

# **MOSFET – N-Channel, QFET®**

**100 V, 48 A, 39 mΩ**

## **FQH44N10**

### **Description**

This N-Channel enhancement mode power MOSFET is produced using ON 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, audio amplifier, DC motor control, and variable switching power applications.

### **Features**

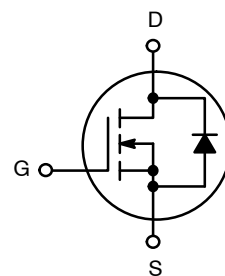
- 48 A, 100 V,  $R_{DS(on)} = 39 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 24 \text{ A}$
- Low Gate Charge (Typ. 48 nC)
- Low  $C_{rss}$  (Typ. 85 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating



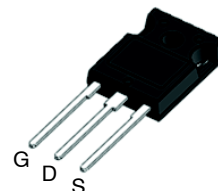
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| $V_{DS}$ | $R_{DS(on)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|----------|--------------------------|-------------------|
| 100 V    | 39 mΩ @ 10 V             | 48 A              |

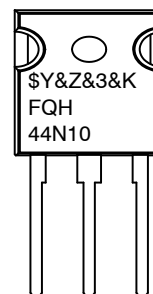


**POWER MOSFET**



**TO-247-3LD  
CASE 340CK**

### **MARKING DIAGRAM**



|          |                         |
|----------|-------------------------|
| \$Y      | = ON Semiconductor Logo |
| &Z       | = Assembly Plant Code   |
| &3       | = Numeric Date Code     |
| &K       | = Lot Code              |
| FQH44N10 | = Specific Device Code  |

### **ORDERING INFORMATION**

See detailed ordering and shipping information on page 2 of this data sheet.

# FQH44N10

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C, Unless otherwise noted)

| Symbol                            | Parameter                                                                      |                                     | FQH44N10-133 | Unit |
|-----------------------------------|--------------------------------------------------------------------------------|-------------------------------------|--------------|------|
| V <sub>DSS</sub>                  | Drain-Source Voltage                                                           |                                     | 100          | V    |
| I <sub>D</sub>                    | Drain Current                                                                  | Continuous (T <sub>C</sub> = 25°C)  | 48           | A    |
|                                   |                                                                                | Continuous (T <sub>C</sub> = 100°C) | 34           |      |
| I <sub>DM</sub>                   | Drain Current                                                                  | Pulsed (Note 1)                     | 192          | A    |
| V <sub>GSS</sub>                  | Gate-Source Voltage                                                            |                                     | ±25          | V    |
| E <sub>AS</sub>                   | Single Pulsed Avalanche Energy (Note 2)                                        |                                     | 530          | mJ   |
| I <sub>AR</sub>                   | Avalanche Current (Note 1)                                                     |                                     | 48           | A    |
| E <sub>AR</sub>                   | Repetitive Avalanche Energy (Note 1)                                           |                                     | 18           | mJ   |
| dv/dt                             | Peak Diode Recovery dv/dt (Note 3)                                             |                                     | 6.0          | V/ns |
| P <sub>D</sub>                    | Power Dissipation                                                              | (T <sub>C</sub> = 25°C)             | 180          | W    |
|                                   |                                                                                | Derate Above 25°C                   | 1.2          | W/°C |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range                                        |                                     | -55 to +175  | °C   |
| T <sub>L</sub>                    | Maximum Lead Temperature for Soldering Purpose<br>1/8" from Case for 5 seconds |                                     | 300          | °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.

1. Repetitive rating; pulse-width limited by maximum junction temperature.

2. L = 0.345 mH, I<sub>AS</sub> = 48 A, V<sub>DD</sub> = 25 V, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.

3. I<sub>SD</sub> ≤ 43.5 A, di/dt ≤ 300 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C.

## THERMAL CHARACTERISTICS

| Symbol           | Parameter                                     | FQH44N10-133 | Unit |
|------------------|-----------------------------------------------|--------------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case, Max.    | 0.83         | °C/W |
| R <sub>θCS</sub> | Thermal Resistance, Case-to-Sink, Typ.        | 0.24         | °C/W |
| R <sub>θJA</sub> | Thermal Resistance, Junction to Ambient, Max. | 40           | °C/W |

