# (PNP) 2N6040, 2N6042, (NPN) 2N6043*, 2N6045*

***Preferred Device**

# Plastic Medium-Power Complementary Silicon Transistors

. . . designed for general−purpose amplifier and low−speed switching applications.

- High DC Current Gain −
  $h_{FE}$ = 2500 (Typ) @ $I_C$ = 4.0 Adc
- Collector−Emitter Sustaining Voltage − @ 100 mAdc −
  $V_{CEO(sus)}$ = 60 Vdc (Min) − 2N6040, 2N6043
  = 100 Vdc (Min) − 2N6042, 2N6045
- Low Collector−Emitter Saturation Voltage −
  $V_{CE(sat)}$ = 2.0 Vdc (Max) @ $I_C$ = 4.0 Adc − 2N6043,44
  = 2.0 Vdc (Max) @ $I_C$ = 3.0 Adc − 2N6042, 2N6045
- Monolithic Construction with Built−In Base−Emitter Shunt Resistors
- EPOXY MEETS UL 94, V−0 @ 0.125 in
- ESD Ratings: Human Body Model, 3B > 8000 V
  Machine Model, C > 400 V

**MAXIMUM RATINGS** (Note 1)

| Rating | Symbol | 2N6040 2N6043 | 2N6042 2N6045 | Unit |
|---|---|---|---|---|
| Collector−Emitter Voltage | $V_{CEO}$ | 60 | 100 | Vdc |
| Collector−Base Voltage | $V_{CB}$ | 60 | 100 | Vdc |
| Emitter−Base Voltage | $V_{EB}$ | 5.0 | | Vdc |
| Collector Current− Continuous<br>Peak | $I_C$ | 8.0<br>16 | | Adc |
| Base Current | $I_B$ | 120 | | mAdc |
| Total Power Dissipation<br>@ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | <br>75<br>0.60 | | <br>W<br>W/°C |
| Operating and Storage Junction, Temperature Range | $T_J$, $T_{stg}$ | −65 to +150 | | °C |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $\theta_{JC}$ | 1.67 | °C/W |
| Thermal Resistance, Junction to Ambient | $\theta_{JA}$ | 57 | °C/W |

1. Indicates JEDEC Registered Data.

ON Semiconductor®

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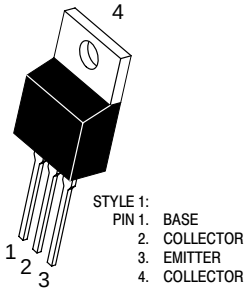
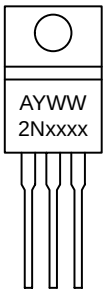
## DARLINGTON, 8 A COMPLEMENTARY SILICON POWER TRANSISTORS 60 V − 100 V, 75 W




**TO−220AB**
**CASE 221A−09**
*Style 1*

**MARKING DIAGRAM**




xxxx = Specific Device Code:
6040, 6042, 6043, 6045
A = Assembly Location
Y = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| 2N6040 | TO−220AB | 50 Units / Rail |
| 2N6042 | TO−220AB | 50 Units / Rail |
| 2N6043 | TO−220AB | 50 Units / Rail |
| 2N6045 | TO−220AB | 50 Units / Rail |

