# Silicon Carbide (SiC) MOSFET – EliteSiC, 192 mohm, 1700 V, M1, TO-247-4L
# NVH4L200N170M1

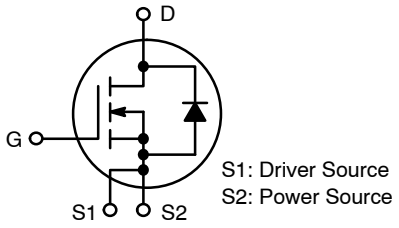
| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 1700 V | 290 mΩ @ 20 V | 13 A |

### Features

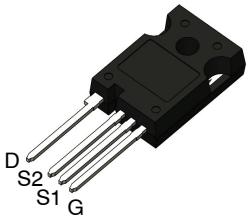
- Typ. $R_{DS(on)}$ = 192 mΩ @ $V_{GS}$ = 20 V
- Ultra Low Gate Charge ($Q_{G(tot)}$ = 31 nC)
- High Speed Switching with Low Capacitance ($C_{oss}$ = 33 pF)
- 100% Avalanche Tested
- These Devices are Pb−Free and are RoHS Compliant

### Typical Applications

- Automotive On Board Charger
- Automotive DC−DC Converter for EV/HEV




**N−CHANNEL MOSFET**




**TO−247−4L**
**CASE 340CJ**

### MARKING DIAGRAM


H4L200N170M1 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability

### MAXIMUM RATINGS ($T_J$ = 25°C unless otherwise noted)

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | 1700 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | −15/+25 | V |
| Recommended Operation Values of Gate−to−Source Voltage | | $T_C$ < 175°C | $V_{GSop}$ | −5/+20 | V |
| Continuous Drain Current (Note 1) | Steady State | $T_C$ = 25°C | $I_D$ | 13 | A |
| Power Dissipation (Note 1) | Steady State | $T_C$ = 25°C | $P_D$ | 107 | W |
| Continuous Drain Current (Note 1) | Steady State | $T_C$ = 100°C | $I_D$ | 9.2 | A |
| Power Dissipation (Note 1) | Steady State | $T_C$ = 100°C | $P_D$ | 54 | W |
| Pulsed Drain Current (Note 2) | $T_C$ = 25°C, $t_p$ = 100 μs | | $I_{DM}$ | 45 | A |
| Operating Junction and Storage Temperature Range | | | $T_J$, $T_{stg}$ | −55 to +175 | °C |
| Source Current (Body Diode) | | | $I_S$ | 23 | A |
| Single Pulse Drain−to−Source Avalanche Energy ($I_{L(pk)}$ = 11.9 A, L = 1 mH) (Note 3) | | | $E_{AS}$ | 71 | mJ |
| Maximum Lead Temperature for Soldering (1/25″ from case for 10 s) | | | $T_L$ | 270 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Single pulse, limited by max junction temperature.
3. EAS of 71 mJ is based on starting $T_J$ = 25°C; L = 1 mH, $I_{AS}$ = 11.9 A, $V_{DD}$ = 120 V, $V_{GS}$ = 18 V.

### ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| NVH4L200N170M1 | TO−247−4L | 30 Units / Tube |

## THERMAL CHARACTERISTICS

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Junction−to−Case − Steady State (Note 1) | $R_{\theta JC}$ | 1.4 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain−to−Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 1 mA | 1700 | – | – | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D$ = 1 mA, referenced to 25°C | – | 0.5 | – | V/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 1700 V, $T_J$ = 25°C | – | – | 100 | μA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 1700 V, $T_J$ = 175°C | – | – | 1 | mA |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{GS}$ = +25/−15 V, $V_{DS}$ = 0 V | – | – | ±1 | μA |
| **ON CHARACTERISTICS** (Note 2) | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 2.6 mA | 1.8 | 3.1 | 4.3 | V |
| Recommended Gate Voltage | $V_{GOP}$ | | −5 | – | +20 | V |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 20 V, $I_D$ = 8.5 A, $T_J$ = 25°C | – | 192 | 290 | mΩ |
| | | $V_{GS}$ = 20 V, $I_D$ = 8.5 A, $T_J$ = 175°C | – | 414 | – | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 20 V, $I_D$ = 8.5 A | – | 4.6 | – | S |
| **CHARGES, CAPACITANCES & GATE RESISTANCE** | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = 1000 V | – | 596 | – | pF |
| Output Capacitance | $C_{OSS}$ | | – | 33 | – | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | – | 2.5 | – | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = −5/20 V, $V_{DS}$ = 1000 V, $I_D$ = 8.5 A | – | 31 | – | nC |
| Gate−to−Source Charge | $Q_{GS}$ | | – | 9.1 | – | |
| Gate−to−Drain Charge | $Q_{GD}$ | | – | 7.8 | – | |
| Gate−Resistance | $R_G$ | f = 1 MHz | – | 4.1 | – | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = −5/20 V, $V_{DS}$ = 1200 V, $I_D$ = 8.5 A, $R_G$ = 2 Ω inductive load | – | 7.7 | – | ns |
| Rise Time | $t_r$ | | – | 8 | – | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | – | 13 | – | |
| Fall Time | $t_f$ | | – | 26 | – | |
| Turn−On Switching Loss | $E_{ON}$ | | – | 261 | – | μJ |
| Turn−Off Switching Loss | $E_{OFF}$ | | – | 50 | – | |
| Total Switching Loss | $E_{tot}$ | | – | 311 | – | |
| **SOURCE−DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Continuous Source−Drain Diode Forward Current | $I_{SD}$ | $V_{GS}$ = −5 V, $T_J$ = 25°C | – | – | 23 | A |
| Pulsed Source−Drain Diode Forward Current (Note 2) | $I_{SDM}$ | | – | – | 79 | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = −5 V, $I_{SD}$ = 8.5 A, $T_J$ = 25°C | – | 4.3 | – | V |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = −5/20 V, $I_{SD}$ = 8.5 A, $dI_S/dt$ = 1000 A/μs | – | 14 | – | ns |
| Reverse Recovery Charge | $Q_{RR}$ | | – | 75 | – | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## TYPICAL CHARACTERISTICS

