

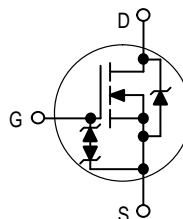
Advance Information

TMOS E-FET™

Power Field Effect Transistor
N-Channel Enhancement-Mode Silicon Gate

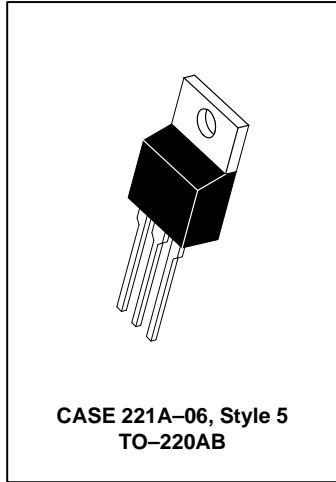
This advanced high voltage TMOS E-FET is designed to withstand high energy in the avalanche mode and switch efficiently. This new high energy device also offers a drain-to-source diode with fast recovery time. Designed for high voltage, high speed switching applications in power supplies, PWM motor controls and other inductive loads, the avalanche energy capability is specified to eliminate the guesswork in designs where inductive loads are switched and offer additional safety margin against unexpected voltage transients.

- Avalanche Energy Capability Specified at Elevated Temperature
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Low Stored Gate Charge for Efficient Switching
- Internal Source-to-Drain Diode Designed to Replace External Zener Transient Suppressor-Absorbs High Energy in the Avalanche Mode
- ESD Protected. Designed to Typically Withstand 400 V Machine Model and 4000 V Human Body Model.



MTP55N06Z

TMOS POWER FET
55 AMPERES
60 VOLTS
RDS(on) = 18 mΩ



MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|-----------------|------------|---------------------|
| Drain-to-Source Voltage | V_{DSS} | 60 | Vdc |
| Drain-to-Gate Voltage ($R_{GS} = 1.0 \text{ M}\Omega$) | V_{DGR} | 60 | Vdc |
| Gate-to-Source Voltage — Continuous | V_{GS} | ± 20 | Vdc |
| — Non-Repetitive ($t_p \leq 10 \text{ ms}$) | V_{GSM} | ± 40 | Vpk |
| Drain Current — Continuous @ $T_C = 25^\circ\text{C}$ | I_D | 55 | Adc |
| — Continuous @ $T_C = 100^\circ\text{C}$ | I_D | 35.5 | |
| — Single Pulse ($t_p \leq 10 \mu\text{s}$) | I_{DM} | 165 | Apk |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ | P_D | 113 | Watts |
| Derate above 25°C | | 0.91 | W/ $^\circ\text{C}$ |
| Operating and Storage Temperature Range | T_J, T_{stg} | -55 to 150 | $^\circ\text{C}$ |
| Single Pulse Drain-to-Source Avalanche Energy — Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = 25 \text{ Vdc}$, $V_{DS} = 60 \text{ Vdc}$, $V_{GS} = 10 \text{ Vdc}$, Peak $I_L = 55 \text{ Apk}$, $L = 0.3 \text{ mH}$, $R_G = 25 \Omega$) | E_{AS} | 454 | mJ |
| Thermal Resistance — Junction-to-Case | $R_{\theta JC}$ | 1.1 | $^\circ\text{C/W}$ |
| — Junction-to-Ambient | $R_{\theta JA}$ | 62.5 | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | T_L | 260 | $^\circ\text{C}$ |

This document contains information on a new product. Specifications and information herein are subject to change without notice. E-FET is a trademark of Motorola, Inc. TMOS is a registered trademark of Motorola, Inc.

