

**APT1004RKN 1000V 3.6A 4.00Ω**  
**APT1004R2KN 1000V 3.5A 4.20Ω**

## 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	APT1004R2KN	APT1004RKN	UNIT
$V_{DSS}$	Drain-Source Voltage	1000	1000	Volts
$I_D$	Continuous Drain Current	3.5	3.6	Amps
$I_{DM}$	Pulsed Drain Current ①	14.0	14.4	Amps
$V_{GS}$	Gate-Source Voltage	±30		Volts
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$ , Derate Above $25^\circ\text{C}$	125		Watts
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150		$^\circ\text{C}$

#### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions / Part Number	MIN	TYP	MAX	UNIT
$BV_{DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 250\mu\text{A}$ )	APT1004RKN	1000		Volts
		APT1004R2KN	1000		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 ② ( $V_{DS} > I_{D(ON)} \times R_{DS(ON)}$ Max, $V_{GS} = 10V$ )	APT1004RKN	3.6		Amps
		APT1004R2KN	3.5		Amps
$V_{GS(TH)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 1.0\text{mA}$ )	2		4	Volts
$R_{DS(ON)}$	Static Drain-Source On-State Resistance ② ( $V_{GS} = 10V, I_D = 0.5 I_D$ [Cont.])	APT1004RKN		4.00	Ohms
		APT1004R2KN		4.20	Ohms

#### THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			1.00	$^\circ\text{C/W}$
$R_{\theta JA}$	Junction to Ambient			80	$^\circ\text{C/W}$
$T_L$	Max. Lead Temp. for Soldering Conditions: 0.063" from Case for 10 Sec.			300	$^\circ\text{C}$

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



**DYNAMIC CHARACTERISTICS**

**APT1004R/1004R2KN**

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 ③	$V_{GS} = 10V, I_D = I_D [\text{Cont.}]$ $V_{DD} = 0.5 V_{DSS}$		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	$V_{DD} = 0.5 V_{DSS}$ $I_D = I_D [\text{Cont.}], V_{GS} = 15V$ $R_G = 1.8\Omega$		10	20	ns
$t_r$	Rise Time			9	18	ns
$t_d(\text{off})$	Turn-off Delay Time			32	48	ns
$t_f$	Fall Time			23	46	ns

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristic / Test Conditions / Part Number	MIN	TYP	MAX	UNIT
$I_S$	Continuous Source Current (Body Diode)	APT1004RKN		3.6	Amps
		APT1004R2KN		3.5	Amps
$I_{SM}$	Pulsed Source Current ① (Body Diode)	APT1004RKN		14.4	Amps
		APT1004R2KN		14.0	Amps
$V_{SD}$	Diode Forward Voltage ② ( $V_{GS} = 0V, I_S = -I_D [\text{Cont.}]$ )			1.3	Volts
$t_{rr}$	Reverse Recovery Time ( $I_S = -I_D [\text{Cont.}], dI_S/dt = 100A/\mu s$ )	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	$V_{DS} = 0.4 V_{DSS}, I_{DS} = P_D / 0.4 V_{DSS}, t = 1\text{ Sec.}$	125			Watts
SOA2	Safe Operating Area	$I_{DS} = I_D [\text{Cont.}], V_{DS} = P_D / I_D [\text{Cont.}], t = 1\text{ Sec.}$	125			Watts
$I_{LM}$	Inductive Current Clamped	APT1004RKN	14.4			Amps
		APT1004R2KN	14.0			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

