

P-Channel Enhancement Mode MOSFET

Feature

- -30V/-70A
 $R_{DS(ON)} = 6.7m$ (typ.) @VGS = -10V
 $R_{DS(ON)} = 11m$ (typ.) @VGS = -4.5V
- 100% Avalanche Tested
- 100% DVDS
- Reliable and Rugged
- Halogen Free and Green Devices Available
 (RoHS Compliant)

Pin Description

Applications

- Switching application
- Li-battery protection
- DC-DC
- Motor control

Ordering and Marking Information

| | | | |
|-----------------------------|-----------------------------|-----------------------------|---|
| D HYG090P03 XYMXXXXXX | U HYG090P03 XYMXXXXXX | V HYG090P03 XYMXXXXXX | Package Code D: TO-252-2L U: TO-251-3L V:TO-251-3S Date Code XYMXXXXXX |
|-----------------------------|-----------------------------|-----------------------------|---|

Note: HUAYI halogen free products contain molding compounds/die attach materials and 100% matte tin plate Termination finish;which are fully compliant with RoHS. HUAYI halogen free products meet or exceed the halogen free

Absolute Maximum Ratings

| Symbol | Parameter | Rating | Unit | |
|--|--|------------|------|------|
| Common Ratings (Tc=25°C Unless Otherwise Noted) | | | | |
| V _{DSS} | Drain-Source Voltage | -30 | V | |
| V _{GSS} | Gate-Source Voltage | 20 | V | |
| T _J | Junction Temperature Range | -55 to 175 | °C | |
| T _{STG} | Storage Temperature Range | | °C | |
| I _S | Source Current-Continuous(Body Diode) | Tc=25°C | -70 | A |
| Mounted on Large Heat Sink | | | | |
| I _{DM} | Pulsed Drain Current * | Tc=25°C | -251 | A |
| I _D | Continuous Drain Current | Tc=25°C | -70 | A |
| | | Tc=100°C | -49 | A |
| P _D | Maximum Power Dissipation | Tc=25°C | 79 | W |
| | | Tc=100°C | 39 | W |
| R _{JC} | Thermal Resistance, Junction-to-Case | | 1.9 | °C/W |
| R _{JA} | Thermal Resistance, Junction-to-Ambient ** | | 75 | °C/W |
| E _{AS} | Single Pulsed-Avalanche Energy *** | L=0.3mH | 143 | mJ |

Note: * Repetitive rating pulse width limited by max.junction temperature.
 ** Surface mounted on 1in2 FR-4 board.
 *** Limited by T_{Jmax}, starting T_J=25°C, L = 0.3mH, R_G= 25 , V_{GS} =-10V.

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

| Symbol | Parameter | Test Conditions | HYG090P03LQ1 | | | Unit |
|-------------------------------|----------------------------------|--|--------------|------|------|------|
| | | | Min | Typ. | Max | |
| Static Characteristics | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | V _{GS} =0V, I _{DS} =-250μA | -30 | - | - | V |
| I _{DSS} | Drain-to-Source Leakage Current | V _{DS} =-30V, V _{GS} =0V | - | - | -1 | μA |
| | | T _J =125°C | - | - | -50 | μA |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} =V _{GS} , I _{DS} =-250μA | -1 | -1.7 | -3 | V |
| I _{GSS} | Gate-Source Leakage Current | V _{GS} = 20V, V _{DS} =0V | - | - | ±100 | nA |
| R _{DS(ON)} | Drain-Source On-State Resistance | V _{GS} =-10V, I _{DS} =-20A | - | 6.7 | 8.1 | m |
| | | V _{GS} =-4.5V, I _{DS} =-20A | - | 11 | 15.4 | m |
| Diode Characteristics | | | | | | |
| V _{SD} | Diode Forward Voltage | I _{SD} =-2 | | | | |

