

# CET05N10L

100V ▲ 105mΩ ▲ 3.5A ▲ Si MOSFET

SILICON Si MOSFET ▲ SMD type

N-channel enhancement mode

UL94V-0 rated flame retardant epoxy

SOT223 package ▲ MSL 3

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

**Rugged and reliable**

## 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                                         | $I_D$          | 3.5A                                            |
| Pulsed Drain Current <sup>Note 1</sup>                           | $I_{DM}$       | 14A                                             |
| Maximum Power Dissipation                                        | $P_D$          | 3W                                              |
| Operating and Storage Temperature Range                          | $T_J, T_{STG}$ | $-55^{\circ}\text{C}$ to $+150^{\circ}\text{C}$ |

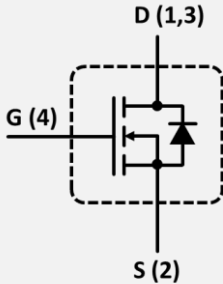
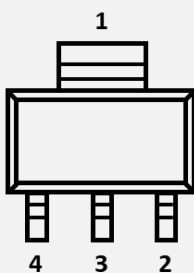
## THERMAL CHARACTERISTICS

| Parameter                                              | Symbol       | Limit                  |
|--------------------------------------------------------|--------------|------------------------|
| Thermal Resistance, Junction-to-Case <sup>Note 2</sup> | $R_{TH\_JC}$ | $42^{\circ}\text{C/W}$ |

## APPLICATIONS

| Battery Management Systems                                                          | E-Bike                                                                              | Industrial Control                                                                  | Power Inverter                                                                        | UPS                                                                                   |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |  |

## PIN DESCRIPTION

| Circuit Diagram                                                                     | Outline - Top View                                                                  | Pin No.          | Description                      |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------|----------------------------------|
|  |  | 1<br>2<br>3<br>4 | Drain<br>Source<br>Drain<br>Gate |

## 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    |      | 3    | V          |
| Static Drain-Source On-Resistance                             | $V_{GS} = 10V, I_D = 2A$                                      | $R_{DS(ON)}$ |      | 105  | 126  | m $\Omega$ |
| Static Drain-Source On-Resistance                             | $V_{GS} = 5V, I_D = 1.5A$                                     | $R_{DS(ON)}$ |      | 113  | 147  | m $\Omega$ |
| <b>Dynamic Characteristics</b> <sup>Note 4</sup>              |                                                               |              |      |      |      |            |
| Input Capacitance                                             | $V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$                         | $C_{ISS}$    |      | 585  |      | pF         |
| Output Capacitance                                            | $V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$                         | $C_{OSS}$    |      | 100  |      | pF         |
| Reverse Transfer Capacitance                                  | $V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$                         | $C_{RSS}$    |      | 30   |      | pF         |
| <b>Switching Characteristics</b> <sup>Note 4</sup>            |                                                               |              |      |      |      |            |
| Turn-On Delay Time                                            | $V_{DD} = 50V, V_{GS} = 10V, I_D = 3A, R_{G(ext)} = 25\Omega$ | $t_{D(ON)}$  |      | 8.5  |      | ns         |
| Turn-On Rise Time                                             | $V_{DD} = 50V, V_{GS} = 10V, I_D = 3A, R_{G(ext)} = 25\Omega$ | $t_R$        |      | 4.1  |      | ns         |
| Turn-Off Delay Time                                           | $V_{DD} = 50V, V_{GS} = 10V, I_D = 3A, R_{G(ext)} = 25\Omega$ | $t_{D(OFF)}$ |      | 73   |      | ns         |
| Turn-Off Fall Time                                            | $V_{DD} = 50V, V_{GS} = 10V, I_D = 3A, R_{G(ext)} = 25\Omega$ | $t_F$        |      | 13   |      | ns         |
| Total Gate Charge                                             | $V_{DS} = 80V, V_{GS} = 4.5V, I_D = 3A$                       | $Q_G$        |      | 9.3  |      | nC         |
| Gate Source Charge                                            | $V_{DS} = 80V, V_{GS} = 4.5V, I_D = 3A$                       | $Q_{GS}$     |      | 1.3  |      | nC         |
| Gate Drain Charge                                             | $V_{DS} = 80V, V_{GS} = 4.5V, I_D = 3A$                       | $Q_{GD}$     |      | 5    |      | nC         |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |                                                               |              |      |      |      |            |
| Drain-Source Diode Forward Current <sup>Note 3</sup>          |                                                               | $I_S$        |      |      | 2.5  | A          |
| Drain-Source Diode Forward Voltage <sup>Note 3</sup>          | $V_{GS} = 0V, I_S = 2A$                                       | $V_{SD}$     |      |      | 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

