

700V N-Channel Super-Junction MOSFET Gen- II

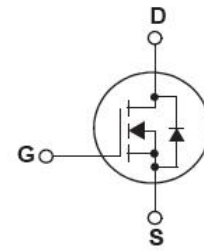
Description

SJ-FET is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.

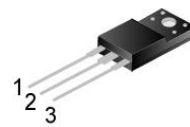
This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand .

extreme dv/dt rate and higher avalanche energy.

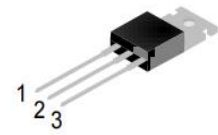
SJ-FET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency.



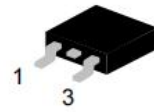
1.Gate 2.Drain 3.Source



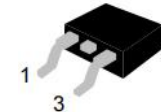
TO-220F-



TO-220-3L



TO-252-2L



TO-263-2

Features

- Multi-Epi process SJ-FET
- 750V @T_J = 150 °C
- Typ. RDS(on) = 0.55Ω
- Ultra Low Gate Charge (typ. Q_g = 13.6nC)
- 100% avalanche tested



Package Marking and Ordering Information:

| Marking | Package | Part # | Hazardous Substance Control | Packing |
|-----------|------------|-----------|-----------------------------|---------|
| SR70R650F | T0-220F-3L | SR70R650F | Pb free | Tube |
| SR70R650T | T0-220-3L | SR70R650T | Pb free | Tube |
| SR70R650D | T0-252-2L | SR70R650D | Halogen free | Reel |
| SR70R650S | T0-263-2L | SR70R650S | Halogen free | Reel |

Absolute Maximum Ratings

| Symbol | Parameter | SR70R650T/D/S | SR70R650F | Unit |
|-----------|---|---------------|-----------|------|
| VDSS | Drain-Source Voltage | 700 | | V |
| ID | Drain Current-Continuous (TC = 25°C) | 7.8* | | A |
| | -Continuous (TC = 100°C) | 4.9* | | |
| IDM | Drain Current - Pulsed (Note 1) | 31.2 | | A |
| VGSS | Gate-Source voltage | ±30 | | V |
| EAS | Single Pulsed Avalanche Energy (Note 2) | 106 | | mJ |
| IAS | Avalanche current, repetitive or not-repetitive (pulse width limited by Tj max) | 2.7 | | A |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 15 | | V/ns |
| dVds/dt | Drain Source voltage slope (Vds=480V) | 50 | | V/ns |
| PD | Power Dissipation (TC = 25°C) | 80 | 30 | W |
| TJ , TSTG | Operating and Storage Temperature Range | -55 to +150 | | °C |
| TL | Maximum Lead Temperature for Soldering Purpose, 1/16" from Case for 10 Seconds | 260 | | °C |

* Drain current limited by maximum junction temperature . Maximum duty cycle D=0.75.

Thermal Characteristics

| Symbol | Parameter | SR70R650T/D/S | SR70R650F | Unit |
|--------|---|---------------|-----------|------|
| RθJC | Thermal Resistance, Junction-to-Case | 1.55 | 4.2 | °C/W |
| RθCS | Thermal Resistance, Case-to-Sink Typ. | 0.5 | - | °C/W |
| RθJA | Thermal Resistance, Junction-to-Ambient | 62 | 80 | °C/W |

