



STP60NE03L-12

N - CHANNEL 30V - 0.009 Ω - 60A - T0-220 STripFET™ POWER MOSFET

| TYPE | V _{DSS} | R _{DS(on)} | I _D |
|---------------|------------------|---------------------|----------------|
| STP60NE03L-12 | 30 V | < 0.012 Ω | 60 A |

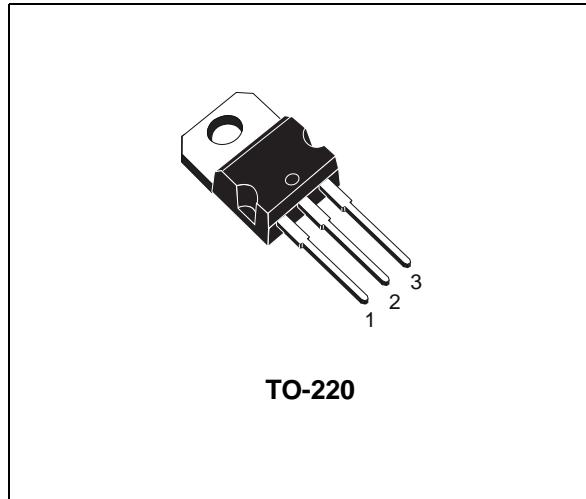
- TYPICAL R_{DS(on)} = 0.009 Ω
- AVALANCE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100 °C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175 °C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

DESCRIPTION

This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

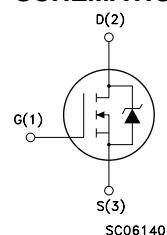
APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- DC-DC & DC-AC CONVERTERS
- AUTOMOTIVE ENVIRONMENT



TO-220

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|--------------------|---|------------|------|
| V _{DS} | Drain-source Voltage (V _{GS} = 0) | 30 | V |
| V _{DGR} | Drain-gate Voltage (R _{GS} = 20 kΩ) | 30 | V |
| V _{GS} | Gate-source Voltage | ± 20 | V |
| I _D | Drain Current (continuous) at T _c = 25 °C | 60 | A |
| I _D | Drain Current (continuous) at T _c = 100 °C | 42 | A |
| I _{DM(•)} | Drain Current (pulsed) | 240 | A |
| P _{tot} | Total Dissipation at T _c = 25 °C | 100 | W |
| | Derating Factor | 0.67 | W/°C |
| dv/dt | Peak Diode Recovery voltage slope | 5.5 | V/ns |
| T _{stg} | Storage Temperature | -65 to 175 | °C |
| T _j | Max. Operating Junction Temperature | 175 | °C |

(•) Pulse width limited by safe operating area

(1) I_{SD} ≤ 60 A, di/dt ≤ 450 A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}

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THERMAL DATA

| | | | | |
|-----------------------|--|-----|------|------|
| R _{thj-case} | Thermal Resistance Junction-case | Max | 1.5 | °C/W |
| R _{thj-amb} | Thermal Resistance Junction-ambient | Max | 62.5 | °C/W |
| R _{thc-sink} | Thermal Resistance Case-sink | Typ | 0.5 | °C/W |
| T _I | Maximum Lead Temperature For Soldering Purpose | | 300 | °C |

AVALANCHE CHARACTERISTICS

| Symbol | Parameter | Max Value | Unit |
|-----------------|--|-----------|------|
| I _{AR} | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max) | 60 | A |
| E _{AS} | Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 15 V) | 250 | mJ |

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------|---|--|------|------|---------|----------|
| V _{(BR)DSS} | Drain-source Breakdown Voltage | I _D = 250 μA V _{GS} = 0 | 30 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current (V _{GS} = 0) | V _{DS} = Max Rating V _{DS} = Max Rating T _c = 125 °C | | | 1 10 | μA μA |
| I _{GSS} | Gate-body Leakage Current (V _{DS} = 0) | V _{GS} = ± 20 V | | | ± 100 | nA |

ON (*)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------|-----------------------------------|---|------|-------|----------------|------|
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} = V _{GS} I _D = 250 μA | 1 | 1.7 | 2.5 | V |
| R _{D(on)} | Static Drain-source On Resistance | V _{GS} = 10V I _D = 30 A V _{GS} = 5V I _D = 30 A | | 0.009 | 0.012 0.018 | Ω |
| I _{D(on)} | On State Drain Current | V _{DS} > I _{D(on)} × R _{D(on)max} V _{GS} = 10 V | 60 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--|---|--|------|--------------------|------|----------------|
| g _{fs} (*) | Forward Transconductance | V _{DS} > I _{D(on)} × R _{D(on)max} I _D = 30 A | 20 | 30 | | S |
| C _{iss} C _{oss} C _{rss} | Input Capacitance Output Capacitance Reverse Transfer Capacitance | V _{DS} = 25 V f = 1 MHz V _{GS} = 0 | | 2200 570 200 | | pF pF pF |

