
**ADVANCED
POWER
TECHNOLOGY**

T-39-15

APT4055BN 400V 12.0A 0.55 Ω
APT3555BN 350V 12.0A 0.55 Ω

POWER MOS IV™

N - CHANNEL ENHANCEMENT MODE HIGH VOLTAGE POWER MOSFETS

MAXIMUM RATINGS

All Ratings: $T_C = 25^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	APT3555BN	APT4055BN	UNIT
V_{DSS}	Drain-Source Voltage 107	350	400	Volts
I_D	Continuous Drain Current	12		Amps
I_{DM}	Pulsed Drain Current ¹	48		Amps
V_{GS}	Gate-Source Voltage	± 30		Volts
P_D	Total Power Dissipation @ $T_C = 25^\circ\text{C}$, Derate Above 25°C	180		Watts
T_J, T_{STG}	Operating and Storage Junction Temperature Range	- 55 to 150		$^\circ\text{C}$

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
BV_{DSS}	Drain-Source Breakdown Voltage ($V_{GS} = 0V, I_D = 250 \mu\text{A}$)	APT4055BN	400		Volts
		APT3555BN	350		Volts
I_{DSS}	Zero Gate Voltage Drain Current ($V_{DS} = V_{DSS}, V_{GS} = 0V$)			250	μA
	($V_{DS} = 0.8 V_{DSS}, V_{GS} = 0V, T_C = 125^\circ\text{C}$)			1000	
I_{GSS}	Gate-Source Leakage Current ($V_{GS} = \pm 30V, V_{DS} = 0$)			± 100	nA
$I_D(ON)$	On State Drain Current ² ($V_{DS} > I_D(ON) \times R_{DS(ON)}$ Max, $V_{GS} = 10V$)	12			Amps
$V_{GS(TH)}$	Gate Threshold Voltage ($V_{DS} = V_{GS}, I_D = 1\text{mA}$)	2		4	Volts
$R_{DS(ON)}$	Static Drain-Source On-State Resistance ² ($V_{GS} = 10V, I_D = 0.5 I_D(ON)$)			0.55	Ohms

THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.68	$^\circ\text{C/W}$
$R_{\theta JA}$	Junction to Ambient			40	$^\circ\text{C/W}$
T_L	Max. Lead Temp. for Soldering Conditions: 0.063" from Case for 10 Sec.			300	$^\circ\text{C}$

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DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{iss}	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1 \text{ MHz}$	650		850	pF
C_{oss}	Output Capacitance		125		275	pF
C_{rss}	Reverse Transfer Capacitance		65		130	pF
Q_g	Total Gate Charge ³	$V_{GS} = 10V, I_D = I_D(\text{Cont.})$ $V_{DD} = 0.5 V_{DSS}$	27		47	nC
Q_{gs}	Gate-Source Charge		3.5		7.5	nC
Q_{gd}	Gate-Drain ("Miller") Charge		14		22	nC
$t_d(\text{on})$	Turn-on Delay Time	$V_{DD} = 0.5 V_{DSS}$ $I_D = I_D(\text{Cont.}), V_{GS} = 15V$ $R_G = 1.8\Omega$			15	ns
t_r	Rise Time				20	ns
$t_d(\text{off})$	Turn-off Delay Time				45	ns
t_f	Fall Time				25	ns

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
I_S	Continuous Source Current (Body Diode)			12	Amps
I_{SM}	Pulsed Source Current ¹ (Body Diode)			48	Amps
V_{SD}	Diode Forward Voltage ² ($V_{GS} = 0V, I_S = -I_D(\text{Cont.})$)			1.3	Volts
t_{rr}	Reverse Recovery Time $I_S = -I_D(\text{Cont.})$ $dI_S/dt = 100A/\mu s$	180	220	260	ns
Q_{rr}	Reverse Recovery Charge	2.4	3.1	3.8	μC

