Wuxi Unigroup Microelectronics CO.,LTD.

# 60V N-Channel Trench MOSFET

## General Description

- Trench Power technology
- Low $R_{DS(ON)}$
- Low Gate Charge
- Optimized for fast-switching applications

## Applications

- Synchronous Rectification in DC/DC and AC/DC Converters
- Isolated DC/DC Converters in Telecom and Industrial

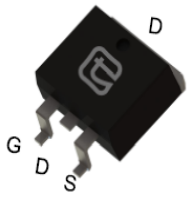
## Product Summary

| | |
|---|---|
| $V_{DS}$ | 60V |
| $I_D$ (at $V_{GS}$=10V) | 145A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | < 4.8mΩ |

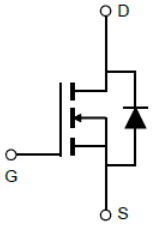
100% UIS Tested

RoHS

TO-263




TO-220


| Part Number | Package Type | Form | Marking |
|---|---|---|---|
| TTB145N06A | TO-263 | Tape & Reel | TTB145N06A |
| TTP145N06A | TO-220 | Tube | TTP145N06A |

## Absolute Maximum Ratings ($T_A$ =25°C unless otherwise noted)

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 60 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current [B] | $T_C$ =25°C | $I_D$ | 105 | A |
| | $T_C$ =100°C | | 105 | |
| Pulsed Drain Current [A] | | $I_{DM}$ | 435 | A |
| Avalanche Current [A] | | $I_{AS}$ | 57 | A |
| Single Pulse Avalanche Energy L =0.3mH [A] | | $E_{AS}$ | 487 | mJ |
| Power Dissipation [C] | $T_C$ =25°C | $P_D$ | 217 | W |
| | $T_C$ =100°C | | 108 | W |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 175 | °C |

**Thermal Characteristics**

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Maximum Junction-to-Case | Steady-State | $R_{\theta JC}$ | 0.69 | °C/W |
| Maximum Junction-to-Ambient | Steady-State | $R_{\theta JA}$ | 100 | |

## Electrical Characteristics($T_J$ =25ºC unless otherwise noted)

| Symbol | Parameter | Conditions | | Value | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| **STATIC PARAMETERS** | | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $I_D$ =250μA,$V_{GS}$ =0V | | 60 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ =60V, $V_{GS}$ =0V | $T_J$ =25ºC | -- | -- | 1 | μA |
| | | | $T_J$ =125ºC | -- | -- | 100 | |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{DS}$ =0V, $V_{GS}$ =±20V | | -- | -- | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ =$V_{GS}$, $I_D$ =250μA | | 2 | 3 | 4 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ =10V, $I_D$ =30A | | -- | 3.8 | 4.8 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ =5V, $I_D$ =20A | | -- | 38 | -- | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$ =30A, $V_{GS}$ =0V | | -- | -- | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current [B] | | | -- | -- | 105 | A |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ =0V, $V_{DS}$ =30V, f =1$MH_Z$ | | -- | 6819 | -- | pF |
| $C_{oss}$ | Output Capacitance | | | -- | 481 | -- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | -- | 461 | -- | |
| $R_g$ | Gate Resistance | f =1$MH_Z$ | | -- | 1.6 | -- | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$ =10V,$V_{DS}$ =30V, $I_D$ =20A | | -- | 125 | -- | nC |
| $Q_{gs}$ | Gate Source Charge | | | -- | 31.6 | -- | |
| $Q_{gd}$ | Gate Drain Charge | | | -- | 36.7 | -- | |
| $t_{D(on)}$ | Turn-On Delay Time | $V_{GS}$ =10V,$V_{DS}$ =30V, $I_D$ =20A, $R_G$ =2.5Ω | | -- | 25 | -- | ns |
| $t_r$ | Turn-On Rise Time | | | -- | 20 | -- | |
| $T_{D(off)}$ | Turn-Off Delay Time | | | -- | 72 | -- | |
| $t_f$ | Turn-Off Fall Time | | | -- | 31 | -- | |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$ =20A, di/dt =100A/μs | | -- | 36 | -- | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | | | -- | 60 | -- | nC |

