



## BUF420M

### HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- STMicroelectronics PREFERRED SALESTYPE
- HIGH VOLTAGE CAPABILITY
- VERY HIGH SWITCHING SPEED
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- LOW BASE-DRIVE REQUIREMENTS

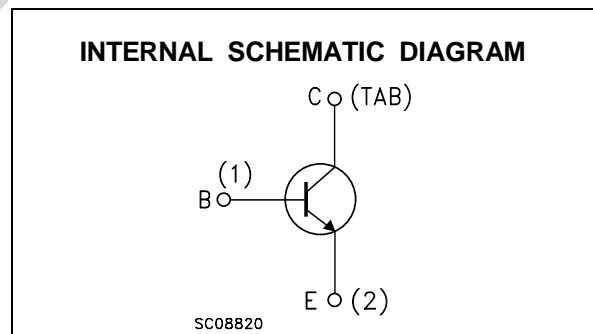
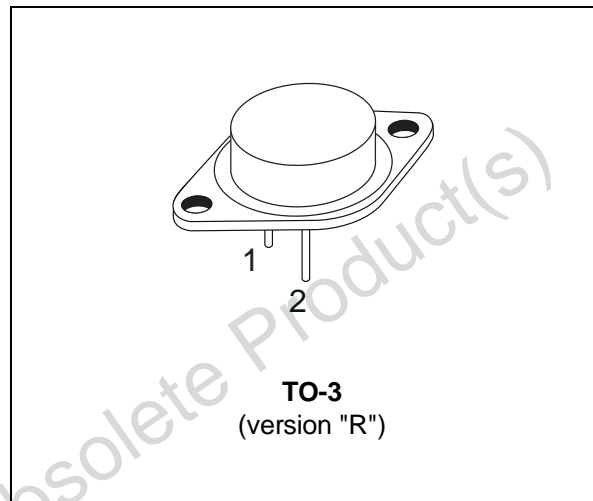
#### APPLICATIONS:

- SWITCH MODE POWER SUPPLIES
- MOTOR CONTROL

#### DESCRIPTION

The BUF420M is manufactured using High Voltage Multi Epitaxial Planar technology for high switching speeds and high voltage capacity. It uses a Cellular Emitter structure with planar edge termination to enhance switching speeds while maintaining a wide RBSOA.

The BUF series is designed for use in high-frequency power supplies and motor control applications.



#### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CEV}$	Collector-Emitter Voltage ( $V_{BE} = -1.5V$ )	850	V
$V_{CEO}$	Collector-Emitter Voltage ( $I_B = 0$ )	450	V
$V_{EBO}$	Emitter-Base Voltage ( $I_C = 0$ )	7	V
$I_C$	Collector Current	30	A
$I_{CM}$	Collector Peak Current ( $t_p < 5$ ms)	60	A
$I_B$	Base Current	6	A
$I_{BM}$	Base Peak Current ( $t_p < 5$ ms)	9	A
$P_{tot}$	Total Dissipation at $T_c = 25$ °C	275	W
$T_{stg}$	Storage Temperature	-65 to 200	°C
$T_j$	Max. Operating Junction Temperature	200	°C

