

- ★ 100% EAS Guaranteed
- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology

#### Product Summary

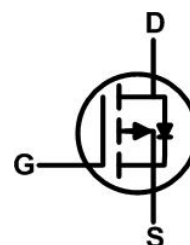
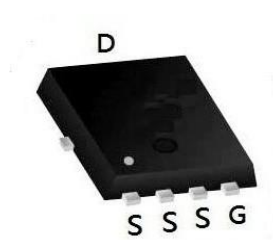


| BVDSS | RDSON | ID   |
|-------|-------|------|
| -40V  | 16mΩ  | -20A |

#### PDFN3333-8L Pin Configuration

#### Description

The XR20P04D is the high cell density trenched P-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications. The XR20P04D meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.



#### Absolute Maximum Ratings (T<sub>A</sub>= 25°C, unless otherwise noted)

| Parameter                                        |                       | Symbol                            | Value      | Unit |
|--------------------------------------------------|-----------------------|-----------------------------------|------------|------|
| Drain-Source Voltage                             |                       | V <sub>DS</sub>                   | -40        | V    |
| Gate-Source Voltage                              |                       | V <sub>GS</sub>                   | ±20        | V    |
| Continuous Drain Current                         | T <sub>C</sub> =25°C  | I <sub>D</sub>                    | -20        | A    |
|                                                  | T <sub>C</sub> =100°C |                                   | -11        |      |
| Pulsed Drain Current <sup>1</sup>                |                       | I <sub>DM</sub>                   | -80        | A    |
| Single Pulse Avalanche Energy <sup>2</sup>       |                       | EAS                               | 57.8       | mJ   |
| Total Power Dissipation                          | T <sub>C</sub> =25°C  | P <sub>D</sub>                    | 40.3       | W    |
| Operating Junction and Storage Temperature Range |                       | T <sub>J</sub> , T <sub>STG</sub> | -55 to 150 | °C   |

#### Thermal Characteristics

| Parameter                                                | Symbol           | Value | Unit |
|----------------------------------------------------------|------------------|-------|------|
| Thermal Resistance from Junction-to-Ambient <sup>3</sup> | R <sub>θJA</sub> | 66    | °C/W |
| Thermal Resistance from Junction-to-Case                 | R <sub>θJC</sub> | 3.1   | °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                                              | -40  | -    | -    | 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> = -40V, 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 | -1.5 | -2.2 | V    |
| Drain-Source On-Resistance <sup>4</sup> |                       | R <sub>DS(on)</sub>  | V <sub>GS</sub> = -10V, I <sub>D</sub> = -20A                                              | -    | 16   | 20   | mΩ   |
|                                         |                       |                      | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -15A                                             | -    | 19   | 25   |      |
| Forward Transconductance <sup>4</sup>   |                       | g <sub>fs</sub>      | V <sub>DS</sub> = -10V, I <sub>D</sub> = -20A                                              | -    | 44   | -    | S    |
| Dynamic Characteristics <sup>5</sup>    |                       |                      |                                                                                            |      |      |      |      |
| Input Capacitance                       |                       | C <sub>iss</sub>     | V <sub>DS</sub> = -20V, V <sub>GS</sub> =0V, f =1MHz                                       | -    | 2525 | -    | pF   |
| Output Capacitance                      |                       | C <sub>oss</sub>     |                                                                                            | -    | 190  | -    |      |
| Reverse Transfer Capacitance            |                       | C <sub>rss</sub>     |                                                                                            | -    | 172  | -    |      |
| Gate Resistance                         |                       | R <sub>g</sub>       | f =1MHz                                                                                    | -    | 10   | -    | Ω    |
| Switching Characteristics <sup>5</sup>  |                       |                      |                                                                                            |      |      |      |      |
| Total Gate Charge                       |                       | Q <sub>g</sub>       | V <sub>GS</sub> = -10V,V <sub>DS</sub> = -20V, I <sub>D</sub> = -20A                       | -    | 35   | -    | nC   |
| Gate-Source Charge                      |                       | Q <sub>gs</sub>      |                                                                                            | -    | 5.5  | -    |      |
| Gate-Drain Charge                       |                       | Q <sub>gd</sub>      |                                                                                            | -    | 8    | -    |      |
| Turn-On Delay Time                      |                       | t <sub>d(on)</sub>   | V <sub>GS</sub> = -10V, V <sub>DD</sub> = -20V, R <sub>G</sub> = 3Ω, I <sub>D</sub> = -20A | -    | 14.5 | -    | ns   |
| Rise Time                               |                       | t <sub>r</sub>       |                                                                                            | -    | 20.2 | -    |      |
| Turn-Off Delay Time                     |                       | t <sub>d(off)</sub>  |                                                                                            | -    | 32   | -    |      |
| Fall Time                               |                       | t <sub>f</sub>       |                                                                                            | -    | 10   | -    |      |
| Drain-Source Body Diode Characteristics |                       |                      |                                                                                            |      |      |      |      |
| Diode Forward Voltage <sup>4</sup>      |                       | V <sub>SD</sub>      | I <sub>S</sub> = -20A, V <sub>GS</sub> = 0V                                                | -    | -    | -1.2 | V    |
| Continuous Source Current               | T <sub>C</sub> =25°C  | I <sub>S</sub>       | -                                                                                          | -    | -    | -20  | 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  $V_{DD} = -25V, V_{GS} = -10V, L = 0.1mH, I_{AS} = -34A$ .
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

