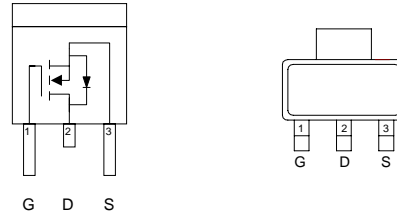


## N-Channel Enhancement Mode MOSFET

### Features

- 30V/30A,  $R_{DS(ON)}=15m\Omega(\text{typ.}) @ V_{GS}=10V$   
 $R_{DS(ON)}=22m\Omega(\text{typ.}) @ V_{GS}=5V$
- Super High Dense Cell Design
- High Power and Current Handling Capability
- TO-252, TO-220 and SOT-223 Packages

### Pin Description

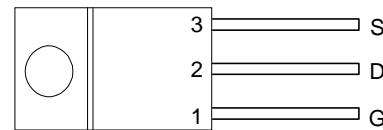


Top View of TO-252

Top View of SOT-223

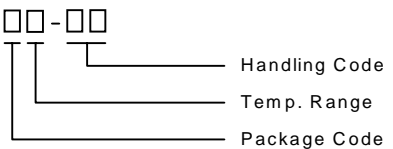

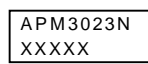
### Applications

- Switching Regulators
- Switching Converters



TO-220 Package

### Ordering and Marking Information

<p>APM3023N □□-□□</p>  <p>Handling Code</p> <p>Temp. Range</p> <p>Package Code</p>	<p>Package Code                  U : TO-252    V : SOT-223    F : TO-220</p> <p>Operating Junction Temp. Range                  C : -55 to 150° C</p> <p>Handling Code                  TR : Tape &amp; Reel</p>
<p>APM3023N U/F: :</p> 	<p>XXXXX - Date Code</p>
<p>APM3023N V : :</p> 	<p>XXXXX - Date Code</p>

### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Rating	Unit
$V_{DSS}$	Drain-Source Voltage	30	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	
$I_D^*$	Maximum Drain Current – Continuous	30	A
$I_{DM}$	Maximum Drain Current – Pulsed	70	

\* Surface Mounted on FR4 Board,  $t \leq 10$  sec.

ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

**Absolute Maximum Ratings (Cont.)** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter		Rating	Unit	
$P_D$	Maximum Power Dissipation	$T_A=25^\circ\text{C}$	TO-252/TO-220	62.5	W
			SOT-223	3	
		$T_A=100^\circ\text{C}$	TO-252/TO220	25	W
			SOT-223	1.2	
$T_J$	Maximum Junction Temperature		150	$^\circ\text{C}$	
$T_{STG}$	Storage Temperature Range		-55 to 150	$^\circ\text{C}$	

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Test Condition	APM3023N			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu\text{A}$	30			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=24V, V_{GS}=0V$			1	$\mu\text{A}$
		$V_{DS}=24V, V_{GS}=0V, T_f=55^\circ\text{C}$			5	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	1	1.5	2	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=10V, I_{DS}=20A$		15	20	m $\Omega$
		$V_{GS}=5V, I_{DS}=10A$		22	28	
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=15A, V_{GS}=0V$		0.7	1.3	V
<b>Dynamic<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=15V, I_{DS}=10A$		15	20	nC
$Q_{gs}$	Gate-Source Charge	$V_{GS}=5V,$		5.8		
$Q_{gd}$	Gate-Drain Charge			3.8		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=15V, I_{DS}=2A,$ $V_{GEN}=10V, R_G=6\Omega$		11	18	ns
$T_r$	Turn-on Rise Time			17	26	
$t_{d(OFF)}$	Turn-off Delay Time			37	54	
$T_f$	Turn-off Fall Time			20	30	
$C_{iss}$	Input Capacitance	$V_{GS}=0V$		1200		pF
$C_{oss}$	Output Capacitance	$V_{DS}=15V$		220		
$C_{riss}$	Reverse Transfer Capacitance	Frequency=1.0MHz		100		

