

N-Channel Super Junction Power MOSFET

Description

SM420R65C is power MOSFET using advanced super junction technology that can realize very low on-resistance and gate charge. It will provide much high efficiency by using optimized charge coupling technology. These user friendly devices give an advantage of low EMI to designers as well as low switching loss.

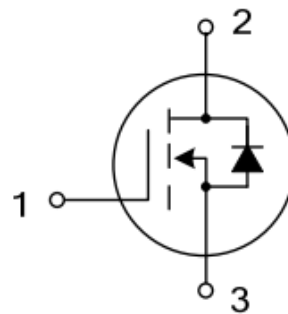
| | |
|-----------------|-------------------------------------|
| I_D | 11A |
| V_{DSS} | 650V |
| $R_{dson(Max)}$ | $0.42\Omega (V_{GS}=10V, I_D=5.5A)$ |
| Q_g | 39nC |

General Features

- 11A,650V, $R_{dson(Max)} = 0.42\Omega @ V_{GS}=10V$
- Low Gate charge
- Low Crss
- Fast Switching
- Improved dv/dt Capability

Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



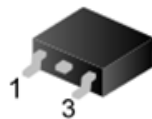
1.Gate 2.Drain 3.Source



TO-220



TO-220F



TO-252

**Order Information**

| Order Information | Marking ID | Package | Packing Type Supplied As |
|-------------------|------------|-----------|---|
| SM420R65CT9RL | 420R65C | TO252-2L | 3000 Units on Reel |
| SM420R65CT2TL | 420R65C | TO220F-3L | 1000 units on Box, 5000 units on Carton |
| SM420R65CT1TL | 420R65C | TO220-3L | 1000 units on Box, 5000 units on Carton |

Absolute Maximum Ratings Ta=25 °C unless otherwise noted

| Parameter | Symbol | Value | Unit |
|-----------------------------------|------------------|------------|------|
| Drain-source Voltage | V _{DS} | 650 | V |
| Gate-source Voltage | V _{GS} | ±30 | V |
| Continuous Drain Current(Ta=25°C) | I _D | 11 | A |
| Drain Current-Pulsed | I _{DM} | 45 | A |
| Total Dissipation (Ta=25°C) | TO252 | 80 | W |
| | TO220 | 68 | |
| | TO220F | 31 | |
| Junction Temperature | T _J | 150 | °C |
| Storage Temperature | T _{STG} | -65 to 150 | °C |
| Single Pulse Avalanche Energy | E _{AS} | 205 | mJ |
| ESD HBM(Human Body Mode) | | ≥2000 | V |
| ESD MM(Machine Mode) | | ≥200 | V |

Electrical Characteristics Ta = 25°C

| PARAMETER | Symbol | Test Condition | MIN | Typ | MAX | UNIT |
|---|---------------------|--|-----|-----|------|------|
| Drain-source Breakdown Voltage | BV _{DSS} | V _{GS} =0V, I _D =250μA | 650 | | | V |
| Gate Threshold Voltage | V _{GS(TH)} | V _{GS} =V _{DS} , I _D =250μA | 2.0 | | 4.0 | V |
| Drain-source Leakage Current | I _{DSS} | V _{DS} =650V, V _{GS} =0V | | | 1 | uA |
| Drain-Source Diode Forward Voltage | V _{SD} | V _{GS} =0V, I _S =11A | | | 1.5 | V |
| Gate-body Leakage Current (V _{DS} = 0) | I _{GSS} | V _{GS} =±30V | | | ±100 | nA |
| Forward Transconductance | G _{FS} | V _{DS} =10V I _D =11A | 3 | | | S |
| Static Drain-source On Resistance | R _{DS(ON)} | V _{GS} =10V, I _D =5.5A | | | 0.42 | Ω |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant in temperature etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings

Thermal Characteristics Ta=25°C

| PARAMETER | | Symbol | TYP | MAX | UNIT |
|-----------------------------|--------------|------------------|-----|-----|------|
| Maximum Junction-to-case | TO252 | R _{QJC} | | 2.5 | °C/W |
| | TO220F,TO220 | | | 3.1 | °C/W |
| Maximum Junction-to-Ambient | TO252 | R _{QJA} | | 63 | °C/W |
| | TO220F,TO220 | | | 80 | °C/W |

