



Features

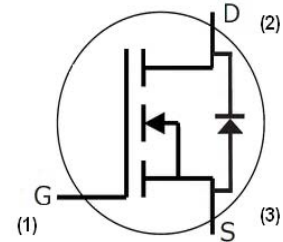
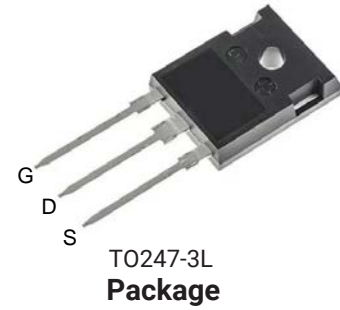
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Resistant to Latch-Up
- Halogen Free, RoHS Compliant

Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC converters
- Battery Chargers
- Motor Drives
- Pulsed Power Applications



| Part Number | Package | Marking |
|--------------|----------|--------------|
| HC2M0040120D | TO247-3L | HC2M0040120D |

Maximum Ratings ($T_c = 25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Value | Unit | Test Conditions | Note |
|----------------|--|-------------|------------------|---|---------|
| V_{DSmax} | Drain - Source Voltage | 1200 | V | $V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$ | |
| V_{GSmax} | Gate - Source Voltage | -10/+25 | V | Absolute maximum values | |
| V_{GSop} | Gate - Source Voltage | -5/+20 | V | Recommended operational values | |
| I_D | Continuous Drain Current | 55 | A | $V_{GS} = 20\text{ V}, T_C = 25^\circ\text{C}$ | Fig. 19 |
| | | 36 | | $V_{GS} = 20\text{ V}, T_C = 100^\circ\text{C}$ | |
| $I_{D(pulse)}$ | Pulsed Drain Current | 160 | A | Pulse width t_p limited by T_{jmax} | Fig. 22 |
| P_D | Power Dissipation | 278 | W | $T_c = 25^\circ\text{C}, T_J = 150^\circ\text{C}$ | Fig. 20 |
| T_J, T_{stg} | Operating Junction and Storage Temperature | -55 to +150 | $^\circ\text{C}$ | | |
| T_L | Solder Temperature | 260 | $^\circ\text{C}$ | 1.6mm (0.063") from case for 10s | |
| M_d | Mounting Torque | 1 | Nm lbf-in | M3 or 6-32 screw | |
| | | 8.8 | | | |



Electrical Characteristics ($T_c = 25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions | Note |
|---------------|--|------|------|------|---------------|--|------------|
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | 1200 | | | V | $V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$ | |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | 3.2 | 4 | V | $V_{DS} = V_{GS}, I_D = 10\text{mA}$ | Fig. 11 |
| | | | 2.4 | | V | $V_{DS} = V_{GS}, I_D = 10\text{mA}, T_J = 150^\circ\text{C}$ | |
| I_{DSS} | Zero Gate Voltage Drain Current | | 1 | 100 | μA | $V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$ | |
| I_{GSS} | Gate-Source Leakage Current | | | 250 | nA | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$ | |
| $R_{DS(on)}$ | Drain-Source On-State Resistance | | 44 | 52 | m Ω | $V_{GS} = 20\text{ V}, I_D = 40\text{ A}$ | Fig. 4,5,6 |
| | | | 82 | | | $V_{GS} = 20\text{ V}, I_D = 40\text{ A}, T_J = 150^\circ\text{C}$ | |
| g_{fs} | Transconductance | | 18.2 | | S | $V_{DS} = 20\text{ V}, I_{DS} = 40\text{ A}$ | Fig. 7 |
| | | | 17.2 | | | $V_{DS} = 20\text{ V}, I_{DS} = 40\text{ A}, T_J = 150^\circ\text{C}$ | |
| C_{iss} | Input Capacitance | | 2440 | | pF | $V_{GS} = 0\text{ V}$ $V_{DS} = 1000\text{ V}$ $f = 1\text{ MHz}$ | Fig. 17,18 |
| C_{oss} | Output Capacitance | | 171 | | | | |
| C_{rss} | Reverse Transfer Capacitance | | 11 | | | | |
| E_{oss} | C_{oss} Stored Energy | | 89 | | μJ | $V_{AC} = 25\text{ mV}$ | Fig 16 |
| E_{ON} | Turn-On Switching Energy (Body Diode) | | 1.7 | | mJ | $V_{DS} = 800\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 40\text{A}, R_{G(ext)} = 2.5\Omega, L = 99\ \mu\text{H}$ | Fig. 25 |
| E_{OFF} | Turn Off Switching Energy (Body Diode) | | 0.4 | | | | |
| E_{ON} | Turn-On Switching Energy (External SiC Diode) | | 1.3 | | | $V_{DS} = 800\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 40\text{A}, R_{G(ext)} = 2.5\Omega, L = 99\ \mu\text{H}$ | |
| E_{OFF} | Turn Off Switching Energy (External SiC Diode) | | 0.4 | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | | 13 | | ns | $V_{DD} = 800\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 40\text{ A}$ $R_{G(ext)} = 2.5\ \Omega, R_L = 20\ \Omega$ Timing relative to V_{DS} Per IEC60747-8-4 pg 83 | Fig. 27 |
| t_r | Rise Time | | 61 | | | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | 25 | | | | |
| t_f | Fall Time | | 13 | | | | |
| $R_{G(int)}$ | Internal Gate Resistance | | 1.8 | | Ω | $f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$ | |
| Q_{gs} | Gate to Source Charge | | 34 | | nC | $V_{DS} = 800\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 40\text{ A}$ Per IEC60747-8-4 pg 21 | Fig. 12 |
| Q_{gd} | Gate to Drain Charge | | 42 | | | | |
| Q_g | Total Gate Charge | | 120 | | | | |



