# AP15P04Q-AU

**P-Channel Enhancement Mosfet**

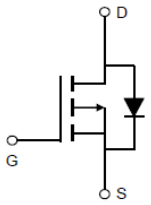
**DATA SHEET**

## Feature

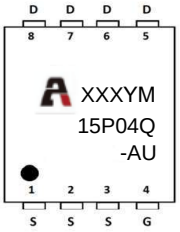
- -40V,-15A
  $R_{DS(ON)}$ <33mΩ @$V_{GS}$=-10V TYP:27 mΩ
  $R_{DS(ON)}$ <42mΩ @$V_{GS}$=-4.5V TYP:34 mΩ
- Advanced Trench Technology
- Lead free product is acquired
- Excellent $R_{DS(ON)}$ and Low Gate Charge
- Tjmax=175℃
- AEC-Q101 qualified

## Application

- PWM applications
- Load Switch
- Power management




**Schematic Diagram**




**Marking and pin Assignment**

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity (PCS) |
|---|---|---|---|---|---|
| 15P04Q-AU | AP15P04Q-AU | PDFN3X3 | 13 inch | - | 5000 |

## ABSOLUTE MAXIMUM RATINGS ($T_J$=25℃ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | -40 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Continuous Drain Current ($T_C$=25℃) | $I_D$ | -15 | A |
| Continuous Drain Current ($T_C$=100℃) | $I_D$ | -10.5 | A |
| Pulsed Drain Current (1) | $I_{DM}$ | -60 | A |
| Single Pulsed Avalanche Energy (2) | $E_{AS}$ | 42 | mJ |
| Power Dissipation | $P_D$ | 38 | W |
| Thermal Resistance from Junction to Case | $R_{\theta JC}$ | 3.9 | ℃/W |
| Thermal Resistance from Junction to Ambient | $R_{\theta JA}$ | 62 | ℃/W |
| Junction Temperature | $T_J$ | 175 | ℃ |
| Storage Temperature | $T_{STG}$ | -55~ +175 | ℃ |

## MOSFET ELECTRICAL CHARACTERISTICS($T_J$=25℃ unless otherwise noted)

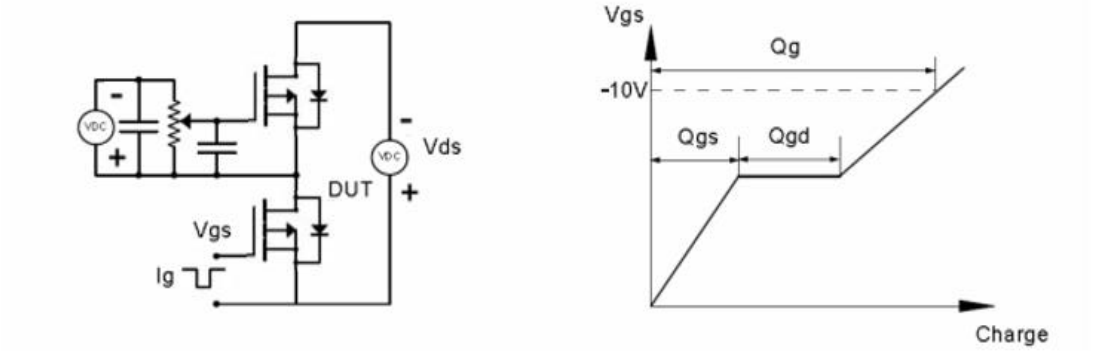
| Parameter | Symbol | Test Condition | Min | Type | Max | Unit |
|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ =-250μA | -40 | - | - | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$ =-40V, $V_{GS}$ = 0V | - | - | 1 | μA |
| Gate-body leakage current | $I_{GSS}$ | $V_{GS}$ =±20V, $V_{DS}$ = 0V | - | - | ±100 | nA |
| Gate threshold voltage(3) | $V_{GS(th)}$ | $V_{DS}$ =$V_{GS}$, $I_D$ =-250μA | -1 | -1.5 | -2.2 | V |
| Drain-source on-resistance(3) | $R_{DS(on)}$ | $V_{GS}$ =-10V, $I_D$ =-15A | - | 27 | 33 | mΩ |
| | | $V_{GS}$ =-4.5V, $I_D$ =-10A | - | 34 | 42 | |
| **Dynamic characteristics** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ =-20V, $V_{GS}$ =0V, f =1MHz | - | 1512 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 115 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 104 | - | |
| **Switching characteristics** | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=-20V, $I_D$=-15A, $V_{GS}$=-10V, $R_G$=2.5Ω | - | 4 | - | ns |
| Turn-on rise time | $t_r$ | | - | 27.5 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 39.4 | - | |
| Turn-off fall time | $t_f$ | | - | 10.4 | - | |
| Total Gate Charge | Qg | VDS=-20V, ID=-8A, VGS=-10V | - | 27.6 | - | nC |
| Gate-Source Charge | Qgs | | - | 4.4 | - | |
| Gate-Drain Charge | Qgd | | - | 5.4 | - | |
| **Source-Drain Diode characteristics** | | | | | | |
| Diode Forward voltage(3) | $V_{DS}$ | $V_{GS}$ =0V, $I_S$=-15A | - | - | -1.2 | V |
| Diode Forward current(4) | $I_S$ | | - | - | -15 | A |
| Reverse Recovery Time | Trr | $V_{GS}$ =0V, $I_S$=-15A,di/dt=100A/μS | - | 10.9 | - | ns |
| Reverse Recovery Char | Qrr | | - | 2.09 | - | nC |

