



# CEB3112

30V ▲ 9mΩ ▲ 46A ▲ Si MOSFET

SILICON Si MOSFET ▲ SMD type

N-channel enhancement mode

UL94V-0 rated flame retardant epoxy

TO263 (D2PAK) package ▲ MSL 3

Super high dense cell density for extremely low  $R_{DS(ON)}$

**High power and current handling capability**






## MAXIMUM RATINGS

| Parameter ( $T_C = 25^\circ\text{C}$ , unless otherwise noted) |                            | Characteristics                             |
|----------------------------------------------------------------|----------------------------|---------------------------------------------|
| Drain-Source Voltage                                           | $V_{DS}$                   | 30V                                         |
| Gate-Source Voltage                                            | $V_{GS}$                   | $\pm 20\text{V}$                            |
| Continuous Drain Current at $T_C = 25^\circ\text{C}$           | $I_D$                      | 46A                                         |
| Continuous Drain Current at $T_C = 100^\circ\text{C}$          | $I_D$                      | 32A                                         |
| Pulsed Drain Current <sup>Note 1</sup>                         | $I_{DM}$ <sup>Note 5</sup> | 184A                                        |
| Maximum Power Dissipation at $T_C = 25^\circ\text{C}$          | $P_D$                      | 45W                                         |
| Power Dissipation Derating above $25^\circ\text{C}$            | $\Delta P_D$               | $0.3\text{W}/^\circ\text{C}$                |
| Single Pulsed Avalanche Energy <sup>Note 6</sup>               | $E_{AS}$                   | 50mJ                                        |
| Single Pulsed Avalanche Current <sup>Note 6</sup>              | $I_{AS}$                   | 10A                                         |
| Operating and Storage Temperature Range                        | $T_J, T_{STG}$             | $-55^\circ\text{C}$ to $+175^\circ\text{C}$ |

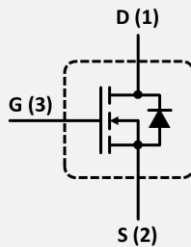
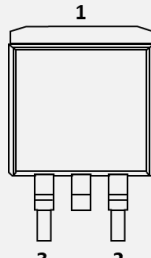
## THERMAL CHARACTERISTICS

| Parameter                               | Symbol       | Limit                         |
|-----------------------------------------|--------------|-------------------------------|
| Thermal Resistance, Junction-to-Case    | $R_{TH\_JC}$ | $3.3^\circ\text{C}/\text{W}$  |
| Thermal Resistance, Junction-to-Ambient | $R_{TH\_JA}$ | $62.5^\circ\text{C}/\text{W}$ |

## APPLICATIONS

| Battery Management Systems                                                          | DC/DC Converter                                                                     | High Side Switches                                                                  | Low Side Switches                                                                     | Power Banks                                                                           |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |  |

## PIN DESCRIPTION

| Circuit Diagram                                                                     | Outline - Bottom View                                                               | Pin No.     | Description             |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------|-------------------------|
|  |  | 1<br>2<br>3 | Drain<br>Source<br>Gate |