Note1: Ensure that the channel temperature does not exceed 150°C

Note2: V_{DD}=50V, T_{ch}=25 °C(initial), I_{AS}=11A, R_g=25Ω

Note3: This transistor is sensitive to electrostatic and should be handled with care

Dynamic Characteristics Ta = 25 °C

| PARAMETER | Symbol | Test Condition | MIN | TYP | MAX | UNIT |
|------------------------------|------------------|--|-----|-----|-----|------|
| Input Capacitance | C _{iss} | V _{DS} =25V, V _{GS} =0V, f=1.0MHZ | | 680 | | pF |
| output Capacitance | C _{oss} | | | 240 | | pF |
| Reverse Transfer Capacitance | C _{rss} | | | 7 | | pF |

Switching Characteristics Ta=25 °C

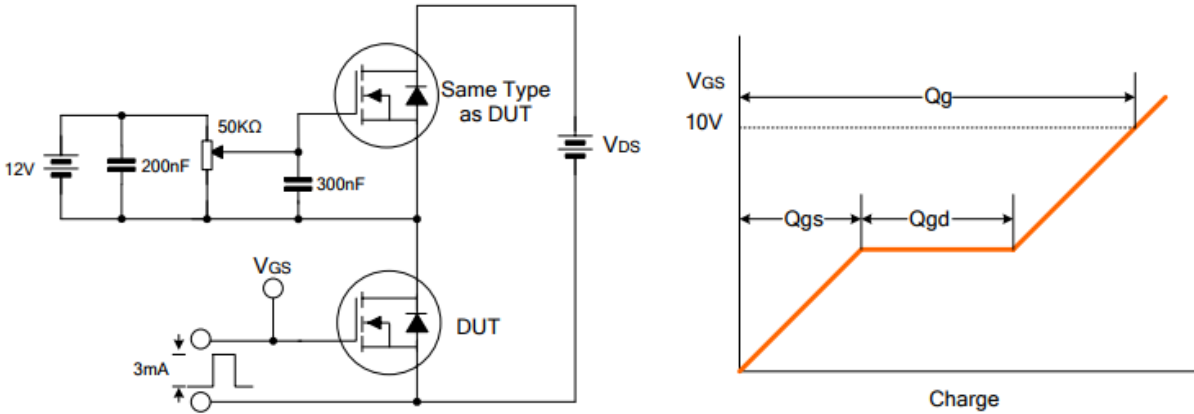
| PARAMETER | Symbol | Test Condition | MIN | TYP | MAX | UNIT |
|---------------------|---------------------|--|-----|-----|-----|------|
| Turn-On Delay Time | T _{d(on)} | V _{DS} =300V, I _D =11A, V _{GS} =10V, R _G =25Ω | | 15 | | nS |
| Turn-On Rise Time | T _r | | | 10 | | nS |
| Turn-Off Delay Time | T _{d(off)} | | | 110 | | nS |
| Turn-Off Rise Time | T _f | | | 9 | | nS |
| Total Gate Charge | Q _g | V _{DS} =480V, I _D =11A, V _{GS} =10V | | 39 | | nC |
| Gate-Source Charge | Q _{gs} | | | 4 | | nC |
| Gate-Drain Charge | Q _{gd} | | | 20 | | nC |