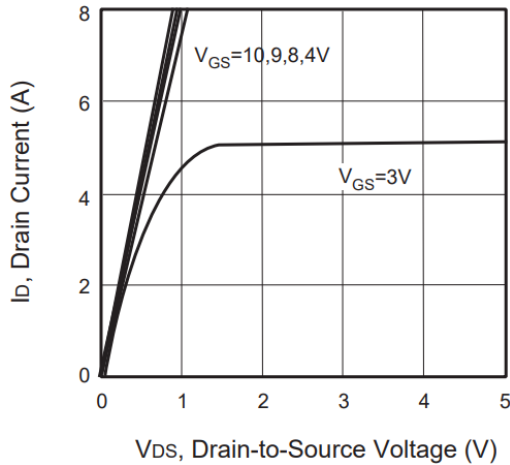


Fig. 2 • Transfer Characteristics

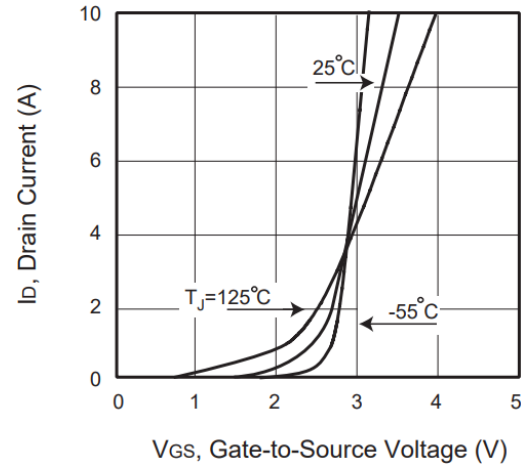


Fig. 3 • Capacitance

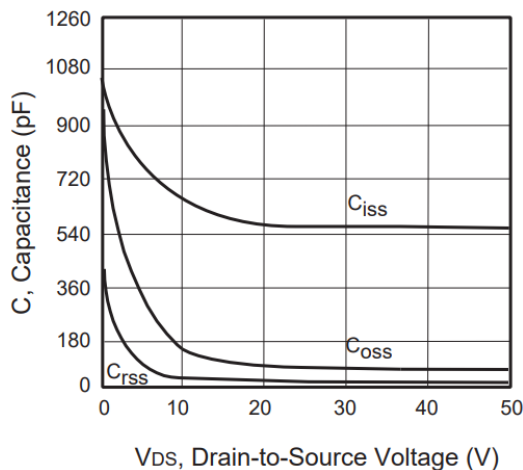


Fig. 4 • On-Resistance Variation with Temperature

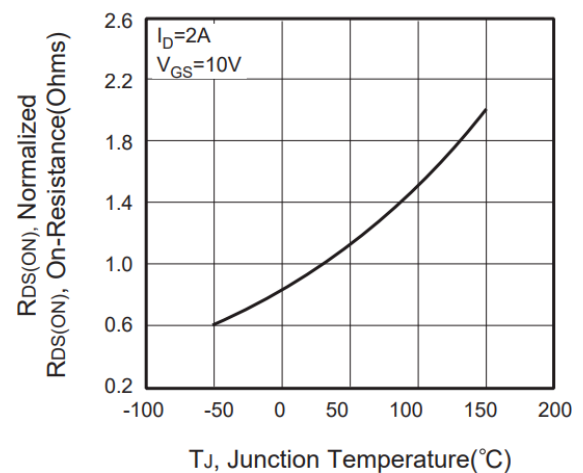


Fig. 5 • Gate Threshold Variation with Temperature

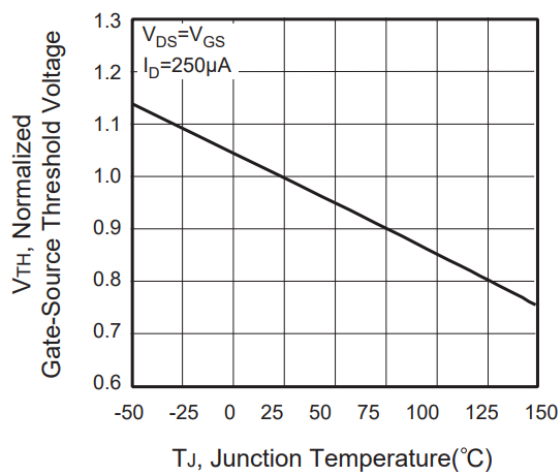
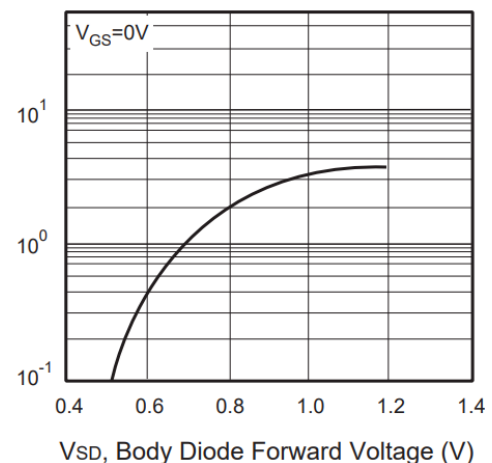


