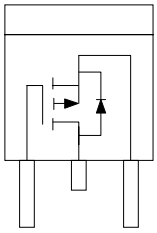
P-Channel Enhancement Mode MOSFET

Features

- -20V/-3.6A , $R_{DS(ON)}$=70mΩ(typ.) @ V_{GS}=-4.5V
  $R_{DS(ON)}$=100mΩ(typ.) @ V_{GS}=-2.5V
- Super High Dense Cell Design for Extremely Low $R_{DS(ON)}$
- Reliable and Rugged
- TO-252 Package

Pin Description



Top View of TO-252

Applications

- Power Management in Notebook Computer , Portable Equipment and Battery Powered Systems.

Ordering and Marking Information

APM2095P □□-□□

- Handling Code
- Temp. Range
- Package Code

Package Code
U : TO-252
Operating Junction Temp. Range
C : -55 to 150°C
Handling Code
TU : Tube
TR : Tape & Reel

APM2095P U :



XXXXX - Date Code

Absolute Maximum Ratings (T$_A$ = 25°C unless otherwise noted)

Symbol	Parameter	Rating	Unit
V_{DSS}	Drain-Source Voltage	-20	V
V_{GSS}	Gate-Source Voltage	±10	
I_D	Maximum Drain Current – Continuous	-3.6	A
I_{DM}	Maximum Pulsed Drain Current (pulse width ≤ 300μs)	-20	

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.

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Rev. A.1 - Nov., 2003

Absolute Maximum Ratings Cont. (T_A = 25°C unless otherwise noted)

Symbol	Parameter		Rating	Unit
P_D	Maximum Power Dissipation	T_C=25°C	50	W
		T_C=100°C	20	
T_J	Maximum Junction Temperature		150	°C
T_{STG}	Storage Temperature Range		-55 to 150	
$R_{\theta JA}$*	Thermal Resistance – Junction to Ambient		50	°C/W
$R_{\theta JC}$	Thermal Resistance – Junction to Case		2.5	

*Mounted on 1in^2 pad area of PCB.

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	APM2095P			Unit
			Min.	Typ.	Max.	
Static						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V , I_{DS}=-250µA	-20			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-16V , V_{GS}=0V			-1	µA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} , I_{DS}=-250µA	-0.5	-0.7	-1	V
I_{GSS}	Gate Leakage Current	V_{GS}=±10V , V_{DS}=0V			±100	nA
$R_{DS(ON)}$[a]	Drain-Source On-state Resistance	V_{GS}=-4.5V , I_{DS}=-3.6A		70	95	mΩ
		V_{GS}=-2.5V , I_{DS}=-2A		100	125	
V_{SD}[a]	Diode Forward Voltage	I_{SD}=-1A , V_{GS}=0V		-0.7	-1.3	V
Dynamic[b]						
Q_g	Total Gate Charge	V_{DS}=-10V , I_{DS}=-3.6A		11	15	nC
Q_{gs}	Gate-Source Charge	V_{GS}=-4.5V		2		
Q_{gd}	Gate-Drain Charge			1.5		
$t_{d(ON)}$	Turn-on Delay Time	V_{DD}=-10V , I_{DS}=-3.6A , V_{GEN}=-4.5V , R_G=6Ω		13	22	ns
T_r	Turn-on Rise Time			36	56	
$t_{d(OFF)}$	Turn-off Delay Time			45	70	
T_f	Turn-off Fall Time			37	58	
C_{iss}	Input Capacitance	V_{GS}=0V , V_{DS}=-15V , Frequency=1.0MHz		550		pF
C_{oss}	Output Capacitance			170		
C_{rss}	Reverse Transfer Capacitance			120		