Electrical Characteristics TC = 25°C unless otherwise noted

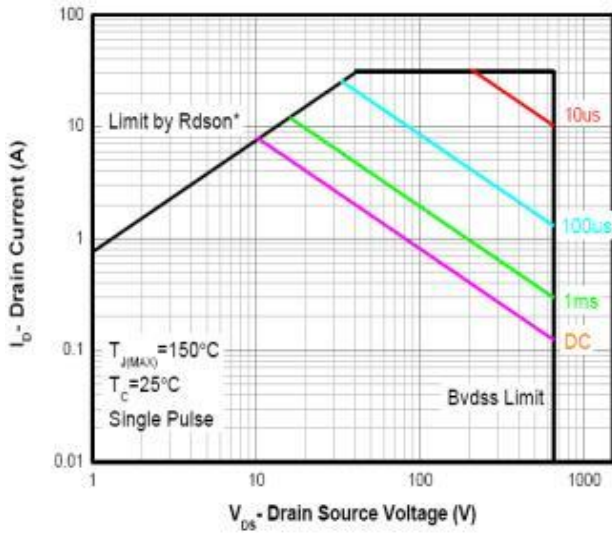
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|--|-----|------|------|------|
| Off Characteristics | | | | | | |
| BVDSS | Drain-Source Breakdown Voltage | VGS = 0V, ID = 250μA, TJ = 25°C | 700 | - | - | V |
| | | VGS = 0V, ID = 250μA, TJ = 150°C | - | 750 | - | V |
| ΔBVDSS/ΔTJ | Breakdown Voltage Temperature Coefficient | ID = 250μA, Referenced to 25°C | - | 0.6 | - | V/°C |
| IDSS | Zero Gate Voltage Drain Current | VDS = 700V, VGS = 0V -TC = 125°C | - | 1 | 100 | μA |
| IGSSF | Gate-Body Leakage Current, Forward | VGS = 30V, VDS = 0V | - | - | 100 | nA |
| IGSSR | Gate-Body Leakage Current, Reverse | VGS = -30V, VDS = 0V | - | - | -100 | nA |
| On Characteristics | | | | | | |
| VGS(th) | Gate Threshold Voltage | VDS = VGS, ID = 250μA | 2.0 | 3.0 | 4.0 | V |
| RDS(on) | Static Drain-Source On-Resistance | VGS = 10V, ID = 3.5A (TO-220, TO-220FTO-263) | - | 0.55 | 0.65 | Q |
| | | VGS = 10V, ID = 3.5A (TO-252) | - | 0.56 | 0.67 | Q |
| Dynamic Characteristics | | | | | | |
| Ciss | Input Capacitance | VDS = 100V, VGS = 0V, f = 1.0MHz | - | 480 | - | pF |
| Coss | Output Capacitance | | - | 22 | - | pF |
| Crss | Reverse Transfer Capacitance | | - | 1.1 | - | pF |
| Qg | Total Gate Charge | VDS = 400V, ID = 7.8A, VGS = 10V (Note 4) | - | 13.6 | - | nC |
| Qgs | Gate-Source Charge | | - | 3.2 | - | nC |
| Qgd | Gate-Drain Charge | | - | 5.6 | - | nC |
| Rg | Gate resistance | f=1 MHz, open drain | - | 9.6 | - | Q |
| Switching Characteristics | | | | | | |
| td(on) | Turn-On Delay Time | VDS = 400V, ID = 3.9A RG = 10Q, VGS = 10V (Note 4) | - | 11 | - | ns |
| tr | Turn-On Rise Time | | - | 21 | - | ns |
| td(off) | Turn-Off Delay Time | | - | 40 | - | ns |
| tf | Turn-Off Fall Time | | - | 31 | - | ns |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| IS | Maximum Continuous Drain-Source Diode Forward Current | | - | - | 7.8 | A |
| ISM | Maximum Pulsed Drain-Source Diode Forward Current | | - | - | 31.2 | A |
| VSD | Drain-Source Diode Forward Voltage | VGS = 0V, IS = 7.8A | - | 0.9 | 1.4 | V |
| trr | Reverse Recovery Time | VGS = 0V, VDS = 400V, IS = 3.9A, dIF/dt = 100A/μs | - | 205 | - | ns |
| Qrr | Reverse Recovery Charge | | - | 1.4 | - | μC |
| Irrm | Peak Reverse Recovery Current | | - | 12 | - | A |

NOTES:

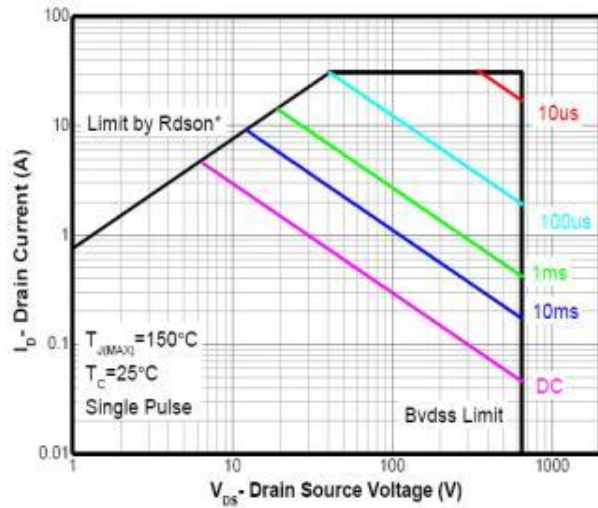
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. ID=IAS, VDD=50V, Starting TJ=25 °C.
3. ISD≤ID, di/dt≤200A/us, VDD≤BVDSS, Starting TJ= 25 °C.
4. Essentially Independent of Operating Temperature Typical Characteristics.

Typical Performance Characteristics

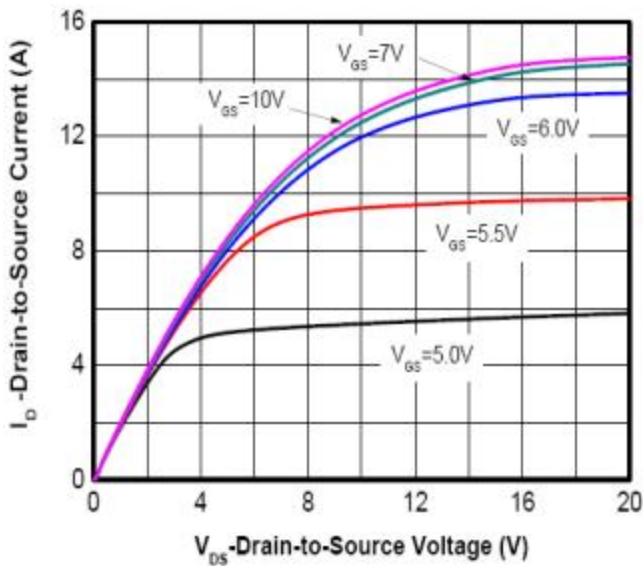
Typ1. Safe operating area $T_C=25^\circ\text{C}$
 TO-220, TO-252 TO-263



