

# Complementary Silicon Plastic Power Transistors

... designed for use as high-frequency drivers in audio amplifiers.

- DC Current Gain Specified to 4.0 Amperes  
 $h_{FE} = 40 \text{ (Min) @ } I_C = 3.0 \text{ Adc}$   
 $= 20 \text{ (Min) @ } I_C = 4.0 \text{ Adc}$
- Collector-Emitter Sustaining Voltage —  
 $V_{CEO(sus)} = 120 \text{ Vdc (Min) — MJE15028, MJE15029}$   
 $= 150 \text{ Vdc (Min) — MJE15030, MJE15031}$
- High Current Gain — Bandwidth Product  
 $f_T = 30 \text{ MHz (Min) @ } I_C = 500 \text{ mAdc}$
- TO-220AB Compact Package

## MAXIMUM RATINGS

| Rating                                                                                | Symbol         | MJE15028<br>MJE15029 | MJE15030<br>MJE15031 | Unit                         |
|---------------------------------------------------------------------------------------|----------------|----------------------|----------------------|------------------------------|
| Collector-Emitter Voltage                                                             | $V_{CEO}$      | 120                  | 150                  | Vdc                          |
| Collector-Base Voltage                                                                | $V_{CB}$       | 120                  | 150                  | Vdc                          |
| Emitter-Base Voltage                                                                  | $V_{EB}$       | 5.0                  |                      | Vdc                          |
| Collector Current — Continuous<br>— Peak                                              | $I_C$          | 8.0<br>16            |                      | Adc                          |
| Base Current                                                                          | $I_B$          | 2.0                  |                      | Adc                          |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 50<br>0.40           |                      | Watts<br>W/ $^\circ\text{C}$ |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 2.0<br>0.016         |                      | Watts<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                   | $T_J, T_{stg}$ | -65 to +150          |                      | $^\circ\text{C}$             |

## THERMAL CHARACTERISTICS

| Characteristic                          | Symbol          | Max  | Unit               |
|-----------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction to Case    | $R_{\theta JC}$ | 2.5  | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 62.5 | $^\circ\text{C/W}$ |

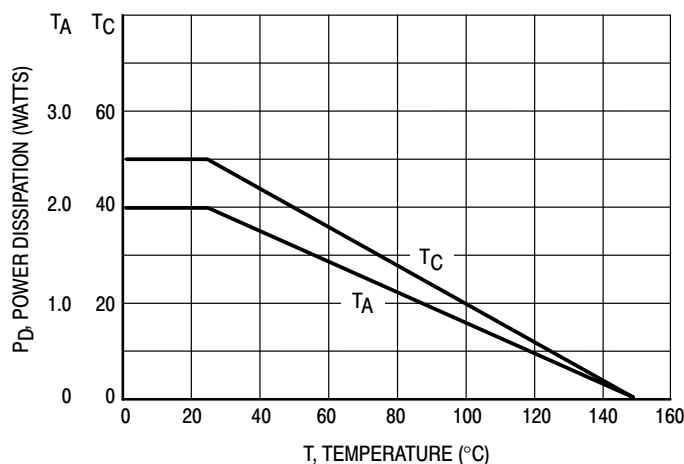


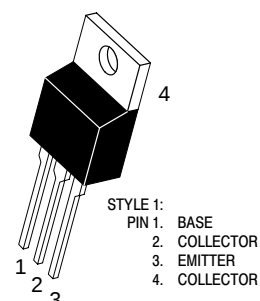
Figure 1. Power Derating

Preferred devices are ON Semiconductor recommended choices for future use and best overall value.