Drain-Source Diode Maximum Ratings and Characteristics Ta=25 °C

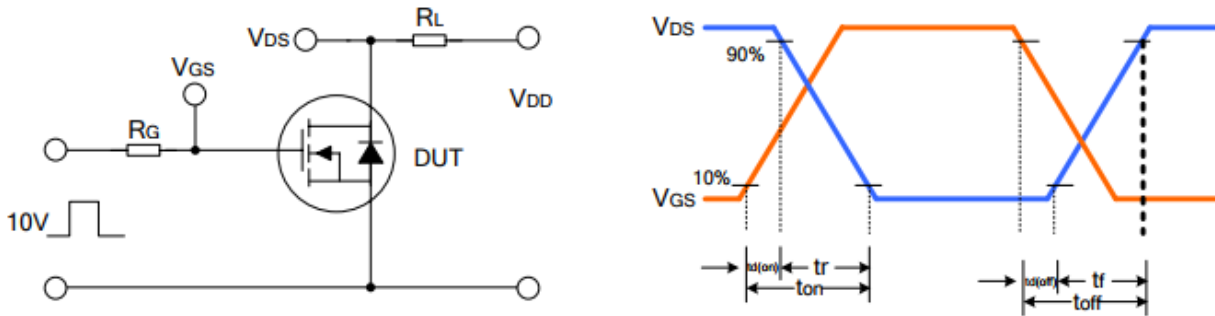
| PARAMETER | Symbol | Test Condition | MIN | TYP | MAX | UNIT |
|----------------------------|-----------------|--|-----|-----|-----|------|
| Max. Diode Forward Current | I _s | Integral Reverse P-N Junction Diode in the MOSFET | | | 11 | A |
| Pulsed Source Current | I _{sm} | | | | 45 | |
| Diode Forward Voltage | V _{SD} | V _{GS} =0V, I _s =11A | | 0 | 1.5 | V |
| Reverse Recovery Time | T _{rr} | V _{GS} =0V, I _s =11A, dI _F /dt=100A/μs | | 280 | | nS |
| Reverse Recovery Charge | Q _{rr} | | | | 3 | |

Test Circuit

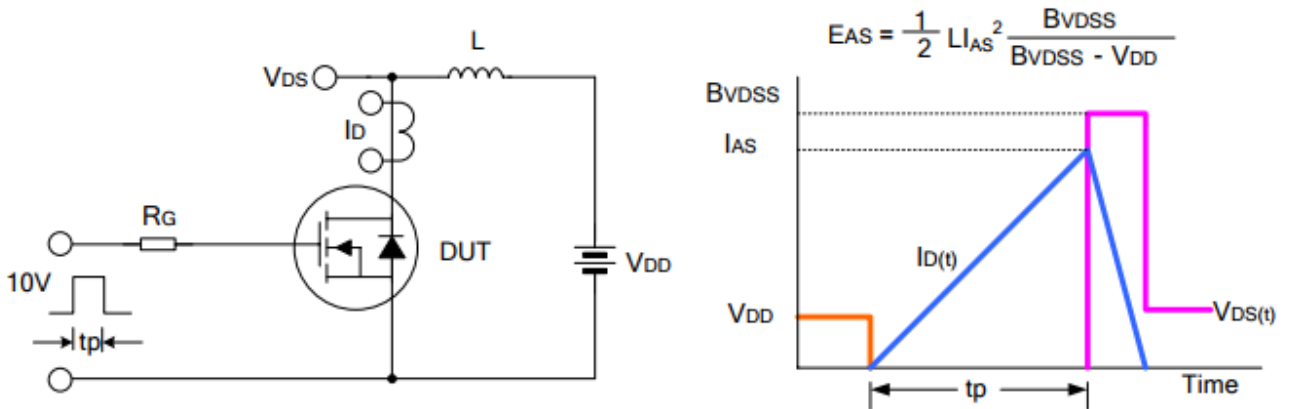
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform



Typical Characteristics Curve

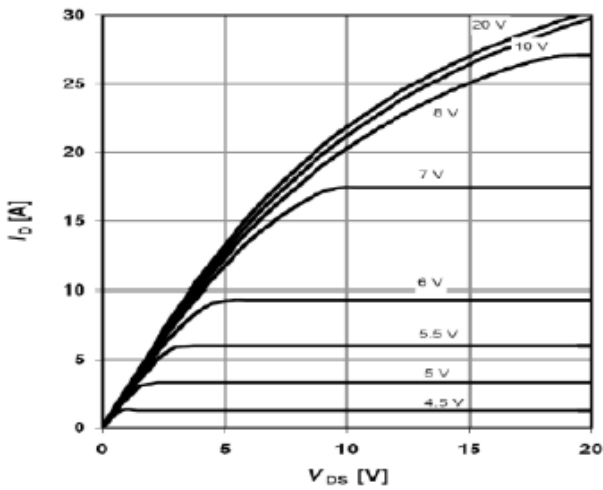


Figure 1: Output Characteristics

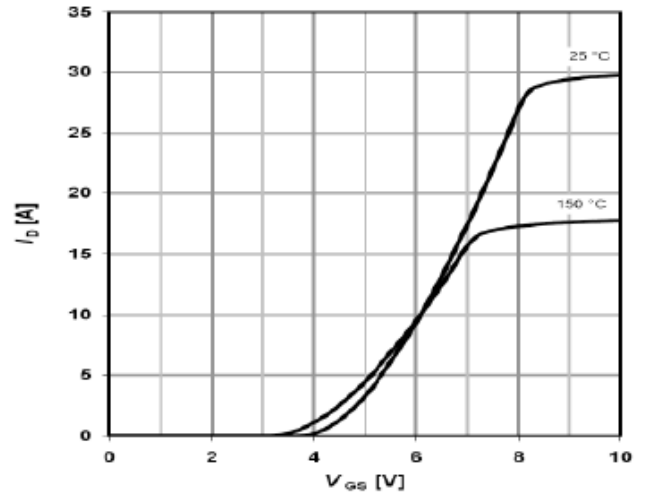


Figure 2: Transfer Characteristics

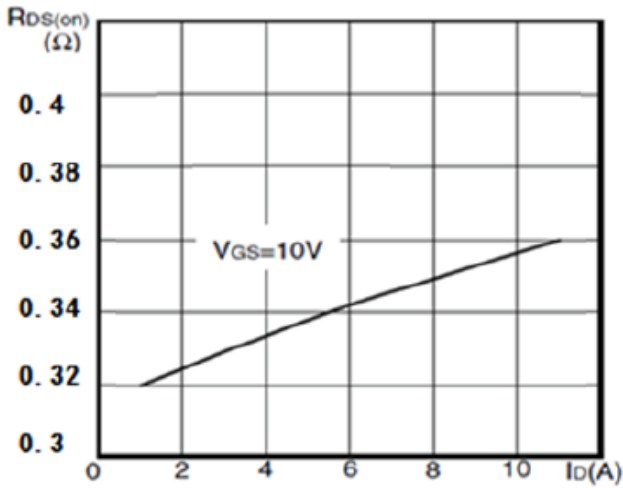


Figure 3: On Resistance Vs Drain Current

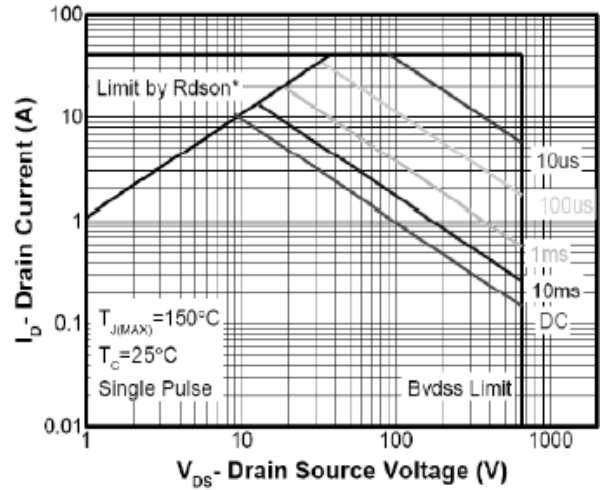


