

# CEB13N10

100V ▲ 140mΩ ▲ 12.8A ▲ 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	$V_{DS}$	100V
Gate-Source Voltage	$V_{GS}$	$\pm 20\text{V}$
Continuous Drain Current at $T_C = 25^\circ\text{C}$	$I_D$	12.8A
Pulsed Drain Current <sup>Note 1</sup>	$I_{DM}$	50A
Maximum Power Dissipation at $T_C = 25^\circ\text{C}$	$P_D$	65W
Power Dissipation Derating above $25^\circ\text{C}$	$\Delta P_D$	$0.43\text{W}/^\circ\text{C}$
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	$R_{TH\_JC}$	$2.3^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient <sup>Note 2</sup>	$R_{TH\_JA}$	$62.5^\circ\text{C}/\text{W}$

## APPLICATIONS

Battery Management Systems	E-Bike	Industrial Control	Power Inverter	UPS

## PIN DESCRIPTION

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

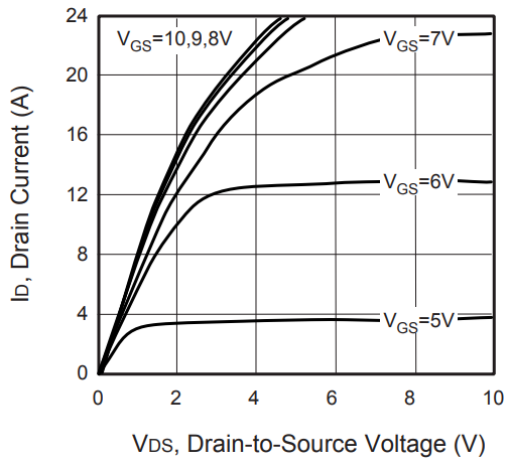
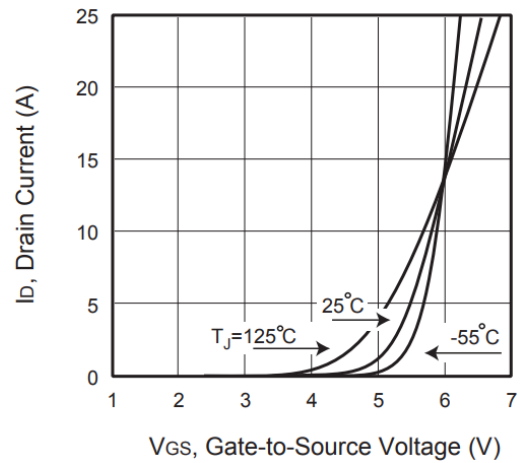
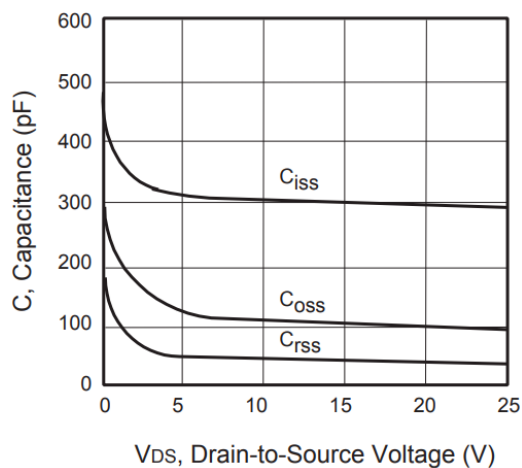
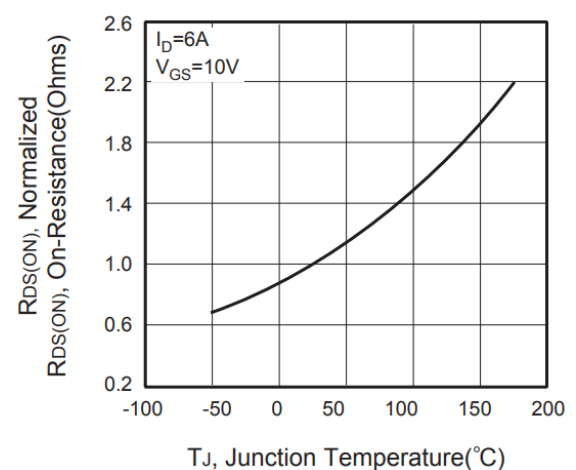
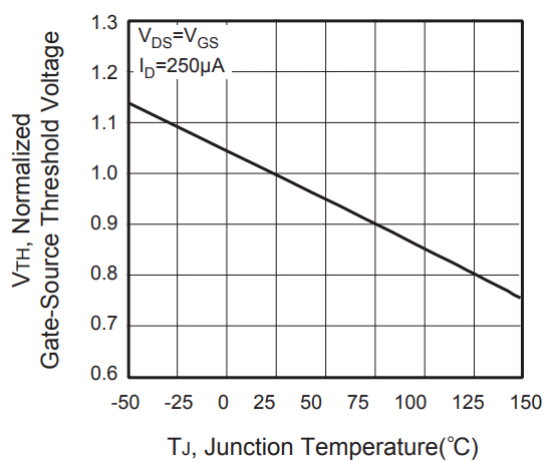
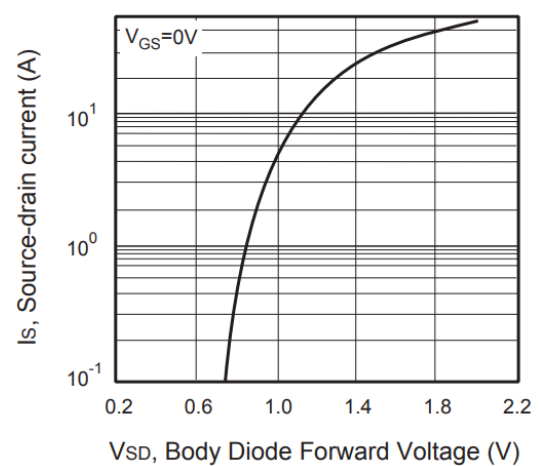
## ELECTRICAL CHARACTERISTICS ▲ $T_C = 25^\circ\text{C}$ , unless otherwise noted

