

## 100V N-Channel SGT Enhancement Mode MOSFET

### Description

The PECN1040D6 uses **Shield Gate Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(on)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

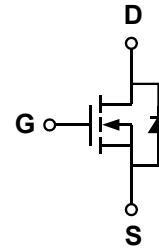
### General Features

- ◆  $V_{DS} = 100V$   $I_D = 40A$   
 $R_{DS(on)}(Typ.) = 14m\Omega$  @  $V_{GS} = 10V$   
 $R_{DS(on)}(Typ.) = 18m\Omega$  @  $V_{GS} = 4.5V$
- ◆ Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- ◆ Very low on-resistance  $R_{DS(on)}$
- ◆ 150 °C operating temperature
- ◆ 100% UIS tested

### Application

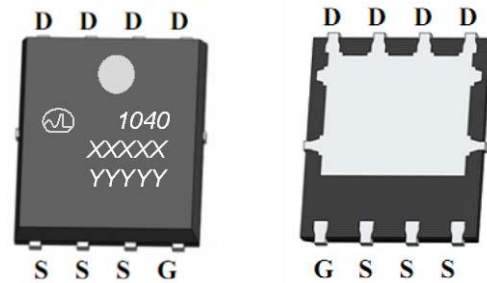
- ◆ Synchronous Rectification in DC/DC and AC/DC Converters
- ◆ Industrial and Motor Drive applications

### Schematic diagram



### Marking and pin assignment

PDFN5\*6-8L-A



Top View

Bottom View

XXXXX—Wafer Information

YYYYY—Date Code



### Ordering Information

| Part Number      | Storage Temperature | Package      | Devices Per Reel |
|------------------|---------------------|--------------|------------------|
| PECN1040D<br>6-G | -55°C to +150°C     | PDFN5*6-8L-A | 5000             |

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

| parameter                            | symbol   | limit   | unit |   |
|--------------------------------------|----------|---------|------|---|
| Drain-source voltage                 | $V_{DS}$ | 100     | V    |   |
| Gate-source voltage                  | $V_{GS}$ | ±20     | V    |   |
| Continuous Drain Current             | $I_D$    | TC=25°C | 40   | A |
|                                      |          | TC=70°C | 32   |   |
| Pulsed Drain Current                 | $I_{DP}$ | 160     | A    |   |
| Avalanche energy(L=0.1mH)            | $E_{AS}$ | 45      | mJ   |   |
| Power Dissipation                    | $P_D$    | TC=25°C | 48   | W |
|                                      |          | TC=70°C | 25   |   |
| Operating junction Temperature range | $T_j$    | -55—150 | °C   |   |

