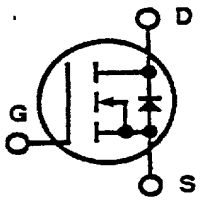
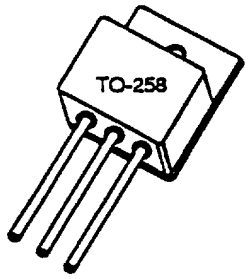



ADVANCED POWER TECHNOLOGY®

| | | | |
|---|---|---|---|
| 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°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°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°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 μA) | APT4020HN / APT4025HN | 400 | | | Volts |
| | | APT3520HN / APT3525HN | 350 | | | |
| $I_{D(ON)}$ | On State Drain Current ② ($V_{DS}$ > $I_{D(ON)}$ x $R_{DS(ON)}$ 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 | μA |
| | Zero Gate Voltage Drain Current ($V_{DS}$ = 0.8 $V_{DSS}$, $V_{GS}$ = 0V, $T_C$ = 125°C) | | | | 1000 | |
| $I_{GSS}$ | Gate-Source Leakage Current ($V_{GS}$ = ±30V, $V_{DS}$ = 0V) | | | | ±100 | nA |
| $V_{GS(TH)}$ | Gate Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 1.0mA) | | 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 | |

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

PHONE . . . (503) 382-8028

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

## DYNAMIC CHARACTERISTICS

APT4020/3520/4025/3525HN

| Symbol | Characteristic | Test Conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $C_{DC}$ | Drain-to-Case Capacitance | f = 1 MHz | | 24 | 36 | pF |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 25V, f = 1 MHz | | 2420 | 2950 | |
| $C_{oss}$ | Output Capacitance | | | 550 | 770 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 205 | 310 | |
| $Q_g$ | Total Gate Charge ③ | $V_{GS}$ = 10V, $V_{DD}$ = 0.5 $V_{DSS}$, $I_D$ = $I_D$ [Cont.] @ 25°C | | 94 | 130 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 11 | 16 | |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | | | 47 | 70 | |
| $t_d(on)$ | Turn-on Delay Time | $V_{GS}$ = 15V, $V_{DD}$ = 0.5 $V_{DSS}$, $I_D$ = $I_D$ [Cont.] @ 25°C, $R_G$ = 1.8Ω | | 13 | 26 | ns |
| $t_r$ | Rise Time | | | 19 | 38 | |
| $t_d(off)$ | Turn-off Delay Time | | | 65 | 97 | |
| $t_f$ | Fall Time | | | 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 | |
| | | APT4025HN / APT3525HN | | | 84 | |
| $V_{SD}$ | Diode Forward Voltage ② ($V_{GS}$ = 0V, $I_S$ = -$I_D$ [Cont.]) | | | | 1.3 | Volts |
| $t_{rr}$ | Reverse Recovery Time ($I_S$ = -$I_D$ [Cont.], $dI_S/dt$ = 100A/µs) | | 180 | 360 | 720 | ns |
| $Q_{rr}$ | Reverse Recovery Charge ($I_S$ = -$I_D$ [Cont.], $dI_S/dt$ = 100A/µs) | | 3 | 6 | 12 | µC |

## 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 Sec. | 250 | | | Watts |
| SOA2 | Safe Operating Area | $I_{DS}$ = $I_D$ [Cont.], $V_{DS}$ = $P_D$ / $I_D$ [Cont.], t = 1 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 µS, Duty Cycle < 2%

