

General Description

The Sanrise SRC60R420 is a high voltage power MOSFET, fabricated using advanced super junction technology. The resulting device has extremely low on resistance, low gate charge and fast switching time, making it especially suitable for applications which require superior power density and outstanding efficiency.

The SRC60R420 break down voltage is 600V and it has a high rugged avalanche characteristics.

The SRC60R420 is available in TO-251, TO-252, TO-263-2, TO-220C and TO-220F packages.

Features

- Ultra Low $R_{DS(ON)} = 420m\Omega @ V_{GS} = 10V$.
- Ultra Low Gate Charge, $Q_g = 14.3nC$ typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved

Application

- TV Power
- High Performance Charger / Adapter
- LED Lighting Power

Symbol

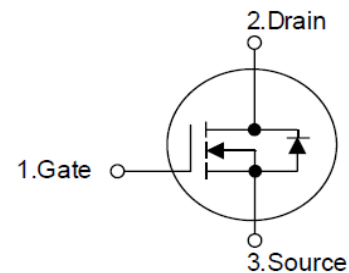


Figure 1 Symbol of SRC60R420

Package Type

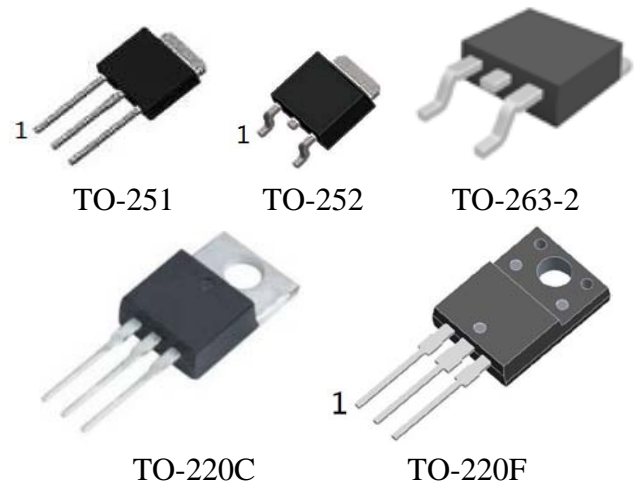


Figure 2 Package Types of SRC60R420

Ordering Information

| | | | | |
|--------------|--------------|---------------|-----------------|--------------|
| Circuit Type | | SRC60R420□□-□ | | E: Lead Free |
| Package | | | G: Green | |
| | D1: TO-251 | | Blank: Tube | |
| | D: TO-252 | | TR: Tape & Reel | |
| | S2: TO-263-2 | | | |
| | TC: TO-220C | | | |
| | TF: TO-220F | | | |

| Package | Part Number | | Marking ID | | Packing Type |
|----------|-----------------|-----------------|--------------|--------------|--------------|
| | Lead Free | Green | Lead Free | Green | |
| TO-251 | SRC60R420D1-E | SRC60R420D1-G | SRC60R420D1E | SRC60R420D1G | Tube |
| TO-252 | SRC60R420DTR-E | SRC60R420DTR-G | SRC60R420DE | SRC60R420DG | Tape & Reel |
| TO-263-2 | SRC60R420S2TR-E | SRC60R420S2TR-G | SRC60R420S2E | SRC60R420S2G | Tape & Reel |
| TO-220C | SRC60R420TC-E | SRC60R420TC-G | SRC60R420TCE | SRC60R420TCG | Tube |
| TO-220F | SRC60R420TF-E | SRC60R420TF-G | SRC60R420TFE | SRC60R420TFG | Tube |

Absolute Maximum Ratings

| Parameter | | Symbol | Rating | Unit |
|---|--------------------|---------------|------------|------|
| Drain-Source Voltage | | V_{DSS} | 630 | V |
| Gate-Source Voltage | | V_{GSS} | ±30 | V |
| Continuous Drain Current | $T_C=25^{\circ}C$ | I_D | 9.3 | A |
| | $T_C=125^{\circ}C$ | | 4.1 | |
| Pulsed Drain Current (Note 2) | | I_{DM} | 28.0 | A |
| Avalanche Energy, Single Pulse (Note 3) | | E_{AS} | 160 | mJ |
| Avalanche Energy, Repetitive (Note 2) | | E_{AR} | 0.3 | mJ |
| Avalanche Current, Repetitive (Note 2) | | I_{AR} | 3.0 | A |
| Continuous Diode Forward Current | | I_S | 9.3 | A |
| Diode Pulse Current | | $I_{S,PULSE}$ | 28.0 | A |
| Operating Junction Temperature | | T_J | 150 | °C |
| Storage Temperature | | T_{STG} | -55 to 150 | °C |
| Lead Temperature (Soldering, 10 sec) | | T_{LEAD} | 300 | °C |

Note:

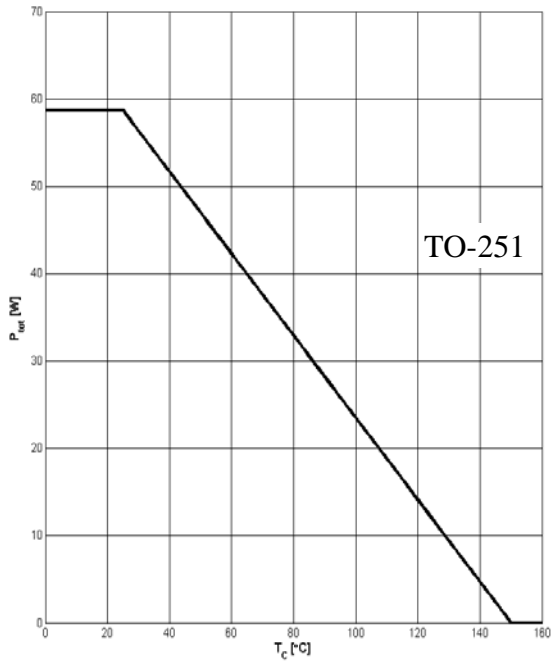
- Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
- Repetitive Rating: Pulse width limited by maximum junction temperature
- $I_{AS} = 3.0A$, $V_{DD} = 60V$, $R_G = 25\Omega$, Starting $T_J = 25^{\circ}C$

Electrical Characteristics
 $T_J = 25^{\circ}\text{C}$, unless otherwise specified.

