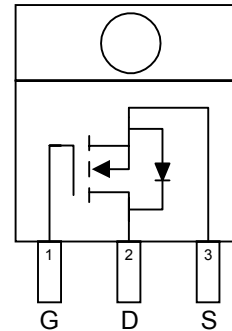


## N-Channel Enhancement Mode MOSFET

### Features

- 30V/70A ,  $R_{DS(ON)} = 7m\Omega(\text{typ.}) @ V_{GS} = 10V$   
 $R_{DS(ON)} = 11m\Omega(\text{typ.}) @ V_{GS} = 4.5V$
- Super High Dense Advanced Cell Design for Extremely Low  $R_{DS(ON)}$
- Reliable and Rugged
- TO-220 , TO-252 and TO-263 Packages

### Pin Description




Top View of TO-220, TO-252 and TO-263

### Applications

- Power Management in Desktop Computer or DC/DC Converters.

### Ordering and Marking Information

<p>APM3009N □□-□□</p> <p>Handling Code</p> <p>Temp. Range</p> <p>Package Code</p>	<p>Package Code</p> <p>F : TO-220    G : TO-263    U : TO-252</p> <p>Operating Junction Temp. Range</p> <p>C : -55 to 125°C</p> <p>Handling Code</p> <p>TU : Tube</p> <p>TR : Tape &amp; Reel</p>
<p>APM3009N F/G/U :</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	60	A
$I_{DM}$	Maximum Drain Current – Pulsed	110	

\* 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	50	W
			TO-263	62.5	
		$T_A=100^\circ\text{C}$	TO-252	20	
			TO-263	25	
$T_J, T_{STG}$	Maximum Operating and Storage Junction Temperature	-55 to 150	$^\circ\text{C}$		
$R_{\theta JA}$	Thermal Resistance – Junction to Ambient	TO-252	50	$^\circ\text{C/W}$	
		TO-263	60		
$R_{\theta JC}$	Thermal Resistance – Junction to Case	TO-252	2.5	$^\circ\text{C/W}$	
		TO-263	2		

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

Symbol	Parameter	Test Condition	APM3009N			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
$BV_{DSS}$	Drain-Source Breakdown	$V_{GS}=0V, I_{DS}=250\mu\text{A}$	30			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=24V, V_{GS}=0V$			1	$\mu\text{A}$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	1		3	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
$R_{DS(ON)}^a$	Drain-Source On-state	$V_{GS}=10V, I_{DS}=35A$		7	9	m $\Omega$
	Resistance	$V_{GS}=4.5V, I_{DS}=20A$		11	15	
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=35A, V_{GS}=0V$	0.6		1.3	V
<b>Dynamic<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=15V, I_{DS}=20A$		22	28	nC
$Q_{gs}$	Gate-Source Charge	$V_{GS}=4.5V,$		12.8		
$Q_{gd}$	Gate-Drain Charge			5		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=15V, I_{DS}=1A,$ $V_{GEN}=10V, R_G=0.2\Omega$		10	15	ns
$T_r$	Turn-on Rise Time			7	13	
$t_{d(OFF)}$	Turn-off Delay Time			35	50	
$T_f$	Turn-off Fall Time			10	20	
$C_{iss}$	Input Capacitance	$V_{GS}=0V$		2400		pF
$C_{oss}$	Output Capacitance	$V_{DS}=15V$		500		
$C_{rss}$	Reverse Transfer Capacitance	Frequency = 1.0MHz		240		