A. Single pulse width limited by maximum junction temperature.

B. The maximum current rating is package limited.

C. The power dissipation $P_D$ is based on $T_{J(MAX)}$ =175ºC, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

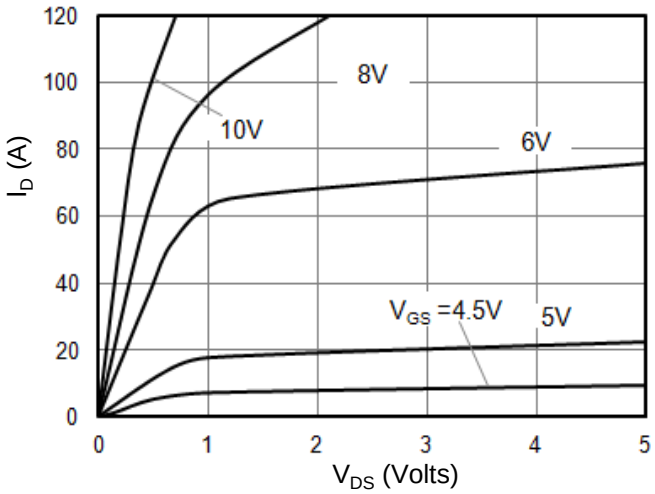



**Figure 1: On-Region Characteristics**

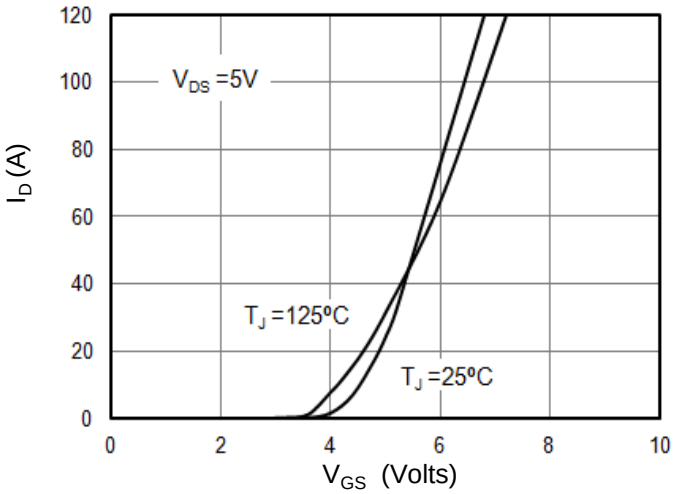



