

APM3009N

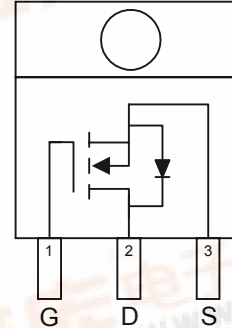


N-Channel Enhancement Mode MOSFET

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

APM3009N □□-□□ 	Package Code F : TO-220 G : TO-263 U : TO-252 Operating Junction Temp. Range C : -55 to 125 °C Handling Code TU : Tube TR : Tape & Reel
APM3009N F/G/U :	XXXXX - Date Code

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	± 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.	
Static						
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	μA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	1		3	V
I_{GSS}	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$			± 100	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=10V, I_{DS}=35A$		7	9	m Ω
		$V_{GS}=4.5V, I_{DS}=20A$		11	15	
V_{SD}^a	Diode Forward Voltage	$I_{SD}=35A, V_{GS}=0V$	0.6		1.3	V
Dynamic^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		

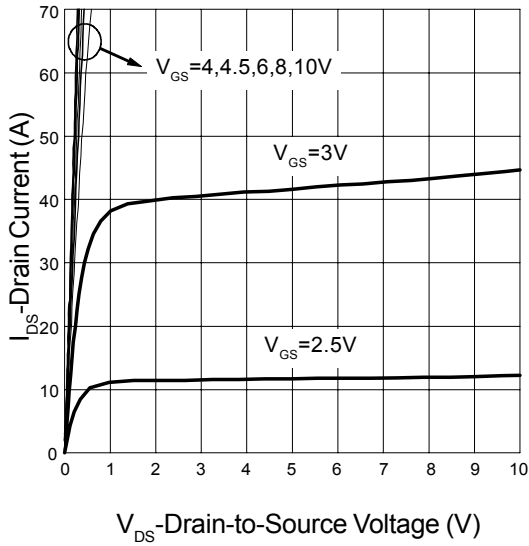
Notes

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

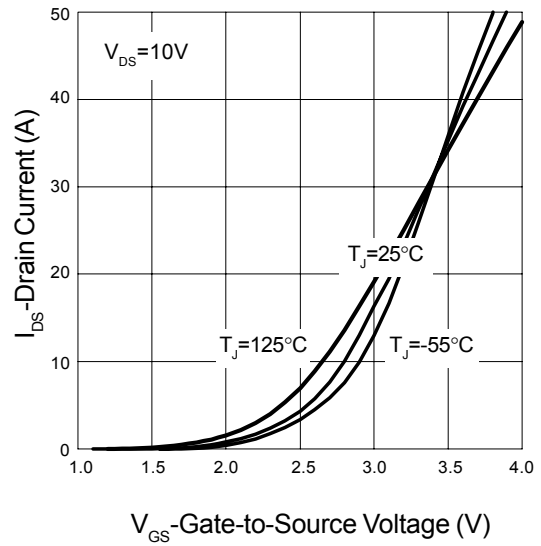
^b : Guaranteed by design, not subject to production testing

