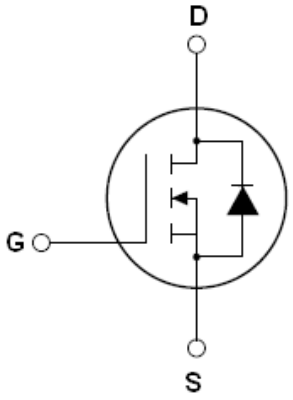
# N-Channel Super Junction Power MOSFET Ⅲ

## General Description

The series of devices use advanced trench gate 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.

| | | |
|---|---|---|
| $V_{DS}$ | 800 | V |
| $R_{DS(ON)\ MAX}$ | 420 | mΩ |
| $I_D$ | 11 | A |




**Schematic diagram**

## Features

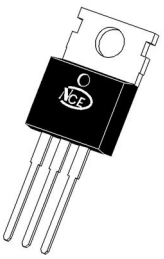
- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

## Application

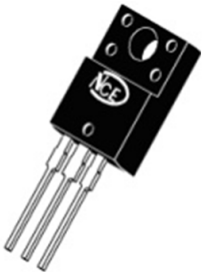
- Power factor correction（PFC）
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply（UPS）

## Package Marking And Ordering Information

| Device | Device Package | Marking |
|---|---|---|
| NCE80T420 | TO-220 | NCE80T420 |
| NCE80T420F | TO-220F | NCE80T420F |



**TO-220**



**TO-220F**

## Table 1. Absolute Maximum Ratings ($T_C$=25℃)

| Parameter | Symbol | NCE80T420 | NCE80T420F | Unit |
|---|---|---|---|---|
| Drain-Source Voltage ($V_{GS}$=0V) | $V_{DS}$ | 800 | | V |
| Gate-Source Voltage ($V_{DS}$=0V), AC (f>1 Hz) | $V_{GS}$ | ±30 | | V |
| Continuous Drain Current at $T_C$=25°C | $I_{D\ (DC)}$ | 11 | 11* | A |
| Continuous Drain Current at $T_C$=100°C | $I_{D\ (DC)}$ | 8.5 | 8.5* | A |
| Pulsed drain current **(Note 1)** | $I_{DM\ (pluse)}$ | 44 | 44* | A |
| Maximum Power Dissipation($T_C$=25℃) | $P_D$ | 188 | 33.8 | W |
| Derate above 25°C | | 1.5 | 0.27 | W/°C |
| Single pulse avalanche energy **(Note 2)** | $E_{AS}$ | 144 | | mJ |
| Avalanche current **(Note 1)** | $I_{AR}$ | 6 | | A |
| Repetitive Avalanche energy ， $t_{AR}$ limited by $T_{Jmax}$ **(Note 1)** | $E_{AR}$ | 0.7 | | mJ |

| Parameter | Symbol | NCE80T420 | NCE80T420F | Unit |
|---|---|---|---|---|
| Drain Source voltage slope, $V_{DS}$ ≤480 V, | dv/dt | 50 | | V/ns |
| Reverse diode dv/dt， $V_{DS}$ ≤480 V,$I_{SD}$<$I_D$ | 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 | NCE80T420 | NCE80T420F | Unit |
|---|---|---|---|---|
| Thermal Resistance，Junction-to-Case（Maximum） | $R_{thJC}$ | 0.66 | 3.69 | °C /W |
| Thermal Resistance，Junction-to-Ambient （Maximum） | $R_{thJA}$ | 62.5 | 80 | °C /W |

**Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)**

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **On/off states** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | 800 | | | V |
| Zero Gate Voltage Drain Current(Tc=25℃) | $I_{DSS}$ | $V_{DS}$=800V,$V_{GS}$=0V | | 0.05 | 1 | μA |
| Zero Gate Voltage Drain Current(Tc=125℃) | $I_{DSS}$ | $V_{DS}$=800V,$V_{GS}$=0V | | | 100 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | | | ±100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 3 | 3.5 | 4 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=5.5A | | 350 | 420 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 20V, $I_D$ = 5.5A | | 7 | | S |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=50V,$V_{GS}$=0V, F=1.0MHz | | 2600 | | PF |
| Output Capacitance | $C_{oss}$ | | | 95 | | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 7 | | PF |
| Total Gate Charge | $Q_g$ | $V_{DS}$=640V,$I_D$=11A, $V_{GS}$=10V | | 48 | | nC |
| Gate-Source Charge | $Q_{gs}$ | | | 17 | | nC |
| Gate-Drain Charge | $Q_{gd}$ | | | 14 | | nC |
| **Switching times** | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=480V,$I_D$=5.5A, $R_G$=4Ω,$V_{GS}$=10V | | 12 | | nS |
| Turn-on Rise Time | $t_r$ | | | 7 | | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 62 | | nS |
| Turn-Off Fall Time | $t_f$ | | | 5 | | nS |
| **Source- Drain Diode Characteristics** | | | | | | |
| Source-drain current(Body Diode) | $I_{SD}$ | $T_C$=25°C | | | 11 | A |
| Pulsed Source-drain current(Body Diode) | $I_{SDM}$ | | | | 44 | A |
| Forward on voltage | $V_{SD}$ | $T_j$=25°C,$I_{SD}$=11A,$V_{GS}$=0V | | 0.9 | 1.3 | V |
| Reverse Recovery Time | $t_{rr}$ | $T_j$=25°C,$I_F$=11A,di/dt=100A/μs | | 290 | | nS |
| Reverse Recovery Charge | $Q_{rr}$ | | | 2.2 | | uC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | | 15 | | A |