**Notes:**

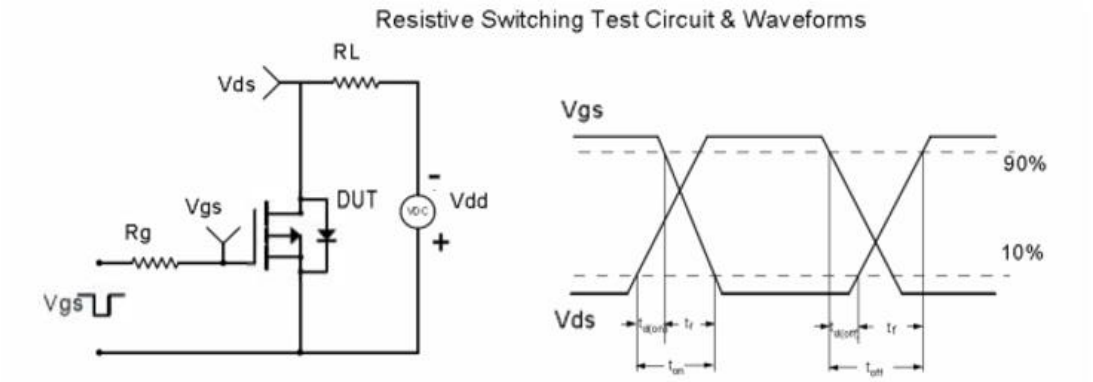
1. Repetitive Rating: pulse width limited by maximum junction temperature
2. EAS Condition:$T_J$=25℃,$V_{DD}$=-20V,$R_G$=25Ω,L=0.5mH,$I_{AS}$=-13A
3. Pulse Test: pulse width≤300μs, duty cycle≤2%
4. Surface Mounted on FR4 Board,t≤10 sec

