

APT5011JNF 500V 46.0A 0.11Ω  
 APT5013JNF 500V 42.0A 0.13Ω

"UL Recognized" File No. E145592 (S)

**POWER MOS IV®**

**SINGLE DIE ISOTOP® PACKAGE**

**N-CHANNEL ENHANCEMENT MODE HIGH VOLTAGE POWER FREDFETS**

**MAXIMUM RATINGS**

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

Symbol	Parameter	APT 5011JNF	APT 5013JNF	UNIT
$V_{DSS}$	Drain-Source Voltage	500	500	Volts
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	46	42	Amps
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	184	168	
$V_{GS}$	Gate-Source Voltage	±30		Volts
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	520		Watts
	Linear Derating Factor	4.16		W/°C
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150		°C
$T_L$	Lead Temperature: 0.063" from Case for 10 Sec.	300		

**STATIC ELECTRICAL CHARACTERISTICS**

Symbol	Characteristic / Test Conditions / Part Number	MIN	TYP	MAX	UNIT
$BV_{DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 4.0\text{ mA}$ )	APT5011JNF	500		Volts
		APT5013JNF	500		
$I_{D(ON)}$	On State Drain Current <sup>(2)</sup> ( $V_{DS} > I_{D(ON)} \times R_{DS(ON)}$ Max, $V_{GS} = 10V$ )	APT5011JNF	46		Amps
		APT5013JNF	42		
$R_{DS(ON)}$	Drain-Source On-State Resistance <sup>(2)</sup> ( $V_{GS} = 10V, 0.5 I_{D(ON)}$ )	APT5011JNF		0.11	Ohms
		APT5013JNF		0.13	
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = V_{DSS}, V_{GS} = 0V$ )			4	mA
	Zero Gate Voltage Drain Current ( $V_{DS} = 0.8 V_{DSS}, V_{GS} = 0V, T_C = 125^\circ\text{C}$ )			4	
$I_{GSS}$	Gate-Source Leakage Current ( $V_{GS} = \pm 30V, V_{DS} = 0V$ )			±100	nA
$V_{GS(TH)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 2.5\text{ mA}$ )	2		4	Volts

**THERMAL CHARACTERISTICS**

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.24	°C/W
$R_{\theta CS}$	Case to Sink (Use High Efficiency Thermal Joint Compound and Planer Heat Sink Surface.)		0.06		

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

**405 S.W. COLUMBIA STREET  
 BEND, OREGON 97702-1035  
 U.S.A.**

**PHONE . . . (503) 382-8028**

**FAX . . . . . (503) 388-0364**

**DYNAMIC CHARACTERISTICS**

**APT5011/5013JNF**

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{iss}$	Input Capacitance	$V_{GS} = 0V$		6200	7200	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 25V$		1120	1500	
$C_{rss}$	Reverse Transfer Capacitance	$f = 1\text{ MHz}$		420	630	
$Q_g$	Total Gate Charge ③	$V_{GS} = 10V$		250	370	nC
$Q_{gs}$	Gate-Source Charge	$V_{DD} = 0.5 V_{DSS}$		35	50	
$Q_{gd}$	Gate-Drain ("Miller") Charge	$I_D = I_D [Cont.] @ 25^\circ C$		120	180	
$t_d(on)$	Turn-on Delay Time	$V_{GS} = 15V$		18	36	ns
$t_r$	Rise Time	$V_{DD} = 0.5 V_{DSS}$		25	50	
$t_d(off)$	Turn-off Delay Time	$I_D = I_D [Cont.] @ 25^\circ C$		48	75	
$t_f$	Fall Time	$R_G = 0.6\Omega$		12	25	

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$I_S$	Continuous Source Current (Body Diode)	APT5011JNF		46	Amps
		APT5013JNF		42	
$I_{SM}$	Pulsed Source Current ① (Body Diode)	APT5011JNF		184	Amps
		APT5013JNF		168	
$V_{SD}$	Diode Forward Voltage ② ( $V_{GS} = 0V, I_S = -I_D [Cont.]$ )			1.8	Volts
$dv/dt$	Peak Diode Recovery $dv/dt$ ④			5	V/ns
$t_{rr}$	Reverse Recovery Time ( $I_S = -I_D [Cont.]$ , $di/dt = 100A/\mu s$ )	$T_j = 25^\circ C$	170	250	ns
		$T_j = 125^\circ C$	240	400	
$Q_{rr}$	Reverse Recovery Charge ( $I_S = -I_D [Cont.]$ , $di/dt = 100A/\mu s$ )	$T_j = 25^\circ C$	1.7	3.2	$\mu C$
		$T_j = 125^\circ C$	3.6	5	
$I_{RRM}$	Peak Recovery Current ( $I_S = -I_D [Cont.]$ , $di/dt = 100A/\mu s$ )	$T_j = 25^\circ C$	20	25	Amps
		$T_j = 125^\circ C$	30	40	

