

650V N-ch Planar MOSFET

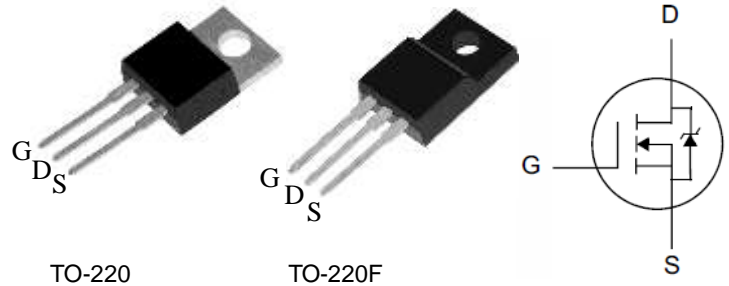
| | | |
|-----------|---------------------|-------|
| V_{DSS} | $R_{DS(ON)}$ (Typ.) | I_D |
| 650 V | 0.75Ω | 10 A |

General Features

- RoHS Compliant
- $R_{DS(ON),typ.}=0.75\ \Omega@V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

Applications

- Adaptor
- Charger
- SMPS Standby Power



Package No to Scale

Ordering Information

| | | |
|------------|------------|-------------|
| PART NUMBE | SK10N65B-T | SK10N65B-TF |
| PACKAGE | TO-220 | TO-220F |

Absolute Maximum Ratings

$T_C=25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | SK10N65B-T | SK10N65B-TF | Units |
|-------------------|---|------------|-------------|-------|
| V_{DSS} | Drain-to-Source Voltage | 650 | | V |
| V_{GSS} | Gate-to-Source Voltage | ±30 | | |
| I_D | Continuous Drain Current | 10 | | A |
| I_{DM} | Pulsed Drain Current at $V_{GS}=10V$ | 40 | | |
| E_{AS} | Single Pulse Avalanche Energy | 800 | | mJ |
| P_D | Power Dissipation | 125 | 45 | W |
| | Derating Factor above 25°C | 1.0 | 0.36 | W/°C |
| T_L | Soldering Temperature Distance of 1.6mm from case for 10 seconds | 300 | | °C |
| T_J & T_{STG} | Operating and Storage Temperature Range | -55 to 150 | | |

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Thermal Characteristics

| Symbol | Parameter | SK10N65B-T | SK10N65B-TF | Units |
|-----------------|---|------------|-------------|-------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | 1.0 | 2.78 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 62 | 100 | |

Electrical Characteristics

OFF Characteristics

 $T_J = 25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|------------|-----------------------------------|------|------|------|-------|---|
| BV_{DSS} | Drain-to-Source Breakdown Voltage | 650 | -- | -- | V | $V_{GS}=0V, I_D=250\mu A$ |
| I_{DSS} | Drain-to-Source Leakage Current | -- | -- | 1 | uA | $V_{DS}=650V, V_{GS}=0V$ |
| | | -- | -- | 100 | | $V_{DS}=520V, V_{GS}=0V, T_J=125^\circ\text{C}$ |
| I_{GSS} | Gate-to-Source Leakage Current | -- | -- | +100 | nA | $V_{GS}=+30V, V_{DS}=0V$ |
| | | -- | -- | -100 | | $V_{GS}=-30V, V_{DS}=0V$ |

ON Characteristics

 $T_J = 25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|--------------|--------------------------------------|------|------|------|----------|-------------------------------|
| $R_{DS(ON)}$ | Static Drain-to-Source On-Resistance | -- | 0.75 | 0.90 | Ω | $V_{GS}=10V, I_D=5.0A$ |
| $V_{GS(TH)}$ | Gate Threshold Voltage | 2.0 | -- | 4.0 | V | $V_{DS}=V_{GS}, I_D=250\mu A$ |
| gfs | Forward Transconductance | -- | 8.0 | -- | S | $V_{DS}=15V, I_D=5.0A$ |

Dynamic Characteristics

Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|-----------|-------------------------------|------|------|------|-------|--|
| C_{iss} | Input Capacitance | -- | 1660 | -- | pF | $V_{GS}=0V, V_{DS}=25V, f=1.0\text{MHz}$ |
| C_{rss} | Reverse Transfer Capacitance | -- | 15 | -- | | |
| C_{oss} | Output Capacitance | -- | 130 | -- | | |
| Q_g | Total Gate Charge | -- | 32 | -- | nC | $V_{DD}=520V, I_D=10A, V_{GS}=0 \text{ to } 10V$ |
| Q_{gs} | Gate-to-Source Charge | -- | 8.0 | -- | | |
| Q_{gd} | Gate-to-Drain (Miller) Charge | -- | 8.5 | -- | | |

Resistive Switching Characteristics

Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|--------------|---------------------|------|------|------|-------|---|
| $t_{d(ON)}$ | Turn-on Delay Time | -- | 11 | -- | nS | $V_{DD}=325V, I_D=10A, V_{GS}=10V, R_g=4.7\Omega$ |
| t_{rise} | Rise Time | -- | 15 | -- | | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | -- | 40 | -- | | |
| t_{fall} | Fall Time | -- | 17 | -- | | |