## Electrical Characteristics (TA=25°C unless otherwise noted)

| Parameter                        | Symbol              | Condition   | Min | Typ  | Max  | Unit |
|----------------------------------|---------------------|---|-----|------|------|------|
| <b>Static Characteristics</b>    |                     |   |     |      |      |      |
| Drain-source breakdown voltage   | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA  | 100 | -    | -    | V    |
| Zero gate voltage drain current  | I <sub>DSS</sub>    | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V  | -   | -    | 1    | μA   |
|                                  |                     | T <sub>J</sub> =75°C  | -   | -    | 5    |      |
| Gate Leakage Current             | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V  | -   | -    | ±100 | nA   |
| Gate threshold voltage           | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 1.0 | 1.7  | 2.5  | V    |
| Drain-source on-state resistance | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A   | -   | 14   | 18   | mΩ   |
|                                  |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A  |     | 18   | 24   |      |
| Forward Transconductance         | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =5A   | -   | 10   | -    | S    |
| <b>Diode Characteristics</b>     |                     |   |     |      |      |      |
| Diode Forward Voltage            | V <sub>SD</sub>     | I <sub>SD</sub> =1A, V <sub>GS</sub> =0V  | -   | 0.7  | 1.2  | V    |
| Diode Continuous Forward Current | I <sub>S</sub>      |   | -   | -    | 55   | A    |
| Reverse Recovery Time            | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> =20A di/dt = 500A/μs                              | -   | 35   | -    | ns   |
| Reverse Recovery Charge          | Q <sub>rr</sub>     |   | -   | 50   | -    | nC   |
| <b>Dynamic Characteristics</b>   |                     |   |     |      |      |      |
| Gate Resistance                  | R <sub>G</sub>      | f=1.0MHz  | -   | 0.8  | 1.6  | Ω    |
| Input capacitance                | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =50V<br>f=1.0MHz                                   | -   | 1200 | -    | pF   |
| Output capacitance               | C <sub>OSS</sub>    |   | -   | 180  | -    |      |
| Reverse transfer capacitance     | C <sub>RSS</sub>    |   | -   | 8    | -    |      |
| Turn-on delay time               | t <sub>D(ON)</sub>  | V <sub>GS</sub> =10V, V <sub>DS</sub> =50V, R <sub>L</sub> =2.5Ω,<br>R <sub>G</sub> =3Ω | -   | 11   | -    | ns   |
| Turn-on Rise time                | t <sub>r</sub>      |   | -   | 5    | -    |      |
| Turn-off delay time              | t <sub>D(OFF)</sub> |   | -   | 21   | -    |      |
| Turn-off Fall time               | t <sub>f</sub>      |   | -   | 5    | -    |      |
| Total gate charge                | Q <sub>g</sub>      | V <sub>GS</sub> =10V, V <sub>DS</sub> =50V, I <sub>D</sub> =20A                         | -   | 20   | -    | nC   |
| Gate-source charge               | Q <sub>gs</sub>     |   | -   | 4    | -    |      |
| Gate-drain charge                | Q <sub>gd</sub>     |   | 2   | 3.1  | -    |      |

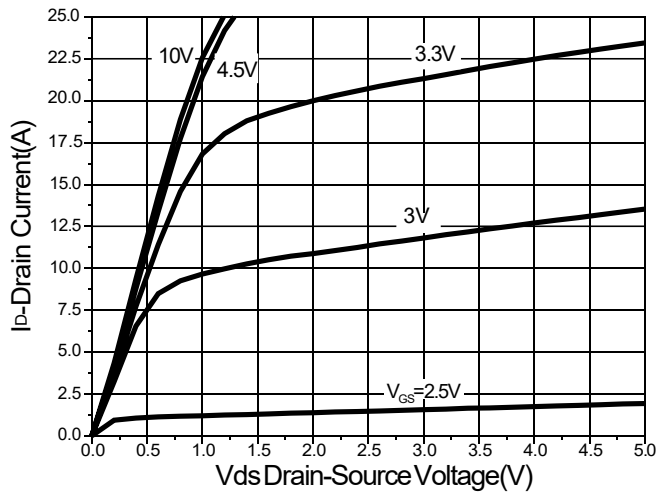
## Thermal Characteristics

| Parameter                                | Symbol           | Typ          | Max | Unit |
|--|------------------|--------------|-----|------|
| Maximum Junction-to-Ambient <sup>A</sup> | R <sub>θJA</sub> | 20           | 25  | °C/W |
| Maximum Junction-to-Ambient <sup>A</sup> |                  | Steady-State | 45  |      |
| Maximum Junction-to-Lead <sup>B</sup>    | R <sub>θJC</sub> | 2.1          | 2.6 |      |

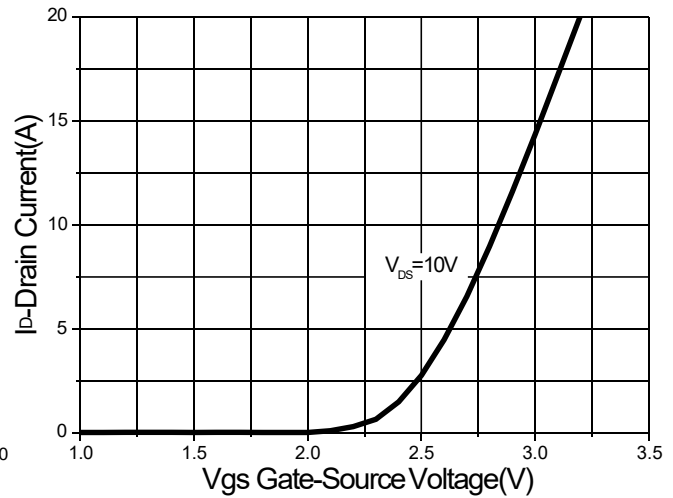
A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any given application depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating.

