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FQP11N40C / FQPF11N40C

N-Channel QFET® MOSFET

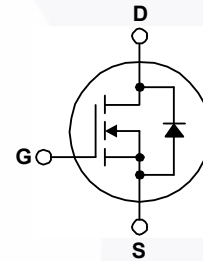
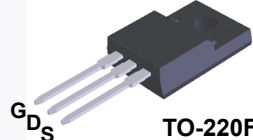
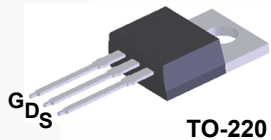
400 V, 10.5 A, 530 mΩ

Features

- 10.5 A, 400 V, $R_{DS(on)} = 530 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 5.25 \text{ A}$
- Low Gate Charge (Typ. 28 nC)
- Low Crss (Typ. 85 pF)
- 100% Avalanche Tested

Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.



MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | FQP11N40C | FQPF11N40C | Unit |
|----------------|---|---|------------|---------------------|
| V_{DSS} | Drain to Source Voltage | 400 | | V |
| I_D | Drain Current | -Continuous ($T_C = 25^\circ\text{C}$) | 10.5 | 10.5 * |
| | | -Continuous ($T_C = 100^\circ\text{C}$) | 6.6 | 6.6 * |
| I_{DM} | Drain Current - Pulsed (Note 1) | 42 | 42 * | A |
| V_{GSS} | Gate to Source Voltage | ± 30 | | V |
| E_{AS} | Single Pulsed Avalanche Energy (Note 2) | 360 | | mJ |
| I_{AR} | Avalanche Current (Note 1) | 11 | | A |
| E_{AR} | Repetitive Avalanche Energy (Note 1) | 13.5 | | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 4.5 | | V/ns |
| P_D | Power Dissipation ($T_C = 25^\circ\text{C}$) - Derate above 25°C | 135 | 44 | W |
| | | 1.07 | 0.35 | W/ $^\circ\text{C}$ |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +150 | | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | 300 | | $^\circ\text{C}$ |

*Drain current limited by maximum junction temperature

Thermal Characteristics

| Symbol | Parameter | FQP11N40C | FQPF11N40C | Unit |
|-----------------|--|-----------|------------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max | 0.93 | 2.86 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max | 62.5 | 62.5 | $^\circ\text{C}/\text{W}$ |

Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|------------|---------|-----------|------------|----------|
| FQP11N40C | FQP11N40C | TO-220 | Tube | N/A | 50 units |
| FQPF11N40C | FQPF11N40C | TO-220F | Tube | N/A | 50 units |

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|--|-----|------|------|---------------------------|
| Off Characteristics | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | 400 | -- | -- | V |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$, Referenced to 25°C | -- | 0.54 | -- | $\text{V}/^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$ | -- | -- | 1 | μA |
| | | $V_{DS} = 320\text{ V}, T_C = 125^\circ\text{C}$ | -- | -- | 10 | μA |
| I_{GSSF} | Gate-Body Leakage Current, Forward | $V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$ | -- | -- | 100 | nA |
| I_{GSSR} | Gate-Body Leakage Current, Reverse | $V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$ | -- | -- | -100 | nA |
| On Characteristics | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$ | 2.0 | -- | 4.0 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 5.25\text{ A}$ | -- | 0.43 | 0.53 | Ω |
| g_{FS} | Forward Transconductance | $V_{DS} = 40\text{ V}, I_D = 5.25\text{ A}$ | -- | 7.1 | -- | S |
| Dynamic Characteristics | | | | | | |
| C_{iss} | Input Capacitance | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$ | -- | 840 | 1090 | pF |
| C_{oss} | Output Capacitance | | -- | 250 | 325 | pF |
| C_{rss} | Reverse Transfer Capacitance | | -- | 85 | 110 | pF |
| Switching Characteristics | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 200\text{ V}, I_D = 10.5\text{ A}, R_G = 25\ \Omega$ (Note 4) | -- | 14 | 40 | ns |
| t_r | Turn-On Rise Time | | -- | 89 | 190 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 81 | 170 | ns |
| t_f | Turn-Off Fall Time | | -- | 81 | 170 | ns |
| Q_g | Total Gate Charge | $V_{DS} = 320\text{ V}, I_D = 10.5\text{ A}, V_{GS} = 10\text{ V}$ (Note 4) | -- | 28 | 35 | nC |
| Q_{gs} | Gate-Source Charge | | -- | 4 | -- | nC |
| Q_{gd} | Gate-Drain Charge | | -- | 15 | -- | nC |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I_S | Maximum Continuous Drain-Source Diode Forward Current | | -- | -- | 10.5 | A |
| I_{SM} | Maximum Pulsed Drain-Source Diode Forward Current | | -- | -- | 42 | A |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 10.5\text{ A}$ | -- | -- | 1.4 | V |
| t_{rr} | Reverse Recovery Time | $V_{GS} = 0\text{ V}, I_S = 10.5\text{ A}, di_F / dt = 100\text{ A}/\mu\text{s}$ | -- | 290 | -- | ns |
| Q_{rr} | Reverse Recovery Charge | | -- | 2.4 | -- | μC |

