

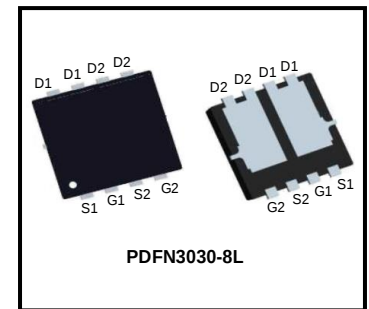
## 30V Dual N-Channel Enhancement Mode Power MOSFET

### Description

EMQ40DN03T1 uses advanced power trench technology that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

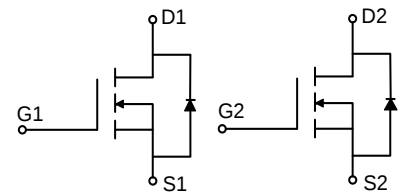
### Features

- $V_{DS} = 30V$ ,  $I_D = 40A$   
 $R_{DS(on)} < 9m\Omega @ V_{GS} = 10V$   
 $R_{DS(on)} < 14m\Omega @ V_{GS} = 4.5V$
- Green Device Available
- Low Gate Charge
- Advanced High Cell Density Trench Technology
- 100% EAS Guaranteed



### Applications

- Power Management Switches
- DC/DC Converter



### Absolute Maximum Ratings (TA = 25°C, unless otherwise noted)

| Parameter                                        |                     | Symbol         | Value      | Unit |
|--------------------------------------------------|---------------------|----------------|------------|------|
| Drain-Source Voltage                             |                     | $V_{DS}$       | 30         | V    |
| Gate-Source Voltage                              |                     | $V_{GS}$       | $\pm 20$   | V    |
| Continuous Drain Current                         | $T_C = 25^\circ C$  | $I_D$          | 40         | A    |
|                                                  | $T_C = 100^\circ C$ |                | 25.3       |      |
| Pulsed Drain Current <sup>1</sup>                |                     | $I_{DM}$       | 160        | A    |
| Single Pulse Avalanche Energy <sup>2</sup>       |                     | EAS            | 31.2       | mJ   |
| Total Power Dissipation                          | $T_C = 25^\circ C$  | $P_D$          | 28.4       | W    |
| Operating Junction and Storage Temperature Range |                     | $T_J, T_{STG}$ | -55 to 150 | °C   |

### Thermal Characteristics

| Parameter                                                | Symbol          | Value | Unit |
|----------------------------------------------------------|-----------------|-------|------|
| Thermal Resistance from Junction-to-Ambient <sup>3</sup> | $R_{\theta JA}$ | 73    | °C/W |
| Thermal Resistance from Junction-to-Case                 | $R_{\theta JC}$ | 4.4   | °C/W |

