

### • General Description

The TF4410 combines advanced trench MOSFET technology with a low resistance package to provide extremely low  $R_{DS(ON)}$ . This device is ideal for load switch and battery protection applications.

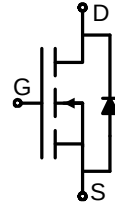
### • Features

- Advance high cell density Trench technology
- Low  $R_{DS(ON)}$  to minimize conductive loss
- Low Gate Charge for fast switching
- Dual DIE in one package

### • Application

- Power Management in Notebook Computer,
- Portable Equipment and Battery
- Powered Systems

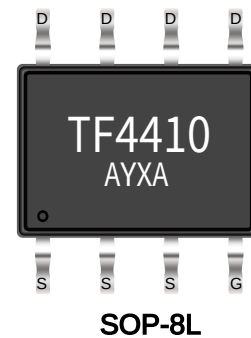
### • Product Summary



$$V_{DS} = 30V \quad I_D = 15A$$

$$R_{DS(ON)(10V \text{ typ})} = 6.1m\Omega$$

$$R_{DS(ON)(4.5V \text{ typ})} = 9.2m\Omega$$



### • Package Marking and Ordering Information:

|                           |                                      |
|---------------------------|--------------------------------------|
| Part NO.                  | TF4410                               |
| Marking1                  | TF4410                               |
| Marking2                  | Y:year code; X:Week; AA:device code; |
| Basic ordering unit (pcs) | 4000                                 |

### • Absolute Maximum Ratings ( $T_C = 25^\circ C$ )

| Parameter                      | Symbol                 | Rating     | Unit       |
|--------------------------------|------------------------|------------|------------|
| Drain-Source Voltage           | $V_{DS}$               | 30         | V          |
| Gate-Source Voltage            | $V_{GS}$               | $\pm 20$   | V          |
| Continuous Drain Current       | $I_{D@TC=25^\circ C}$  | 15         | A          |
|                                | $I_{D@TC=75^\circ C}$  | 11         | A          |
|                                | $I_{D@TC=100^\circ C}$ | 9.0        | A          |
| Pulsed Drain Current ①         | $I_{DM}$               | 45         | A          |
| Total Power Dissipation        | $P_D@TC=25^\circ C$    | 35         | W          |
| Total Power Dissipation        | $P_D@TA=25^\circ C$    | 2.8        | W          |
| Operating Junction Temperature | $T_J$                  | -55 to 150 | $^\circ C$ |
| Storage Temperature            | $T_{STG}$              | -55 to 150 | $^\circ C$ |
| Single Pulse Avalanche Energy  | $E_{AS}$               | 35         | mJ         |

●Thermal resistance

| Parameter                                    | Symbol     | Min. | Typ. | Max. | Unit  |
|----------------------------------------------|------------|------|------|------|-------|
| Thermal resistance, junction - case          | $R_{thJC}$ | -    | -    | 4.5  | ° C/W |
| Thermal resistance, junction - ambient       | $R_{thJA}$ | -    | -    | 60   | ° C/W |
| Soldering temperature, wavesoldering for 8 s | $T_{sold}$ | -    | -    | 265  | ° C   |

●Electronic Characteristics

| Parameter                         | Symbol       | Condition                     | Min. | Typ | Max.      | Unit       |
|-----------------------------------|--------------|-------------------------------|------|-----|-----------|------------|
| Drain-Source Breakdown Voltage    | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$     | 30   | -   | -         | V          |
| Gate Threshold Voltage            | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$ | 1.2  | 1.5 | 2.5       | V          |
| Drain-Source Leakage Current      | $I_{DSS}$    | $V_{DS}=30V, V_{GS}=0V$       | -    | -   | 1.0       | $\mu A$    |
| Gate- Source Leakage Current      | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$   | -    | -   | $\pm 100$ | nA         |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=15A$         | -    | 6.2 | 8.5       | m $\Omega$ |
|                                   |              | $V_{GS}=4.5V, I_D=10A$        | -    | 9.2 | 12        | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS}=25V, I_D=10A$         | -    | 8   | -         | S          |
| Source-drain voltage              | $V_{SD}$     | $I_S=10A$                     | -    | -   | 1.20      | V          |