Source-Drain Body Diode Characteristics $T_J=25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|----------|--|------|------|------|-------|---|
| I_{SD} | Continuous Source Current ^[2] | -- | -- | 10 | A | Integral pn-diode in MOSFET |
| I_{SM} | Pulsed Source Current ^[2] | -- | -- | 40 | | |
| V_{SD} | Diode Forward Voltage | -- | -- | 1.5 | V | $I_S=10\text{A}$, $V_{GS}=0\text{V}$ |
| t_{rr} | Reverse Recovery Time | -- | 460 | -- | ns | $V_{GS}=0\text{V}$ $I_F=I_S$, $di/dt=100\text{A}/\mu\text{s}$ |
| Q_{rr} | Reverse Recovery Charge | -- | 1.5 | -- | nC | |

Note:

[1] $T_J=+25^\circ\text{C}$ to $+150^\circ\text{C}$

[2] Pulse width $\leq 380\mu\text{s}$; duty cycle $\leq 2\%$.

Typical Characteristics

Figure 1. Maximum Transient Thermal Impedance

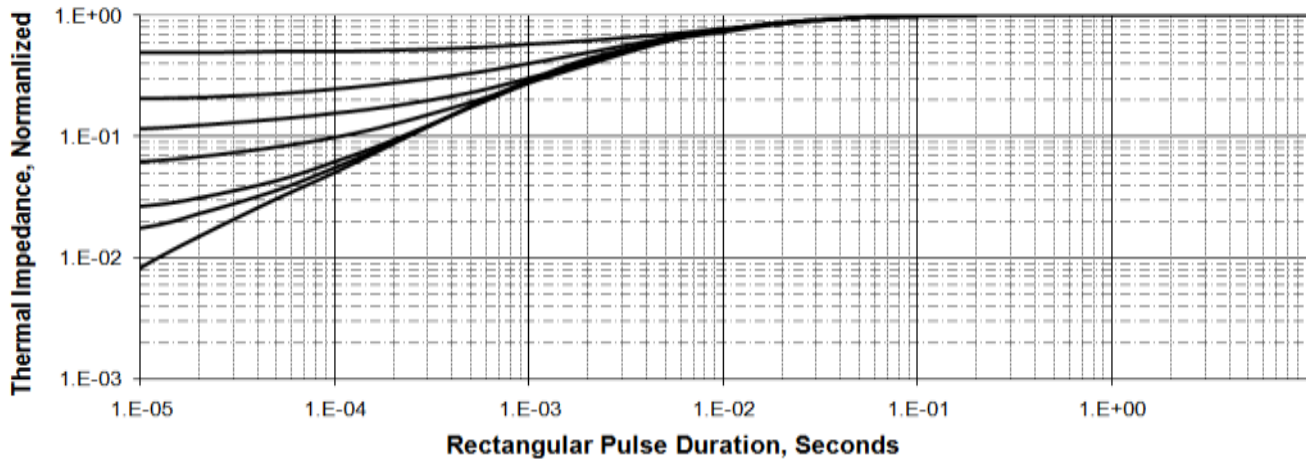


Figure 2. Max. Power Dissipation vs Case Temperature

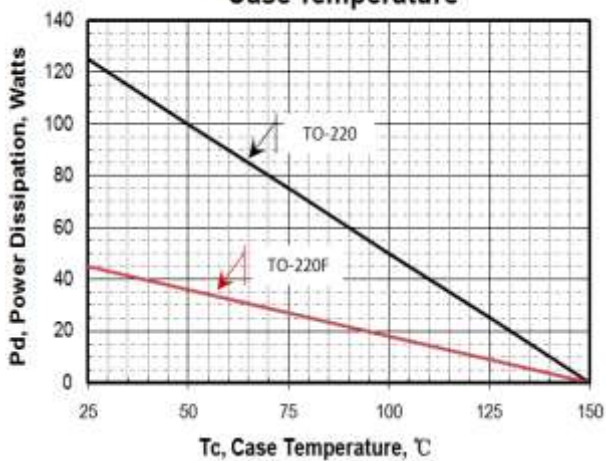


Figure 3. Maximum Continuous Drain Current vs Tc

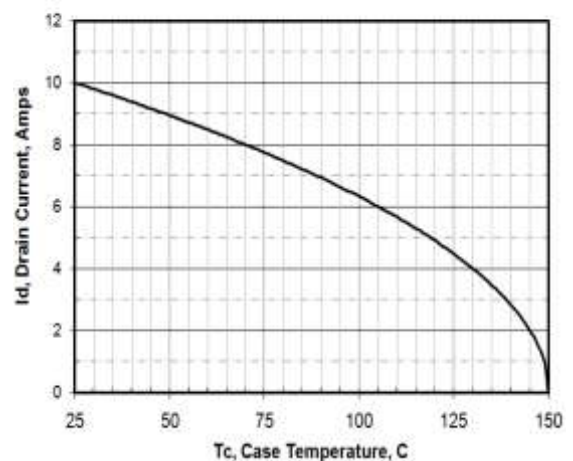


Figure 4. Output Characteristics

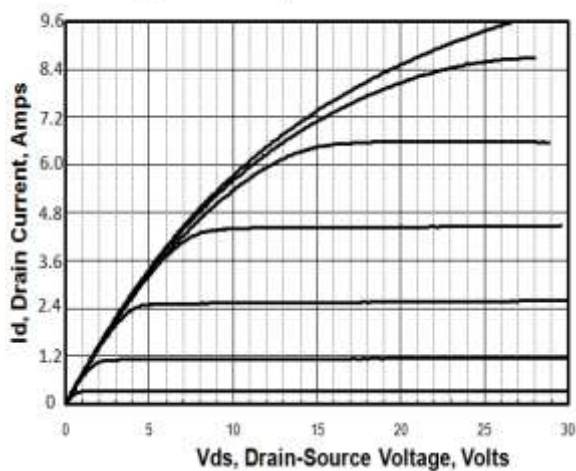
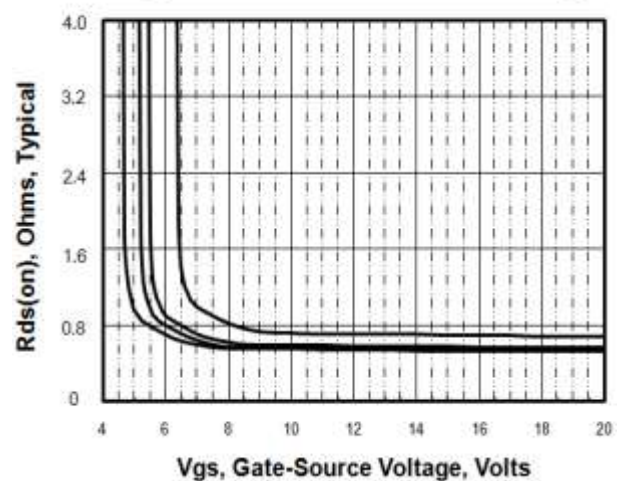


Figure 5. Rds(on) vs Gate Voltage



Typical Characteristics(Cont.)