**NPN**  
**MJE15028\***  
**MJE15030\***  
**PNP**  
**MJE15029\***  
**MJE15031\***

\*ON Semiconductor Preferred Device

**8 AMPERE**  
**POWER TRANSISTORS**  
**COMPLEMENTARY**  
**SILICON**  
**120-150 VOLTS**  
**50 WATTS**



**CASE 221A-09**  
**TO-220AB**

# MJE15028 MJE15030 MJE15029 MJE15031

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

### OFF CHARACTERISTICS

|                                                                                                                    |                                          |                |            |            |                 |
|--------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------|------------|------------|-----------------|
| Collector–Emitter Sustaining Voltage (1)<br>( $I_C = 10\text{ mAdc}$ , $I_B = 0$ )                                 | MJE15028, MJE15029<br>MJE15030, MJE15031 | $V_{CEO(sus)}$ | 120<br>150 | —<br>—     | Vdc             |
| Collector Cutoff Current<br>( $V_{CE} = 120\text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 150\text{ Vdc}$ , $I_B = 0$ ) | MJE15028, MJE15029<br>MJE15030, MJE15031 | $I_{CEO}$      | —<br>—     | 0.1<br>0.1 | mAdc            |
| Collector Cutoff Current<br>( $V_{CB} = 120\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 150\text{ Vdc}$ , $I_E = 0$ ) | MJE15028, MJE15029<br>MJE15030, MJE15031 | $I_{CBO}$      | —<br>—     | 10<br>10   | $\mu\text{Adc}$ |
| Emitter Cutoff Current<br>( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )                                                |                                          | $I_{EBO}$      | —          | 10         | $\mu\text{Adc}$ |

### ON CHARACTERISTICS (1)

|                                                                                                                                                                                                                                                         |               |                      |                  |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------|------------------|-----|
| DC Current Gain<br>( $I_C = 0.1\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )<br>( $I_C = 2.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )<br>( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )<br>( $I_C = 4.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ ) | $h_{FE}$      | 40<br>40<br>40<br>20 | —<br>—<br>—<br>— | —   |
| DC Current Gain Linearity<br>( $V_{CE}$ From 2.0 V to 20 V, $I_C$ From 0.1 A to 3 A)<br>(NPN TO PNP)                                                                                                                                                    | $h_{FE}$      | Typ<br>2<br>3        |                  |     |
| Collector–Emitter Saturation Voltage<br>( $I_C = 1.0\text{ Adc}$ , $I_B = 0.1\text{ Adc}$ )                                                                                                                                                             | $V_{CE(sat)}$ | —                    | 0.5              | Vdc |
| Base–Emitter On Voltage<br>( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )                                                                                                                                                                       | $V_{BE(on)}$  | —                    | 1.0              | Vdc |

### DYNAMIC CHARACTERISTICS

|                                                                                                                             |       |    |   |     |
|-----------------------------------------------------------------------------------------------------------------------------|-------|----|---|-----|
| Current Gain — Bandwidth Product (2)<br>( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 10\text{ MHz}$ ) | $f_T$ | 30 | — | MHz |
|-----------------------------------------------------------------------------------------------------------------------------|-------|----|---|-----|

(1) Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

(2)  $f_T = |h_{fe}| \cdot f_{test}$ .