**PACKAGE CHARACTERISTICS**

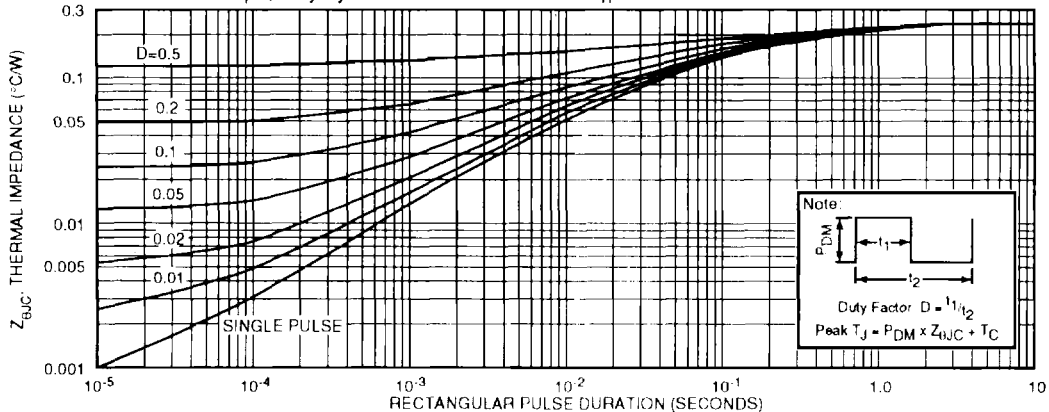
Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT
$L_D$	Internal Drain Inductance (Measured From Drain Terminal to Center of Die.)		3		nH
$L_S$	Internal Source Inductance (Measured From Source Terminals to Source Bond Pads)		5		
$V_{isolation}$	RMS Voltage (50-60 Hz Sinusoidal Waveform From Terminals to Mounting Base for 1 Min.)	2500			Volts
$C_{isolation}$	Drain-to-Mounting Base Capacitance ( $f = 1MHz$ )		35		pF
Torque	Maximum Torque for Device Mounting Screws and Electrical Terminations.			13	in·lbs

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

③ See MIL-STD-750 Method 3471

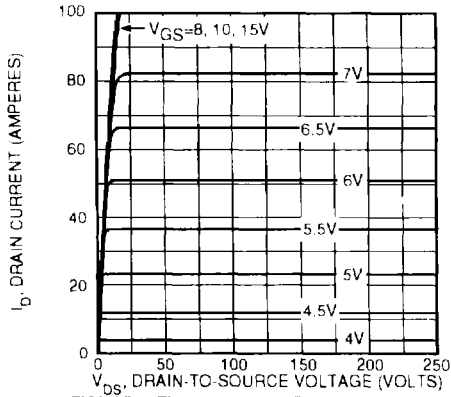
④  $I_S \leq -I_D [Cont.]$ ,  $di/dt = 100A/\mu s$ ,  $V_{DD} \leq V_{DSS}$ ,  $T_j \leq 150^\circ C$ ,  $R_G = 2.0\Omega$ ,  $V_R = 200V$ .