## Test Circuit & Waveform

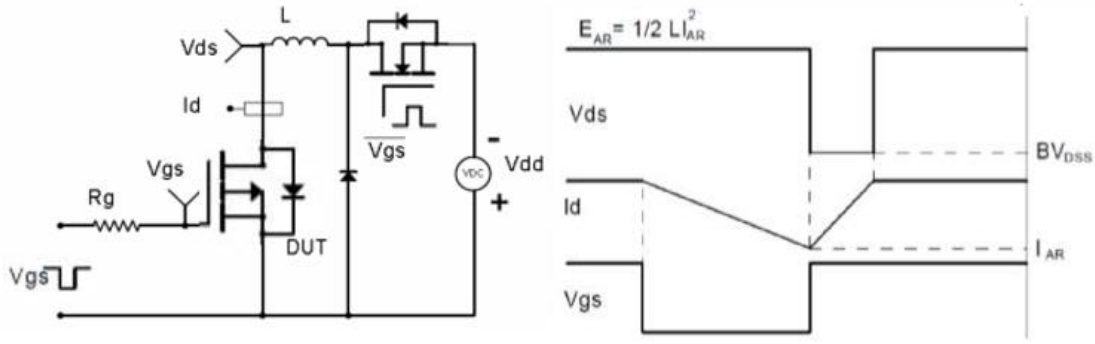
Gate Charge Test Circuit & Waveform



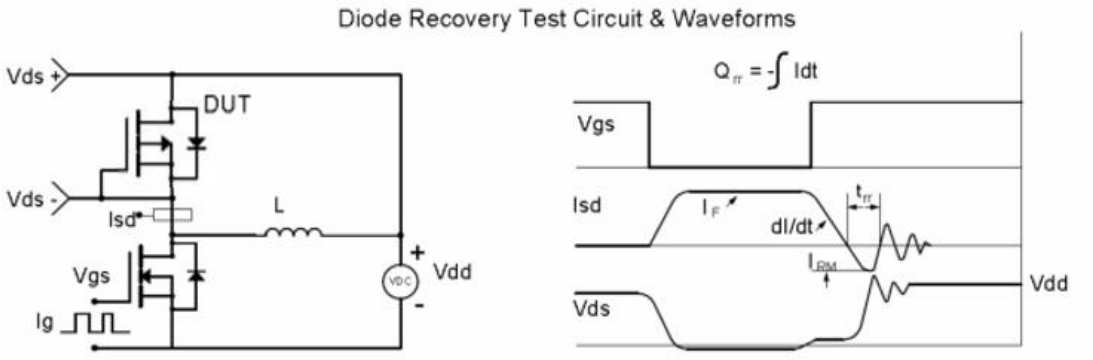

Resistive Switching Test Circuit & Waveforms




Unclamped Inductive Switching (UIS) Test Circuit & Waveforms




Diode Recovery Test Circuit & Waveforms



## Typical Performance Characteristics

Fig1. Typical Output Characteristics@Tj= 125℃

