



CEB6405

-60V ▲ 38mΩ ▲ -22A ▲ Si MOSFET

SILICON Si MOSFET ▲ SMD type

P-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}	-60V
Gate-Source Voltage	V _{GS}	±25V
Continuous Drain Current at T _C = 25°C	I _D	-22A
Continuous Drain Current at T _C = 100°C	I _D	-14A
Pulsed Drain Current ^{Note 1}	I _{DM}	-88A
Maximum Power Dissipation at T _C = 25°C	P _D	41.6W
Power Dissipation Derating above 25°C	ΔP _D	0.33W/°C
Single Pulsed Avalanche Energy ^{Note 4}	E _{AS}	24.5mJ
Single Pulsed Avalanche Current ^{Note 4}	I _{AS}	7A
Operating and Storage Temperature Range	T _J , T _{STG}	-55°C to +150°C

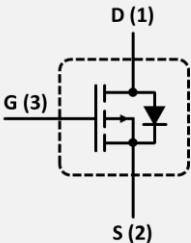
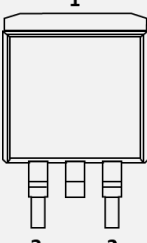
THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Case	R _{TH_JC}	3°C/W
Thermal Resistance, Junction-to-Ambient	R _{TH_JA}	62.5°C/W

APPLICATIONS

DC/DC Converter	DC Fan	Load Switches	Power Banks	USB Storage
				

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}	-60			V
Zero Gate Voltage Drain Current	$V_{DS} = -60V, V_{GS} = 0V$	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	$V_{GS} = V_{DS}, I_D = -250\mu A$	$V_{GS(th)}$	-1		-3	V
Static Drain-Source On-Resistance	$V_{GS} = -10V, I_D = -10A$	$R_{DS(ON)}$		38	46	m Ω
Static Drain-Source On-Resistance	$V_{GS} = -4.5V, I_D = -5A$	$R_{DS(ON)}$		48	60	m Ω
Dynamic Characteristics ^{Note 3}						
Input Capacitance	$V_{DS} = -25V, V_{GS} = 0V, f = 1MHz$	C_{ISS}		1320		pF
Output Capacitance	$V_{DS} = -25V, V_{GS} = 0V, f = 1MHz$	C_{OSS}		125		pF
Reverse Transfer Capacitance	$V_{DS} = -25V, V_{GS} = 0V, f = 1MHz$	C_{RSS}		80		pF
Switching Characteristics ^{Note 3}						
Turn-On Delay Time	$V_{DD} = -48V, V_{GS} = -10V, I_D = -20A, R_{G(ext)} = 6\Omega$	$t_{D(ON)}$		13		ns
Turn-On Rise Time	$V_{DD} = -48V, V_{GS} = -10V, I_D = -20A, R_{G(ext)} = 6\Omega$	t_R		8		ns
Turn-Off Delay Time	$V_{DD} = -48V, V_{GS} = -10V, I_D = -20A, R_{G(ext)} = 6\Omega$	$t_{D(OFF)}$		48		ns
Turn-Off Fall Time	$V_{DD} = -48V, V_{GS} = -10V, I_D = -20A, R_{G(ext)} = 6\Omega$	t_F		15		ns
Total Gate Charge	$V_{DS} = -48V, V_{GS} = -10V, I_D = -20A$	Q_G		26		nC
Gate Source Charge	$V_{DS} = -48V, V_{GS} = -10V, I_D = -20A$	Q_{GS}		3		nC
Gate Drain Charge	$V_{DS} = -48V, V_{GS} = -10V, I_D = -20A$	Q_{GD}		9		nC
Drain-Source Diode Characteristics and Maximum Ratings						
Drain-Source Diode Forward Current		I_S			-22	A
Drain-Source Diode Forward Voltage ^{Note 2}	$V_{GS} = 0V, I_S = -9A$	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.
- 4: $L = 1mH, I_{AS} = 7A, V_{DD} = 24V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

