

# BUV21

## SWITCHMODE™ Series NPN Silicon Power Transistor

This device is designed for high speed, high current, high power applications.

### Features

- High DC Current Gain:  
 $h_{FE} \text{ min} = 20$  at  $I_C = 12 \text{ A}$
- Low  $V_{CE(sat)}$ ,  $V_{CE(sat)}$   
 $\text{max} = 0.6 \text{ V}$  at  $I_C = 8 \text{ A}$
- Very Fast Switching Times:  
 $TF \text{ max} = 0.4 \mu\text{s}$  at  $I_C = 25 \text{ A}$
- Pb-Free Package is Available\*

### MAXIMUM RATINGS

| Rating  | Symbol         | Value      | Unit             |
|---|----------------|------------|------------------|
| Collector-Emitter Voltage                               | $V_{CEO(SUS)}$ | 200        | Vdc              |
| Collector-Base Voltage                                  | $V_{CBO}$      | 250        | Vdc              |
| Emitter-Base Voltage                                    | $V_{EBO}$      | 7          | Vdc              |
| Collector-Emitter Voltage ( $V_{BE} = -1.5 \text{ V}$ ) | $V_{CEX}$      | 250        | Vdc              |
| Collector-Emitter Voltage ( $R_{BE} = 100 \Omega$ )     | $V_{CER}$      | 240        | Vdc              |
| Collector-Current – Continuous                          | $I_C$          | 40         | Adc              |
| – Peak ( $PW \leq 10 \text{ ms}$ )                      | $I_{CM}$       | 50         | Apk              |
| Base-Current Continuous                                 | $I_B$          | 8          | Adc              |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$     | $P_D$          | 250        | W                |
| Operating and Storage Junction Temperature Range        | $T_J, T_{stg}$ | -65 to 200 | $^\circ\text{C}$ |

### THERMAL CHARACTERISTICS

| Characteristics                      | Symbol        | Max | Unit               |
|--------------------------------------|---------------|-----|--------------------|
| Thermal Resistance, Junction-to-Case | $\theta_{JC}$ | 0.7 | $^\circ\text{C/W}$ |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

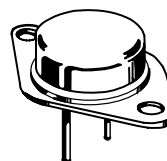
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



ON Semiconductor®

<http://onsemi.com>

**40 AMPERES  
NPN SILICON POWER  
METAL TRANSISTOR  
200 VOLTS – 250 WATTS**



TO-204AE (TO-3)  
CASE 197A

### MARKING DIAGRAM



BUV21 = Device Code  
G = Pb-Free Package  
A = Assembly Location  
Y = Year  
WW = Work Week  
MEX = Country of Origin

### ORDERING INFORMATION

| Device | Package          | Shipping         |
|--------|------------------|------------------|
| BUV21  | TO-204           | 100 Units / Tray |
| BUV21G | TO-204 (Pb-Free) | 100 Units / Tray |

# BUV21

## ELECTRICAL CHARACTERISTICS

| Characteristic  | Symbol         | Min        | Max         | Unit |
|---|----------------|------------|-------------|------|
| <b>OFF CHARACTERISTICS</b> (Note 1)   |                |            |             |      |
| Collector–Emitter Sustaining Voltage<br>( $I_C = 200\text{ mA}$ , $I_B = 0$ , $L = 25\text{ mH}$ )  | $V_{CEO(sus)}$ | 200        |             | Vdc  |
| Collector Cutoff Current at Reverse Bias:<br>( $V_{CE} = 250\text{ V}$ , $V_{BE} = -1.5\text{ V}$ )( $T_C = 25^\circ\text{C}$ unless otherwise noted)<br>( $V_{CE} = 250\text{ V}$ , $V_{BE} = -1.5\text{ V}$ , $T_C = 125^\circ\text{C}$ ) | $I_{CEX}$      |            | 3.0<br>12.0 | mAdc |
| Collector–Emitter Cutoff Current<br>( $V_{CE} = 160\text{ V}$ )   | $I_{CEO}$      |            | 3.0         | mAdc |
| Emitter–Base Reverse Voltage<br>( $I_E = 50\text{ mA}$ )  | $V_{EBO}$      | 7          |             | V    |
| Emitter–Cutoff Current<br>( $V_{EB} = 5\text{ V}$ )   | $I_{EBO}$      |            | 1.0         | mAdc |
| <b>SECOND BREAKDOWN</b>   |                |            |             |      |
| Second Breakdown Collector Current with base forward biased<br>( $V_{CE} = 20\text{ V}$ , $t = 1\text{ s}$ )<br>( $V_{CE} = 140\text{ V}$ , $t = 1\text{ s}$ )  | $I_{S/b}$      | 12<br>0.15 |             | Adc  |