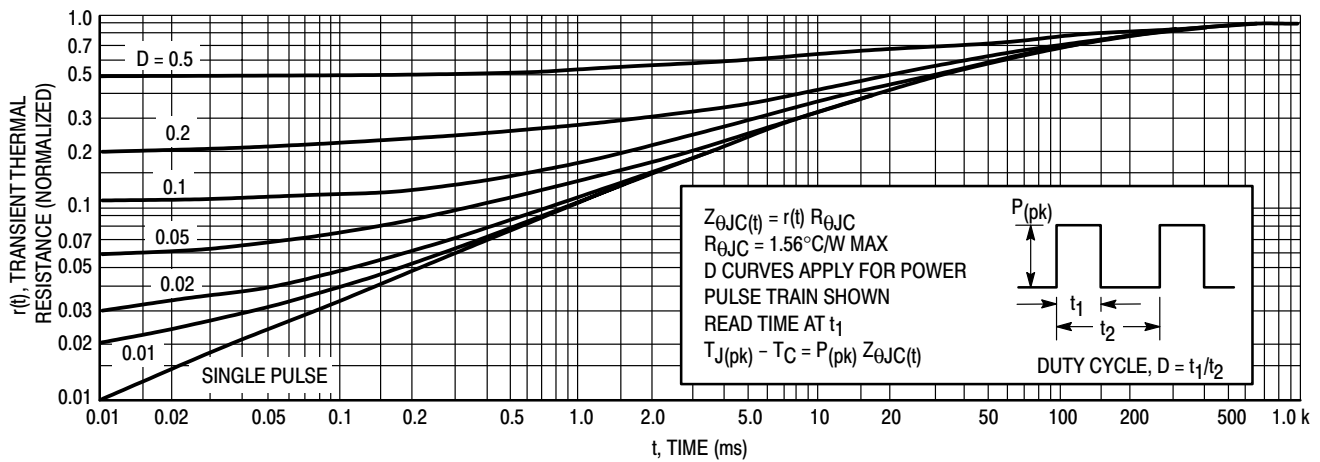


Figure 2. Thermal Response

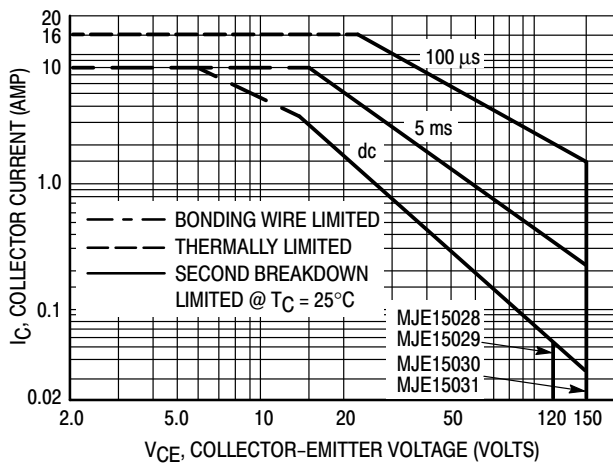
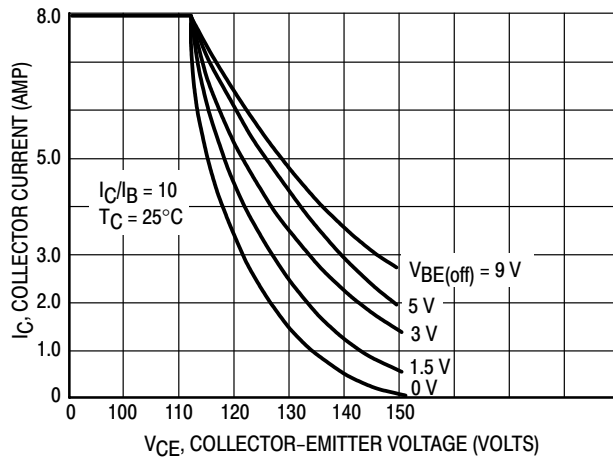


Figure 3. Forward Bias Safe Operating Area

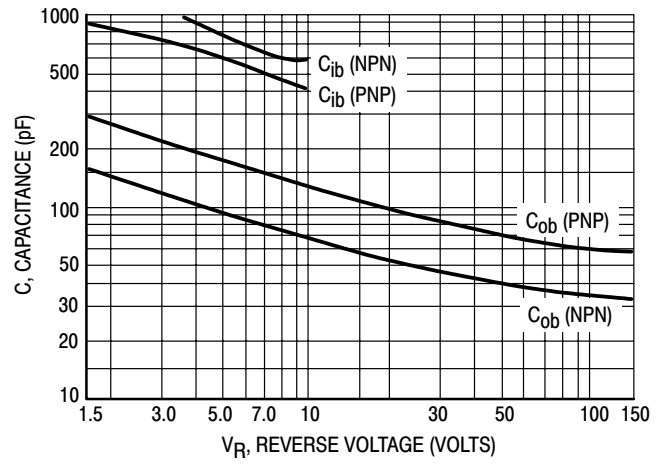
There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation, i.e., the transistor must not be subjected to greater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

