

# CEM1510

100V ▲ 7mΩ ▲ 14A ▲ Si MOSFET

SILICON Si MOSFET ▲ SMD type

N-channel enhancement mode

UL94V-0 rated flame retardant epoxy

SO8 package ▲ MSL 3

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

**High power and current handling capability**

## MAXIMUM RATINGS

| Parameter ( $T_A = 25^{\circ}\text{C}$ , unless otherwise noted) |                | Characteristics                                 |
|--|----------------|---|
| Drain-Source Voltage   | $V_{DS}$       | 100V  |
| Gate-Source Voltage  | $V_{GS}$       | $\pm 20\text{V}$                                |
| Continuous Drain Current   | $I_D$          | 14A   |
| Pulsed Drain Current <sup>Note 1</sup>                           | $I_{DM}$       | 56A   |
| Maximum Power Dissipation  | $P_D$          | 3.1W  |
| Operating and Storage Temperature Range                          | $T_J, T_{STG}$ | $-55^{\circ}\text{C}$ to $+150^{\circ}\text{C}$ |

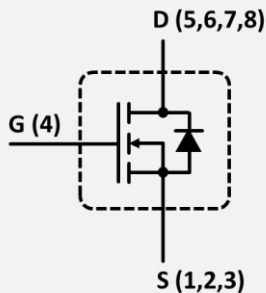
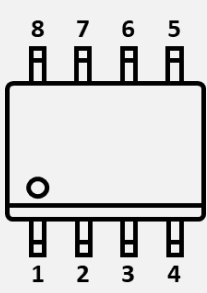
## THERMAL CHARACTERISTICS

| Parameter   | Symbol       | Limit                  |
|---|--------------|------------------------|
| Thermal Resistance, Junction-to-Ambient <sup>Note 2</sup> | $R_{TH\_JA}$ | $40^{\circ}\text{C/W}$ |

## APPLICATIONS

| Audio Amplifier   | DC Fan  | Industrial Control  | Power over Ethernet   | Synchronous Rectification   |
|---|---|---|---|---|
|  |  |  |  |  |

## PIN DESCRIPTION

| Circuit Diagram  | Outline - Top View  | Pin No.   | Description   |
|--|---|---|---|
|  <p>D (5,6,7,8)</p> <p>G (4)</p> <p>S (1,2,3)</p> |  <p>8 7 6 5</p> <p>1 2 3 4</p> | <p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> <p>7</p> <p>8</p> | <p>Source</p> <p>Source</p> <p>Source</p> <p>Gate</p> <p>Drain</p> <p>Drain</p> <p>Drain</p> <p>Drain</p> |

