## Dual N-Channel Enhancement Mode Power MOSFET

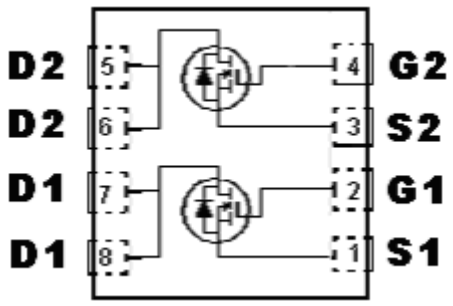
| | |
|---|---|
| **$BV_{DSS}$** | **60V** |
| **$I_D$@$V_{GS}$=10V, $T_C$=25°C** | **15.7A** |
| **$I_D$@$V_{GS}$=10V, $T_C$=100°C** | **9.5A** |
| **$I_D$@$V_{GS}$=10V, $T_A$=25°C** | **4.5A** |
| **$I_D$@$V_{GS}$=10V, $T_A$=70°C** | **3.6A** |
| **$R_{DS(ON)}$@$V_{GS}$=10V, $I_D$=5A** | **33mΩ(typ)** |
| **$R_{DS(ON)}$@$V_{GS}$=4.5V, $I_D$=5A** | **36mΩ(typ)** |

## Features

- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- Pb-free lead plating and Halogen-free package

## Equivalent Circuit

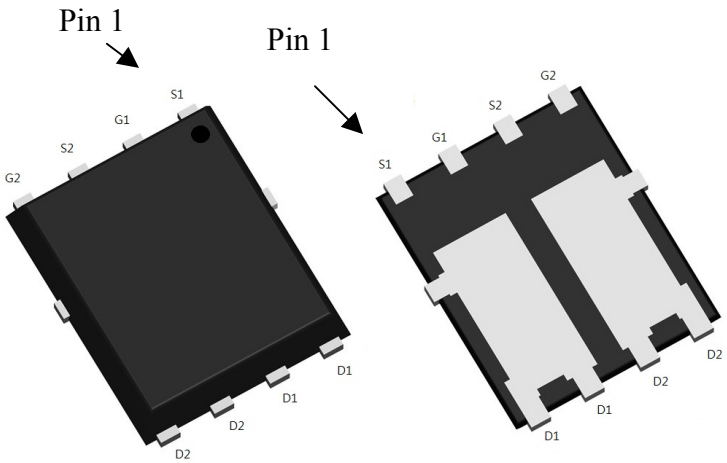
MTB60A06DH8




G：Gate D：Drain S：Source

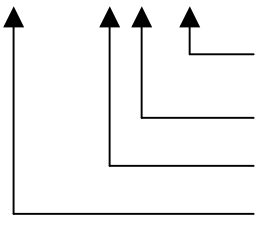
## Outline

DFN5x6




## Ordering Information

| Device | Package | Shipping |
|---|---|---|
| MTH60D40N8-0-T6-G | DFN 5 ×6<br>(Pb-free lead plating and halogen-free package) | 3000 pcs / tape & reel |



Environment friendly grade : S for RoHS compliant products, G for RoHS compliant and green compound products

Packing spec, T6 : 3000 pcs / tape & reel,13” reel

Product rank, zero for no rank products

Product name

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

| Parameter | | | Symbol | Limits | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DS}$ | 60 | V |
| Gate-Source Voltage | | | $V_{GS}$ | ±20 | |
| Continuous Drain Current @$T_C$=25°C, $V_{GS}$=10V | | (Note 1) | $I_D$ | 15.7 | A |
| Continuous Drain Current @$T_C$=100°C, $V_{GS}$=10V | | (Note 1) | | 10 | |
| Continuous Drain Current @$T_A$=25°C, $V_{GS}$=10V | | (Note 2) | $I_{DSM}$ | 4.5 | |
| Continuous Drain Current @$T_A$=70°C, $V_{GS}$=10V | | (Note 2) | | 3.6 | |
| Pulsed Drain Current @ $V_{GS}$=10V | | (Note 3) | $I_{DM}$ | 60 | |
| Avalanche Current | | (Note 3) | $I_{AS}$ | 15 | |
| Single Pulse Avalanche Energy @ L=1mH, $I_D$=10Amps, $V_{DD}$=50V | | (Note 5) | $E_{AS}$ | 50 | mJ |
| Repetitive Avalanche Energy | | (Note 3) | $E_{AR}$ | 2.1 | |
| Power Dissipation | $T_C$=25°C | (Note 1) | $P_D$ | 21 | W |
| | $T_C$=100°C | (Note 1) | | 8.4 | |
| | $T_A$=25°C | (Note 2) | $P_{DSM}$ | 1.8 | |
| | $T_A$=70°C | (Note 2) | | 1.2 | |
| Operating Junction and Storage Temperature | | | Tj, Tstg | -55~+150 | °C |

*Drain current limited by maximum junction temperature

## Thermal Data

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Thermal Resistance, Junction-to-case, max | | $R_{\theta JC}$ | 6 | °C/W |
| Thermal Resistance, Junction-to-ambient, max | (Note 4) | $R_{\theta JA}$ | 70 | |

Note : 1.The power dissipation $P_D$ is based on $T_{J(MAX)}$=150°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

2. The value of $R_{\theta JA}$ is measured with the device mounted on 1 in²FR-4 board with 2 oz. copper, in a still air environment with $T_A$=25°C. The value in any given application depends on the user's specific board design. The power dissipation $P_{DSM}$ is based on $R_{\theta JA}$ and the maximum allowed junction temperature of 150°C.

3. Ratings are based on low frequency and low duty cycles to keep initial $T_J$=25°C.

4. When mounted on1 in² copper pad of FR-4 board ; 125°C/W when mounted on minimum copper pad.

5. 100% tested by conditions of L=0.1mH, $I_{AS}$=10A, $V_{GS}$=10V, $V_{DD}$=25V.

