

*New Jersey Semi-Conductor Products, Inc.*

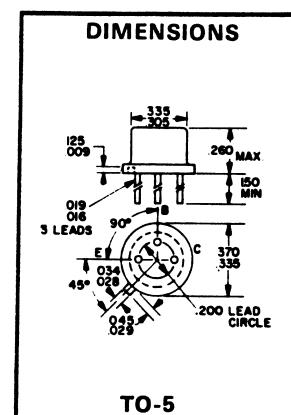
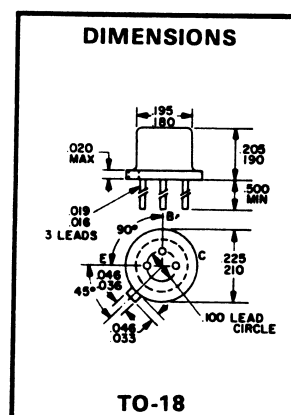
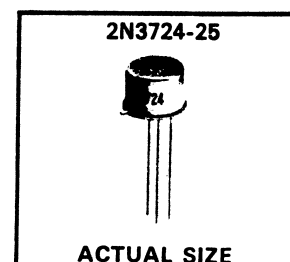
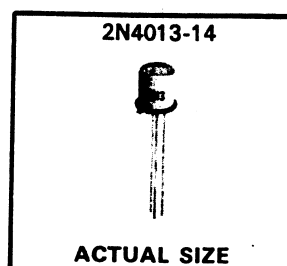
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TELEPHONE: (201) 376-2922  
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SILICON  
SWITCHING TRANSISTORS **2N3724 2N4013**  
**2N3725 2N4014**

# **HIGH SPEED NPN SILICON PLANAR EPITAXIAL HIGH-VOLTAGE HIGH-CURRENT TRANSISTORS**

- High Voltage: 80V min. 2N3725, 2N4014
- High Gain: 65 typ. @ 1000 mA
- Low  $V_{CE(sat)}$ : 0.5V typ. @ 1000 mA
- Low  $C_{ob}$ : 4.8 pF typ. @ 10V. 2N3725, 2N4014
- Fast  $t_{on}$ : 18 nsec typ. @ 500mA
- Fast  $t_{off}$ : 45 nsec typ. @ 500mA



The ITT 2N3724 • 2N3725 and 2N4013 • 2N4014 are high-voltage, high-current NPN silicon planar epitaxial transistors useful for applications requiring breakdown voltages up to 50V and operating current to one ampere. Low saturation voltage and fast switching times make the transistor ideal for high-frequency amplifiers, core drivers, relay drivers and pulse generators.

## **ABSOLUTE MAXIMUM RATINGS**

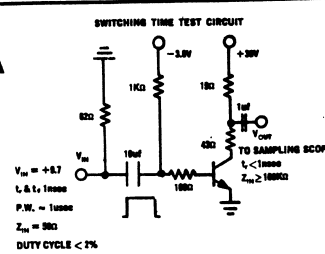
| CHARACTERISTICS                                                           | 2N3724<br>2N4013                | 2N3725<br>2N4014               | UNITS        |
|---------------------------------------------------------------------------|---------------------------------|--------------------------------|--------------|
| Collector-to-Base Voltage                                                 | 50                              | 80                             | Volts        |
| Collector-to-Emitter Voltage (shorted base)                               | 50                              | 80                             | Volts        |
| Collector-to-Emitter Voltage (open base)                                  | 30                              | 50                             | Volts        |
| Emitter-to-Base Voltage                                                   | 6.0                             | 6.0                            | Volts        |
| Collector Current (300 $\mu$ sec; 1% duty cycle)                          | 1.0                             | 1.0                            | Amps         |
| Junction Temperature (op. and stg.)                                       | -65 to +200                     |                                | $^{\circ}$ C |
| Maximum Power Dissipation                                                 | 2N4013<br>2N4014                | 2N3724<br>2N3725               |              |
| Total Dissipation @ $T_c = 25^{\circ}$ C<br>(derate above $25^{\circ}$ C) | 1.2<br>(6.8 mW/ $^{\circ}$ C)   | 3.5<br>(20mW/ $^{\circ}$ C)    | Watts        |
| Total Dissipation @ $T_A = 25^{\circ}$ C<br>(derate above $25^{\circ}$ C) | 0.36<br>(2.06 mW/ $^{\circ}$ C) | 0.8<br>(4.56 mW/ $^{\circ}$ C) | Watts        |

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## ELECTRICAL CHARACTERISTICS @ 25°C unless otherwise noted.