**Electrical Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise noted)**

| Parameter                               |                       | Symbol               | Test Conditions                                                                        | Min. | Typ. | Max. | Unit |
|-----------------------------------------|-----------------------|----------------------|----------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics                  |                       |                      |                                                                                        |      |      |      |      |
| Drain-Source Breakdown Voltage          |                       | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                           | 30   | -    | -    | V    |
| Gate-Body Leakage current               |                       | I <sub>GSS</sub>     | V <sub>DS</sub> = 0V, V <sub>GS</sub> = ±20V                                           | -    | -    | ±100 | nA   |
| Zero Gate Voltage Drain Current         | T <sub>J</sub> =25°C  | I <sub>DSS</sub>     | V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V                                            | -    | -    | 1    | μA   |
|                                         | T <sub>J</sub> =100°C |                      |                                                                                        | -    | -    | 100  |      |
| Gate-Threshold Voltage                  |                       | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                             | 1.0  | 1.6  | 2.5  | V    |
| Drain-Source On-Resistance <sup>4</sup> |                       | R <sub>DS(on)</sub>  | V <sub>GS</sub> = 10V, I <sub>D</sub> = 8A                                             | -    | 7    | 9    | mΩ   |
|                                         |                       |                      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 6A                                            | -    | 10.5 | 14   |      |
| Forward Transconductance <sup>4</sup>   |                       | g <sub>fs</sub>      | V <sub>DS</sub> = 10V, I <sub>D</sub> = 5A                                             | -    | 20   | -    | S    |
| Dynamic Characteristics <sup>5</sup>    |                       |                      |                                                                                        |      |      |      |      |
| Input Capacitance                       |                       | C <sub>iss</sub>     | V <sub>DS</sub> = 15V, V <sub>GS</sub> =0V, f =1MHz                                    | -    | 1390 | -    | pF   |
| Output Capacitance                      |                       | C <sub>oss</sub>     |                                                                                        | -    | 178  | -    |      |
| Reverse Transfer Capacitance            |                       | C <sub>rss</sub>     |                                                                                        | -    | 141  | -    |      |
| Gate Resistance                         |                       | R <sub>g</sub>       | f =1MHz                                                                                | -    | 2.8  | -    | Ω    |
| Switching Characteristics <sup>5</sup>  |                       |                      |                                                                                        |      |      |      |      |
| Total Gate Charge                       |                       | Q <sub>g</sub>       | V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 15V, I <sub>D</sub> = 10A                    | -    | 9.5  | -    | nC   |
| Gate-Source Charge                      |                       | Q <sub>gs</sub>      |                                                                                        | -    | 2.5  | -    |      |
| Gate-Drain Charge                       |                       | Q <sub>gd</sub>      |                                                                                        | -    | 1.9  | -    |      |
| Turn-On Delay Time                      |                       | t <sub>d(on)</sub>   | V <sub>GS</sub> =10V, V <sub>DD</sub> = 15V, R <sub>G</sub> = 3Ω, I <sub>D</sub> = 10A | -    | 8.3  | -    | ns   |
| Rise Time                               |                       | t <sub>r</sub>       |                                                                                        | -    | 25   | -    |      |
| Turn-Off Delay Time                     |                       | t <sub>d(off)</sub>  |                                                                                        | -    | 13   | -    |      |
| Fall Time                               |                       | t <sub>f</sub>       |                                                                                        | -    | 6.2  | -    |      |
| Reverse Recovery Time                   |                       | t <sub>rr</sub>      | I <sub>F</sub> =10A, dI <sub>F</sub> /dt=100A/μs                                       | -    | 9    | -    | ns   |
| Reverse Recovery Charge                 |                       | Q <sub>rr</sub>      |                                                                                        | -    | 2    | -    | nC   |
| Drain-Source Body Diode Characteristics |                       |                      |                                                                                        |      |      |      |      |
| Diode Forward Voltage <sup>4</sup>      |                       | V <sub>SD</sub>      | I <sub>S</sub> = 1A, V <sub>GS</sub> = 0V                                              | -    | -    | 1.2  | V    |
| Continuous Source Current               | T <sub>C</sub> =25°C  | I <sub>S</sub>       | -                                                                                      | -    | -    | 40   | A    |

Note :

1. Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)} = 150^\circ\text{C}$ .
2. The EAS data shows Max. rating . The test condition is  $V_{DD} = 25V, V_{GS} = 10V, L = 0.1mH, I_{AS} = 25A$ .
3. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper, The value in any given application depends on the user's specific board design.
4. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$ .
5. This value is guaranteed by design hence it is not included in the production test.