## PACKAGE MARKING AND ORDERING INFORMATION

| Part Number  | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|--------------|----------|---------|----------------|-----------|------------|----------|
| FQH44N10-133 | FQH44N10 | TO-247  | Tube           | N/A       | N/A        | 30 Units |

# FQH44N10

## 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            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$               | 100 |     |      | V                   |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ |     | 0.1 |      | V/ $^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$                      |     |     | 1    | $\mu\text{A}$       |
|                                |                                           | $V_{DS} = 80\text{ V}, T_C = 150^\circ\text{C}$                   |     |     | 10   |                     |
| $I_{GSSF}$                     | Gate–Body Leakage Current, Forward        | $V_{GS} = 25\text{ V}, V_{DS} = 0\text{ V}$                       |     |     | 100  | nA                  |
| $I_{GSSR}$                     | Gate–Body Leakage Current, Reverse        | $V_{GS} = -25\text{ V}, V_{DS} = 0\text{ V}$                      |     |     | -100 | nA                  |

### ON CHARACTERISTICS

|              |                                   |                                                 |     |      |       |          |
|--------------|-----------------------------------|-------------------------------------------------|-----|------|-------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 2.0 |      | 4.0   | V        |
| $R_{DS(on)}$ | Static Drain–Source On–Resistance | $V_{GS} = 10\text{ V}, I_D = 24\text{ A}$       |     | 0.03 | 0.039 | $\Omega$ |
| $g_{FS}$     | Forward Transconductance          | $V_{DS} = 40\text{ V}, I_D = 24\text{ A}$       |     | 31   |       | S        |

### DYNAMIC CHARACTERISTICS

|           |                              |                                                                 |  |      |      |    |
|-----------|------------------------------|-----------------------------------------------------------------|--|------|------|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$ |  | 1400 | 1800 | pF |
| $C_{oss}$ | Output Capacitance           |                                                                 |  | 425  | 550  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                 |  | 85   | 110  | pF |

### SWITCHING CHARACTERISTICS

|              |                     |                                                                                 |  |     |     |    |
|--------------|---------------------|---------------------------------------------------------------------------------|--|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 50\text{ V}, I_D = 43.5\text{ A}, R_g = 25\text{ }\Omega$<br>(Note 4) |  | 19  | 45  | ns |
| $t_r$        | Turn-On Rise Time   |                                                                                 |  | 190 | 390 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                 |  | 90  | 190 | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                                 |  | 100 | 210 | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 80\text{ V}, I_D = 43.5\text{ A}, V_{GS} = 10\text{ V}$<br>(Note 4)   |  | 48  | 62  | nC |
| $Q_{gs}$     | Gate–Source Charge  |                                                                                 |  | 9.0 |     | nC |
| $Q_{gd}$     | Gate–Drain Charge   |                                                                                 |  | 24  |     | nC |

### DRAIN–SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

|                 |                                                       |                                                                                   |  |     |     |    |
|-----------------|-------------------------------------------------------|-----------------------------------------------------------------------------------|--|-----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain–Source Diode Forward Current |                                                                                   |  |     | 48  | A  |
| I <sub>SM</sub> | Maximum Pulsed Drain–Source Diode Forward Current     |                                                                                   |  |     | 192 | A  |
| V <sub>SD</sub> | Drain–Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 48A                                       |  |     | 1.5 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                 | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 43.5 A,<br>dI <sub>F</sub> /dt = 100 A/μs |  | 98  |     | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                               |                                                                                   |  | 360 |     | nC |

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.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