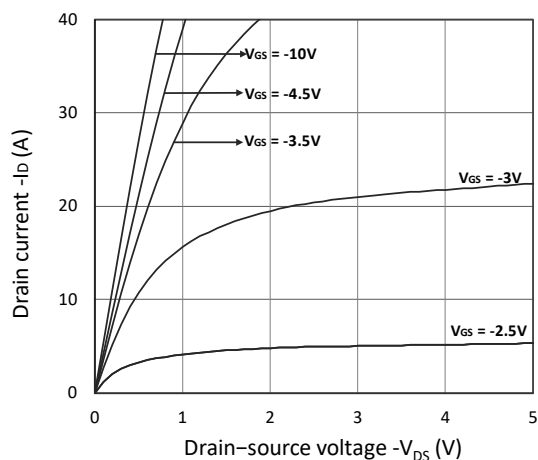


Figure 1. Output Characteristics

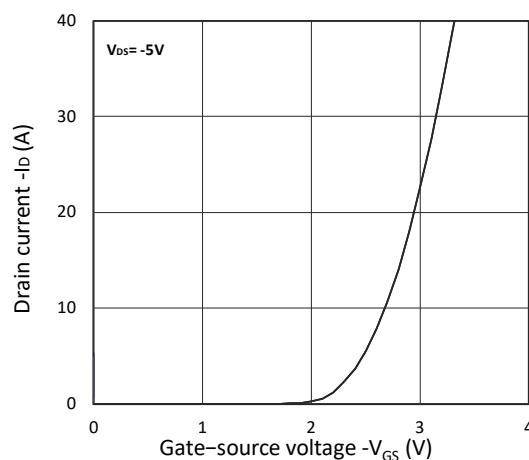


Figure 2. Transfer Characteristics

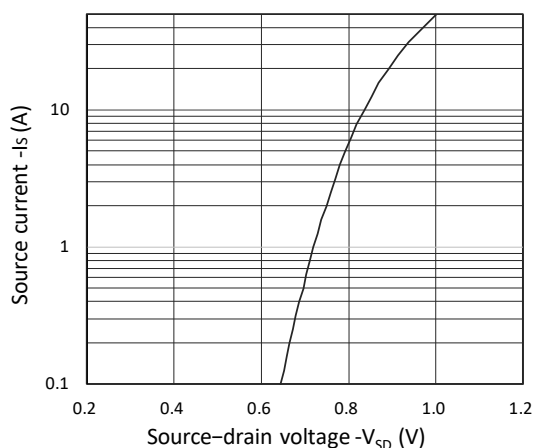


Figure 3. Forward Characteristics of Reverse

