



CEB13N65S

650V ▲ 270mΩ ▲ 13.8A ▲ 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



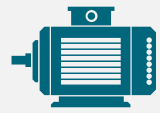




MAXIMUM RATINGS

Parameter ($T_C = 25^\circ\text{C}$, unless otherwise noted)		Characteristics
Drain-Source Voltage	V_{DS}	650V
Gate-Source Voltage	V_{GS}	$\pm 30\text{V}$
Continuous Drain Current at $T_C = 25^\circ\text{C}$	I_D	13.8A
Continuous Drain Current at $T_C = 100^\circ\text{C}$	I_D	6.2A
Pulsed Drain Current ^{Note 1}	I_{DM} ^{Note 5}	55.2A
Maximum Power Dissipation at $T_C = 25^\circ\text{C}$	P_D	160W
Power Dissipation Derating above 25°C	ΔP_D	$1.28\text{W}/^\circ\text{C}$
Single Pulsed Avalanche Energy ^{Note 6}	E_{AS}	306mJ
Single Pulsed Avalanche Current ^{Note 6}	I_{AS}	3.5A
Operating and Storage Temperature Range	T_J, T_{STG}	-55°C to $+150^\circ\text{C}$

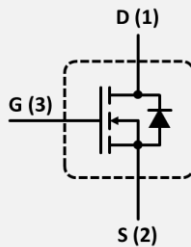
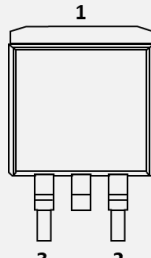
THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Case	R_{TH_JC}	$0.78^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	R_{TH_JA}	$62.5^\circ\text{C}/\text{W}$

APPLICATIONS

EV Charging	Industrial Inverters	Motors & Drives	Power Factor Correction	Renewable Energy	SMPS	UPS
						

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
Off Characteristics						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	BV_{DSS}	650			V
Zero Gate Voltage Drain Current	$V_{DS} = 650V, V_{GS} = 0V$	I_{DSS}			1	μA
Gate Body Leakage Current, Forward	$V_{GS} = 30V, V_{DS} = 0V$	I_{GSSF}			100	nA
Gate Body Leakage Current, Reverse	$V_{GS} = -30V, V_{DS} = 0V$	I_{GSSR}			-100	nA
On Characteristics ^{Note 2}						
Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu A$	$V_{GS(th)}$	2.5		4.5	V
Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 6A$	$R_{DS(ON)}$		270	320	m Ω
Dynamic Characteristics ^{Note 3}						
Input Capacitance	$V_{DS} = 150V, V_{GS} = 0V, f = 1MHz$	C_{ISS}		910		pF
Output Capacitance	$V_{DS} = 150V, V_{GS} = 0V, f = 1MHz$	C_{OSS}		60		pF
Reverse Transfer Capacitance	$V_{DS} = 150V, V_{GS} = 0V, f = 1MHz$	C_{RSS}		15		pF
Switching Characteristics ^{Note 3}						
Turn-On Delay Time	$V_{DD} = 400V, V_{GS} = 10V, I_D = 6A, R_{G(ext)} = 10\Omega$	$t_{D(ON)}$		30		ns
Turn-On Rise Time	$V_{DD} = 400V, V_{GS} = 10V, I_D = 6A, R_{G(ext)} = 10\Omega$	t_R		13		ns
Turn-Off Delay Time	$V_{DD} = 400V, V_{GS} = 10V, I_D = 6A, R_{G(ext)} = 10\Omega$	$t_{D(OFF)}$		65		ns
Turn-Off Fall Time	$V_{DD} = 400V, V_{GS} = 10V, I_D = 6A, R_{G(ext)} = 10\Omega$	t_F		11		ns
Total Gate Charge	$V_{DS} = 400V, V_{GS} = 10V, I_D = 1A$	Q_G		25		nC
Gate Source Charge	$V_{DS} = 400V, V_{GS} = 10V, I_D = 1A$	Q_{GS}		4		nC
Gate Drain Charge	$V_{DS} = 400V, V_{GS} = 10V, I_D = 1A$	Q_{GD}		10		nC
Drain-Source Diode Characteristics and Maximum Ratings						
Drain-Source Diode Forward Current		I_S			15	A
Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_S = 6A$	V_{SD}			1.2	V
Reverse Recovery Time	$I_D = 6A, di/dt = 100A/\mu s$	t_{RR}		240		ns
Reverse Recovery Charge	$I_D = 6A, di/dt = 100A/\mu s$	Q_{RR}		2.35		μC
Peak Reverse Recovery Current	$I_D = 6A, di/dt = 100A/\mu s$	I_{RR}		16.8		A