| SYMBOL                                                                                                                             | 2N3724<br>2N4013                                  |                                              |                                             | 2N3725<br>2N4014                                  |                                              |                                            | UNIT                                                                                                             | CONDITIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------|---------------------------------------------|---------------------------------------------------|----------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                    | MIN.                                              | TYP.                                         | MAX.                                        | MIN.                                              | TYP.                                         | MAX.                                       |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b><math>BV_{CBO}</math></b><br><b><math>BV_{CES}</math></b><br><b><math>LV_{CEO}^{1,2}</math></b><br><b><math>BV_{EBO}</math></b> | <b>50</b><br><b>50</b><br><b>30</b><br><b>6.0</b> |                                              |                                             | <b>80</b><br><b>80</b><br><b>50</b><br><b>6.0</b> |                                              |                                            | <b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b>                                                             | <b><math>I_C = 10\mu A</math></b><br><b><math>I_C = 10\mu A</math></b><br><b><math>I_C = 10mA</math></b><br><b><math>I_E = 10\mu A</math></b>                                                                                                                                                                                                                                                                                                                       |
| <b><math>h_{FE}^1</math></b>                                                                                                       | 30<br>60<br>40<br>35<br>25<br>30<br>30<br>20      | 60<br>90<br>65<br>50<br>45<br>65<br>45<br>40 | 150                                         | 30<br>60<br>40<br>35<br>20<br>25<br>30<br>20      | 60<br>90<br>65<br>50<br>40<br>65<br>40<br>35 | 150                                        |                                                                                                                  | $I_C = 10mA$ $V_{CE} = 1.0V$<br>$I_C = 100mA$ $V_{CE} = 1.0V$<br>$I_C = 300mA$ $V_{CE} = 1.0V$<br>$I_C = 500mA$ $V_{CE} = 1.0V$<br>$I_C = 800mA$ $V_{CE} = 2.0V$<br><b><math>I_C = 1000mA</math> <math>V_{CE} = 5.0V</math></b><br>$I_C = 100mA$ $V_{CE} = 1.0V$ $T_A = -55^\circ C$<br>$I_C = 500mA$ $V_{CE} = 1.0V$ $T_A = -55^\circ C$                                                                                                                           |
| <b><math>V_{CE(sat)}^1</math></b>                                                                                                  |                                                   | 0.11<br>0.13<br>0.22<br>0.3<br>0.4<br>0.5    | 0.25<br>0.2<br>0.32<br>0.42<br>0.65<br>0.75 |                                                   | 0.19<br>0.21<br>0.31<br>0.4<br>0.5<br>0.6    | 0.25<br>0.26<br>0.4<br>0.52<br>0.8<br>0.95 | <b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b>                                 | $I_C = 10mA$ $I_B = 1.0mA$<br>$I_C = 100mA$ $I_B = 10mA$<br>$I_C = 300mA$ $I_B = 30mA$<br>$I_C = 500mA$ $I_B = 50mA$<br>$I_C = 800mA$ $I_B = 80mA$<br><b><math>I_C = 1000mA</math> <math>I_B = 100mA</math></b>                                                                                                                                                                                                                                                     |
| <b><math>V_{BE(sat)}^1</math></b>                                                                                                  |                                                   | 0.64<br>0.75<br>0.89<br>0.9<br>1.0<br>1.1    | 0.76<br>0.86<br>1.1<br>1.2<br>1.5<br>1.7    |                                                   | 0.64<br>0.75<br>0.89<br>0.9<br>1.0<br>1.1    | 0.76<br>0.86<br>1.1<br>1.2<br>1.5<br>1.7   | <b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b><br><b>Vdc</b>                                 | $I_C = 10mA$ $I_B = 1.0mA$<br>$I_C = 100mA$ $I_B = 10mA$<br>$I_C = 300mA$ $I_B = 30mA$<br>$I_C = 500mA$ $I_B = 50mA$<br>$I_C = 800mA$ $I_B = 80mA$<br>$I_C = 1000mA$ $I_B = 100mA$                                                                                                                                                                                                                                                                                  |
| <b><math>I_{CBO}</math></b>                                                                                                        |                                                   | 0.25<br>27                                   | 1.7<br>120                                  |                                                   | 0.33<br>25                                   | 1.7<br>120                                 | <b><math>\mu A</math></b><br><b><math>\mu A</math></b><br><b><math>\mu A</math></b><br><b><math>\mu A</math></b> | $V_{CB} = 40V$<br>$V_{CB} = 60V$<br>$V_{CB} = 40V$ $T_A = 100^\circ C$<br>$V_{CB} = 60V$ $T_A = 100^\circ C$                                                                                                                                                                                                                                                                                                                                                        |
| <b><math>C_{ob}</math></b><br><b><math>C_{ib}</math></b>                                                                           |                                                   | 6.0<br>40                                    | 12<br>55                                    |                                                   | 4.8<br>40                                    | 10<br>55                                   | <b>pF</b><br><b>pF</b>                                                                                           | <b><math>V_{CB} = 10V</math></b><br><b><math>V_{EB} = 0.5V</math></b>                                                                                                                                                                                                                                                                                                                                                                                               |
| <b><math>h_{fe}</math></b>                                                                                                         | 3.0                                               | 4.5                                          |                                             | 3.0                                               | 4.5                                          |                                            |                                                                                                                  | $I_C = 50mA$ $V_{CE} = 10V$<br>$f = 100MHz$                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b><math>t_{on}</math></b>                                                                                                         |                                                   | 18                                           | 35                                          |                                                   | 18                                           | 35                                         | <b>nsec</b>                                                                                                      | <b><math>I_C \approx 500mA</math></b><br><b><math>I_{B1} \approx 50mA</math></b><br><b><math>I_{B2} \approx 50mA</math></b><br> <p>SWITCHING TIME TEST CIRCUIT</p> <p><math>V_{CC} = +5V</math><br/> <math>V_{EE} = -5V</math><br/> <math>P.W. = 100ns</math><br/> <math>T_A = 25^\circ C</math><br/> <math>Z_{in} = 50\Omega</math><br/> <math>DUTY CYCLE &lt; 1\%</math></p> |
| <b><math>t_{off}</math></b>                                                                                                        |                                                   | 45                                           | 60                                          |                                                   | 45                                           | 60                                         | <b>nsec</b>                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

NOTES: 1. Pulsed width  $\leq 300 \mu sec$ ; 1% duty cycle.  
2. Lowest emitter-to-collector voltage.