## ELECTRICAL CHARACTERISTICS ▲ $T_C = 25^\circ\text{C}$ , unless otherwise noted

| Item                                                          | Condition                                                     | Symbol       | Min. | Typ. | Max. | Unit       |
|---------------------------------------------------------------|---------------------------------------------------------------|--------------|------|------|------|------------|
| <b>Off Characteristics</b>                                    |                                                               |              |      |      |      |            |
| Drain-Source Breakdown Voltage                                | $V_{GS} = 0V, I_D = 250\mu A$                                 | $BV_{DSS}$   | 30   |      |      | V          |
| Zero Gate Voltage Drain Current                               | $V_{DS} = 30V, V_{GS} = 0V$                                   | $I_{DSS}$    |      |      | 1    | $\mu A$    |
| Gate Body Leakage Current, Forward                            | $V_{GS} = 20V, V_{DS} = 0V$                                   | $I_{GSSF}$   |      |      | 100  | nA         |
| Gate Body Leakage Current, Reverse                            | $V_{GS} = -20V, V_{DS} = 0V$                                  | $I_{GSSR}$   |      |      | -100 | nA         |
| <b>On Characteristics</b> <sup>Note 2</sup>                   |                                                               |              |      |      |      |            |
| Gate Threshold Voltage                                        | $V_{GS} = V_{DS}, I_D = 250\mu A$                             | $V_{GS(th)}$ | 1    |      | 3    | V          |
| Static Drain-Source On-Resistance                             | $V_{GS} = 10V, I_D = 20A$                                     | $R_{DS(ON)}$ |      | 9    | 12   | m $\Omega$ |
| Static Drain-Source On-Resistance                             | $V_{GS} = 4.5V, I_D = 10A$                                    | $R_{DS(ON)}$ |      | 11   | 14   | m $\Omega$ |
| <b>Dynamic Characteristics</b> <sup>Note 3</sup>              |                                                               |              |      |      |      |            |
| Input Capacitance                                             | $V_{DS} = 15V, V_{GS} = 0V, f = 1MHz$                         | $C_{ISS}$    |      | 735  |      | pF         |
| Output Capacitance                                            | $V_{DS} = 15V, V_{GS} = 0V, f = 1MHz$                         | $C_{OSS}$    |      | 145  |      | pF         |
| Reverse Transfer Capacitance                                  | $V_{DS} = 15V, V_{GS} = 0V, f = 1MHz$                         | $C_{RSS}$    |      | 110  |      | pF         |
| <b>Switching Characteristics</b> <sup>Note 3</sup>            |                                                               |              |      |      |      |            |
| Turn-On Delay Time                                            | $V_{DD} = 15V, V_{GS} = 10V, I_D = 10A, R_{G(ext)} = 3\Omega$ | $t_{D(ON)}$  |      | 13   |      | ns         |
| Turn-On Rise Time                                             | $V_{DD} = 15V, V_{GS} = 10V, I_D = 10A, R_{G(ext)} = 3\Omega$ | $t_R$        |      | 7    |      | ns         |
| Turn-Off Delay Time                                           | $V_{DD} = 15V, V_{GS} = 10V, I_D = 10A, R_{G(ext)} = 3\Omega$ | $t_{D(OFF)}$ |      | 45   |      | ns         |
| Turn-Off Fall Time                                            | $V_{DD} = 15V, V_{GS} = 10V, I_D = 10A, R_{G(ext)} = 3\Omega$ | $t_F$        |      | 18   |      | ns         |
| Total Gate Charge                                             | $V_{DS} = 15V, V_{GS} = 4.5V, I_D = 10A$                      | $Q_G$        |      | 9.3  |      | nC         |
| Gate Source Charge                                            | $V_{DS} = 15V, V_{GS} = 4.5V, I_D = 10A$                      | $Q_{GS}$     |      | 1.8  |      | nC         |
| Gate Drain Charge                                             | $V_{DS} = 15V, V_{GS} = 4.5V, I_D = 10A$                      | $Q_{GD}$     |      | 4.8  |      | nC         |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |                                                               |              |      |      |      |            |
| Drain-Source Diode Forward Current                            |                                                               | $I_S$        |      |      | 34   | A          |
| Drain-Source Diode Forward Voltage                            | $V_{GS} = 0V, I_S = 1A$                                       | $V_{SD}$     |      |      | 1.3  | V          |

### Notes

- 1: Repetitive Rating: Pulse width limited by maximum junction temperature.
- 2: Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
- 3: Guaranteed by design, not subject to production testing.
- 4: Limited only by maximum temperature allowed.
- 5: Pulse width limited by safe operating area.
- 6:  $L = 1mH, I_{AS} = 10A, V_{DD} = 25V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$ .

## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

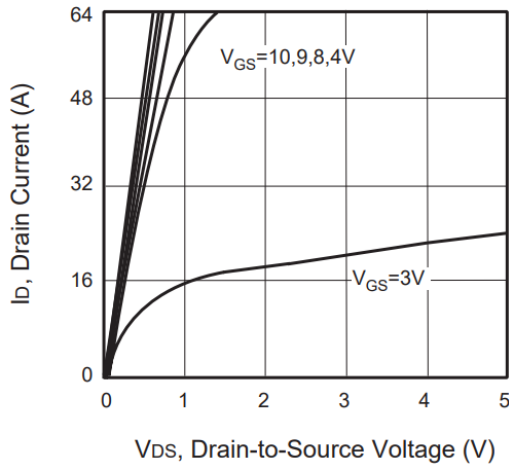


Fig. 2 • Transfer Characteristics

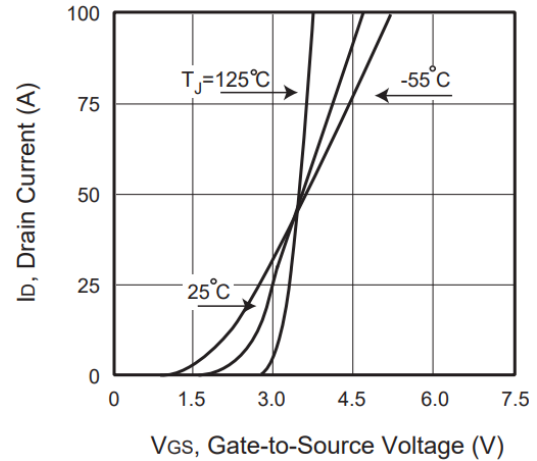


Fig. 3 • Capacitance

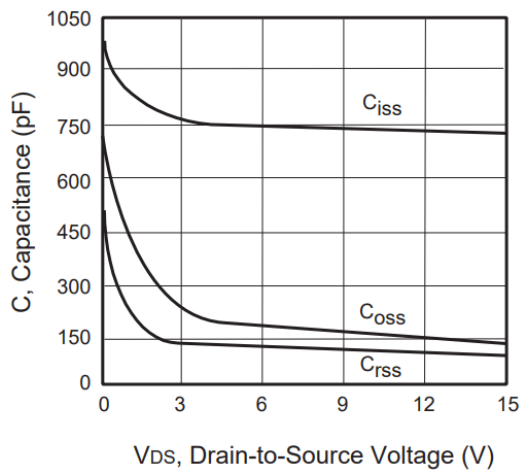


Fig. 4 • On-Resistance Variation with Temperature

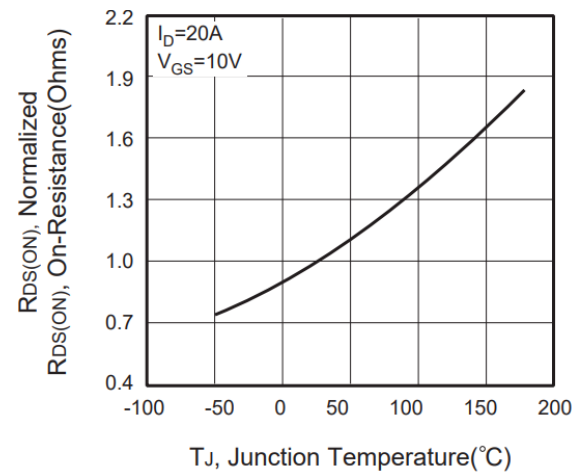


Fig. 5 • Gate Threshold Variation with Temperature

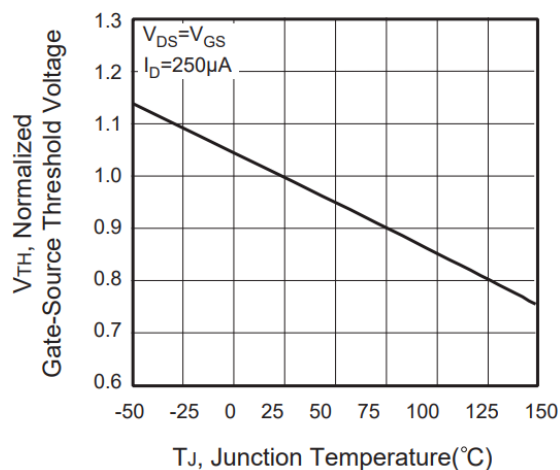
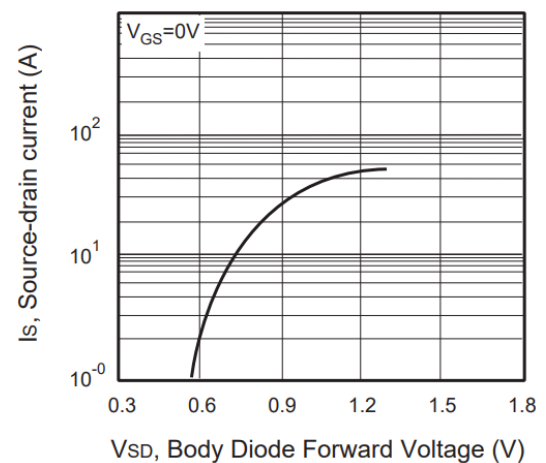