Typical Characteristics

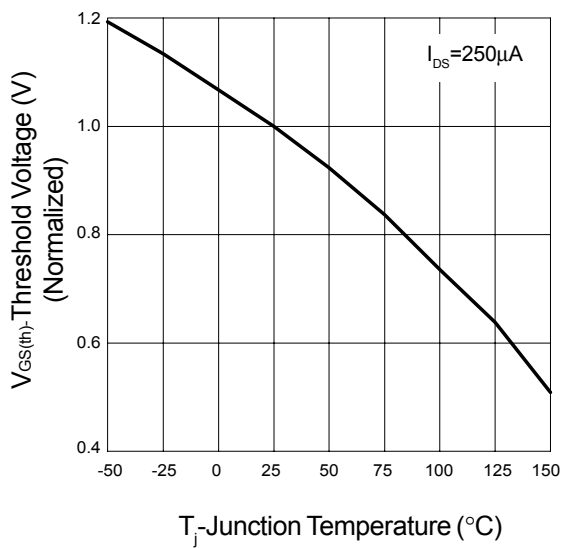
Output Characteristics



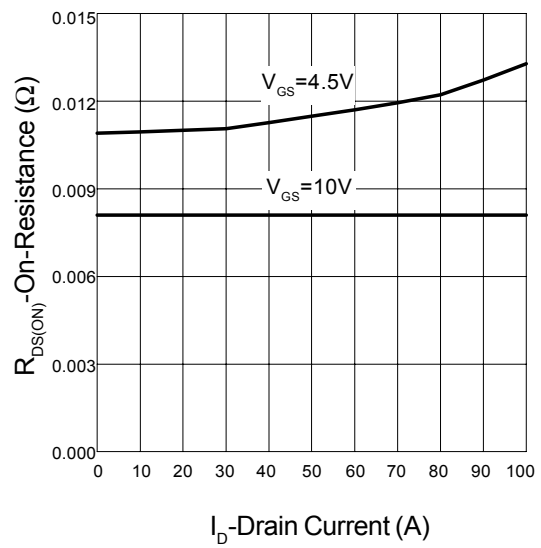
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

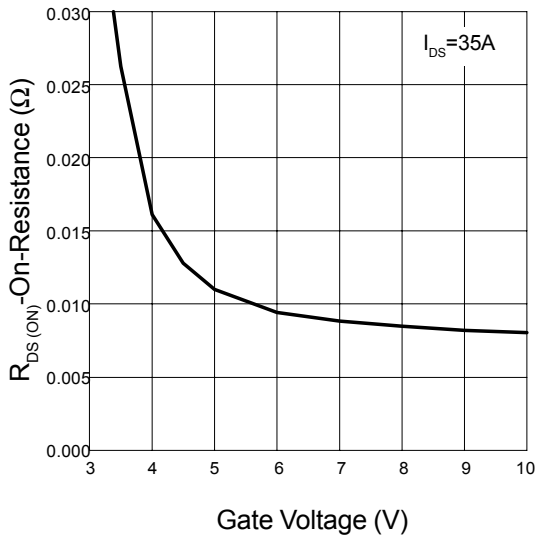


On-Resistance vs. Drain Current

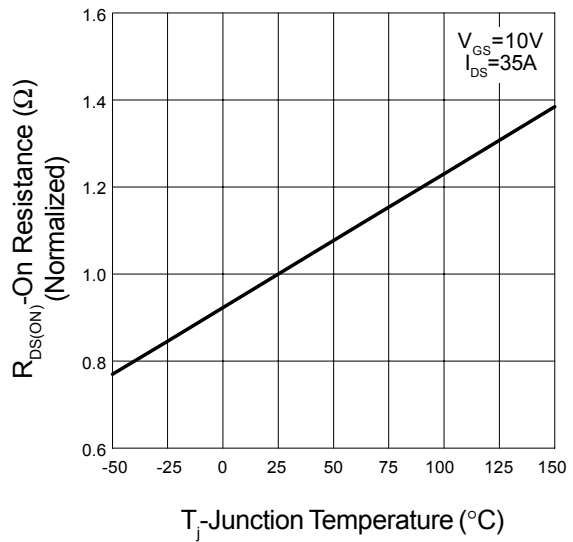


Typical Characteristics Cont.

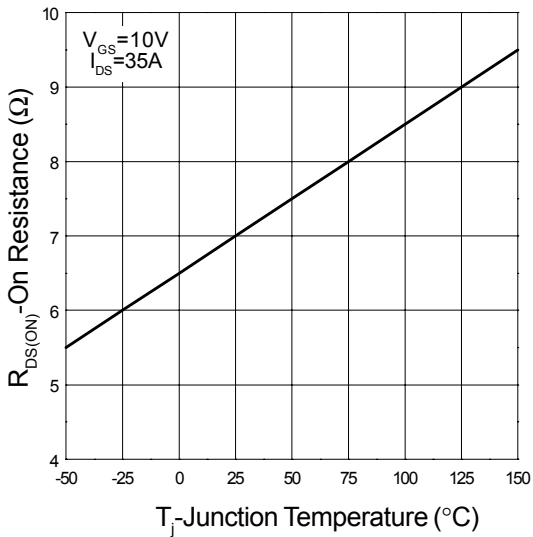
On-Resistance vs. Gate-to-Source Voltage