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------|--|---|------|----------------|------|----------------|
| $t_{d(on)}$ t_r | Turn-on Delay Time Rise Time | $V_{DD} = 15 \text{ V}$ $I_D = 30 \text{ A}$ $R_G = 4.7 \Omega$ $V_{GS} = 5 \text{ V}$ (Resistive Load, see fig. 3) | | 40 260 | | ns ns |
| Q_g Q_{gs} Q_{gd} | Total Gate Charge Gate-Source Charge Gate-Drain Charge | $V_{DD} = 24 \text{ V}$ $I_D = 60 \text{ A}$ $V_{GS} = 5 \text{ V}$ | | 35 18 13 | 45 | nC nC nC |

SWITCHING OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------------------|---|--|------|------------------|------|----------------|
| $t_{d(off)}$ t_f | Turn-off Delay Time Fall Time | $V_{DD} = 15 \text{ V}$ $I_D = 30 \text{ A}$ $R_G = 4.7 \Omega$ $V_{GS} = 5 \text{ V}$ (Resistive Load, see fig. 3) | | 75 50 | | ns ns |
| $t_{r(Voff)}$ t_f t_c | Off-voltage Rise Time Fall Time Cross-over Time | $V_{DD} = 24 \text{ V}$ $I_D = 60 \text{ A}$ $R_G = 4.7 \Omega$ $V_{GS} = 15 \text{ V}$ (Inductive Load, see fig. 5) | | 35 120 175 | | ns ns ns |

SOURCE DRAIN DIODE

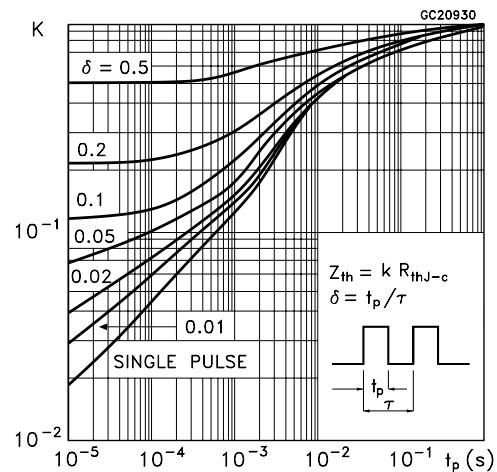
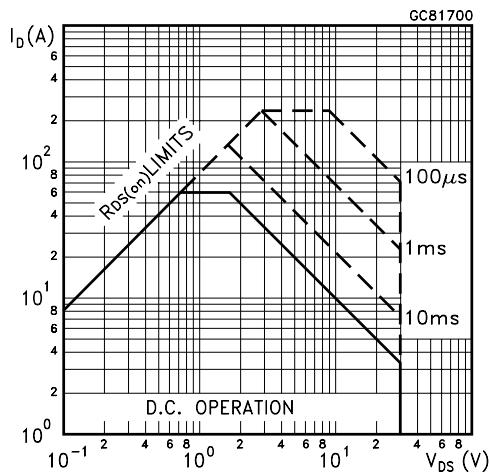
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|--|--|------|------------------|-----------|--------------------------|
| I_{SD} $I_{SDM}(\bullet)$ | Source-drain Current Source-drain Current (pulsed) | | | | 60 240 | A A |
| $V_{SD} (\ast)$ | Forward On Voltage | $I_{SD} = 60 \text{ A}$ $V_{GS} = 0$ | | | 1.5 | V |
| t_{rr} Q_{rr} I_{RRM} | Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current | $I_{SD} = 60 \text{ A}$ $\frac{di}{dt} = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 15 \text{ V}$ $T_j = 150^\circ\text{C}$ (see test circuit, fig. 5) | | 55 0.1 3.5 | | ns μC A |

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(*) Pulse width limited by safe operating area

