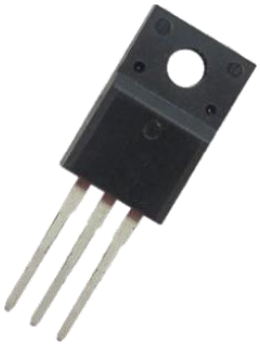


CEF12N65A

650V ▲ 620mΩ ▲ 12A[Note 4] ▲ Si MOSFET

SILICON Si MOSFET ▲ THT type
N-channel enhancement mode
UL94V-0 rated flame retardant epoxy
TO220F-3L package▲ Electrical insulated mounting tab
Super high dense cell density for extremely low $R_{DS(ON)}$
High power and current handling capability

MAXIMUM RATINGS

Parameter (T_C = 25°C, unless otherwise noted)		Characteristics
Drain-Source Voltage	V_{DS}	650V
Gate-Source Voltage	V_{GS}	±30V
Continuous Drain Current at T_C = 25°C	I_D	12A Note 4
Continuous Drain Current at T_C = 100°C	I_D	8.5A Note 4
Pulsed Drain Current Note 1	I_{DM} Note 5	48A Note 4
Maximum Power Dissipation at T_C = 25°C	P_D	60W
Power Dissipation Derating above 25°C	ΔP_D	0.4W/°C
Single Pulsed Avalanche Energy Note 6	E_{AS}	500mJ
Single Pulsed Avalanche Current Note 6	I_{AS}	10A
Operating and Storage Temperature Range	T_J, T_{STG}	-55°C to +175°C

THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Case	R_{TH_JC}	2.5°C/W
Thermal Resistance, Junction-to-Ambient	R_{TH_JA}	65°C/W

APPLICATIONS

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

PIN DESCRIPTION

Circuit Diagram	Outline ▪ Front View	Pin No.	Description
D (2), G (1), S (3)	1 2 3	1 2 3	Gate Drain Source

ELECTRICAL CHARACTERISTICS ▲ T_C = 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}	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 = 250μA	$V_{GS(th)}$	2		4	V
Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 5.5A	$R_{DS(ON)}$		620	750	mΩ
Dynamic Characteristics Note 3						
Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz	C_{ISS}		1650		pF
Output Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz	C_{OSS}		175		pF
Reverse Transfer Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz	C_{RSS}		5		pF
Switching Characteristics Note 3						
Turn-On Delay Time	V_{DD} = 300V, V_{GS} = 10V, I_D = 12A, $R_{G(ext)}$ = 25Ω	$t_{D(ON)}$		38		ns
Turn-On Rise Time	V_{DD} = 300V, V_{GS} = 10V, I_D = 12A, $R_{G(ext)}$ = 25Ω	t_R		61		ns
Turn-Off Delay Time	V_{DD} = 300V, V_{GS} = 10V, I_D = 12A, $R_{G(ext)}$ = 25Ω	$t_{D(OFF)}$		103		ns
Turn-Off Fall Time	V_{DD} = 300V, V_{GS} = 10V, I_D = 12A, $R_{G(ext)}$ = 25Ω	t_F		66		ns
Total Gate Charge	V_{DS} = 400V, V_{GS} = 10V, I_D = 12A	Q_G		33		nC
Gate Source Charge	V_{DS} = 400V, V_{GS} = 10V, I_D = 12A	Q_{GS}		7.6		nC
Gate Drain Charge	V_{DS} = 400V, V_{GS} = 10V, I_D = 12A	Q_{GD}		9.4		nC
Drain-Source Diode Characteristics and Maximum Ratings						
Drain-Source Diode Forward Current		I_S			5.9	A
Drain-Source Diode Forward Voltage Note 2	V_{GS} = 0V, I_S = 5.9A	V_{SD}			1.4	V

Notes

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

2: Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 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 = 10mH, I_{AS} = 10A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C

REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 ▪ Output Characteristics

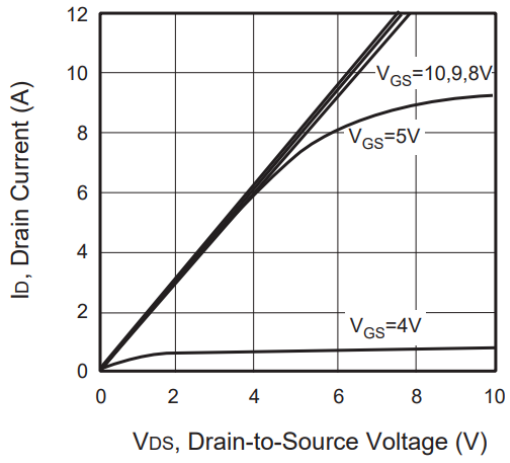


Fig. 2 ▪ Transfer Characteristics

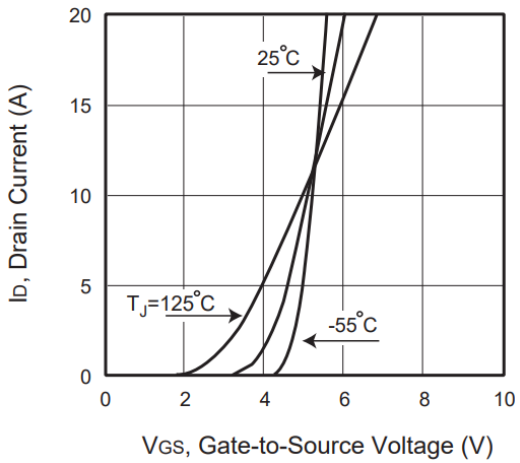


Fig. 3 ▪ Capacitance

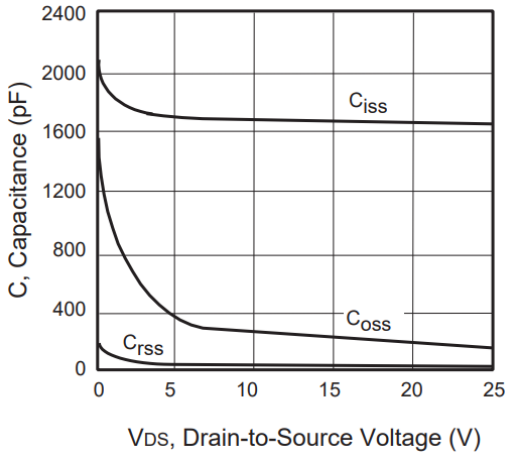


Fig. 4 ▪ On-Resistance Variation with Temperature

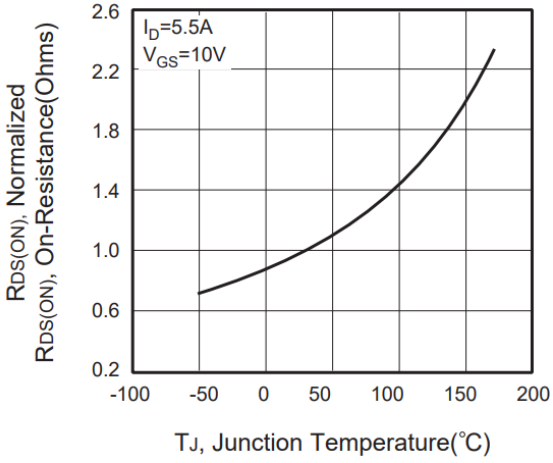


Fig. 5 ▪ Gate Threshold Variation with Temperature

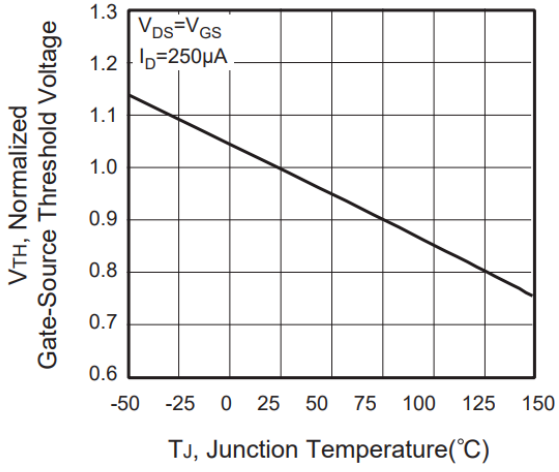
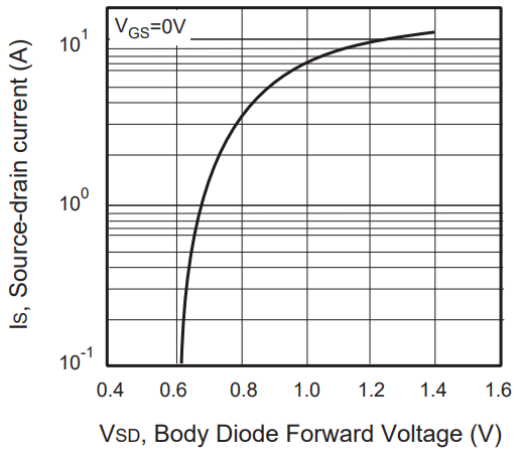