**Figure 2: Transfer Characteristics**

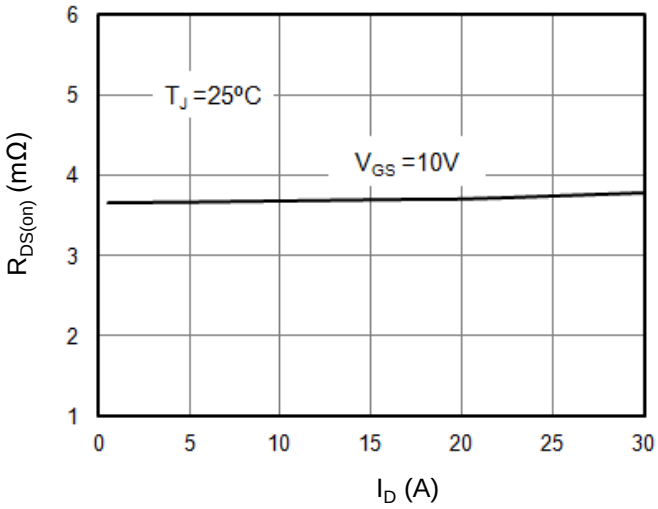



**Figure 3: On-Resistance vs. Drain Current**

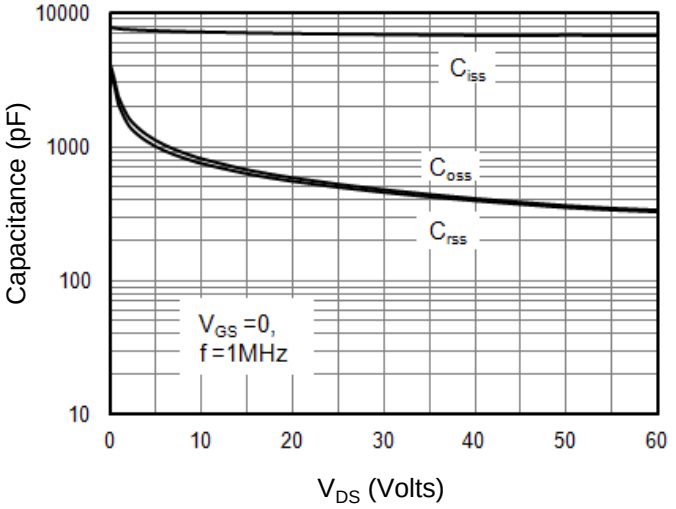



**Figure 4: Capacitance Characteristics**

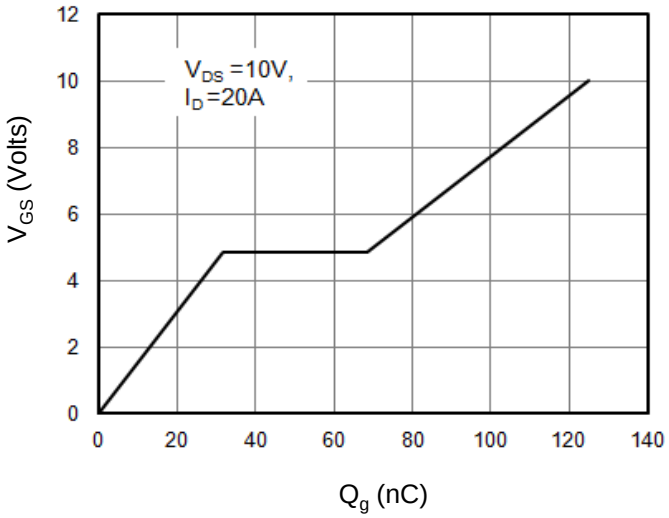



