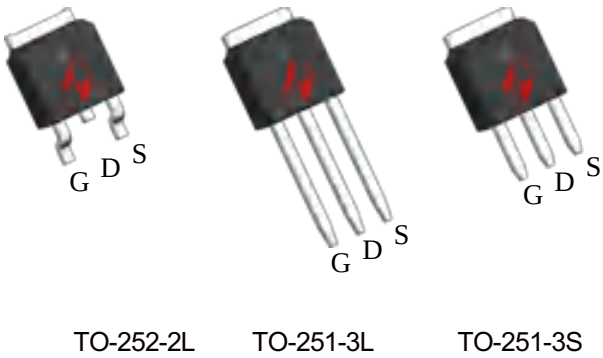


P-Channel Enhancement Mode MOSFET

Feature

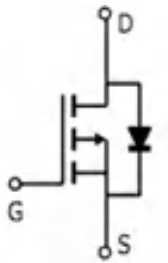
- -30V/-90A  
 $R_{DS(ON)} = 4.4m\Omega(\text{typ.}) @V_{GS} = -10V$   
 $R_{DS(ON)} = 7.4m\Omega(\text{typ.}) @V_{GS} = -4.5V$
- 100% avalanche tested
- Reliable and Rugged
- Halogen Free and Green Devices Available  
(RoHS Compliant)

Pin Description



Applications

- Power Management in DC/DC converter.
- Load switching.
- Motor control.



P-Channel MOSFET

Ordering and Marking Information

|                                                                                                                        |                                                                                                                        |                                                                                                                        |                                                                     |
|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
|  <b>D</b><br>HYG045P03<br>XYMXXXXXX |  <b>U</b><br>HYG045P03<br>XYMXXXXXX |  <b>V</b><br>HYG045P03<br>XYMXXXXXX | <b>Package Code</b><br>D: TO-252-2L    U: TO-251-3L    V: TO-251-3S |
| <b>Date Code</b><br>XYMXXXXXX                                                                                          |                                                                                                                        |                                                                                                                        | <b>Assembly Material</b><br>G: Halogen Free                         |

Note: HUAYI lead-free products contain molding compounds/die attach materials and 100% matte tin plate Termination finish; which are fully compliant with RoHS. HUAYI lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020 for MSL classification at lead-free peak reflow temperature. HUAYI defines “Green” to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

HUAYI reserves the right to make changes, corrections, enhancements, modifications, and improvements to this product and/or to this document at any time without notice.

## Absolute Maximum Ratings

| Symbol                                         | Parameter                                  |          | Rating     | Unit |
|------------------------------------------------|--------------------------------------------|----------|------------|------|
| Common Ratings (Tc=25℃ Unless Otherwise Noted) |                                            |          |            |      |
| V <sub>DSS</sub>                               | Drain-Source Voltage                       |          | -30        | V    |
| V <sub>GSS</sub>                               | Gate-Source Voltage                        |          | ±20        | V    |
| T <sub>J</sub>                                 | Junction Temperature Range                 |          | -55 to 175 | °C   |
| T <sub>STG</sub>                               | Storage Temperature Range                  |          | -55 to 175 | °C   |
| I <sub>S</sub>                                 | Drain Current-Continuous                   | Tc=25°C  | -90        | A    |
| Mounted on Large Heat Sink                     |                                            |          |            |      |
| I <sub>DM</sub>                                | Pulsed Drain Current *                     | Tc=25°C  | -360       | A    |
| I <sub>D</sub>                                 | Continuous Drain Current                   | Tc=25°C  | -90        | A    |
|                                                |                                            | Tc=100°C | -63.5      | A    |
| P <sub>D</sub>                                 | Maximum Power Dissipation                  | Tc=25°C  | 60         | W    |
|                                                |                                            | Tc=100°C | 30         | W    |
| R <sub>θJC</sub>                               | Thermal Resistance, Junction-to-Case       |          | 2.5        | °C/W |
| R <sub>θJA</sub>                               | Thermal Resistance, Junction-to-Ambient ** |          | 110        | °C/W |
| E <sub>AS</sub>                                | SinglePulsed-Avalanche Energy ***          | L=0.3mH  | 273***     | mJ   |

Note: \* Repetitive rating; pulse width limited by max junction temperature.  
 \*\* Surface mounted on FR-4 board.  
 \*\*\* Limited by T<sub>Jmax</sub>, starting T<sub>J</sub>=25°C, L = 0.3mH, R<sub>G</sub>= 25Ω, V<sub>GS</sub> = -10V.