B: The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

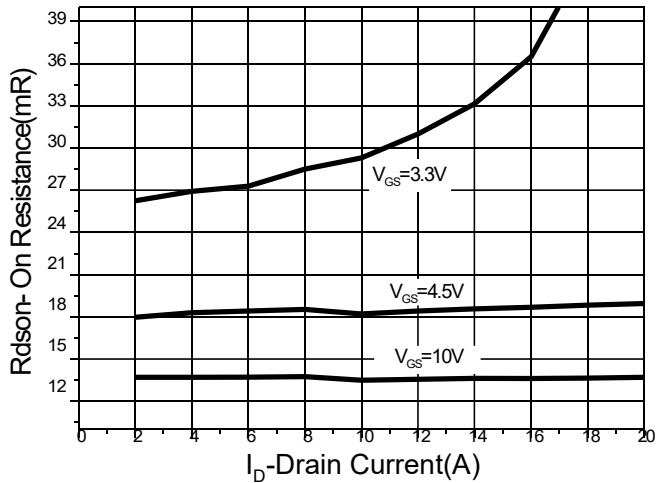
## Typical Performance Characteristics



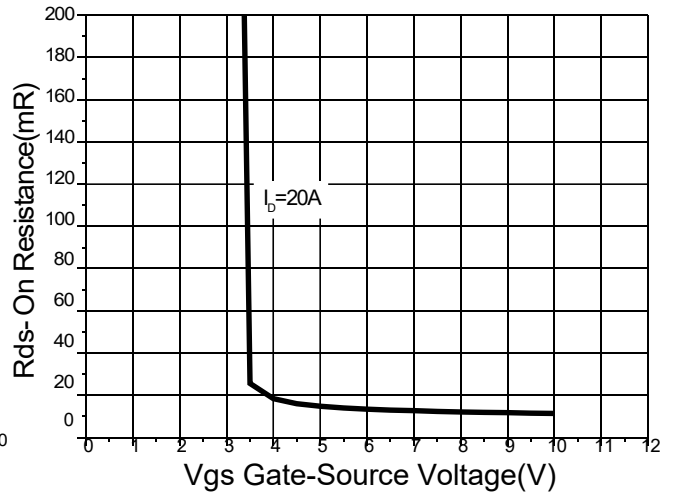
**Fig1 Output Characteristics**



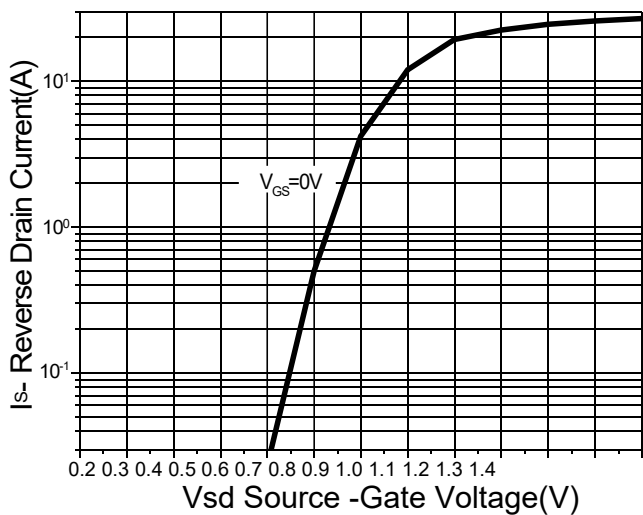
**Fig2 Transfer Characteristics**



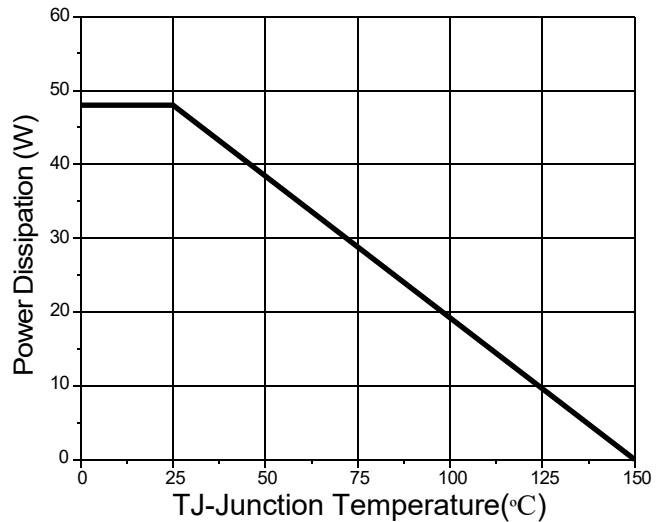