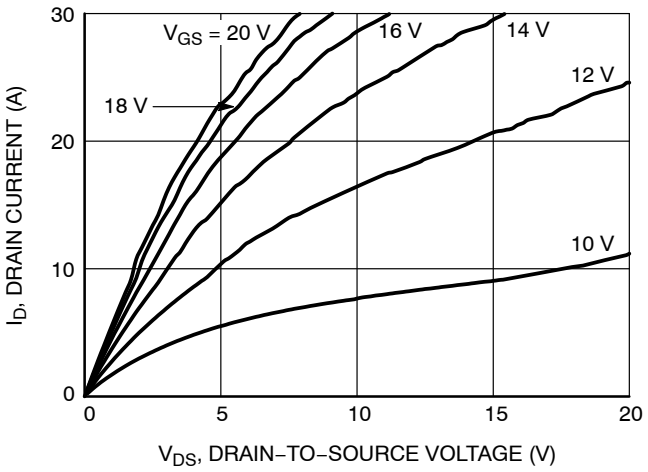



**Figure 1. On−Region Characteristics**

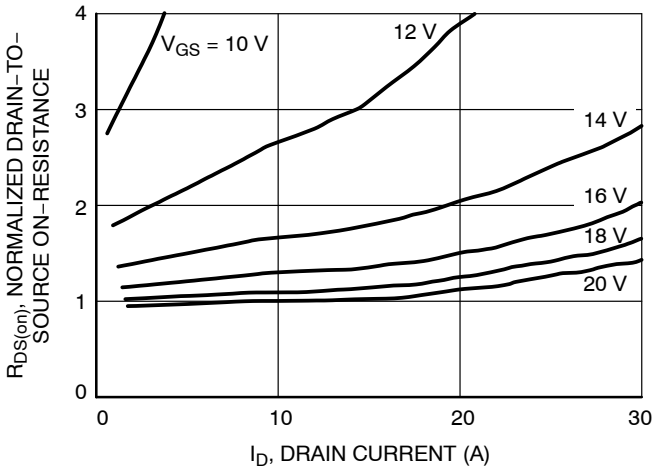



**Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage**

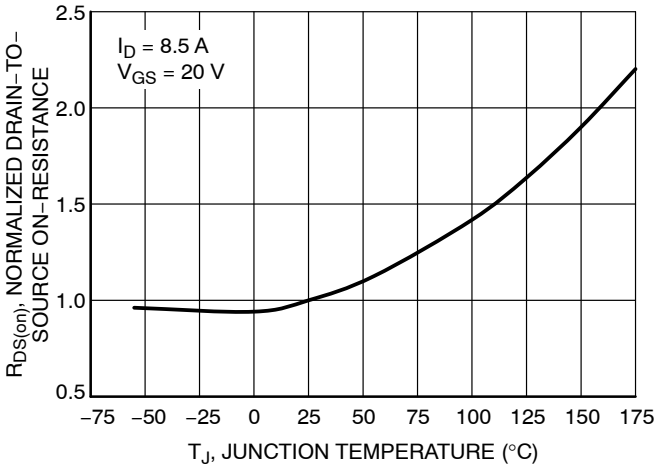



**Figure 3. On−Resistance Variation with Temperature**

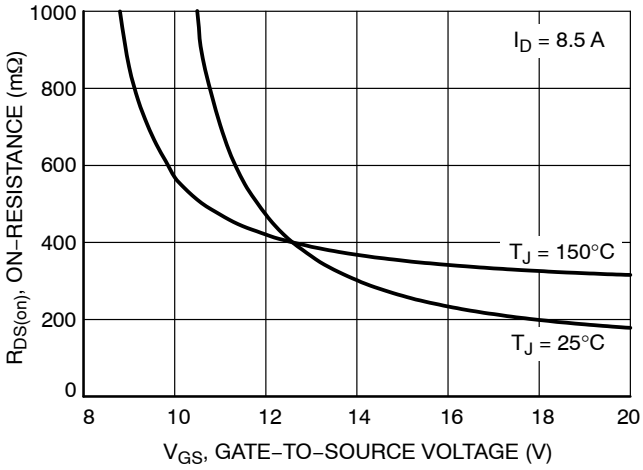



**Figure 4. On−Resistance vs. Gate−to−Source Voltage**

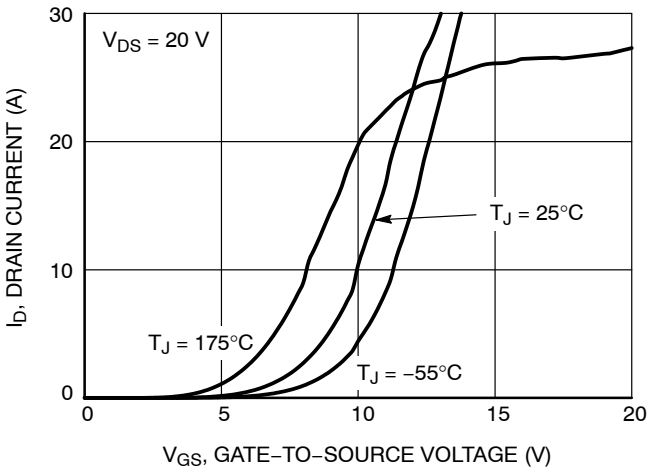



