



## Description

### JMT N And P-Channel Enhancement Mode MOSFET

#### Features

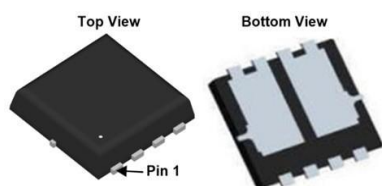
- N-Channel: 30V, 9A  
 $R_{DS(ON)} < 21m\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)} < 35m\Omega @ V_{GS} = 4.5V$
- P-Channel: -30V, -5A  
 $R_{DS(ON)} < 52m\Omega @ V_{GS} = -10V$   
 $R_{DS(ON)} < 90m\Omega @ V_{GS} = -4.5V$
- Excellent Gate Charge x  $R_{DS(ON)}$  Product(FOM)
- Very Low On-resistance  $R_{DS(ON)}$
- Fast Switching Speed

#### Application

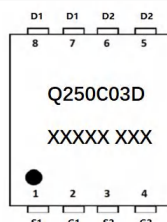
- Battery Protection
- Load Switch
- Power Management



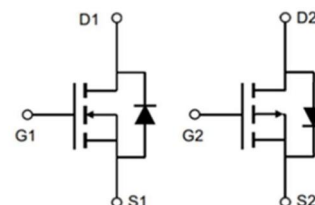
**100% UIS TESTED!**  
**100%  $\Delta V_{ds}$  TESTED!**



PDFN3x3-8L-D



Marking and pin Assignment



Schematic Diagram

## Package Marking and Ordering Information

| Device Marking | Device      | OUTLINE | Device Package | Reel Size | Reel (PCS) | Per Carton (PCS) |
|----------------|-------------|---------|----------------|-----------|------------|------------------|
| Q250C03D       | JMTQ250C03D | TAPING  | PDFN3x3-8L-D   | 13inch    | 5000       | 50000            |

## Absolute Maximum Ratings ( $T_C=25^{\circ}C$ unless otherwise specified)

| Symbol          | Parameter                                       | Max. N-Channel       | Max. P-Channel | Units         |
|-----------------|-------------------------------------------------|----------------------|----------------|---------------|
| $V_{DSS}$       | Drain-Source Voltage                            | 30                   | -30            | V             |
| $V_{GSS}$       | Gate-Source Voltage                             | $\pm 20$             | $\pm 20$       | V             |
| $I_D$           | Continuous Drain Current                        | $T_C = 25^{\circ}C$  | -5             | A             |
|                 |                                                 | $T_C = 100^{\circ}C$ | -3.3           | A             |
| $I_{DM}$        | Pulsed Drain Current <sup>note1</sup>           | 36                   | -20            | A             |
| $E_{AS}$        | Single Pulsed Avalanche Energy <sup>note2</sup> | 12                   | 12             | mJ            |
| $P_D$           | Power Dissipation                               | $T_C = 25^{\circ}C$  | 2.2            | W             |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case            | 43                   | 57             | $^{\circ}C/W$ |
| $T_J, T_{STG}$  | Operating and Storage Temperature Range         | -55 to +150          |                | $^{\circ}C$   |



## N-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise specified)

| Symbol                                                 | Parameter                                                 | Test Condition                                                                          | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                           |                                                                                         |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                            | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                              | 30   | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                           | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V                                               | -    | -    | 1    | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                              | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                              | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                           |                                                                                         |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 1.0  | 1.5  | 2.5  | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br><small>note2</small> | V <sub>GS</sub> =10V, I <sub>D</sub> =5A                                                | -    | 16   | 21   | mΩ    |
|                                                        |                                                           | V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A                                               | -    | 25   | 35   | mΩ    |
| Dynamic Characteristics                                |                                                           |                                                                                         |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                         | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                  | -    | 490  | -    | pF    |
| C <sub>Oss</sub>                                       | Output Capacitance                                        |                                                                                         | -    | 79   | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                              |                                                                                         | -    | 61   | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                         | V <sub>DS</sub> =15V, I <sub>D</sub> =5.8A,<br>V <sub>GS</sub> =10V                     | -    | 5.2  | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                        |                                                                                         | -    | 0.9  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                               |                                                                                         | -    | 1.3  | -    | nC    |
| Switching Characteristics                              |                                                           |                                                                                         |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                        | V <sub>DS</sub> =15V, I <sub>D</sub> =3A,<br>V <sub>GS</sub> =10V, R <sub>REN</sub> =3Ω | -    | 4.5  | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                         |                                                                                         | -    | 2.5  | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                       |                                                                                         | -    | 14.5 | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                        |                                                                                         | -    | 3.5  | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                           |                                                                                         |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current  |                                                                                         | -    | -    | 9    | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current      |                                                                                         | -    | -    | 36   | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                     | V <sub>GS</sub> =0V, I <sub>S</sub> =9A                                                 | -    | 0.8  | 1.2  | V     |

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=15V, V<sub>GS</sub>=10V, L=0.5mH, R<sub>g</sub>=25Ω, I<sub>AS</sub>=7A

T<sub>J</sub>=25°C, V<sub>DD</sub>= -15V, V<sub>GS</sub>= -10V, L=0.5mH, R<sub>g</sub>=25Ω, I<sub>AS</sub>= -7A