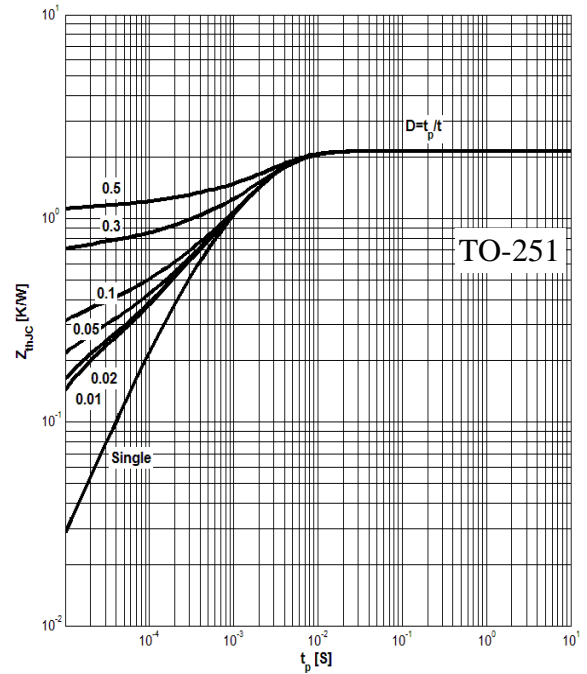
| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---------------|---|-----|------|------|---------|
| Statistic Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 600 | | | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=600V, V_{GS}=0V$ | | | 1 | μA |
| Gate-Body Leakage Current | Forward | $I_{GSSF}, V_{GS}=30V, V_{DS}=0V$ | | | 100 | nA |
| | Reverse | $I_{GSSR}, V_{GS}=-30V, V_{DS}=0V$ | | | -100 | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2.5 | 3.4 | 4.3 | V |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=4.5A$ | | 340 | 420 | mΩ |
| Gate Resistance | R_G | f=1MHz, Open Drain | | 2.83 | | Ω |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS}=50V, V_{GS}=0V, f=1MHz$ | | 556 | | pF |
| Output Capacitance | C_{OSS} | | | 152 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 8.0 | | |
| Effective output capacitance, energy related ^{NOTE4} | $C_{O(er)}$ | $V_{GS}=0V, V_{DS}=0\dots 480V$ | | 61 | | pF |
| Effective output capacitance, time related ^{NOTE5} | $C_{O(tr)}$ | | | 162 | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=400V, I_D=4.5A, R_G=10\Omega, V_{GS}=10V$ | | 8 | | ns |
| Rise Time | t_r | | | 16 | | |
| Turn-off Delay Time | $t_{d(off)}$ | | | 12 | | |
| Fall Time | t_f | | | 18 | | |
| Gate Charge Characteristics | | | | | | |
| Gate to Source Charge | Q_{gs} | $V_{DD}=480V, I_D=4.5A, V_{GS}=0 \text{ to } 10V$ | | 4.1 | | nC |
| Gate to Drain Charge | Q_{gd} | | | 5.5 | | |
| Gate Charge Total | Q_g | | | 14.3 | | |
| Gate Plateau Voltage | $V_{plateau}$ | | | 5.4 | | V |
| Reverse Diode Characteristics | | | | | | |
| Drain-Source Diode Forward Voltage | V_{SD} | $V_{GS}=0V, I_{SD}=4.5A$ | | 0.84 | 1.1 | V |
| Reverse Recovery Time | t_{rr} | $V_R=400V, I_F=4.5A, dI_F/dt=100A/\mu s$ | | 244 | | ns |
| Reverse Recovery Charge | Q_{rr} | | | 2.34 | | μC |
| Peak Reverse Recovery Current | I_{rrm} | | | 19 | | A |

Note:

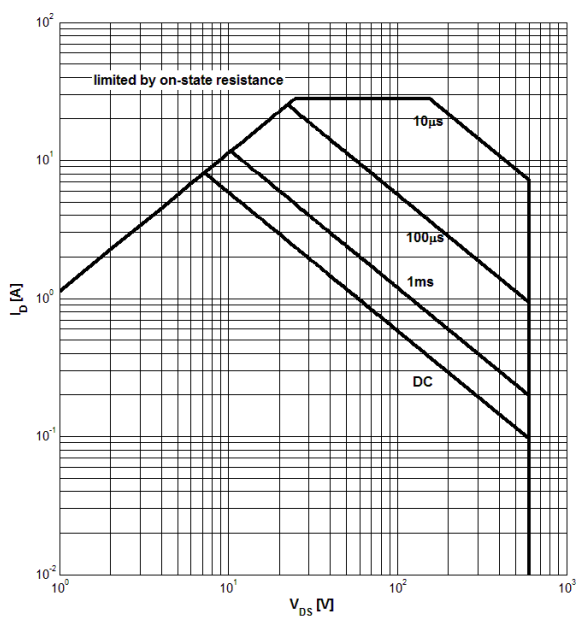
- $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 480V
- $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 480V

Typical Performance Characteristics
Figure 1: Power Dissipation


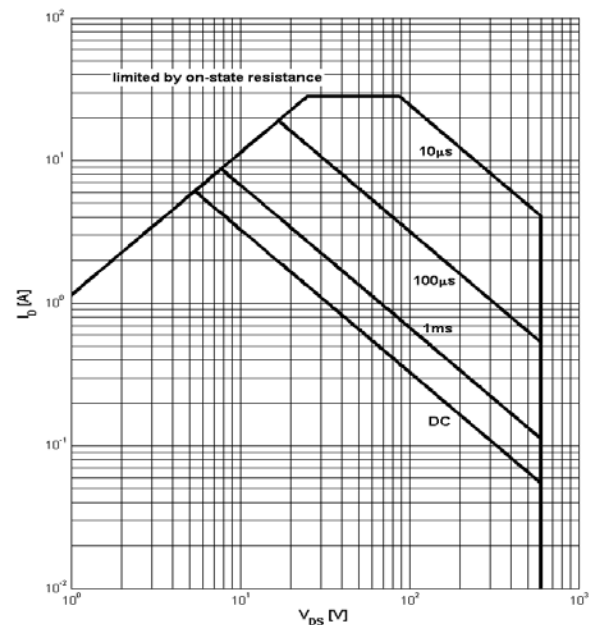
$$P_{tot} = f(T_c)$$

Figure 2: Max. Transient Thermal Impedance


$$Z_{(th)C} = f(t_p); \text{ parameter: } D = t_p/T$$

Figure 3: Safe Operating Area


$$I_D = f(V_{DS}); T_c = 25^\circ\text{C}; V_{GS} > 7\text{V}; \text{ parameter } t_p$$