Figure 4: Safe Operating Area

Operating Area

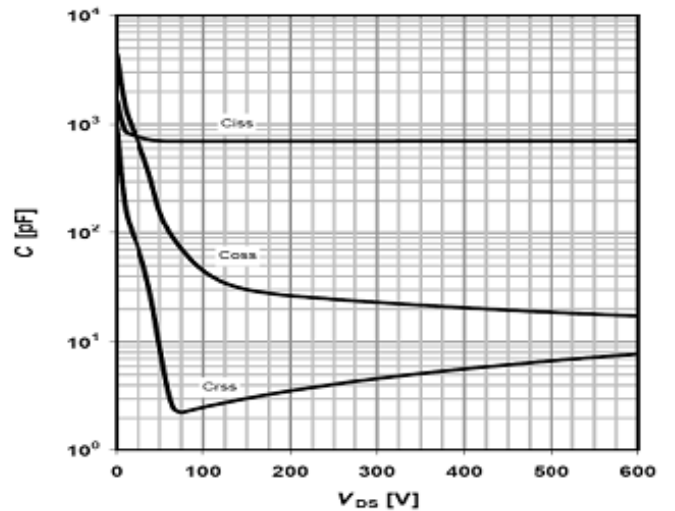
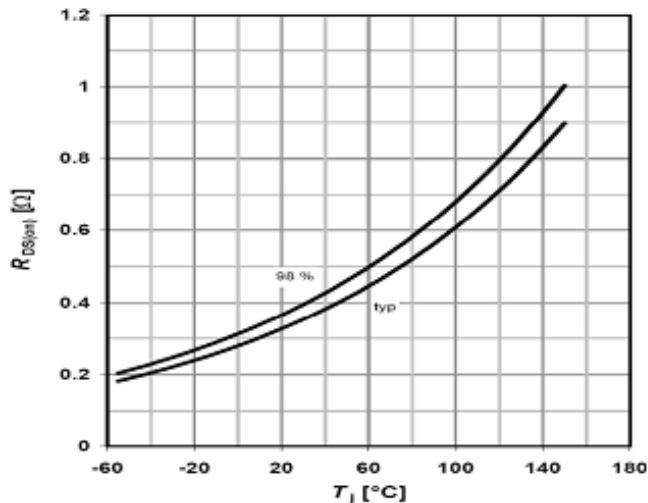


Figure5: On Resistance Vs Junction Temperature Characteristics

Figure6: Capacitance

Typical Characteristics Curve

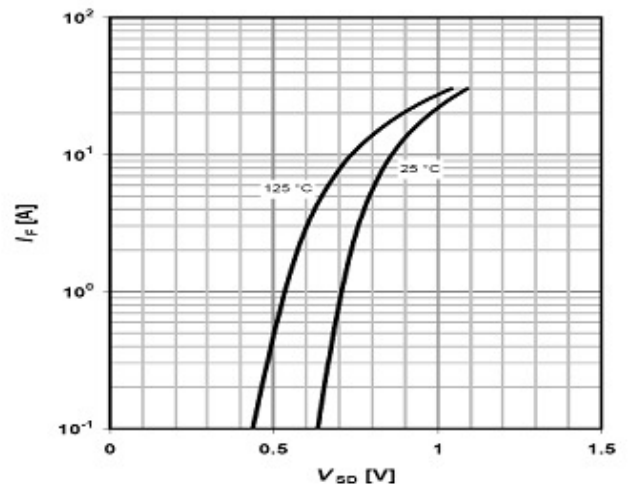
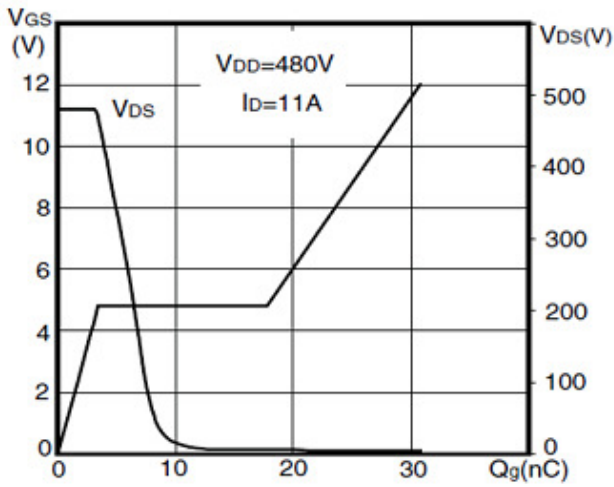