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%

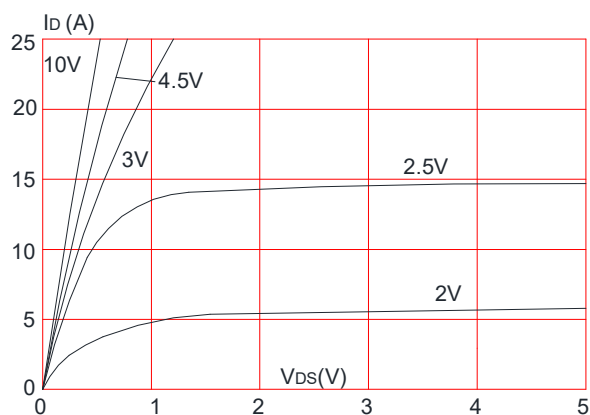


## P-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise specified)

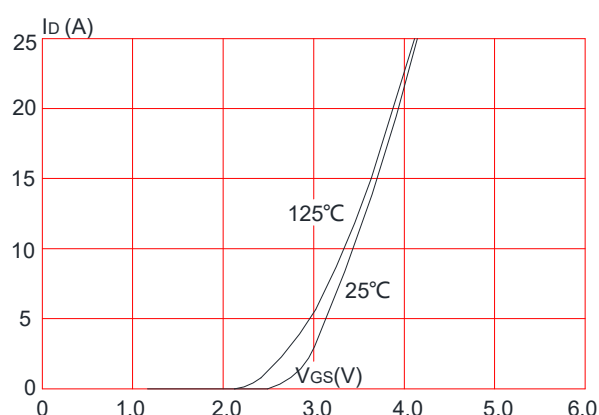
| Symbol                                                 | Parameter                                                 | Test Condition                                                                                  | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                           |                                                                                                 |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                            | V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA                                                    | -30  | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                           | V <sub>DS</sub> = -30V, V <sub>GS</sub> =0V,                                                    | -    | -    | -1   | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                              | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V                                                     | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                           |                                                                                                 |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA                                      | -1.0 | -1.6 | -2.5 | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br><small>note3</small> | V <sub>GS</sub> = -10V, I <sub>D</sub> = -4.1A                                                  | -    | 40   | 52   | mΩ    |
|                                                        |                                                           | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.5A                                                 | -    | 64   | 90   |       |
| Dynamic Characteristics                                |                                                           |                                                                                                 |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                         | V <sub>DS</sub> = -15V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                        | -    | 580  | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                        |                                                                                                 | -    | 98   | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                              |                                                                                                 | -    | 74   | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                         | V <sub>DS</sub> = -15V, I <sub>D</sub> = -4.1A,<br>V <sub>GS</sub> = -10V                       | -    | 6.8  | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                        |                                                                                                 | -    | 1    | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                               |                                                                                                 | -    | 1.4  | -    | nC    |
| Switching Characteristics                              |                                                           |                                                                                                 |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                        | V <sub>DD</sub> = -15V, I <sub>D</sub> = -1A,<br>V <sub>GS</sub> = -10V, R <sub>GEN</sub> =2.5Ω | -    | 14   | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                         |                                                                                                 | -    | 61   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                       |                                                                                                 | -    | 19   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                        |                                                                                                 | -    | 10   | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                           |                                                                                                 |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current  |                                                                                                 | -    | -    | -5   | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current      |                                                                                                 | -    | -    | -20  | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                     | V <sub>GS</sub> =0V, I <sub>S</sub> = -5A                                                       | -    | -0.8 | -1.2 | V     |

## Typical Performance Characteristics-N

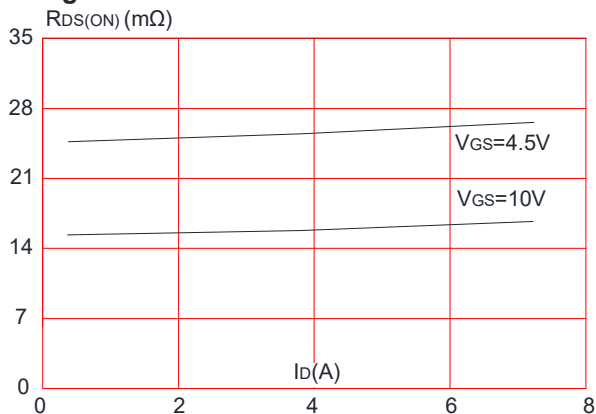
**Figure1: Output Characteristics**



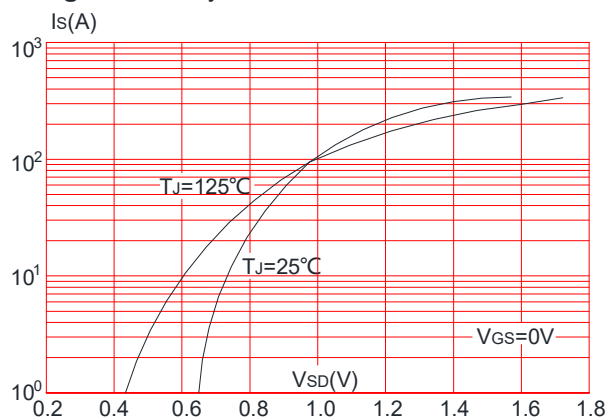
**Figure 2: Typical Transfer Characteristics**



