



Features

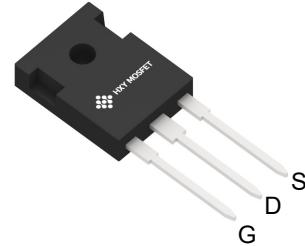
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Resistant to Latch-Up
- Halogen Free, RoHS Compliant

Benefits

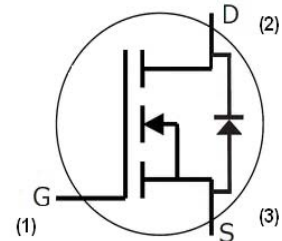
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC converters
- Motor Drive
- Pulsed Power Applications



TO-247



| Part Number | Package | Qty(PCS) |
|-------------|---------|----------|
| HSCT20N170 | TO-247 | 30 |

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

| Symbol | Parameter | Value | Unit | Test Conditions | Note |
|----------------|--|-------------|------------------|--|---------|
| V_{DSmax} | Drain - Source Voltage | 1700 | V | $V_{GS} = 0\text{ V}$, $I_D = 100\text{ }\mu\text{A}$ | |
| V_{GSmax} | Gate - Source Voltage | -10/+25 | V | Absolute maximum values, AC ($f > 1\text{ Hz}$) | |
| V_{GSop} | Gate - Source Voltage | -5/+20 | V | Recommended operational values | |
| I_D | Continuous Drain Current | 72 | A | $V_{GS} = 20\text{ V}$, $T_C = 25\text{ }^\circ\text{C}$ | Fig. 19 |
| | | 48 | | $V_{GS} = 20\text{ V}$, $T_C = 100\text{ }^\circ\text{C}$ | |
| $I_{D(pulse)}$ | Pulsed Drain Current | 160 | A | Pulse width t_p limited by T_{jmax} | Fig. 22 |
| P_D | Power Dissipation | 520 | W | $T_c = 25\text{ }^\circ\text{C}$, $T_j = 150\text{ }^\circ\text{C}$ | Fig. 20 |
| T_J, T_{stg} | Operating Junction and Storage Temperature | -40 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 | M3 or 6-32 screw | |
| | | 8.8 | | | |



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

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions | Note |
|---------------|--|------|------|------|---------------|--|------------------------|
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | 1700 | | | V | $V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$ | |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | 2.6 | 4 | V | $V_{DS} = V_{GS}, I_D = 18\text{mA}$ | Fig. 11 |
| | | | 1.8 | | V | $V_{DS} = V_{GS}, I_D = 18\text{mA}, T_J = 150^\circ\text{C}$ | |
| I_{DSS} | Zero Gate Voltage Drain Current | | 2 | 100 | μA | $V_{DS} = 1700\text{ V}, V_{GS} = 0\text{ V}$ | |
| I_{GSS} | Gate-Source Leakage Current | | | 600 | nA | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$ | |
| $R_{DS(on)}$ | Drain-Source On-State Resistance | | 45 | 70 | m Ω | $V_{GS} = 20\text{ V}, I_D = 50\text{ A}$ | Fig. 4,5,6 |
| | | | 90 | | | $V_{GS} = 20\text{ V}, I_D = 50\text{ A}, T_J = 150^\circ\text{C}$ | |
| g_{fs} | Transconductance | | 21.7 | | S | $V_{DS} = 20\text{ V}, I_{DS} = 50\text{ A}$ | Fig. 7 |
| | | | 24.4 | | | $V_{DS} = 20\text{ V}, I_{DS} = 50\text{ A}, T_J = 150^\circ\text{C}$ | |
| C_{iss} | Input Capacitance | | 3672 | | 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 | | 6.7 | | | | |
| E_{oss} | C_{oss} Stored Energy | | 105 | | | | μJ |
| E_{ON} | Turn-On Switching Energy (SiC Diode FWD) | | 2.1 | | mJ | $V_{DS} = 1200\text{ V}, V_{GS} = -5/20\text{ V},$ $I_D = 50\text{A}, R_{G(ext)} = 2.5\Omega, L = 105\ \mu\text{H},$ $T_J = 150^\circ\text{C},$ using SiC Diode as FWD | Fig. 26, 29b Note 2 |
| E_{OFF} | Turn Off Switching Energy (SiC Diode FWD) | | 0.86 | | | | |
| E_{ON} | Turn-On Switching Energy (Body Diode FWD) | | 4.7 | | mJ | $V_{DS} = 1200\text{ V}, V_{GS} = -5/20\text{ V},$ $I_D = 50\text{A}, R_{G(ext)} = 2.5\Omega, L = 105\ \mu\text{H},$ $T_J = 150^\circ\text{C},$ using MOSFET as FWD | Fig. 26, 29a Note 2 |
| E_{OFF} | Turn Off Switching Energy (Body Diode FWD) | | 0.93 | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | | 65 | | ns | $V_{DD} = 1200\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 50\text{ A},$ $R_{G(ext)} = 2.5\ \Omega,$ Timing relative to V_{DS} Inductive load | Fig. 27, 29 Note 2 |
| t_r | Rise Time | | 20 | | | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | 48 | | | | |
| t_f | Fall Time | | 18 | | | | |
| $R_{G(int)}$ | Internal Gate Resistance | | 1.3 | | Ω | $f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$ | |
| Q_{gs} | Gate to Source Charge | | 44 | | nC | $V_{DS} = 1200\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 50\text{ A}$ Per IEC60747-8-4 pg 21 | Fig. 12 |
| Q_{gd} | Gate to Drain Charge | | 57 | | | | |
| Q_g | Total Gate Charge | | 188 | | | | |

