# MM50G3U120BMX

1200V 50A IGBT

March 2024 Preliminary-H RoHS Compliant

## PRODUCT FEATURES

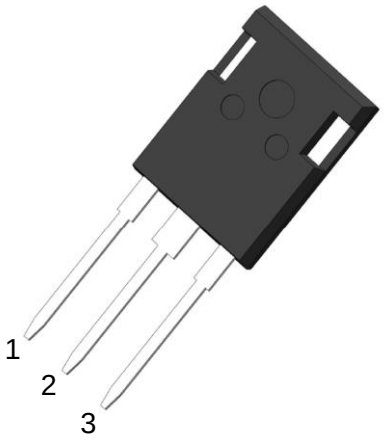
☐ IGBT chip in trench FS-technology

☐ Low switching losses

☐ $V_{CE(sat)}$ with positive temperature coefficient

☐ Fast switching and short tail current

☐ Free wheeling diodes with fast and soft reverse recovery




## APPLICATIONS

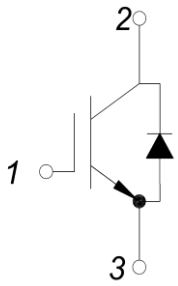
☐ High frequency switching application

☐ Medical applications

☐ Motion/servo control

☐ UPS systems

1.Gate
2.Collector
3.Emitter




| Type | $V_{CES}$ | $I_C$ | $V_{CE(sat)}$ $T_J$=25°C | $T_{Jmax}$ | Marking | Package |
|---|---|---|---|---|---|---|
| MM50G3U120BMX | 1200V | 50A | 1.95V | 175°C | MM50G3U120BMX | TO-247 Plus |

ABSOLUTE MAXIMUM RATINGS($T_C$ =25°C unless otherwise specified)

| Symbol | Parameter/Test Conditions | | Values | Unit |
|---|---|---|---|---|
| $V_{CES}$ | Collector Emitter Voltage | $T_J$=25℃ | 1200 | V |
| $V_{GES}$ | Gate Emitter Voltage | | ±20 | |
| | Transient Gate Emitter Voltage（tp≤10μs,D<0.01） | | ±30 | |
| $I_C$ | DC Collector Current | $T_C$=25℃ | 83 | A |
| | | $T_C$=110℃ | 50 | |
| $I_{Cpuls}$ | Pulsed collector current,tp limited by $T_{Jmax}$ | | 150 | |
| $P_{tot}$ | Power Dissipation Per IGBT | | 535 | W |
| $V_{RRM}$ | Repetitive Reverse Voltage | $T_J$=25℃ | 1200 | V |
| $I_{F(AV)}$ | Average Forward Current | $T_C$=95℃ | 50 | A |
| $I_{Fpuls}$ | Diode pulsed current,tp limited by $T_{Jmax}$ | | 150 | |
| $T_{Jmax}$ | Max. Junction Temperature | | 175 | ℃ |
| $T_{Jop}$ | Operating Temperature | | -40~175 | |
| $T_{stg}$ | Storage Temperature | | -55~150 | |
| Weight | | | 8 | g |

