



CEB4060AL

60V ▲ 60mΩ ▲ 17A ▲ 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

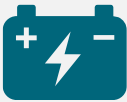




MAXIMUM RATINGS

Parameter ($T_C = 25^\circ\text{C}$, unless otherwise noted)		Characteristics
Drain-Source Voltage	V_{DS}	60V
Gate-Source Voltage	V_{GS}	$\pm 20\text{V}$
Continuous Drain Current at $T_C = 25^\circ\text{C}$	I_D	17A
Continuous Drain Current at $T_C = 100^\circ\text{C}$	I_D	12A
Pulsed Drain Current ^{Note 1}	I_{DM} ^{Note 4}	68A
Maximum Power Dissipation at $T_C = 25^\circ\text{C}$	P_D	43W
Power Dissipation Derating above 25°C	ΔP_D	$0.3\text{W}/^\circ\text{C}$
Operating and Storage Temperature Range	T_J, T_{STG}	-65°C to $+175^\circ\text{C}$

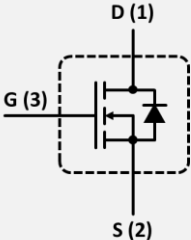
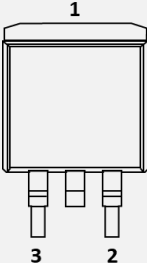
THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Case	R_{TH_JC}	$3.5^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	R_{TH_JA}	$62.5^\circ\text{C}/\text{W}$

APPLICATIONS

Battery Management Systems	DC/DC Converter	DC Fan	Industrial Control	Power Switches
				

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}			25	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	1.5	2	V
Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 12A$	$R_{DS(ON)}$		60	75	m Ω
Static Drain-Source On-Resistance	$V_{GS} = 5V, I_D = 6A$	$R_{DS(ON)}$		70	90	m Ω
Forward Transconductance	$V_{DS} = 10V, I_D = 6A$	g_{FS}		10		S
Dynamic Characteristics ^{Note 3}						
Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$	C_{ISS}		405		pF
Output Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$	C_{OSS}		120		pF
Reverse Transfer Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$	C_{RSS}		30		pF
Switching Characteristics ^{Note 3}						
Turn-On Delay Time	$V_{DD} = 30V, V_{GS} = 10V, I_D = 15A, R_{G(ext)} = 51\Omega$	$t_{D(ON)}$		10	13	ns
Turn-On Rise Time	$V_{DD} = 30V, V_{GS} = 10V, I_D = 15A, R_{G(ext)} = 51\Omega$	t_R		7	9	ns
Turn-Off Delay Time	$V_{DD} = 30V, V_{GS} = 10V, I_D = 15A, R_{G(ext)} = 51\Omega$	$t_{D(OFF)}$		84	110	ns
Turn-Off Fall Time	$V_{DD} = 30V, V_{GS} = 10V, I_D = 15A, R_{G(ext)} = 51\Omega$	t_F		22	29	ns
Total Gate Charge	$V_{DS} = 48V, V_{GS} = 10V, I_D = 15A$	Q_G		12	17	nC
Gate Source Charge	$V_{DS} = 48V, V_{GS} = 10V, I_D = 15A$	Q_{GS}		1.1		nC
Gate Drain Charge	$V_{DS} = 48V, V_{GS} = 10V, I_D = 15A$	Q_{GD}		3.2		nC
Drain-Source Diode Characteristics and Maximum Ratings						
Drain-Source Diode Forward Current		I_S			15	A
Drain-Source Diode Forward Voltage ^{Note 2}	$V_{GS} = 0V, I_S = 6A$	V_{SD}		0.9	1.3	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: Pulse width limited by safe operating area.

REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

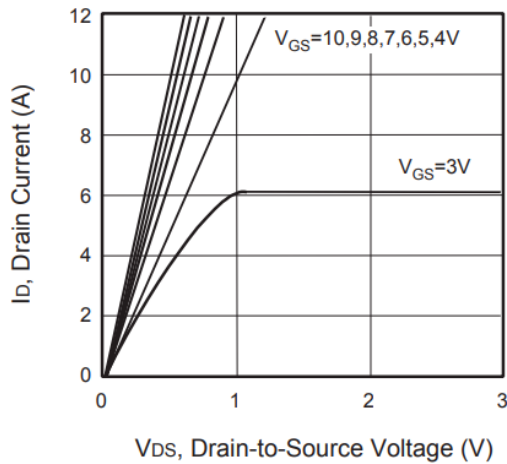


Fig. 2 • Transfer Characteristics

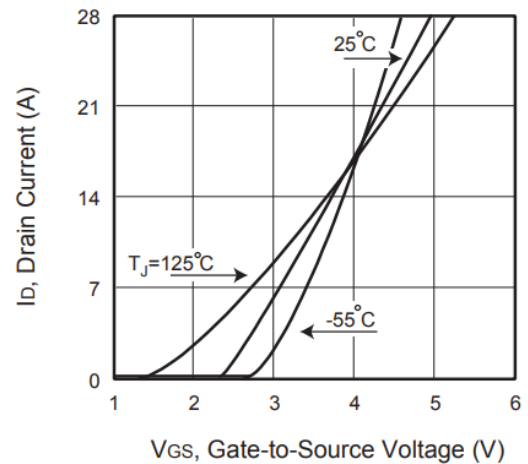


Fig. 3 • Capacitance

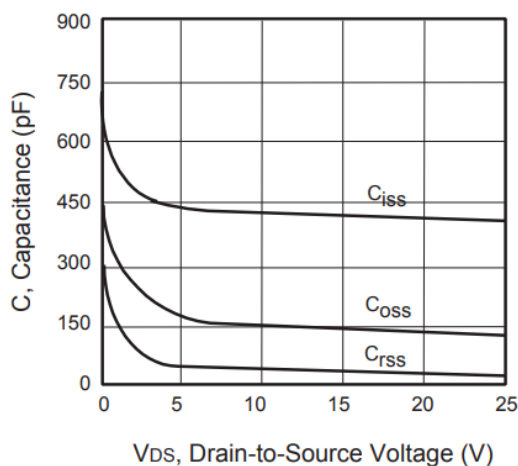


Fig. 4 • On-Resistance Variation with Temperature

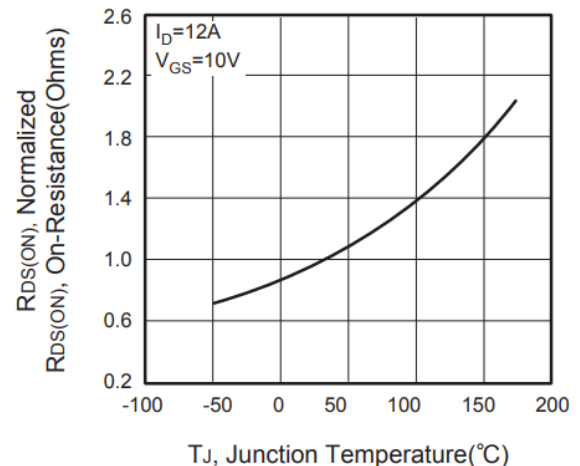


Fig. 5 • Gate Threshold Variation with Temperature

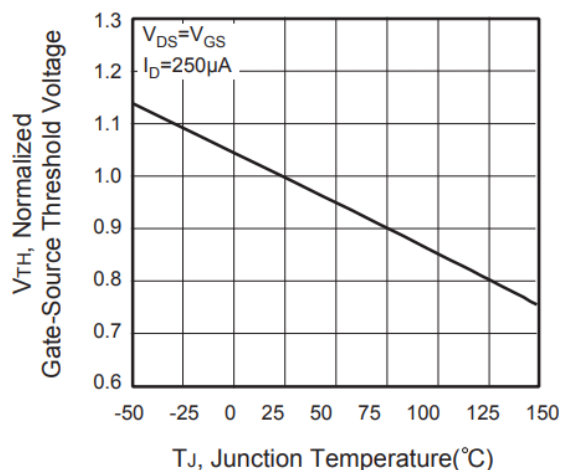
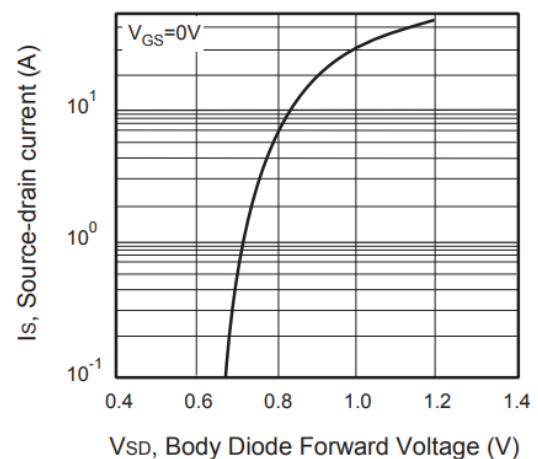