The data of Figures 3 and 4 is based on  $T_{j(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{j(pk)} < 150^\circ\text{C}$ .  $T_{j(pk)}$  may be calculated from the data in Figure 2. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

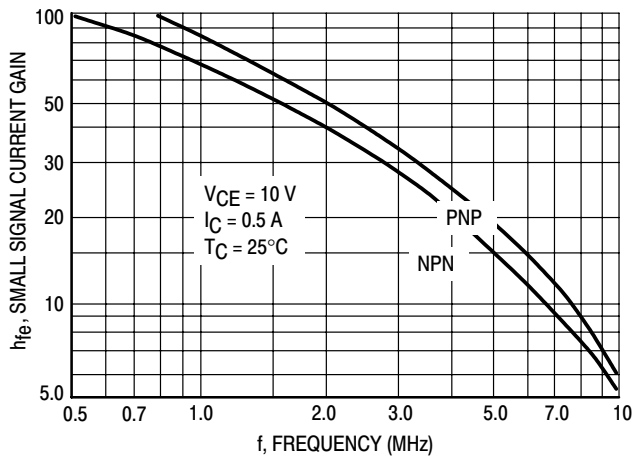
# MJE15028 MJE15030 MJE15029 MJE15031



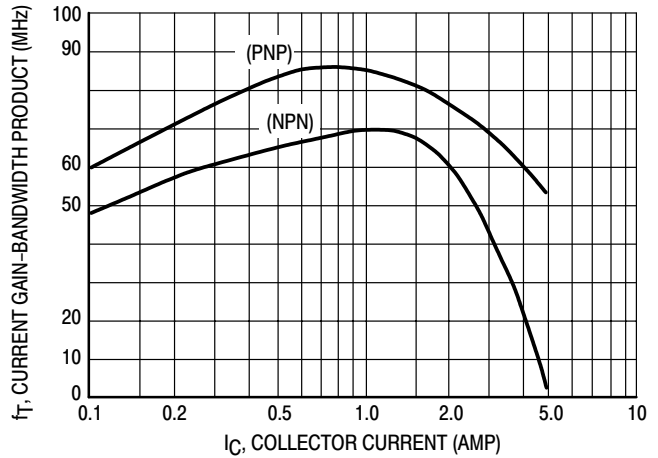
**Figure 4. Reverse-Bias Switching Safe Operating Area**



