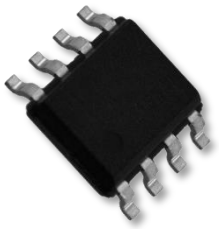


# CEM6188A

## 60V ▲ 17mΩ ▲ 7.4A ▲ Dual Si MOSFET

**SILICON Si MOSFET** ▲ SMD type
Dual 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**

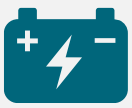
## MAXIMUM RATINGS

| Parameter ($T_A$ = 25°C, unless otherwise noted) | | Characteristics |
|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 60V |
| Gate-Source Voltage | $V_{GS}$ | ±20V |
| Continuous Drain Current | $I_D$ | 7.4A |
| Pulsed Drain Current Note 1 | $I_{DM}$ | 29.6A |
| Maximum Power Dissipation | $P_D$ | 2W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55°C to +150°C |

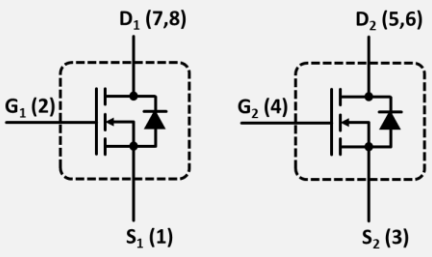
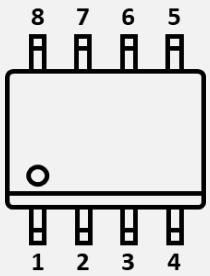
## THERMAL CHARACTERISTICS

| Parameter | Symbol | Limit |
|---|---|---|
| Thermal Resistance, Junction-to-Ambient Note 2 | $R_{TH\_JA}$ | 62.5°C/W |

## APPLICATIONS

| Audio Amplifier | Battery Management Systems | DC/DC Converter | Industrial Control | Power Switches |
|---|---|---|---|---|
|  |  |  |  |  |

## PIN DESCRIPTION

| Circuit Diagram | Outline ▪ Top View | Pin No. | Description |
|---|---|---|---|
|  |  | 1 | Source MOSFET 1 |
| | | 2 | Gate MOSFET 1 |
| | | 3 | Source MOSFET 2 |
| | | 4 | Gate MOSFET 2 |
| | | 5 | Drain MOSFET 2 |
| | | 6 | Drain MOSFET 2 |
| | | 7 | Drain MOSFET 1 |
| | | 8 | Drain MOSFET 1 |

## ELECTRICAL CHARACTERISTICS ▲ $T_A$ = 25°C, unless otherwise noted

| Item | Condition | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250μA | $BV_{DSS}$ | 60 | | | V |
| Zero Gate Voltage Drain Current | $V_{DS}$ = 60V, $V_{GS}$ = 0V | $I_{DSS}$ | | | 1 | μA |
| 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 |
| **On Characteristics** Note 3 | | | | | | |
| Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | $V_{GS(th)}$ | 1 | | 3 | V |
| Static Drain-Source On-Resistance | $V_{GS}$ = 10V, $I_D$ = 6A | $R_{DS(ON)}$ | | 17 | 23 | mΩ |
| Static Drain-Source On-Resistance | $V_{GS}$ = 4.5V, $I_D$ = 4A | $R_{DS(ON)}$ | | 22 | 31 | mΩ |
| **Dynamic Characteristics** Note 4 | | | | | | |
| Input Capacitance | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1MHz | $C_{ISS}$ | | 780 | | pF |
| Output Capacitance | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1MHz | $C_{OSS}$ | | 115 | | pF |
| Reverse Transfer Capacitance | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1MHz | $C_{RSS}$ | | 95 | | pF |
| **Switching Characteristics** Note 4 | | | | | | |
| Turn-On Delay Time | $V_{DD}$ = 30V, $V_{GS}$ = 10V, $I_D$ = 7A, $R_{G(ext)}$ = 4.7Ω | $t_{D(ON)}$ | | 15 | | ns |
| Turn-On Rise Time | $V_{DD}$ = 30V, $V_{GS}$ = 10V, $I_D$ = 7A, $R_{G(ext)}$ = 4.7Ω | $t_R$ | | 7 | | ns |
| Turn-Off Delay Time | $V_{DD}$ = 30V, $V_{GS}$ = 10V, $I_D$ = 7A, $R_{G(ext)}$ = 4.7Ω | $t_{D(OFF)}$ | | 43 | | ns |
| Turn-Off Fall Time | $V_{DD}$ = 30V, $V_{GS}$ = 10V, $I_D$ = 7A, $R_{G(ext)}$ = 4.7Ω | $t_F$ | | 8 | | ns |
| Total Gate Charge | $V_{DS}$ = 48V, $V_{GS}$ = 4.5V, $I_D$ = 7A | $Q_G$ | | 14 | | nC |
| Gate Source Charge | $V_{DS}$ = 48V, $V_{GS}$ = 4.5V, $I_D$ = 7A | $Q_{GS}$ | | 2 | | nC |
| Gate Drain Charge | $V_{DS}$ = 48V, $V_{GS}$ = 4.5V, $I_D$ = 7A | $Q_{GD}$ | | 9 | | nC |
| **Drain-Source Diode Characteristics and Maximum Ratings** | | | | | | |
| Drain-Source Diode Forward Current Note 2 | | $I_S$ | | | 1.6 | A |
| Drain-Source Diode Forward Voltage Note 3 | $V_{GS}$ = 0V, $I_S$ = 1.5A | $V_{SD}$ | | | 1.2 | V |

