



# STP14NF06

## N-CHANNEL 60V - 0.1Ω - 14A TO-220 STripFET™ POWER MOSFET

| TYPE      | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-----------|------------------|---------------------|----------------|
| STP14NF10 | 60 V             | < 0.12 Ω            | 14 A           |

- TYPICAL R<sub>DS(on)</sub> = 0.1Ω
- EXCEPTIONAL dv/dt CAPABILITY
- LOW GATE CHARGE AT 100 °C
- 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

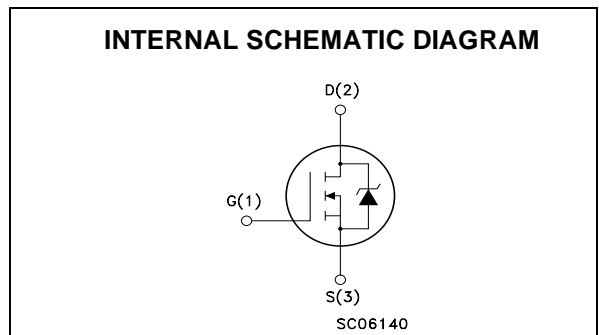
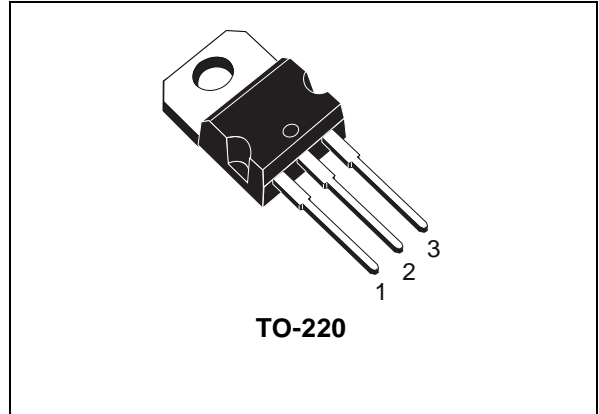
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- AUTOMOTIVE ENVIRONMENT

### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter  | Value      | Unit |
|---------------------|--|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 60         | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 60         | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                 | ±20        | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 14         | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C | 10         | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                               | 56         | A    |
| P <sub>TOT</sub>    | Total Dissipation at T <sub>C</sub> = 25°C           | 45         | W    |
|                     | Derating Factor                                      | 0.3        | W/°C |
| dv/dt (1)           | Peak Diode Recovery voltage slope                    | 6          | V/ns |
| E <sub>AS</sub> (2) | Single Pulse Avalanche Energy                        | 50         | mJ   |
| T <sub>stg</sub>    | Storage Temperature                                  | -65 to 175 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                  | 175        | °C   |

(●) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 7A, di/dt ≤ 300A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.  
 (2) Starting T<sub>j</sub> = 25°C, I<sub>D</sub> = 114A, V<sub>DD</sub> = 15V



## STP14NF06

### THERMAL DATA

|                |  |      |      |
|----------------|--|------|------|
| Rthj-case      | Thermal Resistance Junction-case Max           | 3.33 | °C/W |
| Rthj-amb       | Thermal Resistance Junction-ambient Max        | 62.5 | °C/W |
| T <sub>I</sub> | Maximum Lead Temperature For Soldering Purpose | 300  | °C   |

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED) OFF

| Symbol               | Parameter   | Test Conditions   | Min. | Typ. | Max.    | Unit     |
|----------------------|---|---|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source Breakdown Voltage                        | I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0  | 60   |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C |      |      | 1<br>10 | μA<br>μA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ±20V  |      |      | ±100    | nA       |

### ON (1)

| Symbol              | Parameter                         | Test Conditions  | Min. | Typ. | Max. | Unit |
|---------------------|-----------------------------------|--|------|------|------|------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                               | 2    |      |      | V    |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10V, I <sub>D</sub> = 7 A  |      | 0.10 | 0.12 | Ω    |
| I <sub>D(on)</sub>  | On State Drain Current            | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>V <sub>GS</sub> = 10V | 14   |      |      | A    |