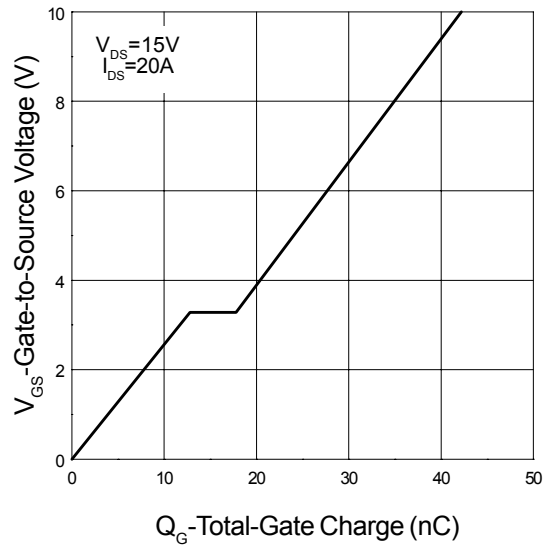
On-Resistance vs. Junction Temperature



On-Resistance vs. Junction Temperature

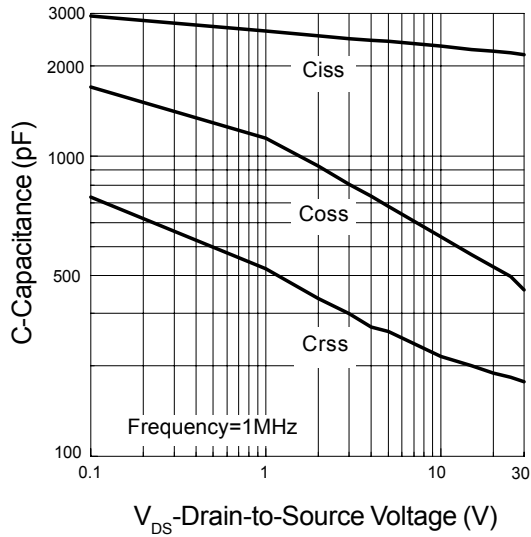


Gate Charge

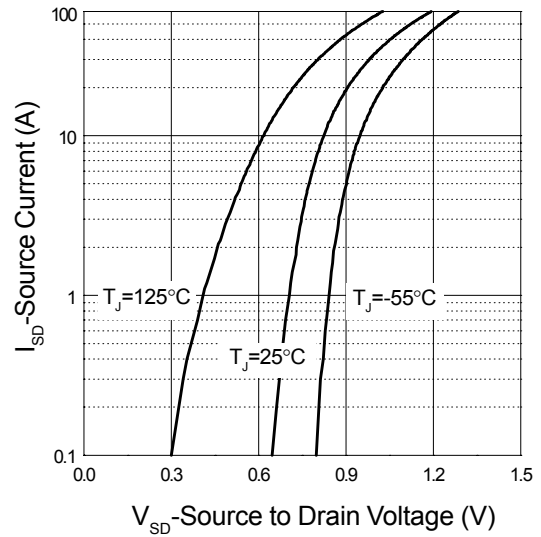


Typical Characteristics Cont.