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: Limited only by maximum temperature allowed.
- 5: Pulse width limited by safe operating area.
- 6: $L = 50mH, I_{AS} = 3.5A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ C$

REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

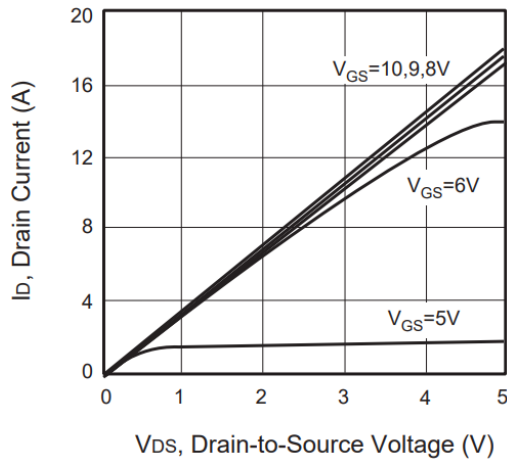


Fig. 2 • Transfer Characteristics

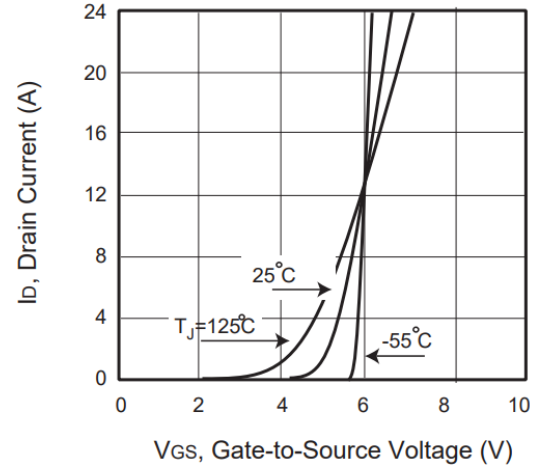


Fig. 3 • Capacitance

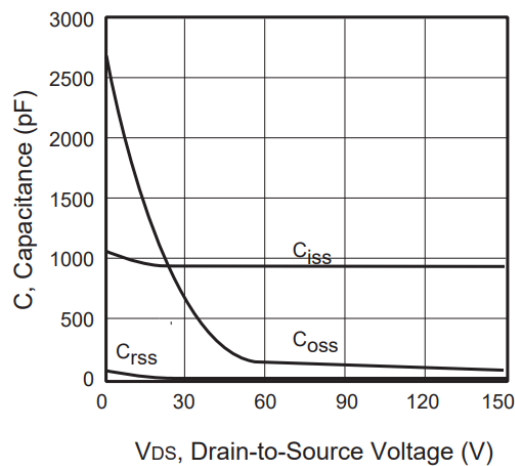


Fig. 4 • On-Resistance Variation with Temperature

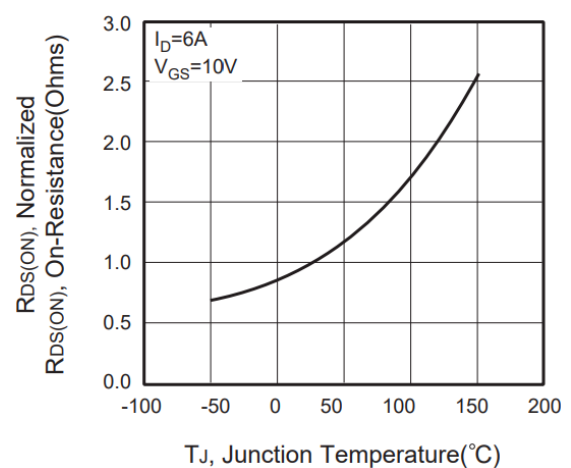


Fig. 5 • Gate Threshold Variation with Temperature

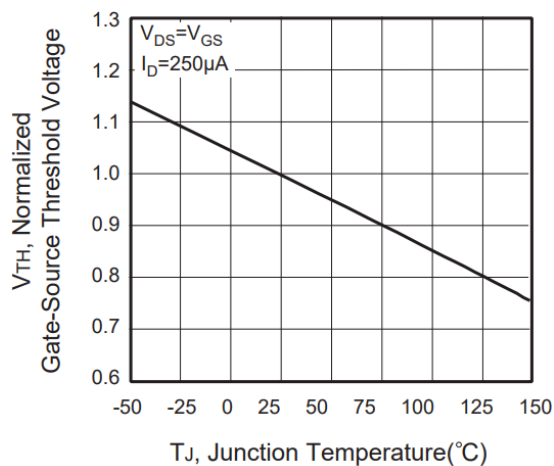
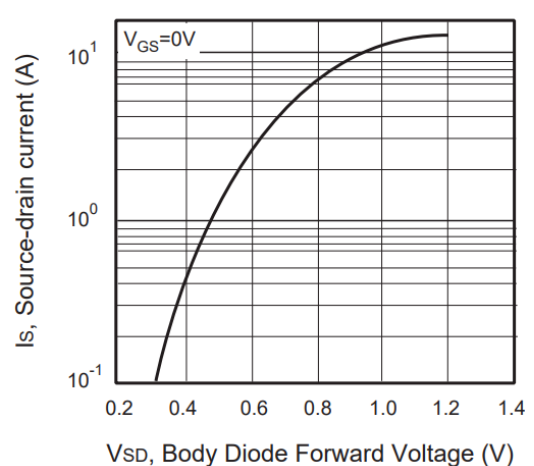