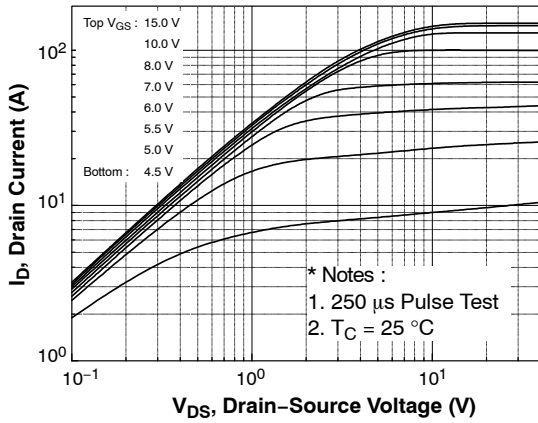


Figure 1. On-Region Characteristics

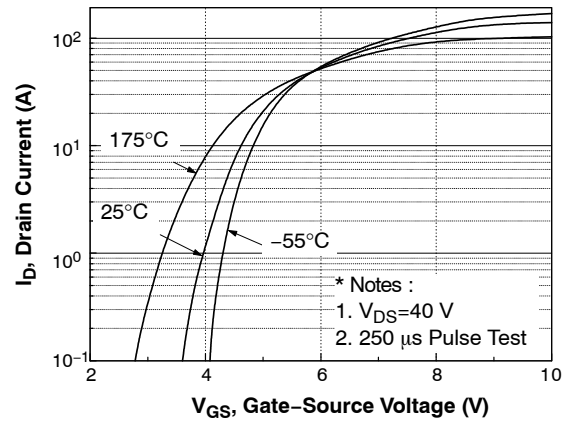


Figure 2. Transfer Characteristics

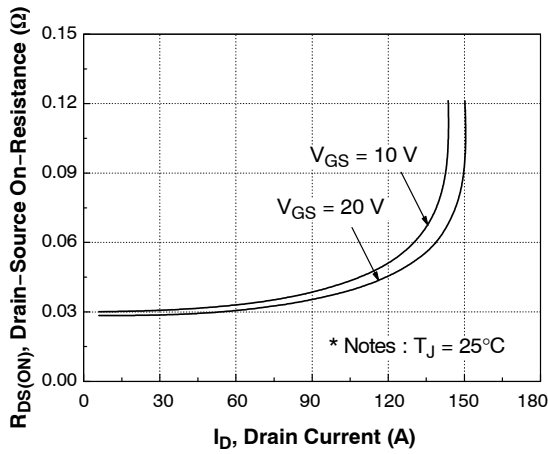


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

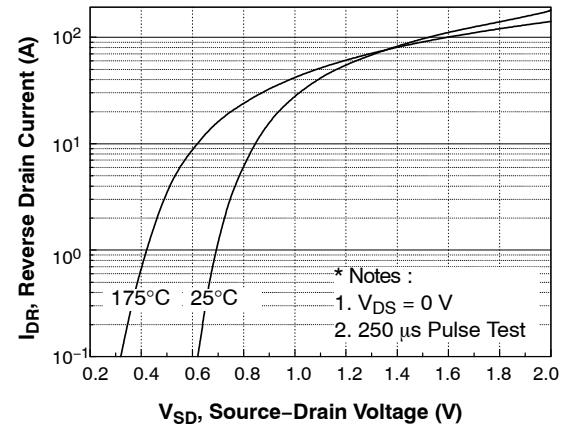