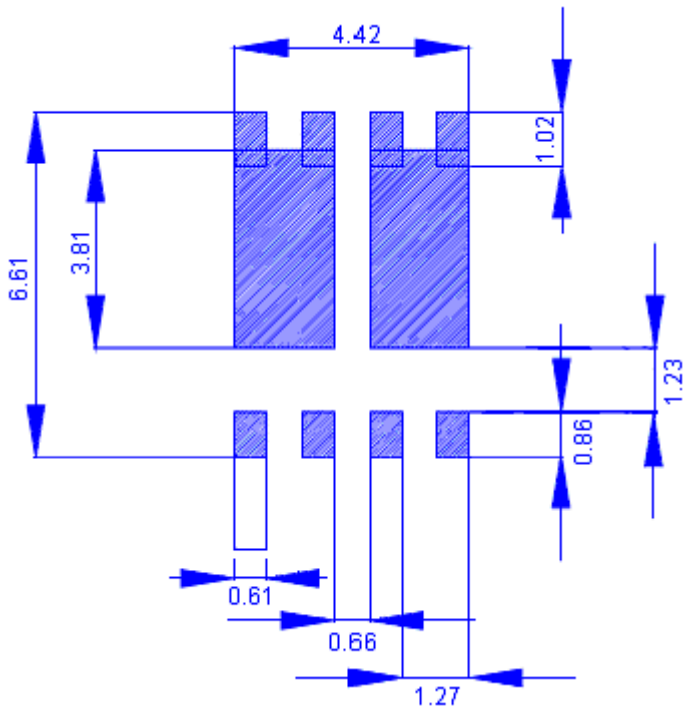
## Characteristics (Tj=25°C, unless otherwise specified)

| Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|
| **Static** | | | | | |
| $BV_{DSS}$ | 60 | - | - | V | $V_{GS}$=0V, $I_D$=250μA |
| $\Delta BV_{DSS}/\Delta Tj$ | - | 0.06 | - | V/°C | Reference to 25°C, $I_D$=250μA |
| $V_{GS(th)}$ | 1.0 | - | 2.5 | V | $V_{DS}$ = $V_{GS}$, $I_D$=250μA |
| *$G_{FS}$ | - | 7 | - | S | $V_{DS}$ =10V, $I_D$=5A |
| $I_{GSS}$ | - | - | ±100 | nA | $V_{GS}$=±20V |

| | | | | | |
|---|---|---|---|---|---|
| $I_{DSS}$ | - | - | 1 | μA | $V_{DS}$ =48V, $V_{GS}$ =0V |
| | - | - | 25 | | $V_{DS}$ =48V, $V_{GS}$ =0V, Tj=85°C |
| *$R_{DS(ON)}$ | - | 33 | 40 | mΩ | $V_{GS}$ =10V, $I_D$=5A |
| | - | 36 | 47 | | $V_{GS}$ =4.5V, $I_D$=5A |
| **Dynamic** | | | | | |
| *Qg | - | 17.4 | 26.1 | nC | $V_{DS}$=30V, $I_D$=5A, $V_{GS}$=10V |
| *Qgs | - | 3.1 | - | | |
| *Qgd | - | 2.9 | - | | |
| *$t_{d(ON)}$ | - | 9 | 13.5 | ns | $V_{DS}$=30V, $I_D$=1A, $V_{GS}$=10V, $R_G$=6Ω |
| *tr | - | 17 | 25.5 | | |
| *$t_{d(OFF)}$ | - | 34.8 | 52.2 | | |
| *$t_f$ | - | 7 | 10.5 | | |
| Ciss | - | 882 | 1323 | pF | $V_{GS}$=0V, $V_{DS}$=30V, f=1MHz |
| Coss | - | 43 | 65 | | |
| Crss | - | 37 | 56 | | |
| Rg | - | 2.3 | - | Ω | f=1MHz |
| **Source-Drain Diode** | | | | | |
| *$I_S$ | - | - | 15 | A | |
| *$I_{SM}$ | - | - | 60 | | |
| *$V_{SD}$ | - | 0.81 | 1.2 | V | $I_S$=5A, $V_{GS}$=0V |
| *trr | - | 11.4 | - | ns | $V_{GS}$=0V, $I_F$=5A, $dI_F/dt$=100A/μs |
| *Qrr | - | 7 | - | nC | |

