CEB60N15

150V ▲ 13.2mΩ ▲ 60A ▲ 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°C, unless otherwise noted)		Characteristics
Drain-Source Voltage	V_{DS}	150V
Gate-Source Voltage	V_{GS}	±20V
Continuous Drain Current at T_C = 25°C	I_D	60A
Continuous Drain Current at T_C = 100°C	I_D	38A
Pulsed Drain Current Note 1	I_{DM}	240A
Maximum Power Dissipation at T_C = 25°C	P_D	104W
Power Dissipation Derating above 25°C	ΔP_D	0.83W/°C
Single Pulsed Avalanche Energy Note 4	E_{AS}	31.25mJ
Single Pulsed Avalanche Current Note 4	I_{AS}	25A
Operating and Storage Temperature Range	T_J, T_{STG}	-55°C to +150°C

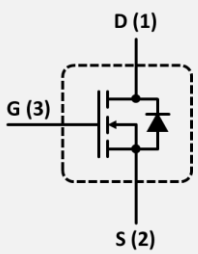
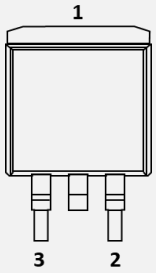
THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Case	R_{TH_JC}	1.2°C/W
Thermal Resistance, Junction-to-Ambient Note 2	R_{TH_JA}	62.5°C/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°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}	150			V
Zero Gate Voltage Drain Current	V_{DS} = 150V, V_{GS} = 0V	I_{DSS}			1	µA
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
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 = 20A	$R_{DS(ON)}$		13.2	17	mΩ
Dynamic Characteristics Note 3						
Input Capacitance	V_{DS} = 75V, V_{GS} = 0V, f = 1MHz	C_{ISS}		1920		pF
Output Capacitance	V_{DS} = 75V, V_{GS} = 0V, f = 1MHz	C_{OSS}		225		pF
Reverse Transfer Capacitance	V_{DS} = 75V, V_{GS} = 0V, f = 1MHz	C_{RSS}		15		pF
Switching Characteristics Note 3						
Turn-On Delay Time	V_{DD} = 75V, V_{GS} = 10V, I_D = 20A, $R_{G(ext)}$ = 10Ω	$t_{D(ON)}$		25		ns
Turn-On Rise Time	V_{DD} = 75V, V_{GS} = 10V, I_D = 20A, $R_{G(ext)}$ = 10Ω	t_R		6		ns
Turn-Off Delay Time	V_{DD} = 75V, V_{GS} = 10V, I_D = 20A, $R_{G(ext)}$ = 10Ω	$t_{D(OFF)}$		38		ns
Turn-Off Fall Time	V_{DD} = 75V, V_{GS} = 10V, I_D = 20A, $R_{G(ext)}$ = 10Ω	t_F		7		ns
Total Gate Charge	V_{DS} = 75V, V_{GS} = 10V, I_D = 20A	Q_G		30		nC
Gate Source Charge	V_{DD} = 75V, V_{GS} = 10V, I_D = 20A	Q_{GS}		9		nC
Gate Drain Charge	V_{DD} = 75V, V_{GS} = 10V, I_D = 20A	Q_{GD}		6		nC
Drain-Source Diode Characteristics and Maximum Ratings						
Drain-Source Diode Forward Current		I_S			60	A
Drain-Source Diode Forward Voltage Note 2	V_{GS} = 0V, I_S = 20A	V_{SD}			1.2	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: L = 0.1mH, I_{AS} = 25A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C

5: Pulse width limited by safe operating area.

REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 ▪ Output Characteristics

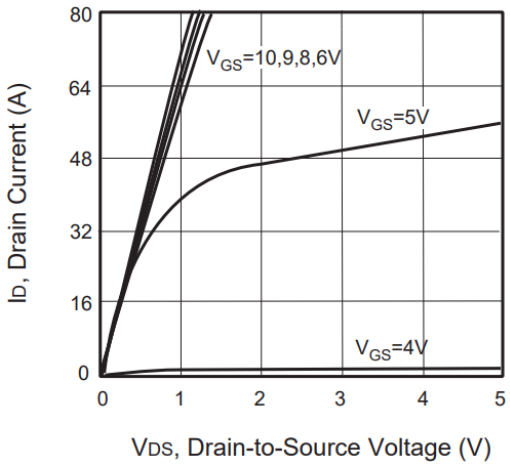


Fig. 2 ▪ Transfer Characteristics

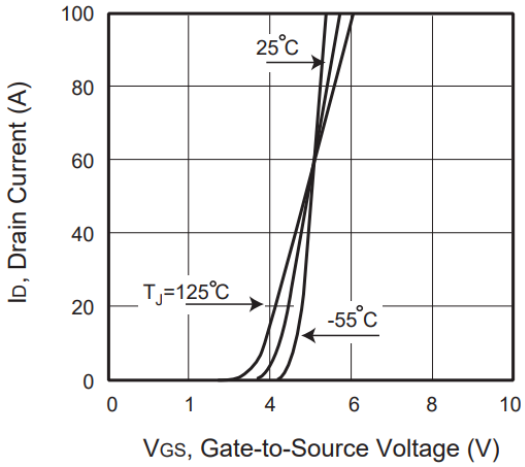


Fig. 3 ▪ Capacitance

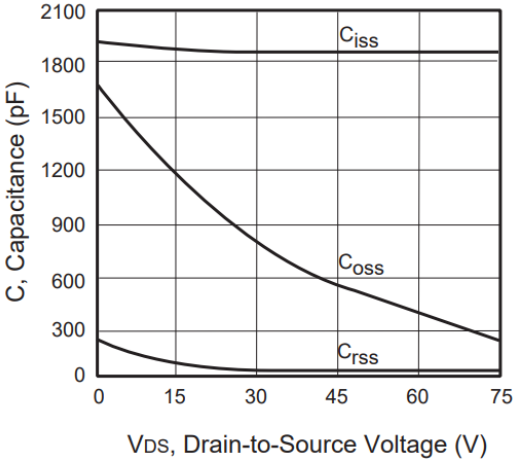


Fig. 4 ▪ On-Resistance Variation with Temperature

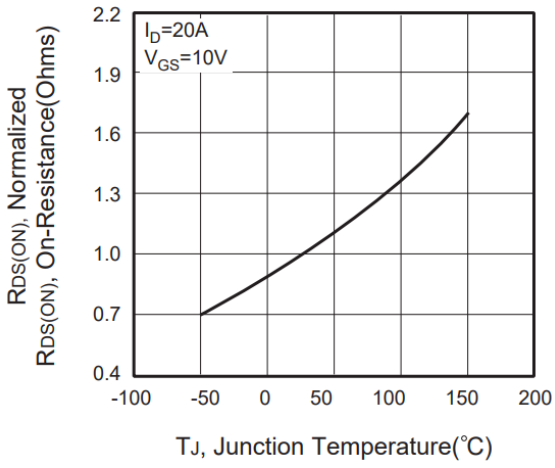


Fig. 5 ▪ Gate Threshold Variation with Temperature

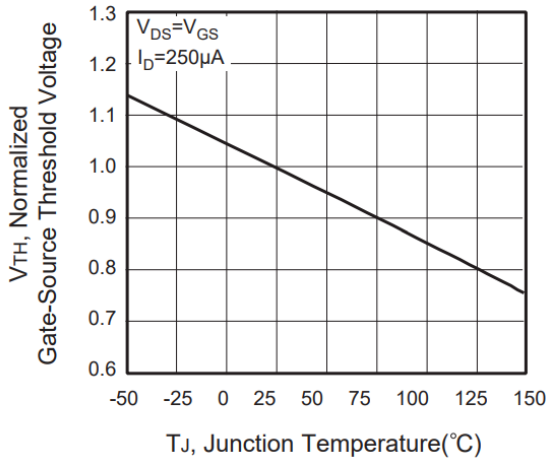
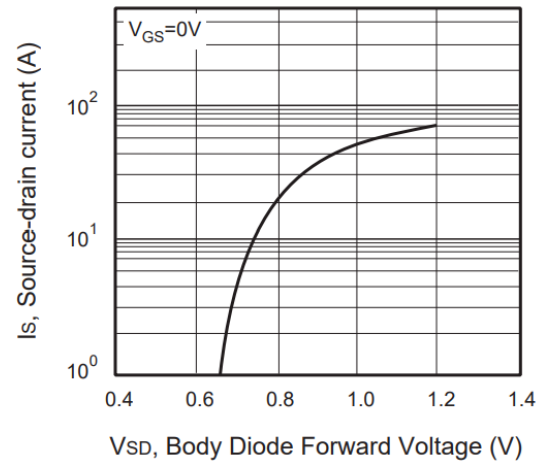