IGBT

ELECTRICAL CHARACTERISTICS *($T_C$=25°C unless otherwise specified)*

| Symbol | Parameter/Test Conditions | | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{GE(th)}$ | Gate Emitter Threshold Voltage | $V_{CE}=V_{GE}$, $I_C$=1.0mA | | 5.2 | 5.8 | 6.5 | V |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $I_C$=50A, $V_{GE}$=15V, $T_J$=25℃ | | | 1.95 | 2.4 | |
| | | $I_C$=50A, $V_{GE}$=15V, $T_J$=125℃ | | | 2.35 | | |
| | | $I_C$=50A, $V_{GE}$=15V, $T_J$=150℃ | | | 2.45 | | |
| $I_{CES}$ | Collector Leakage Current | $V_{CE}$=1200V, $V_{GE}$=0V, $T_J$=25℃ | | | | 100 | μA |
| | | $V_{CE}$=1200V, $V_{GE}$=0V, $T_J$=150℃ | | | | 10 | mA |
| $I_{GES}$ | Gate Leakage Current | $V_{CE}$=0V,$V_{GE}$=±20V, $T_J$=25℃ | | -400 | | 400 | nA |
| $Q_g$ | Gate Charge | $V_{CE}$=600V, $I_C$=50A , $V_{GE}$=15V | | | 0.28 | | μC |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V, $V_{GE}$=0V, f =1MHz | | | 5.1 | | nF |
| $C_{res}$ | Reverse Transfer Capacitance | | | | 145 | | pF |
| $t_{d(on)}$ | Turn on Delay Time | $V_{CC}$=600V,$I_C$=50A $R_G$ =10Ω, $V_{GE}$=±15V, Inductive Load | $T_J$=25℃ | | 25 | | ns |
| | | | $T_J$=125℃ | | 35 | | ns |
| | | | $T_J$=150℃ | | 35 | | ns |
| $t_r$ | Rise Time | | $T_J$=25℃ | | 25 | | ns |
| | | | $T_J$=125℃ | | 30 | | ns |
| | | | $T_J$=150℃ | | 30 | | ns |
| $t_{d(off)}$ | Turn off Delay Time | $V_{CC}$=600V,$I_C$=50A $R_G$ =10Ω, $V_{GE}$=±15V, Inductive Load | $T_J$=25℃ | | 200 | | ns |
| | | | $T_J$=125℃ | | 245 | | ns |
| | | | $T_J$=150℃ | | 260 | | ns |
| $t_f$ | Fall Time | | $T_J$=25℃ | | 150 | | ns |
| | | | $T_J$=125℃ | | 178 | | ns |
| | | | $T_J$=150℃ | | 205 | | ns |
| $E_{on}$ | Turn on Energy | $V_{CC}$=600V,$I_C$=50A $R_G$ =10Ω, $V_{GE}$=±15V, Inductive Load | $T_J$=125℃ | | 5.5 | | mJ |
| | | | $T_J$=150℃ | | 6.2 | | mJ |
| $E_{off}$ | Turn off Energy | | $T_J$=125℃ | | 2.6 | | mJ |
| | | | $T_J$=150℃ | | 2.8 | | mJ |
| $I_{SC}$ | Short Circuit Current | tpsc≤10μs , $V_{GE}$=15V $T_J$=125℃,$V_{CC}$=600V | | | - | | A |
| $R_{thJC}$ | Junction to Case Thermal Resistance （Per IGBT） | | | | | 0.28 | K /W |

Anti-Parallel Diode

ELECTRICAL CHARACTERISTICS *($T_C$=25°C unless otherwise specified)*

| Symbol | Parameter/Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_F$ | Forward Voltage | $I_F$=50A , $V_{GE}$=0V, $T_J$=25℃ | | 1.8 | 2.3 | V |
| | | $I_F$=50A , $V_{GE}$=0V, $T_J$=125℃ | | 1.55 | | |
| | | $I_F$=50A , $V_{GE}$=0V, $T_J$=150℃ | | 1.5 | | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=50A , $V_R$=600V $dI_F/dt$=-1300A/μs $T_J$ =150℃ | | 460 | | ns |
| $I_{RRM}$ | Max. Reverse Recovery Current | | | 52 | | A |
| $Q_{RR}$ | Reverse Recovery Charge | | | 12 | | μC |
| $E_{rec}$ | Reverse Recovery Energy | | | 4.7 | | mJ |
| $R_{thJCD}$ | Junction to Case Thermal Resistance （Per Diode） | | | | 0.49 | K /W |