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

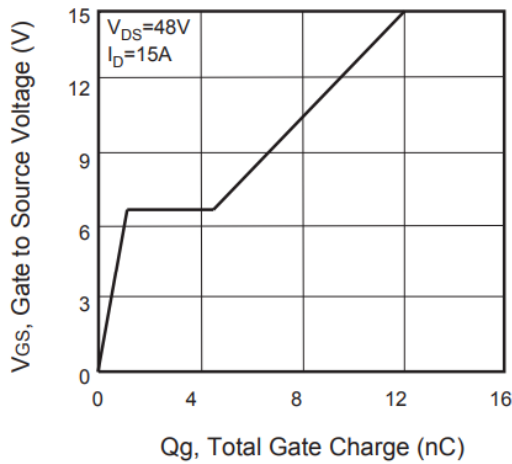


Fig. 8 • Maximum Safe Operating Area

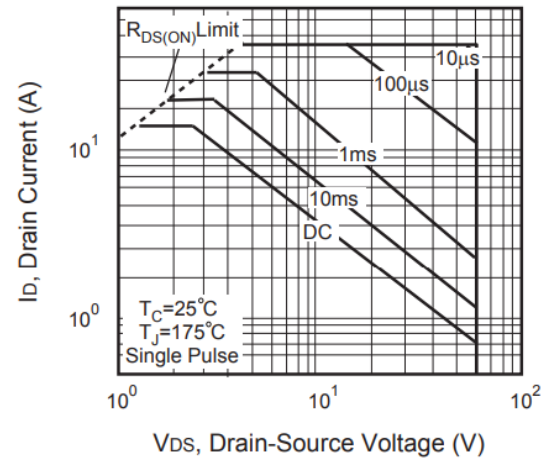


Fig. 9 • Switching Test Circuit

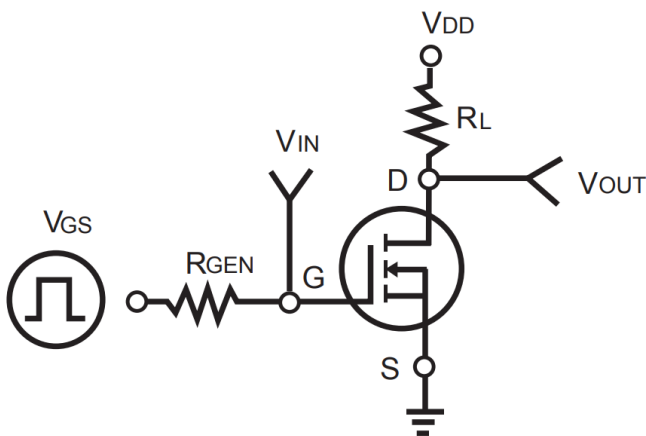


Fig. 10 • Switching Waveforms

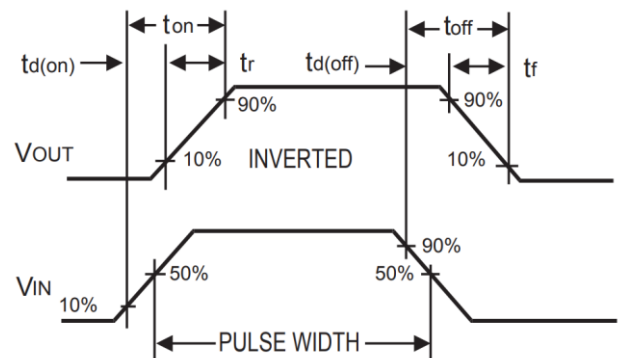
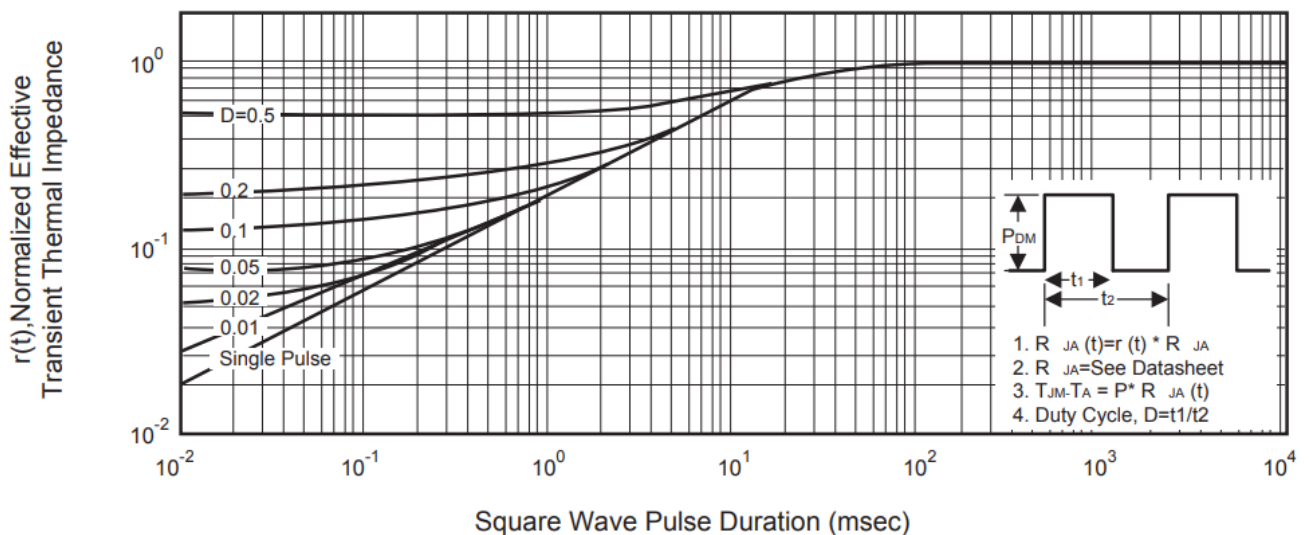