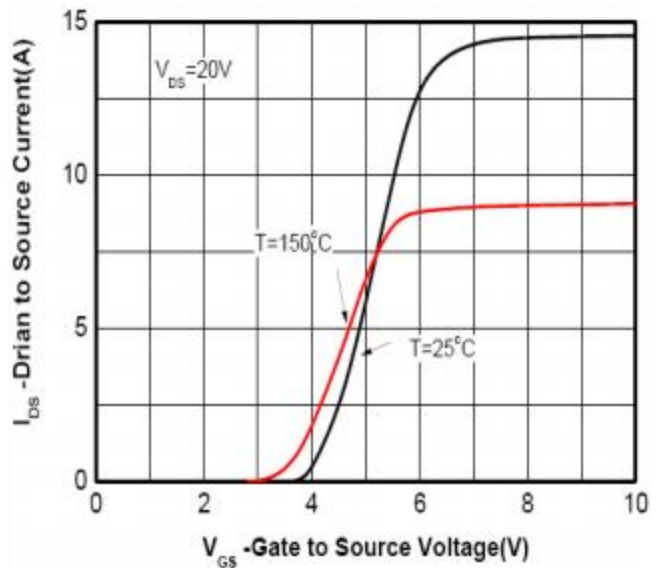
Typ2. Safe operating area $T_C=25^\circ\text{C}$
 TO-220FullPAK

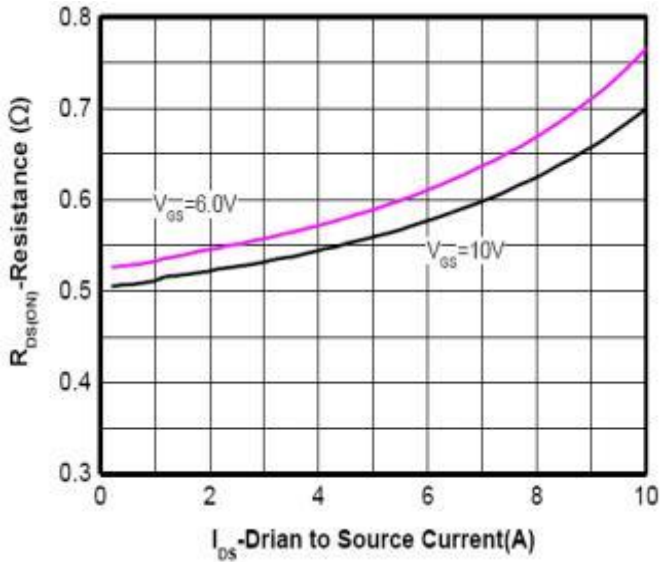
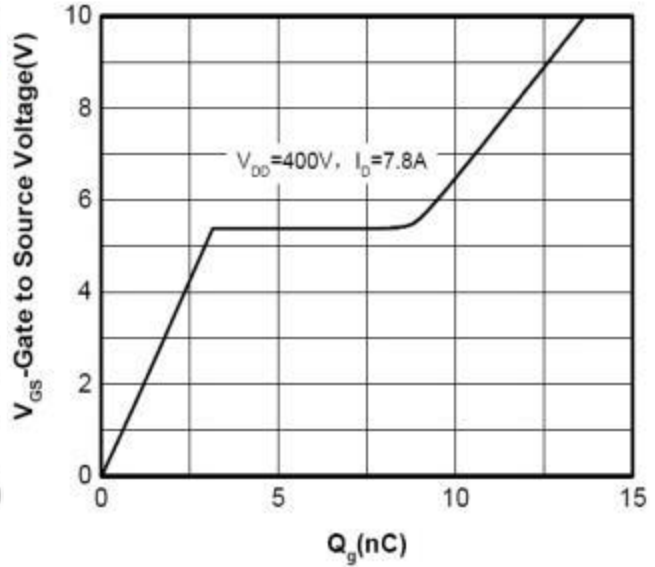
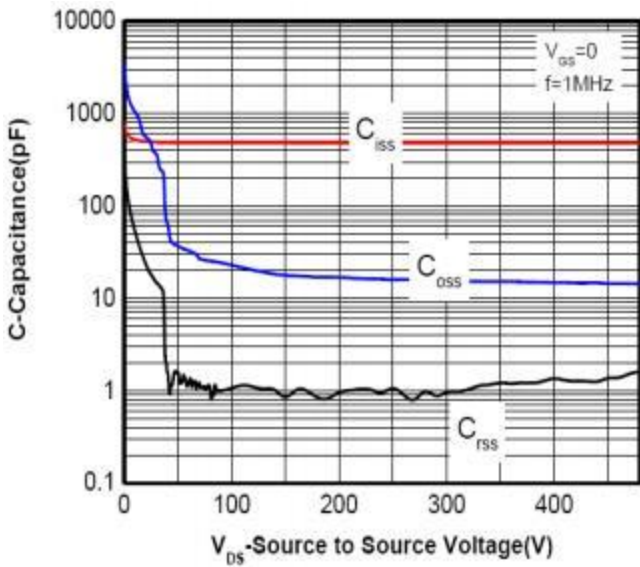
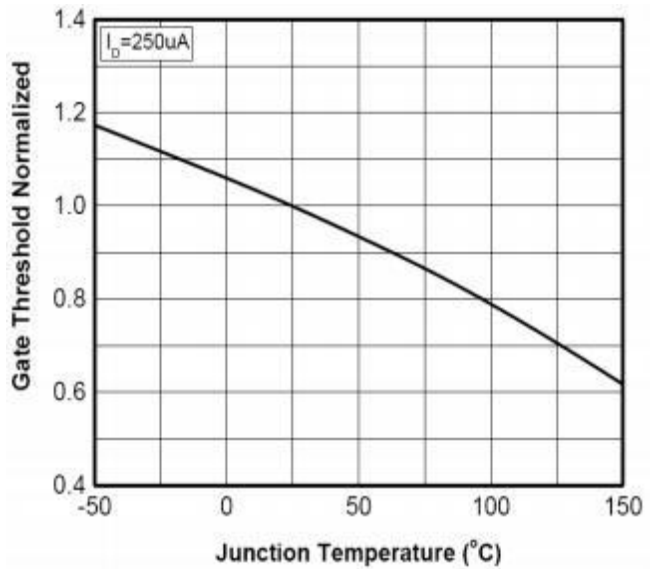