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

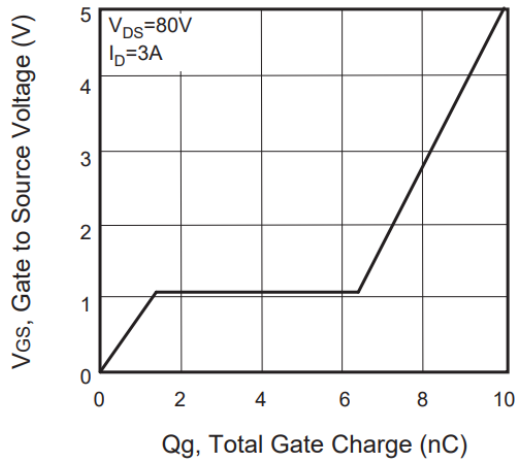


Fig. 8 • Maximum Safe Operating Area

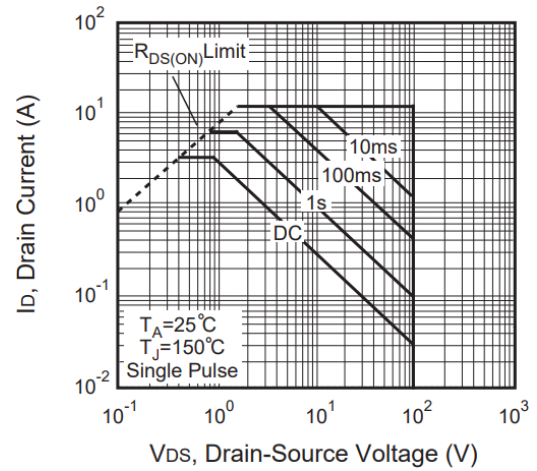


Fig. 9 • Breakdown Voltage Variation vs. Temperature

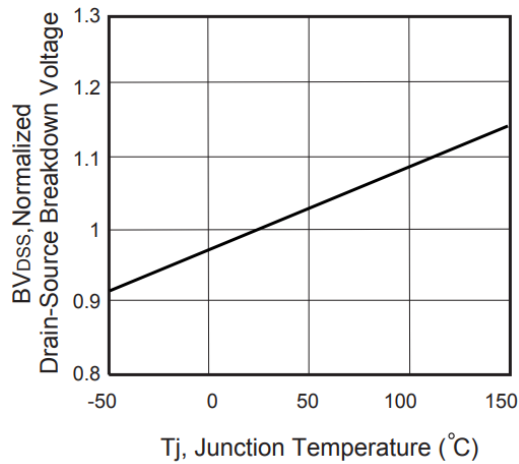


Fig. 10 • Switching Test Circuit