Reverse Diode Characteristics

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|-----------------------|----------------------------------|------|------|------|--|---------------|
| V _{SD} | Diode Forward Voltage | 4.0 | | V | V _{GS} = - 5 V, I _{SD} = 20 A, T _J = 25 °C | Fig. 8, 9, 10 |
| | | 3.6 | | V | V _{GS} = - 5 V, I _{SD} = 20 A, T _J = 150 °C | |
| I _S | Continuous Diode Forward Current | | 60 | A | T _C = 25 °C | Note 1 |
| I _{S, pulse} | Diode Pulse Current | | 160 | A | V _{GS} = - 5 V, Pulse width t _p limited by T _{jmax} | |
| t _{rr} | Reverse Recovery Time | 54 | | ns | V _{GS} = - 5 V, I _{SD} = 40 A T _J = 25 °C VR = 800 V dif/dt = 1000 A/μs | Note 1 |
| Q _{rr} | Reverse Recovery Charge | 283 | | nC | | |
| I _{rrm} | Peak Reverse Recovery Current | 15 | | A | | |

Note (1): When using SiC Body Diode the maximum recommended V_{GS} = -5V

Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|------------------|---|------|------|------|-----------------|---------|
| R _{θJC} | Thermal Resistance from Junction to Case | 0.33 | 0.45 | °C/W | | Fig. 21 |
| R _{θJC} | Thermal Resistance from Junction to Ambient | | 40 | | | |