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

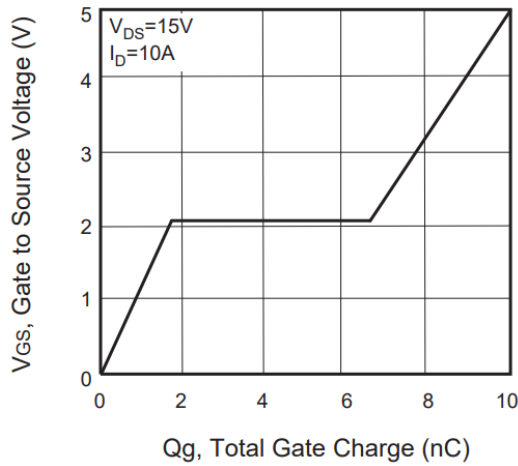


Fig. 8 • Maximum Safe Operating Area

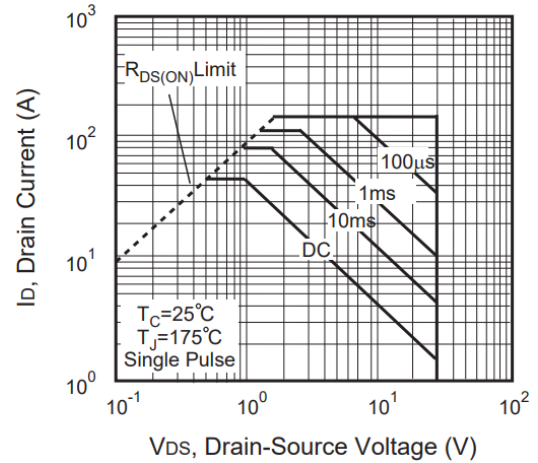


Fig. 9 • Breakdown Voltage Variation vs. Temperature

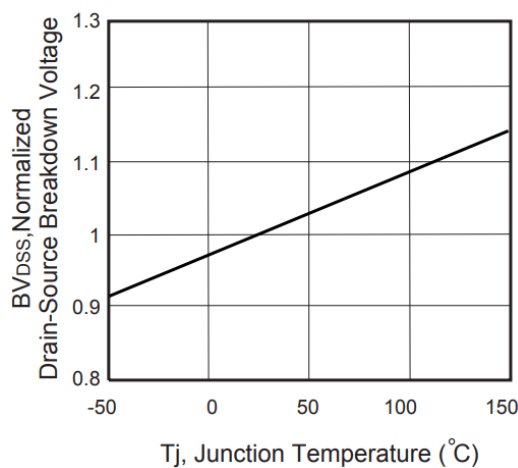


Fig. 10 • Switching Test Circuit

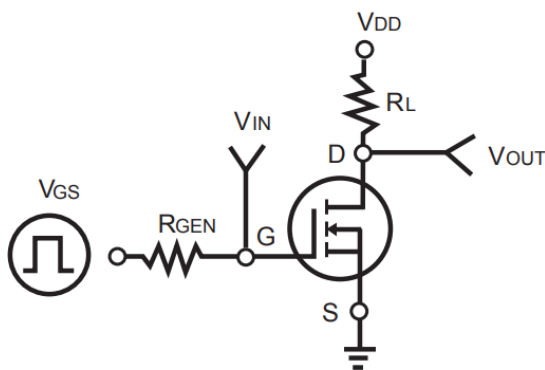
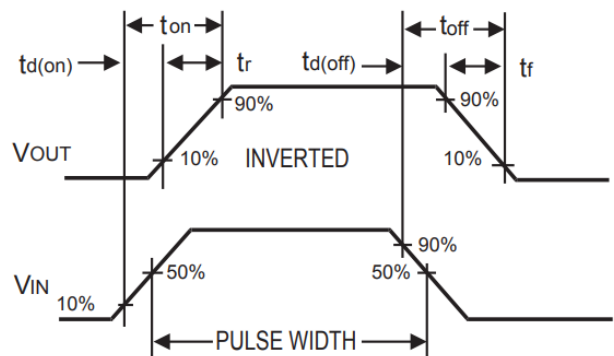
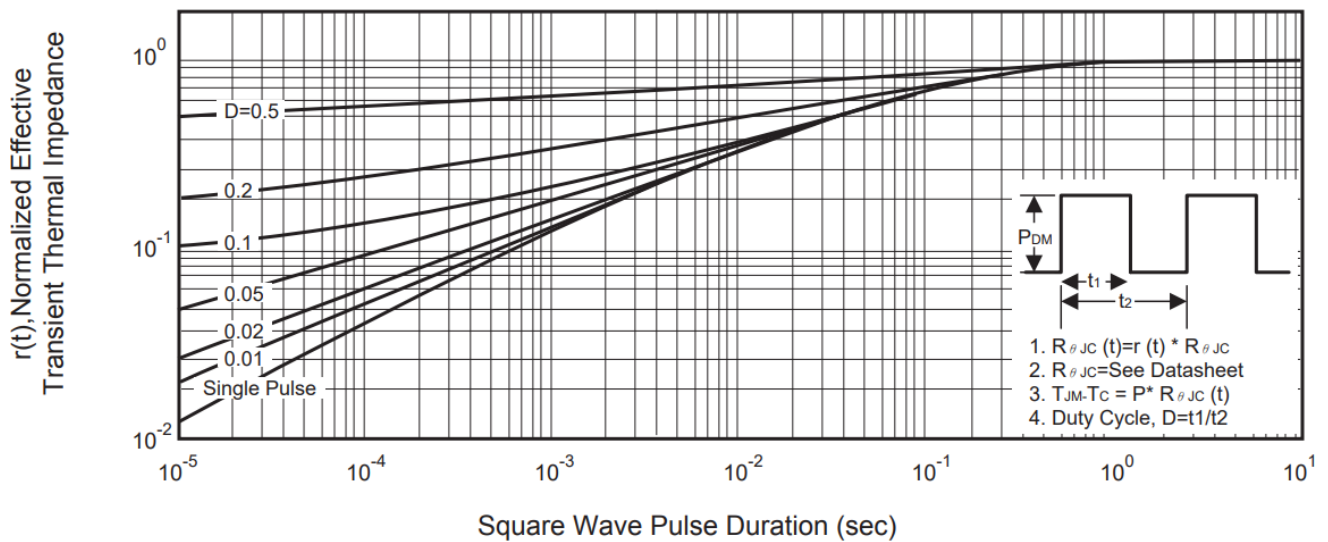