Electrical Characteristics (Cont.) (T_c =25°C Unless Otherwise Noted)

| Symbol | Parameter | Test Conditions | HYG090P03LQ1 | | | Unit |
|------------------------------------|---|---|--------------|------|-----|------|
| | | | Min | Typ. | Max | |
| Dynamic Characteristics | | | | | | |
| R _G | Gate Resistance | V _{GS} =0V, V _{DS} =0V, F=1MHz | - | 5.6 | - | |
| C _{iss} | Input Capacitance | V _{GS} =0V, V _{DS} =-25V, Frequency=1MHz | - | 2332 | - | pF |
| C _{oss} | Output Capacitance | | - | 297 | - | |
| C _{rss} | Reverse Transfer Capacitance | | - | 273 | - | |
| t _{d(ON)} | Turn-on Delay Time | V _{DD} =-15V, R _G =2.5 Ω, I _{DS} =-20A, V _{GS} =-10V | - | 9 | - | ns |
| T _r | Turn-on Rise Time | | - | 62 | - | |
| t _{d(OFF)} | Turn-off Delay Time | | - | 74 | - | |
| T _f | Turn-off Fall Time | | - | 76 | - | |
| Gate Charge Characteristics | | | | | | |
| Q _g | Total Gate Charge(V _{GS} =-10V) | V _{DS} =-24V, I _{DS} =-20A | - | 56 | - | nC |
| | Total Gate Charge(V _{GS} =-4.5V) | | - | 29 | - | |
| Q _{gs} | Gate-Source Charge | | - | 9 | - | |
| Q _{gd} | Gate-Drain Charge | | - | 16 | - | |
| V _{plateau} | Gate plateau voltage | | - | -3.5 | - | V |

Note: *Pulse test pulse width 300us duty cycle 2%

Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature

Figure 8: Source-Drain Diode Forward



Figure 9: Capacitance Characteristics

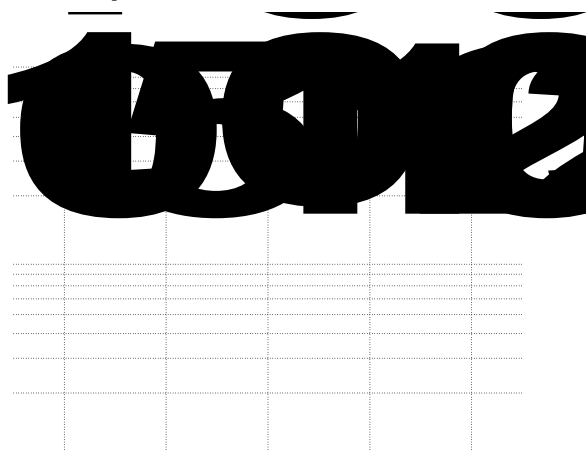
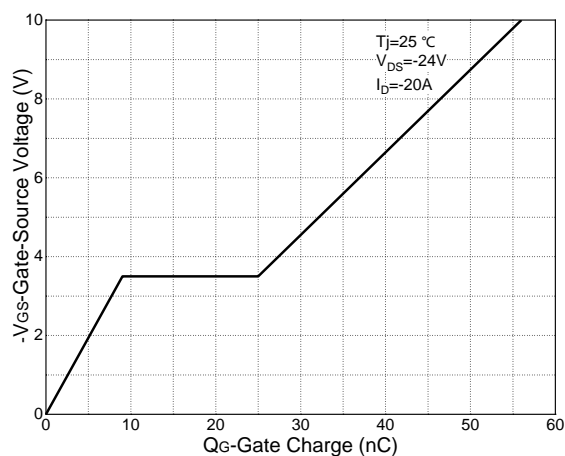
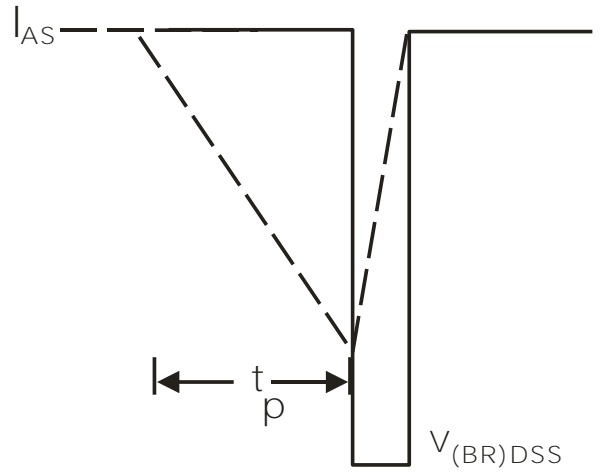
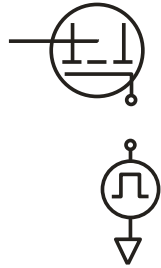


