

# MOSFET – N-Channel, QFET

400 V, 16 A, 270 mΩ

## FQP17N40

### Description

This N-Channel Enhancement Mode Power MOSFET is produced using onsemi'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.

### Features

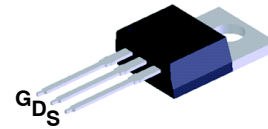
- 16 A, 400 V  $R_{DS(on)} = 270 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 8.0 \text{ A}$
- Low Gate Charge (Typ. 45 nC)
- Low  $C_{TSS}$  (Typ. 30 pF)
- 100% Avalanche Tested
- This Device is Pb-Free.

### ABSOLUTE MAXIMUM RATINGS

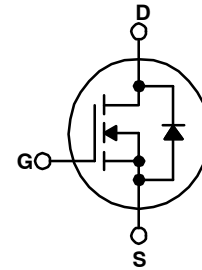
( $T_C = 25^\circ\text{C}$  unless otherwise noted.)

| Symbol         | Parameter                                                                                                | Value           | Unit                     |
|----------------|----------------------------------------------------------------------------------------------------------|-----------------|--------------------------|
| $V_{DSS}$      | Drain-Source Voltage                                                                                     | 400             | V                        |
| $I_D$          | Drain Current<br>– Continuous ( $T_C = 25^\circ\text{C}$ )<br>– Continuous ( $T_C = 100^\circ\text{C}$ ) | 16<br>10.1      | A                        |
| $I_{DM}$       | Drain Current – Pulsed (Note 1)                                                                          | 64              | A                        |
| $V_{GSS}$      | Gate-Source Voltage                                                                                      | $\pm 30$        | V                        |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                                                  | 1000            | mJ                       |
| $I_{AR}$       | Avalanche Current (Note 1)                                                                               | 16              | A                        |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)                                                                     | 17              | mJ                       |
| $dv/dt$        | Peak Diode Recovery $dv/dt$ (Note 3)                                                                     | 4.5             | V/ns                     |
| $P_D$          | Power Dissipation<br>– ( $T_C = 25^\circ\text{C}$ )<br>– Derate Above $25^\circ\text{C}$                 | 170<br>1.35     | W<br>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             | $^\circ\text{C}$         |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



TO-220-3  
CASE 340AT



### MARKING DIAGRAM

|                        |
|------------------------|
| &Z&3&K<br>FQP<br>17N40 |
|------------------------|

&Z = Assembly Plant Code  
 &3 = Date Code (Year & week)  
 &K = 2-Digit Lot Code  
 FQP17N40 = Specific Device Code

### ORDERING INFORMATION

| Device   | Package               | Shipping†            |
|----------|-----------------------|----------------------|
| FQP17N40 | TO-220-3<br>(Pb-Free) | 1000<br>Units / Tube |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](http://BRD8011/D).

# FQP17N40

## THERMAL CHARACTERISTICS

| Symbol          | Parameter                                     | Value | Unit |
|-----------------|-----------------------------------------------|-------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Max     | 0.74  | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient, Max. | 62.5  |      |

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

### Off Characteristics

|                                      |                                           |                                                     |     |      |      |               |
|--------------------------------------|-------------------------------------------|-----------------------------------------------------|-----|------|------|---------------|
| $BV_{DSS}$                           | Drain-Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 400 | –    | –    | V             |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to 25°C | –   | 0.44 | –    | V/°C          |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$        | –   | –    | 1    | $\mu\text{A}$ |
|                                      |                                           | $V_{DS} = 320\text{ V}, T_C = 125^\circ\text{C}$    | –   | –    | 10   | $\mu\text{A}$ |
| $I_{GSSF}$                           | 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            | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 3.0 | –    | 5.0  | V        |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 8.0\text{ A}$      | –   | 0.21 | 0.27 | $\Omega$ |
| $g_{FS}$     | Forward Transconductance          | $V_{DS} = 50\text{ V}, I_D = 8.0\text{ A}$      | –   | 13   | –    | S        |

### Dynamic Characteristics

|           |                              |                                                                 |   |      |      |    |
|-----------|------------------------------|-----------------------------------------------------------------|---|------|------|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$ | – | 1800 | 2300 | pF |
| $C_{oss}$ | Output Capacitance           |                                                                 | – | 270  | 350  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                 | – | 30   | 40   | pF |