## Electrical Characteristics(Tc =25°C Unless Otherwise Noted)

| Symbol                 | Parameter                        | Test Conditions                                            | HYG045P03LQ1 |       |      | Unit |
|------------------------|----------------------------------|------------------------------------------------------------|--------------|-------|------|------|
|                        |                                  |                                                            | Min          | Typ   | Max  |      |
| Static Characteristics |                                  |                                                            |              |       |      |      |
| BV <sub>DSS</sub>      | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =-250uA               | -30          | -     | -    | V    |
| I <sub>DSS</sub>       | Drain-to-Source Leakage Current  | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V                 | -            | -     | -1   | uA   |
|                        |                                  | T <sub>J</sub> =125°C                                      | -            | -     | -50  | uA   |
| V <sub>GS(th)</sub>    | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =-250uA | -1.0         | -1.2  | -3.0 | V    |
| I <sub>GSS</sub>       | Gate-Source Leakage Current      | V <sub>GS</sub> = ± 20V, V <sub>DS</sub> =0V               | -            | -     | ±100 | nA   |
| R <sub>DS(ON)*</sub>   | Drain-Source On-state Resistance | V <sub>GS</sub> =-10V, I <sub>D</sub> = -20A               | 2            | 4.4   | 5.5  | mΩ   |
|                        |                                  | V <sub>GS</sub> =-4.5V, I <sub>D</sub> = -20A              | 3            | 7.4   | 9.5  | mΩ   |
| Diode Characteristics  |                                  |                                                            |              |       |      |      |
| V <sub>SD</sub> *      | Diode Forward Voltage            | I <sub>SD</sub> = -20A, V <sub>GS</sub> =0V                | -            | -0.82 | -1.2 | V    |
| t <sub>rr</sub>        | Reverse Recovery Time            | I <sub>SD</sub> = -20A, dI/dt=100A/us                      | -            | 26    | -    | ns   |
| Q <sub>rr</sub>        | Reverse Recovery Charge          |                                                            | -            | 22    | -    | nC   |

**Electrical Characteristics (Cont.)** (T<sub>c</sub> =25°C Unless Otherwise Noted)

| Symbol                      | Parameter                    | Test Conditions                                                                           | HYG045P03LQ1 |       |     | Unit |
|-----------------------------|------------------------------|-------------------------------------------------------------------------------------------|--------------|-------|-----|------|
|                             |                              |                                                                                           | Min          | Typ   | Max |      |
| Dynamic Characteristics     |                              |                                                                                           |              |       |     |      |
| R <sub>G</sub>              | Gate Resistance              | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz                                          | -            | 5.2   | -   | Ω    |
| C <sub>iss</sub>            | Input Capacitance            | V <sub>GS</sub> =0V,                                                                      | -            | 7660  | -   | pF   |
| C <sub>oss</sub>            | Output Capacitance           | V <sub>DS</sub> =-25V,                                                                    | -            | 649   | -   |      |
| C <sub>rss</sub>            | Reverse Transfer Capacitance | Frequency=1.0MHz                                                                          | -            | 575   | -   |      |
| t <sub>d(ON)</sub>          | Turn-on Delay Time           | V <sub>DD</sub> = -20V, R <sub>G</sub> =3Ω, I <sub>DS</sub> = -20A, V <sub>GS</sub> =-10V | -            | 24    | -   | ns   |
| T <sub>r</sub>              | Turn-on Rise Time            |                                                                                           | -            | 19    | -   |      |
| t <sub>d(OFF)</sub>         | Turn-off Delay Time          |                                                                                           | -            | 75    | -   |      |
| T <sub>f</sub>              | Turn-off Fall Time           |                                                                                           | -            | 33    | -   |      |
| Gate Charge Characteristics |                              |                                                                                           |              |       |     |      |
| Q <sub>g</sub>              | Total Gate Charge            | V <sub>DS</sub> = -24V, V <sub>GS</sub> = -10V, I <sub>D</sub> = -20A,                    | -            | 135.5 | -   | nC   |
| Q <sub>gs</sub>             | Gate-Source Charge           |                                                                                           | -            | 12.5  | -   |      |
| Q <sub>gd</sub>             | Gate-Drain Charge            |                                                                                           | -            | 29.7  | -   |      |