**Fig3 Rds(on)-Drain current**



**Fig4 Rds(on)-Gate Drain voltage**



**Fig5 Source-Drain Diode Forward**



**Fig6 Power De-rating**

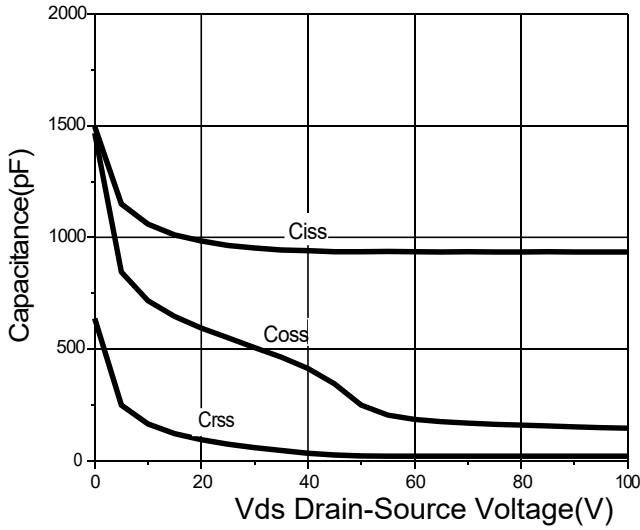


Fig7 Capacitance vs Vds

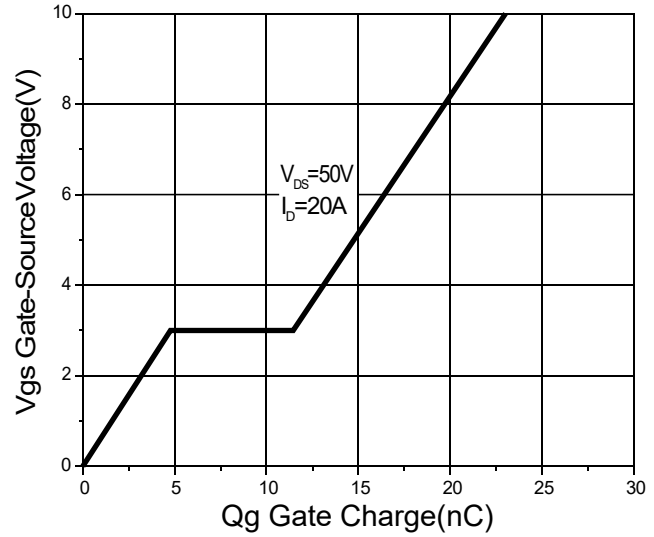


Fig8 Gate Charge