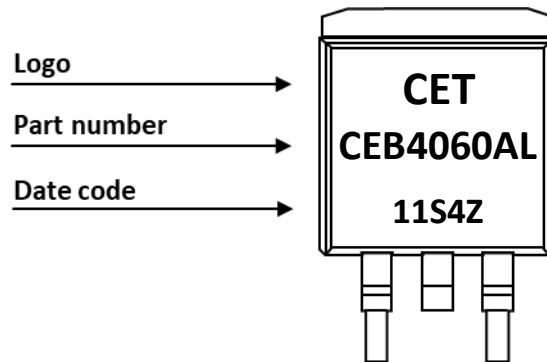


Fig. 11 • Normalized Thermal Transient Impedance Curve



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									

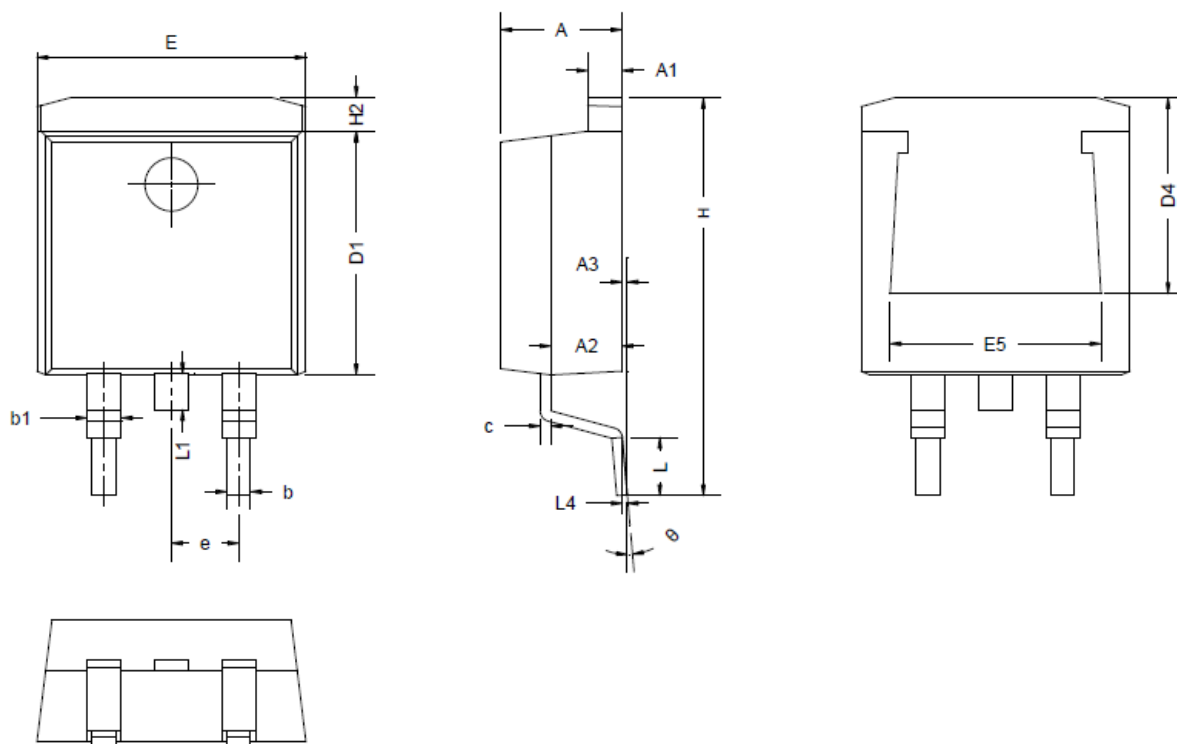
Coding list for „Month“

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.
CEB4060AL	TO263 (D2PAK)	Reel	800pcs	800pcs	6,400pcs

