

# CEA6961

**-60V ▲ 90mΩ ▲ -3.2A ▲ Si MOSFET**

**SILICON Si MOSFET ▲ SMD type**

P-channel enhancement mode

UL94V-0 rated flame retardant epoxy

SOT89 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	$V_{DS}$	-60V
Gate-Source Voltage	$V_{GS}$	$\pm 20\text{V}$
Continuous Drain Current	$I_D$	-3.2A
Pulsed Drain Current <sup>Note 1</sup>	$I_{DM}$	-12.8A
Maximum Power Dissipation	$P_D$	2W
Operating and Storage Temperature Range	$T_J, T_{STG}$	$-55^{\circ}\text{C}$ to $+150^{\circ}\text{C}$

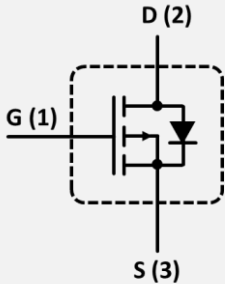
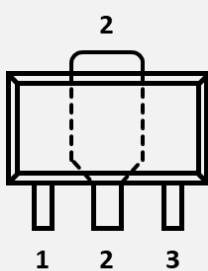
## THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Ambient <sup>Note 2</sup>	$R_{TH\_JA}$	$62.5^{\circ}\text{C/W}$

## APPLICATIONS

DC/DC Converter	DC Fan	Load Switches	Power Banks	USB Storage
				

## PIN DESCRIPTION

Circuit Diagram	Outline - Top View	Pin No.	Description
		1 2 3	Gate Drain Source

## 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	$V_{GS} = 0V, I_D = -250\mu A$	$BV_{DSS}$	-60			V
Zero Gate Voltage Drain Current	$V_{DS} = -60V, V_{GS} = 0V$	$I_{DSS}$			-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	$V_{GS} = 10V, I_D = -1A$	$R_{DS(ON)}$		90	120	m $\Omega$
Static Drain-Source On-Resistance	$V_{GS} = 4.5V, I_D = -1A$	$R_{DS(ON)}$		106	150	m $\Omega$
<b>Dynamic Characteristics</b> <sup>Note 4</sup>						
Input Capacitance	$V_{DS} = -30V, V_{GS} = 0V, f = 1MHz$	$C_{ISS}$		960		pF
Output Capacitance	$V_{DS} = -30V, V_{GS} = 0V, f = 1MHz$	$C_{OSS}$		70		pF
Reverse Transfer Capacitance	$V_{DS} = -30V, V_{GS} = 0V, f = 1MHz$	$C_{RSS}$		45		pF
<b>Switching Characteristics</b> <sup>Note 4</sup>						
Turn-On Delay Time	$V_{DD} = -30V, V_{GS} = -10V, I_D = -1A, R_{G(ext)} = 6\Omega$	$t_{D(ON)}$		11		ns
Turn-On Rise Time	$V_{DD} = -30V, V_{GS} = -10V, I_D = -1A, R_{G(ext)} = 6\Omega$	$t_R$		4		ns
Turn-Off Delay Time	$V_{DD} = -30V, V_{GS} = -10V, I_D = -1A, R_{G(ext)} = 6\Omega$	$t_{D(OFF)}$		75		ns
Turn-Off Fall Time	$V_{DD} = -30V, V_{GS} = -10V, I_D = -1A, R_{G(ext)} = 6\Omega$	$t_F$		14		ns
Total Gate Charge	$V_{DD} = -30V, V_{GS} = -4.5V, I_D = -3A$	$Q_G$		8.5		nC
Gate Source Charge	$V_{DD} = -30V, V_{GS} = -4.5V, I_D = -3A$	$Q_{GS}$		2.1		nC
Gate Drain Charge	$V_{DD} = -30V, V_{GS} = -4.5V, I_D = -3A$	$Q_{GD}$		3.3		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Drain-Source Diode Forward Current		$I_S$			-1.6	A
Drain-Source Diode Forward Voltage <sup>Note 3</sup>	$V_{GS} = 0V, I_S = -1A$	$V_{SD}$			-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