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

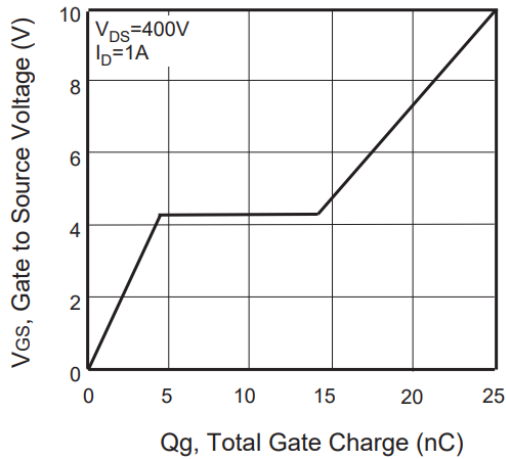


Fig. 8 • Maximum Safe Operating Area

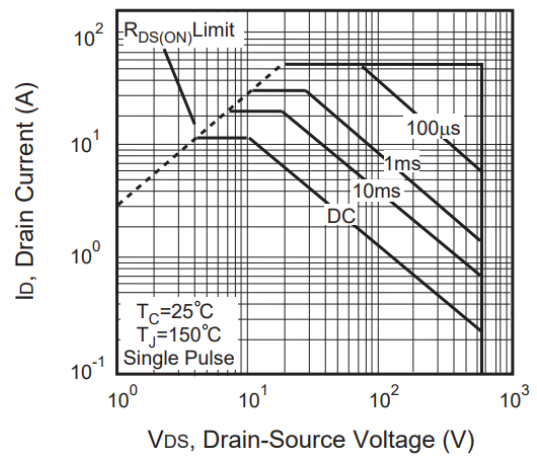


Fig. 9 • Breakdown Voltage Variation vs. Temperature

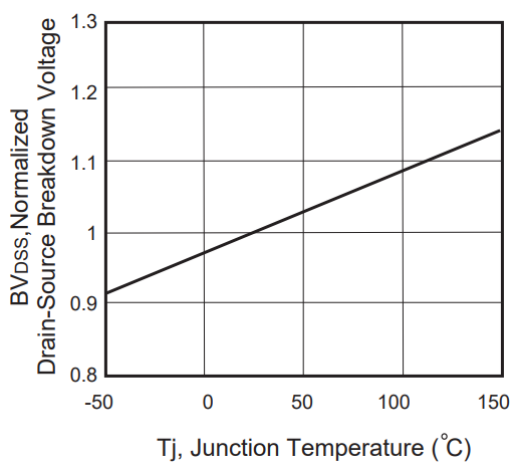


Fig. 10 • Switching Test Circuit