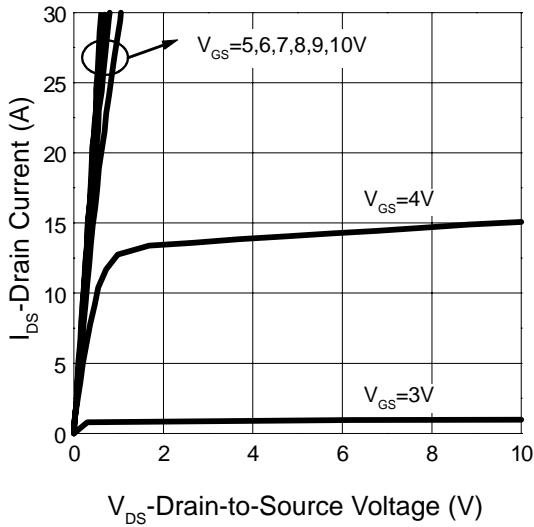
## Notes

<sup>a</sup> : Pulse test ; pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$

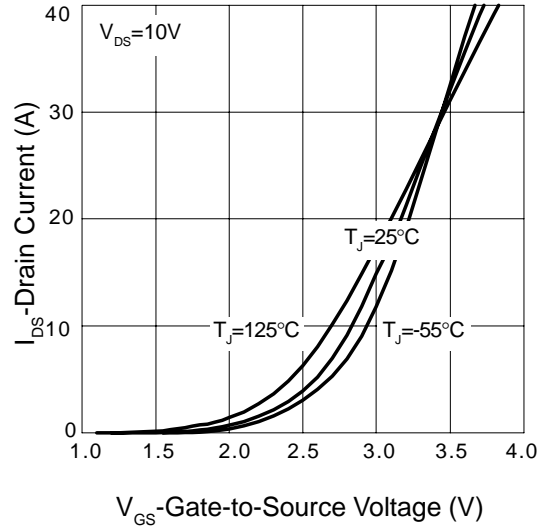
<sup>b</sup> : Guaranteed by design, not subject to production testing

## Typical Characteristics

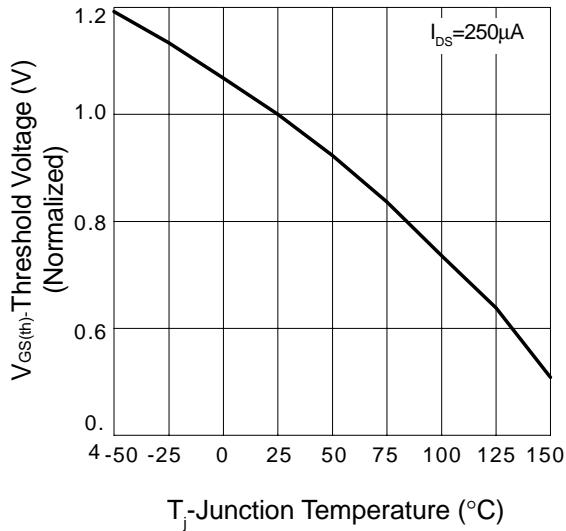
Output Characteristics



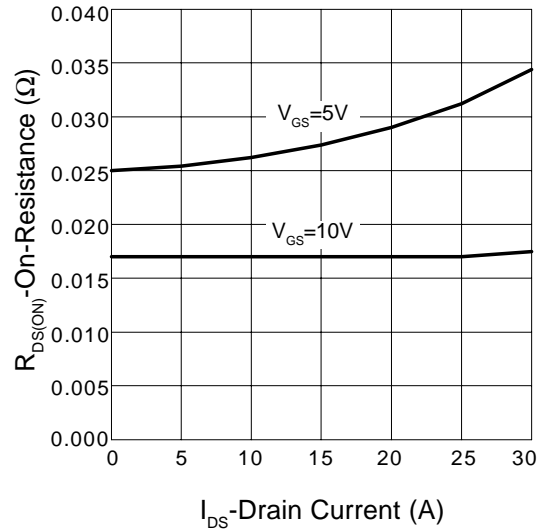
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

