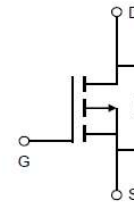


Feature

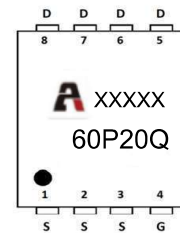
- -20V,-60A
 $R_{DS(ON)} < 7.0m\Omega @ V_{GS} = -4.5V$
 $R_{DS(ON)} < 9.0m\Omega @ V_{GS} = -2.5V$
- Advanced Trench Technology
- Lead free product is acquired
- Excellent $R_{DS(ON)}$ and Low Gate Charge



Schematic Diagram

Application

- PWM applications
- Load Switch
- Power management



Marking and pin Assignment

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity (PCS) |
|----------------|----------|----------------|-----------|------------|----------------|
| 60P20Q | AP60P20Q | PDFN3X3 | 13 inch | - | 5000 |

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|--|-----------------|-----------|---------------------------|
| Drain-Source Voltage | V_{DS} | -20 | V |
| Gate-Source Voltage | V_{GS} | ± 12 | V |
| Continuous Drain Current ($T_a = 25^\circ\text{C}$) | I_D | -60 | A |
| Continuous Drain Current ($T_a = 100^\circ\text{C}$) | I_D | -42 | A |
| Pulsed Drain Current ⁽¹⁾ | I_{DM} | -240 | A |
| Single Pulsed Avalanche Energy ⁽⁴⁾ | E_{AS} | 81 | mJ |
| Power Dissipation | P_D | 80 | W |
| Thermal Resistance from Junction to Case | $R_{\theta JC}$ | 1.6 | $^\circ\text{C}/\text{W}$ |
| Junction Temperature | T_J | 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{STG} | -55~ +150 | $^\circ\text{C}$ |

MOSFET ELECTRICAL CHARACTERISTICS($T_a=25^{\circ}\text{C}$ unless otherwise noted)

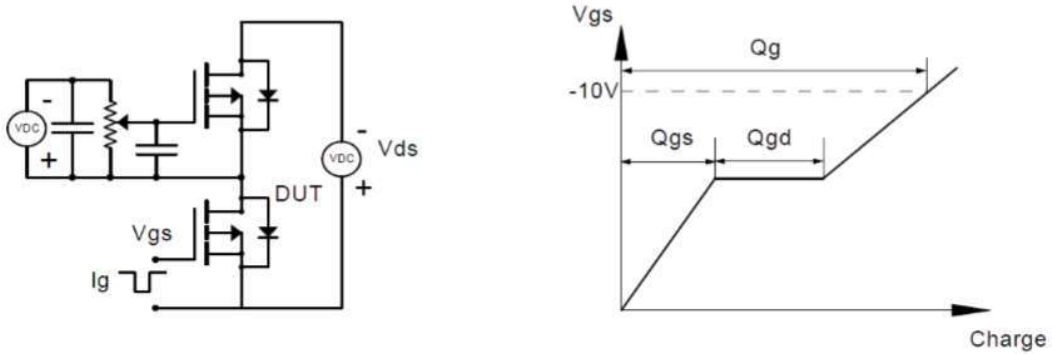
| Parameter | Symbol | Test Condition | Min | Type | Max | Unit |
|---|---------------|---|------|------|-----------|------------|
| Static Characteristics | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = -250\mu A$ | -20 | - | - | V |
| Zero gate voltage drain current | I_{DSS} | $V_{DS} = -20V, V_{GS} = 0V$ | - | - | 1 | μA |
| Gate-body leakage current | I_{GSS} | $V_{GS} = \pm 12V, V_{DS} = 0V$ | - | - | ± 100 | nA |
| Gate threshold voltage ⁽³⁾ | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = -250\mu A$ | 0.35 | 0.6 | 1.0 | V |
| Drain-source on-resistance ⁽³⁾ | $R_{DS(on)}$ | $V_{GS} = -4.5V, I_D = -20A$ | - | 5.8 | 7.0 | m Ω |
| | | $V_{GS} = -2.5V, I_D = -10A$ | - | 7.0 | 9.0 | |
| Dynamic characteristics | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = -10V, V_{GS} = 0V, f = 1MHz$ | - | 7170 | - | pF |
| Output Capacitance | C_{oss} | | - | 860 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 650 | - | |
| Switching characteristics | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = -10V, I_D = -15A, R_L = 0.5\Omega$ $V_{GS} = -4.5V, R_G = 3\Omega$ | - | 20 | - | ns |
| Turn-on rise time | t_r | | - | 55 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 100 | - | |
| Turn-off fall time | t_f | | - | 35 | - | |
| Total Gate Charge | Q_g | $V_{DS} = -10V, I_D = -20A,$ $V_{GS} = -4.5V$ | - | 63 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 10 | - | |
| Gate-Drain Charge | Q_{gd} | | - | 18 | - | |
| Source-Drain Diode characteristics | | | | | | |
| Diode Forward voltage ⁽²⁾ | V_{DS} | $V_{GS} = 0V, I_S = -20A$ | - | - | -1.2 | V |
| Diode Forward current ⁽³⁾ | I_S | | - | - | -60 | A |