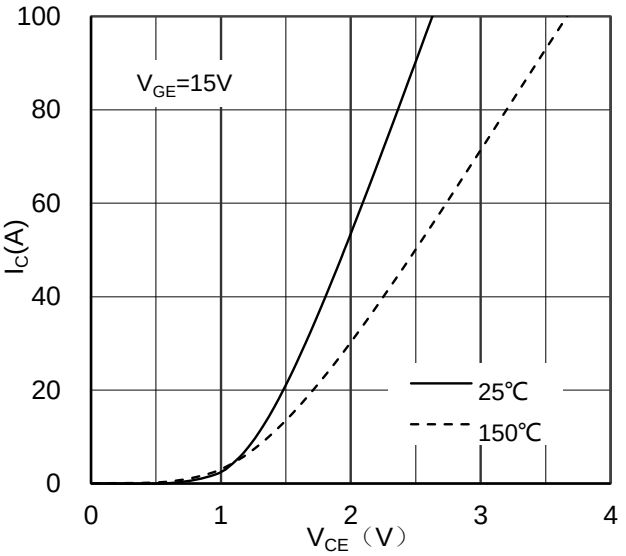



Figure 1. Typical Output Characteristics IGBT

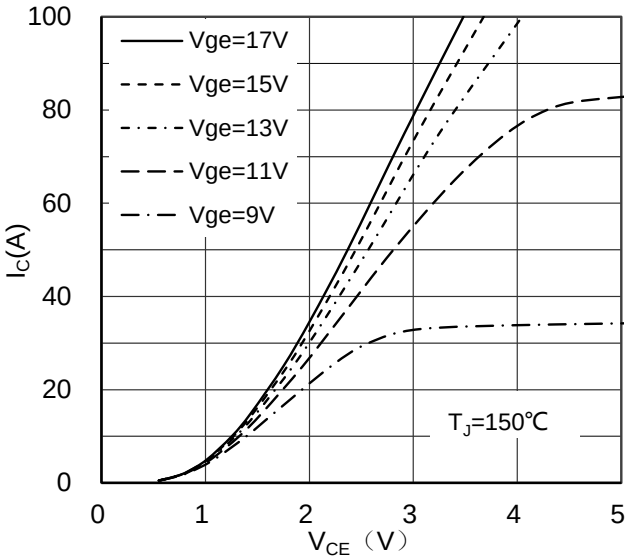



Figure 2. Typical Output Characteristics IGBT

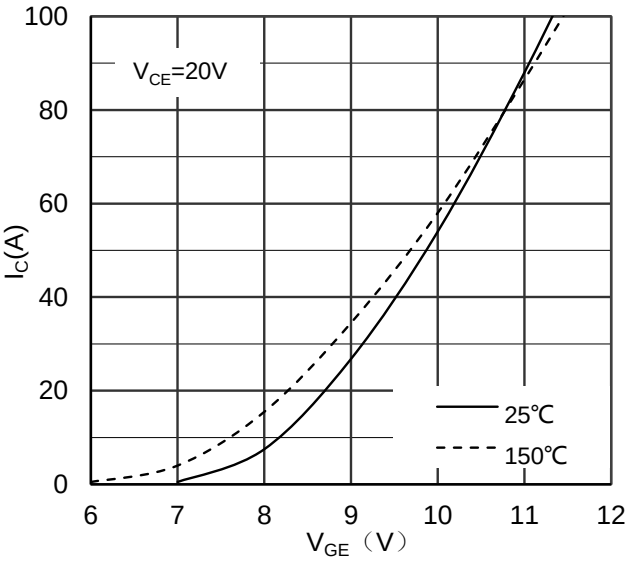



Figure 3. Typical Transfer characteristics IGBT

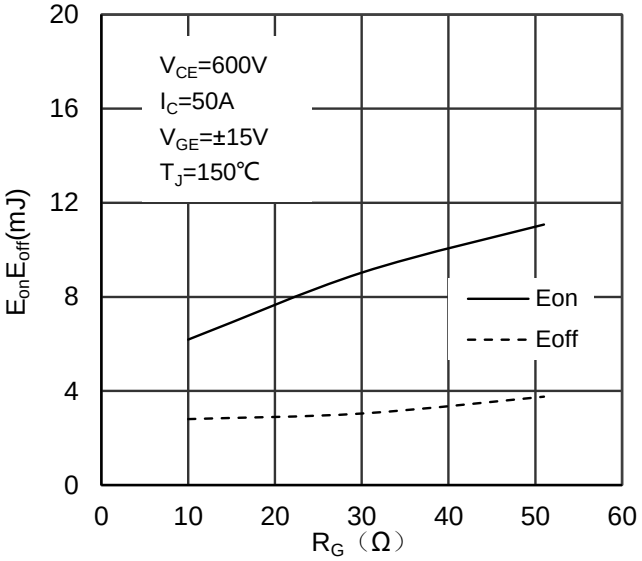



Figure 4. Switching Energy vs Gate Resistor IGBT

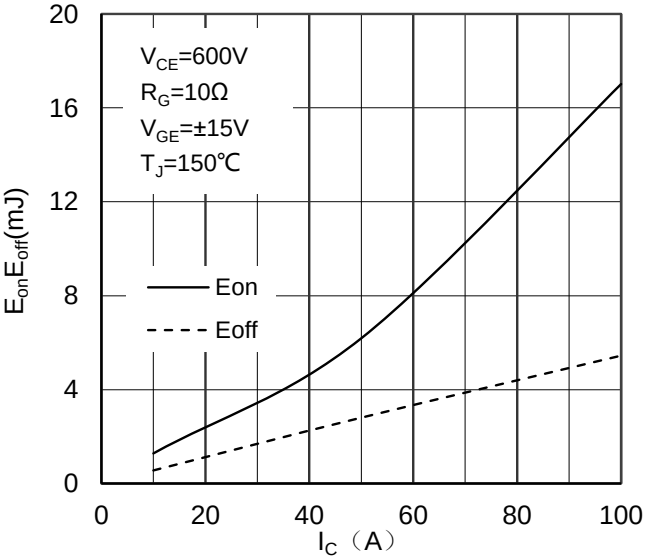



Figure 5. Switching Energy vs Collector Current IGBT