**Figure 5: Gate Charge Characteristics**

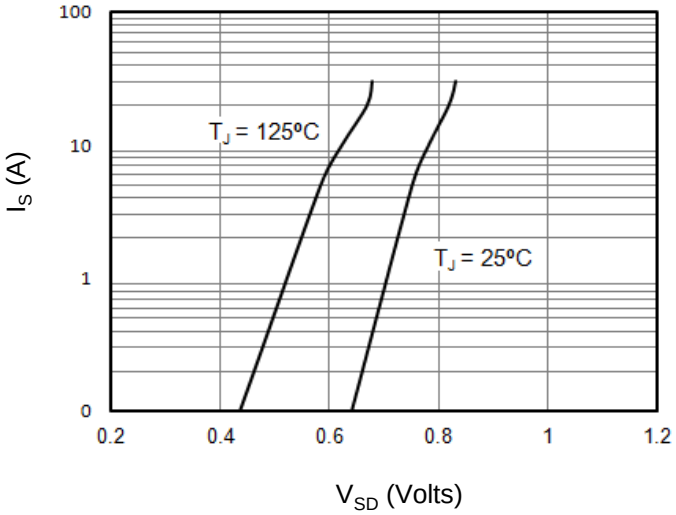



**Figure 6: Body Diode Forward Voltage**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

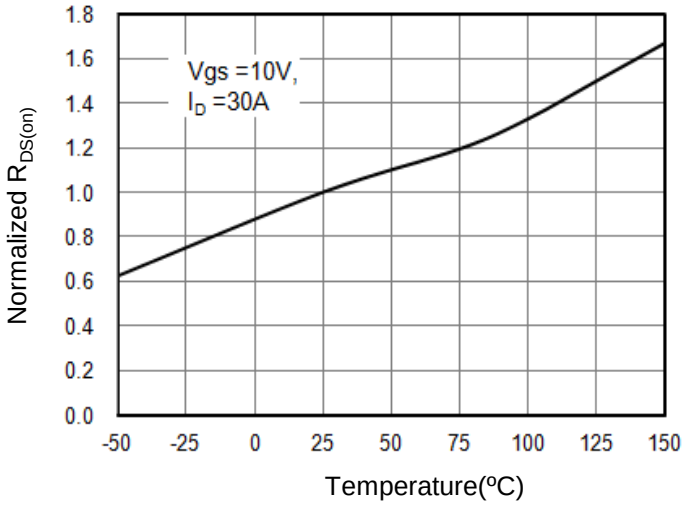



**Figure 7: On-Resistance vs. Junction Temperature**

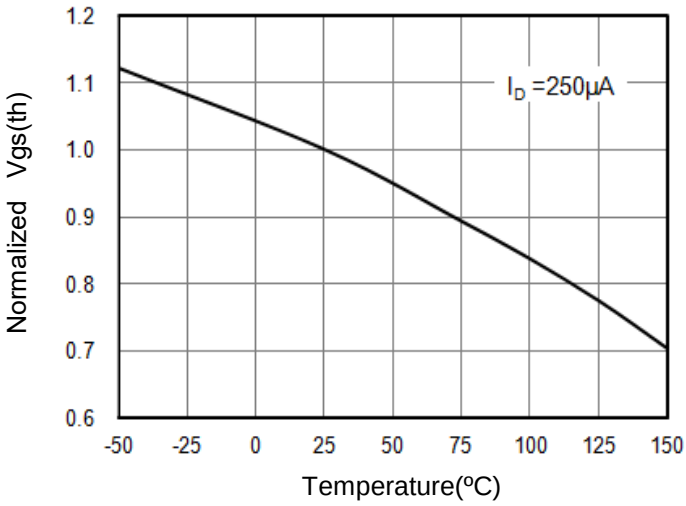



