Powering the SiC evolution™

# GP3T072A120H

| | |
|---|---|
| $V_{DS}$ | 1200 V |
| $R_{DS,on}$ | 71 mΩ |
| $I_{D\ (TC=25C)}$ | 31 A |
| $T_j$,max | 175°C |

## QSiC™ 1200V SiC MOSFET

### Features

- High speed switching
- Reliable body diode
- All parts tested to greater than 1,400V
- Avalanche tested to 160mJ
- Driver source pin for gate driving

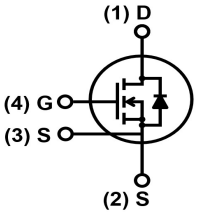
### Benefits

- Lower capacitance
- Higher system efficiency
- Easy to parallel
- Lower Switching Loss
- Longer creepage distance

### Applications

- Solar Inverters
- Switch mode power supplies, UPS
- Induction heating and welding
- EV charging stations
- High voltage DC/DC converters
- Motor drives

### Package




(1) D (Drain)
(2) S (Source)
(3) S (Driver Source)
(4) G (Gate)

| Part # | Package | Marking |
|---|---|---|
| GP3T072A120H | TO-247-4L | 3T072A120H |

RoHS

**Maximum Ratings**, at $T_j$=25°C, unless otherwise specified

| Characteristics | Symbol | Conditions | Values | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | $V_{rated}$ | $V_{GS}$=0V, $I_{DS}$=1μA | 1200 | V |
| Continuous Drain Current | $I_D$ | $T_C$=25 °C, $T_j$=175 °C | 31 | A |
| | | $T_C$=100 °C, $T_j$=175 °C | 23 | |
| Pulsed Drain Current | $I_{D,pulse}$* | $T_C$=25°C | 70 | |
| Gate Source Voltage | $V_{GSmax}$ | | -8/22 | V |
| | $V_{GSop}$ | Recommended operational | -4.5/18 | |
| Power Dissipation | $P_{tot}$ | $T_C$=25°C | 147 | W |
| Operating & Storage Temperature | $T_j$, $T_{storage}$ | Continuous | -55...175 | °C |
| Single Pulse Avalanche Energy | $E_{AS}$ | L=1.0mH, $I_{AS}$=17.9A, V=50V | 160 | mJ |

### Thermal Characteristics

| Characteristics | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| Thermal Resistance, Junction to Case | $R_{thJC}$ | | - | 0.81 | 1.02 | °C/W |
| Thermal Resistance, Junction to Ambient | $R_{thJA}$ | | - | - | 40.0 | |

* Pulse width is limited by $Tj_{max}$

## **Static Electrical Characteristics**, at $T_j$=25°C, unless otherwise specified

| Characteristics | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $I_{DS}$=1mA | 1200 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=1200V, $V_{GS}$=0V | - | 0.1 | 1.0 | μA |
| | | $V_{DS}$=1200V, $V_{GS}$=0V, $T_j$=175°C | - | 1 | - | |
| Gate-Source Leakage Current | $I_{GSS+}$ | $V_{GS}$=18V, $V_{DS}$=0V | - | 10 | 100 | nA |
| | $I_{GSS-}$ | $V_{GS}$=-4.5V, $V_{DS}$=0V | - | -10 | -100 | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$=$V_{DS}$, $I_{DS}$=5mA | 1.8 | 2.9 | 4 | V |
| | | $V_{GS}$=$V_{DS}$, $I_{DS}$=5mA, $T_j$=125°C | - | 2.2 | - | |
| | | $V_{GS}$=$V_{DS}$, $I_{DS}$=5mA, $T_j$=175°C | - | 2.0 | - | |
| Drain-Source On-Resistance | $R_{DSon}$ | $V_{GS}$=18V, $I_{DS}$=10A | - | 71 | 92 | mΩ |
| | | $V_{GS}$=18V, $I_{DS}$=10A, $T_j$=125°C | - | 103 | - | |
| | | $V_{GS}$=18V, $I_{DS}$=10A, $T_j$=175°C | - | 132 | - | |
| Transconductance | $g_{fs}$ | $V_{DS}$=20V, $I_{DS}$=10A | - | 6 | - | S |
| Gate Input Resistance | $R_G$ | f=1MHz, $V_{AC}$=25mV, D-S Short | - | 3.1 | - | Ω |

## **AC Electrical Characteristics**, at $T_j$=25°C, unless otherwise specified

| Characteristics | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$=0V, $V_{DS}$=1000V, f=200kHz, $V_{AC}$=25mV | - | 1293 | - | pF |
| Output Capacitance | $C_{OSS}$ | | - | 50 | - | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | - | 4 | - | |
| Coss Stored Energy | $E_{OSS}$ | | - | 29 | - | μJ |
| Turn-On Switching Energy | $E_{ON}$ | $V_{DD}$=800V, $I_{DS}$=10A, $R_{G(ext)}$=2.5Ω, $V_{GS}$=-4.5/+18V, L=975μH, FWD=GP3T072A120H | - | 81 | - | μJ |
| Turn-Off Switching Energy | $E_{OFF}$ | | - | 41 | - | |
| Total Switching Energy | $E_{TOT}$ | | - | 122 | - | |
| Turn-On Switching Energy | $E_{ON}$ | $V_{DD}$=800V, $I_{DS}$=10A, $R_{G(ext)}$=2.5Ω, $V_{GS}$=-4.5/+18V, L=975μH, FWD=GP3D010A120B | - | 54 | - | μJ |
| Turn-Off Switching Energy | $E_{OFF}$ | | - | 29 | - | |
| Total Switching Energy | $E_{TOT}$ | | - | 83 | - | |
| Turn-On Delay Time | $t_{D(on)}$ | $V_{DD}$=800V, $I_{DS}$=10A, $R_{G(ext)}$=2.5Ω, $V_{GS}$=-4.5/+18V, L=975μH, FWD=GP3T072A120H | - | 12 | - | ns |
| Rise Time | $t_R$ | | - | 3 | - | |
| Turn-Off Delay Time | $t_{D(off)}$ | | - | 22 | - | |
| Fall Time | $t_F$ | | - | 16 | - | |
| Total Gate Charge | $Q_G$ | $V_{DD}$=800V, $I_{DS}$=10A, $V_{GS}$=-4.5/+18V | - | 53 | - | nC |
| Gate to Source Charge | $Q_{GS}$ | | - | 18 | - | |
| Gate to Drain Charge | $Q_{GD}$ | | - | 10 | - | |