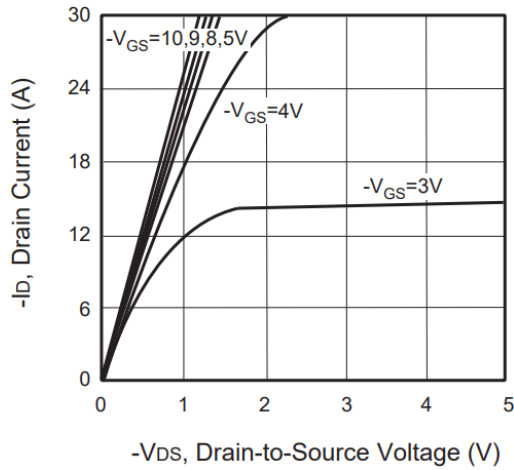


Fig. 2 • Transfer Characteristics

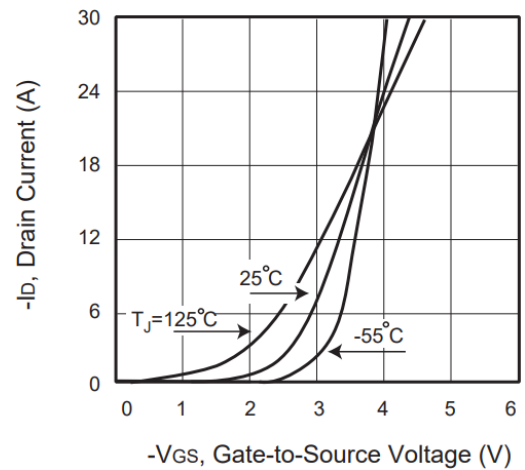


Fig. 3 • Capacitance

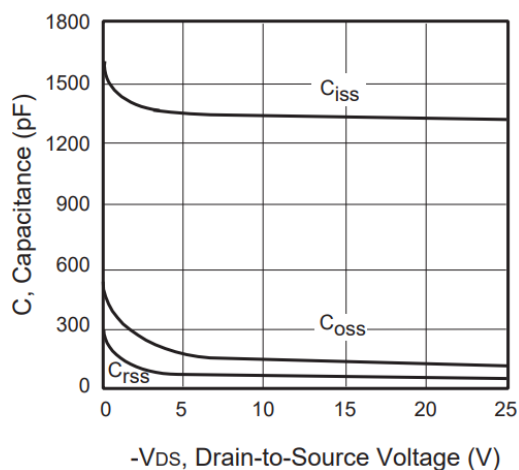


Fig. 4 • On-Resistance Variation with Temperature

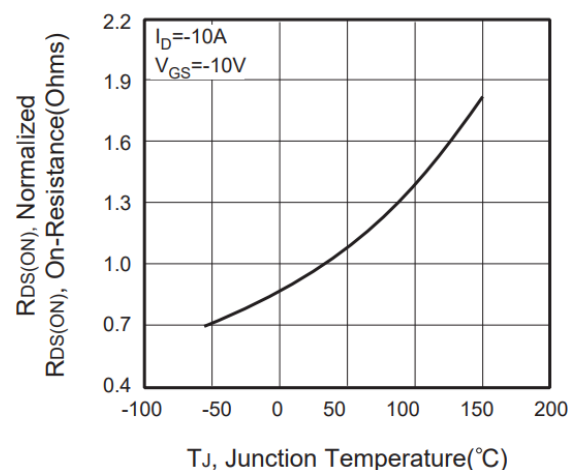


Fig. 5 • Gate Threshold Variation with Temperature

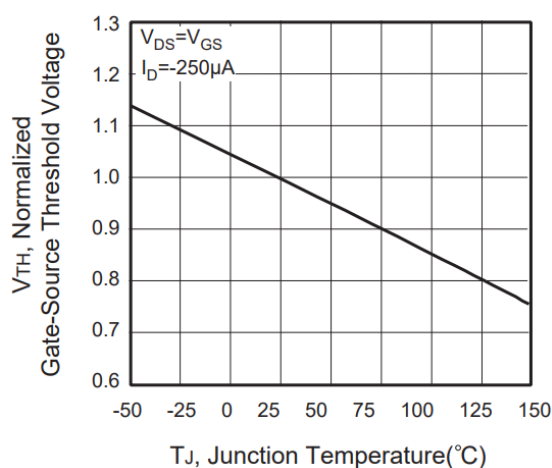
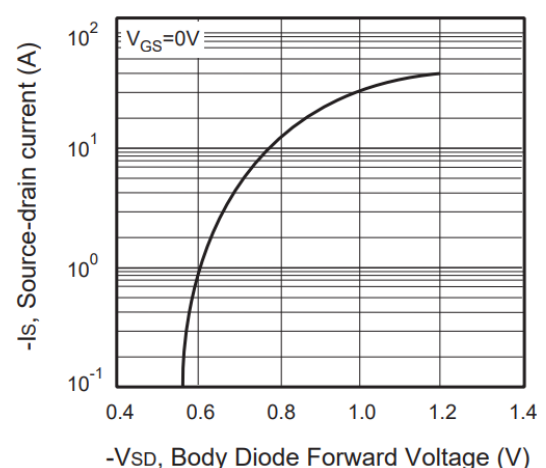