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|----------------------|-----|-----|-----|-------|
| Drain-to-Source Breakdown Voltage (V _{GS} = 0 Vdc, I _D = 250 μAdc) Temperature Coefficient (Positive) | V _{(BR)DSS} | 60 | — | — | Vdc |
| | | — | 53 | — | mV/°C |
| Zero Gate Voltage Drain Current (V _{DS} = 60 Vdc, V _{GS} = 0 Vdc) (V _{DS} = 60 Vdc, V _{GS} = 0 Vdc, T _J = 125°C) | I _{DSS} | — | — | 1.0 | μAdc |
| | | — | — | 10 | |
| Gate-Body Leakage Current (V _{GS} = ±20 Vdc, V _{DS} = 0 Vdc) | I _{GSS} | — | — | 100 | nAdc |

ON CHARACTERISTICS (1)

| | | | | | |
|---|---------------------|-----|-------|-----|-------|
| Gate Threshold Voltage (V _{DS} = V _{GS} , I _D = 250 μAdc) Threshold Temperature Coefficient (Negative) | V _{GS(th)} | 2.0 | 3.0 | 4.0 | Vdc |
| | | — | 6.0 | — | mV/°C |
| Static Drain-to-Source On-Resistance (V _{GS} = 10 Vdc, I _D = 27.5 Adc) | R _{DS(on)} | — | 14 | 16 | mΩ |
| Drain-to-Source On-Voltage (V _{GS} = 10 Vdc) (I _D = 55 Adc) (I _D = 27.5 Adc, T _J = 125°C) | V _{DS(on)} | — | 0.825 | 1.2 | Vdc |
| | | — | 0.74 | 1.0 | |
| Forward Transconductance (V _{DS} = 4.0 Vdc, I _D = 27.5 Adc) | g _{FS} | 12 | 15 | — | Mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|----------------------|---|------------------|---|------|------|----|
| Input Capacitance | (V _{DS} = 25 Vdc, V _{GS} = 0 Vdc, f = 1.0 MHz) | C _{iss} | — | 1390 | 1950 | pF |
| Output Capacitance | | C _{oss} | — | 520 | 730 | |
| Transfer Capacitance | | C _{rss} | — | 119 | 238 | |

SWITCHING CHARACTERISTICS (2)

| | | | | | | |
|-------------------------------|---|---------------------|---|-----|-----|----|
| Turn-On Delay Time | (V _{DD} = 30 Vdc, I _D = 55 Adc, V _{GS(on)} = 10 Vdc, R _G = 9.1 Ω) | t _{d(on)} | — | 27 | 54 | ns |
| Rise Time | | t _r | — | 157 | 314 | |
| Turn-Off Delay Time | | t _{d(off)} | — | 116 | 232 | |
| Fall Time | | t _f | — | 126 | 252 | |
| Gate Charge (See Figure 8) | (V _{DS} = 48 Vdc, I _D = 55 Adc, V _{GS} = 10 Vdc) | Q _T | — | 40 | 56 | nC |
| | | Q ₁ | — | 7.0 | — | |
| | | Q ₂ | — | 18 | — | |
| | | Q ₃ | — | 15 | — | |

SOURCE-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|--------------------------------|--|-----------------|---|------|-----|-----|
| Forward On-Voltage | (I _S = 55 Adc, V _{GS} = 0 Vdc) (I _S = 55 Adc, V _{GS} = 0 Vdc, T _J = 125°C) | V _{SD} | — | 0.93 | 1.1 | Vdc |
| | | | — | 0.82 | — | |
| Reverse Recovery Time | (I _S = 55 Adc, V _{GS} = 0 Vdc, dI _S /dt = 100 A/μs) | t _{rr} | — | 57 | — | ns |
| | | t _a | — | 32 | — | |
| | | t _b | — | 25 | — | |
| Reverse Recovery Stored Charge | | Q _{RR} | — | 0.11 | — | μC |

INTERNAL PACKAGE INDUCTANCE

| | | | | | |
|--|----------------|---|-----|---|----|
| Internal Drain Inductance (Measured from contact screw on tab to center of die) (Measured from drain lead 0.25" from package to center of die) | L _D | — | 3.5 | — | nH |
| | | — | 4.5 | — | |
| Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad) | L _S | — | 7.5 | — | |

- (1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
- (2) Switching characteristics are independent of operating junction temperature.