Fig. 6 ▪ Body Diode Forward Voltage Variation with Source Current



REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 ▪ Gate Charge

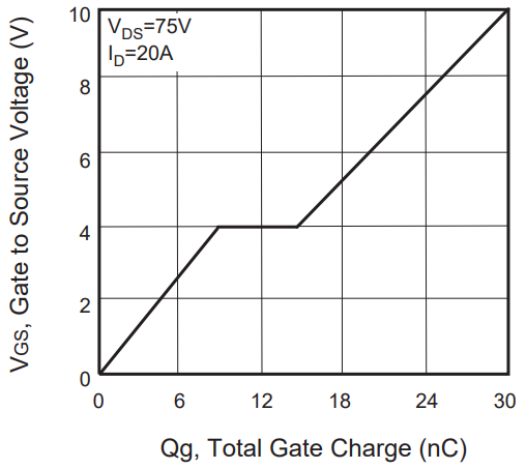


Fig. 8 ▪ Maximum Safe Operating Area

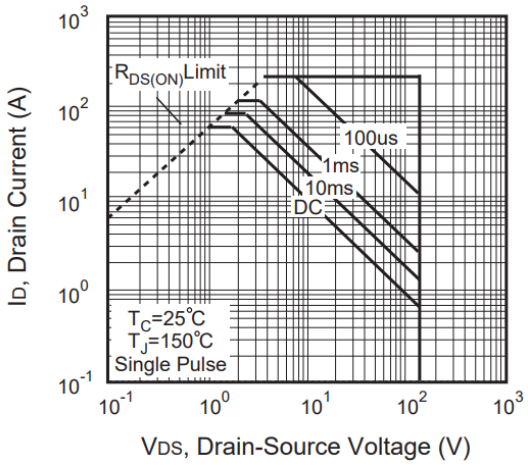


Fig. 9 ▪ Breakdown Voltage Variation vs. Temperature

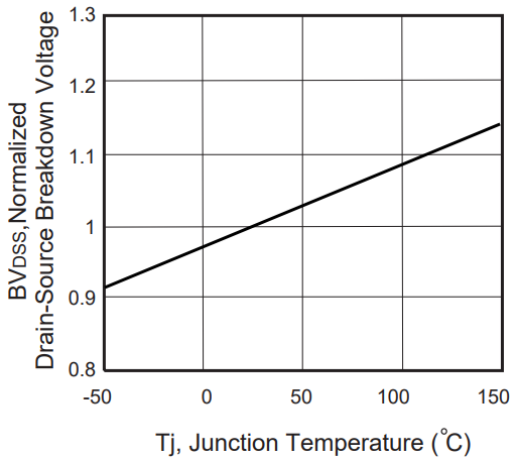


