

APT4020HN	400V	23.5A	0.20Ω
APT3520HN	350V	23.5A	0.20Ω
APT4025HN	400V	21.0A	0.25Ω
APT3525HN	350V	21.0A	0.25Ω

## 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 3520HN	APT 4020HN	APT 3525HN	APT 4025HN	UNIT
$V_{DSS}$	Drain-Source Voltage	350	400	350	400	Volts
$I_D$	Continuous Drain Current @ $T_C = 25^\circ\text{C}$	23.5		21.0		Amps
$I_{DM}$	Pulsed Drain Current ①	94		84		
$V_{GS}$	Gate-Source Voltage	±30				Volts
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	250				Watts
	Linear Derating Factor	2.0				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 ( $V_{GS} = 0V, I_D = 250 \mu\text{A}$ )	APT4020HN / APT4025HN		400	Volts
		APT3520HN / APT3525HN		350	
$I_{D(ON)}$	On State Drain Current ② ( $V_{DS} > I_{D(ON)} \times R_{DS(ON)}$ Max, $V_{GS} = 10V$ )	APT4020HN / APT3520HN		23.5	Amps
		APT4025HN / APT3525HN		21.0	
$R_{DS(ON)}$	Drain-Source On-State Resistance ② ( $V_{GS} = 10V, 0.5 I_D$ [Cont.])	APT4020HN / APT3520HN		0.20	Ohms
		APT4025HN / APT3525HN		0.25	
$I_{DSS}$	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 ( $V_{GS} = \pm 30V, V_{DS} = 0V$ )			±100	nA
$V_{GS(TH)}$	Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 1.0\text{mA}$ )	2		4	Volts

#### THERMAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case			0.50	°C/W
$R_{\theta JA}$	Junction to Ambient			40	

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**DYNAMIC CHARACTERISTICS**

APT4020/3520/4025/3525HN

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
$C_{DC}$	Drain-to-Case Capacitance	$f = 1 \text{ MHz}$		24	36	pF
$C_{iss}$	Input Capacitance	$V_{GS} = 0V$		2420	2950	
$C_{oss}$	Output Capacitance	$V_{DS} = 25V$		550	770	
$C_{rss}$	Reverse Transfer Capacitance	$f = 1 \text{ MHz}$		205	310	nC
$Q_g$	Total Gate Charge ③	$V_{GS} = 10V$		94	130	
$Q_{gs}$	Gate-Source Charge	$V_{DD} = 0.5 V_{DSS}$		11	16	
$Q_{gd}$	Gate-Drain ("Miller") Charge	$I_D = I_D [\text{Cont.}] @ 25^\circ\text{C}$		47	70	ns
$t_{d(on)}$	Turn-on Delay Time	$V_{GS} = 15V$		13	26	
$t_r$	Rise Time	$V_{DD} = 0.5 V_{DSS}$		19	38	
$t_{d(off)}$	Turn-off Delay Time	$I_D = I_D [\text{Cont.}] @ 25^\circ\text{C}$		65	97	
$t_f$	Fall Time	$R_G = 1.8\Omega$		21	42	

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	UNIT	
$I_S$	Continuous Source Current (Body Diode)	APT4020HN / APT3520HN			23.5	Amps
		APT4025HN / APT3525HN			21.0	
$I_{SM}$	Pulsed Source Current ① (Body Diode)	APT4020HN / APT3520HN			94	Amps
		APT4025HN / APT3525HN			84	
$V_{SD}$	Diode Forward Voltage ② ( $V_{GS} = 0V, I_S = -I_D [\text{Cont.}]$ )			1.3	Volts	
$t_{rr}$	Reverse Recovery Time ( $I_S = -I_D [\text{Cont.}], di_S/dt = 100A/\mu s$ )	180	360	720	ns	
$Q_{rr}$	Reverse Recovery Charge ( $I_S = -I_D [\text{Cont.}], di_S/dt = 100A/\mu s$ )	3	6	12	$\mu C$	

**SAFE OPERATING AREA CHARACTERISTICS**

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
SOA1	Safe Operating Area	$V_{DS} = 0.4 V_{DSS}, I_{DS} = P_D / 0.4 V_{DSS}, t = 1 \text{ Sec.}$	250			Watts
SOA2	Safe Operating Area	$I_{DS} = I_D [\text{Cont.}], V_{DS} = P_D / I_D [\text{Cont.}], t = 1 \text{ Sec.}$	250			
$I_{LM}$	Inductive Current Clamped	APT4020HN / APT3520HN	94			Amps
		APT4025HN / APT3525HN	84			