Reverse Diode Characteristics

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|-----------|----------------------------------|------|------|------|--|-------------------------|
| V_{SD} | Diode Forward Voltage | 4.1 | | V | $V_{GS} = -5\text{ V}, I_{SD} = 25\text{ A}$ | Fig. 8, 9, 10 Note 1 |
| | | 3.6 | | V | $V_{GS} = -5\text{ V}, I_{SD} = 25\text{ A}, T_J = 150^\circ\text{C}$ | |
| I_S | Continuous Diode Forward Current | | 72 | A | $T_c = 25^\circ\text{C}, V_{GS} = -5\text{ V}$ | Note 1 |
| t_{rr} | Reverse Recovery Time | 70 | | ns | $V_{GS} = -5\text{ V}, I_{SD} = 50\text{ A}, V_R = 1200\text{ V}$ $di/dt = 1400\text{ A}/\mu\text{s}$ | Note 1 |
| Q_{rr} | Reverse Recovery Charge | 530 | | nC | | |
| I_{rrm} | Peak Reverse Recovery Current | 14 | | A | | |

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

Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|-----------------|---|------|------|---------------------------|-----------------|---------|
| $R_{\theta JC}$ | Thermal Resistance from Junction to Case | 0.22 | 0.24 | $^\circ\text{C}/\text{W}$ | | Fig. 21 |
| $R_{\theta JA}$ | Thermal Resistance from Junction to Ambient | | 40 | | | |