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

2. $T_j$=25℃,$V_{DD}$=50V,$V_G$=10V, $R_G$=25Ω

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

**Figure1. Safe operating area for TO-220**

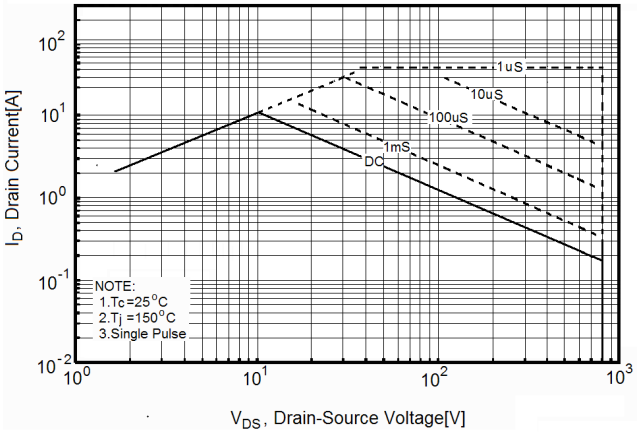



**Figure2. Safe operating area for TO-220F**

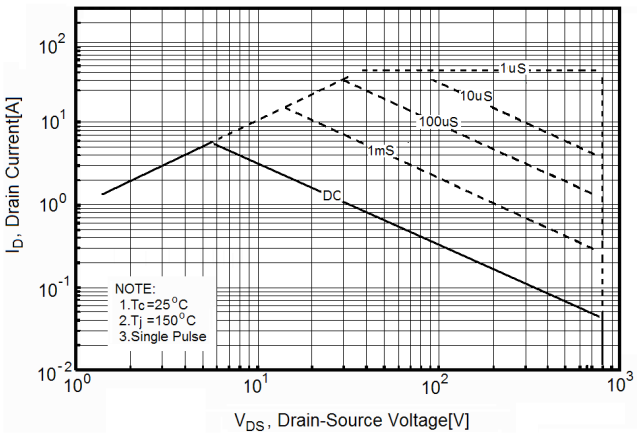



**Figure3. Source-Drain Diode Forward Voltage**

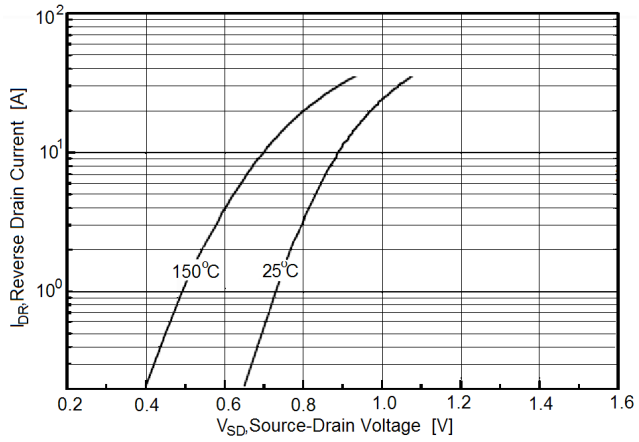



**Figure4. Output characteristics**

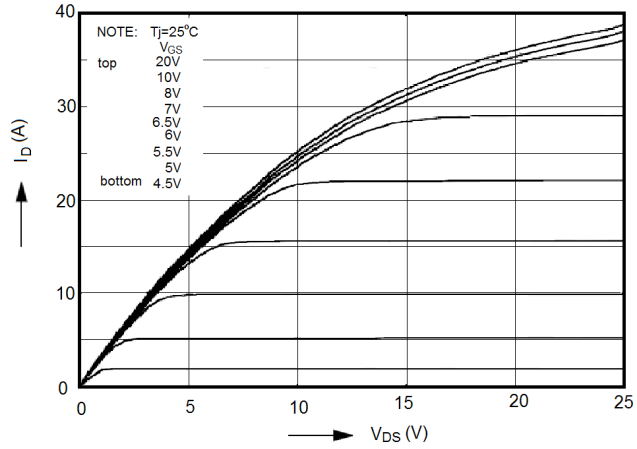



**Figure5. Transfer characteristics**

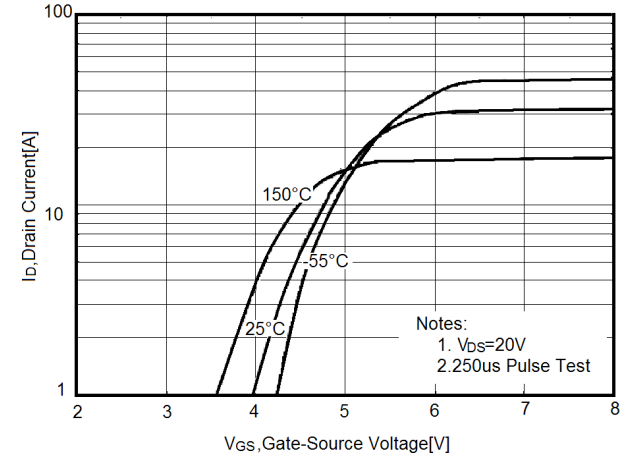



