

### Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)MAX}$ | $I_D$ |
|---------------|-----------------|-------|
| 650V          | 180mΩ@10V       | 21A   |

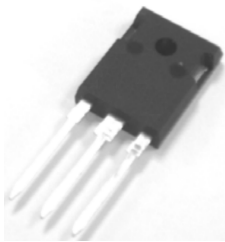
### Feature

- Low on-resistance and low conduction losses
- Ultra Low Gate Charge cause lower driving requirements
- New technology for high voltage device

### Application

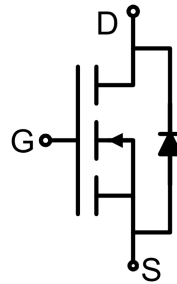
- Power factor correction
- Switched mode power supplies
- Uninterruptible Power Supply

### Package

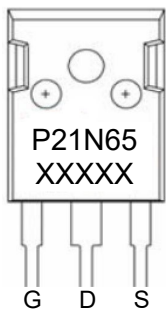


TO-247AB

### Circuit diagram



### Marking



### Absolute maximum ratings (Ta=25°C unless otherwise noted)

| Parameter   | Symbol                    | Value      | Unit                      |
|---|---------------------------|------------|---------------------------|
| Drain-Source Voltage                                  | $V_{DS}$                  | 650        | V                         |
| Gate-Source Voltage                                   | $V_{GS}$                  | ±30        | V                         |
| Continuous Drain Current                              | $I_D$                     | 21         | A                         |
| Drain Current-Continuous( $T_C = 100^\circ\text{C}$ ) | $I_D (100^\circ\text{C})$ | 13.2       | A                         |
| Pulsed Drain Current                                  | $I_{DM}$                  | 84         | A                         |
| Power Dissipation                                     | $P_D$                     | 188        | W                         |
| Thermal Resistance, Junction-to-Case                  | $R_{\theta JC}$           | 0.66       | $^\circ\text{C}/\text{W}$ |
| Single pulse avalanche energy                         | $E_{AS}$                  | 441        | mJ                        |
| Junction Temperature                                  | $T_J$                     | 150        | $^\circ\text{C}$          |
| Storage Temperature                                   | $T_{STG}$                 | -55 ~ +150 | $^\circ\text{C}$          |

### Electrical characteristics ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

| Parameter                                   | Symbol        | Test Condition  | Min. | Typ. | Max. | Unit          |
|---|---------------|---|------|------|------|---------------|
| <b>Static Characteristics</b>               |               |   |      |      |      |               |
| Drain-source breakdown voltage              | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 250\mu\text{A}$                         | 650  |      |      | V             |
| Zero gate voltage drain current             | $I_{DSS}$     | $V_{DS} = 650V, V_{GS} = 0V$                                |      |      | 1    | $\mu\text{A}$ |
| Gate-body leakage current                   | $I_{GSS}$     | $V_{GS} = \pm 20V, V_{DS} = 0V$                             |      |      | ±100 | nA            |
| Gate threshold voltage                      | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$                     | 3    |      | 4    | V             |
| Drain-source on-resistance <sup>1)</sup>    | $R_{DS(on)}$  | $V_{GS} = 10V, I_D = 10.5A$                                 |      | 150  | 180  | m $\Omega$    |
| <b>Dynamic characteristics<sup>2)</sup></b> |               |   |      |      |      |               |
| Input Capacitance                           | $C_{iss}$     | $V_{DS} = 50V, V_{GS} = 0V, f = 1\text{MHz}$                |      | 2250 |      | pF            |
| Output Capacitance                          | $C_{oss}$     |   |      | 83   |      |               |
| Reverse Transfer Capacitance                | $C_{rss}$     |   |      | 1.6  |      |               |
| Total Gate Charge                           | $Q_g$         | $V_{DS} = 480V, V_{GS} = 10V, I_D = 21A$                    |      | 36   |      | nC            |
| Gate-Source Charge                          | $Q_{gs}$      |   |      | 14   |      |               |
| Gate-Drain Charge                           | $Q_{gd}$      |   |      | 8.5  |      |               |
| Turn-on delay time                          | $t_{d(on)}$   | $V_{DD} = 380V, V_{GS} = 10V, I_D = 11A, R_{GEN} = 4\Omega$ |      | 11   |      | nS            |
| Turn-on rise time                           | $t_r$         |   |      | 6    |      |               |
| Turn-off delay time                         | $t_{d(off)}$  |   |      | 61   |      |               |
| Turn-off fall time                          | $t_f$         |   |      | 4.5  |      |               |
| <b>Source-Drain Diode characteristics</b>   |               |   |      |      |      |               |
| Diode Forward Current <sup>1)</sup>         | $I_S$         |   |      |      | 21   | A             |
| Diode Forward voltage                       | $V_{DS}$      | $V_{GS} = 0V, I_S = 21A$                                    |      |      | 1.3  | V             |
| Reverse Recovery Time                       | $t_{rr}$      | $T_J = 25^\circ\text{C}, I_F = 21A$                         |      | 310  |      | nS            |
| Reverse Recovery Charge                     | $Q_{rr}$      | $di/dt = 100A/\mu\text{s}^1$                                |      | 5    |      | $\mu\text{C}$ |