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

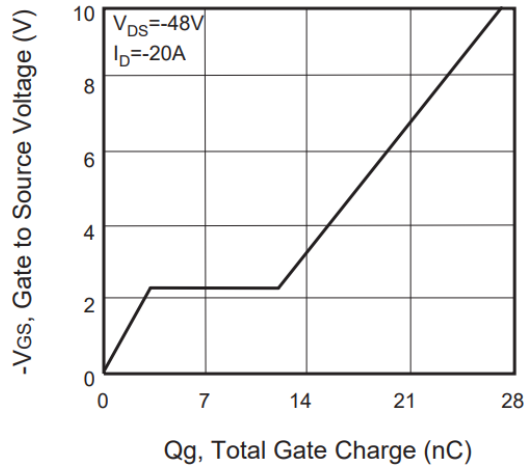


Fig. 8 • Maximum Safe Operating Area

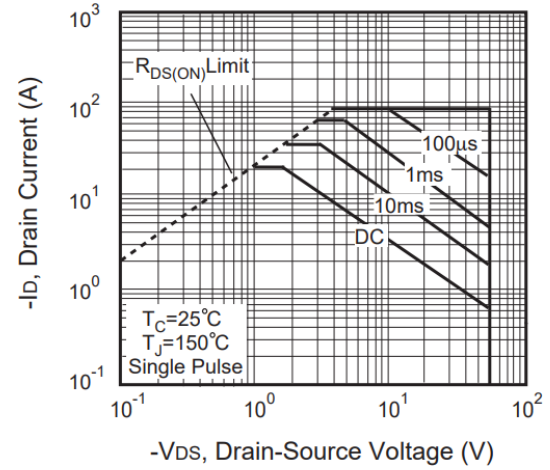