## Typical Characteristics

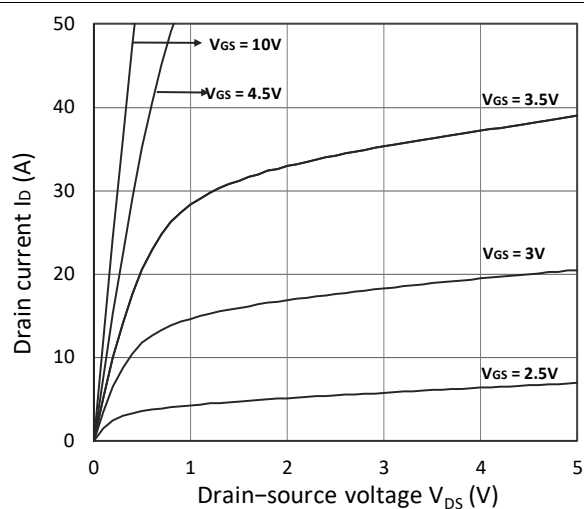


Figure 1. Output Characteristics

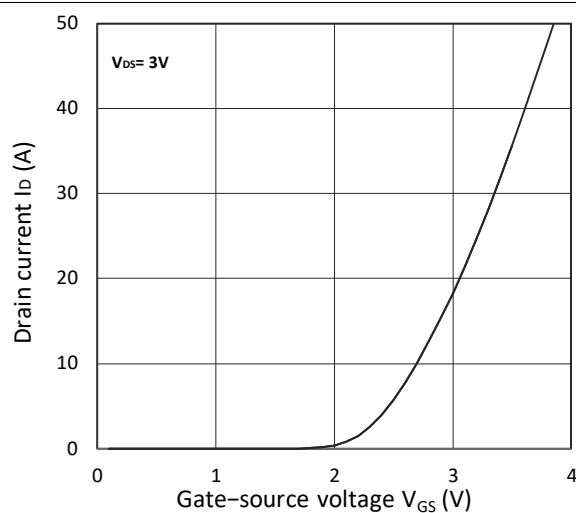


Figure 2. Transfer Characteristics