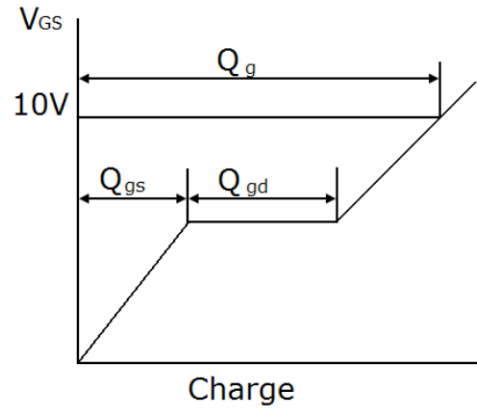
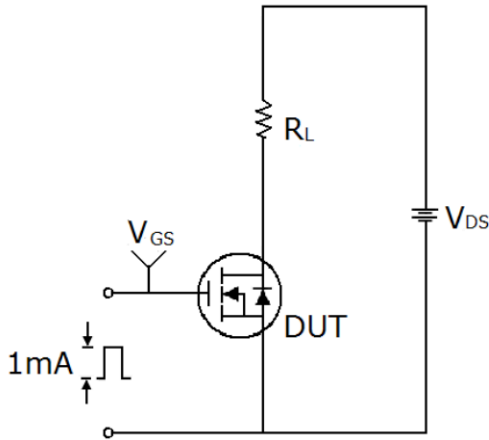
Notes:

1) Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

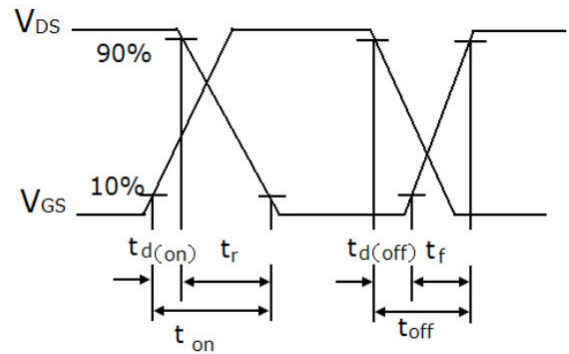
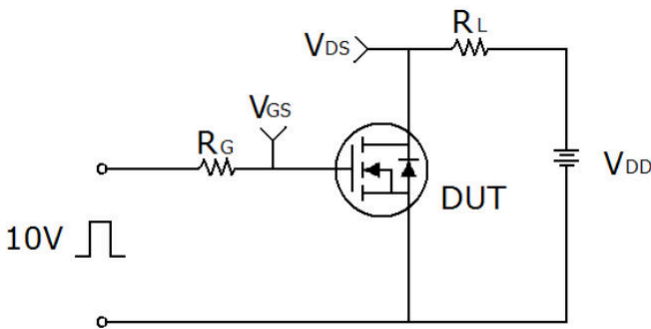
2) Guaranteed by design, not subject to production testing.