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

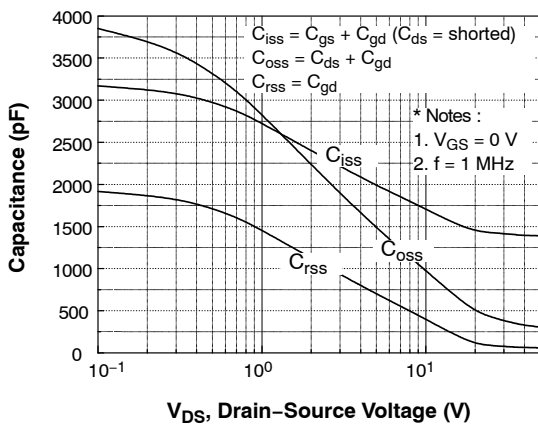


Figure 5. Capacitance Characteristics

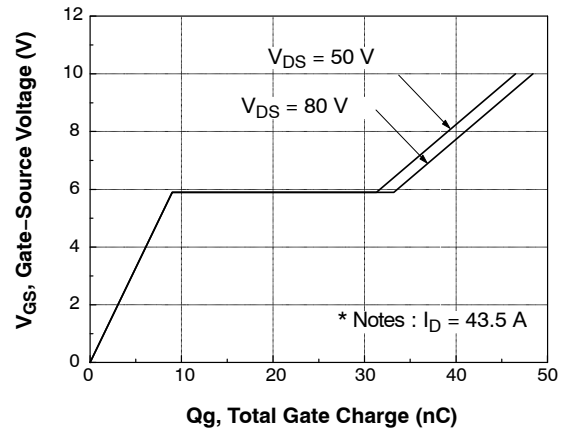


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

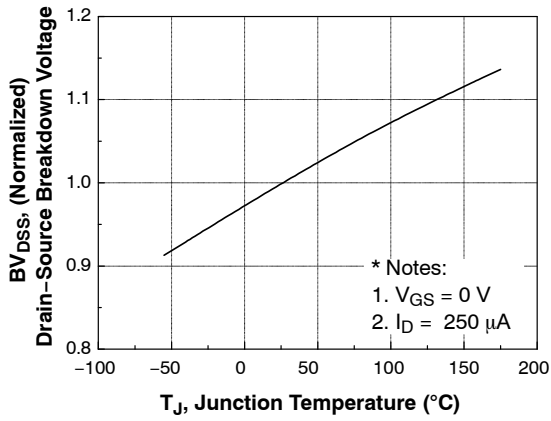


Figure 7. Breakdown Voltage Variation vs. Temperature