Fig. 10 ▪ Switching Test Circuit

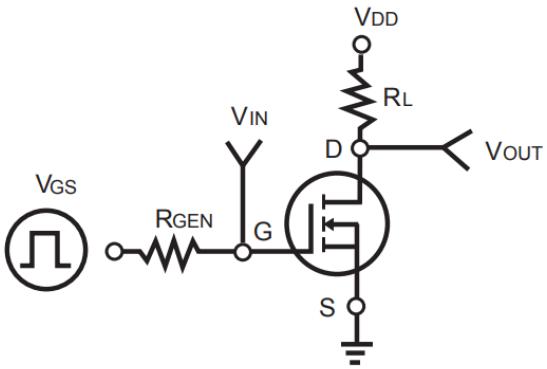
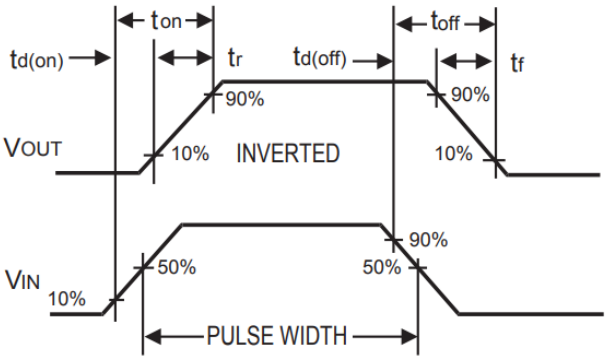
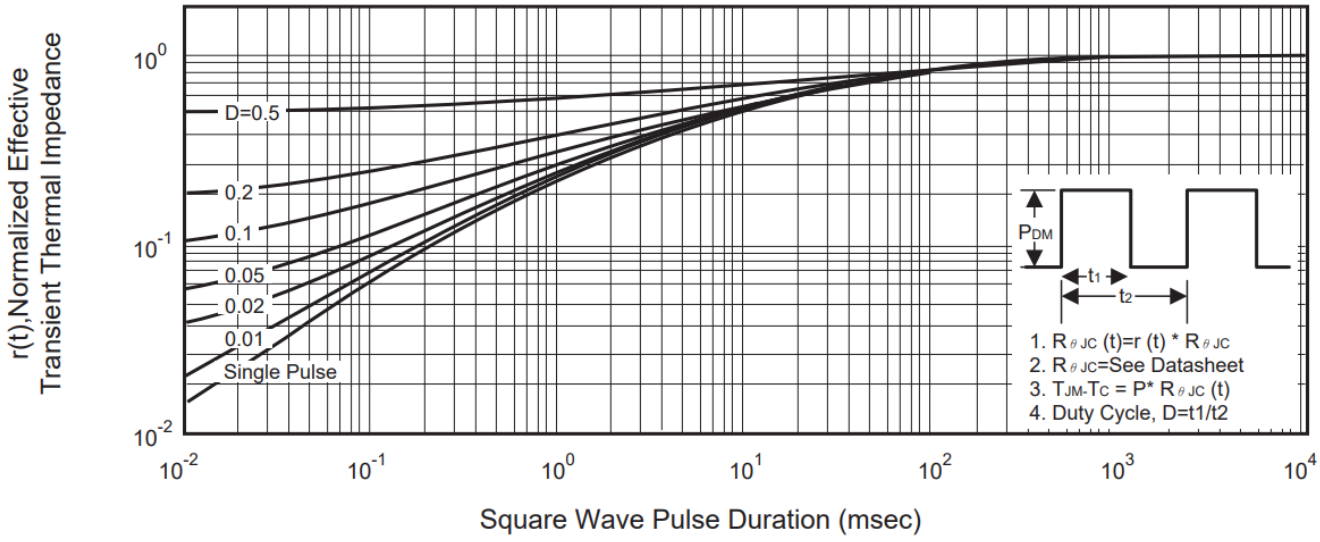


Fig. 11 ▪ Switching Waveforms

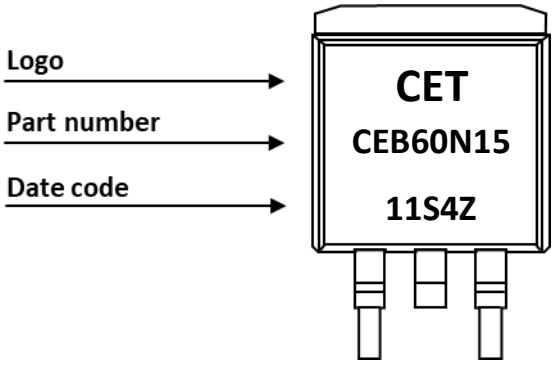


REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 12 ▪ Normalized Thermal Transient Impedance Curve