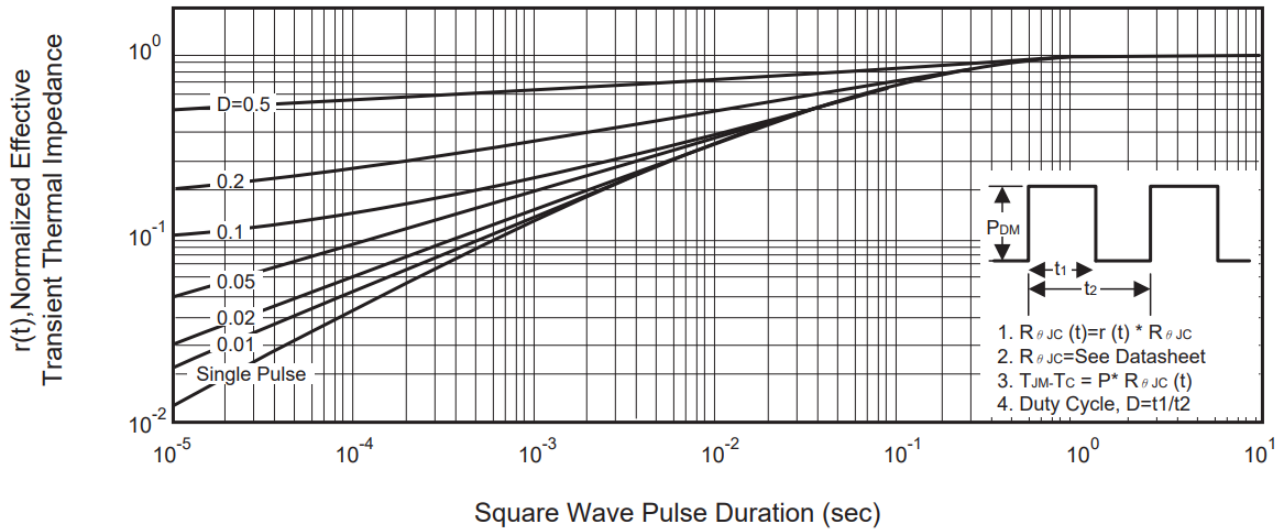


Fig. 11 • Switching Waveforms

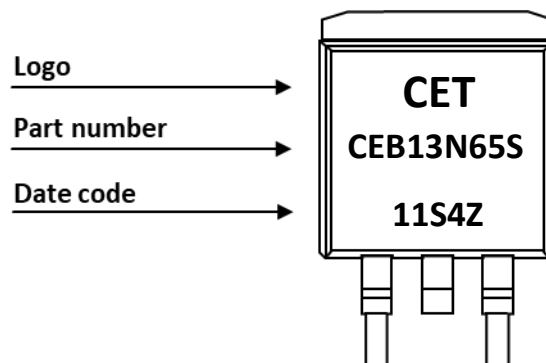


REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

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



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.
CEB13N65S	TO263 (D2PAK)	Reel	800pcs	800pcs	6,400pcs