●Electronic Characteristics

| Parameter                    | Symbol    | Condition                               | Min. | Typ   | Max. | Unit |
|------------------------------|-----------|-----------------------------------------|------|-------|------|------|
| Input capacitance            | $C_{iss}$ | f = 1MHz<br>$V_{DS}=15V$<br>$V_{GS}=0V$ | -    | 1007  | -    | pF   |
| Output capacitance           | $C_{oss}$ |                                         | -    | 128.9 | -    |      |
| Reverse transfer capacitance | $C_{rss}$ |                                         | -    | 117.7 | -    |      |

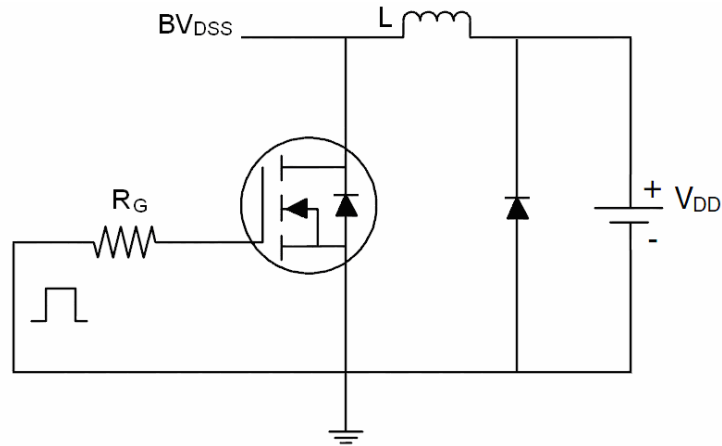
●Gate Charge characteristics( $T_a = 25^\circ C$ )

| Parameter            | Symbol   | Condition    | Min. | Typ  | Max. | Unit |
|----------------------|----------|--------------|------|------|------|------|
| Total gate charge    | $Q_g$    | $V_{DD}=15V$ | -    | 23.1 | -    | nC   |
| Gate - Source charge | $Q_{gs}$ | $I_D=10A$    | -    | 4.28 | -    |      |
| Gate - Drain charge  | $Q_{gd}$ | $V_{GS}=10V$ | -    | 4.32 | -    |      |

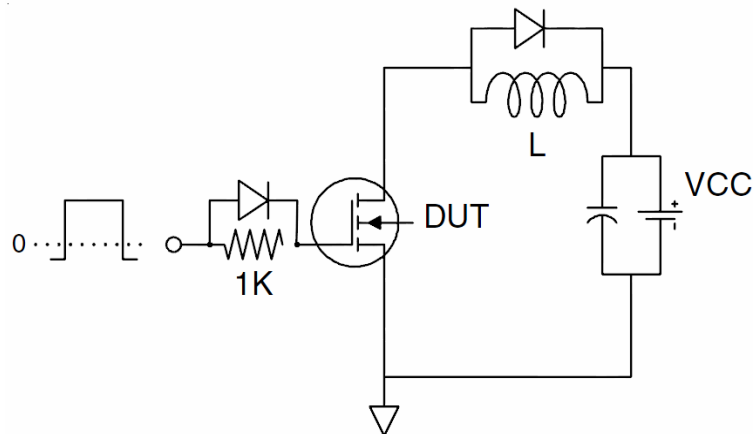
Note: ① Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$  ;