Figure 4: Safe Operating Area


$$I_D = f(V_{DS}); T_c = 80^\circ\text{C}; V_{GS} > 7\text{V}; \text{ parameter } t_p$$

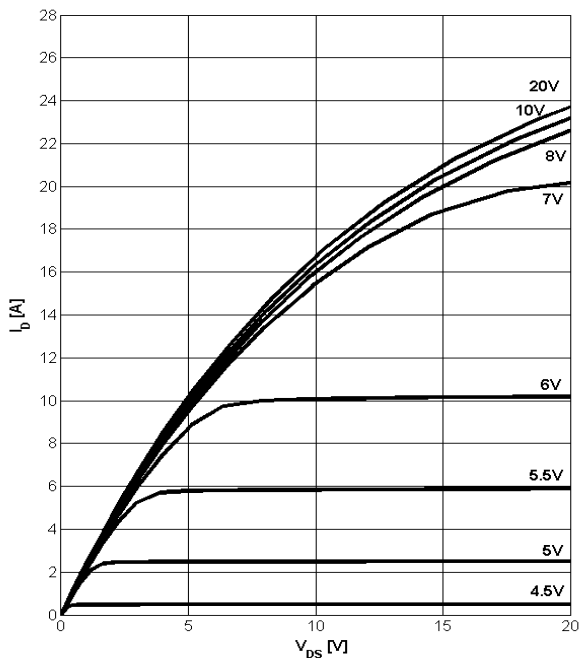
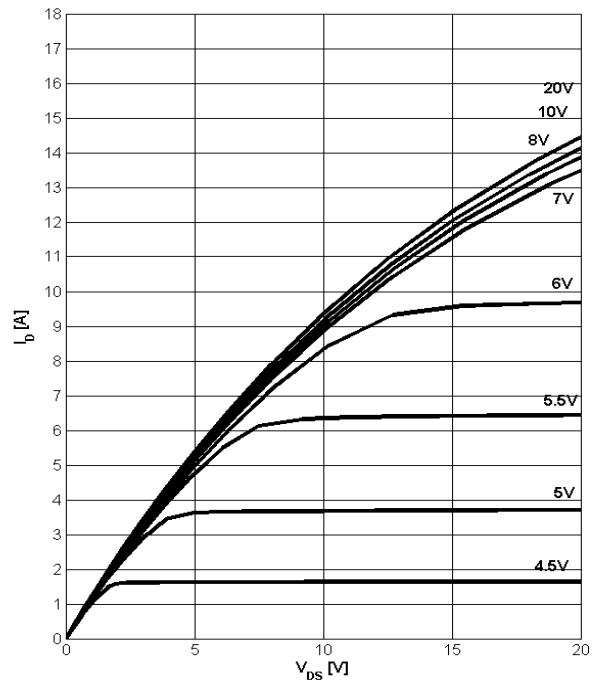
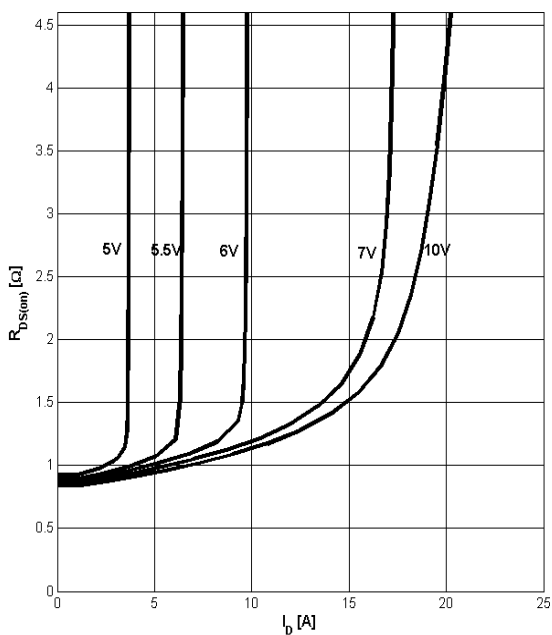
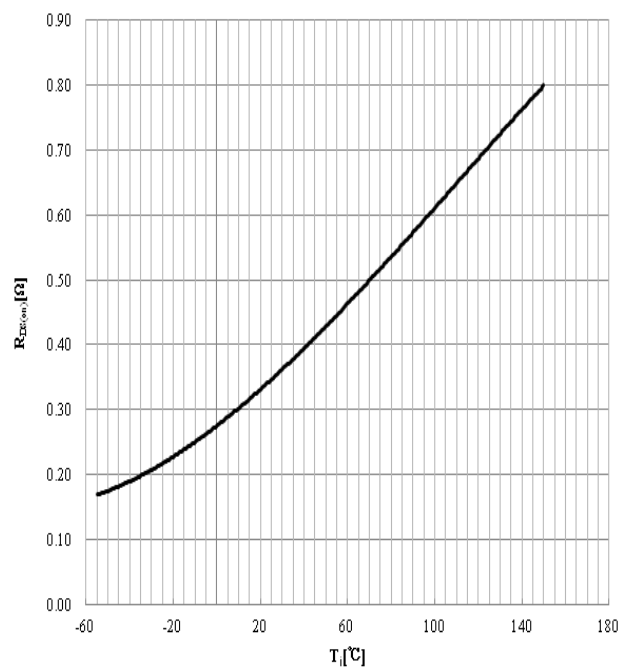
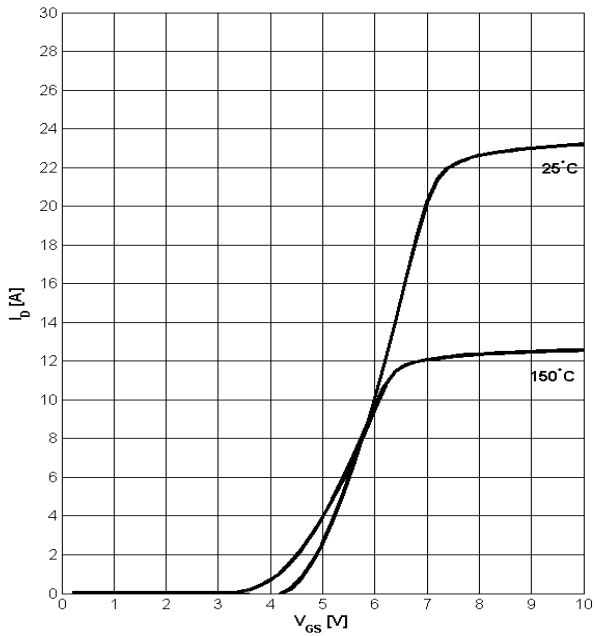
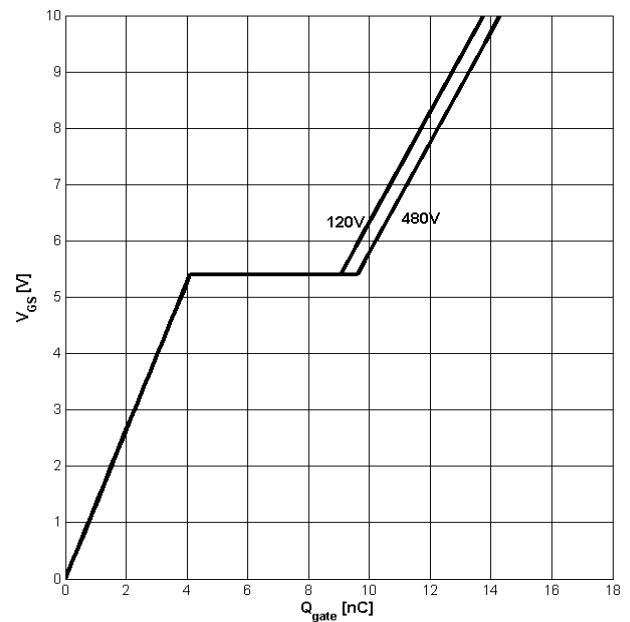
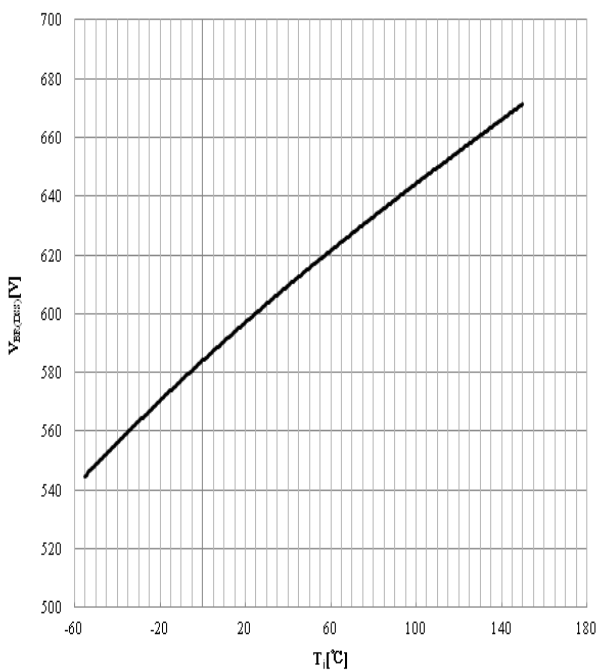
Figure 5: Typ. Output Characteristics