Typical Performance

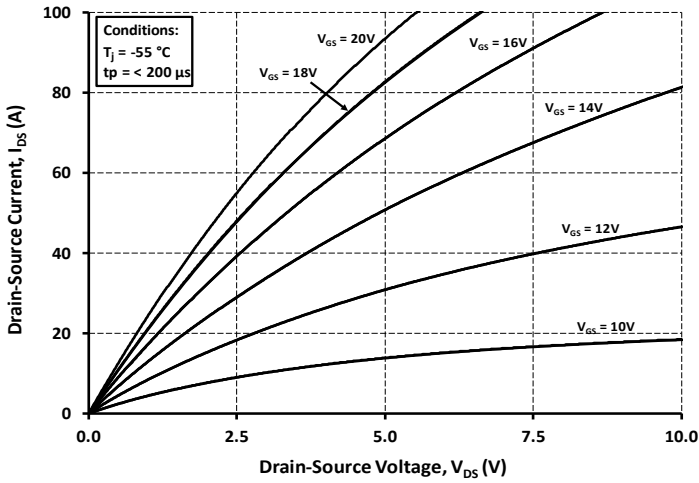


Figure 1. Output Characteristics $T_j = -55^\circ\text{C}$

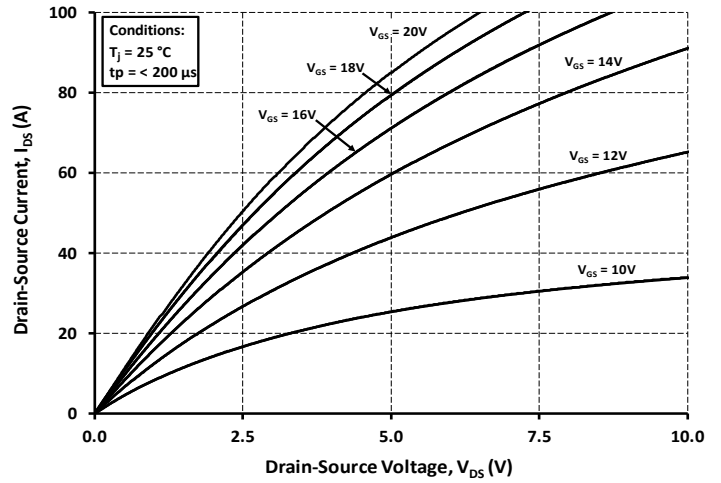


Figure 2. Output Characteristics $T_j = 25^\circ\text{C}$

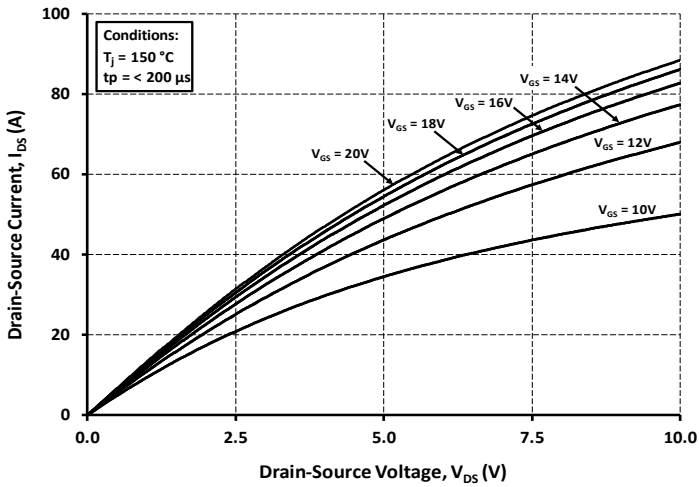


Figure 3. Output Characteristics $T_j = 150^\circ\text{C}$

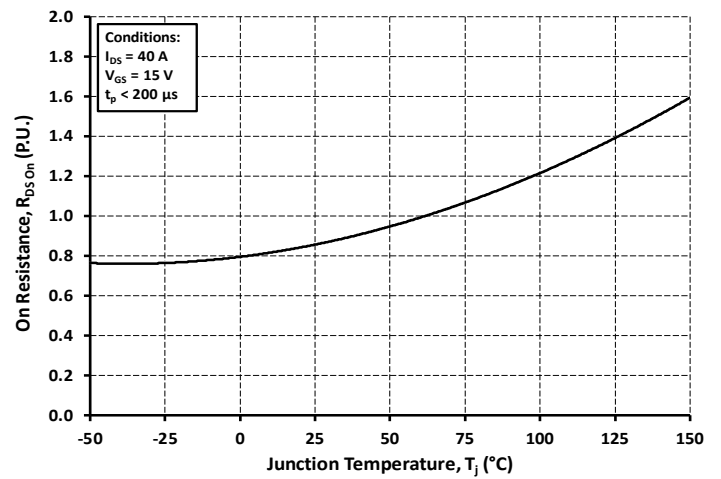


Figure 4. Normalized On-Resistance vs. Temperature

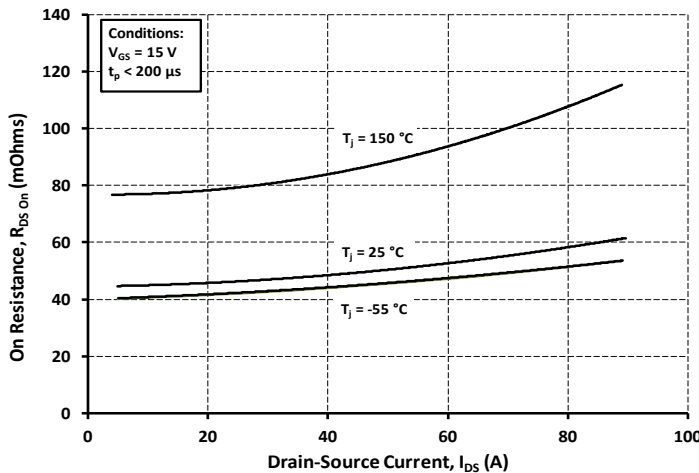


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

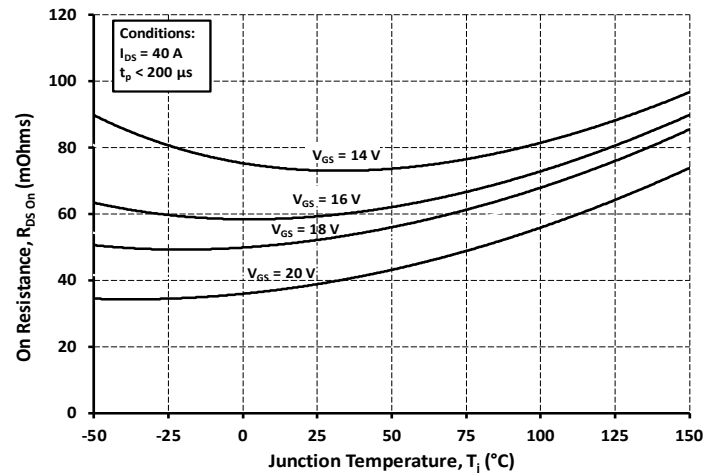


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage



Typical Performance

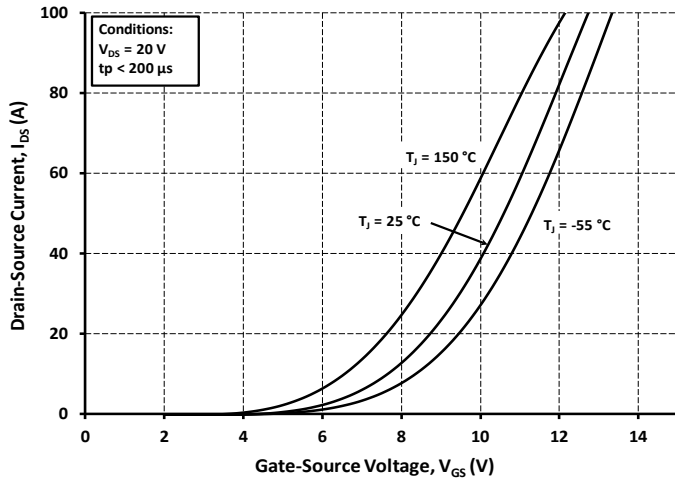


Figure 7. Transfer Characteristic for Various Junction Temperatures

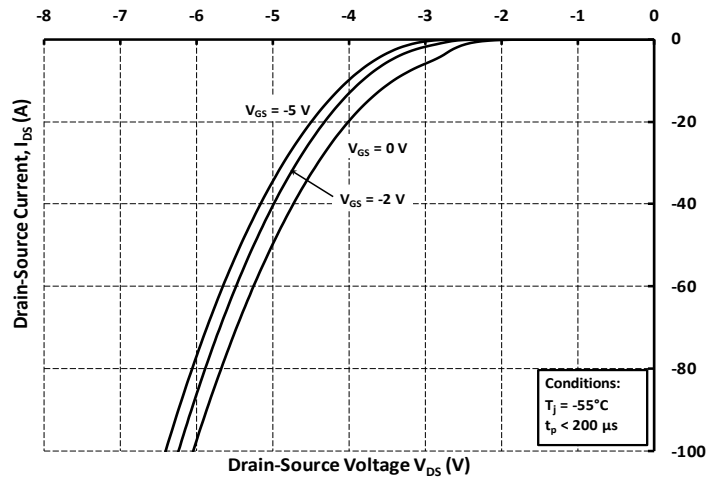


Figure 8. Body Diode Characteristic at -55 °C

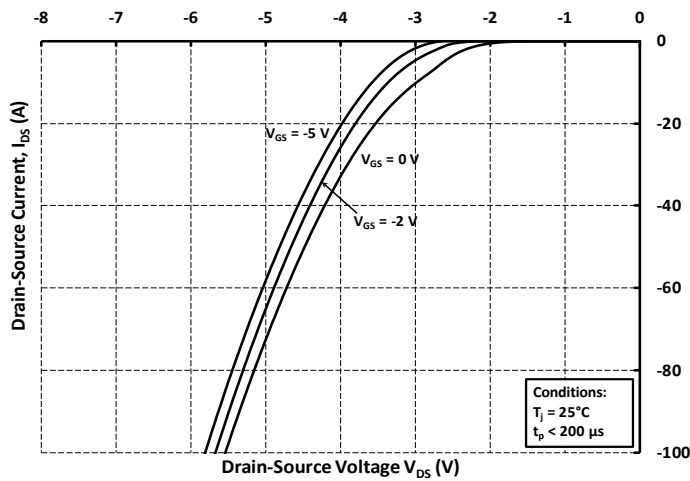


Figure 9. Body Diode Characteristic at 25 °C

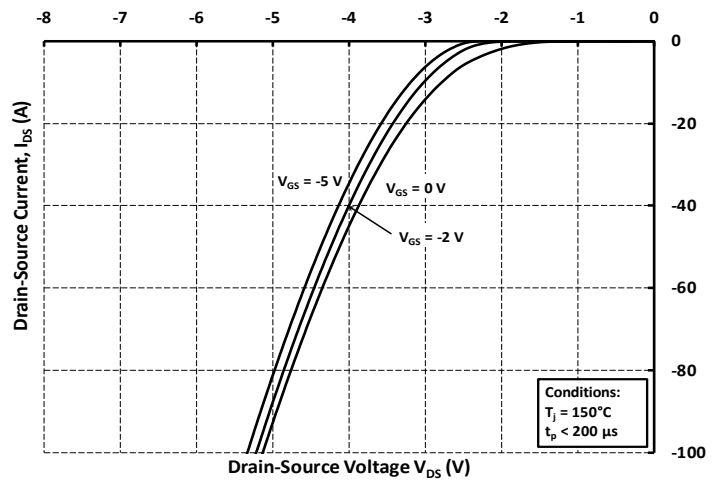


Figure 10. Body Diode Characteristic at 150 °C

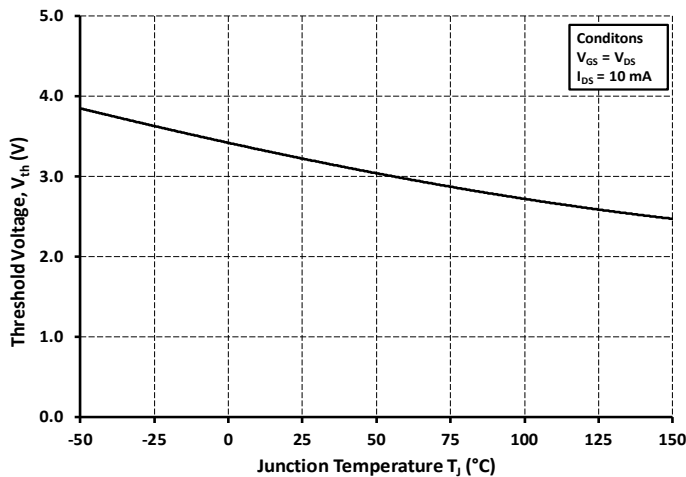


Figure 11. Threshold Voltage vs. Temperature

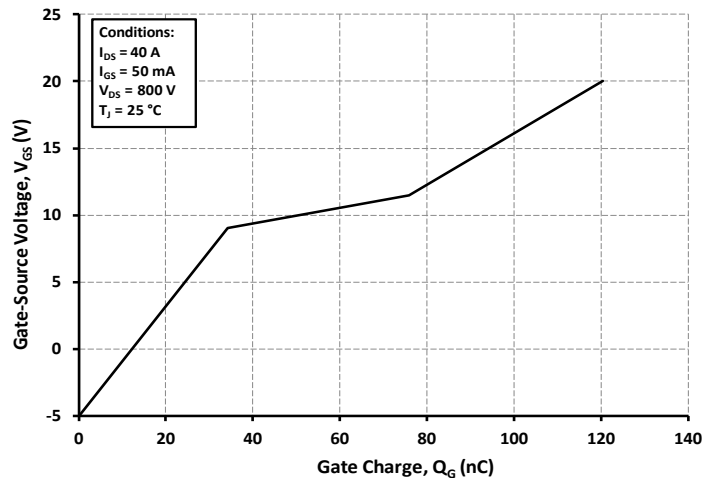


Figure 12. Gate Charge Characteristics