### Switching Characteristics

|              |                     |                                                                               |   |      |     |    |
|--------------|---------------------|-------------------------------------------------------------------------------|---|------|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 200\text{ V}, I_D = 17.2\text{ A}, R_G = 25\text{ }\Omega$ (Note 4) | – | 40   | 90  | ns |
| $t_r$        | Turn-On Rise Time   |                                                                               | – | 185  | 380 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                               | – | 90   | 190 | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                               | – | 105  | 220 | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 320\text{ V}, I_D = 17.2\text{ A}, V_{GS} = 10\text{ V}$ (Note 4)   | – | 45   | 60  | nC |
| $Q_{gs}$     | Gate-Source Charge  |                                                                               | – | 11.4 | –   | nC |
| $Q_{gd}$     | Gate-Drain Charge   |                                                                               | – | 21.7 | –   | nC |

### Drain-Source Diode Characteristics and Maximum Ratings

|                 |                                                       |                                                                                   |   |     |     |    |
|-----------------|-------------------------------------------------------|-----------------------------------------------------------------------------------|---|-----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain–Source Diode Forward Current |                                                                                   | – | –   | 16  | A  |
| I <sub>SM</sub> | Maximum Pulsed Drain–Source Diode Forward Current     |                                                                                   | – | –   | 64  | A  |
| V <sub>SD</sub> | Drain–Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 16 A                                      | – | –   | 1.5 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                 | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 17.2 A,<br>dI <sub>F</sub> /dt = 100 A/μs | – | 290 | –   | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                               |                                                                                   | – | 2.5 | –   | μC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

### NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2.  $L = 6.8\text{ mH}$ ,  $I_{AS} = 16\text{ A}$ ,  $V_{DD} = 50\text{ V}$ ,  $R_G = 25\text{ }\Omega$  starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 17.2\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