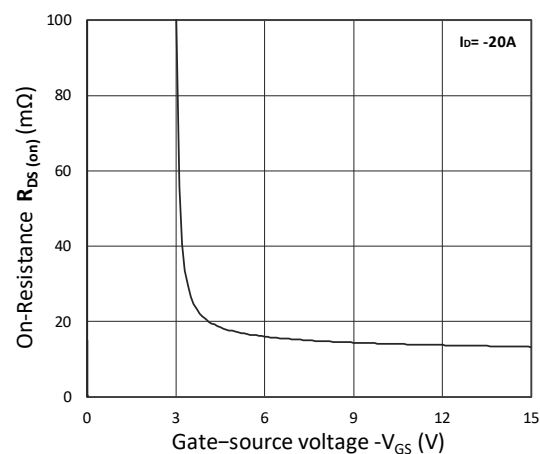


Figure 4.  $R_{DS(on)}$  vs.  $V_{GS}$

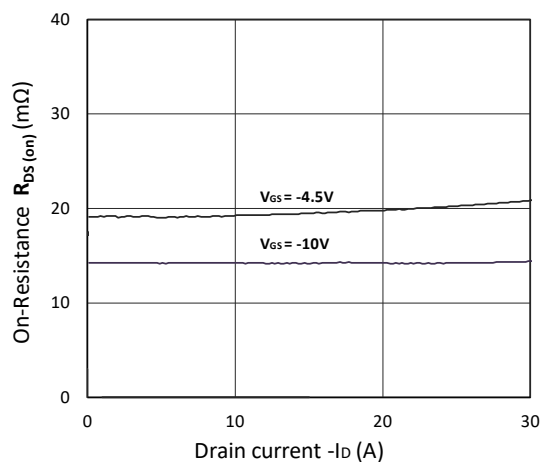


Figure 5.  $R_{DS(on)}$  vs.  $I_D$

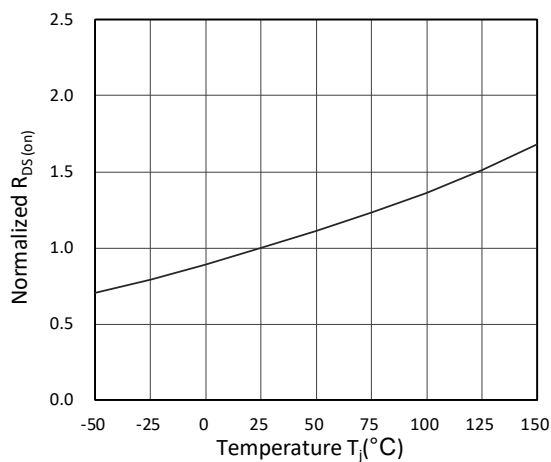


Figure 6. Normalized  $R_{DS(on)}$  vs. Temperature