Note: \*Pulse test; pulse width ≤ 300us, duty cycle ≤ 2%

## Typical Operating Characteristics

Figure 1: Power Dissipation

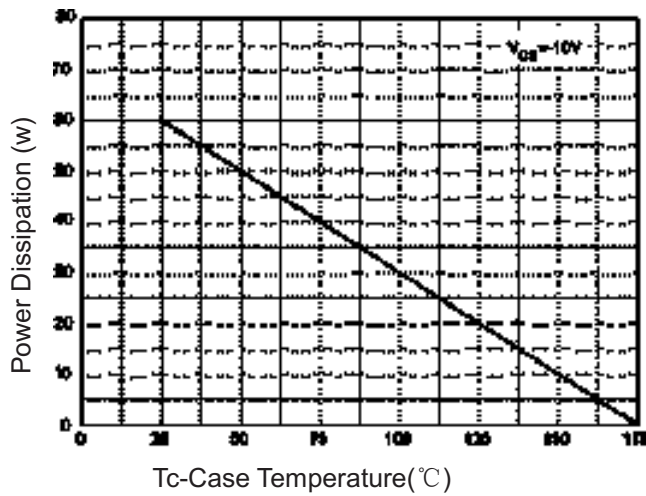


Figure 2: Drain Current

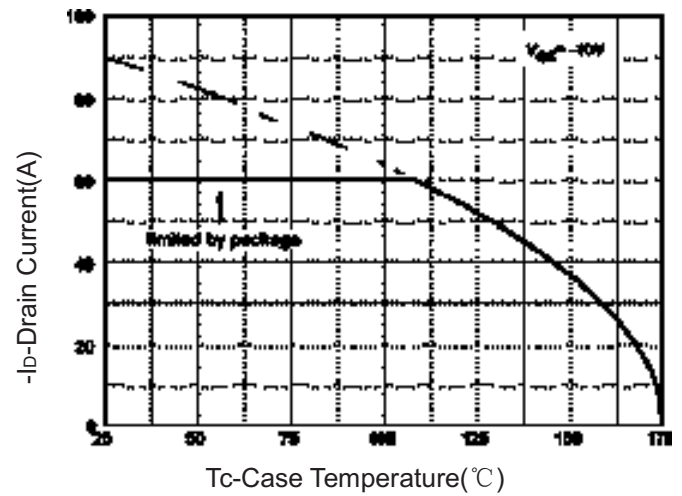


Figure 3: Safe Operation Area