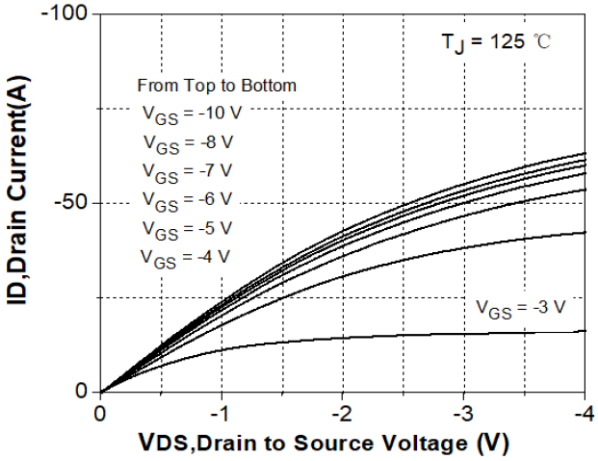



Fig2. Transconductance vs. Drain Current @Tj= -25/25/75/125℃

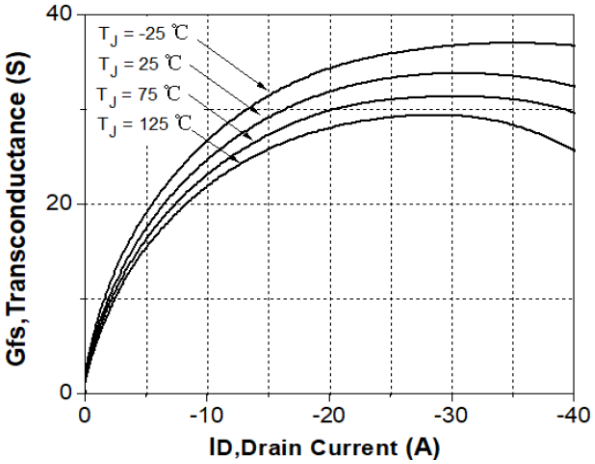



Fig3. Typical Transfer Characteristics @Tj= -25/25/75/125℃

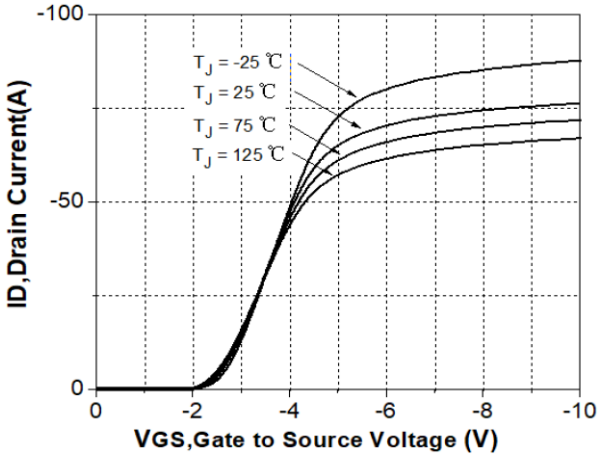



Fig4. Static Drain - Source On - State Resistance vs. Drain Current @Tj= -25℃