Fig. 11 • Switching Waveforms

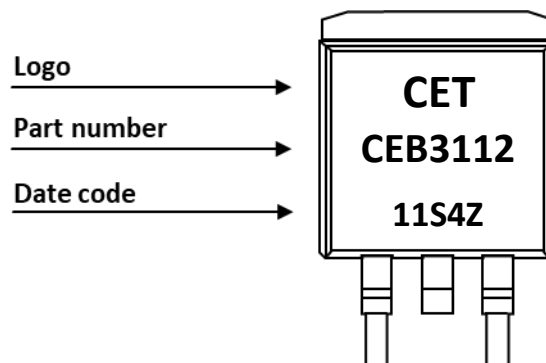


## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 12 • Normalized Thermal Transient Impedance Curve



## PART MARKING



## DATE CODE

Example: 11S4Z



Coding list for „Day“

|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | A  |
| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 |
| B  | C  | D  | E  | F  | G  | H  | I  | J  | K  |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| L  | M  | N  | O  | P  | Q  | R  | S  | T  | U  |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| V  |    |    |    |    |    |    |    |    |    |
| 31 |    |    |    |    |    |    |    |    |    |

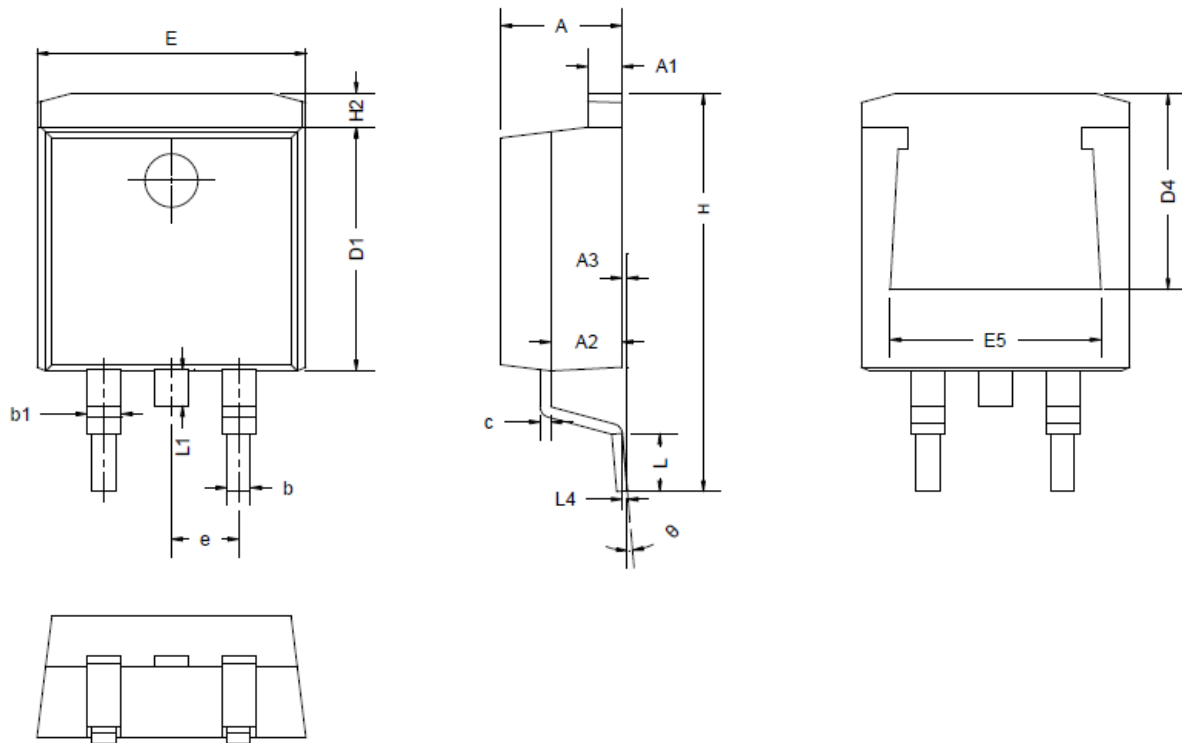
Coding list for „Month“

|     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| 1   | 2   | 3   | 4   | 5   | 6   |
| Jan | Feb | Mar | Apr | May | Jun |
| 7   | 8   | 9   | A   | B   | C   |
| Jul | Aug | Sep | Oct | Nov | Dec |

Coding list for „Year“

|      |      |      |      |      |
|------|------|------|------|------|
| 0    | 1    | 2    | 3    | 4    |
| 2020 | 2021 | 2022 | 2023 | 2024 |
| 5    | 6    | 7    | 8    | 9    |
| 2025 | 2026 | 2027 | 2028 | 2029 |

## PACKAGE OUTLINE



| Sym | Millimeters<br>(Min.) | Millimeters<br>(Typ.) | Millimeters<br>(Max.) |
|-----|-----------------------|-----------------------|-----------------------|
| A   | 4.37                  | 4.57                  | 4.77                  |
| A1  | 1.22                  | 1.27                  | 1.42                  |
| A2  | 2.49                  | 2.69                  | 2.89                  |
