

N-Channel Super Junction Power MOSFET II

General Description

The series of devices use advanced super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)

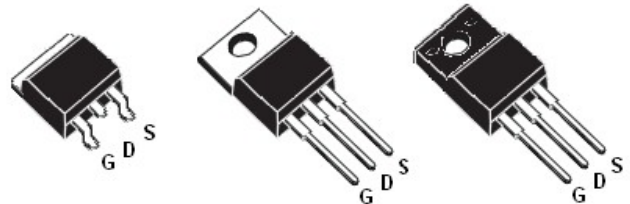
| | | |
|------------------|-----|------------|
| V_{DS} | 650 | V |
| $R_{DS(ON) MAX}$ | 210 | m Ω |
| I_D | 19 | A |



Schematic diagram

Package Marking And Ordering Information

| Device | Device Package | Marking |
|-----------|----------------|-----------|
| HMS17N65D | TO-263 | HMS17N65D |
| HMS17N65 | TO-220 | HMS17N65 |
| HMS17N65F | TO-220F | HMS17N65F |



TO-263

TO-220

TO-220F

Table 1. Absolute Maximum Ratings ($T_c=25^\circ\text{C}$)

| Parameter | Symbol | HMS17N65D HMS17N65 | HMS17N65F | Unit |
|--|-----------------|-----------------------|-----------|---------------------|
| Drain-Source Voltage ($V_{GS}=0V$) | V_{DS} | 650 | | V |
| Gate-Source Voltage ($V_{DS}=0V$) | V_{GS} | ± 30 | | V |
| Continuous Drain Current at $T_c=25^\circ\text{C}$ | $I_D(DC)$ | 17 | 17* | A |
| Continuous Drain Current at $T_c=100^\circ\text{C}$ | $I_D(DC)$ | 12 | 12* | A |
| Pulsed drain current (Note 1) | $I_{DM(pluse)}$ | 51 | 51* | A |
| Maximum Power Dissipation($T_c=25^\circ\text{C}$) | P_D | 145 | 33.5 | W |
| Derate above 25°C | | 1.16 | 0.268 | W/ $^\circ\text{C}$ |
| Single pulse avalanche energy (Note 2) | E_{AS} | 370 | | mJ |
| Avalanche current (Note 1) | I_{AR} | 7.5 | | A |
| Repetitive Avalanche energy, t_{AR} limited by T_{jmax} (Note 1) | E_{AR} | 0.8 | | mJ |

| Parameter | Symbol | HMS17N65D HMS17N65 | HMS17N65F | Unit |
|---|----------------|-----------------------|-----------|------|
| Drain Source voltage slope, $V_{DS} \leq 480V$, | dv/dt | 50 | | V/ns |
| Reverse diode dv/dt, $V_{DS} \leq 480V, I_{SD} < I_D$ | dv/dt | 15 | | V/ns |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55...+150 | | °C |

* limited by maximum junction temperature

Table 2. Thermal Characteristic

| Parameter | Symbol | HMS17N65D HMS17N65 | HMS17N65F | Unit |
|---|------------|-----------------------|-----------|-------|
| Thermal Resistance, Junction-to-Case (Maximum) | R_{thJC} | 0.86 | 3.73 | °C /W |
| Thermal Resistance, Junction-to-Ambient (Maximum) | R_{thJA} | 62 | 80 | °C /W |

Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--|--------------|---|-----|------|-----------|------------|
| On/off states | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 650 | | | V |
| Zero Gate Voltage Drain Current($T_c=25^\circ C$) | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | | | 1 | μA |
| Zero Gate Voltage Drain Current($T_c=125^\circ C$) | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | | | 100 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 30V, V_{DS}=0V$ | | | ± 100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2.0 | | 4.0 | V |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=8A$ | | 185 | 210 | m Ω |
| Dynamic Characteristics | | | | | | |
| Forward Transconductance | g_{FS} | $V_{DS} = 20V, I_D = 8A$ | | 11 | | S |
| Input Capacitance | C_{iss} | $V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$ | | 1360 | | pF |
| Output Capacitance | C_{oss} | | | 115 | | pF |
| Reverse Transfer Capacitance | C_{rss} | | | 4.8 | | pF |
| Total Gate Charge | Q_g | $V_{DS}=480V, I_D=17A,$ $V_{GS}=10V$ | | 29 | 45 | nC |
| Gate-Source Charge | Q_{gs} | | | 6.5 | | nC |
| Gate-Drain Charge | Q_{gd} | | | 12 | | nC |
| Intrinsic gate resistance | R_G | $f = 1 MHz$ open drain | | 10 | | Ω |
| Switching times | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=380V, I_D=8A,$ $R_G=5.5\Omega, V_{GS}=10V$ | | 10 | | nS |
| Turn-on Rise Time | t_r | | | 5 | | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 55 | 75 | nS |
| Turn-Off Fall Time | t_f | | | 4.5 | 10 | nS |
| Source- Drain Diode Characteristics | | | | | | |
| Source-drain current(Body Diode) | I_{SD} | $T_c=25^\circ C$ | | | 17 | A |
| Pulsed Source-drain current(Body Diode) | I_{SDM} | | | | 45 | A |
| Forward On Voltage | V_{SD} | $T_j=25^\circ C, I_{SD}=8A, V_{GS}=0V$ | | 0.9 | 1.2 | V |
| Reverse Recovery Time | t_{rr} | $T_j=25^\circ C, I_F=8A, di/dt=100A/\mu s$ | | 270 | | nS |
| Reverse Recovery Charge | Q_{rr} | | | 3.3 | | μC |
| Peak Reverse Recovery Current | I_{rrm} | | | 24 | | A |

Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2. $T_j=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

