

**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 <sup>①</sup>	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
$I_D(\text{ON})$	On State Drain Current <sup>②</sup> ( $V_{DS} > I_D(\text{ON}) \times R_{DS}(\text{ON}) \text{ Max}, V_{GS} = 10V$ )	APT1004RKN	3.6		Amps
		APT1004R2KN	3.5		Amps
$V_{GS}(\text{TH})$	Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 1.0\text{mA}$ )	2		4	Volts
$R_{DS}(\text{ON})$	Static Drain-Source On-State Resistance <sup>②</sup> ( $V_{GS} = 10V, I_D = 0.5 I_D [\text{Cont.}]$ )	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.

USA  
405 S.W. Columbia Street  
EUROPE

Avenue J.F. Kennedy Bât B4 Parc Cadéra Nord

Bend, Oregon 97702-1035

F-33700 Merignac - France

Phone: (541) 382-8028

Phone: (33) 5 57 92 15 15

FAX: (541) 388-0364

FAX: (33) 5 56 47 97 61

**DYNAMIC CHARACTERISTICS**

**APT1004R/1004R2KN**

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V V <sub>DS</sub> = 25V f = 1 MHz		805	950	pF
C <sub>oss</sub>	Output Capacitance			115	160	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			37	60	pF
Q <sub>g</sub>	Total Gate Charge ③	V <sub>GS</sub> = 10V, I <sub>D</sub> = I <sub>D</sub> [Cont.] V <sub>DD</sub> = 0.5 V <sub>DSS</sub>		35	55	nC
Q <sub>gs</sub>	Gate-Source Charge			4.3	6.5	nC
Q <sub>gd</sub>	Gate-Drain ("Miller") Charge			18	27	nC
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> = 0.5 V <sub>DSS</sub> I <sub>D</sub> = I <sub>D</sub> [Cont.], V <sub>GS</sub> = 15V R <sub>G</sub> = 1.8Ω		10	20	ns
t <sub>r</sub>	Rise Time			9	18	ns
t <sub>d(off)</sub>	Turn-off Delay Time			32	48	ns
t <sub>f</sub>	Fall Time			23	46	ns

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristic / Test Conditions / Part Number	MIN	TYP	MAX	UNIT
I <sub>S</sub>	Continuous Source Current (Body Diode)	APT1004RKN		3.6	Amps
		APT1004R2KN		3.5	Amps
I <sub>SM</sub>	Pulsed Source Current ① (Body Diode)	APT1004RKN		14.4	Amps
		APT1004R2KN		14.0	Amps
V <sub>SD</sub>	Diode Forward Voltage ② (V <sub>GS</sub> = 0V, I <sub>S</sub> = -I <sub>D</sub> [Cont.])			1.3	Volts
t <sub>rr</sub>	Reverse Recovery Time (I <sub>S</sub> = -I <sub>D</sub> [Cont.], di <sub>S</sub> /dt = 100A/μs)	150	290	580	ns
Q <sub>rr</sub>	Reverse Recovery Charge	0.8	1.65	3.3	μC

