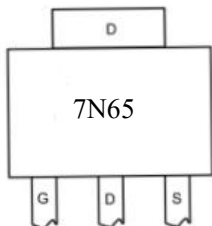
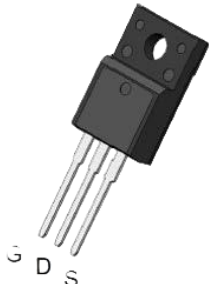
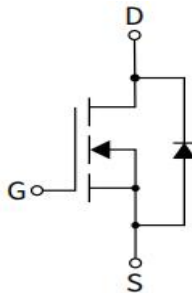




| Features                                                                                                                                                                                        | Bvdss                                                                                                                                                           | Rdson                                                                               | ID                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                                                                                                                                                                                 | 650V                                                                                                                                                            | 1.2Ω                                                                                | 7A                                                                                  |
| <ul style="list-style-type: none"><li>➤ Planar Mosfets</li><li>➤ Excellent RDS(on)</li><li>➤ Low Gate Charge</li><li>➤ High current Capability</li><li>➤ Green product RoHS compliant</li></ul> | <b>Application</b> <ul style="list-style-type: none"><li>➤ Power factor correction (PFC)</li><li>➤ Switching power supply (SMPS)</li><li>➤ LED driver</li></ul> |                                                                                     |  |
|                                                                                                                                                                                                 |                                                                                                                                                                 |                                                                                     |                                                                                     |
| <b>Package</b>                                                                                                                                                                                  |                                                                                                                                                                 |                                                                                     |                                                                                     |
|                                                                                                                |                                                                                |  |                                                                                     |
| Marking and pin assignment                                                                                                                                                                      | TO-220F Top view                                                                                                                                                | Schematic diagram                                                                   |                                                                                     |

## Package Marking and Ordering Information

| Device Marking | Device   | Device Package | Quantity |
|----------------|----------|----------------|----------|
| 7N65           | HL7N65RF | TO-220F        | 50       |

## Absolute Maximum Ratings ( $T_J=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter                                   |                            | Symbol    | Value     | Unit               |
|---------------------------------------------|----------------------------|-----------|-----------|--------------------|
| Drain-Source Voltage                        |                            | $V_{DS}$  | 650       | V                  |
| Gate-Source Voltage                         |                            | $V_{GS}$  | $\pm 30$  | V                  |
| Continuous Drain Current <sup>1</sup>       | $T_C=25^{\circ}\text{C}$   | $I_D$     | 7         | A                  |
|                                             | $T_C=100^{\circ}\text{C}$  |           | 4.4       | A                  |
| Pulsed Drain Current <sup>2</sup>           |                            | $I_{DM}$  | 28        | A                  |
| Body-Diode Continuous Current               |                            | $I_S$     | 7         | A                  |
| Avalanche Current <sup>3</sup>              |                            | $I_{AS}$  | 8.2       | A                  |
| Single Pulsed Avalanche Energy <sup>3</sup> |                            | EAS       | 332       | mJ                 |
| Total Power Dissipation <sup>4</sup>        | $T_C = 25^{\circ}\text{C}$ | $P_D$     | 189       | W                  |
|                                             | $T_C=100^{\circ}\text{C}$  |           | 76        |                    |
| Operating Junction Temperature Range        |                            | $T_J$     | -55 ~ 150 | $^{\circ}\text{C}$ |
| Storage Temperature Range                   |                            | $T_{STG}$ | -55 ~ 150 | $^{\circ}\text{C}$ |



## Thermal Resistance Ratings

| Parameter                           | Symbol          | Value | Unit                 |
|-------------------------------------|-----------------|-------|----------------------|
| Thermal Resistance Junction-Ambient | $R_{\theta JA}$ | 54    | $^{\circ}\text{C/W}$ |
| Thermal Resistance Junction-Case    | $R_{\theta JC}$ | 3.7   | $^{\circ}\text{C/W}$ |

## Ordering Information

| Ordering Number | Package | Pin Assignment |   |   | Packing |
|-----------------|---------|----------------|---|---|---------|
| Halogen Free    |         | G              | D | S |         |
| HL7N65RF        | TO-220F | 1              | 2 | 3 | Tube    |