**THERMAL DATA**

R <sub>thj-case</sub>	Thermal Resistance Junction-Case	Max	0.63	°C/W
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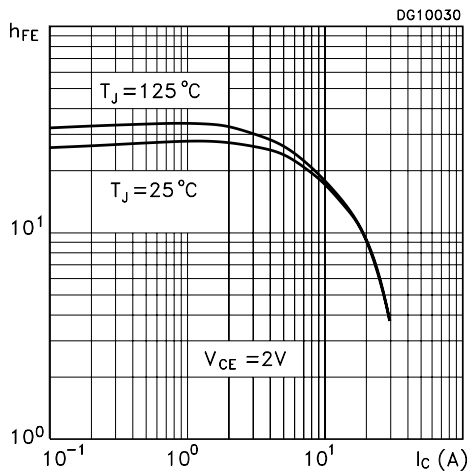
**ELECTRICAL CHARACTERISTICS** (T<sub>case</sub> = 25 °C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I <sub>CEr</sub>	Collector Cut-off Current (R <sub>BE</sub> = 5 Ω)	V <sub>CE</sub> = 850 V V <sub>CE</sub> = 850 V T <sub>C</sub> = 100 °C			0.2 1	mA mA
I <sub>CEV</sub>	Collector Cut-off Current (V <sub>BE</sub> = -1.5V)	V <sub>CE</sub> = 850 V V <sub>CE</sub> = 850 V T <sub>C</sub> = 100 °C			0.2 1	mA mA
I <sub>EBO</sub>	Emitter Cut-off Current (I <sub>C</sub> = 0)	V <sub>EB</sub> = 5 V			1	mA
V <sub>CEO(sus)*</sub>	Collector-Emitter Sustaining Voltage (I <sub>B</sub> = 0)	I <sub>C</sub> = 200 mA L = 25 mH	450			V
V <sub>EBO</sub>	Emitter Base Voltage (I <sub>C</sub> = 0)	I <sub>E</sub> = 50 mA	7			V
V <sub>CE(sat)*</sub>	Collector-Emitter Saturation Voltage	I <sub>C</sub> = 10 A I <sub>B</sub> = 1 A I <sub>C</sub> = 10 A I <sub>B</sub> = 1 A T <sub>C</sub> = 100°C I <sub>C</sub> = 20 A I <sub>B</sub> = 4 A I <sub>C</sub> = 20 A I <sub>B</sub> = 4 A T <sub>C</sub> = 100°C		0.8 0.5	2.8 2	V V V V
V <sub>BE(sat)*</sub>	Base-Emitter Saturation Voltage	I <sub>C</sub> = 10 A I <sub>B</sub> = 1 A I <sub>C</sub> = 10 A I <sub>B</sub> = 1 A T <sub>C</sub> = 100°C I <sub>C</sub> = 20 A I <sub>B</sub> = 4 A I <sub>C</sub> = 20 A I <sub>B</sub> = 4 A T <sub>C</sub> = 100°C		0.9 1.1	1.5 1.5	V V V V
di <sub>c</sub> /dt	Rate of rise on-state Collector Current	V <sub>CC</sub> = 300 V R <sub>C</sub> = 0 t <sub>p</sub> = 3 μs I <sub>B1</sub> = 1.5 A T <sub>C</sub> = 25°C I <sub>B1</sub> = 1.5 A T <sub>C</sub> = 100°C I <sub>B1</sub> = 6 A T <sub>C</sub> = 100°C	70 150	100		A/μs A/μs A/μs
V <sub>CE(3μs)</sub>	Collector-Emitter Dynamic Voltage	V <sub>CC</sub> = 300 V R <sub>C</sub> = 60 Ω I <sub>B1</sub> = 1.5 A T <sub>C</sub> = 25°C I <sub>B1</sub> = 1.5 A T <sub>C</sub> = 100°C		2.1	8	V V
V <sub>CE(5μs)</sub>	Collector-Emitter Dynamic Voltage	V <sub>CC</sub> = 300 V R <sub>C</sub> = 60 Ω I <sub>B1</sub> = 1.5 A T <sub>C</sub> = 25°C I <sub>B1</sub> = 1.5 A T <sub>C</sub> = 100°C		1.1	4	V V
t <sub>s</sub> t <sub>f</sub> t <sub>c</sub>	INDUCTIVE LOAD Storage Time Fall Time Cross Over Time	I <sub>C</sub> = 10 A V <sub>CC</sub> = 50 V V <sub>BB</sub> = - 5 V R <sub>BB</sub> = 0.6 Ω V <sub>clamp</sub> = 400 V I <sub>B1</sub> = 1 A L = 0.25 mH		1 0.05 0.08		μs μs μs
t <sub>s</sub> t <sub>f</sub> t <sub>c</sub>	INDUCTIVE LOAD Storage Time Fall Time Cross Over Time	I <sub>C</sub> = 10 A V <sub>CC</sub> = 50 V V <sub>BB</sub> = - 5 V R <sub>BB</sub> = 0.6 Ω V <sub>clamp</sub> = 400 V I <sub>B1</sub> = 1 A L = 0.25 mH T <sub>C</sub> = 100°C			2 0.1 0.18	μs μs μs
V <sub>CEW</sub>	Maximum Collector Emitter Voltage without Snubber	I <sub>C</sub> = 10 A V <sub>CC</sub> = 50 V V <sub>BB</sub> = - 5 V R <sub>BB</sub> = 0.6 Ω I <sub>B1</sub> = 1 A L = 0.25 mH T <sub>C</sub> = 125°C	500			V
t <sub>s</sub> t <sub>f</sub> t <sub>c</sub>	INDUCTIVE LOAD Storage Time Fall Time Cross Over Time	I <sub>C</sub> = 10 A V <sub>CC</sub> = 50 V V <sub>BB</sub> = 0 R <sub>BB</sub> = 0.15 Ω V <sub>clamp</sub> = 400 V I <sub>B1</sub> = 1 A L = 0.25 mH		1.5 0.04 0.07		μs μs μs