Notes

[a] : Pulse test ; pulse width ≤300µs, duty cycle ≤ 2%

[b] : Guaranteed by design, not subject to production testing

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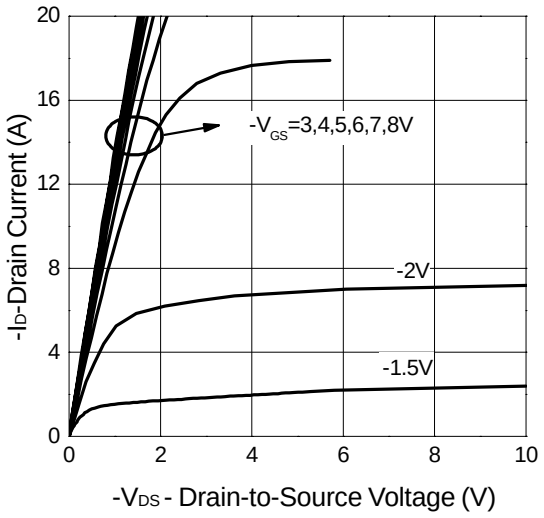
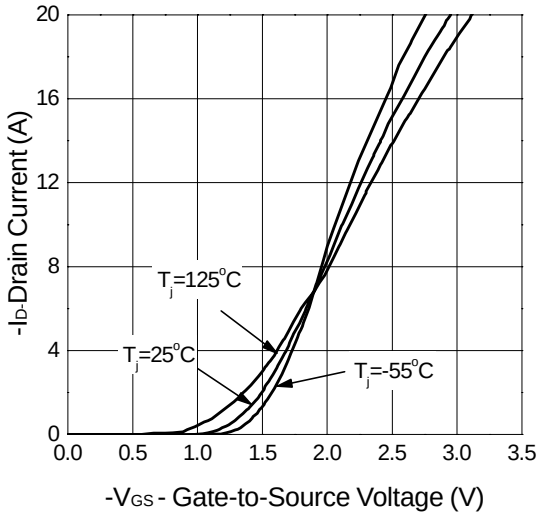
Typical Characteristics

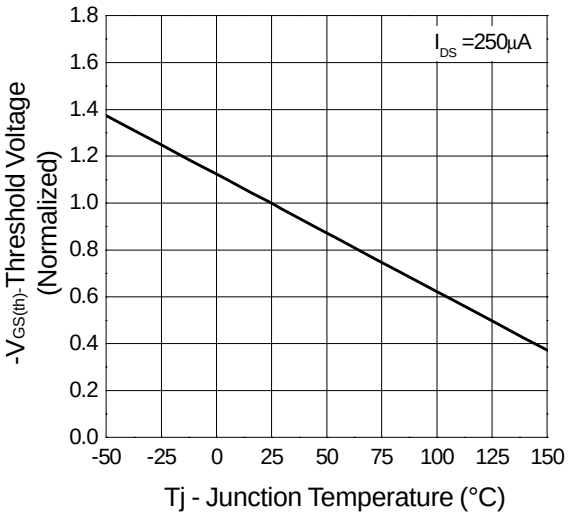
Output Characteristics



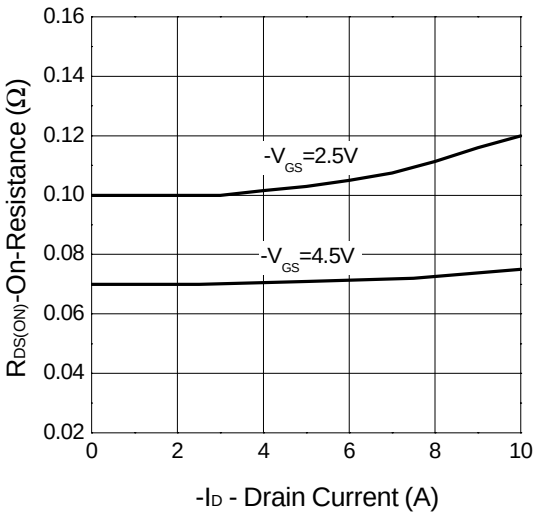
Transfer Characteristics



Threshold Voltage vs. Junction Temperature



On-Resistance vs. Drain Current



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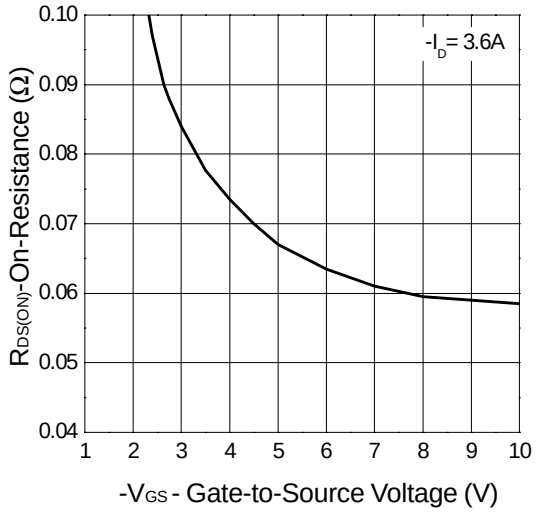
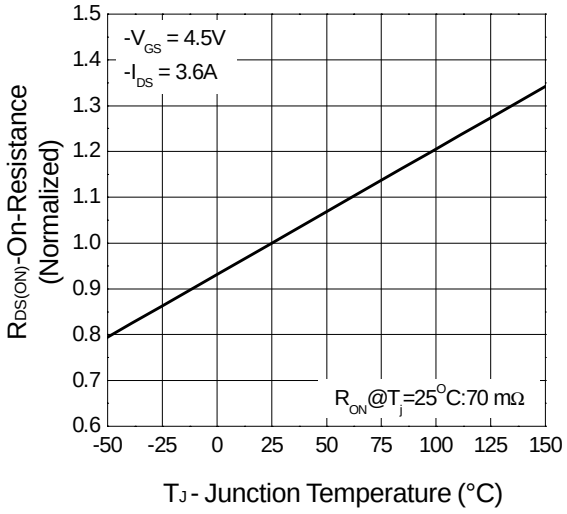
Typical Characteristics