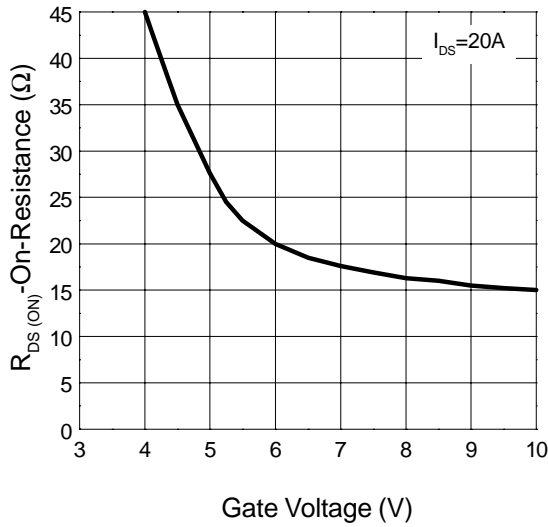


On-Resistance vs. Drain Current

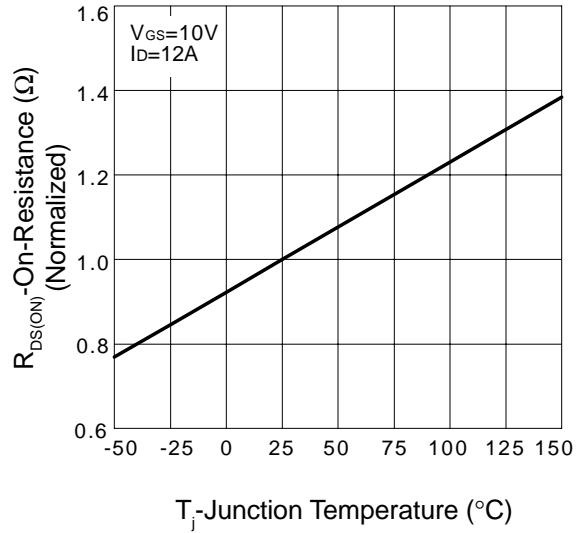


Typical Characteristics (Cont.)

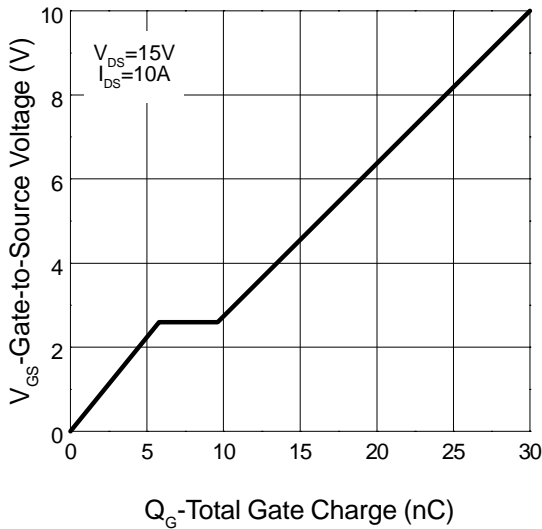
On-Resistance vs. Gate-to-Source Voltage