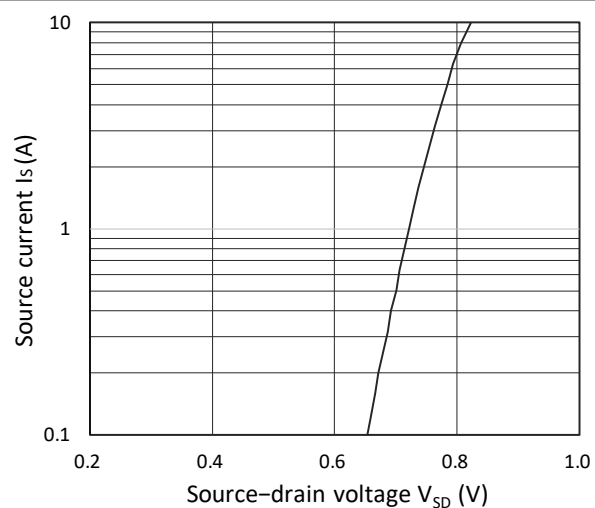
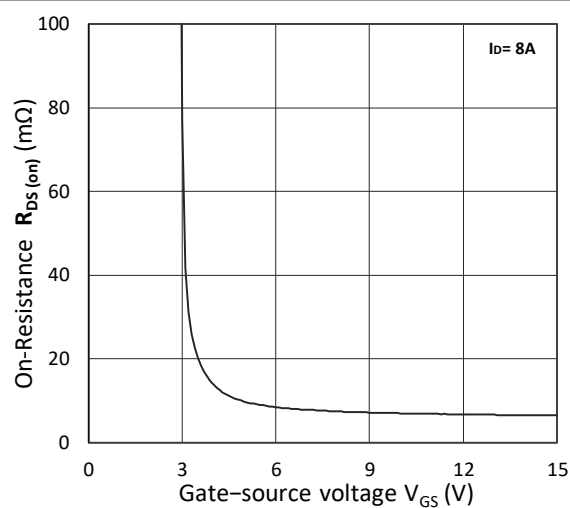
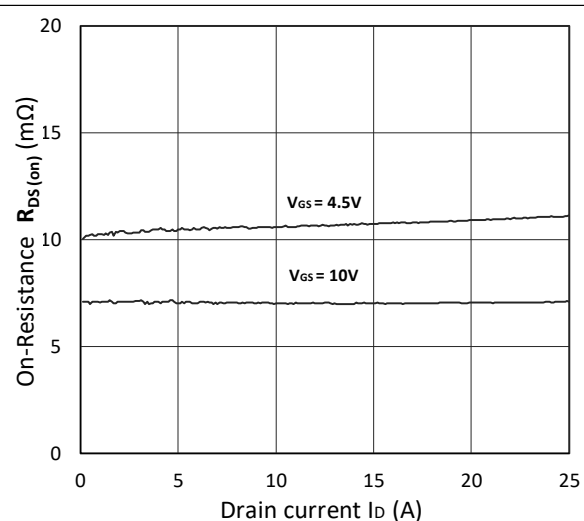
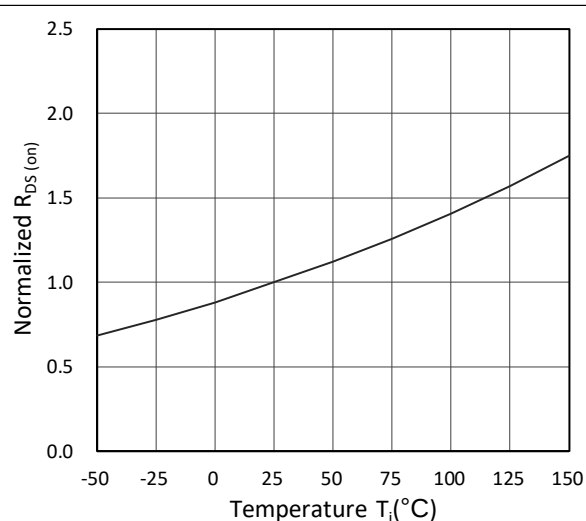