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

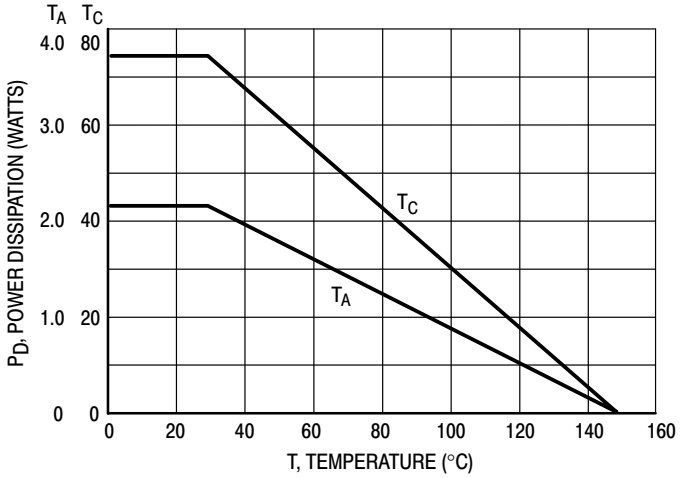



**Figure 1. Power Derating**

***ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector−Emitter Sustaining Voltage ($I_C$ = 100 mAdc, $I_B$ = 0) | 2N6040, 2N6043 | $V_{CEO(sus)}$ | 60 | – | Vdc |
| | 2N6042, 2N6045 | | 100 | – | |
| Collector Cutoff Current | | $I_{CEO}$ | | | μA |
| ($V_{CE}$ = 60 Vdc, $I_B$ = 0) | 2N6040, 2N6043 | | – | 20 | |
| ($V_{CE}$ = 100 Vdc, $I_B$ = 0) | 2N6042, 2N6045 | | – | 20 | |
| Collector Cutoff Current | | $I_{CEX}$ | | | μA |
| ($V_{CE}$ = 60 Vdc, $V_{BE(off)}$ = 1.5 Vdc) | 2N6040, 2N6043 | | – | 20 | |
| ($V_{CE}$ = 100 Vdc, $V_{BE(off)}$ = 1.5 Vdc) | 2N6042, 2N6045 | | – | 20 | |
| ($V_{CE}$ = 60 Vdc, $V_{BE(off)}$ = 1.5 Vdc, $T_C$ = 150°C) | 2N6040, 2N6043 | | – | 200 | |
| ($V_{CE}$ = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc, $T_C$ = 150°C) | 2N6041, 2N6044 | | – | 200 | |
| ($V_{CE}$ = 100 Vdc, $V_{BE(off)}$ = 1.5 Vdc, $T_C$ = 150°C) | 2N6042, 2N6045 | | – | 200 | |
| Collector Cutoff Current | | $I_{CBO}$ | | | μA |
| ($V_{CB}$ = 60 Vdc, $I_E$ = 0) | 2N6040, 2N6043 | | – | 20 | |
| ($V_{CB}$ = 100 Vdc, $I_E$ = 0) | 2N6042, 2N6045 | | – | 20 | |
| Emitter Cutoff Current ($V_{BE}$ = 5.0 Vdc, $I_C$ = 0) | | $I_{EBO}$ | – | 2.0 | mAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain | | $h_{FE}$ | | | – |
| ($I_C$ = 4.0 Adc, $V_{CE}$ = 4.0 Vdc) | 2N6040, 2N6043, | | 1000 | 20.000 | |
| ($I_C$ = 3.0 Adc, $V_{CE}$ = 4.0 Vdc) | 2N6042, 2N6045 | | 1000 | 20,000 | |
| ($I_C$ = 8.0 Adc, $V_{CE}$ = 4.0 Vdc) | All Types | | 100 | – | |
| Collector−Emitter Saturation Voltage | | $V_{CE(sat)}$ | | | Vdc |
| ($I_C$ = 4.0 Adc, $I_B$ = 16 mAdc) | 2N6040, 2N6043, | | – | 2.0 | |
| ($I_C$ = 3.0 Adc, $I_B$ = 12 mAdc) | 2N6042, 2N6045 | | – | 2.0 | |
| ($I_C$ = 8.0 Adc, $I_B$ = 80 Adc) | All Types | | – | 4.0 | |
| Base−Emitter Saturation Voltage ($I_C$ = 8.0 Adc, $I_B$ = 80 mAdc) | | $V_{BE(sat)}$ | – | 4.5 | Vdc |
| Base−Emitter On Voltage ($I_C$ = 4.0 Adc, $V_{CE}$ = 4.0 Vdc) | | $V_{BE(on)}$ | – | 2.8 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Small Signal Current Gain ($I_C$ = 3.0 Adc, $V_{CE}$ = 4.0 Vdc, f = 1.0 MHz) | | $\|h_{fe}\|$ | 4.0 | – | |
| Output Capacitance | 2N6040/2N6042 | $C_{ob}$ | – | 300 | pF |
| ($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 0.1 MHz) | 2N6043/2N6045 | | – | 200 | |
| Small−Signal Current Gain ($I_C$ = 3.0 Adc, $V_{CE}$ = 4.0 Vdc, f = 1.0 kHz) | | $h_{fe}$ | 300 | – | – |