② Pulse Test: Pulse width < 380  $\mu s$ , Duty Cycle < 2%

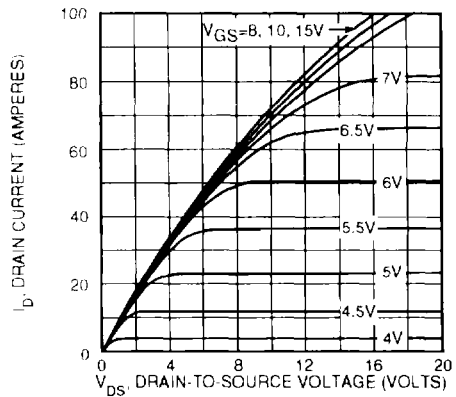


**FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION**

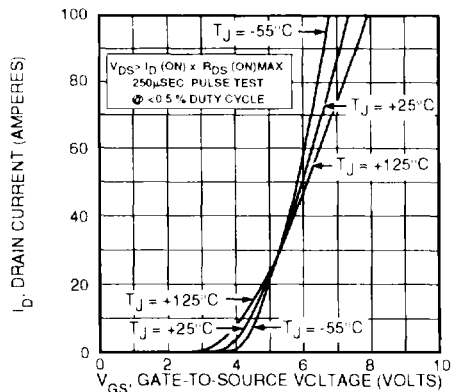
**APT5011/5013JNF**



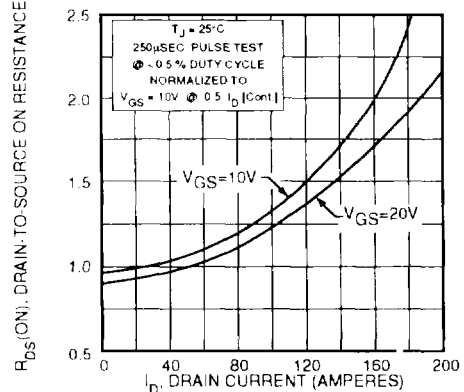
**FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS**



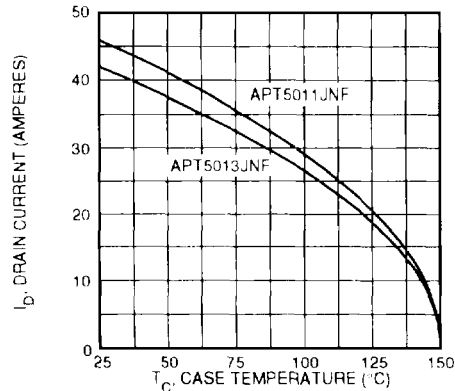
**FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS**



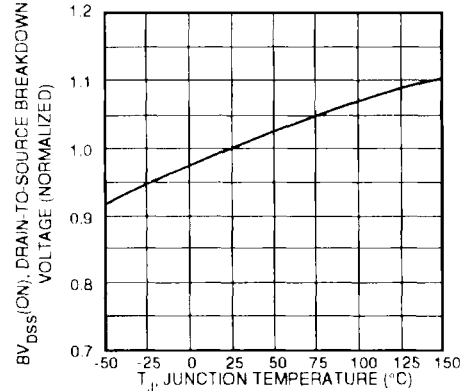
**FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS**



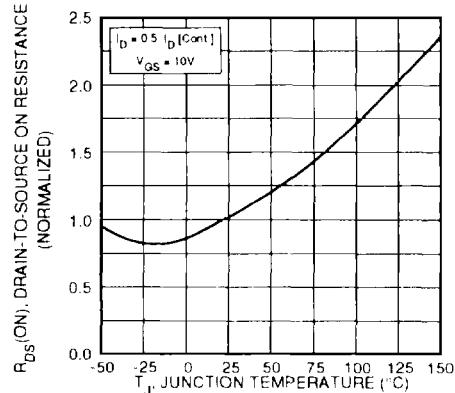
**FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT**



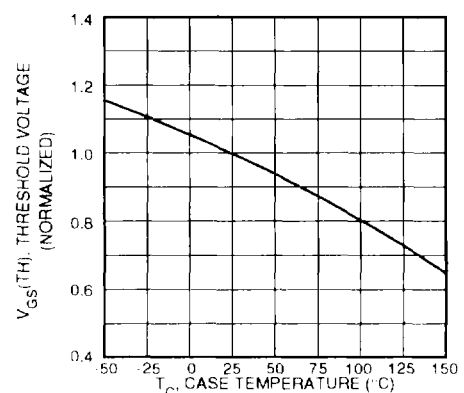
**FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE**



**FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE**



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



**FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE**

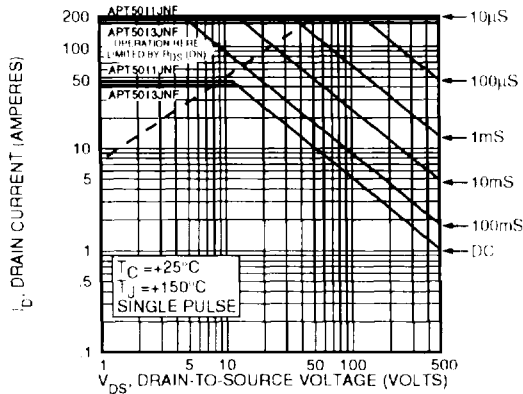


FIGURE 10, MAXIMUM SAFE OPERATING AREA

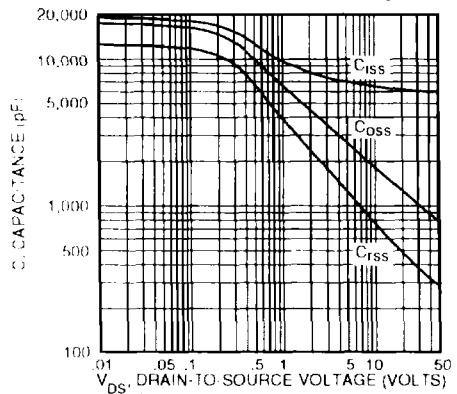


FIGURE 11, TYPICAL CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

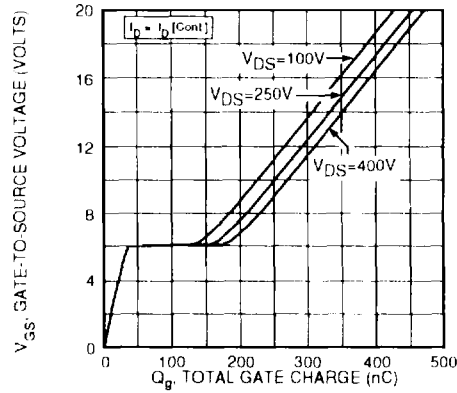


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

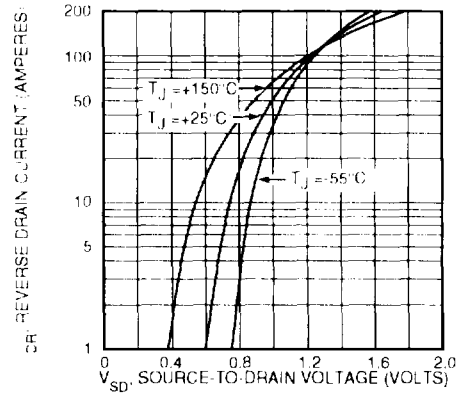
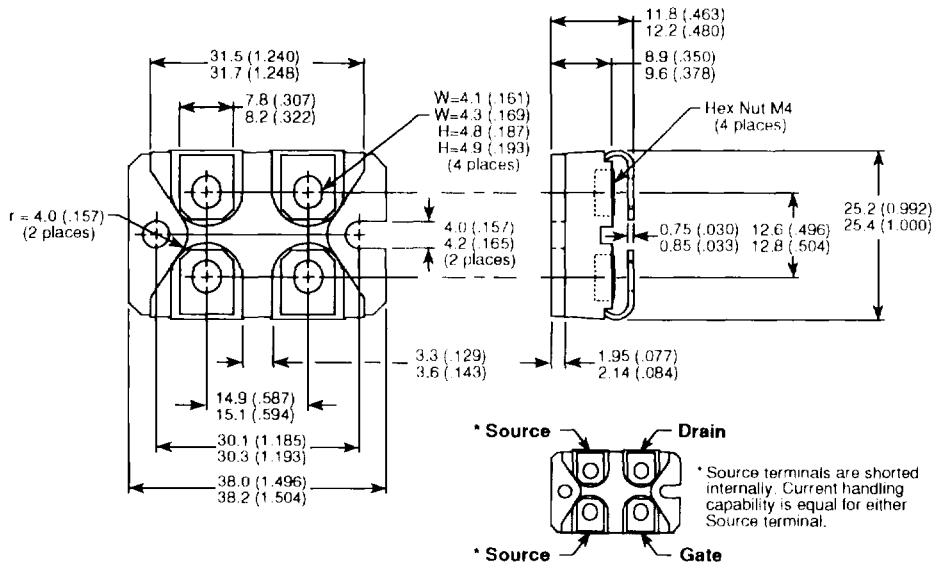


FIGURE 13, TYPICAL SOURCE-DRAIN DIODE FORWARD VOLTAGE

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

SOT-227 (ISOTOP®) Package Outline



\* Source      \* Drain  
\* Source      \* Gate

\* Source terminals are shorted internally. Current handling capability is equal for either Source terminal.

Dimensions in Millimeters and (Inches)

ISOTOP® is a Registered Trademark of SGS Thomson