

**ADVANCED  
POWER  
TECHNOLOGY**

T-39-13

APT1004RAN	1000V	3.9A	4.00 Ω
APT904RAN	900V	3.9A	4.00 Ω
APT1004R2AN	1000V	3.5A	4.20 Ω
APT904R2AN	900V	3.5A	4.20 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	APT				UNIT
		904RAN	1004RAN	904R2AN	1004R2AN	
$V_{DSS}$	Drain-Source Voltage	900	1000	900	1000	Volts
$I_D$	Continuous Drain Current	3.9		3.5		Amps
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	15.6		14		Amps
$V_{GS}$	Gate-Source Voltage	±30				Volts
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$ , Derate Above $25^\circ\text{C}$	150				Watts
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	- 55 to 150				°C

**STATIC ELECTRICAL CHARACTERISTICS**

Symbol	Characteristic / Test Conditions / Part Number	MIN	TYP	MAX	UNIT	
$BV_{DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 250 \mu\text{A}$ )	APT1004RAN / APT1004R2AN		1000	Volts	
		APT904RAN / APT904R2AN		900	Volts	
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = V_{DSS}, V_{GS} = 0V$ ) ( $V_{DS} = 0.8 V_{DSS}, V_{GS} = 0V, T_C = 125^\circ\text{C}$ )				250	$\mu\text{A}$
					1000	
$I_{GSS}$	Gate-Source Leakage Current ( $V_{GS} = \pm 30V, V_{DS} = 0V$ )				±100	nA
$I_D(ON)$	On State Drain Current <sup>2</sup> ( $V_{DS} > I_D(ON) \times R_{DS(ON)} \text{ Max}, V_{GS} = 10V$ )	APT1004RAN / APT904RAN		3.9	Amps	
		APT1004R2AN / APT904R2AN		3.5	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 <sup>2</sup> ( $V_{GS} = 10V, I_D = 0.5 I_D(\text{Cont.})$ )	APT1004RAN / APT904RAN			4.00	Ohms
		APT1004R2AN / APT904R2AN			4.20	Ohms

**THERMAL CHARACTERISTICS**

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.85	°C/W
$R_{\theta JA}$	Junction to Ambient			30	°C/W
$T_L$	Max. Lead Temp. for Soldering Conditions: 0.063" from Case for 10 Sec.			300	°C

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Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{iss}$	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1\text{ MHz}$		805	950	pF
$C_{oss}$	Output Capacitance			115	160	pF
$C_{rss}$	Reverse Transfer Capacitance			37	60	pF
$Q_g$	Total Gate Charge <sup>3</sup>	$V_{GS} = 10V, I_D = I_D [\text{Cont.}]$ $V_{DD} = 0.5 V_{DSS}$		35	55	nC
$Q_{gs}$	Gate-Source Charge			4.3	6.5	nC
$Q_{gd}$	Gate-Drain ("Miller") Charge			18	27	nC
$t_d(\text{on})$	Turn-on Delay Time	$V_{DD} = 0.5 V_{DSS}$ $I_D = I_D [\text{Cont.}], V_{GS} = 15V$ $R_G = 1.8$		12	23	ns
$t_r$	Rise Time			10	20	ns
$t_d(\text{off})$	Turn-off Delay Time			33	50	ns
$t_f$	Fall Time			14	27	ns

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristic / Test Conditions / Part Number	MIN	TYP	MAX	UNIT	
$I_S$	Continuous Source Current (Body Diode)	APT1004RAN / APT904RAN			3.9	Amps
		APT1004R2AN / APT904R2AN			3.5	Amps
$I_{SM}$	Pulsed Source Current <sup>1</sup> (Body Diode)	APT1004RAN / APT904RAN			15.6	Amps
		APT1004R2AN / APT904R2AN			14	Amps
$V_{SD}$	Diode Forward Voltage <sup>2</sup> ( $V_{GS} = 0V, I_S = -I_D [\text{Cont.}]$ )			1.3	Volts	
$t_{rr}$	Reverse Recovery Time ( $I_S = -I_D [\text{Cont.}], dI_S/dt = 100A/\mu s$ )	150	290	580	ns	
$Q_{rr}$	Reverse Recovery Charge	0.8	1.65	3.3	$\mu C$	