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. $L = 5.7\text{ mH}, I_{AS} = 10.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 10.5\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

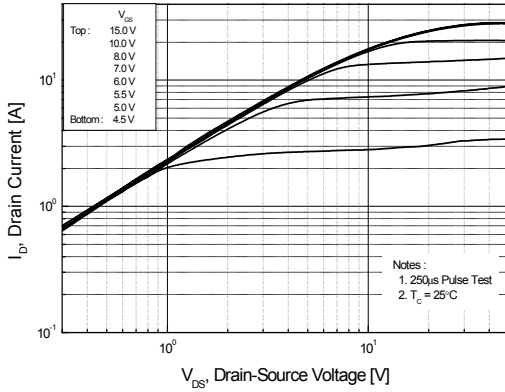


Figure 2. Transfer Characteristics

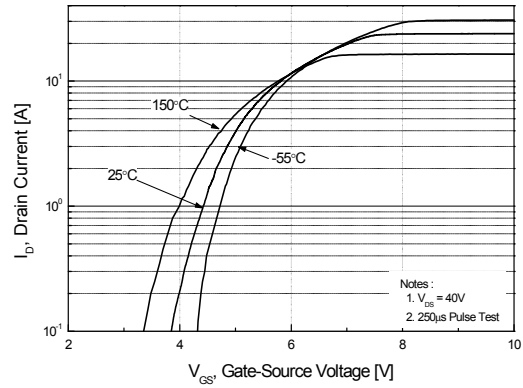


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

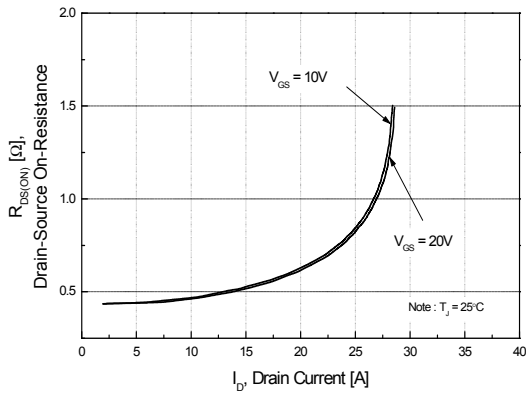


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

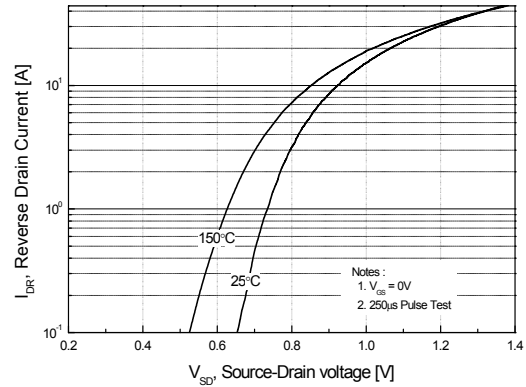


Figure 5. Capacitance Characteristics

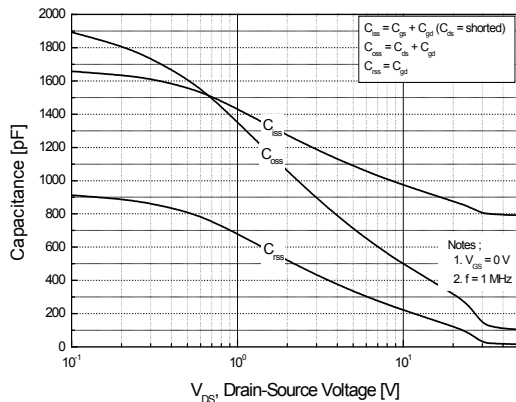
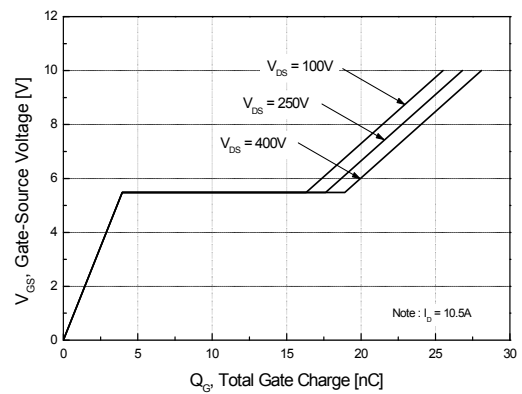