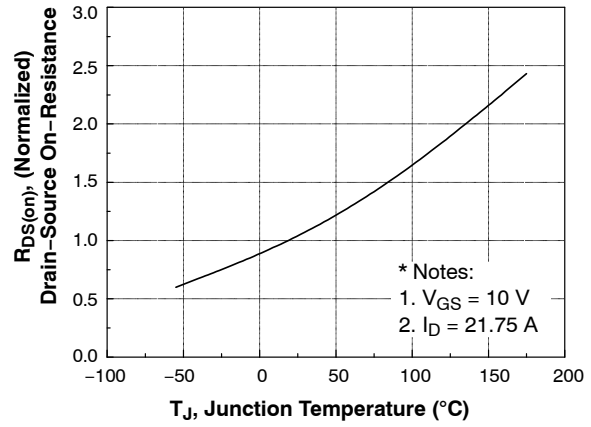


Figure 8. On-Resistance Variation vs. Temperature

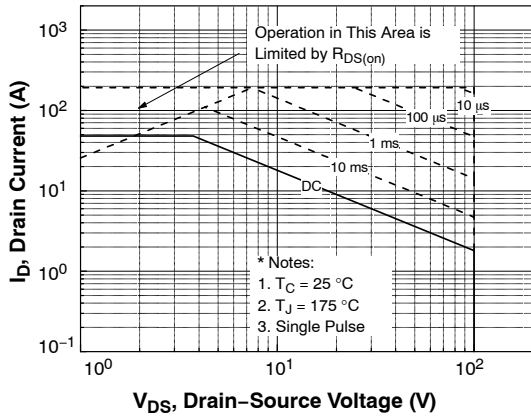


Figure 9. Maximum Safe Operating Area

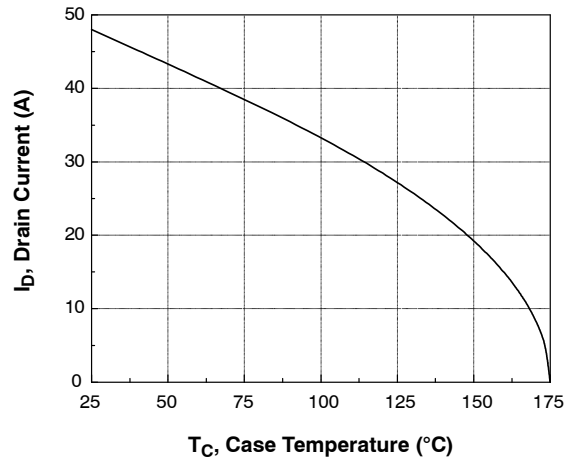


Figure 10. Maximum Drain Current vs. Case Temperature

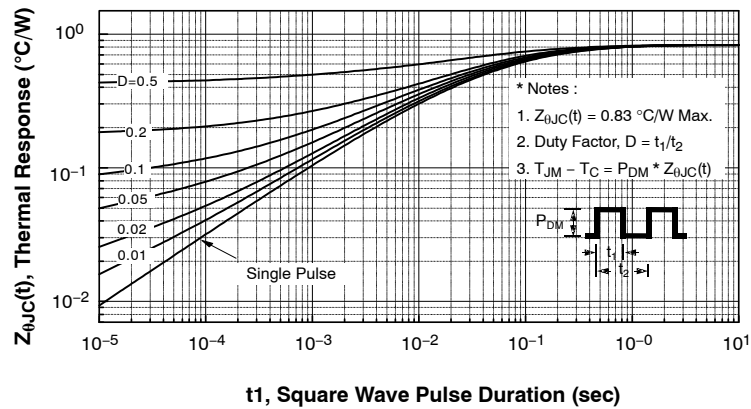