SAFE OPERATING AREA CHARACTERISTICS

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
SOA1	Safe Operating Area	$V_{DS} = 0.4 V_{DSS}, I_{DS} = P_D / 0.4 V_{DSS}, t = 1 \text{ Sec.}$	180			Watts
SOA2	Safe Operating Area	$I_{DS} = I_D(\text{Cont.}), V_{DS} = P_D / I_D(\text{Cont.}), t = 1 \text{ Sec.}$	180			Watts
I_{LM}	Inductive Current Clamped		48			Amps

1.) Repetitive Rating: Pulse width limited by maximum junction temperature. See Transient Thermal Impedance Curve. (Fig.1)

2.) Pulse Test: Pulse width < 380 μs
Duty Cycle < 2%
3.) See JEDEC MIL-STD-750C Method 3471

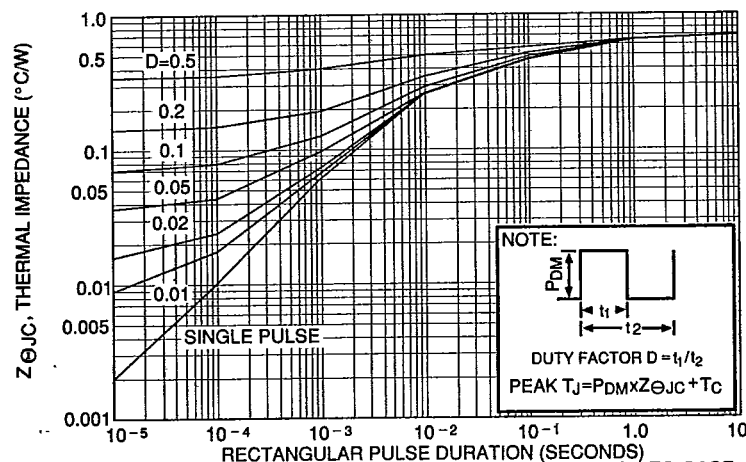


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

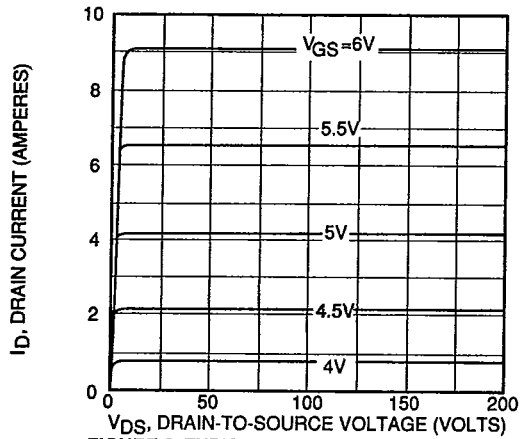


FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS

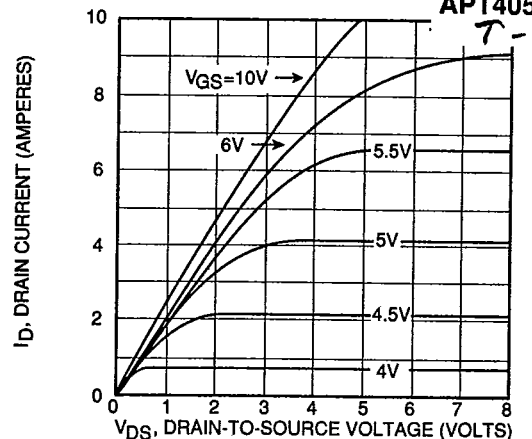


FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS

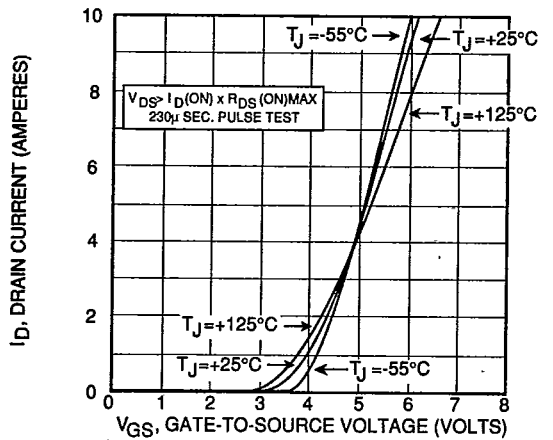


FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS

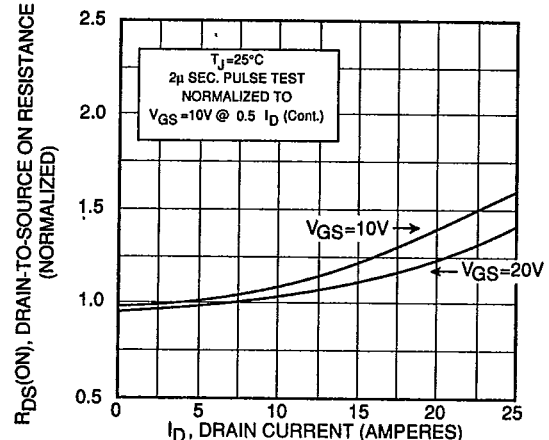


FIGURE 5, $R_{DS(ON)}$ vs DRAIN CURRENT