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

| Item  | Condition   | Symbol       | Min. | Typ. | Max. | Unit       |
|---|---|--------------|------|------|------|------------|
| <b>Off Characteristics</b>                                    |   |              |      |      |      |            |
| Drain-Source Breakdown Voltage                                | $V_{GS} = 0V, I_D = 250\mu A$                                 | $BV_{DSS}$   | 100  |      |      | V          |
| Zero Gate Voltage Drain Current                               | $V_{DS} = 100V, V_{GS} = 0V$                                  | $I_{DSS}$    |      |      | 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 3</sup>                   |   |              |      |      |      |            |
| Gate Threshold Voltage  | $V_{GS} = V_{DS}, I_D = 250\mu A$                             | $V_{GS(th)}$ | 1.4  |      | 2.4  | V          |
| Static Drain-Source On-Resistance                             | $V_{GS} = 10V, I_D = 14A$                                     | $R_{DS(ON)}$ |      | 7    | 8.5  | m $\Omega$ |
| Static Drain-Source On-Resistance                             | $V_{GS} = 4.5V, I_D = 10A$                                    | $R_{DS(ON)}$ |      | 8    | 10.5 | m $\Omega$ |
| <b>Dynamic Characteristics</b> <sup>Note 4</sup>              |   |              |      |      |      |            |
| Input Capacitance   | $V_{DS} = 50V, V_{GS} = 0V, f = 1MHz$                         | $C_{ISS}$    |      | 2700 |      | pF         |
| Output Capacitance  | $V_{DS} = 50V, V_{GS} = 0V, f = 1MHz$                         | $C_{OSS}$    |      | 290  |      | pF         |
| Reverse Transfer Capacitance                                  | $V_{DS} = 50V, V_{GS} = 0V, f = 1MHz$                         | $C_{RSS}$    |      | 15   |      | pF         |
| <b>Switching Characteristics</b> <sup>Note 4</sup>            |   |              |      |      |      |            |
| Turn-On Delay Time  | $V_{DD} = 50V, V_{GS} = 10V, I_D = 14A, R_{G(ext)} = 6\Omega$ | $t_{D(ON)}$  |      | 9    |      | ns         |
| Turn-On Rise Time   | $V_{DD} = 50V, V_{GS} = 10V, I_D = 14A, R_{G(ext)} = 6\Omega$ | $t_R$        |      | 3    |      | ns         |
| Turn-Off Delay Time   | $V_{DD} = 50V, V_{GS} = 10V, I_D = 14A, R_{G(ext)} = 6\Omega$ | $t_{D(OFF)}$ |      | 26   |      | ns         |
| Turn-Off Fall Time  | $V_{DD} = 50V, V_{GS} = 10V, I_D = 14A, R_{G(ext)} = 6\Omega$ | $t_F$        |      | 4    |      | ns         |
| Total Gate Charge   | $V_{DS} = 50V, V_{GS} = 4.5V, I_D = 14A$                      | $Q_G$        |      | 24   |      | nC         |
| Gate Source Charge  | $V_{DS} = 50V, V_{GS} = 4.5V, I_D = 14A$                      | $Q_{GS}$     |      | 7    |      | nC         |
| Gate Drain Charge   | $V_{DS} = 50V, V_{GS} = 4.5V, I_D = 14A$                      | $Q_{GD}$     |      | 10   |      | nC         |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |   |              |      |      |      |            |
| Drain-Source Diode Forward Current <sup>Note 2</sup>          |   | $I_S$        |      |      | 2    | A          |
| Drain-Source Diode Forward Voltage <sup>Note 3</sup>          | $V_{GS} = 0V, I_S = 14A$                                      | $V_{SD}$     |      |      | 1.2  | V          |

### Notes

- 1: Repetitive Rating: Pulse width limited by maximum junction temperature
- 2: Surface Mounted on FR4 Board,  $t \leq 10$  sec
- 3: Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
- 4: Guaranteed by design, not subject to production testing.

## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

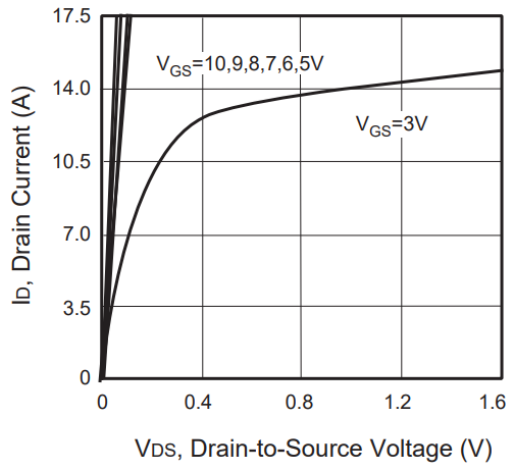


Fig. 2 • Transfer Characteristics

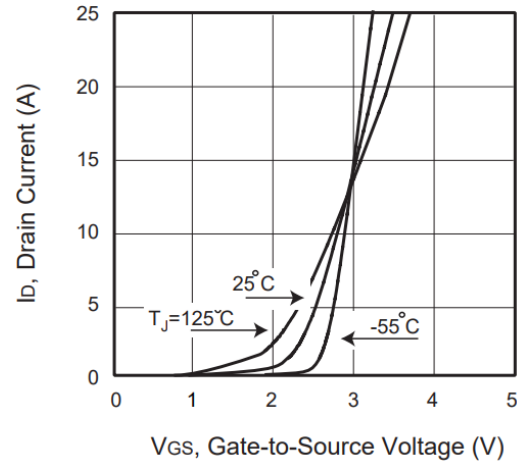


Fig. 3 • Capacitance

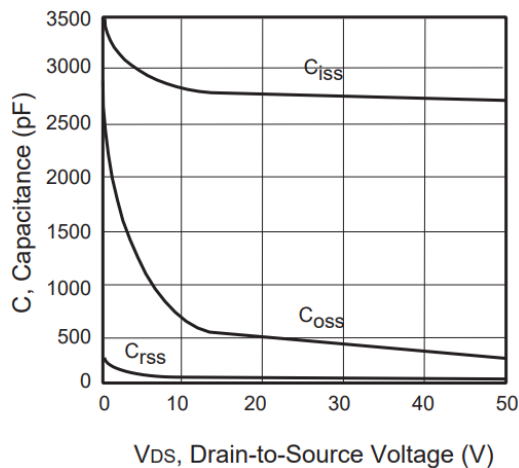


Fig. 4 • On-Resistance Variation with Temperature

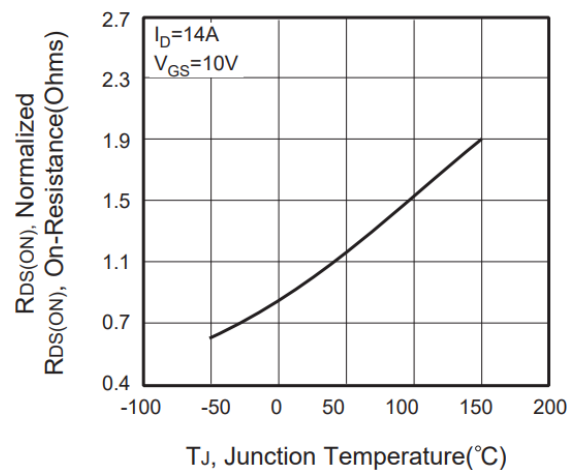


Fig. 5 • Gate Threshold Variation with Temperature

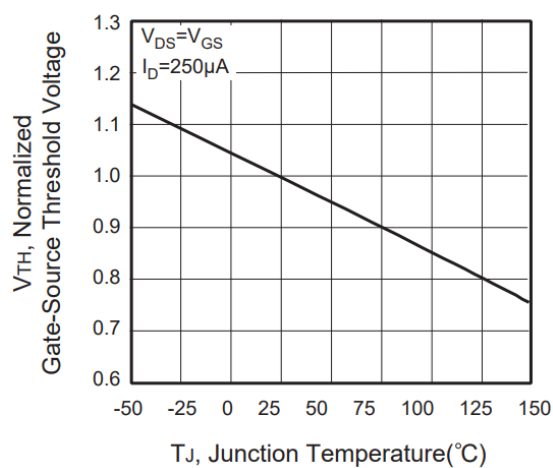
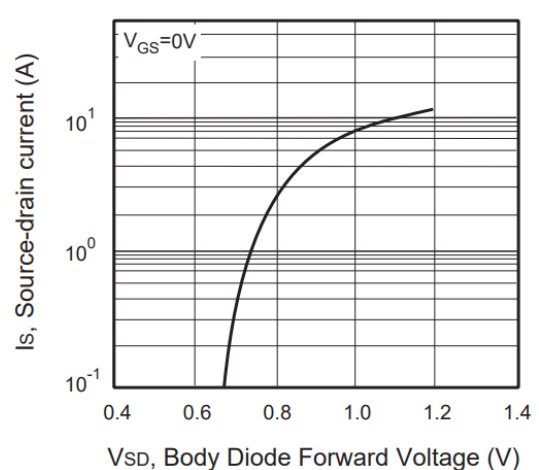