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 6: Typ. Output Characteristics

 $I_D = f(V_{DS}); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 7: Typ. Drain-Source On-State Resistance

 $R_{DS(ON)} = f(I_D); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 8: Typ. Drain-Source On-State Resistance

 $R_{DS(ON)} = f(T_j); I_D = 4.5\text{A}; V_{GS} = 10\text{V}$

Figure 9: Typ. Transfer Characteristics


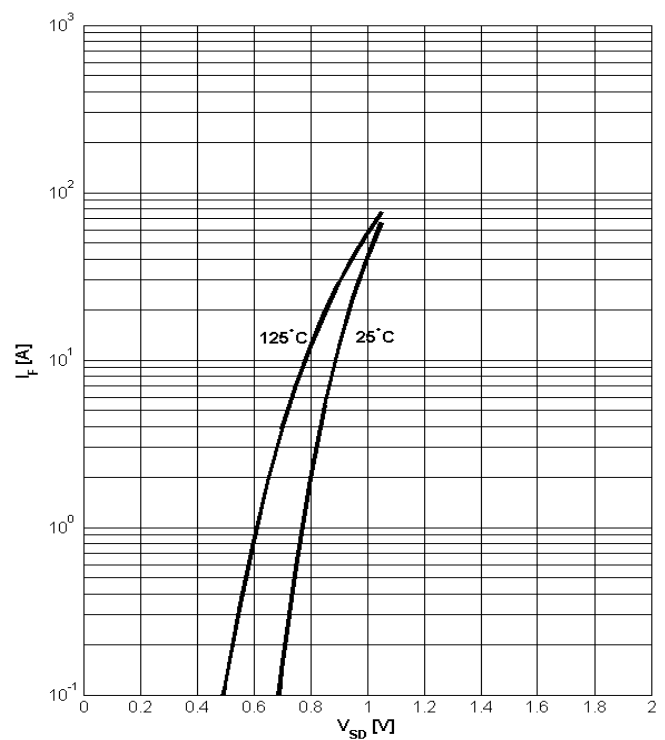
$$I_D = f(V_{GS}); V_{DS} = 20V$$

Figure 10: Typ. Gate Charge


$$V_{GS} = f(Q_{gate}), I_D = 4.5A \text{ pulsed}$$

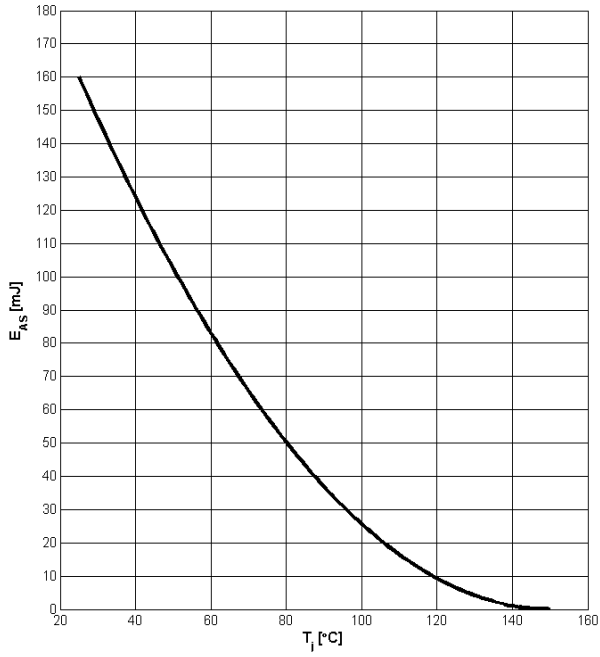
Figure 11: Drain-Source Breakdown Voltage


