

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

### Product Summary



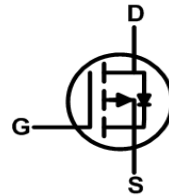
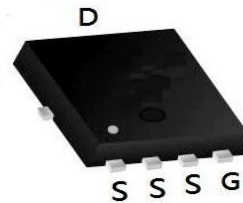
| BVDSS | RDSON | ID   |
|-------|-------|------|
| -60V  | 49mΩ  | -20A |

### Description

The UD20P06D 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 UD20P06D meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

### PDFN3333-8L Pin Configuration



### Absolute Maximum Ratings

| Symbol                      | Parameter                                   | Rating     | Units            |
|-----------------------------|---------------------------------------------|------------|------------------|
| $V_{DS}$                    | Drain-Source Voltage                        | -60        | V                |
| $V_{GS}$                    | Gate-Source Voltage                         | $\pm 20$   | V                |
| $I_D@T_C=25^\circ\text{C}$  | Continuous Drain Current, $V_{GS} @ -10V^1$ | -20        | A                |
| $I_D@T_C=100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ -10V^1$ | -12        | A                |
| $I_D@T_A=25^\circ\text{C}$  | Continuous Drain Current, $V_{GS} @ -10V^1$ | -4.5       | A                |
| $I_D@T_A=70^\circ\text{C}$  | Continuous Drain Current, $V_{GS} @ -10V^1$ | -4.0       | A                |
| $I_{DM}$                    | Pulsed Drain Current <sup>2</sup>           | -30        | A                |
| EAS                         | Single Pulse Avalanche Energy <sup>3</sup>  | 18.1       | mJ               |
| $I_{AS}$                    | Avalanche Current                           | -13        | A                |
| $P_D@T_C=25^\circ\text{C}$  | Total Power Dissipation <sup>4</sup>        | 25         | W                |
| $P_D@T_A=25^\circ\text{C}$  | Total Power Dissipation <sup>4</sup>        | 2          | W                |
| $T_{STG}$                   | Storage Temperature Range                   | -55 to 150 | $^\circ\text{C}$ |
| $T_J$                       | Operating Junction Temperature Range        | -55 to 150 | $^\circ\text{C}$ |

### Thermal Data

| Symbol          | Parameter                                        | Typ. | Max. | Unit               |
|-----------------|--------------------------------------------------|------|------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup> | ---  | 62   | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 5    | $^\circ\text{C/W}$ |

