



CES2331A

-20V ▲ 33mΩ ▲ -4.3A ▲ Si MOSFET

SILICON Si MOSFET ▲ SMD type

P-channel enhancement mode

UL94V-0 rated flame retardant epoxy

SOT23 package ▲ MSL 3

Super high dense cell density for extremely low $R_{DS(ON)}$

Rugged and reliable

MAXIMUM RATINGS

Parameter ($T_A = 25^{\circ}\text{C}$, unless otherwise noted)		Characteristics
Drain-Source Voltage	V_{DS}	-20V
Gate-Source Voltage	V_{GS}	$\pm 8\text{V}$
Continuous Drain Current	I_D	-4.3A
Pulsed Drain Current ^{Note 1}	I_{DM}	-17.2A
Maximum Power Dissipation	P_D	1.25W
Operating and Storage Temperature Range	T_J, T_{STG}	-55°C to +150°C

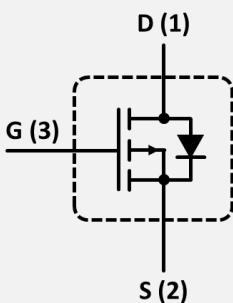
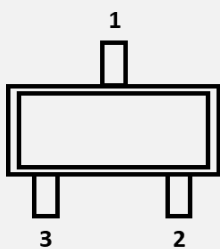
THERMAL CHARACTERISTICS

Parameter	Symbol	Limit
Thermal Resistance, Junction-to-Ambient ^{Note 2}	R_{TH_JA}	100°C/W

APPLICATIONS

Data Server Control	DC/DC Converter	Network Devices	Portable Products	USB Storage
				

PIN DESCRIPTION

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

ELECTRICAL CHARACTERISTICS ▲ $T_A = 25^\circ\text{C}$, 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}	-20			V
Zero Gate Voltage Drain Current	$V_{DS} = -20V, V_{GS} = 0V$	I_{DSS}			-1	μA
Gate Body Leakage Current, Forward	$V_{GS} = 8V, V_{DS} = 0V$	I_{GSSF}			100	nA
Gate Body Leakage Current, Reverse	$V_{GS} = -8V, V_{DS} = 0V$	I_{GSSR}			-100	nA
On Characteristics ^{Note 3}						
Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu A$	$V_{GS(th)}$	-0.4		-1	V
Static Drain-Source On-Resistance	$V_{GS} = -4.5V, I_D = -3.3A$	$R_{DS(ON)}$		33	42	m Ω
Static Drain-Source On-Resistance	$V_{GS} = -2.5V, I_D = -2.8A$	$R_{DS(ON)}$		45	55	m Ω
Static Drain-Source On-Resistance	$V_{GS} = -1.8V, I_D = -2A$	$R_{DS(ON)}$		55	75	m Ω
Dynamic Characteristics ^{Note 4}						
Input Capacitance	$V_{DS} = -10V, V_{GS} = 0V, f = 1MHz$	C_{ISS}		795		pF
Output Capacitance	$V_{DS} = -10V, V_{GS} = 0V, f = 1MHz$	C_{OSS}		100		pF
Reverse Transfer Capacitance	$V_{DS} = -10V, V_{GS} = 0V, f = 1MHz$	C_{RSS}		90		pF
Switching Characteristics ^{Note 4}						
Turn-On Delay Time	$V_{DD} = -10V, V_{GS} = -4.5V, I_D = -4A, R_{G(ext)} = 3\Omega$	$t_{D(ON)}$		12		ns
Turn-On Rise Time	$V_{DD} = -10V, V_{GS} = -4.5V, I_D = -4A, R_{G(ext)} = 3\Omega$	t_R		8		ns
Turn-Off Delay Time	$V_{DD} = -10V, V_{GS} = -4.5V, I_D = -4A, R_{G(ext)} = 3\Omega$	$t_{D(OFF)}$		83		ns
Turn-Off Fall Time	$V_{DD} = -10V, V_{GS} = -4.5V, I_D = -4A, R_{G(ext)} = 3\Omega$	t_F		41		ns
Total Gate Charge	$V_{DD} = -10V, V_{GS} = -4.5V, I_D = -4A$	Q_G		10.2		nC
Gate Source Charge	$V_{DD} = -10V, V_{GS} = -4.5V, I_D = -4A$	Q_{GS}		1		nC
Gate Drain Charge	$V_{DD} = -10V, V_{GS} = -4.5V, I_D = -4A$	Q_{GD}		2.1		nC
Drain-Source Diode Characteristics and Maximum Ratings						
Drain-Source Diode Forward Current ^{Note 2}		I_S			-1	A
Drain-Source Diode Forward Voltage ^{Note 3}	$V_{GS} = 0V, I_S = -1.6A$	V_{SD}			-1.2	V