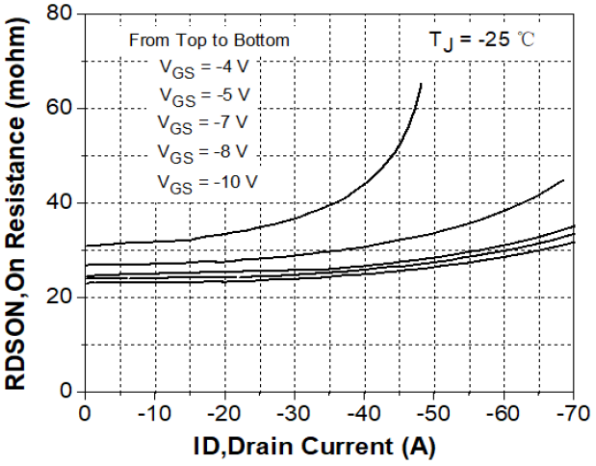



Fig5. Static Drain - Source On - State Resistance vs. Drain Current @Tj= 25℃

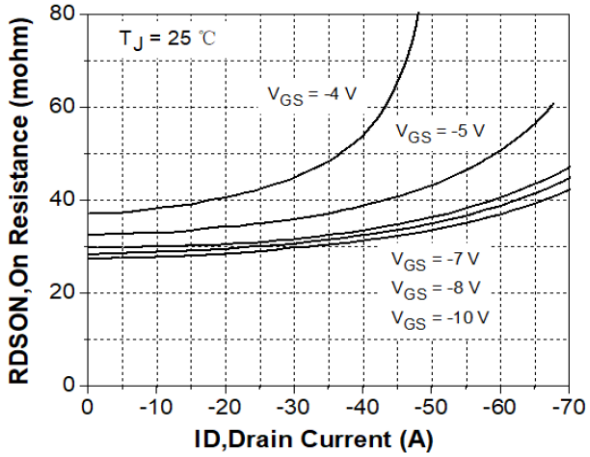



Fig6. Static Drain - Source On - State Resistance vs. Drain Current @Tj= 75℃

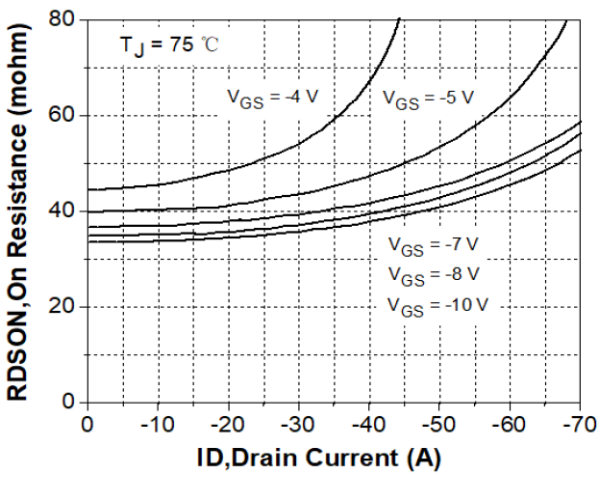


Fig7. Static Drain - Source On - State Resistance vs. Drain Current @Tj= 125℃

