

**APT1004RGN 1000V 3.3A 4.00Ω**

# 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	APT1004RGN	UNIT
$V_{DSS}$	Drain-Source Voltage	1000	Volts
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	3.3	Amps
$I_{DM}$	Pulsed Drain Current ①	13.2	
$V_{GS}$	Gate-Source Voltage	$\pm 30$	Volts
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	100	Watts
	Linear Derating Factor	0.8	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$T_L$	Lead Temperature: 0.063" from Case for 10 Sec.	300	

### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$BV_{DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 250\mu\text{A}$ )	1000			Volts
$I_{D(ON)}$	On State Drain Current ② ( $V_{DS} > I_{D(ON)} \times R_{DS(ON)}$ Max, $V_{GS} = 10V$ )	3.3			Amps
$R_{DS(ON)}$	Drain-Source On-State Resistance ② ( $V_{GS} = 10V, 0.5 I_{D(ON)}$ )			4.00	Ohms
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = V_{DSS}, V_{GS} = 0V$ )			250	$\mu\text{A}$
	Zero Gate Voltage Drain Current ( $V_{DS} = 0.8 V_{DSS}, V_{GS} = 0V, T_C = 125^\circ\text{C}$ )			1000	
$I_{GSS}$	Gate-Source Leakage Current ( $V_{GS} = \pm 30V, V_{DS} = 0V$ )			$\pm 100$	nA
$V_{GS(TH)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 1.0\text{mA}$ )	2		4	Volts

### SAFE OPERATING AREA CHARACTERISTICS

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
SOA1	Safe Operating Area	$V_{DS} = 0.4 V_{DSS}, I_{DS} = P_D / 0.4 V_{DSS}, t = 1 \text{ Sec.}$	100			Watts
SOA2	Safe Operating Area	$I_{DS} = I_{D(ON)}, V_{DS} = P_D / I_{D(ON)}, t = 1 \text{ Sec.}$	100			
$I_{LM}$	Inductive Current Clamped		3.3			Amps

**CAUTION:** These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

#### USA

405 S.W. Columbia Street

#### EUROPE

Avenue J.F. Kennedy Bât B4 Parc Cadéra Nord

APT Website - <http://www.advancedpower.com>

Bend, Oregon 97702-1035

Phone: (541) 382-8028

FAX: (541) 388-0364

F-33700 Merignac - France

Phone: (33) 5 57 92 15 15

FAX: (33) 5 56 47 97 61

**DYNAMIC CHARACTERISTICS**

**APT1004RGN**

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{DC}$	Drain-to-Case Capacitance	$f = 1 \text{ MHz}$		8	12	pF
$C_{iss}$	Input Capacitance	$V_{GS} = 0V$		805	950	
$C_{oss}$	Output Capacitance	$V_{DS} = 25V$		115	160	
$C_{rss}$	Reverse Transfer Capacitance	$f = 1 \text{ MHz}$		37	60	
$Q_g$	Total Gate Charge	$V_{GS} = 10V$		35	55	nC
$Q_{gs}$	Gate-Source Charge	$V_{DD} = 0.5 V_{DSS}$		4.3	7	
$Q_{gd}$	Gate-Drain ("Miller") Charge	$I_D = I_D [\text{Cont.}] @ 25^\circ\text{C}$		18	27	
$t_{d(on)}$	Turn-on Delay Time	$V_{GS} = 10V$		10	20	ns
$t_r$	Rise Time	$V_{DD} = 0.5 V_{DSS}$		12	24	
$t_{d(off)}$	Turn-off Delay Time	$I_D = I_D [\text{Cont.}] @ 25^\circ\text{C}$		33	50	
$t_f$	Fall Time	$R_G = 1.8\Omega$		16	32	

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$I_S$	Continuous Source Current (Body Diode)			3.3	Amps
$I_{SM}$	Pulsed Source Current <sup>①</sup> (Body Diode)			13.2	
$V_{SD}$	Diode Forward Voltage <sup>②</sup> ( $V_{GS} = 0V, I_S = -I_D [\text{Cont.}]$ )			1.3	Volts
$t_{rr}$	Reverse Recovery Time ( $I_S = -I_D [\text{Cont.}], di_S/dt = 100A/\mu s$ )		290	580	ns
$Q_{rr}$	Reverse Recovery Charge ( $I_S = -I_D [\text{Cont.}], di_S/dt = 100A/\mu s$ )		1.65	3.3	$\mu C$

**THERMAL CHARACTERISTICS**

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			1.20	W/°C
$R_{\theta JA}$	Junction to Ambient			80	

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%

APT Reserves the right to change, without notice, the specifications and information contained herein.