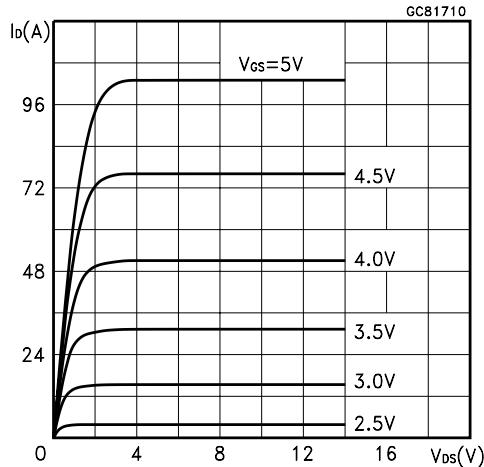
Safe Operating Area

Thermal Impedance

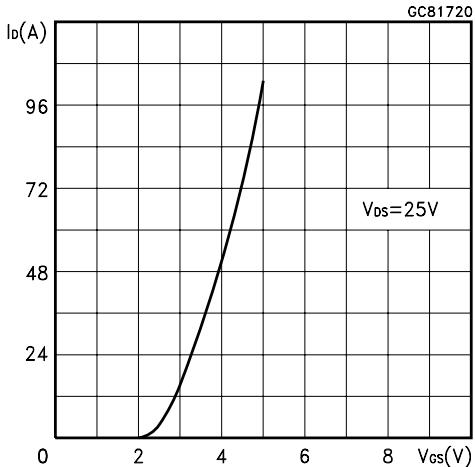


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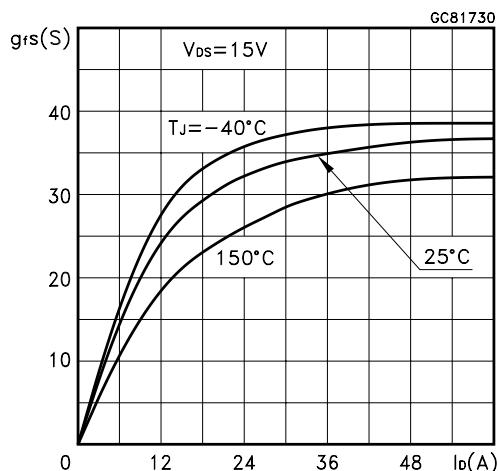
Output Characteristics