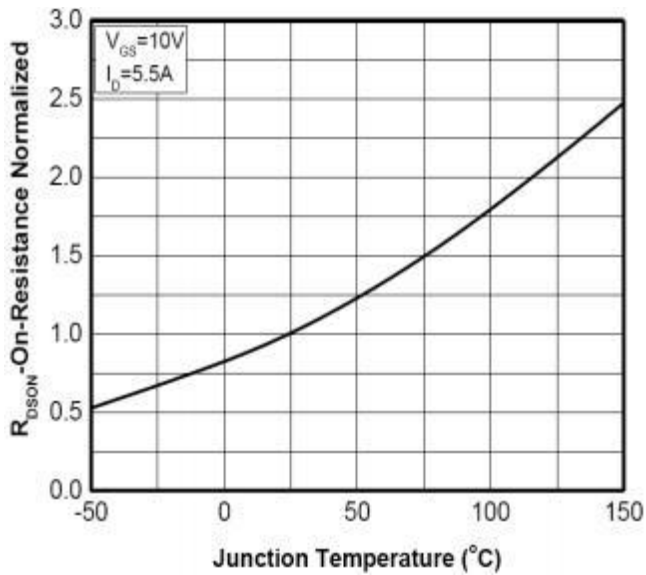
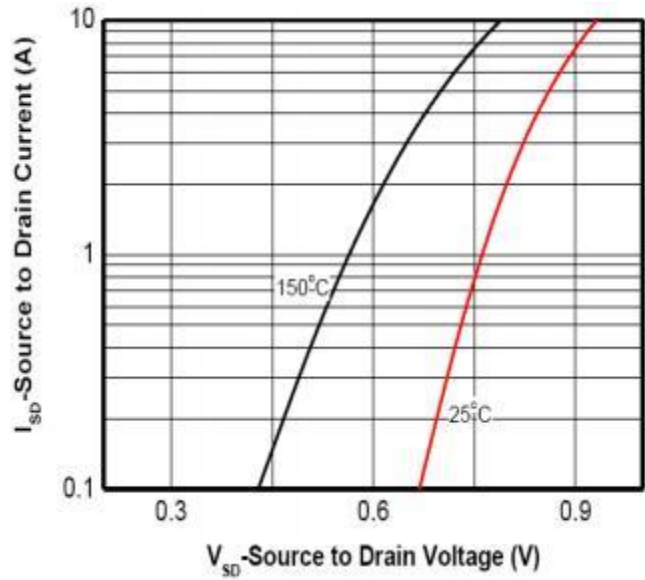
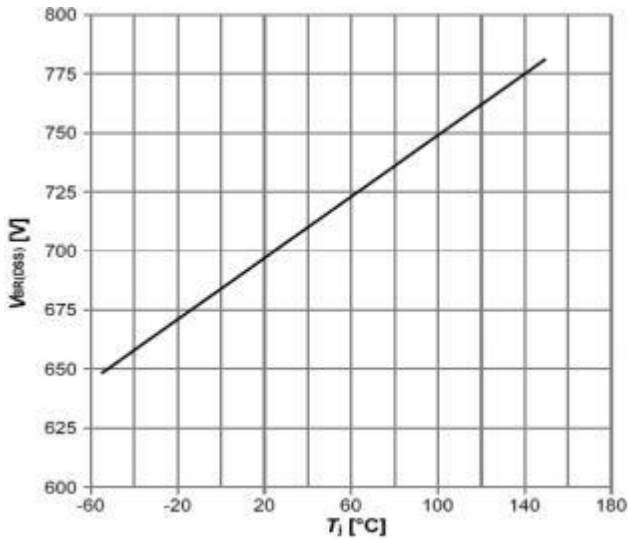
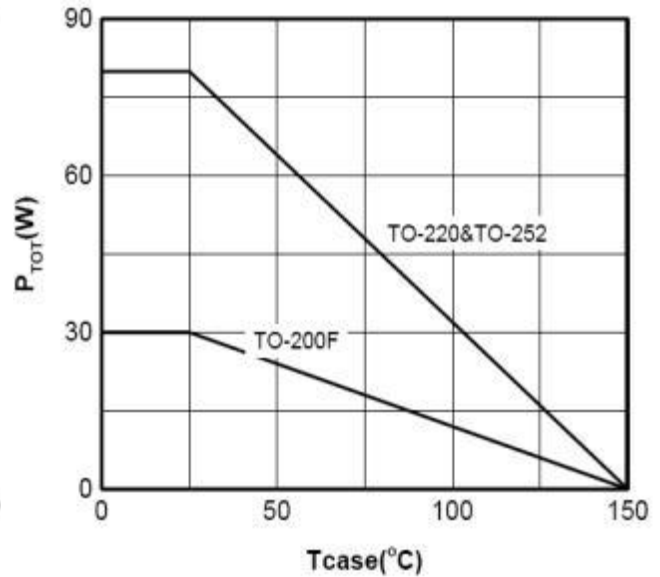
Typ3. output characteristics $T_j=25^\circ\text{C}$