*Indicates JEDEC Registered Data.

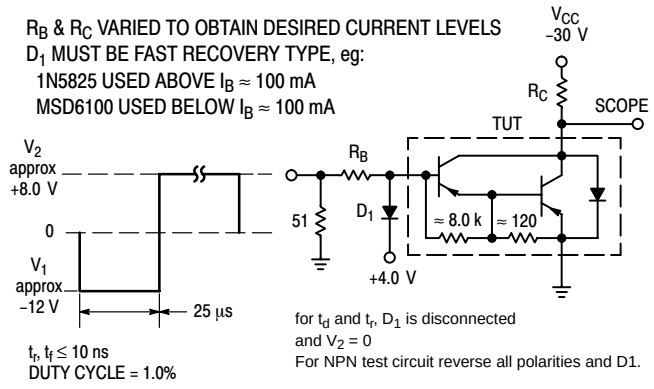



**Figure 2. Switching Times Equivalent Circuit**

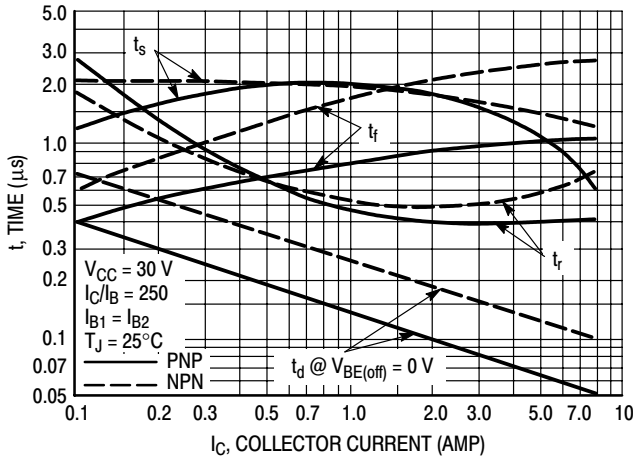



**Figure 3. Switching Times**

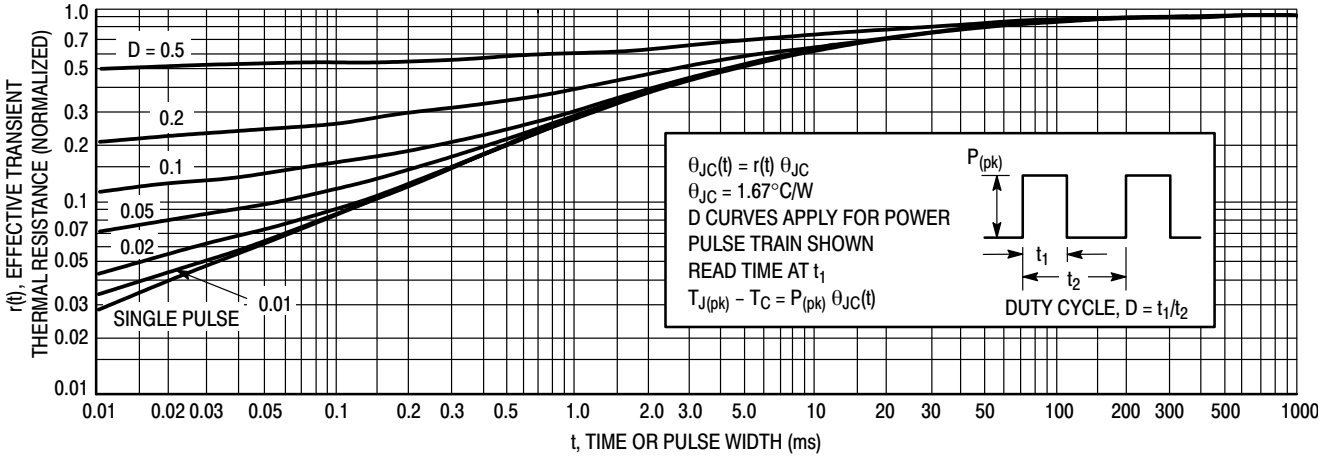



**Figure 4. Thermal Response**

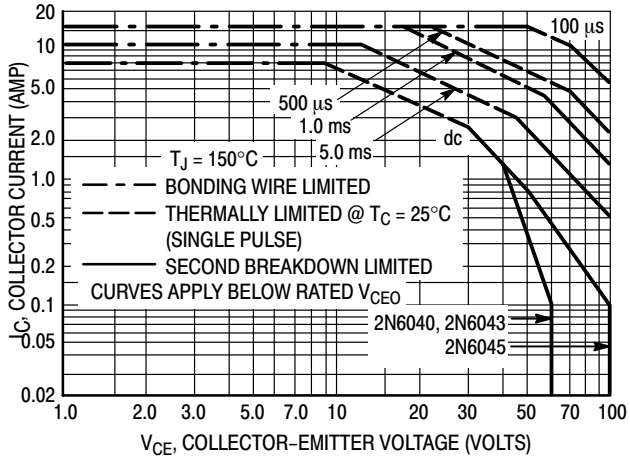