Notes:

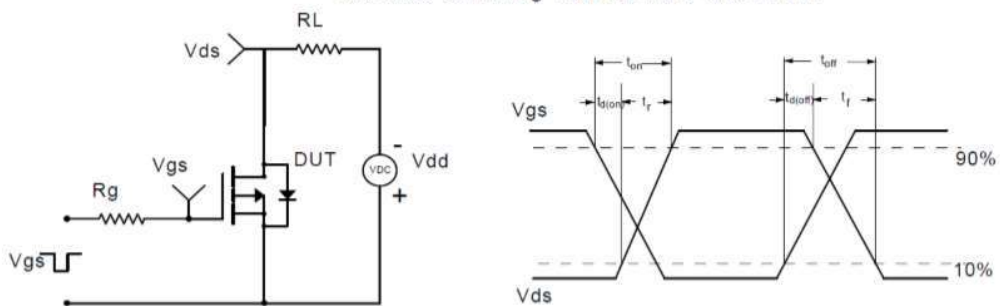
1. Repetitive Rating: pulse width limited by maximum junction temperature
2. Pulse Test: pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
3. Surface Mounted on FR4 Board, $t \leq 10$ sec
4. EAS Condition: $T_J = 25^{\circ}\text{C}, V_{DD} = -10V, R_G = 25\Omega, L = 0.5mH$

Test Circuit

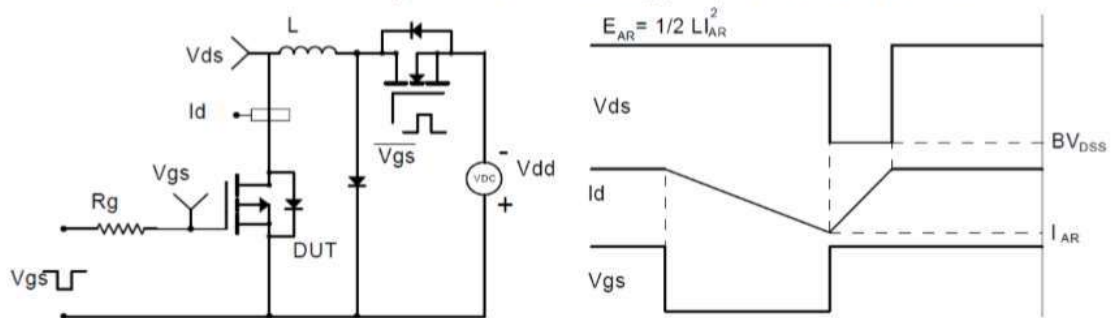
Gate Charge Test Circuit & Waveform



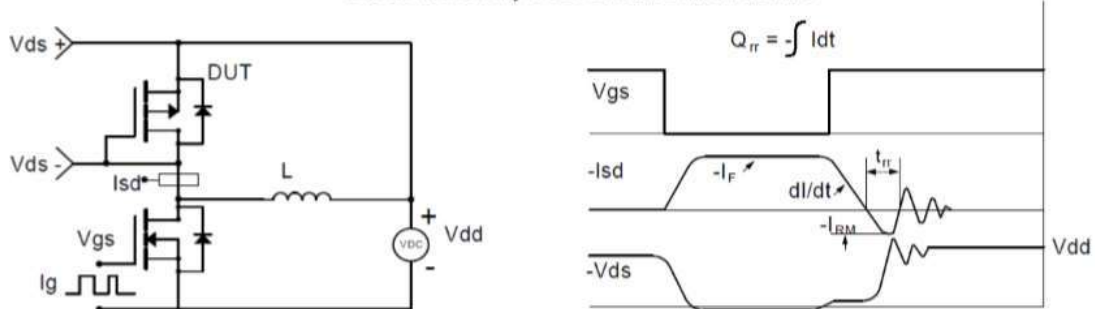
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Typical Performance Characteristics