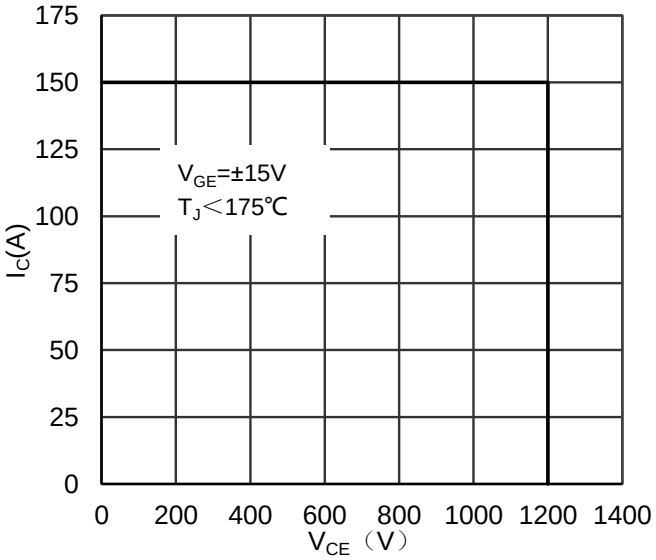



Figure 6. Reverse Biased Safe Operating Area IGBT

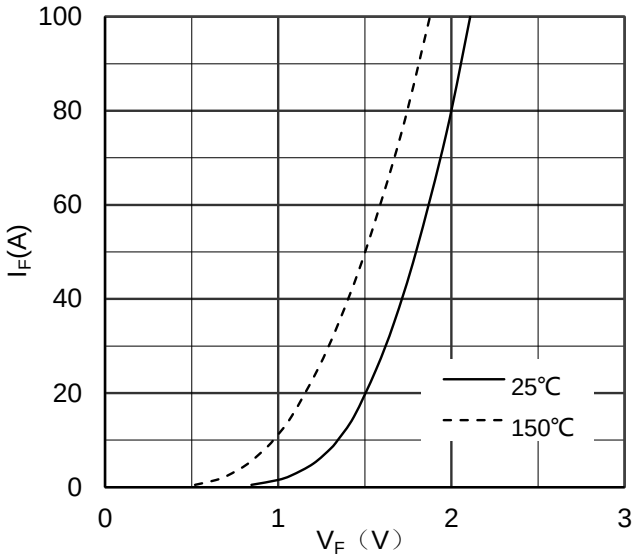



Figure 7. Diode Forward Characteristics Diode

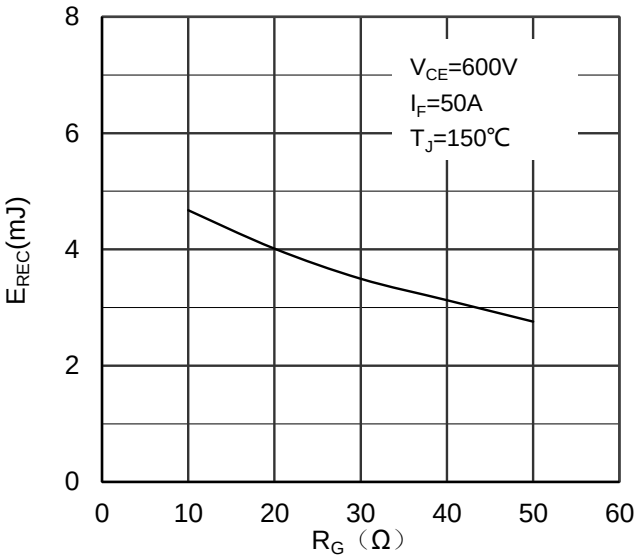



Figure 8. Switching Energy vs Gate Resistor Diode

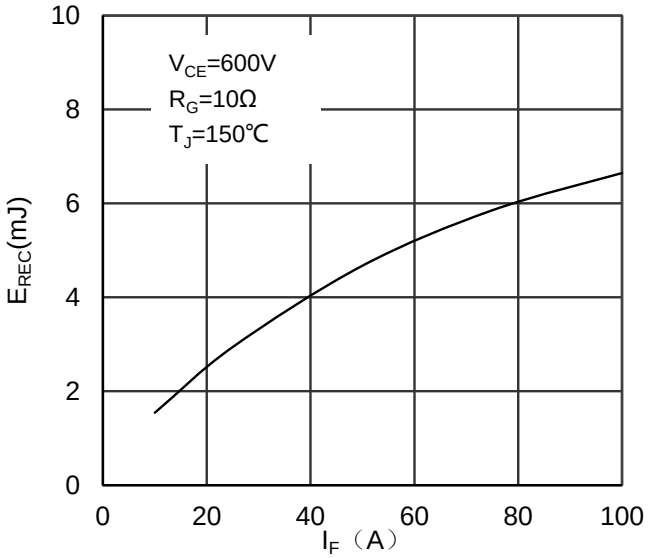



Figure 9. Switching Energy vs Forward Current Diode

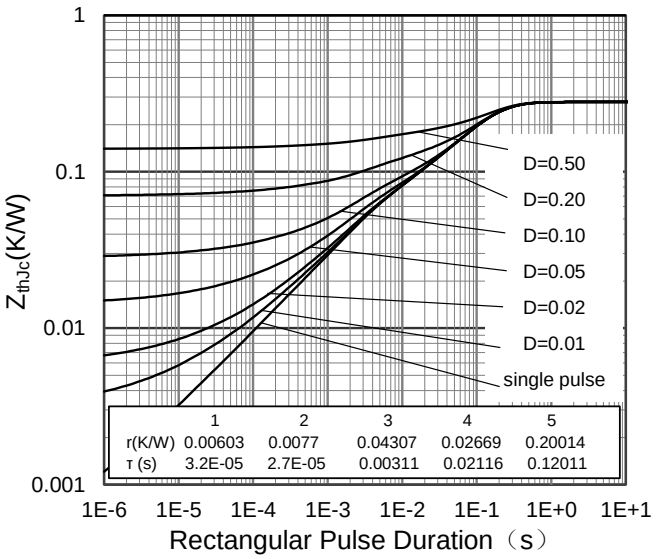