Figure 6. Peak Current Capability

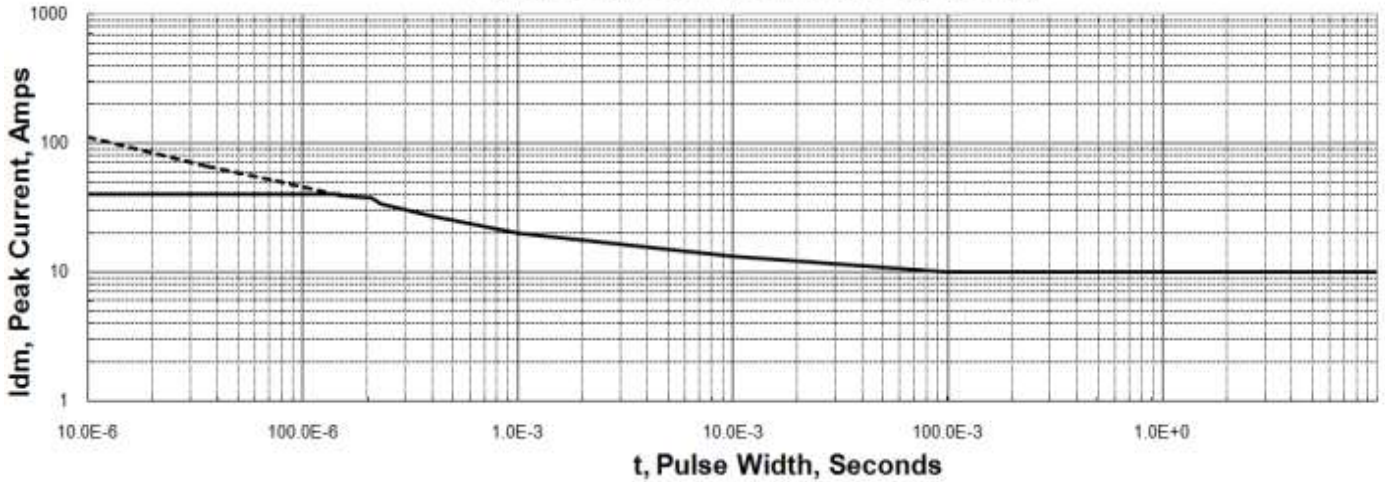


Figure 7. Transfer Characteristics

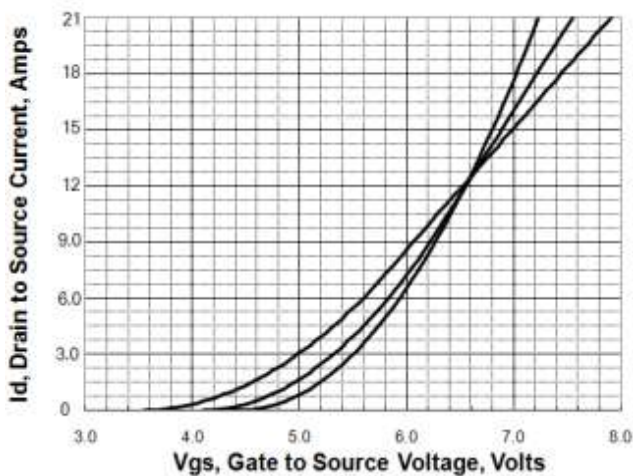


Figure 8. Unclamped Inductive Switching Capability

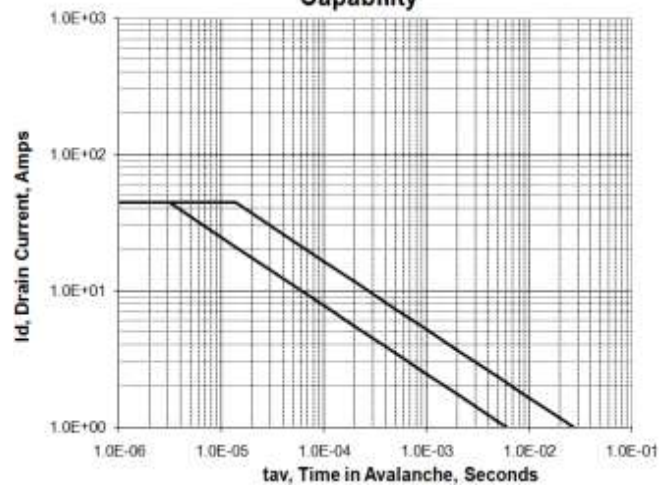


Figure 9. Drain to Source ON Resistance vs Drain Current

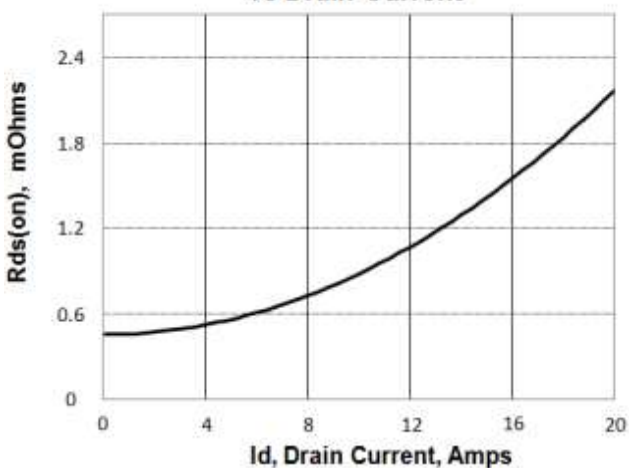
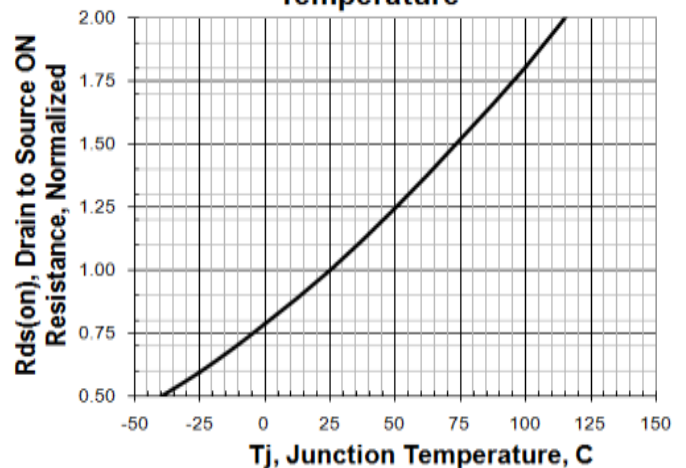


Figure 10. Rds(on) vs Junction Temperature



Typical Characteristics(Cont.)