### DYNAMIC

| Symbol              | Parameter                    | Test Conditions   | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|---|------|------|------|------|
| g <sub>fs</sub> (1) | Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>I <sub>D</sub> = 7 A |      | 7    |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0                                   |      | 361  |      | pF   |
| C <sub>oss</sub>    | Output Capacitance           |   |      | 54   |      | pF   |
| C <sub>rss</sub>    | Reverse Transfer Capacitance |   |      | 21   |      | pF   |

**ELECTRICAL CHARACTERISTICS (CONTINUED)**

**SWITCHING ON**

| Symbol      | Parameter          | Test Conditions  | Min. | Typ. | Max. | Unit |
|-------------|--------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 30V, I_D = 7 A$<br>$R_G = 4.7\Omega, V_{GS} = 10V$<br>(see test circuit, Figure 3) |      | 12.5 |      | ns   |
| $t_r$       | Rise Time          |  |      | 32   |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 48 V, I_D = 14 A,$<br>$V_{GS} = 10V$   |      | 11.2 | 15   | nC   |
| $Q_{gs}$    | Gate-Source Charge |  |      | 3.7  |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |  |      | 3.2  |      | nC   |

**SWITCHING OFF**

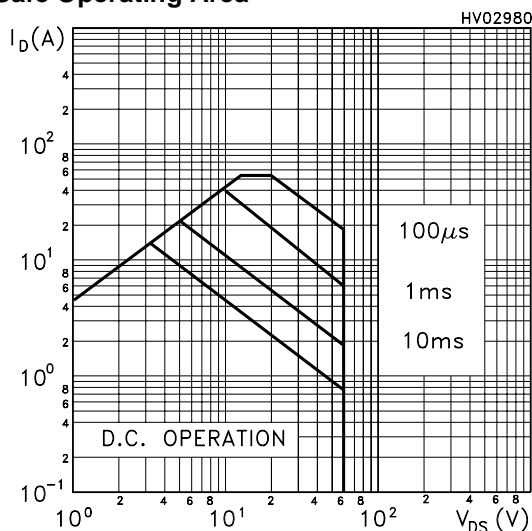
| Symbol       | Parameter           | Test Conditions  | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(off)}$ | Turn-off-Delay Time | $V_{DD} = 30 V, I_D = 7 A,$<br>$R_G = 4.7\Omega, V_{GS} = 10V$<br>(see test circuit, Figure 3) |      | 30   |      | ns   |
| $t_f$        | Fall Time           |  |      | 9.5  |      | ns   |

**SOURCE DRAIN DIODE**

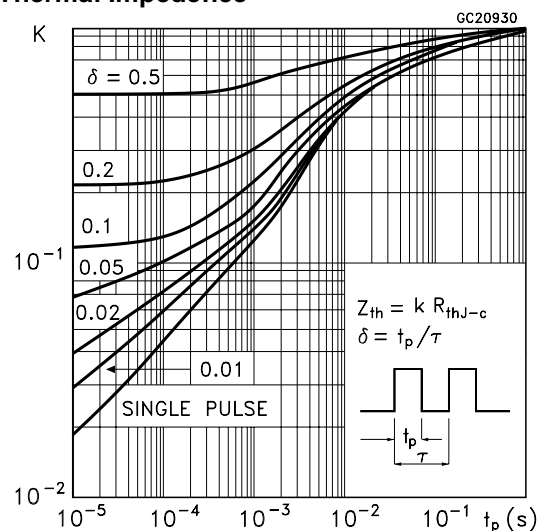
| Symbol        | Parameter                     | Test Conditions  | Min. | Typ. | Max. | Unit |
|---------------|-------------------------------|--|------|------|------|------|
| $I_{SD}$      | Source-drain Current          |  |      |      | 14   | A    |
| $I_{SDM} (1)$ | Source-drain Current (pulsed) |  |      |      | 56   | A    |
| $V_{SD} (2)$  | Forward On Voltage            | $I_{SD} = 14 A, V_{GS} = 0$  |      |      | 1.3  | V    |
| $t_{rr}$      | Reverse Recovery Time         | $I_{SD} = 14 A, di/dt = 100A/\mu s,$<br>$V_{DD} = 30 V, T_j = 150^\circ C$<br>(see test circuit, Figure 5) |      | 38   |      | ns   |
| $Q_{rr}$      | Reverse Recovery Charge       |  |      | 61   |      | nC   |
| $I_{RRM}$     | Reverse Recovery Current      |  |      | 3.2  |      | A    |