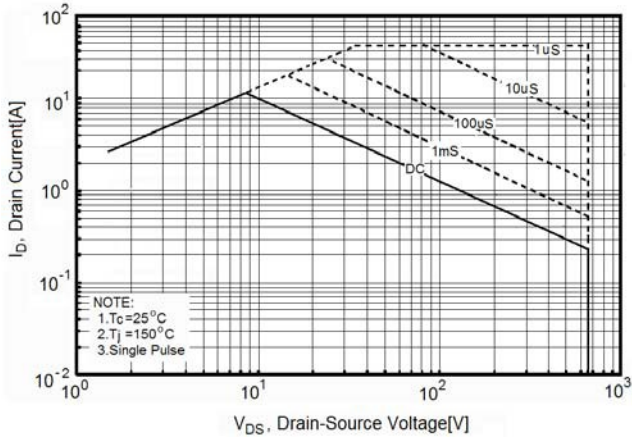


Figure2. Safe operating area for TO-220F

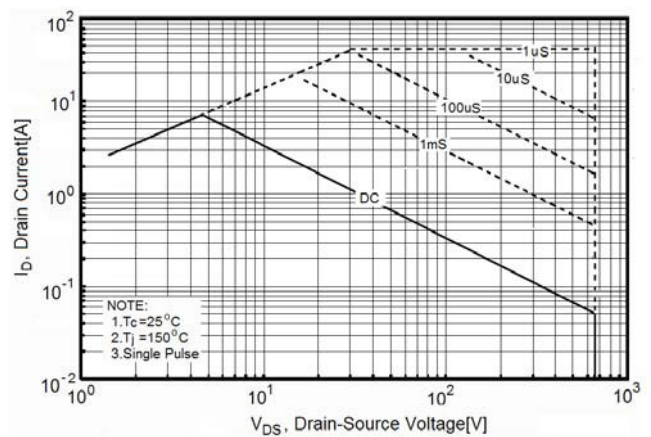


Figure3. Source-Drain Diode Forward Voltage

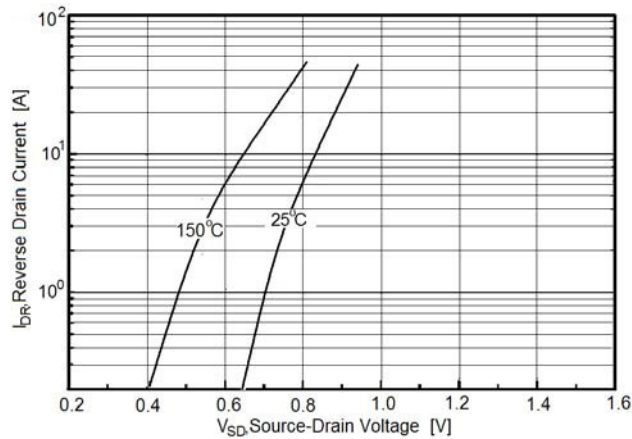


Figure4. Output characteristics

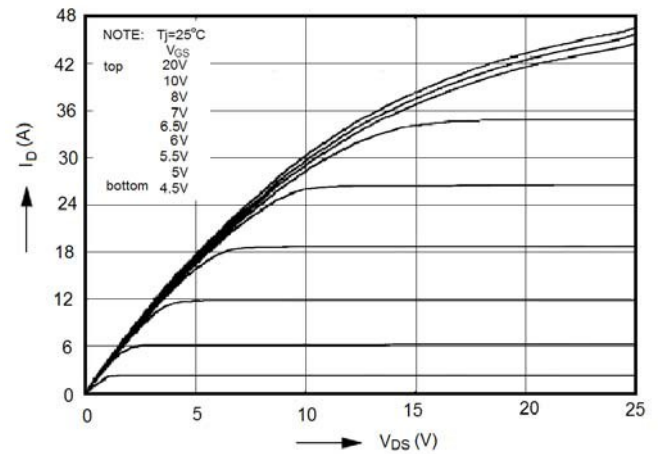


Figure5. Transfer characteristics

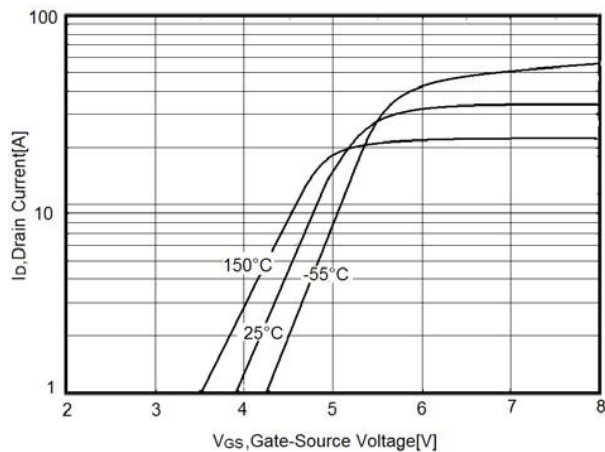


Figure6. Static drain-source on resistance