**Figure 5. Capacitances**



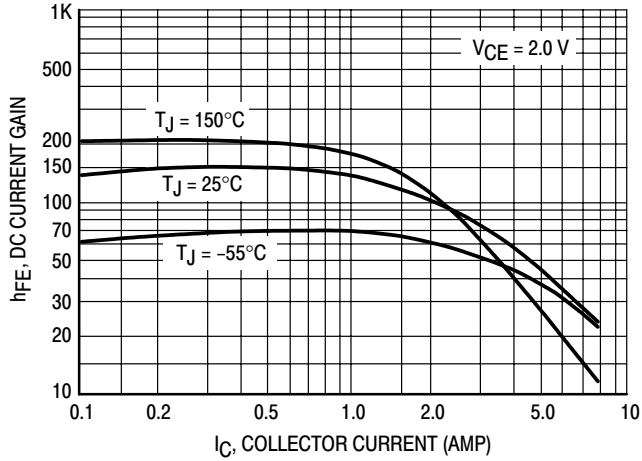
**Figure 6. Small-Signal Current Gain**



**Figure 7. Current Gain-Bandwidth Product**

# MJE15028 MJE15030 MJE15029 MJE15031

NPN — MJE15028 MJE15030



PNP — MJE15029 MJE15031

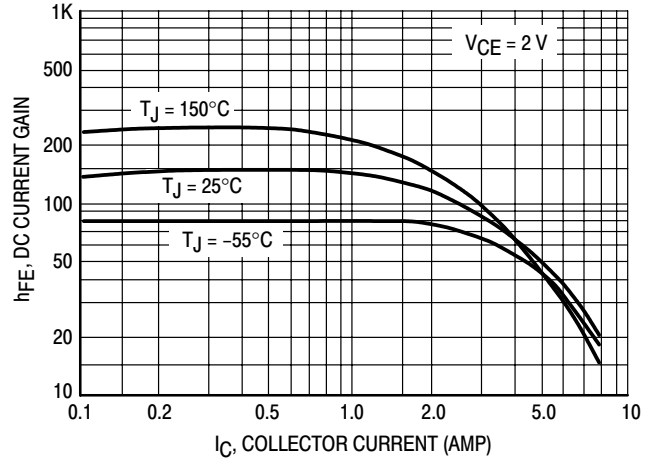
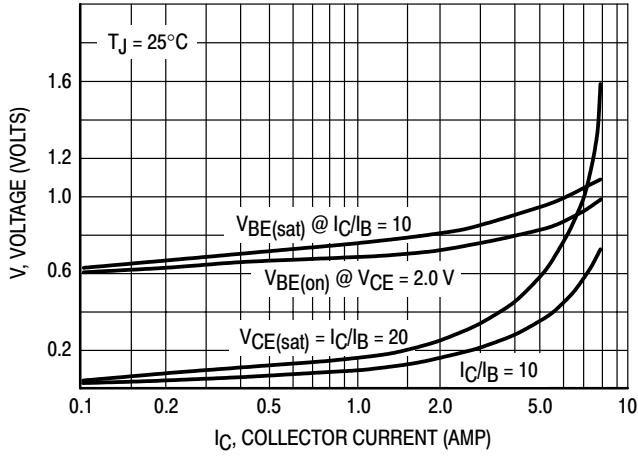