Typical Performance

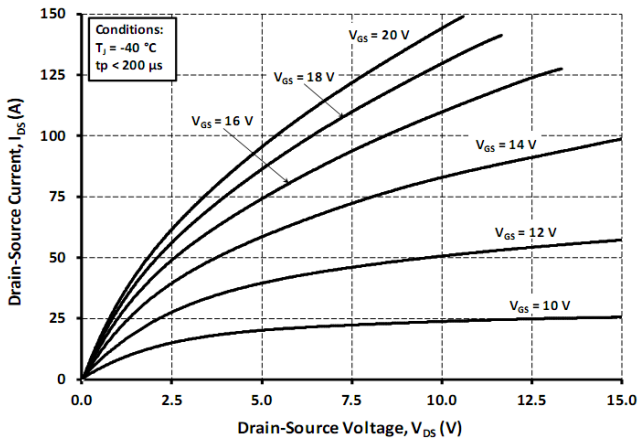


Figure 1. Output Characteristics $T_J = -40\text{ }^\circ\text{C}$

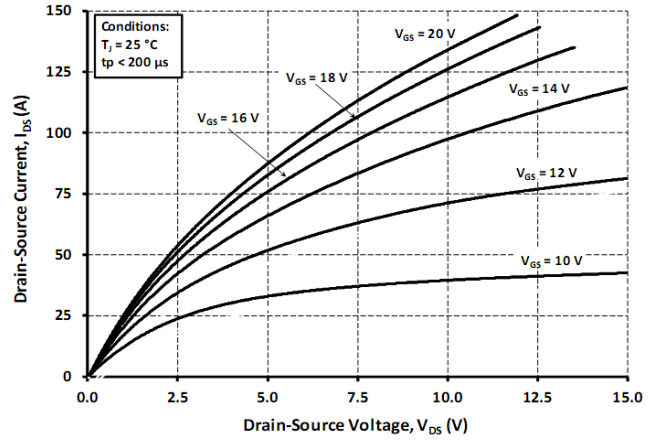


Figure 2. Output Characteristics $T_J = 25\text{ }^\circ\text{C}$

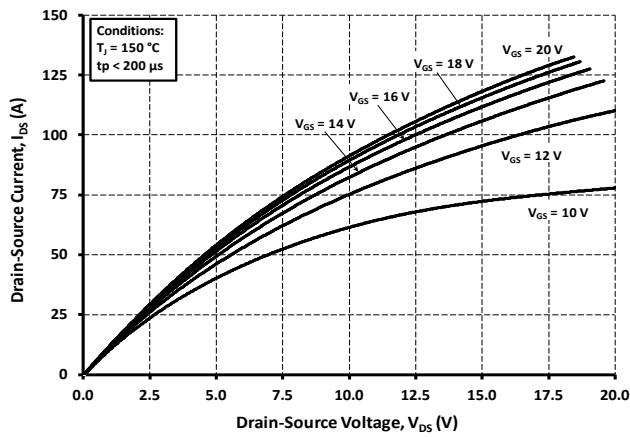


Figure 3. Output Characteristics $T_J = 150\text{ }^\circ\text{C}$

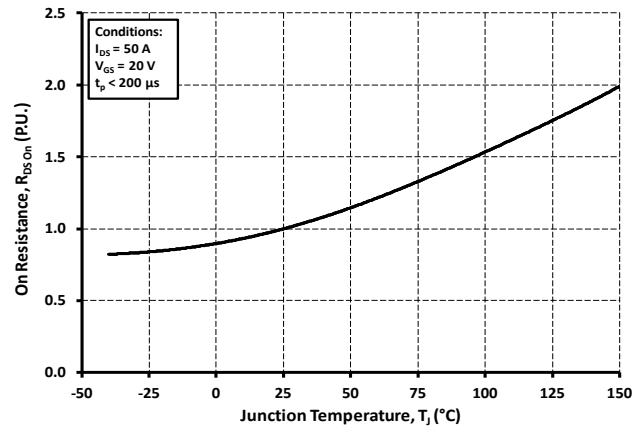


Figure 4. Normalized On-Resistance vs. Temperature

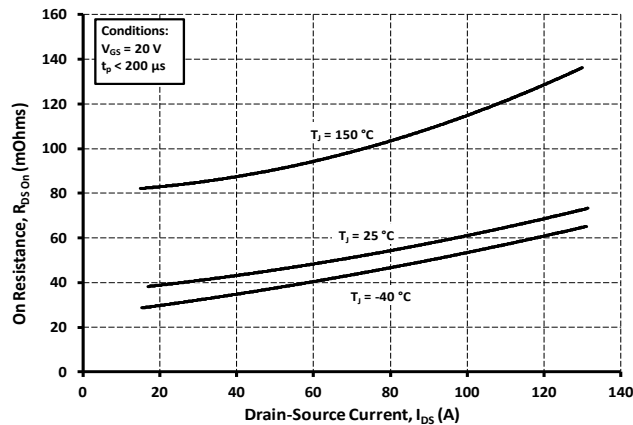


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

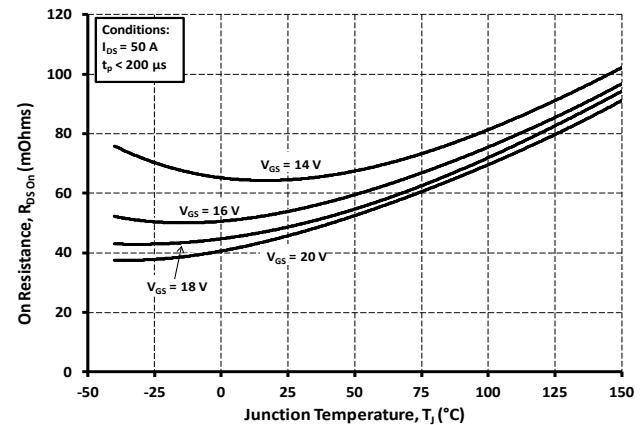