**P-Ch 60V Fast Switching MOSFETs**
**Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**

| Symbol                       | Parameter                                      | Conditions                                                      | Min. | Typ.   | Max.      | Unit                |
|------------------------------|------------------------------------------------|-----------------------------------------------------------------|------|--------|-----------|---------------------|
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage                 | $V_{GS}=0V$ , $I_D=-250\mu A$                                   | -60  | ---    | ---       | V                   |
| $\Delta BV_{DSS}/\Delta T_J$ | $BV_{DSS}$ Temperature Coefficient             | Reference to $25^\circ\text{C}$ , $I_D=-1mA$                    | ---  | -0.023 | ---       | $V/^\circ\text{C}$  |
| $R_{DS(ON)}$                 | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS}=-10V$ , $I_D=-10A$                                      | ---  | 49     | 60        | $m\Omega$           |
|                              |                                                | $V_{GS}=-4.5V$ , $I_D=-6A$                                      | ---  | 61     | 75        |                     |
| $V_{GS(th)}$                 | Gate Threshold Voltage                         | $V_{GS}=V_{DS}$ , $I_D=-250\mu A$                               | -1.2 | ---    | -2.5      | V                   |
| $\Delta V_{GS(th)}$          | $V_{GS(th)}$ Temperature Coefficient           |                                                                 | ---  | 4      | ---       | $mV/^\circ\text{C}$ |
| $I_{DSS}$                    | Drain-Source Leakage Current                   | $V_{DS}=-24V$ , $V_{GS}=0V$ , $T_J=25^\circ\text{C}$            | ---  | ---    | -1        | $\mu A$             |
|                              |                                                | $V_{DS}=-24V$ , $V_{GS}=0V$ , $T_J=55^\circ\text{C}$            | ---  | ---    | -5        |                     |
| $I_{GSS}$                    | Gate-Source Leakage Current                    | $V_{GS}=\pm 20V$ , $V_{DS}=0V$                                  | ---  | ---    | $\pm 100$ | nA                  |
| $g_{fs}$                     | Forward Transconductance                       | $V_{DS}=-5V$ , $I_D=-15A$                                       | ---  | 12     | ---       | S                   |
| $Q_g$                        | Total Gate Charge (-4.5V)                      | $V_{DS}=-15V$ , $V_{GS}=-4.5V$ , $I_D=-15A$                     | ---  | 6.1    | ---       | nC                  |
| $Q_{gs}$                     | Gate-Source Charge                             |                                                                 | ---  | 3.1    | ---       |                     |
| $Q_{gd}$                     | Gate-Drain Charge                              |                                                                 | ---  | 1.8    | ---       |                     |
| $T_{d(on)}$                  | Turn-On Delay Time                             | $V_{DD}=-15V$ , $V_{GS}=-10V$ , $R_G=3.3\Omega$ ,<br>$I_D=-15A$ | ---  | 2.6    | ---       | ns                  |
| $T_r$                        | Rise Time                                      |                                                                 | ---  | 8.6    | ---       |                     |
| $T_{d(off)}$                 | Turn-Off Delay Time                            |                                                                 | ---  | 33.6   | ---       |                     |
| $T_f$                        | Fall Time                                      |                                                                 | ---  | 6      | ---       |                     |
| $C_{iss}$                    | Input Capacitance                              | $V_{DS}=-15V$ , $V_{GS}=0V$ , $f=1MHz$                          | ---  | 585    | ---       | pF                  |
| $C_{oss}$                    | Output Capacitance                             |                                                                 | ---  | 100    | ---       |                     |
| $C_{rss}$                    | Reverse Transfer Capacitance                   |                                                                 | ---  | 85     | ---       |                     |

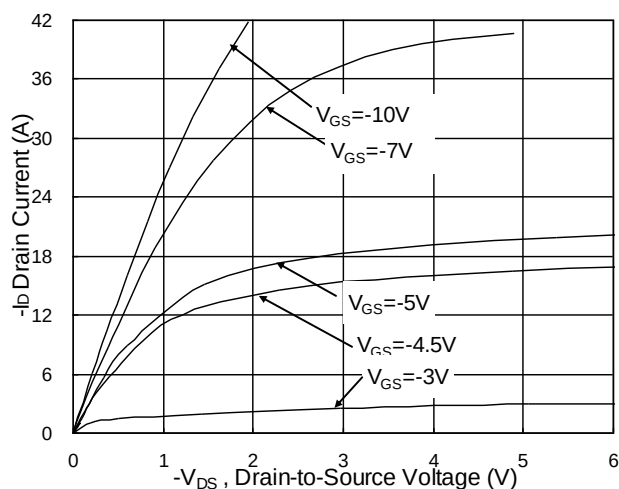
**Diode Characteristics**

| Symbol   | Parameter                                | Conditions                                                  | Min. | Typ. | Max. | Unit |
|----------|------------------------------------------|-------------------------------------------------------------|------|------|------|------|
| $I_S$    | Continuous Source Current <sup>1,5</sup> | $V_G=V_D=0V$ , Force Current                                | ---  | ---  | -20  | A    |
| $I_{SM}$ | Pulsed Source Current <sup>2,5</sup>     |                                                             | ---  | ---  | -30  | A    |
| $V_{SD}$ | Diode Forward Voltage <sup>2</sup>       | $V_{GS}=0V$ , $I_S=-1A$ , $T_J=25^\circ\text{C}$            | ---  | ---  | -1.2 | V    |
| $t_{rr}$ | Reverse Recovery Time                    | $I_F=-15A$ , $dI/dt=100A/\mu s$ ,<br>$T_J=25^\circ\text{C}$ | ---  | 6.1  | ---  | nS   |
| $Q_{rr}$ | Reverse Recovery Charge                  |                                                             | ---  | 1.4  | ---  | nC   |