Figure 10. IGBT Transient Thermal Impedance

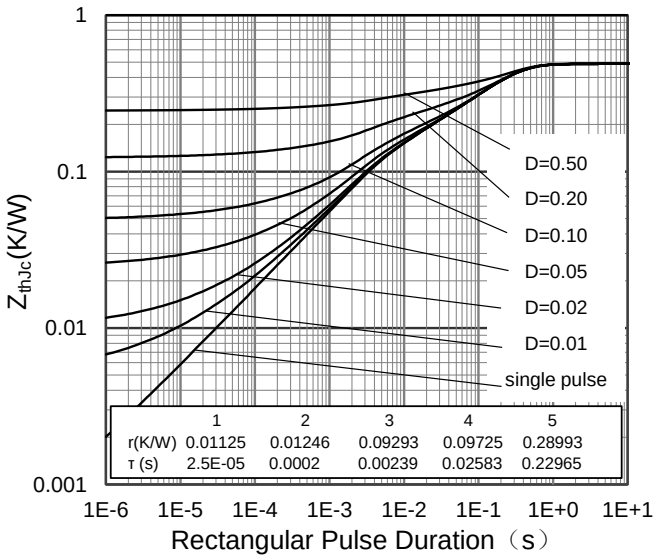



Figure 11. FRED Transient Thermal Impedance

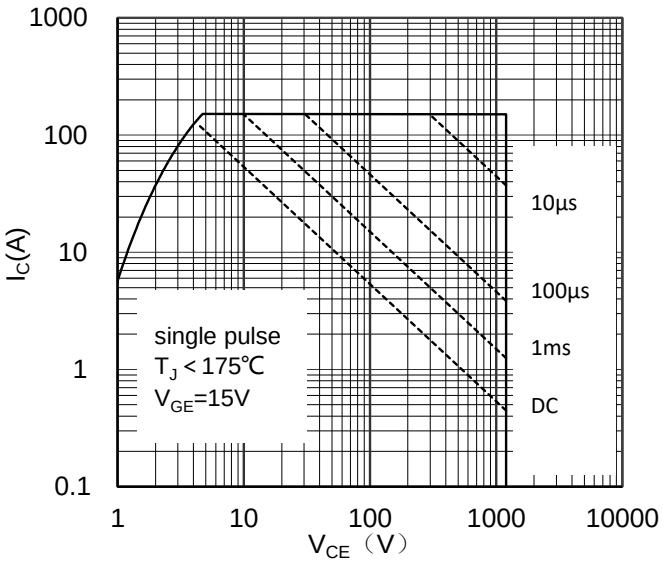
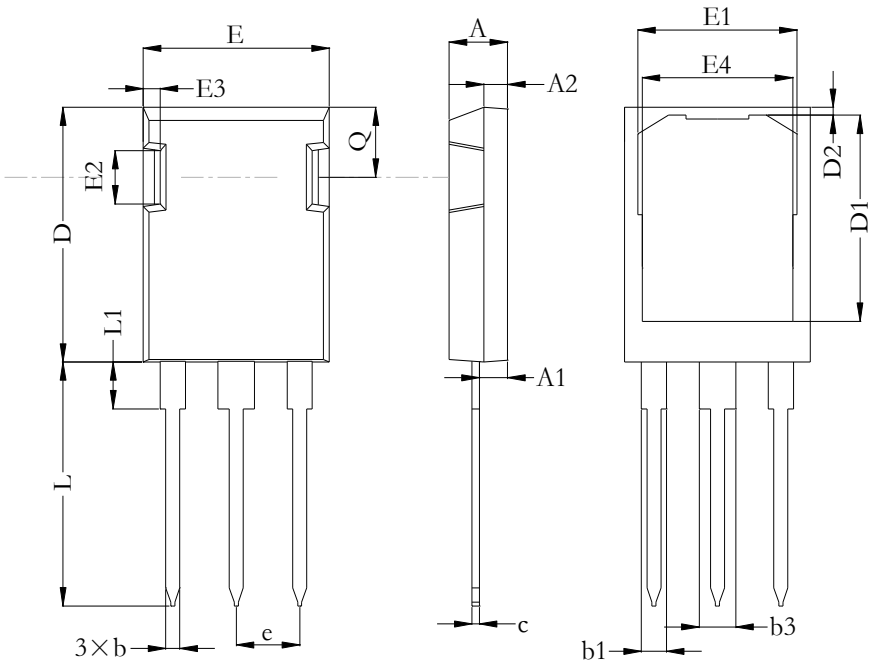



Figure 12. Forward Biased Safe Operating Area




| Symbol | Min | Nom | Max |
|---|---|---|---|
| A | 4.83 | 5.02 | 5.21 |
| A1 | 2.29 | 2.42 | 2.54 |
| A2 | 1.91 | 2.04 | 2.16 |
| b | 1.07 | 1.20 | 1.33 |
| b1 | 1.91 | 2.16 | 2.41 |
| b3 | 2.87 | 3.13 | 3.38 |
| c | 0.55 | 0.62 | 0.68 |
| e | | 5.44BSC | |
| D | 20.80 | 20.95 | 21.10 |
| D1 | 16.25 | 16.95 | 17.65 |
| D2 | 0.50 | 0.65 | 0.80 |
| E | 15.75 | 15.94 | 16.13 |
| E1 | 13.10 | 13.63 | 14.15 |
| E2 | 3.68 | 4.39 | 5.10 |
| E3 | 1.00 | 1.45 | 1.90 |
| E4 | 12.38 | 12.91 | 13.43 |
| L | 19.81 | 20.07 | 20.32 |
| L1 | 3.70 | 3.85 | 4.00 |
| Q | 5.49 | 5.75 | 6.00 |

单位：mm

Figure 13. Package Outline