Notes

- 1: Repetitive Rating: Pulse width limited by maximum junction temperature
- 2: Surface Mounted on FR4 Board, $t \leq 5$ sec
- 3: Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
- 4: Guaranteed by design, not subject to production testing.

REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Output Characteristics

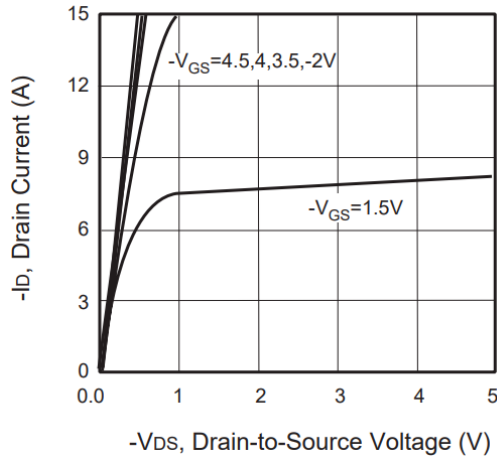


Fig. 2 • Transfer Characteristics

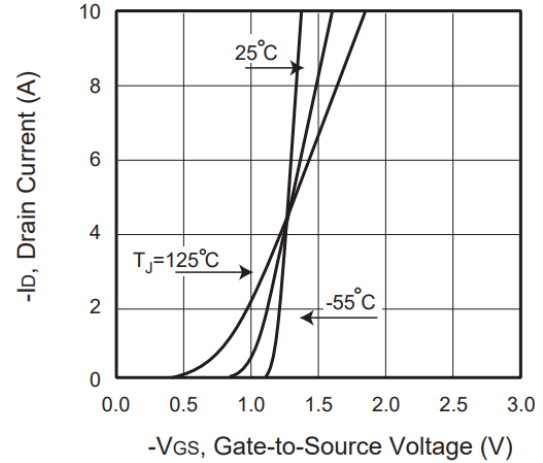


Fig. 3 • Capacitance

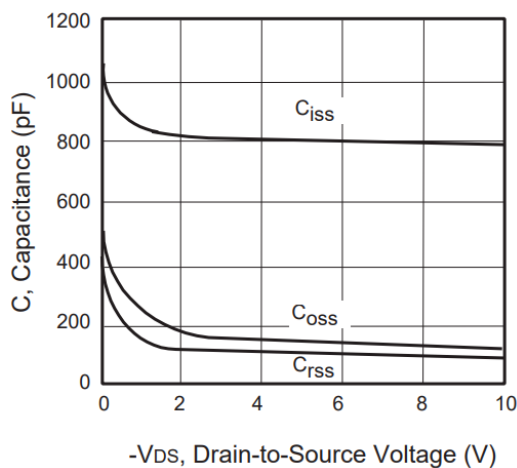


Fig. 4 • On-Resistance Variation with Temperature

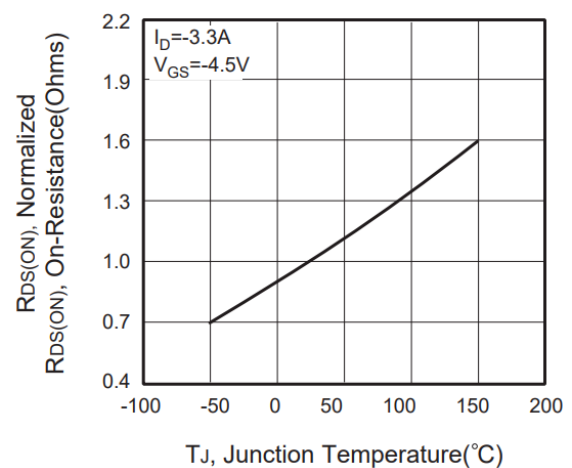


Fig. 5 • Gate Threshold Variation with Temperature

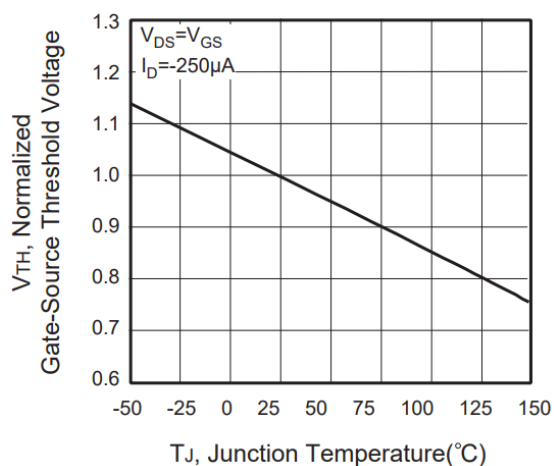
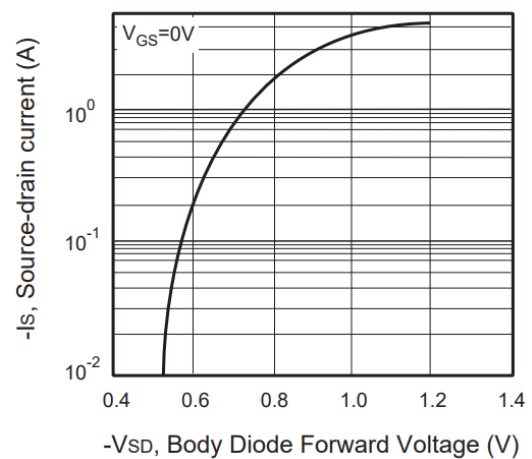