## Test Circuit

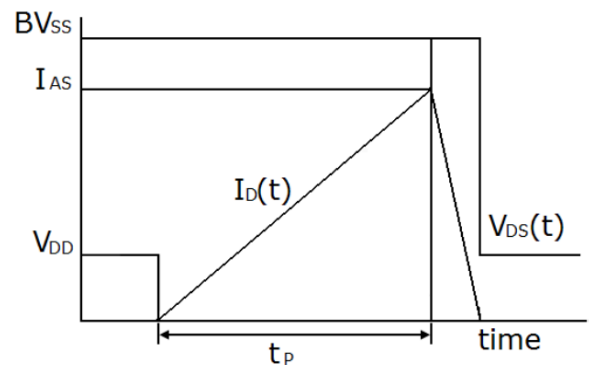
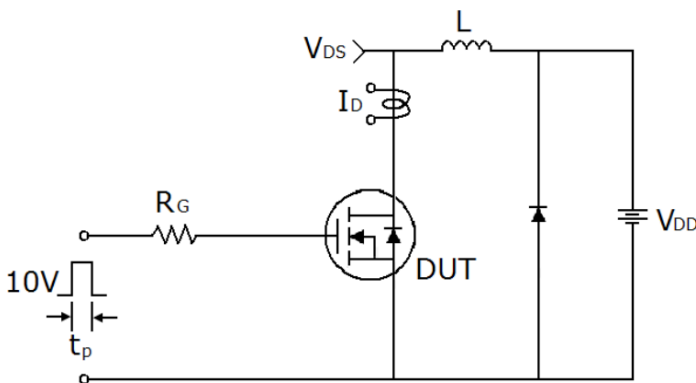
### 1) Gate charge test circuit & Waveform