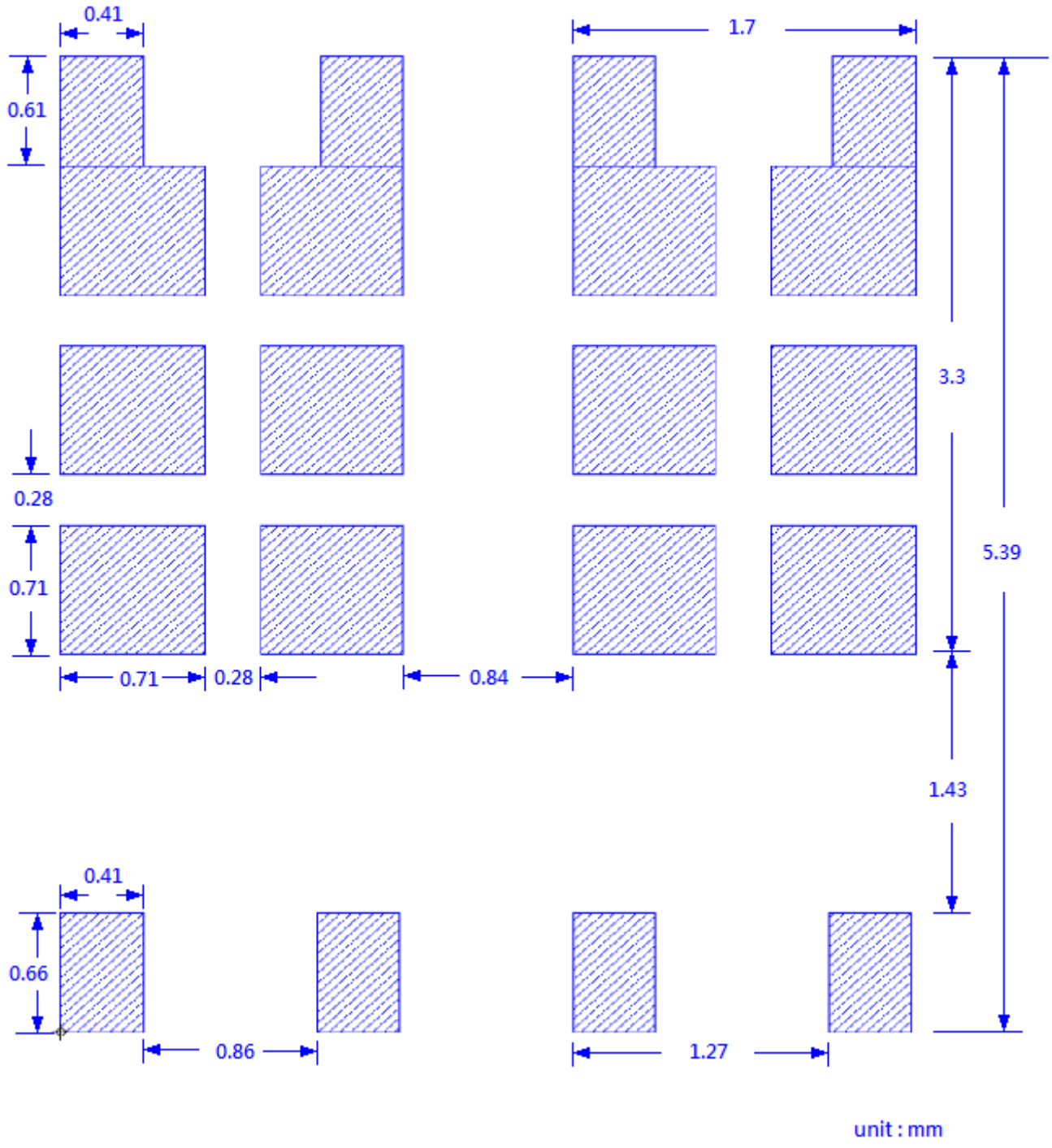
*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

## Recommended Soldering Footprint




unit : mm

## Recommended Stencil Design

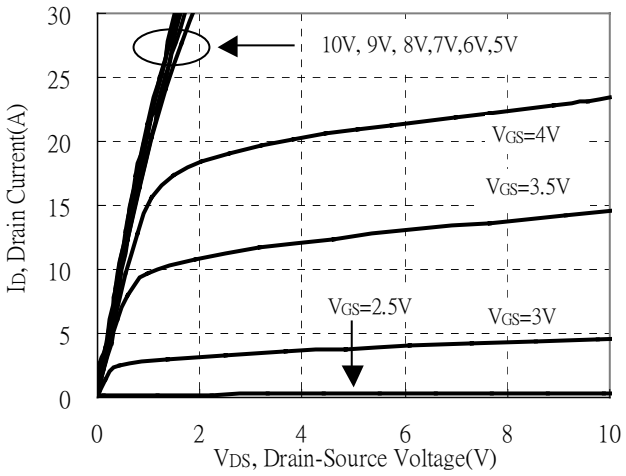



**Note : 1. Stencil thickness 5 mil (0.127mm)**

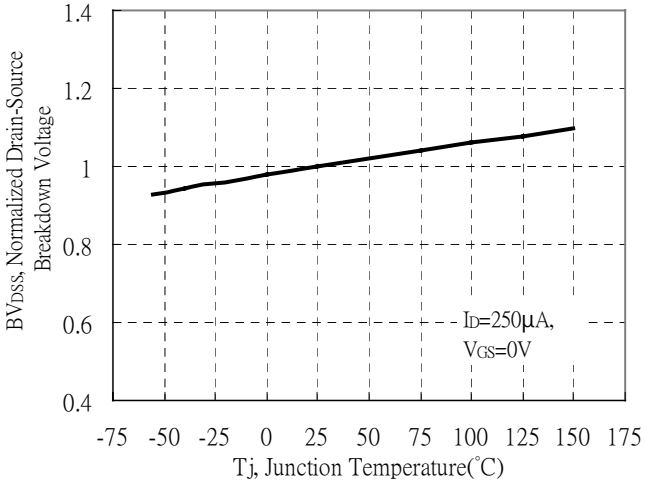
**2. May need to be adjusted to specific requirements.**