## **Body Diode Characteristics**, at Tj=25°C, unless otherwise specified

| Characteristics | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| Max Continuous Diode Fwd Current | $I_S$ | $V_{GS}$=-5V, $T_C$=25°C | - | - | 31 | A |
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=-5V, $I_{SD}$=5A | - | 3.8 | - | V |
| Reverse Recovery Time | $t_{RR}$ | $I_{SD}$=10A, $V_R$=800V, $V_{GS}$=-4.5/+18V, $di_F/dt$=9.0A/ns | - | 8 | - | ns |
| Reverse Recovery Charge | $Q_{RR}$ | | - | 162 | - | nC |
| Peak Reverse Recovery Current | $I_{RRM}$ | | - | 34 | - | A |

## Typical Performance

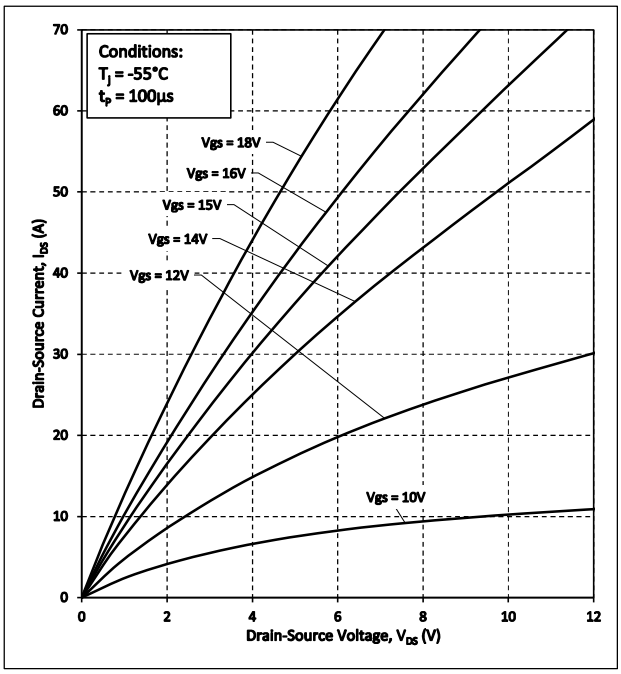



**Figure 1. Output Characteristics $T_j$ = -55°C**

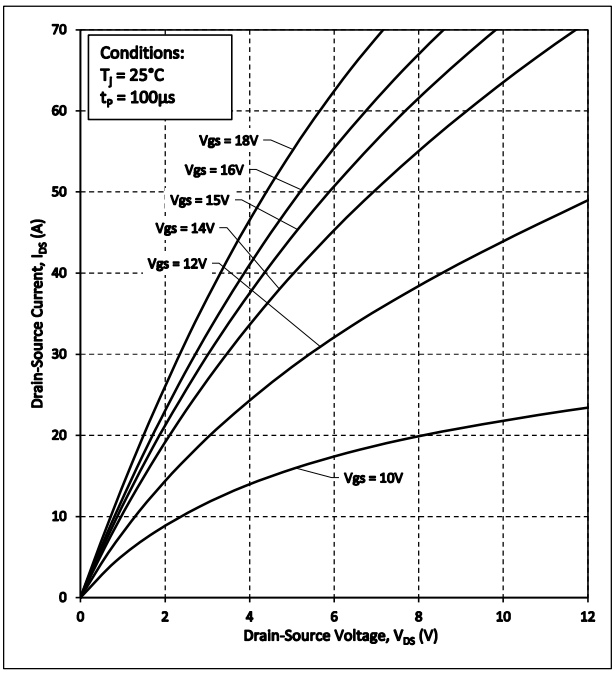