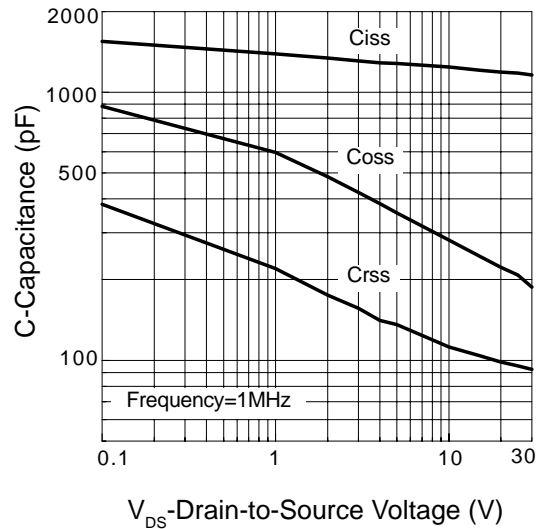
On-Resistance vs. Junction Temperature



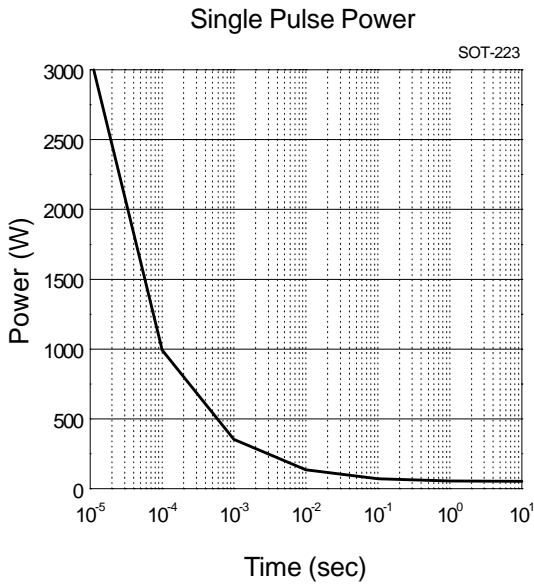
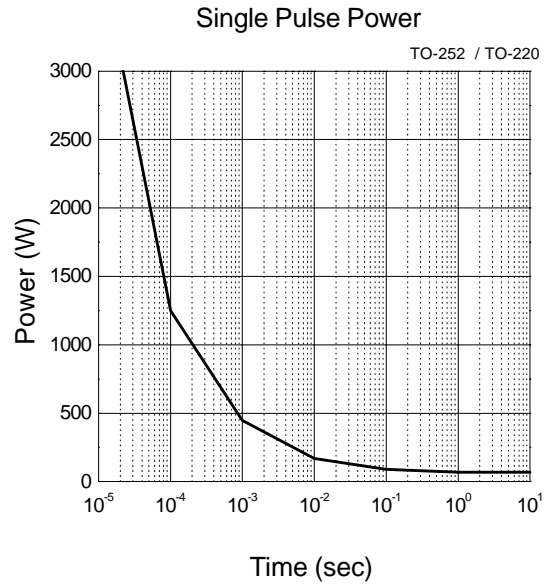
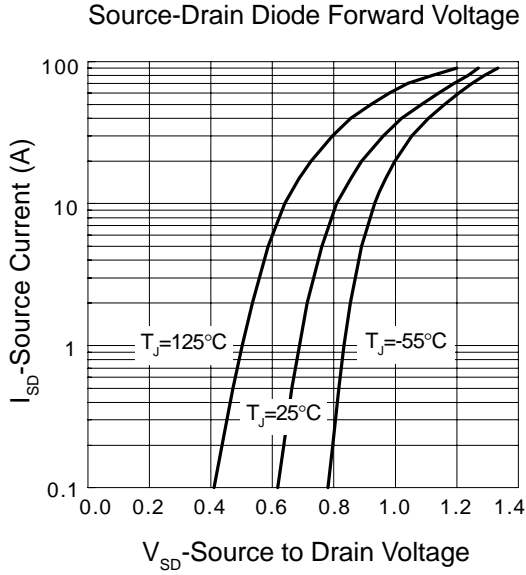
Gate Charge