### P-Ch 40V Fast Switching MOSFETs

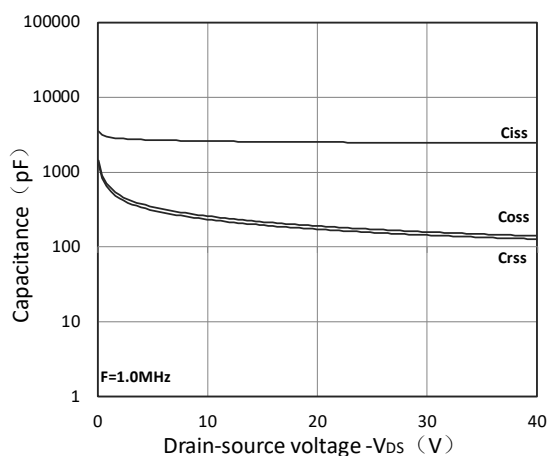


Figure 7. Capacitance Characteristics

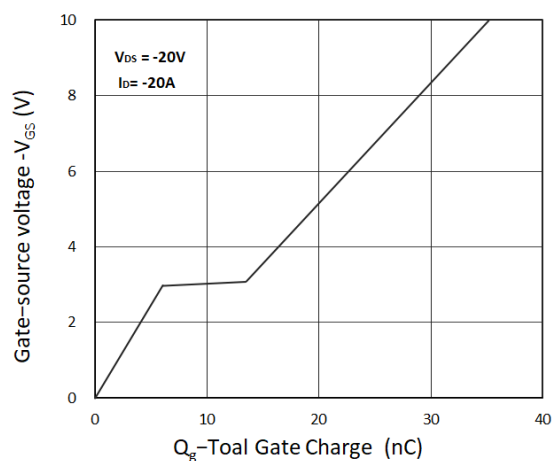


Figure 8. Gate Charge Characteristics

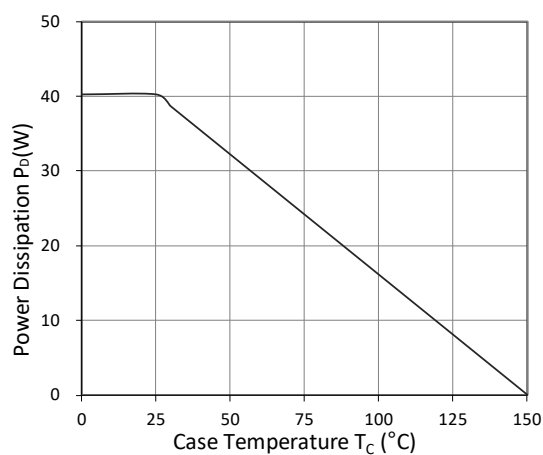