**Figure 2. Output Characteristics $T_j$ = 25°C**

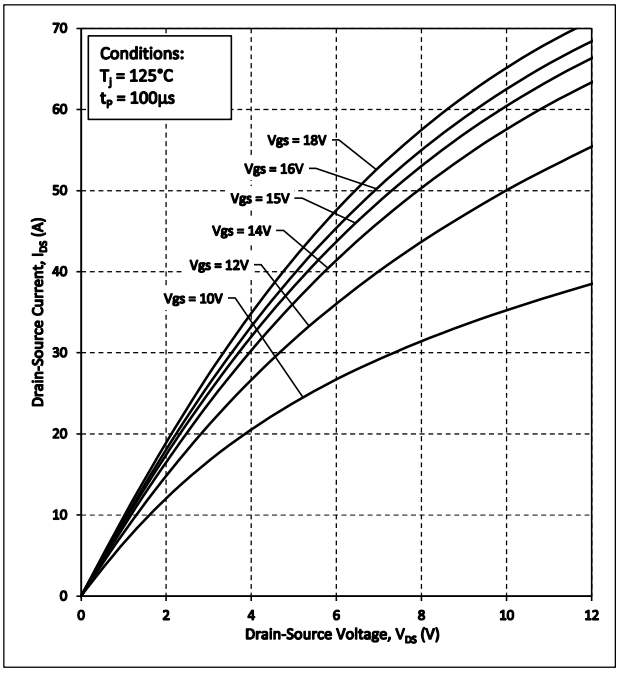



**Figure 3. Output Characteristics $T_j$ = 125°C**

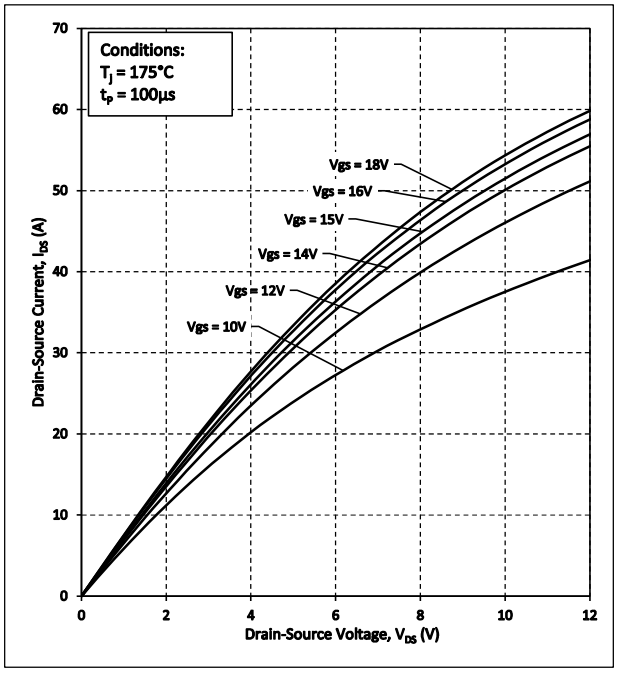



**Figure 4. Output Characteristics $T_j$ = 175°C**

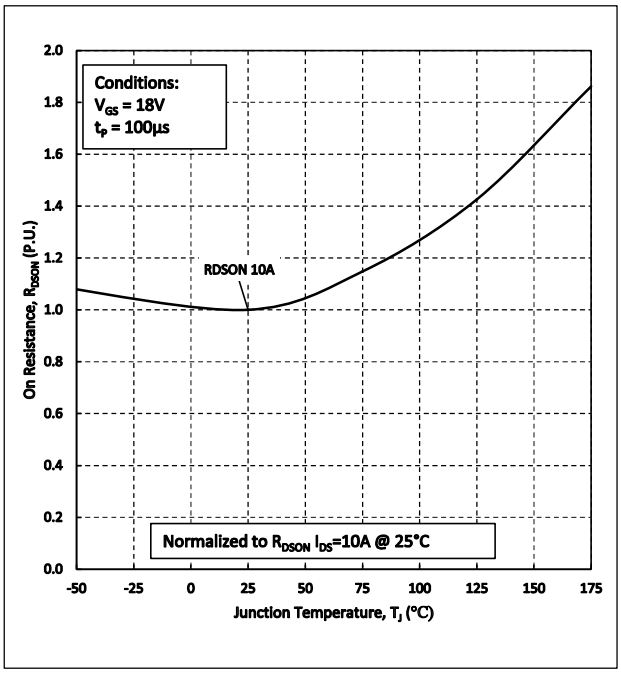



Figure 5. Normalized On-Resistance vs. Temperature

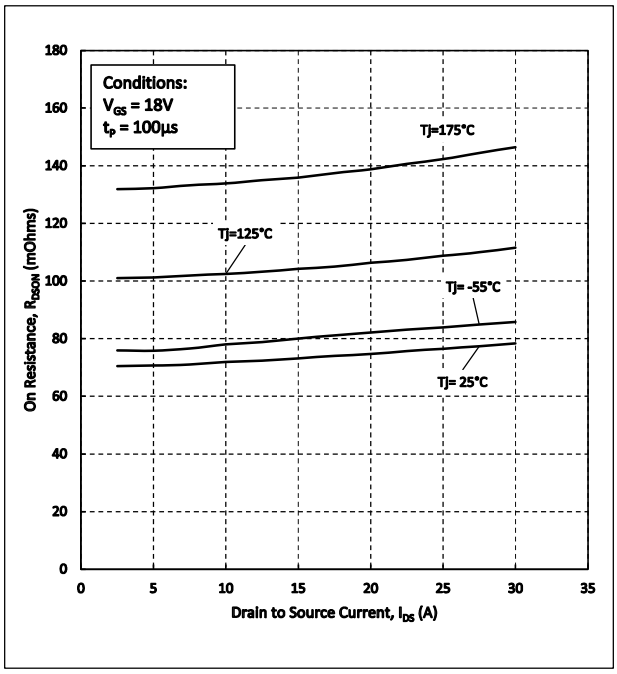



Figure 6. On-Resistance vs. Drain Current For Various Temperature

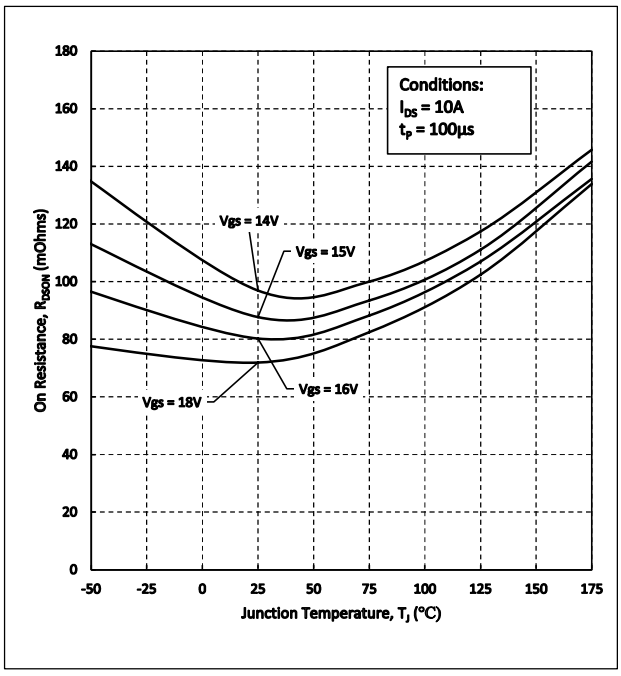



Figure 7. On-Resistance vs. Temperature For Various Gate Voltages

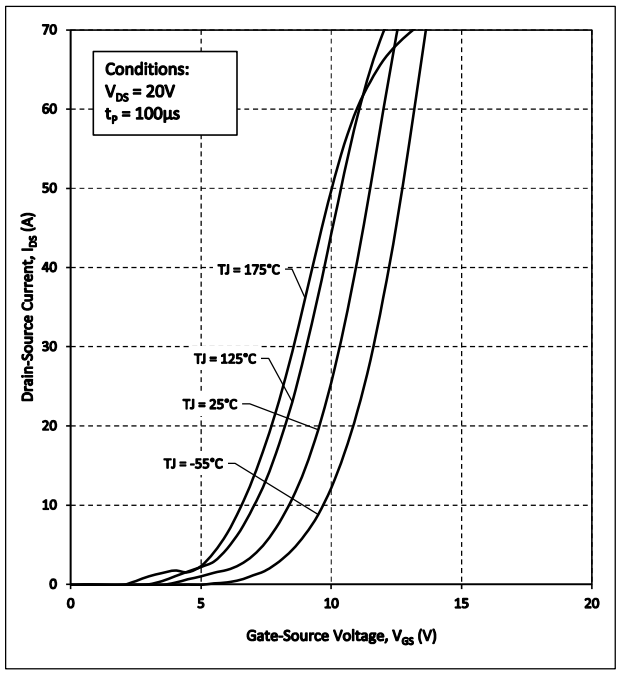



Figure 8. Transfer Characteristic for Various Junction Temperatures

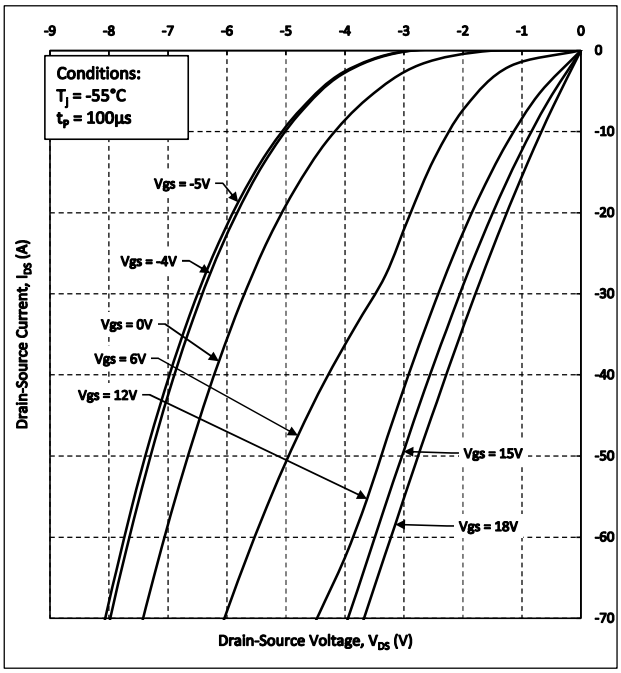



Figure 9. Body Diode Characteristics at $T_j$ = -55°C