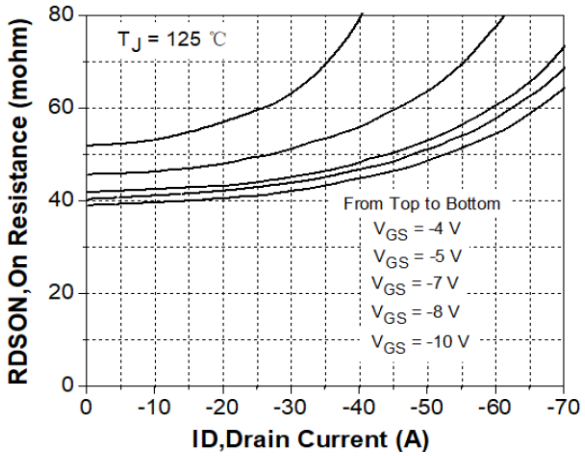



Fig8. Gate Charge Characteristics

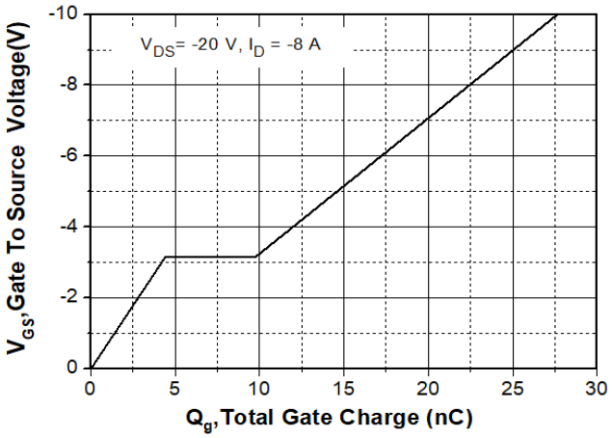



Fig9. Breakdown Voltage vs. Junction Temperature

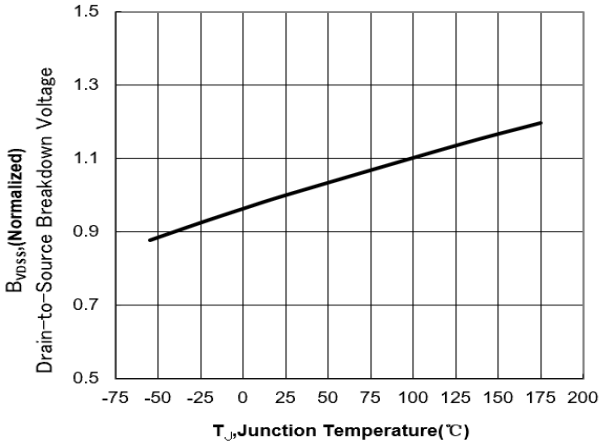



Fig10. Gate Threshold Voltage vs. Junction Temperature

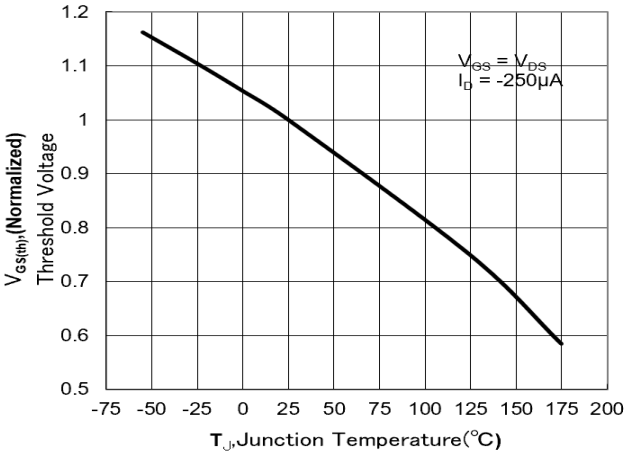



