

# CEB9060N

55V ▲ 8.5mΩ ▲ 90A ▲ 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	$V_{DS}$	55V
Gate-Source Voltage	$V_{GS}$	$\pm 20\text{V}$
Continuous Drain Current at $T_C = 25^\circ\text{C}$	$I_D$	90A
Pulsed Drain Current <sup>Note 1</sup>	$I_{DM}$ <sup>Note 6</sup>	360A
Maximum Power Dissipation at $T_C = 25^\circ\text{C}$	$P_D$	166W
Power Dissipation Derating above $25^\circ\text{C}$	$\Delta P_D$	1.11W/ $^\circ\text{C}$
Single Pulsed Avalanche Energy <sup>Note 4</sup>	$E_{AS}$	325mJ
Single Pulsed Avalanche Current <sup>Note 4</sup>	$I_{AS}$	50A
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	$R_{TH\_JC}$	0.9 $^\circ\text{C}/\text{W}$
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	Industrial Control	Low Side Switches

## PIN DESCRIPTION

Circuit Diagram	Outline - Bottom View	Pin No.	Description
		1 2 3	Drain Source 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	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	55			V
Zero Gate Voltage Drain Current	$V_{DS} = 55V, V_{GS} = 0V$	$I_{DSS}$			25	$\mu A$
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	$V_{GS} = V_{DS}, I_D = 250\mu A$	$V_{GS(th)}$	2		4	V
Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 62A$	$R_{DS(ON)}$		8.5	10.5	m $\Omega$
Forward Transconductance	$V_{DS} = 25V, I_D = 62A$	$g_{FS}$		30		S
<b>Dynamic Characteristics</b> <sup>Note 3</sup>						
Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$	$C_{ISS}$		3695		pF
Output Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$	$C_{OSS}$		765		pF
Reverse Transfer Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$	$C_{RSS}$		60		pF
<b>Switching Characteristics</b> <sup>Note 3</sup>						
Turn-On Delay Time	$V_{DD} = 28V, V_{GS} = 10V, I_D = 62A, R_{G(ext)} = 4.5\Omega$	$t_{D(ON)}$		24	48	ns
Turn-On Rise Time	$V_{DD} = 28V, V_{GS} = 10V, I_D = 62A, R_{G(ext)} = 4.5\Omega$	$t_R$		11.9	23.8	ns
Turn-Off Delay Time	$V_{DD} = 28V, V_{GS} = 10V, I_D = 62A, R_{G(ext)} = 4.5\Omega$	$t_{D(OFF)}$		60	120	ns
Turn-Off Fall Time	$V_{DD} = 28V, V_{GS} = 10V, I_D = 62A, R_{G(ext)} = 4.5\Omega$	$t_F$		19	38	ns
Total Gate Charge	$V_{DS} = 44V, V_{GS} = 10V, I_D = 62A$	$Q_G$		68.1	90.5	nC
Gate Source Charge	$V_{DS} = 44V, V_{GS} = 10V, I_D = 62A$	$Q_{GS}$		12.6		nC
Gate Drain Charge	$V_{DS} = 44V, V_{GS} = 10V, I_D = 62A$	$Q_{GD}$		22.7		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Drain-Source Diode Forward Current		$I_S$			62	A
Drain-Source Diode Forward Voltage <sup>Note 2</sup>	$V_{GS} = 0V, I_S = 62A$	$V_{SD}$			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:  $L = 260\mu H$ ,  $I_{AS} = 50A$ ,  $V_{DD} = 24V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$ .
- 5: Limited only by maximum temperature allowed.
- 6: Pulse width limited by safe operating area.

## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

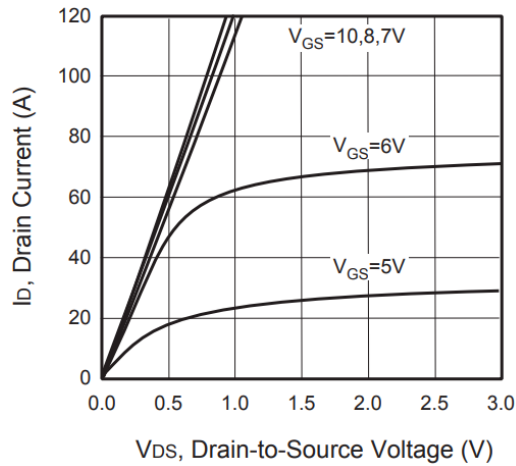


Fig. 2 • Transfer Characteristics

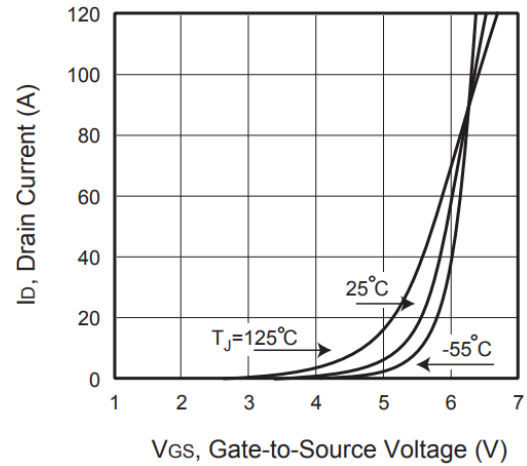


Fig. 3 • Capacitance

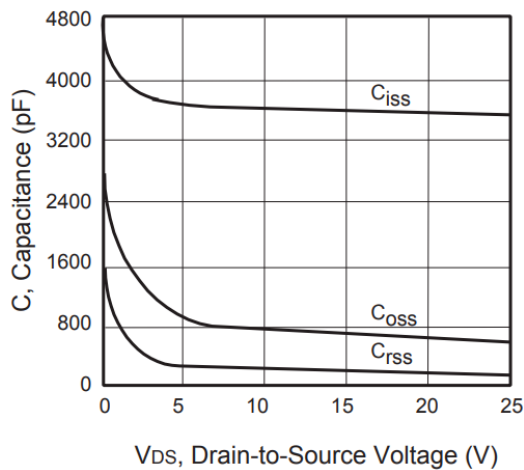


Fig. 4 • On-Resistance Variation with Temperature

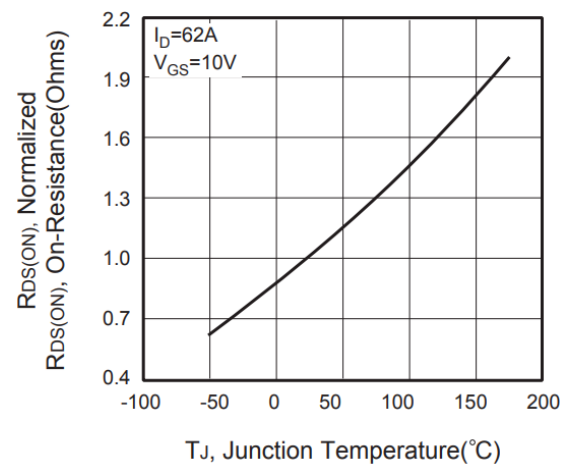


Fig. 5 • Gate Threshold Variation with Temperature

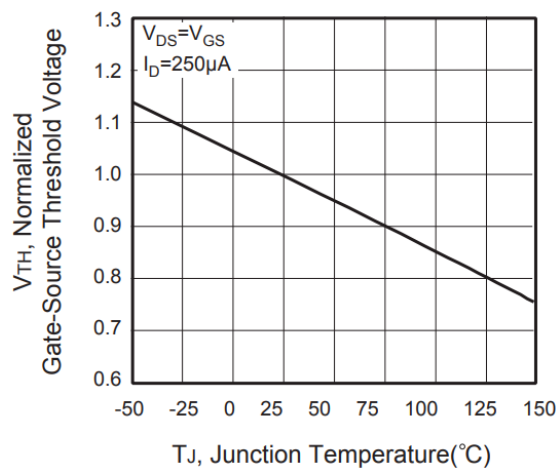
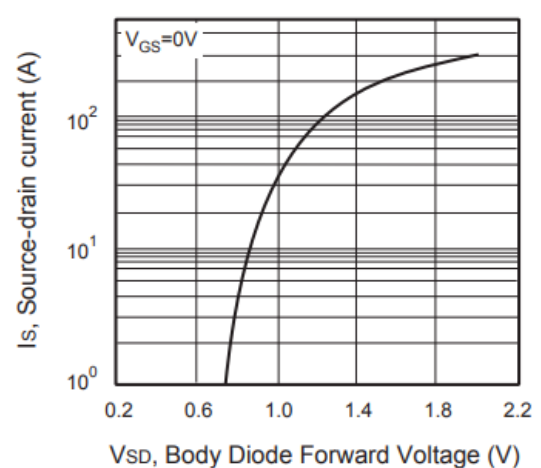


