# 2N6487, 2N6488, (NPN)
# 2N6490, 2N6491 (PNP)

**2N6488 and 2N6491 are Preferred Devices**

# Complementary Silicon Plastic Power Transistors

These devices are designed for use in general−purpose amplifier and switching applications.

### Features

- DC Current Gain Specified to 15 Amperes −
  $h_{FE}$ = 20 − 150 @ $I_C$ = 5.0 Adc
  = 5.0 (Min) @ $I_C$ = 15 Adc
- Collector−Emitter Sustaining Voltage −
  $V_{CEO(sus)}$ = 60 Vdc (Min) − 2N6487, 2N6490
  = 80 Vdc (Min) − 2N6488, 2N6491
- High Current Gain − Bandwidth Product
  $f_T$ = 5.0 MHz (Min) @ $I_C$ = 1.0 Adc
- TO−220AB Compact Package
- Pb−Free Packages are Available*

### MAXIMUM RATINGS (Note 1)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector−Emitter Voltage<br>2N6487, 2N6490<br>2N6488, 2N6491 | $V_{CEO}$ | <br>60<br>80 | Vdc |
| Collector−Base Voltage<br>2N6487, 2N6490<br>2N6488, 2N6491 | $V_{CB}$ | <br>70<br>90 | Vdc |
| Emitter−Base Voltage | $V_{EB}$ | 5.0 | Vdc |
| Collector Current − Continuous | $I_C$ | 15 | Adc |
| Base Current | $I_B$ | 5.0 | Adc |
| Total Power Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 75<br>0.6 | W<br>W/°C |
| Total Power Dissipation @ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 1.8<br>0.014 | W<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −65 to +150 | °C |

### THERMAL CHARACTERISTICS

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction−to−Case | $R_{\theta JC}$ | 1.67 | °C/W |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 70 | °C/W |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Indicates JEDEC Registered Data.

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

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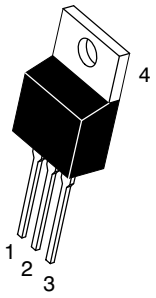
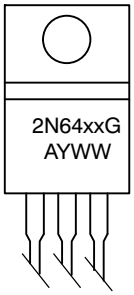
## 15 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 60−80 VOLTS, 75 WATTS

### MARKING DIAGRAM




TO−220AB
CASE 221A
STYLE 1




2N64xx = Specific Device Code
xx = See Table on Page 5
G = Pb−Free Package
A = Assembly Location
Y = Year
WW = Work Week

### ORDERING INFORMATION

See detailed ordering, marking, and shipping information in the package dimensions section on page 5 of this data sheet.

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

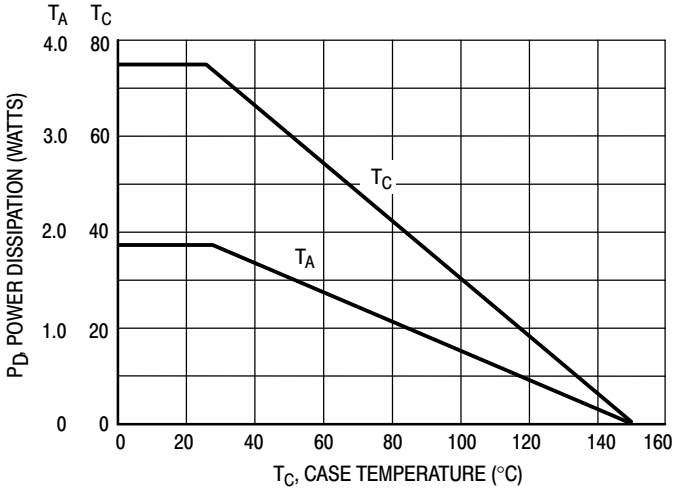
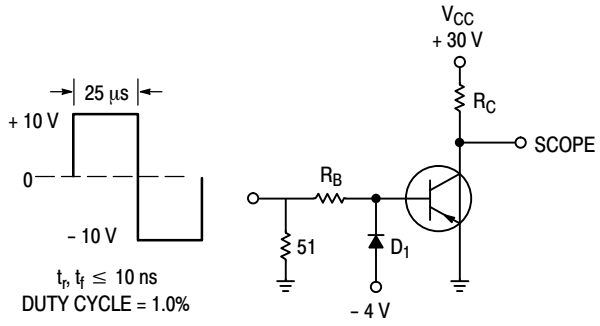



**Figure 1. Power Derating**

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted) (Note 2)