**Figure 5. Active−Region Safe Operating Area**

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

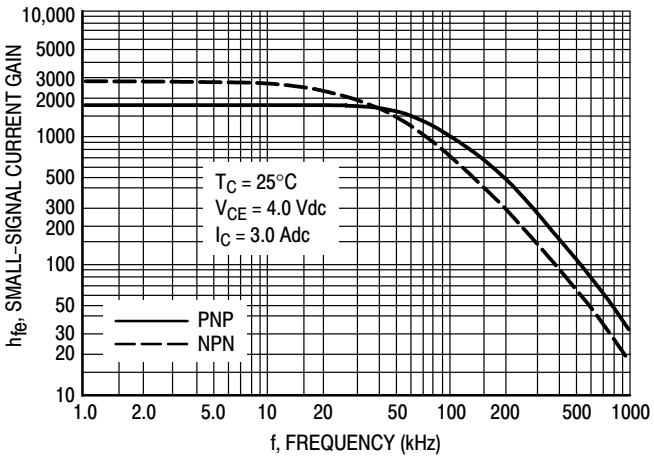



**Figure 6. Small−Signal Current Gain**

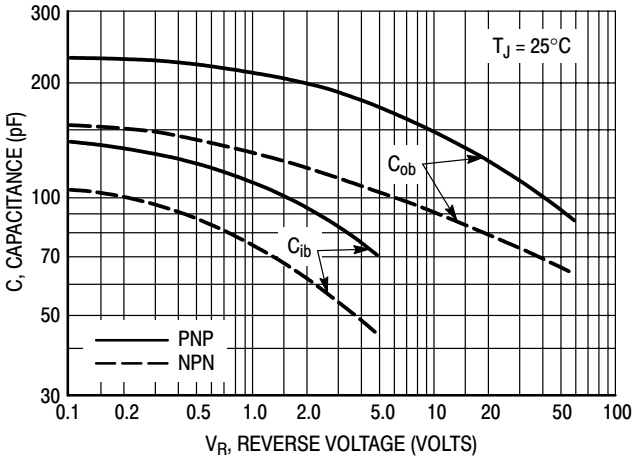