Figure 9. Power Dissipation

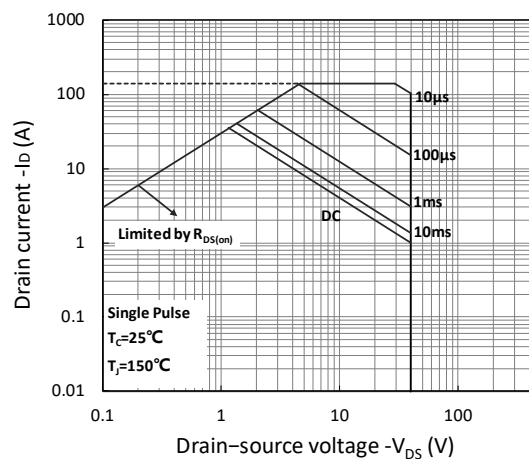


Figure 10. Safe Operating Area

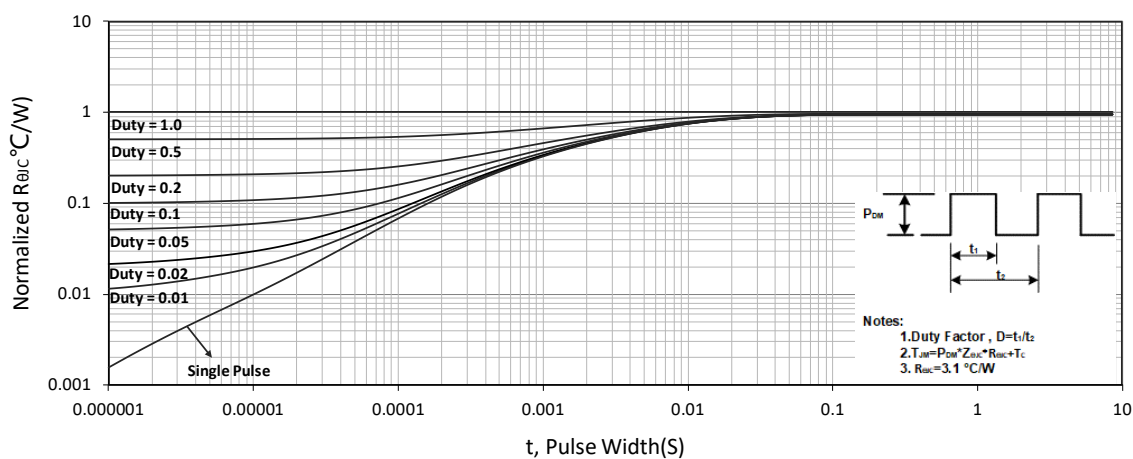


Figure 11. Normalized Maximum Transient Thermal Impedance

#### Test Circuit

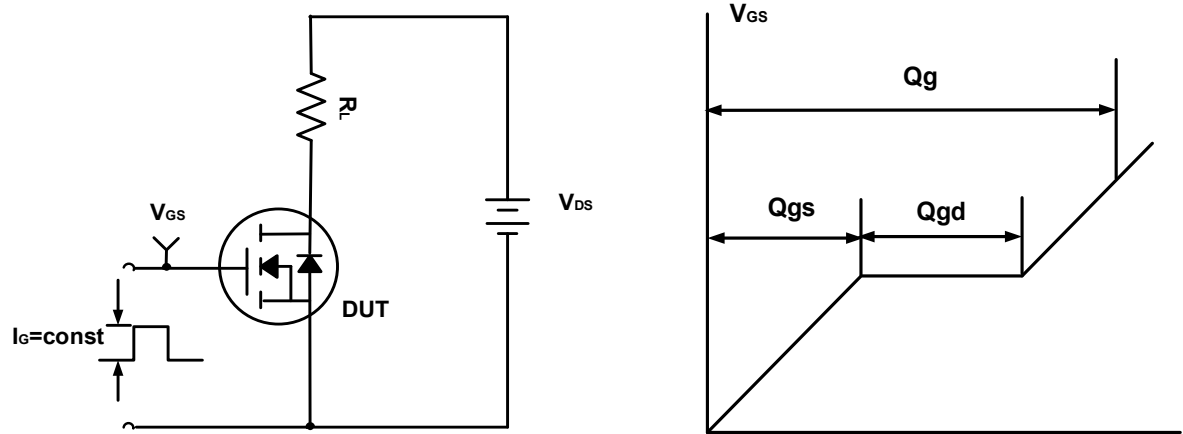