**Figure 5. Transfer Characteristics**

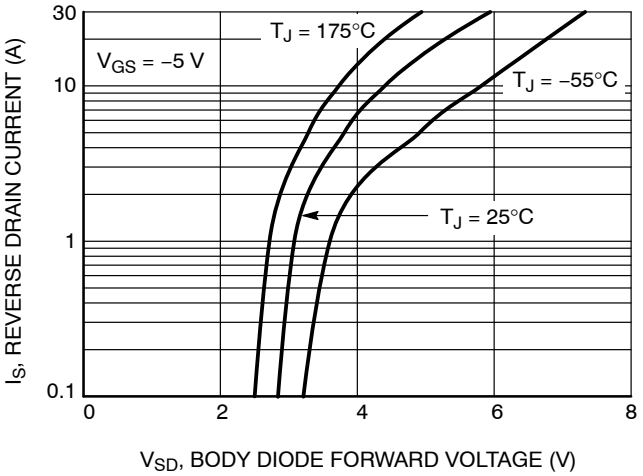



**Figure 6. Diode Forward Voltage vs. Current**

## TYPICAL CHARACTERISTICS

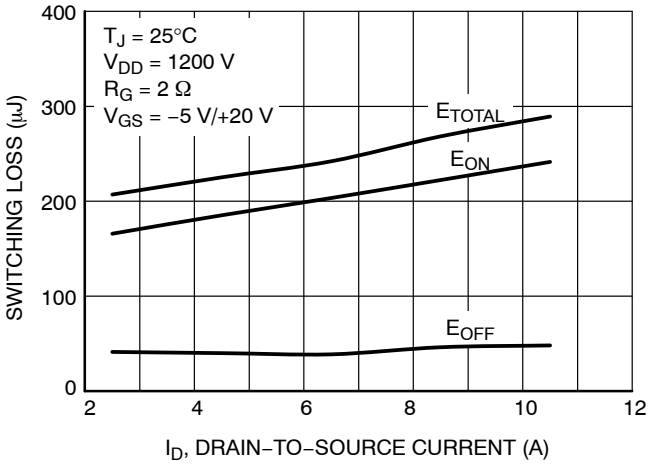



**Figure 7. Switching Loss vs. Drain−to−Source Current (25°C)**

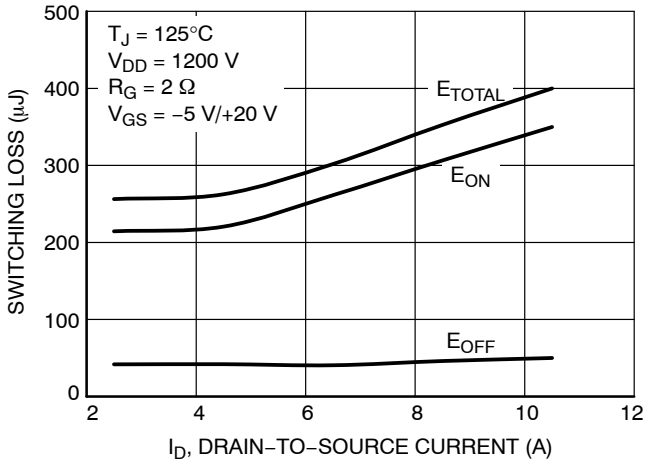



**Figure 8. Switching Loss vs. Drain−to−Source Current (125°C)**

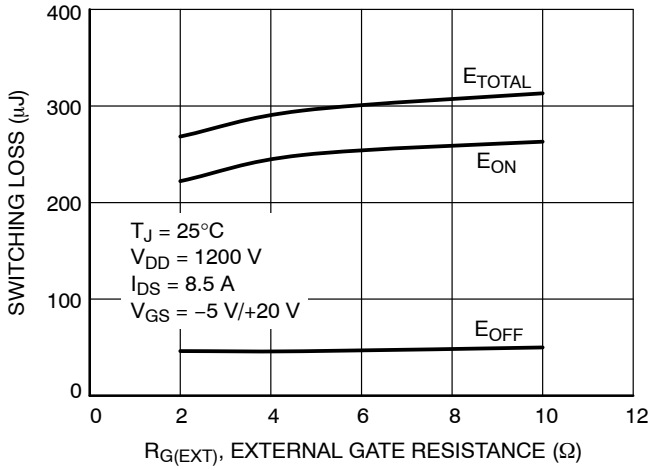