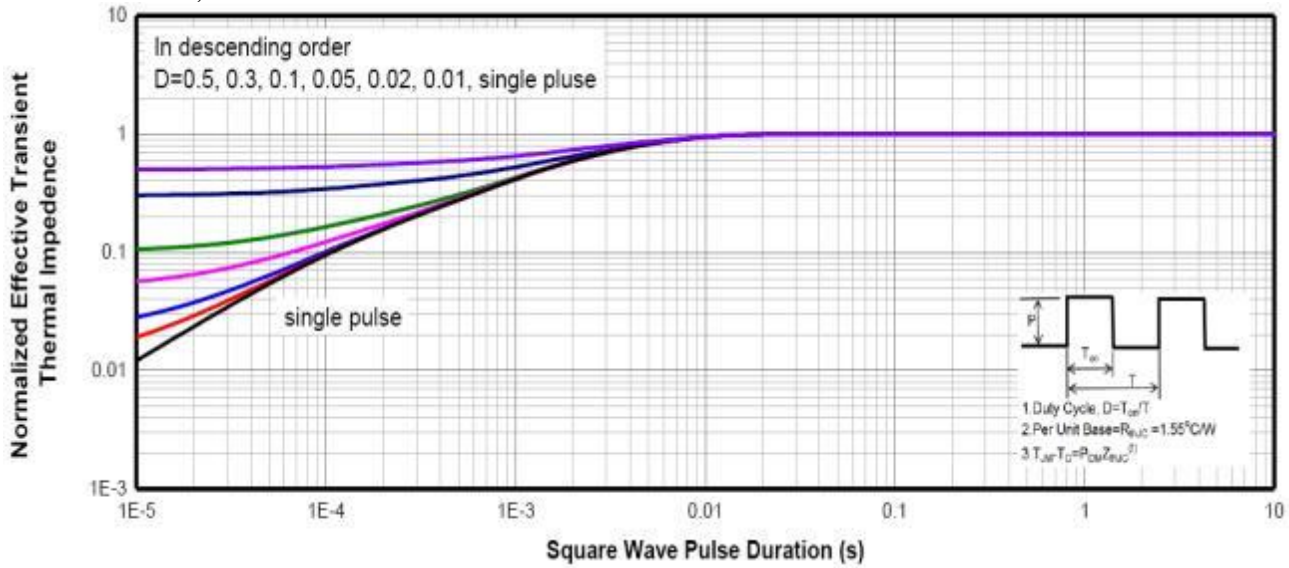
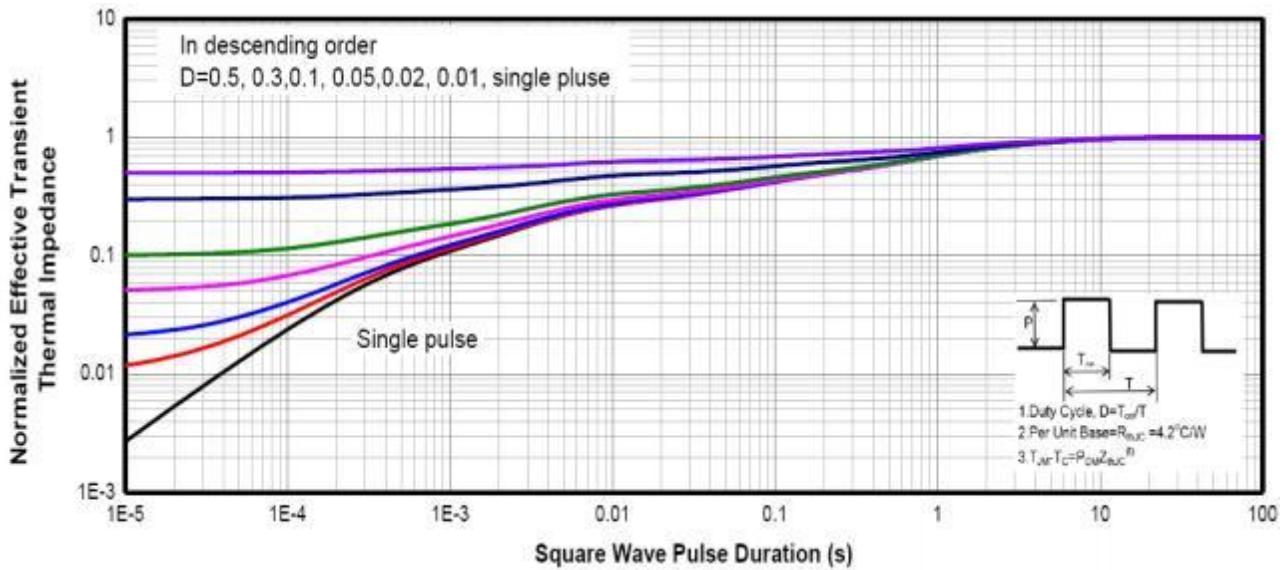