Figure 11. Breakdown Voltage vs Temperature

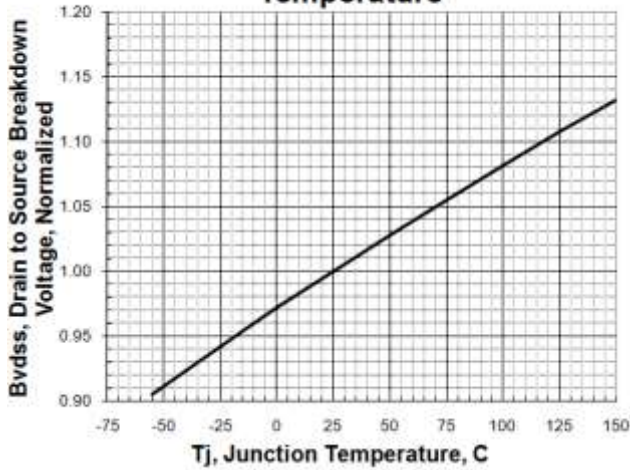


Figure 12. Threshold Voltage vs Temperature

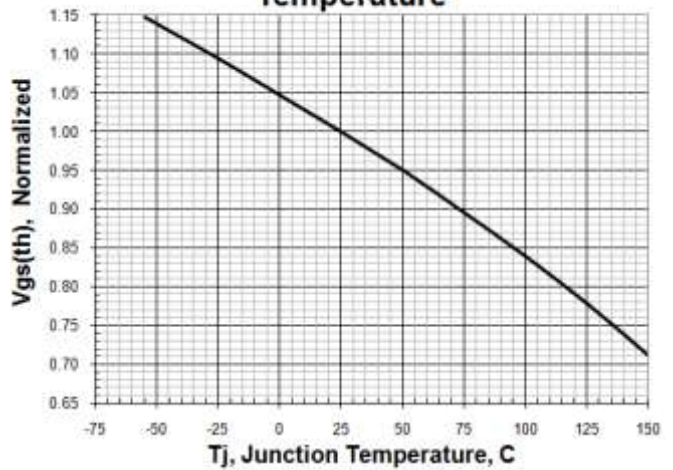


Figure 13 . Maximum Safe Operating Area

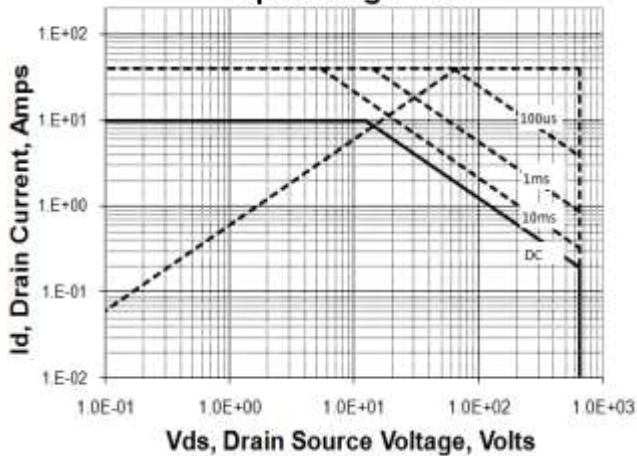


Figure 14. Capacitance vs Vds

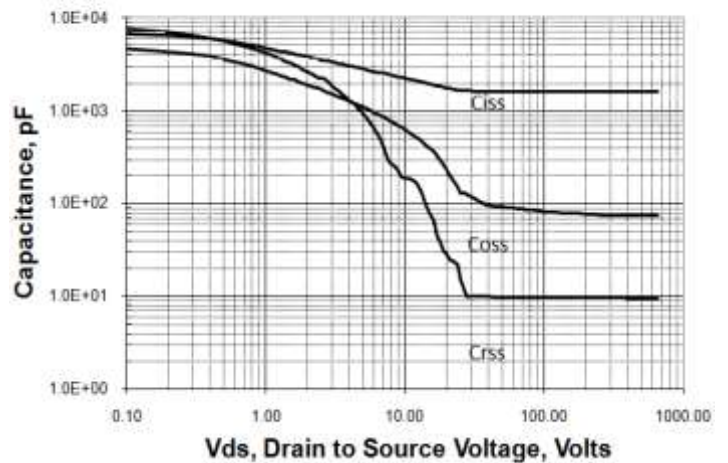


Figure 15 . Typical Gate Charge

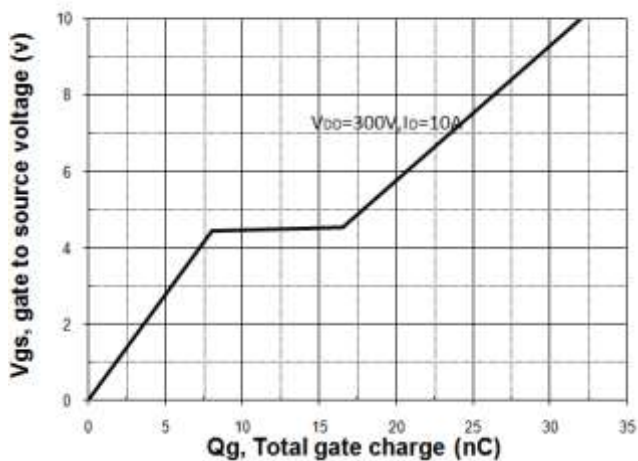
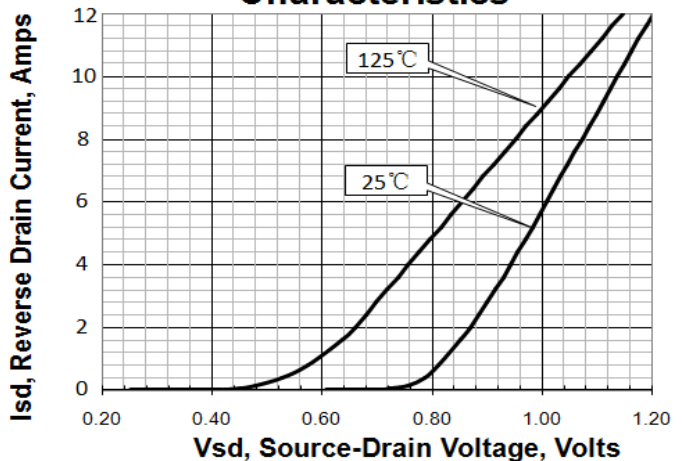