Item	Condition	Symbol	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	100			V
Zero Gate Voltage Drain Current	$V_{DS} = 100V, V_{GS} = 0V$	$I_{DSS}$			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	$V_{GS} = V_{DS}, I_D = 250\mu A$	$V_{GS(th)}$	2		4	V
Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 6A$	$R_{DS(ON)}$		140	180	m $\Omega$
Forward Transconductance	$V_{DS} = 10V, I_D = 6A$	$g_{FS}$		5		S
<b>Dynamic Characteristics</b> <sup>Note 3</sup>						
Input Capacitance	$V_{DD} = 25V, V_{GS} = 0V, f = 1MHz$	$C_{ISS}$		295		pF
Output Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$	$C_{OSS}$		85		pF
Reverse Transfer Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$	$C_{RSS}$		35		pF
<b>Switching Characteristics</b> <sup>Note 3</sup>						
Turn-On Delay Time	$V_{DD} = 80V, V_{GS} = 10V, I_D = 12.8A, R_{G(ext)} = 9.1\Omega$	$t_{D(ON)}$		10	20	ns
Turn-On Rise Time	$V_{DD} = 80V, V_{GS} = 10V, I_D = 12.8A, R_{G(ext)} = 9.1\Omega$	$t_R$		8	16	ns
Turn-Off Delay Time	$V_{DD} = 80V, V_{GS} = 10V, I_D = 12.8A, R_{G(ext)} = 9.1\Omega$	$t_{D(OFF)}$		17	35	ns
Turn-Off Fall Time	$V_{DD} = 80V, V_{GS} = 10V, I_D = 12.8A, R_{G(ext)} = 9.1\Omega$	$t_F$		8	16	ns
Total Gate Charge	$V_{DD} = 80V, V_{GS} = 10V, I_D = 12.8A$	$Q_G$		12	16	nC
Gate Source Charge	$V_{DD} = 80V, V_{GS} = 10V, I_D = 12.8A$	$Q_{GS}$		3.3		nC
Gate Drain Charge	$V_{DD} = 80V, V_{GS} = 10V, I_D = 12.8A$	$Q_{GD}$		5.3		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
Drain-Source Diode Forward Current		$I_S$			12.8	A
Drain-Source Diode Forward Voltage <sup>Note 2</sup>	$V_{GS} = 0V, I_S = 12.8A$	$V_{SD}$			1.5	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.