| A3  | 0.00                  | 0.13                  | 0.25                  |
| b   | 0.70                  | 0.81                  | 0.96                  |
| b1  | 1.17                  | 1.27                  | 1.47                  |
| c   | 0.30                  | 0.38                  | 0.53                  |
| D1  | 8.50                  | 8.70                  | 8.90                  |
| D4  | 6.60                  | -                     | -                     |

| Sym | Millimeters<br>(Min.) | Millimeters<br>(Typ.) | Millimeters<br>(Max.) |
|-----|-----------------------|-----------------------|-----------------------|
| E   | 9.86                  | 10.16                 | 10.36                 |
| E5  | 7.06                  | -                     | -                     |
| e   | 2.54 BSC              |                       |                       |
| H   | 14.70                 | 15.10                 | 15.50                 |
| H2  | 1.07                  | 1.27                  | 1.47                  |
| L   | 2.00                  | 2.30                  | 2.60                  |
| L1  | 1.40                  | 1.55                  | 1.70                  |
| L4  | 0.25 BSC              |                       |                       |
| θ   | 0°                    | 5°                    | 9°                    |

## ORDERING INFORMATION

| Part Number | Package       | Packing | Reel Qty. | Inner Box Qty. | Outer Box Qty. |
|-------------|---------------|---------|-----------|----------------|----------------|
| CEB3112     | TO263 (D2PAK) | Reel    | 800pcs    | 800pcs         | 6,400pcs       |