Figure 3. Forward Characteristics of Reverse

Figure 4.  $R_{DS(on)}$  vs.  $V_{GS}$ Figure 5.  $R_{DS(on)}$  vs.  $I_D$ Figure 6. Normalized  $R_{DS(on)}$  vs. Temperature

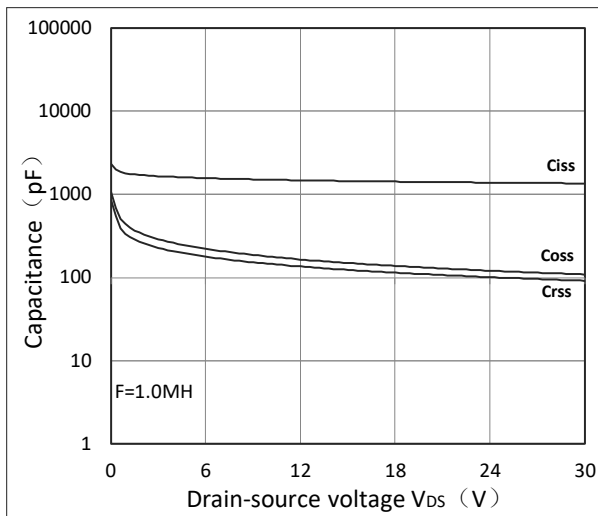


Figure 7. Capacitance Characteristics

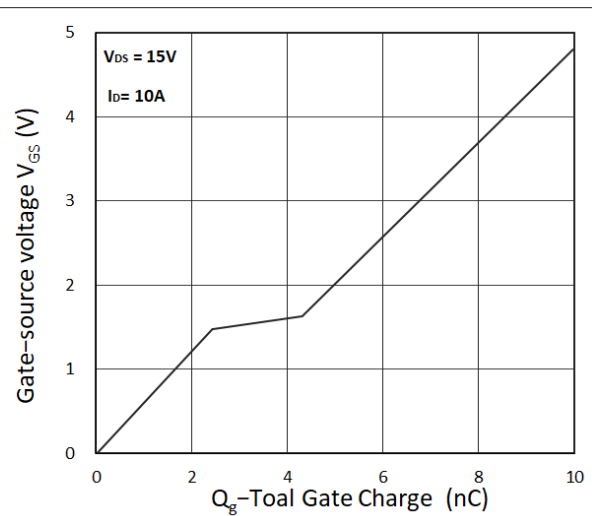


Figure 8. Gate Charge Characteristics

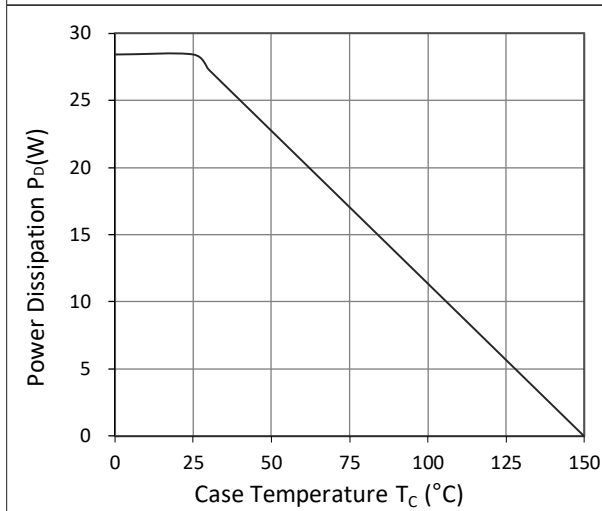


Figure 9. Power Dissipation

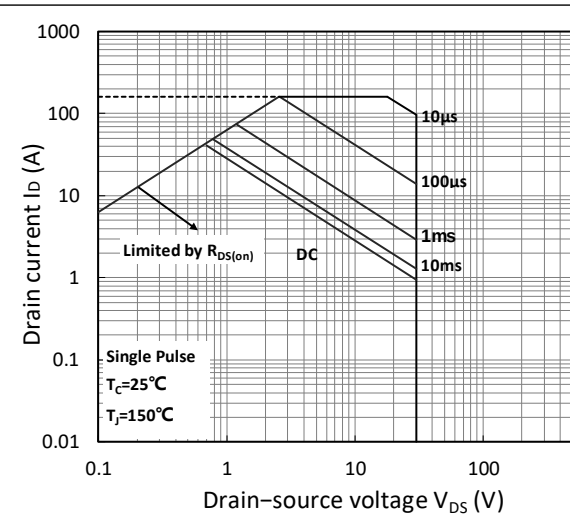


Figure 10. Safe Operating Area

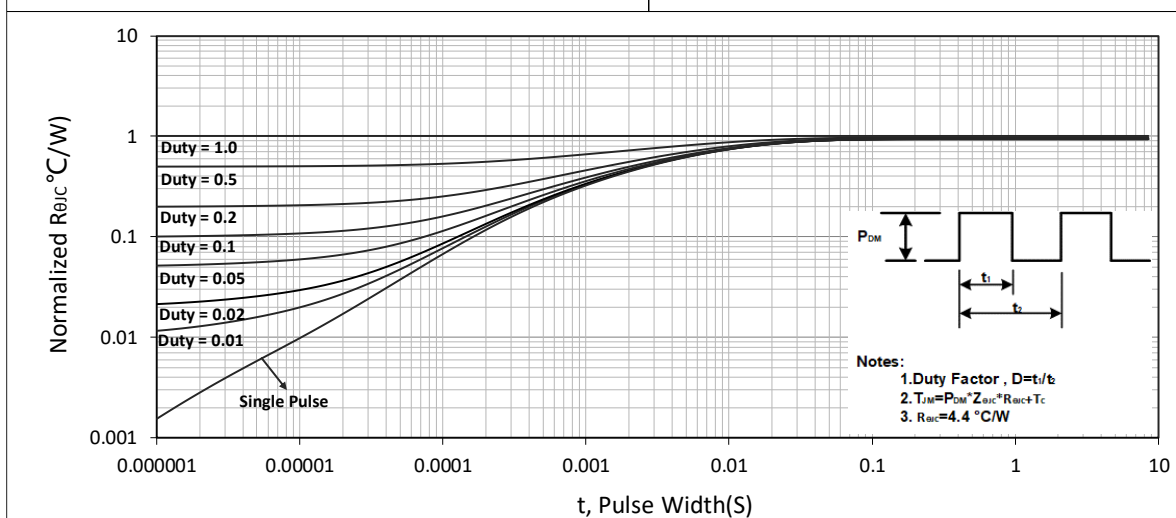


Figure 11. Normalized Maximum Transient Thermal Impedance

## Test Circuit

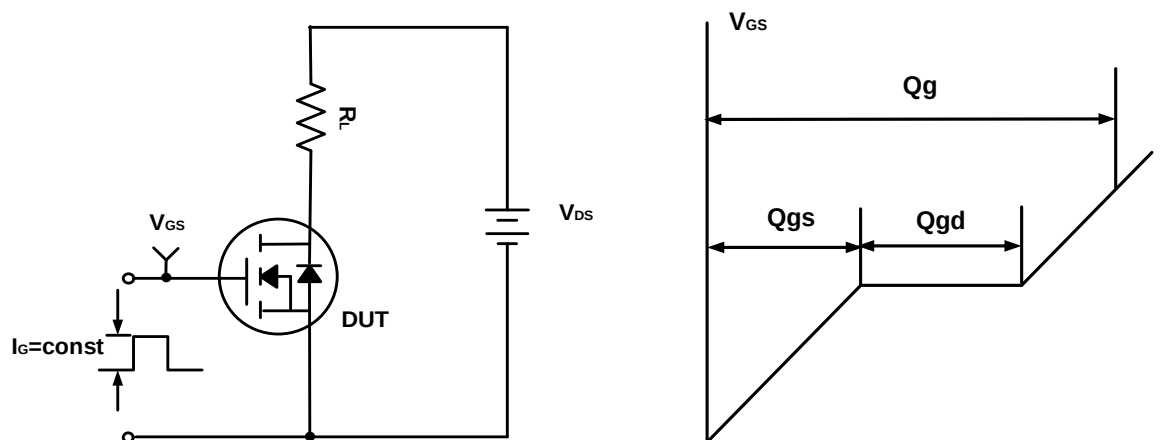


Figure A. Gate Charge Test Circuit & Waveforms

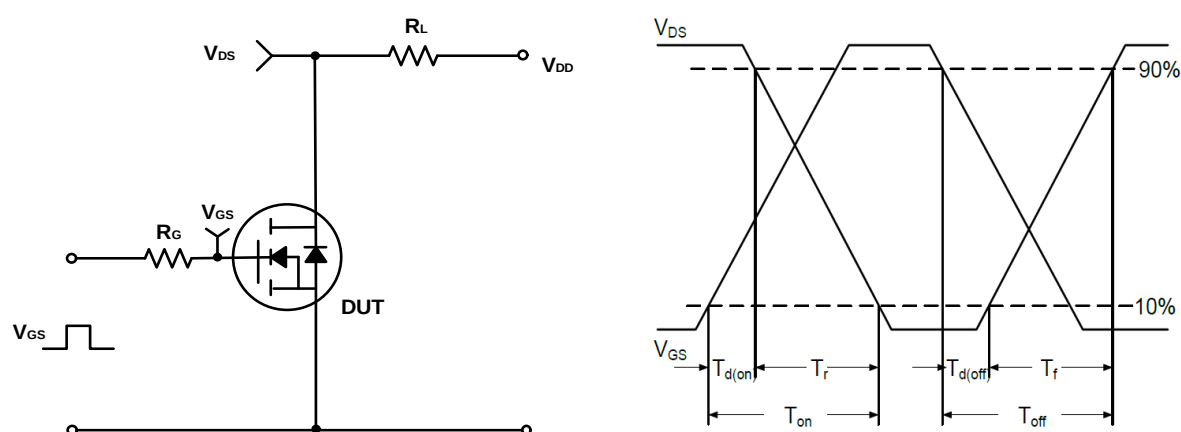


Figure B. Switching Test Circuit & Waveforms

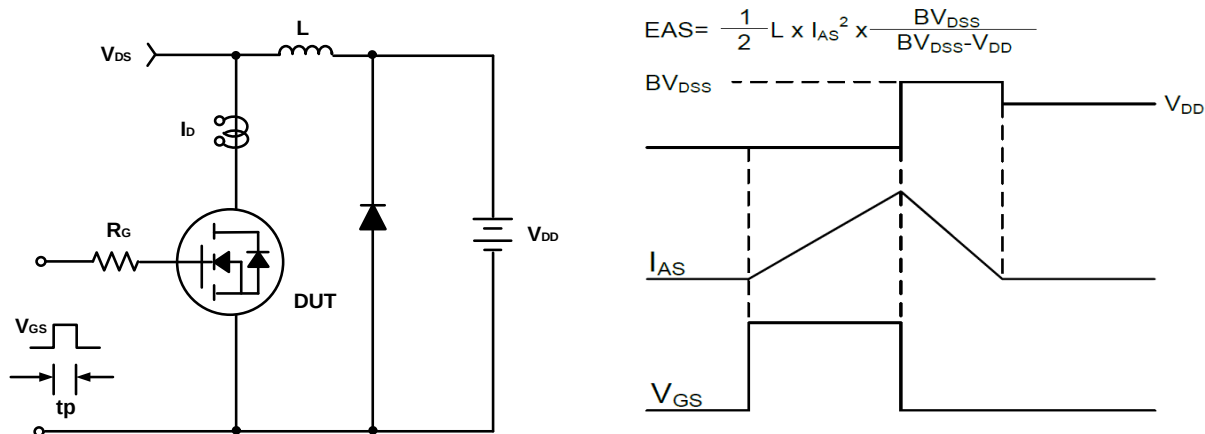


Figure C. Unclamped Inductive Switching Circuit & Waveforms

## Mechanical Dimensions for PDFN3030-8L

| PACKAGE OUTLINE |        |           |