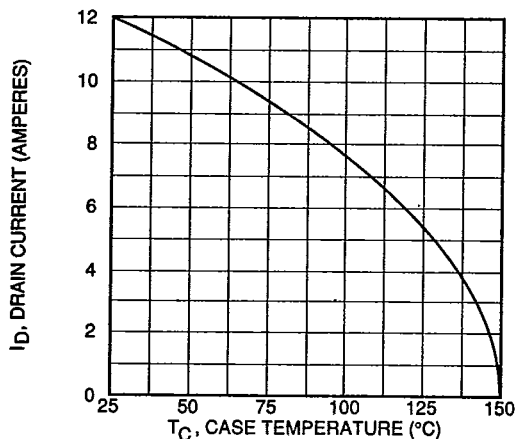


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

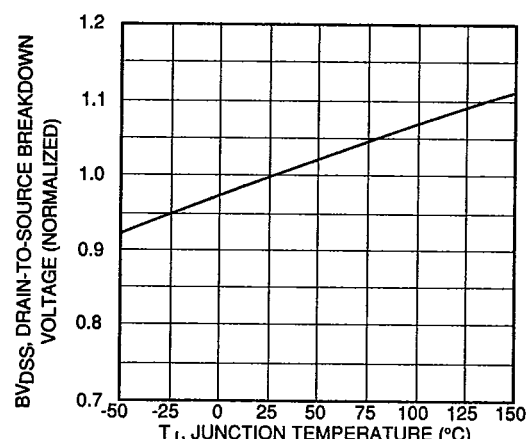


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

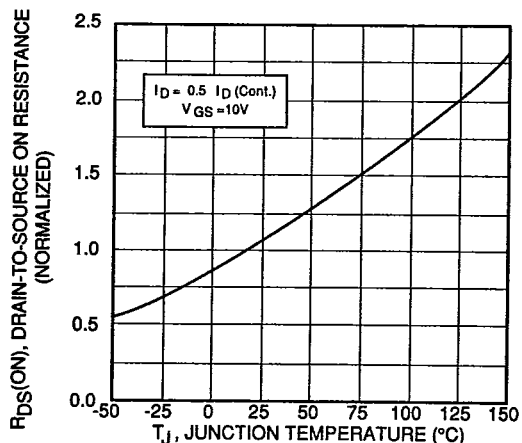


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

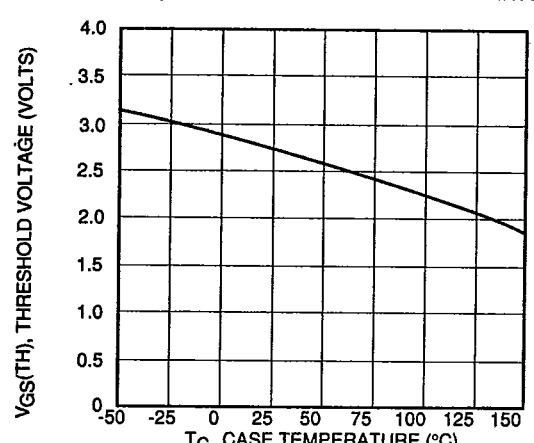
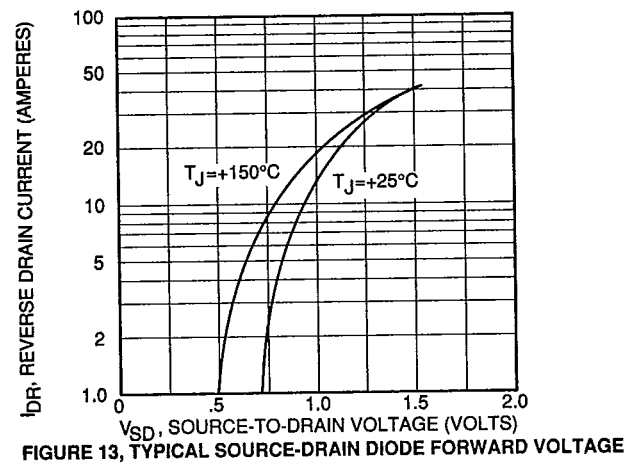
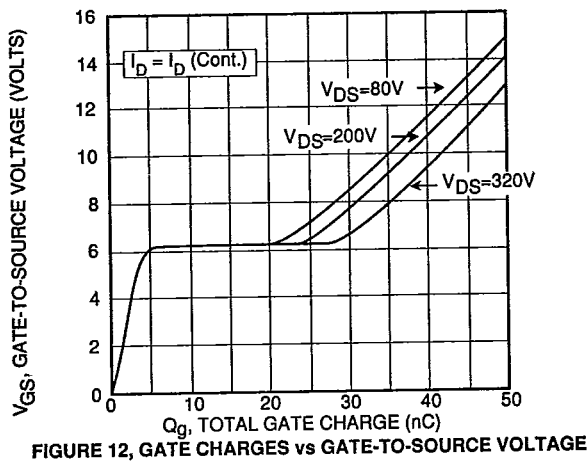
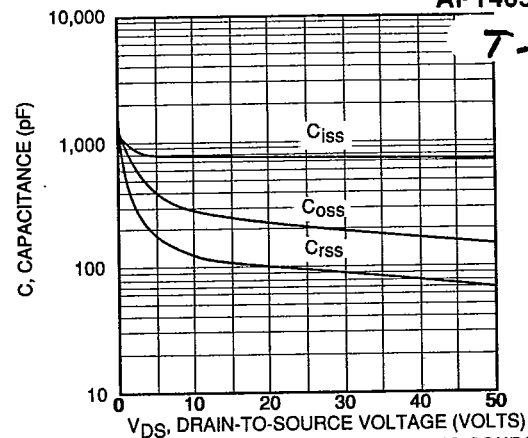
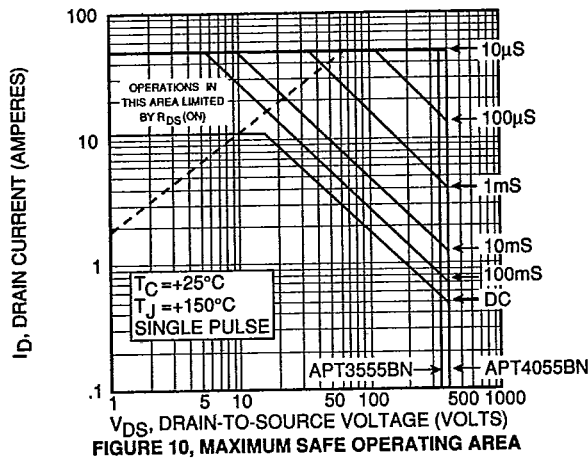
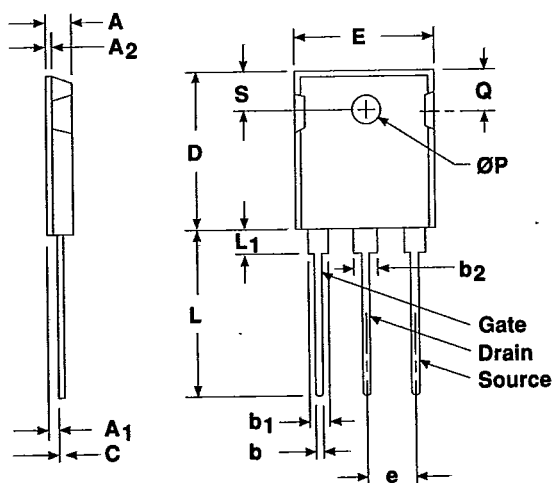