**Figure 8: Vgs(th) vs. Junction Temperature**

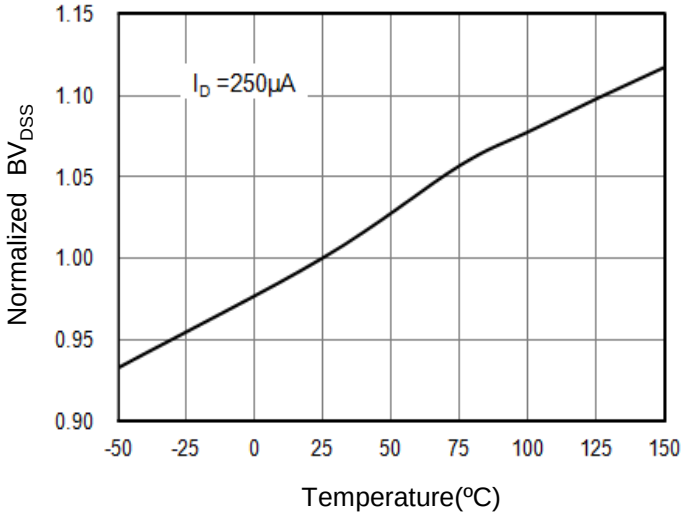



**Figure 9: $BV_{DSS}$ vs. Junction Temperature**

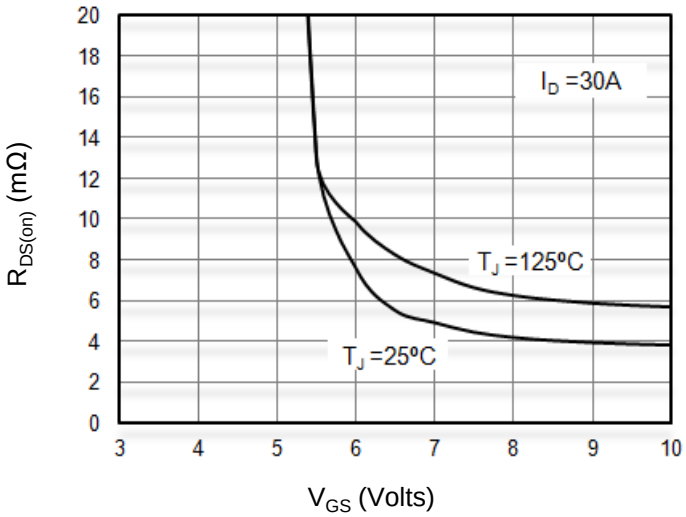



**Figure 10: On-Resistance vs. Gate-Source Voltage**

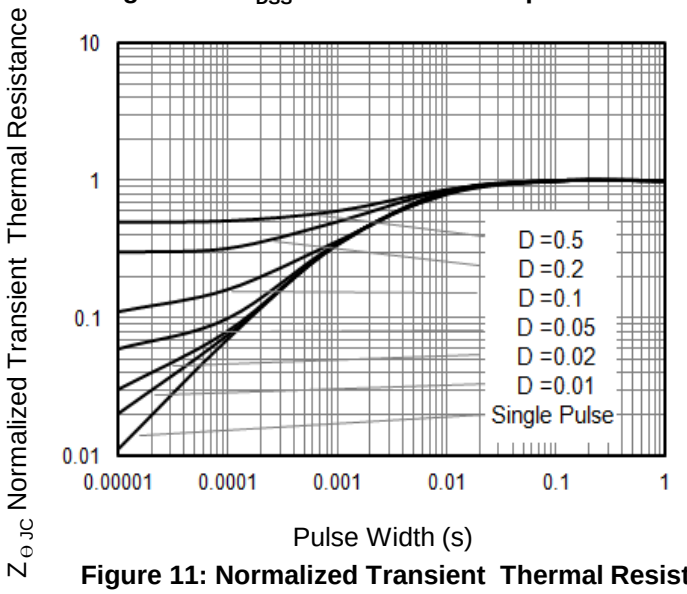



**Figure 11: Normalized Transient Thermal Resistance**

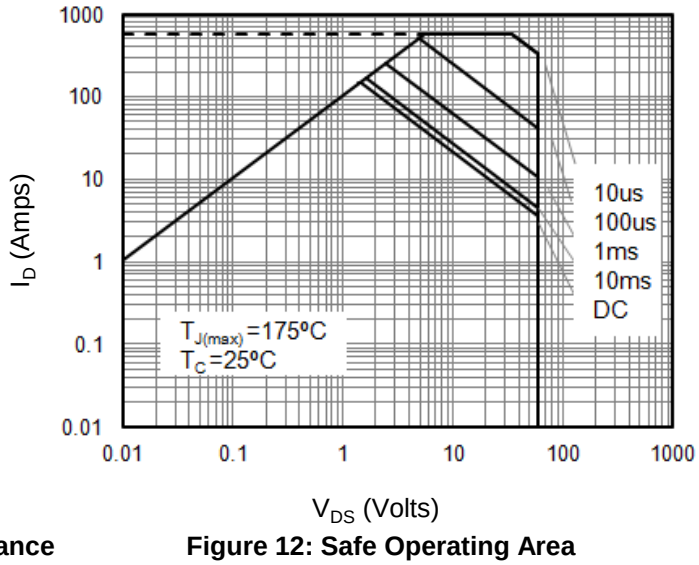