Figure 8. DC Current Gain

NPN



PNP

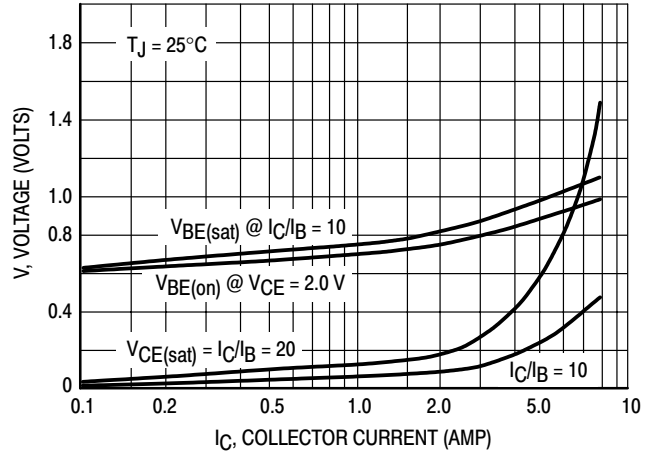


Figure 9. "On" Voltage

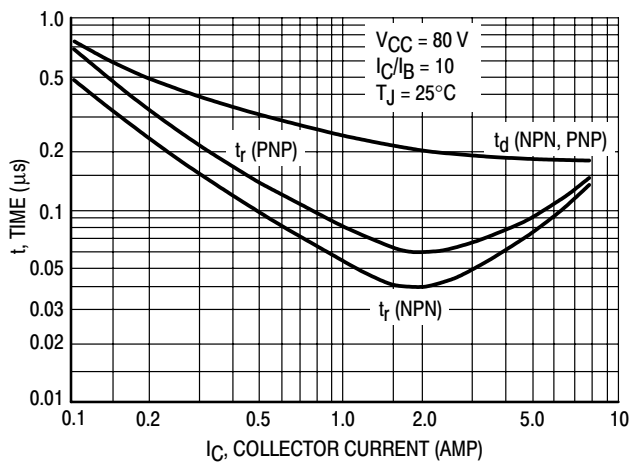


Figure 10. Turn-On Times

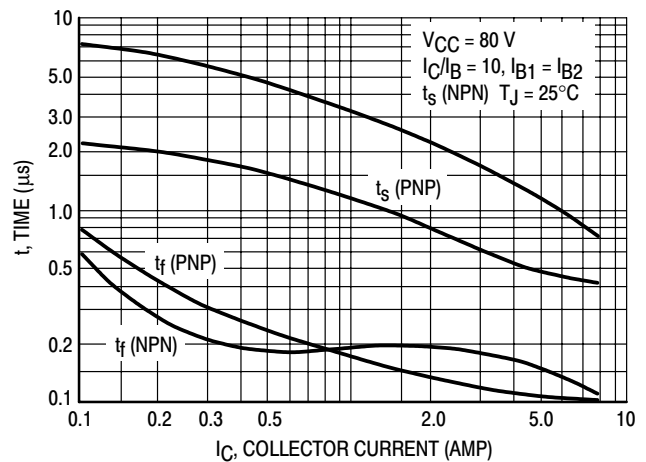
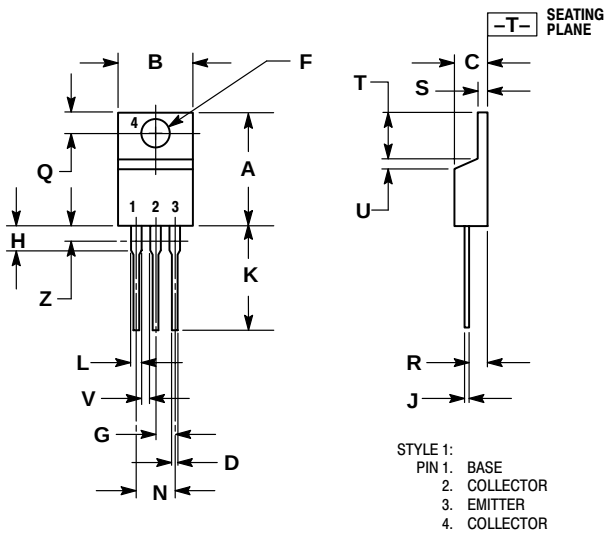


Figure 11. Turn-Off Times

# MJE15028 MJE15030 MJE15029 MJE15031

## PACKAGE DIMENSIONS

### TO-220AB CASE 221A-09 ISSUE AA



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.570  | 0.620 | 14.48       | 15.75 |
| B   | 0.380  | 0.405 | 9.66        | 10.28 |
| C   | 0.160  | 0.190 | 4.07        | 4.82  |
| D   | 0.025  | 0.035 | 0.64        | 0.88  |
| F   | 0.142  | 0.147 | 3.61        | 3.73  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.155 | 2.80        | 3.93  |
| J   | 0.018  | 0.025 | 0.46        | 0.64  |
| K   | 0.500  | 0.562 | 12.70       | 14.27 |
| L   | 0.045  | 0.060 | 1.15        | 1.52  |
| N   | 0.190  | 0.210 | 4.83        | 5.33  |
| Q   | 0.100  | 0.120 | 2.54        | 3.04  |
| R   | 0.080  | 0.110 | 2.04        | 2.79  |
| S   | 0.045  | 0.055 | 1.15        | 1.39  |
| T   | 0.235  | 0.255 | 5.97        | 6.47  |
| U   | 0.000  | 0.050 | 0.00        | 1.27  |
| V   | 0.045  | ---   | 1.15        | ---   |
| Z   | ---    | 0.080 | ---         | 2.04  |

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