



**THE DATASHEET OF  
DNLS412E-13**





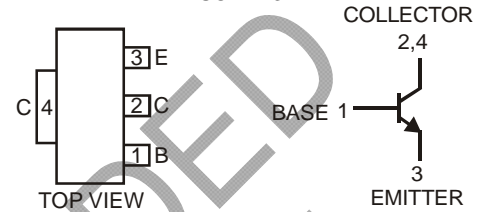
Lead-free Green

## Features

- Epitaxial Planar Die Construction
- Low Collector-Emitter Saturation Resistance  $R_{CE(SAT)} = 57.5m\Omega$  at 4A
- High DC Current Gain  $h_{FE} > 400$  at  $I_C = 3A$
- Complementary PNP Type Available (DPLS315E)
- Ideally Suited for Automated Assembly Processes
- Ideal for Medium Power Switching or Amplification Applications
- **Lead Free By Design/RoHS Compliant (Note 1)**
- **"Green" Device (Note 2)**



SOT-223



Schematic and Pin Configuration

## Mechanical Data

- Case: SOT-223
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminals: Finish — Matte Tin annealed over Copper Leadframe (Lead Free Plating). Solderable per MIL-STD-202, Method 208
- Marking Information: See Page 3
- Ordering Information: See Page 3
- Weight: 0.112 grams (approximate)

## Maximum Ratings @ $T_A = 25^\circ C$ unless otherwise specified

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	12	V
Collector-Emitter Voltage	$V_{CEO}$	12	V
Emitter-Base Voltage	$V_{EBO}$	5	V
Continuous Collector Current	$I_C$	4	A
Peak Pulse Current	$I_{CM}$	10	A

## Thermal Characteristics

Characteristic	Symbol	Value	Unit
Power Dissipation @ $T_A = 25^\circ C$ (Note 3)	$P_D$	1	W
Thermal Resistance, Junction to Ambient Air (Note 3) @ $T_A = 25^\circ C$	$R_{\theta JA}$	125	$^\circ C/W$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ C$

- Notes:
1. No purposefully added lead.
  2. Diodes Inc.'s "Green" policy can be found on our website at [http://www.diodes.com/products/lead\\_free/index.php](http://www.diodes.com/products/lead_free/index.php).
  3. Device mounted on FR-4 PCB, pad layout as shown on page 4 or in Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

### Electrical Characteristics @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>Off Characteristics</b>						
Collector-Base Breakdown Voltage	V <sub>(BR)CBO</sub>	12	—	—	V	I <sub>C</sub> = 100μA, I <sub>E</sub> = 0
Collector-Emitter Breakdown Voltage	V <sub>(BR)CEO</sub>	12	—	—	V	I <sub>C</sub> = 10mA, I <sub>B</sub> = 0
Emitter-Base Breakdown Voltage	V <sub>(BR)EBO</sub>	5	—	—	V	I <sub>E</sub> = 100μA, I <sub>C</sub> = 0
Collector Cutoff Current	I <sub>CBO</sub>	—	—	100	nA	V <sub>CB</sub> = 10V, I <sub>E</sub> = 0
Emitter Cutoff Current	I <sub>EBO</sub>	—	—	100	nA	V <sub>EB</sub> = 4V, I <sub>C</sub> = 0
<b>On Characteristics (Note 4)</b>						
Collector-Emitter Saturation Voltage	V <sub>CE(SAT)</sub>	—	0.02	0.04	V	I <sub>C</sub> = 0.1A, I <sub>B</sub> = 1mA
		—	0.03	0.06		I <sub>C</sub> = 0.1A, I <sub>B</sub> = 0.5mA
		—	0.06	0.18		I <sub>C</sub> = 1A, I <sub>B</sub> = 50mA
		—	0.20	0.35		I <sub>C</sub> = 3A, I <sub>B</sub> = 20mA
		—	0.23	0.40		I <sub>C</sub> = 4A, I <sub>B</sub> = 50mA
Base-Emitter Saturation Voltage	V <sub>BE(SAT)</sub>	—	—	1.1	V	I <sub>C</sub> = 3A, I <sub>B</sub> = 20mA
Base-Emitter Turn-On Voltage	V <sub>BE(ON)</sub>	—	—	1.0	V	V <sub>CE</sub> = 2V, I <sub>C</sub> = 3A
DC Current Gain	h <sub>FE</sub>	500	—	—	—	V <sub>CE</sub> = 2V, I <sub>C</sub> = 0.1A
		400	—	—		V <sub>CE</sub> = 2V, I <sub>C</sub> = 3A
		100	—	—		V <sub>CE</sub> = 2V, I <sub>C</sub> = 10A
<b>AC Characteristics</b>						
Transition Frequency	f <sub>T</sub>	150	—	—	MHz	V <sub>CE</sub> = 5V, I <sub>C</sub> = 50mA, f = 50MHz
Input Capacitance	C <sub>ibo</sub>	—	240	—	pF	V <sub>EB</sub> = 0.5V, f = 1MHz
Output Capacitance	C <sub>obo</sub>	—	35	—	pF	V <sub>CB</sub> = 10V, f = 1MHz
Switching Times	t <sub>on</sub>	—	40	—	ns	V <sub>CC</sub> = 10V, I <sub>C</sub> = 500mA
	t <sub>off</sub>	—	500	—	ns	I <sub>B1</sub> = -I <sub>B2</sub> = 50mA

Notes: 4. Pulse Test: Pulse width ≤300μs. Duty cycle ≤2.0%.