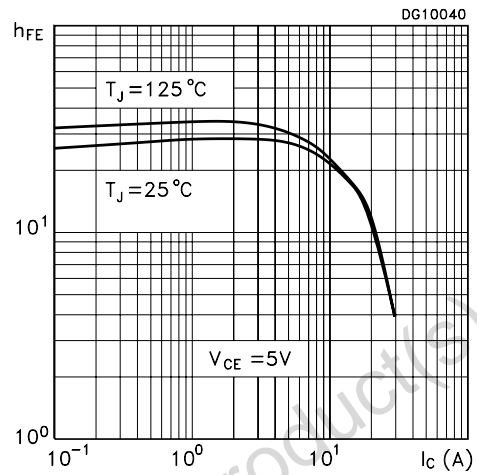
**ELECTRICAL CHARACTERISTICS** (continued)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
$t_s$ $t_f$ $t_c$	INDUCTIVE LOAD Storage Time Fall Time Cross Over Time	$I_C = 10\text{ A}$ $V_{BB} = 0$ $V_{clamp} = 400\text{ V}$ $L = 0.25\text{ mH}$	$V_{CC} = 50\text{ V}$ $R_{BB} = 0.15\ \Omega$ $I_{B1} = 1\text{ A}$ $T_C = 100^\circ\text{C}$			3 0.15 0.25	$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
$V_{CEW}$	Maximum Collector Emitter Voltage without Snubber	$I_C = 10\text{ A}$ $V_{BB} = 0$ $I_{B1} = 1\text{ A}$ $T_C = 125^\circ\text{C}$	$V_{CC} = 50\text{ V}$ $R_{BB} = 0.15\ \Omega$ $L = 0.25\text{ mH}$	500			V
$t_s$ $t_f$ $t_c$	INDUCTIVE LOAD Storage Time Fall Time Cross Over Time	$I_C = 20\text{ A}$ $V_{BB} = -5\text{ V}$ $V_{clamp} = 400\text{ V}$ $L = 0.12\text{ mH}$	$V_{CC} = 50\text{ V}$ $R_{BB} = 0.6\ \Omega$ $I_{B1} = 4\text{ A}$		2.2 0.06 0.12		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
$t_s$ $t_f$ $t_c$	INDUCTIVE LOAD Storage Time Fall Time Cross Over Time	$I_C = 20\text{ A}$ $V_{BB} = -5\text{ V}$ $V_{clamp} = 400\text{ V}$ $L = 0.12\text{ mH}$	$V_{CC} = 50\text{ V}$ $R_{BB} = 0.6\ \Omega$ $I_{B1} = 4\text{ A}$ $T_C = 125^\circ\text{C}$			3.5 0.12 0.3	$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
$V_{CEW}$	Maximum Collector Emitter Voltage without Snubber	$I_{C\text{Woff}} = 30\text{ A}$ $V_{BB} = -5\text{ V}$ $L = 0.12\text{ mH}$ $T_C = 125^\circ\text{C}$	$V_{CC} = 50\text{ V}$ $R_{BB} = 0.6\ \Omega$ $I_{B1} = 6\text{ A}$	400			V