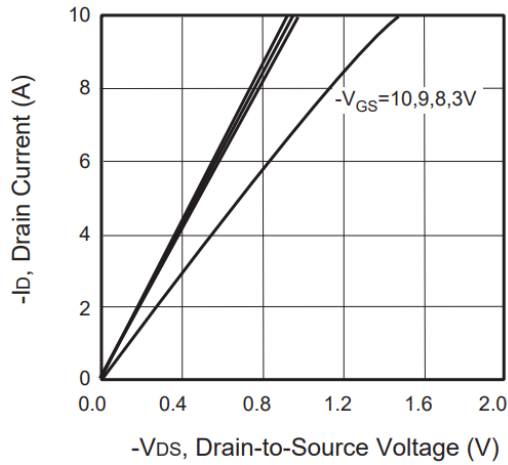


Fig. 2 • Transfer Characteristics

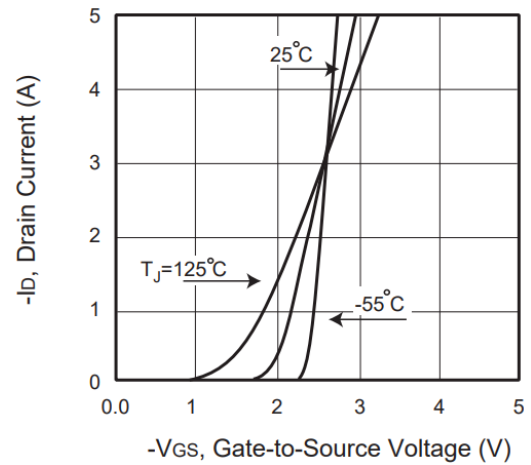


Fig. 3 • Capacitance

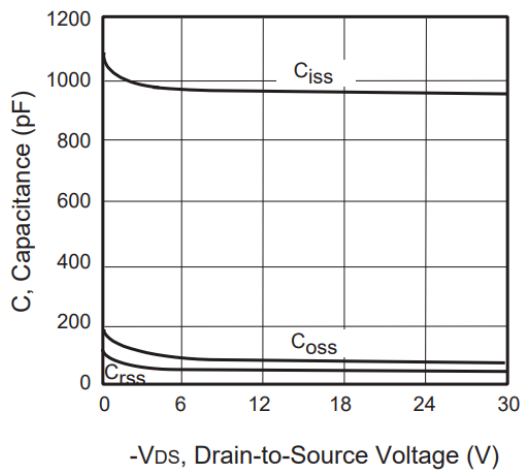


Fig. 4 • On-Resistance Variation with Temperature

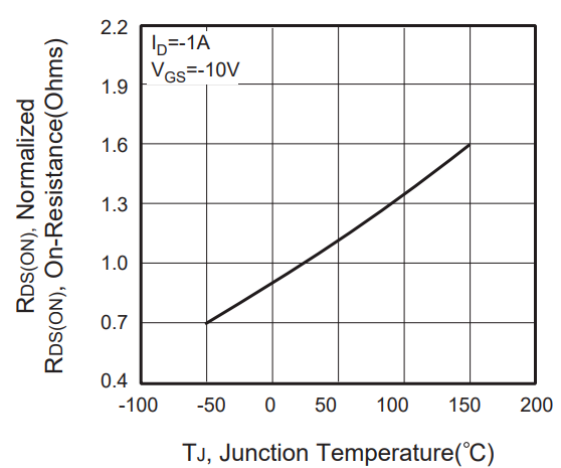


Fig. 5 • Gate Threshold Variation with Temperature

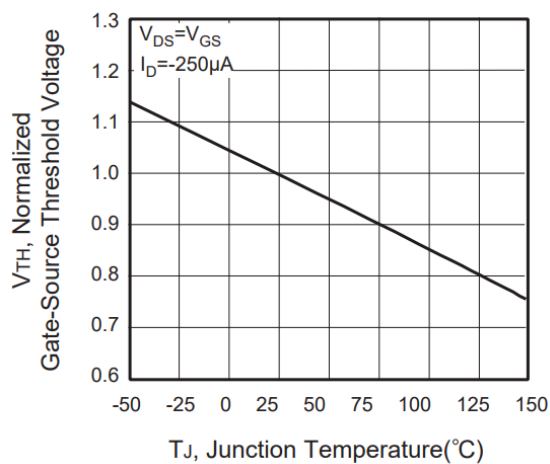
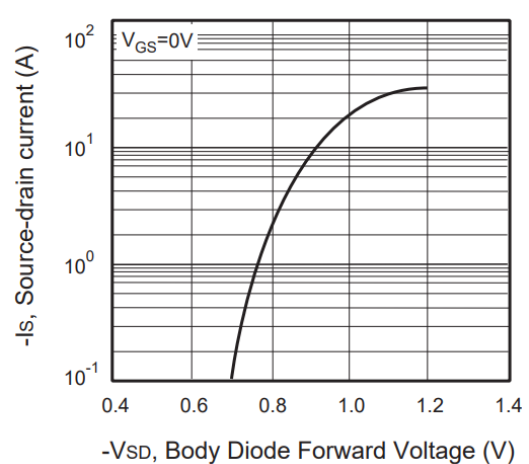