Fig11. On-Resistance Variation vs. Junction Temperature

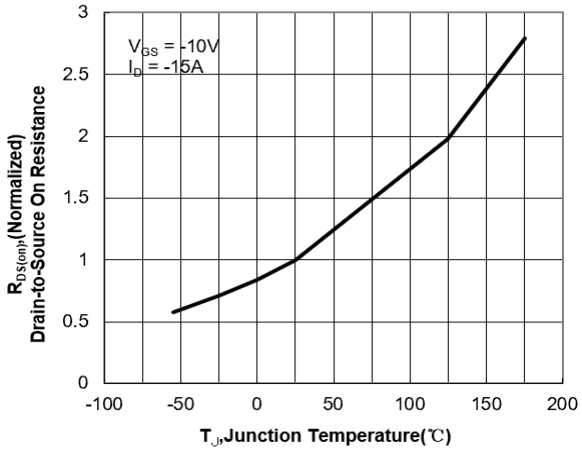



Fig12. Maximum Drain Current vs. Case Temperature

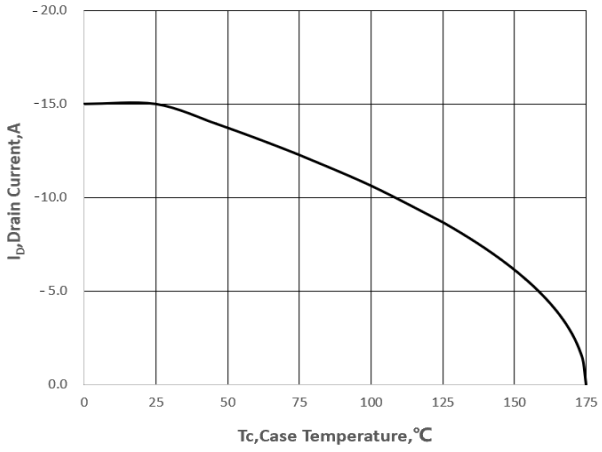


Fig13. Body Diode Forward Voltage vs. Reverse Drain Current

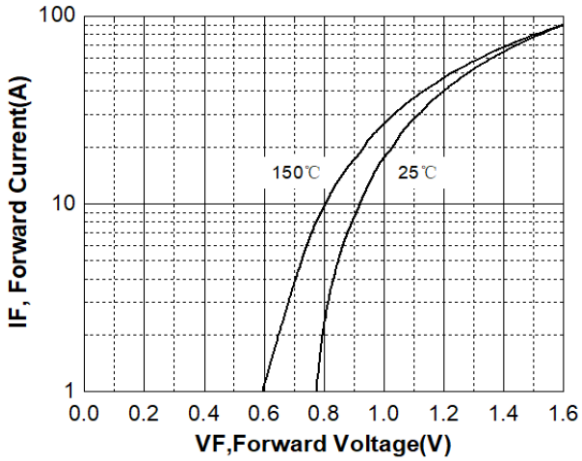



Fig14. Typical Output Characteristics@Tj= 25℃