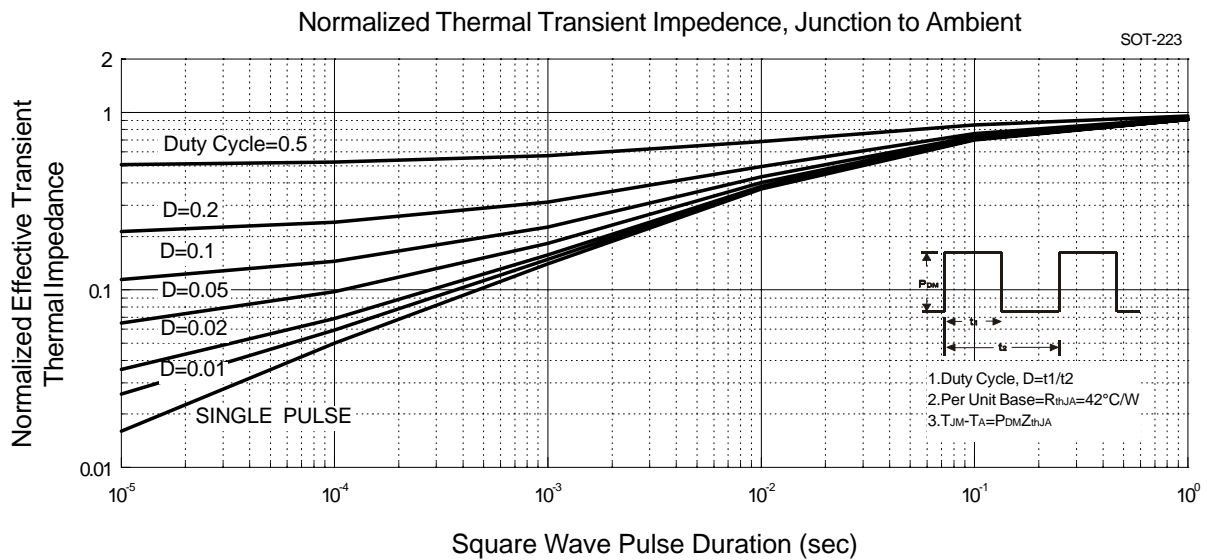
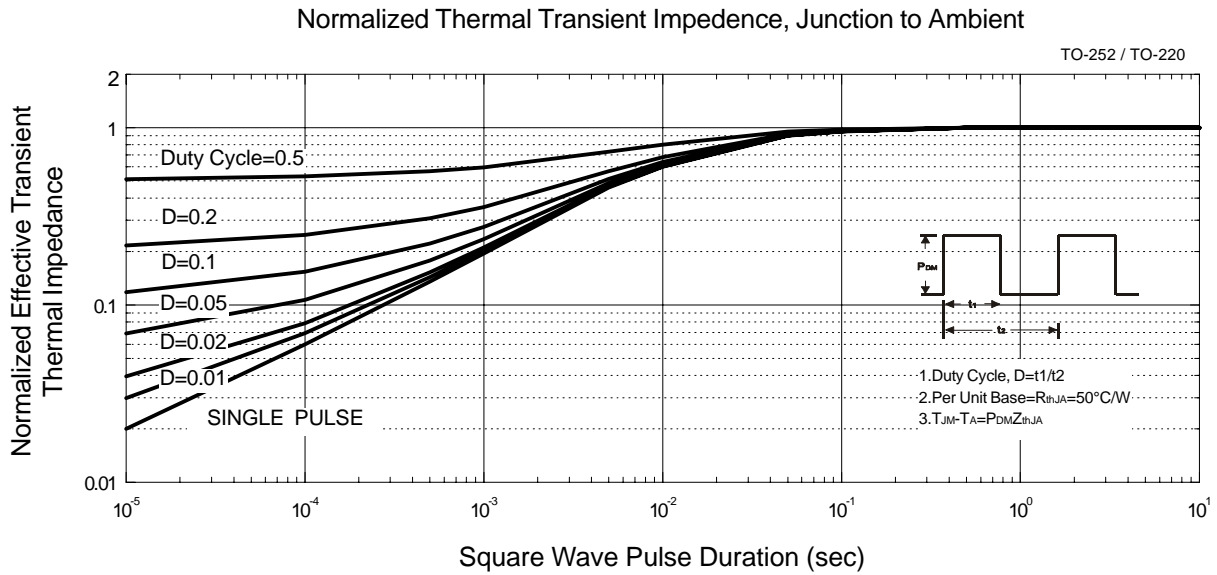
Capacitance Characteristics



Typical Characteristics (Cont.)

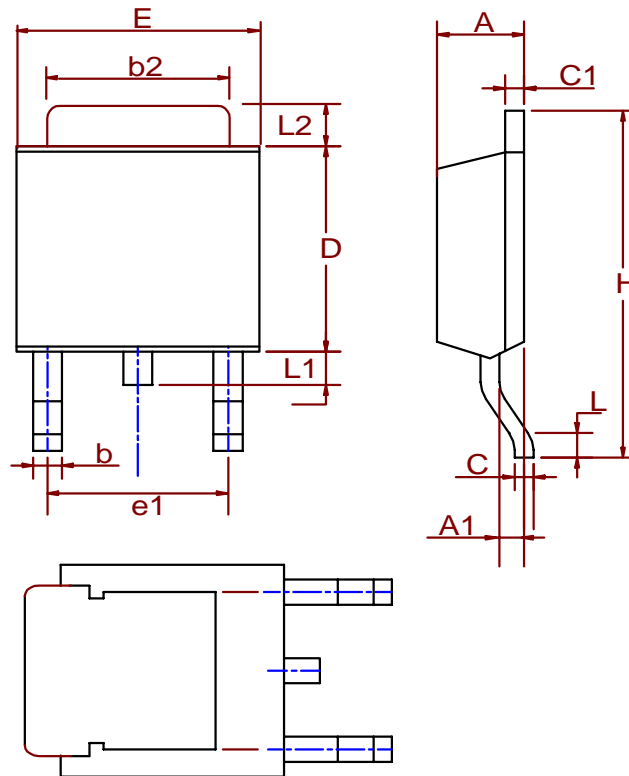


Typical Characteristics (Cont.)