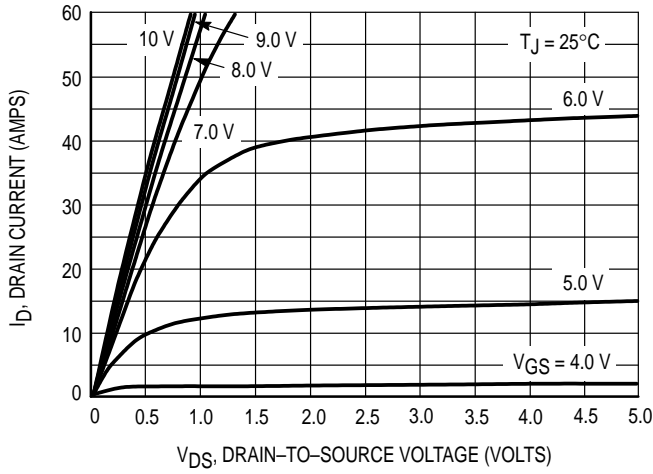


Figure 1. On-Region Characteristics

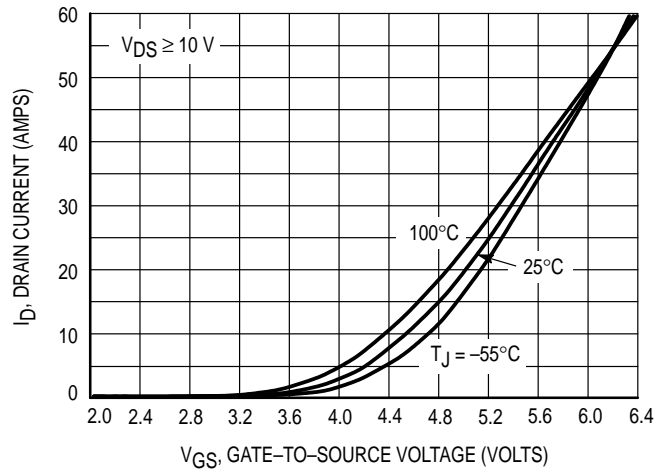


Figure 2. Transfer Characteristics

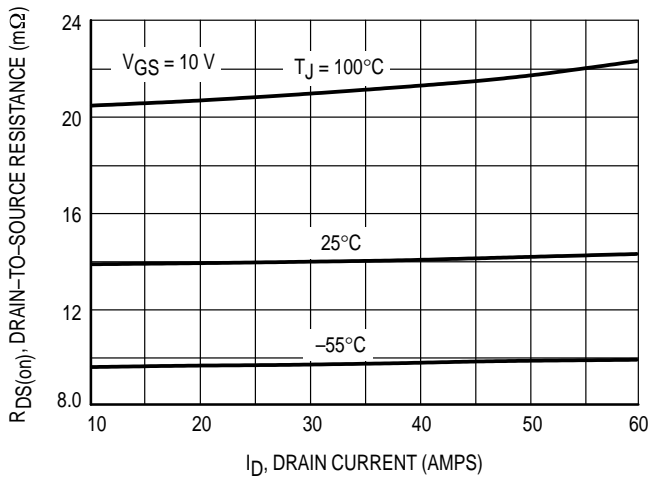


Figure 3. On-Resistance versus Drain Current and Temperature

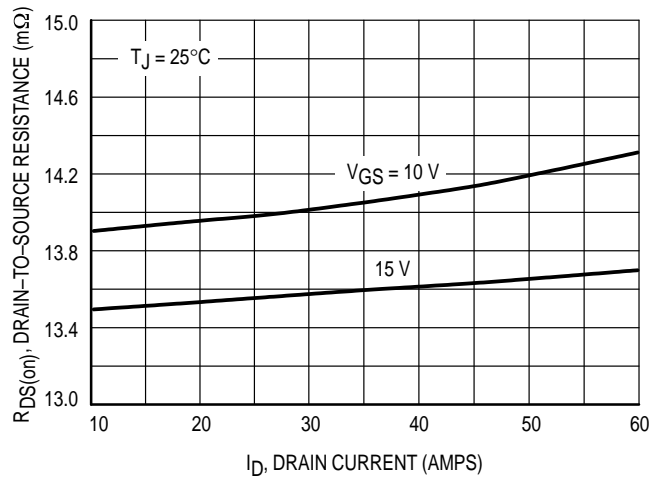