Fig. 6 ▪ Body Diode Forward Voltage Variation with Source Current



REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 ▪ Gate Charge

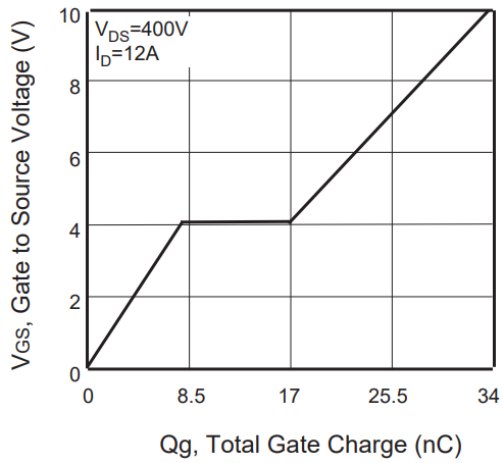


Fig. 8 ▪ Maximum Safe Operating Area

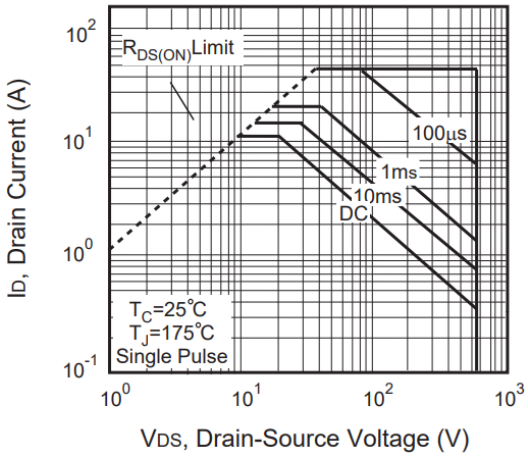


Fig. 9 ▪ Breakdown Voltage Variation vs. Temperature

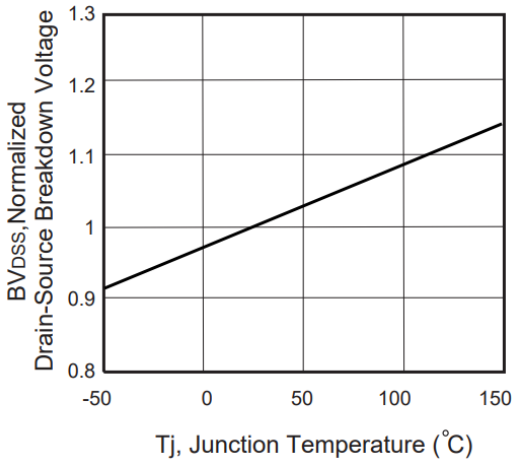


Fig. 10 ▪ Switching Test Circuit

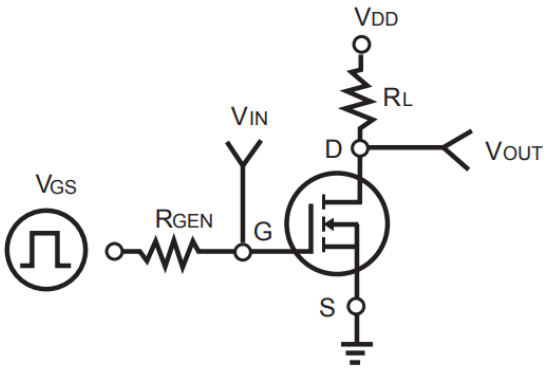
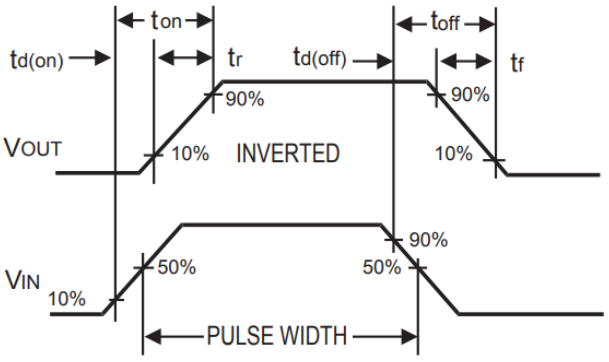
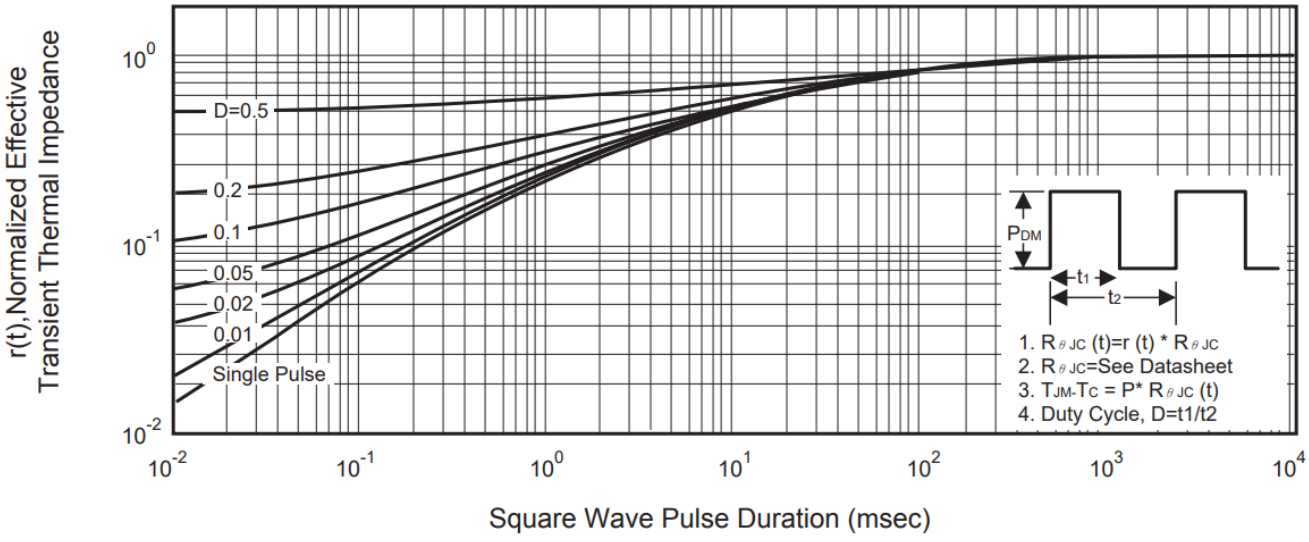