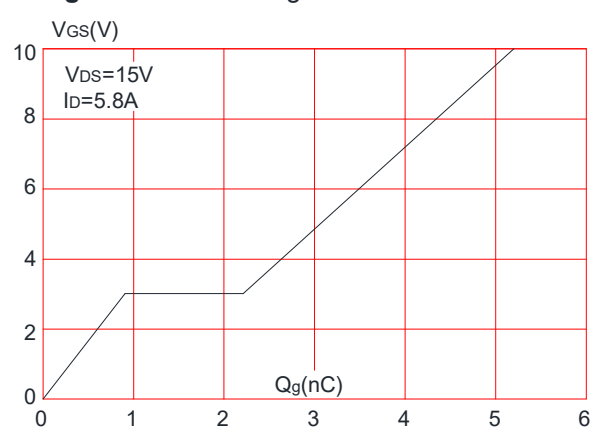
**Figure 3: On-resistance vs. Drain Current**



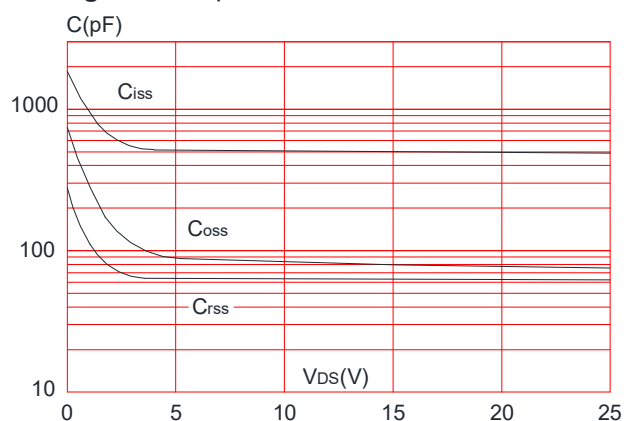
**Figure 4: Body Diode Characteristics**