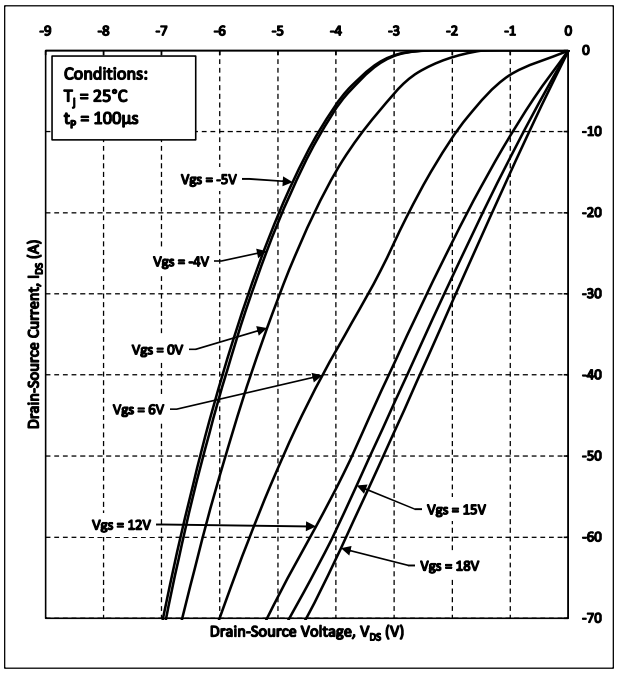



Figure 10. Body Diode Characteristics at $T_j$ = 25°C

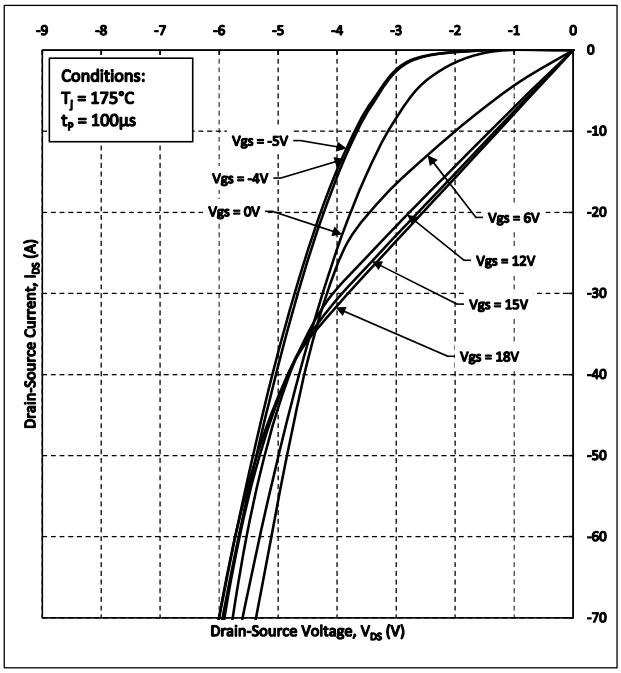



Figure 11. Body Diode Characteristics at $T_j$ = 175°C

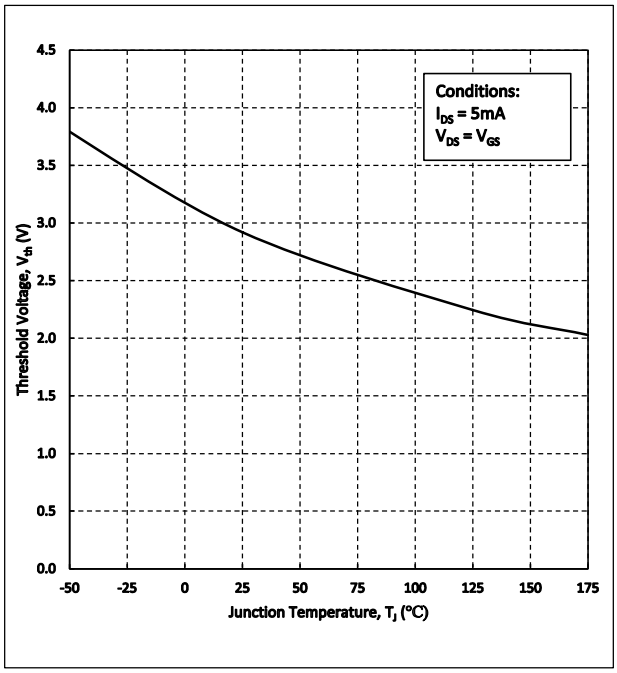



Figure 12. Threshold Voltage vs. Temperature

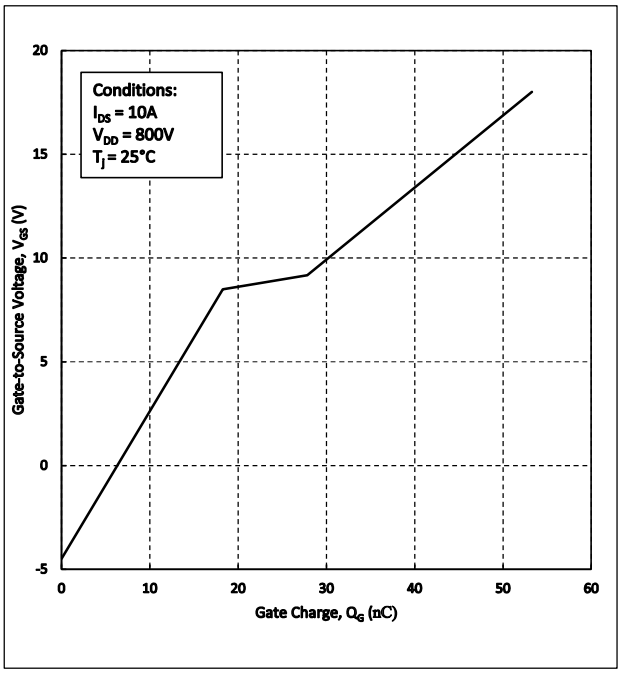



Figure 13. Gate Charge Characteristics

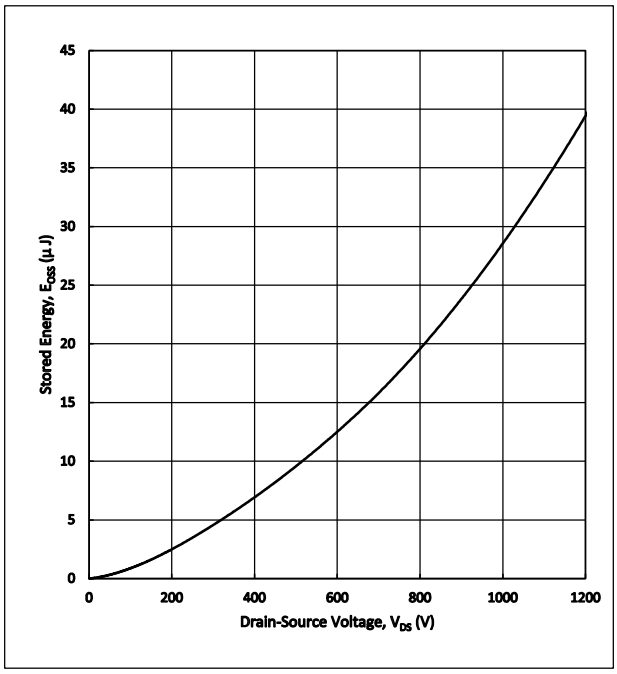



Figure 14. Output Capacitor Stored Energy

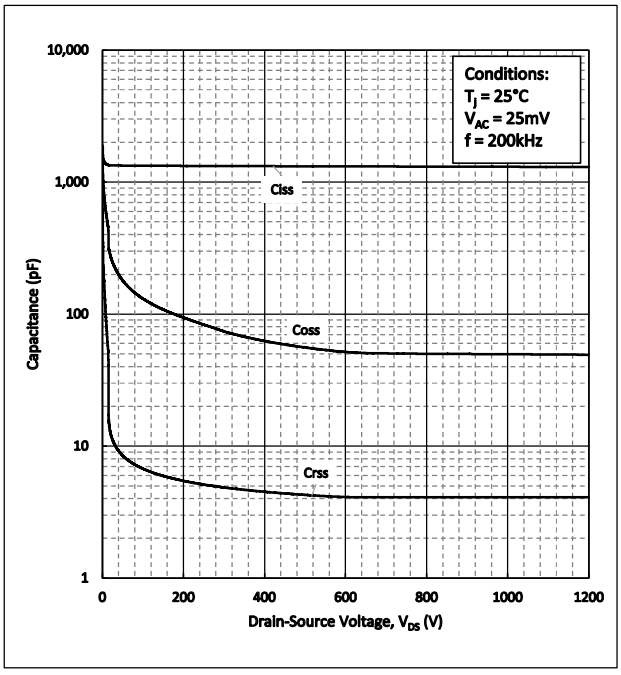



Figure 15. Capacitance vs Drain-Source Voltage

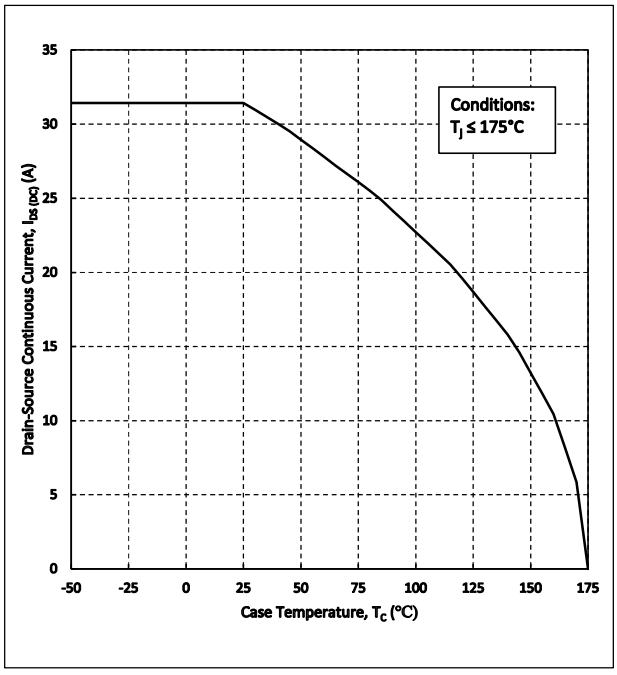



Figure 16. Continuous Drain Current Derating vs. Case Temperature

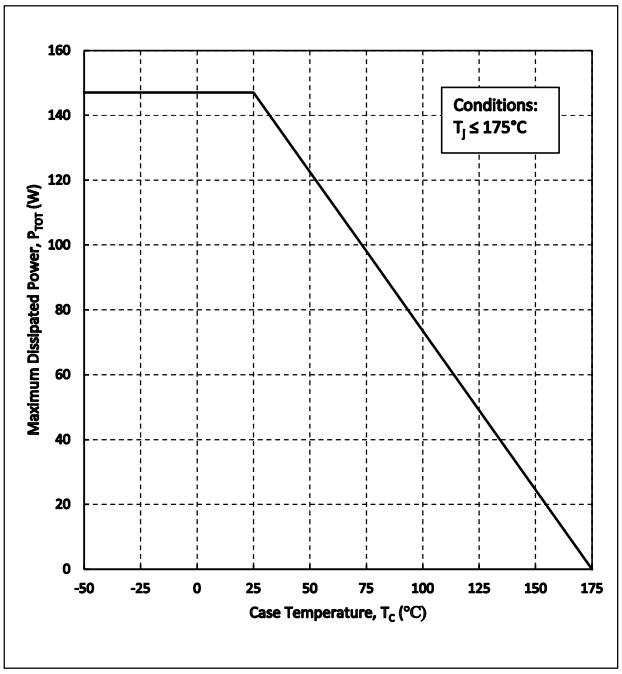