③ See MIL-STD-750 Method 3471

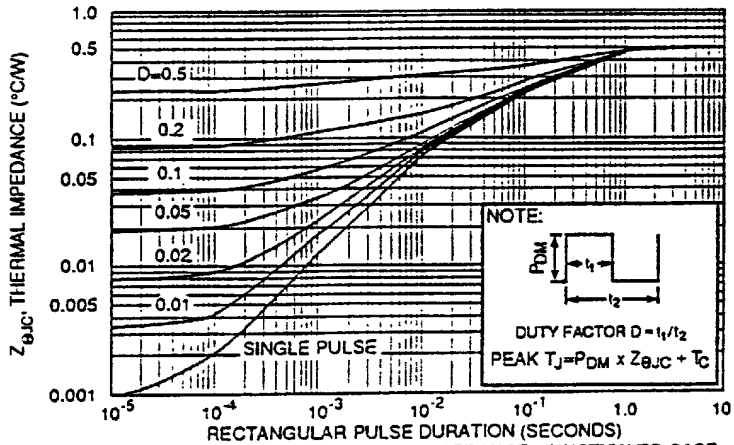



FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSE DURATION

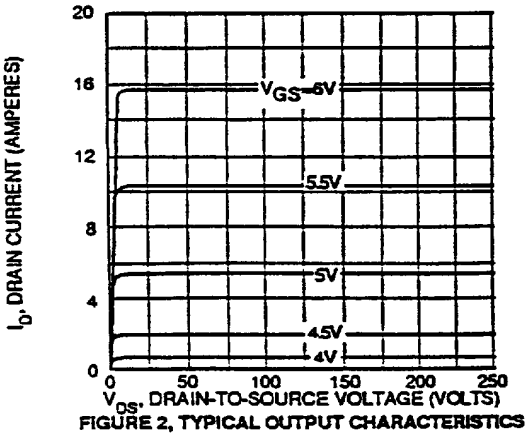



FIGURE 2, TYPICAL OUTPUT CHARACTERISTICS

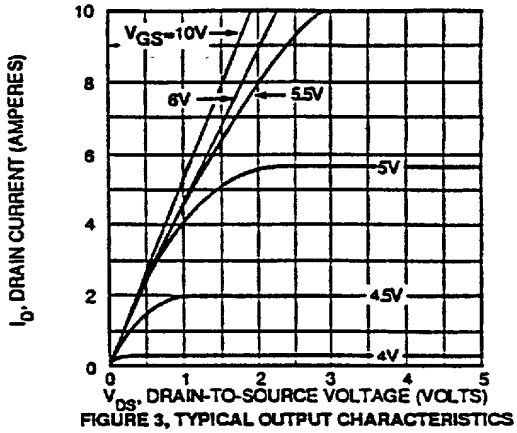



FIGURE 3, TYPICAL OUTPUT CHARACTERISTICS

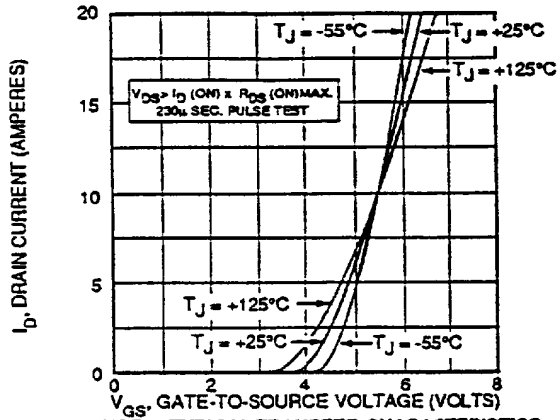



FIGURE 4, TYPICAL TRANSFER CHARACTERISTICS

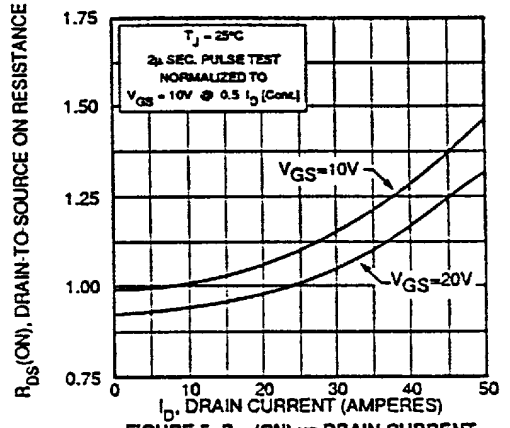



FIGURE 5, $R_{DS}$(ON) vs DRAIN CURRENT