Figure7: Gate Charge Waveform
Diode Forward Voltage

Figure8: Source-Drain

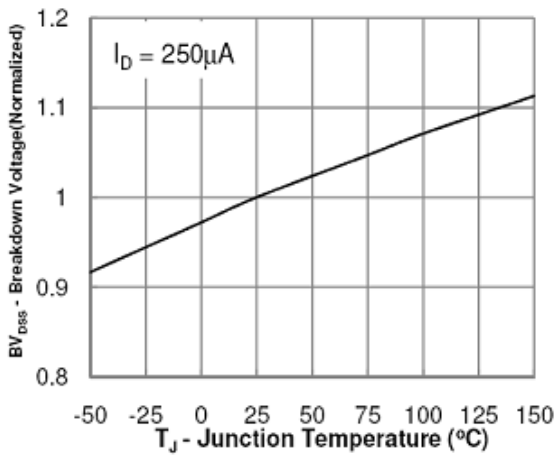
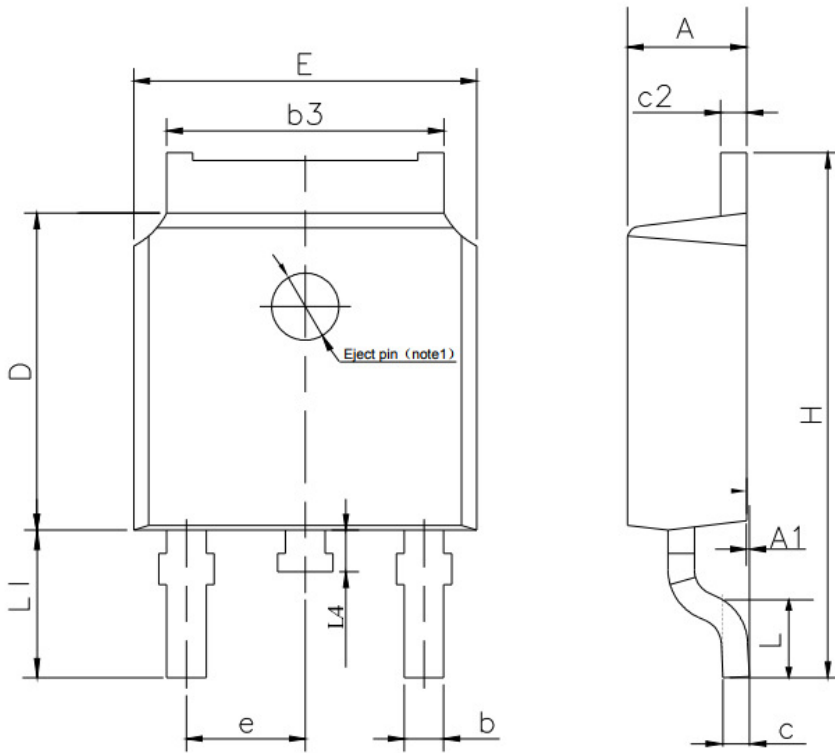


Figure9: Breakdown Voltage Vs Junction Temperature

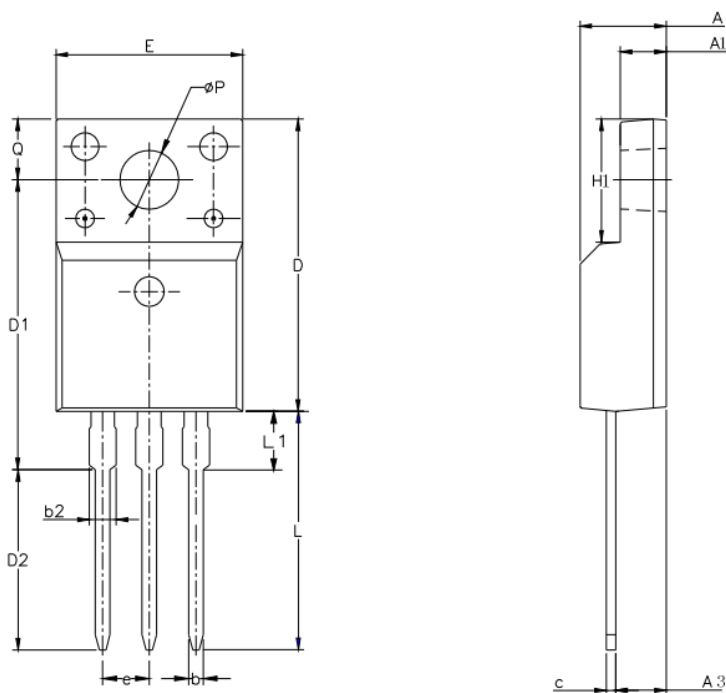
Note: The above characteristics curves are presented for reference only and not guaranteed by production test unless otherwise noted

Outline Information (TO252-2L)