## Typical Characteristics

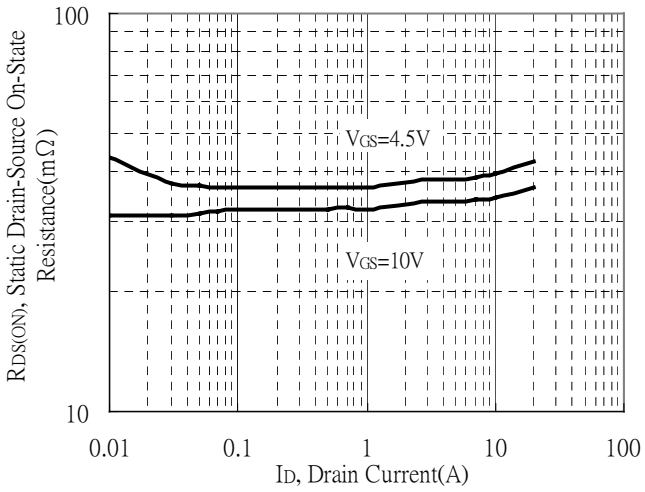
Typical Output Characteristics



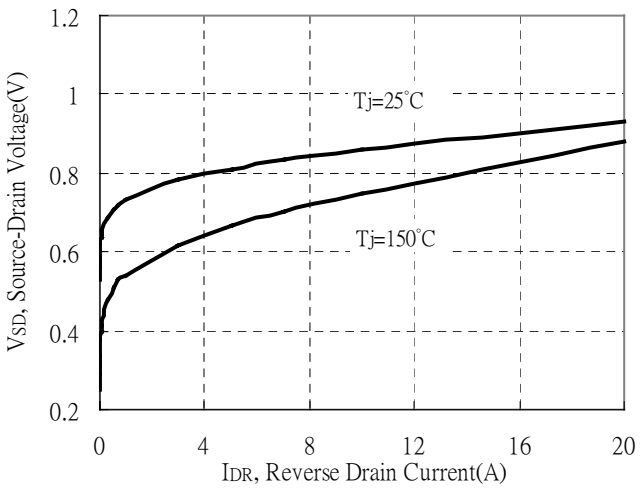

Brekdown Voltage vs Ambient Temperature



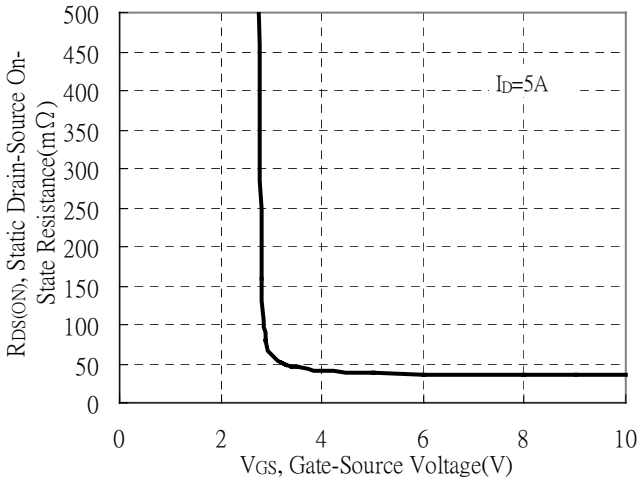

Static Drain-Source On-State resistance vs Drain Current



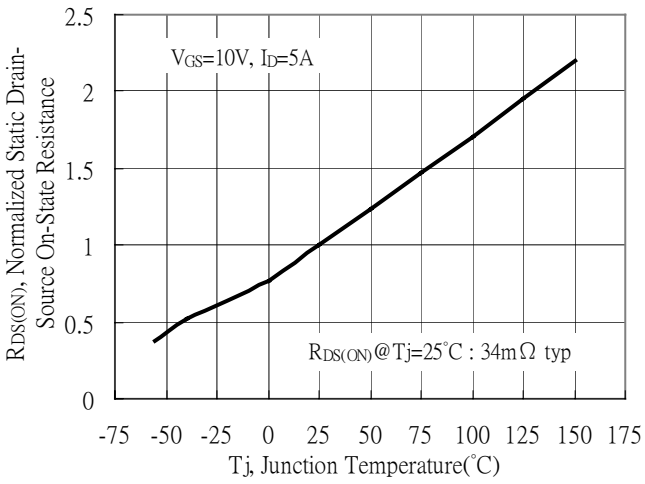

Reverse Drain Current vs Source-Drain Voltage




Static Drain-Source On-State Resistance vs Gate-Source Voltage