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

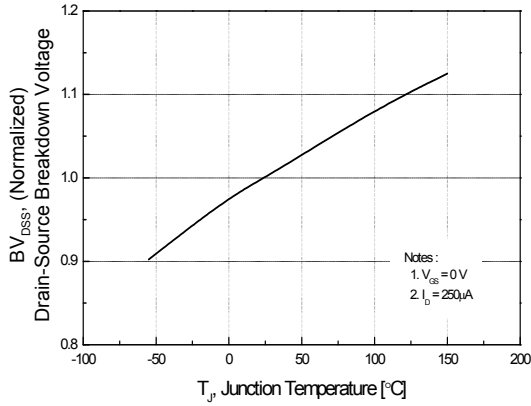


Figure 8. On-Resistance Variation vs. Temperature

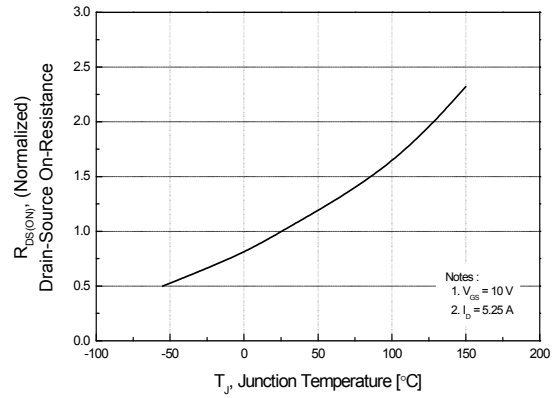


Figure 9-1. Maximum Safe Operating Area of FQP11N40C

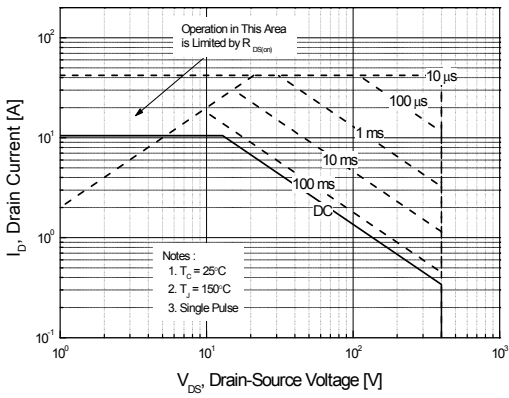


Figure 9-2. Maximum Safe Operating Area of FQPF11N40C

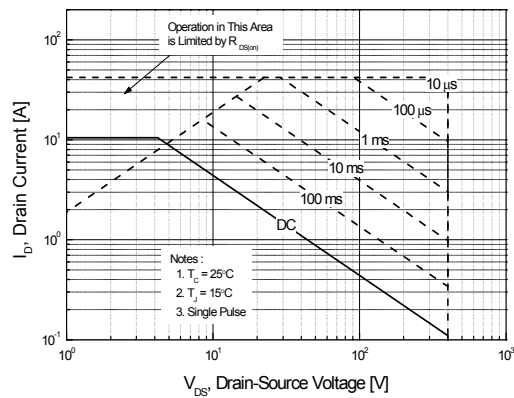
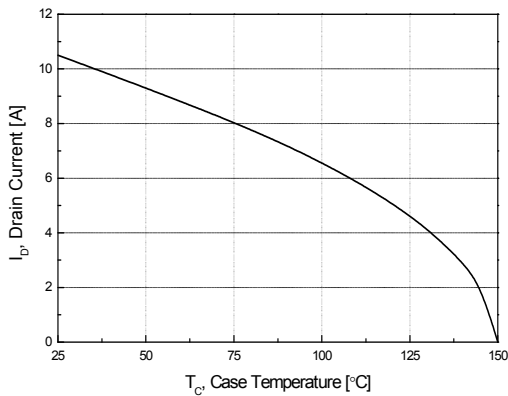