Figure 1: Output Characteristics

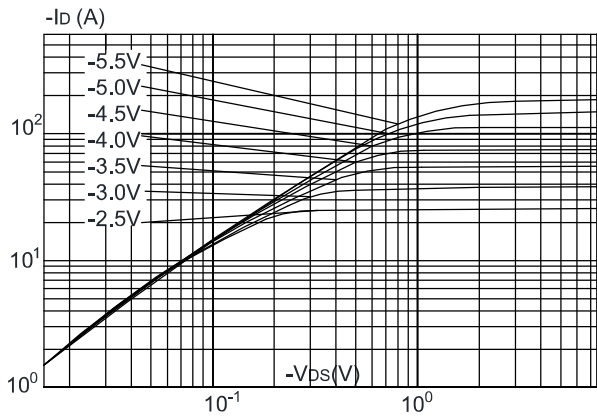


Figure 2: Typical Transfer Characteristics

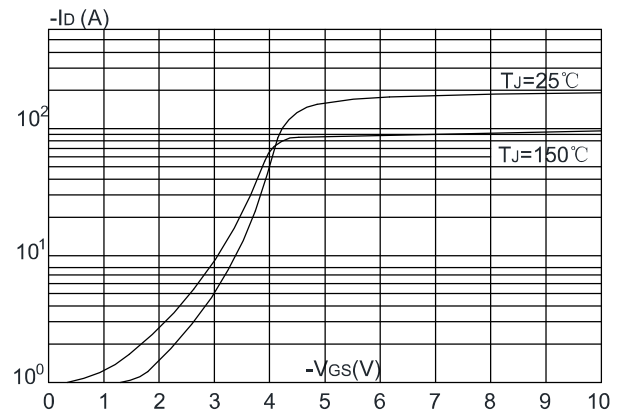


Figure 3: On-resistance vs. Drain Current

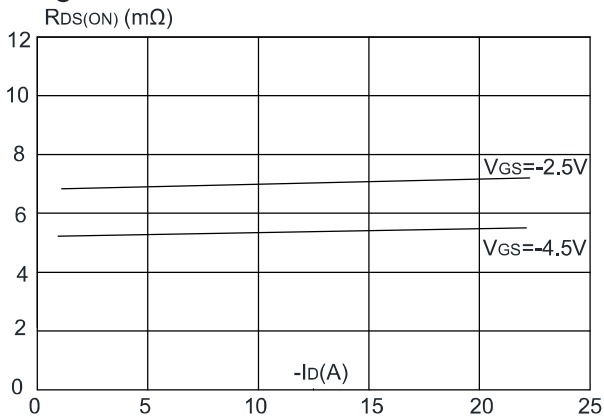


Figure 4: Body Diode Characteristics

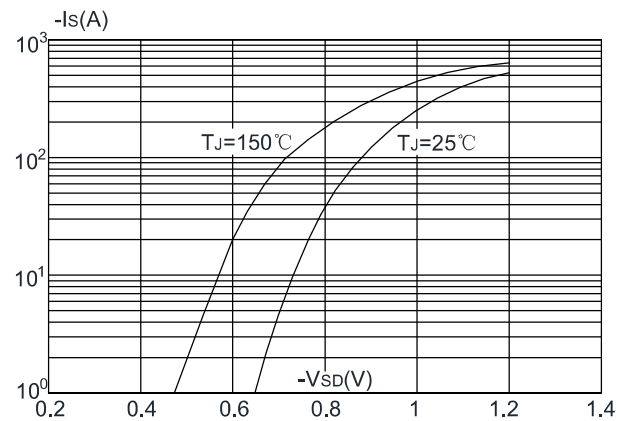


Figure 5: Gate Charge Characteristics

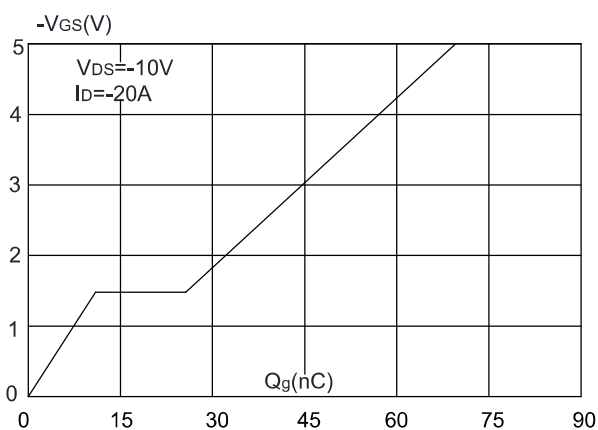


Figure 6: Capacitance Characteristics

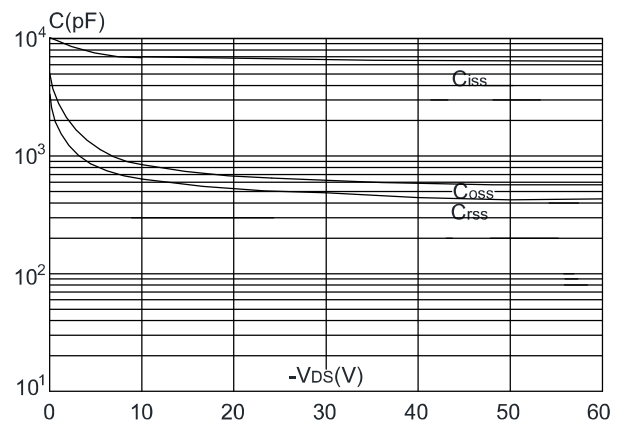


Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