Note: 1. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

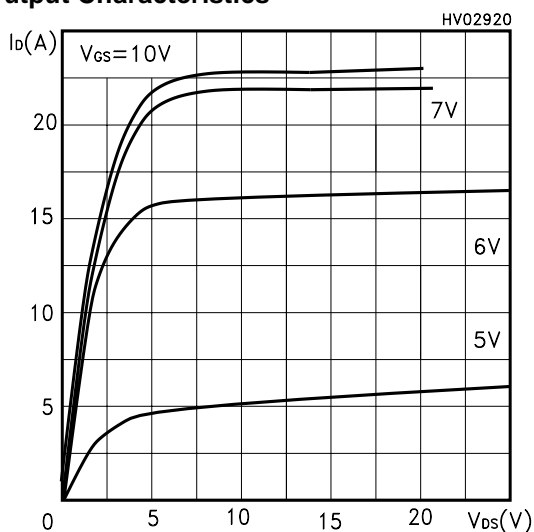
**Safe Operating Area**



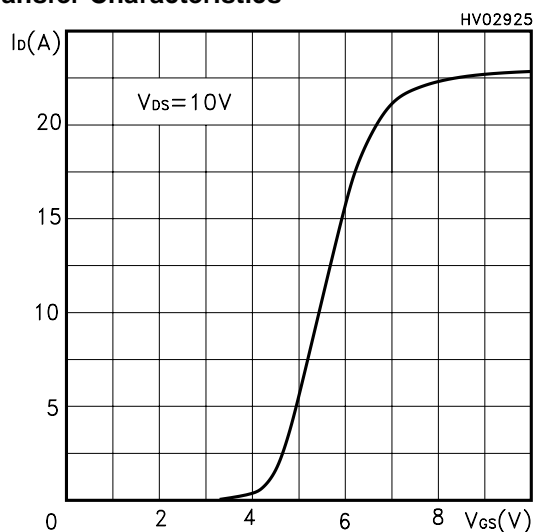
**Thermal Impedance**



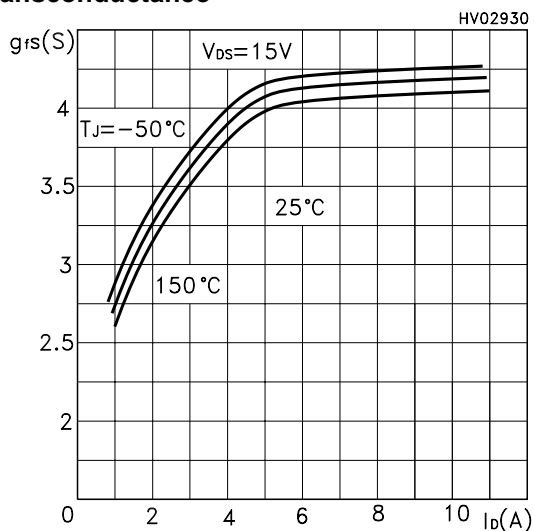
Output Characteristics



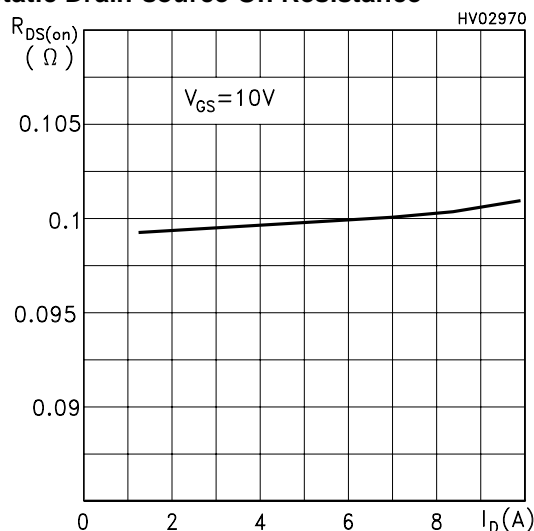
Transfer Characteristics