**SAFE OPERATING AREA CHARACTERISTICS**

Symbol	Characteristic	Test Conditions / Part Number	MIN	TYP	MAX	UNIT
SOA1	Safe Operating Area	$V_{DS} = 0.4 V_{DSS}, I_{DS} = P_D / 0.4 V_{DSS}, t = 1\text{ Sec.}$	150			Watts
SOA2	Safe Operating Area	$I_{DS} = I_D [\text{Cont.}], V_{DS} = P_D / I_D [\text{Cont.}], t = 1\text{ Sec.}$	150			Watts
$I_{LM}$	Inductive Current Clamped	APT1004RAN / APT904RAN	15.6			Amps
		APT1004R2AN / APT904R2AN	14			Amps

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

2.) Pulse Test: Pulse width < 380  $\mu s$   
 Duty Cycle < 2%  
 3.) See MIL-STD-750 Method 3471

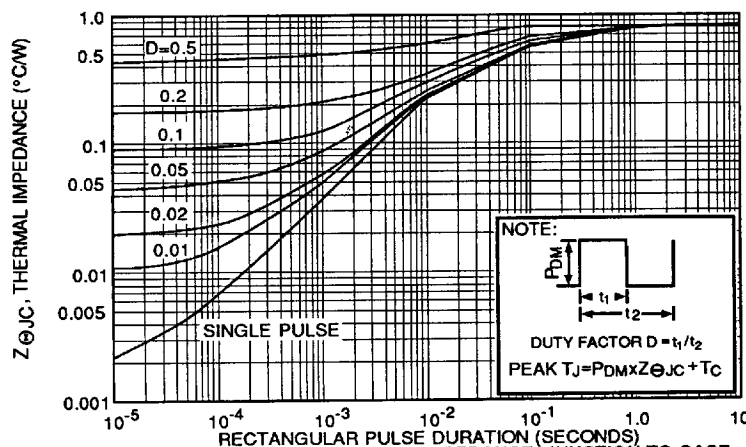