Fig. 6 • Body Diode Forward Voltage Variation with Source Current



REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Gate Charge

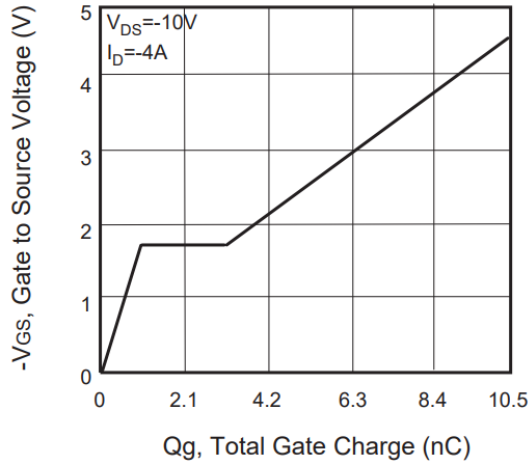


Fig. 8 • Maximum Safe Operating Area

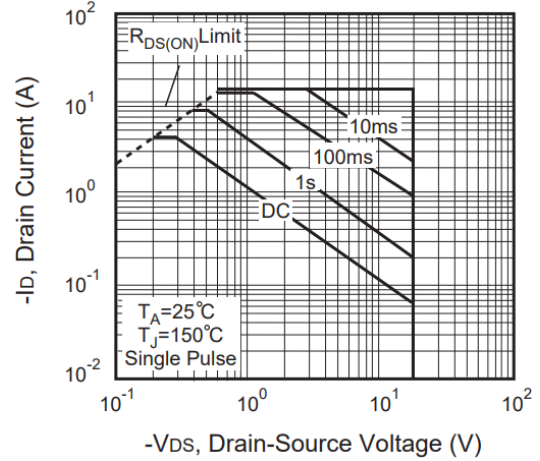


Fig. 9 • Breakdown Voltage Variation vs. Temperature