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage



Typical Performance

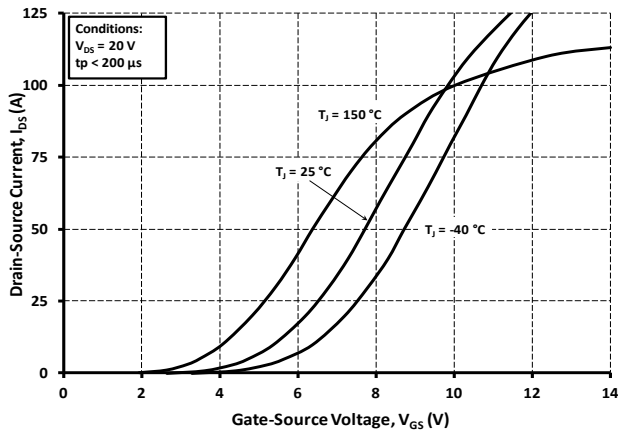


Figure 7. Transfer Characteristic For Various Junction Temperatures

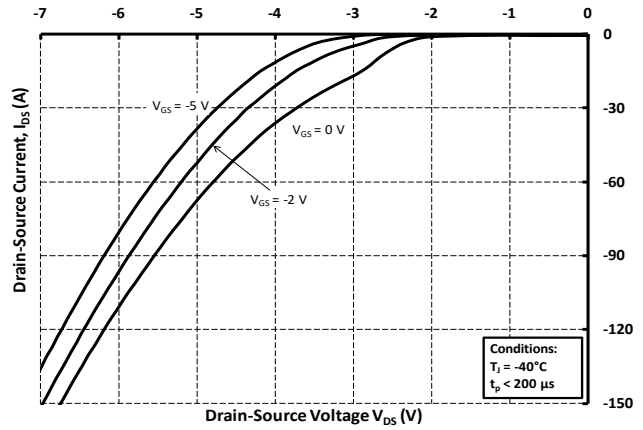


Figure 8. Body Diode Characteristic at -40 °C

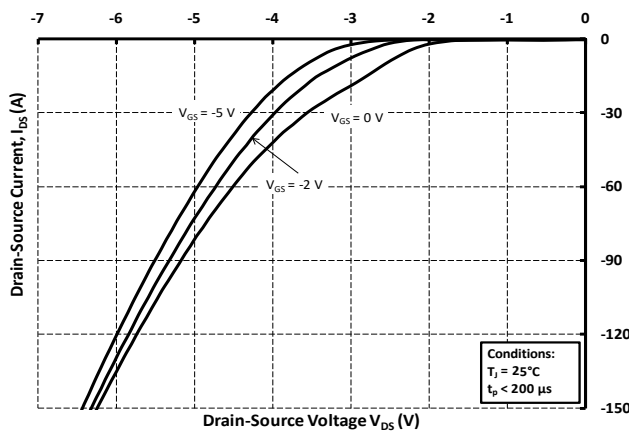


Figure 9. Body Diode Characteristic at 25 °C

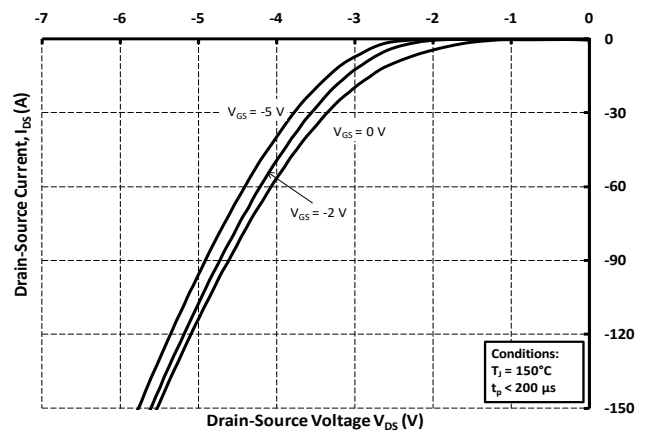


Figure 10. Body Diode Characteristic at 150 °C

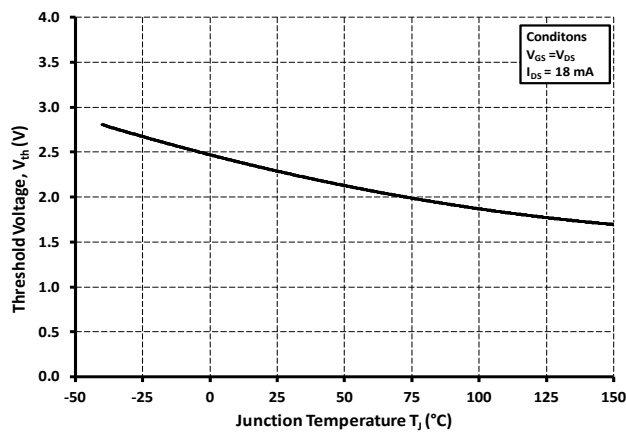


Figure 11. Threshold Voltage vs. Temperature

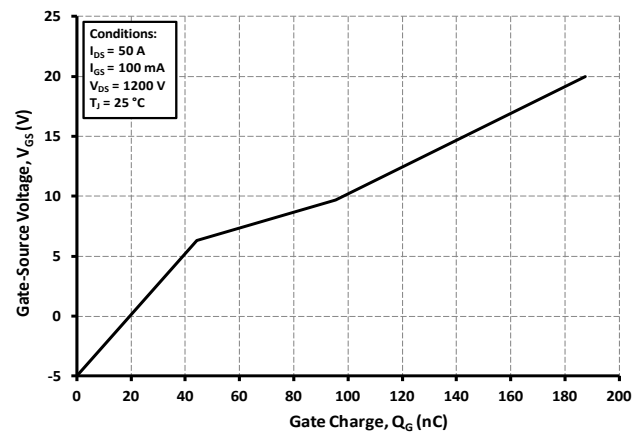


Figure 12. Gate Charge Characteristic