$$V_{BR(DSS)} = f(T_j); I_D = 1mA$$

Figure 12: Forward Characteristics of Reverse Diode


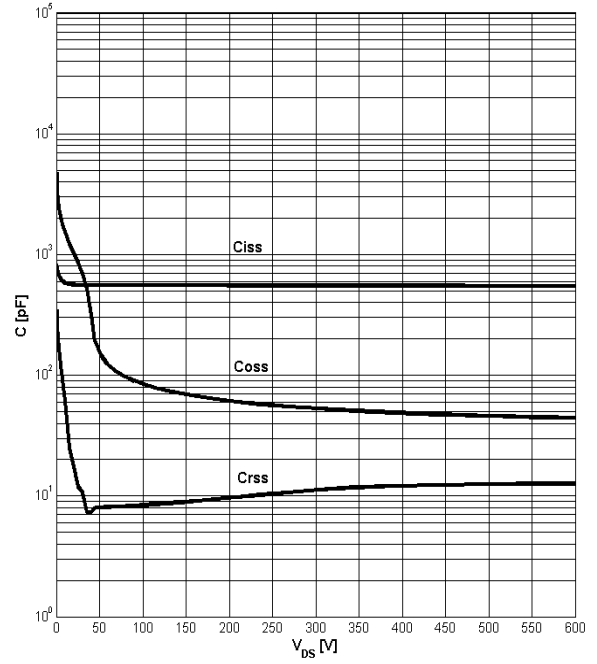
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

Figure 13: Avalanche Energy



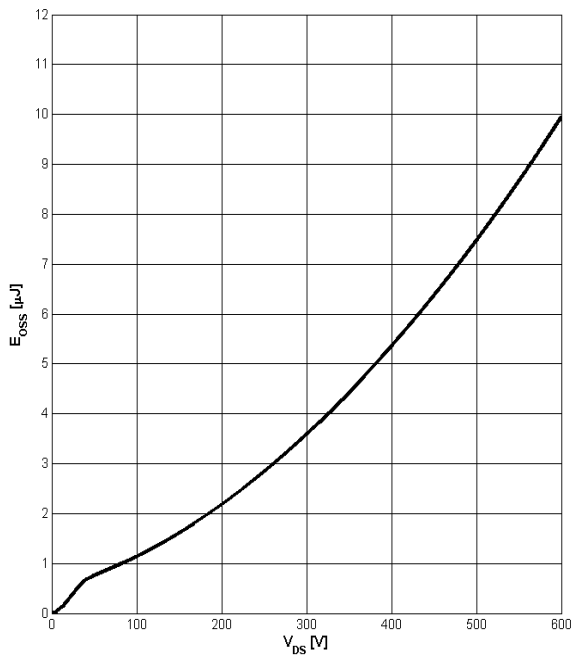
$E_{AS}=f(T_j); I_D=3.0A; V_{DD}=60V$

Figure 14: Typ. Capacitances

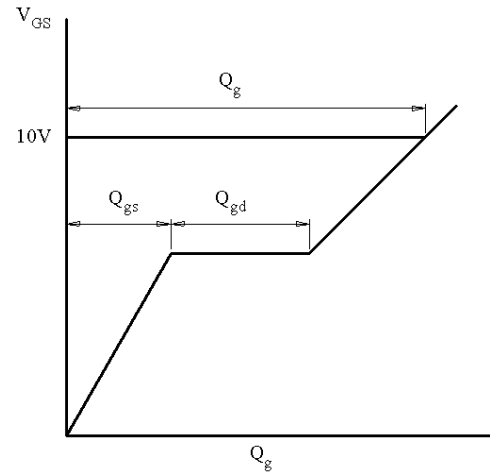
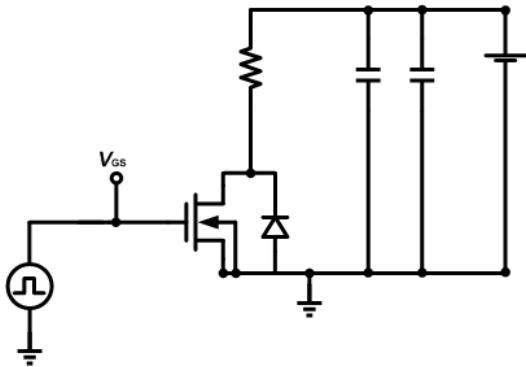
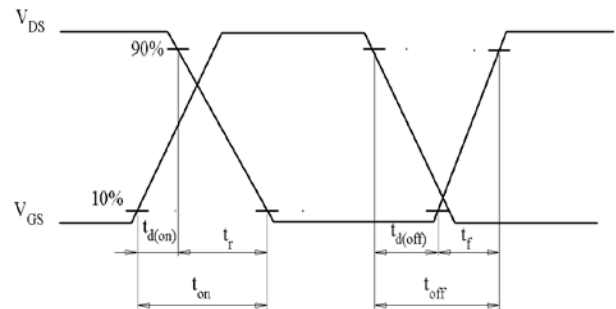
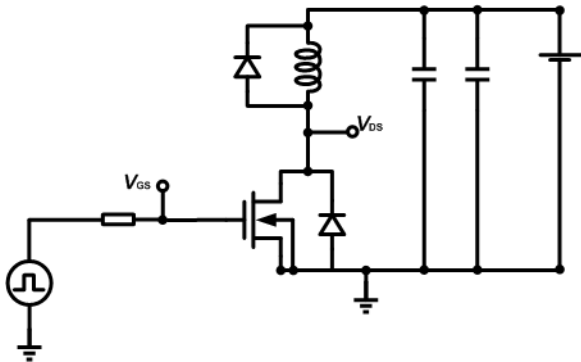
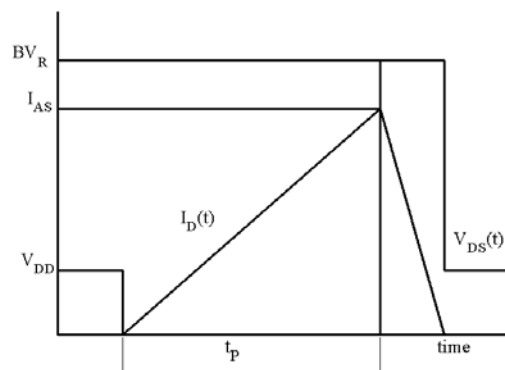
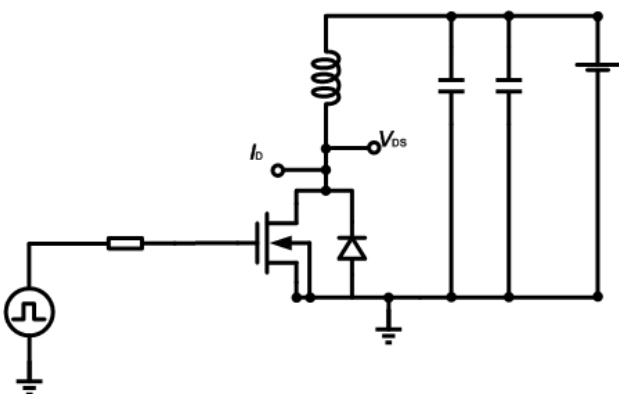