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector−Emitter Sustaining Voltage (Note 3)<br>($I_C$ = 200 mAdc, $I_B$ = 0) | 2N6487, 2N6490<br>2N6488, 2N6491 | $V_{CEO(sus)}$ | <br>60<br>80 | <br>−<br>− | Vdc |
| Collector−Emitter Sustaining Voltage (Note)<br>($I_C$ = 200 mAdc, $V_{BE}$ = 1.5 Vdc) | 2N6487, 2N6490<br>2N6488, 2N6491 | $V_{CEX}$ | <br>70<br>90 | <br>−<br>− | Vdc |
| Collector Cutoff Current<br>($V_{CE}$ = 30 Vdc, $I_B$ = 0)<br>($V_{CE}$ = 40 Vdc, $I_B$ = 0) | 2N6487, 2N6490<br>2N6488, 2N6491 | $I_{CEO}$ | <br>−<br>− | <br>1.0<br>1.0 | mAdc |
| Collector Cutoff Current<br>($V_{CE}$ = 65 Vdc, $V_{EB(off)}$ = 1.5 Vdc)<br>($V_{CE}$ = 85 Vdc, $V_{EB(off)}$ = 1.5 Vdc)<br>($V_{CE}$ = 60 Vdc, $V_{EB(off)}$ = 1.5 Vdc, $T_C$ = 150°C)<br>($V_{CE}$ = 80 Vdc, $V_{EB(off)}$ = 1.5 Vdc, $T_C$ = 150°C) | 2N6487, 2N6490<br>2N6488, 2N6491<br>2N6487, 2N6490<br>2N6488, 2N6491 | $I_{CEX}$ | <br>−<br>−<br>−<br>− | <br>500<br>500<br>5.0<br>5.0 | μAdc |
| Emitter Cutoff Current ($V_{BE}$ = 5.0 Vdc, $I_C$ = 0) | | $I_{EBO}$ | − | 1.0 | mAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain<br>($I_C$ = 5.0 Adc, $V_{CE}$ = 4.0 Vdc)<br>($I_C$ = 15 Adc, $V_{CE}$ = 4.0 Vdc) | | $h_{FE}$ | <br>20<br>5.0 | <br>150<br>− | − |
| Collector−Emitter Saturation Voltage<br>($I_C$ = 5.0 Adc, $I_B$ = 0.5 Adc)<br>($I_C$ = 15 Adc, $I_B$ = 5.0 Adc) | | $V_{CE(sat)}$ | <br>−<br>− | <br>1.3<br>3.5 | Vdc |
| Base−Emitter On Voltage<br>($I_C$ = 5.0 Adc, $V_{CE}$ = 4.0 Vdc)<br>($I_C$ = 15 Adc, $V_{CE}$ = 4.0 Vdc) | | $V_{BE(on)}$ | <br>−<br>− | <br>1.3<br>3.5 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Current−Gain − Bandwidth Product (Note 4)<br>($I_C$ = 1.0 Adc, $V_{CE}$ = 4.0 Vdc, $f_{test}$ = 1.0 MHz) | | $f_T$ | 5.0 | − | MHz |
| Small−Signal Current Gain ($I_C$ = 1.0 Adc, $V_{CE}$ = 4.0 Vdc, f = 1.0 kHz) | | $h_{fe}$ | 25 | − | − |

2. Indicates JEDEC Registered Data.
3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
4. $f_T = |h_{fe}| \bullet f_{test}$




$R_B$ AND $R_C$ VARIED TO OBTAIN DESIRED CURRENT LEVELS.
FOR PNP, REVERSE ALL POLARITIES.

$D_1$ MUST BE FAST RECOVERY TYPE, e.g.:
1N5825 USED ABOVE $I_B \approx 100$ mA
MSD6100 USED BELOW $I_B \approx 100$ mA