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

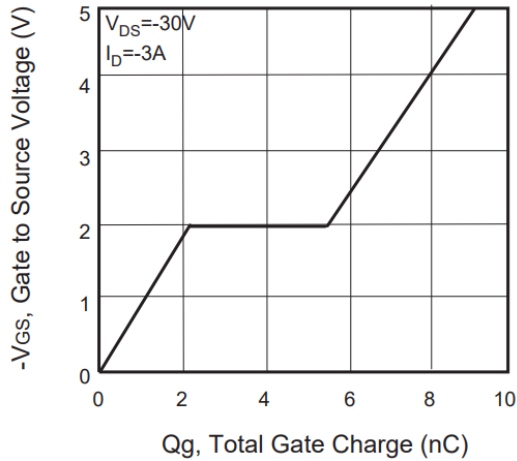


Fig. 8 • Maximum Safe Operating Area

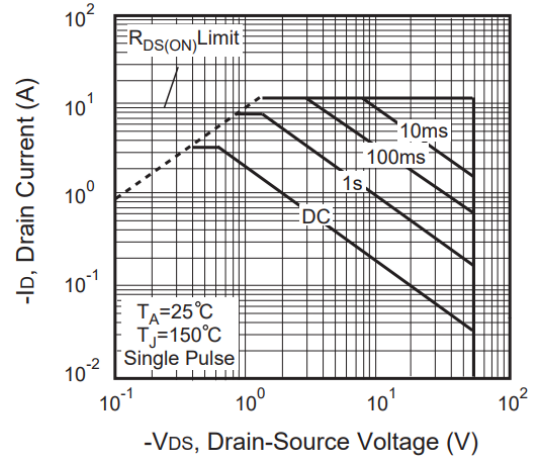