$C=f(V_{DS}); V_{GS}=0; f=1MHz$

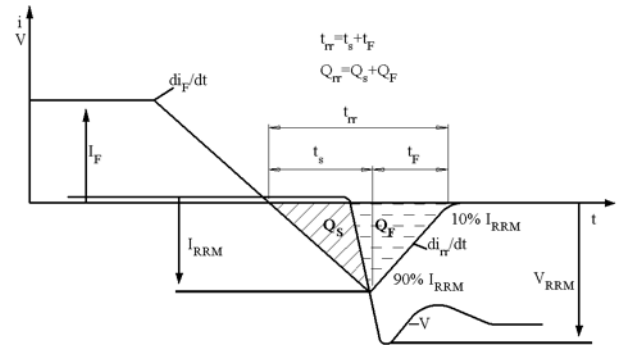
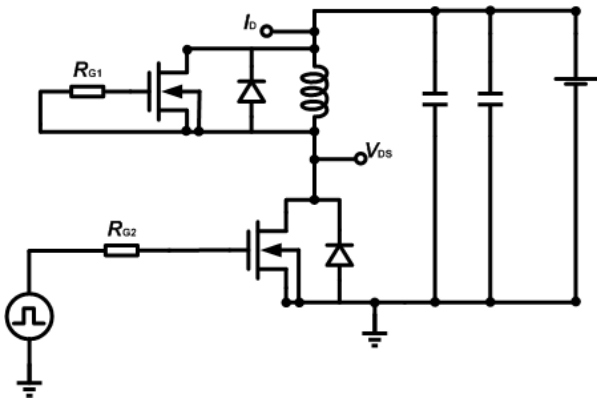
Figure 15: C_{OSS} Stored Energy

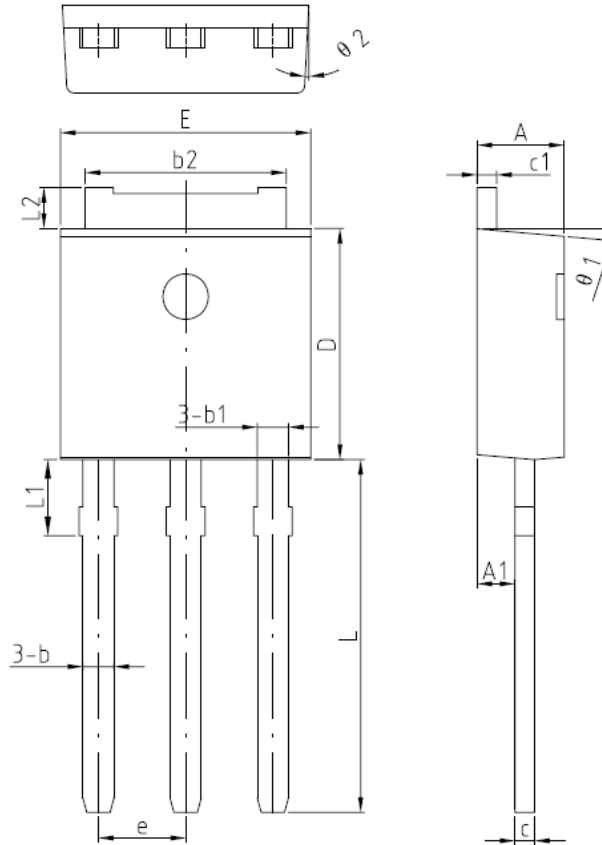


$E_{OSS}=f(V_{DS})$

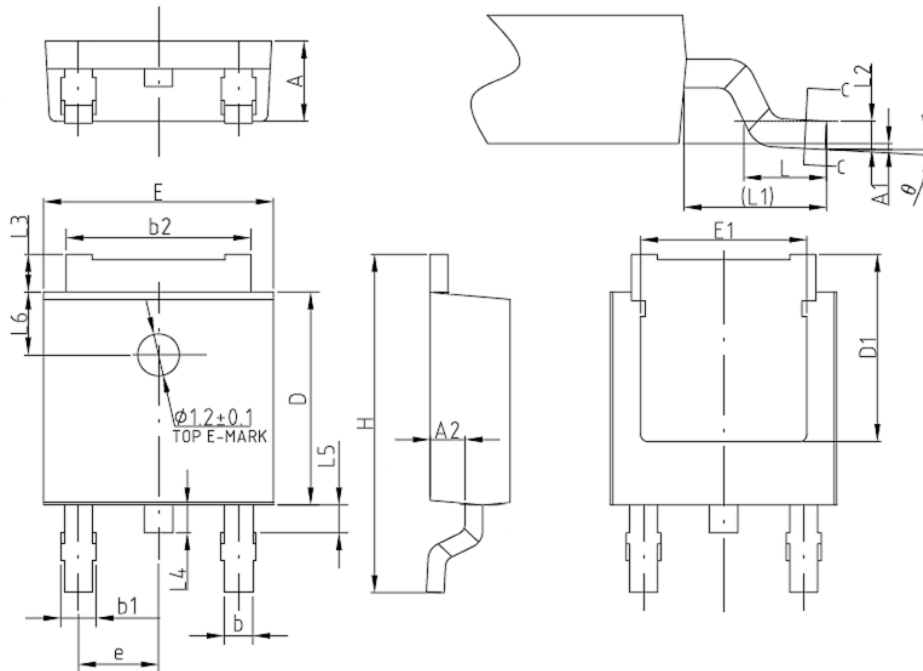
Test Circuits
1. Gate Charge Test Circuit & Waveform