Fig. 9 • Breakdown Voltage Variation vs. Temperature

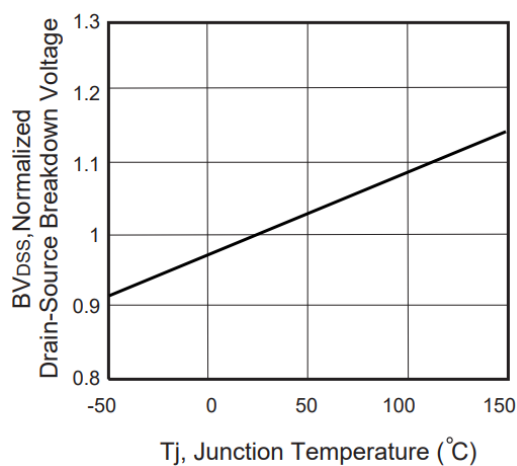


Fig. 10 • Switching Test Circuit

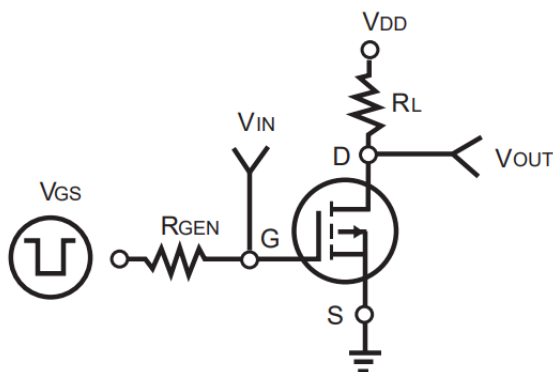
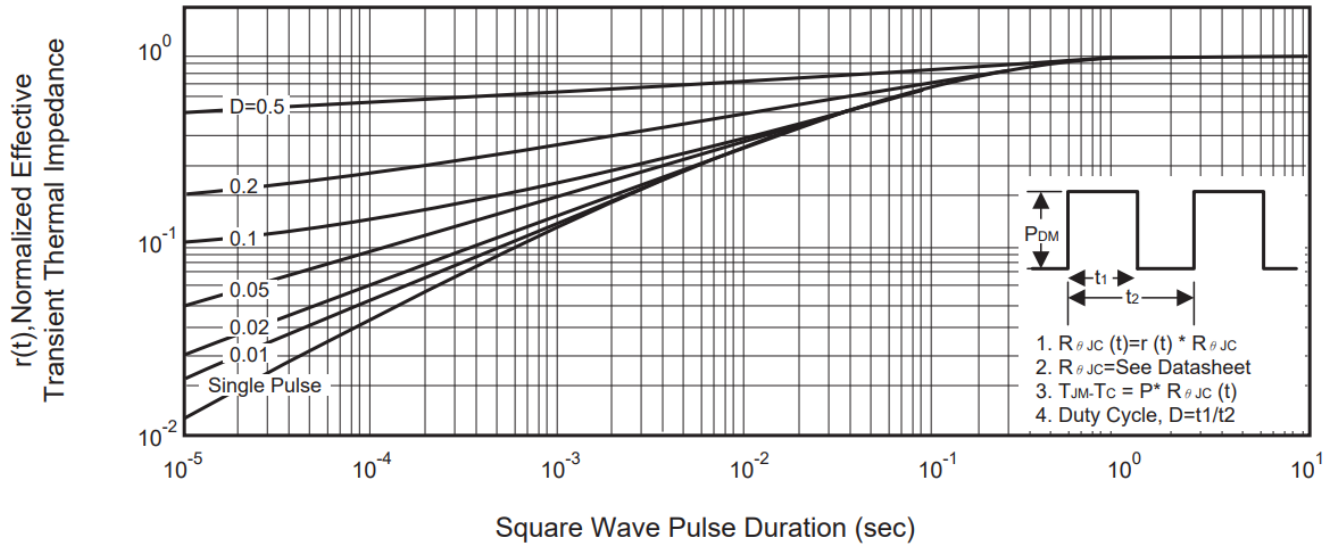