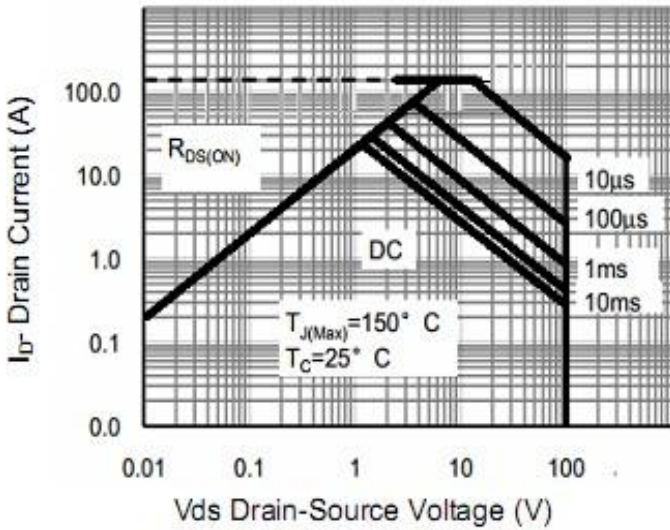


Fig9 Safe Operation Area

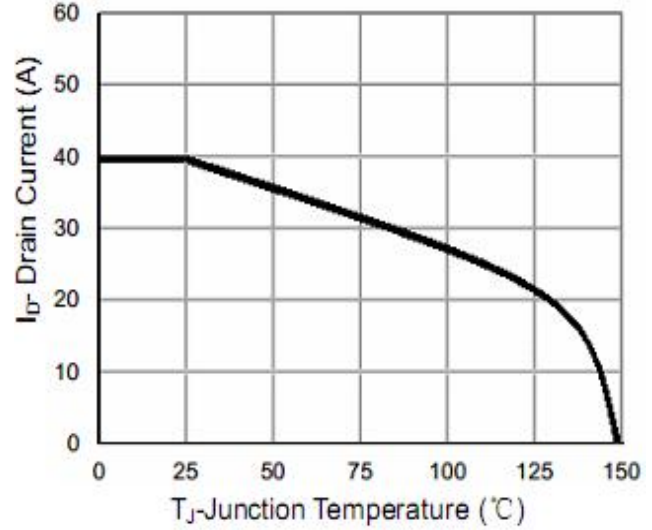


Fig10 Current De-rating

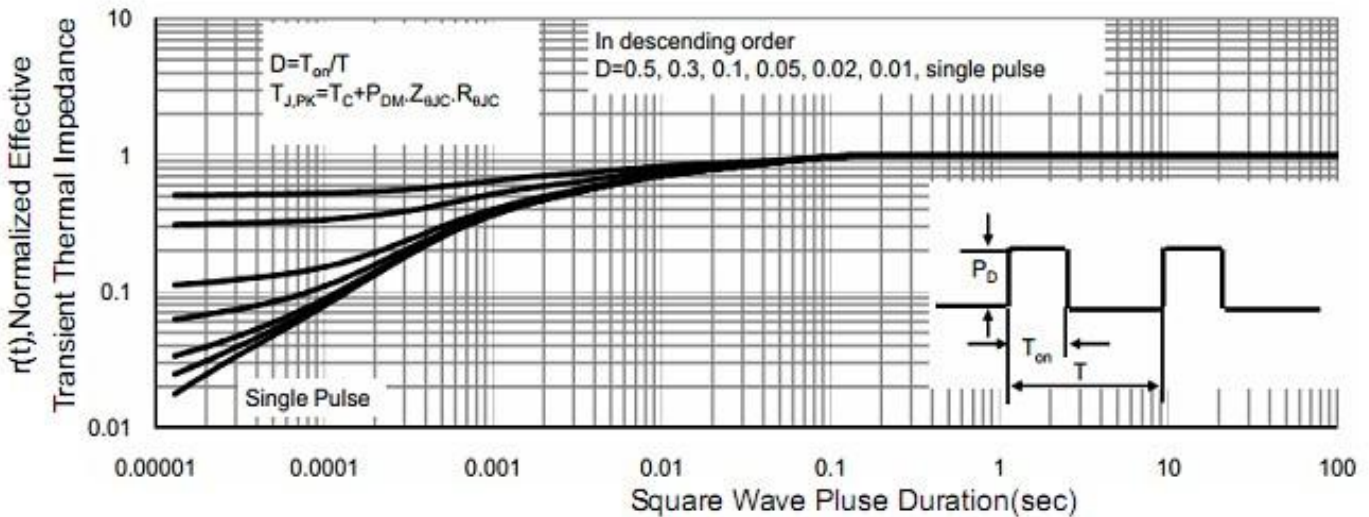
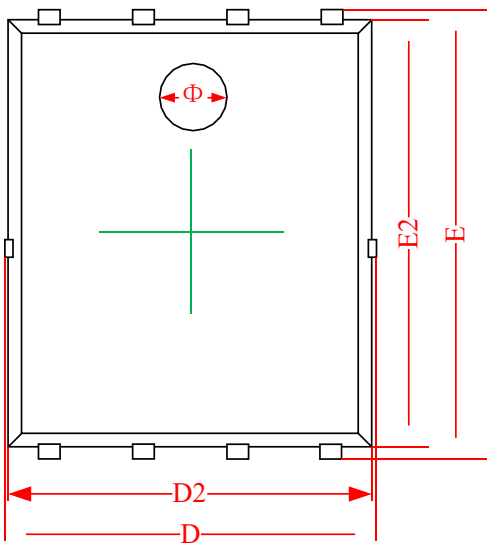
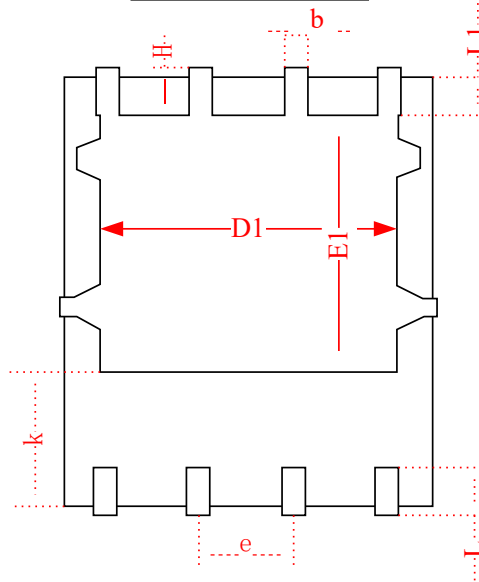
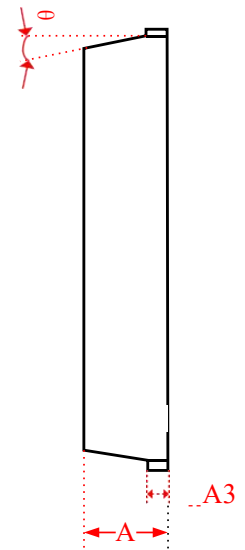