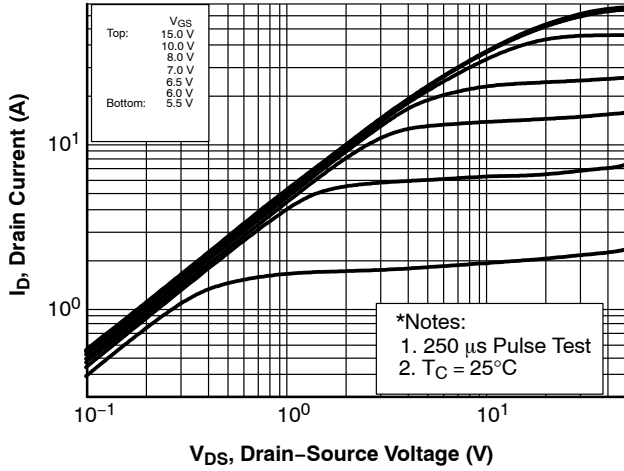


Figure 1. On-Region Characteristics

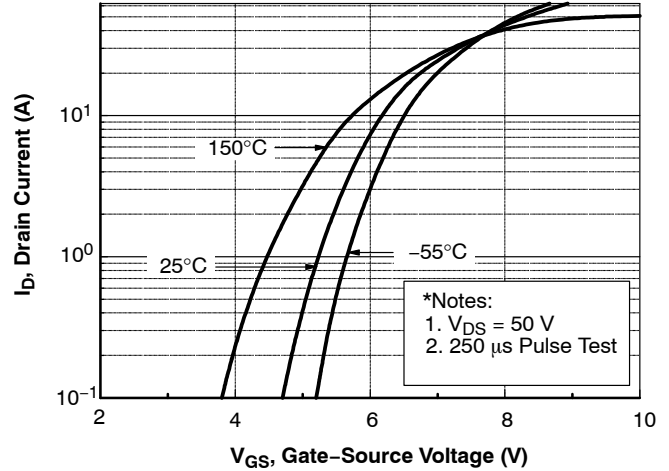


Figure 2. Transfer Characteristics

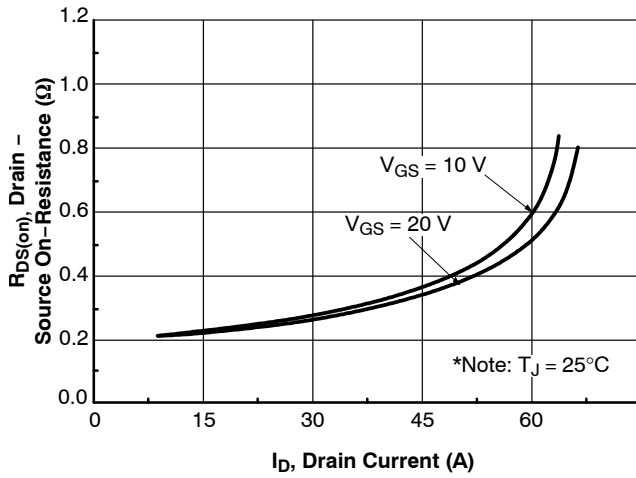


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

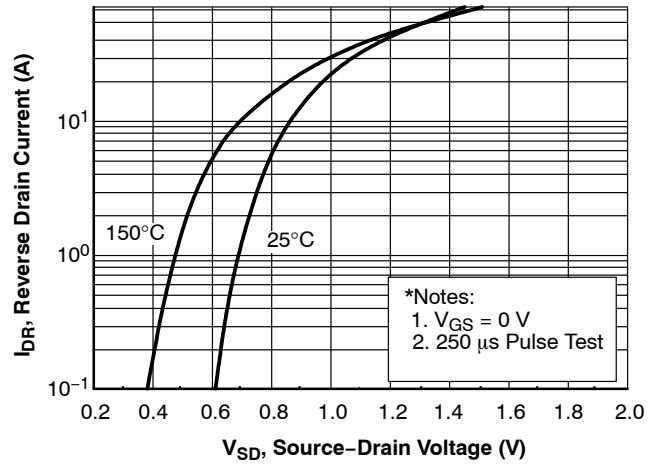


Figure 4. Body Diode Forward Voltage Variation vs Source Current and Temperature

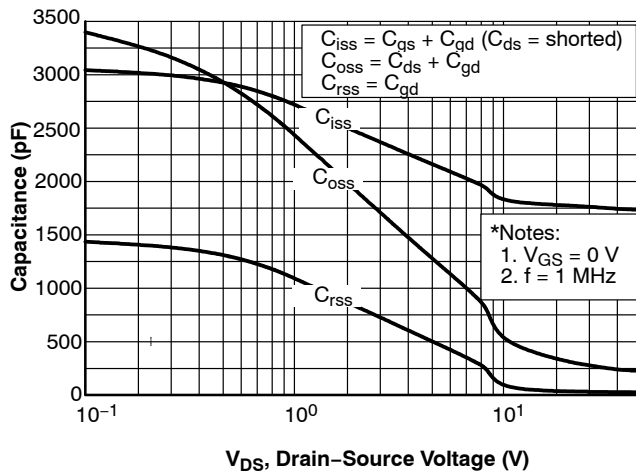


Figure 5. Capacitance Characteristics

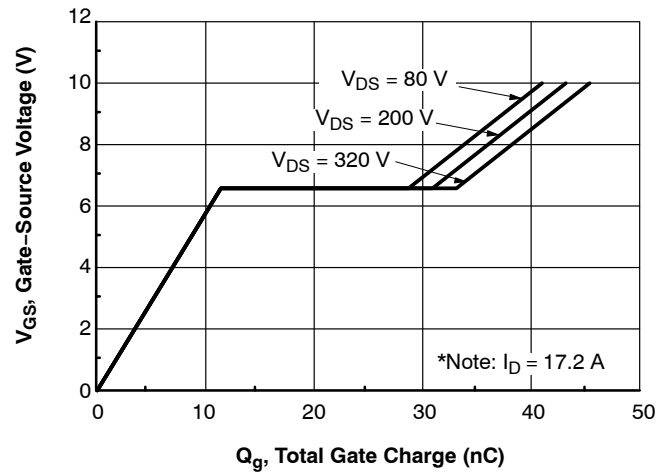


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (CONTINUED)