Typical Performance

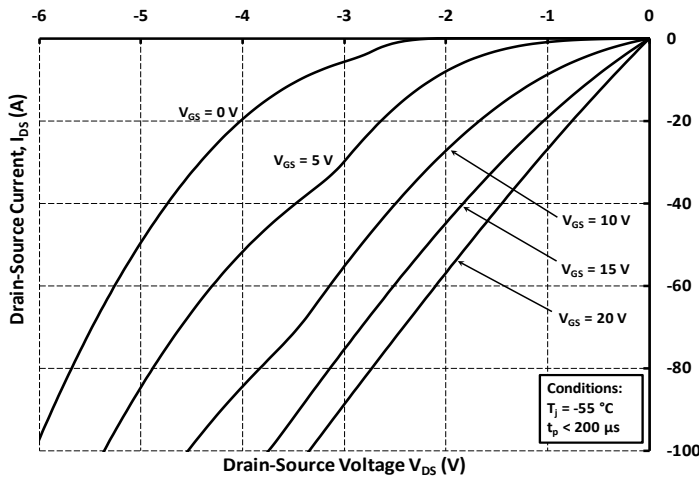


Figure 13. 3rd Quadrant Characteristic at -55 °C

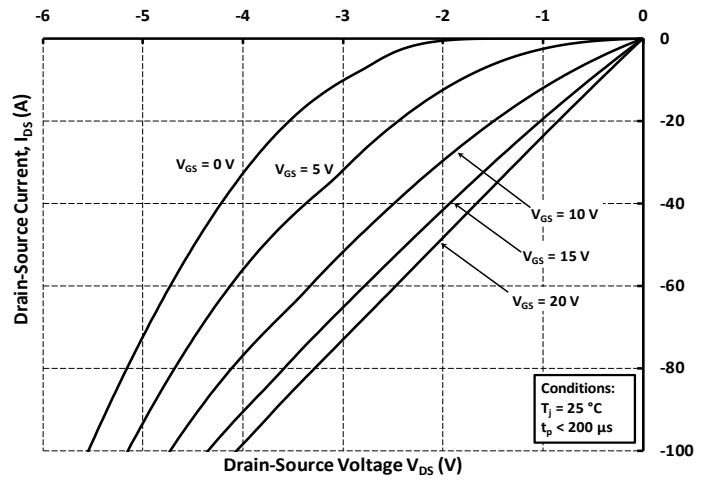


Figure 14. 3rd Quadrant Characteristic at 25 °C

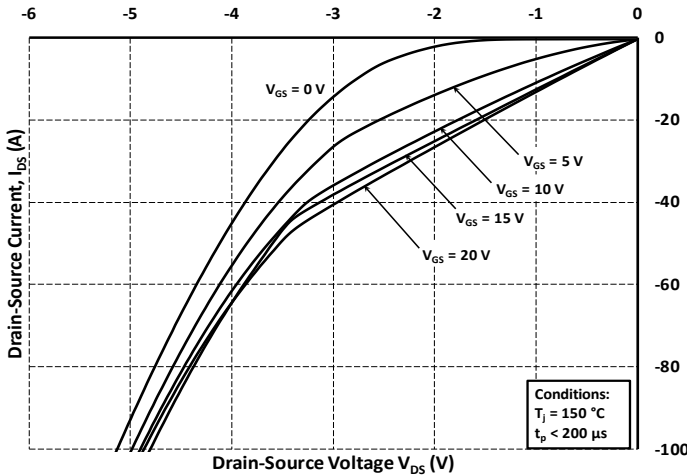


Figure 15. 3rd Quadrant Characteristic at 150 °C

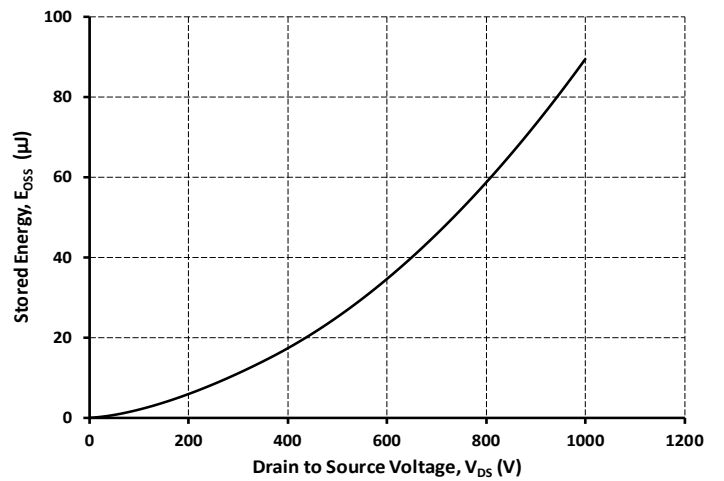


Figure 16. Output Capacitor Stored Energy

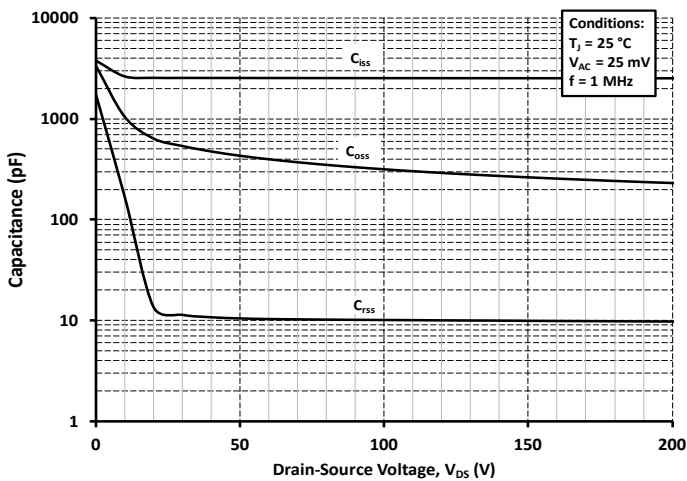


Figure 17. Capacitances vs. Drain-Source Voltage (0-200 V)

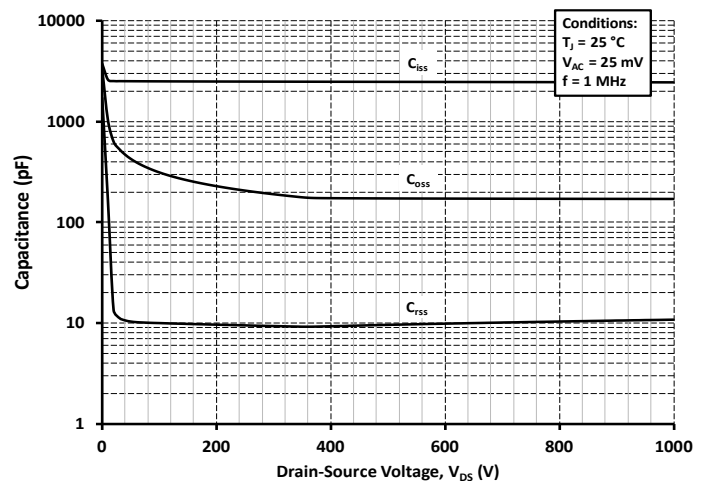


Figure 18. Capacitances vs. Drain-Source Voltage (0-1000 V)