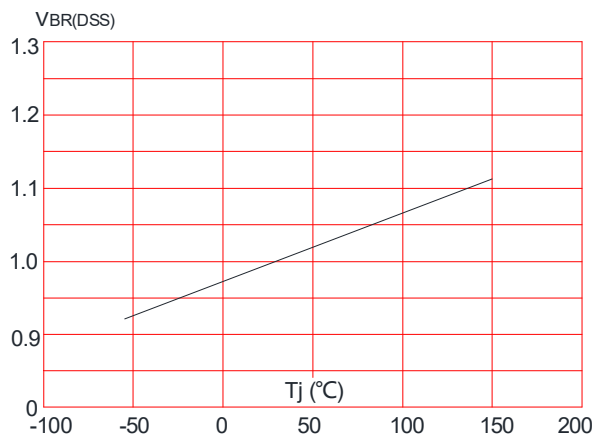


**Figure 5: Gate Charge Characteristics**

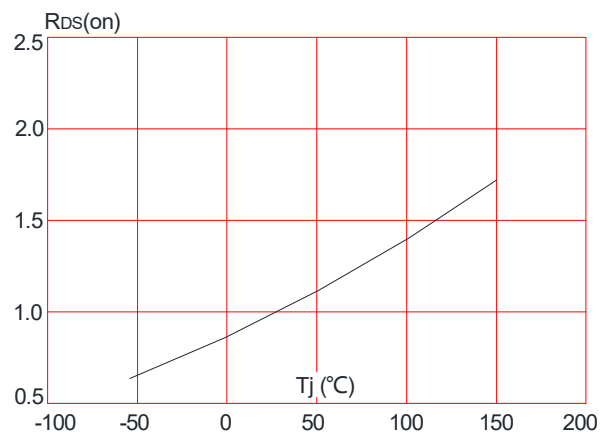


**Figure 6: Capacitance Characteristics**

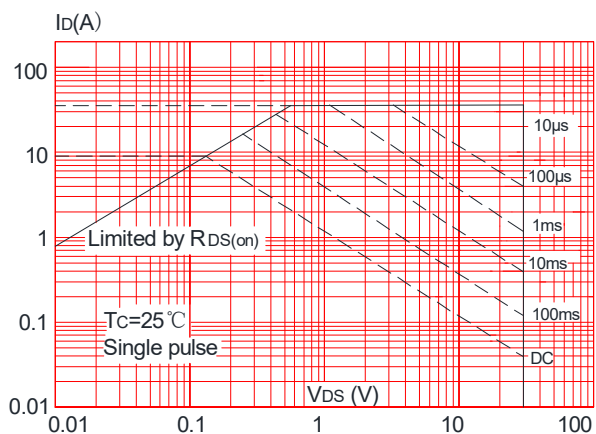




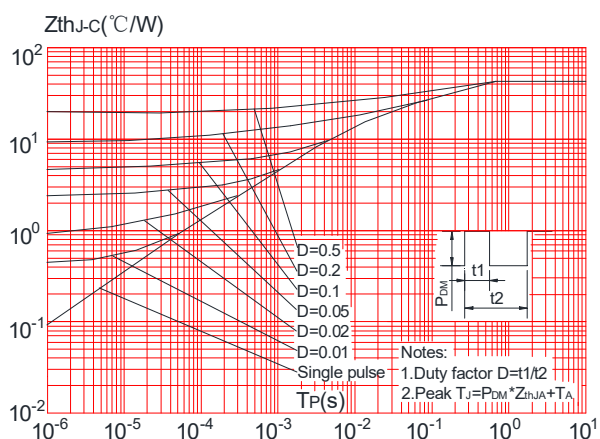
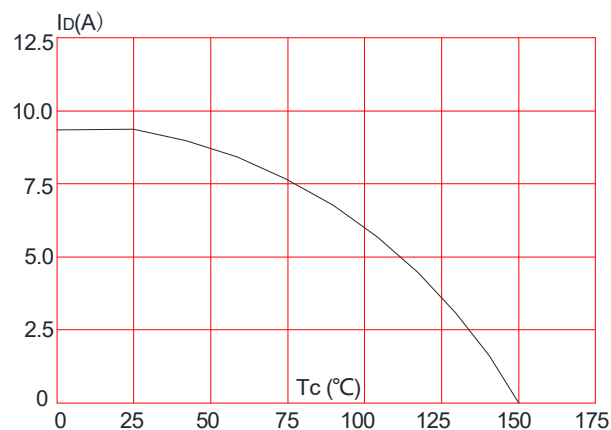
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