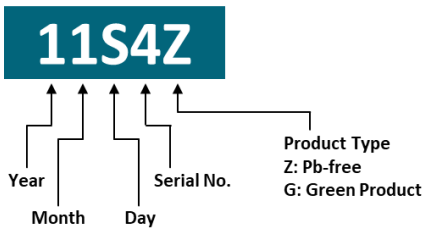


PART MARKING



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									

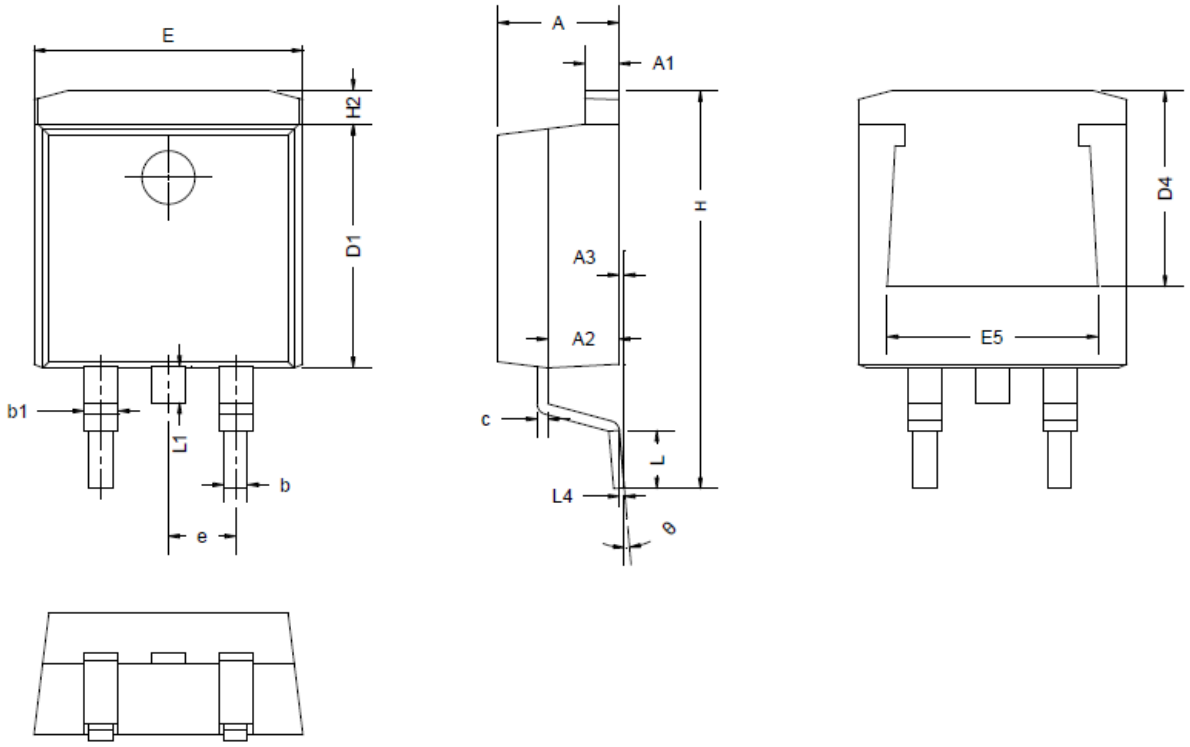
Coding list for „Month“

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



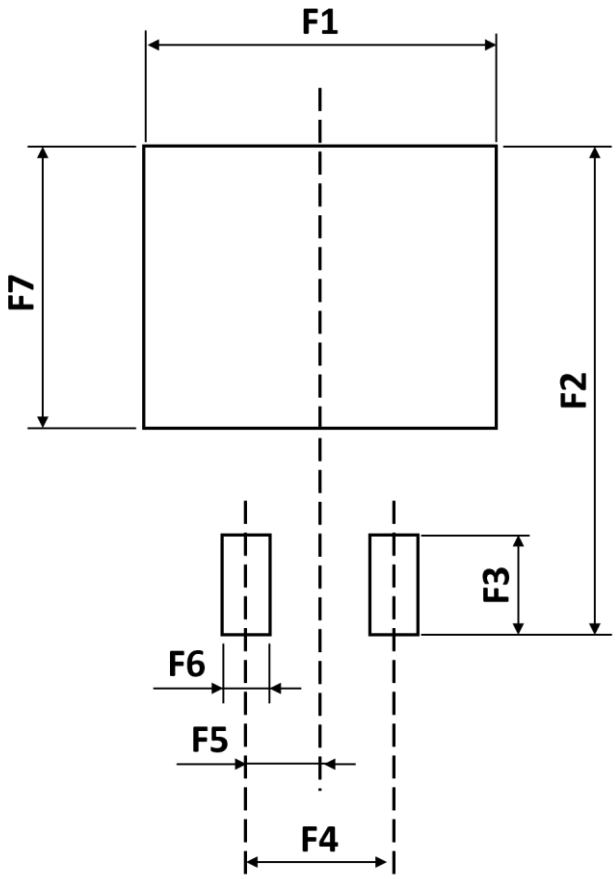