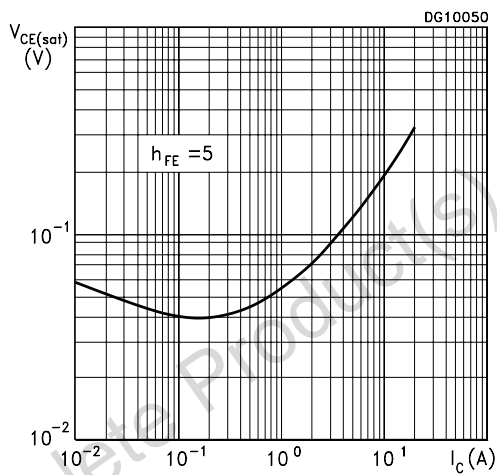
DC Current Gain



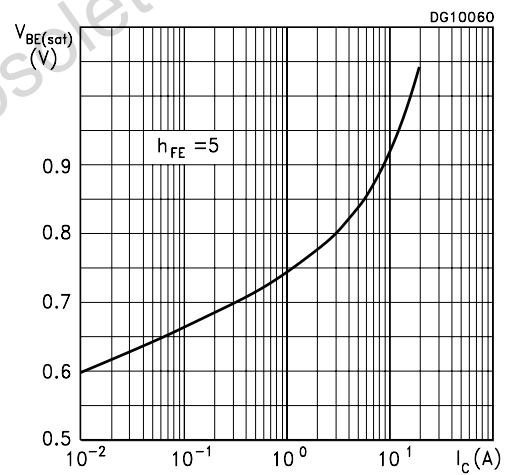
DC Current Gain



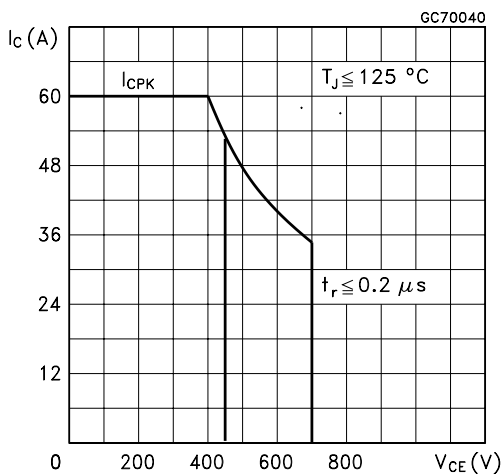
Collector Emitter Saturation Voltage



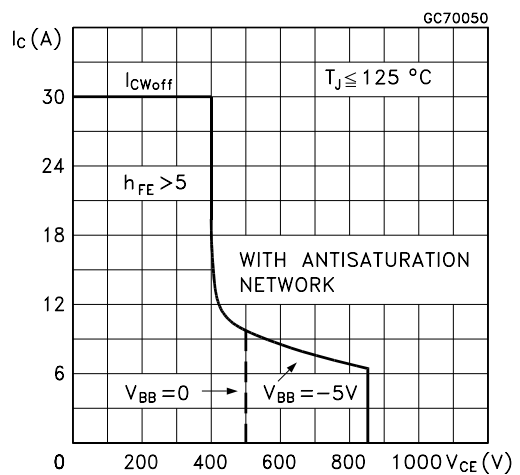
Base Emitter Saturation Voltage



Forward Biased Safe Operating Area



Reverse Biased Safe Operating Area



Storage Time Versus Pulse Time.