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

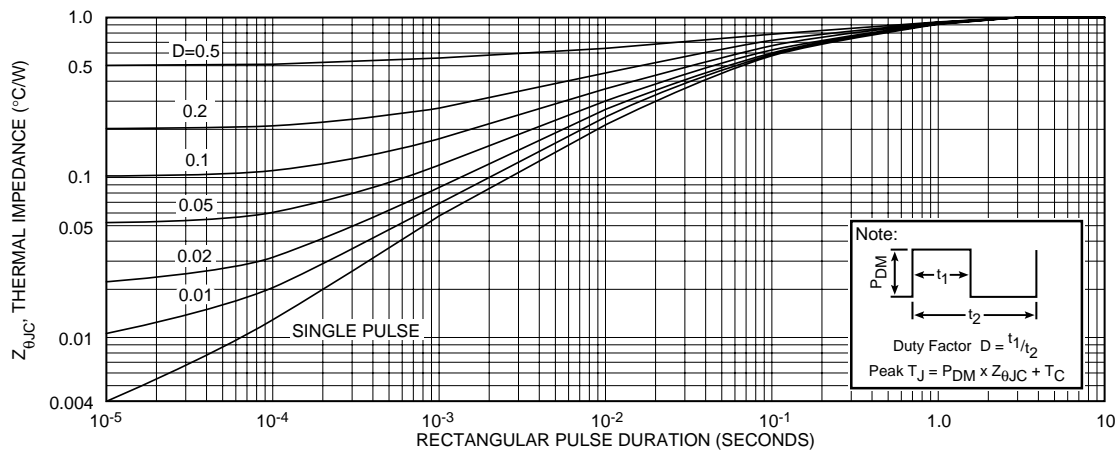
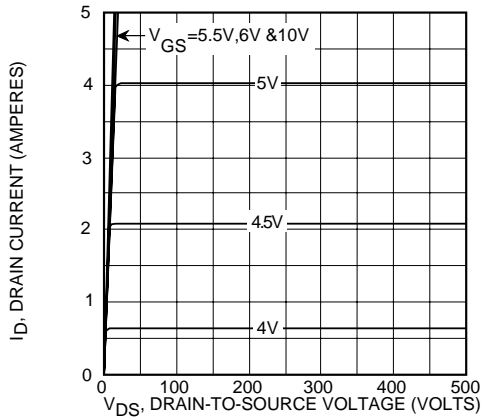
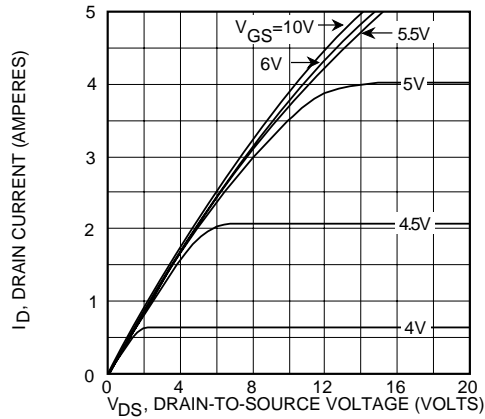


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

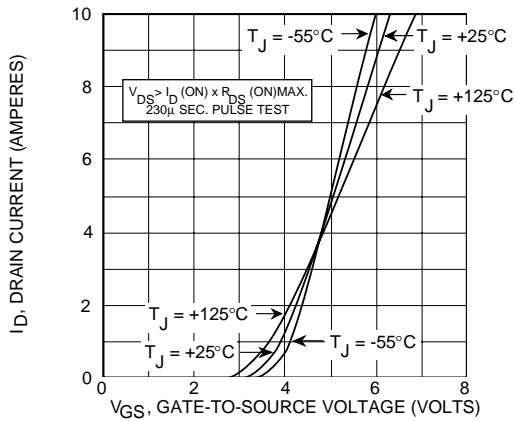
**APT1004R/1004R2KN**



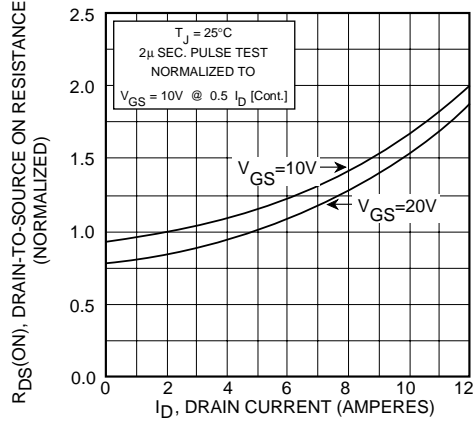
**FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS**