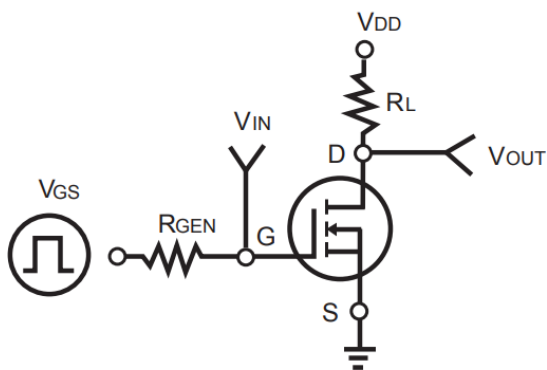
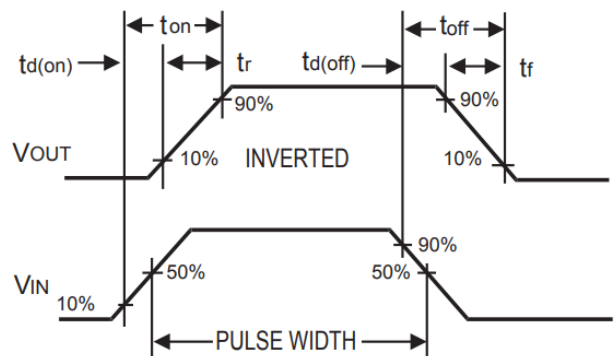
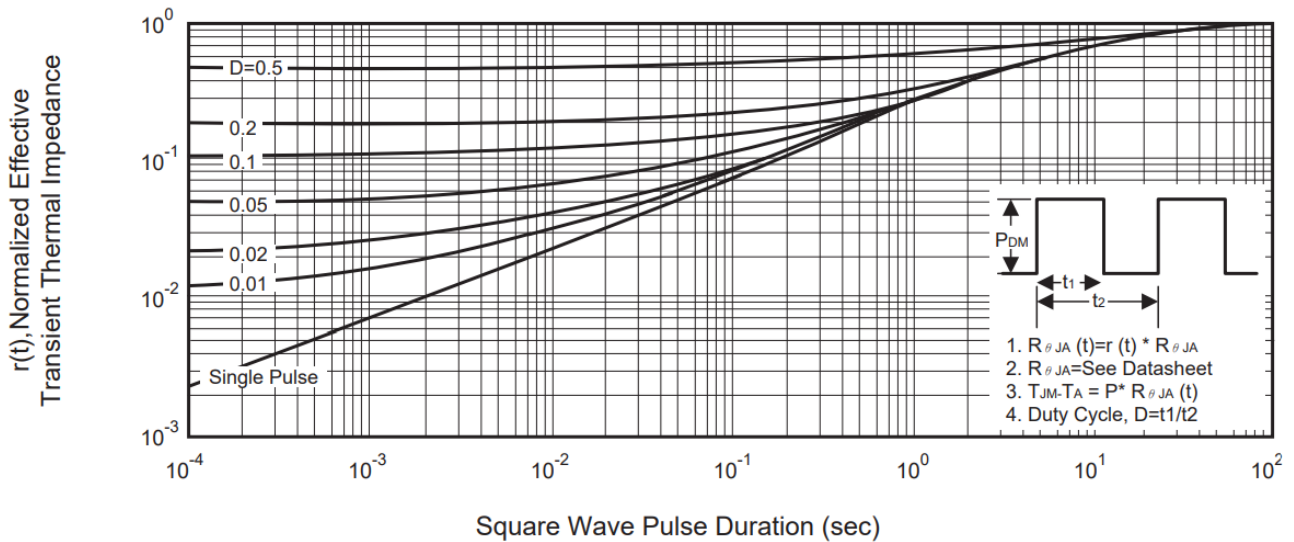


Fig. 11 • Switching Waveforms

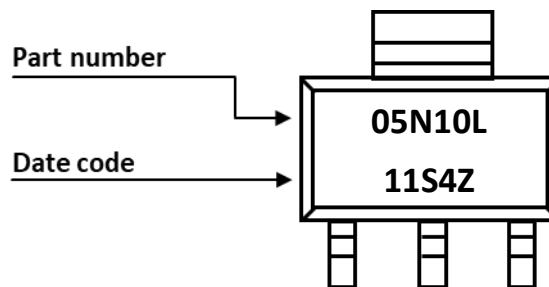


## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 12 • Normalized Thermal Transient Impedance Curve