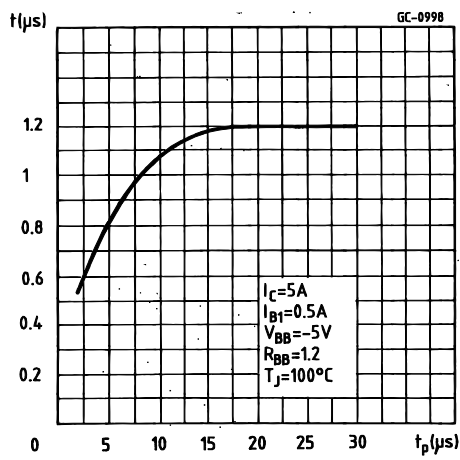
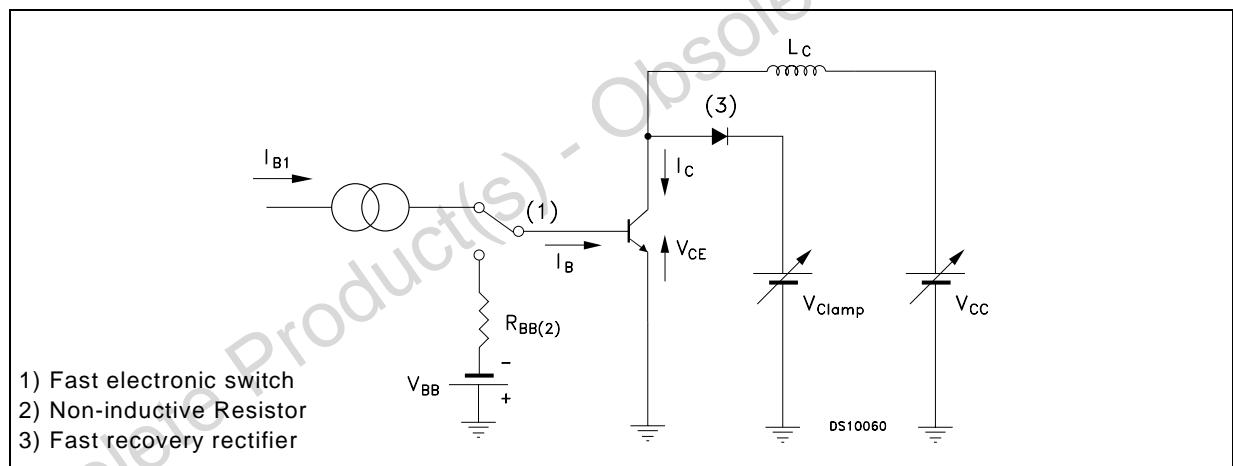
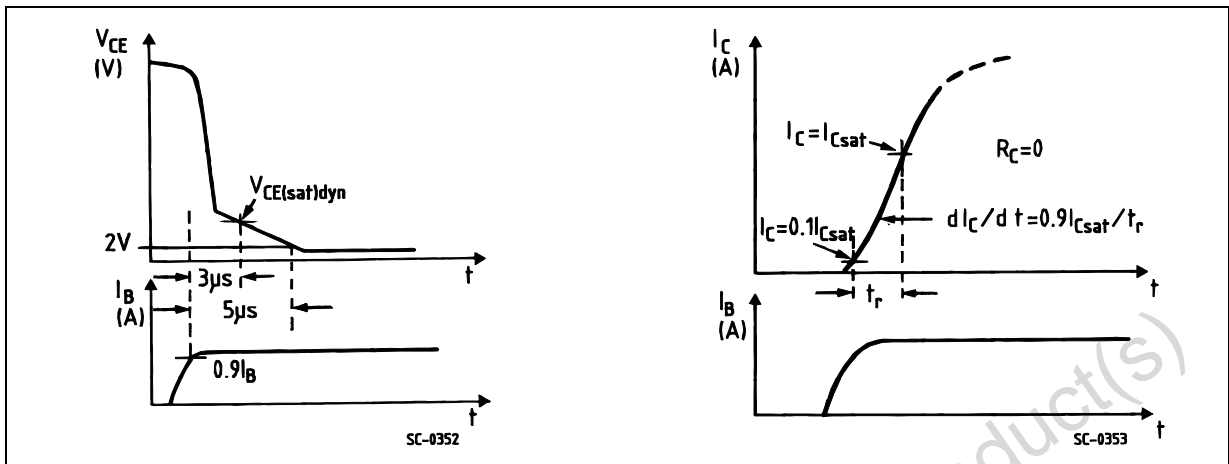


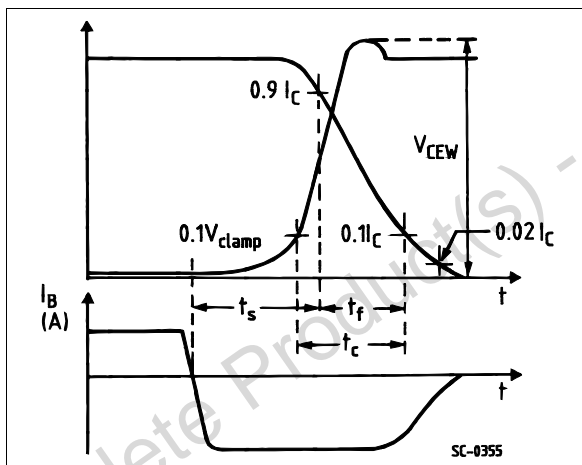
Figure 1: Inductive Load Switching Test Circuit.