**Figure 12: Safe Operating Area**

**Figure A：Gate Charge Test Circuit and Waveforms**

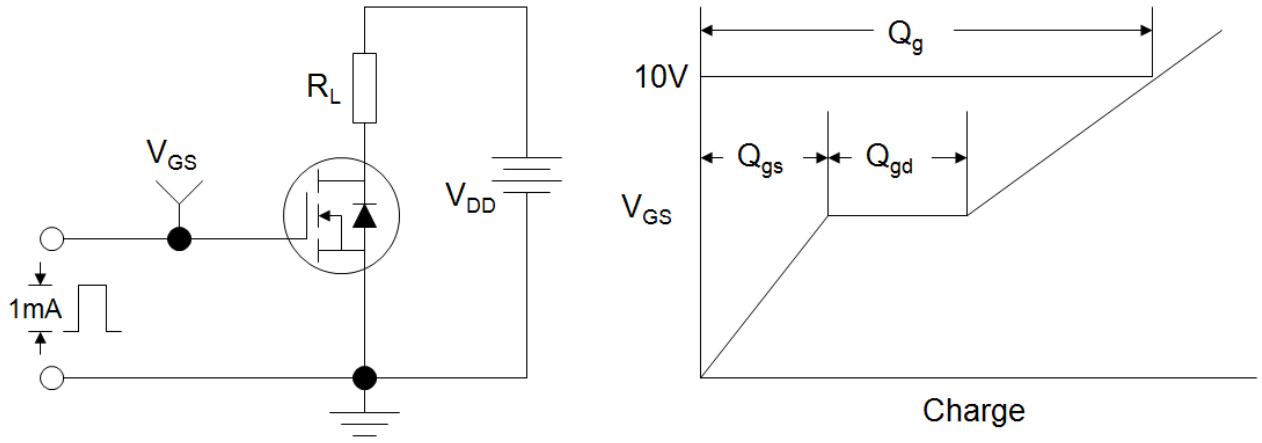



**Figure B：Resistive Switching Test Circuit and Waveforms**

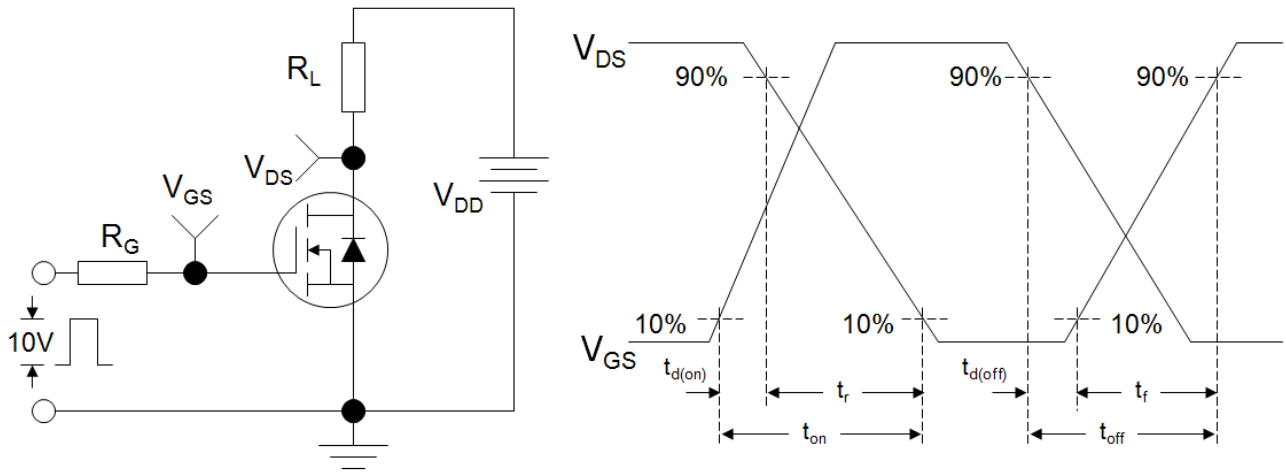
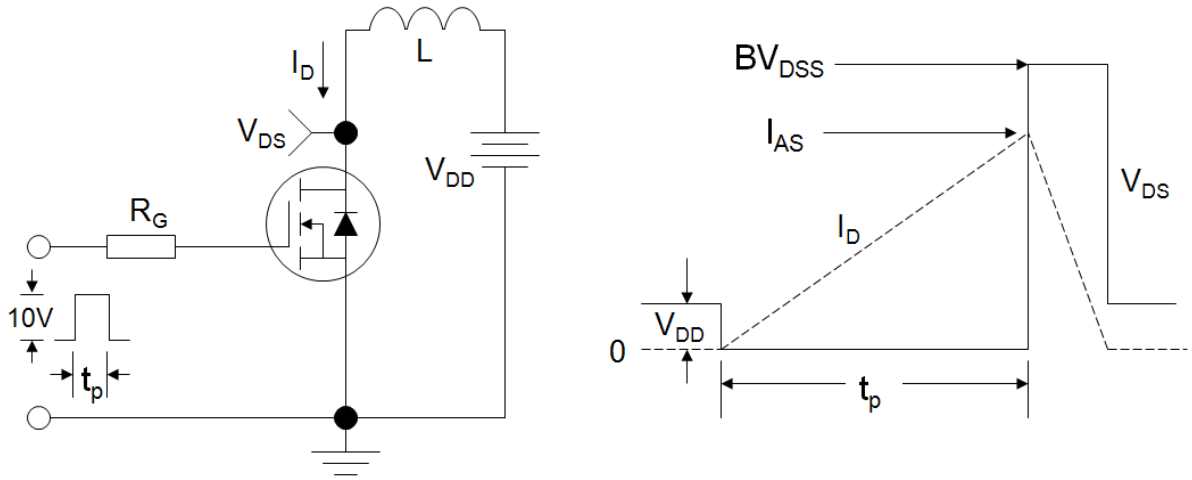
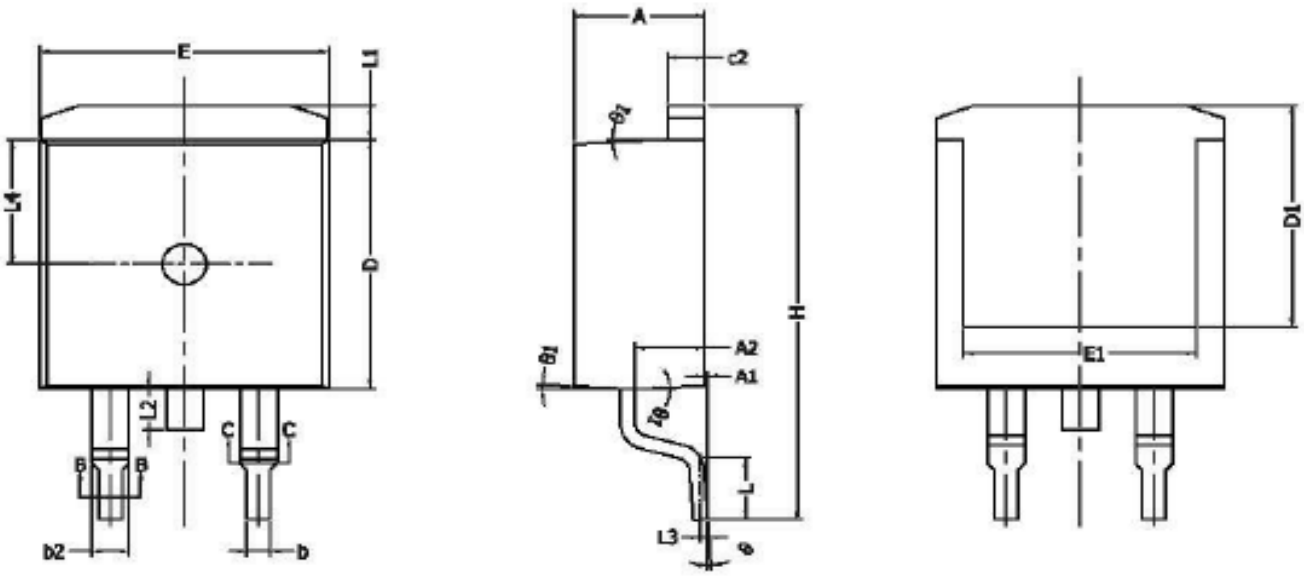