## Test Circuit

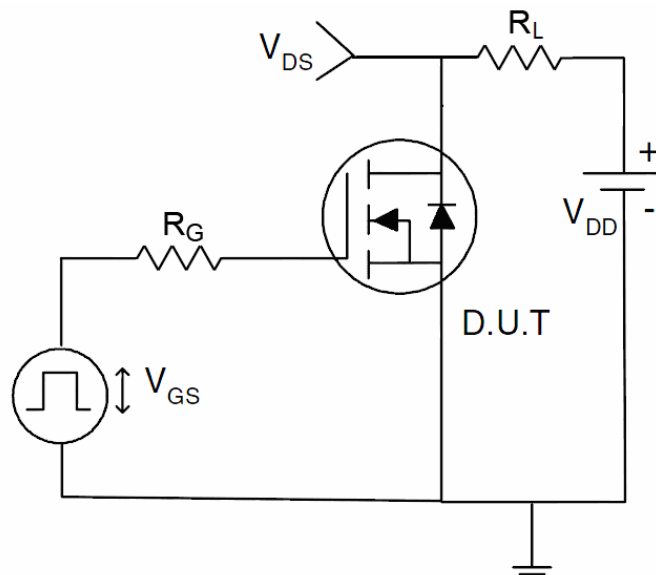
### 1) $E_{AS}$ test Circuit



### 2) Gate charge test Circuit



### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics

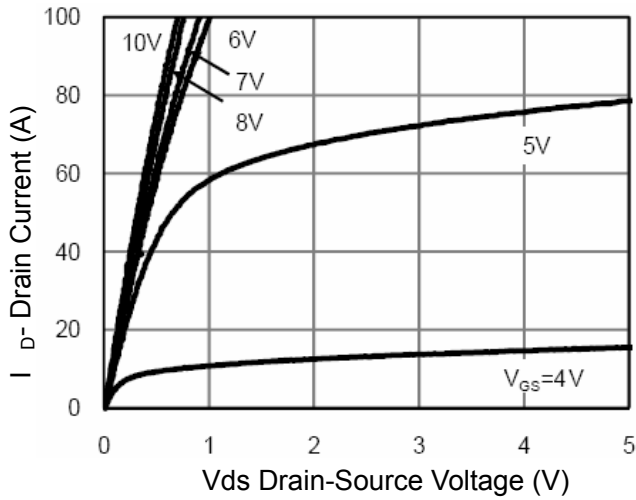


Figure 1 Output Characteristics

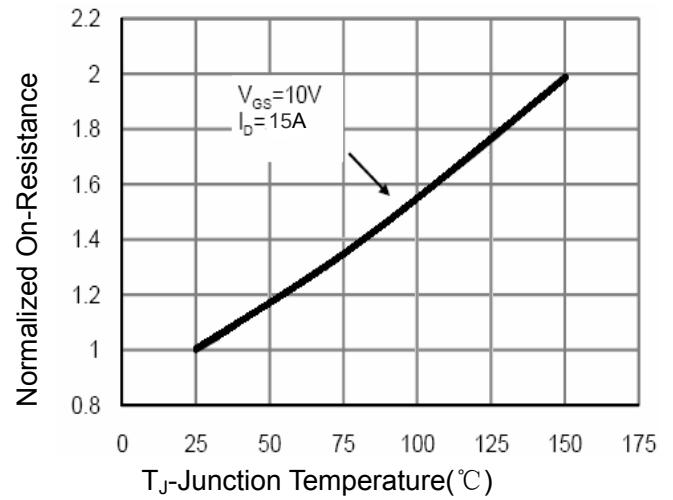


Figure 4  $R_{dson}$ -Junction Temperature

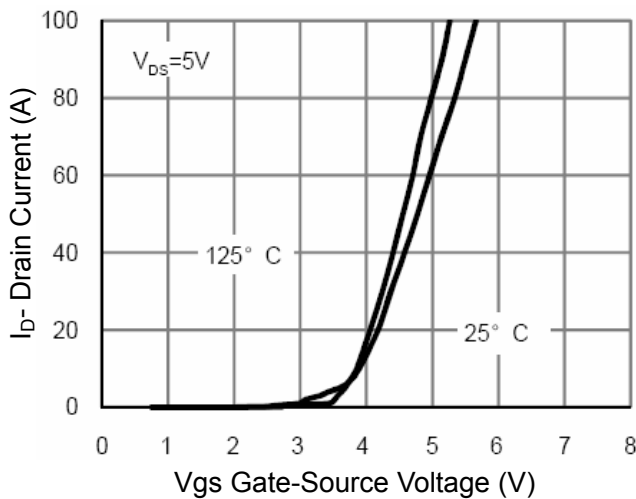


Figure 2 Transfer Characteristics

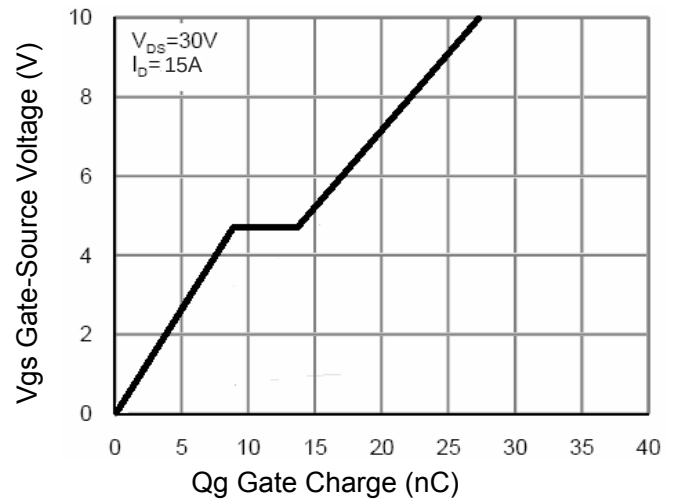