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

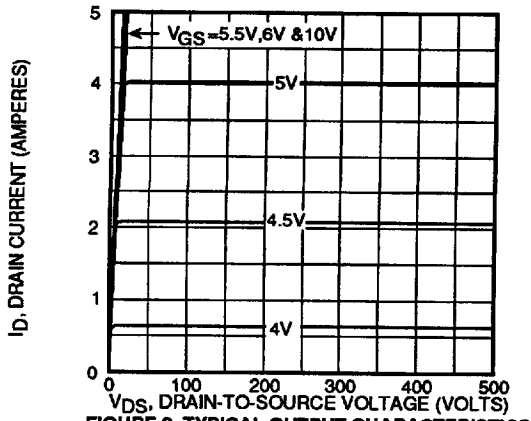


FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS

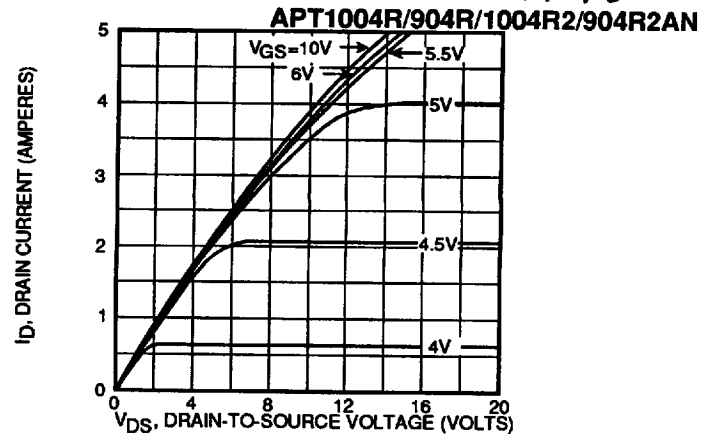


FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS

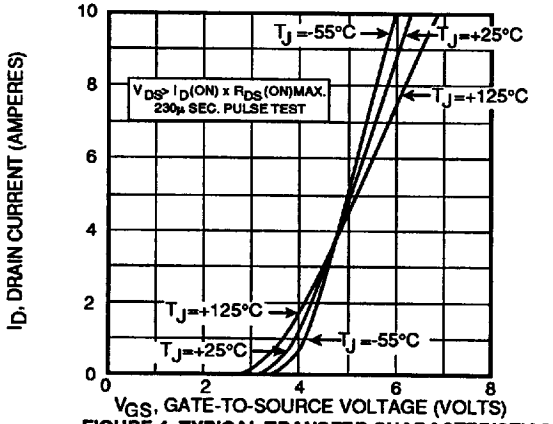


FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS

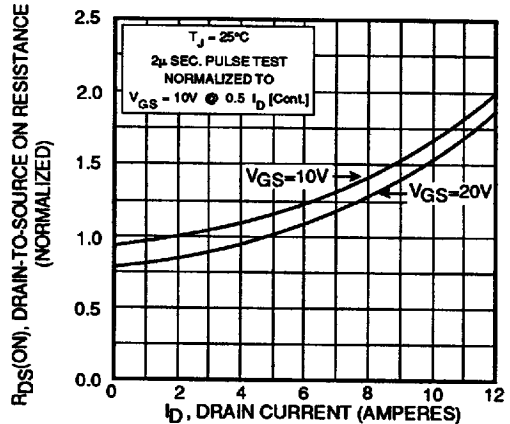


FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT

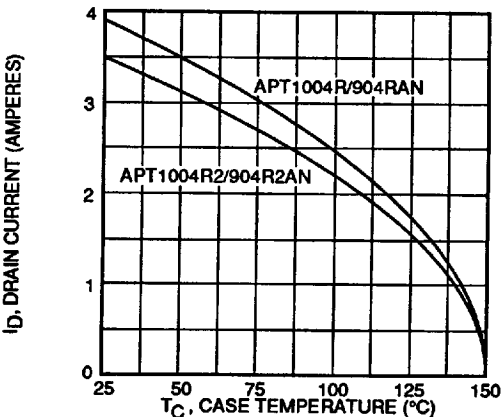


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

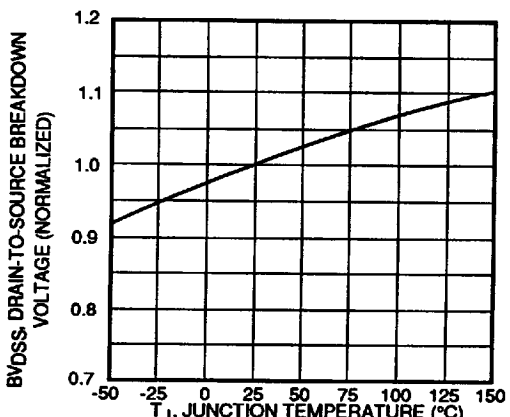


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

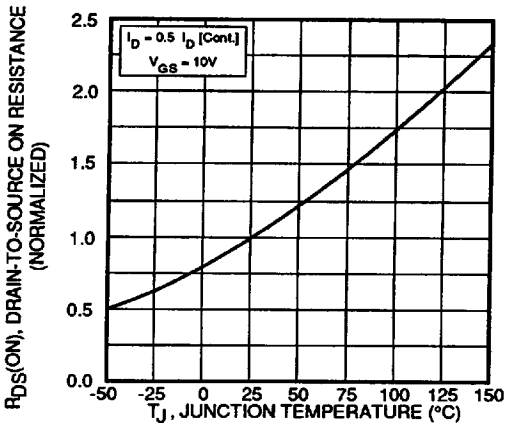