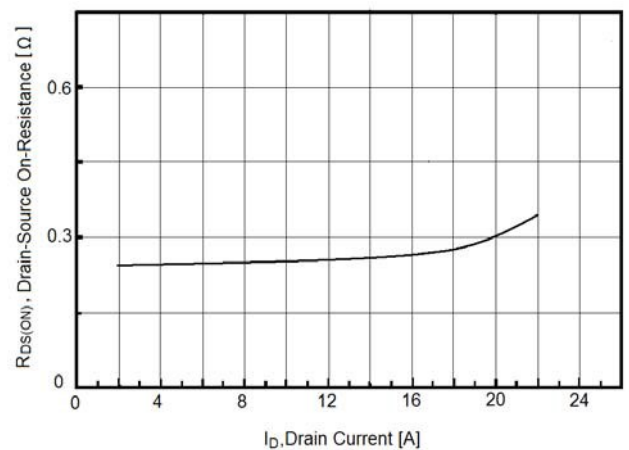


Figure7. $R_{DS(ON)}$ vs Junction Temperature

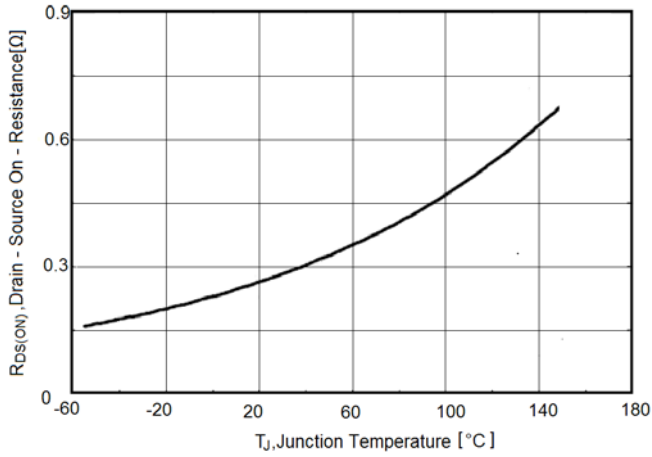


Figure8. BV_{DSS} vs Junction Temperature

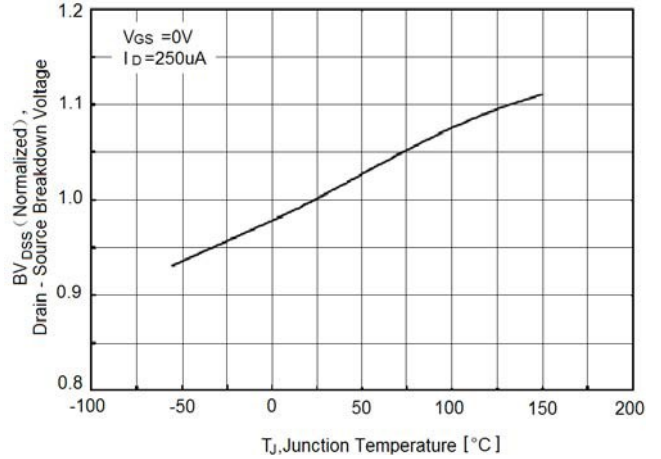


Figure9. Maximum I_D vs Junction Temperature

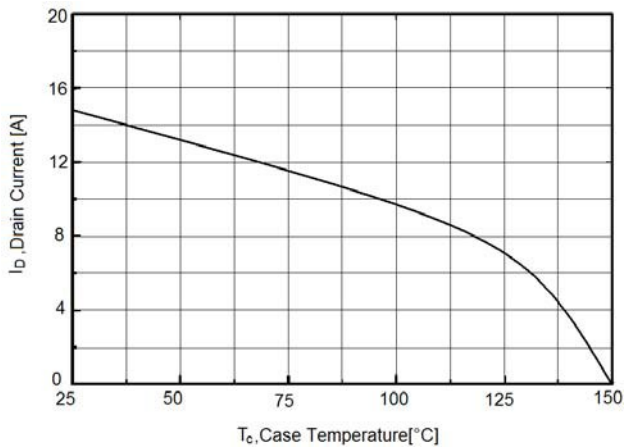


Figure10. Gate charge waveforms

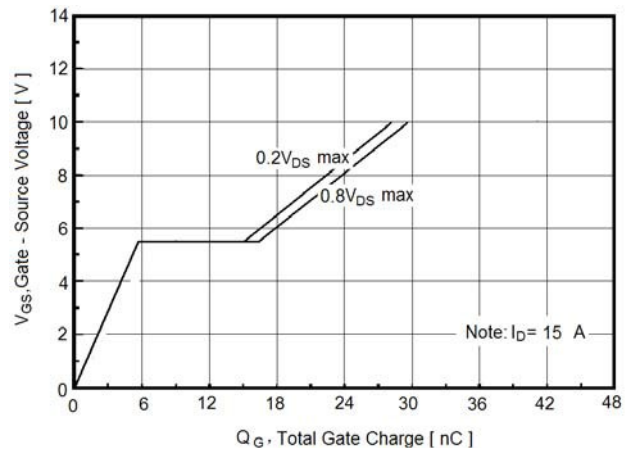