## ON CHARACTERISTICS

 (Note 1)

|  |               |          |            |     |
|--|---------------|----------|------------|-----|
| DC Current Gain<br>( $I_C = 12\text{ A}$ , $V_{CE} = 2\text{ V}$ )<br>( $I_C = 25\text{ A}$ , $V_{CE} = 4\text{ V}$ )                  | $h_{FE}$      | 20<br>10 | 60         |     |
| Collector–Emitter Saturation Voltage<br>( $I_C = 12\text{ A}$ , $I_B = 1.2\text{ A}$ )<br>( $I_C = 25\text{ A}$ , $I_B = 3\text{ A}$ ) | $V_{CE(sat)}$ |          | 0.6<br>1.5 | Vdc |
| Base–Emitter Saturation Voltage<br>( $I_C = 25\text{ A}$ , $I_B = 3\text{ A}$ )  | $V_{BE(sat)}$ |          | 1.5        | Vdc |

## DYNAMIC CHARACTERISTICS

|  |       |     |  |     |
|--|-------|-----|--|-----|
| Current Gain – Bandwidth Product<br>( $V_{CE} = 15\text{ V}$ , $I_C = 2\text{ A}$ , $f = 4\text{ MHz}$ ) | $f_T$ | 8.0 |  | MHz |
|--|-------|-----|--|-----|

## SWITCHING CHARACTERISTICS

 (Resistive Load)

|              |   |          |     |               |
|--------------|---|----------|-----|---------------|
| Turn-on Time | ( $I_C = 25\text{ A}$ , $I_{B1} = I_{B2} = 3\text{ A}$ ,<br>$V_{CC} = 100\text{ V}$ , $R_C = 4\ \Omega$ ) | $t_{on}$ | 1.0 | $\mu\text{s}$ |
| Storage Time |   | $t_s$    | 1.8 |               |
| Fall Time    |   | $t_f$    | 0.4 |               |

1. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

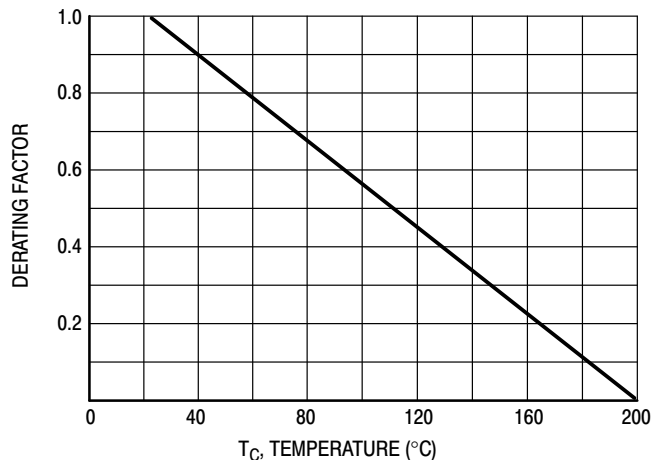


Figure 1. Power Derating

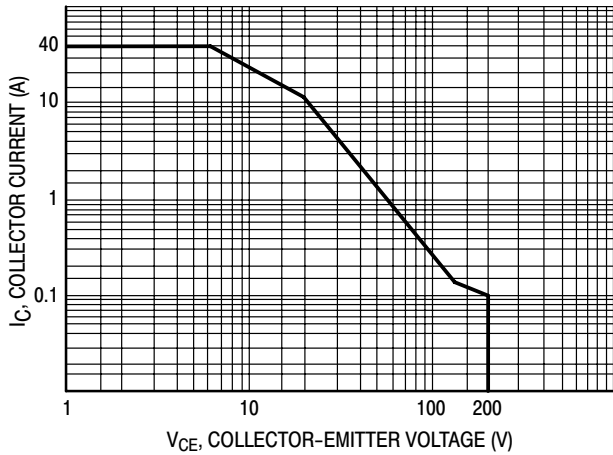


Figure 2. Active Region Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 2 is based on  $T_C = 25^\circ C$ ,  $T_{J(pk)}$  is variable depending on power level. Second breakdown limitations do not derate the same as thermal limitations.