Fig. 11 • Switching Waveforms

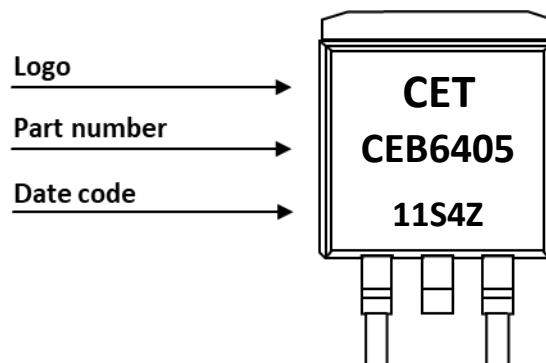


REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

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									

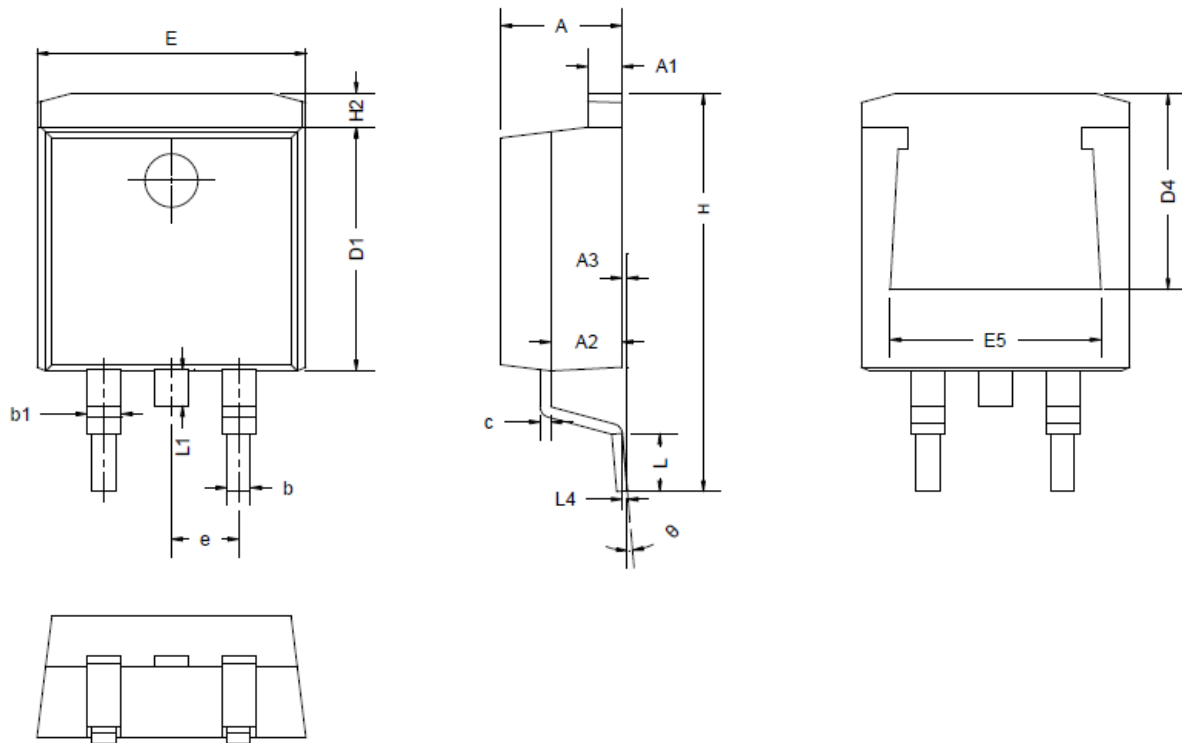
Coding list for „Month“

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



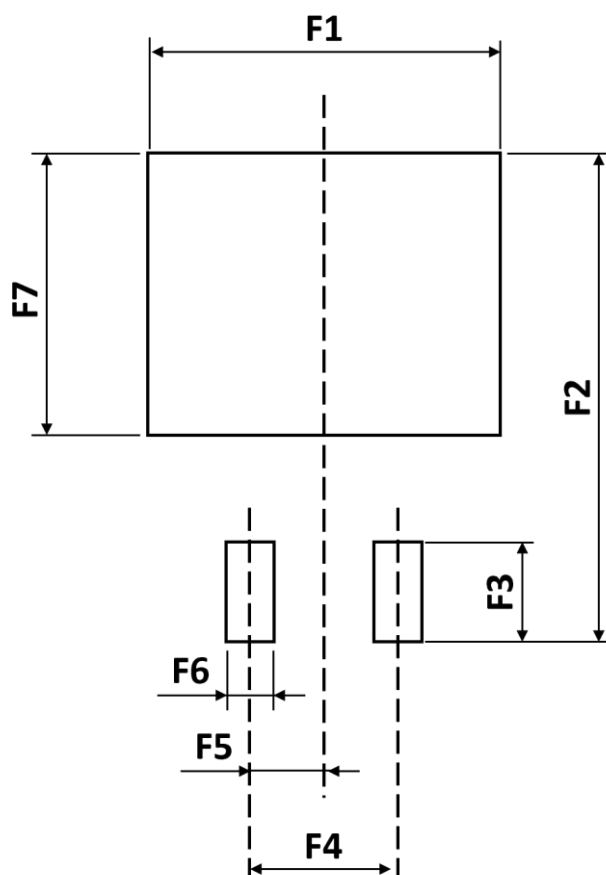