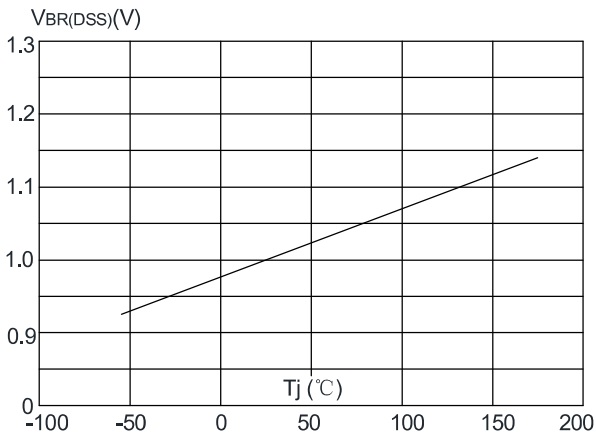


Figure 8: Normalized on Resistance vs. Junction Temperature

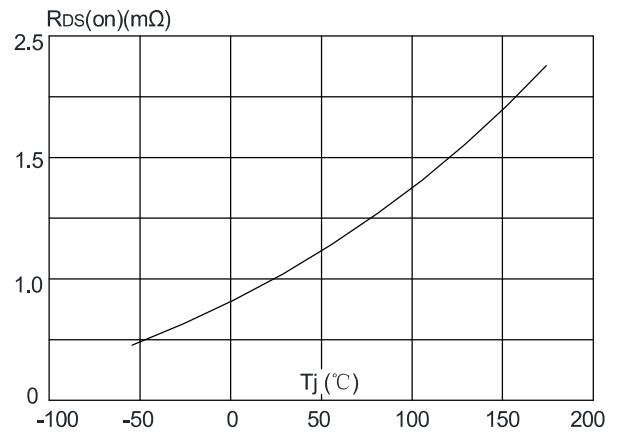


Figure 9: Maximum Safe Operating Area

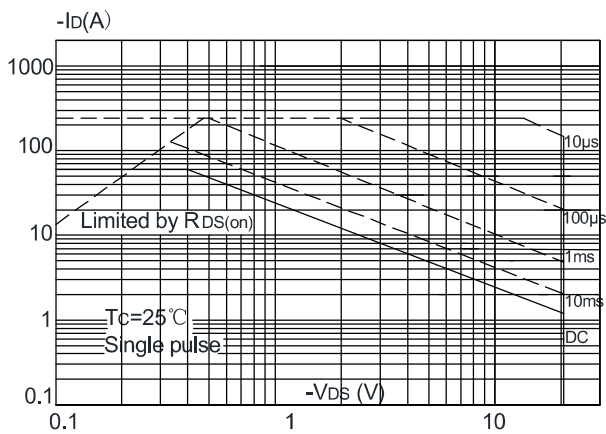


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

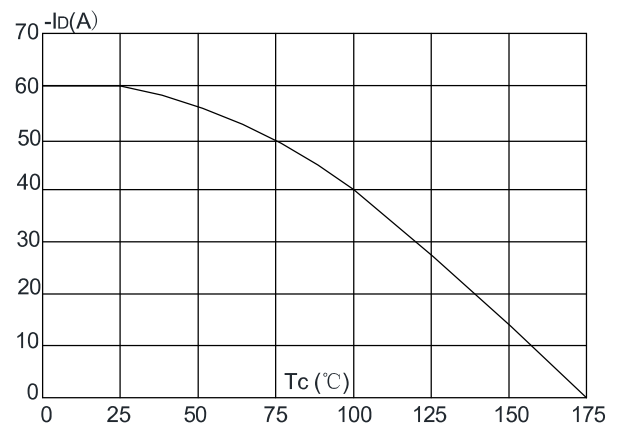
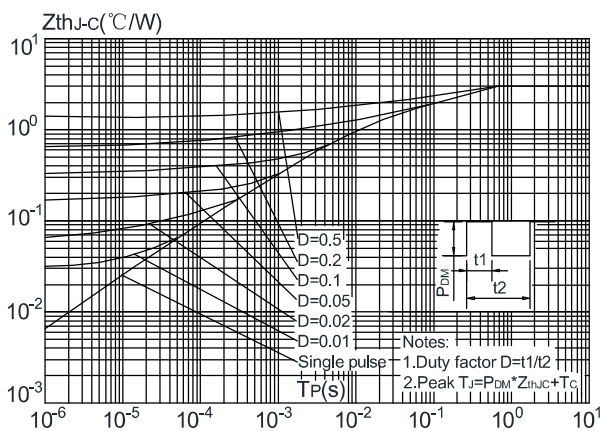
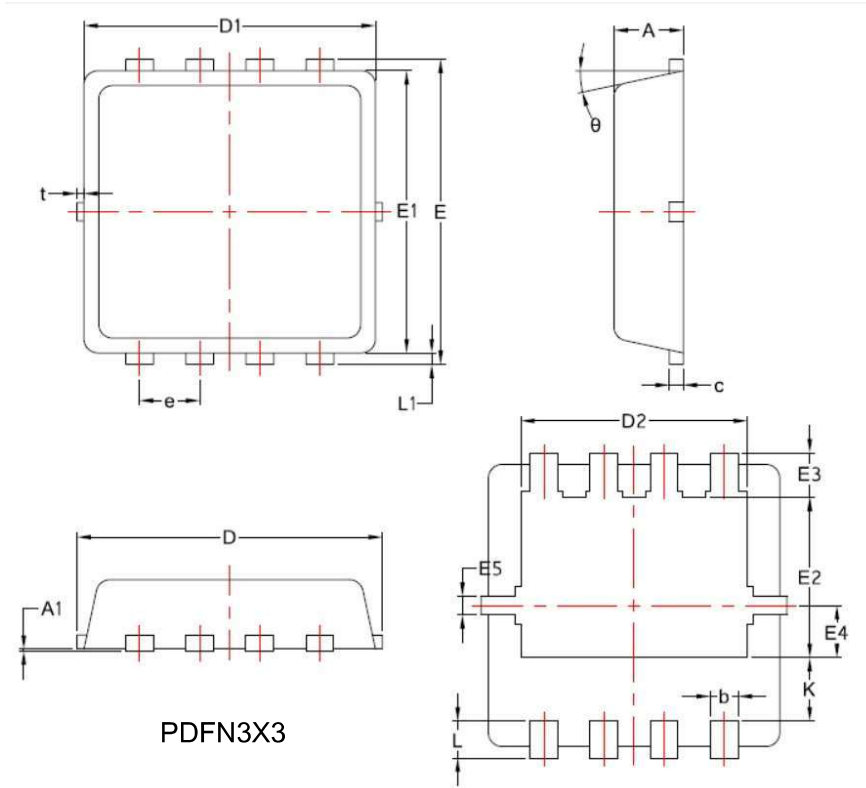


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case



Package Mechanical Data



| SYMBOL | COMMON | | |
|--------|--------|-------|------|
| | MM | | |
| | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.85 |
| A1 | / | / | 0.05 |
| b | 0.20 | 0.30 | 0.40 |
| c | 0.10 | 0.152 | 0.25 |
| D | 3.15 | 3.30 | 3.45 |
| D1 | 3.00 | 3.15 | 3.25 |
| D2 | 2.29 | 2.45 | 2.65 |
| E | 3.15 | 3.30 | 3.45 |
| E1 | 2.90 | 3.05 | 3.20 |
| E2 | 1.54 | 1.74 | 1.94 |
| E3 | 0.28 | 0.48 | 0.65 |
| E4 | 0.37 | 0.57 | 0.77 |
| E5 | 0.10 | 0.20 | 0.30 |
| e | 0.60 | 0.65 | 0.70 |
| K | 0.59 | 0.69 | 0.89 |
| L | 0.30 | 0.40 | 0.50 |
| L1 | 0.06 | 0.125 | 0.20 |
| t | 0 | 0.075 | 0.13 |
| theta | 10° | 12° | 14° |