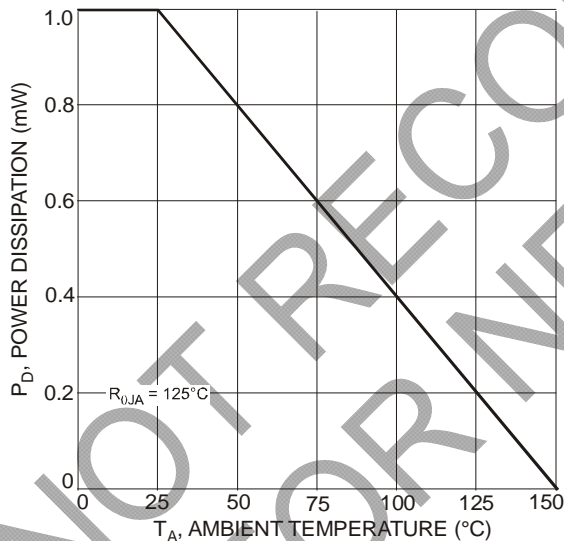


Fig. 1 Max Power Dissipation vs. Ambient Temperature

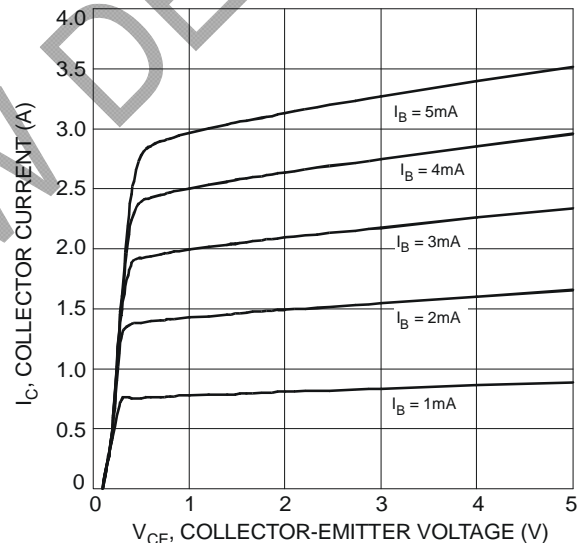


Fig. 2 Typical Collector Current vs. Collector-Emitter Voltage

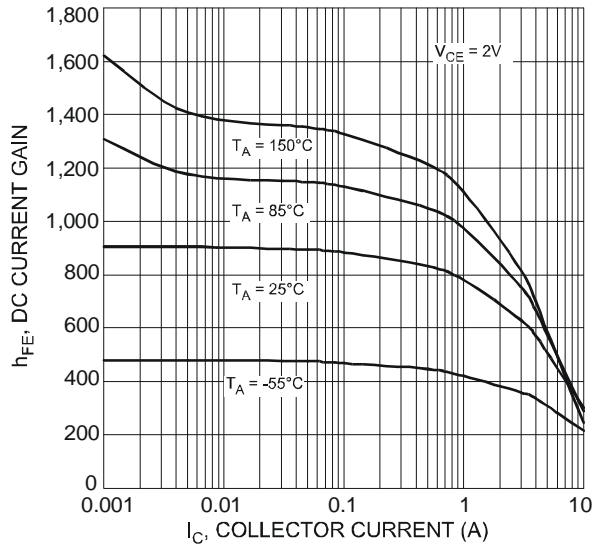


Fig. 3 Typical DC Current Gain vs. Collector Current

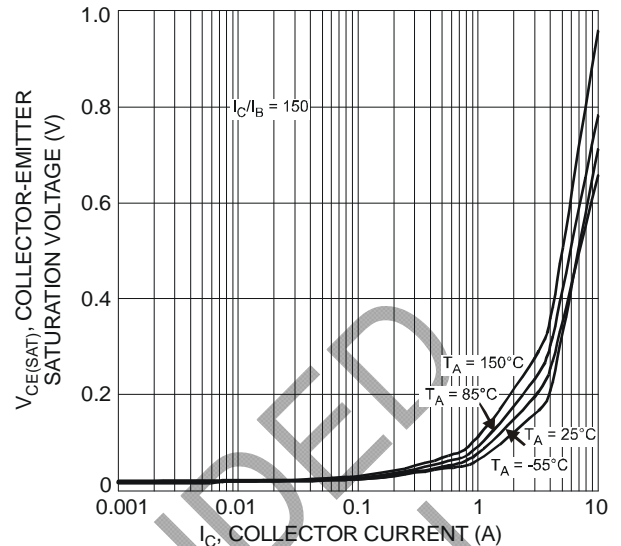


Fig. 4 Typical Collector-Emitter Saturation Voltage vs. Collector Current

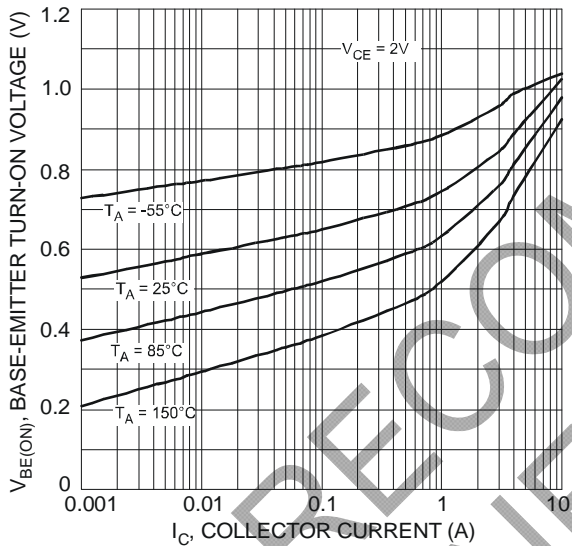


Fig. 5 Typical Base-Emitter Turn-On Voltage vs. Collector Current

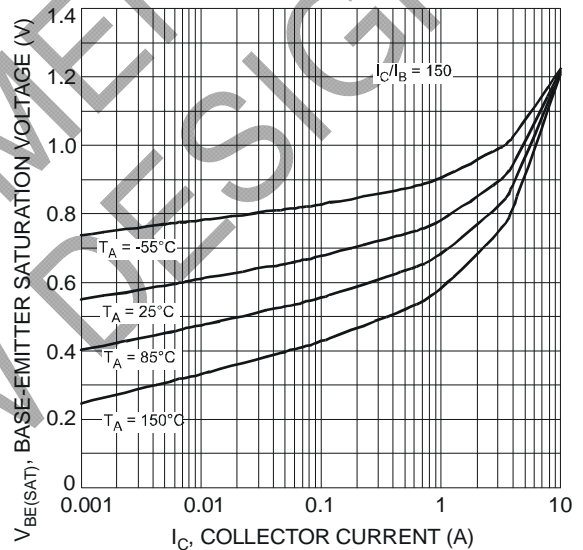


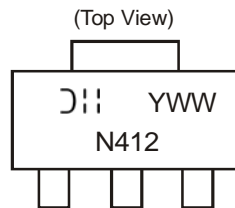
Fig. 6 Typical Base-Emitter Saturation Voltage vs. Collector Current

**Ordering Information** (Note 5)

Device	Packaging	Shipping