**Figure C：Unclamped Inductive Switching (UIS) Test Circuit and Waveforms**



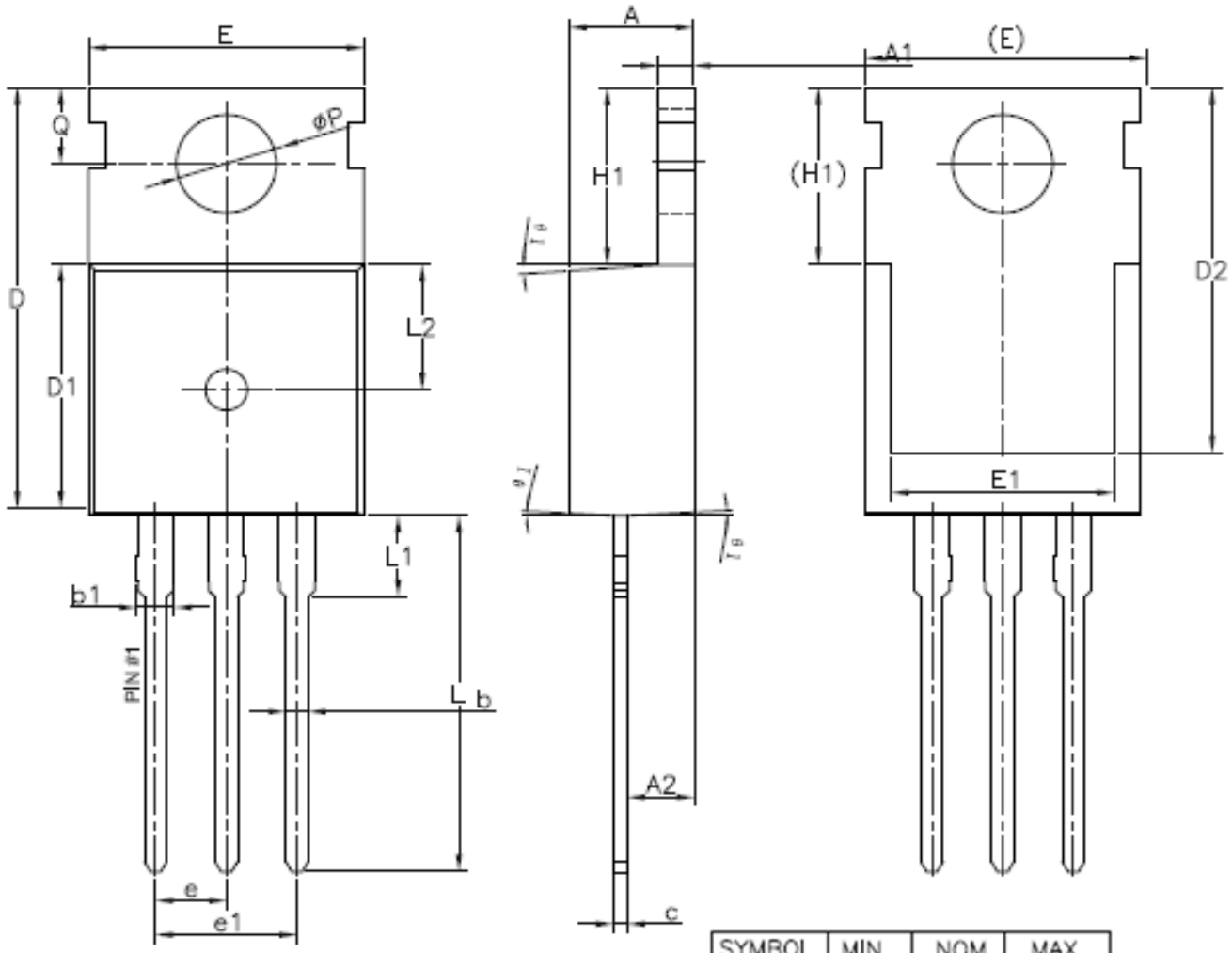
# TO-263(集佳)