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

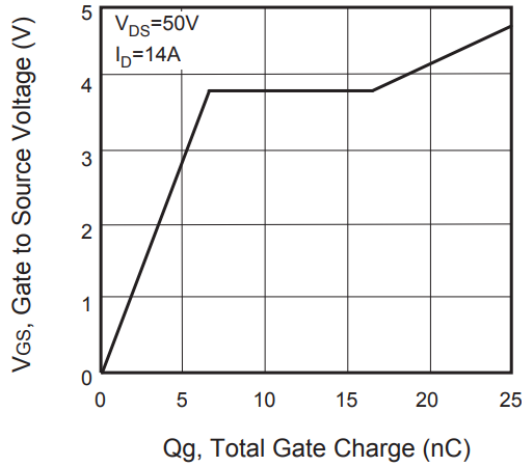


Fig. 8 • Maximum Safe Operating Area

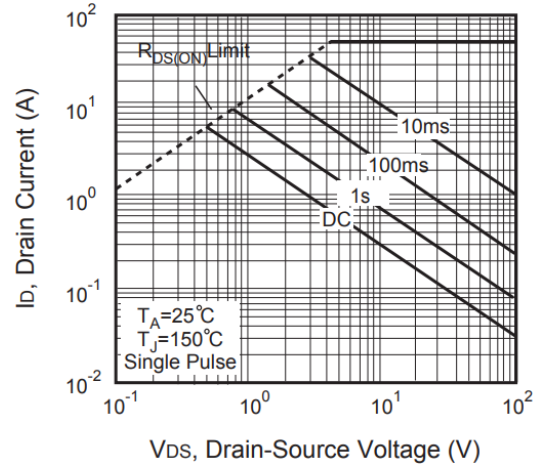


Fig. 9 • Breakdown Voltage Variation vs. Temperature

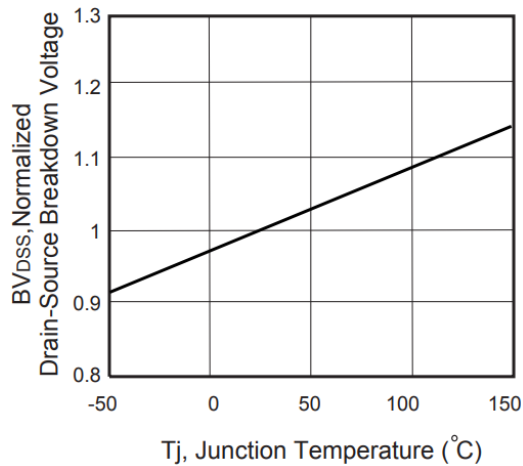
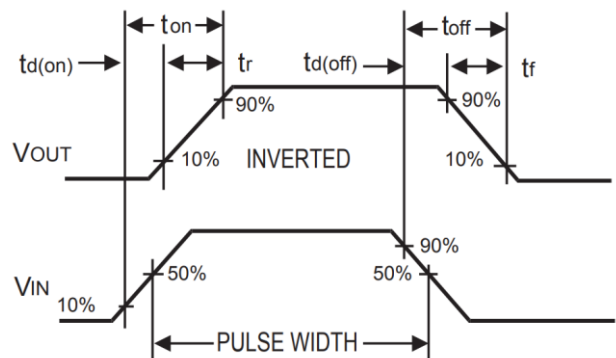


Fig. 10 • Switching Test Circuit

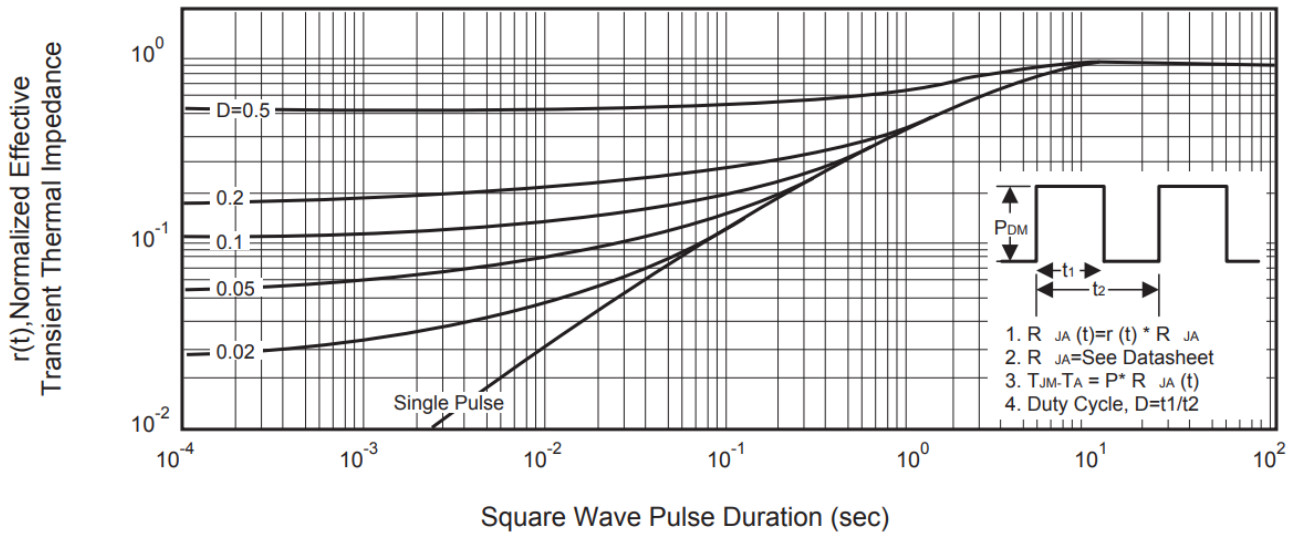


Fig. 11 • Switching Waveforms

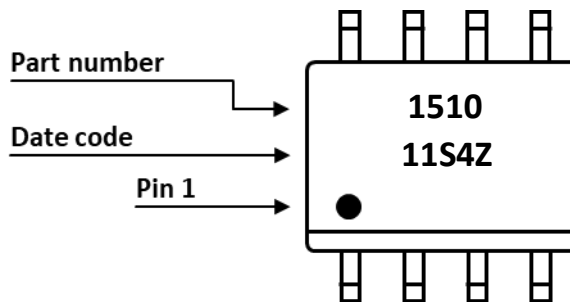


## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 12 • Normalized Thermal Transient Impedance Curve