Figure 5 Gate Charge

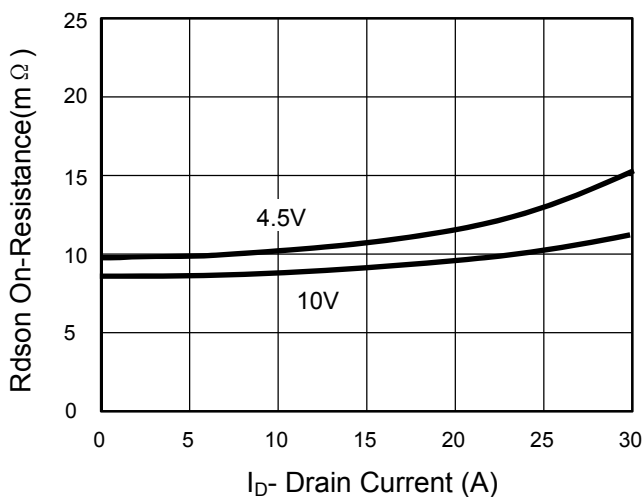


Figure 3  $R_{dson}$ - Drain Current

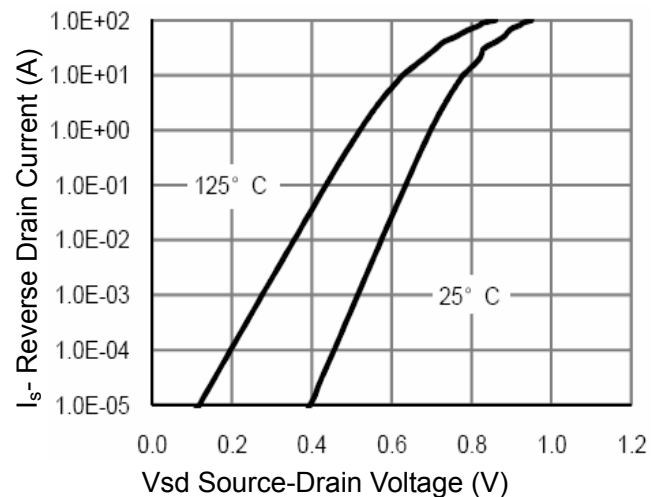


Figure 6 Source- Drain Diode Forward

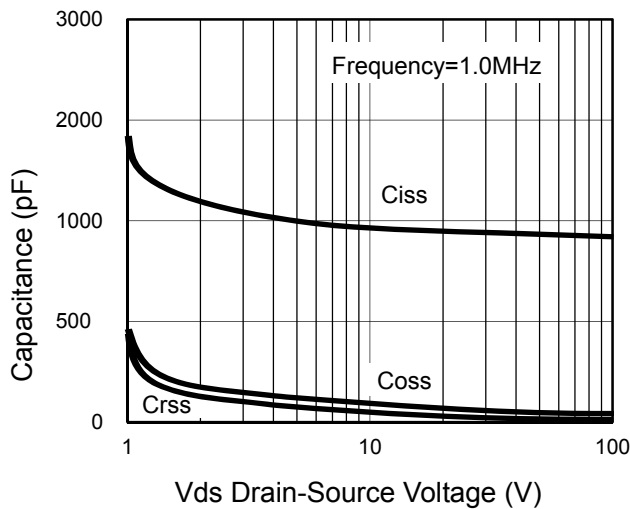


Figure 7 Capacitance vs Vds

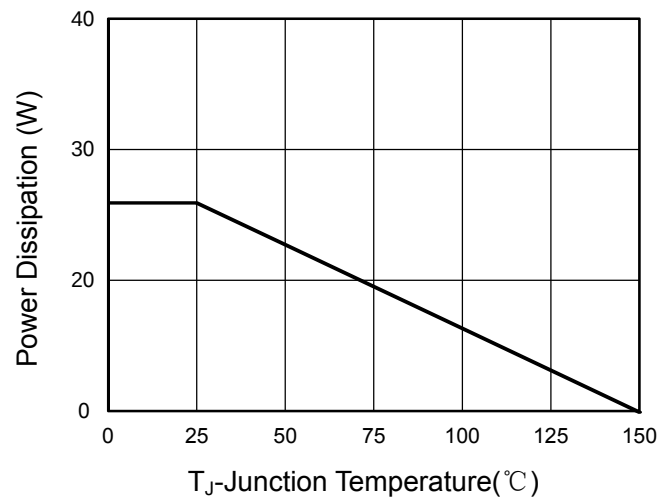


Figure 9 Power De-rating

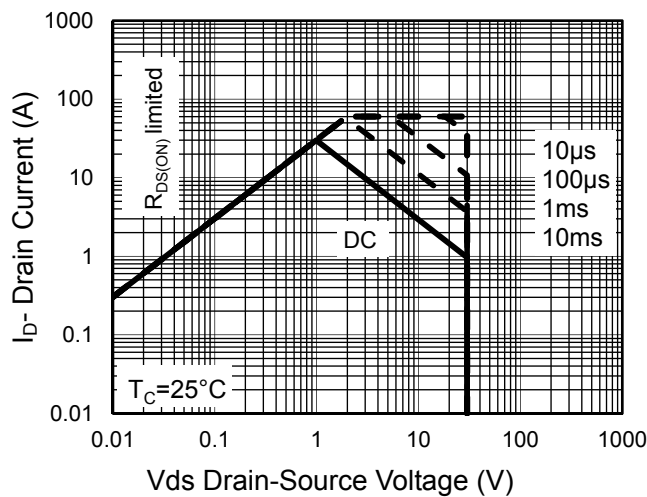


Figure 8 Safe Operation Area

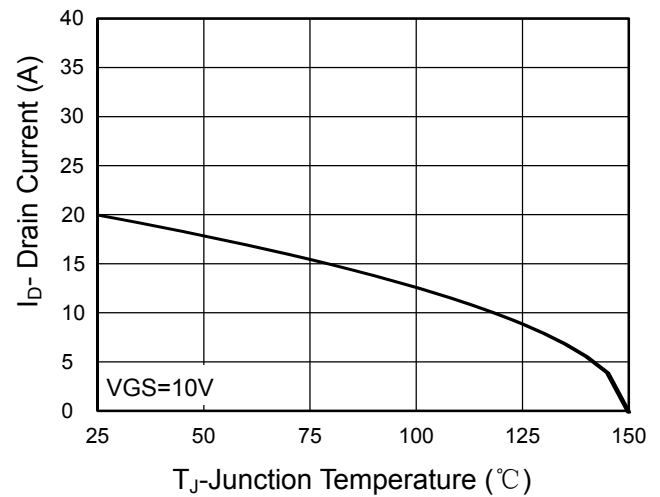