## 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

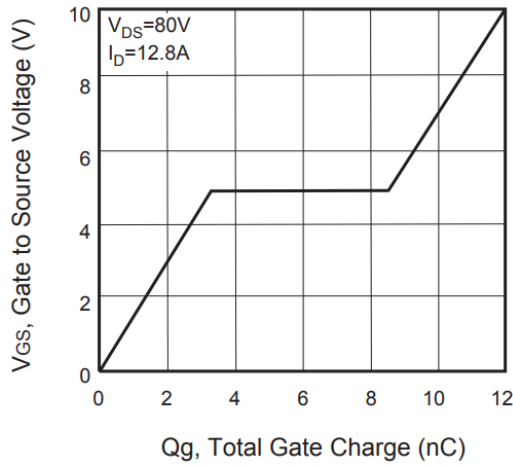


Fig. 8 • Maximum Safe Operating Area

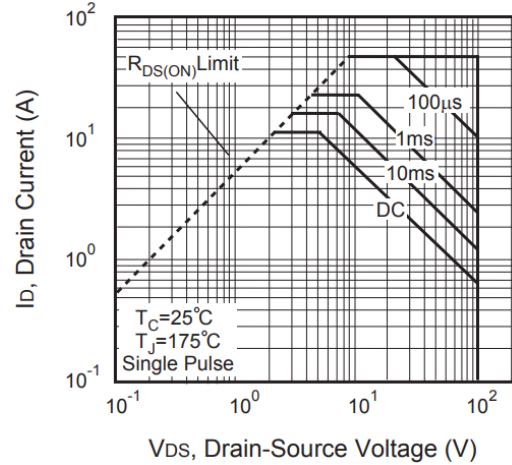


Fig. 9 • Switching Test Circuit

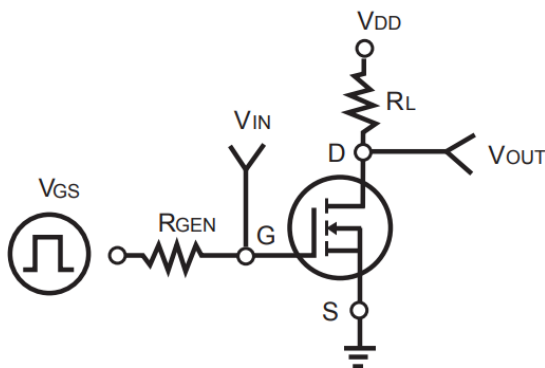


Fig. 10 • Switching Waveforms

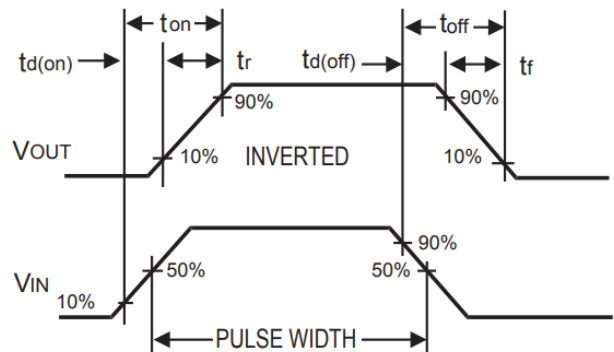
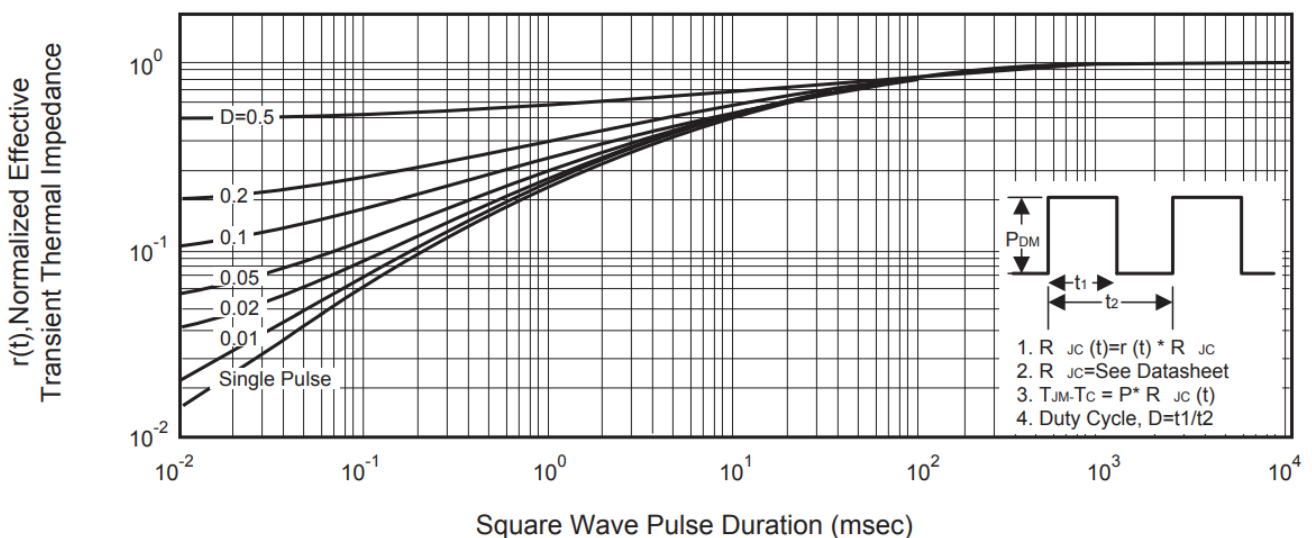
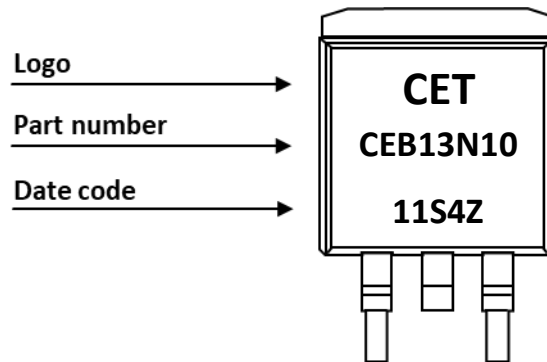