Typical Performance

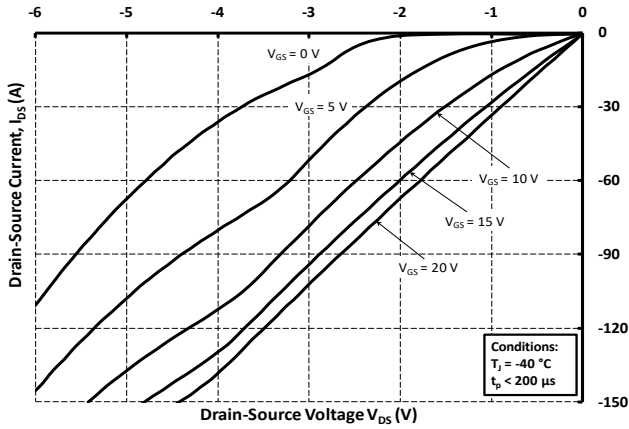


Figure 13. 3rd Quadrant Characteristic at -40 °C

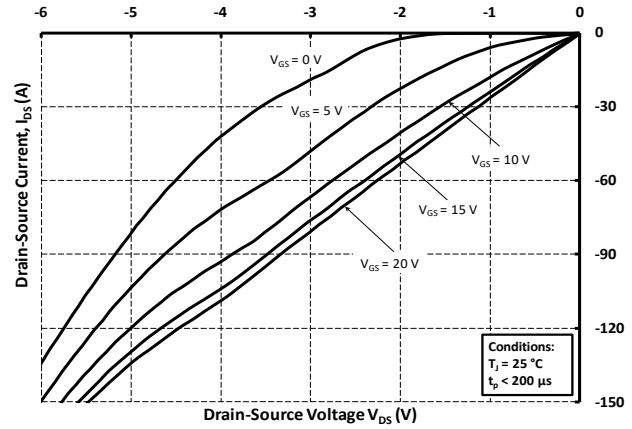


Figure 14. 3rd Quadrant Characteristic at 25 °C

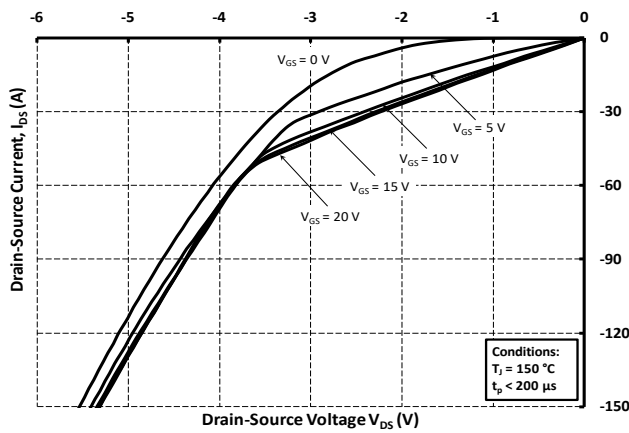


Figure 15. 3rd Quadrant Characteristic at 150 °C

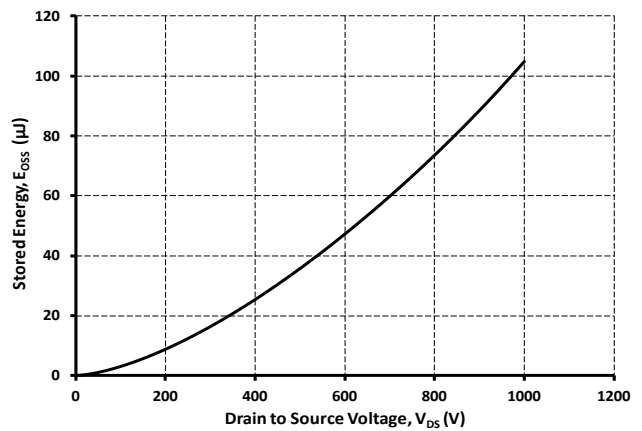


Figure 16. Output Capacitor Stored Energy

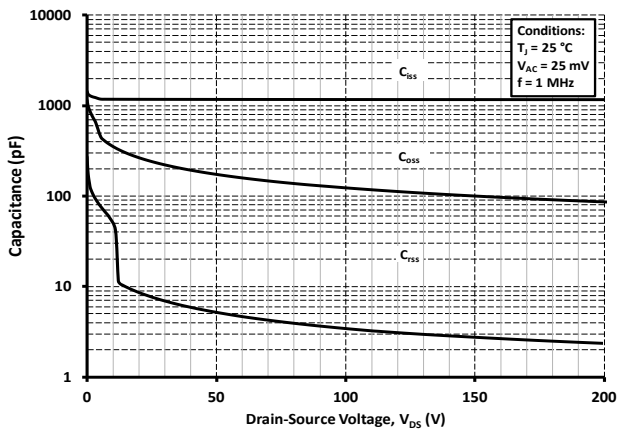


Figure 17. Capacitances vs. Drain-Source Voltage (0-200 V)

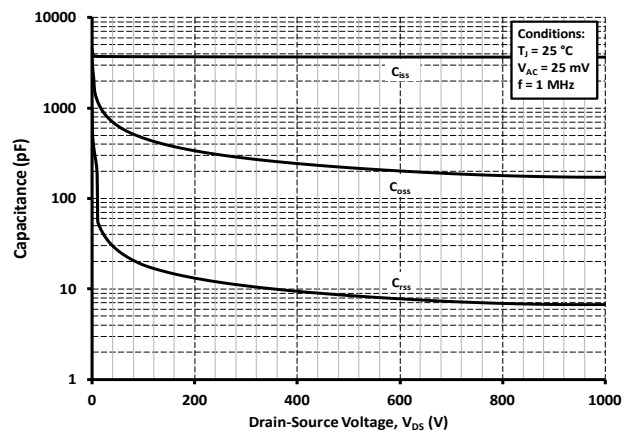


Figure 18. Capacitances vs. Drain-Source Voltage (0-1000 V)