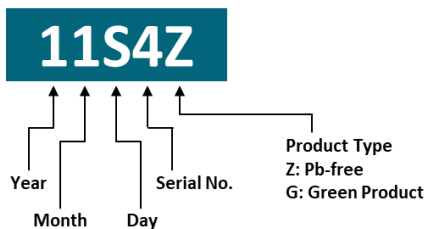


## PART MARKING



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

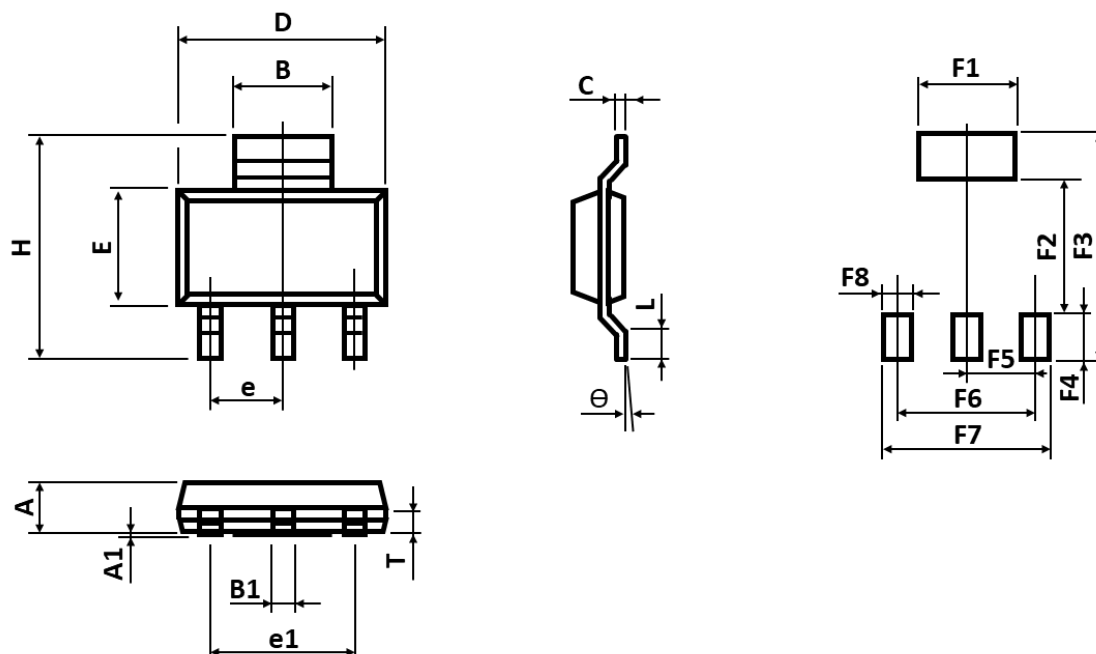
Coding list for „Month“

|     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| 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   | 1.500              | -                  | 1.700              |
| A1  | 0.020              | -                  | 0.100              |
| B   | 2.950              | -                  | 3.200              |
| B1  | 0.670              | -                  | 0.800              |
| C   | 0.240              | -                  | 0.350              |
| D   | 6.300              | -                  | 6.850              |
| e   | 2.300 TYP          |                    |                    |

| Sym | Millimeters (Min.) | Millimeters (Typ.) | Millimeters (Max.) |
|-----|--------------------|--------------------|--------------------|
| e1  | 4.600 TYP          |                    |                    |
| E   | 3.300              | -                  | 3.800              |
| H   | 6.700              | -                  | 7.300              |
| L   | 0.900              | -                  | -                  |
| T   | 0.600              | -                  | 0.800              |
| Θ   | 10° MAX            |                    |                    |

| Sym | Millimeters (Min.) | Millimeters (Typ.) | Millimeters (Max.) |
|-----|--------------------|--------------------|--------------------|
| F1  | -                  | 3.500              | -                  |
| F2  | -                  | 4.600              | -                  |
| F3  | -                  | 8.000              | -                  |
| F4  | -                  | 1.600              | -                  |