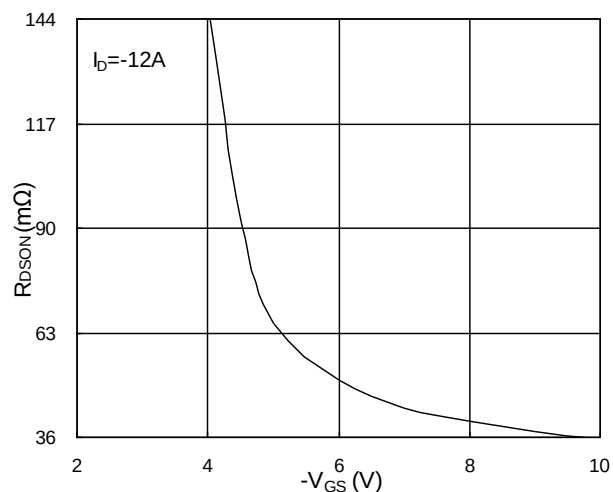
Note :

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
- 2.The data tested by pulsed , pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is  $V_{DD}=-25V$ ,  $V_{GS}=-10V$ ,  $L=0.1mH$ ,  $I_{AS}=-19A$
- 4.The power dissipation is limited by  $150^\circ\text{C}$  junction temperature
- 5.The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications , should be limited by total power dissipation.

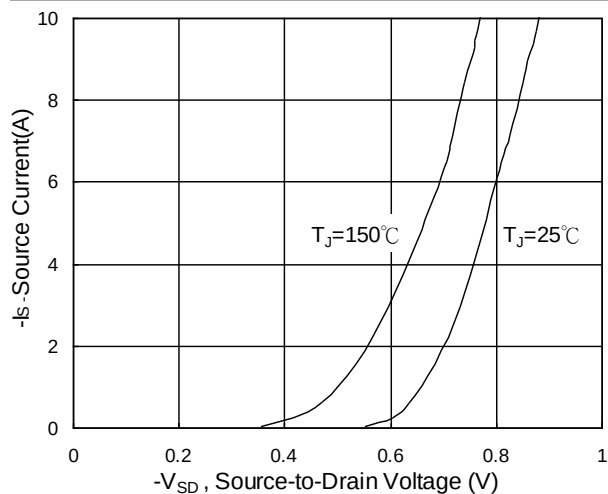
### Typical Characteristics



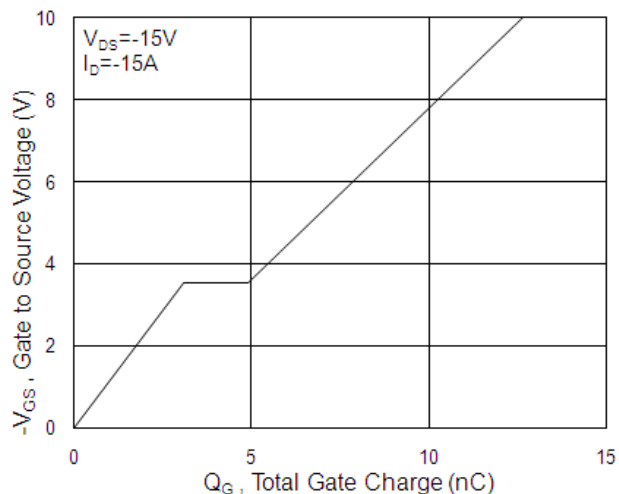
**Fig.1 Typical Output Characteristics**