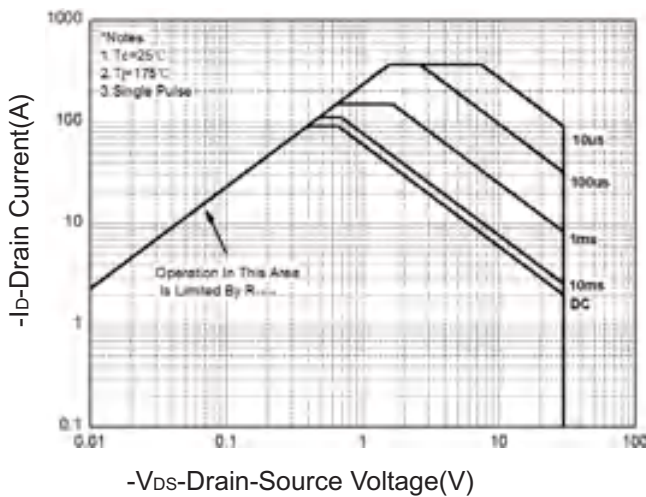


Figure 4: Thermal Transient Impedance

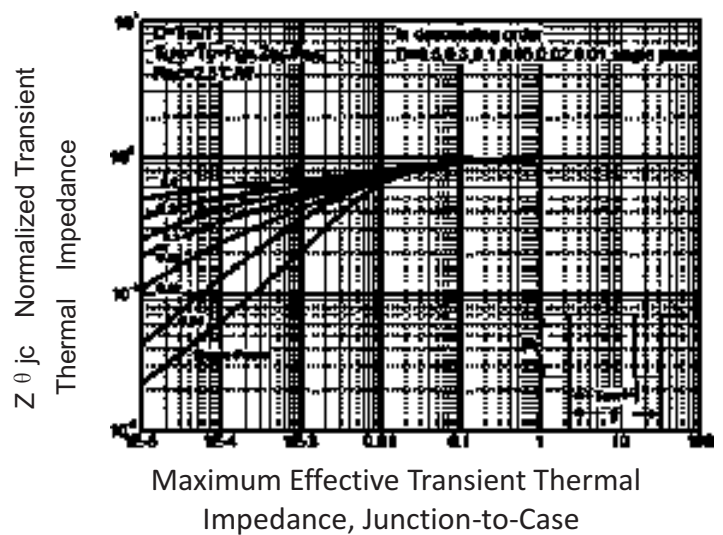


Figure 5: Output Characteristics

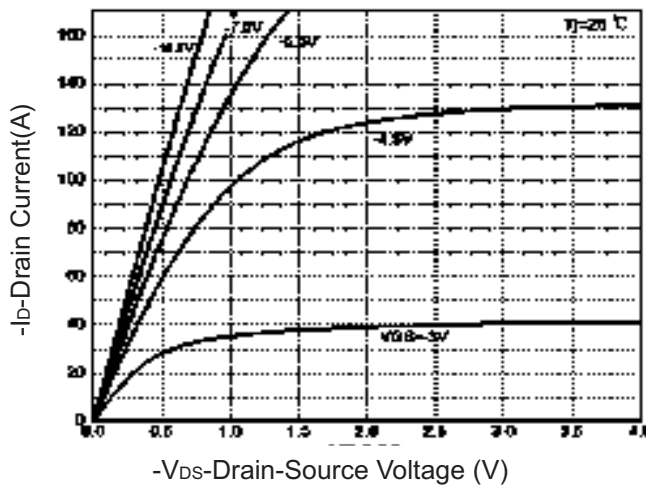
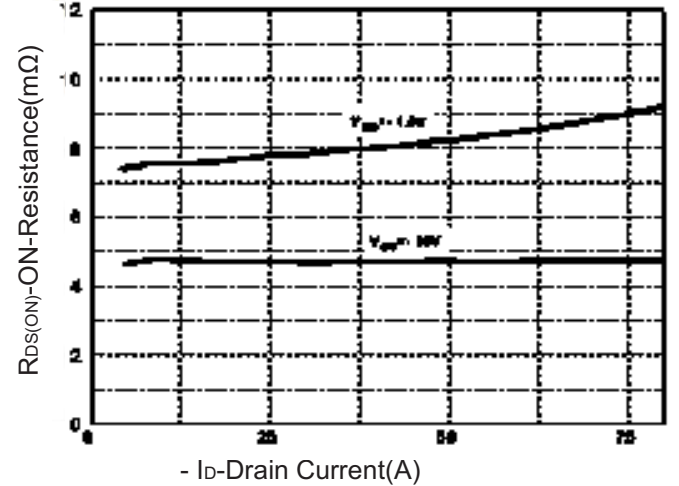