Typical Performance

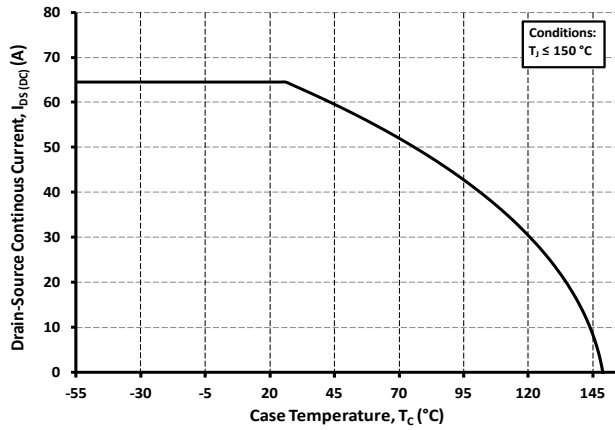


Figure 19. Continuous Drain Current Derating vs. Case Temperature

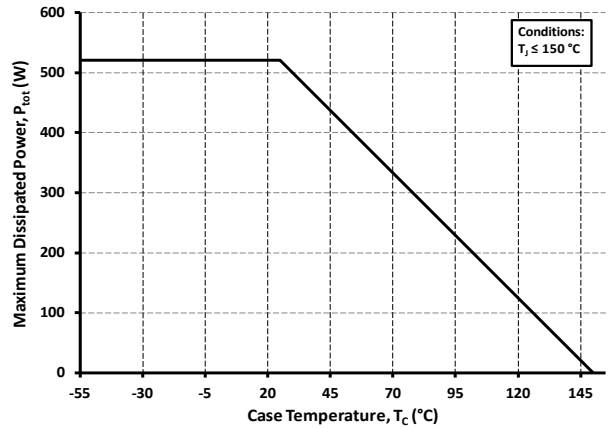


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

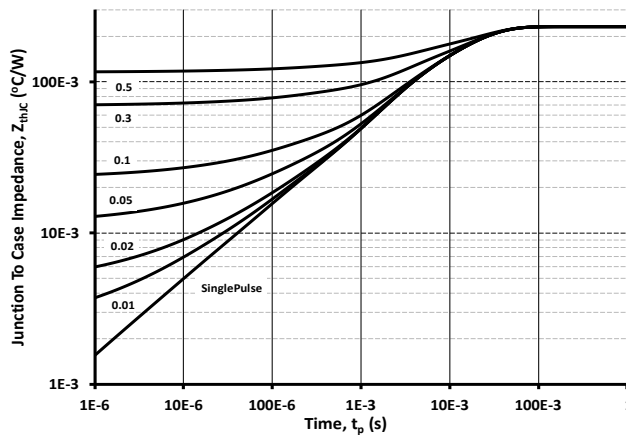


Figure 21. Transient Thermal Impedance (Junction - Case)

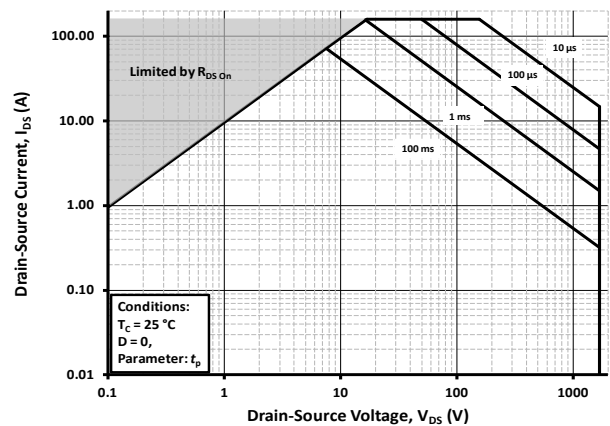


Figure 22. Safe Operating Area

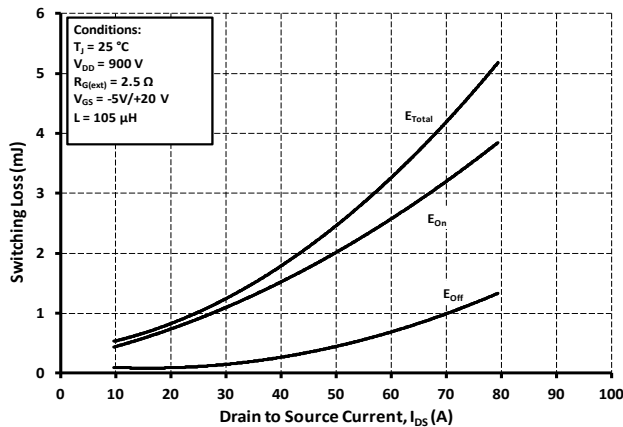


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V = 900V$)