Figure 16. Body Diode Transfer Characteristics



Test Circuits and Waveforms

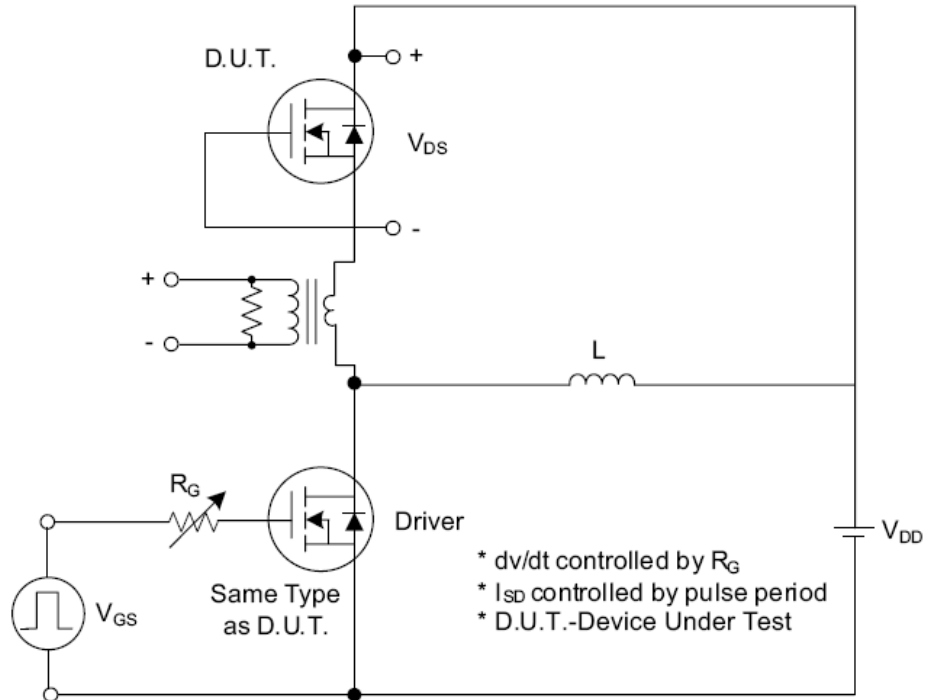


Fig. 1.1 Peak Diode Recovery dv/dt Test Circuit

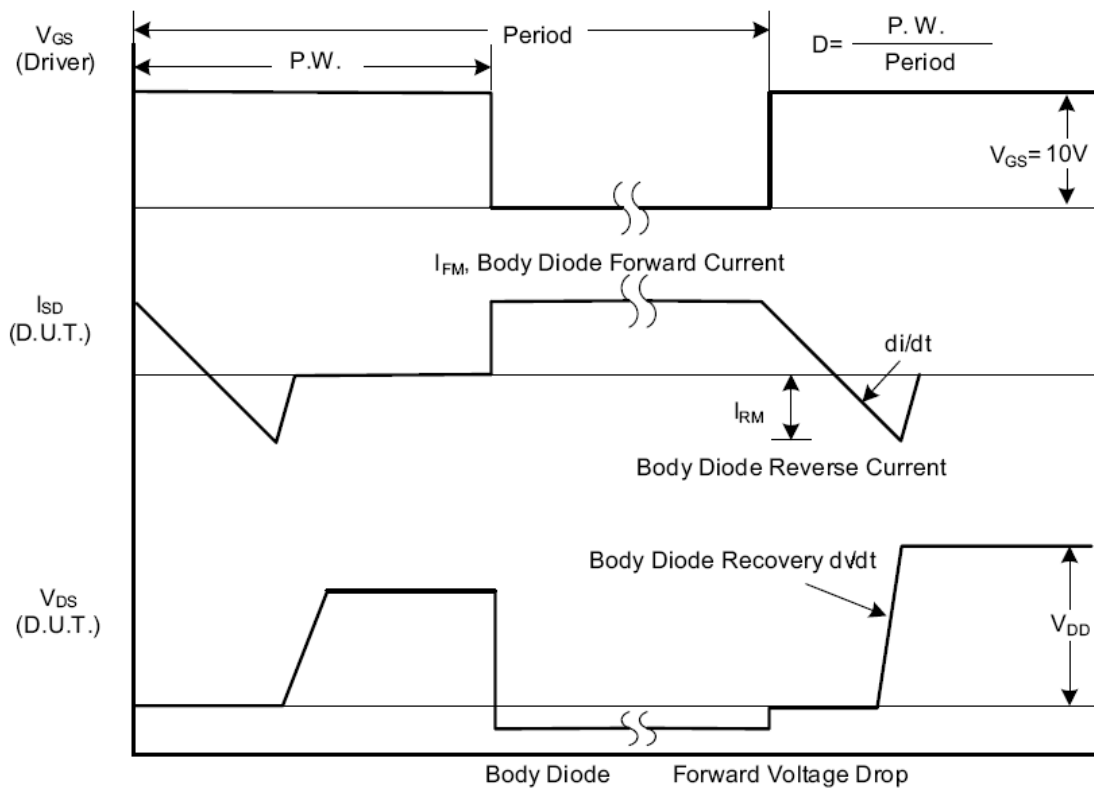


Fig. 1.2 Peak Diode Recovery dv/dt Waveforms

Test Circuits and Waveforms

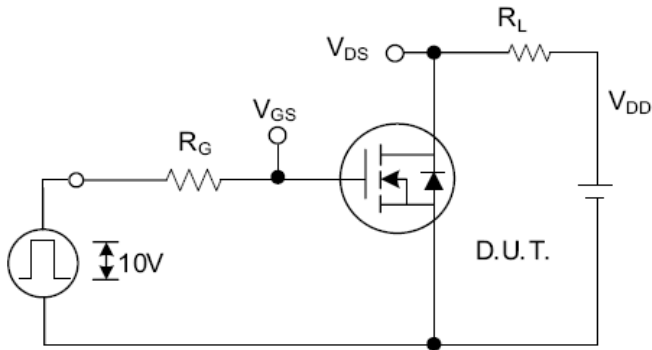


Fig. 2.1 Switching Test Circuit

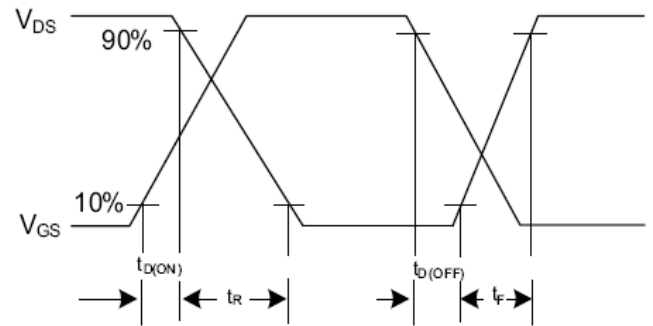


Fig. 2.2 Switching Waveforms

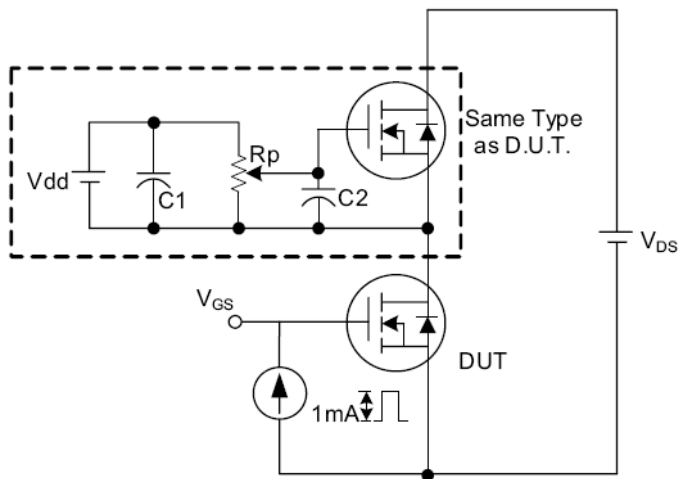


Fig. 3.1 Gate Charge Test Circuit

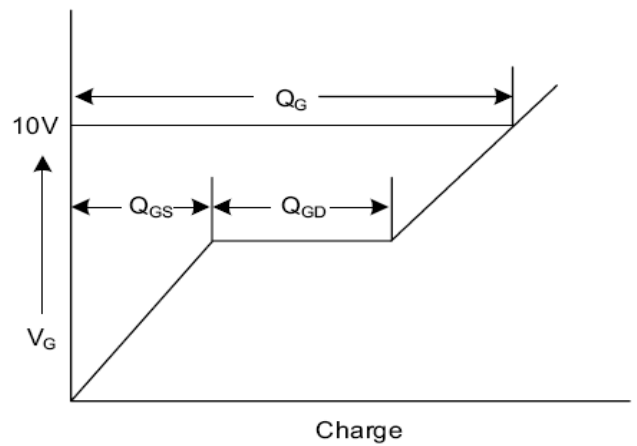