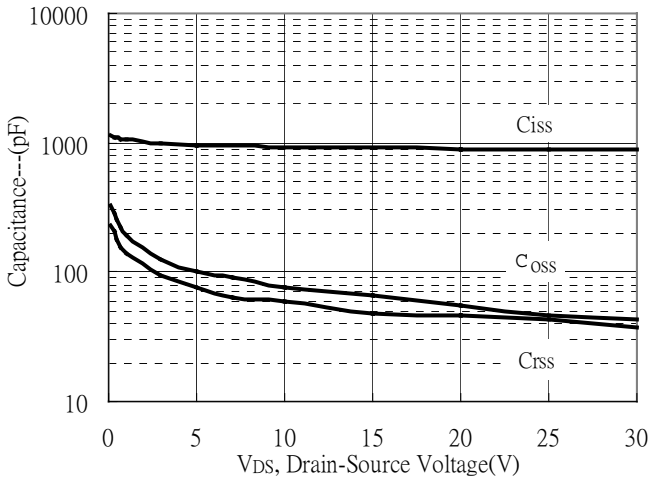



Drain-Source On-State Resistance vs Junction Tempearture

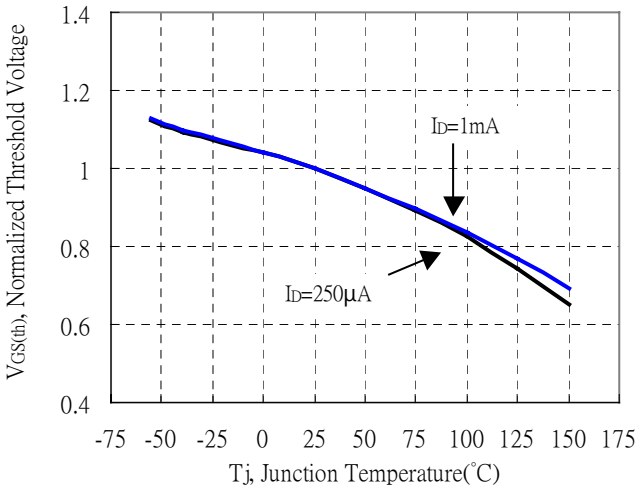


## Typical Characteristics(Cont.)

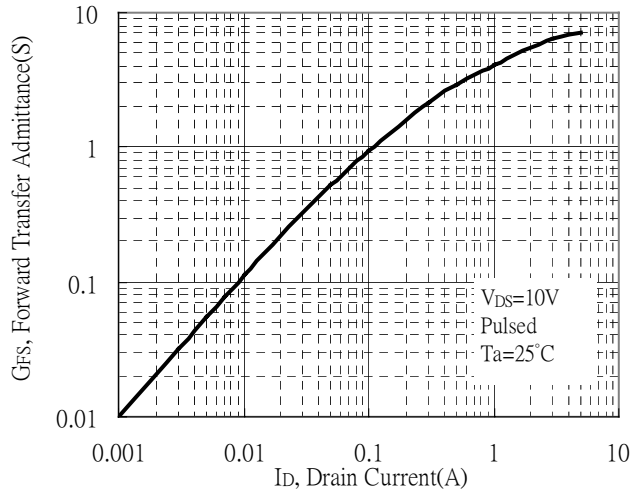
Capacitance vs Drain-to-Source Voltage



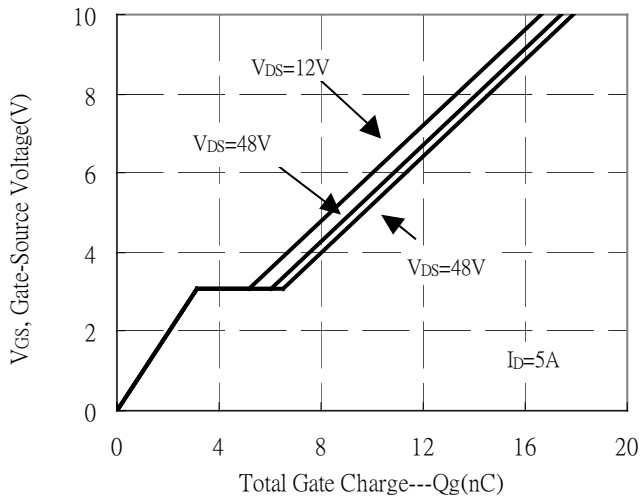

NormalizedThreshold Voltage vs Junction Tempearture



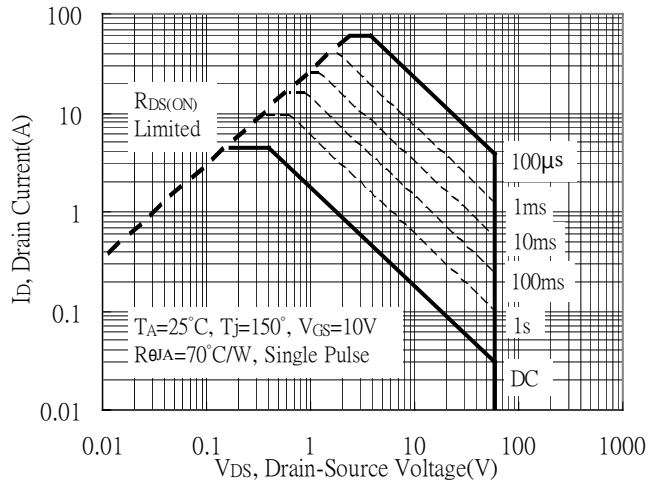

Forward Transfer Admittance vs Drain Current