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

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TO-247 Schematic (Type AD Proposed)

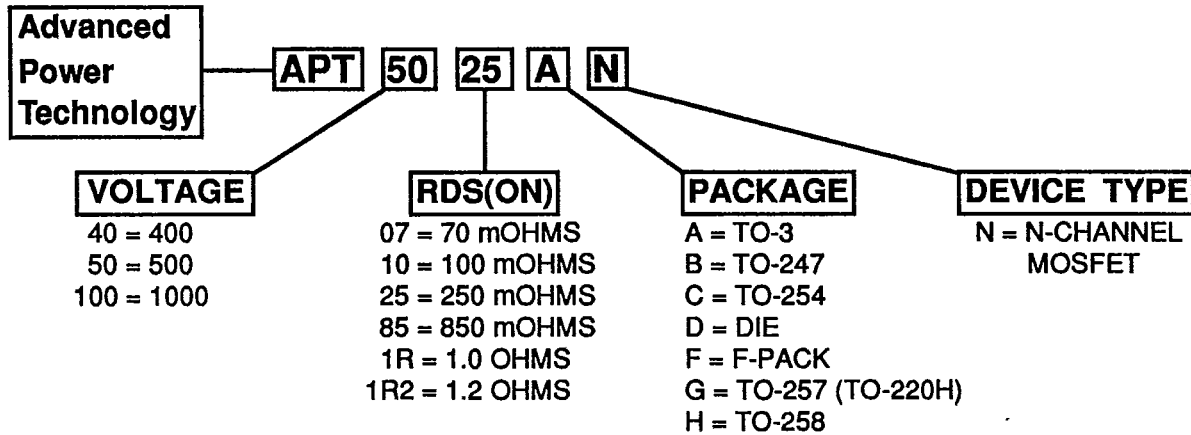


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	.185	.209	4.69	5.31	
A1	.087	.102	2.21	2.59	
A2	.059	.098	1.49	2.49	4
b	.040	.055	1.01	1.40	4
b1	.065	.084	1.65	2.13	4
b2	.113	.123	2.87	3.12	
C	.016	.031	0.40	0.79	
D	.819	.845	20.80	21.46	
e	.610	.640	15.49	16.26	
L	.215 BSC		5.25 BSC		
L1	.780	.800	19.81	20.32	4
ØP	.140	.144	3.55	3.66	
Q	.212	.244	5.38	6.20	
S	.242 BSC		6.15 BSC		

Notes:

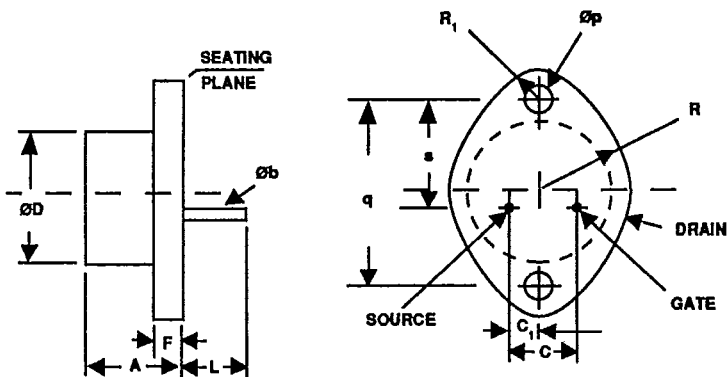
1. Refer to applicable symbol list.
2. Dimensions and tolerances per ANSI V14.5, 1982.
3. Maximum radius of .050 on all foot edges and corners.
4. Lead dimensions uncontrolled in L₁
5. Controlling dimension: Metric.