Capacitance Characteristics

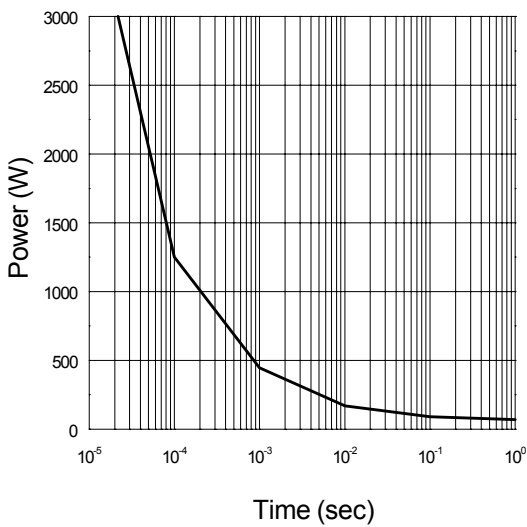


Source-Drain Diode Forward Voltage



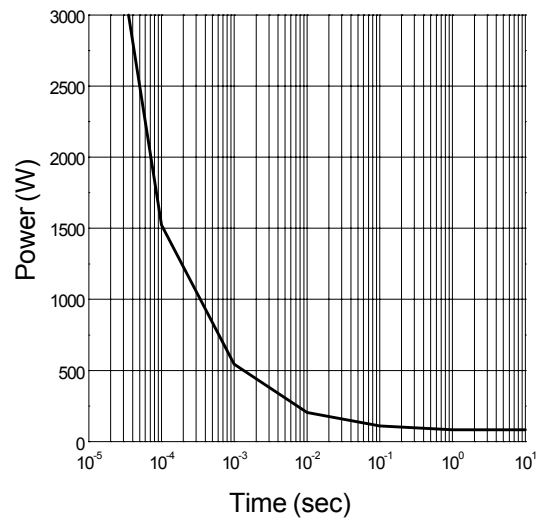
Single Pulse Power

TO-252



Single Pulse Power

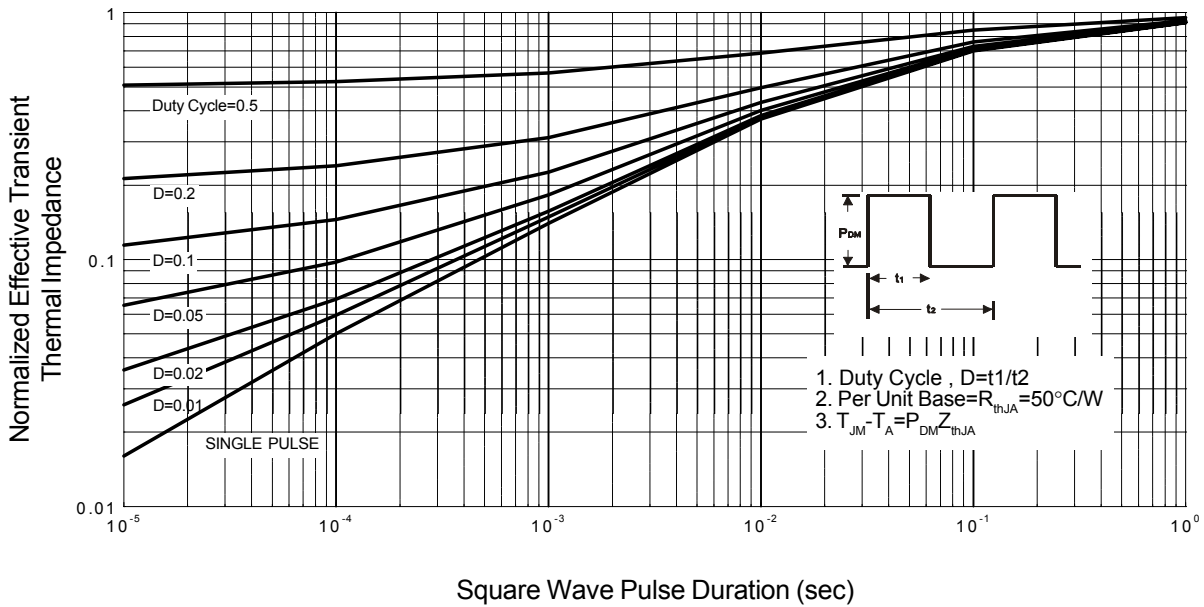
TO-263



Typical Characteristics Cont.