At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

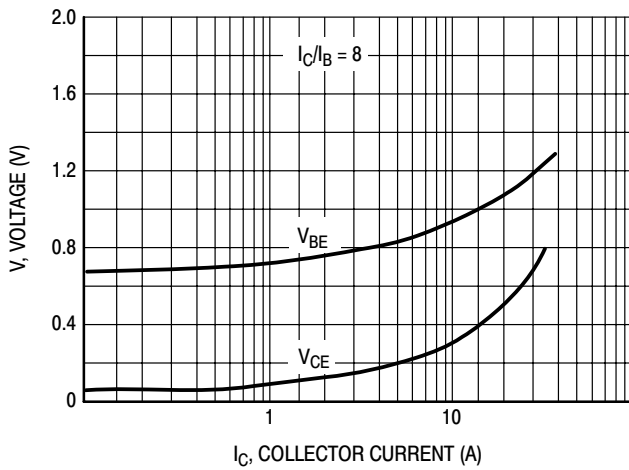


Figure 3. "On" Voltages

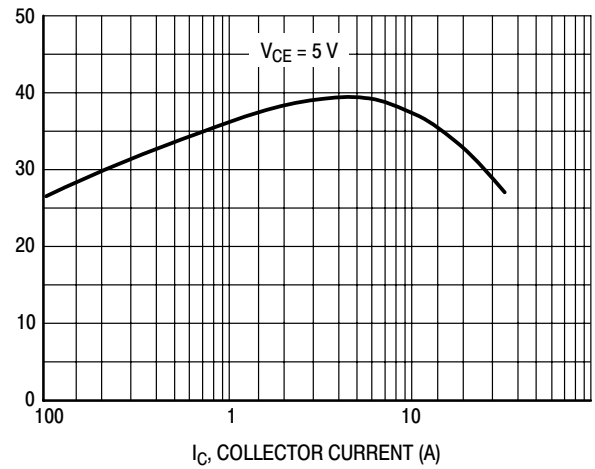


Figure 4. DC Current Gain

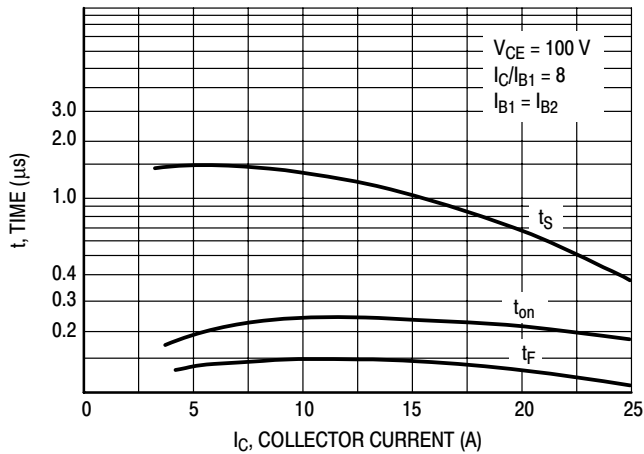
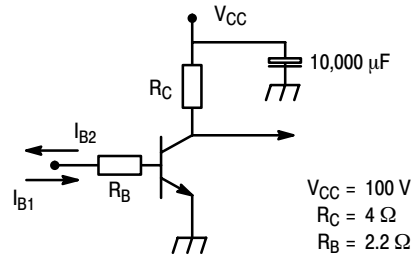


Figure 5. Resistive Switching Performance



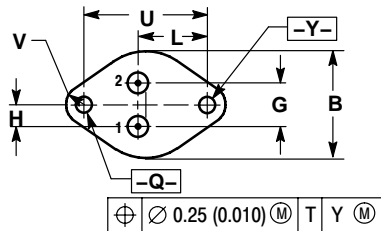
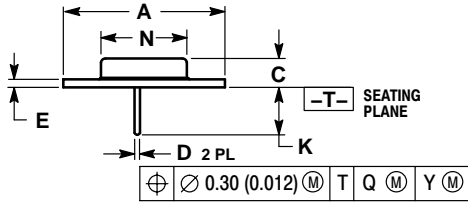
$R_C - R_B$ : Non inductive resistances

Figure 6. Switching Times Test Circuit

# BUV21

## PACKAGE DIMENSIONS


### TO-204 (TO-3) CASE 197A-05 ISSUE K



- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 1.530 REF |       | 38.86 REF   |       |
| B   | 0.990     | 1.050 | 25.15       | 26.67 |
| C   | 0.250     | 0.335 | 6.35        | 8.51  |
| D   | 0.057     | 0.063 | 1.45        | 1.60  |
| E   | 0.060     | 0.070 | 1.53        | 1.77  |
| G   | 0.430 BSC |       | 10.92 BSC   |       |
| H   | 0.215 BSC |       | 5.46 BSC    |       |
| K   | 0.440     | 0.480 | 11.18       | 12.19 |
| L   | 0.665 BSC |       | 16.89 BSC   |       |
| N   | 0.760     | 0.830 | 19.31       | 21.08 |
| Q   | 0.151     | 0.165 | 3.84        | 4.19  |
| U   | 1.187 BSC |       | 30.15 BSC   |       |
| V   | 0.131     | 0.188 | 3.33        | 4.77  |

SWITCHMODE is a trademark of Semiconductor Components Industries, LLC.

**ON Semiconductor** and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

#### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 61312, Phoenix, Arizona 85082-1312 USA  
**Phone:** 480-829-7710 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 480-829-7709 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada

**Japan:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
**Phone:** 81-3-5773-3850

**ON Semiconductor Website:** <http://onsemi.com>

**Order Literature:** <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.