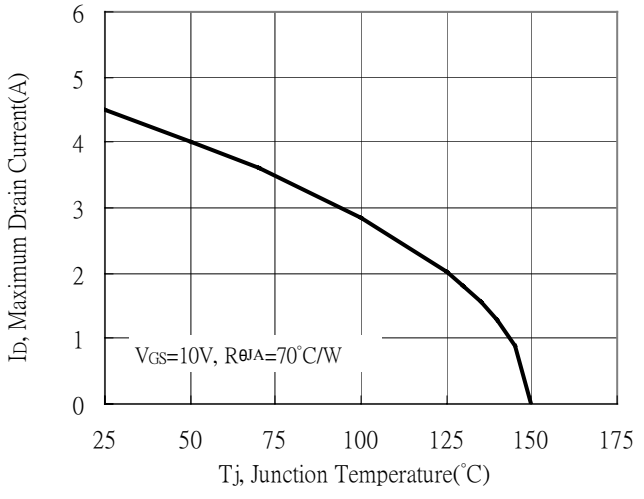

Gate Charge Characteristics




Maximum Safe Operating Area

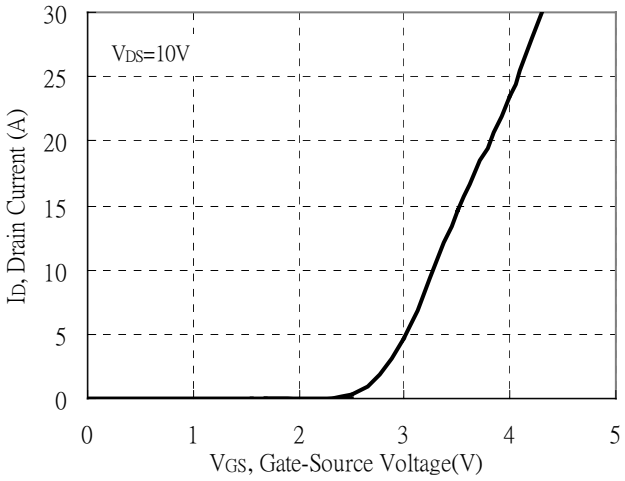



Maximum Drain Current vs Junction Temperature

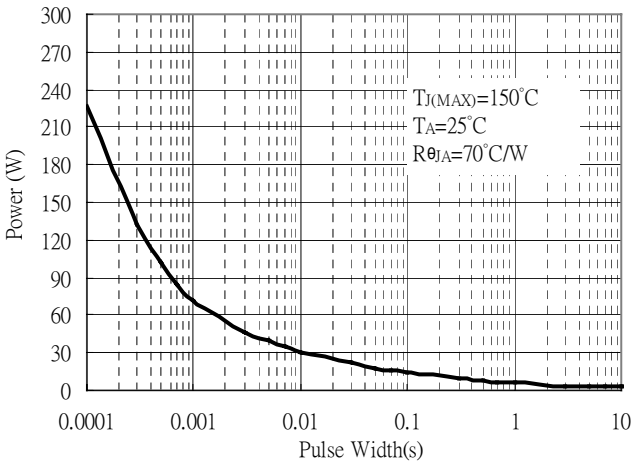


## Typical Characteristics(Cont.)

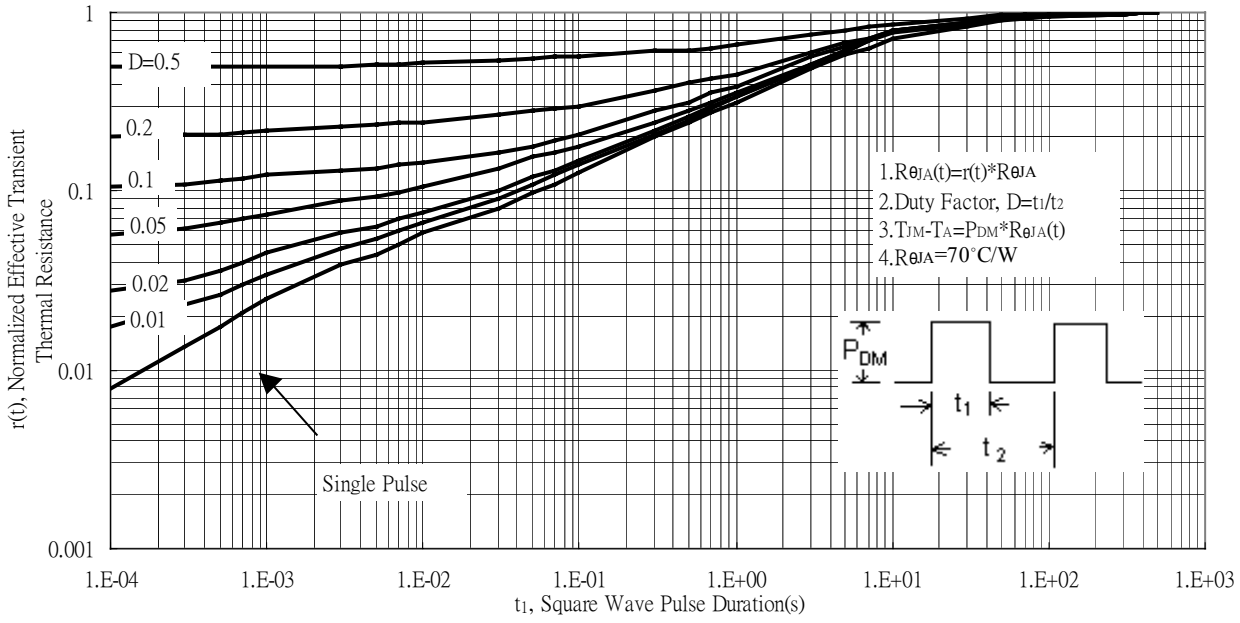
Typical Transfer Characteristics



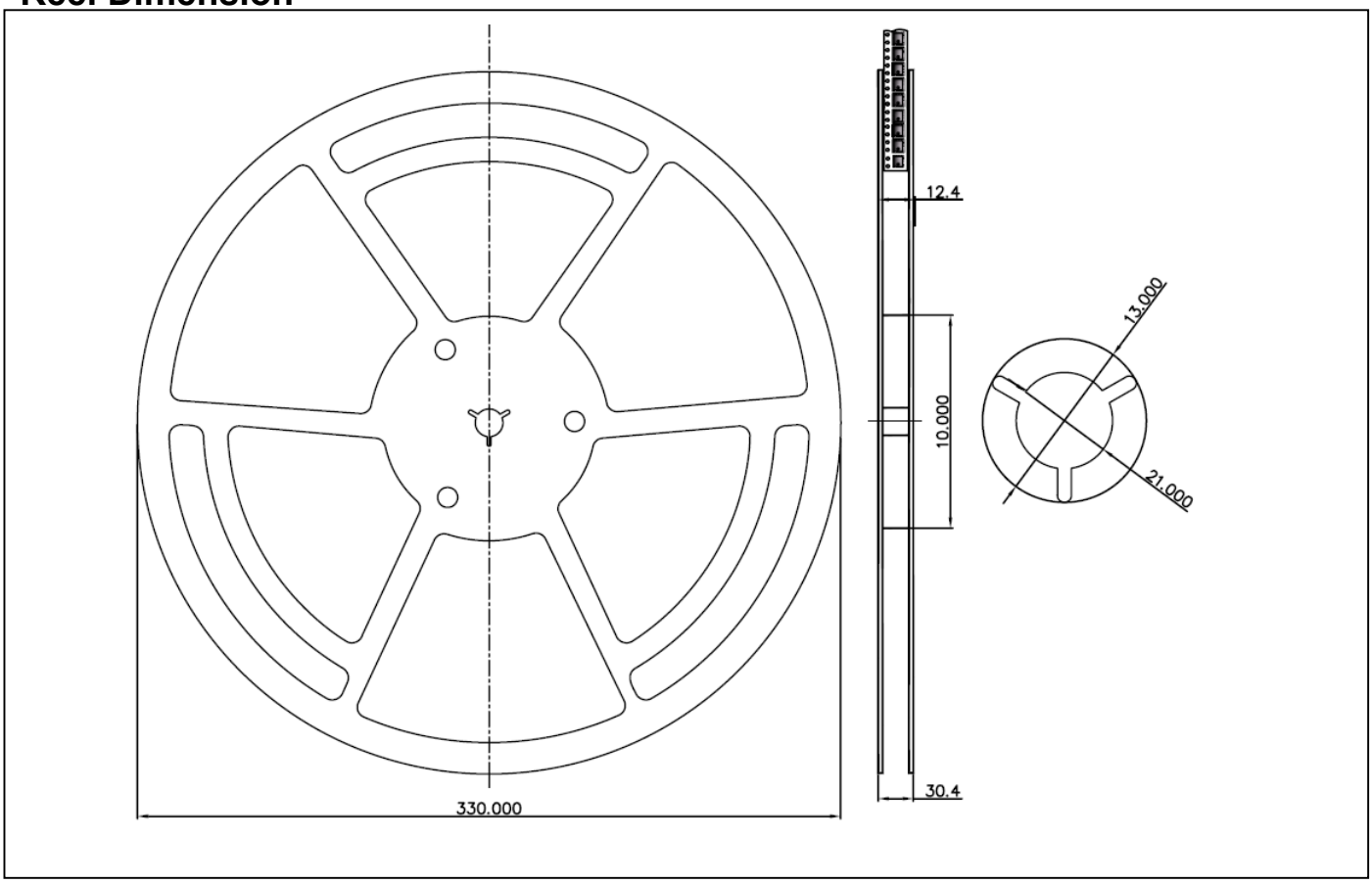

Single Pulse Maximum Power Dissipation
(Please see Note on page 2)