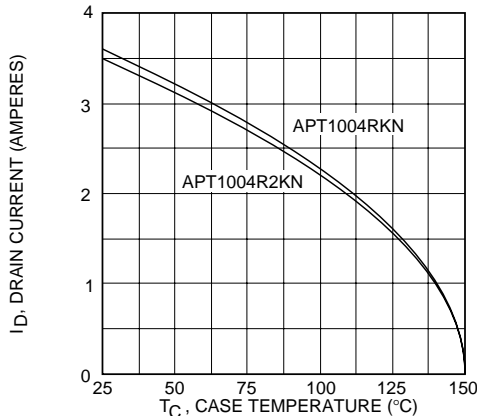
**FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS**



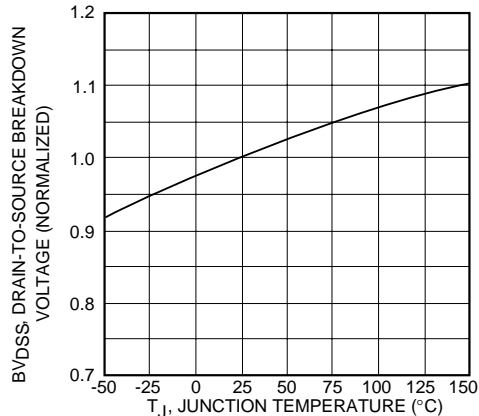
**FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS**



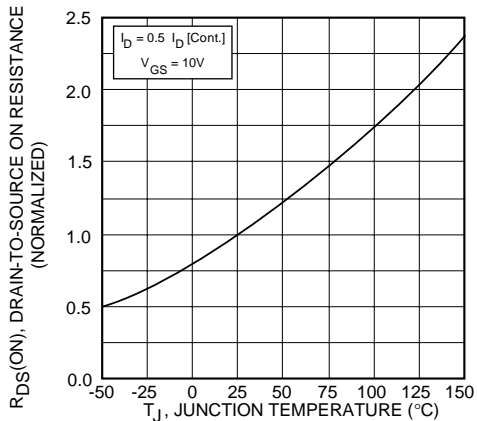
**FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT**



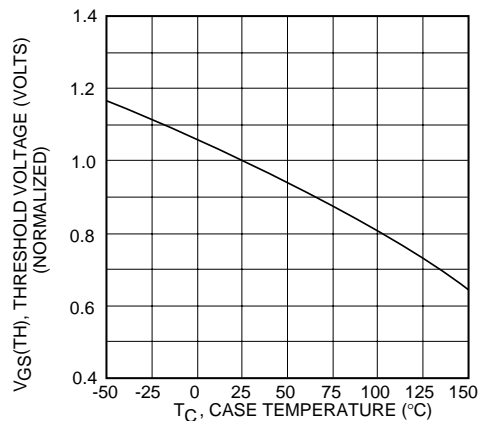
**FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE**



**FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE**



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



**FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE**

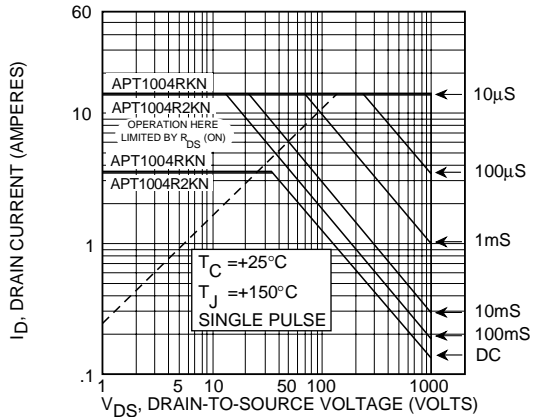


FIGURE 10, MAXIMUM SAFE OPERATING AREA

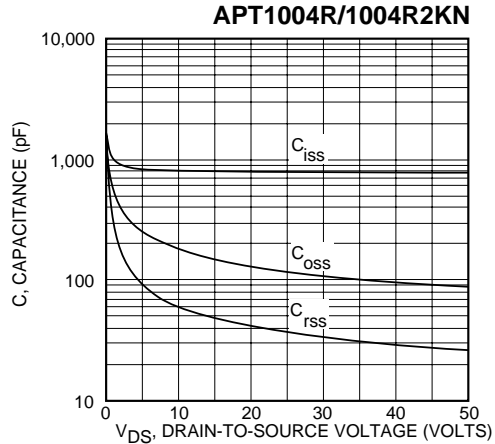


FIGURE 11, TYPICAL CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

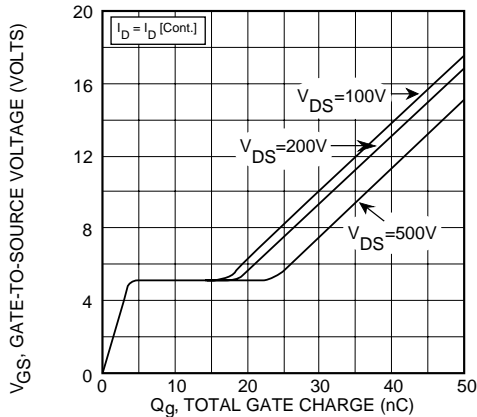


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

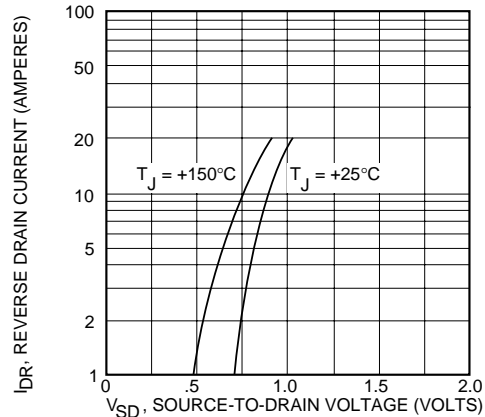
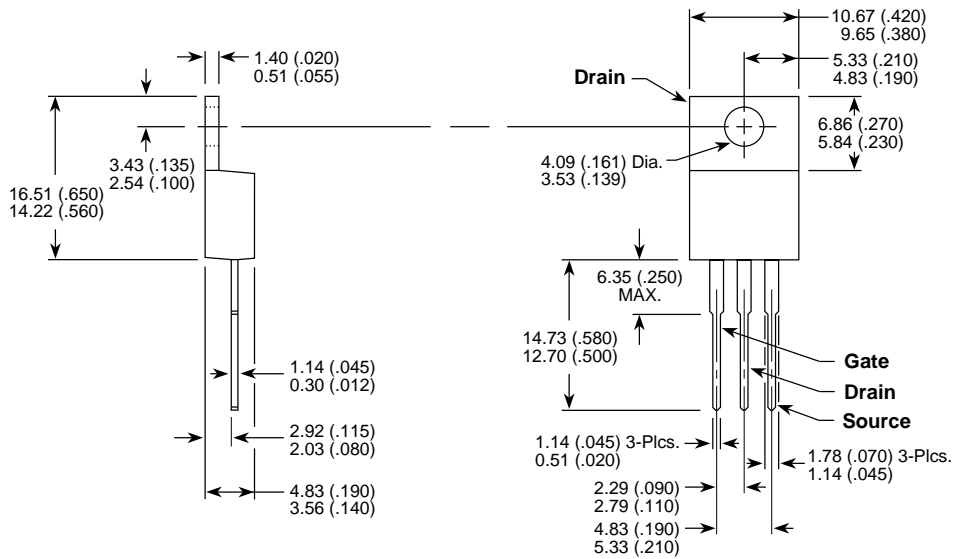


FIGURE 13, TYPICAL SOURCE-DRAIN DIODE FORWARD VOLTAGE

### TO-220AB Package Outline



Dimensions in Millimeters and (Inches)