**Figure 17. Maximum Power Dissipation Derating vs Case Temperature**

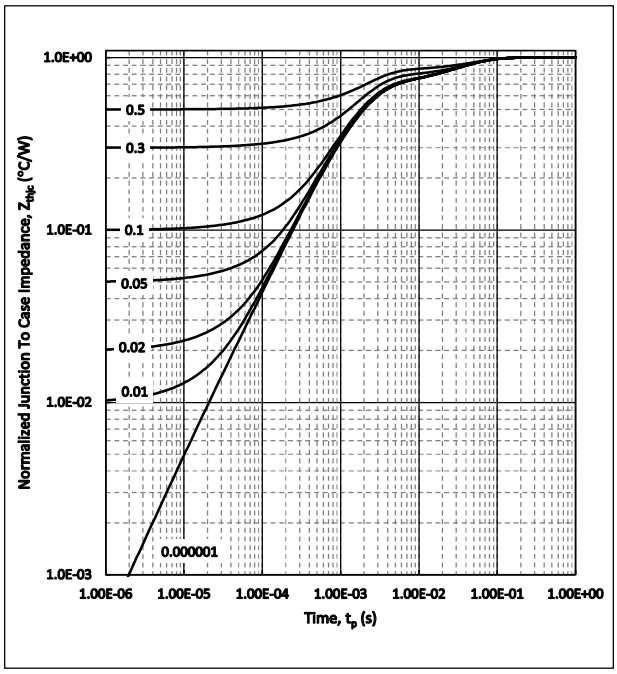



**Figure 18. Transient Thermal impedance (Junction to Case)**

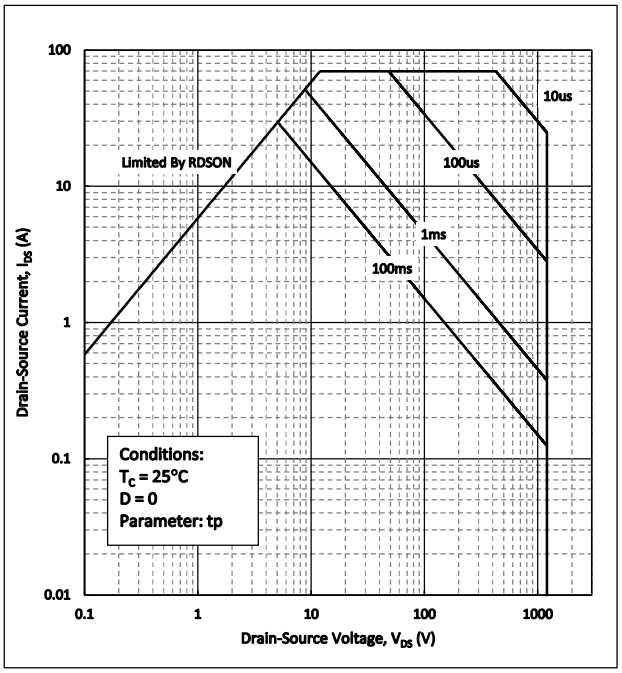



**Figure 19. Safe Operating Area**

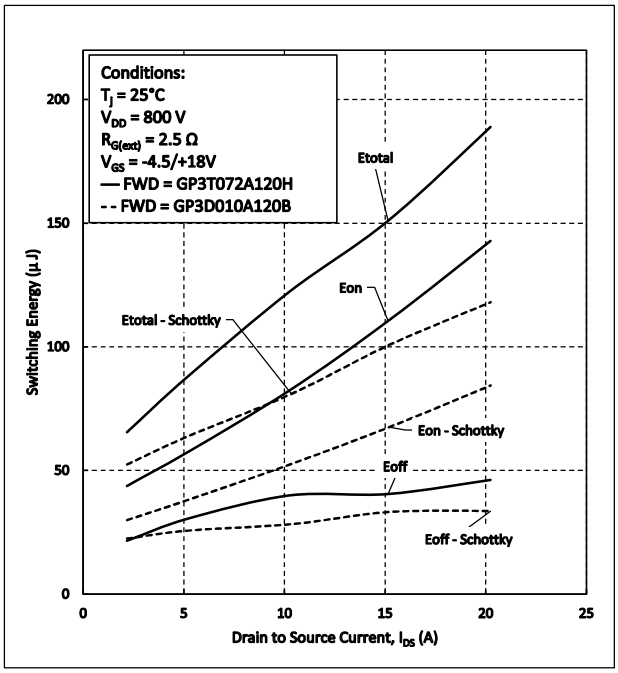



**Figure 20. Clamped Inductive Switching Energy vs. Drain Current**

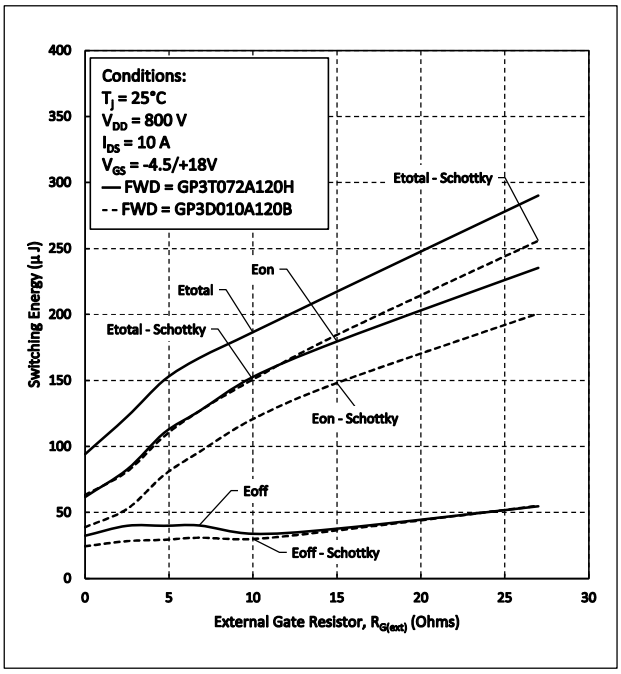



**Figure 21. Clamped Inductive Switching Energy vs. $R_{G(ext)}$**

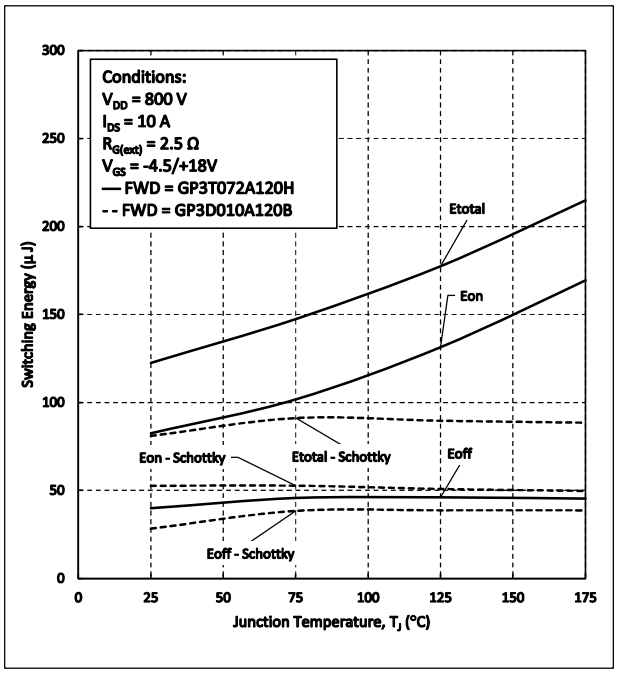



**Figure 22. Clamped Inductive Switching Energy vs. Temperature**

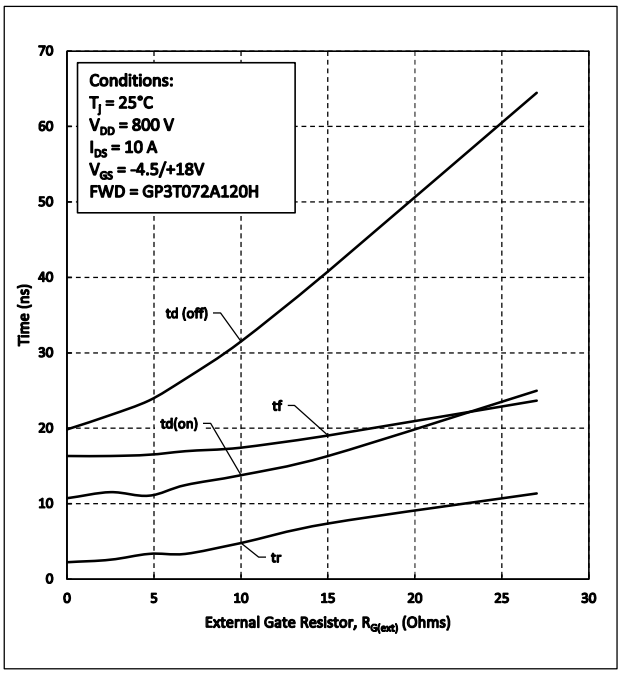



**Figure 23. Switching Times vs $R_{G(ext)}$**

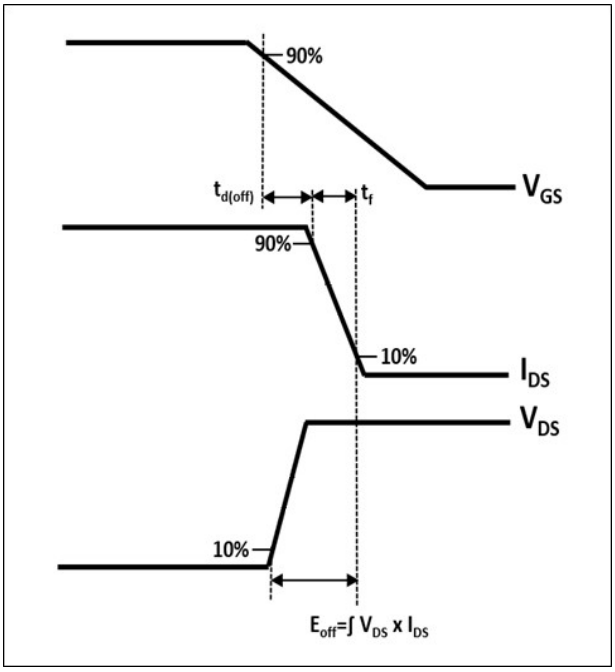