Figure11. Capacitance

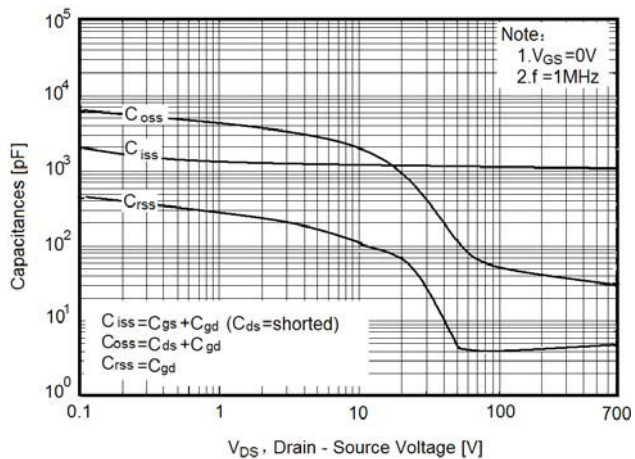
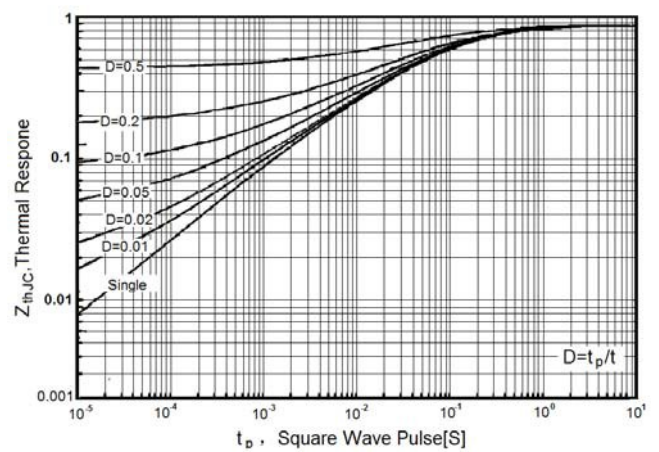
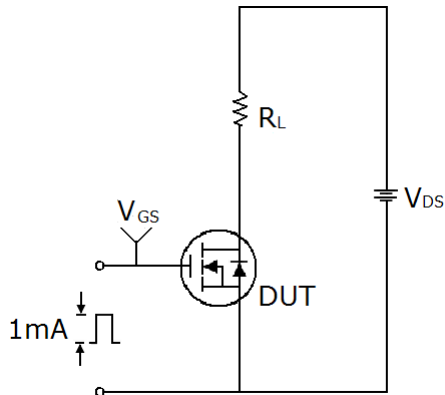


Figure12. Transient Thermal Impedance

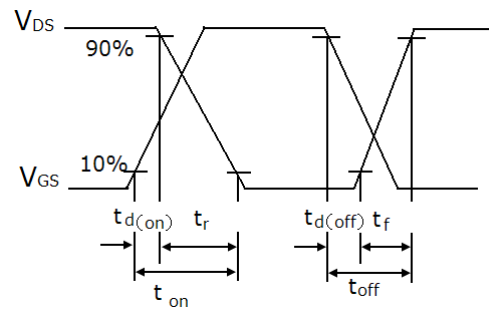
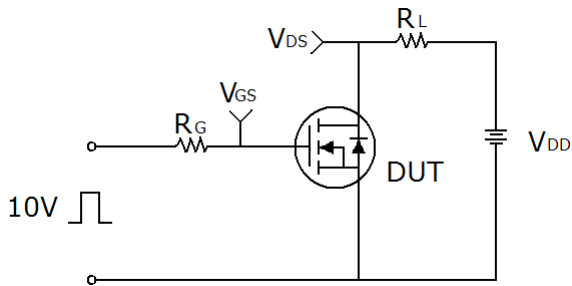


Test circuit

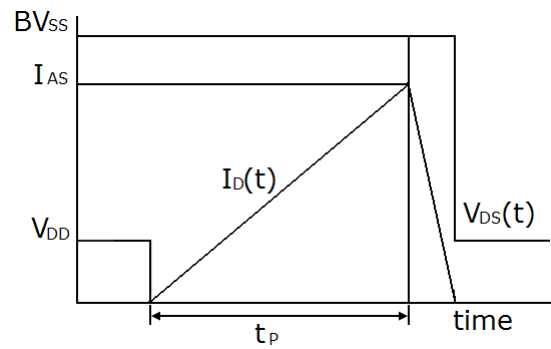
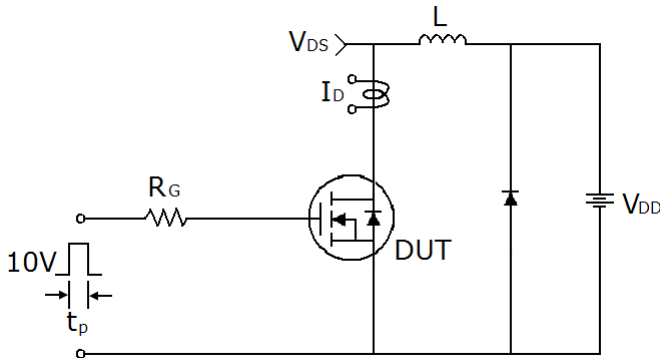
1) Gate charge test circuit & Waveform