- 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

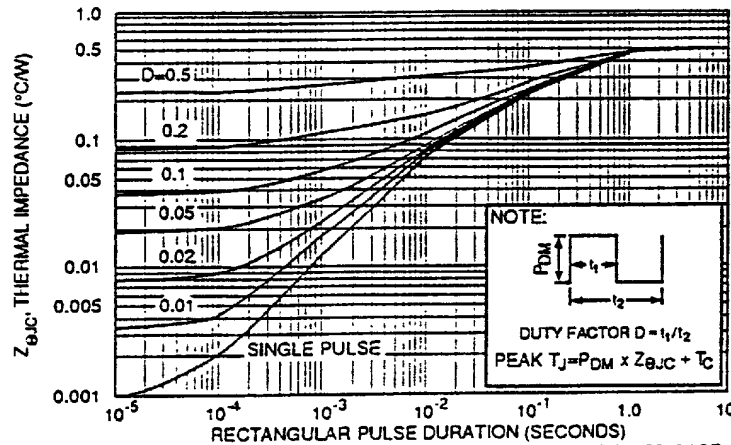


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

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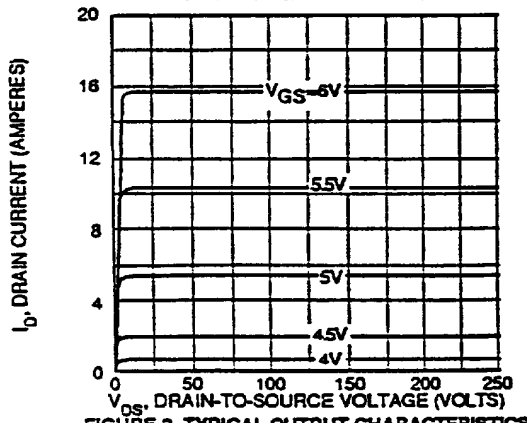


FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS

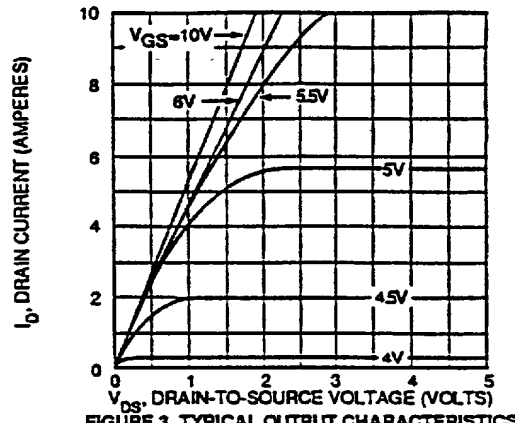


FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS

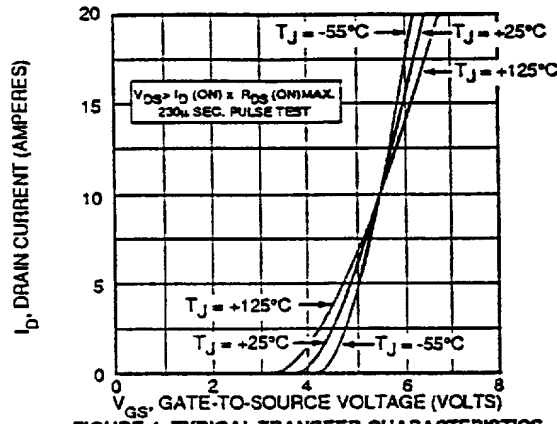


FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS

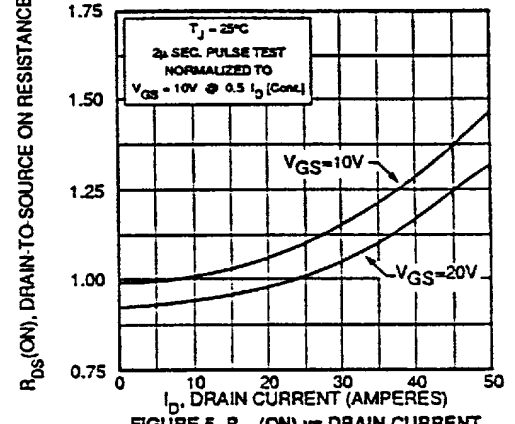


FIGURE 5,  $R_{DS(ON)}$  vs DRAIN CURRENT

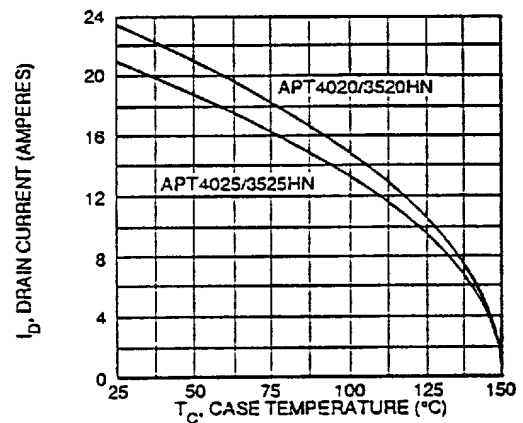


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

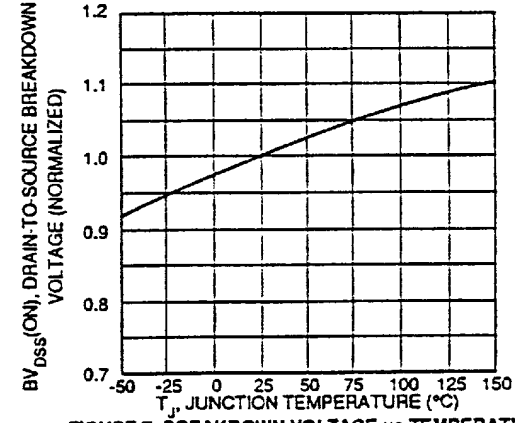


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

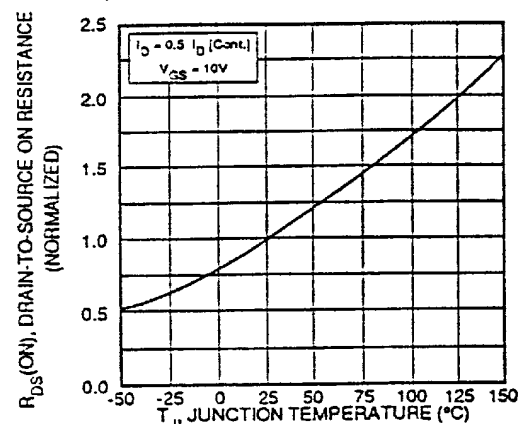


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

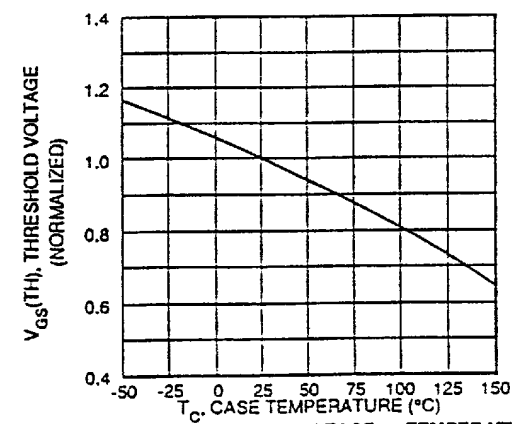


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

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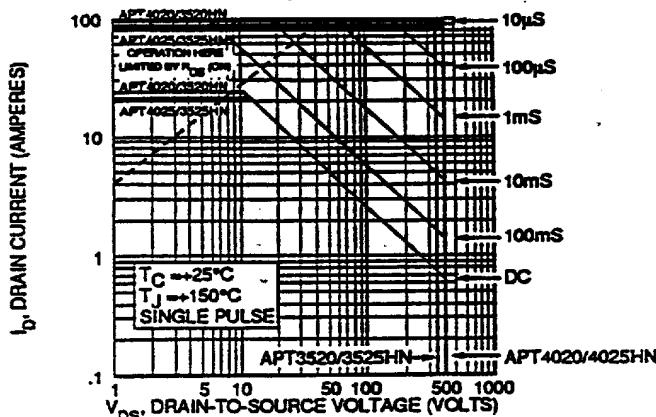