Fig. 3.2 Gate Charge Waveform

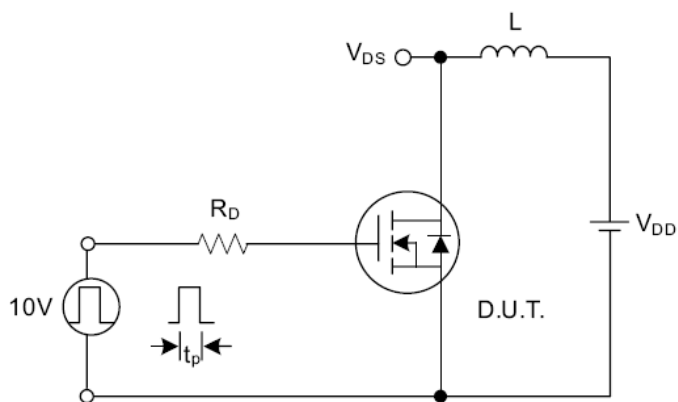


Fig. 4.1 Unclamped Inductive Switching Test Circuit

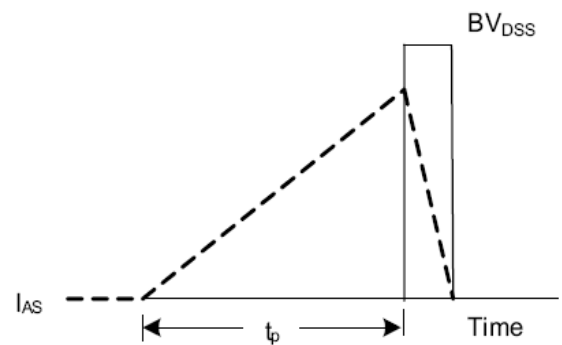
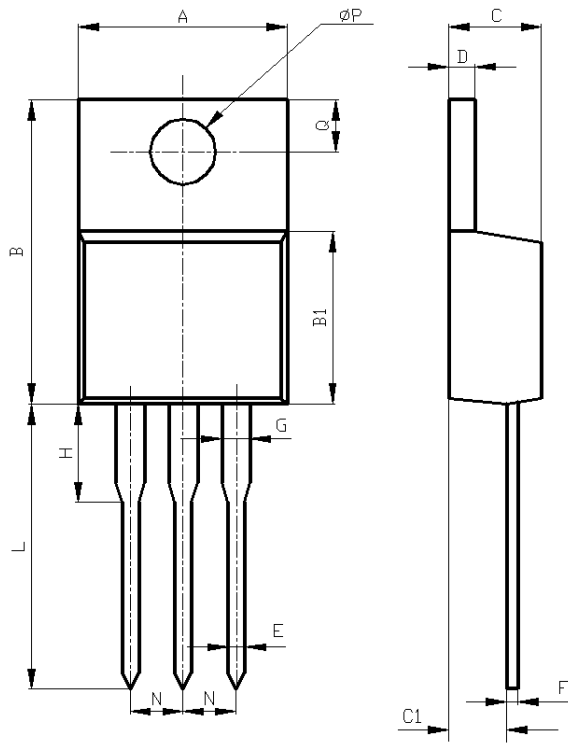


Fig. 4.2 Unclamped Inductive Switching Waveforms

PACKAGE OUTLINE

TO-220

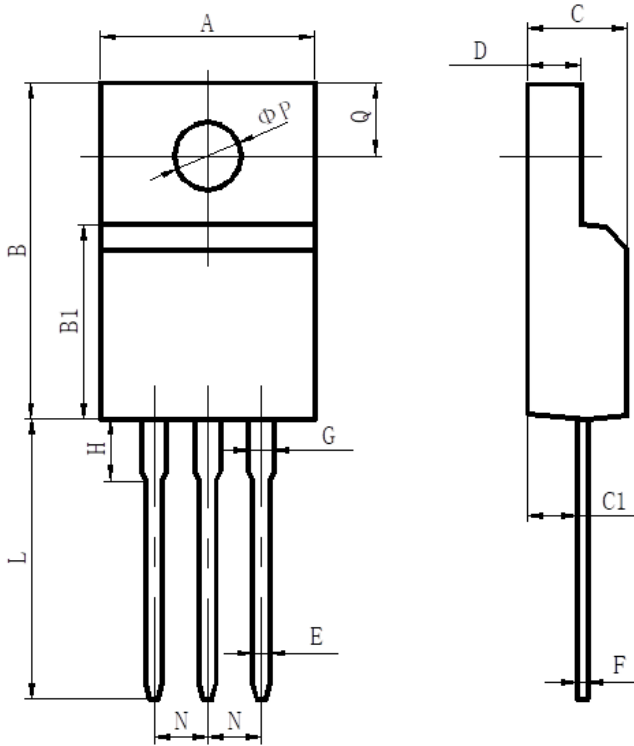


: mm

| | Unit (mm) | |
|----------|-----------|------|
| | MIN | MAX |
| A | 10.1 | 10.5 |
| B | 15.2 | 15.6 |
| B1 | 9.00 | 9.40 |
| C | 4.40 | 4.60 |
| C1 | 2.40 | 3.00 |
| D | 1.20 | 1.40 |
| E | 0.70 | 0.90 |
| F | 0.40 | 0.60 |
| G | 1.17 | 1.37 |
| H | 3.30 | 3.80 |
| L | 13.1 | 13.7 |
| N | 2.34 | 2.74 |
| Q | 2.40 | 3.00 |
| ϕP | 3.70 | 3.90 |

PACKAGE OUTLINE

TO-220F



| | Unit (mm) | |
|----------|-----------|-------|
| | MIN | MAX |
| A | 9.70 | 10.30 |
| B | 15.50 | 16.10 |
| B1 | 8.99 | 9.39 |
| C | 4.40 | 4.80 |
| C1 | 2.15 | 2.55 |
| D | 2.50 | 2.90 |
| E | 0.70 | 0.90 |
| F | 0.40 | 0.60 |
| G | 1.12 | 1.42 |
| H | 3.40 | 3.80 |
| L | 12.6 | 13.6 |
| N | 2.34 | 2.74 |
| Q | 3.15 | 3.55 |
| ϕP | 3.00 | 3.30 |