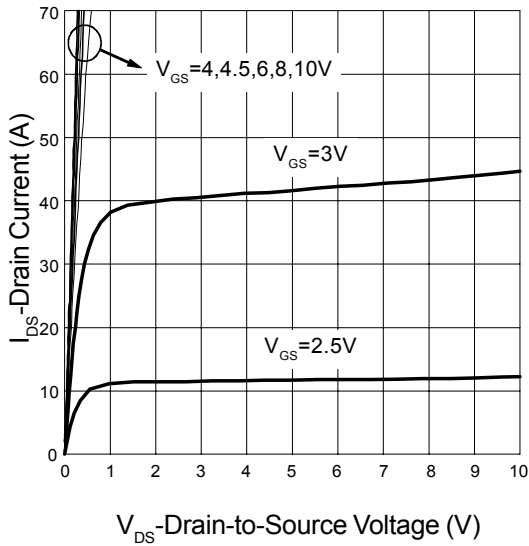
### Notes

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

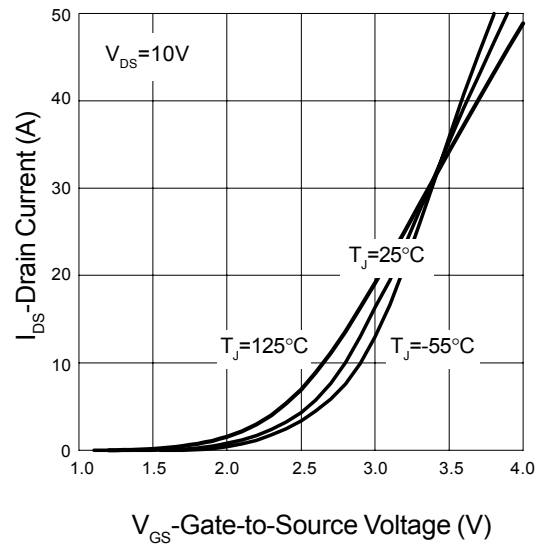
<sup>b</sup> : Guaranteed by design, not subject to production testing

## Typical Characteristics

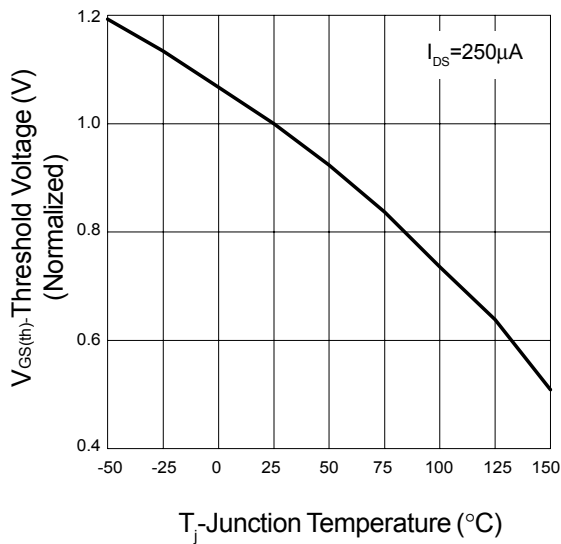
Output Characteristics



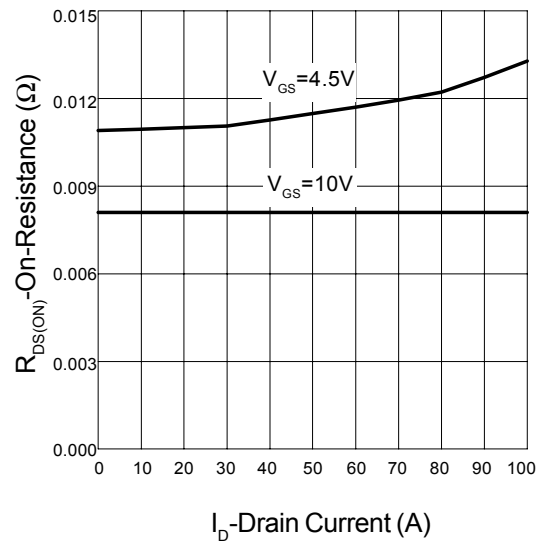
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