|-----------------|--------|-----------|
|                 | SYMBOL |           |
|                 | MM     |           |
|                 | MIN    | MAX       |
|                 | A      | 0.70 0.95 |
|                 | b      | 0.20 0.40 |
|                 | c      | 0.10 0.25 |
|                 | D      | 3.15 3.45 |
|                 | D1     | 2.90 3.20 |
|                 | D2     | 1.53 1.98 |
|                 | E      | 3.00 3.40 |
|                 | E1     | 3.00 3.20 |
|                 | E2     | 2.15 2.75 |
|                 | e      | 0.65BSC   |
|                 | H      | 0.30 0.52 |
|                 | L      | 0.30 0.50 |
|                 | L1     | 0.15REF   |
|                 | K      | 0.28 0.48 |
|                 | θ      | - 12°     |

## Marking Codes

| Part Number | Marking Code                                         |
|-------------|------------------------------------------------------|
| EMQ40DN03T1 | <p>Q40DN03 = Device code<br/>WWXXXXX = Date code</p> |

## Revision History

| No. | Version | Date       | Revision Item    | Request    | Function and characteristic checking | Package dimension checking | Typos checking |
|-----|---------|------------|------------------|------------|--------------------------------------|----------------------------|----------------|
| 1   | 1.0     | 2021-09-18 | Released Version | Qi Shu Kun | Qi Shu Kun                           | Liu Jia Ying               | Liu Jia Ying   |
|     |         |            |                  |            |                                      |                            |                |
|     |         |            |                  |            |                                      |                            |                |
|     |         |            |                  |            |                                      |                            |                |