**Notes**

**1: Repetitive Rating: Pulse width limited by maximum junction temperature**

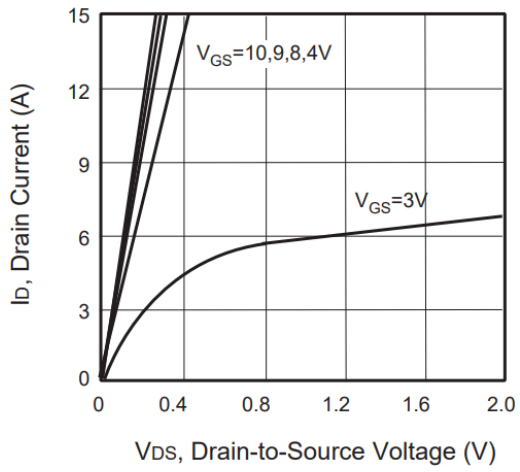
**2: Surface Mounted on FR4 Board, t ≤ 10 sec**

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

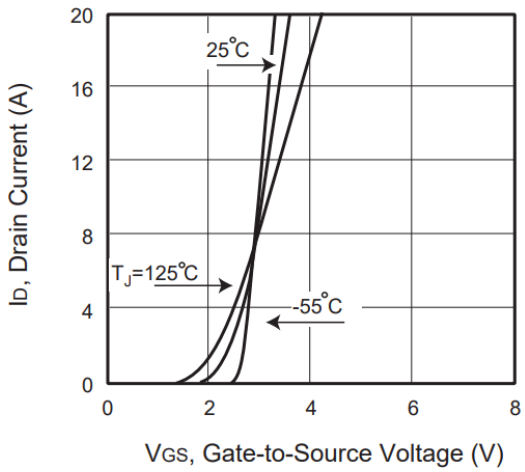
**4: Guaranteed by design, not subject to production testing.**

## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

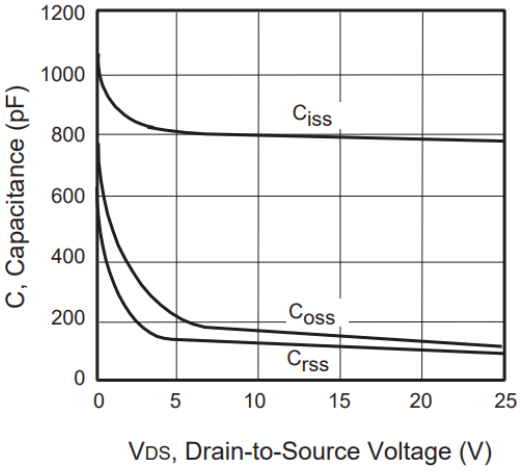
### Fig. 1 ▪ Output Characteristics



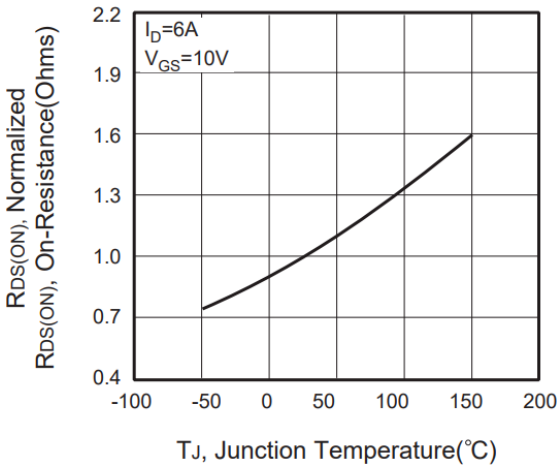

### Fig. 2 ▪ Transfer Characteristics



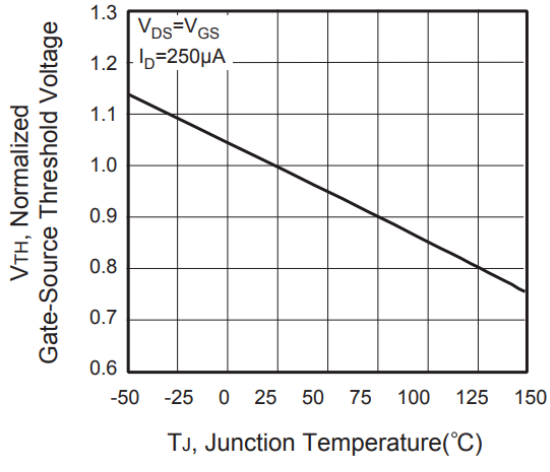

### Fig. 3 ▪ Capacitance



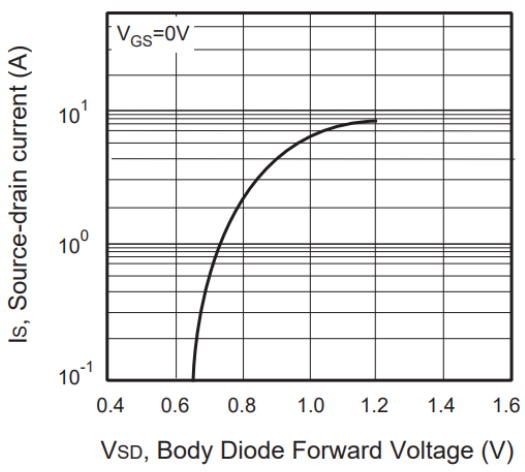

### Fig. 4 ▪ On-Resistance Variation with Temperature




### Fig. 5 ▪ Gate Threshold Variation with Temperature

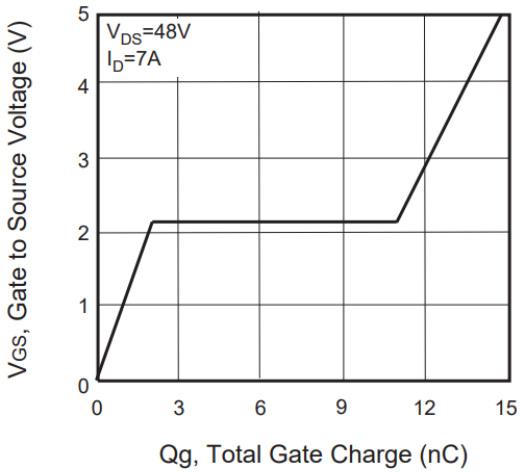