**SAFE OPERATING AREA CHARACTERISTICS**

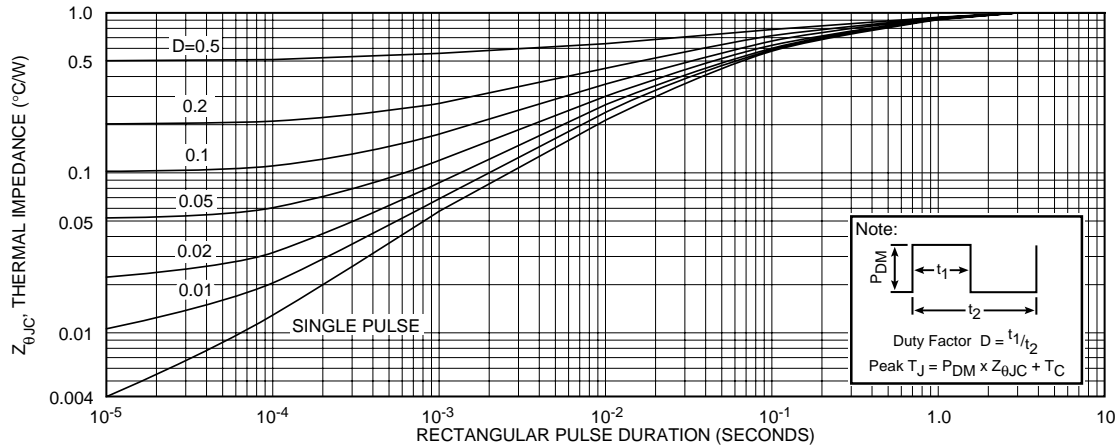
Symbol	Characteristic	Test Conditions / Part Number	MIN	TYP	MAX	UNIT
SOA1	Safe Operating Area	V <sub>DS</sub> = 0.4 V <sub>DSS</sub> , I <sub>DS</sub> = P <sub>D</sub> / 0.4 V <sub>DSS</sub> , t = 1 Sec.	125			Watts
SOA2	Safe Operating Area	I <sub>DS</sub> = I <sub>D</sub> [Cont.], V <sub>DS</sub> = P <sub>D</sub> / I <sub>D</sub> [Cont.], t = 1 Sec.	125			Watts
I <sub>LM</sub>	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 μs, Duty Cycle < 2%

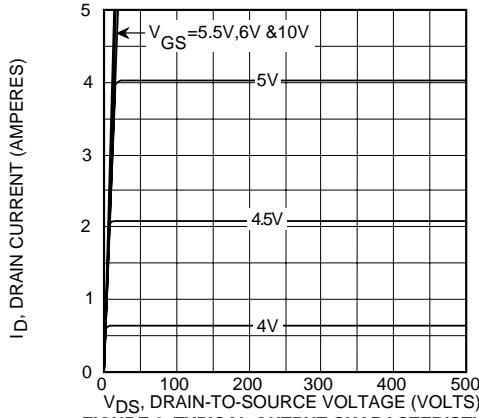
③ See MIL-STD-750 Method 3471

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

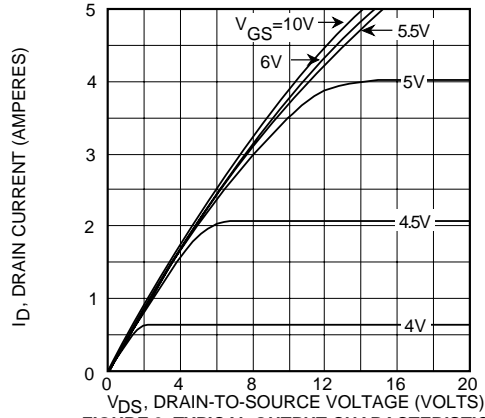


**FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION**

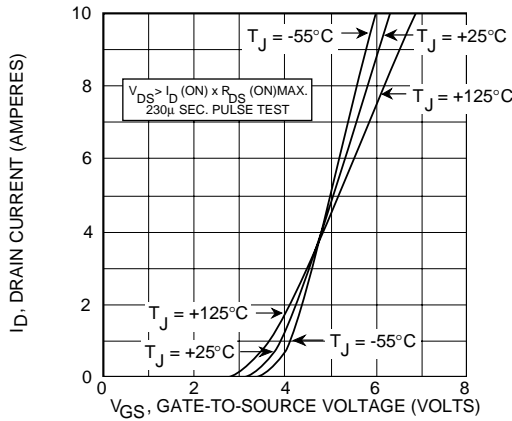
**APT1004R/1004R2KN**



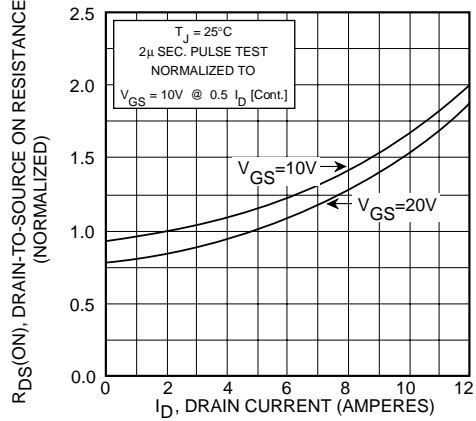
**FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS**