Typ4. transfer characteristics



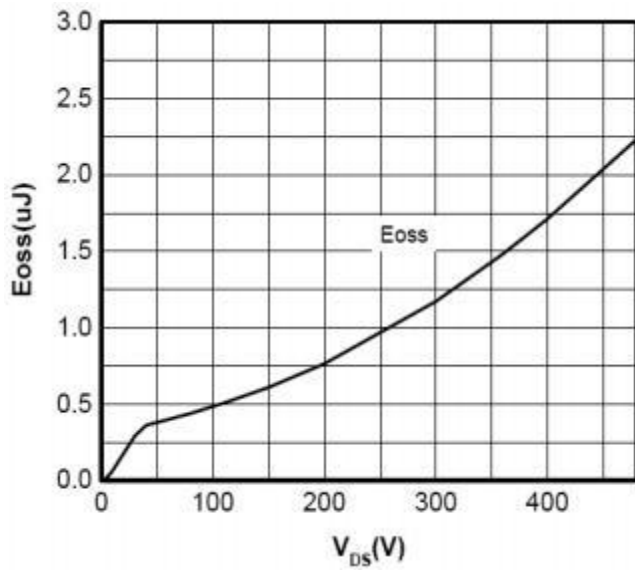
Typical Performance Characteristics
Typ5. drain-source on-state resistance

Typ6. gate charge characteristics

Typ7. Capacitances

Typ8. Normalized VGS(th) characteristics


Typical Performance Characteristics
Typ9. Normalized on-resistance vs temperature

Typ10. Forward characteristics of reverse diode

Typ11. Drain-source breakdown voltage

Typ12. Power dissipation


Typical Performance Characteristics
Typ13.Max. transient thermal impedance
TO-220, TO-252 TO-263