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

| Parameter                         | Symbol       | Test Conditions                                                       | Min | Typ  | Max       | Units         |
|-----------------------------------|--------------|-----------------------------------------------------------------------|-----|------|-----------|---------------|
| Drain-Source Breakdown Voltage    | $BV_{DSS}$   | $I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$                             | 650 | -    | -         | V             |
| Drain-Source Leakage Current      | $I_{DSS}$    | $V_{DS}=650\text{V}$ , $V_{GS}=0\text{V}$ , $T_J=25^{\circ}\text{C}$  | -   | -    | 1         | $\mu\text{A}$ |
|                                   |              | $V_{DS}=650\text{V}$ , $V_{GS}=0\text{V}$ , $T_J=55^{\circ}\text{C}$  | -   | -    | 5         |               |
| Gate-Source Leakage Current       | $I_{GSS}$    | $V_{GS}=\pm 30\text{V}$ , $V_{DS}=0\text{V}$                          | -   | -    | $\pm 100$ | nA            |
| Gate Threshold Voltage            | $V_{GS(th)}$ | $V_{GS}=V_{DS}$ , $I_D=250\mu\text{A}$                                | 2   | 2.8  | 4         | V             |
| Static Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}=10\text{V}$ , $I_D=3.5\text{A}$                               | -   | 1.2  | 1.4       | $\Omega$      |
| Forward Transconductance          | $g_{fs}$     | $V_{DS}=5\text{V}$ , $I_D=3.5\text{A}$                                | -   | 3    | -         | S             |
| Gate Resistance                   | $R_g$        | $V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$             | -   | 1.6  | -         | $\Omega$      |
| Total Gate Charge                 | $Q_g$        | $V_{DS}=520\text{V}$ , $V_{GS}=10\text{V}$ ,<br>$I_D=7\text{A}$       | -   | 25   | -         | nC            |
| Gate Source Charge                | $Q_{gs}$     |                                                                       | -   | 7    | -         |               |
| Gate Drain Charge                 | $Q_{gd}$     |                                                                       | -   | 7.9  | -         |               |
| Turn-On Delay Time                | $T_{d(on)}$  | $V_{DS}=325\text{V}$ , $I_D=7\text{A}$ , $R_G=25\Omega$               | -   | 21   | -         | ns            |
| Rise Time                         | $T_r$        |                                                                       | -   | 49   | -         |               |
| Turn-Off Delay Time               | $T_{d(off)}$ |                                                                       | -   | 89   | -         |               |
| Fall Time                         | $T_f$        |                                                                       | -   | 53   | -         |               |
| Input Capacitance                 | $C_{iss}$    | $V_{GS}=0\text{V}$ , $V_{DS}=25\text{V}$ ,<br>$f=1\text{MHz}$         | -   | 1185 | -         | pF            |
| Output Capacitance                | $C_{oss}$    |                                                                       | -   | 91   | -         |               |
| Reverse Transfer Capacitance      | $C_{rss}$    |                                                                       | -   | 2.9  | -         |               |
| Continuous Source Current         | $I_S$        | $V_G=V_D=0\text{V}$ , Force Current                                   | -   | -    | -         | A             |
| Diode Forward Voltage             | $V_{SD}$     | $I_S=3.5\text{A}$ , $V_{GS}=0\text{V}$                                | -   | 0.8  | 1.2       | V             |
| Reverse Recovery Time             | $t_{rr}$     | $V_R=400\text{V}$ , $I_F=7\text{A}$ , $di/dt=100\text{A}/\mu\text{s}$ | -   | 349  | -         | ns            |
| Reverse Recovery Charge           | $Q_{rr}$     |                                                                       | -   | 3.1  | -         | $\mu\text{C}$ |



## Notes:

1. Computed continuous current assumes the condition of  $T_{J\_Max}$  while the actual continuous depends on the thermal & Electromechanical application board design.
2. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
3. This single-pulse measurement was taken under the following condition [ $L=10mH, V_{GS}=10V, V_{DS}=50V$ ] while its value is limited by  $T_{J\_Max}=150^{\circ}C$ .
4. The power dissipation  $P_D$  is based on  $T_{J\_Max}=150^{\circ}C$ .
5. This value is guaranteed by design hence it is not included in the production test.