Figure 6: Drain-Source On Resistance



## Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature

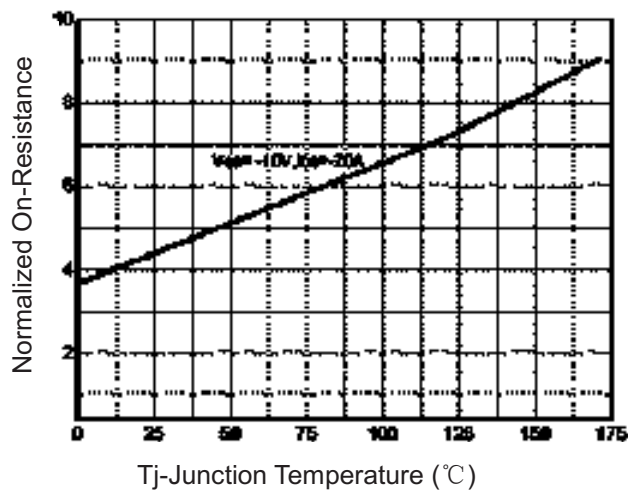


Figure 8: Source-Drain Diode Forward

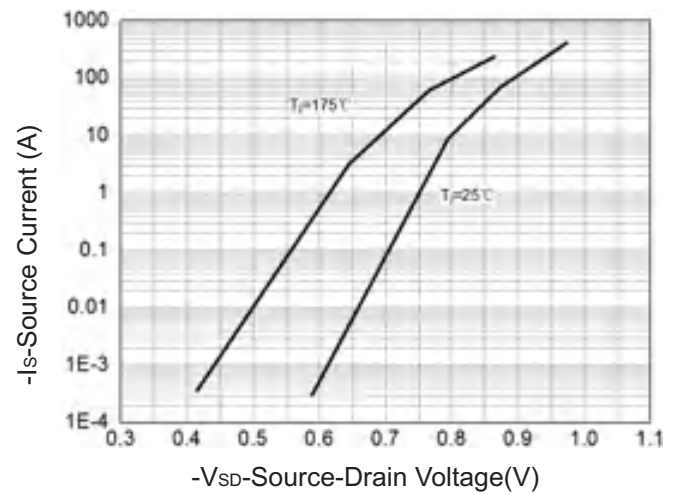


Figure 9: Capacitance Characteristics

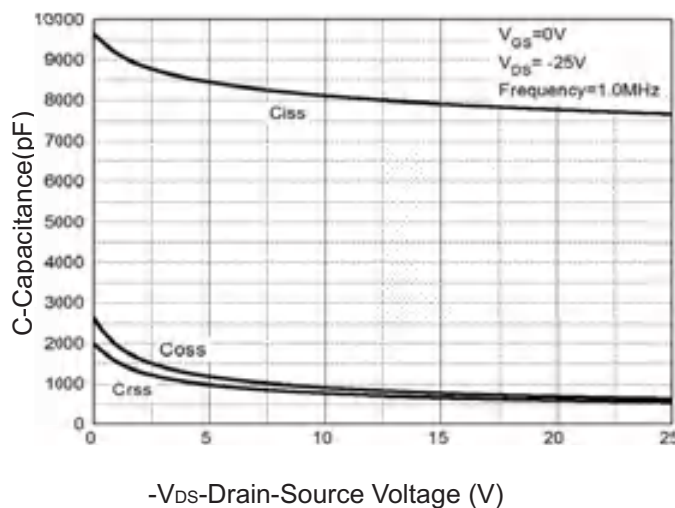
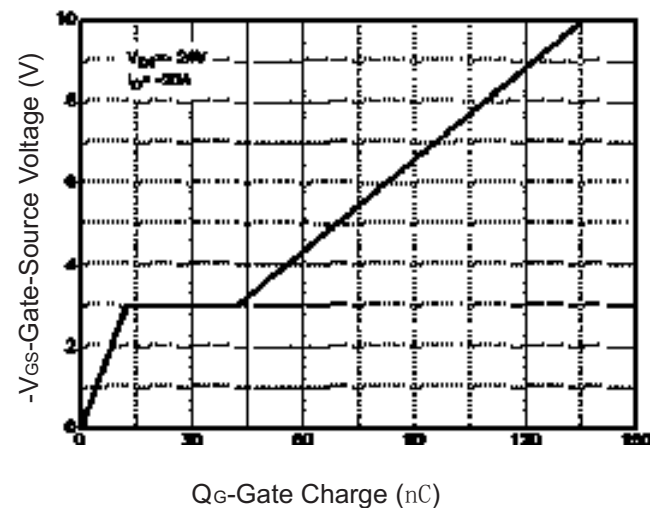
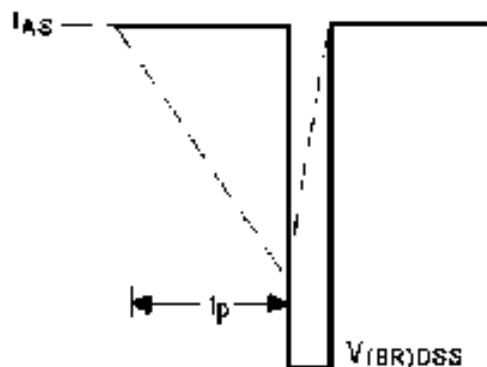
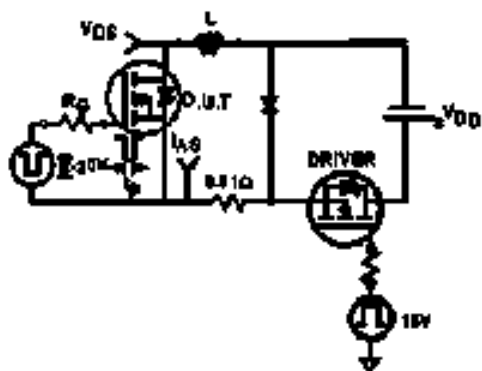