### Fig. 6 ▪ Body Diode Forward Voltage Variation with Source Current

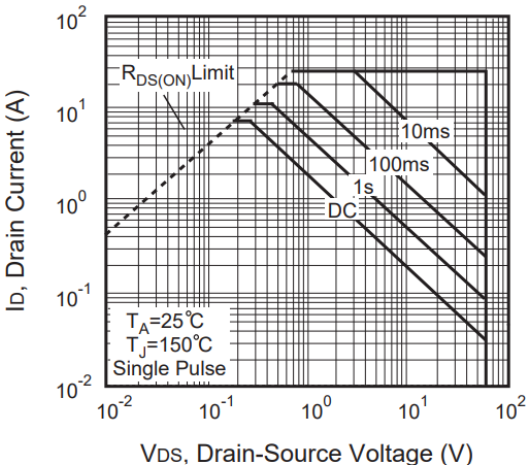


## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

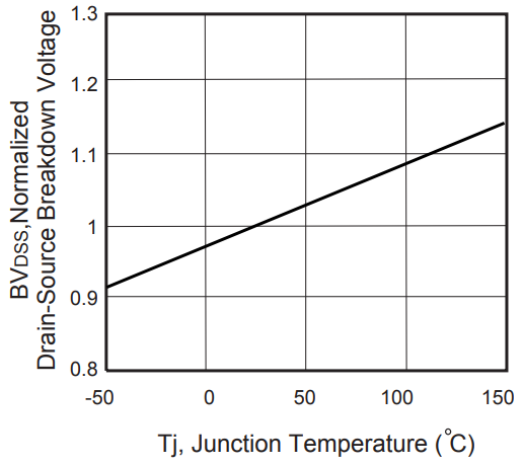
### Fig. 7 ▪ Gate Charge



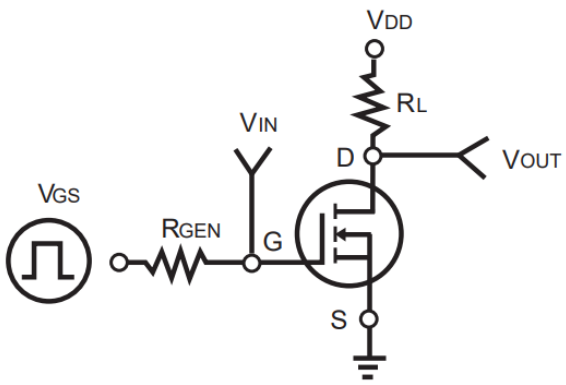

### Fig. 8 ▪ Maximum Safe Operating Area



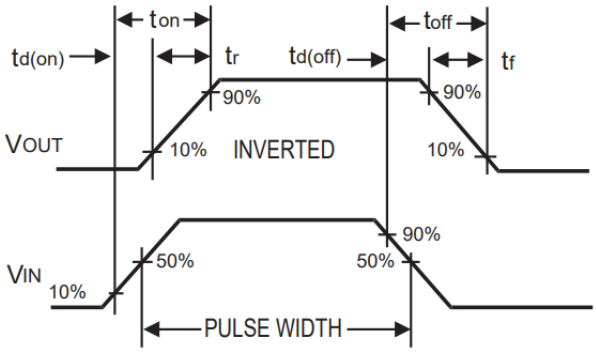

### Fig. 9 ▪ Breakdown Voltage Variation vs. Temperature




### Fig. 10 ▪ Switching Test Circuit

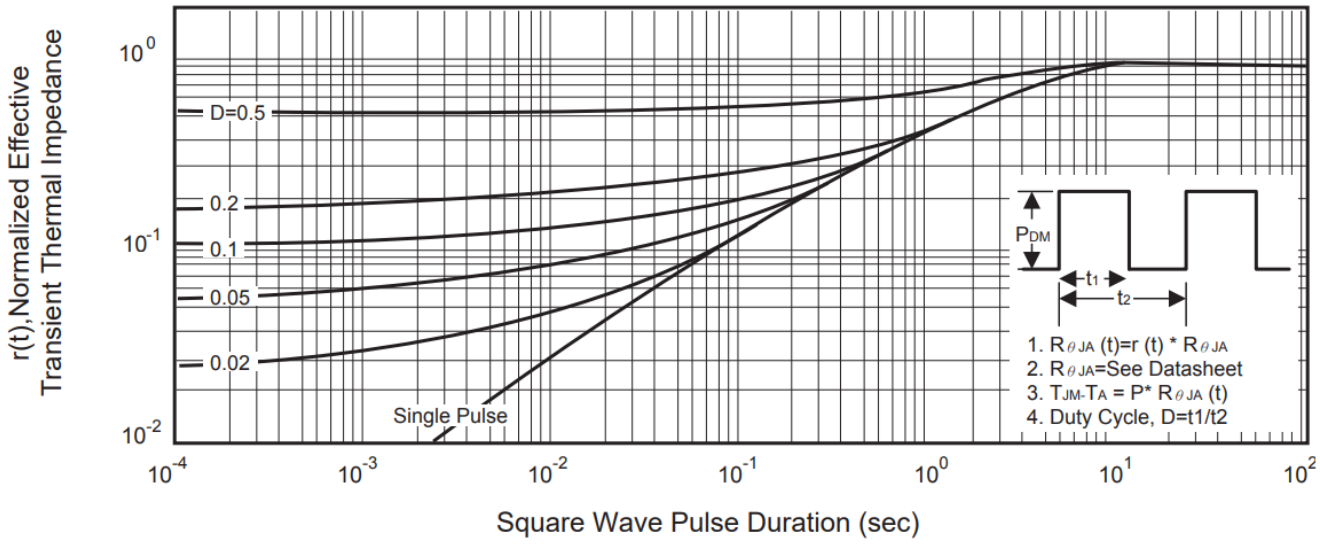