## RECOMMENDED PAD LAYOUT



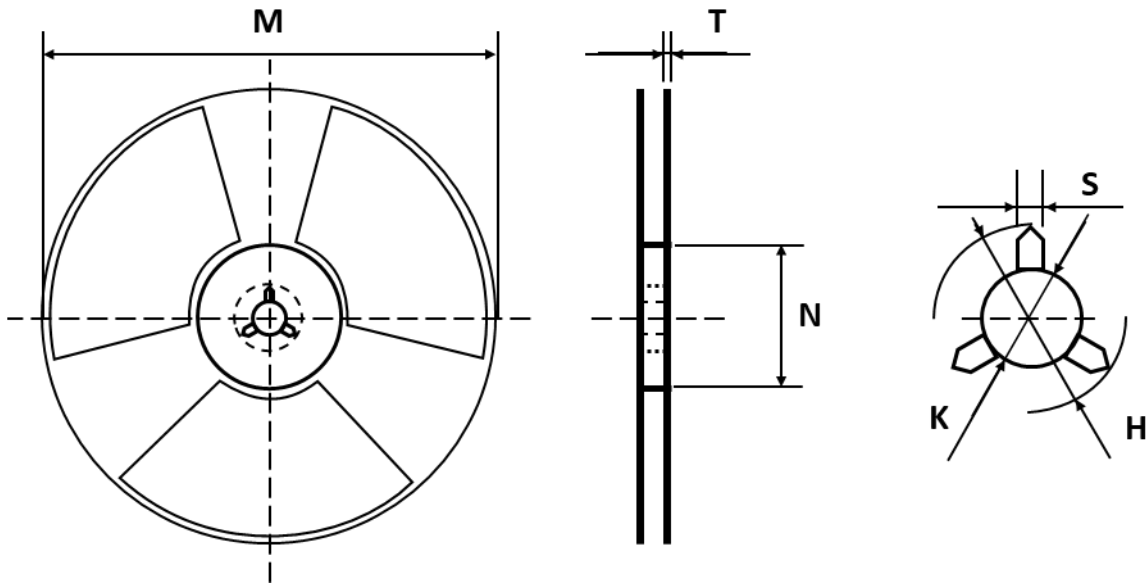
| Sym | Millimeters<br>(Min.) | Millimeters<br>(Typ.) | Millimeters<br>(Max.) |
|-----|-----------------------|-----------------------|-----------------------|
| F1  | -                     | 12.20                 | -                     |
| F2  | -                     | 16.90                 | -                     |
| F3  | -                     | 2.54                  | -                     |
| F4  | -                     | 5.08                  | -                     |

| Sym | Millimeters<br>(Min.) | Millimeters<br>(Typ.) | Millimeters<br>(Max.) |
|-----|-----------------------|-----------------------|-----------------------|
| F5  | -                     | 2.54                  | -                     |
| F6  | -                     | 1.60                  | -                     |
| F7  | -                     | 9.75                  | -                     |

### Notes:

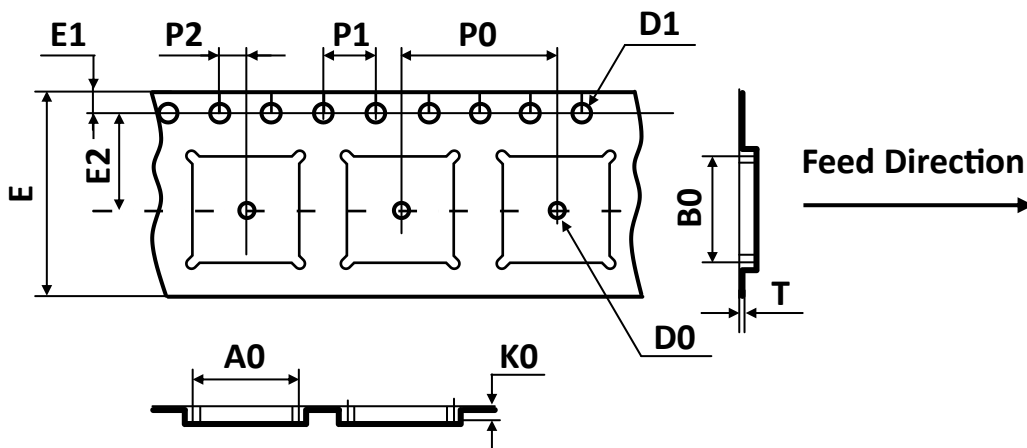
1. The suggested land pattern dimensions have been provided for reference only.
2. For further information, please reference document IPC-7351A.

## REEL DIMENSIONS ▲ All dimensions in mm



| Tape Size | Reel Size | M       | N       | T     | H     | K              | S              |
|-----------|-----------|---------|---------|-------|-------|----------------|----------------|
| 24mm      | Ø330      | Ø330.00 | Ø100.00 | 2.10  | 22.00 | 13.00          | 2.00           |
|           |           | ±2.00   | ±0.50   | ±0.20 | ±0.50 | +0.50<br>-0.20 | +0.50<br>-0.20 |