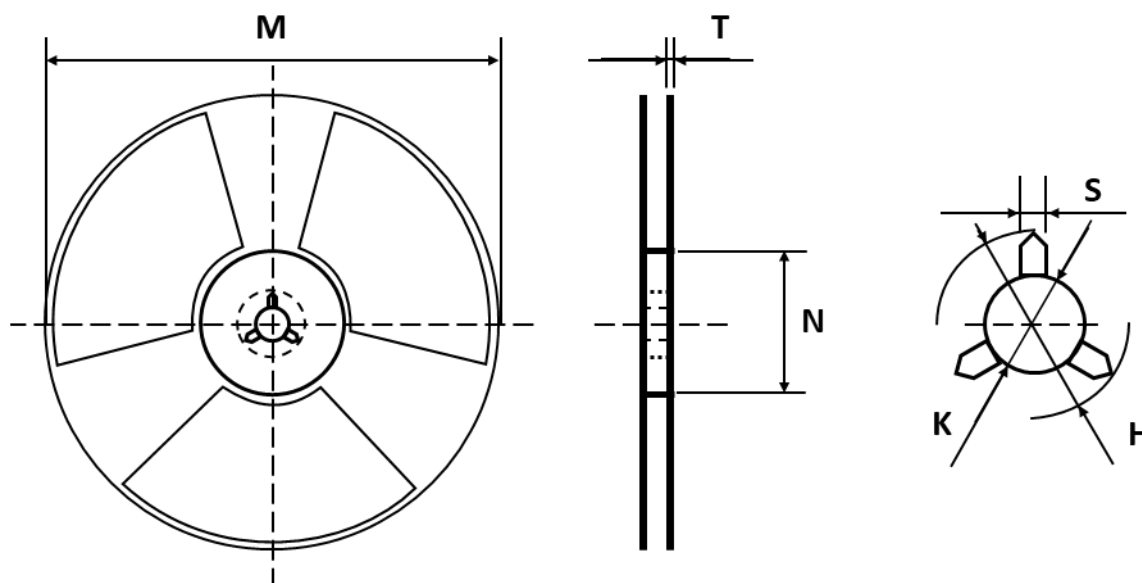
| Sym | Millimeters (Min.) | Millimeters (Typ.) | Millimeters (Max.) |
|-----|--------------------|--------------------|--------------------|
| F5  | -                  | 2.300              | -                  |
| F6  | -                  | 4.600              | -                  |
| F7  | -                  | 5.600              | -                  |
| F8  | -                  | 1.200              | -                  |

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

## ORDERING INFORMATION

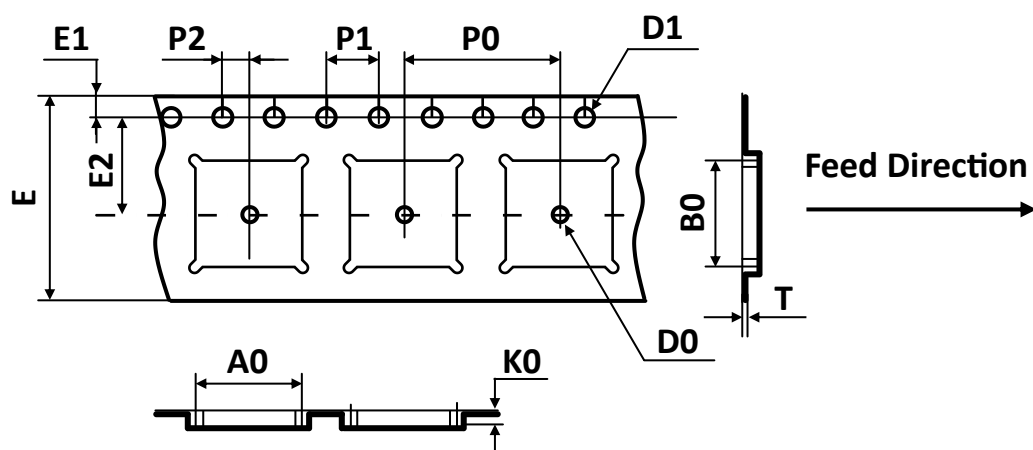
| Part Number | Package | Packing | Reel Qty. | Inner Box Qty. | Outer Box Qty. |
|-------------|---------|---------|-----------|----------------|----------------|
| CET05N10L   | SOT223  | 7" Reel | 2,500pcs  | 5,000pcs       | 15,000pcs      |