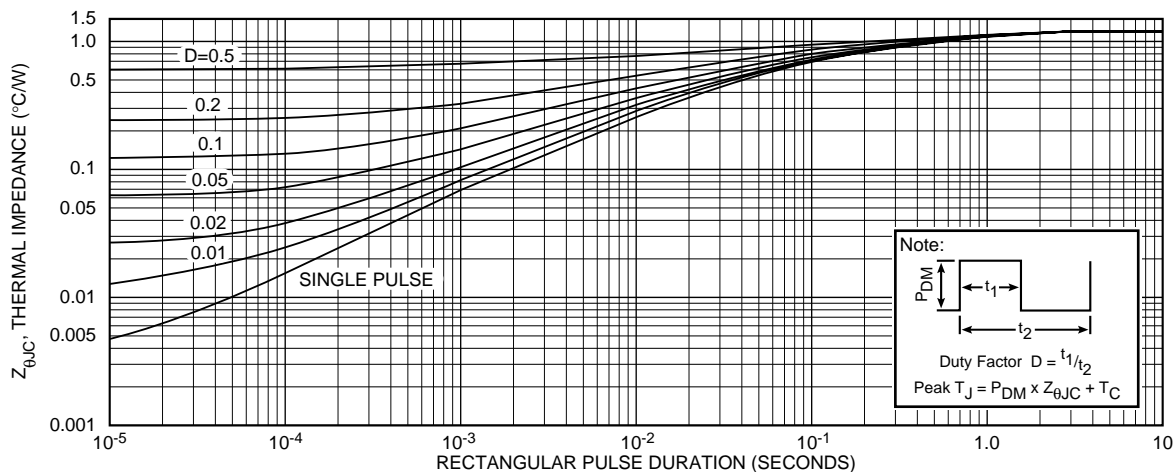
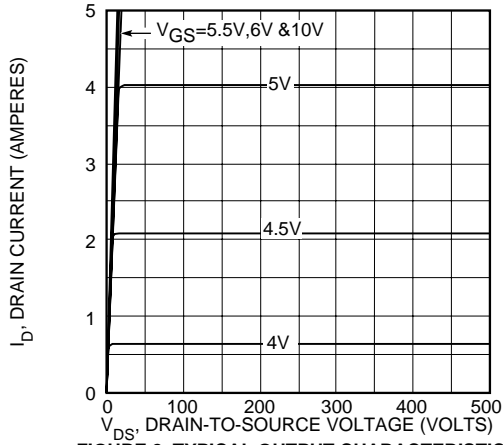
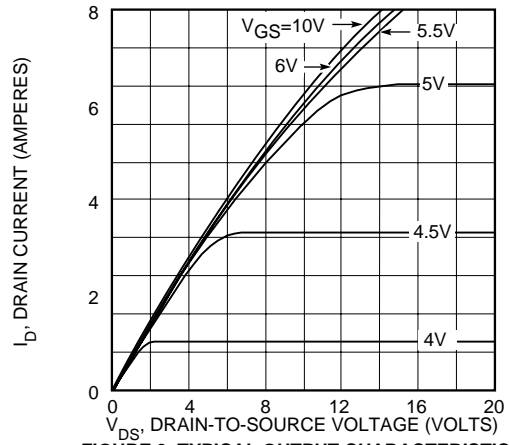


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

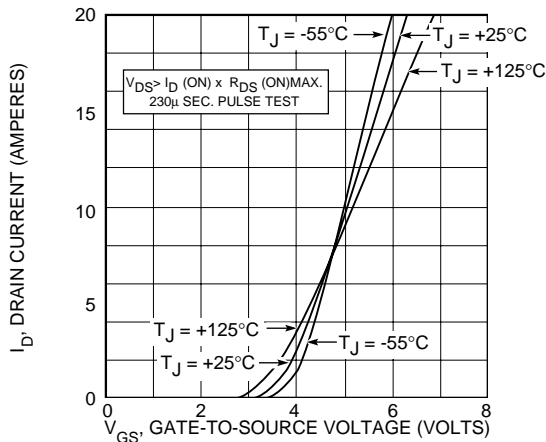
**APT1004RGN**



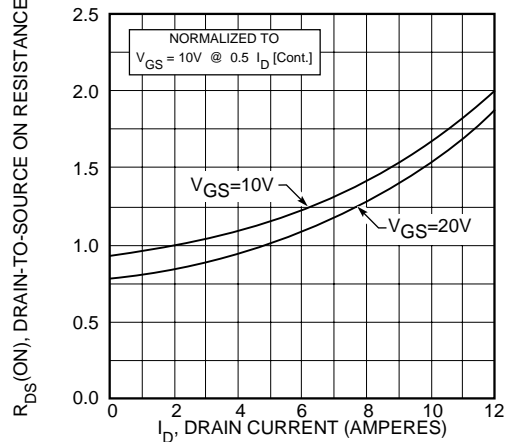
**FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS**