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

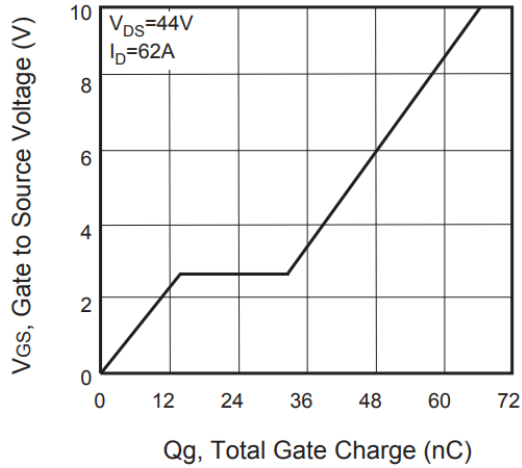


Fig. 8 • Maximum Safe Operating Area

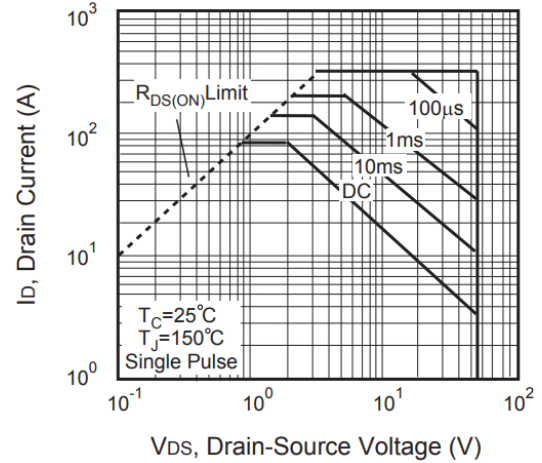


Fig. 9 • Switching Test Circuit



Fig. 10 • Switching Waveforms

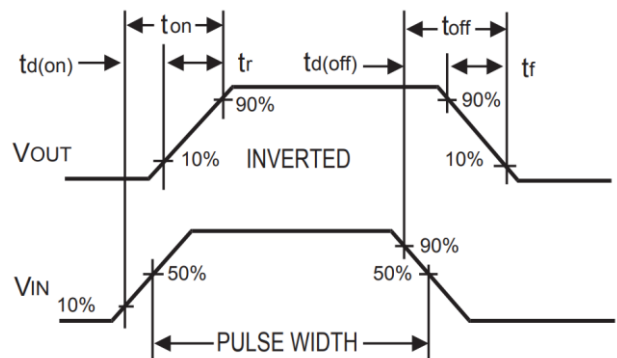
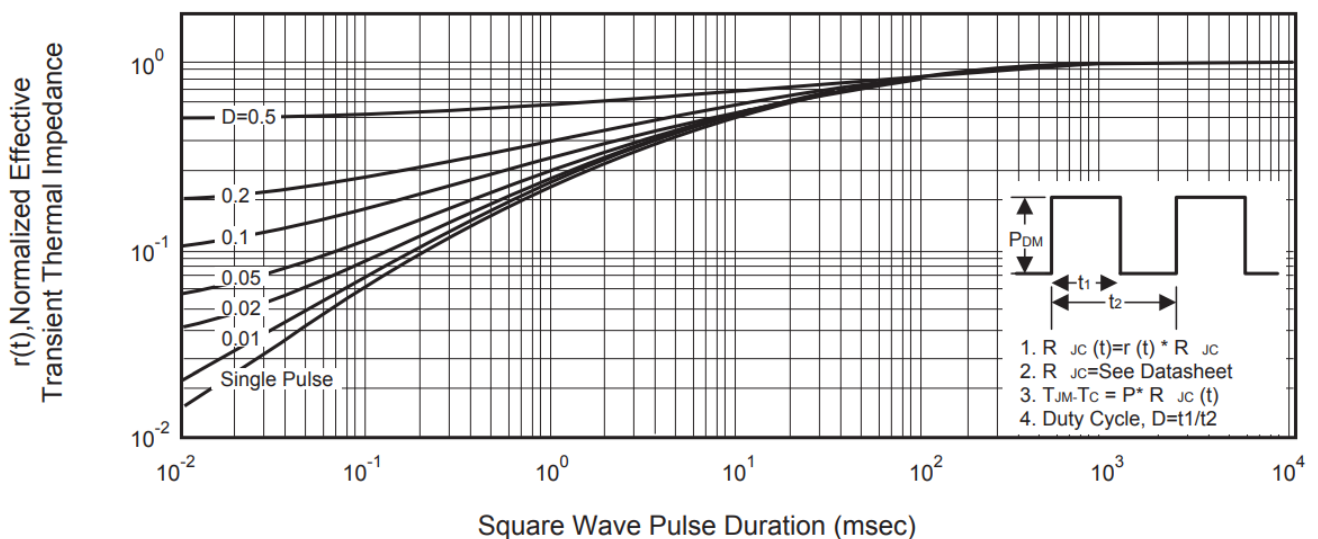
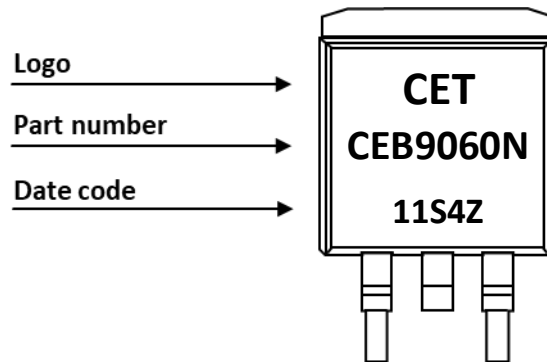


Fig. 11 • Normalized Thermal Transient Impedance Curve



## 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 (Min.)	Millimeters (Typ.)	Millimeters (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 (Min.)	Millimeters (Typ.)	Millimeters (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.
CEB9060N	TO263 (D2PAK)	Reel	800pcs	800pcs	6,400pcs