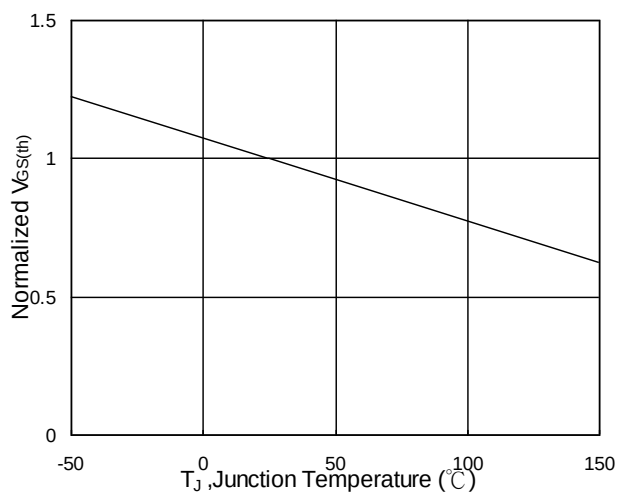
**Fig.2 On-Resistance v.s Gate-Source**



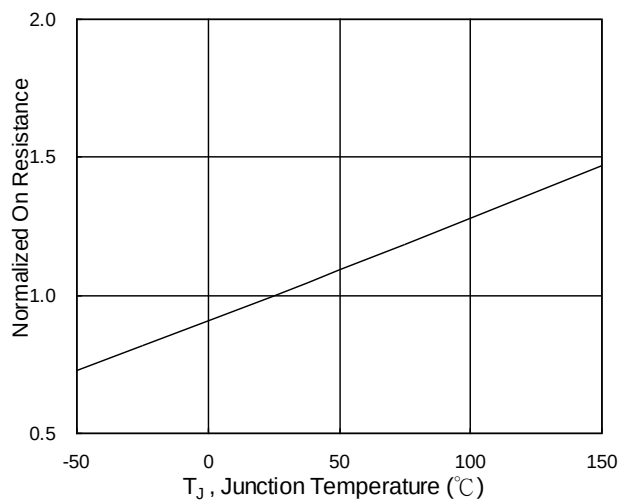
**Fig.3 Forward Characteristics Of Reverse**