RECOMMENDED PAD LAYOUT

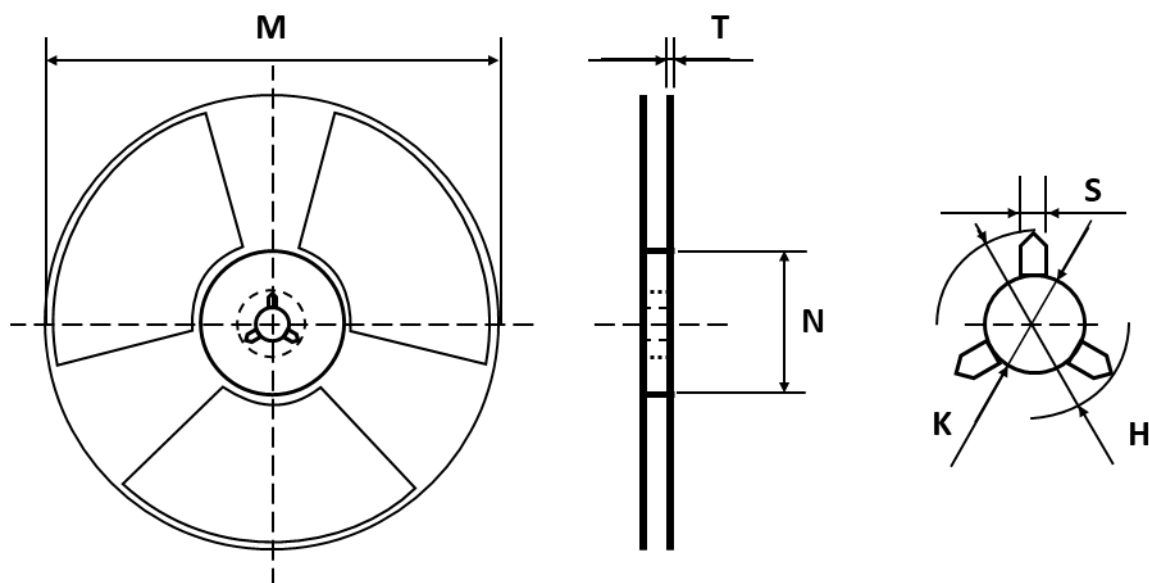


Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F1	-	12.20	-
F2	-	16.90	-
F3	-	2.54	-
F4	-	5.08	-

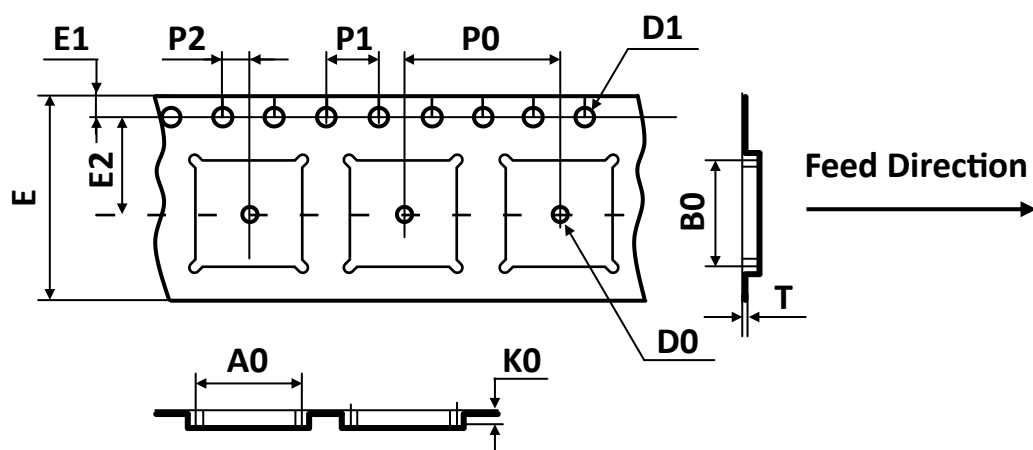
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F5	-	2.54	-
F6	-	1.60	-
F7	-	9.75	-

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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