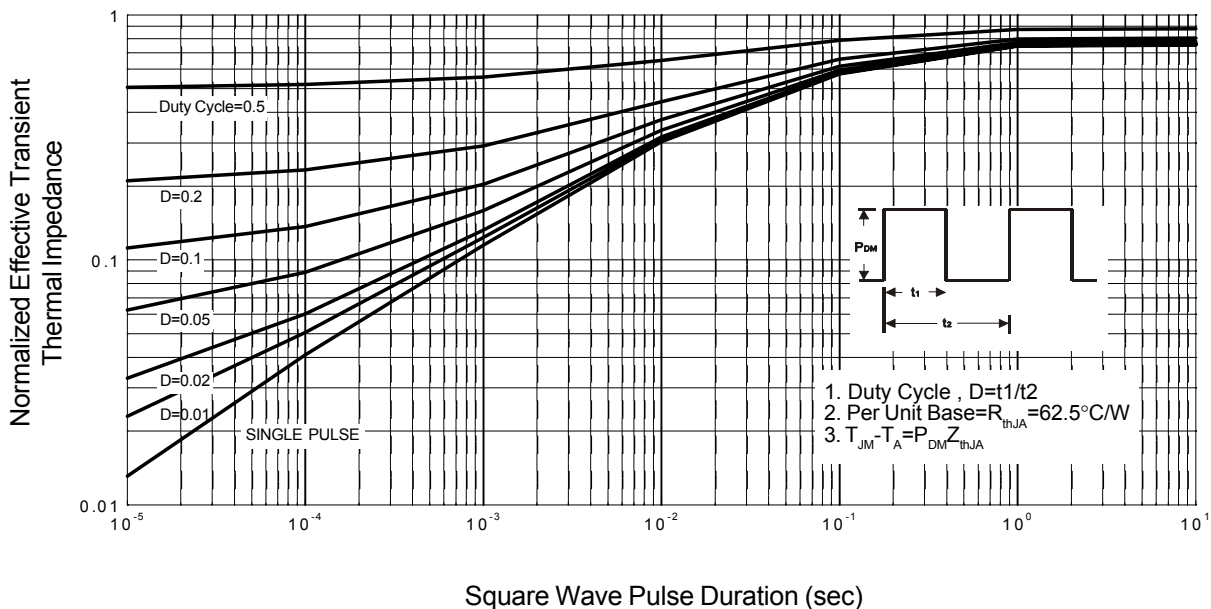
Normalized Transient Thermal Impedance, Junction to Ambient

TO-252



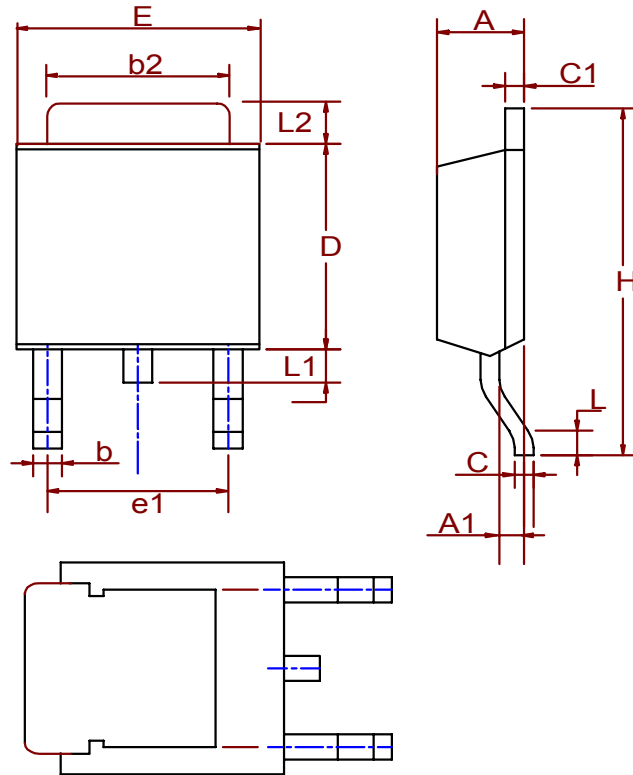
Normalized Transient Thermal Impedance, Junction to Ambient