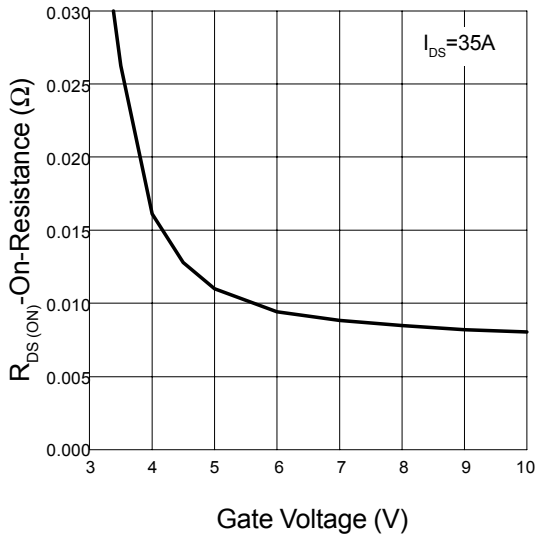


On-Resistance vs. Drain Current

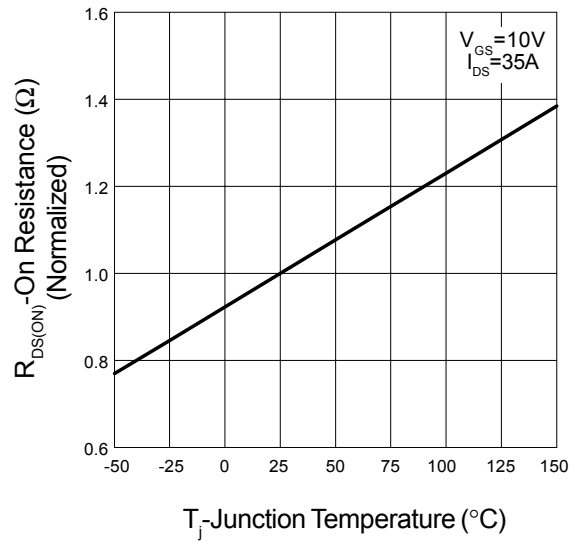


Typical Characteristics Cont.

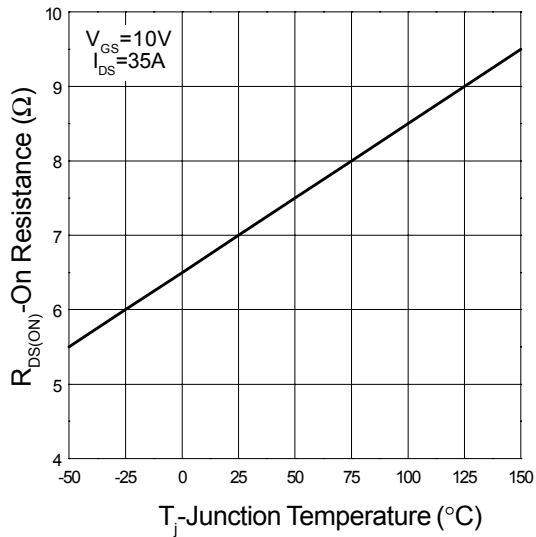
On-Resistance vs. Gate-to-Source Voltage