Typical Performance

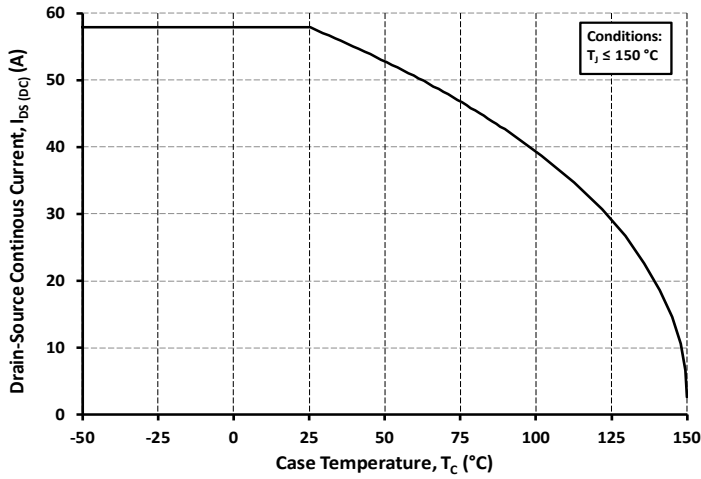


Figure 19. Continuous Drain Current Derating vs. Case Temperature

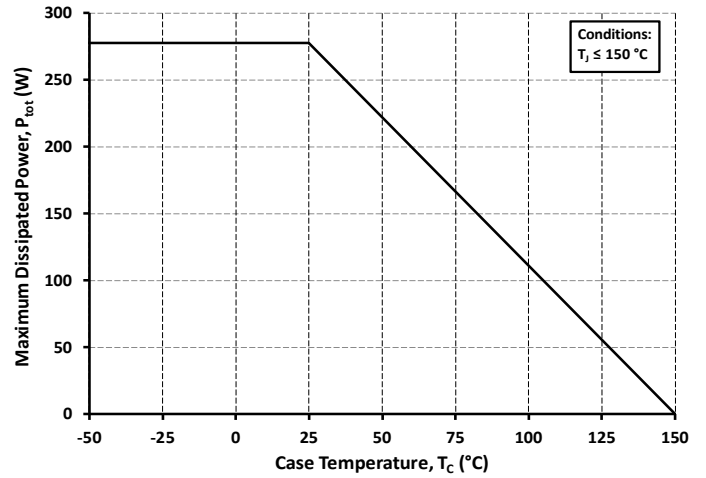


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

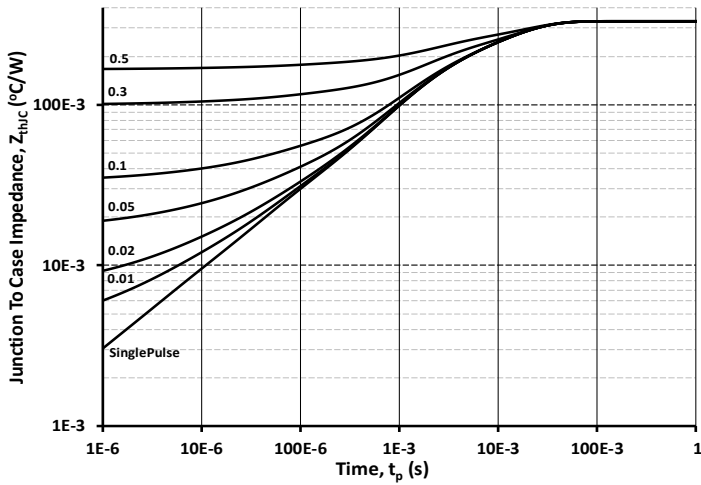


Figure 21. Transient Thermal Impedance (Junction - Case)

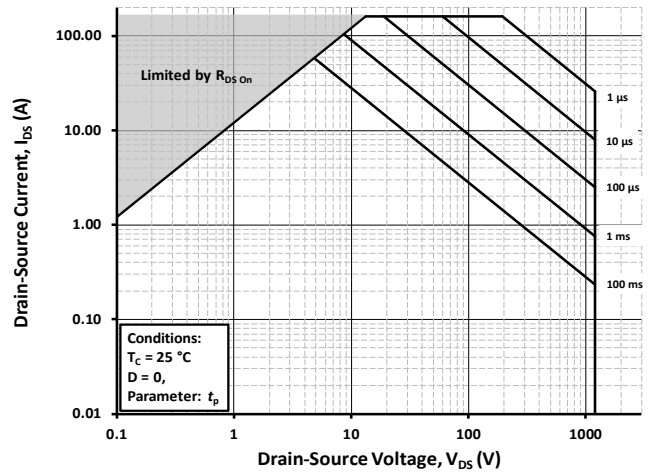


Figure 22. Safe Operating Area

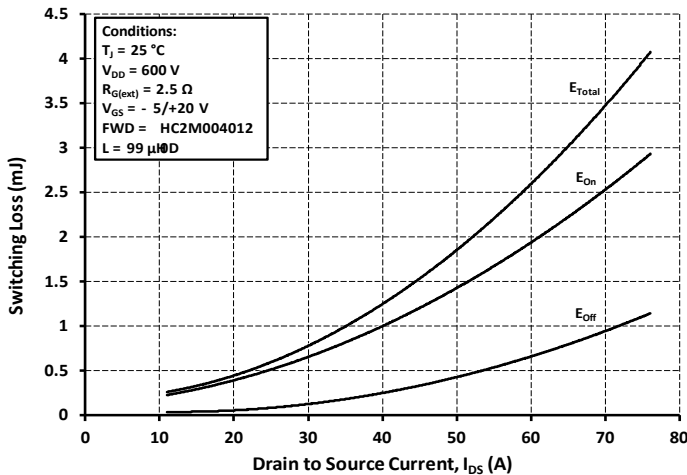


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600V$)