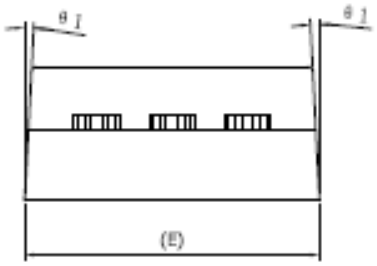



COMMON DIMENSIONS
(UNITS OF MEASURE =MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 4.40 | 4.50 | 4.60 |
| A1 | 0 | 0.10 | 0.25 |
| A2 | 2.20 | 2.40 | 2.60 |
| b | 0.76 | — | 0.89 |
| b1 | 0.75 | 0.80 | 0.85 |
| b2 | 1.23 | — | 1.37 |
| b3 | 1.22 | 1.27 | 1.32 |
| c | 0.47 | — | 0.60 |
| c1 | 0.46 | 0.51 | 0.56 |
| c2 | 1.25 | 1.30 | 1.35 |
| D | 9.10 | 9.20 | 9.30 |
| D1 | 8.00 | — | — |
| E | 9.80 | 9.90 | 10.00 |
| E1 | 7.80 | — | — |
| e | 2.54 BSC | | |
| H | 14.90 | 15.30 | 15.70 |
| L | 2.00 | 2.30 | 2.60 |
| L1 | 1.17 | 1.27 | 1.40 |
| L2 | — | — | 1.75 |
| L3 | 0.25BSC | | |
| L4 | 4.60 REF | | |
| θ | 0° | — | 8° |
| θ1 | 1° | 3° | 5° |

# TO-220（集佳）




| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 4.40 | 4.50 | 4.60 |
| A1 | 1.27 | 1.30 | 1.33 |
| A2 | 2.30 | 2.40 | 2.50 |
| b | 0.70 | – | 0.90 |
| b1 | 1.27 | – | 1.40 |
| c | 0.45 | 0.50 | 0.60 |
| D | 15.30 | 15.70 | 16.10 |
| D1 | 9.10 | 9.20 | 9.30 |
| D2 | 13.10 | – | 13.70 |
| E | 9.70 | 9.90 | 10.20 |
| E1 | 7.80 | 8.00 | 8.20 |
| e | 2.54BSC | | |
| e1 | 5.08BSC | | |
| H1 | 6.30 | 6.50 | 6.70 |
| L | 12.78 | 13.08 | 13.38 |
| L1 | – | – | 3.50 |
| L2 | 4.60REF | | |
| ΦP | 3.55 | 3.60 | 3.65 |
| Q | 2.73 | – | 2.87 |
| θ1 | 1° | 3° | 5° |

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