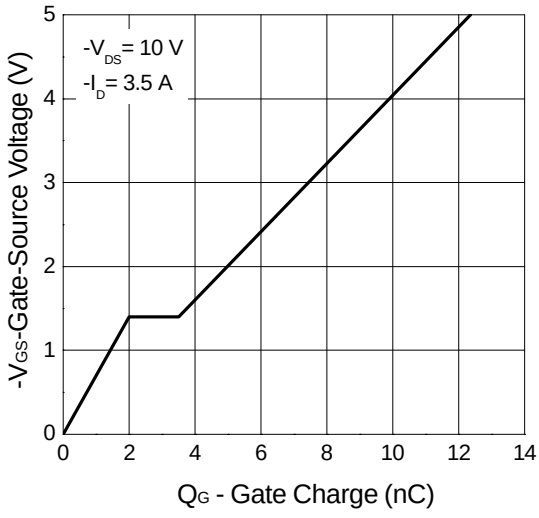
On-Resistance vs. Gate-to-Source Voltage



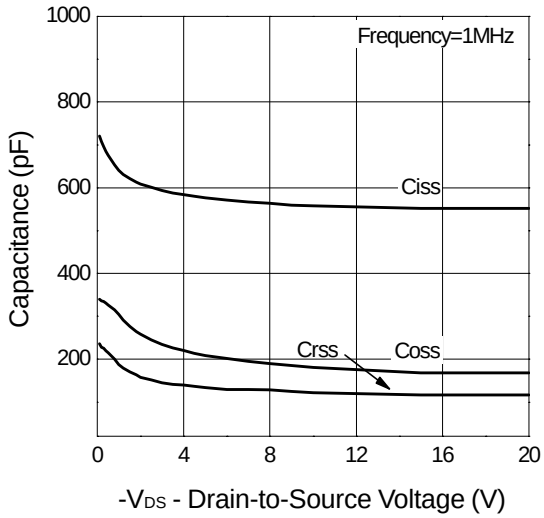
On-Resistance vs. Junction Temperature



Gate Charge



Capacitance



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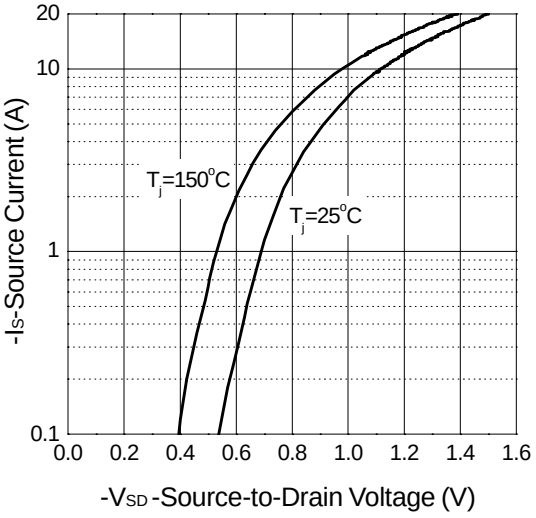
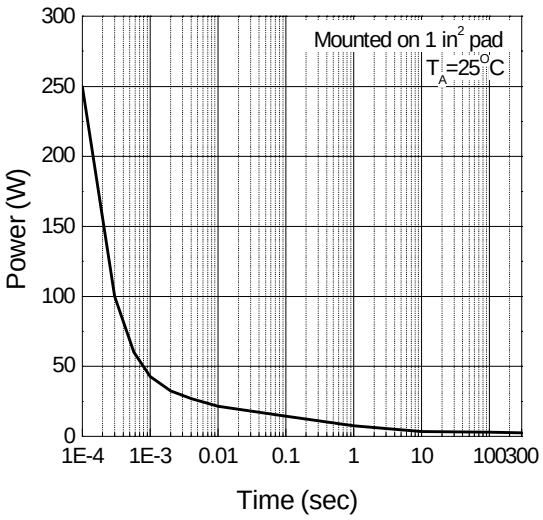
Typical Characteristics