Typ14.Max. transient thermal impedance
TO-220FullPAK


Typical Performance Characteristics

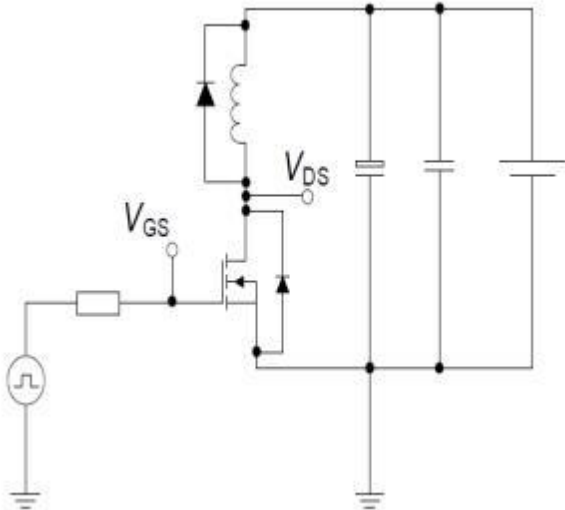
Typ15.Coss stored energy



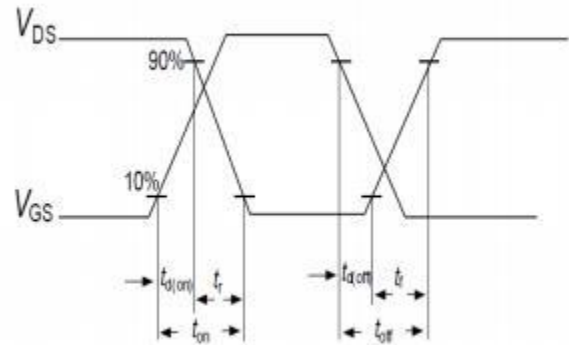
Test circuits

Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load

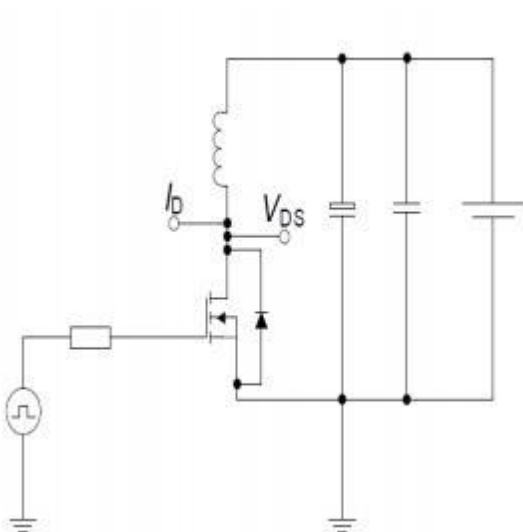


Switching time waveform

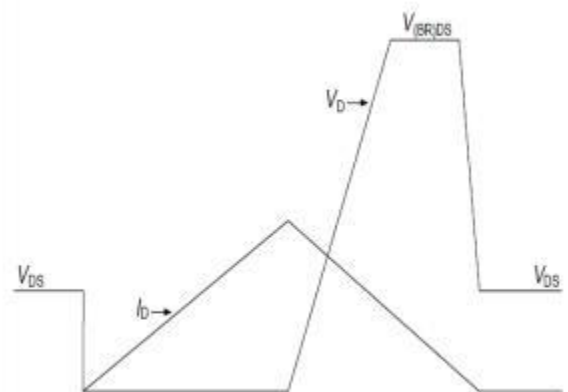


Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit



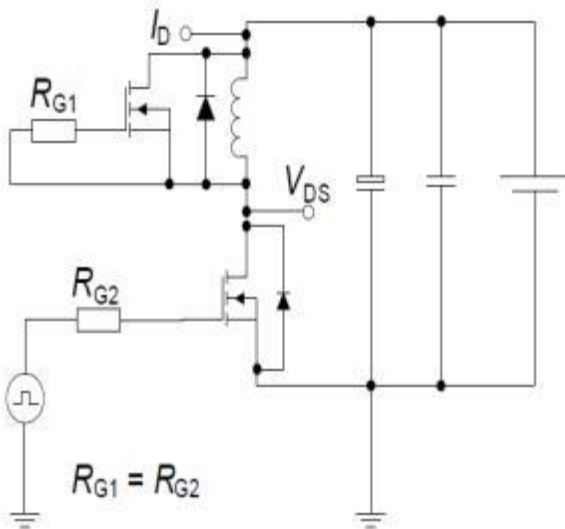
Unclamped inductive waveform



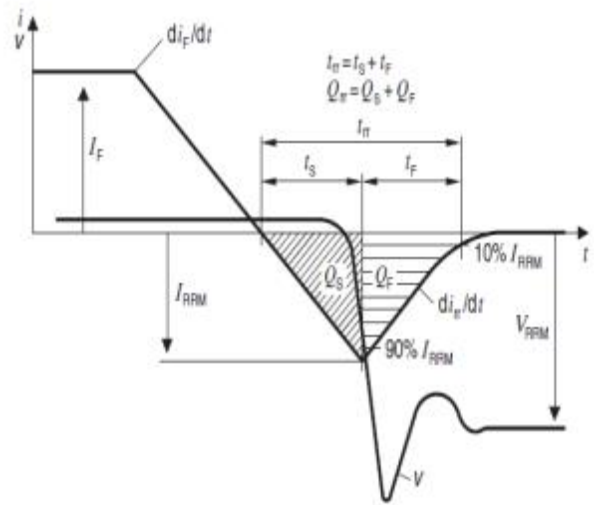
Test circuits

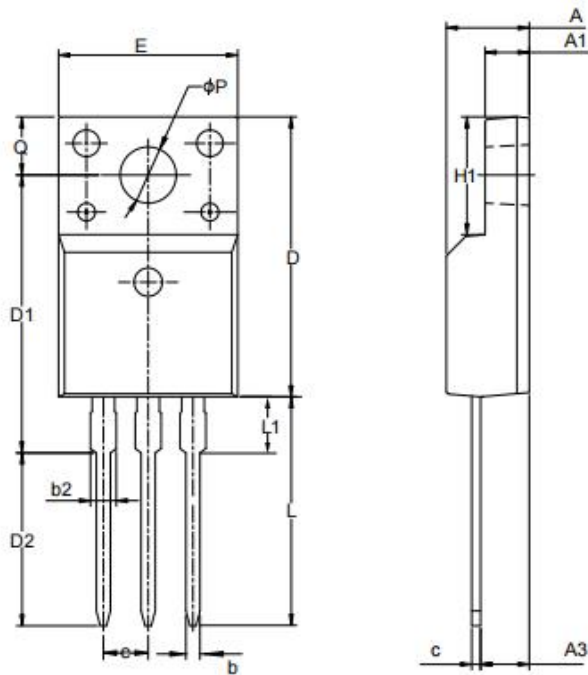
Test circuit and waveform for diode characteristics