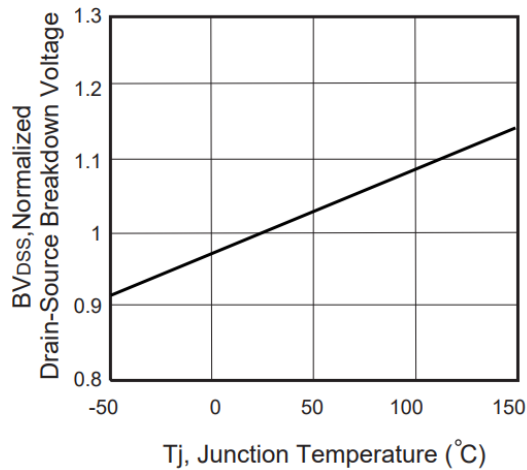


Fig. 10 • Switching Test Circuit

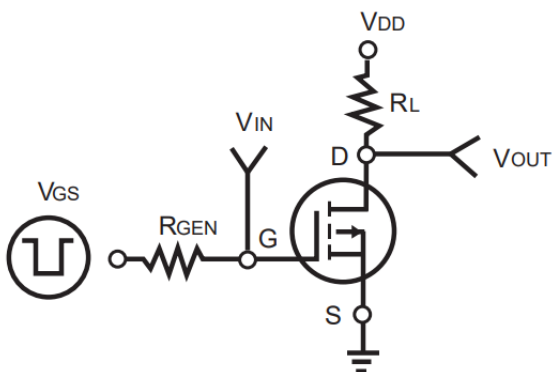
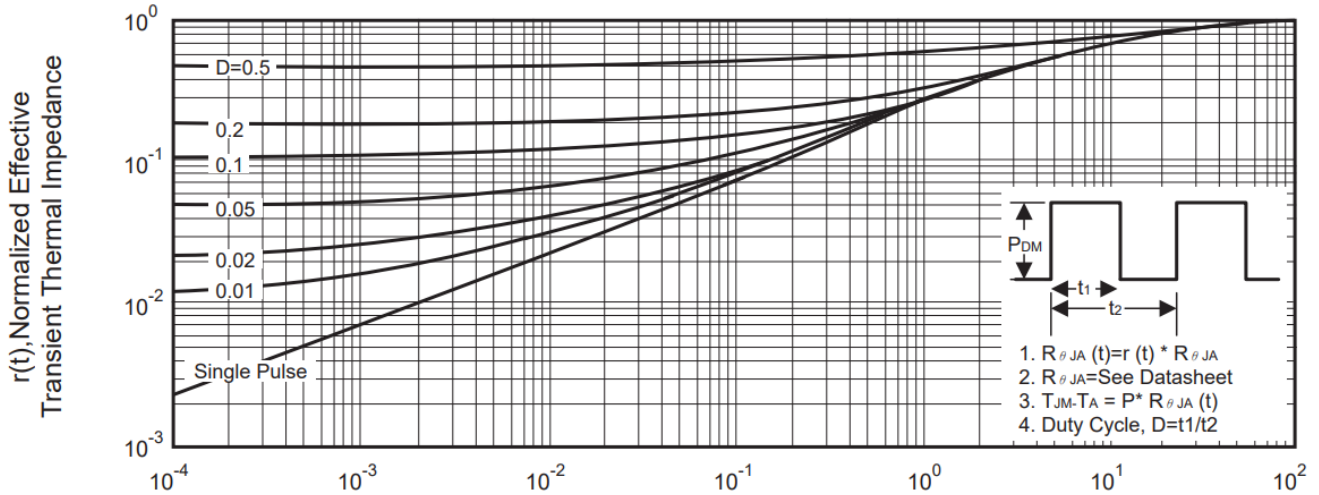


Fig. 11 • Switching Waveforms

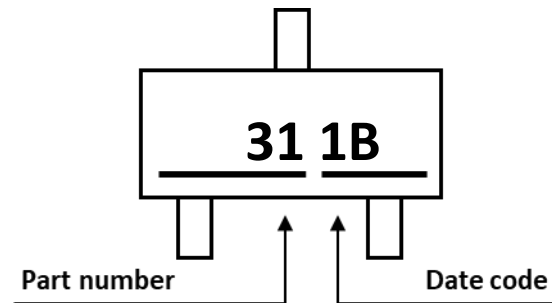


REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 12 ▪ Normalized Thermal Transient Impedance Curve