**Figure 2. Switching Time Test Circuit**

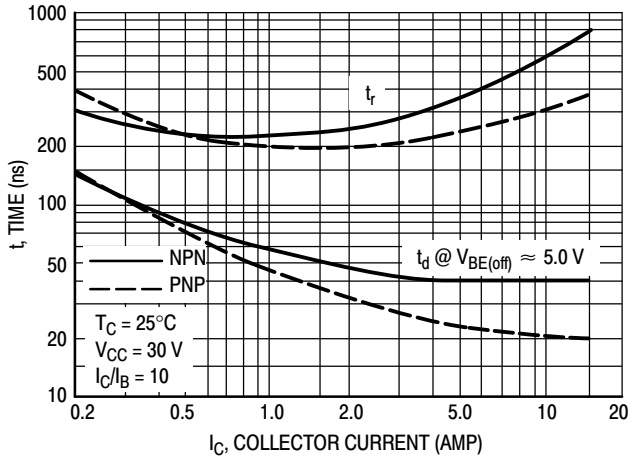



**Figure 3. Turn−On Time**

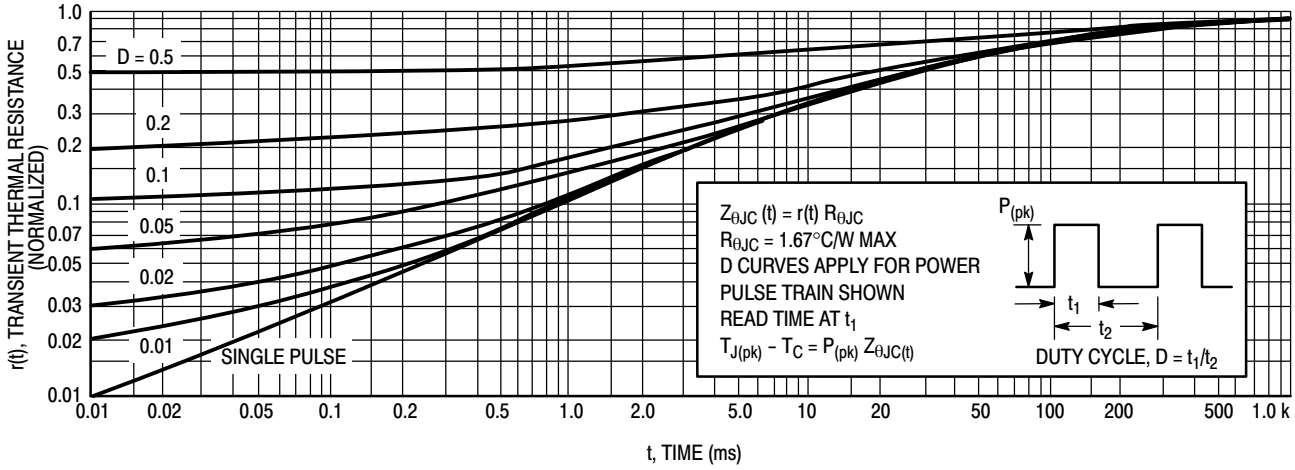



**Figure 4. Thermal Response**

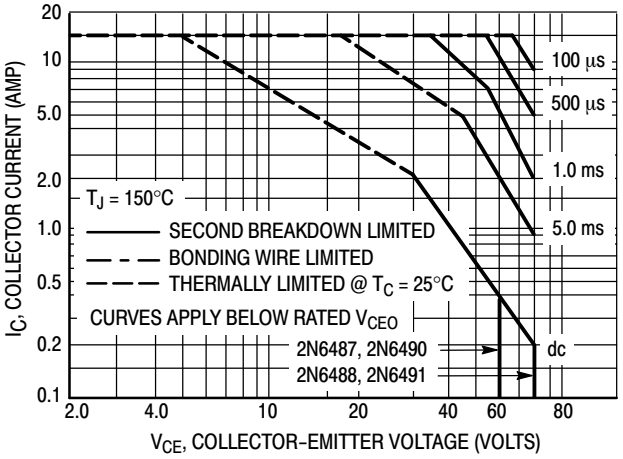



**Figure 5. Active−Region Safe Operating Area**

There are two limitations on the power handling ability of a transistors 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 $T_{J(pk)} \leq$ 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