**Figure 24. Turn-off Transient Definitions**

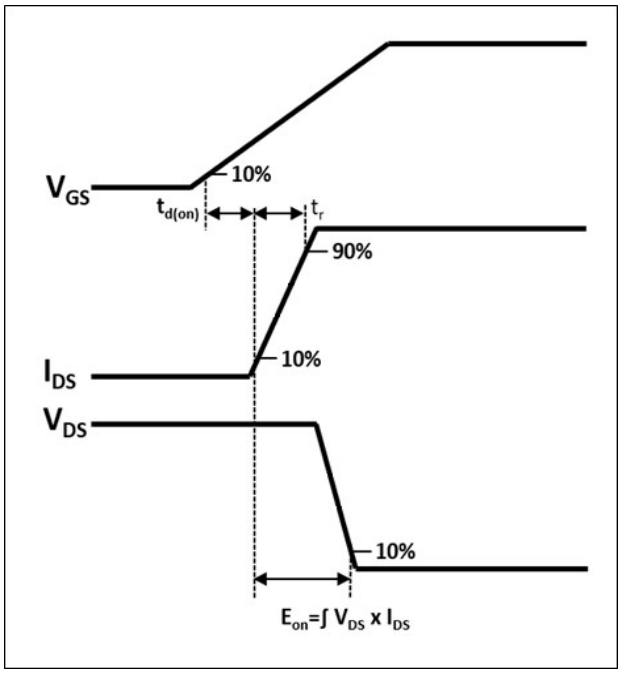



Figure 25. Turn-on Transient Definitions

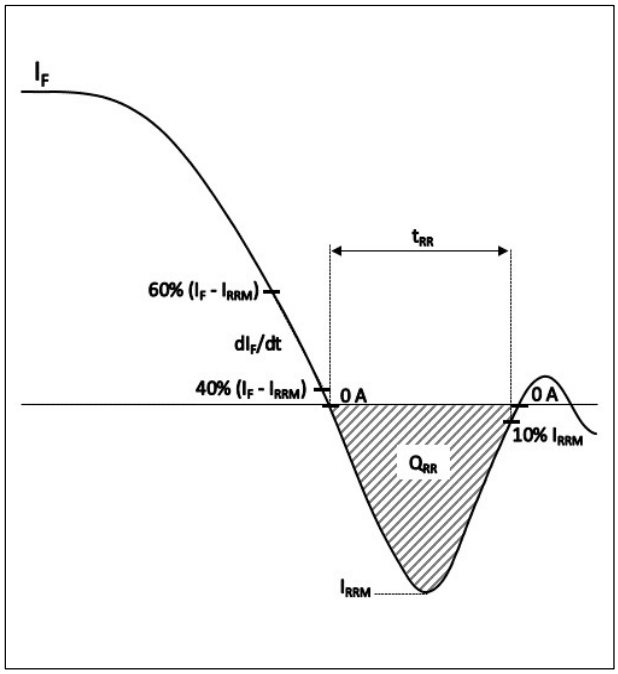
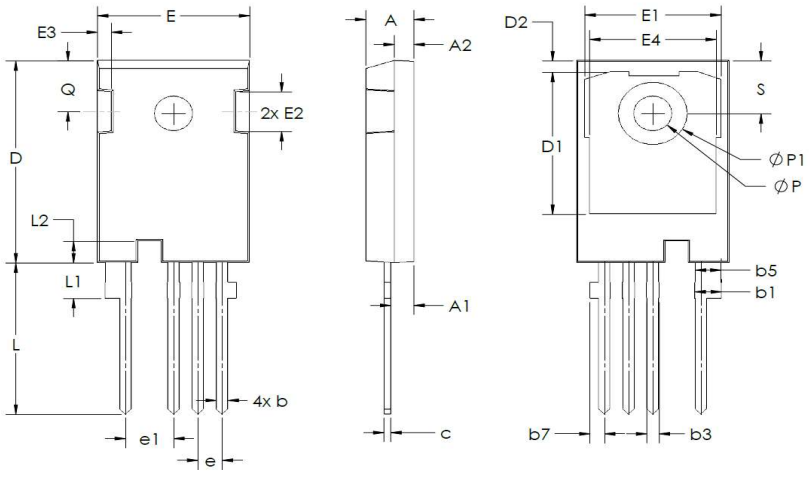



Figure 26. Reverse Recovery Definitions

## Package Dimensions TO-247-4L




| Sym | Millimeters | | Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 4.83 | 5.21 | 0.190 | 0.205 |
| A1 | 2.29 | 2.54 | 0.090 | 0.100 |
| A2 | 1.91 | 2.16 | 0.075 | 0.085 |
| b | 1.07 | 1.33 | 0.042 | 0.052 |
| b1 | 2.39 | 2.94 | 0.094 | 0.116 |
| b3 | 1.07 | 1.60 | 0.042 | 0.063 |
| b5 | 2.39 | 2.69 | 0.094 | 0.106 |
| b7 | 1.30 | 1.70 | 0.051 | 0.067 |
| c | 0.55 | 0.68 | 0.022 | 0.027 |
| c1 | 0.55 | 0.65 | 0.022 | 0.026 |
| D | 23.30 | 23.60 | 0.917 | 0.929 |