**Figure 9. Switching Loss vs. External Gate Resistance**

## TYPICAL CHARACTERISTICS

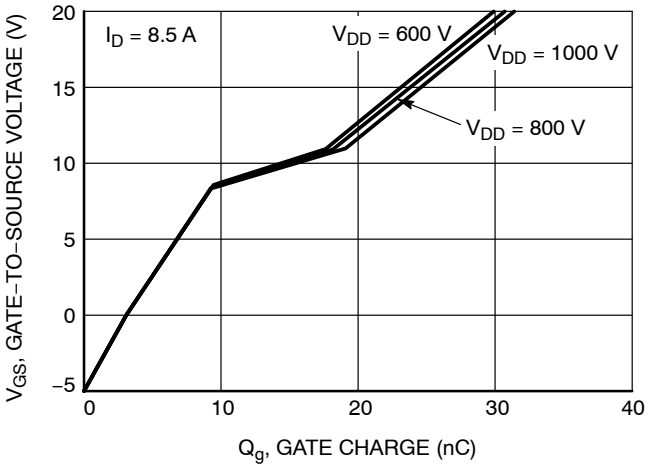



**Figure 10. Gate−to−Source Voltage vs. Total Charge**

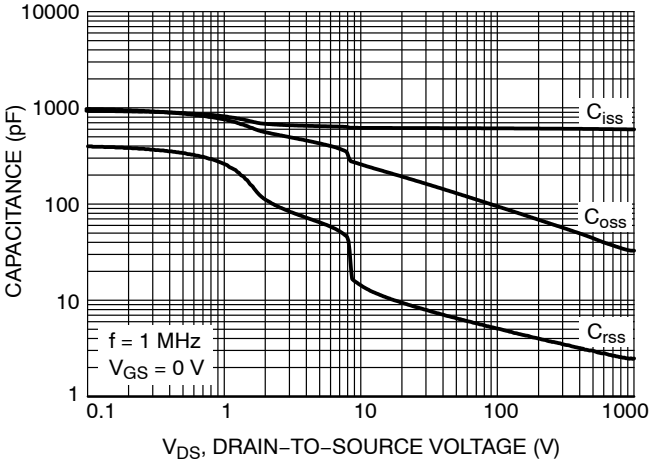



**Figure 11. Capacitance vs. Drain−to−Source Voltage**

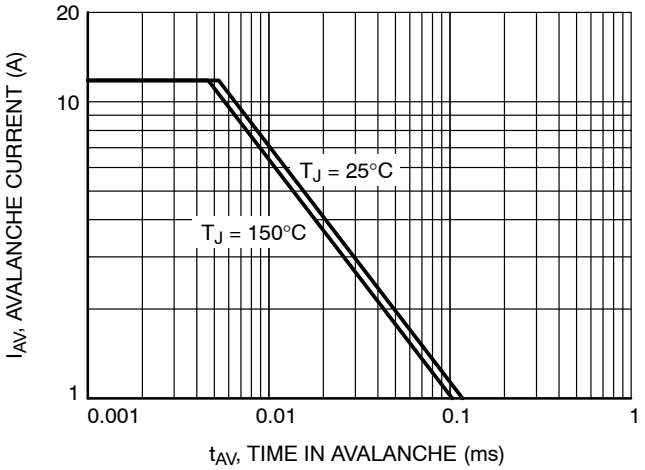