TO-263



Package Informaion

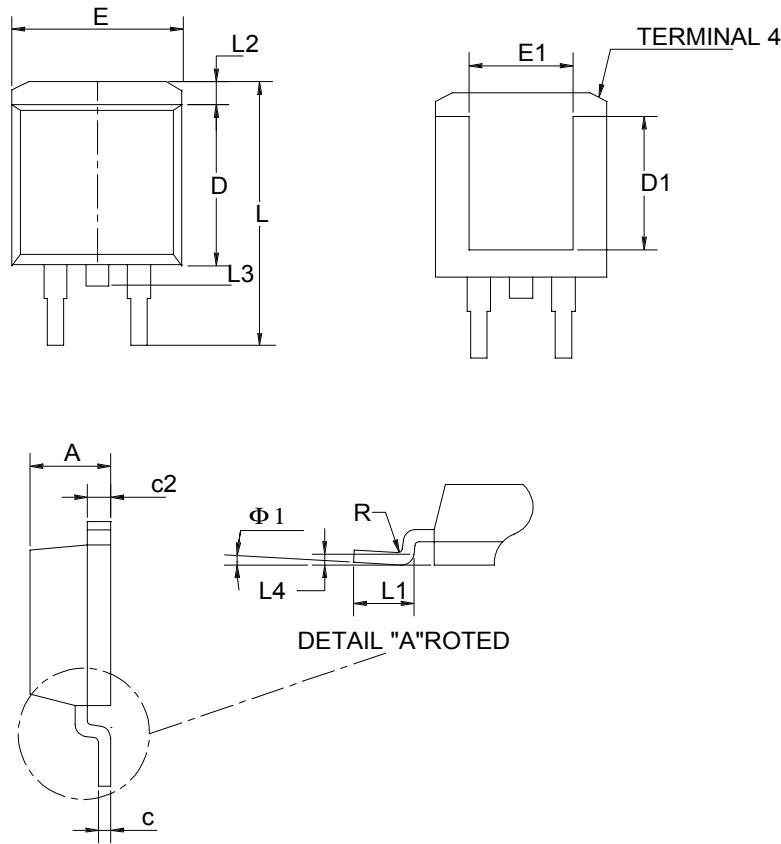
TO-252(Reference JEDEC Registration TO-252)



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.

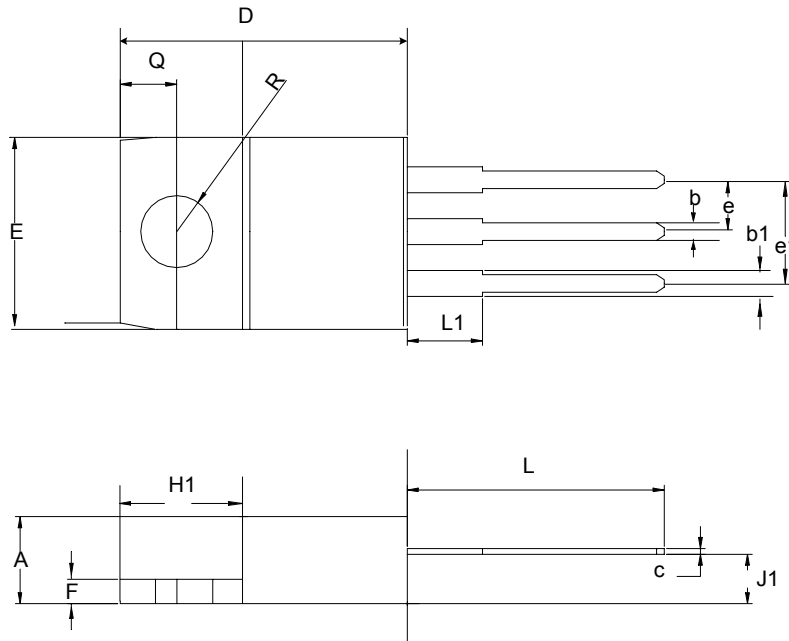
TO-263 (Reference JEDEC Registration TO-263)



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)