## Test Circuit-N

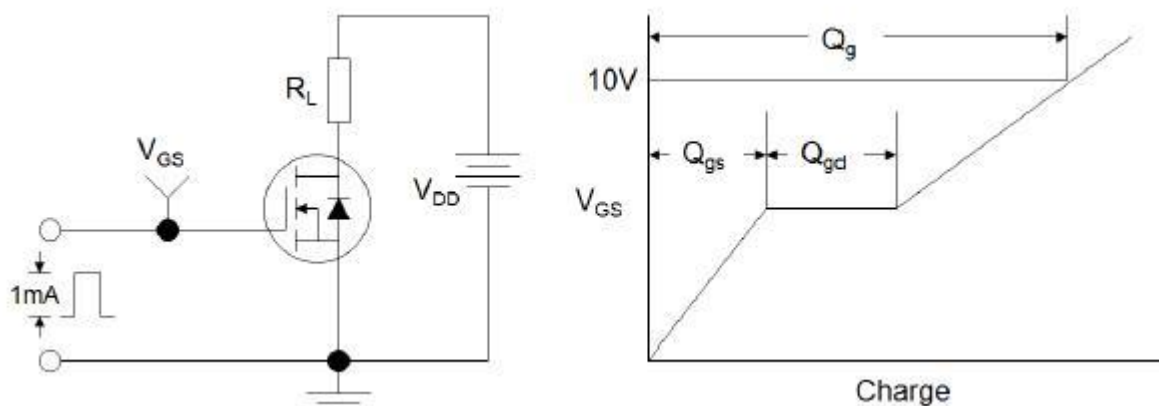


Figure1:Gate Charge Test Circuit & Waveform

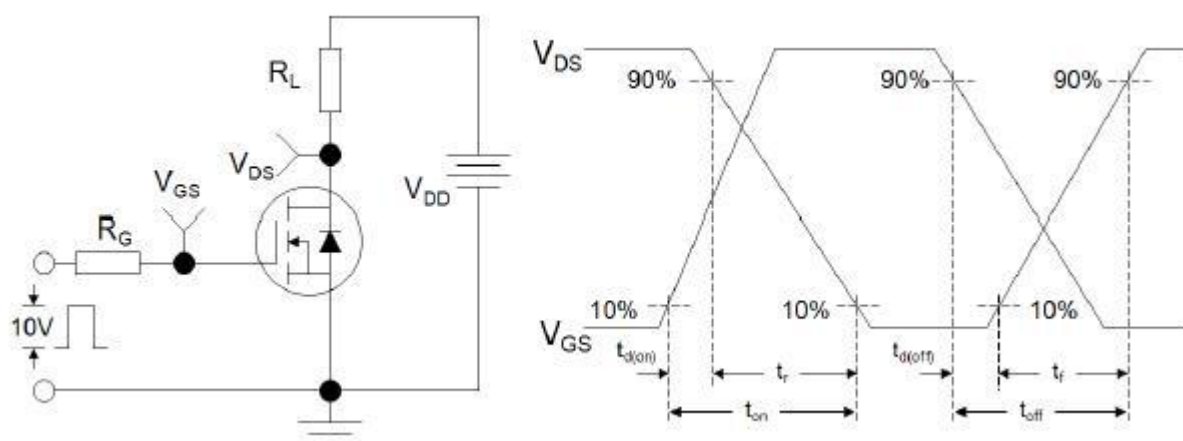


Figure 2: Resistive Switching Test Circuit & Waveforms

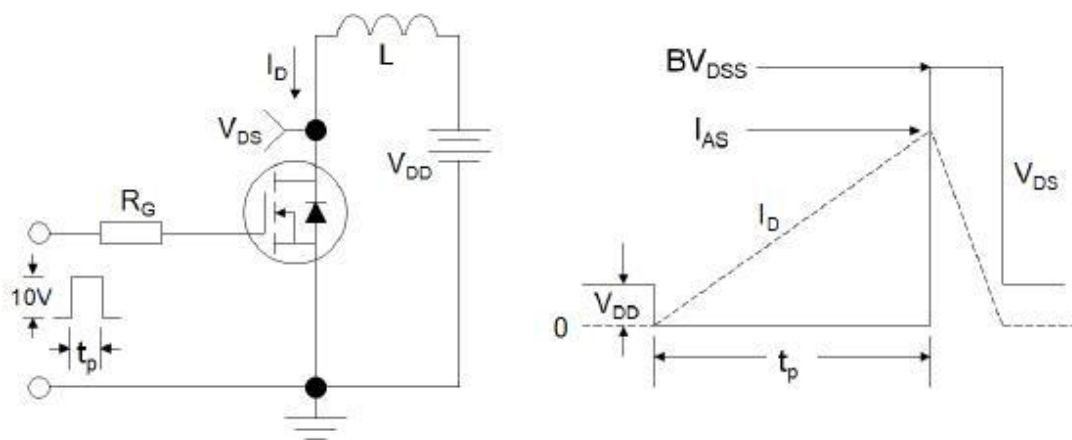
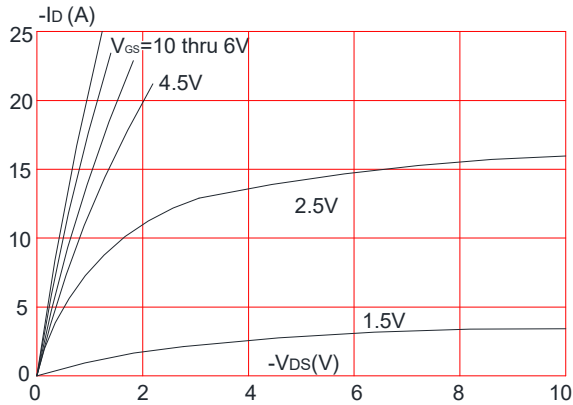


Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms

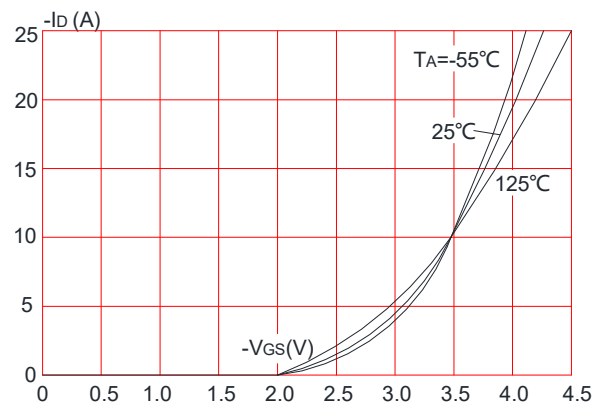


## Typical Performance Characteristics-P

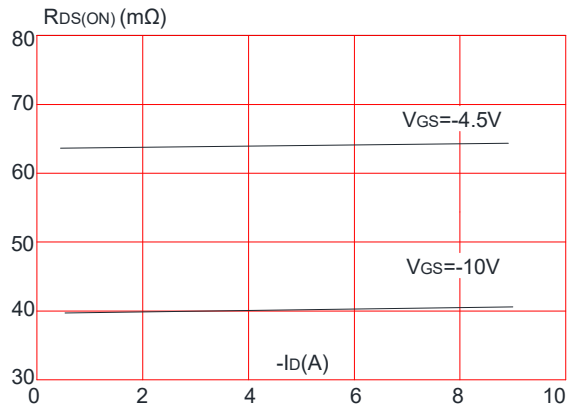
**Figure1: Output Characteristics**



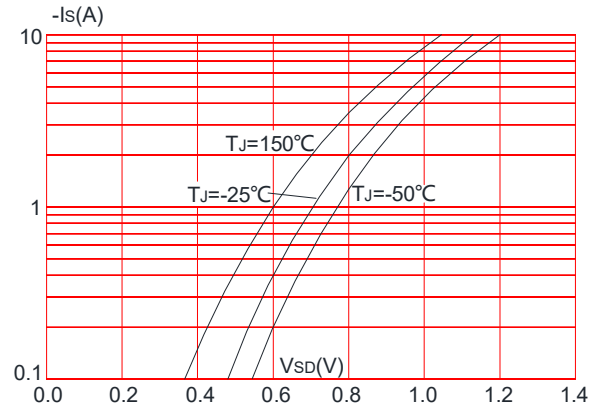
**Figure 2: Typical Transfer Characteristics**



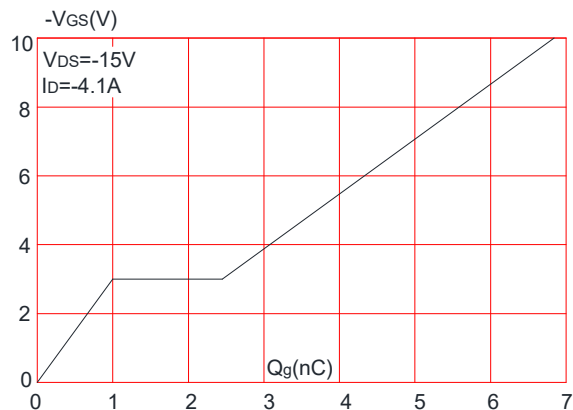
**Figure 3: On-resistance vs. Drain Current**