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-

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.
CEB60N15	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	-

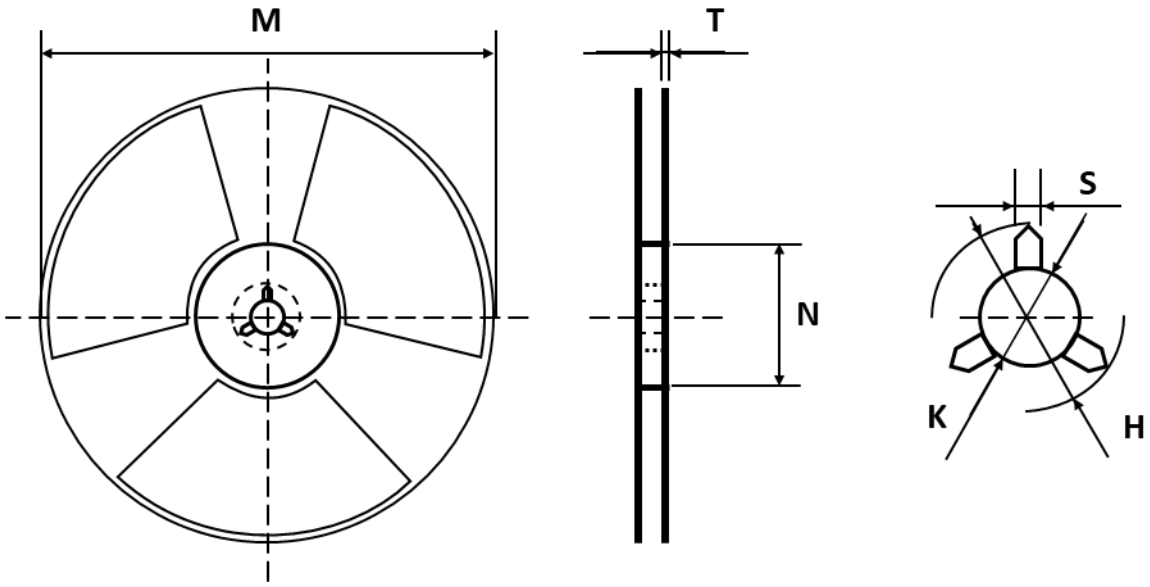
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F5	-	2.54	-
F6	-	1.60	-
F7	-	9.75	-

Notes:

1. The suggested land pattern dimensions have been provided for reference only.

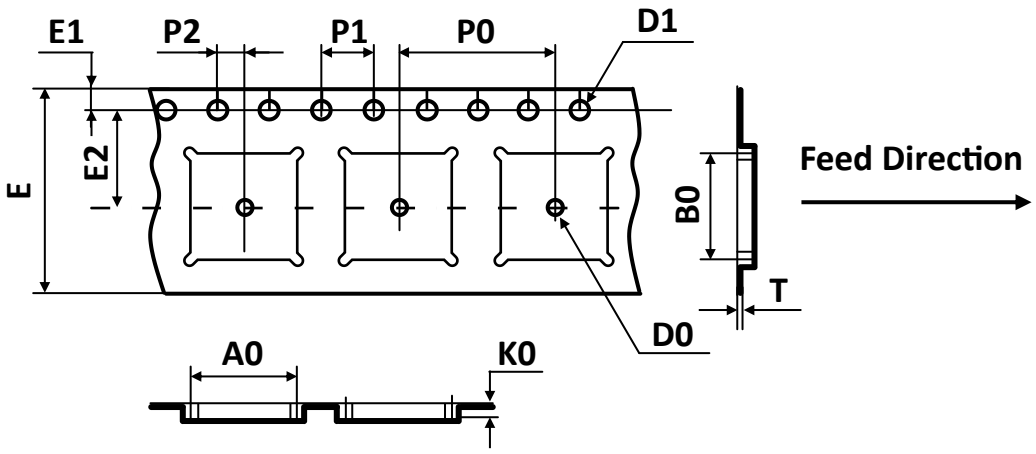
2. For further information, please reference document IPC-7351A.

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

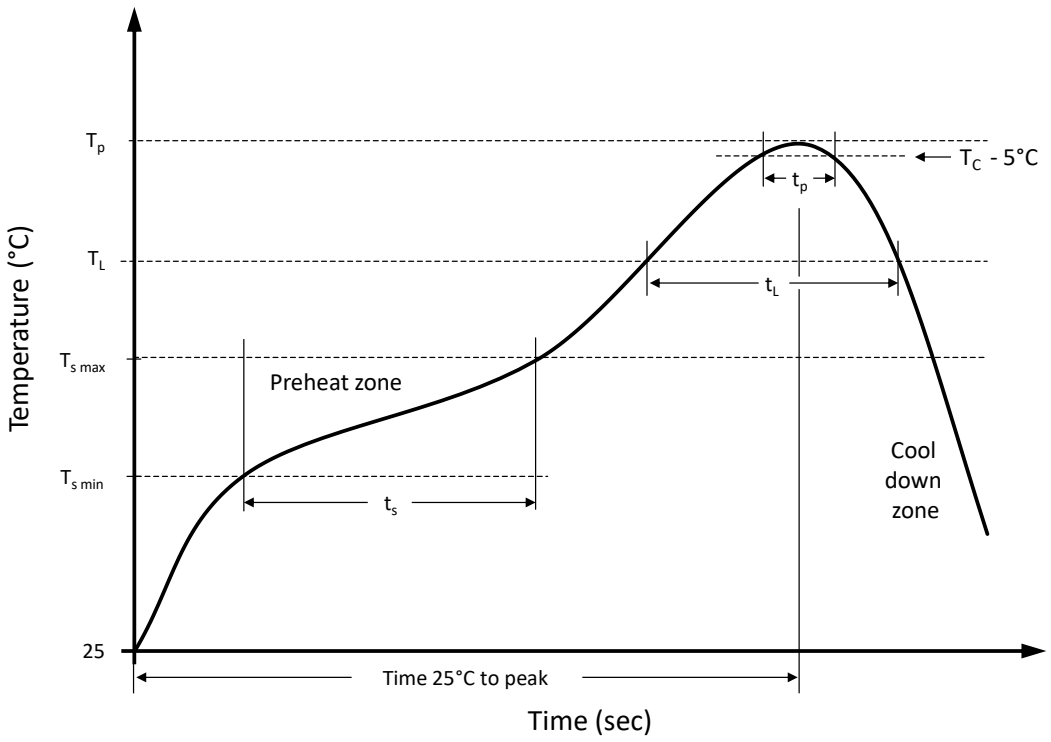
TAPE DIMENSIONS ▲ All dimensions in mm



Package	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
TO263 (D^2PAK)	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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