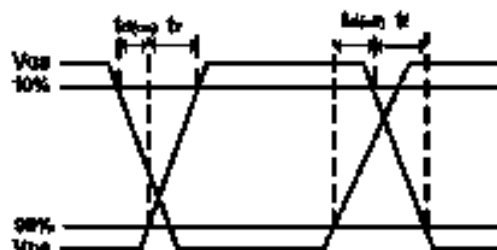
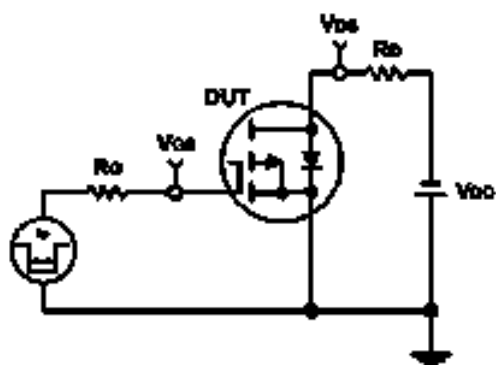
Figure 10: Gate Charge Characteristics



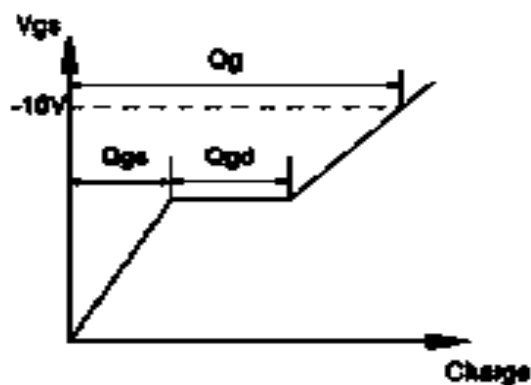
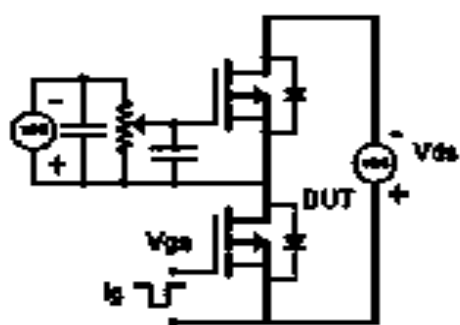
## Avalanche Test Circuit



## Switching Time Test Circuit



## Gate Charge Test Circuit



## Package Information

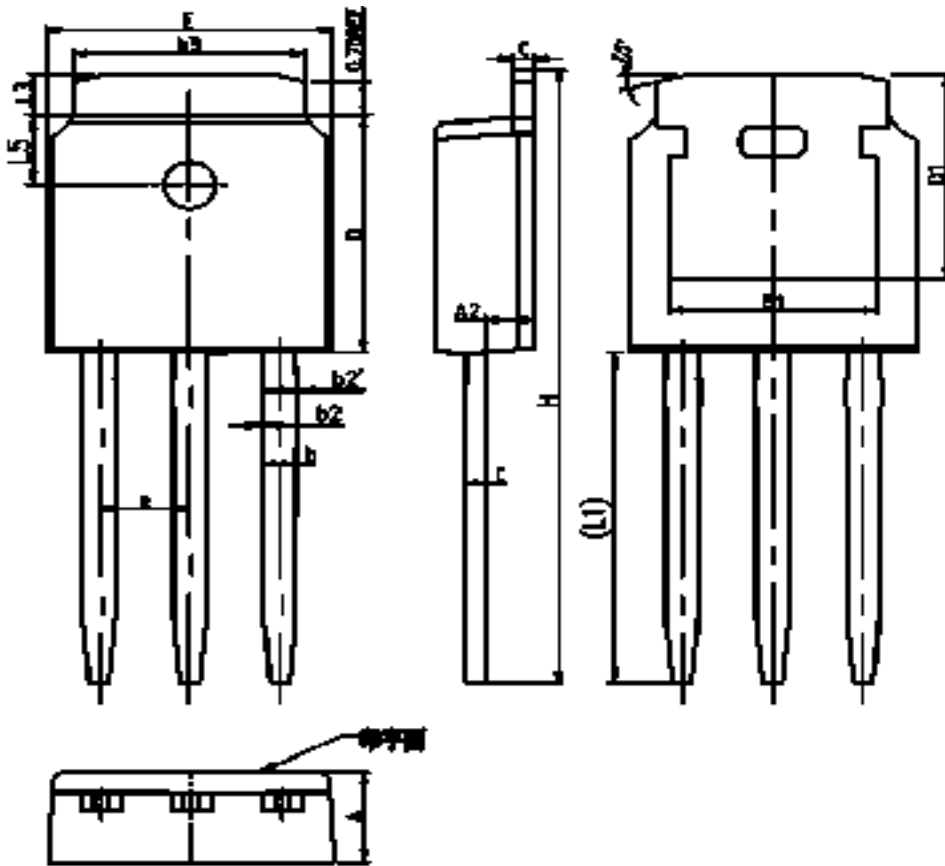
The technical drawing consists of five views of a mechanical part:

- Front View (Top Left):** Shows a rectangular part with a central circular hole. Dimensions include  $L5$  (height of the top flange),  $B2$  (width of the top flange),  $B$  (total width),  $L4$  (height of the main body),  $a$  (height of the base), and  $b$  (width of the base).
- Top View (Top Right):** Shows the top flange with a central rectangular slot. Dimensions include  $C$  (width of the slot),  $H$  (height of the flange), and  $F1$  (width of the flange).
- Left Side View (Middle Left):** Shows the side profile with a curved fillet. Dimensions include  $L2$  (height of the base),  $R$  (radius of the fillet), and  $A1$  (total height).
- Right Side View (Middle Right):** Shows the side profile with a curved fillet. Dimensions include  $A$  (total height).
- Detail View (Bottom Left):** A magnified view of the fillet, labeled (U), showing the transition between the base and the main body.

| COMMON DIMENSIONS |          |       |       |
|-------------------|----------|-------|-------|
| SYMBOL            | mm       |       |       |
|                   | MIN      | NOM   | MAX   |
| A                 | 2.20     | 2.30  | 2.40  |
| A1                | 0.00     | -     | 0.20  |
| A2                | 0.97     | 1.07  | 1.17  |
| b                 | 0.68     | 0.78  | 0.90  |
| b3                | 5.20     | 5.33  | 5.50  |
| c                 | 0.43     | 0.53  | 0.63  |
| D                 | 5.98     | 6.10  | 6.22  |
| D1                | 5.30REF  |       |       |
| E                 | 6.40     | 6.60  | 6.80  |
| E1                | 4.63     | -     | -     |
| e                 | 2.286BSC |       |       |
| H                 | 9.40     | 10.10 | 10.50 |
| L                 | 1.38     | 1.50  | 1.75  |
| L1                | 2.90REF  |       |       |
| L2                | 0.51BSC  |       |       |
| L3                | 0.88     | -     | 1.28  |
| L4                | -        | -     | 1.00  |
| L5                | 1.65     | 1.80  | 1.95  |
| θ                 | 0°       | -     | 8°    |