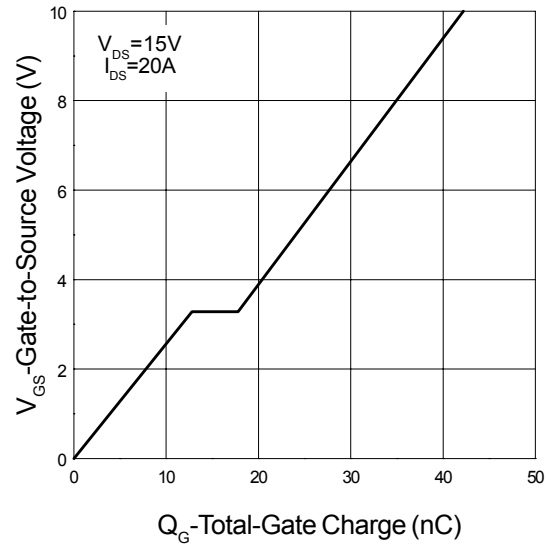
On-Resistance vs. Junction Temperature



On-Resistance vs. Junction Temperature

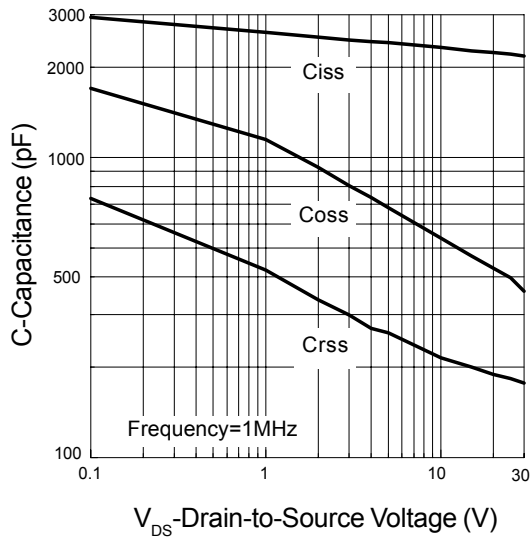


Gate Charge

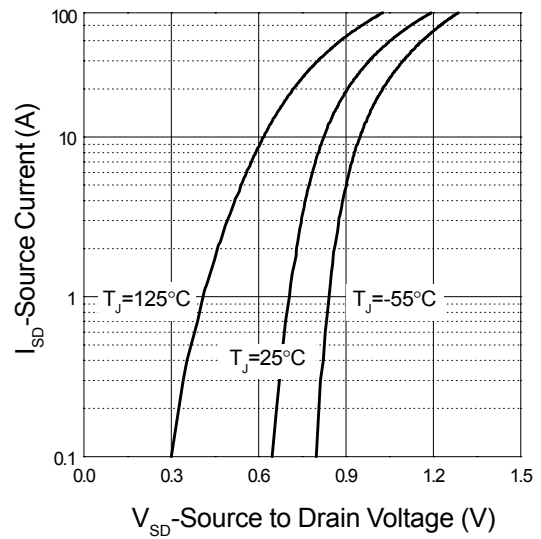


Typical Characteristics Cont.