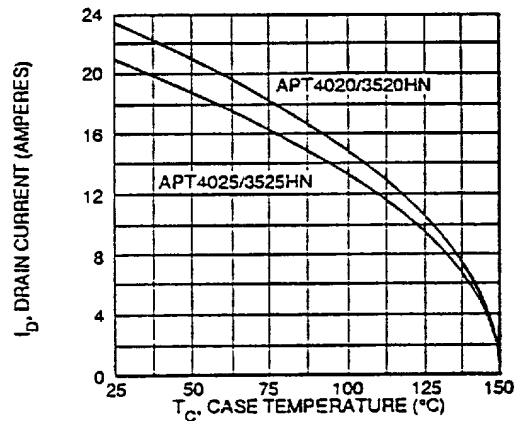



FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

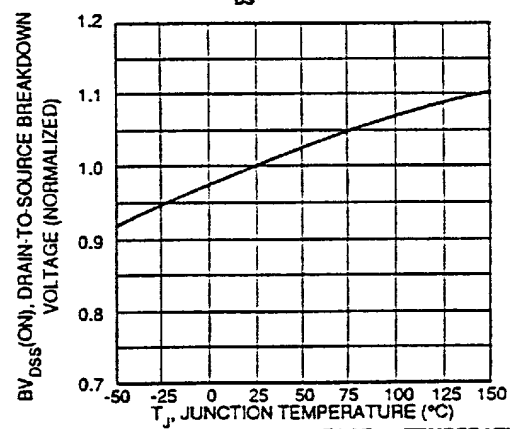



FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

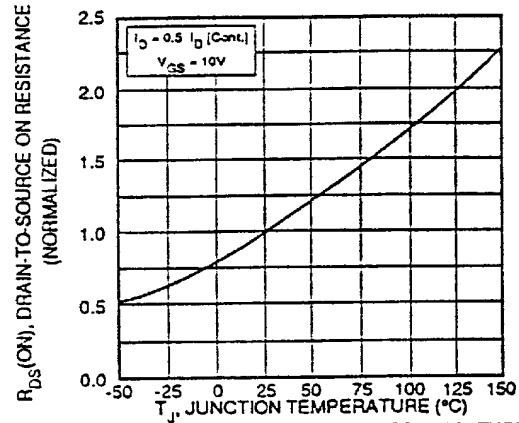



FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

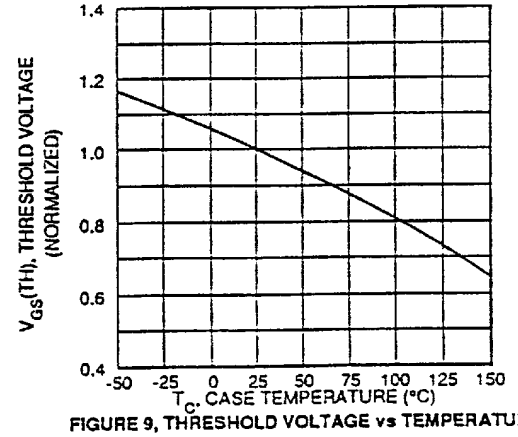



FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

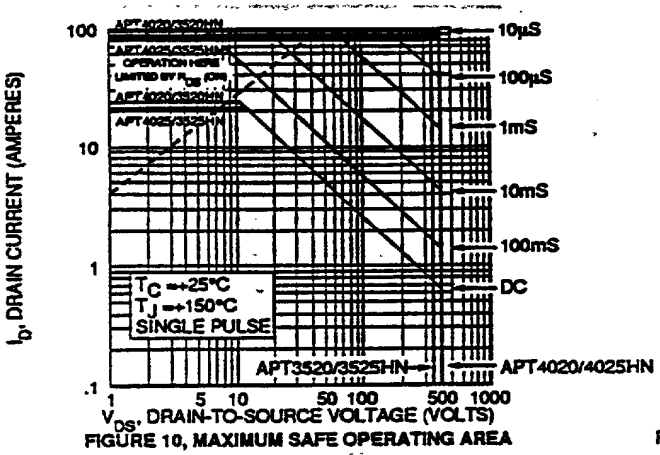