**Figure 12. Unclamped Inductive Switching Capability**

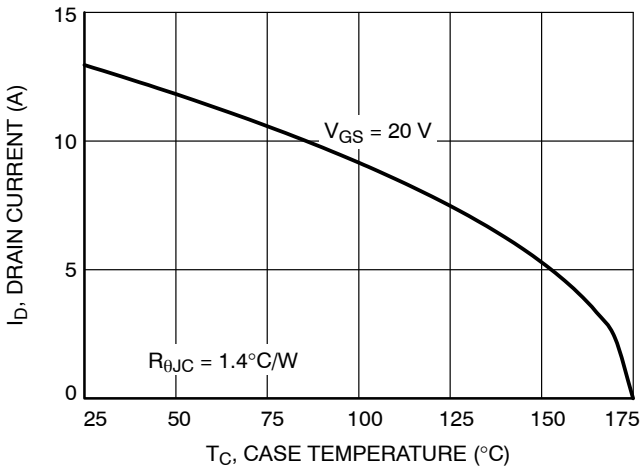



**Figure 13. Maximum Continuous Drain Current vs. Case Temperature**

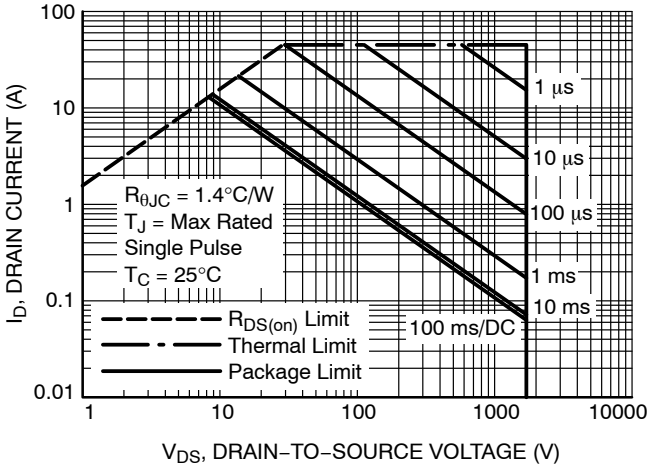



**Figure 14. Safe Operating Area**

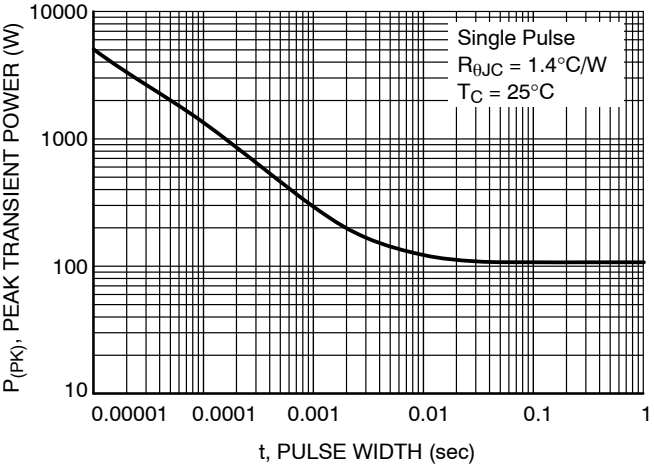



**Figure 15. Single Pulse Maximum Power Dissipation**

## TYPICAL CHARACTERISTICS

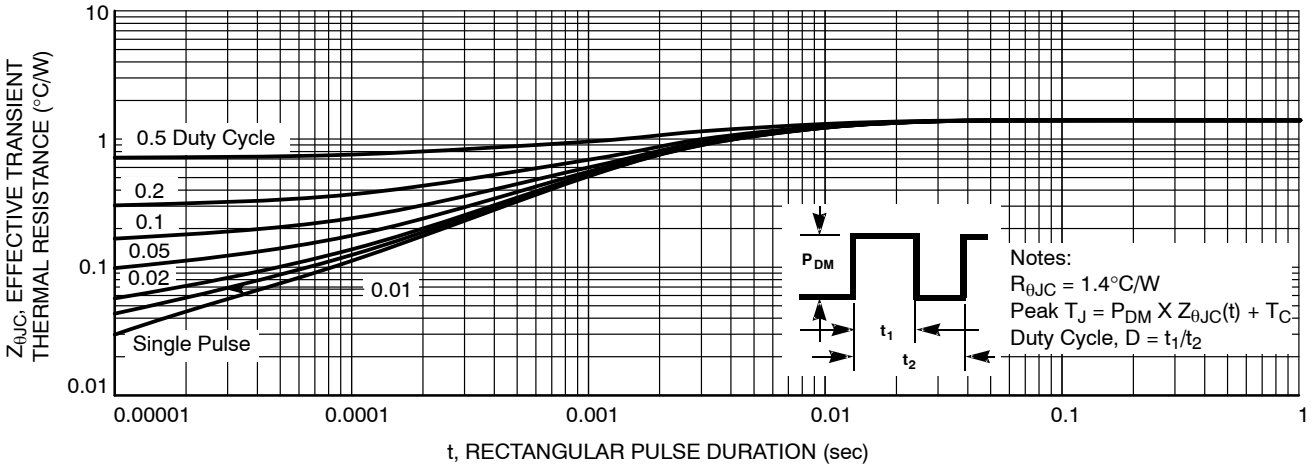
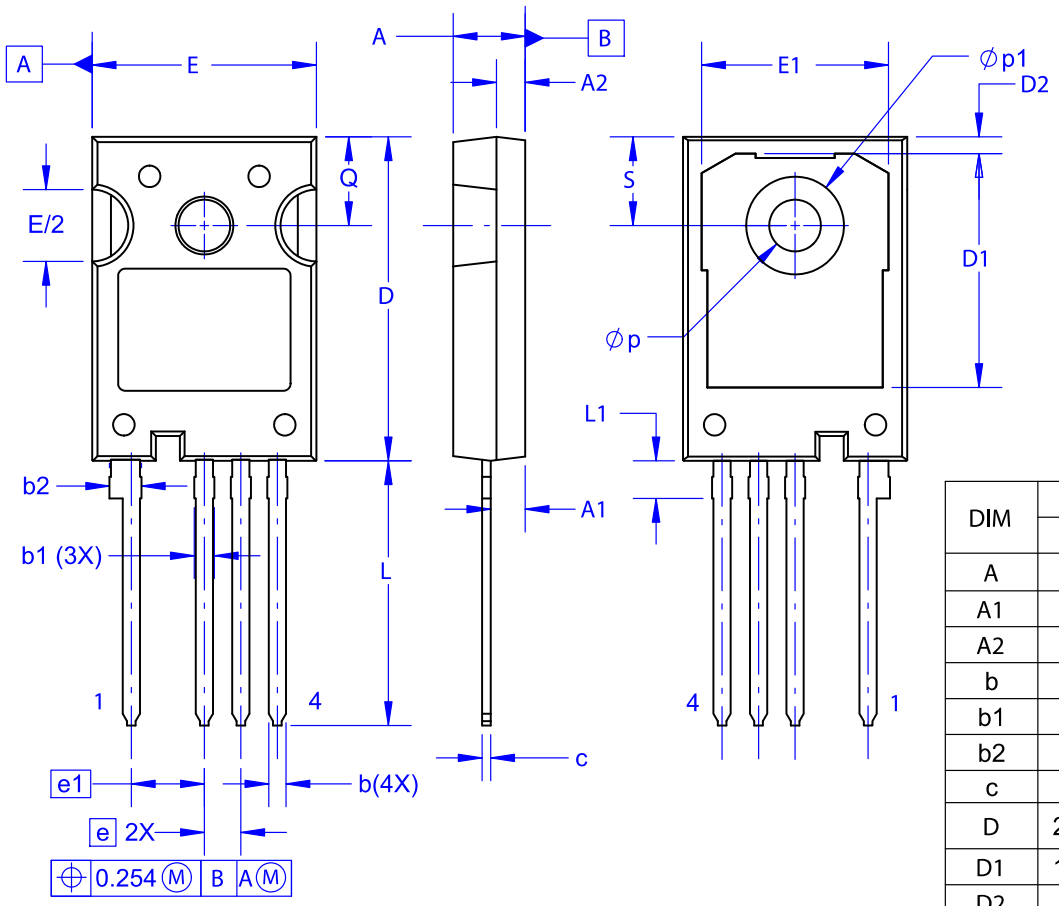