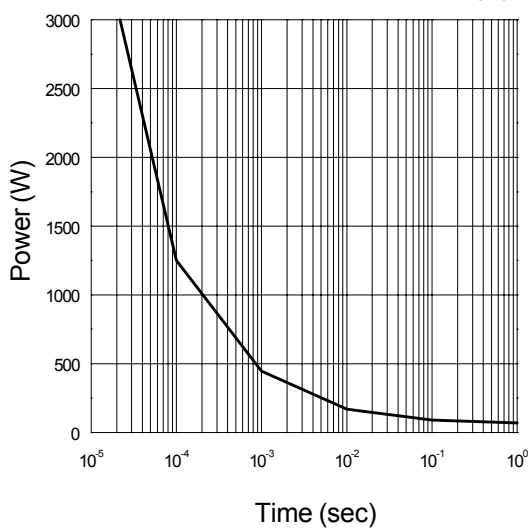
Capacitance Characteristics



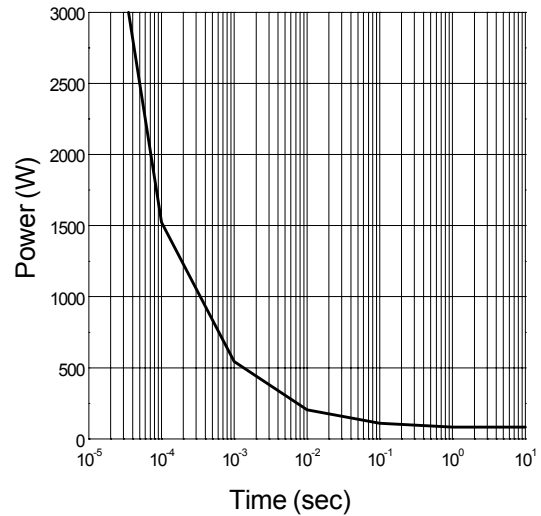
Source-Drain Diode Forward Voltage



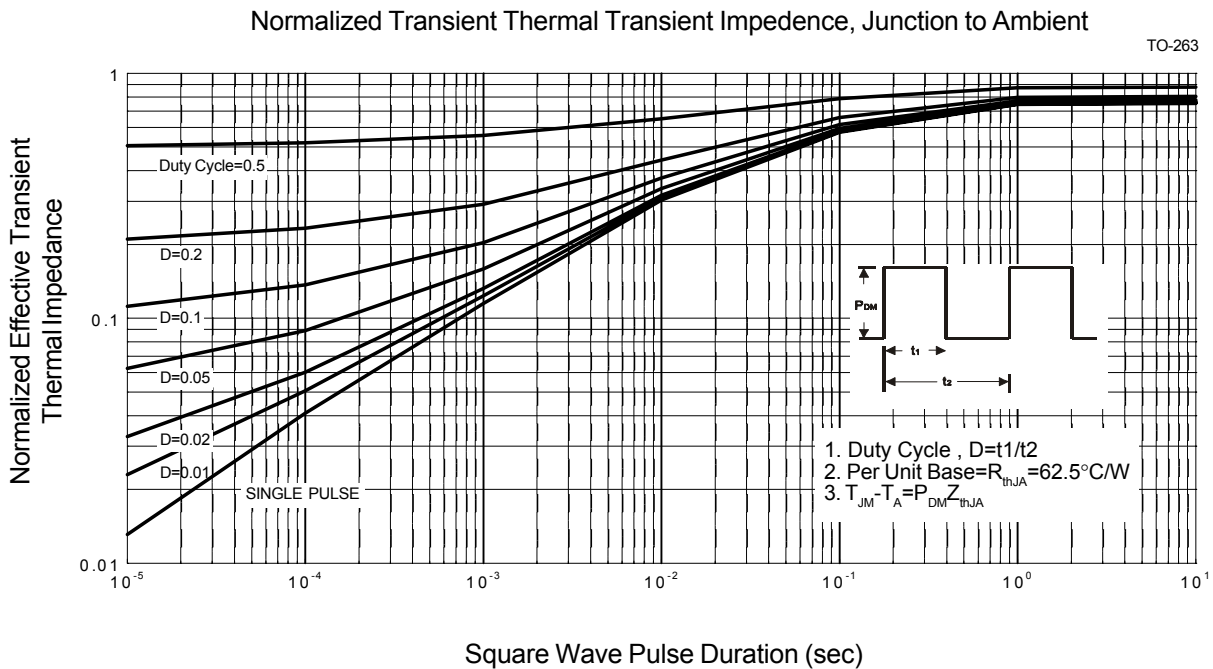
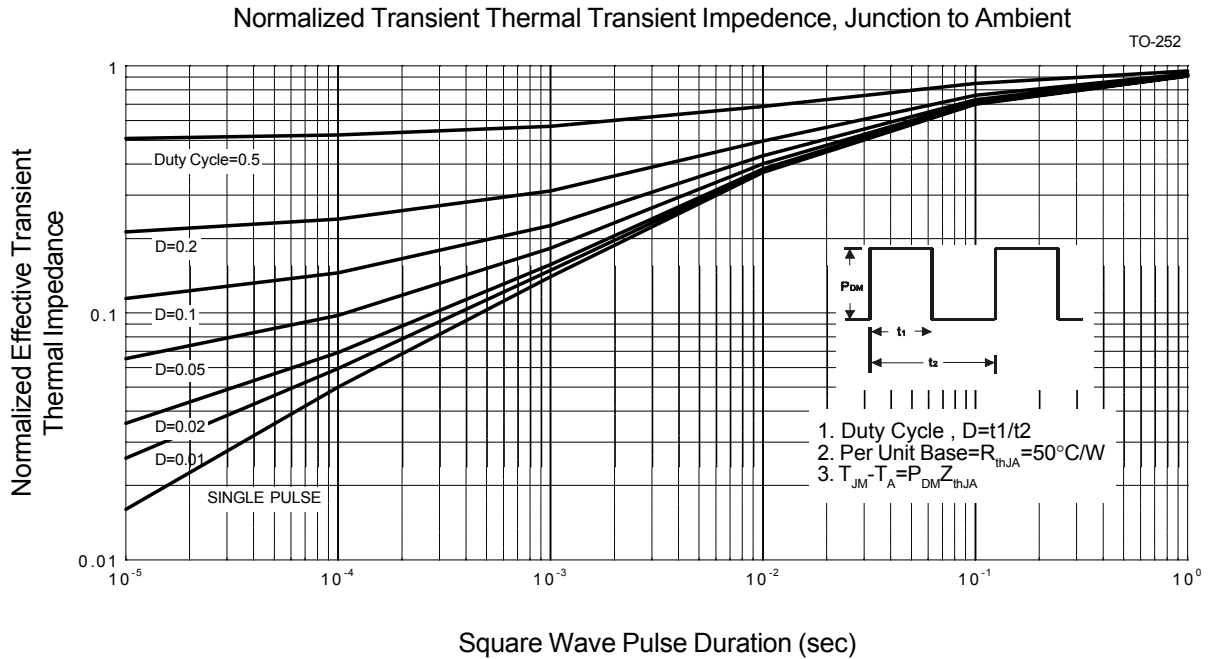
Single Pulse Power TO-252