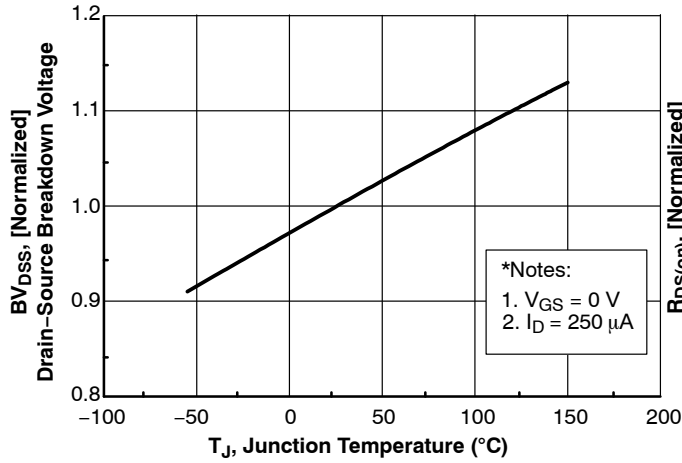


Figure 7. Breakdown Voltage Variation vs Temperature

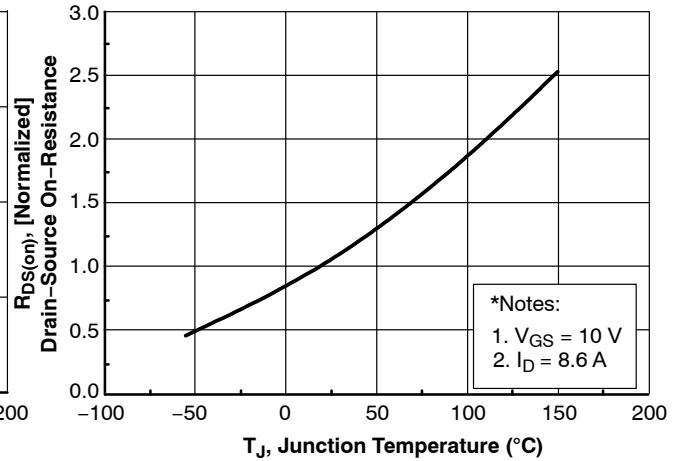


Figure 8. On-Resistance Variation vs Temperature

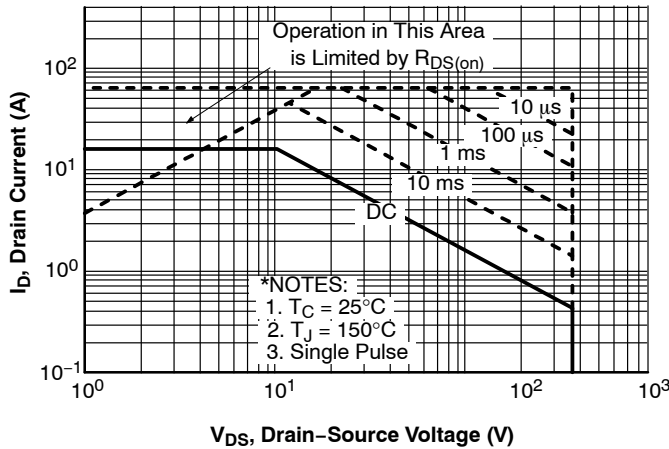