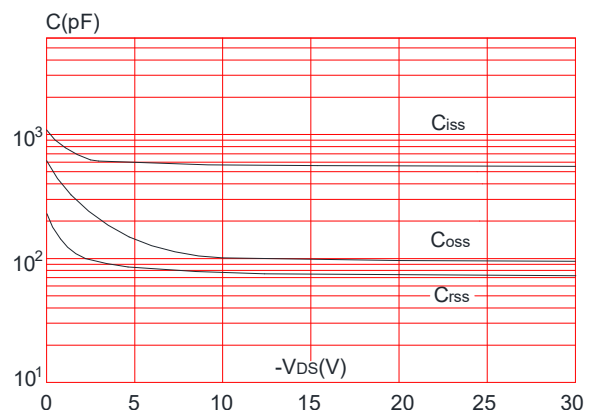
**Figure 4: Body Diode Characteristics**



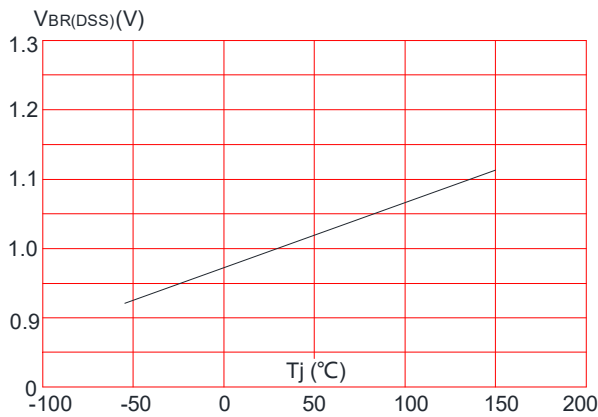
**Figure 5: Gate Charge Characteristics**



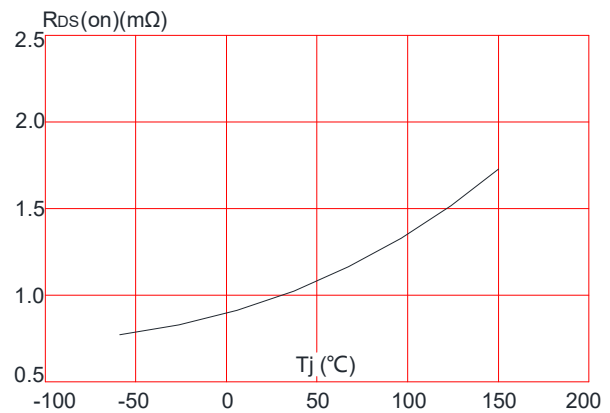
**Figure 6: Capacitance Characteristics**



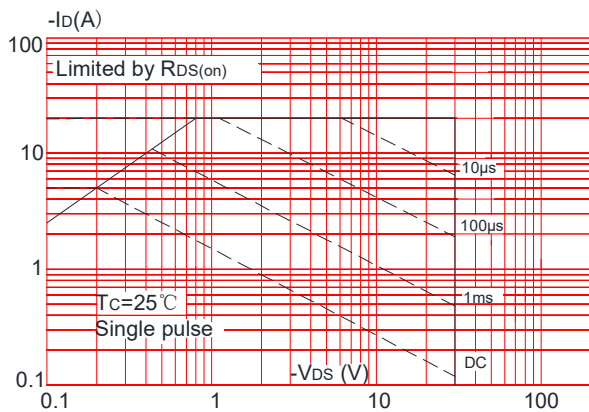
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



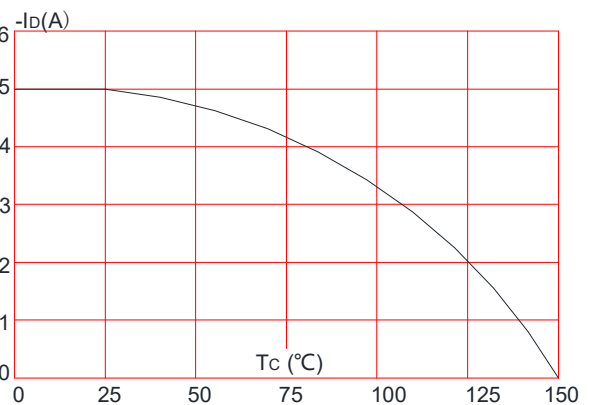
**Figure 8:** Normalized on Resistance vs. Junction Temperature



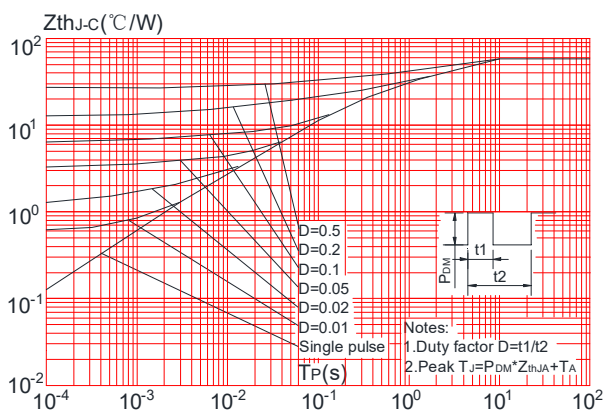
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature

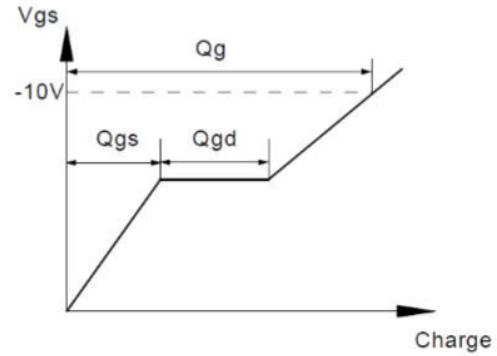
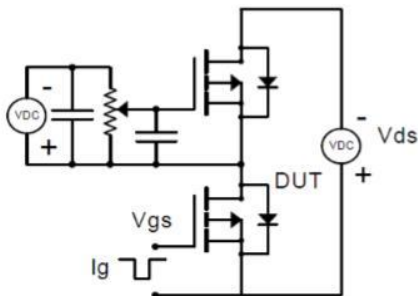


**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

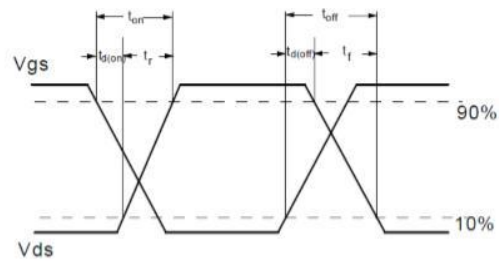
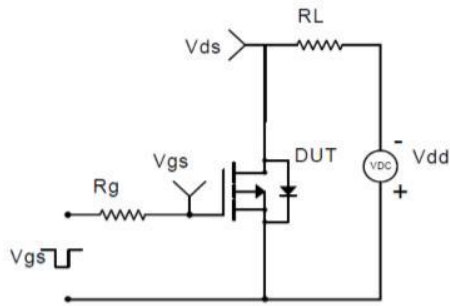


## Test Circuit-P

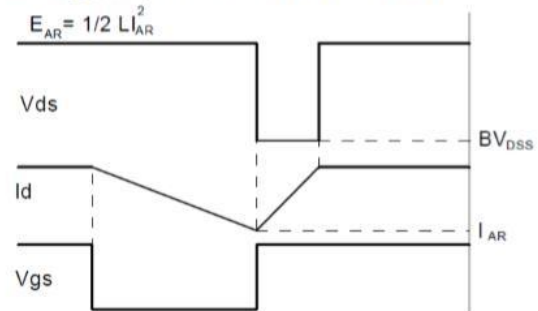
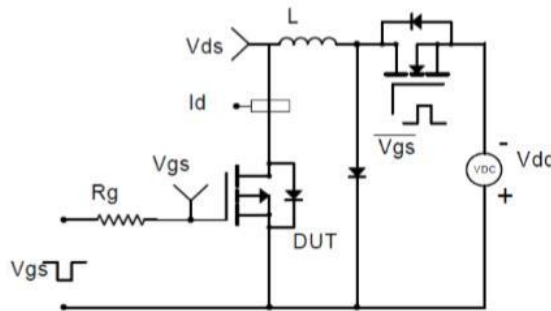
Gate Charge Test Circuit & Waveform



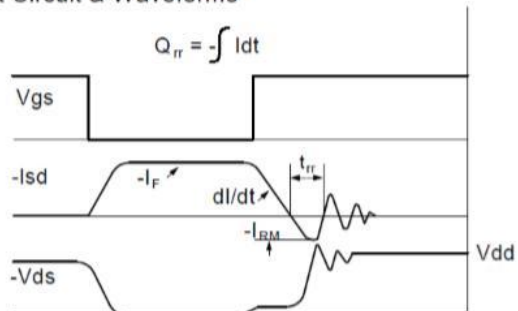
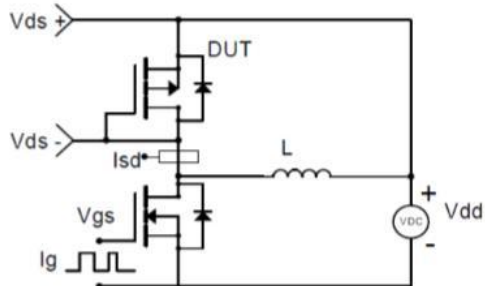
Resistive Switching Test Circuit & Waveforms



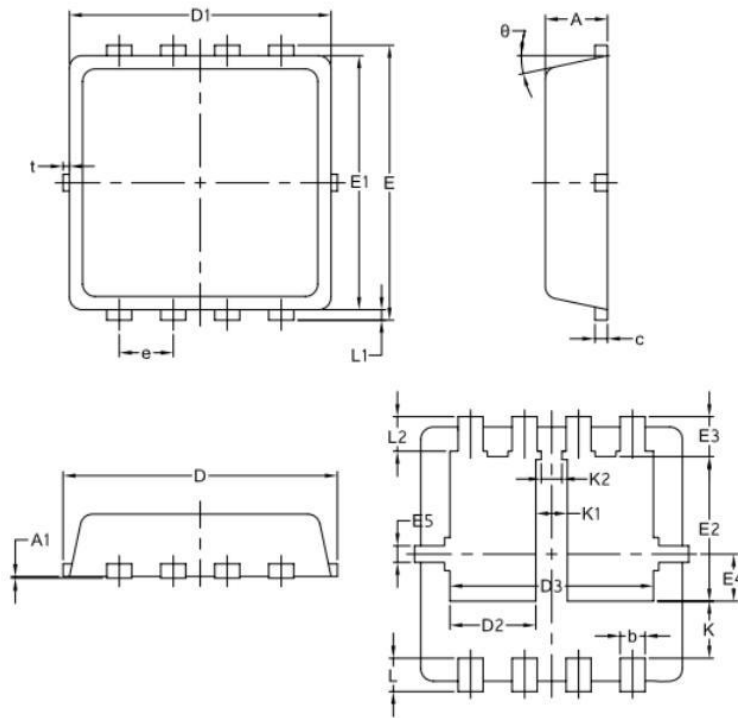
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