Single Pulse Power TO-263

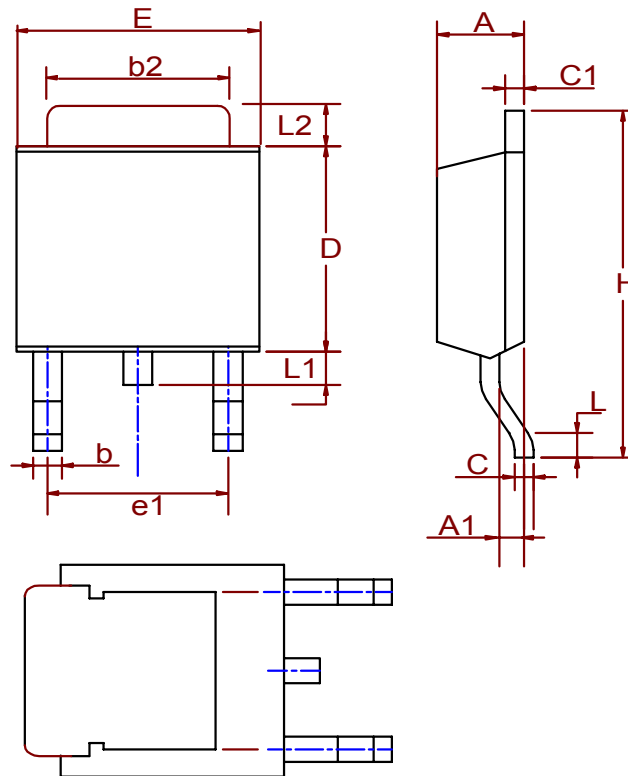


Typical Characteristics Cont.



Package Informaion

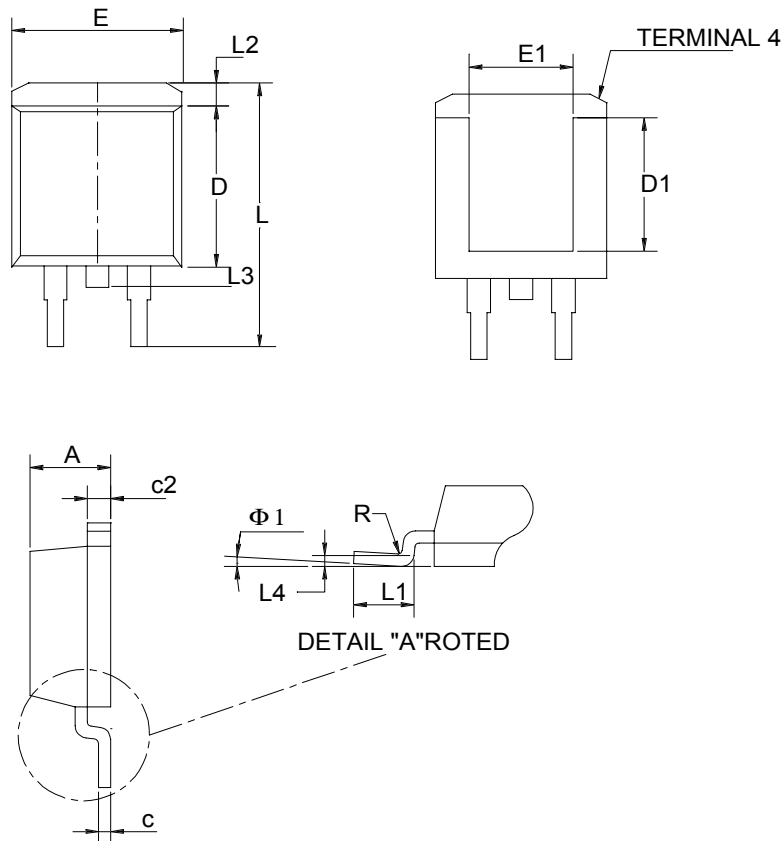
TO-252( Reference JEDEC Registration TO-252)