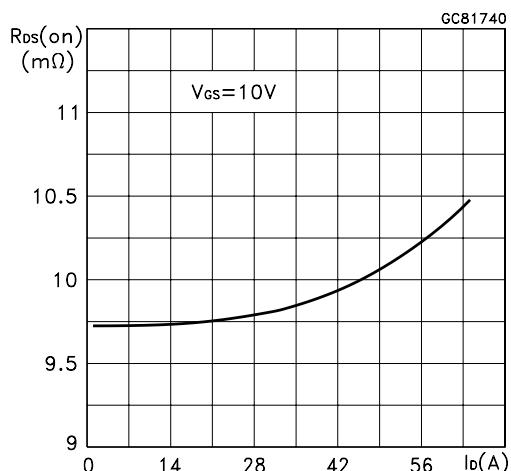
Transfer Characteristics



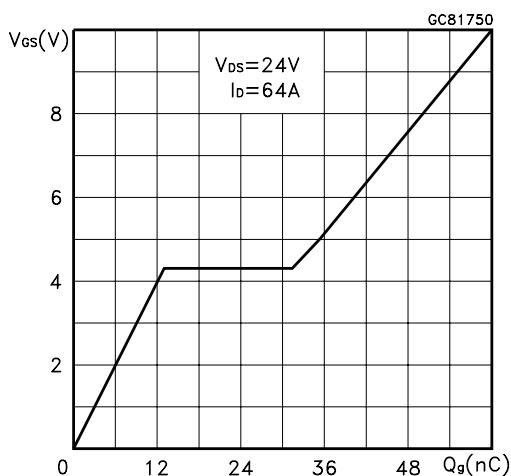
Transconductance



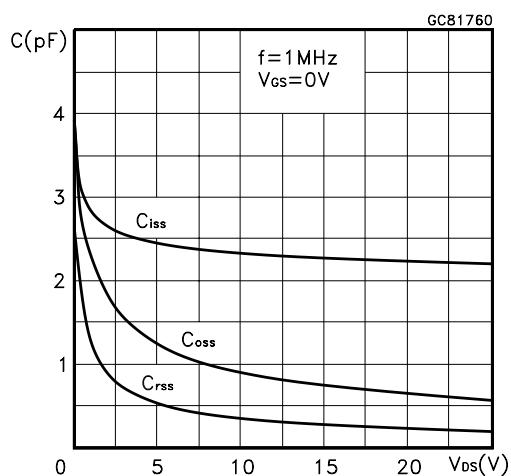
Static Drain-source On Resistance



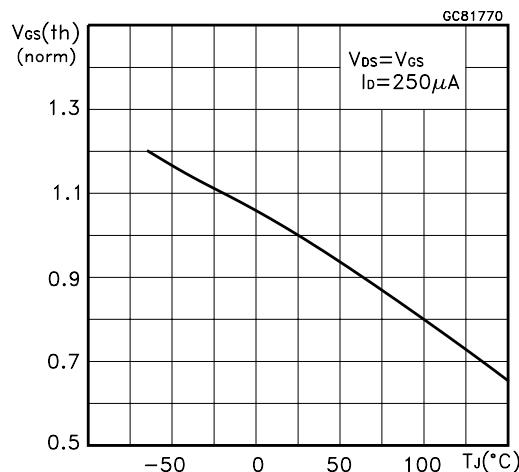
Gate Charge vs Gate-source Voltage



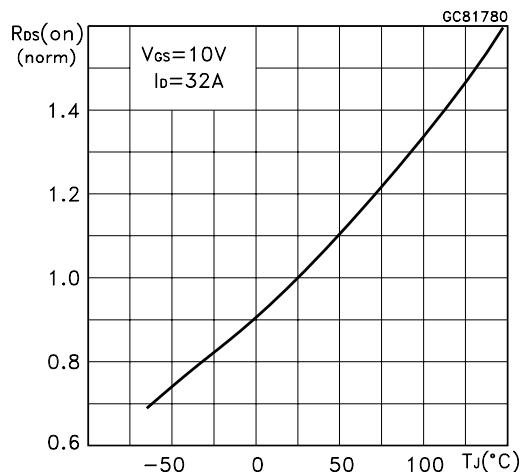
Capacitance Variations



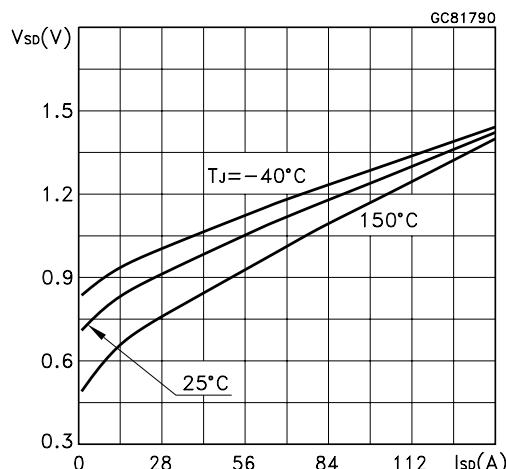
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics



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Fig. 1: Unclamped Inductive Load Test Circuit