**Figure6. Static drain-source on resistance**

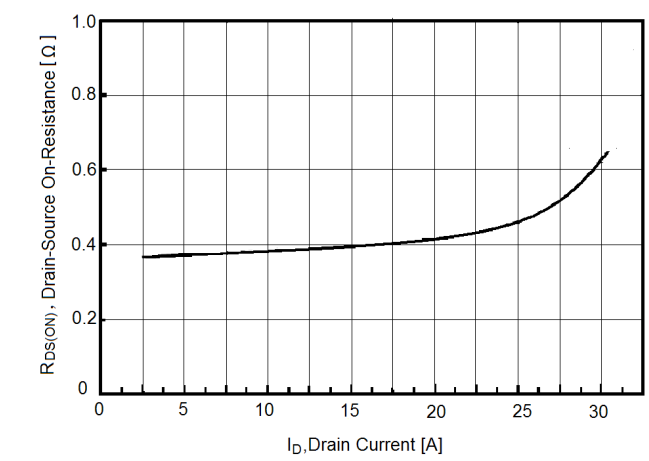


**Figure7. $R_{DS(ON)}$ vs Junction Temperature**

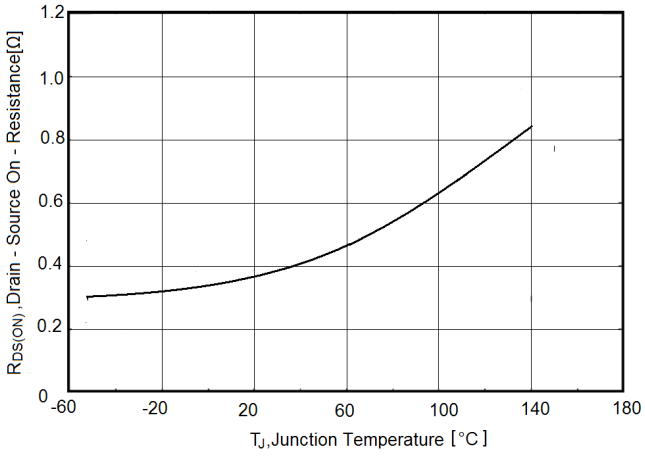



**Figure8. $BV_{DSS}$ vs Junction Temperature**

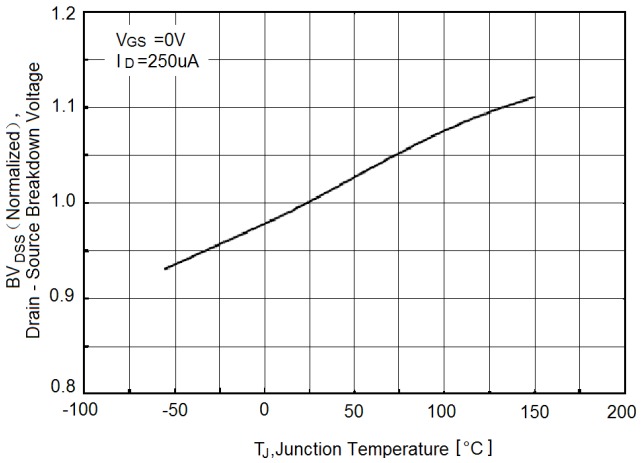



**Figure9. Maximum $I_D$ vs Junction Temperature**

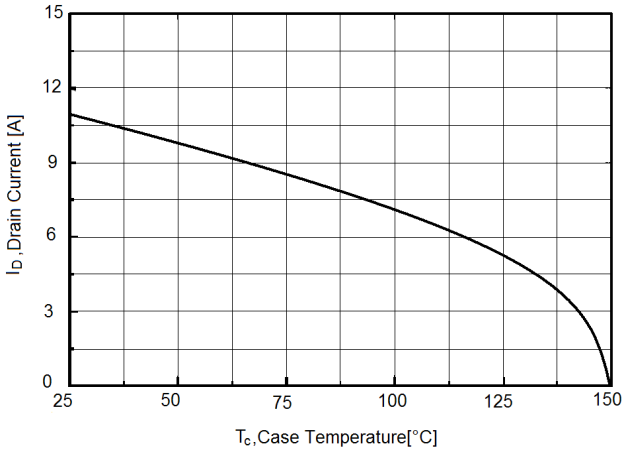



**Figure10. Transient Thermal Impedance for TO-220**

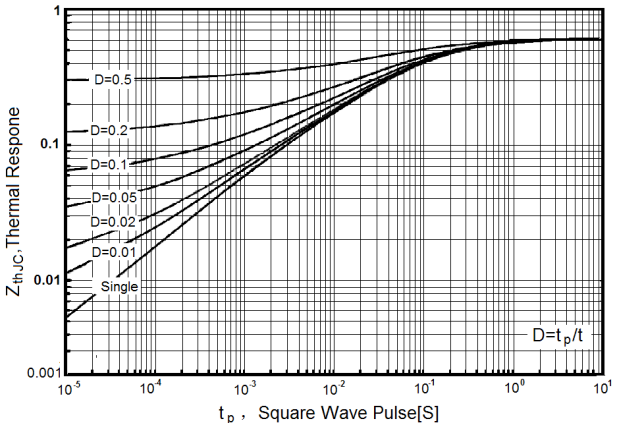
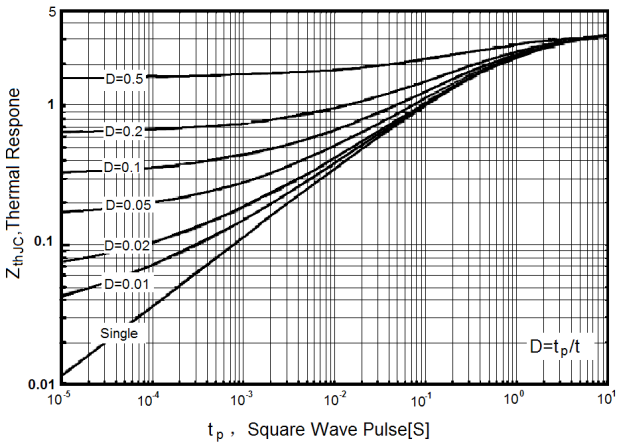
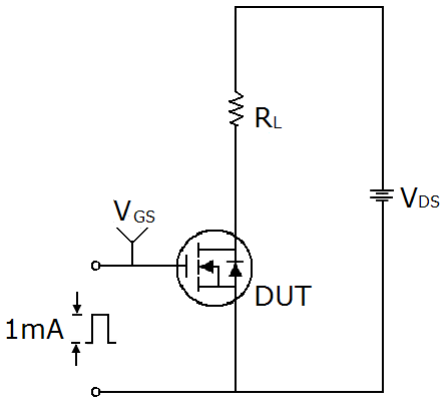