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

**Packaging Information Cont.**

TO-263 ( Reference JEDEC Registration TO-263)

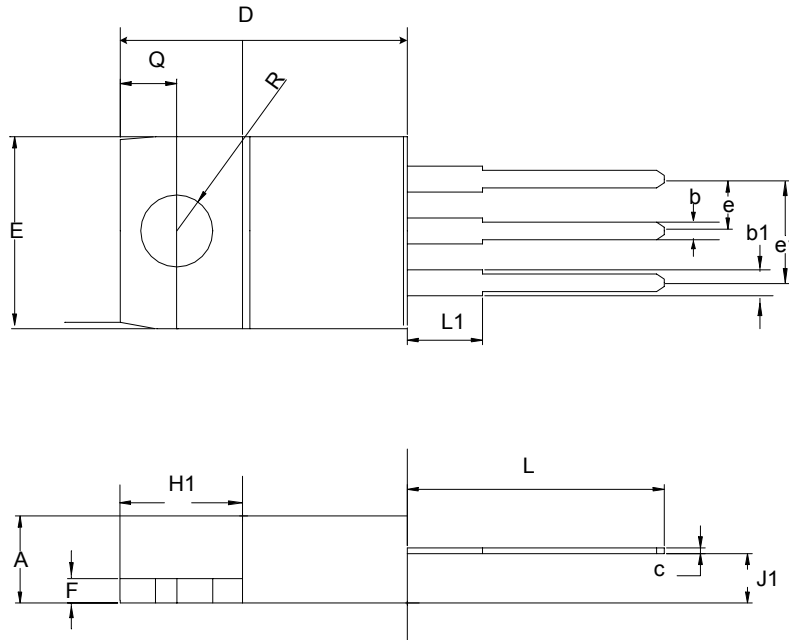


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	0.160	0.190
b	0.51	1.016	0.02	0.040
b2	1.14	1.651	0.045	0.065
c	0.38 TYP.		0.015 TYP.	
c2	1.14	1.40	0.045	0.055
D	8.64	9.65	0.340	0.380
E	9.65	10.54	0.380	0.415
L	14.60	15.88	0.575	0.625
L1	2.24	2.84	0.090	0.110
L2	1.02	2.92	0.040	0.112
L3	1.20	1.78	0.050	0.070



**Package Information Cont.**

TO-220 ( Reference JEDEC Registration TO-220)



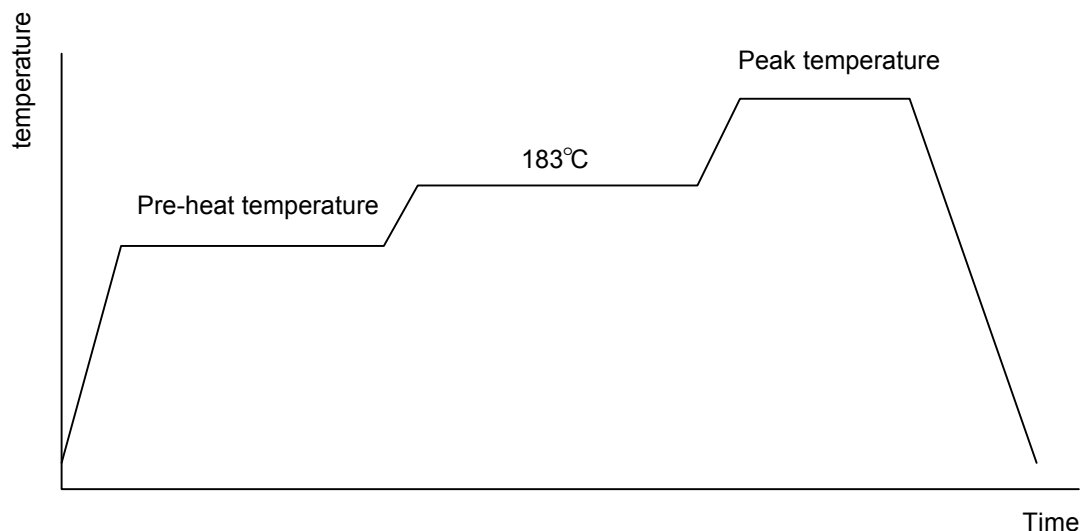
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	3.56	4.83	0.140	0.190
b1	1.14	1.78	0.045	0.070
b	0.51	1.14	0.020	0.045
c	0.31	1.14	0.012	0.045
D	14.23	16.51	0.560	0.650
e	2.29	2.79	0.090	0.110
e1	4.83	5.33	0.190	0.210
E	9.65	10.67	0.380	0.420
F	0.51	1.40	0.020	0.055
H1	5.84	6.86	0.230	0.270
J1	2.03	2.92	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.	