Fig. 11 • Switching Test Circuit

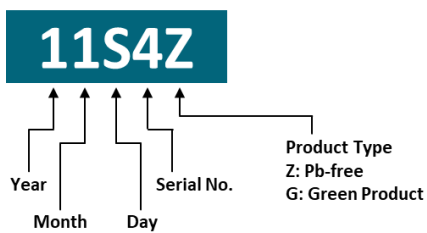


## PART MARKING



## 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									

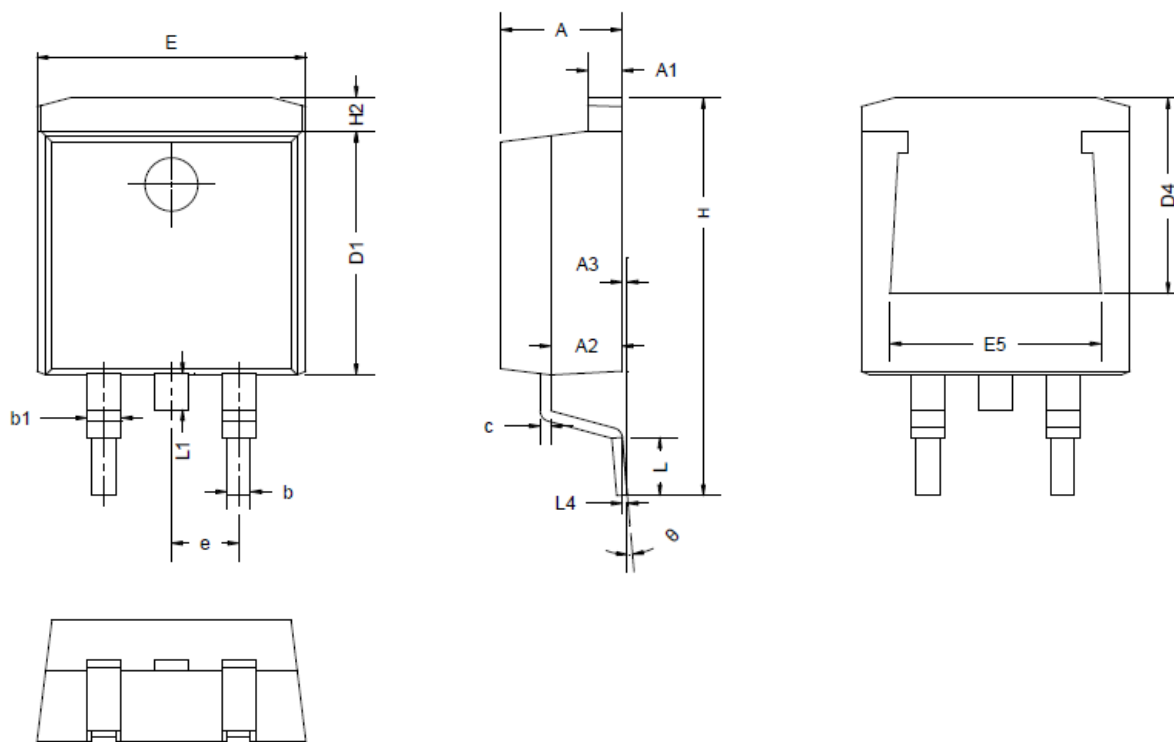
Coding list for „Month“

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



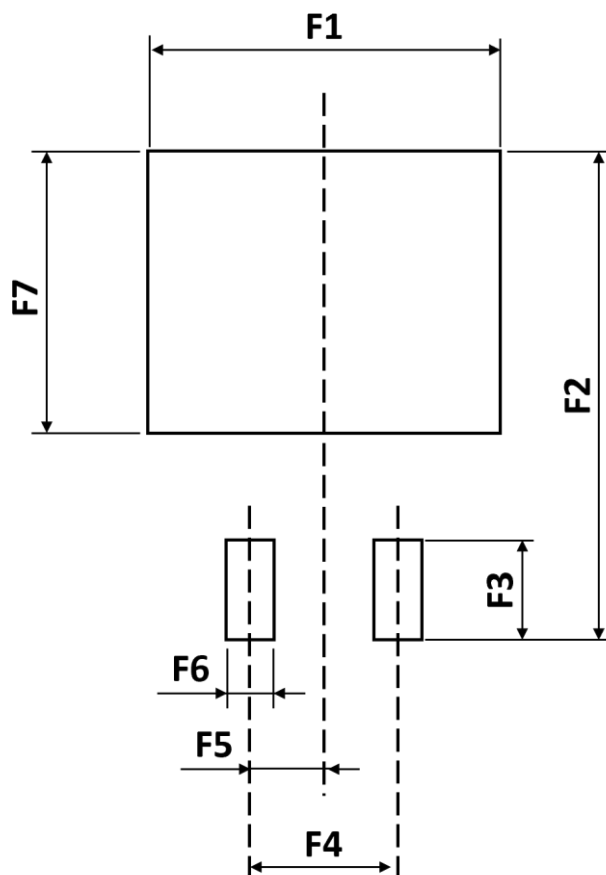