Figure 9. Maximum Safe Operating Area

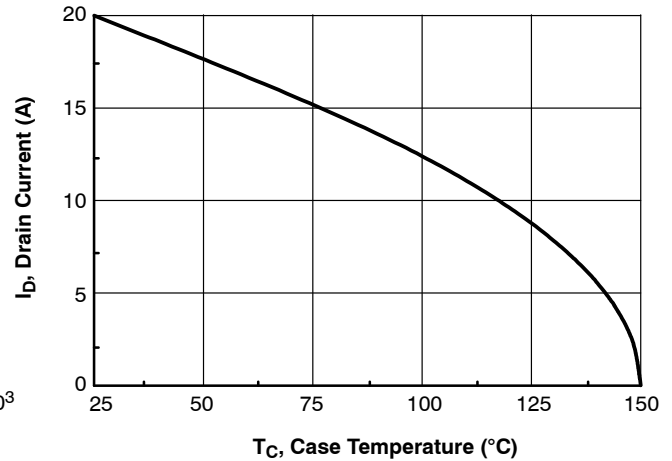


Figure 10. Maximum Drain Current vs. Case Temperature

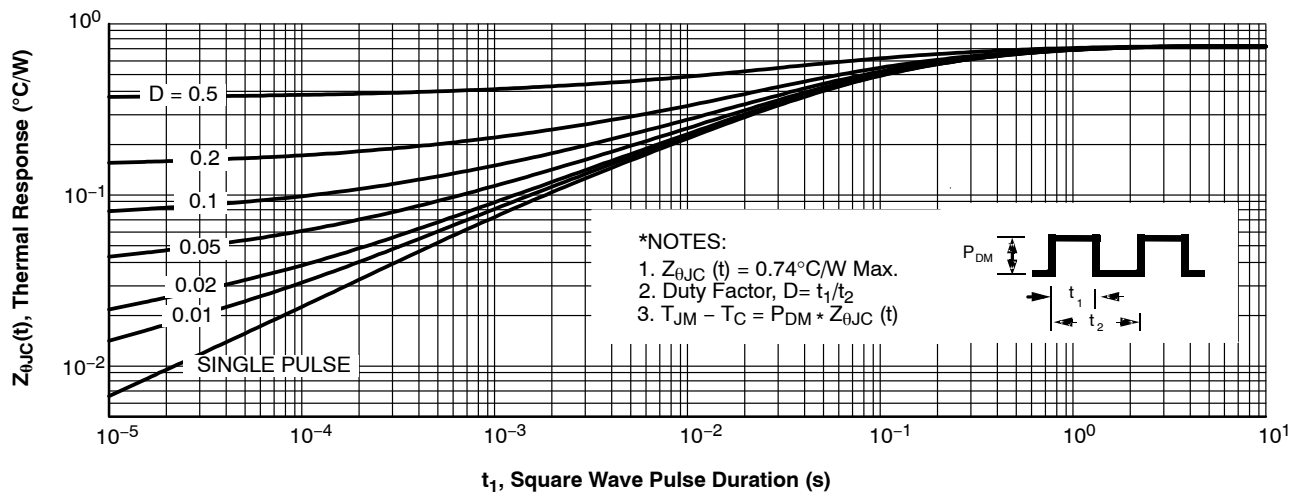


Figure 11. Transient Thermal Response Curve

# FQP17N40

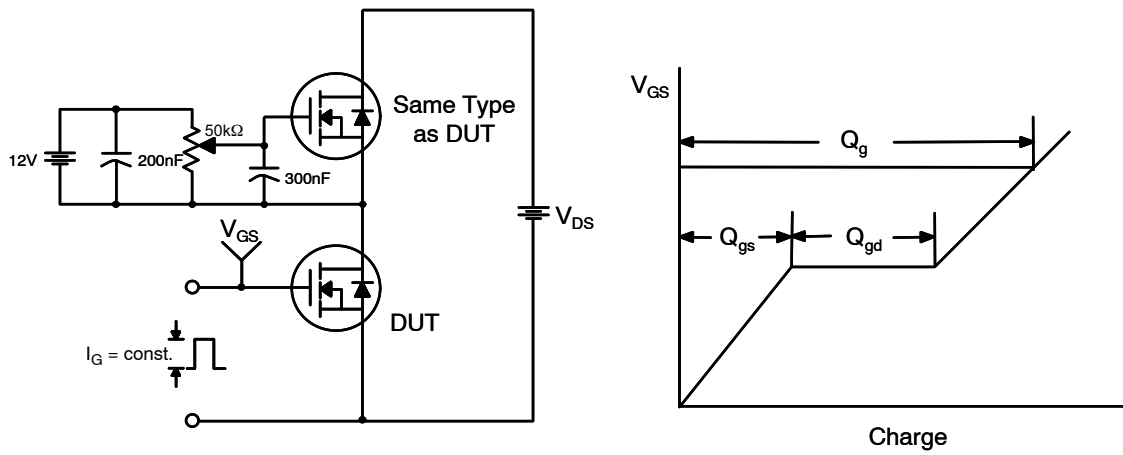