Figure 10 Current De-rating

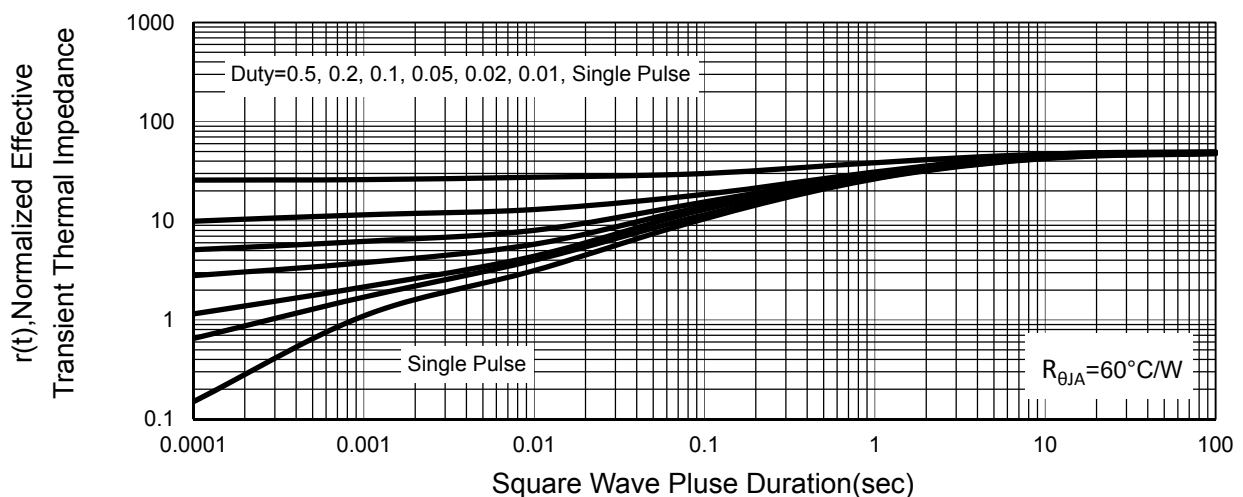
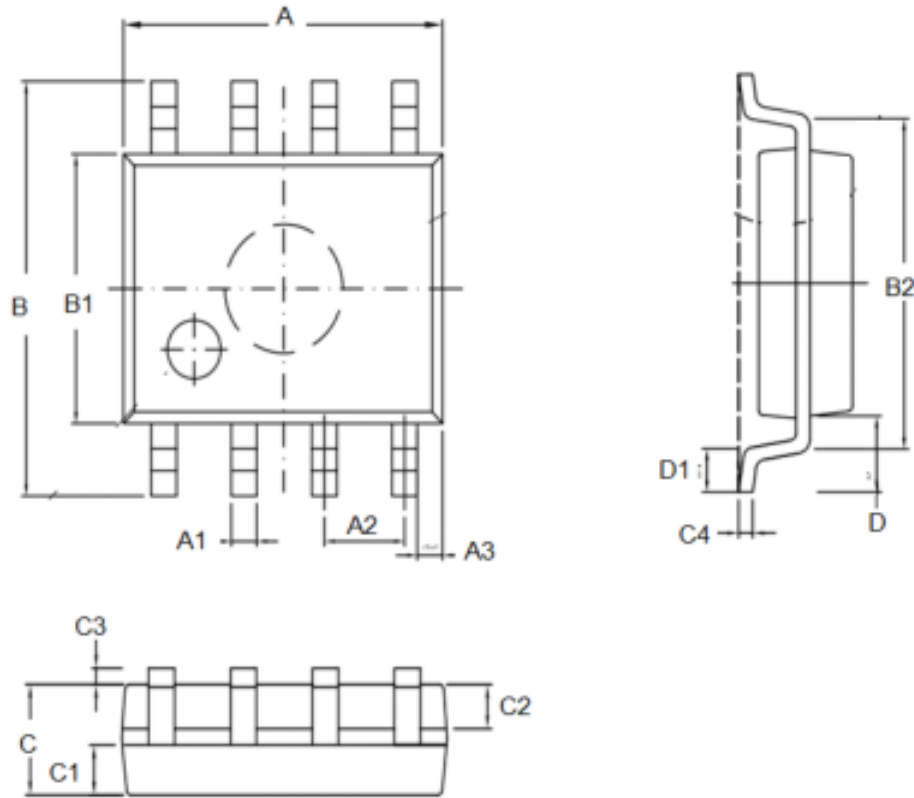


Figure 11 Normalized Maximum Transient Thermal Impedance

### SOP-8L Package Outline Dimensions



Unit: mm

| SYMBOL | min  | TYP  | max  | SYMBOL | min  |      | max  |
|--------|------|------|------|--------|------|------|------|
| A      | 4.80 |      | 5.25 | C      | 1.30 |      | 1.75 |
| A1     | 0.37 |      | 0.49 | C1     | 0.55 |      | 0.75 |
| A2     |      | 1.27 |      | C2     | 0.55 |      | 0.65 |
| A3     |      | 0.41 |      | C3     | 0.05 |      | 0.20 |
| B      | 5.80 |      | 6.20 | C4     | 0.10 | 0.20 | 0.23 |
| B1     | 3.80 |      | 4.10 | D      |      | 1.05 |      |
| B2     |      | 5.00 |      | D1     | 0.40 |      | 0.62 |

Note:

1. Controlling dimension: in millimeters.

2. General tolerance:  $\pm 0.05$  mm.

3. The pad layout is for reference purposes only.