Package Information

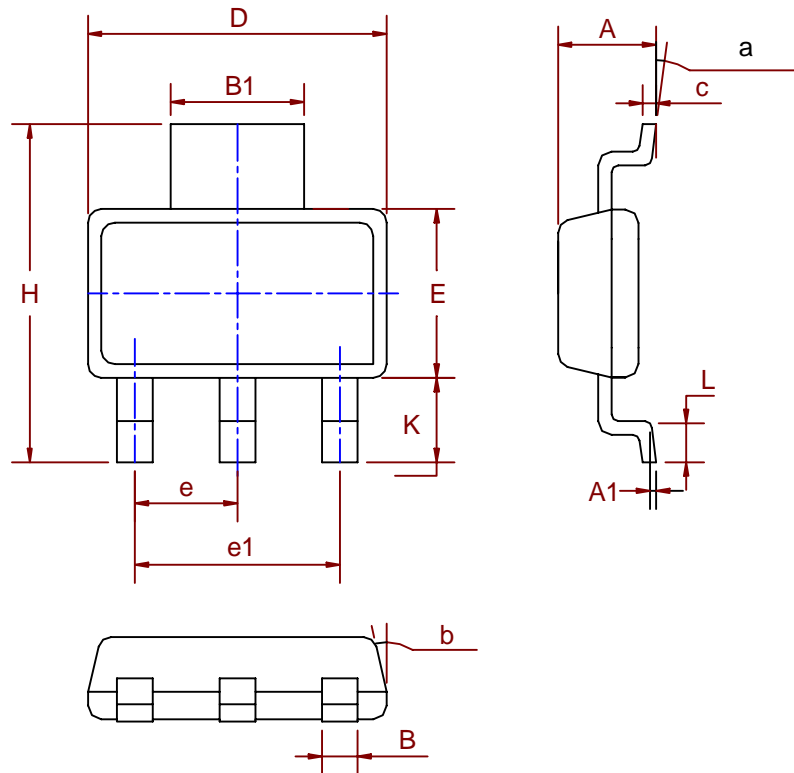
TO-252( Reference JEDEC Registration TO-252)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	2.18	2.39	0.086	0.094
A1	0.89	1.27	0.035	0.050
b	0.508	0.89	0.020	0.035
b2	5.207	5.461	0.205	0.215
C	0.46	0.58	0.018	0.023
C1	0.46	0.58	0.018	0.023
D	5.334	6.22	0.210	0.245
E	6.35	6.73	0.250	0.265
e1	3.96	5.18	0.156	0.204
H	9.398	10.41	0.370	0.410
L	0.51		0.020	
L1	0.64	1.02	0.025	0.040
L2	0.89	2.032	0.035	0.080

## Package Information

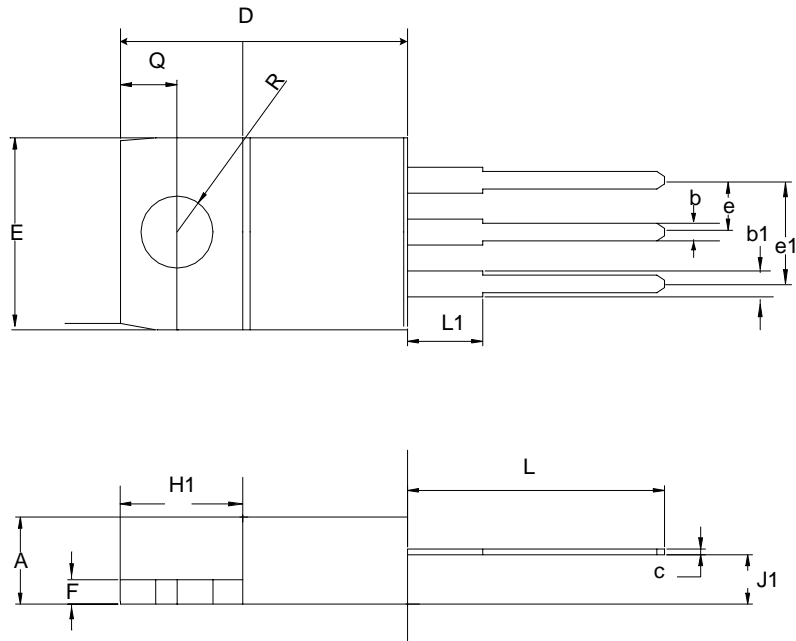
SOT-223( Reference JEDEC Registration SOT-223)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.50	1.80	0.06	0.07
A1	0.02	0.08		
B	0.60	0.80	0.02	0.03
B1	2.90	3.10	0.11	0.12
c	0.28	0.32	0.01	0.01
D	6.30	6.70	0.25	0.26
E	3.30	3.70	0.13	0.15
e	2.3 BSC		0.09 BSC	
e1	4.6 BSC		0.18 BSC	
H	6.70	7.30	0.26	0.29
L	0.91	1.10	0.04	0.04
K	1.50	2.00	0.06	0.08
α	0°	10°	0°	10°
β	13°		13°	