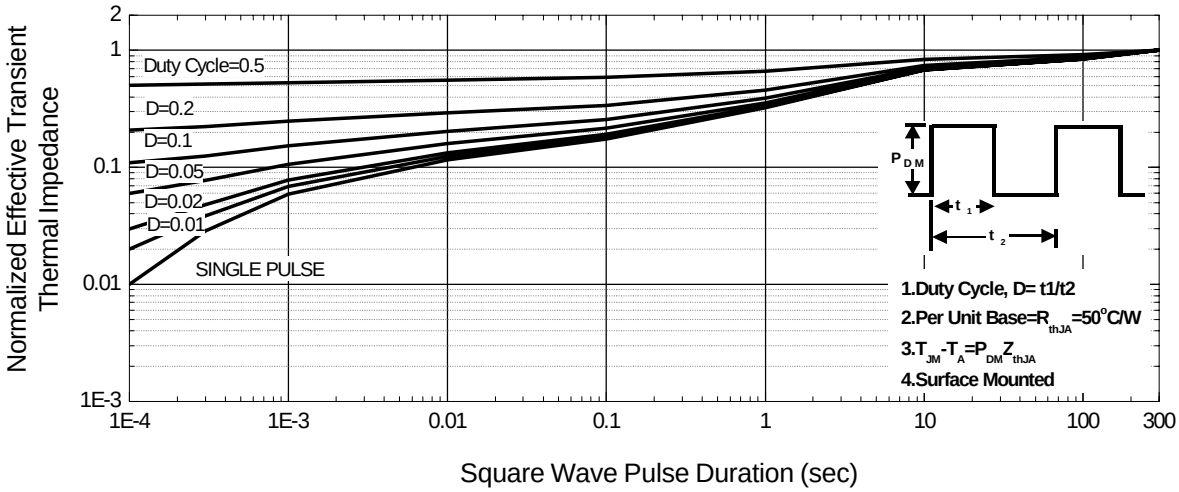
Source-Drain Diode Forward Voltage



Single Pulse Power

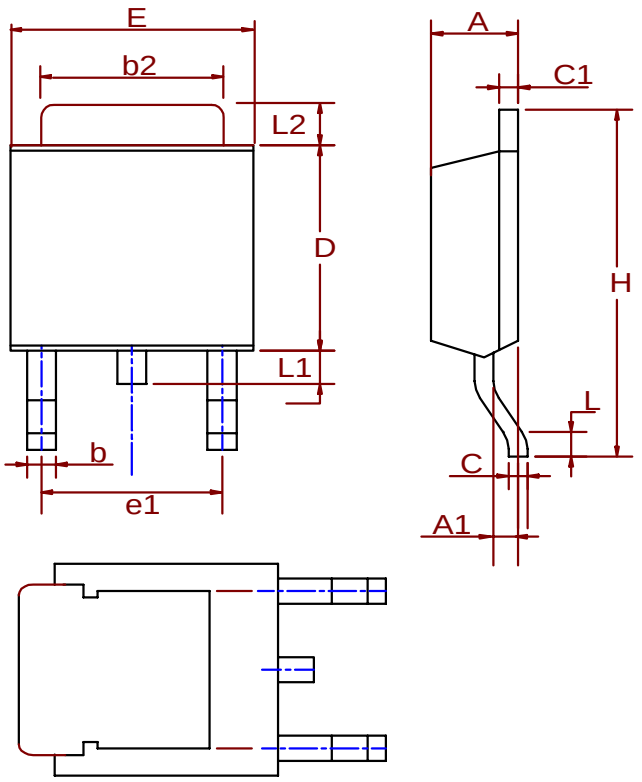


Normalized Thermal Transient Impedence, Junction to Ambient



Packaging 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

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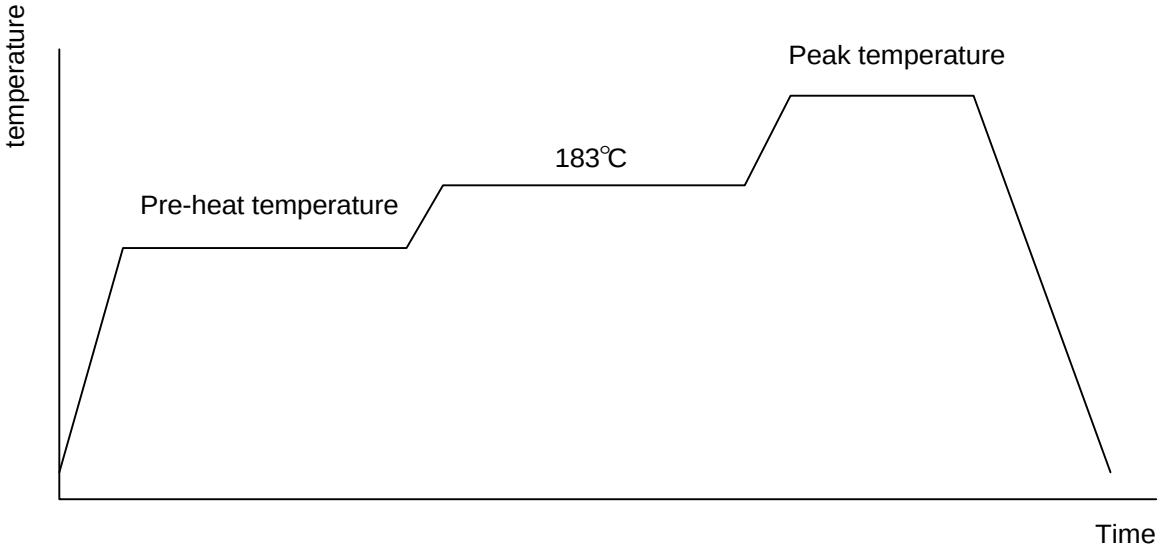
Physical Specifications

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 mm³**	**pkg. thickness < 2.5mm and pkg. volume < 350mm³**