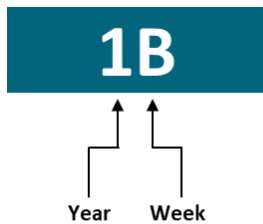


PART MARKING



DATE CODE

Example: 1B



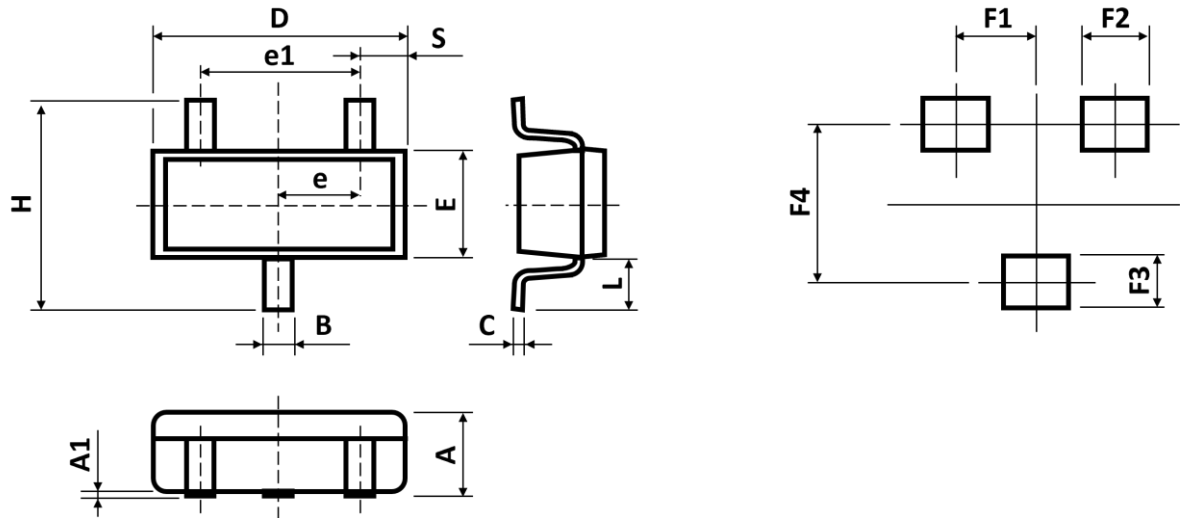
Coding list for „Week“

A	B	C	D	E	F	G	H	I
1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18
J	K	L	M	N	O	P	Q	R
19-20	21-22	23-24	25-26	27-28	29-30	31-32	33-34	35-36
S	T	U	V	W	X	Y	Z	
37-38	39-40	41-42	43-44	45-46	47-48	49-50	51-52	

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 AND RECOMMENDED PAD LAYOUT



Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
A	0.890	-	1.250
A1	0.000	-	0.100
B	0.300	-	0.500
C	0.085	-	0.200
D	2.720	-	3.040
E	1.400	-	1.800

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F1	-	0.950	-
F2	-	0.760	-

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
e	0.95 BSC		
e1	1.780	-	2.180
H	2.500	-	3.100
L	0.550 REF		
S	0.410	-	0.610