Fig11 Normalized Maximum Transient Thermal Impedance

- PDFN5\*6-8L-A

**Top View**

**Bottom View**

**Side View**


| SYMBOLS  | DIMENSIONS IN MILLIMETERS |       |       | DIMENSIONS IN INCHES |       |       |
|----------|---------------------------|-------|-------|----------------------|-------|-------|
|          | MIN                       | NOM   | MAX   | MIN                  | NOM   | MAX   |
| A        | 0.870                     | 0.900 | 0.930 | 0.034                | 0.035 | 0.036 |
| A3       | 0.152REF.                 |       |       | 0.006REF.            |       |       |
| D        | 4.944                     | 5.020 | 5.096 | 0.195                | 0.198 | 0.201 |
| E        | 5.974                     | 6.050 | 6.126 | 0.235                | 0.238 | 0.241 |
| D1       | 3.910                     | 4.010 | 4.110 | 0.154                | 0.158 | 0.162 |
| E1       | 3.375                     | 3.475 | 3.575 | 0.133                | 0.137 | 0.141 |
| D2       | 4.870                     | 4.900 | 4.930 | 0.192                | 0.193 | 0.194 |
| E2       | 5.720                     | 5.750 | 5.780 | 0.226                | 0.227 | 0.228 |
| k        | 1.190                     | 1.290 | 1.390 | 0.047                | 0.051 | 0.055 |
| b        | 0.350                     | 0.380 | 0.410 | 0.014                | 0.015 | 0.016 |
| e        | 1.270TYP.                 |       |       | 0.050TYP.            |       |       |
| L        | 0.559                     | 0.635 | 0.711 | 0.022                | 0.025 | 0.028 |
| L1       | 0.424                     | 0.500 | 0.576 | 0.017                | 0.020 | 0.023 |
| H        | 0.574                     | 0.650 | 0.726 | 0.023                | 0.026 | 0.029 |
| $\theta$ | 10°                       | 11°   | 12°   | 10°                  | 11°   | 12°   |
| $\Phi$   | 1.150                     | 1.200 | 1.250 | 0.045                | 0.047 | 0.049 |