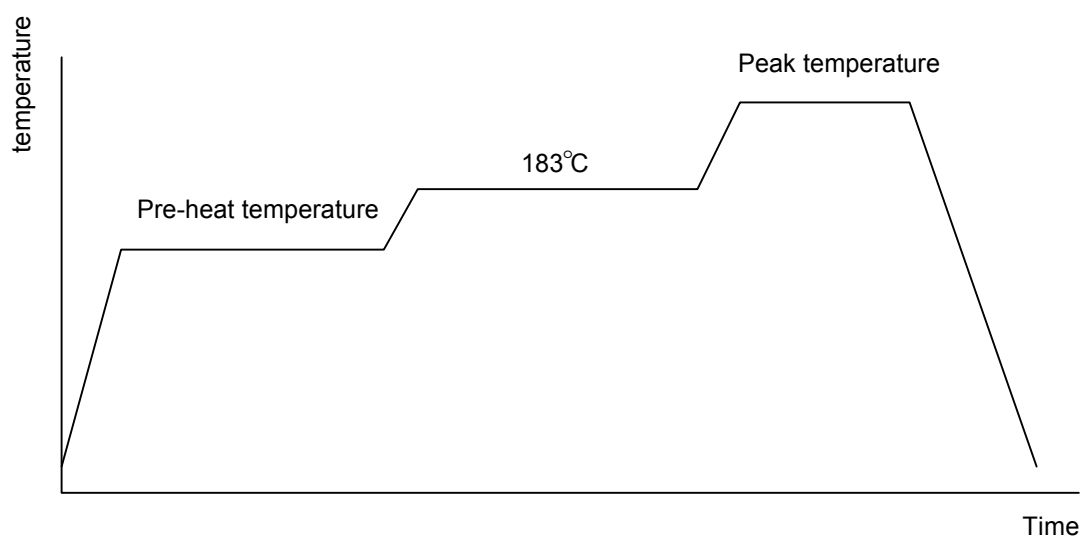
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	3.56	4.83	0.140	0.190
b1	1.14	1.78	0.045	0.070
b	0.51	1.14	0.020	0.045
c	0.31	1.14	0.012	0.045
D	14.23	16.51	0.560	0.650
e	2.29	2.79	0.090	0.110
e1	4.83	5.33	0.190	0.210
E	9.65	10.67	0.380	0.420
F	0.51	1.40	0.020	0.055
H1	5.84	6.86	0.230	0.270
J1	2.03	2.92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

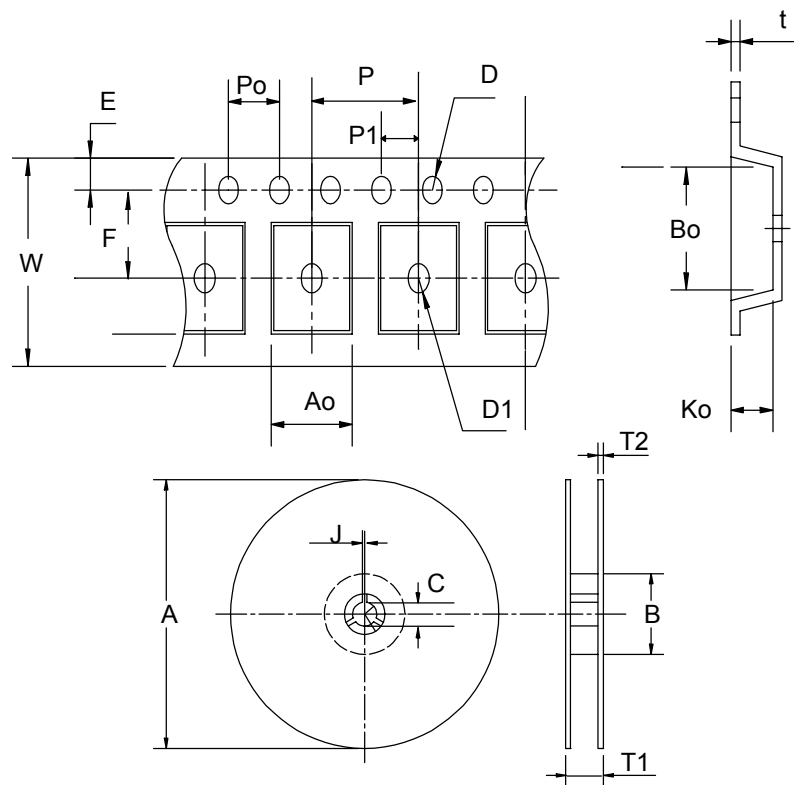
Package Reflow Conditions

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



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 16 - 0.1	8 ± 0.1	1.75± 0.1
Application	F	D	D1	Po	P1	Ao	Bo	Ko	t
TO-252	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
TO-263	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
Application	F	D	D1	Po	P1	Ao	Bo	Ko	t
TO-263	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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