## Typical Performance Characteristics

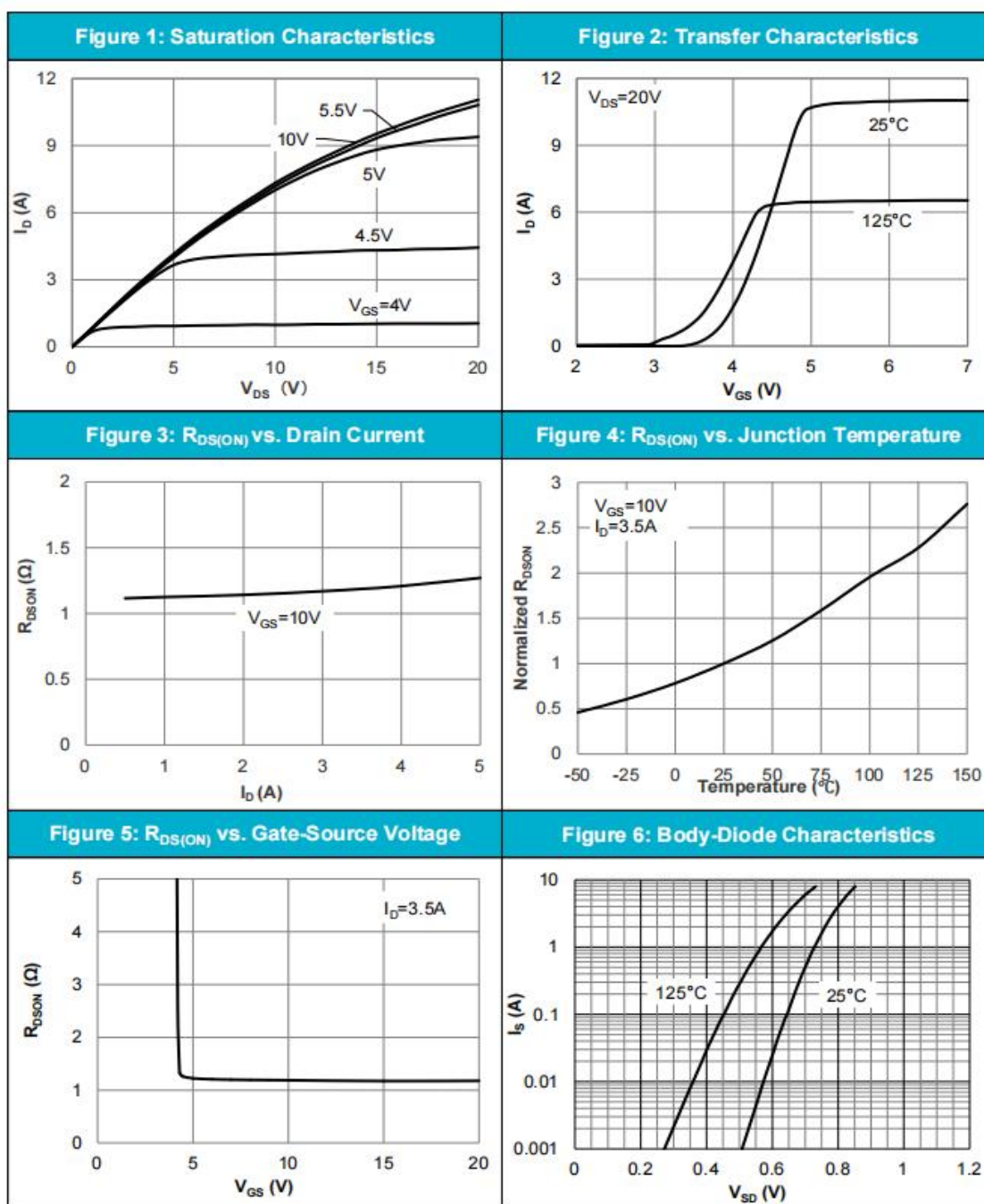




Figure 7: Gate-Charge characteristics

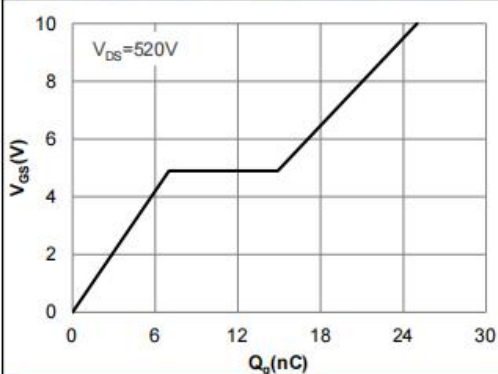


Figure 8: Capacitance characteristics

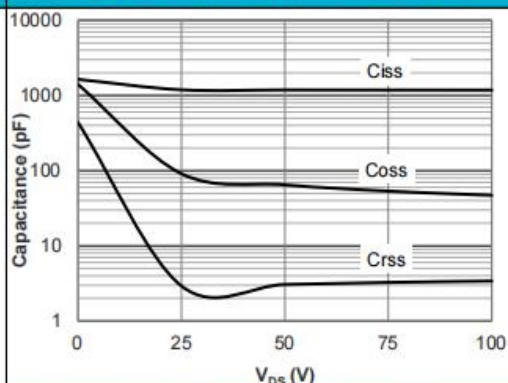


Figure 9: Current De-rating

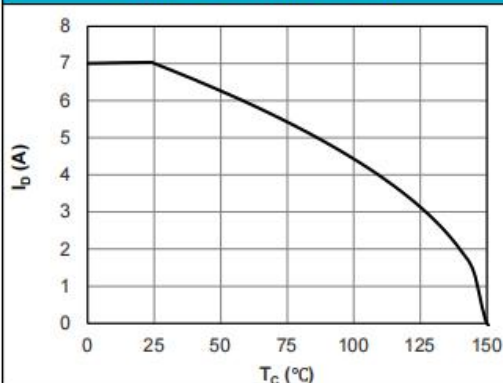