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-

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.
CEB13N10	TO263 (D2PAK)	Reel	800pcs	800pcs	6,400pcs

## RECOMMENDED PAD LAYOUT



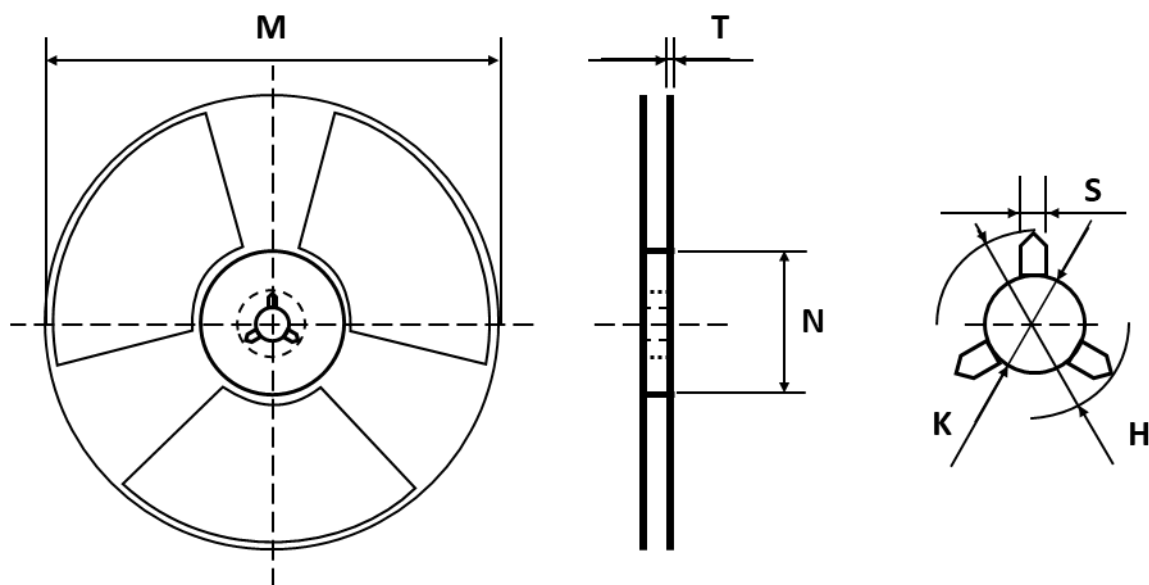
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F1	-	12.20	-
F2	-	16.90	-
F3	-	2.54	-
F4	-	5.08	-