FIGURE 10, MAXIMUM SAFE OPERATING AREA

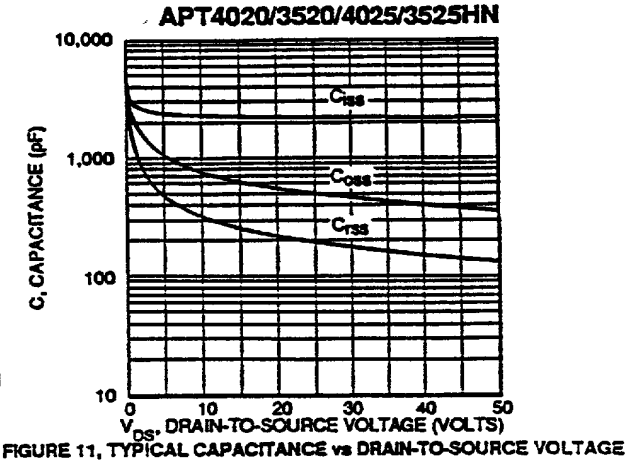



FIGURE 11, TYPICAL CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

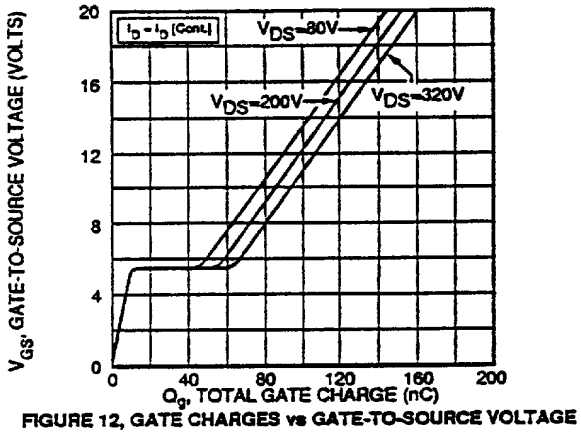



FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

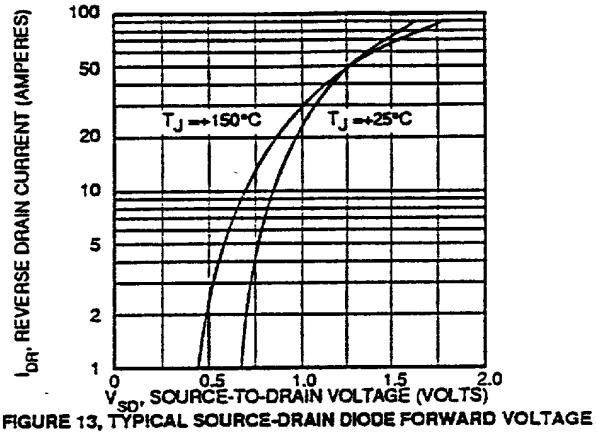
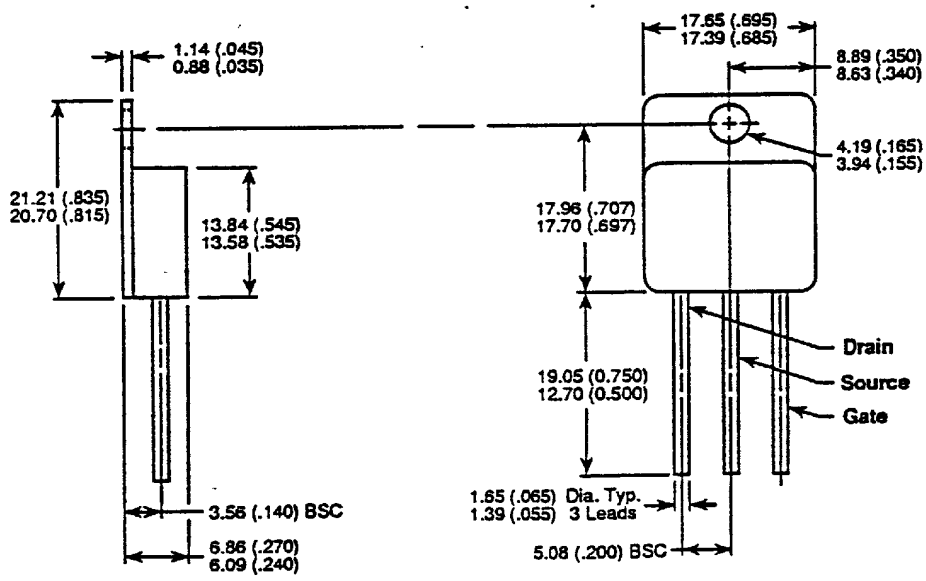



FIGURE 13, TYPICAL SOURCE-DRAIN DIODE FORWARD VOLTAGE

## TO-258AA Package Outline




Dimensions in Millimeters and (Inches)

050-4013
Rev A