**Figure 16. Junction−to−Case Thermal Response**

## PACKAGE DIMENSIONS

**TO−247−4LD**
CASE 340CJ
ISSUE A

DATE 16 SEP 2019




NOTES:

A. NO INDUSTRY STANDARD APPLIES TO THIS PACKAGE.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS,MOLD FLASH,AND TIE BAR EXTRUSIONS.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5-2009.

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.80 | 5.00 | 5.20 |
| A1 | 2.10 | 2.40 | 2.70 |
| A2 | 1.80 | 2.00 | 2.20 |
| b | 1.07 | 1.20 | 1.33 |
| b1 | 1.20 | 1.40 | 1.60 |
| b2 | 2.02 | 2.22 | 2.42 |
| c | 0.50 | 0.60 | 0.70 |
| D | 22.34 | 22.54 | 22.74 |
| D1 | 16.00 | 16.25 | 16.50 |
| D2 | 0.97 | 1.17 | 1.37 |
| e | 2.54 BSC | | |
| e1 | 5.08 BSC | | |
| E | 15.40 | 15.60 | 15.80 |
| E1 | 12.80 | 13.00 | 13.20 |
| E/2 | 4.80 | 5.00 | 5.20 |
| L | 18.22 | 18.42 | 18.62 |
| L1 | 2.42 | 2.62 | 2.82 |
| p | 3.40 | 3.60 | 3.80 |
| p1 | 6.60 | 6.80 | 7.00 |
| Q | 5.97 | 6.17 | 6.37 |
| S | 5.97 | 6.17 | 6.37 |

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
**Technical Library:** www.onsemi.com/design/resources/technical−documentation
**onsemi Website:** www.onsemi.com

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