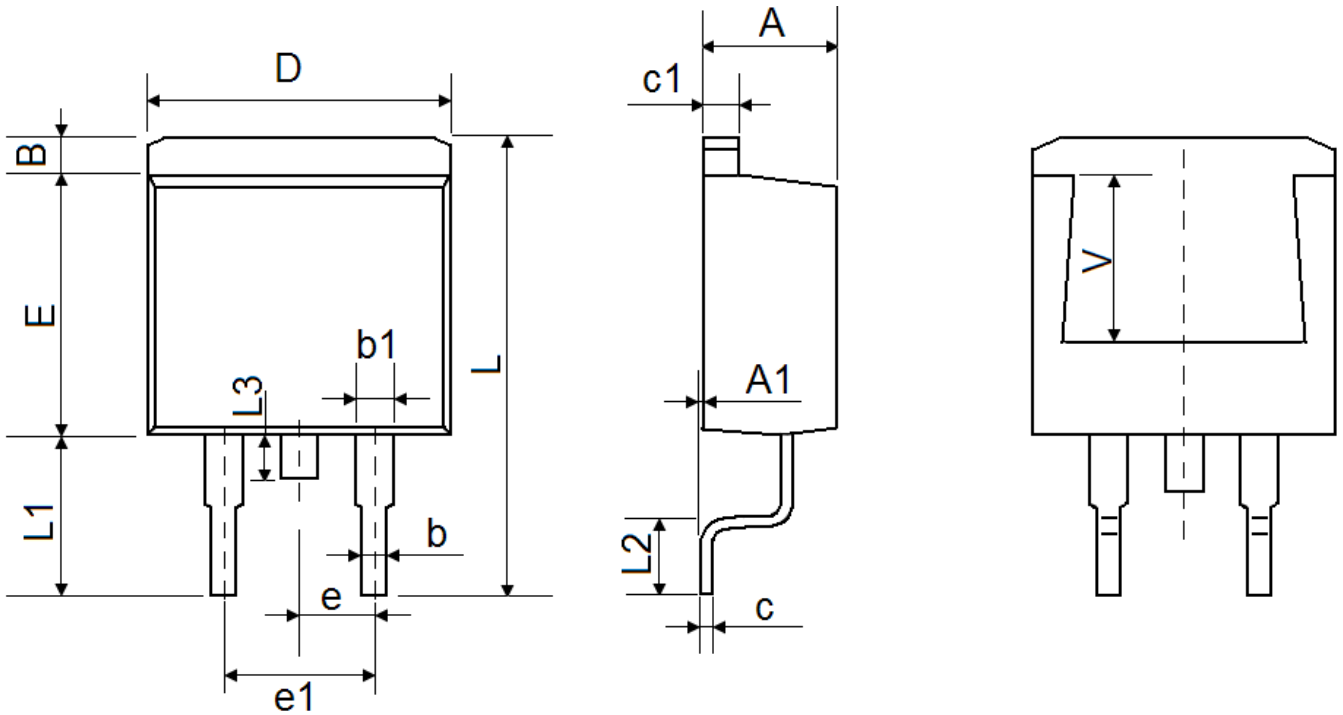
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms