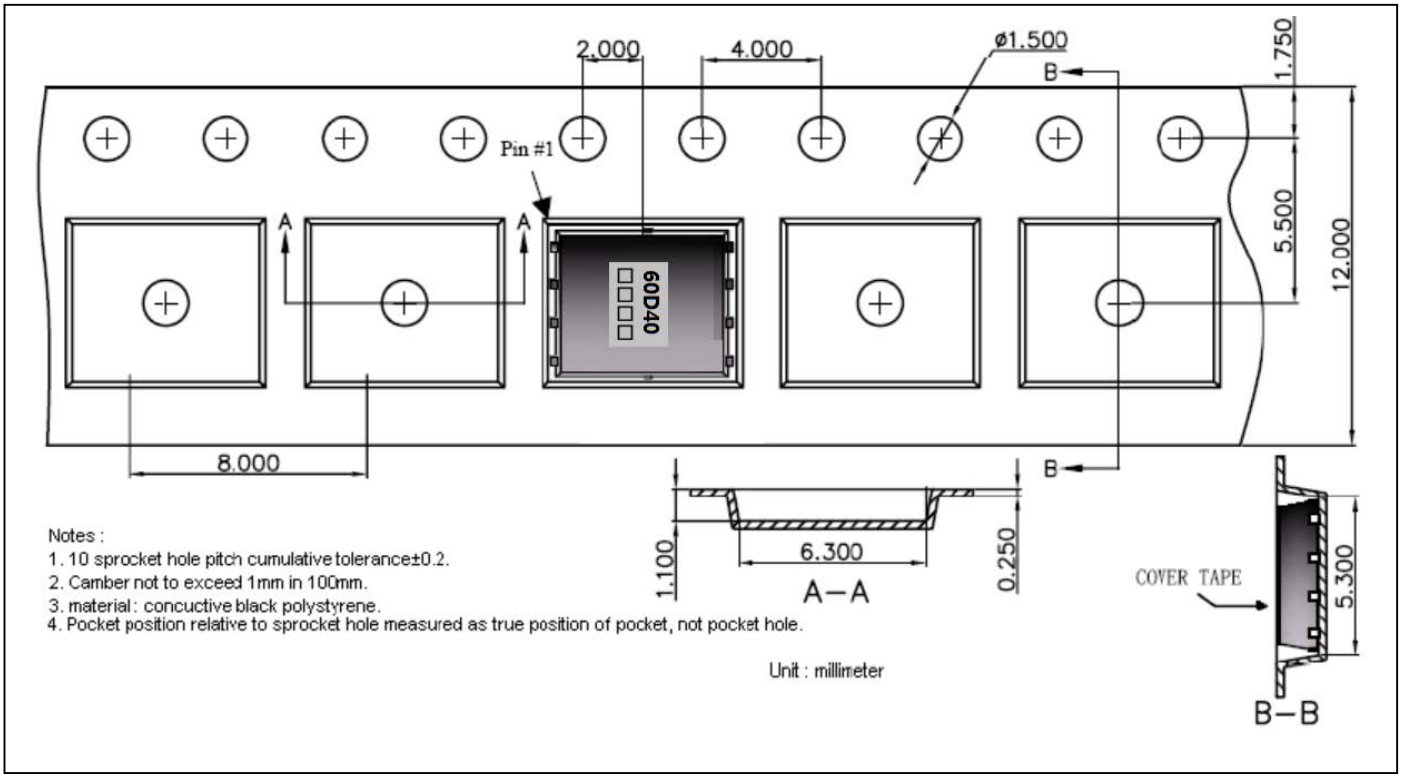

Transient Thermal Response Curves



## Reel Dimension



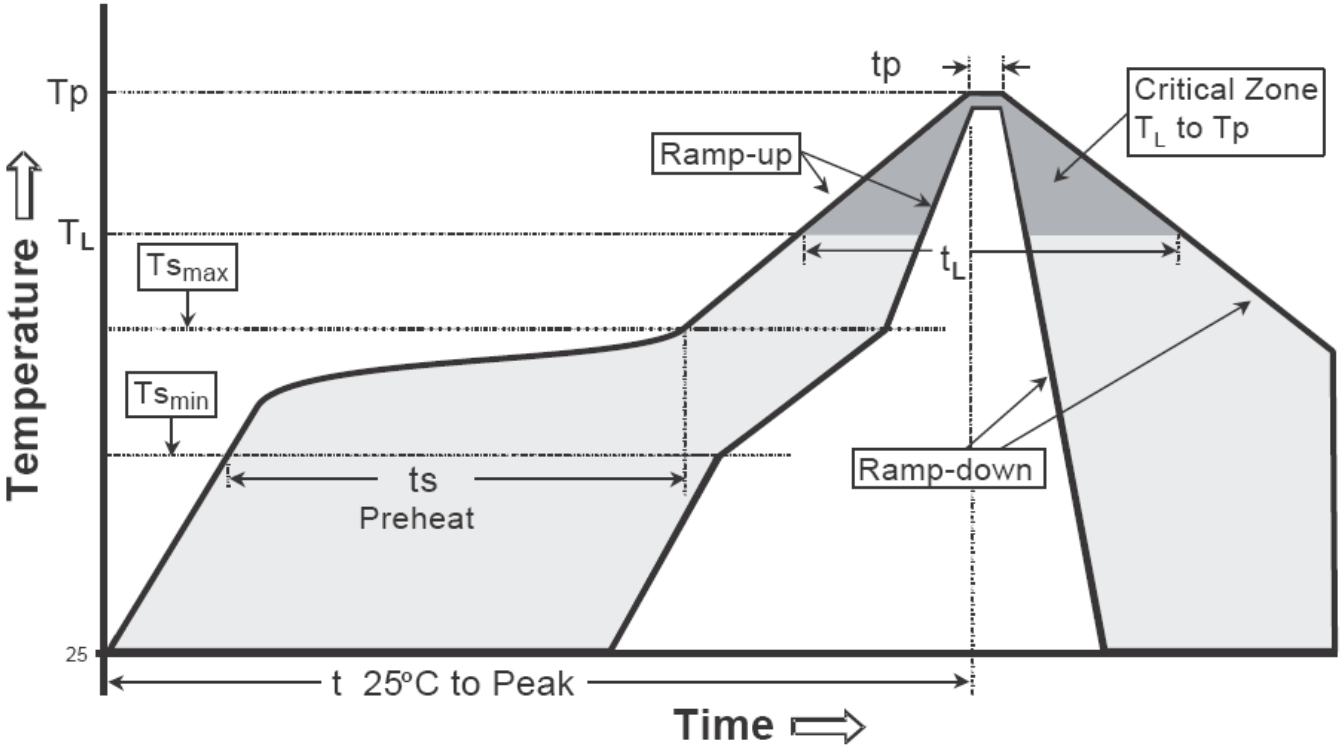

## Carrier Tape Dimension



## Recommended wave soldering condition

| Product | Peak Temperature | Soldering Time |
|---|---|---|
| Pb-free devices | 260 +0/-5 °C | 5 +1/-1 seconds |

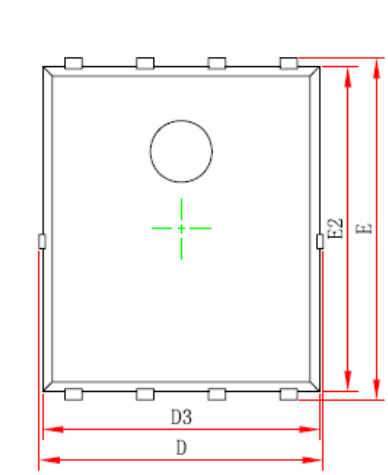
## Recommended temperature profile for IR reflow

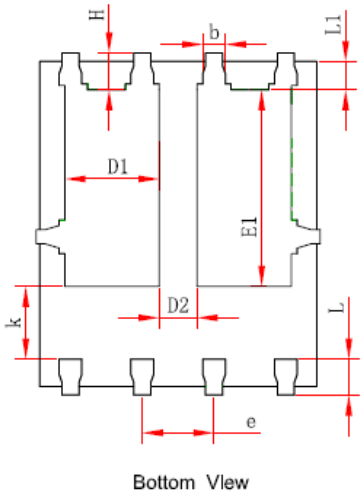


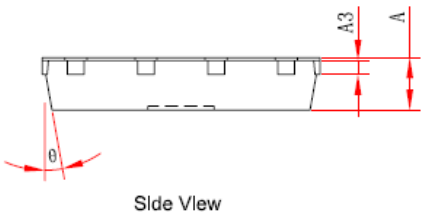

| Profile feature | Sn-Pb eutectic Assembly | Pb-free Assembly |
|---|---|---|
| Average ramp-up rate (Tsmax to Tp) | 3°C/second max. | 3°C/second max. |
| Preheat<br>−Temperature Min(Ts min)<br>−Temperature Max(Ts max)<br>−Time(ts min to ts max) | <br>100°C<br>150°C<br>60-120 seconds | <br>150°C<br>200°C<br>60-180 seconds |
| Time maintained above:<br>−Temperature (TL)<br>− Time (tL) | <br>183°C<br>60-150 seconds | <br>217°C<br>60-150 seconds |
| Peak Temperature(TP) | 240 +0/-5 °C | 260 +0/-5 °C |
| Time within 5°C of actual peak temperature(tp) | 10-30 seconds | 20-40 seconds |
| Ramp down rate | 6°C/second max. | 6°C/second max. |
| Time 25 °C to peak temperature | 6 minutes max. | 8 minutes max. |

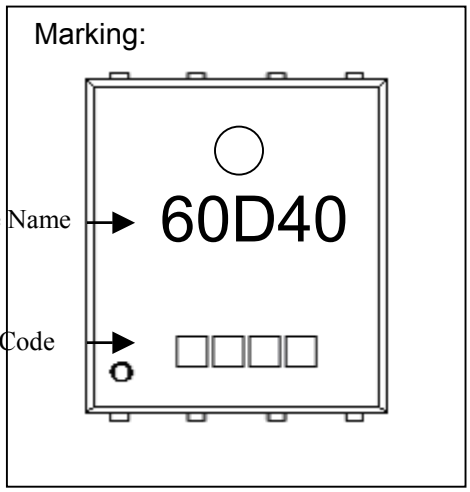
Note :1. All temperatures refer to topside of the package, measured on the package body surface.