### 2) Switch Time Test Circuit

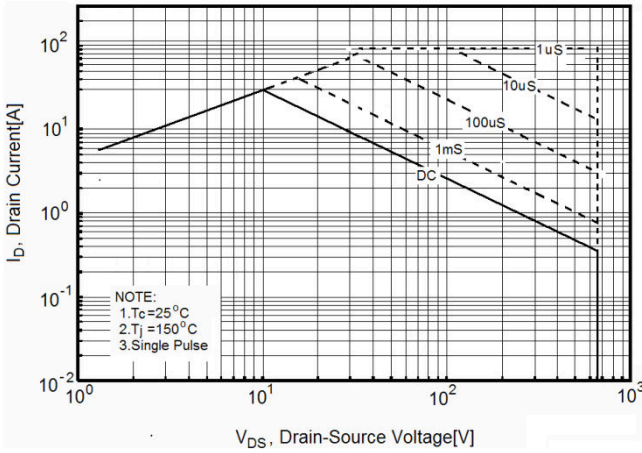


### 3) Unclamped Inductive Switching Test Circuit & Waveforms

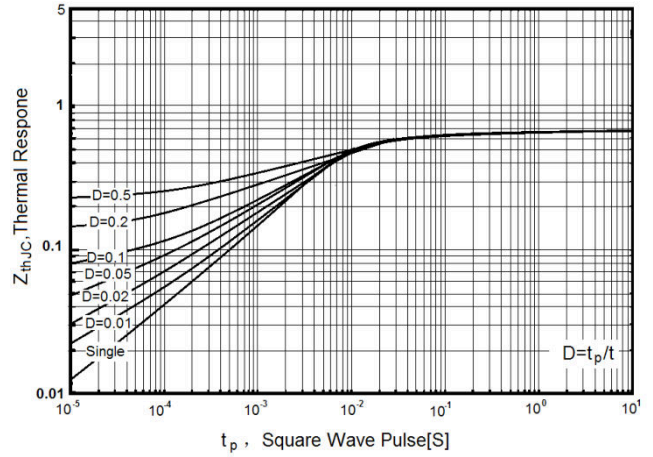


### Typical Characteristics

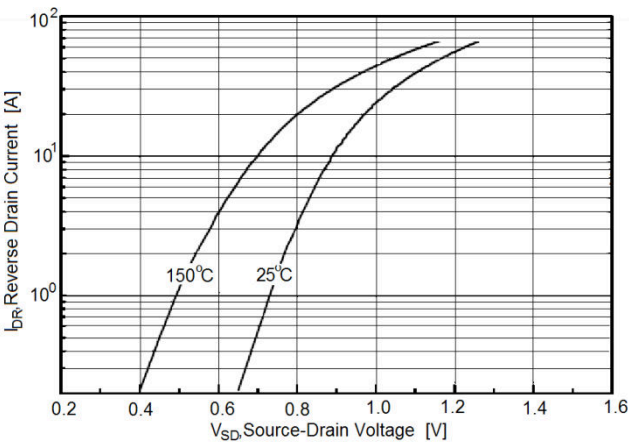
**Figure1. Safe operating area**



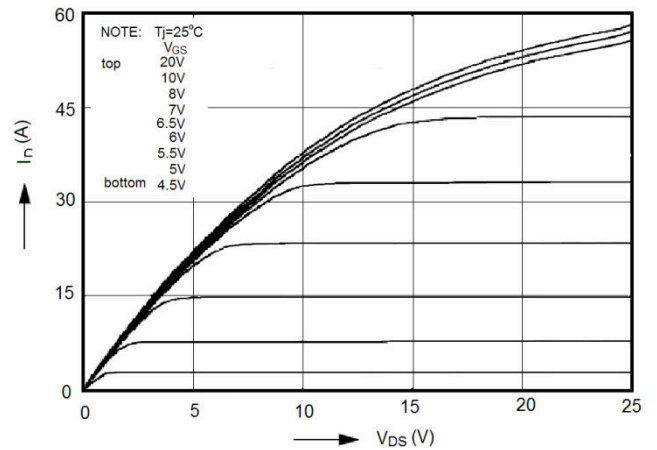
**Figure2. Transient Thermal Impedance**



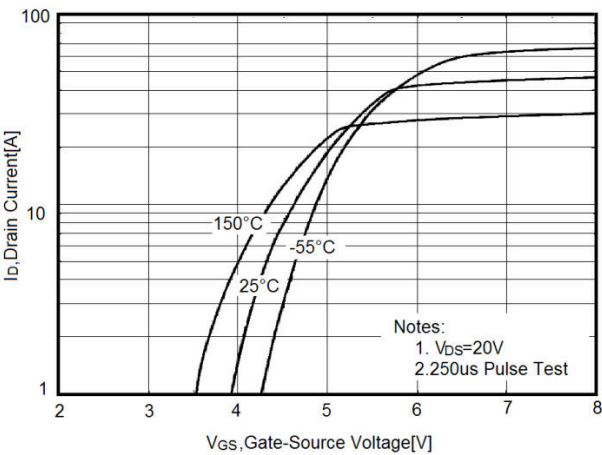
**Figure3. Source-Drain Diode Forward Voltage**