## RECOMMENDED PAD LAYOUT



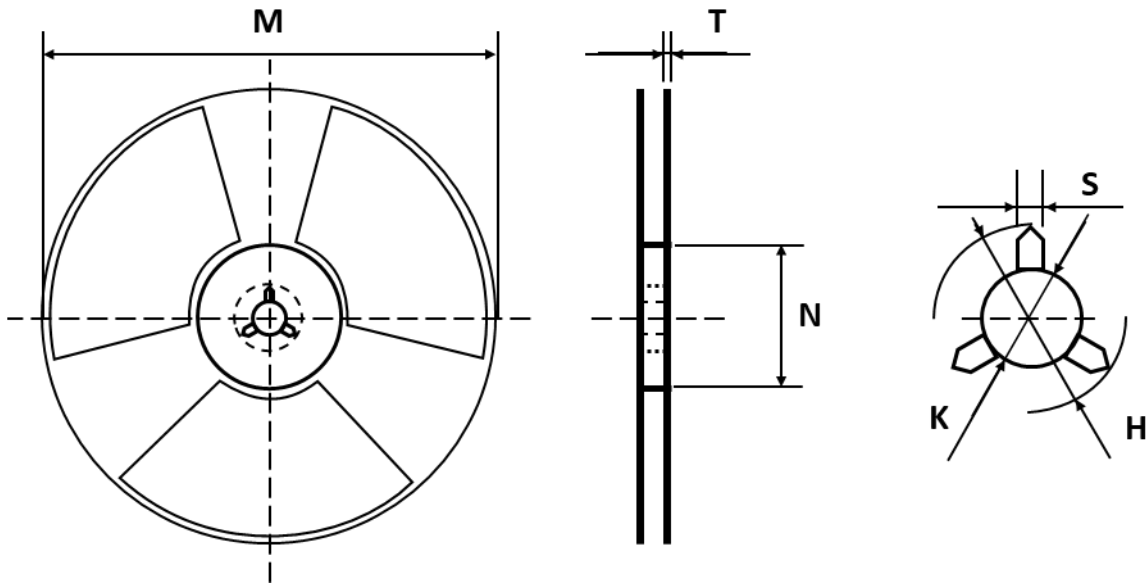
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F1	-	12.20	-
F2	-	16.90	-
F3	-	2.54	-
F4	-	5.08	-

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F5	-	2.54	-
F6	-	1.60	-
F7	-	9.75	-

### Notes:

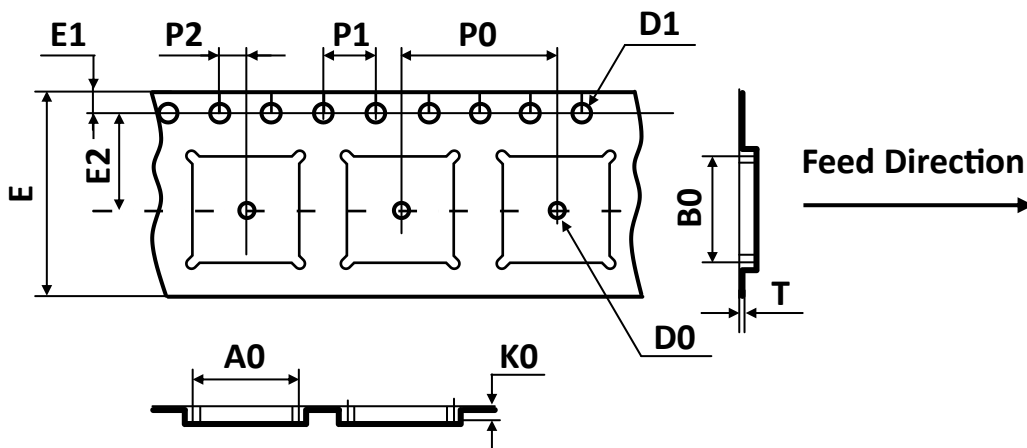
1. The suggested land pattern dimensions have been provided for reference only.
2. For further information, please reference document IPC-7351A.