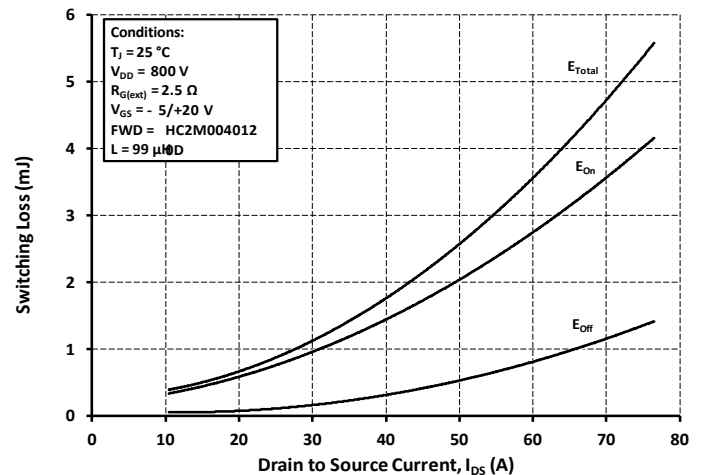


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800V$)



Typical Performance

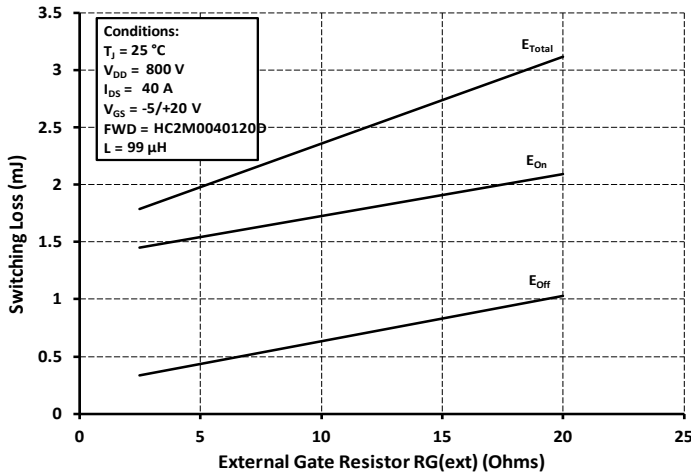


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

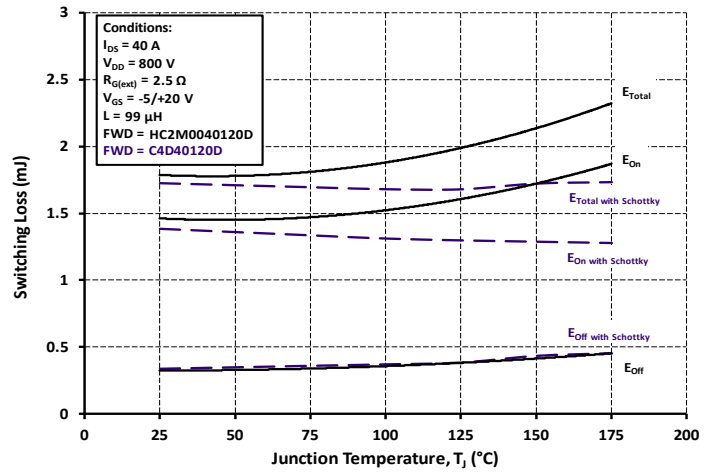


Figure 26. Clamped Inductive Switching Energy vs. Temperature

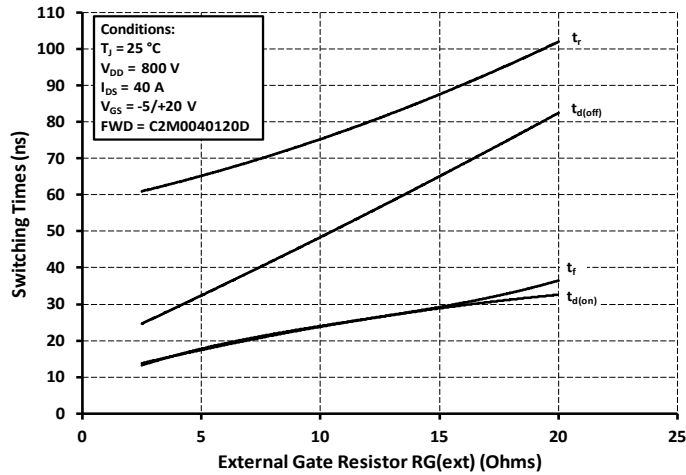


Figure 27. Switching Times vs. $R_{G(ext)}$

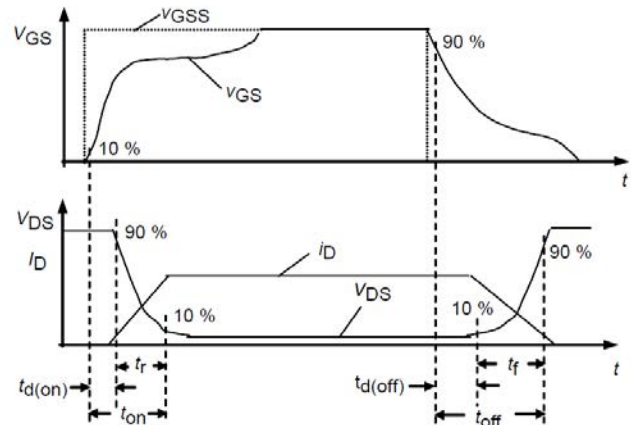


Figure 28. Switching Times Definition

IEC 1161/04



Test Circuit Schematic

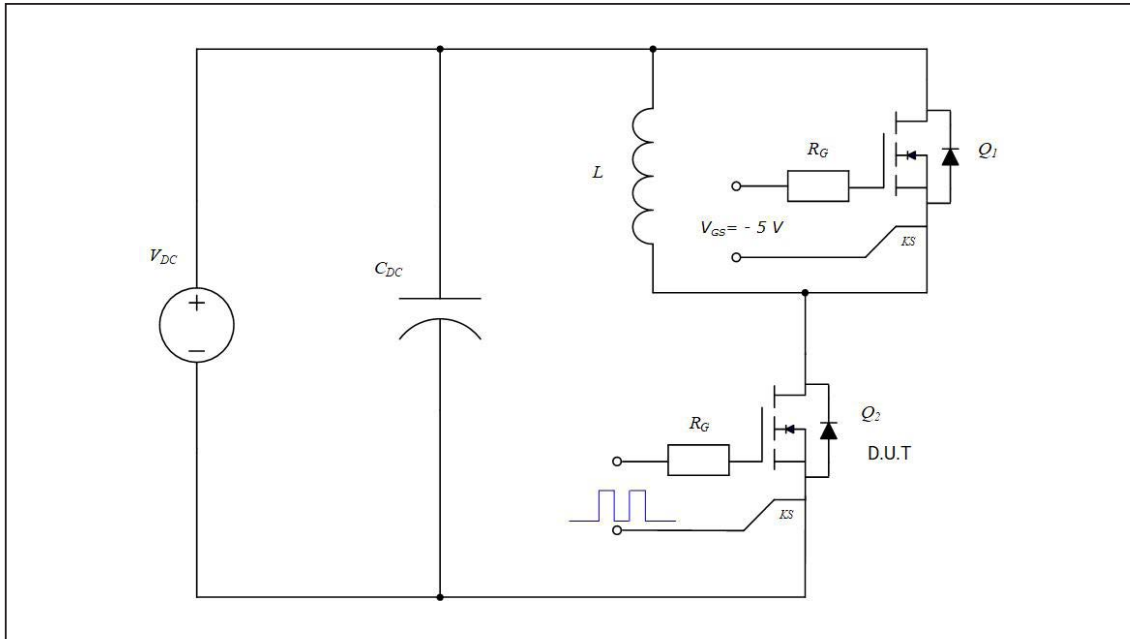


Figure 29. Clamped Inductive Switching
Waveform Test Circuit

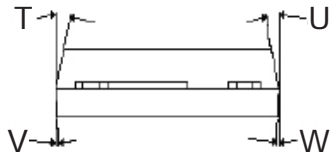
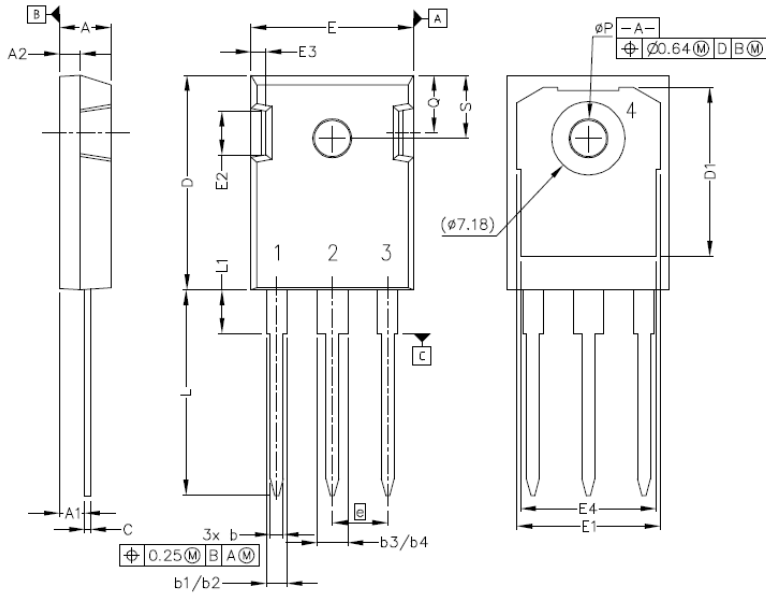
ESD Ratings

| ESD Test | Resulting Classification |
|----------|--------------------------|
| ESD-HBM | 3A (4000V - 8000V) |
| ESD-CDM | C3 (>=1000V) |



Package Dimensions

Package T0247-3L

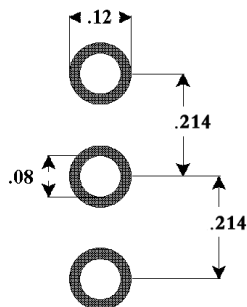


Pinout Information:

- Pin 1 = Gate
- Pin 2, 4 = Drain
- Pin 3 = Source

| POS | Inches | | Millimeters | |