Fig. 9 • Breakdown Voltage Variation vs. Temperature

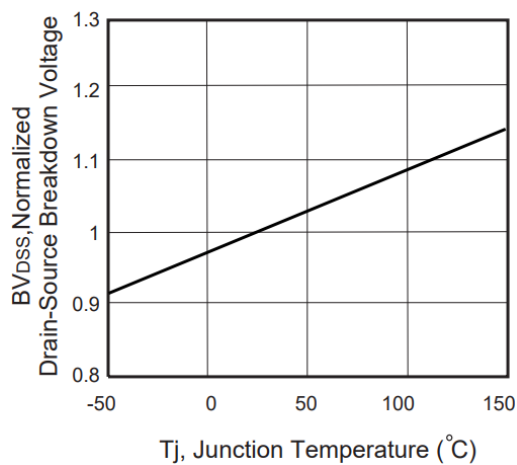


Fig. 10 • Switching Test Circuit

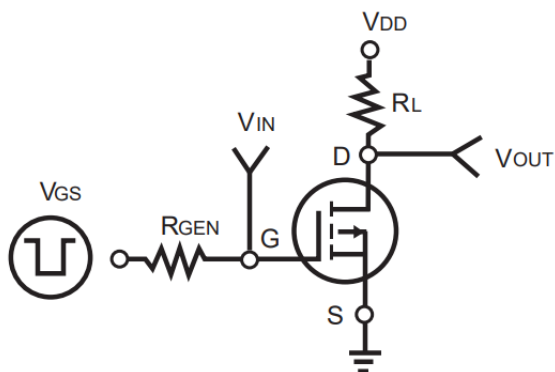
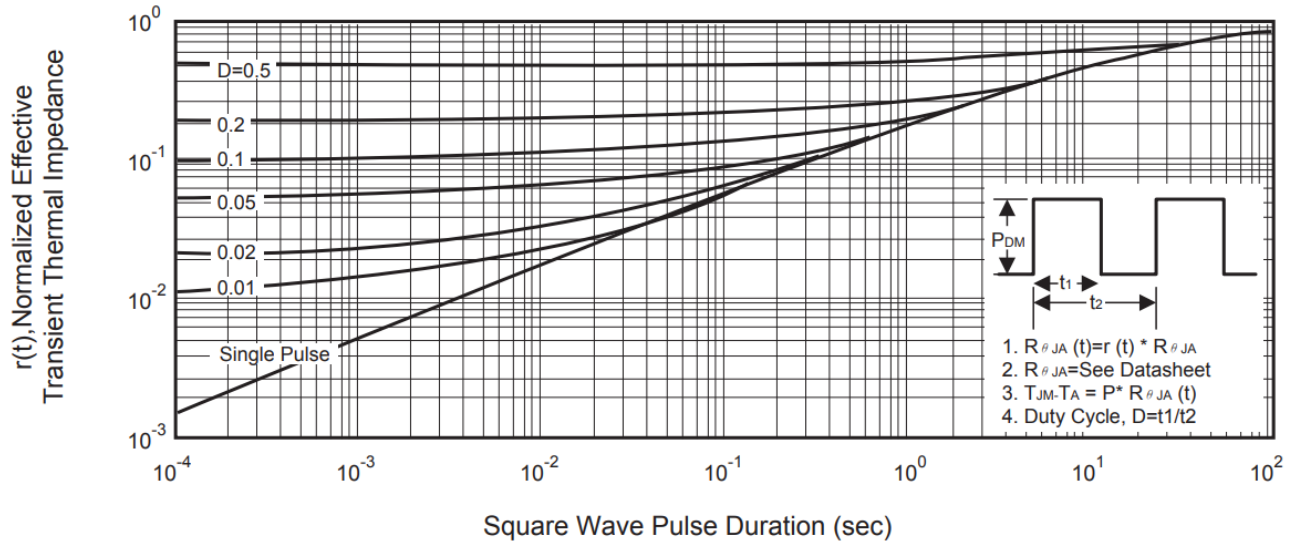