RECOMMENDED PAD LAYOUT

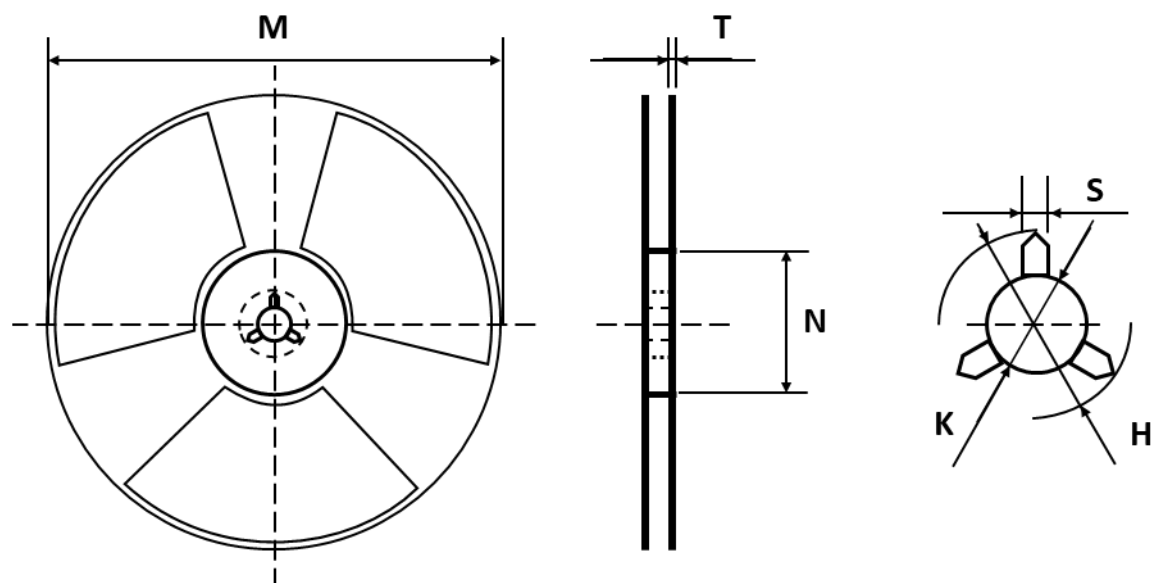


Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F1	-	12.20	-
F2	-	16.90	-
F3	-	2.54	-
F4	-	5.08	-

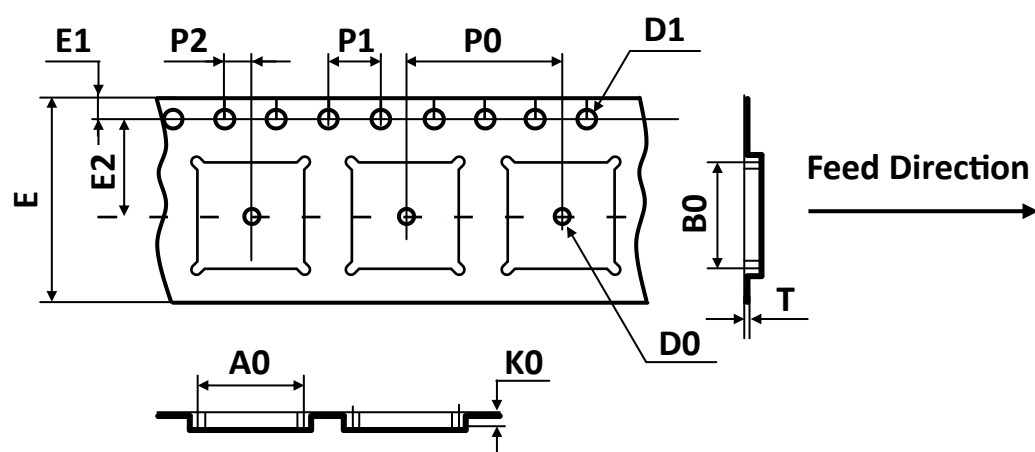
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F5	-	2.54	-
F6	-	1.60	-
F7	-	9.75	-

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 ² 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.	$T_{s \min}$	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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