|-----|----------|------|-------------|-------|
| | Min | Max | Min | Max |
| A | .190 | .205 | 4.83 | 5.21 |
| A1 | .090 | .100 | 2.29 | 2.54 |
| A2 | .075 | .085 | 1.91 | 2.16 |
| b | .042 | .052 | 1.07 | 1.33 |
| b1 | .075 | .095 | 1.91 | 2.41 |
| b2 | .075 | .085 | 1.91 | 2.16 |
| b3 | .113 | .133 | 2.87 | 3.38 |
| b4 | .113 | .123 | 2.87 | 3.13 |
| c | .022 | .027 | 0.55 | 0.68 |
| D | .819 | .831 | 20.80 | 21.10 |
| D1 | .640 | .695 | 16.25 | 17.65 |
| D2 | .037 | .049 | 0.95 | 1.25 |
| E | .620 | .635 | 15.75 | 16.13 |
| E1 | .516 | .557 | 13.10 | 14.15 |
| E2 | .145 | .201 | 3.68 | 5.10 |
| E3 | .039 | .075 | 1.00 | 1.90 |
| E4 | .487 | .529 | 12.38 | 13.43 |
| e | .214 BSC | | 5.44 BSC | |
| N | 3 | | 3 | |
| L | .780 | .800 | 19.81 | 20.32 |
| L1 | .161 | .173 | 4.10 | 4.40 |
| ØP | .138 | .144 | 3.51 | 3.65 |
| Q | .216 | .236 | 5.49 | 6.00 |
| S | .238 | .248 | 6.04 | 6.30 |
| T | 9° | 11° | 9° | 11° |
| U | 9° | 11° | 9° | 11° |
| V | 2° | 8° | 2° | 8° |
| W | 2° | 8° | 2° | 8° |

Recommended Solder Pad Layout



T0247-3L



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