**Fig.4 Gate Charge Characteristics**



**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**

P-Ch 60V Fast Switching MOSFETs

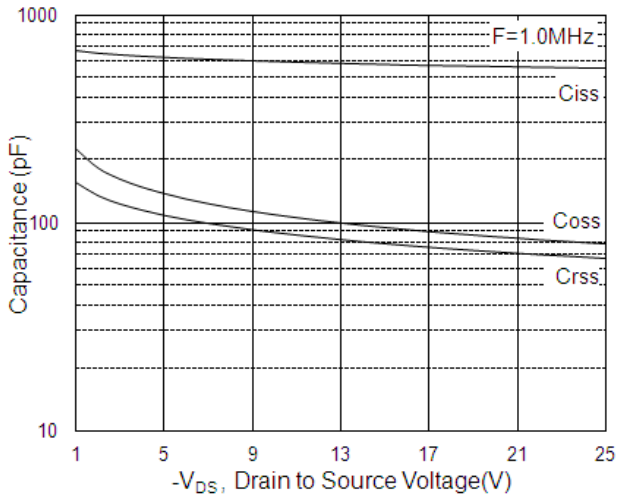


Fig.7 Capacitance

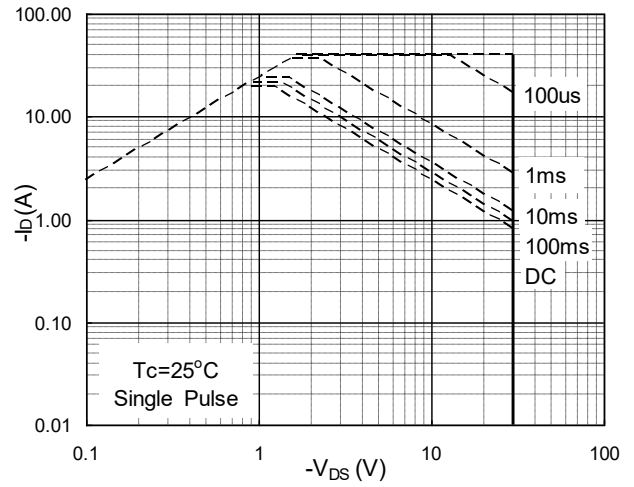


Fig.8 Safe Operating Area

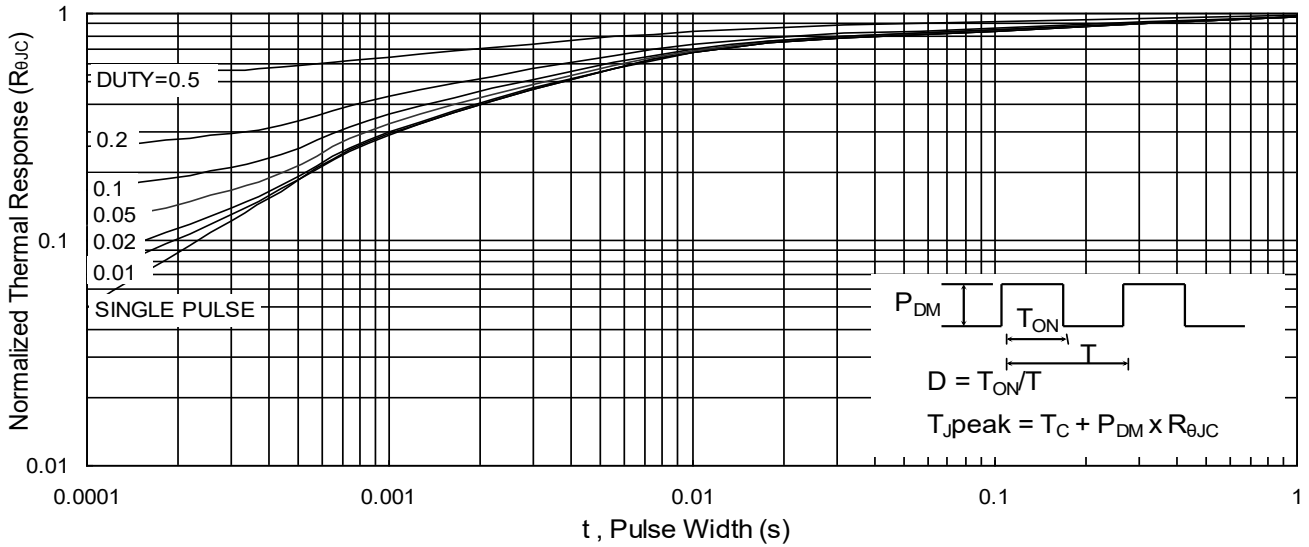


Fig.9 Normalized Maximum Transient Thermal Impedance

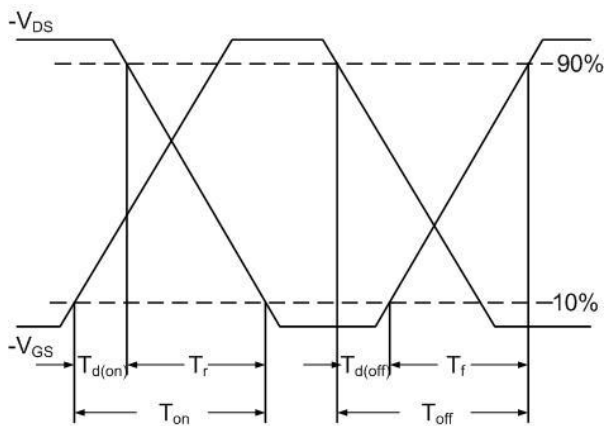