Fig. 11 ▪ Switching Waveforms

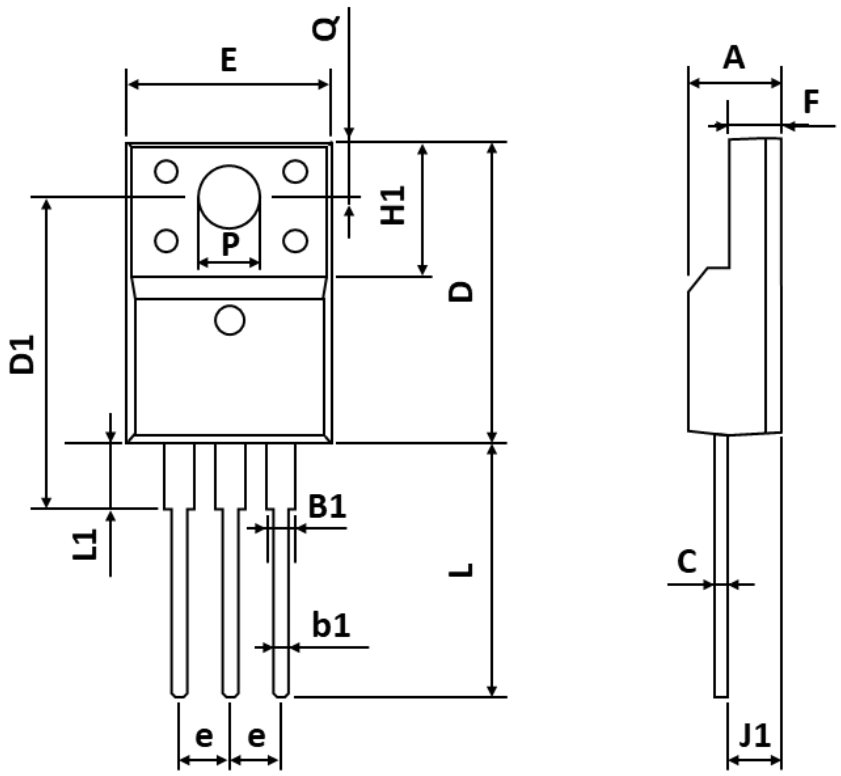


REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 12 ▪ Normalized Thermal Transient Impedance Curve