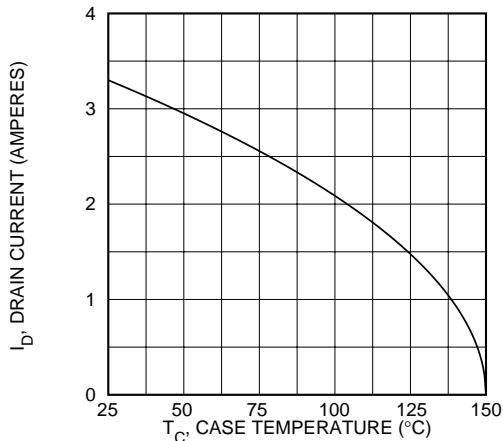
**FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS**



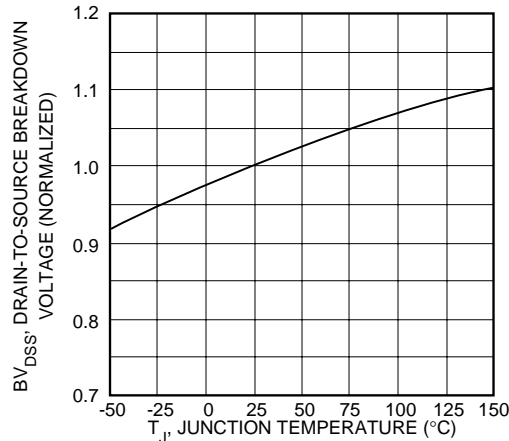
**FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS**



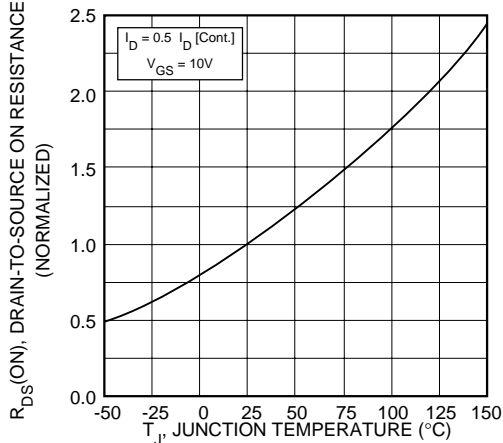
**FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT**



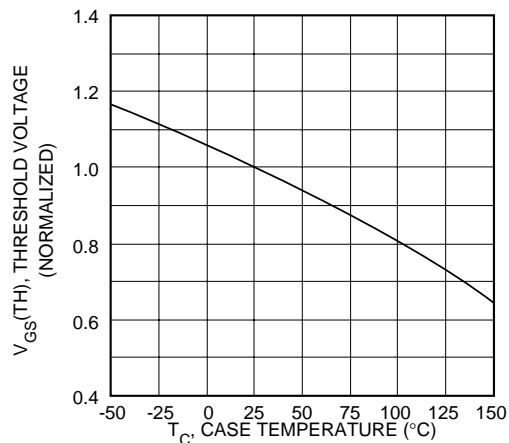
**FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE**



**FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE**

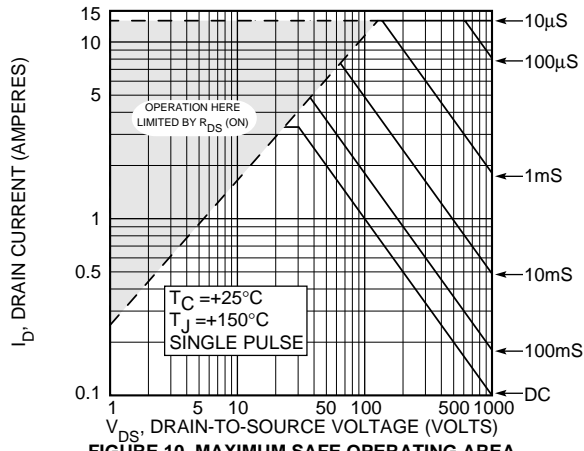


**FIGURE 8, ON-RESISTANCE vs. TEMPERATURE**

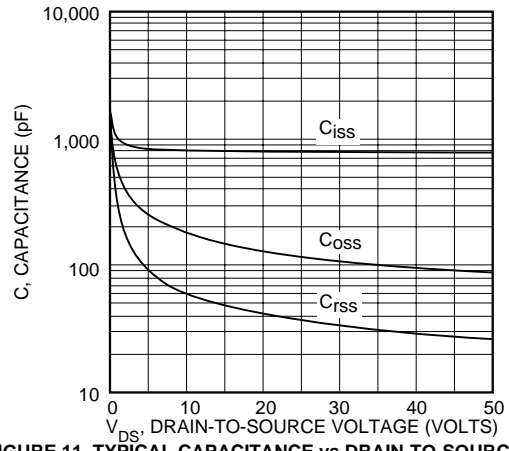


**FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE**

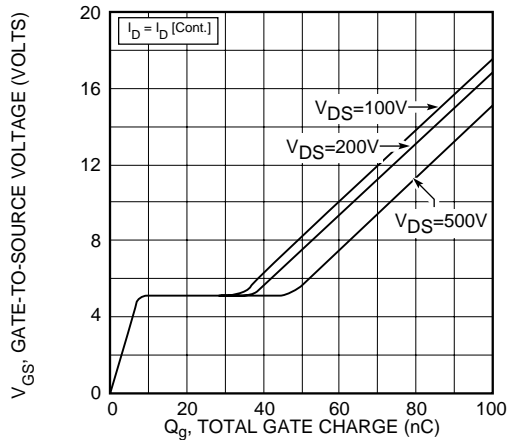
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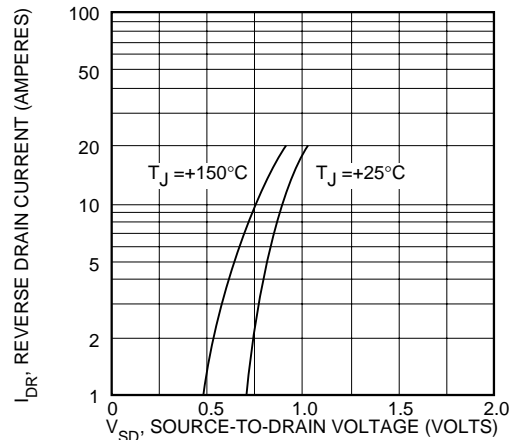
**FIGURE 10, MAXIMUM SAFE OPERATING AREA**



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

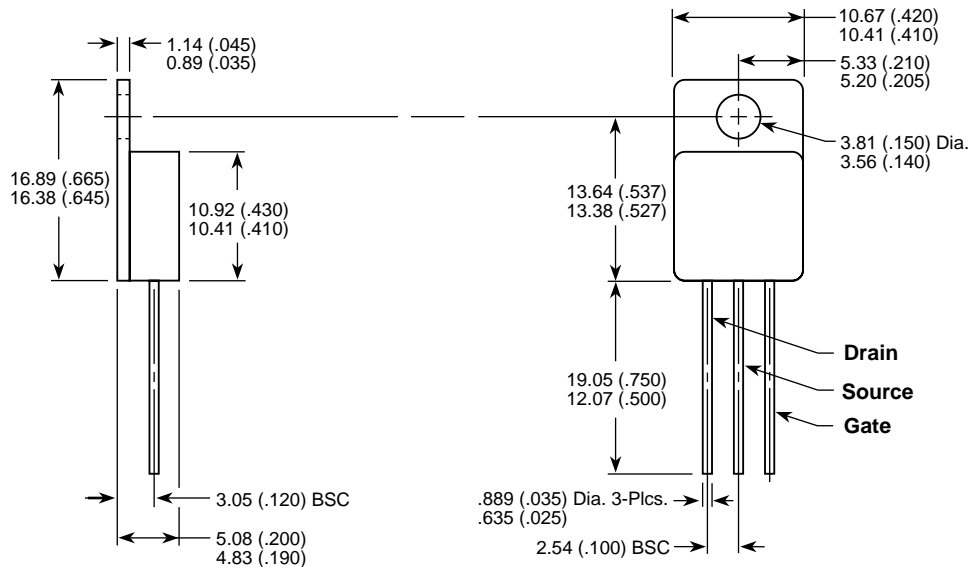


**FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE**



**FIGURE 13, TYPICAL SOURCE-DRAIN DIODE FORWARD VOLTAGE**

**TO-257AA Package Outline**



Dimensions in Millimeters and (Inches)



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