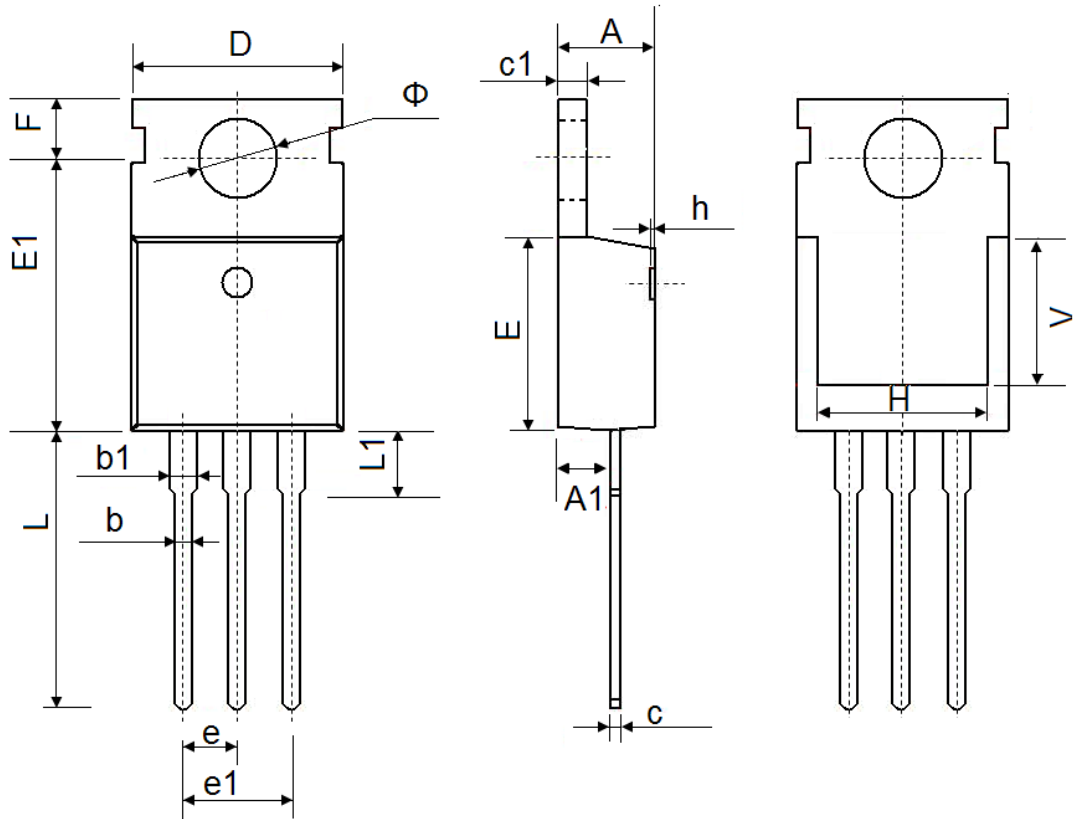


TO-263-2L Package Information



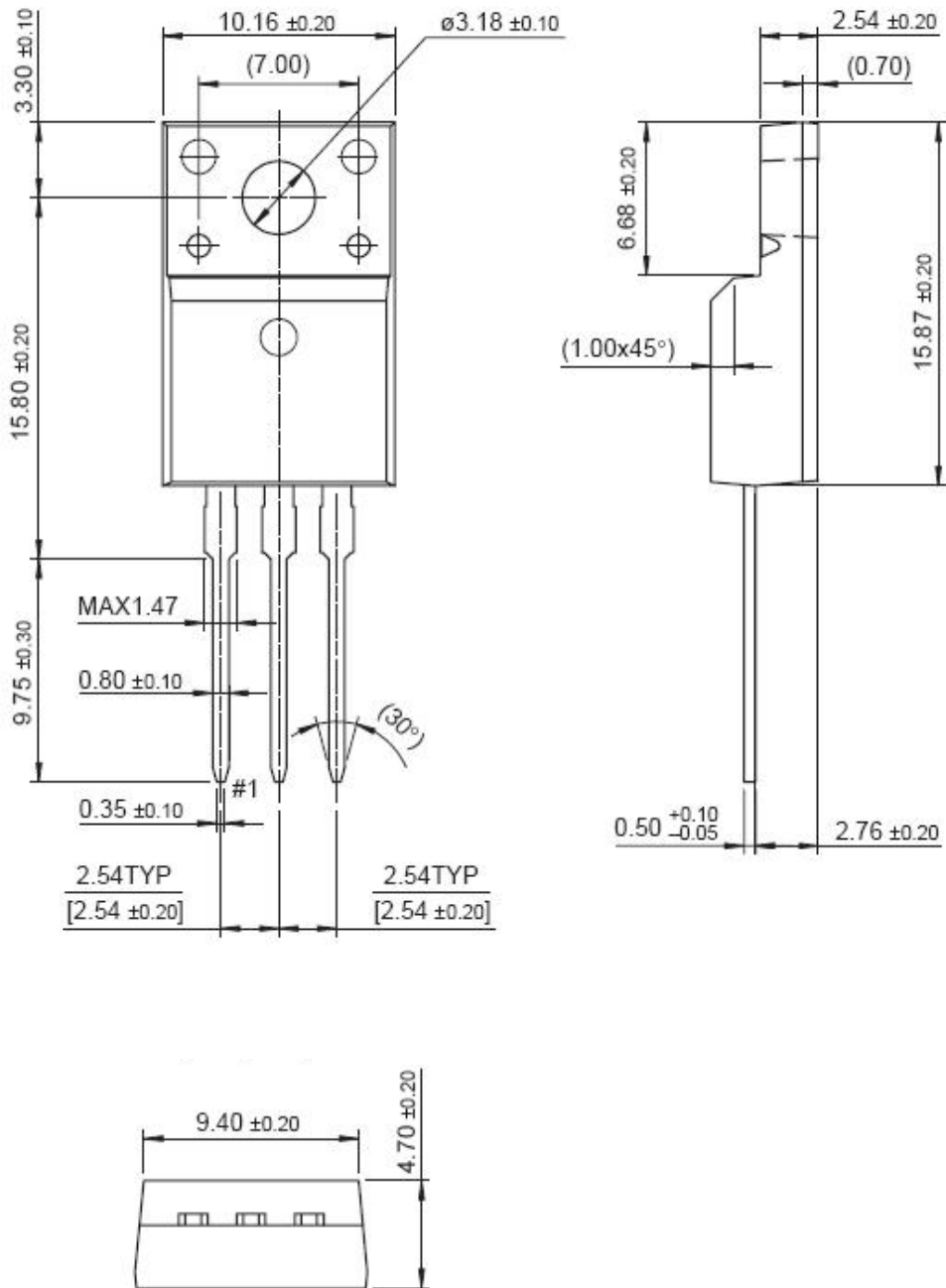
| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.470 | 4.670 | 0.176 | 0.184 |
| A1 | 0.000 | 0.150 | 0.000 | 0.006 |
| B | 1.170 | 1.370 | 0.046 | 0.054 |
| b | 0.710 | 0.910 | 0.028 | 0.036 |
| b1 | 1.170 | 1.370 | 0.046 | 0.054 |
| c | 0.310 | 0.530 | 0.012 | 0.021 |
| c1 | 1.170 | 1.370 | 0.046 | 0.054 |
| D | 10.010 | 10.310 | 0.394 | 0.406 |
| E | 8.500 | 8.900 | 0.335 | 0.350 |
| e | 2.540 TYP. | | 0.100 TYP. | |
| e1 | 4.980 | 5.180 | 0.196 | 0.204 |
| L | 15.050 | 15.450 | 0.593 | 0.608 |
| L1 | 5.080 | 5.480 | 0.200 | 0.216 |
| L2 | 2.340 | 2.740 | 0.092 | 0.108 |
| L3 | 1.300 | 1.700 | 0.051 | 0.067 |
| V | 5.600 REF | | 0.220 REF | |

TO-220-3L-C Package Information



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.400 | 4.600 | 0.173 | 0.181 |
| A1 | 2.250 | 2.550 | 0.089 | 0.100 |
| b | 0.710 | 0.910 | 0.028 | 0.036 |
| b1 | 1.170 | 1.370 | 0.046 | 0.054 |
| c | 0.330 | 0.650 | 0.013 | 0.026 |
| c1 | 1.200 | 1.400 | 0.047 | 0.055 |
| D | 9.910 | 10.250 | 0.390 | 0.404 |
| E | 8.9500 | 9.750 | 0.352 | 0.384 |
| E1 | 12.650 | 12.950 | 0.498 | 0.510 |
| e | 2.540 TYP. | | 0.100 TYP. | |
| e1 | 4.980 | 5.180 | 0.196 | 0.204 |
| F | 2.650 | 2.950 | 0.104 | 0.116 |
| H | 7.900 | 8.100 | 0.311 | 0.319 |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| L | 12.900 | 13.400 | 0.508 | 0.528 |
| L1 | 2.850 | 3.250 | 0.112 | 0.128 |
| V | 7.500 REF. | | 0.295 REF. | |
| Φ | 3.400 | 3.800 | 0.134 | 0.150 |

TO-220F Package Information



Dimensions in Millimeters