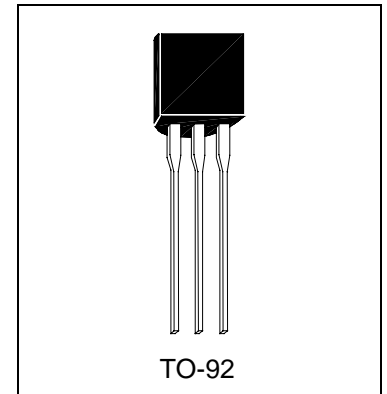
PNP EPITAXIAL PLANAR TRANSISTOR

## Description

The HE9012 is designed for use in 1W output amplifier of portable radios in class B push-pull operation.

## Features

- High total power dissipation ( $P_T$ : 625mW)
- High collector current ( $I_C$ : 500mA)
- Complementary to HE9013
- Excellent linearity



## Absolute Maximum Ratings

- Maximum Temperatures
  - Storage Temperature ..... -55 ~ +150 °C
  - Junction Temperature ..... +150 °C Maximum
- Maximum Power Dissipation
  - Total Power Dissipation ( $T_A=25^\circ\text{C}$ ) ..... 625 mW
- Maximum Voltages and Currents ( $T_A=25^\circ\text{C}$ )
  - $V_{CBO}$  Collector to Base Voltage ..... -40 V
  - $V_{CEO}$  Collector to Emitter Voltage ..... -20 V
  - $V_{EBO}$  Emitter to Base Voltage ..... -5 V
  - $I_C$  Collector Current ..... -500 mA
  - $I_{BP}$  Base Current ..... -100 mA

## Electrical Characteristics ( $T_A=25^\circ\text{C}$ )

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
$BV_{CBO}$	-40	-	-	V	$I_C=-100\mu\text{A}, I_E=0$
$BV_{CEO}$	-20	-	-	V	$I_C=-1\text{mA}, I_B=0$
$BV_{EBO}$	-5	-	-	V	$I_E=-100\mu\text{A}, I_C=0$
$I_{CBO}$	-	-	-100	nA	$V_{CE}=-25\text{V}, I_E=0$
$I_{EBO}$	-	-	-100	nA	$V_{EB}=-3\text{V}, I_C=0$
$*V_{CE(sat)}$	-	-	-0.6	V	$I_C=-500\text{mA}, I_B=-50\text{mA}$
$*V_{BE(sat)}$	-	-	-1.2	V	$I_C=-500\text{mA}, I_B=-50\text{mA}$
$V_{BE(on)}$	-	-	-0.9	V	$V_{CE}=-1\text{V}, I_C=-10\text{mA}$
$*h_{FE1}$	112	180	300		$V_{CE}=-1\text{V}, I_C=-50\text{mA}$
$*h_{FE2}$	40	-	-		$V_{CE}=-1\text{V}, I_C=-500\text{mA}$
Cob	-	-	8	pF	$V_{CB}=-10\text{V}, f=1\text{MHz}$
$f_T$	100	-	-	MHz	$V_{CE}=-1\text{V}, I_C=-10\text{mA}, f=100\text{MHz}$