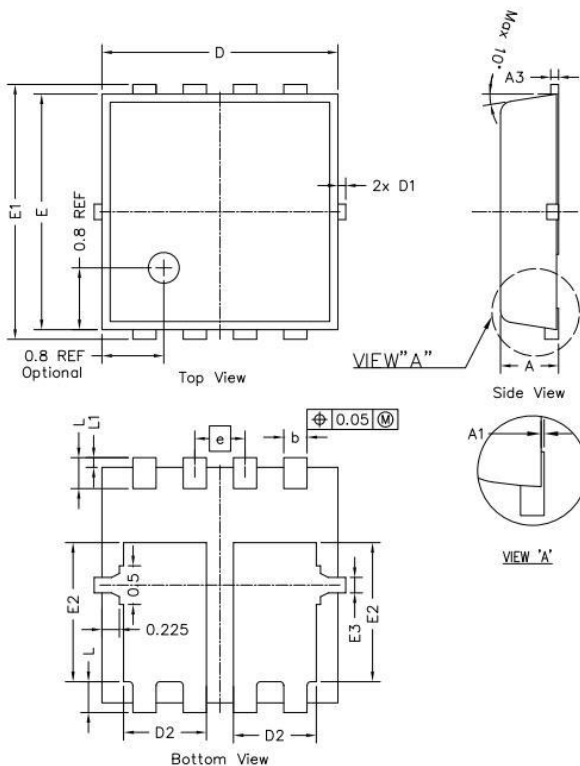


## Package Mechanical Data-PDFN3x3-8L-D-Type A



| SYMBOL | COMMON |       |      |
|--------|--------|-------|------|
|        | MM     |       |      |
|        | MIN    | NOM   | MAX  |
| A      | 0.70   | 0.75  | 0.85 |
| A1     | /      | /     | 0.05 |
| b      | 0.25   | 0.30  | 0.39 |
| c      | 0.14   | 0.152 | 0.20 |
| D      | 3.20   | 3.30  | 3.45 |
| D1     | 3.05   | 3.15  | 3.25 |
| D2     | 0.84   | 1.04  | 1.24 |
| D3     | 2.30   | 2.45  | 2.60 |
| E      | 3.20   | 3.30  | 3.40 |
| E1     | 2.95   | 3.05  | 3.15 |
| E2     | 1.60   | 1.74  | 1.90 |
| E3     | 0.28   | 0.48  | 0.65 |
| E4     | 0.37   | 0.57  | 0.77 |
| E5     | 0.10   | 0.20  | 0.30 |
| e      | 0.60   | 0.65  | 0.70 |
| K      | 0.50   | 0.69  | 0.80 |
| K1     | 0.30   | 0.38  | 0.53 |
| K2     | 0.15   | 0.25  | 0.35 |
| L      | 0.30   | 0.40  | 0.50 |
| L1     | 0.06   | 0.125 | 0.20 |
| L2     | 0.27   | 0.42  | 0.57 |
| t      | 0      | 0.075 | 0.13 |
| θ      | 10°    | 12°   | 14°  |

## Package Mechanical Data-PDFN3x3-8L-D-Type B



| SYMBOLS | DIMENSION IN MM |       |       | DIMENSION IN INCHES |       |       |
|---------|-----------------|-------|-------|---------------------|-------|-------|
|         | MIN             | NOM   | MAX   | MIN                 | NOM   | MAX   |
| A       | 0.700           | 0.750 | 0.800 | 0.028               | 0.030 | 0.031 |
| A1      | ---             | ---   | 0.050 | ----                | ----  | 0.002 |
| A3      | 0.144           | 0.152 | 0.202 | 0.006               | 0.006 | 0.008 |
| b       | 0.250           | 0.300 | 0.350 | 0.010               | 0.012 | 0.014 |
| e       | 0.65 BSC        |       |       | 0.026 BSC           |       |       |
| D       | 2.950           | 3.050 | 3.150 | 0.116               | 0.120 | 0.124 |
| E       | 2.950           | 3.050 | 3.150 | 0.116               | 0.120 | 0.124 |
| D1      | ---             | ---   | 0.125 | ----                | ----  | 0.005 |
| E1      | 3.200           | 3.300 | 3.400 | 0.126               | 0.130 | 0.134 |
| D2      | 0.970           | 1.070 | 1.170 | 0.038               | 0.042 | 0.046 |
| E2      | 1.700           | 1.800 | 1.900 | 0.067               | 0.071 | 0.075 |
| E3      | 0.150           | 0.200 | 0.250 | 0.006               | 0.008 | 0.010 |
| L       | 0.300           | 0.400 | 0.500 | 0.012               | 0.016 | 0.020 |
| L1      | 0.075           | 0.125 | 0.175 | 0.003               | 0.005 | 0.007 |



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