APT PART NUMBERING SYSTEM - EXAMPLES



PACKAGE OUTLINES

Package A TO-3 (TO-204AA)

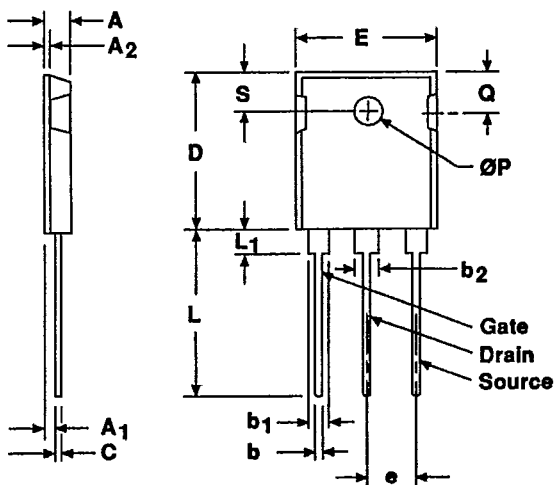


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	.250	.360	6.35	9.15	2
Øb	.038	.043	.97	1.10	
ØD		.875		22.23	
C	.420	.440	10.67	11.18	2
C ₁	.205	.225	5.21	5.72	
F	.060	.135	1.52	3.43	
L	.312	.500	7.92	12.70	
Øp	.151	.161	3.84	4.09	
q	1.177	1.197	29.90	30.40	
R	.495	.525	12.57	13.34	
R ₁	.131	.188	3.33	4.78	
s	.655	.675	16.64	17.15	
					1

Notes:

- These dimensions should be measured at points .050" (1.27 mm) to .55" (1.40 mm) below seating plane. When gate is not used, measurement will be made at seating plane.
- Two leads.

Package B TO-3P (TO-247 Type AD Proposed)



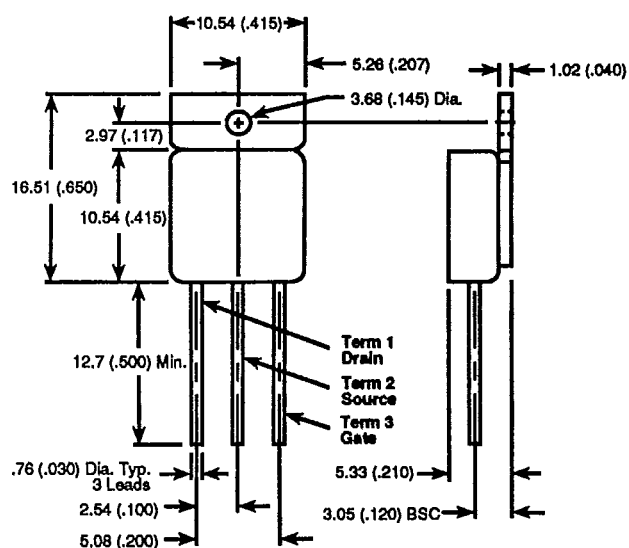
SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	.185	.209	4.69	5.31	4
A ₁	.087	.102	2.21	2.59	
A ₂	.059	.098	1.49	2.49	
b	.040	.055	1.01	1.40	
b ₁	.065	.084	1.65	2.13	
b ₂	.113	.123	2.87	3.12	
C	.016	.031	0.40	0.79	
E	.819	.845	20.80	21.46	
L	.610	.640	15.49	16.26	
L ₁	.215 BSC		5.25 BSC		
ØP	.780	.800	19.81	20.32	4
Q	.140	.144	3.55	3.66	
S	.212	.244	5.38	6.20	
	.242 BSC		6.15 BSC		

Notes:

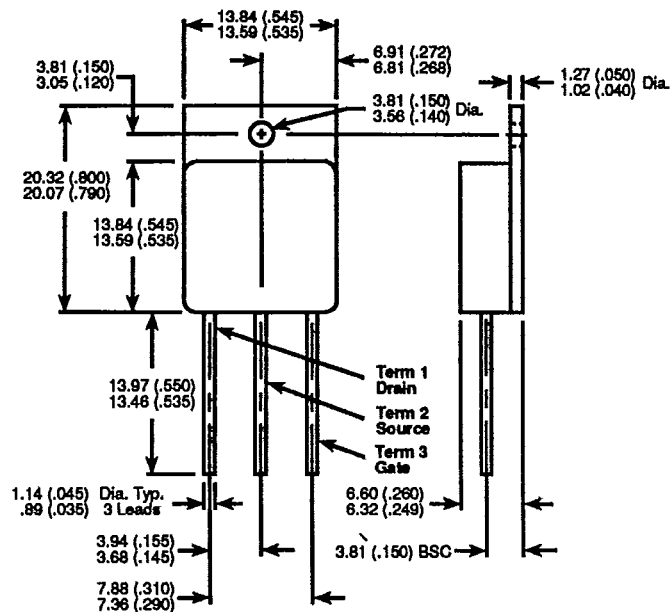
- Refer to applicable symbol list.
- Dimensions and tolerances per ANSI V14.5, 1982.
- Maximum radius of .050 on all boot edges and corners.
- Lead dimensions uncontrolled in L
- Controlling dimension: Metric.

PACKAGE OUTLINES (Continued)

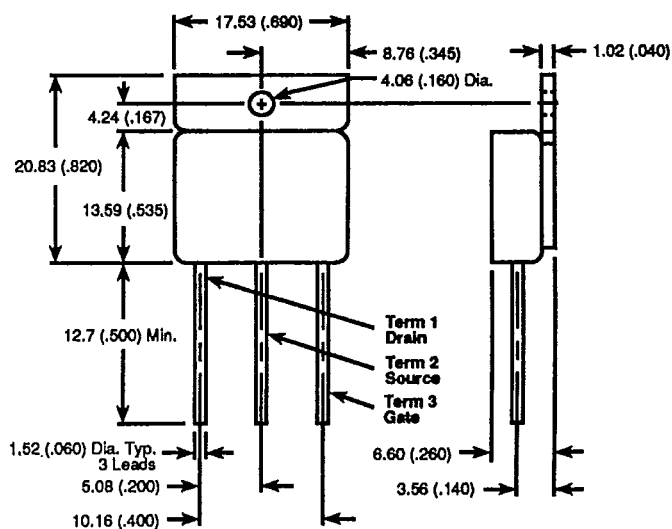
Package G TO-257AA (TO-220 Herm.)



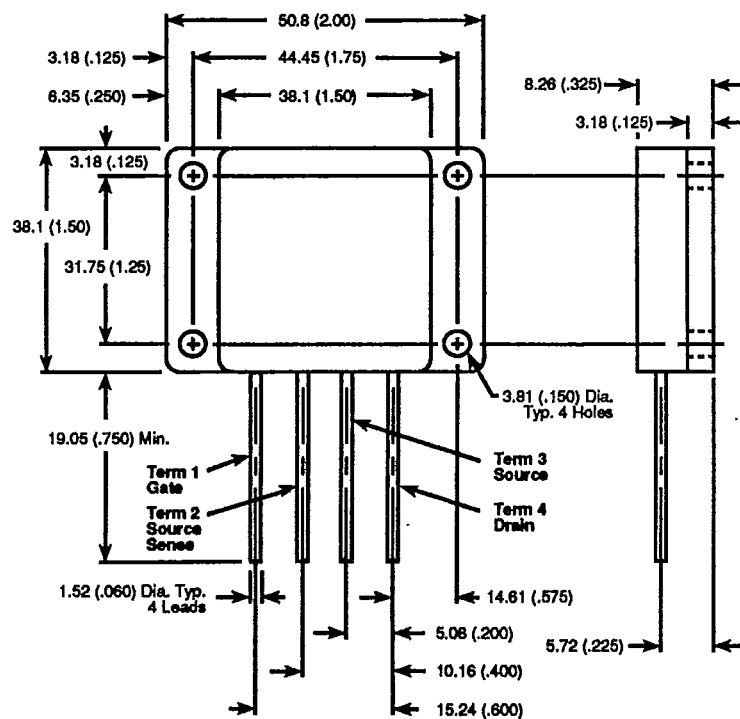
Package C TO-254AA



Package H TO-258AA (TO-247 Herm.)