Figure A. Gate Charge Test Circuit & Waveforms

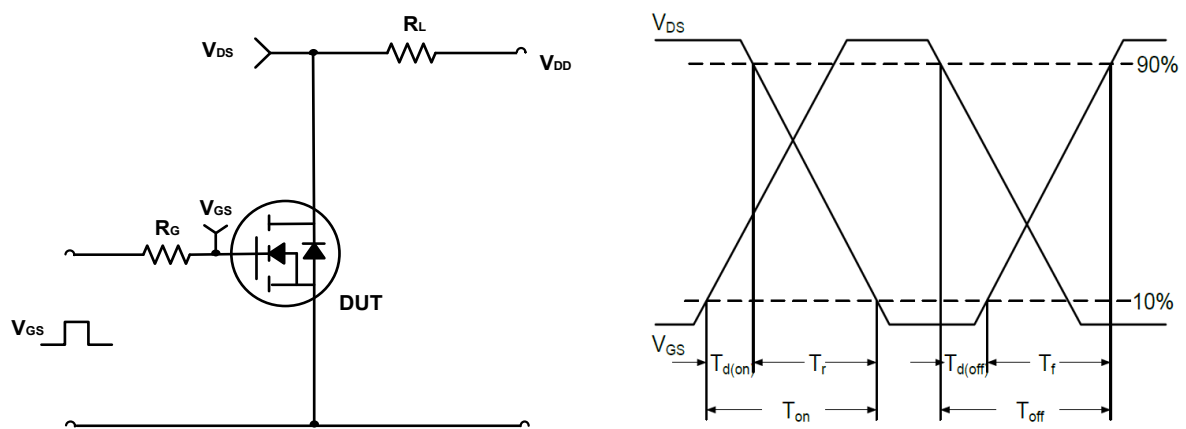


Figure B. Switching Test Circuit & Waveforms

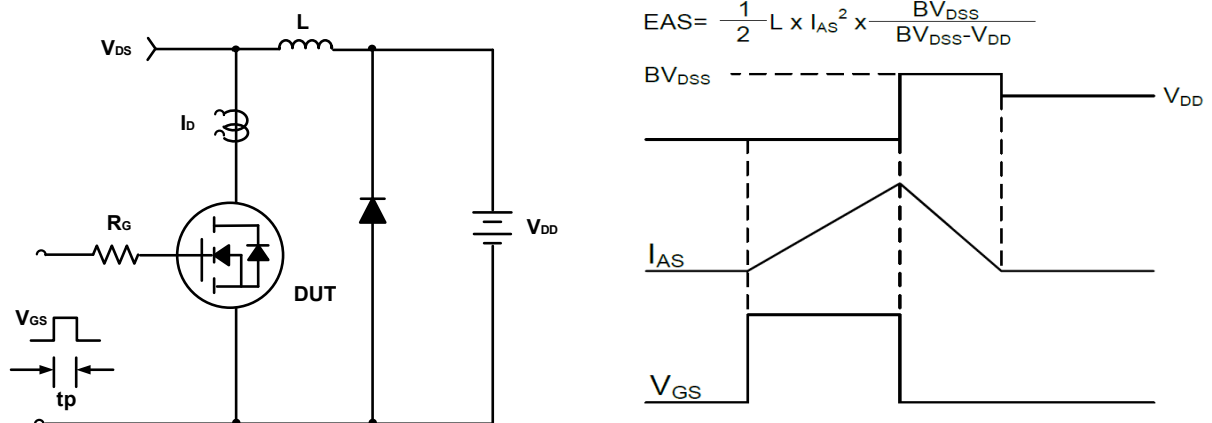
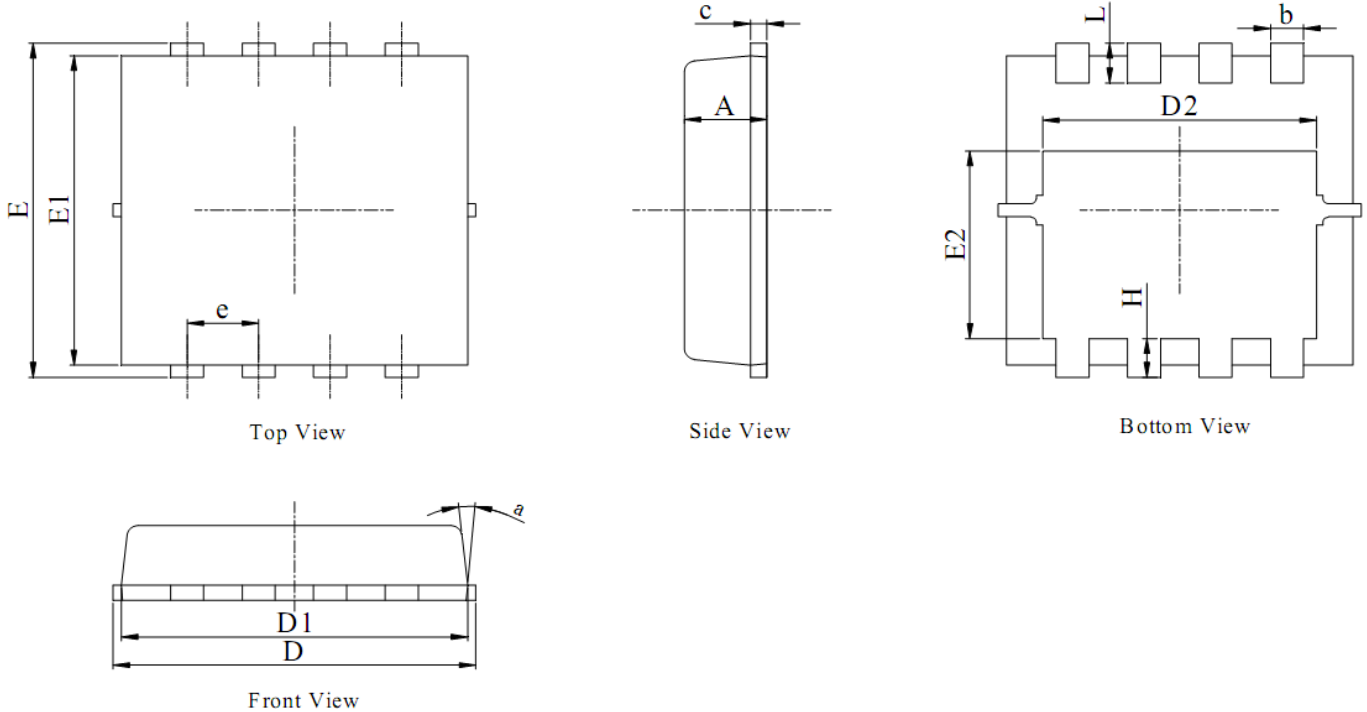