### Fig. 11 ▪ Switching Waveforms

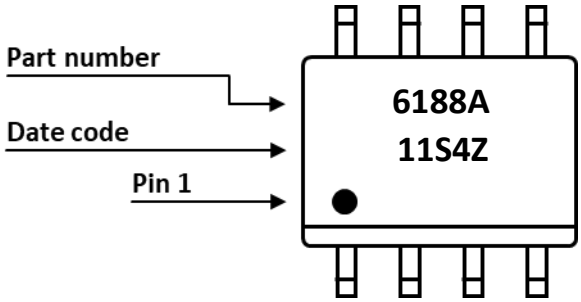


## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

**Fig. 12 ▪ Normalized Thermal Transient Impedance Curve**

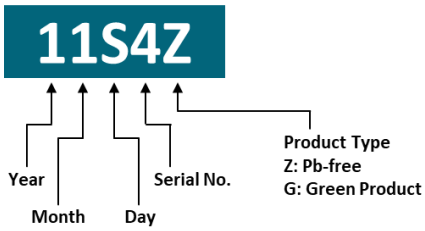



## PART MARKING




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

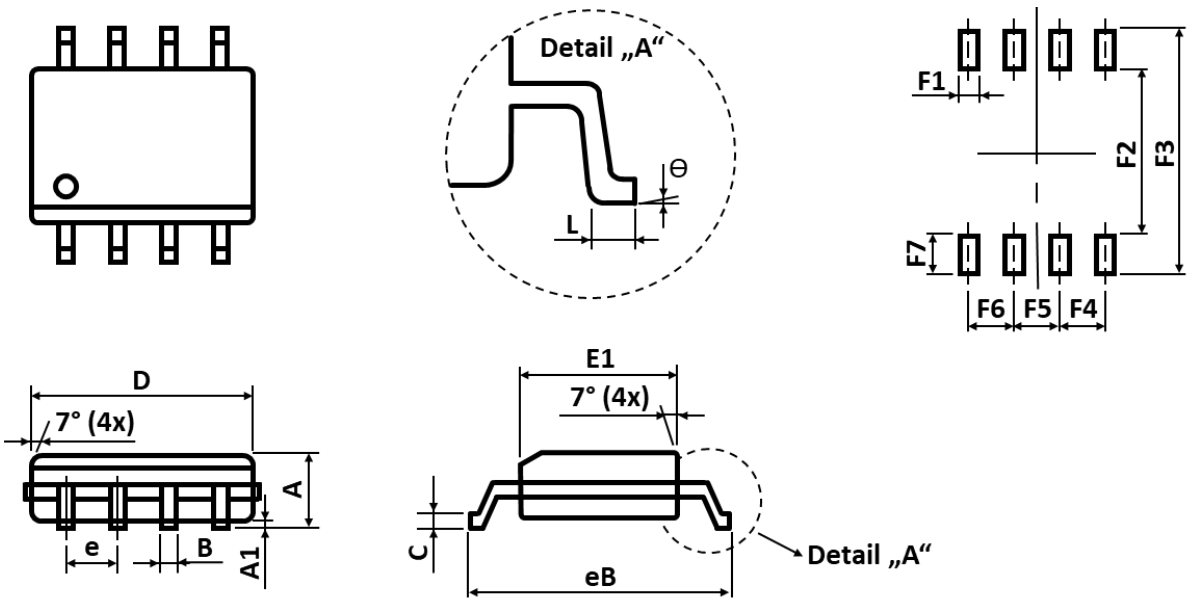
Coding list for „Month“

| | | | | | |