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

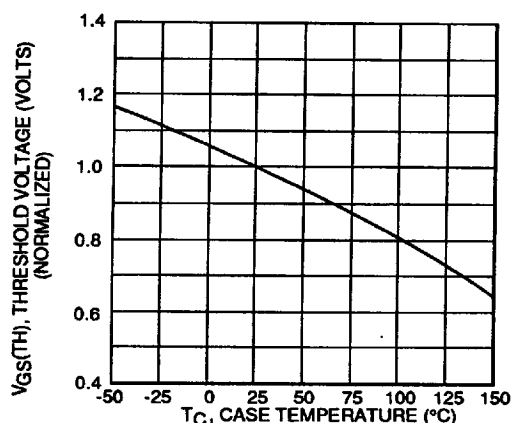


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

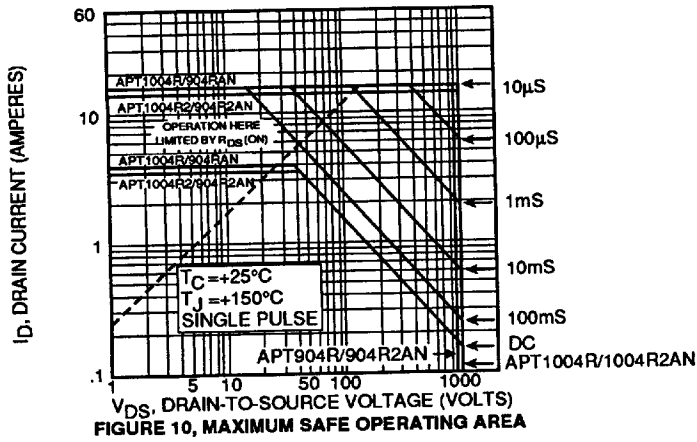


FIGURE 10, MAXIMUM SAFE OPERATING AREA

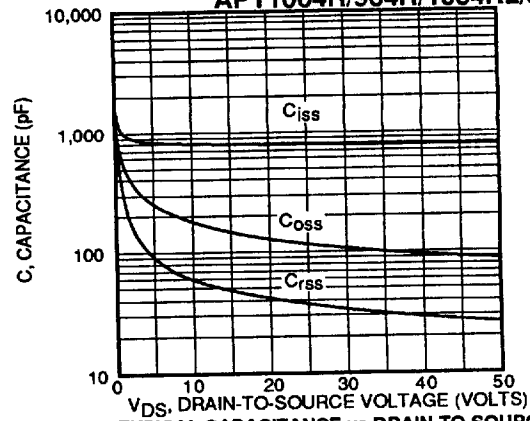


FIGURE 11, TYPICAL CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

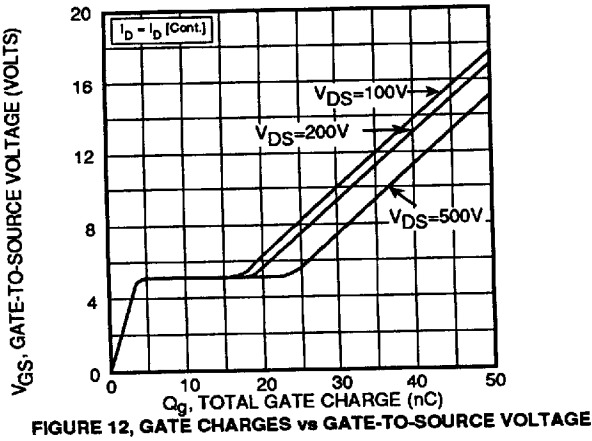


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

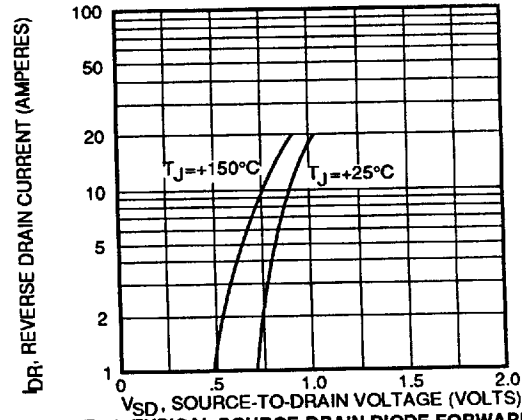
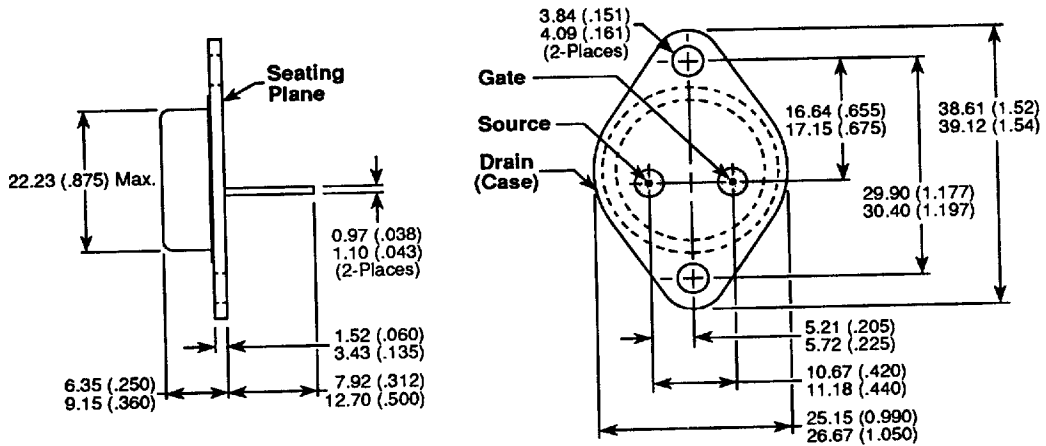


FIGURE 13, TYPICAL SOURCE-DRAIN DIODE FORWARD VOLTAGE

TO-3 Package Outline (TO-204AA)



Dimensions in Millimeters and (Inches)