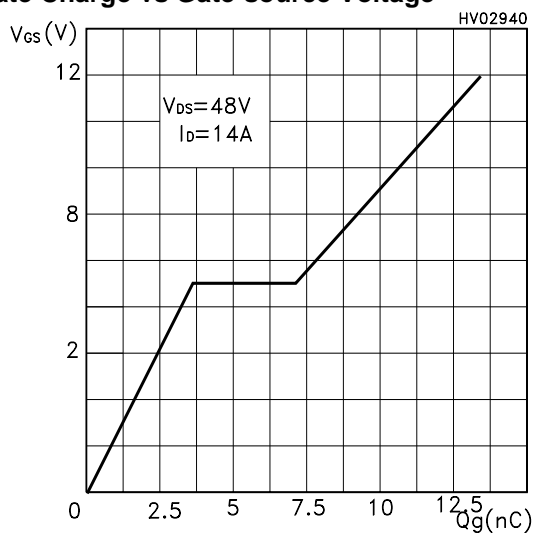
Transconductance



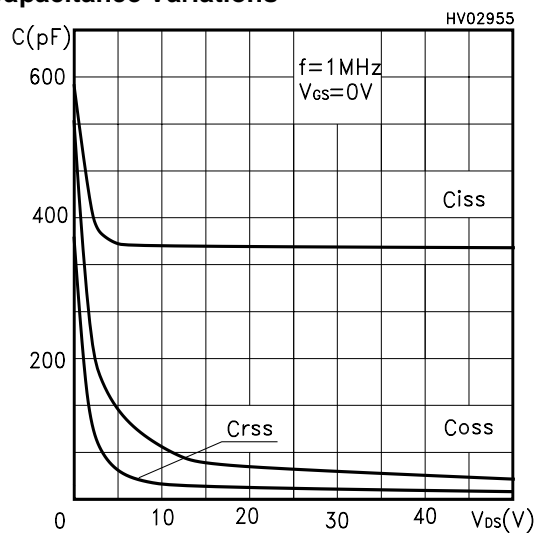
Static Drain-source On Resistance



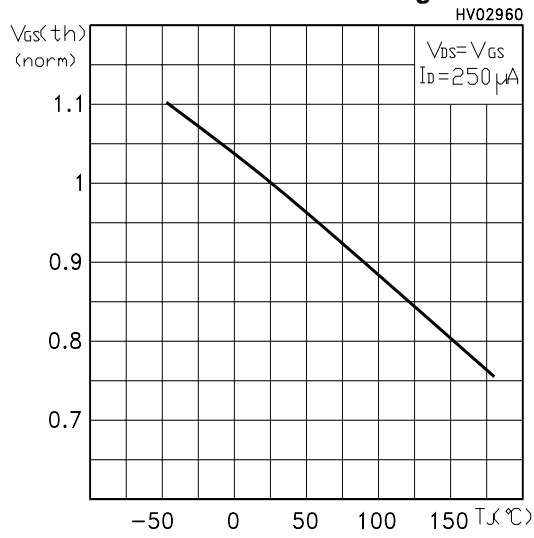
Gate Charge vs Gate-source Voltage



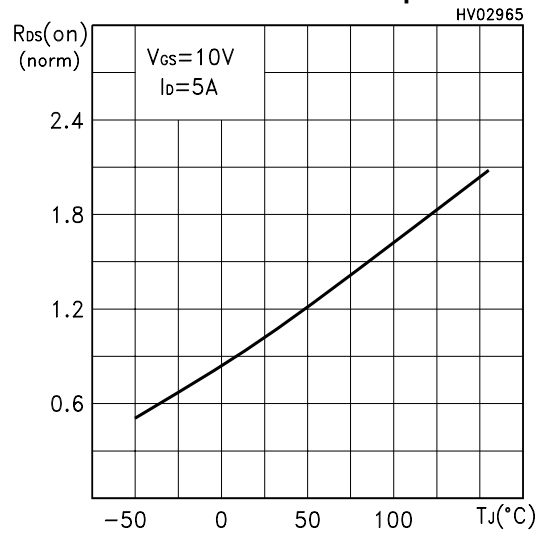
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