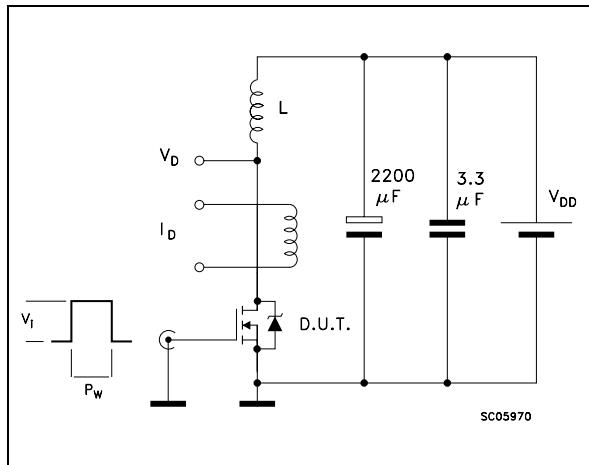


Fig. 2: Unclamped Inductive Waveform

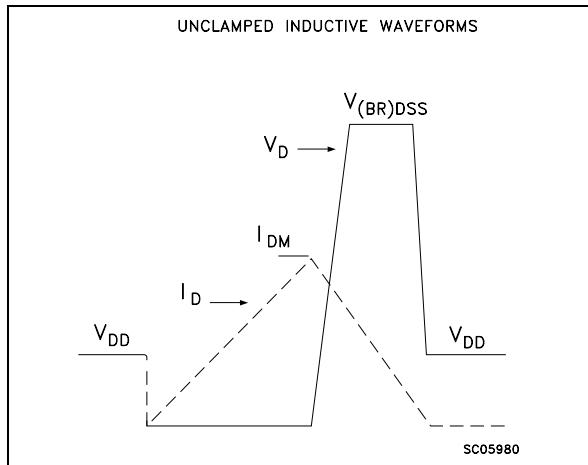


Fig. 3: Switching Times Test Circuits For Resistive Load



Fig. 4: Gate Charge test Circuit

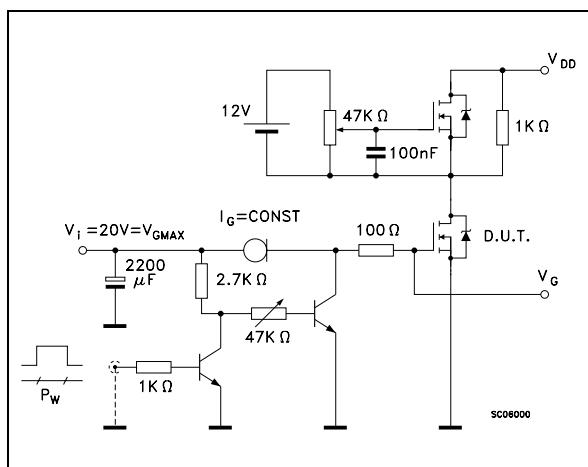
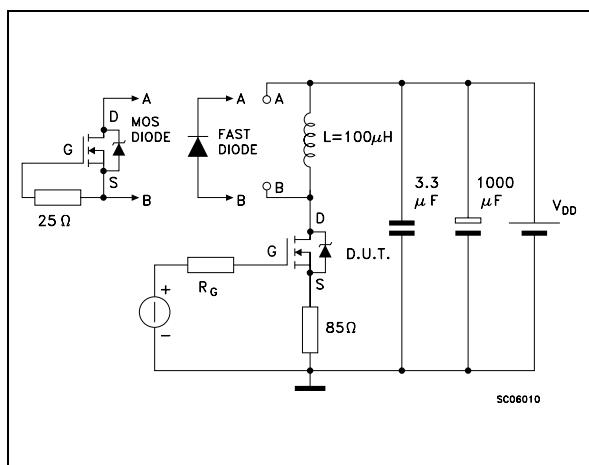
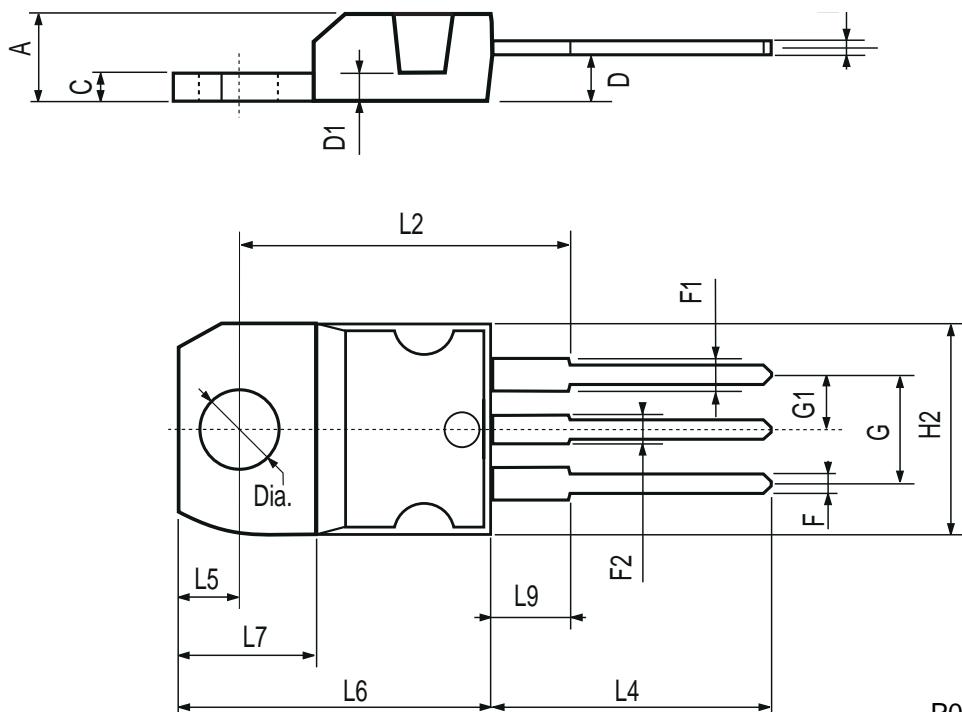


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| D1 | | 1.27 | | | 0.050 | |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| G | 4.95 | | 5.15 | 0.194 | | 0.203 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H2 | 10.0 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.4 | | | 0.645 | |
| L4 | 13.0 | | 14.0 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.2 | | 6.6 | 0.244 | | 0.260 |
| L9 | 3.5 | | 3.93 | 0.137 | | 0.154 |
| DIA. | 3.75 | | 3.85 | 0.147 | | 0.151 |



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