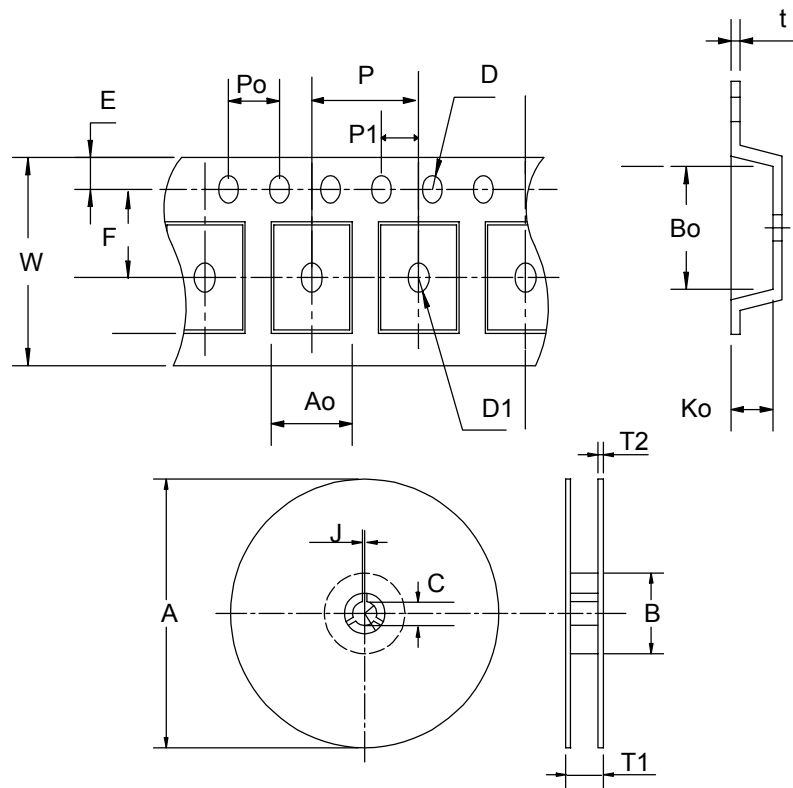
## Package Reflow Conditions

pkg. thickness ≥ 2.5mm and all bags	pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm	pkg. thickness < 2.5mm and pkg. volume <
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 & Reel Dimension



<b>Application</b>	A	B	C	J	T1	T2	W	P	E
<b>TO-252</b>	330±3	100 ± 2	13 ± 0.5	2 ± 0.5	16.4 +0.3 -0.2	2.5± 0.5	16 + 0.3 16 - 0.1	8 ± 0.1	1.75± 0.1
<b>Application</b>	F	D	D1	Po	P1	Ao	Bo	Ko	t
<b>TO-252</b>	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
<b>Application</b>	A	B	C	J	T1	T2	W	P	E
<b>TO-263</b>	380±3	80 ± 2	13 ± 0.5	2 ± 0.5	24 ± 4	2± 0.3	24 + 0.3 - 0.1	16 ± 0.1	1.75± 0.1
<b>Application</b>	F	D	D1	Po	P1	Ao	Bo	Ko	t
<b>TO-263</b>	11.5 ± 0.1	1.5 + 0.1	1.5± 0.25	4.0 ± 0.1	2.0 ± 0.1	10.8 ± 0.1	16.1± 0.1	5.2± 0.1	0.35±0.013

(mm)

## Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
TO- 252	16	13.3	2500
TO- 263	24	21.3	1000

## Customer Service

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