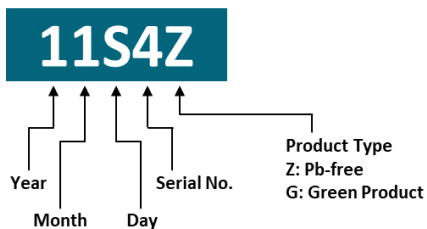


## PART MARKING



## 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 |    |    |    |    |    |    |    |    |    |

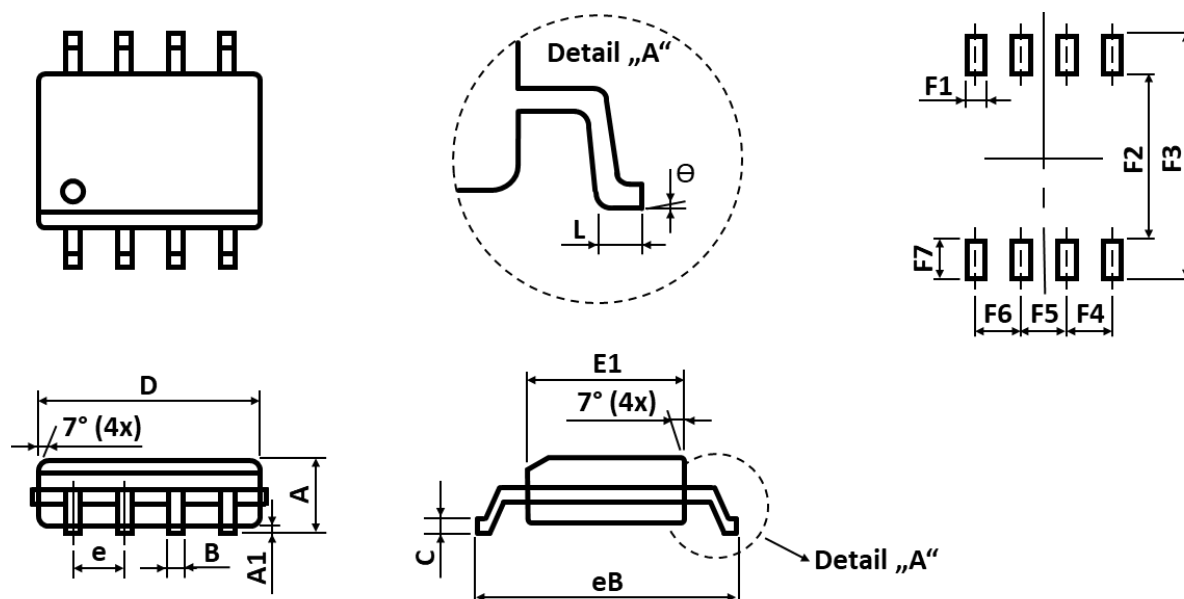
Coding list for „Month“

|     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| 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 AND RECOMMENDED PAD LAYOUT



| Sym | Millimeters (Min.) | Millimeters (Typ.) | Millimeters (Max.) |
|-----|--------------------|--------------------|--------------------|
| A   | 1.350              | -                  | 1.750              |
| A1  | 0.100              | -                  | 0.250              |
| B   | 0.310              | -                  | 0.510              |
| C   | 0.170              | -                  | 0.250              |
| D   | 4.690              | -                  | 5.000              |

| Sym | Millimeters (Min.) | Millimeters (Typ.) | Millimeters (Max.) |
|-----|--------------------|--------------------|--------------------|
| F1  | -                  | 0.500              | -                  |
| F2  | -                  | 4.250              | -                  |
| F3  | -                  | 6.250              | -                  |
| F4  | -                  | 1.270              | -                  |

| Sym | Millimeters (Min.) | Millimeters (Typ.) | Millimeters (Max.) |
|-----|--------------------|--------------------|--------------------|
| E1  | 3.700              | -                  | 4.060              |
| eB  | 5.800              | -                  | 6.200              |
| e   | -                  | 1.270              | -                  |
| L   | 0.400              | -                  | 0.950              |
| θ   | 0°                 | -                  | 8°                 |

| Sym | Millimeters (Min.) | Millimeters (Typ.) | Millimeters (Max.) |
|-----|--------------------|--------------------|--------------------|
| F5  | -                  | 1.270              | -                  |
| F6  | -                  | 1.270              | -                  |
| F7  | -                  | 1.000              | -                  |