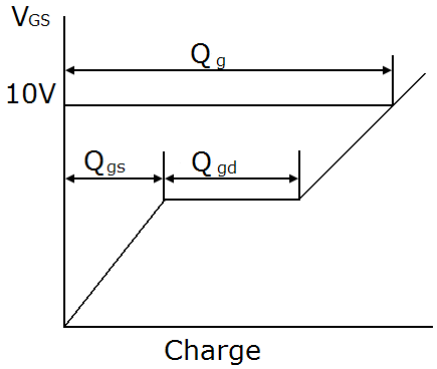

**Figure11. Transient Thermal Impedance for TO-220F**



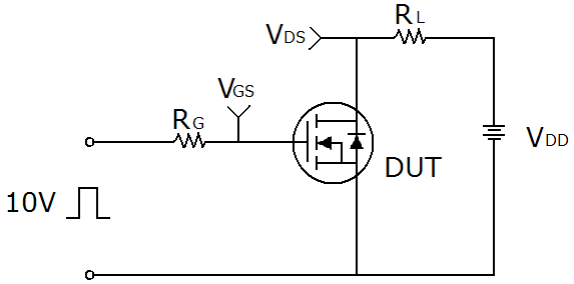
# Test circuit

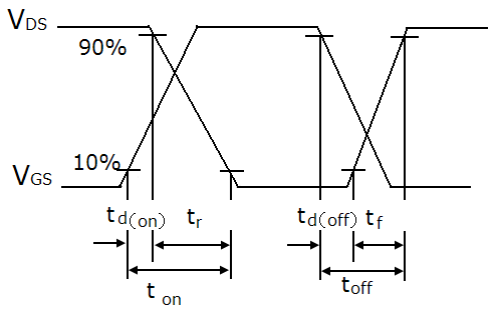
**1）Gate charge test circuit & Waveform**