| D1 | 16.25 | 17.65 | 0.640 | 0.695 |
| D2 | 0.95 | 1.25 | 0.037 | 0.049 |
| E | 15.75 | 16.13 | 0.620 | 0.635 |
| E1 | 13.10 | 14.15 | 0.516 | 0.557 |
| E2 | 3.68 | 5.10 | 0.145 | 0.201 |
| E3 | 1.00 | 1.90 | 0.039 | 0.075 |
| E4 | 12.38 | 13.43 | 0.487 | 0.529 |
| e | 2.54 BSC | | 0.100 BSC | |
| e1 | 5.08 BSC | | 0.200 BSC | |
| L | 17.31 | 17.82 | 0.681 | 0.702 |
| L1 | 3.97 | 4.37 | 0.156 | 0.172 |
| L2 | 2.35 | 2.65 | 0.093 | 0.104 |
| ØP | 3.51 | 3.65 | 0.138 | 0.144 |
| ØP1 | 7.19 REF | | 0.283 REF | |
| Q | 5.49 | 6.00 | 0.216 | 0.236 |
| S | 6.04 | 6.30 | 0.238 | 0.248 |

## Notes

**RoHS Compliance**

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented March, 2013. RoHS Declarations for this product can be obtained from the Product Documentation sections of www.SemiQ.com.

**REACh Compliance**

REACh substances of high concern (SVHC) information is available for this product. Since the European Chemicals Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future,please contact our office at SemiQ Headquarters in Lake Forest, California to insure you get the most up-to-date REACh SVHC Declaration. REACh banned substance information (REACh Article 67) is also available upon request. SemiQ Inc., reserves the right to make changes to the product specifications and data in this document without notice. SemiQ products are sold pursuant to SemiQ's terms and conditions of sale in place at the time of order acknowledgement.

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