Figure 12. Gate Charge Test Circuit & Waveform

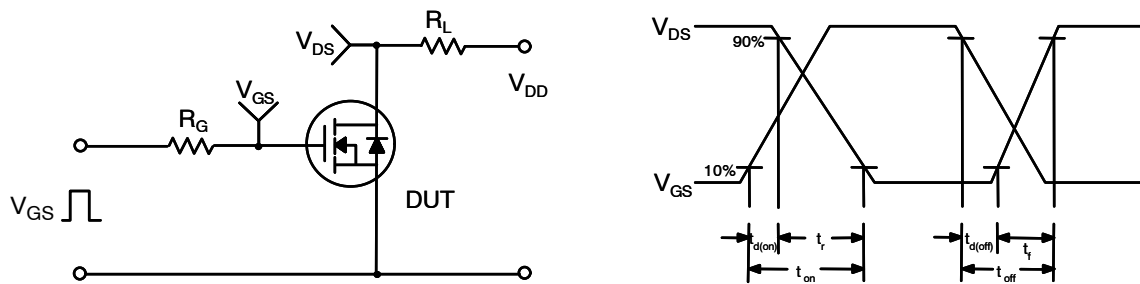


Figure 13. Resistive Switching Test Circuit & Waveforms

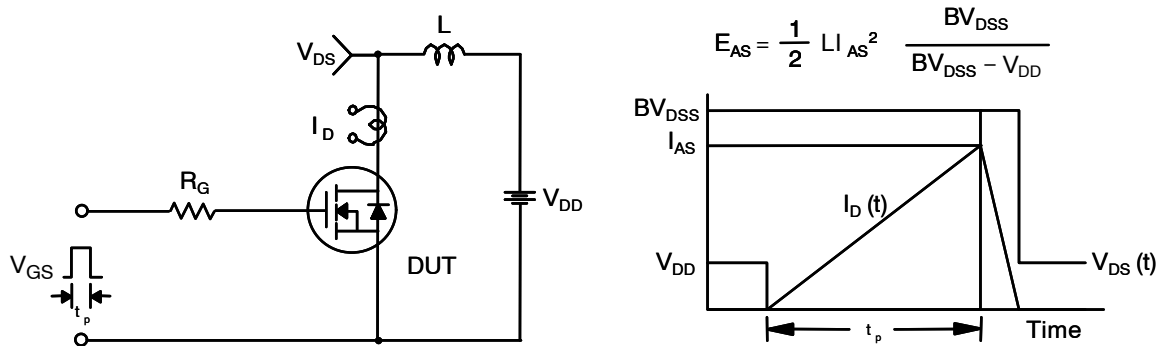
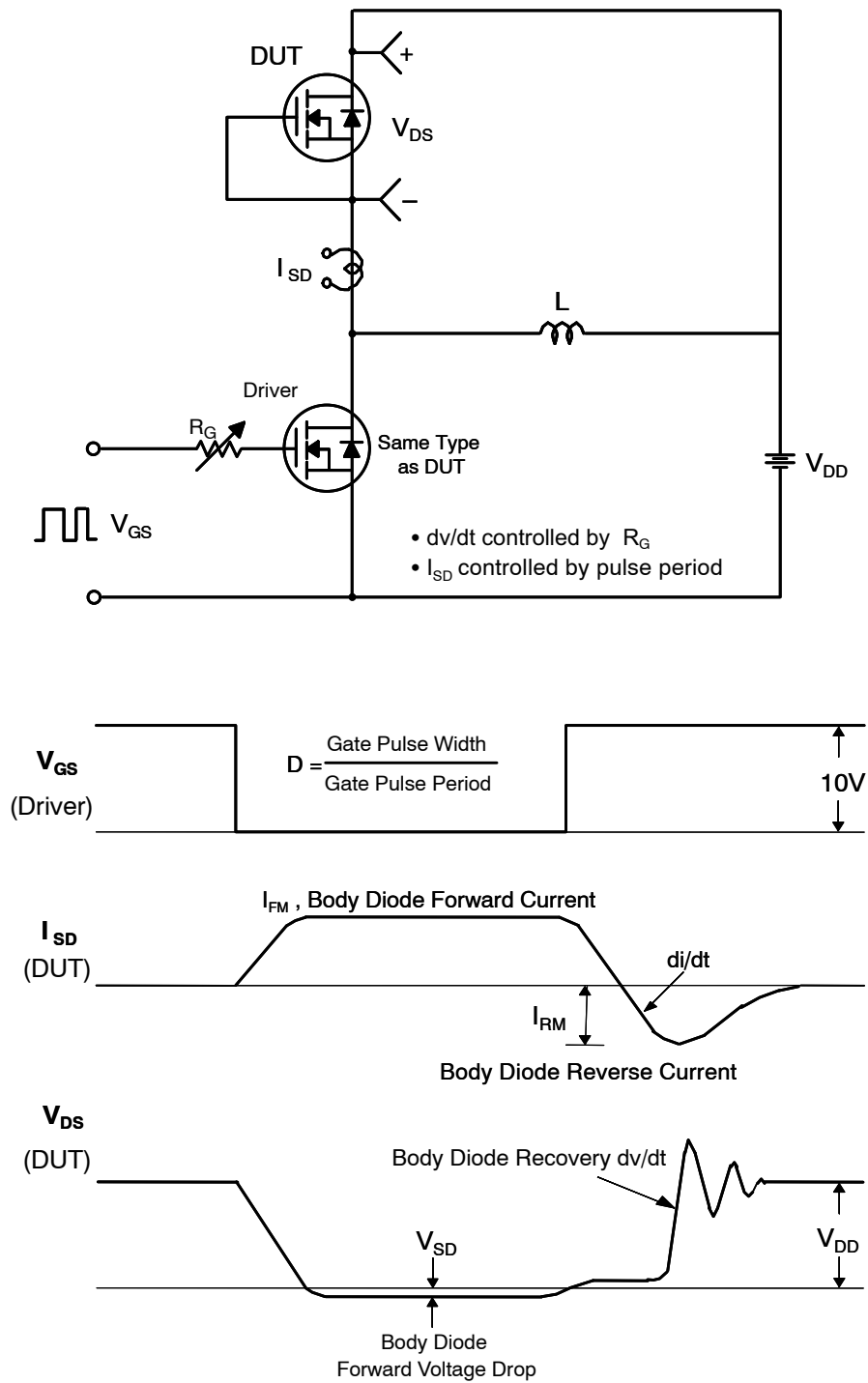