# HYG045P03LQ1 D/U/V

TO-251-3L



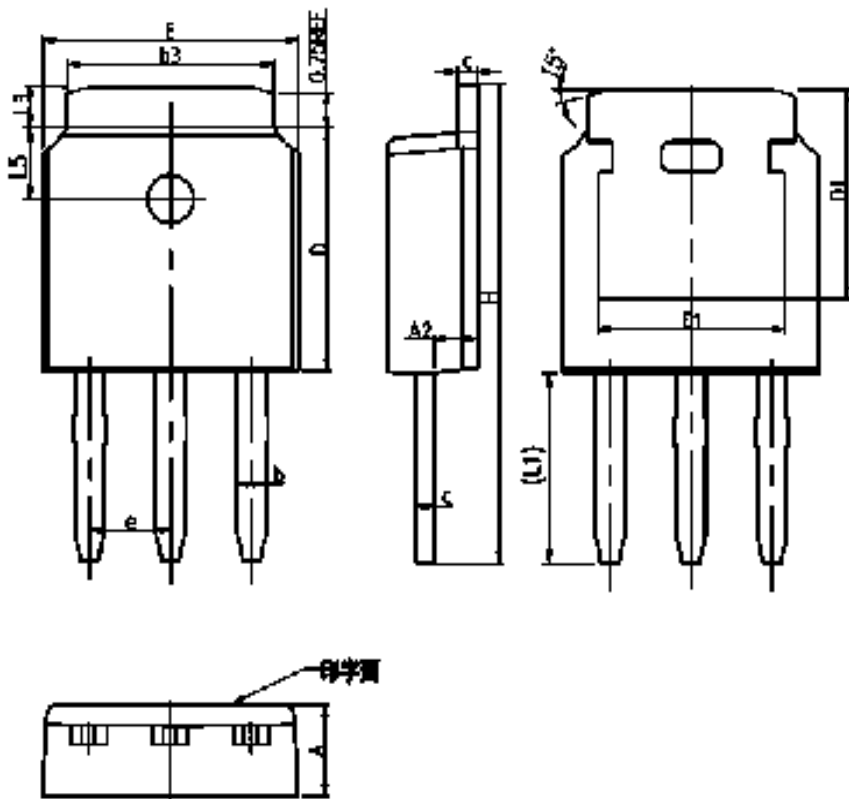
COMMON DIMENSIONS

| SYMBOL | mm       |       |       |
|--------|----------|-------|-------|
|        | MIN      | NOM   | MAX   |
| A      | 2.20     | 2.30  | 2.40  |
| A2     | 0.97     | 1.07  | 1.17  |
| b      | 0.68     | 0.78  | 0.90  |
| b2     | 0.00     | 0.04  | 0.10  |
| b2'    | 0.00     | 0.04  | 0.10  |
| b3     | 5.20     | 5.33  | 5.50  |
| c      | 0.43     | 0.53  | 0.63  |
| D      | 5.98     | 6.10  | 6.22  |
| D1     | 5.30REF  |       |       |
| E      | 6.40     | 6.60  | 6.80  |
| E1     | 4.63     | -     | -     |
| e      | 2.286BSC |       |       |
| H      | 16.22    | 16.52 | 16.82 |
| L1     | 9.15     | 9.40  | 9.65  |
| L3     | 0.88     | 1.02  | 1.28  |
| L5     | 1.65     | 1.80  | 1.95  |



# HYG045P03LQ1 D/U/V

TO-251-3S



COMMON DIMENSIONS

| SYMBOL | mm       |       |       |
|--------|----------|-------|-------|
|        | MIN      | NOM   | MAX   |
| A      | 2.20     | 2.30  | 2.40  |
| A2     | 0.97     | 1.07  | 1.17  |
| b      | 0.68     | 0.78  | 0.90  |
| b3     | 5.20     | 5.33  | 5.50  |
| c      | 0.43     | 0.53  | 0.63  |
| D      | 5.98     | 6.10  | 6.22  |
| D1     | 5.30REF  |       |       |
| E      | 6.40     | 6.60  | 6.80  |
| E1     | 4.63     | -     | -     |
| e      | 2.286BSC |       |       |
| H      | 10.00    | 11.22 | 11.44 |
| L1     | 3.90     | 4.10  | 4.30  |
| L3     | 0.88     | 1.02  | 1.28  |
| L5     | 1.65     | 1.80  | 1.95  |



Table 1.SnPb Eutectic Process – Classification Temperatures (Tc)

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>≥350 |
|-------------------|--------------------------------|--------------------------------|
| <2.5 mm           | 235 °C                         | 220 °C                         |
| ≥2.5 mm           | 220 °C                         | 220 °C                         |

Table 2.Pb-free Process – Classification Temperatures (Tc)

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>350-2000 | Volume mm <sup>3</sup><br>≥2000 |
|-------------------|--------------------------------|------------------------------------|---------------------------------|
| <1.6 mm           | 260 °C                         | 260 °C                             | 260 °C                          |
| 1.6 mm – 2.5 mm   | 260 °C                         | 250 °C                             | 245 °C                          |
| ≥2.5 mm           | 250 °C                         | 245 °C                             | 245 °C                          |

## Reliability Test Program

| Test item     | Method        | Description                              |
|---------------|---------------|------------------------------------------|
| SOLDERABILITY | JESD-22, B102 | 5 Sec, 245°C                             |
| HOLT          | JESD-22, A108 | 168 Hrs /500 Hrs /1000 Hrs, Bias @ 150°C |
| PCT           | JESD-22, A102 | 96 Hrs, 100%RH, 2atm, 121°C              |
| TCT           | JESD-22, A104 | 500 Cycles, -55°C~150°C                  |

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