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

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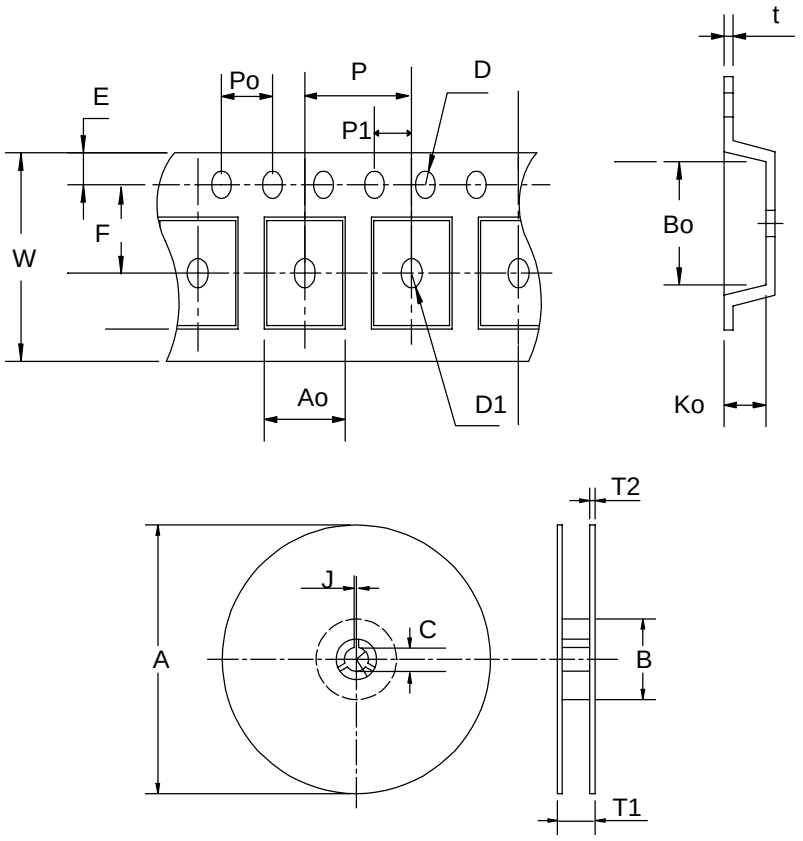
Reliability test program

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 Dimensions



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

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Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
TO- 252	16	13.3	2500

Customer Service

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