Figure 4. On-Resistance versus Drain Current and Gate Voltage

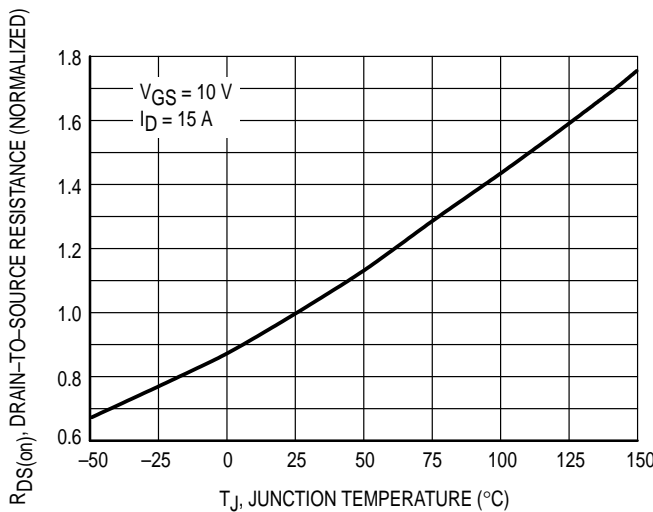


Figure 5. On-Resistance Variation with Temperature

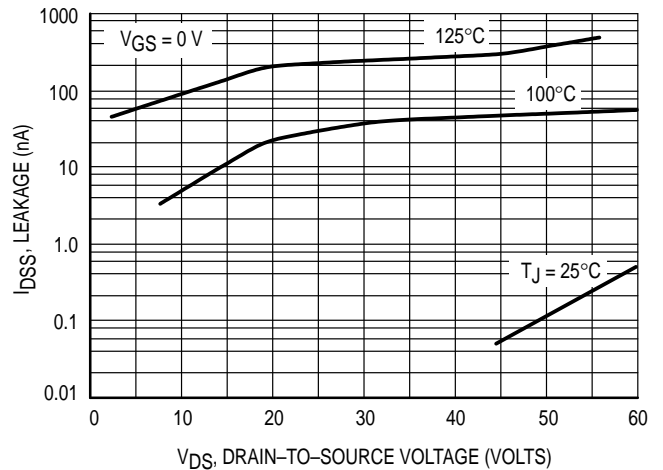


Figure 6. Drain-to-Source Leakage Current versus Voltage

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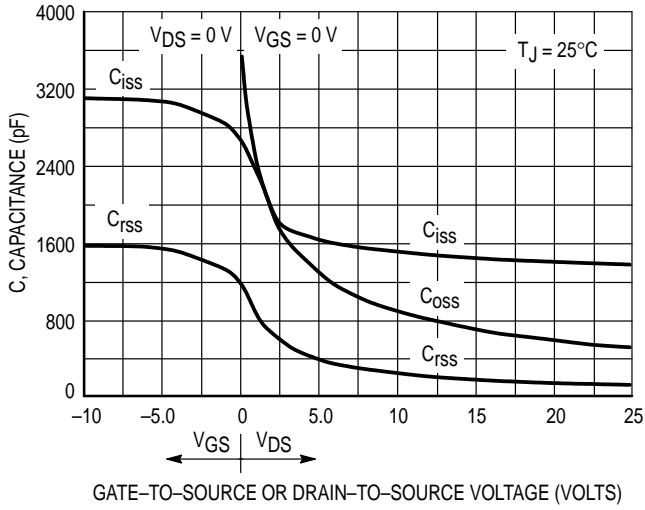