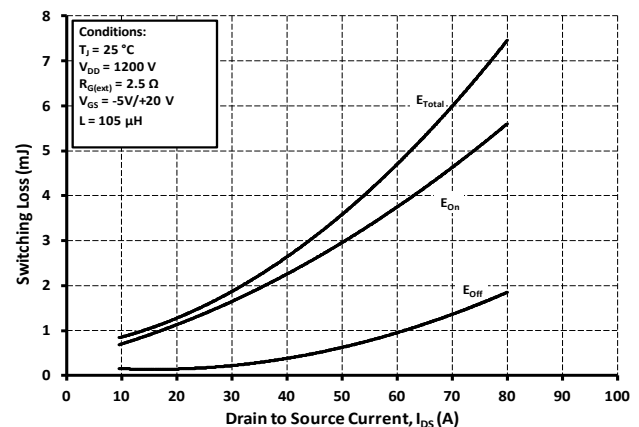


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V = 1200V$)



Typical Performance

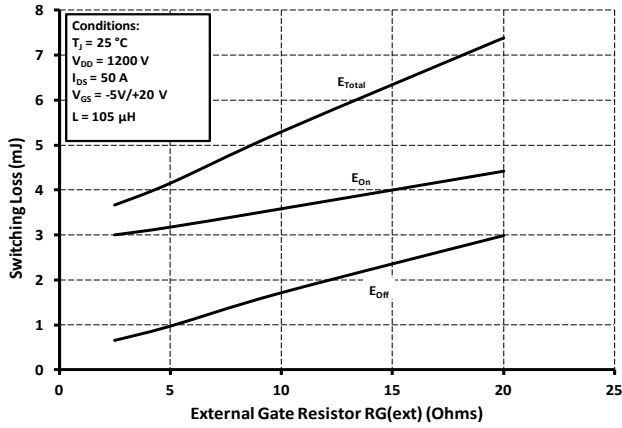


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

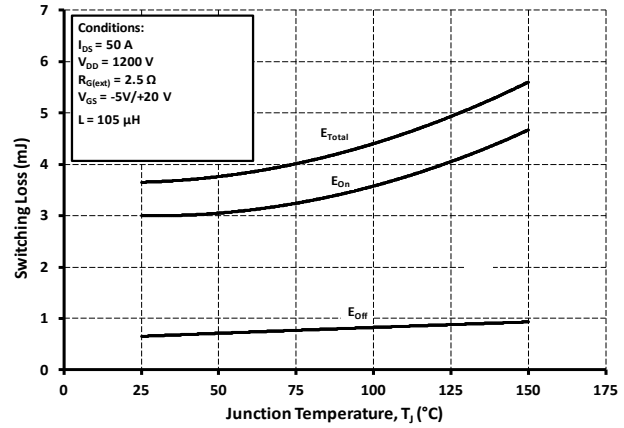


Figure 26. Clamped Inductive Switching Energy vs. Temperature

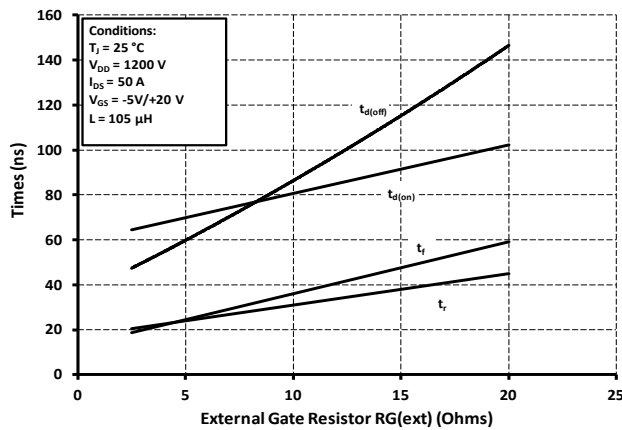


Figure 27. Switching Times vs. $R_{G(ext)}$

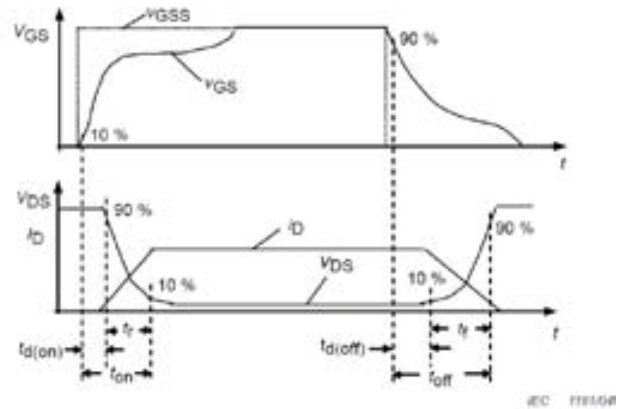


Figure 28. Switching Times Definition



Test Circuit Schematic

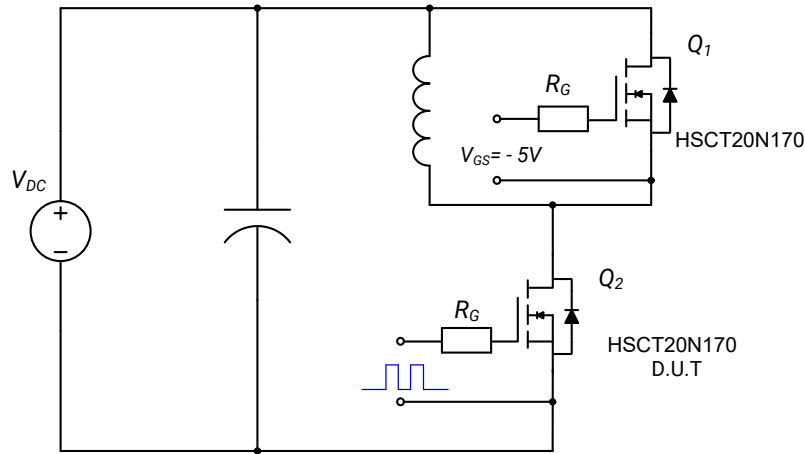


Figure 29a. Clamped Inductive Switching Test Circuit using MOSFET intrinsic body diode