Figure 10: Maximum Safe Operating Area (TO-220C/TO-263)

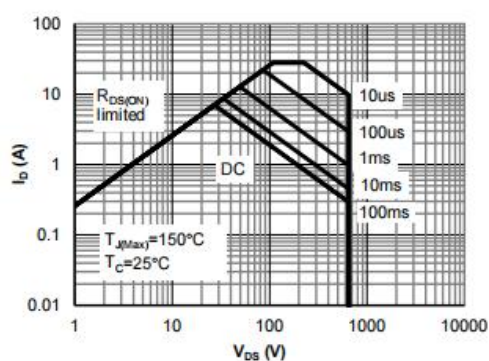


Figure 11: Maximum Safe Operating Area (TO-220F)

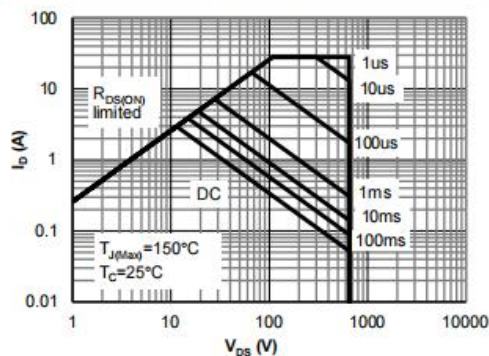


Figure 12: Normalized Maximum Transient Thermal Impedance (TO-220F)

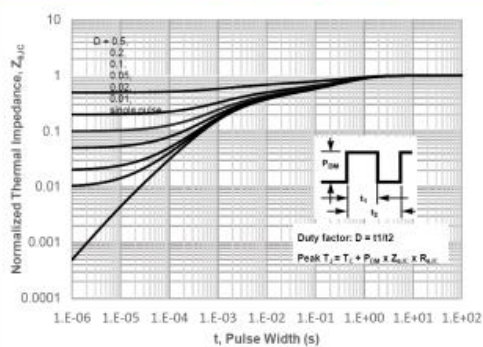
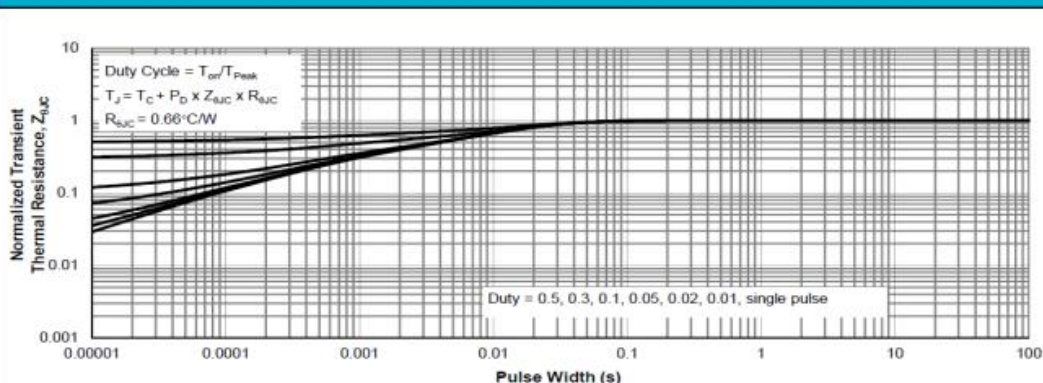