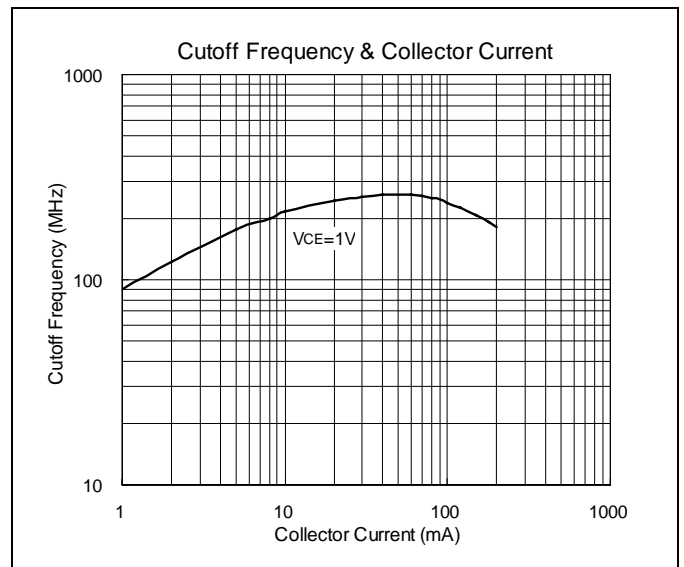
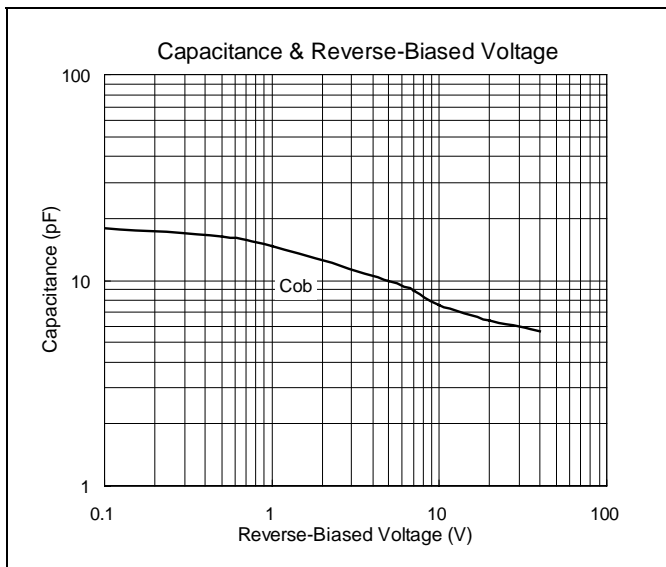
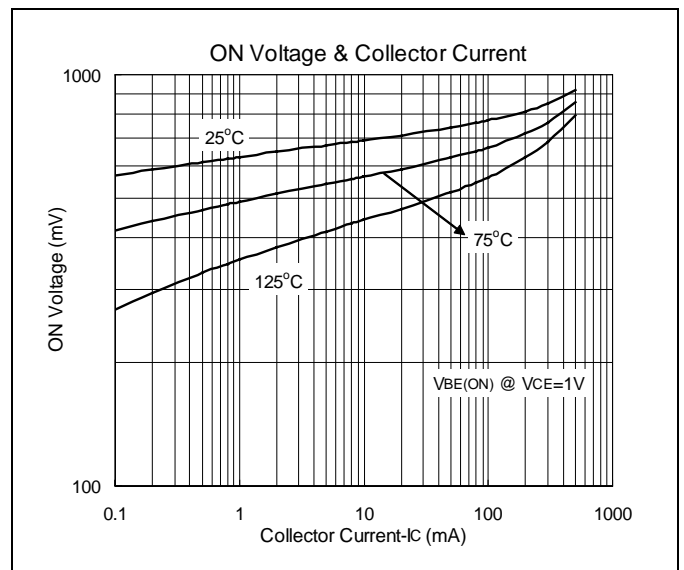
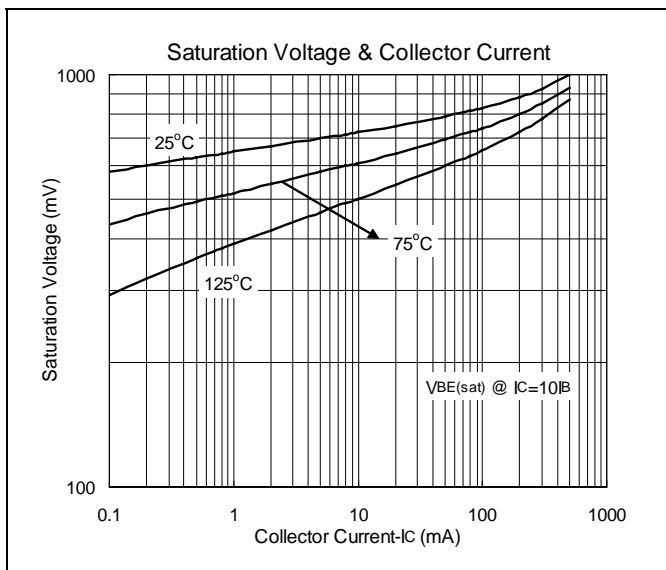
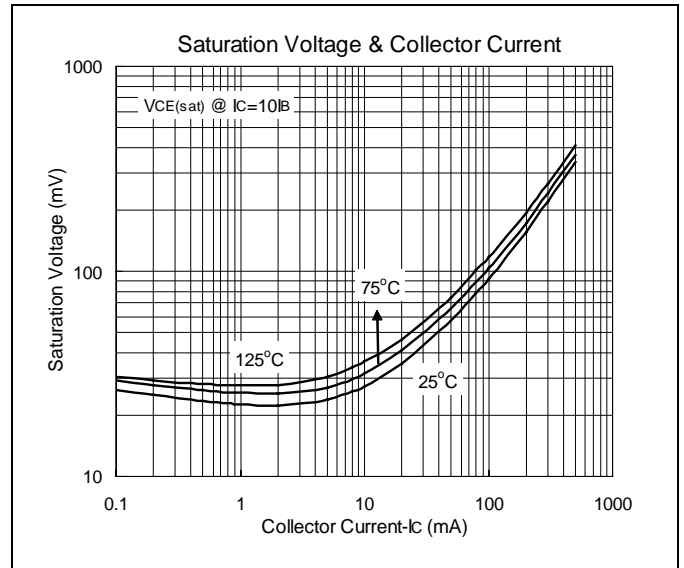
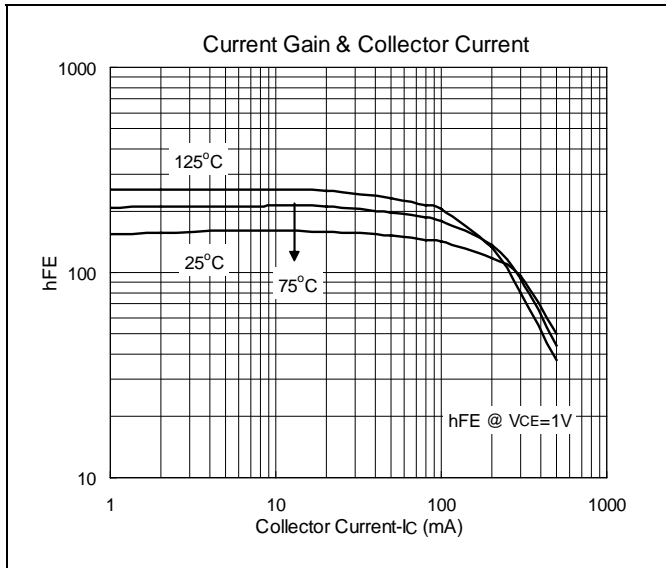
\*Pulse Test: Pulse Width  $\leq 380\mu\text{s}$ , Duty Cycle  $\leq 2\%$