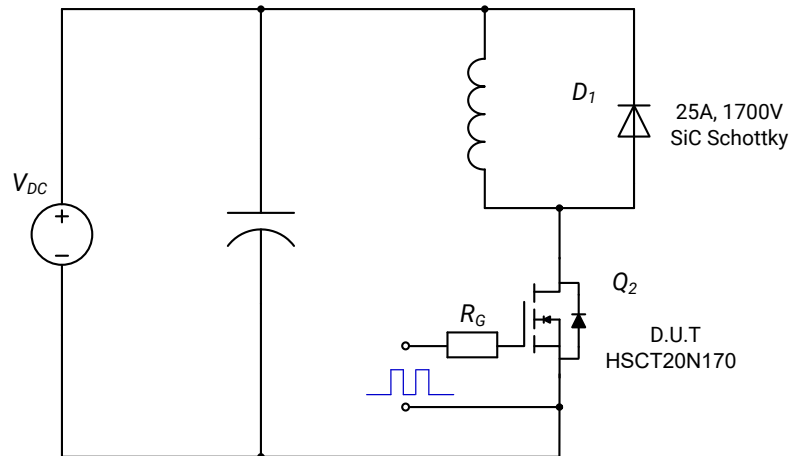


Figure 29b. Clamped Inductive Switching Test Circuit using SiC Schottky diode

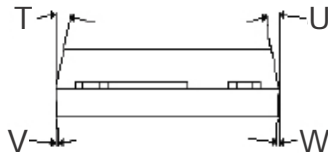
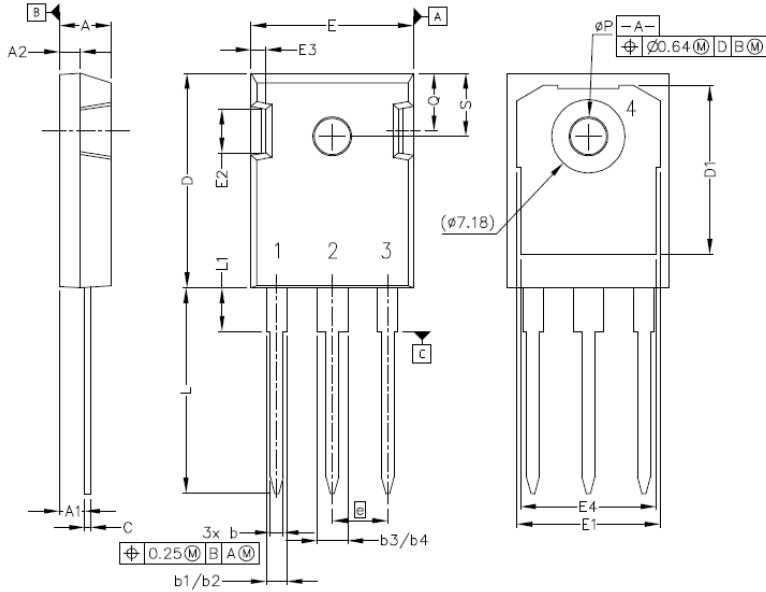
ESD Ratings

| ESD Test | Total Devices Sampled | Resulting Classification |
|----------|--------------------------|--------------------------|
| ESD-HBM | All Devices Passed 4000V | 3A (>4000V) |
| ESD-CDM | All Devices Passed 1000V | IV (>1000V) |



Package Dimensions

Package TO-247

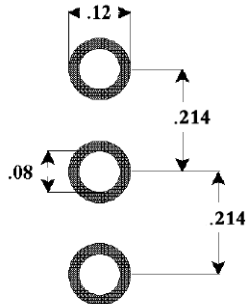


Pinout Information:

- 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



TO247-3L



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