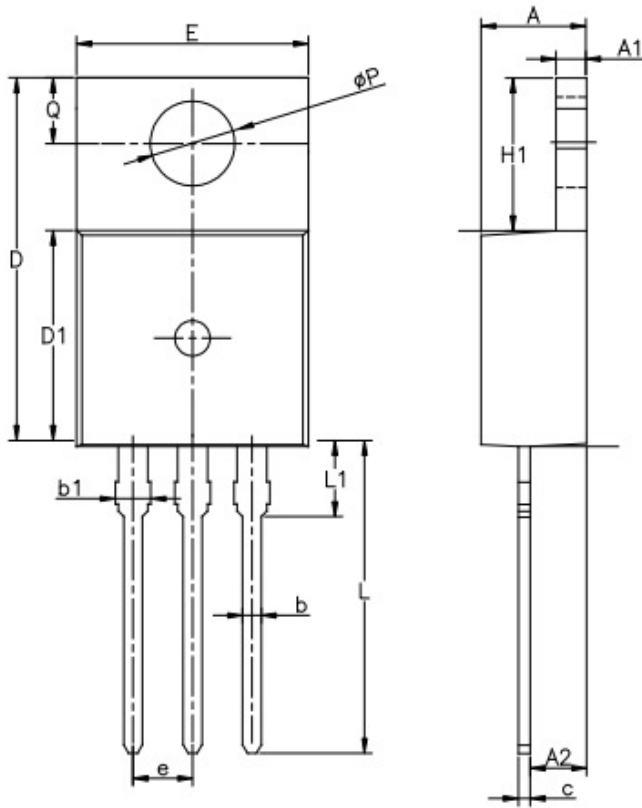
| SYMBOL | MIN | NOM | MAX |
|--------|---------|-------|-------|
| A | 2.10 | 2.30 | 2.50 |
| A1 | 0 | --- | 0.127 |
| b | 0.66 | 0.76 | 0.89 |
| b3 | 5.10 | 5.33 | 5.46 |
| c | 0.45 | --- | 0.65 |
| c2 | 0.45 | --- | 0.65 |
| D | 5.80 | 6.10 | 6.40 |
| E | 6.30 | 6.60 | 6.90 |
| e | 2.30TYP | | |
| H | 9.60 | 10.10 | 10.60 |
| L | 1.40 | 1.50 | 1.70 |
| L1 | 2.90REF | | |
| L4 | 0.60 | 0.80 | 1.00 |

Outline Information (TO220-3L)



| SYMBOL | MIN | NOM | MAX |
|----------|---------|-------|-------|
| A | 4.42 | 4.70 | 5.02 |
| A1 | 2.30 | 2.54 | 2.80 |
| A3 | 2.50 | 2.76 | 3.10 |
| b | 0.70 | 0.80 | 0.90 |
| b2 | — | — | 1.47 |
| c | 0.35 | 0.50 | 0.65 |
| D | 15.25 | 15.87 | 16.25 |
| D1 | 15.30 | 15.75 | 16.30 |
| D2 | 9.30 | 9.80 | 10.30 |
| E | 9.73 | 10.16 | 10.36 |
| e | 2.54BCS | | |
| H1 | 6.40 | 6.68 | 7.00 |
| L | 12.48 | 12.98 | 13.48 |
| L1 | / | / | 3.50 |
| ϕP | 3.00 | 3.18 | 3.40 |
| Q | 3.05 | 3.30 | 3.55 |

Outline Information (TO220F-3L)



| SYMBOL | MIN | NOM | MAX |
|----------|---------|-------|-------|
| A | 4.30 | 4.50 | 4.70 |
| A1 | 1.00 | 1.30 | 1.50 |
| A2 | 1.80 | 2.40 | 2.80 |
| b | 0.60 | 0.80 | 1.00 |
| b1 | 1.00 | — | 1.60 |
| c | 0.30 | — | 0.70 |
| D | 15.10 | 15.70 | 16.10 |
| D1 | 8.10 | 9.20 | 10.00 |
| E | 9.60 | 9.90 | 10.40 |
| e | 2.54BSC | | |
| H1 | 6.10 | 6.50 | 7.00 |
| L | 12.60 | 13.08 | 13.60 |
| L1 | — | — | 3.95 |
| ΦP | 3.40 | 3.70 | 3.90 |
| Q | 2.60 | — | 3.20 |