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

## ORDERING INFORMATION

| Part Number | Package | Packing  | Reel Qty. | Inner Box Qty. | Outer Box Qty. |
|-------------|---------|----------|-----------|----------------|----------------|
| CEM1510     | SO8     | 13" Reel | 2,500pcs  | 5,000pcs       | 40,000pcs      |

## REEL DIMENSIONS ▲ All dimensions in mm



| Tape Size | Reel Size | M                | N                | T             | H              | K              | S             |
|-----------|-----------|------------------|------------------|---------------|----------------|----------------|---------------|
| 12mm      | Ø330      | Ø330.00<br>±2.00 | Ø100.00<br>±0.50 | 2.20<br>±0.20 | 20.00<br>±1.00 | 13.20<br>±0.20 | 3.00<br>±1.00 |

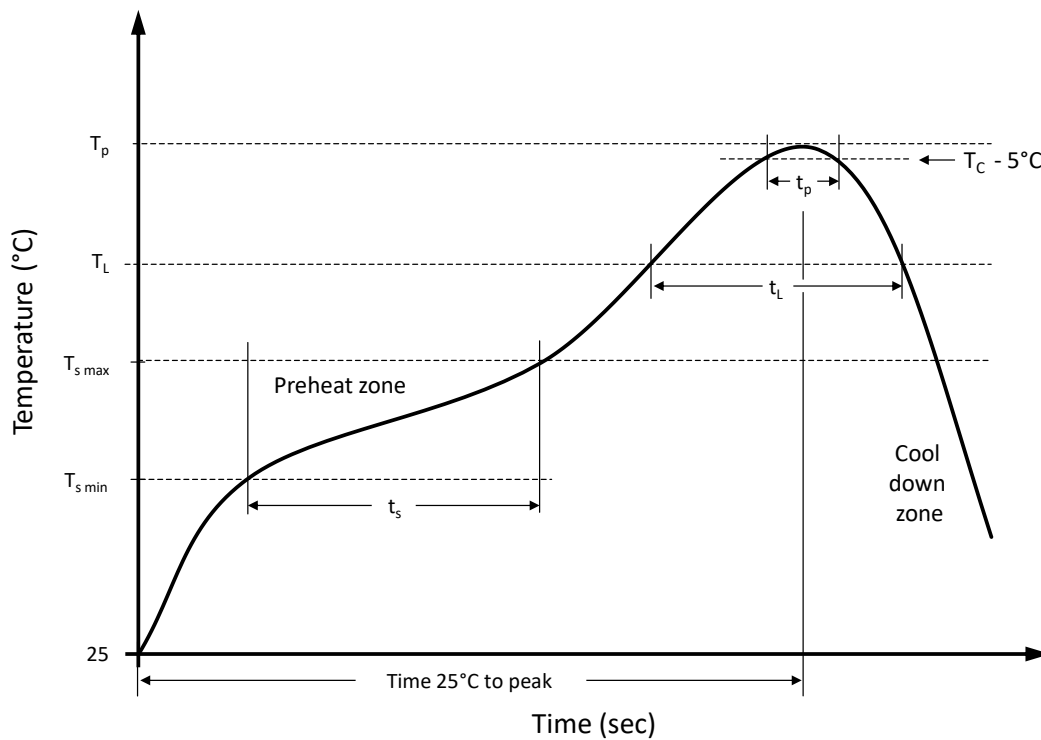
## TAPE DIMENSIONS ▲ All dimensions in mm



| Package | A0            | B0            | K0            | D0            | D1            | E              | E1            | E2            | P0            | P1            | P2            | T             |
|---------|---------------|---------------|---------------|---------------|---------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|
| SO8     | 6.50<br>±0.10 | 5.30<br>±0.10 | 2.05<br>±0.15 | 1.50<br>±0.10 | 1.50<br>±0.10 | 12.00<br>±0.10 | 1.75<br>±0.10 | 5.50<br>±0.10 | 8.00<br>±0.10 | 4.00<br>±0.10 | 2.00<br>±0.05 | 0.25<br>±0.02 |

**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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