TO-220 ( Reference JEDEC Registration TO-220)



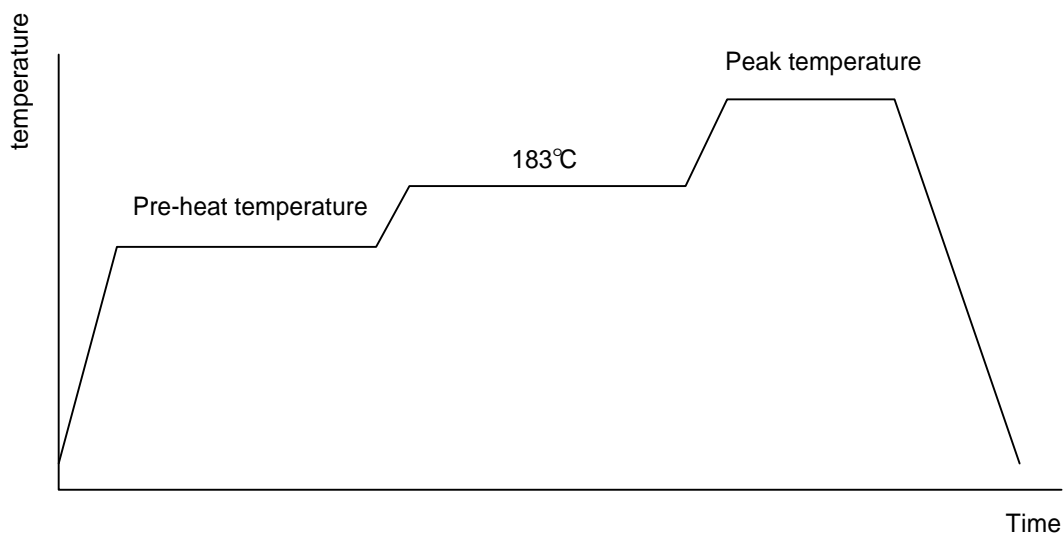
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	3.56	4.83	0.140	0.190
b1	1.14	1.78	0.045	0.070
b	0.51	1.14	0.020	0.045
c	0.31	1.14	0.012	0.045
D	14.23	16.51	0.560	0.650
e	2.29	2.79	0.090	0.110
e1	4.83	5.33	0.190	0.210
E	9.65	10.67	0.380	0.420
F	0.51	1.40	0.020	0.055
H1	5.84	6.86	0.230	0.270
J1	2.03	2.92	0.080	0.115
L	12.7	14.73	0.500	0.580
L1	3.65	6.35	0.143	0.250
R	3.53	4.09	0.139	0.161
Q	2.54	3.43	0.100	0.135

## Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb)
Lead Solderability	Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.

## Reflow Condition (IR/Convection or VPR Reflow)

Reference JEDEC Standard J-STD-020A APRIL 1999



## Classification Reflow Profiles

	Convection or IR/ Convection	VPR
Average ramp-up rate(183°C to Peak)	3°C/second max.	10 °C /second max.
Preheat temperature 125 ± 25°C)	120 seconds max	
Temperature maintained above 183°C	60 – 150 seconds	
Time within 5°C of actual peak temperature	10 –20 seconds	60 seconds
Peak temperature range	220 +5/-0°C or 235 +5/-0°C	215-219°C or 235 +5/-0°C
Ramp-down rate	6 °C /second max.	10 °C /second max.
Time 25°C to peak temperature	6 minutes max.	