|---|---|---|---|---|---|
| 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.) |
|---|---|---|---|
| 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.) |
|---|---|---|---|
| F1 | - | 0.500 | - |
| F2 | - | 4.250 | - |
| F3 | - | 6.250 | - |
| F4 | - | 1.270 | - |

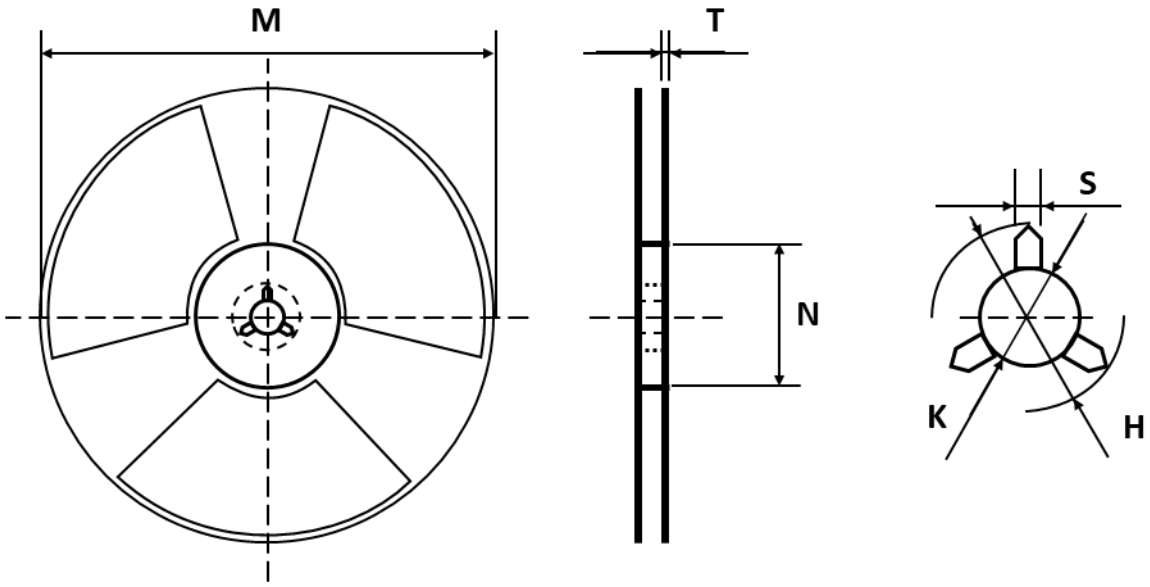
| Sym | Millimeters (Min.) | Millimeters (Typ.) | Millimeters (Max.) |
|---|---|---|---|
| F5 | - | 1.270 | - |
| F6 | - | 1.270 | - |
| F7 | - | 1.000 | - |