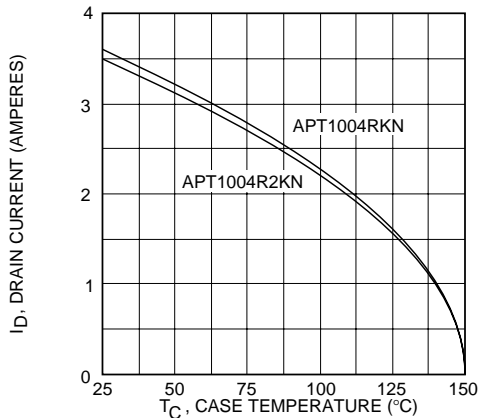
**FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS**



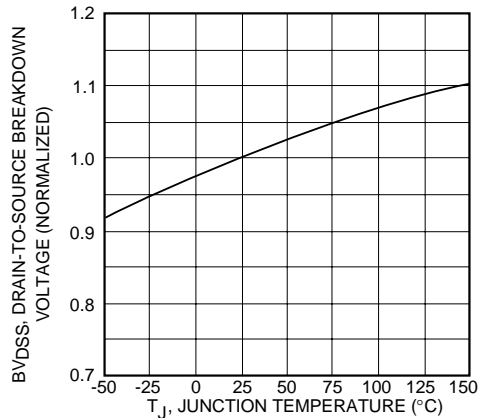
**FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS**



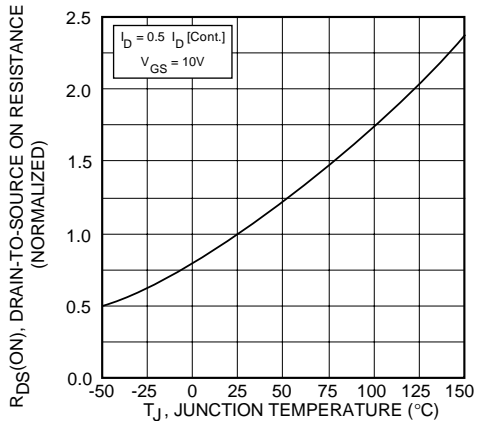
**FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT**



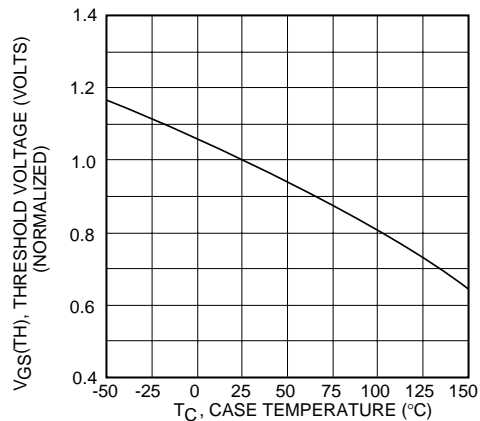
**FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE**



**FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE**



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



**FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE**

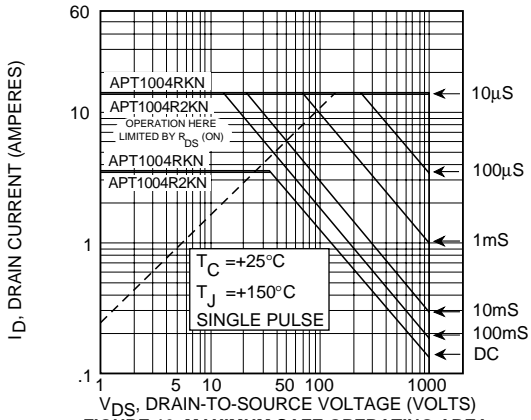


FIGURE 10, MAXIMUM SAFE OPERATING AREA

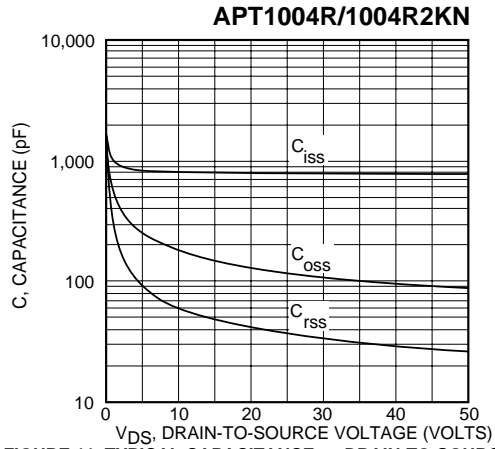


FIGURE 11, TYPICAL CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

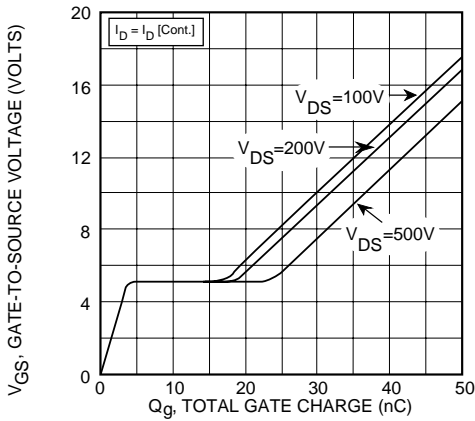


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

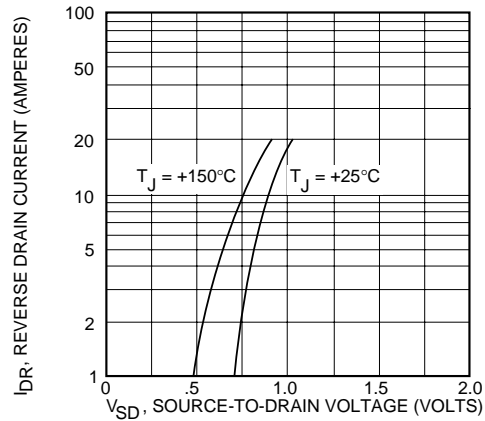
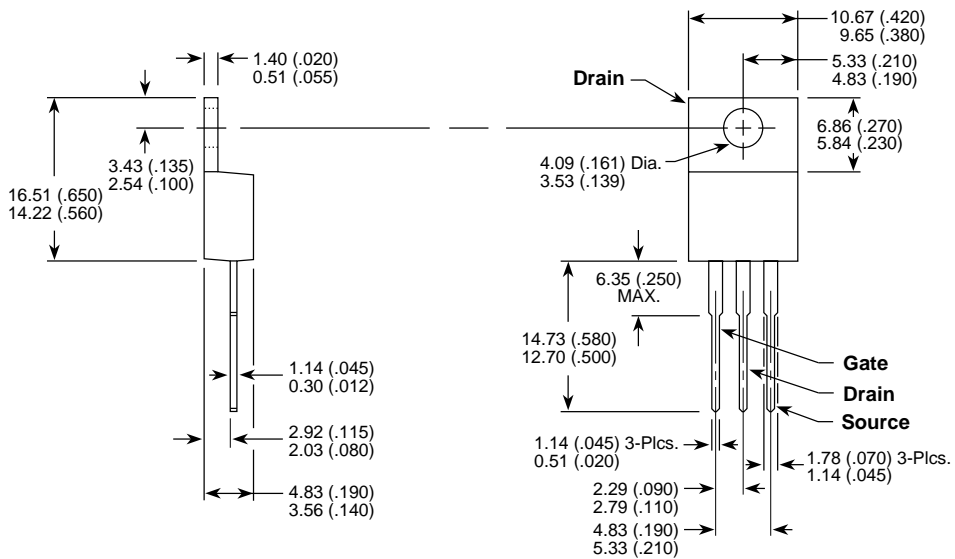


FIGURE 13, TYPICAL SOURCE-DRAIN DIODE FORWARD VOLTAGE

### TO-220AB Package Outline



Dimensions in Millimeters and (Inches)



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