Figure 11. Transient Thermal Response Curve

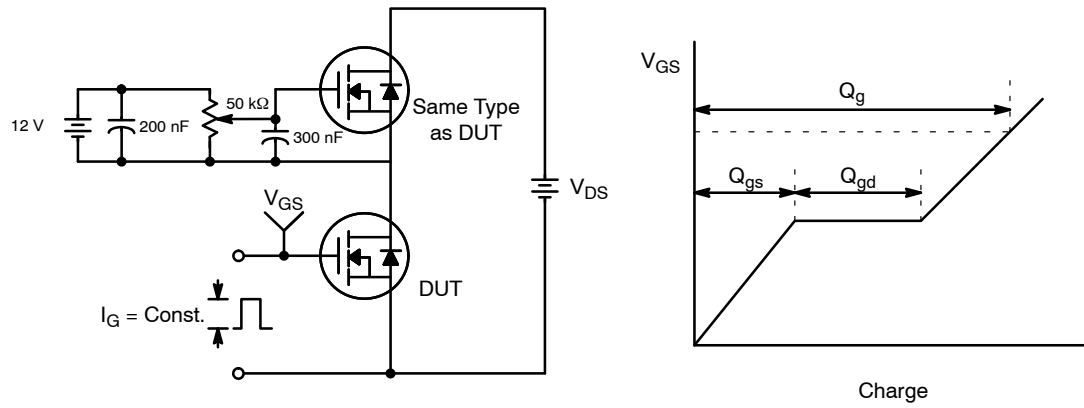


Figure 12. Gate Charge Test Circuit & Waveform

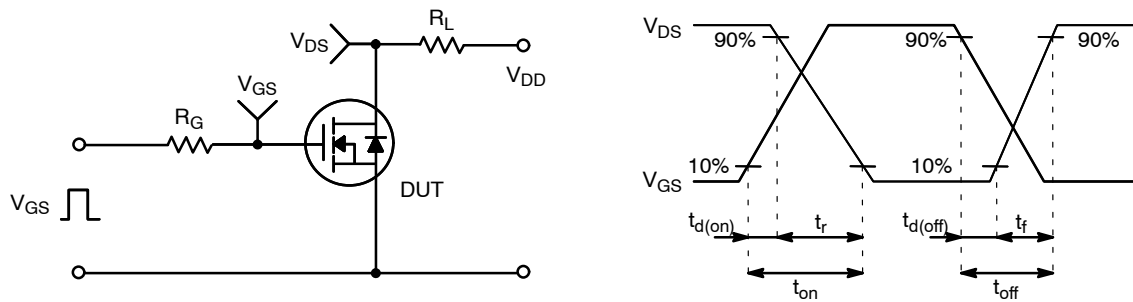


Figure 13. Resistive Switching Test Circuit & Waveforms

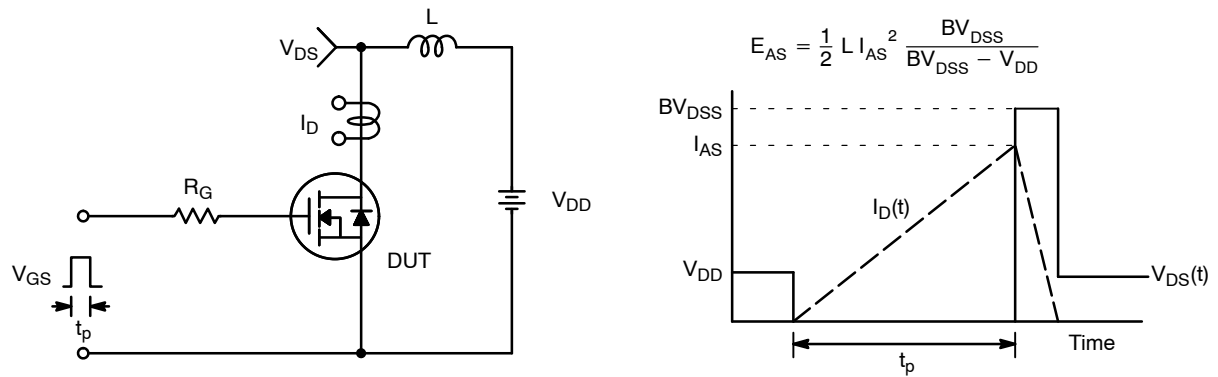
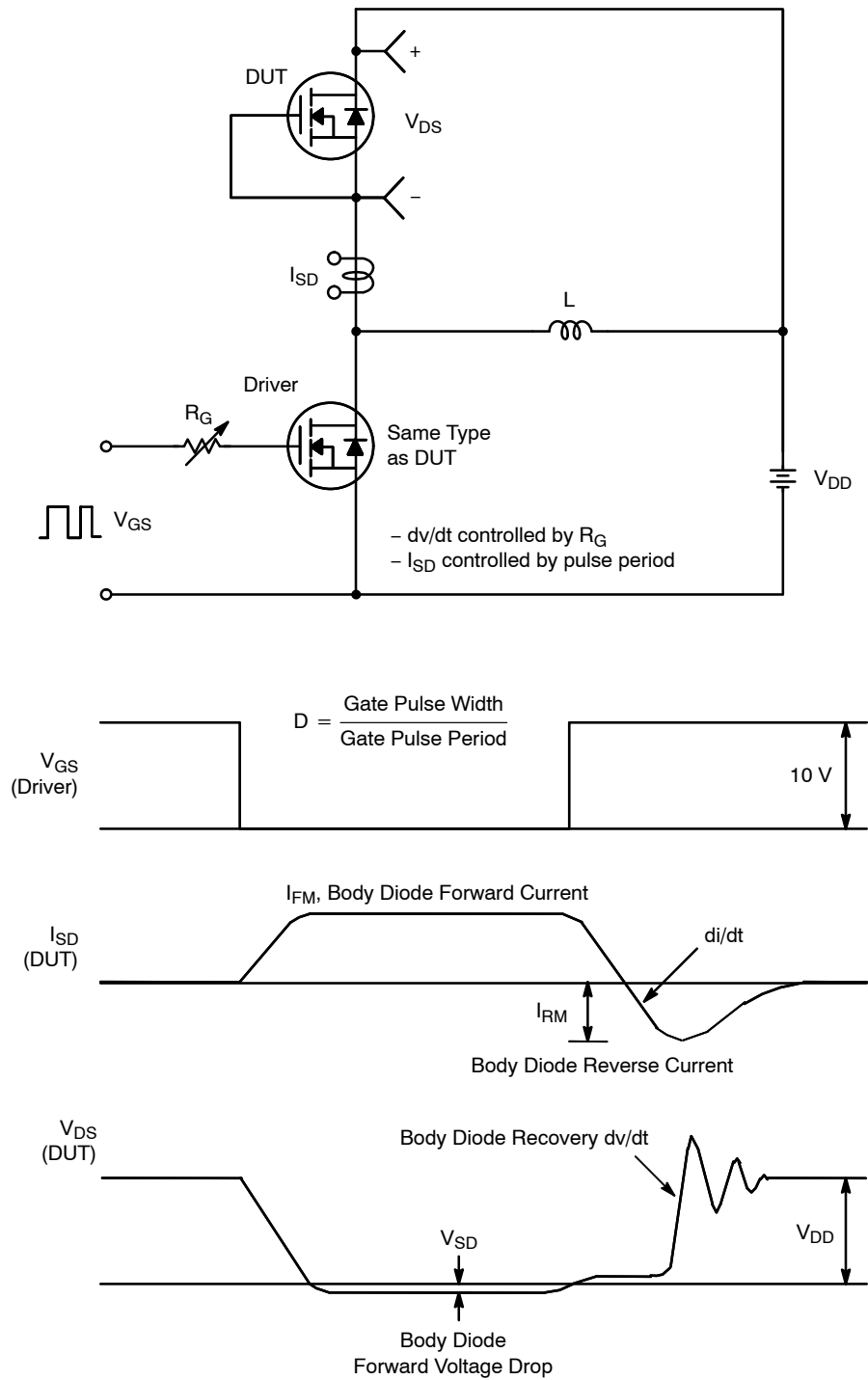