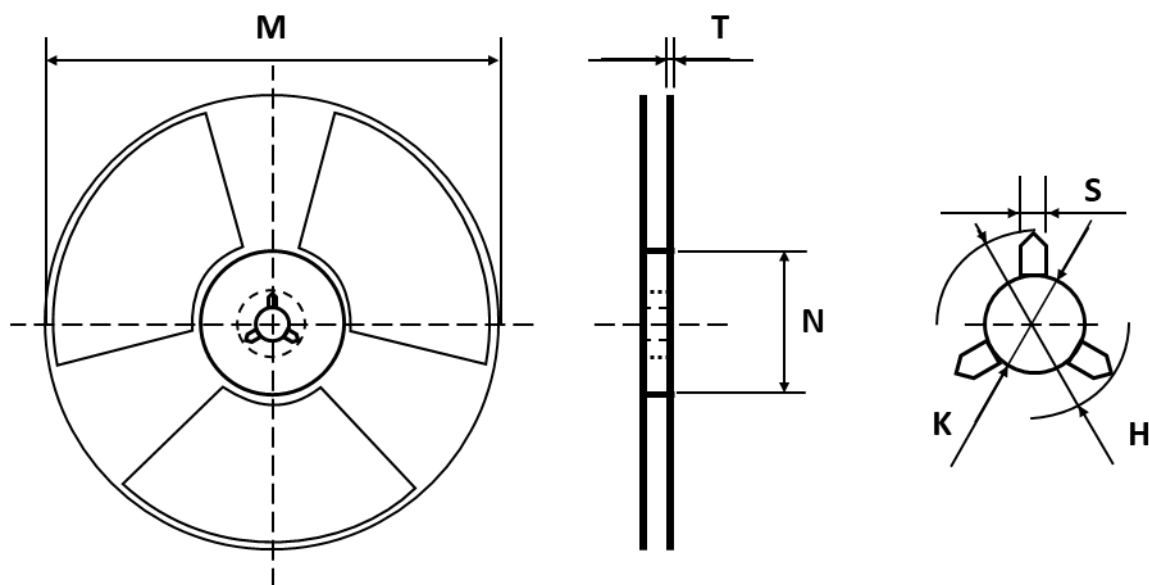
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
F3	-	0.760	-
F4	-	2.290	-

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

ORDERING INFORMATION

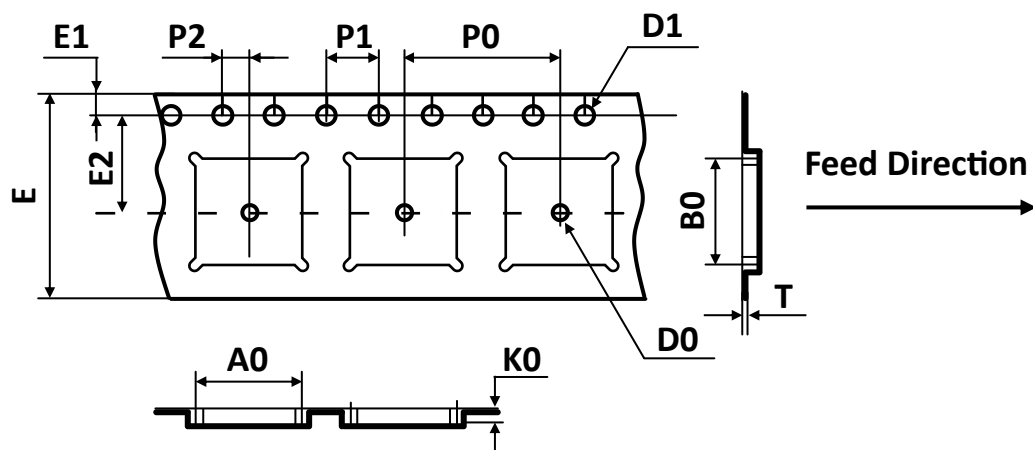
Part Number	Package	Packing	Reel Qty.	Inner Box Qty.
CES2331A	SOT23	7" Reel	3,000pcs	15,000pcs

REEL DIMENSIONS ▲ All dimensions in mm



Tape Size	Reel Size	M	N	T	H	K	S
8mm	Ø180	Ø178.00 ±1.00	Ø54.00 ±0.50	1.20 ±0.20	20.00 ±1.00	13.30 ±0.30	3.00 ±1.00

TAPE DIMENSIONS ▲ All dimensions in mm



Package	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
SOT23	3.25 ±0.10	3.25 ±0.10	1.35 ±0.10	1.00 ±0.10	1.50 ±0.10	8.00 ±0.10	1.75 ±0.10	3.50 ±0.10	4.00 ±0.10	4.00 ±0.10	2.00 ±0.05	0.20 ±0.02

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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