Figure 10. Maximum Drain Current



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve of FQP11N40C

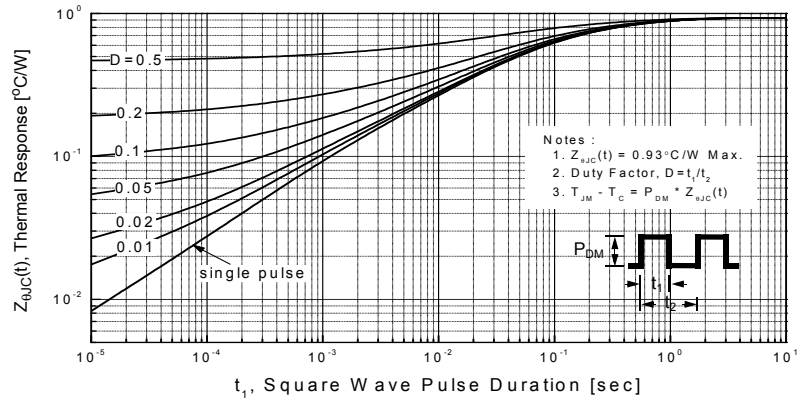


Figure 11-2. Transient Thermal Response Curve of FQPF11N40C

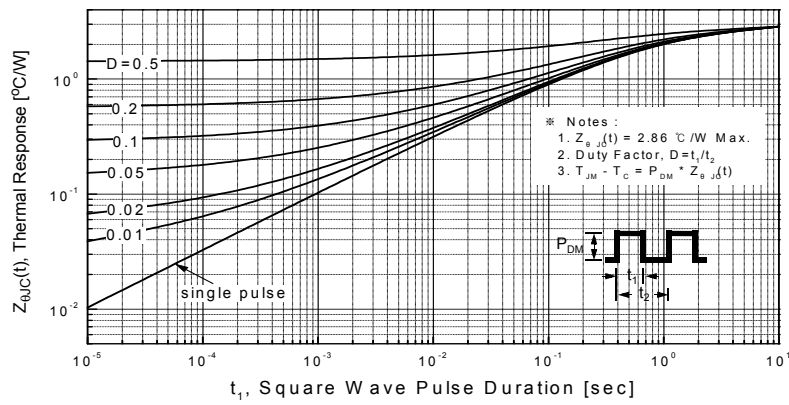


Figure 12. Gate Charge Test Circuit & Waveform

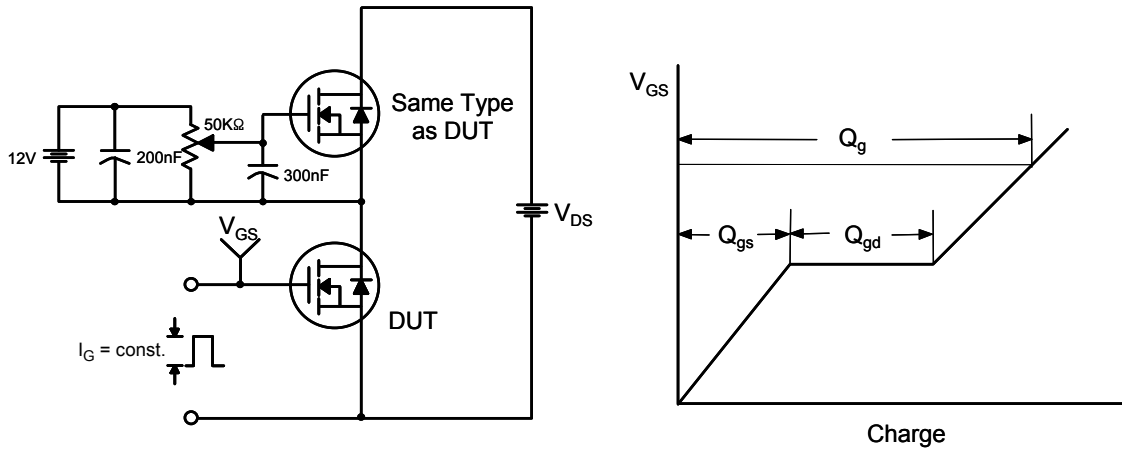


Figure 13. Resistive Switching Test Circuit & Waveforms

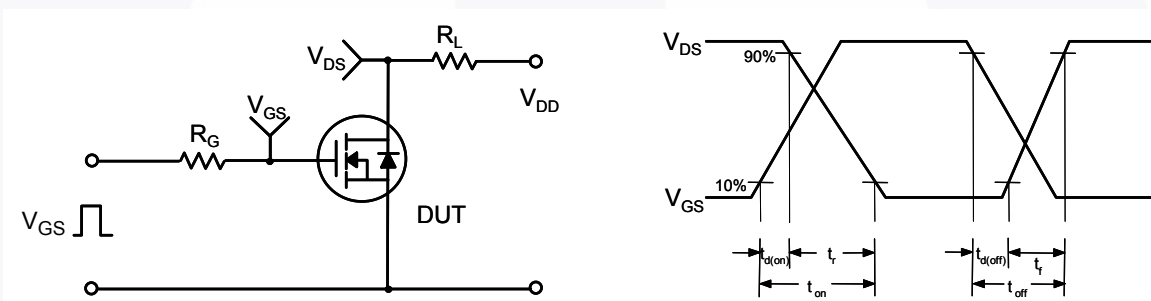
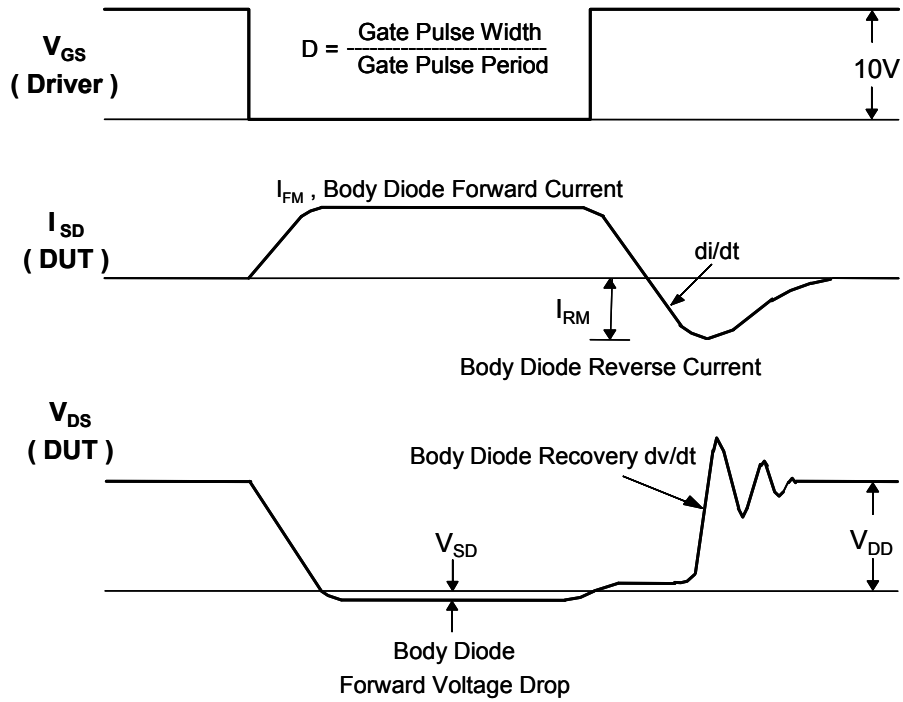