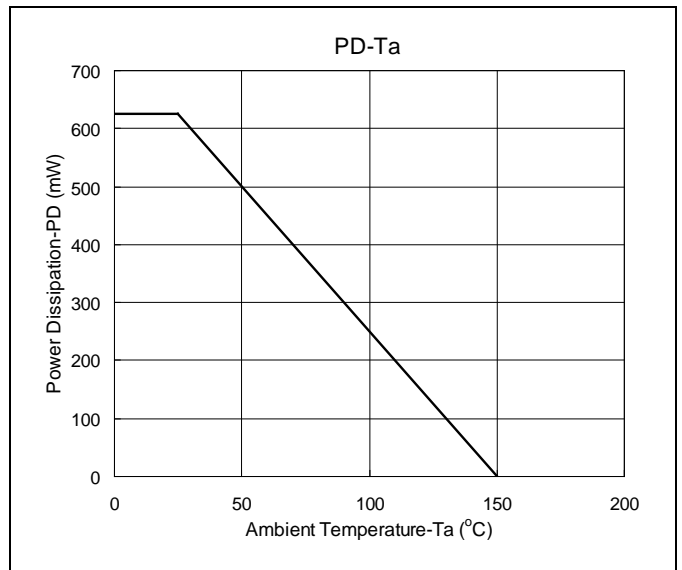
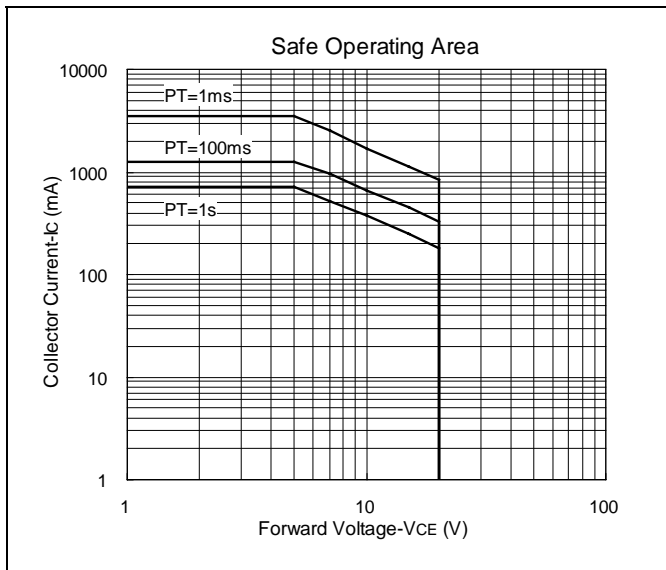
## Classification on $h_{FE1}$