Fig. 11 • Switching Waveforms

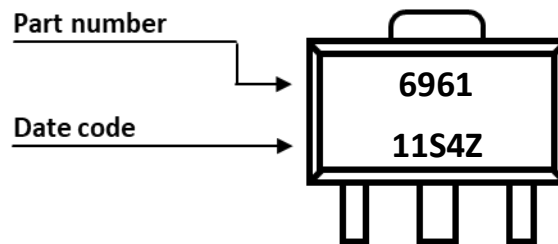


## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

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									

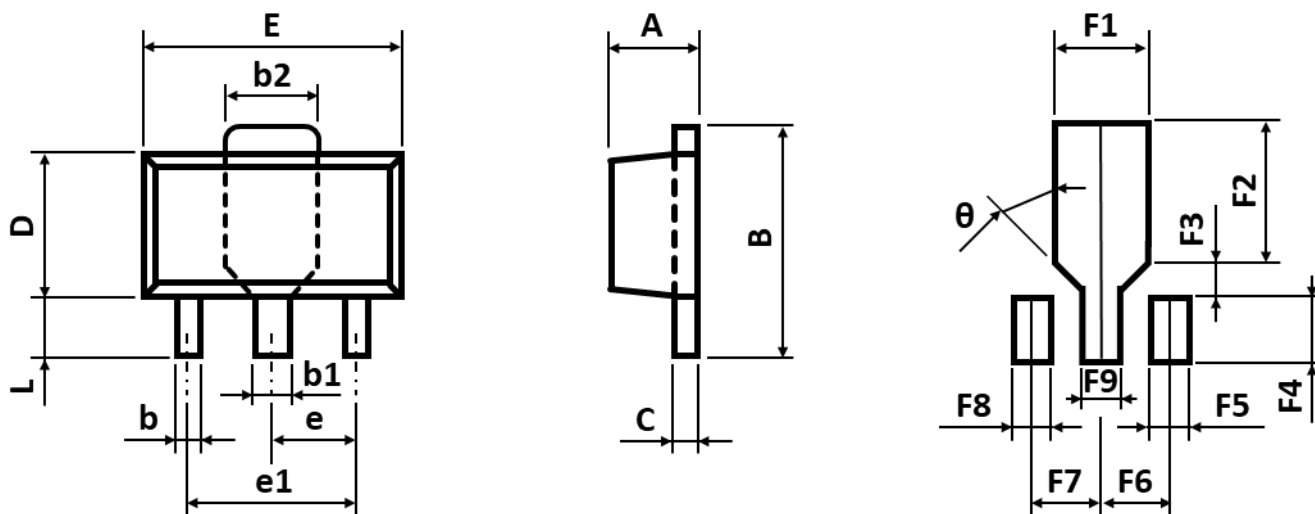
Coding list for „Month“

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	1.400	-	1.600
B	4.000	-	4.400
b	0.370	-	0.470
b1	0.450	-	0.560
b2	1.550	-	1.750
C	0.360	-	0.460

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
D	2.300	-	2.700
E	4.300	-	4.700
e	1.400	-	1.600
e1	2.950	-	3.050
L	0.800	-	1.200

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F1	-	2.000	-
F2	-	3.100	-
F3	-	0.750	-
F4	-	1.400	-
F5	-	0.800	-

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F6	-	1.500	-
F7	-	1.500	-
F8	-	0.800	-
F9	-	0.800	-
Θ	45°		

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

## ORDERING INFORMATION

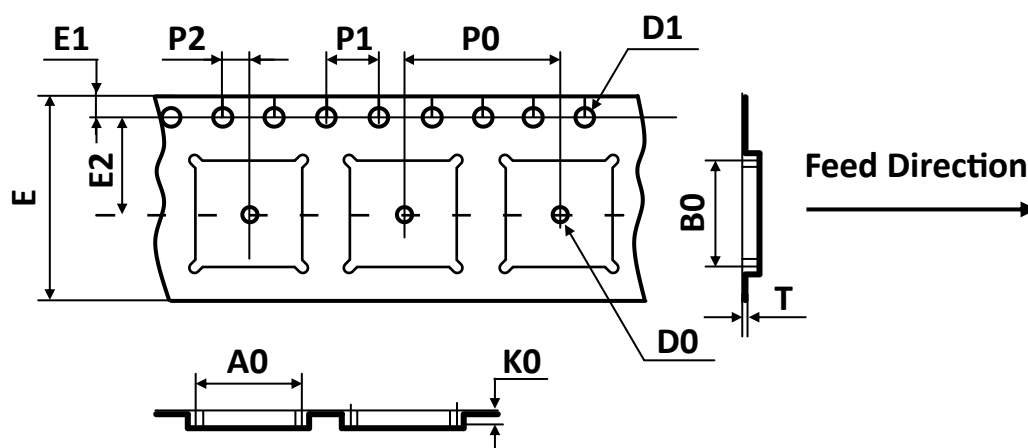
Part Number	Package	Packing	Reel Qty.	Box Qty.
CEA6961	SOT89	7" Reel	1,500pcs	4,000pcs