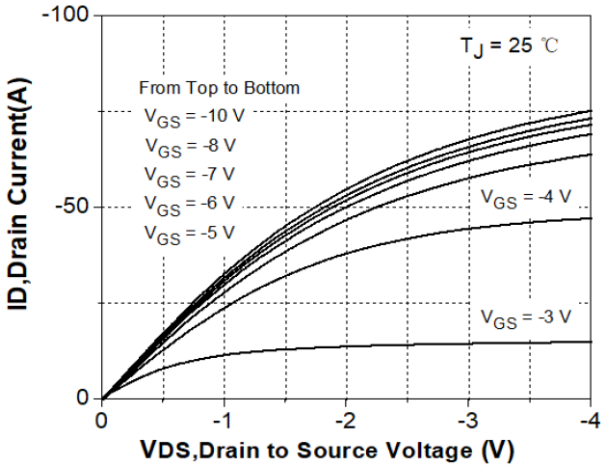


Fig15. Safe Operating Area

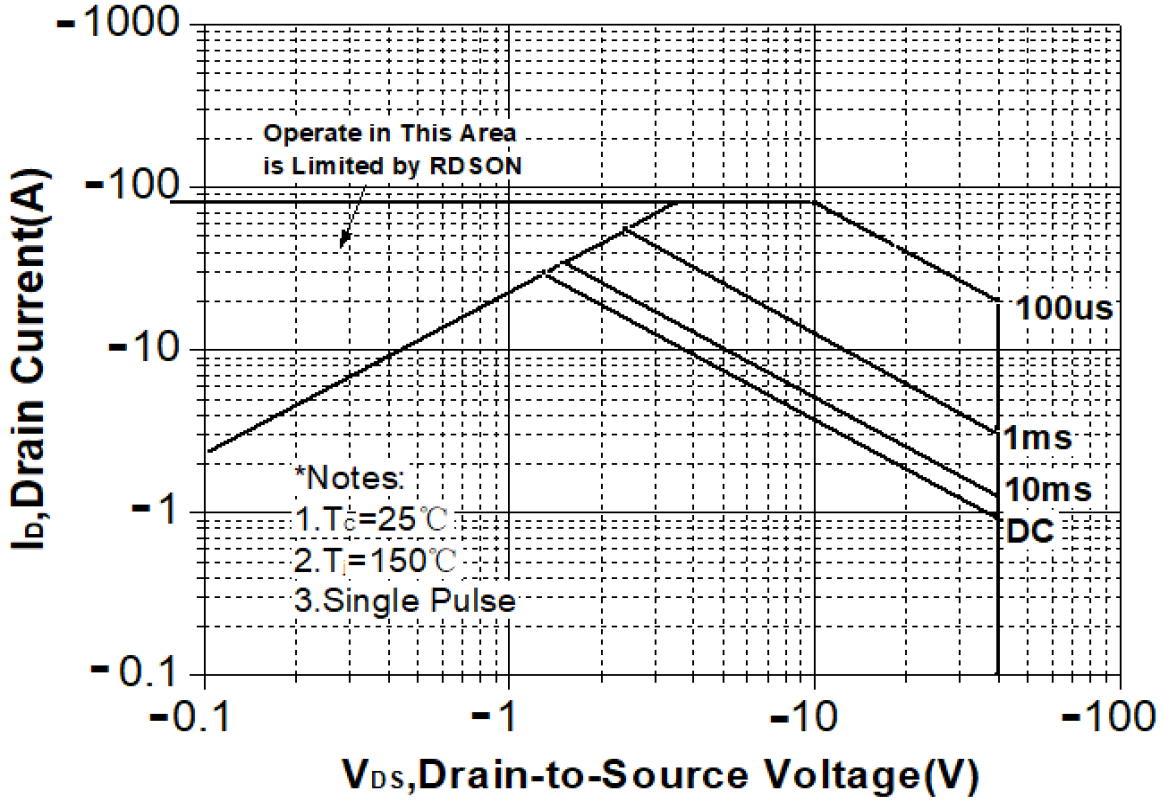
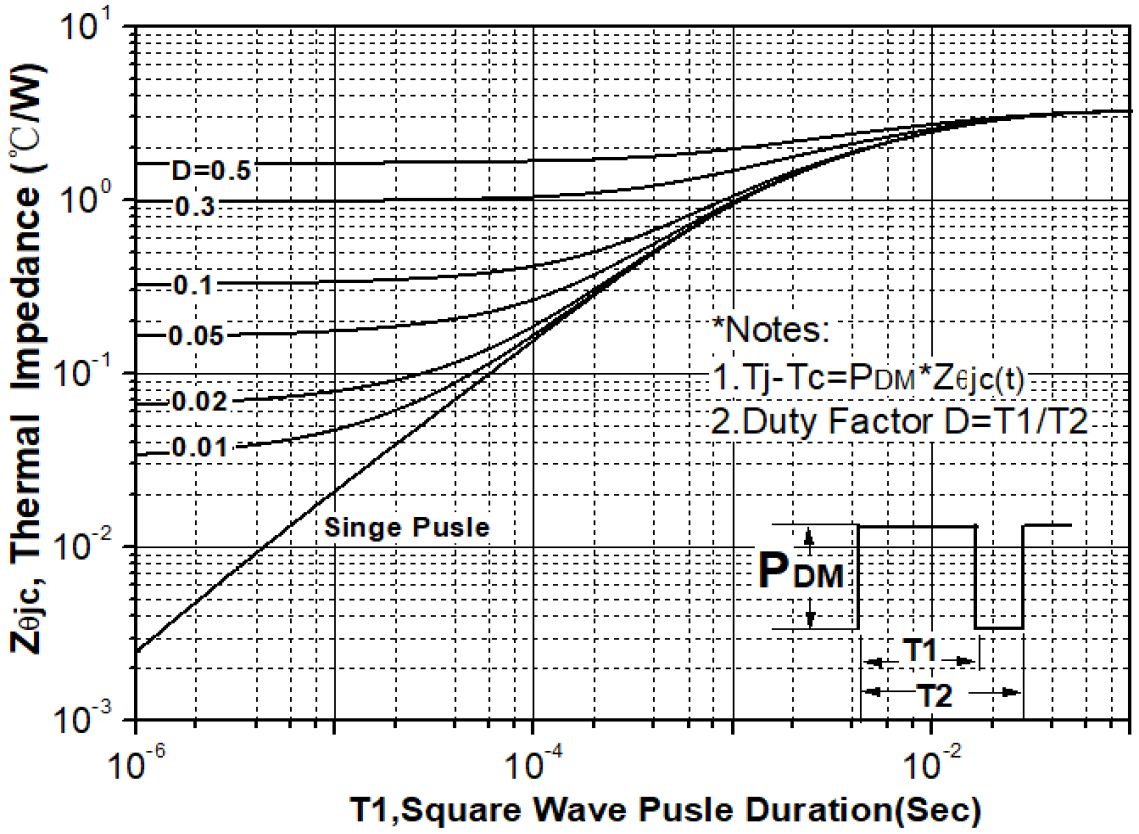
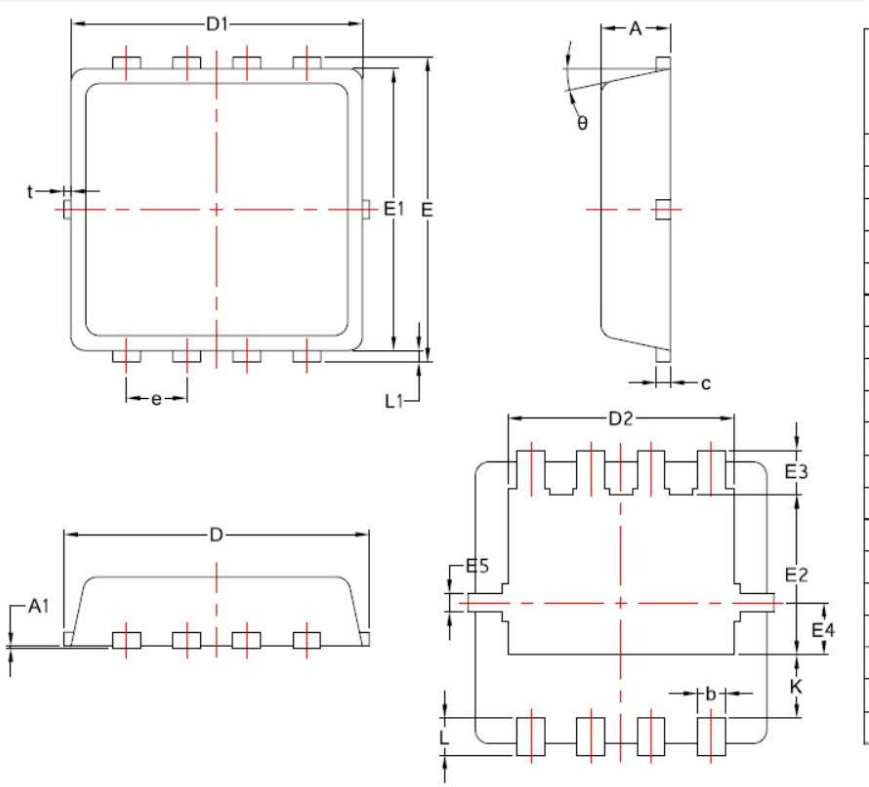



Fig16. Transient Thermal Response Curve



## PDFN3X3 Package Information




| 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 |
| θ | 10° | 12° | 14° |