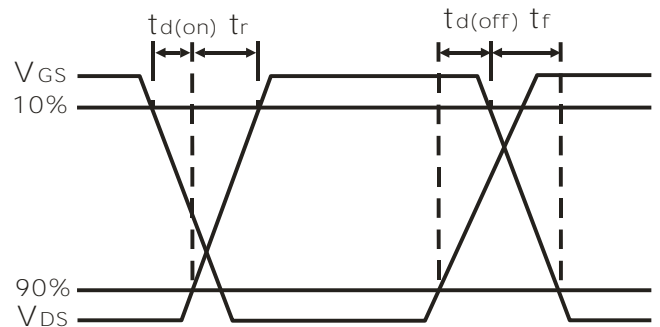
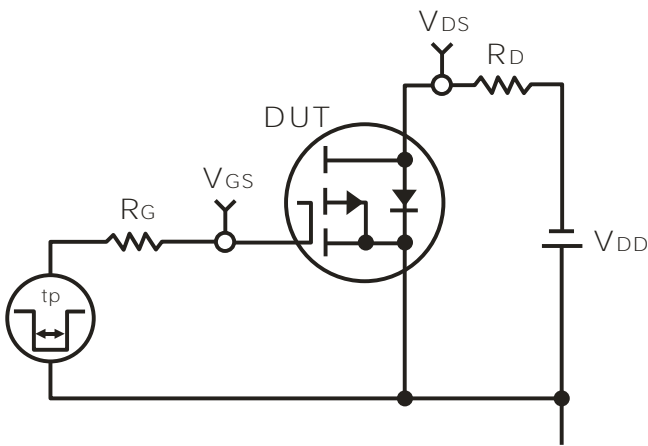
Figure 10: Gate Charge Characteristics



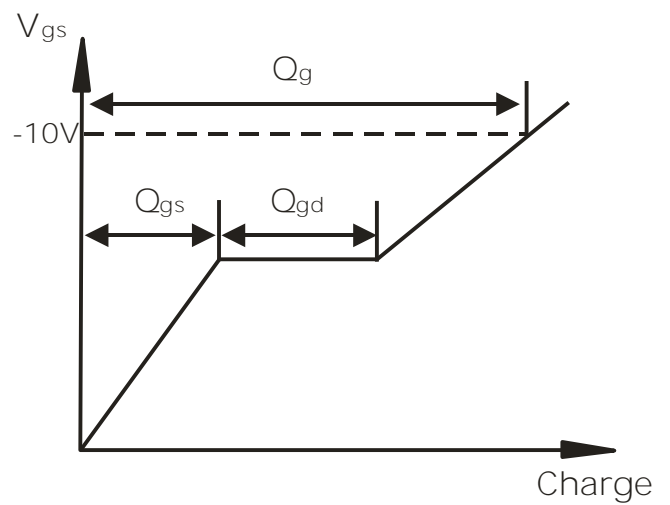
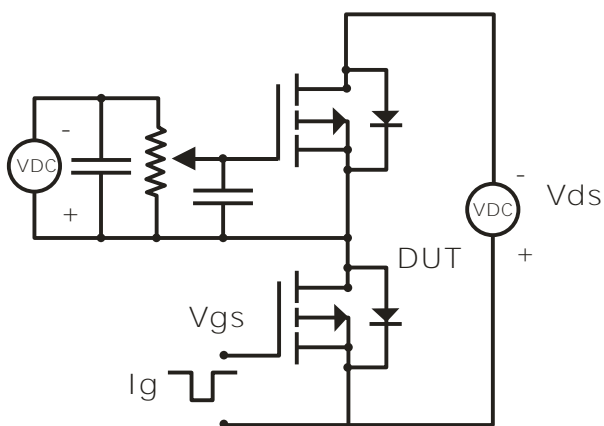
Avalanche Test Circuit