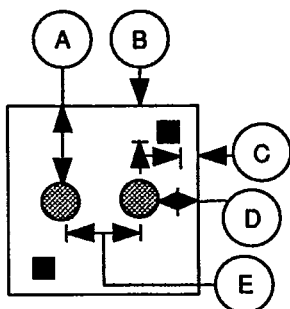
Package F (F-Pack)



DIE TOPOGRAPHICAL LAYOUT DETAILS FOR APT POWER MOS IV™ DIE

APT - 104 = .199 x .203 In.

- Source Pads = .036 In. diam
- Gate pads = .018 x .019 In.



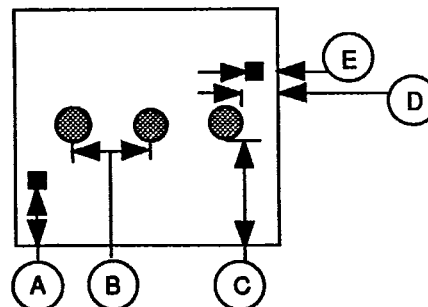
Letters = Internal dimensions

A = .081 In. B = .039 In. C = .018 In.

D = .040 In. E = .082 In.

APT - 105 = .290 x .250 In.

- Source Pads = .036 In. diam
- Gate pads = .018 x .019 In.



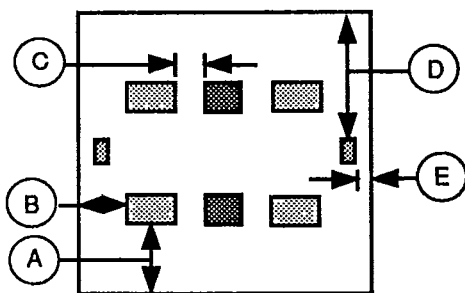
Letters = Internal dimensions

A = .055 In. B = .085 In. C = .105 In.

D = .042 In. E = .018 In.

APT - 101 = .320 x .320 In.

- Source Pads = .037 x .024 In.
- Source Pads = .030 x .024 In.
- Gate pads = .014 x .019 In.



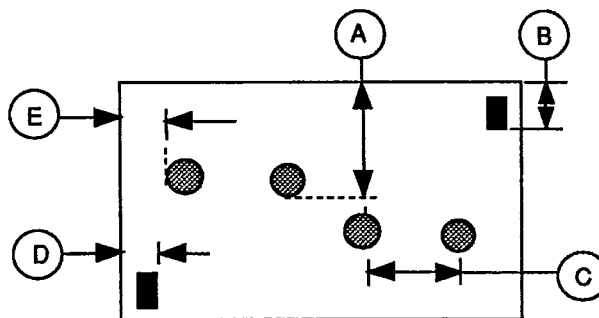
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A = .077 In. B = .062 In. C = .048 In.

D = .149 In. E = .018 In.

APT - 102 = .414 x .254 In.

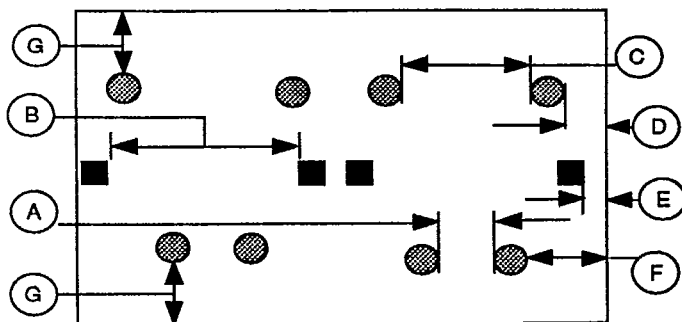
- Source Pads = .036 In. diam
- Gate pads = .012 x .019 In.



Letters = Internal dimensions

A = .117 In. B = .037 In. C = .097 In.

D = .031 In. E = .046 In.



APT - 107 = .588 x .388 In.

- Source pads = .036
- Gate pads = .017 x .018

Letters = Internal dimensions

A = .057 In. B = .240 In. C = .151 In.

D = .045 In. E = .017 In. F = .091 In. G = .088 In.