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

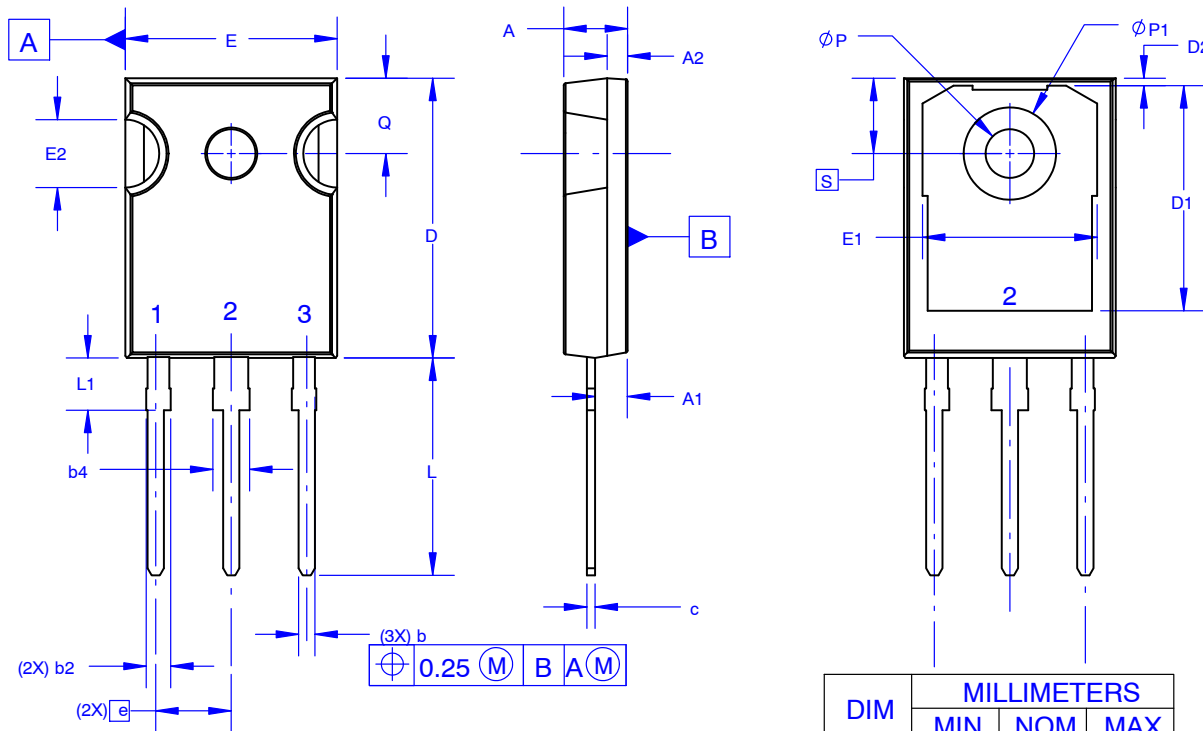
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**Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

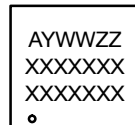
**TO-247-3LD SHORT LEAD**  
**CASE 340CK**  
**ISSUE A**

DATE 31 JAN 2019



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.  
B. ALL DIMENSIONS ARE IN MILLIMETERS.  
C. DRAWING CONFORMS TO ASME Y14.5 - 2009.  
D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.  
E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

**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.

| DIM       | MILLIMETERS |       |       |
|-----------|-------------|-------|-------|
|           | MIN         | NOM   | MAX   |
| A         | 4.58        | 4.70  | 4.82  |
| A1        | 2.20        | 2.40  | 2.60  |
| A2        | 1.40        | 1.50  | 1.60  |
| b         | 1.17        | 1.26  | 1.35  |
| b2        | 1.53        | 1.65  | 1.77  |
| b4        | 2.42        | 2.54  | 2.66  |
| c         | 0.51        | 0.61  | 0.71  |
| D         | 20.32       | 20.57 | 20.82 |
| D1        | 13.08       | ~     | ~     |
| D2        | 0.51        | 0.93  | 1.35  |
| E         | 15.37       | 15.62 | 15.87 |
| E1        | 12.81       | ~     | ~     |
| E2        | 4.96        | 5.08  | 5.20  |
| e         | ~           | 5.56  | ~     |
| L         | 15.75       | 16.00 | 16.25 |
| L1        | 3.69        | 3.81  | 3.93  |
| $\phi P$  | 3.51        | 3.58  | 3.65  |
| $\phi P1$ | 6.60        | 6.80  | 7.00  |
| Q         | 5.34        | 5.46  | 5.58  |
| S         | 5.34        | 5.46  | 5.58  |

|                         |                              |                                                                                                                                                                                  |
|-------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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