Figure C. Unclamped Inductive Switching Circuit & Waveforms

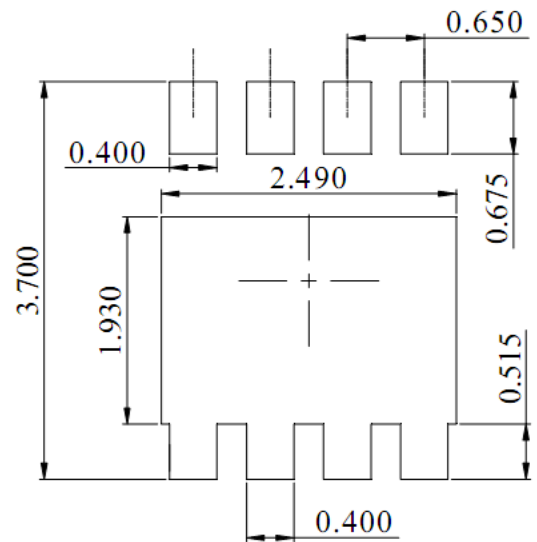
#### Package Mechanical Data-PDFN3333-8L-Single



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M,1994.
2. ALL DIMENSIONS IN MILLIMETER (ANGLE IN DEGREE).
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| DIM. | MILLIMETER |      |      |
|------|------------|------|------|
|      | MIN.       | NOM. | MAX. |
| A    | 0.70       | 0.75 | 0.80 |
| b    | 0.25       | 0.30 | 0.35 |
| c    | 0.10       | 0.20 | 0.25 |
| D    | 3.00       | 3.15 | 3.25 |
| D1   | 2.95       | 3.05 | 3.15 |
| D2   | 2.39       | 2.49 | 2.59 |
| E    | 3.20       | 3.30 | 3.40 |
| E1   | 2.95       | 3.05 | 3.15 |
| E2   | 1.70       | 1.80 | 1.90 |
| e    | 0.65 BSC   |      |      |
| H    | 0.30       | 0.40 | 0.50 |
| L    | 0.25       | 0.40 | 0.50 |
| a    | ---        | ---  | 15°  |



DIMENSIONS:MILLIMETERS