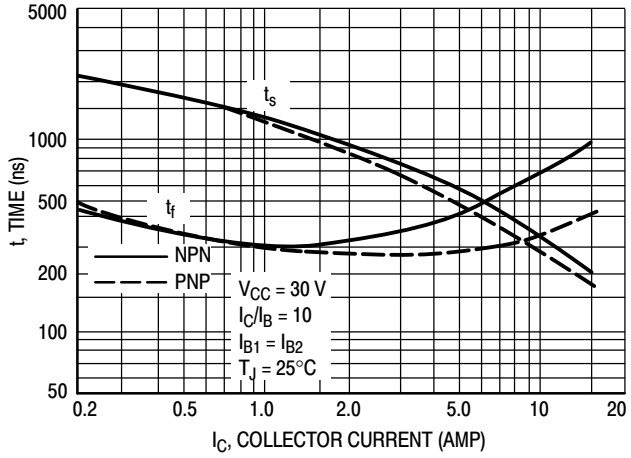



**Figure 6. Turn−Off Time**

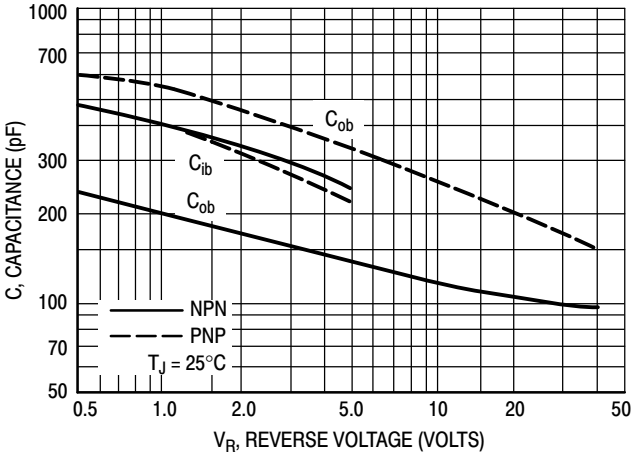



**Figure 7. Capacitances**

**NPN**
**2N6487, 2N6488**

**PNP**
**2N6490, 2N6491**

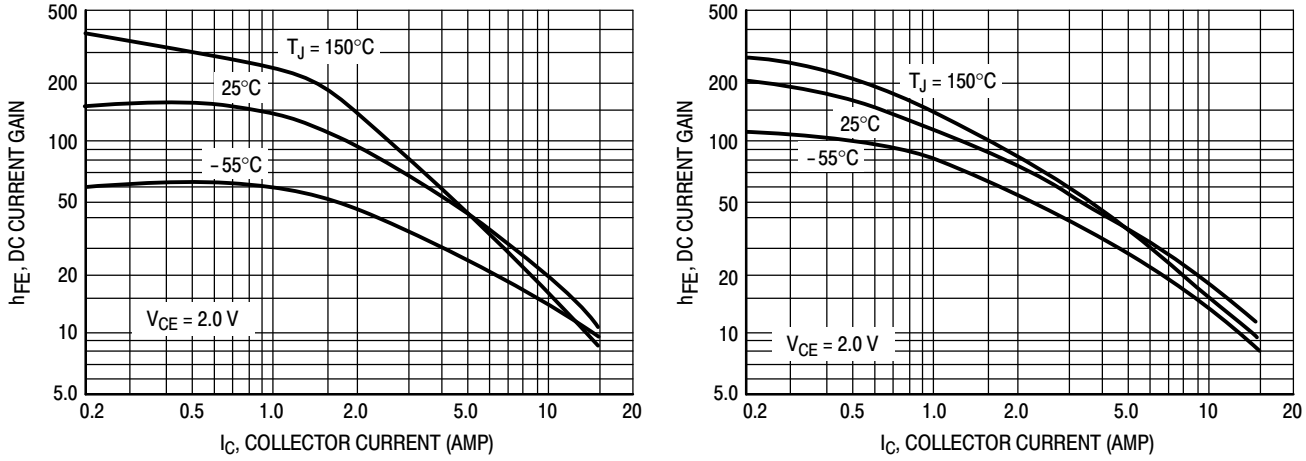



**Figure 8. DC Current Gain**

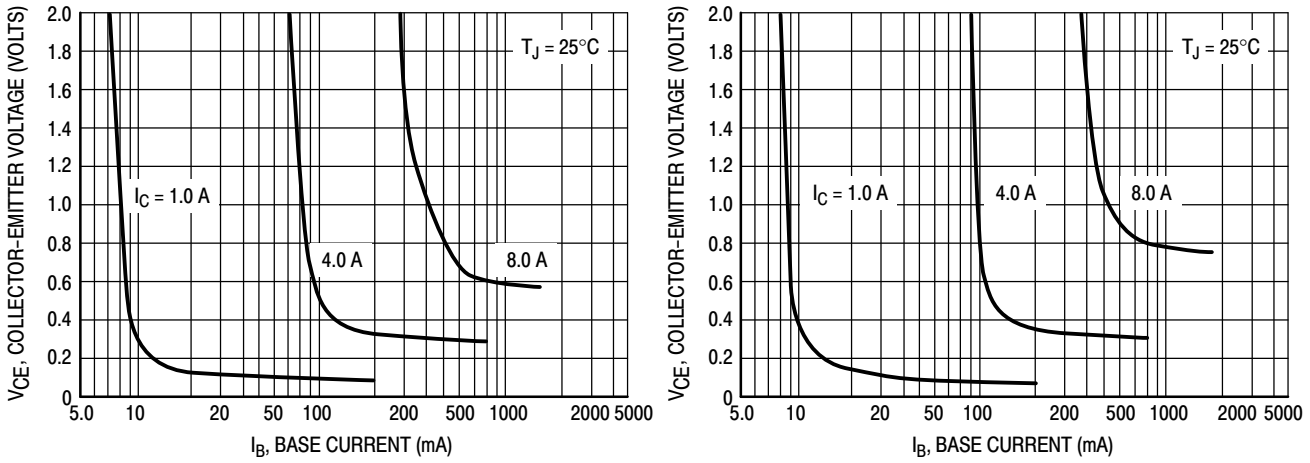



**Figure 9. Collector Saturation Region**

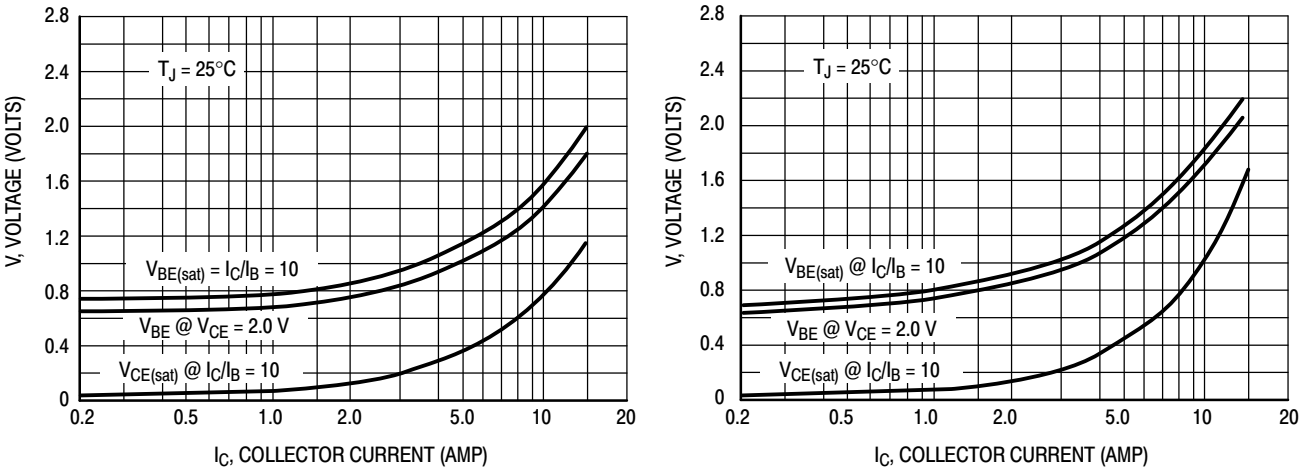


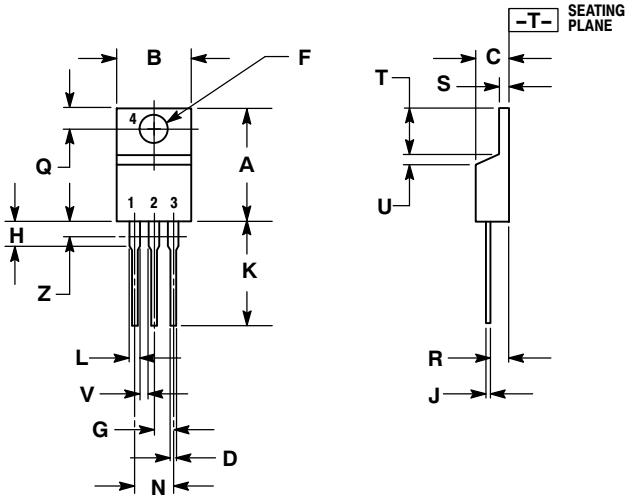

**Figure 10. "On" Voltages**

## ORDERING INFORMATION

| Device | Device Marking | Package | Shipping |
|---|---|---|---|
| 2N6487 | 2N6487 | TO−220AB | 50 Units / Rail |
| 2N6487G | | TO−220AB (Pb−Free) | |
| 2N6488 | 2N6488 | TO−220AB | 50 Units / Rail |
| 2N6488G | | TO−220AB (Pb−Free) | |
| 2N6490 | 2N6490 | TO−220AB | 50 Units / Rail |
| 2N6490G | | TO−220AB (Pb−Free) | |
| 2N6491 | 2N6491 | TO−220AB | 50 Units / Rail |
| 2N6491G | | TO−220AB (Pb−Free) | |

## PACKAGE DIMENSIONS

**TO−220**
CASE 221A−09
ISSUE AE




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 | 0.161 | 3.61 | 4.09 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.155 | 2.80 | 3.93 |
| J | 0.014 | 0.025 | 0.36 | 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 |



**PUBLICATION ORDERING INFORMATION**

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**Europe, Middle East and Africa Technical Support:**
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**2N6487/D**