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

# FQP17N40



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



TO-220-3LD  
CASE 340AT  
ISSUE B

DATE 08 AUG 2022

| DIM | MILLIMETERS  |      |       |
|-----|--------------|------|-------|
|     | MIN.         | NOM. | MAX.  |
| A   | 4.00         | --   | 4.70  |
| A1  | SEE NOTE "F" |      |       |
| A2  | 2.10         | --   | 2.85  |
| b   | 0.55         | --   | 1.00  |
| b2  | 1.10         | --   | 1.62  |
| b4  | 1.42         | --   | 1.62  |
| c   | 0.36         | --   | 0.60  |
| D   | 13.90        | --   | 16.30 |
| D1  | 8.13         | --   | 9.40  |
| D2  | 11.50        | --   | 14.30 |
| D3  | 15.42        | --   | 16.51 |
| E   | 9.65         | --   | 10.67 |
| E1  | 7.59         | --   | 8.65  |
| e   | 2.40         | --   | 2.67  |
| H1  | 6.06         | --   | 6.69  |
| L   | 12.70        | --   | 14.04 |
| L1  | 2.70         | --   | 4.10  |
| P   | 3.50         | --   | 4.00  |
| Q   | 2.50         | --   | 3.40  |
| z   | 2.13 REF     |      |       |
| z1  | 2.06 REF     |      |       |
| θ   | 3°           | --   | 5°    |

IF PRESENT, SEE NOTE "D"

GENERIC  
MARKING DIAGRAM\*



XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



NOTES:

- A) REFERENCE JEDEC, TO-220, VARIATION AB
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
- D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
- E) DOES NOT COMPLY JEDEC STANDARD VALUE.
- F) "A1" DIMENSIONS AS BELOW:  
SINGLE GAUGE = 0.51 - 0.61  
DUAL GAUGE = 1.10 - 1.45
- PRESENCE IS SUPPLIER DEPENDENT
- H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

|                  |             |                                                                                                                                                                                     |
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