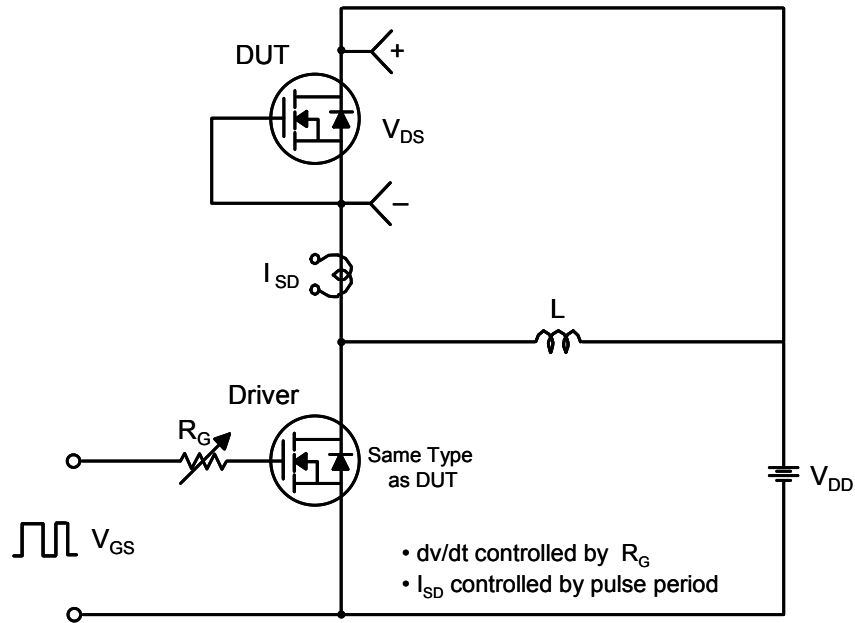


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions



NOTES:

- A) CONFORMS TO JEDEC TO-220 VARIATION AB EXCEPT WHERE NOTED
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D) DRAWING FILE/REVISION: MKT-TO220Y03REV1

Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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Mechanical Dimensions



Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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