PACKAGE OUTLINE

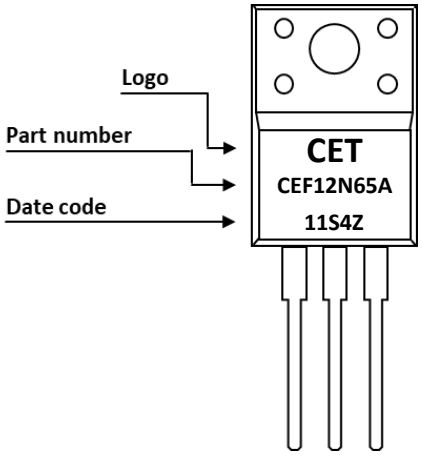


Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
A	4.500	-	5.000
B1	1.000	-	1.500
b1	0.700	-	0.950
C	0.420	-	0.700
D	15.670	-	16.070
D1	14.800	-	16.000
E	9.960	-	10.360
e	2.340	-	2.740
F	2.340	-	2.740
H1	6.480	-	6.900
J1	2.550	-	2.950
L	12.080	-	13.480
L1	2.230	-	3.650
Q	3.100	-	3.500
P	2.980	-	3.380

ORDERING INFORMATION

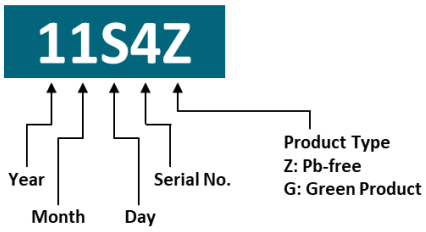
Part Number	Package	Packing	Tube Qty.	Inner Box Qty.	Outer Box Qty.
CEF12N65A	TO-220F-3L	Tube	50pcs	1,000pcs	4,000pcs

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									

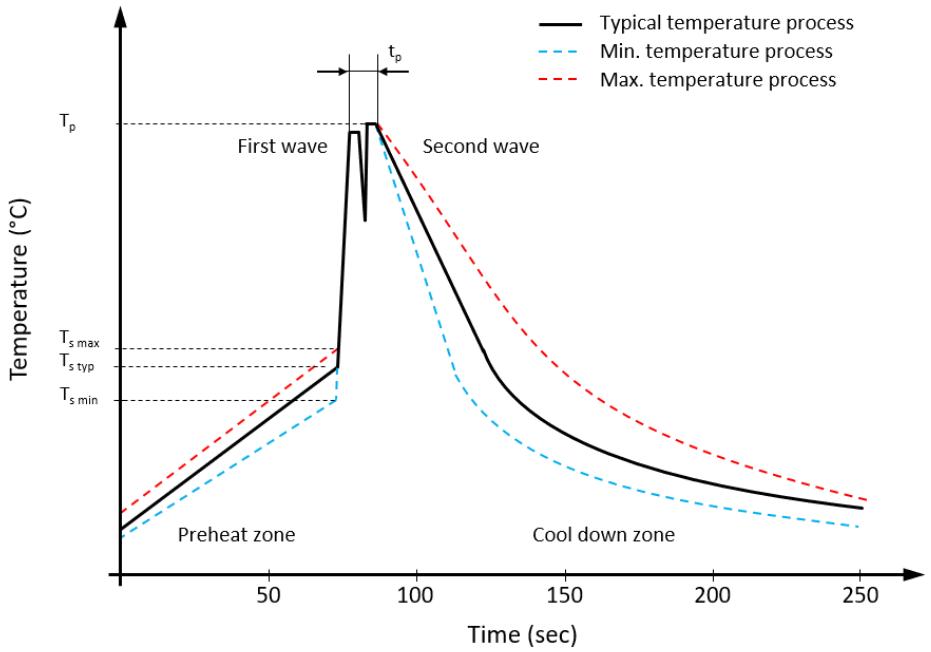
Coding list for „Month“

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

RECOMMENDED WAVE SOLDERING PROFILE ▲ THT PACKAGE



Classification wave soldering profile ▲ Refer to EN 61760-1: 2006

Profile Features		Value ▲ Sn-Pb Assembly	Value ▲ Pb-free Assembly
Preheat temperature min.	$T_{s\ min}$	100 °C	100 °C
Preheat temperature typical	$T_{s\ typ}$	120 °C	120 °C
Preheat temperature max.	$T_{s\ max}$	130 °C	130 °C
Preheat time t_s from $T_{s\ min}$ to $T_{s\ max}$	t_s	70 seconds	70 seconds
Peak temperature	T_p	235 °C to 260 °C	245 °C to 260 °C
Time of actual peak temperature	t_p	Max. 10 seconds Max. 5 second each wave	Max. 10 seconds Max. 5 second each wave
Ramp-down date min.		~ 2 °C/second	~ 2 °C/second
Ramp-down rate typical		~ 3.5 °C/second	~ 3.5 °C/second
Ramp-down rate max.		~ 5 °C/second	~ 5 °C/second
Time 25°C to 25°C		4 minutes	4 minutes

REVISION TABLE

Revision	Date	Status	Notes
001	30/09/2022	Initial release	Initial publication

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