## TAPE DIMENSIONS ▲ All dimensions in mm

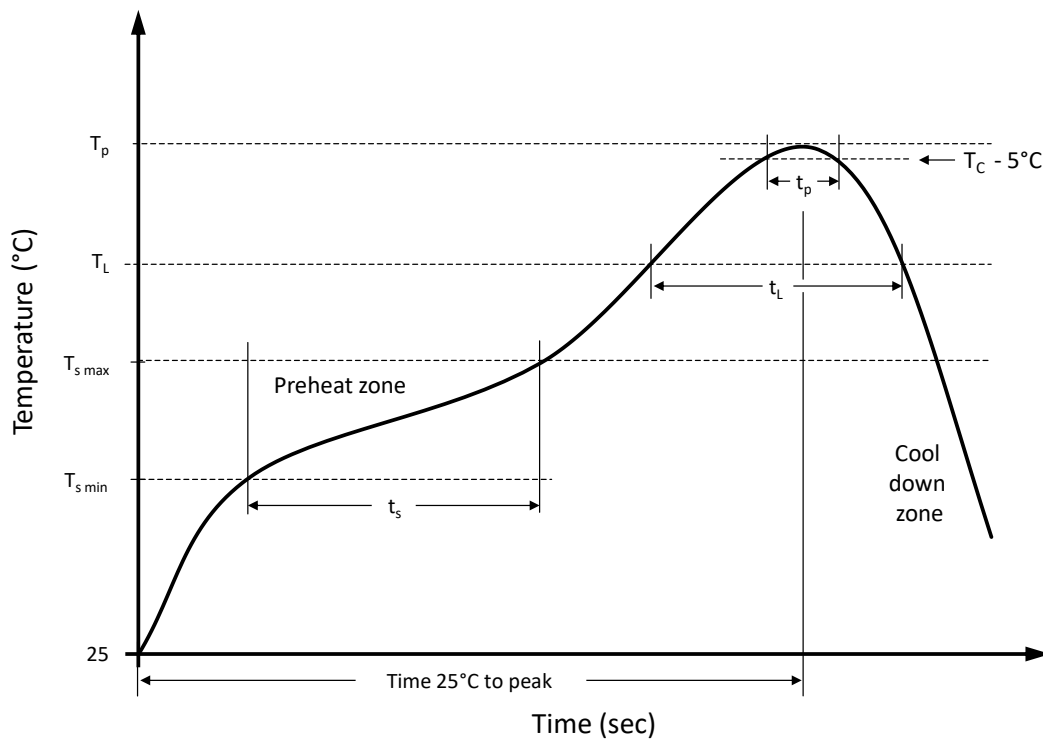


| Package                       | A0    | B0    | K0    | D0    | D1    | E     | E1    | E2    | P0    | P1    | P2    | T     |
|-------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| TO263<br>(D <sup>2</sup> PAK) | 10.80 | 16.30 | 4.85  | 1.50  | 1.55  | 24.00 | 1.75  | 11.50 | 16.00 | 4.00  | 2.00  | 0.35  |
|                               | ±0.10 | ±0.10 | ±0.10 | ±0.10 | ±0.05 | ±0.30 | ±0.10 | ±0.10 | ±0.10 | ±0.10 | ±0.10 | ±0.05 |

**Note:** All dimensions meet EIA-481-D requirements.



## RECOMMENDED REFLOW SOLDERING PROFILE



### Recommended reflow soldering conditions ▲ Refer to JEDEC J-STD-020E

| Profile Features                                                         |              | Sn-Pb Eutetic Assembly | Pb-Free Assembly |
|--------------------------------------------------------------------------|--------------|------------------------|------------------|
| Preheat temperature min.                                                 | $T_{s \min}$ | 100 °C                 | 150 °C           |
| Preheat temperature max.                                                 | $T_{s \max}$ | 150 °C                 | 200 °C           |
| Preheat time $t_s$ from $T_{s \min}$ to $T_{s \max}$                     | $t_s$        | 120 seconds            | 120 seconds      |
| Ramp-up rate ( $T_L$ to $T_p$ )                                          |              | max. 3 °C/second       | max. 3 °C/second |
| Liquidous temperature                                                    | $T_L$        | 183 °C                 | 217 °C           |
| Time $t_L$ maintained above $T_L$                                        | $t_L$        | 150 seconds max.       | 150 seconds max. |
| Peak package body temperature                                            | $T_p$        | 235°C                  | 260°C            |
| Timeframe of within 5°C below and up to max actual peak body temperature | $t_p$        | 20 seconds max.        | 30 seconds max.  |
| Ramp-down rate ( $T_L$ to $T_p$ )                                        |              | max. 6 °C/second       | max. 6 °C/second |
| Time 25°C to peak temperature                                            |              | max. 6 minutes         | max. 8 minutes   |

## REVISION TABLE

| Revision | Date       | Status          | Notes               |
|----------|------------|-----------------|---------------------|
| 001      | 30/09/2022 | Initial release | Initial publication |
|          |            |                 |                     |
|          |            |                 |                     |
|          |            |                 |                     |
|          |            |                 |                     |
|          |            |                 |                     |

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