Fig.10 Switching Time Waveform

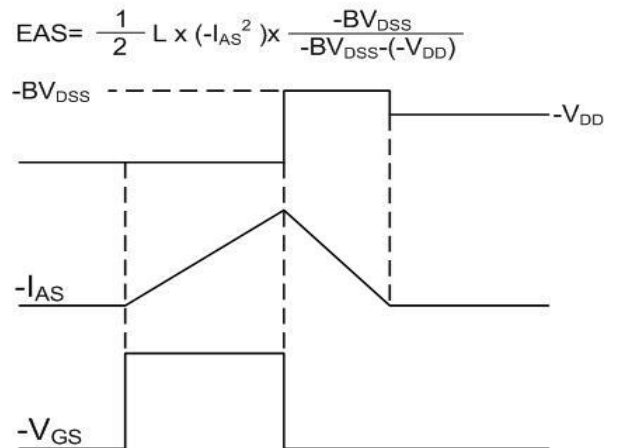
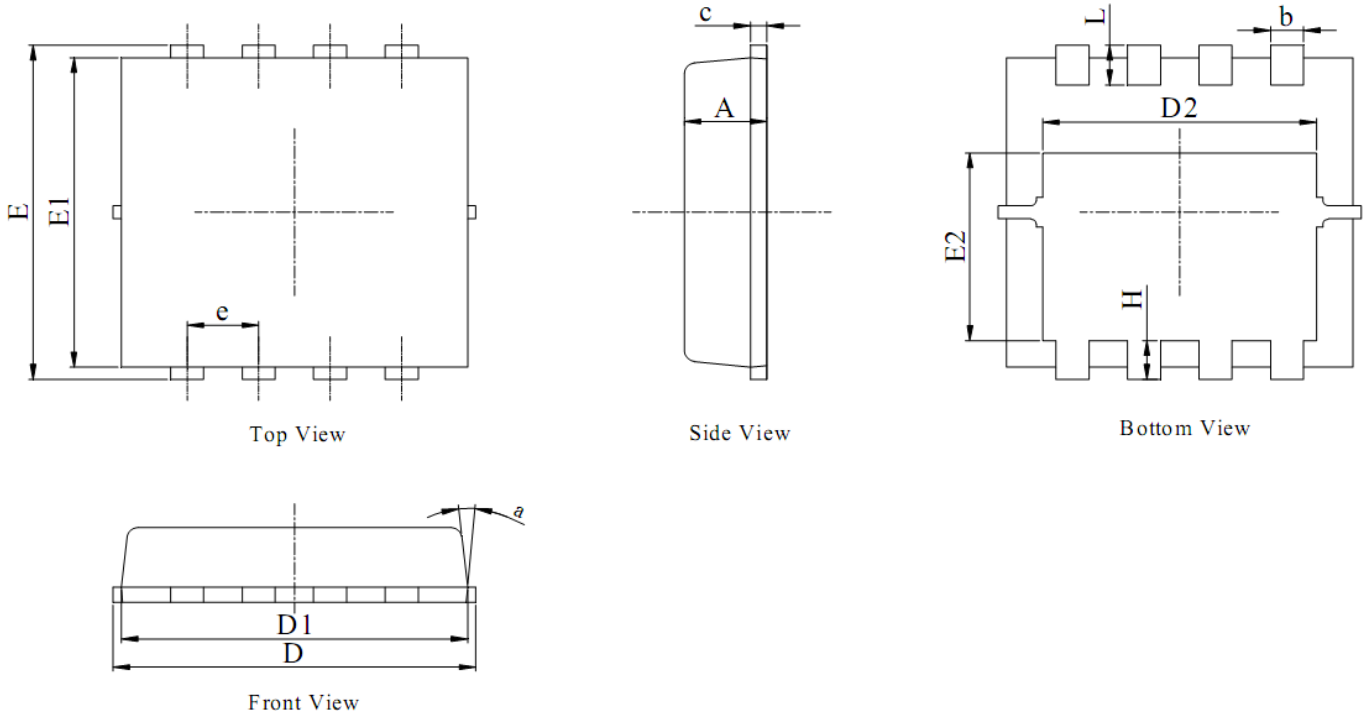


Fig.11 Unclamped Inductive Switching Waveform

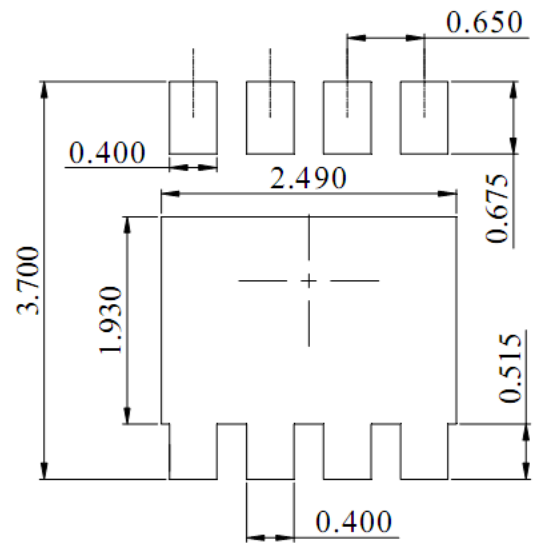
### Package Mechanical Data-PDFN3333-8L-Single



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M,1994.
2. ALL DIMENSIONS IN MILLIMETER (ANNGLE 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