## 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 -0.20	+0.50 -0.20

## TAPE DIMENSIONS ▲ All dimensions in mm

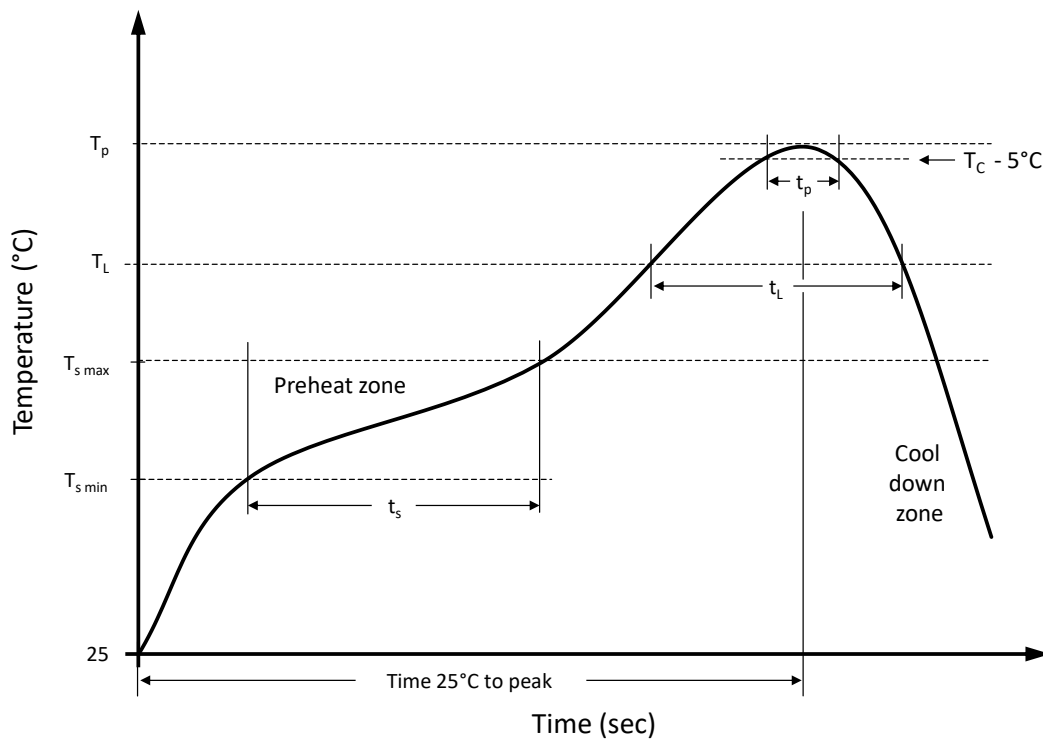


Package	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
TO263 (D <sup>2</sup> PAK)	10.80	16.30	4.85	1.50	1.55	24.00	1.75	11.50	16.00	4.00	2.00	0.35
	±0.10	±0.10	±0.10	±0.10	±0.05	±0.30	±0.10	±0.10	±0.10	±0.10	±0.10	±0.05

**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 <sub>s min</sub>	100 °C	150 °C
Preheat temperature max.	T <sub>s max</sub>	150 °C	200 °C
Preheat time t <sub>s</sub> from T <sub>s min</sub> to T <sub>s max</sub>	t <sub>s</sub>	120 seconds	120 seconds
Ramp-up rate (T <sub>L</sub> to T <sub>p</sub> )		max. 3 °C/second	max. 3 °C/second
Liquidous temperature	T <sub>L</sub>	183 °C	217 °C
Time t <sub>L</sub> maintained above T <sub>L</sub>	t <sub>L</sub>	150 seconds max.	150 seconds max.
Peak package body temperature	T <sub>p</sub>	235°C	260°C
Timeframe of within 5°C below and up to max actual peak body temperature	t <sub>p</sub>	20 seconds max.	30 seconds max.
Ramp-down rate (T <sub>L</sub> to T <sub>p</sub> )		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

## DISCLAIMER

Except for the written expressed warranties, MGT does not implicitly, by assumption or whatever else, warrant, under-take, promise any other warranty or guaranty for any MGT product.

All information and technical specifications made available by MGT are for guidance only and we reserve the right to change or modify them without prior notice. Unless expressly stated in writing by MGT, we reject any guarantees, obligations, or warranties.

All MGT products with the technical specifications described are suitable for use in certain applications. Operating, production, storage and environmental conditions can have a massive influence on the parameters mentioned in the data sheets, which cause the performance to vary over time.

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.

MGT components are not designed or rated for use in life support, rescue, safety critical, military, or aerospace applications where failure or malfunction could result in property or environmental damage, serious injury or death. In the aforementioned cases, please contact us before using MGT products.

In principle, we reserve all rights and MGT's general terms and conditions apply. You can find them on our website [www.mgt.co.com](http://www.mgt.co.com).