Switching Time Test Circuit



Gate Charge Test Circuit

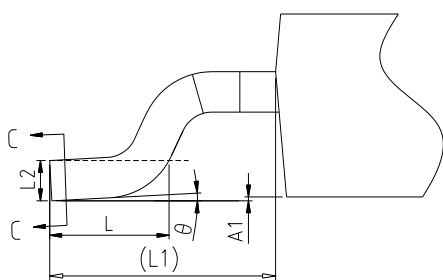
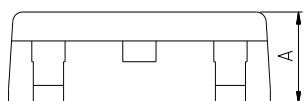
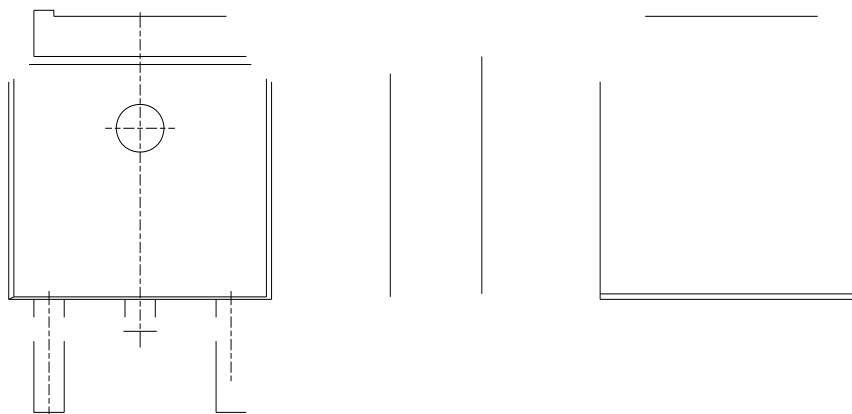


Device Per Unit

| Package Type | Unit | Quantity |
|--------------|------|----------|
| TO-252-2L | Tube | 75 |
| TO-252-2L | Reel | 2500 |
| TO-251-3L | Tube | 75 |
| TO-251-3S | Tube | 75 |