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

### Notes:

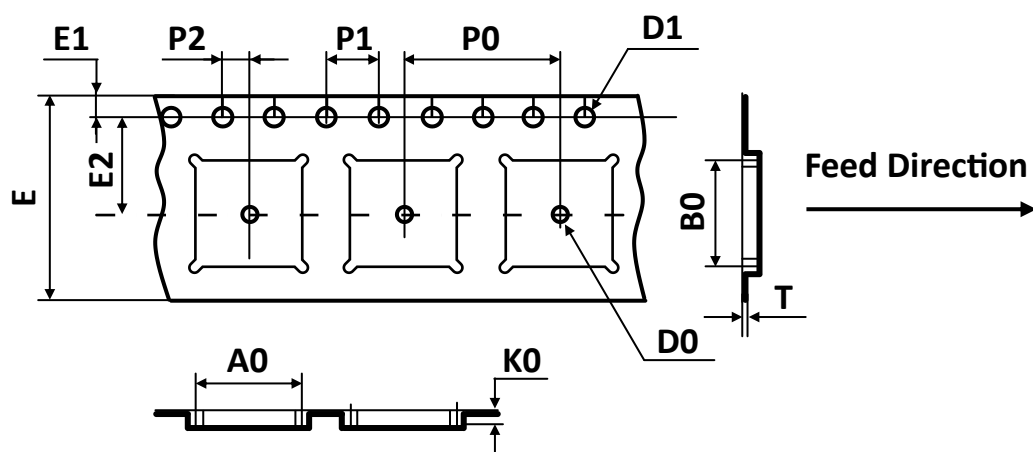
1. The suggested land pattern dimensions have been provided for reference only.
2. For further information, please reference document IPC-7351A.

## 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

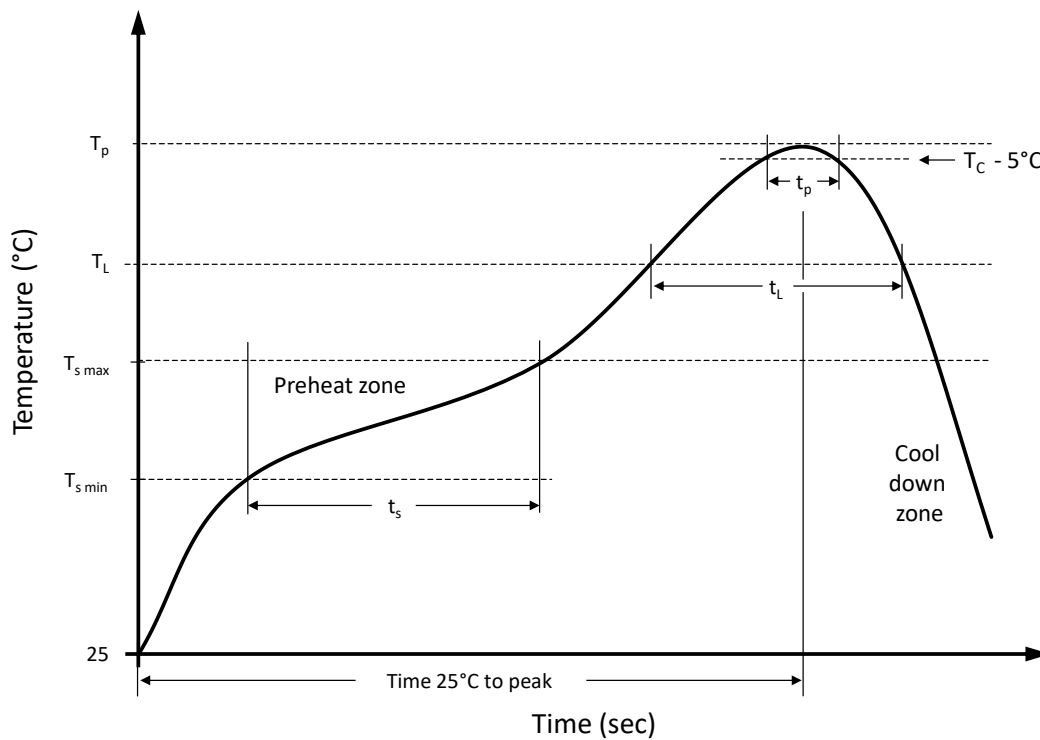
## TAPE DIMENSIONS ▲ All dimensions in mm



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

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