Figure 13: Normalized Maximum Transient Thermal Impedance (TO-220C/TO-263)





## Test Circuit and Waveform

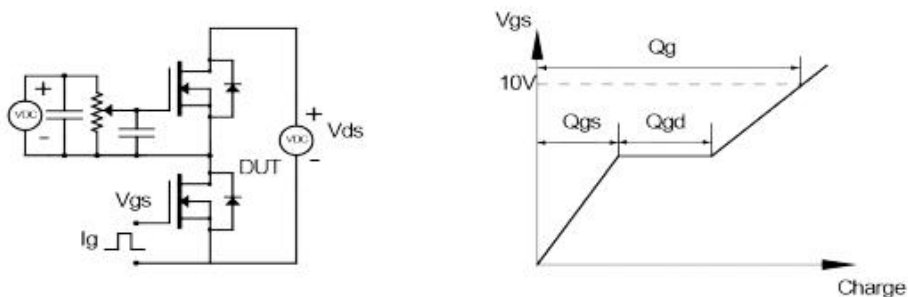


Figure1: Gate Charge Test Circuit & Waveforms

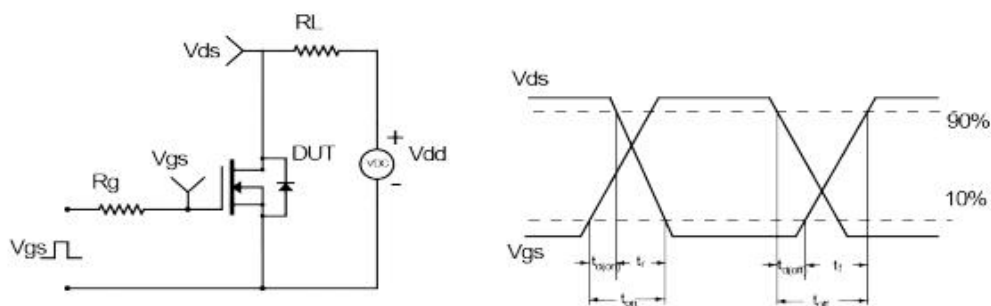


Figure2: Resistive Switching Test Circuit & Waveforms

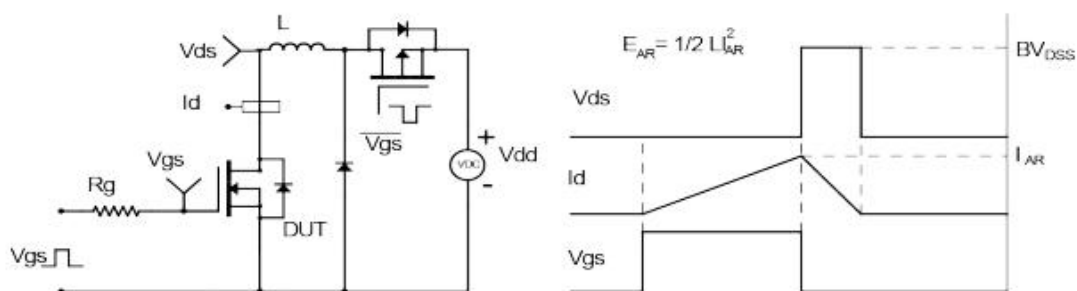


Figure3: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

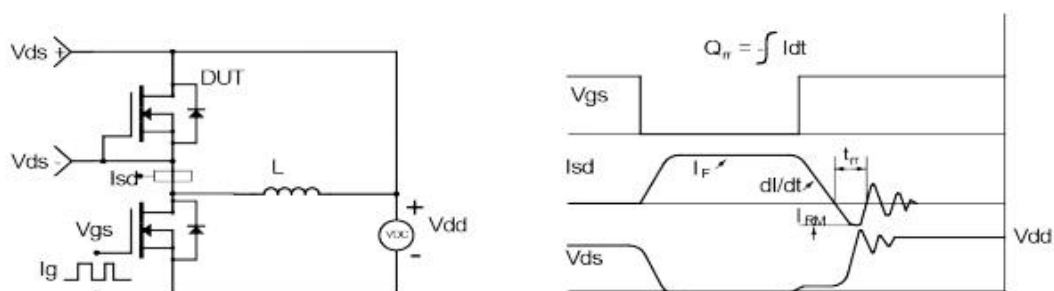
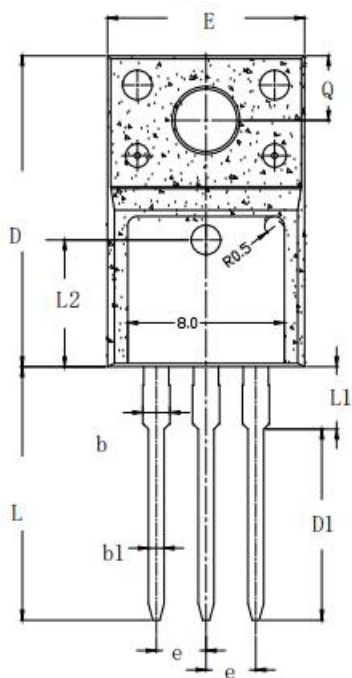


Figure4: Diode Recovery Test Circuit & Waveforms

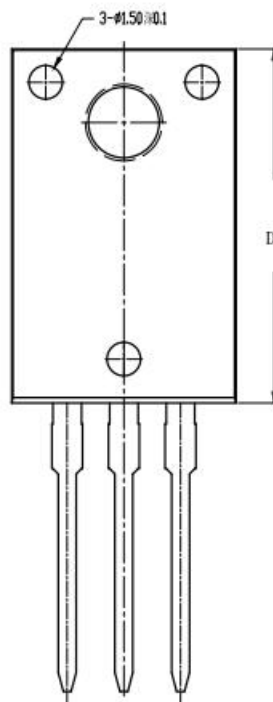




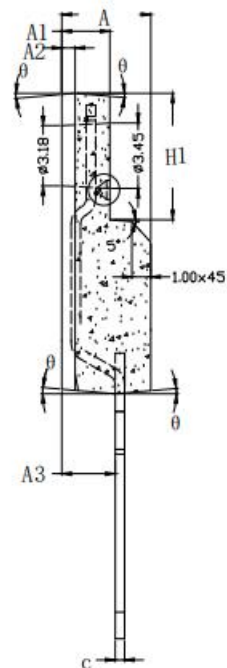
## Package Dimensions TO-220F



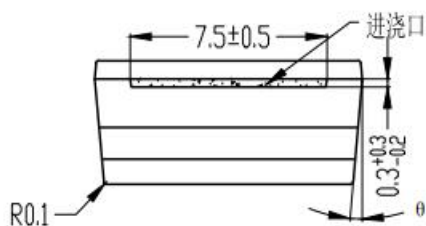
TOP VIEW



BOTTOM VIEW



SIDE VIEW



SIDE VIEW

| SYMBOL | MILLIMETER |       |       |
|--------|------------|-------|-------|
|        | MIN        | TYP.  | MAX   |
| A      | 4.60       | 4.70  | 4.80  |
| A1     | 2.39       | 2.54  | 2.69  |
| A2     | 0.60       | 0.70  | 0.80  |
| A3     | 2.81       | 2.82  | 2.83  |
| b      | 1.61       | 1.62  | 1.63  |
| b1     | -          | 0.80  | -     |
| c      | -          | 0.50  | -     |
| D      | 15.72      | 15.87 | 16.02 |
| D1     | -          | 9.75  | -     |
| E      | 9.91       | 10.06 | 10.21 |
| e      | 2.54 BSC   |       |       |
| H1     | 6.67       | 6.68  | 6.69  |
| L      | 12.90      | 12.93 | 12.96 |
| L1     | -          | 3.18  | -     |
| L2     | 6.47 REF   |       |       |
| Q      | -          | 3.30  | -     |
| θ1     | 1°         | 3°    | 5°    |



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