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

## ORDERING INFORMATION

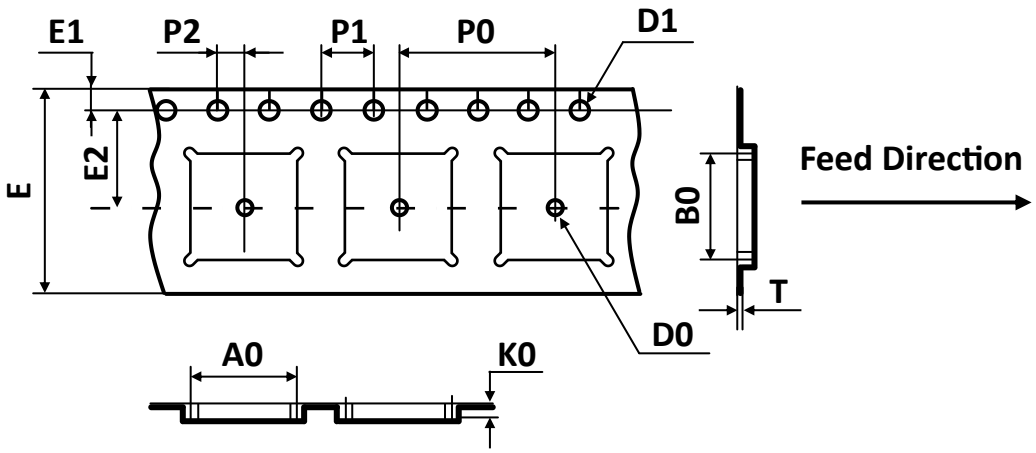
| Part Number | Package | Packing | Reel Qty. | Inner Box Qty. | Outer Box Qty. |
|---|---|---|---|---|---|
| CEM6188A | SO8 | 13” Reel | 2,500pcs | 5,000pcs | 40,000pcs |

## REEL DIMENSIONS ▲ All dimensions in mm




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

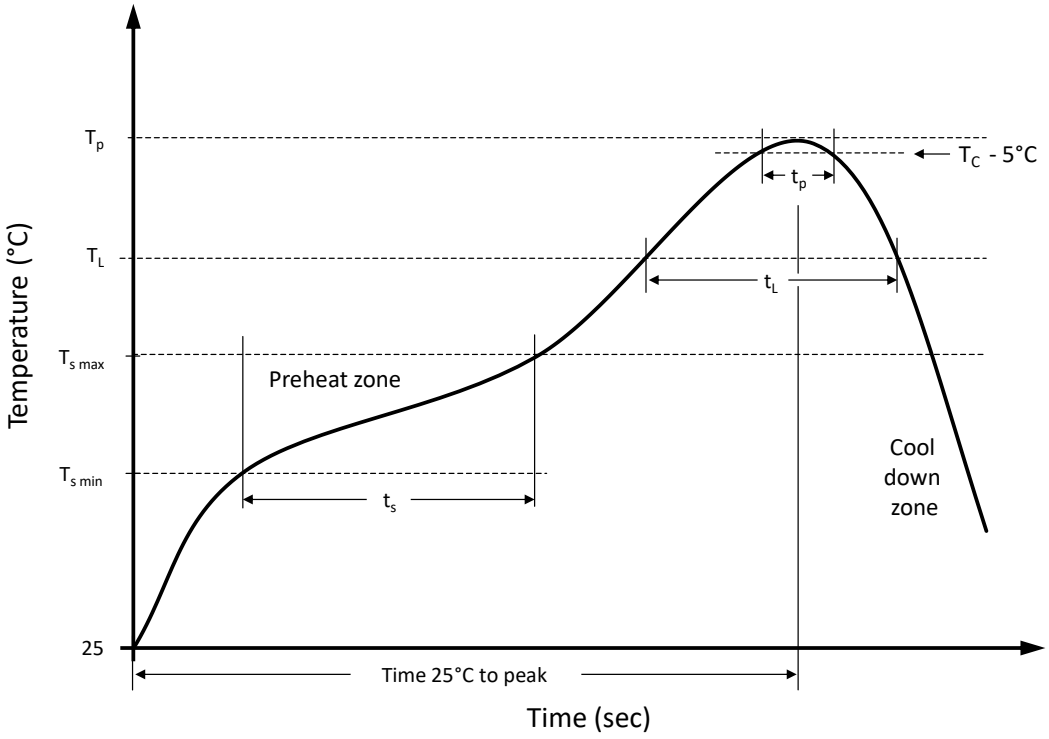
## TAPE DIMENSIONS ▲ All dimensions in mm




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