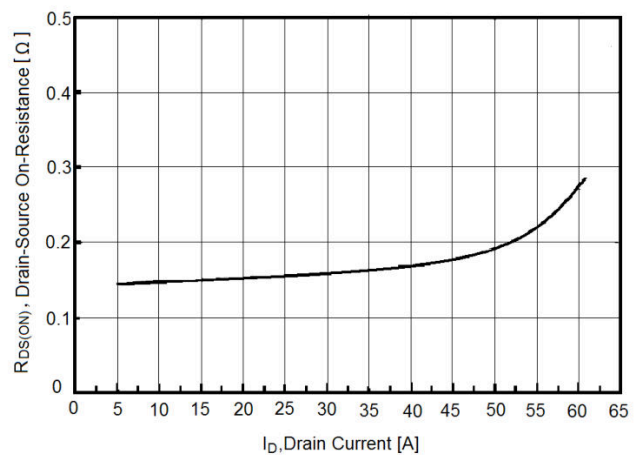
**Figure4. Output characteristics**



**Figure5. Transfer characteristics**

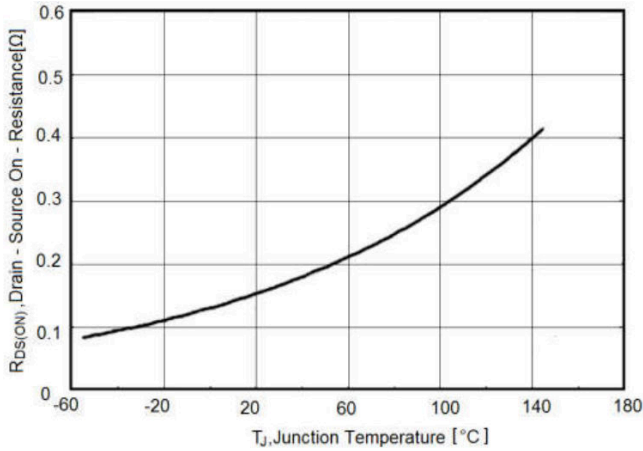


**Figure6. Static drain-source on resistance**

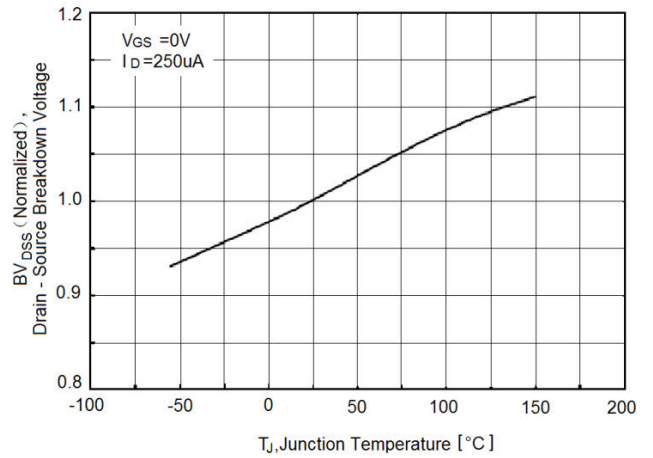


## Typical Characteristics

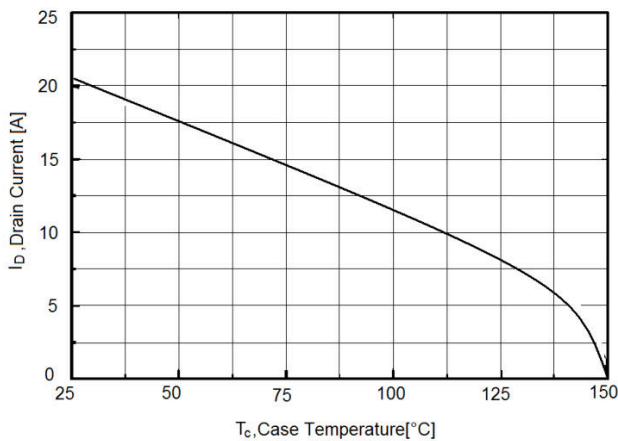
**Figure7.  $R_{DS(ON)}$  vs Junction Temperature**



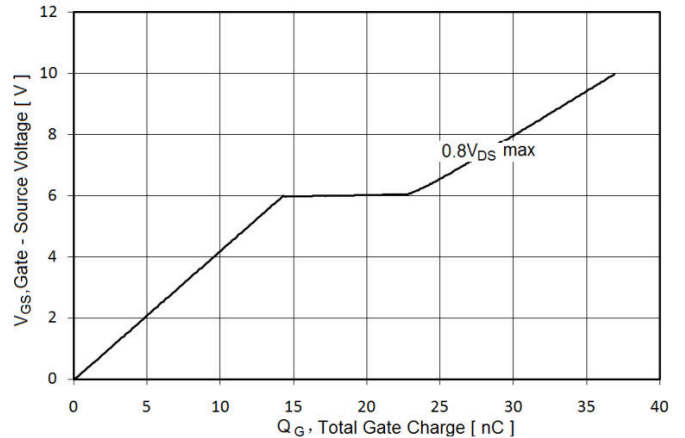
**Figure8.  $BV_{DSS}$  vs Junction Temperature**



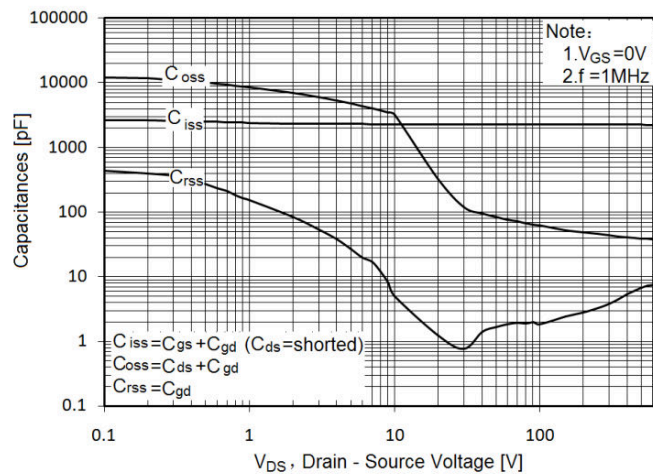
**Figure9. Maximum  $I_D$  vs Junction Temperature**