FIGURE 10, MAXIMUM SAFE OPERATING AREA

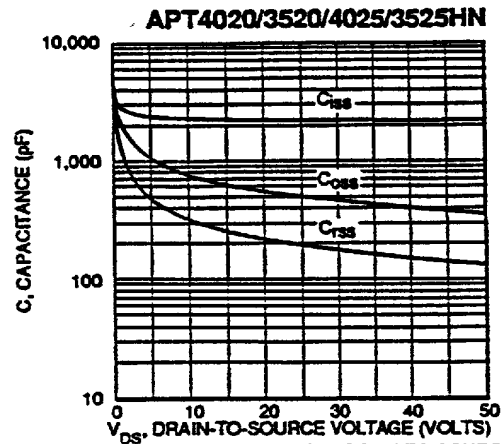


FIGURE 11, TYPICAL CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

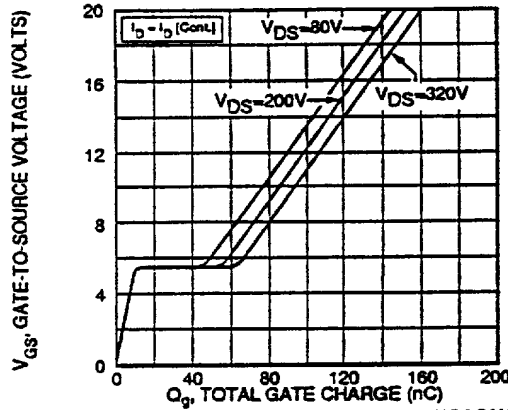


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

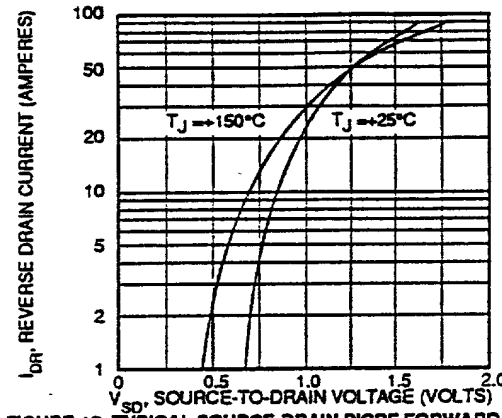
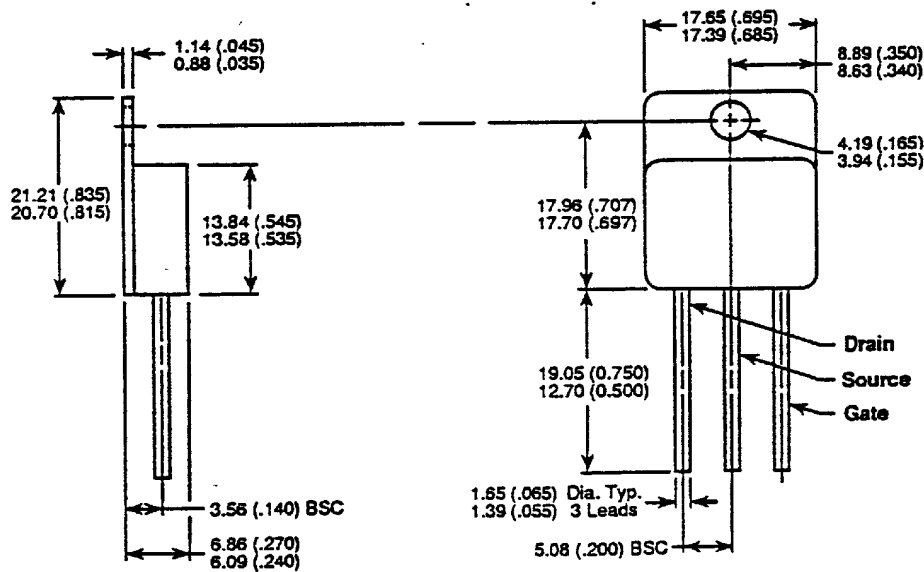


FIGURE 13, TYPICAL SOURCE-DRAIN DIODE FORWARD VOLTAGE

TO-258AA Package Outline



Dimensions in Millimeters and (Inches)

050-4013 Rev A

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