2. Switch Time Test Circuit

3. Unclaimed Inductive Switching Test Circuit & Waveforms


4. Test Circuit and Waveform for Diode Characteristics

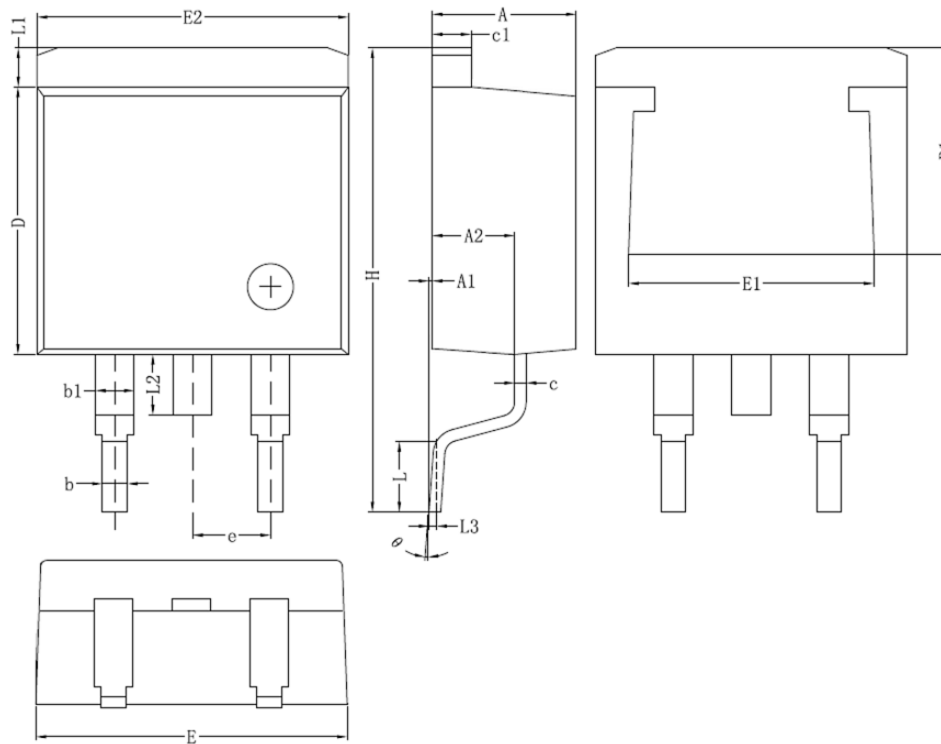


Mechanical Dimensions
TO-251
Unit: mm


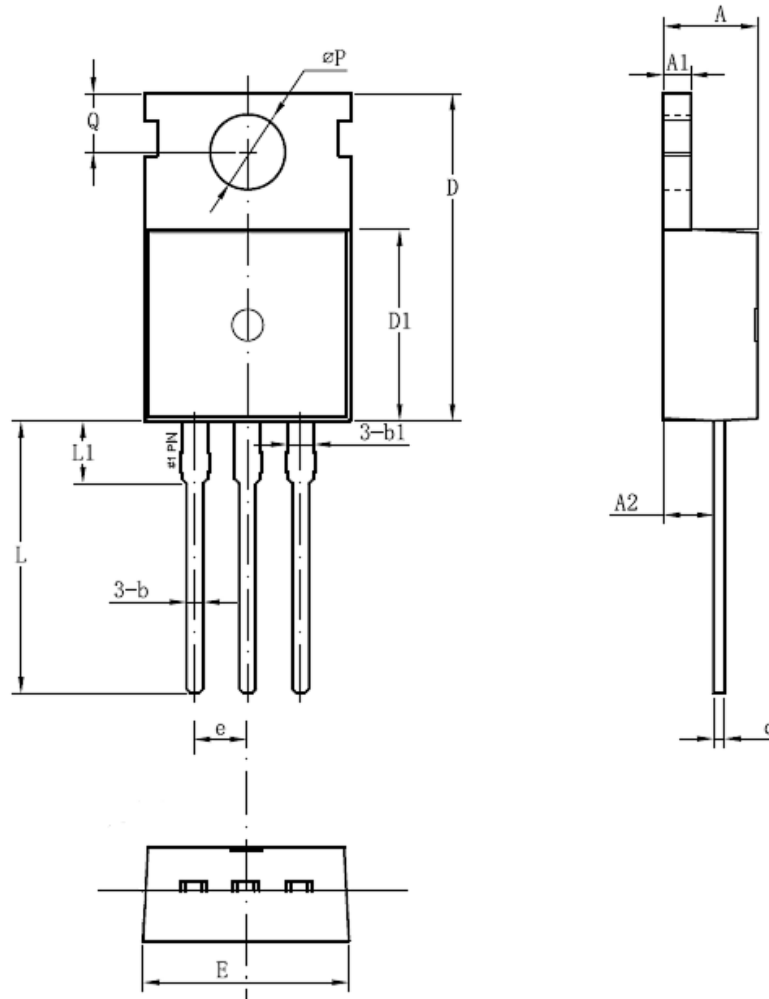
| Symbol | Dimensions(mm) | | |
|--------|----------------|------|------|
| | Min. | Typ. | Max. |
| A | 2.20 | 2.30 | 2.40 |
| A1 | 0.90 | 1.01 | 1.17 |
| b | 0.50 | - | 0.91 |
| b1 | - | 0.81 | - |
| b2 | 5.13 | 5.33 | 5.46 |
| c | 0.46 | 0.50 | 0.60 |
| c1 | 0.46 | 0.50 | 0.60 |
| D | 5.95 | 6.10 | 6.25 |
| E | 6.45 | 6.60 | 6.75 |
| e | 2.286(BSC) | | |
| L | 9.00 | 9.30 | 9.60 |
| L1 | - | 2.00 | - |
| L2 | 0.90 | - | 1.25 |
| θ1 | - | 5° | - |
| θ2 | - | 3° | - |