## REEL DIMENSIONS ▲ All dimensions in mm



| Tape Size | Reel Size | M                | N               | T             | H              | K              | S             |
|-----------|-----------|------------------|-----------------|---------------|----------------|----------------|---------------|
| 8mm       | Ø180      | Ø178.00<br>±1.00 | Ø54.00<br>±0.50 | 1.20<br>±0.20 | 20.00<br>±1.00 | 13.30<br>±0.30 | 3.00<br>±1.00 |

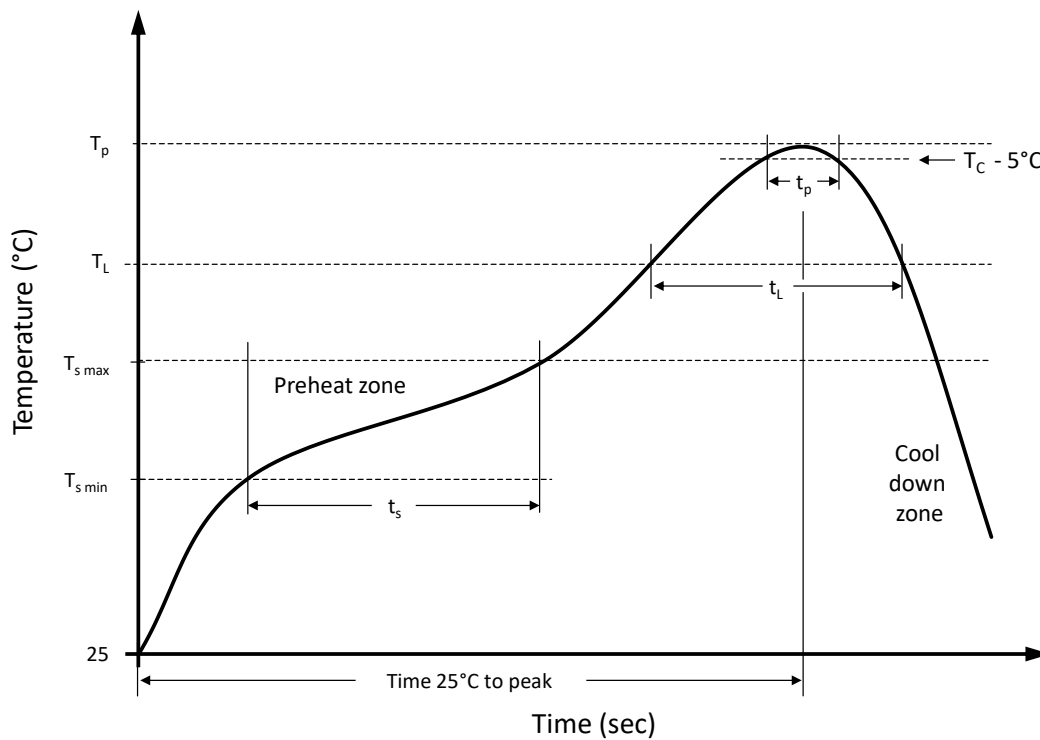
## TAPE DIMENSIONS ▲ All dimensions in mm



| Package | A0            | B0            | K0            | D0            | D1            | E             | E1            | E2            | P0            | P1            | P2            | T             |
|---------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| SOT223  | 2.40<br>±0.10 | 2.60<br>±0.10 | 1.20<br>±0.10 | 1.00<br>±0.10 | 1.50<br>±0.10 | 8.00<br>±0.10 | 1.75<br>±0.10 | 3.50<br>±0.10 | 4.00<br>±0.10 | 4.00<br>±0.10 | 2.00<br>±0.05 | 0.20<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.                                                 | $T_{s \text{ min}}$ | 100 °C                 | 150 °C           |
| Preheat temperature max.                                                 | $T_{s \text{ max}}$ | 150 °C                 | 200 °C           |
| Preheat time $t_s$ from $T_{s \text{ min}}$ to $T_{s \text{ max}}$       | $t_s$               | 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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It is subject to the user's duty of care to design and validate his products in such a way that appropriate measures are taken, such as protective circuits or redundant systems to ensure the safety standards required in the application.

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