**Figure 7. Capacitance**

**PNP**
**2N6040, 2N6042**

**NPN**
**2N6043, 2N6045**

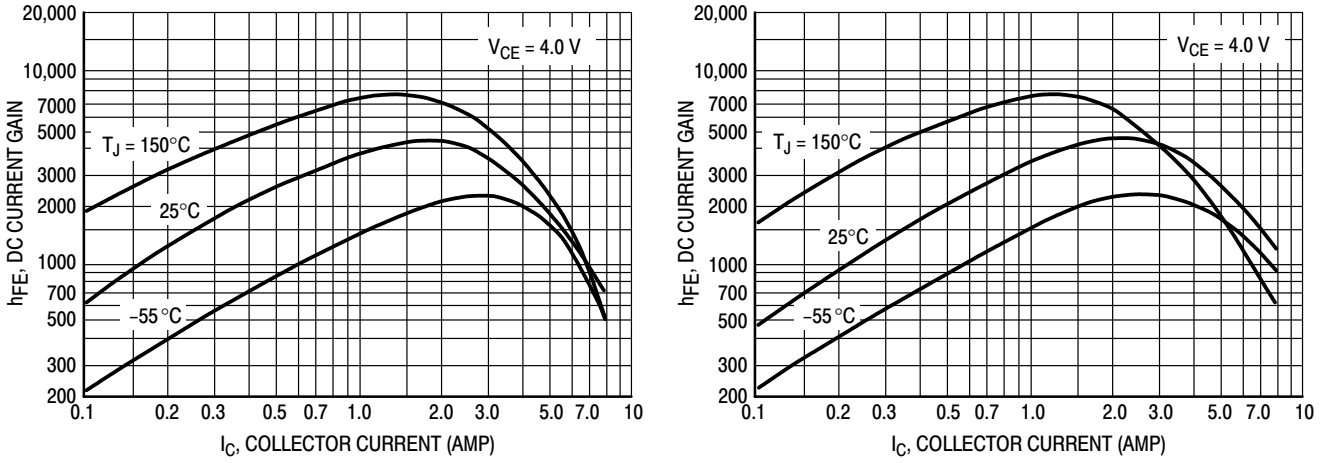



**Figure 8. DC Current Gain**

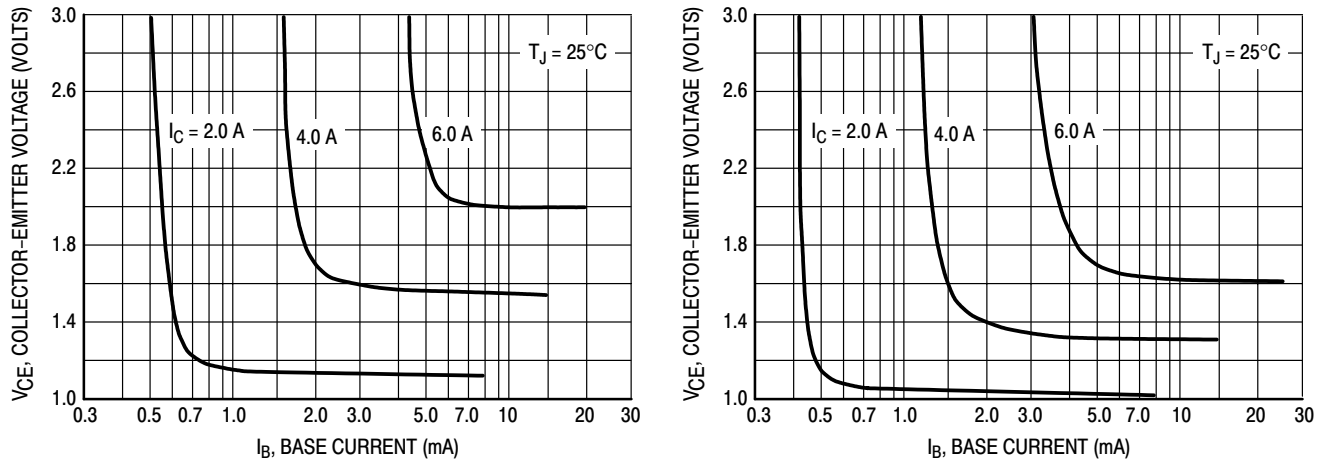



**Figure 9. Collector Saturation Region**

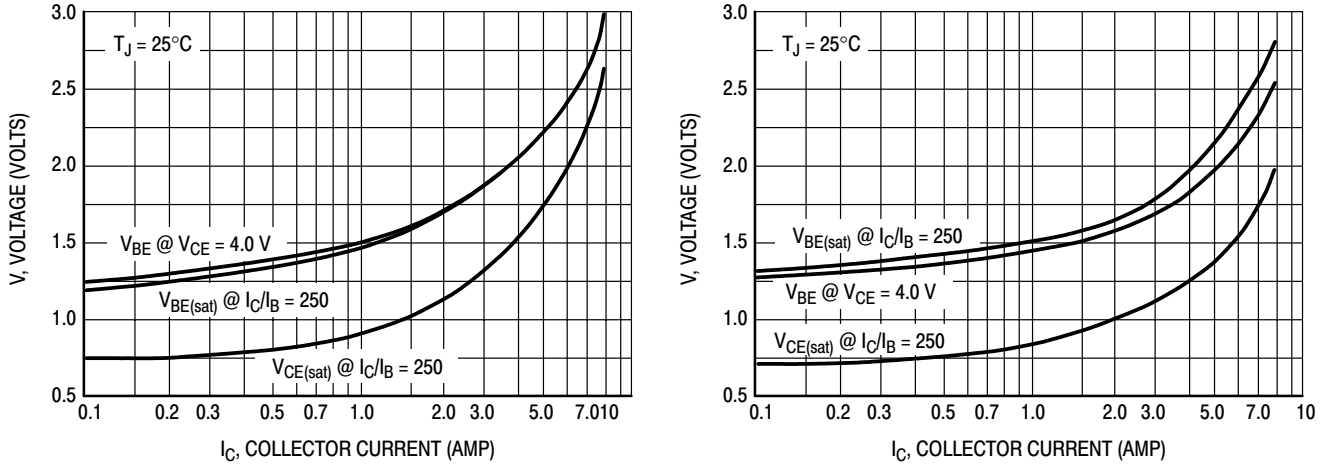
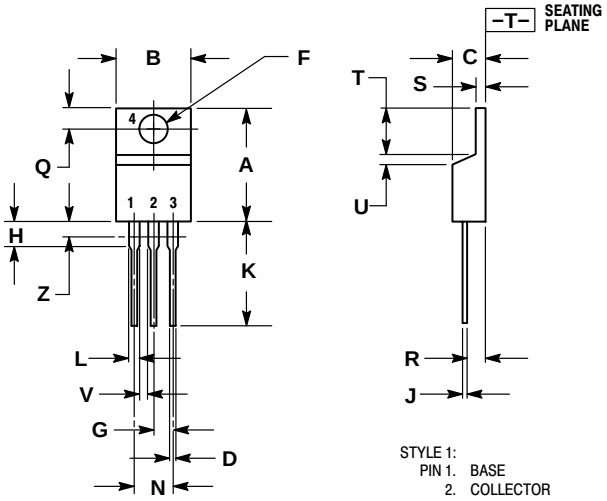



**Figure 10. “On” Voltages**

## PACKAGE DIMENSIONS

**TO−220AB**
**CASE 221A−09**
**ISSUE AA**




STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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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