Mechanical Dimensions (Continued)
TO-252
Unit: mm


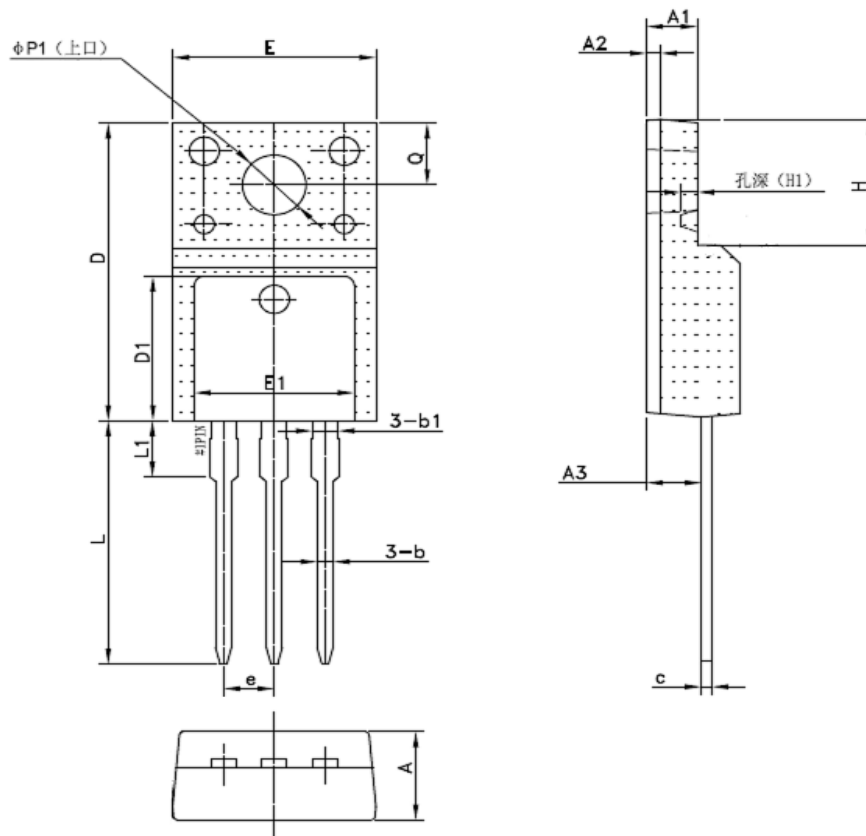
| Symbol | Dimensions(mm) | | |
|--------|----------------|-------|-------|
| | Min. | Typ. | Max. |
| A | 2.20 | 2.30 | 2.40 |
| A1 | 0 | - | 0.10 |
| A2 | 0.90 | 1.00 | 1.17 |
| b | 0.70 | 0.76 | 0.90 |
| b1 | 0.77 | - | 1.10 |
| b2 | 5.13 | 5.33 | 5.46 |
| c | 0.45 | - | 0.60 |
| D | 5.95 | 6.10 | 6.25 |
| D1 | - | 5.30 | - |
| E | 6.45 | 6.60 | 6.75 |
| E1 | - | 4.80 | - |
| e | 2.286(BSC) | | |
| H | 9.70 | 10.10 | 10.40 |
| L | 1.25 | 1.50 | 1.75 |
| L1 | - | 2.90 | - |
| L2 | - | 0.51 | - |
| L3 | 0.90 | - | 1.25 |
| L4 | - | 0.80 | - |
| L5 | - | 1.00 | - |
| L6 | - | 1.80 | - |
| θ | 0° | - | 8° |

Mechanical Dimensions (Continued)
TO-263-2
Unit: mm


| Symbol | Dimensions(mm) | | |
|--------|----------------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.30 | 4.60 | 4.85 |
| A1 | 0.00 | 0.10 | 0.25 |
| A2 | 2.59 | 2.69 | 2.89 |
| b | 0.70 | 0.81 | 0.96 |
| b1 | - | 1.27 | - |
| c | 0.36 | 0.40 | 0.61 |
| c1 | 1.15 | 1.27 | 1.40 |
| D | 8.55 | - | 9.40 |
| D1 | 6.40 | - | - |
| E | 9.80 | 10.10 | 10.31 |
| E1 | 7.60 | - | - |
| E2 | 9.80 | 10.00 | 10.20 |
| e | 2.54(BSC) | | |
| H | 14.70 | 15.20 | 16.00 |
| L | 2.00 | 2.30 | 2.84 |
| L1 | 1.00 | 1.27 | 1.40 |
| L2 | - | - | 2.20 |
| L3 | - | 0.25 | - |
| θ | 0° | - | 8° |

Mechanical Dimensions (Continued)
TO-220C
Unit: mm


| Symbol | Dimensions(mm) | | |
|----------|----------------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.30 | 4.50 | 4.70 |
| A1 | 1.20 | 1.30 | 1.40 |
| A2 | 2.20 | 2.40 | 2.60 |
| b | 0.70 | 0.80 | 0.95 |
| b1 | - | 1.27 | - |
| c | 0.40 | 0.50 | 0.65 |
| D | 15.20 | 15.70 | 16.20 |
| D1 | 9.00 | 9.20 | 9.40 |
| E | 9.70 | 10.00 | 10.20 |
| e | 2.54(BSC) | | |
| L | 12.60 | 13.08 | 13.60 |
| L1 | - | 3.00 | - |
| ϕP | 3.50 | 3.60 | 3.80 |
| Q | 2.60 | 2.80 | 3.00 |

Mechanical Dimensions (Continued)
TO-220F
Unit: mm


| Symbol | Dimensions(mm) | | |
|--------|----------------|--------|-------|
| | Min. | Typ. | Max. |
| A | 4.30 | 4.70 | 4.90 |
| A1 | 2.34 | 2.54 | 2.90 |
| A2 | - | 0.70 | - |
| A3 | 2.56 | 2.76 | 2.96 |
| b | 0.55 | - | 0.95 |
| b1 | - | 1.28 | - |
| c | 0.42 | 0.50 | 0.70 |
| D | 14.70 | - | 16.07 |
| D1 | - | 7.70 | - |
| E | 9.96 | 10.16 | 10.36 |
| E1 | - | 8.00 | - |
| e | 2.54(BSC) | | |
| H | - | 6.70 | - |
| (H1) | - | (0.81) | - |
| L | 12.48 | 12.98 | 13.50 |
| L1 | - | 2.93 | - |
| ΦP1 | - | 3.18 | - |
| Q | 2.90 | 3.30 | 3.50 |



Sanrise Technology Limited Company

<http://www.sanrise-tech.com>

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