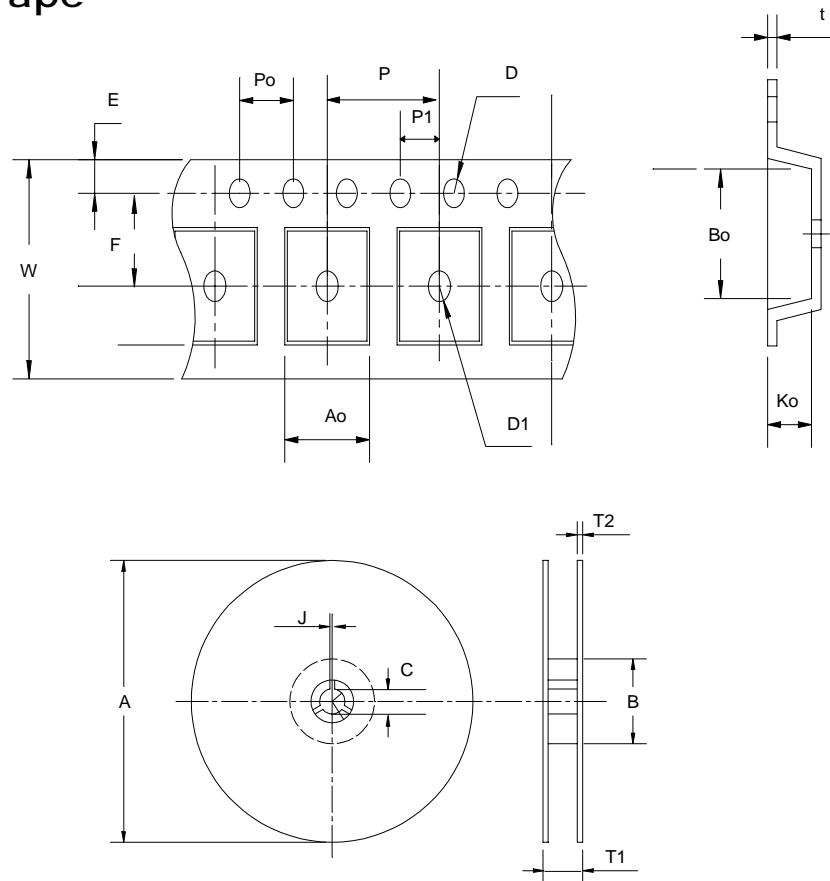
## Package Reflow Conditions

pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm <sup>3</sup>	pkg. thickness < 2.5mm and pkg. volume < 350mm <sup>3</sup>
Convection 220 +5/-0 °C		Convection 235 +5/-0 °C
VPR 215-219 °C		VPR 235 +5/-0 °C
IR/Convection 220 +5/-0 °C		IR/Convection 235 +5/-0 °C

## Reliability test program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245°C, 5 SEC
HOLT	MIL-STD 883D-1005.7	1000 Hrs Bias @ 125°C
PCT	JESD-22-B, A102	168 Hrs, 100% RH, 121°C
TST	MIL-STD 883D-1011.9	-65°C ~ 150°C, 200 Cycles

## Carrier Tape



Application	A	B	C	J	T1	T2	W	P	E
TO-252	330 ± 3	100 ± 2	13 ± 0.5	2 ± 0.5	16.4 +0.3 -0.2	2.5 ± 0.5	16 +0.3 -0.1	8 ± 0.1	1.75 ± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	7.5 ± 0.1	1.5 ± 0.1	1.5 ± 0.25	4.0 ± 0.1	2.0 ± 0.1	6.8 ± 0.1	10.4 ± 0.1	2.5 ± 0.1	0.3 ± 0.05
Application	A	B	C	J	T1	T2	W	P	E
SOT-223	330 ± 1	62 ± 1.5	12.75 ± 0.15	2 ± 0.6	12.4 ± 0.2	2 ± 0.2	12 ± 0.3	8 ± 0.1	1.75 ± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5 ± 0.05	1.5 ± 0.1	1.5 ± 0.1	4.0 ± 0.1	2.0 ± 0.05	6.9 ± 0.1	7.5 ± 0.1	2.1 ± 0.1	0.3 ± 0.05

## Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
TO- 252	16	13.3	2500
SOT- 223	12	9.3	2500

## Customer Service

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