Test circuit for diode characteristics

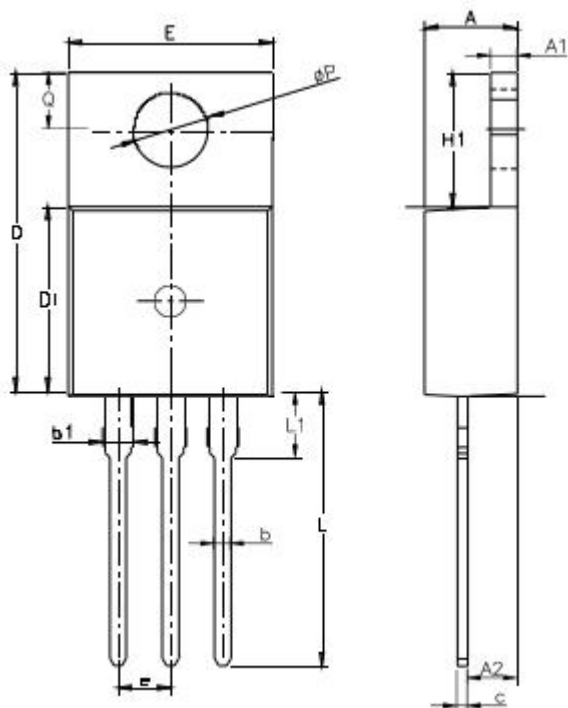


Diode recovery waveform

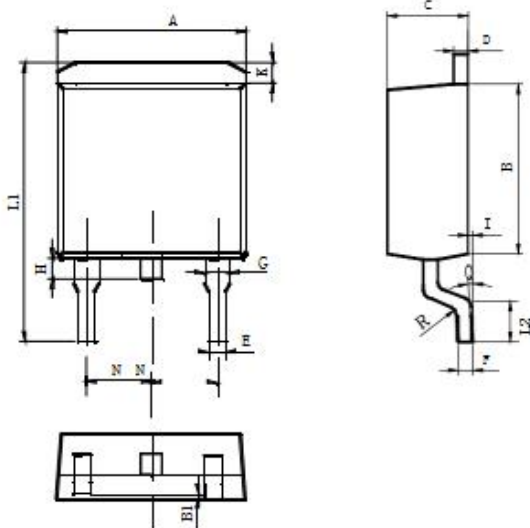


Package Outline
TO-220 Full PAK


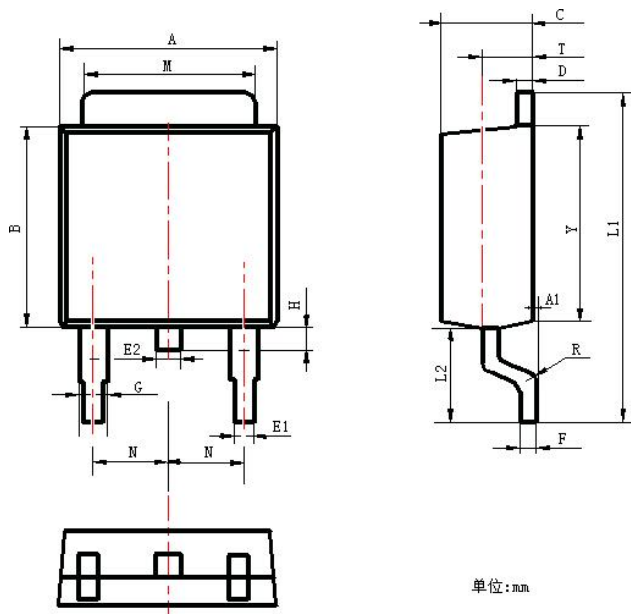
| COMMON DIMENSIONS | | | |
|-------------------|------------|-------|-------|
| Items | Values(mm) | | |
| | MIN | NOM | MAX |
| A | 4.42 | 4.7 | 5.02 |
| A1 | 2.3 | 2.54 | 2.8 |
| A3 | 2.5 | 2.76 | 3.1 |
| b | 0.7 | 0.8 | 0.9 |
| b2 | -- | -- | 1.47 |
| c | 0.35 | 0.5 | 0.65 |
| D | 15.25 | 15.87 | 16.25 |
| D1 | 15.3 | 15.75 | 16.3 |
| D2 | 9.3 | 9.8 | 10.3 |
| E | 9.73 | 10.16 | 10.36 |
| e | 2.54BSC | | |
| H1 | 6.4 | 6.68 | 7 |
| L | 12.48 | 12.98 | 13.48 |
| L1 | -- | -- | 3.5 |
| ϕP | 3 | 3.18 | 3.4 |
| Q | 3.05 | 3.3 | 3.55 |

TO-220-3L


| COMMON DIMENSIONS | | | |
|-------------------|------------|-------|------|
| Items | Values(mm) | | |
| | MIN | NOM | MAX |
| A | 4.3 | 4.5 | 4.7 |
| A1 | 1 | 1.3 | 1.5 |
| A2 | 1.8 | 2.4 | 2.8 |
| b | 0.6 | 0.8 | 1 |
| b1 | 1 | - | 1.6 |
| c | 0.3 | - | 0.7 |
| D | 15.1 | 15.7 | 16.1 |
| D1 | 8.1 | 9.2 | 10 |
| F | 9.6 | 9.9 | 10.4 |
| e | 2.54BSC | | |
| H1 | 6.1 | 6.5 | 7 |
| L | 12.6 | 13.08 | 13.6 |
| L1 | | | 3.95 |
| ΦP | 3.4 | 3.7 | 3.9 |
| Q | 2.6 | | 3.2 |

Package Outline
TO-263-2L


| Items | Values(mm) | | |
|-------|------------|------|------|
| | MIN | NOM | MAX |
| A | 9.8 | 10 | 10.4 |
| B | 8.9 | 9.6 | 9.5 |
| B1 | 0 | - | 0.1 |
| C | 4.4 | 4.5 | 4.8 |
| D | 1.16 | 1.4 | 1.5 |
| E | 0.7 | 0.75 | 0.95 |
| F | 0.3 | 0.45 | 0.6 |
| G | 1.07 | 1.38 | 1.47 |
| H | 1.3 | - | 1.8 |
| K | 0.95 | 1 | 1.37 |
| L1 | 14.5 | 15.2 | 16.5 |
| L2 | 1.6 | 2 | 2.3 |
| I | 0 | - | 0.2 |
| Q | 0° | 3° | 8° |
| R | 0.4 | | |
| N | 2.35 | 2.4 | 2.7 |

TO-252-3L


单位: mm

| Items | Values(mm) | | |
|-------|------------|------|------|
| | MIN | NOM | MAX |
| A | 6.3 | 6.5 | 6.9 |
| A1 | 0 | - | 0.16 |
| B | 5.7 | - | 6.3 |
| C | 2.1 | 2.3 | 2.5 |
| D | 0.3 | 0.5 | 0.7 |
| E1 | 0.6 | 0.65 | 0.9 |
| E2 | 0.7 | 0.65 | 1 |
| F | 0.3 | 0.5 | 0.6 |
| G | 0.7 | 0.9 | 1.2 |
| L1 | 9.6 | 10 | 10.5 |
| L2 | 2.7 | - | 3.1 |
| H | 0.4 | - | 1 |
| M | 5.1 | 5.2 | 5.5 |
| N | 2.09 | 2.2 | 2.49 |
| R | 0.3 | | |
| T | 1.4 | - | 1.6 |
| Y | 5.1 | 5.9 | 6.3 |