Figure 7. Capacitance Variation

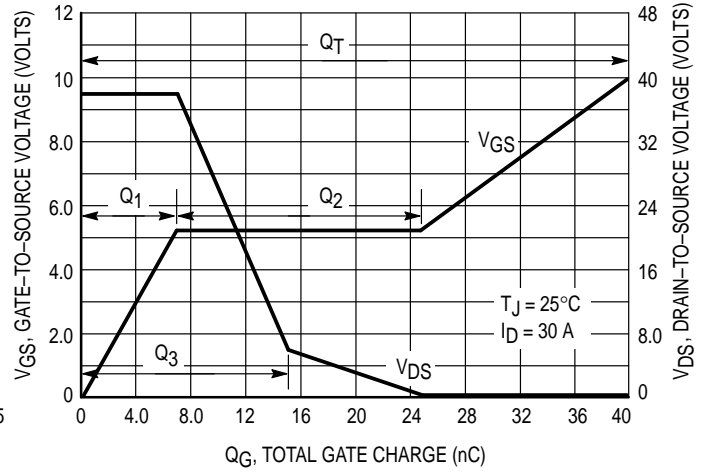


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

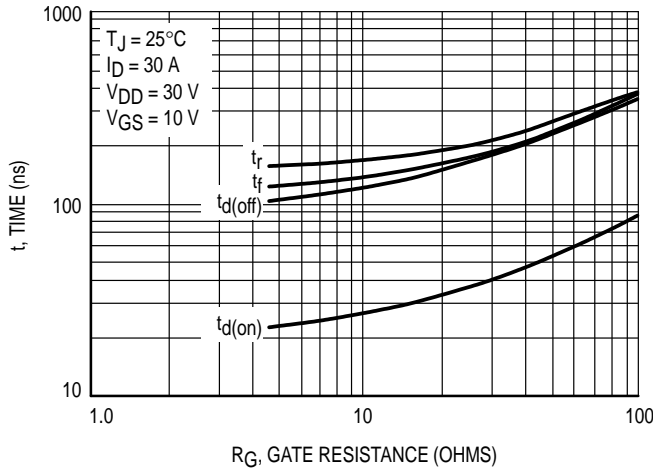


Figure 9. Resistive Switching Time Variation versus Gate Resistance

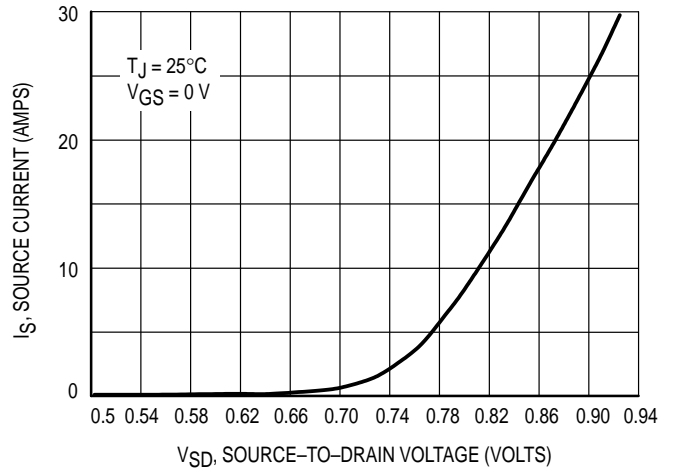


Figure 10. Diode Forward Voltage versus Current

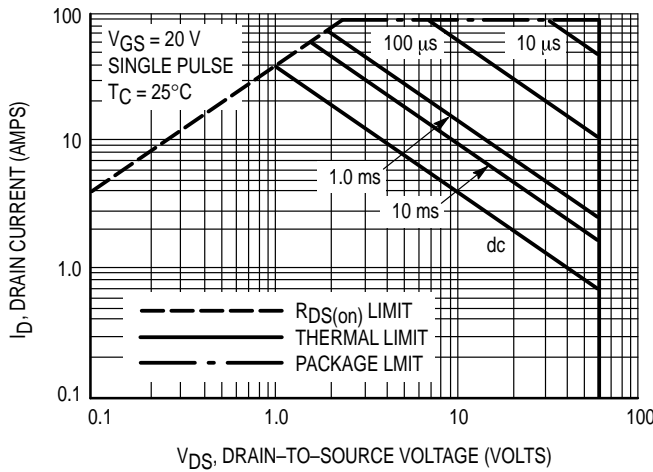


Figure 11. Maximum Rated Forward Biased Safe Operating Area

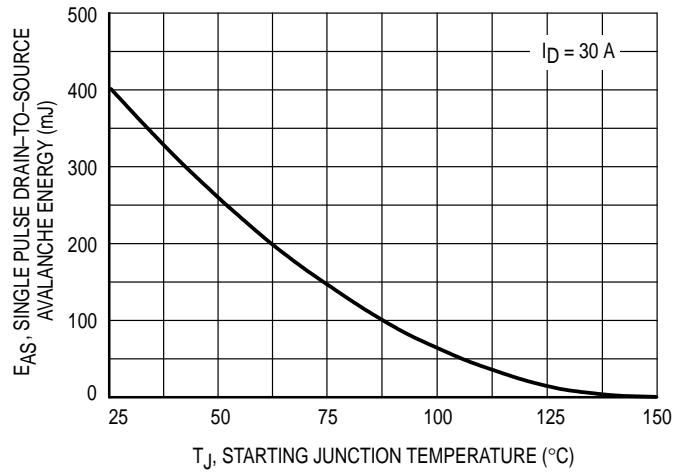


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

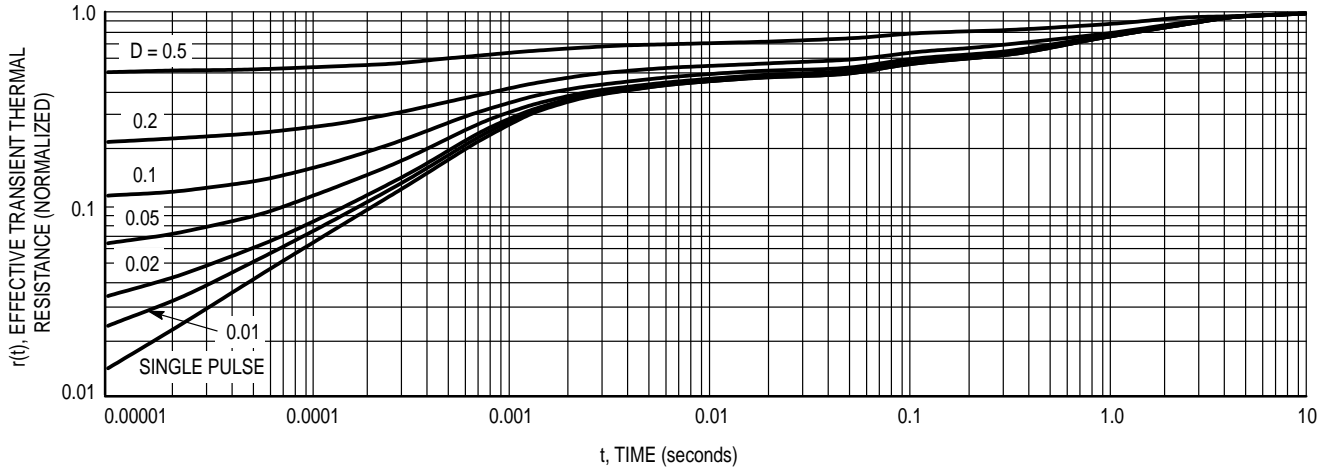


Figure 13. Thermal Response

PACKAGE DIMENSIONS

MECHANICAL DRAWING OF THE MOSFET PACKAGE. The drawing shows a top view and a side view. Dimensions are labeled with letters A through Z. The top view shows a square package with four pins (1, 2, 3, 4) and a central gate. The side view shows the package height and lead lengths. A 'SEATING PLANE' is indicated at the top of the package body.

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

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.

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

CASE 221A-06
ISSUE Y

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