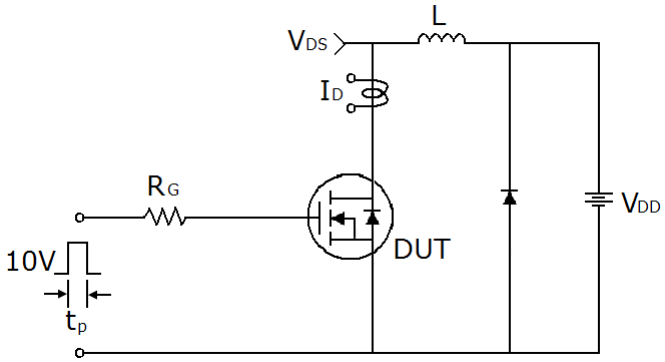



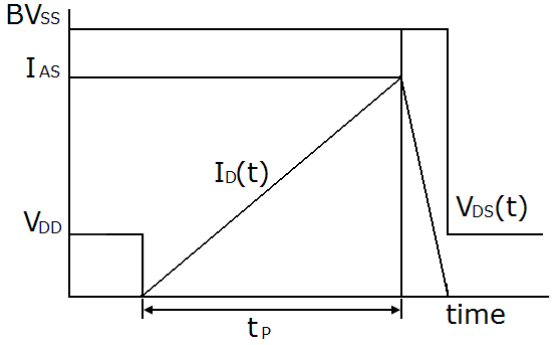

**2）Switch Time Test Circuit:**



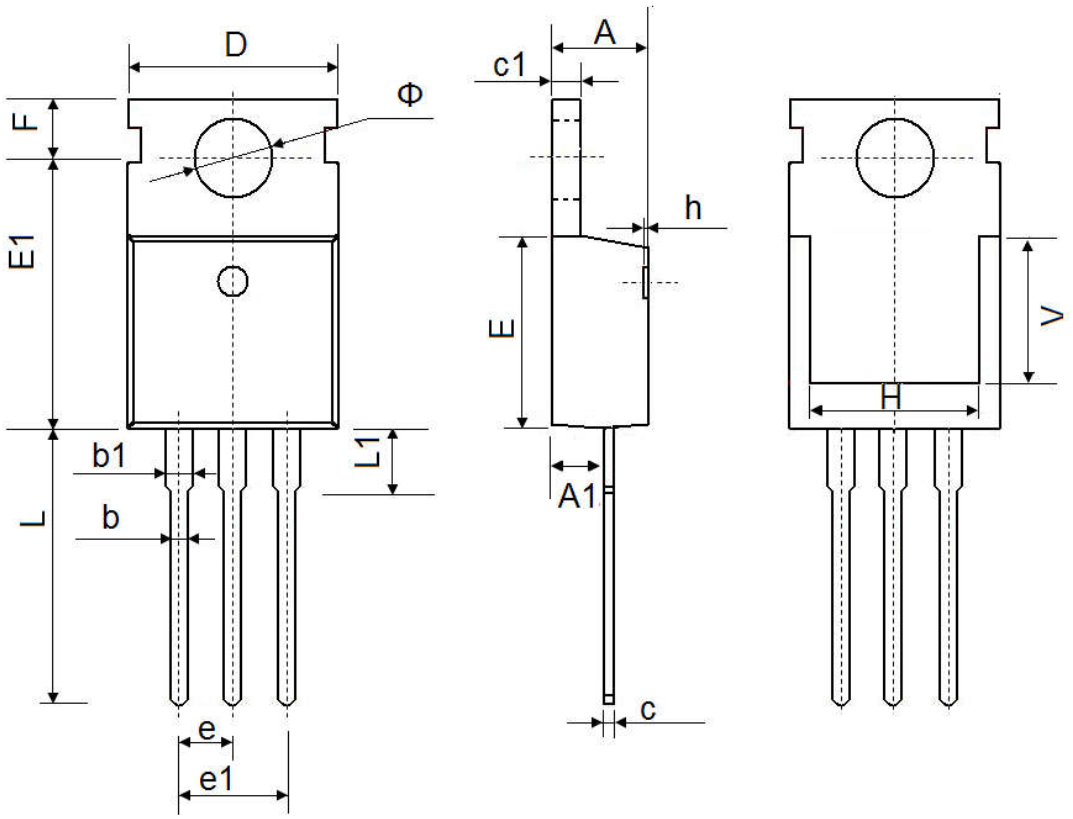




**3）Unclamped Inductive Switching Test Circuit & Waveforms**



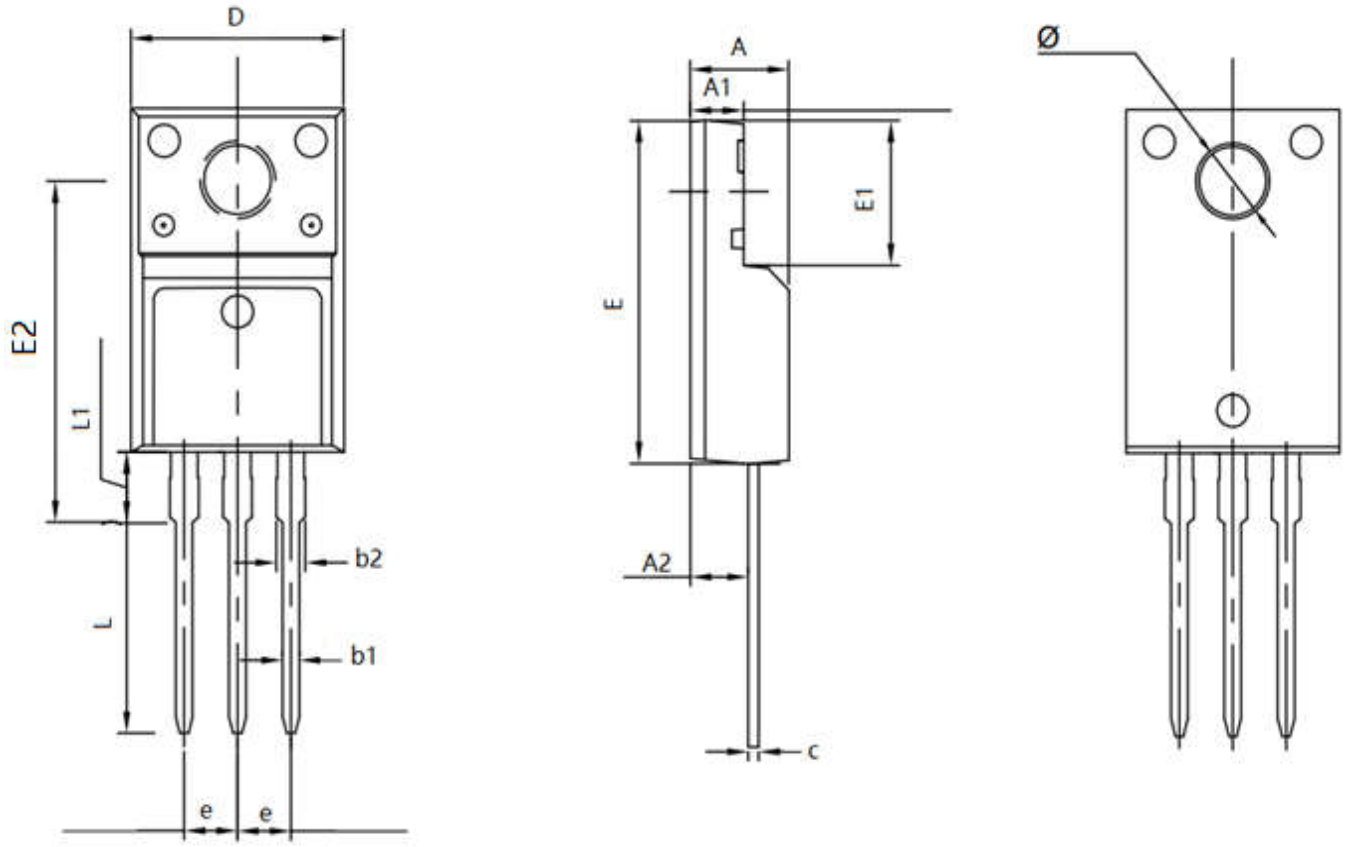



# TO-220-3L-C Package Information




| 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




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 4.500 | 4.900 | 0.177 | 0.193 |
| A1 | 2.340 | 2.740 | 0.092 | 0.108 |
| A2 | 2.560 | 2.960 | 0.101 | 0.117 |
| b1 | 0.700 | 0.900 | 0.028 | 0.035 |
| b2 | 1.180 | 1.580 | 0.046 | 0.062 |
| c | 0.400 | 0.600 | 0.016 | 0.024 |
| D | 9.960 | 10.360 | 0.392 | 0.408 |
| E | 15.670 | 15.970 | 0.617 | 0.629 |
| E1 | 6.500 | 6.900 | 0.256 | 0.272 |
| E2 | 15.500 | 16.100 | 0.610 | 0.634 |
| e | 2.540 TYP | | 0.100 TYP | |
| Φ | 3.080 | 3.280 | 0.121 | 0.129 |
| L | 12.640 | 13.240 | 0.498 | 0.521 |
| L1 | 3.030 | 3.430 | 0.119 | 0.135 |

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