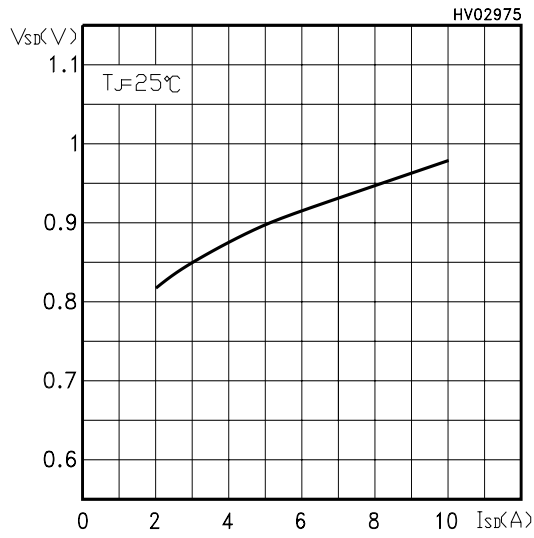


Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform



Fig. 3: Switching Times Test Circuit For Resistive Load



Fig. 4: Gate Charge test Circuit

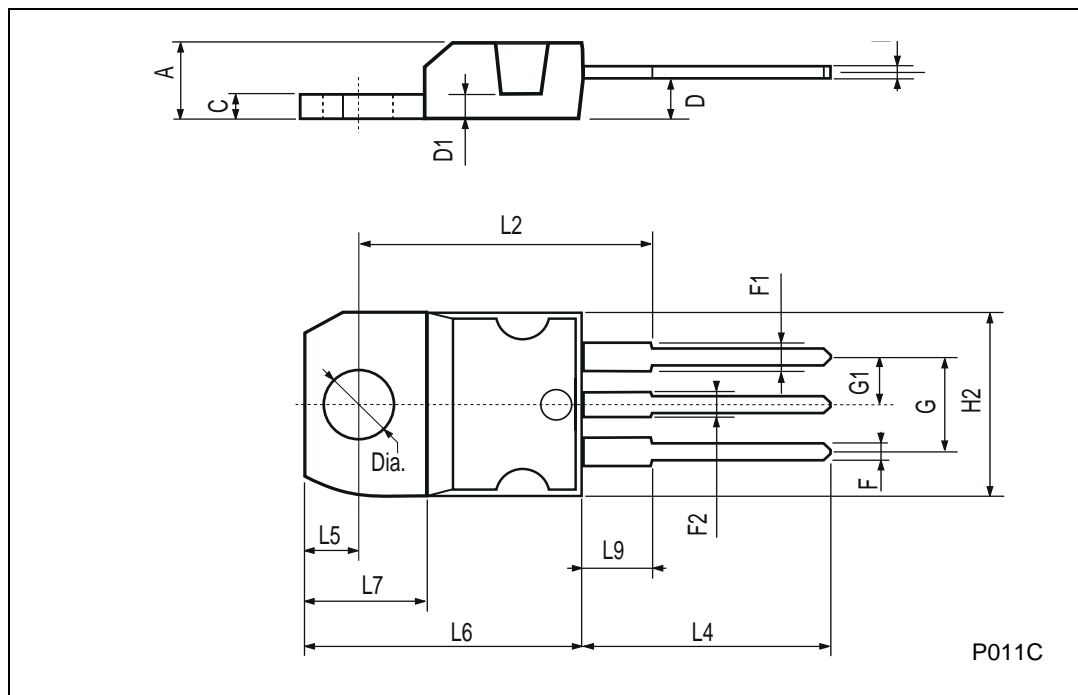


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



## 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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