2.For devices mounted on FR-4 PCB of 1.6mm or equivalent grade PCB. If other grade PCB is used, care should be taken to match the coefficients of thermal expansion between components and PCB. If they are not matched well, the solder joints may crack or the bodies of the parts may crack or shatter as the assembly cools.

## DFN5x6 Dimension




8-Lead DFN5x6 Plastic Package
Package Code : N8

| DIM | Millimeters | | Inches | | DIM | Millimeters | | Inches | |
|---|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | | Min. | Max. | Min. | Max. |
| A | 0.900 | 1.000 | 0.035 | 0.039 | E2 | 5.674 | 5.826 | 0.223 | 0.229 |
| A3 | 0.254 REF | | 0.010 REF | | k | 1.190 | 1.390 | 0.047 | 0.055 |
| D | 4.944 | 5.096 | 0.195 | 0.201 | b | 0.350 | 0.450 | 0.014 | 0.018 |
| E | 5.974 | 6.126 | 0.235 | 0.241 | e | 1.270 TYP | | 0.050 TYP | |
| D1 | 1.470 | 1.870 | 0.058 | 0.074 | L | 0.559 | 0.711 | 0.022 | 0.028 |
| D2 | 0.470 | 0.870 | 0.019 | 0.034 | L1 | 0.424 | 0.576 | 0.017 | 0.023 |
| E1 | 3.375 | 3.575 | 0.133 | 0.141 | H | 0.574 | 0.726 | 0.023 | 0.029 |
| D3 | 4.824 | 4.976 | 0.190 | 0.196 | θ | 10° | 12° | 10° | 12° |

Notes: 1.Controlling dimension: millimeters.
2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.

Material:

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.