Rank	G	H	I1	I2
Range	112-166	144-202	176-246	214-300



### Characteristics Curve







### TO-92 Dimension

3-Lead TO-92 Plastic Package  
HSMC Package Code: A

**Marking:**

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

Date Code      Control Code

Note: Green label is used for pb-free packing

Pin Style: 1. Emitter 2. Base 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	4.33	4.83
B	4.33	4.83
C	12.70	-
D	0.36	0.56
E	-	*1.27
F	3.36	3.76
G	0.36	0.56
H	-	*2.54
I	-	*1.27
$\alpha 1$	-	*5°
$\alpha 2$	-	*2°
$\alpha 3$	-	*2°

\*: Typical, Unit: mm

### TO-92 Taping Dimension

DIM	Min.	Max.
A	4.33	4.83
D	3.80	4.20
D1	0.36	0.53
D2	4.33	4.83
F1,F2	2.40	2.90
H	15.50	16.50
H1	8.50	9.50
H2	-	1
H2A	-	1
H3	-	27
H4	-	21
L	-	11
L1	2.50	-
P	12.50	12.90
P1	5.95	6.75
P2	50.30	51.30
T	-	0.55
T1	-	1.42
T2	0.36	0.68
W	17.50	19.00
W1	5.00	7.00

Unit: mm

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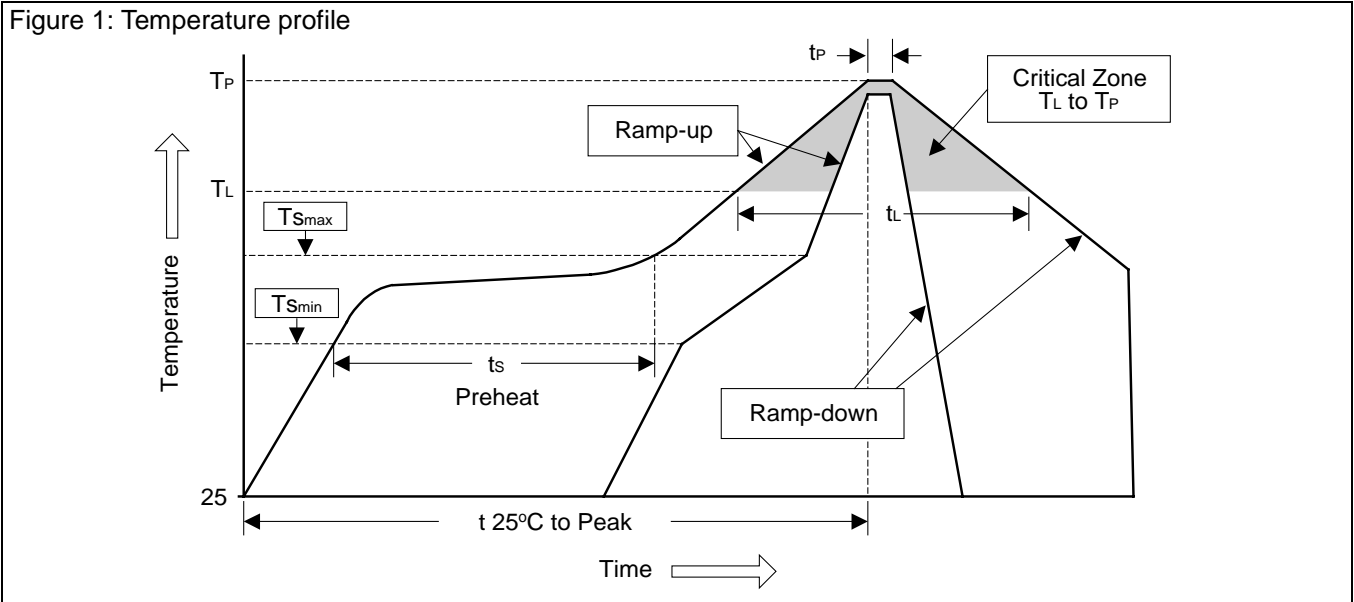
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### Soldering Methods for HSMC's Products

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



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate ( $T_L$ to $T_P$ )	$<3^{\circ}\text{C}/\text{sec}$	$<3^{\circ}\text{C}/\text{sec}$
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	$<3^{\circ}\text{C}/\text{sec}$	$<3^{\circ}\text{C}/\text{sec}$
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	$<6^{\circ}\text{C}/\text{sec}$	$<6^{\circ}\text{C}/\text{sec}$
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