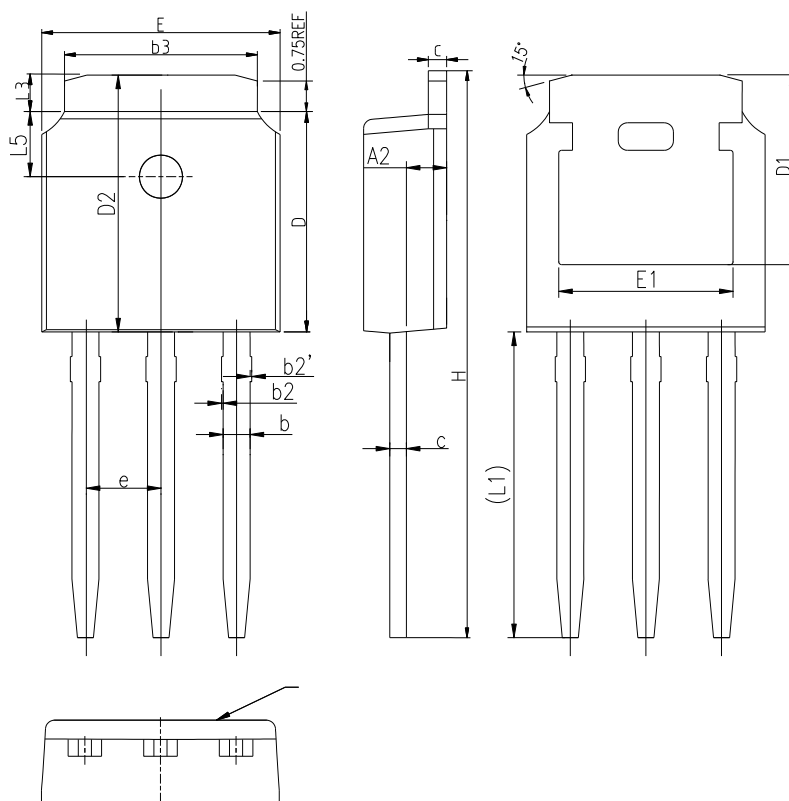
Package Information

TO-252-2L



| COMMON DIMENSIONS | | | |
|-------------------|----------|-------|-------|
| SYMBOL | mm | | |
| | MIN | NOM | MAX |
| A | 2.20 | 2.30 | 2.40 |
| A1 | 0.00 | - | 0.12 |
| A2 | 0.97 | 1.07 | 1.17 |
| b | 0.68 | 0.78 | 0.90 |
| b3 | 5.20 | 5.33 | 5.46 |
| c | 0.43 | 0.53 | 0.61 |
| D | 5.98 | 6.10 | 6.22 |
| D1 | 5.30REF | | |
| E | 6.40 | 6.60 | 6.73 |
| 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 | 0.50 | - | 1.00 |
| L5 | 1.65 | 1.80 | 1.95 |
| | 0° | - | 8° |

TO-251-3L



| COMMON DIMENSIONS | | | |
|-------------------|----------|-------|-------|
| SYMBOL | mm | | |
| | MIN | NOM | MAX |
| A | 2.20 | 2.30 | 2.38 |
| 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 | 5.46 |
| c | 0.43 | 0.53 | 0.61 |
| D | 5.98 | 6.10 | 6.22 |
| D1 | 4.30 | 5.30 | 6.00 |
| D2 | 6.92 | 7.12 | 7.32 |
| E | 6.40 | 6.60 | 6.73 |
| 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 |

TO-251-3S

H

| COMMON DIMENSIONS | | | |
|-------------------|----------|------|------|
| SYMBOL | mm | | |
| | MIN | NOM | MAX |
| A | 2.20 | 2.30 | 2.38 |
| A2 | 0.97 | 1.07 | 1.17 |
| b | 0.68 | 0.78 | 0.90 |
| b3 | 5.20 | 5.33 | 5.46 |
| c | 0.43 | 0.53 | 0.60 |
| D | 5.98 | 6.10 | 6.22 |
| D1 | 5.30REF | | |
| E | 6.40 | 6.60 | 6.73 |
| E1 | 4.63 | - | - |
| e | 2.286BSC | | |
| H | 10.00 | | |

Classification Profile



Classification Reflow Profiles

| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|--|------------------------------------|------------------------------------|
| Preheat & Soak | | |
| Temperature min (T_{smin}) | 100 °C | 150 °C |
| Temperature max (T_{smax}) | 150 °C | 200 °C |
| Time (T_{smin} to T_{smax}) (t_s) | 60-120 seconds | 60-120 seconds |
| Average ramp-up rate (T_{smax} to T_P) | 3 °C/second max. | 3°C/second max. |
| Liquidous temperature (T_L) | 183 °C | 217 °C |
| Time at liquidous (t_L) | 60-150 seconds | 60-150 seconds |
| Peak package body Temperature (T_P)* | See Classification Temp in table 1 | See Classification Temp in table 2 |
| Time (t_P)** within 5°C of the specified classification temperature (T_c) | 20** seconds | 30** seconds |
| Average ramp-down rate (T_P to T_{smax}) | 6 °C/second max. | 6 °C/second max. |
| Time 25°C to peak temperature | 6 minutes max. | 8 minutes max. |
| *Tolerance for peak profile Temperature (T_P) is defined as a supplier minimum and a user maximum. | | |
| ** Tolerance for time at peak profile temperature (t_P) is defined as a supplier minimum and a user maximum. | | |

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

| Package Thickness | Volume mm <350 | Volume mm 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 <350 | Volume mm 350-2000 | Volume mm 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 |
| HTRB | JESD-22, A108 | 168/500 Hrs, Bias @ 150°C |
| HTGB | JESD-22, A108 | 168 /500 Hrs, V _{gs} 100% @ 150°C |
| PCT | JESD-22, A102 | 96 Hrs, 100%RH, 2atm, 121°C |
| TCT | JESD-22, A104 | 250/500 Cycles, -55°C~150°C |

Customer Service

Worldwide Sales and Service: sales@hymexa.com

Technical Support: Technology@hymexa.com

Huayi Microelectronics Co., Ltd.

No.8928, Shangji Road, Economic and Technological Development Zone, Xi'an, China

TEL: (86-029) 86685706

FAX: (86-029) 86685705

E-mail: sales@hymexa.com

Web net: <http://www.hymexa.com/>