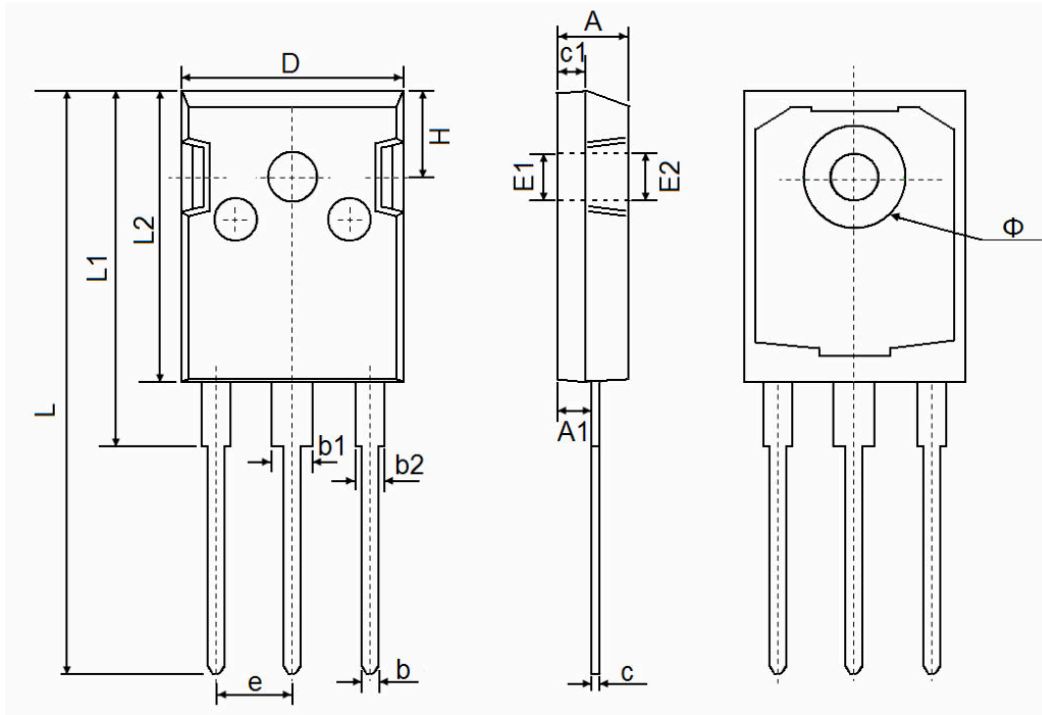
**Figure10. Gate charge waveforms**



**Figure11. Capacitance**



### TO-247AB Package Information



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.850                     | 5.150  | 0.191                | 0.200 |
| A1     | 2.200                     | 2.600  | 0.087                | 0.102 |
| b      | 1.000                     | 1.400  | 0.039                | 0.055 |
| b1     | 2.800                     | 3.200  | 0.110                | 0.126 |
| b2     | 1.800                     | 2.200  | 0.071                | 0.087 |
| c      | 0.500                     | 0.700  | 0.020                | 0.028 |
| c1     | 1.900                     | 2.100  | 0.075                | 0.083 |
| D      | 15.450                    | 15.750 | 0.608                | 0.620 |
| E1     | 3.500 REF                 |        | 0.138 REF            |       |
| E2     | 3.600 REF                 |        | 0.142 REF            |       |
| L      | 40.900                    | 41.300 | 1.610                | 1.626 |
| L1     | 24.800                    | 25.100 | 0.976                | 0.988 |
| L2     | 20.300                    | 20.600 | 0.799                | 0.811 |
| φ      | 7.100                     | 7.300  | 0.280                | 0.287 |
| e      | 5.450 TYP                 |        | 0.215 TYP            |       |
| H      | 5.980 REF                 |        | 0.235 REF            |       |