## REEL DIMENSIONS ▲ All dimensions in mm



Tape Size	Reel Size	M	N	T	H	K	S
12mm	Ø180	Ø178.00	Ø60.00	1.50	20.00	13.20	3.00
		±1.00	±0.50	±0.20	±1.00	±0.20	±1.00

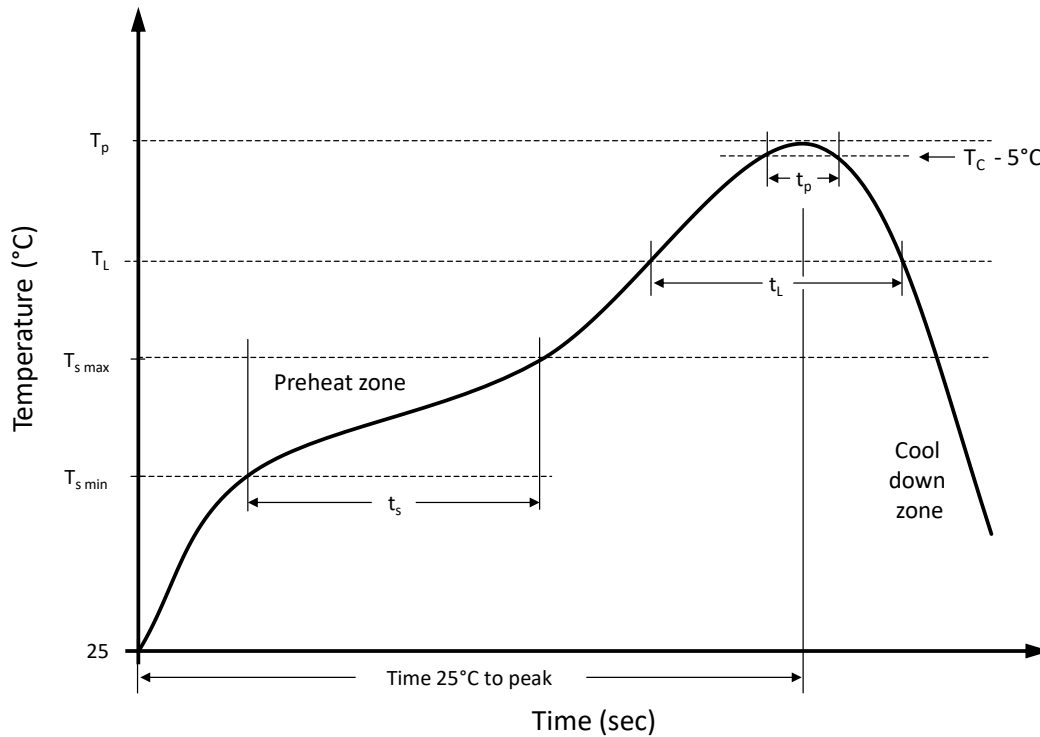
## TAPE DIMENSIONS ▲ All dimensions in mm



Package	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
SOT223	4.90	4.50	1.80	1.50	1.50	12.00	1.75	5.50	8.00	4.00	2.00	0.25
	±0.10	±0.10	±0.10	±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.	$T_{s \text{ min}}$	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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