DNLS412E-13	SOT-223	2500/Tape & Reel

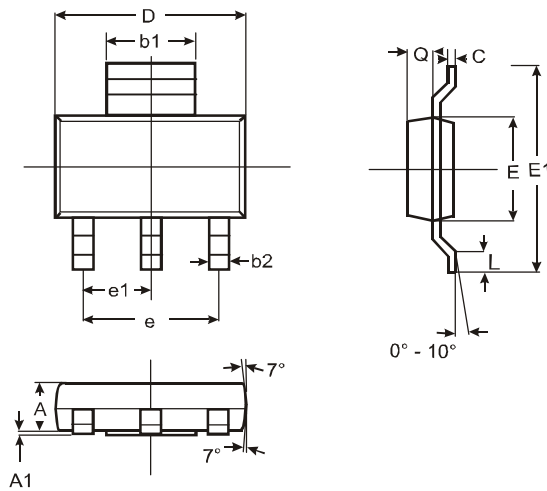
Notes: 5. For packaging details, go to our website at <http://www.diodes.com/ap2007.pdf>.

**Marking Information**



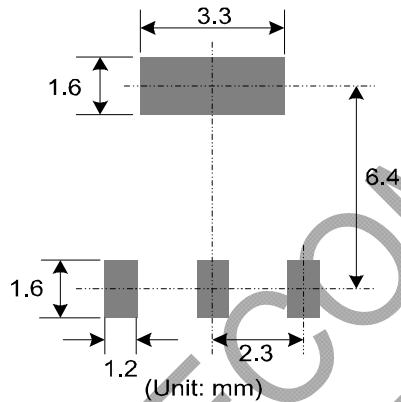
N412 = Product Type Marking Code  
 YWW = Date Code Marking  
 Y = Last digit of year ex: 7 = 2007  
 WW = Week code 01 - 52

### Package Outline Dimensions



SOT-223			
Dim	Min	Max	Typ
A	1.55	1.65	1.60
A1	0.010	0.15	0.05
b1	2.90	3.10	3.00
b2	0.60	0.80	0.70
C	0.20	0.30	0.25
D	6.45	6.55	6.50
E	3.45	3.55	3.50
E1	6.90	7.10	7.00
e	—	—	4.60
e1	—	—	2.30
L	0.85	1.05	0.95
Q	0.84	0.94	0.89
<b>All Dimensions in mm</b>			

### Suggested Pad Layout:



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