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-

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.
CEB6405	TO263 (D ² PAK)	Reel	800pcs	800pcs	6,400pcs

RECOMMENDED PAD LAYOUT



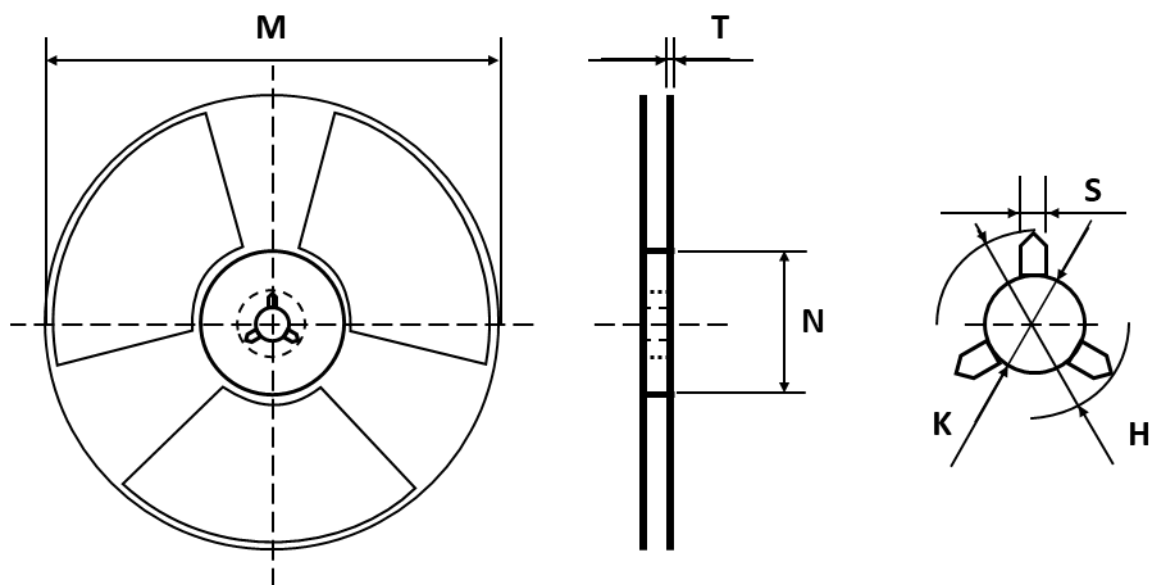
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F1	-	12.20	-
F2	-	16.90	-
F3	-	2.54	-
F4	-	5.08	-

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

Notes:

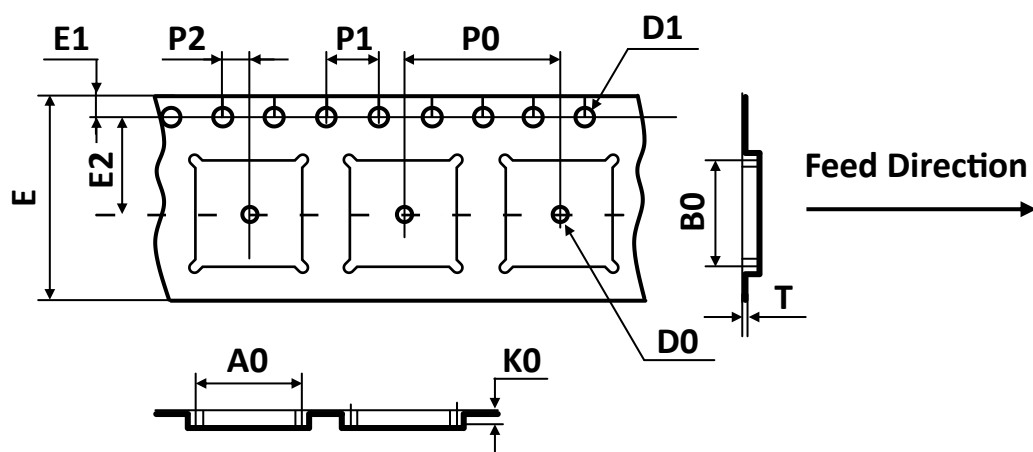
1. The suggested land pattern dimensions have been provided for reference only.
2. For further information, please reference document IPC-7351A.

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

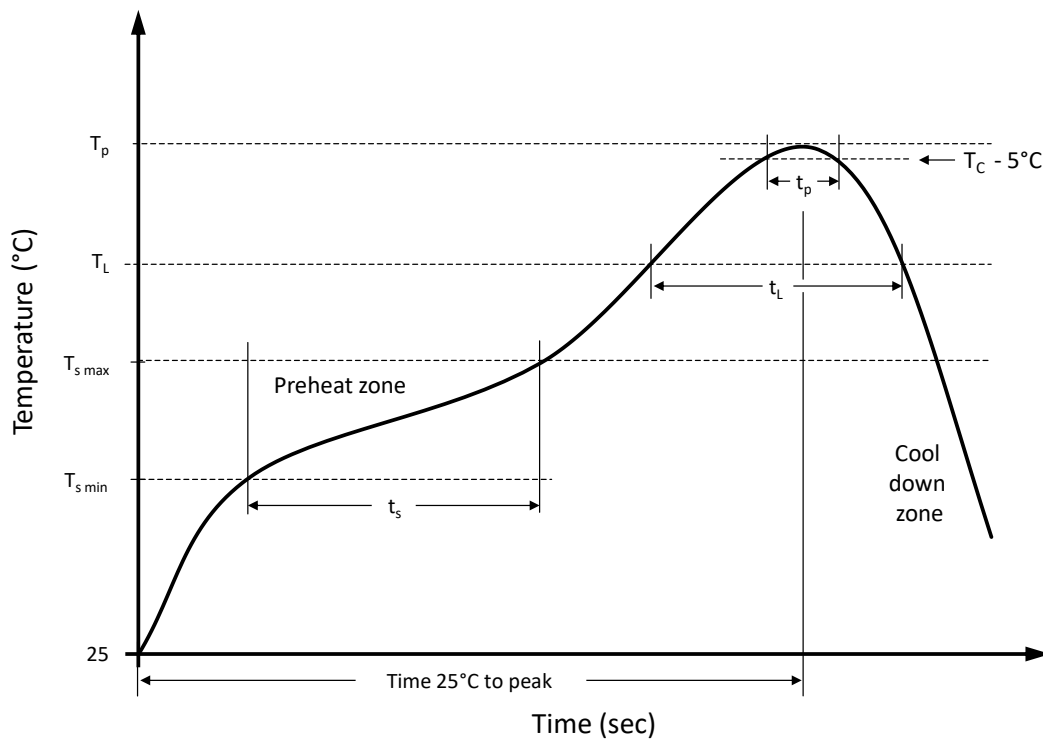
TAPE DIMENSIONS ▲ All dimensions in mm



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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