Turn-on Switching Test Waveforms.

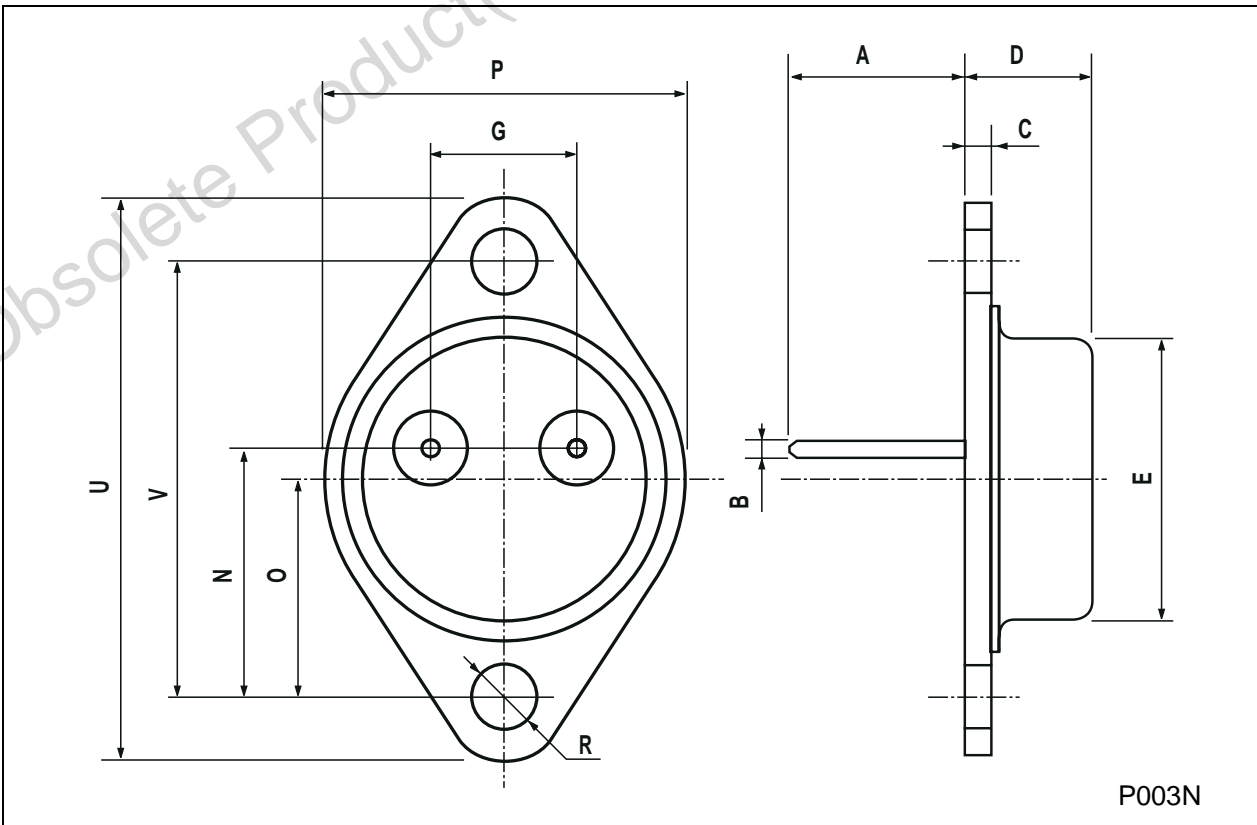


Turn-off Switching Test Waveforms (inductive load).



**TO-3 (version R) MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A		11.7			0.460	
B	0.96		1.10	0.037		0.043
C			1.70			0.066
D			8.7			0.342
E			20.0			0.787
G		10.9			0.429	
N		16.9			0.665	
P			26.2			1.031
R	3.88		4.09	0.152		0.161
U			39.50			1.555
V		30.10			1.185	



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